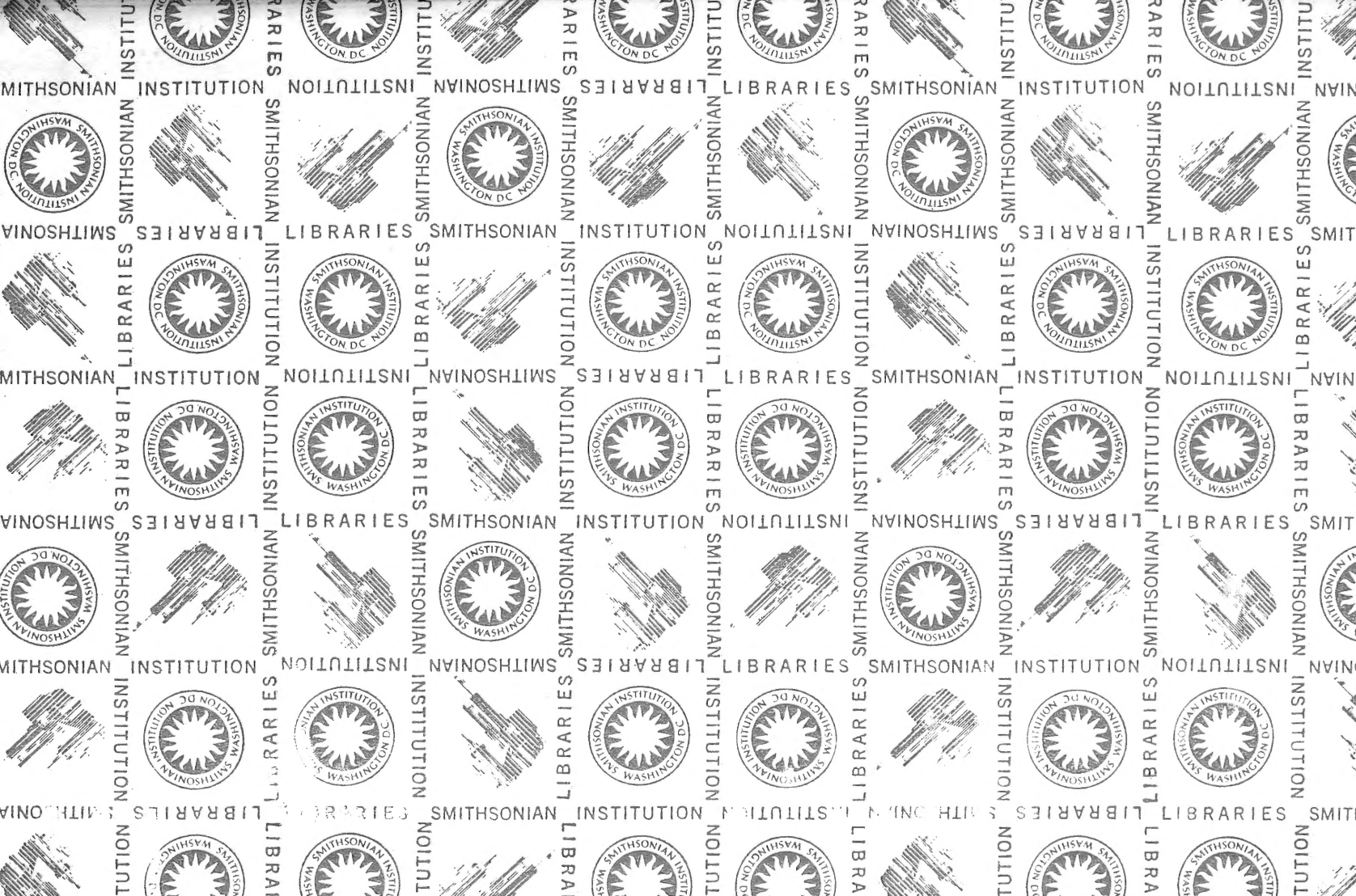
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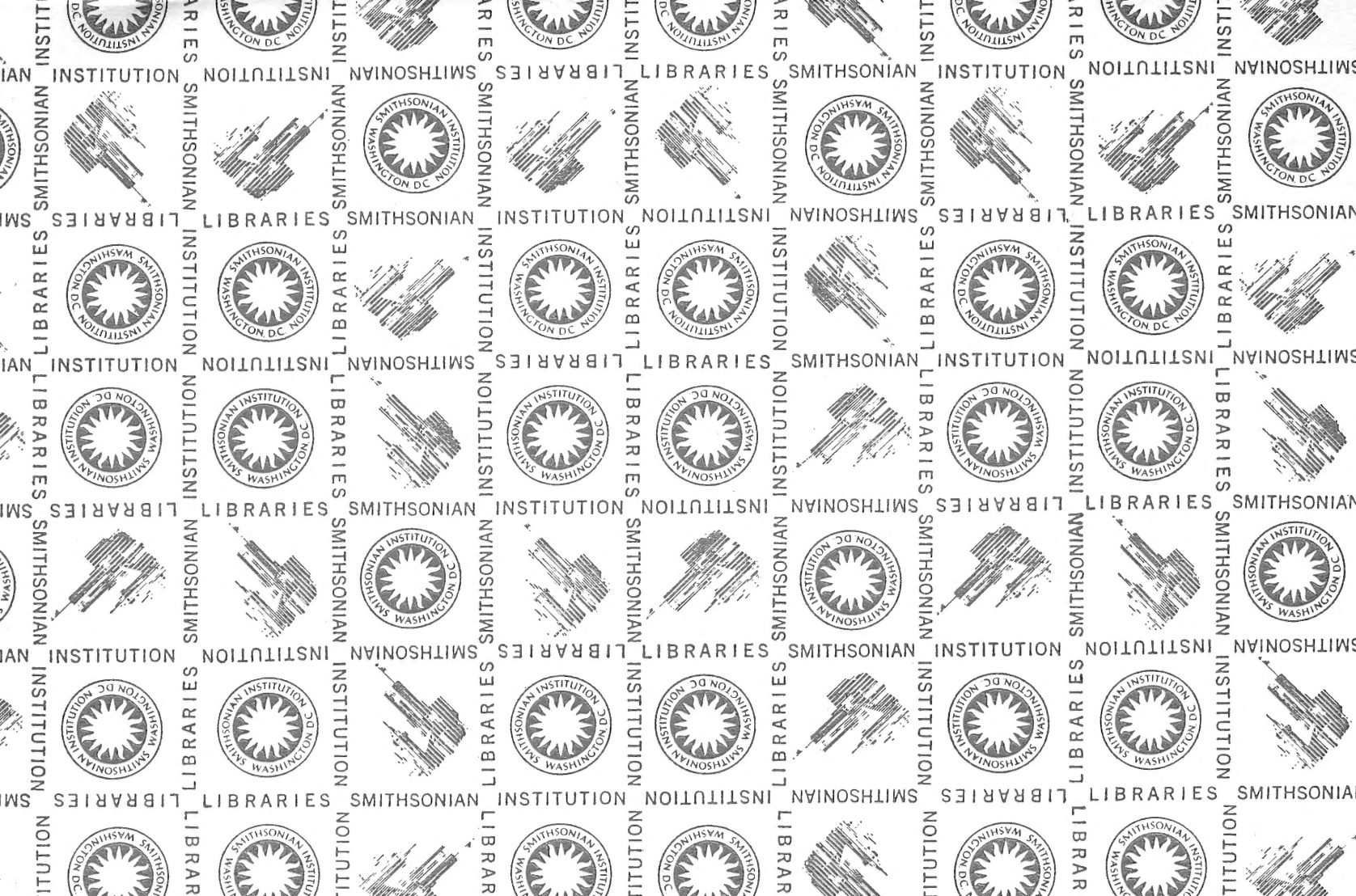
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Volume XIX

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Tubiflorae

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Volume XIX

Tubiflorae

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Addenda — Descriptiones plantarum novarum in tomo XIX Florae URSS commemoratum

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16. N. ventricosa (Sibth. et Sm.) Griseb. 344

Genus 1209. *Pulmonaria* L.

1. P. officinalis L. 345
2. P. mollissima Kern. 347

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3. P. rubra Schott 348
4. P. Filarszkyana Javorka 349
5. P. angustifolia L. 350

Tribe 6. **Myosotideae** Rchb.

Genus 1210. *Myosotis* L.

Subgenus 1. *Strophiostoma* (Turcz.) M. Pop.

1. M. amoena (Rupr.) Boiss. 359
2. M. propinqua Fisch. et Mey. 360
11410. 3. M. pseudopropinqua M. Pop. 361
4. M. sparsiflora Mikan 361

Subgenus 2. *Eumyosotis* DC.

5. M. palustris Lam. 363
6. M. caespitosa Schultz 366
7. M. baltica Samuels. 357
8. M. sicula Guss. 368
9. M. littoralis Stev. 368
10. M. idaea Boiss. et Heldr. 371
11. M. ucrainica Czern. 372
12. M. silvatica Hoffm. 373
11420. 13. M. Krylovii Serg. 374
14. M. sachalinensis M. Pop. 375
15. M. pseudovariabilis M. Pop. 375
16. M. suaveolens W. et K. 376
17. M. alpestris Schmidt 377
18. M. asiatica Schischk. et Serg. 378
19. M. arvensis Hill 379
20. M. heteropoda Trautv. 379
21. M. lazica M. Pop. 380
22. M. collina Hoffm. 382
11430. 23. M. micrantha Pall. 383
24. M. refracta Boiss. 384
25. M. versicolor Smith 384

Tribe 7. **Eritrichieae** Benth. et Hook.

Subtribe 1. **Cynoglossinae** M. Pop.

Genus 1211. *Lepechiniella* M. Pop.

Section 1. Holoptereae M. Pop.

1. L. seravschanica (Lipsky) M. Pop. 391
2. L. arassanica (B. Fedtsch.) M. Pop. 392

Section 2. Lophoptereae M. Pop.

3. L. transalaica (B. Fedtsch.) M. Pop. 393
4. L. Korshinskyi M. Pop. 394
5. L. omphaloides (Schrenk) M. Pop. 397

6. L. ferganensis M. Pop. 398
7. L. alaica M. Pop. 401
11440. 8. L. minuta (Lipsky) M. Pop. 402

Genus 1212. *Lappula* Gilib.

Section 1. Sclerocaryum DC.

1. L. ceratophora M. Pop. 417
2. L. spinocarpos (Forsk.) Aschers. 418
3. L. cristata (Bge.) B. Fedtsch. 419
4. L. diploloma (Schrenk) Gürke 420
5. L. balchaschensis M. Pop. 423

Section 2. Eulappula Gürke

6. L. marginata (M. B.) Gürke 425
7. L. Lipskyi M. Pop. 427
8. L. heteracantha (Ldb.) Gürke 427
9. L. semiglabra (Ldb.) Gürke 430
11450. 10. L. macrantha (Ldb.) Gürke 432
11. L. patula (Lehm.) Aschers. 436
12. L. macra M. Pop. 438
13. L. stricta (Ldb.) Gürke 438
14. L. intermedia (Ldb.) M. Pop. 440
15. L. tenuis (Ldb.) Gürke 442
16. L. brachycentroides M. Pop. 444
17. L. anisacantha (Turcz.) Gürke 445
18. L. consanguinea (Fisch. et Mey.) Gürke 447
19. L. echinata Gilib. 449
11460. 20. L. tianschanica M. Pop. et Zak. 451
21. L. tadshikorum M. Pop. 452
22. L. rupestris (Schrenk) Gürke 455
23. L. sericata M. Pop. 457
24. L. glabrata M. Pop. 458
25. L. Korshinskyi M. Pop. 459
26. L. aktaviensis M. Pop. 460
27. L. barbata (M. B.) Gürke 461
28. L. microcarpa (Ldb.) Gürke 462
29. L. kulikalonica Zak. 465
11470. 30. L. ulacholica M. Pop. 466
31. L. Drobovii M. Pop. 467
32. L. semialata M. Pop. 468
33. L. Popovii Zak. 471
34. L. coronifera M. Pop. 472
35. L. petrophila Pavl. 473
36. L. Lipschitzii M. Pop. 474
37. L. occultata M. Pop. 475
38. L. sinaica (DC.) Aschers. 475
39. L. sessiliflora (Boiss.) Gürke 477

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Genus 1213. *Hackelia* Opiz

11480. 1. H. deflexa (Wahlenb.) Opiz 480
2. H. thymifolia (DC.) M. Pop. 481

Genus 1214. *Eritrichium* Schrad.

Section 1. Pseudohackelia M. Pop.

1. E. latifolium Kar. et Kir. 489
2. E. pamiricum B. Fedtsch. 490
3. E. Fetissovii Rgl. 494
4. E. pseudolatifolium M. Pop. 494
5. E. dubium O. Fedtsch. 495
6. E. pseudostrictum M. Pop. 496
7. E. sub-Jacquemontii M. Pop. 497
8. E. turkestanicum Franch. 498
11490. 9. E. sachalinense M. Pop. 499

Section 2. Coloboma DC.

10. E. rupestre (Pall.) Bge. 501
11. E. jenisseense Turcz. 503
12. E. pulviniforme M. Pop. 504
13. E. mandshuricum M. Pop. 505
14. E. Maackii Maxim. 506
15. E. pectinatum (Pall.) DC. 508
16. E. incanum (Turcz.) DC. 509
17. E. sichotense M. Pop. 510
18. E. jacuticum M. Pop. 511
11500. 19. E. kamtschaticum Kom. 511
20. E. sericeum (Lehm.) DC. 512

Section 3. Eueritrichium DC.

21. E. nanum (Vill.) Schrad. 514
22. E. caucasicum (Alb.) Grossh. 514
23. E. villosum (Ldb.) Bge. 517
24. E. aretioides (Cham.) DC. 519
25. E. Czekanowskii Trautv. 520

Genus 1215. *Stephanocarium* M. Pop.

1. S. Olgae (B. Fedtsch.) M. Pop. 522

Genus 1216. *Tianschaniella* B. Fedtsch.

1. T. umbellifera B. Fedtsch. 523

Subtribe 2. **Lithosperminae** M. Pop.

Genus 1217. *Anoplocaryum* Ldb.

1. A. compressum (Turcz.) Ldb. 525

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Genus 1218. *Allocarya* Greene

11510. 1. A. orientalis (L.) Brand 525

Genus 1219. *Amblynotus* Johnst.

1. A. obovatus (Ldb.) Johnst. 528

Tribe 8. **Asperugeae** Zak.

Genus 1220. *Asperugo* L.

1. A. procumbens L. 530

Tribe 9. **Craniospermeae** (DC.) M. Pop.

Genus 1221. *Craniospermum* Lehm.

Section 1. Eu-Craniospermum M. Pop.

1. C. subvillosum Lehm. 533
2. C. canescens DC. 534
3. C. subfloccosum Kryl. 534

Section 2. Diploloma (Schrenk) M. Pop.

4. C. echioides (Schrenk) Bge. 535

Tribe 10. **Heterocaryeae** Zak.

Genus 1222. *Heterocaryum* DC.

1. H. laevigatum (Kar. et Kir.) DC. 539
2. H. rigidum DC. 540
3. H. echinophorum (Pall.) Brand 544
11520. 4. H. macrocarpum Zak. 545
5. H. Szovitsianum (Fisch. et Mey.) DC. 546
6. H. oligacanthum (Boiss.) Bornm. 546

Tribe 11. **Rochelieae** DC.

Genus 1223. *Rochelia* Rchb.

Section 1. Eurochelia Zak.

1. R. disperma (L. f.) C. Koch 551
2. R. retorta (Pall.) Lipsky 552
3. R. persica Bge. 553
4. R. Bungei Trautv. 554
5. R. karsensis M. Pop. 557
6. R. leiocarpa Ldb. 557
7. R. campanulata M. Pop. 559
11530. 8. R. claviculata M. Pop. 560
9. R. jackabaghi Pavl. 560
10. R. peduncularis Boiss. 561
11. R. macrocalyx Bge. 562

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Section 2. Cryptocarpa Zak.

12. R. cardiosepala Bge. 563

Tribe 12. Cynoglosseae DC.

Genus 1224. *Rindera* Pall.

Section 1. Pseudomattia M. Pop.

1. R. tianschanica M. Pop. 569
2. R. tschotkalensis M. Pop. 570
3. R. ferganica M. Pop. 571

Section 2. Mattia Bge.

4. R. oschensis M. Pop. 572
5. R. umbellata (W. et K.) Bge. 572

Section 3. Cyphomattia Kusn.

11540. 6. R. lanata (Lam.) Bge. 573

Section 4. Mattiorindera M. Pop.

7. R. Korshinskyi (Lipsky) Brand 574

Section 5. Oxyrindera M. Pop.

8. R. ochroleuca Kar. et Kir. 577

Section 6. Eurindera Kusn.

9. R. tetraspis Pall. 579
10. R. cyclodonta Bge. 580
11. R. baldshuanica Kusn. 581

Section 7. Echinorindera M. Pop.

12. R. echinata Rgl. 581
13. R. austroechinata M. Pop. 582
14. R. coechinata M. Pop. 583
15. R. turkestanica Kusn. 583
11550. 16. R. oblongifolia M. Pop. 584
17. R. holochiton M. Pop. 585

Genus 1225. *Bilegnum* Brand

1. B. Bungei (Boiss.) Brand 587

Genus 1226. *Paracarygum* Boiss.

Section 1. Macromattiastrum (Brand) M. Pop.

1. P. incanum (Ldb.) Boiss. 593

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Section 2. **Modestomattiastrum** (Brand) M. Pop.

2. P. laxiflorum Trautv. 594
3. P. karataviense Pavl. 597
4. P. himalayense (Klotzsch) C. B. Clarke 597
5. P. turcomanicum Bornm. et Sint. 599
6. P. gracile Czernjak. 600

Section 3. Euparacaryum Boiss.

7. P. strictum (C. Koch) Boiss. 601

Section 4. Microparacaryum M. Pop.

11560. 8. P. intermedium (Fresen.) Lipsky 602
9. P. Bungei (Boiss.) Brand 605

Genus 1227. *Omphalodes* Moench

Section 1. **Arctotertiariae** M. Pop.

1. O. cappadocica (Willd.) DC. 609
2. O. Kusnetzovii Klok. 613
3. O. Lojkae Somm. et Lev. 614
4. O. rupestris Rupr. 615

Section 2. Pseudoparacaryum M. Pop.

5. O. linifolia (L.) Moench 616

Section 3. Maschalanthus DC.

6. O. scorpioides (Haenke) Schrank 619

Genus 1228. *Trachelanthus* Ktze.

1. T. hissaricus Lipsky 621
2. T. Korolkovii Lipsky 622

Genus 1229. *Lindelofia* Lehm.

Section 1. Brandia M. Pop.

11570. 1. L. macrostyla (Bge.) M. Pop. 627

Section 2. Pseudocynoglossum M. Pop.

2. L. Olgae (Rgl. et Smirn.) Brand 629
3. L. Capusii (Franch.) M. Pop. 630
4. L. stylosa (Kar. et Kir.) Brand 633
5. L. angustifolia (Schrenk) Brand 637
6. L. pterocarpa M. Pop. 638

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Genus 1230. *Solenanthus* Ldb.

Section 1. Petiolares Zak.

1. S. circinnatus Ldb. 642

Section 2. Kuschakewiczia Zak.

2. S. turkestanicus (Rgl. et Schmalh.) Kusn. 644
3. S. plantaginifolius Lipsky 648

Section 3. Hirsuti Zak.

4. S. hirsutus Rgl. 650
11580. 5. S. kokanicus Rgl. 651
6. S. stamineus (Desf.) Wettst. 652
7. S. karateginus Lipsky 653

Section 4. Apennini M. Pop.

8. S. Biebersteinii DC. 655
9. S. brachystemon Fisch. et Mey. 656

Genus 1231. *Cynoglossum* L.

1. C. seravschanicum (B. Fedtsch.) M. Pop. 661
2. C. viridiflorum Pall. 662
3. C. tianschanicum M. Pop. 663
4. C. pictum Ait. 664
5. C. nebrodense Guss. 667
11590. 6. C. montanum L. 668
7. C. divaricatum Steph. 670
8. C. officinale L. 671
9. C. holosericeum Stev. 672

Genus 1232. *Paracynoglossum* M. Pop.

1. P. denticulatum (DC.) M. Pop. 674
2. P. imeretinum (Kusn.) M. Pop. 676
3. P. asperrimum (Nakai) M. Pop. 679

Tribe 13. **Trichodesmeae** Zak.

Genus 1233. *Suchtelenia* Kar.

1. S. calycina (C. A. M.) DC. 681

Genus 1234. *Caccinia* Savi

Section 1. Eucaccinia Boiss.

1. C. crassifolia (Vent.) C. Koch 686

Section 2. Pseudoheliocarya M. Pop.

2. C. dubia Bge. 688

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Genus 1235. *Trichodesma* R. Br.

11600. 1. T. incanum (Bge.) DC. 690

Family CXXXIX. **Verbenaceae** Juss.

Genus 1236. *Verbena* L.

1. V. bracteosa Michx. 694
2. V. officinalis L. 694
3. V. supina L. 695
4. V. hastata L. 696

Genus 1237. *Lippia* L.

1. L. nodiflora (L.) Rich. 697

Genus 1238. *Vitex* L.

1. V. agnus-castus L. 698

Genus 1239. *Clerodendron* L.

11607. 1. C. foetidum Bge. 700

PREFACE

The Boraginaceae, with 52 genera — about 350 species — account for a large part of the gamopetalous families treated in the present volume (XIX). M. G. Popov, corresponding member of the Academy of Sciences of the Ukrainian SSR, who is responsible for this section, has studied this family for many years. One of the difficulties he has encountered concerns the boundaries between the genera which have been repeatedly revised in the Soviet as well as in the foreign literature. Also many of the available specimens are incomplete. As a result there has been in some cases a departure from the procedure followed in the Flora in the presentation of material (extensive notes, numerous varieties, etc.).

Convolvulaceae, treated by Yu. S. Grigor'ev, and Cuscutaceae, treated by A. Ya. Butkov, are also families notable for their novel presentation as well as for their commercial value.

The Editors

1 Order 36. **Tubiflorae** AGARDH.

Flowers usually bisexual, typically of 4 whorls (i. e., with 1 whorl of stamens). Corolla gamopetalous, regular, often symmetrical; stamens inserted on corolla, usually 2—4 owing to reduction, rarely 5, pistils mostly of 2, rarely of 3—5 carpels; ovary usually superior, 2—5-locular, rarely 1-locular; ovules many or few in each locule, with 1 integument; endosperm highly or poorly developed, sometimes absent. Herbs or shrubs, with alternate or opposite, rarely reduced leaves, sometimes leafless.

Family 134. **CONVOLVULACEAE*** JUSS.

Flowers borne singly in axils of leaves, otherwise few or many in cymous (type of dichasium) or subcapitate inflorescences, actinomorphous, nearly always bisexual. Sepals 5, free or connate at base, sometimes unequal, in fruit usually persistent, enclosing fruit, or deflected to one side. Corolla of 5 petals, gamopetalous, funnel-shaped, campanulate, rarely patelliform or tubular, its limb 5-lobed or prismatic with obsolete lobes. Stamens 5, inserted at base of corolla, alternate to lobes; filaments sometimes unequal, often dilated at base, mostly entirely hidden, rarely exserted from corolla. Pistil 1; ovary superior, 1-locular or with 2—4 (or more) locules; styles 1—2; stigmas entire, capitate, sometimes 2-lobed or stigmas 2. Fruit usually a few- or 1-seeded capsule. Annual or perennial herbs, often with twining stems, also shrubs and semishrubs. Leaves alternate, often entire, rarely more or less lobed or dissected; stipules usually lacking. The leaves and stems of many species contain a milky juice.

Genus **PORANA***

Porana sichota-alinensis Krysht., Oligocene, Uss. (Amagu River).

2 Key to Genera

1. Stamens exserted from corolla; styles 2; flowers small, crowded at apex of stem in short spicate or subcapitate inflorescence; corolla with distinct, oblong or lanceolate-oblong lobes. Low semi-shrub with numerous small leaves . . . . . 1175. Cressa L.

* Treatment by Yu. S. Grigor'ev.

+ Stamens not exserted from corolla; styles 1, with 1 or 2 stigmas; flowers usually larger; lobes of corolla usually very short, often barely visible . . . . . 2.

2. Styles with 1 capitate stigma . . . . . 1176. Ipomoea L.

+ Styles with 2 linear or elliptic stigmas . . . . . 3.

3. Calyx subtended by 2 large, amplexicaul bracts different from cauline leaves; stigmas elliptic or oblong-elliptic. 1178. Calystegia R. Br.

+ Calyx not subtended by bracts or bracts very narrow, linear; upper cauline leaves sometimes so close to flowers as to be mistaken for bracts, but then their shape very similar to lower cauline leaves. Stigmas linear-cylindrical or oblong-linear . . . . 1177. Convolvulus L.

Genus 1175. **CRESSA*** L.

L. Sp. pl. (1753) 223.

Flowers sessile or subsessile, borne singly in axils of upper leaves, together forming capitate or spicate inflorescence; sepals nearly equal; corolla funnel-shaped, deeply 5-partite, lobes divergent in open flower; stamens 5, filaments long, exserted from corolla; styles 2, stigmas capitate; ovary 2-celled, with 4 ovules; capsule 1-seeded, dehiscing by 2—4 valves. Low, strongly branching semishrub, with small leaves and flowers.

About 3—4 widely spread species, particularly in the tropics and subtropics.

1. C. cretica L. Sp. pl. ed. 1 (1753) 222; Ldb. Fl. Ross. III, 1, 95; Boiss. Fl. or. IV, 114; Grossg., Fl. Kavk. III, 239; Hayek, Prodr. Fl. Balc. II, 41. — C. cretica subsp. genuina Palib. in Mat. Fl. Kavk. 37 (1913)b; in Russk. bot. zhurn. 3 (1915) 23. — Exs.: G. R. F. No. 1735.

3 Perennial semishrubs, 5—30 cm high; stems erect or ascending, profusely and densely branching, very densely leafy, stems and leaves with more or less dense appressed or spreading hairs; leaves small, sessile, thickish, usually dimorphic, cordate-ovate or ovate on stems, oblong-lanceolate or linear-oblong on branches. Flowers sessile or subsessile, more or less crowded in densely spicate or subcapitate terminal inflorescences; calyx subtended by 2 bracts, ca. 2.5—3 cm long, appressed-hairy; sepals oblong-obovate or spatulate; corolla tube as long as calyx, lobes shorter, oblong or lanceolate-oblong, with hairy tip, recurved at flowering; filaments long, like styles markedly exserted from corolla; stigmas capitate; capsule conical-ovoid or ovoid, much longer than calyx, hairy above, usually 1-seeded; seeds oblong or ovoid-oblong, very finely alveolate, dull. Fl. June-September.

Solonchaks and saline shores. — Caucasus: Cisc., E. Transc.; Centr. Asia: Kara K. (part of Mtn. Turkm.), Amu D., Syr D., Pam.-Al. (S). Gen. distr.: W. and E. Med., Bal.-As. Min., Arm.-Kurd., Iran., Ind.-Him., also Africa and Arabia. Described from Crete. Type in London.

* From the Greek kreterin — Cretan plant.

Genus 1176. **IPOMOEA*** L.

L. Sp. pl. (1753) 153. — Pharbitis Choisy in Mem. Soc. Phys. Genev. VI (1833) 438.

Flowers 1 or few on axillary peduncles; bracts small, on pedicel, not adjacent to calyx; sepals 5, variously shaped; corolla usually regular, funnel-shaped-campanulate, nearly entire or slightly lobed; stamens 5, filaments widening below; style 1, stigma capitate, sometimes more or less lobed. Capsules 2—3-locular, 4—6-seeded, dehiscing by 4—6 valves. Annual or perennial herbs, often with twining stems.

To 300 species, most of which are widespread in the tropics.

1. Cultivated perennial, with large edible tubers . . . ★I. batatas (L.) Lam.
\+ Annual, ornamental or weed . . . . . 2.
2. Flowers large; corolla ca. 4—5 cm long. . . . . ★I. purpurea (L.) Roth.
4 \+ Flowers small; corolla 7—15 mm long . . . . . 3.
3. Stems and leaves glabrous (E. Siberia and the Far East). . . . . 1. I. sibirica (L.) Pers.
\+ Stems and leaves stiff-haired (tropical plant, in the USSR confined to the southern part of Central Asia) . . . . . 2. I. hispida (Vahl) Roem. et Schult.

1. I. **sibirica** (L.) Pers. Syn. I (1805) 183; Choisy in DC. Prodr. IX, 377; Turcz. Fl. Baic.-dahur. II, 284; Ldb. Fl. Ross. III, 1, 87; Kom., Fl. Man'chzh. III, 1, 308; Liou-Tchen-Ngo et Ling Yong, Fl. Illustr. Nord. Chine, 1, 33. — Convolvulus sibiricus L. Mant. Pl. II (1771) 203. — C. rupestris Pall. Reise, III, 260, Anchang (1776) 723, non Willd. — Ic.: Liou-Tchen-Ngo et Ling Yong. l. c. tab. XII.

Annual; stem 30—70 cm long, usually with long twining branches, entire plant glabrous; leaves more or less long-petioled, cordate, becoming long-acuminate. Peduncles axillary, as long as leaves or shorter, usually with 1—3 flowers, rarely with numerous flowers, in fruit distinctly thickened distally; sepals oblong or oblong-ovate, ca. 5 mm long, acute; corolla funnel-form-campanulate, pink or white (?), ca. 15 mm long (about three times as long as calyx); stamens unequal, lower part of filaments widened, papillate; capsule conical-spherical, 6—8 mm long, with small beak, 2-celled, 4-seeded; seeds oblong, trihedral (one face inflated), dark, nearly black, with very small whitish outgrowths. August—September.

Crops and fallow lands, meadows. — E. Siberia: Dau. (Selenga); Far East: Uss. Gen. distr.: Mong. (NE), Ch. (Manchuria, N. Ch.). Described from Siberia. Type in London.

2. I. **hispida** (Vahl) Roem. et Schult. Syst. IV (1819) 238; Hall. f. in Engl. Bot. Jahrb. XVIII, 123. — Convolvulus hispidus Vahl, Symb. Bot. III (1794) 29. — Ipomoea eriocarpa R. Br. Prodr. Fl. Nov. Holl. 1 (1810) 484; Choisy in DC. Prodr. IX, 369; Clarke in Hook. Fl. Brit. Ind.

* From the Greek if — worm, omois — similar; twining plant similar to Convolvulus.

IV, 204. — I. sessiliflora Roth, Nov. Pl. Spec. (1821) 116. — Convolvulus eriocarpus (R. Br.) Spreng. Syst. I (1825) 598. — C. sessiliflorus (Roth) Spreng. Syst. I (1825) 598. —

Annual; stem 1—2 m long, twining or trailing, stiff-haired; leaves more or less long-petioled, oblong-lanceolate, ovate-lanceolate or ovate, cordate at base, gradually acuminate or acute, sparse hairs. Axillary peduncles very short, usually with 1—3 crowded flowers, rarely flowers numerous; sepals acuminate with broad base, ca. 7—8 mm long, stiff-haired; corolla ca. 7—9 mm slightly longer than calyx, tubular-campanulate, with 5 bands of hairs, pink or red; stamens unequal, hidden in corolla, filaments broadened below; capsule slightly shorter than sepals, ca. 5—6 mm across, broadly ovoid or subglobose, 4-valved, 4-seeded; seeds ca. 2.5 mm long, slightly wrinkled, nearly smooth. Fl. July—August.

A weed of irrigated areas in the southern part of Central Asia. — Centr. Asia: Pam.-Al. (lower reaches of the Kafirnigan River). Gen. distr.: Tropical Africa, Madagascar, tropical Asia (north up to Afghanistan), N. Australia. Described from E. India. Type in London.

★I. purpurea (L.) Roth, Bot. Abh. (1787) 27; Post, Fl. Syria Palest. and Sin. ed. II, vol. II, 212. — Convolvulus purpureus L. Sp. pl. ed. II (1762) 219. — Pharbitis purpurea (L.) Voigt. Hort. suburb. Calc. (1845) 354; Hayek, Prodr. Fl. Balc. II, 36; V. Petrov in Fl. Yugo-Vost. VI, 55. — P. hispida Choisy in Mém. Soc. Phys. Genèv. VI (1833) 440. — Ic.: Hegi, III. Fl. V, 3, fig. 3050.

Annual; stems long, branching, twining, with sparse hairs; leaves with long petioles, usually exceeding blade, broad, cordate, acuminate, with sparse hairs. Flowers 1 or 2—4 on long axillary peduncles; sepals ovate-lanceolate, more or less acuminate, more or less pubescent in lower part; corolla large, ca. 4—5 cm long, funnel-shaped-campanulate, red, sky-blue or violet, sometimes tube or entire corolla white; stamens much shorter than corolla with glabrous filaments (without papillae); capsule 3-celled. Fl. June — August (September).

An ornamental plant of American origin. Widespread in gardens and parks in the southern regions of the USSR.

★I. batatas (L.) Lam. Tabl. Encycl. I (1791) 465; Clarke in Hook. Fl. Brit. Ind. IV, 202; Baker et Rendle in This-Dyer, Fl. Trop. Afr. IV, 2, 175; Gagnep. et Courch. in Lec. Fl. Indo-Chine, IV, 240; Van Ooststroom in Blumea, III, 3, 512. — Convolvulus batatas L. Sp. pl. (1753) 154. — C. edulis Thunb. Fl. Jap. (1784) 84. — Batatas edulis (Thunb.) Choisy in Mém. Soc. Phys. Genève, VI (1833) 435 et in DC. Prodr. IX, 338; Miq. Fl. Ned. Ind. II, 599.

Perennial; plant with large oblong or fusiform tubers; stems trailing or ascending, rarely twining, to 3—5 m long, glabrous or more or less hairy; leaves more or less long-petioled, broadly ovate or subrounded, acute or obtuse, broadly cordate or truncate at base, entire, more or less lobed or 3—5-(7-) partite, glabrous or with sparse hairs. Axillary peduncles slightly longer than or as long as petioles, with 1 or few (or even numerous) flowers;

sepals oblong or oblong-ovate, 7—12 mm long, glabrous or hairy; corolla
6 campanulate or tubular-campanulate, ca. 3—4.5 cm long, pale violet; stamens unequal, hidden in corolla, the filaments broadened at base; capsule ovoid, usually 4-valved.

I. batatas is cultivated for its tubers which, like potatoes, are used as food, in the production of starch, molasses, etc. It is widespread in tropical and subtropical countries, and has recently also been introduced in the USSR, mainly in the southern part of Central Asia and the Caucasus. Described from India. Type in London.

Genus 1177. **CONVOLVULUS*** L.

L. Sp. pl. (1753) 153.

Flowers 1—3 in axils of leaves, more or less long-peduncled or forming a kind of dichasial inflorescence, or crowded in a capitate inflorescence; calyx usually ebracteate; sepals equal or the outer different from the inner, sometimes 2 outer sepals larger than the 3 inner ones; corolla funnelform-campanulate, with very short and broad, sometimes barely discernible, rarely more or less well developed lobes; stamens 5, inserted at base of corolla, filaments sometimes unequal, often broadened in lower part; styles 1, with 2 linear-cylindrical stigmas; ovary 2-locular, ovules 4; capsule 2-celled, 4-valved, 4-, rarely 1—3-seeded, sometimes indehiscent, with 1 seed. Perennial, rarely annual herbs, with twining or erect stems, semishrubs or shrubs, sometimes profusely branching with spiny branches. Leaves alternate, usually simple or entire.

Most of the 180—190 species Mediterranean.

1. Strongly branching shrubs or semishrubs, with stiff, spiny branches . 2.
\+ Semishrubs or herbaceous perennials; branches stiff but not spiny . 7.
2. Leaves few, with hastate, cordate or rounded base . . . . . 3.
\+ All leaves with cuneate base . . . . . 5.
3. Leaves densely covered with appressed hairs, thus often silvery-silky. Juvenile branches densely tomentose, velutinous . . . . . 3. C. olgae Rgl. et Schmalh.
\+ Leaves glabrous or with sparse hairs . . . . . 4.
7
4. Juvenile branches densely covered with short appressed hairs . . . . . 1. C. lycioides Boiss.
\+ Juvenile branches and entire plant glabrous, very rarely short-tomentose . . . . . 2. C. campanulatus Zapr.
5. Sepals glabrous or with sparse hairs, unequal, the outer 2 broad, ovate-rounded, with cordate base, much wider than the 3 inner sepals . . . . . 4. C. gortschakovii Schrenk.
\+ Sepals more or less densely pubescent, their shape different, the outer only slightly different from the inner . . . . . 6.

* From the Latin convolvere —twine, referring to the twining stems of many species.

6. Flowers 2—5(6), at apices of branches, rarely single; calyx 5—7(8) mm long; plant with divaricate, short, crowded branches, forming rather compact, rarely loose, trailing cushions . . . . . 6. C. tragacanthoides Turcz.

\+ Flowers 1 (often several or many) on short lateral branches, diverging at a right angle . . . . . 5. C. fruticosus Pall.

7. Stems, leaves, peduncles and calyx densely white tomentose. Leaves broad, elliptic or ovate, rounded at base, short-petiolate. Flowers single, on axillary peduncles, large; corolla 30—45 mm long . . . . . 26. C. persicus L.

\+ Plant different, glabrous or of different pubescence, not tomentose . . . . . 8.

8. Leaves saggitate, saggitate-hastate (rarely cordate) at base, petioles more or less long . . . . . 9.

\+ Leaves cuneately tapering, rarely rounded at base, sessile or subsessile . . . . . 12.

9. Semishrubs, with short cespitose shoots and long, long-branching, erect stems. Corolla pale yellow, 25—35 mm long, glabrous, with short, broadly triangular lobes . . . 28. C. pseudoscammonia C. Koch.

\+ Herbaceous plants, with twining, rarely trailing or ascending stems. Corolla with 5 bands of more or less dense hairs, rarely glabrous . . . . . 10.

10. Stems more or less densely long-spreading-hairy. Corolla 30—40 mm long . . . . . 27. C. hirsutus Stev.

\+ Stems glabrous or with scattered thin hairs in upper part . . . . . 11.

11. Corolla 15—26 mm long, pink, rarely white, glabrous or with 5 bands of hairs above. A weed . . . . . 30. C. arvensis L.

8 \+ Corolla (20)25—40 mm long, yellow, with 5 reddish bands, these glabrous or with inconspicuous hairs. In the USSR confined to the southern coast of the Crimea. . . . . 29. S. scammonia L.

12. Sepals glabrous. Leaves also glabrous, rarely with appressed hairs beneath . . . . . 13.

\+ Sepals more or less densely pubescent, rarely glabrous, but both surfaces of leaves more or less densely hairy. . . . . 14.

13. Sepals rounded, with small mucro (Dzu-Tarb., T. Sh., Pam.-Al.) . . . . . 14. C. pseudocantabrica Schrenk.

\+ Sepals more or less long-acuminate (Mtn. Turkm.) . . . . . 15. C. ascabadensis Bornm. et Sint.

14. Sepals obovate, rounded at apex, ca. 3—4 mm long, with dense appressed-sericeous hairs and hairy-ciliate margin. Corolla white, 5—8(9) mm long, with 5 rather distinct lobes . . . . . 7. C. erinaceus Ldb.

\+ Sepals acutish, acute or acuminate. Corolla usually larger . . . . . 15.

15. Outer sepals (7)8—12 mm long, broad, elliptic or ovate, inflated, rather long-, rarely short-acuminate, with dense appressed hairs; inner sepals shorter, rounded with rather long mucro. Corolla pale yellow, (18)20—30 mm long. Stems and leaves with dense appressed sericeous hairs . . . . . 23. C. holosericeus M. B.

\+ Sepals different, not inflated; corolla usually white or pink . . . . . 16.

16. Stems more or less numerous, rather dense with divaricate branches in lower part, simple (like branches) above, bearing 1—2(3) flowers. Leaves linear-subulate, ca. 0.5 mm wide, canaliculate above, Corolla 17—23 mm long (Centr. Asia) . . . . . 13. C. krauseanus Rgl. et Schmalh.

\+ Plant different . . . . . 17.

17. Flowers few, crowded in capitate inflorescences at tips of stems (sometimes at tips of lateral branches) sometimes singly in axils of upper leaves. Sepals with more or less dense very long hair or short-haired with long hairs only above; outer sepals long-acuminate. Stems and leaves covered with dense appressed silvery hairs, usually sericeous . . . . . 18.

\+ Plant different . . . . . 21.

18. Plant with short branching caudex, forming small tufts, with more or less numerous rosettes of leaves and few flower-bearing stems (Crimea) . . . . . 19.

\+ Plant with short caudex and 1 or few flower-bearing stems, without rosettes (Caucasus and Mtn. Turkm.) . . . . . 20.

19. Sepals squamose with dense long hairs . . . . . 22. C. tauricus (Bornm.) Juz.

\+ Sepals with dense short appressed hairs and scattered long hairs (these more dense above). . . . . 21. C. sericocephalus Juz.

20. Corolla 20—25(28) mm long. . . . . 19. C. commutatus Boiss.

\+ Corolla 10—15 mm long . . . . . 20. C. calverti Boiss.

21. Herbaceous perennials with trailing or ascending stems, 2—20 (rarely to 30—40) cm long. Stems, leaves and calyx with dense, appressed hairs, silvery-sericeous. Flowers single, or several in small, dense inflorescences . . . . . .22.

\+ Plant and pubescence different . . . . . .23.

22. Leaves linear or linear-oblanceolate, narrow, (0.5)1—4(5) mm wide. Flowers always single. Corolla (8)9—15 mm long. . . . . 25. C. ammanii Desr.

\+ Leaves wider, (5)6-25 mm wide (only the uppermost sometimes narrower). Flowers in small, dense inflorescences, rarely single. Corolla 15—25 mm long . . . . . 24. C. lineatus L.

23. Stems 60—100 cm high, thick, sturdy, erect, with long divaricate branches, and appressed or spreading hairs. Flowers more or less many, borne singly in spreading, long-branching, dichasial inflorescences. Sepals 3—5.5 mm long, with more or less dense appressed hairs; corolla 10—23 mm long, red or bright pink; capsule 5—7 mm long, glabrous; sepals curved outward or even downward. Plants of loess foothills of southern Central Asia . . . . . 16. C. subhirsutus Rgl. et Schmalh.

\+ Plant different . . . . . 24.

24. Herbaceous plants with rather weak, usually ascending, rarely erect stems. Sepals with dense long hairs. . . . . 25.

\+ Herbaceous plants, often semishrubs, with short woody shoots. Stems herbaceous, sturdy, erect. Pubescence of calyx different . . 26.

25. Outer sepals acute or acutish, the inner acuminate. Corolla (8) 10—16 mm long . . . . . 18. C. pilosellifolius Desr.

10 + Outer sepals more or less acuminate (rarely acute), the inner rounded, with long mucro. Corolla (10)15—25 mm long . . . . . 17. C. cantabrica L.

26. Leaves, at least the median and upper, ovate or subrounded, always rounded at base. Stems and leaves spreading, densely villous . . . . . 11. C. divaricatus Rgl. et Schmalh.

\+ Leaves different, tapering at base . . . . . 27.

27. Sepals (2)3—4 mm long . . . . . 28.

\+ Sepals 5—7 mm long . . . . . 29.

28. Sepals short-acuminate, glabrous or more or less densely short-haired; corolla 9—15 mm long. Plants of sandy deserts. . . . . 10. C. korolkovii Rgl. et Schmalh.

\+ Sepals acute or acutish, always densely hairy; corolla 8—11 mm long. Plants of pebbly and sandy-clayey deserts . . . . . 9. C. hamadae (Vved.) V. Petr.

29. Sepals densely villous. Leaves oblong or oblong-elliptic, ca. 5—6 mm wide . . . . . 12. C. michelsonii V. Petr.

\+ Sepals with appressed or semiappressed hairs. Leaves narrower . . . . . 8. C. subsericeus Schrenk.

Section 1. ACANTHOCLADA Boiss. Fl. or. IV (1879) 84; V. Petrov in Byull. Mosk. obshch. isp. prir. XLIV, 3, 132. — Shrubs or semishrubs, with firm spiny branches. Flowers 1 or few in small dense inflorescence. Ovary glabrous or more or less pubescent.

1. C. lycioides Boiss. Diagn. pl. I, 7 (1847) 28. — C. leiocalycinus γ. lycioides Boiss. Fl. or. IV (1879) 86. — C. leiocalusinus V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3 (1935) 132, ex p. — C. bucharicus Lipsky in sched.

Divaricately branching shrub, with firm spiny branches; perennial branches with grayish-dark brown bark, glabrous; young branches gray-green with dense short appressed hairs; leaves glabrous or with sparse hairs of several kinds, lower leaves on branches often elliptic or oblong-ovate, cuneate at base, the upper oblong or oblong-triangular, hastate at base or cuneate with obtuse auricles; sepals 2—5 mm long. Flowers single in axils of leaves; pedicels 10—20 mm long, sparsely pubescent; sepals ellip-
13 tic or oblong-elliptic, rounded at apex, 5 mm long, glabrous, stiff; corolla 15—20 mm long, white (or pink), with 5 bands of hairs at least inside. Ovary glabrous. Fl. (March?) April—May.

Dry stony slopes. — Centr. Asia: Pam.-Al. (S. and C. Tadzhikistan). Gen. distr.: Iran. Described from Iran (Shiraz). Cotype in Leningrad.

Note. Boissier wrongly describes the corolla as glabrous.

2. C. campanulatus Zapr. in Izv. Tadzh. Bazy AN, I, vyp. 1. (1933) 73. — C. leiocalycinus V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3(1935) 132, ex p. non Boiss.

Spiny, divaricately branching shrub to 1.5 m high; perennial branches glabrous, reddish-brown, sometimes shiny, their numerous short branchlets strong, branching, leafy, green when young, becoming acute spinous,

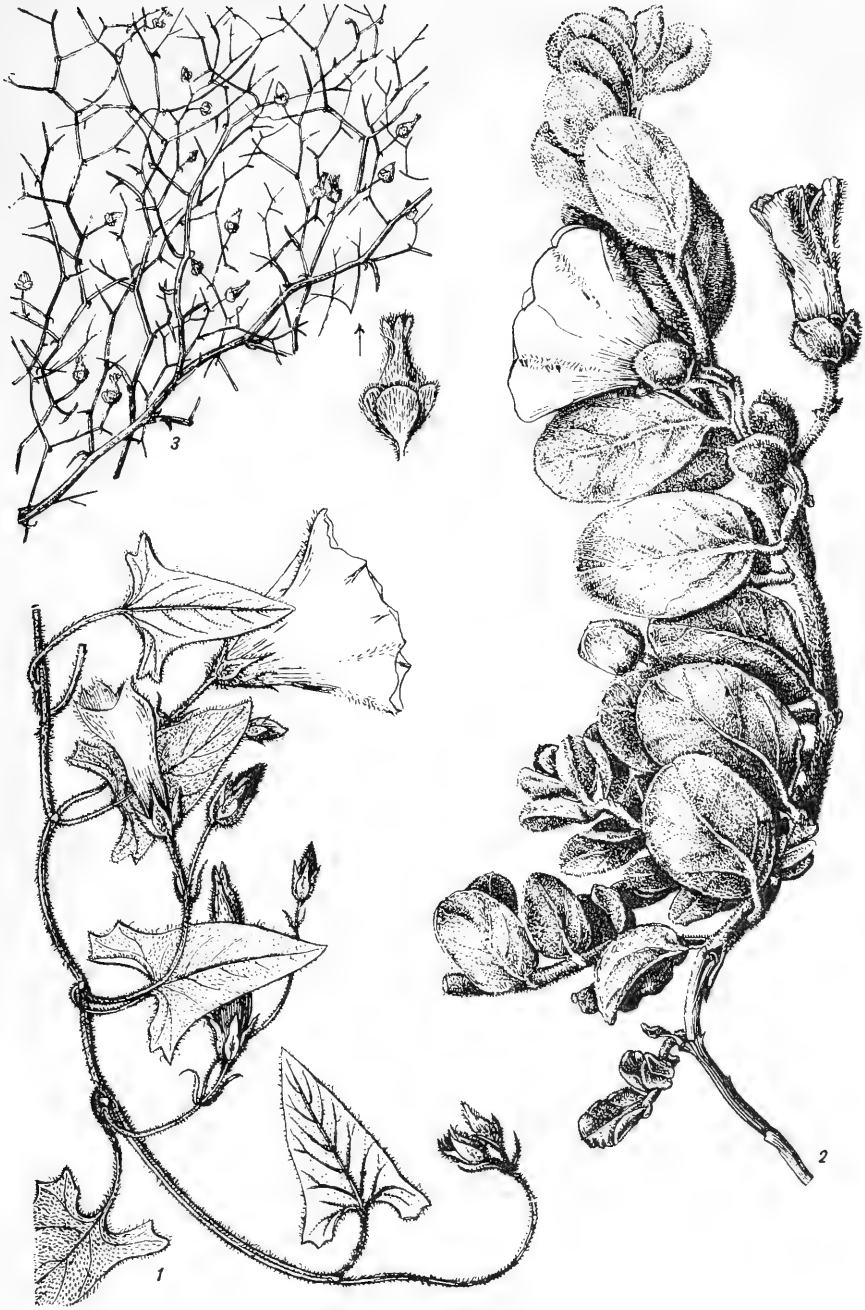

PLATE I. 1 — Convolvulus hirsutus Stev.; 2 — C. persicus L.; 3 — C. erinaceus Ldb., flowers with withered corolla.

glabrous (rarely short-haired), leaves 1—1.5(2) cm long; glabrous, coriaceous, broad- or oblong-triangular, rarely lanceolate, at base hastate (with obtuse auricles), cordate, rounded, rarely broadly cuneate, apex rounded, petioles 1—3 mm long. Flowers solitary, axillary; pedicels thin, glabrous, ca. 1 cm long; calyx glabrous, of 5 lanceolate, spreading, green, acute, 3.5 mm long leaflets; corolla 9 mm long, light pink, nerves deeper colored, campanulate, tube ca. 2.5 mm across, teeth 5, triangular-lanceolate, acute, ca. 1.5 mm long; stamens 5, approximate in bundles, filaments ca. 4.5 mm long; anthers oblong, 2 mm long, with nearly parallel cells; styles glabrous, 5 mm long. July.

Steep, stony and rocky slopes. — Centr. Asia: Pam.-Al. (known only from a few points in S. Tadzhikistan). Endemic. Described from Kara-Tau Mountains in S. Tadzhikistan. Type lost (?).

Note. No herbarium specimens with flowers and fruit are available, nor have I seen the type specimen with its single flower. The present data on the flower are therefore copied from the original description. Needless to add, a revision is required.

3. C. olgae Rgl. et Schmalh. in Izv. Obshch. lyubit. estestvozn. antrop. i etnogr. XXXIV, 2 (1882) 55; O. and B. Fedch., Perech. rast. Turk. V, 28. — C. leiocalycinus V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3 (1935) 132, ex p. non Boiss.

Perennial; low-growing, dense divaricately branching spiny shrub forming rather large spiny cushions (to 70—80 cm across); perennial branches
14 gray-brown, sometimes with residual hairs; young branches very densely hairy, velutinous, bearing large spiny branchlets; leaves of various shapes with densely appressed hairs usually appearing sericeous, elliptic with cuneate base or ovate-triangular or oblong-triangular, at base hastate (but with obtuse auricles), rounded or truncate, petiolate; petioles 2—5 mm long. Flowers single, in axils of leaves; pedicels (20)30—45 mm long, downy, the median with 2 small caducous stipules; sepals broadly elliptic or obovate, 6—7 mm long, with scarious margin, glabrous or the median with sparse hairs; corolla 17—19 mm long, pale pink, with 5 bands of hairs on the outside; ovary glabrous; capsule glabrous, ca. 7—8 mm long, slightly flattened above; sepals horizontal in fruit. May—June.

Pebbly and stony slopes in lower mountain belt. — Centr. Asia: Pam. Al. (basin of Kashka Dar'ya River, Zeravshan valley). Endemic. Described from Zeravshan valley (Dashti-Kozy). Type in Leningrad.

4. C. gortschakovii Schrenk in Fisch. et Mey. Enum. Pl. a Schrenk lect. I (1841) 18; Ldb. Fl. Ross. III, 1, 88; O. and B. Fedch., Perech. rast. Turk. V (1916) 29; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 134; Kryl., Fl. Zap. Sib. IX, 2210. — Ic.: Schrenk. l. c.

Shrub or semishrub with dense divaricate branches, sometimes nearly pulviniform, 10—20 cm high; branches with more or less numerous, short, strong spiny branchlets diverging at right angle; branches, branchlets and leaves densely covered with appressed hairs, usually appearing silvery-sericeous; leaves oblanceolate, lanceolate or linear-lanceolate, gradually tapering at base, acute or obtuse above. Flowers on short (1—2 mm) pedicels, borne singly on short lateral branches often terminated by 2 small spines;

sepals with scattered hairs, often glabrous, short-ciliate above along margin, 8—12 mm long, unequal, the outer 2 broad, ovate-rounded, cordate at base, much wider than the inner; corolla 17—22 mm long, pink; capsule broadly elliptic, ca. 6 mm long, with sparse hairs at apex. May—June.

Sands, dry pebbly and stony slopes. — W. Siberia: Alt. (Irtysh River valley), possibly in Irt.; Centr. Asia: Balkh. (Ayaguz, Black Irtysh). Gen. distr.: Dzu.-Kash., Mong. Described from Ayaguz (north of Lake Balkhash). Type and cotype in Leningrad.

Note. Very close to C. fruticosus Pall. Available specimens are intermediate between these two species.

5. C. fruticosus Pall. Reise, II, Anchang (1773) 734; Ldb. Fl. Ross. III, I. 87; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 132; O. and B. Fedch., Perech. rast. Turk. V, 29; Kryl., Fl. Zap. Sib. IX, 2210. — C. spinosus L. fil. Sp. pl. Suppl. (1781) 137. — Ic.: Pall. l. c. tab. M.

Shrub; divaricately branching semishrub or shrub, to 40—50 cm high; branches usually long, directed upward, with more or less numerous branches of the second order at a right angle, the lower often long and branching, the upper simple, short, sturdy, spiny, rarely all branches rather short and plant compact, nearly pulviniform; branches, branchlets and leaves with dense appressed hairs, appearing sericeous; rarely leaves with more or less spreading hairs, subsessile, oblanceolate (rarely oblong-obovate) to sublinear, gradually tapering at base, acute or obtuse at apex. Flowers on (1)2—6 mm long pedicels, borne singly on short lateral branchlets usually terminated by 2 spines; sepals with dense appressed hairs, rarely more or less spreading, 6—10 mm long, very variable in shape, broadly ovate, ovate, elliptic or elliptic-oblong; corolla (15)17—26 mm long; capsule 5—7 mm long, pubescent. April—July.

Lowland and foothill deserts, less frequent in steppe zone, reaching mountains. On stony and pebbly slopes, pebbly lowlands, fixed sands. — W. Siberia: Irt. (possibly also in U. Tob.); Centr. Asia: Ar.-Casp., Balkh., Kyz. K., Kara K., Mtn. Turkm., Amu D., Syr D., reaches Pam.-Al. (Alai valley). Gen. distr.: Iran., Dzu.-Kash., Mong. Described from Irtysh River valley. Type in London.

6. C. tragacanthoides Turcz. in Bull. Soc. Nat. Mosc. V (1832) 201; Liou-Tchen-Ngo et Ling Yong. Fl. Illustr. Nord Chine, 1, 9. — C. spinifer M. Pop. in Tr. Turkest. Gos. univ. 4 (1922) 56; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 134. — C. fruticosus f. tianschanica Palib. in sched. herb. Acad. — Ic.: M. Pop. l. c. 65; Liou-Tchen-Ngo et Ling Yong, l. c. tab. I.

Shrub; low-growing spiny semishrub 4—10(15) cm high, densely branching, forming rather compact, rarely loose, trailing tuft-cushions; branchlets sturdy, spiny; leaves narrowly linear, rarely oblanceolate, 0.5—4(5—6) mm wide, gradually tapering at base, rounded above, like young branches covered with dense appressed hairs, silvery-sericeous. Flowers 2—5(6), rarely single at tips of branches, flower-bearing branches sometimes exceeding the others; pedicels 2—5 mm; sepals 5—7(8) mm long, elliptic or oblong-obovate, short-acuminate or rounded-truncate, with small mucro, like

16 pedicels with very dense semiappressed short hairs; corolla 15—25 mm long, pink, with 5 bands of dense hairs; capsule thin, hairy mainly above, ca. 4—6 mm long. May—June (July).

Foothills as well as mountains (at low elevations on dry pebbly and stony slopes). — Centr. Asia: Dzu-Tarb. (Dzungarian Ala-Tau), T. Sh. (NE), Syr D. (Fergana valley). Gen. distr.: N. Ch. Described from N. China, between Kyakhta and Wanchuan. Type in Leningrad.

Note. This polymorphic species has two forms, one with narrow, linear or oblanceolate-linear leaves, 0.5—2 mm wide, growing in the Fergana valley, and rarely reaching Tien Shan, described as Convolvulus spinifer M. Pop. The other form (var. oblanceolata G. Grig.) is distinguished by wider, 1.5—5(6) mm wide, oblanceolate or elongate-oblanceolate leaves and often more long-acuminate or mucronate sepals. It occurs in Tien Shan, Dzungarian Ala-Tau, and in the western part of Dzungaria and Kashgaria. Both forms occur in N. China.

Section 2. RIGIDIRAMEA V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3 (1935) 135. — Semishrubs with short woody shoots, or herbaceous perennials. Stems stiff, erect, long-branching, not spiny. Flowers single, rarely in groups of few. Ovary glabrous or pubescent.

7. **C. erinaceus** Ldb. in Eichwald, Pl. nov. casp.-cauc. (1831) 11; Ldb. Fl. Ross. III, 1, 88; O. and B. Fedch., Perech. rast. Turk. V, 29; Boiss. Fl. or IV, 87; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 135. — Ic.: Eichwald, l. c. tab. VII.

Shrub; semishrub 25—50 cm high, with short woody shoots and more or less abundant, profusely and divaricately branching, long, stiff (often more or less geniculately flexuose), herbaceous stems; branches and branchlets usually at a right angle; leaves mostly in lower part, often lacking in upper part of stem, narrow, linear, stiff, like stem more or less densely covered with short, appressed hairs. Flowers 1—3(5) on short lateral branches; sepals broad, obovate or oblong-obovate, rounded at apex, ca. 3—4 mm long, with dense appressed sericeous hairs and densely ciliate margins; corolla 5—8(9) mm long, white (?), with 5 densely hairy bands, on the outside, rather deeply 5-lobed, lobes wide; capsule ca. 4—5 mm long, more or less hairy above. May—July. (Plate I, Figure 3.)

Hilly sands and sandy plains. — Centr. Asia: Ar.-Casp., Kyz. K., Kara
17 K., reaching the Lake Balkhash area and Pam.-Al. (S.). Gen. distr.: Iran (N.). Described from the eastern coast of the Caspian Sea. Type in Leningrad.

Note. Both Petrov and Grossgeim report this species for eastern Transcaucasia, but these records require verification.

8. **C. subsericeus** Schrenk in Fisch. et Mey. Enum. pl. nov. I (1841) 19; Ldb. Fl. Ross. III, 1, 89; O. and B. Fedch., Perech. rast. Turk. V, 31; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 135. — C. neglectus Palib. in Russk. bot. zhurn. 3 (1915) 24.

Perennial; semishrub 20—50 cm high, with very short woody shoots or many stiff, divaricately long-branching herbaceous stems (branches always

turning forward at an acute angle) often grayish owing to more or less dense appressed hairs; leaves narrow, linear or lanceolate-linear, tapering at base, with more or less dense appressed hairs, caducous. Flowers single, rarely 2 on more or less spreading lateral branches; sepals elliptic, ovate or oblong-ovate, 5—7 mm long, short- or rather long-acuminate, with dense appressed- or semiappressed hairs; corolla white (or pale pink?), 12—16 mm long; capsule ca. 4—5 mm long, glabrous, with few hairs only above. June—July (August).

Sandy deserts, on hilly sands. — Centr. Asia: Balkh. (sands near Balkhash, Alakul', Muyunkum), reaching Pam.-Al. (sands to the south), and probably Kyz. K. Endemic. Described from near Lake Balkhash. Type in Leningrad.

9. **C. hamadae** (Vved.) V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3 (1935) 135. — C. subsericeus ssp. hamadae Vved. in Schedae ad Herb. Fl. As. Med. XII (1927) 32. — C. subsericeus auct. fl. As. Med. p. p. non Schrenk. — C. denudatus V. Petr. l. c. 135. — Exs.: HFAM, No. 290.

Perennial; stem 10—45 cm high, divaricately branching (branches and especially branchlets often diverging at a right or nearly at a right angle), with more or less dense short closely appressed, rarely more or less spreading hairs. Sepals elliptic or oblong-elliptic, acute or acutish, ca. 3—4 mm long, with more or less dense and rather long semiappressed hairs; corolla 8—11 mm long. Other characters as in C. subsericeus Schrenk. June—August (September).

Stony, pebbly and gravelly-sandy deserts. — Centr. Asia: Kyz. K., Kara K., Pam.-Al. (S. and SW). Gen. distr.: Iran. Described from the foothills of Kara Tau (N. Pam.-Al.). Cotype in Leningrad.

Note. Very close to C. subsericeus Schrenk, with which it is linked by intermediate forms.

18 **Economic importance.** A widespread species, essentially a pasture plant browsed mainly in fall and winter, very rarely in the summer.

10. **C. korolkovii** Rgl. et Schmalh. in Tr. Bot. Sada. VI, 2 (1880) 338; O. and B. Fedtsch., Perech. rast. Turk. V, 32; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 136. — C. turcomanicus (O. Ktze.) V. Petr. l. c. 136. — C. dorycnium var. turcomanicus O. Ktze. in Tr. Bot. Sada. X, 1 (1887) 221. — C. eremophilus Pauls. in Botanisk Tidskrift, 27, 2 (1906) 146, non Boiss.

Perennial; semishrub 15—50 cm high, with very short woody shoots and few or many rather thin, long, usually flexuose, divaricate, long branching herbaceous stems, like leaves with more or less dense short spreading (rarely appressed) pubescence; leaves oblong or linear, the upper sometimes oblong-lanceolate, often with curly margin, with acute tapering base. Flowers single, rarely 2—3, on short lateral branches; sepals (2)3—4.5 mm long, ovate, elliptic or oblong-elliptic, usually short-acuminate, glabrous, with sparse hairs or with more or less dense short pubescence; corolla 9—15 mm long, yellowish or pinkish white; capsule ca. 4—5 mm long, glabrous. May — June (rarely August — October).

Sandy deserts, on fixed sands and sandy plains. — Centr. Asia: Kyz. K., Kara K. Endemic. Described from the lower reaches of the Amu Darya. Type in Leningrad.

Note. The pubescence of the sepals varies widely, from glabrous to sparse or dense hairs. V. Petrov separated the form with glabrous sepals as C. turcomanicus (O. Ktze.) V. Petr. This is a mistake, if only because in the type of C. korolkovii Rgl. et Schmalh. the sepals are also subglabrous. Moreover, specimens with glabrous and more or less pubescent sepals occur throughout the distribution area of C. korolkovii.

Economic importance. A pasture plant eaten by cattle, and especially by sheep, mainly in fall and winter, very rarely in the summer.

11. C. divaricatus Rgl. et Schmalh. in Tr. Bot. Sada. VI. 2 (1880) 338; O. and B. Fedch., Perech. rast. Turk. V, 30; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 136. — Exs.: G. R. F. No. 1425; HFAM, No. 287.

Perennial; semishrub, with very short, sometimes hardly developed woody shoots and few or many stems, 20—60 cm high, divaricate, long-branching, often flexuose, like leaves with dense spreading hairs, herbaceous;
19 lower (sometimes only the lowermost) leaves linear-lanceolate or oblong; median and upper leaves ovate or subrounded, rarely ovate-lanceolate, sessile, usually acuminate, always rounded at base, sometimes very small. Flowers single, rarely 2—3 on short lateral branches; sepals (4)5—6 mm long, oblong-ovate or ovate-lanceolate, usually rather long-acuminate, rarely acute, spreading, densely villous; corolla (10)11—15 mm long, yellowish- or pink-white; capsule ca. 4—5 mm long, glabrous, sparingly pubescent only at apex. April—May (June).

Sandy deserts. — Centr. Asia: Kyz. K., Kara K., extending to the Lake Balkhash area and Pam.-Al. (S.). Endemic. Described from the lower reaches of the Amu Darya. Type in Leningrad.

Economic importance. A pasture plant eaten, mainly by sheep, in the fall and winter grazing period.

12. C. michelsonii V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3 (1935) 136. — C. korolkovii var. michelsonii V. Petr. l. c. 136.

Perennial; plant 50—60 cm high; stem and leaves with dense spreading villous hairs; leaves rather wide, ca. 5—6 mm, oblong or oblong-elliptic, tapering at base. Sepals 5—6 mm long, rather long-acuminate, densely villous. Otherwise like the preceding species. May—June.

Sandy deserts. — Centr. Asia: Kyz. K. (southern part). Endemic. Described from near the Asil'-Mambet pit in southern Kyzyl-Kum. Type in Leningrad.

Note. I have seen only two specimens of this species. Its status has not been proven; its characters are intermediate between C. divaricatus Rgl. et Schmalh. and C. korolkovii Rgl. et Schmalh.

13. C. krauseanus Rgl. et Schmalh. in Tr. Bot. Sada. VI, 2 (1880) 339; O. and B. Fedch., Perech. rast. Turk. V, 29; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 139.

Perennial; semishrub, 20—30 cm high, with short, thick, woody shoots; herbaceous stems more or less numerous, long and divaricately branching in lower part, thin, simple above, bearing 1—2(3) flowers, like leaves densely covered with appressed hairs, silvery-sericeous; leaves linear-subulate,

ca. 0.5 mm wide, canaliculate above. Flowers 1—2 at tips of stems, rarely 3 flowers on stem; sepals elliptic, short-acuminate or inner sepals short-mucronate, 6—7 mm long, with dense, almost appressed silvery hairs; corolla 17—23 mm long, white (or pale yellow?), with 5 bands of thick hairs; capsule hairy above. June—August (October).

20 Stony slopes. — Centr. Asia: Syr D. (apparently confined to the lower reaches of the Naryn River in the Fergana valley). Endemic. Described from near Tashkent. Type in Leningrad.

Note. According to the original description that the type was collected near Samarkand, but its label refers to the vicinity of Tashkent. Presumably neither is correct, as the species has never been collected at either locality. C. krauseanus seems to be confined to the lower reaches of the Naryn River.

14. C. pseudocantabrica Schrenk in Fisch. et Mey. Enum. pl. nov. I (1841) 21; Ldb. Fl. Ross. III, 1, 89; O. and B. Fedch., Perech. rast. Turk. V, 32, ex p.; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 141. — C. dianthoides Kar. et Kir. in Bull. Soc. Nat. Mosc. XIV (1841) 708. — C. pseudocantabrica ssp. dianthoides Vved. in Sched. ad Herb. Fl. As. Med. VII, 16. — Exs.: GRF No. 2779; HFAM, No. 154.

Perennial; plant 30—70 cm high, with thick tap-root; stems few, long-branching, covered with dense short tightly appressed hairs, thus usually appearing silvery gray or grayish; leaves narrowly linear, usually 0.5—2 mm (rarely to 3—4 mm) wide, rarely lower leaves wider, to 5—7 mm wide, oblong; all leaves glabrous above and beneath or with sparse appressed hairs. Flowers 1—2 at tips of stems and lateral branches or in small dichasial (rarely pleiochasial) inflorescences; sepals 4—6(7) mm long, obovate, oblong-elliptic, rarely nearly oblong, completely glabrous, coriaceous, rounded at apex, with small, often recurved mucro, rarely very short-acuminate; corolla red or bright pink, 15—23 mm long; capsule ellipsoid, 6—8 mm long, glabrous, half or more hidden in calyx. May—August.

Stony slopes in lower and middle mountain belt; in the northern part of the distribution area (Tarbagatai) in foothiils. — Centr. Asia: Dzu-Tarb., T. Sh., Pam.-Al. Gen. distr.: Dzu.-Kash. (Kuldja). Described from Dzu-Tarb. (Koksu River). Type in Leningrad.

15. C. ascabadensis Bornm. et Sint. ex Bornm. in Beih. Bot. Zentralbl. XX, 2, (1906) 181; O. and B. Fedch., Perech. rast. Turk. V, 32, ex p.; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 140. — C. pseudocantabrica ssp. ascabadensis Vved. in Sched. ad Herb. Fl. As. Med. VII, (1925) 16. — C. dorycnioides Bornm. et Sint. in Sched. ad exs.: Sint. Iter trans.-pers. 1900—1901. No. 1892.

Perennial; sepals 7—9(10) mm long, glabrous, oblong-elliptic or nearly oblong, rarely ovate-oblong, more or less long-acuminate; corolla (18) 20—26 mm long; capsule slightly protruding from calyx. Other characters as in preceding species. May—July.

21 Dry mountain slopes. — Centr. Asia: Mtn. Turkm. Gen. distr.: Iran. (N.). Described from Kopet Dagh. Cotype in Leningrad.

16. C. subhirsutus Rgl. et Schmalh. in Tr. Bot. Sada. VI, 2 (1880) 339; O. and B. Fedch., Perech. rast. Turk. V, 33; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 141. — Exs.: GRF, No. 1424; HFAM, No. 444.

Perennial; plant 60—100 cm high, with thick taproot and robust long and divaricately branching stems with appressed or more or less spreading hairs below, with dense appressed hairs above; leaves elliptic, oblong, oblong-lanceolate or linear-oblong, tapering at base, usually acute, with more or less dense or sparse long hairs. Flowers usually more or less numerous, single, in long, divaricately branching dichasial inflorescences; sepals oblong or oblong-obovate, 3—5.5 mm long, short-acuminate or mucronate, with more or less dense appressed hairs (the inner often pubescent along midrib only); corolla 10—23 mm long, red or bright pink; capsule ellipsoid or subglobose, ca. 5—7 mm long, glabrous, sepals in fruit deflexed or even reflexed. Fl. May—July, Fr. June—September.

One of the common and very typical plants of loess foothills. — Centr. Asia: T. SH., Amu D., Syr D., Pam.-Al., Mtn. Turkm. **Gen. distr.**: Iran. Described from W. Tien Shan. Type in Leningrad.

Note. The form described from W. Tien Shan by M. G. Popov and A. I. Vvedenskii (ad declivia saxoso-argillosa ad pedes montis Tschimgan Minoris 10 VII 1926 in Sched. ad Herb. Fl. As. Med. f. XII, 1927, 31) is known only from a few points near the locus classicus. It closely resembles C. subhirsutus and hardly appears to be a separate species. It differs from C. subhirsutus by thinner, comparatively fewer-leaved stems, longer (to 1.5—2 mm), always spreading hairs in the lower part of the stem, and some other minor characters.

Economic importance. The plant contains alkaloids and is officinal. It is of some value as pasture, being eaten by cattle.

Section 3. SOLUTORACEMOSA V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV (1935) 141. — Perennial herbs, with comparatively thin, erect or trailing, never spiny stems. Flowers in small, compact (dichasial) inflorescences, rarely single. Capsule glabrous or more or less pubescent.

22 17. C. cantabrica L. Sp. pl. (1753) 158; M. B. Fl. taur.-cauc. I; 147; Ldb. Fl. Ross. III, 1, 89; Boiss. Fl. or. IV, 95; Shmal'g., Fl. II, 245; Grossg., Fl. Kavk. III, 241; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV. 3, 141.; C. euxinus V. Petr. l. c. 142. — Exs.: Billot, Fl. Gall. et Germ. exs. No. 2318; Dörfler, Herb. norm. No. 5136; Todaro, Fl. Sicula, No. 627. — Ic.: Hegi, Ill. Fl. V, 3, f. 3057.

Perennial; stems 15—50 cm long, erect or ascending, branching, with more or less dense, thin, long-spreading or shorter appressed hairs, sometimes with both kinds of hairs present; leaves oblong-linear, oblong, oblanceolate or oblong-lanceolate, sparsely long-haired, the upper leaves cuneate at base, the lower gradually tapering. Flowers at tips of stems and rather long lateral branches, single, often few (2—4) in small, compact (sometimes subcapitate) dichasial inflorescences; sepals (5)6—9 mm long, with more or less dense long hairs, the outer oblong, obovate-oblong or subrhombic, more or less long-acuminate, the inner broadly elliptic or obovate, rounded above with long mucro; corolla (10)15—25 mm long, pink; capsule 4—7 mm long, shorter than sepals, globose-ovoid, pubescent above. May—July.

Steppes, gravelly slopes, pebbly river terraces, near roadsides, etc. — European part: Bes., Bl., Crim.; Caucasus: everywhere. Gen. distr.: W. and E. Med. (up to Centr. Eur.), Bal.-As. Min., Arm.-Kurd., Iran. Described from W. Mediterranean area. Type in London.

18. C. pilosellifolius Desr. in Lam. Encycl. III (1789) 551; Boiss. Fl. or. IV. 103; Palibin in Mat. Fl. Kavk. XXXVII, 31; Grossg., Fl. Kavk. III, 241. — C. sogdianus Bge. Reliq. Lehman. (1851) 395; O. and B. Fedch., Perech. rast. Turk. V, 34; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 143. — Exs.: HFAM, No. 443 (sub C. sogdiano Bge.).

Perennial; stem 50—130 cm long, rather thin, weak, often ascending, branching, with dense or sparse, thin, long, spreading hairs or short and tightly appressed hairs sometimes with both long, spreading and shorter appressed hairs; leaves ovate-lanceolate, lanceolate, elliptic, oblong or oblong-linear, more or less densely or sparsely hairy, upper leaves rounded or cuneate-rounded at base, the lower gradually tapering. Flowers on thin lateral branches single, often few, more or less crowded or remote, in small dichasial inflorescences; sepals 4—7(8) mm long, the outer oblong or oblong-
23 obovate, acute, herbaceous, green in upper part, the inner elliptic, acuminate, covered with dense long, spreading, rarely more or less appressed hairs; corolla (8) 10—16 mm long, pink; capsule glabrous, ca. 4—5 mm long, usually shorter than calyx. May—August (September).

Fallow land, crops (mostly irrigated), along irrigation ditches on foothills and riparian valleys. — Caucasus: E. and S. Transc., Tal. (?) Centr. Asia: Kyz. K., Kara K. (riparian valleys and irrigated land), Mtn. Turkm., Amu D., Syr D., Pam.-Al. (S. and SW). Gen. distr.: E. Med., Bal.-As. Min., Arm.-Kurd., Iran., Arabia. Described from E. Mediterranean area. Type in Paris.

Note. A weed sometimes very abundant among crops (cotton).

Section 4. INERMIA Boiss. em. V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3 (1935) 143. — Perennial herbs, rarely semishrubs, with erect, rarely trailing, never spiny stems. Leaves silvery-sericeous owing to dense appressed hairs. Flowers in compact, sometimes subcapitate inflorescences, rarely single. Capsule pubescent.

19. C. commutatus Boiss. Diagn. pl. nov. I, 11 (1849) 81; Fl. or. IV, 94; Palibin in Mat. Fl. Kavk. XXXVII, 21; Grossg., Fl. Kavk. III, 242.

Perennial; plant 12—25 cm high, with very shortly branching, woody taproot; stems few or many, erect or ascending at base, with short (rarely rather long) branches, like leaves covered with dense appressed-sericeous hairs, often (but not always) solitary or remote, spreading hairs; leaves linear-oblong or oblong or (particularly the lower) oblong-oblanceolate, tapering at base, acute. Flowers few, in compact, sometimes subcapitate, terminal inflorescences, rarely flowers solitary on lateral branches or in axils of leaves; sepals (8)9—14 mm long, covered with dense long spreading hairs, the outer elliptic or oblong-elliptic, long-acuminate, the inner elliptic,

rounded at apex, with long mucro, rarely acuminate; corolla 20—25(28) mm long, pink, with 5 dense bands of hairs; capsule pubescent (?). May—June.

Dry, pebbly and stony slopes. — Caucasus: S. Transc. Gen. distr.: Arm.-Kurd., Iran. Described from Iraq. Type in Geneva.

20. C. calverti Boiss. Diagn. pl. nov. II, 3 (1856) 124; Fl. or. IV, 94. p. p.: Grossg. Fl. Kavk. III, 242. — C. ruprechtii Boiss. Fl.
24 or. IV (1879) 96; Grossg. l. c. 242; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 143. — C. commutatus V. Petr. l. c. non Boiss. — Exs.: Herb. Fl. Cauc. No. 139, 385 (sub C. ruprechtii Boiss.)

Perennial; plant 5—20 cm high; stems simple or with short branches, without flowers (rarely with 1—2 flowers); flowers crowded at tips of stems; leaves oblong-obovate, oblong-elliptic or oblong or (mainly the lower) oblanceolate; sepals (5)6—9 mm long; corolla 10—15 cm long; in other characters similar to C. commutatus Boiss. May—June (July).

Dry, pebbly and stony slopes. — Caucasus: Dag., possibly S. Transc.; Centr. Asia: Mtn. Turkm. Gen. distr.: Arm.-Kurd., Iran. Described from Armenia. Type in Geneva.

21. C. sericocephalus Juz. in Bot. mat. Gerb. Bot. Inst. AN SSSR XII (1950) 219. — C. calverti β. elongata Kusn. in herb. — Exs.: Dörfler, Herb. Fl. No. 4563, p. p.

Perennial; plant 15—30 cm high, with short woody caudex bearing small tufts; herbaceous stems erect or ascending at base, simple or with 1—2(3—4) short branches, like leaves densely covered with appressed sericeous hairs, often together with scattered semiappressed or nearly spreading hairs; leaves long, linear or oblanceolate, gradually tapering at base, acute. Flowers few (rarely single) clustered in compact, sometimes subcapitate inflorescences at tips of stems and branches subtended by few rather long, linear leaves; bracts long, linear-subulate; sepals 8—13 mm long, with short dense appressed hairs, as well as scattered (in upper part of sepals sometimes more dense) semiappressed or spreading long hairs; outer sepals oblong-obovate or nearly oblong, very long-acuminate, inner sepals elliptic or obovate, rounded at apex, with long mucro, rarely acuminate; corolla 16—20 mm long, pink (or white ?). June.

Steppes. — European part: Crim. Endemic. Described from the Crimea. Type in Leningrad.

22. C. tauricus (Bornm.) Juz. in Bot. mat. Gerb. Bot. Inst. AN SSSR XII (1950) 214. — C. calverti β. tauricus Bornm. in Beih. Bot. Zentralbl. XX, 2 (1906) 181. — C. saxatilis M. B. Fl. taur.-cauc. I (1808) 146, non Vahl. — C. lanuginosus Ldb. Fl. Ross. III, 1 (1847—1849) 88, p. max. p. — C. calverti Schmalh. Fl. II (1897) 244, non Boiss. — C. triqueter V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3 (1935) 144, p. p. non Rehm. nec Vahl.

25 Perennial; plant (3)5—25 cm high, with short woody caudex bearing small tufts, with more or less numerous rosettes; flower-bearing stems few, erect or ascending, like leaves with dense appressed sericeous hairs, usually together with more or less dense and long spreading hairs, simple or with few short branches, often leafless or few-leaved; leaves linear or

oblanceolate-linear, 1—4.5(5) mm wide, acute or obtuse, gradually tapering at base. Flowers in dense capitate terminal inflorescences, subtended by more or less long leaves, rarely flowers single and if so flowers confined to short lateral branches or to axils of leaves; sepals (6)7—12 mm long, with more or less dense spreading long hairs, outer sepals elliptic or oblong, long-acuminate, inner sepals elliptic, rounded at apex, with long mucro, rarely long-acuminate; corolla (12)13—20 mm long, pink; capsule ca. 5—6 mm long, broadly ovoid or subglobose, more or less pubescent. May—June.

Limestone and chalky slopes, stony and rocky localities, rarely dry steppes in lower belt of Crimean yaila.— European part: Crim. Endemic. Described from the Crimea. Type in Leningrad.

Note. According to S. V. Yuzepchuk, this species vicariates with C. bracteosus Juz. (Bot. mat. Gerb. Bot. inst. AN SSSR, XII, 1950) in the upper belt of Crimean Yaila. The latter species is very close to C. tauricus Juz., from which it is mainly distinguished by the broader (2—8 mm wide), oblanceolate or subspatulate leaves and by some further minor characters. Its status is doubtful.

23. **C. holosericeus** M. B. Fl. taur.-cauc. I (1808) 147; Ldb. Fl. Ross. III, 1, 91; Boiss. Fl. or. IV, 95; Shmal'g., Fl. II, 244; Grossg., Fl. Kavk. III, 241; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 144.— Ic.: M. B. Cent. pl. rar. tab. 24.

Perennial; semishrub, with very short woody shoots; herbaceous stems 8—35 cm long, decumbent or ascending, like leaves with dense appressed sericeous hairs, often with reduced shoots in axils of leaves; leaves linear or oblanceolate-linear, rarely oblanceolate, gradually tapering at base, acute, rarely obtuse. Flowers 1—2 on short or rather long lateral branches, also single or small, dense, dichasial inflorescences of few flowers at tips of stems; sepals with dense appressed hairs, outer sepals (7)8—12 mm long, broadly elliptic or ovate, swollen-convex, more or less long-, rarely short-
26 acuminate, inner sepals shorter than outer, rounded, with rather long appendage; corolla (18)20—30 mm long, pale yellow (cream); capsule 4—6 mm long, shorter than calyx, ellipsoid, beaked, more or less pubescent. May—July.

Dry steppes, dry stony and gravelly slopes.— European part: Crim.; Caucasus: W. Transc. Gen. distr.: Bal.-As. Min., Arm.-Kurd., Iran. Described from the Crimea. Type in Leningrad.

Note. The flowers are cream-colored, not white as often indicated in the literature (including the first description in "Fl. taur.-cauc.").

24. **C. lineatus** L. Syst. ed. X (1759) 923; M. B. Fl. taur.-cauc. I, 146; Ldb. Fl. Ross. III, 1, 90; Shmal'g., Fl. II, 244; O. and B. Fedch., Perech. rast. Turk. V, 34; Grossg., Fl. Kavk. III, 242; Kryl., Fl. Zap. Sib. IX, 2212; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 145.— C. besseri Spreng. Syst. veg. I (1825) 610.— Exs.: HFAM, No. 289.

Perennial; rhizome branching; stems few, decumbent or ascending, 3—20(30—40) cm long, like leaves with dense appressed sericeous hairs; leaves elliptic, oblong, oblong-oblanceolate, rarely linear-oblong, (5)6—25 mm wide (only the upper sometimes narrower), acute, tapering at base, lower leaves rather long-petiolate. Flowers few, in dense inflorescences at tips

of stems and branches (usually shorter than leaves), rarely single; sepals 6—10 mm long with dense appressed sericeous hairs, outer sepals oblong or oblong-elliptic, often tapering and deflexed in upper part, inner sepals often broader, acuminate; corolla 15—25 mm long, bright pink; capsule ovate, more or less appressed-hairy. June—August.

Stony slopes and chalky outcrops, semideserts, steppes, dry meadows, often on heavily grazed sites, roadsides, waste land, etc. — European part: U. Dnp., M. D., V.-Don (southern part), Transv., Bes., Bl., Crim., L. Don, L. V.; Caucasus: everywhere; W. Siberia: Alt., U. Tob. (southern part); Centr. Asia: everywhere (rarely Kyz. K., Kara K.). **Gen. distr.:** E. and W. Med., Bal.-As. Min., Arm.-Kurd., Iran.; extending to Centr. Eur. Described from S. Europe. Type in London.

25. **C. ammanii** Descr. in Lam. Encycl. III (1789) 549; Ldb. Fl. Ross. III, 1, 90; Turcz. Fl. baic.-dah. II, 285; O. and B. Fedch., Perech. rast. Turk. V, 34; Kryl., Fl. Zap. Sib. IX, 2211; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 145.

Perennial; stems few or many, 2—10(15) cm long, decumbent or ascending, like leaves with dense appressed, rarely semi-appressed sericeous hairs;
27 leaves linear or linear oblanceolate, tapering at base, (0.5) 1—4(5) mm wide. Flowers single on long or short branches; sepals (3.5) 4—7 mm long, with dense appressed sericeous hairs, outer sepals oblong or oblong-elliptic, acute or slightly acuminate, inner sepals broader, elliptic, acuminate; corolla (8) 9—15 mm long, pale pink or whitish; capsule ca. 4—5 mm long, broadly ovate, beaked, sparingly pubescent above. (May) June—August.

Dry pebbly slopes, sands, steppes (sometimes solonetzic soil). — W. Siberia: Alt.; E. Siberia: Ang.-Say., Dau.; Centr. Asia: Dzu-Tarb. (N.), Balkh. (NW). **Gen. distr.:** Dzu.-Kash., Mong., N. Ch. Described from Siberia. Type in Paris.

Section 5. **PANNOSA** Boiss. Fl. or. IV (1879) 85; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 145. — Herbaceous perennials, with ascending, rarely decumbent, unarmed stems. Leaves and stems densely tomentose. Flowers single or few. Capsule glabrous.

26. **C. persicus** L. Sp. pl. (1753) 158; M. B. Fl. taur.-cauc. I, 148; Ldb. Fl. Ross. III, 1, 87; Boiss. Fl. or. IV, 99; Shmal'g., Fl. II, 244; O. and B. Fedch., Perech. rast. Turk. V, 34; Grossg., Fl. Kavk. III, 240; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 145; M. Il'in in Sb. pam. akad. Fomina (1938) 49. — Exs.: G. R. F. No. 519; Herb. Fl. Cauc. No. 97.

Perennial; stems 15—50 cm long, ascending, rarely erect, simple or long-branching (branches nearly at right angles), densely leafy, like leaves with very dense whitish or rufous tomentose pubescence; leaves elliptic, oblong-elliptic, rarely ovate, rounded at base, short-petiolate, apex, rounded, rarely acute. Flowers single, on short or rather long, more or less divergent axillary peduncles with 2 small bracts; sepals elliptic or broadly ovate, 10—15 mm long, with rounded or acute apex, densely tomentose; corolla white,

30—45 mm long, with 5 bands of hairs outside; capsule broadly ellipsoid or ovoid, ca. 10—12 mm long, when glabrous ripe. Fl. May—June. (Plate I, Figure 2.)

Sands along shores of Caspian and Black seas. — Caucasus: Dag., W., E. and S. Transc.; Centr. Asia: Ar.-Casp., Kara K. Gen. distr.: Bal.-As. Min. (southern and western shores of Black Sea), Iran. (southern shore of Caspian Sea). Described from southern shore of Caspian Sea. Type in London.

Section 6. VOLUBILIA Boiss. Fl. or. IV (1879) 85; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 146. — Perennial herbs with twining
28 stems. Leaves cordate or sagittate at base, like stems more or less pubescent. Flowers 1—2 in axils of peduncles or in dichasial inflorescences; capsule pubescent.

27. C. hirsutus Stev. in M. B. Fl. taur.-cauc. I (1808) 422; Ldb. Fl. Ross. III, 1, 92; Boiss. Fl. or. IV, 105; Shmal'g., Fl. II, 243; Grossg., Fl. Kavk. III, 240; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 146. — C. sagittifolius Sibth. et Sm. Fl. Graeca, I (1806—1809) 133, non Salisb. — C. sibthorpii Roehm. et Schult. Syst. veg. IV (1819) 295. — Ic.: M. B. Cent. pl. rar. tab. 6.

Perennial; stems to 1 m or longer, twining, rarely prostrate, long-branching, with more or less dense, long spreading hairs; leaves triangular, cordate, often cordate-sagittate at base, with broad, obtusely angular or short-lobed auricles, more or less pubescent, with rather long petioles. Flowers 1—3 on long, divergent, axillary, hairy peduncles; sepals 9—12 mm long, oblong or oblong-elliptic, acuminate, with long spreading hairs; corolla 30—40 mm long, white or light pink, with 5 bands of hairs; capsule broadly ellipsoid or subglobose, 6—10 mm long, shorter than calyx, more or less pubescent; seeds tuberculate. June—July. (Plate I, Figure 1.)

Gardens, vineyards, near settlements, etc. — European part: Crim.; Caucasus: Cisc. Gen. distr.: W. Med. (France), E. Med., Iraq, Bal.-As. Min. Described from the Crimea (Gurzuf). Type in Leningrad.

Section 7. SCANDENTIA Boiss. Fl. or. IV (1879) 85; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 146. — Herbaceous perennials with twining stems, rarely semishrubs with erect stems and short woody shoots. Leaves cordate, sagittate or hastate at base, like stems completely glabrous or more or less pubescent. Flowers disposed in 1—2 or in small dichasial inflorescences. Capsule glabrous.

28. C. pseudoscammonia C. Koch in Linnaea, XXII (1849) 746; Palibin in Mat. Fl. Kavk. XXXVII, 31; Grossg., Fl. Kavk. III, 241. — C. cappadocicus Hausskn. et Sint. ex Woronow in Vestn. Tifl. bot. sada, X (1908) 31. — Exs.: Woronow, Fl. cauc. exs. No. 271.

Perennial; semishrub, 40—70 cm high, with short woody shoots; herbaceous stems erect, rather thin, the divaricate long branches (with branches at right angle) glabrous like leaves; leaves short-petiolate, hastate or sagittate-hastate

at base, with rather long, narrow, entire, acute auricles; lower leaves tri-
29 angular or oblong-triangular, median and upper oblong-linear or linear, acute. Flowers 1(2) on long declinate lateral branches; sepals glabrous, 10—15 mm long, coriaceous-membranous with curly margin, elliptic, rounded apex, with small mucro or notched, sometimes unequal (the outer shorter than the inner); corolla 25—35 mm long, pale yellow, with short, broadly triangular lobes, glabrous (lacking bands of hairs common to many other species); capsule ovoid-conical, ca. 10 mm long, glabrous, short-beaked; sepals more or less declinate in fruit. Fl. May—July.

Stony slopes, among shrubs. — Possibly in the Caucasus (S. Transc.), since it grows in contiguous sections of Arm.-Kurd. (former Artvin District). Described from Armenia. Type in Berlin.

29. C. scammonia L. Sp. pl. (1753) 153; M. B. Fl. taur.-cauc. I, 145; Ldb. Fl. Ross. III, 1, 93; Boiss. Fl. or. IV, 108; Shmal'g., Fl. II, 243; Palibin in Mat. Fl. Kavk. XXXVII, 35; V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3, 146.

Perennial; stems long, rather thin and weak, twining, branching, like leaves completely glabrous; leaves with rather long petioles, hastate or sagittate-hastate base with broad, acutely toothed-lobate auricles, blade acute, often acuminate, broadly triangular or triangular-ovate, the upper often narrower, oblong or even sublinear. Flowers 2—6(7) in small dichasial inflorescences, on long axillary peduncles, rarely single; pedicels 6—12 mm long; sepals membranous, 8—11 mm long, elliptic or oblong-elliptic, often with curly margins, usually notched, with small mucro, glabrous, often outer shorter than the inner; corolla yellow, (20)25—40 mm long, glabrous or with inconspicuous bands of hairs at apex; capsule 6—9 mm long, broadly ovoid-conical, glabrous when ripe. June—August.

Forests and shrubby thickets, rarely open habitats. — European part: Crim. **Gen. distr.**: E. Med., Bal.-As. Min., Arm.-Kurd. Described from Syria, Media and Cappadocia. Type in London.

Economic importance. The root yields a yellow-brown resin, a laxative recognized in the Soviet pharmacopoeia.

30. C. arvensis L. Sp. pl. (1753) 153; M. B. Fl. taur.-cauc. I, 145; Ldb. Fl. Ross. III, 1, 91; Turcz. Fl. baic.-dah. II, 286; Boiss. Fl. or. IV, 108; Shmal'g., Fl. II, 243; O. and B. Fedch., Perech. rast. Turk. V. 35; Grossg., Fl. Kavk. III, 240; Kryl., Fl. Zap. Sib. 2212. — C. minor Gilib. Fl. lithuan. I (1781) 43. — C. arvensis var. sagittifolius Turcz. Fl. baic.-dah. II (1847) 288. — C. sagittifolius Fisch. Catal. horti Gorenk.
30 (1810) 28, nomen, non Salisb.; Kom., Fl. Man'chzh. III, 1, 302; Liou-Tchen-Ngo et Ling Yong, Fl. Illustr. Nord Chine, 1, 17; Grossg., Fl. Kavk. III, 240. — C. fischerianus V. Petr. in Byull. Mosk. obshch. isp. prir. XLIV, 3 (1935) 147; Kryl., Fl. Zap. Sib. IX, 2214. — Ic.: Hegi, III. Fl. V, 3, tab. 218; Sorn. rast. SSSR, III, Fig. 349, 350, 351; Liou-Tchen-Ngo et Ling Yong, l. c. tab. III and IV.

Perennial, sucker-forming plant; stems 20—100 (120) cm high, usually few, twining, rarely spreading, glabrous or with scattered thin hairs above; leaves petiolate, ovate-elliptic, elliptic, triangular, oblong or linear-oblong, hastate or sagittate-hastate at base, with broad entire or 1—2-toothed

auricles, rarely rounded-cordate, glabrous or with scattered short hairs. Flowers 1—2(3) on axillary peduncles usually longer than leaves; sepals 4—6 mm long, oblong or oblong-obovate, often notched or with small mucro, glabrous, sometimes with ciliate margin, rarely with some hairs on surface; corolla 15—26 mm long, pink, rarely white, glabrous or with bands of hairs in upper part; capsule smooth, globose-ovoid, ca. 6—7 mm long, produced to small beak above; seeds dark gray or brown, slightly tuberculate. (April) May—September.

Crops, fallow land, near roadsides, waste land, gardens, slopes without vegetation, etc. One of the most widespread weeds. — European part: everywhere, except for Kar.-Lap. and north of Dv.-Pech.; Caucasus: everywhere; W. Siberia: Ob (southern part), U. Tob., Irt., Alt.; E. Siberia: Ang.-Say., Dau.; Far East: Ze.-Bu., Uss., Sakh.; Centr. Asia: everywhere. **Gen. distr.**: widely spread almost all over the world. Described from Europe. Type in London.

Note. Komarov, Petrov, and others have distinguished the narrow-leaved form of C. arvensis as C. sagittifolius Fisch. or C. fischerianus V. Petr. Since one and the same specimen of C. arvensis L. may produce stems with broad as well as narrow leaves, depending on environment, this view is unfounded. Stronger illumination and dry soil are usually associated with narrow leaves; in the shade or in more favorable conditions, broad leaves develop.

33 A sucker-forming perennial with intense vegetative development. Although it is frequent as a weed among crops and seriously damages crops, it is a fair fodder plant, readily eaten by cattle.

Genus 1178. **CALYSTEGIA*** R. Br.

R. Br. Prodr. Fl. Nov. Holl. (1810) 483.— Volvulus Medik. Staatsw. Vorles. Phys.-Oek. Ges. I (1791) 202.

Flowers single in axils of leaves, on more or less long peduncles. Calyx subtended by 2 more or less appressed, large, leaf-shaped bracts; sepals 5, nearly equal; corolla infundibular-campanulate, with 5 very short, faintly defined lobes; stamens 5, filaments broadening in lower part; style 1, stigmas 2, elliptic or oblong-elliptic; ovary 1-locular or not quite 2-locular; capsule four-valved, four-seeded. Perennial herbs; usually with twining or spreading stems; leaves alternate, petiolate, simple.

To 10—12 species in all continents, particularly in the temperate-humid zones.

1. Leaves reniform or cordate-reniform, thickish (slightly fleshy). Filaments glabrous in lower part, without papilliform hairs. Plants of coastal areas . . . . . 1. C. soldanella (L.) R. Br.
\+ Leaves not as above. Filaments with papillae or papilliform hairs in lower part . . . . . 2.

* From the Greek kalyx — calyx; stego — to close, referring to the calyx enclosed in the bracts.

PLATE II. 1 — Calystegia soldanella (L.) R.Br.; 2 — C. pellita (Ldb.) G. Don.; 3 — C. silvestris (Willd.) Roem. et Schult.

2. Bracts almost vesicularly swollen, completely concealing calyx. Flowers large; corolla 5.5—8 cm long, white. Plants of forests and shrubby thickets, Crimea and Caucasus . . . . . 3. C. silvestris (Willd.) Roem. et Schult.

\+ Bracts not swollen. Flowers smaller; corolla to 6 cm long . . . . . 3.

3. Stems, often also leaves, with more or less dense hairs . . . . . 5. C. pellita (Ldb.) G. Don.

\+ Stems and leaves glabrous . . . . . 4.

4. Stems twining. Corolla (3.5)4—6 cm long, white or pink; bracts 1.5—2.5(3) cm long . . . . . 2. C. sepium (L.) R. Br.

\+ Stems prostrate, rarely twining or erect. Flowers smaller; corolla 2—3(3.5) cm long, pink; bracts 0.8—1.5 cm long . . . . . 4. C. hederacea Wall.

34 1. C. soldanella (L.) R. Br. Prodr. Fl. Nov. Holl. (1810) 483; Ldb. Fl. Ross. III, I, 93; Shmal'g., Fl. II, 243; Kom., Fl. Man'chzh. III, 1, 304; Liou-Tchen-Ngo et Ling Yong, Fl. Illustr. Nord Chine, 1; 19; Grossg., Fl. Kavk. III, 243. — Convolvulus soldanella L. Sp. pl. (1753) 159; M. B. Fl. taur.-cauc. I, 371. — Ic.: Hegi; III. Fl. V, 3, f. 3055; Liou-Tchen-Ngo et Ling Yong, l. c. tab. V.

Perennial with long, creeping, long-branching rhizome; stems long-branching, decumbent (never twining), like other parts of plant glabrous; leaves with rather long petioles (usually longer than blade), slightly fleshy, reniform or cordate-reniform, often notched, margin often slightly undulant-dentate. Peduncles long, usually longer than leaves; bracts broad, ovate or elliptic, slightly fleshy, 1—1.7 cm long, with rounded apex, hardly longer than or as long as sepals; sepals broad with rounded apex; corolla 3.5—5 cm long, pink-violet, with very short lobes; stamens much shorter than corolla, filaments broadening in lower part, glabrous (without papilliform hairs); capsule ellipsoid, glabrous. May—June. (Plate II, Figure 1.)

Confined to sand or coastal sand dunes. — European part: Crim.; Caucasus: W. Transc. Gen. distr.: Atl. Eur., Med., Bal.-As. Min., Iran. (southern shore of Caspian Sea), China, Japan, N. Am. (California), S. Am., Australia and New Zealand. Described from England. Type in London.

2. C. sepium (L.) R. Br. Prodr. Fl. Nov. Holl. (1810) 483; Ldb. Fl. Ross. III, 1, 94; Shmal'g., Fl. II, 242; Kom., Fl. Man'chzh. III, 1, 305; Liou-Tchen-Ngo et Ling Yong, Fl. Illustr. Nord Chine, 1, 29; Grossg., Fl. Kavk. III, 243; Kryl., Fl. Zap. Sib. IX, 2215. — Convolvulus sepium L. Sp. pl. (1753) 153; M. B. Fl. taur.-cauc. I, 145; Hegi, III. Fl. V, 3, 2081. — Ic.: Hegi, III. Fl. V, 3, f. 3052; Liou-Tchen-Ngo et Ling Yong, l. c. tab. X.

Perennial; with long-branching creeping rhizome; stems to 2—3 m long, weak, twining, like all other parts glabrous; leaves petiolate, broad, triangular or triangular-ovate, cordate or cordate-sagittate, with rounded, often angular or slightly lobate lower lobes, usually slightly acuminate, acute. Peduncles usually longer than leaves; bracts lanceolate, ovate or broadly ovate, cordate, acute, rarely obtuse or rounded, 1.5—2.5(3) cm long; sepals slightly shorter than bracts, ovate or ovate-lanceolate, acute; corolla (3.5)4—6 cm long, white or pink (var. rosea Choisy); stamens much

shorter than corolla, filaments broadening in lower part, bearing papilliform hairs; capsule ca. 1 cm long, globular with short beak. Fl. May—August.

35 Shores of rivers and lakes, along irrigation canals, mostly in thickets of trees, shrubs or grasses (reeds, for example), sometimes also in gardens, vineyards, fields. — European part: everywhere except for the north (Kar.-Lap., Dv.-Pech.); Caucasus: everywhere; W. Siberia: U. Tob., Irt., Alt.; E. Siberia: Dau; Far East: Ze.-Bu., Udda, Uss., Sakh.; Centr. Asia: everywhere. Gen. distr.: Scand. (southern part only), Centr. and Atl. Eur., Med. (west and east), Bal.-As. Min., Arm.-Kurd., Iran., Mong., Dzu.-Kash., rest of China, Japan, temperate zones of N. and S. Am., Australia, New Zealand. Earlier records from Java seem erroneous (see: Oostroom in Blumea (1939)). Described from W. Europe. Type in London.

Note. In the European part of the USSR, W. Siberia, the Caucasus and Central Asia, this species is represented by a white-flowered form, in E. Siberia and the Far East, in NE and SE China, by a pink form which some authors raise to specific rank, C. rosea Choisy (e.g., Komarov, Fl. Man'chzh. III); however, the pink-flowered C. sepium from E. Asia and W. Europe (Balkans — see Hayek, Prodr. Fl. Balc.) sometimes cultivated, as well as from N. America, which (except for the color of the corolla), indistinguishable from the white-flowered form, makes this seem doubtful.

According to Hegi (Ill. Fl. Mittel-Europ.) flowering is prolonged, with flowers developing gradually, not simultaneously as in C. silvestris.

3. C. **silvestris** (Willd.) Roem. et Schult. Syst. veget. IV (1819) 183; Ldb. Fl. Ross. III, 1, 93; Hayek, Prodr. Fl. Balc. 2, 41. — Convolvulus sylvestris Willd. Enum. Ber. (1809) 202. — C. sylvaticus Waldst. et Kit. Pl. rar. Hung. III (1812) 290. — Calystegia sylvatica (Waldst. et Kit.) Choisy in DC. Prodr. IX (1845) 433; Shmal'g., Fl. II, 243; Grossg., Fl. Kavk. III, 243. — Ic.: Waldst. et Kit. l. c. tab. 261.

Perennial; stems to 3 m and longer, weak, twining, like all other parts glabrous; leaves more or less long-petioled, broad, triangular or ovate-sagittate, usually slightly acuminate, acute, with rounded, obtusely angled or slightly notched-lobed lower lobes. Pedicels long, usually longer than petioles; bracts 1.5—2.5 cm long, broad, rounded-ovate, rounded or obtuse, rarely acute, much inflated, entirely hiding calyx; sepals shorter than bracts, ovate or oblong-ovate, obtuse, rarely acute; corolla large, 5.5—8 cm long, 5—6 cm across, white; stamens much shorter than corolla, filaments broaden-

36 ing in lower part and bearing papillae; capsule globular, with short beak. May—August. (Plate II, Figure 3.)

Forests (often edges), shrubby thickets, sometimes in gardens and parks. European part: Crim.; Caucasus: Dag. (?), Cisc., W. and E. Transc., Tal., probably reaching the L. Don area bordering on the Caucasus. Gen. distr.: Centr. Eur. (SE only), W. Med. (Italy, Sicily), Bal.-As. Min., Arm.-Kurd., Iran. (confined to southern coast of Caspian Sea). Described from Hungary. Type in Berlin.

Note. Deserves attention as an ornamental for its attractive, large, white flowers. According to Hegi all flowers on a plant develop simultaneously (III. Fl. Mittel-Europ.).

4. **C. hederacea** Wall. in Roxb. Fl. Ind. II(1824) 94; Kom., Fl. Man'chzh. III, 1, 303; Kryl., Fl. Zap. Sib. IX, 2218; Liou-Tchen-Ngo et Ling Yong, Fl. Illustr. Nord Chine, 1, 25. — Convolvulus acetosaefolius Turcz. in Bull. Soc. Nat. Mosc. 1 (1840) 73. — Calystegia acetosaefolia Turcz. Fl. baic.-dah. II, 2 (1856) 289. — Ic.: Liou-Tchen-Ngo et Ling Yong, l. c. tab. VIII.

Perennial; stems (5)10—60(100) cm long, rather thin, weak, usually prostrate, rarely twining or (as in low-growing specimens) erect, glabrous like all parts; leaves long-petiolate, the lower ovate or oblong-ovate, rounded at apex, at base rounded, often cordate; median and upper leaves hastate, with larger, triangular, rarely nearly oblong, usually acute median lobe and 2—3-lobed or large-toothed lateral lobes (lobes or teeth usually acute); in low-growing specimens stems erect (f. vernalis Kryl.); often only lower leaves develop. Peduncles usually longer than, rarely as long as leaves; bracts ovate or oblong-ovate, 8—15 mm long, acute or obtuse, their back keeled in lower part, usually longer than calyx; corolla pink, 20—30(35) mm long, and almost as wide; stamens much shorter than corolla, lower part of filaments often broadening, papillate; capsule ca. 1 cm long, glabrous. June—September.

Plowed fields, fallow land, particularly in sandy soils, along riverbanks, slopes in localities without turf. — W. Siberia: Alt. (rare); Far East: Uss.; Centr. Asia: Syr D. (only record — Kosaral Lake, O. Fedchenko). Gen. distr.: Mong., Dzu.-Kash. (rare), rest of China, Japan, northern part of Ind.-Him., Afghanistan, Abyssinia (?), Malay Peninsula (introduced?). Described from Malay Peninsula. Type in London.

5. **C. pellita** (Ldb.) G. Don, Gen. Syst. IV (1838) 296; Ldb. Fl. Ross. III, 1, 95; Korshinsky in Mél. Biolog. Acad. Sc. St. Pétersb. XIII, 506;
37 Liou-Tchen-Ngo et Ling Yong, Fl. Illustr. Nord Chine, 1, 23; Kryl., Fl. Zap. Sib. IX, 2217. — Convolvulus pellitus Ldb. Fl. alt. I (1829) 223. — Calystegia dahurica var. pellita Choisy in DC. Prodr. IX (1845) 433. — C. dahurica Turcz. Fl. baic.-dah. II (1847) 287; Kom., Fl. Man'chzh. III, 1, 304. — Ic.: Ldb. Ic. pl. Fl. Ross. III t° 206; Liou-Tchen-Ngo et Ling Yong, l. c. tab. VI, VII.

Perennial, with long branching rhizome; stems 40—80(100) cm high, more or less branching, erect or ascending in lower part, in upper part twining, with dense hairs, sometimes glabrous only at base; leaves with short petioles (ca. 5—6 mm long), oblong or broadly lanceolate, acute or rounded, base truncate or slightly cordate, often with small triangular auricles, usually (mainly along nerves) more or less hairy. Peduncles nearly as long as leaves or slightly shorter; bracts ovate or oblong-ovate, obtuse or acute, 1.5—2 cm long, longer than sepals, like peduncles more or less hairy; sepals ovate-lanceolate, with subglabrous or hairy apex; corolla pink, ca. 4—6 cm long; filaments with papilliform hairs in lower part; capsule ca. 1 cm long, with short beak. July—August (September). (Plate II, Figure 2.)

Dry, herbaceous slopes, meadows, shrubby thickets, fallow land, sometimes among crops. — W. Siberia: Alt.; E. Siberia: Ang.-Say., Dau.; Far East: Ze. Bu., Uss. Gen. distr.: Mong., Ch.-Jap. Described from the area of Irkutsk. Type in Leningrad.

Note. Within the distribution area of this species C. pellita × C. sepium hybrids are frequent. These show the entire range of transitions between the parent species. Some of them are cultivated as distinct species (C. subvolubilis Ldb. — see: Kryl., Fl. Zap. Sib. IX, 2217), but as has been shown by Korzhinskii (l. c.), they are not species at all.

Family CXXXV. **CUSCUTACEAE*** CHOISY

Calyx usually 5-, rarely 4-lobed, subglobular, campanulate or tubular, nearly entire or more or less deeply parted, membranous or fleshy, pale or more or less colored, smooth, sometimes finely tuberculate. Corolla usually 5-, rarely 4-lobed, gamopetalous, tubular, campanulate or urn-shaped, pale or colored, persistent in fruit or deciduous, smooth or with fine tubercles, its lobes triangular, triangular-ovate to subrounded, entire or crenate, erect, curved or more or less spreading, obtuse or acu-
38 minate. Stamens as many as corolla lobes inserted between them; filaments linear or subulate, sometimes obsolete; anthers nearly oval, ovate, cordate or subglobular, obtuse or acuminate, pale or colored; under each stamen there are scales of different shapes as long as corolla tube; these reach bases of stamens or are shorter and are free from base or else more or less adnate to tube, appressed or curved inward, with dentate apex and velutinous or ciliate margins. Ovary superior, free, 2-locular, usually with 2 ovules per locule, globular or flattened-globular, with 2 or (through fusion), 1 style and conical subulate or ovoid capitate stigmas. Fruit a capsule, usually globose or flattened-globose, membranous or bacciform, opening by basal transverse annular slit or else opening longitudinally. Annual, rarely overwintering, leafless, parasite, its thread-like, twining stems attaching themselves to the plant by haustoria.

One genus.

Genus 1179. **CUSCUTA**** L.

L. Sp. pl. (1753) 124; Engelm. in Transact.Acad.Sc.St.-Louis, I, 3 (1859) 453; Yuncker in Mem. Torr. Bot. Club, 18, 2 (1932) 121.

The morphology of the genus agrees with the description of the family.

Note. Cuscuta is a well known parasite of many field, truck and garden plants to which it causes heavy losses in quantity and quality of the harvest (extensively described in the literature). According to M. I. Ulashkevich (1931) the sugar content in sugar beet, attacked at an early stage by C. campestris Yunck., was reduced by 2.66%. A. D. Arkhipova (1940) and I. I. Smirnova (1941) observed a reduction by 20—30% in the output of hemp infected by C. epilinum Weiche, and a 70% reduction in seed yield. Lucerne infected by C. approximata Bab., near Tashkent,

* Treatment by A.Ya. Butkov.

** From the Arabic kechout.

yielded about half the normal crop in the second and third cutting. Infected
39 lucerne usually gives a sparse stand, presumably as a result of the winter killing a part of the plants. Fruit trees attacked by Cuscuta soon die off or produce poor harvests of fruits which are smaller, lighter and of rather poor taste. According to P. P. Arkhangel'skii (1940) vineyards are destroyed by C. lehmanniana Bge. There have also been reports of farm animals being poisoned by dodder. Therefore Cuscuta thus comprises some of the most harmful and dangerous of weeds. In the USSR all these species are included in the list of quarantine items.

Cuscuta reproduces mainly by seeds, but also through fragments of stems which may attach themselves to the host plants. It produces large numbers of seeds (to 2,500 in C. epilinum, to 30,000 in C. lehmanniana, and to 15,500 in one plant of C. campestris), which remain viable for several years. They are mainly dispersed together with those of poorly cleaned cultivated plants, but also by animals, as well as by water and manure. Gontaev estimates that after one month 8% of the seeds obtained from fresh manure are viable. Measures to control the parasite include: 1) control and careful cleaning of seeds, 2) skim ploughing, presowing and fallow, 3) shallow ploughing, 4) regular crop rotations including grass and fallow, 5) mechanical and chemical destruction of foci of dodder in fields and gardens and along edges of fields.

1. Ovary (capsule) with 2 styles . . . . . 2.
\+ Style 1 . . . . . 25.
2. Stigmas elongate, subulate or slightly thickened . . . . . 3.
\+ Stigmas capitate . . . . . 19.
3. Stigmas sessile on styles, nearly as long as distinct styles or longer; total length equal to ovary or shorter . . . . . 4.
\+ Stigmas shorter than ovary, sessile or subsessile, subulate . . . . . 16.
4. Calyx nearly entire, with very broad obtuse lobes. Flowers on thin, pink or reddish peduncles as long as or slightly longer than flowers, in umbelliform inflorescences (Centr. Asian plant) . . . . . 1. C. babylonica Auch.
40 \+ Calyx cleft more or less deeply (to middle or deeper) . . . . . 5.
5. Flowers very small, to 1.6 mm long; lobes of corolla with hornlike apical outgrowths . . . . . 2. C. alba Presl.
\+ Flowers larger, to 2 mm long; lobes of corolla without hornlike outgrowths . . . . . 6.
6. Styles and stigmas longer than ovary . . . . . 7.
\+ Styles and stigmas shorter than ovary or nearly as long . . . . . 11.
7. Stems dark red. Flowers pink, in loose, few-flowered (5—8) glomerules (Pamir plant) . . . . . 7. C. callinema Butk.
\+ Stems pale or slightly colored. Flowers white or slightly pink, in many-flowered, denser glomerules . . . . . 8.
8. Flowers sessile; lobes of calyx broadly elliptic, sometimes subrhombic; scales in corolla tube more or less 2-partite . . . . . 9.
\+ Flowers short-pediceled; lobes of calyx ovate, scales entire . . . . . 10.
9. Lobes of calyx very broad, deeply imbricate, abruptly passing into short fleshy point; scales in corolla tube large, slightly notched, curved inward. Inflorescences dense, globose. . 5. C. cupulata Engelm.

\+ Lobes of calyx narrower, not deeply overlapping, without fleshy tip, with distinctly keeled back; scales smaller, distinctly 2-partite. Flowers in looser globose inflorescences. On lucerne . . . . . 6. C. approximata Babingt.

10. Flowers white, large, 4—5 mm long, with thin, nearly transparent lobes, distinctly pediceled, in many-flowered, loose, globose glomerules ca. 1 cm across; calyx shorter than corolla tube . . . . . 4. C. trifolii Babingt.

\+ Flowers pink-white, to 3 mm long, very short-pediceled, 8—12 (16) in dense glomerules 0.5—0.7 mm across; calyx nearly as long as corolla . . . . . 3. C. epithymum Murr.

11. Calyx cleft nearly to base into free lobes with slightly thickened apex, like corolla lobes thin, transparent, the latter curved inward at apex . . . . . 9. C. indica (Engelm.) Petr.

\+ Calyx usually cleft to middle, if deeper then lobes overlapping, like corolla lobes fleshier, not transparent; corolla lobes recurved or spreading . . . . . 12.

12. Calyx and corolla smooth outside . . . . . 13.

\+ Calyx and corolla finely tuberculate outside . . . . . 14.

13. Flowers pink or pink-white. Styles and stigmas filiform, slightly
41 shorter than ovary; corolla distinctly exceeding calyx, its tube funnelshaped, scales small, not extending beyond middle of tube, slightly fimbriate. Stems strongly branching, red or reddish . . . . 10. C. europaea L.

\+ Flowers yellowish white. Styles and stigmas much shorter than ovary; corolla nearly as long as or somewhat longer than calyx, corolla tube urceolate, scales large, broad, long-fimbriate. Stems slightly branching, usually greenish yellow. On flax. . . . . 11. C. epilinum Weiche.

14. Flowers short-pediceled, white, in loose, few-flowered glomerules, white; lobes of calyx broadly triangular; stigmas yellowish, subulate (Fergana valley). . . . . 8. C. ferganensis Butk.

\+ Flowers sessile, in dense glomerules; calyx lobes ovate-rhombic, overlapping; stigmas violet . . . . . 15.

15. Lobes of corolla spreading, acute, often with thickened apex. Scales in corolla tube truncate or more or less rounded . . . . . 12. C. brevistyla H. Bt.

\+ Lobes of corolla erect, obtuse, curved inward at apex. Scales in corolla tube distinctly 2-partite . . . . . 13. C. araratica Butk.

16. Flowers very small, to 2 mm long, clustered in umbelliform inflorescences. Calyx with 4—5 obtuse lobes . . 14. C. pedicellata Ldb.

\+ Flowers large, 3—5 mm long, in rather dense or loose glomerules; calyx with 4—5 or 5 acute or acuminate lobes . . . . . 17.

17. Calyx deeply cleft, its lobes narrowly triangular, acute; corolla deep pink. Stems purple . . . . . 17. C. stenocalycina Palib.

\+ Calyx cleft to half or slightly deeper, its lobes broadly triangular; corolla white or pink; stems pink . . . . . 18.

18. Flowers in loose glomerules. Calyx smooth, its lobes acute, recurved at apex. Corolla lobes acuminate, erect or slightly recurved at apex . . . . . 15. C. kotschyana Boiss.

+ Flowers in rather dense glomerules. Calyx angled, its lobes acuminate, erect. Corolla lobes broadly triangular, acuminate, spreading . . . . . 16. C. stapfiana Palib.

19. Calyx angled, its lobes with acutely decurrent keels . . . . . 18. C. chinensis Lam.

42 + Calyx lobes smooth without sharply protruding keels . . . . . 20.

20. Scales in corolla tube very small, usually shorter than tube, sometimes reduced to small lateral teeth. Stems usually orange-yellow. Capsule large, flattened-globose, with deep broad pit between styles, indehiscent or dehiscing by irregular transverse suture . . . . . 19. C. australis R. Br.

+ Scales in corolla tube large, as long as tube; color of stems different . . . . . 21.

21. Flowers usually large, 4—5 mm long; corolla tube not more than twice as long as calyx . . . . . 22.

+ Flowers smaller, 2—3 mm long; corolla tube slightly exceeding calyx or nearly as long . . . . . 23.

22. Corolla tube nearly three times as long as calyx, its lobes oval-triangular, acuminate, curved inward; capsule subglobose; inflorescences racemiform . . . . . 23. C. suaveolens Ser.

+ Corolla tube nearly twice as long as calyx, its lobes ovate, obtuse, curved outward; capsule globose-conical . . . . 24. C. gronovii Willd.

23. Stems purple; calyx pink; corolla dingy purple . . . . . 22. C. karatavica Pavl.

+ Stems yellow or pink-yellow. . . . . 24.

24. Calyx lobes orbicular-ovate, obtuse. . . . 20. C. campestris Yuncker.

+ Calyx lobes acute. . . . . 21. C. basarabica Buia.

25. Stigmas capitate, spherical, oval or cylindrical-oval, on distinct styles, as long as the latter or shorter. . . . . 26.

+ Stigmas conical, sessile or subsessile, sometimes on distinct styles (C. g i g a n t e a Griff.) but then always more or less longer than styles; flowers large, to 8—10 mm long . . . . . 34.

26. Stigmas by concrescence entire, notched or more or less 2-partite, always connate at base . . . . . 27.

+ Stigmas not as above, free . . . . . 33.

27. Stigmas as long as or nearly as long as styles . . . . . 28.

+ Stigmas $\frac{1}{2}$ to $\frac{1}{3}$ length of styles . . . . . 32.

28. Flowers to 4—5 mm long; corolla $1\frac{1}{2}$ to 2 times as long as calyx . 29.

+ Flowers large, usually 6—7 mm long; corolla $2\frac{1}{2}$ to 3 times as long as calyx . . . . . 31.

29. Calyx lobes fleshy, smooth or more or less tuberculate on the
43 outside, without discernible glandular appendages . . . . . 25. C. monogyna Vahl.

+ Calyx lobes markedly thickened at back, with distinct glandular appendages . . . . . 30.

30. Calyx lobes with pectinate appendages on the outside . . . . . 26. C. lophosepala Butk.

+ Calyx lobes with callous appendages on the outside . . . . . 27. C. tianschanica Palib.

31. Calyx lobes smooth, keeled . . . . . 28. C. lehmanniana Bge.
+ Calyx lobes markedly thickened on the outside, with pectinate or tuberculate glandular appendages . . . . . 29. C. bucharica Palib.
32. Corolla twice as long as calyx, cylindrical, with erect or slightly curved lobes $\frac{1}{2}$ to $\frac{2}{5}$ length of tube . . . 30. C. lupuliformis Krocker.
+ Corolla 3—4 times as long as calyx, slightly swollen about middle, slightly tapering at apex with inward curved lobes $\frac{1}{6}$ to $\frac{1}{7}$ length of tube . . . . . 31. C. engelmanni Korsh.
33. Flowers sessile or subsessile; stigmas more or less spherical . . . . . 32. C. japonica Choisy.
+ Flowers more or less distinctly pediceled; stigmas oval . . . . . 33. C. colorans Maxim.
34. Flowers large, to 10 mm long; styles hardly as long as stigma . . . . . 34. C. gigantea Griff.
+ Flowers not more than 7 mm long; styles half length of stigma or hardly distinguishable . . . . . 35.
35. Corolla cylindrical; styles of ovaries distinct, half length of stigma . . . . . 35. C. pamirica Butk.
+ Corolla broadly campanulate; styles of ovaries indistinct and thus stigma apparently sessile . . . . . 36. C. convalariiflora Pavl.

Subgenus 1. **Cuscuta** Engelm. in Transact. Acad. Sc. St.-Louis, I, 3 (1859) 459. — Styles 2, stigmas elongate.

Section 1. EUCUSCUTA Engelm. l. c. 460. — Styles nearly as long as or longer than, as thick as or thicker than filiform stigma; capsule dehiscing regularly by circular split.

1. **C. babylonica** Auch. ex Choisy in Mém. Soc. phys. et hist. nat. Gen. (1841—42) 270; Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 461 (excl. var.); Boiss. Fl. or. IV, 118; Palibin in Russk. bot. zhurn. 3, 25; Yuncker in Mem. Torr. Bot. Club, 18, 2, 273, excl. var.— Ic.: Choisy, l. c. tab. I, f. 1; Yuncker, l. c. f. 142.

44 Annual; stems filiform, to 1 mm thick, branching, yellowish or reddish, glabrous, smooth. Flowers ca. 3 mm long, white, on thin, pink or reddish pedicels as long as or slightly longer than flowers, the flowers in more or less many-flowered (to 15) loose umbelliform inflorescences, subtended by small ovate acuminate entire colored bracteole; calyx semispherical-campanulate, ca. 1.5mm long, half as long as corolla, nearly entire, with very broad obtuse lobes; corolla campanulate, finely tuberculate outside, cleft nearly to middle, its lobes ovate, obtuse or slightly acuminate, erect or slightly declinate; stamens inserted in notches between corolla lobes; their anthers large, ovate-cordate, slightly longer than the thin, nearly transparent filaments, scales as long as corolla tube, free to middle, oblong-ovate, with entire margin, only apex more or less crenate, curved inward; ovary nearly globose, smooth, styles very short with elongate-conical stigmas; styles and stigmas much longer than ovaries; capsule flattened-globose, ca. 2 mm across, thin-walled, 3—4-seeded, with persistent

corolla; seeds irregularly ovoid, ca. 0.7—0.8 mm long, yellowish brown, scabrous. Fl. June—July, Fr. August—October.

This species is parasitic mainly on perennial herbs and semi-shrubs in dry deserts, sometimes it is observed on lucerne and cotton and on mulberry in nurseries (it has been reported on Alhagi, Lagonychium farctum, Morus alba, and Medicago sativa). — Centr. Asia: Mtn. Turk., Kara K., Syr D., Pam.-Al. Gen. distr.: Iran. Described from Iraq. Type in Paris.

2. **C. alba** Presl, Del. Prag. (1822) 87. — C. epithymum var. alba Engelm. in Transact. Acad. Sc. St.-Louis, I, 3 (1859) 463. — C. epithymum var. kotschyi Palib. in Mat. Fl. Kavk. IV, 2 (1912) 49, p. p. non Engelm. — C. epithymum alba (Presl) Trabut in Bull. Soc. bot. France, XXXVII (1907) 53; Yuncker in Mem. Torr. Bot. Club, 18, 2, 285 p. p.

Annual; stems thin, filiform or subcapilliform, yellowish green or reddish, branching, glabrous, smooth. Flowers 1.5—1.6 mm long, 5—7 in small globose glomerules to 0.5—0.6 mm across, sessile, white; calyx 1.2—1.5 mm long, membranous, cleft nearly to base into broadly ovate or rhombic-ovate acuminate lobes; corolla urceolate, ca. 1.5 mm long, slightly exceeding calyx, with elliptic, nearly acuminate, sometimes hood-shaped lobes erect or slightly turned inward terminated by divaricate, horn-like appendages; anthers rounded-cordate; filaments thin, cuneate; scales nearly as long as tube of corolla, broadly elliptic, more or less
45 2-partite, fimbriate; ovary subglobose, with 2 styles and filiform, colored stigmas nearly as long as styles; styles and stigmas nearly as long as ovary; capsule subglobose, 1.2—1.8 mm across, membranous, dehiscing by narrow, slitlike openings between persistent styles; seeds ellipsoid, ca. 0.8 mm long, 0.5 mm wide, scabrous. Fl. June, Fr. July—August.

Mainly parasitic on herbaceous perennials, mostly Labiatae on chalky and limestone mountain slopes. — European part: L. Don, L. V., Crim. Gen. distr.: Med., Bal.-As. Min. Described from Italy. Cotype in Leningrad.

3. **C. epithymum** Murr. in L. Syst. veg. ed. XIII (1774) 140; Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 461 p. p.; Boiss. Fl. or. IV, 115, p. p.; Shmal'g., Fl. II, 245, excl. var. β.; Palibin in Mat. Fl. Kavk. IV, 2, 45, p. p.; Szaf., Kulcz., Pawl. Rosl. Polsk. 472; Ganeshin in Tr. po prikl. bot. XVIII, 1, 296, p. p.; Grossg., Fl. Kavk. III, 239; Koroleva, Poviliki SSSR, 394, p. p.; Yuncker in Mem. Torr. Bot. Club, 18, 2, 283, p. p.; Koroleva in Sorn. rast. SSSR, III, 386, p. p.; Kryl., Fl. Zap. Sib. IX, 2221; V. Petrov in Fl. Yugo-Vost. VI, 61; Buia in Bull. Fac. Agronom. Cluj, VII, 93. — Ic.: Ganeshin, op. cit., Figure 1; Fedch. and Fler., Fl. Evrop. Rossii, Figure 656; Buia, l. c. f. 95. — Exs.: G. R. F. No. 1586.

Annual; stems thin, filiform, 0.3—0.5(1) mm thick, yellow or slightly reddish, glabrous, smooth, branching. Flowers small, 2—3 mm long, very short-pediceled, 8—12(16) in dense globose glomerules 0.5—0.7 cm across; calyx 1.5—2 mm long, more or less fleshy, nearly campanulate, cleft to middle or beyond into broadly ovate, acuminate lobes thickened abaxially; corolla to 3 mm long, hardly exceeding calyx, pink-white, its lobes

ovate-triangular, acuminate, with distinctly thickened tip, nearly as long as tube, spreading; scales slightly shorter than corolla tube, elongate-lanceolate, fimbriate, free to base, concave; anthers yellow or yellowish-green, ca. 0.5 mm long, ovoid-oblong, free nearly to middle; ovary subglobose or flattened-globose, with 2 styles and red filiform stigmas; styles and stigmas nearly 2—2½ times as long as ovary; capsule membranous, flattened-globose, tetrahedral, ca. 2 mm across; seeds very small, ca. 1 mm long, 0.8 mm wide, scabrous, light- to dark-brown. Fl. June—July, Fr. July—August.

A parasite of wild perennial and annual herbs, rarely on shrubs, sometimes in fields of leguminous crop plants (clover, lucerne, etc.). — European
46 part: Dv.-Pech., Balt., Lad.-Ilm., V.-Kama, U. Dnp., M. D., V.-Don, L. Don, Bl., U. Dnp., Bes., L. V.; Caucasus: Cisc., W., S. and E. Transc.; W. Siberia: U. Tob., Irt., Alt.; Centr. Asia: Ar.-Casp., Balkh. Gen. distr.: Scand., Centr. and Atl. Eur., Med., Bal.-As. Min., Arm.-Kurd., Dzu.-Kash. Introduced into N. Am. Described from W. Europe. Type in London.

4. **C. trifolii** Babingt. in Ann. a. Mag. Nat. Hist. XIII (1844) 252; Palibin in Mat. Fl. Kavk. IV, 2, 50; Szaf., Kulcz. Pawl. Rosl. Polsk. 472; Grossg., Fl. Kavk. III, 239; Buia in Bull. Fac. Agronom. Cluj, VII, 100. — C. epithymum Yuncker in Mem. Torr. Bot. Club, 18, 2, 151 p. p.— C. epithymum var. vulgaris Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 461, p. p.; Ganeshin in Tr. po prikl. bot. XVIII, 1, 281, p. p.; Koroleva, Poviliki SSSR, 17 p. p. — C. epithymum var. trifolii Babingt. Mon. Br. Bot., 302; Shmal'g., Fl. II, 246; Syreishch., Ill. fl. Mosk. gub. IV, 138. — C. epithymum ssp. trifolii (Babingt. et Gibs.) Hegi, III, Fl. V, 3, 2096. — Ic.: Babingt. in Ann. a. Mag. Nat. Hist. XVI, tab. 1, f. 3; Hegi, l. c. f. 3066; Buia, l. c. tab. XXXIV, XXXV, XXXVI.

Annual; stems filiform, to 1 mm across, branching, glabrous, smooth. Flowers to 5 mm long, in loose globose glomerules 8—12 mm across, pedicels distinct, (1)2(3) mm; calyx broadly campanulate, ca. 2 mm long, shorter than corolla tube, membranous, cleft for ¾ to broad, ovate, thin, transparent, acuminate (var. macranthera Buia) sometimes obtuse (var. muresensis Buia) lobes; corolla cylindrical or nearly campanulate, to 4 mm long, with triangular-ovate, acuminate or obtuse, thin, transparent, more or less declinate, rarely erect lobes half length of or nearly as long as corolla tube; scales nearly as long as or slightly shorter than corolla tube, elliptic, free to base, with fimbriate margin; anthers ovoid or broadly ovoid, sometimes free nearly to middle; ovary subglobose, ca. 1.5 mm across, the 2 styles nearly as long as ovary, stigmas colored; styles and stigmas nearly twice as long as ovary. Fl. June—July, Fr. August—September. (Plate III, Figure 3.)

A parasite usually of cultivated clover, sometimes of weeds and wild perennial herbs (particularly Leguminosae). — European part: Lad.-Ilm.,
49 U. Dnp., V.-Don; Caucasus: E. and W. Transc. Gen. distr.: Atl., C. and S. Eur., Med. Described from England.

5. **C. cupulata** Engelm. in Bot. Zeit. (1846) 276; Ganeshin in Tr. po prikl. bot. XVIII, 283; Kryl. Fl. Zap. Sib. IX, 2222, p. p.; Grossg., Fl. Kavk. III, 239; V. Petrov in Fl. Yugo-Vost. VI, 63. — C. planiflora Kryl., Fl. Alt. IV

(47)

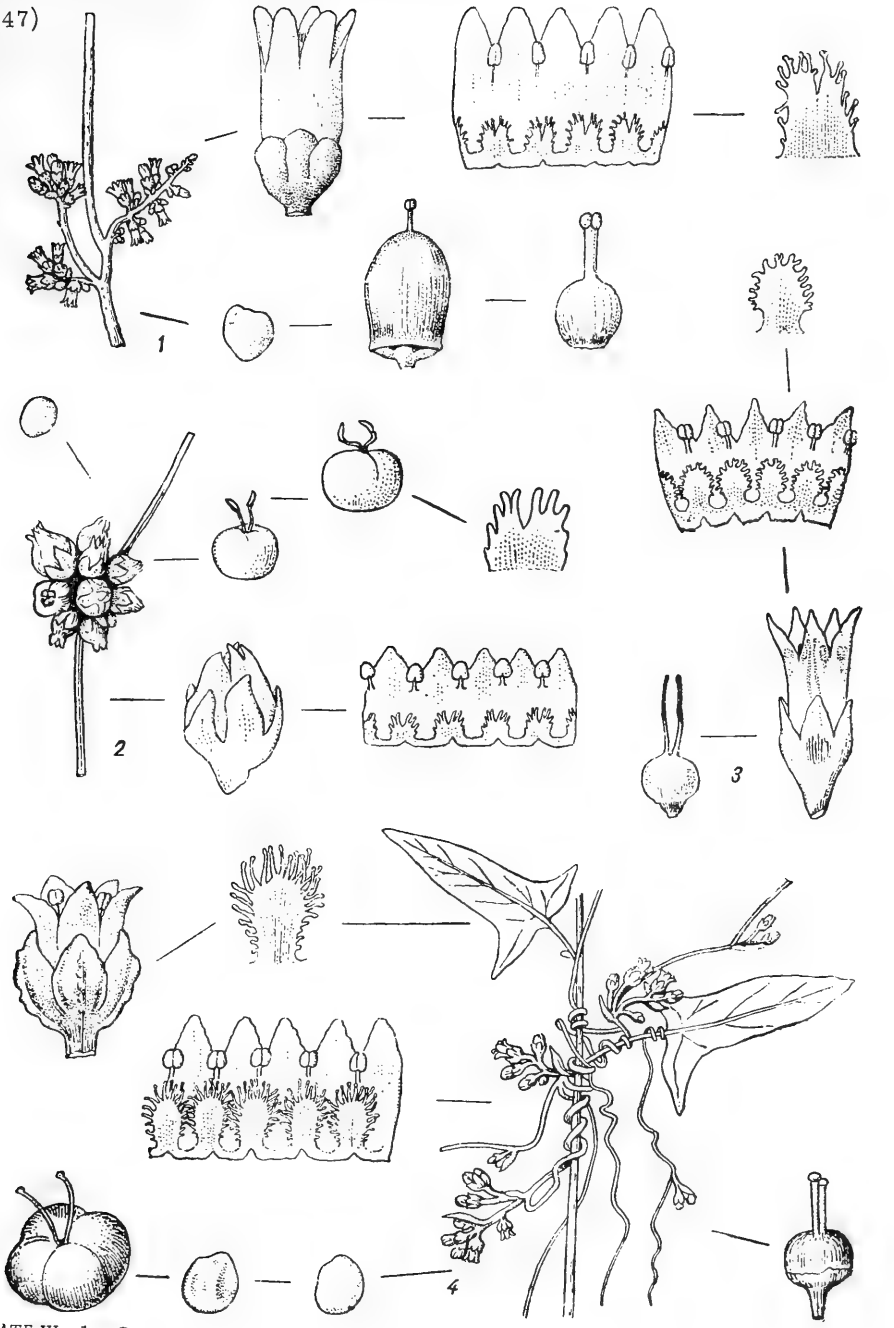

PLATE III. 1 — Cuscuta japonica Choisy, branch with inflorescence, flowers, corolla, fruit, seeds, capsule, ovary; 2 — C. indica (Engelm.) branch with inflorescence, seeds, ovary, capsule, calyx, flowers, corolla; 3 — C. trifolii Babingt., flowers, corolla, ovary; 4 — C. chinensis Lam. branch with inflorescence, ovary, calyx, flowers, corolla, seeds, capsule.

(1907) 874, non Tenore. — C. planiflora var. approximata Engelm. in Transact. Acad. Sc. St.-Louis, I, 3 (1859) 465, p. p.; Palibin in Mat. Fl. Kavk. IV, 2, 51, p. p.; Boiss. Fl. or. IV, 116, p. p. — C. approximata Korol. Poviliki SSSR (1932) 20, p. p. non Babingt. — C. approximata urceolata (Ktze.) Yuncker in Mem. Torr. Bot. Club, 18, 2, 297, p. p. — C. asiatica Pall. in herb. — Ic.: Ganeshin, ibid., Figure 3. — Exs.: G. R. F. No. 1585.

Biennial; stems filiform, pale or slightly colored, glabrous, smooth. Flowers small, 2.5—3 mm long, sessile, white or pink, the dense, more or less globose glomerules to 10 mm across, subtended by triangular obtuse bracts; calyx cup-shaped, 2—2.5 mm long, more or less fleshy, pale or slightly yellow, cleft to middle or beyond (var. schiraziana Engelm.) into broadly elliptic, subrhombic lobes abruptly passing into narrow fleshy tips; corolla slightly longer than calyx, subcylindrical, slightly swollen at middle, its lobes nearly as long as tube, broadly ovate, obtuse, spreading, imbricate; anthers oval-cordate, pale, shorter than filaments; scales nearly as long as corolla tube, their apices reaching base of filaments, oblong, usually slightly 2-partite, fimbriate in upper part, inward curved, free to middle; ovary subglobose or distinctly flattened-globose, ca. 1.5 mm across, the 2 styles with colored stigmas, exceeding ovary; capsule flattened-globose, membranous, to 3.5 mm across; seeds ovoid or irregularly spherical, scabrous, ca. 1 mm wide, 1.2 mm long. Fl. June—July, Fr. July—August.

A parasite on wild perennial herbs and semishrubs. — European part: M. Dnp., V.-Don, Transv., Bes., Bl., L. Don, L. V., Crim.; Caucasus: Cisc., Dag., W., S. and E. Transc.; W. Siberia: U. Tob., Irt., Alt.; Centr. Asia: Ar.-Casp., Balkh., Dzu-Tarb., Mtn. Turkm., Pam.-Al., T. Sh. Gen. distr.: Bal.-As. Min., Arm.-Kurd., Iran., Dzu.-Kash. Described from the Caucasus and Altai.

6. **C. approximata** Babingt. in Ann. Mag. Nat. Hist. XIII (1844) 254; Ganeshin in Tr. po prikl. bot. XVIII, 1, 284; Koroleva, Poviliki SSSR, 20, p. p.; in Sorn. rast. SSSR, III, 388; Yuncker in Mem. Torr. Bot. Club, 18, 2, 295, p. p. (excl. var.). — C. planiflora var. approximata Engelm. in Transact. Acad. Sc. St.-Louis, I, 3 (1859) 465, p. p.; Boiss, Fl. or. IV, 116; Palibin in Mat. Fl. Kavk. IV, 2, 52. — Ic.: Babingt. l. c. XVI, tab. 1, f. 1; Ganeshin, op. cit. Figure 4; Koroleva, Poviliki SSSR, Figures 7, 8, in Sorn. rast. SSSR, III, Figure 354 (semen). — Exs.: G. R. F. No. 1594.

Annual; stems thin, filiform, pale green or slightly colored, glabrous, smooth. Flowers small, ca. 3 mm long, white, sessile, the more or less dense glomerules subtended by narrow triangular, obtuse bracts; calyx campanulate, ca. 2 mm long, imbricate and fleshy at base, cleft nearly to base into broadly elliptic, subrhombic, pointed, outward curved lobes, imbricate; corolla slightly longer than calyx, subcylindrical, its lobes broadly ovate, acute, spreading; stamens inserted between corolla lobes; anthers cordate-ovate, pale, nearly as long as or shorter than thin filaments, scales nearly as long as corolla tube, oblong, flat, distinctly 2-partite, fimbriate; ovary subglobose; styles 2, stigmas colored, subulate, longer than styles; styles and stigmas as long as or longer than ovary; capsule flattened-spherical, membranous, with 3—4 small, irregularly ovoid or

globose seeds about 1 mm across, dark brown or brown, scabrous when ripe. Fl. June—September, Fr. August—October.

Parasitic on cultivated lucerne and associated weeds, mainly on irrigated land, abundant in the southern republics of Central Asia where it causes extensive damage. — European part: L. V.; Central Asia: Ar.-Casp. (southern part), Balkh., Kyz. K., Kara K., Amu D., Syr D., Pam.-Al., T. Sh. (W.). Gen. distr.: Atl. and Centr. Eur., Med., Bal.-As. Min., Iran., Dzu.-Kash., Ind.-Him. Described from England. Type in London.

7. C. callinema Butk. in Bot. mat. Gerb. Inst. bot. i zool. AN UzSSR, XI (1948) 14.

Annual; stems filiform, branching, dark red, glabrous, smooth. Flowers pinkish, subsessile, in loose, few-flowered glomerules, subtended by semi-rounded, entire or slightly crenate bracts, ca. 2 mm long, covered with small tubercles; calyx ca. 3 mm long, semi-spherical, pale, finely tuberculate, cleft to middle into broad triangular, acuminate, entire lobes; corolla urceolate, longer than calyx, pinkish, covered with small tubercles, its lobes as long as tube, triangular, acuminate, spreading, entire or crenulate
51 with inward curved margins; stamens inserted in rictus of corolla; anthers rounded or ovate-cordate, pale, the thin, subulate filaments nearly as long; scales large, nearly as long as calyx tube, oblong, with unevenly fringed tip; ovary subglobose, with thin, cylindrical styles and subulate, yellowish stigmas; styles and stigmas slightly longer than ovary; capsule flattened-globose, ca. 2 mm across, thin-walled, usually with 4 seeds; seeds subglobose, ca. 1 mm across, yellow, scabrous, angled inside, hilum rounded. Fl. July—August, Fr. July—September.

Parasitic on perennial herbs and semishrubs, in high mountain belt; recorded on Astragalus roschanicus B. Fedtsch., Artemista lehmanniana Bge. and Lactuca orientalis Boiss. — Centr. Asia: Pam.-Al. (W. Pamir). Gen. distr.: Iran (?). Described from W. Pamir (basin of Gunt River). Type in Tashkent.

8. C. ferganensis Butk. in Bot. mat. Gerb. Inst. bot. i zool. AN UzSSR, XI (1948) 13. — C. epithymum ssp. angustata f. sulphurea Palib. in Russk. bot. zhurn. 3 (1915) 26.

Annual; stems thin, ca. 0.5 mm across, branching, pale or reddish, glabrous, smooth. Flowers white, short-pediceled, in loose, few-flowered heads, subtended by pale, oblong, entire bracteoles; calyx 2—2.5 mm long, semi-spherical, finely tuberculate, cleft for half into broad, triangular, entire, acuminate lobes; corolla urceolate, nearly twice as long as calyx, finely tuberculate, its lobes imbricate at base, acuminate, nearly as long as tube, more or less spreading, their tips slightly turned inward; stamens inserted at base of corolla lobes, anthers rounded-cordate, yellow, on thin short filaments; scales large, nearly as long as corolla tube, oblong, more or less truncate, thinly and unevenly fimbriate; ovary subglobose, glabrous, smooth, pale, the 2 divergent styles passing into thin, subulate, yellowish stigmas nearly as long as style; styles and stigmas shorter than ovary; capsule flattened-globose, ca. 2 mm across, with thin, transparent walls, corolla persistent, tightly enclosing capsule; seeds 3—4 irregularly globose, ca. 1 mm across, angled inside, light brown, scabrous. Fl. May—June, Fr. June—July.

Parasite of annual and perennial herbaceous plants in the loessic semi-desert of Fergana valley. — Centr. Asia: Syr D. Endemic. Described from Fergana valley (near the Chust railway station). Type in Tashkent.

52 9. C. indica (Engelm.) Petr. in Fl. yugo-vost. VI (1936) 63, comb. — C. europaea var. indica Engelm. Monogr. (1859) 469. — C. pellucida Butk. in Bot. mat. Gerb. Inst. bot. i zool. AN UzSSR, XI (1948) 15. — C. capitata Nevski in Tr. Bot. Inst. AN SSSR, ser. 1, No. 4 (1937) 318, non Roxb. — C. epithymum ssp. angustataf. brachystigma Palib. in Russk. bot. zhurn. 3 (1915) 26. — C. europaea ssp. indica Petr. l. c.

Annual; stems capilliform, branching, pale or slightly colored, glabrous, smooth. Flowers small, ca. 2.5 mm long, sessile or subsessile, transparent, in dense few-flowered (3—8), globose inflorescence, subtended by transparent, ovate-triangular bracteoles; calyx 1—1.5 mm long, semi-spherical, transparent, glabrous, smooth, cleft nearly to base into ovate, acuminate lobes with slightly thickened apex; corolla urceolate, transparent, nearly twice as long as calyx, its lobes nearly half as long as tube, ovate, acuminate, with inward curved tip; stamens inserted in rictus of corolla, anthers subglobose, with cordate base, pale, longer than thin filaments; scales very small, inserted below middle of corolla tube and nearly reaching its middle, thin, 2-parted, fimbriate; ovary flattened-globose, ca. 1.5 mm across, smooth, styles short, shorter than or equal to ovary, stigmas thickened; walls of ovary and capsule transparent; capsule subglobose, glabrous, smooth, with 4 seeds; seeds irregularly rounded, ca. 1 mm across, scabrous, yellowish. Fl. June—July, Fr. July—August. (Plate III, Figure 2.)

Parasitic on herbs and semishrubs in steppes and semi-steppes, on mountain slopes of rubble and stones, rarely fine earth, in the lower vegetation belts. — European part: L. V.; West Siberia: Irt.; Centr. Asia: Ar.-Casp., Balkh., Pam.-Al., T. Sh. Endemic. Described from Krasnoarmeisk. Type in Leningrad.

10. C. europaea L. Sp. pl. (1753) 124; Turcz. in Bull. Soc. Nat. Mosc. XXII, 2, 357; Engelm. in Transact. Acad. St.-Louis, I, 3, 468; Boiss. Fl. or. IV, 117; Shmal'g., Fl. II, 246; Szaf., Kulcz., Pawl. Rosl. Polsk. 472; Palibin in Mat. Fl. Kavk. IV, 2, 53; Ganeshin in Tr. po prikl. bot. XVIII, 1, 285; Grossg., Fl. Kavk. III, 238; Yuncker in Mem. Torr. Bot. Club, 18, 2, 274; Koroleva, Poviliki SSSR, 23; in Sorn. rast. SSSR, III, 389; Kryl., Fl. Zap. Sib. IX, 2220; Buia in Bull. Fac. Agronom. Cluj, VII, 80; Sugawara, Ill. Fl. of Saghal. IV, 1565. — Ic.: Ganeshin, op. cit., Fig. 5; in Sorn. rast. SSSR, III, Fig. 352, 353, 355; Hegi, III, Fl. V, 3, f. 3069. — Exs.: Fl. pol. exs. No. 753.

53 Annual; stems thickish, to 2.5 mm across, red or reddish, branching, glabrous, smooth. Flowers 2—3 mm long, pinkish or pinkish white, pedicels very short, sometimes very distinct, in rather large, globose, loose inflorescences, to 1.5 cm across; calyx obconical, to 3 mm long, fleshy at base, sometimes angled, cleft for nearly half into 4—5 broadly ovate or broadly triangular, obtuse, entire lobes; corolla slightly longer than calyx, the 4—5 lobes nearly half as long or nearly as long as tube, broadly triangular or ovate, obtuse, entire, erect or slightly curved; stamens inserted in

angles between corolla lobes, slightly shorter than lobes, anthers ovate-cordate or subglobose anthers, subulate filaments slightly longer than anthers; scales small, usually not exceeding middle of corolla tube, rarely slightly longer, more or less 2-parted, or entire, usually with few apical fringes, appressed to back of tube; ovary subglobose or elongate-globose, to 2.5 mm long, the 2 filiform styles and stigmas usually divergent, shorter than or nearly as long as ovary; capsule flattened-globoid, usually with 4 seeds; seeds subglobular or globular-ovoid, angled inside, ca. 1—1.3 mm long, scabrous. Fl. June—July, Fr. July—August.

Parasitic on many wild herbaceous perennials (nettle, hops, etc.), shrubs and young trees, mostly at edges of forests and in shrubby thickets along banks of rivers, streams and springs as well as on mountain slopes of rubble and fine earth. It is also parasitic on such cultivated plants as hemp, tobacco, clover, lucerne, vetch, currants, gooseberry, lilac. — European part: Kar.-Lap., Dv.-Pech., Balt., Lad.-Ilm., U. V., V.-Kama, U. Dnp., V.-Don, Transv., U. Dns., Bes., Bl., Crim., L. Don, L. V.; Caucasus: Cisc., Dag., W., S. and E. Transc.; West Siberia: Ob, U. Tob., Irt., Alt.; East Siberia: Yenis., Lena-Kol. (probably not further north than 62° N.), Ang.-Say., Dau.; Far East: Ze.-Bu., Uss., Sakh.; Centr. Asia: Ar.-Casp., Balkh., Dzu-Tarb., Pam.-Al., T. Sh. Gen. distr.: all Europe (excluding the Arctic regions), Med., Bal.-As. Min., Arm.-Kurd., Iran., Ind.-Him., Dzu.-Kash., Mong. (Manchuria). Described from W. Europe. Type in London.

Note. In Central Asia there is a form with smaller, sessile flowers in more compact, globose inflorescences and with longer scales, sometimes reaching the base of the filaments. Further study will presumably warrant specific status.

54 In Lug District of Leningrad Region, S. S. Ganeshin collected on vetch specimens of dodder which differed from the typical European dodder in having indehiscent capsules, larger seeds, and a longer calyx, and in several characters of the flowers. This he (op. cit.) separated as subspecies C. europaea ssp. viciae (Schultz) Ganesch., though other investigators recognized it as a species, C. viciae Schultz, or as a variety, C. europaea var. viciae Engelm. (Engelmann, Buia). It has also been considered synonymous with C. europaea L. (Yuncker). As the only collections available are those of Ganeshin, we are unable to determine the true taxonomic status of this form, and further material is required.

11. C. epilinum Weiche in Archiv Apoth. VIII (1824) 54; Engelm. in Transact. Sc. Acad. St. Louis, I, 3, 470; Boiss. Fl. or. IV, 118; Shmal'g., Fl. II, 246; Szaf., Kulcz., Pawl. Rosl. Polsk. 472; Ganeshin in Tr. po prikl. bot. XVIII, 1, 268; Koroleva, Poviliki SSSR, 26; in Sorn. rast. SSSR, III, 390; Kryl., Fl. Zap. Sib. IX, 2221; Yuncker in Mem. Torr. Bot. Club, 18, 2, 277; Grossg., Opr. rast. Kavk. 351;— Ic.: Ganeshin, op. cit., Fig. 7; Hegi, III. Fl. V, 3, f. 3072. — Exs.: G. R. F. No. 326.

Annual; stems thin, filiform, ca. 8 mm across, greenish-yellow, glabrous, smooth, slightly branching. Flowers sessile or subsessile, in compact, globular inflorescences; calyx semi-spherical, ca. 3 mm long, deeply cleft into broadly ovate, acuminate, entire lobes nearly as long as corolla;

corolla urceolate, yellowish-white, slightly exceeding calyx, its lobes half length of tube, broadly triangular, entire, slightly acuminate or obtuse, spreading; stamens inserted at corners between corolla lobes, their anthers oval, pale, filaments thin, subulate, shorter than anthers; scales nearly as long as corolla tube, oval, entire or more or less 2-parted, fimbriate, free, appressed to wall of calyx tube; ovary subglobular, with short, remote styles and hardly thickened, oblong, colored stigmas; styles and stigmas shorter than ovary; capsule flattened-globose, ca. 4 mm across, with typical deep slit between styles; seeds irregularly globose, ovoid or nearly ovoid, ca. 1.2 mm across, alveolate-ramentaceous, often concrescent in 2 or 3. Fl. June—July, Fr. July—August.

On flax, rarely on weeds. — European part: Dv.-Pech., Lad.-Ilm., U. V.,
55 U. Dnp., M. D., V.-Don, L. Don, Transv., U. Dns., Bl., Bes.; Caucasus: Cisc., West Siberia: U. Tob., Irt., Alt.; East Siberia: Ang.-Say., Dau., Far East: Uss.; Centr. Asia: Ar.-Casp., Balkh., T. Sh., Pam.-Al. Gen. distr.: Worldwide on flax. Described from W. Europe (probably from W. Germany).

12. C. brevistyla H. Br. ex A. Rich. Tent. fl. abyss. II (1850) 79; Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 467; Boiss. Fl. or. IV, 117; Yuncker in Mem. Torr. Bot. Club, 18, 2, 289; Nevskii in Tr. Bot. inst. AN SSSR, ser. I, No. 4, 318. — C. planiflora C. B. Clarke in Hook. Fl. Brit. Ind. IV, 227, p. p. non Tenore. — Ic.: Yuncker, l. c. f. 153.

Annual; stems nearly capilliform, to 0.5 mm across, colored, branching, glabrous, smooth. Flowers small, 2—2.5 mm long, white or faintly pinkish, sessile, in compact, globular inflorescences, 0.4—0.5 (0.7) cm across; calyx cyathiform, ca. 2 mm long, 4—5-parted nearly to base, outer side finely tuberculate like corolla lobes, at calyx lobes rhombic-ovate, thickened dorsally, tapering to fleshy, acuminate tip; corolla nearly as long as or slightly longer than calyx, with more or less cylindrical, somewhat inflated tube and 4—5 triangular, ovate, acuminate, entire lobes imbricate at base, often with thickened tip, more or less spreading; stamens inserted in rictus of corolla, anthers rounded-cordate, pale or slightly colored, nearly as long as subulate filaments; scales attached to base of corolla tube, nearly as long as the latter, free nearly to base, oblong or broadly linear, more or less rounded or truncate, finely fringed, inward curved; ovary subglobose, with 2 thin styles as long as or shorter than colored, hardly thickened stigmas; styles and stigmas as long as ovary or slightly shorter; capsule flattened-globose; seeds usually 4, rounded-cordate, angled inside, brown, scabrous. Fl. July—August, Fr. August—September.

Parasitic on annual and perennial herbs, rarely on semi-shrubs (common on Labiatae, Leguminosae and Compositae) on dry, fine earth to rubbly or stony mountain slopes. — Caucasus: Dag., S. and E. Transc.; Centr. Asia: Mtn. Turkm., Pam.-Al., T. Sh. Gen. distr.: Med., Iran., Ind.-Him., Africa. Described from Abyssinia. Cotype in Leningrad.

13. C. araratica Butk. sp. n. in Addenda, XIX, 703.

Annual; stems filiform, to 0.8 mm thick, reddish, branching, glabrous,
56 smooth. Flowers ca. 3 mm long, sessile, (4)6—12(15) in compact, globular

glomerules 6—8 mm across; calyx ca. 2 mm long, semi-spherical or obconical, fleshy, pale, cleft for nearly half into 5 broad-ovate or rhombic-ovate, obtuse lobes thickened at back, finely tuberculate outside; corolla ca. 2.5 mm long, slightly exceeding calyx, urceolate, finely tuberculate outside, cleft for $^1/_3$ to $^1/_2$ into rhombic-ovate, obtuse, imbricately spreading lobes with inward curved tip, thickened at back; scales as long as corolla tube, oblong, with nearly parallel margins, distinctly 2-lobed, the irregularly dentate apex directed towards middle of corolla tube, intervals as wide as scales; stamens sessile at angles between corolla lobes, anthers cordate, pale, on subulate filaments slightly longer than anthers; ovary subglobose, with 2 short styles and slightly thickened, brilliantly colored stigmas; stigmas and styles nearly as long as ovary; capsule membranous with persistent styles and colored stigmas, globose-tetrahedral, slightly flattened, ca. 2 mm across, with 3—4 seeds; seeds nearly ellipsoid, ca. 1 mm long, pale, scabrous. Fl. July, Fr. August.

Parasitic herbaceous on perennials on dry mountain slopes. — Caucasus: S. Transc. Gen. distr.: Arm.-Kurd. Described from Mount Ararat (Ararat, Takel'tau). Type in Leningrad.

Section 2. EPISTIGMA Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 460. — Stigmas subulate or filiform, subsessile; capsule dehiscing only when fully ripe by a transverse, broken suture.

14. C. pedicellata Ldb. Fl. alt. I (1829) 293; Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 472; Kryl., Fl. Zap. Sib. IX, 2219; Yuncker in Mem. Torr. Bot. Club, 18, 2, 271. — C. turcomanica C. Winkl. ex Palibin in Russk. bot. zhurn. 3 (1915) 27. — Ic.: Ldb. Ic. pl. tab. 234.

Annual; stems capilliform, branching, yellowish or reddish, glabrous, smooth. Flowers very small, not more than 2 mm long, white, their distinct, thin pedicels as long as or slightly longer than flowers, in few-flowered (6—15), umbelliform inflorescences subtended by small, ovate, obtuse, entire bracts; calyx 4—5-lobed, ca. 1.2 mm long, semi-spherical, smooth, cleft for half into broad-ovate, obtuse or slightly acuminate, very thin, entire, transparent lobes; corolla 4—5-lobed, nearly twice as long as calyx, white, urceolate, sometimes subglobular, cleft for half into broadly triangular
57 or ovate, acutish, entire lobes; stamens sessile between corolla lobes, their anthers cordate-sagittate, slightly shorter than or as long as thin filaments; scales attached to base of corolla tube, almost as long, narrow, truncate, fimbriate; ovary subglobose, glabrous, with subsessile, thin apical stigmas; styles and stigmas shorter than or as long as ovary; capsule subglobose, ca. 1.5 mm across, thin, transparent, usually with 4 seeds; seeds irregularly ovoid, ca. 1 mm long, dark brown, scabrous. Fl. April—May, Fr. June—July.

Parasitic mainly on ephemeral plants, rarely on perennial herbs or semi-shrubs in deserts, semi-deserts and lower mountain belts. — European part: L. V.; West Siberia: Irt.; Centr. Asia: Ar.-Casp., Balkh., Kyz. K., Kara K., Mtn. Turkm., Amu D., Syr D., Pam.-Al., T. Sh. Gen. distr.: Iran. Described from West Siberia (Arkaul). Type in Leningrad.

15. C. kotschyana Boiss. Diagn. ser. I, 7 (1846) 29; Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 471; Palibin in Mat. Fl. Kavk. IV, 2, 57; Grossg., Fl. Kavk. III, 238; Yuncker in Mem. Torr. Bot. Club, 18, 2, 269, excl. var. — C. pulchella V. Petr. in Fl. Yugo-Vost VI (1936) 65, non Engelm.; Pavlov in Fl. Tsentr. Kazakhst. III, 50. — C. pulchella var. altaica Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 472. — Exs.: Kotschy, Pl. pers. austr. No. 749.

Annual; stems thin, filiform, pinkish, branching, glabrous, smooth. Flowers ca. 3 mm long, pale or faintly pinkish, subsessile or on pedicels as long as calyx, in few-flowered, loose glomerules subtended by thin, nearly transparent, elliptic, obtuse or slightly acuminate bracts; calyx semi-spherical, ca. 2 mm long, finely tuberculate outside, cleft to middle or slightly deeper into triangular, entire, acute lobes with inward curved tip; corolla 2—2.5 mm long, more or less cylindrical, finely tuberculate, with broadly triangular, more or less abruptly acuminate, entire, erect or slightly declinate lobes as long as corolla tube, thickened at apex; stamens inserted between corolla lobes, with ovate-cordate, yellow anthers and thin, subulate filaments; scales large, as long as or slightly longer than corolla tube, oblong, more or less spatulate, free, entire or more or less 2-parted, with fringed apex; ovary subglobose, with more or less fleshy tip, stigmas sessile, cylindrical; capsule subglobose, usually with 4 seeds; seeds ovoid, ca. 1 mm long, 0.8 mm wide, angled inside, brown, scabrous. Fl. May—June, Fr. July—August.

Parasite of perennial, rarely annual herbs, semi-shrubs, especially on
58 species of Compositae, in wormwood-mixed herb and grass and wormwood-halophytic groups. — European part: L. V.; Caucasus: Transc.; West Siberia: Alt. (?); Centr. Asia: Ar.-Casp., Balkh., Kara K. (northern part), Kyz. K. (northern part), Mtn. Turkm. Gen. distr.: Iran. Described from Iran. Type in Geneva.

16. C. stapfiana Palib. in Russk. bot. zhurn. 3 (1915) 25. — C. kotschyana Yuncker in Mem. Torr. Bot. Club, 18, 2 (1932) 139, p. p. non Boiss.

Annual; stems filiform, pinkish, branching, glabrous. Flowers ca. 3 mm long, subsessile or on distinct pedicels, in rather compact glomerules to 1 cm across, subtended by broadly ovate, more or less fleshy bracts colored outside; calyx cyathiform, ca. 2 mm long, angled, as long as corolla tube, cleft for nearly half into broadly triangular, entire, abruptly acuminate lobes; corolla urceolate, white, slightly longer than calyx, finely tuberculate outside, the broadly triangular-ovate, entire, acuminate, spreading lobes nearly as long as tube; stamens sessile between corolla lobes, upright, with rounded-cordate anthers, subulate filaments slightly longer than anthers; scales broadly oblong, longer than corolla tube, free with dentate-fimbriate apex; ovary flattened-globose, more or less fleshy at apex, with the thick, short, subulate, sessile stigmas nearly as long as ovary; capsule flattened-globose, with 3—4 seeds; seeds globular, ca. 1 mm across, angled inside, brownish, scabrous. Fl. June—July, Fr. July—August.

Parasitic on annuals and perennials on rubbly mountain slopes. — Centr. Asia: Pam.-Al. (Pamir). Gen. distr.: Iran. Described from Afghanistan. Type in Leningrad.

17. C. stenocalycina Palib. in Russk. bot. zhurn. 3 (1915) 26.

Annual; stems thin, to 0.8 mm thick, purple, branching, glabrous, smooth. Flowers on short pedicels almost as long as calyx, in loose, few-flowered (6—12), umbelliform inflorescences subtended by narrow triangular, acuminate, pinkish bracts; calyx 4—5-lobed, ca. 3 mm long, cleft to or nearly to base into entire narrow, acuminate, smooth, purple lobes; corolla 4—5-lobed, ca. 4 mm long, urceolate, finely tuberculate outside, delicate pink, cleft for half or deeper into entire triangular-acuminate,
59 erect or slightly outwardly curved lobes; stamens sessile between corolla lobes, rounded-cordate anthers, on short thin filaments slightly longer than anthers; scales inserted at base of corolla tube and appressed to it, narrow, not more than half length of tube, with more or less truncate, ciliate-dentate apex; ovary flattened-globose, ca. 2 mm across, the 2 sessile or subsessile, sometimes remote, faintly colored stigmas as long as or slightly shorter than ovary; capsule flattened, fleshy below styles, ovate-tetrahedral, smooth, usually with 4 seeds, persistent corolla tightly appressed to capsule; seeds irregularly ovoid, ca. 1 mm long, brown, scabrous. Fl. July, Fr. August—September.

Parasitic on wild, herbaceous perennials or semi-shrubs on fine earth-stony slopes in upper mountain belts. — Centr. Asia: T. Sh., Pam.-Al. Endemic. Described from near Tashkurgan in the upper reaches of the Yakkobag-Darya River. Type in Leningrad.

Subgenus 2. Grammica Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 459. — Ovary with 2 unequal styles and capitate stigmas.

Section 3. EUGRAMMICA Engelm. l. c. 460. — Stigmas capitate; capsule with more or less irregularly persistent ring.

18. C. chinensis Lam. Encycl. II (1790) 222; Boiss. Fl. or. IV, 120; Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 880; Yuncker in Mem. Torr. Bot. Club, 18, 2, 209. — C. ciliaris Hohen. in Boiss. Diagn. II, 3 (1856) 129. — C. breviflora auct. Fl. As. Med. p. p. — Ic.: Yuncker, l. c. f. 80.

Annual; stems filiform, 0.6—0.8 mm across, pale yellow, glabrous, smooth. Flowers ca. 4 mm long, yellowish, their short pedicels as long as or slightly longer than calyx, 3—7 in small, umbelliform inflorescences subtended by narrowly triangular, keeled, entire, nearly transparent bracts; calyx broadly obconical, 2—2.5 mm long, cleft for half into triangular-ovate, obtuse, acutely keeled lobes; keels decurrent and hence calyx angular; corolla slightly longer than calyx, urceolate, dissected for nearly half into triangular-ovate, obtuse, erect or more or less spreading lobes; stamens inserted between corolla lobes just below notch, nearly half length of lobes, filaments flat, pale, slightly cuneate, anthers ovate-cordate, yellow, slightly shorter than filaments; scales large, reaching base of filaments, oblong or spatulate, entire or more or less 2-parted (var. ciliaris Engelm.), long-ciliate, free nearly to base; ovary flattened-globose, with

60 2 long, thin, divergent styles, as long as or slightly longer than ovary, and club-shaped stigmas; capsule flattened-globose, ca. 3 mm across, membranous, with persistent corolla and styles; between these there is a deep depression; the capsule dehisces at base by an uneven, transverse suture; seeds usually 4, ovoid, ca. 1.5 mm long, angled inside, pale brown, scabrous, with narrow, oblong hilum. Fl. May—July, Fr. June—September. (Plate III, Figure 4.)

Parasitic on weeds in weedy habitats and on cultivated plants (kenaf, cotton, jute, legumes). — Far East: Ze.-Bu., Uss.; Centr. Asia: Dzu-Tarb., Kyz. K., Mtn. Turkm., Pam.-Al., T. Sh. Gen. distr.: Iran., Dzu.-Kash., Mong., Jap.-Ch. Described from specimens grown in the Botanical Garden in Paris from seeds brought from China. Type in Paris.

Section 4. CLISTOGRAMMICA Engelm. l. c. 460. — Stigmas capitate; capsule slightly fleshy (bacciform) in upper part.

19. C. australis R. Br. in Prodr. Fl. Nov. Holl. et ins. Van-Diemen, I (1810) 491. — C. australis var. tinei (Insenga) Yuncker in Mem. Torr. Bot. Club, 18, 2 (1932) 126. — C. breviflora Vis. Fl. dalm. II (1847) 231; Palibin in Mat. Fl. Kavk. IV, 2, 57; Ganeshin in Tr. po prikl. bot. XVIII, 1, 292; Koroleva, Poviliki SSSR, 292; in Sorn. rast. SSSR, III, 393; Grossg., Fl. Kavk. III, 238; V. Petrov in Fl. Yugo-Vost. VI, 66. — C. obtusiflora var. breviflora Engelm. in Transact. Acad. Sc. St.-Louis, I, 3 (1859) 493; Boiss. Fl. or. IV, 191; Mal'tsev in Tr. Byuro po prikl. bot. III, 8, 21. — C. rogowitschiana Trautv. in Mél. Biol. II (1855) 285. — Ic.: Mal'tsev, op. cit. III, 8, tabl. VI, Fig. 22.

Annual; stems thin, filiform, orange-yellow, branching, smooth. Flowers small, ca. 2 mm long, yellowish, subsessile or on very short pedicels, in compact glomerules, subtended by nearly transparent, lanceolate, obtuse bracts; calyx obconical, cleft for half into 4—5 ovate, obtuse, entire lobes; corolla twice as long as calyx, campanulate, pale yellow, cleft for half into 4—5 triangular-ovate, obtuse, entire lobes more or less declinate at flowering; stamens sessile in notches between corolla lobes, slightly shorter than these, with flat, subulate filaments and ovate-oval anthers; scales small, 2-parted, with short fringes, sometimes reduced to 2 small teeth or obsolete (var. breviflora); ovary flattened-globose, smooth, the 2 free, thin, unequal styles with colored capitate stigmas; capsule
61 flattened-globose, thin-walled, dehiscing irregularly into parts or detaching intact from base, with persistent calyx, corolla and styles; between the latter there is a distinct deep concavity; seeds 3—4 per capsule, irregularly ovoid, ca. 1 mm long, light or dark cinammon brown or brown, scabrous. Fl. June—July, Fr. July—September.

Parasitic on weeds, many herbaceous cultivated plants, fodder legumes (clover, lucerne), kitchen plants, gourds, technical and ornamental plants. One of the most troublesome weeds, especially in southern regions. — European part: M. D., Bes., Bl., L. Don, L. V.; Caucasus: Cisc., W. Transc.; West Siberia: U. Tob. (?), Irt.; Far East: Uss.; Centr. Asia: Ar.-Casp., Balkh., Dzu-Tarb., Kyz. K., Kara K. (?), Amu D., Syr D., Pam.-Al., T. Sh. Gen. distr.: Atl. Eur., Med. (W.), Bal.-As. Min. (northern part),

Ind.-Him., Dzu.-Kash., rest of China, Australia. Described from Australia. Type in London.

20. C. campestris Yuncker in Mem. Torr. Bot. Club, 18, 2 (1932) 138; Buia, Cuscutele Românici (1939) 48. — C. arvensis Malz. in Tr. Byuro prikl. bot. VIII, 3 (1915) 257, non Beyr; Petrov in Fl. Yugo-Vost. VI, 66. — C. arvensis var. calycina Engelm. in Trans. Acad. Sc. St.-Louis, I, 3 (1859) 495; Koroleva, Poviliki SSSR, 29; in Sorn. rast. SSSR, III, 391. — C. pentagona ssp. calycina Yuncker in Illin. Biol. Monograph. VI, 2–3, 50; Ganeshin in Tr. prikl. bot. XVIII, 1, 293. — C. kamelorum Pavl. in Vestn. AN Kaz. SSR, 8 (1950) 20. — Ic.: Mal'ts. l. c. Tabl. 129, Fig. 891; Ganeshin, l. c. Fig. 10; Yuncker, l. c. f. 14. — Exs.: Fl. Hung. exs. No. 772.

Annual; stems filiform, to 0.8 mm across, yellow or pinkish yellow, branching, shiny, smooth. Flowers on 2–2.5 mm pedicels, white or slightly greenish white, 3–8 in loose inflorescences subtended by lanceolate, acuminate, ca. 2 mm long bracts; calyx semi-spherical, 2–2.5 mm long, smooth, shiny, more or less deeply cleft into broadly oval or slightly rounded, obtuse lobes as long as or slightly longer than corolla tube; corolla campanulate, its lobes nearly as long as tube, ovate-cuneate or triangular, entire or slightly crenate, spreading, with slightly inward curved tip; scales oval, long-fimbriate, as long as or longer than corolla tube and thus scale fringes emerging from persistent corolla in fruit; stamens inserted at base of notches between lobes, nearly as long as or shorter than lobes, with thin, shiny, subulate filaments and broadly oval or oval-cordate, yellow anthers; ovary flattened-globose, smooth, the thin, distinctly unequal styles (becoming
62 nearly equal in fruit) with capitate stigmas much shorter than styles; styles with stigmas nearly as long as ovary; capsule flattened-globose, light cinammon brown, ca. 3–3.5 mm across, slightly fleshy with deep apical depression, irregularly dehiscing, with 2–4 seeds and persistent calyx and corolla; seeds irregularly ovoid, angled inside, light cinammon brown or brown, scabrous, to 1.5 mm long, 1.2 mm wide, 0.8 mm thick. Fl. July–August, Fr. August–September.

Introduced; parasitic on weeds and cultivated plants (jute, kenaf, clover, lucerne, vetch, lentils, oats, barley, timothy, Dalmatian chrysanthemum, petunia and others), sometimes on wild plants. — European part: Lad.-Ilm., U. Dnp., M. D.; Caucasus: Cisc.; Centr. Asia: Kara K. (Chardzhou, Geoktepe), Syr D., T. Sh., Pam.-Al. A native of North America. Described from Texas. Type in U. S. A.

Note. The first record of this species in the USSR is due to D. Larionov in 1913. This was confirmed in 1915 by A. Mal'tsev on the basis of specimens collected in 1914 by A. Gromyko in the former Mogilev Province. In 1927, Ganeshin (op. cit.) found it growing in the Leningrad Region (near the Dubrovo Sovkhoz, Luga District). Ganeshin noted that specimens of this species preserved in the herbarium of the Botanical Institute of the Academy of Sciences of the USSR grow in Dergachi and Gumennoe (Ukrainian SSR) as well as near Molotov. According to Koroleva (op. cit.) the herbarium also includes specimens from Kuban'. In 1942 the species was found in Uzbekistan (Tashkent). There are reports (Zap. po semenovodstvu, VII, 2 (1930)) of seeds in specimens of leguminous seeds in Bryansk, Gorki, Kalinin, Kursk,

Tambov, Orel and Odessa regions and in Belaya Tserkov' and Shevchenko districts of Kiev Region. A. Baitukalov (Tr. opytn. uchrezhd. Volzh.-Kam. obl. IV (1929)) reported the presence of vetch seeds in samples of clover seeds from the Mari ASSR. I. I. Smirnova (Karant. sorn. Kazakhskoi SSR i mery bor'by s nimi (1941)) reports this vetch for 11 regions of the Kazakh SSR.

21. C. basarabica Buia in Contrib. la Stud. Cusc. in Romania (1938) 35; Cuscutele Românici, 58. — Ic.: Buia, Cusc. Roman. tab. XXI, XXII. —
Annual; stems filiform, 0.5—1.5 mm thick, golden yellow. Flowers 2—3(3.5) mm long, usually on thickened, 2—6 mm long pedicels, 10—35 in loose glomerules; calyx cyathiform, darker than stems, ca. 2.2 mm long,
63 deeply cleft into rounded-ovate, slightly acute lobes with incumbent or free margins; corolla golden, paler than calyx, 2.5—3.2 mm long, the lanceolate-ovate, acuminate lobes crenulose, with inward curved tip; stamens inserted in notches between corolla lobes, ca. 1 mm long, filaments subulate; anthers reddish or blackening, slightly shorter than filaments; scales ca. 2—2.5 mm long, with long-ciliate margins and apex, erect or inward curved; styles ca. 2 mm long, stigmas capitate, ca. 0.75 mm wide; capsule 2.5—3.5 mm long, 3.5—4 mm wide; seeds subglobular, 1.2—1.6 mm across, usually 4 per capsule. Flowers from May to October.
Parasitic on weeds. — European part: Bes. Gen. distr.: N. Balkans. Described from Bessarabia. Type in Bucharest.
Note. The description is from Buia's monograph (l. c.) because we did not study herbarium specimens of this species.

22. C. karatavica Pavl. in Vestn. AN Kaz. SSR. 8 (1950) 19.
Annual; stems thin, filiform, branching, bright purple, glabrous, smooth; bracts lanceolate, ca. 2 mm long, obtuse, entire, colored. Flowers ca. 3 mm long, dingy purple or pink, on 1—2 mm long pedicels, 6—8 in loose glomerules; calyx semi-spherical, ca. 2.5 mm long, pink, cleft for half or more into broadly triangular-ovate, obtuse, entire lobes; corolla urceolate, slightly longer than calyx, dingy purple, with entire, flat, triangular, acuminate, spreading lobes nearly as long as tube; stamens sessile between lobes, anthers yellow, ovate-cordate, half as long as the pink, subulate filaments; scales large, as long as or longer than corolla tube, oblong, long-fimbriate at apex; ovary subglobose, brownish-purple, the 2 styles equal, with capitate, yellowish stigmas $^1/_4$—$^1/_5$ length of styles; capsule ca. 3 mm across, flattened-globose, with deep apical concavity; styles widely remote at base; seeds 2—4 per capsule, obovoid, angled inside, ca. 1—1.5 mm long, yellowish brown or brown, scabrous. Fl. July—August, Fr. August—September.
Discovered on Verbena prostrata. — Centr. Asia: T. Sh. Endemic. Described from Kara-Tau Range. Type in herbarium of Academy of Sciences of the Kazakh SSR in Alma-Ata, cotype in the Moscow University herbarium.

23. C. suaveolens Ser. in Ann. Sc. Phys. Nat. Lyon (1840) 519; Yuncker in Americ. Journ. Bot. X, 4; Mem. Torr. Bot. Club, 18, 2, 148. —
C. racemosa Malz. in Tr. Byuro po prikl. bot. VIII, 3, 257, non Mart. —
64 C. racemosa var. chiliana Engelm. in Transact. Acad. Sc. St.-Louis,

I, 3 (1859) 505; Ganeshin in Tr. po prikl. bot. XVIII, 1, 294. — Ic.: Mal'tsev, op. cit. Tabl. 129, Fig. 890; Ganeshin, op. cit. Fig. 11; Yuncker, l. c. f. 22.

Annual; stems filiform, often reddish, branching, glabrous, smooth. Pedicels usually longer than calyx, flowers rather large, to 4—5 mm long, in loose, racemiform inflorescences; bracts small, ovate, scarious; calyx broadly campanulate, half length of corolla tube, cleft for nearly half into oval-triangular, obtuse lobes; corolla tubular-campanulate, oval-triangular acuminate, lobes with inward curved tip; scales oval, with fimbriate margin, as long as or slightly shorter than corolla tube; stamens inserted below notches between corolla lobes, filaments short, anthers oval; styles longer than ovary, stigmas capitate; capsule nearly ovoid, with persistent calyx and corolla, walls thin, slightly thickening in upper part; seeds 2—4, ovoid or oval, often appearing as if with apical beak, to 1.9 mm long, 1.5 mm wide, 1 mm thick, brown or dark brown, finely tuberculate; hilum short, linear, sometimes horizontal. June.

Introduced; native of South America, discovered in 1914 in Belorussia (former Mogilev Province, Chausy county, village Slastena), on clover. Also introduced in W. Europe, U. S. A., Australia and Africa.

Note. Various reports of the discovery of this species in Russia have appeared in botanical and agricultural literature; e. g., Mal'tsev (op. cit.) mentions it from the former Podolia, Voly'n, Chernigov, Ekaterinoslav, Kursk, Vitebsk and Bessarabia provinces. However, only one locality (see above) has been confirmed; specimens in the herbarium of the Botanical Institute of the Academy of Sciences of the USSR.

24. C. gronovii Willd. ex Roem. Syst. veg. VI (1820) 205; Yuncker in Mem. Torr. Bot. Club, 18, 2, 173. — C. gronovii var. vulgivaga Engelm. in Acad. Sc. St.-Louis, I, 36 (1859) 507; Szaf., Kulcz., Pawl. Rosl. Polsk. 473. — Ic.: Yuncker in Illin. Biol. Monograph. VI, 2—3, f. 37, 100, 101, 148; Britt. et Br. Ill. Fl. III. f. 2963.

67 Annual; stems filiform, to 1 mm across, glabrous, smooth, branching. Flowers ca. 4 mm long, pedicels distinct, as long as or longer than calyx, in loose or more or less compact, paniculate inflorescences; bracts small, ovate, acuminate, entire, more or less concave; calyx nearly semi-spherical, cleft into broadly ovate, obtuse, sometimes subrounded, in part finely tuberculate lobes with thin, nearly transparent margin, thickened at back; corolla to twice as long as calyx, campanulate, the ovate-triangular, obtuse, entire, declinate lobes as long as or slightly shorter than corolla tube; scales oblong, nearly as long as or slightly shorter than corolla tube, with irregularly fimbriate apex, free to base; stamens sessile in notches between corolla lobes, slightly shorter than the latter, with oval anthers and flat, thin, cuneate filaments almost twice as long as anther; ovary subovate, glabrous, smooth, the thin styles approximate at base, shorter or slightly longer than ovary (var. longistyla Ganesch.), stigmas capitate, colored; capsule globose-conical, ca. 3.5 mm wide, 4 mm long, with 2—4 seeds, calyx and corolla persistent; seeds ca. 1.5 mm long, ovoid, one side inflated, the other distinctly concave, brown, scabrous.

Found once in the former Yuryev Botanical Garden (now Tartu, Estonia). Native of North America. Introduced in W. Europe.

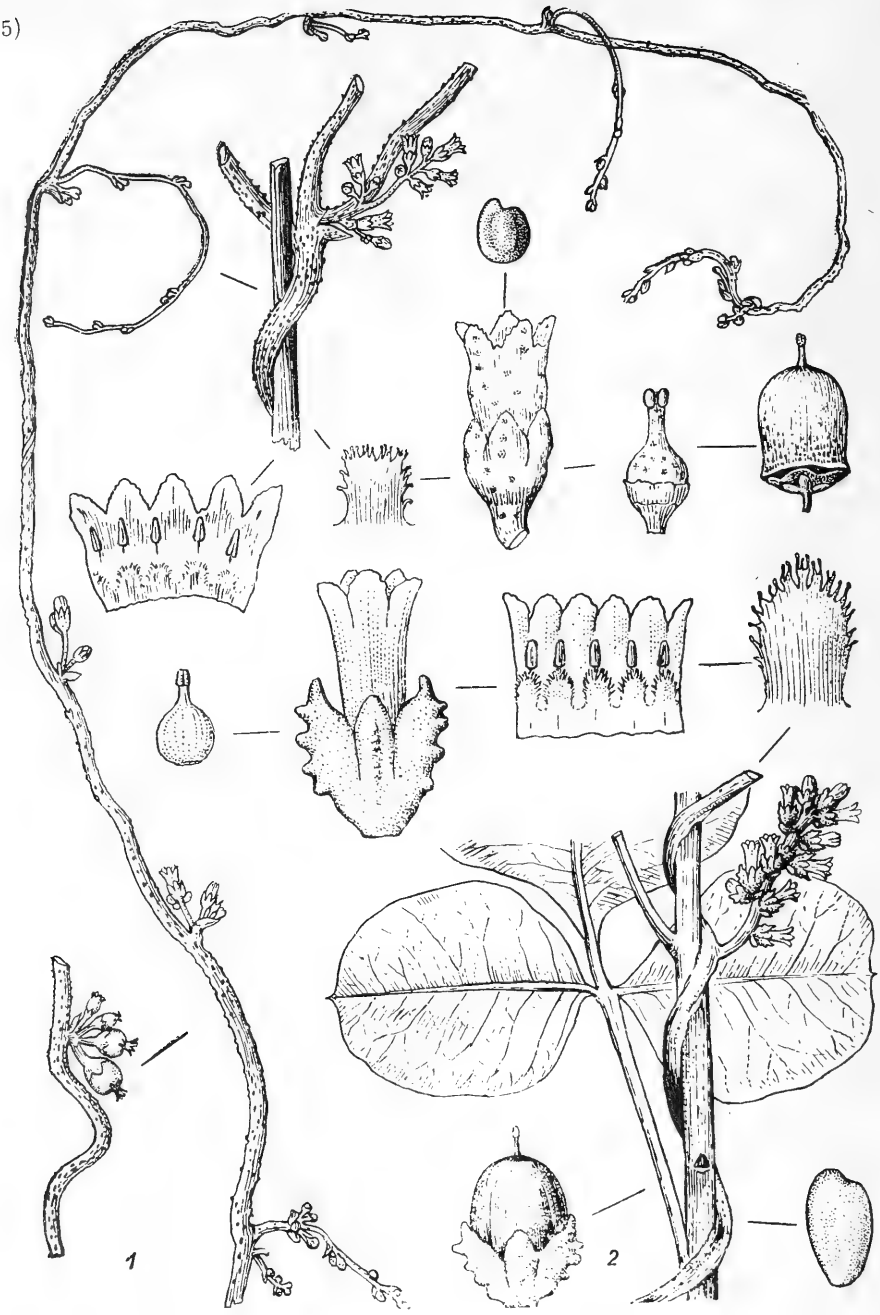

PLATE IV. 1 — Cuscuta lupuliformis Krocker, branch, branchlet with inflorescence, calyx, flower, ovary, capsule, corolla, branchlet with fruit, seed; 2 — C. bucharica Palib., branchlet with inflorescence, calyx, corolla, flower, ovary, capsule, seed.

Subgenus 3. Monogyna Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 460. — Styles completely or incompletely connate (style 1); capsule regularly dehiscing by circular slit.

Section 5. MONOSTYLOS Maxim. Prim. fl. amur. (1859, II) 200. — Monogynella Engelm. l. c. (1859, V) 460. — Stigma capitate, subglobose or ovoid, entire or more or less 2-parted.

25. C. monogyna Vahl, Symb. II (1791) 32; Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 514; Boiss. Fl. or. IV, 121; Palibin in Mat. Fl. Kavk. IV, 2, 59; Ganeshin in Tr. po prikl. bot. XVIII, 1, 296; Grossg., Fl. Kavk. III, 238; Koroleva, Poviliki SSSR, 394; Sorn. rast. SSSR, III, 394; Kryl., Fl. Zap. Sib. IX, 2221; Yuncker in Mem. Torr. Bot. Club. 18, 2, 256, p. p. — C. astyla Engelm. in Bot. Zeit. IV (1846) 276. — Ic.: Ganeshin, Fig. 12; Sibth. et Sm. Fl. Graeca, III, tab. 257; Yuncker, l. c. f. 128. — Exs.: Fl. cauc. exs. No. 292.

Annual; stems threadlike, to 2 mm thick, branching, reddish or pale, sometimes verrucose or smooth; bracts small, ca. 1 mm long, ovate or ovate-triangular, fleshy, concave, pale or more or less colored. Flowers 3.5—4.5 mm
68 long, sessile or distinctly pediceled, pink or nearly white, in few-flowered, loose, spicate inflorescences; calyx nearly spherical, ca. 2 mm long, cleft nearly to base into broadly ovate, obtuse, entire, fleshy, more or less tuberculate lobes with concave back; corolla 3—3.5 mm long, urceolate, its lobes ovate, obtuse, entire or crenulose, erect or slightly declinate, sometimes with inward curved tip, nearly half length of corolla tube; anthers inserted in rictus of corolla, sessile, oval or oval-cordate, colored, sometimes with dotted spots; scales inserted at middle of corolla tube, truncate, more or less 2-parted, slightly and irregularly fimbriate, nearly reaching base of anthers; ovary subglobose, ca. 1 mm across, glabrous, smooth, attenuate to very short (0.5—0.45 mm) style with subglobose, slightly 2-parted, colored stigma nearly as long as style; capsule ovoid or subglobose, to 4 mm long, smooth, with 1—2 seeds; seeds ca. 4 mm long, light or dark brown, irregularly globular-cordate, faintly scabrous. Fl. June—July, Fr. July—August.

Mainly on wild trees, shrubs, perennials and herbaceous plants, often in gardens and vineyards (Uzbekistan and Turkmenistan), infecting fruit trees, berries and ornamental plants, rarely field crops (sunflower). — European part: M. Dnp., V.-Don (southeastern part), Transv., Bes., Bl., Crim., L. Don, L. V.; Caucasus: Cisc., Dag., W., E. and S. Transc.; West Siberia: Ob (?), U. Tob., Irt., Alt.; Centr. Asia: Ar.-Casp., Balkh., Dzu.-Tarb., Kyz. K., Kara K., Mtn. Turkm., Amu D., Syr D, Pam.-Al., T. Sh. Gen. distr.: Med., Bal.-As. Min., Arm.-Kurd., Iran., Dzu.-Kash., Mong. Described from the East (Syria).

Note. It is doubtful whether in the USSR this species extends further east than Altai. In the herbarium of the Botanical Institute of the Academy of Sciences of the USSR there is a single specimen labeled "Krasnoyarsk." As the same label marks specimens of the species from Podolia, and judging from the faint pencil tracing of "Krasnoyarsk" and the suspicion of the last three letters having been added later, this record is doubtful.

26. C. lophosepala Butk. in Bot. mat. Gerb. Inst. bot. i zool. AN UzSSR, XI (1948) 17.

Annual; stems threadlike, to 1.5 mm thick, glabrous, smooth, pale. Flowers sessile, in short, spicate inflorescences to 2 cm long; bracts small, ovate, entire, fleshy, with pectinate appendages dorsal; calyx semi-spherical, ovoid, cleft to base into broadly ovate, obtuse lobes to 3 mm long, peripheral lobes with pectinate apical appendages; corolla hardly longer than calyx,
69 cylindrical, white, its lobes nearly as long as the tube, broadly ovate, obtuse, entire or irregularly notched-dentate, erect, with slightly inward curved tip; anthers sessile, ovate-cordate, yellow, covered with spots; scales inserted below middle of corolla tube, concave, oblong, rounded at apex, with ciliate margins, nearly reaching base of anthers; ovary subglobose, ca. 2 mm across; style shorter than ovary, as long as the capitate, 2-parted stigma; capsule ovoid, with 3—4 large, ca. 3 mm long, light brown, scabrous seeds. Fl. July, Fr. August.

Parasitic on wild, perennial herbs and semishrubs on fine earth-pebbly and stony mountain slopes, in valleys of mountain rivers. Observed on Perovskia angustifolia S. Kudr. and Artemisia sp. — Centr. Asia: T. Sh. Endemic. Described from Central T. Sh. ([former] Ketmen-Tyube [now Toktogul] district, Ayak-Tyk River gorge). Type in Tashkent.

27. C. tianschanica Palib. in Russk. bot. zhurn. 3 (1915) 28.

Annual; stems threadlike, to 3 mm thick, branching, glabrous, smooth, reddish brown. Flowers to 4.5 mm long, sessile, short, compact, few-flowered, spicate panicles; bracts ca. 2 mm long, broadly ovate, obtuse, entire, fleshy, colored at back; calyx ca. 2 mm long, cleft to base, the rounded ovate, obtuse, colored lobes fleshy in upper part, markedly thickened dorsally; corolla cylindrical, nearly twice as long as calyx, pink or white, its lobes nearly as long as tube, oval, obtuse, entire or crenate, slightly recurved; anthers sessile, inserted just below throat of corolla, triangular-ovate, colored; scales inserted below middle of corolla tube, truncate, with finely and irregularly fimbriate margins, not reaching or hardly touching base of anthers; ovary flattened-globose, smooth, with short style and subglobose, 2-lobed, colored stigma nearly as long as style; capsule subglobose, reddish brown, with 2—3 mm long, ovoid, brown, scabrous seeds obliquely notched at base. Fl. July—August or August—September.

Parasitic on wild, perennial herbs and shrubs in mountain river valleys. — Centr. Asia: T. Sh.. Pam.-Al. Gen. distr.: Dzu.-Kash. Described from E. T. Sh. (Sükuoshuchr). Type in Leningrad.

28. C. lehmanniana Bge. in Mém. Acad. Sc. Pétersb. sér. VII (1851) 220; Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 515, excl. var.; Boiss. Fl. or. IV, 112; Koroleva, Poviliki SSSR, 43; in Sorn. rast. SSSR, III, 397; Yuncker in Mem. Torr. Bot. Club, 18, 2, 129, excl. var. — Ic.:
70 Koroleva, op. cit. Figs. 28, 34. — Exs.: GRF, No. 1587; HFAM, No. 153.

Annual; stems threadlike, to 2 mm across, branching, cylindrical, sometimes angled, pale, often speckled or reddish, sometimes verrucose, glabrous, smooth. Flowers to 6(7) mm long, pinkish turning brown, sessile or on pedicels to 3 mm long, clustered in large, to 8 cm long, spicate inflorescences; bracts subrounded, fleshy, entire or slightly crenate, nearly as long as or

slightly shorter than calyx; calyx semi-spherical or ovoid, 2—2.5 mm long, more or less fleshy, cleft nearly to base into ovate or broadly ovate, obtuse or slightly acuminate, entire, concave lobes with keeled back; corolla funnelform, finely tuberculate outside, 2—3 times as long as calyx, its lobes half length of tube, oval, obtuse, crenulose overlapping at base, curved outward; scales as long as corolla tube, adnate to its middle, oval with densely fimbriate margin, touching base of anthers; anthers sessile, ovate-cordate, ca. 1.5 mm long, yellow or slightly violet; ovary ovate, with short style and thickened cylindrical-oval, entire or more or less 2-parted stigma as long as style; capsule ovoid, 5—6 mm long, 4—4.5 mm wide, smooth, shiny, dark brown, with 3—4 irregularly rounded-cordate, ca. 3 mm long, slightly scabrous, yellow to brown seeds. Fl. June—August, Fr. July—September.

Commonly on large, herbaceous plants, shrubs and trees growing in the tugais,* along irrigation ditches, banks of mountain streams in the lower mountain belt, rarely on sands; it also infects seedlings, young fruit trees and ornamental trees and shrubs in nurseries, gardens and vineyards, rare on lucerne or cotton. — Centr. Asia: Ar.-Casp., Balkh., Kyz. K., Amu D., Syr D., Pam.-Al., T. Sh. Endemic. Described from Central Asia. Type in Leningrad.

29. C. bucharica Palib. in Russk. bot. zhurn. 3 (1915) 28.

Annual; stems thick, threadlike, to 3 mm across, cylindrical, sometimes angled or slightly flattened, branching, reddish brown or pale, verrucose. Flowers 5—8 mm long, sessile or on short thick pedicels, in loose to 8 cm long paniculate inflorescences; bracts to 2 mm long, ovate, concave, entire, pale or colored; calyx to 3 mm long, finely tuberculate, cleft nearly to base into ovate or broadly ovate, nearly transparent, often irregularly notched-
71 dentate lobes with thin margin, markedly thickened at back, tuberculate or pectinate; corolla approximately $2\frac{1}{2}$—3 times as long as calyx, cylindrical or slightly broadening distally, finely tuberculate, white or pink, turning more or less brown after flowering, its lobes half length of tube, oblong, orbicular, fleshy, with slightly curled margin, divergent, erect or slightly declinate; anthers inserted in rictus of corolla, sessile, oval or ovate, yellow; scales adnate to corolla tube from base, oval or cuneate, with fimbriate apex, reaching base of anthers; ovary subglobose, ca. 3 mm across, the 1—1.5 mm long style crowned by a cylindrical-ovoid, entire or slightly notched, colored stigma nearly as long as style; capsule elongate-ovoid, ca. 6 mm across, turning brown, with 3—4 seeds to 4 mm long, irregularly rounded-cordate, yellow to dark brown, slightly scabrous. Fl. August—September, Fr. September—October. (Plate IV, Figure 2.)

Parasitic mainly on shrubs and trees, rarely on perennial herbs, on dry, fine earth-pebbly and stony mountain slopes. Observed on species of dog rose briar, honeysuckle, ash, pomegranate, almond, pistachio, Christ's thorn, grapevine. — Centr. Asia: Pam.-Al. Endemic. Described from Tadzhikistan. Type in Leningrad.

30. C. lupuliformis Krocker, Fl. Siles. (1787) 261, tab. 36; Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 516; Boiss. Fl. or. IV, 22;

* [Tugai, bottomland complex with forests, shrubs and meadows in river valleys (Central Asia, USSR).]

Shmal'g., Fl. II, 246; Kryl., Fl. Alt. IV, 875; Palibin in Mat. Fl. Kavk. IV, 2, 60; Szaf., Kulcz., Pawl. Rosl. Polsk., 472; Ganeshin in Tr. po prikl. bot. XVIII, 1, 298; Koroleva, Poviliki SSSR, 39; Grossg., Fl. Kavk. III, 238; Kryl., Fl. Zap. Sib. IX, 2222; Yuncker in Mem. Torr. Bot. Club, 18, 2, 254. — C. monogyna Turcz. in Bull. Soc. Nat. Mosc. XXII, 2, 358, non Vahl. — C. flava Sievers ex Ldb. Fl. alt. I (1829) 294. — Ic.: Syreishch., Ill. Fl. Mosk. gub. III, 46; Ganeshin, op. cit. Fig. 13, 14; Rchb. Ic. Fl. Germ. XVIII, t. 1343; Yuncker, l. c. f. 254. — Exs.: GRF, No. 1583; Fl. Hung. exs. No. 393; Fl. exs. Austro-Hung. No. 639.

Annual; stems threadlike, rather thick, to 3 mm, reddish brown, rarely verrucose, branching, glabrous, smooth. Flowers sessile or short-pediceled, pink or nearly white, turning brown after flowering, in short, interrupted, spicate racemes; bracts oval or ovate, entire; calyx to 2 mm long, semi-
spherical, colored or greenish, turning brown when dry, its lobes broadly ovate or ovate, obtuse, entire, smooth; corolla cylindrical, approximately
72 twice as long as calyx, with oblong-ovate, entire or crenulose, obtuse, erect or more or less divergent lobes nearly half length of tube; stamens inserted just below rictus of corolla, their apices nearly at level of notches between lobes; anthers oblong-ovate, sessile or on short distinct filaments; scales inserted in lower part of corolla tube, oval or ovate, entire or 2-lobed, sometimes obsolete, with irregularly fimbriate margin, not reaching middle of tube; ovary subglobose or broadly ovate, drawn out into more or less cylindrical style with 2-parted, oval stigma $\frac{1}{3}$—$\frac{1}{4}$ length of style; capsule ovate or ovate-conical, to 7—9 mm long, 6 mm across, usually topped by persistent, dried corolla; seeds rounded-cordate, to 3 mm long, light to dark brown, scabrous. Fl. July, Fr. August. (Plate IV, Figure 1.)

Parasitic mostly on trees, shrubs and perennial herbs and affecting fruit and ornamental plantings and berries along banks of rivers and lakes, on flooded meadows, in gardens, nurseries. — European part: U. V., V.-Kama, U. Dnp., M. Dnp., V.-Don, Transv., Bl., L. D., L. V.; Caucasus: S. Transc.; West Siberia: Ob (south only), U. Tob., Irt., Alt.; East Siberia: Ang.-Say.; Centr. Asia: Ar.-Casp., Balkh., Dzu-Tarb., Pam.-Al., T. Sh. Gen. distr.: Centr. Eur., Dzu.-Kash., Mong. (W.). Described from Silesia.

Note. In the eastern part of the distribution area (east of the Volga) the predominant plants differ slightly from the typical European form in the distinct short filaments, entire scales and longer pedicels. In his monograph, Engelmann (1859) included these plants in the Asian C. lupuliformis var. asiatica Engelm.; later (1928) Ganeshin proposed C. lupuliformis ssp. asiatica S. Gan. The status of this form requires special study.

31. C. engelmanni Korsh. in Mém. Acad. Sc. Pétersb. sér. VIII, IV, 4 (1896) 96; Koroleva, Poviliki SSSR, 43; in Sorn. rast. SSSR, IV, 398.— C. gigantea engelmanni (Korsh.) Yuncker in Mem. Torr. Bot. Club, 18, 2, 256. — C. lupuliformis Krock. var. asiatica Engelm. auct. p. p. — Ic.: Koroleva, op. cit. Fig. 31, 32.

Annual; stems rather thick, threadlike, to 3 mm thick, branching, reddish brown or more or less light, covered with small dark tubercles or spots, glabrous. Flowers subsessile, but often on thin, distinct pedicels, 7—8 mm

long, white, clustered in bundles in short, racemiform inflorescences; bracts small, to 2 mm long, ovate, fleshy, entire; calyx semi-spherical, to
73 2 mm long, deeply cleft into broadly ovate, obtuse, entire lobes; corolla more or less cylindrical, to 2—2.5 mm across, slightly inflated about middle, slightly tapering towards apex, 3—4 times as long as calyx, the triangular-ovate, obtuse, crenulose lobes erect or with slightly inward curved tip, $^1/_6$—$^1/_7$ length of tube; scales inserted at base of corolla tube, not reaching its middle, oval or ovate, rounded, fimbriate, connate for half their length, slightly concave; anthers sessile, inserted between lobes in throat of corolla, oblong, slightly acuminate, pale; ovary ovoid, with thin, subulate, 1.5—2 mm long style nearly as long as ovary, and 2-lobed stigma parted nearly to base, half length of style; capsule ovoid, subglobose-ovoid, to 7 mm across, usually colored, corolla persistent after flowering, with 3—4 seeds light to dark brown, scabrous, ca. 3 mm across. Fl. July, Fr. August—September.

Parasitic mainly on trees and shrubs, rarely on perennial herbs, in mountain forests. — Centr. Asia: T. Sh., Pam.-Al. Endemic. Described from Alai Range (between Gul'cha and Lyangar). Type in Leningrad.

32. **C. japonica** Choisy in Zoll. Syst. Verzeichn. Ind. Arch. Pfl. (1854) 134 (n. v.); Pl. Javan. (1858) 30. — C. joponica var. thyrsoidea Engelm. in Transact. Acad. Sc. Sc.-Louis, I, 3 (1859) 517. — C. japonica var. thyrsoidea Kom. in Tr. Bot. Sada, XXV (1907) 310, non Engelm.; Kom. and Alis., Opred. II, 880; Yuncker in Mem. Torr. Bot. Club, 18, 2, 252, excl. var. — C. systyla Maxim. Prim. fl. amur. (1859) 200. — Ic.: Tarasaki, Ic. fl. Japonicae (1933) tab. 1401.

Annual; stems rather thick, fleshy, threadlike, to 2 mm across, branching, glabrous, smooth, more or less reddish, sometimes brilliantly colored. Flowers to 4 mm long, sessile or subsessile, clustered in bundles in 3 cm long racemiform inflorescences; bracts ca. 2 mm long, fleshy, rhombic-rounded, obtuse, entire, strongly thickened dorsally; calyx fleshy, ca. 1.5—2 mm long, cleft for $^3/_4$ of their length into broadly ovate or rounded, entire, obtuse lobes more or less thickened at back; corolla short-campanulate, pink, two or more times as long as calyx, with rounded-triangular, obtuse, erect or slightly curved lobes $^1/_2$ to $^2/_5$ length of tube; anthers sessile, inserted between teeth in rictus of corolla, oval, yellow; scales inserted at base of corolla tube, free nearly to base, reaching middle of corolla or
74 slightly beyond, elongate, entire or more or less 2-parted, with irregularly fimbriate margins; ovary globose, glabrous, smooth, more or less colored, the long thin style as long as or slightly longer than ovary, stigmas 2 completely free, globose or subglobose; capsule oval or ovoid, ca. 4 mm long, more or less colored, with 1—2 rounded-cordate seeds, inflated on one side, slightly concave on the other, ca. 2 mm long, 2.5 mm wide, slightly scabrous, the inflated side colored. Fl. August, Fr. September. (Plate III, Figure 1.)

Meadows and shrubby thickets in riparian valleys mostly parasitic on shrubs and perennial herbs. — Far East: Ze.-Bu., Uss. Gen. distr.: China, Japan. Described from Japan.

33. C. colorans Maxim. Prim. Fl. Amur. (1859) 200. — C. japonica var. paniculata Engelm. in Transact. Acad. Sc. St.-Louis, I, 3 (1859) 517; Yuncker in Mem. Torr. Bot. Club, 18, 2, 253.

Annual; stems filliform, 1—1.5 mm thick, branching, glabrous, smooth, more or less reddish. Flowers to 4 mm long, pediceled, clustered in short, to 3 cm long, paniculate inflorescences; bracts fleshy, ca. 1.5 mm long, rounded-oval, obtuse, entire, thickened at back; calyx ca. 1.5 mm long, cleft nearly to base into subrounded, entire lobes with distinctly thickened back; corolla $2\frac{1}{2}$ times as long as calyx, campanulate, white (when dried), with rounded-oval, nearly erect lobes half length of tube; scales inserted in lower part of corolla tube, nearly reaching middle or slightly beyond middle of tube, free for half, short-fimbriate; anthers sessile, inserted in rictus of corolla, oval or oval-ovate, pale or slightly colored; ovary subglobose, yellow, sometimes reddish in upper part, glabrous, smooth, style slightly longer than ovary, bearing 2 oval stigmas; capsule ovoid-globose or subglobose, reddish, glabrous, smooth. Fl. August, Fr. September.

Parasitic on wild, perennial herbs and shrubs, on mountain slopes. — Far East: Ze.-Bu. Gen. distr.: China. Described from China (Peking). Type in Leningrad.

Note. Our plants are not identical with the typical C. colorans Maxim. distributed in China; they differ from it in the smaller corolla and slightly different shape of the stigmas (oval, not conical). In fact, they are intermediate between C. japonica Choisy and C. colorans Maxim. As our material is inadequate, the taxonomic status of this taxon is difficult to determine with confidence.

75 Section 6. CALLINACHE Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 460. — Stigmas conical, sometimes subulate; corolla deciduous.

34. C. gigantea Griff. in Not. pl. asiat. I (1847) 243; Engelm. in Transact. Acad. Sc. St.-Louis, I, 3, 516. — C. reflexa Palibin in Russk. bot. zhurn. 3 (1915) 29, non Roxb.; Yuncker in Mem. Torr. Bot. Club, 18, 2, 255, excl. var. — Ic.: Yuncker, l. c. f. 127.

Annual; stems threadlike, ca. 2 mm across, branching, brownish red, sometimes pale, covered with small brownish spots, glabrous, smooth or finely verrucose. Flowers sessile or short-pediceled, large, to 10 mm long, clustered in bundles forming paniculate inflorescences; bracts ovate, acuminate, entire, coriaceous, colored at back; calyx semi-spherical, to 3 mm long, pale or colored, cleft for $\frac{3}{4}$ of its length into ovate-oval, obtuse, entire or crenulose lobes; corolla to 8 mm long, cylindrical, completely white or speckled, its lobes $\frac{1}{4}$—$\frac{1}{5}$ length of tube, triangular, obtuse, entire, erect or curved; anthers sessile, oval-oblong, inserted just below rictus of corolla; scales inserted at base of corolla tube, $\frac{1}{3}$ length of tube, free for half, oblong, semi-rounded with fimbriate margin; ovary elongate-ovoid, ca. 2 mm across, smooth, passing into thin style with 2, faintly pinkish, conical stigmas longer than style; capsule elongate-ovoid, ca. 3—3.5 mm across, 5 mm long, smooth, pale, sometimes speckled; seeds irregularly ovoid, dark brown, ca. 3 mm long, 2 mm wide, slightly scabrous. Fl. July—August, Fr. September—October.

Parasitic on wild trees and perennial herbs in mountain stream valleys, on species of Salix, Populus, Lonicera, Hippophae rhamnoides and others. — Centr. Asia: T. Sh. (Yunkuru River), Pam.-Al. Gen. distr.: Iran. Described from Afghanistan. Type in London.

35. **C. pamirica** Butk. in Bot. mat. Gerb. Inst. bot. i zool. AN UzSSR, XI (1948) 18.

Annual; stems threadlike, to 1 mm across, branching, reddish brown or pale, with small, reddish spots, glabrous, smooth sometimes verrucose. Flowers to 7 mm long, sessile or on distinct, verrucose pedicels, in loose, few-flowered, paniculate inflorescences; bracts ca. 2 mm long, triangular-ovate, entire, concave, faintly colored; calyx semi-spherical, to 3 mm long,
76 pale or colored, cleft nearly to base into ovate-rounded, entire, obtuse lobes; corolla ca. 5 mm long, 3 mm across, subcylindrical, white, lobes half length of tube, ovate-triangular, entire, more or less spreading; stamens inserted just below rictus of corolla, anthers, oval, faintly colored, filaments very short; scales inserted at base of corolla tube, reaching its middle, semi-rounded, with finely fimbriate margins; ovary subglobose, to 3 mm across, glabrous, smooth, the short style crowned by 2 conical, more or less connate, often unequal, dark violet stigmas; styles and stigmas half length of ovary; capsule subglobose, to 4 mm across, smooth, with 3—4, to 4 mm long, brown, smooth seeds. Fl. July—August, Fr. September—October.

Parasitic on shrubs, stony mountain slopes in high mountain regions. Observed on species of Ephedra. — Centr. Asia: Pam.-Al. Endemic. Described from Pamir (Bazar Dara Range). Type in Tashkent.

36. **C. convallariiflora** Pavl. in Byull. Mosk. obshch. isp. prir. XLVII, 1 (1938) 82.

Annual; stems threadlike, to 2 mm across, branching, pale or colored, glabrous, smooth. Flowers sessile or on pedicels to 7 mm long, in few-flowered bundles forming short, paniculate inflorescences; bracts ca. 2 mm long, ovate, obtuse, concave, entire; calyx semi-spherical, to 3 mm long, pale or faintly colored, cleft nearly to base into broadly ovate or subrounded, obtuse, entire lobes thickened at back; corolla broadly campanulate, nearly twice as long as calyx, white, its lobes half as long as tube, ovate-oblong, obtuse, entire or crenulose, curved; anthers sessile, inserted in rictus of corolla, ovate-cordate, pale; scales inserted in lower part of corolla, nearly as long, semi-rounded, free with densely short-fimbriate margin; ovary subglobose, ca. 3 mm across, smooth, with 2 approximate, thick, conical, pale, sessile or subsessile, more or less connate stigmas; capsule subglobular or ovoid, ca. 5—6 mm across, glabrous, smooth, with 3—4, ca. 2 mm long, brown, slightly scabrous seeds. Fl. July—August, Fr. August—September.

Parasitic on trees, shrubs and large perennial meadow grasses, in floodplains of mountain rivers and in gardens. Observed on species of Salix, Rosa, Rubus, Epilobium. — Centr. Asia: T. Sh., Pam.-Al. Endemic. Described from Talass Ala-Tau (lower reaches of Dzhebogly-Su). Type in Moscow University, cotype in Leningrad.

77 Family CXXXVI. **POLEMONIACEAE*** VENT.

Flowers single or in terminal, corymbiform, paniculate, rarely axillary or capitate inflorescences, if capitate then surrounded by leaves. Upper pedicels ebracteate or with many bracts. Flowers purple, violet-blue or white; calyx free, more or less 5-parted, often base and margins membranous; corolla regular or slightly asymmetrical, sometimes tube elongate-funnelform or nearly saucer-shaped, short-campanulate or rotate, with 5-cleft limb. Stamens 5, inserted in tube or exserted from it, erect or curved; anthers attached at back, oval or oblong; pollen flattened-globose. Disk cartilaginous, more or less prominent around base of ovary; ovary superior, ovoid or oblong, sessile, 3-locular; ovules 1 or many per locule, attached to center by 1—4 placentas. Stigma simple, shortly 3- or 2-parted above. Capsule ovoid or oblong-ovoid, more or less trihedral, trilocular; seeds single or many per locule, plano-inflated or angled; cotyledons leaf-shaped, radicle visible. Annual or perennial, usually glandular-haired herbs. Lower leaves often opposite, sheathed, the upper (sometimes all) alternate, entire, dentate, pinnatisect or palmatisect.

According to Brand (Pflanzenr. IV, 250 (1907)), the family Polemoniaceae comprises 12 genera, 2 of which grow wild and 1 is cultivated in the Soviet Union. Most species of Polemonium and Phlox are distributed in North America; both genera are represented in the Soviet Union by one section.

Key to Genera

1. Calyx tube herbaceous, with network of veins. Leaves pinnate . . . . . Genus 1180. **Polemonium** L.
+ Calyx tube white-membranous or membranous only between veins. Cauline leaves entire . . . . . 2.
2. Calyx with membranous folds between lobes which elongate post-florally, not rupturing . . . . . Genus 1182. **Collomia** Nutt.
+ Calyx without membranous folds between lobes, usually rupturing to base at maturation of fruit . . . . . Genus 1181. **Phlox** L.

78 Genus 1180. **POLEMONIUM** ** L.

L. Sp. pl. (1753) 162; Davidson, Gen. Polem. 1950.

Flowers single, in clusters of 2—3, often in paniculate or corymbiform inflorescences; calyx herbaceous, nerved, campanulate, rarely tuberculate, always more or less glandular; corolla rotate-campanulate, campanulate or funnelform, distinctly longer than calyx, rounded lobes shorter or longer than tube; stamens attached to corolla in lower part, usually with barbate base, filaments usually slightly shorter than corolla; style smooth, as long as or longer, rarely distinctly shorter than corolla; ovary subglobose, ovoid or oblong, 3 or many, rarely 1—2 ovules per locule. Capsule oblong

* Treatment by V.N. Vasil'ev.

** According to different sources from the Greek p o l e m o s — war; alternately from Polemon, the Greek philosopher.

or subglobose, more or less enclosed in calyx; seeds black or dark, rarely green, oblong, angled, wingless or narrowly winged with straight whitish green embryo and abundant albumen; radicle usually 1½ times rarely same length as cotyledon. Perennial, rarely annual herbs with alternate, imparipinnate leaves, radical leaves long-petiolate, cauline leaves short-petiolate, usually with many leaflets.

Forty species, mostly in North America, 2 in South America, 14 in Eurasia — where specific diversity decreases from east to west.

1. Rhizome branching, bearing several stems, 7—27 cm high . . . . . 2.
+ Rhizome simple, not branching, stems higher . . . . . 8.
2. Stems thick, 11—14 cm high, densely pubescent in upper part, subglabrous below; leaf petioles with broadened base, leaflets 8—14 mm long (Commander Islands) . . . . . 13. P. majus Tolm.
+ Stems thin, leaflets much shorter than those of preceding species . . 3.
3. Stems pubescent from base to apex . . . . . 4.
+ Stems glabrous in lower part or completely glabrous . . . . . 5.
4. Flowers in reduced, subcapitate, corymbiform inflorescences; pedicels commonly shorter than calyx, slightly elongating post-florally; corolla 2½ times as long as calyx. . . 11. P. boreale Adams.
+ Flowers in loose or slightly compressed corymb; pedicels filiform, often longer than calyx; corolla twice as long as calyx . . . . . 10. P. humile Willd.
5. Stems branching nearly from base; corolla 7—10 mm long, with narrow lobes . . . . . 14. P. parviflorum Tolm.
+ Stems simple, branching only in inflorescence; corolla larger . . . . 6.
6. Stems 8—14 cm high; corolla 11—13 mm long, with oboval lobes. . . . . 12. P. hyperboreum Tolm.
+ Stems higher; corolla larger . . . . . 7.
7. Stems glabrous beneath; flowers in loose, corymbiform inflorescence; pubescence barely discernible with naked eye; seeds fusiform . . . . . 8. P. pulchellum Bge.
+ Stems pubescent from apex to base; flowers in compact, corymbiform inflorescence; pubescence distinctly visible, especially on the calyx; seeds ovoid or ellipsoid . . . . . 9. P. pseudopulchellum V. Vassil.
8. Corolla lobes with ciliate margins . . . . . 9.
+ Corolla lobes with margins not ciliate . . . . . 12.
9. Corolla 3—4 times as long as calyx; calyx lobes shorter, rarely as long as tube, obtuse; stamens exserted from corolla at anthesis . . . . . 7. P. liniflorum V. Vassil.
+ Corolla comparatively shorter; calyx lobes longer than tube; stamens not exserted from corolla at anthesis . . . . . 10.
10. Stems rather thin, few-leaved, with 1—2 leaves; inflorescence few-flowered, corymbiform, slightly elongating . . . . . 3. P. acutiflorum Willd.
+ Stems thickish, with abundant leaves; inflorescence rather large, paniculate, usually with short branches, rarely a corymbiform panicle . . . . . 11.

11. Petals with slightly ciliate margins; pubescence of branches of inflorescence, pedicels and calyces not prominent; calyx 7—8 mm long . . . . . 1. P. villosum Rud.
+ Petals with densely ciliate margins; pubescence of branches of inflorescence, pedicels and calyces distinct; calyx 0.8—1.3 cm long . . . . . 2. P. pacificum V. Vassil.
12. Leaflets entire; wild plants . . . . . 13.
+ Leaflets pinnatisect; cultivated . . . . . 5. P. sibiricum D. Don.
13. Corolla 8—15 mm long, 2—2½ times as long as calyx, its lobes rounded or slightly tapering distally; calyx lobes shorter than or as long as tube . . . . . 6. P. coeruleum L.
+ Corolla 16—21 mm long, not more than twice as long as calyx, its lobes slightly tapering distally; calyx lobes longer than, rarely as long as tube . . . . . 4. P. caucasicum N. Busch.

Section 1. EUPOLEMONIUM Peter in Engl. — Pr. Pflanzenf. IV, 3a
80 (1891) 52. — Corolla more or less campanulate to nearly rotate, its tube longer than ocrea. Inflorescence loose to compact, leaflets entire (except for P. sibiricum D. Don).

Series 1. Villosa V. Vassil. — Calyx with simple and glandular or only glandular hairs (sometimes these obsolete at ripening of fruit), 7—13 mm long, its lobes commonly longer than tube. Stamens always much shorter than corolla.

1. P. villosum Rud. ex Georgi, Beschreib. Russ. Reich. III, IV (1800) 771. — P. coeruleum subsp. villosum (Rud.) Brand in Pflanzenr. IV, 250 (1907) 38, ex p. excl. synon. P. acutiflorum Willd.; Kom., Fl. Kamch. III, 41, ex p. excl. synon. P. acutiflorum Willd. — P. coeruleum auct. pl. non L.

Perennial; stems erect or slightly ascending, 30—90 cm high, very leafy, simple or with small terminal leaflets; branchlets and pedicels with dense multicellular, curly, not prominent hairs; lower part of stem completely glabrous; leaves imparipinnate, with 10—13 pairs of lanceolate to narrowly lanceolate, acute, 6—18 mm long leaflets, glabrous on both sides with short-ciliate margins. Inflorescence a narrow pyramidal or umbelliform panicle; calyx 7—8 mm long, campanulate, deeply 5-parted, with simple and glandular hairs, almost glabrous when ripe, lobes dark green, usually bluish after ripening of seeds, nearly 1½ times as long as tube; corolla nearly campanulate or rotate, blue, 15—20 mm long, with acuminate, rarely rounded lobes with slightly ciliate margins, and pilose ring in rictus; stamens shorter than corolla; anthers oval; styles as long as or longer than corolla; capsule globose seeds; oblong, 3 mm long, 0.6 mm wide, fusiformly curved with narrow wings. Fl. July, Fr. September.

Damp meadows in riparian valleys and alpine belt, shrubby thickets, rarely sand dunes. — Arctic: Arc. Sib., An.; East Siberia: Yenis., Lena-Kol., Ang.-Say., Dau.; Far East: Kamch., Okh., Ze.-Bu., Uda, Uss., Sakh. Endemic. Described from Siberia. Type in Leningrad.

Note. The synonymy of Polemonium is quite confused because of the too restricted diagnoses of older authors, the lack of types and unclear records of habitats. Corroboration of our interpretation is provided by Rudolph: "In Sibirien ziemlich gemein...". Indeed, omitting P. coeruleum L. and the vicariant P. liniflorum V. Vassil., none of the large species of Polemonium is as widespread in the central latitudes of
81 Siberia as P. villosum Rud. Davidson (l. c.) identifies P. acutiflorum Willd. with P. villosum (P. coeruleum subsp. villosum (Rud.) Brand) as a synonym of P. villosum Rud.

2. P. pacificum V. Vassil. in Bot. mat. Gerb. Bot. inst. AN SSSR, XV (1953). 222.

Perennial; stems erect or slightly ascending, very leafy, simple, 30—60 cm high, in upper part with abundant multicellular, curly hairs, becoming sparser and sparser downward with base of stem usually completely glabrous; leaves imparipinnate with 9—13 pairs of lanceolate or oblong-oval, short-acuminate, 0.8—2.5 cm long leaflets, glabrous above, sparsely hairy beneath, margins of upper leaves with glandular, clavate hairs. Inflorescence terminal, paniculate, more or less compressed, rarely corymbiform (if so, then plant similar to P. acutiflorum Willd.); branches of inflorescence and pedicels with abundant, simple and glandular hairs; calyx (7)8—13 mm long, campanulate, deeply 5-parted, densely hairy, often villous, its lobes dark green, becoming tinged with blue, 2—2½ times as long as tube, acute; corolla broadly campanulate, twice as long as calyx, dark blue, its lobes obovate, obtusely acuminate or rounded above, with remote hairs outside, ciliate margins, and hairy ring inside tube; stamens shorter than corolla, their filaments adnate to corolla tube, bearing fascicle of hairs; anthers elliptic or ovate; capsule 3-locular, globose; seeds black, nearly fusiform, verrucose. Fl. June—July, Fr. August—September. (Plate V, Figure 3.)

Meadows, sandy ridges of riparian valleys and their slopes. — Arctic: Chuk., An.; Far East: Kamch. (and Commander Islands), Okh., Sakh. Endemic. Described from Bering Island. Type in Leningrad.

Note. Close to P. villosum Rud., from which it differs in the larger calyces, denser pubescence, and more densely ciliate margins of petals; from P. acutiflorum Willd. it differs in the thicker, evenly leafy stem and usually paniculate inflorescence. It represents a Pacific race of the series Villosa V. Vassil.

