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The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin*.

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The dates at which these separate papers are published are recorded in the tables of contents of each of the volumes.

The present volume is the hundred and fifth of this series.

The *Bulletin*, the first of which was issued in 1875, consists of a series of separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogs of type specimens, special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

REMINGTON KELLOGG,
Director, United States National Museum.

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³ Erratum: On page 322, for "Proctotrupoidea" read "Proctotrupoidea."

⁴ Erratum: On page 553, in crossheads for species, for "Phyllodoce" read "Phyllodoce."

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NOTES ON SHRIMPS FROM THE MARSHALL ISLANDS

By FENNER A. CHACE, JR.

The collections on which the following notes are based were made during biological surveys of the northern Marshall Atolls of Eniwetok, Bikini, Rongelap, and Rongerik in 1946 and 1947, under the sponsorship of the U. S. Department of the Navy. Only the decapod shrimps of the families Penaeidae, Sergestidae, Pasiphaeidae, Processidae, Thalassocaridae, and the genera *Automate* and *Athanas* of the Alpheidae are included here. Pressure of other work has precluded the possibility of completing the study of the remaining shrimps of these collections in a reasonable length of time. It is hoped that Dr. A. H. Banner of the University of Hawaii will be able to work up the remaining alpheid shrimps; and Dr. L. B. Holthuis of the Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands, has agreed to include those of the families Hippolytidae, Rhynchocinetidae, Palaemonidae, Gnathophyllidae, and Stenopodidae in a forthcoming report on macrurous Crustacea collected by recent expeditions to several of the Pacific island groups.

1

Family PENAEIDAE
Subfamily PENAEINAE

Metapenaeopsis sp. ?

FIGURE 1

Bikini Atoll: 1½ miles south of west end of Bikini Island; 12 fathoms, coral bottom; Apr. 23, 1946; J. P. E. Morrison; 1 male abdomen.

This species may be identical with *Metapenaeopsis dalei* (Rathbun, 1902). Comparison of the petasma (fig. 1) with those of the type specimens of *M. dalei* discloses certain differences, however, such as the form of the left distoventral projection, which is armed with only three teeth in the Bikini specimen and not noticeably curved over the right distoventral projection as in *M. dalei*. The form of the right distoventral projection is also slightly different from those in the types. The petasma of *M. dalei* is figured by Rathbun (1902, fig. 10) and is discussed by Kubo (1949, p. 100, fig. 33). Some of the smallest type specimens of *M. dalei* have the petasmata very similar to that of the present specimen, but they are distinctly different in specimens having petasmata of similar size (about 6 mm. in length). Because of the fragmentary condition of the Bikini specimen, it seems best to defer a specific determination until more specimens are available and until more is known of the distribution and variation of the species of *Metapenaeopsis*.

Subfamily SICYONIINAE

Sicyonia bispinosa (de Haan) ?

FIGURE 2

? *Hippolyte bispinosus* de Haan, 1844, pl. 45, fig. 9.

? *Sicyonia bispinosa* de Haan, 1849, p. 195.—de Man, 1911a, p. 120, pl. 10, figs. 42-42c.

Rongelap Atoll: Lagoon; 23+ fathoms; June 16, 1946; M. W. Johnson; 2 females.

The larger of these two specimens has the carapace considerably macerated. The smaller specimen has a carapace length of 4.4 mm. (total length about 18.5 mm.). It agrees almost exactly with de Man's description and figure. The only differences noted are the slightly longer lateral carina on the rostrum, which reaches quite to the third rostral tooth, and the form of the ventral rostral tooth, which is directed downward somewhat more than indicated in de Man's figure. Both of these differences may be attributable to the slightly larger size of the present specimen. De Man does not mention, how-

ever, the pronounced excavation of the posterior margin of the pleuron of the fifth abdominal somite (fig. 2,*b*) which appears to be characteristic of the species.

These specimens have the unarmed antennal angle, notched dorsal carina of the second abdominal somite, spinose basis and ischium of

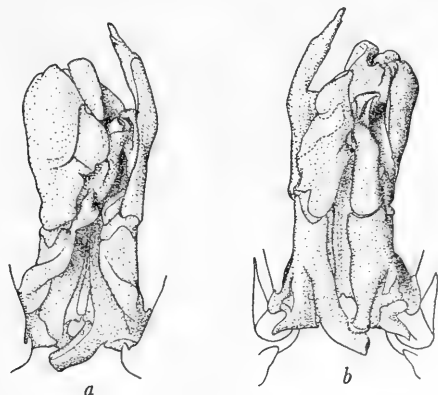


FIGURE 1.—Petasma of *Metapenaeopsis* sp.?: *a*, Posterior view, X 7; *b*, anterior view, X 7.

the first chelipeds, and the typical dorsal armature of the carapace characteristic of Division I or *carinata* group diagnosed by Burkenroad (1934, p. 71) and later abandoned by that author (1945, p. 3). Unlike many of the members of that group, however, the present specimens

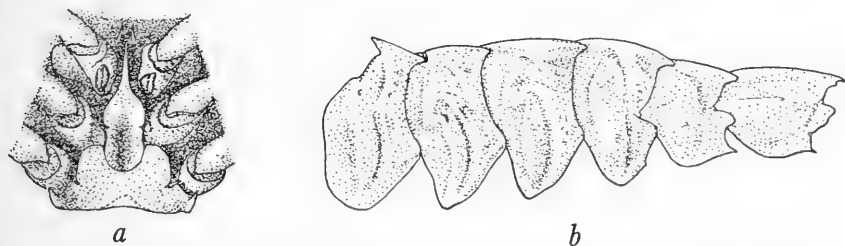


FIGURE 2.—*Sicyonia bispinosa* (de Haan)?: *a*, Thelycum, X 8.2; *b*, abdomen, X 7.6.

have the fifth abdominal somite terminating dorsally in a distinct tooth on each side.

Although it is probable that the Rongelap specimens are conspecific with the young male from the Sulu Archipelago that de Man called *S. bispinosa*, additional study of Japanese material must be made before they can certainly be assigned to de Haan's species.

Family SERGESTIDAE

Subfamily SERGESTINAE

Sicyonella maldivensis Borradaile

FIGURE 3,a

Sicyonella maldivensis Borradaile, 1910, p. 259, pl. 16, figs. 3, 3a.—Calman, 1914, p. 258 (part), figs. A, B.—Hansen, 1919, p. 28, pl. 2, fig. 4,a-g.

Bikini Atoll: Northeast end of lagoon at *Bowditch* anchorage; surface light at night; Apr. 23, 1946; L. P. Schultz and J. P. E. Morrison; 1 female.—Same; Apr. 25, 1946; L. P. Schultz; 1 male, 1 female.

Although the petasma of the male specimen in the present collection has the proportions of certain of the parts slightly different from those in Calman's and Hansen's figures, the organ is structurally the same. As Burkenroad (1937, p. 507) has suggested, there are probably local forms of the species of *Sicyonella* which differ from each other in minor characters only.

The male has a carapace length of 6.0 mm. (total length, about 22.5 mm.); the females have carapace lengths of 6.6 and 7.8 mm. (total lengths, about 22.5 and 26.5 mm.).

Inasmuch as the thelyca of the species of *Sicyonella* have not been figured heretofore, this opportunity is taken to include a figure of this structure from one of the Bikini specimens (fig. 3,a), as well as one of a female of *Sicyonella inermis* (Paulson) (= *S. elegans* (Calman)) (fig. 3,b); the latter specimen is one of two males and six females collected north of Bahrein Island, Persian Gulf, by D. S. Erdman in April, May, and June 1948. It will be seen from these figures that the thelycum of *S. inermis* corresponds with Burkenroad's (1937, p. 508) description. That of *S. maldivensis* agrees in general with the corresponding structures in *S. inermis* and differs from the thelyca of the species of *Sergestes* in like manner. It will be noted, however, that in *S. maldivensis* the coxal lamellae covering the sperm receptacles are somewhat different in shape, the structures associated with the opening of the oviduct on the coxa of the third leg are unlike those in *S. inermis*, there is a prominent, bidentate structure immediately posterior to the coxa of this leg, and there is no median papilla on the anterior part of the 13th sternite as there is in *S. inermis*.

Subfamily LUCIFERINAE

Lucifer faxoni Borradaile

Lucifer faxoni Borradaile, 1915, p. 228.—Hansen, 1919, p. 61, pl. 5, fig. 3,a-i.

Rongelap Atoll: One-half mile off Yugui Island in 13 fathoms; surface light at night; July 30, 1946; E. S. Herald; 3 males.

Lucifer sp. ?

Eniwetok Atoll: Southwest Passage, leeward side of reef two miles south of Rigili Island; surface light at night; May 24, 1946; L. P. Schultz; 1 male, 2 females.

These specimens belong to Hansen's Group B (1919, p. 56), but

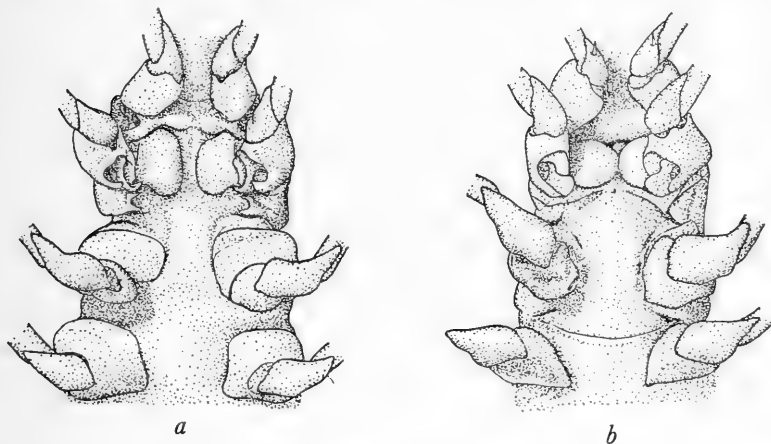


FIGURE 3.—Thelyca of species of *Sicyonella*: a, *S. maldivensis* Borradaile with a carapace length of 7.8 mm., X 13.6; b, *S. inermis* (Paulson) with a carapace length of 8.1 mm., X 13.6.

they do not correspond with any of the species so far known in that group. As a matter of fact, the petasma most nearly resembles that of *Lucifer orientalis* Hansen (1919, p. 55, pl. 4, fig. 7, a-g), which belongs to Group A. It is possible, though unlikely, that the specimens are immature; in any case, the material is not in sufficiently good condition or abundant enough to provide a detailed description.

Family PASIPHAEIDAE

Leptochela robusta Stimpson

Leptochela robusta Stimpson, 1860, p. 43.—de Man, 1920, p. 19, pl. 3, figs. 7-7j, pl. 4, figs. 7k-7x.—Kemp, 1925, p. 252.—Armstrong, 1941, p. 1.

Bikini Atoll: Northeast end of lagoon at *Bowditch* anchorage; surface light at night; Mar. 30, 1946; L. P. Schultz and V. E. Brock; 44 males, 97 females and juveniles (8 ovigerous).—Same; Apr. 23-25, 1946; L. P. Schultz and J. P. E. Morrison; 2,750 males and females.—Lagoon, four miles south of west end of Bikini Island; about 25 fathoms; sand and "Halimeda" bottom; Aug. 26, 1947; J. P. E. Morrison; 1 male.

Eniwetok Atoll: Lagoon off Eniwetok Island at *Bowditch* anchorage; surface light at night; May 23, 1946; L. P. Schultz; 4 males, 5 females.—Southwest Passage, leeward side of reef two miles south of

Rigili Island; surface light at night; May 24, 1946; L. P. Schultz; 10 males, 28 females and juveniles.—Lagoon; subtidal; June 6, 1946; M. W. Johnson; 1 female.

Rongelap Atoll: Lagoon one-half mile off Yugui Island; 13 fathoms; surface light at night; July 30, 1946; E. S. Herald; 33 males, 101 females and juveniles.—Lagoon one-half mile off Lomuial Island; 13 fathoms; surface light at night; July 31, 1946; E. S. Herald; 2 males, 3 females.

Rongerik Atoll: Lagoon 200 yards off Eniwetak Island; surface light at night; June 28, 1946; L. P. Schultz and E. S. Herald; 12 males, 5 females.

This is by far the commonest decapod crustacean in the collections made during the Marshall Islands surveys. The fact that it was taken at a surface light in great numbers at some times and sparsely or not at all at other times may or may not indicate that a lunar periodicity of some sort is involved.

More or less critical examination of more than 500 specimens in the present collections indicates that but one species is involved. Of this number, only two specimens can be considered aberrant. One has three instead of two pairs of telson spines anterior to the terminal ones; the other specimen has two lateral spines on one side of the telson and only one on the other side. The collections would indicate, therefore, that the genus is represented by but a single species in the Marshalls area, whereas Armstrong (1941) found two (*L. robusta* and *L. aculeocaudata hainanensis*) in a collection from Samoa. It may be of interest that the specimens recorded from the Hawaiian Islands by Rathbun (1906, p. 929) are, as her description indicates, not *L. robusta*; they appear to belong to a species closely allied to, and possibly identical with, *L. aculeocaudata* Paulson. Considerable additional study of the Indo-Pacific species of *Leptochela* must be made before the various forms can be defined satisfactorily.

The dentition of the fingers of the second chela in 100 specimens selected at random from the lot taken in Bikini lagoon shows greater variation than has been evidenced heretofore (table 1). In general, the number of spines on the fingers appears to increase with the size of the specimen. The largest specimen critically examined, a female with a carapace length of 3.7 mm., has 54 spines on the fixed finger, whereas the smallest specimens have but 28 to 34 spines. Although the modal numbers of these teeth probably are of specific importance, especially when correlated with specimen size, it is apparent that the number is less sharply defined for each species than Kemp's diagnoses would indicate. The number of small spines in the intervals between the larger ones at the middle of the fingers may be of greater taxonomic importance, but here also there is considerable variation; in the speci-

mens examined, these numbers vary from three to nine, and appear to increase with specimen size.

The relative numbers of males and females in this collection do not bear out Armstrong's suggestion (1941, p. 1) that a submerged light may exert a greater attraction for males than for females. Including 89 males and 121 females and juveniles, of which 4 are ovigerous, that

TABLE 1.—*Variation in dentition on fingers of second chelae of specimens of Leptocheila robusta from Bikini Lagoon*

| <i>Denticles</i> | <i>Fixed fingers</i> | <i>Dactyls</i> |
|------------------|--------------------------|----------------|
| 24 | ----- | 1 |
| 25 | ----- | 2 |
| 26 | ----- | 2 |
| 27 | ----- | ----- |
| 28 | 1 | 2 |
| 29 | ----- | 10 |
| 30 | ----- | 2 |
| 31 | 2 | 12 |
| 32 | 1 | 13 |
| 33 | 1 | 11 |
| 34 | 1 | 10 |
| 35 | 6 | 11 |
| 36 | 3 | 12 |
| 37 | 8 | 6 |
| 38 | 10 | 2 |
| 39 | 8 | 2 |
| 40 | 11 | 1 |
| 41 | 10 | 1 |
| 42 | 7 | ----- |
| 43 | 5 | ----- |
| 44 | 10 | ----- |
| 45 | 6 | ----- |
| 46 | 4 | ----- |
| 47 | 3 | ----- |
| 48 | 1 | ----- |
| 49 | ----- | ----- |
| 50 | ----- | ----- |
| 51 | 1 | ----- |
| 52 | ----- | ----- |
| 53 | ----- | ----- |
| 54 | 1 | ----- |

were sexed of the lot of 2,750 specimens taken in Bikini lagoon on April 23–25, the sexed individuals of the entire collection amount to 195 males and 361 females and juveniles, of which 12 are ovigerous. The small number of egg-bearing females suggests that the eggs usually are produced at some other season of the year or that ovigerous specimens are not attracted by a submerged light as are females without eggs.