3. P. acutiflorum Willd. ex Roem. et Schult. Syst. Veg. IV (1819) 792; Benth. in DC. Prodr. IX, 318; Kryl., Fl. Zap. Sib. IX, 2226. — P. coeruleum β. acutiflorum Ldb. Fl. Ross. III (1847) 84. — P. coeruleum subsp. villosum Brand in Pflanzenr. IV, 250 (1907) 38, ex p.; Davidson, Gen. Polem., 223, ex p. — P. campanulatum Fries in Notis. Sällsk. Fauna et Fl. Fenn. XIII (1871) 258, nom. nud.

Perennial; rhizome oblique; stems single, ascending, low, 15—40(50) cm high, sparsely leafy, in upper part covered like pedicels and calyx, with rather
82 long, multicellular, glandular hairs, or else smooth (like leaves); leaves mainly in lower part of stem, as long as or longer than 3—10 cm long, 1—3.5 cm wide petiole; leaflets lanceolate, oblong-elliptic, acute, 5—20 mm long, 2—7 mm wide. Inflorescence a few-flowered, corymbiform subsequently

elongating panicle; calyx longer than pedicel, the 5 narrowly triangular, slightly acuminate lobes longer than tube; corolla violet-blue, ca. 2.5 cm across, 1.8—2.2 cm long, 2—2½ times as long as calyx, rounded lobes tapering towards apex, shortly or obtusely acuminate with sparsely ciliate margins; stamens short, styles as long as or longer than corolla; anthers ovate; capsule subglobose; seeds pyriform, 2.2 mm long, 1 mm wide, rimmed by distally broadened wings. Fl. July—beginning of August, Fr. September. (Plate V, Figure 2.)

Damp, moss tundras, moss bogs, banks of lakes and streams, shrubby or herbaceous slopes. — Arctic: Arc. Eur., Nov. Z., Arc. Sib., Chuk., An.; European part: Kar.-Lap. (Kola Peninsula - rarely), Dv.-Pech. (Far North and Arctic Urals); West Siberia: Ob (N.); East Siberia: Yenis. (N.), Lena-Kol. (N.); Far East: Kamch., Okh. (N.). Gen. distr.: Scand. (N.), Ber., N. Am. (Alaska, British Columbia). Described from NW America. Type in Berlin.

Note. This species grows together with hybrids, with P. villosum Rud., from which it differs in the more complex inflorescences and the more abundant pubescence of the calyx. Some specimens have flowers (f. album). Brand (l. c.) and Davidson (l. c.) include P. acutiflorum Willd. in the synonymy of P. villosum Rud. In fact, these species are easily distinguishable by their morphology and distribution. P. acutiflorum is restricted to the tundra and P. villosum to the forest; the former is low-growing with a simple (not branching) inflorescence; the latter has a large, branching inflorescence.

4. P. **caucasicum** N. Busch in Tr. Bot. muz. XIX (1926) 187. — P. coeruleum Palib. in Mat. Fl. Kavk. 37 (1913) 64, non L. — Ic.: N. Bush, op. cit. Pl. XVII; Davidson, Gen. Polem. f. 1.

Perennial; stem erect, leafy, glabrous, with short-glandular hairs only above, 50—95 cm high; leaves imparipinnate, with 5—11 pairs of lanceolate, acute, sessile leaflets, glabrous on both surfaces, sometimes with few, very short hairs along midrib above. Inflorescence compressed with few branches, sometimes a simple raceme; branches of inflorescence, pedicels and upper part of stem with glandular hairs; calyx with short glandular hairs, 8.5—10 mm long, its lobes oblong or oblong-lanceolate, acute, longer than or as long as tube, 4.75—5.5 mm long, 3 mm wide at base; corolla blue,
83 large, 16—21 mm long, 9—13.5 mm wide, its tube shorter than calyx, with rounded lobes; anthers oval, filaments shorter than corolla; styles shorter than or as long as corolla; capsule 4—5 mm long, broadly obovate, subglobose, with 8—14 seeds per locule; seeds pyriform, rimmed by wings broadening above, brown or cinammon brown, 2.5—3 mm long, 1—1.5 mm wide. Flowers middle of June—August (September), Fr. August—September.

Open slopes in foothills, ledges, upper part of forest belt, subalpine belt, from 1,350 to 2,150 m. — European part: all regions (very rare); Caucasus: Cisc., Dag., W., E. and S. Transc.; West Siberia: Alt. (SW); Centr. Asia: Balkh., Dzu.-Tarb., T. Sh. Gen. distr.: Dzu.-Kash. Described from Kabarda. Type in Leningrad.

Note. Busch separated this species, believing it to be readily distinguishable from P. coeruleum L. (s. str.) distributed in Europe and West Siberia. It could just as well have been compared with P. villosum Rud.,

widespread mainly in Siberia. P. caucasicum has more characters in common with P. villosum than with P. coeruleum. In any case it may be regarded as intermediate between the series Villosa and Coerulea.

5. P. sibiricum D. Don in Edinb. Phil. Journ. VII (1822) 287. — P. dissectum Rchb. Ic. Fl. Germ. IV (1840) 38. — P. coeruleum γ. dissecta Benth. in DC. Prodr. IX (1845) 317. — P. coeruleum var. bipinnatifidum Rgl. et Herd. in Tr. Bot. Sada, I (1872) 482. — Ic.: Rchb. l. c. tab. 463.

Perennial; stem high, 30—50 cm high, branching, markedly furrowed, pubescent at first becoming smooth; leaflets pinnatisect, with linear-lanceolate lobes. Flowers in dense, terminal panicles; calyx hairy; corolla white or blue; stamens as long as, pistil longer than corolla; stigmas 2 or 3. In other characters apparently identical with P. villosum Rud.

This species seems to have been introduced into cultivation from seeds collected in Siberia. Judging by the rather large flowers and the pubescence of the stem and calyx, it must be considered as derived from P. villosum Rud. not from P. coeruleum which lacks these characters. In the last century it was grown in the Petersburg Botanical Garden. Cultivated in gardens. Not seen wild in Siberia.

Series 2. **Coerulea** V. Vassil. — Calyx glabrous or with short glandular hairs, 3—7 mm long, its lobes obtuse, shorter than or as long as tube; stamens exserted from open corolla.

6. P. coeruleum L. Sp. pl. (1753) 162; Benth. in DC. Prodr. IX, 317; Ldb. Fl. Ross. III, 83; Brand in Pflanzenr. IV, 250, 37; Kryl., Fl. Zap. Sib. IX, 2225. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 1334; Brand. l. c. f. 10, A, B; Fl. Yugo-Vost. VI, Fig. 569.

84 Perennial; rhizome thick, creeping, with dense root fibers; stems single, erect, simple, 35—100 cm high, smooth, glabrous below, glandular-hairy above; leaves glabrous, smooth, lower leaves long, the upper short-petiolate, the uppermost sessile; leaflets 15—27, sessile, oblong-lanceolate, acuminate, with obliquely rounded base. Inflorescence a branching terminal panicle; pedicels with glandular hairs, shorter than calyx; calyx campanulate, the obtuse, oblong-oval lobes slightly longer than tube; corolla blue, rarely white (var. album Herd.), ca. 15 mm long (2—2½ times as long as calyx), rotate-campanulate, its lobes twice as long as calyx tube, rounded or slightly acuminate, entire, not ciliate; corolla tube whitish, with internal ring of hairs; filaments long, as long as, rarely slightly shorter than corolla; ovary subglobose with many ovules; capsule subglobose, as long as calyx with many 3.2 mm long, 0.9 mm wide, black, curved-oblong seeds, with narrow wings broadening above; embryo greenish white, 2 mm long; cotyledon ⅔ length of radicle. Fl. June—July, Fr. August—September.

Damp meadows, especially in valleys, riverbanks, forest glades. — European part: Kar.-Lap., Dv.-Pech., Lad.-Ilm., Balt., U. V., U. Dnp., M. Dnp., U. Dns., V.-Don, V.-Kama, Transv., Bes., Bl.; West Siberia: Ob, U. Tob., Irt., Alt.; East Siberia: Ang.-Say. (southwestern part).

Gen. distr.: Scand., Centr. and Atl. Eur. Described from W. Europe. Type in London.

Note. This species is vicarious with the North American P. vanbruntiae Britt. which Davidson, in his monograph, lists as a subspecies of P. coeruleum L. For this, as well as for other species of the series Coerulea, the faintly cleft calyx, stamens usually exceeding the corolla, rounded corolla lobes and weakly glandular pubescence are typical.

7. P. liniflorum V. Vassil. in Bot. mat. Gerb. Bot. inst. AN SSSR, XV (1953) 218. — P. coeruleum auct. quoad. pl. Sib. Or. et Orientis Extremi, non L. — P. coeruleum var. villosum Kom. et Aliss., Opred. rast. Dal'nevost. kr. II (1932) 880, non Brand. — Ic.: Kom. and Alis., op. cit. tab. 268.

Perennial; stems thin, erect or slightly ascending at base 35—75 cm high, short-haired only at apex; leaves imparipinnate, 9—13-paired with lanceolate, narrowly lanceolate, linear, acuminate leaflets, 0.5—3.5 cm long, 2.5—6 mm wide, glabrous on both surfaces. Inflorescence loose, paniculate, rarely corymbiform; branches of inflorescence and pedicels densely covered with short, glandular hairs; calyx glabrous or with short glandular hairs, campanulate, 3—4 mm long, its lobes narrowly triangular, shorter than or as long as tube; corolla blue or pale blue, rarely white (f. album), rotate or broadly campanulate, 12—14 mm long, 3—4 times as long as calyx, its lobes tapering slightly above and below, twice as long as tube, rounded or acuminate, with ciliate margins; stamens slightly shorter, as long as or slightly longer than corolla; anthers oval; pistil longer than or as long as corolla; capsule broadly ovoid; seeds 4.5 mm long, 1.3 mm wide, narrowly elliptic, trihedral, with one face deeply depressed, the indistinct wings broadening above, tuberculate, dark chestnut. Fl. June—July and second half of August, Fr. July—August.

River valleys, broadleaved, mixed and coniferous forests, forest meadows and plots. — West Siberia: Alt.; East Siberia: Lena-Kol. (southern part), Ang.-Say. (eastern part), Dau.; Far East: Ze.-Bu., Uda, Uss. **Gen. distr.**: Mong., Jap.-Ch. Described from the Amur area. Type in Leningrad.

Note. F. album includes specimens with white flowers. In Krasnoyarsk Territory and Irkutsk Region, specimens have been collected which are transitional between P. coeruleum L. and P. liniflorum V. Vassil. Only from the Baikal area and eastward to the Seas of Okhotsk and Japan P. liniflorum occurs without transitional forms. A hybrid with P. villosum Rud. differs from the type in the longer calyx lobes by comparison with the calyx tube and the larger flowers. One of the most beautiful species of Polemonium.

Series 3. **Humilia** V. Vassil. — Stems many, low, 7—30 cm high. Inflorescences few-flowered (3—6); corolla lobes rounded above, truncate, etc., sometimes slightly emarginate.

This series includes, in addition to the Russian species, the American P. pulcherrimum Hook.

8. **P. pulchellum** Bge. in Ldb. Fl. alt. (1829) 233; Benth. in DC Prodr. IX, 317; Ldb. Fl. Ross. III, 84, excl. var.; Kryl., Fl. Zap. Sib. IX, 2227; Davidson, Gen. Polem. 250, ex p. — P. lanatum subsp. pulchellum Brand in Pflanzenr. IV, 250 (1907) 40. — Ic.: Ldb. lc. pl. fl. ross. I (1829) tab. 20.

Perennial; rhizome more or less branching; stems few, rarely single, low, 8—25 cm high, slightly branching or simple, smooth in lower part, in upper part densely glandular-hairy with pedicels; leaves mostly crowded at base of stem, cauline leaves 1—3 (or absent), imparipinnate, 3—15 cm long, 1—2 cm wide, radical leaves $\frac{1}{2}$—$\frac{2}{3}$ length of stem; leaflets 8—10 pairs, elliptic or ovate, rarely rounded-ovate, short-acuminate or obtuse, 3—10 mm
86 long, 2—5 mm wide. Flowers few, at apex of stem and on branches of corymbiform-paniculate inflorescence; calyx with short glandular hairs, with ovate-lanceolate, obtusely acuminate lobes; corolla 2—2.5 cm across, $2\frac{1}{2}$—3 times as long as calyx, lobes of corolla bluish-lilac, broadly obovate, rounded or slightly emarginate, obscurely crenate, nearly twice as long as yellowish tube, with interrupted internal ring of hairs at base of stamens; capsule ovoid; seeds 2.3 mm long, 1.2 mm wide, elliptic or ovate, plano-convex, wingless. Fl. July—August, Fr. August, September. (Plate V, Figure 6.)

Alpine and subalpine mountain belt, on shady cliffs, stony and pebbly slopes. — West Siberia: Alt.; East Siberia: Ang.-Say. (Khamar-Daban). Described from Altai. Type in Leningrad.

Note. In the Baikal area and Transbaikalia this species vicariates with the very closely related P. pseudopulchellum V. Vassil., from which it differs by the white hairs, less compact inflorescence and ovate seeds (fusiform in P. pseudopulchellum).

9. **P. pseudopulchellum** V. Vassil. in Bot. mat. Gerb. Bot. inst. AN SSSR, XV (1953) 225.

Perennial; rhizome multicipital, with simple, erect or slightly ascending stems, to 1.5(2) mm across in lower half, (12)15—30 cm high, entirely covered with sparse, short, twisted, multicellular hairs; leaves imparipinnate, with 6—8 pairs of leaflets, cauline leaves (1)2(3), the upper leaves with 2—4 leaflets, the remaining leaves form a rosette, half length of stem or more; leaflets sessile or on petiolules to 1 mm long, thin, elliptic, 10—16 mm long, 4—6 mm wide, both surfaces with sparse scattered short light hairs. Inflorescence of few-flowered, umbelliform panicle; pedicels with dense divergent hairs; calyx 6—9 mm long, deeply cleft, its lobes lanceolate, acuminate, weakly and shortly pubescent, longer than tube; corolla blue, campanulate, to 1.5 cm long, with broad obovate rounded lobes, and ring of hairs inside tube; stamens shorter than corolla, with ellipsoid anthers; styles shorter than or as long as corolla; capsule ovoid, dotted, with longitudinal, depressed suture at middle, seeds few (6—10), trihedral, fusiform, wingless, dark chestnut, to 2 mm long, ca. 1 mm wide. Fl. June—August, Fr. August—September. (Plate V, Figure 1.)

Well drained sections of riparian valleys and mountain slopes, sandy
87 and pebbly soils. — East Siberia: Lena-Kol., Ang.-Say. (Irkutsk), Dau.; Far East: Okhot. Endemic. Described from specimens from the southern slope of Verkhoyansk Range. Type in Leningrad.

10. P. humile Willd. ex Roem. et Schult. Syst. Veg. IV (1819) 792; Hult. Fl. Kamtch. IV, 73. — P. pulchellum β. humile Ldb. Fl. Ross. III, 84. — P. lanatum subsp. boreale Brand in Pflanzenr. IV, 250 (1907) 40, ex p. — P. boreale Adams in Mém. Soc. Nat. Mosc. V (1817) 92, ex p.; Kom., Fl. Kamch. III, 42, ex p.; Kryl., Fl. Zap. Sib. IX, 2227, ex p. — Ic.: Hult. l. c., tab. 4, c, d.

Perennial; rhizome elongate, thin, simple or branching above, pale; stems low, 8—25 cm high, often few, thin with crisp glandular hairs, simple or with 2—3 branches above; leaves imparipinnate, with 8—11 pairs of leaflets; leaflets oval, obovate, elliptic, obtuse or with very short mucro, subglabrous above, soft-haired beneath and along margins; radical leaves numerous, not exceeding $^2/_3$ length of stem at anthesis, cauline leaves 1—3, shorter than the radical, with fewer leaflets. Flowers in loose or more or less compressed, few-flowered terminal corymb; pedicels and calyx glandular-lanate, pedicels filiform, usually shorter than calyx; calyx to 7 mm long, deeply 5-parted, the acute, lanceolate lobes longer than tube; corolla bright blue, rotate or cup-shaped, twice as long as calyx, corolla lobes rounded, with slightly undulant margins; stamens and styles shorter than corolla; anthers ovoid, rarely rounded; capsule rounded; seeds 3 mm long, 0.8 mm wide, black, nearly fusiform, slightly curved, wingless, with scarious appendage above. Fl. June, July, beginning of August, Fr. September.

Turfy pebbles, sands, rock crevices near water, gravelly offshore bars near the sea, alpine and subalpine belts. — Arctic: Chuk., An.; Far East: Kamch., Okh. Endemic. Described from Kamchatka. Type in Berlin.

Note. The treatment is difficult owing to Willdenow's (l. c.) brief diagnosis and the ambiguity of his geographical information: "In Sibiriae orientalis maritimis arenosis." Hultén (l. c.) writes that he saw the type in Willdenow's herbarium (number 3770), and gives a corresponding illustration. From this it appears that Willdenow's specimen was collected in Kamchatka. There is therefore no reason to confuse the original Arctic P. boreale Adams with P. humile, as has been done by countless authors, including Davidson. In fact, it is easily distinguished from the Arctic species by its smaller flowers, longer and thinner pedicels, and less
88 profuse pubescence, and from P. pulchellum Bge. and P. pseudopulchellum V. Vassil. in the smaller dimensions of the entire plant and its parts and the rather shorter pedicels.

11. P. boreale Adams in Mém. Soc. Nat. Mosc. V (1817) 92; Kom., Fl. Kamch. III, 42, ex p.; Kryl., Fl. Zap. Sib. IX, 2228, ex p. — P. lanatum subsp. boreale (Adams) Brand in Pflanzenr. IV, 250 (1907) 40, ex p. — P. lanatum Pall. Reise, III (1776) 33, nom. nud. — P. pulchellum var. macranthum Ldb. Fl. Ross. III (1847) 85. — Ic.: Davidson, Gen. Polem. f. 12.

Perennial; rhizome vertical or obliquely ascending, its upper part branching and producing several erect or ascending, often slightly curved, simple or slightly branching, 7—15 cm high stems, with rather long, multicellular hairs with small, spherical head from base to apex; leaves crowded at base of stem and on young shoots, single or in pairs at points of branching, 2—7 cm long, 6—15 mm wide, often similar to leaves of moonwort, imparipinnate,

petiolate, covered with hairs beneath, along margins and stem, lower leaves with petioles nearly as long as blade, upper leaves subsessile; leaflets 6—8 pairs, 2—10 mm long, 1.5—5 mm wide, slightly fleshy, elliptic, ovate or obovate, obtuse or short-acuminate. Inflorescence few-flowered (3—6); flowers on densely lanate pedicels, crowded at tips of stem and branches; pedicels shorter than calyx, thicker than in other species of this series; calyx densely villous, 6—7 mm long, with oblong-ovate, obtusely acuminate lobes; corolla violet-blue, nearly 2½ times as long as calyx, ca. 20 mm across, with rounded-obovate or subrounded lobes with obtusely crenate margin; stamens and styles shorter than corolla; filaments adnate to corolla tube, producing fascicle of tangled hairs; seeds 2.3 mm long, 0.7 mm wide, ovoid, with very narrow wings, with flag-shaped broadening above. Fl. July—August, Fr. September.

Sandy hillocks, coastal sands, dry slopes, dry, rarely damp, moss-lichen tundra, pebbly seashores, subalpine belt, alpine coppices. — Arctic: Arc.
91 Eur., Nov. Z., Arc. Sib., Chuk., An.; European part: Urals (Arctic); East Siberia: Lena-kol. (northern part); Far East: Kamch. Gen. distr.: Arc., Scand. (Arctic), N. Am. (Alaska). Described from Siberia. Type in Berlin.

12. P. **hyperboreum** Tolm. in Fedde, Repert. XXIII, 18—25 (1927) 273.

Perennial; stems few, rarely single, ascending, branching only in inflorescence, 8—14 cm high, nearly smooth in lower part, distinctly pubescent in upper part; radical leaves 4—10 cm long, their petioles broadening at base, leaflets narrowly elliptic, obtuse, to 10 mm long; cauline leaves usually 1—2, 1 sometimes as long as radical but with small leaflets, other always weakly developed. Inflorescence loose, hairy pedicels usually longer than calyx; calyx campanulate, markedly expanding at base in fruit, narrow acute lobes much longer than tube, densely pubescent when young (hairs shorter than in P. b o r e a l e) becoming smooth, glabrous; corolla blue, 2½ times as long as calyx, ca. 11—13 mm long, with narrow oboval, obtuse lobes twice as long as tube; anthers broadly ovate, nearly rounded, small, ca. 1 mm long; seeds rounded, ca. 3—3.5 mm across. Fl. July. (Plate V, Figure 5.)

Damp moss tundra. — Arctic: Arc. Sib. (mouth of Pyasina River), Lena-Kol. (northern part). Endemic. Described from Pyasina River. Type in Tomsk.

N o t e. This species has been little studied. It differs from the Arctic P. b o r e a l e Adams by the thin stem (sparingly pubescent only in upper part), by small flowers, markedly cleft calyx with narrow sparingly pubescent lobes; from P. h u m i l e Willd. it differs in its small dimensions, smaller flowers, rounded seeds, and other characters. From both it differs in the faint, nearly indiscernible hairs on all parts. Its phylogeny is doubtful, though it appears to be closest to P. h u m i l e Willd. The American P. p u l c h e r r i m u m Hook. is close to P. h u m i l e Willd. and P. h y p e r b o r e u m A. Tolm. It is distinguished from both in its smaller flowers and leaflets and more massive rhizome.

13. P. **majus** Tolm. in Fedde, Repert. XXIII, 18—25 (1927) 274.

Perennial; rhizome apparently branching; stem erect, 11—14 cm high, thickish, simple, rather densely pubescent in upper part, nearly smooth

(89)

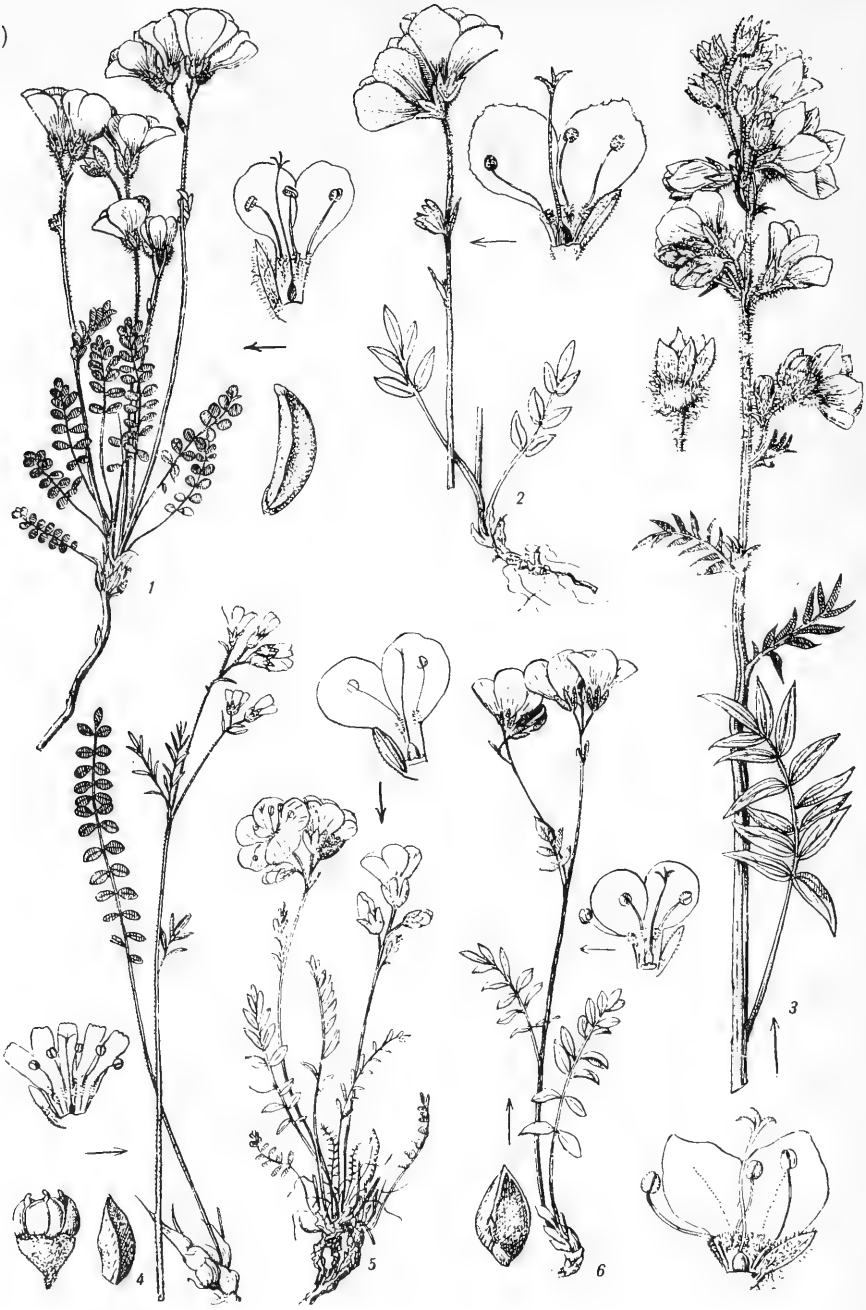

PLATE V. 1 — Polemonium pseudopulchellum V. Vassil.; 2 — P. acutiflorum Willd.; 3 — P. pacificum V. Vassil.; 4 — P. parviflorum Tolm.; 5 — P. hyperboreum Tolm.; 6 — P. pulchellum Bge.

in lower part; radical leaves of variable size, their petioles strongly broadened at base, larger in sterile specimens than in the fertile, to 15—17 cm long, imparipinnate, with 15—25 oval or oval-lanceolate, acute,
92 2—3 cm long leaflets; cauline leaves 2—3, from 3 to 8 cm long, with 7—17 lanceolate, 8—14 mm long leaflets. Inflorescence few-flowered, subcapitate; pedicels tomentose; calyx campanulate, 12—15 mm long, with acutish lobes, much longer than pedicels; corolla rotate-campanulate, blue, 23—26 mm long, lobes tapering, obtuse, 1½ times as long as tube; stamens 5—7 mm long, shorter than corolla, with large, oblong-ellipsoid anthers; styles slightly longer than stamens. August.

Apparently in dry habitats. — Far East: Kamch. (Mednyi Island). Endemic. Described from Mednyi Island (Commander Islands). Type in Leningrad.

Note. Among the Russian species of Polemonium, this species occupies a special position. Several significant characters (shape of petals, cilia along petal margins, rather thick stem, large leaves and rather large calyx) bring it into relation with the series Villosa, but the presence of a few stems (not only one) brings it close to the series Humilia.

Series 4. **Parviflora** V. Vassil. — Stems branching, thin. Inflorescence loose. Flowers small; corolla lobes narrow, obtuse, rounded or with small beak, sometimes slightly dentate.

This series includes the North American P. mexicanum Cerv. ex Lag. and P. micranthum Benth., distributed in the northern states of Mexico and the United States; the latter also spreads to South America, from Brazil to Patagonia.

14. **P. parviflorum** Tolm. in Bot. mat. Gerb. Glav. Bot. Sada, IV, 6 (1923) 1.

Perennial; plant 22—26 cm high, its branching rhizome covered with reduced leaves, with few ascending, branching (or few-branched), smooth or sparingly pubescent stems; radical leaves 8—10 cm long, with 7—12 pairs of leaflets, cauline leaves shorter, with fewer leaflets, elliptic or subrounded, 3—6 mm long, glabrous above, pubescent beneath. Flowers in loose, few-flowered inflorescences; pedicels very thin, usually longer than calyx, tomentose; calyx campanulate, with lanceolate lobes; corolla pale blue, funnelform-campanulate, twice as long as calyx, 7—10 mm long, its obtuse lobes slightly dentate above, somewhat longer than tube; stamens slightly shorter than corolla; styles slightly longer than stamens; seeds ovoid, trihedral, wingless, 2.1 mm long, 0.9 mm wide. Fl. August, Fr. August—September. (Plate V, Figure 4.)

Valleys in coniferous forests. — Arctic: Arc. Sib.; East Siberia: Yenis., Lena-Kol.; Far East: Okh. (coast), Kamch. Described from Kolyma. Type in Leningrad.

93 Genus 1181. **PHLOX*** L.

L. Sp. pl. (1753) 151.

Flowers in terminal corymbs, often in pyramidal panicle, rarely single; calyx tubular or campanulate-tubular, often glandular, its tube transparent

* Phlox, Theophrastus' name for the plant with fire-red flowers.

between green nerves, epidermis often tuberculate-folded, lobes acute, narrow, after flowering rupturing with accrescent capsule to base; corolla funnelform, rarely tubiform, with thin, smooth or pubescent tube and oval or oblong, entire or 2-parted lobes; stamens short, adnate to and enclosed in tube; styles smooth, short or elongate; ovary oval or oblong, with 1, rarely 2 or more ovules per cell; capsule ovoid, not longer than calyx. Seeds wingless, embryo usually green, entirely or nearly entirely filling seed. Perennial herbs, sometimes semishrubs, rarely annuals. Leaves entire, the lower opposite, the upper often alternate.

About 50 species in North America, one in the Soviet Union (Siberia). Many species, e. g., P. paniculata L., P. maculata L. and their many garden forms, are exquisite ornamental plants extensively grown in gardens.

Section 1. OOPHILA Brand in Pflanzenr. IV, 250 (1907) 58.— Embryo filling nearly entire seed, 1.5—3 mm long, Locules with 2 ovules.

1. P. sibirica L. Sp. pl. (1753) 153; Benth. in DC. Prodr. IX, 307; Ldb. Fl. Ross. III, 82; Herder in Tr. Bot. Sada, I, 478; Brand in Pflanzenr. IV, 250, 77; Kryl., Fl. Zap. Sib. IX, 2224.— Ic.: Trautv. Pl. Imag. 35, tab. 24.

Perennial; cespitose plant; stems many, creeping or ascending, 8—15 cm high, entire plant pubescent; leaves linear, 2—5 cm long, 2—3 mm wide, mucronate, with long-haired margins, with slightly drooping edges, lower leaves soon wilting. Flowers terminating stems, single or few; pedicels much longer than calyx; calyx and pedicels glandular-hairy, their lobes linear-subulate, slightly longer than tube, tube of corolla as long as or slightly longer than calyx, its lobes slightly longer than tube; locules with 2 ovules. Fl. June, Fr. July—August.

Dry meadows, stony slopes. — European part: V.-Kama, Transv.; West
94 Siberia: U. Tob., Irt., Alt.; East Siberia: Lena-Kol., Ang.-Say., Dau.; Far East: Okh. Gen. distr.: Arc. Am. Described from Siberia. Type in London.

Note. According to Brand (l. c.) this species represents a mixture of sections Oophila and Heterostylon. Its closest relations are P. nana Nutt. (Mexico, Texas) and P. nelsonii Brand (southeast Arizona).

Genus 1182. **COLLOMIA*** Nutt.

Nutt. Gen. North. Amer. Pl. I (1818) 126.

Flowers in terminal, capitate inflorescences enclosed in leaf-shaped envelope, rarely axillary; calyx obconical or tubular-campanulate, glandular, folded between lobes, persistent, with green lobes, entire tube (rarely only between nerves) membranous; corolla funnelform or cup-shaped, 2—4 times as long as calyx, smooth or glandular, its lobes usually much shorter than tube; stamens adnate to tube, exserted or inserted with glabrous base; pistil smooth, longer than calyx; ovary ovoid or oblong, with 1, rarely

* From kolla — mucilage, referring to the stickiness of the seeds when immersed in water.

2—5 ovules in 3 locules; capsule obovate or obconical, tapering at base, rarely oval or subglobose. Seeds wingless. Annual herbs, glandular-hairy above. Leaves alternate, rarely pinnatisect.

Nine species in North America.

1. **C. linearis** Nutt. Gen. Amer. I (1818) 126, excl. syn.; Linch. in Sov. bot. 3 (1940) 105. — Collomia parviflora Hook. in Bot. Mag. LVI (1829) tab. 2892. — Gilia linearis A. Gray in Proc. Amer. Acad. XVII (1882) 223. — Ic.: Linch., op. cit. Fig. 1.

Annual; stems 15—30 cm high, usually branching in upper part; leaves alternate, linear, slightly mucronate, 4—5 cm long, 0.4—0.7 cm wide. Inflorescence a cyme of 5—10 flowers, subtended by several, rounded-triangular bracts, 1—1.5 cm long, ca. 0.5 cm wide; flowers pink, blue when dry; calyx campanulate, ca. 0.6 cm long, whitish-membranous in lower, 5-parted in upper half, with 5 green, herbaceous, narrow, triangular denticles with dense glandular hairs; corolla sympetalous, with long tube, with 5 oval, ca. 3 mm long, 1.5 mm wide lobes; calyx tube ca. 1 cm long, ca. 1 mm wide; stamens 5, inserted in corolla tube; ovary superior, with long, distally short-3-parted style nearly as long as corolla tube; fruit a trilocular capsule with 1 seed per cell, dehiscing when ripe.

In the spring of 1939 I. A. Linchevskii found this American species in the Botanical Garden of the Tadzhikistan station of the Academy of Sciences of the USSR in Stalinabad, where it had apparently been introduced with some American phloxes. Collomia linearis has blossomed in seed-beds as well as in woods. In 1943, 1945 and 1946 it was found in some parts of the South Urals State Reserve where it flowered and apparently bore fruit.

Family CXXXVII. **HYDROPHYLLACEAE** * LINDL.

Flowers usually small, ebracteate, opposite leaves, single or in cymes twisted above, secund; calyx deeply 5-cleft or 5-parted, persistent, more or less accrescent in fruit; corolla white, blue or purple, sympetalous, regular, 5-sect or 5-lobed above, lobes obtuse, 3-nerved, tube 15-nerved; stamens 5, inserted at base of corolla, with thin filaments and 2-locular anthers; pistil 1, ovary ovoid-conical, free, slightly bristly-hairy, 1-locular, rarely 2-locular; style filiform, 2-sect, stigmas small, capitate; capsule globose, oblong or ovoid, 2-valved, dehiscent, with persistent middle placenta; seeds globose, oblong or ovoid, undulant-rugose. Annual or perennial herbaceous plants, erect or decumbent, branching, usually pubescent; leaves alternate, usually pinnatilobate or pinnatisect, ebracteate.

Seventeen genera and about 170 species, mostly in North America. One genus — Phacelia — occurs in the USSR.

Genus 1183. PHACELIA* Juss.

Juss. Gen. (1789) 129.

Flowers many, short-pediceled or subsessile, ebracteate, usually in secund, dense or sparse, often 2-sect inflorescences; calyx 5-parted, without appendages; corolla blue, violet, white, rarely dingy yellow, campanulate, campanulate-tubular or nearly rotate, deciduous, 5-sect or 5-lobed, tube folded on the inside or with small scales; stamens 5, usually exserted,
96 adnate to corolla between scales; pistil 1, ovary 1-, rarely 2-locular, glabrous at base, with bristly hairs above; style 2-sect, stigmas small, capitate; capsule ovoid, dehiscing by 2 valves, with bristly hairs in upper part; seeds 4, ovoid, spherical-inflated dorsally, 2-faceted ventrally, transversely undulant-rugose. Annual or perennial herbaceous plants, usually short-haired or bristly-haired; leaves alternate, entire or large-toothed, usually lobed or pinnatisect.

About 80 species, in the western part of North America and in Mexico, some species in Peru and Chile (Andes). Cultivated and escaped in the USSR.

1. P. tanacetifolia Benth. in Trans. Linn. Soc. XVII (1837) 280; DC. Prodr. IX, 299; Grossg., Opr. rast. Kavk. 281. — Ic.: Bot. Mag. tab. 3703. — Exs.: Fl. stiriaca exs. No. 1226, 1227.

Annual; plant to 30—70 cm high, scabrous-hairy or bristly-hairy, entire plant covered with short, more or less thick, white, rarely long, sparse, unicellular hairs; stems nearly erect, green, sometimes reddish violet, brittle; leaves alternate, pinnatisect, 2—12 cm long, 1.5—6(8) cm wide, imparipinnate, asymmetrical; sessile lobes oblong or ovate, 0.5—2 cm long, 2—7 mm wide, unevenly notched-toothed, acute. Flowers many, ebracteate, on 1—2 mm pedicels or subsessile, in spicate, often 2-parted, 3—8 cm long, 0.6—1.2 cm wide, compact inflorescences; calyx 6.5—7 mm long, villous, covered with long, straight, white hairs, twice as long as capsule, with linear-oblong, acute lobes, 5.5—6 mm long, 0.7 mm wide; corolla pink-blue campanulate, 8 cm long, glabrous, slightly longer than calyx, auricled, tube 4 mm long, with 5 equal, obovate, obtuse, entire, 4 mm long, 3 mm wide lobes; stamens 5, with thin long protruding filaments 1.2 cm long, inserted between scales; pistil 1, ovary ovoid or ovate, brown, 1 mm long, 0.5 mm wide in its upper part with white, erect, upright, long hairs, style filiform, deeply parted, 1.4 cm long, pubescent below, stigmas small; capsule ovoid, 3.5 mm long, 3 mm wide, brown, covered in upper part with sparse, white, long, upright, unicellular hairs, dehiscing by 2 valves; seeds 4, generally ovoid, dorsally
97 rounded-inflated, ventrally 2-faceted, undulant-rugose, with alveoli in the wrinkles and small pits at their margins. July.

Cultivated as a honey plant growing as a weed in kitchen gardens and fields of wheat, rye, millet and lentil. — European part: Balt., U. V., V.-Don, Transv. (Kusary). Gen. distr.: N. Am. and Centr. Eur. (cultivated). Described from California. Type in London.

Economic importance. Cultivated as a honey plant. The nectar is yellowish, the honey white, fragrant and delicious. One hectare yields 2 tons of honey (Rudnev - 1 ton). Deserving wide cultivation (Grossg., Rast. res. Kavk. 87).

* Treatment by S.G. Gorshkova.

** From the Greek f a c e l o s — fascicle, referring to the seemingly fascicular arrangement of the flowers.

Family CXXXVIII. BORAGINACEAE G. DON

Flowers 5-merous, regular, often obscurely zygomorphic (as seen in the slight irregularity of the sepals and petals), rarely distinctly zygomorphic (Caccinia and the tribe Echieae). Calyx sympetalous or rather cupulate, i. e., sepals not separating from torus individually or collectively, sometimes entire calyx detaching from the peduncle together with the fruit, more or less cleft into 5 teeth or deeply cut (parted) into 5 lobes, usually slightly or strongly growing in fruit, rarely undergoing other changes, e. g., hardening of the base, and associated excrescences, etc. Corolla brachymorphic, i. e., with short tube and rather wide, more or less flat, rotate limb; anthers subsessile, enclosed in corolla tube; style short, throat of corolla covered with scales or protuberances produced by invagination of petals along their midrib, mesomorphic tube more or less elongate, limb usually campanulate; stamens with short or long filaments, sometimes exserted like style; scales present or replaced by longitudinal folds constricting in tube) or corolla dolichomorphic (more or less tubular, elongate, with boundary between tube and limb indistinct, if scales lacking or present then even if boundary is distinct, the limb narrowly campanulate to nearly tubular, only apex cleft into short teeth (denticles)); other forms of corolla rare (Trichodesma, Caccinia). In bud petals usually overlapping, one entirely covered by others; following three with overlapping margins, each covering edge of preceding and subsequent petal (sic); the outer fifth is
98 free. Rarely petals in bud, contorted, where all 5 petals arranged like the 3 median petals in the preceding case, i. e., covering the preceding petal at one side and the following one at the other (tribe Myosotideae). Even more rarely petals valvate, Heliotropium sections Bucanium and Catoxys. Anthers usually dorsally attached to petals, rarely nearly at base, oblong to linear, sometimes sagittate, obtuse or mucronate, the mucro being a continuation of the connective, stamens usually free, rarely fused at base or for entire length and then forming tube, usually glabrous, sometimes with lanate back (Trichodesma). Sometimes base of filaments may bear hairy scales or fascicles of hairs, the corolla tube may be completely pubescent inside, though more often it is usually glabrous but for fascicles of hairs. The base of the corolla often carries a narrow (protective) ring of small scales or a thickening or an uninterrupted, glabrous or hairy ring. This ring protects the nectar stored beneath the hypopygnous disk (protective ring), which has often been erroneously called nectary or nectar bearing. Stamens (anthers) usually 5 in one whorl, rarely irregularly separated, regularly unequal in the zygomorphic Echieae. Ovary superior, 4-locular, with terminal style (Heliotropioideae) or 4-lobed and then style basal, inserted in depression between parts of ovary, rarely even in this case apical; each part of ovary corresponds to 1 cell or ovule; style more or less long, glabrous or pubescent, entire, rarely split into two short branches each with a stigma, even more rarely each of these in turn split, totalling 4 stigmas. In an entire style the stigma may be entire, dotted or capitate or more or less 2-lobed. A unique stigma occurs in the Heliotropioideae: from their rounded disk at base of serving stigma ascends a sterile conical apex. Ovules inverted, with micropyle turned up and inward. Seeds exalbuminous or with thin albumen (perisperm). The cells of the ovary usually

bear 1 nutlet (4 for entire fruit), rarely (Tournefortia, Cerinthe) fruit dividing into 2 bilocular halves, very rarely (Rochelia) fruit reduced to 2 ovarian lobes with 1—2 nutlets, 1-2-3 nutlets sometimes in 4-locular ovary. Pericarp of nutlets thin or thick, sometimes stony, occasionally (Tournefortia) surrounded by a suberose epicarp; form of fruit variable, cross section usually trihedral; the external face, if sharply limited by acute ribs, is designated as dorsal area; if continuous with the sides it is called 'back'. Sometimes the nutlets are dorsoventrally compressed, flat
99 (Cynoglosseae and some others) or rounded turbinate. They may be smooth, tuberculate, pitted, plicate-rugose, hairy or spiny (the spines often have anchor heads) or with wings produced along ribs. The gynobase is that part of the torus which carries the nutlets and from which they usually separate when ripe (sometimes it is simply called: torus). It may be flat or appear like a cone or 4-faceted pyramid rising from the bottom of the calyx after the abscission of the corolla; the actual nutlets may be borne in depressions or on protuberances. The style, borne at the apex of the pyramidal gynobase may inconspicuously pass into its acute apex and persist partly or wholly in ripe fruit. The area of its attachment to the gynobase is called the cicatrice (trace); this may be basal or ventral, i. e., near the base of the nutlet (this is best seen when the nutlet is straight and its apex is in one line with the center of the cicatrice); however, even with a basal cicatrice the nutlet may be curved nearly to a horizontal position, its apex diverging from the vertical line joining the center of the cicatrice; in the Anchuseae the two sides of the nutlet are unequal, one smaller than the other. The nutlet tapers just above the cicatrice to a more or less long stalk which passes into the body of the nutlet; this may be solid (Alkanna) or often apparently hollow as in the Anchuseae where a pit on the stalk carries a soft white caruncle on which ants feed. This leads insects to transport the nutlets, thus aiding distribution. The caruncle, derived from the tissue of the gynobase, forms a protuberance removed together with the nutlet. Such caruncles occur in Myosotis (section Strophiostoma) on stalkless nutlets. In Anchuseae the stalk has a thickened outer layer which often appears as a smooth or ribbed ring (ring of attachment). The ventral cicatrice may be large, extending along most — or over the entire length — of the nutlet, also — as in Cynoglosseae — it may be flat and attached to the faces of the pyramidal gynobase; in this case the nutlet grows downwards, to below the base, and deflects the lobe of the calyx; otherwise it grows at both apex and base, the apices of the nutlets overtopping the pyramid of the cicatrice, hiding the style. Nutlets with a basal cicatrice grow only at their apex, upwards if erect and laterally if curved. The Eritricheae have a small ventral cicatrice; its nutlets are trihedral in cross section, and have an acute ventral keel. The cicatrice is either at the base of this keel (and then the nutlet grows mainly apically), or at its middle (superbasal cicatrice — Hackelia, Eritrichium) and then the nutlet grows at both apex and base, often turning turbinate, with the sides similar to base and apex, the nutlet appearing to grow with its back to the disk, obliquely above the pyramidal gynobase. Simultaneously with the growth of the nutlet, the gynobase also may grow so that the final position of the nutlets, style and calyx depends on their combined growth. In the Anchuseae a ventral cicatrice is a rarity, especially with nearly horizontally (reniformly) curved nutlets, in which case

the basal ring crosses to the ventral side (Nonea ventricosa). In Bothriospermum the nutlet is quite unique, reniformly curved but vertical, attached by a small (true) basal cicatrice to the flat gynobase by its lower end and with a large, spurious cicatrice at the curved, free, ventral side, with an annular thickening (as in the Anchuseae) but without a caruncle. The seeds and embryo are mostly straight, but often curved — section Maschalanthus of Omphalodes when the nutlet is not curved and in the Anchuseae (Nonea, Anchusa) and Lithospermeae (Alkanna) when the nutlet is curved. The radicle of the embryo always turns upward, towards the apex of the nutlet. When appearing above ground, the cotyledons are flat, more or less thick, and bristly. The nectary is a hypogynous, thin or thickened, entire or lobed disk. Pollination is usually by insects; plants with very small corollas (very small-flowered heliotropes, small-flowered Lappula) are cleistogamous or autogamous. A series of genera (Pulmonaria, Arnebia, Macrotonia and Symphytum) show diamorphic heterostyly of the Primula type. The yellow corollas of the large-flowered Arnebia and Macrotomia are notable for violet spots, which disappear after pollination. In Myosotis and other genera, when the color changes, scales are seen to protrude from the throat of the corolla. The zygomorphic flower of Caccinia is unique.

The Boraginaceae in our delimitation are herbs, perennials, biennials or annuals with semishrubs confined to the Heliotropeae. Leaves are alternate, very rarely opposite (Omphalodes scorpiodes, Stephanocaryum olgae, Allocarya orientalis), usually entire, only in some Anchuseae obscurely angled-toothed. The coarse pubescence of the leaves and parts of the stems is typical due to white tubercles (multicellular excrescences of the epidermis) with simple, usually apical bristles. These bristles and tubercles are clearly developed in Echieae, Anchuseae; less
101 so in Cynoglossinae, Lithospermeae, Eritricheae and Heliotropeae. In the first two tribes the bristles are spinescent or prickly (Asperugo, Symphytum asperum). Some genera (Nonea, Pulmonaria and others) in addition to bristly hairs also have glandular ones. The inflorescences of Boraginaceae, too, are typical. These are always cymose (dichasial) with cymes mostly one-sided, more or less strongly twisted bostrices, with or without bracts. These in turn may be disposed in a paniculate, racemiform, corymbiform, capitate or spicate inflorescence if the stem branches above and bears bostrices on its branches. At the ends of the main branches and stems the bostrices are arranged in 2 (rarely 3—4) bifurcations. While the fruits ripen the bostrices straighten and often become markedly elongated.

Note. We are following G. Don in giving the Boraginaceae limited range, exclusive of Cordiaceae (subfamilies Cordioideae and Ehretioideae Guerke) which comprise only shrubs and woody plants bearing drupes and which seem to us to be too different from the overwhelming majority of Russian herbaceous Boraginaceae. Phylogenetically the Cordiaceae are essentially primitive, whereas the Boraginaceae are later xerocarpous and herbaceous derivatives. The Heliotropioideae in particular should be separated as the family Heliotropiaceae along the lines suggested by Van Tieghem. The characteristics given above refer to the Boraginaceae sensu strictu.

We are retaining the traditional classification of De Candolle with improvements and revisions by Boissier (Fl. or. IV, 125—284), Bentham and Hooker (Gen. pl. II, 834—865), Guerke (Nat. Pflanzenf. IV, 3a, 90—131), Brand (in Pflanzenr. IV, 252, Cynoglosseae and Cryptantheae), Johnston (The Old World Genera of the Boraginoideae, in Contr. Gray Herb. LXXIV (1924) 42—73), and Zakirov (Burachnikovye Zeravshana (1941)).

Key to Genera

1. Ovary entire, 4-locular, the apical style with characteristic relatively large, conical stigma; when ripe ovary divided into 4 straight nutlets or 2 bilocular, corklike halves ventrally attached at their base to the slightly raised slightly pyramidal gynobase. Seeds with thin perisperm. Herbs or subshrubs, with white and yellow, small or medium-sized flowers with petals variously disposed in bud; if annuals, then not ephemeral. The lower surface of the leaves (Heliotropeae DC.) bears typical dotted glands (not glandular hairs). 2.

102 + Ovary 4-, rarely (Rochelia) 2-lobed, lower part of basal style rarely discernible because lobes of ovary are sunk in the large gynobase, hence ovary apparently entire, spuriously apical style emerging from top of gynobase (Heterocaryum, Suchtelenia, Trichodesma), but then stigma small capitate, not conical or large. (Subfamily Boraginoideae Guerke). . . . . 3.

2. Fruit large, 6—8—10 mm across, when ripe dividing into 2 bilocular drupes with spongy-corklike epicarp and coarse, hornlike endocarp . . . . . 1184. Tournefortia L.

+ Fruit small, split, of 4 small nutlets (or 1 by reduction); inner walls of the nutlets thin, stiff, without corklike epicarp . . . . . 1185. Heliotropium L.

3. Torus flat. Nutlets attached basally, very rarely ventral and then with ring of attachment developed as caruncle (Anchuseae). Nutlets always without prickles, rarely with rudimentary wings . . . . . 4.

+ Torus (gynobase) more or less pyramidal with nutlets ventrally attached, often prickly or winged . . . . . 27.

4. Cicatrice hollowed out, appearing as a short stalk or ring of attachment, thickened along its free margin; protruding outward below nutlet from pit of stalk or ring as a white caruncle. Nutlets always asymmetrical, often more or less curved, wrinkled or tuberculate. Corolla variable (brachymorphic, mesomorphic or dolichomorphic), with fornices (Anchuseae Koch) . . . . . 5.

+ Cicatrice flat or nearly flat, not hollowed out, rarely with (Myosotis sect. Strophiostoma) mostly without caruncle; sometimes with solid (Alkana, Trigonotideae) or hollow stalk but then without caruncle (Stenosolenium) . . . . . 15.

5. Throat of corolla with well-developed scales, often hairy, rarely glabrous . . . . . 6.

+ Throat without scales, instead fascicles of hairs or scales rudimentary with pubescence retained. Calyx cleft into more or less short teeth which grow into sacciform excrescences in undivided part of fruit. Glandular hairs present. . . . . 14.

6. Scales very long, as long as stamens, lanceolate, acute, papilliform. Corolla dolichomorphic, hiding stamens and scales in tube proper or in funnelform-tubular limb. Rather large herbs with broad leaves growing mainly in forests . . . . . 1199. Symphytum L.

\+ Scales obtuse or notched, short; corolla shorter, mesomorphic or brachymorphic . . . . . 7.

103 7. Short, broad filaments with subulate appendage borne below large, violet anthers and covering their lower part. Corolla characteristic: rotate, large, blue, with very short tube and acute lobes. Anthers with subulate mucro. Nutlets erect with longitudinal wrinkles. Coarse-villous annual weed with oval leaves . . . . . 1901. Borago L.

\+ Filaments as usual, filiform, without appendages below anthers. Shape of corolla different . . . . . 8.

8. Corolla mesomorphic, characteristic: lobes linear, rolled outward; corolla tube with fascicles of hairs at base of stamens, stamens with hairy filaments and small anthers projecting far from throat. Scales broad at level of throat, glabrous. Radical leaves cordate-ovate, large, with long petiole. Perennial herbs (in forests, W. Caucasus) . . . . . 1200. Trachystemon D. Don.

\+ Corolla mesomorphic or brachymorphic, of the usual type. Stamens with very short filaments, not protruding from corolla tube . . . . . 9.

9. Nutlets as in forget-me-nots, usually one per flower, white, dorsoventrally compressed, erect, smooth or glabrous, with narrow borders along ribs, with small, basal, tapered cicatrice resembling an oval depression from which there protrudes a small, white, rounded caruncle; in contrast to Myosotis, large nutlets markedly protrude from calyx. Corolla small, blue in bud, with twisted, overlapping lobes. Small, annual herbs, with uniquely branching stem, very short main stem producing long, lateral branches branching in turn; all branches terminating with short, furcately branching, leafy inflorescences. Leaves spatulate-linear, obtuse. (Confined to high mountain belt of Dagestan). . . . 1203. Trigonocaryum Trautv.

\+ Shape of nutlets different, always with ring of attachment, rarely erect, and if so then slightly compressed laterally, more often curved and wrinkled or tuberculate; stem branches of the usual kind. Corolla nearly brachymorphic, resembling forget-me-nots. Petals overlapping in bud . . . . . 10.

10. Corolla brachymorphic as in forget-me-not. Radical leaves large, ovate-cordate with long petioles. (If lanceolate or oblong, then Anchusa sect. Cynoglottis (A. barrelieri DC.)). Perennial

104 forest herbs (Caucasus, Altai and Sayan Mountains). Nutlets semicurved or nearly erect, with longitudinal wrinkles, ca. 3 mm long. . . . . 1202. Brunnera Stev.

\+ Corolla usually mesomorphic, rarely almost brachymorphic (Phyllocara and Gastrocotyle). All leaves lanceolate or linear, elongate, gradually tapering below, not distinctly divided into blade or petiole . . . . . 11.

11. Corolla small (5—7(10) mm long), brachy- or nearly mesomorphic. Scales small, papilliform, not pubescent. Inflorescences very leafy, dense bostrices. Annual herbs, usually spreading on ground, with thick stem and oblong and lanceolate leaves. Calyx stellately spreading after abscission of nutlets. Nutlets horizontal, wrinkled, with ventral cicatrice . . . . . 12.

\+ Corolla larger, typically mesomorphic. Bostrices not very leafy. Stems often erect, rarely procumbent. Nutlets with basal attachment-ring . . . . . 13.

12. Corolla nearly brachymorphic, hardly longer than calyx, pale blue, 3—5 mm long. Calyx in flower 3 mm long . . . 1207. Gastrocotyle Bge.

\+ Corolla nearly mesomorphic, to 10 mm long, pale red-violet. Calyx in flower 5—6 mm long . . . . . 1206. Phyllocara Gusul.

13. Corolla small (ca. 10 mm long) to large, typically mesomorphic, its tube erect, as in preceding. Scales usually with, rarely without (A. stylosa) hairs, papilliform. Nutlets erect to strongly curved; calyx cleft into lobes or cut into teeth. Perennial, biennial or annual herbs. (Some species of Nonea are included here) . . . . . 1204. Anchusa L.

\+ Tube of corolla small, mesomorphic, geniculately curved, its small limb with a few, unequal lobes. Annual weeds with curved, wrinkled nutlets . . . . . 1205. Lycopsis L.

14. Nutlets with netted or straight wrinkles, rarely smooth, usually more or less curved, rarely straight and then not shiny. More or less xerophyllous herbs with rather narrow, lanceolate, linear, rarely oblong leaves. Scales present or replaced by fascicles of hairs. Annual, biennial or annual herbs . . . . . 1208. Nonea Medic.

\+ Nutlets erect, black, smooth, shiny, obtuse. Scales replaced by short hairs. Perennial herbs of forests with large radical leaves, blossoming in early spring but more abundantly in summer. Corolla
105 medium- or almost large, violet-blue or red . . . 1209. Pulmonaria L.

15. Fruit of 2 smooth bilocular halves, resembling Tournefortia but without suberous epicarp. Glabrous herbs, with amplexicaul, ovate, cauline leaves. Corolla dolichomorphic, tubular, without scales. Anthers with sagittate base. (Caucasus, S. European part of USSR). (Cerintheae DC.) . . . . . 1197. Cerinthe L.

\+ Fruit normally of 4 nutlets; ovary 4-, rarely 2-lobed (Rochelia). 16.

16. Corolla distinctly dolichomorphic, zygomorphic, with small, unequal lobes. Style exserted, usually 2-parted, rarely entire, often hairy below. Stamens unequal, in pairs, with long filaments and small anthers. Usually coarse-bristly herbs with stems terminating with racemiform or spicate bostrices. Nutlets of the Lithospermeae type (Echieae DC.), stony, with flat cicatrice . . . . . 1198. Echium L.

\+ Corolla actinomorphic; stamens and corolla lobes equal. Rarely (Lycopsis) slightly zygomorphic, small, with geniculately curved tube, anthers sessile in tube, etc. Style, if exserted, never 2-parted or pubescent. Inflorescence not a racemiform or spicate series of bostrices . . . . . 17.

17. Lobes of corolla imbricately folded in bud. Nutlets variable, with flat cicatrice or on hollow or solid stalk, without caruncle (Lithospermeae) . . . . . 18.

\+ Lobes of corolla imbricate in bud. Nutlets always erect, small, slightly dorsoventrally compressed, with narrow distinct borders along ribs, smooth, without, rarely with caruncle, with basal cicatrice, without stalk. Corolla brachymorphic. (Myosotideae Rchb.) . . . . . 1210. Myosotis L.

18. Nutlets entirely without stalk, sessile on flat or slightly inflated pedestal. Nutlets usually ovoid, stony, rarely vertical-reniform, pericarp not stony, with spurious ventral cicatrice . . . . . 19.

\+ Nutlets with distinct stalk with nutlets attached to the not quite flat or slightly pyramidal gynobase; stalk always without caruncle or nutlets attached (without stalk) at base of ventral keel, on small, oblique tetrahedral pedestal . . . . . 23.

19. Corolla dolichomorphic, medium-sized or large, with small
106 apical teeth. Nutlets stony. Style, sometimes also anthers protruding . . . . . 20.

\+ Corolla mesomorphic, funnel-shaped, large, medium or small; sometimes nutlets stony, with broad pedestal of attachment, ovate or oblong, with ventral keel and distinct unsegmented apex. (Subtribe Eulithospermeae) . . . . . 21.

++ Corolla small, brachymorphic, with scales in throat. Nutlets vertical-reniform, small, 0.7 mm high, attached to flat torus by small, flat cicatrice, with a spurious cicatrice similar to ventral (concave) side of Anchuseae, i. e., a hollow ring with thickened margin, without caruncle. Delicate annual plants resembling forget-me-nots, with loose, erect, slightly leafy bostrices. A very singular genus, as far as the nutlets are concerned. (Far East, and Tadzhikistan-Sarai on Pyandzh) . . . . 1193. Bothriospermum Bge.

20. Anthers slightly protruding from blue corolla, arcuately curved, without acute appendage, completely free of each other, attached to filaments close to their bases. Nutlets curved, globose-ovoid, more or less irregular, tuberculate (in our species). Perennial herbs, sometimes nearly subshrubs, with numerous radical leaves, usually with few stems. Leaves lanceolate with appressed bristles. Corolla 17—20 mm long. (Transcaucasia) . . . . . 1192. Moltkia Lehm.

\+ Anthers with flat, lanceolate apical continuation of the connective, not protruding (if protruding then forming a conical tube with interlinked bases). Nutlets ovoid, slightly curved. Perennial or biennial herbs, usually with large, yellow, rarely blue or dark red medium or large corollas, usually with spreading, bristly, sometimes spinescent, rarely with appressed, silvery hairs . . . . . 1190. Onosma L.

21. Style with more or less 2-parted or 4-parted tip and globose stigma; if entire, stigma deeply 2-lobed. Bristly herbs, without scales or folds in throat of corolla. Flowers dimorphous-heterostylous . . . . . 22.

\+ Style entire, with capitate-dotted, entire or 2-lobed stigma. Corolla small, medium or large, its throat with scales, more often with longitudinal folds, otherwise open, glabrous, rarely pubescent. Fruit

often smooth, resembling porcelain, rarely (in annual species) tuberculate, without luster. Perennial or annual herbs . . . . . 1186. Lithospermum L.

22. Style nearly entire, with two globose or one 2-lobed stigma; base of corolla tube without protective ring. Perennial high mountain herbs with medium, violet flowers or with large, yellow inflorescences capitate in flower, with fascicles of lanceolate or linear, radical leaves . . . . . 1187. Macrotomia DC.

+ Style nearly entire, with 2 globose stigmas, or 2- to 4-parted, with a stigma on each branch. Base of corolla tube with an internal hairy, protective ring. Perennial herbs with yellow flowers like those of Macrotomia, or with blue flowers, but then leaves broad or biennials or annuals . . . . . 1188. Arnebia Forsk.

23. Throat of corolla with scales. Nutlets tetrahedral with thin, sometimes scarious pericarp. Mesophyllous genera, mainly Siberian, with white pubescence of appressed, thin setae. (Subtribe Trigonotideae) . . . . . 24.

+ Corolla without scales or folds in throat. Nutlets erect or curved, ovoid, their back continuous with their sides, not set off by acute ribs; pericarp hard, though not quite stony, wrinkled-tuberculate. Style not exserted from corolla. Villous-hairy, xerophyllous herbs . . . . . 26.

24. Corolla brachymorphic, resembling forget-me-not, small or medium-sized, blue; plants similar to Myosotis, but nutlets smaller, 1—2 mm long, tetrahedral, with small stalk or triangular basal-ventral cicatrice, pericarp thin, sometimes pubescent. Perennial species mainly in the Far East; annuals with very small flowers and hairy nutlets from the Pacific to the Caucasus . . . . . 1196. Trigonotis Stev.

+ Corolla mesomorphic, medium to large. Perennials, much larger than Trigonotis, more like Pulmonaria or Symphytum. Nutlets 2—3 times as large, with small, ventral-basal cicatrice. Style long, often protruding . . . . . 25.

25. Corolla tube 3—4 mm long, shorter than broadly campanulate limb. Nutlets black. Rhizome long-creeping, resembling a cord. Upper 5—6 leaves approximate, almost whorled. Corolla dark violet. (S. Sikhote-Alin' Range) . . . . . 1195. Brachybotrys Maxim.

+ Corolla tube as long as limb and calyx or longer than calyx. Nutlets white, smooth, glabrous, tuberculate or wrinkled, sometimes with narrow marginal wings or short spines along back of gynophore. Rhizome short, not creeping. Leaves spaced evenly. Corolla usually sky-blue . . . . . 1194. Mertensia Roth.

26. Nutlets ovoid, nearly erect, acute, stony, with hollow ventral-basal stalk. Corolla light violet, with long narrow tube and small campanulate limb. Style parted distally into two branches, with globose stigmas. Annuals with lanceolate leaves and spreading, bristly pubescence. (Transbaikalia) . . . 1189. Stenoselenium Turcz.

+ Nutlets much curved, nearly horizontal, attached to torus by short, solid, nearly ventral stalk. Style entire. Corolla (in our species) yellow. Calyx stellately divergent in fruit. Very soft, glandular hairs above. (Caucasus) . . . . . 1191. Alkanna Tausch.

27(3). Calyx in fruit of 5 nearly equal, narrow, slightly elongating and widening, sometimes markedly elongating and expanding lobes or teeth, always without broad, entire, cup-shaped base. Nutlets mostly with anchorlike spines, rarely with lateral wings along back . . . . . 28.

\+ Calyx cup-shaped, broadening, comparatively large in fruit. Nutlets usually without spines or wings . . . . . 48.

28. Nutlets attached to pyramidal gynobase by flat ventral side, hence cicatrice apical and firmly adhering to face of pyramid growing with apex of gynobase, and never overtopping style; style often thickened in lower part, persistent as pointed apex of fruit. Nutlets dorsoventrally compressed, growing mainly downward from free base, suspended from pyramid of cicatrice, and diverging from calyx below; if cicatrice does not develop postflorally and remains a narrow pyramid, nutlets grow outward from cicatrice to form a flat cross (Omphalodes). Nutlets usually with anchorlike spines or smooth and winged. Flowers brachymorphic, mesomorphic or dolichomorphic. (Cynoglosseae Koch) . . . . . 29.

\+ Attachment of nutlets to pyramidal gynobase different — either apex free and ascending above apex of gynobase with style on top (Erithricheae), or nutlets confined in depression of the rather large gynobase with vertical plates discernible between nutlets; these crosswise plates converge at style, which is not exceeded by nutlets, which are attached by base and apex in the depression between plates of gynobase and grow only together with it (Heterocaryeae); otherwise lobes [?] of ovary 2, nutlets 1—2, resembling those of Eritricheae but entire ventral keel adnate to rod-shaped gynobase and growing with it (Rochelieae) . . . . . 37.

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29. Nutlets usually smooth, unarmed, sometimes with spines along disk and wing, winged (i. e., with more or less scarious or coriaceous wing (Subtribe Pterocarpeae) along periphery disk) (Subclass Pterocarpeae) . . . . . 30.

\+ Nutlets wingless, with more or less dense spines bearing anchorlike head . . . . . 33.

30. Corolla tubular, dolichomorphic, with small, acute or obtuse, apical teeth of medium length. Gynobase high-pyramidal. Nutlets large, with flat wings. Scales in throat weakly defined. Perennial herbs . . . . . 31.

\+ Corolla brachymorphic or mesomorphic, the well developed limb with scales in throat and rounded-obtuse lobes. Anthers hidden below scales. Nutlets slightly smaller . . . . . 32.

31. Wings simple, single, more or less scarious, broad. Anthers not protruding from limb of corolla. Perennial, not cespitose, rarely slightly cespitose herbs, with oblong, lanceolate or linear radical leaves . . . . . 1224. Rindera Pall.

\+ Wings double, appearing to separate for entire length into two layers. Anthers markedly protruding from corolla. Plants forming low, compact, nearly woody tufts. Stems low; leaves narrow, lanceolate-linear, white-gray. (Peak of Kopet Dagh) . . . . . 1225. Bilegnum Brand.

32. Corolla mesomorphic, with elongate campanulate, not rotate tube. Gynobase high-pyramidal. Nutlets forming pyramid. Wing flat or inward curved, inflated into a kind of vesicle above back of pedestal. Calyx not cup-shaped in fruit. Perennial, biennial or annual plants of the arid zones of the ancient Mediterranean area . . . . . 1226. Paracaryum Boiss.

\+ Corolla brachymorphic of the forget-me-not type. Gynophore low-pyramidal even in fruit. Nutlets nearly horizontal-crosswise when ripe. Delicate mesophyllous, perennial or annual herbs. (Mainly Caucasus) . . . . . 1227. Omphalodes Moench.

33. Corolla tubular, dolichomorphic, but not very long, with small apical teeth or tubular-funnel-shaped. Scales small, at base of teeth or below. Anthers (and style) protruding between teeth or extending beyond. Perennial herbs . . . . . 34.

110 \+ Corolla mesomorphic, funnel-shaped, with rounded, obtuse lobes and campanulate limb, medium-sized. Stamens and style protruding from behind large scales which close the throat, or corolla brachymorphic, with anthers and style enclosed in tube, hidden by large scales in throat . . . . . 35.

34. Small tubular or nearly tubular corolla with anthers protruding from behind teeth. More or less densely pubescent perennial herbs, villous or tomentose, rarely with simple hairs . . . . . 1230. Solenanthus Ldb.

\+ Anthers protruding behind teeth or lobes of corolla. Perennial, high, subglabrous herbs, with large radical leaves and yellow corollas. Flowers in bostrices forming paniculate inflorescence. (Pamir area, W. Tien Shan) . . . . . 1228. Trachelanthus Kuntze.

35. Corolla mesomorphic, medium-sized, bright blue or dark red. Stamens protruding from throat but not beyond limb. Perennial herbs, with oblong or lanceolate, more or less densely pubescent leaves . . . . . 1229. Lindelofia Lehm.

\+ Corolla brachymorphic, small or medium-sized. Anthers and style inside tube of corolla. Limb of corolla rotate or cup-shaped. Variously colored . . . . . 36.

36. Nutlets 5—10 mm long, abscissing from thickened base of style together with narrow, awn-shaped band of tissue attached to apex of cicatrice. Larger perennial or biennial herbs. Corolla violet-red or blue, rarely yellow . . . . . 1231. Cynoglossum L.

\+ Nutlets 3—4 mm long, abscissing from gynobase without awn. Less sturdy annual or biennial herbs. Corolla blue . . . . . 1232. Paracynoglossum M. Pop.

37. Nutlets with free growing apex rising above style, i. e., with basal- or central-ventral, usually small cicatrice, 2—5 cm high, often spiny, sometimes unarmed, rarely winged. Flowers small, brachymorphic, very rarely mesomorphic. Mostly annuals. Ovary 4-lobed. (Eritrichieae Bent. et Hook.) 38.

\+ Like Eritrichieae in its (short-pyramidal) gynobase, ventral attachment of nutlet with oblong, ski-shaped, protruding, nearly central cicatrice and free-growing apices of nutlets; but nutlets large, 3—4 mm, with thickened, winglike rim curving down back, unarmed.

Corolla dolichomorphic or short, 6—10 mm long, nearly tubular, without scales in throat. Anthers slightly upright on corolla, their filaments longer than anthers. Biennial or perennial, bristly herbs.
111 (Baikal and Ulu-Tau). (Craniospermeae DC.). One genus . . . . . 1221. **Craniospermum** Lehm.

++ Nutlets attached to depression of gynobase or entire ventral keel adnate to thin gynobase, i. e., somehow or other adnate to gynobase, without free apex . . . . . 47.

38. Ripe nutlets (at least some) winged or wingless, with spines with or without anchorlike head; dorsal wings and spines sharply set off from sides by acute ribs. Gynophore often elongate, rarely short. Nutlets on long gynophore dorsoventrally compressed, on short gynophore not compressed, turbinate. (Subtribe Cynoglossoideae). 39.

\+ Nutlets wingless, unarmed, netted-rugose, tuberculate or smooth, not dorsoventrally curved, not turbinate, with inflated back, indistinctly set off from sides by obtuse, rounded rib, if disk set off from sides by acute ribs then nutlets turbinate. Anomalous species of E r i t r i c h i u m and S t e p h a n o c a r y u m of the preceding subtribe. Gynophore short, indistinct (Subtribe Lithospermoideae). . . 43.

39. All or nearly all nutlets with broad, coriaceous-membranous, entire wing with entire or dentate margin. Cicatrice basal. Gynophore thin, prismatic or subulate. Teeth of wing usually tipped with anchorlike spines . . . . . 1211. **Lepechiniella** M. Pop.

\+ Nutlets usually with spines along margin of disk, rarely with dentate wing along margin or only 1—2 nutlets winged, others spiny. Gynophore pyramidal-subulate or conical-pyramidal, short, indistinct . . . . . 40.

40. Gynophore pyramidal-subulate, long. Cicatrice basal. Ventral nutlet completely or predominantly attached to gynophore. Margin of disk often with anchorlike spines, in some species wing (or winglike rim) with anchorlike teeth, or with spines along margin; nutlets never hairy, on disk or laterally, usually finely tuberculate, rarely smooth . . . . . 1212. **Lappula** Gilib.

\+ Gynophore not subulate, conical-pyramidal or very low-pyramidal. Margin of nutlet disk with one row of spines. Cicatrice central . . 41.

41. Gynophore conical-pyramidal, well-developed but shorter than ripe nutlets. Spines along margin of ovoid disk often arranged pectinately, their apex with anchorlike head, smooth along margins
112 beneath, not crenate or hairy. Small, coarse hairs frequent on disk and at sides . . . . . 1213. **Hackelia** Opiz.

\+ Gynophore low, slightly developed, broad. Some species of E r i t r i c h i u m (section Pseudohackelia) are very close to the preceding but differ by their white flowers . . . . . 42.

42. Spines along margin of disk short, anchorlike, erect or curved. Pedicels sometimes in whorls, or rather in bundles of 3—6, as is usual in the Boraginaceae forming racemes together with solitary flowers . . . . . 1216. **Tianschaniella** B. Fedtsch.

\+ Margin of disk with more or less long or anchorlike spines (in the latter case nutlets dorsoventrally compressed) or spines pectinately arranged without or only with rudiment of anchorlike

tip; margins of spines often crenate. Nutlets dorsoventrally compressed, as in Hackelia (section Pseudohackelia) or not compressed, with high sides, thus turbinate, with acute, dorsal pedestal oblique at apex. Dorsally and laterally pedestal may be rough-haired. Perennial, often pulvinate herbs, often with gray or sericeous hairs. (Nutlets with crown). . . . . 1214. Eritrichium Schrad.

43. Nutlets turbinate, with high sides and central cicatrice ("base" in the given case), with dorsal wall of pedestal obliquely inclined and then sharply set off from sides by acute ribs and with acute, elevated apex or dorsal wall of pedestal with depressed, perpendicular, rounded, long axis of turbinate nutlet, surrounded by thickened, elevated pubescent ridge . . . . . 44.

\+ Nutlets not turbinate, ordinary, ovoid or oblong, dorsally inflated, smoothly passing across flexure to side or border more abrupt with obtuse, not sharply acute rib. Cicatrice basal; apex of nutlet tapering, obtuse, with ventral keel . . . . . 45.

44. Nutlets with obliquely truncate, dorsal pedestal, lined outward, without elevated, thickened margin, set off from sides by acute ribs, with acute triangular apex. Leaves alternate, usually with sericeous hairs. Flowers in racemes. (Nutlets without crown, i. e., disk without marginal spines) . . . . . 1214. Eritrichium Schrad.

\+ Nutlets highly turbinate, with horizontal, depressed, rounded dorsal pedestal surrounded by high, elevated, thickened, densely hairy margin, thus apex of nutlets not acute. Leaves of stem opposite, rather broad, oval, delicate, green. Racemes poorly developed,
113 solitary flowers on long pedicels in axils of upper, alternate leaves. Perennial, loosely cespitose, small herbs. (Alpine belt of W. Tien Shan) . . . . . 1215. Stephanocaryum M. Pop.

45. Gynophore conical, small (ca. 1 mm high), but very distinct, especially after abscissing of nutlets, with filiform style markedly rising above black, finely tuberculate, shagreen nutlets. Leaves green, subglabrous, oblong, acute, petioled, alternate. Racemes very distinct, leafy, long. Flowers Myosotis-like blue, rather large. Annuals, with branching, glabrous stem. (Mongolia and Dauria) . . . . . 1217. Anoplocaryum Ldb.

\+ Gynophore obsolete, not more than 0.5 mm, pyramidal (careful observation required!). Style hidden between nutlets. Leaves different . . . . . 46.

46. Nutlets with thin walls, netted-pitted or rugose-tuberculate, brown, dull when ripe. Flowers very small, white. Racemes leafy. Leaves elongate-linear, lower cauline leaves opposite. Annuals, small. (Kamchatka). . . . . 1218. Allocarya Greene.

\+ Nutlets white, shiny, smooth, thick-walled. Small xerophyllous, gray- and appressed-hairy plants. Leaves alternate, small, spatulate. Racemes short, with bracts only below. Corolla blue, nearly Myosotis-like, medium-sized. (Mongolia, Dauria, Baikal, isolated in Altai) . . . . . 1219. Amblynotus Johnst.

47. Ovary with only 2 lobes. Nutlets 1—2 in fruit, obliquely oblong-lanceolate, small, similar to those of Lappula, if 2 then accrescent with ventral keels entirely adnate to thin, high gynobase, growing

together with it, style remaining above their apex. Nutlets usually covered with tubercles bearing anchorlike, stellate heads, rarely smooth, shiny. Annual, delicate herbs, with small, blue flowers, calyx lobes markedly accrescent in fruit. (Rochelieae DC.) . . . . . 1223. Rochelia Rchb.

\+ Ovary with 4 lobes embedded in depression of gynobase attached with entire ventral surface, thus growing to ripeness together with gynobase, not descending below its base, their apices not rising above apex of gynobase; topped by the style. Nutlets spiny, sometimes with winglike, dentate rim. Annual herbs, with small, blue-violet flowers and slightly accrescent calyx lobes in fruit. (Heterocaryeae Zak.) . . . . . 1222. Heterocaryum DC.

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48. Patelliform accrescent calyx folding in the process of accrescence like a double sheet of paper with unequal teeth and marginal lobes. Annuals, with hamate-aculeate stem. Nutlets laterally compressed, smooth, glabrous, small, attached as in Erithricheae. Flowers small, in axils of upper leaves. A weed. (Asperugeae Zak.). . . . . 1220. Asperugo L.

\+ Calyx patelliform, not folding in half, remaining patelliform (not folding) with 5 regular marginal lobes. Nutlets often, as in Heterocaryeae, embedded in depression of gynobase, rarely as in Cynoglossinae. In its flowers — a heterogeneous tribe; two perennial genera have unique flowers, one annual has brachymorphic ones (Trichodesmeae Zak.). . . . . 49.

49. Perennial herbs, with large or medium, unique shape of corollas. Lobes of calyx acute, triangular. Root thick, cylindrical or creeping. Leaves acute or obtuse . . . . . 50.

\+ Annual, small plant, with small, blue, brachymorphic corolla. Leaves slightly fleshy, subglabrous, oblong, with white tubercles, the lower opposite. Racemes loose, leafless. Calyx patelliform, with obtuse, rounded lobes. Nutlets embedded in depressions of gynobase, as in Heterocaryeae, with inflated back, smooth or covered with small spines. Ephemeral in deserts. . . . 1233. Suchtelenia Kar.

50. Corolla slightly zygomorphic, with thin long tube, with long, linear or shorter, oblong lobes. Scales glabrous. Anthers glabrous, irregular, the posterior anther large, the lateral reduced in pairs, with the anterior the smallest. Base of cell of usually blue anther with 2 points. Nutlets large, dorsoventrally compressed, stony, rugose, usually 1—2 at bottom of patelliform calyx. Leaves fleshy, rough-bristly, bristles borne on large tubercles. . 1234. Caccinia Savl.

\+ Corolla with very short tube and flat, large, blue limb, its lobes broad with soft mucros. Anthers subsessile, lanceolate, fused in cone, their base tomentose at back, apex produced to long, spirally twisted, subulate appendage. Nutlets large, 1—2, rarely more, lying at bottom of patelliform calyx (in our species), dorsoventrally compressed, rugose. Softly bristly, gray or sericeous plant. Leaves oblong, acute, soft, the lower opposite. Rhizome branching, creeping . . . . . 1235. Trichodesma R. Br.

115 Tribe 1. HELIOTROPEAE DC. Prodr. IX (1845) 531. — Subfamily Heliotropioideae Gürke in Pflanzenfam. IV, 3 (1893) 90; Kuzn. in Mat. Fl. Kavk. IV, 2, 76; M. Popov in Tr. Bot. Sada, XLII, 210. — Heliotropieae Agardh. Cl. pl. (1825) 15; Benth. et Hook. Gen. II, 834. — The entire, not lobed ovary, topped by style with stigma, falling together with fruit, not persistent on gynobase after abscission of hemicarps and nutlets; stigma conical, truncate-conical or conical-subulate, rarely stylelike, large; base of cone sometimes an undulant ring covered with stigmatic papillae with a conical, glabrous or hairy apex with 2—4 papillae, not receiving pollen. Style as long as stigma or shorter, rarely longer. Ovary with 2—4 longitudinal sutures along which it separates when ripe into 2 hemicarps or 4 nutlets. Fruit of 2 drupaceous bilocular halves (hemicarps) with spongy, not juicy, epicarp, or of 4 unicellular nutlets, of which 2—3 or only one may develop. Cotyledons of erect embryo flat. Seeds with thin layer of albumen (perisperm); herbs or semishrubs.

Note. In contrast to the predominantly subtropical-cold tribes of the true Boraginaceae, this tribe is essentially tropical-subtropical. This ecological difference corresponds to the distinction between apical styles of Heliotropeae and basal styles of true Boraginaceae, and between the Heliotropeae as mainly trees, lianas and shrubs in tropical habitats and in the subtropical zone chiefly herbaceous plants, in line with somatic reduction. But even here the annual Heliotropeae do not reach the extreme reduced annual ephemeral stage (annual ephemerals of genera Lappula, Nonea, Paracaryum, Lithospermum, Asperugo and others), which is very common in the true Boraginaceae, as in the cryophilic group of plants. The principal centers of development of the true Boraginaceae lie in the subtropical zones (exception — Trichodesma, a genus of Welwitschiaceae), though sometimes in the cold zone (Myosotis, Mertensia, and Pulmonaria). The contrast between Heliotropeae and true Boraginaceae justifies their recognition as subfamilies (Guerke and others) and preferably as families (van Tieghem and others). In fact, it is much more difficult to distinguish them from Cordiaceae (subfamily Cordioideae and Ehretioideae Guerke) than from true Boraginaceae; Cordiaceae are also woody and tropical-subtropical but their drupes are juicy, bringing them closer to the tropical species of Tournefortia, from which they differ only in the typical stigma; however, the shape of the stigma in the genus Tournefortia and in Cordiaceae is so variable that it is difficult to find an essen-
116 tial difference between them. This is why De Candolle brought Tournefortia in relation to Eritricheae rather than including it in the tribe Heliotropeae.

Genus 1184. **TOURNEFORTIA*** L.

L. Sp. pl. (1753) 140.

Calyx 5-parted, small, not changing in fruit, with narrow lobes; corolla 5-merous, small, usually funnelform, its tube pubescent outside, usually

* After J.P. Tournefort, the prominent French botanist and traveler (1656—1708), a predecessor of Linnaeus.

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PLATE VI. Tournefortia sogdiana (Bge.) M. Pop., part of flowering plant, branch with fruit, calyx, section of flower, section between corolla lobes, pistil.

exceeding calyx, its limb campanulate or flat, with acute or obtuse lobes variously folded in bud; scales in throat absent, but folds sometimes present; anthers subsessile in corolla tube; stigma truncate-conical or nearly flat, if conical then often 2-lobed or with 2—4 apical papillae, usually pubescent. Fruit drupaceous, the juicy or suberous (spongy) epicarp splitting into two halves, or entire. Herbs. Leaves usually alternate, entire. Cymes usually leafless, curved, more or less thick. Corolla white.

A predominantly tropical genus including evergreen trees with large, coriaceous leaves, small trees with silvery foliage (T. argentea L.) and shrubs. About 100 species, in four sections.

Section 1. ARGUZIA DC. Prodr. IX (1845) 514. — Genus Arguzia Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 559. — Corolla lobes in bud folded lengthwise valvately converging or overlapping. Drupes dry not juicy with spongy or suberous epicarp, of two 2-locular parts. Herbs. Subtropical with one species in the cold zone.

1. Leaves sessile; stems herbaceous, green, pubescent. Corolla tube densely hairy outside, its limb to 8 mm across; anthers attached slightly above base of corolla tube; style about as long as stigma. Fruit appressed-short-hairy separating at length into two halves, longer than wide. (Along shores of rivers, lakes, seas) . . . . . 1. T. sibirica L.

119 + Leaves petioled; stems covered with white, peeling epidermis. Corolla tube glabrous outside and inside with anthers attached at its upper end. Corolla limb small, ca. 4 mm across, style 3—5 times as long as stigma. Fruit readily separating into two halves, wider than high, densely long-villous. (Sandy deserts of Centr. Asia) . . . . . T. sogdiana (Bge.) M. Pop.

1. T. sibirica L. Sp. pl. (1753) 141; Kuzn. in Mat. Fl. Kavk. IV, 2, 77; M. Pop. in Tr. Bot. Sada, XLII, 212; Kryl., Fl. Zap. Sib. IX, 2231. — T. arguzia Roem. et Schlut. Syst. IV (1819) 540; Ldb. Fl. Ross. III, 97; Boiss. Fl. or. IV, 125; Shmal'g., Fl. II, 220. — Messerschmidia arguzia L. f. Suppl. (1781) 132. — Ic.: Gaertn. De fruct. II, tab. 109, f. 3; Fedch. and Fler., Fl. Evrop. Rossii, Fig. 669. — Exs.: GRF, No. 182; Herb. Fl. Cauc. No. 143.

Perennial; rhizome creeping, cordlike; stems 15—40 cm high, erect, flexuose, spreading-branching, herbaceous, rather densely covered with appressed or spreading hairs; leaves sessile, cuneate or rounded at base, oblong, lanceolate-oblong or sublinear, obtuse, 1—3 cm long, greenish, grayish or gray from appressed hairs borne on small tubercles. Scorpioid cymes terminating stems and branches, small, few-flowered, short, single or in panicle, elongating in fruit; calyx grayish, its lobes lanceolate, acute, $\frac{1}{2}$—$\frac{1}{3}$ length of corolla tube; corolla rather large, tube 6—7 mm long, densely hairy outside, its limb to 8 mm across, its lobes ovate or oblong, obtuse or acute; stigma short, thick, truncate-conical, nearly stylelike,

pubescent, almost as long as style; fruit ovoid, ca. 8 mm high, with depressed apex; suberous epicarp thinner, the horny endocarp thicker than in T. sogdiana. April—June.

Solonetzic shores of seas, lakes and other water bodies; on irrigated lands. — European part: L. Don, Bl., Bes., L. V., M. Dnp., Crim.; Caucasus: Cisc., Dag., W. and E. Transc.; West Siberia: Alt., U. Tob., Irt.; East Siberia: Dau.; Far East: Uss.; Centr. Asia: Ar.-Casp., Balkh., Syr D., Kara K. (west, along the Caspian). Gen. distr.: Bal.-As. Min., Iran. (along shores of the Caspian), Mong., Jap. Described from Dauria. Type in London.

Note. Very variable in size of flowers. The Volga race has very small flowers, nearly half the length of those from Taman Peninsula described by Steven as Arguzia cimmerica Stev., which differ in the very long corolla tube.

Var. rosmarinifolia (Turcz.) M. Pop. l. c. [T. arguzia var. rosmarinifolia Turcz. Fl. baic.-dah. II (1849) 498. — T. rosmarini-
120 folia Turcz. Suppl. ad Fl. baic.-dah. (1857) XLV. — Arguzia rosmarinifolia Stev. l. c. 559]. — Messerschmidia rosmarinifolia Willd. ex Roem. et Schult. Syst. IV (1819) 544. — T. arguzia β. angustior DC. Prodr. IX (1845) 514.

Leaves oblong-linear or linear; flowers small; corolla lobes gradually acuminate; style not overtopping apex of fruit, remaining free at bottom of deeper apical depression of fruit. Endemic in Dauria (near Bulunda Lake, along shores of the Gusinoe Lake).

2. T. sogdiana (Bge.) M. Pop. in Izv. Turk. otd. Russk. Geogr. obshch. XV (1922) 52 in nota; Tr. Bot. Saba, XLII, 211. — Heliotropium sogdianum Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1854) 403; Boiss. Fl. or. IV, 146.

Perennial; rhizome horizontal, long, thin, cordlike; stems 10—30 cm high, thin, white, few, flexuose, simple or with slightly declined branches, erect with bristly hairs mainly above, leaves with rather long petioles $^1/_3$—$^2/_3$ length of 1—3 cm long, oblong-elliptic, rarely ovate or oblong, obtuse blade with unequal margins, cuneate, rarely rounded base, pale green, covered with sparse, proximally more dense, bristly hairs borne on small tubercles, also blade dotted-glandular. Scorpioid cymes terminating stems and stronger branches, solitary or in pairs, secund, uniserial, rather loose, with distinctly separating flowers, 2—5 cm long, becoming looser and more elongate in fruit; calyx with spreading rough hairs, 2—2.5 mm long, $^1/_2$—$^1/_3$ length of corolla tube, with linear-lanceolate, acute lobes; corolla tube glabrous, sometimes with isolated cilia, 4—5 mm long, its limb 4 mm across with rounded, obtuse, undulant-crisped lobes, hairy outside; anthers attached in throat of corolla tube, nearly protruding; style glabrous, 3—5 times as long as conical stigma, with hairy apex; fruit 7—9 mm across, subglobose or flattened-ellipsoid, densely villous, splitting into two halves; seeds in all cells or obsolete in 1—2. April. (Plate VI.)

Sandy deserts on friable sands (sand containing barite, quartz or pyrite).— Centr. Asia: Kyz. K., Kara K. Endemic. Described from N. Kyzyl-Kum (clayey steppe? between Chakyr-Ata and Nazarbai-Kuduk). Cotype in Leningrad.

Genus 1185. **HELIOTROPIUM*** L.

L. Sp. pl. (1753) 130.

Calyx 5-parted, rarely 5-toothed, persistent or abscissing with fruit; corolla turbinate or funnelform, lobes 5, possibly with 5 intermediate teeth,
121 lobes overlapping in bud or folded lengthwise or convolute and nearly valvately converging or rolled lengthwise and curved inward; stamens 5, free, filaments very short, anthers elongate, sometimes with hamately curved apex; style erect, stigma with broad base, conical or subulate resembling short style. Ovary with 4 sutures; nutlets 4, free, sometimes concrescent in pairs or only one nutlet developing; embryo erect or curved; albumen present (not in all species?); cotyledons plano-convex. Herbs or subshrubs; leaves alternate, entire. Cymes secund, uniserial-biserial, without bracts. Flowers white, rarely yellow (violet in some exotic species).

Two hundred and twenty species, in many sections; 6 sections represented in the USSR by 22 species.

1. Perennial herbs or subshrubs . . . . . 2.
\+ Annuals . . . . . 6.
2. Corolla lobes rounded-ovate or oblong, obtuse, with crisped-undulant margin, overlapping in buds, never curved inward (Section Radula Bge.) . . . . . 3.
\+ Corolla lobes with short, broader base, linear or linear-subulate, acute, curved inward before and after flowering owing to a sharp basal fold, slightly rolled lengthwise, nearly valvately converging. (Section Catoxys Bge.) . . . . . 4.
3. Nutlets with rounded, spongy gibbosity at back near base. Inflorescences sparse, 1.5—3.5 cm long. Rhizome oblique, woody, not cordlike . . . . . 4. H. turcomanicum M. Pop. et Korov.
\+ Nutlets without spongy gibbosity at back. Inflorescences denser, 0.5—1.5 cm long. Rhizome creeping, cordlike . . . . . 5. H. arguzioides Kar. et Kir.
4. Corolla tube hairy inside, from anthers up . . . 2. H. transoxanum Bge.
\+ Corolla tube and limb glabrous inside . . . . . 5.
5. Inflorescence very loose, flowers in nearly erect scorpioid cymes, strongly separated, the lower on stipes, small; corolla tube 3—4 mm, rarely to 6 mm long. Leaves 5—6 mm to 2 cm long. Plant to 30—40 cm high . . . . . 1. H. dasycarpum Ldb.
\+ Inflorescence denser; flowers sessile, more or less approximate, larger than in the preceding (especially the calyx); corolla tube 5—6 mm long; largest leaves 2—4 cm long. Entire plant 40—70 cm high . . . . . 3. H. grande M. Pop.
6. Corolla tube pubescent inside . . . . . 7.
122 \+ Corolla tube glabrous inside . . . . . 11.
7. Flowers yellow. Corolla lobes folded lengthwise in bud, nearly valvately converging. (Section Bucanion Sczegl.) . . . . . 8.

* From the Greek helios — sun, tropein — turning, from the idea held by ancient authors that the flowers turn towards the sun.

+ Flowers white, corolla lobes in aestivation not longitudinally folded, nearly overlapping. (Section Agoraea Bge.) . . . . . 9.

8. Corolla tube continuously covered inside from anthers up with irregularly disposed, spreading hairs. Cymes and stems and margins of leaves (especially the young) with long white lanate hairs . . . . . 6. H. bucharicum B. Fedtsch.

+ Corolla tube with ring of hairs above anthers spreading in different directions, glabrous beyond with a second ring of antrorse hairs below throat. Leaves, stems and cymes rough-haired, not soft or lanate . . . . . 7. H. biannulatiforme M. Pop.

9. Calyx abscisses together with nutlets, not persistent. Corolla with long tube and large white limb. Nutlets pubescent . . . . . 11. H. chorossanicum Bge.

+ Calyx persistent. Nutlets glabrous . . . . . 10.

10. Corolla small, its tube 3—3.5 mm long, limb ca. 3 mm across. Scorpioid cymes short, sparse in fruit . . . . . 13. H. seravschanicum M. Pop.

+ Corolla much larger, tube 6—10 mm long, limb 4—8 mm across. Scorpioid cymes elongate, sparse in fruit . . . . . 12. H. olgae Bge.

11. Style long, nearly 4 times as long as small, glabrous stigma. Corolla tube narrow, 8—10 mm long, limb small, its lobes ovate, acute. Nutlets short-haired. (S. Tadzhikistan) . . . . . 10. H. fedtschenkoanum M. Pop.

+ Style almost as long as or shorter than stigma, or style lacking . . 12.

12. Corolla elongate, 10—12 mm long, tubular-clavate; its tube sparingly pubescent outside or glabrous, 2—3 times as long as calyx, limb narrowly campanulate, with small, 1 mm long, nearly erect lobes. Stigma subsessile, elongate-conical to stylelike, short-haired above. Scorpioid cymes loose, long, nearly erect. Leaves small, ovate, with rounded, rarely cuneate base, glabrous above, grayish-hairy beneath. (S. Transcaucasia) . . . . . 8. H. szovitsii (Stev.) Bge.

+ Corolla narrowly tubular, 7—8 mm long, densely hairy-villous outside. Leaves usually oblong, cuneate at base, acute, rarely ovate with rounded base, completely covered with thin gossamer sericeous
123 hairs, less densely above than beneath . . . . 9. H. kowalenskyi Sczegl.

++ Corolla with short tube, as long rarely $1\frac{1}{2}-2$ times as long as or slightly shorter than calyx, limb more or less spreading or nearly obsolete . . . . . 13.

13. Corolla with rather large and broad white limb, 4—8 cm across, fairly long tube, longer than calyx, hairy outside with obtuse lobes. Nutlets small, finely pubescent and slightly pitted . . . . . .

+ Corolla with small flat limb 2—4 mm across or with very small, nearly indiscernible limb with ca. 0.5 mm long, erect lobes. Style much shorter than stigma . . . . . 15.

14. Stigma short-conical, with broad, flat, basal, pileiform, subsessile margin. Leaves mostly ovate with rounded base (Caucasus), oblong, with cuneate base in var. intermedium Andrz., S. European part of USSR . . . . . 14. H. suaveolens M. B.

+ Stigma conical, glabrous, hardly longer than pubescent style. Leaves mostly oblong, with cuneate base. (Dagestan) . . . . . 15. H. styligerum Trautv.

15. Limb distinct, flattish, 2—3(4) mm across, with rounded-obtuse lobes, nutlets 1—2 mm long, glabrous or short-haired or when ripe one lenticular nutlet completely enclosed by calyx and abscissing with it. . . . . 16.

\+ Limb indistinct, very small, with very small, erect lobes. Nutlets small, 1—2 mm long, and glabrous or elongate, and finely pubescent, nearly rod-shaped, 3—5 mm long dorsally with long, sericeous, downward appressed hairs . . . . . 19.

16. Ovary ripens only in one lobe (rarely 2), flat on one side, inflated on the other, the glabrous, slightly wrinkled nutlet growing with calyx and abscissing with it. Calyx 5-toothed. Stems few, procumbent or ascending. Leaves hoary on both surfaces. (Section Piptoclaina (G. Don) Engl.). . . . . 22. H. **supinum** L.

\+ All four lobes of ovary developing into fruit of 4 nutlets, 5-parted calyx persistent when ripe. Stems erect. Leaves usually green above. (Section Agoraea Bge.) . . . . . 17.

17. Nutlets strongly pitted-tuberculate. Stigma elongate, conical-
124 subulate, distinctly 2-parted at apex. Calyx lobes linear, stellately spreading after abscission of nutlets. Scorpioid cymes glabrous, loose below. Leaves ovate or oblong. (S. European part of USSR, Crimea, Caucasus) . . . . . 16. H. **europaeum** L.

\+ Nutlets smooth or slightly tuberculate. Stigma short-conical, obtuse (not subulate-acuminate). Calyx lobes oblong, campanulately diverging, less spreading in fruit . . . . . 18.

18. Nutlets glabrous. Scorpioid cymes, at least in their lower part, loose, generally thinner than in the preceding. (Crimea, Caucasus, SE European part of USSR, Centr. Asia). . . . . 17. H. **ellipticum** Ldb.

\+ Nutlets with short dense pubescence. Scorpioid cymes compact, shorter. Plant grayer and larger. (Transcaucasia, S. Centr. Asia) (H. lasiocarpum Fisch. et Mey.) . . . . See 17. H. **ellipticum** Ldb.

19. Lobes of small (3 mm long) corolla obtuse, imbricate in bud. Nutlets glabrous or finely pubescent, 1—2 mm long. Calyx slightly accrescent. Flowers short (in pebbly foothills of Centr. Asian deserts) . . . . . 20.

\+ Lobes of small corolla very small, ovate, acute, slightly rolled lengthwise and nearly valvate in bud. Nutlets elongate, 3—5 mm long, covered below with long hairs appressed. Calyx markedly accrescent in fruit; pedicels long. (In sandy deserts). . . . . 21.

20. Corolla 3 mm long, with 0.5 mm long ovate, acutish lobes, with even margin, erect. Intermediate teeth lacking. Anthers ca. 2 mm long, more acute. Stigma conical at base, subulate. (Kopet Dagh). . . . . 18. H. **litvinovii** M. Pop.

\+ Corolla 2—2.5 mm long, its lobes 0.5 mm long, ovate, with crisped margin. Intermediate teeth well developed, $\frac{1}{2}$ length of lobes. Anthers more obtuse, not longer than 1.5 mm. Stigma conical, style-like. (Desert ridges on Ili River, also north of Lake Balkhash area). . . . . 19. H. **parvulum** M. Pop.

21. Stems more or less pubescent. Leaves usually not gray beneath, sparingly pubescent, mostly attenuate at base. Intermediate, plicate teeth present between corolla lobes. Nutlets 3 mm long . . . . . 20. H. **acutiflorum** Kar. et Kir.

\+ Stems glabrous, with sparse hairs. Leaves gray-haired beneath, base rounded or cordate. Intermediate teeth lacking. Nutlets 5 mm long . . . . . 21. H. micranthum (Pall.) Bge.

125 Section 1. CATOXYS Bge. Heliotr. (1869) 317; Boiss. Fl. or. IV, 127; M. Pop. in Tr. Bot. Sada, XLII, 235. — Sect. Pleurolosia Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1854) 398—399 (p. p.). — Sect. I Catimas DC. Prodr. IX (1845) 532. — Annuals, usually subshrubs, stems strongly branching furcately. Tube of corolla more or less long, lobes of small limb triangular, attenuate into subulate or linear mucro, curved inside tube before and after flowering, but not overlapping; calyx slightly accrescent in fruit, persistent or deciduous. Fruit or 4 nutlets, sometimes difficult to separate. Stigma conical, style short. In our species the cymes are scorpioid, loose, long and erect corollas are whitish, calyx abscisses with fruit.

Other species on the plateau of Iran and NW Africa (Iran: H. kumgense Bge., H. halam Boiss. et Buhse, H. eremobium Bge. and others; Africa: H. lineatum Del.).

1. H. dasycarpum Ldb. in Eichw. Fl. casp.-cauc. (1831—1833) 11; DC. Prodr. IX, 535; Ldb. Fl. Ross. III, 101; Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII, 400; Heliotr. 323; Boiss. Fl. or. IV, 140; M. Pop. in Tr. Bot. Sada, XLII, 235. — H. schrenkianum Ldb. Fl. Ross. III (1849) 102. — H. gymnostomum Hemsl. in Hook. Ic. pl. XVIII (1883) tab. 1755. — H. brachuicum Stocks in Hook. Kew Gard. Misc. IV (1852) 173. — Ic.: Eichw. l. c. tab. 5.

Perennial; root thick, woody, producing several stems 20—50 cm high, with spreading or even divaricate and furcate branches from base or only above, sturdy, becoming woody below, green, covered with sparse hairs on tubercles, or grayish, especially above, with dense, semi-appressed hairs and peeling bark; petioles $\frac{1}{3}-\frac{2}{3}$ length of blades, upper leaves subsessile; blade 1—2 cm long, small, ovate or oblong, often rounded, rarely cuneate, at base acutish, rough, the slightly thickened margin appearing rolled, nerves sharply protruding beneath, green, subglabrous or covered with sparse bristles borne on tubercles or merely with white tubercles, more or less gray, especially beneath, with thin appressed bristly hairs. Scorpioid cymes single or in pairs, at ends of stems and branches, very loose, with 3—10 flowers, often elongate, the lower flowers far removed from the upper, secund, slightly twisted; lower flowers on stipes about as long as or longer than calyx, upper flowers sessile; calyx ca. 2—3 mm long, green or gray-haired, its lobes ovate or oblong, acute or obtuse, slightly enlarging and more or less spreading in fruit, slightly campanulate and stellate after abscission of fruit; corolla tube 3—5 mm long outside with more or less dense downward
126 turned hairs, rarely subglabrous, glabrous inside; limb small, the linear, acute or linear-subulate lobes with broader base, $\frac{1}{2}-\frac{1}{6}$ length of tube, broad base plicate or even forming in intervals between teeth an inward facing annular limb, curved inward before and after flowering; stigma elongate-conical, sparingly pubescent, nearly as long or twice as long as the hairy, sometimes glabrous style; anthers attached at middle of tube or

close to throat; nutlets ovoid, smooth, covered below with appressed, long, sericeous hairs or glabrous, 3.5—4 mm long. April—May.

Sandy deserts, sands and pebbly trails in mountains. — Centr. Asia: Kara K., Kyz. K., Ar.-Casp., Syr D., Balkh. Gen. distr.: Iran. (eastern part, N. Afghanistan; Baluchistan?). Described after the Eichwald specimens, collected near Krasnovodsk. Type in Leningrad.

Note. This species is highly variable in pubescence, size of flowers, shape and length of corolla teeth and other characters which led to the recognition (see M. Pop. in Tr. Bot. Sada, XLII, 236) of the varieties: var. eichwaldi Bge., var. hispidum Bge., var. sericeum Bge., var. schrenkianum Bge.

2. H. transoxanum Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1854) 402; Heliotr. 317, 319; Boiss. Fl. or. IV, 139; M. Pop. in Tr. Bot. Sada, XLII, 238. — H. desertorum Boiss. et Buhse in Nouv. Mém. Soc. Nat. Mosc. XII (1860) 150.

Perennial; apart from the usually larger corolla with tube pubescent inside and its short lobes, similar in all characters to the preceding. It is usually more densely pubescent, in all parts, than the type of H. dasycarpum; rarely green individuals with reduced pubescence, similar to H. dasycarpum var. schrenkianum are, however, encountered. The only essential difference from H. dasycarpum is the internal pubescence of the 5—7 mm long corolla tube. (Plate VIII, Figure 2.)

Sandy deserts, somewhat consolidated sands. — Centr. Asia: Kara K., Kyz. K. Endemic. Described from S. Kyzyl-Kum. Cotype in Leningrad.

3. H. grande M. Pop. nom. n. — H. gymnostomum M. Pop. in Tr. Bot. Sada, XLII (1931) 239, descr. non Hemsley.

Perennial; stems numerous, 50—70 cm high, erect, thick, woody in lower part, furcately branching nearly from base, flexuose, with elongate, spreading branches, like stems scabrous-hairy or short-villous, becoming glabrous with age; leaves rather large, the largest 3—4 cm long, 2—2.5 cm wide, oblong or elliptic, rarely obovate, cuneately attenuate into petiole, this slightly shorter than or $\frac{1}{2}-\frac{1}{3}$ length of blade, rarely (on sterile branches)
127 with rounded base, acute or obtuse, greenish above, with tangled and appressed short hairs on both surfaces, more densely so beneath where sometimes grayish, the hairs borne on more or less large tubercles, nerves prominent beneath, depressed above. Commonly inflorescence broadly, loosely paniculate due to profuse branching of stems; scorpioid cymes horizontally or obliquely antrorse, divaricate, secund, leafless, rather compact at onset of flowering, becoming slightly loose in fruit, always denser than in H. dasycarpum Ldb.; branches of inflorescence gray-haired; pedicels very short or flowers sessile; calyx rather large, 4—5—6 mm long in flower, its lobes oblong or ovate, sometimes linear-oblong, obtuse, thinly tomentose-grayish; corolla tubular, 5—7 mm long, white, the tube hairy outside, glabrous inside, longer than calyx by $\frac{1}{3}$ or nearly twice as long; lobes of limb linear-subulate, with broad base, $\frac{1}{3}-\frac{1}{2}$ length of tube, i. e., 2—3 mm long, curved inward to and after flowering, in throat tube with folds and pleats inside, hairy along nerves outside; anthers sessile above middle of tube, 2.5—3 mm long, oblong, acutish, erect (but their arrangement variable;

dimorphism ?); style ca. 1.5 mm long, pubescent; stigma as long or slightly longer, conical, obtuse, with pubescent apex; hypogynous disk narrow, annular, slightly lobed; nutlets 3.5—4 mm long, with long appressed hairs, rarely glabrous below, abscissing with calyx. April—May. (Plate VIII, Figure 1.)

Sandy deserts and sandy hills in the semidesert belt. — Centr. Asia: Kara K. Endemic. Described from Repetek. Type in Leningrad.

Note. This species also resembles H. dasycarpum from which it is distinguished by the higher growth (of 50—70 cm) and highly ligneous stems at base, hence plant nearly a shrub with larger leaves to 3—4 cm long and 2—2.5 cm wide, scorpioid cymes more compact with more sessile flowers, the lower of which are not as remote as in H. dasycarpum, on hardly discernible pedicels slightly larger than the flowers.

H. grande is so similar to H. dasycarpum that I would not hesitate to unite them, but its habitat is so distinct that I prefer to retain it as a separate species, with more or less differentiated distribution area. It may be considered as a specific Paropamisus (Badghis) form which vicariates with H. dasycarpum in the area between Murgab-Tedzhen.

Section 2. RADULA Bge. in Bull. Soc. Nat. Mosc. XLII, 2 (1870) 326;
128 Boiss. Fl. or. IV, 127; M. Pop. in Tr. Bot. Sada, XLII, 242. — Perennial, sometimes subshrub. Lobes of corolla overlapping in buds ovate or oblong, obtuse, in our species crisped-undulant. Calyx persistent, not accrescent.

In addition to the following species up to 10 species in the E. Mediterranean area, Iran and N. Africa.

4. H. turcomanicum M. Pop. et Korov. in Tr. Bot. Sada, XLII (1931) 246. — H. persicum auct. non Lam. — Sericostoma kotschyi Boiss. (vide Burtt. in Kew Bulletin, 1949, No. 2, 137—138). — H. ramosissimum Burtt. l. c. p. p. non Sieb. ex DC. Prodr. IX (1845) 536 (species africana).

Perennial; stems 40—50 cm high, grayish, sturdy, erect, woody, from base or middle with spreading, woody branches covered with thin, appressed, bristly hairs turning downward; leaves with short petioles, few, lanceolate, gradually tapering at both ends, margin undulant, recurved blade, grayish with semi-appressed, thin bristles on large solid tubercles above, smaller and less dense beneath; cauline leaves 25—35 mm long, 4—8 mm wide, the upper much smaller. Scorpioid cymes many, usually paired, rather sparse, forming broad paniculate inflorescence, short (1.5—3.5 cm long), in fruit erect, sparse; flowers small, sessile; calyx 2—2.5 mm long, the obtuse, oblong lobes as long as corolla tube, gray with small, tangled, rough hairs; corolla whitish, its tube pubescent outside, glabrous inside, lobes oblong, obtuse, with crisped margin, ca. 0.75 mm long, i. e., $^1/_3$ length of tube; anthers oblong, 0.75 mm long, sessile below middle of tube; style glabrous, very short; stigma conical, glabrous, 0.75 mm long, much longer than style; nutlets 4, separating from each other, at first long-tomentose-villous, later slightly hairy, 1.5—2 mm high, with spongy, rounded dorsal gibbosity near base. May. (Plate VIII, Figure 7.)

Pebbled beds of dried-up mountain streams in the semidesert belt. — Centr. Asia: Mtn. Turkm. (Chandyr — W. Kopet Dagh, Greater Balkhan

(129)

PLATE VII. Heliotropium fedtschenkoanum M. Pop., habit of plant, flowers without corolla, section between corolla lobes, section of flower, pistil, seed.

Range). Gen. distr.: E. Med., Iran. Described from Chandyr. Type in Tashkent, cotype in Leningrad.

Note. H. turcomanicum M. Pop. et Korov. should be applied to the Iranian plant called by Boissier "H. persicum Lam." According to
131 Barth, H. persicum Lam. is actually Sericostoma (S. persicum (Lam.) Burtt = S. kotschyi (Boiss. et Hoh.) Franch.). Barth proposes that the plant, erroneously interpreted by Boissier and Bunge as H. persicum Lam., should be H. ramosissimum Sieb., but this epithet refers to the Egyptian plant which has a woodier stem, nutlets lacking suberous tubercles at the base and long hairs on the back of the nutlets. If, then, the N. Iranian (and Turkmenistan) race is distinguished from the S. Egyptian race, there remains no other name for it but H. turcomanicum; it would, however, be difficult to locate its geographical limit with H. ramosissimum. As all the Iranian specimens seen, as well as those of Punjab and some of Egypt, are H. turcomanicum, this limit presumably passes through a point more to the south of Iran. But in Afghanistan there grows H. ramosissimum Sieb. (Griffith, No. 5936), which I also [?] saw from Arabia (Ehrenberg!); this and other specimens of Boissier and Clarke were referred to H. undulatum Vahl. and H. persicum Lam., but Barth claims that the first of these species should be called H. bacciferum Forsk. (Fl. Aeg. Arab. 1775, 38), by its spreading stems, and the second belongs to Sericostoma, not Heliotropium. The spongy basal tubercle on the nutlets brings our species in relation to the tropical African H. nubicum Bge.

5. H. arguzioides Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 406; M. Pop. in Tr. Bot. Sada, XLII, 242; Ldb. Fl. Ross. III, 101; Bge. Heliotr. 327 and 329. — H. radula Fisch. et Mey. ex Ldb. Fl. Ross. III, (1849) 101; Bge. l. c.; Boiss. Fl. or. IV, 144.

Perennial; rhizome cordlike, long, creeping; stems 20—40 cm high, robust, more or less strongly branching, densely hairy, gray below, becoming glabrous, covered with the white remnants of thin bark; leaves with canescent petioles $\frac{1}{4}-\frac{1}{2}$ length of blade; blade 1—2 cm long, oblong-elliptic, oblong or ovate, rarely nearly lanceolate, cuneate or rounded at base, acute or obtuse, stiff, with slightly rolled margin, more or less densely canescent, more so beneath, greenish-gray to white-gray, with short, spreading, simple hairs. Scorpioid cymes terminating stems and stronger branches, short, 0.5—1.5 cm long, compact, secund, biseriate, usually paired, with few flowers; flowers small, pubescent; calyx spreading, canescent, 1.5—2 mm long, cleft to half, its lobes ovate, obtuse; tube of white corolla appressed-hairy outside, 2—4 mm long, cylindrical or slightly swollen at middle; limb very small, with ovate,
132 crisped-undulant lobes; anthers attached at middle of tube of corolla or slightly higher, acute or obtuse, linear-oblong, wider at base; stigma tetrahedral, elongate-conical, glabrous or slightly hairy, twice as long or just as long as style; nutlets ovoid, smooth or slightly tuberculate, covered with long, sericeous, antrorse, slightly spreading hairs or glabrous, 2—2.25 mm long. April—May.

Sandy deserts. — European part: L. V.; Centr. Asia: Ar.-Casp., Balkh., Kyz. K. Endemic. Described from the sandy desert southeast of Lake Balkhash near Arganata (from the Karelin and Kirilov collections). Type in Moscow, cotype in Leningrad.

Note. This species is very close to H. turcomanicum M. Pop. et Korov., which is widespread in Iran and Africa, vicariating with H. ramosissimum and H. nubicum. H. nubicum grows in the hamada and should be regarded as the ancestor of our sandy-desert H. arguzoides. Judging by the distribution area of H. arguzoides (rare in the sandy deserts of Iran and even less prevalent in NW Africa), it appears to be a young species of the Late Tertiary or even Pleistocene, probably the result of hybridization between the hamada species H. turcomanicum and the littoral Tournefortia sibirica (or some shrubby, phylogenetically more primitive Tournefortia such as T. fruticosa L.).

Section 3. BUCANION Sczegl. in Bull. Soc. Nat. Mosc. XXVI (1853) 328; Bge. Heliotr. 305; Boiss. Fl. or. IV, 127. — Corolla lobes rolled inward longitudinally, or folded and nearly valvately converging, not overlapping in bud; corolla tube long, limb small; calyx persistent after dehiscence, not accrescent. Annuals. Flowers yellow, or white (H. fedtschenkoanum, H. kowalenskii, H. szovitsii). In addition to our species a few species in Asia Minor and Iran.

6. **H. bucharicum** B. Fedtsch. in Izv. Bot. Sada, XV, 1 (1915) 1, tab. I; M. Pop. in Tr. Bot. Sada, XLII, 226. — Ic.: B. Fedch., op. cit.; Rast. Turk. Fig. 191.

Perennial; stems erect, simple, or with few spreading branches, robust, 20—50 cm high, densely covered with short whitish stiff hairs; leaves short-petioled or sessile; blade when young nearly completely enveloped in white wool, becoming long-white-lanate especially at margin, hairy along surface, rounded-ovate, large, 3—5 cm long, nearly as wide, obtuse, with prominent nerves beneath, rounded or slightly cordate at base. Scorpioid cymes paired or 3—4, dense, secund, biseriate, 2—6 cm long, elongating, white-lanate in
133 fruit; calyx white-haired, nearly tomentose, persistent, ca. 3 mm long, with sublinear, obtuse lobes; corolla yellow, its tube 6—8 mm long, short-haired outside, from anthers to throat evenly and densely covered inside, with indistinct, longitudinal rows of hairs; limb small, its lobes nearly erect, oblong, obtuse, ca. 0.5 mm long; style short, glabrous; stigma 2—3 times as long as style, conical-subulate; nutlets oblong, smooth, glabrous, 1.5 mm long. April—May.

Loess escarpments in the semidesert belt. — Centr. Asia: Pam.-Al. (near Guzar). Endemic. Described from Guzar. Type in Leningrad.

Note. Judging by its habitat and its very restricted distribution, it might be viewed as an introduced semi-weed. It is close to H. griffithii Boiss., another species with restricted distribution in Afghanistan (see Note to following species). H. griffithii may, in fact, be in Afghanistan, in any event growing within the distribution area of the section, whereas H. bucharicum is more probably a secondary species, not of Afghanistan, which grows at the periphery of this area, and vicariates with H. griffithii.

7. **H. biannulatiforme** M. Pop. in Tr. Bot. Sada, XLII (1931) 227.

Perennial; plant 25—40 cm, occasionally 8—10 cm high; stems spreading-branching from base, in small individuals sometimes simple, covered with

short, rather dense, semi-appressed hairs and longer, spreading bristles, abundant on young branches, much less so on older ones; petioles more or less long, always shorter than blade; blade to 2—2.5 cm long, broadly ovate, with rounded or subcordate base, obtuse or acute at apex, nerves slightly prominent beneath, narrowly furrowed above, with crisp, long hairs, denser beneath, forming a loose, grayish, very sparse tomentum with bristles along nerves and along margin, above less densely pubescent, sometimes nearly green, with short hairs confined to nerves, with copious dotted glands beneath. Scorpioid cymes terminating branches, single and paired, compact, becoming sparser, uniserial, curved at apex, erect in lower part, 1—3(6) cm long; calyx subsessile, on very short stipes, persistent, ca. 4 mm long, the lobes linear, acute, with densely spreading hairs outside; corolla 9—10 mm long, yellow, its tube narrow, long, twice as long as calyx, hairy outside, inside glabrous but for 2 rings of hairs, the one just above anthers of hairs extend-
134 ing in different directions, the other (in throat) of antrorse hairs; limb hardly funnelform, nearly straight, its lobes 0.5—0.75 mm long, subovate, obtuse; anthers acute, attached nearly at base of tube; stigma conical, slightly elongating, slightly longer than usually glabrous style; nutlets 1.25 mm long, ovoid, glabrous, smooth. May—July.

In variegated Tertiary-Cretaceous, gypsiferous rocks, mountain semi-desert and gypsiferous desert belt. — Centr. Asia: Pam.-Al. (foothills of western spurs of Gissar Range). Endemic. Described from near Shirabad. Type in Tashkent, cotype in Leningrad.

Note. The relationships between the four allied yellow-flowered species of the section Bucanion, between H. bucharicum and H. biannulatiforme, on the one hand, and H. griffithii and H. biannulatum, on the other, are obscure (I saw the type specimens of all four). This is due notably to the incompleteness of the type specimens of the Afghan species. Although H. bucharicum and H. biannulatiforme are represented by a mass of beautifully collected and dried plants which provide a clear-cut conception of these species, the type specimens of H. griffithii and H. biannulatum are mutilated fragments. Hence I could not go beyond a tentative solution of the relationships between these species.

8. **H. szovitsii** (Stev.) Bge. in Bull. Soc. Nat. Mosc. XLII (1869) 308; Boiss. Fl. or. IV, 132; Kuzn. in Mat. Fl. Kavk. IV, 2, 99, p. p.; Gross., Fl. Kavk. III, 247, p. p. — Bucanion szovitsii Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 568. — **Exs.**: Pl. or. exs. No. 371.

Perennial; stems 20—30 cm high, robust, slightly flexuose, branching from base with long, flexuose, strongly spreading, nearly divaricate branches, these and stems canescent, with appressed short hairs; leaves with ovate or oblong, 1—3 cm long blades and thin petioles $\frac{1}{2}-\frac{2}{3}$ length of blade, this rounded at base, obtuse at apex, grayish beneath, short-appressed-hairy, with 2 pairs of thick lateral nerves, glabrous or subglabrous (with scattered short bristles above). Scorpioid cymes many, at ends of branches, loose, long, racemiform, nearly erectly ascending and only slightly twisted even at apices, leafless, 3—10 cm long, very loose in fruit; calyx sessile or subsessile, 2.5 mm long in flower, ca. 3—4 mm long in fruit, with broadly linear, obtuse, appressed- and short-haired lobes, persistent; corolla clavate-tubular, 7—8 (to 10) mm long, glabrous or with few short cilia along

nerves outside, completely glabrous inside, its tube short, nearly as long
135 as calyx, narrowing above anthers, then gradually broadening into narrow tubular-campanulate limb longer than tube, cleft into ovate semi-rounded, erect, completely obtuse, ca. 1 mm long lobes, notches between lobes entire, without intermediate teeth; anthers 1.5 mm long, oblong, obtuse, in lower part of short corolla; stigma pubescent 1.5 mm long with nearly subulate broadly conical base, and 2 divaricate mucros; gynobase pyramidal. June—July. (Plate VIII, Figure 12.)

Stony slopes in semi-desert belt. — Caucasus: S. Transc. (Nakhichevan). Gen. distr.: Iran. (N.). Described from Nakhichevan. Type in Leningrad.

Note. The corolla lobes of this species are broad and irregularly imbricate in bud. Hence, in spite of Bunge (Heliotr., 1869), Boissier included it in section Agoraea. As H. szovitsii is the type of Bucanion Stev. and, accordingly, of the section Bucanion Bge. this procedure is very strange. Also in the Agoraea it occupies a wholly unnatural position, between H. lasiocarpum F. et M. and H. dissitiflorum Boiss., which, though close, do not resemble H. szovitsii.

Hybrids between this and the following species are likely. In the USSR, H. szovitsii is confined to the area of Nakhichevan and H. kowalenskyi to Araks River: Ordubad, Megri and Daralagez.

9. **H. kowalenskyi** Sczegl. in Bull. Soc. Nat. Mosc. XXVI (1853) 326 tab. V, f. 2.

Perennial; resembling preceding species in nearly divaricate branching of stem and pubescence, but leaf blades usually oblong, cuneate at base, acute at apex, rarely ovate, with rounded base, continuously covered with thin bristly hairs, less densely above than beneath. Racemes-scorpioid cymes very similar, long, erect, loose; calyx sessile but its lobes narrowly linear, longer and more acute; corolla quite different, resembling that of H. szovitsii but narrower, narrowly tubular, of same length, 7—8 mm, densely hairy-villous outside (this immediately distinguishes it from H. szovitsii); limb as long as in H. szovitsii but narrower, tubular, its lobes 1 mm long, oblong, with intermediate teeth linear-subulate nearly as long as lobes, sometimes reduced to a denticle; anthers 1.5 mm long, oblong, obtuse, with inward curved subulate tip; stigma on broad disk, elongate-conical, not
136 subulate, obtuse, pubescent, 1.5 mm long; style very short; nutlets ovoid, glabrous, smooth, obtuse, 1.5 mm long, after abscission of nutlets calyx nearly stellately divergent; gynobase pyramidal. June—July.

Stony slopes (in steppe and semi-steppe belt?). — Caucasus: S. Transc. (Megri, Zurabad mountains, Ordubad; Daralagez). Endemic. Described from specimens collected by Kovalenskii between Nakhichevan and Ordubad. Type in Moscow.

Note. I did not see the original Shchegleev specimens, but I have no doubt that my description refers to Shchegleev's species, although in the author's illustration the corolla lacks intermediate teeth (nor are they mentioned in the lengthy description), and the lobes are exactly as in H. szovitsii. Bunge did not see the original H. kowalenskyi. Ignoring Shchegleev's exact description, which distinguishes it from H. szovitsii, he reduced it to its synonymy. Actually, H. kowalenskyi is so much closer to the Iranian H. samoliflorum Bge. than to H. szovitsii

that more material from the intermediate areas may be needed to warrant their being put in one species. H. samoliflorum is known from only one locality in CW Iran (between Kashan and Qum, on the road to Teheran-Isfahan, ca. 34° N., Bunge collections). The differences are a more dense and spreading pubescence, ovate-rounded leaves, obtuse calyx lobes, slightly shorter corolla and the very thin, subulate, intermediate teeth of H. samoliflorum. On the other hand H. kowalenskyi is certainly close to H. styligerum Trautv., distinguished only by the flatter limb and longer style. Shchegleev (op. cit.) adds the completely sessile flowers as another character distinguishing his species from H. szovitsii, whereas in H. szovitsii the lower flowers at least are on very short but discernible peduncles.

10. H. fedtschenkoanum M. Pop. in Tr. Bot. Sada, XLII (1931) 229.

Perennial; stems to 60 cm high, erect, robust, spreading-branching from base, shortly and densely pubescent gray, with sparse bristles; lower leaves large, long-petioled, their petioles nearly as long as blade, petioles of upper leaves and those on branches much shorter; blade rounded-ovate with slightly cordate or rounded base, 4—5 cm long and as wide, the smallest 1 cm long and as wide, obtuse, sometimes with herbaceous mucro, coarse, rugose, the nerves depressed above, coarse-haired, prominent and more densely and coarsely pubescent, nearly velutinous beneath; stems and main branches leafless above, rather long-bifurcate, with cymes in branches of fork. These paired or in 3's, in flower short, compact, later elongating, looser, biseriate; calyx caducous, its lobes linear, obtuse, bristly-villous, nearly as long or as long as corolla tube, at first ca. 5 mm long, later to 10 mm; corolla tube thin, 8—10 mm long, hairy outside, glabrous inside, the limb white, 2—3 mm across, procumbent, with ovate-acute lobes; anthers at middle of corolla tube; style with sparse hairs, long, ca. 2 mm, 4 times as long as the small, conical, glabrous stigma; nutlets oblong, smooth, short velutinous-hairy, 1.5—1.75 mm long. June—July. (Plate VII.)

Variegated gypsiferous strata, semi-steppe belt. — Centr. Asia: Pam.-Al. (in mountains along Vakhsh, Kafirnigan, Babatag). Endemic. Described from Sangtud on the Vakhsh (Regel collections). Type in Leningrad.

Note. This species cannot be closely linked to any other. All the E. Mediterranean species of Heliotropium with the exception of H. sogdianum have short styles. This has drupaceous fruits and belongs to Tournefortia. H. styligerum from Dagestan has a much shorter style, a very different linking of corolla lobes in the bud (for this reason it is referred to the section Agoraea) and many other characters which distinguish it from our species.

In its vegetative parts and its overall habit our species is very close to H. biannulatiforme or to H. olgae, but distinctly differs from them in the corolla and the gynaeceum. Thus it adds to the large number of characteristic and sharply isolated types that have escaped to the variegated strata near Bukhara. I would refer it to the group of younger relicts of the Iranian center which includes Schrenkia insignis, Astragalus thlaspi and others. Presumably it originated in the Pliocene simultaneously with H. biannulatiforme and H. olgae.

Section 4. AGORAEA Bge. Heliotr. (1869) 289; Boiss. Fl. or. IV, 127. — Euheliotropium DC. Prodr. IX (1845) 537; Gürke, l. c. 93 (p. p.). — Fruit of 4 separate nutlets. Corolla tube broad, overlapping in bud. Calyx 5-parted, persistent or abscissing with fruit. Annuals. Flowers (ours) white. I propose that the following sections be included here: Hedysoma Bge. (Heliotrop. (1869) 299; Boiss. Fl. or. IV, 127 — all parts of the plants as in the preceding but calyx abscissing with nutlets). Peliostylis Stev. (in Bull. Soc. Nat. Mosc. XXIV (1851) 652 — stigma pileiform with obsolete conical apex).

11. H. chorassanicum Bge. Heliotr. (1869) 301; Boiss. Fl. or. IV, 129; M. Pop. in Tr. Bot. Sada, XLII, 225.

138 Perennial; stems 10—40 cm high, spreading-branching from base, rarely simple, erect, robust, with dense short coarse hairs, grayish-white; petioles long, $^1/_4 - ^3/_4$ length of blade; blade 1—5 cm long, 1—3 cm wide, slightly cordate or rounded at base, ovate, obtuse, with velutinous coarse hairs, greenish with depressed nerves above, flat, grayish with prominent nerves beneath; stems under inflorescence long-bifurcate. Scorpioid cymes dense at first, elongating to 5 cm or more, loose-biseriate, paired or in 3—4; calyx persistent; gray-velutinous, 2—2.5 mm long in flower, to 4—5 mm in fruit, with linear, obtuse lobes, corolla tube slightly longer or twice as long as calyx, downy outside, hairy inside; limb 5—7 mm across, its lobes ovate-rounded; stamens below middle of tube; stigma conical-subulate, longer than glabrous style; nutlets 1.5 mm long, ovoid, smooth, short-downy, rarely glabrous. April — June.

Sandy hills in Badkhyz, mountain semi-desert at the northern foot of Paropamizus. — Centr. Asia: Mtn. Turkm., Kara K. (southeastern part). **Gen. distr.**: Iran. (E. Iran, NW Afghanistan). Described from Khorassan. Type in Paris, cotype in Leningrad.

Note. Var. lasiocarpum Bge. (l. c. 301) with downy nutlets is the only representative in the USSR. Variations in the size of the corolla, as in H. olgae, were not seen either in the Rurkmenian or in the Afghan-Iranian specimens; neither did I see the naked-fruited forms from Central Asia. In all other species of the genus, the pubescence of the fruit seems to become apparent only after fertilization. Even in the downy-fruited individuals the young ovaries appear completely glabrous when viewed with a magnifying glass. Hence, determination of the downy-fruited variations on specimens flowering too young may lead to confusion. In Central Asia the Russian species are confined to the basin of the Murgab-Tedzhen, i. e., Paropamisus or Badghis section with the only locality near Ashkhabad to one side of this area. This may be a secondary introduction, since like H. olgae it may to a certain degree become a weed.

Economic importance. Because of its large, snow-white corollas a very handsome ornamental species.

12. H. olgae Bge. in Tr. Bot. Sada, III (1874) 114; M. Pop. in Tr. Bot. Sada, XLII (1931) 223. — H. chorassanicum var. olgae Rgl. et Schmalh. Descr. pl. nov. Fedtsch. (1882) 56.

139 Perennial; stems 10—40 cm high, herbaceous, robust, erect, with spreading, sturdy branches nearly from base, rarely (in small individuals) with simple,

semi-appressed downy hairs; petioles almost half length of blade, the latter 1—3 cm long, ovate or rounded-ovate, rounded or slightly cordate at base, usually obtuse, stiff, rugose, green or greenish above, often velutinous with dense spreading down along nerves, dotted-glandular beneath between nerves. Scorpioid cymes single or paired, rarely 3—4, secund, biseriate, rather compact at first, becoming longer and looser, to 5 cm long; calyx persistent, declined after abscission of fruit, nearly stellately spreading, elongate, linear, obtuse, with spreading gray hairs, 2—2.5 mm long in flower; corolla tube 6—8, to 10 mm long, downy outside and inside; limb 3—8 mm across, with obtuse, ovate, spreading lobes; nutlets ovoid, smooth, glabrous, 1.5 mm long. April—July. (Plate VIII, Figure 3.)

Stony places in foothills (semi-desert belt), and in plains: gravels and conglomerates with gypsiferous horizon, variegated Tertiary and Cretaceous strata, rarely as weeds in fields, also in desert sands. — Centr. Asia: Syr D., T. Sh. (W.), Pam.-Al. (scattered in foothills), Kyz. K. Endemic. Described from the semi-desert between Syr-Darya and Tashkent, to the south of Tashkent (Fedchenko collections). Type in Leningrad.

Note. In this species the relative and absolute dimensions of the tube and limb of the corolla vary markedly. The type has a long tube and broad, large limb. The former is sometimes reduced (4—5 mm); rarely the limb is large (Mikhel'son's specimens from Kuropatkino). In corollas with a long tube the limb is often so strongly reduced that the corolla becomes tubular (very pronounced in Nevesskii's specimens from Mogoltau and in mine from Santo).

With styles $\frac{1}{2} - \frac{1}{3}$ the length of the stigma or slightly shorter the anthers are attached at the very base of the tube, sometimes slightly higher. Such variation in the flower also marks some other species of the genus, e. g., H. biannulatiforme, and appears to be related to the environment of the plant, with reduced corollas in drier, less favorable environments. H. olgae is very close to H. chorassanicum, from which it differs only in the persistent calyx and glabrous nutlets (usually downy in the latter, but possibly glabrous). The distribution areas of these two species are disjoined. In a monograph I would put them in H. chorassanicum, with two subspecies, ssp. euchorassanicum (var. lasiocarpum and var. leiocarpum) and ssp. olgae.

140 13. **H. seravschanicum** M. Pop. in Tr. Bot. Sada, XLII (1931) 222; Zakirov, Burachn. Zeravsh. 11.

Perennial; stem erect, sturdy, divaricately branching from base, shortly and coarsely downy, grayish; petioles rather long, blades 1.5—3.5 cm long and as wide, rounded-ovate, slightly cordate or rounded at base, obtuse, greenish, stiff, with velutinous stiff down, nerves depressed above, protruding beneath; branches below inflorescence short. Scorpioid cymes compact, short, paired or 3—4, biseriate; calyx canescent, 3—3.5 mm long, its lobes oblong-linear, obtuse, not enlarging in fruit; corolla small, tube as long as calyx, downy outside, with yellowish hairs inside, limb 3 mm across, with ovate, procumbent, obtuse lobes, without intermediate teeth; anthers attached below middle of tube; stigma subsessile, stylelike-conical; nutlets glabrous, smooth, 2 mm long. June—July. (Plate VIII, Figure 4.)

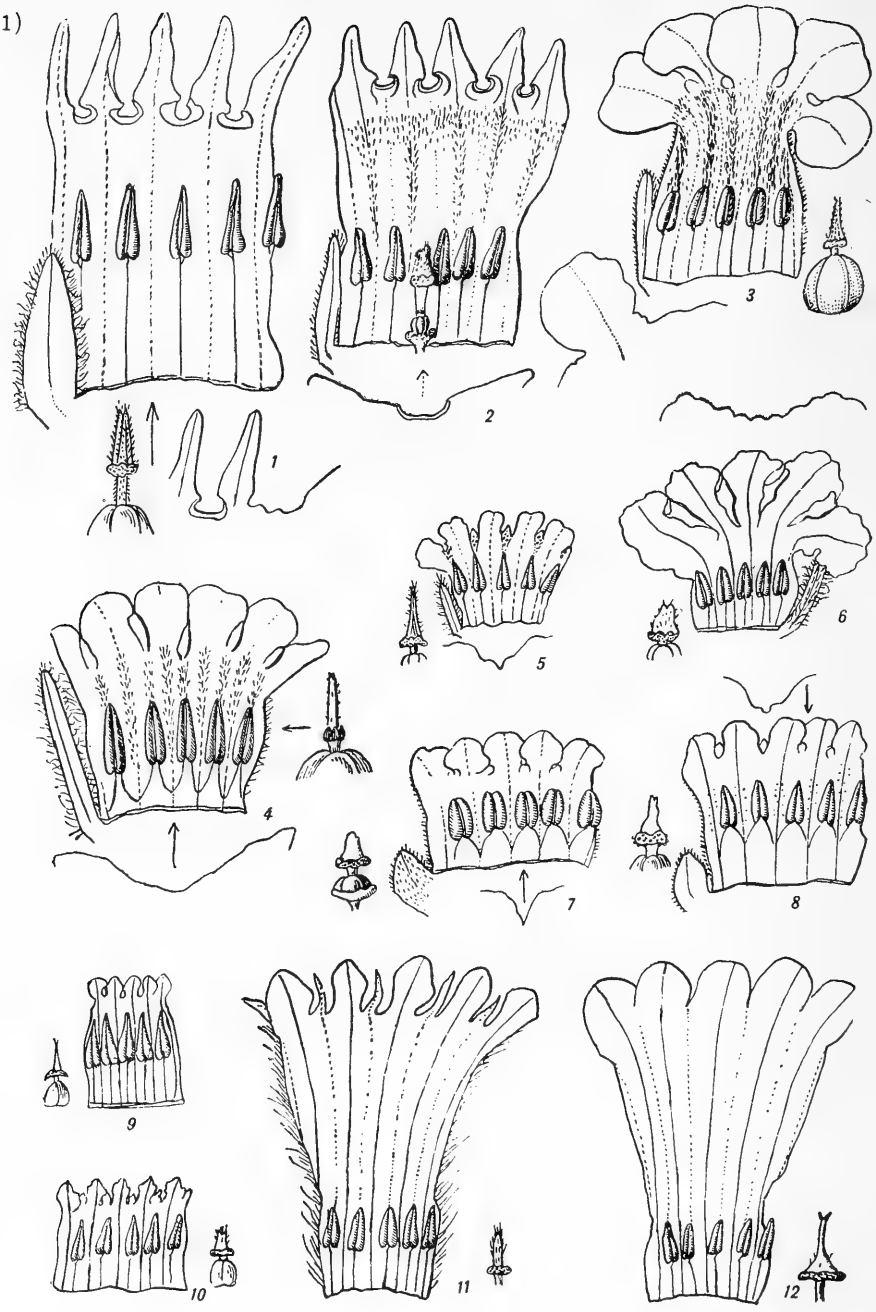

PLATE VIII. Sections of flower, incisions between corolla lobes and pistil: 1 — Heliotropium granbe M. Pop.; 2 — H. transoxanum Bge.; 3 — H. olgae Bge.; 4 — H. seravschanicum M. Pop.; 5 — H. ellipticum Ldb.; 6 — H. suaveolens M.B.; 7 — H. turcomanicum M. Pop. et Korov.; 8 — H. ramosissimum (Sieb.) DC., for comparison 9 — H. litvinovii M. Pop.; 10 — H. parvulum M. Pop.; 11 — H. samoliflorum Bge., for comparison 12 — H. szovitsii (Stev.) Bge.

Variegated strata in mountainous semi-desert and semi-steppe belt. — Centr. Asia: Pam.-Al. (upper reaches of Zeravshan River). Endemic. Described from upper Zeravshan, Pakhud and Veshab villages (Komarov collections). Type in Leningrad.

Note. This species is certainly a cross between H. ellipticum and H. olgae. Leaves and internal pubescence of the corolla very similar to C. olgae, but its scorpioid cymes, size and shape of the corolla and short bifurcation below the inflorescence are very much like those of H. ellipticum. It should be retained as a separate species in spite of the very distinct hybrid character, because it is very stable. The stigma is more stylelike than in H. olgae, the anthers are $1\frac{1}{2}$ times as long, though the corolla is much smaller, and the internal pubescence of the corolla is mainly confined to the nerves, and lacking between them.

14. H. suaveolens M. B. Fl. taur.-cauc. III (1819) 116; DC. Prodr. IX, 535; Ldb. Fl. Ross. III, 99; Boiss. Fl. or. IV, 133; Shmal'g., Fl. II, 221; Kuzn. in Mat. Fl. Kavk. IV, 2 (1913) 97; Grossg., Fl. Kavk. III, 247. — H. europaeum M. B. Fl. taur.-cauc. I (1808) 118. — H. commutatum C. Koch in Linnaea, XXII (1849) 627, p. p. — H. intermedium Andrz. in Eichw. Skizze (1830) 140; DC. Prodr. IX, 535; Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 563. — H. odorum Szov. ex Stev. l. c. (1851) 567. — Ic.: Rchb. Pl. crit. IV (1826) tab. 379.

Perennial; stem 10—30 (40) cm high, erect, simple only in small, weak individuals, usually spreading-branching at base, with long ascending branches, short-appressed-gray-downy; leaves with long thin petioles and oval, oblong or ovate blades, cuneate at base, rather large, 2—4 cm long, rarely small, 1—3 cm long, rather thin, greenish, generally rather mesophyllous, acute or obtuse, the nerves slightly protruding below, faintly depressed above, both surfaces shortly and sparsely downy. Scorpioid cymes usually paired at ends of branches, sometimes single, or in groups of 3, on short, glabrous peduncle or nearly lateral in axil of upper leaf, rather compact, biseriate, secund, leafless, slightly loose in fruit, 2—5 cm long; calyx sessile, gray-downy-villous, ca. 2 mm long, its lobes lanceolate-linear, acute, nearly not elongating in fruit, not quite stellately spreading; corolla white, medium-sized, its tube strongly downy, usually faceted, twice as long as calyx, ca. 7 mm across, plano-calyciform limb with oblong or ovate, rounded lobes, undulant at apex; intermediate teeth lacking; anthers oblong, 1 mm long, at middle of corolla tube; style very short; stigma wide, the basal disk with markedly protruding margins, its apex short, conical, thick, downy; stigma generally pileiform (character of section Piliostylis Stev. too insignificant to justify its separation); nutlets small, 1.5 mm high, ovoid, pitted-tuberculate, but less deeply so than in H. europaeum, in contrast to it more thinly downy; gynobase very low-conical. May—July. (Plate VIII, Figure 6.)

Stony slopes in mountainous semi-desert and steppe belt, sands, pastures, weedy places, etc. — European part: Bes., M. Dnp., Bl., L. V., L. Don, Crim.; Caucasus: everywhere except W. Transcaucasia. Gen. distr.: Bal.-As. Min., Iran. (N.). Described from Taman. Type in Leningrad.

Note. The type specimen from Taman in the NW Caucasus is a very large plant with large leaves, large flowers and glabrous nutlets. H. odorum Szov. described from Armenia represents the S. Transcaucasian

race with small, rounded-ovate, green leaves, looser cymes, downy nutlets
144 and smaller flowers. H. intermedium Andrz., described from Kherson and S. Podolia, is the race of the Dnieper-Dniester steppe with narrow, oblong, acute leaves, small flowers, corolla limb 4 mm across, and downy nutlets. H. commutatum C. Koch — according to Koch native to Georgia and Shirvan — is most closely allied to H. odorum Szov. It is usually mistaken for H. europaeum but its nutlets are twice as large. This is a pertinent character for H. odorum Szov., hence H. commutatum may be a race of H. europaeum L.

15. H. styligerum Trautv. in Tr. Bot. Sada, VII (1881) 484; Kuzn. in Mat. Fl. Kavk. IV, 2, 96; Grossg., Fl. Kavk. III, 247. — Exs.: Herb. Fl. Cauc. No. 386.

Perennial; stem erect, 15—40 cm high, rather robust, sturdy, with nearly divaricate long branches, often from base, gray, covered with short, appressed down; petioles short, $\frac{1}{4}-\frac{1}{6}$ length of blade; blades rather large, 2—4 cm long, ovate-oblong and oblong, rather mesophyllous, i. e., not rough, and rather thin, the nerves slightly depressed above, slightly prominent beneath, cuneate at base, acute at apex, ash-gray and short-haired beneath, much less densely appressed-downy above. Scorpioid cymes 2—4, rarely single, on rather long peduncles terminating branches, overtopping upper leaves (tips of branches leafless), leafless, compact at onset of flowering, capitate, soon elongating, thin, loose, secund, biseriate, 2—5 cm long; calyx sessile, persistent, 3 mm long in flower, hardly elongating stellately opening in fruit, its lobes linear, obtuse, hoary; corolla usually small or medium, its tube markedly downy 3—4 mm long, hardly longer than calyx; limb broadly campanulate-calyciform, ca. 4—5 mm (to 7 mm) across, with rounded or obovate, oblong-ovate, slightly crisped lobes; longitudinal, glabrous folds present, intermediate teeth lacking or short, triangular; anthers oblong, at or slightly above middle of tube, 1.5 mm long; style pubescent, 0.7—1 mm long; stigma 1 mm long, elongate-conical-subulate, downy; nutlets glabrous, smooth (rarely slightly tuberculate), 1.5 mm long; gynobase pectinately compressed, pyramidal, low. July—August.

Stony, shale taluses, meadows, shrubby formations, reaching rather high altitudes in mountains. — Caucasus: Dag., Cisc. (only Eastern, to Dzaudzhikau). Endemic. Described from Dagestan (Becker collections from Akhta village). Type in Leningrad.

145 Note. It appears that Kuznetsov did not clearly understand the relationship of this species which is endemic to the eastern part of the Main Range in the Caucasus; brought it into relation with H. ellipticum Ldb., H. europaeum L. (op. cit. 83), and H. suaveolens M. B. (op. cit. 97). In actual fact it is closest to H. kowalenskyi Sczegl., but, relying on Bunge, Kuznetsov concealed this latter species in the synonymy of H. szovitsii and hence overlooked it. I myself am at a loss as to the separation of H. styligerum and H. kowalenskyi, but for the slightly longer style and more compact cymes. The corolla limb, which provided the basis for the inclusion of these two related species in different sections, is highly variable in both species. In H. kowalenskyi this variability is seen in the intermediate teeth; in H. styligerum in the flatness and diameter of the limb as well as in the presence or absence of small intermediate

teeth. The large-flowered forms of H. styligerum, from Dagestan (Ruprecht), near Grozny Region (Kuznetsov) or elsewhere distinctly show traces of the effect on our species of crossing with H. suaveolens, a native of the Caucasus. I believe this effect to be responsible for the divergence of H. styligerum from the type of its related, southern, Iranian progenitor H. kowalenskyi towards H. suaveolens. Hence H. styligerum must be accepted as an Iranian element in the flora of Dagestan, where many representatives which are similar in this flora may be found (e.g., Solenanthus petiolaris DC of the Boraginaceae and many other species in other families as well). It appears to me that E. ellipticum and especially H. europaeum have no share in the origin of the endemic E. Caucasian H. styligerum.

16. **H. europaeum** L. Sp. pl. (1753) 130; DC. Prodr. IX, 534; Ldb. Fl. Ross. III, 99; Boiss. Fl. or. IV, 130; Shmal'g., Fl. II, 220; Kuzn. in Mat. Fl. Kavk. IV, 2, 92; Grossg., Fl. Kavk. III, 247; Kryl., Fl. Zap. Sib. IX, 2232. — H. stevenianum Andrz. ex Besser in Flora (1832) Beibl. 21, nom. nud.; Andrz. Enum. pl. Podol. 116, cum descript. see. Litw. in Sched. ad Herb. Fl. Ross. No. 1527. — H. subcanescens Andrz. ex Besser in Flora (1832) Beibl. 21, nom. nud. — H. incanescens Andrz. l. c. (descript.). — H. tenuiflorum Guss. Fl. Sic. synops. I (1842) 216. — H. commutatum C. Koch in Linnaea, XXII (1849) 627—628. — Ic.: Rchb. Ic. Fl. germ. XVIII, tab. 93; Hegi, III. Fl. V, 3, tab. 220; Fedch. and Fler., Fl. Evrop. Rossii, Fig. 670; Stank. and Tal., Opred. Fig. 427. — Exs.: GRF, No. 1527; Wolosczak, Fl. pol. exs. No. 658; Fl. Austr.-Hung. No. 3716, No. 3717; Fl. Hung. No. 773; Fl. bohem.-slov. No. 515.

Perennial; stem 10—30 cm high, branching from base and hence plant often apparently multicaulescent, with ascending and semi-recumbent stems, which branch in turn; the hairs short, appressed, slightly grayish or gray; leaves rather large (smaller in some races), oblong, cuneate at base, long-
146 petioled, usually yellowish-green, rarely dull grayish, rather delicate, often with xeromorphous anatomy, the thin nerves prominent below, nearly smooth above; blades 2—4 cm, obtuse or acute; petioles thin, $\frac{1}{2}-\frac{2}{3}$ length of blade. Profusely branching stem bearing many scorpioid cymes, 1—4 at ends of branches, directly above leaves (without peduncle) or in axils of upper leaves, compact at first, soon elongating, becoming loose, thin (thinner and looser than in preceding and following species), leafless, to 10 cm long, nearly erect; calyx sessile, downy-villous, with linear lobes, ca. 1.5—2 mm long in flower, to 4 mm in fruit, stellately spreading after abscission of nutlets; corolla small, 2—3 mm long, white, the tube downy outside, glabrous inside, as long as or shorter than calyx, the limb 2—3 mm across, campanulate-calyciform, with oblong, obtuse lobes; nutlets ca. 2 mm high, ovoid, glabrous (very rarely downy), deeply pitted and acutely tuberculate; style very short, stigma conical-subulate, not more than 0.7—0.8 mm long; gynophore compressed-pectiniform. May—June.

Stony slopes, sands, fallows, weedy places. — European part: Bes., U. Dnp., Bl., L. V., L. Don, Crim.; Caucasus: everywhere. Gen. distr.: Bal.-As. Min., Centr. Eur., N. Afr., Arm.-Kurd., Iran. (only N. and NW Iran). Described from Europe. Type in London.

Note. H. europaeum is not homogeneous throughout its wide distribution area, as there are some more or less different races which have given rise to many synonyms. H. stevenianum Andrz. is the E. European race described from Podolia with several smaller corollas (0.5—1 mm) and smaller (by 0.5 mm) nutlets. Ledebour renamed it var. micranthum (Ldb. Fl. Ross. III, 99), a name used by Litvinov in his "Herb. Fl. Ross." No. 1527. Steven (l. c.) ignored H. stevenianum Andrz. calling this race H. subcanescens Andrz. (ex Stev. in Bull. Mosc. (1851) 564). I saw Steven's specimen from Sudak. In the Crimea grow H. stevenianum (yellowish-green) and another, gray race which might be given the same epithet. The latter is a product of the crossing of H. dolosum Not. (= littorale Stev. = subcanescens Andrz. ex spec. auth. = incanescens Andrz. ex descrip.) and H. stevenianum (H. europaeum var. stevenianum Schmalh. Fl. II (1895) 220).

The gray race which, as Steven correctly points out, is common in the Crimea also occurs in the lower reaches of the Dniester, Bug and Dnieper rivers (on sands?). In the Caucasus it is encountered among the usual
147 yellowish-green H. stevenianum. If subcanescens Andrz. refers to H. dolosum Not., this race has no valid name. Steven probably had in mind this race with this name, but subcanescens Andrz. Stev., non Andrz. in herb. is too confusing to be appropriate. H. tenuiflorum Guss. refers to the race with densely and distinctly downy nutlets, confined to the Crimea, for example "Tauria," No. 8221 Herb. Trautv." (classified as H. lasiocarpum Fisch. et Mey. by Trautvetter and Kuznetsov). This specimen may not come from the Crimea since no new specimens have been collected there. Believing H. carduchorum C. Koch (Linnaea, XXII (1949) 627) to be a synonym of H. tenuiflorum Guss. (a highly improbable view), Kuznetsov reported this race (l. c. 95—96) for Artvin. I have seen the gray Caucasian race (H. subcanescens Stev. non Andrz.) with downy nutlets. H. commutatum C. Koch is more likely to be the large-flowered race with nutlets twice as large as those of H. europaeum (according to Koch). According to its author, this species is common to Georgia and Shirvan, where it is known as H. europaeum; however, according to the description, the stigma is short-conical, which makes it different from H. europaeum. Bunge (Heliotr. 296), who saw Koch's type, includes the species in the synonymy of H. suaveolens, even though Koch recognized H. suaveolens (l. c. 628) and H. commutatum as distinct.

17. **H. ellipticum** Ldb. in Eichw. Pl. casp.-cauc. (1831—1833) 6, 10; Ldb. Fl. Ross. III, 100; Kuzn. in Mat. Fl. Kavk. IV, 2, 88; M. Pop. in Tr. Bot. Sada, XLII, 220. — H. strictum Ldb. Fl. Ross. III (1849) 100. — H. lasiocarpum Fisch. et Mey. in Ind. Sem. Hort. Petrop. IV (1837) 38. — H. eichwaldi Steud. Nomencl. ed. 2, I (1840—1841) 744; DC. Prodr. IX, 535; Bge. Heliotr. 291—292; Boiss. Fl. or. IV, 131; C. B. Clarke in Hook. Fl. Brit. Ind. IV, 149; Kryl., Fl. Zap. Sib. IX, 2233. — H. dolosum Not. Repert. Fl. Ligust. (1844) 284. — H. littorale Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 565. — H. macrocarpum Guss. Enum. pl. Inar. (1854) 214, tab. 7. — H. incanescens Andrz. Enum. pl. Podol. (1862) 116. — Ic.: Eichw. l. c. tab. 4. — Exs.: GRF, No. 1526.

Perennial; stem 10—40 cm high, herbaceous, robust, usually spreading-branching from base, with sturdy long branches and appressed downy hairs, canescent; leaves with petioles $^1/_2 - ^2/_3$ length of blade, with ovate-oblong-oval, obtuse, 1.5—3.5 cm long blade, green above, canescent beneath with appressed hairs borne on tubercles, sometimes both surfaces canescent; lateral nerves depressed above, protruding beneath. Scorpioid cymes single or in pairs, sometimes 3—4, the lateral and terminal on distinct
148 peduncles, secund, biseriate, short at first, compact, more or less elongating in fruit, looser, from 2 to 5 cm long; calyx gray, with short hairs, ca. 2 mm long, its lobes oblong, obtuse, hardly elongating, slightly spreading in fruit, not quite stellately diverging after abscission of fruit; corolla small, ca. 3 mm long, its tube downy outside, lobes of limb round-ovate, $^1/_2 - ^1/_3$ length of tube, intermediate teeth small, more or less developed; anthers attached below middle of corolla tube; stigma conical to conical-subulate, much longer than glabrous style, slightly downy; nutlets ovoid, smooth or slightly rugose-tuberculate, dorsally inflated, glabrous or downy, 1.5 mm long. May—July. (Plate VIII, Figure 5.)

Stony slopes in semi-desert and semi-steppe belt, rarely in steppes, often as a weed in oases, river gravels, sands. — European part: Bl., L. V., L. Don, Crim.; Caucasus: Cisc., Dag., E. and S. Transc.; West Siberia: Alt.; Centr. Asia: everywhere. Gen. distr.: Iran., Ind.-Him., Bal.-As. Min., Med. Described from the eastern shore of the Caspian Sea. Type in Leningrad.

Note. This species may be regarded as a vicariant of H. europaeum. The characters mentioned in the Key readily distinguish them. Their distributions overlap over a vast area from Italy to the Caucasus; although hybrids sometimes occur here, the species remain distinguishable, unmixed. I believe that H. lasiocarpum Fisch. et Mey. should be put with H. ellipticum, as neither has a disjunct distribution area. H. europaeum L. has a race with downy nutlets (H. tenuiflorum Guss.), as has H. ellipticum (H. lasiocarpum Fisch. et Mey.). There is no need to apply a different nomenclature, as Kuznetsov has done (Mat. Fl. Kavk. IV, 2, 1913) on page 86 (H. lasiocarpum as a species), and on page 95 (H. tenuiflorum as a variety).

As delimited here the species includes var. littorale Kusn. l. c. (1913) 90. A dull gray, more densely pubescent plant, nutlets glabrous, rarely slightly downy, scorpioid cymes loose, leaves usually acute, rarely obtuse. (This includes H. littorale Stev., H. dolosum Not., and H. incanescens Andrz. — the last with faintly downy nutlets.) This race was first described from N. Italy (H. dolosum Not.) and by Steven from the Crimea (H. littorale); it is common in the Caucasus. I believe that H. incanescens Andrz. belongs here, with its sparingly pubescent nutlets, different from those of H. lasiocarpum; in habit the plant resembles the Crimean H. littorale. H. strictum Ldb., which Ledebour himself distinguishes from his H. ellipticum by the acute leaves, is also very
149 close to H. littorale; throughout Central Asia it grows alongside the type race and H. lasiocarpum.

Var. lasiocarpum (Fisch. et Mey.) M. Pop. l. c. 221 [H. lasiocarpum Fisch. et Mey, l. c.; Ldb. Fl. Ross. III, 100; Boiss. Fl. or. IV, 131; Kuzn., Mat. Fl. Kavk. IV, 2, 86. — H. eichwaldi var. lasiocarpum

C. B. Clarke in Hook. Fl. Brit. Ind. IV (1885) 150]. — Nutlets densely spreading-downy, scorpioid cymes compact, plant canescent. — Caucasus: E. and S. Transc. (rarely); Centr. Asia: often in the north to 43° N. **Gen. distr.**: Iran., to India in the south. Predominantly a southern race of deserts. Like the preceding species it tends strongly to become a weed.

Note. The seeds contain the toxic alkaloid heliotropin; nutlets falling into bread cause poisoning. (See A. Ya. Butkov and D. D. Goloviznin, Geliotrop opushennoplodnyi, Tashkent, 1948.)

18. **H. litvinovii** M. Pop. in Tr. Bot. Sada, XLII (1931) 218.

Perennial; stem erect, rather thin, 10—35 cm high, with spreading branches, canescent, with coarse down; petioles $^1/_4 - ^1/_2$ length of blade, blade rounded or slightly cordate at base, broadly ovate, obtuse, usually 1—1.5 cm long and as wide or less, rarely to 2.5 cm long and as wide, green, slightly downy above, with profuse dotted yellow glands, canescent beneath, with spreading, coarse down. Scorpioid cymes in upper flower-bearing part compact, distinctly biseriate, in lower fruit-bearing part sparse, terminal, single or paired, 3—9 cm long with spreading calyces, in addition sessile clusters of flowers in axils of leaves, sometimes also reduced scorpioid cymes at base of stem; calyx in flower 2 mm, in fruit 3 mm long, gray, coarse-downy, its lobes oblong-linear, obtuse, not spreading in fruit, not spreading after abscission, easily torn; corolla 2.5—3 mm long, its tube downy outside, glabrous inside, the limb very small, lobes erect, oblong-ovate, obtuse, 0.5 mm long, overlapping in bud; anthers attached at middle of tube; stigma sessile, conical-subulate with broad annular base, slightly downy, acute, ca. 1 mm long; nutlets linear-oblong, blackish, glabrous, thinly dotted, smooth or somewhat rugose (under magnifying glass), 0.5—0.75 mm long. July—August. (Plate VIII, Figure 9.)

Shale slopes in semi-desert belt. — Centr. Asia: Mtn. Turkm., Kara K. (only near Chuli and in Akhchakuima). Endemic. Described from near Chuli. Type in Leningrad.

Note. This species is very close to the Iranian H. gracilliforme Bge. (solonetzes of the Maman desert) known to me only from the authors' descriptions (Bge. Heliotr. and Boiss. Fl. or.), from which it is distinguished by the broadly ovate, not elliptic leaves, absence of intercalary teeth of the
150 corolla which are ovate-triangular in H. gracillimum and only half as long as the outer lobes while in our species they are absent or hardly discernible.

19. **H. parvulum** M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 333.

Perennial; root thin and if thickened then with 2 winglike stripes of bark; stem branching from base, 2—10 cm long, with spreading, ascending or erect, secondarily branching branches; entire plant canescent-tomentose-downy; leaves rounded-ovate, obtuse, slightly cordate or rounded at base, small, 0.5—1.5 cm long; nerves depressed above, markedly protruding below, with longer and thicker hairs along nerves. Scorpioid cymes subcapitate, numerous, biseriate, often in axils of leaves, 5—10-flowered, 0.3—1 cm long, nearly entire branch leafless; flowers very small; calyx 1.5—2 mm long, cleft for $^3/_4$ into oblong-ovate, obtuse lobes, canescent, stellate-campanulate

after abscission of nutlets, persistent; corolla 2—2.5 mm long, hardly protruding from calyx, white, nearly tubular, lobes of very short (0.5 mm) limb glabrous, erect, ovate, with undulant, acute margin; intermediate teeth well developed, triangular, half length of lobes; tube densely downy outside, glabrous inside; anthers attached at middle of tube, less than 1 mm long, oblong, obtuse; stigma subsessile, conical-stylelike, 0.5 mm long, downy, especially at apex; nutlets oblong, smooth, glabrous, nearly 2 mm long, black when ripe. (Plate VIII, Figure 10.)

Stony desert — Centr. Asia: T. Sh. (Trans-Ili Ala-Tau, Boguty Mountains, desert at foot of rocky mountain near Sary Chagan). Endemic? Type in Leningrad.

20. H. acutiflorum Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 406; Boiss. Fl. or. IV, 139; Bge. in Mém. Acad. Pétersb. sav. étrang. VII, 400; Ldb. Fl. Ross. III, 101.

Perennial; stem green, not white-shiny, with sparse downy hairs, fruticose, many times furcately branching from base, rarely simple, 5—10 to 30 cm high; petioles rather long hairy, half length of or as long as blade; blade 1—3 cm long, ovate-elliptic to lanceolate-elliptic, acutish, small, cuneately tapering at base, rarely rounded, sparsely downy, with hairs borne on tubercles, sometimes canescent beneath (nearly as in H. micranthum Bge.), subglabrous above. Scorpioid cymes extra-axillary, often opposite
151 leaf, numerous, on spreading, downy peduncles, loose, short, subcapitate, rarely elongate, with 3—7 flowers on short pedicels almost as long as calyx; flowers small; calyx canescent-villous, ca. 2 mm long at first, ca. 3—4 mm long in fruit, its teeth oblong-ovate, subacute, stellately spreading after abscission of nutlets; corolla 3 mm long, tubular, with retrorse hairs outside, its limb very small, lobes ovate-lanceolate, acute, $^1/_4$ length of tube, with smaller, intercalary teeth and inverted folds inside throat; anthers attached slightly below middle of corolla tube; stigma short-conical, slightly shorter than glabrous style, downy; nutlets oblong-linear, obtuse, inflated dorsally, covered with long, sericeous hairs appressed below, rarely glabrous, 3 mm long. April—June.

Sandy deserts. — Centr. Asia: Balkh., Ar.-Casp., Kyz. K., Kara K. Endemic. Described from sands near Arganata (near the eastern end of Lake Balkhash), from the collections of Karelin and Kirilov. Type in Moscow, cotype in Leningrad.

Note. This species is clearly related to the two species in the preceding section, notably with H. parvulum M. Pop. As in the pair of perennial species H. turcomanicum — H. aguzoides, the hamada H. parvulum must be viewed as the progeniter of the sandy-desert H. acutiflorum, with characters of both the hamada, small-flowered species of the section Agoraea and the much more divergent H. micranthum Bge., which has many characters in common with our perennial species of section Catoxys, e.g., acute corolla lobes, long hairs of the nutlets, etc.

21. H. micranthum (Pall.) Bge. in Mém. Acad. Pétersb. sav. étrang. VII (1854) 399; Boiss. Fl. or. IV, 138 (H. micranthos); Kuzn. in Mat. Fl. Kavk. IV, 2; Fedch. and Fler., Fl. Evrop. Rossii, 775 [H. micranthos (Pall.) Bge.]; M. Pop. in Tr. Bot. Sada, XLII, 232. — Onosma

micranthos Pall. It. II(1773)485; App. 734, tab. L. — Tournefortia micranthos DC. Prodr. X (1846) 67; Ldb. Fl. Ross. III, 98.

Perennial; stem subglabrous, with solitary bristles and tubercles, yellowish-white, many times furcately branching from or nearly from base, fruticose, rarely simple, 10—20 cm high; petioles thin, rather long, hairy, 1/3 length of blade; blade green, 1—2.5 cm long, oblong or ovate-oblong, rounded or slightly cordate at base, acutish or obtusish, gray beneath, with dense short bristles borne on tubercles, subglabrous, with sparse tubercles above. Racemes extra-axillary, often opposite leaf, many, on thin spreading peduncles, very loose, with 3—5 flowers sessile on thin spreading pedicels
152 as long as or 2—4 times as long as calyx; flowers small; calyx canescent, ca. 2 mm long at first, 4—5 mm long in fruit, its lobes oblong, subacute; corolla 3 mm long, whitish, tubular, the limb very small, lobes ovate-lanceolate, acute, 1/4 length of tube, which is covered outside with retrorse hairs; intervals between corolla teeth broadening, nearly rectilinearly dissected; anthers attached slightly above middle of corolla tube; stigma elongate-conical, downy, slightly longer than downy style; nutlets long-oblong, obtuse, dorsally inflated, covered with 5 mm long sericeous hairs appressed below.

Note. Morphologically, this is one of the most amazing species among the ancient Mediterranean Heliotropium, which are very different from the American Heliotropium, and should perhaps be separated from them. H. micranthum stands out among them as they stand out in relation to the American species. The specific characters of our species are very long peduncles, calyces markedly elongating (3 times) in fruit, and narrow, elongate nutlets. The only related species (by section) is H. acutiflorum Kar. et Kir., which resembles the non-sandy-desert species of Heliotropium of the flora of the ancient Mediterranean far more than H. micranthum resembles them. H. acutiflorum links H. micranthum with the hamada species H. parvulum M. Pop. (deserts on Ili River), H. litvinovii M. Pop. (Kopet Dagh), and H. gracillimum Bge. (Iran).

Section Pseudonosma is certainly closest to Catoxys. In the structure of the corolla, aestivation of its lobes, by the leaves and their pubescence, Pseudonosma is very similar to some species of Catoxys, e. g., H. dasycarpum, H. aucheri, H. carmanicum and others. Even the pubescence of the nutlets is very reminiscent of that in H. dasycarpum or H. aucheri. What distinguishes them from the species of this section is the annual root and the calyx accrescent in fruit, on the one hand, and the position and character of the scorpioid cymes, on the other. These latter are unusually profuse in the fruticose specimens, all along the stem; they are far remote from the nearest leaves, which are on the other side. Thus each scorpioid cyme is borne on a rather long stipe, being a terminal inflorescence it soon shifts the developing lateral branch to one side and becomes lateral, and its stipe is markedly accrescent with the lateral branch, which it overtops. This process repeats itself, i. e., the lateral branch of the first order shifts the lateral branch of the second order, etc. The
153 overall structure of stems represents a sympodium giving the impression of being monopodial, bearing seemingly lateral scorpioid cymes which are in fact terminal inflorescences.

Some of this development is also observed in species of Catoxys where this process is confined to the apex of the stems, whereas in species of Pseudonosma it extends to their base.

Section 5. PIPTOCLAINA (G. Don) Endl. Gen. pl. (1840) 1402; DC. Prodr. IX, 33; Ldb. Fl. Ross. III, 98; Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1893) 93; Kuzn. in Mat. Fl. Kavk. IV, 2, 85. — Gen. Piptoclaina G. Don, Syst. Gard. IV (1838) 308 et 364. — Sect. Piptoclaina Bge. in Bull. Soc. Nat. Mosc. XLII (1869) 289; Boiss. Fl. or. IV, 126. — Ovary with 3 rudimentary lobes, only one nutlet developing. Calyx shortly 5-toothed, growing over fruit and abscissing with it. Corolla lobes imbricate in bud, oblong, obtuse. Annuals. Flowers white.

22. H. supinum L. Sp. pl. (1753) 130; DC. Prodr. IX, 533; Ldb. Fl. Ross. III, 98; Boiss. Fl. or. IV, 127; Kuzn. in Mat. Fl. Kavk. IV, 2, 85; Clarke in Hook. Fl. Brit. Ind. IV, 149; Grossg., Fl. Kavk. III, 247; Popov in Tr. Bot. Sada, XLII, 217. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 93, f. 1, 1—8.

Annual plant branching from base; stems spreading, ascending, the central often erect, 5—20 cm long, spreading-branching, weak, white-gray, with appressed down and rough, longer hairs; leaves on rather long petioles, $^1/_3$ length of blade, fine haired like stems; blade ovate or oblong-oval, obtuse, 1—2 cm long, both surfaces white-gray, with dense, appressed down, cuneate or rounded-cuneate at base, nerves depressed above, slightly protruding beneath. Scorpioid cymes lateral and terminal, short, compact, single or in pairs, not overtopping upper leaves; flowers sessile; calyx canescent, 2 mm long at first, 4—5 mm in fruit, compactly enveloping fruit, its teeth small, oblong, obtuse; corolla 2—3 mm long, downy outside, the small limb with ovate, obtuse lobes; anthers linear, attached below middle of corolla tube; stigma short-conical, downy, as long as glabrous style; fruit ovoid, flat nutlet on one side, inflated on the other, glabrous, slightly tuberculate-rugose, with what appears to be a narrow, winglike rim along margin, 4—5 mm long. June—August.

Inundated and slightly solonetzic localities in the semi-desert belt. — Caucasus: E. Transc., Tal.; Centr. Asia: Kara K. (southeastern part), T. Sh. (Kara-Tau). Gen. distr.: Med., Ind.-Him., tropical Africa. Described from S. France. Type in London.

Note. As rightly claimed by Bunge in his lengthy description of the
154 fruit (l. c. 284—285), the fruit in this species is so distinctive that as proposed by Don a separate genus would be fully justified. The only obstacle would be H. malabaricum from tropical India, which is just a race of our species, normally having fruits of 4, rarely 2—3, nutlets. In H. supinum the three empty lobes of the ovary persist with their flat side adnate to the center. The style also shifts and becomes lateral.

Tribe 2. LITHOSPERMEAE DC. in Meisn. Comm. (1836—1843) 189; DC. Prodr. X (1846) 57.

Calyx mostly regular, cleft nearly to base into 5 linear or lanceolate lobes, elongating in fruit, or changing little, though its base sometimes

hardens slightly and bears tuberculate protuberances, or becomes pentagonal (Arnebia section Cornutae, Onosma subgenus Aponosma). Corolla of variable size and color, actinomorphic, brachymorphic (subtribe Trigonotideae), mesomorphic (subtribe Eulithospermeae and others) or dolychomorphic (subtribe Onosmeae, Moltkieae), usually without scales in throat, smooth or with longitudinal folds, rarely with scales (subtribe Trigonotideae, Bothriospermum, some Eulithospermeae, for example some Lithospermum). Anthers on short filaments in corolla tube or in its throat usually not exserted (Moltkia, some Onosma, Mertensia), obtuse or with acute scarious apical appendage (Onosma, some Lithospermum), base of locules acute, sometimes sagittate, attached to filament above base, sometimes nearly at base (Moltkia). Style with entire (Trigonotideae) or 2-lobed stigma or cleft into 2 short or 4 longer branches (Arnebia, Stenosolenium). Nutlets erect or curved inward, sometimes vertical, reniformly curved (Bothriospermum), sessile on flat or slightly conical (pyramidal) torus (gynobase) with nearly flat or slightly inflated basal cicatrice, without broad attachment or fleshy appendage and thickened margin, sometimes (Trigonotideae, Alkanna and Stenosolenium) nutlets attenuate to small, hollow or not solid stalk and then torus slightly pyramidal. Nutlets small, borne near apex, smooth or tuberculate, rugose, very rarely downy, always without anchorlike bristles, without broad wings, very rarely with narrow marginal wing (some Mertensia from Trigonotideae).

Subtribe 1. **EULITHOSPERMEAE** M. Pop. — Corolla usually mesomorphic, the tube more or less elongate with rotate, patelliform or campanulate limb, mostly without scales. Anthers not protruding, obtuse or with small apical appendage. Stigma often 2-parted or 2-lobed. Nutlets with broad, flat or
155 nearly flat cicatrice, borne at base of torus. Nutlets generally ovoid, usually erect, more or less acute, rarely slightly curved with apex turned more or less towards style, pericarp firm, nearly stony, smooth, appearing polished, or rugose-tuberculate.

Genus 1186. **LITHOSPERMUM** * L.
L. Sp. pl. (1753) 132.

Calyx divided nearly to base into 5 even, usually linear lobes elongating but otherwise not changing in fruit; corolla actinomorphic, 5-merous, white, yellow or violet, its tube as long as calyx (nearly brachymorphic) or longer, sometimes twice as long, usually downy outside; limb usually campanulate, rarely patelliform, neither flat, not tuberculate, with oblong or ovate, obtuse lobes, with velutinous, longitudinal scales in throat or with small, velutinous scales, rarely without folds or scales and then downy inside, usually with ring of small scales, or thickened in lower part of tube to a protective ring covering access to nectar, rarely without such a ring; anthers attached near throat or below, sometimes at base of tube on very short filaments, not

*. From the Greek lithos — stone, sperma — seed, referring to the plant's hard seeds.

exserted, usually oblong, obtuse, acute or with small mucronate appendage, glabrous; style more or less long, not exserted from throat, entire, not bifurcate; stigma entire or indistinctly 2-lobed, capitate, small. Nutlets on flat torus, triangular-rounded in profile, with inflated or flat pedestal, erect, often ovoid, sometimes smooth, lustrous, white or gray, sometimes (in the USSR only in annual fruits) rugose-tuberculate, 2—6 mm long, with short acute erect apex.

Note. A very large and heterogeneous genus of up to 100 species, and the only genus of the tribe which is nearly universally distributed (with the exception of Australia). The largest number and greatest diversity of species are found in North America, in parts of South America, the Mediterranean area and Africa. Only 7 species grow in the USSR.

An important study is H. Spengler's Der Blütenbau von Lithospermum (Österr. Bot. Zeitschr. LXVIII (1919) Nos. 5—7, pp. 109—123).

1. Perennial herbs, 40—100 cm high. Nutlets smooth, lustrous, appearing polished, not tuberculate . . . . . 2.

156 + Annual, sometimes overwintering (biennial?) plants, 5—20 cm (rarely to 30 cm) high. Nutlets tuberculate-rugose or finely verrucose-tuberculate, usually dark gray or yellowish-gray. (Section Rhytispermum (Link) DC.) . . . . . 5.

2. Corolla mesomorphic, 15—20 mm long, violet or yellow. Throat of corolla with longitudinal velutinous folds, not scales. In addition to flowering stems the rhizomes bear sterile, spreading or inclined shoots or rosettes of radical leaves. . . . . 3.

+ Corolla nearly 6—9 mm long (brachymorphic), whitish. Rhizome produces only erect, flowering stems (neither sterile shoots nor rosettes). Corolla with small velutinous scales in throat. (Section Eulithospermum DC.) . . . . . 4.

3. Corolla violet, 15 mm long. Plants with flowering and sterile stems, erect at first, later drooping or spreading. Leaves 1-nerved, lanceolate. Rhizome rather thin. (Steppe belt of European part of the USSR and light forests and shrubby formations in the Caucasus.) (Section Margarospermum Rchb.). . . . . 1. L. purpureo-coeruleum L.

+ Corolla yellow, 20 mm long. Rhizome produces flowering stems and rosettes of radical leaves. All leaves with prominent median and several pairs of looped lateral nerves. Rhizome thicker (western half of Tien Shan). (Section Pseudomacrotomia M. Pop.). . . . . 2. L. tschimganicum B. Fedtsch.

4. Corolla 8—9 mm long. Nutlets grayish white. Leaves oblong, with 2 pairs of prominent lateral nerves. More profusely pubescent, hairs on stem spreading. Root dark red, producing a dye (Far East) . . . . . 3. L. erythrorhizon Sieb. et Zucc.

+ Corolla 6—7 mm long. Nutlets white. Leaves lanceolate, with 1 pair of prominent lateral nerves. Stems and leaves with sparser, appressed hairs. Root dark brown, not yielding dye. (European part of USSR, Caucasus, Central Asia, W. Siberia). . 4. L. officinale L.

5. Corolla yellow, tube downy outside and inside, without scales or folds. Leaves linear, acute. Entire plant, especially calyx, covered

with coarse, spreading, white hairs. Scorpioid cymes compact even in fruit. Nutlets yellowish-gray, gibbous, with sharply defined lateral processes. Often overwintering and apparently biennial. (Confined to southern shore of the Crimea). . . . . 5. L. apulum (L.) Vahl.

\+ Corolla white (sometimes yellowish) or violet, glabrous inside,
157 with velutinous, longitudinal folds in throat. Anthers at lower part of tube, oblong, with small acute apical appendage. Leaves obtuse, lanceolate or oblong-linear. Hairs semi-appressed. . . . . 6.

6. Corolla violet, its tube narrow, longer than limb. Inflorescence with rufous-yellow hairs (hairy-bristly). Scorpioid cymes compact, elongating little in fruit. Sepals converging in fruit, covering nutlets, not divaricate. Nutlets finely tuberculate, not prominently plicate-tuberculate, with sharply defined lateral processes, gibbous. (Confined to southernmost parts of the USSR: E. Transcaucasia (very rare), Turkmenia, Astrakhan (introduced?)) . . . . . 6. L. tenuiflorum L. f.

\+ Corolla violet or white (slightly yellowish), limb as long as tube. Scorpioid cymes very elongate, loose with divergent calyx strongly spreading in fruit. Nutlets without distinct lateral processes, prominently tuberculate-plicate, sometimes also finely tuberculate . . . . . 7. L. arvense L.

Section 1. MARGAROSPERMUM Rchb. Fl. Germ. exc. I (1830) 337; Ldb. Fl. Ross. III, 131. — Corolla medium-sized, violet, without scales in throat but with velutinous, longitudinal folds and protective basal ring. Nutlets smooth or slightly dotted-pitted, not rugose-tuberculate. In our species the rhizome produces besides fertile stems also sterile ones which droop later or fall to the ground.

Note. Both range and characters of this section are poorly delimited. Reichenbach (l. c.) included in it only our species, which Spach (Hist. Vég. Phan. IX (1840) 31) promoted to a genus very close to Lithospermum. Grisebach separated Lithodora, the section with the subshrubby, violet-flowered Mediterranean species; De Candolle included Lithodora Griseb. in Margarospermum.

1. L. purpureo-coeruleum L. Sp. pl. (1753) 132; Ldb. Fl. Ross. III, 131; Boiss. Fl. or. IV, 218; Shmal'g., Fl. II, 238; Grossg., Fl. Kavk. III, 269. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 112 (1313); Hegi, III. Fl. V, 3, f. 3112, g — i, 3113 and 3114. — Exs.: Herb. Fl. Cauc. No. 287.

Perennial; rhizome short, becoming woody, dark, thin with few short branches, the sturdy, adventitious roots producing few stems, some flowering, others sterile, as long as fertile roots, later drooping or decumbent; rhizomes not producing rosette fertile and sterile stems 30—50 cm high, not branching, spreading-hairy, densely leafy; leaves, except the lower, broadly linear, lanceolate, with 1 prominent median nerve, without prominent lateral nerves, flat, sessile, acute, 2—4 cm long, with slightly appressed sparse hairs, dark above, paler beneath. Inflorescences at apices of stems, of short, few-flowered, loose cymes furcately arranged in groups of 2—3,

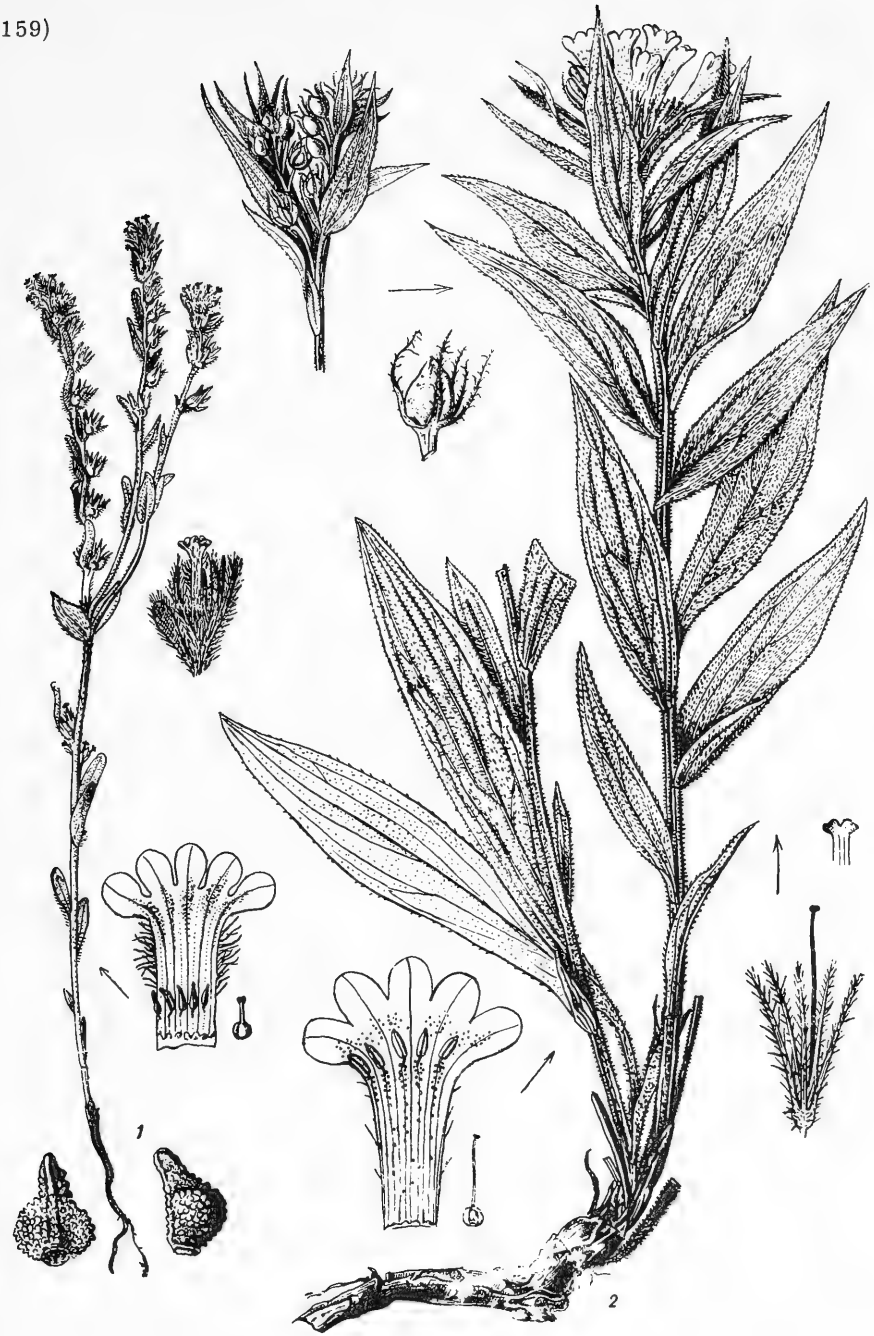

PLATE IX. 1 — Lithospermum tschimganicum B. Fedtsch., 2 — L. tenuiflorum L. f.

rarely single; bracts lanceolate, acute, longer than flowers; calyx with narrow lanceolate lobes, 10—15 mm long in fruit, covered with white, spreading, bristly hairs; corolla blue-violet, changing in hue, rather large, 15 mm long, its limb ca. 10 mm across, its tube as long as limb, downy outside (hairs also on lower part of limb); limb campanulate, its lobes ovate, obtuse, half length of limb, velutinous, the tube with longitudinal folds in throat; fruit stalks short, thickish; nutlets ca. 4—5 mm long, ovoid, obtuse, white, smooth, lustrous. April—June.

Central European species of the beech-oak complex, in light forests, shrubby formations, mountains to central belt. — European part: U. Dns., M. Dnp., V.-Don, Bes., Bl., L. Don, Crim.; Caucasus: everywhere. Gen. distr.: Iran. (N. Iran), Bal.-As. Min., Med. (S. Europe), Centr. Eur. Described from Hungary, Spain, etc. Type in London.

Note. This species, so unlike our other species, is very close to the Pyrenean L. gastoni Benth. and even closer to the Japanese L. zollingeri Sieb. et Zucc. (L. japonicum A. Gray).

Section 2. PSEUDOMACROTOMIA M. Pop. — Corolla medium-sized, yellow, without scales, with velutinous-glandular, longitudinal folds in throat, with indistinct protective ring in lower part of tube. Rhizome bearing fertile stems and sterile rosettes, no sterile shoots.

2. L. tschimganicum B. Fedtsch. in Izv. Bot. Sada, V, 1 (1906) 42; Lipskii in Tr. Bot. Sada, XXVI, 421. — Macrotomia tschimganica M. Pop. in Zakir. Burachn. Zeravsh. (1941) 24.

Perennial; rhizome and root dark, not yielding dye; 2 cm thick, rhizome multicipital bearing 1—3 fertile stems and 1 rosette; radical leaves oblong-elliptic, gradually attenuate to short petiole, with petiole 10—20 cm long, 1—2(3) cm wide, with 3—4 pairs of prominent lateral and median nerves, the former sometimes forming loop, covered with soft downy hairs, grayish-
161 green, acute; stems 20—60 cm high, densely leafy, with spreading hairs, nearly villous, with narrow, squamiform leaves beneath; other cauline leaves grayish-green, oblong-lanceolate, acute, downy-haired, with median nerve and few (2—3) pairs of prominent lateral nerves often with looplike anastomoses, sessile, 3—6(8) cm long, 1—2 (3) cm wide, turned upward. Scorpioid cymes short, compact at first, few-flowered, 1—3 arranged subcapitately at ends of stems, slightly elongating and straightening in fruit; bracts lanceolate, almost as long as flowers; pedicels very short; calyx ca. 8 mm long in flower, its lobes linear, hairy, 10—12 mm long in fruit; corolla yellow, tube almost 15 mm long, sparsely downy-hairy outside, limb small, campanulate, 7—9 mm across, the lobes oblong, obtuse, with slightly undulant margin, long longitudinal folds densely covered with short glandular hairs penetrating far into throat of corolla, else tube glabrous inside, with indistinct, glabrous basal protective ring of a row of small thickenings; anthers on very short filaments attached in throat, oblong, obtuse, ca. 2 mm long; style long, ca. 18 mm long; stigma capitate, entire; nutlets ovoid, large, 5—6 cm long, with obtuse ventral keel, dorsally rounded, slightly gibbous, smooth, lustrous, with sparse dotted pits, grayish (white- to dark-gray), acute. April—May. (Plate IX, Figure 1.)

Herbaceous slopes in semi-desert belt, usually among shrubs.— Centr. Asia: T. Sh. (Alma-Ata, Kirghiz Range, Talas Ala-Tau, Fergana Range), Pam.-Al. (Osh, Upper Zeravshan). Endemic. Described from Talas Ala-Tau (Chimgan). Type in Leningrad.

Note. A very unique species of Lithospermum; in habit, presence of radical leaves, and flowers with long, tubular corolla closer to Macrotomia (particularly M. ugamensis M. Pop.). However, the entire, not bifurcated stigma makes it a Lithospermum. It somewhat resembles the violet European species of section Margarospermum, notably the Pyrenean L. gastoni Benth. Related species may occur in NW China, e.g., Kansu. The leaves somewhat resemble those of L. erythrorhizon Sieb. et Zucc.; the flowers are quite different.

Section 3. EULITHOSPERMUM DC. Prodr. X (1846) 76.— Flowers whitish, small (to medium large); with small velutinous scales instead of longitudinal folds in throat of corolla; sterile shoots and radical rosettes of leaves absent. Apparently a chiefly North American section with smooth, lustrous nutlets.

162 3. L. **erythrorhizon** Sieb. et Zucc. in Abhandl. Akad. München, IV, 3 (1846) 149; Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 888.— Ic.: Useful, Pl. Jap. II, tab. 370; Sprengler, l.c. tab. I, fig. 11.

Perennial; root not thick, obliquely vertical, netted-fibrous, dark red, yielding dye, producing 1—3 stems; stems 50—80(100) cm high, erect, with rather profuse downy hair, usually with some erect branches only above; leaves many, oblong-lanceolate or oblong, the uppermost lanceolate, upright, flat, median and 2—4 lateral nerves prominent beneath, canescent, with rather dense downy hair; lowermost leaves squamiform. Scorpioid racemes short, terminal, in fruit erect, rather loose; bracts lanceolate, usually longer than flowers; flowers medium large, usually small, yellowish-white; calyx with white bristly hairs, its lobes linear, 4—5 mm long, as long as corolla tube, 10—15 mm long in fruit; corolla with short tube downy outside with short velutinous scales in throat; limb rather flat, 5—8 mm across; fruit stalks 3—6 mm long, slightly thickened; nutlets smooth, lustrous, brownish, 3—4 mm long, smooth, sometimes with dotted pits. June.

Dry stony slopes among shrubby thickets.— Far East: Uss., Sakh. (and the Kurile Islands). Gen. distr.: China, Japan. Described from Japan. Type in Munich.

Note. This species is close to L. officinale, with which it is often united and with which it is vicariant, although in some characters it resembles among others the North American L. latifolium Mchx. It differs from L. officinale in the red root, rough hairs of the stem, broader and more downy leaves (with the exception of the broadleaved forms of L. officinale), 2—3 pairs of protruding lateral nerves, slightly larger flowers and brownish, not purely white, nutlets. In the original description it is mistakenly reported as an annual.

4. L. **officinale** L. Sp. pl. (1753) 132; Ldb. Fl. Ross. III, 130; Grossg., Fl. Kavk. III, 269; Kryl., Fl. Zap. Sib. IX, 2279 — Ic.: Rchb. Ic. Fl.

Germ. XVIII, 1313; Hegi, III. Fl. V, 3, f. 3112, d—f, 3115 and 3116; Spengler, l. c. tab. I, f. 9a and 9b. — Exs.: Billot, Fl. Gall. et Germ. No. 1535.

Perennial; stems 50—100 cm high, with short, appressed down or nearly smooth, usually with thin, spreading branchlets above, sometimes paniculately branching; leaves dense, lanceolate, 5—10 mm wide, rarely oblong-lanceolate,
163 long-acuminate, with 1 median and 2 lateral nerves, prominent beneath, with sparse appressed hairy down, lower leaves squamiform. Flowers in short scorpioid cymes in racemes or umbels in upper branching part of stem, dense at first, in fruit strongly elongate, loose and erect; flowers white or yellowish-white, mostly small; calyx ca. 4 mm long, its lobes linear, white-bristly, elongating to 10 mm in fruit; corolla slightly protruding from calyx, its tube slightly downy outside, the limb broadly campanulate, 4—5 mm across, with oblong, obtuse lobes; scales in throat short, downy; fruit stalks thin, erect, distinct, 2—5 mm long; nutlets white, lustrous, smooth, ovoid or oblong, ca. 3 mm high. April—June.

Shrubs, bright weedy forests, sometimes in weedy habitats. — European part: nearly everywhere except for the Arctic, but further south more frequent in forest steppes and steppes than in the forest zone, Crim.; Caucasus: everywhere; Siberia: to Baikal in the east; Centr. Asia: nearly everywhere in mountainous parts and sporadic. Gen. distr.: Iran., Arm.-Kurd., Bal.-As. Min., Med., Centr. Eur., Mong. Described from Europe. Type in London.

Note. There is a form with broad leaves, with 5 prominent nerves beneath. In some respects this resembles L. erythrorhizon, near Kustanai on the Tobol River (fr. VII 1906 Fedoseev).

Section 4. RHYTISPERMUM (Link) DC. Prodr. X (1846) 73; Boiss. Fl. or. IV. 216; Kuzn. in Mat. Fl. Kavk. IV, 2 (1913) 398. — Genus Rhytispermum Link, Handbuch, I (1829) 579. — Annuals. Flowers small. Nutlets tuberculate-rugose, usually gray or yellowish-gray, often with distinctly disarticulated apex. Corolla throat with oblong, velutinous folds, scales or scales and folds lacking.

Series 1. Apula M. Pop. — Corolla yellow, its tube downy inside, without scales or folds in throat.

5. L. apulum (L.) Vahl, Symb. II (1790) 32; DC. Prodr. X, 75; Boiss. Fl. or. IV, 218; Shmal'g., Fl. II, 237. — Myosotis apula L. Sp. pl. (1753) 131. — L. strigosum M. B. Fl. taur.-cauc. III (1818) 121; DC. Prodr. X, 75. — Ic.: Fl. Graeca, tab. 158; Schlecht. Fl. Deutschl. ed. 5, XIX, tab. 1920; Spengler, l. c. tab. I, f. 3a and 3b. — Exs.: Schultz, Herb. norm. No. 1102.

Annual; stem erect, 10—30 cm high, simple, sometimes branching from base and apparently multicaulescent, like leaves with coarse spreading bristles; leaves directed upward, oblong-linear, sometimes sublinear, rather numerous, acutish or even acute, with spreading bristles; overwintering individuals (forms?) with a rosette of elongate and linear leaves

which die at flowering. Inflorescence of one or more terminal, short, dense scorpioid cyme (racemes), dense also in fruit; bracts linear or lanceolate-linear, slightly exceeding or not exceeding flowers, white-bristly; calyx to 10 mm long in fruit, with dense white bristles, its lobes linear in flower, in fruit lanceolate-linear, acute, converging, ca. 4 mm long; corolla small, 7—8 mm long, yellow, its tube thin, downy outside; lobes of limb oblong, glabrous, the limb nearly half length of tube, tube hairy inside, with a protective ring of small scales below; anthers attached inside tube, oval, acute; nutlets ca. 4—5 mm high, nearly smooth or finely tuberculate dorsally, lustrous, brownish, its sides finely tuberculate, with distinctly developed shoulders at middle, its apex laterally compressed, gibbous. April.

Stony slopes, dry pastures. — European part: Crim. (southern shore). Gen. distr.: Bal.-As. Min., Med. Described from S. Italy. Type in London.

Note. This Mediterranean species reaches in the USSR the eastern limit of its distribution. In many characters it is reminiscent of L. tenuiflorum, but its leaves are narrower, the pubescence is more spreading and white; and the leaves do not turn yellow, even in the inflorescence; unlike the group of L. arvense (Spengler, l. c. 111) the corolla is yellow, not blue, hairy inside. For some strange reason Bieberstein writes in his description of L. strigosum: "corolla minima purpurascens." According to Bentham and Hooker (l. c. 861), the less deeply cleft calyx of this species should be placed with the Canary Islands species in a special section.

Series 2. **Arvensia** M. Pop. — Corolla violet or whitish; corolla tube glabrous inside.

6. **L. tenuiflorum** L. f. Suppl. (1781) 130; DC. Prodr. X, 75; Ldb. Fl. Ross. III, 130; Boiss. Fl. or. IV, 217; Shmal'g., Fl. II, 237. — L. fulvidulum Bert. Misc. I (1842) 13. — Myosotis tenuiflora Viv. Fl. Lyb. (1824) 9. — Ic.: Jacq. lc. rar. II, tab. 313; Viv. l. c. tab. 1, f. 2. — Exs.: Fl. Palaest. exs. No. 160.

Annual; stem 5—15(20) cm high, erect, simple or branching (sometimes from base), covered with sparse, semi-appressed, antrorse hairs; lower leaves slightly spatulate, short-petioled, obtuse, the median oblong-linear, sessile, obtuse, with semi-appressed, white-bristly hairs; hairs of upper surface on small tubercles. Scorpioid racemes (cymes) terminal on stems and branches, short, dense, usually with rufous hairs, not elongate even in
165 fruit; bracts sublinear, obtuse, slightly longer than flowers, hairy-ciliate; calyx 4 mm long in flower, to 10 mm in fruit, its lobes lanceolate-linear, densely rufous-bristly-hairy, not divaricate in fruit; fruit stalks very short, thickish; corolla violet-blue, small, 5—6 mm long, the long thin tube with appressed hairs outside, $1\frac{1}{2}$ times as long as limb, limb campanulate, with rather narrow lobes, ca. 2 mm across, lobes glabrous beneath; nutlets ca. 5 mm high, generally ovoid, densely and finely tuberculate, gibbous, with strongly developed lateral shoulders at middle, their apex laterally compressed; nutlets yellowish-gray, lustrous. March—April. (Plate IX, Figure 2.)

Stony slopes in southern semi-desert. — European part: L. V. (near Astrakhan); Caucasus: E. Transc. (Boz-Dag); Centr. Asia: Mtn. Turkm., Kara K. (Krasnovodsk) — confined to the southernmost parts of Turkmenia where it reaches its northern boundary. Gen. distr.: Bal.-As. Min. (Greece, Asia Minor), Iran., Med. (Syria, Palestine), N. Afr. Described from Egypt. Type in London?

7. L. arvense L. Sp. pl. (1753) 132; Ldb. Fl. Ross. III, 129; Shmal'g., Fl. II, 237; Kuzn. in Mat. Fl. Kavk. IV, 2, 398; Kryl., Fl. Zap. Sib. IX, 2278. — L. incrassatum Guss. Ind. Sem. V (1826) 6; Prodr. Fl. Sic. I, 211; DC. Prodr. X, 74; Boiss. Fl. or. IV, 217. — L. sibthorpianum Griseb. Spic. Fl. Rumel. II (1844) 86; Grossg., Fl. Kavk. III, 269. — L. calycinum Wettst. in Denkschrift. Akad. Wien, L (1885) 30, non Moris, 1834. — L. czernjaevii Klok. et Shost. in Izv. Kiev. bot. sada, XIV (1932) 3, nomen; Trudy N.-d. inst. bot. I (1936) 75. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 113, f. V, 14—19; Hegi, III. Fl. V, 3, f. 3112; Spengler, l. c. tab. I, f. 1a and 1b. — Exs.: GRF, No. 1174.

Annual; stem usually single, simple or slightly branching above, robust, appressed-hairy above, (5)10—20(40) cm high, sometimes (in race L. sibthorpianum) with ascending branches from base; leaves grayish, oblong-linear, small, rarely short-oblong, conversely linear-oblong, lower leaves more or less tapering towards base, spatulate, usually obtuse, the median and upper leaves sessile, acutish, all leaves flat or with slightly rolled margins, more densely appressed (semi-appressed) hairy-bristly above, the hairs on tubercles, less hairy and without tubercles beneath; radical rosette sometimes present (specimens collected in late fall); spring plants without rosette; leaves 1—3(4) cm long, 4—8(10) mm wide. Scorpioid cymes few, terminating stems and branches, on simple stems, usually paired and forked, at apex of stem, few-flowered, sparse even in flower, rarely dense (in race L. czernjaevii), much elongating with strongly spreading calyx
166 in fruit; pedicels very short; bracts usually lanceolate or oblong-linear, slightly longer than flowers; calyx small at first, 3—5 mm long, with sub-linear, white-hairy lobes, in fruit markedly accrescent, with elongate, lanceolate-linear, divaricate lobes not covering fruit; corolla white, straw-colored or blue-violet (race L. incrassatum Guss. and var. coerulescens DC.), sometimes (var. bicolor Bert.) with white limb and violet tube, small, 4—6 mm long, hairy-downy outside, the tube slightly longer than calyx and as long as campanulate limb, lobes of limb oblong, obtuse, usually not more than half length of limb; anthers attached below middle of tube, oblong, with apical mucro; fruit stalks short or very short, not markedly or markedly obconically thickened (in race L. incrassatum Guss.); nutlets gray, slightly shiny or dull, 2—4 mm high, ovoid, finely verrucose, heavily tuberculate-plicate, with or without faintly developed lateral protuberances, slightly gibbous, suberect; cicatrice slightly inflated, rounded. April—June.

Stony slopes, pastures, waste lands, sands, steppes, rarely in forest zone, oases, mountain slopes. — Except for the Arctic rather widespread in the USSR, in the European part to 60° N., in Siberia to 57—58° N., in the Baikal area rare in the east; absent in the Kuriles and Sakhalin. Gen. distr.: Centr. Eur., Med., Bal.-As. Min., Iran., Jap.-Ch., Ind.-Him. Described from Europe. Type in London.

Note. Many small races related to this species have been described. In addition to those in the synonymy there are also some further W. European races. The type L. arvense has white corollas and rather slightly thickened fruit stalks. Var. coerulescens DC. (var. coeruleum Griseb.) and L. incrassatum Guss. often occur in the south, notably in Central Asia and the Caucasus; I see no way of separating them as a distinct species. Some authors regard L. incrassatum Guss. as a teratological form, with the ovary buried in the thickened pedicel; though this is more or less regular in the Sicilian plant, it is not so in the plant of the same name which Boissier and others list for the eastern flora, which is not monstrous — it is a form with conically thickened pedicels which is distributed over the subtropical zone, together with the blue-flowered race with slightly thickened fruit stalks (var. coerulescens DC.). In the white-flowered steppe race (of the type L. arvense) there also occur forms with conically thickened fruit stalks (L. gasparrini Heldr.). In the Caucasus there are frequent forms with numerous, ascending stems, often with narrower corollas (Grossgeim's L. sibthorpianum
167 Griseb., which Grisebach in his description relates to specimens from the Caucasus and Georgia). A similar form bearing white flowers (as in all L. arvense) occurs on the southern shore of the Crimea, near Sevastopol. L. sibthorpianum, described from Greece, and seems to be a race of maritime sands and cliffs; the Crimean specimens appears to resemble it most closely, but I share Boissier's doubt (l. c.) concerning the possibility of separating this race into a distinct species. Kuznetsov (in herbarium; the pertinent lists were not printed) distinguished the following varieties of L. arvense: var. procumbens Kusn. (f. coeruleiflora Kusn. and f. albiflora Kusn.) — apparently identical with Grossgeim's L. sibthorpianum — var. laevicarpum Kusn. and var. leucocarpum Kusn. Another poorly differentiated form is L. czernjaevii Klok. et Shost., an overwintering or biennial form growing in sands from the Dnieper to the Lower Volga and possibly further east, which Klokov believes to be the wild ancestor of the weed L. arvense (s. s.). This has a rosette of radical leaves, usually 2—10 stems, leaves larger and wider than usual in L. arvense, 2—5 cm long, 5—10 mm wide, often with crisped-hairy margin, scorpioid cymes denser, subcapitate in flower, with larger glandular-downy bracts, corolla whitish, slightly larger than in L. arvense.

Genus 1187. **MACROTOMIA*** DC.

DC. in Meisn. Comm. (1836—1843) 90 et in Prodr. X (1846) 26, em. Boiss. Fl. or. IV, 211.— Munbya Boiss. Diagn. I, 11 (1849) 114.— Aipyanthus Stev. in Bull. Nat. Mosc. XXIV (1851) 600 et Johnst. in Contrib. Gray Herb. LXXIII (1924) 47.— Leptanthe Klotzsch in Bot. Ergebn. Waldemar Reise (1862) 95, tab. 63.

Calyx parted nearly to base into 5 equal usually linear or linear-lanceolate lobes, more or less elongating in fruit, especially in section Leptanthe. Corolla regular or nearly so, with long tube, downy outside, with campanulate or nearly rotate (section Aipyanthus) limb, medium-sized

* From the Greek macros — large, long, and tome — slice, cut, probably referring to the deeply cleft calyx.

(10—20 mm long), red-violet, or yellow, large (20—35 mm long) (section Aipyanthus). Throat of corolla without scales or folds, sometimes with traces of velutinous hairs. Anthers oblong-linear, 2—4 mm long, obtuse, subsessile, attached at middle or upper part of corolla tube or in throat (but then slightly protruding), filament very short, nearly median, all 5 anthers on same level or 2 below and 3 above (M. echioides (L.) Stev.). Flowers in all species apparently dimorphic-heterostylous. Style entire
168 or hardly dissected; stigmas 2, globular or 1 and deeply 2-lobed, the lobes globular. Corolla with protective ring of scales or thickenings. Nutlets large, 4—7 mm long, ovoid, erect, plicate-tuberculate or longitudinally pectinates dorsally, gray or brown. Perennial, low herbs of the alpine belt with thick, dark red root, multicipital, producing rosettes of leaves and flowering stems. Inflorescence compressed, cylindrical or globose. — Caucasus and Central Asia.

1. Corolla wine-red, turning blue; limb small-campanulate. Inflorescences small. Nutlets with 3 longitudinal, tuberculate, low dorsal ridges. Root markedly reddening. Mountains of Central Asia (Section Munbya (Boiss.) M. Pop.). . . . . 2.
+ Corolla yellow, with long thin tube and broad, flat limb 10—20 mm across. Inflorescences larger. Root producing larger or smaller amounts of dye. Mountains of the Caucasus. (Section Aepyanthus (Stev.) M. Pop.) . . . . . 3.
2. Leaves lanceolate or linear, very short-acuminate, strongly bristly, with protruding median nerve. Stems spreading-bristly. Anthers 2.5 mm long. Nutlets ca. 4 mm high. Tien Shan, Pamir area . . . . . 1. M. euchroma (Royle) Pauls.
+ Leaves oblong or ovate, acute, faintly bristly with 3 protruding nerves. Anthers 3—4 mm long. Nutlets 5—7 mm high. Talas Ala-Tau . . . . . 2. M. ugamensis M. Pop.
3. Plants gray-, nearly white-tomentose. Leaves lanceolate to linear, radical leaves long-acuminate, with 3 protruding nerves. Corolla tube very long, to 30 mm; limb orange or yellow, to 20—25 mm across, anthers in one ring. Root yielding abundant dye. (Confined to former Kars region and in Asia Minor) . . . . . 3. M. densiflora (Ldb.) Macbride.
+ Plants greenish with rather soft sparse bristles. Leaves lanceolate-oblong to oblong, green, short-acuminate, with 1 median nerve. Corolla tube 15—18 mm long, the limb yellow, with violet spots later disappearing. Anthers 2 below, 3 above middle of tube in throat. Root almost without dye, brown. (Caucasus) . . . . . 4. M. echioides (L.) Boiss.

Section 1. MUNBYA (Boiss.) M. Pop. — Genus Munbya Boiss. I. Cyananthae Boiss. l. c. (1849) 115. — Calyx lobes shorter than corolla in flower. Inflorescences small, capitate. Corolla wine-red, ca. 15 mm
169 long, resembling corolla of preceding section. Nutlets tuberculate, with 3 dorsal ridges almost without shoulders. Although Boissier also referred to Munbya the yellow-flowered species (our section Aepyanthus), he placed first the violet species of Munbya — Himalayan section.

1. M. euchroma (Royle) Pauls. in Bot. Tidskrift, XXVII (1906) 216; Lipsk. in Tr. Bot. Sada, XXVI, 305—310. — M. perennis (Schrenk) Boiss. Fl. or. IV (1879) 212, in nota; Clarke in Hook. Fl. Brit. Ind. IV, 177. — M. cyanochroa Boiss. Fl. or. IV (1879) 212. M. endochroma Hook. et Thoms. ex Henders. and Hume, Jarkand (1873) 328, nom.; Boiss. l. c., 212, in nota. — Lithospermum euchromon Royle, Ill. Bot. Himal. (1839) 305. — Stenosolenium perenne Schrenk, Enum. pl. nov. I (1841) 34. — Munbya cyanochroa Boiss. et M. perennis Boiss. Diagn. I, 11 (1849) 115. — Arnebia perennis DC. Prodr. X (1846) 95; Ldb. Fl. Ross. III, 139. — A. tingens DC. l. c. 96. — A. euchroma Johnst. in Contrib. Gray Herb. LXXIII (1924) 49. — Macrotomia onosmoides Rgl. et Smirn. in Tr. Bot. Sada, V, (1877) 624. — Ic.: Paulsen, Stud. Veg. Pamir. (1928) 58; M. Popov, quoting Baranov in Izv. Turk. otd. Russk. Geogr. obshch. XVII, tab. III, f. 8—15.

Perennial; low, slightly (sometimes strongly) tufted herb, with habit resembling perennial Onosma; root 2 cm thick, dark red; radical leaves numerous, lanceolate or lanceolate-linear to linear, 10—15 cm long, 5—10 mm wide, acutish, erect, with distinct median nerve, bristly especially along margin, gradually tapering to broad petiole; stems few, 10—30 cm high, erect, spreading-bristly; cauline leaves rather numerous (about 10), lanceolate-linear or lanceolate or linear, sessile, 2—5 cm long, less than 10 mm wide (3—7 mm), with 1 nerve, bristly. Inflorescences of 1—3 short scorpioid cymes, sessile at apex of non-branching stems, small, capitate, nearly not elongating even in fruit; bracts few, linear-lanceolate, not exceeding flower; calyx in flower slightly shorter than corolla, ca. 12 mm long, the bristly linear acute lobes 20—25(30) mm long flower; corolla wine-red, the narrow tube ca. 12—15 mm long limb campanulate, nearly half length of tube, 8 mm across; flowers dimorphic: anthers sometimes near middle of corolla tube, style exserted, stigma distinctly 2-parted, in other individuals anthers in the throat, stigma of short style obscurely 2-lobed; lobes of limb ovate-oblong, obtuse, half length of limb; anthers 2.5 mm long; nutlets 4 mm long, ovoid, erect, brown, with median and 2 lateral, longitudinal dorsal ridges, sharply keeled ventrally,
170 finely tuberculate all over, apex short, compressed laterally. June—July.

Stony slopes, rarely among rocks in alpine belt. — Centr. Asia: T. Sh., Pam. — Al. Gen. distr.: Iran. (S. Iran and Afghanistan), Him., W. Tib. Described from W. Himalayas. Type in London, cotype (?) in Leningrad.

2. M. ugamensis M. Pop. in Izv. Turk. otd. Russk. Geogr. obshch. XVII (1925) 26. — Ic.: ibid., Table III, Figures 1—7.

Perennial; root 2 cm thick, vertical, yielding dye; radical leaves few, rather short, ca. 10 cm long, lanceolate or oblong-lanceolate, acute, with 3 sharply protruding nerves, much less bristly than in preceding species; stems 20—40 cm high, few, thin, velutinous and slightly glandular-downy, not bristly, simple, erect, sometimes flexuose; cauline leaves to 15, oblong or ovate, sessile or semi-amplexicaul, with 3 protruding nerves, bristly-ciliate along margin, with short appressed bristles on tubercles above, downy-hairy beneath, in general pubescence sparse, slightly glandular. Inflorescences terminal, small, capitate; bracts lanceolate, few, slightly exceeding or not exceeding flowers, with long-bristly margin; calyx in flower nearly half length of corolla tube, with bristly, lanceolate-linear lobes, elongating

in fruit to 20 mm; corolla blue-red, glandular-downy outside, 13—15(20) mm long, the narrow tube broadening below throat exserted from calyx, the limb small, ca. 7—8 mm across with short, ovate, obtuse lobes, slightly velutinous towards throat; style 2-parted; anthers in throat, ca. 3—4 mm long, oblong, lower ends of cells free, mucronate; stigma 2-lobed or stigmas 2, globose (but flowers sometimes dimorphic, as in preceding species); nutlets with 3—5 low dorsal ridges, ventrally keeled, entire surface alveolate-tuberculate, brown-gray, broadly ovoid, without lateral appendages, ca. 5—7 cm [?] high. June—July.

Stony slopes and rocks in alpine belt. — Centr. Asia: T. Sh. (only in Talas Ala-Tau). Endemic. Described from Ugam River (Tashkent Ala-Tau, i.e., northwestern part of Talas Ala-Tau). Type in Tashkent.

Note. This species is close to M. euchroma, but differs in its broad, short, 3-nerved, acute leaves and less bristly, slightly glandular pubescence. Also it shows an affinity with Lithospermum tschimganicum B. Fedtsch., though much less than with M. euchroma.

171 Section 2. AEPYANTHUS (Stev.) M. Pop. — genus Aipyanthus Stev. l. c. — Munbya II. Chrysanthae Boiss. Diagn. I, 11 (1849) 116. — Inflorescences more nearly capitate; corolla yellow, very large, tube to 30 mm long, 2—3 times as long as calyx, limb broad, flat (patelliform).

Note. My interpretation of Aepyanthus is broader than Steven's, who included in his genus only M. echioides, not M. densiflora.

3. **M. densiflora** (Ldb.) Macbride in Contrib. Gray Herb. n. s. XLVIII (1916) 56. — M. cephalotes Boiss. Fl. or. IV (1879) 212. — Munbya cephalotes Boiss. Diagn. I, 11 (1849) 116. — Munbya conglobata Boiss. Diagn. I, 11 (1849) 116. — Arnebia cephalotes DC. Prodr. X (1846) 96. — A. densiflora Ldb. Fl. Ross. III (1849) 140. — Lithospermum densiflorum Ldb. ex Nordm. in Bull. Acad. Sc. Pétersb. II (1837) 312.

Perennial; root 2 cm thick (sometimes more), dark red, yielding dye, multicipital, with fascicles of thick radical leaves tomentose like the flower-bearing stems; entire plant appressed-gray-, nearly white-tomentose, not bristly; stems 20—30(40) cm high robust, thick, faceted-sulcate, simple, branching above subcorymbiformly into many scorpioid cymes; radical leaves lanceolate-linear, gradually acuminate, with 3 prominent nerves, 5—15 cm long, to 1 cm wide, gradually tapering towards base; cauline leaves upright, many, overlapping, lanceolate, sessile, long-acuminate. Inflorescences 5—10 cm across, of a few (many) scorpioid cymes slightly straightening and elongating in fruit turning inflorescence corymbiform; bracts indistinct, lanceolate, not exceeding flowers; calyx large, 15 mm long, to 30 mm in fruit, the linear, erect, acute lobes with ciliate bristly margin; corolla tube ca. 30 mm long, thin, downy outside, the limb orange (yellow), to 25 mm across, nearly flat, its lobes semi-rounded, short, slightly velutinous at base; anthers in throat, oblong, 3—5 mm long; style less than half length of tube; stigma indistinctly 2-lobed, with globular lobes; nutlets 4 mm high, globose-ovoid, finely tuberculate, dorsally apparently without longitudinal crests, with large tubercles at base, ventrally keeled. June—August.

Stony slopes and rocks in alpine belt. — Caucasus: W. Transc. Flerov's report for Maikop is probably wrong. Gen. distr.: Bal.-As. Min. (Greece, Asia Minor). Described from Asia Minor (near Trebizond). Type in Leningrad.

172 4. M. echioides (L.) Boiss. Fl. or. IV (1879) 211; Grossg., Fl. Kavk. III, 270. — Lycopsis echioides L. Sp. pl. ed. II (1762) 199; Lehm. Pl. Asperif. II, 270. — Anchusa echioides M. B. Fl. taur.-cauc. I (1808) 123. — Arnebia echioides DC. Prodr. X (1846) 96; Ldb. Fl. Ross. III, 140. — Aipyanthus echioides Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 599. — Munbya echioides Boiss. Diagn. I, 11 (1849) 116. — Lithospermum setosum Fisch. et Mey. Ind. Sem. Petrop. I (1835) 3. — L. tournefortii Johnst. in Journ. Arn. Arb. XXXIII, 4 (1952) 336— Arn. longiflora C. Koch in Linnaea, XXIII (1849) 640. — Ic.: Bot. Mag. tab. 4409; Gartenfl. XXV, tab. 877; Gürke in Pflanzenf. IV, 3, 125, f. 50, A—B.

Perennial; root dark brown, almost without dye; thinner than in the preceding, bi-tricipital, its crown with black-brown glabrous scales; plant covered with rather soft and weak hairs appearing greenish, not bristly (in spite of the name); stems usually 1—3, 20—40 cm high, erect, simple, with capitate, not very large apical inflorescence of 1—3 scorpioid cymes which straighten and elongate rather markedly in fruit, covered with rather sparse, spreading, short, bristly hairs, sometimes glabrous in lower part; radical leaves elliptic-lanceolate or oblong-lanceolate or oblong, rather delicate, green, 5—10 cm long, to 15—20 cm at flowering, 1—3(5) cm wide in fruit, rather short-acuminate, gradually tapering to broad petiole, with sparse slightly spreading bristles nearly without tubercles, with prominent median nerve and ciliate margin; cauline leaves few, lanceolate, sessile, acutish, 3—5 cm long, 0.5—15 mm wide. Inflorescence 4—5 cm across; bracts lanceolate, broadened below, not exceeding flower, rather soft with sparse short bristles; calyx 10—14 mm long in flower, its lobes linear, obtuse, rather soft hairy-ciliate, slightly elongating in fruit to 15—18 mm; corolla large, yellow, its tube narrow, about $1\frac{1}{2}$ times length of calyx, 15—17 mm long, sparsely downy outside, smooth in throat, the limb patelliform, broad, 10—15(17) mm across, with short, broad, semi-rounded lobes, with violet spots which disappear; anthers 3 in throat, 2 below, sometimes all in throat; stigma 2-lobed; nutlets 4 mm high, broadly (nearly globularly) ovoid, brown, slightly shiny, without distinct dorsal ridges, with sharp, longitudinal ventral keel, rather finely tuberculate-pitted, without lateral appendages, the rather short apex laterally compressed. April—June.

Stony and herbaceous slopes in alpine area. — Caucasus: everywhere,
173 very frequent on Main Range, rare in Lesser Caucasus. Gen. distr.: Iran. (N. Iran), Arm.-Kurd., Bal.-As. Min. (Asia Minor). Described from Armenia. Type in Paris.

Genus 1188. **ARNEBIA*** Forsk.

Forsk. Fl. Aeg. Arab. (1775) 62—63 em. DC. Prodr. X (1846) 94—95 (§ 1 Species annuae).

* Arabic name of the plant.

Calyx subsessile, readily abscissing in fruit, divided nearly to base into linear lobes, more or less markedly elongating in fruit, its base as in Macrotomia or Lithospermum unchanged in fruit or (in some annual species) accrescent and embracing the nutlet and then hardening, tuberculate, sometimes (A. cornuta — A. decumbens) also producing short angular appendages, becoming pentahedral; corolla violet, pink or yellow, in the latter case often with violet spots on lobes of limb, the tube narrow, exceeding calyx, downy outside, with small or rather large patelliform limb, and ovate or rounded, obtuse lobes, sometimes dentate or even almost short-fimbriate; scales and folds lacking in throat, sometimes velutinous stripes as rudimentary small folds at base of tube with a squamiform, hairy ring ("nectary"), protecting the nectar, ring rarely absent (Toxostigma); filaments short, attached in throat or at middle of tube, often all on one level, sometimes spirally removed, 2 below and 3 above, near throat. Flowers usually dimorphous-heterostylous, or anthers in throat, and short style hidden in tube, or anthers at middle of tube and then style long, exserted; style dissected into 2 branches, very short or long and then dissected with either 2, rarely 4 stigmas, capitate, or stigmas flat, spatulate (Toxostigma); nectary at base of ovary. Nutlets erect, oblong or ovoid, small, 2 mm high, tuberculate, with acute, erect apex, rarely smooth.

Note. The relationship between Arnebia and Macrotomia is very ambiguous. De Candolle included Macrotomia in Echieae and Arnebia in Lithospermeae. Boissier (1879) appeared to have grasped their limits by including in Arnebia only the annual, yellow-flowered, desert species agreeing with the type of Arnebia. Later he included as species anomala A. obovata Bge., with violet flowers and perennial stem. Maksimovich
174 (1881) described the perennial, blue-flowered A. fimbriata Maxim. from Mongolia; Richard (1854) described as Toxostigma A. lutea (A. Rich.) Armori from Abyssinia and A. purpurascens (A. Rich.) Baker, both perennials. Considering these species as well as A. szechenyi, a perennial described from Kansu, we are extending the limits of Arnebia in comparison with Boissier, Bentham and Gürke; even so it is very closely related to Macrotomia, the only character distinguishing them being squamiform ring at the base of the corolla often erroneously called nectary which prevents access to the nectar in Arnebia and is lacking in Macrotomia.

1. Perennials or biennials. Calyx without protuberances or tubercles, not hardening at base in fruit . . . . . 2.
\+ Annuals. Calyx hardening at base in fruit, angular, with papilliform tubercles . . . . . 5.
2. Corolla blue; styles nearly entire; corolla limb well developed. Leaves obovate or spatulate-oblong or lanceolate. (W. Tien Shan to Upper Zeravshan) . . . . . 1. A. obovata Bge.
\+ Corolla yellow, with developed limb. Leaves lanceolate to linear. . . . 3.
3. Perennials, nearly cespitose . . . . . 4.
\+ Biennials or annuals. Limb with violet spots . . . . . 2. A. guttata Bge.
4. Plant less canescent, limb without violet spots (rolling plains in Tien Shan and Pamir) . . . . . 3. A. tibetana Kurz.

+ Limb with violet spots. Gray plant (Pamir) . . . . . 4. A. thomsonii C. B. Clarke.

5. Corolla with well developed limb, with violet spots . . . . . 6.

+ Corolla nearly without limb, tuberculate. Calyx in fruit 5-angled at base or cylindrical, hardening with white papillae. (In deserts) . . . . 9.

6. Large, greenish annuals to 40 cm high. Corolla limb 18—20 mm across. (Tadzhikistan, mountains) . . . . . 7.

+ Canescent, more densely pubescent plant; corolla limb 8—15 mm across (foothills throughout Central Asia and deserts) . . . . . 8.

7. Some corolla lobes larger, yellow, others small, violet (S. Tadzhikistan) . . . . . 5. A. coerulea Schipcz.

+ All lobes yellow, with large violet spots . . . . . 6. A. baldshuanica (Lipsky) Schischk.

8. Corolla limb 10—15 mm across. Hairs dense, bristly, canescent. (Foothills of Tien Shan and the Pamir area) . . . . . 7. A. grandiflora (Trautv.) M. Pop.

175 + Limb 8—10 mm across, less flat (foothills of Kopet Dagh and Kara Kum) . . . . . 8. A. transcaspica M. Pop.

9. Calyx in fruit pentagonal at base, hardening . . . . . 9. A. decumbens (Vent.) Coss. et Kral.

+ Calyx in fruit with rounded-ovate base bearing white papilliform tubercles, teeth broader and longer in fruit . . . . 10. A. linearifolia DC.

Section 1. CYANANTHAE M. Pop. — Perennials. Calyx with few elongated lobes, its base not hardening. Corolla often violet-blue or pink, rarely yellow-white through loss of anthocyanin but then not yellow, yellowish, without violet spots, with thick basal protective ring of hairy scales; style entire or hardly split, stigmas 2, globose-capitate. — Mongolia, southeastern Central Asia. — In addition to these species there are A. fimbriata Maxim. (Mongolia) and A. szechenyii Kanitz from Kansu, the latter with whitish corolla.

1. A. obovata Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1851) 407; Boiss. Fl. or. IV, 215; Rgl. Descrip. pl. Fedtsch. 57; Lipskii in Tr. Bot. Sada, XXVI, 526—529. — A. sewerzowi Rgl. l. c. (1882) 58. — A. olgae Rgl. l. c. (1882) 58; Lipskii, op. cit. 529—530. — Lithospermum sewerzowii (Rgl.) Johnst. in Journ. Arn. Arb. XXXIII, 4(1952) 329.

Perennial, sometimes biennial; root dark, woody, of differing thickness, sometimes thin, the biennials, more often in the biennials than in the perennials, 2 cm thick and then multicipital, and plant divaricately multicaulescent, entire plant canescent, hairy; stems 10—20(30) cm high, canescent, with coarse, short, semi-spreading hairs, sometimes associated with long-bristly, divaricate (nearly furcate), flexuose (not erect, virgate), thickish branches; leaves thickish, 1—3(5) cm long, rarely longer, spatulate-oblong, rarely obovate, obtuse, tapering at base, with 1 nerve, canescent, with short appressed bristles on large tubercles and coarse hairs between them. Scorpioid cymes numerous, at tips of branches, strongly curved and capitate at onset of flowering, later straightening, slightly attenuate, loose in fruit; bracts

linear or lanceolate, shorter than flowers; calyx in flower ca. 7 mm long, with linear, rather coarsely white-bristly, obtuse lobes, little elongating in fruit; corolla pink-blue (pale violet), densely downy-hairy outside, with thin, long (15 mm) tube, twice as long as calyx, with small patelliform limb (ca.
176 8 mm across), its lobes ovate, obtuse, slightly velutinous at base of throat; flowers dimorphic-heterostylous: in individuals with short style, stamens on distinct filaments attached in throat and anthers entirely or nearly entirely exserted from throat, in other individuals stamens at middle of corolla and stigma protruding from throat by almost 2—3 mm; anthers oblong-linear, ca. 2 mm long, yellow, obtuse at both ends; style short-truncate, with 2 globose stigmas in long-styled flowers, entire 2-lobed stigma in short-styled flowers. Nutlets 3 mm long, gray, narrow, erect, oblong, with distinct lateral appendages and long, erect, laterally compressed, acute apex, dorsally without lateral combs, ventrally indistinctly keeled, finely verrucose-tuberculate. April—June.

Middle and lower mountain belt, gypsiferous, usually variegated rocks, semi-deserts and semi-steppes. — Centr. Asia: Pam.-Al. (upper course of Zeravshan River, foothills of Turkestan and Alai Ranges). Syr D. Endemic. Described from the Fon, tributary of the Zeravshan River (Leman, 1841). Type in Leningrad and Paris.

Section 2. GUTTATAE M. Pop. — Perennial, biennial and annual herbs. Calyx not hardening at base in fruit, its lobes usually linear, slightly elongating. Corolla violet, yellow, with 5 violet spots between lobes, rarely without; limb lobes semi-rounded, obtuse; style shortly 2-parted, stigmas capitate. Nutlets finely tuberculate. — Afghanistan and NW India to Central Mongolia. — Besides the following species A. griffithii Boiss. (annual).

2. **A. guttata** Bge. Ind. Sem. Hort. Dorp. (1840) 7; Ldb. Fl. Ross. III, 139; Kryl., Fl. Zap. Sib. IX, 2282. — Lithospermum guttatum (Bge.) Johnst. in Journ. Arn. Arb. XXXIII, 4 (1952) 330.

Perennial, biennial; root of different thickness, sometimes thin in biennial or annual plants, sometimes 2—3 cm across, perennial and then multicipital, dark red, yielding dye; stem 10—20 cm high, rarely single, often few, slightly branching or with long spreading bristles from base; leaves lanceolate-spatulate or broadly linear, rarely lanceolate, spreading, usually obtuse, rarely acute, green or gray, with spreading bristles, 1-nerved, lower leaves to 5 cm long, the median and upper 2—3 cm long, 0.3—0.7 cm wide, few; bristles on large tubercles, especially on upper surface of leaves, small bristles also present, and then many leaves gray. Scorpioid cymes few or many, at tips of branches, dense at first, straightening and slightly elongating in fruit, but calyces contiguous, secund; bracts lanceolate-linear, short, not longer than
177 flowers; calyx 5—7 mm long in flower, its lobes linear with white long bristles, not exceeding 10 mm in fruit; corolla yellow, the tube narrow, sparsely downy, ca. 15 mm long, the limb 8—10 mm across, flat, with 5 small, dark violet spots, the lobes short, ovate, obtuse; flowers dimorphic-heterostylous; anthers ca. 1.5 mm long; style very shortly split; stigmas capitate; nutlets gray, 2.5 mm long, ovoid, finely verrucose-tuberculate appendages faintly developed, apex short acute. April—June.

Stony slopes in semi-desert belt. — West Siberia: Alt.; Centr. Asia: Dzu.-Tarb., T. Sh. (E.). Gen. distr.: Mong., Dzu.-Kash. Described from E. Altai (Bunge, 1839). Type in Leningrad.

3. **A. tibetana** Kurz in Journ. As. Soc. Beng. XLIII (1874) 189; C. B. Clarke in Hook. Fl. Brit. Ind. IV, 176.

Perennial; root dark violet, 2 cm thick, multicipitate, yielding dye; stems few, angled, 10—20 mm high, few-branched, terminated by corymbiform inflorescence of several scorpioid cymes, spreading-canescent and short-bristly-hairy; roots bear rosettes alongside flowering stems; leaves elongate-lanceolate, flat, gray-red, with rather thick coarse hairs; radical leaves to 10 cm long, 1 cm wide, obtuse, tapering towards base, cauline leaves shorter, 3—5(6) cm long, acute, rarely leaves narrow, linear, acute, 4—6 mm wide, with rather long bristles on large tubercles, interspersed with many small ones. Scorpioid cymes short, dense, straightening but remaining dense in fruit; bracts indistinct, short, lanceolate-linear and linear; calyx ca. 8 mm long, becoming to 15 mm long, its lobes gray, narrowly linear, long-haired; corolla yellow, its tube thin, to 20 mm long, twice as long as calyx, the limb ca. 10 mm across, with ovate, rounded-obtuse lobes, without spots between them; nutlets light gray, 2—3 mm long, finely verrucose-tuberculate, with erect acute apex, nearly without appendages. June—July.

Stony habitats in alpine belt. — Centr. Asia: T. Sh. (C.), Pam.-Al. (Pamir). Gen. distr.: Tib., Him. Described from Tibet (locality unknown). Type in Calcutta?

4. **A. thomsonii** C. B. Clarke in Hook. Fl. Brit. Ind. IV (1895) 176.

Perennial; very similar to the preceding but grayer, hairy-bristly; leaves broader, narrower, linear, often acute. Scorpioid cymes crowded, capitate,
178 straightening; corolla smaller, the tube 10—12 mm long, limb 5—7 mm across, with violet spots. July—August.

Stony slopes of Pamir. — Centr. Asia: Pam.-Al. (Pamir). Gen. distr.: Him., Tib. Described from Lekh. Type in London.

Section 3. **CORNUTAE** M. Pop. in Addenda XVIII, 704. — Annuals. Corolla yellow or violet, the tube long, the limb sometimes reduced, usually with violet spots; base of calyx hardening in fruit, its protuberances sometimes seen as angles (and then pentahedral) or with white papilliform tubercles, usually strongly bristly at base; style 4-parted with capitate stigmas.

Series 1. **Eu-cornutae M. Pop.** — Calyx pentahedral at base in fruit, with 5 triangular protuberances. Stems usually erect, 5—30 cm high, rarely spreading, with long spreading bristles. Leaves lanceolate, bristly, acute. Scorpioid cymes in fruit erect, loose. Calyx in fruit with hardening, pentahedral base clasping fruit, its 5 angular, vertical teeth opposite linear sepals. Corolla yellow, with long tube, the limb variously developed, the type (desert) small or more or less broad, with violet spots. Style 4-parted. Nutlets 2—3 mm high, finely tuberculate, gray.

5. **A. coerulea** Schipcz. in Bot. mat. Gerb. Gl. Bot. Sada, II (1921) 97.

Annual stem erect, 15—30 cm high, simple or slightly branching, with long spreading coarse bristles; lower leaves lanceolate, ca. 10 cm long, to 1 cm wide, slightly tapering towards base, acute, the upper lanceolate-linear, all leaves with sparse spreading bristles, greenish, short-acuminate. Scorpioid cymes few, at apices of branches, crowded at first, later elongating; bracts lanceolate-linear, 2—3 times as long as calyx, bristly; calyx 5-parted, with linear, white haired bristly lobes, ca. 8 mm long in flower; corolla large, its tube very long, to 23 mm, downy outside, narrow, slightly broadening above, 3—4 times as long as calyx, half violet, half yellow or entirely violet; limb large, to 18 mm across, slightly zygomorphic, the lower of the 5 broad, ovate lobes shorter, entirely violet, the upper longer, yellow (not blue), downy outside. Flowers dimorphic-heterostylous; anthers 2 mm long, filaments 0.5—1 mm long; style shortly 4-parted; stigmas capitate; fertile calyces and nutlets unknown. March—May.

179 Mountain slopes of semi-steppe belt. — Centr. Asia: Pam.-Al. (only lower Vakhsh and Pyandzh: Kurgan-Tyube, Sarai, Muminabad — A. Regel', 1884). Endemic. Described from the localities mentioned. Type in Leningrad.

Note. Although fertile calyces are unknown, they are certainly pentahedral in fruit with 5 protruding angles. The species is ill-named (coerulea), as the corolla is yellow though the violet spots are very large nearly covering the entire lobes. The tube of the corolla has a violet hue. This is the largest and most large-flowered group, linked by transitions with the following two large-flowered foothill races.

6. **A. baldshuanica** (Lipsky) Schischk. in herb. et ex Nevski in Acta Inst. bot. Acad. Sc. URSS, fasc. IV (1937) 317, p. p. — A. orientalis var. baldshuanica Lipsky in Tr. Bot. Sada, XXVI (1910) 524.

Annual; large, robust, to 40 cm high, green broadleaved plant with flowers as large as in preceding species, limb to 20 mm across, tube to 25 mm but corolla entirely yellow and its spots, although 3—4 mm across, not covering lobes; leaves greener, more acute. Racemes very long in fruit (10—20 cm), base of calyx not bristly or slightly so. April—May.

Semi-steppe belt, 1,500—2,000 m. — Centr. Asia: Pam.-Al. (only in the southern part of Tadzhikistan, at the foot of Gissar Range, not found west of Surkhan, in the southeastern part of Fergana valley). Endemic. Described from Bal'dzhuan. Type in Leningrad.

7. **A. grandiflora** (Trautv.) M. Pop. in Lapin, Opred. rast. Tashkentsk. oazisa (1938) 342, No. 319; Zakir., Burachn. Zeravsh. 23. — A. orientalis var. grandiflora Lipsky in Tr. Bot. Sada, XXVI (1910) 522. — A. cornuta var. grandiflora Trautv. Bull. Soc. Nat. Mosc. IV (1866) 422. — Ic.: Gartenfl. XXVI (1877) 523, tab. 921.

Annual; plant 5—20 cm high, with very dense spreading bristles, canescent; leaves lanceolate to linear, acute. Fertile racemes shorter than in preceding species, 5—10 cm long; corolla yellow, the small violet spots ca. 2 mm across, its limb 10—15 mm across. April—May.

Loess foothills, rarely on stony slopes in semi-desert belt. — Centr. Asia: Dzu-Tarb., T. Sh., Pam.-Al., Syr D. (From Ili River southward towards

Zeravshan and Surkhan, Gorno-Badakhshan ASSR and Fergana valley). Endemic. Described from Tashkent. Type in Leningrad.

Note. Morphologically the limit between this and the preceding species is doubtful. Lipskii was probably right when he claimed (op. cit., p. 525) that there was no limit. Geographically, the distinction is more clear-cut:
180 near Samarkand or Tashkent there occurs only A. grandiflora, but on Babatag (Surkhan) and in Fergana valley their distribution areas are adjacent or overlapping. A. grandiflora also grows throughout the Fergana valley and A. baldshuanica is found near Gulcha in its southeastern corner. Nevskii (op. cit.) was unable to distinguish them. In the northeast, the typical A. grandiflora extends to the Ili River, where the Tarbagatai specimens (after which A. cornuta var. grandiflora Trautv. was described) are no longer typical. The plants are weak, thin, more sparingly pubescent, the limb smaller than in the type; hence I could not accept them as the type of the species.

8. A. transcaspica M. Pop. sp. n. in Addenda XVIII, 705. — A. orientalis var. tubata Lipsky in Tr. Bot. Sada, XXVI (1910) 520, p. p.

Annual; stem 20—30 cm high, very divaricately branching, whitish, subglabrous, with sparse, long, spreading bristles; leaves lanceolate, green, very sparingly pubescent, obtuse, acute. Fertile racemes loose, not exceeding 10 cm, rather few-flowered; calyx with sparse coarse bristles; corolla yellow, with (15—17—20 cm) long, narrow tube and small broadly funnel-shaped limb, 8—10 mm across; violet spots large, covering notches between lobes. April—May.

Sands and stony mountain slopes. — Centr. Asia: Kara K., Mtn. Turkm. (Kopet Dagh (west), Greater Balkhany and Dzhebel). Endemic. Type in Leningrad (near Dzhebel railway station, flower — 3 V 1911," A. Seimuradov, No. 1034).

Note. This is a transitional form to the typical desert A. decumbens. It differs from A. grandiflora by the reduced pubescence and much smaller, campanulate corolla limb, flatter than in A. grandiflora. The group is very common in Kara Kum and the Kopet Dagh foothills. The Karkaralinsk specimens appear to differ slightly from those from sandy Kara Kum (for example, route via Ioldere, flowers, 15 V 1916, B. A. Fedchenko, No. 264; near Nukhur village, flowers, fruit, 15 V 1916, Chernyakovskaya, No. 1162). In Kara Kum forms transitional between A. transcaspica and A. decumbens are frequent.

A form very close to A. grandiflora M. Pop. grows near Ashkhabad (e. g., the hills near Keshi, flowers, 15—16 IV 1907 (anonymous), Resht, on stones, flowers, fruit, 12 VII 1926, Chernyakovskaya, No. 83).

9. A. decumbens (Vent.) Coss. et Kral. in Bull. Soc. Bot. France, IV (1857) 398, 402. — Lithospermum decumbens Vent. Descr. pl. nouv. Jard. Cels. (1800) 37, tab. 37; Fedch. and Fler., Fl. Evrop. Rossii, 792; Kryl., Fl. Zap. Sib. IX, 2281. — L. micranthum Viv. Fl. Lyb. Spec. (1824) 10, tab. 1, f. 4. — Onosma divaricatum Lehm. Pl. Asperif. II (1818) 372. — Lithospermum cornutum Ldb. Fl. alt. (1829) 175. — Arnebia cornuta F. et M. Ind. Sem. Petrop. I (1835) 22; DC. Prodr. X, 95; Ldb. Fl. Ross. III, 139; Boiss. Fl. or. IV, 213; Shmal'g., Fl.

181 II, 238.— Lithospermum tubatum Bertol. Misc. Bot. I (1842) 15.— Arnebia viviani Coss. et Dur. in Ann. Sc. Nat. sér. IV, I (1854) 240.— A. orientalis Lipsky in Tr. Bot. Sada, XXVI (1910) 513, excl. var. grandiflora et baldshuanica.— Ic.: Vent. l. c.; Ldb. Ic. pl. Fl. Ross. I, tab. 25; Fedch. and Fler., op. cit. 792.

Annual; stem 5—20 cm high with sparse spreading bristles, with solitary horizontal besides more dense shorter bristles, simple or with spreading branches sometimes from base, usually erect; leaves lanceolate or linear-lanceolate, usually 2—5 cm long, 3—10 mm wide, the lower obtuse, the upper acute, with long spreading bristles along margin and along midrib beneath, or with sparsely semi-appressed bristles, usually greenish, rarely canescent. Scorpioid cymes terminating branches and stems, erect even in flower, not curved, loose, with separating calyces, with sparse coarse bristles; bracts lanceolate to linear, acute, slightly exceeding flowers, with ciliate-bristly margin; calyx in flower 6—7(8) mm long, with linear narrow lobes, long-bristly, its base pentahedral, very stiff in fruit, with 6 (sic!) angular protuberances, closely surrounding the nutlets, calyx lobes narrowly linear, upright elongating; corolla nearly tubular, 10—15 mm long, the very small, campanulate limb 2—4 mm across; corolla lobes short, ovate or oblong, 1—2 mm long, corolla downy outside, without violet spots on limb (or with tiny dots); nutlets oblong-ovoid, erect, acute, gray, finely tuberculate; fertile calyx on short peduncle, not abscissing. March—May.

Sandy and stony deserts, reaching mountainous, stony-gypsiferous semi-desert.— European part: L. V. (Astrakhan); West Siberia: Alt.; Caucasus: S. and E. Transc.; Centr. Asia: all desert regions from the foothills of Kopet Dagh to the foothills of Altai, and northward to 48° N. Gen. distr.: N. Afr., Iran., Mong., Dzu.-Kash. Described from specimens grown in the Celsius garden from seeds collected in Baghdad by Brugge and Olivier in 1798. Type in Paris.

Note. Ventenat's detailed description and very accurate drawing leave no doubt about the identity of our plant. Lithospermum tubatum Bertol., somehow described from the same localities on the Euphrates (I saw the type species "ad Bamboudsch, leg. Chesney, No. 62"), is indistinguishable from Lithospermum decumbens Vent.: its corolla is 12—13 mm long, tubular. Bertoloni himself did not compare it with previously described species such as L. decumbens, L. micranthum
182 Viv., or L. cornutum Ldb. Therefore Lipskii's claim that the corolla in L. tubatum is longer than that in L. decumbens (reaching 20 mm) is quite arbitrary. He seems to have had in mind our A. transcaspica, erroneously identified by him with L. tubatum Bert., or the transitional forms between them.

Series 2. Basituberculatae M. Pop.— Calyx hardening at base in fruit, obscurely pentahedral, rather more ovate, with long coarse bristles and covered with white papilliform tubercles when fully ripe; calyx lobes lanceolate-linear or lanceolate, much elongating, to 30 mm. Cymes divaricate in fruit, very dense. Plant small, 5—10 cm high, divaricately branching; corolla tubular, nearly limbless.

10. A. linearifolia DC. Prodr. X (1846) 95; Boiss. Fl. or. IV, 214; Grossg., Fl. Kavk. III, 271.— Lithospermum aucheri Johnst. in Journ. Arn. Arb. XXXIII, 4(1952) 328.

Annual; stem 5—10 cm high, subglabrous, divaricately branching from base; leaves few, lanceolate or oblong-lanceolate, obtuse, flat, slightly and shortly appressed-bristly, not long-bristly as in A. decombens. Scorpioid cymes secund, dense, arcuately divergent, dense even in fruit; bracts lanceolate, subglabrous, few, as long as sepals; calyx large at flowering, ca. 10 mm long, with dense bristles beneath, the broad obtuse lobes more or less distinctly 3-nerved, very markedly accrescent (to 30 mm) in fruit, becoming lanceolate; corolla yellow, with narrow glabrous or downy tube up to 1½ times length of calyx, 15—20 mm; limb small, plano-campanulate, 3—5 mm across, the oblong, obtuse lobes with ciliate margin; violet spots absent; flowers dimorphic-heterostylous; anthers ca. 1 mm long; style shortly 4-parted, stigmas capitate or with two 2-lobed stigmas; nutlets 4 mm long, broadly trihedral-ovoid, brown, lustrous, densely, obtusely tuberculate-rugose. March—April.

Stony deserts.— Caucasus: S. Transc. (near Nakhichevan); Centr. Asia: Mtn. Turkm. (Krasnovodsk), Kyz. K. (lower reaches of the Amu Darya, Sultan-Uizdag). Gen. distr.: Iran., Arabia, N. Afr. (Egypt). Described from Arabia. Type (Aucher, No. 2368) in Geneva.

Note. The Amu Darya specimens typically have calyces with subglabrous bases.

Genus 1189. **STENOSELENIUM*** Turcz.

Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 253.

Calyx cleft nearly to base into linear, acute lobes, not changing in fruit,
183 without hardening base, its teeth only slightly elongating; corolla light violet, ca. 20 mm long, with long narrow tube and small campanulate limb, its lobes short, ovate, rounded, the throat open, without scales or folds, with a narrow, protective ring at base of tube; anthers sessile, attached spirally from below middle of tube to below throat: 3 close to throat, 2 below middle of tube, oval, obtuse; filiform style enclosed in tube, short-bipartite, with 2 globose-capitate stigmas; nutlets obliquely ovoid, ca. 2 mm long, gray, appearing stony, slightly pitted-tuberculate, attached to concave gynobase, the short tubular, obliquely truncate stalk attached to lower ventral side of nutlet, with acute keel above stalk, nutlets vertical in fruit, with acute apex.

Distinguished from Arnebia (to which it is close by its flowers, habit and the 2-partite style) by the unique attachment of the nutlets by a hollow stalk. Bentham and Hooker, as well as Gürke, placed it in Arnebia, but the fruits are more reminiscent of those of Alkanna. Its nutlets make it an anomalous genus in the tribe, as is the case with Alkanna.

1. S. saxatile (Pall.) Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 253.— Anchusa saxatilis Pall. Reise III (1776) 718; Roem. et Schult. Syst. IV, 99.— Onosma saxatile Lehm. Pl. Asperif. II(1818)371; Spreng. Syst. I, 549.— Ic.: Pall. l. c. tab. F, f. 1.

* From the Greek stenos — narrow, thin and solen — tube, referring to the shape of the corolla.

Annual; root thin, vertical, not yielding dye; stem 10—30 cm high, robust, cylindrical with long spreading, white bristles, rarely simple, often branching from base or higher, with several declined branches; leaves lanceolate, rarely lanceolate-linear, sessile, acute, the lowermost obtuse, 3—5 cm long, 5—10 mm wide, canescent, with long sparse bristles, with very few tiny bristles, and a prominent midrib. Scorpioid cymes few-flowered, at ends of branches, loose even in flower, in fruit erect, elongate, with markedly separating calyces and long, lanceolate, acute, ciliate-bristly bracts; calyx linear, 10 mm long in flower, to 12—15 mm in fruit, with long white bristles; corolla light violet, with sparse hairs outside, ca. 20 mm long; tube gradually broadening in limb, limb 4—6 mm across; nutlets ca. 2 mm long, ovoid, dorsally rounded but slightly pectinate towards apex, ventrally keeled, the stalk ca. 5 mm long, gray-brown, lustrous, pitted-tuberculate. June—July.

Rocky and stony habitats. — East Siberia: Ang.-Say. (Irkutsk), Daur. (along Selenga River). Gen. distr.: Mong. Described from Selenginsk. Type in London, cotype in Leningrad.

184 Subtribe 2. ONOSMEAE M. Pop. — Corolla medium large or large (10—30 mm long), in these and some closely related species dolychomorphous, tubular-claviform or tubular-campanulate or tubular, open with small-toothed rim, without scales or folds in throat; anthers on short filaments, the most elongating lanceolate or fused into a cone or joined only at base, produced to flat lanceolate appendage of the connective. Anthers concealed in upper part of corolla or protruding from it. Style filiform, exserted. At base of corolla tube there is a glabrous or pubescent protective ring. Nutlets of the Eulitospermum type, ovoid, basally attached to flat torus, erect or slightly curved, the apex differentiated, usually tuberculate. Annual, rarely biennial, herbs with coarse pubescence.

Genus 1190. **ONOSMA** L.

L. Sp. pl. ed. 2 (1762) 196.

Calyx usually parted nearly to base, rarely (Aponosma) with short tube. Corolla tubular, protruding from calyx, sometimes gradually or abruptly broadening with open throat, if cylindrical then tapering in throat, and teeth small, triangular, erect or curved outwardly, rarely elongate, much shorter than the tubular part, nearly as long as tube (O. longilobum); corolla white or yellow, sometimes reddening after flowering and turning dark or sky blue or dark red, but then blue when dry. Anthers elongate, deeply split at base, lower ends of cells free, with small pointed appendages, apex of anther usually with flat-scarious, bidentate, rarely acute appendage, anthers usually joined below by basal appendages, rarely (Protonosma and some Haplotricha) adhering for entire length to produce conical tube hidden in corolla, but usually more or less, sometimes considerably exserted. Filaments rarely filiform, often gradually, rarely markedly, broadening towards base. Annular nectary often developed as a very narrow ring,

rarely as 10 individual glands at base of corolla, glabrous or pubescent. Style filiform, most exserted from corolla and anthers, glabrous; stigma small, entire or slightly 2-lobed. Nutlets 3—6 mm long, erect, trihedral-ovoid, slightly gibbous, with sharp ventral keel, dorsally slightly keeled or rounded, with lateral ribs, often smooth and lustrous, rarely tuberculate-verrucose, usually tapering to laterally compressed beak. Herbs, rarely
185 subshrubs, 10—100 cm high, leaves entire, usually narrow, with coarse, sometimes spiny bristles, rarely silvery, large bristles on multicellular, glabrous or stellate downy tubercles. Mostly in mountains and semi-deserts, rarely in the steppe zone.

Because of the morphological uniformity of the genus the species of Onosma are difficult to distinguish. For the same reason they are not satisfactorily united in natural groups. Two of the three sections occur in the USSR; the third is Chinese.

1. Calyx with short tube, because of the markedly protruding nerves, angular in fruit, its lobes much increasing in width in fruit, becoming nearly membranous, often 2 or 3 concrescent. Entire plant covered with dense appressed white sericeous hairs; leaves usually oblong; inflorescence paniculate. (Caucasus). (Section Aponosma DC.) . . . . . 1. O. sericeum Willd.

\+ Calyx without tube, not becoming angular, its lobes elongate, free to base, their consistency not changing in fruit. Rarely with appressed sericeous hairs (but then leaves linear), often spreading, spiny. (Section Euonosma DC.) . . . . . 2.

2. Tubercles bearing bristles glabrous, not stellately pubescent (most obvious on upper side of leaves, where tubercles larger). (Subsection Haplotricha Boiss.) . . . . . 3.

\+ Tubercles bearing large bristles stellately pubescent; hairs fine. (Section Asterotricha Boiss.) . . . . . .29.

3. Corolla (18)20—30 mm long (large-flowered groups of Haplotricha) . . . 4.

\+ Corolla 10—20 mm long (small-flowered groups* of Haplotricha). . . . .16.

4. Subshrubs with epigeal woody branching base, fertile stems and erect sterile shoots (without rosettes). Leaves narrow, elongate, lanceolate or linear, often with downward rolled margins, mostly with appressed, sericeous or slightly sericeous hairs. Corolla open, 18—22 mm long, pure yellow; stamens with filaments as long as or slightly longer than anthers not exserted. (Group Suffruticosa) . . . . . 5.

\+ Herbaceous plants with or without rosettes of leaves; sterile shoots lacking. Pubescence (particularly bristles) more or less spreading, sometimes horizontal (except for O. azureum). Filaments shorter than anthers . . . . . 6.

5. Inflorescence, sometimes also some leaves with rufous hairs. Leaves linear, gray- or white-sericeous-hairy, largely preserved and whitening the following year (branches at base). Calyx in fruit markedly accrescent, to 25 mm. Corolla ca. 22 mm long, slightly

* The larger-flowered (15—20 mm) species of the Central Asian groups of Ferganica and Persica are also included here.

longer than calyx. Nutlets 3—4 mm long. Stems villous. (Crimea and NW Caucasus) . . . . . 2. O. polyphyllum Ldb.

\+ Plant gray-green. Leaves not persistent until following year. Stems with appressed hairs. Calyx slightly accrescent in fruit, to 13 mm long, with white bristles; corolla twice as long as calyx (18—20 mm). Nutlets 2—3 mm long. (Don to Yenisei) . . . . . 3. O. simplicissimum L.

6. Corolla as in Suffruticosa, pale yellow, in some species turning red or even blue after flowering . . . . . 9.

\+ Corolla sky-blue, not changing color, 25—30 mm long. Stems branching in upper part or simple, but then thin, white. Leaves even beneath without thick, canescent down. 8.

\++ Corolla dark wine-red in flower, dark blue (nearly black) when dry. Stems with long, horizontally spreading bristles. Calyx with fine white hairs; stigmas capitate; nectary hairy. Perennials. Stems not branching. Leaves gray-haired, white canescent with thick down beneath. (Group Praehimalaica) . . . . . 7.

7. Corolla ca. 30 mm long. Calyx 15—20—25 mm long. Leaves linear or linear-lanceolate, cauline leaves ca. 3—7 cm long, to 12—15 mm wide. (Pamir area, Pyandzh to Zeravshan, Alai Range) . . . . . 4. O. atrocyaneum Franch.

\+ Corolla 20—22 mm; calyx 10—13 mm long. Leaves ovate-lanceolate, cauline leaves 3—5 cm long, 16 mm wide. (Possibly hybrid of O. atrocyaneum × O. albicaule). (Confined to Samarkand mountains, on rocks in Ogalyka) . . . . . 5. O. maracandicum Zak.

8. Leaves covered with long bristly spreading hairs. Corolla tubular, opening slightly widening, not tapering in throat; calyx lobes very strongly elongate, its tips elongating nearly to corolla throat, spreading-bristly; nectary glabrous. The thick capitate root produces many white, not branching, 15—30 cm high stems. Leaves linear-lanceolate, with uneven crisped margin, short-acuminate, without branchlets in their axils. (In Turanica group). (Greater Balkhan). . . . . 10. O. leucocarpum M. Pop.

\+ Leaves and stems with sparse appressed hairs; bristles obsolete, appressed to leaves. Axils of all leaves bear thin sterile branches with narrow linear leaves. Cauline leaves lanceolate, long-acuminate towards apex, subglabrous, with even margin. Calyx with spreading yellow bristles, sericeous, nearly half length of corolla. Corolla slightly downy outside, its throat broadly gaping. Nectary hairy. (Fergana Range). (In Ferganica group). . . . . 6. O. azureum Schipcz.

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9. Anthers adhering over entire length, forming slightly conical tube protruding from corolla. Corolla yellow, turning brown (not blue); large species with thick stems and narrow elongate leaves. (Mountains of Central Asia, S. Siberia and N. Mongolia). (Group Tianschanica) . . . . . 10.

\+ Anthers adhering only at bases, not along sides, their apices diverging exserted from the corolla (as clearly visible in the dried flowers) . . . . . 13.

10. Corolla 25—30 mm long, glabrous or hardly downy outside. Perennial herbs of Central Asia and S. Siberia (to Yenisei) . . . . . 11.

\+ Corolla 20—22 mm long, densely downy outside. Biennial herbs of SW Ukraine. Podolian Upland, Kamenets (to Odessa) and Moldavia . . . . . 24. O. calycinum Stev.

11. Corolla 30 mm long, dark brown after flowering. Sepals 30 mm long in fruit. Leaves usually green, wider, 1—3 cm wide, with long sparse bristles on tubercles, almost without interspersed bristles. Calyx very spiny, with long bristles. Nutlets larger, 6—7 mm long. (Confined to variegated rocks from Alai Range (Gulcha) through Upper Zeravshan (Rokh) to Kulyab on Pyandzh) . . . . . 17. O. baldshuanicum Lipsky.

\+ Corolla 25—30 mm long, turning brown, but not as dark, after flowering; calyx to 25—26 mm long. Leaves narrower, sometimes very narrow. Nutlets 5—6 mm long. (Mainly in Tien Shan and S. Altai, southwest to Upper Zeravshan, northeast to Krasnoyarsk) . . . 12.

12. Leaves green, 3—5 mm wide, elongate, like stems covered with long, sparse, horizontally spreading bristles, almost without interspersed small bristles. Plant spiny due to long spreading bristles. Corolla 27 mm long, not markedly exceeding calyx. (Typical form confined to the Chu-Ili mountains and Kara-Tau; forms transitional to O. gmelini on Kirghiz Range and Trans-Ili Ala-Tau) . . . . . 16. O. irritans M. Pop.

\+ Leaves slightly broader, in E. Tien Shan obtuse, canescent, bristles
188 crowded, short, interspersed with smaller bristles; corolla 25—27 mm long, twice as long as the 20 mm long calyx [sic]. (From Yenisei and NW Mongolia to Upper Zeravshan, mainly in steppe and forest zone in Tien Shan) . . . . . 15. O. gmelini Ldb.

13. Biennial (monocarpic perennial) plant, usually with few stems to 30 cm high. Corolla markedly gaping, 20—25 mm long, yellow, turning brown after flowering. Leaves small, cauline leaves 3—4 times as long as wide, spatulate. Pubescence neither coarse nor dense, very long and spreading. Sepals narrowly linear in fruit. Nutlets 3 mm long, with distinct protuberances. (Transcaucasia). Probably a young hybrid species (ruprestre × armeniacum) . . . . . 22. O. microcarpum Stev.

\+ Biennials, usually with 1—2 (5—6 mm) thick, high stems. Corolla not as markedly gaping; sepals more elongate (to 20—30 mm) in fruit. Leaves more elongate, average cauline leaves 10 times as long as wide. Pubescence coarse-spiny, long-bristly. Nutlets 4—5 mm long (high). (Group Praemontana) . . . . . 14.

14. Corolla large, 25—32 mm long, turning pink after flowering, later red, (in some races, especially in O. caspium, turning blue). Canescent. Sturdy, to 60—70 mm high plant. Nutlets 5 mm long. (E. Caucasus, Central Asia to Ili River in the northeast) . . . . . 18. O. dichroanthum Boiss.

\+ Corolla after flowering turning brown, neither pink nor blue (i. e., flavescent, unable to form anthocyanin), 20—25 mm long. Calyx often with light white or yellowish hairs. Nutlets ca. 4 mm long. . . 15.

15. Corolla glabrous or subglabrous. Nutlets more or less plicate-tuberculate, sometimes only with traces of tubercles or folds at juncture of fruit and beak (the young, unripe fruit distinctly rugose). (Lower reaches of the Volga, Dagestan coast) . . . 19. O. setosum Ldb.

\+ Corolla sparsely but distinctly downy (villous). Nutlets closer to 3 mm long than to 4 mm, smooth, without lateral tubercles or folds, slightly smaller. (Crimea and Taman Peninsula) . . . . . 19. O. visianii Clem.

++ Corolla distinctly downy at apex, especially in bud. Leaves very crowded, upright, narrow. Plant grayer, pubescent. (Caucasus, mainly Lesser Caucasus) . . . . . 20. O. armeniacum Klok.

16. Biennial steppe species, from the Baikal area to the Carpathians, in the south to Altai and Tarbagatai, Balkhash, Mugodzhar Hills, Ciscaucasia and the steppe region of the Crimea. Corolla yellow at first, turning brown (only in O. polychromum turning red and
189 blue). (Group Stepposa) . . . . . 17.

\+ Perennial species, in many species the yellow corolla turning red or blue or reddish (brown only in the Caucasian species) . . . . . 20.

17. Anthers connate for entire length. Corolla densely downy, ca. 20 mm long (degree of sympetaly 10) . . . . . 24. O. calycinum Stev.

\+ Anthers connate only at base. Corolla glabrous, rarely downy, 10—18 mm long . . . . . 18.

18. Corolla large, 16—18 mm long 25. O. arenarium* W. et K.

\+ Corolla smaller, 10—12 mm long . . . . . 19.

19. Corolla yellow, turning brown after flowering, glabrous or downy . . . . . 27. O. tinctorium M. B.

\+ Corolla yellow at first, turning red at first, dark blue, later glabrous . . . . . 28. O. polychromum Klok.

20. Anthers adhering in tube, exserted from sky-blue corolla (15 mm long), with upper part of filaments visible. Multicaulescent, from thick, capitate root; stems low, white, thin, short-downy. Leaves short, small, oblong with short coarse bristles. (Chalks and limestones in the Turan lowland of the Caspian area, from Emba to Ustyurt and Karabugaz). (Group Turanica). (Average 8) . . . . . 11. O. stamineum Ldb.

Anthers adhering only at base, not exserted, or only apices exserted from corolla . . . . . 21.

21. Small (8—10 mm) wine-red corolla with lanceolate-linear, erect, acute teeth, ca. 5 mm long. Appendages of anthers acute, not bidentate, filaments very short. Nectary long-haired. Plant with white bristly down, multicaulescent, slightly cespitose, low; calyx white. Nutlets 4 mm long. (Kopet Dagh, in semi-steppe belt). (Group Chorassanica) . . . . . 12. O. longilobum Bge.

\+ Corolla teeth short, anthers with bidentate appendages . . . . . 22.

22. Corolla white- or yellowish-blue (blue at apex), not changing color, plicate, with large verrucae along ribs below teeth, 15—20 mm long, constricted in throat. Stems branching, branches sterile or with short terminal inflorescences. Nectary glabrous or pubescent.

* Plant less bristly, leaves shorter and narrower (from the Volga to the Baikal area). . . . . 26. O. transrhymnense Klok.

190 (Apparently young hybrid species or O. azureum or O. atro-cyaneum × O. grupe Praepamirica). (Group Ferganica). . . . 23.

\+ Corolla not verrucose along ribs outside, yellow in flower. . . . . 25.

23. Thin sterile branches in axils of nearly all cauline leaves. Hairs short, appressed, with very short bristles on leaves, short-canescent on stems. (Habit as in O. azureum, degree of sympetaly 8, but corolla different). . . . 7. O. brevipilosum Schischk.

\+ Axillary branches fewer, terminated with short inflorescences. Hairs on stems and leaves spreading. . . . . 24.

24. Stems with rather soft villous down, without long spreading bristles. Leaves short, oblong-lanceolate, tapering from broad base to acute apex . . . . . 8. O. ferganense M. Pop.

\+ Stems with long drooping bristles, nearly white-downy. Leaves soft, spatulate-lanceolate, elongate, tapering towards base, short-. . . acuminate, with long bristles above, both surfaces hairy-downy . . . . . 9. O. trachycarpum Levin.

25. Stems few, ascending, low, not branching. Leaves 3—4 mm wide, small, linear, slightly spatulate, acute, with spreading long bristles. Inflorescences capitate. Corolla claviform, 12—15 mm long, nearly open, yellow, not reddening, glabrous, downy only on teeth; nectary glabrous; sepals narrowly linear, little elongating, not divergent in fruit. Nutlets 2—3 mm long. (Transcaucasia). (Group Caucasica) . . . . . 23. O. rupestre M. B.

\+ Corolla yellow at first, turning red or blue, rarely not changing color (homochromous), but then nectary glabrous. At least in ripe fruits stems often white, bluish at first in O. livanovii, in which species stems also branch . . . . . 26.

26. Stems white, not branching; leaves not bright green, canescent; corolla 15—20 mm long, turning red after flowering; nectary glabrous, markedly dissected. (In mountains of Pamir-Alai). (Group Praepamirica). . . . . 27.

\+ Stems branching in upper part; leaves coriaceous, green, oblong or lanceolate, with coarse spiny bristles. (Variegated rocks in semi-deserts of Araks and Pyandzh) . . . . . 28.

27. Upper part of corolla tube much broadening, swollen; filaments less expanded at base. Leaves on stem dense, numerous, lanceolate, long-acuminate to linear, with markedly spreading,
191 ciliate bristles along margin, bristles on surface of leaves appressed. Stems usually few, 20—40 cm high, thin, white. (From Alai to Darvaza, in upper part of mountain belt) . . . . . 13. O. zerizaminum Lipsky.

\+ Upper half of corolla tube less strongly broadening; filaments short, sharply expanding below. Leaves not as numerous, linear-lanceolate to oblong-lanceolate, in the latter case with 3, rather densely canescent-downy, bristly nerves, bristles along margin not as spreading nor as long. (From Samarkand to Kelif and Darvaza) . . . . . 14. O. barsczewskii Lipsky.

28. Corolla 14—18 mm long, downy outside, not turning red or blue, with gaping throat; nectary hairy; filaments gradually expanding below. Stems from the start white, nearly shiny. Leaves

2—4 cm long, to 1.5 cm wide. Nutlets 4 mm long. (Zangezur, Ordubad). (Group Atropatano-Luristana) . . . . 29. O. gracile Trautv.

\+ Corolla 10 mm long, yellow at first, turning dark red, later dark blue, glabrous outside, with constricted throat; nectary glabrous; filaments short, with rhombic expanding base. Stems bluish at first, white, and shiny in fruit. Leaves with stiff rolled margins, 2—3 cm long, usually less than 1 cm wide. Nutlets 3—3.5 mm long. (On Pyandzh (Kelif-Shirabad to Kabadian)). (Group Oxica) . . . . . 30. O. livanovii M. Pop.

29(2). Corolla ca. 10 mm long, with constricted throat, yellow at first, turning dark red, then dark blue, downy outside. Filaments short, rhombic-broadening. Multicaulescent from thick capitate root. Stems branching, downy at first, turning white. Leaves short, lanceolate or oblong, velutinous-gray, with (pseudo-) stellate down. Nutlets 3.5 mm long, smooth, with acute sides, one-colored. (Amu Darya, from Kelif to Guzar). (Group Oxiana) . . . . . 31. O. macrorhizum M. Pop.

\+ Corolla 15—30 mm long, with gaping throat. Filaments slightly expanding below. Leaves linear-spatulate, with distinct stellate hairs. Subshrubby base produces fertile and reduced, sterile shoots. (Crimea, Caucasus). (Group Stellulata) . . . . . 30.

30. Corolla 15—20 mm long, white-yellow (cream), 1½ times as long as calyx. Calyx yellowish-bristly or rufous-bristly outside, white and soft haired inside. Leaves more nearly spatulate.

192 (Crimea, NW Caucasus (Novorossisk district)). . . 32. O. rigidum Ldb.

\+ Corolla 20—30 mm long, 2—3 times as long as calyx, white at first, after flowering dark brown (red-violet). Calyx usually with coarse-haired margin . . . . . 31.

31. Ash-gray to canescent-green plant. Nutlets long-acuminate, 3.5—4 mm long. Cauline leaves to 0.9 cm wide. Calyx 10 mm, in fruit to 15—20 mm long. Stems simple, often strongly arcuately curved below inflorescence. Corolla glabrous, 20—28 mm long. (Crimea, NW Caucasus) . . . . . 33. O. tauricum Pall.

\+ Green to gray-green, sometimes gray-tinged plant. Nutlets 2.5—3.5 mm long, short-acuminate. Cauline leaves to 1.5 cm wide. Calyx 8 mm (in fruit) to 18 mm long. Stems sometimes branching, less curved below inflorescence. (Caucasus). . . . . 34. O. caucasicum Levin.

Section 1. APONOSMA DC. Prodr. X (1846) 65. — Calyx with short tube, angular in fruit through development of markedly protruding nerves, its lobes much widening becoming nearly membranous in fruit, 2 or 4 markedly accrescent. Entire plant densely appressed-hairy, white-sericeous, with longer bristles on small simple, not stellately downy tubercles. Subshrubs with oboblong leaves, sterile short shoots; flowering stem with paniculate inflorescences. — Caucasus, Asia Minor, NW Iran, Syria.

1. O. sericeum Willd. Sp. pl. I (1797) 774; Ldb. Fl. Ross. IV, 128; Shmal'g., Fl. II, 241; Grossg., Fl. Kavk. III, 273. — Colsmannia flava

Lehm. in Mag. Ges. Nat. Berl. 8 (1818) 92. — O. elegans C. Koch in Linnaea, XVII (1843) 306. — O. flavum Vatke ex Boiss. Fl. or. IV (1879) 186. — O. flavidum Boiss. Diagn. I, 11 (1849) 100. — O. trachytrichum Boiss. l. c. 103. — O. brachysolen Boiss. l. c. 104. — O. isauricum Boiss. et Heldr. in Boiss. Diagn. I, 11 (1849) 101. — O. briquetii Czecz. in Acta Soc. Bot. Pol. IX, 1—2 (1932) 42. — O. szovitsii Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 591, 596. — Ic.: Lehm. Ic. Pl. Asperif. tab. 10; Gard. Chron. ser. III, LII, 281; Probl. bot. I (1950) 27, Figure 5.

Perennial; subshrub to nearly herbaceous plant, base short-branching, producing sterile and fertile short shoots; entire plant densely appressed-hairy, white-sericeous, rarely greenish, long bristles often on small simple, rarely (O. isauricum Boiss. et Heldr.) on few stellate tubercles; leaves short, wide, 2.5 cm long, 0.8—1.5 cm wide, on sterile shoots oboblong, attenuate to petioles, on fertile stems lanceolate, sessile, acute; stems
193 simple, ascending, 20—45 cm, whitish. Inflorescence usually paniculate, not large, of few, rarely 1—2, scorpioid cymes; pedicels very distinct, angular in fruit; bracts indistinct, linear; calyx 13—17 mm long, markedly elongating in fruit, 18—25 mm long, short-tubular beneath, angled in fruit, its lobes connate in pairs, rarely free, membranous-broadening, tapering below, rarely (O. szovitsii) tube not angled, its lobes not connate and not membranous, with short appressed hairs, villous below; corolla white-yellow, very rarely blue, 18—24 mm long, with gaping throat, densely appressed-downy, with short, obtuse teeth; anthers connate only at base, with short, bidentate, terminal appendage, not or slightly exserted from corolla, filaments shorter than anthers, slightly broadening below; stigma 2-lobed; nectary glabrous; nutlets 4—5 mm long, whitish, bulbiform, i. e., with sides rounded not acute, not gibbous, smooth. June—July.

Stony slopes in middle mountain belt of oak forests, sometimes in cultivated areas, e. g., vineyards, from 500 to 1,800—1,900 m. — Caucasus: E. and S. Transc., isolated in Dag. (Andi Koisu, Chir-Yurt), reported for Cisc. (Mashuk, Stavropol?). Gen. distr.: Iran., Arm.-Kurd., E. Med. Described from Diarbekir. Type in Berlin.

Note. Views on the status of section Aponosma, which range from its recognition as a separate genus (Lehmann) to negation of its validity and amalgamation with Haplotricha (Boissier), depend upon whether attention has been focused on the pure type of the species, which contrasts sharply with others of Onosma, or on transitional forms due to hybridization with different species of Euonosma. In this I follow Alphonse De Candolle. O. szovitsii Stev., described from Iranian Azerbaidzhan and differing in the narrowly linear, free, elongate teeth, the calyx slightly angled at base, leaves sometimes very long, cannot be separated. Such forms grow in the USSR — in Araks, for example, in Ordubad.

Section 2. EUONOSMA DC. Prodr. X (1846) 57. — Calyx divided nearly to base, the 5 narrow lobes slightly broadened, more or less elongate in fruit, but not changed in consistency nor membranous; calyx tube obsolete, base of calyx not angular in fruit. Hairs sparsely appressed-sericeous, often spreading and spiny. — Tibet, Himalayas, NW Mongolia, but mainly in

the provinces of Iran and the East Mediterranean to the Atlantic; some species are steppe plants.

194 Subsection 1. HAPLOTRICHA Boiss. Fl. or. IV (1879) 179; Engl. — Pr. Pflanzenf. IV, 3a (1897) 127. — Estellata Schur, Enum. Pl. Transsylv. (1866) 468. — Multicellular tubercles on vegetative organs which bear larger bristles, glabrous, i. e., without stellately arranged small hairs parallel to surface of organ. Covers the entire distribution area of the section and the eastern wing of the Himalayas. In Mongolia, Central Asia and most of the steppe parts of Iran it alone is represented.

Group 1. Suffruticosa M. Pop. — Subshrub to nearly herbaceous; fertile stems and erect sterile shoots produced from the epigeal woods, branching base (caudex). Leaves narrow, elongate, lanceolate-linear or linear, often with rolled margins and appressed-sericeous hairs. Corolla pure yellow, claviform, 18—22 mm long, gaping. Stamens not exserted from corolla, the filaments as long as or slightly longer than anthers. Nectary glabrous or subglabrous. This group is related to the group Stellulata, from Asterotricha (see group 14).

2. O. polyphyllum Ldb. in Pander's Beitr. Naturk. Ostseeprov. Russl. (1820) 72; Ldb. Fl. alt. I, 182; Ldb. Fl. Ross. III, 128; Steven in Bull. Soc. Nat. Mosc. XXIV, 590, 594; Shmal'g., Fl. II, 240; Grossg., Fl. Kavk. III, 272. — O. caespitosum Pall. ex Stev. l. c. 40. — O. bifrons Stev. ex DC. Prodr. X, 65. — Ic.: Ldb. Ic. Fl. Ross. tab. 24; Moellers Deutsch. Gärtn.-Zeit. XXIV, 536; Probl. bot. I (1950) 87; fig. 4. — Exs.: GRF, No. 920.

Perennial; low subshrub 15—30 cm high, base branching with thick decumbent branches producing shorter, thin branches of last year, which are covered with the dead, overwintering, falcately curved leaves, gray-white in color; leaves linear, crowded on sterile shoots, sericeous-white, with appressed hairs and rolled margins, acute, 2—7 cm long, 0.2—0.5 cm wide, on fertile stems more remote, shorter, slightly broader. Fertile stems 10—20 cm high, thickish, with soft spreading dense hairs (rufous above), simple; inflorescence usually a 2-parted head, of 2 compact scorpioid cymes, calyx and short pedicels densely covered with thick spreading rufous hairs; calyx lobes narrowly linear, acute, 12—15 mm long, 20—25 mm in fruit, with rufous lanate hairs, white-hairy inside along margin; bracts linear; corolla glabrous, 20—23 mm long, broadly tubular with gaping throat, pale yellow, turning brown; anthers not exserted, as long as filaments, these broadening slightly below; appendages scabrous, acutely bidentate; nectary glabrous; nutlets ca. 4 mm long, narrow, white, smooth, shiny. April—May.

195 Stony slopes and rocks, mainly on limestones, rarely in sparse forests, from coast to 1,000 m. — European part: Crim. (mountains, mainly southern slopes towards the sea); Caucasus: W. Transc. (Markotkh Range). Endemic. Described from the southern part of the Crimea. Type in Leningrad.

Note. This distinct Crimean mountain relict species is easily recognized by several characters; at present it has no geographical junction with

the other species in its group, neither with O. simplicissimum which does not grow in the steppe part of the Crimea nor with O. fruticosum Labill., which is endemic to Cyprus. However, some specimens with leaves to 0.5—0.7 mm broad and canescent-green, sparse hairs tend towards these species, especially towards O. simplicissimum.

3. O. **simplicissimum** L. Sp. pl. ed. 2 (1762) 196; Ldb. Fl. Ross. III, 127; Shmal'g., Fl. II, 240; Kryl., Fl. Zap. Sib. IX, 2284; Fl. Yugo-Vost. VI, 120. — O. simplex Gaertn. Fruct. I (1788) 325. — O. sibiricum Lam. III. Gener. I (1791) 407. — O. tanaiticum Klokov in Bot. Zhurn. (Kiev) VI, 3 (1949) 72—73. — Ic.: Gaertn. l. c. tab. 67; Bot. Mag. XLVIII, tab. 2248; M. B. Cent. pl. rar. III, tab. 57. — Exc.: GRF, No. 128.

Perennial; subshrub, sometimes (in northern part of its distribution) a nearly herbaceous plant; branches elongate or reduced from base; old brown branches covered with remnants of white epidermis, without leaves; leaves of sterile shoots more remote than in O. polyphyllum, cauline leaves still more remote, all linear or broadly lanceolate-linear, acute, more or less canescent, with appressed, small and large bristles on tubercles, on petioles or at margin of leaves sometimes slightly spreading, the margins slightly rolled, 3—5 mm long, 2—4 mm wide. Fertile stems 10—20 cm high, sturdy, erect, simple, canescent, with appressed down; inflorescence small, usually furcate, of 2 scorpioid cymes, compressed in flower, markedly elongating and straightening in fruit; pedicels short; calyx 6—8 mm long in flower, angular in fruit, to 13 mm with appressed gray bristles; sepals linear, acute; corolla broadly tubular-campanulate, ca. 18(20) mm long, 2—3 times as long as calyx, glabrous, pale yellow; anthers not exserted from corolla, slightly shorter than filaments, these broadening at base, their appendage short, scabrous; nectary glabrous or short and sparingly pubescent; nutlets 2.5 mm long, smooth, lustrous, dark gray with well developed shoulders. May—July.

Stony steppes or exposed rocks, rarely in loess or sandy steppes, sometimes in sparse forests and on cliffs, in the mountains of Altai to 1,300 m. — European part: V.-Don, L. Don, V.-Kama, Transv., L. V.; West Siberia:
196 U. Tob., Irt., Alt.; East Siberia: Ang.-Say. (western part); Centr. Asia: Ar.-Casp. (northern part), Balkh., Dzu.-Tarb. Southern limit about 47° N., the northern at 55° N., eastward to the upper reaches of the Yenisei, west to the Dnieper. Endemic. Described from Siberia. Type in London.

Note. This enormously widespread endemic of the steppe belt varies considerably in the width of the leaves, from narrowly linear with strongly rolled margins to flat, lanceolate-linear. M. V. Klokov described the very narrow-leaved race with sericeous, completely appressed hairs from the Middle Don as O. tanaiticum Klokov "Botanichnyi zhurn.," 1949 (VI, 3, 72—73 and Note, pp. 74—75)), claiming O. tanaiticum and O. simplicissimum to differ in "small but numerous characters, as presented in the comparative table." He also proposed series Simplicissima Klok. for these two species, "which do not manifest any close phylogenetic relationship to other species of the genus."

Group 2. **Praehimalaica** M. Pop. — Herbaceous perennials. Corolla dark wine-red, black-violet, when dry. Stems not branching. Nectary

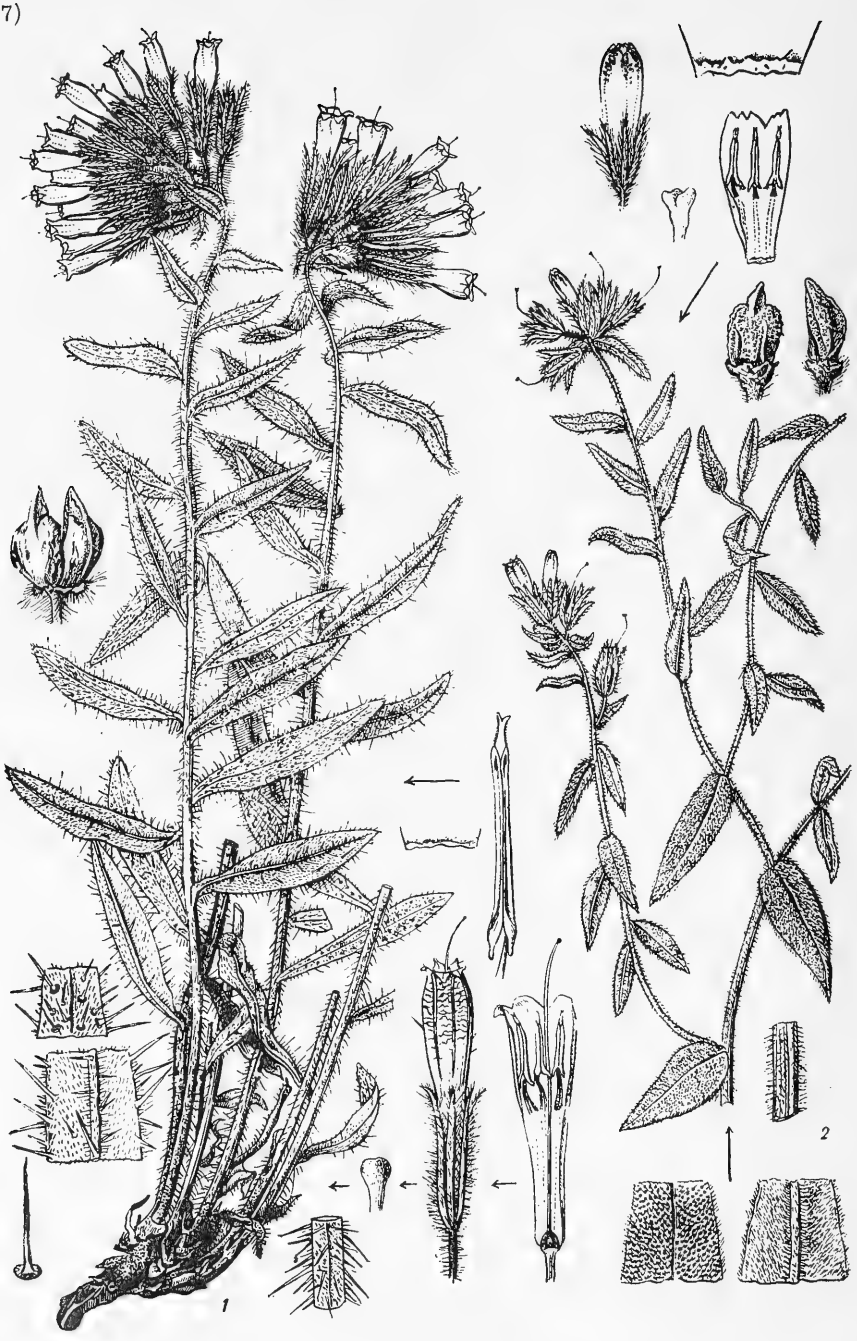

PLATE X. 1 — Onosma atrocyaneum Franch; 2 — O. ferganense M. Pop.

hairy. Filaments shorter than anthers; stigma capitate, not 2-lobed. Canescent pubescence, with markedly spreading long bristles. — Confined to the Pamir area, in the Himalayan section of Iranian Province, in mountains.

4. O. atrocyaneum Franch. in Ann. Sc. nat. sér. VI, XVIII (1884) 214; Lipskii in Tr. Bot. Sada, XXVI, 496; O. and B. Fedch., Perech. rast. Turk. V. 45.

Perennial; root multicipital; stems few, 10—35 cm high, simple, white, with short, coarse down and long, horizontally spreading or retrorse bristles exceeding diameter of stem; radical rosettes lacking; cauline leaves rather numerous, horizontal, lanceolate or oblong-lanceolate, 3—5 cm long, 0.5—1.5 cm wide, sessile, short-acuminate, velutinous-canescent with short coarse down beneath, slightly green above, with sparse, long, spreading bristles along nerve beneath and along margins. Inflorescence capitate, mostly of 1 compact scorpioid cyme; pedicels thin, rather long, to 8(10) mm, bristly-villous; bracts lanceolate, shorter than calyx, calyx ca. 15 mm long, with not very coarse or dense white bristles; calyx lobes linear, acute, little elongating in fruit (to 20 mm); corolla 25—30 mm long, tubular or claviform, with gaping throat, black-blue (dark violet), glabrous outside, with
199 short curved teeth; anthers not exserted, pale, nearly as long as filaments, these slightly broadening distally, adhering only by bases; appendage deeply 2-toothed; nectary hairy; nutlets 5 mm long, with acute lateral rib, gray, slightly plicate-tuberculate, lustrous, without verrucose tubercles. May—August. (Plate X, Figure 1.)

Rocky and stony slopes in upper mountain belt, Central Asian juniper woodland, mainly on Paleozoic limestones. — Centr. Asia: Pam.-Al. (from Alai Range to Kulyab). Endemic. Described from Upper Zeravshan, from Novobad. Type in Paris.

Note. The only relationship of this exquisite species is with the Himalayan O. hookeri Clarke and O. thomsoni Clarke which are similar in the color of the corolla and the pubescence of the nectary.

5. O. maracandicum Zak. in Tr. Uzb. Gos. univ. Nov. ser. No. 28, Biologiya, 15(1941) 22. — Ic.: Zak. l. c. fig. 9.

Perennial; like the preceding, but corolla ca. 20 mm long, leaves shorter and wider, the tufts more compact. A doubtful species, possibly a hybrid of O. atrocyaneum × barsczewskii.

Central Asia: Pam.-Al. (only in mountains near Samarkand, Agalyk village). Type in Tashkent.

Group 3. **Ferganica** M. Pop. — Corolla 20—30 cm long, sky-blue or bluish, rarely yellow, color not changing. Nectary more or less hairy. Stems with axillary branches in upper half or sterile or with short inflorescence. Perennial herbs without radical rosettes. Stigmas 2-lobed; calyx little elongating in fruit. Nutlets finely tuberculate-verrucose, dull.

6. O. azureum Schipcz. in Bot. mat. Gerb. Bot. Sada, II, 24—25 (1921) 93.

Perennial; multicaulescent from multicipital root; stems erect, slightly angular, 30—40 cm high, with short appressed hairs, with dense lanceolate leaves, nearly along entire stem axillary buds produce thin, sterile branches with elongate, linear leaves producing an unusual habit; stems bluish in lowest part, with apical inflorescence; leaves lanceolate, gradually long-acuminate, 4—5 cm long, in lower part 0.5—1 cm wide, subsessile, declined, green, covered with large flat tubercles bearing very short, appressed bristles, long spreading bristles absent. Inflorescence crowded, compressed, with 1 or 2 short, few-flowered scorpioid cymes; pedicels thin, 5—8 mm long, like calyx base covered with spreading bristly villous hairs; bracts lanceolate-linear, shorter than calyx; calyx 12—15 mm long, with long, lanceolate-linear, dense sometimes yellow, semi-appressed bristles, nearly sericeous; corolla, 23—25 mm long, broadly tubular-campanulate,
200 with gaping throat, sky-blue, with short broad curved teeth, pale in lower part, slightly downy but without verrucae along ribs outside under teeth; anthers not exserted, connate only at base, their terminal appendages deeply 2-toothed, the filaments broadening slightly below, slightly shorter than anthers; nectary hairy; nutlets 5—6 mm long, with nearly rectangular body abruptly tapering to short beak, pale, wrinkled at sides, entire surface densely and finely tuberculate, not lustrous. June. (Plate XI, Figure 1.)

Centr. Asia: T. Sh. Endemic. Described from former Andizhan district (ascending on Kizyl-Su, flowers, 11 VI 1911, Knorring and Minkwitz, No. 1023). Fertile specimens also from the Kugart River gorge between the estuary of the Kizyl-Su River and Katyn-Ak-Chek, forest along the river, 2 VI 1911, Knorring and Minkwitz, No. 371. Type in Leningrad.

Note. A very unique species resembling the average Chinese species of section Protonosma in the sky-blue corolla, branching stem and nutlets, but anthers coherent in the tube, the corollas small, the filaments villous at base.

7. O. **brevipilosum** Schischk. sp. n. in Addenda XVIII, 704.

Perennial; multicipital root produces numerous 40—50 cm high, angular stems, covered with short appressed hairs; leaves declined, lanceolate, 4—6 cm long, 8—10 mm wide, gradually long-acuminate, sessile, flat, covered with small and slightly larger, completely appressed bristles borne on large tubercles, without long spreading bristles, with lanceolate leaves bearing sterile branches especially in upper half in their axils, base of stems bluish. Inflorescence at apex of stem of 1—2 small but compact scorpioid cymes; pedicels thin, short; calyx semi-appressed with long gray bristles, ca. 10—12 mm long, with linear lobes; corolla yellow, tubular, contracted in throat, 15—18 mm long, with short teeth, glabrous outside but rugose-tuberculate along ribs under teeth; filaments slightly broadening, shorter than anthers; nectary glabrous. May.

Centr. Asia: T. Sh. (Fergana Range, subalpine meadows along the Uraks River near Kenkol, flowers, 29 V 1899, Litvinov). Endemic.

Very much like O. azureum Schipcz., but corolla yellow, constricted in the throat, large-verrucose outside along ribs, and nectary glabrous.

8. O. **ferganense** M. Pop. sp. n. in Addenda XVIII, 703.

Perennial; entire plant covered with short spreading gray down, velutinous; multicipital root bears few stems, ca. 40—50 cm high, angled, densely

201 spreading-downy, without long bristles, in upper half with long, axillary branches terminated by short inflorescences; leaves declined, sessile, oblong-lanceolate, 4—5 cm long, 1—1.5 cm wide, gradually acuminate, canescent, nearly velutinous, above with thin spreading bristles borne on large tubercles; leaves of axillary branches lanceolate, $\frac{1}{2}-\frac{1}{3}$ as long. Inflorescences very short scorpioid cymes, elongating in fruit; pedicels short, with short gray villous hairs; calyx gray downy-villous, 7—10 mm long, slightly elongating in fruit, with linear lobes; corolla tubular, hardly claviform, constricted in throat, 17 mm long, glabrous outside, yellow, with bluish ribs and throat, tuberculate-verrucose along ribs; anthers not exserted, slightly shorter than filaments, slightly expanding below; nectary subglabrous; nutlets 5 mm long, erect, with rectangular body, abruptly tapering towards apex, light gray, finely tuberculate-verrucose, dull. June. (Plate X, Figure 2.)

Centr. Asia: Fergana Range (near the Kenkol Pass, flowers, fruit, 17 VI 1899, Litvinov). Type in Leningrad.

Note. Distinctly related to O. azureum by its nutlets and to O. brevipilosum by its corollas, but distinguished from both in the thick, velutinous, gray down, the broader leaves and the longer axillary branches bearing inflorescences. The peculiar concentration of closely related species on Fergana Range leads to the hypothesis that they are the result of some recent crossing involving O. atrocyaneum. This is corroborated by the presence of similar forms with verrucose corollas in Upper Zeravshan, in the distribution area of O. atrocyaneum.

9. O. trachycarpum Levin in Bot. mat. Gerb. Bot. inst. AN SSSR, XII (1950) 223, cum ic.

Perennial; root multicipital, producing few 20—40 cm high stems, these not branching or with few long or with numerous branches always terminated by short inflorescence; stems white, with short coarse down besides long thin horizontal or even retrorse bristles (as in O. atrocyaneum); leaves elongate, 5—10 cm long, 1—2 cm wide, oblong-lanceolate or oblong, obtuse, sessile or tapering towards base, soft with long spreading bristly pubescence on nerve above and along margins, short-hairy or subglabrous between bristles (on tubercles), in the former case canescent as in O. atrocyaneum, in the latter green as in O. irritans. Inflorescences short, of compact scorpioid cymes, these often solitary at ends of stems and branches or main stem with bifurcate cyme; pedicels short, spreading, thinly white-
202 bristly; bracts lanceolate, short; calyx not very stiff, with thin white semi-spreading bristles, ca. 10 mm long, slightly accrescent in fruit, with linear, obtuse lobes; corolla bluish, 15—18 mm long, broadly tubular, its throat gaping or slightly constricted, nearly entirely glabrous, more or less verrucose-tuberculate along ribs outside, with short curved teeth; anthers nearly not exserted, slightly shorter than the proximally slightly broadening filaments, their appendage short, abruptly 2-toothed; nectary glabrous or sparingly pubescent; nutlets 4 mm long, pale gray, abruptly tapering to beak, finely tuberculate-verrucose, slightly lustrous. June—July. (Plate XI, Figure 2.)

Stony slopes, mountain belt, Central Asian juniper woodlands. — Centr. Asia: T. Sh. Endemic. Described from the northern slope of Kirghiz

Range (gorge of Aksa River, flowers, fruit, 7 VII 1916, Zinserling and E. Zvyagintseva, No. 1121, greener form; descending from Kotonuzbe, fruit, 24 VII 27, Nikitina, No. 109; former Andizhan district, Air-Tash Mountain, Kaike-Bel Pass, flowers, 24 VI 1911, Minkwitz, No. 1315, gray-downy). Type in Leningrad.

Note. This species rather close to O. atrocyaneum with its long, spreading bristles on stems and leaves, as well as in the size and shape of the leaves, but corolla and nutlets are identical with the two preceding species. The Andizhan specimens are closer to O. atrocyaneum; those from the Kotonuzbe are intermediate between them and the type.

Somewhat related to O. trachycarpum is the form from Upper Zeravshan (Kuli-Kalon Lake, flowers, 30 VI 1911, Lipskii, No. 4187), obviously a hybrid of O. atrocyaneum × O. barsczewskii, with bluish corolla, 20 mm long, tuberculate-rugose along ribs. Leaves, pubescence and stigma are as in O. atrocyaneum.

Group 4. Turanica M. Pop. — Corolla sky-blue. Stems many, thin, low, white, simple or branching. Short leaves covered with coarse spreading bristles. Radical rosettes lacking. Nectary glabrous. Stigma shortly 2-lobed, nearly entire, not capitate. Nutlets smooth, lustrous. Root very thick, multicipital, black, not red. — Limestone in desert belt, in Turan in the Caspian area.

10. O. leucocarpum M. Pop. from Bobrov in Tr. Bot. Sada, XLIV (1931) 71 et 78, nomen et locus classicus; descr. in Bot. mat. Gerb. Bot. inst. AN SSSR, XII, 225, from Figure.

Perennial; even when very old root does not crumble into bundles under the bark as distinctly as O. stamineum; stems 10—30 cm mostly ca.
203 15—20 cm high, simple, branchless, slightly thickish, yellow at first, after flowering white, covered with short, coarse, retrorse down mixed with single spreading bristles or the latter absent; leaves acute, rather dense on stems, 1—2 cm long, in the robust specimens to 3 cm long, linear-lanceolate, sessile, stiff, declined, with crisped, uneven, thickened margins, green, with coarse long spreading bristles, and short, slightly thicker bristles. Inflorescence terminal, usually of one compact scorpioid cyme not straightening or elongating in fruit, with dense long spreading white bristles; pedicels very short, none exceeding 5 mm in length; bracts lanceolate-linear, not long; calyx with very long spreading white bristles, its lobes linear, acute, very strongly elongating in fruit, 20—30 mm long (in flower 15 mm); corolla sky-blue, 25—30 mm long, tubular, gradually expanding towards gaping throat, with small, triangular, curved teeth, glabrous, not verrucose outside; anthers adherent only by base, their apices exserted from corolla, approximately as long as the distally slightly broadening filaments, 8 mm long; nectary lobate, glabrous; nutlets ca. 5 mm long, smooth, lustrous, pale gray, without shoulders, gradually tapering to beak, gibbous. April—June.

Rocks and stony taluses. — Centr. Asia: Mtn. Turkm. (Greater Balkhan Range). Endemic. Described from the Kulidzh Gorge (350 m, in rock crevices, flowers, 3 VI 1928, Bobrov and Yarmolenko, No. 297). Type in Leningrad.

11. O. stamineum Ldb. in Eichw. Pl. casp.-cauc. (1833) 10; Fl. Ross. III, 123; Boiss. Fl. or. IV, 184; Lipskii in Tr. Bot. Sada. XXVI, 379. — O. cyaneum Less. ex Ldb. Fl. Ross. III, 123. — Ic.: Eichw. l. c. tab. 3.

Perennial; root under bark disintegrating into cordlike bundles; stems many, 15—30 cm high, simple, rarely (when apex damaged) branching, stiff, white, covered with short, retrorse, nearly appressed down, with or without solitary spreading bristles; leaves 1—2 cm long, oblong-linear or lanceolate or even oblong, small, declined, dense, coarse, with uneven, undulant margin, with coarse spreading bristles on large tubercles, and small prickly bristles. Inflorescences short, few-flowered cymes not elongating in fruit; pedicels 1—2 mm long; bracts short, oblong; calyx 10 mm long in flower, in fruit not exceeding 15 mm, white-bristly, with linear obtuse lobes; corolla sky-blue, tubular-funnelform, with broadly spreading throat and small, triangular, curved teeth, glabrous outside, 15 mm long; anthers adnate
204 to tube for entire length, exserted from corolla, 7—8 mm long, with long, slightly 2-toothed, white-scarious appendages; filaments longer than anthers, not broadening below; nectary lobed, glabrous; nutlets 3 mm long, smooth, lustrous, pale gray, gradually tapering to beak. May—June.

Limestones, chalks. — Centr. Asia: Ar.-Casp. (lower Emba to southern Chink Ust-Urt and Karabugaz, also Mangyshlak). Endemic. Described from the eastern shore of the Caspian. Type in Leningrad.

Note. Differs from the preceding species in the shorter leaves, calyces and corolla, and the small nutlets, but mainly in the completely exserted anthers. Geographically there is no contact between these two species.

Group 5. Chorassanica M. Pop. — Perennial, polycarpic herbs. Stems low, simple, produced from thick multicipital root. Radical rosettes present. Leaves with spreading white bristles. Scorpioid cymes dense, capitate, not straightening or elongating in fruit. Calyx on short thin pedicels, with appressed white hairs, slightly elongating in fruit, with descending, narrow linear lobes. Corolla reddish, tubular, 8—10 mm long, with lanceolate, acute, erect teeth as long as tube; anthers free, their appendages long, thinly acuminate, not truncate or 2-toothed, extending nearly to apices of corolla teeth; filaments very short. Nectary sparingly pubescent. Stigmas nearly not exserted from corolla. — Khorasan, Kopet Dagh.

12. O. longilobum Bge. Heliocarya (1871) 12; Boiss. Fl. or. IV, 183. — Ic.: Probl. bot. I (1950) 101, Fig. 2.

Perennial; entire plant white-villous-bristly, with thin bristles; root multicipital, thick, its dark red bark yielding dye; rosettes and stems bearing some resemblance to closely appressed tufts; stems 10—20 cm high, white, with short coarse down and dense, short, thin, spreading bristles, thin, often ascending, simple; leaves of radical rosettes oblong-oblanceolate, gradually tapering to thin, long bristly petioles, 3—10 cm long, to 1 cm wide, acute, with long spreading bristles, with short-coarse down between bristles; cauline leaves few, caducous, lanceolate or oblong-lanceolate, acute or obtuse, declined, sessile, 1.5—3 cm long, 4—8 mm wide, often canescent, with dense down and spreading bristles or greenish. Scorpioid cymes dense, capitate, single, rarely 2, at tips of stems, not straightening, not loose in fruit;

pedicels thin, the lower fruiting, to 5—7 mm long with spreading thin bristles; bracts lanceolate-linear, shorter than calyx; calyx small, ca. 10 mm long in flower, to 13 mm in fruit, densely semi-appressed, later semi-spreading, inside mainly with white hairy bristles, with narrowly linear, obtuse, soft
205 lobes not divergent in fruit, calyx readily abscissing with nutlets; corolla reddish-violet, not changing color, 8—10 mm long, tubular, glabrous, its teeth erect, narrow, acute, unusually long for the genus, folded lengthwise, as long as tube, i. e., 4—5 mm; appendages of anthers thinly acuminate, anthers (with appendage) 4 mm long, filaments gradually broadening towards base; nectary hairy; nutlets ca. 4 mm long, narrow (oblong), completely smooth, white or slightly greenish, without spots, with short beak. May.

Frequent on limestone, rare on pebbly slopes, 1,000—2,600 m. — Centr. Asia: Mtn. Turkm. (Kopet Dagh). Gen. distr.: Iran. (Khurasan). Described from N. Iran. Type in Paris.

Group 6. Praepamirica M. Pop. — Corolla 15—20 mm long, yellow, reddening after flowering, the tube markedly enlarged in upper part, slightly constricted in throat, glabrous outside; anthers connate only at base, slightly exserted. More or less spreading-bristly; nectary glabrous. Stigma capitate. Perennial herbs with rosettes. Stems not branching, white. Pamir area, in mountains.

13. O. zerizaminum Lipsky in Tr. Bot. Sada, XXVIII (1908) 44.

Perennial; root medium thick, black-red, multicipitate, producing to 10(15) white stems, these bluish at first, simple, 20—40 cm high, thin, covered above with sparse appressed down, without long bristles; leaves in rosettes lanceolate or linear, attenuate to long ciliate petiole, cauline leaves sessile, all leaves elongate, acute, coarse, declined, median cauline leaves 2—4 cm long, (1.5)2—5 mm wide, with appressed, rarely semi-appressed thin bristles on both surfaces, and few, horizontally spreading bristles along margin, appearing ciliate, canescent, 1-nerved. Inflorescences capitate, of one compact scorpioid cyme; pedicels very short; bracts lanceolate, extending to apex of calyx; calyx with soft gray bristles, white-pinnate along margin of linear, obtuse sepals, calyx 10 mm long in flower, to 15 mm in fruit; corolla ca. 18 mm long, tubular below, markedly enlarged above, with constricted throat, glabrous with short curved teeth, yellowish turning pink or red; anthers 6 mm long, not exserted, connate only at base, longer than filaments, these with sharp, nearly rounded base; nectary glabrous; nutlets 5 mm long, gradually tapering to 2-keeled beak on sharply defined shoulders, pitted-rugose. July. (Plate XII, Figure 1.)

206 Stony slopes and taluses in subalpine zone. — Centr. Asia: Pam.-Al. (from Alai Range to Darvaza; not in Upper Zeravshan). Endemic. Described from Karategin, Zerizamin River (17 VII 1897, Lipskii, No. 755). Type in Leningrad.

Note. Some small individuals have narrowly linear leaves, 1.5—2 mm wide, and are externally very distinct (e. g., Korzhinskii's specimens from Katta-Karamuk, Golbek's from Gardaneh-Kaftar).

14. O. barsczewskii Lipsky in Tr. Bot. Sada, XXVI (1909) 494. — O. albicaule M. Pop. in N. A. Dimo, Pochv. eksp. bass. Syr-Dar. and Amu-Dar. II (1916) 69. — Ic.: M. Pop., op. cit. tab. 18.

Perennial; the thin, black-red root produces few (1—5), 25—50 cm high, rather thin, white, simple stems covered above with appressed down, without long bristles; leaves on stems rather crowded, rosettes few, poorly developed, often absent; leaves of rosettes elongate, 10—15 cm long, lanceolate, gradually tapering to petiole, acute, cauline leaves lanceolate, often oblong, usually tapering gradually from wide sessile base to apex, acuminate, 1-, often 3-nerved, canescent, coarse; median leaves 5—8 cm long, 1—2 cm wide at base, with appressed bristles (later semi-appressed) on both surfaces and semi-spreading bristles on petioles and along margin. Inflorescence a compact, capitate, solitary scorpioid cyme terminating stems, rarely cymes double, not elongating or straightening in fruit; pedicels very short, the lower to 5 mm long, villous-bristly; bracts lanceolate, covering calyx; calyx with soft gray bristles, semi-spreading along margin, 12—14 mm in flower, 15—16 mm in fruit, with linear, acute lobes; corolla tubular, less broadening in upper part than in O. zerizaminum, distinctly tapering in throat, with small teeth, 18—20 mm long, yellow turning pink and eventually violet-red, glabrous outside; anthers nearly not exserted, connate only at base, slightly longer than the filaments, these faintly broadening below; appendage with 2 acute teeth. Nectary glabrous; nutlets ca. 5 mm long, in profile square, sharply tapering to beak, lustrous, pitted-rugose at sides. May—June.

Stony slopes, red sands, rarely loess slopes in mountain belt, ca. 1,000—1,500 m, in semi-steppe and Central Asian juniper woodland belt. — Centr. Asia: Pam.-Al. (from Upper Zeravshan to Darvaza (Pyandzh) to the south). Endemic. Described from Gissar Range (Kara-Tag Gorge, near Khakimi village, flowers, 8 VIII 1882, A. Regel'). Type in Leningrad.

Note. This species is highly variable in the width of the leaves (narrowly)
207 lanceolate or nearly ovate), and in its pubescence (slightly or densely gray). O. albicaule Pop. differs from the type in low growth, narrow, lanceolate-linear, 1-nerved leaves, and more dense and bristly, gray pubescence. It is endemic to foothills, semi-deserts and above all to the red sands of Guzar and Kelif and extends to Samarkand (Agalyk) in the north.

Group 7. Tianschanica M. Pop. — Corolla large, 25—30 cm long, yellow, after flowering brown, not red or blue; anthers fused laterally into conical tube, slightly exserted; stigma 2-lobed; nectary glabrous; fruiting calyx with markedly elongating lobes. Perennial, rarely biennial?, herbs with coarse bristly spreading hairs, elongate lanceolate-spatulate leaves and distinct radical rosettes; stems thick, not white, simple. — Pamir area, Tien Shan, Altai, NW Mongolia (Altai), W. Sayans (to Yenisei).

15. O. gmelini Ldb. Fl. alt. I (1829) 184; Fl. Ross. III, 126; Stev. in Bull. Soc. Nat. Mosc. XXIV, 588, 592; Kryl., Fl. Zap. Sib. IX, 2283. — O. echioides var. gmelini (Ldb.) Kryl., Fl. Alt. IV (1907) 881. — ?O. cashmiricum Jonnston in Journ. Arnold. Arbor. XXI, 1 (1940) 50. — Ic.: Rchb. Pl. crit. IV, tab. 380; Ldb. Ic. Fl. Ross. III, tab. 280.

Perennial; the rather thin root produces several (1—5), thick (3—4—5 mm across), 20—50 cm high, usually bluish, rarely green stems, these not branching, often ascending, densely covered with thin, long, spreading bristles often yellow in upper part, with very loose coarse down between them; leaves of radical rosettes lanceolate-spatulate, elongate, to 15 cm long, 1.5 cm wide, gradually tapering to petiole with long spreading bristles, cauline leaves antrorse, not long, 3—4 cm, 4—6 mm wide, oblong-linear or lanceolate, sessile, obtuse or short-acuminate with thin long semi-spreading bristles, upper leaves reduced, often with yellowish bristles and slightly stiff down between bristles. Inflorescences capitate of 1—2 cymes at apex of stems, dense and drooping in flower, straightening and elongating in fruit; pedicels very short, to 2—3 mm, with spreading bristles; bracts lanceolate, bristly, shorter than calyx; calyx with long, white or yellow, spreading bristly hairs, 12—17 mm, in fruit ca. 20 mm long, its linear, acute lobes converging in fruit; corolla pale yellow, turning brown, glabrous, broadly tubular, gradually broadening in throat, gaping, 25 mm long, with small, triangular, curved teeth; anther tube ca. 8 mm long, apex (mainly
208 appendages) exserted, longer than slightly broadening filaments; nectary glabrous, spatulate; nutlets oblong, 5 mm long, gradually tapering to beak, smooth, lustrous. May—June—July.

Stony slopes, rocks, rarely in steppes in the mountain-steppe belt. — West Siberia: Alt.; East Siberia: Ang.-Say. (W.); Centr. Asia: Dzu.-Tarb., T. Sh., Pam.-Al. (to Upper Zeravshan). Gen. distr.: NW Mongolia, Kashmir. Described from S. Altai (between Cheremshanka and Butakova, flowers, 28 IV 1828, Ledebour). Type in Leningrad.

Note. The Pamir area specimens (from Mogoltau, Upper Zeravshan) differ slightly from the Altai type in being perennial, with acute leaves, more coarse hairs, larger corolla, becoming dark brown after flowering and looser fertile racemes. In general the three species of the group are very close, and linked by several transitions. The species may grow in the central Kazakhstan hills (Kara-Kingir, Ulutau).

16. O. irritans M. Pop. ex Pavl. in Acta Univ. As. Med. ser. VIII-b. Bot. 19 (1935) 29 et Ind. Kewensis, Suppl. IX (1931—1935) (lapsu: irrigans, quod est nomen absurdum!).

Perennial; stems thick, simple, few, 20—40 cm high, white-green, like leaves covered with spreading thin, long, pure white bristles to 4—5 mm long; radical and cauline leaves elongate, median cauline leaves 4—7 cm long, 4—5 mm wide, nearly broadly linear or lanceolate-linear, with nearly parallel margins, radical leaves tapering to long petiole, the cauline sessile, all leaves acute, green; short hairs absent between long bristles. Inflorescences capitate at apex of stems, usually of 1 large, dense, erect scorpioid cyme not elongating in fruit; bracts lanceolate, as long as calyx; calyx on very short, white-bristly stipe, with very long sparse white bristles, its long, linear, acute, slightly diverging lobes ca. 20 mm long in flower, to 25 mm in fruit; corolla 25—27 mm long, broadly tubular, gradually and slightly broadening in throat, gaping, yellow, turning dark brown, with short triangular teeth; pollen tube ca. 10 mm long, with only appendages exserted; filaments slightly shorter than anthers, slightly broadening; nectary glabrous; nutlets 5 mm long, very gibbous (curved), dark gray, lustrous,

rugose-pitted and tuberculate, mainly at sides, gradually tapering to beak. May—June.

Rocks, gravels, semi-steppe belt. — Centr. Asia: T. Sh. (Chu-Ili Mountain, Kara-Tau, adjacent parts of Trans-Ili Ala-Tau, Kirghiz Range, Talas Ala-Tau). Endemic. Described from Andrakai, a natural landmark in Chu-Ili Mountains (Krasnov, 1886, flowers). Type in Leningrad.

209 Note. This species seems to extend farther east than Tien Shan (Kuldja, A. Regel) and westward in the Pamir area to the Turkestan Range (Minkwitz). Its type (Chu-Ili Mountains) is remarkably distinguished from O. gmelini by the narrow, green, long leaves, very long white bristles, elongated sepals and tuberculate fruits.

17. O. baldshuanicum Lipsky in Tr. Bot. Sada, XXVI (1909) 504. — Ic.: Probl. bot. I (1950), Fig. 8.

Perennial; root thin, multicipital; stems 1—5, 20—50 cm high, often ascending, brown or green, not turning blue, subglabrous, covered only with sparse, long horizontally spreading bristles; leaves oblong or oblong-lanceolate, much wider than those of either O. irritans or O. gmelini, longer than the latter, median cauline leaves 5—7 cm long, ca. 1 cm wide, green, stiff (in fruit), radical leaves to 15 cm long, 2 cm wide, gradually tapering to long bristly-ciliate petiole, cauline leaves sessile, all leaves short-acuminate or obtuse, covered only with sparse, long, spreading white bristles especially profuse along margin of leaf. Inflorescence 1, rarely of 2 compact, drooping scorpioid cymes at tips of stems, straightening but remaining compact in fruit; pedicels very short, the lower hardly 2—3 mm long, bristly; bracts lanceolate, shorter than calyx; calyx in flower 20 mm long, canescent, appressed, elongate-long-bristly in fruit 30 mm long, with broadly linear acute lobes; corolla 30—32 mm long, yellow, turning black-brown, gradually broadening towards throat, gaping, with short triangular teeth, glabrous; tube 10—11 mm long, filaments slightly broadening, shorter than tube, appendages hardly exserted; nutlets 6 mm long, ovoid, brown-gray, smooth, lustrous, gradually tapering to beak. May.

Stony slopes, especially red sands, 1,000—1,500 m. — Centr. Asia: Pam.-Al. (from Alai Range to Kulyab, i. e., Pyandzh in the south). Endemic. Described from Bal'dzhuan in Tadzhikistan, from the Chorab-Dara stream (flowers, V, 1883, Musa). Type in Leningrad.

Note. In the eastern part of Alai Range and Fergana Range this species merges with O. irritans, from the type of which it differs distinctly by the broad (1—2 cm) leaves, larger flowers and nutlets, and wider sepals. The narrower specimens from Mada (Alai Range), which retain all the typical characters of O. baldshuanicum, have much thicker and thinner bristles, more like O. irritans. The specimens from Gulcha are even closer to O. irritans by the smaller growth, but have narrower leaves and sepals than O. baldshuanicum; the nutlets are 7 mm long and smooth, as in O. baldshuanicum. Such plants may occur in Taran-Bazar (Fergana Range).

210 Group 8. Praemontana M. Pop. — Corolla yellow, turning brown, in one species turning pink or blue, 20—30 mm long; anthers connate only at base,

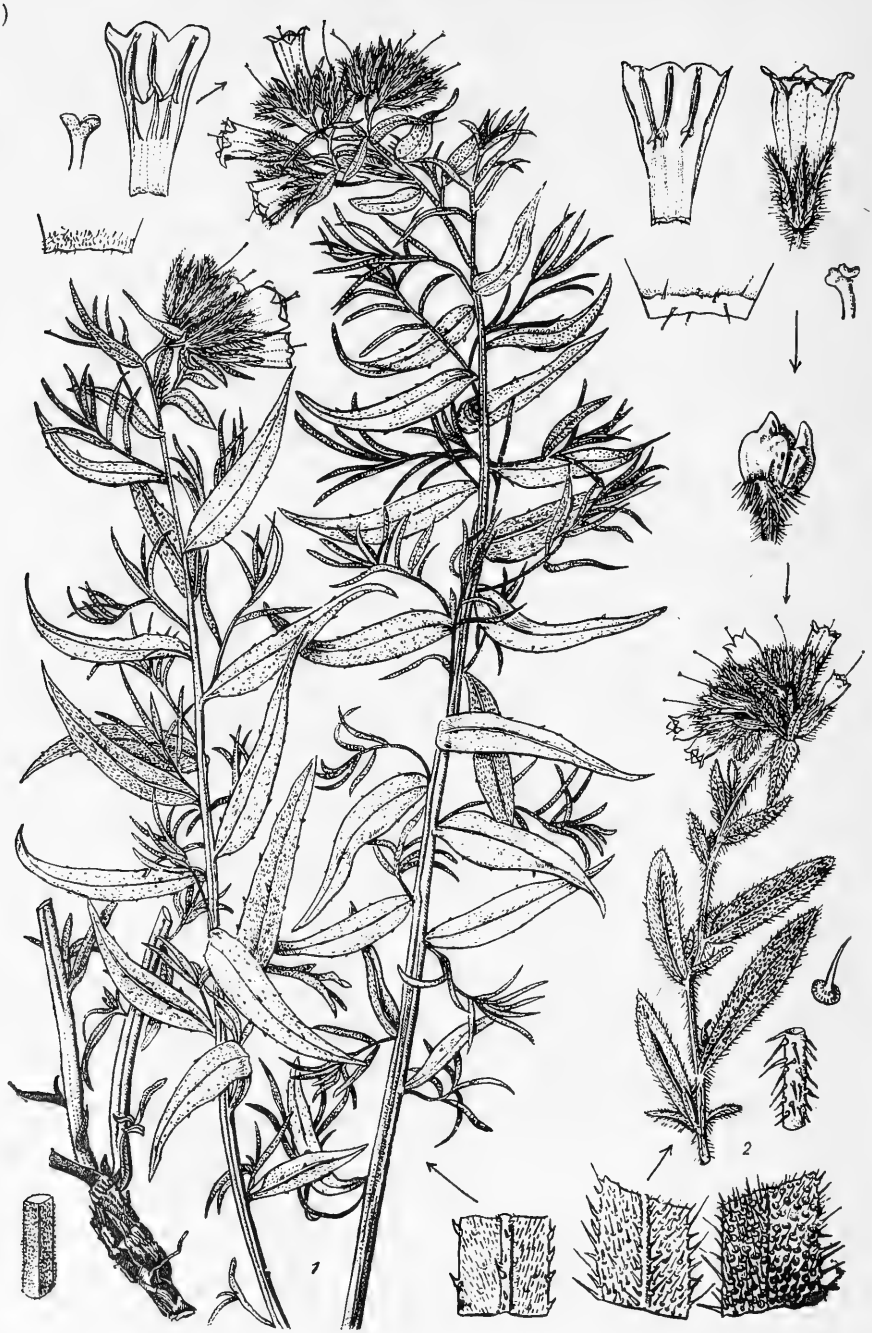

PLATE XI. 1 — Onosma azureum Schipcz; 2 — O. trachycarpum Levin.

longer than filaments; nectary glabrous; stigma 2-lobed; calyx markedly elongating in fruit, spreading-coarse-bristly. Stems branching above with numerous cymes. Biennial high herbs, with thick stems, narrow elongate leaves and radical rosettes.— Very widespread, from the Ili River in the east to the Atlantic Ocean in the west.

Note. This group is sympatric with Stepposa, which genetically is its later Pleistocene derivative.

18. O. dichroanthum Boiss. Diagn. pl. or ser. 1, 11 (1849) 107; Grossg., Fl. Kavk. III, 272.— O. strigosum Stev. in Bull. Soc. Nat. Mosc. XXIV (1854) 586, 594.— O. caspium Gruner in Bull. Soc. Nat. Mosc. XL, 4 (1867) 62, 441.— O. setosum β. dichroanthum Boiss. Fl. or. IV (1879) 181; Lipskii in Tr. Bot. Sada, XXVI, 499.— O. setosum δ. bucharicum Lipsky, op. cit. 503.— Ic.: Probl. bot. I (1950) 87, Fig. 7.

Perennial; stems 1—3, thick, 40—60 cm high, usually slightly reddish, sometimes bluish, with dense long spreading bristles, in upper part always with few short, rarely long branches, covered with short, rather dense, coarse down as well as thin long horizontal bristles; leaves elongate, broadly linear or lanceolate, to 15 cm long, 8—12 mm wide; in rosettes long tapering to bristly-hairy petiole, cauline leaves sessile, median leaves 5—8(10) cm long, 5—10 mm wide, appressed, canescent, with slightly rolled margins, with thin spreading bristles above and along midrib beneath especially along margins, also with bristly down, their apex obtuse or short-acuminate. Scorpioid cymes compact, drooping, usually forming short, narrow inflorescence, rarely paniculate, spreading; pedicels short, the lower to 10 mm long (in fruit), with dense white spreading bristles; bracts narrow, lanceolate-linear, acute, as long as calyx; fertile scorpioid cymes straightening and elongating; calyx semi-appressed in flower, in fruit with long dense spreading, white, never yellow bristles, calyx lobes long, 20 mm in flower, 25 mm in fruit, lanceolate or broadly liner, acute, slightly converging;
213 corolla long-tubular, ca. 30 mm long, gradually broadening towards gaping throat, yellow, pink and slightly blue after flowering, in Transcaucasian species (O. caspium) brilliant blue, glabrous outside, with small, triangular, curved teeth; anthers ca. 10 mm long (connate at base), much longer than filaments, scabrous, exserted with truncate appendages; nutlets 4—6 mm long, lustrous, spotted hence darkish, strongly gibbous, with sharply protruding sides, slightly tuberculate-pitted. April—June.

Loess foothills, often in secondary weedy localities, and in oases throughout mountainous Central Asia; variegated rocks along the Kura.— Caucasus: Dag., E. and S. Transc.; Centr. Asia: Dzu.-Tarb. (Dzungarian Ala-Tau), T. Sh., Pam.-Al., Mtn. Turkm. Gen. distr.: Iran. Described from foot of Demavend Mountain (near Ask, 23 VI 1943, Kochi, No. 383). Type in Leningrad.

Note. The Kura O. caspium and the Tashkent O. dichroanthum differ in many characters; in the first the leaves are narrower, the hairs coarser, the corolla turns blue. The Kopet Dagh specimens seem to be intermediate between these groups and ours, hence the need to distinguish several races or, for the time being, to establish one species distinguished from the related ones. The latter alternative is more rational, the more so as no Iranian material is available, and the relation of the type of O. dichroanthum to these groups cannot be determined.

19. O. setosum Ldb. in Pander's Beitr. Naturk. Ostseeprov. Russl. (1820) 70; Fl. alt. I (1829) 181; Fl. Ross. III, 126; Grossg., Fl. Kavk. III, 272; Fl. Yugo-Vost. VI, 122. — O. echioides auct. non L. — Ic.: Ldb. Ic. Fl. Ross. II, tab. 196.

Biennial; stems 1—3, 30—60 cm high, thick, whitish or green, with dense long spreading and thin bristles in upper half with branches terminated by inflorescences; sparing coarse down grows between horizontal bristles of stem; leaves elongate, ribbonlike or lanceolate, radical leaves spatulate, long-attenuate to spreading bristly petiole, to 10 cm long, 1 cm wide (rosettes badly preserved, as common in biennials), cauline leaves sessile, 5—10 cm long, 5—10 mm wide, obliquely antrorse, short-acuminate, spreading, bristly especially along margins. Inflorescence broadly paniculate with rather long lateral branches. Scorpioid cymes on lateral branches single, on main stem 2—3, rather compact, markedly elongating and straightening in fruit hence fertile stems broad above; bracts lanceolate, as long as calyx; pedicels short, the lower to 7 mm long, with spreading bristles; calyx 15 mm long,
214 with spreading white or yellow bristly hairs, reaching 20 mm in fruit, its lobes broadly linear, acute; corolla yellow, turning brown, not pink or blue, broadly tubular-campanulate, with gaping throat, glabrous outside, with short curved teeth; anthers ca. 8 mm long, scabrous, connate at base, slightly longer than the proximally broadening filaments, with bidentate, hardly exserted appendages; nectary glabrous; nutlets ca. 4 mm long, lustrous, dark gray, slightly plicate-pitted and tuberculate, strongly gibbous. May—June.

Stony and clayey semi-deserts. — European part: L. V. (semi-deserts in the Caspian area); Caucasus: Dag. (rarely on Caspian coast). Endemic. Described from Astrakhan. Type in Leningrad.

Note. In spite of the close relationship of this to the two preceding species, we recognize it as a local, Caspian group. Its distribution area is plausibly reported to extend to Grozny (Shmal'g., II, 240), and all three species of the group occur in Dagestan, O. dichroanthum in the south, O. armeniacum in the mountains, and O. setosum along the littoral; the first two at least produce hybrid forms. On the Main Range (S. Osetia, Dzaudzhikau, Dar'yal, etc.) there are sometimes found plants intermediate between O. armeniacum and O. calycinum or O. setosum.

20. O. armeniacum Klok. nom. n. in herb. et hoc loco. — O. hispidum Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 587, 592 non Wall. Cat. (1828) No. 938; G. Don, Syst. IV, 317. — O. echioides β. hispidum C. Koch in Linnaea, XVII (1843) 305.

Biennial; as the preceding but the leaves usually more crowded, narrower and more densely bristly; stems paniculate in upper part; stems and leaves in addition to bristles with profuse, coarse, sometimes very short down. Calyx in flower white-gray, with dense semi-appressed hairs, rarely yellowish, pedicel 10 mm long, markedly elongating in fruit; corolla narrower at first, more tubular, later gaping especially when young; villous-downy outside; anthers more strongly exserted from corolla.

Stony slopes, 500 to 3,000 m. — Caucasus: Dag., E. and S. Transc. Gen. distr.: Arm.-Kurd. (Lesser Armenia). Described from Georgia.

21. O. visianii Clem. in Att. 3 Riun. Sc. Ital. (1842) 519; DC. Prodr. X, 62; Ldb. Fl. Ross. III, 126.— O. echioides L. β. Sp. pl. ed. 2 (1762) 196; Stev. in Bull. Sos. Nat. Mosc. XXIV, 585, 593.—

Biennial; very close to O. setosum and O. armeniacum, but differing from the first in the denser canescent pubescence, more crowded and more ribbonlike leaves, more compact and bristly inflorescences, and
215 especially in the remotely downy corolla, which is glabrous in O. setosum; from the second it differs in the broader leaves, and from both by the slightly smaller, smooth nutlets. May—June.

Wormwood semi-desert, on slopes.— European part: Crim. (Feodosiya, Sudak, Alushta and others); Caucasus: Cisc. (Taman). Gen. distr.: Bal.-As. Min., Centr. Asia.

Note. Many authors, including Javorka and Levin, name this plant as O. arenarium W. et K., and they may be right. Others, e. g., Steven, call it O. echioides; if one refers to O. echioides Linnaeus, this, too, is correct; Shmal'gauzen (Fl. Sr. i Yuzhn. Ross. II, 240) seems to refer it to O. echioides var. setosum Ldb. (sp.), with O. visianii Clem. as synonym. O. echioides L. would be preferable if it had not been proven (Jávorka, Lakait) that O. echioides is an asterotrichous form which, according to Lakait, is widespread in Italy. The relationship between O. visianii and O. arenarium is not clear; they are probably identical although the latest flora, by Hegi, claims the flowers to be larger in O. visianii, smaller in O. arenarium; also in O. arenarium the corolla is described as glabrous. The steppe species with downy corolla distributed from Odessa to Kamenets-Podolski is very close (see O. calycinum Stev., in the Stepposa group). This latter group is surely derived from the Mediterranean group Praemontana.

22. O. microcarpum Stev. ex DC. Prodr. (1846) 62; Stev. in Bull Soc. Nat. Mos. XXIV, 588, 591.— O. microspermum Stev. in Bull. Soc. Nat. Mosc. XI (1838) 305, nomen nudum; Boiss. Fl. or. IV, 191; Grossg., Fl. Kavk. III, 273.— O. gmelini β. microcarpum Ldb. Fl. Ross. III (1849) 126.— O. spathulatum Wettst. et O. stapfii Wettst. in Denkschr. Akad. Wissensch. Wien L. (1885) 29.— O. microspermum α. spathulatum et β. stapfii Bornm. in Bull. Herb. Boiss. sér. 2, VII (1907) 783, Beih. Bot. Centralbl. XXVIII, 2, 468.— Ic.: Probl. bot. I (1950) 87, Fig. 3.

Biennial; stems 1—4, usually 20—40 cm high, ascending or erect, thickish, white-green, rarely with bluish tinge, commonly few-branched above, with thin, spreading, very long bristles and like leaves with coarse down; leaves rather short, rosettes drying early (before flowering), cauline leaves dense, spreading, 2—5 cm long, 5—6, rarely to 10 mm wide, lower leaves obtuse, spatulate, the upper obtuse or acute, sessile, with long, spreading, ciliate bristles. Inflorescences of 2—3 scorpioid cymes or narrowly paniculate, if lateral branches present then scorpioid cymes single. Scorpioid cymes rather compact, because of the small size of the calyx not large, in flower very much twisted with undeveloped sepals falcately curved, straightening
216 and elongating in fruit; pedicels short, bristly; bracts linear, shorter than calyx; calyx small, 8—12 mm long, to 15 mm in fruit, its lobes narrow, linear, acute, usually yellowish, rarely white, long-bristly, spreading in fruit,

with converging lobes; corolla 20—25 mm long, pale yellow, campanulate-claviform, with gaping throat and small curved teeth, glabrous or slightly villous-downy (hairs longer on teeth); anthers usually not exserted from corolla, connate only at base, their appendages slightly exposed, bidentate; filaments slightly broadening below, slightly shorter than 7 mm long anthers; nectary glabrous; nutlets ca. 3 mm long, dark gray, ovoid, rather abruptly tapering to beak, slightly tuberculate, smooth, lustrous. June.

Stony and rocky slopes, to 2,000 m. — Caucasus: Dag., E. and S. Transc. Endemic. Described from Georgia. Type in Leningrad.

Note. This species is a hybrid of O. armeniacum × O. rupestre between which it is intermediate probably from the Pleistocene. Nevertheless the morphological characters which bound them to the parent species have been gradually purified, so that it can be said to have become a good species, with only rare cases of small, ca. 15 mm long corollas, which unite it with O. rupestre and of individuals with longer, less spreading-bristly leaves, transitional to O. armeniacum.

Group 9. **Caucasica** M. Pop. — Corolla yellow, turning brown after flowering, 12—15 mm long, tubiform, slightly broadening towards gaping throat, very slightly villous outside near teeth. Calyx small, with narrow linear teeth, slightly elongating, not converging in fruit; nectary glabrous; anthers connate at base, not exserted or hardly exserted from corolla. Nutlets very small, 2—3 mm long. Small, multicaulescent, herbaceous (monocarpic perennial) plant, with small, linear, 1—2 cm long, 2—3 mm wide, long-bristly leaves and bluish, ascending, not branching stems, 10—20 cm high. — Lesser Caucasus (Lesser Armenia).

23. O. rupestre M. B. Fl. taur.-cauc. I (1808) 132; Ldb. Fl. Ross. III, 127; Boiss. Fl. or. IV, 191; Grossg., Fl. Kavk. III, 272. — ? O. tenuiflorum Willd. Sp. pl. I (1797) 775. — O. diffusum Boiss. et Huet, Diagn. ser. 2, III (1856) 137, nomen nudum. — **Ic.**: Lehm. Ic. rar. pl. Asperif. tab. 12; Lodd. Bot. Cab. XIX, tab. 1880; Probl. bot. I (1950) 87, Fig. 6. — **Exs.**: Pl. or. exs. No. 145.

Perennial; apparently perennial sometimes monocarpic perennial plant;
217 root thin, multicipital, often with elongate branches; stems several (to 10), nodose-ascending, thin, (8)10—20 cm high, bluish, usually simple, very rarely with 1—2 short branches with coarse spreading bristles and thin scabrous down; leaves linear, 1.5—2.5 cm long, 1.5—2.5 mm wide, not very dense, obliquely turned upward, lower leaves usually slightly longer, spatulate-tapering to base (if rosettes present and on fertile stems they sometimes dry up before flowering), to 5 cm long but also narrower, with coarse spreading white bristles along margins and upper surface, and with very short bristles, the margins sometimes slightly rolled, acute. Terminal inflorescence of 1—2, rarely 3, scorpioid cymes, these not very compact, not straightening or elongating in fruit, hardly looser than in flower (easily distinguished from O. microcarpum); pedicels short, even the lower not exceeding 5 mm in fruit; bracts linear, short, inconspicuous; calyx usually ciliate-hairy, canescent, with white, rarely yellowish hairs and bristles, its lobes narrowly linear, ca. 10 mm long, to 12 mm in fruit, not converging,

rather more recurved; corolla pale yellow, broadly tubular, gradually broadening towards throat, 12—15 mm long, or claviform, glabrous outside, villous only on the short, triangular, curved teeth; anthers 5—6 mm long, connate only at base, hardly longer than the slightly broadened filaments, not exserted or hardly exserted from corolla; their appendages bidentate; nectary glabrous; nutlets light gray, 3 mm long, rather abruptly tapering to beak, i. e., with distinctly protruding light-rugose shoulders. May.

Stony and rocky slopes, 500—1,900 m. — Caucasus: E. and S. Transc. (mainly in Lesser Caucasus, very rare on Main Range). Gen. distr.: As. Min. (NE), NW Iran.

Note. This is the smallest species of the Onosma, with very tiny flowers and seeds and typical small, narrow leaves, not found in any other species of the genus. Boissier correctly noted that but for some small individuals of O. microcarpum, no species resembles O. rupestre. Its closest relatives probably occur in Asia Minor.

Group 10. **Stepposa** M. Pop. — Corolla yellow, usually turning brown after flowering, and later dark blue, small, 12—18 mm long, tubular, with gaping throat, short-toothed. Nectary glabrous. Stigma 2-lobed. Calyx elongating in fruit with spreading bristles. Leaves broadly linear, elongate (cordlike). Stems branching above, the paniculate inflorescence spreading
218 in fruit. Nutlets 3—4 mm long, lustrous. Baikal to Hungary (Carpathians), south to Tarbagatai, Balkhash, Mugodzhar, Ciscaucasia, Crimean steppes, N. Balkans.

24. O. **calycinum** Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 588, 592. — O. visianii Stev. in Bull. Soc. Nat. Mosc. XXIV, 589, 592; Javorka in Mus. Hung. IV, 420, non Clem. — O. echioides β. and δ. Ldb. Fl. Ross. III (1849) 125. — O. echioides var. b. arenarium Schmalh. Fl. II (1897) 240. — Exs.: Fl. exs. Austro-Hung. No. 1415.

Biennial with coarse, long, horizontal, spreading bristles; stems 1—3, large, thick, 30—40 cm high, often reddish, in upper half paniculate, usually pyramidal, the branches terminated by cymes; rosettes drying towards flowering, their leaves probably long-spatulate; cauline leaves dense, usually turned upward, lanceolate ribbonlike, median leaves 6—8 mm long, ca. 7 mm wide, sessile, acute with coarse spreading bristles, and very short coarse down, slightly canescent and if not then green, coarse. Scorpioid cymes sparse, few-flowered, not strongly twisted, slightly straightening, and elongating in fruit; pedicels very short, in fruit even the lowere ca. 5 mm long, with long spreading bristles; bracts lanceolate or oblong-lanceolate, acute, shorter than calyx; calyx, especially the fertile, with long spreading white (never yellow!) bristles, in flower ca. 5 mm long, the lanceolate-linear, acute lobes converging, often connate in pairs, 20—22 mm long in fruit; corolla ca. 17 mm long, slightly longer than calyx, tubular-claviform, gaping, with dense spreading down outside, yellow, turning brown; anthers exserted from corolla, conglutinate at apex below appendage, hence forming a tube, 8 mm long, not scabrous, smooth, their appendages broadly truncate; filaments approximately as long as anthers, slightly broadening below; nectary glabrous; nutlets ca. 4 mm long, expanding above, with

2 distinct shoulders, abruptly tapering to short flat beak, tuberculate-rugose, nitid. June.

Limestone outcrops. — European part: U. Dnp., Bl., Bes. (Podolian Upland, right bank of the Dnieper to Odessa). Gen. distr.: Bal.-As. Min. (N. Balkan Peninsula), Centr. Eur. (lower Austria, Hungary). Described from Podolia.

Note. Once the Crimean plant is called O. visianni Clem. (e.g., Ledebour), O. visianni (= O. calycinum Stev. non Lallem.) of Steven and Javorka requires renaming. As pointed out by Javorka, this is a very
219 characteristic species, a biennial, without preserved rosettes. Sepals are connate in pairs, as in section Aponosma, the corolla is densely downy, the anthers form a tube, as in groups Turanica and Tianschanica. In the coarse pubescence, comparatively large nutlets and broader leaves, it is closer to O. setosum and O. visianii of the Praemontana than to the other Stepposa.

25. O. arenarium W. et K. Pl. rar. Hungar. III (1812) 308; Stev. in Bull. Soc. Nat. Mosc. XXIV, 589, 593. — O. echioides β. arenarium Ldb. Fl. Ross. III (1849) 125; Shmal'g., Fl. II, 240. — O. calycinum Lallem. Ind. Sem. Hort. Petrop. IX (1842) 81. — Ic.: W. et K. l. c. tab. 279. — Exs.: Fl. exs. Austro-Hung. No. 1412.

Biennial, perennial; very similar to the preceding and O. visianii but tending towards O. tinctorium. Apparently, but not reliably biennial; stems often green, with dense leaves. Scorpioid cymes more compact; calyx with mixture of yellowish hairs; sepals sometimes in groups of 2—3, more often free; corolla distinctly bristly in bud, less downy when in flower, anthers free, except at base, with scabrous margin; nutlets smooth, smaller, 3 mm long, darkish. June.

Sands and gravels along coast. — European part: M. Dnp.?, Bl., Bes.? Gen. distr.: Centr. Eur. Described from Hungary. Type in Vienna.

Note. An extremely confusing species, ambiguous even though certainly related to the present group. — Our specimens vary, some have red stem, adnate to sepals, with less dense leaves (e. g., Kherson district, between Ivanovskie Peski and Zbur'evskie Peski (sands), 29 VI 1926, Poretskii, No. 23/908 or, more close to O. calycinum, 21/907), others, e. g., from Odessa (Nordman, Rozen) and from Aleshkovskie Peski (sands) (Transhel) have green stems, more dense leaves, calyx with yellowish hairs. According to Klokov (and his herbarium label), this should be regarded with the others as O. borysthenicum Klok., distinct from O. arenarium which, in the opinion of Klokov (and in spite of Steven, Jávorka and others), does not grow in the USSR. It differs from O. visianii in the smaller corolla, dark nutlets and in being more distinctly biennial.

26. O. transrhymnense Klok. in spisok rast. gerb. Fl. SSSR, XII (1953) No. 3564. — O. arcochrysum Klok. l. c.

Biennial; stems 1—5, 30—40 cm high, whitish-green, less thick and weaker than in the preceding, paniculately branching above, spreading in fruit, not as coarse but with soft spreading bristles; rosettes dying at flowering;
220 cauline leaves many, linear-ribbonlike, often with slightly rolled margins, 3—5 cm long, 3—5 mm wide, i. e., shorter and narrower than in the preceding

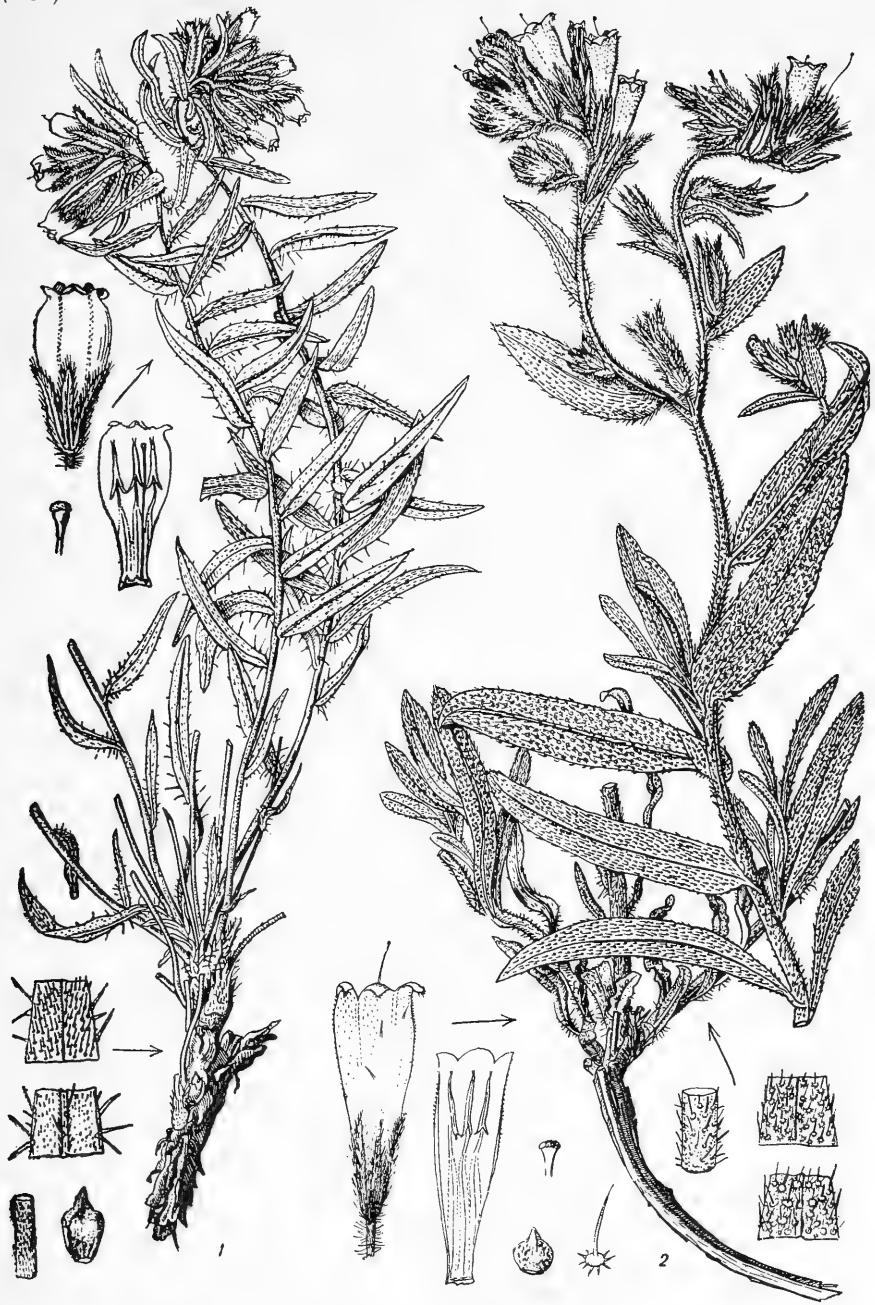

PLATE XII. 1 — Onosma zerizaminum Lipsky; 2 — O. caucasicum Levin.

species, soft, with rather soft spreading bristles, finely scabrous-downy. Scorpioid cymes small, not very compact, slightly elongating and straightening in fruit; pedicels short, in lower flowers to 5 mm long; bracts lanceolate, shorter than calyx; calyx yellowish, sometimes golden, semi-appressed in flower, in fruit with spreading bristles 10—12 mm long, with free, broadly linear, acute, converging lobes up to 20 mm long; corolla 15—17 mm long, pale yellow, glabrous or sparsely downy outside, turning brown, gaping; anthers scabrous, free except at base, with truncate appendages; nectary glabrous; nutlets 3—4 mm long, dark gray, nitid, smooth or hardly tuberculate, gradually tapering to beak. May—June.

Steppes, on stony slopes. — European part: Transv.; West Siberia: U. Tob., Irt. (southern part), Alt.; East Siberia: Ang.-Say.; Centr. Asia: Ar.-Casp. (northern part), Balkh. (northern part). Apparently distributed from the Ural River (from Chkalov) to Baikal in the east. Endemic. Described from the Semipalatinsk region, between Chernoyarskaya and Pavlodar on the right bank of the Irtysh River, flowers, 2 VI 1890, Schmidt. Type in Leningrad.

Note. This species is extremely difficult to distinguish from O. arenarium, as it was described in the Soviet Union from specimens collected on Aleshkovskie Peski (sands), with whitish-green stems and yellowish pubescence of the calyces. The only essential characters distinguishing it from O. arenarium are the shorter and narrower leaves and the sparser bristles, differences clearly of a racial, not specific value. It is far easier to identify this geographical race by its distribution area, as it is restricted to Asia, and absent in Europe. With the best intentions, I am unable to tell it from the Yenisei O. acrochrysum, which Klokov claims to be closer to O. gmelini. I cannot see this in the Transural race. It is biennial, not perennial, its stems branch, the corolla is small, not large as in O. gmelini, the anthers are free, not united in a tube — all these are characteristic for O. gmelini and the entire Tianschanica group, as opposed to the Stepposa group. Similarly I cannot accept Klokov's second species, O. erianthum, a form with gray, not yellowish hairs on the calyx from the same steppe area in Asia (Ulutau), as the typical O. transrhymnense (according to Klokov himself).

27. O. tinctorium M. B. Beschreib. Länder Terek Kur. (1800) 136; Fl. taur.-cauc. I (1808) 131; III, 130; Boiss. Fl. or. IV, 182; Fl. Yugo-
223 Vost. VI, 121. — O. echioides δ. parviflorum Ldb. Fl. Ross. III, 125. — O. echioides c. tinctorium Schmalh. Fl. II, (1897) 240. — Ic.: M. B. Cent. pl. rar. tab. 79; Syreishch., Ill. Fl. Mosk. rub. III, 59.

Biennial; stems 1—5, with spreading villous small, very thin bristles; often entangled in lower part of stem, with short scabrous down between bristles, often greenish, sometimes reddening, with short thin branches bearing inflorescences; rosettes dying at flowering; cauline leaves lanceolate or broadly linear-ribbonlike, upright, more or less dense, acute, canescent, bristly, not very long, 3—5 cm, 3—6 mm wide, without coarse semi-spreading bristles. Scorpioid cymes small, not very compact, drooping in flower, slightly elongating, straightening in fruit; pedicels short; bracts lanceolate, as long as calyx; calyx whitish-gray at flowering, with white (not yellow) appressed hairs, ca. 8—10 mm long, with lanceolate-

linear, free, acute lobes, markedly elongating in fruit, to 20 mm long, semi-spreading, the calyx with long, not coarse bristles; corolla 10—12 mm long, tubular, gaping, yellow, turning brown, glabrous (or slightly downy?) outside; anthers connate at base, ca. 4—5 mm long, slightly longer than filaments, hardly or not exserted; nectary glabrous; nutlets 3 mm long, gradually tapering to beak, smooth, lustrous, dark. May—June.

Steppes. — European part: M. Dnp., Bl., Bes. ?, V.-Don, L. Don, L. V., Transv. (rarely); Crimea (steppes); Caucasus: Cisc. (Taman, Eisk). Endemic. Described from near Kerch. Type in Leningrad.

Note. We agree with Klokov in the interpretation of O. tinctorium as a homochromous, small-flowered, steppe Onosma distributed more to the southwest than the heterochromous O. polychromum Klok., but with parts of their distribution areas overlapping. In the Crimea and along the Dnieper, to Belaya Tserkov', only O. tinctorium grows, which is also the only species in steppes along the sea from the Dnieper to Kal'mius. Both species grow in Askaniya-Nova and in Voronezh Region only O. polychromum grows in the Lower Don area. The lower and middle part of the Volga area, to the Urals in the east, is the distribution area of O. polychromum, but O. tinctorium is very rare and sporadic near Krasnoarmeisk, Kuibyshev and Mugodzhar Hills (south of Berchogur). Thus, O. tinctorium cuts through the distribution area of O. polychromum and reaches Turgai, where O. tinctoriiforme Klok. also grows. These two species have the smallest flowers of the steppe species of Onosma. In the west (beyond the Dnieper) and east (beyond the Urals) they are replaced by the larger flowered O. arenarium (W.) and O. transrhymnense (E.).

224 28. **O. polychromum** Klok. in herb. et hoc loco. — O. tricolor M. Klok. in herb. — O. mugodzaricum Klok. in herb. — O. tinctorium β. M. B. Dl. taur.-cauc. III (1819) 131. — Ic.: M. B. Cent. pl. rar. tab. 79.

Biennial or perennial; monocarpic plant; stems 1—5, thickish, usually turning more or less blue, with spreading, not very coarse long bristles and fine scabrous down, paniculately branching above, spreading-branching in fruit; leaves of rosettes to 10 cm long, linear-spatulate, tapering to long bristly petiole, median cauline leaves 4—5 cm long, 3—7 mm wide, all leaves obtuse, with slightly rolled margin, canescent, margin and upper surface with semi-spreading bristles and fine scabrous down. Scorpioid cymes small, compact, elongating and straightening in fruit; all pedicels short, 3—4 mm not long even in fruit, bristly; bracts lanceolate, shorter than calyx; calyx in flower small, 8—10 mm long, with appressed hairy bristles, gray (not yellowish!), markedly elongating to 15 mm rarely to 20 mm in fruit, with diverging lanceolate-linear acute lobes, with long spreading but not coarse bristles; corolla ca. 12—13 mm rarely to 15 mm long, tubular, gaping in throat, straw-colored, turning pink, then reddening and eventually dark blue, glabrous outside, with short, triangular, recurved teeth; anthers connate only at base, scabrous, hardly or not exserted, ca. 5 mm long, with narrow terminal appendages; filaments short, broadening below; nectary glabrous; nutlets ca. 3.5 mm long, dark gray, smooth, lustrous, gradually tapering to beak. May—June.

Steppes and pastures and roadsides, loess soil, rarely limestones. — European part: Bl., V.-Don, L. Don, L. V., M. V., Transv.; Caucasus: Cisc.; West Siberia: U. Tob. ?; Centr. Asia: Ar.-Casp. (northwestern part). Endemic. Described from Ciscaucasia. Type in Leningrad.

Note. I fully agree with Klokov that this group should be separated from O. tinctorium s.l.; already Bieberstein referred to it as O. tinctorium β. and correctly reported the changing color of the corolla as well as its distribution area: "in the Caspian-Caucasian lowlands." Actually, its main area includes the Lower and Middle Volga, west to the Don (Voronezh Region) and east to the Urals and slightly beyond. However, I do not accept the splitting of this species into the Caucasian O. polychromum Klok. and the Volga-Urals O. iricolor Klok. (Klokov sometimes refers to these as synonyms on the labels). O. mugodzharicum Klok. is certainly a hybrid of O. polychromum and O. transrhymnense; as it is obviously very young it may be accepted as a species only if it has been isolated from
225 the parental species. In this case this has not been done. Both O. polychromum and O. transrhymnense (= erianthum) occur in the Mugodzhar Hills. The same O. mugodzararicum grows in Ulutau where O. transrhymnense is also present; insofar as I know, O. polychromum is absent. In O. mugodzharicum the corolla is ca. 17—18 mm long and the nutlets 4 mm long.

Group 11. Atropatano-Luristana M. Pop. — Perennials. Stems white (with white, shiny epidermis), thin, branching, nearly ligneous. Leaves rather short, green, flat, with very coarse short bristles. Flowers on short pedicels, in loose, small scorpioid cymes; calyx with slightly elongating lobes; corolla pale yellow, 12 mm long, downy outside, with gaping throat. Anthers connate at base, hardly or not exserted, appendages acute, filaments gradually broadening below, nectary glabrous, nutlets 4 mm long, dark, slightly brownish-rugose, short-beaked. Typical semi-desert, Iranian group, restricted to the variegated rocks of the Mesocenozoic.

29. O. **gracile** Trautv. in Tr. Bot. Sada, II (1873) 478; Boiss. Fl. or. IV, 193; Grossg., Fl. Kavk. III, 272. — Ic.: Probl. bot. I (1950) 101, Fig. 1.

Polycarpic perennial plant; root brown, ligneous, not yielding dye; multicipital root producing few erect, stiff, 20—40 cm high, white stems with shiny epidermis, short remote bristles, branching from base or middle, with thin fertile branches at apex without radical leaves or rosettes; enlarged cauline leaves from base of stem to middle, not decreasing in size as in rosetted species, lowermost leaves linear or oblong-linear, the median larger, lanceolate or oblong, 2—4 cm long, 5—20 mm wide, sessile, spreading, coriaceous, large, green, both surfaces, especially the upper, with short bristles on large tubercles and spreading spiny bristles, or else glabrous, rugose. Inflorescences of small, few-flowered, loose scorpioid cymes, not straightening or elongating in fruit; lower fruiting pedicels to 5 mm long, thin, downward curved, bristly; bracts linear, shorter than calyx; calyx in flower ca. 8—10 mm long, in fruit to 15 mm, with very narrowly linear, subfiliform, not converging lobes, spreading-thin-white-bristly, rarely bristles

nearly yellowish; corolla tubular but hardly broadening in throat and gaping, pale, not darkening after flowering, 12 mm long, with dense soft down, the
226 teeth short, triangular, erect. Anthers ca. 6 mm long, connate at base, their appendages scabrous, acute or truncate, hardly or not exserted; filaments somewhat square, broadening below, shorter than anthers; nutlets very broad, nearly quadrate, slightly tuberculate, dark, lustrous, 4 mm long, with small beak. May—June.

Stony slopes on variegated rocks. — Caucasus: S. Transc. (Ordubad, Zangezur). Endemic. Described from Belav in Armenia (Radde, 17 VI 1871). Type in Leningrad.

Note. This species is very close to the Iranian O. kotschyi Boiss. and O. asperrimum Bornm., which was later described from here (SW Iran). Together they form the special group Atropatano-Luristana, unknown in the central or eastern parts of Iran, though a similar group, Oxica, is found in the area of the Amu Darya. An ancient, early Pliocene desert type. Its corolla somewhat resembles O. tinctorium, but its vegetative parts differ sharply.

Group 12. Oxica M. Pop. — Perennial. Stems branching, bluish at first, white in fruit, shiny, with white epidermis. Leaves short, green, with short spreading, nearly spiny bristles. Flowers in short compact scorpioid cymes, short-pediceled; calyx slightly elongating in fruit, small; corolla ca. 10 mm long, yellow, turning red and eventually dark blue, glabrous, constricted in throat; filaments short, sharply rhombic-broadening; anthers free, not exserted; nectary glabrous; stigma capitate. Nutlets 3 mm long — Iranian Province, Himalayan section (upper reaches of Amu Darya, Oxus).

30. O. livanovii M. Pop. in N. A. Dimo, Pochv. eksp. bass. Syr Dar. i Amu Dar. II (1916) 70. — Ic.: M. Pop. l. c. Tab. 19; Probl. bot. I (1950) 87, Fig. 7.

Perennial; polycarpic plant; root multicipital, thick, red, yielding dye; stems few, 20—30 cm high, branching above, rather stiff, bluish at flowering, white in fruit, with shiny epidermis, and short coarse scabrous bristles or down; radical leaves absent; cauline leaves enlarging towards middle of stem, lower leaves linear, later drying, median leaves lanceolate or oblong, 1.5—3 cm long, 4—10 mm wide, declined, stiff, green, sessile, coriaceous, with short, coarse, spreading bristles on dense small tubercles, and uneven ciliate margin, acute, prickly- or tuberculate-scabrous between tubercles. Scorpioid cymes of inflorescence capitate, few-flowered, short, compact, not elongating in fruit; pedicels short, the lower fruiting pedicels not more than 3—4(10) mm long, declinate-bristly; bracts short, lanceolate; calyx small,
227 7 mm long in flower, to 10 mm in fruit, with linear, acute, not converging lobes, and white, not coarse, semi-appressed bristles, spreading-bristly in fruit, canescent; corolla ca. 10 mm long, slightly inflated-tuberculate, strongly constricted in throat, glabrous outside, yellow, eventually black-blue, with very short, obtuse, curved teeth; anthers ca. 5 mm long, connate only at base, with terminal, bidentate appendages hardly exserted or not exserted; filaments short, sharply rhombic-broadening below; nectary glabrous; nutlets 4 mm long, dark gray, markedly gibbous, with sharply

protruding shoulders and acute ribs, lustrous, slightly rugose and tuberculate, short-beaked. April—May.

Red sands in variegated, Mezo-cenozoic strata. — Centr. Asia: Pam.-Al. (from Samarkand Mountains to Kelif in the south, along the Amu Darya from Kelif to Kabadian Mountains and Babatag). Endemic. Described from near Shirabad. Type in Tashkent.

Note. Our species (and group) are surely very closely related to the species of the preceding group (e. g., vegetative organs, small flowers), from which they are distinguished by the heterochromous, swollen-tubular corolla constricted in the throat, resembling the group Praepamirica, though smaller; all considered our species presumably derived from the Iranian group Atropatano-Luristana, which hybridized with Praepamirica in the Pamir area, connected in turn with the Himalayan Maharanga.

Subsection 2. ASTEROTRICHA Boiss. Fl. or. IV (1879) 180; Engl. — Pr. Pflanzenf. IV, 3a, 127. — Stelligera Schur, Enum. pl. Transsilv. (1866) 468. — Tubercles bearing large bristles with stellate hairs.

Group 13. Oxiana M. Pop. — Perennials. Gray-velutinous downy, nearly tomentose, with bristles borne on tubercles covered above with upright, stellate and small simple hairs. Rosettes present. Stems low, branching; calyx slightly elongating in fruit. Corolla small, 12 mm long, yellow at first, eventually dark blue, constricted in throat; filaments short, with abruptly rhombic-broadening base; anthers connate at base, not exserted; stigma capitate-2-lobed; nectary glabrous; nutlets lustrous. Endemic to Amu Darya, Pamir area.

31. O. macrorhizum M. Pop. in N. A. Dimo, Pochv. eksp. bass. Syr Dar. and Amu Dar. II (1916) 71. — Ic.: M. Pop. l. c. tab. 20; Probl. bot. I (1950) 87, Fig. 1.

Perennial; polycarpic plant; root multicipital, thick, its red bark yielding dye, producing many (to 15) stems; these 20—30 cm high, not thick, branching
228 above, with white epidermis densely covered with short coarse velutinous down, becoming naked; rosettes thick, but not large, their leaves oblong- or lanceolate-spatulate, tapering to slightly bristly petioles, 5—10 cm long, acute, tomentose-gray, with velutinous thick down of thick, short, upright bristles, these larger on tubercles, bearing slightly upright stellate hairs; cauline leaves enlarging towards middle, lower leaves linear, median leaves lanceolate, 2—4 cm long, 5—10 mm wide, declined, sessile, acute, both surfaces velutinous; scorpioid cymes of inflorescence small, few-flowered, compact, hardly elongating in fruit; pedicels thin, the lower not more than 10 mm long in fruit, spreading-bristly; bracts short, lanceolate; calyx small, ca. 7 mm long in flower, gray, with semi-appressed, not coarse, loose bristles and hairs, to 10 mm long in fruit, its linear, acute lobes not converging, bristles soft, spreading; corolla ca. 10—12 mm long, tubular, constricted in throat, glabrous or slightly downy outside, yellow turning, eventually black-brown, with small, triangular, recurved teeth; anthers ca. 5 mm long, not

exserted; filaments short, with abruptly rhombic-broadening base; nectary glabrous; nutlets 3 mm long, dark gray, lustrous, strongly gibbous, with acute sides and gradually tapering beak, hardly distinctly tuberculate, nearly smooth. May.

Variegated, low-mountains of semi-steppe, on saliferous-gypsiferous substratum. — Centr. Asia: Pam.-Al. (from Guzar to Kelif). Endemic. Described from the foot of the Kugitang Mountains, village of Khodzha-Fil-Ata. Type in Tashkent.

Note. In many characters this species is very close to O. liwanowii from which it differs in the character of the pubescence: tomentose-velutinous, dense, gray, with a unique type of stellate bristles; the hairs on tubercles do not lie horizontally in one plane as in other Asterotricha, but irregularly in 2 rows, turning upward, parallel to the central bristle; there are also simple bristles among the stellate ones, producing what may be called a pseudo-stellate pubescence. The species grows in the same area as O. liwanowii, but for the generally accepted subsectional division into Haplotricha and Asterotricha (which I feel is significant even from the genetic point of view), I would willingly combine them in one group.

Group 14. Stellulata M. Pop. — Subshrub, perennial. Caudex short,
229 irregularly branching, the branches producing bundles of sterile "radical leaves" (reduced shoots). Fertile stems produced from the center of such sterile shoots, among the dead leaves of the previous year, with a slight though not sharp increase in size of cauline leaves towards middle of stem, the stems numerous, usually not branching; leaves spatulate, gray or greenish; calyx not strongly enlarged in fruit; fertile scorpioid cymes straightening, sparse; corolla large, 20—25 mm long, claviform, i. e., strongly expanding in upper part, 2—3 times as long as calyx; anthers connate at base, nearly not exserted; nectary glabrous; filaments hardly broadening towards base, as long as or slightly longer than anthers; nutlets 3—4 mm long. — Asia Minor, S. Europe.

32. O. rigidum Ldb. in Pander's Beitr. Naturk. Ostseeprov. Russl. (1820) 67; Fl. Ross. III, 124. — O. stellulatum β. rigidum (Ldb.) Schm. Fl. II (1897) 241. — O. stellulatum β. pallidum Boiss. Fl. or IV (1879) 201. — O. pallidum Boiss. ex Grossg., Fl. Kavk. III (1932) 271. — Ic.: Ldb. Ic. Fl. Ross. III, tab. 238.

Perennial; subshrub, multicaulescent; stems thin, often ascending, usually with spreading sparse short bristles, simple, 20—30 cm high, greenish-white; leaves linear- or lanceolate-spatulate, the cauline 3—4 cm long, 3—6 mm wide, obtuse, green-gray (not gray as in O. tauricum), upright, their bristles semi-spreading. Scorpioid cymes compact, drooping in flower, straightening and sparse in fruit, 1 or 2 at tips of stems; pedicels very short, the lower not more than 3 mm long in fruit, with spreading bristles; bracts lanceolate or linear, shorter than calyx, inconspicuous; calyx 8—10 mm long in flower, ca. 15 mm in fruit, often with rufous or yellow, rarely with gray bristles, these thin, rather compact, contiguous at first, spreading in fruit; calyx lobes linear, acute, diverging; corolla ca. 20 mm long, tubular-campanulate, broad and gaping in throat, approximately twice as long as calyx (or less),

straw-colored, turning brown, with remote and coarse down outside; nutlets 3 mm long, pale or yellow, nearly smooth, lustrous, sometimes slightly pitted. May—June.

Calcareous slopes. — European part: Crim. (southern mountainous part); Caucasus: W. Transc. (NW near Novorossiisk and Gelendzhik). Endemic. Described from the Crimea (between Gurzuf and Nikita). Type in Leningrad.

Note. O. pallidum Boiss. (Diagn. ser. I, 11 (1849) 112) from W. Anatolia actually seems to be O. rigidum Ldb., but since I have never seen the type or the Anatolian specimens, I cannot confirm this suspicion.
230 As noted by Boissier, our species is essentially very close to O. stellulatum s.l. In fact, I consider it a hybrid between the type O. stellulata and one of the Haplotricha. The specimens I saw from Novorossiisk (Lipskii, 9 VI 1891) were unfortunately without root; with branching stem and tubular corolla they appeared to be hybrids of O. stellulatum and O. tinctorium. The Vorob'ev and Klopotov specimens from Kuban (peak of Mokhnatyi Shikhan, 28 VII 1906) are probably hybrids of O. stellulatum × O. armeniacum. It is possible that O. ampliatum Velen. reported by Stankov and Taliev (Opred. (1949) 777) for the Crimea belongs to this hybrid group of forms.

33. O. tauricum Pall. in Nov. Act. Ac. Sc. Petrop. X (1792) 306; Willd. in Gesel. Naturf. Fr. Berl. Neue Schr. II (1799) 122; Javorka in Ann. Mus. Hung. IV, 439. — O. stellulatum Ldb. Fl. Ross. III, 123; Shmal'g., Fl. II, 241; Grossg., Fl. Kavk. III, 271. — O. stellulatum γ. angustifolium Boiss. Fl. or. IV (1879) 201. — O. erectum Sibth. et Sm. Fl. Graeca, Prodr. I (1806) 121. — Ic.: Sibth. et Sm. Fl. Graeca, II, tab. 173 (poor), Gard. Chron. XVI, 21 and others. — Exs.: GRF, No. 520.

Perennial; subshrub, stiff, gray, very xerophilous in habit; stems thickish, large, 20—40 cm high, simple; leaves of sterile shoots usually numerous, linear-spatulate, gray-hoary, with almost completely appressed, gray hairs, 4—6 cm long, 3—4 mm wide, obtuse, with involuted margins; median cauline leaves 2—7 mm wide, antrorse, obtuse. Scorpioid cymes terminating stems single or paired, drooping in flower, straightening and elongating in fruit; pedicels not more than 3 mm long in fruit, appressed-bristly; bracts linear, gray, longer than calyx; this 9—10 mm long in flower, ca. 15 (to 20) mm in fruit, semi-appressed-gray, white- and pinnate-bristly at margin, their lobes linear, acute, diverging in fruit; corolla more than twice as long as calyx, markedly and gradually broadening towards throat, gaping, ca. 25 mm long, whitish at first, later dark, nearly black-brown, glabrous outside, bidentate; filaments slightly shorter than anthers; nutlets ca. 4 mm long, pale, smooth, oblong, prolonged into rather thin beak. May—June.

Stony localities, slopes, taluses. — European part: Crim. (from Cape Tarkhankut to Kerch Peninsula); Caucasus: W. Transc. (northwestern part). Gen. distr.: Bal.-As. Min. Described from the Crimea. Type in London?

Note. O. stellulatum W. et K. from SE Europe (Hungary and N. Balkans) differs from our species in the long pedicels, as long as the calyx,
231 yellow and not whitish corolla, wider leaves (8—15 mm wide), sparser hairs. Its leaves are generally large, the radical exceeding half the height of the

stem. Our species is usually very gray (ash-gray), the hairs are sometimes tomentose-velutinous, rarely semi-spreading.

34. O. caucasicum Levin nom. nov. — O. stellulatum Ldb. Fl. Ross. IV, 123, non W. et K.; Boiss. Fl. or. IV, 201; Shmal'g., Fl. II, 241; Grossg., Fl. Kavk. III, 271. — O. stellulatum var. kubanicum N. Popov in Tr. Tifl. bot. sada, XII, 2 (1912) 156. — O. angustifolium Grossh., Fl. Kavk. III, 271, non Lehm. — Ic.: Bot. Mag. XXIII, tab. 889.

Perennial; leaves very variable in width and pubescence, some narrow and gray, semi-involute, as in O. tauricum, wide, flat, gray, with appressed hairs or green with spreading bristles, as in O. rigidum; stems sometimes to 40 cm high, simple, branching, sometimes arcuately ascending; calyx larger, often ca. 15 mm long in flower, white-appressed-bristly-tomentose or gray-appressed as in O. tauricum, to completely covered with sparse long spreading bristles; corolla generally large, ca. 30 mm long, glabrous outside, whitish, turning black-brown, sometimes more tubular or shorter, as in O. tauricum; nutlets ca. 3.5 mm, smaller than in O. tauricum, with short beak. June—July. (Plate XII, Figure 2.)

Stony slopes, taluses, rocks. — Caucasus: Cisc., Dag. W. (Novorossiisk), E. and S. Transc. Gen. distr.: Arm.-Kurd. Described from Kuban. Type in Leningrad?

Note. Some specimens of O. caucasicum are difficult to distinguish from O. tauricum. Also transitional stages may be found to O. rigidum Ldb.

Subtribe 3. ALKANNEAE M. Pop. — See characteristics of the subtribe in the description of the tribe, and of Alkanna Tausch., given below.

One genus: Alkanna Tausch.

Genus 1191. **ALKANNA*** Tausch.

Tausch in Flora, VII (1824) 234; DC. Prodr. X, 97.— Alcanna orph. in Bull. Congr. (1870) 138.— Baphorhiza Link, Handb. 2 (1831) 378.— Camptocarpus C. Koch in Linnaea, XVII (1843) 304.

Calyx divided nearly to base into lanceolate-linear lobes, slightly swollen in fruit, stellately opening after abscission of fruit. Corolla slightly irregu-
232 lar, yellow (or, in our species, violet), medium-sized, mesomorphic, with rather wide tube and campanulate limb, without scales or longitudinal folds in throat, usually open, sometimes with transverse, glabrous folds, with narrow protective ring above base of tube usually without hairs, lobes of limb short, obtuse. Anthers with very short filaments, included in corolla tube, sometimes separating, oblong, obtuse; style more or less long, not exserted. Nutlets usually 2—1, markedly curved (upper half horizontal or even turned downward), on short stipe shifted nearly to ventral side of nutlet (cicatrice of stipe not pierced), rugose or finely tuberculate, small; embryo curved.

* From the Arabic alhenneh, the name of the root of Anchusa tinctoria, which yields a red dye.

Alkanna is anomalous in the tribe, and distinctly transitional to the Anchuseae especially Nonea, as evident from the slight inflation of the fertile calyx, the glandular pubescence and curved nutlets; but the attachment of the nutlets is lithospermous. Guerke refers Alkanna to the Anchuseae. There are about 30 species, all in the ancient Mediterranean area, from Spain and Morocco to Iran, but mainly in the East Mediterranean provinces.

Section 1. BAPHORHIZA (Link) DC. Prodr. X (1846) 97. — Baphoriza Link, l. c. pro gen. — In the throat or below it there are indistinct, glabrous, transverse folds with 3 stamens inserted between and 2 below them.

1. Leaves wide, undulant or dentate; bracts ovate, obtuse; corolla twice as long as calyx; plant with glandular hairs . . . . . 1. A. orientalis (L.) Boiss.

\+ Leaves narrow, entire; bracts triangular-cordate, acute; corolla slightly exceeding calyx; glandular hairs absent . . . . . 2. A. cordifolia C. Koch.

1. A. orientalis (L.) Boiss. Diagn. ser. I, 4 (1844) 46; DC. Prodr. X, 97; Ldb. Fl. Ross. III, 141; Boiss. Fl. or. IV, 227; Kuzn. in Mat. Fl. Kavk. IV, 2, 325; Grossg., Fl. Kavk. III, 265. — Anchusa orientalis L. Sp. pl. (1753) 133. — Lithospermum orientale L. Syst. ed. XIV (1767) 145. — Camptocarpus orientalis C. Koch in Linnaea, XVII (1843) 305. — Ic.: Fl. Graeca, tab. 160; Bot. Mag. tab. 515; Buxb. Cent. XII, tab. 29. —

Perennial; root vertical, rather thick, dark but not yielding dye, multicipital, thickened above, producing few stems and rosettes of radical leaves; stems 20—40 cm high, erect or ascending, thickish, simple or loosely branching from middle, rather soft, with dense glandular hairs and sparse remote
233 bristles, rather more villous; radical leaves spatulate-oblong or oblong-lanceolate, 5—15 cm long, 8—15 (20) mm wide, obtuse, with slightly protruding lateral nerves, tapering to petiole at base; cauline leaves shorter, lanceolate or oblong, median and upper leaves sessile, acute, with a prominent midrib; all leaves (Russian entire) rather densely hirsute, with glandular-downy hairs sometimes yellowish. Scorpioid cymes short, capitate only at onset of flowering, later markedly elongating, spreading, leafy, up to 20 cm long; bracts oblong, small, coarsely gray- or yellowish-velutinous, much longer than calyx; calyx small, ca. 5 mm long, with lanceolate, obtuse, coarsely downy-hairy lobes, calyx in fruit slightly inflated at base, drooping on rather short pedicels, stellately spreading after falling of nutlets, ca. 15 mm across, lobes appressed-downy inside; corolla pale yellow, ca. 10 mm long, tube glabrous, slightly longer than calyx, limb campanulate, 4 mm long, 7—8 mm across, with slightly unequal ovate obtuse lobes, glandular-hairy in throat; nutlets horizontally disposed, ovoid, 3—4 mm long, densely tuberculate-rugose, gray, with the very short stipe at center of their ventral side; areola of attachment ovoid, ca. 0.7 mm long, without aperture; torus slightly fleshy, protruding, small. May—June—July.

Stony slopes in the central mountain belt. — Caucasus: S. Transc. (mainly along the Araks River), E. Transc. Gen. distr.: Bal.-As. Min., Iran. (N.), Syria, Palestine, Sinai Peninsula. Described "from the East." Type in London.

2. A. cordifolia C. Koch in Linnaea, XXII (1849) 640; Boiss. Fl. or. IV, 228; Grossg., Fl. Kav. III, 265; Kuzn. in Mat. Fl. Kavk. IV, 2, 333.

Perennial; very close to the preceding but differing mainly by the absence of glandular downy hairs, although more bristly coarse-hairy than A. orientalis, especially on calyx. Radical leaves rather narrow, lanceolate-spatulate, ca. 5—10 cm long, ca. 1 cm wide, with abundant large white tubercles and short spreading bristles at upper surface. Stems more villous. Cauline leaves as in A. orientalis but bristly; bracts more acute. Calyx long-white-bristly at base. According to Boissier the limb of corolla is large, as long as tube, and the nutlets are larger and reticular.

Caucasus: S. Transc. (somewhere near the Turkish border). Gen. distr.: Arm.-Kurd., As. Min. Described from Pontus Mountains. Type in Berlin.

Note. I cannot sustain Boissier's consideration of this species as distinguished from A. orientalis, inasmuch as the pertinent specimens
234 were not in my possession. The only specimen I did see, which was somewhat similar to Koch's description, was that from Bitlis vilayet (Harput-Todvan, 30 V 1916, Shishkin). However, its corolla was not larger than in A. orientalis and the nutlets were not yet completely ripe. More likely this is a race of the broadly distributed A. orientalis Boiss.

Subtribe 4. MOLTKIEAE M. Pop. — See characteristics of the description of the genus Moltkia.

One genus Moltkia Lehm.

Genus 1192. **MOLTKIA** Lehm.*

Lehm. in Neue Schrift. Naturf. Gesellsch. Halle, III, 2 (1817) 3; Pl. Asper. II (1818) 2, 339.— Moltkea Wettst. in Oesterr. Bot. Zeitschr. LXII (1918) 361—369.

Calyx cleft nearly to base, regular, with linear or linear-lanceolate acute teeth, not changing in fruit, lobes only slightly elongating. Corolla elongate, tubular, much exceeding calyx, blue (or rarely yellow); tube narrow, thin, limb tubular-campanulate, gradually broadening from tube, teeth (lobes) erect, not curved, shortly oblong, corolla entirely glabrous outside, inside without folds or scales, also without a protective ring at base of corolla tube. Anthers shortly exserted from corolla, linear, at first erect, later arcuately curved, obtuse at both ends, attached to filament nearly by base, filaments longer than anthers, attached to limb below its lobes (teeth). Style long exserted, stigma entire, dot-like. Nutlets small, straight or curved, rugose or dotted, triangular-ovoid, with flat areola of attachment. Semishrubs, with lanceolate

* After I.G. Moltke, the Danish founder of the Museum of Natural History in Copenhagen.

grayish leaves. Scorpioid cymes, compact, subanthesis, capitate at apex of stem, bracteate.

The genus comprises 6—7 species, from Italy to Iran, which are isolated in the W. Himalayas. A very unique genus, related to the Mediterranean Lithospermum section Lithodora on the one hand and to Echium on the other, for the corolla is slightly irregular, tubular.

Section 1. EUMOLTKIAE Boiss. Fl. or. IV (1879) 221. — Eumoltkia Gürke, Pflanzenf. IV, 3, 122. — Eumoltkea Wettst. l. c. — Nutlets pitted-tuberculate (not smooth).

235 1. M. coerulea (Willd.) Lehm. l. c. (1817) 3; Ldb. Fl. Ross. III, 129; DC. Prodr. X, 72; Boiss. l. c.; Kuzn. in Mat. Fl. Kavk. IV, 2, 395; Grossg., Fl. Kavk. III, 268. — Onosma coeruleum Willd. Sp. pl. I (1797) 775. — M. punctata Lehm. l. c.; Pl. Asp. tab. 44. — M. anatolica Boiss. Diagn. I. 11 (1849) 114. — Ic.: Lehm. Ic. Asp. tab. 43 (1821); Gürke, l. c. f. 48, E—F; Wettst. l. c. f. 5.

Perennial; plant almost semishrub; root rather thick, vertical, not yielding dye, densely multicipital at apex, producing up to 10 stems and tufts (rosettes) of radical leaves; the whole plant canescent, even tomentose at root neck; radical leaves lanceolate-linear, long-attenuate below, 5—10 cm long, 3—8 mm wide, flat, acute, yellowish, canescent or gray, with completely appressed bristles; stems stiff, robust, rounded, 10—30 cm high, not branching, white or canescent, with appressed bristles above, covered with many leaves; leaves (cauline) lanceolate, the lower subspatulate, obtuse, upper and median leaves acute, 3—5(6) cm long, 4—8 mm wide, completely appressed-bristly, reaching inflorescence. Cymes 2 or 3 at apex of stem, short, curved, forming capitate (3—6 cm across) inflorescence, later, especially in fruit, straightening and elongating, up to 5—7 cm long, a little loose; bracts lanceolate, short; calyx in flower ca. 7—8 mm long, lobes subglabrous, spreading-hirsute at margin, in fruit up to 10 mm long; corolla dark blue, 17—20 mm long, limb $\frac{1}{3}$ to $\frac{1}{2}$ as long as tube, limb ca. 3 mm wide, teeth 1.5—2 mm long, slightly irregular; stamens exserted above teeth for 1—3 mm, unequal; anthers dark, ca. 1.5 mm long; nutlets (usually only one developing) massive, rather shapeless, in the Russian species curved so that the upper half is nearly horizontal, in general spherical-ovoid, pale brown, dingy, tuberculate, the tubercles forming two marginal crests at back, bilaterally pitted, without distinct keel at the curved ventral side, conical and directed horizontally at apex. May.

Stony slopes in semi-deserts and deserts. — Caucasus: S. and E. Transc. (to Tbilisi in the west). Gen. distr.: Iran (N.), Arm.-Kurd., Bal.-As. Min. (As. Min.), Syria. Described from Armenia. Type (probably collected by Tournefort) in Berlin.

Note. Boissier referred the Russian plant to var. subcristata Boiss. (Fl. or. IV, 221) which is characterized by the tuberculate crests on the back of the nutlet.

Subtribe 5. BOTHRIOSPERMEAE M. Pop. — See characteristics of the subtribe in the description of the tribe Lithospermeae and description of the genus Bothriospermum.

One genus — Bothriospermum Bge.

236 Genus 1193. **BOTHRIOSPERMUM*** Bge.

Bge. Enum. pl. Chin. (1832) 47; Fisch. et Mey. Ind. Sem. Hort. Petrop. (1835) 23.

Calyx cleft nearly to base into lanceolate lobes, not changing in fruit, small, hairy-bristly. Corolla small, blue or white, funnel-shaped, with short tube not emerging from calyx and broadly campanulate or patelliform limb, lobes rounded, obtuse and notched at apex, imbricate in aestivation, throat of corolla with scales. Anthers included in corolla tube, small, acute or obtuse. Style short, stigma capitate. Nutlets reniform, vertical, attached to torus by small triangular areola (cicatrice), finely shagreen-tuberculate at both sides and dorsally, inflated dorsally, obtuse at apex, regular or at ventral basal side concave and with large pseudo-cicatrice recalling that of the Anchuseae, i. e., appearing as an elliptic opening in fruit envelope surrounded by a thickened margin. Embryo slightly curved. Annuals or biennials, delicate herbs, scorpioid cymes straightening in fruit, loose, hardly leafy. Fruit on short pedicel later drooping.

In habit like Myosotis sparsiflora. Three to four species mainly in Japan and China.

Note. Even though De Candolle described quite correctly the fruits of the genus, yet Bentham, Hooker, Fischer and Gürke erroneously claim that the pseudocicatrice is real and therefore include the genus in the Eritrichieae (Gürke).

1. B. tenellum (Horn.) Fisch. et Mey. l. c. (1835) 24; DC. Prodr. X, 116; Hook. Fl. brit. Ind. IV 167; Lipskii in Tr. Bot. Sada, XXVI, 460; Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 887. — Anchusa tenella Horn. Hort. Hafn. I (1813) 176. — Cynoglossum diffusum Roxb. Fl. Ind. ed. Wall. I (1824) 7. — C. prostratum Don, Prodr. Fl. nep. (1825) 100.

Perennials; stems 10—30 cm high, thin, weak, subfiliform, subglabrous, sparsely covered with small, appressed bristles, rarely simple, often spreading-branching with long branches; leaves thin, delicate, greenish, oblong, gradually tapering (the lower longly, the upper shortly) at base, obtuse or the upper leaves acute, 1—3 cm (to 5 cm) long, 5—17 mm wide, sparsely covered with short, appressed bristles on tubercles. Racemes elongate after flowering, loose, numerous, below with few lanceolate and
237 acute bracts 1.5—5 mm long, above with very small bracts; flowers many, very small, ca. 1 mm long, on thin, short, extraaxillary pedicels, in fruit reaching 3—5 mm in length and drooping; calyx covered with semi-spreading, short, white bristles; corolla blue or white, hardly longer than calyx, limb 0.5—1 mm across; fruiting calyx up to 4 mm long, with divergent acute lobes; nutlets small, 0.7 mm long, oval-reniform, gray, very small but densely shagreen-tuberculate, pseudo-cicatrice oval-rounded, occupying a large part of the ventral concave side. April—May.

Gardens, weedy places, in the Far East on stony slopes, plains, pastures.— Centr. Asia: Pam.-Al. (only in S. Tadzhikistan near Saiat on the Pyandzh River); Far East: Uss. (especially near Khabarovsk), Uda. Gen. distr.: Jap.-Ch., Ind.-Him., introduced into the Hawaiian Islands. Described from N. China. Type in Denmark.

* From the Greek botrys — cluster and sperma — seed.

Note. A rather variable plant, sometimes the pubescence is denser, canescent, but then the leaves are smaller and not as shady. Plants of this type, gray, with rather narrow, undulant leaves, were collected on the Pyandzh River.

Subtribe 6. TRIGONOTIDEAE M. Pop. — Gynophone somewhat ascending, not flat but low-pyramidal, slightly accrescent in fruit, more closely resembling the gynophone of some Eritrichium (tribe Eritrichideae) or the genus Omphalodes (tribe Cynoglossideae). The attachment of the nutlets is not typically basal but basal-ventral or even slightly suprabasal-ventral, with a small cicatrice lying at the base of the ventral keel of the nutlet. The nutlets tend to be tetrahedral, a form characteristic of Eritrichium, with a sharply defined, dorsal gynophone (disk).

The genus Mertensia with its large corolla is closer in this character to the typical Lithospermum, and its nutlets sometimes have an obscurely defined dorsal areola. The genus Brachybotrys has a corolla that is transitional to being short but in its exserted stamens it is similar to the flowers of Mertensia; the nutlets have a sharply defined dorsal areola typical for the Trigonotideae. The genus Trigonotis with its completely brachymorphic Myosotis-like corolla and its tetrahedral nutlets so closely resembles Eritrichium (tribe Eritrichideae) that their inclusion in different tribes is purely provisory.

The delicate, mesophyllous, forest and meadow herbs belong to the Flora region of the Ginkgo and the Boreal regions (Mertensia). The subtribe is intermediate between the authentic Lithospermideae and the Eritrichideae.

238. Genus 1194. **MERTENSIA*** Roth.

Roth. Cat. Bot. I (1797) 24; Prodr. X, 87.— Pneumaria Hill. Veg. Syst. VII (1764) 40.— Steenhammera Rchb. Fl. Germ. exc. I (1830) 337; Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 5 (245).— Casselia Dumort. Obs. bot. (1823) 21, non Nees (1823).— Eritrichium sect. I Oreocharis DC. Prodr. X (1846) 123—124.— Mertensianthe M. Pop. in Zakir. Burachn. Zeravsh. (1941) 8 and 21, Fig. 8.

Calyx 5-sect or 5-parted, not changing in fruit, shorter than corolla tube. Corolla usually sky blue or blue, mesomorphic, funnel-shaped, with more or less wide cylindrical tube, hollow inside, rarely hairy, limb campanulate, lobes ovate, oblong or semi-rounded, obtuse; scales usually present as narrow transverse folds or platelets in corolla throat. Stamens 5, with filaments usually ribbon-shaped, broad and short, attached in throat between scales; anthers oblong or ovate, sometimes sagittate at base, longer than filaments, exserted from throat but not reaching apex of corolla; style long, filiform, often exserted from corolla. Nutlets rather large, sometimes fleshy, usually white, tetrahedral, inflated at back, smooth, rugose or grumose, rarely with narrow wing at margin, more rarely prickly with short prickles

* After the botanist Mertens, a colleague of Koch.

along margin and disk; sides converging at the ventral side into an acute, sometimes nearly winged keel, apex free, acute, base rounded, cicatrice ventral-basal, small. Torus (gynophore) slightly elongating, short-conical, gradually passing into free style to which nutlets not adnate by ventral keel, rarely nutlets turbinate, with winged rim above (Mertensianthe). Perennial herbs, glabrous or sparingly pubescent, usually of medium height or even taller, rarely low. In addition to fertile leafy stems, bundles of radical leaves usually with ovate blades develop from the thin or rarely thickened rhizome. Inflorescence leafless, ebracteate, composed of small cymes or few-flowered loose bostryces, paniculate (if lateral branches are present) or simply 2—3-forked, or corymbiform (if stem simple).

Note. The species of Mertensia, with few exceptions, resemble each other outwardly so much that it is nearly impossible to distinguish them unless ripe, or at least half-ripe, nutlets are available. The confusion and complexity of the synonymy arose because the older authors had been describing species without the fruits thus ignoring their taxonomic significance. The first to point out the importance of the fruits was N. S. Turchaninov, but since the fruits of many of the species were unknown to him
239 he was unable to use them in the systematics. In the 18th century, beginning with Linnaeus, the species of this genus were included in the genus Pulmonaria from which they differed in the character of the nutlets, the attachment of which was more like that of the nutlets of Eritrichium than that of Anchusa, and also by the more mesomorphic flowers, and in particular by the style usually being exserted from the flower, as well as by the leafless scorpioid cymes. They were later, commencing with Léman's monograph (1818), included in the genus Lithospermum, from which they were distinguished even more by these characters, in addition to the presence of scales in the throat and the glabrous leaves and stems.

The distribution of Mertensia is uncommon for most of the genera of the Boraginaceae. In the Soviet Union the species are concentrated in Siberia, similar only to the genus Eritrichium. In the southwest they both extend to the Himalayas where they are represented by specific, distinct sections; their second center occurs in North America. In general, these genera are Arctic Tertiary by origin, evolved mainly in the boreal, cryophilic, later wave of invasion from Tertiary Artic. There is only one species in Central America (M. pulmonarioides Roth. = M. virginica (L.) G. Don) and apparently none in China. The North American species are described in Williams' new monograph (A Monograph of the Genus Mertensia in North America. Ann. Missouri Bot. Garden, 24 (1937) 17—159). They have nothing in common with the Siberian species except for the circumpolar, littoral M. maritima (L.) S. F. Gray and the Aleutian-Kurile-Kamchatka M. pilosa (Cham.) DC. However, the finding of the latter in Kamchatka is not fully reliable.

1. Nutlets ca. 3 mm across, rounded-turbinate or rounded-obconical, i. e., without acute apex, regular at all sides, growing to the side of the dorsal rounded areola, surrounded by an annular low crown (narrow annular wing), margins of crown and disk (dorsal gynophore of nutlet) finely pubescent inside, sides of nutlet glabrous. Radical leaves with cordate-ovate or suborbicular blade, sparsely

appressed-hairy at both sides. Stems low, 10—15 cm, with few (3—4) leaves. Inflorescence small. Corolla sky blue. (Gissar Range). (Section Mertensianthe) . . . . . 14. M. dshagastanica Rgl.

\+ Nutlets not turbinate, definitely acute at apex, with ventral acute keel and sides (back) distinguished from base; disk inflated but not winged,
240 if winged then wings plano-spreading, not ascending to form a crown (Sections Steenhammera and Eumertensia) . . . . . 2.

2. Nutlets smooth, lustrous, not winged at margin of the dorsal areola, with very acute ventral keel, dorsally inflated. Scales small. Sepals in fruit ovate. Nectary annular, inconspicuous. Maritime plants, with juicy, glaucous, spreading stems and obovate or oblong, very glaucous leaves. Flowers small, blue, up to 10 mm long, numerous. (Section Steenhammera). . . . . 1. M. maritima (L.) S. F. Gray.

\+ Plants not maritime, with erect stems. Corolla usually more than 10 mm long. (Section Eumertensia) . . . . . 3.

3. Nutlets narrowly winged at margin of the dorsal areola. (wing ca. 1 mm wide), nearly smooth. Leaves with sharply prominent nerves. (Only in the Pacific islands and in Kamchatka). (Series Pterocarpae) . . . . . 4.

\+ Nutlets without wings at margin of the dorsal aveola, with either teeth or prickles or without both wings and prickles at margin of disk and then disk tuberculate or rugose . . . . . 5.

4. Leaves usually spreading-hairy beneath, appressed-hirsute above, ovate or oblong, acute. Calyx hairy-downy, canescent. Stems low. Inflorescence small. Flowers rather large. (Kamchatka, Anadyr) . . . . . 10. M. kamczatica (Turcz). DC.

\+ Leaves glabrous, with subparallel nerves. Calyx lobes finely prickly at margin, otherwise glabrous. (Southern (and Central?) Kurile Islands) . . . . . 11. M. pterocarpa (Turcz.) Tatewaki et Ohwi.

5. Calyx cleft only to $\frac{1}{2}$ its depth into triangular teeth. Leaves on stem subcordate at base. (Series Utriculosae) . . . . . 6.

\+ Calyx dissected nearly to base into 5 lobes . . . . . 7.

6. High plants, 25—40 cm, with thin, erect, delicate stem. Leaves thin, sometimes thicker, oblong, obtuse. Pedicels thinner, as long as calyx. Corolla 8—10 mm long, blue. Nutlets with very narrow serrate-dentate wing (rim) along margin of the dorsal areola. Near Baikal area . . . . . 12. M. serrulata (Turcz.) DC.

\+ Low plants, 10—15 cm, glaucous. Stems low, usually hidden in rubble. Leaves mainly in the lower part of stem, the lower oblong-spatulate, the upper cordate-ovate, small, all leaves glaucous, fleshy. Pedicels short, $\frac{1}{4}$ to $\frac{1}{2}$ as long as calyx, 1—3 mm long. Corolla dark-, nearly black-blue, 12—14 mm long. Nutlets ovoid, oblong, with rounded back,
241 without wings or rim along margin. (Tarbagatai) . . . . . 13. M. tarbagataica B. Fedtsch.

7. Leaves completely glabrous, sometimes with few hairs at margin. Corolla 12—15 (20—23) mm long, blue. (Series Sibiricae M. Pop.) . . . 8.

\+ Leaves more or less pubescent, at least at upper surface and sometimes even at the lower . . . . . 11.

8. Leaves glaucous, rather compact, larger. Tube of the shorter corolla broad. Nutlets 6 mm long. (E. Siberia) . . . . . 9.
\+ Leaves delicate, green, not glaucous. Tube of the longer corolla narrow. Nutlets 3—4 mm long. (Mountains of Altai and Tarbagatai) . . . . . 10.
9. Blade of radical leaves large, up to 10 cm long, cordate-ovate. More robust plants. (Around the Baikal and on the Lena) . . . . . 2. M. sibirica (L.) G. Don.
\+ Blade of radical leaves oblong, somewhat smaller. Plants less robust. (Along the Yenisei) . . . . . 3. M. jenissejensis M. Pop.
10. Leaves larger and more delicate. Corolla shorter, ca. 15 mm long. (Altai) . . . . . 4. M. pallasii (Ldb.) G. Don.
\+ Leaves smaller, not as delicate, sometimes hairy. Corolla longer, up to 20 mm. (Tarbagatai) . . . . . 5. M. popovii Rubtz.
11. Nutlets pectinately tuberculate at back, at margin with more or less long prickles. (Pacific coast). (Series Cristatae) . . . . . 12.
\+ Nutlets finely tuberculate at back, without prickles or wings, ca. 3 mm long. Leaves (glabrous beneath) narrower, oblong-lanceolate to linear. (S. Siberia). (Series Tuberculatae) . . . . . 13.
12. Nutlets with cuneate denticles at margin of the dorsal aveola and dentate-pectonate at its median line. Leaves ovate, nerved. Sepals finely hispid along margin, otherwise glabrous. (Okhotsk coast) . . . . . 9. M. rivularis (Turcz.) DC.
\+ Nutlets short-prickly or dentate along margin of the dorsal areola with several pectinate-dentate rows along back. Leaves larger, densely hairy beneath. Sepals uninterruptedly villous-downy. Inflorescence wider, spreading. (Kamchatka, Ganal'skie Vostryaki Range) . . . . . 8. M. pilosa (Cham.) DC.
13. Leaves oblong-lanceolate. Corolla tube twice as long as calyx and limb. Rhizome thin . . . . . 6. M. stylosa (Fisch.) DC.
\+ Leaves lanceolate-linear. Corolla tube 3—4 times as long as calyx and limb. Rhizome short, nearly tuberiform . . . . . 7. M. **davurica** (Sims) G. Don.

242 Section 1. STEENHAMMERA (Rchb.) A. Gray in Proc. Am. Acad. N. S. 2 (1874) 52. — Genus Steenhammera Rchb. Fl. Germ. exc. I (1830) 337. — Throat with scales. Nutlets glabrous, smooth, inflated, without tubercles, prickles or wings, black when ripe.

1. M. maritima (L.) S. F. Gray, Nat. Arr. brit. Plants, 2 (1821) 354; G. Don, Syst. IV, 320; DC. Prodr. X, 88; Ldb. Fl. Ross. III, 132; Williams, l. c. 34—39. — Pulmonaria maritima L. Sp. pl. (1753) 136. — Pneumaria maritima Hill. Veg. Syst. 7 (1764) 40, tab. 37; Britt. a. Br. III. Fl. north. Unit. St. ed. 2, III, 82. — Steenhammera maritima Rchb. Fl. Germ. exc. I (1830) 337; Turcz. in Bull. Soc. Nat. Mosc. XIII, 5 (245). — Mertensia simplicissima (Ldb.) G. Don, Syst. IV (1838) 319; DC. Prodr. X, 89; Ldb. Fl. Ross. III, 132. — Pulmonaria simplicissima Ldb. in Nova Acta Acad. Petrop. V (1815) 518. — Mertensia asiatica Macbride in Contrib. Gray Herb. n. s.

XLVIII (1915) 53. — M. maritima ssp. asiatica Takeda in Journ. of Bot. XLIX (1911) 202. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 1317; Britt. a. Br. l. c.; Fedch. and Fler., Fl. Evrop. Rossii, 789.

Perennials; glabrous, fleshy plants, very glaucous with waxy bloom; root thin, plagiotropic with few stems above; radical leaves (at least at flowering) lacking; stems few, fleshy, erect or ascending or spreading, 15—40 cm high, rather densely leafy, with short declined branches above; cauline leaves rather similar in shape, spatulate-oblong, short-acuminate, flat, fleshy, small, 1—3 cm long, tapering to broad petiole; upper leaves obovate, sessile, obtuse, declined. Inflorescence umbelliform-corymbiform, becoming paniculate at apex if stem branched, with short broad leaves below and small bracts above; pedicels thin, filiform, glabrous, more or less drooping, longer than calyx; calyx glabrous, 5-sect nearly to base, with oblong-lanceolate, acute lobes ovate in fruit, 3—5 mm long; corolla blue, tubular-funnel-shaped, 7—8(10) mm long, tube ca. 4—5 mm long, as long as calyx, lobes short, ovate, obtuse, up to $^1/_3$ as long as limb; scales distinct, broad, notched, but the lower appear like brackets near the throat; filaments flat, broad; anthers oblong, hardly as long as to considerably longer than filaments, 1.5 mm long; style not exserted from corolla or barely so; nutlets 3—5 mm long, smooth, inflated and broad at back. June—August.

Sandy shores and gravels of the northern seas and rivers. — Arctic: Arc. Eur., Arc. (E.) Sib. and Far East along the Pacific (mainland and islands) to Korea and Japan. Gen. distr.: circumpolar. Described from Lapland. Type in London.

243 Note. A special race, which some accept as the independent species M. asiatica Macbride, grows along the Pacific shores on Kamchatka, Sakhalin, the Kurile Islands and in the Maritime Territory. If M. asiatica is to be considered as a separate species then it should be called M. simplicissima (Ldb.) G. Don because it was described by Ledebour from East Asia (obviously Kamchatka) under the name Pulmonaria simplicissima, without distinguishing it from the circumpolar Arctic M. maritima. I saw and studied Ledebour's original specimen and am convinced that it is the race later named M. asiatica.

Section 2. EUMERTENSIA A. Gray in Proc. Am. Acad. N. S. 2 (1874) 52; Williams, l. c. 28—29 (excl. M. virginica). — Nutlets tuberculate or prickly or narrowly-winged, not black, usually white. Scales present in throat. Corolla tube usually glabrous inside (rarely downy). Stems erect. Plants not maritime.

Series 1. Sibiricae M. Pop. — Nutlets white, not winged, without prickles, netted-rugose dorsally. Plants glabrous, glaucous or green. Leaves ovate or oblong, obtuse or short-acuminate.

2. M. sibirica (L.) G. Don, Syst. IV (1838) 319; DC. Prodr. X, 89. — Pulmonaria sibirica L. Sp. pl. (1753) 135. — Lithospermum sibiricum Lehm. Asperif. II (1816) 293. — Steenhammera sibirica Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 7 (247). — Mertensia denticulata Ldb. Fl. Ross. III (1849) 133, non G. Don, quae est species americana. — Ic.: Gmelin, Fl. Sib. IV, p. 75, tab. 39 (sub Anchusa); The Garden, XVIII (1880) 514.

Perennials; rhizome horizontal, 1.5 cm thick; stems usually single, glabrous, furrowed, 50—80 cm high, simple or with few floriferous branches above; radical leaves large, blade ovate or oblong, thick, glabrous, fleshy,

12 cm long, 6—7 cm wide, cordate or rounded at base, with lateral arcuate nerves and broad long petioles reaching 20 cm in length; cauline leaves few, median leaves larger, oblong, acute. Inflorescence rather large, corymbiform, composed of 2 scorpioid cymes at end and with 1—2 additional lateral (on lateral branches) cymes; bracts 1—2, only at base of cymes; pedicels thick, glabrous, 2—3 times as long as calyx, recurved in fruit, up to 1.5—2 cm long; calyx cleft for $^2/_3$, glabrous, glaucous, 4—5 mm long, with oblong-linear, acute lobes; corolla 12 mm long, broad, campanulate, blue (sky blue?), tube 5 mm wide, twice as long as calyx, pale, hairy inside, the limb as long as tube or slightly shorter, campanulate, dark blue,
244 with short rounded lobes; scales distinct, broad; filaments ribbon-shaped, shorter than the ovate anthers; style exserted from corolla for 4—5 mm; nutlets inflated at back and netted-rugose or tuberculate, smooth at sides, white, 4—5 mm long. June—July.

Banks of rivers and streams, gravels or sands in the taiga. — East Siberia: Ang.-Say., Lena-Kol., Dau. Endemic. Described from Siberia (from Gmelin's drawing from the Lena River). Type in London.

Note. Linnaeus' P. sibirica was based on Gmelin's plant which the latter reported from the Lena River, so these are the type and locus classicus of Linnaeus' species. The synonymization by Ledebour in "Fl. Ross." (III, 133) appears therefore quite strange since the plant from the Lena River was treated by him as M. denticulata G. Don and the Altai plant as P. sibirica G. Don, in spite of the report by Don himself. We accept the synonymy of Turchaninov and partly of De Candolle.

3. M. jenissejensis M. Pop. sp. n. in Spisok Gerb. rast. Fl. SSSR. XII (1953) — Exs.: GRF, No. 3566.

Perennials; root rather thin, oblique; stems 40—50 cm high, erect, glabrous, rather thick, glaucous, simple or slightly branching above; radical leaves with long petioles, blades small, ovate-elliptic, 5—6 cm long, rounded or cordate at base, short-acuminate at apex, glaucescent, slightly fleshy, completely glabrous; cauline leaves 3—5(7), small, elliptic, sessile, evenly tapering at both ends, glaucous. Inflorescence short-paniculate, nearly corymbiform; pedicels glabrous, longer than calyx, the lower recurved in fruit, up to 1.5 cm long; calyx glabrous, glaucous, 4 mm long in flower, 6 mm in fruit, cleft to $^2/_3$ into oblong, acute, fleshy lobes slightly scabrous at margin; corolla tube 2—$2^1/_2$ times as long as calyx, pale, wide but thinner than in M. sibirica, ca. 4—5 mm wide (in herbarium), limb blue, campanulate, shorter than tube; the entire corolla 15 mm long, lobes ovate-orbicular, ca. 3 mm long; style exserted from corolla; nutlets large, ca. 5 mm long, broad-ovate, tuberculate along back, smooth at sides. June—July.

Meadows near streams, riverbanks, along the Yenisei River. — East Siberia. Ang.-Say. (western part), Yenis. Endemic. Described from Angara (Balagansk area, Shcherbakova, Herb. Fl. URSS. No. 3566). Type in Leningrad.

4. M. pallasii (Ldb.) G. Don, Syst. IV (1838) 319. — Lithospermum pallasii Ldb. Fl. alt. I (1829) 176. — Steenhammera pallasii Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 7 (247). — Mertensia sibi-
247 rica Ldb. Fl. Ross. III, 133; Kryl., Fl. Zap. Sib. IX, 2276, non G. Don. — Pulmonaria bracteata Roem. et Schult. Syst. IV (1819) 747. — Ic.: Ldb. Ic. Fl. Ross. I, tab. 26.

PLATE XIII. 1 — Mertensia rivularis (Turcz.) DC; 2 — M. kamczatica (Turcz.) DC.

Perennials; stem thin, weak, glabrous, furrowed, simple, 20—40 cm high; radical leaves and the lower (or median) cauline leaves cordate-rounded or cordate-ovate, obtuse, thin-scarious, delicate, green, radical leaves long-petioled, lower cauline short-petioled, blades 4—6 cm long; upper cauline leaves ovate-oblong, subsessile, the uppermost sessile, acute, also thin-scarious. Inflorescence small, few-flowered, corymbiform, with filiform pedicels and 1—2, small, ovate leaves at base; pedicels and calyx glabrous, equal in length; calyx dissected to base into linear obtuse lobes, 4—5 mm long; corolla bright blue, ca. 15 to 18 mm long, tube ca. 8—10 mm long, rather narrow, twice as long as calyx, glabrous inside, limb campanulate, $^2/_3$ as long as tube, lobes not deeper than half the limb, ovate, obtuse; scales low, appearing as brackets; filaments elongate; anthers linear, 2—3 mm long, shorter than filaments, in limb but not reaching to its incisions; style slightly or not exserted from corolla. May—June.

Shady cliffs and near them in Altai. — West Siberia: Alt. (Narym Range, Sinyukha Mountain). Endemic. Described from Narym Mountains, from Sinyaya Sopka, from the Pallas collections. Type in Leningrad.

5. M. popovii Rubtz. sp. n. in Addenda, XVIII, 706.

Perennials; rhizome thin, short, sometimes slightly thick-tuberiform; stem usually single, simple, very rarely with 1—2 branches above, thin, 30—50 cm high, sparingly short-downy below, subglabrous above; radical leaves rarely preserved, small, blades small, ovate, rounded at base and acute at apex; cauline leaves rather numerous, the lower more or less long-petioled, blades ovate or ovate-oblong, obtuse or acute, 2—4(5) cm long, delicate, thin, green, without any trace of a glaucous bloom, nerves faintly protruding, glabrous except along margin; upper cauline leaves oblong, sessile, 2—3 cm long, cuneately tapering towards base, uppermost leaves slightly amplexicaul. Inflorescence a terminal, paired, forked scorpioid cyme, the cymes short, few-flowered, leafy only at base with usually 2 small, oblong, acute leaves; pedicels filiform, not long, the lower declinate in fruit, reaching 1 cm in length, appressed- and fine-downy; cymes nearly not elon-
248 gating in fruit and fruit stalks forming almost an umbel at apex; calyx ca. 4 mm long, dissected nearly to base into linear, acute lobes scabrous or short-hispid at margin; corolla dark blue, 12—15—20 mm long, with bright-colored narrow tube 2—3 times as long as calyx, limb campanulate, rather narrow, $^2/_3$ to almost as long as tube, lobes ovate, obtuse, short; scales well developed, appearing as arcuate brackets; anthers ca. 2 mm long, linear, longer than filaments, their apices not extending to incisions between corolla lobes; style filiform, slightly exserted from corolla; nutlets 4 mm long, white, oblong, rugose-tuberculate at the inflated back and at sides, acute. June.

Forests, glades, meadow slopes in upper forest belt in the mountains of Tarbagatai and Saura. — Centr. Asia: Dzu-Tarb. (Tarbagatai, Saura). Endemic. Described from Tarbagatai, Ak-Chok mountain pass, subalpine meadow, 2,000 m. Type in Leningrad, cotype in Alma-Ata.

Note. This is the southwesternmost race of the group of M. sibirica s.l. (Series Sibiricae); further southwest, this cryophilous group could not penetrate the more arid mountains of Tien Shan. The Saura-Tarbagatai race has the smallest leaf blades of all the races of this group; it already

has hairs, although very few, on the stem and along the margin of the leaves; the corolla and sepals are narrow and the comparatively small nutlets are narrow as well. Our species differs from the related Altai race (M. pallasii) by the slightly protruding styles, oblong not ovate leaves, never cordate at base and, seemingly, more delicate. It is possible, however, that the Altai and Saura-Tarbagatai races are connected through gradual transitions. The type of our species is the most different from M. pallasii.

Series 2. Tuberculatae M. Pop. — Nutlets white, tuberculate, without wings or prickles, ca. 3 mm long. Leaves oblong, lanceolate or linear, appressed-bristly above, glabrous beneath. Calyx pubescent.

6. M. stylosa (Fisch.) DC. Prodr. X (1846) 91; Ldb. Fl. Ross. III, 135. — Pulmonaria stylosa Fisch. in Mém. Soc. Nat. Mosc. III (1812) 62. — Lithospermum stylosum Turcz. Cat. Baic. (1838) No. 804. — Steenhammera stylosa Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 8 (248).

Perennials; rhizome thin, decumbent, producing 1 stem, rarely slightly thickened and with few stems; stem erect or slightly ascending at base, 20—40(50) cm high, simple or with 1—2 branches above, ribbed-furrowed, usually glabrous below, with scattered, semi-appressed bristles above, sometimes few-hairy also below; radical leaves of sterile rosettes small, 2—4 cm long, with thin long petioles, blades small, ovate or oblong, acute,
249 slightly cordate at base, glabrous beneath, remotely appressed-short-hispid above, with distinct but thin lateral nerves, usually 2 pairs in number; cauline leaves rather dense, sessile, lower leaves slightly tapering at base, upper leaves rounded at base, oblong or lanceolate, long-acuminate, glabrous and pale beneath, above green, appressed-short-scabrous-downy. Inflorescence on simple stem composed of 2 terminal scorpioid cymes, reduced, umbelliform at first, later forkedly elongating sometimes, with lateral branches bearing lateral scorpioid cymes, also later elongating; pedicels shorter than or as long as calyx, gray, with appressed down, declinate, relatively thick, ca. 5—10 mm long in fruit; calyx grayish hairy-downy, nearly 5-parted, with lanceolate or oblong acute lobes, 3—4 mm long; corolla 10—12 mm long, blue-violet, tube $1\frac{1}{2}-2$ times as long as calyx, limb narrowly campanulate, slightly shorter than tube, with ovate, obtuse lobes; scales narrow but rather long, distinct; filaments ribbon-shaped, thickened at apex under anthers; anthers oblong, 1.5 mm long, longer than filaments; style far exserted from corolla (2—3 mm); nutlets 3 mm long, ovoid, obtuse, tuberculate-granular, inflated at back and finely dotted-tuberculate at sides. June—July.

Subalpine meadows. — East Siberia: Ang.-Say., Dau. Endemic. Described from the Baikal area. Type in Leningrad.

Note. The M. meyeriana Macbride described by Macbride (Contrib. Gray Herb. n. s. XLVIII (1916) 52) is probably M. stylosa; although he notes that it is close to M. dahurica, it distinctly differs from it by "tubo limbum subaequante, foliis superioribus oblongo-lanceolatis." It was collected by F. Meyer somewhere in W. Mongolia ("Zairansk," 20 V 1911).

Type in the Gray Herbarium. Could it be that "Zairansk" is Zaisan and that this enigmatic plant was actually collected within the USSR?

7. M. davurica (Sims) G. Don, Syst. IV (1838) 318; DC. Prodr. X, 91; Ldb. Fl. Ross. III, 136; Kryl., Fl. Zap. Sib. IX, 2277 ("dahurica"). — Pulmonaria davurica Sims in Curt. Bot. Mag. (1815) No. 1743; Lodd. Bot. Cab. VI, tab. 528. — Steenhammera dahurica Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 10 (250). — Ic.: Sims, l. c.; Lodd. l. c.

Perennials; rhizome reduced, sometimes nearly tuberiform, usually with 2—3 thick ends; stem single, furrowed, erect, simple or often branching above in inflorescence, glabrous below, sparingly pubescent above but sometimes canescent with denser pubescence, 20—50 cm high; radical leaves of sterile rosettes long-petioled, soon withering, blades rounded or cuneate at
250 base, very rarely cordate, ovate-oblong or oblong, rather thick, small; cauline leaves numerous, directed upward, lanceolate or lanceolate-linear to linear, except for the spatulate lowermost leaves acute, sessile, early withering, appressed-hairy at upper surface with hairs on small tubercles, glabrous beneath. Inflorescence either of two terminal scorpioid cymes thus appearing bifurcate, or if stem with branches above then inflorescence paniculate; cymes leafless, at first short, dichasial or volute, erect in fruit, sometimes elongating, loose; pedicels gray-downy, shorter than calyx or the lowermost just as long; calyx gray-hairy-downy, dissected to base into linear, acute lobes, 3—5 mm long; corolla blue-violet, 12—15 mm long, claviform-funnel-shaped, with very long tube glabrous inside, 3—4 times as long as calyx, limb short, $^1/_3$ to $^1/_2$ as long as tube; style hardly exserted from corolla; nutlets white, rugose-tuberculate, 3 mm long. June—July.

Wooded slopes, alpine and subalpine meadows. — West Siberia: Alt.; East Siberia: Ang.-Say. (along the Serlikh River, Minusinsk district, in the West Sayans), Dau. Gen. distr.: Mong. Described from Dauria. Type in London.

Note. Very close to M. stylosa, differing only in the narrower leaves and longer corolla tube, 3—4 times (not $1^1/_2-2$ times) longer than calyx. The leaves are thicker and the rhizome is reduced which makes M. davurica more xerophilous when compared with M. stylosa. In general M. davurica is the most xerophilous species in the genus and the most distinguished in the structure of the corolla. Its description was based on specimens grown in England from seeds sent by Fischer from the Goren botanical garden. Sims referred to a specimen in the Pallas herbarium with the inscription P. davurica, which may possibly be considered as the type specimen. He never regarded himself as the author of the species, rather acknowledging Lambert or even Pallas. Pulmonaria gracilis Roem. et Schult. (Syst. IV (1819) 747) might be identified as M. davurica, even from De Candolle's description (Prodr. X, 91), yet the given habitat — "Ad sinum Ochotensem et in insulis adjacentibus, Pallas" — certainly does not fit that of the species which does not occur either on the Okhotsk coast or the islands adjacent to it.

Series 3. Cristatae M. Pop. — Nutlets white, with one or three longitudinal dentate dorsal combs, dentate-spiny along margin of back. Leaves oblong, villous or glabrous beneath, appressed-bristly above.

251 8. M. **pilosa** (Cham.) DC. Prodr. X (1846) 90; Ldb. Fl. Ross. III, 134.— Pulmonaria pilosa Cham. in Linnaea, IV (1829) 449.— Steenhammera pilosa Turcz. in Bull. Soc. Nat. Mosc. (1840) 9 (249).— ? Pulmonaria pubescens Roem. et Schult. Syst. IV (1819) 744.— M. eastwoodiae Macbr. in Contrib. Gray Herb. N. S. 49 (1917) 18.— M. alaskana Eastw. in Bot. Gaz. 33 (1902) 287, non Britt.

Perennials; stems very sparingly crisp-hairy, mainly in inflorescence and under nodes, otherwise completely glabrous or subglabrous, high, ca. 70 cm, branching above (in inflorescence), paniculate; radical leaves long-petioled (7—10 cm), blades 5—7 cm long, cordate-ovate or ovate or slightly cordate, acute, sparsely hairy beneath with curved spreading bristles, scabrous above (hairs short, straight, appressed, borne on small tubercles), with arcuate lateral nerves; cauline leaves ovate or often oblong, lower leaves tapering at base, upper leaves sessile, all long-acuminate, hairy beneath, scabrous above, large (median cauline to 10 cm long, 3—4 cm wide). Inflorescence racemiform, paniculate if lateral branches present, umbelliform if stem simple; pedicels 2—3 times as long as calyx, 1 cm in flower, 1.5—2 cm in fruit, drooping, spreading-bristly-hairy; calyx 5-parted, lobes narrowly lanceolate, acute, grayish and soft-hairy with semi-spreading hairs, 5 mm long in flower, to 8—10 mm in fruit; corolla ca. 15 mm long, blue, tube hairy inside, broad, slightly longer than calyx, limb as long as or slightly shorter than tube with ovate-orbicular lobes, ca. 1 mm long; style not exserted from corolla; nutlets pectinate-rugose at back, tuberculate at sides, unevenly toothed along margin of the dorsal areola, appearing as if with rudimentary, torn wing. June—July.

Far East: Sakh. (Kurile Islands), Kamch. **Gen. distr.**: northwestern part of North America. Described from N. Am. Eschscholtz Bay (Saint Lawrence Island?). Type in Berlin, cotype in Leningrad.

Note. It resembles and is often identified with M. paniculata (Ait.) G. Don which is widespread in N. America. Williams (l. c. 140) regarded this as a dubious species. Somehow he did not see the original specimen of Pulmonaria pilosa Cham. which is preserved at the Herbarium of the Botanical Institute of the Academy of Sciences of the USSR, although judging by the labels bearing his notes he examined some of our material. I saw the only specimen from Kamchatka referring to the Russian species (Ganal'skie Vostryaki, 1831, Rider); the other specimens cited in part by Komarov in "Flora Kamchatki" belong to M. kamczatica (Turcz.) DC.

9. M. rivularis (Turcz.) DC. Prodr. X (1846) 90; Ldb. Fl. Ross. II, 135; Kom., Fl. Kamch. III, 55.— Steenhammera rivularis Turcz.
252 in Bull. Soc. Nat. Mosc. XIII (1840) 8 (248).— Lithospermum rivulare Turcz. Cat. Baic. (1838) 74.— ?P. gracilis Roem. et Schult. Syst. IV (1819) 747 (possibly, ex loco is referred here).

Perennials; stem erect (sometimes ascending at base), glabrous below, scabrous above, with appressed short bristles, usually branching, sometimes from below, sometimes branching only in upper part; radical leaves long-petioled, blades cordate-ovate, long-acuminate, usually glabrous beneath, rarely remotely appressed-bristly, still more rarely (in the type?) hairy, scabrous-downy above mainly near apex of blade, with appressed bristles borne on white tubercles, nerves thin, arcuate, lateral nerves 2 pairs;

cauline leaves ovate or oblong, long-acuminate, as hairy as the radical leaves, sessile except for the short-petioled lower ones. Inflorescence usually a terminal forked cyme (scorpioid cyme) with short branches in flower, elongating in fruit, additional scorpioid cymes often on lateral branches, in general inflorescence small but sometimes many-flowered; pedicels several times longer than calyx, erect in fruit, up to 1—1.5 mm long, thin, covered with appressed bristles; 3—3.5 mm long, 5-parted, lobes oblong, acute, usually short-bristly only along margins, rarely (in the type) short-hairy along back; corolla ca. 2 [sic] mm (10—14 mm long), with tube glabrous inside, twice as long as calyx, the limb as long as tube, rather broadly campanulate, lobes short, obtuse; scales elongated, narrow; anthers ca. 1.5 mm long, oval, obtuse; filaments clavate, ca. 2 mm long; style slightly exserted from corolla; nutlets along dorsal areola with longitudinal dentate comb and 2 marginal rows of spines, otherwise dorsally tuberculate-rugose, white, smooth along sides, ca. 3 mm long, spines ca. 0.5 mm long, unequal, not anchor-like. June—July. (Plate XIII, Figure 1.)

Far East: Okh., Kamch. Endemic. Described from the area between Yakutia and Okhotsk (according to Turchaninov), more precisely, between Aldan and Okhotsk (Ledebour). Type in Leningrad.

Note. This delicate species is distributed mainly along the coast of Okhotsk (Ayan, Okhotsk, Dzhugdzhur Range, etc.), in the south up to the Amgun' River and the sources of the Bureya, and in the north to Kamchatka. (I saw only fragments of stem apices from Kamchatka without the exact locality given (Kastal'skii) and from the Petropavlovsk area (K. Bogdanovich, 1898)). In habit it is like M. stylosa but is strikingly distinguished from it by the very long pedicels and longer corolla tube, the calyx being scabrous only along margins and not gray-villous, and mainly by the nutlets
253 with two rows of prickle-like denticles along the dorsal areola. According to the nutlets our species is close to M. pilosa (Cham.) DC., but differs by the less hairy and smaller leaves, the smaller calyxes usually hairy only along the margin of the lobes, and by the smaller corolla. The prickles along the margins of the dorsal areola are more distinct and longer than in M. pilosa.

M. nivalis Kom. (Fl. Kamch. III (1930) 54) is closely related to this species. Its nutlets, however, are unknown and hence its systematic position cannot be precisely determined. The type-specimen is unusual. In the markedly pubescent leaves it is more like M. kamczatica, but its nutlets are too young to establish their characteristics.

Series 4. Pterocarpae M. Pop. — Nutlets slightly rugose, nearly smooth, encircled at margin of the dorsal areola by entire wing ca. 1 mm wide. Leaves oblong or ovate, with sharply protruding, sometimes parallel nerves. Pacific coast and islands.

10. M. kamczatica (Turcz.) DC. Prodr. X (1846) 100; Ldb. Fl. Ross. IV, 136. — Steenhammera kamczatica Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 10(250). — Lithospermum kamtczaticum Turcz. l. c. 18. — M. elliptica Ldb. Fl. Ross. III (1849) 134; Kom., Fl. Kamch. III, 55. — M. longistyla Ldb. l. c. 135; Kom., op. cit. 55.

Perennials; rhizome rather thin, usually oblique, dark. Plants appressed-hairy, generally like M. pilosa but lower, with smaller leaves and narrower inflorescence; stem subglabrous, 20—30—40 cm high, erect or ascending at base, simple or with few branches; radical (sterile rosettes) leaves with distinctly subcordate-ovate blades and long petiole, the blades 3—5 cm (rarely more) long, petioles up to 10 cm long; cauline leaves oblong or elliptic, long-acuminate (the lower small, narrowly spatulate, withering at flowering), lower leaves tapering at base, upper leaves sessile, sparsely semi-appressed and coarse-hairy at both surfaces or glabrous at upper surface, the young leaves sometimes gray beneath with thick hairs, 3—4(5) cm long, 1.5—2 cm wide, with 1 medium and 2 pairs of lateral, arcuate, thin nerves. Inflorescence small, composed of two terminal scorpioid cymes, leafless, borne on very long stalks (forked), dense, short subanthesis, elongating in fruit, sometimes with additional 1—2 scorpioid cymes on the lateral branches, branches upright and appressed so that inflorescence narrow; pedicels at first as long as calyx, gray-villous, elongating in fruit, 1—2 cm long, erect; calyx gray-villous-hairy, ca. 5 mm long, with lanceolate acute lobes; corolla blue, funnel-shaped, variable in length and width, tube 6—8 mm long, glabrous inside, the limb just as long, more or less campanu-
254 late, usually wider than in M. stylosa, lobes of limb very wide and short; scales narrow, well developed; filaments ribbon-shaped, broadening above; anthers oblong, 1.5 mm long, longer than filaments; style variably exserted from corolla, rarely not exserted (long-styled forms — M. longistyla Ldb.); nutlets (viewed from the back) ovate, slightly plicate at sides (possibly from drying), winged at margin, wing ca. 1 mm wide, entire, rimming the ovate dorsal areola disk. June—July. (Plate XIII, Figure 2.)

Meadows, mountain slopes, banks of rivers and streams, very common. — Arctic: Arc. Sib., Chuk., Anad.; Far East: Kamch., Okhot., Sakh. (Shumushu Island). Endemic. Described from Kamchatka, China. Type in Leningrad.

Note. Resembling M. pilosa (Cham.) DC. from which it differs in the winged and nearly smooth nutlets (in M. pilosa pectinate-dentate, wingless) and the small, narrow and poor inflorescence, smaller leaves and often the slightly exserted style. The synonymy of this species is quite complicated. The name Pulmonaria pubescens Roehm. et Schult. (Syst. IV (1819) 744) almost unquestionably refers to M. kamczatica and holds priority. The specimens I saw from Shumushu Island (north of the Kuriles) unquestionably pertained to M. kamczatica and it is highly probable that P. pubescens was described from this island (from the Steller collections). But the problem is that something similar to M. pilosa is growing there, so that one cannot be fully convinced of the identity, particularly since I have never seen the original P. pubescens. It is quite likely that Lithospermum schreberianum Sprengel (Syst. I (1825) 546) from Kamchatka should also be included here, as its synonymy includes Pulmonaria pumila Schrank (P. pumila Schrank in Nov. Acta Phys.-Med. Acad. Caesareae Leop. Carol. Naturae Curiosorum, IX (1818) 101; Schrank, Genus Pulmonariae illustratum, No. 3 (p. 101)). According to Schrank this plant was in the herbarium (in Munich?) with the note from its sender (Pallas?)— "Pulmonaria sibirica pumila e Kamtschatka." Although Schrank's description is brief there is nothing in it

contradicting the characters of M. kamczatica, hence our species should be called M. pumila (Schrank).

11. M. pterocarpa (Turcz.) Tatewaki et Ohwi in Acta Phytotax. et Geobot. II (1933) 25; Investigation in plants of Shikotan Island, South Kuriles, 1940. — Steenhammera pterocarpa Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 5 (245).

Perennials; rhizome thin, multicipital stems (sometimes few) ca. 40 cm high, erect, simple, ribbed, subglabrous; leaves of sterile rosettes long-petioled, blades cordate-ovate, mucronate, glaucous, glabrous; cauline leaves
255 rather dense, ovate or ovate-oblong, flat, 4 cm (3—5 cm) long, often with thick glaucous bloom beneath, rarely green, with typical parallel nerves (nearly as in a monocotyledon), cuneate-rounded and gradually tapering at base to short petiole, gradually acuminate at apex, lower leaves glabrous at both surfaces, upper leaves with small tubercles above bearing short appressed bristles; lowermost cauline leaves reduced, spatulate, tapering to long petiole, drying up at flowering. Inflorescence usually of two terminal scorpioid cymes, sometimes with an additional lateral branch with 1 bostryx, cymes short, loose, leafless; pedicels 1—1.5 cm long, filiform, canescent, with short acicular, nearly appressed bristles densely covering base of calyx; calyx incised nearly to base, lobes lanceolate, acute, with 1—3 parallel nerves, glabrous but with appressed bristles along margin and inside, 5—7 mm long; corolla blue, funnel-shaped, 12—14 mm long, tube approximately as long as calyx, wide, glabrous inside, the limb narrowly campanulate, slightly longer than tube, with semi-orbicular lobes, one-third of the limb; scales appearing as a thin fold ca. 0.3 mm high but broad (from stamen to stamen); filaments flat, markedly broadening under anther, attached to tube a little above scales, 3—4 mm long; anthers oblong, obtuse, ca. 2 mm long, extending to incisions between lobes of limb; style hardly exserted from corolla; nutlets 3—4 mm long, light brown, oblong, dorsal areola inflated, with longitudinal keel appearing as an elevated smooth line, with rather wide (1 mm), undulant, brown wing along margins, slightly grumose at sides. July.

Meadows on mountain slopes. — Far East: Sakh. (Kurile Islands, of the southern group: Shikotan, Iturup; of the middle group: Urup). Endemic. Described from the Kurile Islands. Type in Leningrad.

Series 5. Utriculosae M. Pop. — Calyx cleft to $\frac{1}{2}$, sometimes to $\frac{1}{3}$ of its length into teeth, not incised below, saccate. Nutlets different.

12. M. serrulata (Turcz.) DC. Prodr. X (1846) 89; Ldb. Fl. Ross. III, 133. — Steenhammera serrulata Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 6 (246). — Lithospermum serrulatum Turcz. Cat. Baic. (1838) No. 805.

Perennials; rhizome thin, dark, usually producing one stem but sometimes thicker and multicipital, when thin then creeping and branching; stem thin, erect or ascending at base, glabrous, simple or branching above with elongate, spreading branches, 25—40 cm high, brownish below; radical leaves with
256 petioles longer than blade, blades ovate, acute, shallowly cordate at base, 3—6 cm long, 2—3.5 cm wide, glabrous, appearing serrate at margin owing to

short curved bristles; cauline leaves — the lower smallest, soon drying, spatulate-oblong, tapering at base, the median largest, oblanceolate, obtuse, the upper oblong or ovate, sessile, often nearly cordate-amplexicaul, all flat, thin or thicker, glaucescent, finely appressed-bristly at margin. Inflorescence on simple stem on approximately 10-flowered umbel small, nearly leafless, on branching stem with lateral umbels and then on the whole irregularly paniculate; scorpioid cymes dense at first, elongating in fruit; pedicels glabrous, filiform, about as long as calyx; calyx glabrous, campanulate, ca. 3 mm long, 5-partite to 1/2, sometimes only to 1/3, into ovate, obtuse or acute denticles finely scabrous at margin; corolla blue, funnel shaped, 8—10 mm long, tube 5 mm long, slightly longer than calyx, the limb cleft for 1/2 into ovate, obtuse lobes; scales very distinct, wide, 1/3 mm high, incised at the middle; filaments attached to tube slightly below scales, narrowly ribbon-shaped, as long as the oblong anthers, 1.5 mm long; style not or often exserted from corolla; nutlets finely white-rugose-granular at faces and along back, with narrow, white, serrate-dentate wing (rim) along margin of the inflated dorsal areola. June—July.

Stony places in the subalpine belt. — East Siberia: Dau. Endemic. Described from the eastern shore of Lake Baikal (at the waterfalls between the Barguzin and Upper Angara Rivers — Turchaninov). Type in Leningrad.

Note. An endemic of the Baikal area with small flowers and unique calyx. Peculiarly enough, it appears to me to be affined with the geographically remote M. tarbagataica B. Fedtsch. In the Baikal area individuals with coarser and more glaucescent leaves are found, which in habit are closer to M. tarbagataica than the type with delicate leaves growing around the waterfalls. These individuals are found in the vicinity of Barguzin, basin of the Ina River, gravels on the banks of the Ina (flowers, 14 VI 1911, Korotkii and Nikolaev, No. 527).

13. M. tarbagataica B. Fedtsch. in Izv. Peterb. Bot. Sada, XV (1915) 402; Rast. Turk. (1915) 666, nomen; Perech. rast. Turk. 6 (1916) 348.

Perennials; plants 10—15 cm high, glaucous; rhizome thin, nearly cord-like, branching, apparently creeping in wet pebbles, dark, producing low stems from different places (apices of branches, lateral buds); lower part of stems
257 growing in wet pebbles usually nearly horizontal and covered with brown scarious scales, epigeal part of stem erect, ca. 10 cm high, simple, glabrous, glaucous, fleshy (partly reminiscent of M. maritima), thin but robust, apex leafless for 3—5 cm under inflorescence; leaves mainly in the lower half of stem, the lowermost leaves developing from scales of underground part, oblong-spatulate, tapering at base to petiole, the 3—5 upper leaves nearly cordate-ovate, sessile, semi-amplexicaul, obtuse, 1—3 cm, often ca. 2 cm long, without any hairs even along margin, fleshy, gray-glaucous. Inflorescence small, capitate, i. e., appearing as a much compressed dichasium; pedicels 1—3 mm long, fleshy, glaucous; bracts absent; flowers up to 10 in inflorescence, normally developed 2—5, the remaining degenerating without yielding fruit; calyx glaucous, glabrous, cleft for 1/2 into triangular-oblong or lanceolate acute teeth 4—5 mm long; in fruit calyx elongating-semiglobular thus concealing nutlets; corolla (in herbarium) appearing dark, nearly black-blue, ca. 12—14 mm long, the limb weakly defined, appearing to be merely an extension of the tube, 1/3 to 1/2 as long as tube,

teeth oblong, 2 mm long, obtuse, erect, tube twice as long as calyx; scales low, wide, arc-like; filaments thin, 1.5—2 mm long, attached slightly below scales; anthers oblong, obtuse, yellow, 1.5 mm long; style filiform, far exserted from corolla, approximately for 5 mm; nutlets ovoid-oblong, with rounded back, without wings or rim at margin, when ripe (these I did not see) possibly tuberculate along back, with apex acute and protruding from calyx. July.

Centr. Asia: Dzu.-Tarb. (Tarbagatai). Endemic. Described from the Su-Asu mountain pass. Type in Leningrad.

Section 3. MERTENSIANTHE M. Pop. comb. n. — Genus Mertensianthe M. Pop. in Zakir. Burachn. Zeravsh. (1941) 21, Fig. 8. — Nutlets rounded-turbinate, with winglike, hairy crown at the rounded, hairy dorsal areola, i. e., with narrow but thick wing, vertical and even slightly incurved, sides of nutlets smooth, glabrous.

14. M. dshagastanica Rgl. in Tr. Bot. Sada, VI, 2 (1880) 340; Lipsky, ibid. XXVI, 478. — Mertensianthe seravschanica M. Pop. l. c.

Perennials; rhizome short, thick, covered with black scales, with thin,
258 dark, adventitious roots; stem delicate, thin, weak, 5—15 cm high, subglabrous or sparsely appressed-bristly; radical leaves flat, remotely appressed-bristly, with 3—12 cm long petioles, blades delicate, cordate-ovate, acute or rounded or obtuse, 2—4 cm long, green, sparsely covered at upper side with appressed bristles on flat broad tubercles, subglabrous beneath; cauline leaves few, the lower two nearly opposite, the upper two alternate, sometimes nearly opposite, ovate or oblong, sessile, acute, small. Inflorescence at apex of stem, loose and few-(2—10) flowered, nearly umbelliform, drooping to one side, leafless; pedicels filiform, thin, long, 5—12 mm, remotely appressed-bristly; calyx 5-sect to base, lobes linear, acute, densely long-, sometimes white-hairy particularly along margins; corolla blue, 13—15 mm long, clavate-tubular; tube nearly twice as long as calyx, glabrous inside, the limb nearly half as long as tube, very narrowly campanulate, the lobes half the limb-length, 2—3 mm long, ovate, obtuse; scales oblong, high, yellow, rounded-obtuse; filaments short, 1—1.5 mm long; anthers linear-oblong, 3 mm long, yellow; style markedly exserted from corolla; hypogynous disk fleshy, 4-lobed; nutlets ca. 3 mm high (diameter), rounded-obconical, with smooth rounded sides and elongated crown; margins of crown and areola (inside crown) finely hairy. June—July.

Calcareous rocks in the alpine belt. — Centr. Asia: Pam.-Al. (mainly Gissar Range). Gen. distr.: Dzu.-Kash. (Jagasatay Mountains in Kuldja — very doubtful!). Probably endemic. Seemingly described from the Jagasatay Mountains in Kuldja. Type in Leningrad.

Note. In 1940—1941, without having examined the original M. dshagastanica Rgl., I assumed that the Zeravshan plants could not be identical with the Kuldja (Jagasatay) ones. On examining the original specimens in 1949 and 1950 I found them in such a poor state, without fruit and with very few flowers, that it was difficult to determine them, but despite this I was convinced that they actually referred to the Zeravshan (Gissar) species. My

first conclusion, that the Gissar plants could not be the same species as that of Jagasatay, remained and I am almost convinced now that the labels on these original specimens are wrong. They were written by E. Regel, not A. Regel, collector. The plant (M. dshagastanica Rgl.) was probably collected in upper Zeravshan or Karategin, where A. Regel had collected plants many times, and the unlabeled plant fell into the hands of E. Regel who, without analyzing it, wrote: Jagasatay not far from Kuldja, "unweit von Kuldscha."

259 Genus 1195. **BRACHYBOTRYS*** Maxim.

Maxim. ex Olivier in Hook. Ic. pl. XIII (1878) 43.

Calyx incised to base into nearly subulate lobes, slightly broadening in fruit; corolla broadly funnel-shaped, with broad limb, ca. 10 mm long, and wide, the tube very short, 3—4 mm long, divided inside into longitudinal segments appearing as thickened cords in continuation of the filaments, the limb cup-shaped-campanulate, with lobes extending for $^2/_3$ of limb-length, ovate-oblong, obtuse, ca. 5 mm long. Scales triangular-trapeziform, rather large, ca. 1.5 mm high, hardly 2-lobed at apex. Stamens inserted in throat between scales, filaments somewhat dilated at base, subulate, 5 mm long; anthers 3—4 mm long, oblong, dorsally attached to filaments, cordate at base, with dotted mucros at apex, reaching the apex of lobes; style long, filiform, markedly exserted from corolla. Nutlets 4—5 mm long, attached to a very short, small, conical gynophore by small triangular cicatrice occupying a basal-ventral position, ovate-tetrahedral, flat at sides and base, with sharp ventral keel above cicatrice, short-downy around, black when ripe; dorsal areola flat, rimmed with acute ribs but not winged. The genus is undoubtedly related to Mertensia, reminiscent of some unique, forest Mertensia.

1. B. paridiformis Maxim. ex Olivier, l. c. (1878); Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 880 and 884. — Ic.: Oliv. l. c. Tab. 1254; Kom. and Alis., op. cit. Table 269.

Perennials; rhizome cordlike, creeping, ca. 3 mm thick, with elongated internodes and brown scales; stem single; erect, 50—80 cm high, subglabrous below, faintly crisped-hairy above, canescent at top with appressed short hairs; radical leaves absent; lower cauline leaves not developed, about 5, the lowermost scalelike, the next spatulate-lanceolate, long-petioled, acute, appressed-canescent-hairy beneath, glabrous above, gradually tapering to larger blade; upper leaves approximate, forming "whorls" of 5—6 leaves each, somewhat varying in size, cuneately tapering at base to short petiole, blades oblong, long-acuminate at apex, delicate, later becoming compact, appressed-hairy beneath, glabrous above, distinctly pinnately
260 nerved; largest leaves 10—15 cm long, 4—7 cm wide (in upper third), the smallest $^1/_2$ to $^2/_3$ times as long. Peduncle (apex of stem) thin, appressed-gray-hairy, 5—10 cm high; cyme leafless, umbelliform, with 3—5—7 flowers; pedicels thin, erect, 1—1.5 cm long, appressed-grayish-downy; calyx

* From the Greek brachys — short and botrys — raceme.

gray-hairy, lobes linear-subulate, ca. 10 mm long; corolla pink-blue (according to Kom. and Alis. "dark violet"), limb 10 mm across. May—June.

Shady leafy forests. — Far East: Uss. (southern end of Sikhote-Alin Range). Gen. distr.: China (Manchuria). Described from Manchuria. Type in London, cotype in Leningrad.

Genus 1196. **TRIGONOTIS*** Stev.

Stev. in Bull. Soc. Nat. Mosc. XXIV 1851) 603.— Endogonia Turcz. ex Lindl. Veget. Kingd. ed 1 (1846) 656, nomen nudum.— Myosotis sect. Endogonia Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 257.— Eritrichium sect. Endogonia DC. Prodr. X (1846) 128.— Eritrichium genus Sylvatica Maxim. in Bull. Acad. Sc. Pétersb. XVII (1874) 444.

Calyx small, 5-parted not to base, with linear or lanceolate, little elongating lobes; corolla blue, like Alyosotis typically short, with short tube and nearly flat limb, lobes of limb rounded-obtuse, oval, short, in annual species corolla very small, campanulate; scales in throat appearing as narrow crescent-shaped folds; anthers attached in tube below scales, ovate or oblong, acute or obtuse, 0.5—1 mm long; style short; stigma hidden in tube capitate. Nutlets with thin delicate pericarp, tetrahedral-ovoid, ovate (when viewed from the back), with acute triangular apex, distinct dorsal areola, twisted sides forming an acute ventral keel and with small ventral cicatrice at base of keel. Embryo erect. Herbs with the habit of forget-me-not. About 10—15 species mainly in China, Japan and the Himalayas.

Note. Very close to Eritrichium, i. e., transitional to the Eritricheae just as the Eritricheae genus Amblynotus is transitional to the Lithospermeae. Trigonotis differs from Eritrichium only in its flatter gynophore and its nutlets with delicate, thin pericarp, without prickles at the margins of the dorsal areola. These are also absent in some species of Eritrichium but in such species the pericarp is hard and the leaves narrow, xeromorphic, usually silvery with dense appressed hairs. The species of Trigonotis are delicate, mesophilic herbs, sparsely hairy, with spatulate leaves and long, loose, racemes.

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1. Annuals. Corolla very small, 1.5 mm long, 1 mm across. Nutlets on stipes, very small, often downy. Fruiting pedicels usually clavate-thickened under calyx. Small plants with small spatulate leaves, in habit like annual forget-me-not .... 4. T. **peduncularis** (Trev.) Benth.

\+ Perennial, delicate, thin herbs. Rhizome delicate, thin, brittle, sometimes creeping. Corolla 5—10 mm across. Fruiting pedicels longer, 15—30 mm, more drooping, not clavate-thickened under calyx. (Only east of the Baikal area) ..... 2.

2. All leaves, even the radical, oblong-lanceolate, cuneately tapering at base, without differentiated petiole, acute at apex, delicate, subglabrous, 2—5 cm long. Racemes distinct, nearly leafless, with bracts only at base, ebracteate above ..... 3. T. **myosotidea** Maxim.

* From the Greek treis — three and gonia — corner, after the acutely triangular nutlets.

+ Median cauline and especially lower leaves with long, distinctly differentiated petiole, blades semi-rounded or subcordate, thus abruptly tapering at base, lanceolate or oblong, acute. Stems often spreading, very thin, weak. Flowers single in axils of upper leaves (racemes very loose, few-flowered, leafy) . . . . . 3.

3. Stems rooting above. Leaves glabrous, acute. (Upper reaches of the Amur) . . . . . 2. T. radicans (Turcz.) Stev.

+ Stems not rooting above, in the fall developing filiform rooting branches from axils of upper leaves. Leaves less acute, more appressed-hairy. (Middle and lower course of the Amur, Ussuri) . . . . . 1. T. koreana Nakai.

Section 1. SYLVATICA (Maxim.) M. Pop. — Eritrichium group Sylvatica Maxim. in. Bull. Acad. Sc. Pétersb. XVII (1874) 44. — Perennials. Corolla 5—12 mm across. Anthers obtuse. Nutlets attached to gynophore by small, ventral-basal, stipeless cicatrice.

1. T. koreana Nakai in Bot. Mag. Tokyo, XXXI (1917) 219. — Exs.: GRF, No. 2326 (sub nom. T. radicans).

Perennial; rhizome short, black, brittle, producing thick fiberlike black rootlets, few stems and bundles of radicle leaves; stems 10—20 cm long (later up to 40 cm), weak, thin, in the spring at the onset of flowering short, a small shrub in habit, in the summer elongating, lying on the ground, glabrous in lower part, appressed-bristly-hairy and sometimes grayish above, simple, in the fall producing from the axils of upper leaves thin lateral rooting branches; radical leaves and the lower cauline with long petioles, 2—5 times as long as blades and sometimes reaching 10 cm, blades delicate,
262 flat, oblong (varying from ovate to oblong-lanceolate), rarely oval, 1—3 cm long, 1—1.5 cm wide, sometimes reaching 4—6 cm in length and 2—3 cm in width, short, sparsely appressed bristly-hairy at both sides, obtuse at apex (from obtuse to acute); upper leaves short-petioled, blades narrower and smaller, oblong or lanceolate, base of all blades either slightly cordate or rounded or cuneate. Racemes very few-flowered (flowers few in axils of upper leaves, actually outside the axils), very loose, leafy, sometimes only the very apex without leaves; pedicels thin, filiform, long, 1.5—3(4) cm long, drooping, with few appressed bristles; calyx lobes 3—4 mm long, lanceolate, acute, sparsely covered with appressed bristles and hairs; corolla blue, tube very short, the limb flat, 6—10(12) mm across, lobes ovate or oval, rounded-obtuse, $^3/_4$ to $^1/_2$ as long as limb; scales large, ovate-trapeziform, 2-lobed at apex, papillate; anthers oval, 0.5—1 mm long, obtuse; nutlets ca. 2 mm long, downy. May—June. (Plate XIV, Figure 1.)

Forests, shrubby formations. — Far East: Uss., Ze.-Bu., Uda. (very common). Gen. distr.: China, Korea. Described from Korea, Cheju (former Quelpart) Island (Nakai), but in his description the author also reported specimens from the Soviet Maritime Territory. Type in Tokyo.

Note. All the plants of the middle and lower Amur that were identified as "T. radicans (Maxim.) Gürke" (Komarov, Fl. Man'chzh. III, 325; Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 888) and "Eritrichium

radicans DC." (Maksimovich, Prim. Fl. Amur, 1859, 203; Bull. Acad. Sc. Pétersb. XVII, 448) should be referred to this species. According to the description this widespread plant is very variable in shape of leaf-blade and size of flowers. Var. grandis is a distinguished larger plant with leaf blade 4—6 cm long, 2—3 cm wide and corolla 10—12 mm across. In general the plant differs very little from T. radicans and rather represents its southern race (or more precisely, formally T. radicans represents the northeastern race of T. koreana Nakai).

2. T. radicans (Turcz.) Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 603.— Myosotis radicans Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 258.— Eritrichium radicans DC. Prodr. X (1846) 128; Ldb. Fl. Ross. III.

Perennials; plant morphology generally as in the preceding species but more delicate, more mesophilic; stems thin, long, resembling (in summer and fall) runners rooting at apex; leaves separate, all — even the upper —
263 with short, thin petioles, blades oblong, large (4—7 cm long), acute, subcordate at base. Pedicels long, filiform; calyx slightly appressed-hairy, lobes oblong-lanceolate, 5 mm long; nutlets ovoid-tetrahedral, smooth, short-downy, 2 mm long, black, hardly rimmed at the dorsal areola, acute.

Damp rocks.— East Siberia: Dau. (River Argun', Turchaninov). Endemic. (Only the original specimens are available, other collections were never made.) Type in Leningrad.

Note. The only available reliable specimens of this species were late, already in fruit. I noticed that specimens of another species, T. myosotideum Maxim., in flower and fruit had been added to these specimens and hence the original diagnosis "praeter flores majores" refers actually to T. myosotideum, and is probably correct only for T. radicans.

3. T. myosotidea Maxim. in Bull. Acad. Sc. Pétersb. XXVII (1881) 506 (in nota ad T. petiolarem); Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 888 ["T. myosotideum (Maxim.) Gürke"].— Eritrichium myosotideum Maxim. Prim. Fl. Amur. (1859) 203 et in Bull. Acad. Sc. Pétersb. XVII (1872) 447.

Perennials; rhizome creeping, thin, black; radical rosettes of leaves absent; stems single or few, erect, glabrous in lower part, ribbed, shiny, faintly appressed-hairy or subglabrous above, simple or with few long branches, 15—40 cm long; cauline leaves oblong-lanceolate to lanceolate, the lowermost slightly spatulate, gradually tapering to short petiole, median and upper leaves acuminate, i. e., nearly equally tapering at both ends, delicate, green, sparsely and shortly appressed-acicular-bristly at both surfaces. Cymes rather distinct, loose, erect, numbering 2—5 (according to number of stem branches), leafless or with bracts only at base, 5—15 cm long; pedicels filiform, horizontal, 1—1.5 cm long, sparsely appressed-bristly, often later arcuate-down curved; lobes of the appressed-short-bristly calyx lanceolate, acute, ca. 3(5) mm long; corolla blue, with short tube and flat limb is 5—8 mm in diameter, lobes oval, obtuse, not reaching (at incisions) throat; scales rather low, broad, hardly notched at apex, velutinous-papillate; anthers oblong, obtuse, 0.7 mm long; nutlets 1.5—2 mm long, erect, ovoid-tetrahedral, acute, shiny, glabrous; cicatrice small, at ventral side, without stipe. June—July. (Plate XIV, Figure 3.)

Damp, swampy meadows. — East Siberia: Dau. (Argun'); Far East: Uss.,
264 Ze.-Bu., Uda. Gen. distr.: China (NE). Described from Amur (near Kitsi Lake, 20 VI 1855, Maksimovich). Type in Leningrad.

Note. This plant is much like Myosotis in habit (for example, M. palustris or M. caespitosa) and also grows in damp places. Its leaves, however, are very acute. Undoubtedly there are hybrid, intermediate forms between this species and T. radicans but they are difficult to distinguish.

Section 2. ANNUAE M. Pop. — Annual. Flowers very small, 1.5 mm long, anthers acute, peduncle under calyx claviformly thickened. Nutlets attached to thorus by thin stipe.

4. T. peduncularis (Trev.) Benth. ex S. Moore et Baker in Journ. Linn. Soc. XVII (1879) 384, nomen; Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 888; Kuzn. in Mat. Fl. Kavk. IV, 2, 394; Grossg., Fl. Kavk. III, 268. — Myosotis peduncularis Trev. in Schrift. Naturf. Ges. in Berlin, VII (1813) 147. — Eritrichium pedunculare DC. Prodr. X (1846) 128; Ldb. Fl. Ross. III, 153; Shmal'g., Fl. II, 227. — Trigonotis clavata Stev. in Bull. Soc. Nat. Mosc. (1851) 603. — Myosotis clavata auct. fl. Ross.; Chamisso in Linnaea, IV, 445. — Ic.: Fedch. and Fler., Flora Evropeiskoi Rossii, 790; Gürke in Pflanzenf. IV, 3a, p. 120.

Annuals; stem 5—20 cm high, rarely simple, usually branching from base, the plant often appearing multicaulescent; branches (stems) erect or ascending, thin, subfiliform, appressed-short-bristly (hairy), all terminate with long, leafless racemes as long as or longer than the leafy part; leaves small, (0.5)1—2 cm long, few, the lower spatulate, oblong or lanceolate, sometimes orbicular, gradually tapering to short petiole, obtuse, upper leaves sessile, acute, sometimes very small, all canescent, with short appressed bristles, rarely green. Racemes apical, usually many-flowered, ebracteate, erect, secund, loose in fruit, elongate; pedicels appressed-gray-downy, short at onset of flowering, 3—6 mm long in fruit, filiform, abruptly and markedly thickening at apex under calyx, ascending to subhorizontal; calyx gray-appressed-downy, ca. 1 mm long in flower, to 2—2.5 mm in fruit, nearly stellately opening, lobes oblong, acute; corolla blue, very small, ca. 1.5 mm long, hardly exserted from calyx, lobes of limb smaller
267 than 0.5 mm, oval, rounded-obtuse; scales appearing as arcuate small folds; anthers 0.2 mm long, ovate, acute, within corolla tube; nutlets ca. 1 mm long at back, tetrahedral, with broad ovate dorsal areola, short-downy, rarely glabrous, attached to thorus by small thin stipe extending from below the ventral keel. May—June. (Plate XIV, Figure 2.)