Family PROCESSIDAE

Nikoides sibogae de Man

Nikoides sibogae de Man, 1918, p. 160; 1920, p. 193, pl. 16, figs. 50-50j; 1922, p. 46.

Bikini Atoll; 1946; M. W. Johnson; 1 ovigerous female.

The single specimen has a carapace length, exclusive of the rostrum, of 4.2 mm. It agrees very well with de Man's description (1920) of the type specimen. The species appears to differ from *N. danae* Paulson, with which it was synonymized by Gurney (1937, p. 89), in the following particulars: The outer spine of the antennal scale falls far short of the end of the blade, rather than exceeding the blade as noted by Nobili (1906, p. 80) and Gurney; the third maxillipeds exceed the antennal scale by nearly or quite all of the two distal segments, not by little more than the terminal segment; the non-chelate first leg surpasses the antennal scale by the dactyl and most of the propodus, rather than by the dactyl alone; and the fourth legs extend beyond the antennal scale by the dactyl, propodus, and nearly all of the carpus, rather than by the dactyl and somewhat more than half of the propodus, as noted by Nobili in *N. danae*. Until more is known of the variation in the species, it seems best to retain de Man's name for this form with the longer and more slender appendages.

Nikoides nanus, new species

FIGURE 4

Eniwetok Atoll: Runit Island; intertidal; May 30, 1949; M. W. Johnson; 1 male holotype (USNM 94741).

Bikini Atoll: Namu Island; reef at shore inside lagoon; Apr. 3, 1946; M. W. Johnson; 1 male paratype.

Carapace armed with a prominent antennal spine extending well beyond the anterior margin; lower anterior angle of carapace rounded and armed with a marginal row of eight or ten long, slender spinules. Rostrum (fig. 4,*b*) small, reaching barely as far as the proximal ends of the eyestalks, and provided with a long, slender spinule on each side; these spinules seem to be set in a notch in the upper margin of the rostrum, but no true rostral tooth is apparent. Abdomen mostly smooth and bare on the first four somites, covered with an increasing number of slender spinules on the fifth and sixth somites and the telson, as well as on the inner uropods; sixth somite a little more than twice as long as fifth; pleura of both fifth and sixth somites armed with a sharp posterior tooth (fig. 4,*c*). Telson more than 1½ times as long as sixth somite, armed with two pairs of dorsal and three pairs of distal spines, in addition to the numerous spinules covering the surface (fig. 4,*d-e*).

Eyes very large, the cornea being nearly as wide as the combined lengths of the stalk and cornea (fig. 4,*a*). Antennular peduncle with the penultimate slightly longer than the distal segment (fig. 4,*a,f*);

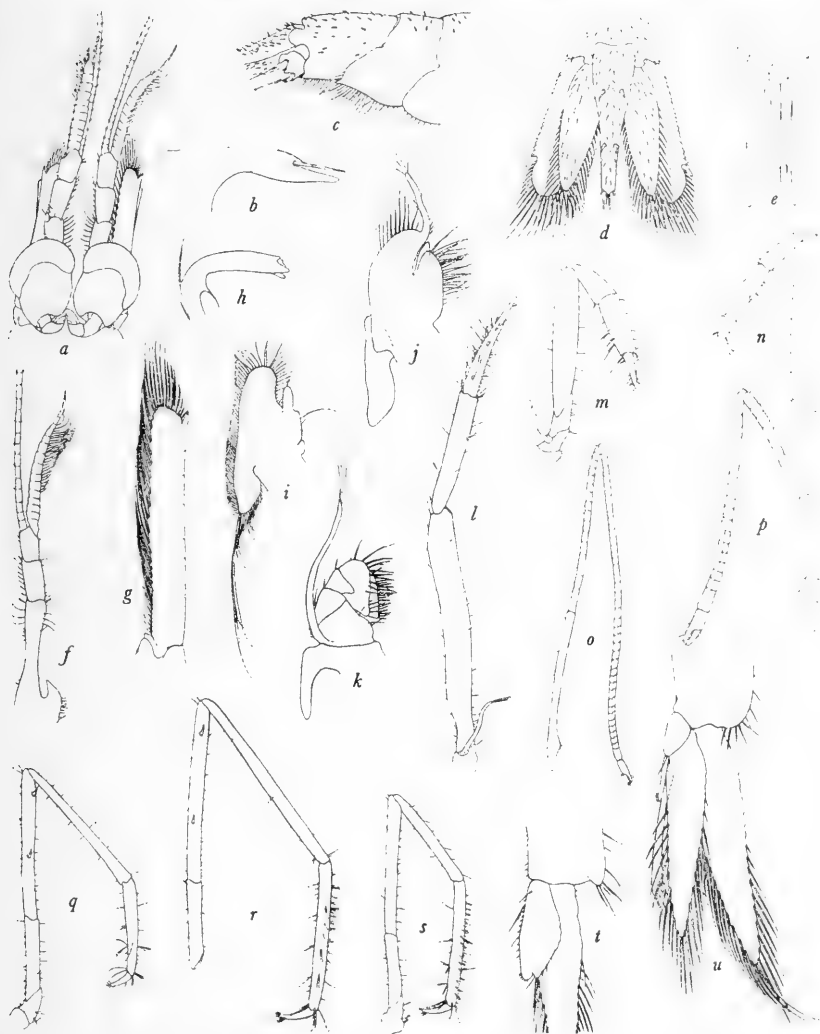


FIGURE 4.—*Nikoides nanus*, new species, holotype: *a*, Frontal part in dorsal view, X 11; *b*, rostrum in lateral view, X 66; *c*, fifth and sixth abdominal somites in lateral view, X 10.6; *d*, telson and uropods in dorsal view, X 10.3; *e*, tip of telson, X 67.9; *f*, right antennule in dorsal view, X 10.6; *g*, right antennal scale in dorsal view, X 16.5; *h*, right mandible, X 33; *i*, right second maxilla, X 18.3; *j*, right first maxilliped, X 26.4; *k*, right second maxilliped, X 22; *l*, right third maxilliped, X 10.3; *m*, right first leg, X 10.3; *n*, left first leg, X 10.3; *o*, right second leg, X 10.3; *p*, left second leg, X 10.3; *q*, right third leg, X 10.3; *r*, right fourth leg, X 10.3; *s*, right fifth leg, X 10.3; *t*, endopod of right first pleopod, X 26.4; *u*, right second pleopod, X 26.4.

inner antennular flagellum about as long as combined lengths of carapace and first three abdominal somites; outer flagellum composed of about 17 segments, the first 12 of which are swollen. Antennal scale (fig. 4,*g*) about $6\frac{1}{2}$ times as long as broad; the outer distal spine falls slightly short of the level of the distal end of the blade. Antennal peduncle reaching about as far as distal end of second antennular segment; antennal flagella more than $1\frac{1}{2}$ times as long as body. Third maxillipeds (fig. 4,*l*) exceed antennal scale by slightly more than the two distal segments. Right leg of first pair (fig. 4,*m*) chelate and extending beyond the antennal scale by the length of the fingers and about one-half of the hand. Left leg of first pair (fig. 4,*n*) simple, overreaching antennal scale by the length of the dactyl and about three-fourths of the propodus. Exopods of the first legs small, extending little if at all beyond the ischium. Right leg of second pair (fig. 4,*o*) reaching beyond antennal scale by the lengths of the chela, carpus, and one-third of the merus; carpus divided into about 43 articulations and merus into about 15 less distinct ones. Left leg of second pair (fig. 4,*p*) overreaching antennal scale by chela and carpus; carpus composed of about 19 articulations and merus of about 6 indistinct ones. Third leg (fig. 4,*q*) extending beyond antennal scale by dactyl, propodus, and about one-half of carpus; fourth leg (fig. 4,*r*) by dactyl, propodus, and three-fourths of carpus; and fifth leg (fig. 4,*s*) by the dactyl and three-fourths of the propodus. The appendix masculina on the second pleopods reaches to the distal fifth of the endopod and bears four long spines on its obliquely truncate end (fig. 4,*u*).

The mouthparts are shown in figure 4,*h-k*. The first maxilla is apparently so reduced that its proper orientation could not be determined after it was removed.

The carapace of the holotype measures 2.5 mm. in length, and the entire animal is approximately 10 mm. long from the tip of the rostrum to the end of the telson. The paratype is about 10.5 mm. long and has a carapace length of 2.7 mm.

This species is apparently smaller than any of the previously known species of *Nikoides*. It is distinguished also by its smaller and differently formed rostrum, different proportions of the antennular peduncle, and shorter exopods on the first pair of legs. The latter character possibly strengthens Gurney's contention (1937, p. 89) that *Nikoides* is not a valid genus and can only be maintained as a matter of convenience; it seems best, however, to retain its identity for the present at least.

Processa molaris, new species

FIGURE 5

Rongelap Atoll: Burok Island; intertidal coral; July 18, 1946; M. W. Johnson; 1 ovigerous female holotype (USNM 94763).

Bikini Atoll: Namu Island; reef at shore inside lagoon; April 3, 1946; M. W. Johnson; 3 female paratypes (2 ovigerous).

Carapace with the antennal angle acute but not spinous; lower anterior margin of carapace rounded and armed with a marginal row of about five plumose setae. Rostrum (fig. 5,*a,b*) not reaching as far as the ends of the eyes; it is simple, rather sharply upturned at the tip, and armed with a few movable dorsal spines in the distal fourth and with a stout seta inserted on each lateral surface just back of the tip. Abdomen mostly smooth and bare except for a few slender spinules or stout setae on the fifth and sixth somites, as well as on the telson and inner uropods; sixth somite about one-third again as long as fifth; pleuron of fifth somite rounded, that of sixth somite armed with a posterior tooth (fig. 5,*c*). Telson fully $1\frac{3}{4}$ times as long as sixth somite, armed with two pairs of dorsal and three pairs of distal spines (fig. 5,*d,e*).

Eyes not large, the cornea little if any wider than the stalk (fig. 5,*a*). Antennular peduncle with the penultimate distinctly shorter than the distal segment (fig. 5,*f*); outer flagellum composed of 13 segments, the first 10 of which are swollen. Antennal scale (fig. 5,*g*) slightly more than three times as long as broad; the outer distal spine falls short of the end of the blade. Antennal peduncle reaching about as far as the distal end of the second antennular segment; antennal flagella somewhat longer than the body. Third maxillipeds (fig. 5,*m*) extend beyond antennal scale by slightly more than the length of the distal segment. Right leg of first pair (fig. 5,*n*) chelate and reaching about to end of antennal scale. Left leg of first pair (fig. 5,*o*) simple and also reaching about as far as end of scale. Right leg of second pair (fig. 5,*p*) reaches beyond antennal scale by the chela and about one-third of the carpus; carpus divided into six articulations, the proximal two of which are obscure; merus undivided. Left leg of second pair (fig. 5,*q*) slightly longer than the right, but otherwise similar to it. Third leg (fig. 5,*r*) overreaches antennal scale by slightly more than the dactyl and propodus; fourth leg (fig. 5,*s*) by the dactyl, propodus, and about one-third of the carpus; and the fifth leg (fig. 5,*t*) by little more than the dactyl.

The mouthparts are shown in figure 5,*h-l*. The most unusual feature of these appendages is the relatively enormous size of the

mandible; this can be appreciated by comparing the figures of the mandible and of the antennal scale, which are drawn to the same scale. The basal portion of the mandible is so large that it occupies a considerable portion of the branchial cavity; it is plainly visible as a large subspherical structure lying beneath the anterolateral portion of the carapace.

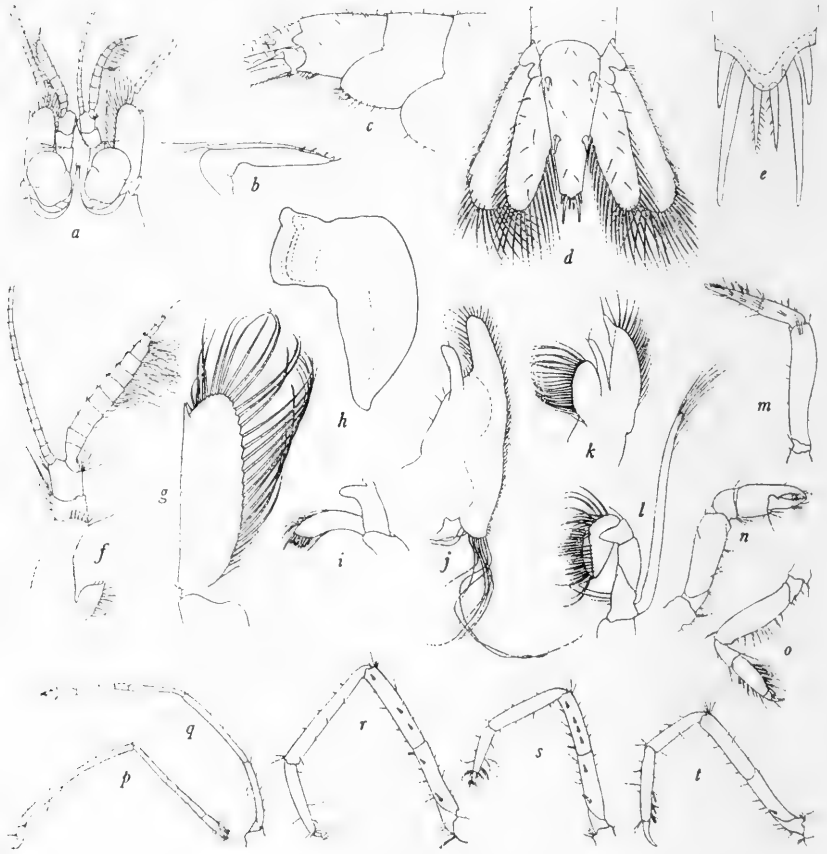


FIGURE 5.—*Processa molaris*, new species: *a*, Frontal part of holotype in dorsal view, X 11; *b*, rostrum of holotype in lateral view, X 24.5; *c*, fifth and sixth abdominal somites of paratype in lateral view, X 17.9; *d*, telson and uropods of paratype in dorsal view, X 17.1; *e*, tip of telson of paratype, X 73; *f*, right antennule of holotype in dorsal view, X 18.3; *g*, left antennal scale of holotype in dorsal view, X 25.2; *h*, left mandible of holotype, X 25.2; *i*, left first maxilla of paratype, X 25.2; *j*, left second maxilla of paratype, X 25.2; *k*, left first maxilliped of holotype, X 25.2; *l*, left second maxilliped of holotype, X 25.2; *m*, left third maxilliped of holotype, X 11; *n*, right first leg of holotype, X 11; *o*, left first leg of holotype, X 11; *p*, right second leg of holotype, X 11; *q*, left second leg of holotype, X 11; *r*, left third leg of holotype, X 11; *s*, left fourth leg of holotype, X 11; *t*, left fifth leg of holotype, X 11.

The carapace of the holotype measures 2.0 mm. in length, and the entire animal is approximately 8.5 mm. long. The carapace lengths of the paratypes vary from 1.7 to 2.0 mm.

This species is probably closely related to *Processa coutieri* Nobili, the only other species of the genus with the carpus of the second legs 6-jointed. It differs from Nobili's descriptions and figures (Nobili, 1904, p. 234; 1906, p. 78, pl. 4, figs. 3, 3a) in having the rostrum shorter rather than longer than the eyes; in having the first antennular segment much longer rather than shorter than the two following segments; and in having the telson armed distally with three pairs of spines (the median pair plumose) rather than two pairs of spines and some long plumose hairs. It is very possible that Nobili's description is in error as far as the last two characters are concerned, but the difference in rostral length is so great that it seems advisable to keep the two forms distinct at least until the type of *P. coutieri* can be reexamined.

Family THALASSOCARIDAE

Thalassocaris crinita (Dana)

FIGURE 6

Regulus crinitus Dana, 1852, p. 599; 1855, pl. 39, figs. 6a-h.

Thalassocaris crinita de Man, 1920, p. 95, pl. 9, figs. 22-22o.—Armstrong, 1941, p. 5.

Bikini Atoll: Eastern end of lagoon; 30-33 fathoms, coral bottom; Mar. 29, 1946; L. P. Schultz; 1 male, 5 females (3 ovigerous).

Rongelap Atoll: Lagoon; 23 fathoms; June 16, 1946; M. W. Johnson; 2 ovigerous females.

The single male in this collection has a carapace length of 5.1 mm. This measurement in the females varies from 3.0 to 5.4 mm., ovigerous specimens having the carapace from 4.1 to 5.4 mm. long.

Family ALPHEIDAE

Automate johnsoni, new species

FIGURE 7

Bikini Atoll: May 1946; M. W. Johnson; 1 male holotype (USNM 94746).—Bokonfuaaku Island; intertidal in potholes; May 16, 1946; M. W. Johnson; 1 ovigerous female paratype.—Enirik Island; intertidal; 1946; M. W. Johnson; 1 juvenile.

Eniwetok Atoll: Bogombogo Island; intertidal; May 31, 1946; M. W. Johnson; 1 male paratype.

Rostrum (fig. 7a) triangular and prominent, but not reaching as far forward as anterior margin of carapace; no lateral grooves on

carapace at base of rostrum. Carapace and abdomen smooth, polished, and unarmed. Fifth and sixth abdominal somites subequal in length. Telson (fig. 7,*b*) about 1.15 times as long as sixth somite, armed dorsally with two pairs of spines and, distally, with two pairs of spines and three pairs of plumose setae, as well as about a dozen long, simple setae directed upward and backward from the posterior margin. The telson of the male paratype from Bogombogo Island is obviously aberrant in that it lacks the anterior dorsal spine on the

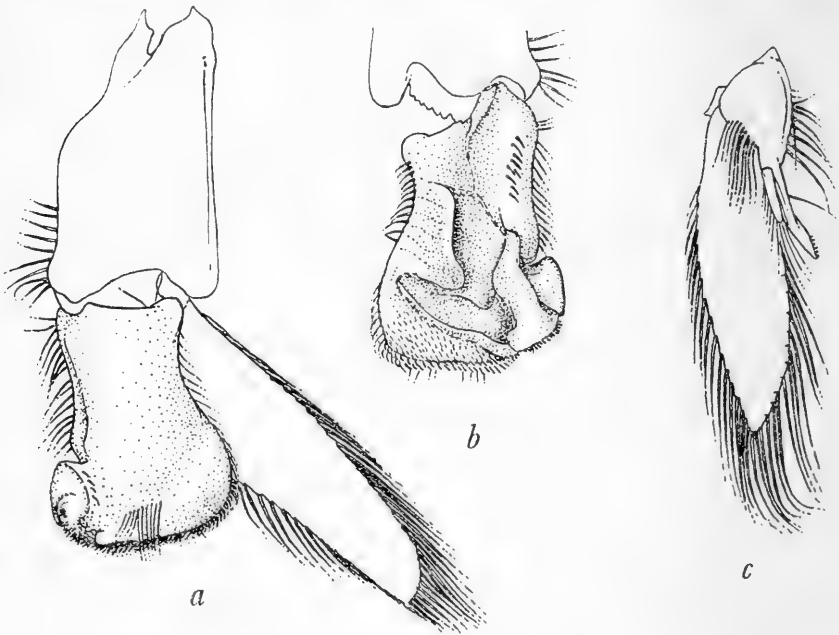


FIGURE 6.—*Thalassocaris crinita* (Dana): *a*, First pleopod of male in posterior view, X 25.3; *b*, endopod of first pleopod of male in anterior view, X 25.3; *c*, endopod of second pleopod of male in anterior view, X 25.3.

right side and has two smaller additional spines (one marginal and one submarginal) on that side between the posterior dorsal tooth and the posterior margin.

Antennular peduncle (fig. 7,*c*) with penultimate more than twice as long as distal segment and not quite $2\frac{1}{2}$ times as long as wide; tip of stylocerite reaching slightly beyond distal margin of proximal segment; inner antennular flagellum somewhat longer than carapace and first abdominal somite; outer flagellum with the first 12 or 13 segments swollen. Antennal scale (fig. 7,*d*) reaching to distal fourth or fifth of penultimate antennular segment. Antennal peduncle slightly over-

reaching antennular peduncle; antennal flagellum nearly as long as carapace and first four abdominal somites. Third maxillipeds (fig. 7,*j*) extend beyond antennal scale by slightly more than terminal segment. First legs (fig. 7,*k,l*) exceed antennal scale by about the length of the chela. Second legs (fig. 7,*m*) reach beyond scale by chela, carpus, and one-fourth of merus. Third legs (fig. 7,*n*) exceed antennal scale by dactyl and three-fourths of propodus; fourth legs

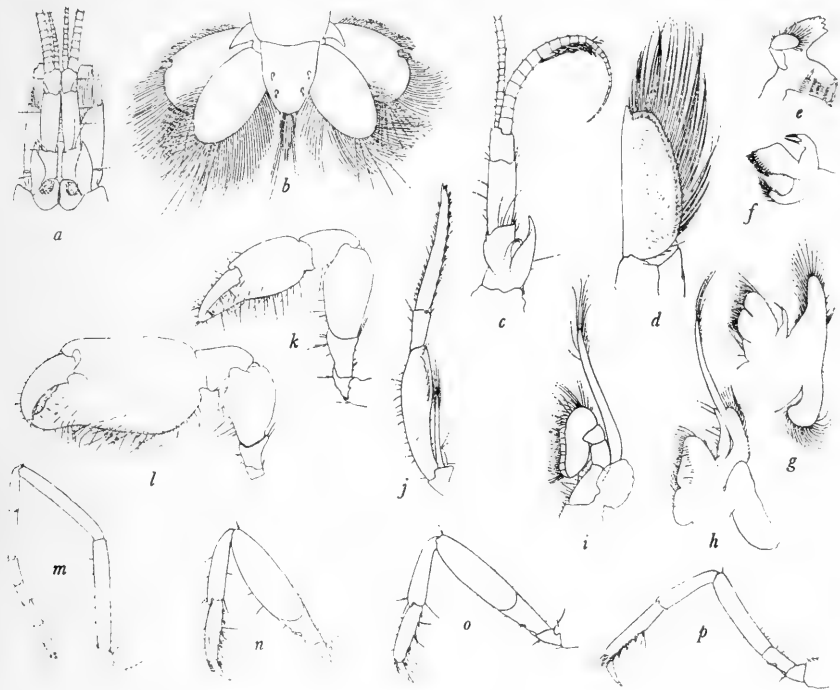


FIGURE 7.—*Automate johnsoni*, new species: *a*, Frontal part of male paratype in dorsal view, X 6.2; *b*, telson and uropods of holotype in dorsal view, X 8.4; *c*, right antennule of holotype in dorsal view, X 11; *d*, left antennal scale of holotype in dorsal view, X 19.8; *e*, left mandible of holotype, X 14.3; *f*, left first maxilla of holotype, X 14.3; *g*, left second maxilla of holotype, X 14.3; *h*, left first maxilliped of holotype, X 14.3; *i*, left second maxilliped of holotype, X 14.3; *j*, left third maxilliped of holotype, X 7; *k*, left first leg of holotype, X 7; *l*, left first leg of female paratype, X 5.1; *m*, left second leg of holotype, X 7; *n*, left third leg of holotype, X 7; *o*, left fourth leg of holotype, X 7; *p*, left fifth leg of holotype, X 7.

(fig. 7,*o*) by dactyl and one-fourth of propodus; and fifth legs (fig. 7,*p*) by nearly the length of the dactyl.

Mouthparts are shown in figure 7,*e-i*.

The ovigerous female paratype differs from the two adult males in having the antennular peduncles slightly more slender, the stylocerite slightly shorter and therefore not perceptibly overreaching the proximal antennular segment, and the antennal scales slightly shorter,

in addition to the sexual differences involving the outer antennular flagellum and the first chela noted by Coutière (1905, p. 855) in *A. gardineri* and *A. dolichognatha*.

In the immature specimen from Enirik Island, the antennular segments are much more robust and there are but six or eight swollen segments in the outer antennular flagellum.

The male holotype is approximately 12 mm. long and has a carapace length of 3.6 mm. The male paratype from Bogombogo Island has a carapace length of 4.7 mm., the ovigerous female from Bokonfuaaku Island has the carapace 3.9 mm. long, and the immature individual from Enirik Island has a carapace length of 1.8 mm.

This species is closely related to, if not identical with, *A. gardineri* Coutière. It differs from Coutière's description and figures (1905, p. 854, figs. 127, 128), as well as from a Siamese specimen tentatively identified as *A. gardineri* by W. L. Schmitt (Suvatti, 1938, p. 47), in the following particulars: the rostrum is triangular rather than rounded and is not delimited laterally by grooves on the carapace; the antennular peduncle is stouter, the penultimate segment being about $2\frac{1}{2}$ rather than 4 or more times longer than wide; the stylocerite is slightly longer, usually overreaching rather than falling short of the end of the proximal segment; and the antennal scale reaches nearly or quite to the distal fifth of the penultimate antennular segment rather than extending but little beyond the middle of that segment. All these distinctions may prove to be unimportant when additional material becomes available, but it seems advisable for the present to consider the Marshall Islands form distinct, in order to stress the differences. The species is close to *Automate* sp. de Man (1911b, p. 140, pl. 1, figs. 2-2d), but whether any or all of these forms are distinct must remain for later workers to decide.

Athanas djiboutensis Coutière

Athanas djiboutensis Coutière, 1897, p. 234; 1905, p. 856, fig. 129.—Tattersall, 1921, p. 368.

Bikini Atoll: Namu Island; reef inside lagoon; Apr. 3, 1946; M. W. Johnson; 1 male.—Same; April 4, 1946; 2 ovigerous females.—Bokonfuaaku Island; intertidal potholes; May 16, 1946; M. W. Johnson; 1 male, 1 ovigerous female.—Enirik Island; intertidal; 1946; M. W. Johnson; 2 males.

Eniwetok Atoll: Bogen Island; intertidal potholes; May 21, 1946; M. W. Johnson; 1 male.—Bogombogo Island; intertidal; May 31, 1946; M. W. Johnson; 1 ovigerous female.

Rongelap Atoll: Eniaetok Island; intertidal potholes; June 16, 1946; M. W. Johnson; 1 male.—Burok Island; intertidal coral; July 18, 1946; M. W. Johnson; 1 ovigerous female.

These specimens agree very well with Coutière's description and figures except that the rostrum reaches at most as far as the end of the second antennular segment and frequently is slightly shorter. The males have carapace lengths of from 1.4 to 2.3 mm. and the ovigerous females from 1.5 to 2.2 mm. In the smallest male, from Enirik Island, Bikini Atoll, the left first cheliped is very small and similar to the minor cheliped of the female; the right cheliped in this specimen is lacking. It is not possible to tell from the material at hand whether this anomaly is due to the immaturity of the specimen or whether it is indicative of polymorphism in the males of this species as suggested by Tattersall. Only two of the remaining five males in the collection retain the major cheliped, and in both of these it is as figured by Coutière. Three of these males have the minor cheliped; it agrees with Coutière's figure, except that the merus is noticeably broader. In the three females in which the major cheliped is intact, it corresponds with Coutière's figure except that the fingers are crossed at the extreme tips.

Athanas marshallensis, new species

FIGURE 8

Eniwetok Atoll: Bogombogo Island; intertidal; May 31, 1946; M. W. Johnson; 1 male holotype, 9 male and 9 ovigerous female paratypes.

Bikini Atoll: Namu Island; outside reef; Apr. 4, 1946; M. W. Johnson; 1 male paratype.

Rongelap Atoll: Tufa Island; lagoon side, under rocks; July 16, 1946; M. W. Johnson; 2 ovigerous female paratypes.

Carapace and abdomen sparsely pubescent. Rostrum (fig. 8,*a,b*) reaching slightly beyond middle of second antennular segment, with a dorsal carina on the anterior two-thirds of its length. No supra-corneal spines. Extracorneal tooth prominent and sharp, but falling well short of anterior margin of cornea. Infracorneal tooth small and blunt, not reaching nearly as far as extracorneal. Anterolateral margin of carapace rounded, unarmed. Sixth abdominal somite slightly longer than fifth (fig. 8,*c*); posterior angle of pleuron of fifth somite acute. Telson (fig. 8,*c-d*) nearly $1\frac{1}{4}$ times as long as sixth somite and 2.7 times as long as its distal margin; it is armed with the usual two pairs of dorsal and two pairs of distal spines, with numerous marginal setae between the two sets of distal spines.