Fields, fallows, pastures, shrubby formations. — European part: L. V. (near Astrakhan); Caucasus: Dag.; Far East: Uss. (very common), Ze.-Bu., Uda.; Centr. Asia: Ar.-Kasp. (Kosaral Lake), Balkh. Gen. distr.: Him., Jap.-Ch. Described from near Astrakhan. Type in Berlin?

Note. Bentham, and not Steven, should be regarded as the author of the specific name T. peduncularis. In his description of Trigonotis in 1851, Steven also stated that Eritrichium pedunculare and E. radicans

PLATE XIV. 1 — Trigonotis koreana Nakai; 2 — T. peduncularis (Trev.) Benth; 3 — T. myosotidea Maxim.

refer to this genus, yet later he named the annual species T. clavata, in preference to a specific epithet reflecting more the morphology.

This species is endemic to North and Northeastern China, but occurs very sporadically in Central Asia and the Caucasus, probably because when it was collected it was not distinguished from the similar annual Myosotis. It is the only annual species in the genus Trigonotis and hence it would be more accurate to accept T. radicans (Turcz.) Stev. (transitional to the Eritricheae) as the generic type.

Tribe 3. **CERINTHEAE** DC. in Meisn. Comm. (1838) 187 et in Prodr. X (1846) 2.— Mericarps 2, each 2-locular, i.e., nutlets appearing connated in pairs, the mericarps attached to the flat gynophore by flat orbicular areola (by cicatrice). Style basal, free; corolla long, tubular, without scales or folds; anthers elongating at apex to lanceolate-subulate appendage.

Cerinthe, the only genus.

Note. This remarkable "anomalous" tribe is distinguished by the unique morphology of the fruit. In the characters of the flower it stands near Onosmeae: long corolla without scales or folds in the throat, anthers with long, lanceolate-linear appendage. Other characters distinguishing the tribe from Onosmeae are the complete absence of long bristles, and the wider leaves amplexicaul-cordate at base. The unique structure of the fruit is an atavism, repressing to the ancestral structure (typical for the ancient arboreal subfamily Ehretieae) by reduction through which the genus Cerinthe (partly composed of annuals) originated. One of the immediate ancestors was unquestionably the genus Onosma.

268 Genus 1197. **CERINTHE*** L.

L. Sp. pl. (1753) 136.

Flowers rather large. Calyx (glabrous) dissected nearly to base into 5 lobes slightly accrescent in fruit; corolla yellow, often with violet spot, long, wide-tubular, with more or less long teeth erect or curved at apex. Scales and folds absent in throat. Anthers on very short filaments (in our species), not exserted from corolla, rarely filaments long thus exserted (not in our species), oblong-lanceolate, sagittate and twisted at the free bases which often end with narrow coherent appendages, tapering at apex to scarious, flat, lanceolate-subulate, long appendage. Style basal, long, exserted; stigma dotlike-capitate; ovary 2-lobed, the lobes bilocular. Each of the lobes developing into one globular or oval, bilocular, smooth nutlet with stony wall, attached to flat thorus by small basal flat areola. Glabrous or subglabrous, often glaucous herbs, annual or perennial, with amplexicaul ovate leaves and dense, short, leafy scorpioid cymes.

European genus.

* Virgil's name for the plant. From the Greek kerinthos — bee bread. The plant is eagerly sought by bees.

1. Perennials, with sterile rosettes (bundles) of radical leaves beside floriferous stems. Corolla yellow or violet at apex, cleft for 1/4 to 1/3 into obtuse teeth; anthers hidden in corolla tube. Radicals longer, up to 2 cm, drooping. Bracts without bristles at margin . . . . . 1. C. alpina Kit.

\+ Usually biennials, rarely perennial but without sterile radical rosettes. Corolla usually a light greenish-yellow, cleft for 1/2 into narrow, acute teeth between which anthers visible. Pedicels shorter, up to 1.5 cm, usually ascending. . . . . 2. C. minor L.

++ Annuals; corolla with very short teeth reflexed after flowering . . . . . ★C. major L.

Section 1. CERANTHE Rchb. Pl. crit. tab. (1827) 491. — Corolla teeth more or less long, i. e., corolla cleft for 1/4 to 1/2 its length. Not annuals.

1. C. alpina Kit. in Schult. Oesterr. Fl. I (1814) 353; Boiss. Fl. or. IV, 149; Grossg., Fl. Kavk. III, 274. — C. glabra Mill. Dict. (1768)
269 No. 2; DC. Prodr. X, 3; Rouy, Fl. Fr. X, 279; Hegi, III. Fl. V, 3, 2188. — Ic.: degi, l. c. f. 3137; Rchb. Ic. pl. rar. V, f. 638. — Exs.: Fl. exs. Austro-Hung. No. 931.

Perennials; rhizome rather thick, dark brown, bearing above several squamous buds, some of which producing rosettes (bundles) of radical leaves and the others flower-bearing stems; plants glabrous, smooth, glaucescent- or yellowish-green; stems few, ascending or erect, 30—60 cm high, densely leafy, furcately branching above; leaves of sterile rosettes large, 10—30 cm long, obspatulate-oblong or narrowly ovate, gradually tapering to petiole, obtuse, rounded or acute, median cauline leaves oblong, usually 4—6 cm long (to 10 cm) and 4 mm wide, uppermost leaves cordate-ovate, rounded-obtuse at apex, cordate or sagittate at base, amplexicaul, gradually becoming smaller along stem upwards and downwards, all leaves glabrous, smooth, without tubercles (or tubercles faintly protruding later), green, delicate, entire and smooth at margin. Flowers in dense, leafy scorpioid cymes, drooping; pedicels to 2 cm long, usually drooping; calyx lobes unequal, lanceolate, glabrous, half as long as corolla, slightly elongating (up to 1 cm) after flowering; corolla 9—12 mm long, with 5 small, broadly ovate teeth curved backward at apex, tube pale yellow, teeth yellow or violet; anthers four times as long as filaments, with small capilliform appendages at basal ends of cells, violet, hidden in tube; mericarps ovoid, ca. 3 mm long, dark brown, slightly shiny, obtusely ribbed. May—July.

Alpine belt, pebbly places and taluses, also weedy meadows. — Caucasus: rarely in the subalpine or the alpine belts of the Main Range, mainly in its western part, rarely in the Lesser Caucasus, for example on Adzhar-Imeretia Range. Gen. distr.: Centr. Eur., Bal.-As. Min. Described from the Carpathians. Type in Berlin.

Note. This high-mountain, undoubtedly perennial species is mainly a Middle European plant, but like so many of these it apparently appears in isolated areas in the Caucasus. According to Boissier (l. c.) it is distinguished from the European specimens only by the slightly larger calyx and corolla, with violet teeth, but this last characteristic is not persistent

in the Caucasian specimens. Boissier saw it in some isolated specimens from Lazistan which he cited in his flora. Apparently it forms hybrids with C. minor L.

2. C. minor L. Sp. pl. (1753) 137; Ldb. Fl. Ross. III, 102; Boiss. Fl. or. IV, 148; Shmal'g., Fl. yuzhn. Ross. II, 241; Grossg., Fl. Kavk. III,
270 274; Kryl., Fl. Zap. Sib. IX, 2286; Rouy, Fl. Franc. X, 281; Hegi, III. Fl. V, 3, 2190.— Ic.: Hegi, l. c. tab. 222, 2, f. 3136, c—b; Rchb. Ic. Fl. Germ. XVIII, tab. 94.

Annuals, rarely biennials or perennials (monocarpic); root rather thin, vertical; stem erect, rarely ascending, branching from base or in upper part, cylindrical or slightly angular due to slightly decurrent leaves, glabrous, glaucescent, sometimes violet; radical leaves (if preserved) oblong-spatulate, up to 15 cm long, gradually tapering to petiole, obtuse, lower cauline leaves oblong-spatulate, cuneately tapering towards the auriculate, amplexicaul base, upper leaves ovate, amplexicaul-cordate at base, all leaves obtuse to even notched, dense, with white protruding tubercles without bristles, glaucous-green, often with white spots, especially the radical, upper leaves sometimes turning blue. Flowers in dense scorpioid cymes; bracts oblong-lanceolate, more or less cordate at base; pedicels later erect, rarely horizontal, up to 1.5 cm long; calyx lobes narrowly elliptic or oblong, obtuse, like bracts ciliate along margin with thin bristles; corolla 10—14 mm long, nearly twice as long as calyx, cleft for $^1/_3$ or $^1/_2$ into lanceolate, acute, erect, more or less converging teeth, pale yellow, often with 5 purple spots at base inside teeth; anthers several time (4—5) longer than filaments, almost reaching the corolla teeth, basal ends of cells with filiform appendages; mericarps ovoid, acute, ca. 3 mm long, mat-shiny, gray, with black or blackish spot. June—July.

Fields, roadsides, stony slopes.— European part: U. Dns., Bes., U. Dnp., M. Dnp., Bl., Crim.; Caucasus: everywhere (in the lower mountain belt); West Siberia: Alt. (apparently rarely introduced). Gen. distr.: Centr. Eur., Bal.-As. Min., Med., Iran. Described from Europe (Austria). Type in London.

Note. In Trudy N.-d. inst. Bot. IV (1941) 202, the Crimean and also the Odessa plant are considered as the species C. quinquemaculata Wahlenb. (C. maculata MB. Fl. taur-cauc. I, 134 (non All., non Linn.) and others).

Section 2. CERINTHE Rchb. Fl. Germ. exc. (1832) 339.— Corolla appearing truncate, with teeth reflexed after flowering. Annuals.

★C. major L. Sp. pl. (1753) 136; Hegi, III. Fl. V, 3, 2187, f. 3136, a and b.

Biennials; stem 20—50 cm high; lower leaves spatulate or obovate, tapering to petiole, obtuse, upper leaves ovate, cordate-amplexicaul,
271 tubercles at margin of lower leaves with short bristles, corolla [?] up to 3 mm long, yellow at base, red from site of attachment of stamens to apex; filaments not as long as anthers.

Centr. Asia: There is a single specimen with the label "Alma-Ata, Nedzvetskii," which was probably cultivated (I myself have never seen this plant as an escaped weed near Alma-Ata). **Gen. distr.:** Centr. Eur. Never reported again from the USSR.

Tribe 4. ECHIEAE DC. in Meisn. Pl. vasc. (1836—1843) 281; Prodr. X (1846) 4. — Calyx somewhat irregular, dissected nearly to base into 5 linear-lanceolate lobes slightly elongating in fruit, coarse-bristly, otherwise not changing in fruit; corolla medium or large, whitish, blue or violet, distinctly zygomorphic, of the long type, i. e., tubular or funnel-shaped-tubular, without distinct division into tube and limb, with small, unequal lobes at apex, open, without scales or folds, tube without hairy scales or bundles of hairs where filaments attached; stamens 2 lower (anterior) attached near base of corolla, 2 lateral slightly higher and the posterior one still higher; style long, filiform, furcate at apex, entire in one species, hairy below. Nutlets ovoid, gray, tuberculate, straight or curved, with very distinct lateral appendages, obscurely differentiated at the short apex and with flat basal cicatrice. Coarse to bristly annual or biennial herbs, with narrow long bristly leaves and typical inflorescences: cymes spicate or racemiform, dense, one-sided, apical. Echium L. is the only genus of this tribe in the Soviet Union.

Genus 1198. **ECHIUM*** L.

L. Sp. pl. (1753) 139; Buck in Linnaea (1837) 129.

Calyx 5-parted nearly to base into linear, acute, bristly lobes not elongating in fruit. Corolla more or less zygomorphic, obliquely incised into 5, somewhat unequal, short lobes, the upper longer, more or less downy outside, tubular-campanulate or campanulate, without distinct division into tube and limb, whitish-bluish, blue or violet to red (never yellow); throat gaping, without scales or folds. Stamens unequal, filaments thin, long, attached at middle or below middle of corolla at different heights, appearing spirally, arranged, often exserted; anthers small, short, orbicular-oval or
272 oval. Style long, filiform, hairy, at least in lower part, protruding, usually furcately 2-parted at apex, each branch with small capitate stigma, rarely style entire, with 1 stigma. Protective ring present (inside base of corolla), consisting of separate or fused hairy or glabrous scales. Nutlets straight, tetrahedral-ovoid, 2—3 mm long, tuberculate, acute, with flat or slightly depressed basal areola. Biennial or annual (in the USSR) coarse-bristly herbs, with narrow, lanceolate, bristly leaves. Scorpioid cymes usually paniculately disposed at end of stems. An ancient, Mediterranean genus growing more west of the USSR and being common to the western subregion of the ancient Mediterranean where its species are perennials or shrubs (mainly in Macronesia). The eastern boundary of distribution of the genus lies near the Caspian Sea in the Caucasus, with the exception of the

* From the Greek echis — snake; the name used by ancient authors for the Boraginaceae because of the shape of their inflorescences.

anthropochorous species (E. vulgare and E. italicum) which were introduced much further east by man.

1. Style not split at apex; stigma one; corolla dark red, 12—15 mm long. Inflorescence dense, spicate. (Section Holostigma) . .1. E. rubrum Jacq.
+ Style 2-parted at apex; stigmas 2; corolla violet, blue or whitish (Section Schizostigma) . . . . . 2.
2. Stamens not exserted from corolla, shorter than the latter; corolla 25—40 mm long, broadly campanulate, bright violet (dark violet when dry). Plants coarse-bristly. (Only in Lenkoran District) . . . . . 2. E. amoenum Fisch. et Mey.
+ Stamens more or less exserted from corolla. Corolla violet or blue, 10—20 mm long, or whitish and ca. 10 mm long . . . . . 3.
3. Corolla whitish or pale blue (light lilac), 10—12 mm long. Inflorescence pyramidal-paniculate, rarely narrowly racemiform. Stems and leaves covered with coarse long bristles. . . . . .5. E. italicum L.
+ Corolla blue (rarely white) or violet, 15—20 mm long, pubescence not coarse-bristly . . . . . 4.
4. Radical leaves lanceolate, with one prominent midrib. Corolla blue, 10—15 mm long. Stems with spreading bristles above white, fine, dense down . . . . . 4. E. vulgare L.
+ Radical leaves oblong or oval, with 3 prominent nerves. Corolla violet, 15—20 mm long, with corolla more broadening at apex. Stems usually glabrous under the spreading bristles . . . . . 3. E. plantagineum L.

Section 1. HOLOSTIGMA C. Koch in Linnaea, XXII (1849) 629. — Stigma
273 entire, slightly 2-lobed at end of unbranched entire style; corolla small, dark red. Flowers in compact, spicate panicle of bostryces.

1. E. **rubrum** Jacq. Fl. Austr. V (1788) app. 27, tab. 3; DC. Prodr. X, 20; Ldb. Fl. Ross. III, 104; Boiss. Fl. or. IV, 240; Shmal'g., Fl. II, 239; Hegi, III. Fl. V, 3, 2196. — E. rossicum Gmel. Syst. II. II (1791) 323. — E. acutifolium Lehm. Pl. Asperif. (1818) 321; Ic. Asperif. tab. 3. — E. clavatum Lehm. Pl. Asperif. II (1818) 440; Ldb. Fl. Ross. III 106. — E. linearifolium C. Koch in Linnaea, XXIII (1850) 629; Boiss. Fl. or. IV, 205; Grossg., Fl. Kavk. III, 274. — Ic.: Jacq. l. c.; Hegi, l. c. f. 3141; Rchb. Ic. Fl. Germ. XVIII, tab. 1299, f. III. — Exs.: GRF, No. 1123; Fl. cauc. exs. No. 192.

Biennials; stem usually single, erect, (20)30—60(80) cm high, robust, subangular, not very densely nor very coarsely spreading-bristly-hairy, glabrous underneath bristles, simple; leaves numerous, linear, or lanceolate, lower and radical leaves only partly preserved till flowering, gradually tapering at base, all leaves acute, greenish, rarely slightly grayish, bristly at both surfaces, with bristles subspreading, borne on large tubercles, leaves becoming smaller and narrow-linear towards the median, 4—6 cm long, ca. 0.5—1 cm wide. Inflorescence narrowly paniculate, often nearly spicate, more or less long, sometimes up to 20—30 cm, dense, rarely subcapitate (in small individuals); cymes 1—3 cm long, little elongating even in fruit,

white-bristly-hairy; bracts lanceolate-linear, inconspicuous, not exceeding flowers; calyx sparsely white-bristly, ca. 7 mm long, with linear acute lobes slightly elongating in fruit; corolla 12—15 mm long, dark (wine) red, not strongly broadening above (near lobes), twice as long as calyx, somewhat downy outside, lobes ovate-oblong, obtuse, ca. 1.5 mm long; filaments markedly exserted, like style; anthers 0.5 mm long; nutlets black, ca. 2 mm high, triangular-ovoid, gibbous (slightly curved), finely tuberculate, at sides of the small apex; cicatrice depressed, faintly rimmed, flat inside rim, ventral keel partly downy. May—July.

Steppes, herbaceous slopes, shrubby formations in the steppe belt of European part, middle and lower mountain belts, to the subalpine belt of Caucasus. — European part: southern steppe and forest-steppe, in the east to Ural River and Ural mountains, in the north to Oka, Crim.; Caucasus: everywhere; Centr. Asia; Mtn. Turkm. (east Kopet-Dagh?; eastern shore of the Caspian Sea, Karelin). Gen. distr.: Centr. Eur., Bal.-As. Min. Described from Austria. Type in Vienna.

274 Note. This highly variable steppical, Pontic species stands out among the other species of the genus throughout its entire wide distribution area which extends from Czechoslovakia to Armenia. The Crimean form is especially distinguished with white-sericeous pubescence of the calyces and the leaves. Low individuals with subcapitate inflorescences are frequent in the Caucasus. Var. acutifolium Hohen. (Bull. Soc. Nat. Mosc. 303; DC. Prodr. X, 20; Ldb. Fl. Ross. III, 105) with tangled hairs is also distinct. I have not seen the original of the enigmatic E. linearifolium C. Koch. According to Grossgeim (Fl. Kavk. III, 274) it differs from E. rubrum Jacq. by its corymbiform inflorescence, the corolla three times, and not twice, as long as the calyx, and the capitate stigma. Boissier compares it with E. italicum and E. glomeratum Poir., and Ledebour (Fl. Ross. 106) identifies it as E. glomeratum Poir., but according to the unparted style it might be placed closer to E. rubrum Jacq. P., as indicated by Boissier from Redan (Ruprecht), who related it to this species though it actually is Onosma caucasicum Levin.

Section 2. SCHIZOSTIGMA C. Koch in Linnaea, XXII (1849) 629. — Style bifurcate above, with a separate stigma on each branch.

Series 1. Grandiflora M. Pop. — Stamens not exserted from corolla; corolla large, 25—40 mm long, very handsome, violet.

2. E. amoenum Fisch. et Mey. Ind. IV Sem. Hort. Petrop. (1837) 35 et in Hohen. in Bull. Soc. Nat. Mosc. (1838) 303; Ldb. Fl. Ross. III, 105; Boiss. Fl. or. IV, 209; Grossg., Fl. Kavk. III, 275. — Exs.: GRF. No. 885.

Perennials or biennials; root rather thick, dark, producing one or several stems; stems robust, thick, high, up to 50—80 cm, some stems lower, ca. 30 cm but then often ascending at base and thinner, more or less densely and coarsely spreading-bristly, simple, or above, mainly in inflorescence, with few branches; radical leaves withering at flowering; cauline leaves 2—4 cm

long, up to 8 cm in the very large individuals, oblong-lanceolate or broadly lanceolate, lower leaves tapering at base, median and upper leaves sessile, all acute, covered at both surfaces with very coarse spreading bristles borne on tubercles and with small bristles among them, if those many then leaves canescent. Scorpioid cymes short at first, 1—3, if branches present then inflorescence corymbiform, markedly elongating in fruit up to 20 cm and suberect; leaves underneath flowers lanceolate, sometimes distinctly cordate-broadening at base, few, acute; calyx ca. 10 mm long in flower, very bristly, with narrow linear lobes elongating to 15 mm in fruit, base
275 of calyx slightly hardening at this time; corolla bright (in herbarium dark)-violet, 3—4 cm long, broadly and obliquely campanulate, finely downy outside, with short, semi-orbicular lobes; posterior stamens completely included in corolla, the anterior lower almost exserted because of the low short lobes, filaments sparsely long-hairy; anthers ca. 1.5 mm long; style not exserted, widely 2-parted at apex; nutlets gray, ca. 4 mm high, almost straight, with very distinct lateral appendages, densely and sometimes nearly pectinately acute-tuberculate along back and sides. May—July.

Mountain slopes, meadows, river gravels, roadsides. — Caucasus: Tal. Gen. distr.: Iran. (N.). Described from the C. A. Meyer collections from Talysh (1830). Type in Leningrad.

Note. This large-flowered form has a limited distribution and is endemic to Hyrcania. E. grandiflorum Desf. (E. macranthum Roem. et Schult.) from the W. Mediterranean (Algiers, S. France, Sardinia, etc.), is closely related to it and differs very little.

Series 2. Vulgaria M. Pop. — Corolla 10—20 mm long, violet at back; stamens more or less markedly exserted from corolla. Inflorescences racemiform-paniculate or capitate, not pyramidal-paniculate.

3. E. plantagineum L. Mantissa II(1771) 202; Boiss. Fl. or. IV 208; Shmal'g., Fl. II, 238; Hegi, III. Fl. V, 3, 2192; Coincy in Morr. Journ. Bot. XIV, 328; Rouy, Fl. Fr. X, 308; Grossg., Fl. Kavk. III, 275. — E. violaceum Ldb. Fl. Ross. III (1849) 105, non L. Mant. I (1767) 42. — t.: Rchb. Ic. Fl. Germ. XVIII, tab. 1300.

Biennials; stems 20—40 cm high, erect or ascending, robust, sparsely spreading-bristly, glabrous between the long bristles or with few small bristles; radical leaves withering at flowering, blades oval, 3—8 cm long, rather broad, obtuse tapering to long petiole, with slightly protruding nerves, rather finely bristly-long-hairy; cauline leaves oblong-lanceolate or lanceolate, sessile, lower leaves obtuse, tapering at base, upper leaves semiamplexicaul-dilated at base, acute at apex, at margin flat or crisped-hairy, median leaves ca. 3 cm long, up to 1 cm wide, all leaves rather softly and sparsely bristly-hairy. Inflorescences apical, capitate at first, consisting of few, few-flowered cymes that later elongate and loosen; bracts few, lanceolate-linear, shorter than flowers; calyx in flower 7—9 mm long, with linear acute lobes slightly white-bristly, reaching up to 10 mm in fruit; corolla violet, 15—20(22) mm long, limb strongly oblique and moderately
276 campanulate-broadening, with short obtuse lobes, subglabrous outside but along nerves and lobes ciliate with long hairs; two lower stamens usually

hairy and distinctly exserted from corolla, the three upper not exserted; anthers ca. 0.5 mm long; style shortly 2-parted at apex, exserted from corolla; nutlets 2—2.5 mm high, light gray, acutely and densely tuberculate, with indistinct appendages, nearly straight. May—June.

Deserts, roadsides, occasionally introduced in the USSR. — European part: Crim. (near Gurzuf, according to Steven); Caucasus: W. Transc. (near Sukhumi and Batumi). Also observed (or cultivated?) in the Leningrad Region. Gen. distr.: Med., Bal.-As. Min. Described from Italy. Type in London.

Note. This Mediterranean species is often named E. violaceum L., which would have priority were it possible to establish whether Linnaeus had this species in mind. In his diagnosis he wrote that the stamens are exserted from the corolla and reported it from Austria. In the opinion of other authors (Gordon, for example) it is related to E. rubrum Jacq., and Moris, who probably saw the Linnaean type, considers it close to E. pustulatum Sieb. et Sm. Accordingly, it is proposed by Coincy (l. c. 329) that the name E. violaceum should be ignored.

E. plantagineum L. is intermediate between E. amoenum and E. vulgare. In the flowers and size of the corolla, the faintly exserted stamens, shape of the leaves and pubescence it is close to E. amoenum; in its exserted stamens and smaller size of all its parts it is more like E. vulgare from which it differs however in many other characters.

4. E. vulgare L. Sp. pl. (1753) 139; DC. Prodr. X, 18; Ldb. Fl. Ross. III, 104; Boiss. Fl. or. IV, 206; Shmal'g., Fl. II, 239; Kryl., Fl. Zap. Sib. IX, 2287; Grossg., Fl. Kavk. III, 275; Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 888. — Ic.: Hegi, III. Fl. tab. 222, f. 4; Rchb. Ic. Fl. Germ. XVIII, tab. 1298, f. II and many others.

Biennials; stems one or often few, usually erect, robust, (20)30—50(100) cm high, usually simple, rarely short-branching above, rounded, grayish-white with fine down and spreading-bristly-hairy, bearing narrow and loose paniculate inflorescence; leaves lanceolate, with one prominent midrib, grayish, with subappressed or semi-spreading hairs, lower leaves withering at flowering, spatulate-lanceolate, 5—10 cm long, 8—15 mm wide, gradually tapering at base, obtuse or acute, cauline leaves sessile, lanceolate or lanceolate-linear, upper leaves hardly dilated at base, acute, 2—6 cm long, 5—10 mm wide, bristly and more or less downy underneath hairs, more or less gray, rarely greenish. Scorpioid cymes in loose raceme, if stem
277 branching then in panicle, 5—20 cm long, 5—10 cm wide, provided with few bracts; cymes not very dense, slightly elongating (up to 10 cm) in fruit and straightening; calyx ca. 5—7 mm long in flower, white-bristly, with small acute lobes elongating in fruit up to 8—10 mm; corolla 10—15 mm long, bright, blue-violet or nearly blue, pink-red in flower, not broadly campanulate, oblique in throat, upper lobes strongly prominent, up to 4—5 mm long, lower lobes half as long, all lobes obtuse; glabrous filaments with small (0.2—0.3 mm) anthers strongly exserted from corolla; style just as hairy, short-furcate at apex; nutlets small, 2—2.5 mm long, gray, rather gibbous, with indistinct appendages, neither strongly nor densely tuberculate. May—July.

Deserts, fallows, roadsides, stony naked slopes, especially common in the steppe belt. — European part: everywhere except for the Arctic, but in the wooded belt more rare than in the south; Caucasus: everywhere (W. Transc. and Tal., rarely); West Siberia: Ob. (S.), Alt.; East Siberia: rarely, apparently introduced; Centr. Asia: Ar.-Kasp. (northern part), Balk. (northern part), Dzu-Tarb., T. Sh. (only east to Alma-Ata), in other regions apparently introduced casually (Dzhizak, Pendzhikent, Arslanbob). Gen. distr.: Centr. Eur., Bal.-As. Min. Described from Europe. Type in London.

Series 3. Italica M. Pop. — Corolla whitish, sometimes light blue, small, ca. 10 mm long; stamens markedly exserted from corolla, very densely and coarsely bristly. Inflorescence usually pyramidal-paniculate. Radical leaves remain green throughout flowering and fruiting.

5. E. italicum L. Sp. pl. (1753) 139; Boiss. Fl. or. IV, 205; Shmal'g., Fl. II, 239; Hegi, III. Fl. V, 3, 2197; Rouy, Fl. Fr. X, 504; Coincy in Journ. Bot. XVI, 66; Regnier in Monde des Plantes, sér. 3, 30 (1929) 2—9. — E. altissimum Jacq. Fl. Austr. V, 3 App. (1778); DC. Prodr. X, 24; Ldb. Fl. Ross. III, 106; Grossg., Fl. Kavk. III, 275. — E. asperrimum Lam. Tabl. Encycl. I (1791) 412; M. B. Fl. taur.-cauc. I, 135. — E. pyramidatum DC. Prodr. X (1846) 23; Ldb. Fl. Ross. III, 105. — E. pyramidale La Peyr. Hist. Abr. Pl. Pyr. (1813) 90. — Ic.: Jacq. l. c. tab. 16; Rchb. Ic. Fl. Germ. XVIII tab. 1298, f. I.

Biennial, monocarpic plants; stem often single (rarely few), thick, robust, erect, 40—80 cm high, finely whitish-downy, above down densely coarse-bristly, nearly spinescent, bristles horizontal, thick, large, broadly branching from base or higher, forming pyramidal-paniculate inflorescence, rarely narrowly racemiform, the branches sturdy, densely and coarsely white- or yellowish-bristly; radical leaves many, oblong-lanceolate, acute,
278 nearly equally tapering at both ends, with dark midrib and sometimes with indistinctly protruding lateral nerves, 10—20 cm long, 1—2 cm wide, densely and coarsely bristly, the bristles on upper surface borne on large white tubercles; cauline leaves few, lanceolate, sessile, reduced towards inflorescence, acute, densely spreading-bristly, with small sparse bristles between the large ones. Inflorescence usually pyramidal-paniculate, large, often beginning from base part of stem; scorpioid cymes at first dense and short, straightening in fruit, reaching 10 cm, spiny-bristly; calyx in flower nearly sericeous-white with dense bristles concealing its lobes, ca. 7 mm long, lobes acute, linear, little elongating in fruit but then bristles spreading and becoming coarse; corolla whitish, white-bluish or light lilac, 10—13 mm long, very little broadening above, with subequal short orbicular hairy lobes; filaments and style markedly exserted, the style shortly 2-parted at end; nutlets gray, ca. 3 mm long, slightly gibbous, with distinct appendages, acutely plicate and white-tuberculate. April—June.

Fields, deserts, roads, sometimes stony slopes in the lower mountain belt, in the south in the steppe belt. — European part: Bes., Bl., Crim.; Caucasus: everywhere in the lower foothill belt; Centr. Asia: Bal.-As. Min. Described from Italy. Type in London.

Tribe 5. ANCHUSEAE DC. in Meisn. Comm. (1838) 189, Prodr. X (1846) 27. — Calyx nearly regularly cleft into 5 teeth or dissected into 5 narrow lobes, more or less broadening and sacciform below in fruit, only the lobes elongating in fruit, otherwise calyx not elongating. Corolla short, medium or long (the latter only in Symphytum), rarely of a specific type (Borago), variously colored, actinomorphic, with 5 lobes or teeth (if long), always with scales in throat; anthers usually closed, not exserted from corolla, rarely protruding on long filaments (Trachystemon) or on short ones (Borago), without appendage at apex, rarely with mucro (Borago); style always entire, glabrous; stigma usually capitate, entire. Torus flat. Nutlets rarely erect (Pulmonaria, Borago, some Nonea, Brunnera), usually more or less curved or reniform and horizontal, always with distinct attachment-ring to torus and with white caruncle, most often oblique and rugose, rarely smooth, glabrous or downy but always without prickles or wings. Perennial, biennial and annual herbs, usually with coarse hairs, with
279 inflorescence of various cymes, but never spicate or racemiform.

An ancient Mediterranean tribe: ancient Mediterranean (Caucasian flora), showing numerous features of affinity with Echieae, Lithospermeae and Myosotis and none with the Cynoglossinae or Eritricheae.

Genus 1199. SYMPHYTUM* L.

L. Sp. pl. (1753) 136; Gürke in Nat. Pflanzenf. IV, 3a, 112; Kuzn. in Mém. Acad. Sc. Pétersb. VIII ser. XXV, 5 (1910) 22.

Flowers medium-sized, the long type; calyx dissected nearly to base or for ½ to ⅓ into unequal narrow lobes or teeth, slightly elongating in fruit, otherwise remaining unchanged; corolla tubular, blue or yellow, limb nearly as long as tube, tubular-campanulate or ovally inflated, with small, erect or recurved teeth at apex; scales elongate, usually lanceolate, converging like a cone, velutinous, not protruding from limb (Section Eusymphytum Kusn.) or very long protruding (Section Bulbosum Kusn.); anthers oblong, elongate, attached in throat (at level of scale-base), on thin filament, not exserted from limb; style filiform, long, usually exserted; stigma small, capitate. Nutlets rarely erect, often curved to horizontal, not rugose or rugose, sometimes granular (dotted-tuberculate) or smooth, attachment-ring basal, with teeth or scars at margin; caruncle protruding. Root more or less thickened; leaves usually broad, the upper sometimes decurrent; cymes leafless, paired or single at apices of stems, sometimes in paniculate inflorescence (if stem branching). Perennial, rather large herbs.

This ancient Mediterranean genus consists mainly of rather tall herbs whose habitats are mainly in the wooded, relict islands of the ancient Mediterranean. Some of its species are found in Central Europe and one even in the taiga zone of the Boreal region. About 20—25 species.

1. Upper leaves decurrent on stem, without petioles . . . . . 2.
\+ Upper leaves tapering to petiole, without decurrent bands on stem (not decurrent) . . . . . 5.

* From the Greek symphyton — symphyein — growing together. The name given by ancient authors to plants used in the treatment of broken bones.

2. Corolla blue-violet or violet-sky blue . . . . . 3.
+ Corolla pale yellow, calyx dissected nearly to base. Upper leaves indistinctly decurrent. Rhizome nodose, horizontal. (Carpathians) 4.
280
3. Entire plant coarse-hirsute (nearly prickly). Calyx 5-parted nearly to base, half as long as corolla, with lanceolate long-acuminate lobes; corolla violet. (Throughout European part of USSR) . . . . . 9. S. officinale L.
+ Entire plant finely grayish-hirsute (villous-downy). Calyx cleft for $^1/_3$ into slightly unequal obtuse teeth, $^1/_3$ as long as the sky blue corolla. (Caucasus) . . . . . 6. S. caucasicum M. B.
4. Cauline leaves elliptic or oblong, cuneately tapering to petiole; radical leaves absent . . . . . 2. S. tuberosum L.
+ Cauline leaves ovate, the lower two petioled, the upper 1—2 sessile, short-decurrent. Radical leaves with cordate-rounded, large blade, long petioled . . . . . 1. S. cordatum W. et K.
5. Corolla sky blue. Stem clinging, beset with retrorse, prickly bristles . . . . . 6.
+ Corolla pale yellow. Lower leaves more or less cordate, oblong . 7.
6. Calyx cleft for $^3/_4$ or nearly to base, very small, $^1/_4$—$^1/_5$ as long as corolla, its teeth very short, obtuse . . . . . 7. S. asperum Lepech.
+ Calyx parted up to $^3/_4$, $^1/_3$—$^1/_2$ as long as corolla, its teeth broader and longer, acute. Otherwise hardly distinguishable from the preceding species. (Talysh) . . . . . 8. S. peregrinum Ldb.
7. Stem strongly branching, entirely soft-villous. Rhizome short, tuberiform, not perennial. Leaves more or less regularly disposed along the erect stem, ovate, usually cordate at base, softly gray-villous but not tomentose, rather numerous. Calyx villous, cleft for $^1/_2$ to $^3/_4$ . . . . . 4. S. tauricum Willd.
+ Stems not branching, simple, or branching only at base. Rhizome horizontal, long, perennial . . . . . 8.
8. Stems soft-villous with spreading short hairs. Leaves tomentose-downy beneath. Calyx spreading-bristly, teeth shorter than its tube, obtuse; style very long, ca. 5 mm, exserted from corolla. Resembling S. caucasicum but leaves not decurrent, and corolla whitish. Weedy or cultivated plants . . . . . 5. S. orientale L.
+ Stems not soft-villous. Cauline leaves few. Calyx glabrous, ciliate only at margins, rarely bristly . . . . . 9.
9. Radical leaves orbicular-cordate, large, 10—15 cm across; cauline leaves ovate, subglabrous, very short-hairy above. Stems erect,
281 not branching, finely downy, not bristly. (Carpathians) . . . . . 1. S. cordatum W. et K.
+ Radical leaves broadly ovate, smaller, 5—10 mm long, faintly cordate or rounded at base. Pubescence poor, without coarse thick prickly bristles. Stems usually elongate, rooting, ascending, branching at base. (Colchis) . . . . . 3. S. grandiflorum DC.

Section 1. EUSYMPHYTUM Kusn. in Mém. Acad. Sc. Pétersb. XXV, 5 (1910) 23; Mat. Fl. Kavk. IV, 2 (1913) 220. — Scales hidden, not exserted from limb.

Subsection 1. OCHROLEUCA Kusn. l. c. (1910) 41, l. c. (1913) 236. — Corolla pale yellow, neither blue nor violet, without anthocyanin.

1. S. cordatum W. et K. Ic. Pl. rar. Hung. I (1802) 6; Willd. in Ges. Naturf. Fr. Neue Schrift, II, 121; DC. Prodr. X, 40; Ldb. Fl. Ross. III, 116; Shmal'g., Fl. II, 228; Jav. Mag. Fl. 844. — S. cordifolium Baumg. Enum. Stirp. Transsilv. I (1816) 126. — S. pannonicum Pers. Syn. II (1805) 161. — Ic.: W. et K. l. c. tab. 7; Rchb. Ic. Fl. Germ. XVIII, tab. 102, f. 2. — Exs.: Fl. exs. Austro-Hung. No. 2131; Fl. Hung. No. 774; Rosliny Polskie, No. 250; Fl. exs. Reipubl. Bohem.-Sloven. No. 625.

Perennials; rhizome thick, nodose, horizontal, producing only one flowering stem or one radical leaf; radical leaves with long, thin, finely downy petioles, blade large, deeply cordate with nearly closed basal incision, orbicular, acuminate at apex, very finely and remotely bristly above, glabrous beneath, 10—15 cm long, delicate, shady; stems simple, thin, weak, 20—40 cm high, remotely hairy with small solitary bristles, bearing few (2—4) leaves; lower cauline leaves (1—2) broadly ovate, more or less cordate at base with short petioles, upper leaves (1—2) below inflorescence ovate or oblong, not cordate at base, sessile, slightly decurrent. Cymes usually paired at ends of stems, leafless; pedicels very short-downy, 5—10 mm long; calyx deeply incised nearly to base, lobes narrowly lanceolate at first, triangular-lanceolate in fruit, long-acuminate, glabrous or finely downy, only at margins with or without single short bristles, up to 12 mm long in fruit; corolla pale yellow, ca. 15 mm long, the limb campanulate-tubular, not constricted above,
282 with short triangular teeth; scales large-papillose; anthers 2.5 mm long; style markedly exserted; nutlets semi-curved, ovoid, finely dotted-papillose (granular), ca. 3 mm long. May.

Shady mountain forests, often spruce, rarely broadleaved. — European part: U. Dns., M. Dnp. (Podolia). Gen. distr.: Centr. Eur. (Carpathians). Described from the Carpathians. Type in Paris.

2. S. tuberosum L. Sp. pl. (1753) 136; DC. Prodr. X, 38; Ldb. Fl. Ross. III, 115; Shmal'g., Fl. II, 228; Hegi, III. Fl. V, 3, 2226; Jav. Mag. Fl. 845. — S. nodosum Schur, Enum. Pl. Transsylv. (1866) 468. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 102, f. III; Hegi, l. c. f. 3162; Jav. l. c. 2798, f. 5. — Exs.: Fl. exs. Austro-Hung. No. 3719; Fl. pol. exs. No. 851; Hayek, Fl. Stir. No. 1231.

Perennials; rhizome rather thick or thin, horizontal or oblique, thickened in some places as small, hazelnut-sized tubers, producing at apex only one fertile stem; lateral shoots and radical leaves absent; stems 20—40 cm high, simple or with one lateral branch, more or less densely bristly-villous, slightly angualr, erect; cauline leaves oblong, 5—10, lower leaves squamiform with undeveloped blade, the upper 1—2 tapering at base as a wide petiole, median 3—5 leaves approximate, sessile or subsessile, cuneate at base, all leaves acute, delicate, 5—10 cm long, 1.5—4 cm wide, uppermost leaves and under cymes some median leaves sessile and short-decurrent on stem, insignificantly appressed-short-bristly beneath, green, prominently nerved. Scorpioid cymes apical, paired or single, small, loose, leafless; pedicels short-downy, 3—5 mm long, drooping; calyx dissected nearly to base into lanceolate or linear, acute, 4—6 mm long lobes, spreading-bristly

and finely downy between bristles; corolla 15—20 mm long, pale yellow or straw-colored, with rather broadly campanulate limb; style markedly exserted; nutlets globulose-ovoid, 3—5 mm long, black, slightly rugose-tuberculate and dotted-granular, semi-curved. May—June.

Mainly in broadleaved, beech, hornbeam and oak forests. — European part: U. Dns. (Carpathians and Subcarpathians), M. Dnp. (Podolia), Bes., L. Don (very doubtful on the Mius River). Gen. distr.: Centr. Eur., Bal.-As. Min. (Balkans). Described from S. Germany. Type in London.

Note. This unique Central European species, endemic to the Carpathians occurs mainly in the mountain-forests, occasionally it descends to the lowlands adjacent to these mountains; these localities are Kremenets and Pochaev (all the others refer to S. tauricum Willd.).

It is difficult to indicate to which species this one is related; perhaps
283 the closest is S. cordatum with which it is sometimes sympatric, but hybridization apparently occurs rarely in spite of the wide distribution of these species in the Carpathians. Such a hybrid was called S. ullepitschii Wettst. (S. cordatum W. et K × S. tuberosum L.), but the plant described under this name (Fl. exs. Austro-Hung. No. 2130) appears very similar to S. tuberosum L.

Included in our species are S. leonhardtianum Pugsley (Journ. of Bot. 69 (1931) 89) and S. foliosum Rehm. S. leonhardtianum is distinguished from S. tuberosum by the following: leaves 3—6, elliptic, ovate, rarely lanceolate; cymes with 5—20 flowers; calyx lobes nearly half as long as corolla tube; corolla 12—20 mm long, wider than in S. tuberosum; nutlets 2.5—3.5 mm long. Occurs in the USSR in the Carpathians and near Pochaev.

In S. tuberosum there are 6—12 cauline leaves, leaves oblong; cymes with 10 flowers; calyx lobes as long as corolla tube; corolla not as wide, 12—16 mm long; nutlets ca. 4 mm long. — Extreme W. Europe.

While attempting to prove that the originals in the Linnaeus herbarium were from England and not S. Germany, as Linnaeus himself submitted, Pugsley separated the Atlantic race from the Central European as an independent species, but this procedure is not convincing.

S. foliosum Rehm. (Verh. zool.-bot. Gesellsch. Wien, XVIII (1868) 495; Exs.: Fl. pol. exs. No. 851; Fl. exs. Austro-Hung. No. 3709) is very close to S. tuberosum, but apparently there is some effect of hybridization with S. officinale which is manifested in the larger size of the plant, the decurrence even of the median leaves, the variability of the calyx (length of teeth). This view was also expressed by Pugsley (l. c. 92). The race is known from broadleaved forests along the Dniester River (Chernelitsa) from which the type was described in Lvov.

3. S. grandiflorum DC. Prodr. X (1846) 40; Ldb. Fl. Ross. III, 116; Boiss. Fl. or. IV, 175; Kuzn. in. Mém. Acad. Sc. Pétersb. XXV, 5 (1910) 44; Mat. Fl. Kavk. IV, 2, 241; Grossg., Fl. Kavk. III, 258. — S. ibericum Stev. ex M. B. Fl. taur.-cauc. III (1819) 647, nomen; Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 579. — S. abchasicum Trautv. in Bull. Soc. Nat. Mosc. XLIII (1870) 72. — S. grandiflorum var. abchasicum (Trautv.) Kusn. l. c. 46. — Ic.: Kuzn. op. cit. (1910) Table I, Figure 12, 10, 13 and 14. — Exs.: GRF, No. 1736.

Perennials; rhizome sturdy, cordlike, ligneous, often arcuate, branching, the long branches usually producing 1—3 secondary stems, floriferous and sterile; radical leaves absent; stems weak, erect or ascending, nearly decumbent at base, 20—40 cm high, simple, sparingly and usually irregularly spreading-long-bristly, bearing 6—10 leaves; cauline leaves ovate, usually
284 with bristly petioles, only upper leaves sessile, all small, 3—6 cm long, rounded or slightly cordate at base, acute, sparsely appressed-fine-hairy. with solitary bristles on upper surface, sometimes silvery above. Cymes apical, paired or single, small, dense in flower, loose in fruit but not elongating; pedicels short-spreading-bristly, thin, 3—5 mm long (the lower sometimes up to 10 mm long); calyx deeply (for $^3/_4$) dissected, lobes linear, more or less elongate, obtuse, glabrous or more or less bristly, coarsely ciliate-bristly at margin, 3—4 mm long; corolla pale yellow, ca. 15 mm (up to 20 mm) long, limb campanulate, with small, broadly triangular or orbicular teeth; scales large-papillose; style not strongly exserted; nutlets semicurved, dark gray, finely granular, 3 mm high. March—April.

Usually broadleaved forests, the lower mountain belt up to 1,000 m. — Caucasus: Cisc. (western part—Maikop), W. Transc. Endemic. (Probably present in the adjacent Lazistan.) Described from Georgia. Type in Geneva.

Note. This endemic, Colchic species is related to S. cordatum and S. tauricum, but sharply distinguished from them by the rhizome and the general habit. It appears to me that these three species are not as closely related as thought by Kuznetsov. The branches of the long rhizome are developed from the radix. The branch extends to the surface of the earth and produces there three shoots, one of them a fertile stem and the other two sterile ones, bearing only leaves. Later, towards the fall, these shoots become procumbent just as branches of the rhizome; sometimes their leaves are preserved until the next year, usually not dying. These shoots are 10—20 (30) cm long.

The length of the sepals and especially their accrescence in fruit are very variable; the form with very long calyx lobes (as long as corolla tube) and much elongating in fruit (up to 20 mm) was called var. abchasicum (Trautv.) Kusn. by Kuznetsov.

4. S. tauricum Willd. in Ges. Naturf. Fr. Neue Schr. II (1799) 120; DC. Prodr. X, 39; Ldb. Fl. Ross. III, 116; Boiss. Fl. or. IV, 172; Shmal'g., Fl. II, 228; Kuzn. in. Mém. Acad. Sc. Pétersb. XXV, 5, 41; Mat. Fl. Kavk. IV, 237.— S. bullatum Horn. Hort. Hafn. I (1813) 179.— Ic.: Sims, Bot. Mag. tab. 1787; Jacq. Eclog. tab. 81; Fedch. and Fler., Fl. Evrop. Rossii, 782.

Biennials or perennials (monocarpic). Root short, sometimes obliquely declined and thickened not branched, producing at apex a floriferous stem and also lateral sterile shoots sometimes becoming rhizomatic thus yielding a perennial form, usually growing and dying together with the fertile stem;
285 stem erect, rather thick, spreading-soft-villous, usually with many lateral branches, spreading-branching above, rarely simple; apparently rosette of radical leaves present in the first year then withering in the winter without flowering; cauline leaves rather many, petioled except for the uppermost leaves, blades ovate, small, acute, usually grayish, hairy-villous, subcordate

or more or less cordate or truncate at base, highly variable in this respect and in density of pubescence. Cymes rather loose, racemiform (numerous on branched individuals), secund, leafless, not long, 3—5 cm; pedicels glandular-bristly like calyx, 3—5 mm long, drooping; calyx in flower 3—5 mm long, incised for $\frac{1}{3}$—$\frac{1}{2}$, bristly, with lanceolate, obtuse teeth up to 5—6 mm long in fruit; corolla pale yellow, 10—12 mm long, 2—3 times as long as calyx, limb tubular-campanulate, gaping, with broad short teeth; style slightly exserted; nutlets 2.5 mm long, semi-curved, dark gray, finely dotted-granular. April—May.

Apparently weedy in open forests. — European part: Bes., Bl., M. Dnp., L. Don, Crim.; Caucasus: W. Transc. (extreme northern part along the Black Sea). Endemic. (Occurring possibly in the N. Balkans). Described from the Crimea. Type in Berlin.

Note. Phylogenetically, this species may be regarded as the monocarpic derivative of the typically perennial, forest species S. grandiflorum DC.

5. **S. orientale** L. Sp. pl. (1753) 136; Prodr. X, 39; Boiss. Fl. or. IV, 171; Hayek, Prodr. Fl. Balc. 2, 55.

Perennials; stem erect, sturdy, angular, short-branching, more or less densely but shortly and softly villous; leaves (median cauline) ovate or oblong, cordate at base, with short petioles, white- or gray-downy-tomentose beneath, slightly grayish-downy above; upper leaves reduced, subsessile or sessile, not decurrent, oblong. Cymes dense, short in flower, becoming loose and erect in fruit; calyx long, parted for less than $\frac{1}{2}$ into lanceolate-linear, obtuse teeth, oblong-sacciform in fruit, spreading-bristly, up to 10 mm long; corolla whitish, tube approximately as long as calyx, the limb campanulate, ca. 10 mm long, hardly longer than tube; style markedly exserted; nutlets (small, smooth, curved, laterally keeled at apex, tapering from above the attachment-ring, according to Boissier). April—May.

Wet places in forests. — European part: Bl. (near Odessa), M. Dnp.
286 (S. Podolia, in Turchaninov herbarium). Gen. distr.: As. Min. (from Constantinople to Ankara). Described from Constantinople. Type in Paris.

Note. This is a very ambiguous species for which Linnaeus cited two different species (synonyms) by Tournefort, one with blue flowers, the other with white from Constantinople. The first synonym probably refers to S. asperum Lepech. and the second to what De Candolle and Boissier regarded as S. orientale, though some older authors were of another opinion. Roemer and Schultes (Syst. IV, 65), like Willdenow (Enum. H. Berol. I, 183), referred Tournefort's plant with the white flowers to S. tauricum Willd. Likewise, S. orientale in Hegis (p. 2223) is described as having leaves that taper gradually to petioles, without a cordate base. Shmal'gauzen (Fl. Yu. Z. Ross. 403) reported S. orientale from Rashkov on the Dniester, but in "Fl. Sr. i Yuzhn. Ross." he disregarded this species and its locality. I accept S. orientale as the specimen which was described by Boissier: the Wiedeman specimens from Byzantium and Ankara and the southern coast of Pontus (according to Boissier from Bithynia).

This S. orientale resembles S. caucasicum more than S. tauricum and in general it is intermediate between them. I did see specimens of another species from Byzantium and Caria and also from Anatolia

(Chikhachev) that looked rather annual and resembled S. tauricum. Boissier regarded them as S. tauricum although they can hardly be considered as such.

With no reason Kuznetsov (op. cit. (1913) 239) blamed Boissier for introducing such great confusion. It may be that Boissier did erroneously accept the above specimens as S. tauricum, but he understood S. orientale quite correctly as well as its synonymy.

Subsection 2. CYANEA Kusn. in Mém. Acad. Sc. Pétersb. XXV, 5 (1910) 23; Mat. Fl. Kavk. IV, 2 (1913) 220. — Corolla with anthocyanin, violet, blue, pink, sometimes white in albino plants.

6. S. caucasicum M. B. Fl. taur.-cauc. (1808) 128; DC. Prodr. X, 38; Ldb. Fl. Ross. III, 115; Boiss. Fl. or. IV, 172; Shmal'g., Fl. II, 228; Kuzn. in Mém. Acad. Sc. Pétersb. XXV, 5, 28; Mat. Fl. Kavk. IV, 2, 224; Grossg. Fl. Kavk. III, 258. — Ic.: Hook. Bot. Mag. tab. 3188; Kuzn., op. cit., Table 1, Figures 2 and 6. — Exs.: Pl. or. exs. 1928, No. 240.

Perennial, monocarpic? Rhizome reduced, short-fusiform, with long thick roots; radical leaves (annotinous rosettes) withering at flowering; stem
287 usually single, 40—60 cm high, rather thick, like leaves shortly grayish soft-villous or downy-villous, with few short lateral branches; cauline leaves fairly numerous, ovate or oblong, lower leaves with relatively long petiole, obtuse, truncate or rounded at base, upper and median leaves with short broad petiole or sessile and slightly decurrent on stem forming very narrow protruding green stripes along its ribs, cuneate towards base, acute at apex, gray-hairy beneath, velutinous, the same above but sparsely so, 5—10 cm long, 2—4 cm wide, nerves subreticulate, rarely leaves green and sparingly pubescent (var. glabriusculum DC.). Cymes apical on stem and upper lateral branches, few-flowered, leafless, twisted to one side, becoming erect and loose after flowering, appearing as short racemes; pedicels drooping, 3—5 mm long, grayish-downy and sometimes with prickly short bristles; calyx narrowly campanulate, 4—6 mm long, elongating in fruit up to 8 mm, up to 10—15 mm in the Dagestan individuals, grayish-glandular-downy, sometimes coarse with curved filiform bristles, sometimes scabrous, incised for $\frac{1}{3}$ into unequal lanceolate rounded-obtuse erect teeth; corolla blue, tube distinctly longer than calyx, ca. 7—8 mm long, limb nearly as long (entire corolla ca. 15 mm long), campanulate, with narrow triangular short teeth; scales large-papillose; anthers ca. 2 mm long; style slightly exserted from corolla; nutlets pale, oblong, nearly straight, oblique, at large side finely but sharply netted-wrinkled, finely tuberculate within this net, 3—3.5 mm long. May—June.

Edges and glades in the forests of the drying parts of the Caucasus. — Caucasus: Cisc., Dag., E. Transc. Endemic. Described from Terek. Type in Leningrad.

Note. By its decurrent upper leaves this species resembles S. officinale and is distinguished from all the other Caucasian species with anthocyanin corollas. It differs noticeably from S. officinale by the calyx being cleft for only $\frac{1}{3}$, its teeth obtuse, the corolla blue and not dingy violet, and by the pale, wrinkled nutlets (instead of black, smooth, luminous).

7. S. asperum Lepech. in Nov. Acta Acad. Petrop. XIV (1805) 442; Kuzn. in Mém. Acad. Sc. Pétersb. XXV, 5, (1910) 35; Mat. Fl. Kavk. IV, 2, 230; Grossg. Fl. Kavk. III, 286. — S. asperrimum Sims, Bot. Mag. (1806) tab. 929; M. B. Fl. taur.-cauc. I, 129; DC. Prodr. X, 38; Ldb. Fl. Ross. III, 115; Boiss. Fl. or. IV, 175; Shmal'g., Fl. II, 227. — S. echinatum Ldb. Ind. Sem. Hort. Dorp. Suppl. (1811) 5 et (1820) 4; DC. Prodr. X, 40. — Ic.: Sims, Bot. Mag. tab. 929; Lepech, l. c. tab. 7; Gürke in Nat. Pflanzenf. IV, 3a, 113, f. 48, A; Kuznetsov, op. cit. (1910), Table I, Figures 3 and 7; Hegi, III. Fl. V, 3, f. 3158, a—e.

Perennials; stem up to 1.5 m high, strongly branching, spiny-scabrous, covered with firm, short, slightly arcuate, prickly bristles and with small
288 straight bristles between them; leaves not decurrent, more or less long-petioled only the upper leaves with short but distinct petioles or sessile, ovate-oblong or oblong to lanceolate in uppermost leaves, rounded or rounded-cuneate at base, lowermost leaves sometimes subcordate, long-acuminate, median leaves 10 cm long, 5—6 cm wide, usually grayish beneath, covered with rather thick soft hairs, with short hamate prickles along midrib, sparsely coarse-hairy above, bristles straight, borne on large tubercles; cymes many, apical, usually paired, solitary on lateral branches, together forming a paniculate inflorescence, leafless, rather short, loose in fruit; pedicels 5—10 mm long, drooping, thin, downy and prickly-bristly with very small bristles; calyx in flower (3)4—5 mm long, densely bristly, dissected for $\frac{1}{2}$—$\frac{3}{4}$ into lanceolate, obtuse or subobtuse teeth, in fruit up to 8—10 mm long, sacciform-ovate below, teeth shorter or longer than the undivided part, less densely prickly-bristly, bristly at tips, with short curved prickles at base; corolla blue, ca. 15 mm long, outside dotted-papillose, tube longer than calyx, limb campanulate, as long as tube or slightly longer, with triangular-ovate short lobes; style markedly exserted from corolla, with capitate stigma; nutlets ca. 4 mm long, nearly black, semi-curved, ovoid, with lateral straight nerves from the attachment-ring, dorsally netted-rugose, finely dotted-tuberculate, attachment-ring low, smooth, with small teeth inside. May—July.

Damp places in mountains, banks of small rivers and streams, edges of forest, meadows, from foothills to the subalpine belt. — European part: introduced into the Baltic area, Lad.-Ilm., Dv.-Pech., U. V., M. Dnp.; Caucasus: everywhere (except for Tal.?). Gen. distr.: Centr. Eur. (introduced and cultivated). Described from the Bieberstein collections, locality not indicated, apparently grown from seeds. Type in London?

Note. In the Caucasus there are individuals with densely bristly villous stems without decurrent leaves and with shorter calyx teeth; these may be hybrid forms of S. asperum × S. caucasicum. They are also often distinguished by their low habit. Representative specimens: between Kel'ny and Bechenakh, on gravel in Nakhichevan'-Chai River, flowering 30 V 1947 (A. Grossgeim); between Tskharo and Tabistskhurskoe Lake, meadows in Kuni River valley, 5—6 VII 1916 (P. N. Krylov and E. I. Shteinberg).

The leaves are sometimes sparsely hairy beneath so that they are green,
289 not grayish; this is very often observed in the cultivated specimens.

mic importance. A valuable fodder for pigs and rabbits, yielding ests per summer. An area of 25 m^2 is enough to provide one green fodder from April to October, for which purpose it is often cultivated in W. Europe (see: Hegi, l. c. 2221—2222).

8. **S. peregrinum** Ldb. Ind. Sem. Hort. Dorp. (1820) 4; Sprengel, Syst. I, 563; DC. Prodr. X, 37; Ldb. Fl. Ross. III, 114; Kuzn. in. Mém. Acad. Sc. Pétersb. XXV, 5 (1910) 31; Mat. Fl. Kavk. IV, 2, 228; Grossg. Fl. Kavk. III, 258. — Ic.: Kuzn., op. cit. (1910) Table I, Figure A, 4 and 8.

Perennials; closely related to the preceding, probably just a race in it; stems apparently lower; leaves usually less hairy beneath, none cordate at base (even the radical cuneate at base), narrower, oblong. Cymes as in S. asperum. According to Kuznetsov the main difference is seen from the calyx; its teeth are dilated below and acute or acutish at the apex; in flower the calyx is 2 to 3 times shorter than the corolla and not 4—5 times. These distinctions do not seem to me to be constant.

Forests. — Caucasus: Tal. Endemic. Description based on specimens grown in the Yur'ev (Tartu) botanical garden. Type in Leningrad.

Note. I am retaining the independent status of this species only as a concession to Kuznetsov's authority. I did not observe the distinctions indicated, i. e., the size of the calyx compared with the corolla, the depth of its lobes, and the acuteness of the lobes (teeth). I believe that Boissier was correct in including it in the synonymy of S. asperum (asperrimum) as a garden, hybrid form. As a matter of fact Ledebour did not indicate the locality of his species when he described it for the first time in 1820. It was only 29 years later (in "Fl. Ross.") that he mentioned Talysh as such, adding that he had only seen cultivated specimens. I find Kuznetsov's claim, that this species "may be identified with S. asperum Lepech (= S. asperrimum Sims)," rather strange.

I could not find any basis for Sprengel's report on Podolia as a locality (l. c.), which was repeated by De Candolle (l. c.).

9. **S. officinale** L. Sp. pl. (1753) 136; DC. Prodr. X, 37; Ldb. Fl. Ross. III, 114; Boiss. Fl. or. IV, 171; Shmal'g., Fl. II, 227; Kuzn. in. Mém. Acad. Sc. Pétersb. XXV, 5 (1910) 23; Mat. Fl. Kavk. IV, 2, 220; Kryl., Fl. Zap. Sib. IX, 2260; Hegi, III. Fl. V, 3, 2223. — S. bohemicum Schmidt, Fl. Boem. III (1795) 13, tab. 263. — S. tanaicense Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 577. — S. uliginosum Kern. in
290 Oesterr. Bot. Zeitschr. XIII (1863) 227. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 102; Kuzn. op. cit. (1910), Plate 1, Figures 1 and 5; Hegi, l. c. tab. 29, f. 4. — Exs.: Fl. exs. Austro-Hung. No. 2638.

Perennials; rhizome short, black, with long thick roots, polycarpic; radical leaves and lateral shoots absent; stem usually single, robust, thick, high, 50—100 cm, strongly branching mainly above, more or less densely bristly-villous, angular, with hamate prickles along faces, narrowly winged in upper part owing to narrow stripes from the decurrent upper leaves; cauline leaves numerous, usually large, oblong, long-acuminate, lower leaves with narrowly winged petioles, blade rounded at base, upper leaves approximate, sessile, cuneate or rounded-cuneate at base, strongly decurrent along stem and branches, often largely undulant at margin, all leaves coarsely

appressed-bristly above, subglabrous or canescent beneath, with hairs rather dense, lower midrib long-bristly, margins with curved prickles, median leaves usually 10—15 cm long, 3—5 cm wide. Cymes dense, apical on stems and branches, drooping, forming generally paniculate inflorescence, later straightening, elongate, loose, secund, leafless; pedicels 5—10 mm long, with coarse short spreading bristles; calyx ca. 5 mm long in flower, fruiting calyx ovate or pyriform, 10—15 mm long, dissected for $^3/_4$ into lanceolate, long-acuminate teeth, sparsely short-spiny-bristly, the bristles often arcuate; corolla dingy dark violet, rarely pink-red or pink or white, finely papillose-sericeous, 15—20 mm long, tube twice as long as calyx, the limb usually oval, constricted above, slightly shorter than tube, teeth broad, triangular, short; style a little exserted or not at all; nutlets gibbous or horizontal and obliquely ovoid, semi-curved, ovoid, 4—5 mm long, black, smooth, luminous. May—July.

Damp meadows, swampy places, rivers and streams in the taiga and the steppe zones. — European part: nearly everywhere except for the Arctic part, Crim. (rarely); Caucasus: Cisc. (rarely); West Siberia: Ob (seldom), U. Tob. (rarely); Centr. Asia: Dzu.-Tarb., Balkh. Gen. distr.: Centr. Eur. Described from Europe. Type in London.

Note. Some varieties of this widespread European species have been distinguished according to the color of the corolla (var. purpureum Pers. (Ench. I, 161; DC. Prodr. X, 37) with red or pink corollas; var. ochroleucum DC. l.c. = S. bohemicum Schmidt — with straw-colored or white corollas, mainly in the western parts), others according to the general morphology which is dependent on the geographical zone. Hegi claimed
291 accordingly two varieties: var. lanceolatum Weinm. (in Bull. Soc. Nat. Mosc. VII (1837) 57; Ldb. Fl. Ross. III, 114; Rouy, l.c. 290. — f. angustifolium (Opiz) G. Beck).

Var. stenophyllum Cel. — var. glabrescens Nickels apud Kirschleger — S. uliginosum Kerner — S. vetteri Thellung. — Glabrous. Leaves narrow, semi-decurrent. Warm places in the south of European Russia, Hungary, Rumania, etc. The latter is distributed in the south and the east of the USSR where it vicariates the downy, broadleaved European (type) form. Cf.: Rouy. Fl. Fr. X, 290; also Bot. Kozl. XXII, 67—69 and XXVIII, 132—137 (in connection with S. tanaicense Stev.)

Also known are hybrids with S. asperum, a species cultivated in the distribution area of S. officinale, under the name S. uplandicum Nym. (Syll. (1854—55) 80; Hegi, III. Fl. V, 3, 2222).

Genus 1200. **TRACHYSTEMON*** Don.

D. Don. in Edinb. New Phil. Journ. XIII (1832) 239; G. Don, Syst. IV, 309.— Nordmannia Ldb. in Bull. Acad. Sc. Pétersb. II (1837) 312.— Psilostemon DC. Prodr. X (1846) 35.

Calyx campanulate, 5-parted for half or less, sacciform-ovate in fruit; corolla medium—large, very unique, tube short, slightly longer than calyx inside at the middle with 5 fascicles of hairs alternating with the hairy

* From the Greek trachys — rough and stemon — thread, due to the structure of the corolla.

filaments, with 5 small hairy glands below forming a protective ring; lobes of limb free from each other down to scales, lanceolate-linear, curved below, violet, twice as long as tube, outside with solitary bristles; scales in throat 5, broad, low, glabrous, truncate, notched at middle of apex, tightly overlapping at margins; stamens with broadened, coarse-hairy bases between scales, filaments longer than tube, sparsely long-ciliate, vertically and parallelly arising above scales for 6 mm, anthers oblong-linear, obtuse at both ends, attached nearly at middle; stigma dot-like, on long style. Nutlets hidden in the sacciform calyx, small, semi-curved, oblique, black, luminous, with very few thin wrinkles and very large but indistinct (thickened) basal ring, the nutlets attached to a slightly pyramidal gynophore. Forest herb,
292 with large cordate radical leaves and short stems. Inflorescence a small panicle of nearly leafless dichasial cymes.

Note. The name of this genus should be Trachystemon. The name Psilostemon was invented by De Candolle, since, as he reported, the word Trachystemon does not fit the characters of the plant. This was an arbitrary decision. The genus Nordmannia Ldb. was described 5 years after the publication of the genus Trachystemon and, accordingly, is superfluous. Borago orientalis L. (=B. cordifolia Moench) is the same type species for both genera. The specialists in Caucasian flora (Grossgeim, Kolakovskii) who retained the name Nordmannia were obviously confused by Kuznetsov (op. cit. (1913) 243), who wrote in a note to Trachystemon that the genus could be divided into two sections. Kuznetsov undoubtedly overlooked the fact that the type of Trachystemon is T. orientale (L.) D. Don and this species could belong to the section Eutrachystemon.

1. T. orientale (L.) D. Don in Edinb. New Phil. Journ. XIII (1832) 239; G. Don. Syst. IV, 309; Kuzn. in Mat. Fl. Kavk. IV, 2 (1913) 248; Grossg., Fl. Kavk. III, 259.— Borago orientalis L. Sp. pl. (1753) 197.— B. cordifolia Moench, Meth. Suppl. (1802) 275.— Nordmannia cordifolia Ldb. in Bull. Acad. Sc. Pétersb. II (1837) 312.— N. orientalis Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 577; Kolakovsk., Fl. Abkh. IV, 19; Grossg., Opred., 288.— Psilostemon orientale DC. Prodr. X (1846) 36; Ldb. Fl. Ross. III, 113; Boiss. Fl. or. IV, 177.— Ic.: Sibth. Fl. Graeca, tab. 175; Bot. Reg. tab. 288; Jaub. et Sp. III. tab. 419; Ann. Hort. IV, 471 (Nordmannia cordifolia); Loew. in Ber. Deutsch. Bot. Ges. IV, tab. VIII, f. 2–3 (Psilostemon orientale).— Exs.: Fl. cauc. exs. No. 144.

Perennials; rhizome rather thick, obliquely horizontal, with copious, cord-like, adventitious roots; stem single, low, 10–30(40) cm high, not branching, remotely short-bristly with recurved bristles, glandular in inflorescence; radical leaves 1–2, small at flowering, later reaching (only blades) 30 cm in length and width, petioles obsolete; blades delicate, ovate-cordate, with broad basal notch, acute, remotely beset with small firm appressed bristles; cauline leaves few, small, 1–3 cm long, lowermost leaves small, subcordate-ovate, median and upper leaves oblong, all leaves sessile, acute, lower leaves sometimes absent. Cymes dichasial-furcate, loose, borne on stipes, the lower in axils of upper leaves, the upper at end of stem, forming a panicle,
293 with small, inconspicuous bracts; pedicels thin, filiform, as long as to twice as long as calyx, glandular, remotely bristly; calyx in flower ca. 4 mm long,

sparsely spreading-bristly, broadly sacciform in fruit, up to 10 mm long, teeth triangular in fruit, short; corolla with brown-violet limb, lobes up to 10 mm long, the tube ca. 5—6 mm long, corolla of the closed flower (in bud) markedly exserted from calyx as a narrow cone; anthers 2.5 mm long; nutlets 2.5 mm long, with acutish lateral apex. April—May.

Broadleaved forests of the lower mountain belt. — Caucasus: Cisc. (western part), W. Transc. Gen. distr.: As. Min. Described from Constantinople. Type in London.

Genus 1201. **BORAGO*** L.

L. Sp. pl. (1753) 137; Benth. et Hook. Gen. II, 854.

Calyx 5-sect nearly to base into lanceolate-linear lobes, elongating in fruit, otherwise remaining unchanged; corolla rotate or broadly campanulate, nearly tubeless or with very short tube and large limb; notched scales or folds alternating with stamens in throat; stamens 5, filaments short, thick, impressed inside, outside with obtuse scale-like appendage directed upward, anthers large, oblong-linear, connectives with short thin mucro at apex converging as a cone; style long, filiform; stigma capitate. Nutlets straight, subcylindrical or oval, longitudinally rugose and finely tuberculate, rarely smooth, attachment-ring rugose. Caruncle markedly protruding.

Section 1. EUBORAGO DC. Prodr. X, 34; Kuzn., Mat. Fl. Kavk. IV, 2, 246. — Corolla rotate, nearly tubeless, with hairy protective ring inside near base, and with erect, broad appendages between stamens, notched at truncate apex above; filaments with obtuse lanceolate appendage at back (outside); anthers with mucro. Nutlets rugose-plicate.

The other two sections, Cyathonena DC. and Boraginastrum DC., each consists of one species in the western subregion of the ancient Mediterranean.

1. B. officinalis L. Sp. pl. (1753) 137; DC. Prodr. X, 35; Ldb. Fl. Ross. III, 113; Boiss. Fl. or. IV, 150; Shmal'g., Fl. II, 229; Kuzn. in Mat. Fl. Kavk. IV, 2, 247; Kryl., Fl. Zap. Sib. IX, 2261. — B. aspe-
294 ra Gilib. Fl. lithuan. I (1781) 25. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 101; Stankov and Taliev, Opred. Fig. 436.

Biennials; stem erect or ascending, thick, robust, long-hairy and spreading bristly, usually branching above; leaves finely undulant-dentate at margin, lower leaves with petioles and oval blades, bristly-hairy, 3—7 cm long, 2—5 cm wide, obtuse, upper leaves sessile, oblong. Inflorescence usually corymbiform-paniculate, with few lanceolate, small leaves at base; scorpioid cymes leafless, short, loose, with flowers drooping on long, spreading, bristly pedicels; calyx long white bristly at margins of lobes, 10—12 mm long, up to 15 mm in fruit, lobes lanceolate, obtuse; corolla pale blue, 15—20 mm across, lobes of limb oblong-lanceolate, acute, stellately spreading,

* The name given to the plant by medieval authors; derived apparently from the Spanish or late Latin word borra, burra — shaggy beard.

incisions between them extending nearly to stamens; anthers dark violet, 5—6 mm long, filaments much dilated at base and much shorter than anthers, with appendages ca. 2.5 mm long; nutlets 5 mm long, erect, oblong, ventrally keeled, dorsally very unequal-sided, with vertical, raised lines of small tubercles along the inflated sides, the apex short, obtuse, compressed; attachment-ring dark, thickened, transversely ribbed; caruncle very large, protruding. May—June.

Weedy places near residential areas or kitchen gardens, sometimes grown as a condiment (the leaves have an agreeable, cucumberlike odor). — European part: rare in all parts but the Arctic, as a weed or occasionally cultivated. Very rarely in the Caucasus, Centr. Asia or West Siberia. Gen. distr.: Med., Centr. Eur., Iran. Described from Europe. Type in London.

Genus 1202. **BRUNNERA** *Stev.

Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 582.— Anchusa sect. IV. Myosotoides DC. Prodr. X (1846) 49.

Corolla typically short, Myosotis-like, tube short, as long as or slightly longer than calyx but shorter than limb, limb flat, 3—7 mm wide, with short obtuse lobes; scales short, ovate, obtuse, short-velutinous; anthers in tube of corolla on short filaments; style short, not exserted from throat. Nutlets small, 3 mm long, curved but not horizontal; rugose; cymes without radical [?]
295 leaves; calyx small, dissected for $^3/_4$ into linear acute lobes. Perennial herbs, with small or medium-sized blue flowers; radical leaves with long petioles and cordate-ovate blades.

1. Corolla 5—10 mm across. Blades of radical leaves larger, sometimes up to 20 cm long and wide, basal notch broadly open so blade appearing sometimes triangular. Pedicels relatively long. Bristles fewer, stiff. (Altai and Sayans) . . . . . 1. **B. sibirica** Stev.
\+ Corolla 3—4 mm across. Blades of radical leaves smaller, usually 4—7 cm long, with narrower basal notch and rounded sides, gray-velutinous beneath. Calyx comparatively longer, pedicels shorter. Plants smaller in all parts (western part of the Greater Caucasus) . . . . . 2. B. macrophylla (M. B.) Johnst.

1. **B. sibirica** Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 582; Johnston in Contrib. Gray Herb. XXIII, 54; Kryl., Fl. Zap. Sib. IX, 226; Il'in in Mat. po istor. fl. i rast. I, 270.— Anchusa myosotidiflora β. grandiflora DC. Prodr. X (1846) 50; Ldb. Fl. Ross. III, 121.— Anchusa sibirica Iljin in Animadv. ex Herb. Univers. Tomsk. 5 (1935).

Perennials; rhizome obliquely horizontal, finger-thick (0.5—1 cm), black, rather long, producing black-brown, filiform, adventitious roots, nearly smooth; stem usually single, erect, 25—80 cm high, sparsely covered with stiff, recurved, short bristles, not branching; radical leaves with long bristly petioles reaching 10—45 cm, blades 6—22 cm long and wide, acute,

* After the Swiss botanist and traveler S. Brunner (1790—1844), who traveled in the Crimea in 1831.

cordate-deltoid, with broadly open basal notch, with rounded auriculate basal lobes, very shortly and sparsely subappressed-bristly above, less pubescent or glabrous beneath, with solitary bristles only along nerves, green, rather thick; cauline leaves many times smaller than radical leaves, few, the lowermost petioled, with small, ovate blades, median and upper leaves sessile, oblong or even nearly lanceolate, acute. Scorpioid cymes in axils of upper, attenuate leaves, on long thin peduncles 5 cm long, as long as or slightly longer than supporting leaves, few-flowered, ebracteate, short-racemiform, generally forming small panicle at apex of stem; pedicels long, thin, 2—4 times as long as calyx; calyx 3 mm long, campanulate, dissected for $^3/_4$ into linear-subulate diverging lobes, not changing in fruit, like pedicels shortly appressed-bristly; corolla blue, tube almost as long as calyx, the limb flat, dissected to throat into oblong or obovate lobes
296 rounded at apex, and longer than tube; scales small, ovate, dotted-papillose (like upper surface of petals), without hairs; style ca. 1 mm long; stigma capitate, slightly notched; nutlets 2.5—3 mm long, semi-curved, with acute apex turned slightly to one side, longitudinally rugose with thick, high nerves. June. (Plate XV, Figure 2.)

Meadows in the taiga belt. — West Siberia: Ob (southeastern part near Tomsk), Alt.; East Siberia: Ang.-Say. (W.). Endemic. Described from Tomsk. Type in Helsinki.

Note. According to M. M. Il'in this species of Altai and the Sayans may be regarded as an ancient, Pliocene relict of the beech-hornbeam-oak forests that existed in Altai, Kuznetsk Ala-Tau, and in W. Sayans extinct Pleistocene at the end of the Tertiary period.

2. B. macrophylla (M. B.) Johnst. in Contrib. Gray Herb. XXIII (1924) 54; Lordkip. in Bot. zhurn. XXI, 3, 290; Kolak., Fl. Abkh. IV, 20. — Myosotis macrophylla M. B. Fl. taur.-cauc. I (1808) 119, 421; III, 120. — Anchusa myosotidiflora Lehm. Asperif. II (1818) 234; Ldb. Fl. Ross. III, 120; DC. Prodr. X, 50; Boiss. Fl. or. IV, 157. — Brunnera myosotidiflora Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 582. — Ic.: M. B. Cent. pl. rar. I, tab. 14. — Exs.: GRF, No. 778.

Perennials; rhizome 2 cm thick, obliquely horizontal, 5—15 cm long, black, squamous, producing thick cordlike dark adventitious roots; stem usually single, 20—50 cm high, thin, weak, erect, not branching, very sparingly covered (like petioles of radical leaves) with very small bristles appressed below; radical leaves with petioles 6—22 cm long, blades delicate, cartaceous, cordate-ovate, with rather narrow basal notch, 5—12 cm long and wide, very rarely somewhat deltoid and then notch more open, basal lobes rounded, acute at apex, often densely grayish beneath, with small white bristles, rarely finely downy, green above, covered with few, slightly longer, appressed bristles; cauline leaves much smaller than the radical, few, the lowermost (2) with rather long petioles and oblong-ovate blades, other leaves sessile, ovate-oblong or oblong, acute, 1.5—3 cm long. Inflorescence composed of apical scorpioid cymes, shortly paniculate-corymbiform, rarely, as in preceding species, paniculate (for example, Novyi Afon, Lipskii); cymes loose, few-flowered, ebracteate, racemiform; pedicels thin, declined, 2—4 times as long as calyx, like calyx sparsely covered with small, appressed bristles; calyx small, ca. 1 mm long in flower, later up to 2 mm, with lanceolate-subulate

lobes; corolla blue, Myosotis-like tube slightly longer than calyx, the
297 limb 3—4 mm across, with ovate-rounded lobes approximately as long as tube; scales small, dotted-papillose; nutlets 2.5 mm long, pale, almost straight, markedly exserted from calyx; arcuate at back, ventral keel hard, straight, longitudinally rugose with narrow, prominent, acute nerves, usually 1—2 nutlets in each calyx. March—April.

Oak forests, mountain slopes. — Caucasus: Cisc. (western part), W. Transc., E. Transc. (only Kakhetiya). Endemic. Described from Aragva River. Type in Leningrad.

Genus 1203. **TRIGONOCARYUM** * Trautv.

Trautv. in Tr. Bot. Sada, III (1875) 278.— Myosotis sect. Phyllocephalum Boiss. Fl. or. IV (1879) 234.

Calyx parted for $^1/_2$ or $^2/_3$ into triangular-lanceolate teeth barbate inside, later hardly changing; corolla rather the short-type, conical and with thick veins at base, tube shorter than calyx, the limb blue-violet, nearly flat, 2—3 mm across, lobes ovate, rounded, convolute to the left in bud (i. e., each lobe half covered by the one to its left and covering its neighbor by its right half); anthers on very short filaments, included in corolla tube, ovate-oblong, obtuse; scales in throat small, ovate, papillose, without hairs; style short; stigma entire, capitate; gynophore flat; nutlets comparatively large, exceeding calyx, erect, as in Myosotis nearly always single, whitish, dorsoventrally compressed, dorsally inflated, ventrally with obtuse protruding keel and therefore trihedral in cross section, appearing ovate from the back, acute at margin, appearing rimmed, obtuse at apex, smooth, glabrous; areola of attachment (cicatrice) basal, small, tapering, oval, impressed like a pit, with small, rounded, white caruncle protruding from pit. Annuals. Main stem with very short internodes and rapidly interrupted in growth; long lateral branches with long internodes developing from axils of stem lower leaves; third order growing from median axils of lateral branches, all branches terminate with short, furcately branching, leafy inflorescence; leaves spatulate-linear, obtuse.

1. T. involucratum (Stev.) Kusn. in Izv. Russk. Geogr. obshch. 46, (1910) 35; Mat. Fl. Kavk. IV, 2, 290; Grossg., Fl. Kavk. III, 261.— Myosotis involucrata Stev. in Mém. Soc. Nat. Mosc. III (1812) 253 et in Cat. Hort. Gorenk. (1812) 27; DC. Prodr. X, 107; Ldb. Fl. Ross. III. 144; Boiss. Fl. or. IV, 242.— Trigonocaryum prostra-
298 tum Trautv. in Tr. Bot. Sada, III (1875) 278.— Ic.: Kuzn., V debryakh Dagestana, Table 1.— **Exs.**: GRF, No. 2995.

Annual; plants 2—10 cm high, sparsely covered in all parts with sub-appressed, equal bristles borne on small tubercles, generally green; root thin but apparently deep; main stem up to 3 cm high, stem branches semi-decumbent; leaves 1—1.5 cm long, up to 3—5 mm wide above, gradually tapering at base. Terminal inflorescences leafy, once or twice furcate,

* From the Greek trigonos — triangular and caryon — nut, nutlet.

few flowered, 1—3 cm long and wide; bracts 1—2 cm long, similar to cauline leaves in shape; calyx ca. 2 mm long, sessile or on short curved pedicel, campanulate. June—July.

Taluses and stony slopes in the subalpine and alpine belts, rarely below, in the eastern part of Main Caucasian Range. — Caucasus: Dag., Cisc. Endemic. Described from Tvak-Dag Mountain of E. Caucasus. Type in Helsinki.

Note. Owing to the structure of the cicatrice which lacks a defined basal ring, this genus cannot be included in the Anchuseae, as Guerke and Kuznetsov have done. It is undoubtedly closely related to Myosotis and should be placed together with it in the tribe Myosotideae, in which the corolla is twisted in aestivation. However, it is still quite probable that phylogenetically it represents a derivative from the hybridization of some primary Anchuseae and Myosotideae. This was how the genus Brunnera evolved. The two genera Trigonocaryum and Brunnera are representatives of the Tertiary (Neocene) history of the forest Boraginaceae, when they had just migrated to the south from their Arcto-Tertiary habitat. Trigonocaryum is interesting evidence of these old migrations and, alongside Hypericum asperuloides Czern., is endemic to the eastern part of the Main Caucasian Range.

Genus 1204. ANCHUSA * L.

L. Sp. pl. (1753) 133; Gusul. in Bul. Facult. St. Cern. I, 73—120 et tab. I—XIII; 235—324 et tab. I—V (1927).

Calyx cleft for $\frac{1}{3}$—$\frac{1}{2}$ or nearly to base into narrow lobes somewhat elongating in fruit, otherwise unchanged; corolla small to medium-large, usually medium-sized, with elongate tube exceeding calyx (sometimes twice as long) and campanulate limb, short-type only in one species, with very short tube and flat limb; scales in throat well developed, sometimes large,
299 hairy, rarely papillose, anthers on very short filaments, hidden either under scales or between them; style short or elongate, rarely even exserted from throat. Nutlets straight or often curved and then arcuate at back and with short obtuse apex, sparsely rugose with few wrinkles, often finely (dotted) tuberculate, with basal or rarely nearly ventral attachment-ring, with caruncle inside. Perennial, biennial or annual herbs, usually with narrow, elongate, most often lanceolate leaves; inflorescences paniculate, consisting of cymes provided with small bracts.

Common to the ancient Mediterranean, mainly in its western subregion; some species distributed in S. Africa.

1. Calyx parted only to middle or slightly lower. Nutlets oblique .... 2.
+ Calyx dissected nearly to base ..... 8.
2. Calyx teeth acute (Anchusa officinalis s.l.). Villous-hairy ..... 3.

* The ancient name for some Boraginaceae, from the Greek anchein — to bind. Used in medicine as an astringent.

+ Calyx teeth obtuse. Hairs appressed, short, often falling. . . . . 4.

3. Cymes loose in fruit, with calyxes remote. Calyx ca. 10 mm long in fruit. Leaves broader and stem greener. Flowers large; style exserted from calyx . . . . . 6. A. officinalis L.

+ Cymes dense in fruit, with calyces approximate. Calyx smaller, 7—8 mm long in fruit. Leaves and stems gray-villous. Flowers smaller; style not exserted from calyx . 7. A. procera Bess.

4. Corolla yellow or slightly bluish. Calyx teeth with distinct rather wide membranous rim . . . . . 5.

+ Corolla blue or violet . . . . . 6.

5. Leaves narrow, lanceolate-linear, green, coarse-scabrous. Fruiting calyx less than 8 mm long . . . . . 4. A. ochroleuca M. B.

+ Leaves lanceolate, broader than 1 cm, downy at both sides, grayish. Fruiting calyx 10—15 mm long. . . . . 5. A. pseudoochroleuca Shost.

6. Plants finely hairy, grayish; calyx profusely covered with soft white hairs, teeth without membranous rim. . . . . 7.

+ Plants sparsely coarse-bristly. Calyx more sparsely coarse-hairy, mainly at margins, teeth with narrow, inconspicuous membranous rim. Leaves green. (Sands along river valleys and shores of the Black Sea) . . . . . 3. A. gmelini Ldb.

7. Calyx parted for $\frac{1}{3}$ to $\frac{1}{2}$ (Crimea) .1. A. leptophylla Roem. et Schult.

300 + Calyx dissected for more than $\frac{1}{2}$. Leaves lanceolate-linear. . . . . 2. A. incana Ldb.

8. Perennials, sometimes biennials . . . . . 9.

+ Annuals . . . . . 10.

9. All parts of plant coarsely long-bristly. Calyx with acute lobes. Scales in throat of corolla with bundle of long thick white hairs. Nutlets large, 5—6 mm long, trihedral-oblong, coarsely wrinkled and finely dotted-tuberculate . . . . . 8. A. italica Retz.

+ All parts of plant downy-scabrous. Calyx with obtuse lobes, small, in flower 2 mm long. Scales in throat of corolla finely papillose only at margins. Nutlets smaller, 2—3 mm long, oblong, finely hairy, transversely rugose and finely tuberculate . . . . . 12. A. barrelieri (All.) Vitm.

10. Nutlets straight, narrowly oblong, 4 mm long; style as long as calyx. Leaves nearly always entire. Scales white-hairy. Corolla small, bluish. (Feodosia, Taman', Anapa). . . . . 9. A. thessala Boiss. et Sprun.

+ Nutlets curved, ovoid, oblique, 3 mm long. Leaves angular-dentate . . . . . 11.

11. Corolla tube less than $1\frac{1}{2}$ times as long as calyx, limb 5—7 mm across; style exserted from calyx for up to 2 mm. Sclaes white-hairy. (Kerch, Pitsunda, along coast) . . . . . 10. A. pusilla Gusul.

+ Corolla tube $1\frac{1}{2}$—3 times as long as calyx, limb 7—10 mm across, darker, violet; style persistent, long, filiform, considerably exceeding calyx (by 5—6 mm). Scales finely dotted-papillose. (Crimea, Odessa, Moldavia) . . . . . 11. A. stylosa M. B.

Section 1. EUANCHUSA Griseb. Spic. Fl. Rumel. II (1844) 96; DC. Prodr. X, 42; Ldb. Fl. Ross. III, 117; Kuzn. in Mat. Fl. Kavk. IV, 2, 253. — Subgenus Euanchusa Gusul. l. c. 76. — Perennials or biennials. Inflorescence leafy. Calyx parted for half, rarely deeper; corolla tube longer than limb. Scales covered with short hairs. Nutlets curved, obliquely ovoid, with an oblique beak; areola of attachment basal or nearly ventral.

Series 1. Leptophyllae Gusul. (pro sect.) l. c. 84. — Perennials. Bristles borne on tubercles, curved or appressed, coarse, rarely plants tomentose with longer soft hairs. Stigma spherical, abruptly rarely gradually tapering to style.

1. A. leptophylla Roem. et Schult. Syst. IV (1819) 90; Kuzn. in Mat. Fl. Kavk. IV, 2, 256; Gusul. l. c. 91. — A. canescens Stev. in Bull. Soc.
301 Nat. Mosc. XXIV (1851) 581. — A. officinalis Ldb. Fl. Ross. III, 117; Shmal'g., Fl. II, 229 (p. p.). — A. ochroleuca Boiss. Fl. or. IV, 153, p. p. — Ic.: Gusul. l. c. tab. I, f. F — I; Rchb. Pl. crit. f. 471; Ic. Fl. Germ. XVIII, tab. 108, f. III.

Perennial, often apparently biennial plants, ash-gray in color, with rather thick short down; stem erect, 40—70 cm high, thin, furrowed, simple or branching above, more or less gray, downy with recurved hairs; leaves lanceolate, radical leaves 5—10 cm long, 6—10 mm wide, gradually tapering to petioles a little shorter than blade, cauline leaves rather dense, gradually reduced and narrower upward, sessile except for the lower, all leaves gray or grayish, acute, usually ascending, long-bristly at margin, appearing ciliate. Panicle apical, usually small, rather narrow, rarely strongly branching, with small oblong bracts. Cymes first dense, capitate, soon elongating and becoming looser, 3—10 cm long; calyx subsessile, pedicel even in fruit not exceeding 1—2 mm, appressed-gray-downy, with longer bristles along midrib and margins, in flower rather narrowly campanulate, ca. 7 mm long, parted for a little less than half into oblong lobes rounded-obtuse at apex, not membranous at margin, calyx in fruit ovoid-spherical, sacciform; corolla blue-violet (sky blue), medium-large, tube $1\frac{1}{4}$—$1\frac{1}{3}$ (to $1\frac{1}{2}$ times) as long as calyx, limb campanulate, 6—7 mm across, with oblong lobes rounded at apex; scales oblong, rounded at apex, densely short-hairy, 3 mm long; anthers 3—4 mm long, disposed below scales; nutlets ca. 4 mm long, gray, with acutish wrinkles, finely dotted-tuberculate on surface, beak compressed, obtuse. June.

Steppe and stony slopes, roadsides. — European part: Bl. (Nikolaev), Crim.; Caucasus: W. Transc. (Abkhazia, Tsebel'da, weedy places). Gen. distr.: Bal.-As. Min. Described from "Southern Europe;" only later Reichenbach (Pl. crit. III, 84) reported that the species grew predominantly in Greece, but Gusuleac did not list even one locality in Greece, discounting Thrace. Type in Berlin.

2. A. incana Ldb. Fl. Ross. III (1849) 117. — A. angustissima C. Koch in Linnaea, XXII (1849) 633; Gusul. l. c. 239. — A. gmelini var. armeniaca Kusn. in Mat. Fl. Kavk. IV, 2 (1913) 260. — Ic.: Gusul. l. c. tab. II, f. A—E.

Perennial or biennial; very close to the preceding species, as correctly noted by Kuznetsov, being an intermediate between A. leptophylla, A. gmelini and A. ochroleuca. Flowers blue and thus distinguished
302 from A. ochroleuca, but resembling it by the coriaceous rim along margins of sepals. Hairs denser at both surfaces of leaves and thus distinguished from A. gmelini, but coarse and thus distinguished from A. leptophylla. Leaves narrow, linear as in A. gmelini, but shorter than in the latter. Corolla tube only slightly longer than calyx, as in A. leptophylla.

Gusuleac emphasizes that the diagnostic character of this species, compared with A. leptophylla, is the more deeply cleft calyx ($^1/_2-^2/_3$) as distinctly visible in the original Ledebour specimen. June.

Stony slopes, river gravels. — Caucasus: S. Transc. **Gen. distr.:** Bal.-As. Min. (only As. Min. to Lycaonia in the west). Described from Pontus Range, Hemsin (C. Koch-type A. angustissima C. Koch); Rize (Nordmann-type A. incana Ldb.).

Note. It is very difficult to draw a line between this species and A. leptophylla in Asia Minor.

3. A. **gmelini** Ldb. in Pand. Beiträge I (1820) 60 (62); Ldb. Fl. Ross. III, 118; Kuzn. in Mat. Fl. Kavk. IV, 2 (1913) 258; Gusul. l. c. 92. — A. linearifolia d'Urv. Enum. pl. Archip. (1820) 20 et in Mém. Soc. Linn. I (1822) 276. — Ic.: Gusul. l. c. tab. III; I. G. Gmel. It. I, tab. 37, f. 2.

Perennial, biennial; stem well-developed, erect, 50—80 cm high, virgate, sparingly covered with appressed short bristles or subglabrous, usually slightly branching only above; leaves linear or narrowly lanceolate-linear, 5—15 cm long, 3—8 mm wide, lower leaves gradually tapering at base, median and upper leaves sessile, green above, sparsely covered with tubercles bearing short firm bristles, short-bristly along midrib, otherwise glabrous, long-thin-acuminate at apex. Inflorescence a small narrow panicle, rarely broadly paniculate when stems strongly branching, with very small bracts; cymes dense only at beginning of flowering, later elongating, loose; calyx subsessile, in flower 4—5 mm long, narrowly campanulate, greenish, remotely covered with appressed short bristles mainly along margins of lobes, parted for $^1/_3-^1/_2$ into oblong-lanceolate, obtuse teeth, nearly without membranous margin, calyx in fruit spherical-ovoid; corolla violet, medium-large, its tube nearly twice or $1^1/_2$ times as long as calyx, limb 7—10 mm across, with ovate lobes rounded at apex; nutlets 4 mm long, subhorizontal, semi-ovoid, with rather acute apex, acutely rugose and finely dotted-tuberculate. June—July.

Sands of large rivers and maritime sands in steppe zone. — European
303 part: Bl., M. Dnp. V.-Don, L. V., L. Don; Caucasus: Cisc. **Gen. distr.:** Bal.-As. Min. (Balkans). Described from the Don. Type in Leningrad.

4. A. ochroleuca M. B. Fl. taur.-cauc. I (1808) 125 p. p., em. Ldb. Fl. ross. III, 119; Boiss. Fl. or. IV, 153 p. p.; Shmal'g., Fl. II, 229, p. p.; Kuzn. in Mat. Fl. Kavk. IV, 2, 260; Gusul. l. c. 92. — Ic.: Bot. Mag. tab. 1608.

Perennial or biennial; stem 40—80 cm high, thin, stiff, virgate, subglabrous, sparsely covered with small curved bristles, more or less strongly branching

above, sometimes paniculately so; leaves usually lanceolate-linear to sublinear, greenish, sparingly pubescent, sparsely covered above with white tubercles bearing short firm appressed bristles, subglabrous beneath, with short bristles only along midrib, 4—8 cm long, 5—10 mm wide, lower leaves gradually long-tapering to petiole, median and upper leaves sessile, all leaves acute. Cymes at first dense, capitate, soon elongating and becoming looser, forming a narrow small panicle, with very small bracts; calyx subsessile, in flower narrowly campanulate, ca. 7 mm long, greenish, appressed-short-bristly, parted for half into oblong obtuse teeth with narrow but distinct membranous ribs, short-ciliate at margin towards apex, calyx in fruit broadly ovoid, 7—9 mm long; corolla yellow, medium-sized, tube slightly longer than calyx ($^1/_3$—$^1/_4$); limb 7—10 mm across, with ovate lobes rounded at apex; nutlets 3 mm long, obliquely ovoid, acutely rugose and dotted-tuberculate. May—July.

Sands and in steppes, rarely on stony slopes. — European part: L. Don, L. V. Endemic. Described from the arid Caspian-Caucasian steppes. Type in Leningrad.

Note. This typically narrowleaved species resembling A. gmelini grows only along the Donets and Don Rivers, probably also on the Lower Volga (I saw the Claus specimens from the steppes of Astrakhan) and possibly on the lower Donets. Further to the west is the habitat of the broadleaved and more pubescent, grayish race, with larger leaves and larger fruiting calyces, described as the independent species A. pseudoochroleuca Shost. The notion that this western race is the result of hybridization with A. officinalis (A. procera) is highly probable. I saw specimens (Khotin district, Lipkany, collected by K. Keichel, 1898) with distinctly light blue flowers and broad leaves that were very similar to the hybrid of A. officinalis × A. ochroleuca (A. baumgarteni Nym.). It is possible that the narrowleaved Don race is not the formal type of A. ochroleuca and that a mistake was made here. The speci-
304 men which was apparently Bieberstein's original with the inscription "in apricis herbidis caspico-caucasicis inque Armenia" actually belongs to the broadleaved race. The North Caucasian (Kuban) specimens are broadleaved and more like A. pseudoochroleuca than the Volga-Don steppe race and hence it is possible that this species was not validated. It might have been better then to describe the Volga-Don race as a new species.

5. A. pseudoochroleuca Shost. in Tr. N.-d Inst. bot. IV (1941) 199. — A. ochroleuca var. legitima Schinz, Enum. pl. Transsilv. (1866) 465. — A. ochroleuca Gusul. l. c. (p. p.). — A. pustulata Pacz. Mat. Fl. Bess. (1912) 60—62, non Schur.

Perennial; stems 30—60 cm high, branching, coarse-scabrous, with the common subappressed bristles; leaves acute at apex, undulant at margins, coarse-scabrous at both surfaces, evenly beset with thick semi-appressed bristles; lower leaves oblong, 5.5—15 cm long, 0.5—2 cm wide, tapering at base to a winged petiole, medium and upper leaves sessile, oblong-lanceolate, 4—15 cm long, 0.8—2.3 cm wide. Cymes leafy, short in flower; pedicels up to 2 mm long; calyx tubular-funnel-shaped, 6—8.5 mm long, up to 15 mm long in fruit, tube whitish above with dense appressed bristles, parted nearly to middle into obtuse teeth with scarious and ciliate rim at margin; corolla

yellow or bluish, glabrous, tube 8—10 mm long, the limb 9—11 mm across, with oblong lobes, 3—4 mm long; scales ca. 2 mm long; anthers ca. 2 mm long, on 1 mm long filaments; nutlets obliquely ovoid, 3 mm long, rugose, dotted-tuberculate on the entire surface. May—July.

Calcareous steppe slopes. — European part: Bes., M. Dnp., Bl. Endemic. Described from the Moldavian SSR (Kolkotova Balka 4 km northwest of Blizhnii Khutor, flowers, 28 VII 1930, Opperman). Type in Kharkov.

Note. As the author noted, this species differs from A. ochroleuca in its wider cauline leaves, hairy at both surfaces, larger fruiting calyx, and other characters; but the original Bieberstein specimens are as reported in the preceding Note. On the other hand a broadleaved, western race of this kind was earlier described under the name A. baumgarteni Nym.

Series 2. Homotrichae Gusul. l. c. 85 et 97 (pro sect.). — Biennials, rarely perennials. Hairs rather long, regular, without short down between them. Anthers disposed under scales. Stigma clavate.

6. **A. officinalis** L. Sp. pl. (1753) 191; Ldb. Fl. Ross. III, 117 (p. p.); Shmal'g., Fl. II, 229 (p. p.); Kuzn. in Mat. Fl. Kavk. IV, 2, 253; Grossg., Fl. Kavk. III, 260. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 108, f. I;
305 Gusul. l. c. tab. I; Stankov and Taliev, Opred. ris. 437. — Exs.: GRF. No. 327.

Biennial; stem tall, 40—100 cm, angular, sparsely and rather long spreading-hairy, greenish, usually branching above; leaves usually undulant at margin, appearing angular-dentate, broadly lanceolate or lanceolate, 5—10(12) cm long, usually more than 1 cm wide, rather delicate, soft, greenish, sparsely spreading-hairy, with curved bristles borne at upper surface on small white tubercles, acute, lower leaves tapering to a more or less long petiole, upper leaves sessile, even slightly amplexicaul. Inflorescence paniculate, more or less large, with small, lanceolate-linear, ciliate bracts; cymes dense at first, capitate, later elongating, loose, up to 10 cm long; calyx subsessile, in flower 5—7 mm long, parted to middle into lanceolate acute lobes, in fruit broadly ovate, sacciform, grayish long-bristly; corolla violet, rather large, tube a little or $1\frac{1}{2}$ times exceeding calyx, the limb 7—10 mm across, with ovate lobes; style distinctly exserted from calyx; nutlets obliquely ovoid, ca. 4 mm long, gray, acutely transversely rugose and finely dotted-tuberculate. June—July.

Weedy places, kitchen gardens near roadsides, field edges, exposed cliffs in forests and steppe zones, mainly in the taiga, but may occur in the steppe and especially in the damp regions of the Caucasus as an introduced plant. It grows for the most part in the northwest, but it may reach the forest zone of the Volga. (It often vicariates with the very close A. procera Bess. in the steppe zone). — European part: Balt., Lad.-Ilm., U. Dnp., U. V., V.-Kama, V.-Don, Transv.; Caucasus: Cisc. and Tal. (very rare, introduced). Gen. distr.: Centr. Eur., Bal.-As. Min. (Balkans). Described from Europe. Type in London.

7. A. procera Bess. Enum. pl. Volhyn. (1822) 8; Gusul. l. c. 98. — A. stricta Herbich in Flora (1855) 641. — A. officinalis Ldb. Fl. Ross. III (1849) 117 (p. p.); Shmal'g., Fl. II, 229 (p. p.). — Ic.: Gusul. l. c. tab. II; Rchb. Ic. Fl. Germ. XVIII, tab. 107, f. II. — Exs.: Baenitz, Herb. Europ.

Biennial; closely related to the preceding species, representing a more xerophilous, steppe race; stem high, short-hairy, grayish; leaves thicker, grayish, directed upwards. Inflorescence usually narrower, compressed, when stem strongly branching then broadly paniculate; cymes very dense in fruit, spicate, with approximate, often overlapping calyces; calyx grayish-hairy, smaller and less inflated, the teeth somewhat obtuse; corolla small,
306 tube slightly exserted from calyx, the limb dark, 5—7 mm across; style not exserted from calyx after falling of corolla; stigma more clavate than in A. officinalis; nutlets 4 mm long, shorter than in the preceding species. May—July.

Cliffs, meadows, sands, stony slopes. — European part: M. Dnp., U. Dns., Bl., L. Don?; Caucasus: Cisc. Gen. distr.: Bal. As.-Min. (Balkans), Centr. Eur. (locally introduced from Germany). Described from Volyn' and Podolia. Type in Leningrad, cotype in Kiev.

Note. It is doubtful whether this species constantly differs from A. officinalis. It is more or less definitely distinguished only in fruit, when the characters of compact cymes and short style are obvious. It is difficult, nearly impossible, to distinguish it in flower, for even in A. officinalis there are individuals with smaller flowers. The drawing by Gusuleac does not show the characteristic cymes. All the characters mentioned in the text (pp. 98—99) which he emphasized as being typical for A. procera, such as the pubescence of the bracts and calyx, are present in A. officinalis. The calyx-teeth are also acute in A. procera and hence even this feature, noted by Hegi (III, Fl. V, 3, 2198, in the Key), is not significant and Gusuleac ignored it.

It is assumed that A. procera originated as a hybrid between A. officinalis and A. ochroleuca or between A. officinalis and A. leptophylla. The latter combination gave rise to an enigmatic species described under the name A. agardhii Lehm. (Asperif. (1818) 241), which was partly recognized by Gusuleac, who reported its locality as Siberia. He recorded this hybrid for Simferopol, and described the hybrid A. officinalis × A. ochroleuca — A. baumgarteni (Nym. Consp. Fl. Europ. (1881) 510) as follows: pubescence of A. officinalis or more or less of A. ochroleuca; calyx lobes obtuse, not membranous-rimmed towards apex; corolla pale violet, yellow or variously colored; occurs in Transylvania but also unquestionably in the USSR (see Note to A. ochroleuca).

Section 2. BUGLOSSUM (Gaertn.) Rchb. Ic. Fl. Germ. exc. I (1830) 343; DC. Prodr. X, 46; Kuzn. in Mat. Fl. Kavk. IV, 2, 262. — Genus Buglossum Gaertn. De fruct. I (1788) 322, tab. 67; subgenus Buglossum Gusul. l. c. 76. — Calyx dissected to base. Corolla limb as long as tube or longer. Nutlets straight, netted-rugose, with basal areola of attachment. Scales densely covered with long (up to 2 mm) hairs.

8. A. italica Retz. Obs. I (1779) 12; Ldb. Fl. Ross. III. 119; Boiss. Fl. or. IV, 154; Shmal'g., Fl. II, 230; Kuzn. in Mat. Fl. Kavk. IV, 2, 264; Gusul. l. c. 105. — A. azurea Mill. Gard. Dict. ed. VIII (1868) 9; Grossg., Fl. Kavk. III, 260. — A. paniculata Ait. Hort. Kew. I (1768)
307 171. — A. amoena Gaertn. l. c. tab. 67, f. 2. — Ic.: Bot. Mag. tab. 2197; Rchb. Ic. Fl. Germ. XVIII, tab. 106, f. 5; Hegi, III. Fl. V, 3, f. 3143; Gusul. l. c. tab. VI. — Exs.: Pl. Palaest. exs. No. 155.

Perennial; root thick, multicipital; stem thick, erect, 40—100 cm high, usually spreading-paniculately branching, with long, coarse, spreading bristles; radical leaves 10—30 cm long, up to 5—6 cm wide, oblong-elliptic, gradually tapering at base, with sparse but long and very coarse bristles; cauline leaves oblong-lanceolate or lanceolate, median and upper leaves sessile, all acute and bristly. Inflorescence paniculate, partly leafy; cymes loose, few-flowered, very early straightening, only below with small bracts; pedicels distinct, bristly; thickening and elongating to 0.5—1 and even 1.5 cm in fruit; calyx in flower 7—10 mm long, subtubular, dissected to base into linear, acute, long-white-bristly lobes, becoming lanceolate and reaching 15(18) mm in fruit; corolla rather large, sky-blue, tube slightly longer than calyx, the limb 10—15 mm across, nearly flat, with ovate-semi-orbicular lobes; scales protruding, white, villous; style exserted from calyx after falling of corolla; nutlets large, ca. 7 mm long, trihedral-oblong, with abrupt ventral keel, rugose with large angular wrinkles on the inflated wall and sides, beakless, nearly obtuse, slightly tapering beneath under basal ring, brown. April—May.

Fields, deserts, gardens, irrigation ditches, sometimes in crops in arid non-irrigated serozem or montane chestnut soils in Central Asia. — European part: Bl., L. Don, L. V., Crim. (mainly at the southern coast); Caucasus: mainly in the eastern part, but sometimes also in the west; Centr. Asia: everywhere up to 43—44° N., in oases. Gen. distr.: Med., Iran., Bal.-As. Min., Ind.-Him. Described from Italy.

Section 3. BUGLOSELLUM Gusul. l. c. 76, pro subgen. — Section Buglossum Rchb. DC. Kusn. l. c. (ex parte quo ad species annuas). — Annuals. Calyx dissected nearly to base. Corolla limb large or (in the USSR) smaller than tube. Scales covered with fine hairs shorter than scales. Nutlets straight or slightly curved, obliquely ovoid.

9. A. thessala Boiss. et Sprun. Diagn. I, 11 (1849) 99; Boiss. Fl. or. IV, 160; Kuzn. in Mat. Fl. Kavk. IV, 2 (1913) 263; Shmal'g., Fl. II, 230; Lipskii in Tr. Bot. Sada, XIII, 2, 320; Gusul. l. c. 108. — Ic.: Gusul. tab. VIII, f. A—E et tab. X, f. I—K.

Annual; stem 10—40 cm high, erect, robust, sparsely beset with spreading,
308 short bristles, later becoming naked, usually branching below with short or elongate branches, spreading; leaves lanceolate, subentire, hardly or sparingly angular-dentate, lower leaves spatulate, gradually tapering to petiole and obtuse; upper leaves sessile, acute, 2—5 cm long, 0.5—1 cm wide, greenish, sparsely short-bristly, bristles borne on white rather large tubercles, coarse, acicular. Cymes few-flowered, loose, the young reduced, strongly elongating and loose in fruit, up to 15 cm long; pedicels distinct, bristly, elongating

up to 1—2 cm in fruit and then slightly thickened; calyx in flower 5—6 mm long, tubular-campanulate, dissected to base into linear acute lobes sparsely covered with long white bristles, elongating in fruit up to 10 mm, and then narrowly linear; corolla pale violet or bluish, small, tube as long as calyx or (in first flowers) up to 1½ times as long, the limb campanulate, 4—7 mm across; scales oblong, 1.5 mm long, densely covered with white acute hairs 0.5 mm long; style exserted from calyx after falling of corolla for 2 mm (less than in A. stylosa), hardly exserted from fruiting calyx; nutlets straight, 4 mm long, 1—1.5 mm wide, subcylindrical, with blunt keel ventrally, dorsally inflated and with longitudinal subvertical wrinkles, finely dotted-tuberculate between wrinkles, slightly tapering at apex, somewhat tapering above basal ring. May—July.

Stony slopes (?), weedy places. — European part: Crim. (near Feodosia, Kerch Peninsula); Caucasus: Cisc. (only Taman'), W. Transc. (Anapa). Gen. distr.: Bal.-As. Min. (N. Greece, Bulgaria, Rumania). Described from Thessalia. Type in Geneva.

Note. This species is very close to the following species and may be easily confused with it. It is also like Lycopsis arvensis in habit. It differs from A. pusilla Gusul. and Lycopsis by the straight nutlets, and from the latter also by the long style exserted from the calyx, the smooth, not transversely rugose, erect and not curved corolla tube and the limb with equal lobes. It is very similar to A. italica in the nutlets and all characters of the calyx and is unquestionably (phylogenetically) its annual derivative.

I have not seen the type (a single specimen). In the Herbarium of the Academy of Sciences of the USSR there are two different specimens bearing this name. One (Salonica, flower, VI 1905, Adamovich) greatly resembles our Crimean-Caucasian plant, and the other (Kalampaka, Hagios Stephanos, flower, fruit, 4 V 1896, P. Sintenis, Iter thessalicum, No. 46) is definitely another species, with ovoid, finely netted-wrinkled nutlets, dense one-sided cymes, short pedicels and short style, with broad, dentate leaves — probably Lycopsis variegata L.

309 10. A. pusilla Gusul. in Bul. Facult. de St. Cernaut, I (1927) 109. — A. stylosa var. Major Kusn. in Mat. Fl. Kavk. IV, 2 (1913) 263, non DC. et Boiss. — Ic.: Gusul. l. c. tab. IV, f. A—G et tab. X, f. L—M.

Annual; similar in general to the preceding species but the leaves usually angular-dentate along margin, the nutlets more or less arcuately curved, obliquely ovoid, with arclike wrinkles, 3 mm long. In var. elatior Gusul. the leaves are broader than in A. thessala, oblong, stem sturdy, 15—20 cm high, branching nearly from base; in var. gracilis Gusul. stem is simple or nearly so, and the leaves narrower, lanceolate. May.

Shores of the Black Sea, in sands. — European part: Crim. (Kerch Peninsula — var. elatior); Caucasus: W. Transc. (Pitsunda Cape — var. gracilis). Gen. distr.: As. Min. Described from Azov (Gmelin) and Amazia (Bornmüller, No. 736 — cotype in Leningrad).

Note. Kuznetsov had referred this plant to A. stylosa as var. major; it is distinguished for A. stylosa by the scales covered with rather long white hairs and not very short papillae and also by the shorter style and smaller corollas. The authentic var. major DC. (Prodr. X, 48 and

Boissier, Fl. or. IV, 160 — A. spruneri Boiss. Diagn. I, 11 (1849) 98) differs from our species in the finely papillose scales, as in A. stylosa; in all other characters it is like A. pusilla. All these four species represent different combinations of the same set of characters and all are very similar to the genus Lycopsis.

11. A. stylosa M. B. Fl. taur.-cauc. I (1808) 123; DC. Prodr. X, 48; Ldb. Fl. Ross. III, 120; Boiss. Fl. or. IV, 159; Shmal'g., Fl. II, 230; Kuzn. in Mat. Fl. Kavk. IV, 2, 262; Gusul. l. c. 109. — Ic.: M. B. Cent. pl. rar. tab. 23; Rchb. Pl. crit. VIII, f. 966; Gusul. l. c. tab. VIII, f. F—L et tab. X, f. E—F.

Annual; stem erect, simple or branching above, robust, with very sparse spreading short bristles, 15—40 cm high; leaves lanceolate, rarely oblong-lanceolate in the very large individuals, angular-dentate along margins, very rarely subentire (in thin individuals), lowermost leaves withering soon, rather abruptly tapering to petiole as long as blade, the median leaves cuneately tapering at base, median and upper leaves sessile, 2—5 cm long, 0.4—1.5 cm wide, lower leaves obtuse, the rest acute, green, soft, very sparsely covered with short, sturdy, acicular bristles borne on small white tubercles, bristles longer and slightly curved along margin of leaves.
310 Cymes dense only at the beginning, soon becoming loose, straightening and elongating up to 10—15 cm in fruit, very loose; bracts few, lanceolate-linear, acute; pedicels distinct, bristly, reaching 0.5—1 cm in fruit, erect, rather thin; calyx in flower ca. 5 mm long, sparsely grayish-appressed-bristly, dissected nearly to base into lanceolate-linear obtuse lobes, little elongating and markedly diverging in fruit; corolla violet, medium-large, tube twice as long as calyx, pink, the limb dark violet, 7—10 mm across, with ovate lobes rounded at apex; scales protruding from throat, 1.5 mm long, ovate, rounded at apex, short-papillose (nearly dotted); anthers grayish, large, with very small mucro at apex; style protruding from throat and scales, after falling of corolla exserted for 5—6 mm; nutlets arcuately, nearly horizontally curved, ca. 3 mm long, 2 mm high, slightly compressed laterally, with acute ventral keel, nerves straight below, arcuate in upper half, finely dotted-tuberculate between them, gray, basal ring smooth. May.

Stony slopes, sometimes in crops. — European part: Balt., Bes., Crim. (north to Simferopol). Gen. distr.: Bal.-As. Min. (Balkans, except for Greece, As. Min.). Described from the Crimea. Type in Leningrad.

Note. This species, which is easily distinguished by the special pubescence of the scales and the long style, is replaced in Greece by the allied species A. spruneri Boiss. and is encountered very often in Asia Minor. Transitional forms resembling A. stylosa, but with hairy scales, occur on the Kerch Peninsula (near Kerch, along the coast, Herb. Fischer).

Section 4. CYNOGLOTTIS Gusul. l. c. 77 (pro subgen.). — Perennials. Flowers small; calyx dissected to base; corolla blue with short tube and flat limb larger in diameter than the tube long. Nutlets straight, rugose, with basal ring. Scales dotted-papillose, short-hairy at sides.

12. A. barrelieri (All.) Vitm. Sum. pl. I (1789) 385; DC. Prodr. X, 48; Ldb. Fl. Ross. III, 120; Boiss. Fl. or. IV, 155; Shmal'g., Fl. II, 230; Kuzn. in Mat. Fl. Kavk. IV, 2, 268; Gusul. l. c. 117.— Buglossum barrelieri All. Fl. Pedem. I (1775) 48.— Myosotis obtusa W. et K. Pl. rar. Hung. I (1802) 103.— Ic.: Bot. Mag. tab. 2349; W. et K. Pl. rar. Hung. tab. 100; Gusul. l. c. tab. XIII, f. A—G; Fiori et Paol. Fl. Ital. ill. 332, f. 2808.

Perennial or biennial, monocarpic. Root short, not very thick, usually unicipital; stem 50—80 cm high, rather thick, erect, angular-furrowed, shortly downy-villous, grayish, usually appressed- or spreading-branching from the middle or above, with thin short branches; lowermost leaves
311 large, oblong-lanceolate or spatulate, obtuse, gradually tapering to a more or less long petiole, median and upper leaves mostly lanceolate and acute, sessile, 3—7(10) cm long, 1—1.5 cm wide, usually finely angular-dentate along margin, rarely entire, finely gray-downy, slightly villous. Inflorescence usually a terminal distinct panicle consisting of many (even in fruit) short cymes with small linear bracts; pedicels short, thin, 2—5(7) mm long; calyx small, campanulate, gray-downy, in flower 2—3 mm long, in fruit up to 5—6 mm, dissected to base into oblong-linear, obtuse lobes; corolla small, typically short, Myosotis-like, tube shorter than calyx, 1—1.5 mm long, the limb violet-blue, nearly flat, 7—10 mm across, with ovate-rounded lobes; scales ovate-orbicular, 0.6—0.7 mm long, dotted-papillose, shortly white-hairy only at sides; style very short; nutlets gray, nearly straight, slightly curved, 2—3 mm long, with long, straight nerves, slightly arcuate at apex, densely and finely tuberculate between nerves; basal ring thick. May—June.

Stony slopes.— European part: U. Dns., Bes., M. Dnp. Gen. distr.: Bal.-As. Min., Med. (C. Italy, Dalmatia). Described from Italy. Type in Italy.

Note. This unique species may be regarded as a hybrid of Anchusa and Myosotis (type M. suaveolens), but the best treatment would be to separate it into an independent genus since it is distinct among the other species of Anchusa particularly by its Myosotis-like short-type corolla which (even in aestivation although not often) is twisted as in Myosotis and not imbricate (see: Gusuleac, l. c. 117). It deserves generic status more than Lycopsis owing to the many characters distinguishing it from the section Buglosellum genus Anchusa. It might also be possibly linked to the genus Brunnera, as a special section Cynoglottis.

Genus 1205. LYCOPSIS* L.

L. Sp. pl. (1753) 139; Benth. et Hook. Gen. pl. II, 856; Gürke in Pflanzenf. IV, 3, 115; Kuzn. in Tr. Bot. Muz. AN, VIII, 95; Mat. Fl. Kavk. IV, 2, 273.— Anchusa subgen. Lycopsis Gusul. in Bul. Facult. St. Cern. I (1927) 77 et 112.

Calyx dissected nearly to base into 5 unequal bristly lobes slightly elongating in fruit, otherwise unchanged; corolla medium-type, slightly

* From the Greek lykos — wolf and opsis — appearance, vision; the name for some of the Boraginaceae, used by the ancient authors.

zygomorphic, the tube longer than calyx and limb, arcuately or geniculately
312 curved (inside calyx), limb campanulate, lobes unequal; scales developing in throat, short-hairy; anthers included in middle of tube, subsessile; style short, included in corolla tube, not exserted from calyx after falling of corolla, stigma conical-capitate, 2-lobed; nutlets small, curved, obliquely ovoid, rugose, with basal, rounded, thickened ring. Low annual herbs, sparsely bristly; cymes loose in fruit, with lanceolate bracts.

This genus is very close to Anchusa section Buglosellum Gusul. and should not be separated as an independent genus, but Bentham and Hooker emphasized that due to the ascending gynophore it and Gastrocotyle represent a transition to the Eritricheae.

1. Leaves usually dentate. All parts of plant with longer hairs. Fruiting racemes denser. Calyx not stellately opening in fruit . . . . . 1. L. arvensis L.
+ Leaves usually entire, broader. Hairs shorter. Fruiting racemes very loose. Fruiting calyx stellately opening . . . . 2. L. orientalis L.

1. L. arvensis L. Sp. pl. (1753) 139; DC. Prodr. X, 54; Ldb. Fl. Ross. III, 12; Shmal'g., Fl. II, 231; Hegi, III. Fl. V, 3, 2203. — L. arvensis ssp. occidentalis Kusn. in Tr. Bot. Muz. AN (1911) 96—97; Mat. Fl. Kavk. IV, 2, 274. — Anchusa arvensis M. B. Fl. taur.-cauc. I (1808) 123; Boiss. Fl. or. IV, 160; Gusul. in Bul. Facult. St. Cern. I, 113. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 109, f. 1; Kuzn., op. cit. (1911) Table I, Figures 5—8; Gusul. l. c. tab. XII, f. C (corolla).

Annual; stem 10—50 cm high, erect, robust, simple or spreading-branching above, sparsely hairy, with horizontally spreading, rather long and coarse bristles; leaves lanceolate (linear-lanceolate in the weaker individuals to oblong-lanceolate), lower cauline leaves gradually tapering at base, median and upper leaves sessile, all leaves angular-dentate at margin and often undulant, mostly 3—7 cm long, 4—15 mm wide, acute or obtuse, rather thin, green, sparsely covered with bristles on tubercles, some bristles thin and short, others thick and long, mainly along margins of leaves and on lower nerve (as well as on stem). Cymes dense, apical on stem and branches, paired or single, not forming a special panicle, few-flowered, relatively dense in fruit, slightly elongating; bracts lanceolate or lanceolate-linear, acute, as long as flowers, long bristly-ciliate at margin; pedicels short, bristly, reaching 5—10 mm in fruit, ascending; calyx in flower ca. 5 mm long,
313 lobes lanceolate-linear, long-white-bristly at margins, elongating in fruit, the lower lobes larger, up to 15 mm long, the entire calyx broadly ovate in fruit with diverging lobes; corolla violet, tube almost as long as calyx, curved in upper part or at the middle, smooth outside (not wrinkled), the limb 4—6 mm across, campanulate, oblique because of the unequal lobes, lobes short, semi-orbicular, upper lobes larger, 1—2 mm long, finely downy on outer surface; scales rather large, with long [?] white acute hairs; anthers small, oblong, ca. 1 mm long, two disposed close to base of tube, 3 just below the middle; style short, much lower than calyx teeth, completely hidden in it and not extending above ripe nutlets; nutlets moderately curved, obliquely ovoid, ca. 3 mm long, gray, netted-rugose and finely dotted-tuberculate between wrinkles. May—July.

Fields, waste lands, kitchen gardens, roadsides. — European part: Kar.-Lap., Dv.-Pech., Balt., Lad.-Ilm., U. Dnp., U. V., V.-Don, V.-Kama, U. Dns. Gen. distr.: Centr. Eur., Bal.-As. Min. (Balkans). Described from Europe. Type in London.

2. L. orientalis L. Sp. pl. (1753) 139; Ldb. Fl. Ross. III. 122. — L. arvensis spp. orientalis O. Ktze. in Tr. Bot. Sada, X, 216; Shmal'g., Fl. II, 231; Kuzn. in Tr. Bot. Muz. AN (1911) 104; Mat. Fl. Kavk. IV, 2 (1913) 287. — Anchusa orientalis Rchb. Ic. Fl. Germ. XVIII (1858) 63; Boiss. Fl. or. IV, 161; Gusul. l. c. 114. — L. micrantha Ldb. in Pand. Beitr. (1820) 65. — L. erecta d'Urv. Archip. (1821) 22, p. p. — L. taurica Stev. in Bull. Soc. Nat. Mosc. XL (1857) 337. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 109; Kuzn., op. cit. (1911) Table I, Figures 9—10.

Annual; much resembling the preceding. Pubescence (bristles) shorter but usually thicker; stems usually furcately branching; leaves nearly always entire but sometimes dentate, broader (on the average). Fruiting racemes elongate, loose; pedicels longer, calyx in fruit with lobes nearly stellately opening; corolla blue, smaller, tube curved above middle, the limb more regular; nutlets more densely and uninterruptedly finely tuberculate. May—July.

Fields, kitchen gardens, wastelands, roadsides, etc. — European part: M. Dnp., Bl., L. Don, L. V., V.-Don, Transv., Crim.; Caucasus: nearly everywhere; Centr. Asia: nearly everywhere. Gen. distr.: Med., Bal.-As. Min., Arm.-Kurd., Iran., Ind.-Him. Described from the East, probably from Armenia according to Tournefort. Type in London.

Note. The real differences between this species and the preceding one are indistinct and hence Kuznetsov combined them into one species. He distinguished them, however, as two subspecies and added var. inter-
314 media as the intermediate between them. Nonetheless, from the herbaria it can be seen that at times he wrote the names L. arvensis L. and L. orientalis L. as if he were distinguishing two species, e. g., L. arvensis var. intermedia, although according to his book it would have been necessary to write L. arvensis spp. orientalis var. intermedia. When he wrote L. arvensis L. on the label it is unclear whether he assumed the species sensu lato (as it appears in his book) or as the narrow taxon L. arvensis ssp. occidentalis Kusn. For this reason his labels in the herbaria are of little help in determining how he actually distinguished these species (subspecies). As a result all authors have accepted the race with broad and entire leaves, furcately branching stems, loose fruiting cymes and stellately open calyces in fruit as L. orientalis, a race common to the southeast of the European part of the USSR, the Caucasus and Central Asia. The trouble is that both of these races may be introduced as weeds by man from the original distribution area of one race to that of the other. For example, in the mountainous regions of the Caucasus there undoubtedly occurs L. arvensis although originally only L. orientalis grew there and in Central Asia. I saw the narrow-leaved forms (with dentate leaves) in Transcaucasia as well as in Central Asia. The three species L. micrantha Ldb., L. erecta d'Urv. and L. taurica Stev. were described from the Crimea, but according to the material in the Herbarium of the Botanical Institute of the Academy of

Sciences of the USSR there is no other independent race in the Crimea. L. arvensis and even more L. orientalis are common to this area.

Genus 1206. **PHYLLOCARA*** Gusul.

Gusul. in Bull. Facult. St. Cern. I (1927) 119.

Calyx dissected nearly to base into 5 lanceolate lobes elongating and stellately spreading after fruiting, otherwise unchanged; corolla medium-type, small, with tube exceeding calyx, limb small, shorter than tube, narrowly campanulate, with very short obtuse lobes; scales very short-papillose, oblong-trapezoid, obtuse at apex; anthers hidden in corolla tube; style rather short; nutlets reniform-curved, horizontal, low, netted-rugose, with short obtuse apex, and with ventral, elliptic-oblong attachment-ring. Low, annual, bushy, branching herbs, with thick stems; leaves crowded, oblong. Cymes dense, not exceeding leaves, provided with large bracts. Calyx covered with long white acicular bristles. In habit and characters resembling Gastrocotyle. Distinguished from the species of Anchusa in habit, the ventral attachment of the reniform-curved nutlets, and the stellately spreading calyx.

315 1. P. aucheri (DC.) Gusul. l. c. 120. — Anchusa aucheri DC. Prodr. X (1846) 49; Boiss. Fl. or. IV, 158; Kuzn. in Mat. Fl. Kavk. IV, 2, 268.

Annual; stem 10—15 cm high, thick, furcately spreading-branching from base, with short branches, subglabrous, sparsely spreading-short-bristly; leaves oblong, large for the size of the plant, 4—8 cm long, 1—2 cm wide, cuneately tapering at base, obtuse at apex, usually finely angular-dentate at margin, flat, thick, green, above with semi-spreading, acicular bristles on large white tubercles, subglabrous below, leaves crowded at apex of short branches. Cymes disposed among branches and leaves, not forming panicle, fruiting cymes erect, dense, 3—5 cm long, provided with large oblong bracts exceeding flowers; pedicels short, thick, recurved; calyx 5—6 mm long in flower, nearly scarious, dissected nearly to base into narrowly lanceolate, long-acuminate lobes with long white acicular bristles along margins, not falling in fruit, stellately open with triangular-lanceolate spreading lobes; corolla with tube broadening above, 1½ times as long as calyx, pale, limb 2.5 mm long, with suberect, ovate, rounded, obtuse lobes, pale red-violet; scales 1.2 mm long, trapezoid-oblong, obtuse, finely papillose, without hairs; anthers oblong, obtuse, 2 mm long; style within corolla tube, 7 mm long; stigma capitate, rarely passing gradually to style; nutlets reniform, 6 mm long, 2.5 mm high, yellowish-gray, largely netted-rugose, finely tuberculate between wrinkles, apex rounded-obtuse. May—June.

Stony slopes. — Caucasus: S. Transc. (formerly Kars district, near Karakurt). Gen. distr.: Arm.-Kurd. Described from Mesopotamia and Taurus Mountains (Osh). Type in Geneva.

Note. Koch erroneously reported this species for the Crimea (obviously mixing the words Tauria and Taurus) and consequently Gusuleac placed it

* From the Greek phyllon — leaf and kara — head.

among the European species of Anchusa. Kuznetsov figured that it could be found somewhere in the mountainous part of the Crimea, but this appears highly improbable.

Genus 1207. **GASTROCOTYLE*** Bge.

Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1854) 405.

Calyx dissected to base into lanceolate, long, coarsely white-bristly lobes, after falling of corolla lobes stellately spreading; corolla pale blue,
316 hardly longer than calyx, short-type, tube short, limb campanulate to obtuse lobes; scales small, ovate, papillose, notched-cleft above or rounded; anthers sub-globular, cordate at base, 0.5 mm long, with small mucro at apex, subsessile in tube of corolla below scales; style very short; stigma entire, thick, gradually passing into style, not capitate, rather claviform. Nutlets mostly 2, rarely 1 or 3—4, horizontal, curved, nearly reniform, with ventral attachment, ring large, oval, thick and slightly dentate at margin, elongating at ventral side of nutlet, apex short, obtuse (when viewed from the side), gray, slightly netted-rugose and densely finely tuberculate; basal gynophore formed as a white inflated rim — probably expansion of the hypogynous disk (nectary), flat at base, the short style reflexed from this rim to the side. Annual herbs, with spreading stems, coarse-bristly. Flowers small.

Note. We disagree with Brand who referred this genus to the tribe Eritrichieae (Cryptantheae) on the grounds that the gynophore was "pyramidal, with 4 deep, lateral depressions." The elevation of the torus is very slight; when the nutlets are ripe the disk, i. e., the nectary, lying under them, is thickened and simultaneously elevates them; if there are only 2 nutlets the disk swelling under them shifts the style horizontally to one side. Our genus is very close to Anchusa and especially to those species separated as the genus Phyllocara Gusul.

Boissier's note (l. c.) about the nutlets was due to an oversight. He took the gynophore (torus) as it appeared after the nutlets have fallen and described the nutlets as similar to those of Paracaryum. The thickened, inflated margin is actually the swollen, nectariferous ring and not the wing of the nutlet.

1. G. hispida (Forsk.) Bge. in Mém. Acad; Pétersb. sav. étrang. VII (1854) 405; Lipsky in Tr. Bot. Sada, XXVI, 478.— Anchusa hispida Forsk. Fl. aegypt.-arab. (1775) 40; DC. Prodr. X, 50; Boiss. Fl. or. IV, 158; Muschler, Man. Fl. Egypt. (1912) 796.

Biennial; root very thin, vertical; stems few (more precisely, stem branching from base with branches nearly equal to main stem), obliquely ascending in the spring, with solitary flowers in the axils of nearly all the leaves, later (summer) becoming procumbent and due to the development of short axillary branches appearing as spikes, 5—25 cm long, hairy with few spreading soon falling bristles; leaves narrowly oblong or lanceolate-

* From the Greek gaster — stomach and cotyle — cup.

oblong, obtuse, angular-dentate at margin, sometimes slightly undulant,
317 lower leaves longer, up to 6—7 cm long, slightly tapering at base, other leaves sessile, 6—12 mm wide, somewhat reduced towards apex of stem, slightly fleshy, sparsely covered at both surfaces with coarse, spreading bristles, some longer, borne on large tubercles, the others smaller, lying between them, the much later upper leaves especially bristly. The spring axillary flowers on short recurved pedicels, the summer flowers (in spike-like axillary cymes) sessile; calyx 3 mm long; corolla 3.5 mm long, the limb 2—3 mm across, lobes oblong, ca. 1 mm long; nutlets ca. 4 mm long, reniform-crescent-shaped, slightly compressed at sides, 2 mm long, light gray, with few acute nerves or wrinkles and large tubercles between them. April.

Salinized weedy places in desert oases, roadsides, etc. — Centr. Asia: Kara K., Kyz. K., Pam.-Al., T. Sh., Ar.-Casp., Balkh. Gen. distr.: Med., Iran., Am.-Kurd. Described from Kyz. K., from the Yana-Darya. Type in Leningrad.

Genus 1208. **NONEA*** Medic.

Medic. Phil. Bot. I (1789) 31.

Calyx parted for $^1/_4$—$^1/_2$ into triangular, more or less long-acuminate teeth, in fruit sacciformly-swollen with nutlets inside invisible from the outside; corolla medium-large or small, tube usually as long as or shorter than the calyx, the limb long-campanulate, narrowly or broadly so, approximately as long as tube, shortly-lobed with lobes mostly entire; scales small, velutinous, long-hairy or laciniate (most authors write that the scales are found in the middle part of the tube, we find the scales at the upper margin of the tube); anthers usually at the same level as scales, oblong, obtuse; style not exserted from throat; stigma elongate-claviform, 2-lobed. Nutlets usually dark, rarely straight, often half curved or reniform, subhorizontal or if completely so then with ventral keel, longitudinally or transversely rugose or netted-rugose, glabrous or more or less hairy-downy, with smooth or ribbed and dentate basal ring.

Note. Nonea differs from Anchusa only by the more elongated, funnel-shaped corolla limb, short-lobate only at apex.

1. Nutlets straight, vertically oblong, obtuse, with longitudinal wrinkles or smooth; attachment-ring to gynophore thin, smooth, finely downy,
318 with entire lower margin (typical representatives of the section Orthocaryum DC.). Annuals; leaves more or less dentate; calyx-teeth rather long, thinly-acuminate; corolla medium to large . . . . . 2.
\+ Nutlets more or less curved, with obtuse apex laterally compressed, netted-rugose or smooth . . . . . 5.
2. Corolla violet-pink, with well developed, broadly campanulate limb, 4—8 mm across. Nutlets 3—4 mm long, smooth, gray, more or less downy . . . . . 5. N. rosea (M. B.) Link.

* After the Erfurt physician and botanist J.P. Nonne, who lived at the end of the 18th century.

+ Corolla yellow (very close taxa, probably races of one species) . . . 3.

3. Corolla relatively large, the tube markedly protruding from the calyx, limb 10—15 mm across, broadly campanulate. Stems usually densely long-bristly with spreading bristles. Leaves strongly dentate. (E. Transc.). 3. **N. setosa** (Lehm.) Roem. et Schult.

+ Corolla smaller, tube not protruding from calyx, limb slightly developed . . . . . 4.

4. Upper campanulate part of limb protruding from calyx, 5 mm across. Bracts ovate, large. Cymes loose, long. Calyx (15 mm) $1\frac{1}{2}$ times as long as in the following. Slightly bristly plants, mainly in Ciscaucasia . . . . . 2. **N. lutea** (Desr.) Rchb.

+ Corolla smaller, but sometimes the same. Cymes in fruit short, dense. Bracts lanceolate. Calyx 8—10 mm long in fruit. Small and bristly plants . . . . . 4. **N. flavescens** (C. A. M.) Fisch. et Mey.

5. Nutlets semi-curved, bent but not horizontal, smooth or nerved but without net of wrinkles along back; attachment-ring smooth, finely downy or obscurely ribbed and hardly dentate along lower margin (transitional species from Orthocaryum to Cryptanthera) . . . . . 6.

+ Nutlets horizontal, usually netted-wrinkled along back, rarely nearly smooth and rugose only at sides; ring often thickened, with transverse ribs and dentate along lower free, sometimes indistinct (i. e., very narrow) margin, sometimes margin high but smooth . . . . . 10.

6. Corolla small, inconspicuous, the limb to 3 mm across. Annuals . . 7.

+ Corolla with broadly campanulate limb ca. 10 mm across. Nutlets semicurved, rugose. (Caucasus) . . . . . 8.

7. Nutlets (ripe) quite smooth, without wrinkles, markedly curved but not horizontal; attachment-ring thin, entire, finely downy.
319 Corolla whitish, 6 mm long, limb 2 mm across. (Turkmenia) . . . . . 7. **N. turcomanica** M. Pop.

+ Nutlets subhorizontal or horizontal, downy . . . . . 9. **N. melanocarpa** Boiss. f. **macra** Boiss.

8. Annuals. Corolla violet-rose . . . . . 9.

+ Perennials or biennials. Corolla yellowish-white. Calyx distinctly downy, with short teeth. (Dagestan) . . . . . 1. N. alpestris (Stev.) G. Don.

9. Calyx-teeth short, as in the preceding. Glandular-downy (in various densities) plants with more or less numerous additional long bristles, at least in the upper part of the stem and on calyx. Nutlets semi-curved as in the preceding (in the subalpine belt of the entire Caucasus) . . . . . 6. **N. versicolor** (Stev.) Sweet.

+ Calyx-teeth long, thin-acuminate. Plants shortly glandular-downy without long bristles. Nutlets nearly straight, 3 mm long, rugose at sides (only near Kagizman) . . . . . *N. karsensis M. Pop.

10. Nutlet horizontal and reniformly curved, finely netted-rugose; attachment-ring nearly indistinct, very low. Annuals; corolla very small. (Crimea and E. Transcaucasia) . . . . . 16. **N. ventricosa** (Sibth. et Sm.) Griseb.

\+ Nutlets although horizontal not reniformly curved . . . . . 11.

11. Nutlets curved, downy; attachment-ring very low, dark, obscurely ribbed and very finely toothed . . . . . 9. **N. melanocarpa** Boiss f. **macra** Boiss.

\+ Attachment-ring higher, distinctly toothed, with acute transverse ribs, sometimes high and smooth but then nutlets netted-rugose . . 12.

12. Annuals. Corolla small, rarely medium-sized . . . . . 13.

\+ Perennials. Corolla dark red or violet . . . . . 15.

13. Leaves oblong-lanceolate. Corolla white, narrow, inconspicuous . 14.

\+ Leaves narrowly lanceolate, long-ciliate at margin. Corolla blue- or red-violet. Nutlets completely smooth at back, rugose at sides. (Deserts and semi-deserts of the Caucasus and Central Asia) . . . . . 10. **N. caspica** (Willd.) G. Don.

14. Attachment-ring with acute transverse ribs, as in the preceding, but nutlets netted-rugose on back; nutlets ca. 4 mm long, thickly netted-rugose. Leaves larger and wider. (Introduced). . . . . 11. **N. pallens** Petrovič.

\+ Attachment-ring smooth, finely downy, only outer margin
320 thickened and tuberculate-dentate. Nutlets large, 5 mm long, finely netted-rugose. Leaves lanceolate, densely grayish-downy. (Central Asia, only on the Vakhsh). . . . . 8. N. macropoda M. Pop.

15. Nutlets large, 6—8 mm long . . . . . 16.

\+ Nutlets smaller, 3—4 mm long . . . . . 17.

16. Plants very coarsely, nearly spiny-bristly, with creeping rhizomes not producing rosettes of radical leaves. Leaves comparatively small, with subparallel margins, lanceolate, not decurrent. Fruiting cymes very loose; pedicels long, spreading-bristly (Dagestan) . . . . . 15. N. daghestanica Kusn.

\+ Plants softly velutinous, glandular-downy above, without bristles. Leaves larger and wider. Large rosettes of radical leaves present. Cauline leaves decurrent. Bracts very large. Stem sturdy, ribbed. (Dagestan, Talysh, Zuvant) . . . . . 14. **N. decurrens** (C. A. M.) G. Don.

17. Corolla with rather narrow limb, not more than 6 mm across. Leaves few on stem . . . . . 12. **N. pulla** (L.) DC.

\+ Corolla with broad violet limb 10—15 mm across. Leaves numerous. (W. Transcaucasia) . . . . . 13. **N. intermedia** Ldb.

Section 1. ORTHOCARYUM DC. Prodr. X (1846) 28. — Nutlets straight or nearly so, or slightly curved, usually longitudinally nerved-wrinkled, but sometimes (N. alpestris, N. versicolor)netted-rugose. Corolla yellow or violet, with various tinges.

Series 1. Alpestres M. Pop. — Perennial plants. Corolla yellow. Nutlets slightly curved.

1. N. alpestris (Stev.) G. Don, Syst. IV (1838) 336; DC. Prodr. X, 28; Ldb. Fl. Ross. III, 108; Boiss. Fl. or. IV, 164; Kuzn. in Mat. Fl. Kavk. IV, 2, 305; Grossg., Fl. Kavk. III, 263. — Anchusa alpestris Stev. in Mém. Soc. Nat. Mosc. III (1812) 245 et in Trans. Linn. Soc. XI, 409; Roem. et Schult. Syst. IV, 93. — Lycopsis alpestris Lehm. Asperif. II (1818) 260. — Ic.: Stev. in Transact. Linn. Soc. Ind. XI, tab. 32.

Perennial or biennial; root not thick, vertical, if perennial then producing several stems; stems ascending or erect, 15—30(60) cm high, thick, somewhat angular, sparsely downy-villous below, densely glandular and finely villous-downy above, with few long straight spreading bristles; leaves narrow or wide, lanceolate, lower leaves spatulate-lanceolate, gradually long tapering at base, median and upper leaves sessile, usually finely den-
321 tate and ciliate at margin, acute. Cymes apical, 2—5(7) in number forming a corymbiform inflorescence, dense in flower, in fruit erect, 3-branched, 5—10 cm long; bracts lanceolate, acute, hairy, not exceeding flowers; calyx in flower 4—5 mm long, subsessile or sessile, only the lower on short, curved, spreading, downy pedicels, in fruit ovoid or broadly tubular-ovate, 6—8 mm long (rarely up to 10 mm), not constricted near teeth, with short, triangular, 1—2 mm long teeth, densely glandular-downy-villous, with solitary bristles along nerves; corolla pale yellow, darker yellow in throat, rather large, tube slightly longer than calyx, ca. 7 mm long, the limb as long as the tube, broadly campanulate, rather widely open, 8—10 mm across, the lobes 2 mm long, broad, semi-orbicular; scales small, ovate, papillose at apex, sparsely long-hairy at sides; anthers 1.5 mm long; nutlets 3.5 mm long, slightly curved, tapering, arcuate at back and with erect but oblique acute ventral keel, nearly netted with acute nerves and smooth, glabrous, pale between them; basal ring orbicular, thickened, slightly downy outside. June—July.

Apparently on stony slopes and taluses. — Caucasus: Dag. Endemic. Described from Shakh-Dag Mountains. Type in Helsinki.

Series 2. Flavescentes M. Pop. — Annuals. Corolla yellow. Nutlets straight.

2. N. lutea (Desr.) Rchb. ex DC. Prodr. X (1846) 28; Visiani, Fl. Dulon II, 251; Rchb. Ic. Fl. Germ. XVIII, 59 (non Rchb. Fl. Germ. exc. I, 338, quae est N. ventricosa Griseb.); Ldb. Fl. Ross. III, 107; Boiss. Fl. or. IV, 163, Shmal'g., Fl. II, 232; Kuzn. in Mat. Fl. Kavk. IV, 2, 297; Hayek, Prodr. Fl. Balc. II, 68. — Anchusa lutea M. B. Fl. taur.-cauc. I (1808) 126. — ? Lycopsis lutea Desr. in Lam. Encycl. meth. Dict. III (1789) 657. — Ic.: Rchb. l. c. tab. 101, II, f. 8—17.

Annual; stem 20—30 cm high, usually branching from base, rarely simple, if branching then with elongate, low branches, spreading, glandular-downy, remotely bristly; leaves lanceolate-oblong, acute, lower leaves gradually tapering at base, upper leaves sessile, rather long and wide, up to 10 mm wide, greenish, bristly along margin at upper surface and along nerves. Cymes leafy, short in flower, 1 or several apical at stems and branches, fruiting cymes much elongate, with calyces remote; bracts oblong, much long-acuminate; calyx in flower ca. 10 mm long, later quickly enlarging, in fruit up to 20 mm long, then ovate-oblong, parted nearly to middle into

322 lanceolate, long-acuminate teeth, sparsely glandular-downy, with scattered, firm, spreading bristles on nerves; corolla pale yellow, ca. 10 mm long, nearly tubular, limb small, up to 5 mm across, lobes ovate, obtuse, somewhat unequal; nutlets 5—6 mm long, oblong-cylindrical, straight, glabrous, brown (ripe black?), longitudinally rugose, with short obtuse apex, slightly keeled ventrally; attachment-ring low, thick, smooth. May—June.

Stony slopes in the steppe and semi-steppe belts, also in oak forests. — European part: V.-Don, L. V., L. Don (to Voroshilovgrad Region in the west); Caucasus: everywhere. Gen. distr.: Iran., Bal.-As. Min. (Balkans), Med. (introduced; Dalmatia, Italy (Modena)), Centr. Eur. (introduced). Described from Dalmatia (Ragusa). Type in Paris.

Note. It is extremely difficult to determine the proper name for this plant. In describing Lycopsis lutea, Desrousseaux reported its locality with some doubt: "it is said that the habitat of this species is Africa." He himself described it from specimens grown in Paris. The description corresponds with what we call N. lutea, but it is so general that it is impossible to be confident of its identity with N. lutea. Reichenbach (Fl. Germ. exc. I (1830) 338) presented plant No. 2318 which he called N. lutea DC. (Fl. Fr. suppl. 420); he placed Lycopsis lutea Lam. in its synonymy and pointed out that it grows in Dalmatia where it had been collected by Peter. However, Nonea lutea DC. (Fl. fr. suppl. 420) is Alkanna lutea DC. (Prodr. X, 102), i. e., not Nonea, and the Dalmatian plant collected by Peter is N. ventricosa Griseb., as I myself verified checking the Peter specimen. In "Prodr." (X (1846) 28), Alfred De Candolle rectified the mistake made by his father (in Fl. Fr. suppl. 420) and Reichenbach (in Fl. exc. I, 338), correctly describing the nutlets and correctly indicating the distribution area — from Kherson through the Caucasus up to Iran. However, Visiani (1877) discovered that N. lutea actually grows as a weed near Ragusa in Dalmatia, and Reichenbach apparently drew it from the Ragusa specimens (1857) in his "Icones Fl. Germ." (XVIII, tab. 101). At a later date Hayek confirmed that N. lutea grows in Dalmatia and hence this species, based on the Reichenbach drawing and identical with the Caucasian plant, may possibly occur on the Dalmatian coast, yet there is no assurance that it corresponds with Lycopsis lutea Desr., the origin of which is unknown. Consequently the name of our plant Nonea lutea (Desr.) Rchb. ex DC. is provisional and ignoring Desrousseaux's synonym, it would be more accurate to write simply N. lutea Rchb. ex DC. or then priority would have to be given to the name M. dubia Nocca (Hort. ticin. (1800) ab.
323 3). Lycopsis ciliata Willd. (Sp. pl. I (1797) 880 (780 after Ind. Kew)) is also a synonym of N. lutea Rchb., in addition to the earlier but doubtful synonyms Asperugo divaricata Murr. (1776) and Oskampia trichotoma Moench (Meth. (1794) 421 (after Ind. Kew.- Alkanna lutea)).

3. N. setosa (Lehm.) Roem. et Schult. Syst. IV (1819) 754; DC. Prodr. X, 28; Ldb. Fl. Ross. III, 108; Grossg., Fl. Kavk. III, 263. — Lycopsis setosa Lehm. Asperif. II (1818) 269. — N. lutea var. setosa Kusn. in Mat. Fl. Kavk. IV (1913) 303.

Annual; plants typically with profuse, long, spreading bristles above, shortly glandular-soft-downy, upper part of plant and calyces especially bristly but many bristles also on stem and upper leaves, often early winter plants and then with rather large rosette of radical leaves; stems single

in weak individuals, many in strong specimens and then ascending or even decumbent below, 10—30 cm high, downy, long-bristly especially above; leaves strongly bristly and ciliate at margin, lanceolate, denticulate at the nearly parallel margins, not wide, 5—8(10) mm, 2—4 cm long, in large individuals wider, oblong-lanceolate, lower leaves and especially the radical tapering at base forming a broad petiole, obtuse, median and upper leaves sessile, acute, sometimes radical leaves spatulate-oblong. Cymes few-flowered, dense at first, short, rapidly becoming loose, 2 — 5 cm long; lower bracts triangular:lanceolate, the upper lanceolate, acute; pedicels short, ascending or patent; calyx ca. 10 mm long in flower, tubular, in fruit cylindrical-sacciform, up to 12 mm long, the teeth triangular-lanceolate, half as long as unparted part of calyx, densely covered with fine glandular down and 2 mm long, shiny bristles along nerves; corolla large, tube slightly longer than calyx, the limb as long as tube (6—8 mm), broadly campanulate, 10—15 mm across; nutlets 3.5 mm long, straight, finely downy, indistinctly wrinkled. April—May.

Hills. — Caucasus: E. Transc. Endemic. Described from Georgia (Adams). Typical population near Tbilisi, from where it was described. Also from the former Ekaterinenfel'd (Shovits!). Not typical in other parts of the Caucasus; the specimens transitional to N. lutea Rchb. are probably hybrid derivatives. Type in Berlin.

4. N. **flavescens** (C. A. M.) Fisch. et. Mey. Ind. II Sem. Hort. Petrop.
324 (1835) 17; Prodr. X, 29; Ldb. Fl. Ross. III, 108; Grossg., Opred. 289. — Lycopsis flavescens C. A. M. Verz. d. Pflanzen (1831) 98. — N. lutea var. flavescens Lipsky, Fl. Kavk. (1899) 395; Kuzn. in Mat.

Annual; plants low, 7—12 cm high, rarely up to 20 cm, with 1 to few stems, densely covered with finely glandular down and rather profuse spreading bristles; leaves denticulate at the nearly parallel margins, obtuse oblong to sublinear. Cymes short even in fruit, dense, apical on stems (not strongly drawn apart), bracts large, triangular-lanceolate; calyces small, attached to each other, in flower 6 mm, in fruit 8—10 mm long, densely glandular-hairy and with few bristles, teeth short, 1.5—3 mm long; corolla small, slightly protruding from calyx, with reduced limb 2—3 mm long, ca. 3 mm across; nutlets 3.5 mm long, straight, oblong, slightly or markedly downy. April—May.

Apparently in saline soils of semi-desert lowlands. — Caucasus: E. Transc., Tal. **Gen. distr.**: Arm.-Kurd., Iran. Described from Salyany. Type in Leningrad (mixed plants from Salyany and Lenkoran — the latter not typical, representing a transition to N. lutea).

Note. The leaves of this species are more like those of N. setosa than N. lutea, but the inflorescences are dense even in fruit and the flowers are small, which distinguishes it from N. setosa. It is different from N. lutea not only by the leaves and the smaller flowers but also by the character of the inflorescences which in N. lutea are loose, bearing very large, broad, ovate bracts; the calyx in N. lutea is nearly $1\frac{1}{2}$ times larger, with long teeth. There are, however, many transitions from N. flavescens to both N. lutea and N. setosa. Authentic N. lutea growing in Lenkoran is by all indications (also in Iran) but with smaller corollas. The Lenkoran N. lutea was accepted by C. A. Meyer and

Hohenacker also as N. flavescens, but it is sturdier and the corolla is slightly larger.

When Meyer described his new species he was apparently unaware of the existence of L. lutea Desr. since he did not try to compare the two. His new species is hardly distinguished from what we call N. lutea and hence it would be more accurate to synonymize Lycopsis flavescens with Lycopsis lutea.

Series 3. Roseae M. Pop. — Annuals; flowers violet.

5. N. rosea (M. B.) Link, Enum. Hort. Berol. I (1821) 167; C. Koch in Linnaea XVII, 304; Ldb. Fl. Ross. III, 109; Kuzn. in Mat. Fl. Kavk. IV, 306; DC. Prodr. X, 29; Boiss. Fl. or. IV, 164 (ex min. parte); Shmal'g., Fl. II, 232, p. p. — Anchusa rosea M. B. Fl. taur.-cauc. I (1808) 125; III (1818) 123. — Lycopsis rosea Lehm. Pl. Asperif. II
325 (1818) 261. — Ic.: M. B. Cent. pl. rar. tab. 43; Rchb. Pl. crit. tab. 330.—

Annual; stems usually many, 20—30 cm high, ascending, rarely erect, short-downy, variously and generally not strongly spreading-bristly, mainly in upper part, sturdy, simple or with one branch above; rosette often more or less developed (i. e., winter plant), radical leaves up to 10 cm long, to 15 mm wide, spatulate-oblong or spatulate-lanceolate, usually dentate at margins, gradually tapering to petiole 5—7 mm long, obtuse; lower leaves shortly tapering at base, upper and median leaves sessile, acute, 1—4 cm long, 5—10(20) mm wide; all leaves thickly downy and variously bristly. Cymes at first dense, in fruit straightening and elongate, rather loose, up to 10 cm long; bracts ovate, oblong or lanceolate and then inconspicuous; pedicels short, 1—3 mm long; calyx in fruit more or less broadly (oblong or ovoid) sacciform, more or less glandular-downy and generally not markedly bristly, teeth triangular, acute, 2—3 mm long; corolla more or less dark pink, tube shorter or longer than calyx, the limb (campanulate) more or less developed, 4 to 8 mm across; nutlets straight, oblong, obtuse, 3—4 mm long, more or less downy, nearly without wrinkles, gray; attachment-ring basal, smooth, slightly downy. April—May.

Stony slopes, gravels, weedy places. — Caucasus: Cisc. (E.), E. and S. Transc., Tal. Endemic. Described from Kizlyar. Type in Leningrad.

Note. This species displays parallel variability, although less so, to the yellow-flowered annual species of the section Orthocaryum. If its distribution were greater it would have to be separated into analogous taxa (large-, medium- and small-flowered). The Kizlyar specimens definitely differ from the Transcaucasian specimens in their broader leaves and, in particular, the ovate bracts, the very few bristles and the rather dense down, the broadly ovoid, sacciform calyx, the small corollas with limb 2—3 mm long and up to 4 mm across. In the Transcaucasian specimens the bristles are many more, the calyx oblong-sacciform and the corollas larger, the tube is longer than the calyx and the limb is ca. 7—8 mm across. The Transcaucasian Tbilisi population is very similar to the yellow-flowered N. setosa; in every region the populations have an assemblage of characters like the corresponding regional form of the yellow-flowered series. The distinction from the corresponding yellow-flowered species is actually found

only in the color of the corolla. Kuznetsov correctly observed this, while De Candolle and Boissier referred most of the specimens to N. lutea Rchb. as a colored variety.

It can be assumed that the entire, polymorphic complex of the Caucasian Nonea (including N. intermedia and N. decurrens) was evolved
326 only in the Pleistocene as the result of hybridization between the intruding steppe N. pulla and the local, yellow-flowered Nonea of the section Orthocaryum, e. g., N. setosa.

6. N. versicolor (Stev.) Sweet, Hort. Brit. ed. 1 (1827) 292; Ldb. Fl. Ross. III, 109; Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 571; Kuzn. in Mat. Fl. Kavk. IV, 2, 308. — N. rosea DC. Prodr. X, 29; Boiss. Fl. or. IV, 164; Shmal'g., Fl. II, 232, p.p. — Anchusa versicolor Stev. in Mém. Soc. Nat. Mosc. III (1812) 254; Cat. Hort. Gorenk. (1812) 27. — Lycopsis versicolor C. A. M. Verz. d. Pfl. Cauc. (1831) 98. — Ic.: Bot. Mag. tab. 3477.

Annual, biennial or perennial; stems usually few, ascending or erect, robust, simple or branching above, grayish-downy, glandular-downy above, with small number of spreading bristles mainly in the upper part; leaves lanceolate, the lower usually spatulate, gradually tapering to form a petiole, obtuse, median and upper leaves sessile, acute, all leaves usually entire, rarely denticulate, downy, very remotely thin-bristly. Cymes short, 3—5 cm long, rather dense or loose, erect; bracts lanceolate; pedicels short, 2—4 mm long, drooping, spreadingly glandular-downy; calyx rather short, in fruit ovoid-sacciform, 7—10 mm long, with short, broadly triangular, obtuse teeth, finely glandular-downy and very sparsely long-bristly; corolla large, pale violet, tube as long as calyx, the limb broadly campanulate, longer than tube, 10—15 mm across, the lobes very short and broad; nutlets pale gray, semi-curved, arcuate at back, ventral crest straight but protruding obliquely, wrinkles thick and distinct, extending from base upwards and bending towards apex, finely dotted-tuberculate in between; attachment-ring thickened, downy. June—July.

Subalpine and alpine belts of Caucasus, fields, near villages, etc. — Caucasus: everywhere except for Talysh and W. Transcaucasia, rarely in Armenia (Aragats, for example). Gen. distr.: As. Min. (E. Anatolia, Lazistan). Described from Kazbek, at the northern slope of the Caucasus (Steven). Type in Helsinki.

Note. Differs very little from N. alpestris (Stev.) G. Don except for the color of the corolla, as pointed out by Kuznetsov who presumed though that N. versicolor was always an annual, which actually it is not. These
329 two species form a pair of provisional species such as the pair N. lutea — N. rosea.

Like all these species N. versicolor is highly variable. Cymes are often dense in fruit and the calyx is not very broadly campanulate, much like the calyx in N. alpestris. However, there are specimens from the northern slope of the central part of Main Range (Teberda — Litvinov; Kazbek, Sioni and Kobi — Meyer; Kaishaur — Overin, and others) that are markedly gray, the cymes are loose and strongly leafy, the calyx campanulate and very broad, in general they resemble outwardly N. obtusifolia (Willd.) Roem. et Schult, but with nutlets as in N. verisicolor. These specimens

PLATE XV. 1 — Nonea macropoda M. Pop.; 2 — Brunnera sibirica Stev.

also occur in Dagestan. There are individuals with thin, annual (spring) roots, but most are with 2—3 year old roots. The specimens from Armenia show a distinct intergradation toward N. pulla and its forms.

★N. karsensis M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 310.

Annual; 10—20 cm high, densely short-glandular-downy above but typically without any long acicular bristles; stems robust, branching from base with long, ascending branches, subglabrous below or sparsely short-downy; radical rosettes lacking; cauline leaves lanceolate or lanceolate-linear, the lower slightly tapering at base, the others sessile, acute, 2—5 cm long, 2—8 mm wide, above with very short prickly bristles borne on tubercles, slightly glandular-hairy along margins, glabrous beneath. Cymes short, subcapitate, only 1—2 below calyx drawn back; bracts lanceolate; pedicels short, 1—2 mm, glandular; fruiting calyx elongate, narrowly sacciform, 10—12 mm long, short-glandular-downy, without long bristles, teeth elongate, triangular-lanceolate, acuminate, blue-colored, reaching 5 mm in length; corolla violet, large, tube shorter than calyx-teeth, ca. 5 mm long, the limb broad, calyciform-campanulate, ca. 10 mm long, up to 12—15 mm wide, smaller on lateral branches, lobes very short and broad; nutlets pale gray, straight, trihedral-oblong, bent to one side, with 2 acute keels — ventral and dorsal, one smaller side of nutlet flat and hardly rugose, the other inflated and not sharply netted-rugose, the whole surface glabrous, smooth; basal ring narrow, nearly triangular, hardly thickened; caruncle nearly indistinct.

Known from Kagizman. (Flowers, fruit, 7 VI 1914, Volchanetskii).

330 Section 2. CRYPTANTHERA DC. Prodr. X (1846) 29; Ldb. Fl. Ross. III, 109; Boiss. Fl. or. IV, 163; Gürke in Nat. Pflanzenf. IV, 3a, 116; Kuzn. in Mat. Fl. Kavk. IV, 2, 312. — Nutlets more or less curved but not reniform, usually netted-rugose; attachment-ring basal not ventral, rarely thin, smooth.

Note. The name of this section is inappropriate since in all sections of Nonea the anthers are hidden in the corolla tube. De Candolle's fourth section with exserted anthers has now been separated into the genus Elizaldia Willk. (see: Johnst. Contr. Gray Herb. XXIII (1924) 56).

Series 1. Albiflorae M. Pop. — Corolla white, small. Basal ring without transverse, acute ribs, smooth, finely downy.

7. N. turcomanica M. Pop. in Spisok rast. Gerb. Fl. SSSR, XII (1953). No. 3575.

Annual; multicaulescent, branching from base with spreading ascending stems, 5—10 cm long, rarely with simple, non-branching stem; stems angular, rather robust, very far apart, glandular-downy-villous above, with flexuose thin hairs, nearly without acicular bristles, occasionally with solitary thin bristles above in the inflorescence; leaves narrowly or broadly lanceolate, the lower long-tapering at base, spatulate, obtuse, 4—5 cm long, 5—8 mm wide below apex, median leaves with nearly parallel margins, obtuse,

approximately the same size, upper leaves gradually reduced into bracts, oblong-lanceolate or lanceolate, acute, median and lower leaves usually finely and unevenly toothed at margins, all leaves more or less grayish, sparsely downy, sparingly bristly at upper surface, bristly-ciliate at margin, subglabrous beneath, with bristles scattered along midrib. Fruiting cymes rather dense, few-flowered, short, inflorescence generally hardly separated from the lower leaf-bearing part of the stem, always as an apical simple continuation of stem, with axillary solitary flowers besides; bracts longer than calyx; pedicels very short, even the lower not more than 2 mm long, the others nearly obsolete; fruiting calyx small, 6—8 mm long, ovate-sacciform, densely (gray) glandular-downy-villous, with single, thin, long bristles hardly discernible in the long villous pubescence, calyx-teeth short, 1—2 mm long, triangular, acute; corolla very small, narrow, subtubular, white, tube as long as calyx, ca. 4 mm long, the limb 2 mm long, hardly broadening, very narrowly campanulate, the lobes smaller, 1 mm long,
331 orbicular-ovate; nutlets black-brown, 2.5 mm long, markedly curved, almost horizontal, with apex pressed to the side, semi-ovate, without ribs, rounded at back, glabrous or smooth or hardly wrinkled at sides, with thin acute ventral keel, attachment-ring basal, rather high, not thickened, smooth, slightly downy; caruncle small, mammiform, brown. March.

Semi-deserts, the foothills of Kopet Dagh. — Centr. Asia: Mtn. Turkm. (plains near Kizyl-Arvat railway station, also Ashkhabad, commonly west to Kara-Kala and Atrek). Endemic. Described from Ashkhabad. Type in Leningrad.

Note. This very interesting and rather surprising species is closely related to the species in section Orthocaryum by the smooth attachment-ring and the smooth (or nearly so) nutlets, but the latter are markedly curved, not straight. Among section Orthocaryum only the small-flowered races of N. lutea (N. flavescens) may be regarded as related species; our species has, however, white corolla and much smaller strongly curved nutlets. It differs from N. picta Fisch. et Mey., from which these specimens were separated by Lipski, by the smooth nutlets and the smooth but not thickened ring.

It is noteworthy that in Tadzhikistan (on Vakhsh), on the upper reaches of Zeravshan and near Dzhizak, occur transitional forms between N. turcomanica and N. caspica, although N. turcomanica itself is not found there. These specimens are very numerous. In Kopet Dagh there are real hybrids between N. turcomanica and N. caspica.

8. N. macropoda M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 309.

Annual; plant 7—10 cm high, shortly gray-glandular-downy, with solitary, remote, thin, acicular bristles above down; stem sturdy, branching from base or only above or simple, entirely and densely gray-downy and with solitary bristles; leaves lanceolate, acute, subentire, densely gray-downy, with solitary thin bristles, short-ciliate at margin, 2—4 cm long, 5—8 mm wide, lowermost leaves spatulate and evidently obtuse. Cymes in fruit short, dense; bracts large, oblong-lanceolate or lanceolate; pedicels short, even the lower up to 2 mm, densely downy, curved; fruiting calyx broad, sacciform-campanulate, with broad triangular acute teeth 4—5 mm long,

densely glandular-downy, with scattered, thin, acicular bristles, the teeth hardly shorter than the undivided part of calyx; corolla white, small, tube not exceeding calyx-teeth, the limb ca. 3 mm across and long, with oblong,
332 obtuse, spreading lobes ca. 1 mm long, the rest of limb (above scales) 2 mm long; nutlets large, 5 mm long, subhorizontal, glabrous, finely netted-rugose at sides and back, basal ring very high, smooth and not ribbed, tuberculate-dentate and downy at lower edge, thickened; caruncle undeveloped. (Plate XV, Figure 1.)

Mountain slopes. — Centr. Asia: Pam.-Al. (Kurgan-Tyube, Kara-Tau Mountains near Chiglin spring). Endemic. Described from the above-indicated site. Type in Leningrad.

Note. A very interesting species which resembles both N. turcomanica (small white flowers and downy basal ring without acute transverse ribs) and N. melanocarpa (shape of leaves and calyx-teeth). However, it is very easily distinguished from the first species by the netted-rugose surface of the nutlets, the very high ring, and the sharply tuberculate thickening at the lower edge; and from the second by the flowers, the high stipe (ring), and the glabrous nutlets. Outwardly it resembles N. nigricans DC., though the corolla of the latter is dark, red, the basal ring acute, ribbed (as in N. picta) and the nutlets are more rugose-tuberculate; the entire plant is larger and the calyx-teeth more long-acuminate. In general N. nigricans DC. (Spain, Tunisia, Sicily) is closely related to N. picta and might be its vicarious race. N. micrantha Boiss. et Reut. has the same nutlets as N. nigricans. In all these species the nutlets are smaller than in N. macropoda.

Series 2. Pictae M. Pop. — Basal ring with transverse acute ribs and hence dentate at the lower thickened margin. Corolla violet, blue- or red-pink or dark red.

9. N. **melanocarpa** Boiss. Diagn. I, 11 (1849) 96 et Fl. or. IV, 165. — N. melanocarpa var. macra Boiss. in herb; Lipskii in Tr. Bot. Sada. XXVI, 469—471. — N. szowitsiana Stev. in Bull Soc. Nat. Mosc. XXIV (1851) 574. — N. armena Stev. l.c. 574. — ? N. sordida Fisch. et Mey. Ind. II Sem. Hort. Petrop. (1835) 43.

Annual, often winter plants and then more robust, with more stems and a rosette of radical leaves; stems usually few, slightly ascending, 10—30 cm high, not very densely glandular-downy, with few, thin but distinct bristles, simple or branching; lower leaves many in the early winter individuals, shortly or narrowly lanceolate-spatulate, obtuse, frequently denticulate at margin, gradually long-tapering, usually withering at fruiting, upper leaves broadly lanceolate, 2—5 cm long, ca. 1 cm wide, usually nearly entire, acute, the uppermost leaves lanceolate, all leaves glandular-downy and slightly
333 thin-bristly, ciliate at margin. Fruiting cymes rather loose and long, 3—10 cm; bracts the oblong to lanceolate, acute; pedicels thin, short, spreading-downy, declinate, the lowermost short, 3—4 mm; calyx in fruit ovoid or even campanulate-sacciform, ca. 7—8 mm long, more or less densely glandular-downy and slightly thin-bristly; teeth rather short, 1—3 mm long, broad, oblong-triangular, acute but not long-acuminate; corolla dark or light

violet, small, tube approximately as long as calyx, the limb shorter than calyx, ca. 3 mm long, 2—3 mm across, tubular below, then slightly campanulate, with short small lobes; nutlets 4 mm long, horizontal, subreniform, low (due to the very low attachment-ring), dark brown, downy with hairs longer on ring, ring ventral, very low, oblong-oval, obscurely transversely ribbed, denticulate at outer free margin, ribs extending into thick, short wrinkles at side of nutlet. April—May.

Oases, pastures, gardens, roadsides, etc. — Caucasus: S. Transc.; Centr. Asia: Syr D. (Tashkent), Pam.-Al. (Dzhizak, Samarkand, Vakhsh valley, Boldzhuan). Gen. distr.: Med. (E.), Iran. Described from Palestine. Type in Geneva.

Note. The typical form (Jerusalem, Boissier and Fl. Palaest. exs. No. 159) is more robust, with thick strong stems, grayer pubescence, larger gray calyces thus slightly different from our plants, but the nutlets are exactly the same. The form which Boissier designated in the herbarium as F. macra (Iran, Derderian) appears to be just like our Central Asian form. In Central Asia this is a typical introduced plant. The specimens from Chu-Ili Mountains (Kendyltas, Krasnov) do not appear to be as typical, the nutlets are higher, generally between the nutlets of N. melanocarpa and N. picta.

N. melanocarpa Boiss. f. macra Boiss. is common near Teheran from where Bornmüller reported it in "Doerflers Herbarium Normale" (No. 4267) under the name N. picta (M. B.) Fisch. et Mey. (in incultis ad Teheran) as also cited by Kuznetsov (Mat. Fl. Kavk. IV, 2, 314 — in exs. and Note).

N. sordida Fisch. et Mey. was described according to cultivated specimens grown in the Botanical Garden of Leningrad. Its native locality was recorded as the eastern shore of the Caspian Sea but the collector is not indicated (probably G. S. Karelin). In the diagnosis, which concurs with that of N. picta, all the characters of the latter are repeated word for word except for the following points about the nutlets: N. picta "carpellis glabris depressis altitudine latioribus basi plicato-crenatis," N. sordida "carpellis pubescentibus depressis altitudine latioribus basi subplicatis integris."
334 The specimens in the Herbarium of the Botanical Institute of the Academy of Sciences of the USSR (Cult. in Hort. Petr. 1835) have glabrous nutlets as in the typical but cultivated N. picta. Apparently they were substituted by mistake. There are no other specimens of this species in the Herbarium. N. szovitsiana Stev. was erroneously reported by Kuznetsov from Baku where it does not grow, although there is a special form N. caspica. It is unquestionably found in Erivan, and hence perhaps it would be more correct to name our population N. szovitsiana.

10. N. caspica (Willd.) G. Don, Syst. IV (1838) 336; DC. Prodr. X, 30; Ldb. Fl. Ross. III, 110. — Onosma caspica Willd. Sp. pl. I (1797) 775. — Lycopsis caspica Lehm. Pl. Asperif. II (1818) 256; Ldb. Fl. alt. I, 185. — Nonnea picta Fisch. et Mey. Ind. II Sem. Hort. Petrop. (1835. 43; DC. Prodr. X, 30; Ldb. Fl. Ross. III, 110; Boiss. Fl. or. IV, 166; Shmal'g., Fl. II, 232; Kuzn. Mat. Fl. Kavk. IV, 2, 312; Grossg., Fl. Kavk. 263; Kryl., Fl. Zap. Sib. IX, 2264 [N. picta Sweet, Hort. Brit. ed. 1 (1827) 292]. — Lycopsis picta Lehm. Asperif. II, 255;

Ldb. Fl. alt. I, 185. — Anchusa picta M. B. Fl. taur.-cauc. I (1808) 137. — Nonnea diffusa Boiss. et Buhse in Mém. Soc. Nat. Mosc. (1860) 152. — Exs.: Herb. Fl. Cauc. No. 182; Pl. or. exs. No. 120.

Annual; spring rarely early winter plants, 5—30 cm high, sparsely covered with fine grayish down, glandular above or throughout and with many but remote, more or less long bristles; stems often branching at base with drooping or even prostrate branches, plants appearing multicaulescent, rarely (in depressed individuals) stems slightly branching or simple and then usually low; leaves lanceolate, 2—5 cm long, 3—4 mm to 10 mm wide, narrow, long-acuminate, more or less denticulate at margins, especially the lower, upper leaves usually entire, all sparsely covered with small, more or less glandular down and with fairly numerous bristles, bristly-long-ciliate at margins. Fruiting cymes variously loose; very loose but sometimes more or less dense; bracts narrowly lanceolate or lanceolate-linear, long-acuminate; pedicels short, drooping; fruiting calyx ovoid or spherical-sacciform, small, 7—10 mm long, the teeth triangular-lanceolate, long- and thin-acuminate (nearly subulate), approximately as long as the undivided part, calyx more or less densely glandular-downy and with fairly numerous bristles differing in length; corolla small, usually violet-red, sometimes pink or white, the tube as long as calyx, usually yellowish, with narrowly campanulate limb sometimes as long as tube, up
335 to 4—5 mm across, sometimes shorter than tube and less developed, 3—4 mm across, lobes small, ca. 0.5—1 mm long; nutlets black, horizontal, short-ovoid, 3 mm long, glabrous, ring high, glabrous or finely downy; transversely ribbed, with 10—15 acute ribs protruding as teeth at the free (lower) edge, proceeding at side of nutlet nearly up to back as straight wrinkle-nerves. April—May.

Stony slopes, rocky zones in semi-deserts and semi-steppes (Caucasus), solonetzic, sandy, and as stony deserts. — European part: L. V.; Caucasus: Dag., E. and S. Transc., Tal.; Centr. Asia: everywhere except for the high mountains (steppe and high mountain belts). Gen. distr.: Iran. (only in N. Iran). Described from the northern coast of the Caspian Sea. Type in Berlin.

Note. We combine N. caspica and N. picta into one species, as Boissier and Kuznetsov did, although De Candolle, Ledebour, Koch and Steven distinguished them. Lipskii (Tr. Bot. Sada, XXVI, 464—469) combined them too but included also N. turcomanica M. Pop. and N. macropoda M. Pop. N. caspica is, of course, not homogeneous throughout its vast distribution area, from W. Mongolia to Transcaucasia. If the populations from the foothills of the Pamir area and from Araks were to be compared (in "Herb. Fl. Cauc.") then definite differences would be found, but the character of the nutlets remains the same.

Anchusa picta was described from several places: "In sandy deserts near the Volga, Terek, Kuma, common; also in vineyards near Astrakhan and E. Georgia."

I saw the originals "from Astrakhan to Kizlyar," which by no means are distinguished from any of the specimens of the Caspian area and, accordingly, from N. caspica. Probably those are the specimens from Terek and Kuma. However, the Transcaucasian specimens distinctly differ from the above and are also distinguished from the Caspian and mountain plants of Central Asia.

Var. diffusa M. Pop. (N. diffusa Boiss. et Buhse, l. c.). — A Transcaucasian race. Corolla larger, bright pink-violet, the limb rather large, 4—5(6) mm across (especially large in the Erevan specimens, up to 10 mm across). Fruiting cymes with very remote pedicels (hence the authors wrote: flowers solitary in axils of upper leaves). Bristles numerous. This race is particularly common in Araks and Talysh. Collection in "Herb. Fl. cauc.", No. 182.

F. erivanensis M. Pop. — Corolla especially large. Collection in "Pl. or. exs.", No. 120.

Var. bakuensis M. Pop. (N. bakuensis M. Pop. — N. picta var. szovitsiana Kusn. in Mat. Fl. Kavk. IV, 2, 314 — quoad pl. bakuensem).—
336 Often winter plants. All parts gray, plant multicaulescent. Stems sturdy, slightly bristly or nearly without bristles. Leaves distinctly dentate at margins and short-ciliate. Fruiting cymes dense, at least in upper part. Calyx gray-glandular-villous, with few thin bristles, teeth relatively larger and more thinly acuminate. Corolla dark violet, limb 2—4 mm across. — Environs of Baku (common).

Var. picta M. Pop. (N. picta Fisch. et Mey., Anchusa picta M. B.). — Spring plants. Fruiting cymes very loose. Stems sparsely bristly. Leaves not markedly dentate, narrow, long-ciliate. Corolla rather smaller, light blue-violet. Calyx-teeth much elongating. L.V. (Astrakhan, Gurev), Cisc.

I found nothing in the Central Asian populations which would differentiate them and thus they could be united in one race.

Var. turkestanica M. Pop. (N. turkestanica M. Pop.). — Usually spring plants. Leaves slightly dentate. Bristles few or many. Sometimes plants with very distinct glandular down, notably in individuals from Tadzhikistan near Gorno-Badakhshan (f. glandulosissima). Fruiting cymes often dense as in var. bakuensis but sometimes loose or very loose as in var. picta, but the corolla usually small, dark red-violet, rarely pink or white (which I believe is due to hybridization with N. turcomanica or N. melanocarpa). A form very similar to var. bakuensis grows near Kanibadam. It is a winter plant with strongly dentate leaves and may possibly have been introduced into the Sakte oil fields from Baku.

Series 3. **Pallidae** M. Pop. — Nutlets subglobose, with very short apex, much wrinkled, horizontal and borne on the high, cylindrical, distally dentate basal ring. Flowers white. Annuals.

11. **N. pallens** Petrovič, Addit. Fl. Nyss. (1885) 129; Fl. Nyss. 130; Hayek, Prodr. Fl. Balc. II, 68. — N. pulchella Paczoski in Zap. Kiev. obshch. estestvoisp. X (1889) 429—430; Shmal'g., Fl. II, 231. — Exs.: F. Schultz, Herb. norm. No. 2238.

Annual; plants 10—40 cm high; stem single, erect, branching above, robust, sparsely glandular-downy, nearly without bristles, rarely branching from base and then plant appearing multicaulescent; leaves broadly lanceolate, delicate, flat, acute, 4—7 cm long, ca. 1 cm wide, only the lowermost cauline leaves gradually and shortly tapering at base, the rest sessile,

greenish or grayish, sparsely (sometimes densely) covered with glandular down and scattered short bristles borne above on small tubercles, entire,
337 shortly and finely bristly-ciliate at margin. Fruiting cymes rather loose (or compressed), with large broad lanceolate bracts; pedicels short, the lowermost 5—10 mm long, the others 2—4 mm, drooping or declinate, short-glandular-downy; fruiting calyx ca. 10 mm long, spherical-sacciform or campanulate, rather densely glandular-downy, with few very thin bristles, teeth triangular-lanceolate, thin-acuminate, longer than the undivided part of calyx; corolla light yellow or white (straw-colored), small, nearly tubular, the tube much shorter than calyx, the limb narrowly (nearly tubularly) campanulate, slightly exserted from calyx, 4 mm long, as long as tube, lobes 1.5 mm long, obovate; nutlets ca. 4 mm long, 2.5 mm high, nearly black, subhorizontal. thickly netted-rugose; ring high, transversely ribbed, thin, incurved and dentate at free lower margin. April—May.

Rocks, stony slopes and sands. — European part: Bl. (Nikolaev Region: on the lower Dnieper, Ingulets). Gen. distr.: N. Balkans. Described from Nis, Yugoslavia.

Note. This plant is very similar in habit to N. lutea and even more so to N. flavescens, but the leaves are entire and the corolla is smaller; the main distinction is pronounced in the nutlets, which are very different and more like those of N. pulla. The specimens collected near Filippopole are perennials and are transitional to N. pulla. Pachoskii's specimens are more xerophilous than those from the Balkan, they are smaller in size, 10—20 cm high, more strongly pubescent, sometimes gray, with numerous bristles, with narrower leaves and rather dense racemes; the corolla is narrower and shorter, the calyx also smaller. Pachoskii (1915) himself identified his species (N. pulchella) with the Balkan N. pallens and noted that it had been introduced into Russia and frequently soon disappeared from the localities it had inhabited (Pachosk., Stepi Khersonsk. gub. (1915) 299).

Series 4. Pullae M. Pop. — Perennial herbs. Calyx-teeth short. Corolla medium-large.

12. **N. pulla** (L.) DC. Fl. Fr. ed. 3 (1805) 626; DC. Prodr. X, 32; Ldb. Fl. Ross. III, 111; Boiss. Fl. or. IV, 166; Shmal'g., Fl. II, 231; Kuzn. in Mat. Fl. Kavk. IV, 2, 315; Grossg., Fl. Kavk. III, 263; Kryl., Fl. Zap. Sib. IX, 2262; Hegi, Ill. Fl. V, 3, 2206. — Lycopsis pulla L. Syst. ed. X (1767) 916. — Anchusa pulla M. B. Fl. taur.-cauc. I (1808) 125. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 101; Stankov and Taliev, Opred. Fig. 439. — Exs.: Fl. exs. Reipubl. Bohem.-Sloven. No. 1260.

Perennial; stems thick, large, 25—50 cm high, furrowed, finely glandular-
338 downy, short-villous above but without acicular bristles, usually corymbiformly branching; leaves oblong-lanceolate or lanceolate, sessile, the lower shorter and narrower, withering at flowering, lobate, other leaves sessile, median and upper leaves subcordate at base, all leaves entire, short-gray-downy, at margin without bristles or with 3—5 mm long, ca. 1 mm wide ones. Cymes composing a corymbiform-paniculate inflorescence, loose in fruit, with rather short lanceolate bracts; pedicels short or calyx subsessile,

drooping, short-glandular-downy; calyx 6—8 mm long, broadly tubular-ovoid-sacciform in fruit, glandular-gray-downy, with few thin bristles and very short, triangular, acute teeth ca. 1 mm long, $^1/_3$—$^1/_4$($^1/_5$) as long as undivided part; corolla dark-red, twice as long as flowering calyx, ca. 10—12 mm long, tube approximately as long as calyx, the limb as long as tube, narrowly campanulate, the lobes 0.5—1 mm long, broad, obtuse; scales ovate, short, with long lateral hairs; nutlets subglobular, 3 mm long, ca. 3—4 mm high, downy, netted-rugose, with high attachment like a thick, transversely ribbed stipe, downy. May—June.

Steppes, fallows, waste lands, roadsides. — European part: U. Dns. (Zaleshchiki), M. Dnp. (Podolia to the Dnieper, intermediate forms), Crim. (Dubki, N. A. Bush).

The description above is of the typical (from the formal point of view) Czechoslovak race. The Dniester race has the same pubescence, but it is greener, more narrow-leaved and multicaulescent (cliffs of the Dniester near Zaleshchiki, Mondal'skii and Matusyak, 1938). This form was reported by Degen from near Budapest (Pl. Hung. exs.). A special race is distributed more to the east.

Var. rossica (Stev.) M. Pop. (N. rossica Stev. in Bull. Soc. Nat. Mosc. (1851) 572). — Stems spreading and long-coarse-bristly, hardly downy-ciliate, sometimes turning blue. Leaves longer, densely covered above, with thin bristles, bristly-downy beneath. Pedicels thin and longer; calyx and pedicels long-spreading-bristly; corolla slightly shorter than usual but with more campanulate limb. — European part: Lad.-Ilm., Balt. (Riga, Kaunas), Kar.-Lapl., U. Dnp., U. V. (introduced into parks, railroads), V.-Kama, M. Dnp. (except for the western part), V.-Don, Transv., Bl., L. Don, L. V., Crim. (northern steppe part); Caucasus: Cisc. (Kuban); West Siberia: U. Tob., Irt., Alt.; East Siberia: Dau. (introduced?); Centr. Asia: extreme northern part. Endemic.

A very close race of N. atra Griseb. (Bulgaria), only the leaves are
339 narrower (see: Kuzn. in Mat. Fl. Kavk. IV, 2, 322. — N. pulla var. angustifolia Velen.).

Var. taurica (Ldb.) Kuzn. (in Mat. Fl. Kavk. IV, 2 (1913) 317. — N. taurica Ldb. Fl. Ross. III, 111. — Lycopsis taurica Ldb. in Panders Beitr. I (1815) 64). — Usually multicaulescent. Stems low, 10—20 cm high, densely villous-downy, not coarse-bristly; leaves lanceolate-linear, gray, villous-downy. Calyx gray, densely glandular-villous-downy, nearly without longer bristles. Corolla shorter but with wider limb. Very close to N. atra Griseb. — European part: Crim. (southern coast); Caucasus: Cisc. (Anapa). Described from the Crimea.

Note 1. In the Crimea there are forms indistinguishable from the Czechoslovak N. pulla, covered with short gray hairs (near Simferopol, in Dubki, 25 IV 1905, N. A. Bush). The specimen cited by Kuznetsov (l. c. 318) as N. pulla var. taurica does not have villous hairs at all but short velutinous ones as in the Czechoslovak (typical) race. Kuznetsov left this specimen unlabeled.

Var. armeniaca Kusn. (l. c. (1913) 321. — N. armeniaca Grossh. in Opred. rast. Kavk. (1949) 290) and var. lencoranica Kusn. (l. c. 322. — N. lencoranica Grossh. l. c. 290). — Root vertical, shortly multicipital at apex, producing usually few, high stems, without creeping shoots.

Stems covered with fine, recurved bristles and scattered long firm ones. Radical rosette often present. Leaves short, lanceolate or oblong-lanceolate at margin, sparsely and coarsely long-bristly. Cymes usually short. Fruiting calyx tubular-sacciform, 6—8 mm long, short-glandular-downy, with rather numerous long coarse bristles, teeth very short. Corolla smaller, 6—7 mm long, hardly longer than calyx. Scales obsolete, represented as bundles of hairs. Nutlets small, 2.5—3 mm long, low, ovoid, with low ring. — Caucasus: S. Transc. (Atskuri, Shurageli, Karaklisa).

Note 2. The other specimens I saw from Armenia and Kars region hardly resemble those described above and may be regarded as the original N. armeniaca Grossh. Some of these correspond to the type N. armena Boiss. et Huet. non Stev. They have rosettes of entire radical leaves. Their leaves are wide, oblong-lanceolate or lanceolate, the lower and radical leaves tapering to 10 cm long petioles, upper leaves cordate at base or slightly decurrent. Calyx large, 10—12 mm long. Corolla large, 12—15 mm long, with rather broad campanulate limb. Plant covered with short-appressed bristles, the stems and leaves with short retrorse bristles and the calyces grayish (often bluish) with short dense thin erect bristles and crisp glandular hairs. (This fits var. cynocalyx M. Pop. (N. cynocalyx M. Pop.).)
340 Nutlets on low black ring. — S. Transc. (Shakhbuz, Bichenakskii Pass, 2,400 m).

There are transitional forms from this variety to the next. Such plants are found near Sevan Lake, near Elenovka, Archanos Mountain, flowers, fruit, 1928, Shelkovnikov and Kara-Murza; Kars fortress, 31 V 1913, Roop.

Var. persica (Boiss.) M. Pop. (N. persica Boiss. Diagn. I, 77 (1846) 32). — Root thick, shortly multicipital. Stems few, low, ascending, covered with fine recurved hairs and glandular ones without bristles (but remotely bristly in some of the Iranian specimens, particularly from the mountains of Yazd, Baiazeh). Leaves lanceolate-linear or linear, narrower than in N. armeniaca Grossh.

Only one specimen: Nakhichevan, near Nosyrvad, Khabar-Yurt Mountain (Karyagin and Safiev).

Var. lencoranica Kusn. — It seems to me that this variety does not differ from var. armeniaca, apart from its longer calyx-teeth.

Thus, in Transcaucasia there are two races of N. pullae.

1) Xerophyllous, low-mountain plants, with small calyces and short teeth: N. armeniaca — N. lencoranica — N. persica.

2) Mesophyllous, high-mountain plants, with large (10—12 mm) calyces, longer teeth and rather large corollas, transitional to N. intermedia Ldb: N. cyanocalyx - N. voronovii.

Both differ from the lowland European race N. pulla — N. rossica — N. taurica by the nutlets which are more ovoid with low ring and more developed apex, and by the root bearing a radical rosette.

13. N. intermedia Ldb. Fl. Ross. III (1849) 111; Boiss. Fl. or. IV, 167; Kuzn. in Mat. Fl. Kavk. IV, 2, 325; Grossg., Fl. Kavk. III, 264. — Exs.: Pl. or. exs. No. 291.

Perennial; root vertical, rather thick, black, shortly-multicipital at apex, producing rosettes of large radical leaves and 1—3 fertile stems; stems 30—50 cm high, thick, erect or ascending, softly hairy-villous, not

coarsely bristly, very rarely thin-bristly, densely leafy, shortly branching only above; radical leaves (sterile rosettes) oblong-spatulate, 10—15 cm long, 2—3 cm wide, gradually long-tapering at base, acute, sparsely semi-appressed-bristly-hairy, entire, not ciliate at margins; cauline leaves numerous, oblong to lanceolate, sessile and subcordate at base, 3—6 cm long,
341 1—1.5 cm wide, acute, declined, sometimes undulant but not dentate at margin, sparsely semi-appressed-bristly-hairy. Cymes rather short, composing small and short apical panicles nearly corymbiform in fruit, few-flowered, densely capitate in flower, loose in fruit, 3—5 cm long, erect; pedicels 3—8 mm long, drooping or hanging; calyx in fruit sacciform-campanulate, 10—12 mm long, densely glandular-crisp-hairy, without long acicular bristles, sometimes nearly tomentose or short-gray-downy; teeth broadly triangular, more or less short ($^1/_4-^1/_2$ as long as the undivided part of calyx); corolla pale violet, with sometimes redder, sometimes bluer tinge, rather large, tube shorter than calyx, about 5—6 mm long, the limb broad, cup-shaped-campanulate, ca. 10 (up to 15) mm across; nutlets black, rather large, 4 mm high and long, globulose-ovoid, acutely rugose, slightly downy, the ring high, transversely ribbed. June—July.

Subalpine meadows. — Caucasus: Cisc. (W.), W. Transc. Endemic. (Very close to N. pulmonarioides Boiss. et Bal. in Lazistan). Described from Guria (Nordmann). Type in Leningrad.

Note. The typical form is found in Adzharia, Abkhazia and Cherkesia (to Teberda). The population further east, towards the Elburz range and Ushba, in Svanetia, Mingrelia and Mamison pass, is distinct: var. viscida Somm. et Lev. (in Tr. Bot. Sada, XIV (1900) 345; Kuzn. l. c. 326. — N. voronovii Grossh. in herb.). — Leaves narrower, almost lanceolate; stems often finely bristly, yellowish, glandular in upper part. Kuznetsov is quite wrong in describing the leaves as being wider than in type. On the contrary, the leaves are usually narrower, more lanceolate, as can be seen in the Sommier et Levier specimen. In general the characters (width of leaves, color of pubescence, etc.) are not constant.

This species has much in common with N. pulla (L.) DC. It is mainly distinguished from it by the larger corolla, with wide limb, and the dense, numerous, cauline leaves. N. cyanocalyx and N. voronovii are actually transitional from N. pulla to N. intermedia. The species was so named because it looks intermediate between Nonea and Pulmonaria.

14. N. decurrens (C. A. M.) G. Don, Syst. IV (1838) 337; DC. Prodr. X, 32; Ldb. Fl. Ross. III, 111; Boiss. Fl. or. IV, 168; Kuzn. in Mat. Fl. Kavk. IV, 2, 328; Grossg., Fl. Kavk. III, 264. — Lycopsis decurrens C. A. M. Verz. d. Pflz. Cauc. (1831) 98.

Perennial; root apparently vertical and rather thick, short-branching at apex, producing sterile rosettes and fertile stems; stems robust, sturdy, ribbed-furrowed, shortly glandular crisp-downy above, even slightly velutinous, without acicular bristles, 30—50 cm high, corymbiformly branching
342 only above; leaves of sterile radical rosettes broadly oblong-lanceolate, uppermost leaves (under inflorescence) ovate-oblong, all leaves acute, wide at base, short-cuneate and decurrent along stem, 3—8 cm long, 1—3 cm wide, short-glandular-downy, entire at margin, not ciliate. Inflorescence a corymbiform, short panicle composed of short, markedly leafy cymes; cymes

few-flowered, loose in fruit, ca. 3 cm long; bracts large, 2—3 cm long, ovate or oblong, very acute, concealing flowers; pedicels short, thick, 2—8 mm long, drooping, glandular-downy; fruiting calyx broadly campanulate-sacciform (nearly spherical), partly densely short-glandular-downy, rather large, 10—13 mm long, with broadly triangular acute teeth as long as the undivided part; corolla dark red, small, slightly protruding from calyx, 8—9 mm long, with narrowly campanulate limb, 4—6 mm wide; nutlets very large (largest in the genus!), 7—8 mm long, ovoid-globulose, horizontal, rugose-netted or downy; attachment-ring high, smooth, without ribs, densely downy as in Orthocaryum; at lower rim inside with about 30 finger-shaped teeth. Fl. May.

Meadows, shrubby formations, up to the middle belt and the subalpine meadows in higher mountains. — Caucasus: Dag. (Makhach-Kala), Tal. (near Perimbal). Endemic. Described from Perimbal. Type in Leningrad.

Note. This is the most remarkable species in the series Pullae. It is unfortunate that the exact locality of Meyer's original specimens is unknown. Boissier and Kuznetsov recorded it in Talysh, but the plant has never been subsequently collected there; on the other hand, Lipskii found it in Dagestan. I am inclined, therefore, to think that N. decurrens is one of the plants endemic to Dagestan.

The locality of Kartaly specimens, which Kuznetsov separated into the variety angustifolia Kusn. (l. c. 329), is also doubtful. In Sovits's specimens the locality is not indicated either, there are only flowers. They actually represent a transition from N. decurrens to N. intermedia as do Radde's specimens from Lake Tabistskuri. Their corolla is 13 mm long, with limb nearly 10 mm wide. This is more like N. cyanocalyx or N. voronovii than N. decurrens.

15. N. daghestanica Kusn. in Mat. Fl. Kavk. IV, 2 (1913) 320 and 321; Grossg., Fl. Kavk. III, 264.

Perennial; rhizome creeping, with thin long branches, passing at apex into fertile stems; radical rosettes absent; stems ascending, remotely branching from base, 15—30 cm high, with sterile branches nearly pro-
343 cumbent below, spreading, coarsely subspiny-bristly with additional small bristles, the bristles denser in upper part of stem; leaves lanceolate, with parallel margins, obtuse, subentire, 2—4(5) cm long, 0.5—1 cm wide, densely and coarsely bristly on upper surface, more sparsely so beneath, the bristles semi-spreading, borne on large tubercles, ciliate at margin, with coarse, medium-long bristles. Inflorescence irregularly and loose divaricate-corymbiform, small; cymes loose, elongating up to 10 cm in fruit; bracts lanceolate, acute, longer than flowers; pedicels distinct, 5—12 mm long, curved below, coarsely long-spreading-bristly; fruiting calyx broadly sacciform-suborbicular, densely and coarsely bristly, with loose glandular down between bristles, the teeth broadly triangular, obtuse, half as long as the undivided part; corolla black-red-violet, the tube as long as calyx, limb 4 mm long, shorter than tube but rather broadly campanulate, ca. 6 mm across, with short lobes; nutlets large, 6 mm long and high, subglobulose, acutely and thickly netted-rugose, glabrous, attachment-ring high, transversely ribbed, sparsely toothed at lower margin. July—August.

Stony, moving taluses in the subalpine belt. — Caucasus: Dag. Endemic. Described from specimens from Dagestan (Gedym, Alekseenko). Type in Leningrad.

Note. A plant endemic to Dagestan, exquisite like Trigonocaryum, Heliotropium styligerum, and others. It is distinguished from N. pulla (L.) DC. by the very coarse, bristly pubescence and the shape of the small leaves with nearly parallel margins; due to both these characters it bears an astonishing resemblance to the species of Onosma. It also differs from the above species, and all those closely related, by the sterile, elongate branches emerging from leaf-axils and lying on rock waste, also by the cymes loose in fruit, the long pedicels and the very large nutlets. Kuznetsov (l. c.) correctly gave this plant an independent specific status and it was only under the influence of the older authors (Trautfetter) that he included it among the varieties of N. pulla, not without noting however that it should be separated into the independent species N. daghestanica, as accepted by Grossgeim.

Section 3. CYRTOCARYUM DC. Prodr. X (1846) 32; Boiss. Fl. or. IV, 163; Gürke in Pflanzenf. IV, 3a, 117; Kuzn. in Mat. Fl. Kavk. IV, 2, 329. Annuals; corolla whitish, small; nutlets horizontal, reniform, netted-rugose, radially ribbed (towards ring) along sides; attachment-ring ventral, elliptic, extending along ventral, concave side of nutlet, very low.

344 16. N. ventricosa (Sibth. et Sm.) Griseb. Spic. Fl. Rum. II (1844) 93; DC. Prodr. X, 33; Boiss. Fl. or. IV, 169; Shmal'g., Fl. II, 232, Kuzn. in Mat. Fl. Kavk. IV, 2, 329; Grossg., Fl. Kavk. III, 264. — Anchusa ventricosa Sibth. et Sm. Fl. Graeca, II (1813) 58. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 100, f. I and II; Fl. Graeca, II, tab. 169.

Annual; stems few, ascending, 10—20 cm long, shortly-coarse-downy and remotely spreading-bristly especially in upper part, simple; leaves lanceolate, more or less denticulate along margin, obtuse or acute, 2—4 cm long, 0.5—0.8 (1.0) cm wide, lower leaves spatulate gradually tapering at base, median and upper leaves sessile. Cymes very short in flower, little elongating in fruit, dense, 2—3 cm long; bracts lanceolate, acute, longer than flowers; pedicels very short, drooping; calyx subsessile, fruiting calyx broadly subspherical-ovoid, slightly bristly-downy, but with rather many thin acicular bristles, the teeth $^2/_3$ as long as the undivided part, triangular-lanceolate, rather narrow and long-acuminate; corolla small, white, somewhat exceeding calyx, with small limb; nutlets 3—3.5 mm long, low, 1.5—2 mm high, beanlike-reniform, brown, finely but acutely netted-rugose, glabrous, with very low, nearly inconspicuous ventral attachment-ring. April.

Fields, waste land, a weedy plant. — European part: Crim. (near Feodosia, Sevastopol); Caucasus: E. Transc. (former Koryagin district). Gen. distr.: Bal.-As. Min. Described from Greece. Type in London.

Genus 1209. **PULMONARIA*** L.

L. Sp. pl. (1753) 135; A. Kern. Mon. Pulm. (1878)

Calyx cleft into 5 short, triangular teeth not longer than the undivided campanulate part, elongating in fruit, otherwise unchanged. Corolla violet-red or blue (sky blue), tube as long as calyx, the limb rather large, broadly campanulate, 10—15 mm across, with short lobes. Scales absent, tube with bundles of short hairs instead, glabrous or downy inside below bundles, with glabrous protective ring at base of tube. Flowers biheterostylous; anthers either under throat between bundles of hairs or at middle of tube; stigma either at level of throat or at mid-level of tube. Anthers oblong, obtuse. Stigma capitate or slightly 2-lobed. Nutlets straight, 3—4 mm high, ovoid, luminous, sparingly pubescent along ventral acute keel,
345 with obtuse apex, at base with thin, low, entire attachment-ring, sometimes tapering above it. Caruncle claviform, downy. Low, early flowering, forest herbs. Rhizome producing fertile stems and sterile bundles (rosettes) of radical leaves, markedly accrescent in the summer. Cymes paired at apex of stems, few-flowered, loose, nearly leafless.

1. Radical summer leaves cordate-ovate, rather small, long-petioled. Calyx coarse-bristly . . . . . 1. P. officinalis L.
+ Radical summer leaves gradually long tapering into petioles, if sometimes slightly constricted at petiole, then not cordate and pubescence soft, the blades narrow or broad . . . . . 2.
2. Blade of radical leaves broad in summer, 3 cm or usually broader, up to 10 cm . . . . . 3.
+ Blade of radical leaves narrow in summer, 2—3 cm, covered especially beneath with long coarse arcuate hairs and sparsely coarse-bristly. Cauline leaves narrowly lanceolate. Stems coarse-villous . . . . . 5. P. angustifolia L.
3. Flowers red and remaining (violet) red when fully open. Stems covered above with bristles. (Carpathians). . . . . 4.
+ Flowers violet-blue or sky blue when fully open. Stems covered with soft glandular bristles; leaves velutinous-hairy with fine rather soft bristles . . . . . 4. P. mollissima Kern.
4. Radical leaves narrowly elliptic in summer. Cauline leaves elongate, oblong-lanceolate. Nutlets 4—5 mm high . . . . . 2. P. filarszkyana Jav.
+ Radical leaves ovate, more coarsely hairy in summer. Cauline leaves oblong. Nutlets 3.5—4 cm high . . . . . 3. P. rubra Schott.

Series 1. Asperae Kern. Mon. 20. — Calyx sparsely covered with coarse, semi-appressed, long bristles, glandular-downy only at base. Radical leaves cordate-ovate, rather coarse-bristly.

1. P. officinalis L. Sp. pl. (1753) 135, excl. var. β. et γ.; Ldb. Fl. Ross. III, 137; Shmal'g., Fl. II, 233; G. A. Levitskii in Tr. Bot. Muz.

* From the Latin pulmo — lung, owing to the medicinal uses of the plant.

AN, VIII, 1—25; Kuzn. in Mat. Fl. Kavk. IV, 2, 336; Kryl., Fl. Zap. Sib. IX, 2266. — Ic.: Rchb. Ic. Fl. Germ. XVIII; Kern. Mon. Pulm. tab. X et XIII, f. 7, b; Javorka, Icon. tab. 412, f. 2811. — Exs.: Fl. exs. Austr.-Hung. No. 930; Hayek, Fl. Stir. exs. 379; Fl. Bohem. et Morav. exs. No. 376.

346 Annual; rhizome rather thin, 4—5 mm thick, long, curved, obliquely creeping, with cordlike, long, adventitious roots, with scarious scales, dark brown; bundles (rosettes) of radical leaves with 3—5 leaves, their mature leaves with cordate-ovate blades and petioles longer than blade, the blade ca. 5—10 cm long, thin-acuminate, dark green above with white diffuse spots at margin or dark green sparsely covered with long coarse appressed bristles, pale beneath, with same bristles; stems 15—25 cm high, rather weak, remotely spreading-bristly above, with additional small bristles and sparsely glandular-downy; covered at base with large brown scales; cauline leaves oblong, half as long, the lower two tapering to petiole at base, the upper two sessile, acute, pubescent as in radical leaves. Cymes paired, at apex of stem, nearly leafless, few-flowered, loose; pedicels erect or declinate, short, only the lowermost up to 10 mm long, short-bristly, finely but sparsely glandular-downy; calyx in fruit 10—15 mm long, narrowly campanulate, green or with blue tinge, teeth triangular-lanceolate, 2—3 mm long, acute; corolla blue-violet, tube slightly shorter than calyx, the limb campanulate, 7—10 mm across, longer than tube, tube glabrous inside under bundles of hairs at throat; nutlets 3.5—4 mm high, with 2 acute narrow keels (ventral and dorsal), black, luminous, more or less downy. April.

Oak and beech forests. — European part: U. Dns., Balt., U. Dnp., M. Dnp., Bes. Gen. distr.: Centr. Eur. Described from Europe. Type in London.

Note. Widespread in the USSR is P. obscura Dumort. (in Bull. Soc. Roy. Bot. de Belg. IV (1865) 341; A. Kern. Mon. Pulm. 30, tab. IX. — P. officinalis ssp. obscura Murb. Beitr. Fl. Südbosn. 87; Gayer in Magyar Bot. Lapok, 48. — P. officinalis L. var. γ. Linn. l. c.). — Leaves without white spots, dark green at upper side. Bristles on calyx coarser. — European part: everywhere except for the Arctic (east to western slope of Urals), Crim.

Hybrid P. officinalis × P. mollissima Kern. (Mon. Pulm. 32; Levitskii in Tr. Bot. Muz. AN, II, 5 (1905) 81. (former Kiev Province, Cherkassy County, Gorodishche, Levitskii). — Blade of radical leaves ovate-orbicular, tapering obtusely or cuneately to petiole, distinctly nerved, sparsely pubescent, shortly, coarse-bristly. Calyx with coarse bristles (GRF, No. 2181; M. Dnp.: Cherkasy, Gorodishche).

Series 2. Molles Kern. Mon. Pulm. 33. — Blade of summer radical leaves
347 broadly elliptic, gradually tapering at base to petiole, covered with soft, semi-appressed hairs, somewhat mixed with glandular down; young leaves nearly velutinous, soft. Stems in upper part and calyx downy with spreading, rather long, glandular hairs.

2. P. mollissima Kern. Mon. Pulm. (1878) 47; Shmal'g., Fl. II, 233; Kuzn. in Mat. Fl. Kavk. IV, 1, 338; Kryl., Fl. Zap. Sib. IX, 2256. —

P. mollis Ldb. Fl. Ross. III, 137; Boiss. Fl. or. IV, 170, non Wolff. — P. montana ssp. mollissima (Kern.) Nym. ex Hegi, Ill. Fl. V, 3, 2216. — Ic.: Kern. l. c. tab. III; Javorka, Icon. tab. 413, f. 2813. — Exs.: GRF, No. 1173; Hayek, Fl. Stir. exs. No. 1027; Fl. exs. Austro-Hung. No. 929; Fl. Hung. No. 567; Fl. Bohem. et Morav. exs. No. 865; Fl. cauc. exs. No. 97. —

Perennial; rhizome rather thick, short, black, producing large bundles of cordlike adventitious roots; radical leaves large, up to 50 cm long, 8—10 cm wide, elliptic, very gradually long-tapering at base into petioles, petioles shorter than blade in the Siberian and longer in the Caucasian race; blades often slightly velutinous, especially in upper dark green side, pale beneath and more sparingly pubescent with appressed thin rather long hairs sometimes mixed with smaller ones, without glandular down; stems usually sturdy and rather high, 30—50 cm, sparingly pubescent below, in upper part spreading-soft-villous in addition to glandular down, base covered with large brown scales; cauline leaves usually oblong, many times narrower than radical leaves, 3—7 cm long, 1.5—2 cm wide, the two lower hardly cuneate-tapering at base, the rest sessile, subcordate at base, not decurrent, acute, softly hairy, upper leaves with mixture of fine glandular down. Cymes rather dense but becoming loose in fruit, many-flowered, sometimes 4—6 forming a corymbiform panicle; pedicels densely glandular-downy, with short and thin spreading bristles, up to 5 mm long in fruit; fruiting calyx campanulate, 10—13 mm long, beset with short, semi-appressed bristles, mainly along nerves, glandular-downy, besides, teeth triangular-lanceolate, half as long as the undivided part; corolla large, violet-blue (sky blue), larger in the short-styled individuals, limb 8—12 mm across, lobes semi-orbicular, the tube approximately as long as calyx, downy inside under bundles of hairs; nutlets ovoid, 3.5 mm high, subglabrous. April.

Forests, mainly coniferous (spruce-fir). — European part: U. Dns., M. Dnp., Bl. (right bank of the Dnieper), Bes., V.-Don (Volga), Transv.,
348 V.-Kama (Kama); Caucasus: Cisc. (often), W. Transc. (Colchis); West Siberia: everywhere; East Siberia: Ang.-Say. (to Baikal), Lena-Kol. (Lena); Centr. Asia: Dzu.-Tarb. (Tarbagatai and Dzungarian Ala-Tau). Gen. distr.: Centr. Eur., Bal.-As. Min. Described from W. Europe. Type in Vienna.

Note. This species is very close to the Central European P. montana Lej. (= P. mollis Wolff), differing from it by its nearly bristleless calyx, densely velutinous shoots, leaves not decurrent and the yellow anthers; these characters, however, are hardly constant and not specific criteria. The distribution area of this species in the USSR is fragmentary, the species is not growing in the central belt (Orlov, Tambov, Ryazan and Moscow regions). Hence its distribution is as follows: 1) Carpathians (to the Dnieper in the east); 2) beyond the Volga-Urals, stretching from here throughout the Siberian taiga up to Baikal and northward to the Lena River. Absent in the Far Eastern areas; 3) Caucasus. I found no significant difference between the specimens from these three separate parts of the distribution area; the keels on the nutlets of the Caucasian race protrude less sharply though than in the Ural and Siberian races, but this appears to be an insignificant, quantitative difference. In addition, the more abrupt tapering of the blade of the radical leaves to the petioles, as is observed in the Caucasian Pulmonaria, is repeated in some of the Siberian specimens.

3. P. rubra Schott in Bot. Zeit. IX (1851) 395; Kern. Mon. Pulm. 40; Javorka, Mag. Fl. 849; Szafer et al. Rosl. Polsk. 479.— P. transsilvanica Schur in Verh. Sieb. Ver. III (1852) 88 et Enum. pl. Transsylv. (1866) 471.— Ic.: Kern. l. c. tab. 12 and 13, f. 10; Javorka, Icon. tab. 413, f. 2815.— Exs.: Fl. Hung. exs. 568 (f. albocorollata Simk.); Boenitz, Herb. Europ. (from Yablanitsam).

Perennial; rhizome oblique, thin, with few cordlike roots, brown; radical leaves ovate, rather large, (15 cm long, 10 cm wide) acute, abruptly and roundly tapering to narrowly winged petiole almost as long as blade, blade coarsely stiff-bristly at both surfaces with few, long, semi-appressed bristles; stems 20—30 cm high, usually villous and with rather stiff, long spreading bristles, glandular-villous above; cauline leaves oblong, small, lower leaves cuneately tapering at base, upper and median leaves sessile, not very broad or very deep at base, acute, 3—8 cm long, 15—25 mm wide. Cymes rather densely few-flowered, in fruit slightly elongating, paired at apex of simple stem or forming a small corymb if stem branched above; calyx in flower tubular, 12 mm long, shortly thin-bristly and more or less glandular, teeth more or less long, the pedicels and base of calyx finely glandular; corolla red, not
349 turning blue, rather large, the limb ca. 10 mm across, the tube shorter than calyx; nutlets 3—4 mm high. April.

Mountain forests, mainly beech but ascending to the spruce-fir belt.— European part: U. Dns. (Yablonitsa, probably Tatar pass at the upper reaches of the Prut River near Vorokhta). Gen. distr.: E. Carpathians, Balkans. Described from the subalpine elevations of S. Transylvania (collected Kochi). Type in Budapest?

Note. This species is rather problematic. The Hungarian botanists accepted the above-described plant, with broad, ovate, radical leaves, as P. rubra, although Schott wrote that this is a subalpine plant. The later Hungarian botanists described P. dacica Sim. (S. filarszkyana Jav.) as an independent species, apparently arbitrarily. I never saw Schott's original specimens and for this reason I maintain the described plant as P. rubra, following the Hungarians, even if Blotskii considered it as the hybrid P. rubra × obscura (see specimens published by Boenitz and quoted by me in Exs.). Both P. rubra and its narrowleaved, subalpine derivative P. filarszkyana, represent the original features of the Carpathian flora, being its endemic plants; they can hardly be referred to the paleoendemic formations since all species of Pulmonaria are closely related. Our plants are particularly related to P. montana and P. angustifolia. It is probable that the entire complex of these species evolved only in the Pleistocene.

4. P. filarszkyana Javorka in Bot. Közl. XV (1916) 52; Ej. Mag. Fl. 849; Rosl. Polsk. 479.— P. dacica Simk. Enum. Fl. Trassylv. (1886) 406.— P. rubra var. dacica Simk. in Math. Term. Közlem. XV(1878) 583.— Ic.: Javorka, l. c. (1916) 53; Javorka, Icon. tab. 413, f. 2816.

Perennial; resembling the preceding. Rhizome thinner and longer; stems thinner, 20—40 cm high; radical leaves narrowly elliptic (for example when 30 cm long then 5 cm wide), gradually tapering straight to wide, winged petiole without any distinction; bristles more delicate and thinner; cauline leaves elongate, oblong-lanceolate, 10—12 cm long, 2—3 cm wide, tapering

nearly to the very base, upper leaves distinctly decurrent, villous-glandular only in upper part of stem. Calyx slightly longer, 15 mm, and with longer teeth; corolla always red; nutlets 4.5—5 mm high, ovoid, slightly downy. June—July.

Subalpine belt, among fallen trees (Krummholz). — European part: U. Dns. (Carpathians). Gen. distr.: E. Carpathians. Described from Maramuresh in the E. Carpathians. Type in Budapest.

Note. Almost undoubtedly this plant should be named P. dacica Simk. Javorka was too formal in ignoring Simonkai's name only because the
350 original specimens of the latter were also mixed with those now referred to P. rubra.

Series 3. Strigosae Kern. Mon. Pulm. 3; Kuzn., op. cit. 335. — Blades of summer radical leaves lanceolate or oblong-lanceolate, long-acuminate at apex, long, very gradually tapering to narrow winged petiole shorter than blade (though distinct from it), sparsely covered beneath with long, coarse arcuate bristles, remote along nerve, less remotely covered at upper surface with short, coarse downcurved bristles.

5. P. angustifolia L. Sp. pl. (1753) 135; Ldb. Fl. Ross. III, 138; Shmal'g., Fl. II, 233; Kuzn. in Mat. Fl. Kavk. IV, I, 335; Kern. Mon. Pulm. 3. — P. angustifolia ssp. azurea (Bess.) Hegi, III. Fl. V, 3, 2211. — P. azurea Bess. Prim. Fl. Galic. I (1809) 150; Ldb. Fl. Ross. III, 138. — Ic.: Javorka Icon. Hung. tab. 412, f. 2812; Rchb. Pl. Crit. CI, tab. 694; Kern. Mon. Pulm. tab. I; Stankov and Taliev, Opred. 440. — Exs.: GRF, No. 275; Woloszczak, Fl. pol. exs. No. 463; Fl. Hung. exs. No. 564.

Perennial; rhizome short, black, thin, with cordlike adventitious roots; stems low, 15—30 cm, sturdy, furrowed, villous-bristly nearly to base with coarse long slightly recurved hairs; radical leaves long, narrow, 20—30 cm long, 2—3 cm wide, petioles coarsely bristly-villous; cauline leaves lanceolate or lanceolate-linear, acute, sessile, slightly decurrent, both surfaces with coarse hairs and bristles, the base covered with large brown scales. Scorpioid cymes usually paired at apex of stem, rarely forming corymbiform inflorescence with lateral branches, bracts narrow small; fruiting calyx on short, 3—5 mm (lower to 10 mm), curved, bristly pedicels, campanulate, slightly smaller than in preceding series, 8—12 mm long, with sparse coarse bristles, almost without glandular down, its teeth triangular-oblong, rather long, $\frac{1}{3}-\frac{1}{2}$ length of calyx; corolla violet-blue (sky blue), slightly smaller than in Molles, campanulate limb ca. 10 mm across; nutlets ovoid, 3—3.5 mm high, subglabrous. April.

Broadleaved forests, pine forests, sandy soil. — European part: U. Dns., Balt., Lad.-Ilm. (Pskov), U. Dnp., M. Dnp., U. V., V.-Don, Bess., V.-Kama (SW). Gen. distr.: Centr. Eur., Bal.-As. Min. Described from W. Europe (Sweden). Type in London.

351 Note. In the USSR this Pulmonaria has the smallest area of distribution (not counting the Carpathian species). It does not extend far south or north, is absent south of Khar'kov and on the Volga, and does not reach Saratov. It is also absent in the Ladoga-Il'men area (except Pskov) and in

the northern and northeastern forest regions, nor does it extend beyond the Volga. It is absent in the Urals.

P. azurea Bess. was described from Volhynia (Besser mistook the plant later described as P. mollissima Kern. for P. angustifolia L.). To some extent Besser was right because the Linnaean plant is not uniform. Hence, Rouy (Fl. Fr. X, 294) records P. azurea for France, presenting it as synonymous with P. angustifolia (L. Sp. pl. (1753) 135, certe pro parte). However, Hegi synonymizes P. azurea with P. angustifolia L. s. str. According to Ledebour in P. angustifolia the corolla tube is downy inside but glabrous in P. azurea.

The hybrid P. officinalis × P. angustifolia occurs sporadically. At times it is very much like P. mollissima Kern, or like P. officinalis or P. angustifolia. For example, GRF, No. 2180 (Kiev, Goloseevskii forest) and a plant from Volsk (very similar to P. mollissima Kern.).

Tribe 6. MYOSOTIDEAE Rchb. Ic. Fl. Germ. XVIII (1857) 70. — Small, thin, delicate perennial, biennial or annual mesophyllous herbs, without coarse hairs. Flowers medium-sized or small, brachymorphic, very rarely nearly mesomorphic; calyx divided into 5 narrow lobes or 5-toothed, slightly elongating in fruit, otherwise unchanged; corolla sky blue or white, typically radially 5-merous and brachymorphic, its lobes "twisted"-imbricate in bud; anthers usually inside corolla tube, like the short style, rarely (not in our species) exserted. Scales well developed, rarely (not in ours) absent. Nutlets small, erect, smooth, pericarp thin, dorsoventrally compressed, with broad, rounded, smooth back, weak ventral keel, margins acute to rimmed, usually oblong (viewed from the back), attached to flat torus by small, flat or slightly tapering basal cicatrice, sometimes extended downward into narrow caruncle.

Note. This tribe should presumably be a subtribe of the Lithospermeae, very close to the Trigonotidinae, with which it unquestionably shares a relationship in structure and appearance. Trigonotidinae and Myosotideae represent the primary (Paleogene) Arctic-tertiary group, the precursors of the ancient Mediterranean genera of Lithospermeae, Cynoglossinae and
352 Eritricheae, which (through Amblynotus Johnst.) is also very close to Myosotideae. In contrast to the subtropical Trigonotidinae, the Myosotideae (except Mertensia) probably represent the only boreal, criophyllous group of Boraginaceae. The "twisted" gestivation of the corolla lobes distinguishes them morphologically from the Trigonotidinae.

Genus 1210. **MYOSOTIS*** L.

L. Sp. pl. (1753) 31; DC. Prodr. X, 104 (section I Eumyosotis DC and IV. Strophiostoma Endl.).

* Ancient name of the plant, from the Greek myos otis (myosota) — mouse ear.

Corolla brachymorphic, mostly blue, anthers in tube, scales in throat of corolla. Perennial, biennial, often annual herbs, with delicate leaves and thin bristles or hairs (without coarse bristles or large white basal tubercles characteristic for the xerophyllous African and ancient Mediterranean genera), sometimes glabrous or subglabrous, in northern forests, meadows, marshes, steppes and in the subtropical zone, high in mountains or near water, or delicate early ephemera in mountain semi-deserts and semi-steppes.

1. Nutlets on pedestal, with small white caruncle (subgenus Strophiostoma) . . . . . 2.
+ Nutlets different (subgenus Eumyosotis) . . . . . 5.
2. Perennial plant. Rhizome long-creeping. Corolla limb flat, large, 6—8—10 mm across. Calyx usually with straight appressed hairs; hamate hairs absent, even at base of calyx. Peduncles long, horizontally curved, 2—3 times as long as calyx. Scorpioid cymes leafless, long. Leaves oblong or spatulate-oblong. Stems 30—50 cm high. (In mountain forests, mainly W. Caucasus) . . . . . 1. M. amoena (Rupr.) Boiss.
+ Annuals, 10—30(40) cm high, usually spreading-branching from base. Corolla smaller, 2—4(5) mm across; calyx with spreading-hamate hairs at base (very closely related species) . . . . . 3.
3. Scorpioid cymes (racemes) distinct, nearly leafless, only 1—2 with bracts, beneath peduncle, the others without, or all leafless. Peduncles 2—3 times as long as calyx (Caucasus). (M. propinqua Fisch. et Mey. s.l.) . . . . . 4.
353 + Scorpioid cymes (racemes) little differentiated, leafy except for uppermost. Peduncles longer, the lower 3—4 times as long as calyx. Corolla small, 2—4 mm across. (European part, nearly throughout Caucasus; rare in W. and Centr. Siberia) . . . . . 4. M. sparsiflora Mikan.
4. Corolla 4—5 mm across, limb flat . . . 2. M. propinqua Fisch. et Mey.
+ Corolla 3—4 mm across, patelliform (eastern part of Caucasus) . . . . . 3. M. pseudopropinqua M. Pop.
5. Calyx covered with straight, apically hamate, not curved, usually adjacent or half-remote, but not spreading, hairs (series Palustres and Littorales) . . . . . 6.
+ Calyx covered at least in lower part with nearly vertically spreading, apically hamately or furcately curved hairs (series Sylvaticae and Arvenses) . . . . . 15.
6. Perennials. Calyx 5-toothed, cleft for $\frac{1}{3}$ or $\frac{1}{2}$ into triangular teeth, with short, sparse rarely dense hairs. Corolla medium-large, limb rotate, 4—10 mm across. Marshes or damp, muddy meadows . . . . . 7.
+ Annuals, sometimes very small. Calyx as in preceding group (Palustres 2. Annae), corolla 2—3 mm across, or more deeply dissected, with lanceolate teeth and dense long straight, not completely appressed hairs, and then corolla especially small (Littorales) . . . . . 11.

7. Corolla 6—10(12) mm across. Plant usually larger (30—80 cm high) and sturdier. Style often longer, stigma visible between calyx teeth (after falling of corolla, when calyx enlarging). (M. palustris Lam. s.l.) . . . . . 8.