Antennular peduncle (fig. 8,*e*) with distal segment about one-third again as long as penultimate; stylocerite extending slightly beyond penultimate segment; outer antennular flagellum divided at third joint, the inner branch probably composed of three segments, each of which appears to be subdivided so that this branch has the appearance

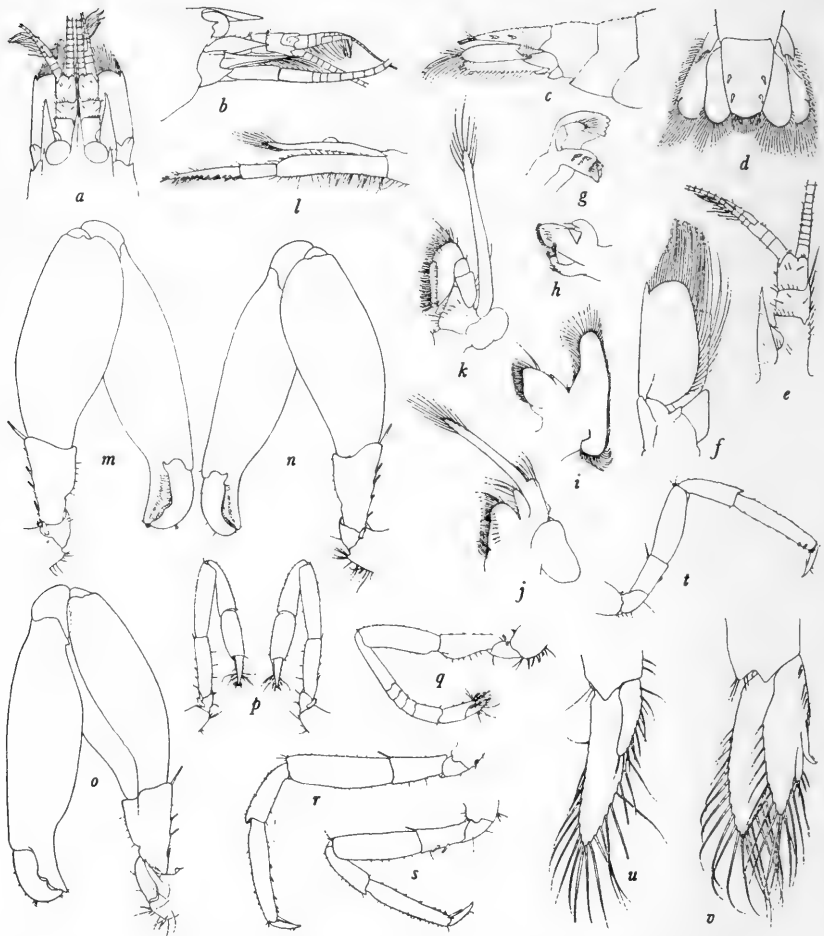


FIGURE 8.—*Athanas marshallensis*, new species: *a*, Frontal part of holotype in dorsal view, X 8; *b*, frontal part of holotype in lateral view, X 8; *c*, posterior part of abdomen of holotype in lateral view, X 8; *d*, telson and uropods of holotype in dorsal view, X 8.4; *e*, left antennule of holotype in dorsal view, X 11.3; *f*, left antennal scale of holotype in dorsal view, X 13.9; *g*, left mandible of holotype, X 13.9; *h*, left first maxilla of holotype, X 13.9; *i*, left second maxilla of holotype, X 13.9; *j*, left first maxilliped of holotype, X 9.8; *k*, left second maxilliped of holotype, X 13.9; *l*, left third maxilliped of holotype, X 9.8; *m*, right first leg of holotype in posterior view, X 9.8; *n*, left first leg of holotype in posterior view, X 9.8; *o*, right first leg of holotype in anterior view, X 9.8; *p*, first legs of ovigerous female paratype in posterior view, X 9.8; *q*, left second leg of holotype, X 9.8; *r*, left third leg of holotype, X 9.8; *s*, left fourth leg of holotype, X 9.8; *t*, right fifth leg of holotype, X 9.8; *u*, left first pleopod of holotype, X 25.2; *v*, left second pleopod of holotype, X 25.2.

of being 6-jointed. Antennal scale (fig. 8,*f*) reaching about to end of antennular peduncle, the outer spine reaching barely as far as distal margin of blade. Antennal peduncle reaching to about middle of distal antennular segment. Third maxillipeds (fig. 8,*l*) barely over-reaching antennal scale. First and second legs with a rudimentary exopod as in some, if not all, other species of *Athanas*. First legs in adult male (fig. 8,*m-o*) little unequal, extending beyond antennal scale by about one-fifth of the merus; coxa armed with a strong, sharp spine anteriorly. First legs in female (fig. 8,*p*) with merus and chela subequal in length and about 1.3 times as long as carpus. Second legs (fig. 8,*q*) reaching nearly to end of antennal scale; carpus with first joint slightly longer than other four together, second, third, and fourth subequal and each less than one-half as long as fifth. Third legs (fig. 8,*r*) extending beyond antennal scale by length of dactyl; fourth legs (fig. 8,*s*) reaching just about to end of scale; and fifth legs (fig. 8,*t*) extending to about middle of antennal scale. Dactyls of last three legs simple, not biunguiculate.

The mouthparts are as shown in figure 8,*g-k*.

Most of the males in this collection lack one or both of the first pair of legs, so that it is not certain whether these legs are sometimes strikingly asymmetrical or not. In all males having carapace lengths from 2.5 to 2.7 mm., however, the remaining leg, if present, is small, approaching the condition in the female. At a carapace length of 2.9 mm. the remaining leg is of intermediate size. One larger male, with a carapace length of 3.1 mm., has both legs large but somewhat more asymmetrical than in the type.

The male holotype is approximately 10 mm. long and has a carapace length of 3.1 mm. The other males from the type locality have carapace lengths of from 2.5 to 3.7 mm., the ovigerous females from 2.5 to 3.2 mm. The male from Namu Island, Bikini Atoll, has a carapace length of 3.4 mm., and the ovigerous females from Tufa Island, Rongelap Atoll, have carapace lengths of 3.4 and 3.5 mm.

This species is named with some hesitation because of the numerous similar forms now known from the Indo-Pacific region. All of the specimens differ uniformly in certain particulars from previous descriptions, however. The present form differs as follows from those species in which the supracorneal spines are lacking and the dactyls of the last three pairs of legs are simple: From *A. crosslandi* Tattersall, 1921, it is distinguished by the shorter rostrum and extracorneal teeth and the longer stylocerite. From *A. dimorphus* Ortmann, 1894, by the shorter stylocerite and shorter and more robust appendages. From *A. esakii* Kubo, 1940, by the longer stylocerite and much smaller

infracorneal tooth. From *A. haswelli* Coutière, 1908, by the shorter carpus of the first legs in the female. From *A. japonicus* Kubo, 1936, by the slightly shorter rostrum, the absence of a dorsal carina behind the rostrum, smaller infracorneal tooth, longer stylocerite, shorter outer spine on the antennal scale, and more robust appendages. From *A. lamellifer* Kubo, 1940, by its much shorter rostrum and shorter and stouter appendages. From *A. minikoensis* Coutière, 1903, by the blunt, rather than sharp, infracorneal tooth and by the carpus of the first leg in the female being more than one-half as long as the merus; the specimens assigned to this species by de Man (1911b, p. 149) have the infraorbital tooth blunt as in *A. marshallensis*, but the telson is 3.8 rather than 2.7 times as long as the width of its posterior margin and the stylocerite is slightly shorter than in

TABLE 2.—Length to width proportions of the leg segments in females of *Athanas marshallensis* (*italics*) and *A. stebbingii*.

| | <i>Merus</i> | | <i>Carpus</i> | | <i>Propodus</i> | |
|----------------------|--------------|------------|---------------|------------|-----------------|------------|
| Right first leg..... | <i>4.3</i> | <i>5.9</i> | <i>3.2</i> | <i>5.0</i> | | |
| Left first leg..... | <i>4.3</i> | <i>6.1</i> | <i>3.0</i> | <i>5.5</i> | | |
| Third leg..... | <i>3.8</i> | <i>5.2</i> | <i>3.2</i> | <i>4.2</i> | <i>6.6</i> | <i>9.3</i> |
| Fourth leg..... | <i>3.9</i> | <i>4.8</i> | <i>3.3</i> | <i>3.6</i> | <i>6.7</i> | <i>8.7</i> |
| Fifth leg..... | <i>3.8</i> | <i>4.8</i> | <i>4.0</i> | <i>3.8</i> | <i>6.4</i> | <i>8.7</i> |

A. marshallensis. From *A. orientalis* Pearson, 1905, by the slightly shorter rostrum and shorter extracorneal and, especially, infracorneal teeth. From *A. ohsimai* Yokoya, 1936, by the longer antennal scale, less massive movable finger of the first cheliped in the male, and shorter fingers of the first cheliped in the female. From *A. polymorphus* Kemp, 1915, by the absence of a pterygostomial tooth and more robust appendages. From *A. tenuipes* de Man, 1910, by the more robust appendages and much broader telson. *A. marshallensis* appears to be most closely allied to *A. stebbingii* de Man, 1920, described from a single ovigerous female from the Java Sea, but it differs from the description and figures of that species (de Man, 1922, p. 18, pl. 2, figs. 10–10a, pl. 3, figs. 10b–f) by its somewhat broader telson and stouter appendages; the telson in *A. marshallensis* is 1.5 times as long as its basal width and 2.7 times as long as its distal width, while the corresponding figures for *A. stebbingii* are 1.7 and 3.4 mm., respectively; the above table shows the proportions of the leg segments in *A. marshallensis* compared with those computed from de Man's measurements of the type of *A. stebbingii*.

Athanas areteformis Coutière

Athanas areteformis Coutière, 1903, p. 79, figs. 17,18; 1905, p. 860, fig. 132.

Bikini Atoll: Namu Island; outside reef; Apr. 4, 1946; M. W. Johnson; 1 male.

This specimen has a carapace length of 2.2 mm. Although it lacks all of the thoracic legs except the second and fifth on the right side, it agrees in all other particulars with Coutière's description and figures.

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LANTERNFLIES OF THE FAMILY ISSIDAE OF THE LESSER
ANTILLES (HOMOPTERA: FULGOROIDEA)

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This report is concerned primarily with the family Issidae as represented in the Lesser Antilles, but opportunity has been taken to comment on a few species of interest from other parts of the Caribbean area. The material on which this study has been based, with only one or two exceptions, was collected by the writer. Holotype and allotype specimens of new species described have been deposited in the U. S. National Museum.

The writer's thanks are tendered to the authorities of the U. S. National Museum and, in particular, to Dr. D. A. Young, of the U. S. Department of Agriculture, for providing facilities for study and assistance whenever it was needed. This work was carried out during the tenure of a fellowship awarded by the John Simon Guggenheim Memorial Foundation.

History and zoogeography

The first member of the group to be recorded from the Lesser Antilles was *Acanalonia viriditerminata*,² which Lethierry described in 1881

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²The writer has stated his reasons elsewhere for placing *Acanalonia* in the family Issidae (*Trans. Ent. Soc. London*, vol. 105, pt. 19, p. 471, 1954).

when studying the collections of Delauney from the French West Indies and referred to the flatid genus *Carthaea* Stål. Thirteen years later Uhler described the new species *musca* from St. Vincent and erected the genus *Cheiloceps* for its reception. According to the existing characterization of *Thionia* Stål, *Cheiloceps* must be placed in synonymy, but its original species and other West Indian species, described below, differ strikingly from typical *Thionia* (e. g., *T. longipennis* Spinola) in the structure of the ovipositor as well as in bodily proportions. There is a little evidence, derived partly from examination of a few undescribed *Thionia* from Central America and partly from comparison of the shape of the ovipositor in various species of the genus *Colpoptera*, that with sufficient material it will prove possible to find a series of intergrading forms. Nevertheless, the West Indian species form a distinct and natural group within the genus, and the name *Cheiloceps* may usefully be preserved at subgeneric level for this group.

These are the only Lesser Antillean issids described, but recently material of a small *Acanalonia* from Antigua, B. W. I., has been referred by Caldwell (*in* Caldwell and Martorell, Puerto Rico Univ. Journ. Agr., 1950, vol. 34, No. 2, p. 268, 1951) to a species described from the Greater Antilles. Apart from this particular disposition, it is relevant to refer to the study of Puerto Rican Issidae in the paper cited, as the data there presented shed much light on the source from which the Lesser Antillean Issidae have been derived.

It appears to be generally true that wherever related faunas can be closely compared, members of the Issidae are among the foremost of those forms which exhibit the greatest degree of morphological difference, and are sensitive indicators of degree of population divergence. In the Lesser Antillean species the differences are most obvious, and sometimes only appreciable, in the genitalia of the male.

One species, *Colpoptera maculifrons* Muir, is clearly polytypic. Two of the processes of the male genitalia vary in their relative lengths to an unusually large extent even within populations from a single locality, and this degree of variation is not appreciably exceeded by that between populations from two or more different localities, even on different islands. Interisland differences, however, which are constant within any one population, appear in the shape of the distal part of the tegmina and in coloration, and it is these, rather than genitalic structure, that provide reliable characters for the recognition of any subspecies.

Of the other Lesser Antillean members of the genus *Colpoptera*, one, described below as new, is very close to *C. nemonticolens* Caldwell. The genitalic differences in both sexes are sufficiently large to make it

necessary to recognize two species, but there can be little doubt that both have descended from a common Greater Antillean progenitor.

In *Cheiloceps* there is little to indicate which Greater Antillean species should be considered nearest, but the choice perhaps lies between *Thionia ramosi* Caldwell and *T. borinquensis* Dozier although the coloration suggests affinity with *Thionia ustulipunctata* Uhler, new combination, and *T. argo* Fennah. The position is clearer in *Acanalonia*, where the relationship between *Acanalonia viriditerminata* (Lethierry) and the Puerto Rican *agilis* Melichar is extremely close, while, as already mentioned, *A. viequensis* Caldwell has been reported both from Vieques Island and from Antigua, B. W. I. It is possible that this species has been derived from the same stock that gave rise to *A. plana* Van Duzee in Jamaica. In view of the close relationship between the Puerto Rican and Lesser Antillean issid faunas it is surprising that no counterpart of the *servillei*-like forms of the Lesser Antilles has been reported from Puerto Rico. The corresponding form which is geographically nearest is *A. robusta* Walker from Jamaica. In Trinidad, to the south, there are two species of *Acanalonia* of generally similar appearance to the insular forms just mentioned. But the differences between either of these and any Antillean species are very pronounced in points of detail, and it is evident that no such close relationship exists as that between the Lesser Antillean and Jamaican species. A similar observation may be made with regard to *Thionia*, but no definite judgment can be formed about *Colpoptera*, as only a single species, as yet undescribed, is known in Trinidad.

Key to genera of Lesser Antillean Issidae

- 1. Mesonotal disc twice as long as broad or longer; posttibiae laterally unarmed; vertex conically produced or not separated from frons by a carina; tegmina held subvertically in repose **Acanalonia** Spinola
- Mesonotal disc less than 1.5 times as long as broad; posttibiae almost invariably armed with one or two spines; vertex not conically produced, always separated from frons by a carina; tegmina for most of length rounded-tectiform in repose 2
- 2. Form broadly ovate; wings very large with margin strongly indented twice and anal lobe larger than anterior lobe; posttibiae laterally bispinose.

Thionia Stål

Form narrow and elongate; wings not exceptionally large, with margin very feebly indented and anal lobe much smaller than anterior lobe; posttibiae laterally with a single spine, occasionally unarmed . **Colpoptera** Burmeister

Genus Colpoptera Burmeister

Colpoptera Burmeister, Handbuch der Entomologie, vol. 2, p. 155, 1835. (Logotype, *Colpoptera sinuata* Burmeister, loc. cit., designated by Melichar, in Wytzman, Genera Insectorum . . ., fasc. 182, p. 92, 1923.)

Neocolpoptera Dozier, Amer. Mus. Nov., vol. 510, p. 22. (Type species, *Neocolpoptera portoricensis* Dozier, loc. cit., original designation.)

Colpoptera memnonia, new species

FIGURE 2, a-i

Testaceous-fuscous; frons laterally, genae anteriorly, and sides of clypeus pallid stramineous, sides of vertex, anterior and posterior margin of pronotum, disc of mesonotum, a sinuate suffusion between disc and tegulae, and metathoracic pleurites fuscous-piceous. Tegmina hyaline at base and between R and costal margin, remainder of corium and clavus fuscous-piceous as far as nodal line, membrane, except anterior to R, brown. Wings hyaline, suffused with brown in distal half.

Anal segment of male with anal foramen situated about one-third from base, in lateral view strongly deflexed distad of anal foramen, with upper margin concave and lower sinuate, lateroapical angles broadly triangularly produced ventrad, apical margin convex. Aedeagus broadly tubular, shallowly curved upward distally, armed ventrolaterally on left about one-fifth from apex with a moderately short stout spine directed cephalad and slightly curved dorsad at apex; a corresponding spine on right side of same shape but distinctly longer; a pair of broadly Y-shaped processes arising near the base of these spines, directed dorsad and closely investing aedeagus. Genital styles subovate, dorsal margin in its basal half strongly bent laterad, dorsal process in anterior view with a stout decurved spine on outer side near base, thence shallowly tapering distad to rounded apex, in lateral view bent cephalad in apical third.

Anal segment of female in profile very narrow and almost straight distad of anal foramen. Pregenital sternite only moderately produced ventrocaudad distally, its hind margin in anteroventral view broadly truncate-convex, very much thickened, and devoid of any eminence on dorsal surface.

Male, length 6.0 mm., tegmen 6.9 mm. Female, length 7.0 mm., tegmen 6.9 mm.

Specimens examined: 1 male (holotype, USNM 62014) and 1 female (allotype), 1,000 ft. in mountain forest, Dominica, B. W. I., July 6, 1939, Fennah. This species is near to *Colpoptera monticolens* Dozier, new combination, and *Colpoptera nemonticolens* Caldwell, new combination. It differs from them in the shape of the male anal segment, in the shape and length of the aedeagal processes, in the shape of the dorsal margin of the genital styles, and in the coloration of the frons.

Colpoptera cyatheae, new species

FIGURE 3, n-r

Vertex broader across apex than long in middle line (2.7:1), frons in middle line as long as broad.

Yellowish testaceous; disc of mesonotum, abdominal tergites, and genitalia testaceous to fuscous-piceous. Tegmina yellowish brown between Sc and costal margin, and along commissural margin of clavus, remainder of corium dark fuscous, almost piceous, membrane wholly brown. Wings more or less suffused with brown.

Anal segment of male with anal foramen situated about one-third from base, in lateral view roundly decurved, then directed approximately caudad, lower lateral margins angulately produced ventrad, apical margin deeply convex. Aedeagus tubular, slightly curved upward distally, a pair of slender spinose processes arising laterally near apex, directed cephalad above aedeagus; a second pair of spinose processes arising ventrolaterally near apex, elongate, directed cephalad and lying close against ventral surface of aedeagus almost to its base. Genital styles subovate, process on dorsal margin almost vertical, tapering dorsad and abruptly bent laterad at right angles at apex and expanded in a horizontal wedge-shaped lobe.

Anal segment of female in profile moderately broad and distinctly curved distad of anal foramen. Pregenital sternite strongly produced ventrocaudad, broadly convex in anteroventral view, a bluntly conical eminence medially on dorsal surface a little distance from margin.

Male, length 5.1 mm., tegmen 6.0 mm. Female, length 5.8 mm., tegmen 6.6 mm.

Specimens examined: 4 males (one the holotype, USNM 62018), 2 females (one the allotype), and a nymph taken on *Cyathea* sp. and other vegetation in mountain forest, Quillesse, St. Lucia, Feb. 21, 1941, Fennah. This species is quite distinct from any so far described. It differs from all in the shape of the male genitalia, from *Colpoptera portoricensis* Dozier, new combination, in its smaller size, and from *Colpoptera rara* Caldwell, new combination, *C. monticolens* Dozier, and *C. nemonticolens* Caldwell in the shape of the hind margin of the pregenital sternite of the female.

Colpoptera meleagris, new species

FIGURE 1, p-v

Testaceous; disc of frons except for a spot on each side at level of antennae and some small spots on lateral margins and disc of clypeus except near base reddish brown; a few spots on pronotum behind eyes, mesonotum, and protibiae and mesotibiae anteriorly yellowish brown; abdomen brown, posterior margin pallid. Tegmina hyaline, tinged pale yellow, sometimes with a broad sinuate vitta from costa at base to humeral eminence, then obliquely to claval suture, thence broaden-

ing into membrane and reaching apical margin between R and M. Wings more or less infusate.

Anal segment of male not very long, anal foramen situated at middle, in profile anal segment weakly declivous distad, lower lateral margin rectangulately produced ventrad at middle; in dorsal view anal segment slightly tapering distad of anal foramen, apical margin deeply convex. Pygofer with dorsolateral angles prominent, lateral margins shallowly concave. Aedeagus curved upward distad, a spinose process, in the form of an inverted Y, on each side near apex, closely adpressed to aedeagus; a pair of long spinose processes arising ventrally and slightly subapically, directed cephalad below aedeagus, sinuate in their basal half. Genital styles subovate, in side view with ventral margin shallowly convex, dorsal margin straight, strongly ascending to process, thence deeply concave to apical margin, which is convex; dorsal process bent laterad at apex in a small horizontal subtriangular plate.

Anal segment of female very long and narrow, evenly decurved throughout, anal foramen situated a little basad of middle. Ovipositor with valvulae long, narrow, and decurved, tapering distally to acuminate tip.

Pregenital sternite markedly produced ventrocaudad, in anteroventral view deeply convex, not twice as broad across base as long in middle line.

Male, length 5.5 mm., tegmen, 5.0 mm. Female, length 4.0 mm., tegmen 5.6 mm.

Specimens examined: 13 males (one the holotype, USNM 62017), 3 females (one the allotype), and 1 nymph, 1,200 ft., Ridgefield, Dominica, B. W. I., June 18, 1940, Fennah. This species would appear to be nearest to *Colpoptera fusca* Caldwell in the shape of the aedeagus, but the two are not closely similar even in this structure, and they differ in the relative length of the ventral spines. More obvious differences are to be found in the shape of the anal segment of the male, of the pregenital sternite of the female, and in bodily coloration.

This species, which inhabits high montane forest, differs profoundly from all species of *Colpoptera* so far described in the shape of the female genitalia, which may be compared with those of *Syrgis* and *Tempsa* from the Orient, or with those of species assigned to the subgenus *Cheiloceps* or *Thionia* (see p. 24).

***Colpoptera lucaris*, new species**

FIGURE 2,*m,n*

Closely similar in size and form to *C. meleagris*, new species.

Light testaceous; clypeus and a broad even band along middle of frons slightly but distinctly darker, abdominal sclerites yellowish

brown, genitalia fuscous. Tegmina hyaline, tinged dull yellow, veinlets in middle area of membrane diffusely overlaid with fuscous; sometimes corium anterior to Cu_1 infuscate from basal third to nodal line. Wings lightly and uniformly suffused brown except at apex of Cu_2 .

Anal segment of male long, distally narrow; anal foramen situated about one-third from base; anal segment in profile evenly decurved throughout, lower margin concave, not at all produced ventrad at level of anal segment. Aedeagus tubular, curved upward distally, a pair of long spinose processes arising ventrally near apex, directed cephalad and lying close against aedeagus, shallowly sinuate in basal half and curved upward distally; a pair of shorter spinose processes arising laterally near apex, shallowly sinuate, directed ventrocephalad. Genital styles broadening distad, ventral margin very shallowly convex, dorsal margin straight, ascending from base to process, declivous distad of it, apical margin convex, dorsal process broad, tapering distad, thickened on anterior face, narrow on margin, abruptly bent laterocaudad at apex in a small subhorizontal lobe.

Female with genitalia similar to those of *C. meleagris*, new species.

Male, length 5.4 mm., tegmen 5.1 mm. Female, length 4.2 mm., tegmen 5.5 mm.

Specimens examined: 1 male (holotype, USNM 62015) and 1 female (allotype) in mountain forest, Dominica, B. W. I., June 11 to July 8, 1939, Fennah. The female specimen is not so definitely marked as the male, but the two are associated by the presence of the vertical band down the middle of the frons.

The occurrence of this species virtually side by side with *C. meleagris* is remarkable, as *meleagris*, by reason of its exceptional female genitalia, stands apart from all other Caribbean *Colpoptera*. Speculation about its origin, however, must await knowledge of the corresponding species in Guadeloupe and Martinique, which lie to the north and south, respectively, of Dominica.

Colpoptera thyone, new species

FIGURE 2,j-l

Testaceous; frons with a cloud in middle of disc and at base, and sublateral margin interruptedly, fuscous; clypeus basally testaceous, distally fuscous-piceous; vertex infuscate except in middle line and in middle of each compartment; antennae fuscous; pronotum infuscate on anterior part of disc and behind eyes, infuscate areas maculate with testaceous; mesonotum with disc (except in middle line), a triangular area near each lateral angle, and a pair of wedge-shaped markings just anterior to disc fuscous; abdominal tergites and ster-

nites, except for a median linear spot posteriorly on latter, brown or fuscous; anal segment castaneous-piceous, genital styles ventrally light fuscous. Tegmina subhyaline, corium and membrane castaneous-fuscous except at base, and a large hyaline spot on costal margin one quarter from base, and a narrower and more elongate area in region of node; clavus lightly marbled with yellowish fuscous. Wings lightly and uniformly infusate.

Anal segment of male rather short, anal foramen situated about one-third from base, apical margin convex; anal segment in profile weakly declivous distad of anal foramen, lower margin concave, lateroapical angles broadly and strongly produced ventrad, acute at tip. Pygofer with dorsal angles roundly produced. Aedeagus long, tubular, curved upwards distally, a narrow subvertical lobe on dorsal surface at base near point of suspension; a pair of moderately long straight spines arising laterodorsally near apex, each with a minute spine dorsally at its base, directed cephalad and lying close against aedeagus. Genital styles subtriangular, ventral margin straight, dorsal margin ascending straight from base to near middle, then abruptly descending to base of dorsal process; apical margin deeply convex, dorsal process relatively short and stout, shortly bifurcate distally with the anterior limb directed dorsad and the posterior laterad.

Anal segment of female moderately long, apical margin transverse. Third valvulae of ovipositor broadly triangular, narrowing distad, apical margin unpigmented, tumid, and membranous. Pregenital sternite with posterior margin transverse, a very short and broad unpigmented setigerous eminence at middle.

Male, length 3.3 mm., tegmen 4.3 mm. Female, length 5.0 mm., tegmen 5.3 mm.

Specimens examined: 26 males, 30 females, and 4 nymphs, mostly taken on *Lantana* sp., Soufriere, St. Lucia, B. W. I., Feb. 25, 1941, Fennah. Holotype male, allotype female, USNM 62016.

This species is distinguished readily by the bold color pattern and by the shape of the male and female genitalia.

Coloptera maculifrons Muir

Coloptera maculifrons Muir, Proc. Hawaiian Ent. Soc., vol. 5, p. 466, 1924.

Coloptera maculifrons dominicana, new subspecies

FIGURE 1, a-e

Brown; frons slightly paler except for a faint transverse bar in basal third; clypeus distally, disc of mesonotum, and a lozenge-shaped mark near each lateral angle piceous; pronotum infusate with testaceous mottling. Tegmina light brown, moderately translucent

near base; distal two-thirds of corium and marginal area of clavus dark fuscous, membrane brown. Wings suffused with brown.

Anal segment of male narrow, moderately long, slightly declivous distad of anal foramen, which is situated about one-third from base and slightly decurved at tip. Aedeagus tubular, weakly curved upward distally, an unequally bifurcate process arising laterally close to apex, directed cephalad, the shorter limb above the longer; a pair of stout spinose processes arising ventrally in apical quarter, each process directed cephalad, lying close to aedeagus, and curved dorsad at its tip; processes of equal length or one process longer than the other, the longer sometimes on left, sometimes on right. Genital styles broadly rounded-triangular, in profile with ventral and dorsal margins straight, apical margin deeply rounded, dorsal process vertical, porrect, distally attenuated, dilated into a small lobe at apex.

Anal segment of female long, decurved distad of anal foramen, which is situated one-third from base. Third valvulae broadly triangular with distal margin unpigmented, slightly tumid. Pregenital sternite strongly produced ventrocaudad, produced portion in anteroventral view almost semicircularly rounded.

Male, length 5.2 mm., tegmen 6.5 mm. Female, length 5.0 mm., tegmen 6.8 mm.

Specimens examined: 17 males, 19 females, and 8 nymphs, Ridgefield, Dominica, B. W. I., July 18, 1940, Fennah (subspecific holotype male, allotype female, USNM 62011).

This subspecies is distinguished from the typical subspecies (of which the holotype is figured for comparison) in the shape of the frons and of the apical margin of the tegmina, as well as in tegminal proportions. There is excellent agreement in the forms of both the male and female genitalia between the present subspecies and the typical subspecies, and it is on this account that the writer feels compelled to assess the differences as being of subspecific value.

Coloptera maculifrons angustior, new subspecies

FIGURE 1, f-h

Closely similar to typical subspecies in size, shape of head and of tegmina, and in shape of male and female genitalia.

Frons uniformly pale testaceous or stramineous with a moderately broad transverse band along basal margin piceous; color of body otherwise as in typical subspecies. Tegmina brown, subopaque, longitudinal veins of corium concolorous or slightly darker than ground color, transverse veinlets concolorous with ground; membrane sepia brown, or a little lighter, with venation pale.

Specimens examined: 8 males and 4 females, Christian Valley, Antigua, B. W. I., August 1943, Fennah (subspecific holotype male, allotype female, USNM 62012); 9 males and 3 females from Nevis, B. W. I., Jan. 16, 1942, Fennah; 2 males and 2 nymphs, St. Kitts, B. W. I., Jan. 23, 1942, Fennah; 1 male and 1 female from forest in the Central Hills, Montserrat, B. W. I., May 21, 1941, Fennah (marked as in the Nevis subspecies); 1 female, Constitution Hill, Christiansted, St. Croix, Virgin Islands, April 1936, H. A. Beatty.

The material from Nevis is generally similar to that from Antigua, but differs in that the mesonotal carinae and lateral areas together with two small spots at the hind margin of the disc are pallid, not uniformly infusate; also, the areas between the pustules on the base of the frons are slightly infumed, so that in the basal part of the frons the pustules are plainly visible.

The specimen from St. Croix is smaller than the Antiguan specimens and the markings are bolder, but otherwise is very close to them in general appearance.

Colpoptera maculifrons grenadana, new subspecies

FIGURE 1, f, j, i

Coloring very similar to Antiguan population of *C. maculifrons angustior*, new subspecies. Tegmina with apical margin straight or very shallowly sinuate, anal angle obtusely rounded; angle formed by projecting apical and sutural margins of membrane slightly obtuse.

Specimens examined: 2 males, 10 females, and 7 nymphs from Mardi Gras, Grenada, Oct. 20, 1943, Fennah (subspecific holotype male, allotype female, USNM 62013).

This population is undoubtedly nearest to *C. maculifrons dominicana*, new subspecies, but the shape of the apical margin of the tegmina creates a superficial resemblance to *C. maculifrons angustior*. The most obvious difference lies in the shape of the anal angle of the tegmina; in the Grenadan subspecies this is definitely obtuse, whereas in *C. maculifrons angustior* it is slightly acute. In the aedeagus the laterodorsal processes are rather longer than in the Leeward Island subspecies.

The nymphs of *C. maculifrons* are, for an issid, most unusual in their coloration. They are pure white, with the apex and base of the frons piceous; a broad, yellowish brown band extends from behind the eyes along the sides of the body to the apex of the abdomen, its inner margin being dark brown. This band, when overlaid with wax, appears dark reddish mauve. As in other nymphs of this genus, a long tuft of stiff, porrect bristles of wax is developed on the ceriferous plates at the apex of the abdomen. Like the adults, the nymphs feed on the unhardened apical stems of dicotyledonous woody perennials, but sometimes also feed below leaves on the midrib.

Colpoptera elevans (Walker)FIGURE 2, *o-s*

Poeciloptera elevans Walker, List of the . . . homopterous insects in the . . . British Museum, suppl., p. 335, 1858.

Colpoptera rugosa Van Duzee, Bull. Buffalo Soc. Nat. Sci., vol. 8, No. 5, p. 36, 1907.

Specimens examined: 2 males, 4 females, and 2 nymphs from Mona, Jamaica, B. W. I., Nov. 1940, Fennah.

This species differs from those from the eastern Caribbean area in the shape of the pregenital sternite of the female and of the lateral margin of the pygofer, which is narrowly produced caudad at middle in a slender process, rounded at its apex.

Colpoptera chrysops, new speciesFIGURE 1, *k-o*

Testaceous or light fuscous; apical half of vertex, frons, genae, and basal two-thirds of clypeus pale yellow, basal part of vertex and lateral margins, sides of head immediately below eyes, and clypeus distally fuscous-piceous; pronotum, tegulae, at least posterior margin of mesonotum, and abdominal sclerites fuscous.