\+ Corolla 4—6 mm across. Stems and leaves always with appressed bristles, generally sparse; rhizome without bundles of leaves or sterile shoots. Calyx also smaller, style short, never protruding from between calyx teeth. Leaves commonly obtuse, sparingly pubescent . . . . . 6. M. caespitosa Schultz.

8. Plant with appressed, sparser hairs, spreading hairs absent . . . . . 9.

\+ Stems (lower part), branches, sometimes also leaves with long spreading bristles . . . . . 10.

9. Bristles on leaves, even the upper, directed toward apex of leaves on both surfaces. Leaves delicate, shady. (W. European part of USSR). . . . . 5. M. palustris var. strigulosa M. et K.

\+ Bristles at lower surface of lower cauline leaves directed downward toward base of leaves, or directed toward apex above.

354 Plants of exposed sites, swampy meadows and swamps. (Throughout Siberia, E. European part of USSR, rarely in west) . . . . . 5. M. palustris var. nemorosa Schmalh.

10. Stems spreading in lower part, with more or less dense, sometimes very sparse bristles, upper part and branches with or without appressed hairs. Racemes not very long. (European part of USSR, east to the Volga, south to steppe belt). . . . . 5. M. palustris Lam. (var. memor Kitt.).

\+ Stems in lower part with appressed bristles, branches elongate with spreading bristles. Racemes loose, very long. (Rare in European part of USSR, in forest belt) . . . . . 5. M. palustris var. laxiflora M. et K.

11. Calyx cleft to half into broad triangular teeth, covered with few, completely appressed short bristles. Corolla 2—3 mm across. (Palustres 2. Annae) . . . . . 12.

\+ Calyx cleft for more than half into lanceolate teeth, rather densely covered with long straight, not quite appressed hairs. Corolla 1—2 mm across. (Littorales). . . . . 13.

12. Pedicels longer, 1—2—3 times as long as calyx; the latter 4—6 mm long in fruit, campanulate. Racemes few-flowered, very loose. Nutlets 1.5 mm high. Shores of Baltic Sea (type) and banks of water bodies in continental parts (special form var. nanella Kusn.?) . . . . . 7. M. baltica Samuels.

\+ Peduncles shorter than or as long as calyx. Calyx in fruit 3—4 mm long. Racemes many-flowered, short, rather dense, 3—8 cm long. Nutlets less than 1 mm long. (Grows in Talysh, Colchis and along the Araks) . . . . . 8. M. sicula Guss.

13. Peduncles horizontal or at 45° to axis, thin, almost 3 mm long, approximately as long as calyx. Stem well-proportioned, 5—20 cm high (with racemes), few-leaved. Racemes loose. Corolla blue. (In steppes, Kharkov and Volsk to Mugodzhar Hills) . . . . . 11. M. ucrainica Czern.

+ Peduncles short, thickened, at a slight angle to or appressed to axis. Stem slightly developed, few-leaved or obsolete . . . . . 14.

14. Stem more developed than in the following, less than in the preceding species, 2—10 (to 15) cm high, with few leaves below racemes. Peduncles 2—4 mm long, thick, obliquely spreading or appressed to axis. Calyx in fruit 3—4 mm long. (Crimea, southern shore) . . . . . 10. M. idaea Boiss. et Heldr.

355 + Stem (3)5—10 cm high, dwarf specimens without leaves above rosette. Fruiting racemes narrow, compact, beginning close to ground. Peduncles thick, turned upward, nearly appressed to axis, 2—3 mm long. Fruiting calyx 2—3 mm long, narrow, nearly tubular-campanulate, with divergent teeth; corolla white. (Crimea, southern coast, rocks along seashore) . . . . . 9. M. litoralis Stev.

15. Perennial, sometimes biennial-triennial species; rhizome thicker if perennial, thinner if biennial-triennial, producing fertile stems and sterile rosettes or more or less long sterile shoots. Corolla larger, limb 4—10 mm across. (Series Silvaticae) . . . . . 16.

+ Annual or biennial (overwintering as radical rosette or reduced sterile shoots produced from lower part of stem). Corolla small, campanulate limb 1—3 mm, in one species (M. heteropoda) 4—6 mm across (Series Arvenses) . . . . . 22.

16. Perennial, with reduced, crowded, erect stems, rhizome and rosettes, usually xeromorphous with stiff, narrower, antrorse leaves, with dense grayish hairs. Calyx densely hairy, grayish or sericeous, not abscissing. Corolla brilliant blue, large. Nutlets obtuse, more distinctly rimmed at apex; stalk larger, transversely elongating. (Steppes in European part of USSR and Siberia, mountains of the Crimea, Caucasus and Centr. Asia). (Silvaticae 2. Alpestres (M. alpestris s.l.)) . . . . . 17.

+ Biennial-triennial, furcate with thin somewhat creeping rhizome producing more or less elongate sterile shoots. Leaves mesophyllous, delicate, thinly membranous, oblong, green. Pedicels thin, long, nearly horizontal. Calyx abscissing, gray-hairy, with copious spreading hamate hairs. Corolla less brilliantly blue or smaller. Nutlets with small oval cicatrice and acute apex. (Western forests of European part of USSR, with disjunct distribution area in the Urals, Altai, and in the taiga of Central Siberia). (Silvaticae 1. Eu-Silvaticae). (M. silvatica s.l.) . . . . . 19.

17. Upper cauline leaves broad, oblong, firm, grayish. Pedicels short, directed upward. Calyx nearly white or sericeous-tomentose, with very few hamate hairs. (In the USSR confined to subalpine belt of the Carpathians and high mountain belt of the Caucasus
356 (where it grows alongside numerous hybrids with M. suaveolens)) . . . . . 17. M. alpestris Schmidt s. s.

+ Upper and median cauline leaves upright, lanceolate or lanceolate-linear . . . . . 18.

18. Leaves gray-downy-villous. Stems sturdy, erect, markedly pubescent. (Mountains of the Crimea, Caucasus and Centr. Asia, steppes from the Carpathians to Baikal and Lena, Amur, Kamchatka) . . . . . 16. M. suaveolens W. et K.

+ Leaves subglabrous, of variable width, often spreading. Stems low, 5—10 cm high, weak, often glabrous, sometimes villous. Corolla smaller than in M. suaveolens. Very polymorphic, transitional species related to M. suaveolens. (Arc. Eur., Arc. Sib., from Nov. Z. to Kamchatka, Caucasus, Altai) . . . . . 18. M. asiatica Schischk. et Serg.

19. Corolla tube distinctly longer than calyx (though not as much as in the Centr. European M. variabilis); after falling of corolla style more or less markedly exserted from teeth of small (1.5—2 mm long) calyx. Corolla 4—5 mm wide. Sterile shoots short, 2—5 cm long. (Lower Yenisei (Turukhansk); in Achinsk and Krasnoyarsk there occurs a form intermediate with M. krylovii) . . . . . 15. M. pseudovariabilis M. Pop.

+ Corolla tube as long as calyx or shorter. Style short, not visible between calyx-teeth and in any case not exserted from them . . . . 20.

20. Sterile shoots very long (15—20 cm). Leaves oblong, the upper short-acuminate. (In mountain taiga of Altai, Kuznetsk Ala-Tau, Sayans, Centr. Urals (Zlatoust) with Abies sibirica predominating) . . . . . 13. M. krylovii Serg.

+ Sterile shoots short, 2—5 cm long . . . . . 21.

21. Upper leaves short-acuminate, almost like those of preceding species (W. European part of USSR to Moscow Region, Kirov) . . . . . 12. M. silvatica Hoffm. s. s.

+ Upper leaves long-acuminate, cuneate at apex, otherwise as in preceding species (S. Sakhalin). . . . . 14. M. sachalinensis M. Pop.

22. Peduncles with short appressed hairs, longer, usually as long as calyx or longer, rarely shorter, mostly horizontally spreading . . . 23.

+ Peduncles short, several times shorter than narrow calyx, spreading-downy (hairy); scorpioid cymes borne in axils of upper leaves, i. e., first flowers of racemes, with bracts or short appressed-downy pedicels borne above leaves (leaves wide) . . . . 26.

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23. Racemes borne low, with first flowers of raceme above upper leaf of stem or in its axil. Peduncles longer, at least the lower (in axil of leaf, or below) slightly exceeding calyx. Racemes more compact. Calyx short-campanulate, open . . . . . 24.

+ Racemes very loose, long, often longer than leaf-bearing part of stem, or as long, starting above upper stem leaf. Peduncles as long or to ½ as long as calyx. Calyx longer and narrower than in preceding . . . . . 25.

24. Corolla larger than in all other Arvenses, its limb 4—6 mm across. Lower peduncle of raceme in axil of upper leaf, longer than calyx, usually arcuately curved downward, above leafless, as long as calyx or shorter. Racemes rather loose. Leaves oblong, sparsely villous. Stem 10—20 cm high, thin. (Transcaucasia) . . . . . 20. M. heteropoda Trautv.

+ All peduncles above upper leaf, hence raceme ebracteate, peduncles usually 1½—3 times as long as calyx. Corolla small, blue. Racemes rather compact. Leaves narrower, lanceolate-spatulate, the upper lanceolate, downy-villous. Stem high (10—40 cm), sturdier than in preceding species. Leaves numerous on stem,

dense. Racemes always shorter than leafy part of stem. There are sturdier biennial forms with slightly larger corolla limbs (3—4 mm across). (Mostly a weed in European part of USSR, West and Central Siberia, Caucasus, not in Centr. Asia.) . . . . . 19. M. arvensis Hill.

25. Corolla tube as in preceding, almost as long as calyx. Corolla small, blue; very thin, exquisite plant. Peduncles filiform, nearly as long to half as long as calyx. Racemes loose, long, commencing, 2—3(5) cm above upper stem leaf, scorpioid not furcately curved at apex. Stem, leaves few (3—5) short, oblong or lanceolate, obtuse. (Mostly Centr. European. In the USSR, usually in the Crimea, in the Transcarpathian Region, Baltic area (Ezel and Dago islands); in the Caucasus confined to Dagestan) . 22. M. collina Hoffm.

\+ Corolla tube distinctly longer than calyx ($1\frac{1}{2}$ times). Corolla yellow turning pink, finally blue. Pedicels $\frac{1}{2}$ to $\frac{1}{3}$ length of calyx, calyx larger than in preceding species (4—5 mm) long; racemes slightly less removed from upper stem leaf, such long racemes at apex distinctly scorpioid. Leaves longer, lanceolate to linear. (Very rare, confined to westernmost part of European part of
358 USSR: Baltic Republics, Kiev area; introduced in the Caucasus near Akhali — Afoni) . . . . . 25. M. versicolor Smith.

26. Peduncles short with appressed down, horizontal or hamately curved downward, $\frac{1}{2} - \frac{1}{3}$ length of small, open calyx. Racemes very thin, loose, shorter than leaf-bearing part of stem. Plant sturdy like M. arvensis, 30—50 cm high. Leaves broad and large, the lower spatulate to oblong-lanceolate, to 8 cm long, 2 cm wide, the upper shorter, oblong, acute, all leaves delicate, mesophyllous. Stems often with sterile lateral branches below; probably an overwintering biennial. Corolla blue, small. (Confined to Adzhar Colchis; in Abkhazia with transitions to M. arvensis) . . . . . 21. M. lazica M. Pop.

\+ Peduncles short (several times shorter than calyx) with spreading down. Plants small, 5—15 cm high, with small oblong-linear leaves and narrow slightly pyriform-tubular calyx. Flowers very small: limb of corolla 1—1.5 mm across . . . . . 27.

27. Peduncles thick, 0.5—1 mm long, more or less spreading, not upright. Plants usually multicaulescent, with rather dense gray spreading down. (Usually in European part of USSR, not above 60° N., Crimea, Caucasus, Centr. Asia, rarely in West Siberia, absent further east) . . . . . 23. M. micrantha Pall.

\+ Peduncles 1—1.5 mm long, recurved, thinner. Drooping calyx nearly appressed to axis, its base more elongate, pyriform-claviform, more delicate. Plants of rocks and shade. Racemes thin, often flexuose, elongating. (Centr. Asia) . . . 24. M. refracta Boiss.

Subgenus 1. Strophiostoma (Turcz.) M. Pop. — Genus Strophiostoma Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 258; Kryl., Fl. Zap. Sib. IX, 2275. — Sect. Strophiostoma DC. Prodr. X (1846) 112; Boiss. Fl. or. IV, 234, 241; Gürke in Pflanzenf. IV, 3, 119. — Peduncles long,

declined, thickened below calyx. Nutlets on stalk (cicatrice), with white cuneate downward directed caruncle (derives from tissue of thickening peduncle below calyx). Delicate perennial forest species and annual species, with delicate mesophyllous leaves and long, drooping peduncles. Calyx cleft to $^2/_3$, with acute lobes, open, covered mainly with semiappressed straight hairs, sometimes slightly hamate at base of calyx. Peduncles 2—4 times as long as calyx.

359 1. M. amoena (Rupr.) Boiss. Fl. or. IV (1879) 241; Kuzn. in Mat. Fl. Kavk. IV, 2, 345; Grossg., Fl. Kavk. III, 235; Kolak., Fl. Abkh. IV, 26. — Strophiostoma amoenum Rupr. in Bull. Acad. Sc. Pétersb. XIV (1856) 229. — Exs.: GRF, No. 828.

Perennial, sometimes flowering annual. Rhizome often present, creeping, cordlike, sometimes absent, root collar or rhizome (if creeping) usually bearing several fertile and some shorter sterile stems; the former rather thick, sturdy, (15)20—30(50) cm high, erect or arcuately ascending at base, ribbed, with sparse spreading villous hairs, appressed-hairy in inflorescence, more or less branching, especially above; leaves of sterile shoots delicate, thinly membranous, mesophyllous, usually spatulate-oblong or otherwise obovate-oblong, obtuse, distinctly tapering to petiole, which usually does not exceed blade; lower cauline leaves oblong or lanceolate-spatulate, the upper sessile, oblong or oblong-lanceolate, usually acute; leaves of variable dimensions, sparsely covered with thin spreading hairs; radical leaves 3—10 cm long, to 1.5—3 cm wide, the cauline leaves 2—4 cm long, 1—1.5 cm wide, some individuals, presumably from light sunny habitats, have narrower, oblong-lanceolate or even smaller, lanceolate leaves. Racemes leafless, 2—3 at apices of stems, reaching 10—15 cm in length, loose, long, with up to 10—15 flowers; pedicels thin, nearly horizontally spreading, ca. 1 cm long, elongating to 1.5—2 cm in fruit and then 2—3 times as long as grayish calyx, with appressed or semiappressed straight hairs (hamate hairs absent), ca. 2 mm long in flower, 5—6 mm long in fruit, with lanceolate, acute lobes; corolla sky blue, tube short, $1^1/_2$ times as long as calyx, limb flat, broad, 6—10 mm across (average 8 mm), with oval, obtuse lobes; scales in throat broad, villous, whitish, forming crown; nutlets black, trihedral-oblong, 1.5 mm long; caruncle ca. 0.5 mm long. June—July.

Mountain forests in central belt, mainly in the western half of the Main Range of the Caucasus, also in the western half of the Lesser Caucasus. — Caucasus: W. Cisc., W., E. and S. Transc. Endemic? (As. Min. — Lazistan?). Described from specimens cultivated in the Petersberg Botanical Garden from seeds labeled M. montana caucasica from Nikitskii Botanical Garden. Ruprecht gives a more precise origin: "Iberia Imeretia". In the herbarium there are Caucasian specimens described by him, collected much later than the original year of description (1856). Hence the type
360 should be given as absent (cultivated plant), though the lectotype could be Ruprecht's specimen (with his signature: Strophiostoma amoenum (inodorum); between Kvishety and Kaishaur, flowers, 10 V 1861).

Note. This species may be considered as the ancestor of the annual species of this section. It is especially close to M. propinqua Fisch. et Mey, from which it differs mainly in being perennial. Its rhizome is generally creeping, branching and cordlike, though sometimes it is obsolete.

As Ruprecht (l. c.) has indicated the annuals may blossom; in any event even with a perennial rhizome the plant lives for a few years [sic]. Other distinctions from the perennial species are the absence of hamate or curved hairs at the base of the calyx and the larger limb of the corolla. However, forms transitional between M. amoena and annual M. propinqua may well turn up.

2. M. propinqua Fisch. et Mey. in Bull. Soc. Nat. Mosc. XII (1839) 163, nomen; Ldb. Fl. Ross. III, 148; Boiss. Fl. or. IV, 241, p. p. — Strophiostroma sparsiflorum var. turczaninoviana Trautv. in Tr. Bot. Sada, VII (1881) 488. — M. sparsiflora ssp. propinqua Kusn. Mat. Fl. Kavk. IV, 2 (1913) 351; var. turczaninoviana Trautv. l. c. 352. — Strophiostoma propinquum Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 259; Rupr. in Bull. Acad. Sc. Pétersb. XIV, 230. — S. sparsiflorum var. propinquum Kryl., Fl. Zap. Sib. IX, (1937) 2276.

Annual or perennial; stems 10—30 cm high, weak, branching from base with more or less sparse spreading villous hairs, often glabrous, with rosettes and even with sterile shoots; leaves delicate, membranous mesophyllous, large and delicate, very similar to those of the preceding species; radical or sterile shoots spatulate-oblong, obtuse, tapering to 4—6 cm long petiole, as long as blade, cauline leaves sessile, oblong, 3—5 cm long, 1.5—2 cm wide, obtuse or acute, rarely (in light-loving plants) reduced, 1—2 cm long, with very sparse spreading hairs. Racemes leafless, loose, to 10 cm long; peduncles $1\frac{1}{2}-2$ times as long as calyx, 3—10 mm long, horizontally spreading with semiappressed down; calyx 2 mm long in flower, to 3—6 mm in fruit, with spreading hairs, and curved, hamate hairs at base of calyx; corolla pale blue, its tube nearly as long as calyx, its limb flat, 4—6 mm across; nutlets brown, 1.2 mm long, caruncle to 0.5 mm long. April—May.

Forests. — Caucasus: Tal. Gen. distr.: N. Iran (Gilan, Astrabad). Described from Astrabad. Type in Leningrad.

Note. This is the true M. propinqua Fisch. et Mey., described from Astrabad (Karelin). Turchaninov (l. c.) rightly wrote "floribus duplo majoribus a praecedente statim dignoscitur"; later authors (Ledebour,
361 Boissier, Trautfetter, Kuznetsov, Grossgeim) accepted as M. propinqua form with small flowers, not larger than M. sparsiflora. Boissier, too, writes: "Valde affinis praecedenti (M. sparsiflorae), flores et corollae erronee majores dicti" referring to Balansa's and Buhse's specimens and to Karelin specimens which he saw. Indeed, the late fruiting specimens from Astrabad (type M. propinqua), though they do not have a large corolla, certainly did have one. Even the flowers preserved at the apex of the raceme have a larger corolla than M. sparsiflora. I also saw in bloom the large-flowered specimens from Bender-Gyaz from the same part of Astrabad (Sintenis, Iter transcaspicopersicum, 1900—1901, No. 1506). Verifying Ledebour and Boissier, Trautfetter described the type form M. propinqua as received by him from Lenkoran, as var. turczaninowiana Trautv., instead of the specimen from Kodzhory, which he accepted as the type.

3. M. **pseudopropinqua** M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 305. — M. propinqua Boiss. Fl. or. IV, 241, p. p. non. Fisch. et Mey. — Strophiostoma sparsiflorum var. propinqua Trautv. in Tr. Bot. Sada, VII (1881) 488; ssp. propinqua Kusn. in Mat. Fl. Kavk. IV, 2, 351 (excl. var. turczaninowiana Trautv.).

Annual, perennial; a race of the preceding, to which it is very similar; with leaves usually less mesophyllous, oblong-lanceolate, acute. Corolla small, with concave limb, 2—3 mm across. April—May.

Forests and shrubs. — Caucasus: E. Transc. (Shemakha, Terter, Kirovabad, Kodzhory), S. Transc. (Erevan). Gen. distr.: Iran. (NW, Iezd), Bal.-As. Min. (As. Min. —often). Described from Nakhichevan ASSR (Shakhbuz area, between Kakhyana and Bichenak). Type in Leningrad.

4. M. **sparsiflora** Mikan ex Pohl in Hoppe, Neues Bot. Taschenbuch, Jahr 1807, 74 et 123; Ldb. Fl. Ross. III, 148; Boiss. Fl. or. IV, 241; Shmal'g., Fl. II, 235; Kuzn. in Mat. Fl. Kavk. IV, 2, 348; Hegi, III. Fl. V, 3, 2175. — Strophiostoma sparsiflorum Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 258; Kryl., Fl. Zap. Sib. IX, 2275. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 1324 (123) f. III; Hegi, l. c. f. 3131. — Exs.: GRF, No. 729; Fl. exs. Austro-Hung. No. 165; Fl. pol. exs. No. 369.

Annual; stems usually single, thick, juicy, faceted, erect or slightly decumbent, often branching from base, weak specimens only above, sub-
362 glabrous, with very sparse spreading hairs, semiappressed and sparsely downy above; rosettes absent; lower cauline leaves spatulate to oblong-lanceolate or lanceolate, obtuse or acute, the upper sessile, oblong-lanceolate, mostly acute, all leaves delicate, membranous, mesophyllous, 2—4 cm long, 1—1.5 cm wide, green, with very sparse spreading hairs. Racemes slightly differentiated, few-flowered, very loose, with 3—5(7) flowers, numerous if stem with many branches, few if branches few; nearly all flowers in axils of bracts, these nearly identical with upper cauline leaves, only slightly smaller, uppermost racemes 1—2-flowered, ebracteate, the lower flowers very low, in bifurcations of stem; pedicels, especially in fruit, thin, long, the lower to 2 cm long, arcuately drooping or horizontal, with short appressed down. Flowers small; calyx in flower 1—1.5 mm long, in fruit 5—6 mm, and then open, with linear-lanceolate acute lobes, covered with sparse, semi-spreading hairs, with short hamate spreading hairs at base of calyx; corolla pale, light blue or nearly white, very small, hardly exceeding calyx, limb concave (short-campanulate), 2—3 mm across; nutlets broader, flat, dorsally ovoid, 2 mm high, brown; caruncle shorter than in preceding species. May—June.

In light, slightly damp, often weedy forests, shrubby formations, shady streams. — European part: nearly everywhere, except the Arctic; West Siberia: rare (Tyumen, Eniseisk — in gardens); Caucasus: Cisc. and W. Transc. (very common); Centr. Asia: Dzu.-Tarb., T. Sh. (eastern part, approximately to Alma-Ata and Osh). Gen. distr.: Centr. Eur., Bal.-As. Min. Described from Czechoslovakia.

Note. This widespread European species, known and studied long before the other species of the subgenus, may be regarded as the most reduced descendant of the perennial species of Strophiostoma. Phylogenetically, the series M. amoena — M. propinqua — M. pseudopropinqua —

M. sparsiflora appears so complete as to leave no doubt about this. This does not imply that M. sparsiflora developed in the Caucasus, or produced Caucasian species, although such a view is possible. In the mountains of Europe there may have existed, until the Pleistocene, a species similar and related to M. amoena, i. e., a large-flowered perennial which gave rise to the annual M. sparsiflora. In herbaria M. pseudopropinqua and M. sparsiflora — which grow abundantly in the Caucasus — are often difficult to distinguish. M. pseudopropinqua seems to be darker blue, and should be readily distinguished in natural surroundings. M. sparsiflora grows mainly on the northern slope of the Main
363 Range and in the area of Colchis. Both species seem to grow in Dagestan and Kuban; with M. pseudopropinqua predominant in the more arid, subtropical parts of the Caucasus. Only field observations will show whether there exist transitional forms between the two species.

Subgenus 2. Eumyosotis DC. — Sect. Eumyosotis DC. Prodr. X (1846) 105; Boiss. Fl. or. IV, 234; Kuzn. in Mat. Fl. Kavk. IV, 2, 353; Gürke in Engl. — Pr. Pflanzenf. IV, 3, 119. — Peduncles usually not as long as in preceding subgenus, not thickened below calyx. Pedestal of attachment of nutlets without caruncle. Plants usually growing in open, sunny, rarely in woody habitats, perennial and annual, cryophyllous, with narrower and more sclerophyllous leaves.

Series 1. Palustres M. Pop. — Hairs on calyx straight, appressed, not spreading, not hamate. Calyx cleft for $\frac{1}{2}$—$\frac{1}{3}$. Perennial and annual species.

A. Perennes

Perennials. Calyx cleft to half into short teeth.

5. M. palustris Lam. Fl. Fr. II (1778) 283; With. Arr. Brit. pl. ed. 2, 225, pro Scorpioides palustris; Ldb. Fl. Ross. III, 143; Boiss. Fl. or. IV, 234; Shmal'g., Fl. II, 234; Kryl., Fl. Zap. Sib. IX, 2267. — M. scorpioides β. palustris L. Sp. pl. (1753) 131. — M. scorpioides L. ex Hegi, III. Fl. V, 3, 2161 (scorpioides), 2163 (ssp. palustris); Grossg., Fl. Kavk. III, 266. — Ic.: Hegi, l. c. tab. 221, f. 4; Rchb. Ic. Fl. Germ. XVIII, tab. 1320, f. I, III. — Exs.: Fl. pol. exs. No. 653.

Perennial; rhizome creeping, with short underground shoots; stems usually single at apex of rhizome, erect or ascending and then rooting in spreading part, rather thick, high, usually ca. 40—50 cm high, rarely 20—30, or to 60—70 cm high, in lower part with fine villous hairs, rarely glabrous, in upper part slightly appressed-downy, usually simple, rarely slightly branching mainly above; leaves lanceolate to oblong-lanceolate or linear-lanceolate, rather large, 3—8 cm long, 5—20 mm wide, delicate, green, membranous, lower leaves (and leaves on sterile shoots, if present) gradually tapering to base, slightly spatulate, obtuse, upper leaves sessile, smaller, acute, with sparse appressed bristles on tubercles or glabrous. Racemes quite distinct, solitary or paired at tips of stems (and few branches),

364 loose, rather short at first, elongating, few-flowered, leafless; flowers large, largest in the genus, delicate blue; pedicels long, (3)5—10 mm, in fruit horizontal or even arcuately recurved, bristles sparse, fine, appressed, and rather large; calyx campanulate, cleft for $^1/_3$ into broad triangular teeth, ca. 2—3 mm long, with sparse, fine appressed bristles, to 5—6 mm in fruit; corolla pale blue, its limb 8—12 mm across, flat, with ovate lobes; tube short, as long as calyx; scales in throats forming crown obstructing tube; white or yellow, broad, papilliform; style usually long, exserted from calyx after abscission of corolla; nutlets oblong, trihedral, black, 1.5—2.5 mm high. May—July.

Forest belt, streams, shores of other water bodies, ditches.— European part: mainly west to Kola Peninsula and south to Kherson, southeast to the Don and Middle Volga (Khvalynsk, Volsk); Caucasus: Cisc., W. Transc.; West Siberia: U. Tob., Alt.; East Siberia: Ang.-Say., Yenis., Lena-Kol. (east to the Lena), Dau. **Gen. distr.**: Scand., Centr. Eur., Bal.-As. Min., Mong., N. Am. Described from Europe. Type in London.

Note. In this rather polymorphic plant many races have been distinguished as species or varieties. I consider all these forms as derived, or just forming, from crossing with M. caespitosa. N. M. Pavlova (Zhurn. Russk. bot. obshch. 14 (1930) 425—452) analyzes many of these. Purely descriptive systematics has confused these races, especially in Eastern Europe; I confine myself to the most prominent of these.

The most common type (from the formal point of view) is var. memor Kittel (Fl. Deutschl. ed. II, I (1944) 421.— var. vulgaris DC. Prodr. X (1846) 105.— var. genuina Gren. et Godr. Fl. Fr. II (1850) 528).— Lower half of stem villous, lower leaves with remote hairs. Flowers large. Calyx covered with sparse bristles. Style exserted between calyx teeth (not always). Close to this, there seems to come M. lithuanica Bess. in herb. (M. palustris var. lithuanica (Bess.) Schmalh., Fl. II, 234.— M. scorpioides micrantha Opiz), which has a less densely pubescent calyx (Pl. Finl. exs. No. 2056). Pavlova did not describe this species and Stankov (Opred. (1949) 269) gives its characters incorrectly as: style long, exserted from calyx teeth. Judging by the type or specimens, M. lithuanica is distinguished by small (3 mm long) calyces with dense white appressed hairs. Stems low, 25—30 cm high. Leaves rather narrow, narrowly lanceolate, acute, with appressed hairs on both surfaces. Peduncles
365 3—5 mm long, horizontal. Calyx teeth short. Corolla small, 3—4 mm across, Style short, hidden in calyx (in pratis humidis, Herb. W. Besser). It resembles M. caespitosa in the small flowers and short style, but the stems are villous, calyx teeth short ($^1/_3$), and leaves shaped as in M. palustris; calyx characteristically densely pubescent.

Var. strigulosa Mert. et Koch (in Röhl. Deutsch. Fl. II (1826) 41; Shmal'g., Fl. II, 234; Kuzn. in Mat. Fl. Kavk. IV, 2, 354).— M. strigulosa Rchb. in Sturm Deutsch. Fl. 42 (1822).— M. caespitosa var. strigulosa Boenn. Prodr. (1832) 55.— Exs. GRF, No. 1485; Fl. exs. Austro-Hung. exs. No. 1404; Hayek, Fl. Stir. exs. No. 1028 (and 242 in a worse condition).— Stems glabrous or subglabrous, with scattered appressed bristles. Leaves green, oblong-lanceolate or lanceolate, with very remote antrorse appressed bristles. Racemes many-flowered, loose. Calyx small, 3—4 mm long, with sparse appressed bristles and short teeth. Corolla medium-large, 5—7 mm across. Style short.

M. laxiflora Rchb. (in Sturm. Deutsch. Fl. 42 (1822); Pavlova, op. cit.; Kryl., op. cit. 2268) very strongly recalls M. caespitosa, but has large corolla and branches with remote hairs (rare, e.g., Otradnoe on Neva, flowers, 5 VII 1918, Litvinov); style long according to Pavlova.

Var. nemorosa Schmalh., Fl. II (1897) 234.— M. nemorosa Bess. Enum. pl. Volh. (1822) 52; Ldb., Fl. Ross. III, 143; Kryl., Fl. Zap. Sib. IX, 2268.— Exs. GRF, No. 1487.— Very similar to M. strigulosa, with thin stems, glabrous or with solitary appressed bristles. Leaves lanceolate, antrorse or declined. Calyx small, with rather dense white appressed bristles; corolla 5—7 mm across; style short. Differs from M. strigulosa in the narrower leaves and (according to Litvinov) by the retrorse hairs on lower surface of lower leaves. Described from the forests of Volyn. Type in Leningrad and Kiev. Pavlova, who finds this character variable, does not distinguish M. nemorosa from M. strigulosa.

The plant published in "Gerb. Russk. Fl." (No. 1487) as M. nemorosa Bess. (corolla small, leaves acute) seems to represent a form of M. caespitosa distributed mainly in Siberia, where the type form (var. memor) is absent.

Var. retrohirsuta Litv. (in Tr. Bot. Muz. Akad. III (1907) 17; Kryl., Fl. Zap. Sib. IX, 2268).— Lower leaves covered with retrorse hairs beneath. Distinguished from M. nemorosa mostly by single stems, narrow leaves and shorter pedicels. Siberia.

The recently described M. praecox Hulph. and M. serotina Hulph. (Svensk. Bot. Tidskrif. 21 (1927) 63—72) with subglabrous stems, large leaves and large flowers, are merely luxuriant forms of M. palustris.

366 Var. scabra Mart. (Prodr. Fl. Mosq. (1817) 9, 32 (after Pavlova).— Stems and leaves with appressed bristles.— Regions: Gorki, Novgorod, Voronezh, Kostroma, Leningrad; K.-F. SSR.

Var. pusilla Meinsh., Fl. Ingr. (1878) 239, after Pavlova.— Stems 6—12 cm high, flowers half as large.

6. M. caespitosa Schultz, Fl. Stargard. Suppl. I (1818) 11; Ldb. Fl. Ross. III, 144; Boiss. Fl. or. IV, 235; Shmal'g., Fl. II, 234; Kuzn. in Mat. Fl. Kavk. IV, 2, 357; Grossg., Fl. Kavk. III, 266; Kryl., Fl. Zap. Sib. IX, 2269; Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 887.— M. scorpioides ssp. caespitosa (K. F. Schultz) Hermann ex. Hegi, III. Fl. V, 3, 2164.— M. lingulata Lehm. Asperif. II (1818) 110.— M. uliginosa Schrad. in Mert. et Koch, Deutsch. Fl. II (1826) 42 et ex DC. Prodr. X (1846) 105, nomen.— Ic.: Sm. Engl. bot. tab. 2661; Rchb. Ic. Fl. Germ. XVIII, tab. 1321, f. 1.— Exs.: GRF, No. 1486; Fl. Finl. exs. No. 874.

Perennial; rhizome usually reduced, sometimes short-creeping, without underground shoots; stems usually single at tip of rhizome, 20—50(60) cm high, usually long-branching from base and thus plant often appearing multicaulescent, thin, subglabrous, with few appressed bristles, never spreading-hairy; leaves 1—3(4) cm long, 0.5—1 cm wide, oblong-lanceolate or lanceolate, obtuse, lower leaves slightly spatulate and obtuse, the upper sessile and acute, thin, delicate, green, with very sparse appressed bristles. Racemes usually numerous, loose, in fruit 20 cm long, thin, leafless, rather many-flowered; peduncles to 1—1.5 cm, thinner and longer than in M. palustris,

horizontally spreading, covered with few appressed bristles; calyx ca. 2 mm long, to 3—4(5) mm in fruit, campanulate, with sparse quite appressed bristles, cleft for nearly half into acute triangular-lanceolate teeth; corolla blue, small, limb 4—6 mm across, with ovate-rounded lobes, the tube as long as the calyx; style short, stigma not protruding from calyx when corolla abscisses; nutlets plano-trihedral, dorsally broadly ovoid, 1—1.5 mm high, brown (or black as in the southern f. australis M. Pop.). April—June.

Swamps, streams, damp localities, banks of water bodies in all parts of the USSR, except the Arctic. **Gen. distr.**: Med., Centr., Eur., Iran., Bal.-As. Min., Ind.-Him., China, Japan(?), N. Am. Described from Germany (Stuttgart).

Note. This species is more widespread than M. palustris and it is only natural that it should produce several geographic races, though these
367 are less distinct than in M. palustris, and have not been studied (cp.: Hegi, l. c. 2165). It seems to me that the southern race, distributed in the arid, subtropical region of the ancient Mediterranean and in particular in the desert and semi-desert parts of Soviet Central Asia can be separated as being more robust and more glabrous than the Central European plants (var. australis M. Pop.). Also, it often produces annual forms close to M. baltica Samuels. Also separated is the Lenkoran (Hyrcanian) var. macrocalyx Fisch. et Mey. (Ind. Sem. Hort. Petrop. (1845) 40; Ldb., Fl. Ross. III, 144; Boiss., Fl. or. IV, 235; Kuzn. in Mat. Fl. Kavk. IV, 2, 359).— Fruiting calyx apparently inflated, to 5—7 mm long.— Caucasus: E. Transc.

Var. nanella Kusn. (op. cit.). — Low plant, with simple stem only 3—4 mm high. Probably an annual form of a southern variety. — Caucasus: S. Transc. (Armenia). **Gen. distr.**: As. Min.

Kuznetsov has collected a unique form (var. jenissejensis M. Pop.) in former Yenisei County (in Yenisei valley, near Lukyanova village, flowers, fruit, 24 VI 1914, Nos. 4625 and 4617, and also in woods near Kholmogorov railroad station, fruit, No. 4289, expedition to former Turukhansk Territory). — Stem thin, well-proportioned, 20—30 cm high. Leaves delicate, lanceolate-spatulate, the upper acute. Racemes sparse, weak. Peduncles horizontal, filiform, longer than calyx. Calyx broadly campanulate, completely stellately open in fruit, divided nearly to base into lanceolate acute lobes with sparse short appressed bristles, 4—5 mm long. Such a deep division of the calyx is not usually observed in M. caespitosa.

B. Annuae

Annuals. Calyx cleft to half, covered with few, completely appressed short bristles.

7. M. baltica Samuels. ex Lindem. Sv. fanerogamfl. (1926) 458 et in Mem. pro Fauna et Flora Fennica, 10 (1934) 94.— M. laxa vix Lehm. Asperif. II (1818) No. 56.— M. caespitosa ssp. laxa (Lehm.) Hegi, III. Fl. V, 3 (1927) 2165.— Exs.: Fl. Finl. exs. No. 875.

Annual; apparently merely an annual form of M. caespitosa Schultz.; stem thin, 7—20 cm high, usually simple or slightly branching above, erect, subglabrous, with few short appressed bristles; leaves oblong to lanceolate, the lower slightly spatulate, the upper sessile, acute, green, with few appressed bristles. Racemes few-flowered, loose, leafless; peduncles long, horizontal or drooping, with appressed bristles, 1—2(3) times as long as calyx; calyx
368 in fruit 4—6 mm long, campanulate, with sparse quite appressed bristles, cleft to half into triangular-lanceolate teeth; corolla small, limb 2—3 mm or 3.5—4 mm across (var. caespitosiflora Eckl.), not flat; tube as long as calyx; style short; nutlets 1.5 mm high. May—June.

Apparently on solonetzic soils near the sea or in semi-deserts.— European part: Balt. (shores of the Baltic Sea). An analogous race grows in West Siberia: Alt., and in the northern parts of Centr. Asia: Balkh., Ar.-Casp. **Gen. distr.**: in area of M. caespitosa. Type in Sweden.

8. M. sicula Guss. Syn. Fl. Sic. I (1842) 214; DC. Prodr. X, 106; Boiss. Fl. or. IV, 235; Rouy, Fl. Fr. X, 322.— **Exs.**: Fl. Ital. exs. No. 628.

Annual; sometimes perennial; stems 5—15 cm high, spreading-branching from base or middle, glabrous; leaves lanceolate-spatulate, small, narrow, glabrous beneath, with few short completely appressed hairs above, obtuse. Racemes short, many-flowered, 3—8 cm long, with approximate flowers, secund; pedicels shorter than calyx or as long, horizontal, with appressed bristles; calyx in fruit 3—4 mm long, narrowly campanulate, nearly tubular, slightly appressed-bristly, teeth as long as calyx tube or shorter; flowers small; limb of corolla 2—3 mm across; nutlets to 1 mm long. May—June.

Damp localities.— Possibly in W. Transc., Talysh and Araks. **Gen. distr.**: Med., Bal.-As. Min. (to Lazistan). Described from Sicily. Type in Palermo?

Note. Though it has been reliably reported as absent in the Soviet Union, M. caespitosa var. macrocalyx Fisch. et Mey. (Ind III Sem. Hort. Petrop (1845) 40; Kuzn., op. cit., 359) is very close to M. sicula Guss., differing only in the longer fruiting calyces, to 6—7 mm, though this does not apply to all specimens; the plants are grown in Leningrad.

Series 2. **Litorales** M. Pop.— Annuals (constant). Calyx cleft for more than half, with lanceolate teeth, rather densely covered with erect, not quite appressed long hairs. Nutlets ca. 1 mm long.

9. M. litoralis Stev. in Fisch. Cat. Hort. Gorenk. (1812) 27, nom. nud.; M. B. Fl. taur.-cauc. III, 118; Ldb. Fl. Ross. III, 144; DC. Prodr. X, 107; Boiss. Fl. or. IV, 236; Kuzn. in Mat. Fl. Kavk. IV, 2, 359.

371 Annual; stems (3)5—10 cm high, sturdy, with semi-spreading hairs, branching from base or above, the branches or rather racemes sometimes divaricate; leaves spatulate-lanceolate or oblong, 1—3(4) cm long, to 1 cm wide, few, often (in dwarf individuals) almost only the radical leaves obtuse, hairy. Racemes in fruit narrow, compact, leafless, 2—5 cm long; peduncles thick, antrorse, nearly appressed to axis of raceme, 2—5 mm long, with appressed gray down; calyx in flower 1—1.5 mm long, in fruit to 2—3 mm

PLATE XVI. 1 — Myosotis lazica M. Pop.; 2 — M. pseudovariabilis M. Pop.

long, narrow, nearly tubular, campanulate, rather appressed gray-hairy, cleft for $^2/_3$ into erect nearly convergent lanceolate long teeth, sometimes with reddish-hairy tips; corolla white, very small, hardly exserted from calyx, the limb ca. 1—1.5 mm across; nutlets ca. 1 mm long, oblong, brown. April—May.

Rocks near coastlines.— European part: Crim. (southern shore). Gen. distr.: Bal.-As. Min. (Greece). Described from the Crimea (Sudak). Type in Leningrad.

Note. Very close to the Mediterranean M. pusilla Loisl., it differs from it according to Boissier (l. c. 237) only in the completely leafless, secund racemes. Boissier himself was in doubt about distinguishing M. idaea and M. litoralis from M. pusilla, and (excluding M. cadmea Boiss., which is closer to M. ucrainica Czern. and more likely placed with the latter) they may actually represent one species, distinguished by the thin and long, always declined peduncles and shorter open calyx. It is also distinguished ecologically: M. pusilla — M. litoralis is common to the littoral, and M. ucrainica — M. cadmea is common to steppe, stony slopes.

The Steven specimens differ: some are small and have white corollas (for example, with the inscription "ex Tauria" on the large label in the herbarium of the Academy of Sciences). These match M. litoralis Kuznetsov. Others match M. idaea Kuznetsov (and Boissier), by their more full grown curved peduncles (e. g., those labelled "Soudagh. Ch. Steven," southern Crimea). Obviously, Steven did not distinguish them.

10. M. idaea Boiss. et Heldr. Diagn. I, 11 (1849) 121; Boiss. Fl. or. IV, 236; Kuzn. in Mat. Fl. Kavk. IV, 2 (1913) 360.— Exs.: GRF, No. 1488 (under M. litoralis Stev., and mixed with it).

Annual; stems 2—10(15) cm high, usually all stems more developed than in M. litoralis, usually erect, with several cauline leaves below racemes, simple or more or less divaricate, but not as strongly divaricate as in M. litoralis, branching; leaves 0.5 to 2 cm long, oblong, the lower spatulate, obtuse, cauline leaves oblong, acute, all leaves with grayish, semi-
372 spreading hairs. Racemes in fruit 2—5(to 10) cm long, leafless, secund, with remote calyces, less compact than in M. litoralis. Flowers very small; calyx in flower ca. 1.5 mm long, gray, with erect, nearly appressed hairs, in fruit 3—4 mm long, cleft to $^2/_3$ into lanceolate-linear, erect teeth; peduncles short, thick, 2—4 mm long, usually more or less declined, rarely appressed to axis; corolla dark blue, small, its tube as long as calyx, the limb 1.5—2 mm across; nutlets black, oblong, 1.2 mm long. April.

Stony slopes.— European part: Crim. (southern shore, from Sevastopol to Sudak Kerch?)). Gen. distr.: Bal.-As. Min. Described from Mount Ida in Crete. Type in Geneva, paratype in Leningrad.

The Klopotov specimen from Kerch Peninsula (fallow field, 15 IV 1906) appears to be a transitional between M. idaea and M. ucrainica in its higher stem, thin pedestal (although usually appressed to axis) and open calyx. Judging by the specimen "Fl. Ital." exs. No. 1530 (ed. A. Béguinot), M. incrassata Guss. (Fl. Sic. Syn I (1842) 214) seems to be indistinguishable from M. idaea Boiss. et Heldr..

11. M. ucrainica Czern. in Bull. Soc. Nat. Mosc. XVIII, 3 (1845) 133; adnot. Consp. fl. Chark. (1859) 43; Ukr. Bot. zhurn. III, 46—47; Kleopov in Visn. Kyyiv Bot. Sadu, IX, 72—73. — M. idaea spp. macedonica Vel. et Charr. Fl. Bulg. Supp. I (1898) 203.— M. macedonica Vel. et Charr. in Sitz. Boehm. Ges. XXXVII (1898) 47.

Spring annual; stems 5—20 cm high, thin, well-proportioned, simple or with few long branches, sometimes produced from axils of lowermost leaves, spreading beneath, appressed-hairy in inflorescence, grayish; lower leaves nearly in rosette, spatulate-lanceolate, gradually tapering to base, 1—3 cm long, 3—8 mm wide, obtuse, villous, the upper sessile, lanceolate or oblong-linear, acute or obtuse, few. Racemes loose, erect, leafless, elongating in fruit, 2—10 cm long, peduncles thin, horizontally declined or diverging at 45°, appressed-downy, as long as calyx or slightly longer or shorter; flowers very small; calyx ca. 1 mm in fruit ca. 3 mm long, cleft for $^3/_4$, with lanceolate-linear, slightly divergent lobes, densely covered with appressed or semi-spreading straight hairs; corolla tube as long as calyx, blue, with campanulate limb, not more than 2 mm across. Nutlets ca. 1 mm long. April—May.

Stony mountain slopes.— European part: M. Dnp., V.-Don (Kharkov, Volsk); West Siberia: U. Tob. (Mugodzhary mountains, Berchogur). Gen. distr.: Bal.-As. Min. (Bulgaria, Greece). Described from Kharkov. Type in Leningrad.

373 Note. The large-flowered forms of this species (M. cadmea Boiss.) are absent in the USSR; they grow mainly near the Sea of Marmara. The completely disjunct occurrence in the Mugodzhary Mountains is astonishing. The labels may be thought to have been mixed up, but as it happens one small specimen of Stellaria alsinoides Boiss. et Buhse, a Central Asian plant, is attached to these specimens, proving that the Ukrainian forget-me-not was indeed collected there. It is my opinion that M. pineticola Klok. et Shost (in Tr. N.-d. inst. bot. IV (1941) 149) should be considered a form of this species. The authors distinguish it by the forest habit (weak, ascending stem, flexuose branches, few leaves, white or pale blue corolla and slightly larger nutlets, 1—1.2 mm long, ca. 0.75 mm wide).— Found in the Bolshoi pine forest near Kharkov. Type in Kharkov.

Series 4. Sylvaticae M. Pop.— Perennials. Calyx divided nearly to base into lanceolate-linear lobes, with spreading, falcately curved hairs, below or hamate hairs at apex. Corolla large, 5—10 mm across.

Two monographs on M. silvatica s.l. have recently appeared: T. Vestergren, Arkiv för Botanik, 29 A, 8 (1939) and K. Domin, Monographicka Studie o Myosotis silvatica Hoffm. Carpatica, I (1939) (known to me only through Medvetskaya-Kornash's article quoted above). Vestergren's monograph is not quite intelligible, and seems to be based on rough notes posthumously published by Stroch. Vestergren (pp. 2—5) proposes a sharp distinction between M. silvatica Hoffm. and M. alpestris Schmidt, primarily in the shape of the nutlets, and in the calyx and some vegetative characters, and recognizes varieties and subspecies in each of these two species (pp. 5—22). Under the heading "Further species of the alpestris group," he mentions M. suaveolens W. et K.,

M. lithospermifolia (Willd.) Horn, etc. (pp. 22—31); on pp. 32—39, under the heading "group of the alpina forms" he mentions among others M. olympica Boiss. (pointing out Central Asia: Vakhsh, Sangulak — A. Regel'). I believe that the entire monograph is unsatisfactory.

A. Eusilvaticae M. Pop.— Rhizome biennial-triennial, creeping, thin. Leaves broad, shady. Forest herbs.

12. M. silvatica Hoffm. Deutschl. Fl. od. Bot. Taschenb. I (1791) 61 DC. Prodr. X, 107; Ldb. Fl. Ross. III, 145; Boiss. Fl. or. IV, 237; Shmal'g., Fl. II, 236 (excluding M. variabilis Angel.); Hook. Fl. brit. Ind. IV, 173; Kuzn. in Mat. Fl. Kavk. IV, 2, 372; Grossg., Fl. Kavk. III, 267; Kryl., Fl. Zap. Sib. IX, 2271; Kom. and Alis., Opred. rast. Dal'nevost kr. II, 887; Rouy, Fl. Fr. X, 339; Hegi, III. Fl. V, 3, 2165.—
374 M. silvatica ssp. frigida Vestergr. in Arkiv för Botanik, 29, 8 (1939) 7—9.— M. intermedia α. grandiflora Ldb. Fl. alt. I (1830) 187.— M. montana Bess. Prim. Fl. Galic. I (1809) 142.— Ic.: Rchb. Fl. Germ. XVIII, tab. 121.— Exs.: Fl. exs. Austro-Hung. No. 3712, No. 1407; Fl. Ital. exs. No. 136, 137.

Perennial; rhizome thin, branching, slightly creeping; stems at apex of rhizome few, rather weak, erect or ascending, with sparse villous hairs, simple, often with divaricate long branches above, 20—40 cm high; radical rosettes of few leaves, the oval blade rather abruptly tapering to long petiole; cauline leaves oblong-lanceolate, the lower slightly tapering to base, the upper sessile, acute, delicate, scarious, diverging at 45—90°, green, sparsely hairy, 2—5 cm long, 0.5—1.3 cm wide. Racemes loose in fruit, long, many-flowered, 5—15 cm long, leafless, in flower crowded, short; peduncles oblique at 45° or perpendicular, 0.5—1 cm long, appressed-downy, as long as or twice as long as calyx; calyx small, 2 mm long, in fruit 3—5(6) mm long, open-campanulate, with linear-lanceolate acute lobes, grayish, with sparse spreading hairs, the rather profuse hairs curved, hamate at base of calyx; corolla dark or light blue, limb flat 5—10 mm across, with ovate-rounded lobes, the tube as long as calyx; nutlets oblong-trihedral, acute, black, 1.5 mm high. May—June.

The description given refers to the type M. silvatica as growing in the forests of Central Europe and in the European part of the USSR.

Forests, shrubs, sometimes in meadows, not in swamps.— European part: Kar.-Lap., Lad.-Ilm., U. V., V.-Kama (Kirov), U. Dns. (typical in the Carpathians). Gen. distr.: Centr. Eur. Described from Germany. Type in Berlin.

13. M. krylovii Serg. in Animadv. Syst. ex Herb. Univ. Tomsk. 6—7 (1936) 6; Kryl., Fl. Zap. Sib. IX, 2270.— M. intermedia Ldb. Fl. alt. I (1829) 187.

Very close to M. silvatica Hoffm., from which it is distinguished only by the more developed, elongate (to 10 cm), sterile shoots produced from the thin (biennial) rhizome alongside the fertile stems. Very delicate, thin plants with loose racemes, growing in the taiga. Peduncles capilliform, $1\frac{1}{2}$—2 times as long as calyx, often slightly arcuate. Axes of racemes thin, slightly flexuose.

Coniferous forests.— West Siberia: Ob. Alt.; East Siberia: Yenis., Ang.-Say., Dau. (Barguzin); Centr. Asia: Dzu.-Tarb. (Lepsinsk). Endemic. Described from Narym and Altai. Type in Tomsk.

Note. Sergievskaya's statement that this species is readily distinguished from "M. silvatica Hoffm., to which this species is related by the long,
375 creeping rhizome, weaker pubescence of the stem and numerous, densely leafy, sterile shoots," refers not to the type, but to M. silvatica as the Siberian steppe forget-me-not, of the type M. suaveolens.

14. M. sachalinensis M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 308.

Close to M. silvatica Hoffm., from which it is almost indistinguishable. Biennial-triennial, with bifurcated stems, rather densely downy-villous; rhizome thin; sterile shoots short, nearly in rosettes; rosette leaves oblong- or lanceolate-spatulate, obtuse, tapering to long petiole; cauline leaves few, oblong-lanceolate or lanceolate, like the leaves of rosettes delicate, membranous, downy-villous, declined, to 1 cm wide, acute, the upper reduced, long, gradually acuminate. Fertile racemes loose, few-flowered; peduncles nearly horizontal, ca. 1 cm long; calyx in fruit slightly loose, 4—5 mm long, campanulate, cleft for $^2/_3$ into lanceolate acute lobes, its lower part with sparse spreading curved hairs hamate at apex; flowers blue, limb 5—6 mm across, nutlets ca. 2 mm high, oblong, acute; cicatrice small, oval, oblique.

Far East: Sakh. Endemic? Described from near Kholmsk in S. Sakhalin. Type in Leningrad.

Note. This species seems to be a case similar to Convallaria majalis and Hepatica nobilis, in which the so-called "European" species reappear in the Far East after an extensive disjunction in Central Siberia. In all these cases the Far Eastern race differs from the European, at least to some degree. With this generalization in mind, I take the risk of describing the Sakhalin plant as a distinct species.

15. M. pseudovariabilis M. Pop. sp. n. in Addenda XVIII, 616.

Perennial; rhizome thin, short-creeping, usually branching above, producing several fertile stems and reduced sterile shoots; stems ascending or erect, simple or with few long drooping branches, sometimes from base up, rather thin, weak, 12—30 cm high, with sparse spreading short hairs in lower, appressed-downy in upper part; leaves of sterile shoots larger, obovate or spatulate-oblong, 3—4 cm long, 1—2 cm wide, sparsely hairy-villous, obtuse, tapering to short petiole; cauline leaves sessile, oblong or oblong-lanceolate, 1.5—3 cm long, 0.5—1 cm wide, acute, flat, delicate, green, divergent, not appressed to stem, with very sparse hairs. Flowering
376 racemes rather compact, short, leafless, in fruit very loose, long, 5—15 cm long, their axes thin, weak; peduncles $1^1/_2$—2 times as long as calyx, nearly horizontal, appressed-downy, thin; pedicels short, shorter than calyx or as long; flowers medium-large; calyx ca. 2 mm in fruit ca. 3—3.5 mm long, campanulate, cleft to about half into lanceolate acute teeth, grayish-downy, the lower part entire, with short spreading very delicate hairs, hamate at apex; corolla blue in full blossom with visibly changing color, its tube slightly longer than calyx (by $^1/_4$ to $^1/_2$), impoverished, the limb 4—5 mm across, with ovate lobes; style after abscission of corolla as long as calyx, sometimes slightly exserted from it. June. (Plate XVI, Figure 2.)

Meadows.— Arctic: Arc. Sib. (Dudinka); East Siberia: Yenis. (Turukhansk). Endemic. Described from Turukhansk. Type in Leningrad.

Note. This interesting species, reminiscent of the common European forest M. silvatica or the Siberian M. krylovii in its wide, mesophyllous leaves and thin creeping rhizome, differs from them sharply in the smaller elongate corollas and long style. In its elongate corolla and long style it resembles the European mountain M. variabilis Angelis with which it is generally allied, though in M. variabilis the corolla is twice as long as the calyx and its limb is nearly twice as large. As noted, the Yunnan (i.e., S. China) Myosotis of the type M. silvatica is distinguished by the very long style. The entire group of long-styled races of M. silvatica is more ancient, in relict state it is confined to certain parts of the distribution area of M. silvatica s.l. The typical M. pseudovariabilis grows only in Turukhansk and further north, in the south (Achinsk, Krasnoyarsk) there grows a form intermediate between M. pseudovariabilis and M. krylovii.

B. Alpestres M. Pop.— Rhizome short, robust, perennial. Stems erect, slightly branching, with branches often antrorse. Leaves narrower or as wide as in Eusilvaticae but more compact, hairy or subglabrous, usually more obtuse, erect. Calyx with fewer hamate hairs, not abscissing in fruit or hardly abscissing. Pedestal of attachment of nutlets triangular, with narrow elongate lateral angles. Light-loving plants of steppes and high mountains (or Arctic). Three very close species connected by transitional forms.

16. **M. suaveolens** W. et K. in Willd. Enum. pl. Hort. Berol. (1809) 176.— M. lithospermifolia Hornem. Hort. Hafn. I (1813) 173.— M. scorpio-
377 ides var. lithospermifolia Willd. l. c. 175.— M. silvatica var. lithospermifolia Kusn. in Mat. Fl. Kavk. IV, 2 (1913) 381.— M. imitata Serg. in Animadv. Syst. ex Herb. Univ. Tomsk. 6—7 (1936).— M. alpestris ssp. asiatica Vestergr. ex Hult. Fl. Kamtch. IV (1930) 80 et l. c. (1939) 21, p. p. —M. stenophylla Knaf ex Vestergr. l. c. (1939) 1677 et Medwecka Kornas in Acta Bot. Polon. XIX (1948) 79—83.— M. blockiana Wol. in herb.— **Exs.**: Fl. exs. Austro-Hung. exs. No. 1410; GRF, No. 276 (known as M. silvatica).—**Ic.**: Sturm, Deutsch. Fl. tab. 665; Schlechtd. Fl. Deutschl. ed. 5, XIX, tab. 1923, I.

Perennial; stems 20—40 cm high, erect, sturdy, slightly angled, rather densely pubescent, with spreading or semi-appressed down; leaves lanceolate, sometimes lanceolate-linear, antrorse, usually appressed to stem, grayish, pubescent. Fruiting racemes straight, elongate, with remote fruits; peduncles shorter than calyx, straight, obliquely upright; calyx 3—5 mm long, with few hamate hairs, not abscissing in fruit; corolla blue, 5—10 mm wide, its tube shorter than limb; nutlets black, shiny, with indistinct marginal rim, the pedestal of attachment strongly elongate. April—June.

Steppes, steppe meadows, shrubs, Caucasus and Central Asia to alpine mountain belt.— European part: common in steppe and forest-steppe zones, Crim.; Caucasus: everywhere; West and East Siberia: throughout steppe zone; Far East: everywhere, except Sakh., Chuk., An.; Centr. Asia: mountain regions. **Gen. distr.**: Centr. Eur. Described from Croatia. Type in Prague and Berlin.

Note. The Caucasian and Crimean steppe Myosotis are indistinguishable from the steppe-plains, European-Siberian or mountainous Central Asian plants. Attempts to do so are conflicting and unreliable. See Note in N. I. Kuznetsov (op. cit.).

17. M. alpestris Schmidt, Fl. Bohem. inchoat. III (1794) 26.— M. silvatica spp. alpestris Koch, Syn. fl. Germ. et Helv. 505; Hegi, III. Fl. V, 3, 2168; Kuzn. in Mat. Fl. Kavk. IV, 2, 383.— Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 121 (1322); Sturm, Deutsch. Fl. tab. 662; Schlechtd. Fl. Deutschl. ed 5, XIX, tab. 1923, II.— Exs.: Fl. Austro-hung. exs. No.1409; Hayek, Fl. Stir. exs. No.651.

Perennial; the type is a characteristic race of the Alps, with large broad oblong cauline leaves; radical leaves tapering to long petiole. Flowering racemes rather short, not strongly elongating in fruit; calyx 3—5 mm long, gray, with appressed hairs and few hamate ones; corolla large, dark blue; peduncles not longer than calyx, straight, obliquely upright. June—July.

378 Alpine belt of the Carpathians and Caucasus.— European part: U. Dns. (Carpathians); Caucasus: everywhere except Tal. (mainly W. Transc.). **Gen. distr.:** Centr. Eur. Described from European Alps.

Note. This species is typical for the Carpathians. In the high mountain belt of the Caucasus some individuals are very close to M. alpestris; more frequent are specimens between it and M. suaveolens. Such transitional forms also grow in the European Alps and therefore Rouy (Fl. Fr. X, 332) includes in his "Flora" M. alpestris and M. suaveolens (and M. lithospermifolia). Individuals very close to M. alpestris occur in Arctic Europe and occasionally in Siberia (e.g., Kolyma).

18. M. asiatica Schischk. et Serg. in Kryl., Fl. Zap. Sib. IX (1937) 2272.— M. alpestris Ldb. Fl. alt. I, 189, non Schmidt; Kryl., Fl. Alt. IV, 891.

Perennial; stems 8—30 cm high, simple, single or 2—5(20) crowded in mat, their base covered with remnants of leaves, lower and middle parts with spreading hairs, hairs in upper part semi-appressed or appressed, blades of radical leaves lanceolate or oblong, 1—5 cm long, 3—10 mm wide, their petioles longer than blade, slightly spreading-hairy above, glabrous or subglabrous beneath; cauline leaves lanceolate or oblong, sessile, short-acuminate, 1—7 cm long, 2—8 mm wide, hairy. Fruiting racemes rather short; peduncles as long as calyx; calyx 3—4 mm long, its hairs erect or curved, not hamate; corolla blue, 7—9 mm across; nutlets black, obtuse, large. June—July.

Dry tundras, arctic and alpine meadows, stony slopes and rocks.— Arctic: Arc. Eur., Arc. Sib.; Caucasus: Cisc. (W.), S. Transc.; West Siberia: Alt. **Gen. distr.:** Mong. ? N. Am. ? Described from Arctic Urals. Type in Tomsk.

Note. The authors erroneously included in their description Vestergren's synonym: the Kamchatka plant is identical with M. suaveolens, common throughout Siberia and the Far East. The arctic plant is more glabrous and weaker and can be regarded as a small species related to M. suaveolens and M. alpestris, though in all these species the distinctions are very inconstant. The Altai specimens from the alpine belt too are transitions between M. asiatica and M. suaveolens and therefore our lectotype is from Arctic Urals. It sometimes grows in the alpine belt of the Caucasus, e.g., in Armenia, Bol'shoi Abul Mountain, 12 VIII 1903, Bordzilovskii.

Series 4. Arvenses M. Pop.— Annuals (rarely biennials or early winter
379 plants). Corolla small, limb 2—3(4) mm across, rarely (M. heteropoda) 4—6 mm across. Calyx with spreading, hamate and curved hairs.

19. M. arvensis Hill, Veg. Syst. VII (1764) 55; Roth, Bot. Abhandl. u. Beobacht. (1787) 20; Hegi, III. Fl. IV, 3, 2070; Grossg., Fl. Kavk. III, 267; Ldb. Fl. alt. I, 187 (M. arvensis Sibth.); Willd. Sp. pl. I, 747; Kryl., Fl. Zap. Sib. IX, 2273.— M. scorpioides β. arvensis L. Sp. pl. (1753) 131.— M. intermedia Link in Schultz, Prodr. Fl. Stardgard. Suppl. I (1818) 12 et Enum. alt. Hort. Berol. (1827) 164; Ldb. Fl. Ross. III. 146; Boiss. Fl. dr. IV, 239; Shmal'g., Fl. II, 235; Kuzn. in Mat. Fl. Kavk. IV, 2, 369.— Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 122.— Exs.: GRF, No. 679, 1489; Fl. exs. Austro-Hung. exs. No. 1406; Hayek, Fl. Stir. exs. No. 1030; Pl. Finl. exs. No. 2061; Fl. Ital. exs. No. 138.

Annual or biennial; stems single, simple or branching from base and then plant apparently multicaulescent, branching often confined to upper part, usually rather sturdy, with spreading villous down below, appressed-downy above; leaves lanceolate or lanceolate-linear, rarely oblong-lanceolate, the lower spatulate, gradually tapering to petiole, the upper sessile, all leaves obtuse or acute, with sparse semi-spreading hairs, sometimes grayish, 2—5 cm long, 0.5—1 cm wide. Racemes in fruit loose, secund, usually shorter than stem, upright, leafless; peduncles appressed-downy, long, $1\frac{1}{2}-2(2\frac{1}{2})$ times as long, rarely as long as calyx, usually horizontal or 45—60° to axis, sometimes arcuate; flowers small; calyx 1—1.5 mm long, in fruit to 4 mm, cleft for $\frac{1}{2}-\frac{2}{3}$ into lanceolate-linear, acute, erect teeth, convergent in ripe fruit ("calyx closed"), more or less gray, with profuse spreading curved hairs, hamate at base; corolla blue, the tube shorter at tip than calyx teeth, the limb 2—4 mm across, concave or nearly flat (corolla 4—5—6 mm) with flat limb, in intermediate forms transitional to M. silvatica (e.g., in the race umbrata (M. et K.) Rouy); nutlets oblong-trihedral, 1.5—2 mm long, brown-black or black, acute. May—July.

Fields, fallows, wastelands, rarely in sands or woods, generally a distinct weed.— European part: nearly everywhere, Crim.; Caucasus: Cisc., Dag.; West Siberia: Ob. Alt.; East Siberia: Yenis. (to Baikal); Centr. Asia: Ar.-Kasp., Balkh. Gen. distr.: Centr. Eur., Scand., Med., Bal.-As. Min. Described from Germany (and Europe in general). Type in London.

20. M. heteropoda Trautv. in Tr. Bot. Sada, II (1873) 479; Kuzn. in Mat. Fl. Kavk. IV, 2 (1913) 368; Grossg., Fl. Kavk. III, 267.— M. hispida β. grandiflora Boiss. Diagn. I, 11 (1849) 123; Boiss. Fl. or. IV, 239.

380 Annual; stems 7—20 cm high, with spreading villous down below, appressed-downy above, in weak individuals thin, simple or branching above, sturdier in larger individuals; lower leaves (if wintering rosette or lower cauline leaves in spring individuals are preserved) spatulate-oblong, obtuse, rather abruptly tapering to petiole, the latter as long as blade or shorter, sparsely villous like stem beneath; median and upper cauline leaves oblong or oblong-lanceolate (to linear in very weak individuals), sessile, acute. Racemes loose, secund, usually above upper leaf (or opposite pair of upper leaves),

sometimes higher, 3—7 cm long, leafless; peduncles thin, filiform, longer than calyx, horizontally drooping, the lower peduncle especially long, opposite upper leaf or in bifurcation of two terminal scorpioid cymes 10 mm long, i. e., more than twice as long as calyx; nutlets rather large; calyx small, ca. 1.5 mm long, in fruit 4 mm, its teeth $^2/_3$ length of entire calyx, lanceolate, acute; hairs spreading, sometimes loose, numerous hairs curved, hamate at base of calyx; corolla blue, the tube nearly as long as (or slightly shorter than) calyx, the limb flat, 4—6 mm across; nutlets ca. 1.5 mm high, olive-colored, with very faint ventral keel. April—May.

Stony slopes in semi-steppe and steppe belt.— Caucasus: Dag., E. Transc. Gen. distr.: As. Min. Described from Manglisi. Type in Leningrad.

Note. This species is unquestionably close to M. collina Hoffm. (M. hispida Schlecht.) but differs distinctly in the larger corolla, longer pedicels (especially the lower), low base of racemes at upper leaves (in M. collina the lowermost pedicel of the raceme is far above the upper leaves), nutlets with a hint of a ventral keel (in M. collina the nutlets are equally inflated on both sides without a sign of a keel). This species vicariates with M. collina: both grow in Asia Minor. I saw the type specimens of M. hispida grandiflora Boiss.: specimen in "olivetis Cretae ad Cydoniam" prefers to M. versicolor (Pers.) Smith, and Balansa's specimens from "Pontus Lazicus" are M. heteropoda Trautv.

21. M. lazica M. Pop. in Spisok gerb. rast. fl. SSSR, XII (1953) 3579— M. intermedia var. brevipedunculata Kusn. in Mat. Fl. Kavk. IV, 2 (1913) 372, p. p.

Annual or overwintering. Stem high, 25—40 cm, erect or ascending, spreading-branching above, sometimes branching from base, if overwintering,
381 producing sterile branches in axils of lower leaves resembling sterile shoots, with sparse spreading hairs in lower half, in inflorescence with appressed hairs; leaves in lower part of stem and on sterile shoots spatulate (oblong in the more luxuriant, green individuals and spatulate-lanceolate on the more xerophyllous), obtuse, 3—8 cm long, 6—7 to 20 mm wide, some green, with sparse down, others grayish, more hairy, with spreading or semi-spreading hairs; upper leaves shorter, oblong, sessile, 1—3(4) cm long, short-acuminate or obtuse. Racemes numerous at tips of branches, thin, leafless, remote from upper leaves rather densely flowered and very narrow because of the very short peduncles, elongate in fruit, 3—10(15) cm long, peduncles filiform, ca. 1 mm long, usually hamate, the calyx pendant, rarely erect; calyx small, to 1 mm long, in fruit 2 mm, rounded-ovate, cleft almost to half into triangular-lanceolate, acute teeth, with long spreading hairs and curved or hamate thin hairs; corolla blue, its tube as long as calyx, the limb 3 mm across; nutlets 1 mm high, plano-trihedral, with very faint ventral keel, ovoid-oblong, black-brown, luminous, acute. June—July. (Plate XVI, Figure 1.)

Forests, irrigated meadows.— Caucasus: W. Transc. (Batum). Described from Batum Region near Bekhlevan, flowers, fruit, 14 VI 1902, Alekseenko and Voronov. Type in Leningrad.

Note. Surprisingly, though Kuznetsov saw the specimen of this interesting species, he failed to separate it from the boreal weed M. arvensis Hill

(M. intermedia Link). It is obviously a very distinct species in its small calyces, very short peduncles, as compared with very long ones in M. arvensis, and large, rather mesophyllous leaves. The specimens from Bekhlevan, which I chose as the type, differ from the others; they are from an exposed site and are light, more xeromorphic, with narrower and more hairy leaves. The more numerous individuals collected in wooded areas have more delicate, larger, green leaves and often produce shoots at root from axils of lower leaves with sterile branches. Their flowers do not differ from the Bekhlevan specimens. Kuznetsov identified these as M. hispida Schlecht., e.g., the specimens of Vvedenskii between Kobulety and Vardzhanauli, forest, 19 VIII 1911 and near Tkhinali, forest, 1 IX 1911, forest below Dzhurfuk Pass, 26 VIII, 1910, Voronov and N. Popov, and others.

M. lazica is generally close to M. arvensis, though clearly distinct in its morphology and distribution area, bounded by damp Lazistan where M. arvensis is usually absent. In the more arid Artvin district (Turkey) Vvedenskii collected a form transitional to M. arvensis, with longer
382 (to 6 mm), more straight peduncles, slightly larger calyces to 3 mm long, and narrow leaves, as in M. arvensis. Apparently Ledebour had similar specimens from Imeretia (Eikhvald?). Specimens from Mzymta (Radde and Koenig) and probably all those from Imeretia and Abkhazia (to Sochi in Krasnodar Territory) may also be included. The typical M. arvensis occurs only north of Tuapse, its distribution area being bounded by the Northern Caucasus and Dagestan.

22. M. collina Hoffm. Deutsch. Fl. ed. 1 (1791) 61; Grossg., Fl. Kavk. III, 268 (excepting var. grandiflora Boiss.); Hegi, III. Fl. V, 3, 2171; Kryl., Fl. Zap. Sib. IX, 2275.— M. hispida Schlecht. in Mag. naturf. Freunde Berl. VIII (1818) 230; Ldb. Fl. Ross. III, 146; Shmal'g., Fl. II, 236; Boiss. Fl. or. IV, 239.— M. arvensis Smith. Engl. Bot. tab. 2558 (1790); Lehm. Pl. Asperif. II, 90.— Ic.: Hegi, l.c.f. 3128; Rchb. Ic. Fl. Germ. XVIII, tab. 122.— Exs.: Fl. exs. Austro-Hung. exs. No.1405; Fl. Ital. exs. No.139; Fl. Finl. exs. No.1289, 2060.

Spring annual; stems 5—20 cm high, thin, well-proportioned, long-branching from above or base, branches terminated by long erect fertile racemes usually longer than the leaf-bearing stem, rarely (in weak individuals) stem not branching, like the entire series covered in lower with villous down and appressed down in upper part; leaves weak, the lower short, 1—2 cm long, spatulate-oblong, tapering to short petiole, obtuse, median and upper leaves generally few, oblong-lanceolate or lanceolate to linear, obtuse, only the uppermost sometimes acute, 1—2 cm long, 2—6 mm wide, sessile, with sparse semi-spreading hairs. Fertile racemes erect, usually strongly elongating, 3—15 cm long, leafless, loose, lowest flower 3—5 cm above uppermost leaf; peduncles capilliform, shorter than calyx, the largest (lower) as long as calyx, horizontally declined, often arcuately drooping with appressed down; flowers very small; calyx ca. 1.5 mm long, in fruit 3—4 mm, narrowly campanulate, cleft for approximately $^2/_3$ into triangular-lanceolate, erect, divergent teeth with erect semi-appressed hairs, the calyx sparsely hairy, the hamate hairs crowded mainly in the entire part; corolla blue (dark blue), small, its tube slightly shorter than calyx, the limb very small, 2 mm across; nutlets ca. 1 mm long, green (not black or brown), compressed, bilaterally inflated, flat sides oblong-ovoid, without ventral keel, acute. April—June.

Stony dry slopes, sands and other light soils, more frequent in open herbaceous steppe cenoses. — European part: U. Dns. (Transcarpathian
383 Region: common to Beregovo), Bl. (near Nikolaev), V.-Don (Kharkov), U. V. (Moscow Region), Crim. (very common at southern shore); Caucasus: Dag. (I regard all other specimens from the Transcaucasia identified by Kuznetsov as M. hispida Schlecht. as endemic Transcaucasian M. heteropoda Trautv.) Gen. distr.: Bal.-As. Min. (As. Min.), Med., Syria, N. Afr., Centr. Eur., Scand. Described from Europe. Type in Berlin.

23. M. micrantha Pall. ex Lehm. in Neue Denkschr. d. naturf. Gesellsch. Halle, III, 2 (1871) 24; Hegi, III. Fl. V, 3, 2172; Stroh in Notizbl. d. Bot. Gartens zu Berlin-Dahlem, 12, 471; Grossg., Fl. Kavk. III, 268; Kryl., Fl. Zap. Sib. IX, 2274. — M. stricta Link in Roem. et Schult. Syst. IV (1819) 104; Ldb. Fl. Ross. III, 147; Boiss. Fl. or. IV, 239; Kuzn. in Mat. Fl. Kavk. IV, 2, 363; Rouy, Fl. Fr. X, 328. — M. arenaria Schrad. in Schultz, Prodr. Fl. Stargard. Suppl. I (1818) 12; Schmal'g. Fl. II, 236. — M. arvensis Rchb. Fl. Germ. exc. I (1830) 340; Sturm, Deutsch. Fl. 42, non Roth nec Hill. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 123; Stankov and Taliev., Opred. Fig. 444. — Exs.: GRF, No. 1490; Hayek, Fl. Stir. No. 1031; Pl. Finl. No. 2059; Kickxia Belgica, No. 142.

Spring annual; stems 5—20 cm high, usually branching and plant apparently multicaulescent, rarely stems slightly branching or simple (and then plant resembling M. collina), spreading, often grayish, short-downy-villous, and appressed down at top of racemes; in lower part of stem leaves often lanceolate-spatulate, 1—2—4 cm long, the lower obtuse, the upper reduced, oblong or lanceolate, sometimes acute, all leaves with more or less dense often grayish spreading-downy hairs. Fertile racemes straightening, 3—20 cm long, with firm thickish axis, rather sparse and narrow owing to the very short peduncles, lowermost peduncles between reduced upper leaves, hence often described as leafy below, a character which distinguishes M. micrantha from the preceding species even in the weak, slightly branching individuals; peduncles 0.5—1 mm long, more or less spreading but straight, with spreading down, in M. collina with appressed hairs, often with curved or hamate hairs at base of calyx; flowers very small, calyx 1.5 mm long, in fruit 4—5 mm wide, slightly campanulate, cleft for $^2/_3$ into lanceolate-linear acute teeth, with more or less dense long hairs, the lower entire part with spreading curved and hamate hairs, teeth with semi-spreading straight hairs; corolla blue, very small, with limb hardly protruding from calyx teeth, ca. 1 mm across; nutlets ca. 1 mm long, oblong, compressed, rounded dorsally, with rudiment of ventral keel in upper part, short-acuminate, ripe nutlets dark brown. April—June.

384 Sandy open localities, stony slopes in lower mountain belt. — European part: nearly everywhere. — Steppes and much of the taiga, but not in the subarctic taiga and in the Arctic, Crim. (common); Caucasus: Cisc., Dag. S. Transc.; W. Siberia: U. Tob., Alt.; East Siberia: Yenis. (rarely); Centr. Asia: nearly everywhere, except foothills of Kara Kum mountains. The form is often more delicate than typical. Gen. distr.: Centr. Eur., Med., Iran. (to W. Himalayas), N. Am. (introduced). Described from the Volga. Type in Berlin (according to Stroch).

24. M. refracta Boiss. Voyag. Espan. (1842) 433; Boiss. Fl. or. IV, 240; Kuzn. in Mat. Fl. Kavk. IV, 2, 362.— M. stricta β. speluncicola Boiss. Fl. or. IV, 240.

Spring annual, generally close to the preceding; stems 5—15 cm high, with few long branches above or from base, rarely simple, branches terminated by long narrow racemes, usually flexuose, with thin axis, not erect or robust as in M. micrantha; leaves few, oblong-linear, lanceolate or oblong, small, 1—2 cm long, the lower slightly tapering to base, the upper sessile, all leaves obtuse, often delicate, mesophyllous, like stem with spreading villous down. Racemes from upper leaves or slightly higher, 5—15 cm long in fruit, flexuose, narrow; peduncles short, 1—1.5 mm long, recurved, thinner than in M. micrantha (this character distinguishes the two species), with spreading or curved down; flowers very small; calyx 1—1.5 mm long, in fruit narrowly tubular, 3—4 mm long, retrorse, nearly appressed to axis, cleft for half into lanceolate-linear teeth, with spreading hamate hairs in lower cylindrical part, and straight spreading hairs on teeth; corolla very small, hardly protruding from calyx, its limb ca. 1—1.5 mm across; nutlets very narrow, ellipsoid, pointed at both ends, brown, 1.5—1.7 mm long. April—May.

Shady cliffs in lower mountain belt.— European part: Crim. (Sudak); Centr. Asia: Mtn. Turkm. (Kopet Dagh — rather frequent and typical), Pam.-Al. (rarely), T. Sh. (less typical, transitional to M. micrantha in Syugaty Mountain). Gen. distr.: Med., Iraq. Described from Spain. Type in Geneva.

Note. I see no difference between this species and Boissier's M. stricta β. speluncicola (M. speluncicola Schott in herb.); the calyx base agrees with what Boissier described for M. refracta as "pyriform-claviform, attenuate."

25. M. versicolor Smith, Engl. Bot. tab. 2558 (1814); Rouy, Fl. Fr. X, 326; Shmal'g., Fl. II, 236.— M. arvensis var. versicolor Pers. Syn. pl. I (1805) 156.— M. lutea (Cav.) Pers. var. versicolor (Pers.)
385 Thell. ex Hegi, Ill. Fl. V, 3, 2173; Stankov and Taliev, Opred. 772.— Ic.: Rchb. Ic. Fl. Germ. XVIII, tab.; Fiori et Paol. Fl. Ital. 331, f. 2798; Hegi, l.c.f. 3130.— Exs.: Fl. exs. Austro-Hung. No. 2937; Petrak, Fl. Bohem. et Morav. exs. No. 486; Fl. Ital. exs. No. 140.

Spring annual or early winter plant; stems 10—30 cm high, thin, well-proportioned, usually with few long declined branches mainly above, rarely from base, the stems spreading below or to middle, mostly with appressed hairs; leaves narrow, elongate, lanceolate-linear or linear, acute, usually ca. 1 cm long, 3—4 mm wide, with long sparse spreading hairs, remote, the lowermost leaves (if present) approximate, spatulate-oblong, short, the cauline hardly tapering to base, sessile. Fertile racemes very loose, 5—20 cm long, peduncles very remote racemes usually not very many-flowered, compact, spirally curved; peduncles short, filiform, appressed-downy, 2—3 mm long, shorter than calyx, obliquely antrorse; flowers small; calyx 2—2.5 mm, in fruit 4—5 mm long, campanulate, cleft for $^2/_3$ (or $^1/_2$) into narrow, nearly linear, divergent teeth, sometimes with dark tinge, the base entire, with dense spreading hamate hairs, the long teeth with sparse semi-appressed straight hairs; corolla with thin tube, distinctly longer than calyx,

protruding for $^1/_4$—$^1/_3$ from calyx, the limb small, campanulate, 2—3 mm across, corolla yellow, turning reddish and finally blue (hence its name); nutlets ca. 1 mm high, slightly compressed, with distinct ventral rudiment of keel, oblong-ovoid, acute, dark brown. May—June.

Herbaceous stony slopes, fields, fallows.— European part: Balt., M. Dnp. (Kiev Region); Caucasus: W. Transc. (Akhali-Afoni, introduced). Gen. distr.: Centr. Eur., Med. (introduced), Ind. (introduced), N. Am. (introduced), Bal.-As.-Min. (Crete and Greece, generally. Not recorded from As. Min.). Described from W. Europe. Type in London.

This species is not exactly delimited.

M. densiflora C. Koch in Linnaea, XIX (1846) 20 et XXII (1849) 641.— is related to M. sylvatica Hoffm., from which it differs in the smaller flowers, very short pedicels, more spreading hairs of the calyx, and the nutlets. First described from the Pontus Mountains, also reported by the same author from Caucasian Osetia. According to Boissier (Fl. or. IV, 237) it is synonymous with M. sylvatica Hoffm., according to Vestergren with M. silvatica Hoffm. ssp. cyanea (Reut.) Vestergr.

Tribe 7. ERITRICHIEAE Benth. et Hook. Gen. pl. II (1876) 836.— Cryptantheae Brand in Fedde, Repert. XXI (1925) 249 et in Pflanzenr. IV, 252 (1931).— Flowers nearly always brachymorphic, i.e., with short
386 tube and more or less distinct limb, and rounded-obtuse short lobes often resembling Myosotis, i.e., with flat limb, especially in the annual species often small campanulate. Anthers subsessile, style short, hidden in corolla tube the throat of which bears more or less distinct scales (sometimes obsolete in the very small annual species). Stigma disklike-capitate, entire. Nutlets 4 (sometimes in fruit rudiments of 1—3 nutlets), erect, ovoid or oblong, dorsoventrally compressed or not, with small ventral lateral cicatrice, with either basal or ventral, the shape of a small triangle, oval or circular narrow furrow, often produced upwards along ventral keel, or line. Gynophore (gynobase) mostly pyramidal-tetrahedral, sometimes long by comparison with the nutlets, nearly subulate-pyramidal, generally short pyramidal, reduced in some genera to a slight broad elevation on the torus; rarely (Anoplocaryum) the pyramid with obtuse angles a cone. When gynophore long and subulate (Lappula) the nutlets are attached by the cicatrice and the keel; in this tribe nutlets generally grow upwards (especially when gynophore is low) and are free (not attached to the gynophore), the style appearing hidden between the nutlets; the nutlets do not grow at the base and hence the calyx is stellately spreading and its lobes are elevated, touching the fruit, not expanded as in the Cynoglossinae. In the Eritricheae the nutlets are small (1—3 mm long), and may be winged, but more often they bear spines (prickles) with or without an anchor head; they may also be tuberculate; in some genera they lack wings or prickles but are netted- or rugose-pitted or tuberculate; in very rare cases they are smooth, lustrous. Usually small herbs, mostly annuals (some genera are wholly annual), with simple, alternate, rarely opposite leaves, medium-sized or small flowers, usually in racemes with bracts or ebracteate.

About 20—30 genera, mainly in the ancient Mediterranean, but Hackelia, Anoplocaryum and 4—5 others are Chinese-Himalayan; the ancient Mediterranean genera are variable, and they are nearly as fully represented in the Eurasian and North American parts.

387 Note. We have excluded from the Myosotideae (Eritricheae) the following Russian genera, which Johnston and Brand have included: 1) Heterocaryum DC. (Zakirov includes this in a separate tribe, Heterocaryeae), 2) Asperugo L. (tribe Asperugeae), 3) Craniospermum Lehm. (tribe Craniospermeae).

Subtribe 1. CYNOGLOSSINAE M. Pop. — Gynophore well developed, longer, nearly obsolete in Eritrichium, Stephanocaryum. Nutlets dorso-ventrally compressed, with wings or prickles along dorsal margins of pedestal (disk), turbinate, not compressed in Eritrichium and Stephanocaryum; prickles with or without anchor head (Eritrichium is transitional), in Stephanocaryum and some Eritrichium without prickles along margin of disk.

Genus 1211. **LEPECHINIELLA*** M. Pop.

M. Pop. in Addenda XVIII, 623.

Calyx parted nearly to base into 5 linear obtuse lobes. Corolla blue or white, not large to small, brachymorphic, i. e., with short tube and broad, nearly flat or more or less widely campanulate limb, 3—10 mm across. Corolla with scales in throat, small, protruding; stamens and styles hidden in tube. Nutlets four, on short distinct cane rising from bottom of flower, with prismatic tetrahedral gynophore, attached in depression at its base by small pedestal, adnate to gynophore above by keel sunk in vertical furrow of gynophore, running from pit to style. Apices of nutlets free, overtopping the short style hidden between them. Nutlets with membranous-winged margin, not large, not more than 10 mm across or long, the wing flat, entire or dentate. Small perennial, rarely annual or biennial herbs of the high mountains of the Pamir area; one species in Kazakh Hills.

Note. Some authors have referred different species to Paracaryum (Cynoglosseae), to Eritrichium or Oreogenia Johnst. (Eritricheae), rarely to Echinospermum. In fact Lepechiniella is closest to Echinospermum, differing from it only by the shorter, prismatic gynophore and the wings of the nutlets (which also occur in some Echinospermum). The stylelike gynophore and the winged nutlets clearly dis-
388 tinguish our genus from Eritrichium. These, plus the perennial nature of Lepechiniella place it far from Oreogenia (type: O. (Eritrichium) munroi (Clarke) Johnst. — a small annual, with smooth wingless nutlets), in which Brand included O. arassanica Brand. Our plants differ from Paracaryum by the nutlets being attached to the gynophore by their apices and growing upward (not downward), their base firmly

* After the botanist, Academician Lepekhin.

attached to the base of the gynophore — a typical character of the tribe; also the thickened style is hidden between the nutlets.

1. Wings entire. Leaves slightly spreading-hairy, ash gray to nearly sericeous. (Section Holoptereae) . . . . . 2.
+ Wings large, acutely toothed. Leaves entirely appressed-hairy to sericeous or with semi-spreading hairs, dull. (Section Lophoptereae) . . . . . 3.
2. Leaves with semi-spreading hairs, ash gray, never sericeous. Radical leaves lanceolate-spatulate. Corolla blue . . . . . 1. L. seravschanica (Lipsky) M. Pop.
+ Leaves nearly sericeous-hairy, linear, narrow. Corolla white. (Angren) . . . . . 2. L. arassanica (V. Fedtsch.) M. Pop.
3. Nutlets (with wing) 5—7 mm across. Limb of corolla 5—8 mm across (Pamir) . . . . . 3. L. transalaica (V. Fedtsch.) M. Pop.
+ Nutlets 2—3.5(5) mm across or long. Corolla small, limb 2—4(6) mm across. (Not in Pamir) . . . . . 4.
4. Nutlets 2—2.5 mm long, style very short, hidden between nutlets as in preceding. Leaves spatulate-lanceolate, rather wide. Corolla 2 mm long and as wide. Stems 10—12 cm high. (Only near Zeravshan glacier) . . . . . 8. L. minuta (Lipsky) M. Pop.
+ Nutlets 3—4(5) mm across or long. Style thin, more or less protruding above nutlets. Leaves longitudinally plicate. Corolla 3—4(6) mm across, longer than calyx. Stems 15—50 cm high . . . . . 5.
5. Corolla 5—6 mm across; nutlets with wing ca. 5 mm across. Densely appressed-sericeous plant . . . . . 6.
+ Corolla 3—4 mm across, with campanulate limb. Hairs semi-appressed, slightly sericeous or spreading. Nutlets (with wing) 3—4 mm long . . . . . 7.

391 6. Perennial multicaulescent plants. Cushions small, not very dense; branches of caudex few (3—7), short, with massed remnants of leaves. One to two nutlets broadly winged, the others wingless. Surface of winged nutlets with sparse small anchorlike prickles. Leaves numerous on stem, lanceolate, rather short. Close to J. transalaica. (Fergana Range) . . . . . 4. L. korshinskyi M. Pop.
+ Annuals or biennials, with 2—10 stems (multicaulescent), not forming cushions. Rosette dying at fruiting. Leaves spatulate-linear. All nutlets winged. Surface of nutlets finely tuberculate without prickles. (Kazakh Hills) . . . . . 5. L. omphaloides (Schrenk) M. Pop.
7. Stems 10—25 cm high, thin. All leaves narrowly linear, elongate. All nutlets winged. Style very distinct, ca. 1 mm long. (Alai) . . . . . 7. L. alaica M. Pop.
+ Stems 30—50 cm high, thick, stiff. Radical leaves spatulate- or narrow-lanceolate. Two nutlets with wings, 2 wingless (as in Lappula). Style 0.3 mm long, protruding slightly above nutlets (Alai) . . . . . 6. L. ferganensis M. Pop.

Judging by the distribution of the species of Lepechiniella, they may be crosses between Paracaryum × Lappula.

PLATE XVII. 1. — Lepechiniella transalaica (B. Fedtsch.) M. Pop.; 2 — L. seravschanica (Lipsky) M. Pop.

Section 1. HOLOPTEREAE M. Pop.— Wings of nutlets entire. Corolla medium-large. Hairs semi-spreading, not completely appressed.

1. L. seravschanica (Lipsky) M. Pop. comb. n.— Paracaryum serawschanicum Lipsky in Tr. Bot. Sada, XXVI (1910) 488. — Mattiastrum saravschanicum Brand in Fedde, Repert. XIV (1915) et in Pflanzenr. IV, 252 (1921) 65.

Perennial; root thin, vertical, 2—5 mm thick, its apex bearing many thin branchlets which may reach 10 cm; on consolidated stony slopes they are reduced to 1—3 cm and form tufts; each branch of the caudex bears a rosette of spatulate leaves with small oblong blade, gradually and long-tapering to petiole and a flowering stem; entire leaf ca. 2 cm long, covered with thick gray semi-appressed, rather coarse long hairs; stems thin, (7)10—15 cm
392 high, with spreading branches above, gray-tomentose-villous; cauline leaves few, 1—1.5 cm long, lanceolate or oblong-linear, like radical leaves obtuse or acute, the lower tapering to base, the upper sessile, declined, gray-tomentose to villous. Inflorescence divaricate-paniculate, of one terminal and 2—5 lateral, very short, capitate scorpioid cymes, nearly not elongating in fruit, ca. 1 cm long or less; pedicels very short, often obsolete, villous; calyx gray-downy, 2 mm long, with linear obtuse lobules, hardly elongating in fruit; corolla blue, 3—3.5 mm long, with broadly campanulate limb, and ovate-rounded lobes; nutlets ca. 4 mm long, pyramidal, glabrous, smooth, ovoid-oblong, its back encircled by a narrow, 0.5—0.7 mm wide, entire wing turning blue along margin; sides of nutlets smooth, glabrous, obliquely converging in ventral keel; gynophore 1.5 mm long; style not thickening 0.5 mm long. June—July. (Plate XVII, Figure 2.)

Rock streams, taluses, rarely on compact stony slopes or rocks, in (alpine and) subalpine belts, 2,500—3,000 m.— Centr. Asia: Pam.-Al. (upper reaches of Zeravshan only). Endemic. Described from upper reaches of Zeravshan (village Revut, 24 VII 1893, Komarov). Type in Leningrad.

2. L. arassanica (B. Fedtsch.) M. Pop. comb. n.— Eritrichium arassanicum B. Fedtsch., Perech. rast. Turkest. V (1913) 57.— Oreogenia arassanica Brand in Fedde, Repert. XXII (1925) 103 et in Pflanzenr. IV, 252 (1931) 186.

Perennial; root thin, vertical, short, producing many reduced branches and forming compact tufts of numerous rosettes borne on branches of caudex, narrow, sublinear, often longitudinally folded, acute, 1—2 cm long, 2—3 mm wide, leaves with nearly appressed, sericeous, dense white hairs; stems numerous, (3)5—12 cm high, weak, thin, ascending, white with long appressed hairs, simple or with small, slightly spreading branches from axils of upper leaves; cauline leaves few, short, declined, ca. 10 mm long, linear or lanceolate-linear, with appressed white hairs. Scorpioid cymes at ends of branches and stem subcapitate, 0.5—1 cm across, only slightly elongating in fruit; pedicels short, distinct, 2—4 mm in fruit; calyx ca. 2—3 mm long; corolla white, small, with broadly campanulate limb, white, with ovate-rounded lobes; scales less than 0.5 mm long, ovate, rounded,
393 papilliform; nutlets often 3, the fourth undeveloped, ca. 3 mm long, 2—2.5 mm wide, ovoid, smooth, glabrous, with membranous, slightly undulant, narrow (ca. 0.5—0.8 mm wide), entire wing along margin of dorsal pedestal turning

blue; gynophore ca. 1 mm long, style 0.5 mm long, thin, hidden between nutlets in fruit. July.

Stony slopes in subalpine belt.— Centr. Asia: T. Sh. (only west). Endemic. Described from Arasan (upper reaches of Angren (Akhan-Goran), 17 VII 1909, Borodin and Kalistov, 63, 163). Type in Leningrad.

Note. Close to the preceding species with which it vicariates, it is mentioned in the Notes to Lindelofia olgae and L. capusii, pairs of vicarious species are frequent in the western parts of the Pamir area and Tien Shan, although the degree of divergence in each pair may differ from true species to poorly defined varieties. Here we have an example of strong divergence in such characters as pubescence, shape of the leaves and color of the corolla, but it should be emphasized that in the western part of Tien Shan north of Angren there grows a race closer to L. seravschanica than the Arasan form, in that its pubescence is duller, gray, less appressed, the stems higher, the corolla blue, and the leaves of average size. It appears that the only distinguishing feature of this race from the Zeravshan plants is the narrower radical leaves. (It is known to us from Talas Ala-Tau (Dzhebogly-Su, Minkevits, 1908; on Topchak-Su River, Pavlov, 1931).) I tend to combine these species.

Section 2. LOPHOPTEREAE M. Pop.— Wings large-toothed. Plant sericeous with completely appressed hairs.

3. L. transalaica (B Fedtsch.) M. Pop. in Addenda XVIII, 624.— Paracaryum transalaicum B. Fedtsch. nomen in Rast. Turkest. (1915) 62.

Perennial; root thin, dark, vertical, with few crowded heads forming small tufts of appressed rosettes and several fertile lateral stems; leaves of rosettes elongate-linear, 4—10 cm long, slightly lobed, gray-sericeous, with long thick appressed hairs, sometimes longitudinally folded, 2—4(5) mm wide, obtuse or acute; stems 3—6(8), lateral, arcuately ascending or nearly erect, 10—25 cm long (high), gray, with completely appressed hairs, rarely simple, often with short spreading branches above; cauline leaves more numerous, to 10, linear, 1—3 cm long, 1—3 mm wide, obtuse, silvery gray. Scorpioid cymes of the paniculate-corymbiform inflorescences leafless, loose, elongating in fruit, erect, upright, to 5—6 cm long, with remote fruits; pedicels
394 short but distinct, thin, appressed-downy, the lower pedicels to 5 mm long (usually to 3 mm) in fruit, flowers rather large; calyx appressed-sericeous, ca. 2 mm long, its lobes linear, acute, nearly unchanged in fruit, curved; corolla Myosotis-like, blue, rarely white, with flat limb, 5—8 mm across, with rounded-ovate lobes; scales trapeziform-ovate, ca. 1 mm long; nutlets with wing wider than long, rounded-ovoid, 5—7 mm long and as wide, their disk narrow, lanceolate, finely tuberculate, sometimes keel with longitudinal row of small anchorlike prickles, rimmed by broad, yellow, coriaceous-scarious, undulant-plicate, generally flat wing, broader than disk, turning blue along margin; teeth of wing crowned with 3—5 prickles on each side; sides of nutlets converging to ventral keel, densely papilliform-aculeate; gynophore 2—2.5 mm long; style 0.5 mm long. July. (Plate XVII, Figure 1.)

PLATE XVIII. 1 — Lappula rupestris (Schrenk) Gürke.; 2 — Lepechiniella omphaloides (Schrenk) M. Pop.

Stony places.— Centr. Asia: Pam.-Al. (Pamir). Endemic. Described from Trans-Ili Range (upper reaches of Kyzyl-Su River, fruit, 20 VII 1878, Kushakevich). Type in Leningrad.

4. L. **korshinskyi** M. Pop. sp. n. in Addenda XVIII, 625.

Perennial; root thin, vertical, short; tufts 5 cm across, not very compact; branches of caudex few, ca. 1 cm long, with massed dark squamiform remnants of leaves; leaves of bundles 3 cm long, lanceolate-spatulate, to 4 mm wide above, obtuse, flat, persisting to winter, with compact appressed hairs, gray-sericeous; stems 5 per tuft, 10—30 cm high, ascending or erect, robust, thin, simple with furcate apex, appressed-hairy; cauline leaves rather many, sometimes to 10, lanceolate, 1—2 cm long, flat, declined, obtuse, with many appressed sericeous hairs. Racemes elongating in fruit, 5—7 cm long, obliquely upright, with sparse fruit, with linear small bracts; peduncles erect, 1—3 mm long; calyx appressed-sericeous in flower, the linear obtuse lobes 3 mm long, nearly not elongating in fruit, ascending, firmly appressed to fruit; corolla
397 blue, its limb nearly flat, 5 mm across; nutlets ca. 5 mm wide (with wing); wings broad, flat, with 5—6 marginal teeth on each side terminated by anchor-like prickles, usually one nutlet winged, the others wingless, with short erect anchorlike prickles along margin of disk; disk oblong, covered with few short anchorlike prickles or only with grumose keel, otherwise smooth; sides of nutlets tuberculate; style thin, 0.5 mm long, nearly hidden between nutlets.

Centr. Asia: T. Sh. (only on Fergana Range, Arslambob and Baubash-Ata mountains). Endemic. Described from locality mentioned (Baubash-Ata, near Arslanbob, on stony slope, flowers 11 VIII, 1895, Korzhinskii, No. 3852). Type in Leningrad.

Note. This species is undoubtedly closely related to L. transalaica, from Pamir, but its leaves are broader, lanceolate and much more abundant on the more erect stems, the fruit is slightly smaller, and only one, rarely two, nutlets are winged. (Compare Lappula korshinskyi M. Pop.)

5. L. omphaloides (Schrenk) M. Pop. comb. n.— Echinospermum omphaloides Schrenk in Bull. phys.-math. Acad. Pétersb. III (1845) 211 (or 214); Ldb. Fl. Ross. III, 159; Lipskii in Tr. Bot. Sada, XXVI, 567; Trautv. in Bull. Soc. Nat. Mosc. XXXIX (1866) IV, 425.— Lappul omphaloides Macbride in Contrib. Gray Herb. V, No. 10 or XLV (1916) 543.

Annual or biennial; entire plant appressed-sericeous-gray; root thin, its neck with rosette functional until flowering but dying at ripening; several (2—10) stems emerge from rosette; its leaves 3—5 cm long, abruptly spatulate-linear or nearly spatulate-lanceolate, to 5 mm wide, obtuse, appressed-sericeous-gray; stems 10—25 cm high, erect or arcuately ascending, more or less branching in upper half, rather thick, hollow with appressed gray down; cauline leaves 1—2 cm long, somewhat spatulate-linear, sessile, acute, usually flat. Racemes few in upper part of stem, elongating in fruit, loose, 5—8 cm long, upright, with very small inconspicuous leaflets nearly to tip of racemes; peduncles conspicuous, the lower to 5—8 mm long, slightly arcuately curved, drooping, the upper 2—3 mm long; calyx like pedicels completely appressed-hairy, gray, with broadly linear obtuse lobes, these horizontal, 3 mm long in fruit; corolla blue, its tube

PLATE XIX. 1 — Eritrichium pseudolatifolium M. Pop.; 2 — Lepechiniella alaica M. Pop.; 3 — L. minuta (Lipsky) M. Pop.

shorter than calyx (2 mm long), the limb 5—6(7) mm across, with ovate-rounded lobes; nutlets broadly winged, the wing ca. 5 mm across; dorsal pedestal oblong, ca. 2.5 mm long with fine white tubercles, without keel or
398 prickles, its wing with yellowish margin, membranous, flat-decumbent or nearly vertical, never curved along back of pedestal, broad (broader than back of pedestal is wide) with sparse marginal teeth bearing anchorlike heads; gynophore as in Lappula, nearly subulate, gradually tapering to style, which does not protrude above upper margin of wings but overtopping nutlets. May. (Plate XVIII, Figure 2.)

Gravels of dry river beds.— Centr. Asia: Balkh. (only near Ata-Su River, flowers 14 V 1843, Schrenk). Endemic. Described from locality mentioned and never collected again.

Note. Strange as it may seem, our species is closest to Lappula rupestris (Schrenk) Gürke in pubescence, character of leaves, stems and flowers, though it differs sharply in the broad-winged flowers. In the genus, it is very close to L. ferganensis and L. alaica. It is not difficult to imagine that L. omphaloides is a hybrid of Paracaryum intermedium × Lappula rupestris; such an interpretation may clear up many points:

1. The presence of long, drooping peduncles, characteristic of Paracaryum intermedium.

2. The existence of a race, on the northern bank of Lake Balkhash slightly south of Ata-Su, with spreading gray down, such as is typical for Paracaryum intermedium. I call this race (which may represent a distinct species — L. balchaschensis M. Pop.) var. balchaschensis M. Pop. In it the rosettes die early. Stems 1—3. Cauline leaves short, wider, obtuse. Entire plant gray, with spreading, coarse down. Pedicels and peduncles shorter, not exceeding 3—4 mm. Wing narrower. Flowers smaller, 3—4 mm across (Nikolskii, 1884, and Popov, 1934).

3. The occurrence in many places of a variety (var. alatavica) of Lappula rupestris with a toothed blue wing on part or on the whole nutlets.

6. L. ferganensis M. Pop. sp. n. in Addenda XVIII, 625.

Biennial (perennial?); root thick as a goose feather, woody, dark, with few heads, bearing a small tuft of crowded rosettes of radical leaves, most
401 of which have dried up and died; leaves of rosettes narrowly linear-lanceolate, spatulate, 3—5 cm long, 3—7 mm wide, above, with appressed gray hairs; stems 30—50 cm high, 5—10 from one root, the lateral arcuately ascending, 3—4 mm thick at base, stiff, slightly flexuose, with sparse appressed hairs, grayish, spreading-branching nearly from base or middle, the branches elongate, thin, ascending, with terminal cymes, cauline leaves remote, linear-spatulate, slightly shorter than the radical, the uppermost linear-lanceolate, often longitudinally plicate, appressed-gray, acute, declined. Flowering cymes compact, becoming very loose in fruit, with very small, lanceolate-linear, nearly inconspicuous bracts; pedicels stiff appressed-hairy, gray, erect in fruit, usually as long as calyx, the lower longer, the upper shorter than calyx; calyx small, in fruit 1.5—2 mm long, its lobes linear-spatulate, obtuse, appressed-downy, appressed to fruits; corolla light blue, as in Lappula microcarpum, small, funnel-shaped,

2—3 mm across, the tube shorter than flowering calyx, less than 1 mm long; limb campanulate, its lobes short, semi-rounded; scales very blue, elongate-trapeziform, large, as long as tube, truncate; anthers oblong, as long as scales, hidden in tube between scales; fruit usually ovoid, heteromeri-carpic, 3—3.5 mm high, the short ($^1/_3$ mm long) style hardly protruding; two nutlets with stiff, yellowish, flat broad wings, narrower at base and apex of nutlet, usually broadest at middle, broader than disk, with about 5 large marginal teeth, 2 nutlets wingless, with about 5 triangular, yellowish teeth along margin of disk; disk of all nutlets green, very finely tuberculate, narrow (lanceolate), with finely tuberculate keel. June.

Centr. Asia: Pam.-Al. (Alai valley, outcrops of red clay on Kul'chi Mountain, flowers, fruit, 26 VI 1931, Lipshits, No. 248). Endemic. Described from indicated locality. Type in Moscow, cotype in Leningrad.

Note. A very poor specimen, possibly of this species, from the Andizhan District, Knorring and Minkvits, 1911, No. 1778.

7. L. alaica M. Pop. sp. n. in Addenda, XVIII, 626.

Biennial; in all characters very similar to preceding species but leaves
402 of rosettes narrowly linear, elongate, 4—8 cm long, ca. 1—2 mm wide, nearly sericeous-gray; stems thin, flexuose, 12—20 cm high, with linear leaves; all nutlets winged; style thin, upright, ca. 1 mm long, gynophore as in Lappula. (Plate XIX, Figure 2.)

Stony-sandy places and sands.— Centr. Asia: Alai valley. Endemic. Described from Kyzyl-Su river valley near Dzhekainda. Stony-sandy floodplain, 21 VI 1913, flowers and fruit, Desyatova, No. 1318. Type in Leningrad.

Note. The very strange circumstance of two related species in Alai valley is due to their being hybrids (possibly ancient) with different combinations of characters between L. transalaica and Lappula microcarpa. L. alaica has the longer style and gynophore of L. microcarpa. Both are good species of Lappula.

8. L. minuta (Lipsky) M. Pop.— Paracaryum minutum Lipsky in Tr. Bot. Sada, XXVI (1910) 489.— Mattiastrum minutum Brand in Fedde, Repert. XIV (1915) 156 et in Pflanzenr. IV, 252 (1911) 65.

Perennial; leaves of radical rosettes functional even in fruiting, spatulate-lanceolate, obtuse, 3—6 cm long, 5—7 mm wide, flat, sericeous-white, with compact thick straight hairs; stems 10—12 cm high, furcately 2—3-partite above with erect thin, firmly appressed-hairy, white branches; cauline leaves sessile, also spatulate-lanceolate, flat, not markedly reduced, obtuse, 1—3 cm long. Cymes on 2—3 branches of stem, upright, 2—4 cm long, with remote fruits; peduncles arcuately curved, thin, short, 1—2 mm long; flowers very small; appressed-downy calyx 2 mm long, with oblong obtuse lobes; corolla blue, not exceeding calyx, its tube 1 mm long, limb campanulate, as long; nutlets 2—2.5 mm long, ovoid, with ca. 1 mm wide, largely and acutely toothed wing; 5—7 blue teeth on each side, with anchorlike head; disk of nutlets oblong-lanceolate, smooth, glabrous, with obsolete keel, rarely with small tubercles; sides of nutlets finely tuberculate-scabrous; gynophore 1.5 mm, style 0.3 mm long. (Plate XIX, Figure 3.)

Stony slopes of alpine belt.— Centr. Asia: Pam.-Al. (Zeravshan glacier). Endemic. Described from indicated locality (flowers, fruit, 5 VIII 1893, V. L. Komarov). Type in Leningrad (not collected again).

Note. Unfortunately, the root was not collected, but all three stems probably come from one rosette; hence it probably grew in rock fissures, forming tufts. It is surprising that after Komarov it was not collected again.

403 Genus 1212. **LAPPULA*** Gilib.

Gilib. Fl. lithuan. (1781) 25; Gürke in Engl.— Pr. Pflanzenf. IV, 3a, 106—107; Brand in Pflanzenr. IV, 252, 136.— Echinospermum Sw. ex Lehm. Pl. Asperif. II (1818) 113.

Calyx small, 1—3 mm long, cleft nearly to base, lobes usually linear, elongating slightly in fruit, otherwise unchanged, stellately spreading beneath fruit or ascending and more or less adjacent to fruit, sometimes longer than fruit. Corolla brachymorphic, rarely myosote, i. e., with short tube as long as calyx, and wide flat rotate limb 4—8 mm across, often smaller, funnel-shaped, i. e., with short tube and more or less campanulate limb 2—3—4 mm across, lobes of limb always short, rounded-obtuse. Corolla mostly blue, rarely white. Scales small, always present in throat. Anthers small, subsessile in tube; style 0—1 mm long, not exserted, stigma entire, slightly disklike. Nutlets erect, small, 1.5—3(4) mm long, triangular in cross section, with ventral keel (with trihedral rib), the flat dorsal pedestal nearly vertical with two marginal ribs; the two lateral faces (known as sides) taper to ventral keel; margins of dorsal pedestal usually bear one row of smooth, more or less long (from 0.2 mm to 3 mm) prickles, sometimes reduced to small tubercles or tubercles without anchorlike head; sometimes margin of disk with a narrow, coriaceous or callous rim, very rarely with a broad wing with anchorlike spines (in other words, the wing is more or less deeply cleft into teeth or spines with anchorlike head). Heteromericarpy is frequent, with some nutlets more or less winged, others wingless, or some fruits of raceme with winged, others with wingless nutlets. Gynophore in ripe fruit tetrahedral-subulate, each face with longitudinal furrow matching the keel of the nutlet, adhering to gynophore for entire or nearly entire length (in the latter case apices of nutlets free, exceeding gynophore); at base of subulate gynophore each face has a flat process, perpendicular to the axis of the gynophore, on which rests the usually rounded rarely truncate base of the nutlet. Cicatrice ventral, basal, in shape of
404 a small narrowly triangular pedestal which penetrates the small basal pit immediately above the foot of the gynophore; here a fibrovascular bundle enters the nutlet, and this is the main connection of the nutlet with the gynophore. At apex of gynophore there is a sessile stigma, on thin style (sic); the apex of the gynophore may sometimes overtop the nutlets as a rather thick tetrahedral mucro (series Sclerocaryopsis and Sinaicae); in this case the nutlets are shorter than the gynophore, and adnate for entire ventral keel; often nutlets as long as gynophore, adnate for entire length of ventral keel (series Diplopleura, Anomalolappula) or longer than gynophore, with free apices rising above gynophore, most frequently the style is short and thus not only the gynophore but also the stigma are hidden between the nutlets; if the style is long then it may rise more or less

* Diminutive of Lappa — burr, burdock, referring to the clinging fruit.

considerably above the nutlets, for example in the series Microcarpae (where it cannot be confused with the free angular and thicker apex of the gynophore as in the series Sinaicae and Sclerocaryopsis). Surface of nutlets (at sides and on disk) rarely smooth, as if burnished, often minutely or finely tuberculate, the tubercles either obtuse or acute, sometimes with short mucro, at times thicker, at times thinner, but not anchorlike as in spines or prickles, usually along margin of disk or along its keel (median line); there are forms transitional between the spines and the tubercles, for example, anchorlike spines-tubercles in the series Sclerocaryopsis and Sinaicae (in L. sinaica), or lateral (additional) rows of tubercles-spines at sides of nutlets, for example in L. consanguinea (Echinatae) or L. tadshikorum (Tianschanicae), etc.

Mostly annuals, rarely biennials and very rarely perennials (3 species), small, from 5 cm to 30 cm, rarely up to 40—80 cm, thin, usually with narrow (often linear or lanceolate) leaves, with more or less long bracteate racemes. Fruits usually on short pedicels, rarely (L. sinaica) on longer. Hairs simple, long, spreading or attached, not very coarse, fine-bristly, sometimes sericeous, rarely borne on large, more often on small or very small tubercles.

Most species are within the boundaries of our flora (about 40—50). The genus (wholly) is ancient-Mediterranean. Evidently the South African species were introduced. I saw L. eckloniana (Lehm.) Brand., which is L. capensis (DC.) Gürke, and not distinguishable from L. patula (Lehm.) Gürke. Further, under the name L. cynoglossoides "Lehm." is the usual L. echinata; other specimens under the name Echinospermum cynoglossoides "Lehm." represent in the Herbarium of the Academy
405 of Sciences some species of the genus Cynoglossum. It is apparent that not one of these specimens corresponds to the real Echinospermum cynoglossoides Lehm. L. concava F. Müll. from Australia (south of 30°S.), to which Brand (l. c. 135) gave a generic rank — Omphalolappula Brand — belongs to the same series Diplopleura as our Central Kazakhstan L. diploloma (Schrenk) Gürke. The North American species (apparently not more than 5), which Brand included in the synonymy of L. diploloma, are very close to ours, for example, L. occidentalis Greene is related to L. intermedia (Ldb.) M. Pop. (two vicarious species) and L. cupulata to L. coronifera. Of the four sections accepted by Gürke, the section Heterocaryum (DC.) Gürke does not refer to the genus Lappula or to the tribe Eritricheae; Homolocaryum (DC.) Gürke is separated into the genus Hackelia Opiz. Heterocaryum and Hackelia are considered also by Brand (1931) as independent. The other two sections — Sclerocaryum (DC.) Gürke, which Brand separated into the genus Sclerocaryopsis Brand, and Eulappula Gürke — have been accepted by us with some changes: we added to Sclerocaryum the series Diplopleura which Gürke referred to Eulappula. As indicated from the key it would probably be better to classify the two sections differently, namely:

1. Cynoglossoides M. Pop. — Free end of gynophore rising above nutlets as a rather thick, tetrahedral mucro. The series Sclerocaryopsis and Sinaicae are included here.

2. Eritrichoides M. Pop. — Gynophore entirely hidden between nutlets. Including the series Diplopleura and all the others.

1. Style arising above nutlets as a thick, more or less angular mucro, exceeding fruit (similar to Paracaryum or Cynoglossum). (The apex of the gynophore should not be confused with the thin style sometimes elevated above the nutlets as in L. barbata or L. microcarpa (section Eulappula, series Microcarpae)). Nutlets, even the ripe ones, not separated from gynophore, beset with obtuse thick tubercles . . . . . 2.

\+ Style as long as the ripe nutlets or shorter with its apex bearing the style hidden between the apices of the nutlets (thin style may sometimes rise above nutlets (series Microcarpae)) . . . . . 6.

2. Nutlets large, 3—5 mm long, with thick, stonelike, sometimes luminous, very grumose walls; larger tubercles with or without small, stellate-anchorlike tip. Disk of nutlets inconspicuous having elevated incurved margins, margins sometimes converging at its middle as a crest. Low, 5—10 cm high herbs, shortly and furcately branching, grayish; branches thick. Leaves linear, obtuse. Flowers small, blue, with campanulate limb. (Series Sclerocaryopsis) . . . . . 3.

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\+ Nutlets with thinner walls, smaller, 2—3 mm long, dull, finely tuberculate, without anchorlike prickles or with very short prickles. Racemes elongate in fruit. Plants without furcate branches. Leaves oblong, lanceolate or linear. Flowers smaller, with nearly tubular corolla (Series Sinaicae). . . . . 4.

3. Lower tubercles of nutlets developed as horns; nutlets luminous; all tubercles without anchorlike tips. Hairs more appressed, gray, slightly sericeous. (Deserts of southern part of Central Asia) . . . . . 1. L. ceratophora M. Pop.

\+ Lower tubercles of nutlets very short; tubercles at middle of nutlet with small, stellate anchorlike tip. Duller plants, spreading-gray-hairy. (All deserts from Astrakhan to Altai and in the south to Iran) . . . . . 2. L. spinocarpos (Forsk.) Aschers.

4. Nutlets dorsally triangular, disk triangular, with thick, finely tuberculate margins ascending and curved above disk. Tubercles without anchorlike tips. Leaves linear, acute. Hairs falling. Branches erect, not branching. Calyx erect, appressed to fruit, not longer than the latter. Pedicels very short, thick. (Kara-Tau desert). . . . . 36. L. lipschitzii M. Pop.

\+ Nutlets laterally compressed, narrow if viewed dorsally, gibbous if viewed from the side, gibbous below, disk without thickened margins. Leaves wide, oblong or lanceolate. Branches diverging at an angle of 45° . . . . . 5.

5. Swelling of nutlet shifted to its bottom, thus nutlet broadest below when viewed from the side, tubercles on the expanded part of the disk with distinct although small, stellate-anchorlike tips. Calyx very short, appressed to base of the much longer fruit. Lower pedicels up to 1 cm long, sometimes recurved, often declined. (Along Araks and isolated near Makhach-Kala; entire southern part of Central Asia from Mangyshlak and Kara-Tau Mountains) . . . . . 38. L. sinaica (DC.) Aschers.

+ Swelling of nutlet less distinct, moved to its middle; disk encircled by thin elevated line, disk and sides of nutlets finely tuberculate. Apex (free) of gynophore thinner, not angular. Calyx lobes strongly exceeding fruit. Pedicels always straight,
407 shorter. (Tien Shan, Pamir-Alai) . . . . . .37. L. occultata M. Pop.

6. Disk of nutlet entirely or partly with more or less broad marginal wing or rim (narrow wing) bearing teeth or spinules . . . . . 7.

+ Nutlets wingless, margin of disk with spines borne on thickened marginal line, more or less attached or apart but not fusing at bases into wing or a narrow rim*, sometimes (2 species) without spines at margin of disk . . . . . 18.

7. Nutlets usually smooth, ventrally adnate to gynophore and not exceeding it, disk with narrow flexuose thick rim covering it completely or for a large part, bearing few teeth or spines. Series Diplopleura. (Deserts of NE Central Asia) . . . . . 8.

+ Nutlets with free apices exceeding gynophore, rarely (Anomalolappula) completely adnate to it, rim recurved, not covering disk, beset with prickles as if cleft into spines, rarely erect or disk with broader, vesicular wing . . . . . 10.

8. Teeth of coriaceous winglike rim triangular, short, without anchorlike tips, 2—4 at each side. Plants 15—30 cm high, markedly branching. Leaves linear. (Nor-Zaisan) . . . . . .3. L. cristata (Bge.) V. Fedtsch.

+ Teeth of rim spinelike, anchorlike at tip. Nutlets smooth, luminous . . . . . 9.

9. Teeth (spines) 4—5 at each side of disk, long, ca. 1.5 mm. Disk half hidden, with median entire keel protruding in the lower part at a high angle. Plants 15—25 cm high, with few erect non-branching branches. (Northeastern deserts of Central Asia) . . . . . .4. L. diploloma (Schrenk) Gürke.

+ Teeth (spines) 3—4 at each side of disk, short, nearly conical. Disk half hidden, with a median low and narrow tuberculate keel. Plants 5—8 cm high, a shrub with short spreading branches. Racemes short. (Shores of Balkhash and Issyk-Kul, in hammadas) . . . . . 5. L. balchaschensis M. Pop.

10. Fruits appearing completely sessile on the spreading, stiff axes of racemes, asymmetrical-pyramidal, small, only one upper nutlet with coriaceous, cup-shaped, high, strongly and acutely toothed rim
408 (wing), the others wingless, completely adnate to gynophore, attached at sides, acutely subaculeate-tuberculate, often all nutlets wingless, disk with anchorlike short prickles at margin. Leaves acute, narrowly linear. Flowers very small, blue. (S. Central Asia and S. Transcaucasia). (Series Anomalolappula) . . . . . 39. L. sessiliflora (Boiss.) Gürke.

+ Nutlets on short but very distinct stipes, somewhat larger . . . . . 11.

* If the fruits in this case are small, ca. 2 mm long, the two lower nutlets have a more or less distinct but generally narrow, entire wing, and the pedicels are long and curved, it will be 35. L. petrophila Pavl., probably identical with Paracaryum bungei (Boiss.) Brand, see genus Paracaryum.

11. Rim of nutlets declined or erect, dissected into spines longer than width of rim. Corolla blue, medium-sized or small, rarely large. (Northern deserts and semi-deserts of Central Asia and the European Caspian area; one species in C. Tien Shan, large-flowered) . . . . . 12.

\+ Wing as wide as spines along its margin or wider than length of spines. Flowers white, small or medium-sized. Rather high (30—50 cm), grayish-hairy species. (S. Central Asia). (Series Sublepechiniella) . . . . . 16.

12. Spines on rim uniserial. (Series Marginatae) . . . . . 13.

\+ Spines on narrow curved rim appearing fused at base, uniserial, with a second lower row of shorter and thinner spines; especially at the narrow side of nutlets, narrow rim not always developed so the species is transitional from the winged to the wingless (to series Macracanthae). Stems 13—30 cm high. Leaves grayish-villous, lanceolate. (From Astrakhan to Omsk) . . . . . 8. L. heteracantha (Ldb.) Gürke.

13. Spines long, narrowly triangular, 1.5—2 mm long; wing flat or nearly so, horizontal, shorter than its spines, rather narrow (1—1.5 mm wide) . . . . . 14.

\+ Spines at margin of wing short, ca. 1 mm, or if wing erect forming high cup with erect, not declined, teeth along margins, then corolla very small. Nutlets usually variable: winged or wingless, in one and the same flower or the same raceme. (Foothills of Altai) . . . . . 15.

14. Corolla large, Myosotis-like, with flat limb 6 mm across. Only 1—2 nutlets winged, sometimes fruit with all nutlets wingless (not in all specimens). Leaves appressed-hairy. Biennials. (C. Tien Shan) . . . . . 30. L. ulacholica M. Pop.

\+ Corolla with funnel-shaped limb 3—4 mm across. Leaves with
409 spreading or semi-spreading hairs. Annuals. Spines 1.5—2 mm long on the narrow ca. 1 mm wide coriaceous rim, sometimes flat, sometimes curved on disk. All nutlets usually equal, winged, smooth in type, with smooth disk, tuberculate in certain varieties. Stems 10—20 cm high, typically spreading-branching. Leaves oblong-lanceolate to linear. Corolla small, ca. 3 mm long, blue. (From the Caspian area to Altai and Mongolia) . . . . . 6. L. marginata (M. B.) Gürke.

15. Corolla comparatively large, with nearly flat Myosotis-like limb 5—6 mm across. Rim of nutlets comparatively narrow, varying in width, spines along its margin short, tooth-like with anchor-like tips. Stems 20—40 cm high. Leaves oblong-spatulate, greenish, with large white tubercles. (S. Altai). . 7. L. lipskyi M. Pop.

\+ Corolla small, limb ca. 3 mm across, campanulate. Wing of nutlet (not all nutlets winged) broad, smooth, appearing as a high cup, dissected into triangular-lanceolate spines as long as the entire (cup-shaped) part of wing, with anchorlike tops. Sides of nutlets largely and acutely white-tuberculate; disk narrow, with thin keel, slightly tuberculate along sides and away from them.

Stems thin, ca. 20 cm high. Leaves linear, sparsely spreading-bristly. A rare and doubtful species. (River Char-Gurban) . . . . . 34. L. coronifera M. Pop.

16. Wing of nutlets (not all winged) flat, curved outward, toothed or cut into spines along margin, smooth on surface, not scabrous (below teeth or spinules) . . . . . 17.

\+ Wing of nutlets very broad, forming a semi-spherical or vesicular cup with a very finely toothed margin beset below (outwardly) with small anchorlike spines; disk and sides of nutlets finely tuberculate. Biennials. Stems 40—50 cm high. Cauline leaves broadly linear, sometimes narrowly linear, grayish. Racemes not very loose in fruit. (Fergana valley) . . . 31. L. drobovii M. Pop.

17. Biennials, similar in habit to the preceding but more delicate, with narrower linear leaves and very long, thin and loose fruiting racemes. Winged nutlets with nearly flat, broad wings, largely toothed at margin, the teeth ending as more or less long, regular, anchorlike spines. Sides of nutlets tuberculate, the disk nearly smooth. (South of Gissar and Zeravshan Ranges) . . . . . 32. L. semialata M. Pop.

\+ Perennials (very rare in genus Lappula). Leaves of radical rosettes, preserved in fruit, rather broad, spatulate-lanceolate,
410 5—7 mm wide below apex, greenish. Stems thin, low, 20—25 cm high, slightly branching or not at all. Nutlets smooth, wing flat or hardly cup-shaped, curved, smooth, more or less deeply toothed along margin, the teeth ending with anchorlike spines. (High mountains of Gissar Range) . . . . . 33. L. popovii Zak.

18(6) Corolla Myosotis-like, i.e., blue, with short tube and flat or nearly flat, broad limb 4—8 mm across. Fruit pyramidal-oblong, often (but not always) with high, 1—1.5 mm thin style elevated above nutlets (Series Microcarpae), rarely (series Rupestres and Tianschanicae) style reduced. Usually biennials (rarely perennials or annuals), rather densely gray-or sericeous-hairy. (North to 47° N.) . . . . . 19.

\+ Corolla small, with campanulate limb, 2—4 mm wide. Hairs usually spreading, dull gray, not very dense. Usually annuals, rarely (series Echinatae) biennials. Fruit usually globose-ovoid, rarely oblong but then with very long spines along margin of disk. Style slightly protruding above nutlets (series Echinatae) or completely hidden between them . . . . . 28.

19. Style elongate, elevated above nutlets for 1—1.5 mm, thin, filiform. Fruit oblong-pyramidal. Spines at margin of disk uniseriate or in a second row of shorter spines along sides. Plants appressed-gray-hairy, with rather high stems, in flower resembling Myosotis. (From the Crimea and Caucasus through Central Asia up to Altai). (Series Microcarpae) . . . . . 20.

\+ Style reduced, hidden among apices of nutlets or elevated above them for less than 0.5 mm . . . . . 22.

20. Spines at margin of nutlets usually biseriate, the main row (along margin of disk) usually of elongate spines up to 1.5—2 mm long, the other row of shorter spines, sometimes both rows with

very short spines. Fruit larger, 3—3.5 mm high. Style 1.5 mm long. Stems tall (40—60(70) cm); racemes looser; corolla limb wider (averagely 2 mm). (Crimea, Caucasus, Kopet-Dagh) . . . . . 27. L. barbata (M. B.) Gürke.

\+ Spines at margin of nutlets usually uniseriate and shorter, up to 1 mm, but often shorter. Nutlets 2—3 mm high. Style 1 mm long. Corolla limb 5—6 mm across. Stems usually low (30—50(60) cm) and racemes looser . . . . . 21.

21. Spines along margin of disk 0.3—0.9(1) mm long. (Altai-Pamir area to Badghis) . . . . . 28. L. microcarpa (Ldb.) Gürke.

411 \+ Spines along margin 0.1—0.2 mm long or absent, replaced by tubercles. (Area as in the preceding) . . . . . L. brachycentra (Ldb.) Gürke, see Note to L. microcarpa (Ldb.)Gürke.

22. Nutlets oblong, small, as in the preceding, with one row only of short spines along margin of disk. Plants usually sericeous-appressed-hairy, rarely gray, with semi-appressed hairs; biennials or even perennials, with 10—30 cm high stems. (Series Rupestres) . . . . . 23.

\+ Nutlets ovoid (fruit globose-ovoid), slightly larger, with two rows of spines along margin of nutlets (main and additional), at least in its lower part. Plants with spreading or semi-spreading hairs, somewhat gray. Stems higher, 25—70 cm. (Series Tianschanicae). 27.

23. Biennials, with grayish or gray, semi-appressed hairs, not sericeous. Nutlets along margin of disk with one row of small, dense spines, 7—8—9 at each side of disk. Stigma subsessile, completely hidden between apices of nutlets. Stems 15—20 cm high. Cauline leaves broadly linear, short. Inflorescence paniculate, with short cymes. Calyx in fruit with short obtuse lobes appressed to base of fruit. (Ak-Tau Mountains of inner Kyzyl-Kum) . . . . . 26. L. aktaviensis M. Pop. et Zak.

\+ Sericeous plants, with densely appressed hairs and with linear leaves; if plants nearly green with short, appressed, very sparse bristles, then radical leaves oblong-spatulate. (NE Central Asia, northeast and north of Balkhash and Ili River, also on the Fergana Range) . . . . . 24.

24. Leaves oblong or lanceolate-spatulate, i. e., rather broad, flat, obtuse, especially the radical . . . . . 25.

\+ Leaves linear, narrow, sometimes subfiliform, sericeous, with completely appressed dense hairs . . . . . 26.

25. Perennials, forming tufts up to 10 cm diameter. Leaves of radical rosettes 7—10 cm long, up to 8—10 mm wide; cauline leaves many (up to 15—20), lanceolate, 2—3 cm long, all leaves densely appressed-sericeous, with long rather thick hairs borne on very small tubercles. Stems 30—45 cm high. Corolla limb 6—8 mm across. Fruit up to 3 mm long; spines of main row erect, 0.2—0.5 mm, with additional lateral row of very short (nearly tubercles) spines. (Fergana Range) . . . 25. L. korshinskyi M. Pop.

\+ Radical leaves oblong-spatulate, green, with short remote bristles borne on large tubercles. Stems 10—20 cm high; cauline leaves

412 few, oblong-linear or lanceolate, green. Nutlets with 1 row of

very short (0.2 mm) incurved spines along margin of disk (as in L. rupestris). Style ca. 0.5 mm long, hidden among nutlets. (North of Lake Balkhash) . . . . . 24. L. glabrata M. Pop.

26. Biennial or perennial rosetted plants. Stems 10—30 cm high. Leaves subspatulate-linear. Spines along margin of disk very short, sometimes reduced to tubercles, incurved. Style ca. 0.3 mm long, protruding for 0.3 mm above apices of nutlets. In certain varieties some nutlets with a winged toothed rim . . . . . 22. L. rupestris (Schrenk) Gürke.

\+ Perennials, forming cushions; leaves narrowly linear. Stems 5—12 cm high. Spines along margin of disk (nutlet) short (0.2—0.5 mm), erect, in two rows, neither reaching apex of nutlet. (Near Lake Sairam) . . . . . 23. L. sericata M. Pop.

27(22) Stems (stem) 40—60 cm high. Cauline leaves lanceolate or lanceolate-linear, the median 3—6 cm long, 4—8(10) mm wide. Pedicels thin, rather long, usually ca. 3 mm, the lower up to 5 mm long, declined-drooping. Corolla 6—8 mm across. Spines of main row at margin of disk rather long (1—1.5 mm), spreading. Style protruding above apices of nutlets for 0.5 mm but not exceeding spines. (Tien Shan) . . . . . 20. L. tianschanica M. Pop. et Zak.

\+ Stems (25)30—50 cm high. Cauline leaves lanceolate-linear or linear, the median 2—3(4) cm long, 2—4(6) mm wide. Pedicels 1—2—3 mm long, erect. Corolla 4—5 mm across. Spines of main row at margin of disk 1—1.2 mm long but sometimes reduced to 0.5 mm. Style hardly exserted above apices of nutlets, not exceeding apices of spines of main row. (W. Tien Shan, Pamir area) . . . . . 21. L. tadshikorum M. Pop.

28(18) Biennials, with relatively high stems, 30—80 cm. Nutlets with 2 or even 3 rows of spines along margin, at least in the lower part. Style slightly protruding above the globose-ovoid fruit (series Echinatae), but one species with oblong fruit, long style and white corolla. (Pamir area). (Series Microcarpae, see above) . . . . . 29.

\+ Annuals, with shorter stems, 10—40 cm high. Spines along margin of nutlet (disk) in one (main) row, additional row absent (in one species, L. semiglabra, with additional row, disk very narrowly lanceolate, with keel of long spines, spines along
413 margin very long, thin), sometimes margin of disk without spines or some nutlets occasionally with short ones (anomalous species of series Strictae), style hidden among apices of nutlets. (Series Strictae and Macracanthae) . . . . . 32.

29. Corolla white, limb campanulate, 2—4 mm across. Fruit oblong; style long, ca. 1 mm, thin; thickened margin of nutlets with one row of short, 0.1—0.5 mm, anchorlike spines or only tubercles. Stems 25—40(45) cm high. Leaves linear, grayish, with subappressed hairs. Fruiting racemes long, very loose . . . . . 29. L. kulikalonica Zak.

\+ Corolla blue (exceptionally white). Fruit globose-ovoid, with 2—3 rows of spines, at least in the lower part of nutlets, sometimes

with only one (main) row in the upper part. Style rising above apices of nutlets for 0.2—1 mm. Calyx lobes stellate-spreading under fruit. (Series Echinatae) . . . . . 30.

30. Calyx lobes stellate-spreading under fruit, markedly elongating, to 7—8 mm (and even longer). Leaves lanceolate, green, subglabrous, 2—3 cm long, declined. Stems 15—30(40) cm high, broadly branching. Disk of nutlet ovate, without crest, sides and disk rugose-tuberculate; spines of main row spreading, 1—2 mm long, with very large anchorlike tip. (Near Lake Baikal and along the Lena River) . . . . . 17. L. anisacantha (Turcz.) Gürke.

\+ Calyx spreading in fruit, up to 4—5 mm long. Leaves upright, rarely declined, 3—5 cm long, grayish, usually not flat. Stems 30—60(80) cm high, usually branching only above, branches short, rarely long, spreading. Disk of nutlet oblong or even oblong-lanceolate, sides and disk sometimes densely oristate-tuberculate but not rugose; spines of main row 1—1.5 mm long, with small anchorlike tip. . . . . 31.

31. Spines on second lateral row nearly as long as spines of main row, extending to apex of nutlets; upper part of nutlets not separated by oval pit. Style slightly protruding above nutlets. Plant usually high, 30—80 cm, branching mainly in upper third or half. Branches and racemes short and loose. Leaves lanceolate, linear in low weak individuals. Hairs spreading, dull gray . . . . . 19. L. echinata Gilib.

\+ Second lateral row of short, often tubercle-like spines distinct only in the lower (thick) part of nutlets, upper part of nutlets
414 separated by deep oval or elliptic pit, sides of nutlets shiny, smooth, without spines and often without tubercles, only margin of disk with short anchorlike spines. Style protruding above nutlets for 0.5—1 mm. Plants like the preceding in habit but still slightly thinner and lower and leaves narrower (comparative average of hundreds of individuals). (Steppe zone in the south, also in the northern deserts and semi-deserts in (everywhere?) the Caucasus and mountains of the southern part of Central Asia, usually in weedy and semi-weedy places) . . . . . 18. L. consanguinea (Fisch. et Mey.) Gürke.

32(28) Spines of main row (along margin of disk of nutlets) 1—2 mm long or completely absent, replaced by tubercles. Flowers blue, small (Series Strictae) or white (Series Macrae) . . . . . 33.

\+ Spines of main row 2—3 mm long. Flowers usually blue (small or medium-sized in L. macrantha), rarely white (L. caspica). (Series Macracanthae) . . . . . 37.

33. Nutlets 2.5 mm long, margin of disk without spines ascending, finely tuberculate, nutlets finely granular-tuberculate, rarely smooth, as if cast along disk and sides; disk oblong-lanceolate. Sometimes few nutlets with 1—2 thin erect anchorlike spines along margin of disk. Style elevated above apices of nutlets for 0.5 mm. Plants relatively tall, 20—50 cm. Leaves lanceolate to linear; hairs dull gray, spreading. Flowers not very small;

limb campanulate, 2—3 mm across, corolla 3.5—4 mm long. (NE part of Central Asia) . . . . . 16. L. brachycentroides M. Pop.

\+ Nutlets with more or less short but consistently present spines along margin . . . . . 34.

34. Corolla white, hardly 2 mm long, with narrow tube, limb very small, narrowly campanulate, half as long as tube. Nutlets 2 mm long, narrowly triangular, smooth at sides and below, with keel of 4—6 small anchorlike spines or tubercles along disk, and few (7—9) thin anchorlike spines along margin of disk. Style hidden. Stems 10—15 cm high, slightly branching. Racemes in fruit elongate, loose. Leaves linear, glabrous above, beset beneath with spreading bristles on large tubercles. (Lake Balkhash) . . . . . 12. L. macra M. Pop.

\+ Corolla normally blue, 3—4 mm long, with distinct campanulate limb approximately as long as tube . . . . . 35.

35. Spines of main row thin, short, 0.5—0.9 mm, far apart, disk of nutlets oblong, without keel, finely tuberculate. Style slightly
415 protruding above apices of nutlets. Fruit 2.5 mm high. Thin plants, with thin erect stem 15—30 cm high; leaves broadly or narrowly linear. Hairs spreading. (From Altai to S. Urals) . . . . . 15. L. tenuis (Ldb.) Gürke.

\+ Spines of main row 1—2 mm long, joined by bases or drawn apart. Fruit 3—3.5 cm high . . . . . 36.

36. Spines of main row 1—1.2 mm long, drawn apart or slightly touching each other; disk ovate or oblong, without keel, tuberculate or rarely smooth. Style almost entirely hidden between nutlets. In habit like L. consanguinea but slightly (on an average) lower, generally smaller; stems 30—50 cm high. Intermediate between L. consanguinea and L. tenuis. (From Altai to Lake Baikal) . . . . . 14. L. intermedia (Ldb.) M. Pop.

\+ Spines of main row ca. 1.5 mm long, usually horizontal and curved, broad at base, adjacent; disk narrow, nearly lanceolate, with protruding keel, tuberculate or rarely smooth. Pedicels rather long, 2—4 mm, sometimes curved. Stems 15—20—30 cm high. Leaves lanceolate-linear. (Lower Volga to Altai. Isolated (var. pamirica) in Pamir) . . . . 13. L. stricta (Ldb.) Gürke.

37. Corolla blue, medium-large, nearly Myosotis-like, limb slightly campanulate, not quite flat, 5—8 mm wide. Fruit oblong, 4—5 mm high; nutlets with oblong disk, beset along keel with fine anchorlike spines; spines of main row (along margin of disk) 2—3 mm long, horizontal, markedly broadening at the adjacent bases. Style hidden between nutlets. Stems 20—40 cm high. Leaves broad, lanceolate or oblong-spatulate, obtuse, subglabrous above and bright green, thick. (From Altai to Aral Sea) . . . . . 10. L. macrantha (Ldb.) Gürke.

\+ Corolla small, with campanulate narrow limb not more than 3 mm across. Leaves linear or linear-oblong. Fruit smaller or narrower. Plants usually 10—25 cm high . . . . . 38.

38. Nutlets and disk narrow, lanceolate, ca. 4 mm long; disk with more or less long anchorlike spines along its median line;

spines of main row (along margin of disk) long (2—3 mm), thin, spreading, below a second lateral row of few thin spines half the length. Leaves lanceolate or oblong-lanceolate to linear, usually glabrous, green above, sparsely spreading-hairy beneath.
416 Pedicels 1—1.5 mm long, up to 4—5 mm long and then usually arcuately curved. Stems 10—20(30) cm high, usually branching with long thin branches. Flowers blue or white. (From the lower Volga and S. Altai to Pamir and Iran) . . . . . 9. L. semiglabra (Ldb.) Gürke.

\+ Nutlets oblong, ca. 3 mm long, disk lanceolate, largely awned-tuberculate; spines of main row 2—2.5 mm long, usually remote, rarely bases adjacent (slightly expanding), spreading. Pedicels very short, ca. 1 mm long, thick, erect. Stems 10—25 cm high. Branches spreading, stiff. Leaves linear, spreading-gray-villous at both surfaces obtuse. Flowers pale blue, small . . . . . 11. L. patula (Lehm.) Aschers.

Section 1. SCLEROCARYUM DC. Prodr. X (1846) 142; Boiss. Fl. or. IV, 247 et 249. — Sclerocaryopsis Brand in Pflanzenr. IV, 252 (1931) 98. — Nutlets with very thick, usually shiny walls appearing stony, inner (ventral) keel completely adnate to gynophore, hardly separated from it even when fruit completely ripe. Gynophore with reduced basal stipe. Annual herbs of deserts and semi-deserts.

Note. Brand's conception of the real, morphological differentiation in the genus Lappula was rather wrong, as evidenced by the fact that after needlessly separating L. spinocarpos into the genus Sclerocaryopsis, he excluded from the genus such closely related species as L. diploloma and L. cristata and, moreover, ranked L. redowskii, a species of the real Lappula, as a variety.

In all the species of this section the ventral keel is entirely adnate to the gynophore. The dorsal areola, disk, is very poorly defined in the type (L. spinocarpos) of the section but the authors are wrong in stating that it is absent in this species and that its nutlets are not rimmed along the margin of the disk. Indeed, the elevated margins (rim) of the disk are so strongly developed that they almost completely cover the disk, leaving it as a narrow, longitudinal slit or furrow; if the margins are adjacent (from both sides of the disk) they cover the disk completely, arising to form what resembles a keel (Boissier writes: "Nuculae. . . facie dorsali carinatae"). Simultaneously, there was a degeneration of the anchorlike tips of the spines and instead there are thick tubercles or tubercled spines. Anchorlike spines are absent in L. ceratophora although owing to the character of the covered disk it is actually Sclerocaryum; these are absent in L. cristata although here the elevated, winglike margins of the disk are not adjacent. On the other hand, the spines in L. diploloma are well
417 developed and the anchorlike tip is distinct, the disk is nearly hidden by the elevated margins but not to the same extent as in L. spinocarpos. The same is true of L. marginata. These two species, like L. balchaschensis, are a transition to the common Lappula, for example, L. macrantha.

Series 1. Sclerocaryopsis M. Pop. — Disk nearly or completely covered (overtopped) by its adjacent thickened margins (rims), sometimes protruding like a keel; spines thick, short, passing into tubercles, often without anchorlike tip. Style elevated above nutlets as a thick mucro. Low, dichasially (furcately) short-branching desert herbs.

1. L. ceratophora M. Pop. comb. n. — Echinospermum ceratophorum M. Pop. in Pop., Kult., Korov. Descr. pl. nov. Turk. (1916) 67, tab. 17. — Sclerocaryopsis spinocarpos Brand in Pflanzenr. IV, 252 (1931) 98, forma fructibus maximis Brand, l. c. 99.

Annual; plants 5—10(15) cm high; root thin, vertical; stem sturdy, thick, appressed-gray-hairy, erect, branching nearly from base or only in upper part, the branches dichasically branched, basal branches often arcuately ascending; leaves appressed-hairy to sericeous, bristly hairs borne on small white tubercles; grayish blades 2—4 cm long, subspatulate-broad-linear, often longitudinally folded, obtuse, spreading. Flowers and fruits at ends of the furcate branches and stem, on short, erect stalks, thick in fruit; calyx in flower ca. 2 mm long, with linear, semi-appressed-downy lobes, 5—6 mm long in fruit, embracing fruit; corolla blue, 2 mm long, i. e., as long as calyx, with very short tube and narrowly campanulate limb, lobes short, ovate, obtuse, 0.5 mm long; fruit rather large, broadly pyramidal, 4—5 mm high, shiny; nutlets markedly compressed at sides, cuneate towards the ventral keel thus with broad gap between them, dorsally cuneate, narrow towards apex, at base triangular, broadening, thickly wrinkled or tuberculate along sides; disk not visible, covered above by the elevated margins appearing like a keel, on margins 2—3 conical spines without anchorlike tip, the two upper ones short and the third low, horizontal, flat, sometimes distinctly longer, bifurcate at apex, horn-like (hence the name of the species), 2—3 mm long; base of nutlet (under disk) flattened, with short tubercle spines; all spines without anchorlike tip; upper part of style up to 1 mm higher than nutlets. April. (Plate XX, Figure 1.)

Stony, gypsiferous deserts, hammadas. — Centr. Asia: Syr D. (stony
418 desert between Leninabad and Kokand), Amu D. (lower reaches of Zeravshan), Kara K., Pam.-Al. (Shirabad). Gen. distr.: Iran. (deserts of Central Iran). Described from Kara-Kum near Khalka, gravel terraces of residual outcrop (fruit 1 VI 1916, Korovin, No. 962). Type in Leningrad.

Note. Brand regarded this species as a form of the common L. spinocarpos. Our species distinctly differs from the drooping, bristly L. spinocarpos by the thinner appressed pubescence sometimes slightly sericeous. The nutlets of our species are larger and provided at base with two hornlike spines absent in L. spinocarpos. The absence of anchorlike spines on the nutlets also distinguishes our species from L. spinocarpos.

2. L. spinocarpos (Forsk.) Aschers. ex Kuntze in Tr. Bot. Sada, X (1887) 215; Kryl., Fl. Zap. Sib. IX, 2252. — Anchusa spinocarpos Forsk. Fl. aegypt.-arab. (1775) 40. — Echinospermum spinocarpos Boiss. Fl. or. IV (1875—1879) 249; Lipskii in Tr. Bot. Sada, XXVI, 557; Schmalg. Fl. Sr. i Yostu. Ross. II, 224. — Sclerocaryopsis spinocarpos Brand in Pflanzenr. IV, 252 (1931) 98. — Echinospermum

vahlianum Lehm. Pl. Asperif. II (1818) 132; Ldb. Fl. Ross. III, 162.— Echinospermum condylophorum Lehm.? l. c. 125.— E. tuberculosum Ldb. in Eichw. Pl. casp.-cauc. (1831) 2, 11.— Ic.: Ldb. l. c. tab. 6 (VI).

Annual; stem erect, 5—15 cm high, often branching from base, rarely from the middle, with dichasial branches, grayish, appressed hairy-bristly; leaves grayish, with semi-spreading or semi-appressed bristly hairs borne on small white tubercles, blades 2—4 cm long, broadly linear, somewhat spatulate, often longitudinally folded, obtuse. Flowers and fruits on dichasial branches, on short thick erect stipes; calyx in flower 3—4 mm, with linear spreading bristly lobes longer than corolla, lobes in fruit up to 6—8 mm long, exceeding fruit; corolla sky-blue, 3 mm long, with very short tube and narrowly campanulate limb, lobes erect, obtuse, 0.5—0.8 mm long; fruit globose-ovoid, ca. 4 mm high; nutlets dorsally cuneate, more ovate-broadened at base thus adjacent below, separated above by depression, sides and lower part pitted-tuberculate; disk a narrow line between two approximate, thick margins ascending to form a keel, spines few, short, thick close to base, bearing rudimentary anchorlike tip seen as a transparent disk, all spines not longer than 0.8 mm, nutlets usually dullish in color, the mature gray; end of gynophore elevated above nutlets for 1.5 mm. March—April. (Plate XXII, Figure 1.)

Deserts and mountainous plains.— European part: L. V.; Caucasus:
419 S. and E. Transc.; West Siberia: Alt.; Centr. Asia: Balkh., Ar.-Kasp., Kyz. K., Kara K., Amu D., Syr D., Dzu.-Tarb., T. Sh., Pam.-Al. **Gen. distr.**: Iran., Arm.-Kurd., Iraq, N. Afr. (from Egypt to Algeria). Described from Egypt (Alexandria). Type in London.

Series 2. **Diplopleura** M. Pop.— Thickened margin of disk protruding as a more or less narrow wing covering or half-covering disk but not completely so. Walls of nutlets thinner. Style not elevated above nutlets as a thick mucro. Branching of stem sometimes not obviously dichasial-furcate. Higher plants, 15—40 cm high, with elongate fruiting racemes; representing a transition to the real Lappula; one small species with habit of the preceding series.

3. **L. cristata** (Bge.) B. Fedtsch., Rast. Turk. (1915) 663; Kryl., Fl. Zap. Sib. IX, 2251.— Echinospermum cristatum Bge. in Delect. Sem. Hort. Dorpat. (1839) VIII; Ldb. Fl. Ross. III, 162.— Omphalodes cristata DC. Prodr. X (1846) 160.— Lappula redowskii var. (vel potius monstrositas) diploloma Brand in Pflanzenr. IV, 252 (1931) 150, pro parte, non Mattiastrum cristatum Brand in Pflanzenr. IV, 252 (1921) 62 et l. c. (1931) 151 (in species excludendae) quod est planta omnino diversa.— Ic.: Bong. et Mey. Verzeichn. am Saissan-nor. . . gesamm. Pflanz. 49, tab. XI.

Annual; sparsely spreading-hairy plants; stem rarely simple, usually branching from the middle or base with ascending, furcate long branches, 15—30 cm high; leaves linear, sometimes somewhat spatulate, 2—7 cm long, 2—5 mm wide, flat, acute, greenish, sparsely spreading-hairy. Racemes at ends of branches and stem, loose in fruit, up to 10—15 cm long, with remote

fruits, slightly leafy; pedicels thin, erect, appressed-downy, the lower up to 3 mm long; flowers small; calyx in flower 3 mm long, sparsely bristly, with linear acute lobes elongating in fruit up to 5 mm; corolla blue, small, hardly longer than calyx, tube very short, limb campanulate, with short ovate-orbicular lobes; fruit 3 mm long, globose-ovoid; nutlets with low sides, finely tuberculate-pitted; disk smooth, narrowly oblong, half hidden by coriaceous winglike high rim, rim higher at base of disk (nutlet) and curved or appressed, few-toothed along margin, teeth 2—4 at each side, larger below (where rim wider) and smaller above (where rim narrower), without anchorlike tip; gynophore short, 1.5 mm long, with column at base; style very short, 0.2 mm long, hidden between nutlets. May.

Sandy places along lake banks. — West Siberia: Alt. (Chernyi Irtysh valley near Nor-Zaisan Lake, after Kryl., ripe fruit, 17 VI 1838 (Politov)).
420 Kryl. (op. cit.) also reports the Arkat Mountains (Shchegleev), but I did not see this specimen. Endemic. Description based on the Politov collections and plants grown in Leningrad from the same seeds. Type in Leningrad.

Note. Brand caused double confusion with respect to this species. On the one hand he included Echinospermum cristatum Bge. in the synonymy of the close but distinctly differing E. diploloma, considering this last rather a monstrosity(!). On the other hand he placed the same name Echinospermum cristatum Bge. in the synonymy of Paracaryum (or, according to Brand, Mattiastrum) cristatum (Schreb.) Boiss., which is a very unique plant from the Armenian-Kurdistan area, with large winged nutlets, 12—14 mm across, with flat wing.

Actually, Lappula cristata is a very distinct species which, remarkably enough, has never been collected again in the 100 years after Politov's collections. We believe that including this species in Omphalodes because of the winged nutlets and absence of anchorlike spines is unjustified. Its habit and other characters are typical for Lappula. V. P. Goloskokov collected a plant at the sources of the Sary-Su River (12 VI 1949) similar to L. cristata but in a mixture with L. stricta with which hybrids are formed in this area.

4. L. diploloma (Schrenk) Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107. — Echinospermum diploloma Schrenk, Enum. pl. nov. I (1841) 36; DC. Prodr. X, 139; Ldb. Fl. Ross. III, 159; Bge. in Mém. Acad. Sc. Pétersb. Sav. étrang. VII (1854) 409. — Lappula redowskii var. (vel potius monstrositas) diploloma Brand in Pflanzenr. IV, 252 (1931) 150, pro parte.

Annual; stem thin, 15—25 cm high, slightly branching in upper part, nearly simple with few long, ascending branches, sparsely hairy with long-spreading, not appressed hairs; leaves rather wide, lanceolate, 2—3 cm long, flat, rather delicate, obtuse, greenish. Racemes at ends of branches and stem, elongate, loose, very leafy, with lanceolate, ca. 1 cm long leaves up to apex of racemes; pedicels firm, erect, 1—2 mm long, spreading-hairy; flowers small; calyx in flower ca. 2.5 mm long, with hairy, linear, acute or obtuse lobes elongating and stellately spreading in fruit, sometimes even slightly curved; corolla 3 mm, blue, tube short, the limb campanulate, with oblong obtuse lobes 0.8 mm long; scales small, ovoid; fruit
423 broadly pyramidal-ovoid, 3 mm high; nutlets triangular when viewed dorsally,

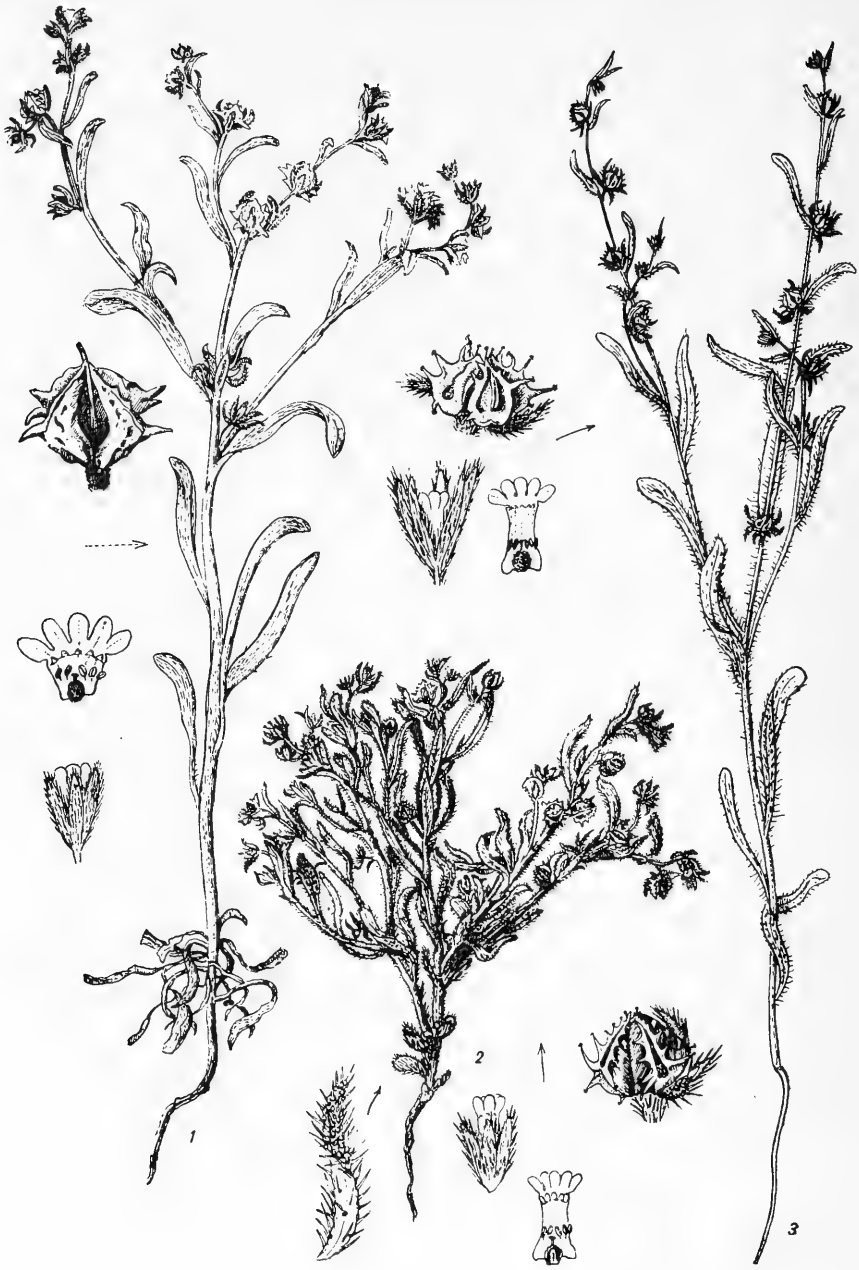

PLATE XX. 1 — Lappula ceratophora M. Pop.; 2 — L. balchaschensis M. Pop.; 3 — L. diploloma (Schrenk) Gürke.

rather strongly compressed at sides, obliquely descending to gynophore at base, shiny, hardly separating from gynophore even in ripe fruit, laterally smooth or large-rugose in cross section; dorsal areola narrow, smooth but with an entire keel high at the lower part and protruding outward at an angle, disk hardly visible, with a rather high, callous-thickened or inflated marginal rim, undulately curved on disk and bearing along each side 4—5 long anchorlike spines triangular-broadened at base, subdeclinate at apex; gynophore 3 mm long, style 0.5 mm long, thin, hidden between nutlets. May. (Plate XX, Figure 3.)

Semi-deserts at 48—49° N., rare. — Centr. Asia: Balkh., Ar.-Casp. Endemic. Described from Ayaguz (Sergiopol') (in declivibus aridis versus fl. Ajagus, flowers, fruit, 29 V 1840, Schrenk). A second locality on Irgiz River near the former Turgai region (fruit, 25 V 1842, L. Leman, fruit 25 V 1914, Desyatova). Type in Leningrad (Schrenk sent the seeds from which the plants were grown in Leningrad).

Note. This species, more than the others of the series Diplopleura, shows a distinct resemblance in the structure of the nutlets to the series Sclerocaryopsis, i. e., with the typical representatives of the section Sclerocaryum DC. Apparently the nutlets do not completely separate from the gynophore. Even in ripe fruits great force is required to separate the nutlets. The ventral keel of the nutlets is attached to the gynophore for the entire length, also as in Sclerocaryopsis, but in contrast to these similarities the slits between the nutlets are narrow, the nutlet walls are slightly thickened, there are long anchorlike spines along the rim and the gynophore is not elevated above the nutlets (without free end) but is equal to them in length. By the absence of dichasial branching of the stem, it is also more related to the typical Lappula than to Sclerocaryopsis.

5. **L. balchaschensis** M. Pop. ex Pavl. in Bot. zhurn. SSSR, 30, 4 (1945) 190.

Annual; stem 4—8 cm high, erect, branching from middle with branches declinate and spreading, bearing racemes at apex; the plant looks like a small shrub, like L. spinocarpos; stems and branches sparsely covered with stiff, spreading, white hairs; leaves rather long, 2—2.5 cm, broadly linear, up to 3 mm wide, sometimes subspatulate, obtuse, green, spreading-hirsute or bristly, the bristles borne on rather large white tubercles. Racemes in fruit not long, bearing small, linear-lanceolate bracts; pedicels thin, drooping or curved, approximately as long as fruit; flowers small,
424 blue; calyx small, with spreading bristles, lobes oblong-linear, elongating and loosely embracing fruit, not declined; corolla small, blue, tube ca. 1.5 mm long, lobes of campanulate limb obtuse, orbicular, 0.5 mm long; fruit subglobulose, 2.5—4 mm across; nutlets hardly separating from gynophore, shiny, appearing coriaceous, narrowly triangular, with sides and base slightly rugose, not tuberculate; dorsal areola (disk) tuberculate at median line along keel, narrow, with ascending thickened white marginal rim, appressed to disk and nearly concealing it, bearing 3—4 spines at each side, spines firm, nearly conical, short, anchorlike at apex, broadening at base and fusing with rim, the spines at apex of nutlet shorter than those at base; style short, hidden between nutlets; gynophore slightly shorter than nutlets. May—June. (Plate XX, Figure 2.)

Stony, hilly deserts. — Centr. Asia: Balkh. (northern shore of Balkhash, stony volcanic shale near Bertys Bay, flowers, fruit, 13 VI 1934, Popov), T. Sh. (Lake Issyk-Kul', Nikitina). Endemic. Described from Bertys Bay. Type in Alma-Ata.

Note. Very similar to L. spinocarpos in the low, spreading habit; by the short gynophore and the distinct disk resembling L. diploloma from which it differs by the small, spreading growth, linear leaves with coarse hairs and by the not inflated rim of nutlets bearing shorter spines. N. V. Pavlov apparently absent-mindedly added his name to the combination L. balchaschensis. He had my manuscript where this combination was made and included in the synonymy of Echinospermum balchaschense M. Pop.

Section 2. EULAPPULA Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Kuzn. in Mat. Fl. Kavk. IV, 2a, 170. — Eleuterocarpellares Zak. Burachn. Zeravsh. (1941) 17. — Style shorter than ripe nutlets, young nutlets with apices not attached to gynophore and therefore growing above gynophore hiding style. Nutlets usually 2—3 mm long, comparatively easily separating from gynophore when ripe. Gynophore with well developed column below supporting base of nutlets. Lateral branches of stem simple, not furcate, with elongate fruiting racemes, rarely long-furcate.

Series 3. Marginatae M. Pop. — Disk of nutlets rimmed with one row of
425 rather long or short, anchorlike spines fused at their expanded bases into narrow coriaceous-scarious wing.

6. L. marginata (M. B.) Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Kuzn. in Mat. Fl. Kavk. IV, 2a, 202; Kryl., Fl. Zap. Sib. IX, 2248. — Myosotis marginata M. B. Fl. taur.-cauc. I (1808) 120; II, 458; III, 120. — Echinospermum marginatum Lehm. Pl. Asperif. II (1818) 130; Ldb. Fl. Ross. III, 158; Shmal'g., Fl. II 225; Boiss. Fl. or. IV, 252.

Annual; stems 10—20 cm high, spreading-branching, often from base, rarely only above, sparsely spreading-villous; leaves in type short and broad, flat, oblong or lanceolate, declinate, green, acute, sometimes (hybrids?) gray, linear, upright. Fruiting racemes elongate, 5—10 cm, leafy, with lanceolate leaves; pedicels medium to long, the lower up to 3 mm long, erect, or ascending or slightly curved; calyx in flower ca. 2 mm long, sparsely semi-spreading-bristly, lobes lanceolate, acute, much elongating in fruit, stellately spreading; corolla small, blue, hardly longer than calyx, ca. 3 mm long, limb campanulate, with small, orbicular obtuse lobes not longer than 0.5 mm; fruit large, ca. 5 mm across (incl. spines at all sides), subglobulose; nutlets ca. 3.5 mm long, smooth or rugulose at sides and base, easily separating from gynophore when ripe; dorsal areola oblong, usually smooth, flat, rarely slightly tuberculate along keel, margin with narrow, winglike, coriaceous keel-like rim curved on disk and bearing long, anchorlike spines, spines triangular-broadening below, obliquely declined at apex, 5—6 at each side, ca. 2 mm long, rim-wing ca. 1 mm wide; gynophore short, 2—2.5 mm long; style up to 0.5 mm long hidden between ripe nutlets. April—May. (Plate XXII, Figure 3.)

Sandy places in semi-desert in the Volga area (more accurately, in the North Caspian semi-desert). — European part: L. V. (Krasnoarmeisk-Astrakhan); Caucasus: Cisc. (Prikum'e and Terek). Special forms in the foothills of Altai and Central Kazakhstan Hills. Gen. distr.: N. Mong. (specific races). Described from Astrakhan. Type in Leningrad (not found).

Note. A very complex and difficult species, as reflected in the literature and herbaria. It was described from Astrakhan (in vineis circa Astrachan frequens — M. B. l. c. I (1808) 120) and later from Terek and Prikum'e. In this region its distribution encompasses the northwestern part of the
426 Caspian desert area. I did not see Bieberstein's specimens and hence cannot confirm the records of either Terek or Prikum'e, but I have seen many specimens from Astrakhan (Claus, Blume, Krasnov, Pachosskii, Goldie, and Becker's specimens from near Sarepta). Subsequent reports are erroneous or doubtful.

Caucasus: Kuznetsov (op. cit. 203) erroneously reported this species from Dagestan-Akhta (Becker, Alekseenko), but it is probably L. patula or a closely related form, certainly not L. marginata. Kuznetsov was correct in doubting the records for Somkhetia and Kakhetia (Eichwald, Ledebour, Boissier) as they are very unlikely.

Central Asia: I did not see the Ural specimens (Krylov, op. cit. 2249, in general distribution) in any of the herbaria. The reports from the Transcaspian area (Krylov, op. cit. 2249) and Turcomania (Ledebour and Boissier) refer to the Karelin specimen which is of doubtful origin and was probably collected somewhere in Gur'ev or Mangyshlak (I saw this specimen in the Ledebour herbarium). In any event this species does not grow in what is modern Turkmenia.

Schrenk's plant from Tersakan is var. kirghisorum M. Pop. Stem erect, robust, with erect or spreading branches. Leaves wider, obtuse. Flowers smaller; spines shorter. May possibly be separated into an independent species, L. kirghisorum M. Pop. (Tersakan (Schrenk, 591)). Salt lake between Ak-Cheku and Argaly Mountains, along shores (flowers, fruit, 19 V 1914, Kosinskii, No. 274); near Lake Dzhaman-Tuz, steppe meadow (flowers, fruit, 5 V 1914, Kucherovskaya, No. 1510). This small species occupies a limited area in the northeastern part of Central Kazakhstan and is close to L. stricta.

According to Krylov, var. granulata Kryl. grows in Altai, specific to the Chuya River. I saw only one specimen (Chuya River near Kiyak-Kara, sands, flowers, fruit, 18 VIII 1931, Sumnevich) that reliably corresponds to Krylov's description. It differs from the typical form (var. laevis Kryl.) by the thin, ascending, weak branches, narrow, nearly linear leaves, longer peduncles, densely white-tuberculate sides and disk of nutlets, narrower rim around disk, nearly disappearing in some nutlets. This specimen is remarkably close to L. semiglabra and L. intermedia. Another specimen from Kosh-Agach (14 VII 1931, Shishkin and Chilikina) is L. semiglabra. Two other specimens (Boro-Bur-Gazy River near entrance to Chuya steppe (21 VIII 1931) and Aksai River (23 VIII 1931, Shishkin and Chilikina)) are closer to the dwarf forms of L. intermedia or hybrids between it and L. granulata (Kryl.) M. Pop. L. granulata M. Pop. is distributed in N. and E. Mongolia (Dariganga; sands Ongon-Elis

(13 and 14 IX 1931, Pobedimova); Tsitsirin-Gol, dry gravels (10 VII 1877, Potanin); Khangai, gravels of Tyupurte River (flowers 9 IX 1926, N. Pavlov). I saw the typical var. laevis Kryl. from Chuya steppe (mountain slopes
427 near Kukuryu, flowers, fruit, 29 VII 1937, Kalinina).

7. L. lipskyi M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 311. — L. marginata f. heterocarpa Lipsky in Kryl., Fl. Zap. Sib. IX (1937) 2249 (nomen).

Annual; stem (20)30—40 cm high, branching from base or above, in weak specimens branching only above, with spreading or ascending, stiff branches, branches slightly branching to form a panicle, with appressed or semi-spreading hairs, ending in elongate racemes; leaves oblong-spatulate, obtuse, rather short, 1—3 cm long (the lower spatulate, up to 4 cm long), up to 1 cm wide, subcoriaceous, beset with large white tubercles bearing spreading hairs or bristles, green and subglabrous above, along margins with large tubercles, somewhat grayish beneath. Fruiting racemes erect, slightly flexuose, loose; pedicels erect, 1—2 mm long, with spreading, fine bristles; calyx in flower ca. 2 mm long, with oblong-linear obtuse lobes covered with large white tubercles bearing small bristles, slightly elongating and spreading in fruit; corolla blue, medium-large, with short tube and flat limb, lobes ovate-rounded; fruit ovoid or globose-ovoid; nutlets 3.5 mm long, oblong, finely tuberculate at sides or smooth, finely granular along disk and often with acutely protruding keel, disk with marginal, coriaceous, more or less wide wing, dentate along margin, the teeth upright, 5—7 at each side, triangular, short, anchorlike at apex, other nutlets in same fruit wingless, with short anchorlike spines along margin of disk, sometimes all nutlets in fruit winged or all wingless; style short, completely hidden among nutlets. June—July.

Shaly hills in the semi-desert belt at foot of southern Altai. — West Siberia: Alt. (River Irtysh, Kal'dzhir valley, Chiganchii, flowers, fruit, VI—VII 1908, Keller, Nos. 4, 5, and 6). Endemic. Described from the above locality. Type in Leningrad.

Series 4. **Heteracanthae** M. Pop. — Spines at margin of disk long, flat, sometimes fusing into narrow winglike rim, additional 1—2 rows of shorter spines behind them along sides of nutlet. Nutlets with free apices. Style hidden among nutlets. Very close to Marginatae but spines bi- and triseriate. Annuals.

8. L. heteracantha (Ldb.) Gürke* in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Kuzn. in Mat. Fl. Kavk. IV, 2 181; Kryl., Fl. Zap. Sib. IX,
428 2244. — Echinospermum heteracanthum Ldb. Suppl. Ind. Sem. Hort. Dorpat. (1823) 3; Ldb. Fl. alt. I, 198 (in adnot.); Fl. Ross. III, 157; Shmal'g., Fl. II, 225; Boiss. Fl. or. IV, 249. — Lappala echinata Gilib. var. heteracantha Brand in Pflanzenr. IV, 252 (1931) 139, pro parte. — Echinospermum semicinctum Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 605. — Ic.: Ldb. in Eichw. Pl. casp.-cauc. tab. 21.

* Javorka (Mag. Fl. 843) writes: Lappula heteracantha (Ldb.) Borb.

Annual; stem erect, robust, 15—30 cm high (with racemes), branching only above in inflorescence, branches ascending, sparsely spreading-hairy; leaves grayish-villous, more glabrous above, lanceolate, rather large, 2—4 cm long, 0.5—0.9 cm wide, obtuse, soft. Fruiting racemes elongate, erect, 5—10 cm long, slightly leafy and only beneath; pedicels distinct, rather thin, erect, the lower to 3—4 mm long, the median 1—2 mm long; flowers small, blue; calyx in flower ca. 2 mm long, lobes in fruit horizontal, slightly elongate, linear, acute; fruit rather large, ca. 5—6 mm across (incl. spines), subglobose; nutlets 3—3.5 mm long, dorsal areola-disk rather narrow, oblong, either finely and acutely tuberculate or rarely smooth along margin with row of long yellow spreading anchorlike spines fusing at base into narrow wing-like rim, spines 5—6 at each side, behind and below them (at sides of nutlets) a second row of shorter and thinner spines, finely tuberculate below side; style not protruding at all from spines. June. (Plate XXII, Figure 13.)

Sandy and stony places in semi-deserts and steppes. — European part: L. V., L. Don (?) (M. Dnp., U. Dns. - variety), Crim.; Caucasus: Cisc., Dag. Endemic. Described from Astrakhan. Type in Leningrad.

Note. A very problematic species. Kuznetsov correctly assumed it to be simply a hybrid, however not L. echinata × L. patula as he proposed, but L. echinata (or L. consanguinea) × L. marginata. The spines are usually disposed in 2 or 3 rows, sometimes all are more or less equal or those in the outside row (along sides of nutlets) much shorter than those inside (along margin of disk). The latter case is typical of L. semicincta (Stev.) M. Pop. Spines of the inner row are connate, but to various degrees even on nutlets of one and the same specimen. In some nutlets there are no connate spines, the nutlets being without a wing-like rim. In general the species represents a collection of transitional forms from L. marginata to L. consanguinea (or L. echinata).

The species was described from Astrakhan where it is very common as are L. marginata and L. consanguinea (formerly Astrakhan province, Bashmakovka village, fruit, 3 VI 1914, Doinikov, No. 129; Sarepta
429 (Krasnoarmeisk) Becker). Kuznetsov (op. cit. 182—183) reported it for nearly the entire Caucasus up to Kars, Rachin and the upper reaches of the Rion River, in addition to Armenia and the Crimea; Shmalgauzen (op. cit.) reported it only for the Northern Caucasus. After an inspection of herbarium material, the following collections appear indisputable: Kizlyar, 1 VI 1890, Lipskii; Kislovodsk, 10 VI 1903, Borodin, No. 570; Nikolaevskaya railroad station, 3 VI 1861, Overin (broadleaved, luxuriant form); former Kuban region "in campis ad fl. Anticetam" (Kuban'), fruit, 15 VII 1829, Meyer, No. 865; Dagestan: Akhty, fruit (1872) 74, Becker. The following specimens from Transcaucasia that are closer to L. consanguinea are dubious: Tobi — Khokhennaker, Tbilisi, Overin; Armenia near Aleksandropol', Bordzilovskii; between Shulaver and Borchalo, Overin; Borzhom, Borodin; Dagestan: Akhty — Alekseenko, Aleksandrovka — Khotsyatovskii, 1897, although all were identified as L. heteracantha by Kuznetsov.

I have not found reliable specimens, except those erroneously identified, from east of the Volga, near the former Ural, Akmolinsk and Semipalatinsk regions, localities which were reported by Krylov (op. cit. 2244). This species does not occur in Turkmenia either. Krylov also reported it from

the Chernyi Irtysh River, Buran (Plotnikov, 1916), but although I did not see this specimen I very much doubt that it is L. heteracantha. The specimen from the Irtysh River opposite the mouth of the Kal'dzhir River (flowers, fruit, 21 VI 1914, Shishkin) is actually closer to L. echinata.

All the records from Siberia (Yakutsk, Tabiganskaya), Kamchatka, Korea, China and S. Africa made by Brand (l. c. 139—140) are unquestionably due to a misunderstanding. A special form (var. omskiana M. Pop.) was found near Omsk (in Herbarium Trautfetter and Meyer, later Goldie, 6 VI 1884); peduncles long (up to 5 mm) and arcuately curved. I suppose that the specimen from Krasnoyarsk, near the monastery (flowers, fruit, 29 V 1910, A. P. Ermolaev, No. 168), would be included here.

The population similar to the Astrakhan form, growing in Podolia (Zaleshchiki on the Dniester*) and probably in Hungary (see Javorka, Mag. Fl. 843 and Icon. Fl. Hug. 2791 (nutlets)) featuring smaller plants, with smaller spines at sides of nutlets, and rim at margin of disk less distinct is L. semicincta (Stev.) M. Pop. It appears that it also grows in the Crimea (for example, Massandra, ripe fruit, 5 IX 1906, Goldie; Kerch', Klopotov). Krylov's report of Ul'yanovsk region is doubtful.

Series 5. Macracanthae M. Pop. — Spines along margin of disk of nutlets usually uniserial but sometimes (L. semiglabra) biseriate, spines of
430 main row long, 2—3 mm. Nutlets with free apices. Style hidden among nutlets. Flowers small or medium (L. macrantha). Annuals.

9. L. semiglabra (Ldb.) Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Kryl., Fl. Zap. Sib. IX, 2246. — Echinospermum semiglabrum Ldb. Fl. alt. I (1829) 204; DC. Prodr. X, 138; Ldb. Fl. Ross. III, 158; Boiss. Fl. or. IV, 251; Lipskii in Tr. Bot. Sada, XXVI, 558—563. — Lappula redowskii var. patula subvar. semiglabra Brand in Pflanzenr. IV, 252 (1931) 149. — Echinospermum caspium Fisch. et Mey. Ind. Sem. Hort. Petrop. V (1838) 34; DC. Prodr. X, 138; Ldb. Fl. Ross. III, 158; Bge. in Rel. Lehm. 409. — Ic.: Ldb. Ic. Fl. Ross. I, tab. 28. — Exs.: Sintenis, Iter transc.-pers. 1900—1901, No. 63 (Echinospermum caspicum Fisch.et Mey.).

Annual; stem 15—30 cm high (with raceme), usually branching from base, whitish, sparsely short-villous, branches long, oblique, branching; leaves 2—3(4) cm long, declined, flat, lanceolate or oblong-lanceolate, lower leaves tapering to petiole, upper leaves sessile, linear and shorter, all usually obtuse, glabrous or subglabrous above, grayish villous-downy beneath, with short coarse hairs borne on tubercles and very small acute hairs among them. Racemes in fruit 5—15 mm long; peduncles short, ca. 1—1.5 mm long, erect or declinate, thick; calyx in flower 1.5 mm long, with short, semi-appressed bristles, lobes in fruit short, ca. 2—3 mm long, linear-oblong, obtuse; corolla blue, 3 mm long, limb campanulate, not more than 2—3 mm across, with short (small) orbicular-obtuse lobes; fruit very high and narrow, ca. 4 mm long (without the long spines); nutlets very narrow, lanceolate, disk (or dorsal areola) lanceolate, median line of disk appearing

* Klokov describes this plant as L. heterocarpa Klok., endemic to Podolia (Bot. Zhurn. AN URSR, IX, 3, 1952, 82).

like a keel with a row of small anchorlike spines and small lateral tubercles, spines at sides of disk horizontal, long (2—3 mm), the bases more or less contiguous but not fusing, about 6 at each side, sides of nutlets acutely tuberculate, sometimes also with solitary spines; style very short, very early hidden between nutlets. April—May. (Plate XXI, Figure 2; Table XXII, Figure 5.)

Sands of deserts and semi-deserts. — European part: L. V. (Krasnoarmeisk, Astrakhan), Transv.; West Siberia: Alt. (only Irtysh valley); Centr. Asia: everywhere in sandy deserts to 47—48° N. Gen. distr.: Tib., Hindu Kush. Described from sands of Irtysh River near Lake Nor-Zaisan. (Meyer, 11 V 1826). Type in Leningrad.

Note. This species was described from the most northeastern point of
431 its distribution area. In this part the corollas are blue, the leaves rather wide, and the peduncles short and erect, although all these characters are not always correlated. In the most southwestern part of its area, near the foot of Kopet Dagh, this species is represented in the sandy desert of Kara-Kum by the vicarious race L. caspia (Fisch. et Mey.) M. Pop., with white corollas, usually narrow sublinear leaves, and 3—4 (5) mm long peduncles usually curved below. The plant is thinner than the type L. semiglabra (Ldb.) Gürke. The border between these races separates the southern desert of Turan from the northern and lies about 42° N. Within their areas both races vary in a parallel way; producing dwarf forms, plants with leaves of different width, plants with finely tuberculate fruits to nearly smooth. Obviously, there are intermediate forms at the contact areas between the two races (L. semiglabra s.s. and L. caspia). Sometimes a reduction of the spines on the nutlet is observed, mainly in the lower fruits which may be short or very short. This is especially true in the plants of the central part of Kyzyl-Kum (var. heterocaryoides M. Pop.). The population in Shugian and Roshan is very unique owing to the elevation and isolation of this area of the Pamir area. Stems markedly branching from base (branches and branchlets), thin, appressed-hairy, 15—20 cm high; leaves short, oblong, glabrous above; peduncles short, erect; corollas small, white; calyx strongly elongating in fruit, upright, longer than fruit and appressed to it; nutlets 2—2.5 mm long; spines along margin of disk ca. 1—1.5 mm long or very thin and short, 0.5—1 mm; sides and disk finely and acutely tuberculate, nearly spinescent. It is quite possible to regard this form as the small species Lappula badachschanica M. Pop. (or var. badachschanica M. Pop.). It also may be a hybrid between Hackelia lipschitzii M. Pop. and L. stricta var. pamirica M. Pop.

Differentiated just as distinctly is L. dsharkentica M. Pop. (L. semiglabra var. dsharkentica M. Pop., L. stricta var. dsharkentica M. Pop.). Stems 2—3 from base, robust, rounded, grayish (hairs partly appressed, partly spreading), 12—25 cm high, declined, repeatedly furcately branching above; leaves oblong-lanceolate, the lower spatulate, rounded-obtuse, 1—2(3) cm long, 0.5—0.8 cm wide, flat, green above, grayish beneath, more densely covered with spreading and curved bristles or hairs, bristles on large tubercles; fruiting racemes short, 3—7 cm, loose, with large oblong bracts; peduncles 1—2 mm long, erect; flowers small, apparently pale blue, nearly white; calyx in flower 1.5 mm, lobes linear, elongate in

fruit and embracing it, obtuse, sparsely bristly; corolla ca. 2.5(3) mm long, with campanulate limb 2 mm across; fruit ovoid, small, ca. 3 mm long; nutlets oblong (not lanceolate or ovoid) acutely tuberculate at sides;
432 disk oblong, with keel of 1—2 rows of small anchorlike spines, otherwise acutely tuberculate or entirely beset with fine anchorlike prickles, spines along margin of disk longer, horizontal, ca. 1 mm long, sometimes shorter and sometimes up to 1.5 mm; style entirely hidden. April. (Plate XXI, Figure 1.)

The characters of all three taxa — L. semiglabra, L. stricta and L. patula — are mixed in this race (form?). In the thick stems and short racemes it is reminiscent of L. stricta, in the leaves it is more like L. semiglabra, and in the short peduncles like L. patula. (Dzharkent — now Panfilov, banks of Usek, flowers, fruit, 23 IV 1907, Divnogorskaya). Type in Leningrad.

L. subsemiglabra M. Pop. (L. semiglabra var. subsemiglabra) is another remarkable form found in the Yenisei area. Spines of the main row ca. 2 mm long, second row of approximately 5 (at each side) thin spines $\frac{1}{4}$ to $\frac{1}{2}$ as long as the main spines and only in the lower part of nutlet, spines of keel (a character by which the plant is referred to L. semiglabra) 5, thin, anchorlike at apex, remote, not more than 0.5 mm high; nutlets and disk oblong-lanceolate, ca. 3.5 mm long; pedicels rather thin, erect, ca. 3 mm long. Leaves lanceolate or lanceolate-linear, relatively short (judging by their preserved remnants), sparingly pubescent especially above, bristles semi-appressed on large tubercles. Stems 25—35 cm high, paniculately branching from the lower third. Corolla small, blue.

Western part of Angara area, Chadobets village, sands, fruit after flowering (blue), 18 VII 1910, Borovikov. Chuno Angara watershed, near Kamenka, wheat field, fruit 6 VII 1908, Blagoveshchenskii; Gremyachii Klyuch, fruit, 19 VIII 1908, the same collector.

It should be noted that the dorsal areola (disk) of all species growing in Central Siberia (Lappula echinata, L. consanguinea, L. intermedia and L. anisacantha) is always without keel thus lacking spines along the median line. L. stricta from Minusinsk is isolated from the main area, and has an elevated keel formed as a tuberculate spineless line, and the main row of spines is not accompanied by additional bilateral rows.

10. **L. macrantha** (Ldb.) Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Kryl., Fl. Zap. Sib. IX, 2247; Brand in Pflanzenr. IV, 252, 142. — Echinospermum macranthum Ldb. Fl. alt. I (1829) 205; Fl. Ross. III, 149; DC. Prodr. X, 139; Bge. Rel. Lehm. 409; Rgl. in Bull. Soc.
435 Nat. Mosc. XLI, I, 86; Boiss. Fl. or. IV, 252; Lipskii in Tr. Bot. Sada, XXVI, 563, ex parte. — Ic.: Ldb. Ic. Fl. Ross. I, tab. 29.

Annual; stem 20—40 cm high, robust, rather thick, usually branching from base with branches obliquely ascending, sparsely and completely spreading-hairy-villous (Brand inaccurately reported: "appressed-sericeous-hairy"); leaves declined, broad, lanceolate- or oblong-spatulate or oblong, obtuse, usually flat, 2—4 cm long, 0.5—1 cm wide, green above or even yellow-green, sparsely spreading-hairy, grayish and densely covered with spreading hairs beneath, borne on more or less large tubercles, only the lowermost leaves somewhat tapering at base, the others sessile. Inflorescence

PLATE XXI. 1 — Lappula dsharkentica M. Pop., 2 — L. semiglabra (Ldb.) Gürke.; 3 — Stephanocaryum olgae (B. Fedtsch.) M. Pop., fruiting calyx and nutlets.

paniculate due to the many lateral branches (in specimens of normal growth, not suppressed); fruiting racemes 3—8 cm long, not very loose, erect, with small, lanceolate, inconspicuous bracts; pedicels erect, thick, 1—2 cm long, spreading-hairy; calyx in flower 1.5—2 mm long, with lanceolate lobes elongating in fruit and embracing the lower half or two-thirds of fruit; corolla brilliant blue, in the first flowers up to 8 mm wide, usually limb ca. 5 mm wide, slightly funnel-shaped, lobes ovate-rounded; fruit oblong, 4—5 mm long; disk of nutlets oblong, with keel of small anchorlike spines, finely and acutely tuberculate along sides, margins of disk beset with long (2—3 mm), horizontal, flat, yellow spines anchorlike at apex, 4—6 at each side of disk; style completely hidden among nutlets. April—May. (Plate XXII, Figure 4.)

Solonetzic sands at edge of sandy northern deserts. — West Siberia: only in Irtysh valley; Centr. Asia: Balkh., Ar.-Kasp. (only near Aral Sea). Endemic. Described from Irtysh valley near Lake Nor-Zaisan (Meyer, 1825). Type in Leningrad.

Note. This species resembles L. semiglabra, as noted by Ledebour (l. c. 1829, 205) but differs by its hairy leaves, much larger corollas, larger nutlets, with their marginal spines more dilated toward base, as well as other characters such as more robust plants with thicker and higher stems and broader leaves; however, if one takes into consideration the suppressed small individuals of L. macrantha, these distinctions are not obvious. Bunge wrote: "Even besides the characters of the fruit this species is readily distinguished by the greenish color of the leaves and the large, brilliant blue flowers." Nevertheless, it seems to me that it is not so simple to distinguish L. macrantha from L. semiglabra which are closely related species. Lipskii erroneously combined under this name two different species, the original L. macrantha and the large, Tien
436 Shan mountain species, namely L. tianschanica M. Pop. and Zak. The habitat he cited refers in particular to this last species. Krylov's reports on L. macrantha from the former Ural, Orenburg and Fergana regions, as well as for Kuldja, are erroneous as the species does not grow there. Brand also was apparently mistaken by the Val'dburg specimen from Karakol (between Sergiopol-Ayaguz and Sassyk-Kyl, southern foot of Tarbagatai) which very probably belongs to the related L. microcarpa and not to L. macrantha, notwithstanding Kurtz's determination. For this reason Brand described the stem of f. macrantha with appressed, sericeous hairs and only thus he could unite the "variety or monstrosity" Lepechiniella (Lappula omphaloides), with its sericeous, appressed hairs and winged nutlets, together with L. macrantha with its completely spreading hairs and wingless nutlets. The Aral form in its isolated area in the Urals differs slightly from the Zaisan specimen by the broader, oblong leaves, the larger tubercles at the base of hairs, and the less dilated spines of nutlets. I have separated it as var. aralensis M. Pop.

11. L. patula (Lehm.) Aschers. ex Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Kuzn. in Mat. Fl. Kavk. IV, 2, 198; Kryl., Fl. Zap. Sib. IX, 2245; Zakir. Burachn. Zeravsh. 19; Hegi, III. Fl. V, 3, 2138. — Echinospermum patulum Lehm. Pl. Asperif. II (1818) 124; Ldb. Fl. Alt. I, 200; DC. Prodr. X, 137; Ldb. Fl. Ross. III, 157; Boiss. Fl. or.

IV, 250; Shmal'g., Fl. II, 225.— Lappula redowskii var. patula Brand in Pflanzenr. IV, 252 (1931) 148.— Myosotis squarrosa M. B. Fl. taur.-cauc. I (1808) 120, non Retz. — Ic.: Hegi, III. Fl. V, 3, f. 3098a.

Annual; stem 10—20 (25) cm high, robust, erect, sometimes few growing from one root, branching from the middle or below, the branches typically divaricate, sometimes spreading at right angles, long, racemiform above, in weak specimens branching few and not as spreading, sparsely hairy, sometimes grayish; cauline leaves linear, sometimes narrowly or broadly so, 2—4 cm long, 1—3(4) mm wide, obtuse, spreading, the lower leaves longer and tapering to petiole, other leaves sessile, grayish, spreading-villous or remotely hairy, hairs borne on small or inconspicuous tubercles. Racemes in fruit short, stiff, sometimes elongating up to 10—12 cm, with one-sided fruits; bracts lanceolate or linear; pedicels very short, ca. 1 mm, thick, erect; calyx in flower ca. 1.5—2 mm long, lobes oblong-linear, elongating
437 in fruit, stellately spreading, hairy; corolla blue, 3—3.5 mm long, campanulate limb up to 2 mm across, with short, semi-orbicular lobes; fruit globose-ovoid, ca. 3 mm long; disk narrow-lanceolate, beset with acute white tubercles and at margin with spreading, approximate or remote anchorlike spines 3—4 at each side; sides of nutlets acutely tuberculate, rarely smooth (var. sublaevis Trautv.), tubercles of disk and sides sometimes anchorlike at tip; style ca. 0.5 mm, hardly visible between apices of nutlets. April—June. (Plate XXII, Figure 6.)

Weedy places, fields, fallow land, river valleys, clay and sandy loam, sometimes gravels. — European part: Crim., Bes., Bl., L. Don, Transv. and north of these areas; West Siberia: U. Tob., Irt., Alt.; East Siberia: Ang.-Say. (Krasnoyarsk, introduced); Centr. Asia: nearly everywhere but mainly in the northern parts (deserts): Ar.-Kasp., Balkh., Dzu.-Tarb., in the south introduced, sporadic; Caucasus: nearly everywhere except for W. Transc. Gen. distr.: Iran., Med., Centr. Eur. (introduced), Dzu.-Kash. Described from Kuma, Terek and L. V. (Krasnoarmeisk-Astrakhan). Type in Hamburg.

Note. This species, more than other species with uniseriate spinules, tends to be anthropochorous. Hegi had already noted this phenomenon; hence the sporadic occurrence of this species as far as the south of Central Asia. It occurs in Kabadian, Pyandzh, Chardzhou, near Andizhan, in the Dal'verzinskaya steppe, but has not been found, for example, in Samarkand or other oases in Central Asia. Its primary area of distribution appears to be steppes at 48—50° N., but through anthropochory it is now growing in Europe and in Asia far beyond its original distribution area. It has also been introduced into S. Africa (L. capensis Brand, L. ecklo niana Brand). In N. Africa as well as in Central Asia there is a form (var. pterocarpum Hochr. Annuaire Conserv. et Jard. Bot. Genève (1904) 192), the nutlets of which have spinules fusing at base into a more or less high, dentate wing, the denticles ending as anchorlike spines. In the USSR this variety was collected in the Dal'verzinskaya steppe (4 V 1915, Spiridonov, No. 174). Var. longicaulis Schrenk (Enum. pl. (1841) 37), with taller and slightly branching stem (in Central Asia (C. Kazakhstan) and in the Caucasus (see: Kuzn., op. cit. 201)) is insignificant. Var. sublaevis Trautv. (in Bull. Soc. Nat. Mosc.

XXXIX, II (1866) 424) is often apparently confused with L. stricta var. leiocarpa M. Pop. In the northern parts of Central Asia L. patula varies so markedly that it is not easy to distinguish some of its specimens from L. semiglabra and in particular from L. stricta. Neither Regel nor Trauvetter made a clear distinction between them.

438 Series 6. Macrae M. Pop. — The characters of the fruit (nutlets) are as in Strictae but nutlets 2 mm long, triangular, with one row of small, thin, remote spinules (not more than 0.5 mm long). Style, as in Strictae, hidden among nutlets. Corolla white and very small, subtubular, ca. 2 mm long, hardly broadening into a limb. Leaves subglabrous, sparingly short-bristly. Resembling also series Sinaicae (L. lipschitzii), but gynophore and style hidden.

12. L. macra M. Pop. in Herb. et Manuscr. 1936 et ex Pavl. in Bot. zhurn. XXX, 4 (1945) 190, quoad nomen, sed non specimina nec descriptionem nuculas alatas vocantem.

Annual; stem thin but rigid, erect, 10—15 cm high, grayish, with completely appressed thin hairs, bearing few furcate branches; leaves greenish, oblong-linear or linear, short, 1—1.5 cm long, 2—3 mm wide, obtuse, glabrous above, beset with spreading bristles beneath borne on small tubercles. Fruiting racemes elongate, with few fruits; bracts linear, short, acute; pedicels erect, short, 0.5—1 mm long; calyx greenish, sparsely beset with small bristles, fruiting calyx slightly elongating, lobes linear, ascending, shorter than fruit or just as long; corolla white, 2 mm long, tube thin, limb narrowly campanulate, half as long as tube; fruit oblong-pyramidal, ca. 2 mm long; nutlets narrowly triangular, smooth at sides and base (below), the disk narrow, with a row or 2—3 rows of 4—6—8 anchorlike spinules or tubercles, with few, uniserial, thin, 7—9 anchorlike spinules (ca. 0.5 mm long) along margin, the lower ones very short; style inconspicuous. May—June.

Porphyric, black, desert hills at the northern shore of Balkhash. — Centr. Asia: Balkh. (only near Bertys Bay at the northern shore of Balkash, flowers, fruit, 17 VI 1934, Popov). Endemic. Described from the indicated locality. Type in Moscow, cotype in Alma-Ata.

Series 7. Strictae M. Pop. (Uniseriales Zak. Burachn. Zeravsh. (1914) 17, part. excl. Sub-Lepechiniella et Microcarpae). — Nutlets with only one row of rather long (1—2 mm) spinules along margin of dorsal areola sometimes dilated at base but not fused into a winglike rim, rarely spinules short, 0.5 mm, or completely lacking. Flowers small. Closely related to the series Marginatae and also to Echinatae.

13. L. stricta (Ldb.) Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Kryl., Fl. Zap. Sib. IX, 2250. — Echinospermum strictum Ldb. Fl. alt. I (1829) 200; Fl. Ross. III, 160; Kryl., Fl. Alt. IV, 905; DC. Prodr. X, 139. — Echinospermum brachysepalum Claus in Beitr. Pflanzenk. russ. Reiches, VIII (1851) 240. — Lappula redowskii
439 Brand in Pflanzenr. IV, 252 (1931) 146, ex minima parte, non Greene. — Ic.: Ldb. Ic. Fl. Ross. tab. 27.

Annual; stem erect, robust, (15)20—30 cm high, usually branching above with short, arcuately ascending, not spreading branches; rarely subradical stems produced from axils of the early dying lateral rosette-leaves, covered with coarse, semi-spreading hairs or bristles borne on small tubercles, slightly grayish, neither sericeous nor silvery; cauline leaves lanceolate-linear, directed upwards, 2—5 cm long, 2—3(4) mm wide, obtuse, often longitudinally plicate, greenish and glabrous at upper surface. Fruiting racemes 3—9(10) cm long with fruits distant, few in number, lateral and terminal racemes composing together a small panicle, with very small inconspicuous bracts; pedicels relatively long, 2—4 mm, erect or curved, sometimes even arcuate, subappressed-hairy; calyx sparsely semi-appressed-bristly, less than 2 mm long in flower, with lanceolate or lanceolate-linear acute lobes elongating to 4 mm in fruit, spreading very little, rather embracing fruit; corolla blue, 2—3 mm long, with campanulate, not spreading limb (in spite of Ledebour's description), not more than 3 mm across (according to Krylov, 4 mm long, 4—5 mm across), with short, ovate-rounded lobes; fruit 3—3.5 mm high, globular-ovoid (incl. spinules) or ovoid (body of nutlets); nutlets elongate-oblong, rugose-tuberculate, rarely smooth at sides; disk (dorsal areola) narrow, lanceolate, smooth or with protruding keel and finely tuberculate, margin of disk ascending as a thick line from the inside of which emerging long (1—1.5 mm) adjacent spines slightly broadening at base, often outcurved over the elevated margin, anchorlike, 4—6 at each side; style short, 0.5 mm long, completely hidden among nutlets in ripe fruit. May—June. (Plate XXII, Figure 7.)

Sandy places in river valleys. — European part: L. V., Transv. (from where Echinospermum brachysepalum Claus was described; I saw the original); West Siberia: Alt., U. Tob., Irt.; Centr. Asia: Balkh. (northern part), Ar.-Kasp. (northern part), Pam.-Al. (Pamir only). Endemic. Described from Irtysh River between Kurchum and Lake Nor-Zaisan (1926, Meyer). Type in Leningrad.

Note. This species is related to L. patula, L. intermedia and L. semiglabra with which it probably forms hybrid, transitional forms and hence one must be very careful in identifying it. Ledebour and Bunge
440 already noted its similarity to L. patula. According to Ledebour it differs from the latter by the non-spreading branches (correctly!), the less villous pubescence, the longer pedicels (a very important character!), the shorter and more approximate spinules on nutlet and the keeled disk. I would only add that the downcurved spines often observed in L. stricta are never found in L. patula. Bunge had some specimens transitional to L. patula (from Sol-Iletsk) and for this reason the differences in the species appeared to him to be less significant.

It seems to me that the species is much more closely related to L. intermedia. Ledebour wrote that this last species differs from L. stricta by the horizontal spinules on nutlet, which is not true, by the keelless disk and the markedly broadening base of nutlets so that the disk is nearly ovate and not narrow-lanceolate as in L. stricta. It seems to me that this last character is essentially the only difference between L. intermedia and L. stricta and hence to determine these species according to this character or by the length of the spinules, shorter in L. intermedia (redowskii) and longer in L. stricta as Krylov reported (Fl. Zap.

Sib. IX, 2240, in Key), seems to me to be unwarranted. These species are so close that I have even considered combining them into one.

When the areola of the fruit is narrow in L. stricta it is difficult to distinguish from L. semiglabra, the spinules of which are thinner, longer and more delicate with additional ones at the sides of the nutlet, and the leaves are more broadly spatulate. Nevertheless, in Pavlodar, Kustanai and Severnoturgai these species are hardly differentiated. The distribution area of L. stricta expands from the lower Volga-(Krasnoarmeisk-Astrakhan)-Altai line at latitudes of approximately (47)48–59° (–52°) in W. Siberia. The records from Dagestan and Tien Shan (Krylov, op. cit.) are incorrect. L. intermedia grows east of Altai to Baikal along the steppes of southern Siberia; the plants in Minusinsk are not L. stricta. Krylov (op. cit. 2246) regarded them as L. redowskii.

Three varieties were described:

Var. leiocarpa M. Pop. — Nutlets smooth, shiny at sides and on disk (specimens from Petropavlovsk collected by Schrenk, ripe fruit 7 VI 1844). Leaves broader. Meyer had earlier noted this plant (I saw the herbarium specimens with his note).

Var. nana Kryl. (Fl. Alt. IV (1907) 906). — Probably refers to L. intermedia. Var. pamirica M. Pop. — Nutlets turning blue at apex; corolla smaller. Pamir. This variety resembles L. intermedia by the feature of the nutlets turning blue.

14. L. intermedia (Ldb.) M. Pop. comb. n. — Echinospermum intermedium Ldb. Fl. alt. I (1929) 199; G. Don, Syst. IV (1837) 349. — Echin. redowskii Bge. Del. Sem. Hort. Dorpat. (1840) VIII; DC.
441 Prodr. X. 137; Ldb. Fl. Ross. III, 158; Kryl., Fl. Alt. IV, 907; Fl. Zap. Sib. IX, 2246, vix Lehm. Pl. Asperif. II (1818) 127 et Myosotis redowskii Horn. Hort. Hafn. (1813–1815) 174 [Lappula redowskii Greene in Pittonia, II (1891) 182]. — Ic.: Ldb. Ic. Fl. Ross. II, tab. 180.

Annual; stem erect, thick (3–4 mm at base), relatively high, 30–50 cm, usually branching in upper part only with many short, obliquely ascending branches; entire plant covered with grayish or gray-white, markedly spreading, thin, not so straight hairs borne on small flat tubercles; cauline leaves numerous, dense, broadly linear or lanceolate-linear, long, 3–5 cm, obtuse, upright, flat or longitudinally plicate, more or less glabrous above. Inflorescence paniculate, composed of lateral and terminal, slightly elongating fruiting racemes, 5–15 cm long, with remote fruit; bracts narrowly linear, not very noticeable; lower pedicels 2–3 mm long, the median 1–2 mm, erect; calyx in flower ca. 2 mm long, lobes spreading in fruit, linear, spreading-hairy, up to 5 mm long; corolla blue, up to 4 mm long, funnel-shaped, limb campanulate, 2–3 mm long, 3 mm wide, lobes of limb short, orbicular-obtuse; fruit subglobose or broadly ovoid-globose, 3–5 mm across; nutlets ovoid, with ovate tuberculate disk and rather smooth, only rugose or tuberculate sides, often turning blue at apex; margins of disk with a thickened ridge bearing rather long spinules, 5–6 at each side; spinules often bluish, slightly broadening at the overlapping or more or less distant bases, ca. 1–1.2 mm long, with anchorlike tip, horizontally curved but sometimes ascendary; style shorter than 0.5 mm, hidden among nutlets.

Sandy places in river valleys, sandy steppes. — West Siberia: Alt.; East Siberia: Ang.-Say. (Kosaya steppe, Turchaninov, and other places), Dau., Lena-Kol. (variety). Gen. distr.: Mong. Described from Altai (in sabulosis ad fl. Katunja, Bunge). Type in Leningrad.

Note. This is a transitional form from L. stricta to the group of L. echinata. In general habit and its high growth it resembles this group, but the spinules along the disk are uniserial as in L. stricta. L. consanguinea, as compared with L. echinata, is characterized by a second row of very short spinules, nearly tubercles, usually only at the lower part of the nutlet. Such a reduction is displayed in L. intermedia. Thus, the name intermedia fits our species very well. Unfortunately,
442 because of this intermediate feature it is difficult to distinguish it from L. stricta or L. consanguinea, and, in some cases, from L. anisacantha. The specimens from Verkhoyansk (24 VI 1913, Mikhailov) are especially close to the latter species, being like L. anisacantha var. uniserialis. This population actually connects these two, rather related species. It is highly probable that hybridization of L. intermedia with L. anisacantha (or L. echinata) produced a special form occurring in Transbaikalia, which I have called L. laxiuscula M. Pop. Its nutlets are nearly like those of L. intermedia but bearing additional spinules below the main row at the sides of the lower part of the nutlets. The nutlets are small, sharply trihedral, the pedicels are longer, the leaves narrow and short, the stem branching, not higher than 40 cm (near Chita, pebbly slopes in the Uletka River valley near Mogzon, ripe fruit, 21 VIII 1930, V. Korzhevin, No. 957).

15. L. tenuis (Ldb.) Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Kryl., Fl. Zap. Sib. IX, 2240. — Echinospermum tenue Ldb. Fl. alt. I (1829) 201; DC. Prodr. X, 139; Ldb. Fl. Ross. III, 160; Kryl., Fl. Alt. IV, 906. — E. polymorphum Lipsky in Tr. Bot. Sada, XXVI (1916) 541, ex minima parte. — L. redowskii Brand in Pflanzenr. IV, 252 (1931) 146, ex minima parte. — Ic.: Ldb. Fl. Ross. II, tab. 182.

Annual; stem erect, 15—30 cm high, branching only in the upper half or third, with short weak branches ascending at 45°, sparsely covered with spreading or semi-spreading, thin hairs; leaves broadly or narrowly linear, rather long, 1—3 cm, 1—4 mm wide, obtuse or acute, upright, grayish, with spreading long hairs borne on very small tubercles, greenish above and sparingly hairy. Inflorescence short-paniculate or subcorymbiform; fruiting racemes 3—10 cm long, not very loose, with linear small bracts; pedicels ca. 1—1.5 mm long, erect, thick; calyx in flower 2.5 mm long, lobes linear, acute, in fruit up to 4 mm long, stellately spreading, spreading-bristly; corolla blue, 3—4 mm long, with campanulate narrow limb 2 mm across, lobes ovate-rounded, short (0.6 mm); fruit ovoid, 2.5 mm high; nutlets ovoid (when viewed from the back), sides of nutlets large, white-tuberculate; disk oblong, keelless, finely white-tuberculate, margin elevated like a white ridge, bearing at each side of disk 5—6 short, thin, remote, declinate or erect, anchorlike spinules less than 1 mm long (0.5—0.9 mm); style thin, 0.6 mm long, slightly protruding above apices of nutlets. May—June.

European part: Urals (southern part near Ataman, steppe, collected by Shell); West Siberia: Alt., U. Tob. (Temir and Aktyubinsk districts, 1904,
443 Yanishevskii); Centr. Asia: Balkh., Dzu.-Tarb. (Dzungaria Ala-Tau). Endemic. Described from Altai (Charysh River, Ledebour, 1826). Type in Leningrad.

Note. This species is closely related to L. intermedia and L. stricta. It is readily distinguished from the latter by the broader, keelless, not lanceolate disk and the short spinules along the margin of the disk; it is much more difficult to distinguish it from L. intermedia, the only significant difference being the shorter, remote spinules along the margin of the disk. This character is scarcely sufficient to separate it even as a race, all the more so since the distribution areas of both species overlap. In my view the specimen from Zmiev (Politov), cited by Ledebour himself (l. c. 1829, 201) as the second original of his Echinospermum tenue, is more likely to be L. stricta (Ldb.) Gürke or a form transitional to it. These three species are all very difficult to distinguish. Krylov (op. cit. (1937) 2240) correctly described and distinguished them.

Echinospermum affine Kar. et Kir. (in Bull. Soc. Nat. Mosc. XIV (1841) 714; Ldb., Fl. Ross. III, 160) does not differ from E. microcarpum Ldb. It is only by chance that Ledebour placed it near E. strictum and compared it as did Karelin and Kirilov, with E. strictum and not E. microcarpum. It is already clear from the original diagnosis: "aculeis. . . uniserialibus. . . disci latitudine brevioribus" that E. affine may only be compared with E. tenue or E. microcarpum. The original specimen of Karelin and Kirilov (between Arkat Mountains and Uzun-Bulak River, Kar. and Kir., 1840) has the long style of E. microcarpum. Schrenk's specimen from Dzungarian Ala-Tau, which Ledebour regarded as Echinospermum affine (l. c. 150) appears to be indistinguishable from E. tenue. I also saw the specimen from Chingiz Mountains (Namas River, flowers, fruit, 29 V 1914, Kossinskii) which is almost the same locality as that from which E. affine K. et K. was described. It fully corresponds to the specimens of E. tenue collected by Shishkin near the Charysh River, i. e., in locus classicus of E. tenue Ldb. 28 VI 1931.

In uniting E. tenue Ldb. and E. affine with E. microcarpum, Lipskii overlooked some important characters distinguishing between them, such as the flat corolla limb and the long style of E. microcarpum. These characters were not only significant in giving a specific status to this taxon but also in transferring it to the series Microcarpae. Nevskii also ignored these characters and identified the thin annual individuals of L. microcarpa in Pamir-Alai with L. tenuis.

A special form with smooth, polished nutlets, both at disk and sides, described as Echinospermum karelini Fisch. et Mey. (Ind. Sem. Hort. Petrop. XI (1845) 67) was grown in the St. Petersburg Botanical Garden in 1845 from seeds sent by Karelin from Zongoria. An escaped form was collected near Lake Nor-Zaisan (Topolev, Mys, Taizhuzgen River,
444 Galechnikovaya steppe, 20 V 1914, Shishkin), which I have called var. karelinii M. Pop. (cf. L. stricta var. leiocarpa M. Pop.). It is possible that this variety is more likely to be included in L. stricta since from the genetical point of view it expresses characters that preceded those of the variety leiocarpa M. Pop.

16. L. brachycentroides M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 314.— Echinospermum brachycentrum Trautv. in Bull. Soc. Nat. Mosc. XXXIX, II (1866) 427, ex parte, non Ldb.; Lipskii in Tr. Bot. Sada, XXVI (1910) 553—556.

Annual; stem rather high, 20—50 cm, in normal specimens rather thick, robust, erect, branching from the upper half or even above with short weak branches, sparsely spreading-hairy; leaves lanceolate or lanceolate-linear, in small individuals linear, usually flat, upright, 2—4 cm long, 3—8 mm wide (up to 2 mm in weak specimens), dullish gray, with spreading or semi-appressed long hairs borne on small tubercles. Inflorescence short-paniculate or subcorymbiform, with few branches spreading to one side, in weak specimens sometimes only with 1—2 terminal racemes; fruiting racemes 3—7 cm long, not very loosely fruited, with small lanceolate or linear bracts; pedicels 1—2 mm long, thick, erect; calyx in flower 2.5 mm long, bristly with semi-spreading hairs, lobes linear, elongating in fruit to 4 mm, partly spreading, partly ascending and covering fruit; corolla 3.5—4 mm long, blue, limb campanulate, 2—3 mm across, lobes rounded-ovate, 0.7 mm long; fruit ovoid-oblong or ovoid, 2.5 mm high; nutlets ovoid, nearly or completely free of spinules, sides of nutlets and disk finely tuberculate, rarely nutlets nearly smooth (var. laevis M. Pop.); disk oblong-lanceolate, finely tuberculate, keelless, rimmed at margin by thin elevated line completely smooth or bearing sporadically obsolete spinules or bristles, sometimes individual fruits or individual nutlets with short anchorlike spinules irregular in number and length. Style rather long, rising above apices of nutlets for 0.5 mm, i. e., smaller than in Microcarpae. May—June.

West Siberia: U. Tob. (Mugodzhar hills, 8 VI 1904, Yanishevskii), Irt. (southern part); Centr. Asia: Balkh. (northern part). Endemic. Described from Dzharly Mountains (21 VI 1843, Schrenk). Type in Leningrad.

Note. See detailed report in first description (1951).

445 Series 8. Echinatae M. Pop. (Multiseriales Zak. Burachn. Zeravsh. (1941) 19, ex parte: excl. ser. Microcarpae M. Pop.).— Nutlets with 1—2 more rows of shorter anchorlike spinules at sides below row of spinules rimming disk, sometimes developing only in the lower, broader part of nutlets. Corolla blue, small, limb campanulate. Style short, hidden among ripe nutlets.

17. L. anisacantha (Turcz.) Gürke in Engl.— Pr. Pflanzenf. IV, 3a (1897) 107; Kryl., Fl. Zap. Sib. IX, 2243, quoad nomen, exd. speciminibus fere omnibus.— Echinospermum anisacanthum Turcz. ex Bge. Del. Sem. Hort. Dorpat. (1840) VIII (in clave) et Ldb. Fl. Ross. III (1846—1851) 156; Turcz. in Bull. Soc. Nat. Mosc. XI (1836) No. 824, 13 (97), nomen; Fl. baic.-dah. II, 520 (316); DC. Prodr. X, 143 (in species tantum nomine nobis cognitae).

Annual; stem 15—30(40) cm high, strongly branching from the middle, with numerous straight branches ascending at 45° and forming a panicle, thick, robust, sparsely spreading-hairy; leaves lanceolate, green, 2—4 cm long, 0.4—1 cm wide, flat, declinate, sparsely spreading-hairy with hairs borne on rather large tubercles. Racemes 3—7 cm, rarely 10 cm long, very leafy

with lanceolate-linear bracts, not very loose; pedicels short, erect, subappressed-hairy, thick, lower pedicels up to 3 mm long, the median shorter; calyx in flower ca. 3—4 mm long, with semi-appressed and short bristles, lobes linear, elongating to 7—8 mm in fruit (and even more) and stellately spreading under fruit, acute, spreading-hairy; corolla blue, as long as calyx, with campanulate limb ca. 2 mm across, lobes of limb ovate-rounded; fruit globular-ovoid, 3 mm high; nutlets densely rugose-tuberculate at sides; disk ovate, without ridge but entirely rugose-tuberculate, spinules at margin of disk long, 1—2 mm, horizontal, (4)6—8 at each side, slightly broadening at base, with large anchorlike head, below them at sides one row of shorter, sometimes very short anchorlike spinules, sometimes absent (var. uniseriales M. Pop.), style hardly protruding above nutlets, to 0.5 mm long. June—August. (Plate XXII, Figure 8.)

Sandy, dry, sometimes weedy places. — East Siberia: Ang.-Say. (southeastern part) and Lena-Kol.; Far. East: Okh. (Ayan, Tiling). Endemic. Described from Baikal (Turchaninov, 1830—1833). Type in Leningrad.

Note. Even in his "Baikalo-daurskaya flora" Turchaninov did not indicate from which locality he had described his species; Ledebour wrote "passim in Sibiria baicalensi et Dauria (Turcz.)", i. e., too general. In
446 the Ledebour Herbarium (709.3), I saw the specimen of "Echinospermum anisacanthum m. In siccis ad Baicalem 1830 Turcz." with Turchaninov's own signature and I regard it as the original. It is a very typical species in the central Siberian area near Baikal and the Lena and is related to L. intermedia. All the other localities reported by Krylov (op. cit. 2244) are incorrect. His description does not contain the typical characters of the species and there is no doubt that he confused it with L. consanguinea. Turchaninov himself did not clearly distinguish his species from the so-called Echinospermum redowskii (i. e., from L. consanguinea and L. intermedia). It is almost certain that the original specimen is from Kultuk at the southern end of the Baikal from where there are numerous Turchaninov specimens: "in ruderatis or in arenosis ad (prope) Kultuk." There are 7 herbarium sheets on one of which Turchaninov wrote E. anisacanthum β. and on the 6 others E. intermedium Led.? In the "Flora" they (Kultuk species) are referred to E. redowskii which Bunge, De Candolle and Ledebour up to Krylov identified without any particular substantiation with E. intermedium Ldb. In the Ledebour Herbarium one specimen bears the name E. redowskii (709.6) and another the name E. anisacanthum (709.3). Ledebour perceived typical characters when he wrote: "caule a basi ramoso. . . calycibus demum patentissimis pedicello erecto plus duplo longioribus. . . . " What confused him was the additional row of spinules below the main row which in our species might be absent (var. uniserialis M. Pop. which he called E. redowskii), or the short spinules (typical E. anisacanthum) or the long ones as in E. heteracanthum. Var. uniserialis M. Pop. type: Baikal, eastern shore, between 53 and 55° N., Barguzin, near settlement, fruit, 5 VIII 1928, V. N. Sukachev, et al., No. 1759.

The typical characters of the species are: 1) comparatively low plants, 15—30 cm high; 2) stem markedly branching from base or the middle; 3) leaves broad, flat, usually short, nearly horizontal, green; 4) calyx lobes markedly elongating in fruit, horizontally spreading (stellately); 5) areola

of nutlet (disk) strongly broadening below, ovate, typical for E. intermedium; 6) spinules of main row (at margin of disk) spreading, long, broad at base.

The plants from the Lena differ slightly from those of the Baikal. They are 12—20 cm high, the leaves are shorter, the calyx lobes not as elongate, spinules of the additional row (at side of nutlets) often longer but thinner, transparent. This character is not always distinct. In the Lena there are transitions to the typical E. anisacanthum. V. Dagaeva identified the Lena specimens with E. heteracanthum Ldb. whose fruits are indeed
447 similar but the leaves differ completely. I suggest that the Lena plants be defined as var. lenensis M. Pop.; type: Amga, source of the Aldan, flowers, fruit, 3 VIII 1902, Olenin (3 sheets—615 and 626). It is also known from Verkhoyansk (24 VI 1913, Mikhailov). There is an isolated locality of a typical population of L. anisacantha between the Middle and Lower Kolymsk (24 VII 1876, Avgustinovich), which Trautvetter identified as E. redowskii var. typica Rgl. It is very likely that this species was described under the name Myosotis redowskii Hornemann (1813), which was later renamed Echinospermum redowskii Lehm. (1818) and also Lappula redowskii Greene; neither the descriptions by the authors nor the exact locality of Myosotis redowskii (hab. in Imp. Ruth. Missa ex Moscovia sub hac nomine, Horn.; in Ruthenia, Lehm.) make it possible to draw a definite conclusion about Myosotis redowskii. The name was apparently given by Fischer but the specimen was not preserved. Our species is closely related to L. intermedia (Ldb.) M. Pop. but differs completely in the leaves, calyces and the second row of spinules on the nutlets. L. intermedia is more closely affined to L. consanguinea whereas L. anisacantha is genetically differentiated from it.

18. L. consanguinea (Fisch. et Mey.) Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Kryl., Fl. Zap. Sib. IX, 2244; Zakir. Burachn. Zeravsh. (1931) 20. — Echinospermum consanguineum Fisch. et Mey. Ind. Sem. Hort. Petrop. V (1838) 35; Bunge in Del. Sem. Hort. Dorpat. (1840) VIII (in clave); DC. Prodr. X, 137; Ldb. Fl. Ross. III, 157. — Lappula echinata var. consanguinea Brand in Pflanzenr. IV, 252 (1931) 140. — L. echinata var. anisacantha Kusn. in Mat. Fl. Kavk. IV, 2 (1913) 176, ex parte.

Annual and biennial; stem erect, high, in biennial individuals frequently 40—60 cm high, in the annuals thin, 20—40 cm high, usually single, erect, very rarely 2—3 stems produced from root, simple, usually densely leafy, short-paniculate-branching above, sometimes subcorymbiform very weak specimens bearing only one terminal fork of racemes; branches obliquely ascending; leaves lanceolate or lanceolate-linear, in weak individuals broadly linear, ascending, 2—5 cm long, 3—8 mm wide, lower leaves slightly spatulate, i. e., tapering at base, obtuse, median and upper leaves sessile, obtuse or acute, usually flat, 1-nerved, like stem sparsely spreading-hairy at both surfaces, grayish. Racemes at ends of all branches and in terminal fork, not strongly elongating in fruit but loosely fruited, 5—10 cm long, with small linear bracts; pedicels thin, rather short, the lower 2—3 mm long, erect, semi-appressed-hairy; calyx in flower, ca. 3 mm long, semi-appressed-hairy, with linear acute lobes elongating to 4—5 mm in fruit and

stellately spreading; corolla blue, hardly longer than calyx, ca. 4 mm, limb campanulate, 3 mm across, with ovate-rounded lobes. Fruit globose-ovoid, ca. 3—3.5(4) mm high (diameter); nutlets rather abruptly broadening below, thus their lower parts tightly adjacent and the upper narrow parts forming between them deep oblong pits or depressions typical for this species, sides of nutlets (in depressions) smooth, shiny; disk oblong, obtusely white-tuberculate, rimmed at margin with ascending thick white line bearing short, ca. 1 mm, thin, declined or erect anchorlike spinules in one (main) row, below mainly in the lower expanded part of nutlet-sides 1—2 more rows of shorter, thicker, anchorlike spinules often becoming tubercles; style protruding above apices of nutlets for 1 mm as a thin point (also characteristic). May—June. (Plate XXII, Figure 9.)

Mainly in and near weedy and ruderal places, fields, fallow lands. European part: Bl.; Caucasus: Dag. and E. Transc.; West Siberia: Irt., Alt., U. Tob.; East Siberia: Ang.-Say. (southern part); Centr. Asia: particularly Balkh., Dzu.-Tarb., less common in Ar.-Kasp., T. Sh., Pam.-Al. Gen. distr.: Hungary, Mongolia, Dzu.-Kash. Described from Altai. In the description of the original there is the note: "in regionibus altaicis," which is repeated by De Candolle with the addition: (Bunge); in Ledebour: "in Sibiria altaica: in insulis fl. Lepsa deserti soongorokirghisici (Kar. et Kir.)". Type in Leningrad (difficult to identify: cultivated specimens with inscription E. consanguineum, Altai).

Note. This problematic species is undoubtedly very close to the more southern L. echinata. It would probably be more accurate to consider L. consanguinea as the phylogenetically original species (form) from which the ruderal-segetal northern L. echinata was derived. The main difference in the nutlets is that in their upper, tapering half there is only one (main) row of spinules and the sides of the nutlets here (facing the pit between them) are smooth; the additional row of short, tubercled, anchorlike spinules is under the main row at the lower sides. In addition L. consanguinea is more delicate and thinner than L. echinata, its leaves narrower and its habit in general more xeromorphous. Krylov (Fl. Alt. IV, 900 and Fl. Zap. Sib. IX, 2243) confused it with L. anisacantha (Turcz.) M. Pop. and partly with L. intermedia. Kuznetsov identified the Caucasian specimens of L. sanguinea with L. anisacantha although he vaguely suspected that they might be L. consanguinea (see Note, op. cit., pp. 179—180). Finally, Turchaninov himself confused his L. anisacan-
449 tha with L. consanguinea and L. intermedia so that it is not surprising that L. anisacantha was not clear for Krylov. The relation between these two species is so close and there are several intergrades between the taxa, in the complex of L. echinata — L. consanguinea — L. intermedia; it is not always possible to refer a particular specimen to one or the other of these three species.

19. L. **echinata** Gilib. Fl. lithuan. (1781) 25; Exerc. phyt. I, 39; Kuzn. in Mat. Fl. Kavk. IV, 2, 171; Brand in Pflanzenr. IV, 252, 137 (var. euechinata Brand); Kryl., Fl. Zap. Sib. IX, 2242.— Myosotis lappula L. Sp. pl. (1753) 131, ed. 2, 189.— M. squarrosa Retz. Obs. bot. II (1791) 9.— Lappula myosotis Moench, Meth. (1794) 417.— Echinospermum lappula Lehm. Pl. Asperif. II (1818) 121; Ldb. Fl. alt.

I, 198; DC. Prodr. X, 136; Ldb. Fl. Ross. III, 155; Shmal'g., Fl. II, 224; Kryl., Fl. Alt. IV, 900.— E. squarrosum Rchb. Fl. Germ. exc. (1832) 345.— E. casanense (casanicum) Wirzen, Geogr. pl. Casan. (1839) 84 et in Flora, XXV (1842) 568.— E. ispahanicum Boiss. Diagn. pl. nov. or. ser. 1, XI (1849) 123.— E. triseriale Bge. Ind. Sem. Hort. Dorp. (1840) VIII (in clave).— Ic.: Rchb. ic. Fl. Germ. XVIII, tab. 128, II, 7—19; Hegi, III. Fl. V, 3, tab. 219, f. 1 et f. 3100b, 3099 and 3098.— **Exs.**: GRF, No. 328; Fl. exs. Austro-Hung. No. 3706.

Biennial, rarely annual; stem usually single, 30—80 cm high, thin or thick depending on height and robustness of plant, sparsely semi-spreading-hairy, branching only in upper third with rather strongly divaricate branches; leaves 3—8(10) cm long, 4—12 mm wide, lanceolate or lanceolate-linear, dense, erect or declinate, obtuse, flat or rarely longitudinally plicate, more or less densely spreading-hairy, greenish, often only above, sometimes grayish, with nearly contiguous hairs, lower leaves tapering at base, median and upper leaves sessile. Inflorescence short-paniculate, sometimes sub-corymbiform, with several lateral branches depending on robustness of plant; fruiting racemes 10—15 cm long, not very loosely fruited, with linear, rather long bracts; pedicels rather thin, erect, the lower 3—4 mm long, the median 1—3 mm long; calyx in flower 3 mm long, lobes linear, obtuse, reaching 5—6 mm in fruit, stellately spreading below; corolla blue, 4—4.5 mm long, with funnel-shaped-campanulate limb up to 4 mm wide, with ovate-rounded lobes; fruit globose-ovoid, 3—4 mm across; nutlets ovoid (viewed from the back), sides of nutlets tuberculate; disk oblong or even oblong-lanceolate, usually covered with large white tubercles bearing at apex a capilliform short point, rarely disk smooth or only tuberculate along keel; spinules at margin of disk (main row) rather flat, curved or upright, 6—7 at each side,
450 1—1.5 mm long, with anchorlike tip, spinules of second row (below the main row at sides of nutlets) nearly as long as spinules of main row or $\frac{1}{4}$—$\frac{1}{2}$ the length, usually extending to apex of nutlet, sometimes a third ventral row present with shorter spinules; styles nearly hidden among nutlets, the largest exserted for one-half, rarely more; deep pits between upper parts of nutlet apices as in L. consanguinea absent. May—July. (Plate XXII, Figure 10.)

Weedy places, fields, roadsides, fallow lands, overgrazed steppes, ravines and river gravels.— European part: nearly everywhere except for the Far North; Caucasus: everywhere; Siberia: everywhere except for the Arctic and high latitudes (subarctic) Far East: Uss., Sakh. (introduced, rare); Centr. Asia- Ar.-Kasp. (only Aral Sea), Balkh. (N.), Dzu.-Tarb. Apparently accidently introduced into Farab (Gol'bek). **Gen. distr.**: Med., Centr. Eur., N. Am. (introduced), S. Africa (introduced). Described from Latvia (Zhiliber). Type in Paris.

Note. The original populations were restricted to steppes from which they penetrated deep into Central Europe with the development of agriculture. In that area it is now regarded as a nuisance.

Kuznetsov distinguished the varieties triserialis (Trautv.) Kusn.; E. lappula var. triserialis Trautv. (in Bull. Soc. Nat. Mosc. XXXIX, II (1866) 423) with 3 rows of spinules at least in the lower part of nutlet; var. biserialis Kusn. (typical for Europe), with 2 rows of nearly equal spinules; var. squarrosa (Retz.) Kusn., with elongate, divaricate branches of stem, long recognized in Western Europe. These are only variable

forms without geographical differentiation. West European botanists have tried to distinguish many others (cf. Hegi, l. c. 2139—40).

Prominent among the material from Siberia was var. sibirica M. Pop. (L. sibirica M. Pop.). — Nutlets with very many, rather delicate long spinules up to 2 mm; because of the copious spinules the fruits appear to be rather large, ca. 5 mm across, ovoid, the disk broader, ovate, with distinct keel of larger tubercles. The habit of the plant is unique, branching from below with stiff long branches, 30—40 cm high. Fruiting racemes very loosely fruited. Hairs gray, semi-spreading; leaves broadly linear. Transbaikalia; basin of Barguzin River, on hills of Bol'shoi. Tuloto, fruit, 22 VI 1911, Zhukova, No. 95 (2 sheets); Barguzin highway between the post offices of Novo-Kurbinskaya and Karymskaya, Atsagatskii Datsan, abandoned pastures, fruit after flowering, 6 VII 1913, Poplavskaya, et a., No. 1462.

451 Series 9. Tianschanicae M. Pop. — Corolla large, Myositis-like, with flat limb 4—6—8 mm across. Nutlets with 2 rows of spinules in the lower part, the main row of long spinules longer than width of disk, sides and disk of nutlets tuberculate-spinous. Style thin, more than 1 mm long but protruding very little over nutlets and covered by upper apices of spines. Differing from the preceding series by the flat limb of the large corolla (Myositis-like flower), from the following by the appressed-silky and spreading-gray hairs, from the series Microcarpae by the short style protruding very little above nutlets.

20. L. tianschanica M. Pop. et Zak. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 317. — Echinospermum macranthum Lipsky in Tr. Bot. Sada, XXVI (1910) 563, quoad specimina citata omnia, non Ldb.

Biennial; stem usually single (rarely few from one root), erect, 40—60 cm high, robust, spreading-hairy below, appressed-hairy above, branching in upper part with weak, short branches diverging at 45°; rosetted radical leaves withering at fruiting, spatulate-lanceolate, 5—10 cm long; cauline leaves lanceolate to lanceolate-linear, median leaves 3—6 cm long, 4—8(10) mm wide, flat, rather soft and strongly declined from stem, acute, greenish, sparsely long-hairy with hairs borne on tubercles on upper surface of leaves, sometimes slightly grayish and more densely hairy. Fruiting racemes loosely fruited with one-sided fruits, weak, 10—15 cm long; bracts small, linear or lanceolate; pedicels thin, rather long, the median ca. 3 mm, the lower up to 5 mm long, declined-drooping; calyx in flower 2—3 mm long, semi-appressed-bristly, with linear acute lobes reaching 4 mm in fruit and usually stellately spreading; corolla Myositis-blue, tube as long as calyx, limb large, nearly flat, 6—8 mm across, with obovate lobes; scales large, bluish; fruit ovoid or globose-ovoid, ca. 3—3.5 mm high; nutlets ovoid-oblong, disk oblong, with row of few short anchorlike spinules along keel, at sides of this row finely and acutely white-tuberculate, along margin with 1 (main) row of spreading, rather long (1—1.5 mm), delicate, often bluish spinules broadening slightly at base and not contiguous, another row of half as long anchorlike spinules not extending to nutlet apex at the acutely white-tuberculate sides; style thin, 1—1.2 mm long, slightly (0.5 mm) elevated above nutlets, not exceeding upper spinules of main row. May—June.

452 Stony and rocky slopes in the spruce forest belt.— Centr. Asia: Dzu.-Tarb. (Dzungarian Ala-Tau), T. Sh. Gen. distr.: Dzu.-Kash. (Kuldja). Described from Zailiiski Ala-Tau (basin of Malaya Almaatinka near Alma-Ata, Gorodetskii, 13 VI 1916, No. 253). Type in Leningrad.

Note. Forms with reduced spinules of the main row are transitional to L. microcarpa and often grow alongside the typical forms northeast of Zailiiski in Dzungarian Ala-Tau.

21. L. tadshikorum M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 319.

Biennial; stem rarely single, usually 2—3 from one root, erect, (25)30—50 cm high, rounded, robust, not very thick, spreading-hairy below, semi-appressed or appressed-hairy above and rather coarsely bristly-hairy, branching in upper part with thin, sparse branches ascending at 45°; radical rosette drying up towards fruiting, rather dense, the leaves (judging by the remnants) lanceolate-spatulate, 3—5(7) cm long, spreading, not very densely bristly-villous; cauline leaves lanceolate-linear or linear, median leaves 2—3(4) cm long, 2—4(6) mm wide, rather densely spreading-bristly-hairy (hairs or bristles borne on large tubercles), grayish, acute or obtuse, flat, rather declinate, deciduous. Inflorescence loosely paniculate; fruiting racemes 3—7 cm long, loosely fruited, with linear, small, inconspicuous bracts; pedicels 1—2—3 mm long, erect, thick; calyx in flower 1—1.5 mm long, lobes linear, 2 mm long, stellately spreading in fruit; corolla blue, small, with slightly campanulate limb 4—5 mm across; fruit subglobose or globose-ovoid, 2—3 mm high; nutlets ovoid, finely spinous-tuberculate at sides; disk oblong or ovate, usually with 3 anchorlike spinules along median line, otherwise finely spinous-tuberculate, the main marginal row with 1—1.2 mm long curved spinules, 3—4—5 at each side of disk (spinules sometimes reduced to 0.5 mm), the lateral row with few spinules half as long as spinules of main row, usually not reaching apex of nutlet; style hardly pro-
455 truding above apices of nutlets, not exceeding apices of spinules of main row. June—July.

Stony and rocky slopes or gravels of dry riverbeds in the subalpine and steppical mountain belts.— Centr. Asia: T. Sh. (W.), Pam.-Al. Gen. distr.: W. Himalayas. Described from the Upper Zeravshan valley (natural boundary Archa-Maidan, fruit, flowers, 29 VIII 1925, No. 140, Dubyanskii and Bazilevskaya). Type in Leningrad.

Note. Among the numerous herbarium specimens from Alai valley, many have white corollas, possibly due to desiccation. The spinules in the main row of the high mountain Badakhshan specimens are often reduced so that the fruit resembles that of L. microcarpa but it is easily distinguished by its globose shape and short style. The Pamir specimens are low, very gray, outwardly just slightly resembling the typical L. tadschikorum; they might be separated into a variety but transitional forms between them and the type are quite common.

The W. Tien Shan specimens (Chatkal Range, Aflatun River, Litvinov, and Talass Ala-Tau, Karagoin Gorge, Minkvits) resemble L. tianschanica in height (ca. 50 cm), but the pedicels are short and the flowers small. There seems to be a disjunction in the distribution area between L. tianschanica and L. tadshikorum along the Talass line in the western

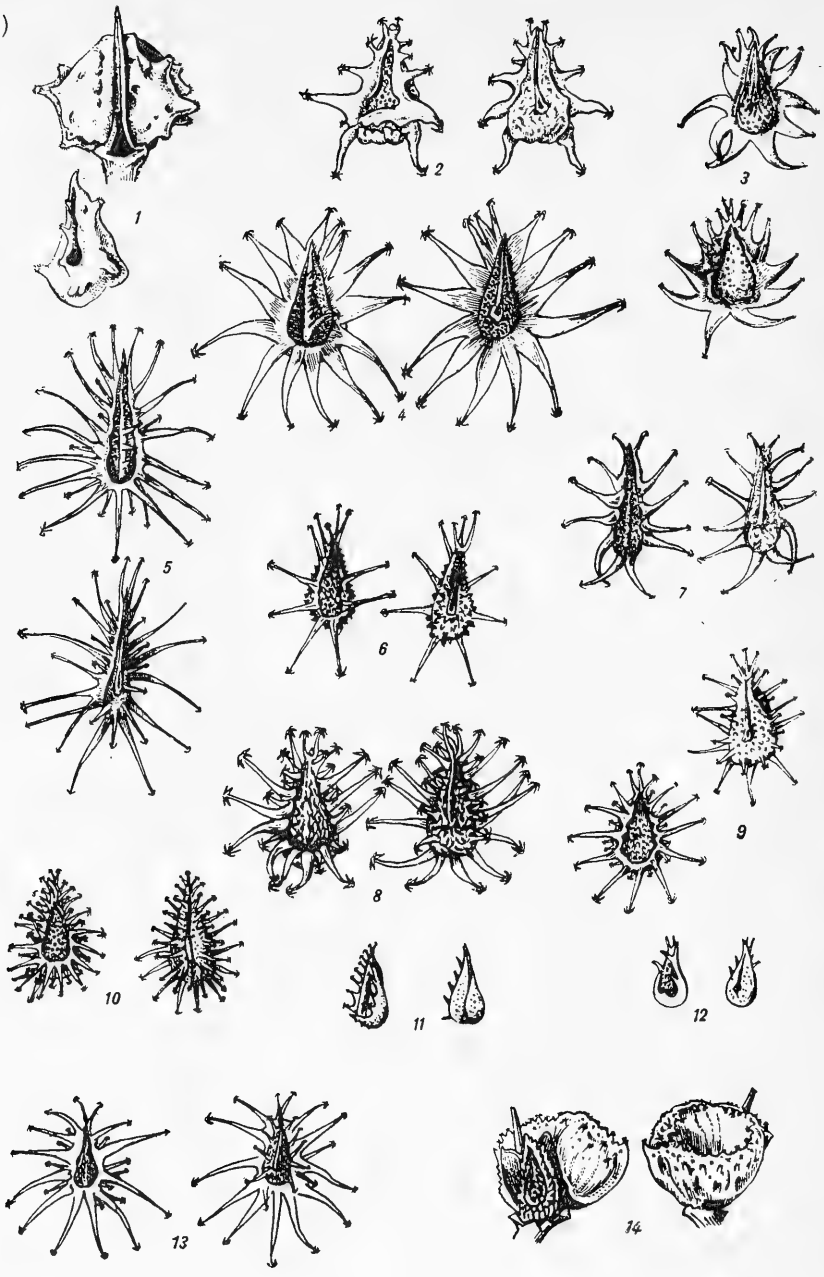

PLATE XXII. Nutlets of species of Lappula, dorsally and ventrally: 1 — L. spinocarpos (Forsk.) Aschers.; 2 — L. concava F. Müll. (for comparison); 3 — L. marginata (M.B.) Gürke.; 4 — L. macrantha (Ldb.) Gürke.; 5 — L. semiglabra (Ldb.) Gürke.; 6 — L. patula (Lehm.) Aschers.; 7 — L. stricta (Ldb.) Gürke.; 8 — L. anisacantha (Turcz.) Gürke.; 9 — L. consanguinea (Fisch. et Mey.) Gürke.; 10 — L. echinata Gilib.; 11, 12 — L. microcarpa (Ldb.) Gürke.; 13 — L. heteracantha (Ldb.) Gürke.; 14 — L. drobovii M. Pop.

part of Aleksandrovskii Range. There is no doubt, however, that these two species are vicarious. Perhaps they should be regarded as hybrids of Microcarpae × Multiseriales between which they are unquestionably intermediate: their corolla is like that of Microcarpae and their nutlets and style like Multiseriales. If they are hybrids they originated far back, in the Pleistocene and perhaps in the Pliocene. This is not a modern hybrid-group. L. rupicola Zak. (Bot. mat. Gerb. Bot. inst. AN SSSR, XIII (1950) 41) should be referred to this species.

Series 10. Rupestres M. Pop.— Nutlets with one row of short spinules along margin of disk, margin hardly distinct as a thick line-ridge. Style short, nearly completely hidden among apices of nutlets, separate from gynophore. Corolla with flat or nearly flat limb 4—8 mm across. Related to Microcarpae from which it is distinguished by the short style; less close to Strictae from which it is distinguished by the Myosotis-type corolla with rather flat limb. Restricted to the northeastern part of Central Asia, mainly in the Central Kazakh hills and the adjacent parts of Tarbagatai and Dzungarian Ala-Tau.

22. L. rupestris (Schrenk) Gürke in Engl.— Pr. Pflanzenf. IV, 3a (1897) 107.— Echinospermum rupestre Schrenk in Bull. phys.-math.
456 Acad. Pétersb. II (1842) 194; DC. Prodr. X, 140; Ldb. Fl. Ross. III, 161; Lipsky in Tr. Bot. Sada, XXVI, 565.— Lappula microcarpa (Ldb.) Gürke var. brachycentra (Ldb.) Brand in Pflanzenr., IV, 252 (1931) 144.— Echinospermum microcarpum Ldb. γ. rupestre Rgl. in Tr. Bot. Sada, V (1876) 623 et VI, 343, ex parte.

Probably biennial, not annual; entire plant gray-appressed-sericeous; stems few from a single root, thin, delicate but rigid, appressed-gray-downy, 10—30 cm high, nearly simple, sometimes only in inflorescence with 1—2 branches besides 1—2 terminal ones; rosette of radical leaves small but distinct, preserved during flowering, withering at ripening of fruit; leaves of rosette 1—3 cm long, spatulate-linear or rarely spatulate-lanceolate, obtuse, usually flat; cauline leaves linear and usually slightly spatulate, 0.5—1 cm, rarely up to 1.5 cm long, 1—3 mm wide, obtuse, slightly sericeous with appressed hairs, spreading-ciliate only beneath along margin. Racemes short in flower but rapidly elongating, 3—5 (to 7) cm long in fruit, ascending, leafless, with fruits distant; pedicels thin, erect, appressed-gray-downy, distinct but not long, the lower 3—6 mm long; calyx in flower 2 mm long, appressed-gray-hairy (downy), lobes linear-oblong, obtuse, lobes up to 3 mm long in fruit, upright not curved below; corolla blue, rather large, in the first (largest flowers) up to 8 mm across, in the last 5—6 mm, limb rotate, lobes of limb ovate, rounded at apex, the tube shorter than calyx; nutlets 2.5 mm long, ovoid-oblong, trihedral in cross section, turning blue in upper part, sides and back densely covered with small white tubercles, cliff margin of disk sharply outlined, smooth, with very few, very short appressed anchor-like spinules, sometimes nearly tubercles without anchor-tip; style short, protruding above nutlets for about $\frac{1}{3}$ mm. May—June. (Plate XVIII, Figure 1.)

Stony slopes of cone-shaped mountains.— (Centr. Asia: Balkh. Ulu-Tau Mountains). Endemic. Described from Ulu-Tau Mountains (Schrenk, 7 VI 1842). Type in Leningrad.

Note. Lipskii's observations about this species, except for the ones referred to the closely related E. brachycentrum Ldb. (see Lipskii, op. cit. 553—555) are essentially correct. Typical L. rupestris is endemic to the Ulu-Tau Mountains, but there are forms growing very close to it in the adjacent areas of Altai (south of the Irtysh) Tarbagatai and Dzungarian Ala-Tau that hardly deserve specific status. The form growing in Karkaralinsk Mountains (Korzhinskii, Kucherovskaya) has partly winged nutlets. Shipchinskii collected a form near Ayaguz (Sergiopol) in the mountains of Ak-Dzhumak and Akchetau, very similar to the Ulu-Tau one
457 except that the surface of the nutlets is scabrous and acutely tuberculate (f. tarbagataica M. Pop.) instead of having white, distinctly separate obtuse tubercles. Alongside this form there is a specimen with a broad, blue, dentate wing around the nutlet exactly as in Lepechiniella. Apparently relating to f. tarbagataica is the specimen from the Ak-Chavly Mountains (20 V 1840, Karelin and Kirillov) which these collectors, and later Ledebour, accepted as E. brachycentrum Ldb. Its nutlets are not ripe enough to determine the texture of their surface reliably. A similar form (var. alatavica M. Pop.) collected in the mountains of Dzungarian Ala-Tau appears to be perennial, with ligneous branches of rootstock broadly cespitose. The texture of the nutlet surface is more reminiscent of the typical form (Ulu-Tau) but the spinules along the margin of the disk are elongate, often outcurved, some nutlets being amazingly surrounded by a dentate wing as in Lepechiniella. — Near Lepsinsk: Dzhaman-Tas Mountains, rocks, fruit, 20 VIII 1930, Rodin, No. 490 and the former Kopal'sk county; Suyuk-Tyube Mountains, flowers, fruit, 17 VI 1909, Lipskii, No. 1643.

With respect to E. brachycentrum Ldb., at least the plant drawn in "Ic. pl." Plate 302, which is annual, high and broadleaved, has obviously nothing in common with E. rupestre Schrenk. Lipskii was quite right in this connection. The original plant of which the drawing by Ledebour was made is not in the Herbarium of the Academy of Sciences, apparently it was in Berlin. What remained in the Herbarium, and was referred to by Lipskii, is Ledebour's unnamed specimen before flowering (more likely it is E. microcarpum). I believe it is not an original specimen and that Lipskii was wrong in asserting that Ledebour had neither the flowers nor the fruit of E. brachycentrum. In Plate 32 it is seen that the specimen had fruit.

23. L. sericata M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 320.— Echinospermum microcarpum β. minimum Rgl. in Tr. Bot. Sada, VI (1880) 343.— E. polymorphum γ. minimum Lipsky in Tr. Bot. Sada, XXVI (1910) 551.

Perennial; plants forming dense but small cushions apparently in rock crevices; branches of rootstock 2—10 in number, short, appressed, rather thick, because of the black, elongate, tight relics of last year's petioles, bearing above bundles of many radical leaves and floriferous low stems; leaves of radical bundles (rosettes) narrowly linear, sometimes subfiliform,

rarely slightly dilated above, slightly spatulate, 2—3 cm long, 0.6—2 mm wide, very densely gray-sericeous with straight tight hairs, without spreading cilia at margin, gradually slightly broadening at base, this dilated part preserved on branches after withering of leaves; stem 5—12 cm
458 high, thin, usually ascending, rarely erect, gray, with tightly appressed short hairs, simple, sometimes bearing at apex only a paired (fork) terminal cyme dichasial (inflorescence); cauline leaves narrowly linear, 0.6—1.5 cm long, erect, like the radical obtuse, sericeous-gray. Racemes (or the 2 racemes in form of fork on higher stems) 2—5 cm long in fruit, erect, with very small linear bracts, not very loose; pedicels short, 1—2 mm long, thick, erect; calyx in flower 2 mm, lobes obtuse, appressed-bristly, linear, hardly elongating in fruit and firmly appressed to lower part of fruit; corolla blue, limb broad, flat, 5—7 mm wide, with large ovate-rounded lobes; fruit ovoid-oblong, 2.5 mm high; nutlets ovoid; disk oblong, like sides densely and finely spinous-tuberculate, along the low elevated margin with small sparse erect spinules (0.2—0.5 mm long) with anchorlike tip, spinules in the two rows not reaching apex of nutlets; style rather small (0.5 mm) exserted above apex of nutlets. June—July.

Rocks or stony slopes in the spruce forest belt (steppe) and the subalpine belt. — Centr. Asia: Dzu. Tarb. (Dzungarian Ala-Tau, upper reaches of Talka River near Lake Sairam-Nor). Gen. distr.: Kuldja (1,500—3,000 m, 22 VII 1877, Regel'). It might probably be found beyond these boundaries, in the adjacent parts of Dzungarian Ala-Tau and E. Tien Shan (south of the Ili River). Endemic. Described from the indicated locality. Type in Leningrad.

24. **L. glabrata** M. Pop. ex Pavl. in Bot. zhurn. XXX, 4 (1945) 191 et in herb. 1938; Bot. mat. Gerb. Bot. inst. AN SSSR, XIV, 322.

Biennial or perennial; root thin, short, vertical, bearing rosette of leaves at apex producing several (or few) floriferous stems; plants green, subglabrous, when young sparsely covered with short appressed straight hairs or bristles borne on small (later large) tubercles; leaves of rosette spatulate, wide-oblong above, up to 8—10 mm wide, 3—6 cm long, flat, obtuse, drying early; stems 10—20 cm high, thin but rigid, simple or branching above; cauline leaves oblong-linear or lanceolate, 1—3 cm long, obtuse, sessile, flat. Racemes short; flowers rather large or small (the Korzhinskii specimens in the USSR are small); calyx 1.5—2 mm, with obtuse broadly linear lobes; corolla blue, with rather flat limb (ca. 3—4 mm across); pedicels thin, erect, short, 1—2 mm long; calyx-lobes in fruit ascending, covering fruit; fruit
459 oblong, nearly prismatic, ca. 2—2.5 mm high; nutlets oblong, with finely tuberculate sides; disk oblong, finely tuberculate-shagreen, the margin elevated as a line beset with short incurved spinules with anchorlike tip (spinules ca. 0.2 mm long); style short, ca. 0.5 mm, hidden among apices of nutlets. June.

Granite cliffs in crevices. — Centr. Asia: Balkh. (only in Bektau-Ata Mountains, 4 VI 1937, Dmitrieva-type; including flowers, fruit, 7 VII 1890, Korzhinskii — very small depressed specimens). Endemic. Described from the indicated locality. Type in Alma-Ata, cotype in Moscow, topotype in Leningrad.

25. L. korshinskyi M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 323.

Perennial; plants forming tufts; roots thin, short, vertical, bearing short branches at apex of the somewhat branching rootstock, branches 1—2(3) cm long, covered with black scales (relics of last year's leaves); tufts ca. 10 cm across, consisting of few (up to 10) approximate bundles or rosettes of radical leaves, the leaves 5—10 cm long, up to 8—10 mm wide, lanceolate-spatulate, flat, obtuse, not very densely gray- or even greenish-sericeous, with completely appressed straight hairs; stems numerous, 5—10 from one tuft, rather robust, arcuately ascending or erect, 30—45 cm high, at onset of flowering 20—25 cm high, densely leafy, leaves 15—20 on stem, appressed-hairy, branching only in inflorescence; cauline leaves lanceolate, slightly tapering at base, obtuse, flat, declined, sparsely appressed-hairy-sericeous at both surfaces. Racemes dense in flower, in fruit 5—10 cm long, with small linear bracts; pedicels thin, short, 1—2 mm long, erect, appressed-downy; calyx in flower 2—3 mm long, sericeous, with linear obtuse lobes, elongating to 3—4 mm and loosely appressed to fruit, shorter than fruit or as long; corolla blue, Myositis-like, with short tube and nearly flat limb 6—8 mm wide, lobes ovate-rounded; fruit ovoid, 2.5 mm long; sides of nutlets tuberculate, bearing an additional row of very short anchorlike spinules, nearly tubercles, below the main row; disk oblong, dark, with a tuberculate low keel sometimes with small spinules, sparsely and finally tuberculate at sides of keel, an extended line ascending along margin of disk bearing short, 0.2—0.4 mm, distant, anchorlike spinules, 4—6 at each side; nutlets oblong, style thin, 0.5 mm long, elevated above nutlets for 0.2—0.5 mm. June.

460 Cliffs, stony slopes, 2,000—2,500 m. — Centr. Asia: T. Sh. (Fergana Range, River Uyunkur-Su, bluffs, fruit, 14 VIII 1895, Korzhinskii, No. 3850, type; natural boundary, Kenkol Sovkhoz Kyzyl-Ungur, flowers, 17 VI and 29 VI 1945, Matveeva, Pokrovskaya). Endemic. Described from Fergana Range. Type in Leningrad.

26. L. aktaviensis M. Pop. et Zak. sp. n. in Addenda XVIII, 622. —

Biennial; root vertical, thin; rosette of radical leaves drying at fruiting, dense, the leaves rather broadly spatulate, obtuse, ca. 3 cm long, up to 5—6 mm wide at apex, rather densely, semi-spreading-hairy and gray-sericeous-hairy at least beneath, sparsely bristly above, bristles borne on large tubercles; stems 15—20 cm high, robust, erect, gray-hairy, with thin, short branches diverging at 45° in upper part or nearly at base, paniculate; cauline leaves ca. 1 cm long, broadly linear, obtuse, declined, gray, with semi-spreading bristly hairs. Fruiting racemes 3—5 cm long, dense, paniculately arranged; pedicels 1—2 mm long, appressed-downy, erect or slightly curved; calyx in flower 1—1.5 mm long, appressed-gray-downy, lobes obtuse in fruit 1—1.5 mm long, appressed to base of fruit; corolla blue, apparently with flat limb 3 mm (?) in diameter (I saw only the one last flower on a specimen with ripe fruit; flowers distinctly reduced, probably twice smaller than the normal); fruit oblong, 2.5—3 mm high; nutlets oblong, all nutlets with small spinous tubercles, spinous-shagreen, sides vertical, finely spinous tuberculate; disk lanceolate-oblong, keel-line with small few anchorlike spinules, sometimes without any, spinules above disk extending laterally from keel, margin of disk thin, elevated, bearing 7—8—9 short, rather dense, erect, 0.2—0.5 mm

long anchorlike spinules in one row at each side; style nearly absent; stigma subsessile on gynophore and completely hidden between free apices of ripe nutlets. April—May.

Stony cliffs in the semi-desert belt. — Centr. Asia: Kyz. K. (Ak-Tau Mountains, steep slopes, fruit, 3 VI 1932, Nikitin and Mikhailova, No. 145). Endemic. Described from indicated locality. Type in Leningrad.

Note. This plant is reminiscent of L. microcarpa in habit and nutlets, but owing to the complete absence of a style it should be separated from the group Microcarpae. This may possibly be just an anomolous individual of L. microcarpa, yet taking into account the fact that in the hills of Kyzyl-Kum there are many differentiated types, this might be an endemic species (or race of L. microcarpa).

461 Series 11. Microcarpae M. Pop. — Corolla with flat limb, Myosotis like. Nutlets oblong, with 1—2 rows of short anchorlike spinules along margin of disk. Style long, elevated highly above apices of nutlets. Usually biennials. Leaves linear. Hairs gray, adjacent. Nearly the entire ancient Mediterranean area from Altai to Spain and Morocco.

27. L. barbata (M. B.) Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Brand in Pflanzenr. IV, 252, 140. — Myosotis barbata M. B. Fl. taur.-cauc. I (1808) 121. — Echinospermum barbatum Lehm. Pl. Asperif. II (1818) 128; DC. Prodr. X, 137; Ldb. Fl. Ross. III, 156; Boiss. Fl. or. 250. — Myosotis saxatilis Pall. in Nova Act. Petrop. (1792) 306, Tabl. taur. (1795) 47, nom. nud. — Echinospermum saxatile Wettst. = Lappula saxatilis Kusn. in Mat. Fl. Kavk. IV, 2 (1913) 183. — Echinospermum filiforme Godet. in DC. Prodr. X (1846) 140. — Ic.: M. B. Cent. pl. rar. (1810) tab. 36. — Exs.: Fl. cauc. exs. No. 348.

Biennial; stem single, rarely few from one root, (30)40—60(70) cm high, erect, delicate, thick in large individuals, usually branching in upper part, paniculate, appressed-short-hairy, grayish; radical rosette withering at fruiting, leaves 3—7 cm long, lanceolate-spatulate, 5—8 mm wide below apex, obtuse, spreading-villous-hairy, gray; cauline leaves lanceolate or broadly linear, usually flat, 2—5 cm long, 3—8 mm wide, obtuse, grayish or gray, with semi-appressed antrorse hairs, spreading-ciliate at margin. Fruiting racemes elongate, 5—20 cm long, with small, indistinct, linear bracts; pedicels erect, 2—5 mm long, appressed-downy; calyx in flower 2 mm long, appressed-downy, with linear lobes little elongating in fruit (up to 4 mm), ascending and loosely embracing fruit; corolla Myosotis-like, blue, the tube shorter than calyx, ca. 2 mm long, limb nearly flat, rotate, 6—8 mm across, with ovate-rounded lobes; fruit ovoid, 3—3.5 mm high, crowned by thin style raised above apices of nutlets for 1—1.5 mm; nutlets dorsally triangular-ovoid, disk and sides sparsely or densely finely tuberculate, disk triangular-ovate, with median keel of large tubercles, margins ascending, thick, with one main row of rather long, 1—2 mm, thin spinules, 4—6 at each side, slightly dilated at base, adjacent, curved or erect, below this row at the sides an additional row of shorter, sometimes tubercle-like, but still anchorlike spinules, sometimes developing only at lower half

of nutlet, sometimes spinules of main and lateral rows reduced to
462 0.5—0.7 mm, to tubercles along margin of disk (form similar to L. brachycentra and L. microcarpa). June.

Stony slopes, rocks, in the lower mountain belt, rarely in oak forests. — European part: Crim. (southern part); Caucasus: everywhere except west; Centr. Asia: Mtn. Turkm. (Balkhany, Kopet-Dagh). Gen. distr.: Arm.-Kurd., Iran. Described from the Crimea (Karasubazar) and Caucasus (Mozdok). Type in Leningrad.

Note. Boissier and Kuznetsov correctly pointed out that in the texture of the nutlet, this species is highly variable as is the following L. microcarpa. Some tubercles on the body of the nutlet are larger, some smaller, sometimes they cover the entire disk along whose median line there may or may not be anchorlike spinules. The spinules along the margin of the nutlet are also variable in length and density, sometimes they are reduced to tubercles but are larger than those on the disk and sides. This form is identical with the form brachycentra of L. microcarpa. Although there is usually a second, additional row of spinules they are not always visible. Contrary to Kuznetsov, a categorical distinction between L. barbata and L. microcarpa according to this character is impossible. Our species (L. barbata) differs from L. microcarpa by the larger habit (averagely of course), larger and flatter corollas, 2 mm wider than in L. microcarpa, style averagely 0.5 mm longer. These differences are quantitative. The varieties virgata Kusn. and pumila Kusn., separated by Kuznetsov, are in my opinion of no significance. E. cariense Boiss. (1844) described from Asia Minor (see Note to L. microcarpa) is more likely a synonym of this species than of L. microcarpa. The Kopet-Dagh Lappula should be referred to L. barbata and not to L. microcarpa because of its high growth, loose branching and loose racemes and larger corollas, but the fruits are slightly smaller than in the Caucasian specimens and in particular the Crimean L. barbata thus approaching morphologically and geographically L. microcarpa. It comprises forms as in L. microscarpa the nutlet-spinules of which are reduced to tubercles (var. brachycentriformis M. Pop.); in the Caucasian population these spinules are often very short yet they are never reduced to tubercles.

28. L. microcarpa (Ldb.) Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Kuzn. in Mat. Fl. Kavk. IV, 2, 193; Kryl., Fl. Zap. Sib. IX, 2241; Brand in Pflanzenr. IV, 252, 142, excl. syn. E. rigidum DC. ex Persia. — Echinospermum microcarpum Ldb. Fl. alt. I (1829) 202; DC. Prodr. X, 140; Ldb. Fl. Ross. III, 160. — E. stylosum Kar. et Kir. in Bull. Soc. Nat. Mosc. XIV (1841) 715; Ldb. Fl. Ross. III, 161 (in Note to E. microcarpum). — E. oligacanthum Ldb. Fl. Ross. III (1846—1851) 161 (f. depauperata). — E. polymorhum Lipsky var.
463 in Tr. Bot. Sada, XXVI (1910) 541—553 (excl. syn. E. tenue Ldb. et var. minimum et var. heterocarpum). — Ic.: Ldb. Ic. Fl. Ross. II, tab. 183; Brand, L. c. f. 15, A—E.

Biennial; root thin, vertical, usually producing several stems, rarely in weak individuals stems single, stems thick, robust, stiff, 30—40(50) cm high, semi-appressed-gray or nearly white-hairy or subtomentose, spreading-branching from the middle or base with thin but stiff branches diverging at

30—45—60°; leaves linear, often slightly spatulate-linear, leaves of radical rosettes (withering at fruiting) more spatulate, 3—4 cm long, cauline leaves 2—3 cm long, 2—3(4) mm wide, often longitudinally plicate, with gray or nearly white semi-spreading or semi-appressed hairs, spreading-long-ciliate along margin; all obtuse, soft, usually spreading. Fruiting racemes not very long, not very loose, ascending obliquely or one-sided; pedicels short, appressed-hairy, erect, 1—2—3 mm long; calyx small, appressed-gray-bristly, ca. 2 mm long, lobes obtuse, hardly elongating in fruit, more or less spreading, corolla blue, M y o s o t i s -like tube as long as calyx, limb pale blue, broadly campanulate, 5—6 mm across in first flowers, with ovate-rounded lobes; fruit ovoid-oblong, ca. 2 mm high; nutlets oblong-triangular, acutely and finely tuberculate at sides and along disk; disk oblong-triangular, usually with anchorlike spinules along keel, with thin erect anchorlike spinules 0.5—1 mm long, along the thickened margin 3—5 at each side; style thin, elevated for 1 mm above apices of nutlets. April—May. (Plate XXII, Figures 11, 12 — nutlets from the original E. o l i g a c a n t h u m Ldb.)

Mountainous semi-steppe belt, stony slopes, also on loess in the southern oases. — West Siberia: Alt.; Centr. Asia: T. Sh., Pam.-Al. (foothills), Balkh., Ar.-Kasp. (Mangyshlak, scarp on the edge of the Usturt Plateau), Mtn. Turkm. (Badkhyz only). Endemic. Described from the southern foothills of Altai (Arkaul Mountains south of Semipalatinsk and from Bukhtarminsk). Type in Leningrad.

N o t e. This species is markedly variable, distributed over a wide and uncommonly naturally variegated area, but still it is impossible to separate different geographical races in it except possibly for the Mangyshlak population which is more or less closer to L. b a r b a t a than to L. m i c r o c a r p a.

The best known of the geographical races (forms) L. b r a c h y c e n t r a (Ldb.) Gürke (l. c. 107; Kryl., Fl. Zap. Sib. IX, 2247. — E. b r a c h y c e n t r u m Ldb. Fl. alt. I (1829) 203; Ic. Fl. Ross. IV, tab. 302. — E. a f f i n e Kar. et Kir. in Bull. Soc. Nat. Mosc. XIV (1841) 714. — L a p p u l a t u b e r c u l a t a Zak. Burachn. Zeravsh. (1941) 18, Figure 4) are distinguished by
464 the spinules along the disk being reduced to tubercles with anchorlike head. These plants are universal and occur in Altai and Central Kazakh Hills up to Zeravshan but generally are not found among the typical forms. They are more inclined to stony slopes and mountains in the south than the type; for example there are mass collections of the typical form near Samarkand and Alma-Ata but not of L. b r a c h y c e n t r a whose type is from Altai (between Butakova and Cheremshanka, 1826, Ledebour). This type specimen from which Ledebour drew Plate 302 has been lost, the only specimens preserved being the flowering ones from Ust'-Bukhtarminsk.

The characteristic form growing in Pamir and in the mountainous part of Badakhshan, L. p a u l s e n i (Brand) M. Pop. (L. m i c r o c a r p a var. p a m i r e n s i s M. Pop. — O r e g o n i a p a u l s e n i Brand in Pflanzenr. IV 252 (1931) 186 et Fedde Repert. XXII (1925) 103), is white-tomentose-downy, not silky. The stems are poor in leaves. Type: Pamir, cliffs at border of Chaikova, flowers, fruit, 7 VIII, 1931, Lipshits, No. 753 (types in Leningrad and Moscow). In habit the southern race of Samarkand, Shirabad, and Boldzhuan differs from the Altai formal prototype by the coarseness of the stems and the rough branches, the grayer, sometimes sericeous hairs.

Perhaps this should be separated as var. squarrosa M. Pop. The high mountain forms from the southern part of Central Asia (upper reaches of the Angren or Upper Zeravshan and Gissar Range) are, on the other hand, thin, delicate plants approaching in characters L. kulikalonica Zak. and L. tadshikorum M. Pop. A more detailed study may possibly result in their being separated into local taxa.

Boissier and Brand were inaccurate in adding the Iranian L. rigida (DC.) M. Pop. (Echinospermum rigidum DC. Prodr. X (1846) 141) to the synonymy of L. microcarpa (Ldb.) if only for the reason that L. microcarpa is absent in Kopet-Dagh and represents the Central Asian (Tien Shan) vicarious race of the ancient Mediterranean L. barbata s. l. Apart from this such synonymy is incompatible with De Candolle's report that L. rigida is a perennial. Boissier viewed L. microcarpa as an annual which is also incorrect. All the Iranian specimens commonly determined as L. microcarpa which I saw were biennials. They differ from the Soviet Tien Shan L. microcarpa by taller habit and long, very loose racemes. The words of Boissier, repeated irrelevantly by Kuznetsov, "racemis laxissimis elongatis," are applicable to this taxon and not to L. microcarpa. The same is true of Echinospermum filiforme Godet which cannot be referred to L. microcarpa (see Boissier, Brand) since it has been described from the Caucasus where L. microcarpa is absent.

L. subcaespitosa M. Pop. (ex Pavl. in Bot. Zhurn. XX, 4 (1945) 183 (quoad nomen, non specimina!) also represents one of the variational
465 forms of L. microcarpa. Characteristic for this plant is the preservation of the rosette of radical leaves during fruiting thus leading to the wrong conclusion that it is a perennial. Stems ascending, weak, leafy only in lower third or fourth, becoming above very weak, very long, loose racemes, such as described for L. rigida (DC.) M. Pop. The fruits are slightly larger than in L. microcarpa, 2.7 mm high. In any case, such a form parallel to the Iranian L. rigida (DC.) M. Pop. grows in the crevices of limestone rocks, i. e., in a special habitat. I saw it in Kugitang (type, IV 1915, Popov, in Tashkent) and in other mountains of Pamir. In Leningrad there are these specimens: W. Tien Shan, system of Chirchik River, slopes of ravine of Nurek-Ata River, fruit, 9 VIII 1914, Minkvits, No. 1160. The specimens which Pavlov referred to this species (Kara-Tau Mountains) represent L. brachycentra (Ldb.) Gürke.

29. L. kulikalonica Zak. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIII (1950) 40.

Biennial; root thin, vertical; radical leaves rosetted, withering early, 3—5 cm long, narrowly spatulate-linear, obtuse, 2—3(4) mm wide under apex, with gray, semi-spreading, long hairs; stems erect, thin, delicate, 25—40 (45) cm high, appressed-gray-hairy, branching in upper part or from base with elongate thin branches; cauline leaves linear, diverging from stem at 30—45°, 2—3 cm long, acute, with grayish subappressed hairs, spreading-ciliate along margin, uppermost leaves ca. 1 cm long. Fruiting racemes very loose, with remote fruits and small linear bracts, up to 20 cm long; pedicels 1—3 mm long, erect, not thick; calyx in flower 2—2.5 mm long, appressed-grayish-downy, lobes linear, acute, reaching 3 mm in fruit and

stellately spreading; corolla white, intermediate type: in first flowers larger, with broadly campanulate limb ca. 4 mm across and ovate-rounded lobes, in last flowers limb 2—3 mm across and lobes oblong-rounded; fruit pyramidal-oblong, 2—3 mm long (high); nutlets with oblong-lanceolate disk, along median line with few anchorlike spinules, in some specimens keel ascending tuberculate, very finely and acutely tuberculate-shagreen at sides of median line (keel), tuberculate along the slightly elevated margin of disk and without spinules, or often beset with very short anchorlike spinules appearing like tubercles, 2—4 at each side of disk (typical fruit of L. brachycentra) or spinules 0.3—0.5 mm long with anchorlike tip; style markedly protruding above apices of nutlets (1 mm and higher). June. (Plate XXIII, Figure 2.)

466 Centr. Asia: Pam.-Al. (only Upper Zeravshan: Kuli-Kalon and Laudon pass, also along Magian-Darya River near Shink and Marguzar). Endemic. Description based on flowering specimens from Kuli-Kalon, 10 VI 1909, A.K. Gol'bek and D.K. Prozorovskii.

Note. A very problematic species. Its flowers are unquestionably white and smaller than in L. microcarpa, its fruits as in the latter, with long, protruding style, sometimes with spinules along margin of disk, sometimes brachycentric, with tubercles only. It may be that this is a young, hybrid species derived from L. microcarpa × L. drobovii. Not very typical forms of the latter species are found in Zeravshan north of the area of L. kulikalonica (see Note to L. drobovii). It is closely related to L. semialata. If the latter had winged nutlets it would be similar to L. kulicalonica and hence it is possible that our species represent only a form (var. isosperma M. Pop.) of L. semialata, a specimen of which is available also from Upper Zeravshan (Gul'bos, flowers, fruit, 18 VII 1913, B.A. Fedchenko, No. 384). Observations in nature will clear up the relationship between the four, long-styled forms (winged Sub-lepechiniella and wingless Microcarpae) in Upper Zeravshan. The herbaria are not sufficient for this purpose. It appears that L. kulikalonica occurs also in the Alai Range (basin of Shakhimardan River, Arpa ravine, flowers, fruit, 24 V 1916, Drobov, No. 1085 and stony slopes in Karamuk valley, flowers, fruit, 19 VI 1913, Dolenko, No. 915).

Series 12. Sub-Lepechiniella M. Pop. — Nutlets partly broadly winged, the other part in the same fruits, or other fruits on same individual, wingless and similar to the fruit of series Microcarpae. Flowers usually small, rarely medium-sized, often white, rarely blue (in L. coronifera). Mostly biennials, but one species annual (L. coronifera).

30. L. ulacholica M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 325.

Biennial; root vertical, thin; radical rosette small, withering at onset of flowering, leaves spatulate-linear, 2—3 mm [cm] long, longitudinally plicate, ca. 4 mm wide (when straightened), obtuse, appressed gray-hairy; stems 15—25 cm high, few, ascending, thin but sturdy, sparsely but wholly appressed-downy, with few thin spreading branches above near the terminal cyme; cauline leaves lanceolate-linear, 1—2 cm long, 2—4 mm wide, acute, flat or

longitudinally plicate, diverging at 45—90°, grayish and more or less densely appressed-hairy but not shiny, not sericeous, long-ciliate at margin. Fruiting racemes loose, 5—10 cm long, upright, with thin axes and linear small
467 bracts; pedicels relatively long, 2—4 mm, thin, appressed-downy, declined but not bent; calyx in flower 2.5 mm long, appressed-downy, lobes linear, acute, slightly elongating and spreading in fruit; corolla blue, Myosotis-like, with short tube as long as calyx, limb nearly flat, ca. 6 mm across, lobes of limb ovate-rounded; fruit partly winged, partly wingless and some only with wingless nutlets, winged nutlets ca. 4 mm across, wings coriaceous, stiff, nearly flat, cleft for $^2/_3$ into narrowly triangular long, 1.5—2 mm, thin-acuminate spinules with anchorlike tip (awn), 3—5 spinules at each side of disk, disk oblong-lanceolate, with few short anchorlike spinules and varying number of tubercles; wingless nutlets oblong, disk oblong-lanceolate, beset with spinules and tubercles, at margin with few short straight anchorlike spinules, sides tuberculate as in the winged ones, with an additional row of very short spinules; style ca. 1 mm long, protruding above apices of wingless nutlets for not more than 0.5 mm, completely hidden by wing of the winged nutlets. June.

Stony slopes in the alpine belt.— Centr. Asia: T. Sh. (Central Tien Shan only: Ulakhol pass, flowers, fruit, 7 VII 1908, Kasatkin, No. 39 (type) and in Kashkara River valley, flowers and fruit, 3 VI 1896, Broterus, No. 143). Endemic. Described from Ulakhol pass. Type in Leningrad.

Note. Much resembling L. marginata in the winged nutlets but the flowers are different, with broad flat Myosotis-like limb, and hairs appressed not spreading. Our species is a biennial, not an annual like L. marginata, and only some of its nutlets are winged. It is closely related to the series Rupestres or Tianschanicae, particularly in the corolla, pubescence and wingless nutlets; owing to the wings of some of the nutlets it is formally placed in the series Sub-Lepechiniella (although this series includes only the small and usually white-flowered species). Very close to the genus Lepechiniella, in particular to L. korschinskyi from Fergana Range, but the latter is a perennial and its wings are cut into shorter teeth.

31. L. drobovii M. Pop. ex Pavl. in Sov. bot. I (1934) 27; Nevskii in Tr. Bot. inst. AN SSSR, ser. 1, 4, 316 (quoad nomen, non specimina citata).— Echinospermum drobovii M. Pop. in Tr. Turk. univ. 4 (1922) 56, 63 and in Tr. Turk. nauchn. obshch. I (1923) 19, 21 and 32.— E. polymorphum var. heterocarpum Lipsky and Tr. Bot. Sada, XXVI (1910) 551, omnia loca citata, ex parte.

Biennial; plant bristly-downy with slightly spreading grayish hairs; stems
468 usually 1—5 from one root, thick, robust, 40—50 cm high, erect, strongly paniculately branching above, with spreading or arcuately ascending branches; leaves of radical rosette withering at fruiting, strongly spatulate-lanceolate-linear, grayish, ca. 5 cm long, 5—7 mm wide below apex; cauline leaves broadly linear, declined, ca. 3 cm long, sessile, upper leaves ca. 1 cm long, all leaves acute, grayish, ciliate at margin. Fruiting racemes at ends of all branches (the stem forming paniculate inflorescence) elongate, loose, nearly leafless; pedicels ca. 1 mm long, erect; flowers apparently very small, white (I saw only the last flowers at the ends of the fruiting racemes,

i. e., reduced flowers compared with the first ones); calyx in last flowers 2 mm long, lobes linear, spreading-hairy, horizontally declined in fruit; corolla with short tube, limb broadly campanulate, 3 mm across, with short, orbicular-obtuse lobes; fruit usually with 1—2 broadly winged nutlets, 1—2 others wingless as in typical Lappula; nutlets (incl. wings) ca. 2 mm long, wings of nutlets white, cup-shaped, high, forming semi-spherical cup or even higher and slightly incurved to form a vesicle but not so closed (with much broader opening than in Paracaryum intermedium), margin of wing denticulate, below margin wing strongly and finely scabrous, with solitary short or longer anchorlike spinules, nutlet-sides finely white-tuberculate; wingless nutlets ovoid-oblong, finely white-tuberculate at sides, with narrow, nearly lanceolate disk (dorsal areola) with tuberculate keel and with short erect wide anchorlike spinules in one row along the thickened margins, protruding above nutlets, 1 mm long, not thickened; gynophore long, 2 mm (i. e., entire length of nutlet), beneath with flat stipe/column supporting base of nutlet typical for Lappula. April—May. (Plate XXII, Figure 14 and Plate XXIII.)

Variegated rocks, conglomerates and exposed areas in the lower mountain belt (semi-desert and semi-steppe belt).— Centr. Asia: Pam.-Al. (only along the periphery of Fergana valley: Namagan-Dzhelalabad, Andizhan-Margelan-Isfara). Endemic. Described from Isfara (variegated and shale foothills of Sara-Tau Mountains, Popov, 1920). Type in Tashkent.

32. L. semialata M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 327.— L. drobovii Nevski in Tr. Bot. inst. AN SSSR, ser. 1, 4
471 (1937) 316, non M. Pop.— Echinospermum drobovii M. Pop. in Tr. Turk. univ. 4 (1922) 56, 63 and in Tr. Turk. nauchn. obshch. I (1923) 19, 21 and 32, ex parte quoad specim. commemorata.— E. polymorphum Lipsky var. heterocarpum Lipsky in Tr. Bot. Sada, XXVI (1910) 551—553, ex parte.— Ic.: M. Pop., op. cit. (1951).

Biennial; appressed-gray-hairy plants; radical leaves rosetted, withering at fruiting, spatulate-linear, ca. 3 cm long, 3—4 mm wide at apex, obtuse; stems 1—3(5) from one root, erect, robust, virgate, 40—60 cm high, grayish-appressed-downy, often reddish, loosely branching in upper part with thin long ascending branches; cauline leaves linear or spatulate-linear, sometimes slightly broadening at apex, appressed-gray-downy, 3—4 cm long, acute, the uppermost leaves reduced, narrow, acute, bristly-ciliate along margin. Fruiting racemes in panicles, very thin, flexuose, to 20 cm long, very upright, with markedly remote fruits, nearly leafless; pedicels 1—2 mm long, erect, short, appressed-downy; calyx in flower 1.5 mm long, lobes linear, acute, horizontally spreading or even curved in fruit; corolla white, tube as long as calyx, the limb broadly campanulate, 3—4 mm across, with short ovate-rounded lobes; nutlets 1—2 winged in fruit, 1—2 wingless, the wings nearly flat or slightly (mainly below) cup-shaped-curved, yellowish, broad, large-toothed at margin, the teeth elongating into more or less long anchorlike spinules; keel of dorsal areola indistinct or smooth, sides finely tuberculate; wingless nutlets oblong, 2.5—3 mm long, with narrow lanceolate disk rimmed by thickened margin bearing rather short erect anchorlike spinules 6—7 at each side, sides of nutlets tuberculate, sometimes in the lower broadened part with a second rudimentary row of very short thick

PLATE XXIII. 1 — Lappula drobovii M. Pop.; 2 — L. drobovii, transitional form to L. kulikalonica Zak.

spinules; style little protruding above nutlets, ca. 0.5 mm long; gynophore rather thick, subulate, 2.5 mm long, with very distinct basal column. May—June.

Gypsiferous, variegated hills and mounds, rarely stony slopes of variegated mountains.— Centr. Asia: Pam.-Al. (only south of Gissar Range). Endemic. Described from Baba-Tag Mountains near Kel'-Bulak, flowers, fruit, 29 VII 1914, Popov, No. 423. Type in Leningrad.

33. L. popovii Zak., Burachn. Zeravsh. in Tr. Uzb. univ. nov. ser. 28 (1941) 19 and in Not. Syst. Herb. Acad. Sc. Uzbek. X (1948) 7.— Ic.: Zakir., op. cit., Figure 5.

Perennial; rootstock of few (up to 10) short, dark, slightly squamose
472 branches produced from top of vertical rather thin root, at apex with rosette of leaves or fertile stems; leaves of radical rosettes (preserved even in fruit) 3—6 cm long, flat, spatulate-lanceolate, 5—7 mm wide below apex, greenish, sparsely spreading-bristly-hairy (bristles at upper surface on large white tubercles), acute or obtuse; petioles ciliate-bristly; stem ca. 1 mm thick, weak, ascending or erect, sparsely grayish-appressed-hairy, with few (1—2) thin branches above usually simple or forming loose long apical fork, 20—25 cm long, with very remote lobes, their axes flexuose, thin, obliquely upright, with very small, nearly indistinct leaves in lower part; pedicels firm, erect, 1—2 mm long, like axis appressed-downy; calyx in flower 1.5—2 mm long, less appressed-downy, with linear acute lobes; corolla white, tube as long as calyx, the limb broadly campanulate, with ovate-rounded short lobes, 3—4 mm across; scales ovate, 0.5 mm long; nutlets varying, 1—2 winged, 1—2 wingless, body of nutlet (without wings in winged ones) ca. 3 mm long, wings flat or obliquely cup-shaped, broad, smooth, deeply large-toothed at margin, the teeth elongating into anchorlike spinules, disk smooth, sides smooth; wingless nutlets ovoid-oblong, disk narrow, oblong-lanceolate, with thickened rim at margin beset with 5 rather long straight spinules anchorlike at tip, sides obtusely tuberculate; style thin, long, ca. 1 mm long above nutlets. July.

Gravels of dry riverbeds in the subalpine belt.— Centr. Asia: Pam.-Al. (Gissar Range only). Endemic. Described from the upper reaches of Zeravshan (Karakul', flowers, fruit, 21 VIII 1940, Popov and Zakirov); also in Chul-bair Mountains and Kun'ya-Kanyaz' natural boundary (1896, Lipskii, No. 789). Type in Tashkent.

34. L. coronifera M. Pop. sp. n. in Addenda XVIII, 623.

Annual; stems thin, erect, ca. 20 cm high, grayish, not very densely appressed-hairy, in upper part with 3 obliquely ascending racemes (with these 20 cm high, without hardly 8 cm); cauline leaves usually drying and falling, linear, ca. 2 cm long, 1.5 mm wide, sparsely spreading-bristly, acute. Racemes with loose fruits, nearly leafless; pedicels 1—2 mm long, appressed-downy, declined to even nearly drooping; flowers apparently small and corolla blue with campanulate limb 3 mm across; calyx-lobes in flower linear, stellately spreading, acute, ca. 3 mm long, in fruit very sparsely spreading-hairy; fruits all with some winged nutlets; nutlets with or without wings,
473 wing broad, smooth, yellowish, appearing as a high cup entire (cup-shaped) or cut at margin into equal triangular-lanceolate lobes with anchorlike

spinules at apex, sides largely and acutely white-tuberculate; disk with an ascending keel-line, slightly tuberculate at sides; wingless nutlets with narrow lanceolate disk rimmed by thick yellow keel bearing 4—5 anchorlike spinules in one row at each side of disk, spinules long, yellow, somewhat declined from the erect position (perpendicular to plane of disk); style 0.1—0.2 mm long; gynophore and nutlets ca. 2.5 mm long. May—June.

Sandy-gravelly banks.— Centr. Asia: Balkh. (boundary with Irtysh), eastern part (former Semipalatinsk county — its southern part near Taubanka, bank of Char-Gurban River, fruit, 26 VI 1914, Shipchinskii, No. 1103[a]). Endemic. Described from the above indicated locality. Type in Leningrad.

Note. Although there is only one specimen of this species in the herbarium I am firmly convinced that it is not a monstrosity, just as Lappula drobovii with its winged nutlets, proved not to be a monstrosity in spite of Lipskii's note. The cup-shape and the wings of the nutlets in Lappula are the result of hybridization with Paracaryum or Lepechinnela. In that region where L. coronifera was collected, Lepechiniella omphaloides also occurs. On the other hand, our species with its winged nutlets approaches L. stricta and hence it may be that L. coronifera originated as a hybrid of Lepechinella omphaloides × Lappula stricta. Future collections and observations will make it possible to establish the significance and validity of our species.

35. L. petrophila Pavl. in Bot. zhurn. 30, 4 (1945) 190.

Annual; grayish-downy, with spreading short stiff hairs on tubercles; stems 7—12 cm high, spreading-branching, with few (1—3) branches; leaves oblong-lanceolate or lanceolate, flat, acute, 1.5—2.5 cm long, 4—8 mm wide, the upper reduced. Racemes at ends of branches forming forked cymes, leafless, flexuose, not long; pedicels curved, elongated, the lower especially long; corolla 1.5—2 mm across; fruiting calyx spreading, small; fruit ovoid-conical, with long (1—1.5 mm) style protruding at apex; nutlets 2 mm long, with flat finely and densely prickly (anchors) dorsal areola, the two lower with cup-shaped narrow white wing with fine anchorlike prickles at nearly the
474 entire margin, two upper nutlets wingless, with small anchorlike spinules along margin of disk broadening only at base, finely tuberculate at sides. April—May.

Stony slopes.— Centr. Asia: T. Sh. (Kara-Tau Mountains only, stony peaks and slopes of residual outcrops at the upper reaches of Taldyk, flowers, fruit, 15 V 1939, Pavlov, No. 324). Endemic. Described from the above locality. Type in Moscow.

Note. As an intermediate between Paracaryum intermedium and Lappula sinaica, this species appears very close to Paracaryum bungei (Boiss.-Brand) and may not actually differ from the latter.

Series 13. Sinaicae M. Pop.— Nutlets without spinules, with tubercles only on disk and sides, narrow, strongly compressed at sides, adnate to gynophore along entire ventral keel. Style thick, protruding rather highly above nutlets. Annuals, with small blue flowers, exclusively in ancient Mediterranean.

36. L. lipschitzii M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 330, f. 2, a.

Annual; stems 15—20 cm high, erect, thin, robust and stiff, racemiformly branched above with few elongate erect branches, stems and branches sparsely appressed-hairy, hairs nearly completely contiguous, short, nearly without tubercles at base; leaves linear, deciduous (fruiting specimens nearly completely leafless), 1.5—2 cm long, 1.5 mm wide, acute, upright, poorly hairy, hairs semi-spreading, white, borne on very small tubercles. Fruiting racemes 3—6 cm long, upright, with small linear bracts, more or less loose; pedicels erect, thick, short, even the lower only ca. 1 mm long; calyx in flower 1—1.2 mm long, lobes linear, elongating and longer than fruit, covered with spreading short hairs borne on rather large tubercles, corolla ca. 2 mm long, subtubular, blue, hardly longer than calyx, the limb half as long as tube, campanulate, with oblong rounded-obtuse lobes; fruit prismatic-pyramidal, 2 mm high, truncate at apex and with thick style 1—1.2 mm long; nutlets narrowly triangular, with narrow triangular disk beset with few white tubercles, margin of disk broad, ascending and like sides of nutlets densely tuberculate, tubercles white, obtuse or acute, rather large, few larger conical ones at margin of disk with rudimentary anchor-like tip, the others without, tubercles arranged at sides in about three rows. April—May.

Centr. Asia: Kara-Tau desert, takyrs overgrown with Haloxylon
475 thickets near Yana-Kurgan, last flowers and fruit, 16 V 1939, Pavlov, No. 355 (identified as Echinospermum microcarpum Ldb.). Endemic (known only from the indicated locality). Type in Moscow, cotype in Leningrad.

37. L. occultata M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 331.— Echinospermum occultatum M. Pop. in Herb.— E. spec. (aff. sinaico) differt a praecedente (E. sinaico) calyce fructum occultanti in Tr. Turk. Gos. univ. 4 (1922) 57.— L. sinaica var. occultata (M. Pop.) Pavl. in Bot. zhurn. XXX, 4 (1945) 191.

Annual; stems (15)20—30 cm high, robust, erect, more or less appressed- or semi-spreading-hairy, usually slightly spreading-branching only in upper part, with few long straight branches ascending at 45°; cauline leaves lanceolate-oblong, rarely lanceolate or oblong, 2—3 cm long, 4—8 mm wide, obtuse, flat, only the uppermost tapering at base and hence somewhat spatulate, the others sessile, sparsely bristly with spreading hairs borne on tubercles, sometimes grayish when hairs denser and obliquely antrorse. Fruiting racemes 5—15 cm long, robust, erect, with linear bracts not obvious; pedicels thick, erect, the lower 3—5 mm long, the median 2—3 mm long; calyx in flower 2 mm long, semi-spreading-bristly, lobes linear, 4—5 mm long in fruit, embracing and partly hiding it (hence the name of the species); corolla blue, subtubular, 2—2.5 mm long, the limb narrowly campanulate, 1—1.5 mm wide, lobes ovate-rounded, 0.5 mm long, tube longer than limb; fruit ca. 3 mm long, ovoid-pyramidal, truncate at apex and with thin style exceeding nutlets by 0.5 mm; nutlets shiny, the ripe brown, oblong (when viewed dorsally), with gibbous back; disk oblong, weakly keeled and rather densely covered with white obtuse distinctly separate tubercles, at the narrow margin with thick ascending smooth rim, at sides rather densely verrucose-tuberculate. April—May.

Shale cliffs and taluses. Centr. Asia: T. Sh., Pam.-Al. (Alai and eastern Turkestan Ranges; isolated in W. Pamir area (Upper Zeravshan, Gorno Badakhshan)). **Gen. distr.**: Dzu.-Kash. (Kuldja). Described from Sary-Tau Mountains, Fergana valley (Turkestan Range). Type in Tashkent.

38. L. sinaica (DC.) Aschers. ex Schweinf. in Mém. Inst. Egypt. II (1887) 111; Brand in Pflanzenr. IV, 252, 144.— Echinospermum sinaicum DC. Prodr. X (1846) 141; Boiss. Fl. or. IV, 251; Lipskii in Tr. Bot. Sada, XXVI, 567.— E. kotschyi Boiss. Diagn. pl. nov. or. ser. 1, VII
476 (1846) 29.— E. divaricatum Bge. in Mém. sav. étr. Acad. Pétersb. VII (1851) 410.— Lappula divaricata B. Fedtsch. Rast. Turk. (1915) 663.

Annual; usually branching from base with arcuately ascending simple lower branches or stems (in weaker individuals), furcately or spreading-branching only above; branches always long, weak, terminated by loose flexuose racemes, stems 10—40 cm high, covered with semi-spreading not very thick gray hairs; leaves mainly crowded below, oblong or oblong-lanceolate, in weak individuals lanceolate, (1)2—7 cm long, 6—14 mm wide, flat, dull-grayish, bristly with semi-spreading hairs borne on small tubercles, lower leaves often tapering at base and spatulate, even upper leaves appearing petioled. Fruiting racemes very long, 5—20 cm long, often fluexuose, rarely loose, with 1—2 oblong reduced leaves below, above with small short lanceolate bracts; pedicels thick, elongate, the lower reaching 7—10 mm, declined or even arcuately recurved, the median erect, 2—5 mm long; calyx in flower 1.5—2 mm long, lobes oblong-linear, nearly not elongating in fruit, much shorter than fruit and hence at its base; corolla blue, 2—3 mm long, limb narrow, campanulate, 1—2(3) mm wide, with small oblong rounded-obtuse lobes; fruit ovoid or broadly pyramidal, 2—2.5 mm high; nutlets narrowly oblong when viewed dorsally, laterally distinctly gibbous below, above appearing depressed (curved), nutlets thus of unusual shape, differing from those of other species of Lappula; disk narrowly oblong, densely white-tuberclate-verrucose, rimmed at margin by thick ascending smooth line bearing remote short conical spinules or tubercles with rudimentary anchorlike tip, sides of nutlets subvertical, rugose-tuberculate, sometimes tubercles prickle-like; style protruding for 1 mm above apices of nutlets. April.

Rocks, often calcareous, along their benches, sometimes in deep shade.— Caucasus: Dag. (Makhach-Kala), S. Transc. (Armenia, Megrin, Nakhichevan ASSR, Ordubad, Norashen); Centr. Asia: Mtn. Turkm., Pam.-Al., T. Sh. (to Kara-Tau northeast of Aleksandrovskii Range), Kyz. K. (mountains inside Kyzyl-Kum), Ar.-Casp. (Mangyshlak). **Gen. distr.**: Iran., Iraq, Sinai Peninsula. Described from Sinai ("in deserto Sinaico, Aucher, No. 118 et 2289"). Type in Geneva.

Note. I examined the original specimens of all three species (L. sinaica, L. kotschyi and L. divaricata) and arrived at the conclusion that they referred to one species. Boissier's Sinai specimens (in horto
477 Sinaico) are young, without ripe fruit, nonetheless they appear to me to be fully identical with the Iranian (including Central Asia and S. Transcaucasia). In habit, branching, width of leaves and pubescence, this is a very variable plant and dependent on the habitat conditions. In shady, moist

rocks the plants are mesophyllous, with broad green leaves, markedly branching; in dry, bright benches or crevices of dry rocks they are narrow-leaved, sometimes with gray hairs and weakly branching.

The species occurs in the northeasternmost points of Central Asia, in the middle of Aleksandrovskii Range and Kara-Tau Mountains, and in the northwest in Mangyshlek and its part of the Kara-Tau Mountains. In the Caucasus it is restricted to a small stretch of the Araks valley.

One of the herbarium sheets of this species collected near Teheran by Bunge (V 1859) bears the following inscription: "Echinosp. a cl. Boiss. cum E. sinaico confusum." Specimens with ripe fruits. From this inscription it would seem that Bunge differentiated the Teheran plant from L. sinaica (DC.) Aschers, which he himself identified with the Isfahan collection (ibid., V 1859). The Teheran plants differ from those from Isfahan only in the pedicels, especially the lower, being much recurved whereas in the Isfahan plants they are nearly erect and in general shorter. The Central Asian specimens usually are like those from Isfahan in this respect but sometimes their pedicels are recurved, although not to the same degree as in the Teheran plants.

Series 14. Anomalolappula M. Pop. — Flowers and fruit completely sessile. Fruit asymmetrical, (obliquely) pyramidal. Nutlets united with gynophore for the entire length of their keel, their margins firmly adjacent especially below, not separating even when ripe, upper nutlet winged-cup-shaped, the others triangular, wingless. Annuals.

39. L. sessiliflora (Boiss.) Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Brand in Pflanzenr. IV, 252 (1931) 144. — Echinospermum sessiliflorum Boiss. Diagn. pl. nov. or. 1 ser. 11 (1849) 124 (by misprint E. sessifolium!) Boiss. Fl. or. IV, 253. — Heterocaryum divaricatum Stocks ex Boiss. Fl. or. IV, 253. — Ic.: Brand; l. c. f. 15, f — j.

Annual; appressed-gray-hairy or even gray-downy, with straight white coarse hairs; stems 5—10 cm high, in small specimens simple with one raceme terminating stem, in larger individuals branching above with 2—4 spreading or ascending branches ending in racemes; leaves narrowly linear, grayish, upright, rarely linear, greenish and declined, obtuse, 0.5—2 cm long,
478 1—2 mm wide, rather numerous. Racemes with small linear bracts; fruiting racemes elongate, sometimes up to 10—15 cm, with stiff firm axis; pedicels very short, curved; calyx in flower ca. 1 mm long, up to 3 mm in fruit, lobes spreading, linear, acute; corolla blue, ca. 1.5 mm long, with ca. 1 mm wide campanulate small limb; nutlets sessile as if adhering to the thick axis of raceme, 2.5—3 cm long, triangular when viewed from the back, the lower with base slightly decurrent on axis, larger, the two lateral and the lower one wingless, acutely subaculeate-tuberculate at sides and at the truncate base, disk triangular, with lateral angles acute and the apical elongate, half hidden, finely tuberculate-scabrous, rimmed along three sides by ascending thick white tuberculate-scabrous rim beset with short erect spinules with anchor-like tip, 2—3(5) at each side of disk, spinules on lateral lower angles often double and longer, apical nutlet often with coriaceous, cup-shaped, high rim

largely and acutely toothed, the teeth anchorlike-aculeate, sometimes all nutlets wingless; style thin, hardly protruding from nutlets (above them). April.

Pebbly slopes. — Caucasus: S. Transc. (Nakhichevan', Erevan); Centr. Asia: Pam.-Al., T. Sh. (W.), Mtn. Turkm. Gen. distr.: Iran. (Iran, all Baluchistan), Iraq. Described from Isfahan, Oshe Elua (?), No. 5017. Type in Geneva.

Note. This characteristic species appears to be very widespread in Central Asia. The spinules along margin of disk are longer or shorter. Brand attributed to it "cicatrix suprabasalis nonnunquam fere centralis" and hence considered it related to some degree to both Lappula and Hackelia; in fact its cicatrice is basal, as common in Lappula and this species has nothing in common with Hackelia. It is rather more related to Rochelia, since at least the flowers are like Rochelia. I saw specimens from Nurata Mountains, a region with highly unique flora, collected by Spiridonov (7 IV 1915, No. 51), in which — as in Rochelia — one, rarely two nutlets develop in the fruit and the disk of the nutlets was completely covered by adjacent margins (var. rochelioides M. Pop.).

An obscure species (probably a monstrosity) is L. cymosa (Stschegl.) B. Fedtsch. (Rast. Turk. (1915) 663. — Echinospermum cymosum Stschegl. im Buli. Soc. Nat. Mosc. XXVII. —I (1854) 184).

The nutlets are the same as in L. semiglabra (Ldb.) Gürke, but habit and leaves are widely different. Stems few, main stem up to 40 cm high, leaves broadly linear, gray, more like L. microcarpa or xeromorphic forms of L. consanguinea. Fruiting racemes capitate, borne at ends of lateral branches, drops of dried resin are visible in those heads and in
479 some places black round bodies, probably accumulation of fungus spores (smut!). Only one specimen was ever collected: in the sandy semi-desert at the foot of Dzungarian Ala-Tau between the Lepsy and Sarkan Rivers by Karelin and Kirillov in 1841. It is almost surely a monstrosity, resulting from fungus infection of the inflorescence. I saw analogous forms (with fruit crowded in a head) in L. tenuis (Dzungarian Ala-Tau) and L. microcarpa (Samarkand).

Genus 1213. **HACKELIA*** Opiz.

Opiz in Berchtold, Oek.-techn. Fl. Boehmens, II, 2 (1839) 147; Johnston in Contrib. Gray Herb. n. ser. LXVIII, 43—48; Brand in Pflanzenr. IV, 252, 117 — Echinospermum sect. 1. Homalocaryum DC. Prodr. X (1846) 135.— Lappula sect. IV Homalocaryum Gürke in Engl.— Prantl. Pflanzenf. IV, 3a (1897) 107.

Calyx divided nearly to base, but usually not as strongly as in Lappula, into 5 linear, lanceolate or oblong lobes changing little in size during fruiting; corolla short-type, Myosotis-like, usually blue, with short tube and flat wide limb 5—20 mm across, with short rounded lobes, rarely small in very reduced forms (for example, H. thymifolia); scales always present but varying in shape; stamens and style inside corolla tube, not emerging from throat. Gynophore broadly pyramidal, short (shorter than nutlets), not

* After Professor P. Hackel who studied the flora of Bohemia.

subulate as in Lappula, with 4 (1 at each face) rather large triangular pits signifying the areola of attachment (cicatrice) of nutlets. Nutlets dorsoventrally compressed, with flat dorsal areola, surrounded by one crested row of flat spinules, with anchorlike tip smooth at sides; sides and base of nutlets cuneate and converging towards the small, oval-triangular areola of attachment disposed centrally or slightly below; ventral keel inconspicuous: ventral side of nutlets above cicatrice free from gynophore, elongating (together with entire apical part of nutlet) and overtopping the gynophore thus hiding the short thin style with its capitate stigma; walls of nutlets rather thin, delicate. Mesophyllous, forest and meadow-forest perennial or biennial herbs, rarely annuals; stems erect, rather high, branched; leaves rather delicate, lanceolate, oblong or even ovate. Racemes more or less elongating in fruit, ebracteate or with small bracts. Fruits always on more or less long, recurved pedicels, 2—10 mm high, broadly pyramidal. Hairs appressed or spreading, borne on small tubercles or without tubercles.

480 About 40 species, mainly in North America; some species with broad leaves and large fruits growing in the mountains of the tropical zone (South America, Asia, Indochina, Himalayas).

1. Larger plant; stems 25—60 cm high; leaves 3—7 cm long, 0.5—1.5 cm wide, lanceolate, acute. Corolla 3—4 mm or even 5—6 mm across, its limb flat. Pedicels recurved, up to 2 cm long. Fruit 3—3.5 mm high (not counting spinules), spinules 1—2 mm long. Hairs, especially on stem, spreading. (Taiga, from Kamchatka and Sakhalin to the Baltic, Visla and Carpathians). . . . . 1. H. deflexa (Wahlenb.) Opiz.

\+ Small thin plants, 10—20(30) cm high; stem thin; leaves linear. Flowers much smaller. Fruit 1.5—2 cm high, with shorter spinules. Hairs small, appressed. (From Pamir to Manchuria) . . . . . 2.

2. Stems strongly and divaricately branching. Disk of nutlets glabrous, with small scattered tubercles only, along margin with dentate-aculeate nearly wing-like rim. Corolla 2—3 mm long. (From Altai to Manchuria) . . . . . 2. H. thymifolia (DC.) M. Pop.

\+ Stems nearly not branching. Disk of nutlets densely bristly-downy, with short spinules along margin sometimes merging in winglike rim below. Flowers still smaller; corolla ca. 1 mm long (Pamir) . . . . . H. thymifolis var. pamirica M. Pop.

1. H. deflexa (Wahlenb.) Opiz in Berchtold, l. c. (1839) 147; Johnston, l. c. (1923) 45; Brand l. c. (1931) 123. — Echinospermum deflexum Lehm. Pl. Asperif. II (1818) 120; DC. Prodr. X, 135; Ldb. Fl. Ross. III, 154; Shmal'g., Fl. II, 224; Kryl., Fl. Alt. IV, 901; Lipskii in Tr. Bot. Sada, XXVI, 556. — Lappula deflexa Garcke, Fl. Nord. u. Mitt. Deutschl. ed. VI (1863) 275; Kryl., Fl. Zap. Sib. IX, 2249; Hegi, Ill. Fl. V, 3, 2140-2142. — Myosotis deflexa Wahlenb. in Svensk Vet. Acad. Handl. Stockholm (1810) 113. — Echinospermum secundum Kar. et Kir. in Bull. Soc. Nat. Mosc. XIV (1841) 713. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 128, I, 1—6; Hegi, Ill. Fl. V, 3, f. 3100, a—c—d; Brand, l. c. f. 14.

Annual (or rarely biennial?). Stems erect, (10)20—60 cm high, usually branching above, rarely from base, with paniculately spreading thin branches, sparsely spreading-villous-hairy; leaves usually lanceolate, soft, greenish, the lower gradually tapering at base, up to 5—7 cm long and 1 cm wide, upper leaves sessile, narrower, 2—5 cm long, 0.3—0.11 mm wide, all leaves sparsely spreading-hairy, acute, always flat. Fruiting racemes loosely fruited but not very long, 5—10 cm, with small, inconspicuous, lanceolate or
481 linear bracts; pedicels more or less elongate, 3—15 mm long, always recurved, drooping in fruit; flowers medium-sized; calyx in flower 1.5 mm long, sparsely semi-appressed-bristly, lobes linear or oblong-linear, obtuse, up to 2—3 mm long in fruit, declined-spreading; corolla blue, limb 4—5—6 mm across, with oblong, rounded-obtuse lobes; scales large, white, broad, markedly protruding from throat, strongly and densely papilliform-villous; fruit broadly (ovoid) pyramidal, ca. 2.5(3.5) mm high (not including spinules); nutlets flat, sides and base smooth or finely dotted-shagreen, dorsal areola ovate, keelless, flat, densely and finely tuberculate-shagreen and often beset with short erect bristles among tubercles thus appearing scabrous-downy, spinules along margin of disk horizontally spreading, sometimes merging at bases into winglike narrow rim, more or less long, 1—2 mm long, thin, delicate. May—June.

Stony slopes in forests. — European part: nearly everywhere except for the Arctic and the southern steppes. Very common in the Urals and the taiga region of the Urals area, becoming rare in lowlands to the Baltic Sea, Visla and the Carpathians; Siberia: nearly all parts within the taiga belt; Far East: nearly everywhere from Kamchataka and Sakhalin; Centr. Asia: Balkh., T. Sh. (central, rarely). Gen. distr.: Centr. Eur., Mong., NE North America; absent in the Far East. Described from Lapland. Type probably in Stockholm.

Note. Ledebour tried to distinguish var. β. with longer spinules exceeding width of disk, sides of nutlets finely tuberculate like disk; he accepted Echinospermum secundum Kar. et Kir. from Arkat Mountains (Arkalyk) and Tarbagatai as this variety, but it appears that these characters are not constant. The winglike rim (merged bases of spinules) characteristic for the indicated specimens and those of Altai also occur in specimens from other parts of the distribution area, including Central Europe. There is no geographical correlation also with the pubescence or lack of pubescence on the disk and sides of the nutlet. Var. parviflora Gaudin (corolla 3—4 mm across) and var. grandiflora Gaudin (corolla 5—6 mm across) are described from the European Alps. Both forms also grow in the USSR: the Altai and Tarbagatai-Tien Shan specimens are large-flowered, the Volga specimens small-flowered. The size of the fruit (nutlets) is also very variable.

2. H. thymifolia (DC.) M. Pop. comb. n. — Echinospermum thymifolium DC. Prodr. X(1846) 136. — E. deflexum var. pumilum Ldb. Fl. Ross. III (1849) 155. — Hackelia deflexa var. pumila Brand in Pflanzenr. IV, 252 (1931) 126. — Lappula thymifolia Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 107; Kryl., Fl. Zap. Sib. IX, 2249. — L. deflexa var. thymifolia Kom. Fl. Manch. III (1907) 319.

482 Annual; stems thin, low, 10—30 cm high, white-hairy, hairs short and straight, branching from the middle (or above, or below in small individuals), with thin, rather divaricate branches; leaves small, 1—2.5 cm long, narrow, 2—5 mm wide, broadly linear, grayish, sparsely semi-appressed-hairy, obtuse. Fruiting racemes short, 3—5 cm, not loose-fruited; flowers and fruit small; pedicels 1—2—3 mm long, declined or recurved, thin; calyx in flower ca. 1 mm long, with oblong-linear lobes; corolla blue, small, not Myosotis-like 2—3 mm long, with funnel-shaped limb ca. 2 mm across; fruit small, 2 mm high, broadly pyramidal; disk of nutlets ovate, weakly keeled, finely and sparsely tuberculate, crested along margin with short, anchorlike spinules merging at bases into winglike rim, wing often curved upward.

Desert-steppe stony slopes and cliffs, in the lower mountain belt. — West Siberia: Alt. (sometimes in Chuya Chulyshman and Ursul valleys); East Siberia: Ang.-Say. (Minusinsk District, in places), Dau. (Selenginsk, Chita, Nerchinsk). Gen. distr.: Mongolia (N.), Manchuria. Described from Selenginsk (Turchaninov, 1837). Type in Geneva, cotypes in Leningrad and Kiev.

Note. In Pamir (Pshart River, cliffs opposite Tugur-Dzhilga ravine, flowers, fruit, 3 VII 1931, Lipshits, No. 457) a special form of this species, var. pamirica M. Pop. (H. tecti mundi M. Pop.), has been collected. It is distinguished in that there are nearly no branches but one terminal forked cyme, with stems rarely branching. The pedicels are thin, the lower to 10 mm long, declined, capilliform. The racemes are very loosely fruited. The corolla is ca. 1 mm long, the scales nearly disappearing. Disk of nutlets more densely downy, the spinules shorter. Type from the indicated locality.

Genus 1214. ERITRICHIUM* Schrad.

Schrad. in Comm. Goetting. IV (1820) 186; DC. Prodr. X, 122 (excl. sect. I, IV, V and VI); Ldb. Fl. Ross. III, 149, excl. sect. III, IV et V; Brand in Pflanzenr. IV, 252, 187, excl. sect. 1 (Microulastrum) et E. daurico (Amblynotus).

Calyx divided nearly to base into 5 linear or lanceolate, sometimes linear-oblong lobes little elongating or changing in fruit; corolla short-typed, small or medium-sized, blue or white, the tube not longer than calyx, the limb 5—10 mm wide, nearly flat or slightly concave, with short obtuse orbicular lobes; scales well developed, closing throat but not protruding from it; anthers and style enclosed in tube of corolla. Gynophore slightly developed, very short-pyramidal, not longer than 1 mm or appearing nearly as disk; nutlets attached to gynophore by small areola at the middle of
483 their ventral side (cicatrice), or turbinate, i. e., sides highly ascending from cicatrice to dorsal areola (disk) or nutlets dorsoventrally compressed with sides not as high, flat, and then on short-pyramidal torus (gynophore), elongating above at apex and hiding style between them, sometimes also growing slightly at base or to one side from gynophore as in Cynoglossum, usually with short hairs at their sides or back; dorsal areola in both cases flat, ovate, with one row of spinules along margin, sometimes bases merging into a dentate narrow wing (rim), very rarely spinules absent along margin and nutlets without crown; style short and thin. Perennial small herbs,

mostly with Myosotis-like blue flowers very similar to forget-me-nots. Mainly in the cold parts of Asia, partly in Europe and the western part of North America.

Note. Authors have interpreted the genus Eritrichium in various ways. De Candolle in particular expanded its range by including those North American species that are now included in the genera Cryptantha and Allocarya and in some of the Asian genera. Brand reduced this range considerably but at the same time included in the new section Microulastrum species which, in my opinion, do not belong to Eritrichium, namely E. pustulosum C. B. Clarke, which should be referred to the genera Microula or Schistocaryum. I believe this is a special type of genus: its nutlets are tuberculate, obliquely turbinate, the small dorsal areola is declined obliquely outside and surrounded by a thickened ring without hairs or spinules. I maintain De Candolle's Eritrichium to be mainly constituted of sections Eueritrichium DC. and Coloboma DC., excluding the section (genus) Amblynotus but including the section Pseudohackelia, one of whose species (E. latifolium Kar. et Kir.) was groundlessly included by Brand in the synonymy of E. nanum (Vill.) Schrad., and another (E. pamiricum B. Fedtsch.) in the genus Hackelia; and in addition, a special section Eritrichiastrum Brand, together with 2 Himalayan-Tibetan species and 1 from Japan.

The type species of Eritrichium is E. nanum (Vill.) Schrad. which grows only in the Alpine-Carpathian mountain country. E. villosum (Ldb.) Bge., the Arctic-Alpine species with its many races is the most closely related to it.

It is not easy to distinguish between the species of Eritrichium because so many of those are essentially races within each series; they are distinguished by insignificant characters and readily hybridize in their contact
484 areas which sometimes may be very extensive, for example all of Altai. Polymorphism in Eritrichium, as presented below, has apparently developed from the glacial period (Pleistocene).

1. Nutlets dorsoventrally compressed, low, not turbinate with apices rising above style and bases away from gynophore, bending below around the sepals. Apparently nutlets do not differ in shape from those of Hackelia but the gynophore is low, short-pyramidal, not more than 1 mm high (2—3 mm in Hackelia, nearly equal to nutlet). (Section Pseudohackelia) . . . . . 2.

\+ Nutlets turbinate, with more or less high sides, abruptly ascending from very flat, low-pyramidal gynophore, with small, more or less flat dorsal areola obliquely declined outside, growing not below gynophore but obliquely above, not at apex but at side of dorsal areola. (Sections Coloboma and Eueritrichium) . . . . . 10.

2. Corolla white not blue, relatively small. Spinules at margin of dorsal areola (disk) always present and anchorlike at apex as in Hackelia. Leaves oblong, i. e., comparatively short and broad. (Pamir area). (Series Albiflora) . . . . . 3.

\+ Corolla blue. Leaves narrower, lanceolate, oblong-linear or linear. Spinules vary rarely (only in one species) completely absent . . . . . 6.

3. Plants densely cespitose; branches of rootstock thick, with many remnants of the previous year's petioles. Leaves rather small, median cauline 1—1.5(2) cm long. Hairs spreading, not appressed . . 4.

\+ Plants not densely cespitose or generally not cespitose; rootstock not branching or slightly so. Hairs appressed, if hairs spreading than plants up to 40 cm high and leaves larger . . . . . 5.

4. Leaves obtuse, rather densely gray-hairy. (Dzungarian Ala-Tau, in the alpine belt) . . . . . 1. E. latifolium Kar. et Kir.

\+ Leaves acute, green, white-hairy. Spinules along margin of disk of nutlets fusing for ½ their height to form a dentate wing, free part of spinules (teeth of wing) covered at margin with tiny bristles. (W. Pamir) . . . . . 2. E. pamiricum B. Fedtsch.

5. Hairs spreading as in the preceding. Branches of rootstock few, sparsely covered with thick remnants of petioles. Plants
485 30—40 cm high (rarely only 15—25 cm — var. minor). Leaves larger, median cauline leaves 2—4 cm long. Nutlets with dentate rim, spinules (teeth) smooth, without bristles along margin. (C. Tien Shan) . . . . . 3. E. fetissovii Rgl.

\+ Leaves, stems and pedicels appressed-hairy. Rootstock not branching. Root thin. Low plants, not more than 20 cm high. (C. Tien Shan, more to the west of the preceding species) . . . . . 4. E. pseudolatifolium M. Pop.

6. Spinules at margin of disk of nutlet without anchor, the tip directed to the front (upwards), not to the side nor downward (nutlets not adhering); pedicels short. (Sakhalin). (Series Coerulea) . . . . . 9. E. sachalinense M. Pop.

\+ Spinules with anchorlike tip, directed to one side and slightly down (nutlets adhering because of spinules) or nutlets (in one species of the upper reaches of Zeravshan) completely without spines. Pedicels filiform, longer. (Pamir and area surrounding). (Series Himalaica) . . . . . 7.

7. Plants cespitose, with erect stems 20—40 cm high. Leaves longer, 2—4 cm . . . . . 8.

\+ Plants low, with filiform weak stems 3—15 cm long . . . . . 9.

8. Leaves flat, linear-lanceolate, greenish, poorly appressed-downy. Spinules along margin of nutlet long (2 mm), flat, horizontal . . . . . 5. E. dubium O. Fedtsch.

\+ Leaves narrowly linear-subfiliform, gray, densely hairy. Spinules along margin of nutlet (of disk) short, less than 0.5 mm long, erect . . . . . 6. E. pseudostrictum M. Pop.

9. Stems prostrate, 5—15 cm. Leaves 1—2 cm long, 1—4 mm wide, obtuse, flat. Pedicels arcuately drooping. Gynophore after falling of nutlets with small holes marking the attachment-sites. Nutlets with short spinules along margin. Plants weakly cespitose, gray. (Pamir) . . . . . 7. **E. sub-jacquemontii** M. Pop.

\+ Stems 2—8 cm long. Plants densely cespitose, sometimes forming cushions, silvery white. Leaves less than 1 cm long. Pedicels erect. Nutlets completely unarmed, back oblong and inflated. (Pamir area) . . . . . 8. E. turkestanicum Franch.

10(1). Leaves filiform, linear or linear-lanceolate to lanceolate, with hairs usually appressed, erect, rather long, white, gray or sericeous, rarely (one species) spreading-villous. Racemes in fruit more or less long and loose. Pedicels long, 5—10 to 15—20 mm long. Nutlets with pectinately disposed spinules along margin of disk, or unarmed (without crown). (Siberia, mainly in steppes, rarely in forest (taiga) belt, rocks, stony slopes). (Section Coloboma DC.) . . . . . 11.

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\+ Leaves short, rather wide, oblong or lanceolate or oblong-linear, never linear or filiform, leaves and stems long-spreading-hairy, hairs often curved thus pubescence soft-villous or even lanate-villous. Racemes short even in fruit. Pedicels short, the longest 3—5 mm long, but usually shorter. Nutlets always with crown (except for the European alpine E. tergloviense). Loosely cespitose or soft-pulvinate Arctic or Arctic-alpine plants (Section Euritrichium DC.) . . 23.

11. Nutlets without crown, unarmed, with smooth margins of dorsal areola . . . . . 12.

\+ Nutlets with crown, i. e., with spinules, spinules usually bluish, without anchorlike tip, pectinately disposed along margin of dorsal areola. . . . . 17.

12. Plants forming dense tufts; branches of rootstock short, woody or more delicate but always thick with dark scales (remnants of the previous year's petioles). Leaves narrowly linear to filiform, sericeous or gray . . . . . 13.

\+ Plants not forming tufts. Rootstock not branching or with one apical branch bearing a dense rosette or two compact ones of lanceolate-spatulate, rather broad leaves, strongly spatulate-tapering at base. (Upper Amur). . . . . 14. E. maackii Maxim.

13. Leaves shorter, 1—3 cm long, usually sericeous, rarely gray (E. tuvinense) . . . . . 14.

\+ Leaves very long, 3—6 cm but narrow, filiform or subfiliform, coarse, straight, dullish gray. (Manchuria, Great Khingan and other places) . . . . . 13. E. mandschuricum M. Pop.

14. Leaves dull, gray. Rootstock with woody branches. Pedicels short, thick, curved. Stems 3—5(7) cm high. Flowers smaller, 3—4 mm across. (Tuva Region) . . . . **E. tuvinense** M. Pop., see Note to E. jenisseense Turcz.

\+ Plants sericeous-hairy, low or of medium height . . . . . 15.

15. Leaves straight, rather coarse, linear, slightly longer than in the two preceding species. Rootstock with more coarse, woody branches. (Altai and Kazakh Hills). . . . . E. altaicum M. Pop., see Note to E. rupestre (Pall.) Bge.

\+ Leaves soft, curved or flexuose, filiform-linear, shorter. Branches of rootstock more delicate, not woody. (W. Siberia and N. Mongolia) . . . . . 16.

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16. Plant not as pulvinate as in the preceding species. Stems slightly higher, 5—10 cm. Pedicels 2—3 times as long as calyx but not more than 10 mm. Racemes in fruit slightly longer, up to 3—4 cm. Nutlets very smooth along margin. (Siberia: Tomsk-Krasnoyarsk) . . . . . 11. E. jenisseense Turcz.

+ Plants pulvinate. Stems 5—8 cm high. Racemes very short even in fruit. Pedicels approximately as long as calyx. Nutlets unarmed at margin of disk but margin slightly thickened, ascending and curved inside. (NW Mongolia) . . . . . 12. E. pulviniforme M. Pop.

17. Plants densely cespitose, rootstock with much shorter branches. Leaves linear, straight, sericeous. (Series Rupestria, comprising the above six, uncrowned species) . . . . . 18.

+ Plants not cespitose; rootstock slightly branching or not branching at all or producing loose, more or less broad tufts as well as elongated branches bearing at end reduced shoots (not rosettes). Leaves not linear or filiform but lanceolate or even broader, usually not sericeous but dullish-gray, rarely sericeous. Fruiting racemes elongate. Pedicels relatively thin and long, usually more than 10 mm (up to 20 mm). (Siberia). Series Pectinata . . . . . 19.

18. Racemes short, 1—2 cm long even in fruit. Pedicels short. Branches of rootstock delicate, not woody. (Dauria and NE Mongolia) . . . . . 10. E. rupestre (Pall.) Bge.

+ Racemes elongating, loose in fruit. Pedicels longer, sometimes longer than 10 mm long. Branches of rootstock harder, woody. (Altai) . . . E. subrupestre M. Pop., see Note to E. rupestre (Pall.) Bge.

19. Plants loosely cespitose. Branches of rootstock numerous, more or less elongate, thick, with remnants of previous year's leaves, each branch terminating by reduced (1—3 cm high) shoot (not rosette). Leaves of shoots short, 1—2 cm long . . . . . 20.

+ Plants not cespitose. Branches of rootstock few, short or absent (but then rootstock unicipital—plant biennial), usually with a single rosette, if rootstock with 1—2 branches then with 2—3 compressed, tightly attached rosettes. Leaves of rosettes longer, 2—5 cm long . . . . . 21.

20. Leaves spatulate-oblong-linear or spatulate-lanceolate, gray,
488 not sericeous. Racemes loose, with long (1—2 cm) pedicels. (Urals, West Siberia: Salair-Kansk) . . . 15. E. pectinatum (Pall.) DC.

+ Leaves spatulate-lanceolate, lanate-sericeous with very long hairs. Racemes loose in fruit, with long pedicels. (Central Siberia: Balagansk-Baikal and northeast to mouth of Lena River) . . . . . 20. E. sericeum (Lehm.) DC.

++ Leaves slightly sericeous, not as long-hairy. Racemes in fruit rather short, usually less than 5 cm, rarely up to 5—7 cm. Pedicels shorter, the lower not more than 10 mm long, the upper shorter. Leaves spatulate-oblong or spatulate-lanceolate. Very close to the preceding. (Kamchatka) . . . . . 19. E. kamtschaticum Kom.

21. Stem sparsely villous with spreading hairs, branching above. Leaves of rosettes larger, 3—7 cm long, green, rounded-obtuse at apex. (Lena-Kolyma, Okhotsk and Uda area) . . . . . 18. E. jacuticum M. Pop.

+ Stems appressed-hairy. Leaves of rosettes gray, densely hairy . . . . . 22.

22. Leaves dull gray, rounded-obtuse at apex, 2—5 cm long. (Transbaikalia, Zeya-Bureya, the northern part of Sikhote-Alin) . . . . . 16. E. incanum (Turcz.) DC.

+ Leaves somewhat sericeous-gray, acute, 5—7 cm long. Very close to the preceding. (Cliffs of southern Sikhote-Alin) . . . . . 17. E. sichotense M. Pop.

23. Pulvinate plants, forming low and rather compact cushions, 5—20 cm across. Stems very short, 1—3(5) cm high, appearing above cushion only after flowering. Spinules of nutlets smooth or nutlets with short smooth teeth instead. . . . . 24.

+ Plants producing loose tufts or even solitary rosettes. Stems well developed even at onset of flowering, 5—15 cm high. Spinules of nutlets scabrous at margin and generally long . . . . . 26.

24. Stems not visible at flowering; flowers borne in axils of the apical leaves of column-like shoots, i.e., at surface of cushion. Corolla blue, 5—6 mm across. (Arctic Siberia) . . . . 24. E. aretioides (Cham.) DC.

+ Floriferous stems slightly elevated above cushion subanthesis, 1—5 cm high . . . . . 25.

25. Flowers as large as in the preceding but cushion small, loose, more like a tuft. Spinules along margin of nutlets elongate, also as in the preceding. (Hybrids between E. aretioides and E. villosum, very common in Arctic Siberia and E. Europe (to Kanin Peninsula)). . . . . E. chamissonis DC.

489 (see Note to E. aretioides (Cham.) DC. and E. villosum (Ldb.) Bge.

+ Flowers larger, 7—10 mm across, blue. Nutlets with a narrow dentate wing-like rim around back without elongate spinules. (E. Carpathians) . . . . . 21. E. nanum (Vill.) Schrad.

26. Leaves of rosettes oblong or lanceolate-oblong, obtuse, like the entire plant sometimes grayish, i. e., more densely long-villous. Corolla blue or in some races white. (Arctic — E. European part and Siberia to Bering Strait and Kamchatka, the alpine mountain belt of S. Siberia, Tien Shan, Pamir area) . . . . . 23. E. villosum (Ldb.) Bge.

+ Leaves of rosettes lanceolate, acute, like the entire plant white-sericeous (i. e., hairs subappressed) hairy-villous. Weakly cespitose plants. Corolla blue. Nutlets as in the preceding. (Caucasus: Main Range) . . . . . 22. E. caucasicum (Alb.) Grossh.

Section 1. PSEUDOHACKELIA M. Pop. —Nutlets dorsoventrally compressed, low, not turbinate, their apices elongating above style, growing below with bases away from gynophore. Nutlets not differing in shape from those of Hackelia, but gynophore low, tiny, not more than 1 mm high, short-pyramidal. Differing from Hackelia by the short gynophore and in addition sometimes spinules without anchorlike tip.

Series 1. Albiflora M. Pop. — Spinules along margin of disk of nutlets with anchorlike tip as in Hackelia. Flowers small, white. Leaves broad and short, oblong. Pamir area.

1. E. latifolium Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 403; Ldb. Fl. Ross. III, 150; Lipskii in Tr. Bot. Sada, XXVI, 532.— E. nanum ssp. villosum var. eu-villosum Brand in Pflanzenr. IV, 252, (1931) 190.

Perennial; small, densely cespitose plants; root apparently hidden in rock crevices, multicipital, producing rootstock branches, branches short, thick with remnants of previous year's petioles; petioles and stem of last year thin, brown; rosettes of radical leaves small, disposed among bundles of previous year's petioles and stems, the leaves oblong, obtuse, 2—3 cm long, cuneately tapering into equally long petioles, downy-subvillous with spreading short hairs; stems thin, slightly flexuose, ascending, spreading-coarse-downy, 6—15 cm long, simple; cauline leaves 6—10, small, oblong,
490 acute, densely semi-spreading-short-hairy, sessile, 1—1.5 cm long. Inflorescence short in flower, composed of short, 1—2(3)-flowered, loose, cymes, elongating slightly in fruit with 1—2 small leaves at the lower part; pedicels long, longer than calyx, thin, spreading-downy; flowers rather small; calyx in flower 1.5 mm long, gray-downy, with ovate, obtuse lobes; corolla white, limb 5 mm across, lobes obovate or rounded-ovate. Ripe fruit absent but judging by the young ovary the fruit is flat, ovoid, with low sides and one row of anchorlike spinules along the margin of the downy disk.

Apparently in cliffs of the alpine belt.— Centr. Asia: Dzu.-Tarb. (only in Dzungarian Ala-Tau, upper reaches of Sarkan River, flowers and very small fruit, 1841, Karelin and Kirilov). Endemic. Type in Moscow, cotype in Leningrad.

Note. In 1948, V. P. Goloskokov made collections of Eritrichium in Dzungarian Ala-Tau, in the basin of the Koksu River, along the Karasyryk River, and on steep, shady cliffs in the forest zone; these specimens were close to E. latifolium, E. pamiricum and E. fetissovii but could not be pertained to any of these. Cespitose plants but branches of rootstock thin, green, 20—25 cm high, with spreading falling hairs. Radical leaves up to 10 cm long, with green, oblong-lanceolate blade, cauline leaves ovate-oblong, ca. 2 cm long. Cymes short, few-flowered, umbelliform, disposed on the branching apex of stem, if stem simple then with one small, slightly drooping apical cyme; pedicels long, erect, short-downy, much longer than calyx; calyx-lobes in fruit 1—2 mm long, obtuse, lanceolate, sparsely white-hairy; corolla absent but undoubtedly white. Gynophore pyramidal, ca. 0.5 mm high. Nutlets dorsoventrally compressed, 2 mm long, oblong, with long-cuneate pointed apex, completely downy, margin of disk with very short (0.1—0.2 mm) thick anchorlike not scabrous spinules. Cicatrice nearly at the center of the ventral side, suborbicular. This taxon is probably E. latifolium, but it grows in low forests and not in the alpine belt and hence the plants are more fully grown, green, with larger leaves (f. umbrosum).

2. E. pamiricum B. Fedtsch. in Tr. Bot. Sada, XXI (1903) 385; Lipskii in Tr. Bot. Sada, XXVI, 534.— Hackelia pamirica Brand in Fedde, Repert. XXII (1925) 104; in Pflanzenr. IV, 252 (1931) 134.—
493 Annual; plants green, densely or loosely cespitose; branches of rootstock short or slightly elongate, thick, covered with dark squamous remnants of past year's petioles; stems thin, numerous, (15)20—30 cm long, usually slightly ascending, simple, with 1—3 cymes at apex; leaves or radical rosettes

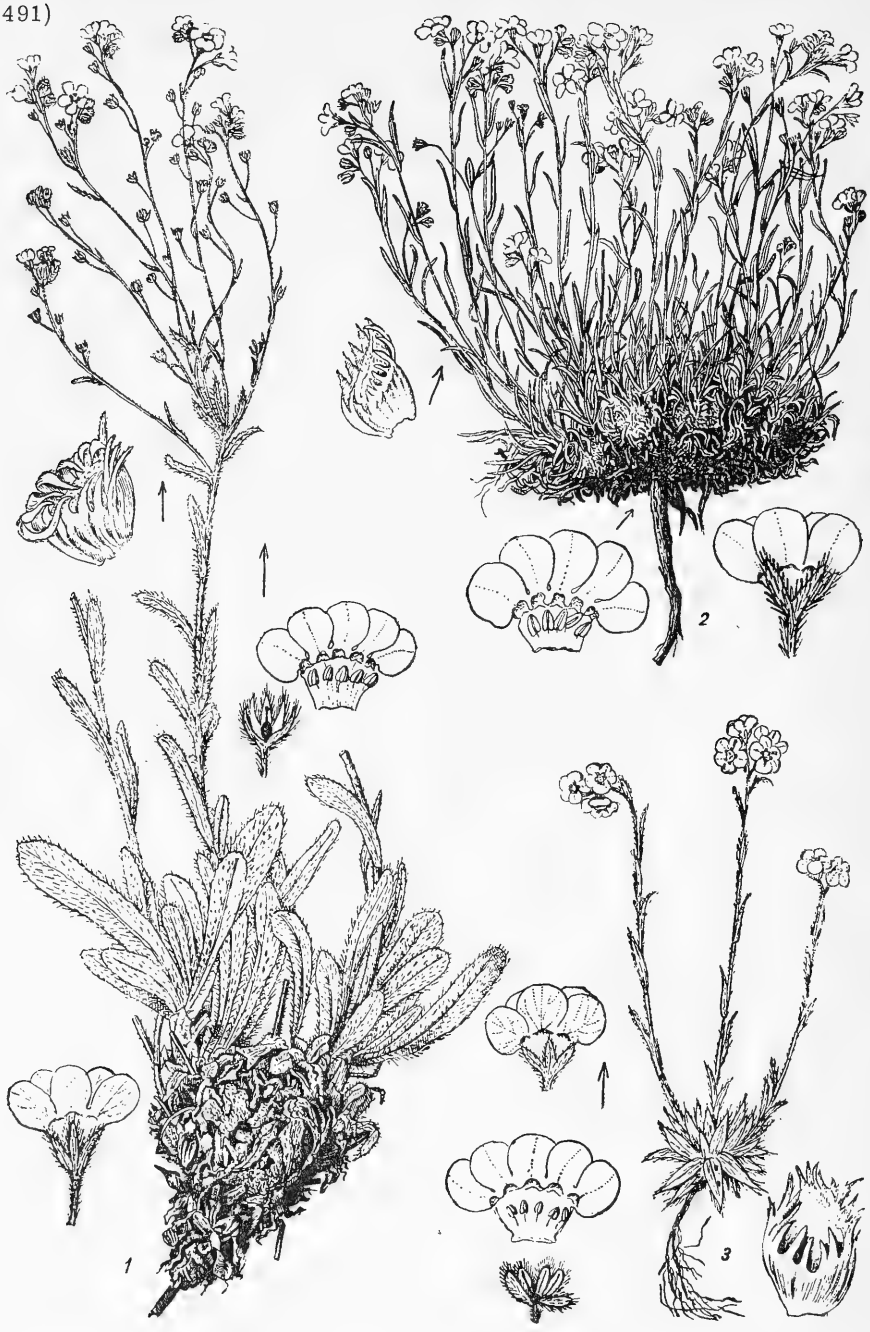

PLATE XXIV. 1 — Eritrichium jacuticum M. Pop.; 2 — E. subrupestre M. Pop.; 3 — E. caucasicum (Alb.) Grossh.

up to 5 cm long, lanceolate or oblong-spatulate, tapering to long petiole, acute, flat; lower cauline leaves similar but with shorter petiole; median and upper cauline leaves sessile, oblong, short, 1—2 cm, all short-acuminate, green, pubescent above and beneath with short, spreading bristles, the bristles at upper surface on large flat tubercles. Cymes even in flower loose, later in fruit very loose and elongate, up to 5—10 cm, directed upwards, nearly leafless; pedicels slightly longer than calyx, the lower up to 1.5—2 cm long in fruit, filiform, drooping, slightly arcuate, spreading-bristly-hairy; flowers small or medium-sized; calyx in flower ca. 1 mm long, in fruit 1.5 mm, spreading-bristly-pubescent, lobes linear, acute; corolla white, Myosotis-like; the tube very short, 0.75 mm long, half as long as limb, the limb flat, ca. 5 mm across, lobes $^3/_4$ the length of limb, ovate, rounded; scales rather large, 0.75—1 mm long, thick, papilliform, 2-lobed at apex; anthers 0.5 mm long, oval, enclosed in corolla tube under scales, nectar scales very distinct at base of tube; style very short, with capitate-discoid stigma; fruit pyramidal-ovoid, 3—3.5 mm high, not overtopped by style; nutlets compressed, oblong, trihedral, dotted-scabrous with fine tubercles along the lower sides, disk without keel, oblong, finely scabrous-pubescent, along margin with anchorlike spinules 7—8 at each side of disk, spinules horizontally spreading, half as long as disk, with bases adjacent but not merging, sometimes merging for $^1/_2$ their length and then forming around disk a dentate membranous wing, its teeth bearing anchorlike heads, spinules with small bristles along margin; cicatrice suprabasal (nearly central), small, elliptic, rounded. June.

Stony and rocky mountain slopes. — Centr. Asia: Pam.-Al. (only W. Pamir and Gorno-Badakhshan; Shugnan). Endemic. (Kashmir?). Described from W. Pamir between Yashilkul' and Khodzha-Nazar, flowers, fruit, 19 VII 1901, O. and B. Fedchenko. Type in Leningrad.

Note. This species is so similar to the preceding that it may be its race, as noted by Lipskii; yet in view of the absence of ripe fruit in E. latifolium and its geographical isolation, I am refraining for the time being from uniting it with E. pamiricum. The differences between the
494 two are the denser and grayer hairs in E. latifolium compared with E. pamiricum and the more obtuse and slightly wider leaves. I saw no difference in young nutlets between E. latifolium and E. pamiricum, considering the characteristic spinules of the latter which are scabrous along the margins.

3. E. fetissovii Rgl. in Tr. Bot. Sada, VI, 2 (1880) 340. — E. latifolium Lipsky in Tr. Bot. Sada, XXVI (1910) 530, p. p. — E. nanum ssp. villosum var. eu-villosum Brand in Pflanzenr. IV, 253 (1931) ex p.

Perennial; plants not cespitose; root not thick, unicipital with one root-stock sparsely covered with rather thick remnants of last year's petioles; stems high, ca. 30—40 cm, 1—2 produced from one root, rather thick, sturdy, sparsely (especially below) spreading-pubescent, simple; radical leaves long-petioled, oblong-lanceolate, obtuse, 5 cm long, green, very remotely spreading-bristly-pubescent, bristles at upper surface borne on white tubercles; cauline leaves sublanceolate, sessile, elongate, 2.5—5 cm long, acute. Inflorescence terminal, small, consisting of 2—3 cymes, cymes short in flower nearly corymbiform-capitate, straightening in fruit and reaching

several cm in length; pedicels only 2—3, distinct only in fruit, finely spreading-pubescent, in fruit 0.3—0.7 (to 9) [?] mm long, erect; flowers rather small, as in preceding; calyx in flower ca. 2 mm long, gray, hardly elongating in fruit, lobes obtuse; corolla white, apparently like in the preceding; gynophore very short, not more than 1 mm high pyramidal, with gaps at apex of pyramid; nutlets ca. 3 mm long, dorsoventrally compressed, glabrous or pubescent, margin of disk with scarious-coriaceous, narrow, dentate rim, the teeth with anchorlike tip, spinules (teeth of rim) smooth at margin.

Damp places between cliffs and shrubs along streams, 1,500—2,000 m. — Centr. Asia: T. Sh. (only known at present beyond borders of USSR, in Kuldja, but might probably be found in C. Tien Shan). Endemic. Described from Yuldus Range. Type in Leningrad.

Note. Very close to the two preceding species from which it differs by the larger habit and rootstock not cespitose. Nonetheless it should probably be united with E. latifolium as Lipskii proposed. There are also smaller individuals (var. minor M. Pop.): Atbash-Tau, Fetisov; Barskaun valley, Rozhevits; Aksai Tien Shan, Lipskii.

4. E. pseudolatifolium M. Pop. sp. n. in Addenda XVIII, 618. — E. latifolium Lipsky in Tr. Bot. Sada, XXVI (1910) 530, ex p.

495 Differs from the preceding by the appressed hairs even silvery on young leaves; root thin, one- or few-headed; stems low, 10—15 cm high, ascending. Leaves with broader oval obtuse or acute blades. Pedicels appressed-pubescent; flowers of the same size and shape but the limb sometimes with blue tinge. Fruit (very young only) appearing to be unarmed but pubescent. June. (Plate XIX, Figure 1.)

Rocks, ravines. — Centr. Asia: T. Sh. (only the southern slope beyond boundaries of USSR: Karateke and gorge of Ui-Tal River, Roborovskii; under Kukurkut pass, Mertsbakher). Endemic (but also occurring in USSR). Descriptions based on Mertsbakher indicated above specimens. Type in Leningrad.

Note. If E. latifolium is to be distinguished from E. fetissovii and E. pamiricum then it is justified to separate the above species as well. It is understandable that they are all only races of E. latifolium Kir. et Kar. s.l. I present them as separate species only to show that E. latifolium is not a simple species and special attention should be paid to its racial composition; more material is necessary to definitively evaluate these species. The material at hand is very fragmentary and clearly insufficient.

Series 2. Himalaica M. Pop. — Spinules along margin of disk with anchorlike tip, rarely spinules absent (nutlets smooth). Flowers medium-sized, blue. Leaves linear or lanceolate-linear, sericeous-appressed-hairy. Himalayas and Pamir. Beside our species there are also E. longifolium Decne., E. strictum Decne. and E. jaquemontii Decne., possibly E. spathulatum Clarke, and others.

5. E. dubium O. Fedtsch. in Tr. Bot. Sada, XXI (1903) 385. — Lappula dubia Brand in Pflanzenr. IV, 252 (1931) 142. — Eritrichium

longifolium Lipsky in Tr. Bot. Sada, XXVI (1910) 534, non Decne. in Jacquem. Voy. Ind. IX (1844) 124, tab. 129.

Perennial; plants slightly cespitose but not forming large tufts, appressed-hairy, slightly grayish; stems few, rather high, 30—40 cm, herbaceous, erect, thin, 1—1.5 mm thick, very sparsely hairy, simple, rarely with one lateral branch above; leaves broadly linear or lanceolate-linear, flat, acute, slightly grayish, sparsely and completely appressed hairy, the radical rosetted, obliquely declined, spatulate, tapering to 6—7 cm long petiole, cauline leaves ca. 10, sessile, 2—4 cm long, 4—7 mm wide. Cymes loose, few-flowered, nearly leafless; pedicels filiform, 6—20 mm long, ascending, appressed-pubescent; calyx 1.5 mm long, with linear acute appressed-hairy lobes;
496 corolla rather large, as in Myosotis, 6—9 mm across, tube as long as calyx, lobes of limb rounded, incisions between them nearly reaching throat; scales yellow, large, papilliform, 2-lobed; stigma hidden between nutlets; fruit globose-pyramidal, the ripe ones apparently 3—4 mm high; nutlets (only young present) compressed more or less, flat, ovoid, the low oblique sides slightly rugose, glabrous, the flat back (disk) tuberculate-rugose and slightly spreading-pubescent, with rather long spinules along margin of disk, the spinules horizontally spreading, flattened, rather broad and long (nearly as long as width of disk), bluish, uniserial, 7—8 at each side, shorter at base of disk; gynophore short-pyramidal, not more than 1 mm high. June—July.

Apparently in rocks and taluses. — Centr. Asia: Pam.-Al. (Pamir only, 3,500—4,000 m, very rarely). Endemic. Described from Pamir (Karasu, flowers, young fruit, 29 VIII 1878, Kushakevich and Togdumbashpamir; Pistan Gorge of Sarikol Range, flowers, 15 VIII 1901, Alekseenko). Type in Leningrad.

Note. Lipskii was quite right in noting the resemblance of this species to the Himalayan E. longifolium Decne., whose description (Jacquem. Voy. Ind. tab. 129) very much fits our plant. According to that description, however, the nutlets have a broad dentate wing at the margin which does not exist in E. dubium. Since we did not see the original or topotypical specimens of E. longifolium Decne. from the Himalayas, we cannot unite our Pamir species with the latter.

6. E. pseudostrictum M. Pop. sp. n. in Addenda XVIII, 618. — E. strictum auct. fl. Pamir. (O. Fedtsch. et alii).

Perennial; densely cespitose plants, entirely appressed-gray, with straight hairs; root thick, multicipital; branches of rootstock short, thick, with thin remnants of previous year's petioles; stems numerous, erect or slightly arcuately ascending, thin, virgate, simple, (15)20—30 cm high, appressed-gray-hairy; leaves narrowly linear, subfiliform, the radical rosetted, withering soon, tapering to petiole, 3—5 cm long, 2—4 mm wide, cauline leaves sessile, narrowly linear to filiform, 1—3 cm long, 1—2 mm wide, acute, somewhat sericeous, gray. Cymes in flower short, in fruit loose, straightening, 2—3 cm long, leafless, 1—2 only at apex of stem; pedicels thin, long, ascending to erect, 2—4 times as long as calyx, the lower pedicels up to 1 (even 1.5) cm long in fruit, appressed-pubescent; calyx ca. 1 mm long, little elongating in fruit, lobes linear, acute; corolla blue, Myosotis-like, 7—8 mm across,
497 the tube short, ca. 1 mm long, the limb flat, with rounded lobes, $^2/_3$ length of limb; scales large, whitish, papilliform, 2-lobed; fruit globose- or ovoid-

pyramidal, ca. 3 mm high, with style hidden among nutlets; nutlets oblong, trihedral in cross section, finely spreading-pubescent, sides of nutlets rather high, finely tuberculate, the back (disk) oblong, nearly flat, densely and finely tuberculate, blue, at margin with short but sturdy, subvertical, anchorlike spinules, 3—7 at each side, spinules below areola especially short; gynophore less than 1 mm high, short-pyramidal. July.

Rocks and taluses. — Centr. Asia: Pam.-Al. (Pamir only, 3,500—4,000 m). Endemic. Described by Chaikova from Pamir, from a border bed, in rocks, flowers, fruit, 7 VIII 1931, Lipshits, No. 756. Type in Moscow and Leningrad.

Note. This species is readily distinguished from the Himalayan E. strictum by its more densely cespitose habit and its subfiliform leaves. The nutlets are very similar. There is no question that these are very closely related species, probably races of one species. I regard as E. strictum Decne. that plant which Clarke accepted as this species (in Hook. Fl. Brit. Ind. IV, 164) and the many specimens found in Leningrad; in habit they approach the next species (linear leaves wider than those described). Our species occurs nearly at the border of Soviet Pamir. It is also close to E. dubium but is more cespitose, its leaves very narrow and the nutlet spinules short.

7. E. sub-jacquemontii M. Pop. sp. n. in Addenda XVIII, 619. — E. turkestanicum auct. fl. Pamir. non Franch.

Perennial; root thin; slightly cespitose plants but dense, gray-sericeous, with appressed straight hairs; rootstock with short branches thick with last year's petioles; stems thin, subfiliform, procumbent or ascending, 5—10(15) cm long, simple; leaves short, radical leaves narrow, linear-spatulate, cauline leaves wider, linear-oblong, 1—1.5 cm long, 1—4 mm wide, obtuse, flat, spreading or drooping. Cymes apical, short, loose, few-flowered, slightly elongating in fruit but still short; pedicels thin-filiform, in fruit (and flower) 2—3 times as long as calyx, the lower to 1—1.5 cm long, usually shorter, in fruit arcuately nodding, appressed-pubescent; calyx sericeous-appressed-hairy, 1—1.5(2) mm long, with oblong-linear acute lobes, hardly elongating in fruit; corolla pale blue, medium-sized or rather small, tube as long as calyx, the limb 4—5 mm across, not quite flat, with ovate-rounded lobes, the incisions between them extending nearly to throat; scales ovate-rounded,
498 ca. 0.5 mm high; nutlets usually 1—2 in fruit, 2(3) mm long, oblong, in cross section trihedral, densely and shortly spreading-pubescent, with low sides, back (disk) flat, pubescent, with obsolete keel, along margin with 1 row of small very short subvertical anchorlike spinules, (3)5—8 at each side of disk; prominent cicatrice oval, nearly central (i. e., at middle of the ventral side) the style hidden below the ventral side of nutlet, thus lying nearly horizontally at bottom of calyx; gynophore very small, ca. 0.5 mm high, with holes left from the protruding cicatrice after falling or ripe nutlets (similar to caruncle of Anchusa). July.

Rocks. — Centr. Asia: Pam.-Al. (Pamir only, 3,500 m). Endemic. Described from Pamir (Pshart River, rocks opposite ravine Tugur-Dzhilga, flowers, fruit, 13 VII 1931, Lipshits, No. 451; other specimens from Pamir are from Ak-Su River (Murgabu), ravine Ayu-Kuzyu-Sai, rocks, 3,500 m, flowers, fruit II VIII 1901, Alekseenko). Type in Moscow, cotype in Leningrad.

Note. This species is closely related to the two preceding ones, especially to E. pseudostrictum, although it is very different in habit. O. A. Fedchenko identified it as E. turkestanicum Franch. (V supplement to "Flora Pamira," p. 29, Tr. Bot. Sada, XXXI, 469). She pointed out its resemblance to the Himalayan E. jacquemontii Decne.

8. **E. turkestanicum** Franch. in Ann. Sc. Nat. 6 sér. XVIII (1884) 216, non O. Fedtsch. in Tr. Bot. Sada, XXXI (1915) 467. — Microcaryum turkestanicum Brand in Fedde, Repert. XXII (1925) 101 et in Pflanzenr. IV, 252 (1931) 202, pro parte.

Perennial; very small plants, 3—5(8) cm, densely cespitose, sericeous-white-gray, growing in rock crevices (probably limestone); branches of rootstock short, thick, with remnants of last year's petioles; stems filiform, 2—7 cm long, ascending, simple, with loose 3—5-flowered apical cymes; leaves of radical rosettes linear-spatulate, 1—3 cm long, 1—3 mm wide, acute; cauline leaves very small, 0.3—1 cm long, linear-oblong, evenly disposed along stem up to inflorescence, acute, sericeous-white. Pedicels filiform, longer than calyx, the lower pedicels comparatively long, up to 1 cm, erect; calyx silvery, ca. 2 mm long in flower, with linear acute lobes; corolla blue, of the short type (Myosotis-like), the limb 4—6 mm across, with ovate-rounded lobes; nutlets 1—2 in fruit, ca. 3 mm long, when solitary then nearly horizontal, ca. 2 mm long in flower, with linear acute lobes; corolla blue, of the short-type (Myosotis-like), the limb 4—6 mm across, with ovate-rounded lobes; nutlets 1—2 in fruit, ca. 3 mm long, when solitary then nearly horizontal, oblong, glabrous, back inflated, completely unarmed along margin, tapering to keel at sides, smooth, glabrous; cicatrice below center but suprabasal,
499 projecting as stipe in lower third of ventral side and attached to one of the faces of the small low-pyramidal gynophore; style small, bent under nutlet, ca. 0.3—0.5 mm long. July.

Rock crevices. — Centr. Asia: Pam.-Al. (Upper Zeravshan only; a dubious specimen from Fergana, Alai or Turkestan Ranges, limestones rocks in the natural boundary of Kara-Shur, flowering 25 V 1913, Dolenko, No. 532). Endemic. Described from Upper Zeravshan, particularly from Yagnob (Kapyu). Type in Paris, cotype in Leningrad.

Note. Typically, this is a dwarf, cushion-like plant, with 2—3 cm long stems and very small leaves. Under other conditions (possibly in wider rock crevices) it grows slightly larger, is less cespitose, not pulviniform, and resembles E. sub-jacquemontii, but is distinguished from the latter by the more sericeous, white hairs, erect pedicels, and the completely unarmed fruit. The Fergana specimen indicates the occurrence of the plant beyond the upper reaches of the Zeravshan River. The last collections outside of Yagnob were made in Makshevatskaya cave (Lipskii), near Kara-Kul', Khshartob and Artuch (Komarov); the last two are less typical plants, more developed, not pulviniform. The phenomenon of unarmed nutlets in some Eritrichium is known also in the section Eueritrichium (E. tergloviense — race of E. nanum) and in the section Coloboma (e. g., E. jenisseense Turcz., and others), so that in this sense E. turkestanicum does not represent an exception.

Series 3. Coerulea M. Pop. — Spinules along disk without anchorlike tip, with apices directed forward. Flowers large, blue. Leaves relatively narrow, lanceolate-linear. Japanese Islands.

9. E. sachalinense M. Pop. sp. n. in Addenda XVIII, 619. — E. nipponicum Suguwara, Ill. Fl. Sagh. IV, 1575, non Makino. — Ic.: Suguwara, l. c. tab. 720.

Perennial; small, loose, cespitose plants, with more or less long branches of rootstock, with few sterile rosettes and floriferous stems; root rather thin, 1—2 mm thick; stems 1—3 in one tuft, low, (7)10—15 cm high, erect or arcuately ascending, slightly ascending above at inflorescence, sturdy, simple, sparsely covered with appressed (not tightly so) long white antrorse hairs, regularly and densely leafy; leaves of rosettes and cauline leaves similar but the radical longer, 2—5 cm long and obtuse, cauline leaves gradually becoming shorter toward apex of stem, nearly acute, all leaves somewhat spatulate,
500 linear-lanceolate, gradually tapering at base, flat, 2—4 mm wide under apex, moderately covered with subappressed hairs, hardly grayish. Cymes two at apex of each stem, short in flower, subcapitate, later slightly elongating, in fruit up to 4 cm long, erect, with few small leaves at base; pedicels short, even the lower only ca. 5 mm long in fruit, the upper 2—3 mm long, subappressed-pubescent; calyx pubescent, in flower 2 mm long, in fruit hardly longer; corolla blue, the tube 1.5 mm long, the limb flat, 5—7 mm wide, with ovate-rounded lobes, depth of incisions equal to limb; nutlets 3—4 mm long, similar to Hackelia in shape, i. e., flattish, sides low, hardly 1 mm high, glabrous, slightly inflated, disk flat, ovate, hardly keeled along its median line, pubescent, at margin with about 6 unequal spinules on each side, the longer spinules hardly shorter than width of disk, whitish, at base with small bristles or glabrous, at apex bluish, the 2—3 small acute spinules directed forward, i. e., not clinging or with hardly visible anchorlike point. July—August.

Stony mountain peaks. — Far East: Sakh. Endemic. Described from the mountains of S. Sakhalin. Type in Sakhalin.

Note. E. nipponicum Makhno (Hackelia (sect. Eritrichiastrum) nipponica Brand) differs from our species by its thick root, the more numerous stems, the more dense and appressed, nearly sericeous, pubescence, and the $1\frac{1}{2}$ times larger flowers (I saw the specimen from Hokkaido, flowers 22 VIII 1926, Terasima, No. 5587).

It is difficult to decide whether our plant belongs to Hackelia or Eritrichium. Brand was not greatly mistaken in referring it to the section Eritrichiastrum Brand genus Hackelia. Its nutlets are intermediate in form between these very closely related genera. They are flat, with low sides and well developed, nearly flat dorsal areola (disk) along whose margin are horizontally spreading, flat spinules — 6 at each side, Thus, the nutlets are not turbinate, their sides are not high, and the dorsal areola is not large, which is altogether characteristic of Eritrichium (especially section Coloboma and even Eueritrichium DC.); the spines do not ascend and are not curved on the disk, whereas in the typical Eritrichium, especially in Coloboma, these features are quite common. Our species differs from Hackelia in structure of spinule apex. In Hackelia as well as in Echinospermum, the apex of the spinule is anchorlike, i.e., with small pointed tips turned to one side and even downward, which provides the spinules and the nutlets with adherence ability. In Eritrichium these apices are shorter and directed upward and thus do not act
501 as clinging head-glochidium. In Echinospermum and Hackelia the

spinules of the disk have neither cilia nor appendages along their margins and are smooth and regular up to the anchorlike head. In other words, the spinules of the nutlets in Echinospermum and Hackelia are more developed as adhesive organs of the fruit. In Eritrichium, on the other hand, the spinules play a negligible role; its nutlets have thinner walls and are more delicate than those of Hackelia and even more so than those of Echinospermum in which the xerophily of the plant includes the xerophilous nutlets, with thicker, stony walls, often tubercled on their surface.

Section 2. COLOBOMA DC. Prodr. X (1846) 126; Ldb. Fl. Ross. Ill, 150. — Hairs usually appressed, often sericeous. Leaves filiform, linear or linear-lanceolate to lanceolate. Flowers blue, medium-sized, rarely small. Nutlets turbinate, with high sides, dorsal areola low, flat, usually pectinate along margin with dense spinules, spinules erect or curved on disk, frequently turning blue at tip; rarely nutlets without spinules; gynophore short-pyramidal, rarely nearly flat. Mainly in Siberia and Mongolia.

Series 1. Rupestria* M. Pop. — Densely cespitose plants, with reduced, thick branches of rootstock. Hairs usually sericeous, rarely gray but still appressed. Pedicels relatively short. Leaves narrowly linear or linear or filiform. Nutlets with crown of short spinules or without (then nutlets nearly like in Trigonotis).

10. **E. rupestre** (Pall.) Bge. Verzeichn. der im Oestl. Theil Altai-Gebirge gesamm. Pflanzen (1836) 14; DC. Prodr. X, 126; Ldb. Fl. Ross. III, 151; Kryl., Fl. Zap. Sib. IX, 2254. — Myosotis rupestris Pall. It. III, app. (1776) 716, tab. E, f. 3, vix Ldb. Fl. alt. I (1829) 190. — Anchusa rupestris Roem. et Schult. Syst. veg. IV (1819) 101. — **Ic.:** Brand in Pflanzenr. IV, 252, f. 19; Pall. l. c.

Perennial; densely and compactly cespitose plants, gray-white-sericeous; branches of rootstock short, appressed-squamose, with black or brown remnants of last year's petioles; stems numerous, erect or ascending, simple, 8—20 cm high, robust, white with appressed long hairs; leaves sericeous, linear, 3—4 mm wide, comparatively long, radical leaves usually slightly spatulate, tapering to petioles 3—5(6) cm long, cauline leaves 5—10 evenly disposed on stem, sessile, 1—2 cm long, all leaves obtuse, upright. Racemes
502 at apices of simple stems, short, subcapitate, later slightly elongating and straightening in fruit; pedicels appressed-hairy, in flower approximately as long as calyx, elongating in fruit but even then the lowermost not longer than 10 mm, sturdy, erect; calyx sericeous, 2—3 mm long in flower, with linear acute lobes little elongating in fruit; corolla very blue, Myosotis-like, limb flat, 7—10 mm wide, with rounded-ovate lobes; scales broad, low, papillose, yellow, with adjacent margins, forming a ring around throat; anthers less than 1 mm long, linear-oblong; nutlets turbinate with steep high (1.5 mm) sides, transversely ribbed, smooth, glabrous, dorsal areola

* Non Rupestria Maxim. im. Mél biol. VIII (1872) 546.

tapering, pubescent or glabrous, pectinate at margin with short spinules, erect or curved on disk, not anchorlike at apex, scabrous, rarely nutlets unarmed. May—June.

West Siberia: Alt., Irt.; East Siberia: Dau. **Gen. distr.** Mongolia, China (NE). Described from Dauria. Type in London.

Note. Pallas, who described Myosotis rupestris from Dauria, did not mention the Altai specimens. Ledebour (Fl. alt. I, 190) positively identified the Altai plants with the Daurian and presented this view in "Fl. Ross." (III, 151—152). I do not know if he saw the original Pallas specimen (I could not find it in the herbarium of the Botanical Institute of the Academy of Sciences of the USSR) or based his views only on Pallas' drawing and description, at any rate the identification of the Daurian plant with the Altai appears very dubious. Of course, these are closely related species (races) distributed mainly in Mongolia, from Manchuria up to the (Central) Kazakh Hills. This microspecies produces a series of local races. Our localities (Dauria, Baikal, Yenisei, Altai) represent only the northern outposts of distribution of this Mongolian microspecies. Two good races are described under E. manshuticum M. Pop. and E. pulviniforme M. Pop., the latter from Mongolia. Less clear is E. jenisseense Turcz. The Daurian and Altai populations, which are closest to E. jenisseense, represent a single or two races. They are very similar but their distribution areas apparently are not adjacent. Unfortunately, the Daurian specimens are in flower so that the characters of the nutlets cannot be precisely established, but from the neighboring eastern part of Mongolia there are abundant specimens with young fruits; I have freely marked them as the original E. rupestre (Pall.) non Bge. (l. c.) since Pallas' description is very inaccurate. Their nutlets always have a pectinate crown of spinules curved on the disk. The racemes even in fruit are very short, 1—2 cm, with 2 approximate upper leaves at their base, and with short pedicels. The branches of the rootstock are softer, not as
503 woody, with black scales. The Altai race has woodier rootstock branches, the fruiting racemes are elongate, the lower pedicels sometimes more than 10 mm long and in general the plant is more sericeous; all these characters are widely variable. Sometimes the nutlets have a pectinate crown of short spinules, sometimes they are smooth and then similar to Trigonotis. Ledebour (Fl. lat.) regarded them as such: "margine edentulis." Bunge (l. c. 14) mistakenly assumed that the crown fell from the ripe nutlets, an assumption repeated by Ledebour (Fl. Ross.), but nothing of the kind actually happens. The fact is that there are two forms growing in Altai, one without a crown on the nutlets, distributed in the Kazakh Hills, the other with a crown of spinules as in the Daurian race E. rupestre s. s. I have named the specimens with a crown on the nutlets E. subrupestre M. Pop. (= E. rupestre Bge., Lede. quoad pl. altaicum) (Plate XXIV, Figure 2) and the other with trihedral nutlets, almost as in Trigonotis, without a crown E. altaicum M. Pop. (= E. rupestre Ldb. p. p.).

11. E. jenisseense Turcz. in DC. Prodr. X (1846) 126; Ldb. Fl. Ross. III, 151.— E. rupestre var. pectinatum Brand in Pflanzenr. IV, 252 (1931) 192 ex minima parte.

Perennial; rather loosely cespitose plants, forming low, sericeous, rather broad tufts; branches of rootstock up to 5 cm long, clavate because of the thickened apex with thin appressed brown or black scales, remnants of last year's petioles, sometimes branches of rootstock 1—2 cm long; root thin, vertical, not deep; stems numerous, thin, subfiliform but sturdy, erect or arcuately ascending, simple, 5—10 cm high, gray-sericeous with long appressed hairs; leaves narrowly linear to subfiliform, sericeous-gray, densely hairy, rosetted leaves numerous, slightly spatulate, often curved, (1)2—3 cm long, not more than 1 mm wide, cauline leaves short, narrow, upright, 0.5—1 cm long, less than 1 mm wide, obtuse, often curved. Racemes at ends of simple stems, few-flowered, in flower short, elongating to 3—4 cm in fruit, loose, leafless, erect; pedicels thin, oblique, in fruit 2—3 times as long as calyx but not longer than 10 mm; calyx sericeous, in flower ca. 2 mm, with linear-oblong lobes; corolla 5—6 mm across, dark blue, with obovate lobes; nutlets small, hardly 1 mm long, turbinate, but more glabrous and smooth, back markedly tapering, pubescent, unarmed at margin (i. e., without crown). June—July.

Stony slopes, often steppes. — West Siberia: Ob (SE); East Siberia: Ang.-Say. (SW). Endemic. Described from near Krasnoyarsk (Turchaninov, 1838). Type in Leningrad.

504 Note. Closely related to E. rupestre s.l., differing from E. rupestre s.s. by the uncrowned nutlets and the very narrow, subfiliform, curved, short leaves. According to this character it approaches most of all the Mongolian E. pulviniforme M. Pop. and according to the nutlets the Altai E. altaicum from which it differs (only?) by the leaves. It is possible that E. altaicum M. Pop. is a hybrid between E. jenisseense and E. subrupestre resulting in the inconstancy of characters of both races in Altai. In addition to Krasnoyarsk, E. jenisseense is common from the Minusinsk steppe region (many specimens). A very closely related species grown in the Tuva ASSR: E. tuvinense M. Pop. Very low and coarse plant. Stems 3—5(7) cm high, hairs gray, dullish, semi-spreading. Corolla small, ca. 3 mm across; pedicels short, thick, recurved; nutlets as in E. jenisseense; branches of rootstock woody. (Tuva ASSR, near Kyzyl, steppe, flowers, fruit, 23 VI 1945, Sobolevskaya). It should be noted that specimens of E. jenisseense sometimes have nutlets with pectinate crown of spinules — along margin of dorsal areola — var. coronatum M. Pop., which may be the hybrid jenisseense × pectinatum.

Reverdatto described in his article (Sistem. zametki gerb. Tomsk. univ. 1936, nos. 1—2, pp. 1—2) a new species (E. martjanovii Reverd. and on p. 2 there is a Key to 4 "steppe species of the genus Eritrichium of Yenisei flora"). It seems clear to me from this article (I never obtained the original E. martjanovii) that Reverdatto regarded our above-named var. coronatum M. Pop. as E. jenisseense Turcz. and the typical E. jenisseense (in our opinion, conforming to the original specimens) he apparently accepted as the new species E. martjanovii; the latter was reported from Krasnoyarsk (locus classicus E. jenisseense!), Kunya Mountain, Charkov and Ust'-Sydinskoe villages. What he called E. rupestre Bge. is our E. altaicum. The author did not report its locality but from the text one may discern that, as Bunge and Ledebour pointed out, he considered E. rupestre to be from Altai, which is not

quite accurate, as we have pointed out above: the original E. rupestre is a Daurian plant. See also Note to Amblyonotus obovatus (Ldb.) Johnst.

12. E. pulviniforme M. Pop. sp. n. in Addenda, XVIII, 620.

Perennial; very densely cespitose, silvery-white, low plants; branches of rootstock very approximate, compressed, short, clavately thickened with brown-black thin scales, remnants of last year's petioles, below rather thin, not woody; stems thin, subfiliform, 5—8(10) cm high, simple, white-appressed-hairy; leaves white-sericeous, very small, narrowly linear, often subfiliform,
505 rosetted leaves many, 1—2(3) cm long, not more than 1 mm wide (usually 0.5 mm), obtuse, weak, often curved, cauline leaves few, narrowly linear, sometimes all leaves slightly spatulate. Inflorescence a few-flowered, short apical raceme, nearly not elongating in fruit; pedicels short, not longer than calyx, more or less declined; calyx sericeous, in flower 2 mm long; corolla blue, small, 4 mm across, the limb slightly funnel-shaped; nutlets 1 mm high, turbinate, smooth, glabrous, unarmed around dorsal areola but with slightly thickened margin incurved on disk. June—July.

Stony mountain slopes. — East Siberia: Ang.-Say. (Tannu-Ola). Gen. distr.: N. Mongolia, near Ubsa oasis. Described from Taishir-Ola Mountains (flowers, fruit, 15 VIII 1877, Potanin). Type in Leningrad.

Note. In habit this species is quite similar to E. jenisseense Turcz., but is more strongly and densely cespitose with weak, curved and narrow leaves. According to the racemes and pedicels which are short in fruit, and the nutlets with their curved margin, this taxon is close to the original Daurian and E. Mongolian E. rupestre s. s., i. e., to its reduced, strongly cespitose variant with crownless nutlets.

13. E. mandshuricum M. Pop. sp. n. in Addenda XVIII, 621.

Perennial; small but densely cespitose plants, densely gray-hairy with short, more or less thick, straight, appressed hairs; branches of rootstock short, woody, thick, thickened above because of the many compactly appressed black-brown scales, remnants of last year's petioles; stems 15—30 cm high, thin, dense, coarse, straight, numerous, simple, gray; leaves narrowly linear to filiform, comparatively very long, the rosetted leaves many, 3—6 cm long, 1 mm wide, coarse, erect, cauline leaves slightly shorter, 2—3 cm long, 1 mm wide or narrower, straight, coarse, acute. Racemes apical on stems, short, dense in flower, erect in fruit, elongating to 3—5 and even 10 cm, leafless; pedicels erect, rarely appressed to axis of raceme, short at first, as long as calyx, later longer in fruit, the lowermost up to 0.8—1 cm long, appressed-pubescent; calyx appressed-pubescent, gray, in flower 2 mm long, with linear acute lobes ca. 3 mm long in fruit; corolla blue, 6—8 mm across, limb not very flat, with oblong lobes; nutlets glabrous, smooth, without crown, shiny, laterally ca. 1 mm high, disk 2 mm long, very oblique, acute at apex, with ascending smooth glabrous keel along median line. June—July.
506 Rocks. — Gen. distr.: Manchuria (Harbin-Tsitsihar, Khingan Mountains). Probably occurring on the Amur in the USSR. Described from Manchuria (Yal, railroad station, fruit, after flowering, 9 VII 1901, Lipskii). Type in Leningrad.

Note. Appears to be closely related to the Altai races E. subrupestre M. Pop. and E. altaicum M. Pop. from which it differs by the unusually long and narrow, subfiliform, erect, coarse leaves, especially the radical, and the dull, not silvery pubescence. A very interesting race of the species E. rupestre s.l. Apart from the type, there are collections from the Khingan Mountains near Barim, (flowers, young fruit, 22 VI 1902, Litvinov; flowers between Harbin and Tsitsihar VIII, 1926, Gordeev and others).

14. E. maackii Maxim. Prim. Fl. Amur. (1859) 202.— E. pectinatum Kom., Fl. Man'chzh. III, 320, non DC. ex parte.— ??E. pauciflorum DC. Prodr. X (1846) 127.— E. rupestre β. tenuior Ldb. Fl. Ross. III, 152.— ?Myosotis pauciflora Ldb. in Mém. Acad. Sc. Pétersb. V (1812) 517.

Mostly biennials, but sometimes perennial; plants with tufts of one or few compact rosettes on slightly branched or unbranched rootstock; root thin, vertical; stems one or several or many, erect or slightly arcuate, sturdy, thin, grayish, appressed-hairy, 15—20 cm high, branching above; radical leaves (rosettes) 2—3 cm long, 3—4 mm wide (below apex), spatulate or rather more spatulate-lanceolate, very much tapering at base, appressed-hairy, grayish, nearly sericeous, obtuse; cauline leaves spatulate-linear or sublinear, 1—2 cm long, 1—3 mm wide, obtuse or acute. Inflorescence corymbiform-paniculate, consisting of 2—4(5) racemes; axis of racemes thin-filiform, ascending, not long, 3—5 cm; racemes loose in fruit, leafless; pedicels filiform, appressed-pubescent, not very long, shorter than 10 mm, usually 5—7 mm (the lower), obliquely declinate; calyx in flower less than 2 mm long, in fruit up to 3 mm, with linear acute lobes, appressed-pubescent; corolla blue, Myosotis-like, 5—6 mm across; nutlets without crown, trihedral-ovoid, 1.5—1.75 mm long, ventrally keeled, dorsally gibbous, acute at apex, with lateral basal (slightly suprabasal) small areola of attachment or back gibbous and sharply defined so that its upper part forms a disk with spreading hairs and sometimes even rudimentary (toothlike) spinules at margin. May—June.

Rocky and stony slopes.— East Siberia: Dau.; Far East: Zee.-Bur. (western part). Endemic. Described from upper Amur near the Onon depression (Maak, 1885). Type in Leningrad.

507 Note. This remarkable plant is a hybrid of Amblynotus dahuricus × Eritrichium (probably E. incanum DC.). Some of the specimens have nutlets transitional from those of Amblynotus to the nutlets of Eritrichium, Section Coloboma. The nutlets of the type (Maak, 1855) which resemble those of Amblynotus are smooth, ovoid, without distinct disk, only the sharp middle curve at the back is an indication of a separate disk at the upper part; some specimens have nutlets with a round back that are ovoid, with no indication of a curve at the middle part. The specimens from Ermakovo village (Maksimovich, 1859) have completely smooth and glabrous nutlets but the middle curve at the back is so abrupt that the upper part becomes very distinct as the dorsal areola which, however, is still slightly inflated and without the characteristic spinules, or even teeth, along the margin. Finally, the specimens from Chernyaev (Maksimovich, 1859) have a very well expressed, ovoid-triangular disk with an elevated margin and 3 denticles-tubercles at both sides.

All this indicates that the crownless species of Eritrichium may represent introgression from Amblynotus, since the latter may be the ancient hybrid Eritrichium × Lithospermum, even from Lithospermum. There is no doubt that such hybridization took part in the Tertiary, which means that Amblynotus, is at least a pre-Pleistocene formation.

It might probably be more correct to place the given species in the series Pectinata, since one of its ancestors was the pectinate E. incanum, with its rather long raceme and fairly long pedicels; yet desiring to place all crownless species in the series Rupestria, I included the given species in the same series. I should emphasize that this is a purely formal conception. Judging by the finding in Dauria of E. pauciflorum (Ldb.) DC. with its crownless nutlets, we may assume that it is very close to E. maackii although Ledebour himself referred it to E. rupestre (Fl. Ross. III, 151), which he regarded as a crownless species (on the basis of his Altai, not Daurian, specimens). I have not seen the original Ledebour specimen.

In "Mél. biol." (VIII (1872) 546), Maksimovich included his species in the synonymy of E. pectinatum together with E. incanum DC., assuming that the presence or absence of a crown may be observed even in one specimen. His assumption is incomprehensible.

Series 2. **Pectinata** M. Pop. — Loosely cespitose plant, with more or less elongate rootstock branches. Hairs usually gray, rarely slightly
508 sericeous. Leaves wider, usually lanceolate-linear or lanceolate. Pedicels long; racemes elongating in fruit, loose. Nutlets pectinate along disk with long not anchorlike spinules.

15. **E. pectinatum** (Pall.) DC. Prodr. X (1846) 124; Ldb. Fl. Ross. III, 152; Kryl., Fl. Zap. Sib. IX, 2255. — Myosotis pectinata Pall. It. III (1776) app. 717, tab. E, f. 4 (nutlets only). — E. rupestre var. b. pectinatum Brand in Pflanzenr. IV, 252 (1931) 192, pro minima parte. — E. ciliatum DC. l. c. 127. — Myosotis ciliata Rud. in Mém. Acad. Sc. Pétersb. I (1809) 349, tab. 11. — Ic.: Pall. l. c. (nutlets); Rud. l. c. tab. 11 (entire plant).

Perennial; loosely cespitose plants; branches of rootstock more or less elongate, thin, not woody, more or less covered with black-brown remnants or with entire rosettes of dead leaves of the last year; stems 15—30 cm high, usually erect, rarely slightly arcuate, thin but rigid, simple, appressed-hairy, gray, sparsely but regularly leafy; leaves of radical rosettes or of the rather short shoots slightly spatulate, oblong-linear or lanceolate, short, 1—2 cm long, 3—4 mm wide (below apex), flat, gray, acute or obtuse, with prominent midrib beneath; cauline leaves linear, as long as radical but somewhat narrower, distinctly ciliate at margin. Inflorescence leafless, consisting of 2—3, rarely 1, racemes, racemes elongating in fruit up to 10 cm and becoming very loosely flowered; pedicels long, the lower up to 2 cm, obliquely declined, thin, appressed-pubescent; calyx in flower ca. 2 mm long, gray, with appressed hairs, lobes linear, obtuse, hardly elongating in fruit; corolla blue, 6—8 mm across, typically of the short-type, with short tube and flat limb, lobes obovate or ovate-rounded; scales yellow, low but

broad, adjacent to throat, papilliform; nutlets small, ca. 1 mm high, ca. 1.5 mm long at the dorsal areola, turbinate, with smooth, sharply tapering sides, dorsal areola slightly depressed, shortly spreading-pubescent, pectinate with 1 row of rather long, usually scabrous non-anchorlike spinules often curved on disk. June—July.

Rocks, pebbles and stony slopes of hills and mountains mainly in the steppe belt, rarely in forests (ascending to the alpine belt? after Krylov). — European part: V.-Kama (only in Central Urals: Semichelovechnyi Kamen', Krylov, and Southern Urals: Nurali Mountain, Krasheninnikov, 1935); West Siberia: Ob (Tomsk), Alt. (Salair); East Siberia: Ang.-Say. (Yenisei). Endemic. Described from Yenisei. Type in London.

509 Note. We have not seen the original specimens of Myosotis pectinata Pall., although Rudolphi writes that Pallas sent them to him. Pallas himself reported his plant from a number of localities in Siberia (Yenisei, Baikal, Kamchatka) where different races grow. It could therefore be more correct to call our species by the much later name E. ciliatum (Rud.) DC., whose originals (Myosotis ciliata Rud.) are available in the USSR and the localities from which Rudolphi reported them (Krasnoyarsk and Salair) are accurate. Nevertheless I have given priority to Pallas' name, denoting Yenisei, probably near Krasnoyarsk, where Myosotis ciliata Rud. was also found as the locus classicus. Ledebour combined all three species (E. pectinatum DC., E. ciliatum DC. and E. incanum DC.) into the one E. pectinatum, a procedure which might be acceptable.

It is difficult to determine whether E. pectinatum (s.s. or s.l.) is found in Altai. It is definitely present on Salair Range but with regard to Altai, from Kolyvan Lake and Zmeinogorsk (see Kryl., Fl. Zap. Sib. IX, 2256) up to Katon-Karagai and Zaisan, it appears that the only species growing there is the polymorphic E. subrupestre M. Pop. some of whose forms are close to E. pectinatum. It is conceivable that E. subrupestre M. Pop. (E. rupestre auct. fl. alt. ex parte and E. pectinatum auct. fl. alt.) is derived from the hybrid E. pectinatum × E. altaicum.

Krylov (op. cit.) recorded the western boundary of E. pectinatum in Siberia as Tisul' (55½° N. and 57¾ E.), Borovlyanka (55° N. and 53½° E.), Salair (54½° N. and 55½° E.), Zen'kova (53⅘° N. and 56½° E.). The interrupted distribution in the Urals is: Semichelovechnyi Kamen', 59½° N. and Southern Urals, Uchalinskii area, Kurali Mountain (Krasheninnikov, 1935). It is difficult to establish the eastern boundary — the easternmost specimens in the herbarium are from the former Kansk county; there are no specimens from Nizhneudinsk (one specimen, apparently E. sericeum DC.); in the former Balagansk county there is another species of the same series, E. sericeum DC. In Baikal (Dauria mainly) E. incanum DC. is found, which is closely related to E. pectinatum.

16. E. incanum (Turcz.) DC. Prodr. X (1846) 127; Turcz. in Bull. Soc. Nat. Mosc. XXIII, 1 (1850) 495 et Fl. baic.-dah. II, 1 (1856) 310. — Myosotis incana Turcz. in Bull. Soc. Nat. Mosc. XI (1838) 97, nomen.

Perennial; very close to the preceding but in addition to a wider, eastern distribution area in Transbaikalia, it is distinguished as follows: mostly biennial plants, not loosely cespitose, with thin root bearing only 1 or 2 rosettes but without shoots; stems slightly sturdier and higher, always strongly branching in inflorescence; radical leaves larger, 2—5 cm long,
510 wider, spatulate, gray, all obtuse; inflorescence corymbiform with branches large in fruit; pedicels ca. $^2/_3$ as long as in E. pectinatum. Corolla slightly smaller; spinules at margin of disk of nutlets short, scabrous, sometimes — but rarely — with anchorlike tip. July.

Dry, southern, stony slopes, in steppes. — East Siberia: Dau.; Far East: Zee.-Bu., Uda. Endemic. Described from Shilka River in Dauria (Turchaninov, 1833). Type in Leningrad.

Note. The main distinctions between this race and the preceding are the character of the rosettes (radical part) and traits of the radical leaves. E. incanum is coarser than E. pectinatum, reduced shoots (nearly rosettes) borne at the ends of the strongly branching rootstock are not developed from its radical part which is featured by one rosette at the end of the few branched or unbranched rootstock. The leaves of this rosette are comparatively large, spatulate, broad, rounded-obtuse. One might say that East Siberia is populated with races related to E. incanum, from which I examined the following two.

17. **E. sichotense** M. Pop. sp. n. in Addenda XVIII, 621. — E. pectinatum Kom. et Al., Opred. rast. Dal'nevost. kr. II, 887, non DC.

Perennial or biennial; root thin; tufts small, consisting of 1—2(3) tight and dense rosettes; leaves of rosettes gray-sericeous, linear-lanceolate to lanceolate, acute, with large midrib, 5—7 cm long, to 7 mm wide; stems slightly ascending or erect, few, 20—30 cm high, sturdy, appressed-gray-hairy, branching in inflorescence; cauline leaves linear, ascending, 2—3 cm long, 2—5 mm wide. Branches of inflorescence up to 5—10 cm long in fruit, somewhat obliquely erect, nearly leafless; pedicels thin, erect, the lower 1—2 cm long, gray; calyx in flower 2 mm long, in fruit up to 4 mm, lobes linear, acute, gray, appressed-bristly; corolla blue, limb flat, ca. 7 mm across, with rounded lobes; nutlets 2.5—3 mm long along the dorsal areola, sides smooth, ca. 1 mm high, disk finely spreading-pubescent, at each margin with 5—10 long, erect, bluish spinules subanchorlike at apex. June.

Rocks. — Far East: Uss. (Sikhote-Alin'). Gen. distr.: Korea, probably also China (Manchuria). Described from Suchan River valley, "Stepkina Shapka" cliff near Novitskii village, steep ravines, flowers, fruit, 30 VI 1921, Shishkin, No. 2782. Type in Vladivostok.

Note. Differs from the very close E. incanum in the acute and
511 sericeous leaves. The typical plants occur only south of Sikhote-Alin' near Suchan; transitional forms to E. incanum grow more to the north near Olga Bay and also in Korea.

18. **E. jacuticum** M. Pop. sp. n. in Addenda XVIII, 622.

Perennial; rosettes few, large, more or less loose; radical leaves greenish, bristly with spreading hairs, 3—7 cm long, broad, up to 1 cm wide (below apex), spatulate, obtuse at apex, often even rounded; stems not many but large and high, 20—40 cm, spreading-villous-bristly, branching in

inflorescence; cauline leaves lanceolate-linear, 2—3(4) cm long, acute, greenish, semi-spreading-bristly. Branches of inflorescence long, up to 10 cm, thin, ascending, appressed-hairy; peduncles and especially pedicels long, the lower pedicels 1.5—2 cm long, thin, erect, gray, appressed-bristly; calyx appressed-bristly, gray, ca. 2—3 mm long, with linear lobes; corolla blue, limb 7—10 mm across; nutlets rather large, more than 2 mm long along dorsal areola, with smooth sides, disk smooth, pectinate at margin with long, bluish or green, scabrous spinules broadening strongly at base, with thin, non-anchorlike apices, often curved on disk; stigma usually ascending above nutlet. June—July. (Plate XXIV, Figure 1.)

Stony slopes and rocks. — East Siberia: Lena-Kol., Okh., Uda (apparently not further north than 60°). Endemic. Described from Aldan River, 738 km from the mouth of the Maya, exposed granite, flowers, fruit, 20 VII 1928, Melvil, No. 390. Type in Leningrad.

Note. This race is undoubtedly affined with E. incanum; it is the Daurian-Amur, northern derivate, similar to E. incanum DC. in the large, broad, completely obtuse radical leaves, distinguished by the drooping, villous-bristly hairs of the stem and leaves. Melvil collected on Aldan, 750—755 km from the mouth of the Maya (No. 208), thin, grayish specimens with narrow cauline leaves, although the hairs of the stems were spreading-villous. These specimens appear transitional to E. incanum and there is no doubt that generally there are transitions between all four, Nos. 15—18, species.

19. E. kamtschaticum Kom., Fl. Kamch. III (1930) 47. — E. pectinatum Pall. It. III, ex p.; Ldb. Fl. Ross. III, 152, ex p., quoad pl. kamtsch.

Perennial; low and rather loosely cespitose plants, broad because of the strongly branching rootstock, branches more or less long and branching,
512 densely covered with remnants or whole bundles of last year's leaves, ending with numerous reduced shoots, nearly rosettes; radical leaves (leaves of reduced shoots) many, approximate, spatulate-oblong or spatulate-lanceolate, tapering at base, rather small, 1—2 cm long, 3—4(5) mm wide (below apex), acute, sericeous-gray, with appressed (spreading at margin) rather coarse straight hairs; stems lateral, thin, rather numerous, ca. 10 cm high, erect or slightly ascending, simple, gray, appressed-hairy; cauline leaves like the radical, hardly distinguished from them in size, shape and pubescence, evenly disposed on stem, the upper leaves nearly not tapering at base. Inflorescence small, consisting of 1—2- or few-flowered apical racemes, little elongating in fruit but raceme may reach 5—7 cm in length, leafy at base otherwise leafless; pedicels medium or long, gray-appressed-pubescent, erect, the lower up to 1 cm long in fruit, the upper shorter; calyx appressed-sericeous-gray, in flower ca. 3 mm long, in fruit 4 mm, with linear, acute lobes; corolla blue, 7—8 mm across, Myosotis-like; nutlets turbinate, glabrous, smooth, ca. 1.5 mm high (at sides), ribbed, keeled along back, beset at margin with long thin bluish scabrous spinules, 6—8 at each side, often recurved, not anchorlike; gynophore very short; style hidden between nutlets. July.

Rock crevices and meadow-lichen stony tundras along mountain ridges. — Far East: Kamch. Endemic. Described from mountains near Nachikin Lake (fruit, 10 VIII 1908, Komarov). Type in Leningrad.

Note. Cespitose plants, consisting of reduced shoots and not of rosettes. Resembles E. pectinatum (Pall.) DC. and most of all E. sericeum DC., differing from the latter by the hardly distinguishable, less loose and short racemes (in fruit), the shorter pedicels and by the slightly larger and coarser leaves.

It should be pointed out that the dates appearing in Komarov's book often do not correspond with the dates noted on the labels. Not one herbarium specimen bears the name "Eritrichium kamtschaticum Kom." written by the author.

20. E. sericeum (Lehm.) DC. Prodr. X (1846) 126; Ldb. Fl. Ross. III, 151; Turcz. Fl. baic.-dah. II, 2, 309.— Myosotis sericea Lehm. Pl. Asperif. II (1818) 98.

Perennial; small, loose, low plants, cespitose due to the strongly branching
513 rootstock with branches more or less elongate and covered with last year's dead leaves, ending in reduced shoots; leaves of shoots very numerous, small, spatulate-lanceolate, acute, ca. 1 cm long, 2—3 mm wide, densely whitish-sericeous-tomentose, with straight appressed long hairs partly spreading, thus appearing like tomentum; stems lateral, thin, gray appressed-hairy, erect or arcuate, sometimes slightly flexuose, simple, 10—20 cm high; cauline leaves small, slightly narrower and smaller than the radical, linear, rather evenly disposed on stem. Racemes single or paired at ends of simple stems, short in flower, very long and loose in fruit, 5—10 cm long; pedicels markedly remote, thin, straight, declined from axis of raceme, long, usually more than 1 cm, appressed-white-pubescent; calyx in flower ca. 3 mm long, with linear acute lobes not curved in fruit; corolla blue, 5—7(10) mm across; nutlets turbinate, glabrous, ca. 1.5 mm long, high, and the dorsal areola at back, rugose-tuberculate at the steep sides, whitish, finely prickly disk, pectinate along margin of back, short, suberect very scabrous spinules. June. (Plate XXV, Figure 3.)

Stony slopes of volcanos and mountains, cliffs.— East Siberia: Ang.-Say. (eastern part), Lena-Kol. and Dau. (near Baikal). Endemic. Described from Angara River (Turchaninov, 1834). Type in Geneva. Cotype in Leningrad.

Note. This species should be considered the Central Siberian vicaroid of the West Siberian E. pectinatum. Its distribution area is from the west in Nizhneudinsk area, in particular at Balagansk, extending to Baikal and then to the northeast along the Lena to Yakutsk, even reaching the upper reaches of Yana River. It is mainly distinguished from E. pectinatum by the short spinules very scabrous at margin, and by the dorsal areola being covered with small spinules; yet these characters are apparently not always constant. Also, the radical leaves are markedly pubescent, nearly tomentose, white-sericeous, which makes the tufts of this plant very similar to those of Androsace incana and distinguishes it from the more western E. pectinatum. It is interesting that the southern Ural form E. pectinatum is very similar to E. sericeum in habit and pubescence of leaves.

Section 3. EUERITRICHIUM DC. Prodr. X (1846) 124; Ldb. Fl. Ross. III, 149, non Brand in Pflanzenr. IV, 252 (1931) 187 et 188.— Leaves short,

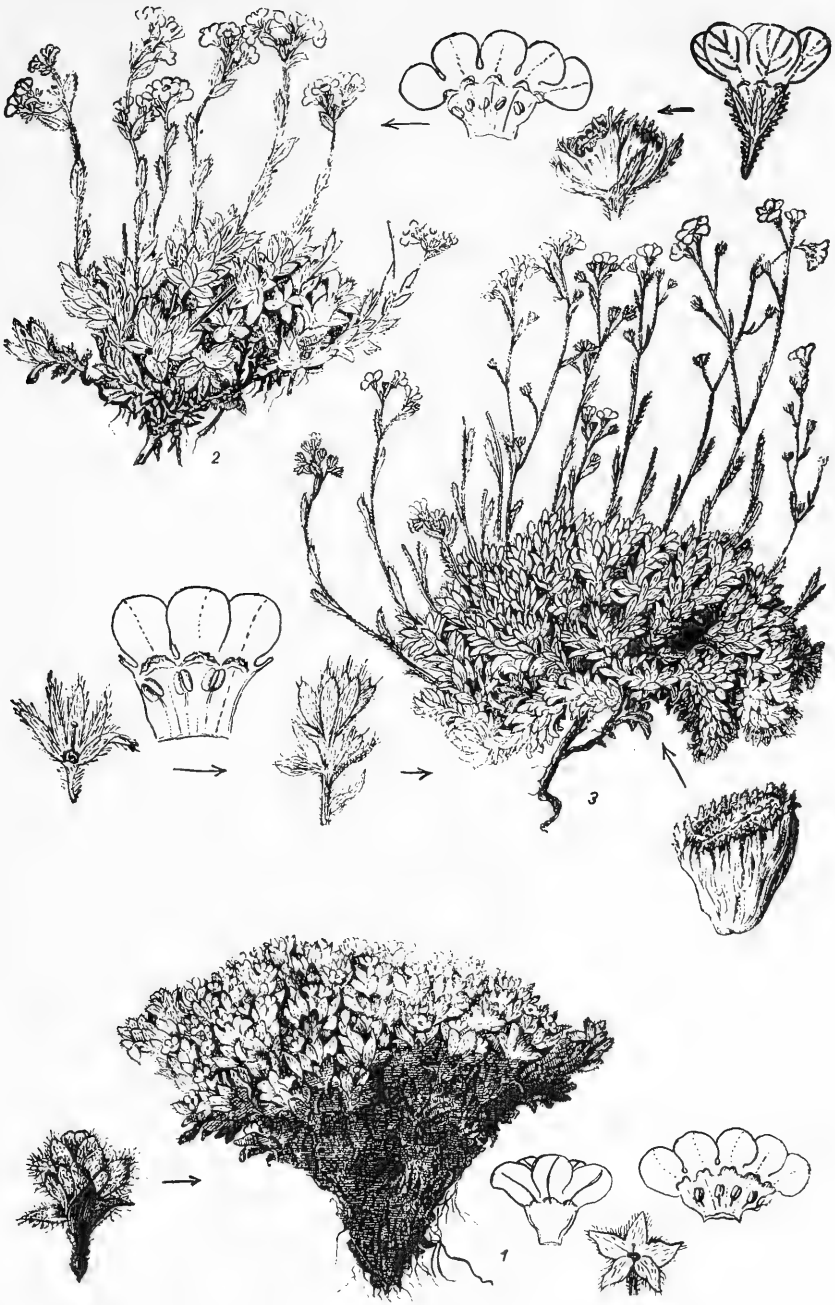

PLATE XXV. 1 — Eritrichium aretioides (Cham.) DC.; 2 — E. tianschanicum Iljin.; 3 — E. sericeum (Lehm.) DC.

rather broad, covered like stem with long spreading hairs, softly villous or even woolly-villous. Racemes short even in fruit, pedicels short. Nutlets turbinate, with steep sides and obliquely truncate dorsal areola
514 pectinate around with scabrous spinules or teeth without anchorlike tips. Loosely cespitose or loosely pulvinate, low-growing herbs of the arctic-alpine areas.

21. E. nanum (Vill.) Schrad. in Comm. Goetting. IV (1820) 186; Hegi, III. Fl. V, 3, 2134. — Myosotis nana Vill. Hist. pl. Dauph. 2 (1878) 459 et Prosp. Pl. Dauph. (1779) 21; All. Fl. Pedem. 54. — Ic.: Vill. Hist. pl. Dauph. tab. XIII; Hegi, l. c. tab. 219, 2 a—b—c et fig. 3095.

Perennial; small, more or less compact pulvinate plants, 5—10 cm in diameter, growing in rock crevices in the alpine, rarely subalpine belt; rootstock strongly branching, branches delicate, thin, covered with brown remnants of last year's leaves, bearing above reduced shoots, nearly rosettes; leaves of rosettes small, ca. 1 cm long, 2—3 mm wide, oblong-linear, acute, long but not densely ciliate-villous; stems low, 2—5 cm high, numerous, simple; cauline leaves linear, acute, half as long and narrow as the rosetted, acute. Racemes few-flowered (with 1—3, rarely 4—5 flowers), very short in flower, also short in fruit, reaching 2—3 cm in length; flowers rather large; pedicels very short even in fruit, the lower 2—3 mm long; calyx in flower ca. 3 mm long, with linear villous-ciliate lobes not elongating in fruit; corolla blue, 7—8(10) mm across, with throat open between the low yellow scales; nutlets glabrous, turbinate, with low (not more than 1 mm) sides, dorsal areola glabrous, 1.5 mm long, surrounded by narrow flat rim dentate at margin (narrow wing). July.

Rock crevices in the high mountain belt of the Alpine-Carpathian mountain system. Bukovina Carpathians, upper reaches of the Moldava. Might possibly be found in the Soviet Carpathians. Gen. distr.: West and Southern Carpathians, Alps. Described from Mont Cenis in the Alps. Type in Paris?

Note. In the Eastern and Southern Carpathians also grows var. E. jankae Simonk. with broad, oblong rosetted leaves, densely white- nearly woolly-hairy. The report of E. nanum from the Caucasus (Ldb. Fl. Ross. III, 149) should refer to E. caucasicum which is close to E. jankae but in the form of its crown it is more closely affined to E. villosum (Ldb.) Bge.

22. E. caucasicum (Alb.) Grossh., Opred. Rast. Kavk. (1949) 287. — E. villosum var. caucasicum Albov, Prodr. Fl. Colch. (1895) 183;
517 Kuzn. in Mat. Fl. Kavk. IV, 2, 203. — E. nanum Ldb. Fl. Ross. III, 149; Boiss. Fl. or. IV, 242 et nonnulli seniores auct. fl. Cauc. non Schrad. — Exs.: GRF, No. 377 (sub E. nano Schrad.).

Biennial or perennial; root thin, not branching at apex, producing mostly 1 rosette, rarely 2—3 approximate rosettes with 1—2, rarely 3—4 ascending stems; leaves of rosettes lanceolate or oblong-lanceolate, acute, 1—2 cm long, 3—5 mm wide, subtomentose-white or even sericeous, with long, white, sometimes semi-appressed, fine hairs; stems erect, rigid, usually ca. 10 cm high, woolly-villous, simple; cauline leaves ascending, almost appressed to stem, oblong or lanceolate to even linear, slightly narrower than the radical and a little shorter, acute, white-villous, sometimes sericeous.

Racemes apical on simple stems, usually 2—3(4), very rarely single, short, nearly capitate in flower, 3—10-flowered, elongating in fruit to 4—5 cm, erect, with somewhat remote fruit; pedicels very short, only the lowermost (in forks between cymes) up to 5—7 mm in fruit, the rest not more than 2—3 mm long; calyx in flower 2.5 mm long, appressed-sericeous-pubescent, lobes oblong-linear, obtuse; corolla blue, 5—7 mm across, Myosotis-like; nutlets smooth, glabrous, 1—1.2 mm high at sides, dorsal areola obliquely truncate, 2—3 mm long, smooth or with narrow blue rim bearing rather long, scabrous spinules, erect or curved on areola; gynophore very low, pyramidal. June—July. (Plate XXIV, Figure 3.)

Alpine pastures (meadows), cliffs 2,000—3,000 m high. — Caucasus: Cisc., W. Transc. Easternmost point: Kazbek Mountain in Central Caucasus. Endemic. Described from Kazbek Mountain (GRF, No. 377), collected by Desulavi (in flower, young fruits, 14 VII 1898). Type published.

Note. The Caucasian species differs distinctly from the Central European type E. nanum — E. jankae as well as from the Arctic-Siberian and mountainous Asian E. villosum. Limited to this isolated area it appears to be a very unique race more reminiscent of E. villosum in habit and crown than of E. nanum or even E. jankae. Its appearance in the Caucasus and its way of migration pose an interesting problem. It most probably penetrated the Caucasus in the Pleistocene from the north via the Urals and along the Volga and Don.

23. **E. villosum** (Ldb.) Bge. Verzeichn. Pfl. Altai-Gebirge (1836) 14; DC. Prodr. X (1846) 126; Ldb. Fl. Ross. III, 150; Kryl., Fl. Zap. Sib. IX, 2253. — Myosotis villosa Ldb. in Mém. Acad. Sc. Pétersb. V (1815) 516; Fl. alt. I, 191. — Myosotis drabaefolia Turcz. ex DC.
518 l. c., — E. nanum ssp. villosum var. eu-villosum Brand in Pflanzenr. IV, 252 (1931) 190. — Ic.: Ldb. Ic. Fl. Ross. II., tab. 215.

Perennial; small, low, loosely cespitose plants; rootstock moderately branching with thin delicate branches, sparsely covered with black-brown remnants of last year's petioles, ending in rosettes of leaves; rosetted leaves oblong or oblong-lanceolate, delicate, usually acute, green, sparingly or strongly villous, with spreading and entangled white long hairs, 1—2 cm long, 4—6 mm wide; stems few, erect or slightly arcuate, 5—15 cm high, usually ca. 10 cm high, simple, more or less villous; cauline leaves oblong, lanceolate or sublinear, acute, smaller and narrower than the radical, flat and delicate. Flowering racemes mostly 2, short in flower, slightly elongating to 1—3 cm in fruit, few-flowered; peduncles and pedicels short, pedicels usually 1—3 mm long, longer only in some — mainly the Arctic — forms; calyx 2.5 mm long in flower, villous, with oblong-linear or linear obtuse lobes hardly elongating in fruit; corolla blue, limb ca. 7 mm across; scales white, leaving the throat open; nutlets glabrous, smooth, sides abruptly tapering, 1—1.3 mm high; dorsal areola ca. 2 mm long, markedly tapering, smooth, with blue, rather long spinules, slightly merging at base, narrow above, scabrous along margin or smooth, not anchorlike, often curved on dorsal areola; gynophore very low, pyramidal. August.

Stony places, rocks, rarely meadows, in the Arctic and the high mountain belt. — Arctic: Nov. Z., Arc. Eur. (Kola Peninsula, Kolguyev, Peninsula, Kanin Peninsula, Vaigach Island (?), N. Urals), Arc. Sib. (Taimyr,

Chukchi Peninsula); West Siberia: Alt.; East Siberia: Ang.-Say., Lena-Kol., Dau.; Far East: Kamch.; Centr. Asia: T. Sh., Pam.-Al. Gen. distr.: N. Mongolia, Himalayas, NW America. Described from Siberia. "Hab. in Sibiriae alpibus cum Dryade octopetala" (Ldb. l. c. (1815) 516). It was later acknowledged to be from Altai. Type 1815 in Leningrad? Berlin? (I could not find it). Type 1830 (Fl. alt. I, 191) in Leningrad.

Note. In spite of the huge Arctic-Alpine distribution area, the variability of this species is not large, much less than in Papaver of the group nudicaule. The most distinct population is E. tianschanicum Iljin in herb. (Plate XXV, Figure 2): plants more pubescent, gray; corolla always white. I found no other differences from the Altai E. villosum. It is distributed in Tien Shan, from Dzungarian Ala-Tau up to Alai and Trans-Ili Ranges, and is absent in W. Tien Shan. In the Pamir area it is found in Darvaz, Karategin (thinner, small-flowered forms with short leaves,
519 areola pubescent). Perhaps the Himalayan E. basificum Clarke (E. sericeum Benth.) should be included here (I saw the original (?) specimens Royle sub E. sericeum Benth.).

The Arctic plants of interest are those thin elongated ones occurring at the lower reaches of the Yenisei and Lena Rivers. Their flowers are small, racemes markedly loose in fruit, but the nutlets do not appear to differ from the typical form. I have designated them as var. tenuigracile M. Pop. Representative specimens: upper reaches of Dudinka River, flowers 21 VII 1914, Kuznetsov and Reverdatto, No. 1252. Tundra on way to Fokina stream (Chekote), flowers, fruit, 16 VII 1914, No. 1010, 18 VII 1933, also Anadyr. I saw no other distinguished forms.

Hybrids between E. villosum and E. aretoides DC. occasionally occur in the far northeastern part of Arctic Siberia and probably in the rest of Siberia up to Vaigach and Novaya Zemlya in the west. They have been given the specific name of E. chamissonis (DC. Prodr. X (1846) 125; Ldb. Fl. Ross. III, 149; Kom. Fl. Kamch. III, 46–49. – E. aretoides × E. villosum). – Forming small cushions, producing stems similar to E. villosum. Leaves obtuse as in E. villosum.

24. **E. aretoides** (Cham.) DC. Prodr. (1846) 125; Ldb. Fl. Ross. III, 149; Kom. Fl. Kamch. III, 46–49. – Myosotis aretioides Cham. in Linnaea, IV (1829) 443. – E. nanum ssp. villosum var. aretioides Brand in Pflanzenr. IV, 252 (1931) 190.

Perennial; plants forming more or less large low cushions, from 5 to 20 cm in diameter and more; rootstock very strongly branching, branches more or less elongate, column-like owing to dense, overlapping, dark leaves of the previous year ending in reduced stems of the current year, the stems also column-like, 1–3(5) cm high, densely covered with overlapping appressed leaves; leaves linear-oblong, lanceolate or even oblong, short, 3–7 mm, sessile, acute or obtuse, densely villous, with gray, semi-spreading, long, not strongly entangled, rather straight hairs. Peduncles (rather the very short stems) bearing 1–3, rarely 4–5, flowers each, very short subanthesis, thus flowers appearing on surface of cushion but not above upper leaves of shoots, after flowering elongating, elevating flowers 1–2 cm above cushion; pedicels short, villous, even in fruit not longer than 1–3 mm; flowers blue, medium-sized; calyx in flower 2 mm long, in fruit

3 mm, lobes linear, villous; corolla bright blue, 5—6 mm across, Myosotis-like with ovate-rounded lobes; scales yellow, low but wide, forming a yellow ring around opening of throat; nutlets turbinate, their sides smooth,
520 1—1.5 cm high, dorsal areola tapering, 1.5—2 mm long, glabrous, short-aculeate along margin with smooth spinules. July. (Plate XXV, Figure 1.)

Stony and clayey dry tundras. — Arctic: Nov. Z., Arc. Eur. (Vaigach), Arc. Sib. (Taimyr, New Siberian Islands), Chuk., An. (also Wrangel Island and Arakamchechen); Far East: Kamch. (Karaginskii Island). Gen. distr.: NW Arctic, America and further to the south. Described from Chukchi Peninsula, Lavrentii Bay. Type in Berlin.

Note. This is a characteristic species of the Arctic. Up to now it has been reported only from Chukchi-Anadyr Region from where it was described, although it is distributed throughout the Arctic, Siberia and even Europe, and is common in Novaya Zemlya. Somehow it has been identified in all these places as E. villosum Bge., although it is hardly similar in habit, being a typical, pulviniform plant, with peduncles not elevated above the surface of the cushion. In this respect, as in others, it is closer to the Alpine-Carpathian E. nanum Schrad. than to E. villosum. The Chukchi-Anadyr specimens have narrower leaves (being more like the linear-oblong leaves of E. nanum), while the Taimyr and Novaya Zemlya specimens have wider and more obtuse leaves. However, there are also similar plants growing on the New Siberian Islands (Kotelny Island), on Arakamchechen Island and Karaginski Island off Kamchatka. The peduncles are elevated above the cushion only after flowering, more so in the western forms than in the Chukchi-Anadyr. In addition there are individuals throughout the distribution area in which the cushions are less distinct and the peduncle-stems are elevated for 2—5 cm above the cushions already in flower. These specimens show features of being transitional from E. aretioides to E. villosum and there can be no doubt that they are hybrids between these species. De Candolle gave them the specific name E. chamissonia DC. (E. latifolium Rupr., non Kar. et Kir.).

Species of undetermined position:

25. E. czekanowskii Trautv. in Tr. Bot. Sada V (1877) 88; Brand in Pflanzenr. IV, 252 (1931) 195.

Perennial; very loosely, nearly not cespitose plants, with habit of Myosotis silvatica; rootstock of few-branched branches more or less elongating up to 5 cm, covered with dark brown remnants of petioles of the previous year, thin, delicate, bearing above one rosette of leaves with one fertile stem; stem 8—10 cm high, erect, very sparsely villous with spreading, soft, twisted hairs, simple, thin; leaves of radical rosettes oblong-spatulate, obtuse, tapering gradually to petiole, 1—1.5 cm long (blade) and 4—8 mm wide (below apex), sparsely covered with straight semi-spreading short hairs;
521 petioles slightly longer than blade, up to 2—3 cm; cauline leaves sessile, oblong, obtuse, ca. 1 cm long, 3—4 in number, erect; all leaves flat, delicate. Inflorescence bifurcate (cyme) with small apical racemes, branches 1.5—3 cm long, leafless; pedicels nearly absent; calyx 1.5—2 mm long, lobes linear-lanceolate, obtuse sparsely bristly with semi-appressed hairs (partly rufous); corolla small, tube a little longer than calyx, slightly swollen, the

limb broadly campanulate, not flat, 3—4 mm across, with ovate-rounded lobes; nutlets not seen (lobes of ovary show no traces of a crown). August.

Arctic: Arc. Sib. (between Olenek and Lena Rivers, near Buotar stream, at timberline, flowers, 3 VIII 1875, Chekanovskii). Never reported again. Type in Leningrad.

Note. This species is probably not related to Eritrichium at all but represents some Myosotis form of the related M. sylvatica. It is incomprehensible what motivated Trautfetter to describe this plant as a species of Eritrichium. We are leaving the name as given in order that botanists of this region should look once again for this indicated species of Eritrichium.

Genus 1215. **STEPHANOCARYUM*** M. Pop.

M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 340.

Calyx divided nearly to base into 5 lanceolate teeth not changing in fruit; corolla of the short-type, limb short and flat, with rounded-ovate lobes, twisted not imbricate in aestivation; anthers and style enclosed in tube; scales rather large, low but broad, yellowish, papilliform completely covering throat; style filiform, rising from middle of nutlets elongating after fertilization, remaining at side of nutlet since gynophore does not expand with capitate stigma, gynophore very flat and conical, nearly like a disk. Nutlets when young separate from each other, normally only one ovule developing, the others retarded in growth; ripe nutlets turbinate, appearing obliquely obconical, attached to gynophore by rounded small areola (apex of recurved cone), sides rounded pubescent, high (3 mm), dorsal disk (base of recurved cone) pubescent, surrounded by elevated, thickened margin beset
522 with short wide erect thin scales densely short-hairy, altogether forming a low crown. Perennial, loosely cespitose low herbs with mesophyllous habit, leaves delicate, flat, opposite, flowers solitary in axils of upper (sometimes alternate) leaves on long thin pedicels drooping after flowering. — W. Tien Shan, limestone rocks in the alpine belt.

1. S. olgae (B. Fedtsch.) M. Pop. l. c. 341. — Trigonotis olgae B. Fedtsch. (sect. nova Antiphyllum B. Fedtsch.) in Bericht. Deutsch. Bot. Gesellsch. XXI, 6 (1903) 325; in Perech. rast. Turk. VI, 349—350. — Omphalodes olgae Brand in Fedde, Repert. XXVI (1929) 172. — Ic.: Fedtsch. l. c. (1903) tab. XVI.

Perennial; root hidden in rock crevices, bearing above a mass of rootstock branches, branching filiform, thin, dark, more or less elongate or short, each branch terminated by sterile short shoot (not rosette) or a fertile stem; stems thin, filiform, very remotely appressed-long-hairy or subglabrous, simple, weak but not decumbent, 5—12 cm high, sterile shoots 2—5 cm high; leaves opposite, oblong-oval, short, 1—2(3) cm long, 0.7—1.5 cm wide, the lower somewhat spatulate ones tapering to short petiole, the upper sessile, all leaves obtuse, delicate, green, sparsely bristly with short appressed

* From the Greek stephanos — wreath, and caryon — nut, nutlet.

hairs borne at upper surface on rather large tubercles. Flowers mostly solitary in axils of sometimes alternate, slightly shorter leaves, 2—7 on one stem; pedicels capilliform, drooping in fruit and reaching 1.5 cm in length; calyx-lobes semi-appressed hairy, lanceolate-linear, acute, in flower 4 mm, in fruit 5 mm long; corolla blue, 10—15 mm across, tube as long as calyx, the limb divided into lobes nearly to base; anthers 1 mm long, oblong; nutlets 3 mm high, the ripe dark, pubescent, narrowly turbinate, surrounded by sepals, only one nutlet developing (in fruit); style filiform, elongating in fruit, even slightly exserted from calyx. July—August. (Plate XXI, Figure 3.)

Crevices of limestone rocks in the alpine belt. — Centr. Asia: T. Sh. (only in the northwestern part of W. T. Sh., in Talass Ala-Tau, upper reaches of Pskem, Ak-Su, Dzhebogly-Su and rivers near them). Endemic. Described from Kuurgen-Turg, Maidantal River valley (upper reaches of Pskem, i. e., Chirchik) (flowers, 5/17 VIII 1879, unripe fruit, I 17 1902, B. A. Fedchenko). Type in Leningrad.

523 Genus 1216. **TIANSCHANIELLA*** B. Fedtsch.

B. Fedtsch. ex M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 337.

Calyx small, dissected to base or for $^2/_3$ into 5 linear-oblong obtuse lobes, in fruit slightly elongating or sometimes unchanged, recurved. Corolla small, almost Myosotis-like tube short, slightly swollen, the limb 3—4 mm across, nearly flat, with orbicular-obtuse lobes. Anthers small, suborbicular, enclosed like the very short style in tube. Gynophore of ripe fruit very low but broadly pyramidal, 4-angular, each face with one depression — scar of nutlet. Nutlets dorsoventrally compressed, ovoid-oblong when viewed dorsally, apices exceeding gynophore and the short style borne at its top, growing also at base below gynophore as in the Cynoglossum, back slightly inflated, nearly flat, bearing along the nearly winglike ascending margin short remote spinules with anchorlike tip 0.2—0.3 mm long. Sides of nutlets low, inflated, with small oblong supracentral cicatrice, and a ventral keel protruding above cicatrice (the keel short because of high position of cicatrice). Perennial herbs, with delicate membranous oblong leaves, subglabrous; inflorescence rather unique, paniculate, formed of long filiform pedicels disposed in few bundles (cymes, dichasia) in racemes or at ends of branches. Closely related to section Pseudohackelia of the genus Eritrichium.

1. T. umbellifera B. Fedtsch. ex M. Pop. l. c. 338 cum tab.

Perennial; root thin, oblique or vertical, with squamose thin head bearing rosette of radical leaves and several floriferous stems; entire plant green, with leaves very remotely covered with large white tubercles bearing appressed bristles; radical leaves 6—10, rather large, oblong, 9—18 cm long, 3—4 cm wide, obtuse at apex, thin, nearly membranous, tapering gradually at base to rather long petiole; stems 40—70 cm high, glabrous, weak, delicate, branching; cauline leaves few, alternate, oblong, smaller than the radical

* Named for its habitat in Tien Shan.

leaves, short-petioled. Racemes in paniculate inflorescence, long, often substituted at apices of branches by bundles of pedicels ("umbels"); pedicels thin,
524 1.5—4 cm long, filiform, erect, thickened at apex below calyx, often gathered in bundles of 3—6 on axes of raceme or at apices of branches (B. A. Fedchenko called these bundles "umbels" and hence the name of the species); calyx 2—2.5 mm long, lobes oblong-linear, obtuse, subglabrous; corolla (blue? or white?), 3—4 mm across, tube ca. 1 mm long, lobes ca. 2 mm long, obovate, obtuse; scales in throat subvertical and rectangular, ca. 1 mm long (high), thickened and papilliform at apex; anthers suborbicular, 0.5 mm long; nutlets 2—3 mm long, markedly remote in fruit, declined toward vertical axis of fruit (gynophore) at nearly 80°, i. e., reclining so that fruit low, 1.5—2 mm high but up to 5 mm wide; at each side of nutlet 6—8 anchorlike spinules; gynophore low but broadly pyramidal, not more than 0.6 mm high, ca. 2 mm wide at base; style 0.3 mm long at apex of gynophore. August—September.

Centr. Asia: T. Sh. (Central T. Sh. along banks of Cholokkapchagai stream, above its exit from gorge, flowers, fruit 3 IX 1939, Yakovleva, No. 250). Endemic. Described from the indicated locality. Type in Leningrad.

Subtribe 2. LITHOSPERMINAE M. Pop. — Gynophore poorly developed, low-conical or very low-pyramidal, indistinct. Nutlets slightly compressed dorsoventrally or not at all, ovoid, not turbinate, without wings or spinules, finely tuberculate, rugose or smooth; cicatrice basal.

Genus 1217. **ANOPLOCARYUM*** Ldb.

Ldb. Fl. Ross. III (1847—1851) 154; Johnston in Contr. Gray Herb. n. ser. LXXIII (1924) 67; Brand in Pflanzenr. IV, 252 (1931) 115.— Echinospermum sect. III. Anople caryum Turcz. in Bull. Soc. Nat. Mosc. XXIII, 1 (1850) 522; Fl. baic.-dab. II, 2, 318.

Calyx small, dissected nearly to base into lanceolate lobes, in fruit lobes slightly accrescent, oblong, nearly scarious, stellately spreading; corolla medium-large, Myosotis-like with short tube as long as calyx, limb nearly flat, blue, 7—8 mm across, with ovoid-rounded lobes; scales medium, wide, weakly 2-lobed at apex, papilliform, white or yellow; anthers and style hidden in corolla tube. Nutlets small, oblong, without spinules or wings, dorsoventrally slightly compressed, finely tuberculate, back inflated, ventrally with tiny, very narrow triangular cicatrice disposed above base but below
525 middle (infracentral and suprabasal), continuing above as a keel not reaching apex of nutlet, the apex freely growing above gynophore. Gynophore short-conical, obscurely pyramidal-angular with inconspicuous depression marking cicatrices of nutlets, shorter than nutlets but bearing at apex the elongated filiform style elevated high above nutlets.

Our species is the type of the genus. This is an annual, subglabrous plant, growing in shade, with much branching stem; leaves oblong, small, delicate; racemes provided with large bracts and hence outwardly somewhat distinct from branches; pedicels thin, up to 1 cm long, declined. Brand included

* From the Greek anoplos — unarmed, and caryon — nut, nutlet.

in this genus four Chinese-Himalayan species which previously had been described as species of Microula, Tretocarya and Schistocaryum. In this way the genus Anoplocaryum probably became heterogeneous, not natural.

1. A. compressum (Turcz.) Ldb. Fl. Ross. (1847—1851) 154; Brand l. c. 116. — Echinospermum compressum Turcz. in Bull. Soc. Nat. Mosc. XIII (1840) 259; XXIII, 1 (1850) 522. — Ic.: Turcz. l. c. (1850) tab. XII.

Perennial; stems thick but weak (soft), subglabrous, rarely or only at the beginning few-branched, later several time furcately strongly branching and then decumbent under weight of racemes terminating the branches, 15—30 cm high, internodes with thin high bands (wings) formed by epidermis, beset along margin with small bristles; leaves many, small, 2—5(7) cm long, delicate (shady form), oblong, acute, tapering at base, the lower with longer petiole, upper leaves short-petioled, 0.7—2 cm wide, glabrous beneath, beset above with thin appressed bristles borne on small tubercles. Racemes elongated in fruit, 5—10 cm long, with large foliaceous bracts, 1—2 cm long, 0.5—1 cm wide, the flowers thus seemingly solitary in axils of upper slightly reduced leaves; pedicels filiform, ca. 0.5—1 cm long, horizontally spreading; calyx in flower 2—4 mm long, lobes slightly hairy, lanceolate, oblong in fruit and stellately spreading; corolla 6—8 mm across (limb), blue; Myosotis-like nutlets 1.5 mm long, black, finely tuberculate (shagreen); gynophore ca. 1 mm high; style 1.5 mm long; stigma diskoid, entire. June—July.

Habitat apparently in shade, in moist rocks. — East Siberia: Dau. (in rupestribus ad Altangan, 1830—1831, Turczaninow). Gen. distr.: Mongolia. Described from the indicated locality. Type in Leningrad.

526 Genus 1218. **ALLOCARYA*** Greene

Greene in Pittonia, I (1887) 20; Gürke in Pflanzenf. IV, 3a, 108; Brand in Pflanzenr. IV, 159.— Plagiobothrys § Allocarya Johnst. in Contrib. Gray Herb. n. ser. LXVIII (1923) 57—80.— Eritrichium sect. VIII. Rytidocaryum DC. Prodr. X (1846) 130; Ldb. Fl. Ross. III, 153.

Calyx small, dissected nearly to base into narrow lobes little elongating in fruit; corolla small or medium, usually white, usually funnel-shaped, i. e., of the short-type and with campanulate, not flat, limb; anthers and style enclosed in corolla tube; scales in throat of corolla absent or represented as thin folds. Nutlets small, oblong or ovoid, without spinules or wings, usually netted-rugose or netted-pitted, slightly compressed dorsoventrally, back rounded (with obtuse not acute rib), sides cuneately tapering to ventral keel; cicatrice small, triangular, subbasal but distinctly lateral, i. e., at ventral side and not at base of nutlet, the ventral keel extending above it. Style short, stigma entire, capitate. Perennial or annual small herbs. Leaves rather narrow, the lower usually opposite and united by sheathed petioles. Stems branching. Racemes with large foliaceous bracts.

Predominantly in North America, some in South America. One species related to those of Northwest America (Alaska) reaches Kamchatka in the USSR.

* From the Greek allos — otherwise, other, differently, caryon — nut, nutlet.

1. A. orientalis (L.) Brand in Pflanzenr. IV, 252 (1931) 178.— Plagiobothrys orientalis Johnst. in Contrib. Gray Herb. LXXXI (1928) 80.— Heliotropium orientale L. Sp. pl. (1753) 131 teste Johnston ex authopsia Herb. Linn.— A. asiatica Kom. in Fedde, Repert. XIII (1914) 236; Fl. Kamch. III, 45.— Plagiobothrys asiaticus Johnst. in Contrib. Gray Herb. LXXIII (1924) 68.— Eritrichium plebejum DC. Prodr. X (1846) 133; Ldb. Fl. Ross. III, 153.— Lithospermum plebejum Chamisso in Linnaea, IV (1829) 446.— Allocarya plebeja Greene in Pittonia, I (1887) 16.

Annual; stems thin, weak, 5—15 cm high, erect or decumbent, sometimes decumbent later under burden of racemes, rarely simple, usually strongly branching with elongate spreading branches bearing racemes at ends, appressed-bristly; leaves oblong-linear, rarely — in large individuals — lanceolate, flat, subglabrous, sparsely appressed-bristly especially along margin, acute or obtuse, 2—4(5) cm long, (1)2—4(6) mm wide, the lower
527 few, 1—3 pairs opposite, the other alternate. Racemes elongating in fruit, loose, up to 10 cm long, longer than the short stem, in weak non-branching specimens single or paired, in branching numerous; pedicels ca. 1 mm long, thick, erect, bristly; bracts foliaceous, oblong-linear, sepals in fruit 3 mm long, linear, half ascending, half recurved embracing fruit; corolla white (yellow inside, Komarov), 2 mm long, with small funnel-shaped limb; nutlets 2 mm long (high), oblong, rugose-pitted or tuberculate, dark, faintly keeled at the rounded back, ventrally with nearly winglike keel; cicatrice below keel oblong, 0.2—0.3 mm long; style in between ripe nutlets. July.

River banks, often pebbly banks, sometimes seashores, coastal sands, often a weed.— Far East: Kamch. (rather common). Gen. distr.: northwestern part of N. Am. Described from Kamchatka (Steller?). Type in Berlin.

Note. The differences between the Kamchatka and Aleutian plants are not great (the latter was described from Unalaska as Myosotis plebeja Cham.) and hence, following Brand, I am uniting them, although Komarov (Fl. Kamch. III, 45—46) wrote: "Our species differs from the related American species A. plebeja Greene by its thinner habit, the more developed terminal inflorescences, the nearly smooth nutlets and their longer mucro." All these distinctions are only of a slight quantitative character.

Genus 1219. **AMBLYNOTUS*** Johnst.

Johnst. in Contrib. Gray Herb. LXXIII (1924) 64.— Eritrichium sect. V. Amblynotus DC. Prodr. X (1846) 128; Ldb. Fl. Ross. III, 152.

Calyx small, cut nearly to base into 5 linear lobes little elongating and remaining erect in fruit, unchanged in any other way. Corolla medium-sized, of the short-type, blue, with short tube as long as calyx, limb nearly flat or broadly campanulate, 3—5 mm across, with rounded-obtuse overlapping lobes; scales low but wide, papilliform, nearly closing throat. Anthers and style hidden in corolla tube. Nutlets small, ovoid-oblong, without

* From the Greek amblys — obtuse, notis — spine, back.

spinules or wings, white, shiny, not compressed dorsoventrally as in many Lithospermum, back inflated, sides flat, with acute keel ventrally, apex of nutlets erect, obtuse, free, the base rounded; cicatrice small, subtriangular, nearly basal and nearly erect (i. e., perpendiculat to the long axis of nutlet
528 as in Lithospermum), only slightly declined toward axis (tapering), a thin suture-like line extending along the ventral keel from the cicatrice to the free apex of the nutlet (Johnston called it a furrow, but it does not appear as such). Gynophore very low, inconspicuous, broad-tetrahedral-pyramidal, with short style at apex of pyramid. Stigma disklike-capitate. Small, perennial, multicaulescent herbs, with gray appressed hairs; racemes short, bracteate, very short in flower, nearly capitate. Leaves small, generally like Eritrichium.

Note. Johnston rightly regarded Amblynotus as a distinct genus and Brand's criticism (1931) (l. c. 19) of its separation from Eritrichium is unwarranted. Amblynotus represents a transition from Eritrichieae to Lithospermeae and the seemingly pyramidal gynophore, the oblique position of the cicatrice, and above all the entire, disklike stigma refer it to the Eritrichieae. Within the Eritrichieae the species is marked by the presence of characters transitional between the tribes.

1. A. obovatus (Ldb.) Johnst. in Contrib. Gray Herb. LXXXIII (1924) 64. — Myosotis obovata Ldb. Fl. alt. I (1829) 190, in nota. — Eritrichium obovatum DC. Prodr. X (1846) 128; Ldb. Fl. Ross. III, 152; Kryl., Fl. Alt. IV, 897. — Krynitzkia obovata A. Gray in Proc. Amer. Acad. XX (1885) 265. — E. dahuricum Brand in Pflanzenr. IV, 252 (1931) 193; Kryl., Fl. Zap. Sib. IX, 2256. —? Myosotis davurica Pall. in herb. Berol. sec. Ldb. Fl. Ross. III, 153 et ex Roem. et Schult. Syst. IV (1819) 774, in obs.

Perennial; root vertical, thick, black, bearing a compact capitate rosette or branching into few thick squamiform short branches, each terminated by a small rosette; entire plant dull gray, with long straight semi-appressed scabrous hair-bristles not on tubercles, rarely sericeous; stems 5—20 cm, usually 10—15 cm high, few or (if caudex branching) many, thin, erect, sometimes arcuate, branching only at apex, the 2—5 branches terminated by racemes or rather by what resembles racemes; leaves of rosettes long persistent, 1—2 cm long, lanceolate- or oblong-spatulate, sometimes linear, obtuse, flat; cauline leaves also obtuse, 1—2 cm long, spatulate, lanceolate,
529 rarely oblong or linear-oblong, sometimes linear, spreading. Racemes 1—5 cm long in fruit, rarely (at least in lower part) with small spatulate bracts; pedicels filiform, 2—10 mm long, erect; calyx ca. 1 mm long in flower, to 3 mm in fruit, the oblong-linear obtuse lobes enveloping the fruit; corolla blue, 3—5(7) mm across (limb); nutlets 1.5—2 mm high; gynophore 0.5 mm long; style 0.7 mm long. June—July.

Pebbly or stony mountain slopes, usually above timberline (Kryl. l. c. (1937) 2257), but apparently descending to steppes, on stony slopes. — West Siberia: Alt. (rarely); East Siberia: Ang.-Say. (Baikal), Dau. Gen. distr.: Mongolia, China (Manchuria). Described from Nerchinsk. Type in Leningrad.

Note. A highly variable species with regard to size, with dwarf plants 5—8 cm high, their racemes capitate in flower, short in fruit, as well as plants 15—20 mm high, with racemes loose in fruit (Ledebour's type is of the dwarf

form). Especially in the dwarf specimens leaves sometimes linear, hence easily mistaken for a species related to Eritrichium rupestre. A plant of this kind may well have been described as Myosotis rupestris Pall., rather than the one we described as Eritrichium rupestre. In this case our E. rupestre (Transbaikalia and NE Mongolia) should be E. pauciflorum (Ldb.) DC. It is doubtful whether Myosotis davurica Pall. belongs to this or another species of Eritrichium. De Candolle included it in the synonymy of Eritrichium pauciflorum DC. (l. c. 127), Ledebour in that of E. obovatum.

Tribe 8. ASPERUGEAE Zak. in Zakir. Burachn. Zeravsh. (1941) 4, 7. — Flowers small; calyx cut nearly to base into 5 lobes with denticles between them, calyx markedly accrescent in fruit, saucer-shaped but folded in the middle, with flat sides, nearly scarious, the entire part with network of prominent nerves, margins with 3—5 large triangular lobes and small, irregular, sometimes bifurcated, hornlike teeth bearing hammate prickles between lobes. Corolla small, brachymorphous. Nutlets laterally compressed, nearly flat, in profile oblong, entirely covered with white tubercles; areola of attachment elliptic, ventral, above middle of ventral keel of nutlet, gynophore stylelike. Style not exserted from nutlets.

Note. The formation of the calyx singles out this genus from all the Boraginaceae; it only partly resembles Trichodesmeae in the saucer-shaped broadened calyx. The attachment of the nutlets and the small, brachymorphous corolla most nearly resemble Eritrichieae, but unlike other Eritrichieae the calyx is different and the nutlets are nearly flattened laterally.
530 The arrangement of the flowers in one or several bundles subtended by the upper paired, approximate leaves is also characteristic.

One anomalous, monotypic, annual genus — Asperugo L.

Genus 1220. **ASPERUGO*** L.

L. Sp. pl. (1753) 198.

Calyx 5-parted, dentate between lobes, becoming broadened, markedly saucer-shaped, folded along middle, nearly membranous, with irregular large lobes and dentate margin. Corolla violet, small, 3 mm long, brachymorphous, the tube shorter than calyx, the limb small, campanulate, with small obtuse scales in throat; anthers subsessile, in tube of corolla; style short; stigma capitate; gynophore columelliform, delicate. Nutlets nearly flat, laterally compressed, with upper ventral cicatrice, densely white-tuberculate, their apex nearly acutely keeled, obtuse; radicle short, much shorter than cotyledon. Delicate, annual, shady herbs, with 1—3(4) flower in axils of upper leaves.

1. A. procumbens L. Sp. pl. (1753) 198; DC. Prodr. X, 146; Ldb. Fl. Ross. 175; Shmal'g., Fl. II, 226; Boiss. Fl. or. IV, 275; Kryl., Fl. Zap.

* From the Latin asper — rough, referring to the bristly leaves.

Sib., IX, 2259; Kuzn. in Mat. Fl. Kavk. IV, 2, 205. — Ic.: Stankov and Taliev, Opred. 434; Rchb. Ic. Fl. Germ. XVIII, tab. 126. — Exs.: GRF, No. 779.

Annual; stem juicy, sharply faceted, its ribs with large, hamate, retrorse spines hence stem clinging, more or less branching with long branches, weak, usually climbing in shrubs or hedges, 10—40 cm long; leaves usually delicate, shady, spatulate-oblong or spatulate-lanceolate, acute, 1.5—4 cm long, 4—15 mm wide, with sparse divaricate bristly hairs. Fertile branches long spreading, 5—30 cm long, one side of upper part with one rather large bract (or 2—4 approximate bracts), but then clusters markedly remote, small, subsessile flowers in axils of bracts as many as bracts of one cluster (1—4); calyx in flower ovate, ca. 1.5 mm long, with prickly adjacent bristles, the lobes unequal, on short recurved pedicel, in fruit very large, ca. 10 mm long and as wide, folded along middle, flattened, cordate-rounded-ovate, the margin with
531 large unequally lobate-dentate lobes, with prominent network of nerves, subglabrous, margins of lobes ciliate-bristly, intermediate teeth with curved prickles; corolla 2—2.5 mm long, violet turning blue, limb ca. 1.5 mm across, with obtuse lobes; nutlets ca. 3 mm long. April—June.

Weedy localities, kitchen gardens, hedges, gardens, weedy shrubs and resting places for cattle in mountains, below cliffs in lower mountain belt. European part: everywhere (except Arctic); Caucasus: everywhere; West Siberia: Ob, Alt. and elsewhere; East Siberia: Dau. (Baikal), Lena-Kol. (introduced); Centr. Asia: mountains and steppes of northern regions. **Gen. distr.**: nearly all Europe, Med., Ind.-Him. Described from Europe. Type in London.

Note. Thin, weakly branching, 10—20 cm high individuals with simple stems and grayish, spatulate-lanceolate or even linear-spatulate leaves sometimes encountered. Their habit is very unique.

Tribe 9. **CRANIOSPERMEAE** (DC. Prodr. IX, 467) M. Pop. — Tribe Cryptantheae Brand (1931), ex parte. — For characteristics see description of Craniospermum. — One genus: Craniospermum Lehm.

Genus 1221. **CRANIOSPERMUM*** Lehm.

Lehm. Pl. Asperif. II (1818) 336; Bge. Heliocarya 9—10; Brand in Pflanzenr. IV, 252, 102.— Diploloma Schrenk in Bull. phys.-math. Acad. Pétersb. II (1844) 195; Johnst. in Contrib. Gray Herb. LXXIII (1924) 61.

Calyx medium-sized, with coarse spreading bristles, cut nearly to base into lanceolate-linear lobes in fruit elongating to 10 mm but remaining erect and embracing fruit; calyx abscisses with nutlets; corolla dolimorphic, small, tubular, slightly broadening above, 6—10 mm long, nearly without limb, with short triangular erect teeth or shorter ovate lobes; scales absent, sometimes throat of corolla with tubercles alternating with lobes, resembling rudimentary scales; filaments elongate, attached to middle of tube; anthers more or less protruding from corolla; dorsifix ca. 1 mm long,

* From the Greek cranion — cranium, sperma — seed.

linear-oblong; style long, exserted; stigma entire, capitate-disklike or a
532 point. Nutlets medium-sized, oblong, with oblong protruding ventral cicatrice, sides low, transversely rugose, rimmed by low (narrow) coriaceous-fleshy, unequally toothed straight wing, almost concealing the narrow, slit-like, dorsal disk (sometimes shifted to apex of nutlet). Gynophore low-pyramidal, the persistent long style pressed between accrescent apices of nutlets, nutlets without spines. Perennial or biennial, low firm herbs of the desert-steppe belt, Mongolia and adjacent South Siberia.

Note. De Candolle and Ledebour did not identify Diploloma with Craniospermum, possibly because they had never seen Schrenk's specimens. Bentham and Hooker, though they too had not seen the specimens of Diploloma, tentatively determined them as Craniospermum. For no apparent reason, Johnston (1924) gave them as synonyms. Brand (1931), apparently following Johnston, united the genera but quite wrongly included Diploloma echioides Schrenk in the synonymy of Craniospermum subvillosum Lehm.

1. Crown of cartilaginous-fleshy truncate wing with small toothed margins surrounds entire dorsal areola, open. Stamens very strongly protruding; lobes of corolla rather large, ovate, curved; stigma a point. Biennial (and in any case monocarpic) plant. (Ulu-Tau Range of Kazakh Hills) . . . . . 4. **C. echioides** (Schrenk) Bge.

\+ Crown of nutlet in upper part of nutlet, lower part of back free, visible. Wings entire, nearly covering opening (through which disk visible). Stamens little protruding. Teeth of corolla short, erect. Stigma capitate-disklike. Perennial, cespitose herbs. (Altai, Baikal). (Section Eu-Craniospermum) . . . . . 2.

2. Loosely tufted plant, sprawling because of longer (3—5 cm long) branches of rhizome. Leaves of rosettes and stems broader, lanceolate or oblong-lanceolate, like stems covered with coarse bristles. Flowers smaller; calyx 3—4 mm long; corolla ca. 7 mm long. (Along banks of Baikal) . . . . . 1. **C. subvillosum** Lehm.

\+ Compact tufts. Leaves of rosettes and stems narrower, lanceolate or sublinear, with soft entangled hairs, sometimes locally lanate. Flowers slightly larger. (Two hardly distinguishable species of Altai.) . . . . . 3.

3. Calyx 4.5—6 mm long; corolla 5.5—7.5 mm long, with ovate obtuse lobes; filaments slightly longer than corolla . . . . . 2. **C. canescens** DC.

533 \+ Calyx 6.5—7.5 mm long; corolla 9—10 mm long, with triangular-lanceolate lobes; filaments nearly as long as corolla . . . . . 3. **C. subfloccosum** Kryl.

Section 1. EU-CRANIOSPERMUM M. Pop. — Crown shifted to upper part of nutlet, lower part of dorsal surface free, visible. Wings with entire margin nearly obliterating aperture through which disk is visible. Perennial herbs, with branching caudex bearing rosettes. Stamens little protruding, teeth of corolla short, erect; stigma capitate-disklike.

1. **C. subvillosum** Lehm. Pl. Asperif. II (1818) 367; Ldb. Fl. Ross. III, 174; Turcz. in Bull. Sos. Nat. Mosc. XXIII (1850) 512; Brand in Pflanzenr. IV, 252, 103, excl. syn.: Diploloma echioides Schrenk et Craniospermum echioides Bge. — Craniospermum hirsutum DC. Prodr. X(1846) 175. — Solenanthus? baicalensis DC. l.c. 166. — Cynoglossum baicalense Pall. ex Roem. et Schult. Syst. IV (1819) 764. — Ic.: Lehm. Ic. Rar. Stirp. (1821) tab. 50; Turcz. l.c. tab. 11.

Perennial; root thick, short, black, with up to 10 thick black branches, their apices covered with scaly remnants of the previous year's leaves, each branch with 1—2 rosette-bundles of green leaves; leaves of rosettes lanceolate- or oblong-lanceolate-spatulate, 5—10 cm long, obtuse, gray, semi-appressed, leaves with spreading bristly margins (especially on petiole), the bristles on small tubercles, with small bristles in between; petioles gradually tapering to blade, nearly as long; blade to 1—1.5 mm wide; the radical leaves small at flowering reaching full size at fruiting. Fertile stems lateral, 2—5 cm in flower, to 10—12 cm long in fruit, simple, with spreading rufous bristles, weak, with few small sessile oblong obtuse leaves, the capitate apical racemes remaining short in fruit; flowers sessile; calyx 3—4 mm long in flower, rufous-villous, the lanceolate-linear lobes to 10 mm in fruit, sacciform, its lobes apparently united with bristles; corolla violet-pink, ca. 7 mm long with triangular, erect, to 1 mm long teeth; anthers and stigma little protruding from corolla; nutlets ca. 3 mm long, narrowly oblong, gray-brown, sides and free lower dorsal surface transversely coarsely-rugose; wings 2 mm long, to 1 mm wide, gray; cicatrice brown, ca. 1 mm long.

534 Sandy and gravelly banks, stony slopes. — East Siberia: Ang.-Say. (near Lake Baikal), Dau. Endemic. Described from Lake Baikal (apparently from Pallas' collections). Type in London.

Note. A very common plant at the southern end of Lake Baikal, often collected, never found in adjacent Mongolia, hence presumably an endemic Baikal species. Herder reports it for Dauria Inshan'.

2. **C. canescens** DC. Prodr. X (1846) 175; Ldb. Fl. Ross. III, 175; Kryl., Fl. Alt. IV, 913; Fl. Zap. Sib. IX, 2258; Brand in Pflanzenr. IV, 252, 103.

Perennial; root thin, vertical, dark, with 3—5 short crowded, 1—2 cm long branches bearing dense tufted bundle-rosette of upright elongate, narrow, 5—8 cm long leaves to 5—8 mm wide at apex, narrowly lanceolate or sublinear-spatulate, gradually tapering to base, acute, with soft white hairs semi-appressed, along margin spreading, grayish white; stems lateral, 5—12 cm long, with lanceolate leaves and white soft-entangled hairs, nearly lanate. Raceme capitate, white or slightly rufous, softly lanate; flowers sessile; calyx 4—5 mm long, soft-lanate; corolla ca. 7—8 mm long, tubular, its teeth exceeding 1 mm, dark violet, oblong, obtuse; anthers narrowly linear, hardly protruding; stigma capitate, not protruding from corolla teeth. According to Krylog the anthers and stigma sometimes protrude markedly.

West Siberia: Alt. (collected once only in SE Altai, along Tobogosh River, a tributary of Chuya, in subalpine belt, flowers, VII 1832, Bunge). Endemic. Type in Leningrad.

3. C. subfloccosum Kryl. in Tr. Bot. Sada, XXI (1903) 10; Fl. Alt. IV, 913 and Fl. Zap. Sib. IX, 2258. — Ic.: Kryl., op. cit. (1903) Table 5, Fig. 2, a—f.

Perennial; root vertical, in upper part branching, densely covered with brown remnants of leaves, bearing rosettes and 1 or few fertile stems, 7—15 cm high; radical leaves 5—9 cm long, 4—6 mm wide, grayish with contiguous retrorse hairs, lanceolate or linear-lanceolate, acute, gradually tapering to petiole, about as long as blade; cauline leaves smaller (2—3.5 cm long, 5—7 mm wide), sessile, lanceolate, obtuse, especially upper part densely covered like stem with grayish flocculent tomentum of fine long hairs.
535 Flowers subsessile, clustered in compact apical capitate inflorescence subtended by 1—2 cauline leaves; bracts lanceolate-linear, inconspicuous; calyx 6.5—7.5 mm long, with dense long hairs, its lobes linear obtuse; corolla lilac, 9—10 mm long, with triangular-lanceolate obtuse teeth, 1 mm—2 mm long; filaments nearly as long as corolla; anthers protruding; stigma usually not protruding from corolla teeth.

West Siberia: Alt. (only in SW Altai, near Katon-Karagai, flowers, V 1901, Krylov). Endemic. Type in Tomsk.

Note. As no specimen was found, the description was taken from Krylov's "Fl. Zap. Sib." (IX, 2258—2259). I am almost convinced that it is identical with the preceding species and that Krylov's distinctions are not reliable. All considered, there seem to be only two species of Eu-Craniospermum: 1) on the Baikal (C. subvillosum Lehm.); 2) on the Altai (C. canescens DC.) — whiter and soft-lanate, not bristly, with narrower leaves, cespitose. Curiously neither has ever been found in Mongolia.

Section 2. DIPLOLOMA (Schrenk) M. Pop. — Diploloma Schrenk in Bull. phys.-math. Acad. Petersb. II (1844) 195. — Crown of nutlet a cartilaginous-fleshy, eroded finely dentate wing enclosing entire dorsal areola, open. Stamens very strongly protruding. Corolla lobes rather large, ovate, recurved (appearing as rudimentary limb). Stigma a point. Biennial.

4. C. echioides (Schrenk) Bge. Heliocarya (1871) 10. — Diploloma echioides Schrenk, l. c.

Perennial; monocarpic; root rather thin, vertical, bearing 1 small compact rosette and 1—3 low thick large stems; leaves of rosette lanceolate-spatulate, apparently not longer than 5 cm, acute, both sides with semi-appressed thin bristles gradually tapering to petiole, with bristles on small tubercles; due to long, dense, not very coarse bristles the previous year's petioles form a nearly tomentose envelope below the live rosette; stems 10—20 cm high, erect, simple, with fine velutinous down and remote long bristles, slightly faceted inflorescence of 3—7 tightly crowded compact racemes forming a corymbiform panicle; cauline leaves lanceolate, short, sessile, grayish, acute. Fruiting racemes elongate, not capitate, 3—7 cm
536 long, with crowded calyces; fruiting calyx sessile, ca. 8 mm long, with linear acute very long and coarse bristly lobes, bristles rufous, calyx abscissing with nutlets; bracts lanceolate-linear, shorter than calyx; corolla ca. 8 mm long, glabrous in throat, its lobes oblong with undulant margin, slightly recurved,

ca. 2 mm long, tapering to base; filaments protruding from lobes for 3 mm, attached slightly above middle of corolla on a tuberclelike swelling, corolla folded inside; nutlets oblong, 3—3.5 mm long, their sides indistinctly rugose, dark, shiny; ventral keel above cicatrice very broad, the wing low but thick, paler than body of nutlet, with margins curved toward disk leaving only a narrow slit, its finely toothed rim turned outwards. May.

Cliffs and dry stony slopes in southern steppe belt (and zone), 50—52° N. — West Siberia: Irt.: Ulu-Tau Mountains (flowers, fruit, 30 V 1842, A. Schrenk). Endemic. Described from locality indicated. Type in Leningrad.

Note. A very interesting plant, in point of habit most nearly resembling Arnebia; in the calyx, corolla and fruit very close to Craniospermum, as discussed in detail by Bunge (l. c.). The wing of the nutlets has a very interesting structure and has only very little in common with the thick wing, ascending for approximately 1 mm of Eu-Craniospermum; here its margin carries small denticle-papillae, whereas the disk carries a smooth, thinner plate which covers both its sides, nearly hiding the margins, leaving only a small slit. In Eu-Craniospermum, the edenticulate wing forms a small vesicle with thin walls. Bunge's suggestion (l. c. 10) that in the Altai C. canescens (his C. subvillosum) the wing may bear anchorlike spines appears to be unfounded.

Craniospermum and Diploloma were often included in the tribe Cynoglossum, which would be acceptable if Cynoglossum was delimited as in De Candolle (1846) or by Ledebour and Bunge. But once Bentham and Hooker had separated the Eritrichieae from Cynoglossum, Craniospermum appeared to belong to the latter. However, the cicatrice, protruding on the ventral side in the shape of a ski, the type of corolla and to some extent of the wing, lead me to accommodate Craniospermum in a tribe by itself.

Tribe 10. **HETEROCARYEAE** Zak. Burachn. Zeravsh. (1941) 4, 7. — Tribe Cryptantheae Brand in Pflanzenr. IV, 252 (1931), ex parte. —
537 For characteristics see Key (p. 85) and description of Heterocaryum. — One genus: Heterocaryum DC.

Genus 1222. **HETEROCARYUM*** DC.

DC. Prodr. X (1846) 144; Brand in Engl. Pflanzenr. IV, 252 (1931) 95; Zakir. Burachn. Zeravsh. 7, 16; Popov in Bot. mat. Gerb. inst. AN SSSR, XIII, 206.

Calyx cut nearly to base into lanceolate-linear lobes elongating in fruit, otherwise calyx unchanged, its lobes only in very oblique fruit sometimes shifting in relation to the other, sometimes falling. Corolla blue-violet, small, brachymorphous, ca. 2 mm long, its tube and sometimes entire corolla shorter than calyx, limb campanulate, not flat as in all other annuals with very reduced corolla, as long as tube. Scales in throat small, papillate. Style short, enclosed in corolla tube; stigma capitate, entire. Gynobase

* From the Greek heteros — different, carya — nutlet.

large, often very oblique and the nutlets apparently decurrent, vertical, 4-winged, nutlets enclosed in angles between wings, style short, sitting crosswise at apex of wings, not elongated or thickened in ripe fruit. Fruit zygomorphous-tapering; nutlets usually unequal (hence the generic name), the upper differing from the 2 more or less equal lateral ones, the lower different from all others, shifted behind the upper; the differences are in the degree of "decurrence" along the fruit stalk and in the ornamentation (spines or wings); in general the nutlets are small, flat, dorsoventrally compressed, 4—7 mm long, oblong, with distinct dorsal areola bearing, often only along its margin, spinules with anchorlike head or dentate wing, its teeth bearing spines with anchorlike head; if nutlets winged then their disk is always smooth (a remarkable correlation). Plant usually covered with thin bristles; one species subglabrous. Leaves linear or lanceolate. Fruiting racemes sparse, with erect bracts. Pedicels long, often thickened, rarely very short. Annual, medium-sized or low erect herbs, with narrow leaves and small flowers.

A genus of the Eastern subregion of the ancient Mediterranean region, ephemerals growing in deserts and semi-deserts, especially in mountainous semi-deserts.

Lipskii, citing Boissier, recognized a single species ("There can be no argument on species or even varieties" (l. c. 537)), excluding E. laevigatum K. K., which he himself had earlier recognized. We cannot agree with this.

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1. Fruits in narrow, loose, flexuose, elongated racemes, subsessile or sessile, thick, short, 4—5 mm long. Lateral nutlets with cup-shaped, scabrous, long-aculeate, winglike rim (wing), slightly recurved at margin, lower nutlet with smooth back, markedly decurrent, nearly arcuate, with free, digitiform-aculeate apex, upper nutlet erect, also with smooth back, with digitiform apical spines and some remote marginal ones . . . . . 6. H. oligacanthum (Boiss.) Bornm.

+ Fruit-stalks elongate, horizontal or obliquely upright, longer than fruit, thickened, gradually thickening above . . . . . 2.

2. Two lateral nutlets with cup-shaped, unequally developed wing with large aculeate teeth, the cup well developed on one, less so on the other. Lower nutlet smooth along back, markedly decurrent on stalk, with spines confined to apex, nearly digitiform, upper nutlet unarmed along back but with uniformly disposed anchorlike spines along thickened margin of back. Plant bristly-hairy, rather robust. Pedicels sometimes reduced . . 5. H. szovitsianum (Fisch. et Mey.) DC.

+ Fruit with cup-shaped, winglike rim on one of the nutlets, but then the plant thin, subglabrous and the nutlets appressed-downy (H. laevigatum) or without winglike rim on all nutlets . . . . . 3.

3. Plant thin, lower, usually 10—15 cm high, subglabrous, glaucescent; leaves flat, oblong-linear or lanceolate, glabrous, with few appressed spinules confined to margins. Fruiting racemes loose. Pedicels thin, long, gradually thickening at apex, horizontally drooping. Fruit tapering markedly. Upper nutlet usually with winglike dentate rim, and glabrous disk, the other nutlets with appressed-gray-downy disk and remote marginal spines. . . 1. H. laevigatum (Kar. et Kir.) DC.

All nutlets wingless or without winglike rim, margin with remote anchorlike spines, back smooth or also bearing spines. Plant with thin bristly hairs, the leaves narrower, lanceolate, hairy . . . . . 4.

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4. Lower nutlet with smooth back, tuberculate, markedly decurrent (i. e., fruit rather oblique), with sparse short spines along thickened margin, apex with a group of nearly digitiformly protruding anchorlike elongated spines (as in H. szovitsianum); lateral nutlets and the slightly longer upper nearly equal, with tuberculate back, the thickened margin, seen as an elevated line, bearing rather long anchorlike spines with rather broad base. Plant robust, to 40 cm high, usually branching and bristly-hairy. Pedicels almost as long as fruit (7—9 mm). (S. Central Asia, S. Transcaucasia). Close to H. szovitsianum . . . . . 4. M. macrocarpum Zak.

\+ Fruit shorter, 5—7 mm long, not as oblique; lower nutlet less decurrent, the stalk erect, 2—3 times as long as fruit. Plant less robust and thinner than the preceding (2 very close species) . . . . 5.

5. Back of lower and upper nutlets entirely covered with several rows of spines, with slightly larger anchorlike spines on broadening base along thickened margin; lateral nutlets with tuberculate back, and long, rather remote spines broadening at base along strongly ascending undulant margin (throughout entire distribution area of genus) . . . . . 2. H. rigidum DC.

\+ All nutlets dorsally tuberculate only, along the margins of dorsal areaolae, along thickened line, all nutlets bear rather thin, long spines slightly broadening at base (only in L. Volga) . . . . . 3. H. echinophorum (Pall.) Brand.

Series 1. Laevigata M. Pop. — Subglabrous plant, with few bristles confined to margin. Stem delicate, subglabrous. Fruit very oblique, lower nutlet shifted towards back stalk, nearly half length of upper nutlet. The nutlets appressed-gray-downy, the upper often with winglike rim with long marginal spines and then disk glabrous, lateral nutlets very narrow, appressed-downy with spines confined to margin. Lower leaves opposite.

1. H. laevigatum (Kar. et Kir.) DC. Prodr. X (1846) 145; Ldb. Fl. Ross. III, 164; Brand in Pflanzenr. IV, 252 (1931) 97. — Echinospermum laevigatum Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 441; Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII, 441; Boiss. Fl. or. IV, 248; Lipskii in Tr. Bot. Sada, XXVI, 340.