Tegmina subhyaline, castaneous-fuscous at base; distad of this, costal cells to level of apex of Sc, and cells of Sc as far as level of node hyaline, corium otherwise fuscous, clavus distinctly lighter and with a yellowish tinge, this coloration extending a little into membrane distad of claval apex; membrane, except as otherwise stated, fuscous. Wings infusate, paler toward base, veins fuscous.

Anal segment of male moderately short, anal foramen situated one-third from base, distal portion flattened with lateral margins slightly elevated, apical margin transverse; in profile anal segment rather narrow, declivous and almost straight distad of anal foramen, lower lateral margins produced ventrad just distad of middle in a triangular lobe. Pygofer with dorsal angles rounded-subrectangulate, not prominent, a straight, tapering process, apically acute, arising at middle of hind margin and directed caudad. Aedeagus moderately long, subtubular, shallowly curved upward, bilaterally symmetrical; four spines arising dorsolaterally near apex, three horizontal, directed cephalad, and one subvertical; lowest member of the horizontal spines straight, tapering distally, the second shorter, curved dorsad distally, the third much shorter than second and sinuate; the subvertical spine shorter than all these, directed dorsomesad. Genital styles subtriangular, lower margin almost straight, apical margin very shallowly convex, dorsal margin ascending to middle, then descending to base of apical process, which is short, directed dorsad, flattened into an ovate disc on outer surface, and acute at apex.

Male, length 5.2 mm., tegmen 6.3 mm.

Specimen examined: Holotype male, Cinchona, Jamaica, July 25, 1924, C. C. Gowdey (USNM 62056).

This species resembles *C. elevans* (Walker) in general build of body and gross structure of male genitalia, and is undoubtedly closely related to it. It differs in the coloration of the head and tegmina and in the shape of the processes of the aedeagus.

Genus *Thionia* Stål

Thionia Stål, Berliner Ent. Zeitschr., vol. 3, p. 321, 1859 (logotype, *Issus longipennis* Spinola, Ann. Soc. Ent. France, vol. 8, p. 348, 1839; designated by Schmidt, Stettiner Ent. Zeit., vol. 71, p. 189, 1910).

Subgenus *Cheiloceps* Uhler

Cheiloceps Uhler, Proc. Zool. Soc. London, 1895, p. 68. (Haplotype, *Cheiloceps musca* Uhler, loc. cit.).

This subgenus is distinguished from the typical subgenus by the shape of the ovipositor, which is relatively elongate strongly tapering distad, decurved, and acute at apex. In the typical subgenus the ovipositor is short and concealed by the short, convexly subquadrate third valvulae.

Thionia (Cheiloceps) musca Uhler

FIGURE 4,*a-e*

Cheiloceps musca Uhler, Proc. Zool. Soc. London, 1895, p. 68.

The figure of the male genitalia was kindly prepared by Dr. W. E. China from a male cotype in the British Museum (Natural History) which is here designated as the holotype. The remaining figures are of a female cotype in the U. S. National Museum which is here designated as the allotype. The typical pair was the only material available for study from St. Vincent.

Thionia (Cheiloceps) musca grenadana, new subspecies

FIGURE 4,*f,g*

Closely similar in external characters to the typical subspecies.

Anal segment of male with lateral margins at middle produced ventrad in a broader lobe. Aedeagus in profile acute apically, a long spinose process arising laterally approximately one-quarter from apex, directed laterad for half its length and slightly curved, then abruptly bent upward and continued straight to acuminate apex.

Male, length 3.8 mm., tegmen 3.1 mm. Female, length 3.8 mm., tegmen 3.8 mm.

Specimens examined: Subspecific holotype male, allotype female, and 2 nymphs, Grenada, B. W. I., Oct. 20, 1943, Fennah (USNM 62057).

This subspecies differs from the typical subspecies in the broader lateral lobe of the anal segment of the male and in the acute apex of the aedeagus in profile. The coloring is closely similar, though the frons of the female is less infusate than that of the allotype of *T. musca musca* Uhler.

Thionia (Cheiloceps) clusia, new species

FIGURE 3,a-d

Of the same bodily shape and proportions as *T. musca* Uhler.

Stramineous; median carina of frons, lateral carinae of vertex, and anterior margin of mesonotum sometimes tinged orange; an ovate spot behind eyes and a smaller spot anteriorly lateral of pronotal disc fuscous. Tegmina subhyaline, tinged yellowish, in male very lightly infusate distally in areas between veinlets, in female more distinctly infusate between R and first claval vein; distal transverse veinlets frequently pallid.

Anal segment of male short, rhombic, anal foramen situated slightly basad of middle, sides converging distally to subacute apex, in profile both upper and lower margin very distinctly sinuate, apex acute. Pygofer rather short with laterodorsal angles obtuse, not prominent, lateral margins produced caudad at middle in an obtusely angulate lobe. Aedeagus tubular, shallowly curved upward distally, in profile narrowest at middle, dorsoapically membranous, devoid of processes; a broad falcate lobe, sclerotized on its posterior margin, between pygofer and base of anal segment on each side. Genital styles broad, expanding distally, ventral margin straight, dorsal margin slightly convex, apical process broad, distally acute with a short thin ledge extending laterad from its anterior margin near base.

Female genitalia as in *T. musca* Uhler.

Male, length 6.2 mm., tegmen 4.5 mm. Female, length 7.9 mm., tegmen, 5.5 mm.

Specimens examined: 35 males, 43 females, and 18 nymphs on *Clusia* sp. near active solfatara, Soufriere, St. Lucia, B. W. I., Mar. 22, 1939, Fennah (holotype male, allotype female, USNM 62009).

This species is distinguished from *T. musca* by tegminal coloration and by the shape of the male anal segment and aedeagus, as well as by the absence of aedeagal processes. In general this species is rarely encountered, but in the small enclave mentioned was observed to maintain a relatively high population over a period of eight years, when the opportunity for further observation ended.

Thionia (Cheiloceps) medusa, new species

FIGURE 3,e-h

Of same bodily shape and proportions as *T. musca* Uhler.

Light brown, speckled testaceous; frons sublaterally infusate with pustules testaceous; a small triangle on each side of middle line at

base, a large ovate spot on each side of pronotum behind eye, a mark on dorsal callus behind eyes, and a spot on anterior face of pronotum laterad of disc piceous, the last mark more or less concealed by hind margin of head; a spot on mesothorax below base of tegmina and a small spot near base of mesocoxae fuscous; a narrow line on outside of pronotal spot white. Tegmina subhyaline with a sordid yellow tinge; cells at apical margin in M and Cu₁ infusate. Wings hyaline, faintly tinged brown, with brown veins.

Anal segment of male elongate-rhombic, anal foramen situated slightly basad of middle, lateral margins tapering from this level to deeply rounded apex; in profile porrect caudad, with lower lateral margin straight or nearly so. Pygofer with laterodorsal angles obtusely rounded, not at all prominent, lateral margins shallowly convex, devoid of processes. Aedeagus tubular, curved upward distally, lateral dorsal margins diverging basad; in profile with a broad and rather long flattened process on each side, closely adpressed to aedeagus, directed ventrocephalad and abruptly narrowed distally into a sinuate spine; these processes in ventral view gradually converging cephalad, but abruptly bent laterocephalad near apex. Genital styles subtriangular, expanding distally, ventral margin feebly convex, dorsal margin straight, ascending to dorsal process, apical margin straight, oblique; dorsal process subtriangular in side view, with a short horizontal lamina arising on outer surface near base, apically bent dorsocephalad in a curved spine.

Female genitalia as in *T. musca*. Pregenital sternite broadly excavate on hind margin, but medially slightly produced dorsocaudad in a short convex lobe.

Male, length 5.8 mm., tegmen 4.5 mm. Female, length 5.6 mm., tegmen 6.5 mm.

Specimens examined: 17 males and 20 females, 1,000 ft. in mountain forest near the Imperial Road, Dominica, B. W. I., June 11-30, 1939, June 15-29, 1940, Fennah (holotype male, allotype female, USNM 62010).

This species differs from *T. musca* in markings, and from this and all other described species in the shape of the male and female genitalia. It resembles *T. borinquensis* Dozier in the presence of a piceous pronotal spot and in the shape of the anal segment of the male, but differs strongly in the position and shape of the aedeagal spines.

Thionia (Cheiloceps) laodice, new species

FIGURES 3, *i-m*; 5, *v*

Of same size and bodily proportions as *T. musca* Uhler.

Vertex as broad as long.

Light yellowish brown, obscurely speckled testaceous; two small triangular areas at base of frons and a small spot behind each eye

castaneous. Tegmina hyaline, tinged sordid yellow, two spots at apical margin in M and Cu fuscous.

Anal segment of male as in *T. medusa*, new species, but with lower lateral margin distinctly more sinuate. Pygofer as in *T. medusa*. Aedeagus tubular, curved upward distally, in profile with a rather long and narrow process on each side, closely adpressed to aedeagus, directed cephalad and curved dorsad distally, abruptly narrowed into a sinuate spine apically and recurved cephalad. Genital styles subtriangular in profile, expanding distad, ventral, apical and dorsal margins almost straight, dorsal process subtriangular, a short subhorizontal flange externally near base, apex rather broadly lobate and twisted so that apical margin is at right angles to axis of body.

Female genitalia as in *T. musca* Uhler. Pregenital sternite very shallowly excavate in median portion.

Specimens examined: 5 males and 7 females, Chance's Mountain, Montserrat, B. W. I., Jan. 18, 1939, Fennah (holotype male, allotype female, USNM 62008).

This species superficially resembles *T. medusa* but differs in the shape and direction of the aedeagal processes, which distally overlie the aedeagus, whereas they underlie it in *T. medusa*; it differs also in the shape of the dorsal process of the genital styles, which is acuminate in *T. medusa*, however viewed, but broad and rounded distally in posterior view in the present species. From *T. musca* it differs in these characters and also in the relatively wider vertex. Of the Greater Antillean species the closest appears to be *T. borinquensis* Dozier, which is of a much darker hue, and differs strongly in the shape and direction of the lateral processes of the aedeagus and in the shape of the dorsal process of the genital styles.

Thionia brevior Fowler

FIGURE 4, *h-j*

Thionia brevior Fowler in Godman and Salvin, *Biologia Centrali-Americana*, Rhynchota, Homoptera, vol. 2, pt. 1, p. 123, 1904.

This species does not occur in the Lesser Antilles, nor, as far as known, anywhere in the West Indies, but the opportunity is taken to publish figures prepared from the type material by Dr. W. E. China for comparison with the preceding species.

Genus *Acanalonia* Spinola

Acanalonia Spinola, *Ann. Soc. Ent. France*, ser. 1, vol. 8, p. 447, 1839 (haplotype, *Acanalonia servillei* Spinola, loc. cit., p. 448).

Acanalonia robusta (Walker)

FIGURE 5, *m-r*

Poeciloptera robusta Walker, *List of the . . . homopterous insects in the . . . British Museum*, vol. 2, p. 449, 1851.

Acanalonia servillei Van Duzee, *Bull. Buffalo Soc. Nat. Sci.*, vol. 8, No. 5, p. 38, 1907.

Specimens examined: 1 male, 2 females, and 3 nymphs from Mona, Jamaica, Nov. 1940, Fennah. The figures are of this male. The holotype of the species is female.

Acanalonia plana (Van Duzee)

FIGURE 5,j-l

Amphiscepa plana Van Duzee, Bull. Buffalo Soc. Nat. Sci., vol. 8, No. 5, p. 37, 1907.

Specimens examined: 1 male and 3 females taken on logwood, Mona, Jamaica, Nov. 1940, Fennah.

Acanalonia viriditerminata (Lethierry)

FIGURE 5,a-f

Carthaea viriditerminata Lethierry, Ann. Soc. Ent. Belgique, vol. 25, p. 14, 1881.
Carthaea simillima Lethierry, loc. cit., p. 15.

Specimen examined: 1 male from Guadeloupe, West Indies (the type locality), July, A. Busck. The figures are of this specimen.

Acanalonia viriditerminata sylvestris, new subspecies

FIGURE 5,i

Size and proportions as in typical subspecies, but head more distinctly acute at extreme apex. Coloration in life sometimes jade green with only humeral callus piceous, sometimes yellowish green with fuscous spots as figured.

Male genitalia as in typical subspecies, but apex of inner pair of aedeagal processes blunt, and gradually bent laterad distally; apex of short secondary process on each of the long ventral processes evenly rounded at tip, not at all dilated.

Specimens examined: 5 males, 9 females, and 2 nymphs, 800 ft. in forest, Chance's Mountain, Montserrat, B. W. I., Jan. 18, 1939, Fennah (subspecific holotype male, allotype female, USNM 62005). Also, 1 female and 4 nymphs, Ottley's Level, St. Kitts, B. W. I., Jan. 23, 1942, Fennah; assigned to this subspecies but in the absence of male material.

This subspecies differs from the typical subspecies in the vertex in dorsal view being more distinctly acute at the apex and not merely deeply rounded, in the inner processes of the aedeagus being blunt apically, not acuminate, and in the rounded, not obliquely truncate apex of the short vertical processes that arise near the middle of the long ventral processes.

Acanalonia virideterminata muscosa, new subspeciesFIGURE 5,*g,h*

Size and proportions, including shape of vertex, as in typical subspecies.

Yellowish green in life; a spot anteriorly on pronotum above eyes piceous; basal part of frons, sides of head, vertex, pronotal and mesonotal discs ferruginous speckled testaceous or green. Tegmina yellowish green, humeral callus, four or five spots in an oblique line distally, a narrow submarginal line apically, interrupted by veins, and posterior margin of clavus interruptedly fuscous.

Genitalia as in typical subspecies, but apex of inner pair of processes blunt and distinctly curved laterad at tip, and the short appendage of each of the long processes abruptly dilated at apex and obliquely truncate.

Specimens examined: 21 males, 28 females, and 65 nymphs, 1,000–1,200 ft. in mountain forest near Imperial Road, Dominica, B. W. I., June, July 1940, Fennah (subspecific holotype male, allotype female, USNM 62004).

This subspecies is distinguished by the dilated apices of the secondary processes of the ventral aedeagal spines.

Acanalonia bonducellae, new speciesFIGURE 4,*k-n*

Vertex about 2.4 times as broad as long in middle line, scarcely longer in middle line than at sides, declivous, rounding into frons; frons broader than long, feebly tricarinate. Tegmina with apical and anal angles rounded. Posttibiae apically 8-spined, basal metatarsal joint 10-spined.

Jade green; a small spot on each side near base of lateral carinae of pronotal disc piceous; protibiae and mesotibiae subferruginous, speckled with testaceous spots.

Anal segment of male moderately long, anal foramen slightly distad of middle, apical margin deeply rounded. Pygofer rather long, laterodorsal angles strongly produced in a narrowly triangular process acuminate at tip, lateral margins strongly oblique. Aedeagus with inner process blunt at apex, distally directed ventrocaudad and slightly mesad; the long apical pair of processes recurved below aedeagus and directed cephalad, devoid of secondary appendages and narrow but not acuminate at tip. Genital styles subtriangular, ventral margin in profile slightly sinuate, deeply rounded apically, dorsal margin ascending concavely from base to dorsal process, apical margin very oblique, straight, dorsal process obliquely truncate apically, sclerotized along distal margin, acute at apex.

Pregenital sternite of female very shallowly convexly produced on posterior margin.

Male, length 7.6 mm., tegmen 7.6 mm. Female, length 8.5 mm., tegmen 10.0 mm.