Annual; stem thin, well-proportioned, 10—15 cm high, simple, glabrous, with solitary appressed bristles in upper part, often terminated by one simple scorpioid cyme, sometimes once furcately branched above, each

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branch bearing a scorpioid cyme; leaves confined to stem (spring plant), the lower 1—2 pairs opposite, the others alternate, sometimes oblong, often linear-oblong or lanceolate, flat, the lower leaves obtuse, slightly spatulate, the upper sessile, acute, all leaves glabrous above and beneath (with few large, indistinct tubercles), with flat white tubercles along margin, sometimes bearing bristles appressed to margin of leaf. Fruiting racemes flexuose, very loose, elongate but with few stipes; long pedicels almost

PLATE XXVI. 1 — Heterocaryum laevigatum (Kar. et Kir.) DC.; 2 — H. szovitsianum (Fisch. et Mey.) DC.; 3 — H. rigidum DC.

three times as long as fruit, horizontally spreading or drooping, erect or slightly arcuately curved, gradually thickening above, with sparse appressed bristles; calyx very small, ca. 1.5 mm long, in fruit its lobes to 3 mm long, oblong-lanceolate, acute, with few bristles marginal; corolla reddish-violet, as long as calyx, not more than 2 mm long; fruit small, ca. 5 mm long, very twisted (zygomorphous); lower nutlet strongly shifted backward on stalk, the upper protruding for nearly half, usually with cup-shaped marginal wing bearing long anchorlike spines, and then disk glabrous, sometimes wings lacking and then all nutlets nearly equal, with appressed-downy narrow lanceolate disk, bearing thin anchorlike marginal spines, 2—3 times as wide as disk. April. (Plate XXVI, Figure 1.)

Stony slopes in mountains and stony deserts. — Centr. Asia: Ar.-Casp. (to Inder Lake in the north), Balkh. (western part only, along Sara-Su River), Kyz. K., Dzu.-Tarb. (Dzungarian Ala-Tau), Pam.-Al. (Kugitang, Kabadian), Mtn. Turkm. (Kushka). Gen. distr.: Iran. (N. Afghanistan, Iran). Described from Ai River and source of Sassyk-Pastau in Dzungarian Ala-Tau. Type in Leningrad.

Series 2. **Rigida** M. Pop. — Small, 10—15 cm high plant, appressed-thin-bristly at first, later with spreading thin bristles and linear bristly leaves. Fruit tapering slightly, lower nutlet slightly shifted brackward in relation to the upper, all nutlets wingless. The most widespread series, reaching furthest north (L. Volga) and apparently also south (to NW Himalayas).

2. **H. rigidum** DC. Prodr. X (1846) 145; Ldb. Fl. Ross. III, 163. — H. minimum Zak. Burachn. Zeravsh. (1941) 16, non DC. — Echino-
543 spermum minimum C. B. Clarke in Hook. Fl. Brit. Ind. IV, 162—163 (non Lehm.)— E. szovitsianum Boiss. Fl. or. IV, 248, p. p. — E. echinophorum (Pall.) Lipsky in Tr. Bot. Sada, XXVI (1910) 533—539, p. p. — H. echinophorum (Pall.) Brand. var. a. minimum (Lehm.) Brand in Pflanzenr. IV, 252 (1931) 95, p. p. — Echinospermum heterocaryum Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1854) 411. — Lappula echinophora Kusn in Mat. Fl. Kavk. IV, 2 (1913) 167, p. p. — Exs.: Herb. Fl. Cauc. No. 181 (sub nom. H. szovitsianum Fisch. et Mey.).

Annual; stems 10—15, in the south to 25 cm high, erect, robust, thick, with very sparse, semi-appressed, white spiny hairs, sometimes simple, with single raceme, often with dichasial-bifurcate cyme with a flower in bifurcation, the 2 branches terminated by raceme; leaves linear, elongate, to 8 cm long, flat, obtuse, rarely (small individuals) acute, with sparse bristles, rather soft, declined. Racemes loose in fruit, not many-flowered, with few lanceolate-linear acute bracts; pedicels long (1—2 m) much thickened, semi-spreading, with white thin bristles, straight, at 45°, 2—3 times as long as fruit; calyx ca. 1.5—2 mm long, the lanceolate, obtuse lobes sparsely bristly, in fruit linear, markedly elongating, arcuately curved; corolla violet-blue (blue in northern forms ?), slightly exserted from calyx, with campanulate limb; fruit small, 5—6 mm long, slightly tapering; upper and lower nutlets covered with anchorlike spinules over margin and entire dorsal areola but here spines thinner, lateral nutlets with marginal spines only, these rather thin and long, gradually tapering to base. April. (Plate XXVI, Figure 3.)

Deserts and mountain semi-deserts, sandy, stony or loess soil, late ephemerals. — Caucasus: S. and E. Transc.; Centr. Asia: Ar.-Casp., Balkh., Dzu.-Tarb., T. Sh., Pam.-Al., Mtn. Turkm., Kyz. K., Syr D. Gen. distr.: Iran., Ind.-Him. Described from Lepsa River (Dzungarian Ala-Tau). Type in Geneva, cotype in Leningrad.

Note. The most widespread species, usually referred to as Echinospermum (or Heterocaryum) minimum Lehm., the name under which the Moscow Society of Nature Lovers circulated the Karelin and Kirilov specimens from Lepsa River (number 1751). One of these specimens De Candolle (son) used to describe his H. rigidum DC. The nutlets are poorly and inaccurately described nor did he detect their heteromorphy. There are differences between the southern form with its strongly branching
544 (repeatedly furcate) and higher stem and scabrous spines at the margins of the nutlets (including the type species) and the northern form with its low, once furcate stem and thin, exquisite, marginal spines. In habit and character of the spines the latter approaches the following species, which is not quite clear to me as I have not seen any specimens from the Lower Volga area. Neither were they seen by Shmal'gauzen (Fl. II, 224), who describes as Echinospermum minimum Lehm. only the specimens he had seen from Inder Lake. In my opinion these are the northern form of H. rigidum DC.

3. H. echinophorum (Pall.) Brand in Pflanzenr. IV, 252 (1931) 95, var. a. minimum (Lehm.) Brand, p.p. — Echinospermum echinophorum (Pall.) Bornm. Pl. Strauss. II (1906) 190; Lipskii in Tr. Bot. Sada, XXVI 533—539, p.p. — Lappula echinophora (Pall.) O. Kuntze in Tr. Bot. Sada, X (1887) 214; Fl. Yugo-Vost. VI, 84. — Myosotis echinophora Pall. Reise, III (1776) 717. — Heterocaryum minimum DC. Prodr. X (1846) 144; Ldb. Fl. Ross. III, 163, p.p. — Echinospermum minimum Lehm. Pl. Asperif. II (1818) 126, 127. — Ic.: Pall. l.c. tab. Ii, fig. 1, A; Fl. Yugo-Vost. VI, 85, Fig. 576.

Annual; stem ca. 10 cm to 20 cm high. Canescent plant, with coarse spreading hairs on tubercles, rarely smooth. Stem erect, simple, sometimes branching from base and then broadly spreading. Leaves linear-lanceolate, obtuse, ca. 2.5 cm long, 1.5—4 mm wide; bracts linear, acute, longer than flowers. Flowers in few-flowered spreading bostryces. Pedicels long, thick, sturdy, 2—3 times as long as fruit (sometimes as long or shorter), declined. Calyx with linear lobes, as long as or longer than nutlets. Corolla blue, as long as calyx. Oblong fruit 5 mm long. Outer areola of nutlet covered with obtuse tubercles, with or without keel, surrounded by filiform rim with 1 row of hamate spines much longer than nutlets wide, broadening at base. April—June.

Stony localities and steppes. — European part: L. V. (estuary of Volga, Paczoski, Claus; Caspian area, Claus). Endemic. Described from Chernoyar, steep banks of the Volga. Type in London.

Note. I have not seen specimens of this species. De Candolle (l.c.) included it in the group Nuculae in eodem fructu similibus (an semper?). He distinguished it from H. rigidum by the uniformity of the nutlets, with spines confined to the narrow margin of the dorsal areola. According to the drawings and the description in all nutlets the disk of the Volga species

has spines only along its margin. Even so, the species must be very close to the northern form of H. rigidum DC. The above description is from
545 "Flora Yugo-Vostoka," which also contains a very good drawing in particular of the fruit.

Series 3. Macrocarpa M. Pop. — Plant sturdier and higher, 15—30(40) cm, bristly-hairy, with linear obtuse leaves. Fruit larger, 6—8(10) mm long, wingless or with wings on one or both lateral nutlets; pedicels shorter, almost as long as fruit. — Southern part of Centr. Asia, south of Transcaucasia and Iran.

4. H. macrocarpum Zak. Burachn. Zeravsh. (1941) 16, Figure 3.

Annual; stem erect, robust, thick, repeatedly furcate, rarely (small individuals) only once, furcate leaves thin-bristly, with spreading semi-appressed bristles; leaves sessile, ribbon-shaped or narrowly linear, elongate, obtuse, flat or longitudinally folded, more or less, not very densely, villous. Racemes few-flowered, with small linear long bracts in fruit sparse, peduncles rather short, thick, at angle of over 45°, straight or slightly arcuate, rather densely appressed-bristly; calyx ca. 2 mm long, the bristly linear lobes markedly elongating in fruit, sometimes exceeding fruit, often falling off; corolla blue-violet, as long as calyx; fruit large, 7—9 mm long, zygomorphous-tapering, much more massive than in preceding series, weaker than in L a e v i g a t a; lower nutlets strongly decurrent on peduncle, slightly arcuate, unarmed, but with elongated elevations along back, intertwined with lines, nearly tuberculate, and few short anchorlike spines along slightly thickened margin interspersed with several long divided palmately spines; upper nutlet almost identical, shorter, more erect, with apical spines not as long-spreading as spines in front; lateral nutlets with 6—8 strongly broadening spines with anchorlike tip along base of elevated margin. April.

Loess hills and stony slopes. — Caucasus: S. and E. Transc. (Nakhichevan ASSR, S. Armenia; lower reaches of the Kura nearly to Baku); Centr. Asia: T. Sh. (west, to Tashkent in the east?), Syr D., Pam.-Al. Gen. distr.: Iran. Described from Samarkand (Zakirov). Type in Tashkent.

N o t e. Surprisingly this beautiful species was not distinguished from H. m i n i m u m DC. or H. r i g i d u m DC.: its pedicels are shorter, its fruit larger, more zygomorphous, the lower nutlet is arcuately curved as compared with the straight one of series Rigida. Likewise the sculpture
546 of the unarmed disk of the nutlets is characteristic. The species appears to be very widespread in Iran, reaching to S. Transcaucasia.

5. H. szovitsianum (Fisch. et Mey.) DC. Prodr. X (1846) 145; Ldb. Fl. Ross. III, 163; Zakir. Burachn. Zeravsh. 17. — E c h i n o s p e r m u m s z o v i t s i a n u m Fisch. et Mey. Ind. II Sem. Hort. Petrop. (1835) 36; Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII, 411; Boiss. Fl. or. IV, 247, p. p. — E. e c h i n o p h o r u m Lipsky in Tr. Bot. Sada, XXVI (1910) 533—539, p. p. — H e t e r o c a r y u m m i n i m u m var. s z o v i t s i a n u m Rgl. in Tr. Bot. Sada, VI (1880) 344. — L a p p u l a e c h i n o p h o r a var. s z o v i t s i a n a O. Kuntze in Tr. Bot. Sada, X (1887) 214. — L. e c h i n o p h o r a

Kusn. in Mat. Fl. Kavk. IV, 2 (1913) 167, p.p.— Heterocaryum echinophorum (Pall.) Brand var. a. minimum (Lehm.) Brand in Pflanzenr. IV, 252 (1931) 95—96, p.p.

Annual; closely resembling the preceding species in the characters of the vegetative organs and scarcely distinguishable from it in flower; but the fruit differs markedly — is slightly shorter (6—7—8 mm long) and much wider by virtue of the broad wings of the lateral nutlets; lower nutlet markedly shifted to the back as in preceding species, decurrent, arcuate, ski-shaped, disk with tubercles elongating in longitudinal elevated lines, and several marginal palmately divergent apical spines; upper nutlet generally similar, shorter and straighter; lateral nutlets unequal (at height of cup), calyciform-winged, the stiff wing with dentate margin, its teeth terminated by an anchorlike spine, rarely one lateral nutlet nearly without wing; disk of winged nutlets always smooth; pedicels thick, as in preceding species, obliquely curved, almost as long as fruit. Plant loosely or densely hairy, canescent. April—May. (Plate XXVI, Figure 2.)

Wooded and stony slopes in mountain semi-desert belt, sometimes in oases.— Caucasus: S. and E. Transc. (same distribution area as for the preceding species); Centr. Asia: T. Sh. (W.), Pam.-Al., Mtn. Turkm. Gen. distr.: Iran. Described from N. Iran. Type in Leningrad.

Series 4. Sessilia M. Pop.— Pedicels very short; fruit subsessile or sessile, slightly zygomorphous-tapering, generally resembling H. szovitsianum. One or both lateral nutlets with cup-shaped dentate wing and then the disk smooth. Plant with thin spreading bristles and narrow linear leaves.

6. H. oligacanthum (Boiss.) Bornm. in Beih. Bot. Centralbl. LIX (1939) 306; Zakir. Burachn. Zeravsh. 16.— Echinospermum oligacanthum Boiss. Fl. or. IV (1879) 248.— Lappula echinophora var. sessilis O. Kuntze in Tr. Bot. Sada, X (1887) 215.— Echinospermum echino-
547 phorum var. sessile Lipsky in Tr. Bot. Sada, XXVI (1910) 539.— Heterocaryum echinophorum var. c. oligacanthum Brand in Pflanzenr. IV, 252 (1931) 96.

Annual; stem erect, robust, thinner than in preceding series, usually with long spreading branches from base or middle, rarely simple, semi-appressed or with sparse spreading bristly hairs, 10—20(30) cm high; leaves with spreading bristly hairs, soft, narrowly linear, often curved, elongate, acute, often longitudinally folded; fruiting racemes long, narrow, loose, flexuose, sometimes axis thickened, often longer than leaf-bearing part of stem. Flowers very small, smaller than in all the preceding groups, sessile; calyx bristly, corolla less than 1 mm long, violet, not longer than calyx; calyx lobes in fruit linear or lanceolate, slightly shorter than fruit; fruit 4—5 mm long, rather broad; lower nutlet curved with lines of tubercles along unarmed disk, margin of liguliform protruding apex with anchorlike palmately divergent spines; upper nutlet obsolete, smooth, the lateral unequal, highly calyciform-winged and then the disk smooth, sometimes single nutlet winged, the other only with spines markedly broadening at base and then disk tuberculate. April—May.

Weedy localities in loess foothills, oases in semi-desert mountain belt. — Centr. Asia: Pam.-Al., Mtn. Turkm. Gen. distr.: Iran. Described from E. Iran (Sirjan-Kerman, Bunge, III 1859). Type in Geneva, cotype in Leningrad.

Note. This species is naturally close to H. szovitsianum but lower, the stems thinner, the leaves narrower, the racemes slightly flexuose and the pedicels nearly obsolete. The fruit is shorter, the flowers are half the length of those of H. szovitsianum. These are annual, weedy plants which may have originated quite recently after the introduction of agriculture.

Heterocaryum deserves further cytological, embryological, systematic and geographical study because of its unique zygomorphous fruit, the combination of its characters and its remarkable division into species. A striking feature is the postfloral, zygomorphous growth of the fruit, and the differentiation of the various nutlets, with separation (appearing as rupture) of the calyx. It is curious that in H. laevigatum the winglike rim may develop only in the upper nutlet, and in H. szovitsianum and H. oligacanthum only in the lateral nutlets, although not symmetrically. Also the presence of a wing is correlated with smoothness of the nutlet, as against
548 the characteristic tubercles and spines on the disk of wingless nutlets in the same fruit. The origin of Heterocaryum is undoubtedly linked with the origin of Suchtelenia, another annual (reduced) genus with the same uncommon large gynobase and nutlets hidden between its winglike vertical protuberance, which has almost exactly opposite characters.

Tribe 11. **ROCHELIEAE** DC. Prodr. X (1846) 175. — Annual thin herbs with linear leaves. Calyx markedly cordate-triangular divided nearly to base into linear lobes elongating in fruit, or lanceolate, often linear, enclosing or surrounding corolla. Corolla blue, very small, hardly longer than calyx, with very small limb. Lobes of ovary 2. Nutlets 1—2, small, trihedral-ovoid or oblong, attached to slightly conical, rather flat base of style, on small, nearly dotted flat areola at base of ventral keel; style persistent, the apically growing nutlets adnate to style by ventral keel; nutlets with tubercles at tipped with stellate hairs. Distinguished from Eritrichieae (Lappula) by 2- (not 4)-lobed ovary and nearly basal nutlets. One genus, in Iran. Differs from Harpagonelleae by the very strong calyx without hornlike processes and nutlets not hidden in cavity of sepals, etc.

Genus 1223. **ROCHELIA*** Rchb.**

Rchb. in Flora, VII (1824) 243.— Raclathris Raf. Sylv. Tellur. (1838) 167.

Calyx 5-parted, its lobes linear or lanceolate, accrescent in fruit, convergent, hamately incurved, rarely erect, declined, with sagittate tips, not curved, with obtuse basal auricles. Corolla tube cylindrical, as long as calyx, longer than limb is wide, erect or slightly curved; throat of corolla glabrous or with small obscure scales, the limb blue, small, funnel-shaped, with 5

* Treatment by N.V. Pavlov; additions and revisions by M.G. Popov.

** After A. Rochel, university gardener and botanist in Pest.

(rarely 6—7) rounded lobes. Stamens 5, filaments very short, with anthers enclosed in corolla, anthers oblong, slightly depressed at base, connective shortly protruding. Ovary 2-lobed, bilocular, the more or less long style protruding between lobes, stigma capitate. Nutlets 2, stiff, uniseriate,
549 attached with narrow areola to base of style, at base of ventral keel obliquely broadening at base, rounded, acuminate-tapering, narrow back and sides covered with stellate-anchorlike short tubercles or glabrous. Seeds erect, cotyledons oval, flat, rootlet more or less long. Annual thin herbs, usually branching, with soft or bristly hairs. Leaves alternate, narrow, nearly linear; flowers small, racemes simple or branching, with pedicels more or less long and thick, bracts linear, opposite or slightly shifted.

Note. Many species, in particular R. disperma and R. cardiosepala, are rather widespread weeds in Central Asia.

1. Sepals in fruit narrowly linear to filiform-linear, without protruding midrib, usually arcuately curved around fruit; nutlets clearly visible between sepals. Pedicels appressed-downy, thin. (Section Eurochelia, series Stellulatae) . . . . 2.

\+ Sepals in fruit lanceolate, oblong or cordate-deltoid, with thick sharply protruding midrib, margins often extended and then nutlets hardly visible or entirely enclosed. Sepals slightly curved, not arcuate. Peduncles spreading, with short bristles . . . . 6.

2. Nutlets smooth, shiny, without tubercles. Calyx in fruit ca. 3 mm long, nearly as long as nutlets. Plant small, thin, usually branching . . . . 6. **R. leiocarpa** Ldb.

\+ Nutlets with dense fine tubercles, with stellate anchorlike tip . . . . 3.

3. Calyx in fruit ca. 3 mm long, nearly as long as fruit, its hairs with hamate apex; sepals appressed to nutlets. Habit and growth as in preceding species. Leaves narrowly linear. (Centr. Asia). . . . . 4. **R. bungei** Trautv.

\+ Calyx as above, leaves wide, flat. High plant. Calyx hairs not hamate . . . . 5. **R. karsensis** M. Pop.

++ Calyx 4—6 mm in fruit. Sepals arcuately enclosing fruit, not appressed it or stellately spreading . . . . 4.

4. Sepals stellately spreading or slightly arcuate, with hamately curved apex, hairs not hamate; peduncles short, to 2 mm. (Talysh, Kopet Dagh, south of Mugodzhar Hills) . . . . 3. **R. persica** Bge.

\+ Sepals mostly arcuately enveloping fruit (two close species, with transitions) . . . . 5.

5. Pedicels short, 2—4 mm long. Fruiting racemes dense and calyxes adjacent; sepals bear spreading hairs with hamate apex. Plant
550 more spreading-branching, more canescent. (S. Transcaucasia and Kopet Dagh) . . . . 1. **R. disperma** (L. f.) C. Koch.

\+ Pedicels longer, 3—10 mm long. Fruiting racemes looser, calyx usually not adjacent. Sepals without hamate hairs. Plant less canescent. (Centr. Asia, everywhere, SE European part of USSR, Caucasus and Crimea). . . . . 2. **R. retorta** (Pall.) Lipsky.

6. Sepals lanceolate, with thick midrib, erect or appressed to or curved away from fruit, usually with hamate tip, sometimes more or less fused (in one species for $^2/_3$ or $^3/_4$). (Series Pedunculares) . . . . 7.

+ Sepals in fruit 5—7 mm long, at base cordate, triangular-deltoid, with thick midrib and the perpendicular nerves converging in a pyramid and compactly adjacent to each other by their sides, hence nutlets invisible. (Section Cryptocarpa) . . . . . 12. R. **cardiosepala** Bge.

7. Nutlets smooth, shiny. Sepals more or less connate . . . . . 8.
+ Nutlets stellate-tuberculate. Sepals nearly free . . . . . 9.

8. Sepals connate only at base; calyx generally campanulate. Peduncles ca. 5 mm long, horizontal (in transitional individuals to 8 mm long, sepals hardly connate. Stems usually branching from base. (Upper Zeravshan) . . . 7. R. **campanulata** M. Pop. et Zak.
+ Sepals connate for $^2/_3$ or $^3/_4$; teeth short, triangular. Peduncles drooping, nodding, 8—10 mm long. (Upper Zeravshan) . . . . . 8. R. **claviculata** M. Pop. et Zak.

9. Sepals ca. 3 mm long in fruit, its lobes appressed to fruit. Peduncles ca. 3 mm long. Plant 5—7 cm high, spreading-branching. (Yakkabag, described by R. Bunge) . 9. R. **jackabaghi** Pavl.
+ Calyx 5—10 mm long in fruit, campanulate, with divergent lobes. Pedicels 5—10 mm long . . . . . 10.

10. Peduncles rather thin, erect or obliquely spreading. Sepals free to base, lanceolate, erect, not curved its apex hardly hamately inward curved. Dwarf plant, (1)2—7 cm high. Fruiting racemes short, sometimes capitate. (Kyzyl-Kum, Gorno-Badakhshan) . . . . . 11. R. **macrocalyx** Bge.
+ Pedicels gradually thickening toward apex, horizontally spreading or drooping. Sepals curved outward, their apex hamately curved
551 inward, very slightly but distinctly fusing at base. Fruiting racemes loose, secund. Plant usually 10—15 cm high . . . . . 10. R. **peduncularis** Boiss.

Section 1. EUROCHELIA Zak. Burachn. Zeravsh. (1941) 20. — Sepals 5, in linear or lanceolate, not converging in fruit (because of narrowness) to enclose nutlets; fruit visible from sides of calyx if sepals linear, or if calyx campanulate then from above.

Series 1. **Stellulatae** Zak. l. c. 21. — Sepals narrow, linear, without sharply protruding midrib, usually arcuately or hamately enclosing fruit; fruit visible between sepals, these rarely spreading, with hamately curved apex.

1. R. **disperma** (L. f.) C. Koch in Linnaea (1849) 649 em. Karjagin in Izv. Akad. nauk Azerb. SSR, 12 (1945) 13—14 and 17; Wettst. in Stapf, Bot. Ergebn. Polak. Exped. I, 31, p. p. — Lithospermum dispermum L. f. Decas pl. rar. (1762) 13, tab. 7. — Ic.: Linn. f. tab. VII.

Annual; canescent plant, with rather densely appressed hairs; lower radical leaves spatulate, obovate or oblanceolate, obtuse, 0.5—2 cm long, tapering to short petiole (sometimes in small rosette) early drying up and abscissing, cauline leaves linear, upright, usually longitudinally folded or

curved, 1—2 cm long and broad, sessile, acute, with rather dense appressed hairs, canescent, sometimes white-sericeous; stems low, 6—20, usually ca. 12—14 cm high, appressed-downy, erect, thin, with spreading fruiting racemes. Fruiting racemes dense, 3—10 cm long, calyces with linear bracts adjacent; pedicels short, ½ (⅓—¼) length of calyx, 2—4 mm long, slightly downcurved, with semi-appressed gray hairs; flowers very small; calyx ca. 1.5 mm, in fruit 5 mm long, arcuately or hamately curved, with rather dense spreading hairs with hamate tips, canescent; corolla ca. 2 mm, tube 1.5 mm, limb ca. 0.5 mm long, campanulate, with ovate-rounded lobes; nutlets 3 mm long, obliquely oblong, acute, with dense tubercles with stellate apex; style exserted 0.5 mm from nutlets. April.

Pebbly and stony slopes of lower mountain belt, i. e., in semi-desert belt. — Caucasus: E. and S. Transc. (mainly along Araks); Centr. Asia: Mtn. Turkm. (to Ashkhabad in the east; Kazandshik, Prokhladnoe, Chuli). Gen. distr.:
552 Iran., Arm.-Kurd., Med. Described from Spain (between Cadiz and Madrid). Type in Sweden or England?

2. R. **retorta** (Pall.) Lipsky in Tr. Bot. Sada, XXVI (1910) 455, em. Karjagin in Izv. Akad. nauk Azerb. SSR, 12 (1945) 13—14. — Lithospermum retortum Pall. It. III (1776) app. 718, tab. I, f. 2. — R. saccharata Rchb. in Flora, VII (1824) 243 excl. syn. L. f. — Rochelia stellulata Rchb. Pl. crit. I (1824) 13, tab. 123; Ldb. Fl. Ross. III, 175; Shmal'g. Fl. II, 226, p. p. — R. disperma Kryl. Fl. Zap. Sib. IX, 2288, non L. f. — Ic.: Pall. l. c.; Stankov and Taliev, Opred. Fig. 433; Rchb. l. c. tab. 123. — Exs.: Fl. Cauc. exs. No. 349.

Annual; canescent plant, less densely pubescent than preceding; stems usually high, well-proportioned, not as spreading-branching in inflorescence as in preceding; peduncles longer, 3—10 mm long, drooping; sepals in fruit often shorter, 3—5 mm long, their spreading hairs although furcate usually without hamate apex.

There are many transitional forms linking this species to the preceding one. Karyagin omitted these abundant intermediate forms.

The most typical characters of R. retorta, remote from R. disperma, are encountered in Gorno-Badakhshan; pedicels reaching 10 mm long and drooping. Such long pedicels occur in Turkmenia but here hairs very gray, and sepals bear many hamate hairs. In adjacent areas, from which L. retortum Pall. was described, the pedicels are usually 3—5 mm long but thinner and more drooping than in R. disperma. All the Caucasian specimens included by Karyagin in R. retorta are much closer to R. disperma than the Central Asian. The Kuban plants (for example, Caucasus, Lipskii, 22 V 1892) are hard to distinguish from R. disperma. The Crimean specimens (Fl. cauc. exs. No. 349) are closer to R. retorta from the locus classicus.

European part: L. V., Bl., M. Dnp., V.-Don, Crim.; Caucasus: everywhere at the foot of mountains or in foothills; Centr. Asia: everywhere, mainly foothills. Gen. distr.: Bal.-As. Min., Centr. Eur. Described from steppes in the Caspian area. Type in London.

Note. Reichenbach simultaneously published the description in Flora (1824) 243 as R. saccharata, and in Pl. crit. tab. 123 as R. stellulata; in both cases he erroneously refers to the other species. In "Flora"

(p. 234) he writes "Pl. crit.," but omits to mention that the specific epithet
553 is saccharata, not stellulata. Karyagin apparently did not notice this, nor the fact that Reichenbach (Flora, 243) mentioned the Volga, Crimea, Caucasus and Hungary for his plant and not Spain, in spite of Linnaeus' (the son) synonym which proves that his R. stellulata (saccharata) is Lithospermum retortum Pall. or R. retorta (Pall.) Lipsky em. Karjag.

3. R. **persica** Bge. ex Boiss. Fl. or. IV (1879) 244; Karyagin in Izv. Akad. nauk Azerb. SSR, 12 (1945) 15 and 17.

Annual; grayish-green plant with slightly spreading or appressed bristly hairs; stems 5—20 cm high, simple, rarely slightly branching from base or middle, the unequal thin branches sometimes overtopping the main stem and terminated by short scorpioid, strongly elongating cymes; lower leaves oblong-oblanceolate or linear-spatulate, long tapering to base, sessile, obtuse, upper and median leaves gradually becoming smaller, linear, all leaves 1-nerved, both sides and margins like stem covered with coarse, slightly spreading or appressed bristles on tubercles. Fruiting racemes, elongate, 5—12 cm long, not strongly spreading, rather dense; bracts linear, narrow, longer than peduncles, pedicels thin, very short, 0.5—2 mm long, much shorter than calyx, downcurved in fruit, semi-spreading, bristly; calyx lobes ca. 1 mm long, linear, calyx semi-cylindrical, small, nearly as long as very small, blue or whitish, corolla, elongating in fruit to as long as or slightly longer than nutlets, erect, stellate-spreading, with hamate tips, outside — like pedicels — with oblique straight, not hamate bristly hairs; nutlets small, 1.5—2.5 mm long, usually single, narrow, with sparse grayish tubercles bearing very short sessile hooks, rather easily abscissing; style exserted from nutlets for $^1/_5$ of its length. April—May.

Stony slopes of semi-desert. — Caucasus: Tal. (Zuvand); West Siberia: U. Tob. (Mugodzhar Hills, Dzhaman-Tau); Centr. Asia: Mtn. Turkm. (Gaudan). Gen. distr.: Iran. Described from Iran. Type in Leningrad.

Note. A unique species, first reported by Karyagin among unclassified material in the Litvinov 1898 collections, after a plant collected in Turkmenia on slopes near the village of Gaudan.

Very close to R. retorta. The stellate spreading of the sepals confined to hamately curved ends not constant. Sometimes sepals slightly hairy and arcuately embracing the fruit, the hamately curved ends increasing the resemblance to R. retorta. A constant differential character is the length of the peduncles which are shorter in R. persica (not exceeding
554 2 mm) and longer (3—10 mm, usually ca. 5 mm) in R. retorta. The Mugodzhar specimens with more frequent pubescent sepals are closer to R. retorta than the Kopet Dagh specimens, but in the length of the peduncles they distinctly belong to P. persica.

4. R. **bungei** Trautv. in Tr. Bot. Sada, IX, 2 (1886) 462. — R. incana Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1852) 419, non Kar. et Kir.; Boiss. Fl. or. IV, 244. — R. disperma et R. stellulata auct. plur. Fl. As. Med. p. p.

Annual; grayish-green plant with appressed bristly hairs; stems 8—30 cm high, simple, often branching from middle or at apex, sometimes from base,

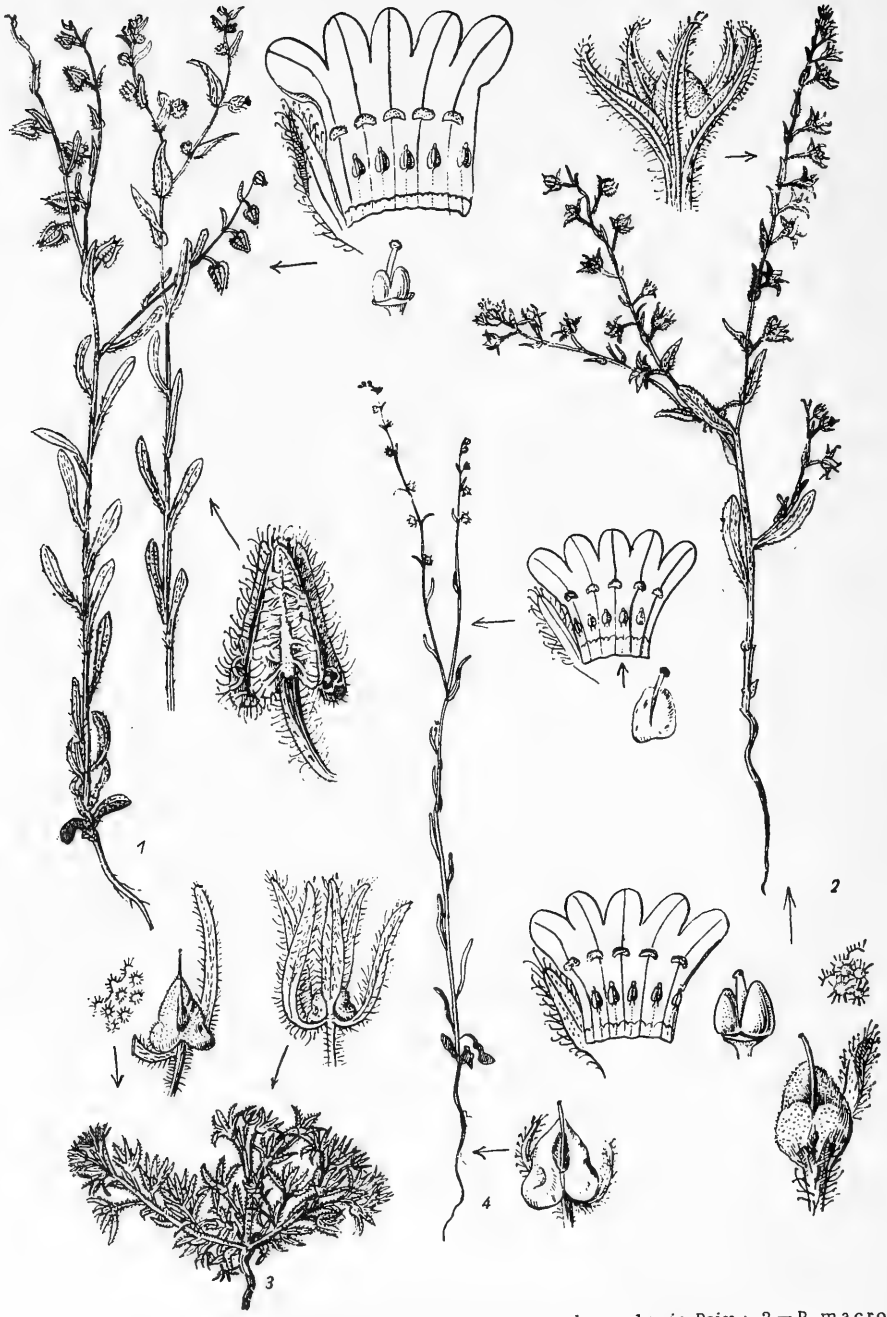

PLATE XXVII. 1 — Rochelia cardiosepala Bge.; 2 — R. peduncularis Boiss.; 3 — R. macrocalyx Bge.; 4 — R. leiocarpa Ldb.

the thin branches, sometimes overtopping main stem, terminated by short scorpioid cymes, much elongating; lower leaves oblong-oblanceolate, long-tapering to base, obtuse; cauline leaves sessile, linear or filiform-linear, obtuse, gradually becoming smaller at apex; uppermost leaves linear or sublinear, all leaves 1-nerved, like stem both sides and margins with stiff appressed bristles on tubercles. Fruiting racemes thin, rather loose, 3—10 cm long; bracts linear, narrow, small; peduncles thin, short, 0.3—2 mm long, shorter than calyx, slightly thickening above, recurved; calyx lobes filiform-linear, semi-cylindrical, small, as long as very small blue corolla, in fruit slightly accrescent but shorter or hardly as long as nutlets, arcuately curved inward and closely adjacent to nutlets with hamately curved tip, their back covered with obliquely upright bristles as on pedicels, not markedly hamate; nutlets usually paired, small, 1.5—2 mm long, with dense grayish tubercles bearing short sessile stellate hooks; style exserted from nutlets for $^1/_4$—$^1/_5$ of its length. April—May.

Stony slopes in semi-desert and semi-steppe belt, river gravels in these belts. — Centr. Asia: Balkh., T. Sh., Dzu.-Tarb., Ar.-Casp., Syr D., Kyz. K., Kara K., Pam.-Al., Mtn. Turkm. Gen. distr.: Iran. Described from Caspian area (Kzyl-Arvat). Type in Leningrad.

Note. A handsome species long confused with the preceding in spite of Trautvetter's diagnoses. Lipskii did not notice the distinctness of the
557 species in the poor but quite typical Caspian specimen determined by Trautvetter; R. microcalycina Bornm. (Mitteil. Thuring. Bot. Ver. XXI (1906), 79) from Asia Minor is very close to this species, differing only in the erect, not hamate, pubescence of the calyx lobes.

In habit and characters closest to R. leiocarpa Ldb., but nutlets tuberculate; probably a hybrid between R. leiocarpa and R. retorta, but the distribution area now lies lower (in mountain belts) than in R. leiocarpa. Both species are collected together in border scarps on the edge of the Ust-Urt Plateau.

5. R. karsensis M. Pop. in Spisok rast. Gerb. Fl. SSSR, XIII (1953) No. 3599.

Annual; stems rather high, with sparse appressed bristles, with thin antrorse branches from base or middle; leaves linear-oblong, the lower slightly spatulate, obtuse, the upper acute, flat, somewhat appressed, with delicate hairy-bristles, especially above. Fruiting racemes erect, very long (to 20 cm) with acute lanceolate-linear bracts; flowers very small; calyx ca. 1 mm long with appressed-silvery pubescence; corolla blue, narrow, ca. 2 mm long, 1 mm across; pedicles recurved, short, shorter than calyx, with appressed hairs, lobes of fruiting calyx linear-filiform, falcate, nearly appressed to but not exceeding nutlets, with sparse semi-appressed or semi-spreading, nearly erect bristles with hardly curved apex; nutlets 2, ca. 3 mm long, obliquely oblong, stellate-tuberculate, persistent part of style protruding for 0.5 mm. April—May.

Meadows. — Caucasus: W. Transc. (Sary-Kamysh near Kars, fruit, 27 VI 1914, Litvinov). Endemic. Described from locality indicated. Type in Leningrad.

Close to R. microcalycina Bornm. It may be wrong to describe a new species, and recognize the Kars plant as a special form of R. microcalycina Bornm. described from localities not far from Kars, especially

in the southwestern part of Asia Minor — Phrygia, Sultan-Dag Mountains near Konya. Yet, our plant is three times as large, its leaves are wider (filiform-linear in R. microcalycina), the racemes are very long (in R. microcalycina 2—5 cm). Three very close species — R. bungei (Centr. Asia), R. karsensis (Armenia) and R. microcalycina (Phrygia — really races — R. bungei Trautv., which in turn is close to R. disperma (L. f.) C. Koch.

6. R. leiocarpa Ldb. Fl. alt. I (1829) 172; DC. Prodr. X (1846) 176; Ldb. Fl. Ross. III, 176; Boiss. Fl. or. IV, 245; Kryl., Fl. Zap. Sib.
558 IX, 2287. — R. incana Kar. et Kir. in Bull. Soc. Nat. Mosc. XIV (1841) 710. — R. stellulata var. Kar. et Kir. l. c. 710. — Ic.: Ldb. Ic. pl. Fl. Ross. III, tab. 244.

Annual; green, rarely grayish-green plant with appressed or slightly spreading bristly hairs; stems 5—25 cm high, simple, often branching from base, middle or at apex, branches thin, usually overtopping main stem, terminated by short, later markedly elongating scorpioid cymes; lower leaves oblong-oblanceolate, long-tapering to base, sessile, obtuse, the median and upper sessile, linear, obtuse, gradually becoming smaller towards apex, the uppermost linear or oblong, 1—2.5 cm long, 1—2 mm wide, all leaves 1-nerved, like stem, both sides and margins covered with stiff appressed or slightly spreading bristles on tubercles. Fruiting racemes narrow, long, loose; bracts linear, narrow, usually longer than, rarely as long as or shorter than pedicels, pedicels thin, slightly thickening above, 1—3 mm long, shorter than or as long as calyx, recurved; calyx lobes linear, semi-cylindrical, small (1—1.5 mm), pale blue, in fruit slightly accrescent (3 mm long) but shorter or hardly as long as nutlets, arcuately curved inward, converging and appressed to fruit, with hamate ends, like pedicels covered along back with obliquely upright bristles with hamate tips; corolla very small (2—2.5 mm long), whitish or pale blue; nutlets small, 1.5—2 mm long, white, glabrous, smooth, shiny; style exserted from nutlets for $^1/_4$—$^1/_5$ of its length. April—May. (Plate XXVII, Figure 4.)

Steppe stony slopes. — West Siberia: Irt.; Centr. Asia: Balkh., T. Sh., Dzu.-Tarb., Ar.-Kasp., Pam.-Al. Gen. distr.: Dzu.-Kash. Described from Irtysh. Type in Leningrad.

Note. One of Lipskii's mistakes in his review of this genus was to make R. incana Kar. et Kir. a synonym of R. disperma (L. f.) C. Koch. A. De Candolle, in his Note to R. leiocarpa Ldb. (Prodr. X (1846) 176 in adnot) pointed out that R. incana Kar. et Kir. obviously belongs here. A comparison of specimens corroborates this proposition. Intermediate specimens are probably hybrids of this species with R. retorta (Pall.) Lipsky em. Karjag having some glabrous fruits; the fact that most fruits are hamate-tuberculate does not invalidate their separation. Ledebour's original description lacked the detailed description of the pubescence, which is more often appressed, and only in the upper part and in the inflorescence slightly spreading.

Undoubtedly there exist hybrids of this species with R. retorta. Those closer to R. leiocarpa, but with tuberculate fruit, we call R. bungei,
559 those closer to R. retorta (long peduncles and long sepals curved around fruit) may be called R. retorta var. leiosperma M. Pop. (e. g., Alai

Range near Lyangar along Taldyk stream, 1,500 m, fruit 26 VI 1901, Alekseenko). Zakirov's var. minuta Zak. comprises the very small (2—7 cm high) shrubby form with fruit sometimes smooth, sometimes slightly tuberculate.

Series 2. **Pedunculares** Zak. Burachn. Zeravsh. (1941) 21. — Sepals lanceolate, with sharply protruding midrib, erect, usually stellate- or campanulate-divergent, sometimes with hamate tips, sometimes considerably connate but generally not arcuate. Pedicels more or less gradually thickening above, bristly, with spreading short hairs with hamate tips.

Note. This series includes typical species (R. peduncular, R. macrocalyx) as well as forms transitional to the preceding series, apparently due to hybridization (R. campanulata, R. jackabaghi, R. clavicula ta). To emphasize this morphological relationship we begin with the transitional species and end with the typical ones.

7. **R. campanulata** M. Pop. et Zak. in Zakir. Burachn. Zeravsh. (1941) 21 et in Not. Syst. ex Herb. Acad. Uzbekistan, X (1948) 10. — Ic.: Zakir., op. cit. Figure 7.

Annual; stem 20—30 cm high, strongly branching usually from base, appressed-gray-hairy; leaves linear, the cauline ones sessile (the lower probably lanceolate-spatulate, obtuse), acute, semi-appressed-bristly, small, the lower leaves to 16 mm long, 5 mm wide, spatulate. Fruiting racemes long, loose many-flowered, often flexuose; bracts small, linear or lanceolate; pedicels rather short, ca. 5 mm, rarely to 7 mm, long, horizontally or obliquely directed upward, not recurved, spreading-bristly. Flowers very small; calyx ca. 1.5 mm long, densely bristly, in fruit campanulate, ca. 3 mm long; sepals low-connate, linear-lanceolate, erect, hardly hamately incurved at apex; corolla blue, ca. 2.5 mm long, its limb 0.5 mm long; nutlets smooth, shiny.

Stony slopes and fields. — Centr. Asia: Pam.-Al. (thus far only Upper Zeravshan). Endemic. Described from Fon River. Type in Tashkent.

Note. Like the preceding species, this species also undoubtedly represents a hybrid of R. leiocarpa and R. peduncularis; for this reason, too, the characters are inconstant. The type of specimen has short
560 pedicels and smaller calyces, which bring it close to R. leiocarpa. In other specimens (e.g., upper reaches of Yagnob, 3,300 m, fruit, 31 VII 1913, Bornmüller, No. 734) the pedicels are to 7 mm, the sepals to 5 mm long, more stellately divergent, less connate and thus closer to R. peduncularis. The nutlets are smooth, or with a hint of tubercles, lacking anchor-like tips, resembling the Yagnob specimens from Talass Ala-Tau (upper reaches of Topchak-Su River, weedy cattle pastures, flowers, fruit, 1 VIII 1931, Pavlov, No. 879).

8. **R. claviculata** M. Pop. et Zak. in Zakir. Burachn. Zeravsh. (1941) 21 et in Not. Syst. ex Herb. Acad. Uzbekistan. X (1948) 12. — Ic.: Zakir., op. cit. Fig. 6.

Annual; stem 7—20 cm high, erect, thin, with few thin branches, appressed-hairy, grayish in upper part or at base; leaves on stem linear, small, 1—1.5 mm

long, 2—3 mm wide, acute, covered with nearly appressed bristly hairs. Fruiting racemes very loose, long, erect, few-flowered, 10—12 mm long, pedicels long, ca. 10 mm, gradually thickening above, usually recurved, rarely horizontal, with sparse short spreading bristles; bracts short, lanceolate; flowers very small; corolla blue, ca. 3 mm long, nearly tubular, (filiform-tubular); calyx 2—2.5 mm long, yellow-bristly, in fruit 4—5 mm long, nearly tubular, highly connate for $^2/_3$—$^3/_4$, its lobes triangular-lanceolate or triangular-oblong, with inward curved hamate teeth; calyx tube with 5 thick sharply protruding nerves, with sparse spreading hairs with hamate tips, nutlets 3 mm long, suberect, obliquely ovoid-oblong, smooth, shiny; style slightly protruding above them.

Fields, mountain belt. — Centr. Asia: Pam.-Al. (confined to upper reaches of Zeravshan). Endemic. Described from Fon River (Saratag village, Popov, 1940). Type in Tashkent.

Note. The connate sepals, rare in L. campanulata, are very distinct in R. claviculata, making it a good species sharply distinguished from both R. peduncularis and R. retorta.

9. R. jackabaghi Pavl. comb. n. — R. retorta var. jackabaghi Lipsky in Tr. Bot. Sada, XXVI (1910) 458.

Annual; small plant, 5—7 cm high, grayish, with spreading branches from base; stems and branches covered with spreading or semi-spreading bristly
561 hairs; leaves short, 5—15 mm long, 2—3 mm wide, few, acute, with sparse coarse spreading bristles; fruiting racemes rather dense and short, 1—5 cm long, erect, sturdy; bracts linear, small, obtuse; pedicels short, 1—3 mm long, horizontal, spreading, thickening at apex, with short spreading bristles and hamate hairs (as in all Pedunculares); flowers very small; calyx ca. 1.5 mm, its lobes lanceolate, densely bristly; in fruit 3 mm long, as long as fruit, and adjacent to it, with sharp protruding midrib, their tips hamately curved inward, outside with spreading, stiff, hamate bristles; corolla small, blue, 2 mm long, its limb ca. 0.5 mm long, narrowly campanulate; nutlets 2.5 mm long, ovoid, paired, the dense fine tubercles apically stellate; style hardly protruding above nutlets. June.

Centr. Asia: Pam.-Al. (Yakkabag, natural boundary Turka, 2,500 m, flowers, fruit, 17 VI 1896, Lipskii, No. 734). Endemic. Known only from locality indicated. Type in Leningrad.

Note. It is incredible that Lipskii should have considered this a variety of R. retorta. Its sepals are lanceolate and erect, the pedicels and vegetative parts are spreading-hairy, and in habit it is more like R. bungei (to which it was originally assigned by Pavlov).

10. R. peduncularis Boiss. Diagn. Ser. I, 7 (1846) 35; Boiss. Fl. or. IV, 246; Zakir. Burachn. Zeravsh. 21.

Annual; grayish-green, slightly spreading-bristly-hairy plant; stem 8—30 cm, usually ca. 15—20 cm high, simple, often branching from middle or slightly above, rarely from base, the branches thin, terminated by short scorpioid cymes, later considerably elongating; lower leaves oblong-oblanceolate or oblong-spatulate, long-tapering to base, rounded, obtuse; the cauline linear, gradually reduced above, the uppermost narrow, 1—1.5 cm long, 2—3 mm wide, 1-nerved, like stem, both sides, (though more densely

beneath) with coarse, appressed or slightly spreading bristles on tubercles. Fruiting racemes short, loose, secund; bracts small, short-lanceolate or linear, shorter than pedicels; the latter rather thick, gradually thickening above, 8—12 mm, 1½—2 times as long as fruiting calyx, spreading or horizontal at first, later often recurved, drooping; calyx lobes in flower small, 1.5 mm long, narrow, linear, semi-cylindrical, nearly as long as very small
562 blue corolla, accrescent in fruit, broad, lanceolate, with thick obtuse cuneate nerve outside, stellately spreading, curved outward, 1½—2 times as long as nutlets, with hamate inward curved tips, both sides of pedicels (more densely outside) with straight spreading bristles with hamate tips, slightly fusing at base, gradually tapering pedicel; nutlets rather large, 3—4 mm long, densely covered with flattish whitish tubercles bearing very small sessile hooks; style short, ca. 0.5 mm long, exserted from between nutlets for ⅙—⅛ its length. May—June. (Plate XXVII, Figure 2.)

Stony slopes. — Centr. Asia: T. Sh. (to Talass Ala-Tau in the east, interrupted in Syugaty Mountains on Ili River), Pam.-Al. Gen. distr.: Iran., Ind.-Him. Described from S. Iran (Kuh-i-Delhu Mountains). Type in Geneva, cotype in Leningrad.

Note. Besides the type specimens (Kuh-i-Delhu, Kotschy, No. 531), I saw handsome specimens, quite identical with our Central Asian form, from N. Iran (Elburz Mountains near foot of Totshal Range, 2,200 m, Bornmüller, No. 7689).

Zakirov contrasted R. intermedia Zak. with this species (Bot. mat. Gerb. AN UzSSR, XIII, 1952, 35), distinguished by smooth shiny nutlets. The new species differs from R. claviculata M. Pop. et Zak. by its open, zygomorphous calyx, with slightly fused lobes. The type is in Tashkent (Shink valley, on Zeravshan).

11. R. macrocalyx Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1851) 419; Boiss. Fl. or. IV, 246. — R. rectipes Stocks in Hook. Journ. Bot. IV (1851) 176; C. B. Clarke in Hook. Fl. Brit. Ind. IV, 166.

Annual; small low, 2—5 cm high, spreading-branching, grayish plant, rarely with simple, robust, spreading-short-bristly stem; leaves resembling a rosette, mainly in lower part of stem, dying in fruit, oblong, obtuse or oblanceolate, 0.5—1.5 mm long, the medium and upper leaves few, linear, obtuse, short with spreading stiff bristles. Fruiting racemes short, dense, 1—3 cm long, sometimes capitate-approximate; peduncles erect or obliquely spreading, 2—10 mm long, thin, with short-spreading bristles; bracts small, linear; calyx very small, 1—1.5 mm long, densely bristly, in fruit considerably elongating, campanulate, its lobes free, lanceolate, straight, 5—7 mm long, with very sharply protruding midrib, tips slightly curved inward or erect, outside with spreading bristles, hamate in lower part of sepals, in their
563 upper part (and on inner surface, as in all species) erect; nutlets paired, 2—2.5 mm long, ovoid-oblong, with dense tubercles bearing stellate anchor-like tips; style distinctly (1 mm) protruding above nutlets. (Plate XXVII, Figure 3.)

Stony slopes. — Centr. Asia: Kyz. K. (Bakali Mountains, Leman), Pam.-Al. (Gorno-Badakhshan). Gen. distr.: W. Him., Iran. Described from Bakali Mountains. Type in Paris.

Note. This species is easily distinguished from R. peduncularis by its manner of growth, its free, erect, not recurved sepals and thin, erect peduncles. Same individuals are only 1—1.5 cm high, and bear a capitate collective fruit. Clark (l. c.) believes R. rectipes Stoks to differ from R. macrocalyx, noting on the sepals 2 basal protuberances. I describe R. rectipes after its type specimens.

Section 2. CRYPTOCARPA Zak. in Zakir. Burachn. Zeravsh. (1941) 20.— Sepals 5 in fruit, cordate, triangular-deltoid, erect, with tightly touching margins converging to a pyramid and completely hiding fruit; in addition to thick midrib sepals also have lateral nerves perpendicular to it as in Pedunculares. Peduncles and calyx bear spreading hairs, the extreme variations of which are described in that section.

12. R. **cardiosepala** Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1851) 420; Boiss. Fl. or. IV 246; Hook. Fl. Brit. Ind. IV, 166.

Annual; grayish-green plant with appressed or slightly spreading bristles; stem 10—45 cm high, simple, often branching from middle or above, rarely from base, the thin branches terminated by short scorpioid cymes much elongating in fruit; few radical, sessile, elliptic leaves, early drying up; lower cauline leaves narrow, linear-spatulate, long-tapering at base, sessile, short-acuminate, gradually reduced upward, uppermost leaves linear, all leaves with nerve visible on both sides, like stem covered with coarse appressed bristles on tubercles. Fruiting racemes loose, secund, 3—8 cm long; bracts broadly ovate to lanceolate, acute, obtuse, small, as long as pedicels; these thin slightly thickening above, rather long (5—7 mm) in fruit, as long as or nearly as long as large calyces, spreading or horizontally declined at first, later drooping with spreading hamate bristles; calyx lobes small, linear, 1.5—2 mm long, densely bristly, nearly as long as very small,
564 2.5 mm long blue corolla, in fruit, broad, 5—8 mm long, cordate-sagittate at base, with rounded obtuse auricles, with straight, flat, obtuse tips, completely convergent, outside with very thick, obtuse cuneate longitudinal nerve and network of prominent lateral nerves, pedicels on both sides (more densely beneath) with erect or obliquely spreading bristles with hamate tips; nutlets rather large, 3—4 mm long, with dense grayish flat tubercles bearing very small stellate tips; style short, protruding from nutlets for $\frac{1}{5}$—$\frac{1}{6}$ of its length. May—June. (Plate XXVII, Figure 1.)

Stony slopes, weedy localities and crops. — Caucasus: S. Transc. (Nakhichevan ASSR); Centr. Asia: Balkh., T. Sh., Dzu.-Tarb., Syr D., Amu D., Kyz. K., Pam.-Al., Mtn. Turkm. Gen. distr.: Iran., Ind.-Him. Described from Kyzyl-Kum. Type in Leningrad.

Note. A very unique species, widespread as a weed (mainly in Central Asia).

Tribe 12. CYNOGLOSSEAE DC. in Meisn. Comment. (1836—1843) 187; Brand in Pflanzenr. IV, 252, 1—19, ex p. — Gynophore (gynobase, torus) pyramidal, tetrahedral, with flat or impressed faces, in the latter case ribs of pyramid developed as wings. Pyramid tapers to style which in lower

part in many genera thickens in fruit, developing as an awn above nutlets. Gynophore very small in flower, increasing in length and volume after fertilization. Lobes of ovary (young nutlets) attached to faces of pyramidal gynophore by apices that fuse with gynophore above, hence apices of nutlets never raised above apex of pyramid or above base of style. Growth of nutlets mainly below gynophore, hence free lower part of nutlets descends below torus and deflects sepals. Ripe nutlets always dorsoventrally compressed, with cicatrice more or less extensive at apex of underside, especially extensive in Paracaryum; free part of nutlet below cicatrice extends downward from gynophore; if it remains small (Omphalodes, some Solenanthi) it is shifted to one side of the latter. Nutlets always with protuberances developed as wings or spines with anchorlike head. In fruit calyx changing little, never a small cup or saucer, as in Trichodesmaeal, divided nearly to base into narrow lobes which elongate slightly and broaden, rarely (Omphalodes) slightly saucer-shaped. Corolla brachymorphous (rotate)
565 to mesomorphous (funnel-shaped) or even dolichomorphous (tubular), nearly always with, rarely (some Rindera) without scales, often with anthocyanin, rarely with flavone, usually (for family) medium-sized, rarely small (2—5 mm long or wide). Usually perennial, rarely (only in brachymorphous genera) biennial-annual herbs, mainly outside tropics (primarily subtropics).

Genus 1224. **RINDERA*** Pall.

Pall. Reise d. versch. Prov. Russ. Reich. I (1771) 486.— Mattia Schult. Observ. bot. (1809) 30, 32.— Cyphomattia Boiss. Fl. or. IV (1875) 293.

Calyx divided nearly to base into narrow lobes unchanged, curved in fruit, upright in flower. Corolla tubular, 8—14 mm long, slightly or twice as long as calyx, yellowish, often with anthocyanin-violet tinge on teeth or tube, rarely smooth, often with scarious transverse folds or scales in throat, rarely scales in middle or lower third of tube, with lobes erect or slightly declined (and then limb slightly funnel-shaped), often lanceolate, elongate, almost as long as tube, rarely shortened and then rounded-obtuse. Filaments short, attached to, rarely below, throat. Anthers linear-oblong, 2—4 mm long, at base sagittate or as usual, apex often obtuse or notched, rarely acute, not always protruding from corolla lobes. Style filiform, usually exserted from, rarely included in corolla; stigma a point or slightly capitate, always entire. Nutlets rather large, winged; the wing 10—20 mm across, with flat back (disk), the slightly protruding median keel appearing as a line, inflated at low rugose sides; abdomen nearly entirely occupied by cicatrice-areola of attachment and high narrow pyramidal torus; nutlets smooth, shiny, unarmed or covered along disk, rarely at sides, with spines with anchorlike head or 1 row with large, flat, anchorlike spines along keel. Wing of nutlets broad, more or less flat, outer margin often turning blue, margin rarely with smooth, often finely dentate. Perennial, rarely to 60—100 cm high, glabrous or pubescent herbs, with short, more or less thin dark vertical root, growing in the ancient Mediterranean (to Greece in the west), 2 species in steppe zone (province); usually growing in semi-desert and semi-steppe belts.

* After Dr. A. Rinder of Moscow, botany enthusiast.

566 Note. Following Kuznetsov (op. cit. 20—29), we merge Rindera, Mattia and Cyphomattia, separated by Boissier in his "Flora orientalis" (IV), in Rindera. Yet there are no clear limits between these three genera or their combinations (Rindera s.l.) and Paracaryum (+ Mattiastrum Brand). Johnston (1924) even merged these genera too. The new species we describe below further complicate Rindera s.l. and bring it closer to Paracaryum. We have provided for nearly all the diversity of the genus, with the exception of 4—5 species of sections Mattiaria (Algeria) and Paramattia (+ Bilegnum Brand), distributed from Greece to NE Iran, but mainly in the Armenian-Kurdistan area.

1. Distinct scales in upper part of corolla tube, between base of filaments (Mattia) or in middle part of cylindrical tube (Pseudomattia) or even in lower part of tube, if so then scales in sacciform protuberances of tube which sharply tapers below protuberances (Cyphomattia). In all, 5 species; leaves and stems covered with gray, sometimes slightly sericeous hairs disappearing during fruiting . . . . . 2.

\+ Corolla tube without scales, replaced by indistinct scarious folds in throat, rarely these absent (and throat smooth) (Rindera) or scales reduced, hamate, in lower third of tube (Mattiorindera). If hairs present on leaves and stem then only when young, the latest — flowering spreading later, glabrous or becoming naked in fruit; only one species (R. oblongifolia) with constant gray hairs and disk of nutlets with dense fine prickles . . . . . 7.

2. Corolla tube with sacciform protuberances containing scales in lower third, resembling incipient spurs, sharply tapering below them. Plant usually hairy to nearly tomentose, with typical fruit of Rindera. (S. Transc.) 6. R. lanata (Lam.) Bge.

\+ Corolla tube even, cylindrical, without external protuberances . . . . . 2.

3. Scales in upper part of tube in throat, semi-rounded, rather large. Plant rather large. (Mattia) . . . . . 4.

\+ Scales in middle of tube, narrow, elongate, thimble-shaped. Low, 10—20 cm high, plants with linear or linear-lanceolate leaves. Fruit prickly along disk. (W. T. Sh.). (Pseudomattia) . . . . . 5.

567 4. Inflorescence with abundant flowers, capitate-corymbiform, turning corymbiform. Cauline leaves numerous, long-acuminate, lanceolate; radical leaves early dying before flowering, long-cuneate at base. Lobes of corolla obtuse. Disk of fruit smooth with unarmed wings. (Carpathians (south) and along Danube in Moldavian ASSR) . . . . . 5. R. umbellata (W. et K.) Bge.

\+ Inflorescence one-sided, drooping, twisted, few-flowered. Radical leaves persistent at flowering, their blade oblong, sharply set off from petiole, nearly cordate; cauline leaves few (4—5), short-acuminate. Corolla lobes oblong-lanceolate, acute, as long as tube. (W. T. Sh.) 4. R. oschensis M. Pop.

5. Corolla limb slightly declined, its lobes lanceolate, acute, $\frac{1}{2}$—$\frac{1}{3}$ length of tube. Scales at middle of tube, small, hamate.

Plant not cespitose, with 1—2 stems from 1 root. Leaves slightly spreading, gray-haired, short-acuminate. Inflorescence capitate small. (SE part of W. T. Sh.) . . . . . 3. R. ferganica M. Pop.

\+ Corolla limb, nearly erect, its lobes ovate to semi-rounded, obtuse . . . . . 6.

6. Lobes of corolla obtuse but longer, half length of tube. Throat without folds. Scales in lower third or middle of tube, thimble-shaped. Fruit with smooth disk, unarmed, wing nearly entire, turning blue. Hairs more sparse, not silvery or sericeous. Leaves lanceolate, short-acuminate . . . . 2. R. tschotkalensis M. Pop.

\+ Lobes of corolla $^1/_3$—$^1/_4$ length of tube. Scales at middle of tube, elongate, thimble-shaped, in throat also crescent-shaped folds. Nutlets with smooth disk and medium keel of 5—7 laminate spines, their wing 4—5 mm wide, finely dentate. Cespitose, slightly silvery or sericeous plant. Leaves sublinear, long-acuminate. (NW part of W. T. Sh.) . . . . . 1. R. tianschanica M. Pop.

7. In lower third of corolla tube rudimentary scales as small appendages. Lobes of corolla nearly erect, spatulate-obovate, obtuse, half length of tube, nearly not protruding from white-tomentose calyx. Fruit with smooth disk, keel not dentate as in real Rindera. Leaves oblong-lanceolate, to 2 cm wide,
568 acute, becoming naked but with persistent, coarse-bristly petioles. Growth and branching as of real Rindera. (S. Pamir area) . . . . . 7. R. korshinskyi (Lipsky) Brand.

\+ Scales absent in corolla tube, but in upper part of tube mostly with transverse folds recalling scales, these rarely absent. Lobes of corolla elongate, oblong-lanceolate or lanceolate, as long as or $1^1/_2$ times length of tube, very rarely half as long. . . . . 8.

8. Anthers with distinct mucro at apex 0.5 mm long; corolla short, pale yellow, with broad ovoid tube, without internal folds, its lobes as long as tube, nearly lanceolate; calyx glabrous, with acute lobes. Leaves glabrous, the radical leaves oblong or oblong-lanceolate. Confiend to sandy semi-deserts along Lepse River in SE of Balkhash area. (Oxyrindera) . . . . . 8. R. ochroleuca Kar. et Kir.

\+ Anthers ordinary, with obtuse or slightly notched apex. Corolla tube narrow, cylindrical. Corolla yellow-purple, due to anthocyanin; calyx more or less lanate . . . . . 9.

9. Disk of nutlets smooth, unarmed; wing often with teeth or spines rarely with smooth margin, or else similar to R. ochroleuca. (Eurindera) . . . . . 10.

\+ Disk of nutlets entirely covered with small spines or tubercles, or with medium keel of 3—7 large spines in 1 row; wing finely toothed, its margin with spines, rarely smooth. (Echinorindera) 12.

10. Wing entire. Plant glabrous from beginning. Limb of radical leaves oblong, rarely lanceolate. Calyx sparsely gray-tomentose. (Steppe belt, from Moldavian SSR and Anapa on Black Sea to Krasnoyarsk and Minusinsk, south to 47° N., north to 50—51° N. (northernmost variant of real Rindera)) . . . . . 9. R. tetraspis Pall.

+ Wing with finely toothed margin, sometimes only finely undulant, its teeth with or without short prickles. Very close to preceding . . 11.

11. Cauline leaves few, narrower, oblong-lanceolate, or like preceding. (Centr. Asia, foothills and semi-steppe to 47° N.) . . . . . 10. R. **cyclodonta** Bge.

+ Cauline leaves wider, ovoid, more numerous (from Dzhizak to S. Pamir area) . . . . . 11. R. **baldschuanica** Kusn.

12. Entire plant gray, with dense, rather soft, appressed. persistent hairs. Fruit ca. 10—12 mm across; disk of nutlets densely
569 covered with small anchorlike spines, sometimes extending to wing. Radical leaves oblong, gradually tapering to petiole, i. e., long-cuneate. Inflorescence one-sided, drooping, twisted. Corolla violet-red. Stems 30—40 cm high. (NW part of W. T. Sh.) . . . . . 16. R. **oblongifolia** M. Pop.

+ Plant with hairs not as dense or long-persistent, naked in fruit as in real R i n d e r a and resembling it in growth and habit . . . . . 13.

13. Small plant but leaves glabrous in fruit, lanceolate-oblong. Fruit 10—12 mm across, disk of nutlets with median keel of large flat anchorlike spines lying in 1 row, smooth. (SW part of W. T. Sh.) . . . . . 15. R. **turkestanica** Kusn.

+ Fruit 12—15(17) mm across; disk of nutlets sparsely and finely tuberculate-aculeate, without keel of large uniseriate spines . . . . . 14.

14. Robust plant, to 50—70 cm high, with thick stem and paniculate inflorescence, with soft sparse, spreading hairs to flowering, later naked. Corolla yellowish-violet. Disk of nutlets finely aculeate. Wings without distinct teeth. Anthers 4 mm long. (NW T. Sh., foothills) . . . . . 12. R. **echinata** Rgl.

+ Plant glabrous, with glabrous stem and leaves. Anthers 3 mm long. (More to south of T. Sh. and Kopet Dagh) . . . . . 15.

15. More robust than preceding, to 1 m high. Blade of radical leaves subcordate, large, broad, to 20 cm long, 8—9 cm wide. Lobes of corolla crenate, declined. Disk of nutlets with very small spines resembling tubercles. Wings without teeth. (Central Kopet Dagh) . . . . . 14. R. **coechinata** M. Pop.

+ Less robust than preceding. Lobes of corolla acute, as in R. e c h i n a t a. Fruit slightly larger; disk and sides of nutlets densely covered with elongate anchorlike spines; wings of nutlets often finely dentate. (SW and SE part of W. T. Sh.) . . . . . 13. R. **austroechinata** M. Pop.

Section 1. PSEUDOMATTIA M. Pop. — Section Mattia Kusn. in Tr. Bot. muz. VII (1910) 30; Brand in Pflanzenr. IV, 252, 67, ex parte. — Scales narrow, at middle of corolla tube, not in throat. Plant narrow, with persistent gray hairs and narrow leaves.

1. R. **tianschanica** M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIII (1950) 216. — Ic.: M. Pop., op. cit. 225.

570 Perennial; nearly cespitose; multicipital thin root producing many sterile rosettes and stems; these 10—15 cm high, robust, erect with dense appressed

hairs, nearly tomentose, faceted, simple, with small corymbiform apical inflorescence; rosette leaves linear or narrowly lanceolate, long-acuminate, gradually tapering to long petiole, young leaves with appressed sericeous hairs, becoming grayish (petioles usually white, with slightly spreading long hairs), 1-nerved, coarse, 5—10 cm long, 3—6 mm wide; cauline leaves linear, shorter and narrower than radical, sessile. Inflorescence leafless, eventually usually corymbiform, in fruit of 2—3 spreading arcuate or erect scorpioid cymes, sometimes impoverished, to 1 cyme; pedicels shorter than calyx, in fruit slightly elongating and then the lower to 5—8 mm long, erect; calyx 5—6 mm long, gray-downy-tomentose, with linear obtuse lobes; corolla narrow, turbinate, its limb nearly not broadening erect, ca. 8 mm long, bluish-purple, nearly not protruding from calyx, its tube pale, 2—3, sometimes 4 times as long as dark limb; lobes of the latter oblong or semi-rounded, obtuse with notches nearly reaching tube; scales of two kinds: low, crescent-shaped, ca. 0.5 mm high, broad, folds in throat; elongate, narrow; scales at middle of tube; filaments as long as oblong anthers, these not exceeding corolla lobes; anthers obtuse, 2 mm long; style not exserted from corolla; nutlets rounded-ovoid, 12 mm long, with wing 10—12 mm wide, dorsal disk of nutlets with keel of about 5, laminate, not anchorlike, more or less long spines, smooth at sides; wing flat, 4—5 mm wide, as wide as lobe, scarious, finely toothed, the teeth with, sometimes without, short anchorlike spines; ventral side of nutlets smooth; ventral cicatrice large, $^3/_4$ as long as nutlet. June—July.

Mountain belt, stony slopes.— Centr. Asia: T. Sh. (Talass Ala-Tau, along Dzhebogly-Su River, Mashat Mountains; Kara-Tau, southern part). Endemic. Described from Mashat Mountains. Type in Leningrad.

2. **R. tschotkalensis** M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIII (1950) 217.

Perennial; radix rather thin, branching above, multicipital; slightly cespitose plant, of sterile rosettes and fertile stems; stems thin, with semi-appressed gray hairs, in flower probably 5—7 cm, in fruit to 10—15 cm high due to elongation of scorpioid cymes, branching only in inflorescence, the 2—4 branches straightening in fruit; rosette leaves lanceolate, 5—8 cm long, 5—7 mm wide, grayish-greenish, with appressed bristly hairs, flat, acute,
571 long tapering to short petiole; cauline leaves few (1—2), linear. Inflorescence capitate at first, of 1—3 crowded, leafless scorpioid cymes, straightening in fruit, elongating to 10 cm, obliquely spreading upward; pedicels tomentose-downy, very short, shorter than calyx, straight appressed to axis of cyme; calyx ca. 7—8 mm long, tomentose-downy, with unequal linear lobes; corolla bluish, turbinate, with erect teeth, ca. 8—9 mm long; tube cylindrical, its lobes oblong, rounded, obtuse, half length of tube; scales in lower third of tube narrow, high, thimble-shaped; throat lacking folds; stamens attached to throat; filaments thin, shorter than anthers; anthers less than 2 mm long, oblong, evenly and slightly notched at base and apex; style hardly exserted from corolla; fruit rather small; nutlets rounded, with wing ca. 10 mm in diameter, their disk smooth, slightly opaque, furrowed but without prickles or spines or with scattered thin prickles; wing turning blue along margin, flat, as wide as disk with fine unarmed teeth. June.

Stony slopes. — Centr. Asia: T. Sh. Endemic. Described from Chotkal. Type in Leningrad.

3. R. ferganica M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIII (1950) 219.

Perennial; root thin, brown, with 1—3-headed apex thickened, squamose; stems low, 5—10 cm high, simple, with dense gray appressed hairs; rosette leaves lanceolate-linear, acute, gradually tapering to short petiole, 3—5 cm long, 2—5 mm wide, gray, nearly sericeous, with appressed hairs; cauline leaves broadly linear, declined, with appressed gray hairs, acute, sessile. Inflorescence capitate, of short terminal scorpioid cymes, 2—4 cm across, leafless, in fruit sessile on leafless elongate stem apex, corymbiform, with erect elongate scorpioid cymes; pedicels short; calyx gray-glaucous, 7 mm long, its lobes lanceolate-linear, acute; corolla pinkish (?), hardly longer than calyx, ca. 9 mm long, tubular, its lobes lanceolate, acute, erect, half length of tube, ca. 3 mm long; throat glabrous; at middle of corolla tube hamate scales; filaments as long as oblong, ca. 2 mm long anthers, these not sagittate at base, obtuse, not reaching tips of corolla lobes; style not exserted; (very young) ovary glabrous, smooth. May. (Plate XXVIII, Figure 3.)

Centr. Asia: T. Sh. Endemic. Described from Osh. Type in Leningrad.

572 Section 2. MATTIA Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1854) 415 (239); Kuzn. in Tr. Bot. muz. VII, 30: Brand in Pflanzenr. IV, 252, 67, p. p. — Mattia Schult. Obs. Bot. (1809) 30, 32 pro gen. — Scales of corolla in throat, large, semi-rounded. Plant higher, 20—50 cm, with oblong or lanceolate, gray-downy leaves.

4. R. oschensis M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, VIII (1950) 220.

Perennial; root curved, brown, branching-multicipital, root neck covered with remnants of bud scales; stems thinly furrowed-ribbed, 25—50 cm high, ascending, simple, short-branching in apical inflorescence, glabrous, arcuately drooping at apex; radical leaves with petioles as long as or twice as long as blade, the blades ovate or oblong, more or less abruptly tapering to petiole, sometimes subcordate, acute, 4—8(10) cm long, 2—5 cm wide, with network of distinct nerves, short and densely gray-downy, with small thin adjacent hairs; petioles also more or less gray-downy, furrowed; cauline leaves few, some of the lower resembling the radical leaves but narrower and smaller, petiole not as long, the other (about 5) sessile, lanceolate, 2—4 cm long, 0.5—1 cm wide, uppermost leaves linear. Inflorescence leafless, dense, drooping, of few lateral and 1—2 terminal scorpioid cymes, capitate-lobate; pedicels gray-downy, shorter than or just as long as calyx; calyx gray-downy, nearly gray-tomentose, 8 mm long, with linear, acute lobes; corolla apparently yellowish-violet, 15 mm long, its lobes as long as tube, lanceolate, acute, nearly erect; scales in throat rather large, crescent-shaped, papillate; filaments attached between scales, shorter than anthers; anthers linear-oblong, 3—4 mm long, abruptly sagittate at base, at apex bipartite, far from reaching apices of corolla lobes; style long exserted; ovary glabrous, smooth. May—June. (Plate XXVIII, Figure 2.)

Mountain slopes. — Centr. Asia: W. T. Sh. Endemic. Described from Yassy River. Type in Leningrad.

5. R. **umbellata** (W. et K.) Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1851) 415 (239); Shmal'g., Fl. II, 223; Kuzn. in Tr. Bot. muz. VII, Shmal'g., ibid. II, 223; Kuzn. in Tr. Bot. muz. VII, 31; Brand in Pflanzenr. IV, 252, 67. — Mattia umbellata Schult. Obs. Bot. (1809) 30. — Cynoglossum umbelatum W. et K. Pl. rar. Hung. II (1805) 58. — **Ic.**: W. et K. l. c. tab. 148; Javorka, Icon. Fl. Hung. f. 2789; Rchb. Ic. Fl. Germ. XVIII, tab. 1328; Kuzn. l. c. Table III, Figure 8 (corolla); Brand, l. c. Figure 8, A—C. — **Exs.**: Fl. Roman. exs. No. 468.

573 Perennial; with dark, not coloring, taproot; plant monocarpous (?); stems 20—60 cm high, simple, ribbed with gossamer hairs, erect, branching, densely leafy, in inflorescence above; radical leaves lanceolate or oblong, 10—15 cm long, to 2 cm wide, tapering at both ends, (rarely more or less abruptly tapering) to petiole, long-acuminate, with loose gossamer hairs drying in fruit; cauline leaves lanceolate, the upper (more than 10, to 20—25) linear, sessile, acute, gradually shorter towards apex. Inflorescence few-branched, with small leaves subtending compact apical bostryces; when branches reduced inflorescence umbelliform, when branches more developed — paniculate-umbelliform; flowers drooping, their pedicels villous, as long as calyx; bracts absent; calyx white-tomentose, ca. 10 mm long, with linear erect lobes; corolla yellowish (orange), 15 mm long, the oblong obtuse nearly erect lobes ca. 5 mm long; style long exserted from corolla; scales slightly below throat, reddish, oblong, 2—3 mm high; filaments 5 mm long, anthers oblong-linear, 6 mm long, with rounded base, their apices reaching slightly beyond corolla lobes; stigma a dot; nutlets smooth, 14—15 mm across with their broad, entire wing; cotyledons broadly ovoid, 3—4 mm long. May—June.

Steppes. — European part: Bes. (southern part along the Danube; Bolgrad, Kajul, Tarakliya, Chadyr-Lunga, i. e., to 46° N.). **Gen. distr.**: Centr. Eur. (mainly Danube valley). Described from Hungary (S. Carpathians).

Note. Tertiary relict of southern Bessarabia, completely isolated from its Asian parents, as well as from the Algerian R. gymnandra Coss. Its distribution area touches that of R. tetraspis.

Section 3. CYPHOMATTIA Kusn. in Tr. Bot. muz. VII (1910) 43. — Cyphomattia Bois. Fl. or. IV (1833) 272, pro gen. — Corolla tube with 5 sacciform external protuberances in lower third, below these sharply tapering, cylindrical. Scales borne in sacciform protuberances as if in spurs. Fruit smooth, with entire smooth wing. Habit typical of real Rindera. Hairs constant, grayish to nearly tomentose. — Confined to Armenia and NW Iran.

6. R. **lanata** (Lam.) Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1854) 415 et Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 106; Kuzn. in Tr. Vot. muz. VII, 43; Brand in Pflanzenr. IV, 252, 72. — Cyphomattia lanata Boiss. Fl. or. IV, 272. — Mattia lanata Schult. Obs. Bot. (1809) 31; DC. Prodr. X, 167. — Cynoglossum lanatum Lam. Encycl.
574 II (1786) 238. — Mattia punctata DC. Prodr. X (1846) 167. — M. canescens

PLATE XXVIII. 1 — Rindera ochroleuca Kar. et Kir.; 2 — R. oschensis M. Pop.; 3 — R. ferganica M. Pop.

DC. l. c. 168. — M. brachyantha Boiss. Diagn. XI (1849) 127. — M. eriantha Ldb. Fl. Ross. III (1849) 173. — M. incana Ldb. l. c. — M. alapadnochiton Vatke in Zeitschr. Ges. Naturwiss. N. F. XI (1875) 126. — Rindera pubescens C. Koch in Linnaea, XXIII (1849) 648. — Ic.: Vent. Choix (1808) tab. 20; Kusn. l. c. tab. I, II (entire plants) and III, f. 9 and 12 (corolla). — Exs.: Kotschy, Pl. Pers. aust. 1845 No. 332.

Perennial; taproot tapering beneath, dark; stems 20—50 cm high, 1—2, erect, faceted, tomentose-downy, paniculately branching, with flower-bearing, sometimes elongated branches; leaves more or less downy, gray; radical leaves lanceolate to oblong or sublinear, acute gradually tapering to long petiole, 8—15 (to 30) cm long, 1—2 (to 6) cm wide; cauline leaves often crowded, sessile, gradually decreasing in size upward, acute, the uppermost sometimes ovate and semi-amplexicaul. Inflorescence paniculate, corymbiform above, its component bostryces dense, becoming loose, ebracteate; pedicels slightly (often considerably) longer than calyx, gray-downy; calyx tomentose, 4—6 mm long, with oblong lobes; corolla 10—11 mm long, pink, turning blue, its lobes erect, lanceolate-linear, as long as tube; scales nearly square; filaments in middle of corolla tube; style 9—12 mm long, exserted; nutlets (with wing) ovoid, 17—22 mm across, their disk smooth, with broad, entire wing; ovary 9 mm long, cotyledons ovate. April—June.

Stony mountain slopes, to 4,000 m. — Caucasus: S. Transc. (mainly along Araks). Gen. distr.: Iran. (NW), Arm.-Kurd., As.-Min. (eastern part of Asia Minor and Syria). Described from Armenia (Levant), from Tournefort's collections. Type in Paris.

Section 4. MATTIORINDERA M. Pop. — Scales as oblong small rudiments in lower third of corolla tube. Corolla lobes obovate-spaculate, length of half cylindrical tube; tube without protuberances. Leaves becoming naked but hairs on petioles persistent. Fruit as in real Rindera, smooth, with smooth disk and edentate wing.

7. R. korshinskyi (Lipsky) Brand in Pflanzenr. IV, 252 (1921) 74. — Cyphomattia korshinskyi Lipsky in Tr. Bot. Sada, XXVI, 2 (1910) 511. —

577 Perennial; root rather thin, oblique, with slightly thickened apex, usually producing 1 stem; stem 40—50 cm high, angular, long-branching above, with scattered bristles, finely dotted; radical leaves oblong-lanceolate, ca. 20 cm long, tapering very gradually to white bristly petiole half length of blade, acute, lower surface and margin ciliate-bristly, green, with tubercles above; cauline leaves sessile, oblong or the upper lanceolate, all leaves green. Inflorescence white-tomentose, of scorpioid cymes, erect, elongating in fruit, paniculate-corymbiform, pedicels more or less tomentose, obliquely upright, as long as or longer than calyx (the lower to 2 cm long); calyx densely white-tomentose, its lobes lanceolate, obtuse, 5 mm long; corolla violet-red hardly longer than calyx, its lobes rounded-spatulate, nearly as long as tube; scales small, short, pale below middle of tube; filaments hardly shorter than anthers, attached slightly below throat of corolla; anthers oblong, ca. 1.5 mm long, slightly sagittate at base, obtuse, protruding between corolla lobes; style

long, exserted; nutlets and wing glabrous, rounded, 15—20 mm across wing, broad, entire or locally finely toothed; disk ovoid, smooth. June.

Centr. Asia: Pam.-Al. (Karategin, between Garm and Nemechi and Damburachi, 1897, Korzhinskii). Endemic. Known and described from indicated localities. Type in Leningrad.

Note. A unique species not naturally related to Cyphomattia nor to R. lanata (Lipskii overlooked the corolla!), intermediate between Mattia and Eurindera; scales rudimentary, corolla lobes obtuse as in Mattia, habit, fruit and naked leaves as in Eurindera. Lipskii correctly noted that it "differs" from C. lanata by the sparse but coarse pubescence.

Section 5. OXYRINDERA M. Pop.— Section Eurindera Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1851) 415; Kuzn. in Tr. Bot. muz. VII, 35; Brand in Pflanzenr. IV, 252 (1921) ex parte.— Corolla without scales or folds, short, ovoid, its lobes lanceolate, as long as tube. Fruit glabrous, like disk smooth, wing entire, as in real Rindera. Anthers with mucro. Plant subglabrous, habit as in real Rindera.

8. R. ochroleuca Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 408; DC. Prodr. X, 170; Ldb. Fl. Ross. III, 174; Kuzn. in Tr. Bot. muz.
578 VII, 41; Brand in Pflanzenr. IV, 252, 75.— Ic.: Kuzn., op. cit. Table III, Figure 3 (corolla).

Perennial; root thick, dark, multicipital, with remnants of previous years' petioles and stems; stem 30—60 cm high, erect, glabrous, the inflorescence loosely and paniculately branching; leaves glabrous, the radical oblong, to 15—30 cm long, 2.5—5 cm wide, gradually tapering to long glabrous petiole, acute; cauline leaves sessile, lanceolate, acute, short (2—4 cm); inflorescence loose, paniculate-corymbiform with few small leaves; scorpioid cymes loose even at flowering; later loose, erect, not long; pedicels glabrous, almost as long as calyx; calyx 7 mm long, glabrous, with sparse short lanate hairs confined to apices of oblong, acute sepals; corolla 12—15 mm long, yellow (not due to anthocyanin), the tube very broad, inflated, ovoid, hardly longer than or as long as calyx, without folds or scales; its lobes lanceolate, erect, about as long as tube; filaments very short; anthers 5 mm long, sagittate at base, with subulate 0.5 mm mucro, far from reaching tips of corolla lobes; style markedly exserted; nutlets ovoid-rounded, 15 mm across, with smooth disk, and broad entire wing; gynophore (torus) high, narrowly pyramidal; nutlets easily detaching. May. (Plate XXVIII, Figure 1.)

Sandy semi-deserts.— Centr. Asia: Balkh. (southeast of Lake Balkhash). Endemic. Described from sands of the lower reaches of Lepsa River, Makancha stream. Type in Leningrad and Moscow.

Note. Differs from R. tetraspis by the glabrous calyx and nearly complete absence of short leaves in the inflorescence, the yellow corolla (its lobes without anthocyanin) and ovoid bulging corolla tube, the anthers mucronate. A species of sandy habitats with a small distribution area touching that of R. tetraspis, growing more to the north, in S. Altai and Tarbagatai; common in Dzungarian Ala-Tau, and more to the south of R. ochroleucae growing on stony slopes near Alma-Ata.

Section 6. EURINDERA Kusn. in Tr. Bot. muz. VII (1910) 35. — Corolla tube cylindrical, without scales but in throat often with transverse scale-like folds present, rarely folds absent and then tube smooth; lobes of limb acute, narrow, as long as or $^2/_3$ (rarely $^1/_2$) length of tube; anthers obtuse; nutlets smooth, with smooth disk and entire or finely toothed wing. Pubescence impoverished, disappearing at fruiting, persistent on calyces. Medium-sized herbs, mainly in Central Asia. Very closely related species.

579 9. **R. tetraspis** Pall. Reise, I (1771) 486; Ldb. Fl. Ross. III, 174; Shmal'g., Fl. II, 223; Kryl., Fl. Zap. Sib. IX, 2237; Kuzn. in Tr. Bot. muz. VII, 38. — Cynoglossum laevigatum L. f. Suppl. (1781) 130. — C. rindera Pallas, Fl. Ross. II (1788) 96. — C. laevigatum L. Syst. ed. 13 (1791) 157. — Mattia laevigata Schult. Observ. bot. (1809) 31. — Rindera laevigata Roem. et Schult. Syst. IV (1819) 83 et 765; DC. Prodr. X, 170. — R. corymbulosa C. Koch in Linnaea, XXII (1849) 648 (from Georgia?). — Ic.: Pall. l. c. (1771) App. tab. F, f. 1, 2; l. c. 1788, tab. 88; Lam. Ill. gen. tab. 92, f. 3 (Cynoglossum); Kuzn., op. cit. Table III, Figures 4, 10.

Perennial; root dark, thin or thick, multicipital, producing several rosettes and 1—2(3) fertile stems, root collar slightly covered with scales, sometimes with some coarse fibers of dead petioles; stems 15—40 cm high, erect, glabrous, ribbed-furrowed, short-paniculate or corymbiformly branching in inflorescence; radical leaves glabrous, petioles more or less long, blades oblong or lanceolate, rarely (special forms) lanceolate-linear to sublinear, acute or obtuse, to 20 cm long and 4 cm wide, usually ca. 1—2 cm wide, gradually or more or less abruptly tapering to petiole; cauline leaves few (to 10), sessile, short, oblong or lanceolate, acute, the uppermost (in inflorescence) amplexicaul, ovate, acute or obtuse, sometimes with tomentose tip. Inflorescence with more or less dense, few-flowered, terminal scorpioid cymes loose in full bloom; straightening and obliquely spreading above in fruit; pedicels hairy, thin, as long as or slightly longer than calyx, elongating in fruit, when the lower reach 2 cm, erect; calyx 5—7 mm long, more or less densely gray- or white-lanate, with linear obtuse lobes; corolla dingy violet, $1^1/_2$—$2^1/_2$ times as long as calyx, broadly tubular, 12—15 mm long, its lobes lanceolate or lanceolate-linear, erect, slightly shorter than or as long as tube; transverse folds in throat absent or narrow; short filaments attached somewhat below throat; anthers 2—3 mm long, sagittate at base, obtuse, far from reaching tips of corolla lobes; style filiform, slightly exserted from corolla; stigma a dot; nutlets rounded or rounded-ovoid (with wing), ca. 15 mm across (or long), disk smooth, wing as broad as disk, more or less smooth or slightly undulant, entire, edentate, sometimes finely undulant-dentate, rarely finely toothed, often turning blue along margin. April—May.

580 Stony slopes, chalk and clay cliffs, rarely steppes, throughout steppe belt, 45(47)° to 50° N. — European part: Bes., L. Dnp., Bl., L. Don, L. V., Transv., Crim. (Kerch'); Caucasus: E. Transc. (Grozny and others), W. Transc. (Anapa); West Siberia: Alt., Ang.-Say. (southwestern part); Centr. Asia: Balkh., Ar.-Kasp. Endemic. Described from Lower Volga. Type in London.

10. R. cyclodonta Bge. in Mém. Acad. Pétersb. sav. étrang. VII (1854) 415; Boiss. Fl. or. IV, 275; Lipsky in Tr. Bot. Sada, XXVI, 2, 570; Kuzn. in Tr. Bot. muz. VII, 36; Brand in Pflanzenr. IV, 252, 71. — R. karabaghensis Brand, l. c. 72. — Ic.: Kuzn., op. cit. Table III, Figure 1.

Perennial; root thick, dark; stems 1—3, low, to 30 cm high, above lanate, faceted, branching in inflorescence; leaves slightly hairy turning subglabrous, linear-lanceolate, lanceolate or oblong-lanceolate, the radical more or less gradually tapering to petiole, 20 cm long, sometimes to 7 cm wide, often narrower and shorter (in type: 10 cm long, 1.5 cm wide). Corolla violet, tubular, its lobes lanceolate, erect, nearly as long or $^2/_3$ as long as tube; calyx tomentose, its lobes linear, about as long as corolla tube; pedicels of corymbiform-paniculate, small inflorescence long, only the upper shorter than calyx, hairy-lanate; scales developed as transverse folds nearly at throat; anthers 2—3 mm long, oblong, sagittate at base, obtuse, 2—3 times as long as short broadened filaments; fruit rounded, broadly winged, disk smooth, margin of wing with distinct fine teeth often turning blue. April—May.

Stony slopes, semi-desert, rarely semi-steppe belt. — Centr. Asia: Kyz. K., Pam.-Al., T. Sh. (to Chu River, according to Lipskii), Balkh., Mtn. Turkm. (Kopet Dagh, eastern part). Gen. distr.: Iran. Described from southern part of Kyz. K. (Tyumen-Bai-Tau, granite cliffs of Bakali). Type in Paris, cotype in Leningrad.

Note. Lipskii correctly claimed no essential differences between this and the preceding species; the differences are merely conventional and I retain them for the sake of tradition. It would be more correct to merge the species. In Central Asia they develop a more complex cycle of forms in which the differences between the proper R. tetraspis and the proper R. cyclodonta are eliminated, though numerous local forms exist. A unique race grows in the Mujunkum desert, another — very narrow-leaved — lives in northern Kara-Tau; southern forms, from Dzhizak south, are close to R. baldshuanica. The proper R. tetraspis is one race of this polymorphous species; transitional forms are particularly abundant in E. Tien Shan. R. karabaghensis Brand, a distinct race with edenticulate wings, was described from Paropamisus (erroneously described as "Bukhara"
581 by Brand) and also grows in East Kopet Dagh (Shamli, 1948, Blinovskii).

11. R. baldshuanica Kusn. in Tr. Bot. muz. VII (1910) 37; Brand in Pflanzenr. IV, 252, 70. — Ic.: Kuzn., op. cit. Table III, Figure 11.

Perennial; rhizome thick; stems 25—40 cm high, few, erect, glabrous, faceted-furrowed, paniculately branching above; leaves glabrous, the radical oblong, gradually tapering to more or less long petiole; cauline leaves many, ovate, sessile, shorter in inflorescence, cordate-ovate with lanate apex. Young scorpioid cymes white-lanate; pedicels as long as calyx; calyx 7—8 mm long, lanate, with linear obtuse lobes; corolla 12 mm long, yellow-violet, $1^1/_2$—2 times as long as calyx, its lobes linear-lanceolate, erect, 5—4 mm long, $^1/_2$ to $^2/_3$ length of tube; scales in throat as small transverse folds; filaments short; anthers oblong-linear, 2—3 mm long, base neither sagittate nor cordate, not exceeding lobes of corolla; anthers to 20 mm long, glabrous, smooth, with broad entire or finely toothed wing. May.

Mainly in variegated hills of semi-desert belt. — Centr. Asia: Pam.-Al. (southern part near Amu Darya and Pyandzh). Endemic. Described from Bal'dzhuan (Sang-Tuda, Regel'). Type in Leningrad.

Note. It was useless of Kuznetsov to describe this species after flowering fruitless specimens from Sang-Tuda with merely random differences from R. cyclodonta. Today all transitional forms between R. baldshuanica and R. cyclodonta are known and all characters by which Kuznetsov distinguishes the first from the second (short corolla lobes, broad profuse leaves, anthers not sagittate) prove to be exaggerated. What we have in fact is merely one of the races of the polymorphous cycle of R. tetraspis (or R. cyclodonta), a more southerly digression from R. tetraspis s. s. — R. cyclodonta.

Section 7. ECHINORINDERA M. Pop. — Section Eurindera Kusn. in Tr. Bot. muz. VII (1910) 35, ex parte. — Scales absent, rarely as transverse folds in throat. Corolla tube cylindrical, without external protuberances, its lobes elongate, lanceolate. Nutlets with spines scattered on disk or with keel of larger spines in one row. Margin of wing mostly with fine spiny teeth. Pubescence impoverished and disappearing as in real Rindera, or more dense and disappearing (R. echinata) or gray and persistent (R. oblongifolia). — Mountains of Central Asia.

12. R. **echinata** Rgl. in Bull. Soc. Nat. Mosc. XLI (1868) 92; Kuzn. in Tr. Bot. muz. VII, 42; Brand in Pflanzenr. IV, 252. 75.

582 Perennial; root dark, thick, with thick collar, bearing large smooth gray shiny scales, remnants of previous year's petioles, never with fibers; young plant before flowering with soft villous hairs, nearly gray; stem 40—60 cm high, thick, erect, usually branching from base with thin, paniculately disposed branches, young stems with soft-villous hairs becoming naked, ribbed; leaves oblong-lanceolate, undulant, with soft downy hairs, later naked, slightly hairy or subglabrous, radical leaves more or less abruptly tapering to petiole, to 30 cm long, cauline leaves numerous, shorter, sessile, acute. Inflorescence large, paniculate, of many scorpioid cymes terminating branches, dense, drooping in flower, elongating and becoming loose, erect in fruit; pedicels more or less longer than calyx, elongating in fruit, the lower to 2—3 cm long, erect, downy at first, later glabrous; calyx sparsely lanate-tomentose, 6—7 mm long, shorter than corolla tube, its lobes lanceolate or linear, obtuse; corolla 10—12 mm long, yellowish-bluish, its throat smooth, without folds or with rudimentary scales-tubercles turned inward; lobes linear, acute, slightly shorter than tube; anthers sagittate at base, notched, 4 mm long, filaments $\frac{1}{2}$ to $\frac{1}{3}$ length of anthers, these not protruding from lobes of corolla; nutlets back of nutlets short-spinous, all over the spines with anchorlike tip; nutlets with rounded wing, 12—16—17 mm across; wing broad, with spinous teeth along outer margin, rarely entire. April—May.

Variegated lowlands, rarely loess hills or stony slopes, in semi-desert (foothill) belt. — Centr. Asia: T. Sh. (NW). Endemic. Described from area between Boroldai and Arys', i. e., from the southwestern foothills of Kara-Tau Range (Severtsov). Type in Leningrad.

13. R. austroechinata M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIII (1950) 222.

Perennial; root thin, vertical, usually 1—3-headed, its apex covered with dull, nearly black scales — remnants of previous year's petioles; stem more or less thick, faceted, glabrous, with numerous branches from below or middle; leaves glabrous, cauline leaves sessile oblong, acute, broad, the uppermost sometimes ovate. Inflorescence paniculate; the scorpioid cymes loose, elongate, straightening after flowering; pedicels subglabrous, well developed, elongating to 3 cm in fruit, erect; calyx 7—8 mm long, with more or less dense tomentose gossamer, its lobes lanceolate-linear; corolla
583 yellow-violet, 12 mm long, tube as long as calyx; lobes linear-lanceolate, acute, slightly shorter than tube; folds in throat, inconspicuous; anthers 2.5—3 mm long; fruit (with wing) 14—18 mm across; disk of nutlets densely covered with longer anchorlike spines, the sides, especially below, also with profuse anchorlike spines; wing of nutlets broad, with sharp fine teeth with spines along outer margin.

Hills in semi-deserts, foothills. — Centr. Asia: T. Sh. Endemic. Described from Khazret-Ayub. Type in Leningrad.

14. R. coechinata M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIII (1950) 223.

Perennial; very similar to R. echinata but appears more robust, to 1 m high, but with thicker stem, glabrous, very strongly branching from base; radical leaves 20—40 cm long, long-petioled, with ovate-oblong blades subcordate at base, sharply set off from petioles, 17 cm long, 8 cm wide; cauline leaves and inflorescence as in preceding; calyx on long pedicel, with white-lanate gossamer hairs, flowering calyx short, ca. 5 mm long; corolla tube distinctly longer than calyx; lobes as long as tube, more declined and broader than in preceding, obtuse or even notched, violet; folds in throat distinct; anthers 3 mm long; fruit comparatively small, 12—15 mm across; disk of nutlet covered with scattered small white spines — tubercles without anchor-like head; wing nearly entire, finely undulant or obscurely toothed locally but teeth without spines. May—June.

Subalpine tragacanth belt — Centr. Asia: Mtn. Turkm. Endemic. Described from Geok-Tepe District. Type in Leningrad.

15. R. turkestanica Kusn. in Tr. Bot. muz. VII (1910) 42; Brand in Pflanzenr. IV, 252, 71. — R. cristatula Lipsky in Tr. Bot. Sada, XXVI, 2 (1910) 569. — Ic.: Kuzn., op. cit. Table III, Figure 2.

Perennial; root thick, multicipital, its neck covered with small dark scales, without fibers; stems 25—30 cm high, 1—2 from one root, erect, faceted-furrowed, simple, glabrous, paniculately branching above (from middle) or from base; leaves slightly hairy, mainly along margin and at tip, radical leaves 5—10 cm long, the oblong orne arly lanceolate acute blade gradually tapering to short petiole; cauline leaves few, lanceolate, acute, sessile. Inflorescence short-paniculate because of lateral branches; pedicels slightly longer than calyx, elongating in fruit and then the lower to 2—3 cm, erect;
584 calyx sparsely bristly-villous, 4—6 mm long, with linear-lanceolate lobes; corolla ca. 10 mm long, yellowish-bluish, twice as long as calyx, its lobes as long as or $^2/_3$ length of tube, narrow, sublinear, acute, erect; tube with

small folds in throat, without scales; filaments very short, attached at throat; anthers much longer than filaments, ca. 3 mm long, sagittate at base, not exserted from corolla lobes; dorsal disk of nutlets smooth but with median longitudinal crest of flattened spines sometimes adnate to toothed keel; the teeth or spines with anchorlike head; fruit (with wing) medium-sized, 12—14 mm across, wing broad, more or less finely undulant or toothed, turning blue along margin. April—May.

Probably on stony slopes in semi-steppe belt. — Centr. Asia: T. Sh. (southern part of W. T. Sh.) Endemic. Described from Kendyr-Auz Pass south of Angren River (Regel'). Type in Leningrad.

16. R. **oblongifolia** M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIII (1950) 224. — Ic.: M. Pop., op. cit. 225.

Perennial; root vertical, dark, thick, with 1—3 heads, the branches covered with soft dark remnants of previous year's petioles; stems 40—50 cm high, furrowed-ribbed, with white villous hairs below, and appressed gray tomentose down above, branching in upper part, with long declined fertile branches; radical leaves few, as in preceding, oblong, 10—15 (20) cm long, to 4 cm wide, gradually tapering to petiole of similar length, rarely tapering abruptly, flat, acute, with dense appressed gray hairs, becoming slightly naked, or not at all, 1—3-nerved; cauline leaves few, the lower oblong, tapering to short petiole; the upper lanceolate, sessile but not amplexicaul, acute. Inflorescence loosely paniculate, nearly leafless with few small narrow leaves at base; — its branches long, erect in flower, terminating in short few-flowered loose bostryces, markedly elongating, to 2 cm, in fruit, thin, erect; calyx 6—7 mm long, gray-downy-villous, with linear, obtuse lobes; corolla pale, 10—12 mm long, tubular, limb slightly funnel-shaped, cut to throat into oblong-lanceolate acute 4—5 mm long lobes; tube 1 1/2 times length of lobes; folds in throat distinct, papillate, ovate, short, almost scales; anthers on filaments as long,
585 sagittate, obtuse, 3—4 mm long, not exceeding teeth of corolla; style exserted; nutlets (with wing) ovoid or nearly rounded, medium-sized, 12—15 mm long, dorsal disk with more or less dense short or long spines with anchorlike head; neither spines nor crests along keel [sic], keel of one row of large fusing or free spines, these also covering sides of nutlets, sometimes extending to broad, nearly flat or undulant-plicate finely toothed wing, with teeth bearing spines.

Stony and pebbly mountain slopes. — Centr. Asia: T. Sh. (west between Talass Ala-Tau and S. Kara-Tau). Described from Tashkent Ala-Tau, from Irgailyk to Gunambai. Endemic. Type in Tashkent.

Species of indistinct affinity (because ripe nutlets not available).

17. R. **holochiton** M. Pop. sp. n. in Addenda XVIII, 626.

Perennial; root thin, obliquely, dark, with 2—3 crowded short branches, partly covered with dark squamiform remnants of previous year's petioles, with rusty brown scales inside, representing the sheathlike expansions of petioles of the radical leaves; stems 15 (in flower)-25 (in fruit) cm high, simple or with few branches in inflorescence, in addition to terminal bifurcation; thin, continuously, not densely spreading-crisp-villous, nearly lanate in inflorescence; radical leaves with long thin petioles, 5—8 cm long, covered with soft short slightly retrorse hairs, their blades oblong, 2/3 length of

petioles, 3—5 cm long, 2—3 cm wide, nearly uniformly tapering at both ends, acute, flat, with 1 distinct nerve, with uniform, regular semi-spreading downy hairs above and beneath; cauline leaves lanceolate, sessile, 5—8, antrorse, acute, 2—4 cm long, 0.4—1.0 cm wide, also with soft downy hairs above and beneath. Inflorescence small, with 1 terminal bifurcation and sometimes 1—2 short lateral branches from axils of upper leaves; axes and pedicels tomentose; racemes short, 2 cm long, reaching 5 cm and loose in fruit; pedicels 3—5 mm, erect; calyx not very densely lanate, 6 mm long, 8 mm in fruit, with linear obtuse lobes; corolla violet, 8—10 mm long, its tube as long as calyx, the lobes oblong-spatulate, obtuse, ca. 4 mm long, erect; scales replaced by crescent-shaped folds; anthers oblong, 3 mm long, obtuse, slightly sagittate at base, filaments half as long; style filiform, strongly ex-
586 serted from corolla; stigma a dot; only unripe fruit seen; nutlets winged, smooth on disk; wing (easily distinguishable) appears finely toothed.

High mountain belt, ca. 3,000 m, stony slopes. — Centr. Asia: T. Sh. Endemic. Described from Fergana Range (Kugart Pass, end of flowering, 6 VIII 1895, Korzhinskii, No. 3833), Pam.-Al. (Alai Range opposite Fergana Myshelai-Dzhalau, flowers 6 VII 1938, anonymous). Type in Leningrad.

Note. Resembling R. oschensis in pubescence and shape of leaves but sharply distinguished by lack of real scales and broad, obtuse corolla lobes. From R. oblongifolia it differs in the smaller leaf blades (2—3 times smaller than in R. oblongifolia), non-branching low stem and smooth disk of nutlets. On the young ovary it is difficult to judge if the mature wing is toothed, as in Echinorindera or nearly entire as in Eurindera. Probably it resembles the latter, as in the smooth disk. Our species is distinguished from all other Eurindera by the thick persistent pubescence; it may be a crossing of R. cyclodonta (i. e., Eurindera) × Lindelofia stylosa or L. olgae. On Myshelai-Dzhailau one flowering specimen was collected as well as narrow-leaved specimens more like L. olgae, but markedly downy. These specimens cannot be referred to any of the known species of Lindelofia: in the herbarium Zakirov determined them as L. pamiro-alaica Zak., but there is no proof of this in the fruit.

Genus 1225. **BILEGNUM*** Brand.

Brand in Fedde, Repert. XIII (1915) 549 et in Pflanzenr. IV, 252 (1921) 54, tab. I, f. W.

Calyx divided to base into linear-spatulate obtuse lobes only slightly elongating in fruit. Corolla tubular, small, bluish, the erect, indistinct, slightly zygomorphous limb, with ovate-rounded, completely obtuse, lobes $^1/_5$ length of tube, one wider than the rest; scales in lower part of tube small, oblong, obtuse. Anthers exserted 2—3 mm beyond lobes of corolla; filaments thin, inserted between scales; anthers small, oblong, less than 1 mm long;
587 style slightly exserted, stigma capitate. Nutlets rather small, 10—12 mm across, compressed, rounded (with wing), ovoid disk smooth, glabrous, with broad (3—4 mm) membranous slightly inward curved wing with double margin, strongly inward curved inside, large-toothed, nearly entire outside.

Note. A monotypic genus of NE Iran acknowledged only by Brand. Boissier included it in Mattia and Kuznetsov in Rindera, neither attaching

* From the Greek bi — two, legnum — margin. Nutlets with margin of wing double.

any significance to the exserted stamens (as in Solenanthus) and the double margin of the wing. The latter character was not even noted by Boissier. Its distribution area is separated from the related sections (Paramattia in the west, Pseudomattia in the east) of Rindera. In view of this I accept Brand's genus.

1. B. bungei (Boiss.) Brand. l. c. (1915) 550 et l. c. (1921) 54. — Mattia bungei Boiss. Fl. or. IV (1875) 274. — Rindera bungei Gürke in Engl. — Pr. Pflanzenf. IV, 3a (1897) 106; Kusn. in Tr. Bot. muz. 35, Table III, Figure 5 (corolla); Bornm. in Beih. Bot. Centralbl. XXXIII, 304.

Perennial; plant forms low, compact, nearly woody tufts owing to the numerous, short, compactly appressed branches of the robust dark caudex; root short, thick, rosettes of sterile shoots from spices of caudex numerous, white-gray, appressed to ground and caudex, narrow-leaved; leaves 4—5 cm long, 3—5 mm wide, lanceolate-linear, acute, white-tomentose or grayish, sometimes sericeous, half-folded; stems low, 8—10 cm high, simple, with few shorter sessile linear white-tomentose leaves, terminating in loose corymbs of 2—3 short scorpioid cymes erect in fruit; pedicels (in fruit) thin, long, to 1.5 cm, erect, hairy-downy. Lobes of tomentose calyx linear-spatulate, obtuse, to 5 mm long in fruit; corolla 7 mm long, tubular; in lower part of tube small scales; stamens markedly exserted; wing of nutlets slightly bluish, its double margin ca. 1—1.5 mm wide, gynophore strongly pyramidal. June—July. (Plate XXIX, Figure 2.)

Stony sections in subalpine belt (tragacanths). — Centr. Asia: Mtn. Turkm. (peak of Chapan-Dag Mountain). Gen. distr.: NE Iran. (near Shahrud). Described from Shahrud. Type in Leningrad and Geneva.

Note. A rocky-stony, subalpine xerophyte with woody caudex forming cushions resembling those of Gypsophila aretioides and others. A very characteristic type of the high, stony plateaus of Iran. Very rare and sparse in NE Iran (Khursan).

588 Genus 1226. **PARACARYUM*** Boiss.

Boiss. Diagn. XI (1849) 128; Fl. or. IV, 253.— Omphalodes sect. Paracaryum § 1. DC. Prodr. X (1846) 159 et Mattia § 3, l.c. 169, ex parte.— Paracaryum et Mattia strum Brand in Pflanzenr. IV, 252 (1921) 45 et 54.

Calyx divided nearly to base into narrow lanceolate lobes slightly accrescent in fruit (mainly in length), extended by downward growing bases of nutlets; corolla violet, its short cylindrical tube as long as or slightly longer than calyx, the funnel-shaped limb as long as or longer than tube, with very obtuse, ovate lobes, obliquely curved upward; scales in throat more or less developed, mostly square, rarely elongate; stamens on very short filaments or sessile, included in corolla tube, not reaching beyond scales; anthers oblong, obtuse; style often short, not protruding from flower. Nutlets dorsoventrally compressed, their margin with broad strongly concave wing almost forming a

* From the Greek para — close, nearby; carya — nutlet.

sac leaving disk of the nutlet hardly visible or wing broad, flat as in Rindera; in annual species wing sometimes narrow, slightly curved; wing always denticulate or entire; ripening nutlets growing downward, depressing sepals; hence style on high-pyramidal gynophore entirely visible even in ripe fruit; cicatrice lanceolate-oblong, occupying large part but not the base of the ventral aspect (of the seeds). Usually distinguished from Rindera by the stamens not exserted from the corolla and by the funnel-shaped, not tubular corolla; but all these genera converge very strongly through sections Pseudomattia and Paramattia of Rindera, and Macro-Mattiastrum of Paracaryum. About 20 species. Almost exclusively in the Iranian ancient Mediterranean province.

1. Perennial, at least biennial plants. Nutlets 5—10(12) mm across. Flowers 4—15 mm long. Stems 10—60 cm high, rather thick. Radical leaves present. (Mountain plants) . . . . . 2.

\+ Delicate annual plants, flowers very small, ca. 2 mm, fruit small, 3—4 mm long. Stems 5—14 cm high, usually considerably branching. Lowermost leaves spatulate-lanceolate. Hairs on upper side of leaves borne on tubercles. (Deserts). (Section Microparacaryum) . . . . . 8.

2. Corolla large, 10—15 mm long, deep red; stamens between very long, lanceolate-linear with short obtuse lobes, scales in throat, with 2 small lateral teeth at middle and long-subulate upper
589 half, anthers in campanulate part of limb; style long, markedly exserted from corolla (section Macromattiastrum). Gray-tomentose plant, with lanceolate leaves. Wing of nutlets, disk aculeate. (Caucasus, near Turkish border) . . . . . 1. P. incanum (Ldb.) Boiss.

\+ Flowers small, 3—6 mm long; scales small, not longer or slightly longer than wide, nearly rectangular, vertically or horizontally elongated, with truncate 2-lobed apex, sides edentate. Stamens rarely exserted from throat, often in corolla tube; style like anthers, not markedly protruding from corolla, often very short . . . . . 3.

3. Wing flat, not curved inward and not forming sac (Section Modestomattiastrum) . . . . . 4.

\+ Wing curved inward, disk of nutlet visible through resulting envelopes, margin of wing acutely fine-toothed, nearly appressed to disk, with callous-like thickening. Flowers purple-red, small, 4—5 mm long; anthers and style enclosed in corolla tube. Stems erect, branching, with brist hairs; leaves lanceolate. Racemes (in fruit) loose. Biennial plants. (S. Transcaucasia) . . . . . 7. P. strictum (C. Koch) Boiss.

4. Flat wing more or less distinctly toothed; disk of nutlet usually prickly, rarely smooth. (Series Lophoptera) . . . . . 5.

\+ Flat wing entire, edenticulate, disk smooth (confined to Kopet Dagh). (Series Holoptera) . . . . . 7.

5. Corolla 2—3 mm long, blue-purple, sometimes nearly blue; anthers and style in corolla tube. Pedicels very short, in

lower fruits 2—3 mm long, median and upper fruits subsessile, nutlets 5—10 mm across, disk spinous, the wing with spiny teeth. Hairs grayish, not long. Biennials. (Pamir area) . . . . . 4. P. himalayense (Klotzsch) C. B. Clarke.

\+ Corolla 4—6 mm long. At least the lower pedicels long, 8—10(15) mm . . . . . 6.

6. Disk of nutlet prickly. Pedicels 1—1.5 cm long, with appressed hairs. Corolla bluish, 4—5 mm long; anthers on short filaments in throat; style exserted from corolla tube, nearly protruding from limb. Scales longer than wide. Biennial, sparsely bristly-hairy. Leaves lanceolate. (S. Transcaucasia) . . . . . 2. P. laxiflorum Trautv.

\+ Disk smooth. Pedicels shorter, the lower 8 mm, the upper 2—4 mm long, completely spreading-villous. Corolla dark red, 6 mm long; anthers and style in corolla tube. Scales larger,
590 oblong, 1.5 mm long. Perennial low plants with spreading soft villous hairs. (Centr. Asia, Kara-Tau) . . . . 3. P. karataviense Pavl.

7. Nutlets rounded, 10—14 mm across. Leaves and stems greenish, with sparse hairs. Stem usually 15—40 cm high, strongly branching, leaves lanceolate. Fruiting racemes many, loose. Biennial plants in semi-desert mountain belt. (Kopet Dagh). . . . . 5. P. turcomanicum Bornm. et Sint.

\+ Nutlets 6—8 mm long, ovoid. Leaves and stems with appressed-gray to ash-gray hairs. Stems thin, subfiliform, 10—20 cm high, nearly simple. Leaves lanceolate-linear. Fruiting racemes very few (1—2), short (2—3 cm). Fruiting racemes. Perennial, cespitose plants of subalpine belt. (Kopet Dagh) . . . . . 6. P. gracile Czernjak.

8. Wing, often in all 4 but at least in 2—3 nutlets of a fruit, inflated, inward curved, finely callous-dentate as in Euparacaryum (see above, 3+) but fruit smaller, (with wing) 4—5 mm across, disk often thin-prickly, wing undulant or also papillate-dentate. Fruit on distinct pedicel, recurved. (Deserts of Kyzyl Kum and Aral area, Gorno-Badakhshan) . . . . . 8. P. intermedium (Fresen.) Lipsky.

\+ Wing narrow, dentate, flat or slight concave, sometimes reduced to rim. Disk strongly prickly, nutlets ca. 3 mm long. Fruit subsessile. Racemes very long, stem markedly reduced (Kyzyl Kum and Gorno-Badakhshan) . . . . . 9. P. bungei (Boiss.) Brand.

Section 1. MACROMATTIASTRUM (Brand) M. Pop. — Generis Mattiastri sect. 1 Macromattiastrum Brand in Fedde, Repert. XIV (1915) 150 et in Pflanzenr. IV, 252 (1921) 55. — Sect. II. Mattiastrum ++ Boiss. Fl. or. IV (1875) 260. — Corolla 8—15 mm long. Scales linear, very long. Stamens inserted in throat; anthers included, not reaching the short-obtuse lobes. Style exserted. Wing flat, not curved inward. This section is very close to Rindera particularly to its first three sections, from which it differs only in the elongate scales. It could be ranked as a genus or as a section of Rindera.

PLATE XXIX. 1 — Paracaryum laxiflorum Trautv.; 2 — Bilegnum bungei (Boiss.) Brand; 3 — Paracaryum bungei (Boiss.) Brand.

593 1. P. incanum (Ldb.) Boiss. Fl. or. IV (1875) 262; Kuzn. in Mat. Fl. Kavk. IV, 2, 152. — Mattia incana Ldb. Fl. Ross. III (1847) 173. — Mattiastrum incanum Brand in Fedde, Repert. XIV (1915) 151 et in Pflanzenr. IV, 252 (1921) 57.

Perennial; root thin, vertical; stem 30—40 cm high, single, robust, erect, gray-tomentose, often branching above, rarely from base; radical leaves early dying, oblong-lanceolate, tapering to long petiole, to 10 cm long, to 1 cm wide, acute; cauline leaves numerous, lanceolate, the lower tapering to base, the upper sessile, all leaves acute, grayish- or white-tomentose, flat, 1-nerved. Inflorescence corymbiform or, if many lateral branches present, corymbiform-paniculate; scorpioid cymes rather dense, few-flowered, in fruit strongly elongate, erect, spreading sideways, nearly leafless; pedicels as long as calyx, strongly elongating, to 2—2.5 cm in fruit, erect; calyx white-tomentose, 7—8 mm long, with lanceolate acute lobes; corolla dark purple-red, 10—15 mm long, tube cylindrical, slightly shorter or as long as calyx, the limb campanulate with short lobes, $^1/_3$—$^1/_2$ length of limb, ovate-rounded, obtuse; scales in throat, elongate (4—5 mm), lanceolate-linear, with thin acute apex $^1/_2$ the length of scale above lateral gibbosities; filaments short, inserted slightly below scales; anthers linear, elongate, 4—3.5 mm long, slightly sagittate at base, obtuse; style filiform, protruding from corolla for 5—6 mm; nutlets with rounded wing, ca. 12 mm across ovoid disk with sparse short thin prickles; membranous wing flat, as wide as disk, finely spinous-dentate; style long, persistent. June. (Plate XXXI, Figure 3.)

Stony slopes. — Caucasus: W. Transc. (near Turkish border). Gen. distr.: As.-Min. (northeast part of Asia Minor west to Angora). Described from Transcaucasia (Nordmann). Type in Leningrad.

Section 2. MODESTOMATTIASTRUM (Brand) M. Pop. — Generis Mattiastri sect. 2 Modestomattiastrum Brand in Fedde, Repert. XIV (1915) 152 et Pflanzenr. IV, 252 (1921) 60. — Sect. II Mattiastrum + Boiss. Fl. or. IV (1876) 257. — Corolla small, 2—6 mm long, usually dark, purple. Scales rectangular, elongating upward or sideways, not linear, obtuse, usually 2-lobed, papillate. Filaments short, anthers 1—2 mm long, oblong or slightly protruding or hidden in tube. Style short, in corolla tube or hardly exceeding corolla limb. Wing of nutlets flat.

594 Series 1. Lophoptera M. Pop. — Wing dentate, teeth with spines.

2. P. laxiflorum Trautv. in Tr. Bot. Sada, III, 2 (1875) 274; Kuzn. in Mat. Fl. Kavk. IV, 2, 151; Brand in Pflanzenr. IV, 252, 52.

Biennial; root thin, vertical; stem usually single, erect, 20—40 cm high, branching from middle or base, with declined branches, spreading below, with sparse bristly villous hairs, above with semi-appressed thin hairs, grayish; radical leaves drying at fruiting, oblong or oblong-lanceolate, nearly obtuse undulant, tapering to long bristly petiole, gray, with spreading hairs, 5—8 cm long; cauline leaves broadly lanceolate, short, 2—5 cm long, short-acuminate, the lower tapering to petiole, the upper sessile, gray with sparse

semi-spreading hairs. Inflorescence paniculate, scorpioid cymes apparently dense, but after flowering and in fruit very loose, elongate, erect, leafless; pedicels gray-downy, as long as calyx, the lower to 1—1.5 cm in fruit, erect; calyx gray, its lobes oblong-linear, in flower lanceolate, obtuse, calyx recurved, to 5—6 mm in fruit; corolla blue-purple, 4—5 mm long, its tube shorter than calyx, the limb short (shorter than tube) campanulate, divided nearly to throat into semi-rounded short lobes; anthers inserted in throat on very short filaments, nearly exserted from corolla; oblong, 2—1.5 mm long, scales elongate, rectangular, with 2-lobed papillate obtuse apex, nearly 2 mm long; style nearly exserted; nutlets ovoid, 9—10 mm long, disk with sparse anchorlike prickles, one row along median line of disk forming a semblance of a keel; wing nearly flat, as wide as disk, with callous-thickened dentate margin, flat part of wing slightly curved inward, sometimes not so; wing and sides of nutlets smooth; style persistent. June. (Plate XXIX, Figure 1.)

Stony slopes of mountain belt (1,500 m). — Caucasus: S. Transc. (Akhalkalak region, village of Khondo). Gen. distr.: Arm.-Kurd., beginning at the Soviet-Turkish border: Artvin, Kaguizman, Kars to Erzerum). Described near Erzerum. Type in Leningrad.

Note. Very close to P. leptophyllum (DC.) Boiss., which also appears to have been described from Erzerum (Aucher-Eloy, No. 2281-vidi),
597 though I believe it was another species with thin stems, narrow linear leaves and smaller fruit with less prickly disk and less dentate wing. The type seen by me had the lower axillary branches almost entirely bitten off and was not typical.

3. P. karataviense Pavl. ex M. Pop. sp. n. in Addenda XVIII, 627.

Perennial; root thick, woody, branching at apex, with decumbent thin branches; radical leaves spatulate-lanceolate-linear, acute, 4—5 cm long, tapering to petiole, cauline leaves lanceolate, sessile, slightly undulant, all leaves with spreading soft hairs; stems 10—20 cm high, robust, few, villous, with few short apical branches. Scorpioid cymes compact, in fruit elongate, loose, erect, leafless; lower pedicels to 8 mm longer than calyx, the upper much shorter, spreading-villous, erect; flowers rather large, black-violet, not blue; calyx 3—4 mm, in fruit to 6 mm long, its lobes lanceolate, acute or obtuse, with naked apex; corolla black-violet, medium-sized, its tube thick-cylindrical, slightly shorter than calyx, 3 mm long, limb as long, broadly campanulate, lobes nearly semi-rounded; scales large, 1.5 mm long, oblong, black, papillate; stamens included in corolla tube, anthers oblong, ca. 2 mm long, on very short filaments; style thick, short, 2 mm long; nutlets (when semi-ripe) with smooth disk and sides, their wing narrow, straight with 7 anchorlike spines on each side, ripe nutlets apparently 10 mm across, style 3—4 mm long. May—June.

Stony (shaly) peaks and slopes in mountain belt. — Centr. Asia: T. Sh. northwestern part of Kara-Tau mountains. Endemic. Described from Kara-Tau mountains. Type in Moscow.

Note. This species is close to the preceding, and yet a more brachymorphous type of the genus, with stamens and style included in the corolla tube, but still longer appendages. It is readily distinguished from P. himalayense by flowers twice as large, black corolla, spreading hairs and smooth disk of nutlets.

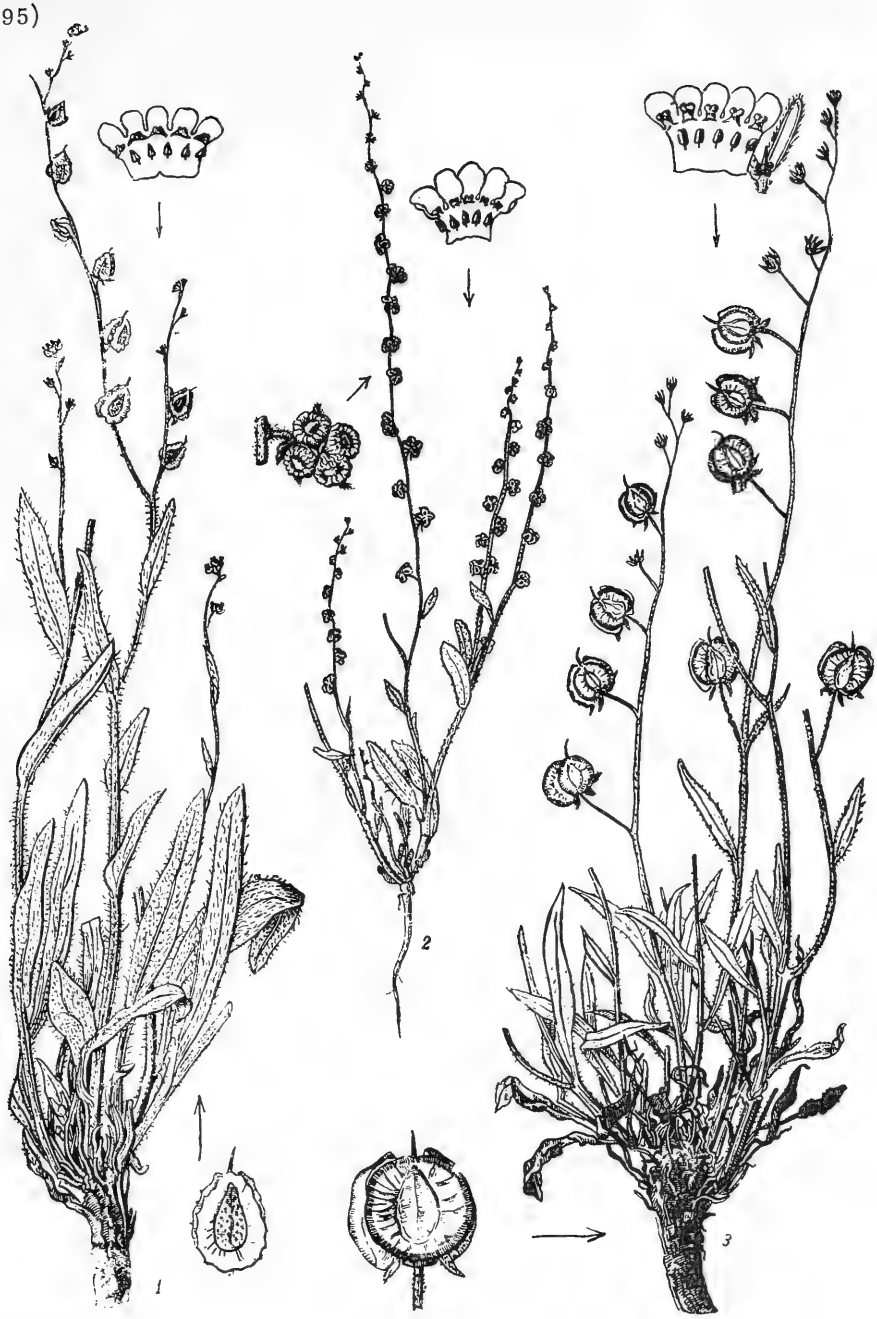

PLATE XXX. 1 — Paracaryum himalayense (Klotzsch) C. B. Clarke.; 2 — P. intermedium (Fresen.), Lipsky.; 3 — P. turcomanicum Bornm. et Sint.

4. P. himalayense (Klotzsch) C. B. Clarke in Hook. Fl. Brit. Ind. IV (1885) 162; Lipsky in Tr. Bot. Sada, XXVI, 2, 485.— Mattia himalayensis Klotzsch in Bot. Ergebn. d. Reise Prinz Waldem. (1862) 94.— Mattiastrum himalayense Brand in Fedde, Repert. XIV (1915) 156 et in Pflanzenr. IV, 252 (1921) 65.— P. emiri M. Pop. Descr. pl. Turk. (1916) 66, tab. 16.— Ic.: Klotzsch, l. c. tab. 64; Gürke in Engl.— Pr. Pflanzenf. IV, 3a, f. 42, L—O; Brand, l. c. (1921) f. 10, L—O; M. Pop., op. cit. Table 16.

598 Biennial; root thin, vertical; stems 20—40 cm high, usually few from one root, ascending or erect from base, robust, semi-spreading or spreading with short bristly hairs, grayish, sometimes whitish, with long ascending branches nearly from base; radical leaves dying at fruiting, spatulate to oblong-lanceolate or lanceolate, obtuse, tapering to petiole, 5—8 cm long; cauline leaves lanceolate, short, 2—4 cm long, the upper sessile, the lower tapering to petiole, 0.5—1 cm wide, acute, with semi-appressed bristly hairs without tubercles, grayish. Inflorescence paniculate, loose; scorpioid cymes very early elongating, becoming straight, 5—10(15) cm long, sometimes more compact or very loose, leafless; flowers and fruit subsessile, rarely pedicels 2—3 mm long in lower part of scorpioid cymes; flowers very small, calyx ca. 1 mm long, downy, with oblong rounded obtuse lobes, in fruit to 3 mm long, recurved; corolla 2—2.5 mm long, blue-purple, nearly blue, its tube less than 1 mm, shorter than calyx, the limb rather broad, broadly campanulate, to 2—2.5 mm wide, with short semi-rounded lobes; scales small, nearly square, slightly protruding from throat, papillate; anthers sessile in corolla tube, ca. 0.5 mm long, oblong; stigma not exserted from throat of corolla; nutlets 5—10 mm across, rounded-ovoid, their disk with sparse short prickles-tubercles, sometimes with spines resembling a median keel and then with anchorlike heads; wing very flat, with bluish dentate margin with callous-like, often inward curved spines on teeth; style ca. 1 mm long. (Plate XXX, Figure 1.)

Stony slopes of mountains, 1,5000—1,000 m, rarely in semi-deserts.— Centr. Asia: Pam.-Al. (mainly in southwestern very rarely in eastern part, especially in Alai Range). Gen. distr.: Hindu Kush, northwest Himalayas, W. Tibet. Described from the Himalayas (Hofmeister), exact locality not known. Type in Berlin?

Note. This species grows in a large part of the southeastern (eastern) region of the distribution area of the genus, the center of which lies in the Armenian-Kurdistan district (East Mediterranean Province); the other species P. tibeticum C. B. Clarke, is very doubtful. Judging from Brand's description it does not appear to differ from our species except in the smaller size of the nutlets (4 mm across), sometimes borne on stalks. As a widely distributed species P. himalayense is very variable: its pubescence is stiff, spreading, or more or less appressed, gray; sometimes (P. emiri) the plant is green, with corolla variable from blue-purple to nearly sky blue, the nutlets are 5 mm to 10 mm long, sometimes the lower fruit has a distinct pedicel and the fruiting racemes are more compact, or elongate and loose.

599 Series 2. Holoptera M. Pop.— Wing entire, disk smooth.

5. P. turcomanicum Bornm. et Sint. in Beih. Bot. Centralbl. XX II (1906) 193 et in Fedde, Repert. (1912) 420. — Mattiastrum turkestanicum Brand in Fedde, Repert. XIV (1915) 155 et in Pflanzenr. IV, 252 (1921) 64.

Biennial; root thin, vertical, usually producing few stems, sometimes with few (to many) rosettes; plant greenish, with sparse appressed down; stems 15—40 cm high, ascending or erect from base, thickish, subglabrous especially below, with very sparse appressed short down above, in weak, dried specimens rarely the whole stem and leaves downy, slightly grayish; radical leaves spatulate-lanceolate, obtuse, tapering to more or less long petiole, blade greenish, faintly downy, very rarely (in dried individuals) narrower, with grayish down, 1-nerved, 5—8 cm long, to 1—1.2 cm wide; cauline leaves few, mainly in lower part of stem, lanceolate, reduced, flat, subglabrous, acute; median leaves 2—4 cm long; branches of stem usually profuse, often long, obliquely ascending from base of stem. Scorpioid cymes leafless, 2 at apex of stem and at ends of lateral branches, forming paniculate-corymbiform inflorescence, very loose, early straightening and elongating to 15 cm; pedicels longer than calyx, downy, to 2—3 cm long in fruit, thin, erect; calyx ca. 3 mm long, in fruit to 5—6 mm long, short-downy, with linear obtuse lobes; corolla dark purple-red, ca. 4 mm long, tube 2 mm long, shorter than calyx, limb campanulate, 2 mm long, cut for $\frac{1}{2}$ into semi-rounded lobes; scales nearly square, ca. 1 mm high, papillate, with distinctly 2-lobed upper margin; anthers sessile in corolla tube, oblong, hardly exceeding 1 mm long; style short, 1.5 mm long; nutlets 9—11 mm across, rounded (with wing), slightly inflated along ovoid disk, smooth, glabrous; wing as wide as disk, flat, slightly undulant, entire; style exserted, 2—4 mm long. (Plate XXX, Figure 3.)

Stony slopes and gypsiferous, Tertiary-Cretaceous rocks in semi-desert belt. — Centr. Asia: Mtn. Turkm. (Kopet Dagh, west and central). Endemic. Described from Ashkhabad vicinity. Cotype in Leningrad.

Note. Slightly variable in width and pubescence of the generally greenish leaves and in size of fruit. The type specimens are very large-fruited (fruit to 14 mm across), usually fruit ca. 10 mm in diameter. In Iran and Asia
600 Minor there appear to be no species close to this. Only the Kopet Dagh P. gracile Czernjak. is somewhat close to P. turcomanicum, and has little in common with P. himalayense.

6. P. gracile Czernjak. in Fedde, Repert. XXVII (1930) 277.

Perennial; root thick, dark, short, multicipital, with short woody branches; plant nearly cespitose, with numerous rosettes and several thin fertile stems, appressed-gray (ash-gray), not sericeous; radical leaves lanceolate-linear, 3—7 cm long, short-acuminate, gradually tapering to more or less long petiole, flat, 1-nerved; stems thin, subfiliform, gray, 10—20 cm high, erect or ascending, with very few (to 5) short lanceolate linear upper leaves and impoverished inflorescence of 1 (rarely 2) terminal scorpioid cyme on leafless stem. Scorpioid cyme capitate at first, later straightening but short, not longer than 2—3 cm, spreading above; pedicels very short, gray, the lower elongating to 5—7 mm in fruit; calyx to 2 mm long, gray, the lanceolate obtuse lobes oblong, recurved and slightly accrescent in fruit; corolla 3—4 mm long, as wide as limb, purple (blue-violet), the tube as long as calyx, the limb funnel-shaped,

with ovate-rounded lobes; scales in throat ovoid-rounded, small, less than 1 mm long (0.5—0.8 mm); stamens attached to middle of corolla tube, extending to base of scales, 1 mm long, oblong, obtuse; fruit seen only semi-developed and then disk smooth, wing narrow, entire, slightly undulant flat; nutlets quite ovoid, 6 mm long; wing less than 1 mm wide; style persistent, spreading, 2—3 mm long. June. (Plate XXXI, Figure 2.)

Subalpine belt of tragacanths. — Centr. Asia: Mtn. Turkm. (Ak-Dag, Razarash Mountain). Endemic. Described from Razarash Mountain. Type in Leningrad.

Note. Although owing to the lack of ripe fruit this species is dubious, it is evidently close only to P. turcomanicum, appearing to be its high-mountain derivative.

Section 3. EUPARACARYUM Boiss. Diagn. XI (1849) 129; Fl. or. IV, 253, ex parte (spec. annuis excl.); Kuzn. in Mat. Fl. Kavk. IV, 2, 149, ex parte. — Genus Paracaryum s.s. Brand in Pflanzenr. IV, 252 (1921) 45 ex parte (species 8—13). — Wing of nut inflated, inward curved on dorsal areola surface into open sac leaving disk visible. Margin of wing recurved, usually thickened, callous-dentate. Flowers usually small, brachymorphous. Perennials or biennials.

601 7. P. strictum (C. Koch) Boiss. Fl. or. IV (1875) 256; Kuzn. in Mat. Fl. Kavk. IV, 2, 150; Brand in Pflanzenr. IV, 252, 50. — Omphalodes stricta C. Koch in Linnaea XVII (1843) 302 et XXII (1849) 646. — Paracaryum hirsutum (DC.) Boiss. Diagn. XI (1849) 130; Brand, l. c. 51. — Omphalodes hirsuta DC. Prodr. X (1846) 159. — Paracaryum undulatum Boiss. Diagn. XI (1849) 129. — P. sintenisii Hausskn. ex Bornm. in Beih. Bot. Centralbl. XX, II (1906) 191; Brand, l. c. 51. — P. rugulosum Kusn. l. c. 149, non Boiss. nec Omphalodes rugulosa DC. — Ic.: Brand, l. c. f. 1, u. — Exs.: Herb. Fl. cauc. No. 180 (under P. rugulosum "Boiss".).

Biennial; root thin, vertical; stems 20—50 cm high, often single, erect, with spreading bristly hairs, with declined branches from middle or below; radical leaves dying at fruiting, spatulate-lanceolate or oblong-lanceolate, gradually tapering to 5—10 cm long petiole, with spreading bristles, often undulant, rarely flat, short-acuminate or nearly obtuse, 1-nerved, 0.5—1 (1.5) cm wide in widest part, usually sparsely villous, greenish, rarely gray, more densely villous; cauline leaves lanceolate or lanceolate-linear, more or less numerous, marginal hairs as in the radical leaves, more or less long-tapering to base, upper leaves sessile, acute, the uppermost to 1—1.5 cm long, linear, narrower on branches of inflorescence. Inflorescence usually loose-paniculate owing to sparse lateral branches, usually with 2 additional terminal scorpioid cymes; even young cymes very loose, elongate, straightening and much elongating in fruit, fruit more or less strongly shifted, especially in the ash gray, narrow-leaved form, leafless; pedicels short, downy; shorter than calyx, fruiting pedicels erect, shorter than fruit, the lowermost sometimes as long as fruit; flowers small, calyx ca. 2—3 mm long, ash gray-hairy, the lanceolate acute lobes to 5 mm in fruits; corolla dark purple-red (sometimes blue purple?), 4—5 mm long, funnel-shaped,

the tube shorter than calyx, limb campanulate, as long as calyx, with short ovate-rounded lobes; anthers sessile in corolla tube, 1.5 mm long; scales ca. 1 mm long, nearly square, their apex 2-lobed, thickened, inflated; style very short, not exserted from corolla tube; nutlets ca. 6 mm long (5—7 mm), with vesicularly swollen curved wing, with dentate margin, the teeth unarmed, disk (inside vesicle) smooth or with thin sparse prickles or tuberculate, nearly flat but with straight smooth crest; dentate curved wing sometimes with finely prickly margin; style short, 1—2 mm. May—June. (Plate XXXI, Figure 1.)

602 Stony slopes and taluses, 1,000—1,500 m. — Caucasus: S. Transc. (along Araks, in Armenia and Nakhichevan ASSR). Gen. distr.: Iran. (NW), Arm.-Kurd. Described from Araks, Armenia. Cotype in Leningrad.

Section 4. MICROPARACARYUM M. Pop. sect. n. — Paracaryum sect. Euparacaryum (ex parte, quoad species annuas) Boiss. Fl. or. IV (1875) 256; Brand in Pflanzenr. IV, 252, 47. — Omphalodes sect. Paracaryum § 1 (ex parte, quoad species annuas) DC. Prodr. X, 159. — Low annuals of desert habitats. Flowers very small, ca. 1—2 mm long. Nutlets small, 2—3 mm long or wide, with wing varying in shape. P. microcarpum Boiss. and P. salsum Boiss. from Iran should be included in this section in addition to our species.

Series 1. Physodes M. Pop. — Wing inflated, incurved, resembling a sac with opening as in Section Euparacaryum but nutlets much smaller.

8. P. intermedium (Fresen.) Lipsky in Tr. Bot. Sada, XXVI, 2 (1910) 487; Brand in Pflanzenr. IV, 252, 47; Thell. in Mém. Soc. sc. nat. et math. Cherbourg, XXXVIII, 420. — Omphalodes intermedia Decne. in Ann. Sc. Nat. 2 sér. II (1834) 255—256. — Cynoglossum intermedium Fresen. in Museum Senckenberg. I (1834) 169 et in Ann. Sc. Nat. 2 sér. II (1834) 47. — Omphalodes micrantha DC. Prodr. X (1846) 159. — O. papillosa DC. l. c. 159. — O. physodes Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1854) 414. — O. glochidiata Bge. l. c. 413. — Paracaryum micranthum Boiss. Diagn. XI (1849) 129 et Fl. or. IV (1875) 255.

Annual; plants poorly pubescent, thus usually greenish (dark green); stem erect, 5—15 cm high, thin, usually branching with few or many spreading branches sparsely bristly with hairs spreading below and shorter and appressed above; cauline leaves (radical leaves absent) usually spatulate-lanceolate, rarely spatulate-linear in the lower part of stem, more or less tapering at base, 1—3 cm long, obtuse or short-acuminate, upper leaves reduced, linear, acute, few, all leaves flat, greenish, sparsely spreading-bristly, bristles at upper surface with small tubercles at base, rarely leaves somewhat grayish with denser pubescence. Cymes one or two terminal at apex of stem, branching individuals with additional cymes on branches so that when branching from base plant appearing broom-shaped, all cymes

605 soon straightening and elongating, usually suberect, all leafless; pedicels at

PLATE XXXI. 1 — Paracaryum strictum (C. Koch) Boiss.; 2 — P. gracile Czernjak.; 3 — P. incanum (Ldb.) Boiss.

first short, downy, as long as calyx, elongating in fruit, the lower as long as fruit, drooping, the upper (and sometimes all) remaining shorter than fruit; calyx very small, ca. 1.5 mm long in flower, with linear-oblong, bristly-pubescent, obtuse lobes reaching 1—2 mm in fruit; corolla blue or blue-purple, ca. 2—3 mm long, tube narrow, limb campanulate, 1—2 mm across, the lobes obtuse, oblong, tapering at base; scales white, small, orbicular, ca. 0.5 mm long, 2-lobed at apex; anthers 0.5 mm long, ovoid, sessile in tube of corolla; style not exserted from corolla tube; nutlets vesicular-globose, ca. 2—3 mm long (without wing); disk oblong, usually covered with few thin spinules, rarely tuberculate, very rarely smooth; wing inflated, white-yellow, often turning blue at margin, strongly incurved, often undulant-plicate at surface, finely and thickly dentate along margin (inside), covered at bend outside with the same colored conical papilliform teeth, sometimes the posterior 1—2 nutlets without wing or only with rudimentary narrow rim; sides of nutlets usually smooth, rarely tuberculate-aculeate; cicatrice oblong or lanceolate, absent only in the lower part of ventral side of nutlet; style short, 0.1—1 mm long; gynophore oblong-pyramidal with nutlets hardly falling off from it. April—May. (Plate XXX, Figure 2.)

Stony, rarely clayey or sandy deserts.— Centr. Asia: Kyz. K., Ar.-Kasp., T. Sh. (Mogol-Tau), Pam.-Al. (Upper Zeravshan — rare; Gorno-Badakhshan Autonomous District, common). Gen. distr.: Iran., E. Med. (Iraq, Egypt, Arabia). Described from mountains in the Sinai Peninsula. Type in Frankfurt-on-Main.

Note. P. calathicarpum (Stocks) Boiss., with the posterior (those toward axis of inflorescence) nutlets wingless, is very common in the USSR. Sometimes there are 1—2 such nutlets or one nutlet does not develop at all and then there are only 3 with a globular-vesicular wing [sic].

Series 2. Pseudo-echinospermum M. Pop.— Wing narrow, like a dentate rim.

9. P. bungei (Boiss.) Brand in Pflanzenr. IV, 252 (1921) 47.— Echinospermum bungei Boiss. Fl. or. IV (1875) 252.— Paracaryum bornmuelleri Brand in Fedde, Repert. XIV (1915) 149.

Annual; stem usually branching from base and plant broom-like in habit with erect cymes on lateral branches, rarely few-branched, the stem short,
606 erect, a few cm high, branches elongated so that plant in fruit 10—15 cm high; stems and leaves bristly with short, semi-spreading hairs, plant canescent; leaves mainly below, on short stem, lanceolate-spatulate, gradually tapering at base to a more or less long petiole, sometimes lanceolate-linear, 1—3 cm long, obtuse or short-acuminate, the uppermost under cymes linear, small, all leaves rather densely bristly-pubescent, the bristles borne on tubercles (at least at upper surface of leaves). Cymes in fruit straightly directed upward, long, to 10 cm, with spreading fruits, leafless; pedicels very short, shorter than calyx and fruit, appressed-pubescent, thickish, sometimes slightly curved, often the upper inconspicuous, thus fruit appearing sessile; calyx in flower 1—1.5 mm long, gray-pubescent, with lanceolate acute lobes slightly elongating in fruit; corolla blue, ca. 2 mm long, with narrow tube,

limb narrow, small, ca. 1 mm across, the lobes oblong, obtuse, tapering at base; scales inconspicuous, white, oblong, inflated at apex; anthers 0.5 mm long, within corolla tube; nutlets ca. 3 mm long, oblong, forming quadrilateral pyramid of fruit, disk oblong, rather densely but finely prickly or tuberculate, with more or less narrow, dentate or sometimes subentire, flat or slightly concave wing at margin, width of wing very variable but not exceeding width of nutlet, usually narrower, wings variable even on nutlets of the same fruit; nutlets smooth or more or less tuberculate at sides and the ventral side separating from the narrow high-pyramidal gynophore; cicatrice lanceolate, remaining free below nutlets (character of Paracaryum, in contrast to the winged fruits of Echinospermum); style 0.5—1 mm long, not exserted from tube, later arising above apices of nutlets. April—May. (Plate XXIX, Figure 3.)

Stony and sandy deserts, also in desert (semi-desert) type mountains. — Centr. Asia: Kyz. K., Pam.-Al. (Gorno-Badakhshan Autonomous District). Gen. distr.: Iran., Tib. Described from the desert of C. Iran. Type in Geneva, cotype in Leningrad.

Note. Boissier wrote that this species "with the nutlets rimmed by a dentate wing, like E. marginatum, forms a transition from Echinospermum to Paracaryum, but by all characters should be related to the first." In spite of this note I am following Brand and including this species in Paracaryum because of the form of the attachment of nutlets to the gynophore (a cicatrice in the shape of a lanceolate areola) and its position (below the gynophore). Boissier was right in noting that this species is transitional from Paracaryum to Echinospermum. This
607 species is rather common in the residual outcrops of mountains in Kyzyl Kum and, strangely enough, in Gorno-Badakhshan (Shugnan, Rushan and Vakhan) in addition to the central desert of Iran.

Genus 1227. **OMPHALODES*** Moench

Moench, Method. (1794) 419; Brand in Pflanzenr. IV, 252 (1921) 96.

Calyx cut for $\frac{1}{2}$ or to $\frac{2}{3}$ into 5 lanceolate or oblong, rarely linear lobes or teeth, in fruit slightly elongating and stellately spreading, not bending below, undivided base of calyx also slightly accrescent forming a small flat cup around nutlets. Corolla white or blue, rotate, of the short-type, with short tube, shorter than calyx, limb flat or slightly concave, rather broad, lobes spreading horizontally, short, ovate or semi-orbicular, 5—15 mm across. Scales in throat short, trapeziform or nearly rectangular, weakly 2-lobed at apex, papilliform. Stamens included in corolla tube, with subsessile ovate small obtuse and not sagittate anthers, not exserted from behind scales (lying under them). Style short, enclosed in corolla tube. Gynophore small, slightly developed, low-pyramidal, with flat or concave faces. Nutlets compressed, oval, small, attached to gynophore by apex, sometimes by a large part of ventral side, growing laterally at bases forming altogether a flat cross if gynophore rarely higher becoming nearly

* From the Greek omphalodes — umbilicus, owing to the shape of the fruit.

pyramidal, small, 3—4 mm long, smooth, without anchorlike spinules but sometimes pubescent, ventrally and laterally with a wing surrounding disk, wing either very narrow, like a rather thickened callous rim, hardly 0.5 mm wide, or wing slightly wider and incurved on the walled side of nutlet, entire or dentate along curved margin; disk smooth. Cicatrice oblong-lanceolate or ovate or nearly orbicular, occupying more than $^1/_5$—$^1/_2$ of the ventral side. Style remaining thin even in fruit. Embryo erect or exceptionally curved in O. scorpioides. Perennial or annual small herbs, thin-appressed-hairy-pubescent or glabrous. Flowers and fruit in loose cymes or solitary on long stipes.

Note. The genus Omphalodes as it is now interpreted consists of 3 geographical groups of species: 1) European-Caucasian; 2) North American, mainly Mexican; 3) East Asian. The members of the last distinctly differ from the European-Caucasian and American species, representing
608 a special subgenus. The North American group of species is also very unique but resembles more the European-Caucasian. Some of the Mexican species have mesophyllous, triangular-cordate leaves and the wing of nutlets in some (O. aliena A. Gray) is nearly flat, the hairs villous as in Paracaryum. Apart from the separation of O. scorpioides into a special Central European section, the genus has not been subdivided otherwise. Brand included O. aliena A. Gray in the section Euomphalodes DC. although in all characters (even the pubescence of the sepals) it is really Paracaryum.

1. Perennial herbs up to 40 cm high. Radical leaves remaining green up to fruiting, with broad blade and long petiole. Corolla large, blue, with rotate limb. (Mountains) . . . . . 2.
\+ Annuals, without radical leaves. Flowers smaller. (Plains) . . . . . 5.
2. Radical leaves with overwintering, coarse blade, ovate or ovate-oblong, very acute, cordate at base, with sharply protruding, pinnate nerves. Cauline leaves sessile . . . . . 1. O. cappadocica (Willd.) DC.
\+ Radical leaves with blade overwintering or not, oblong, obtuse, or short-acuminate, short-cuneate or truncate at base, rarely obscurely cordate, with inconspicuous lateral nerves. Lower cauline leaves distinctly petiolate (O. rupestris Boiss. s.l.) or partly absent (O. kusnetzovii) . . . . . 3.
3. Radical leaves with overwintering, coriaceous blade, glabrous, hairy only along margin. Lower cauline leaves absent. Upper cauline leaves 2—3, approximate below racemes. Calyx subglabrous outside, with lanceolate teeth. Corolla white, 10—15 mm across. (Only Bzyb River in Abkhazia at 400 m) . . . . . 2. O. kusnetzovii Kolak.
\+ Blade of radical leaves not overwintering, not coriaceous, rather densely appressed-fine-hairy on both sides, sometimes canescent. Cauline leaves 5—10, the lower distinctly petioled, the upper sessile, all more or less evenly disposed on stem. Corolla blue. (Alpine belt) . . . . . 4.
4. Blade of radical leaves larger, 3—7 cm to 10 cm long, cuneately tapering to petiole, oblong. Nutlets with strongly dentate hairy

margin (wing). Corolla ca. 20 mm across. (W. Caucasus,
609 mainly limestones in the subalpine belt) . . .3. O. lojkae Somm. et Lev.
+ Blade of radical leaves smaller, 2—5 cm long, more sharply tapering to petiole, truncate or slightly cordate at base. Nutlets with slightly dentate hairy margin. Corolla 10—15 mm across. (E. Main Caucasian Range) . . . . . 4. O. rupestris Rupr.
5. Embryo curved, with radicle adjacent to cotyledons. Nutlets pubescent rather high-conical, their wing scarious, broadly incurved, entire at margin. Stem herbaceous, weak, often strongly branching from base. Lower leaves opposite, the leaves thin, oblong-obspatulate. Flowers on long pedicels, solitary in axils of upper leaves. Corolla blue, 5 mm across. (European part from the western border to Kaluga and Moscow, in the south to N. Caucasus). (Section Maschalanthus DC.) . . . . . 6. O. scorpioides (Haenke) Schrank.
+ Embryo erect as in Omphalodes. Stems erect, robust, whitish below, spreading-branching above. Leaves alternate, lanceolate, subglabrous. Flowers in leafless long racemes of paniculate inflorescence (at ends of branches). Corolla white. Wing of nutlets broad, with curved acutely toothed margin, the nutlets glabrous. (Sometimes in the south: Crimea, Caucasus, cultivated in gardens) . . . . . 5. O. linifolia (L.) Moench.

Section 1. ARCTOTERTIARIAE M. Pop. — Perennials. Radical leaves with large blades and long petioles, usually overwintering, rather thick. Flowers in differentiated leafless racemes (loose racemiform cymes), large or medium-sized. Calyx in fruit saucer-shaped. Gynophore very small (hardly developing) and nutlets growing mainly laterally, not below, thus forming a flat cross on calyx.

Series 1. Vernales M. Pop. — Blades of radical leaves narrowly long-acuminate, coriaceous or nearly so, with markedly protruding, pinnately lateral nerves. Flowers medium-sized, 10—15 mm across, blue. — In forests of mountainous countries of the ancient Mediterranean. In addition to the Russian species the series includes O. verna Moench (Alps) and O. nitida (Willd.) Hoffmg. et Link (Spain).

1. O. cappadocica (Willd.) DC. Prodr. X (1846) 161; Ldb. Fl. Ross. III, 167; Boiss. Fl. or. IV, 266; Kusn. in Bull. Acad. Sc. Pétersb. (1908) 797; Mat. Fl. Kavk. IV, 2, 113; Brand in Pflanzenr. IV, 252 107. — Cynoglossum cappadocicum Willd. Sp. pl. (1797) 767. — O. cornifolia Lehm. Pl. Asperif. II (1818) 182. — O. wittmanniana Stev. in Bull. Soc. Nat. Mosc. XXIV (1851) 607. — O. caucasica Brand, l. c. 109; Kolak. Fl. Abkh. IV, 10. — Ic.: Brand, l. c. 108, f. 15, f—k; Kuzn., op. cit. (1908) Table I, Figures 2 and 4; Kolak., op. cit. Table 1.

Perennial; rhizome rather thin and often elongating, nearly horizontal, flexuous, rarely reduced and then thicker, dark, firm, producing numerous thin adventitious roots, at apex with few heads bearing rather many radical

PLATE XXXII. 1 — Omphalodes lojkae Somm. et Lev.; 2 — O. rupestris Rupr.

leaves and stems; stems thin, weak, 15—30 cm high, more or less strongly appressed-hairy, terminated by one loose cyme; radical leaves large, 10—20(30) cm long, their petioles thin, appressed-hairy, usually longer (sometimes 2—3 times) than blade, the blade ovate or ovate-oblong, deeply cordate with closed basal notch, narrowly acuminate, overwintering, semi-coriaceous, with sharply prominent arcuate lateral nerves, shortly and finely appressed-hairy, the young blade grayish, the mature green, normally 5—10 cm long, 3—5 cm wide in fruit; cauline leaves small, 1—2 cm long, (3)5—7 in number, ovate or oblong, acute, all sessile, 1-nerved, pubescent like the radical. Raceme of flowers at first (early spring and winter) corymbiform but soon elongating, loose, long, up to 15 cm, one-sided; pedicels long, thin, pubescent, subhorizontally drooping in fruit, 2—3 cm long; calyx in flower covered inside and out with appressed silver thick hairs, 4—5 cm long, later growing patelliform, large, up to 20 mm across, with ovate or oblong, acute teeth appressed-hairy outside and inside; corolla sky-blue, 10—15 mm across, with small tube and rotate limb, the lobes ovate-rounded; scales 2 mm long, trapeziform-ovate, white; nutlets small, ca. 2 mm long, oblong, flat, pubescent or subglabrous, attached to gynophore at nearly the entire inflated ventral surface, at margin with low callous thickened rim or with narrow incurved wing aculeate-dentate at margin; disk glabrous, smooth; style not thickening or elongating. February—April. (Plate XXXIII, Figure 2.)

Rocky and stony slopes in broadleaved forests of the southern mountain belt. — Caucasus: W. Transc. (from Adzharis-Tskhali in the south to Sochi). Gen. distr.: As. Min. (Lazistan and Cappadocia only?). Descriptions based on Tournefort's collections apparently from Cappadocia, but this is doubtful. Type in Paris.

Note. We completely agree with Kuznetsov (op. cit. (1908) 786—788)
613 that the typical form of O. cappadocica (with narrow, entire rim on nutlets — Kuznetsov mistakenly called this form O. wittmanniana Stev.) and the form which Brand called O. caucasica Brand (with aculate-dentate wing on nutlets — Kuznetsov mistakenly termed it the typical O. cappadocica) do not represent geographical or any other vicariousness. The type of nutlet and the number of cauline leaves (3 in O. caucasica, 5—7 in O. cappadocica) are inconstant, non-correlated as displayed by the occurrence of var. intermedia Kusn. in which the rim of the nutlets is entire and low, and the leaves number 3. Our species in the western part of Transcaucasia is variable not only in the type of nutlets but also in the size of flowers, calyx and leaves, as well as the density of pubescence, which I believe was caused by hybridization with O. lojkae. Our species differs from the Alpine-Balkan O. verna Moench in the absence of stolons produced from the rhizome, the coarser, overwintering radical leaves and the slightly larger flowers. The nutlets in O. verna are the same as in our typical form. In habit the Pyrenean O. nitida Hoffmgg. et Link differs in the narrower lanceolate and cordate leaves, still apparently overwintering; its nutlets have an aculeate-dentate curved wing as in O. caucasica Brand.

Series 2. Rupestres M. Pop. Blades of radical leaves obtuse or acute, often obtuse, mucronate, with indistinctly protruding lateral nerves, not

cordate at base. Flowers (corolla) sky-blue, rarely white, large, (10)15—20 mm across. — Rocky places usually in the subalpine belt but sometimes in forest belt of Asia Minor (and the Caucasus). In addition to our species the series including O. luciliae Boiss. from Smyrna region.

2. O. kusnetzovii Kolak. in Zam. po. sist. i geogr. rast. Tbil. XIV (1948) 62 cum ic.; Kolak., Fl. Abkh. IV, 10.

Perennial; rhizome apparently reduced, thickened, dark, with many thin adventitious roots; radical leaves numerous, coriaceous, subglabrous, overwintering, 10—15 cm long, their petioles glabrous, longer (to two times) than blade, blades oblong, coriaceous, 3—8 cm long, 2—3.5 cm wide, obtuse, mucronate, more or less sharply tapering to the broad-cuneate base, narrowing into petiole or rounded, subglabrous, with thick bristles scattered on upper surface, serrate along margin, lateral nerves faintly protruding; stems thin, weak, glabrous, with racemes ca. 20 cm high; cauline leaves 2—3 in number, approximate at apex of stem below raceme, oblong, 3—6 cm long, subsessile, cordate or cuneate at base. Raceme single, sometimes double, short, slightly detached from the cauline leaves, rather dense,
614 one-sided, leafless; pedicels drooping, with scattered appressed bristles, 1—2 cm long; sepals lanceolate, acute, appressed-hairy mainly inside, glabrous outside, in flower 3—4 mm long, in fruit apparently up to 10 mm non-divided base of calyx appressed-hairy, in fruit apparently patelliform; corolla white (?), ca. 15 mm across, with rotate limb, divided to half into ovate-rounded lobes; scales 1.5 mm long, ovate; nutlets (judging from ovary) finely pubescent, with pubescent and finely toothed (?) rim. April.

Limestones in the lower forest belt (beech-chestnut forests). — Caucasus: W. Transc. (Abkhazia, Bzyb Gorge, crevices of limestone rocks, 400 m, flowers 24 IV 1947, Kolakovskii). Endemic. Described from the indicated locality. Type in Sukhumi, cotype in Leningrad.

Note. Distinguished from O. lojkae by the glabrous, overwintering radical leaves, cauline leaves only 2—3, sessile and approximate, by the dense racemes, and the smaller flowers.

3. O. lojkae Somm. et Lev. in Tr. Bot. Sada, XII (1892) 157; XVI (1900) 352; Kusn. in Bull. Acad. Sc. Pétersb. (1908) 798; Mat. Fl. Kavk. IV, 2, 114; Grossg., Fl. Kavk. III, 252; Brand in Pflanzenr. IV, 252, 109. — Ic.: Somm. et Lev. l. c. (1900) tab. XXXV. — Exs.: Fl. cauc. exs. No. 215; GRF, 629 (sub nomine falso: O. wittmanniana Stev.)

Perennial; rhizome short, dark, with numerous thin adventitious roots, bearing above rather many radical leaves and stems; radical leaves with long petioles sometimes 2—3 times as long as blade, densely appressed-bristly; blades oblong or ovate, 2—10 cm long, (1)2—5 cm wide, obtuse to acute, sharply cuneate to truncate or rounded at base, densely appressed-short-hairy at both sides, sometimes even grayish, with faintly protruding lateral nerves; stems thin, appressed-hairy, ascending or erect, 10—25(30) cm high; cauline leaves 5—10 in number, smaller than the radical, the lower short-petioled, the upper leaves tapering, sessile, all oblong, acute, pubescent like the radical leaves. Raceme usually single at apex of stem, rather short, very loose, with 2—3 leaves below, leafless above, few-flowered; pedicels long (1—3 cm) or very long (4—5 cm), arcuate or even hamately drooping in

fruit canescent, appressed-pubescent; calyx densely gray-appressed-downy; calyx densely gray-appressed-downy, inside and outside, in flower ca. 4 mm long, in fruit markedly patelliform, reaching 10 mm in diameter, with oblong or ovate acute teeth; corolla ca. 20 mm across, blue, with ovate-
615 rounded lobes; scales small, ovate; nutlets subhorizontal on broad and low pyramidal gynophore, small, 3—3.5 mm long, densely downy, with narrow incurved wing, acutely toothed at margin. June—July. (Plate XXXII, Figure 1.)

Alpine and subalpine belts of the western part of the Caucasian Range, limestone and granite rocks. — Caucasus: Cisc. (western part, basin of Teberda and others), W. Transc. (Sochi, Abkhazia, Megrelia, Svanetia). Endemic. Described from Svanetia, Dzhodissyuk Range, 2,700 m (flowers, fruit, 22 VIII 1890, Sommier and Levier). Type in Florence, cotype in Leningrad.

Note. As Brand (l. c. 109) pointed out and with which Kuznetsov more or less agreed, this species is only a variety (race) of O. rupestris Rupr. It is ecologically and morphologically more adapted to the more moist conditions of the western part of the Caucasian Range and hence the entire plant, its leaves, flowers and nutlets are larger than in O. rupestris, the habitat of which is the dryer, continental, high mountainous part of the Range. There are no essential differences between these "species."

4. O. rupestris Rupr. in Boiss. Fl. or. IV (1875) 267; Kuzn. in Mat. Fl. Kavk. IV, 2, 119 et in Bull. Acad. Sc. Pétersb. (1908) 766; Brand in Pflanzenr. IV, 252, 109. — Ic.: Kuzn. op. cit. (1908) tab. I, f. 1, 6; tab. II, f. 1, 2, 4, 9.

Perennial; rhizome short, thick, dark, with a mass of thin adventitious roots, bearing numerous radical leaves and stems; radical leaves 5—10 cm long, with long petiole 2—4 times longer than blade, sparsely appressed-hairy; blades small, 2—4 cm long, ovate, nearly cordate at base but some truncate and even rounded, usually acute or obtuse, canescent or slightly sericeous with dense and thick appressed hairs, nerves nearly not protruding; stems thin, weak, flexuose, drooping, subglabrous, appressed-hairy above, ca. 10(15) cm long; cauline leaves oblong or ovate, smaller, 5—7 in number, the lower petioled, the upper tapering at base, sessile, canescent with appressed hairs, acute. Raceme single, very loose and few-flowered, below with 1—2 leaves; pedicels thin, long, gray, arcuately drooping after flowering; calyx densely appressed-tomentose on both sides, with ovate acute teeth, in flower 3 mm long, in fruit patelliform, ca. 6—7 mm across; corolla sky-blue, 10—15 mm across; nutlets downy, nearly flatly disposed on flat-pyramidal gynophore, ca. 2.5—3 mm long, with narrow wing (rim) slightly dentate at margin. June—July. (Plate XXXII, Figure 2.)

616 Rocks and taluses in the eastern part of the Caucasian Range, alpine belt. — Caucasus: Cisc. (eastern part), E. Transc. Endemic. Described from Georgian Military Road (Bolto, flowers 14 V 1861, Ruprecht). Type in Leningrad.

Section 2. PSEUDOPARACARYUM M. Pop. — Paracaryum § 2. Calyx accrescens DC. Prodr. X (1846) 160. — Annuals or biennials,

PLATE XXXIII. 1, 1a — Omphalodes scorpioides (Haenke) Schrank.; 2 — O. cappadocica (Willd.) DC.— 3 — O. linifolia (L.) Moench., fruit.

subglabrous, slightly succulent, xerophyllous. Gynophore rather high-pyramidal; nutlets also forming a pyramid; wing of nutlets coriaceous, narrow, more or less dentate or entire. Flowers in distinct leafless or nearly leafless racemes. Corolla white, rarely bluish, medium-sized. — Pyrenees.

5. O. linifolia (L.) Moench, Method. (1794) 419; Rouy, Fl. Fr. X, 336; Brand in Pflanzenr. IV, 252, 101. — Cynoglossum linifolium L. Sp. pl. ed. 1 (1753) 134. — Ic.: Rchb. Ic. XVIII, 89, tab. 125, f. 1; Hegi, III. Fl. V, 3, f. 3103 and 3103, a—b—c.

Annual; stem erect, thin but robust, whitening below in fruit, glabrous, usually branching in upper part, rarely from base, with ascending branches, rarely (in weak specimens) simple; leaves usually lanceolate, the lower gradually tapering at base to petiole, spatulate, early dying, upper leaves lanceolate, sessile, the uppermost (below inflorescence) oblong, reduced, all thick, coarse, glabrous, with solitary firm bristles or spines only along margin. Racemes loose, leafless, elongate, if stem branching then gathered in a paniculate inflorescence; pedicels glabrous, horizontally drooping in fruit, 0.8—2 cm long; calyx glabrous, only with few spines, in flower 3 mm long, in fruit patelliform, more than 10 mm across, with oblong acute teeth; corolla rotate, usually white, rarely pale blue, 8—13 mm across, with ovate-rounded lobes; scales small, trapeziform; nutlets in a pyramid (in one fruit), 4 mm long, oval-globose, glabrous, rather broad, coarse-scarious, incurved, denticulate; cicatrice lanceolate as in Paracaryum; gynophore high-pyramidal; style slightly thickened, short; embryo erect. May—June. (Plate XXXIII, Figure 3.)

619 Orchards, flower beds, roadsides as escaped from lawns. — European part: Crim. (Feodosia); Caucasus: W. Transc. (Batumi). Gen. distr.: Med. (mainly Spain). Type in London.

Section 3. MASCHALANTHUS DC. Prodr. X (1846) 161; Kuzn. in Mat. Fl. Kavk. IV, 2, 109; Brand in Pflanzenr. IV, 252, 98. — Annuals. Stems weak, strongly branching. Flowers small, solitary in axils of upper leaves, on long thin pedicels. Nutlets pubescent, subhorizontal on a very small gynophore, at bottom of the patelliform calyx; wing of nutlets scarious, high, incurved at margin, entire. Embryo curved so that radicle appressed to cotyledon. One Central European species.

6. O. scorpioides (Haenke) Schrank in Denkschrift. Acad. München, III (1812) 222; Ldb. Fl. Ross. III, 168; Shmal'g., Fl. II, 221; Kuzn. in Mat. Fl. Kavk. IV, 2, 109; Brand in Pflanzenr. IV, 252, 98. — Cynoglossum scorpioides Haenke in Jacq. Collect. II (1788) 3. — Ic.: Rchb. Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 125; Hegi, III. Fl. V, 3, f. 3102 b and 3103 d. — Exs.: GRF, No. 829; Fl. exs. Austro-Hung. No. 2935.

Annual; stem weak, decumbent at base, ascending above, very strongly branching nearly from base, hardly distinguished from branches, glabrous or appressed-bristly, 10—20 cm high; leaves oblong-lanceolate, delicate, acute, more or less tapering at base, the lower even spatulate and usually opposite, covered at both sides but more so beneath with small appressed

hairs, 2—4 cm long, 1—2 cm wide. Pedicels solitary in axils of upper leaves, up to 2—3 cm long, capilliform, later arcuately drooping, with small appressed bristles; calyx very sparingly appressed-hairy, subglabrous in fruit, 3 mm long in fruit, patelliform-spreading, up to 10 mm across, with lanceolate or oblong teeth; corolla pale blue, with concave limb 4—5 mm across; nutlets high-tubular, on very small, nearly undeveloped torus (gynophore), attached to it by small rounded areola (cicatrice), finely pubescent, ca. 3 mm long and across; wing scarious, inflated-subvesicular; embryo curved; style not thickened, small, inconspicuous in fruit. April—May. (Plate XXXIII, Figure 1, 1a.)

Weedy, moist forests, mainly in the W. European part of USSR. — European part: sporadically everywhere except for the eastern parts (L. V., V.-Kama, Transv., Dv.-Pech.) but more common in the southwest and south, on the Dnieper, Dniester and Donets Basin; Caucasus: Cisc. (near Stavropol'); E. Transc. (Aragva). Gen. distr.: Centr. Eur. Described from Germany. Type in Germany.

620 Genus 1228. **TRACHELANTHUS*** Kunze

Kunze in Bot. Zeit. VIII (1850) 665; Walp. Ann. Bot. Syst. III, 141; Boiss. Fl. or. IV, 271.— Solenanthus sect. II. Trachelanthus Gürke in Engl.— Pr. Pflanzenf. IV, 3a (1897) 104, ex parte.— Lindelofia sect. I. Trachelanthus Brand in Pflanzenr. IV, 252 (1921) 80.

Calyx (glabrous) divided nearly to base into lanceolate or oblong, acute or obtuse lobes little accrescent in fruit. Corolla yellow but sometimes with violet tinge, nearly cylindrical-tubular, limb very slightly broadening, lobes nearly erect, slightly shorter than tube, elongate, lanceolate or oblong; scales in throat more or less developed. Stamens inserted in throat, with short filaments; anthers large, linear-oblong, sagittate at base, at apex with 2 separate small mucros or 1 fused, not exceeding corolla lobes. Style exserted from corolla. Nutlets dorsoventrally compressed, ovoid, rather large, wingless, disk glabrous or prickly, thickened or not at margins, lateral and ventral sides densely short-aculeate. Cicatrice ovoid, occupying about half of the ventral side, in detached nutlets a strip of awn-like fibrilar-tissue from the thickened base of the style is separated by the cicatrice apex as in the real Cynoglossum (and also Rindera). Gynophore (torus); short-pyramidal. Glabrous perennial large herbs, with large leaves and paniculate inflorescence.

Note. Lipskii (Tr. Bot. Sada, XXIII (1904) 200—201) quite rightly gave an independent status to the genus Trachelanthus based on its vegetative features (glabrous stems and leaves, large size, etc.). In addition it differs from Solenanthus by the anthers not exserted from the corolla and from Lindelofia by the nearly erect and elongate lobes of the yellow corolla, and from both (or at least from Lindelofia) by the fruit with an awn at the apex of the cicatrice. The genus closely resembles Rindera in pubescence and flowers but sharply differs by the wingless nutlets and appears to represent a parallel unit in the subtribe Eucynoglosseae. A genus of Iranian Province.

* From the Greek trachelis — scabrous, anthos — flower.

1. Corolla tube $1\frac{1}{2}$ times as long as calyx. Lobes of limb obtuse, spatulate-oblong-lanceolate. Scales 0.5 mm long. Back of nutlets more or less densely aculeate. (W. T. Sh.) . . . . . 2. T. korolkovii Lipsky.

\+ Corolla tube hardly as long as calyx. Lobes of limb lanceolate, acute. Scales ca. 1 mm long. Back of nutlets smooth or only with 1 row of prickles along keel . . . . . 1. T. hissaricus Lipsky.

621 Series 1. Microfornicati M. Pop. — Scales very small, less than 1 mm long, semi-orbicular or crescent-shaped, slightly protruding outside (as a tubercle). Anthers with one apical mucro (two fused into one). Nutlets with thickened margin on higher gynophore, smooth or prickly along disk. — Pamir area.

1. T. hissaricus Lipsky in Tr. Bot. Sada, XXIII (1904) 202. — Lindelofia hissarica Brand in Pflanzenr. IV, 252 (1921) 82.

Perennial; root thick, with several thick squamose but not fibrous heads each producing either rosette (bundle) of radical leaves or a floriferous stem; stems 1—3, thick, high, 80—100 cm, angular-furrowed, glabrous, paniculately branching above; radical leaves (leaves of bundles of rosettes) in flower 30—50 cm long and in fruit up to 60 cm, glabrous, with white tubercles beneath, green, blade oblong, acute, gradually tapering at base to petiole, elongate, undulant at margin, finely netted-nerved, 5—15 cm wide; cauline leaves rather numerous, the lower tapering to more or less long petiole, oblong, acute, the upper sessile usually ovate, cordate, acute, reduced, 3—5(7) cm long. Inflorescence paniculate, composed of terminal and several lateral cymes; cymes short, even in flower rather loose, few-flowered, with a small leaf at base, otherwise leafless, in fruit straightening and not strongly elongating; pedicels (glabrous), longer than calyx, in fruit the lower 3 cm long, erect; calyx in flower 6 mm long, in fruit up to 10 mm, lobes lanceolate-linear or lanceolate, acute; corolla pale yellow, 13 mm long, tube hardly longer than calyx, cylindrical; limb hardly broadening, divided nearly to base into lanceolate acute nearly erect lobes slightly shorter than tube; anthers 4—5 mm long, scales semi-orbicular-ovate, ca. 1 mm long; nutlets ca. 10 mm long, on flat disk, smooth, glabrous or with a single row (keel) of prickles, densely short-anchorlike-prickly along ascending margins, lateral and ventral sides rounded; cicatrice occupying half of the ventral side. June. (Plate XXXIV, Figures 1, 2.)

Stony mountain slopes in semi-steppe belt, often in forests of Turkestan maple trees and other trees in ravines, 1,500—2,000 m. — Centr. Asia: Pam.-Al. (Upper Zeravshan, Gissar Range). Endemic. Described from Upper Zeravshan (Kshtut, flowers, V 1893, Komarov) and Gissar Range (Khodzha-Obi-Garm, young fruit, 6 VII 1896, Lipskii). Type in Leningrad.

Note. In the plants from Upper Zeravshan the disk of the nutlets is completely smooth (Komarov specimen from Kuli-Mogif, flowers, 10 VI
622 1892) whereas in the plants of the southern slopes of Gissar Range the disks have a longitudinal, keel-like row of prickles and the sepals are obtuse. They represent two different species and I propose to call them T. sogdianus M. Pop. (type: Kshtut, Komarov) and T. hissaricus Lipsky (type — Khodzha-Obi-Garm, Lipskii).

PLATE XXXIV. 1—2 Trachelanthus hissaricus Lipsky.; 3—4 T. korolkovii Lipsky, section of corolla, calyx, fruit.; 5 — T. cerinthoides (Boiss.) Ktze., section of corolla, calyx — for comparison.

Characteristic for T. hissaricus s. l. is the enormous size of the leaves from flowering to fruiting, i. e., in the period of one month the leaves double or triple in size.

2. T. korolkovii Lipsky in Tr. Bot. Sada, XXIII (1904) 199. — Lindelofia korolkovii Brand in Pflanzenr. IV, 252 (1921) 82.

Perennial; root dark, thick, with slightly squamose heads without fibers; stems 80—100 cm high, glabrous, yellowish, thick, finely longitudinally furrowed, spreading-paniculate-branching above; leaves coarse, semi-coriaceous (at fruiting), glabrous; radical leaves large, 30—50 cm long, blades oblong-elliptic, undulant-denticulate at margin, with scattered white tubercles and solitary bristles, gradually tapering to petiole; petioles half as long as blade, trihedral-flattish, glabrous; lower cauline leaves oblong, tapering to short petiole, the upper sessile, sometimes cordate, ovate, reduced. Inflorescence paniculate, composed of many lateral and terminal cymes, generally appearing as a large loose panicle, with leaves only at base of branches, leafless above; pedicels thin, in flower as long as calyx, in fruit longer, up to 2 cm, obliquely spreading; calyx glabrous, lobes lanceolate-linear, acute, 5—7 mm long; corolla yellowish, tube long, $1\frac{1}{2}$ times as long as calyx, limb narrow, with lobes lanceolate-oblong, slightly spatulate, obtuse, ca. 5 mm long, $\frac{2}{3}$ as long as tube; scales very small, seen as crescent-shaped rudimentary folds, ca. 0.5 mm long; anthers 3.5—4 mm long, with mucro at apex; nutlets 7—8—9 mm long, ovoid, back flattened or slightly impressed, more or less densely anchorlike-prickly, ascending sides and ventral side very densely covered with flattish anchorlike spinules not fusing at bases; cicatrice occupying more than half the ventral side, ovate; base of style flattened, 2—4 mm long. June. (Plate XXXIV, Figures 3, 4.)

Stony mountain slopes, among trees or in gorges. — Centr. Asia: T. Sh. (Tashkent Ala-Tau, southern Kara-Tau). Endemic. Described from the upper reaches of Chirchik River, from Pskem River near Nanai, flowers, fruit, 1 VI 1903, Lipskii. Type in Leningrad.

Note. T. hissaricus and T. korolkovii are just as vicarious a pair as Lindelofia olgae and L. capusii, with the same geographical disjunction. Lipskii has clearly described the differences between these species and Trachelanthus. All the same the Tien Shan species appears less robust and in its nutlets it resembles more the Iranian species of the genus than T. hissaricus.

Genus 1229. **LINDELOFIA*** Lehm.

Lehm. in Hamburg. Gartenzeitung, VI (1850) 351 et in Linnaea, XXIV (1851) 215; Benth. et Hook. Gen. pl. II (1876) 848; Gürke in Engl. — Pr. Pflanzenf. IV, 3a, 103.

Calyx divided nearly to base into lanceolate or linear (or linear-oblong) lobes slightly accrescent (elongating) in fruit and bending downward; corolla of the medium-type, funnel-shaped, with elongate tube usually longer than calyx, limb campanulate, the lobes as long as or shorter than the undivided part of limb, orbicular-obtuse; scales in throat either elongate and curved

* After F. Lindelof, a lawyer in Darmstadt who contributed to botanical research.

or oblong, entire or sometimes laterally bigibbous at apex, nearly rectangular, rarely reduced and ovate, much shorter than limb. Stamens exserted from throat, with elongate anthers sometimes sagittate at base, in corolla-limb or nearly exserted from flower; style filiform, long, exserted, with small entire stigma. Nutlets dorsoventrally compressed, ovoid, 5—6 mm long, with distinct areola disk, flat or impressed (concave), bearing long or short, multiserial anchorlike spinules along margin, spinules not fusing at base or fused into more or less narrow membrane (rudimentary wing); lower free part of nutlet covered with thick broad spinules or tubercles; cicatrice terminal at the ventral side, occupying not more than half of belly, ovate, not detaching from style by strip of awn-like fibrilar-tissue; torus (gynophore) high-pyramidal; style long, with persistent base. Perennial herbs of the Himalayas and Pamir-Alai (Tien Shan, Pamir area, Tibet and Hindu Kush).

Note. Lindelofia was established on the base of the two Himalayan species 1) L. spectabilis Lehm. (L. longiflora (Baill.) Gürke. —
626 Cynoglossum longiflorum Benth., 1839) and 2) L. anchusoides Lehm. (Cynoglossum anchusoides Lindl.). Brand in (1915) 1921 unjustifiably determined the second species to be the type of the new genus Adelocaryum to which he referred 6 other, partly new species; he included in Lindelofia, in addition to L. longiflora, 13 more species: those which Boissier and Lipskii had included in the genus Trachelanthus (4 species) and some of those which had earlier been regarded as species of the genus Solenanthus but without the stamens being exserted from the corolla (7 species). To these he added Mattia (Rindera) albida (Kusn.) Wettst. from W. Iran and one new species, L. cynoglossoides Brand from Afghanistan which, in our opinion, is not distinguished from L. macrostyle (Bge.) M. Pop. (L. anchusoides auct. fl. As. Med.). We believe that both species of Lehmann should be included in the one genus Lindelofia and that some of the Himalayan species earlier referred to Solenanthus should be added to it as Brand did; but we are treating Trachelanthus as a separate genus and referring Rindera (Mattia) albida to Rindera and the Algerian Solenanthus lanatus to the genus Turbinaria.

Lindelofia differs from the most closely related Cynoglossum by its mesomorphous corolla with its slightly elongate tube and campanulate limb, by the stamens exserted from the throat, and by the long style far protruding from the corolla though not longer than limb. In flowers Lindelofia is identical with those of section Macromathiastrum in the genus Paracaryum, but differs from it by the wingless nutlets and cicatrice occupying not more than $\frac{1}{2}$ (and not $\frac{4}{5}$) of the ventral side. From Rindera it differs by the campanulate, not erect, limb.

The genus Adelocaryum which Brand conceived, just as he did with Lindelofia, should either be abolished (if A. anchusoides, the first of those enumerated by Brand, is to be taken as its type) or accepted as Cynoglossum coelestinum Lindl. (Adelocaryum coelestinum Brand), the corolla of which is of the short-type as in Cynoglossum, but the nutlets have a concave disk and winglike rim neither of which is common in Cynoglossum. In Brand's list it appears as the sixth species accompanied by a drawing (l. c. (1921) 79, f. 8) in which the nutlets are inaccurate

(the nutlets are much more accurately drawn by Lindley in Bot. Reg. XXV (1839) tab. 36). I am more inclined to regard the so-called Cynoglossum coelestinum Lindl. from India as the type species of Adelocaryum.

1. Corolla blue, 9—12 mm long, with cup-like limb. Scales 3—4 mm long, oblong-lanceolate, laterally bigibbous at apex. Disk of nutlets at margin with 1—2 rows of rather long anchorlike spinules more or less fused at bases, smooth or finely prickly. Stem
627 strongly branching and hence inflorescence paniculate. (Section Brandia) . . . . . 1. L. macrostyla (Bge.) M. Pop.

\+ Corolla dark red sometimes white-red, with narrower limb, rarely blue but then scales small, 1.5—2 mm long, ovate. Stem nearly not branching. (Section Pseudocynoglossum). . . . . 2.

2. Scales long, oblong-lanceolate, 3—4 mm long. Radical leaves rarely more than 10 cm long, spatulate-lanceolate. (Series Macrofornicatae) . . . . . 3.

\+ Scales short, ovate, 1.5—2 mm long. Radical leaves usually larger. (Series Microfornicatae) . . . . . 4.

3. Leaves green, glabrous beneath, sparsely spreading-hairy-bristly above, not more than 10 cm long, acute. Corolla dark wine-colored. (Pamir area) . . . . . 2. L. olgae (Rgl. et Smirn.) Brand.

\+ Leaves and stems nearly grayish, densely appressed-soft-hairy; leaves slightly larger than in the preceding. Corolla white-red, more open, its lobes narrower. Disk of nutlets nearly smooth . . . . . 3. L. capusii (Franch.) M. Pop.

4. Anthers with 2 small mucros at apex (one on each loculus). Corolla dark red. Radical leaves oblong, large in fruit . . . . . 5.

\+ Anthers without discernible mucros at apex. Corolla blue; otherwise as in the following. (Tarbagatai) . . . . . 5. L. angustifolia (Schrenk) Brand.

5. Disk of nutlets tuberculate, finely aculeate at margin; spinules of disk not fusing at base into rim. (Tien Shan except for the west, Pamir area (Zeravshan, Alai)). 4. L. stylosa (Kar. et Kir.) Brand.

\+ Disk of nutlets rimmed at margin by one row of short flat spinules fused below into a completely dentate rim. (Pamir, flat depression about timberline in Tien Shan). . . . . 6. L. pterocarpa M. Pop.

Section 1. BRANDIA M. Pop. — Adelocaryum Brand in Fedde, Repert. XIII (1915) 547—549 [tantum quoad speciem primam: A. anchusoides (Lehm.) Brand] — Corolla blue, 10—12 mm long. Scales laterally bigibbous (not always distinctly) at apex, triangular-lanceolate, elongate, 3 mm long. Disk of nutlets nearly flat, at margin with 2 rows of rather long anchorlike spinules, sparsely and finely aculeate or smooth, sides and ventral side of nutlets densely and shortly anchorlike-aculeate.

1. L. macrostyla (Bge.) M. Pop. comb. n. — Cynoglossum macrostylum Bge. in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1854) 412 (236); Boiss. Fl. or. IV, 266. — Cynoglossum macranthum Rgl. et

628 Smirn. in Tr. Bot. Sada, V (1878) 623. — Lindelofia anchusoides Lipsky in Tr. Bot. Sada, XXIII (1904) 177; Zakir. Burachn. Zeravsh. (1941) 13, f. 1, ex maxima parte (quoad specimina As. Med. et Afghaniae), non Lehm. — Adelocaryum anchusoides Brand in Pflanzenr. IV, 252 (1921) 77, ex parte quoad specim. turkest. et afghan. — Lindelofia cynoglossoides Brand, l. c. 88 (vidi spec. auth.).

Perennial; root thick, dark, at apex with few thick short heads, without fibers or scales; stem usually single, rather thick, robust, 40—80 cm high, angular, gray-villous (bristly-villous) with spreading and even drooping but not long hairs, bristles borne on small tubercles, the stem long-branching from the middle or nearly from base, the branches spreading, firm, long, flower-bearing at apex; leaves comparatively large, long, oblong-lanceolate, acute, all leaves gradually tapering at base, lower and radical leaves with rather long petioles, coarsely and shortly grayish-pubescent (bristly-downy), the bristles borne above on large, below on small, tubercles; radical leaves 50 cm long, 3—5 cm wide, lower cauline leaves approximate, the upper lanceolate, 5—4—3 cm long. Inflorescence paniculate, composed of 2—3 terminal and several lateral cymes; cymes loose from the beginning of flowering, straightening and more or less elongating in fruit but not very strongly, leafless, ascending; pedicels gray-downy, thin, longer than calyx, in fruit up to 10 cm long, longer than fruit, horizontally drooping; calyx in flower ca. 4 mm long, gray-downy, with lanceolate acute lobes little elongating in fruit; corolla blue, tube wide-cylindrical, longer than calyx, ca. 5 mm long, pale, the limb large, campanulate, slightly longer than tube, 6—7 mm long, parted for slightly less than half into ovate-rounded lobes; scales oblong-triangular, 3—4 mm long, inserted in throat and protruding far from it, whitish, obtuse at apex, bigibbous below apex, i. e., appearing 3-lobed at apex; anthers linear, 3—4 mm long, sagittate at base, with obtuse tips nearly reaching apex of scales, attached to throat by filaments; style exserted far from corolla; nutlets ca. 5 mm long, slightly compressed dorsoventrally, ovoid, disk nearly flat or slightly concave, along sides and margin densely anchorlike-aculeate, spinules of marginal (disk) row longer, triangular at base, broadening and slightly fusing by bases to form rim, sometimes rim uninterrupted but narrow, ascending or vertical or even slightly incurved, the disk usually sparsely and finely aculeate, rarely glabrous (smooth); cicatrice ovate, occupying ca. $^2/_3$ of the ventral side, the lower free part of
629 which densely and shortly aculeate; gynophore short-pyramidal; style exserted far from corolla, persistent but thin, separating nutlets not detached from it by awn-like strip. May—June. (Plate XXXV, Figure 1.)

Cultivated places in the south; in waste lands, roadsides, rarely mountain slopes (more as a weed). — Centr. Asia: Pam.-Al. (lower and middle belts), T. Sh. (west only). Gen. distr.: Iran, Afghanistan. Described from Kattakurgan (31 VIII 1841, Lehmann). Type in Paris, cotype in Leningrad.

Note. L. anchusoides Lehm (Himalayas only) differs from our species by the completely appressed-sericeous-hairy stems and leaves and the small size of the leaves, half as long as in L. macrostyla. Bunge and Boissier were right in separating these related species which Lipskii (1904) combined into one. Brand had included Cynoglossum macranthum in the synonymy of his Adelocaryum anchusoides Brand, but redescribed it under the name Lindelofia cynoglossoides

sp. n. from Afghanistan (Griffith, No. 5978), thus clearly showing that he was unable himself to distinguish his Adelocaryum Brand from Lindelofia Lehm. On the northern slope of the Himalayas there is a population which is intermediate between L. macrostyla and L. anchusoides (Gilgit expedition, Dr. Giles).

Section 2. PSEUDOCYNOGLOSSUM M. Pop.— Corolla dark wine-red, with narrower campanulate limb. Nutlets with ascending margin, along margin and sides (and ventral side) shortly and densely anchorlike-aculeate, without elongated spinules along margin of disk. Scales vary.

Series 1. Macrofornicatae M. Pop.— Scales 3—4 mm long, lanceolate.

2. L. olgae (Rgl. et Smirn.) Brand in Pflanzenr. IV, 252 (1921) 87; Zakir. Burachn. Zeravsh. 14.— Solenanthus olgae Rgl. et Smirn. in Izv. Obshch. lyubit. estestvozn. antrop. i etnogr. XXXIV, 2 (1882) 59; Lipskii in Tr. Bot. Sada, XXIII (1904) 190—192.— Ic.: Zakir., op. cit. Fig. 2 (flower, analysis).

Perennial; root rather thick, vertical, usually with few squamose black heads at apex, usually elongating and thickening, each head producing one fertile stem or one rosette of leaves; stems low, 10—20 (rarely up to 30) cm high, rather thin, erect or arcuately ascending, subglabrous or glabrous, herbaceous, simple, in upper part (below inflorescence) long hairy, leafless; radical leaves spatulate-lanceolate, short-acuminate, gradually tapering to petiole, 1-nerved, sparingly or hardly hairy (hairs of upper surface on small tubercles), sometimes subglabrous, green, often glabrous beneath, not more
630 than 10 cm long, usually 5—7 cm long, up to 1 cm wide; cauline leaves lanceolate, sessile, acute, often slightly falcately curved at one side, sparingly hairy, 5—3 cm long, uppermost leaves reduced, linear. Inflorescence composed usually of 2 terminal cymes, rarely of one leafless cyme; cymes in flower 1—2 cm long so that inflorescence nearly capitate but with several large flowers, drooping and then straightening and elongating but not more than 5—7 cm, with very remote fruits; pedicels villous, shorter than calyx, in fruit slightly elongating, lower pedicels up to 1.2 cm long, longer than fruit; calyx in flower gray-villous, 6—8 mm long, lobes narrow, linear, obtuse, dark, nearly not elongating in fruit; corolla violet-dark red, 12—15 mm long, tube as long as calyx or slightly longer, the limb distinctly wider than tube, narrowly campanulate, $^3/_4$ length of tube, cut to middle into ovate-rounded lobes; scales long, ca. 4 mm, lanceolate-oblong, dark, laterally slightly bigibbous at the obtuse apex, inserted in throat and spreading inside the campanulate limb; filaments attached to throat, short, half as long as anthers; anthers linear, 3.5—4 mm long, sagittate at base, at apex with 2 small mucros; nutlets ca. 6 mm long, dorsoventrally markedly compressed, ovoid, lateral and ventral sides of nutlets acutely tuberculate, disk well developed, with a keel along its median line appearing as a line nearly flat above and covered with small tubercles, margin of disk with rim of one row of short thick flattened spinules slightly fusing at their broadened bases; cicatrice oblong-ovate, occupying half the ventral side; style exserted from corolla, persistent

PLATE XXXV. 1 — Lindelofia macrostyla (Bge.) M. Pop.; 2 — L. olgae (Rgl. et Smirn.) Brand.

in fruit but thin; gynophore low-pyramidal, with impressed faces. (Plate XXXV, Figure 2.)

Stony moist mountain slopes, 3,000—3,500 m.— Centr. Asia: Pam.-Al. Endemic. Described from a pass at Auchi-Dagan at Upper Zeravshan (2 VI 1870, O.A. Fedchenko). Type in Leningrad.

Note. Var. intermedia Lipsky (Tr. Bot. Sada, XXIII (1904) 191—192) simply represents luxuriant specimens of L. olgae but has no connection with L. stylosa (collected at Upper Zeravshan between Pakhud and Pinkhon (14 VI 1893, Komarov).

3. L. capusii (Franch.) M. Pop. comb. n.— Adelocaryum capusii
633 Brand in Fedde, Repert. XIII (1915) 548; Pflanzenr. IV, 252, 77.— Paracaryum capusii Franch. in Ann. Sc. Nat. 6 sér. XVIII (1889) 28.— Solenanthus olgae var. tschimganicus Lipsky in Tr. Bot. Sada, XXVI, 2 (1910) 461.

Perennial; root rather thick, with few squamose short branches at apex, generally more robust than the preceding; entire plant appressed-fine-hairy, canescent, the hairs without tubercles; stems 1—3 from a root, simple, not branching, 15—30 cm high; radical leaves lanceolate-spatulate, long-tapering to long petiole together with which up to 10—15 cm long, obtuse, soft-appressed-hairy at both sides; cauline leaves lanceolate, acute, sessile, in general similar to the leaves of the preceding but the hairs appressed, grayish, obtuse. Inflorescence composed of 2 terminal cymes drooping, dense at first, later straightening and long, up to 10 cm; pedicels and calyx gray-pubescent; calyx sometimes gray-tomentose, 5—6 mm long, with acute lanceolate lobes; corolla relatively short, ca. 8—10 mm long, limb more broadly campanulate, the tube as long as calyx, the lobes as long as limb, oblong, obtuse; scales bright, 2.5 mm long, lanceolate, attached in throat and spreading; anthers on short filaments, oblong-linear, ca. 3 mm long, with inconspicuous mucros at apex; nutlets 6 mm long, ovoid, dorsoventrally compressed, disk nearly smooth, with a few visible spinules and tubercles, encircled at margin by one row of very short anchorlike spinules fusing at bases into thin rim, nutlets tuberculate laterally and at ventral side; style, very long-exserted from corolla, persistent but not thin. July.

Moist stony slopes, swamps in mountains in the subalpine belt.— Centr. Asia: T. Sh. (Tashkent Ala-Tau, south to Angren). Endemic. Described from a pass at Turpak-Bel at upper reaches of Chirchik, 2,300 m (Capus, 1861). Type in Paris and fragment — leaf and fruit — in Leningrad.

Note. This is a case of distinct vicaroids, the disjunction between which has led to differentiation of the two close species so completely that a definite morphological as well as geographical distinction has been established. L. capusii is not only distinguished by the thick, grayish, appressed hairs of the more obtuse leaves but also by the flowers that are smaller, not dark red, and the limb wider. Differences in details are also found in the nutlets, in particular: the disk is subglabrous and smooth in L. capusii.

Series 2. **Microfornicatae** M. Pop.— Scales ovate, 1—2 mm long.

PLATE XXXVI. 1 — Lindelofia stylosa (Kar. et Kir.) Brand.; 2 — Solenanthus turkestanicus (Rgl. et Smirn.) Kusn.

4. L. stylosa (Kar. et Kir.) Brand in Pflanzenr. IV, 252 (1921) 85; Zakir. Burachn. Zeravsh. 14.— Solenanthus stylosus Lipsky in Tr. Bot. Sada, XXIII (1904) 193—196.— Cynoglossum stylosum Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 409.— Solenanthus nigricans
634 Schrenk, Enum. pl. nov. II (1842) 29; Ldb. Fl. Ross. III, 171.— Lindilofia benthami Hook. f. in Fl. Brit. Ind. IV (1885) 159.— Lindelofia angustifolia Brand in Pflanzenr. IX, 252 (1921) 87, non Solenanthus angustifolius Schrenk.

Perennial; root thick, vertical, with 2—3 heads at apex, the heads thick, usually squamose with remnants of the previous years' petioles; stems usually single, 15—35 cm high, in fruit up to 50—60 cm, thick, robust, sparsely with soft-appressed-hairy, sometimes gray, nearly always simple, rarely with 1—2 long branches above; radical leaves rather large, blade oblong, rarely lanceolate-oblong, gradually long-tapering to petiole, with distinct lateral nerves, acute at apex, leaves (with petiole) in flower 10—15 cm long, 1—3 cm wide, in fruit up to 40 cm long, 4—6 cm wide, sparsely appressed-short-hairy, rarely grayish; cauline leaves narrow, lanceolate, sessile, acute, 1-nerved, rather numerous, 4—6 cm long (the median), up to 1 cm wide. Inflorescence often composed of only 2 terminal cymes sometimes with additional 1 or 2 cymes of lateral branches (when present); cymes at first dense, one-side, drooping, elongating in fruit to 10—20 cm and straightening, with fruits remote; pedicels gray-tomentose, at first shorter than calyx, elongating in fruit, especially the lower up to 1—2 cm long, erect; calyx in flower 6—7 mm long, gray-tomentose, with linear, acute lobes slightly elongating in fruit; corolla dark red, narrow, tubular, nearly as in Mattia, 10—12 mm long, twice as long as calyx, tube hardly longer than calyx, the limb shorter than tube and divided nearly to throat into oblong obtuse lobes tapering at base, vertical above; scales in throat, small, ovate, 1 mm long, dark; filaments attached in throat, very short; anthers 3.5—4 mm long, linear, exserted from throat but not from corolla, sagittate at base, with small mucros at apex; style exserted from corolla for 5—7 mm, persistent in fruit, slightly thickened at base; nutlets ovoid, markedly compressed dorsoventrally, 6—7 mm long, more or less densely tuberculate or short-spinulose on disk, very densely short-anchorlike-spinulose along margin and sides but spinules there longer than on disk, spinules triangular, broadening at base (in var. pterocarpus Rupr. the spinules along margin fuse into narrowly dentate rim); cicatrice ovate, occupying more than half
637 of the ventral side; gynophore short-pyramidal. June—July. (Plate XXXVI, Figure 1.)

Stony slopes.— Centr. Asia: Dzu.-Tarb., T. Sh., Pam.-Al. Gen. distr.: Tib., Himalaya (northern slope). Described from Dzungarian Ala-Tau (Sarkan River, 1841, Kar. and Kir.). Type in Moscow.

Note. Lipskii united S. nigricans Schrenk and S. angustifolius Schrenk (l. c. 194—195) into one species, noting the characters distinguishing these species, indicated by the author (authors) and Ledebour, as insignificant (leafiness of the stem) or non-existent (mucros on anthers). Brand (1921) again separated these taxa (under the generic name Lindelofia) on the basis of some character incomprehensible to me: 1) fornices infra basin squamis ornati — L. stylosa (Solenanthus nigricans Schrenk); 2) fornices infra basin squamis destituti — L. angustifolia (Solenanthus angustifolius Schrenk).

He regarded L. stylosa as endemic for Tien Shan and expressed the belief that L. angustifolia grew also in the Himalayas to where L. benthami Hook. f. was referred. I am convinced that all the specimens from the Himalayas which Brand reported as relating to L. angustifolius (L. benthami) belong to L. stylosa. The original specimens of Solenanthus angustifolius Schrenk from Tarbagatai (16—17 VI 1841 Schrenk) are a mystery to me. They are very similar to L. stylosa, in which respect Lipskii was right, but all the same the filaments of their stamens are long, as long as the anthers and not half as long (as in L. stylosa) and the mucros at the apices of the loculi are indistinct (Lipskii wrote that "this is some sort of calami lapsus"); corolla blue, not dark red. I could not find in the herbaria any specimens from Tarbagatai which would be like the original specimens of S. angustifolius Schrenk and hence could not decide whether this species was endemic in Tarbagatai (there have been no other collections after Schrenk) or whether its originals represented merely some kind of aberration of S. stylosus. I am inclined to lean to the first proposition. I must add that the Schrenk specimens from the Tokkrau River, 29 V 1943 (Karkaralinsk Mountains, which is inconceivable!) identified as S. angustifolius Schrenk, refer to Lindelofia stylosa, i.e., to S. nigricans Schrenk and that L. stylosa grows in Tarbagatai (original specimens of Solenanthus nigricans Schrenk!).

5. L. angustifolia (Schrenk) Brand in Pflanzenr. IV, 252 (1921) 87, quoad nomen et excl. speciminibus visis.— Solenanthus angustifolius Schrenk ex Fisch. et Mey. in Bull. Acad. Sc. St. Pétersb. X (1842) 353; Schrenk, Enum. pl. nov. II (1842) 28.

Perennial; the flowering specimens of Schrenk (original S. angustifolius) from Tarbagatai are the only ones available. Similar in all to L. stylosa but the corolla is blue, the anthers as long as the filaments,
638 2—2.5 mm long, the apices of the loculi without mucro; leaves (in flowering individuals) lanceolate, acute, markedly appressed-soft-hairy; stems 15—25 cm high, nearly tomentose-hairy at apex. June.

Centr. Asia: Dzu.-Tarb. (only in Tarbagatai along the Karakol stream, 16 VI 1841, Schrenk). Endemic. Described from the indicated locality. Type in Leningrad.

6. L. pterocarpa M. Pop. comb. n.— Solenanthus nigricans β. pterocarpus Rupr. Sert. tiansch. (1866) 62.

Perennial; closely related to L. stylosa but usually more cespitose, with large, declined, dead petioles on heads of root; petioles of radical leaves thicker, whitish and glabrous (in L. stylosa they are hairy); stem usually thickened at the middle; fruiting cymes little elongating, with fruits more remote; the main distinction in fruit: disk of nutlets tuberculate, surrounded at margin by one row of flat spinules fused at bases into narrow rim, the upper spinules triangular, half free and elevated as anchorlike teeth on narrow rim, sides and ventral side of nutlets acutely tuberculate and short-spinulose. Very high mountainous xerophyllous, race of L. stylosa in Pamir. July.

Centr. Asia: T. Sh. (shallow depressions), Pam.-Al. (Pamir). Endemic. Described from Central T. Sh. (near Dzhaman-Davan Pass, 19 VII 1887, Osten-Sacken). Type in Leningrad.

Note. From a formal point of view it would be more correct to treat this plant as a variety of the widespread S. stylosa. In this respect Ruprecht was quite right. I separate it into a species (meaning, naturally, a race) only to emphasize this race which should be distinguished from lower mountain broadly distributed populations.

Genus 1230. **SOLENANTHUS*** Ldb.

Ldb. Ic. Fl. Ross. tab. 26 (1829); Fl. alt. I, 193; DC. Prodr. X (1846) 163 (ex parte excl. sp. 8—10); Gürke in Engl.— Pr. Pflanzenf. IV, 3a (1897) 103—104 (excl. sect. II. Trachelanthus et sp. nonullae sectionis I. Eusolenanthus Gürke); Brand in Pflanzenr. IV, 252, 153—160 (excl. sp. 13).— Kuschakewiczia Rgl. et Smirn. in Tr. Bot. Sada, V, II (1878) 625—626; Gürke, l.c. 105; Brand, l.c. 160.

Calyx divided to base into 5 linear lanceolate or oblong lobes little elongating in fruit; corolla small, 3—10 mm long, tubular, with small erect teeth, with obscure border between tube and limb, sometimes slightly
639 funnel-shaped-tubular but even then with obsolete border between tube and limb, blue, dark red or rarely yellowish, not protruding from calyx or slightly so; scales present, rather large or small, oblong, disposed below middle of corolla, if limb discernible then disposed near throat at the middle of corolla, rarely higher; filaments attached at middle part of corolla or upper (between bases of teeth), elongate, usually markedly, rarely hardly, exserted from behind corolla teeth; anthers small, 1—2 mm long, orbicular-elliptic or oblong, obtuse, not sagittate at base; style more or less long, protruding, rarely not protruding from corolla. Nutlets dorsoventrally compressed, 5—10 mm long, ovoid or nearly globose, with flat or slightly depressed disk at back, margin and sides and ventral side densely spinulose, the spinules anchorlike; cicatrice occupying about half (upper) of the ventral side or less, usually without awn from style, sometimes with awn. Perennial herbs, numbering about 10 species.

1. Blades of radical leaves ovate, cordate at base, rarely distinct from the long petiole. Corolla tubular, without distinct border between tube and limb, with acute triangular erect teeth. Scales disposed in lower third of tubular part of corolla, small. Stamens markedly exserted, with oblong small anthers. Nutlets high-pyramidal-ovoid, plicate, with slightly concave disk sparsely beset with spinules and tuberculate between them, along margin with long flat spinules broadening at base, in some races fusing into a dentate rim. Cicatrice awned. (Section Petiolares) . . . . . 1. S. circinnatus Ldb.

\+ Radical leaves gradually cuneately-tapering to petiole, linear, lanceolate or oblong. Corolla with more or less distinctly defined small campanulate limb or rarely tubular.

* From the Greek solen — tube, anthos — flower.

Scales in throat, i. e., at border of tube and limb at middle of corolla, or if limb indistinct then in lower third or upper third of corolla, lobes (teeth) of corolla variable. Stamens usually exserted, with larger anthers (1.5—2 mm). Nutlets variable . . . . . 2.

2. Spinules densely covering nutlets, trihedral-conical, thick, rather short, densely covered with small papilliform hairs, with rather small anchorlike tips. Nutlets subglobose. Corolla very small, not protruding from calyx. Stamens erect. Radical leaves in fruit oblong and broadly elliptic. (Section Kuschakewiczia) . . . . . 3.

640 + Spinules of nutlets thinner, long, flat, smooth on faces or hardly rough, with rather large anchorlike tips. Nutlets ovoid-globose. Corolla more or less protruding from calyx. Radical leaves variable but always cuneately tapering to petiole . . . . . 4.

3. Corolla yellowish, tubular, 4 mm long, the teeth glabrous. Scales in upper third of tubular part of corolla, hamate-incurved, hairy at apex. Filaments inserted between bases of corolla teeth, i. e., toward its tubular part. Style and stamens much exserted. Inflorescence apical, at first capitate, in fruit with elongated branches, umbelliform. Radical leaves at first (in flower when inflorescence capitate) small, oblong-lanceolate, in fruit very much elongating, broadly elliptic, up to 3—5 cm wide; entire plant including calyx sparingly pubescent. In loess at foothills, often waste lands, from Tashkent to Pyandzh and in Badghis. . . . . . 2. S. **turkestanicus** (Rgl. et Smirn.) Kusn.

\+ Corolla with violet teeth differing in length and width and hairy at margin, tubular part of corolla broad but short, entire corolla 3 mm long. Scales below middle of tubular part, small, nearly triangular, hairless. Filaments not strongly exserted, violet. Style not exserted. Inflorescence narrowly paniculate, not corymbiform, with very many small flowers borne in leafless short cymes gathered into a narrow panicle. Calyx silvery-white-tomentose. (Only in the southwest Pamir area, Boldzuan, Kulyab) . 3. S. **plantaginifolius** Lipsky.

4. Corolla with rather distinct campanulate limb. Scales comparatively large, oblong, disposed in throat, i. e., at border of tube and limb (middle of corolla). Fruit similar to that of Cynoglossum. Inflorescence paniculate. Biennials, with thick villous stem. Radical leaves oblong. (Europe, Crimea, Caucasus to N. Iran, in forests). (Section Apennini) . . . . . 8.

\+ Corolla dark red, with indistinct or more distinct limb. Scales small, disposed in lower third of corolla. Stamens and style exserted. Fruit more like that of Section Kuschakewiczia. Inflorescence capitate at first, later corymbiform, rarely short-paniculate. Radical leaves narrower. Perennials. (Centr. Asia, Pamir area). (Section Hirsuti) . . . . . 5.

5. Corolla 3 mm long, shorter than calyx. Scales nearly square, slightly separated from the below-diluted limb. Plants bristly-hairy, and long villous. Radical leaves oblong-lanceolate, acute.

641 Spinules along margin of disk long; nutlets small (4—5 mm long). Apex of stem leafless under the corymbiform inflorescence. (Southwestern part of Pamir) . . . . . 4. S. **hirsutus** Rgl.

\+ Corolla 5—7 mm long, slightly exserted from calyx, violet-red plants gray-velutinous or soft-pubescent with short hairs. . . . . 6.

6. Radical leaves narrow, lanceolate-linear to sublinear, acute, usually 3-nerved, elongate. Cauline leaves lanceolate-linear, sessile. Hairs short, white-gray, completely appressed. Inflorescence short-paniculate. Corolla ca. 5 mm long, limb somewhat distinct with triangular teeth. Scales in lower third, very small. Sepals linear, acute. Nutlets small, 4—5 mm long, oblong, with flat or hardly inflated disk sparsely beset with short anchorlike spinules and finely tuberculate spinules in-between, margin of disk with spinules the same as on disk, not fusing at bases, short. Stem erect, robust. (Mainly along Zeravshan Range) . . . . . 5. S. **kokanicus** Rgl.

\+ Radical leaves oblong-lanceolate or lanceolate, obtuse, spatulate, with 3—5 less distinct nerves. Cauline leaves sessile, lanceolate, short-acuminate. Hairs short, spreading, velutinous. Inflorescence capitate or short-paniculate. Corolla 5—7 mm long, with indistinct separate, slightly broadened limb, teeth short-triangular. Sepals linear-oblong, obtuse or lanceolate, acute. Scales slightly below middle or in the middle of corolla, rather large, triangular-oblong. Nutlets ca. 7 mm long, with slightly concave disk; spinules on disk and margin longer and broadening at base . . . . . 7.

7. Inflorescence short-paniculate. Corolla 5 mm long. Disk of nutlets smooth. (Pamir) . . . . . 6. S. **stamineus** (Desf.) Wettst.

\+ Inflorescence short, capitate. Corolla 6—7 mm long. Disk of nutlets finely tuberculate. (Pamir area) . . 7. S. **karateginus** Lipsky.

8. Stamens markedly exserted from corolla; anthers small, ca. 1 mm long, orbicular-elliptic. Corolla teeth triangular-oblong. Sepals obtuse, oblong. (Crimea, W. Caucasus, in the east to Tbilisi) . . . . . 8. S. **biebersteinii** DC.

\+ Stamens nearly not exserted from corolla. Corolla with spatulate-obovate teeth. Anthers oblong, 1.5 mm long. (Talysh) . . . . . 9. S. **brachystemon** Fisch. et Mey.

642 Section 1. PETIOLARES Zak. Burachn. Zeravsh. (1941) 14. — Radical leaves with ovate, cordate blade and long petiole. Cauline leaves broad, oblong, the upper even ovate. Corolla tubular, with triangular erect short teeth. Flowers sessile or subsessile. Scales in the lower part of corolla. Stamens and style markedly exserted. Nutlets high-pyramidal, ovoid, with slightly concave disk, anchorlike-spinulose along disk and sides. Tall perennial herbs, stems up to 100 cm high. Inflorescence a rather large

panicle of numerous leafless cymes. Root usually with fusiform-thickened lateral roots.

1. S. **circinnatus** Ldb. Fl. alt. I (1829) 194; Fl. Ross. III, 170; Boiss. Fl. or. IV, 270; Brand in Pflanzenr. IV, 252, 15, 7; Kryl., Fl. Zap. Sib. IX, 2236. — S. petiolaris DC. Prodr. X (1846) 164; Boiss. Fl. or. IV, 270; Lipskii in Tr. Bot. Sada, XXIII, 186—188; Kuzn. in Mat. Fl. Kavk. IV, 2 (1913) 146; Shmal'g., Fl. II, 223; Brand, l. c. 138; Grossg., Fl. Kavk. III, 252. — S. rumicifolius Boiss. Pl. nov. or. dec. II (1875) 9. — S. tenuiflorus Schrenk in Bull. phys.-math. Acad. Sc. Pétersb. II (1844) 194; DC. Prodr. X, 165; Ldb. Fl. Ross. III, 170; Lipskii, Tr. Bot. Sada, XXIII, 185; Brand, l. c. 157. — S. coronatus Rgl. in Izv. Obshch. lyubit. estestvozn, antrop. i etnogr. XXXIV, 2 (1882) 59; Zakir. Burachn. Zeravsh. in Tr. Uzb. Gos. univ. 28, (1941) 14. — Ic.: Ldb. Ic. Fl. Ross. tab. 26.

Perennial; root branching, with fusiform-thickened fibrils, few-headed above, slightly squamose; stems usually single, erect, thick, low at flowering, reaching 80—120 cm in fruit, more or less densely appressed-pubescent-hairy or subglabrous or glabrescent, not branching except for few short branches in axils of upper leaves close to the paniculate inflorescence; radical leaves (more precisely rosetted leaves of sterile shoots), with ovate cordate blade distinct from the long petiole, acute, sparsely appressed-pubescent, often grayish beneath, at flowering small, later reaching 10—20(30) cm in length, 6—19(15) cm wide (at base), thin; petiole as long as or longer than blade, slightly appressed-pubescent; lower cauline leaves petioled, more or less similar to the radical, median and upper leaves semi-amplexicaul, sessile, oblong, the upper even ovate, acute. Inflorescence narrow at first, later spreading-paniculate, consisting of many cymes with additional few ascending lateral branches from axils of upper leaves; cymes dense, twisted at first, in fruit straightening, leafless; pedicels very
643 short or flowers sessile; calyx gray-pubescent, lobes linear-spatulate, obtuse, 3—4 mm in flower, 5—6 mm in fruit; corolla blue, rarely yellowish, tubular, 5—6 mm long, slightly protruding from calyx, teeth triangular, lanceolate or oblong, acute; scales in lower third of tube, narrowly triangular, 0.5—1 mm long; stamens unequal, attached between scales, long, markedly exserted (sometimes described as being twice as long as corolla); anthers small, hardly 1 mm long, broadly elliptic; style exserted from corolla; nutlets 5—7 mm long, ovoid, with slightly concave disk covered with few thin anchorlike spinules sometimes only in one row forming a keel, finely tuberculate between spinules; spinules along disk and at sides anchorlike, more or less long, their bases not fusing or (in the longer) fusing, sometimes only forming dentate rim around disk with teeth ending as anchorlike spinules; rim flat, sometimes so wide that fruits resembling those of Paracaryum; cicatrice ovate, occupying about half (upper) the ventral side, the other part covered with anchorlike spinules. April—May. (Plate XXXVII, Figure 1).

Stony or rocky mountain ravines in the lower and middle belts, moist shady places. — Caucasus: Dag., S. Transc.; West Siberia: Irt.; Centr. Asia: Balkh., Dzu.-Tarb., T. Sh., Pam.-Al., Mtn. Turkm. Gen. distr.: Iran., (to Kurdistan in the west), Himalayas (rarely). Described from

Upper Irtysh and Arkaul (Arkalyk) Mountains (Meyer, 1826). Type in Leningrad.

Note. It seems to me that there is only one species in this section. I presume that the Syrian S. amplifolius Boiss. belongs to the synonymy of the above-described species, although I have not seen specimens of the latter. Naturally, with such a huge distribution area, from Altai to Lebanon, local races of this mountain plant have been formed that are sometimes described as species. The northeastern race (the formal type) has along the disk margin spinules that are comparatively short (1—1.5 mm) and although broadening at the base the bases do not fuse, nutlets ca. 5—6 mm long. Hairs long but less in quantity. The southwestern race (S. petiolaris DC.) has longer spinules (2—2.5 mm) along the disk margin, their bases are flat, very close and almost fusing, sometimes even slightly fusing; nutlets 6—7 mm long; hairs grayish, slightly more dense. This race is very common to the western part of Tien Shan up to the Iranian Elburz. Within this range there are transitions to both the northeastern race and the Pamir area race (S. coronatus). S. coronatus Rgl. is known as the most typical only in the Pamir area, from western Tien Shan (Santalash, B. Fedchenko) up to Shugnan where it grows together with the southwestern
644 race (S. petiolaris) to which it is connected by morphological transitions. It is distinct by the long and flat spinules fusing at their bases so that a dentate rim surrounds the disk, i. e., a wing like in some flat-winged Paracaryum. Apart from the original from Sangi-Dzhuman (above Urgut) I saw specimens also from the Nuratay Mountains (Korovin), Babatag (Rozhevits) and other places. The race S. tenuiflorus Schrenk is isolated in the north, in the Central Kazakhstan area of low, rounded, isolated hills (Ulu-Tau Mountains). This race is distinguished only by the very thin low stems, more glabrous and slightly narrower (purely tubular) corolla, the scales are larger. It is not true that the corolla is three times as long as the calyx, it is longer by $1\frac{1}{2}$—2 times, which also occurs in other races. The nutlets in S. tenuiflorus are 5—6 mm long and more like the nutlets of the type (northeastern race). Another race common to Mogol-Tau Mountains is S. mogoltavicus M. Pop. which differs from all the others by the straw-yellow corollas, its spinules on nutlets are shorter, as in the northeastern race (type S. circinnatus). The Dagestan race, S. daghestanicus M. Pop., is distinguished by its almost completely absent downy and its very small (5—3 mm) corollas that are reddish-violet, its fruits are as in the typical race (S. circinnatus Ldb.).

Section 2. KUSCHAKEWICZIA Zak. Burachn. Zeravsh. (1941) 15.— Genus Kuschakewiczia Rgl. et Smirn. in Tr. Bot. Sada, V, II (1878) 625.— Radical leaves in fruit broadly elliptic-oblong, up to 4—6 cm wide, with few nerves, gradually and cuneately tapering to petiole. Corolla tubular, very small, 3—4 mm long. Flowers sessile or subsessile. Stamens exserted; anthers small. Scales small. Fruit subglobose, densely covered everywhere (disk, sides and free part of ventral side) with triangular-conical, thick, short (ca. 1—1.5 mm) spinules covered uninterruptedly with small papillar hairs. Cicatrice without awn from style. Perennials. Only in Centr. Asia.

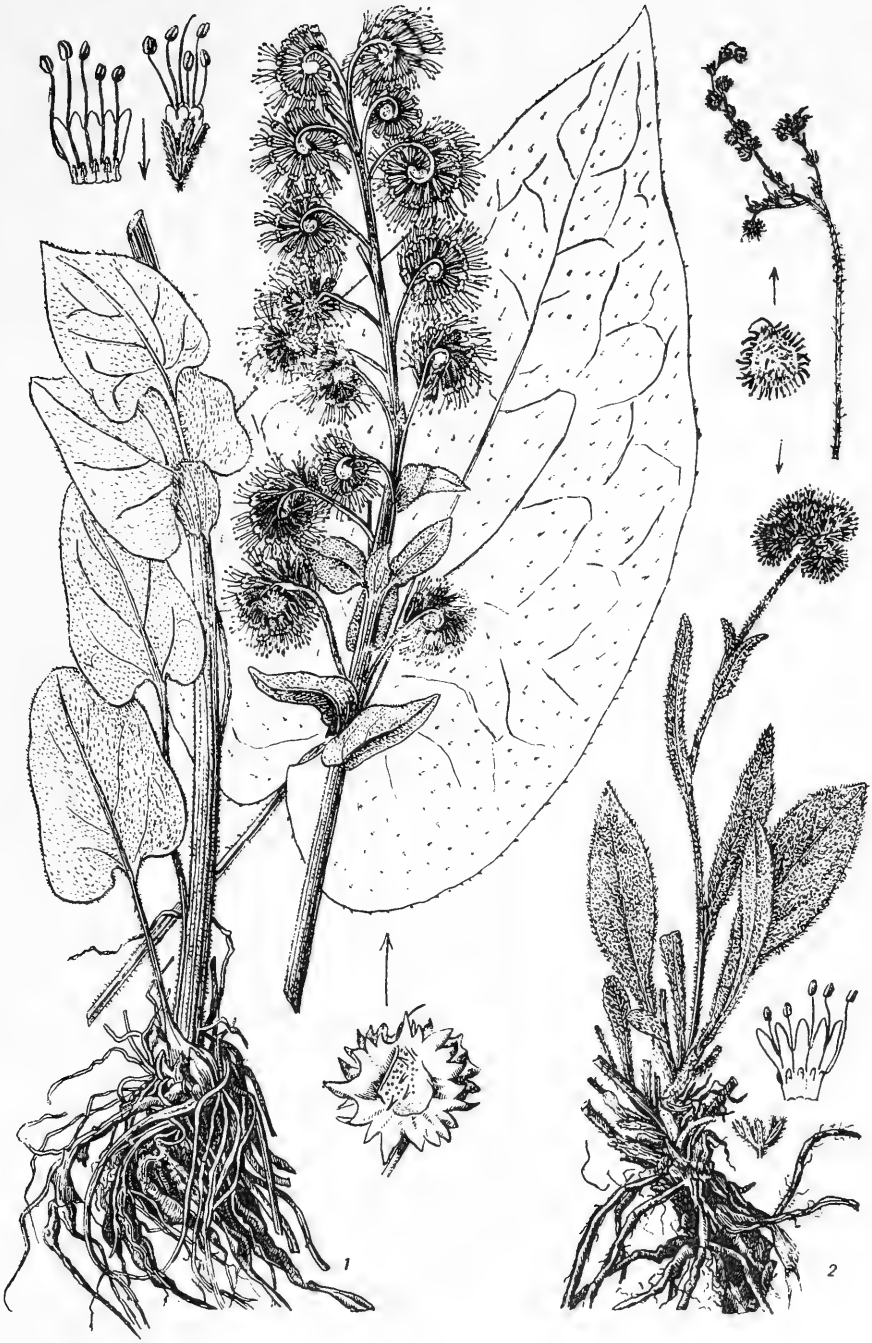

PLATE XXXVII. 1 — Solenanthus circinnatus Ldb.; 2 — S. hirsutus Rgl.