Specimens examined: Holotype male, allotype female (USNM 62007), and 78 males and 88 females on "roucou" (*Caesalpinia bonducella*) in a gully near Plymouth, Montserrat, B. W. I., Jan. 17, 1939, Fennah. A single female from St. Kitts, Jan. 23, 1942, Fennah, also is assigned to this species.

This species is distinguished by the strongly produced laterodorsal angles of the pygofer and by the shape of the processes of the aedeagus.

Acanalonia hewanorrae, new species

[FIGURE 5, s-u

Of same form, size, and color as *A. bonducellae*, new species. Post-tibiae apically 6 to 8 spined, basal metatarsal joint 9-spined.

Anal segment of male moderately long, anal foramen situated slightly distad of middle, apical margin rather broadly rounded. Pygofer with laterodorsal angles bluntly rectangulate, not produced, lateral margins vertical, not oblique. Aedeagus of same form as in *A. bonducellae*, inner pair of processes distally decurved and acuminate; apical processes reflected below aedeagus, devoid of secondary appendages, and acuminate at apex. Genital styles of same form as in *A. bonducellae*.

Pregenital sternite of female produced caudad at middle in a semi-circular lobe, margin distinctly excavate on each side of this lobe.

Specimens examined: Holotype male, allotype female (USNM 62006), and 12 males, 13 females, and 9 nymphs from St. Lucia, B. W. I., Nov. 30, 1938, Fennah. Also assigned to this species are 3 males, 1 female, and 1 nymph from Kingstown, St. Vincent, B. W. I., Mar. 31, 1941, Fennah, and 1 male from Mardi Gras, Grenada, B. W. I., Oct. 30, 1943, Fennah.

This species differs from *A. bonducellae*, which it generally resembles, in the shape of the pygofer, the acuminate apex of all the aedeagal processes, and, in the female, in the shape of the pregenital sternite.

The close agreement in the shape of the anal segment of the male and of the genital styles raises the question whether this species is not perhaps better regarded as a subspecies of *A. bonducellae*. With the material available, recognition of *A. hewanorrae* as a full species appears to be the better interpretation of the data, but if intermediate forms should be found in Martinique, Dominica, and Guadeloupe, the St. Lucian form may have to be reduced in status.

Acanalonia theobromae Fennah

FIGURE 4,0-9

Acanalonia theobromae Fennah, Proc. U. S. Nat. Mus., vol. 95, p. 503, 1945.

Aedeagus with a median spine directed caudad between inner pair of processes, the latter decurved and acuminate at tip, apical processes reflected below aedeagus, acuminate at tip and slightly deflexed, a short secondary process at middle, directed mesad, slightly curved, blunt at apex.

This species was compared in the original description with the Central American species *A. decens* Stål. An additional point in which the two species differ is in the spinose armature of the hind legs. *A. theobromae* has eight spines at the apex of the posttibiae (occasionally seven on one leg), and eight or nine spines on the basal metatarsal joint. The posttibiae of *A. decens* each bear seven spines apically, while the basal metatarsal joint bears six.

EXPLANATION OF FIGURES

FIGURE 1

- Colpoptera maculifrons dominicana*, new subspecies, *a-e*: *a*, frons and clypeus; *b*, vertex and pronotum; *c*, head in profile; *d*, tegmen; *e*, aedeagus, left side.
- Colpoptera maculifrons angustior*, new subspecies, *f-h*: *f*, side view, tegmen in solid line; *g*, frons and clypeus; *h*, pregenital sternite of female, ventral view.
- Colpoptera maculifrons grenadana*, new subspecies, *f, i-j*: *f*, side view, tegmen in broken line distally; *i*, frons and clypeus; *j*, pregenital sternite of female, ventral view.
- Colpoptera chrysoptis*, new species *k-o*: *k*, vertex and pronotum; *l*, frons and clypeus; *m*, tegmen; *n*, anal segment, pygofer and genital style, left side; *o*, aedeagus, left side.
- Colpoptera meleagris*, new species, *p-v*: *p*, vertex and pronotum; *q*, frons and clypeus; *r*, tegmen; *s*, aedeagus, right side; *t*, pygofer and anal segment, right side; *u*, genital style, right side; *v*, pregenital sternite of female.
- Colpoptera cyatheae*, new species, *w-y*: *w*, tegmen; *x*, posterior margin of pregenital sternite of female; *y*, anal segment and terminal sclerites of female, right side.

FIGURE 2

- Colpoptera memnonia*, new species, *a-i*: *a*, frons and clypeus; *b*, vertex and pronotum; *c*, tegmen; *d*, anal segment of male and pygofer, side view; *e*, aedeagus, right side; *f*, distal process of aedeagus, detached and enlarged, posterior view; *g*, genital style, right side; *h*, anal segment and terminal sclerites of female, right side; *i*, posterior margin of pregenital sternite of female.
- Colpoptera thylene*, new species, *j-l*: *j*, anal segment, pygofer and genital style, left side; *k*, aedeagus, left side; *l*, posterior margin of pregenital sternite of female.
- Colpoptera lucaris*, new species, *m,n*: *m*, anal segment, pygofer and genital style, left side; *n*, aedeagus, left side.
- Colpoptera elevans* Walker, *o-s*: *o*, frons and clypeus; *p*, tegmen; *q*, anal segment, pygofer and genital style; *r*, aedeagus, left side; *s*, aedeagus, right side.
- Colpoptera maculifrons maculifrons* Muir, *t-w*: *t*, frons and clypeus; *u*, vertex and pronotum; *v*, head, left side; *w*, tegmen.

FIGURE 3

- Thionia clusiae*, new species, *a-d*: *a*, vertex, pronotum and mesonotum; *b*, anal segment, hind margin of pygofer, left side; *c*, genital style, left side; *d*, aedeagus, left side.
- Thionia medusa*, new species, *e-h*: *e*, vertex, pronotum and mesonotum; *f*, anal segment, hind margin of pygofer and genital style, left side; *g*, aedeagus, left side; *h*, posterior margin of pregenital sternite of female.
- Thionia laodice*, new species, *i-m*: *i*, vertex, pronotum and mesonotum; *j*, anal segment, hind margin of pygofer and genital style, left side; *k*, aedeagus, left side; *l*, dorsal view of spine of right side; *m*, medium portion of posterior margin of pregenital sternite.
- Colpoptera cyatheae*, new species, *n-r*: *n*, vertex and pronotum; *o*, frons and clypeus; *p*, anal segment and hind margin of pygofer, right side; *q*, aedeagus, right side; *r*, anal segment, right side.

FIGURE 4

- Thionia (Cheiloceps) musca musca* (Uhler), *a-e*: *a*, frons and clypeus (allotype); *b*, vertex and pronotum (allotype); *c*, tegmen, (allotype); *d*, wing, (allotype); *e*, male genitalia, left side (holotype).
- Thionia (Cheiloceps) musca grenadana*, new subspecies, *f, g*: *f*, male genitalia, left side; *g*, aedeagus, left side.
- Thionia brevior* Fowler (holotype), *h-j*: *h*, vertex and pronotum; *i*, aedeagus, right side; *j*, genital style, left side.
- Acanalonia bonducellae*, new species, *k-n*: *k*, vertex and pronotum; *l*, anal segment, posterior margin of pygofer and genital style, left side; *m*, aedeagus, left side; *n*, posterior margin of pregenital sternite of female.
- Acanalonia theobromae* Fennah, *o-q*: *o*, aedeagus, left side; *p*, anal segment, lateral margin of pygofer and genital style, left side; *q*, posterior margin of pregenital sternite of female.

FIGURE 5

- Acanalonia viriditerminata viriditerminata* (Lethierry), *a-f*: *a*, side view, legs omitted; *b*, vertex and pronotum; *c*, pygofer, anal segment and genital style, left side; *d*, aedeagus, left side; *e*, apical portion of left lateroventral process of aedeagus; *f*, apical portion of lateral appendage of left distal process of aedeagus.
- Acanalonia viriditerminata muscosa*, new subspecies, *g, h*: *g*, apical portion of left lateroventral process of aedeagus; *h*, apical portion of lateral appendage of left distal process of aedeagus.
- Acanalonia viriditerminata sylvestris*, new subspecies: *i*, apical portion of left lateroventral process of aedeagus.
- Acanalonia plana* (Van Duzee), *j-l*: *j*, side view, rostrum and legs omitted; *k*, aedeagus, left side; *l*, anal segment, posterior margin of pygofer and genital style, left side.
- Acanalonia robusta* (Walker), *m-r*: *m*, head and pronotum in profile; *n*, anal segment of male, lateral margin of pygofer, and genital style, left side; *o*, aedeagus, left side; *p*, apical portion of lateral appendage of left distal process of aedeagus; *q*, diagrammatic transverse section of dorsal surface of aedeagus; *r*, posterior margin of pregenital sternite of female.
- Acanalonia hewanorrae*, new species, *s-u*: *s*, body, left side, legs omitted; *t*, anal segment, lateral margin of pygofer, aedeagus and genital style, left side; *u*, median portion of posterior margin of pregenital sternite of female.
- Thionia laodice*, new species: *v*, anal segment of male, dorsal view.

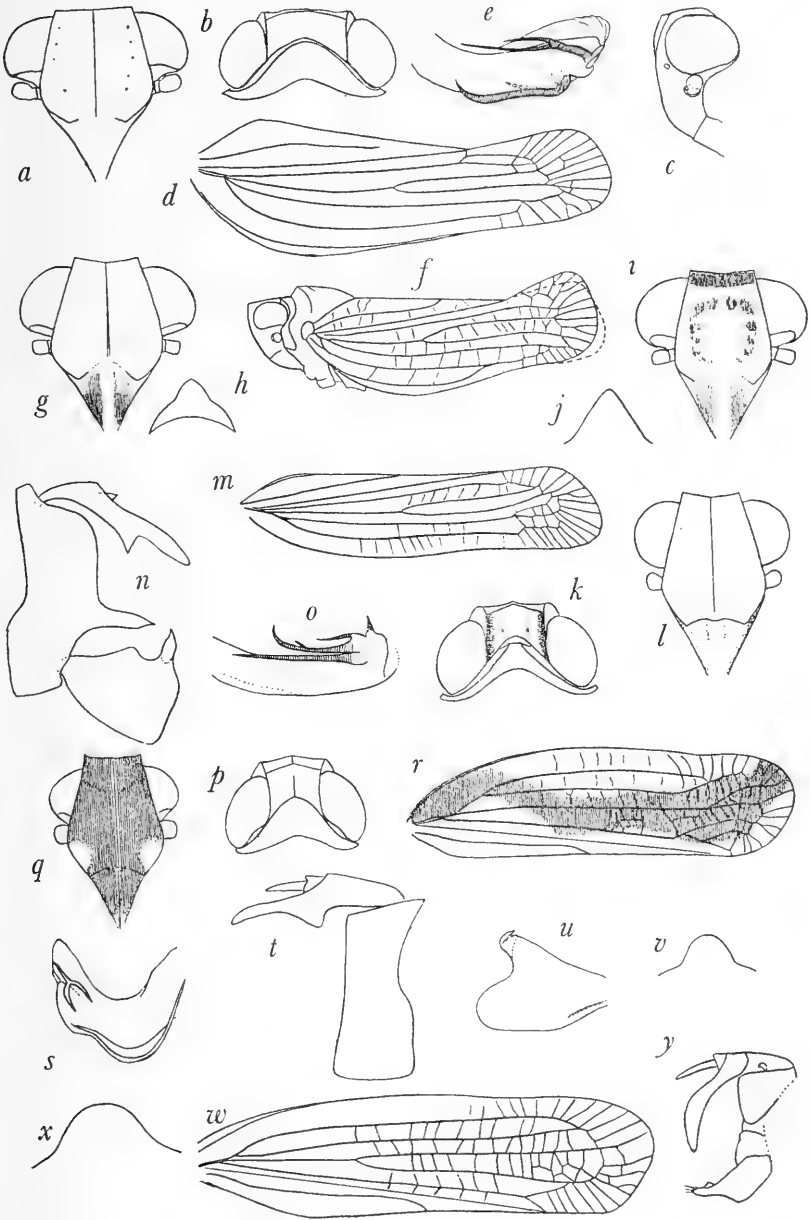


Figure 1.—For explanation see page 41.

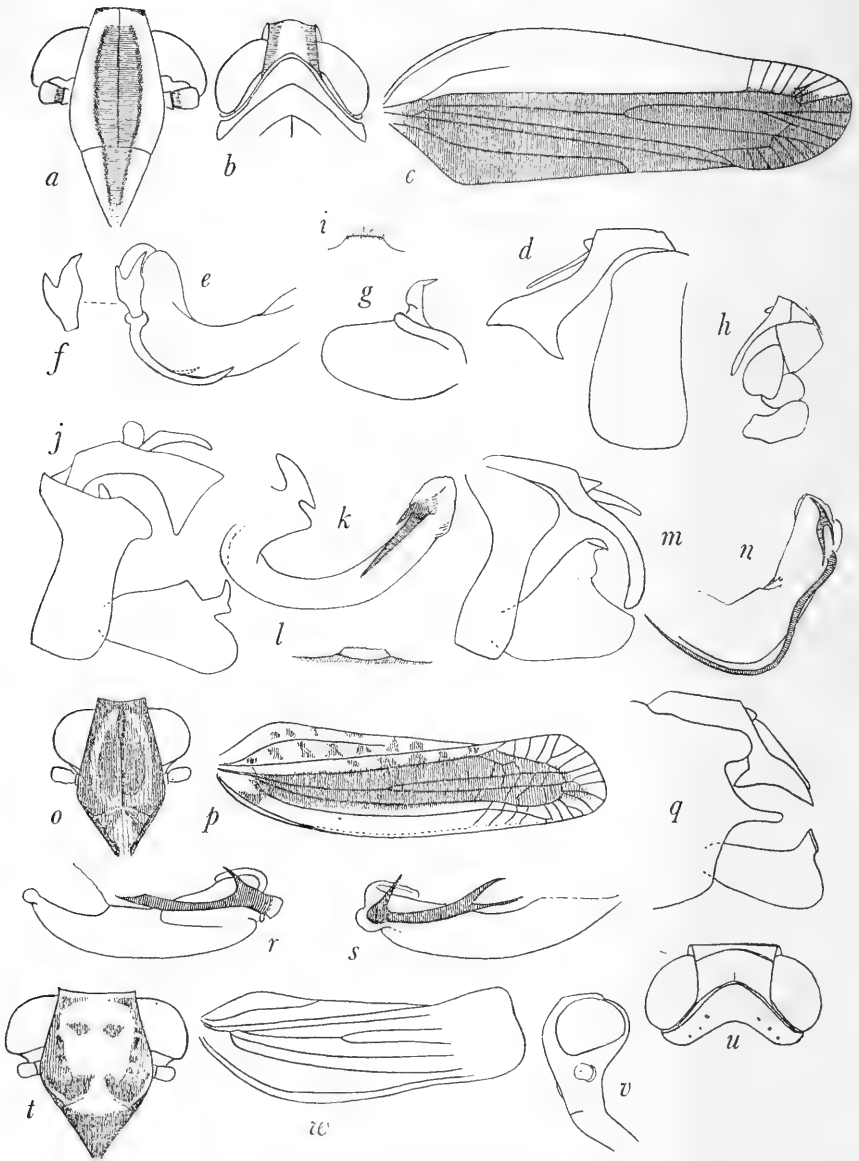


Figure 2.—For explanation see page 41.