2. S. turkestanicus (Rgl. et Smirn.) Kusn. in Mat. Fl. Kavk. IV, 2 (1913) 141; Macbride in Proceed. Amer. Acad. LI, 543; Zakir. Burachn. Zeravsh. 15. — S. kuschakewiczi Lipsky in Tr. Bot. Sada, XXIII (1904) 182. — Kuschakewiczia turkestanica Rgl. et Smirn. l. c. (1878).

Perennial; root dark, more or less thick, vertical, cylindrical, usually producing several stems; stems usually arcuately ascending, 10—15 cm
647 high, more often 20—30 cm high, angular, like leaves sparsely grayish-bristly-hairy (only at flowering when stems still short and leaves $^1/_{10}$ of final size), simple, rather thin; radical leaves at first lanceolate, later nearly oblong or elliptic, obtuse or acute, with few pinnately lateral nerves, up to 3—6 cm wide, cuneate-tapering to long petiole, altogether 15—25 cm long (in fruit), rather coarse, greenish, sparsely covered with semi-appressed hairs; cauline leaves mostly oblong-lanceolate, acute, the lower short-tapering at base, the upper sessile, absent at apex of stem, 6—10 cm long, 2—3.5 cm wide. Inflorescence at first when stem short, spherical-capitate, composed of only terminal short cymes, later cymes elongate and become straightening into an umbelliform inflorescence with unequal rays ascending to the side; pedicels very short, gray-pubescent; calyx gray-pubescent, lobes lanceolate or linear-oblong, obtuse, in flower ca. 3 mm long; corolla yellowish, tubular, hardly longer than calyx, ca. 4 mm long, teeth short, triangular-lanceolate or oblong, often incurved; scales small, hamately incurved, narrow, not hairy-villous at apex, disposed in upper third of corolla near base of teeth; filaments attached in throat (tube), long, considerably exserted; anthers small, hardly 0.5 mm long, orbicular-elliptic to subglobular; nutlets — usually only one developing — large, ca. 8 mm across, subglobular, dorsoventrally compressed, densely and evenly short-spinulose on the entire surface (i. e., on flat back, narrow sides and ventral side), the spinules thick, conical, papilliform, with small anchor-like tip; cicatrice triangular-ovate, occupying $^1/_5$ of the ventral side (its upper part), not awned at apex. March—April. (Plate XXXVI, Figure 2.)

Loess or sandy slopes of foothills in semi-desert steppe, often in oases.— Centr. Asia: Pam.-Al., Syr D. (Tashkent), Mtn. Turkm. (Badghis). Gen. distr.: Iran. (only in Paropamisus part of Afghanistan). Described from Tashkent (Kushakevich), but it is possible that the plant was collected by Kushakevich somewhere more to the south, near Samarkand. Type in Leningrad.

Note. Gürke (1897) and Brand (1921) (the latter in spite of Lipskii's opinion (1904)) retained Kuschakewiczia as a genus, not only because of a lack of faith in E. Regel's stand but also because Brand, and certainly Gürke, knew so little about the Turkestan species of the genus. Solenanthus species, such as S. hirsutus and S. plantaginifolius, are so
648 close to Kuschakewiczia turkestanica that it is impossible to separate the latter into a genus on the basis of such variable characters found in the species of Solenanthus like the disposition of the scales and the attachment of the stamens. Of course, the problem of generic delimitation is very complicated, much more complicated than species delimitation, and in order to be consistent in defining the genera, it is impossible to separate the genus Kuschakewiczia from the genus Solenanthus if the genus Paracaryum or Rindera combines (as in the USSR) such different

sections as Macromattiastrum and Euparacaryum or Pseudomattia and Eurindera, respectively.

It is noteworthy that the remarkable magnitude of the infraspecific differentiation of S. turkestanicus compared with other Solenanthus, is proportional to its ecological differentiation. It is the only species in the genus that extends to the semi-desert belt, in loess foothills, on loess soil, while all the other species of the genus grow on mountains, in rocky and stony places, usually in the semi-steppe belt, i. e., in much more arid conditions.

3. S. plantaginifolius Lipsky in Tr. Bot. Sada, XXIII (1904) 198; Brand in Pflanzenr. IV, 252 (1921) 159.

Perennial; rootstock very thick, long, producing 1 or sometimes several stems; stems angular, erect or decumbent, robust, up to 50 cm high, not branching outside inflorescence, grayish, with appressed entangled hairs, in inflorescence appressed-pubescent; radical leaves resembling the leaves of plantain, ovate-lanceolate or oblong, cuneate-tapering to winged petiole, acute, with 3 subparallel pinnate nerves, very accrescent in fruit, gray-appressed-pubescent, in flower ca. 20 cm long, 3—4 cm wide, in fruit up to 50 cm long and to 14 cm wide; cauline leaves few, much smaller, oblong or lanceolate, the uppermost sometimes even linear, upper leaves sessile. Inflorescence at onset of flowering a very narrow panicle, with branches not arcuate, later paniculate-racemiform, long, leafless, rather dense, composed of many (20—30) small cymes; cymes nearly erect, recurved, in flower rather dense, 2—5 cm long, many-flowered, leafless; fruiting cymes straightening and elongating up to 10 cm, obliquely spreading above; flowers small, subsessile; calyx silvery-white-pubescent, lobes spatulate-oblong-linear, obtuse, 3 mm long, in fruit not elongating; corolla violet-blue, ca. 3 mm long, as long as calyx, teeth unequal, lanceolate or lanceolate-triangular, acute,
649 ciliate at apex, erect, slightly protruding from calyx, tube short, broad, glabrous, pale; scales very small, crescent-shaped, in the lower third of corolla; filaments attached between scales, violet, a little but distinctly exserted from corolla and calyx; anthers black, oblong, 0.65 mm long; style hardly exserted from corolla, in fruit almost inconspicuous; fruit sessile; nutlets 1—2 in fruit but sometimes 3 and even 4, compressed dorsoventrally, globose-ovoid, ca. 10 mm long, with slightly concave back, at sides and ventral side very densely covered with short flat-conical hair-like-papilliform at sides and anchorlike at tip; spinules along disk (back) not as thick but of the same shape thus disk hardly distinct from margins and sides; cicatrice ovate, without awn, occupying $\frac{1}{3}$—$\frac{1}{4}$ the ventral side; gynophore low-pyramidal. April—May.

Stony mountain slopes, in the upper semi-desert and semi-steppe belts, among wormwood or woody-shrubby associations. — Centr. Asia: Pam.-Al. (southwestern part only: Kulyab and Boldzhuan). Endemic. Described from Boldzhuan (flowers, V 1883—1884, Regel'). Type in Leningrad.

Note. This endemic species with its unique corolla is restricted to one of the most remarkable floristic regions of mountainous Central Asia, and I refer it to S. turkestanicus because of the similarity of its fruit, especially the spinules covering it. These spinules are also present in the North African S. lanatus DC. which I think should be separated into the

genus Turbinaria M. Pop. In my opinion Brand uselessly added it to the Himalayan genus Lindelofia. As far as the origin of our species is concerned, it seems possible to regard it as a hybrid (naturally, of Tertiary age) of S. turkestanicus × S. karateginus (stamineus) and therefore it is expected to find in Kulyab-Boldzhuan some other species morphologically close to ours yet closer to the supposed parents. Brand wrote about S. plantaginifolius: "species summopere insignis et forsan allii generis." After the fruit became known the first assumption remained valid and the second proved superfluous.

Section 3. HIRSUTI Zak. Burachn. Zeravsh. (1941) 15.— Radical leaves with oblong, lanceolate or linear blade very gradually tapering to petiole and not reaching more than 2—3(5) cm in width. Flowers sessile or subsessile. Corolla red-violet, 3—7 mm long, limb more or less campanulate distinct from tube, with triangular erect teeth; scales small, at middle or below middle of corolla; Stamens considerably exserted from corolla, with small anthers. Style exserted. Nutlets not large, 5—7 mm long, spinules flat and smooth and with large anchorlike tip. Cicatrice (with awn? or) without awn. Stems nearly not branching.

4. **S. hirsutus** Rgl. in Izv. Obshch. lyubit. estestvozn., antrop. i etnogr. XXXIV, 2 (1882) 60; Lipskii in Tr. Bot. Sada, XXIII, 192; Zakir. Burachn. Zeravsh. 15; Brand in Pflanzenr. IV, 252, 156.

Perennial; rhizome short, oblique, branching, with woody short curved branches, producing numerous adventitious filiform slightly thickened roots; branches of rhizome bearing many leaf bundles (rosettes); stems thin, 10—25 (40) cm high, ascending or erect, rounded, without projected lines, simple, slightly leafy, densely and coarsely (bristly) spreading-villous, the leafless upper part appressed-white-bristly; radical leaves lanceolate (with petiole) 10—15 cm long, 1—2 cm wide, acute, gradually long-tapering to bristly petiole, with few lateral nerves, little accrescent in fruit, at both sides sparsely grayish-bristly-hairy, bristles at upper surface on large flat tubercles, erect, coarse, bristles at lower surface without tubercles, softer and more entangled; cauline leaves few, only in the lower part of stem, lanceolate to linear, acute, the lower tapering at base, the upper sessile, 5—1 cm long, 0.5—1 cm wide. Inflorescence at first capitate, composed of few short leafless cymes, later elongating, becoming corymbiform, furcate if only 2 cymes present, with branches spreading above, reaching 5—8 cm in length; pedicels very short, nearly inconspicuous; flowers usually sessile; calyx gray-pubescent, nearly lanate, 2—3 mm long, in fruit nearly not elongating, lobes linear, obtuse; corolla dark red, 3—4 mm long, hardly exserted from calyx, the limb rather distinct, campanulate, approximately as long as tube, lobes (teeth) oblong, obtuse, not recurved; scales rather large, ca. 0.5 mm long and wide, nearly square, obtuse or elongate-rectangular at the slightly 2-lobed apex, papilliform along upper margin, in throat of corolla or slightly lower; stamens twice length of corolla; anthers ovoid-rounded, ca. 1 mm long, in the southern race oblong, to 2 mm long; nutlets ca. 5 mm long, ovoid-oblong, flat, sparsely and shortly spinulose along back, finely tuberculate between spinules, with uniseriate long horizontal or erect, flat spinules along

slightly thickened margin, slightly spreading at base, turning blue, all spinules with anchorlike head, sides with sparse erect spinules slightly shorter than
651 the marginal; base of style not thickened; cicatrice apparently extends for $\frac{1}{2}$—$\frac{1}{3}$ of ventral side, without awn. April—May. (Plate XXXVII, Figure 2.)

Stony mountain slopes, often in savin or maple and almond forests.— Centr. Asia: Pam.-Al. (only south of Upper Zeravshan). Endemic. Described from Sangi-Dzhuman ravine on Zeravshan Range between Urgut and Magian (flowers, 25 V 1869, O. Fedchenko). Type in Leningrad.

5. S. kokanicus Rgl. in Izv. obshch. lyubit. estestvozn., antrop. i etnogr. XXXIV, 2 (1882) 89; Lipskii in Tr. Bot. Sada, XXIII (1904) 188; Brand in Pflanzenr. IV, 252, 157; Zakir. Burachn. Zeravsh. 15.

Perennial; root thick, woody, dark, long, with 2—3 squamate heads, producing 1, rarely several, stems and few rosettes; stem 30—60 cm high, erect, rather thick, ribbed, furrowed, usually simple, leafy to inflorescence, with 1—2 short straight branches below inflorescence, all soft, thin with gray-appressed downy hairs, thinly tomentose; radical leaves elongate-lanceolate or lanceolate-linear, to 30 cm long, gradually, almost inconspicuously tapering to petiole, acute, 3-nerved, sericeous and gray-thin-tomentose, 0.8—1.5 cm wide, the petioles shorter than blade, nearly white-tomentose; cauline leaves lanceolate or lanceolate-linear, acute, the lower slightly tapering to base, the upper sessile, thin, nearly sericeous-gray-tomentose. Inflorescence a short panicle, small at first, of 5—10 short leafless scorpioid cymes, later straightening, elongating to 5—8 cm, obliquely spreading above; pedicels very short, none more than 3 mm long; calyx gray, tomentose-downy, 2—3 mm long, its lobes linear, obtuse or acute, little changing in fruit; corolla ca. 5 mm long, red-blue, nearly tubular, its limb barely discernible, not clearly set off from tube, teeth 0.6 mm long, triangular, acute, erect; stamens $1\frac{1}{2}$ times length of corolla; anthers oblong, 1—1.5 mm long; scales ca. $\frac{1}{4}$ mm long, rectangular, in lower third of corolla; nutlets ca. 4 mm long, with finely tuberculate flat back, few, thin, flat, smooth, (except for anchorlike head) short, anchorlike spinules, slightly longer along margin and sides, hardly fusing at base; thickened base of style very short, 1—2 mm long; cicatrice ovoid, occupying half the ventral side, without awn; ventral side with fine anchorlike spinules; gynophore short-pyramidal, with impressed faces, and wings (ribs) between them. May—June.

Stony limestones of plateaus on peaks of ranges, upper part of semi-steppe
652 belt, 2,000—2,500 (3,000) m.— Centr. Asia: Pam.-Al. (mainly along Zeravshan Range; Kugitang — at peak and in Alai valley). Endemic (?) Described from Zeravshan Range (Askai Mountain, flowers, 15 V 1869, O. Fedchenko). Type in Leningrad.

Note. S. strictissimus Brand, a very close species, was described from Hindu Kush. It differs from our species only in the longer (7 mm) corollas and the larger (to 1 mm long) square scales. Our species may also occur on the northern slope of the W. Himalayas.

6. S. stamineus (Desf.) Wettst. in Denkschrift. K. K. Acad. Wissenschaft. Wien, L, 2 (1885) 88; Brand in Pflanzenr. IV, 252, 155.— Cynoglossum stamineum Desf. in Ann. Mus. Hist. Nat. X (1807) 431.— Mattia staminea Roem. et Schult. Syst. IV (1819) 82 et 764.— Solenanthus tournefortii DC. Prodr. X (1846) 164; Boiss. Fl. or. IV, 269; Kuzn. in Mat.

Fl. Kavk. IV, 2, 145; Grossg., Fl. Kavk. III, 252.— S. conglobatus DC. l. c. 166.— Ic.: Desf. l. c. tab. 36; Choix Cor. tab. 19; Brand, l.c. fig. 21.

Perennial; root thick, dark, vertical, with 2—3 thick, squamate partly tomentose heads; stems 25—65 cm high, usually single, erect, rather thick, simple, gray, with short soft velutinous hairs, rarely subglabrous, (in more glabrous green-leaved forms), yellowing; radical leaves long, the oblong-lanceolate, acute or obtuse, gray, velutinous-downy blade to petiole as long as blade; total length of leaves 20—30 (to 40) cm, blade 2—3(5) cm wide; lateral nerves poorly defined; the Iranian specimens are prominently 2-nerved; cauline leaves rather numerous, lanceolate, rarely almost oblong, extending to inflorescence, the lower tapering at base, the upper reduced, sessile, obtuse, gray-velutinous-downy, soft, sometimes nearly tomentose, rarely greenish. Inflorescence short, sometimes an interrupted panicle, of 5—10(15) scorpioid cymes, or, nearly capitate with about 5 cymes, bostryces 1—4 cm long, dense, many-flowered, arcuate, in fruit not longer than 5—6 cm straightening, obliquely spreading above; pedicels very short; flowers and fruit subsessile; calyx 3—4 mm long, gray or white, tomentose-downy, its lobes lanceolate or linear, acute or obtuse, nearly not elongating in fruit; corolla violet-red or violet, 5—6(7) mm long, the limb broadening but weakly separated from tube, the teeth triangular, acute, short; scales rather large, trapeziform or nearly rectangular, to 1 mm long, slightly below middle of
653 corolla, slightly 2-lobed, hairy at apex; stamens markedly protruding from corolla, ($1\frac{1}{2}$ times as long), the filaments attached to middle of corolla; anthers ovate or oblong, 1.5—2 mm long; style long, protruding; nutlets 6—7(8) mm long, ovoid, with smooth flat or slightly impressed disk, and short flat anchorlike spinules widely dispersed, sometimes confined to keel, margin with flat, short, broadly triangular, anchorlike spinules with slightly fused bases also disposed in 2—3 lateral rows, ventral side with short dense anchorlike-spinules; cicatrice ovoid, occupying upper half of ventral side, without awn; style slightly thickened at base, inconspicuous in fruit; gynophore short-pyramidal, with impressed faces and winglike ribs. May—June.

Stony slopes, 2,000—3,000 m, in subalpine belt.— Caucasus: S. Transc. (Nakhichevan ASSR, Armenian SSR), E. Transc., Tal.; Centr. Asia: Pam.-Al. (southeast Pamir only: Shugnan, Darvaz). Gen. distr.: Arm.-Kurd., Iran., Bal.-As. Min. (Syria, Greece: Aroania). Described from Asia Minor (Cappadocia) from Tournefort's collections. Type in Paris.

Note. I found no stable differences between the Armenian and Kurdistan (type) S. stamineus and the Pamir specimens, although the latter occupy, as it were, an island isolated from the main distribution area. This species probably grows in Hindu Kush. The plants in the Pamir area have rectangular, not trapeziform, scales and their corollas are more tubular, but these are not important differences. (Earlier, they were recognized as S. karateginus Lipsky, though Lipsky ignored that it was very close to S. stamineus, which is easily distinguished by its characteristic paniculate not capitate inflorescence.)

7. S. karateginus Lipsky in Tr. Bot. Sada, XXIII (1904) 196; Brand in Pflanzenr. 156.

Perennial; root thick, dark, with few squamate heads; stems 20—40 (to 60) cm high, usually single, erect, rarely thick, not branching, slightly angular, with velutinous gray down; radical leaves oblong-spatulate or oblong-lanceolate, obtuse, long-tapering to petiole shorter than 3—4 cm wide, velutinous-gray-downy blade, with 2 distinct lateral nerves; petioles nearly white-tomentose, cauline leaves 4—6 cm long, oblong or lanceolate, few, velutinous-gray-downy, except for lower leaves sessile, acute, the uppermost 1—3 cm long. Inflorescence capitate, becoming corymbiform as scorpioid cymes, elongate, leafless, rising above leafless apex of stem, rarely short-paniculate through small lateral branches; pedicels very short;
654 calyx short-downy, gray, 3—4 mm long, its lobes oblong-linear, obtuse; corolla 6—7 mm long, reddish-blue (violet), nearly tubular, limb, indistinct, teeth erect, triangular-ovate or triangular-lanceolate, acute, short; scales trapeziform, 0.75—1 mm long, indistinctly 2-lobed, papilliform, in middle of corolla; stamens far-protruding, filaments inserted at middle of corolla, anthers ovoid, 1 mm long; nutlets 6—7 mm long, ovoid with flat back, finely tuberculate and sparsely covered with short anchorlike spinules, sometimes confined to keel, along edge of disk spinules in 2—3 rows with flat-broadened base, slightly fusing, and anchorlike head, ventral side short-spinulose; cicatrice occupying more than half of nutlet, ovoid, without awn (?); style with short thickened base. June—July.

Stony mountain slopes, 2,000—3,500 m, in subalpine belt. — Centr. Asia: T. Sh. (west only), Pam.-Al. (southwest mainly). Endemic. Described from Karategin (Kara-Shura Gorge, flowers, fruit, 26 VII 1897, Lipskii). Type in Leningrad.

Note. This species is so close to S. stamineus that it is difficult to distinguish them decisively, the more so as Lipskii's originals more closely resemble the intermediate form with paniculate inflorescence. The most typical specimens (differing from S. stamineus) come from the western part of Tien Shan; their growth is more robust, their stems are thinner, inflorescences are nearly always capitate, even in fruit, and the pubescence is sparser and not as gray as in the Karategin specimens. In general S. karateginus differs from S. stamineus in its seemingly [sic] longer (6—7 mm) corolla and the finely tuberculate, not smooth, disk of the nutlets, but we cannot be certain that these differences are constant. There is no sense in trying to separate the West Tien Shan type of Karategin Solenanthus as S. ugamicus Rubtz. in herb.

Section 4. APENNINI M. Pop. — Radical leaves with oblong or broadly elliptic blade cuneately tapering to petiole. Corolla with different broadening of limb, clearly set off from tube, 6—9 mm long, violet-blue or red. Pedicels distinct, to 1—1.5 cm in fruit. Scales in throat, large, 1—1.5 mm long, trapeziform-oblong. Lobes (teeth) of limb obtuse. Stamens far protruding or scarcely so. Nutlets 7—8 mm long, high-pyramidal, similar to those of Cynoglossum, the very flat back and sides densely covered with short thick smooth anchorlike spinules. Biennials, with thick high bristly-villous stem. A forest type.

655 8. S. biebersteinii DC. Prodr. X (1846) 165; Ldb. Fl. Ross. III, 170; Boiss. Fl. or. IV, 269; Shmal'g., Fl. II, 222; Kuzn. in Mat. Fl. Kavk. IV, 2, 143; Brand in Pflanzenr. IV, 252, 159.— Cynoglossum stamineum M. B. Fl. taur.-cauc. Suppl. (1819) 127, non Desf. (1807).— Solenanthus dubius Fisch. et Mey. ex Hohensack. in Bull. Soc. Nat. Mosc. XI (1838) 306, nomen.— Exs.: Pl. or. exs. No. 269.

Perennial; root dark, vertical, 2 cm thick or less, 1-headed; stems 30—50 cm high, in fruit to 85 cm high, fistular, longitudinally furrowed, with short overtopping branches in upper part only, paniculate, with sparse, sometimes dense, grayish soft villous hairs; radical leaves green throughout flowering, the more or less large, oblong-oval, delicate blade 3—5(7) cm wide, acute, with soft appressed down on both sides, with distinct pinnate lateral nerves, more or less cuneately (not cordately) tapering to petiole, total length 10—15(25) cm; petiole broad, almost as long as blade; cauline leaves rather numerous, the lower similar to the radical, petioles, oval-oblong, the upper sessile, oblong to lanceolate, rather long, 1.5—2 cm wide, the uppermost at base of bostryces, lanceolate-linear, all leaves with soft appressed down, short-acute. Inflorescence paniculate, densely capitate-spicate, becoming paniculate-racemiform, to loosely paniculate in fruit because of the elongated terminal and lateral scorpioid cymes, scorpioid cymes in flower dense, arcuately drooping, in fruit straightening, loose, to 10—15 cm long, spreading above, in lower part with few small lanceolate-linear leaves; pedicels short, in fruit to 1—1.5 cm, erect, gray-downy or villous; calyx ca. 5 mm long, to 10 mm in fruit, with oblong obtuse downy-villous lobes; corolla hardly exserted from calyx, ca. 6 mm long, tubular to funnel-shaped, dark red (or whitish-red ? according to Boissier), the limb as long as tube, slightly campanulate, cut to half into 1.5 mm long, triangular-oblong teeth; scales in throat large, 1—1.2 mm long, oblong, truncate, hardly 2-lobed; stamens markedly exserted, twice as long as corolla; anthers oblong, ca. 1 mm long; style 8 mm long; nutlets ca. 7 mm long, ovoid, with flat back, with sparse short thick anchorlike spinules, smooth between them, along thickened margin and free part of ventral side with dense short (0.5—1 mm) smooth thick erect anchorlike spinules slightly
656 fusing at base; thickened base of style ca. 5 mm long; cicatrice ovoid, occupying less than half the ventral side, not awned. April—May.

Mountain broadleaved forests, cliffs, rarely floodplain forests of lowland.— European part: Crim. (mountain forests); Caucasus: Cisc. (Kuban), W. Transc. (Abkhazia, Mingrelia, Imeretia, Guria, Adzharia), E. Transc. (Mtskheta). Endemic. (or also in Gilan ?). Described from the Crimea, between Kyzyl-Koba at upper reaches of Salgir River and Kara-Uzen' (Steven, 1818?). Type in Leningrad.

Note. The record from Gilan is not reliable. From there, Solenanthus mollissimus (Lehm.) DC. (Cynoglossum mollissimum Lehm.) from the Pallas collections (Gmelin) in the Berlin herbarium was described; this is scarcely distinguishable from S. biebersteinii DC. In the Leningrad herbarium I saw a fragment of the flowers with the label Symphytum corymbiferum Gilan. I expect that Gmelin's specimen, the type of S. mollissimus DC., is very similar to S. biebersteinii DC.

9. S. brachystemon Fisch. et Mey. in Bull. Soc. Nat. Mosc. XI (1838) 306; DC. Prodr. X, 164; Ldb. Fl. Ross. III, 268; Kuzn. in Mat. Fl. Kavk. IV, 2, 142; Grossg., Fl. Kavk. III, 252. — Lindelofia brachystemon Brand in Pflanzenr. IV, 252 (1921) 84.

Perennial; root dark, vertical, to 2 cm thick or thinner, 1-headed; stem 50—80 cm high, thick, erect, fistular, faceted, with sparse, long, entangled, lamellar hairs, paniculately branching above, with few fertile branches from axils of upper leaves; radical leaves 20—30 cm long, long-petioled, their blade oblong or narrowly elliptic to nearly lanceolate, slightly longer than petiole, 10—20 cm long, 2—4(7) cm wide, gradually tapering to petiole, the slightly grayish appressed down sparse above, dense beneath, thin, with prominent lateral nerves, acute; cauline leaves rather numerous, the lower petioled, similar to the radical, oblong, the upper semi-amplexicaul, oblong-lanceolate or lanceolate, rather long, the uppermost reduced. Inflorescence paniculate, racemiform-paniculate from short and dense, terminal and lateral, few-flowered scorpioid cymes (in fruit probably loosely paniculate owing to elongating cymes), at base with few, reduced, lanceolate leaves; pedicels villous, as long as calyx or shorter; in fruit probably longer, erect; calyx gray, with villous soft hairs, its lobes lanceolate, acute or broadly linear, obtuse, 5—7 mm, later 10—11 mm long; corolla 8—10 mm long, violet (?), tubular to funnel-shaped, the slightly campanulate limb shorter than wide
657 tube, cut to half into obovate, rounded-obtuse teeth tapering to base, i. e., spatulate, 2—3 mm long; scales rounded, 1—1.5 mm long, trapeziform-oblong, in throat, even slightly above middle of corolla, 2-lobed, filaments attached to middle of corolla, slightly below scales, ca. 2 mm long, oblong; anthers hardly protruding from corolla teeth but shorter than filaments; style as long as calyx, extending only to scales. (Nutlets with ascending margin with numerous long thin anchorlike spinules along disk, margin and sides with less dense, shorter spinules — Fischer and Meyer, Ledebour, Kuznetsov.) The source of this description of the nutlets by the authors and repeated by Ledebour and Kuznetsov is not known. Fischer and Meyer wrongly report that the disk bears longer and denser spinules than at the margins and sides. Hohenacker presumably collected the nutlets in the winter of 1833—1834 and sent them to Leningrad (then St. Petersburg) where they were sown. In the Academy herbarium there is a shriveled garden specimen with nutlets aborted (due to lack of pollination). Their disk is smooth and bears a few, long spinules, the margin of the disk and sides of the nutlet are very densely covered with shorter spinules. March—April.

Forests in lowlands and foothills. — Caucasus: Tal. Gen. distr.: Iran. (Gilan). Described from Lenkoran' (Hohenacker, 1833). Type in Leningrad.

Note. In its vegetative characters, and probably also in the nutlets, this species is very similar to S. biebersteinii, but in the structure of the slightly larger corolla there are some differences: short stamens, longer anthers, teeth of different shape, but the scales, too, are very similar to those of S. biebersteinii. The stamens and anthers led Brand to transfer this species to Lindelofia, which he interpreted very loosely by comparison with the older authors and even with Lehmann himself.

Genus 1231. **CYNOGLOSSUM*** L.

L. Sp. pl. (1753) 134, ex parte.

Calyx divided to base, the lobes slightly elongating in fruit and then usually stellately spreading. Corolla funnel-shaped or rotate, brachymorphous, with tube 1—3 mm (in ours rarely to 5 mm long), not exceeding lobes of calyx, the limb concave or flat, its lobes ovate, rounded or semi-rounded. Scales trapeziform, rectangular, rarely oblong, 1—2(3) mm long, protruding, with thickened apex, papilliform, more or less 2-lobed. Stamens included
658 in corolla tube, filaments very short; anthers oblong, obtuse, not protruding from scales; style prismatic-columelliform, short, with disklike-capitate or punctate-capitate, entire stigma, not protruding from corolla tube (or scales). Nutlets 5—8 mm long, dorsoventrally compressed. flattish, ovoid, without marginal wings or rim, usually entire surface with anchorlike spinules, rarely back smooth, either slightly inflated, without ascending margin, gradually converging at side of nutlet and then sides densely covered with spinules, or flat and even concave, set off from sides by thickened margin and then less spinulose than margin or sides or even smooth. Ripe nutlets separating from pyramidal gynophore, areola flat, usually ovoid, apex connate to style; style persistent in fruit, rips from the latter a vertical strip of tissue (awn) as in the fruit of geranium, and the awn remains on the nutlet as a horn attached to the apex of the cicatrice. This character is characteristic for the genus. Biennial or perennial herbs with rather high stems, 40—150 cm high. Tubercles at base of hairs small or absent.

Note. Our interpretation of Cynoglossum is far more restricted than that of other recent authors (Clarke, Gürke, Brand, and others), as Section II, Eleutherostylum Brand, is excluded as are several species included in Cynoglossum, in particular those included by Brand in Section I. Eu-Cynoglossum.

Cynoglossum s.s. as accepted here includes C. dioscoridis Vill., C. columnae Ten., C. cheirifolium L., C. magellense Ten., C. clandestinum Desf., and C. sphacioticum Boiss. It is an ancient Mediterranean genus.

The mainly tropical small-flowered and small-fruited species of Cynoglossum I have separated as Paracynoglossum (type C. denticulatum DC.) — see page 673. Some North American species earlier referred to Cynoglossum, in particular C. virginianum L., C. grande Dougl. and C. occidentale Nutt. should be made into genera. The Australian C. latifolium R. Br. is unquestionably a separate genus, Austrocynoglossum M. Pop.

The species of Cynoglossum are considered poisonous; at least when fresh, they are not eaten by cattle. C. officinale — the most thoroughly studied — contains apparently in the root but not in the foliage the toxic alkaloid cynoglossine, a liquid with effects similar to curare, accounting for 0.12% of the fresh weight of the root. Also there is a glucoside (glucoalkaloid) consolidine which hydrolyzes to consolicin—a nerve poison at a concentration of 0.00054%, and dextrose. Cynoglosseine and bitter cynoglossidine
659 are also reported. These alkaloids seem to be produced also in related

* From the Greek kyon — dog; glossa — tongue, presumably referring to the shape and softness of the leaves.

species of Series Rubra; other specific substances may be expected in Series Flavescentia.

1. Nutlets when ripe with margin slightly elevated above, disk, thickened, and more densely covered with spinules; disk flat or even slightly concave . . . . . 2.
+ Nutlets without thickened margin, their disk inflated, rarely nearly flat, gradually converging at margin; margin densely spinulous . . . . . 6.
2. Corolla red-brown, blue or sky-blue. Hairs soft, rather thick; plant grayish, even tomentose . . . . . 3.
+ Corolla greenish-yellow, without any anthocyanin dyes. Plants glabrous or naked in fruit. (Confined to Centr. Asia) . . . . . 5.
3. Corolla sky-blue, limb flat, as in forget-me-not. Plants to 1 m high, with large leaves; radical leaves with petioles to 60 cm long, the blade oblong, to 40 cm long. Hairs sparse, slightly grayish. Nutlets 6—9 mm long, their disk subglabrous. (Tien Shan) . . . . . 3. C. tianschanicum M. Pop.
+ Corolla violet-red or dingy (brown-) red, rarely nearly blue, with funnel-shaped limb. Hairs more dense, gray or tomentose. Leaves smaller, narrower . . . . . 4.
4. Gray plants. Corolla brown-red (rarely blue). Nutlets smaller, 5—7 mm long . . . . . 8. C. officinale L.
+ Nearly white-tomentose plant, often silvery-sericeous. Corolla violet-red (meat-red). Nutlets larger, 6—7 mm long, with nearly smooth disk. (Alpine belt of Greater Caucasus Range and Adzharia) . . . . . 9. C. holosericeum Stev.
5. Stems 1—1.5 mm high, paniculately branching above, with large panicle of flowers. Radical leaves resembling those of burdock, 70 cm long, to 15 cm wide, all leaves with short and dense down beneath. Pedicels sericeous-downy. (In foothills and mountains of Tien Shan) . . . . . 2. C. viridiflorum Pall.
+ Stems 50—80 cm high, with small narrow apical panicle of flowers. Plants completely glabrous, multicaulescent from thick root. Radical leaves absent, leaves in lower part of stem squamiform . . . . . 1. C. seravschanicum (B. Fedtsch.) M. Pop.
6. Pedicels and especially stipes thin, longer, 3—4 times as long as fruit, arcuately drooping. Flowering racemes leafy in lower part.
660 Plants gray, with appressed fine down. Leaves lanceolate, acute. (from E. Altai to Ussuri) . . . . . 7. C. divaricatum Steph.
+ Pedicels and stipes shorter, almost as long as fruit, drooping. Racemes leafless (plant outside Siberia) . . . . . 7.
7. Corolla larger, 5—7 mm across, sky-blue, with network of dark veins. Plant with fine, nearly sericeous gray hairs. Upper leaves sessile, with cordate base, all leaves lanceolate, short-acuminate . . . . . 4. C. pictum Ait.
+ Corolla slightly smaller, red-violet, rarely blue. Pubescence much sparser, plant green or turning green; a mountain plant, not a weed . . . . . 8.

8. Leaves more compact, greenish, with coarse appressed hairs, above and beneath, cauline leaves lanceolate, cordate-semi-amplexicaul, short-acuminate. (Caucasus) . . . . 5. C. nebrodense Guss.
+ Leaves green, thinly scarious, of shady delicate mesophyllous consistency, glabrous above, with scattered coarse hairs beneath, radical leaves with oblong blade, the cauline sessile, slightly cordate at base, not strongly acuminate . . . . 6. C. montanum L.

The following Key may be used when ripe fruits are not available.

1. Flowers greenish-yellow. Plants glabrous or glabrescent. (Centr. Asia) . . . . . 2.
+ Flowers blue, red-blue or brown-red. Plants hairy, grayish, sometimes tomentose, rarely green . . . . . 3.
2. Radical leaves absent; base of stem with squamiform leaves. Multicaulescent glabrous plant. Stems 50—80 cm high. Panicle small. (Gissar Range) . . . . . 1. C. seravschanicum M. Pop.
+ Radical leaves very large, resembling those of burdock, their blades oblong, to 40 cm long. Leaves with short dense down beneath. Pedicels grayish. Stems 1—1.5 m high. (From Altai to the Pamir area, mainly in Tien Shan) . . . . . 2. C. viridiflorum Pall.
3. Corollas blue . . . . . 4.
+ Corollas red-violet or brown-red . . . . . 5.
4. Corolla blue, the limb flat, as in forget-me-not. Perennials, to 1 m high. Radical leaves oblong, to 60 cm long. Hairs sparse, soft, grayish. (W. Tien Shan, 2,000—2,500 m) . . . . . 3. C. tianschanicum M. Pop.
661
+ Corolla funnel-shaped, blue, with network of dark blue veins. Often annuals, 40—80 cm high, with soft, nearly sericeous down . . . . . 4. C. pictum Ait.
5. White-tomentose perennials of alpine belt of the Caucasus. Stems 50—70 cm high. Leaves lanceolate. Corolla purple to blood-red . . . . . 9. C. holosericeum Stev.
+ Gray or grayish, downy or green, not tomentose plants of the non-alpine belt . . . . . 6.
6. Gray-downy plants. Leaves, especially the upper, rather long-acuminate . . . . . 7.
+ Greenish or green, sparsely pubescent plants. Leaves short-acuminate or obtuse, the upper sessile, with cordate base . . . . . 8.
7. Pedicels thin, very long (3—4 times as long as fruit), arcuately drooping. Corolla violet-red. (South Siberia). 7. C. divaricatum Steph.
+ Stipes not longer than fruit, hamately drooping. Corolla brown-red . . . . . 8. C. officinale L.
8. Plants greenish, with coarse appressed hairs on both sides of leaves. (Caucasus, rarely in mountains) . . . . . 5. C. nebrodense Guss.
+ Plants green. Leaves delicate, thinly scarious, glabrous above, slightly coarse-haired beneath. (Caucasus, sporadically in mountains, Crimea, Podolia). . . . . 6. C. montanum L.

Series 1.* Flavescentia M. Pop. — Corolla yellowish, without anthocyanin. Nutlets with flat disk and elevated margin. Plant becoming glabrescent or glabrous.

1. C. seravschanicum (B. Fedtsch.) M. Pop. in N. A. Dimo, Pochv. i bot. issl. v bass. r. r. Syr-Dar'i i Amu-Dar'i, II (1916) 64. — Trachelanthus seravschanicus B. Fedtsch., Perech. rast. Turk. V, (1913) 65 No. 3127.

Perennial; glabrous plants; root thick, multicipital, producing many fertile stems, its apex covered with bud scales; stems 50—80 cm high, glabrous, whitish or straw yellow, erect, simple; radical leaves absent; lower cauline leaves oblong, semi-amplexicaul, dense, glabrous above, beneath with large sparse tubercles bearing short appressed, soon deciduous, 4—6 cm long bristles, upper leaves subovate, shorter. Inflorescence
662 shortly and narrowly paniculate, nearly racemiform, 10—15 cm long, of 2 terminal and 2—4 lateral few-flowered (2—3), nearly leafless scorpioid cymes; pedicels filiform, glabrous, slightly longer than calyx; calyx 2—3 mm long, its lobes lanceolate, acute, glabrous, scabrous-serrate; corolla greenish-yellow, the tube as long as calyx, the limb nearly flat, 4—5 mm across, cut for $^2/_3$ into rounded glabrous lobes; scales low, broad, 2-lobed, papillate; anthers between scales oblong, 1.2 mm long, inserted below scales; nutlets 6 mm long, ovoid, dorsoventrally compressed, with flat, smooth disk or with spinules scattered on it with distinct margin bearing — like the rounded sides and ventral part — dense short anchorlike spinules; cicatrice large, ovoid, occupying upper $^2/_3$ of ventral part, produced to flat awn detached from style; style 2.5 mm long; gynophore thick-pyramidal, with 4 acute protruding angles. June. (Plate XXXVIII.)

Limestone cliffs in subalpine or upper mountain belt. — Centr. Asia: Pam.-Al. (Gissar Range, upper reaches of Karataga River). Endemic. Described from Shut. Type in Leningrad.

Note. Morphologically, this species is the most remarkable Cynoglossum: it has a yellowish corolla without any anthocyanin, which it shares with C. viridiflorum, and lacks radical leaves. The stems are produced from rosettes borne on the root branches, and are covered with brown scales. Scales are also present in the lower part of the stem. In Cynoglossum this structure, reminiscent of Adonis, group Sessiles (A. vernalis, A. volgensis, A. turkestanicus) is exceptional.

2. C. viridiflorum Pall. ex Lehm. Pl. Asperif. II (1818) 160; Roem. et Schult. Syst. IV, 757; Ldb. Fl. Ross. III, 167; DC. Prodr. X, 148; Lipskii in Tr. Bot. Sada, XXVI, 2, 482; Brand in Pflanzenr. IV, 252, 120; Pavl., Fl. Tsentr. Kazakhst. III, 86. — Ic.: Ldb. Ic. Fl. Ross. II, tab. 106; Lehm. Ic. pl. nov. tab. 42.

Perennial; taproot thick, dark, multicipital; stem erect, to 1—1.5 m high, thick, ribbed, green below, glabrous, with sparse short hairy down above, in upper part with long spreading fertile branches forming a large panicle; radical leaves very large, with petiole to 70 cm long, with broad elliptic

* We do not propose a natural division of the genus, as each species is unique and distinct. Instead, we use artificial groups, referred to as series.

blade 7—15 cm wide, gradually tapering to long petiole, the leaves acute, glabrous above, with short, dense, nearly tomentose, grayish down beneath; cauline leaves ovate-oblong, the median and upper sessile, acute, 25—30 cm
663 long; pubescence as in radical leaves; uppermost leaves reduced lanceolate, narrow. Inflorescence paniculate, of lateral branches and terminal scorpioid cymes, large in flower, ebracteate or with small linear bracts; pedicels with gray sericeous down, the lower exceeding the calyx, to 10 mm long, recurved in fruit; calyx 3 mm long, its lobes oblong, obtuse, downy; corolla yellow-green, its limb concave, 4—5(6) mm across with rounded lobes, the tube ca. 2 mm long, the scales trapeziform, 1.5 mm long, 2-lobed, thickened, anthers as long as scales; style very short, 1 mm long; nutlets 6—7 mm long, ovoid, dorsoventrally compressed, the flat or concave back slightly or considerably spinulose, not keeled, margins thickened-ascending, like ventral side with dense short anchorlike spinules; cicatrice ovoid-oblong, occupying half the ventral side, with strip-like awn detaching from style; gynophore pyramidal, with unevenly hairy ribs. May—June.

Sandy-solonetzic lowlands, riverbeds and banks of rivers and streams, solonetzic soil, mainly in northern deserts, rarely in mountains. — West Siberia: Alt. (S. Altai); Centr. Asia: Dzu.-Tarb., Balkh., Ar.-Kasp. (western border of Turgai and Irgiz areas), T. Sh. (scattered), Pam.-Al. (Alai Range). Gen. distr.: Dzu.-Kash. Described from S. Altai (Shemanaikha and Shul'ba). Type in Berlin (Herb. Willd.).

Note. A striking Tertiary species without close relatives, restricted to the ancient dry land of eastern Tien Shan. It is distinguished by its exceptionally robust growth, very large radical leaves and yellow-green corollas.

Series 2. Coerulescentia M. Pop. — Corolla blue or sky-blue, without admixture of red anthocyanin (sic). Nutlets variable — an artificial series. Plant grayish-downy.

3. C. tianschanicum M. Pop. in Bot. mat. Gerb. Bot. inst. AN SSSR, XIV (1951) 305, cum tab.

Perennial; root thick, to 5 cm across, multicipital; stems 1—3 from each root-branch, high, 80—120 cm, erect, slightly ribbed, simple, yellowing below, slightly downy, with short grayish downy hairs above; radical leaves with petiole to 60 cm long, the blade oblong, soft, 40 cm long, gradually tapering to petiole; lower cauline leaves with shorter petioles, the upper markedly reduced, sessile, oblong, the uppermost lanceolate, short-acuminate, with thick midrib and pinnately protruding sides, with sparse short bristles on tubercles above, more dense below, slightly grayish downy. Inflorescence shortly and narrowly paniculate, 10—20 cm long, of 2 terminal and several
664 short lateral few-flowered scorpioid cymes on thin branches; pedicels with appressed short gray bristles, as long as calyx, to 10mm long in fruit, declined or recurved; calyx appressed-gray-downy, 3—4mm long, with oblong, obtuse lobes; corolla bright blue, 10 mm across, limb flat, lobes ovate-rounded, the grooves between them extending for half the width of the limb; scales blue, 2-lobed, strongly papilliform, adjacent, 1.5—1.3 mm long; nutlets 6—7 mm long, ovoid, dorsoventrally compressed, with very

(665)

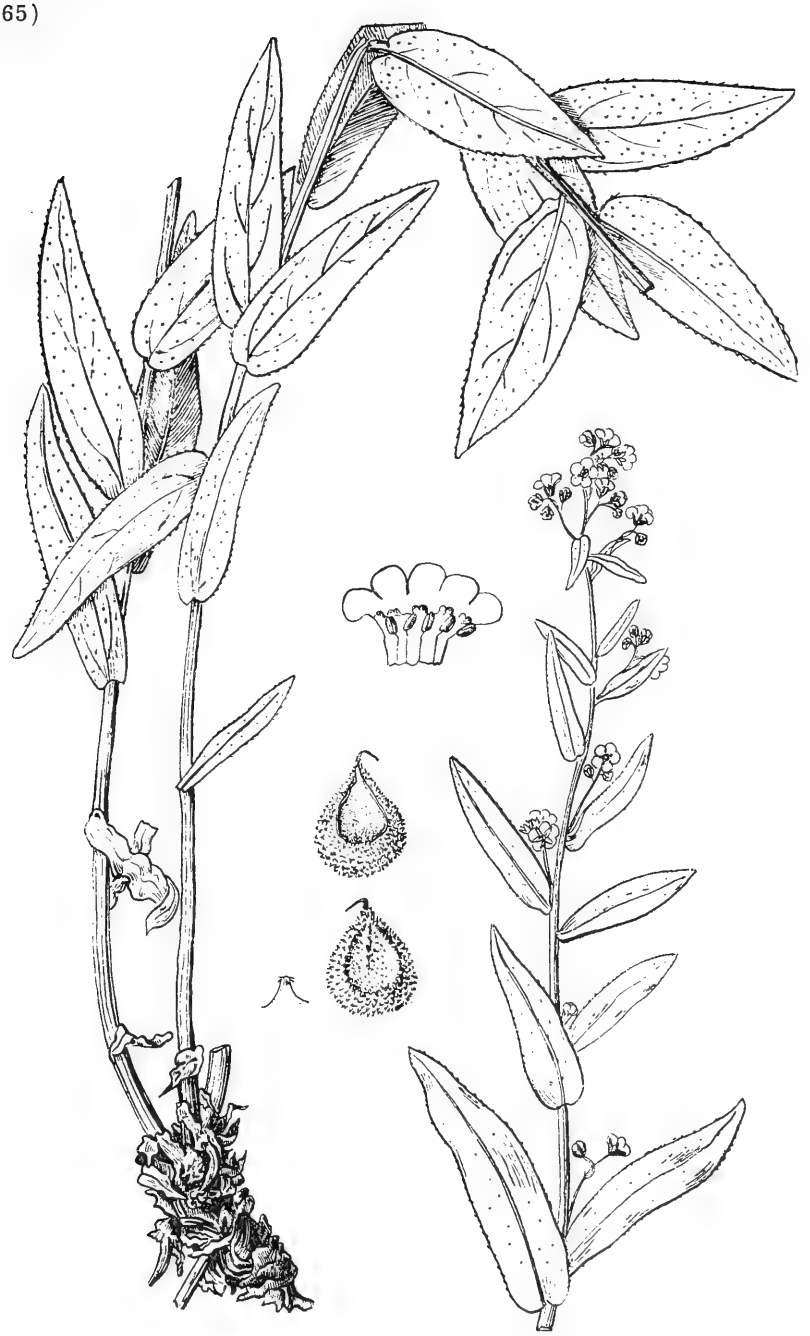

PLATE XXXVIII. Cynoglossum seravschanicum (B. Fedtsch.) M. Pop.

concave dorsal disk, subglabrous, with spinulose keel along back, bearing few short lateral spinules, margin of nutlets strongly ascending covered with short triangular anchorlike spinules, sides and ventral part of nutlet densely covered with short anchor-like spinules; cicatrice apical occupying $^1/_3$ of ventral side. July—August.

Stony mountain slopes, often in stony riverbeds, ravines, between stones. — Centr. Asia: T. Sh. (Talass Ala-Tau: Dzhebogly, Pskem, Chatkal, Sary-Chilek, Uzun-Akhmat). Endemic. Described from ravine of Dzhebogly-Su River near Novo-Nikolaevka (Popov and Abolin, 1921). Type in Tashkent.

Economic importance. A handsome ornamental species recommended for cultivation.

4. C. **pictum** Ait. Hort. Kew. ed. 1, I (1789) 179; Ldb. Fl. Ross. III, 167; Boiss. Fl. or. IV, 265; Shmal'g., Fl. II, 222. — C. creticum Mill. Gard. Dict. ed. 8 (1768) No. 3; Villars, Hist. pl. Dauph. II, 457; Kuzn. in Mat. Fl. Kavk. IV, 2, 134; Brand in Pflanzenr. IV, 252, 129. — Ic.: Bot. Mag. XLVII, tab. 2134; Rchb. Ic. Fl. Germ. XVIII, tab. 130. — Exs.: F. Schultz, Herb. norm. nov. ser. No. 2766.

Biennial or annual; gray soft-downy plant; root thin, vertical; stems usually single with thin longitudinal furrows, erect, simple or with few obliquely ascending fertile branches in upper part; leaves lanceolate, the lower obtuse, gradually tapering to 15 cm long and 1.5 cm wide petiole, the upper antrorse, 5—3 cm long, semi-amplexicaul, acute; all leaves thin, soft, crowded, grayish. Inflorescence loose, of terminal and lateral few-flowered scorpioid cymes, with only 1—2 reduced leaves at base, in fruit erect, slightly elongating, obliquely antrorse; pedicels gray, shorter than calyx or as long, to 10 mm in fruit, usually abruptly hamately recurved below, rarely arcuately drooping; calyx gray-downy or downy-tomentose, 4—6 mm long, its lobes
667 oblong, obtuse, stellately spreading in fruit; corolla blue with dark blue nerves (hence the name: pictum), rather large, its limb funnel-shaped, 5—7 mm across, lobes ovate-rounded, tube short; scales large, rectangular; anthers borne in middle of tube; nutlets ca. 6 mm long, ovoid, dorsally inflated, entire surface evenly covered with short dense anchorlike spinules; cicatrice small, ovoid, occupying $^1/_4$ of the nutlet. April—May.

A weed of waste lands, fields, irrigation ditches, roadsides, etc. — European part: Crim. (southern part); Caucasus: Cisc. (W.), Dag., E. and S. Transc.; Centr. Asia: Mtn. Turkm., Pam.-Al., T. Sh. (W.); rare in oases of southern deserts of Kara-Kum and Kyzyl-Kum. Gen. distr.: Bal.-As. Min., Iran., Med. Described from Madeira Island. Type in London.

Series 3. **Purpurea** M. Pop. — Corolla red-blue (purple), usually changing color in the course of flowering. Nutlets slightly inflated dorsally, nearly flat but without ascending margin, back and sides evenly and densely covered with anchorlike spinules. Leaves green or greenish, with depleted pubescence. — European group.

5. C. **nebrodense** Guss. Fl. sic. prodr. I (1827) 216; Boiss. Fl. or. IV, 265; Kuzn. in Mat. Fl. Kavk. IV, 2, 132. — C. officinale var.

nebrodense Fiori e Paol. Fl. an. ital. (1902) 379.— "C. montanum L." sec. Brand in Pflanzenr. IV, 252, 126 et C. nebrodense Guss. sec. Brand, l.c. 128.— C. parvifolium C. Koch in Linnaea, XXII (1849) 645.— C. dioscoridis Ldb. Fl. Ross. III, 166, non Vill.— Ic.: Fiori e Paol. Ic. Fl. Ital. tab. 2819; Rchb. Ic. Fl. Germ. XVIII, tab. 131.

Biennial or annual; root thin, vertical; stems 40—60 cm high, often single, erect, rather thin, with sparse spreading villous hairs, appressed-downy above, only in the upper part with spreading-branching fertile branches; leaves lanceolate, greenish, both surfaces with very sparse semi-appressed bristly hairs on small white tubercles, margins slightly ciliate, radical leaves soon dying, the lower cauline leaves gradually tapering to petiole, median and upper cauline leaves sessile, with broadened sometimes even subcordate base, short-acuminate, soft, the cauline leaves 3—7 (10) cm long, 1—2 cm wide or slightly narrower. Inflorescence of few scorpioid cymes which soon straighten and elongate to 15 cm in fruit, 1—2 leaflets confined to their base; pedicels appressed-downy, shorter than calyx, slightly elongating in fruit, remaining shorter than fruit, arcuately bending downward, calyx 3—4 mm long, its lobes oblong, obtuse, in fruit to 10 mm long, stellately spreading; corolla small, violet or red-violet, without distinct
668 nerves, 4—6 mm across, tube short, 2—3 mm long, limb slightly funnel-shaped with short obtuse lobes; scales trapeziform, 2-lobed, ca. 1.5 mm long; nutlets 5—6 mm long, ovoid, dorsoventrally compressed, with slightly inflated or nearly flat back but margin not ascending, entire surface evenly and densely covered with medium-sized anchorlike spinules; cicatrice ovoid, occupying $^1/_4$—$^1/_3$ of ventral side. May—June.

Mountain slopes in oak and hornbeam forests, stony soil (predominantly the large luxuriant f. luxurians M. Pop.).— Caucasus: Cisc. (W.), Dag., S. Transc. (Armenia). Gen. distr.: Iran. (NW), Bal.-As. Min., Med. (to Spain and North Africa?). Described from Sicily. Type in Italy.

Note. The plant here described grows in Asia Minor, Syria and (rarely) in the Caucasus, described by Boissier and later, with doubt by Kuznetsov. Brand named it C. montanum L. ssp. extraeuropaeum var. asiaticum Brand, distinguished from the Sicilian-Spanish C. nebrodense only by the shorter scales ("fornices sinum loborum corollae haud superantes"). I believe C. montanum L. to be identical with C. montanum Lam. (C. germanicum Jacq.) (see next species), and that Brand may have been led astray by misunderstanding the letter from Lakaita. The Caucasian-Asia Minor plant described from Sicily may be C. nebrodense Guss.; though the latter appears to be smaller and has smaller and narrower leaves, I see no substantial differences between them. I therefore follow the example of Boissier, who separated the Asia Minor plant as C. lycium Boiss. mss. (C. Koch described it as C. parvifolium C. Koch). Our species can be confused with C. pictum because of its fruits, but differs from it in the violet-red, smaller corolla — without a network of dark protruding nerves — in the absence of flowers, the spreading, villous, glabrescent stem and greenish, subglabrous leaves sparingly pubescent at fruiting, and sometimes by the recurved pedicels.

6. **C. montanum** L. Amoen. Acad. III (1756) 402 in nota; Lam. Fl. Fr. II, 277 et Dict. bot. (Enc. meth.) II (1786 or 1790) 237; Ldb. Fl. Ross. III,

166; Boiss. Fl. or. IV, 264. — C. germanicum Jacq. Obs. bot. II (1767) 31; Shmal'g., Fl. II, 222; Kuzn. in Mat. Fl. Kavk. IV, 2, 130; Rouy, Fl. Fr. X, 339; Brand in Pflanzenr. IV, 252, 124. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 132; Jav. Ic. Hung. Fig. 2784. — Exs.: Fl. Cechoslov. exs. No. 287.

Biennial; root oblique, strongly branching below, usually bearing 1 stem with remnants of dead radical leaves; stem 50—70 cm high, erect, thickish, yellowish, with elevated longitudinal lines and loose semi-spreading hairs,
669 not gray, simple, but with thin elongate spreading branches in apical inflorescence; radical leaves dying at flowering, apparently not large, ca. 10 cm long, elliptic-oblong, ca. 2 cm wide, acute, gradually tapering to long petiole, cauline leaves not very numerous, oblong or oblong-lanceolate, short-acuminate, the lower tapering to petiole, the upper and median sessile, all leaves delicate, thinly scarious, glabrous above, with small tubercles, shiny, slightly and short-haired beneath. Inflorescence loose, its lateral branches strongly removed, terminated by short few-flowered scorpioid cymes and 1—2 longer terminal cymes; bostryces or their branches with 2—3 leaflets confined to lower part; pedicels downy, very short, even in fruit shorter than the elongate calyx, drooping; calyx with sparse, appressed down, 3—5 mm long, its lobes oblong, obtuse, in fruit elongating more than in the other species; corolla red-violet, ca. 4—5 mm across, its tube ca. 1 mm long, limb concave, lobes rounded-ovate; scales 1 mm long, oblong, 2-lobed, papillate; anthers below scales, attached to middle of tube, ca. 0.75 mm long, linear-oblong; nutlets ca. 5 mm long, dorsoventrally compressed, ovoid, the nearly flat or slightly inflated back, entire surface evenly covered with short dense anchorlike spinules; style short; cicatrice small, ovoid. June.

Forests on mountain slopes, stony soil. — European part: U. Dns., M. Dnp. (very rarely), Crim. (frequent in mountainous part); Caucasus: Cisc. (west, in mountains), Dag. (?), W. Transc. (Chkhalta valley in Abkhazia, according to Kolakovskii), S. Transc. (?), Tal. (often). Gen. distr.: Centr. Eur., Bal.-As. Min., Iran. (Gilan), Med. (rarely, in mountians, for example, Italy, Spain). Described from Italy ('in montibus Aequicolorum', leg. Columna). According to Lakaita, the type in the Linnaeus herbarium is missing.

Note. Linnaeus and Lamarck — who did not know of Linnaeus' work — certainly had in mind one and the same plant, and incidentally called it by the same name — montanum, as both cite the description and the drawing of Columna (Colonna) (Minus Cognitarum rariorumque nostro Coelo. . . pars 1 (1616) Romae, 176, tab. p. 175), who calls our plant "Cynoglossa media altera virente folio, rubro fiore, montanum, frigidarum regionum". His drawing of the plant is poor. The reference to p. 170 should be p. 176. Brand referred Columna's plant to what we call our C. nebrodense (see preceding species), on the authority of Lakaita's letter according to which only one species of Cynoglossum grows in the Acqui Mountains,
670 without saying which one. Brand thought this was C. nebrodense and concluded that C. germanicum (our C. montanum) does not occur in the south of Italy whereas according to Fiori and Paoletti it grows throughout the area. I believe that it probably does grow there. In general, this species is typically Middle European, extending east to the Carpathians

and penetrating Podolia, and via the Balkans and Asia Minor to the Crimea and the Caucasus (however, in all these localities it is becoming extinct).

Series 4. **Rubra** M. Pop. — Corolla red or dingy (brown-) red, rarely violet or blue-red. Hairs rather dense, gray or even tomentose-white. Leaves acute, lanceolate. Fruit variable.

7. C. divaricatum Steph. in Lehm. Pl. Asperif. II (1818) 161; Roem. et Schult. Syst. IV (1819) 758; DC. Prodr. X, 154; Kryl., Fl. Zap. Sib. IX, 2235; Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 884. — C. officinale Ldb. Fl. Ross. III, 165, p.p. — Ic.: Lehm. Ic. pl. nov. (1821) tab. 15.

Biennial; root vertical, long, thin, red-brown; plant covered with rather dense, gray, thin nearly sericeous hairs; stems cylindrical, hollow, slightly ribbed, with appressed hairs, in upper part with long divaricate, often repeatedly branching fertile branches to 30 cm long (hence: divaricatum); leaves lanceolate, the radical sometimes oblong-lanceolate, long-tapering to petiole, to 15 cm long, 1.5(2) cm wide, cauline leaves petioled, gradually shortening upward, even the uppermost distinctly tapering to very short petiole, lanceolate, acute, with moderately dense gray down. Inflorescence pyramidal-paniculate, loose, broad owing to many long lateral branches, branches and terminal scorpioid cymes with very remote flowers and 3—4 small, lanceolate or linear-lanceolate leaves per cyme, pedicels long, thin, 2—5 times as long as calyx, in fruit to 2.5—3 cm and hollow, arcuately curved, drooping, sometimes nearly erect, gray-downy; calyx densely sericeous-tomentose, 3—5 mm long, the ovate lobes not strongly elongating in fruit; corolla 4—5 mm across, violet, tube ca. 1 mm long, limb concave, with ovate-rounded lobes; scales dark, less than 1 mm long, oblong, slightly emarginate, anthers in middle of corolla tube, ca. 0.5 mm long, ovoid; nutlets slightly compressed dorsoventrally, nearly rounded-ovoid, with inflated back, with even dense short anchorlike spinules. June—July.

Roadsides, loess ravines, near streams. — West Siberia: Alt. (E.); East Siberia: Ang.-Say., Dau.; Far East: Ze.-Bu., Uss. ("introduced from Transbaikalia," rare). Gen. distr.: Mong., Ch. (N.), Jap. Described from Siberia (Stephan). Type in Germany?

671 Note. This species rarely shows affinity with C. officinale in the shape and pubescence of the leaves, but sharply differs from it not only by the presence of bracts in the cymes, emphasized by the authors, but by the larger pyramidal-paniculate inflorescence, smaller violet corollas, and mainly by the fruit with inflated back without thickened (ascending) margin, and the long fruiting pedicles, the longest in the genus. Probably a Tertiary (Pliocene) species of Mongolia and Dauria with xerophilous root (cp. Stenosolenium).

8. C. officinal L. Sp. pl. (1753) 134; Ldb. Fl. Ross. III, 165. (excl. syn. C. divaricatum Steph); Shmal'g., Fl. II, 222; Kuzn. in Mat. Fl. Kavk. IV, 2, 122; Brand in Pflanzenr. IV, 252, 116. — Ic.: Rchb. Ic. Fl. Germ. XVIII, tab. 129. — Exs.: Fl. Pol. exs. No. 975.

Biennial; taproot usually vertical, dark, rapidly tapering below, with thickened apex, often with remnants of leaves; stem 40—80 (100) cm high, 1 (rarely 2—3) usually erect, furrowed, robust, usually paniculately branching with obliquely ascending branches only in upper part, with sparse grayish soft spreading hairs below, appressed above; radical leaves not persistent at flowering, oblong-lanceolate, acute, gradually tapering to petiole, with the latter 15—20 cm long, to 2(5) cm wide; cauline leaves dense, 2—4 times as long as internode, soft, lanceolate, acute, the lowermost tapering to petiole, the median and upper sessile, all leaves with soft white appressed hairs, gray, 1-nerved, nearly tomentose beneath. Inflorescence paniculate, of 2 terminal and several lateral scorpioid cymes on branches, leaves in cymes few, cymes generally leafless, dense at first, later straightening and elongating; pedicels tomentose, longer than calyx, in fruit to 15 cm, arcuately drooping but not sharply recurved; calyx ca. 3—5 mm long, gray-lanate, its lobes oblong, obtuse, slightly elongating in fruit; corolla funnel-shaped, dingy dark red, sometimes nearly red-blue, rarely white, tube 2—3 mm long, limb 5—7 mm in diameter, concave, with ovate-rounded lobes; scales oblong-rectangular, slightly 2-lobed and papillate, 1—1.25 mm long; anthers oblong, ca. 1 mm long, not exserted (scales protruding from throat), attached in the throat, between bases of scales; filaments very short; nutlets 5—7 mm long, strongly dorsoventrally compressed, ovoid, dorsal disk smooth, without or with slightly defined keel, with more sparse spinules, nearly flat, its
672 margin elevated, thickened, like rounded sides and ventral side densely covered with anchorlike spinules of nearly equal length. May—June.

Weed of roadsides, fields, deserts, ravines or river and stream gravels, etc.— European part: everywhere (north to 65° N., south to the Crimea); Caucasus: everywhere; West Siberia: U. Tob., Alt.; East Siberia: Ang.-Sau. (to Baikal); Centr. Asia: Dzu.-Tarb., T. Sh. (Trans-Ili Ala-Tau to Dzhelanash in the west). Gen. distr.: Centr. Eur., Bal.-As. Min. Described from Europe. Type in London.

Note. In spite of its immense area this species varies but very little. There is var. bicolor Lehm., with white corollas and red scales, and var. purpurascens M. Pop., with violet flowers, sometimes almost blue (probably the result of crossing with C. pictum, between 46 and 48° N.). With respect to the fruits there is var. areolatum (Boiss.) Kusn. (in Mat. Fl. Kavk. IV, 2 (1913) 129.— C. nebrodense var. areolatum Boiss. Fl. or. IV (1879) 265): disk of nutlets glabrous, without or nearly without spinules, spinules broadening and fusing at bases along more distinct margin of disk. Eastern part of Gissar Range, in the Caucasus. Described from S. Dagestan, source of the Samur, south of Shoralo, flowers, fruit, 14—15 VII 1860, Ruprecht.

9. C. holosericeum Stev. in Mém. Soc. Nat. Mosc. III (1812) 255; DC. Prodr. X, 147; Ldb. Fl. Ross. III, 166; Boiss. Fl. or. IV, 264; Kuzn. in Mat. Fl. Kavk. IV, 2, 130; Brand in Pflanzenr. IV, 252, 125.

Perennial or biennial (?); plant loosely and broadly cespitose; root rather thick, dark, short, usually multicipital, often with numerous rosettes and 1—3 flowering stems; stems 40—60 cm high, gray-tomentose, erect, thickish, robust, nearly simple above, only at apex sometimes with 1—2 branches and 1—2 short scorpioid cymes, radical leaves numerous, lanceolate,

to 20—25 cm long, to 2—2.5 cm wide, acute, tapering to long petiole, with rather dense appressed white tomentose hairs, slightly sericeous; cauline leaves antrorse, all but the lowest sessile, lanceolate, slightly amplexicaul, 3—10 cm long, the uppermost sometimes oblong-lanceolate, short, all sericeous-white-tomentose. Scorpioid cymes small form capitate inflorescence, few-flowered, in fruit straightening, loose but not exceeding 5—7 cm, the few lateral ones even shorter, all leafless; inflorescence in fruit short-paniculate to corymbiform; calyx 3—4 mm long, densely tomentose, with acute oblong lobes, corolla ca. 7—8 mm across, violet-red or meat-red, tube ca. 2 mm long, limb funnel-shaped with ovate-rounded lobes;
673 scales 2 mm long, rather narrow and high, nearly rectangular, with thickened apex, hardly 2-lobed, papillate, anthers oblong, 2 mm long, apices like those of scales, filaments short; style 3 mm long; nutlets 6—7 mm long, strongly compressed dorsoventrally, ovoid, the large broad flat disk covered with numerous anchorlike spinules, without any keel, but rimmed by narrow elevated margin, the narrow sides and ventral part densely covered with short anchorlike spinules strongly broadening and fusing at base; cicatrice very small, occupying $\frac{1}{4}$—$\frac{1}{5}$ of ventral part. June-July. (Plate XXXIX, Figure 2.)

Stony slopes in alpine belt.— Caucasus: eastern part of Greater Caucasus (Kuba area, Dagestan)— distribution area apparently disjunct, with main part in Adzharia. Gen. distr.: Amr.-Kurd. (Kars Region). Described from eastern part of Greater Caucasus, between Khingal and Vanda. Type in Helsinki.

Note. According to Kuznetsov (op. cit.) this is an "alpine derivative from C. officinale". But this is highly improbable, as in the Caucasus C. officinale is a weed whereas the recently introduced C. holosericeum probably is a Tertiary relict close to the Apennine C. magellense Ten., which is as white-tomentose as our species.

Genus 1232. **PARACYNOGLOSSUM*** M. Pop.

in Addenda XVIII, 627.— Cynoglossum DC., Clarke, Brand et alii, ex parte.

Close to Cynoglossum, but flowers smaller, 3—4 mm across, blue or white, nutlets small, 2.5—3.5(4) mm long, also dorsoventrally compressed but apex not joined to style and no strip of tissue-awn detaching from style at full maturity. Plant thin, well developed, mostly an annual, sometimes a biennial, mainly of the paleotropical region. Probably about 10—15 species.

Note. Lehmann (1818) in first proposing a natural system of the Boraginaceae included 3 species of this genus in Echinospermum (E. zeylanicum, E. borbonicum and E. javanicum). Inasmuch as he also cited their synonyms (Cynoglossum zeylanicum Thunb. and C. javanicum Thunb.) he knowingly removed them from Cynoglossum. Later English authors studying the flora of India — Roxburg, David Don and George Don, Bentham and others — tended to include them in Cynoglossum. Its definitive acceptance came with A. De Candolle in Vol. X of Prodroma, followed by Bentham and Hooker, Clarke, Gürke, Brand and

* From the Greek para — next to, close; and Cynoglossum.

Johnston, all of whom interpreted Cynoglossum very broadly and
674 inappropriately, placing into it Paracynoglossum and at least four other good genera. I have included in this the latter genus three of our species, and the three species mentioned above, some of the Indo-Himalayan species like C. furcatum Wall., C. glochidiatum Wall. (whose synonymy at this time is difficult to analyze), the African C. lanceolatum Forsk. and two to three Australian species (C. australe R. Br., C. suaveolens R. Br.).

1. Nutlets ca. 3 mm long, marginal spinules of dorsal areola broadening and fusing at base, nearly horizontally declined with tubercles between the spinules. Leaves smaller (2—4 cm long), tapering to base; stems thinner, lower, spreading-bristly below; corollas blue. (Mountains southwest of Pamir) . . . . . 1. P. denticulatum (DC.) M. Pop.

\+ Nutlets slightly larger, 3.5—4 mm long, with marginal spinules of dorsal disk, erect, very slightly broadening not fusing at base, dorsal disk between spinules smooth. Leaves larger . . . . . 2.

2. Plant with appressed gray down, even base of stem without spreading bristles. Leaves lanceolate, dense, with protruding lateral nerves, the upper sessile, the median 4—6 cm long, 1—1.5 cm wide. Spinules of nutlets short, firm. Corollas blue. (W. Transc.) . . . . . 2. P. imeretinum (Kusn.) M. Pop.

\+ Stems ca. 1 m high, spreading and sparsely bristly-villous. Leaves delicate, large, the median ca. 10 cm long, all leaves sparingly pubescent tapering to base, with slightly protruding lateral nerves. Spinules of nutlets longer. Corollas white? (S. Kuriles) . . . . . 3. P. asperrimum (Nakai) M. Pop.

1. P. denticulatum (DC.) M. Pop. comb. n. — Cynoglossum denticulatum DC. Prodr. X (1846) 150; C. B. Clarke in Fl. Brit. Ind. IV, 157; Lipskii in Tr. Bot. Sada, XXVI, 2, 480; Zakir., Burachn. Zeravsh. 12 — C. glochidiatum Brand in Pflanzenr. IV, 252, 133, ex parte, vix Wall. — Ic.: Bot. Reg. tab. 1839 (under the name C. glochidiatum Benth vix Wall.).

Annual; root thin, vertical; stems 20—40 cm high, 1 to 5 per root, ascending or erect at base, angular, in upper half, sometimes in lower, with thin long declined branches, with more or less spreading bristly hairs, bristles sparse (and then plant more mesophyllous) or dense (and then the stems and entire plant grayish, more xerophyllous), with short appressed bristles above; radical leaves early drying up, the cauline oblong to oblong-lanceolate,
675 2—4 cm long in large individuals sometimes larger, the lower to 5—7 cm long, acute, gradually tapering to more or less long petiole, the upper subsessile, distinctly tapering, the uppermost reduced, lanceolate, in lower part of branches; leaves delicate, green, with remote bristly hairs (on sizable tubercles above) or grayish, smaller, acute (in the xerophyllous form, growing mainly in Gornoi Badakhshan). Scorpioid cymes dense, short, soon strongly elongating, in fruit erect, elongate, obliquely antrorse, with remote fruits, leafless; pedicels short, much shorter than fruit, recurved, in the xerophyllous forms slightly longer but shorter than fruit, covered with small

appressed bristles; calyx 1—1.5 mm long, in fruit oblong-lanceolate lobes little elongating (to 2—3 mm), appressed-downy; corolla blue, small, the tube as long as calyx, the limb slightly concave, ca. 4 mm across, with ovate-rounded lobes; scales broad, large, nearly square, distinctly 2-lobed and papilliform, exserted; anthers enclosed, 0.5 mm long; nutlets small, 3—3.5 mm long, dorsoventrally compressed, ovoid-oblong, with flattish disk, non-ascending margin rimmed with 1, rarely 2 rows of longer, horizontally recurved, anchorlike spinules, broadening but not strongly fused at base, markedly anchorlike-spinulose on disk, with 3—5 rows of anchorlike spines, tuberculate between them, sides and ventral part with dense shortly anchorlike spinules. May—June.

Stony slopes, sometimes ravines and even shady gardens in mountain settlements. — Centr. Asia: Pam.-Al. (confined to western part, from upper Zeravshan south to Pyandzh). Gen. distr.: Iran. (Hindu Kush) and Himalayas (W.). Described from the banks of the Indus River in the W. Himalayas. Type in Geneva.

Note. In the Himalayas and India there grow about 10 species of this genus, with characters and synonymy so confused (by Bentham, De Candolle, Clarke, Brand) that only a study of English and Indian herbaria will bring this group into some semblance of order. This task was impossible to accomplish in Leningrad, since only little material and no types were available. In his catalogue of 1828, Wallich (MS) mentioned 9 species of which 7 were new and 2 old (canescens and lanceolatum). The new species were described by Roxburg (1824), Don (1837), Bentham (1839), but beginning with Bentham, interpretations were so careless that they are today incomprehensible. Brand combined C. denticulatum DC. (1846) with C. glochidiatum Wall. (1828, 1839) though Clarke had distinguished them — presumably without basis. According to Clarke, C. glochidiatum was described from Assam. (I could not make out the name of the locality which was
676 illegible in Wallich's catalogue.) Bentham partly followed by Clarke extended the species — unjustifiably, as I believe — confusing C. glochidiatum with C. denticulatum. C. denticulatum was described from the western part of the Himalayas, closer to the USSR. However, in all the Himalayan specimens seen by me the disk of the nutlets between the numerous spinules was smooth. Our specimens have abundant tubercles between the generally very numerous spinules. This might support our view that in the Himalayas there are no forms identical with ours. I did not see De Candolle's type and in identifying it with our plant I was simply following the example of Lipskii and Zakirov. In any event our plant appears to be close to C. denticulatum DC. I do not believe that the two forms mentioned in the diagnosis can be considered as species, even though the gray, xerophyllous form of the Himalayas is very similar to C. canescens Wall. (an W.?)=? C. racemosum Roxb., as there are transitions between the two forms.

2. P. imeretinum (Kusn.) M. Pop. comb. n. — Cynoglossum imeretinum Kusn. in Mat. Fl. Kavk. IV, 2 (1913) 138; Brand in Pflanzenr. IV, 252, 147; Grossg., Fl. Kavk. III, 250. — Ic.: Kolakovsk., Fl. Abkh. IV, table II. — Exs.: Pl. or. exs. No. 239.

PLATE XXXIX. 1 — Paracynoglossum imeretinum (Kusn.) M. Pop.; 2 — Cynoglossum holosericeum Stev.

Biennial, annual; root not thick, usually producing 1 stem, stem 30—50 cm high, erect, angular, firm, strongly branching above with remote or even squamose branches, gray, with short appressed down, leaves oblong, oblong-lanceolate or lanceolate, the lower broader, gradually tapering to petiole, the upper sessile, the uppermost slightly amplexicaul, all leaves gray, with short dense down, of a dense consistency, with prominent lateral nerves, 3—10 cm long, the middle leaves 4—6 cm long, 1—1.5 cm wide. Young scorpioid cymes dense, curved, later rapidly elongating. Inflorescence becoming paniculate; in fruit cymes erect with remote fruit, obliquely spreading above, rarely nearly horizontal, to 10—15(20) cm long, firm, branches and pedicels with appressed gray down; pedicels and stipes short, the latter shorter than fruit, arcuately curved; calyx in flower 1—1.5 mm long, with appressed gray down, the oblong lobes slightly elongating in fruit (2—3 mm); corolla blue, its tube shorter than calyx, the limb nearly flat, 3—4 mm across, with rounded lobes; scales small (not high), transversely rectangular papilliform, slightly protruding from throat; anthers ca. 0.5 mm long;
679 nutlets 3—3.5 mm long, ovoid, with flattish disk, their margin (rim) bearing a row of short vertical large strong spinules nearly not fusing, the disk with dense short anchorlike spinules, more dense along sides and ventral part, without tubercles between spinules; cicatrice ovoid, occupying half the ventral side. July. (Plate XXXIX, Figure 1).

Thinned out forests, glades. — Caucasus: W. Transc. (Imeretia, Guria, Adzharia). Endemic. Described from near Kutaisi (Medvedev, 1866). Type in Leningrad and Tbilisi.

Note. Kuznetsov was nearly right when stating that "this species . . . is very close to the Indian C. micranthum Desf., from which it is distinguished by insignificant characters." It seems to me that it is closer to C. furcatum Wall. described from Nepal, which appears to differ from the more xerophyllous C. micranthum as well as from the tropical C. zeylanicum Thunb. P. furcatum (Wall.) M. Pop. is widespread in subtropical East Asia, China and Japan, from where it may have been introduced into the western part of Transcaucasia. I see no hard and fast differences between P. furcatum and P. imeretinum; if imeretinum is retained it is only because I did not see the type of C. furcatum and because the classification of Paracynoglossum is so extremely confused.

3. P. asperrimum (Nakai) M. Pop. comb. n. — Cynoglossum asperrimum Nakai in Bot. Mag. Tokyo, XXXVII (1923) 6 and 4 (in clave). — C. furcatum Maxim. in Mel. Biol. VIII (1872) 554, p.p. non Wall.

Biennial, annual; stem usually ca. 100 cm high, erect, nearly rounded, slightly angled, strongly declined and long-branching in upper part, sparsely spreading bristly-villous; leaves not crowded on stem, thin-scarious and large, to 15 cm long, 4.5 cm wide, mesophyllous, oblong or oblong-lanceolate, long-acuminate, the lower tapering very gradually to more or less long petiole, the upper subsessile, tapering to base, even the uppermost reduced, leaves lanceolate, all greenish with scattered semi-appressed short bristles, on large white tubercles above; lateral nerves faintly protruding, thin, but distinct. Inflorescence of few-flowered scorpioid cymes terminating stem and on lateral branches, later elongating and straightening, in fruit

loosely paniculate, 10—15 cm in length, obliquely upright, leafless; pedicels thin, slightly longer than calyx, in fruit distinct but shorter than fruit or to 5 mm long, arcuately curved, downy; calyx small, 2 mm, its lobes downy,
680 lanceolate, in fruit 3—4 mm long; corolla small (white?), ca. 3—4 mm across, the tube shorter than calyx with ovate-rounded lobes; nutlets 4 mm long, dorsoventrally compressed, ovoid-oblong, ventral face and sides with dense flat back with sparse long anchorlike spinules, margin faintly defined, smooth along back between spinules; cicatrice ovoid, small, occupying not more than $^1/_4$ of the ventral side. July.

Apparently in weedy localities, woods, light forests and sea coasts. — Far East: S. Kuriles (Jap. Journ. of Bot. II, No. 4; 1925, Tokyo). Gen. distr.: particularly Japan — Hokkaido, Honshu, Shikoku and Kyushu; Korea. Described from the localities indicated. Type in Tokyo.

Note. This is another local race of the widespread, subtropical Asian Paracynoglossum furcatum (Wall.) M. Pop., differing from the preceding by the spreading, villous bristles of the stem, the very sparingly pubescent, large, green, delicate leaves, the longer spinules on the fruit, and probably by longer stipes, and color of corolla. In addition to the typical form, Nakai also recognizes var. yezoense Nakai, which is even more bristly-villous. This is distributed in Ishikari (Hokkaido), and also seems to grow in the S. Kuriles (probably Shikotan and Kunashir islands).

Tribe 13. TRICHODESMEAE Zak. Burachn. Zeravsh. (1941) r, 5 — Tribe Cynoglosseae Brand (1921) ex p. — Calyx markedly accrescent in fruit, patelliform or broadly cup-shaped, 3—5 cm in diameter, its cupular base broadening to a cup with lobes forming angles on this cupular base: rounded (Suchtelenia) or triangular-acute (Trichodesma, Caccinia).

In some species of Trichodesma, e.g., T. indicum R. Br. and in Suchtelenia the gynobase and the manner of attachment of the nutlets to it are of the Heterocaryum type (see Tribe 10. Heterocaryeae). In our Trichodesma and also in Caccinia it is of the Cynoglossum type. The flowers are brachymorphic (Trichodesma) or dolichomorphic (Caccinia); in Suchtelenia they are brachymorphic, of the Cynoglossum type. The lower leaves are opposite (Trichodesma, Suchtelenia) or all leaves (?) are alternate (Caccinia). Perennial herbs (Trichodesma, Caccinia) or ephemers (Suchtelenia).

Genus 1233. **SUCHTELENIA*** Kar.

Kar. in Bull. Soc. Nat. Mosc. XIV (1841) 16, tab. 2.

681 Calyx 5-cleft for $^1/_2$ to $^3/_4$, 2—3 mm long, with broad lobes, in fruit strongly accrescent, plano-calyciform or patelliform, 10—15 mm across, more or less membranous; corolla small, blue, 3—5 mm across, funnel-shaped, with scales in throat; filaments very short; anthers hidden in tube of corolla;

* Named after Suchtelen, military governor of Orenburg, a member of the Karelin expeditions.

style short, 0.5 mm long; stigma small, capitate. Gynobase large, ovoid, with 4 vertical crestlike protuberances alternating with nutlets; when ripe nutlets 4 or 1—2, ovoid, rounded at back, often finely spinulose, ventral side flat, smooth, 1—2 nutlets larger, persistent and become horizontal, the rest undeveloped, attached between crests and easily detached from concavities of gynobase whose central part is destroyed giving the impression of a frame with ovoid cotyledons and short nearly straight radicle. Annual herbs, the fleshy oblong leaves with sparse large white tubercles, usually without bristles, except those on pedicels. Scorpioid cymes terminal, 2—3, with very small bracts, loose, straight in fruit.

Note. This genus is close to Heterocaryum (Tribe Heterocaryeae Zak.). In the character of the gynobase with 4 vertical crests resembling septa and the small, funnel-shaped corolla, in the accrescent, patelliform calyx and nutlets it is closer to Caccinia and Trichodesma. Usually referred to Tribe Cynoglosseae DC.

1. S. calycina (C. A. M.) DC. Prodr. X (1846) 163; Ldb. El. Ross. III, 169; Boiss. Fl. or. IV, 276; N. Pop. in Mat. Fl. Kavk. IV, 2, 101.— Cynoglossum calycinum C. A. M. Verz. Pfl. Cauc. (1831) 100.— Suchtelenia acanthocarpa Kar. in Bull. Soc. Nat. Mosc. XIV (1841) 16.— S. uniserialis Ldb. Fl. Ross. III (1849) 169.— Ic.: Kar. l. c. tab. 2.— Exs.: Herb. Fl. Cauc. No. 285; Pl. or. exs. No. 372.

Annual; stem 10—20 cm high, erect, glabrous, with long opposite spreading branches from base; lowermost leaves opposite, oblong, lower leaves tapering to base, slightly spatulate, the upper alternate sessile, 1—4 cm long, 7—20 mm wide, obtuse, flat, glabrous, white-tuberculate (rather more densely above, very sparsely beneath) tubercles at margin of leaves with short firm bristles, absent from leaf surface. Scorpioid cymes terminal, 2—3, 1—2 at tips of branches, few-flowered, rapidly elongating and then nearly straight; pedicels thin, drooping, hardly as long as calyx, short-bristly or smooth; calyx broadly obconical, its lobes ovate-rounded, obtuse,
682 glabrous, with slightly scabrous margin; corolla blue, small, nearly as long as calyx; anthers 0.5 mm long; fruiting calyx patelliform, 10—15 mm across; nutlets smooth or densely anchorlike-spinulose along back, the abscising ones oblong, 4 mm long, 1.5—2 mm wide, the persistent ones ovoid, 5 mm long, 3—4 mm wide, strongly declined to bottom of calyx. March—April. (Plate XL, Figure 1.)

Stony or clayey, slightly solonetzic deserts. — Caucasus: E. Transc. (low hills along lower Kura River); Centr. Asia: Mtn. Turkm. (westernmost part: Chandyr', Atrek), Kara K., Kyz. K., Ar.-Kasp. (north to Temir, east to Sary-Su River). Endemic. Described from E. Transc. (Karavan-sarai, Kete-Keli, 18 IV 1890, Meyer). Type in Leningrad.

Note. This species, endemic mainly in the Caspian area, may be separated into 2 races — Transcaucasian and Central Asian:

1. Nutlets densely covered along back with anchorlike scabrous spinules (rarely smooth), edenticulate when detached. Calyx broader, more membranous, with distinct network of nerves. Corolla slightly larger and longer than calyx, limb ca. 5 mm across. Leaves oblong. (Centr. Asia) . . . . . S. acanthorpa Kar.

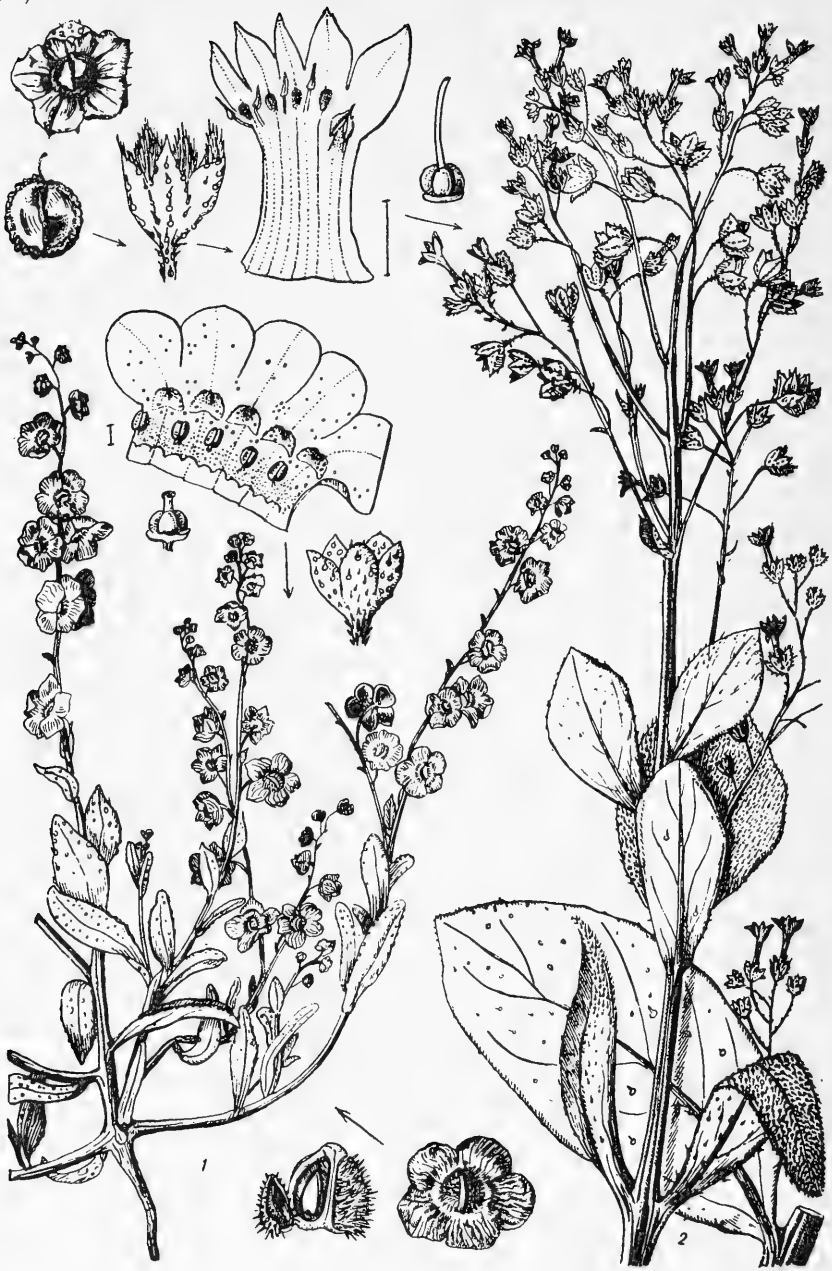

PLATE XL. 1 — Suchtelenia calycina (C.A.M.) DC.; 2 — Caccinia dubia Bge.

+ Nutlets smooth along back, without (rarely with) spinules but finely toothed at margin when detached. Calyx small, more coriaceous, without distinct network of nerves. Corolla smaller, hardly exserted from calyx, limb ca. 4 mm across. Leaves narrower, oblong-lanceolate. (Transcaucasia) . . . . . S. calycina (C. A. M.) DC.

These differences are not constant. In the Caucasus there are individuals with nutlets spinulose along the back but with spinules shorter and fewer than in the Central Asian race; published by Shishkin and Grossgeim, No. 372. On the other hand in Centr. Asia — e. g., at the lower reaches of the Sary-Su River, Krasheninnikov, No. 5164 — there are rare individuals with glabrous fruit.

S. uniserialis Ldb. — very rare form, mainly in Ust-Urt, apparently a transition between both races; nutlets with glabrous back; spinules confined to margin.

685 Genus 1234. **CACCINIA*** Savi

Savi, Cose Bot. (1832) 1—7 cum tabula sine No.f. 1—6.— Anisanthera Raf. Fl. tell. III (1836) 80.

Calyx cut for $^2/_3$—$^3/_4$, strongly elongating and becoming patelliform-flat in fruit; corolla special, its tube cylindrical, elongate, exceeding calyx, limb spreading slightly zygomorphous; dissected to throat into linear-lanceolate or oblong lobes: the 2 upper longer and 3 lower shorter; scales rather large protruding into throat, glabrous; stamens unequal, the median 1 upper with longer filament and large anther, the others smaller, shorter, the 2 lower sometimes obsolete; filaments attached in throat; locules of anthers with 2 subulate basal mucros; style filiform, exserted; stigma punctiform. Gynobase as in Suchtelenia, rimmed by 4 vertical plates; nutlets usually 1—2 developing, large, more or less compressed dorsally with flat back, wingless, sometimes with narrow rim along margin, smooth or spinulose. Perennial herbs, with scattered coarse bristles on large tubercles or subglabrous. Leaves juicy, alternate. Root thick, containing mucilage (to 25% pectin). Inflorescence branching from few-flowered, loose, slightly twisted scorpioid cymes. Five to six species in Iranian floristic province. The closely related genus Heliocarya Bge. grows in Iran.

1. Corolla larger, tube ca. 15 mm long, lobes 7—10 mm long, horizontally spreading. Scorpioid cymes with lanceolate bracts, 2—3 cm long. Stamens especially the posterior strongly exserted; anthers linear-oblong, obtuse, the posterior 5—6 mm long, scales glabrous. Style strongly exserted. Nutlets larger, 8—10 mm long. Leaves acute, oblong-lanceolate or lanceolate. . . . . 1. C. crassifolia (Vent.) C. Koch.

+ Corolla smaller, tube ca. 3 mm long, lobes 3—4 mm long, obliquely spreading. Scorpioid cymes with inconspicuous

* After M. Caccini, Italian magnate of the 17th century, owner of a botanical garden.

linear bracts. Stamens, especially the posterior, hardly exserted. Anthers ovoid, acute, short, 2 mm long. Style not exserted. Scales papilliform. Nutlets smaller, 4—5 mm long. Leaves obovate, obtuse . . . . . 2. C. dubia Bge.

686 Section 1. EUCACCINIA Boiss. Fl. or. IV (1879) 277.— Section Phyllobotrys and Gymnobotrys Bge. Heliocarya (1871) 6, 8.— All filaments erect, protruding. Anthers linear-oblong, obtuse; locules of anthers with 2 basal mucros. Style exserted.

1. C. crassifolia (Vent.) C. Koch in Linnaea, XXII (1849) 647; O. Kuntze in Tr. Bot. Sada, X (1887) 212; N. Pop. in Tr. Yur'evsk. Bot. Sada, XII (1911) 240; Kuzn. in Mat. Fl. Kavk. IV, 2, 104; Grossg., Fl. Kavk. III, 249.— Borago crassifolia Vent. Descr. pl. Jard. Cels. (1800) 100, tab. 100.— C. glauca Savi, Cose Bot. (1832) 8; Ldb. Fl. Ross. III, 17; Boiss. Fl. or. IV, 277.— C. celsii Boiss. Diagn. I, II (1849) 132.— C. rauwolfii C. Koch in Linnaea, XVII (1843) 303; Boiss. Fl. or. IV, 277—278; Grossg., Fl. Kavk. III, 249.— C. macranthera var. crassifolia (Vent.) Brand in Pflanzenr. IV, 252 (1921) 192.— Ic.: Vent. l. c. tab. 100; Savi, l. c. tab. f. 1—6; Gürke in Engl.— Pr. Pflanzenf. IV, 3, f, 41, C, D; N. Pop., op. cit. Fig. 16—20; Brand, l. c. fig. 12.— Exs.: Herb. Fl. Cauc. No. 140.

Perennial; root cylindrical, thick (1—10 cm, depending on growth of plant), branching below, deep; stems 25—90 cm high, often branching, erect, thick, smooth or with few large spinules above, herbaceous, glaucescent, later turning whitish; leaves sessile, oblong-lanceolate or lanceolate, sometimes narrowly lanceolate, glaucous or glaucescent, thick, 5—10 cm long, 1—3 cm wide, usually gradually long-acuminate, rarely oblong, obtuse, with sparse large white tubercles bearing short spinules with hamate spinules along margins and midrib beneath; lower leaves reduced, spatulate, tapering to base, the lowermost squamiform; bracts absent. Inflorescence in general paniculate, of terminal scorpioid cymes single or paired at ends of branches; the latter bostryces few-flowered, loose, slightly twisted, in fruit loose, elongate, straightening, 5—20 cm long, with rather large lanceolate acute bracts; pedicels thin, glabrous pedicels, to 10—15 mm in fruit, drooping horizontally or even arcuately; calyx cylindrical, 8—12 mm long, cut to $^2/_3$ into triangular-lanceolate teeth, soon accrescent, turning ovate at first, patelliform later, 2—3 cm across, its lobes broader, triangular (ovate- or oblong-triangular), tipped with long thin harbate hairs, margin and in part along back with short spinules borne on tubercles; corolla more or less blue-violet, large, its tube glabrous, markedly exserted from calyx; lobes
687 lanceolate-linear, to 10 mm long, acute, nearly horizontally spreading, slightly unequal: the two posterior slightly longer; filaments of posterior stamen ca. 2 mm, anthers ca. 6 mm long, oblong-linear, blue, 2 lateral stamens half as long, the 2 anterior even shorter often hidden in tube; each locule of anthers with 2 subulate short basal mucros; nutlets 8—11 mm long, flat, compressed dorsally, with low margins, back rounded-oval, nearly flat, with prominent thick nerves, and with or without more or less

distinct median crest line of smooth or white-tuberculate to verrucose, rarely with thick small anchorlike bristles, usually also covering the sides; marginal rim of dorsal areola narrow, often triangular, finely toothed, the teeth obtuse or acute and then with anchorlike apex. May—June.

Gypsiferous outcrops, rarely stony slopes. — Caucasus: E. and S. Transc. (from Araks to Baku and Mtskheta, from Armenia to Artvin); Centr. Asia: Mtn. Turkm., Pam.-Al. (to Fergana valley in the east). Gen. distr.: Iran., Arm.-Kurd., (upper reaches of Euphrates; close species in Syria — C. russelii Boiss.). (C. macranthera (Russel) Brand). Described from Iran, between Hamadan and Teheran (Olivier and Bruguières). Type in Paris (if present).

Note. I see no possibility of following Popov in distinguishing C. crassifolia and C. rauwolfii even as varieties, as all differential characters proposed by Bunge, and later by Boissier, Popov and Brand, are either based on inadequate data or simply due to misunderstanding. The small, anchorlike spinules covering the back of the nutlets, considered by Bunge, Boissier and Popov as specific for C. rauwolfii, really are exceptional in the Caucasian material. I saw it only in one specimen from Araks valley, fruit 25 V 1914, Voronov, No. 13884, in all other specimens the nutlets were smooth or tuberculate, not spinulose along the back. Most of Popov's specimens had fruit without spinules along the back; Koch's type is in flower and lacks fruits. Popov arbitrarily chose Ledebour's cultivated specimen as type of C. crassifolia, as it is not identical with the Iranian type species and its derivation is unknown. C. glauca Savi was also described from specimens grown from seeds of unknown origin, probably from the Caucasus, sent to Italy by Fischer (Savi writes "either from Northern Europe or Asia"). The author even omitted to compare it with Borago crassifolia. The glandular hairs in the upper part of the stem, stressed by Brand in distinguishing C. rauwolfii, appears to be based on a misunderstanding, for neither Koch's original nor any other
688 specimen I saw had glandular hairs. Koch distinguished his species from C. glauca Savi by the solitary not articulate stems, calyx not inflated and anthers of the lateral stamens not equal. But all the specimens I saw several had non-articulate stems, a calyx inflated after flowering and the anthers of the two (anterior) stamens always smaller than those of the lateral. In Heliocarya, Bunge made what appears an arbitrary effort to rescue Koch's species, adding some characters such as green, not glaucous, leaves (the upper bristly on both surfaces), shorter and triangular calyx lobes, shorter posterior anther than in C. glauca. In Voronov's specimens, No. 13884, the back of the nutlets is covered with anchorlike spinules and the leaves are glaucous, without bristles on the surface.

Comparing the plants of the Caucasus with those of Central Asia, we do see some differences: the Central Asian plants are on the average more narrowly leaved (lanceolate) than the Caucasian (oblong-lanceolate) leaves, in the former the calyx is narrower, in the latter wider, the flowers in the Central Asian plants are slightly larger and apparently less blue, more palish; the nutlets are smooth or tuberculate, never with dense, anchorlike spinules on the back. But the Caucasian plants agree more closely with Ventenat's and Savi's drawings; geographically they are closer to the type C. crassifolia than the Central Asian, which are more easily distinguished

from C. crassifolia than the Caucasian plants which often have leaves with undulant margin.

Section 2. PSEUDOHELIOCARYA M. Pop. — Filaments all straight, short. Anthers nearly hidden, not exserted, the posterior (only fertile one?)ovoid, acute, its locule mucronate below. Style enclosed. Nutlets with papilliform-dentate margin.

2. C. dubia Bge. Rel. Bot. Lehm. (1847) 242 et in Mém. Acad. Sc. Pétersb. sav. étrang. VII (1854) 418; Lipskii in Tr. Bot. Sada, XXIII, 180; Brand in Pflanzenr. IV, 252, 192.

Perennial; root thick, to 4 cm across; stems 40—100 cm high, robust, glabrous, smooth brown, not shiny as in the preceding, mainly upper part, and inflorescence paniculate-branching; leaves glaucous-green or green, fleshy, large, obovate or oval, rarely oval-oblong, obtuse, broad rounded sometimes mucronate, rarely short-acuminate, 5—15 cm long, 4—5 cm wide, the lower larger, tapering to short broad petiole, median cauline leaves sessile, the upper sometimes reduced, the lowermost rudimentary, becoming squamiform, all leaves strongly scabrous above, with short spinules on large white tubercles, subglabrous, smooth beneath, with few tubercles.
689 Inflorescence paniculate, sharply set-off from leaf-bearing part of stem, nearly leafless, with very small inconspicuous 1—3 mm long, linear or oblong bracts; scorpioid cymes paniculate in upper part of stem, dense, markedly twisted, much elongating in fruit, loose, obliquely ascending; stipes elongate, 8—15 mm, thin, drooping, glabrous or with sparse bristles; corolla blood-red, small, nearly twice as long as calyx, slightly broadening and oblique in throat, lobes of limb obliquely antrorse, nearly campanulate-divergent, 3—4 mm long, obtuse, slightly unequal, the two upper lobes slightly longer; scales ovoid-rounded, villous-papillate, small; anthers not protruding from lobes, on filaments short, the posterior ca. 2 mm long, ovoid, acute, sagittate at base, the other 4 very small (non-functional ?), 0.5 mm long, pairs unequal; style enclosed in corolla; calyx ca. 4 mm long, cut nearly to base into broad oblong-ovate short-acuminate lobes with long-haired tip, margins and midrib with white spinules, fruiting calyx patelliform, ca. 15 mm across, with broadly triangular, nearly not protruding lobes; nutlets usually 1, ovoid-oval, ca. 7 mm long with thin-rugose back, otherwise smooth or slightly shiny, margin with very narrow unequally dentate rim, the teeth papillate, without anchorlike head. May—June. (Plate XL, Figure 2).

Stony slopes. — Centr. Asia: Pam.-Al. (Upper Zeravshan, Alai Range), T. Sh. (Talass Ala-Tau); all three localities disjunct. Endemic. Described from Upper Zeravshan (Leman). Type in Paris, cotype in Leningrad.

Note. A very distinct species similar to the N. Iranian C. strigosa from the foot of Demavend only in external habit. In our species the anthers are very short with ovate base, like style enclosed in corolla. Both characters associate it with Heliocarya. C. strigosa is the real Caccinia (i. e., of Section Eucaccinia Boiss.), with markedly typical protruding anthers, large calyces and nutlets with margins bearing anchorlike teeth. The panicle is especially set-off, the bracts are not developed; the cauline leaves are large, broad and obtuse as in C. dubia. In Heliocarya the panicle

is still even more markedly set-off, the flowers are slightly smaller than in C. dubia, the corolla lacks scales and the nutlets bear long anchorlike spinules along the margin. Plant small. C. actinobole (Section Actinobole Bge.) also resembles in the shape of the flowers our species and Heliocarya more than Eucaccinia, but style and anthers protrude and the posterior anther, although short, (2 mm long), is not as acute; each locule
690 has 2 basal mucros. The panicle is set-off as in our species and Heliocarya, but the leaves are narrower. Small plant. Its main character concerns the filament of the long stamen, which is curved at a right angle below the anther.

Genus 1235. **TRICHODESMA*** R. Br.

R. Br. Prodr. Fl. Nov. Holl. (1810) 496, nom. conserv.— Boraginoides Moench, Method. (1794)515.— Pollichia Medic. Bot. Beobacht. (1783) 247.

Flowers medium or large; calyx 5-cleft or 5-parted, the lobes oblong or lanceolate, sometimes cordate at base, elongating in fruit, and then ovate or flat, patelliform; corolla with short thick tube and flat limb, the lobes short, triangular-ovate, eventually often elongating into taillike appendages; scales none; filaments inconspicuous; anthers large, oblong or lanceolate, much protruding from throat, converging in a cone, with long, awnlike, spirally twisted appendages, crisp-hairy along back, at least at base or all over. Ovary 4—4-partite; gynobase, pyramidal, along ribs of pyramids more or less prominent longitudinal protuberances alternating with nutlets; style terminating pyramidal gynobase, continuing the 4 longitudinal ribs, long, exserted from throat; stigma small, capitate, hidden in cone of anthers. Nutlets rather large, forming pyramid; if single then at bottom of calyx, usually dorsally compressed, with low sides, inflated and then back smooth, shiny or flat and then (in our species) rugose, tuberculate or concave, back with marginal spinules, glabrous or downy; seeds large, cotyledons rounded. Perennial herbs or semishrubs. Leaves alternate or opposite, often tomentose. Bostryces loose, few-flowered, usually in small terminal panicles with small, inconspicuous bracts. Stipes long.

Thirty-eight species. In the subtropical parts of the old world, mainly in the Welwitschia flora. In the USSR, only Section Trachycaryum DC is represented. (Prodr. X (1846) 173).— Nutlets without hairs, without marginal spinules, back wrinkled-tuberculate. SW Asian section with 2 species.

691 1. T. incanum (Bge.) DC. Prodr. X (1846) 174; Bge. in Mém. Acad. Pétersb. sav. étrang. VII (1854) 417; Boiss. Fl. or. IV, 282; Lipskii in Tr. Bot. Sada, XXVI, 490, p. p.; Brand in Engl. Pflanzenr. IV, 252, 36, ppp.— Friedrichstahlia incana Bge. Del. Sem. Hort. Dorpat. (1843) 7.— Boraginella incana O. Ktze. Rev. gen. II (1891) 436.— T. strictum Aitch. et Hemsl. in Journ. Linn. Soc. XIX (1882) 178.— Ic.: B. A. Fedch., Rast. Turk. Exs.: GRF, No. 1122.

* From the Greek trix — hair; desme — bundle, referring to the hairlike appendages of the connectives.

Perennial; rhizome creeping, strongly branching, with thin branches, each producing 1 stem; stems (30)50—100 cm high, spreading or ascending, branching, herbaceous, short-white - or gray-tomentose, short-villous above, glabrescent below, woody, shiny; leaves ash gray with dull tomentose sulphury downy or slightly sericeous-velutinous, rather large, 3—8 cm long, oblong, ovate or oblong-lanceolate, more or less tapering, sessile, acute, flat, alternate or nearly opposite. Inflorescences loose, narrowly paniculate, of few scorpioid cymes terminating branches, with nearly inconspicuous, tomentose bracts; pedicels 1—1.5 cm long, drooping, tomentose, sometimes with distant hairs; buds oblong-urceolate, acute, short-gray-tomentose; calyx ovate-campanulate, divided nearly to base into oblong-lanceolate long-acuminate lobes, gray-tomentose outside, 12—15 mm long, in fruit markedly accrescent, becoming patelliform, nearly membranous, with triangular-ovate 3—4 cm wide lobules, corolla large, ca. 2 cm across, blue, the tube half the length of the calyx, limb flat or even recurved, cut for half into broad triangular-ovate lobes, produced to taillike appendages; conus of yellow anthers 8—10mm high; anthers with long crisp hairs at outer base, glabrous, lanceolate above; awns-appendages as long as anthers, twisted and corkscrew-shaped, nutlets ovoid-oval, 6—8 mm long, 3—4 forming pyramid or 1 nutlet at bottom of calyx, finely tuberculate and rugose along nearly flat back and low sides, sometimes with more or less distinct longitudinal dorsal crest, with uniform rounded, rarely slightly dentate margin near dorsal areola, sulfur-brown, dull, resembling stones. May—July.

Stony, rarely loess or gyssiferous slopes in lower mountain belt, sometimes among crops. — Centr. Asia: Mtn. Turkm., Pam.-Al., T. Sh. (only W. Kara-Tau). Gen. distr.: Iran. (E.). Described from Zeravshan. Type in Paris, cotype in Leningrad.

Note. Lipskii and Brand combined this species with T. molle DC. (Prodr. X (1946) 174) described from Isfahan (western Iran), very close to our species but really only a race. Boissier (l. c.) correctly recognized the differences between them.

692 Family CXXXIX. **VERBENACEAE*** Juss.

Flowers bisexual, numerous, aggregated in racemiform, spicate or capitate, terminal or forked cymes; calyx, pedicels and bracts often colored, calyx tubular or nearly ampullaceous-campanulate, gamosepalous, persistent and often elongating in fruit, 4—5-(rarely 6—8-) sect or dentate, regular or oblique, sometimes nearly bilabiate; corolla gamopetalous, deciduous, white, reddish or bright red, violet, blue or yellowish, tubular or nearly funnel-shaped, with oblique, 4—5-(rarely 6—12-) parted limb, usually unequal, nearly bilabiate, the lobes more or less equal, imbricate; stamens 4(5) fertile, rarely more, inserted in corolla tube, rarely the fifth upper stamen a staminode; anthers 2-celled, parallel; pistil one, of two carpels; ovary

* Treatment by S.G. Gorshkova.

superior free, 4-celled owing to a spurious septum, with one ovule per cell; style simple, stigmas entire, capitate or obliquely declined, sometimes 2-parted; fruit within calyx, a dry, 4-celled drupe or divided into 4 nutlets. Herbs or shrubs, rarely glabrous or pubescent, small trees, sometimes covered with sessile, dotted glands, fragrant. Leaves opposite or whorled, rarely alternate, simple or divided, rarely entire or palmate; bracts absent.

Seventy-seven genera with about 800 species, mainly in tropical and subtropical countries, particularly in Southeast Asia, the Malay Archipelago, Central and South America and the West Indies. Very few species occur in the temperate zone.

Key to Genera

1. Stamens and style not exserted from flower. Herbaceous plants with simple, 3-partite or dissected leaves . . . . . 2.
+ Stamens and style exserted. Shrubs with entire simple ternate or palmate leaves. . . . . 3.
2. Fruit separating into 4 nutlets. Leaves opposite, rarely alternate, entire, pinnatisect or 3-partite . . . . . 1236. Verbena L.
+ Fruit separating into 2 nutlets. Leaves opposite, rarely whorled
693 or alternate, entire, simple . . . . . 1237. Lippia L.
3. Corolla lilac, bilabiate, the upper lip 2, the lower 3-partite. Leaves usually palmate, rarely simple . . . . . 1238. Vitex L.
+ Corolla purple, funnel-shaped, nearly patelliform, with more or less 1-sided 5-partite limb. Leaves simple, entire, ternate, rarely lobate . . . . . 1239. Clerodendron L.

Genus 1236. **VERBENA*** L.

Flowers in terminal spikes, usually on aggregated paniculate inflorescence. Calyx tubular, plicate to 5-ribbed, 5-toothed, in fruit persistent, more or less elongating; corolla lilac, blue, funnel-shaped, nearly patelliform, with straight or twisted cylindrical tube, usually broadening above, the limb 5-lobed oblique, nearly bilabiate, with more or less unequal oblong rounded obtuse usually entire lobes; stamens 4, inserted in upper part of corolla tube, not exserted from flower; ovary subsessile, of 2 carpels, 4-celled; style short 2-partite or with short 2-lobed oblique stigma, its lobes villous in front, smooth behind; fruit within calyx, dry, dividing into 4 nutlets. Herbaceous glabrous or pubescent plants; leaves opposite, rarely alternate, sometimes whorled, entire or dentate, 3-partite or dissected.

Eighty species in tropical and subtropical America, some in Europe, Asia, Africa and Australia.

1. Bracts unequal, of variable shape, large, the lower pinnatisect, 7 mm long, the upper linear-lanceolate, 0.8—1.2 cm long, 4—6 times as long as calyx, recurved . . . . . 1. V. bracteosa Michx.

* Ancient Roman name for many plants used on festive and religious occasions.

+ Bracts 2 mm long, shorter than calyx, ovate, lanceolate or oblong . . . . . 2.

2. Flowers in dense 2—4 cm long spikes; bracts linear; corolla bluish, with more or less notched lobes; nutlets smooth on the inside. Stems 10—40 cm high, nearly erect, sometimes prostrate; leaves medium, multipartite or bipinnatipartite . . . . . 3. V. supina L.

+ Flowers in sparse or dense, usually long, (2)4—19 cm long spikes, aggregated in large 11—30 cm long, 4—14 cm wide panicle; bracts ovate or lanceolate; corolla dark blue or lilac, with entire lobes; nutlets with numerous white scales inside. Leaves medium, tripartite . . . . . 3.

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3. Flowers in sparse thin 3—14 cm long, 3 mm wide spikes; corolla pale lilac; nutlets with numerous whitish scales inside. Stems 30—70 cm high, its angles like leaves and calyx, covered with sparse hairs . . . . . 2. V. officinalis L.

+ Flowers in more or less dense 2—4 cm long, 5 mm wide spikes; corolla dark blue; nutlets with small linear whitish lines inside. Plants to 1.5 cm high, entirely covered with white simple hairs appressed upward . . . . . 4. V. hastata L.

1. V. bracteosa Michx. Fl. bor. Amer. II (1803) 13; Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 911. — Ic.: Bot. Mag. tab. 2910.

Perennial; entire plant covered with long — 1—1.5 mm — unicellular whitish hairs; stems 15-30 cm long, prostrate or ascending, branching, furrowed; leaves oval or more or less spatulate-lanceolate, 2—3 cm long, 1.3 cm wide, their base long- and narrow-cuneate, tapering to 0.2—0.6 cm long petioles, pinnatisect (nearly trisect), with oblong small, 2—6(8) mm long, 1.5—2 mm wide acute often toothed lobes. Flowers in dense terminal 1.5 cm long, 0.8 cm wide spikes; bracts unequal, the lower pinnatisect, 0.7 cm long, 0.4—0.5 cm wide, the upper linear-lanceolate, 0.8—1.2 cm long, 1—1.5 mm wide, 4—6 times as long as calyx, mucronate, entire, all recurved, divaricate, with long-ciliate margin; calyx tubular, 2—2.5 mm long, 0.6 mm wide, pubescent with small, mucronate teeth; corolla lilac or purple-blue, 3.5 mm long, $1\frac{1}{2}$ times as long as calyx, glabrous, with thin, 2.5 mm long, 0.5 mm wide tube and nearly bilabiate 5-lobed limb, the lobes rounded, unequal, the two larger 0.3 mm long, notched above, the three smaller entire, 0.2 mm long; ovary oblong, 0.7 mm long, 0.3 mm wide, with short style and stigma; nutlets oblong-linear, 1.5—2 mm long, 0.5 mm wide, nearly linear, dihedral-inflated, longitudinally rugose, nearly alveolar, dull, brown, inside covered with dense white scales. August.

Weed of roadsides. — Far East: Uss. Gen. distr.: N. Am. Described from N. Am. Type in London.

Note. A sparse weed introduced from North America. Collected near Shkotovo (Vladivostok area).

2. V. officinalis L. Sp. pl. (1753) 20; Ldb. Fl. Ross. III, 329; Boiss. Fl. or. IV, 534; Shmal'g., Fl. II, 301. — Ic.: Lam. III. 1, tab. 17, fig. 1; Rchb. Ic. Germ. XVIII, tab. 1292; Hegi, III. Fl. V, 3, tab. 222, fig. 5;
695 Fedch. and Fler., Fl. Evrop. Rossii, Fig. 794; Sorn. rast. SSSR, III,

Fig. 375; Maevsk., Fl. ed. 7, Fig. 249. — Exs.: Fl. exs. Reipubl. Bohem.-Sloven. No. 260; Fl. Sic. exs. No. 697; Fl. Bohem. et Morav. exs. No. 665; Fl. pol. exs. No. 64.

Perennial; stem erect, branching, 30—70 cm long, its faces covered with appressed hairs; leaves ovate, ovate-oblong, oblong-lanceolate or oblong, 4—8.5 cm long, 1—4 cm wide, sessile cuneately tapering at base, pinnatisect; the median trisect, large-dentate, with obtuse teeth; the upper oblong, incised-crenate or (terminal) entire. Flowers numerous in sparse, thin, terminal, 3—14 cm long, 0.3 cm wide axillary spikes, clustered in large, 12—20(23) cm long, 7—13 cm wide panicle; bracts ovate or lanceolate, 2 mm long, 1 mm wide, acute, shorter than calyx; calyx covered with sparse hairs, 2.5 mm long, 1.5 mm wide, teeth short, 0.5 mm long, acute; corolla pale lilac, 5—5.5 mm long, nearly twice as long as calyx, its tube cylindrical, 3.5—4 mm long, 1.2 mm wide, the limb 5-lobed, lobes unequal, three larger, 1.2 mm long, 1.7 mm wide, 2 slightly smaller, 1 mm long, 1.5 mm wide; stamens 4; ovary oblong, 0.6 mm long, 0.3 mm wide, style and stigma short; nutlets oblong-linear, dihedral-inflated, longitudinally rugose, 1.8—2 mm long, 0.5—0.7 mm wide, shiny, reticulate-rugose, brown in upper part, inside covered with dense white appressed scales. June—August.

Forest edges, meadows, glades, ravines, old riverbeds and coastlines. In mountains to 1,200 m, slopes, gorges. A weed of gardens, kitchen gardens, roadsides. Among irrigated barley, cotton, lucerne, sesame, other cereals (Belorussia and Caucasus). — European part: Lad.-Ilm., U. Dnp., U. Dns., M. Dnp., V.-Don, Bl., Crim. L. Don, Bes.; Caucasus: Cisc., Dag., W., E. and S. Transc., Tal.; Centr. Asia: Mtn. Turkm., Syr D., Pam.-Al., T. Sh. Gen. distr.: Centr. Eur., Med. (W. and E.), Bal.-As. Min., Iran., Ind.-Him., Jap.-Ch., N., C. and S. Am., Australia. Described from Europe. Type in London.

Economic importance. Contains some essential oil with a camphor-like smell. The roots are added to pickled cucumbers for their special aroma (Grossg., Rast. res. Kavk. 50, 321).

3. V. supina L. Sp. pl. (1753) 21; Ldb. Fl. Ross. III, I, 329; Boiss. Fl. or. IV, 534; Shmal'g., Fl. II, 301. — Ic.: Sibth. et Sm. Fl. Graeca, VI, tab. 554; Fl. Yugo-Vost. VI, Fig. 597. — Exs.: GRF, No. 1380, a, b; Fl. pol. exs. No. 858; Fl. Hung. exs. No. 460; Fl. exs. Austro-Hung. No. 934.

696 Annual; plant nearly canescent, entirely covered with coarse short white hairs; stem nearly erect, usually strongly branching, or simple, 10—40 cm long, sometimes prostrate; lower leaves 1.5—4 cm long, 0.6—1.5 cm wide, oblong-ovate, tapering to 0.5—1 cm long petiole, notched at base, the median and upper 1.5—3 cm long, 1—1.5 cm wide, bipinnatipartite, the lobes oblong, obtuse, dentate-incised, trisect, with margins turned up, nearly cartilaginous. Flowers numerous, in dense terminal, 2—4 cm long, 5—6 mm wide spikes, pedicels (0.5) 1—4 cm long; bracts linear or oblong, 2mm long, 0.5 mm wide, shorter than calyx, acuminate; calyx tubular, nearly campanulate, 3 mm long, 1.3 mm wide, short-dentate, the teeth 0.5 mm long; corolla blue, 4—4.5 mm long, $\frac{1}{3}$ the length of the calyx, 5-lobed, tube cylindrical, 3 mm long, 1.5 mm wide; the lobes nearly spatulate, usually incised, 3 lobes 1.3 mm long, 1 mm wide, 2 smaller, 1—1.1 mm long, 0.8 mm wide, stamens 4; ovary oblong,

1.6 mm long, 0.5 mm wide; style short, 0.5 mm long, nearly $^1/_3$ the length of the ovary; nutlets oblong, dihedral-inflated, 1.7 mm long, 0.7 mm wide, brown, smooth. June—August.

Moist solonetzic places, sandy shores, steppes, plains and ravines, sometimes a weed. — European part: Bl., Crim., L. Don, L. V., Bes.; Caucasus: Cisc., E. Transc., Tal.; Centr. Asia: Mtn. Turkm. (Meshed-Messerian). Gen. distr.: Centr. Eur. (S.), Med. (W. and E.), Bal.-As. Min., Iran., Ind.-Him. Described from Spain. Type in London.

4. V. hastata L. Sp. pl. I (1753) 20; Kolak. and Sakh. in Soobshch. Akad. Nauk Gruz. SSR. VII, 5 (1946) 267; Grossg., Opred. rast. Kavk. 321.

Perennial; plant covered with simple white unicellular hairs upward appressed; stem erect, tetrahedral, brown, to 1.5 m tall; leaves hastate, nearly hastate, usually lanceolate, narrow, 5—11 cm long, 1.5—3 cm wide, acute, dentate, cuneate at base, nearly tripartite petioles, 2 cm; bracts small, 2.5—5(8) cm long, 0.4—2 cm wide, on 0.5—1 cm petioles. Flowers numerous, sessile in dense terminal axillary spikes 2—4 cm long, 0.5 cm wide, linear, on 0.5—1.5(2) cm pedicels, forming large sparse panicle 11—30 cm long, 4—14 cm wide; bracts 2mm long, 0.7 mm wide, slightly shorter than calyx, mucronate, with ciliate margin; calyx tubular-campanulate, ribbed, 2.3—3 mm long, 1—1.5 mm wide, 5-toothed, the teeth short small, 0.5 mm long, acute; corolla dark blue, 5.5—7.5 mm long, nearly twice as long as calyx, outside (in lower part) sparsely pubescent, with narrow cylindrical tube 4.5 mm
697 long, 1—1.3 mm wide, broadening above; limb 5-lobed, the lobes oblong-rounded or rounded, entire, unequal, 2 larger 1.5—1.7 mm long, 1.5 mm wide, 3 smaller, 0.7—1.3 mm long, 1 mm wide; stamens 4; ovary oblong, 0.8 mm long, 0.4 mm wide, with 1 style; nutlets oblong-linear, 2—3 mm long, 0.7 mm wide, brown, dihedral-inflated, netted-rugose shiny outside, inside dull, with many small linear whitish spots. September.

Introduced weed. — Caucasus: W. Transc. (near Sukhumi). Gen. distr.: N. Am. Described from Canada. Type in London.

Note. An introduced ornamental from N. America; as yet confined to the vicinity of Sukhumi.

Genus 1237. **LIPPIA*** L.

L.Sp.pl. (1753) 633.— Zapania Lam. Illustr. I(1791) tab. 67

Flowers in capitate or spicate inflorescences; calyx scarious, tubular, 2—4-toothed; corolla tubular, nearly funnel-shaped, the straight or curved tube broadening above and oblique, nearly bilabiate, the upper lip entire or 2-partite, the lower 3-partite; stamens 4, not exserted from tube; anthers 2-locular; ovary 2-locular, 1 ovule per cell; style short, with oblique twisted stigma; fruit small, nearly rounded, enclosed in calyx, dry, separating into 2 nutlets. Herbaceous plants with simple, approximate rarely whorled leaves.

About 100 species, mainly in tropical America, one species grows in the warm countries of Europe and Asia; 2—3 in Africa.

* After the Parisian physician and botanist August Lippi (1678 — 1703).

1. L. nodiflora (L.) Rich. in Michx. Fl. bor. Amer. II (1803) 15; Lam. Encyclop. Meth. Bot. Suppl. V (1817) 520; Ldb. Fl. Ross. III, I, 330; Boiss. Fl. or. IV, 532; Grossg., Fl. Kavk. III, 277.— Verbena nodiflora L. Sp. pl. (1753) 20.— V. repens Bertol. Rar. Ital. Pl. Dec. 2 (1810) 27, No. 1.— Zapania repens Bertol. l.c.— Ic.: Sibth. et Sm. Fl. Graeca, VI, tab. 553.— Exs.: Schultz, Herb. norm. No. 341; Fl. Gall. et Germ. exs. No. 2128, Fl. Ital. exs No. 653.

Perennial; plant appressed-downy; stems nearly filiform, 10—30(35) cm long, prostrate, sometimes ascending; leaves spatulate-cuneate, obtuse, 1.2—2.5 cm long, 0.5—1 cm wide, tapering to short petiole with acutely toothed upper margin. Flowers numerous, in crowded dense, short, spici-
698 form-capitate or ovate-cylindrical, 0.5—1.3 cm long, 0.2—0.5 cm wide inflorescences on long (0.7) 2—5 cm pedicels; bracts obovate or nearly rhombic-cuneate-imbricate, 2—4 mm long, 1.8 mm wide, nearly as long as corolla tube, acuminate, their margin broadly scarious, ciliate; calyx tubular, scarious, 1.5 mm long, 2-partite, 2—4-toothed, 2-keeled, the keel pubescent; corolla pink, tubular to funnel-shaped, 2—2.5 mm long, the tube more or less curved, 1.5 mm long, 1 mm wide, with oblique 2-lipped limb, the upper lip entire, broad, 0.5 mm long, 0.6 mm wide, the lower 3-partite, 0.4 mm long, 0.3 mm wide; stamens 4; ovary nearly globular, 0.7 mm long, with short, 0.4 mm style and oblique capitate stigma; nutlets oval, 1.3—1.5 mm long, 1 mm wide, yellowish, smooth. June—August.

Muddy, moist localities, damp hollows, near rice fields, seashores, usually a weed.— Caucasus: Cisc. (E.), E. Transc., Tal.; Centr. Asia: Mtn. Turkm. (Kzyl-Atrek). Gen. distr.: Med. (W. and E.), Arm.-Kurd., Iran., Ind.-Him., N., C. and S. Am. Described from N. America. Type in London.

Genus 1238. VITEX* L.

L. Sp. pl. (1753) 638.

Flowers in short simple or repeatedly 3-furcate terminal cymes clustered in large racemose paniculate inflorescences; calyx short-campanulate, rarely tubular-campanulate, 5-sect or 5-toothed, its teeth slightly irregular; corolla with short straight cylindrical or curved tube slightly broadening above; limb oblique, 5-sect nearly 2-lipped, the upper lip 2-partite, the lower 3-partite, with lateral lobes large, elongate, broadening slightly larger than the upper and median; stamens 4, adnate to corolla tube, exserted; anthers obcordate; ovary 4-locular; style filiform, protruding, with 2-lobed stigma; fruit a dry, 4-locular drupe. Shrubs or trees; leaves opposite, usually palmate.

About 100 species in warm countries and the temperate zone.

1. V. agnus castus L. Sp. pl. I (1753) 638; Ldb. Fl. Ross. III, I, 331; Boiss. Fl. or. IV, 535; Shmal'g., Fl. II, 302; Fedch., Rast. Turk. 668; Grossg. Fl. Kavk. III, 277.— Ic.: Sibth. et Sm. Fl. Graeca, VII, tab. 609; Rchb. Ic. Fl. Germ. XVIII, tab. 1293; Fedch. and Fler., Fl. Evrop.

* From the Latin viere, to weave, referring to the use of the branches for weaving, like those of willow, possibly also to the similarity of the leaves to those of the willow. (In ancient times (e.g., Pliny) the willow was known as "Vitilia.")

Rossii, Fig. 703.— Exs.: Edit. H. B. Petri Magni, No. 87; Fl. Gall. et Germ. exs. No. 836; Fl. Ital. exs. No. 356.

699 Small shrub or tree, to 1.5 cm high, gray-tomentose, with dense appressed hairs; branches tetrahedral, brown; leaves opposite, petioles 1.5—4 cm palmate, of 5—7 leaflets, 2—10 cm long; 0.4—1.5(2) cm wide, narrowly lanceolate, acute, entire or serrate, tapering to short petiolule, green above, densely pubescent grayish beneath. Flowers numerous, pedicels 0.5—1 mm, in compressed axillary cymes, forming dense paniculate-spiciform interrupted, 7—10 (17) cm long, 2—2.5 cm wide inflorescence; bracts oblong, small, 1.5 mm long, 0.3 mm wide; calyx campanulate, 2.5 mm long, $^1/_3$ the length of the corolla, shortly and acutely incised-dentate, the teeth triangular; corolla lilac, 8—9 mm long, bilabiate, the upper lip 2-sect, 1.8 mm long, the lower 3-sect, median lobe 3 mm long and wide, the lateral 2 mm long, 2 mm wide; corolla tube slightly swollen, glabrous, 6 mm long, 4 mm wide; stamens 4, long, exserted; ovary rounded, small, 1 mm long, 1 mm wide; style long, protruding, 7 times as long as ovary; drupes 3—3.5 mm long, 1.5 mm wide, globular, black. June—August.

Banks of rivers, streams and irrigation ditches, often cultivated.— European part: Bl., Crim.; Caucasus: W., E. and S. Transc.; Centr. Asia: Kara-Kum, Mtn. Turkm., Syr D., Pam.-Al. Gen. distr.: Med. (W. and E.), Bal.-As. Min., Arm.-Kurd., Iran. Described from Italy. Type in London.

Economic importance. Grown as an ornamental. The seeds have a spicy taste and may be used in place of tarragon. The leaves contain 38.9—118.1 mg% vitamin C (Grossg., Rast. res. Kavk. 50, 257).

Genus 1239. **CLERODENDRON*** L.

L. Sp. pl. (1753) 637.— Clerodendrum L. l.c.

Flowers numerous, on pubescent pedicels, with unpleasant odor, in repeatedly furcate terminal cymes or in terminal panicles or heads; calyx campanulate, rarely tubular, sometimes pentahedral, nearly swollen, 5-partite, rarely truncate, persisten; corolla funnel-shaped or nearly patelliform, purple, with protruding long tube and 5-partite limb; stamens 4, inserted in corolla tube, exserted; anthers 2-locular, cells parallel; ovary 4-locular; style filiform, exserted, with 2-partite stigma with acute lobes; fruit a 4-
700 locular dry drupe. Semishrubs, shrubs or trees, with opposite entire, rarely lobed or ternate leaves.

About 90 species in SE Asia, the Malay Archipelago, South and Central America, West Indies and S. Africa.

1. C. foetidum Bge. in Mém. Acad. Sc. Pétersb. par. div. sav. II (1835) 126; Kolak. and Sakh. in Soobshch. Akad. Nauk Gruz. SSR. VII, 3 (1946) 142; Grossg., Opred. rast. Kavk. 321.— Ic.: Bot. Mag. LXXXI, tab. 4880; Hegi, III. Fl. V, 3, 2237, f. 3170.

Semishrub or small shrub to 1—1.5 mm high, with brown or red-brown smooth bark and erect pubescent branches; leaves opposite, broadly cordate, 5—16 cm long, 4—13 cm wide, acute or acuminate, large-toothed to serrate,

* From the Greek cleros — fate, dendron — tree, "tree of fate." Some species have a curative effect, others contain harmful substances.

reticulate, with glands beneath, nerves with sparse short unicellular appressed hairs on both sides, long-petioled, 2.5—7 cm long; bracts (in inflorescence) cordate or oblong, small, 0.4—1.2 cm long, 2—5 mm wide, acute, shorter than flower, with 2—5 mm petioles. Flowers on pubescent, 1.5—2 mm long pedicels, aggregated in large dense compound semi-spherical or capitate terminal corymbs 6—7 cm across; bracts linear, acute, (5)7.5—9 mm long, 0.3—0.5 mm wide, shorter than or as long as calyx (with pedicel), with sparse short hairs; calyx campanulate, 4—5 mm long, 3 mm wide, covered with short white appressed unicellular hairs, with oval-cylindrical, 3 mm long tube and 5-partite or 5-toothed 1—2 mm long, straight or slightly recurved, acutely toothed limb; corolla purple, funnel-shaped, (2.8)3—3.5 cm long, 6—7 times as long as calyx, glabrous outside, with sparse rounded small glands and long thin, 2.5—2.8 cm long, 1 mm wide tube broadening above, and deeply 4—5-partite horizontal limb with nearly equal, ovobate, 6 mm long, 2.5—3 mm wide lobes; stamens 4, exserted, their filaments glabrous, 3—6 cm long; anthers oblong, dark purple; ovary globular, style filiform, 3.3 cm long, exserted, stigma 2-partite or with faintly claviform lobes; anthers 0.8—1 cm long, 5—7 mm wide, greenish-brown, glabrous. August—September.

Muddy stretches of rivers, forest edges.— Caucasus: W. Transc. Gen. **distr.**: China. Described from China. Type in Paris.

Note. Grown in W. Transcaucasia, where also an escaped weed.

ADDENDA XVIII *

DIAGNOSES PLANTARUM NOVARUM IN TOMO XIX FLORAE URSS COMMEMORATARUM

(DIAGNOSES OF NEW SPECIES MENTIONED IN VOLUME XIX)

Februario 1953

CUSCUTA L.

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1. **C. araratica** Butk. sp. n. (§ *Eucuscuta* Engelm.).

Caules filiformes, ad 0.8 mm in diametro, rubelli, ramosi laeves glabri; flores ad 3 mm longi, sessiles in inflorescentias compactas subglobosas paucifloras, 6—8 mm in diametro congesti; bracteae triangulato-ovatae, obtusae. Calyx ad 2 mm longus semiglobosus vel obconicus, carnosus, pallidus, fere ad dimidium dissectus, lobis late ovatis vel rhomboideo-ovatis, obtusis, extus papillosis, dorso incrassatis. Corolla urceolata, calyce vix longior, extus papillosa, ad tertiam — dimidiam partem dissecta, lobis rhomboideo-ovatis, obtusis erectis, apice inflexis, dorso incrassatis, basi tegularibus; squamae tubum corollae aequantes, oblongae, marginibus parallelis, bifidae, apice inaequalidentatae, inflexae, sinubus aequilatis; stamina fauce inserta, antheris rotundato-cordatis, pallidis, filamentis subulatis brevioribus. Ovarium subglobosum, stylis brevissimis, stigmatibus vix incrassatis intenseque coloratis praeditis, cum stigmatibus ovarium subaequantibus. Capsula membranacea, tetragono subglobosa, vix depressa, ad 2 mm in diametro, 3—4-sperma, seminibus subellipticis, ad 1 mm longis, ventre angulatis, pallidis, scabris.

Typus: m. Ararat, Takel-tau 18 VIII 1919, Grossheim (in Inst. Bot. Acad. Sc. URSS).

Ab affini *C. brevistyla* A. Br. lobis corollarum erectis apice inflexis, squamis bifidis differt.

ONOSMA L.

2. **O. ferganense** M. Pop. sp. n. [Sect. *Euonosma* DC., subsect. *Haplotricha* Boiss., series *Ferganica* M. Pop. in Bot. Mat. Gerb. Bot. Inst. AN SSSR XIV (1951) 302].

Perenne. Planta tota breviter patuleque cano-pubescens, tomentella. Radix multiceps, caules nonnullos edens. Caules 40—50 cm alti, angulati, dense patule pubescentes, setis longioribus rigidis omnino destituti, in superiore parte longe ramosi, ramis apice cincinnis brevibus terminatis. Folia caulina patentia, sessilia, oblongo-lanceolata, 4—5 cm longa et 1—0.5 cm lata, ad apicem sensim longeque attenuata, setis patulis tenuibus, ad superiorem paginam basi grosse tuberculatis cana, fere tomentella.

* [This appexdix has been reproduced photographically from the Russian original.]

702 Folia ramorum lanceolata, quam caulina duplo-triplo minora. Cincinni (racemi) breves, fructiferi elongati. Pedicelli breves, breviter cano-hirsuti. Calyx cano pubescenti-hirsutus, 7—10 mm longus, fructifer paulo elongatus, lobis linearibus. Corolla tubulosa, subclavata, ore contracta, 17 mm longa, extus glabra, flavescens, ad costas et apice coerulescens, secus costas tuberculato-verrucosa. Antherae in corollam inclusae, filamentis basi vix dilatatis subbreviores. Annulus nectarifer glaber. Nuculae 5 mm altae, erectae, corpore subquadrato subito in apicem contracto, cinereae, minutissime tuberculato-verruculosae, opacae.

Typus: in Asiae Mediae montibus tianschanicis (Tianschan austro-occidentalis), in jugo Ferganico, ad trajectum Kenkol fl. fr. 17 VI, 1899, Litvinov (in Herb. Acad. Sc. URSS, Leningrad).

Ab affinibus (eadem seriei *Ferganica* M. Pop.) speciebus distinguenda: ab *O. brevipiloso* Schischk. ramulis sterilibus caulis nullis, ramis omnibus florigeris, pubescentia foliorum patente nec adpressa, copiosiore nec parca; ab *O. trachyacarpo* Levin absentia setarum rigidarum patentium, foliis brevibus ad apicem sensim angustatis nec spathulatis setis rigidis longioribus carentibus.

3. **O. brevipilosum** Schischk sp. n.

Perenne; radix multiceps, caules numerosos protrudens; caules 40—50 cm alti, basi crassi, angustati, pilis brevibus appressis tecti; folia reclinata, lanceolata 4—6 cm longa et 8—10 mm lata gradatim longe acuminata, sessilia, plana, setulis brevibus et longiusculis, in tuberculis majusculis omnino appressis (setis longis patulis deficientibus), in axillis imprimis in dimidio superiore ramulos steriles foliis lanceolato-linearibus instructos gerentia. Inflorescentia in apice caulis e racemis scorpioideis 1—2 parvulis sed densis sistens; pedicelli tenues brevesque atque calyces semiappressim et longe griseo-setulosi; calyx 10—12 mm longus lobis linearibus, corollae luteae, tubulosae in fauce angustatae, 15—18 mm longae, dentibus brevibus, externe glabrae sed ad costas sub dentibus rugoso-tuberculatae; filamenta leviter dilatata, antheris breviora; nectarium glabrum.

Typus: Asia Media. Jugum ferganense, in pratis subalpinis ad ripam fl. Urak-Su prope summitatem Kenkol, alt. ca. 2400 m, 1899, Litvinov (in Herb. Inst. Bot. Acad. Sc. URSS).

Toto habitu simillimum est *O. azureo* Schipz., sed corolla lutea in fauce angustata, in costis verrucosa et nectario glabro statim dignoscitur.

ARNEBIA Forsk.

4. Sect. **Cornutae** M. Pop. — Annuae. Corollae luteae, tubo gracili longo, limbo parvo, mediocri vel lato, inter lobos maculis purpureis ornato. Calyx fructifer basi induratus, angulis prominentibus 5 crassis vel tuberculis albis mamillaeformibus munitus.

703 5. **A. transcaspica** M. Pop. sp. n. — *A. orientalis* var. *tubata* Lipsky in A. H. P. XXVI (1910) 520, p.p.

Caulis 20—30 cm altus, subdivaricato ramosissimus, albidus, glabriusculus, setis sparsis longis patentissimis tectus. Folia lanceolata, viridia parce setosa, obtusiuscula v. superiora acuta. Racemi fructiferi laxi, sed non longi, usque ad 10 cm longi, pauciflori. Calyces parce rigide setosi. Corollae flavae, tubo tenui longo (15—20 mm longo), limbo mediocri 8—10 mm lato, campanulato-pelviforme, non plano, maculis violaceis magnis inter lobos ornato.

In Turcomania, in promontoriis montium Kopetdagh et in deserto sabuloso Kara-Kum.

Typus: Ad stat. viae ferreae Dshebel. 3 V 1911, Seidmuradov, N° 1034 (in Herb. Acad. Sc. URSS, Leningrad).

Species transitoria inter *A. decumbentem* Coss. et Kral. desertícolam et *A. grandifloram* M. Pop. submontanam; a prima corollae majoris tubo longiore et limbo multo ampliore, caule elatiore et setis parcissimis ad caulem et folia differt; ab altera, valde hirsuta, eadem nota et corollae limbo minore minusque plano, tandem area separata distincta.

6. **A. grandiflora** M. Pop. in Lapin, Opred. rast. Tashkent. oazisa (1938) 342; Zakir. Burachn. Zeravsh. 23. — A. *orientalis* var. *grandiflora* (Trautv.) Lipsky in A. H. P. XXVI (1910) 522. — *A. cornuta* var. *grandiflora* Trautv. in Bull. Soc. Nat. Mosc. XXXIX (1866) 422; Gartenflora XXV (1877) 523, tab. 921. (Sect. *Cornutae* M. Pop. — series *Eucornutae* M. Pop.).

Caulis 5—20 cm altus, erectus foliis dense setosissimis, canescentibus. Folia lanceolata v. lineari-oblonga, acuta vel obtusiuscula. Racemi fructiferi paulo elongati, 5—10 cm longi. Corolla lutea, tubo tenui longo, limbo majusculo plano-pelviformi 10—15 mm in diam., maculis violaceis satis parvis, ca. 2 mm latis, ornata.

In promontoriis praepamiricis et tianschanicis Asiae Mediae frequentissima.

Typus: ad urb. Taschkent, pag. Toj-Tjube (inter Taschkent et Angren), 17 V 1880, Regel (in Herb. Acad. Sc. URSS, Leningrad).

7. **A. baldshuanica** Schischk. in herb. et nomen ex Nevski in Acta Inst. bot. Acad. Sc. URSS, IV (1937) 317, excl. specimina citata quae ad *A. grandifloram* pertinent. (Sect. *Cornutae* M. Pop. — series *Eucornutae* M. Pop.). — *A. orientalis* var. *baldshuanica* Lipsky in A. H. P. XXXV (1910) 524.

Caulis elatus, robustus, usque ad 40 cm altus, ramosus, laxe setosus, Folia majuscula lanceolata viridia acutiuscula non dense patentissime setosa. Racemi fructiferi elongati, 10—20 cm longi. Corolla magna, tubo usque ad 25 mm longo, limbo usque 20 mm lato maculis majusculis 3—4 mm latis ornata.

In Asiae Mediae montibus Tadshikistaniae australis versus fl. Piandsh nec non in parte orientali vallis Ferganensis.

Typus: Baldshuan. V 1883, Regel (in Herb. Acad. Sc. URSS, Leningrad).

A praecedente quacum a Nevski confusa fuit habitu robustiore foliis virescentibus cauleque laxo setosis, racemis longioribus et corollis majoribus differt; magis ad *A. coeruleam* Schipcz. appropinquat quoad habitum et floris magnitudinem, setositatem laxam, sed haec (*A. coerulea*) lobis 2 minoribus ex toto violaceis, reliquiis 3 flavis, corollae tubo violascente ab *A. baldshuanica* videtur bene distinguitur.

MERTENSIA Roth.

8. **M. Popovii** Rubtz. sp. n. — *M. sibirica* Ldb. Fl. Ross. (1849) 133, quoad pl. e Tarbagatai; Kryl. Fl. Zap. Sib. IX, 2276, quoad plantam e Tarbagatai, non G. Don.

Rhizoma tenue breve obliquum nigrescens, apice unicaule. Caulis 20—30 cm altus, tenuis, basi flexuoso-inflexus, glaber in superiore parte breviter adpresse setulosus simplex. Folia radicalia parva, ovato-subcordata, longepetiolata. Folia caulina inferiora 1—2 longepetiolata, ovata basi subtruncata, media 2—3 ovato-oblonga, subsessilia, superiora 3—4 sessilia oblonga, omnia breviter acuta v. subacuta, viridia, parva: inferiora 2—4 (5) cm long., media 3—4 (5) cm long. et superiora 2—3 cm long., plana, subtus omnino glabra, supra tuberculis minutis adspersa. Cyma terminale breve, ramulis 1—2 cm longis apice ca. 5-floris, floribus approximatis in umbellulam dispositis, basi foliis 2 supremis suffultum, caeterum in ramis et umbellulis aphyllum. Pedicelli tenues 3—7 mm longi asperuli. Flores majusculi. Calyx fere ad basin 5-partitus, lobis lanceolato-linearibus v. fere linearibus, 4—5 mm longis, dorso (facie) glabris, margine adpresse strigillosis. Corolla pulchra coerulea, ca. 15 mm longa, tubo calycem duplo superante (8 mm longo), limbo campanulato tubo aequilongo, ca. 8 mm lato, lobis semiorbicularibus, 2 mm longis (altis). Fornices lati semicirculares, breves vix 0.5 mm longi (alti). Filamenta brevia, 1 mm longa. Antherae sublineares, 2 mm longae. Stylus e corolla exsertus. Nuculae albidae, 3.5 mm longae (altae), ovato-trigonae, dorso convexo rugoso scrobiculatae, margine aptero, lateribus contiguis, nudis.

In montibus Tarbagatai et Saur, satis frequens, in laricetis superioribus subalpinis v. in pratis subalpinis, interdum ad rupes in angustiis.

Typus: montes Tarbagatai, in angustiis Ak-Tschora, in pratis subalpinis, 2000 m, 20 VI 1948, Stepanova (in Herb. Acad. Sc. URSS, Leningrad).

MYOSOTIS L.

9. **M. pseudovariabilis** M. Pop. sp. n. [Sect. *Eumyosotis* DC. Prodr. X (1846) 105. — Series *Sylvaticae* M. Pop.].

705 Perennis. Rhizoma breviter repens, apice ramosum, ramis surculos steriles breves et caules floriferos edentibus. Caules adscendentes vel erecti, simplices vel pauciramosi, tenues et debiles, 12—30 cm. alti, inferne parce et patenter superne adpresse pubescentes. Folia surculorum obovata v. oblonga, 3—4 cm longa, 1—2 cm lata, obtusa, breviter petiolata, non dense patenter pilosa. Folia caulina oblonga v. lanceolato-oblonga, 1.5—3 cm longa,0.5—1 cm lata,acutiuscula, plana,tenera et viridia, patentia, sparse pilosa. Racemi floriferi elongati laxi, 5—15 cm longi, aphylli. Pedicelli fructiferi calyce $1^1/_5$—2-plo longiores vel eo aequilongi, horizontaliter patentes, tenues, adpresse pubescentes. Flores mediocres. Calyx florifer 2 mm longus, fructifer 3—3.5 mm longus, ad medium in dentes lanceolatos acutos fissus, canescens, pilis in parte inferiore integra calycis teneris patentibus, apice uncinatis. Corolla coerulea, junior flavescens?, tubo calyce paulo longiore, limbo 4—5 mm in diam. Stylus calyci aequilongus vel paulo eo excedens.

Typus: Sibiria, prope pagum Turuchansk ad fl. Jenissei inferiorem, in regione subarctica, 30 VI 1902, Ostrovskich (in Herb. Leninopol.). Specimina numerosa vidi ex regione fl. Jenissei inferioris, in australioribus autem, ad Krassnojarsk et Aczinsk, specimina intermedia, ad *M. sylvaticam* vergentia, occurunt.

Valde affinis *M. sylvaticae* Hoffm. europaeae et *M. Krylovii* Serg. sibiricae, sed ab ambabus commemoratis speciebus corollae tubo et stylo elongatis differt. A *M. variabili* Ang. corollis subduplo minoribus et stylo tuboque minus elongatis statim dignoscitur. Caeterum, pro varietate *M. sylvaticae* in Sibiria deficientis habenda esse possit.

ERITRICHIUM Schrad.

10. Sect. **Pseudohackelia** M. Pop. — Nuculae dorsiventraliter compressae, nec turbinatae ut in sectionibus *Eueritrichium* DC. et *Coloboma* DC., eis *Hackeliae* similes, sed gynobasis breviter pyramidalis, non plus quam 1 mm alta, qua nota ab *Hackelia* differt. Transitum praebet inter *Hackeliam* et *Eueritrichium*. Series *Albiflora* M. Pop. — Spinulae ad nucularum disci margines glochidiatae. Flores parvi, albi. Folia oblonga, brevia et lata. — Series tianschanica et pamirica. Seriei species: *E. latifolium* K. et K., *E. pamiricum* B. Fedtsch., *E. Fetissovii* Rgl., *E. pseudolatifolium* M. Pop. — Series est valde affinis generi *Tianschaniellae* B. Fedtsch.).

1. Plantae dense caespitosae; caudicis rami crassi reliquis foliorum dense obtecti. Pubes patula, nec adpressa . . . . . 2.
+ Plantae caespites non formantes, caudex parum ramosa . . . . . 3.
2. Folia obtusiuscula, pube densa patula canenscentia . . . . . **E. latifolium** K. et K.
+ Folia acutiuscula, viridia (Pamir) . . . . **E. pamiricum** B. Fedtsch.

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3. Pubes plantae patula ut in praecedentibus. Planta elatior, foliis majoribus (Tianschan centralis) . . . . . **E. Fetissovii** Rgl.

+ Pubes plantae adpressa. Planta humilis . . . . . 11. **E. pseudolatifolium** M. Pop.

Species omnes commemoratae inter se valde affines et verisimiliter varietates unae (*E. latifolium* K. et K.) sunt generis Tianschaniellae B. Fedtsch. quoque affines. Species (varietates) nostra nova a caeteris seriei pube in omnibus partibus plantae adpressa, radice tenui submonocephala, caulibus 10—15 cu altis, foliis latioribus et nuculis (juniores tantum vidi) margine espinulosis (?) pubescentibus differt.

Typus: In montibus tianschanicis Asiae Mediae ad trajectum Kukurtuk leg. Merzbacher (in Herb. Acad. Sc. URSS, Leningrad).

12. **E. pseudostrictum** M. Pop. sp. n. [Sect. *Pseudohackelia* M. Pop.; series *Himalaica* M. Pop. — Spinulae ad nucularum disci margines glochidiatae, interdum absunt. Flores mediocres coerulei. Folia linearia vel lineari-lanceolata, adpresse pilosa, sericeo-cana. — Species himalaicae: *E. longifolium* Decne., *E. strictum* Decne., *E. Jacquemontii* Decne. et forsan *E. spathulatum* Clarke. Species pamiricae: *E. dubium* O. Fedtsch., etc. (infra descriptae)].

Perenne, dense caespitosum. Radix crassa, multiceps. Caudicis rami breves, petiolorum reliquis incrassati. Planta omnis pilis adpressis erectis canescens. Caules numerosi erecti vel breviter adscendentes, tenues virgati, simplices, (15) 20—30 cm alti, adpresse pilosi cani. Folia anguste linearia, subfiliformia, rosularum cito evanescentia in petiolum attenuata, 3—5 cm longa, 2—4 mm lata, caulina sessilia, anguste linearia vel filiformia, 1—3 cm longa, 1—2 mm lata, acuta, subsericeo-cana. Racemi floriferi breves, fructiferi laxi erecti 2—3 cm longi aphylli, ad apices caulium solitarii vel bini. Pedicelli tenues longi, adpresse pubescentes, erecto-patuli, calyce 2—4-plo longiores, inferiores fructiferi 1—1.5 cm longi. Calyx 1 mm longus, lobis linearibus acutis, fructiferis immutatis, corolla coerulea myosotidea, limbo 7—8 mm in diam., tubo 1 mm longo. Fornices majusculi, albidi papillosi. Fructus orbiculato vel ovato pyramidalis, 3 mm altus, stylo inconspicuo. Nuculae oblongae, patule puberulae, lateribus minute tuberculatis satis elatis, disco (dorso) oblongo, subplano coerulescente dense minute tuberculato, margine utrinque cum spinulis glochidiatis brevibus firmis fere verticalibus 3—7. Gynobasis breviter pyramidalis, minus quam 1 mm alta.

In rupibus et declivibus schistosis. Pamir (Asia Media).

Typus: Ad fortalitium Tschaikovoi, in rupibus, 7 VIII 1931, Lipschitz, n° 756 (in Herb. Univers. Moscoviensis).

Ab *E. stricto* Decne. himalaico differt habitu dense caespitoso et foliis subfiliformibus. Nuculae in utraque specie valde similes. Ab *E. du-*

707 *bio* O. Fedtsch. simili foliis multo angustioribus et nucularum spinulis brevioribus, caespitositate quoque distinguitur. Designare possum beat. Brand (in Pflanzenreich 252, 1931) genera et species asiaticas in maximam confusionem conduxit.

13. **E. sub-Jacquemontii** M. Pop. sp. n. (Sect. *Pseudohackelia* M. Pop. — Series *Himalaica* M. Pop.).

Perenne. Radix tenuis caespites parvi densi. Planta omnis sericeo-cana. Caules tenues subfiliformes, procumbentes superne adscendentes, 5—10(15) cm longi, simplices. Folia brevia, caulina lineari-oblonga, 1—1.5 cm longa, 1—4 mm lata, obtusiuscula, plana, patentia, radicalia angustiora, lineari-spathulata. Racemi ad caulium apices breves, laxi pauciflori etiam fructiferi paulo elongati breves. Pedicelli capillares, fructiferi calyce 2—3-plo longiores, inferiores usque ad 1—1.5 cm longi, vulgo breviores, arcuato-nutantes. Calyx sericeo-pubescens, 1—1.5(2) mm longus, lobis oblongo-linearibus acutiusculis, fructiferis fere immutatis. Corolla pallide coerulea, parva; tubo calyci aequilongo, limbo 4—5 mm in diam. Fornices ovato-orbiculati, 0.5 mm alti. Nuculae in fructu unico saepissime 1—2 evolutae, 2(3) mm longae, oblongae, in sectione transversa trigonae, lateribus pumilis, disco (dorso) plano subtiliter carinato, margine utrinque spinulis brevissimis uniserialibus glochidiatis verticalibus (3)5—8 armato, ut et latera nuculae, pubescente, cicatrice subcentrali ovali substipitata. Gynobasis parvula, 0.5 mm alta, nuculis delapsis perforata.

Typus: Planities Pamir Asiae Mediae. Ad fl. Pschart, in rupibus in adverso angustiis Tugur-Dshilga, 13 VII 1931, Lipschitz, n° 451 (in Herb. Univers. Moscoviensis).

E. turkestanicum Franch. a nostro caespitibus densis pulvinatis, caulibus pumilis 2—8 cm altis, pedicellis erectis, nuculis espinulosis bene differt. *E. Jacquemontii* Decne. nostro habitu similis, sed ex icone Jaquemontii est vera *Hackelia* nec *Eritrichium*: gynobasis alta pyramidalis. Nuculis subalatis ala dentata a nostra specie quoque differt.

14. **E. sachalinense** M. Pop. sp. n. — *E. nipponicum* Sugaw. Ill. Fl. of Saghal. IV, 1575 tab. 720, non Makino (Sect. *Pseudohackelia* M. Pop.).

Perenne. Caespites laxi parvi; caudicis rami plus minusve elongati, rosulas et caules paucos edentes. Caules 1—3 ex uno caespite, pumili, (7) 10—15 cm alti, erecti vel arcuato-adscendentes, firmi, simplices, non dense adpresse pilosi, pilis albis sursum directis apicibus paulo adscendentibus dense et regulariter foliati. Folia rosularum et caulium conformia, rosularia tantum paulo longiora 2—5 cm longa, caulina ad apicem decrescentia, omnia lineari-lanceolata subspathulata, ad basin paulo angustata, rosularia apice obtusa, caulina subacuta, plana, sub apice 2—4 mm lata, pilis non perfecte adpressis vix canescentia. Racemi ad apices cau-

708 lium bini, floriferi abbreviati, serius paulo elongati, fructiferi usque ad 4 cm longi, erecti, basi paucis bracteis suffulti. Pedicelli breves, inferiores etiam fructiferi tantum 5 mm longi, superiores 2—3 mm longi, subadpresse puberuli. Calyx subadpresse pubescens, florifer 2 mm longus, fructifer fere immutatus. Corolla coerulea, tubo 1.5 mm longo, limbo plano 5—7 mm lato, lobis ovato-orbiculatis. Nuculae 3—4 mm longae, eis *Hackeliae* similes, lateribus humilibus vix 1 mm altis glabris, disco (dorso) plano utrinque margine spinulis 6 inaequalibus longiusculis disci latitudine vix brevioribus, basi albicantibus hispidulis apice coerulescentibus non glochidiatis apiculis (spinulis) sursum directis 2—3.

Typus: in montibus insulae Sachalin australis, collectores japonici (in Herb. Sachalinensi).

Ab *E. nipponico* Makino (*Hackelia nipponica* Brand) differt nostra species radice tenui non crassa, caespite laxiore, caulibus minus numerosis, pubescentia canenscente nec subsericea et floribus $1^1/_2$-plo minoribus-

15. **E. pulviniforme** M. Pop. sp. n. [Sect. *Coloboma* DC. Prodr.X (1846) 126.—Plantae dense caespitosae, ramis caudicis brevibus crassis. Pubescentia saepius sericea, rarius cana. Pedicelli satis breves. Folia linearia vel filiformia. Corona nucularum ex setis (spinulis) brevibus formata vel nulla.]

Perenne. Densissime caespitosum, sericeo-album, pumilum. Caudicis rami conferti, breves, clavato-incrassati, apice reliquiis petiolorum nigris densis squamosis incrassati, basi tenues fragiles non lignosi. Caules tenues, subfiliformes, 5—8(10) cm alti, simplices, pilis adpressis albis tecti. Folia sericeo-albida, parva, anguste linearia saepe subfiliformia, rosularia numerosissima 1—2(3) cm longa, 0.5 mm (rarius usque ad 1 mm) lata, obtusiuscula, flaccida, saepe curvata, caulina pauca anguste linearia, omnia interdum subspathulata. Racemi ad caulium apices solitarii, breves. Pedicelli breves, calyce non longiores, patentes. Calyx sericeus, florifer 2 mm longus. Corolla coerulea, parvula, limbo 4 mm in diam. Nuculae 1 mm altae, turbinatae, glabrae et laeves, margine espinulosae (ecoronatae), sed linea elevata et inflexa circumdatae.

Typus: In Mongoliae septentrionalis montibus Taischir-Ola. fl. fr., 15 VII 1877, Potanin (in Herb. Inst. Bot. Acad. Sc. URSS, Leningrad). Specimina visa: numerosa ex montibus Tannu-Ola, e vicinitate lacus Ubsa-Nor, etc.

Species *E. jenisseensi* Turcz. similis, sed magis caespitosa, subpulvinata vel pulvinata, pedicellis et racemis brevibus nuculisque margine elevata ad discum suffultis potius ad *E. rupestre* s. s. appropinquat.

Adnot.: *Eritrichium rupestre* (Pall.) Bge. est species dubia, ex descriptione originaria Pallasii dahurica, sed a Bunge pro altaica specie demonstrata et notis incertis limitata. In montibus Altaicis duo species

709 (formae) similes occurunt, a Bunge et Ledebour confusae. *E. subrupestre* M. Pop. sp. n. — nuculis coronatis et *E. altaicum* M. Pop. sp. n. — nuculis calvis, corona setarum destitutis, in caeteris notis simillimae, ambae verosimiliter a dahurica planta (*Myosotis rupestris* Pall.? — *Amblynotus obovatus* Johnst.) diversae. *E. jenisseense* Turcz. est species distincta *E. altaico* affinis, magis orientalis. In regione Tuva crescit species alia: *E. tuvinense* M. Pop. sp. n. — humile, caulibus 3—5(7) cm altis, pubescentia cana opaca subpatula a praecedentibus distinctum, corollis parvis, 3—4 mm in diam., pedicellis brevibus crassiusculis, declinatis nuculis ecoronatis (ut in *E. altaico* et *E. jenisseensi*), caudicis ramis lignosis (in regione Tuva ad opp. Kisil, 23 VI 1945, Sobolevskaja).

16. **E. mandshuricum** M. Pop. sp. n. (Sect. *Coloboma* DC. — Series *Rupestria* M. Pop.).

Dense caespitosum, caespitibus non amplis, ramis caudicis brevibus lignosis, apice ob reliquias petiolorum squamosas nigras subito incrassatis. Planta omnis pilis brevibus adpressis, densis, rectis et crassiusculis cana. Caules 15—30 cm alti, firmi, tenues, rigidi, erecti numerosi, simplices, cani. Folia angustissime linearia usque ad filiformia, valde elongata, rosularia pauca 3—6 cm longa, 1 mm lata, rigida erecta, caulina 2—3 cm longa, 1—0.5 mm lata, rigida, erecta acutiuscula. Racemi ad apices caulium solitarii breves, fructiferi elongati 3—5(10) cm longi, aphylli. Pedicelli erecti, adpressi, floriferi calyci aequilongi, saerius eo longiores, inferiores usque ad 0.8—1 cm longi, adpresse puberuli. Calyx adpresse canus, 2 mm longus, fructifer 3 mm longus lobis linearibus acutiusculis. Corolla coerulea limbo 6—8 mm in diam. Nuculae calvae laeves nitidae, lateribus 1 mm altis, disco 2 mm longo apice acuto linea media leviter carinato.

In rupibus Mandshuriae.

Typus: Ad stationem Jal, 9 VII 1901, Lipsky (in Herb. Acad. Sc. URSS, Leningrad).

Ab affinibus pubescentia cana foliisque angustissimis elongatis distinguitur.

17. **E. sichotense** M. Pop. sp. n. (Sect. *Coloboma* DC. — Series *Pectinata* M. Pop.).

Perenne vel bienne. Radix tenuis. Caespites parvi, densi. Folia rosularia cano-sericea, lineari-lanceolata vel lanceolata, acuta, nervo medio valido, 5—7 cm longa, usque ad 7 mm lata. Caules adscendentes vel erecti, 20—30 cm alti, firmi, adpresse cani, apice ramosi. Folia caulina linearia, erecta, 2—3 cm longa, 2—5 mm lata. Racemi fructiferi 5—10 cm longi, erecti, subpahylli. Pedicelli tenues erecti, inferiores usque ad 1—2 cm longi, canescentes. Calyx florifer 2 mm, fructifer 3—4 mm longus, lobis linearibus acutis, canis. Corolla coerulea, limbo plano ca. 7 mm in diam. Nuculae lateribus 1 mm altis glabris laevibus, disco 2.5—3 mm longo,

710 puberulo margine utrinque setis (spinulis) 5—10 longis erectis coerulescentibus apice subglochidiatis armata.

In rupibus Extremi Orientis ussuriensis, in montibus Sichote-Alin.

Typus: in valle fl. Suczan (Sutschan) prope pagum Novitzkoe, 30 VI 1921, Schischkin, n° 2782 (in Herb. Vladivostok.).

Valde affine *E. incano* (Turcz.) DC. dahurico, ab eo foliis acutis sericeis distinctum.

18. **E. jacuticum** M. Pop. sp. n. (Sect. *Coloboma* DC. — Series *Pectinata* M. Pop.).

Perenne. Caespites parvi, laxi. Rosulae paucae; earum folia viridescentia pilis patulis sparsis obsita, magna, 3—7 cm longa, lata, spathulata obtusa, sub apice usque ad 1 cm lata. Caules pauci ex uno caespite, patule hirsuti, apice ramosi. Folia caulina lanceolato-linearia, 2—3(4) cm longa, acutiuscula viridescentia, patentim pilosa. Racemi fructiferi usque ad 10 cm longi, tenues, erecti, adpresse pubescentes. Pedicelli longi, fructiferi usque ad 1.5—2 cm longi, tenues erecti, adpresse puberuli. Calyx adpresse strigillosus, canescens 2—3 mm longus, lobis linearibus. Corolla coerulea myosotidea, limbo 7—10 mm in diam. Nuculae majusculae, lateribus laevibus, disco 2 mm longo, laevi, margine spinulis basi dilatatis longis pectinatis hispidulis ad discum inflexis coerulescentibus vel viridibus armato. Stigma e nuculis saepe exsertum.

In Sibiriae boreali-orientali regionibus Jacutiae, Ochotiaeque.

Typus: Ad fl. Aldan, 736 kil. ab ostio fl. Maja, 20 VII 1928, Melvil, n° 390 (in Herb. Acad. Sc. URSS, Leningrad).

Affine sine dubio *E. incano* (Turcz.) DC. unacum eo folia lata et obtusa habet, sed pubescentia patula hirsuta statim dignoscitur.

LAPPULA Moench

19. **L. aktaviensis** M. Pop. et Zak. (Sect. *Eulappula* Gürke. — Series *Rupestres* M. Pop.).

Biennis. Radix tenuis verticalis. Rosula radicalis ad fructificationis tempus evanescens, densa, foliis latiuscule spathulatis obtusis, 3 cm longis et sub apice usque ad 5—6 mm latis, pilis patulis canescentibus. Caules 15—20 cm alti, rigidi, erecti, pilis adpressis cani, fere a basi vel superne paniculato-ramosi, ramis tenuibus patentibus non elongatis. Folia caulina ca. 1 cm longa, late-linearia, obtusa patentia, pube patula rigida canescentia. Racemi fructiferi 3—5 cm longi, densi, paniculatim dispositi. Pedicelli fructiferi 1—2 mm longi, adpresse puberuli, erecti vel vix curvati. Calyx florifer 1—1.5 mm longus, adpresse cano pubescens fructifer usque ad 2 mm longus, lobis obtusis fructui adpressis. Corolla coerulea, limbo videtur (ex floribus ultimis) plano ca. 3 mm lato, verosimiliter in floribus primariis subduplo majore. Fructus oblongus, 2.5—3 cm altus. Nuculae

711 oblongae, lateribus minute tuberculato-asperulis, disco oblongo-lanceolato carina breviter glochidiato-spinulosa ornato et margine aculeis (spinulis) uniserialibus brevibus (0.2—0.5 mm longis), crebris utrinque 7—9 erectis glochidiatis. Stylus subnullus: stigma fere sessile, inter nuculas absconditum.

In semidesertis saxosis in montibus Aktau deserti Kisil-Kum Asiae Mediae, rarissime.

Typus: montes Aktau, 3 VI 1932, Nikitin et Michajlova, n° 145 (in Herb. Acad. Sc. URSS, Leningrad).

Species obscura. Habitu et nuculis valde similis *L. microcarpae* (Ldb.) Gürke in omni Asia Media montana vulgatissimae, sed defectu styli ab ea statim dignoscitur et in seriem alteram (non *Microcarpae* M. Pop.). collocanda est; an specimina anomala *L. microcarpae?*

20. **L. coronifera** M. Pop. sp. n. (Sect. *Eulappula* Gürke. — Ser. *Sub-Lepechiniella* M. Pop. — In eodem fructu nuculae 1—2 alatae, 1—2 exalatae. Flores plerumque minores, saepe albi, in nostra — coerulei. Transitum praebet a *Lappula* ad *Lepechiniellam*).

Annua. Caules erecti tenues, ca. 20 cm alti, pilis non dense adpressis canescentes, superne ramosi. Folia (caulina) linearia, 2 cm longa, 1.5 mm lata, patule et sparse pilosa, acuta. Racemi laxi, subaphylli. Pedicelli fructiferi 1—2 mm longi, adpresse pubescentes, declinati et etiam reflexi. Flores parvi coerulei, limbo corollae campanulato 3 mm in diam. Fructus cum nuculis omnibus alatis vel ex parte alatis. Nucularum ala laevis lata flavescens cupulam latam altam aemulans, margine profunde in dentes triangulari-lanceolatos apice glochidiatos fissa; latera nucularum acute albo tuberculata, discum leviter carinatum. Nucularum exalatarum discus anguste lanceolatus margine spinulis utrinque 4—5 uniserialibus longis rigidis armatus. Stylus 0.1—0.2 mm longus. Gynobasis et nuculae 2.5 mm longae. Calycis lobi fructiferi stellatim patentes, ca. 3 mm longi.

In Asia Media (ad limites Sibiriae) prope fl. Irtysch, ad rivulum Tschar-Gurban prope pagum Taubinka, 26 VI 1914, Schipczinsky, n° 1103a.

Verisimiliter species hybrida: *Lepechiniella omphaloides* (Schrenk) M. Pop. × *Lappula stricta* (Ldb.) Gürke, sed certe characteribus firmis constanter a parentibus diversa; an monstrositas *Lappulae strictae*?

21. **LEPECHINIELLA** M. Pop. gen. n.

(*Eritrichieae*). Calyx fere ad basin in lobos lineares obtusiusculos, in fructu fere non mutatos vix elongatos divisus. Corolla brachymopha, myosotidea, parva, limbo 3—10 mm lato. Fornices in fauce dispositi, parvi, sed bene distincti. Antherae et stylus in corollae tubo inclusae, infra fornices. Gynobasis subprismatica, tetragona, angusta. Nuculae ad gynobasin cicatrice (areola) parva basi ventrali affinae, supra areolam cum

712 gynobasi interno (carina ventrali) connatae ipsa apice liberae, stylum et gynobasis apicem occultantes, triangulari-oblongae, margine late alatae.

Species varias ad Paracaryum (*Cynoglosseae*) vel ad Eritrichium aut Oreogeniam (*Eritrichieae*) ab auctoribus adnumeratas et nonnullas novas in hoc genus retuli. Genus *Lepechiniella* magis affine est *Lappulae*, a qua tantum gynobasi prismatica, crassiore et beviore, nec elongata subulata nuculisque saepissime omnibus alatis differt, cum ea intermediis conjuncta.

Species 8—9 in Asiae Mediae montibus.

1. Nucularum ala integra. — Sect. *Holoptereae* M. Pop. Species 2 valde affines: *L. seravschanica* (Lipsky) M. Pop. = *Paracaryum seravschanicum* Lipsky, 1910, 488 et *L. arassanica* (B. Fedtsch.) M. Pop. = *Eritrichium arassanicum* B. Fedtsch., 1913, 57 = *Oreogenia arassanica* Brand, 1931, 186.
2. Nucularum ala grosse dentata. — Sect. *Lophoptereae* M. Pop. Species 6—7 affines, in Lappula seriei *Sub-Lepechiniella* transeuntibus: *L. minuta* (Lipsky) M. Pop. = *Paracaryum minutum* Lipsky, 1910, 489 = *Mattiastrum minutum* Brand, 1915, 156. *L. omphaloides* (Skhrenk) M. Pop. = *Echinospermum omphaloides* Schrenk 1845, 211 cum varietate *balchaschensi* M. Pop. (*L. balchaschensis* M. Pop. sp. n.) et 4 de novo descriptae, sequentes.

22. **L. transalaica** (B. Fedtsch.) M. Pop. sp. n. — *Paracaryum transalaicum* B. Fedtsch. Раст. Туркест. (1915) 652 (nomen) et specim. auth. in Herb. Leninop. (Sect. *Lophoptereae* M. Pop.).

Perennis. Radix tenuis atra, apice oligocephala caespitem parvum densum formans. Folia rosularum (fasciculorum) elongato-linearia, 4—10 cm longa, paulo spathulata, cano-sericea, interdum complicata, 2—4(5) mm lata, obtusiuscula. Caules 3—6(8) ex uno caespite, arcuato-adscendentes vel suberecti, 10—25 cm alti, pilis adpressissimis cani rarius simplices, saepius patenter breviter ramosi. Folia caulina numerosa (usque ad 10 in numero), linearia, 1—3 cm longa, 1—3 mm lata, obtusiuscula, sericeo-cana. Racemi paniculato-corymbosi, laxiusculi, fructiferi elongati, aphylli erecti usque ad 5—6 cm longi. Pedicelli tenues breves, fructiferi inferiores usque ad 5 mm longi, adpresse pubescentes. Flores majusculi. Calyx adpresse sericeus circa 2 mm longus, lobis linearibus acutiusculis, fructiferis non elongatis reflexis. Corolla coerulea, rarius alba, limbo plano 5—8 mm in diam., tubo brevi. Fornices ca. 1 mm longi. Nuculae omnes alatae, cum ala 5—7 mm in diam., orbiculato-ovatae, disco (facie dorsali) angusto lanceolato minute tuberculato; ala lata flavescens ipse margine coerulescens, plana vel vix undulata, margine grosse et acute dentata disco latiore. Nuculae latera dense papilloso-aculeata. Gynobasis 2—2.5 mm alta. Stylus 0.5 mm longus.

Hab. in planitie elata Pamir Asiae Mediae.

713 Typus: In jugo Transalaico in initiis fl. Kisil-Su, fr., 20 VII 1878, Kuschakevicz (in Herb. Inst. Bot. Acad. Sc. URSS, Leningrad).

23. **L. Korshinskyi** M. Pop. sp. n. (Sect. *Lophoptereae* M. Pop.).

Perennis, non dense caespitosa, radice brevi, caudicis ramis paucis crassis residuis squamatis foliorum annorum praeteritorum obtectis. Folia rosularum 3 cm longa, lanceolato-spathulata sub apice usque ad 4 mm lata, obtusiuscula, plana, persistentia, adpresse et dense cano-sericea. Caules ex uno caespite nonnulli (ca. 5), erecti vel adscendentes, firmi tenues, simplices, apice tantum furcato-ramosi adpresse pilosi. Folia caulina satis numerosa, usque 10—20, lanceolata, 1—2(3) cm longa, plana, patentia, obtusiuscula, adpresse sericeo-pilosa. Racemi floriferi breves, fructiferi elongati, 5—7 cm longi, oblique erecti, dissitiflori, bracteis parvis suffulti. Pedicelli fructiferi erecti 1—3 mm longi. Calyx florifer adpresse sericeus, lobis linearibus obtusis 3 mm longis, fructiferis fere immutatis erectis fructui adpressis. Corolla coerulea, limbo fere plano 5 mm lato. Nuculae in eodem fructu alatae et exalatae. Nuculae 5 mm in diam. (cum ala), ala lata plana utrinque margine 5—6-dentata, dentibus glochidiato-mucronatis. Nuculae exalatae margine breviter spinuloso-dentatae, Nucularum omnium discus oblongus parce spinulosus vel tuberculato-carinatus; nucularum facies laterales tuberculatae. Stylus tenuis, 0.5 mm longus, inter nuculas maturas inconspicuus.

Typus: In Asiae Mediae montibus tianschanicis jugo Ferganensi, montes Baubasch-Ata prope pagum Arslambob, ad declivia lapidosa 2500—3000 m alt., 11 VIII 1895, Korshinsky, n° 5852 (In Herb. Acad. Sc. URSS, Leningrad).

Specimina visa: Prope pagum Arslambob, Kisil-Ungur, 27 VI et 29 VIII 1945, Matveeva.

24. **L. ferganensis** M. Pop. sp. n. (Sect. *Lophoptereae*).

Biennis (vel perennis?). Radix crassitie pennae anserinae, apice oligocephala caespitem parvum formans. Folia surculorum (rosularum) cito evanescentia, angusta, lineari-lanceolata, spathulata, 3—5 cm longa, sub apicè 3—7 mm lata, adpresse cano-pilosa. Caules 5—10 ex una radice, laterales, arcuato-adscendentes, crassiusculi, rigidi, subflexuosi, 30—50 cm alti, non dense adpresse pilosi canescentes, fere a basi vel a medio squarroso ramosi, ramis tenuibus adscendentibus floriferis. Folia caulina sparsa lineari-spathulata, quam rosularia breviora, saepe complicata, adpresse cano-pilosa, acutiuscula, patentia. Racemi floriferi densi, post florescentiam elongati, fructiferi laxi bracteis minimis inconspicuis. Flores parvi, coerulei. Pedicelli adpressissime pubescentes cani fructiferi erecti, calyci subaequilongi, rigidi. Calyx parvus, fructifer 1.5—2 mm longus, lobis lineari-spathulatis, fructu adpressis, obtusiusculis adpresse puberulis. Corolla coerulea, parva 2—3 mm in diam., infundibuliformis. Fructus oblongus,

714 stylo brevi coronatus, heteromericarpus, 3—3.5 mm altus. Nucularum ala lata rigida flavescens plana disco sublatior crenati-dentata. Nuculae exalatae ad margines disci utrinque 5-dentatae. Discus nucularum viridis, minutissime tuberculatus, lanceolatus, media linea minute tuberculatus.

Typus: In Asiae Mediae montibus alaicis in valle Alai ad montem Kultzcha, 26 VI 1931, Lipschitz, n° 248 (in Herb. Univers. Moscoviensis).

25. **L. alaica** M. Pop. sp. n. (Sect. *Lophoptereae*).

Valde affinis *L. ferganensi*, biennis, folia rosularum anguste linearia, 4—8 cm longa 1—2 mm lata, subsericeo-cana. Caules tenues flexuosi 12—20 cm alti, foliis caulinis linearibus. Nuculae omnes alatae, *L. ferganensi* similes. Stylus alte supra nuculas excedens, ca. 1 mm altus.

Typus: in Asiae Mediae valle Alai secus fl. Kisil-Su prope pagum Dshekaindy, 21 VI 1913, Desiatova, n° 1318. (In Herb. Acad. Sc. URSS, Leningrad).

RINDERA Pall.

26. **R. holochiton** M. Pop. sp. n. (Sect. *Eurindera?*).

Radix tenuis obliqua atra apice 2—3-cephala. Caules 15—25 cm alti, simplices vel pauciramosi, tenues, non dense patule crispulo-villosi, in inflorescentia fere tomentosi. Folia radicalia petiolis longis (5—8 cm long.), tenuibus, pilis brevibus mollibus paulo retrorsis tectis, limbis oblongis quam petioli $1^1/_2$-plo brevioribus 3—5 cm longis, 2—3 cm latis, utrinque fere aequaliter angustatis acutis planis in utraque pagina semipatule pubescenti-pilosa, uninervia. Folia caulina lanceolata sessilia, in numero 5—8, erecta, acuta, 2—4 cm longa, 0.4—1 cm lata, in utraque pagina molliter pubescenti-pilosa. Inflorescentia parva ex racemis 2 terminalibus et 1—2 ramulorum lateralium composita, tomentosa. Cincinni floriferi 2 cm, serius usque ad 5 cm longi laxiusculi. Pedicelli 3—5 mm longi erecti. Calyx non dense lanatus, 6 mm florifer longus, fructifer 8 mm longus, lobis linearibus obtusiusculis. Corolla violascens, 8—10 mm longa, tubo calyci aequilongo, lobis oblongo-spathulatis obtusis 4 mm longis erectis. Fornices nulli, plicis transversalibus substituti. Antherae oblongae, 3 mm longae, obtusae, basi vix sagittatae. Filamenta antheris duplo breviora. Stylus e corolla longe excedens. Nuculae . . . . . (ex junioribus observatae: laeves, ala margine minute denticulata).

In Asiae Mediae montibus tianschanicis, jugum Ferganense ad trajectum Kugart, 3000 m, 6 VIII 1895, Korshinsky, n° 3833 (in Herb. Acad. Sc. URSS, Leningrad).

Species quoad sectionem dubia, ut videtur *Eurindera*, sed ab omnibus hujus sectionis speciebus pubescentia distinctissima, qua nota magis ad *Echinorinderas* appropinquat, nempe ad *R. oblongifoliam* M. Pop., sed differt ab ea laminis foliorum 2—3-plo minoribus et caule humili, nec non disco nucularum laevi.

27. **P. karataviense** Pavl. ex M. Pop. [Sect. *Modestomattiastrum* (Brand) M. Pop. — Generis *Matthiastri* sect. 2. *Modestomattiastrum* Brand in Engl. Pflanzenr. IV, 252 (1921) 60].

Perenne. Radix crassa, apice ramosa indurata, ramis tenuibus prostratis. Folia rosularum (radicalia) spathulato-linearia, acutiuscula, 4—5 cm longa, in petiolum angustata, caulina lanceolata sessilia margine leviter undulata, patenter et molliter pilosa. Caules ex una radice pauci 10—20 cm alti firmi, hirsuti, apice breviter ramosi. Racemi floriferi densi, fructiferi elongati, laxi, erecti, aphylli. Pedicelli infimi usque ad 8 mm longi, calyce longiores, superiores breviores, omnes patentissime pilosi, erecti. Flores majusculi atroviolacei nec coerulei. Calyx 3—4 mm longus, fructifer ad 6 mm elongatus, lobis lanceolatis, acutiusculis vel obtusis, apice glabrescentibus. Corolla atroviolacea, tubo crasso calyce paulo breviore 3 mm longo, limbo 3 mm longo campanulato lobis semiorbicularibus. Fornices majusculi 1.5 mm alti, oblongi, atri, papillosi. Stamina tubo corollae inclusa, antheris oblongis 2 mm longis, filamentis brevissimis. Stylus brevis 2 mm longus crassus. Nuculae (semimaturae!) laeves, ala angusta erecta margine utrinque spinulis glochidiatis 7 munita circumdatae. Nuculae maturae verisimiliter 10 mm in diam., stylo 3—4 mm longo coronatae.

Typus: in Asiae Mediae montibus Karatau (Lipschitz, Tekutjev, n° 77). (In Herb. Univers. Moscoviensis).

Species affinis *P. laxifloro* Trautv. sed corolla magis brachymorpha stylo et staminibus inclusis, fornicibus attamen elongatis. A *P. himalayense* Klotzsch floribus duplo majoribus, corolla atroviolacea bene dignoscitur.

28. **PARACYNOGLOSSUM** M. Pop. gen. n.

Cynoglossi species variae, DC., Clarke, Brand aliique; *Cynoglossum* auct. ex parte.

Affine *Cynoglosso* L., generi palaeomediterraneo, ab eo tamen nuculis 2.5—3 mm longis, gynobasis columna („stylo") sine aristis secedentibus differt. — Flores plerumque minores, quam in Cynoglossis veris, plantae saepissime annuae vel biennes, tropicae vel rarius subtropicales regionis Sinae et Japoniae atque Himalayae et Australiae) nec regionis Palaeomediterraneae.

Ad *Paracynoglossum* M. Pop. species sequentes referro: *C. denticulatum* DC. (generis typus), *C. glochidiatum* Wall., *C. furcatum* Wall., *C. zeylanicum* Thunb., *C. javanicum* Thunb., *C. imeretinum* Kusn. (vix a *C. furcato* Wall. diversum), *C. asperrimum* Nakai (aequi modo *C. furcato* Wall. affine), *C. lanceolatum* Forsk., *C. australe* R. Br., *C. suaveolens* R. Br. Species boreali-americanae generis Cynoglossi auct. (subgeneris *Eleutherostylum* Brand) ad genera alia (nova) referenda sunt.

716 Genus *Cynoglossum* L. verum est genus regionis Palaeomediterraneae species sequentes (11—12) continens: *C. officinale* L., *C. montanum* L., *C. Dioscoridis* Vill., *C. Columnae* Ten., *C. clandestinum* Desf. etc.

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VEGETATION REGIONS OF THE USSR

Abbreviated name	Full name
I. Arctic	
1. Arc. Eur.	Arctic (European part)
2. Nov. Z.	Novaya Zemlya
3. Arc. Sib.	Arctic (Siberia)
4. Chuk.	Chukchi
5. An.	Anadyr
II. European part	
6. Kar.-Lap.	Karelia-Lapland
7. Dv.-Pech.	Dvina-Pechora
8. Balt.	Baltic States
9. Lad.-Ilm.	Ladoga-Il'men
10. U. V.	Upper Volga
11. V.-Kama	Volga-Kama
12. U. Dnp.	Upper Dnieper
13. M. Dnp.	Middle Dnieper
14. V.-Don.	Volga-Don
15. Transv.	Transvolga area
16. U. Dns.	Upper Dniester
17. Bes.	Bessarabia
18. Bl.	Black Sea area
19. Crim.	Crimea
20. L. Don.	Lower Don
21. L. V.	Lower Volga
III. Caucasus	
22. Cisc.	Ciscaucasia
23. Dag.	Dagestan
24. W. Transc.	Western Transcaucasia
25. E. Transc.	Eastern Transcaucasia
26. S. Transc.	Southern Transcaucasia
27. Tal.	Talysh
IV. West Siberia	
28. Ob	Ob region (from the eastern slopes of the Urals to the Yenisei River)
29. U. Tob.	Upper Tobol

30. Irt. . . . . Irtysh
31. Alt. . . . . Altai

V. East Siberia

32. Yenis. . . . . Yenisei
33. Lena-Kol. . . . . Lena-Kolyma
34. Ang.-Say. . . . . Angara River-Sayans
35. Dau. . . . . Dauria

VI. Far East

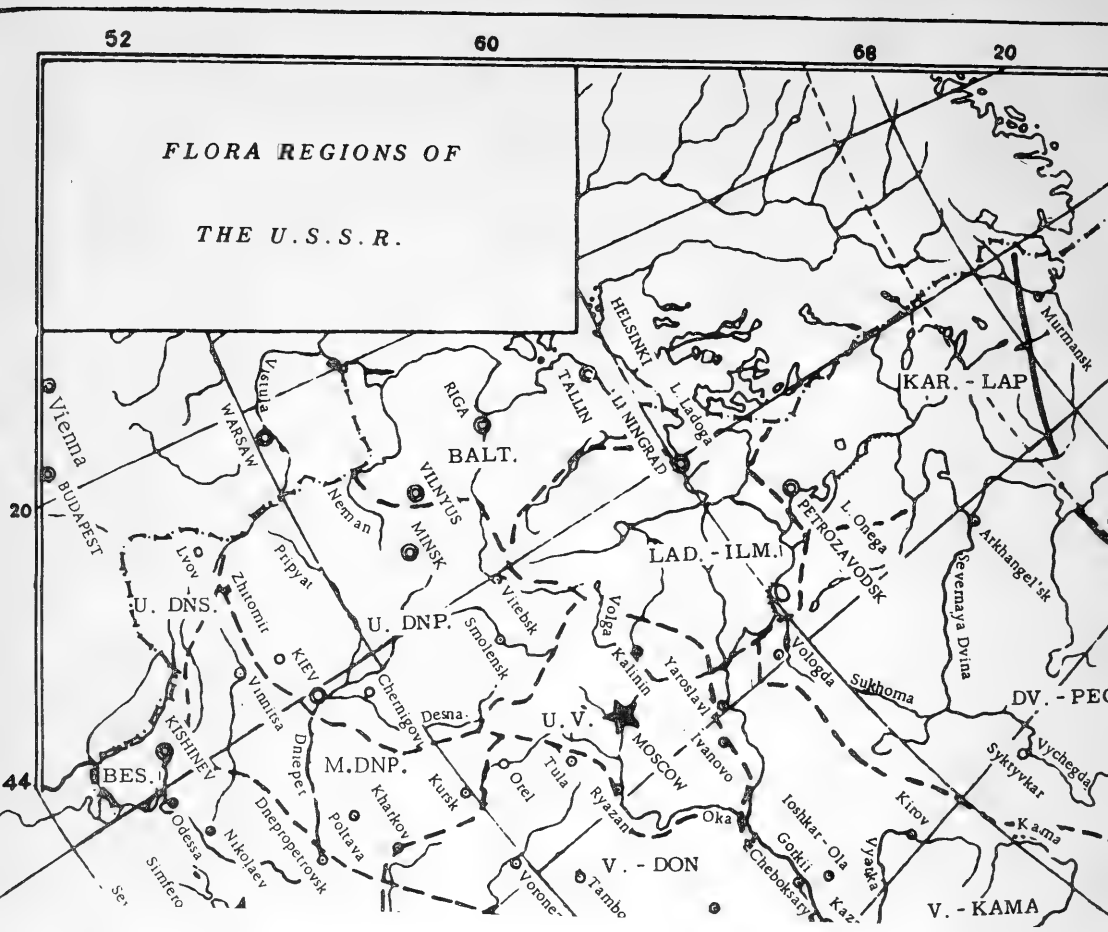
36. Kamch. . . . . Kamchatka
37. Okh. . . . . Okhotsk
38. Ze.-Bu. . . . . Zeya-Bureya
39. Uda . . . . . Uda River area
40. Uss.. . . . . Ussuri
41. Sakh. . . . . Sakhalin

VII. Soviet Central Asia

42. Ar.-Casp. . . . . Aral-Caspian
43. Balkh. . . . . Lake Balkhash area
44. Dzu.-Tarb. . . . . Dzungaria-Tarbatagai
45. Kyz. K. . . . . Kyzyl-Kum
46. Kara K. . . . . Kara-Kum
47. Mtn. Turkm. . . . . Mountainous part of Turkmenistan
48. Amu D. . . . . Amu Darya
49. Syr D. . . . . Syr Darya
50. Pam.-Al. . . . . Pamir-Alai
51. T. Sh. . . . . Tien Shan

Accepted Regions for Indication of General Distribution of Species Appearing in "Flora of the U.S.S.R."

I. Arc. . . . . Arctic (Spitsbergen, Greenland and farther)
II. Scand. . . . . Scandinavia (Norway, Denmark, Sweden, Finland)
III. Centr. Eur. . . . . Central Europe (Germany, Poland, Czechoslovakia, Hungary, Austria, Switzerland)
IV. Atl. Eur. . . . . Atlantic Europe (Netherlands, Belgium, England, France, Portugal)
V. Med. . . . . Mediterranean (including North Africa)
VI. Bal.-As. Min. Balkan Peninsula and Asia Minor
VII. Arm.-Kurd. . . . . Lesser Armenia and Kurdistan
VIII. Iran. . . . . Iran and Afghanistan
IX. Ind.-Him. . . . . India and Himalayas
X. Dzu.-Kash. . . . . [Dzungaria-Kashgar area] Eastern or Chinese Turkestan (Sinkiang)


52
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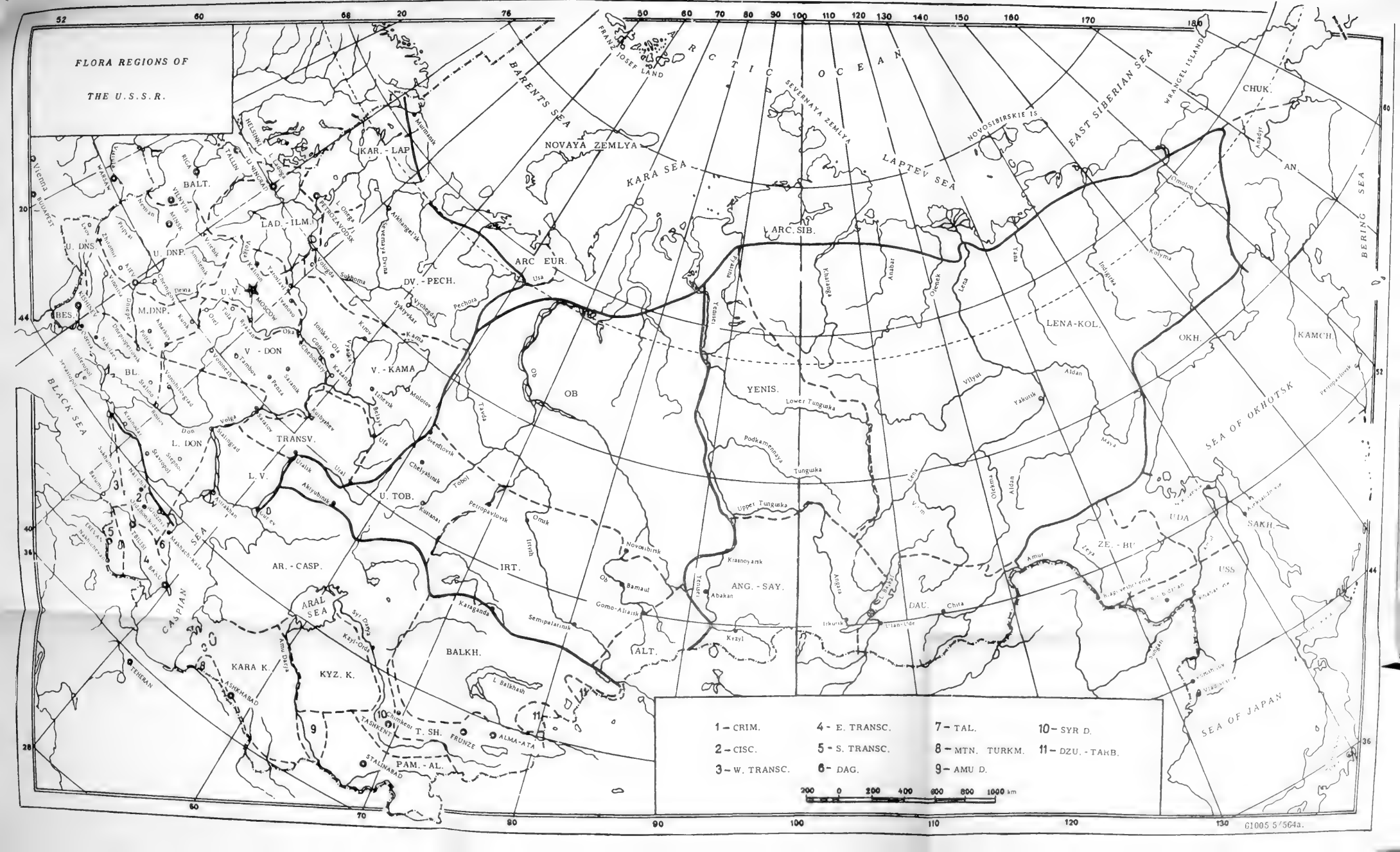
68
20
FLORA REGIONS OF
THE U.S.S.R.
HELSINKI
Murmansk
KAR. - LAP
Vienna
BUDAPEST
Vistula
WARSAW
RIGA
TALLIN
LENINGRAD
L. Ladoga
BALT.
20
Neman
VILNYUS
MINSK
L. Onega
PETROZAVODSK
Arkhangel'sk
Severnaya Dvina
LAD. - ILM.
Lvov
Pripyat
Zhitomir
U. DNS.
U. DNP.
Vitebsk
Volga
Kalinin
Yaroslavl
Vologda
Sukhoma
DV. - PEC
KIEV
Smolensk
Vinnitsa
Chernigov
Desna
U. V.
MOSCOW
Ivanovo
Vychegda
Syktyvkar
KISHINEV
Dnepr
M.DNP.
Tula
Orel
Kursk
Ryazan
Oka
Kirov
Kama
44
BES.
Odessa
Nikolaev
Dnepropetrovsk
Poltava
Kharkov
Ioshkar - Ola
Gorkii
Cheboksary
Vyatka
Simfero
Voronezh
Tambov
V. - DON
V. - KAMA


FLORA REGIONS OF
THE U.S.S.R.
BARENTS SEA
KARA SEA
NOVAYA ZEMLYA
FRANZ JOSEF LAND
ARCTIC OCEAN
SEVERNAYA ZEMLYA
LAPTEV SEA
NOVOSIBIRSKIE IS
EAST SIBERIAN SEA
WRANGEL ISLAND
BERING SEA
SEA OF OKHOTSK
SEA OF JAPAN
BLACK SEA
CASPIAN SEA
ARAL SEA
KAR. - LAP
BALT.
LAD. - ILM.
U. DNS.
U. DNP.
M.DNP.
U. V.
V. - DON
V. - KAMA
TRANSV.
L. V.
L. DON
BES.
BL.
DV. - PECH.
ARC EUR.
ARC. SIB.
OB
YENIS.
LENA-KOL.
OKH.
KAMCH.
CHUK.
AN.
U. TOB.
IRT.
AR. - CASP.
ANG. - SAY.
DAU.
ZE. - BU.
UDA
SAKH.
USS
ALT.
BALKH.
KARA K.
KYZ. K.
PAM. - AL.
T. SH.
1 - CRIM.
2 - CISC.
3 - W. TRANSC.
4 - E. TRANSC.
5 - S. TRANSC.
6 - DAG.
7 - TAL.
8 - MTN. TURKM.
9 - AMU D.
10 - SYR D.
11 - DZU. - TAKB.
200 0 200 400 600 800 1000 km
G1005 5/564a.

XI. Mong.	Mongolia
XII. Jap.-Ch.	Japan and China
XIII. Ber.	North American coast of the Bering Sea
XIV. N. Am.	North America (U. S. A. and Canada)
XV. Tib.	Tibet

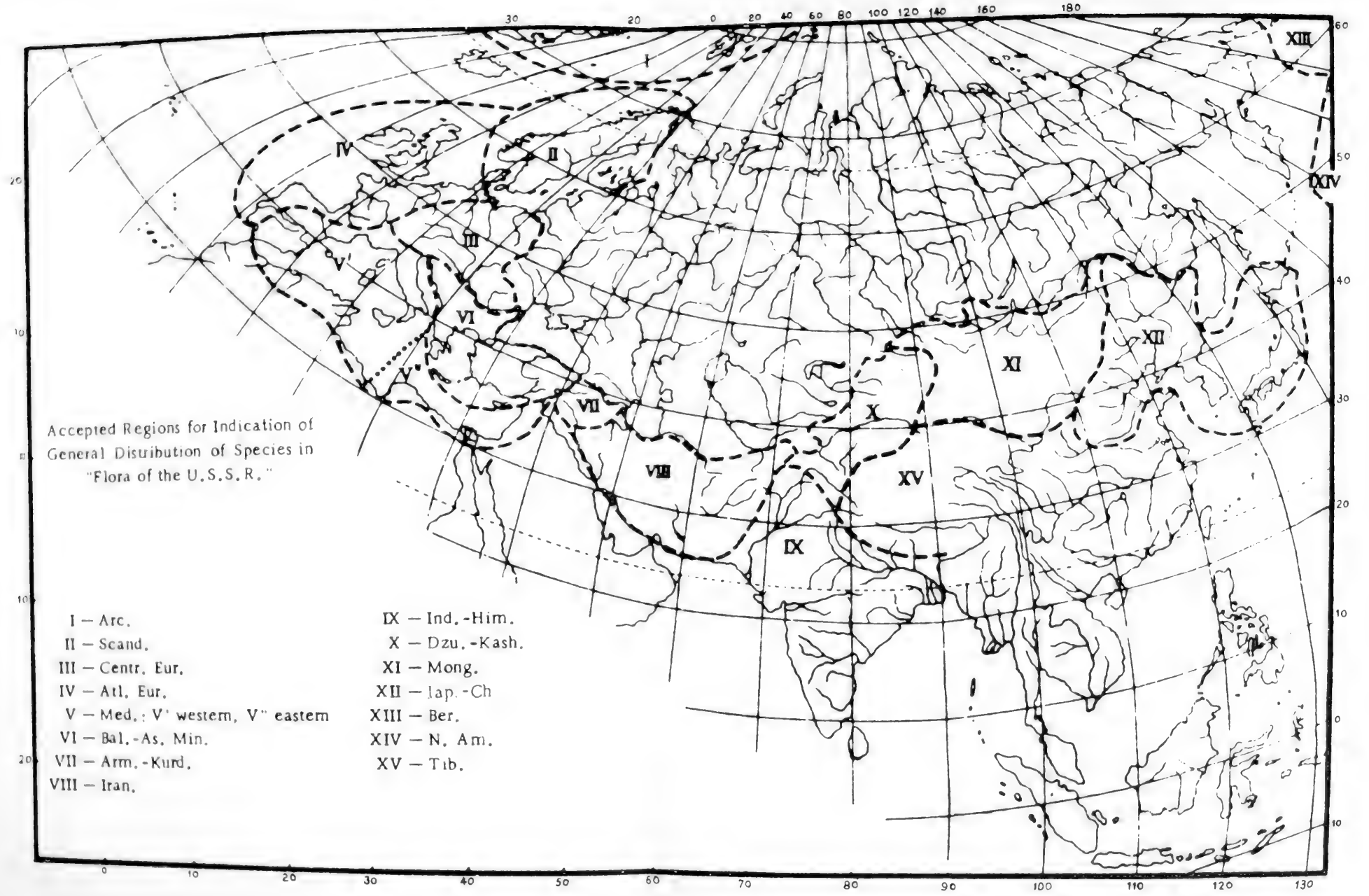
Other Geographical Abbreviations

Afr.	Africa
Aust.	Australia
Centr.	Central
E.	East(ern)
Gr.	Great, Greater
I.	Island
Is.	Islands
Mt.	Mount
Mts.	Mountains
N.	North(ern)
R.	River
S.	South(ern)
W.	West(ern)

TRANSLATOR'S NOTE

1. The Russian term "Srednyaya Aziya" is, in English, Central Asia (or Soviet Central Asia). Therefore the term Middle Asia has been used for Russian "Tsentral'naya Aziya," which is non-Soviet inner Asia, comprising western China (Sinkiang and Tibet) and Mongolia.

2. According to Russian usage, the European part of the USSR is "eastern Europe." Therefore "western Europe" includes the whole of Europe outside the USSR.


Accepted Regions for Indication of General Disuribution of Species in "Flora of the U.S.S.R."
I — Arc.
II — Scand.
III — Centr. Eur.
IV — Atl. Eur.
V — Med.: V' western, V" eastern
VI — Bal.-As. Min.
VII — Arm.-Kurd.
VIII — Iran.
IX — Ind.-Him.
X — Dzu.-Kash.
XI — Mong.
XII — Jap.-Ch
XIII — Ber.
XIV — N. Am.
XV — Tib.

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EXPLANATORY LIST OF ABBREVIATIONS OF RUSSIAN INSTITUTIONS AND PERIODICALS APPEARING IN THIS TEXT

Abbreviation	Full name (transliterated)	Translation
Bot.-geogr. issled. v Turkest.	Botaniko-geograficheskie issledovaniya v Turkestane	Botanical and Geographical Investigations in Turkestan
Bot. Mat. Gerb. Bot. inst. AN SSSR	Botanicheskie Materialy Gerbariya Botanicheskogo instituta AN SSSR	Botanical Materials of the Herbarium of the Botanical Institute of the Academy of Sciences of the USSR
Bot. Mat. Gerb. Gl. Bot. Sada	Botanicheskie Materialy Gerbariya Glavnogo Botanicheskogo Sada	Botanical Materials of the Herbarium of the Main Botanical Gardens
Bot. zap. SPb. univ.	Botanicheskie zapiski Sankt-Peterburgskogo universiteta	Botanical Notes of St. Petersburg University
Bot. zhurn. SSSR	Botanicheskii zhurnal SSSR	Botanical Journal of the USSR
Byull. Glavn. Bot. Sada	Byulleten' Glavnogo Botanicheskogo Sada	Bulletin of the Main Botanical Gardens
Byull. Obshch. lyubit. estestvozn., etnogr.	Byulleten' Obshchestva lyubitelei estestvoznaniya, antropologii i etnografii	Bulletin of the Naturalists', Anthropologists' and Ethnographers' Society
Byull. Voronezh. obshch. estestv.	Byulleten' Voronezhskogo obshchestva estestvoispytatelei	Bulletin of the Voronezh Society of Naturalists
Dendr.	Dendrarii	Arboretum
Der. i kust.	Derev'ya i kustarniki	Trees and Shrubs
Der. i kust. Kavk.	Derev'ya i kustarniki Kavkaza	Trees and Shrubs of the Caucasus
Dikie polezn. i tekhnich. rasteniya SSSR	Dikie poleznye i tekhnicheskie rasteniya SSSR	Useful Wild Plants and Industrial Crops of the USSR
Dikorastushchie r. Kavkaza, ikh rasprostranenie, svoistva i primenenie	Dikorastushchie rasteniya Kavkaza, ikh rasprostranenie, svoistva i primenenie	Wild Plants of the Caucasus, Their Distribution, Properties and Uses
Dokl. AN Azerb. SSR	Doklady Akademii Nauk Azerbaidzhanskoi SSR	Reports of the Academy of Sciences of the Azerbaijan SSR

Fl.	Flora	Flora
Fl. Abkh.	Flora Abkhazii	Abkhasian Flora
Fl. Almat. zapovedn.	Flora Alma-Atinskogo zapovednika	Flora of the Alma-Ata Reserve
Fl. Alt.	Flora Altaya	Altai Flora
Fl. Alt. i Tomsk. gub.	Flora Altaiskoi i Tomskoi gubernii	Flora of Altai and Tomsk Provinces
Fl. Az. Ross.	Flora Aziatskoi Rossii	Flora of Asiatic Russia
Fl. Evrop. Rossii	Flora Evropeiskoi Rossii	Flora of European Russia
Fl. Gruzii	Flora Gruzii	Georgian Flora
Fl. Kamch.	Flora Kamchatki	Kamchatkan Flora
Fl. Kavk.	Flora Kavkaza	Caucasian Flora
Fl. Man'chzh.	Flora Man'chzhurii	Manchurian Flora
Fl. Mosk. gub.	Flora Moskovskoi gubernii	Flora of Moscow Province
Fl. Sev. Kraya	Flora Severnogo Kraya	Flora of the Northern Territory
Fl. Sakh.	Flora Sakhalina	Flora of Sakhalin
Fl. Sib.	Flora Sibiri	Siberian Flora
Fl. Sib. i Dal'n. Vost.	Flora Sibiri i Dal'nego Vostoka	Flora of Siberia and the Far East
Fl. Sr. Ross.	Flora Srednei Rossii	Flora of Central Russia
Fl. Talysh.	Flora Talysha	Talysh Flora
Fl. Tsentr. Kazakhst.	Flora Tsentral'nogo Kazakhstana	Flora of Central Kazakhstan
Fl. Vost. Evr. Ross.	Flora Vostochnoi Evropeiskoi Rossii	Flora of East European Russia
Fl. Yugo-Vost.	Flora Yugo-Vostoka	Flora of the Southeast
Fl. Yugo-zap. Ross.	Flora Yugo-zapadnoi Rossii	Flora of Southwest Russia
Fl. Yur. bot. -sada	Flora Yur'evskogo botanicheskogo sada	Flora of Yur'ev Botanical Garden
Fl. Zap. Sib.	Flora Zapadnoi Sibiri	Flora of West Siberia
Gerb. donsk. fl.	Gerbarii donskoi flory	Herbarium of Don Flora
Gerb. Orlovsk. gub.	Gerbarii Orlovskoi gubernii	Herbarium of Orel Province
Gerb. Ukr. fl.	Gerbarii Ukrainskoi flory	Herbarium of Ukrainian Flora
GRF	Gerbarii Russkoi Flory	Herbarium of Russian Flora
Ill. Fl. Mosk. gub.	Illyustrirovannaya Flora Moskovskoi gubernii	Illustrated Flora of Moscow Province
Izv. AN SSSR	Izvestiya AN SSSR	Bulletin of the Academy of Sciences of the USSR
Izv. Bot. Sada	Izvestiya Botanicheskogo Sada	Bulletin of the Botanical Gardens
Izv. Bot. Sada Petra Vel.	Izvestiya Botanicheskogo Sada Petra Velikogo	Bulletin of Peter the Great Botanical Gardens
Izv. Gl. Bot. Sada	Izvestiya Glavnogo Botanicheskogo Sada	Bulletin of the Main Botanical Gardens
Izv. Kavk. Muzeya	Izvestiya Kavkazskogo Muzeya	Bulletin of the Caucasian Museum

Izv. Kazakhst. fil. AN SSSR	Izvestiya Kazakhstanskogo Filiala Akademii Nauk SSSR	Bulletin of the Kazakhstan Branch of the Academy of Sciences of the USSR
Izv. Kievsk. Bot. Sada	Izvestiya Kievskogo Botanicheskogo Sada	Bulletin of the Kiev Botanical Gardens
Izv. Obshch. lyubit. estestvozn., antrop. i etnogr.	Izvestiya Obshchestva lyubitelei estestvoznaniya, antropologii i etnografii	Bulletin of the Naturalists', Anthropologists' and Ethnographers' Society
Izv. Tadzhik. Bazy AN SSSR	Izvestiya Tadzhikskoi Bazy Akademii Nauk SSSR	Bulletin of the Tadzhikistan Base of the Academy of Sciences of the USSR
Konsp. rast. okr. Khar'kova	Konspekt rastenii okruga Khar'kova	Compendium of Plants of Kharkov District
Korm. rast. Estestv. senokosov i pastb. SSSR	Kormovye rasteniya estestvennykh senokosov i pastbishch SSSR	Fodder Plants of Natural Hay Meadows and Pastures of the USSR
Lesn. zhurn.	Lesnoi zhurnal	Forestry Journal
Mat. (dlya) Fl. Kavk.	Materialy dlya Flory Kavkaza	Materials on Caucasian Flora
Mat. (dlya) fl. Sredn. Azii	Materialy dlya flory Srednei Azii	Materials on Soviet Central Asian Flora
Nov. obozr.	Novoe obozrenie	New Review
Ob. rast. Kievsk. uch. okr.	Obzor rastitel'nosti Kievskogo uchebnogo okruga	Survey of Vegetation in the Kiev Educational District
Och. obozr. i fl. Karpat	Ocherki rastitel'nosti i flory Karpat	Survey of Carpathian Vegetation and Flora
Ocherk. Tifl. fl.	Ocherki Tiflisskoi flory	Survey of Tiflis [Tbilisi] Flora
Opis. Amur. obl.	Opisanie Amurskoi oblasti	Description of the Amur Region
Opis. ist. razv. fl. vost. Tyan'-Shanya	Opisanie istorii razvitiya flory vostochnogo Tyan'-Shanya	Description of the History of the Development of Flora of Eastern Tien Shan
Opis. nov. rast Turk.	Opisanie novykh rastenii Turkestana	Description of New Plants of Turkestan
Opis. nov. vidov	Opisanie novykh vidov	Description of New Species
Opred. der. i kust.	Opredelitel' derev'ev i kustarnikov	Key to Trees and Shrubs
Opred. rast. Dal'nevost. kr.	Opredelitel' rastenii Dal'nevostochnogo Kraya	Key to Plants of the Far Eastern Territory
Opred. rast. Kavk.	Opredelitel' rastenii Kavkaza	Key to Caucasian Plants
Opred. vyssh.	Opredelitel' vysshikh rastenii	Key to Higher Plants
Opred. (vyssh.) rasten. Evrop. chasti SSSR	Opredelitel' (vysshikh) rastenii Evropeiskoi chasti SSSR	Key to Higher Plants of the European USSR

Perech. rast. Turk.	Perechen' rastenii Turkmenii	List of Turkmenian Plants
Pochv. eksped. v bass. r. Syr-Dar'i i Amu-Dar'i	Pochvennaya ekspeditsiya v basseiny rek Syr-Dar'i i Amu-Dar'i	Soil Science Expedition to the Syr-Darya and Amu-Darya River Basins
Putesh.	Puteshestviya	Travels
Rast. i fl. Karp.	Rasteniya i flora Karpat	Plants and Flora of the Carpathians
Rast. letn. pastb. Gandzh.	Rasteniya letnikh pastbishch Gandzhi	Vegetation of Gandzha [now Kirovabad] Summer Pastures
Rast. res. Turkm.	Rastitel'nye resursy Turkmenii	Plant Resources of Turkmenia
Rast. resursy Kavkaza	Rastitel'nye resursy Kavkaza	Plant Resources of the Caucasus
Rast. Sib.	Rastitel'nost' Sibiri	Vegetation of Siberia
Rast. Sr. Az.	Rastitel'nost' Srednei Azii	Vegetation of Soviet Central Asia
Rast. Zakasp. obl.	Rastitel'nost' Zakaspiiskoi oblasti	Vegetation of the Trans-caspian Region
Rastit. Kavk.	Rastitel'nost' Kavkaza	Vegetation of the Caucasus
Rastit. pokrov vost. Pamira	Rastitel'nyi pokrov vostochnogo Pamira	Plant Cover of the Eastern Pamirs
Rastit. syr'e Kazakhst.	Rastitel'noe syr'e Kazakhstana	Plant Resources of Kazakhstan
Rastit. zapovedn. Guralash i Zaaminks. lesn. ugodii	Rastitel'nost' zapovednika Guralash i Zaaminskikh lesnykh ugodii	Vegetation of Guralash Reserve and Zaamin Forest Lands
Rezul't. dvukh puteshevstv. na Kavk.	Rezul'taty dvukh puteshestvii na Kavkaz	Results of Two Travels to the Caucasus
Russk. Fl.	Russkaya Flora	Russian Flora
Russk. lek. rast.	Russkie lekarstvennye rasteniya	Russian Medicinal Plants
Sbor, sushka i raz. lek. rast.	Sbor, sushka i razvitie lekarstvennykh rastenii	Gathering, Drying and Development of Medicinal Plants
Sorn. rast. SSSR	Sornye rasteniya SSSR	Weed Plants of the USSR
Sov. Bot.	Sovetskaya Botanika	Soviet Botany
Spis. rast.	Spisok rastenii	List of Plants
Tr. Bot. inst. AN SSSR	Trudy Botanicheskogo instituta AN SSSR	Transactions of the Botanical Institute of the Academy of Sciences of the USSR
Tr. Bot. Sada	Trudy Botanicheskogo Sada	Transactions of the Botanical Gardens
Tr. Bot. Sada Yur'evsk. Univ.	Trudy Botanicheskogo Sada Yur'evskogo Universiteta	Transactions of the Botanical Gardens of Yur'ev [now Tartu] University

Tr. Byuro prikl. Bot.	Trudy Byuro po prikladnoi botanike	Transactions of the Bureau of Applied Botany
Tr. Dal'nevost. bazy AN SSSR	Trudy Dal'nevostochnoi bazy AN SSSR	Transactions of the Far Eastern Base of the Academy of Sciences of the USSR
Tr. Inst. nov. lub. syr'ya	Trudy Instituta novogo lubyanogo syr'ya	Transactions of the Institute of New Fiber Raw Materials
Tr. Nauk.-Doslid. Inst. Bot. Khar. Derzh. Univ.	Trudy naukovo-doslidnoho instytutu botaniky Kharkivs'koho Derzhavnoho Universytetu	Transactions of the Botanical Research Institute of the Kharkov State University
Tr. Obshch. isp. prir. Khar'k. univ.	Trudy Obshchestva ispytatelei prirody Khar'kovskogo universiteta	Transactions of Naturalists' Society of Kharkov University
Tr. Obshch. sadov. v Odesse	Trudy obshchestva sadovodov v Odesse	Transactions of the Odessa Horticulturists' Society
Tr. Odessk. obshch. sadov	Trudy Odesskogo obshchestva sadovodov	Transactions of Odessa Horticulturists' Society
Tr. Peterb. obshch. estestvoisp.	Trudy Peterburgskogo obshchestva estestvoispytatelei	Transactions of St. Petersburg Naturalists' Society
Tr. pochv.-bot. eksp. Peresl. upr.	Trudy pochvenno-botanicheskoi ekspeditsii Pereslavskogo upravleniya	Transactions of the Soil-Botanical Expedition of Pereslavl Administration
Tr. po geobot. obsled. pastb. Azerb.	Trudy po geobotanicheskim obsledovaniyam pastbishch Azerbaidzhana	Transactions of Geobotanical Investigations of Azerbaijan Pastures
Tr. Odessk. otd. R. obshch. sadov.	Trudy Odesskogo otdeleniya Rossiiskogo obshchestva sadovodov	Transactions of Odessa Branch of the Russian Horticulturists' Society
Tr. prikl. bot. (gen. i sel.)	Trudy po prikladnoi botanike, genetike i selektsii	Transactions of Applied Botany, Genetics and Selection
Tr. Ross. Obshch. sadov.	Trudy Rossiiskogo obshchestva sadovodov	Transactions of the Russian Horticulturists' Society
Tr. SAGU	Trudy Sredneaziatskogo Gosudarstvennogo Universiteta	Transactions of the Soviet Central Asian State University
Tr. Sarat. obshch. estestvoisp.	Trudy Saratovskogo obshchestva estestvoispytatelei	Transactions of the Saratov Naturalists' Society
Tr. Sil'skogospod. komit. bot.	Trudy sil'skohospodar'skoho komiteta botaniky	Transactions of the Botanical Agricultural Committee
Tr. SPb. obshch. estestv.	Trudy Sankt-Peterburgskogo obshchestva estestvoispytatelei	Transactions of the St. Petersburg Naturalists' Society

Tr. Tadzh. bazy AN SSSR	Trudy Tadzhikskoi bazy AN SSSR	Transactions of the Tadzhikistan Base of the Academy of Sciences of the USSR
Tr. Tbil. bot. inst.	Trudy Tbilisskogo botanicheskogo instituta	Transactions of Tbilisi Botanical Institute
Tr. Tbil. (or Tifl.) bot. sada	Trudy Tbilisskogo (Tiflisskogo) botanicheskogo sada	Transactions of the Tbilisi (Tiflis) Botanical Garden
Tr. Turkmensk. bot. sada	Trudy Turkmenskogo botanicheskogo sada	Transactions of the Turkmenian Botanical Garden
Tr. Turk. nauchn. obshch.	Trudy Turkmenskogo nauchnogo obshchestva	Transactions of the Turkmenian Scientific Society
Vest. Akad. Nauk (or AN) Kazakhsk. SSR	Vestnik Akademii Nauk Kazakhskoi SSR	Bulletin of the Academy of Sciences of the Kazakh SSR
Vestn. estestv. nauk	Vestnik estestvennykh nauk	Bulletin of Natural Sciences
Vestn. Ross. Obshch. sadov	Vestnik Rossiiskogo obshchestva sadovodov	Bulletin of the Russian Horticulturists' Society
Vest. Tifl. bot. sada	Vestnik Tiflisskogo botanicheskogo sada	Bulletin of Tiflis Botanical Garden
Visn. Kyyivsk. bot. sadu	Visnyk Kyyivs'kogo Botanichnogo Sadu	Bulletin of the Kiev Botanical Garden
Vyzn. (or Vznachn.) rosl. URSR	Vyznachnyk roslyn URSR	Key to Plants of the Ukrainian SSR
V obl. polupustyni	V oblasti polupustyni	(In the) Semidesert Region
Yadov. rast. lugov i pastb.	Yadovitye rasteniya lugov i pastbishch	Poisonous Plants of Meadows and Pastures
Zam. po sist. i geogr. rast. Tbil. bot. inst.	Zametki po sistematike i geografii rastenii Tbilisskogo botanicheskogo instituta	Notes on Taxonomy and Geography of Plants of the Tbilisi Botanical Institute
Zam. po fl. EL'T	Zametki po flore El'tona	Notes on the Flora of Elton
Zap. Kievsk. Obshch. Estestv.	Zapiski Kievskogo obshchestva estestvoispytatelei	Reports of the Kiev Society of Naturalists
Zap. NOVOROSS. obshch. Estestv.	Zapiski Novorossiiskogo obshchestva estestvoispytatelei	Reports of the Novorossiisk Society of Naturalists
Zap. Russk. geogr. obshch.	Zapiski Russkogo geograficheskogo obshchestva	Reports of the Russian Geographical Society
Zhurn. Bot. obshch.	Zhurnal Botanicheskogo obshchestva	Journal of the Botanical Society
Zhurn. opytn. agron. Yugo-Vost.	Zhurnal opytnoi agronomii Yugo-Vostoka	Journal of Experimental Agronomy of the Southeast

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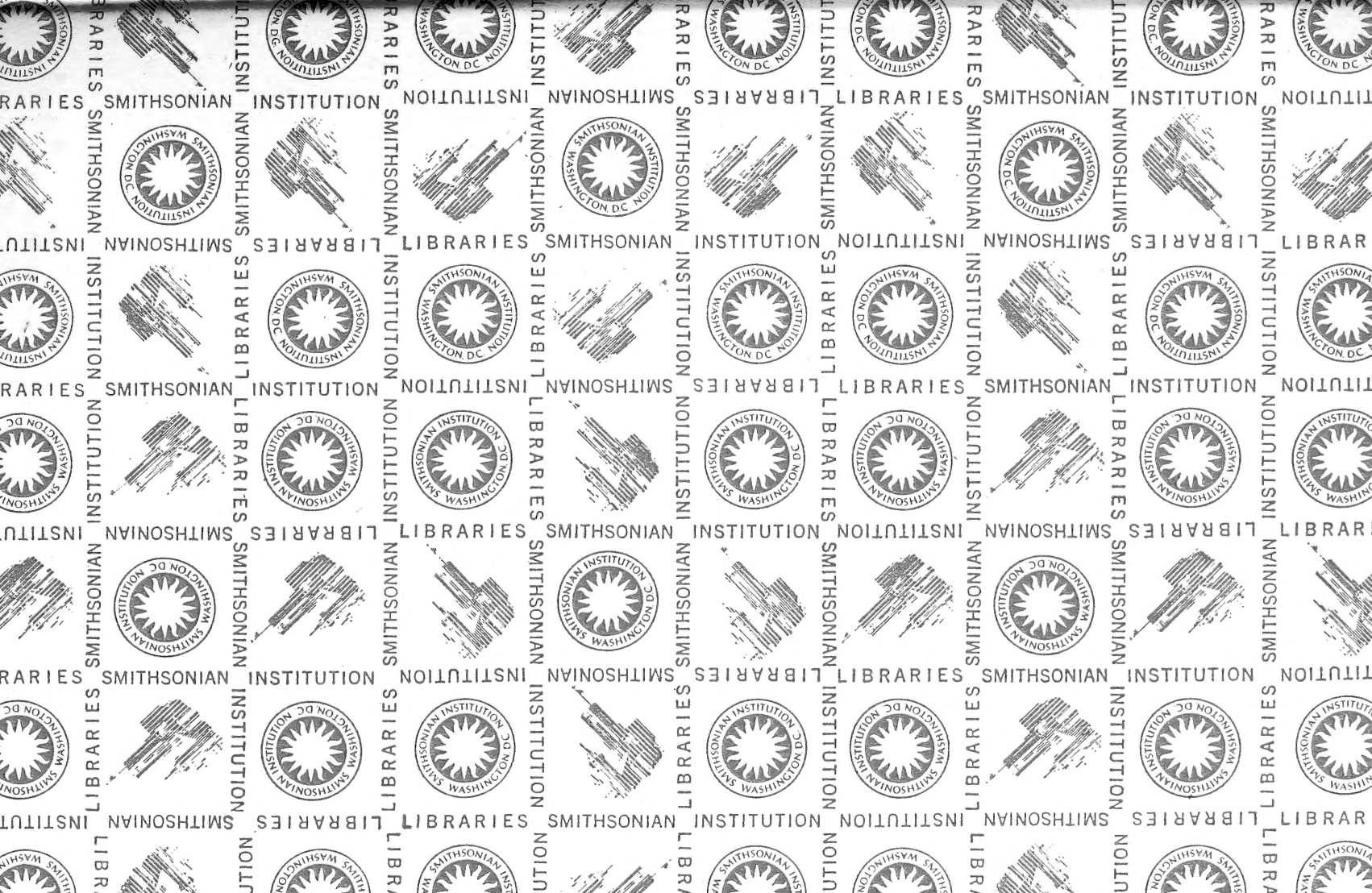
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