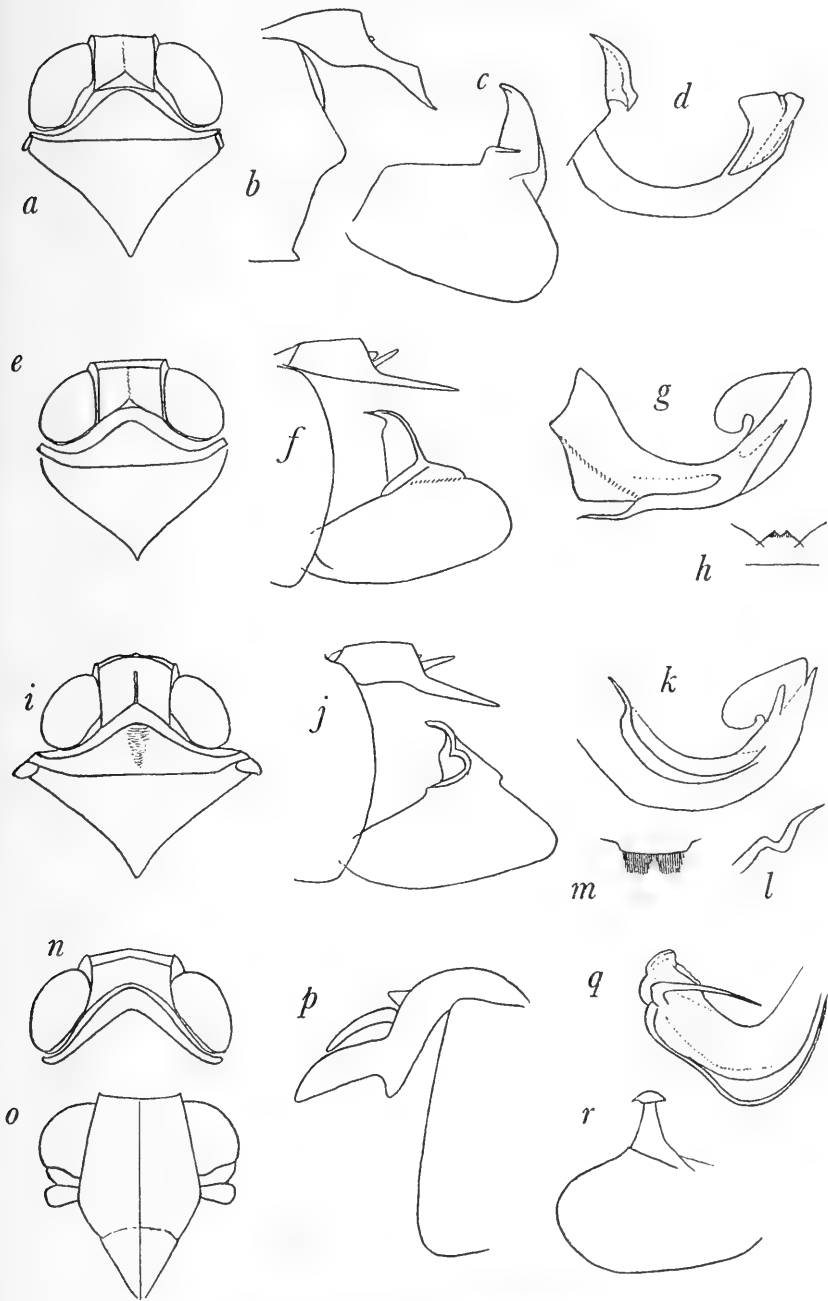


Figure 3.—For explanation see page 42.

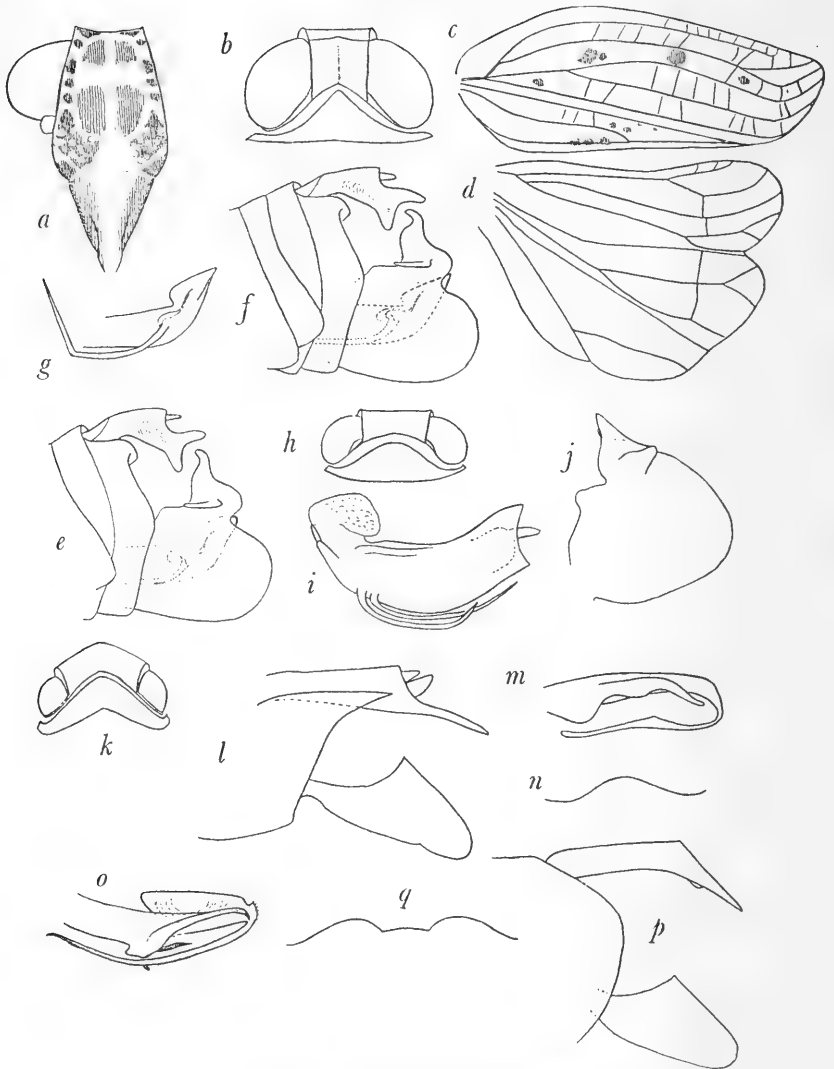


Figure 4.—For explanation see page 42.

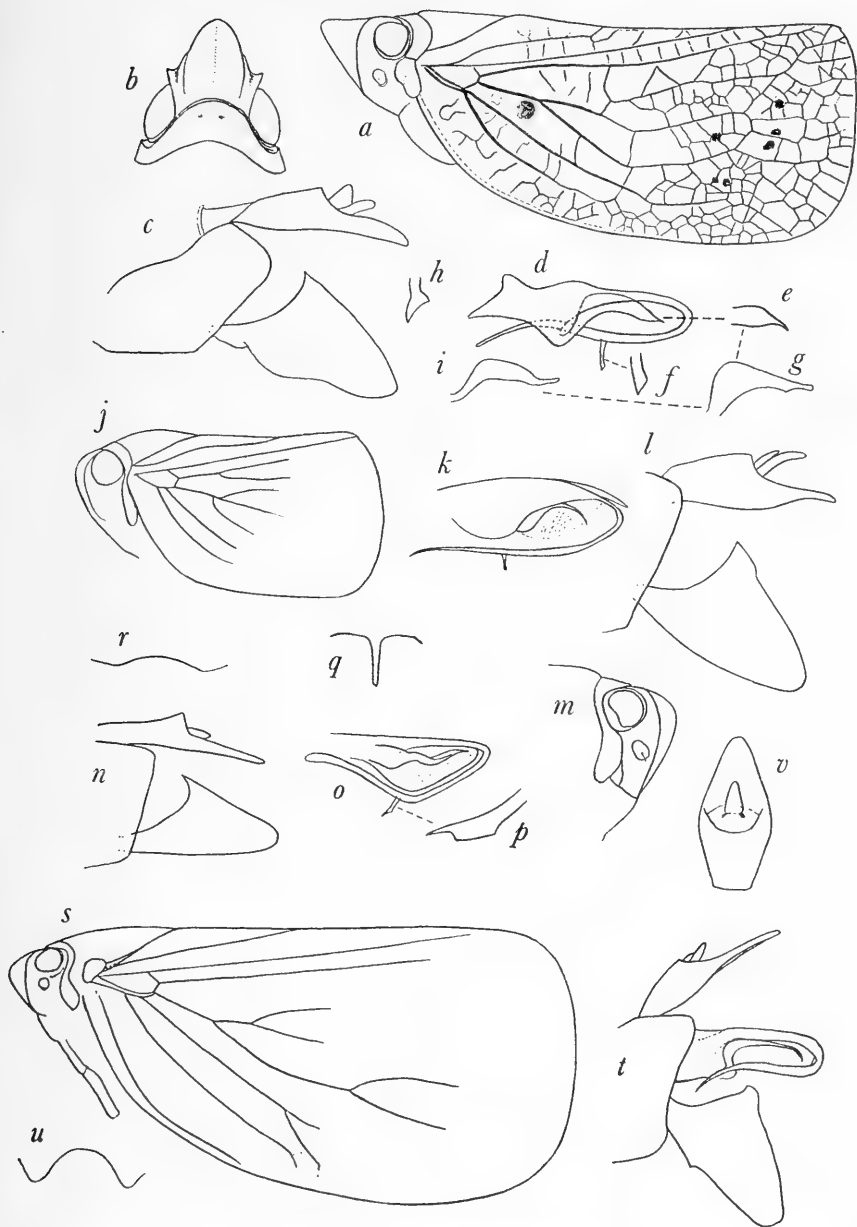


Figure 5.—For explanation see page 42.



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AN ANATOMICAL STUDY OF THE PEREGRINE MEGASCOLECID EARTHWORM *PHERETIMA HUPEIENSIS* IN THE EASTERN UNITED STATES ¹

By William C. Grant, Jr.²

Pheretima (Perichaeta) hupeiensis was first described by Michaelsen (1895) from a specimen collected at Shi-hui-yao near Wuchang, Hupei Province, China. Since then the species has been recorded from a number of localities in China, Korea, and Manchuria. The first verified report of *P. hupeiensis* in the United States is given by Chen (1933) from a specimen collected at Philadelphia, Pa.

Gates (1935) reports that the species was discovered by Dr. W. R. Walton of the U. S. Department of Agriculture on a golf course near Catonsville, Md., in 1935. A specimen collected at Washington, D. C., is also reported by Gates. Numerous reports from golf links in the mid-1930's of an exotic earthworm were probably concerned with *P. hupeiensis*. Its outbreak in Westchester County, N. Y., and in Fairfield County, Conn., initiated a control program by the Connecticut Agriculture Experiment Station, as the large number of castings deposited by the worms on golf greens of the area was becoming a serious problem. Chen (1933) suggests that the species

¹ Representing a portion of a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Yale University.

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was introduced into the United States in shipments of nursery stock, and Schread (1952) believes that human agency alone can account for its present distribution through the medium of turf transports from one golf course to another.

The anatomical study presented here represents the first phase of an investigation that has covered physiological and ecological problems as well. The anatomy of the worm has been reexamined with special reference to variation in size and form, and only those morphological characters are described in detail where they vary from the descriptions of other workers. Bahl's (1950) memoir on the Indian earthworm *Pheretima posthuma* has been an extremely valuable reference. Specimens of *P. hupeiensis* used in the present study have been deposited in the U. S. National Museum, Washington, D. C.

Appreciation is expressed to Dr. Roger B. Friend, Dr. G. E. Pickford, and Prof. G. E. Hutchinson for their counsel during the course of this study.

METHODS: All measurements and dissections were made on specimens swept from the greens of the Pelham Country Club, Pelham, N. Y., on July 7, 1949, or on specimens collected from the nursery plot at the same location on various occasions between July and October 1952. Because of the differential contractility of anesthetized individuals, all measurements of width and length were made on specimens preserved in the field in 4 percent formalin, in which it was hoped that the degree of contraction would be uniform. Widths were taken with calipers to the nearest 0.5 mm. in the region of the worm just posterior to the male pores and genital papillae.

Before sectioning in the laboratory the animals were kept on damp cheesecloth or in aerated tap water for several days in order to allow evacuation of the gut. Worms were then fixed in Petrunkevitch's sublimate fluid for 24 hours, sectioned, and stained with hematoxylin and eosin. Whole mounts of spermathecae, prostates, etc., were made of organs fixed in Petrunkevitch's fluid and cleared in amylnacetate. In order to examine the internal sexual structures it was necessary to reverse the normal procedure and dissect worms from the ventral side.

Before analysis all specimens to be examined were placed in the following categories:

1. Mature. Clitellum fully developed.
2. Semimature. Clitellar segments distinct but with all setae and dorsal pores still visible.
3. Immature. Clitellar segments not differentiated. Male pores and genital papillae well developed.
4. Juvenile. No differentiation of clitellar segments and with male pores and genital papillae lacking or indistinct.

COLOR: *Pheretima hupeiensis* varies in life from pale green to deep olive. Occasionally it is of a deeper hue anteriorly, although this is by no means a characteristic condition. A distinct purple or black line is apparent on the dorsal midline extending from the posterior margin of the clitellum to the last segment, interrupted intersegmentally by the dorsal pores. The clitellum in the mature condition is a brilliant ivory, while the clitellar regions of the semimature are almost black in color. With the exception of the clitellum there is apparently no deepening of color with age. This description is in near agreement with that of Chen (1933) and that of Schread (1952). The specimens from the Pelham collection seldom showed the pronounced difference in coloration from the dorsal to ventral surfaces as described by Chen for worms of the Yangtze Valley, China. His description of animals with a light chocolate clitellum was probably of individuals past their sexual prime, as this color is quite common just before clitellar degeneration.

SIZE: In the preserved specimens from Pelham, the size varies from 89 to 22 mm. in length, and from 5.5 to 1 mm. in width. The mean lengths and widths for each of the four categories described above and their standard deviations are shown in table 1. The relationship between length and width is presented graphically in figure 1. The line representing the regression of width on length indicates a constant isometric relationship between length and diameter. In the equation $W=a+bL$ the values of the constants a and b are 0.18 and 0.058, respectively. The correlation coefficient of 0.77 is highly significant. The analysis justifies the earlier assumption that worms preserved under standard conditions are uniformly contracted.

In specimens from Szechwan Province, China, Chen (1931) gives a size range from 70 to 130 mm. in length, and 3 to 6 mm. in diameter, while his 1933 Yangtze Valley description mentions worms as long as 222 mm. Kobayashi (1938) gives lengths of 61 to 150 mm. with widths up to 5 mm. in specimens from Korea. The type specimen described by Michaelsen (1895) from Hupei Province, China, measured 40 mm. in length with a diameter of 3.5 mm. A specimen described by Gates (1935) from Washington, D. C., was 70 mm. long and 3 mm. wide.

It would be extremely difficult to draw any definite conclusions from these figures, for, with the exception of Gates' specimen it is not known under what conditions the worms were measured, nor is there an indication of their state of maturity. Nevertheless, there is some indication that on the Asiatic mainland the species is larger than the peregrine population of the United States. The relation of width to length suggests that the figures of Chen and Kobayashi show worms

in a greater state of attenuation than my formalin specimens. In order to obtain some idea of the differences the length-width relationship may be expressed in the form of an index ($w/1 \times 100$). Mean values for the Pelham population ranging from juvenile to mature are 6.2, 6.2, 5.8, and 6.0. If the longest worm is correlated with the greatest diameter and the shortest with the smallest the following indices

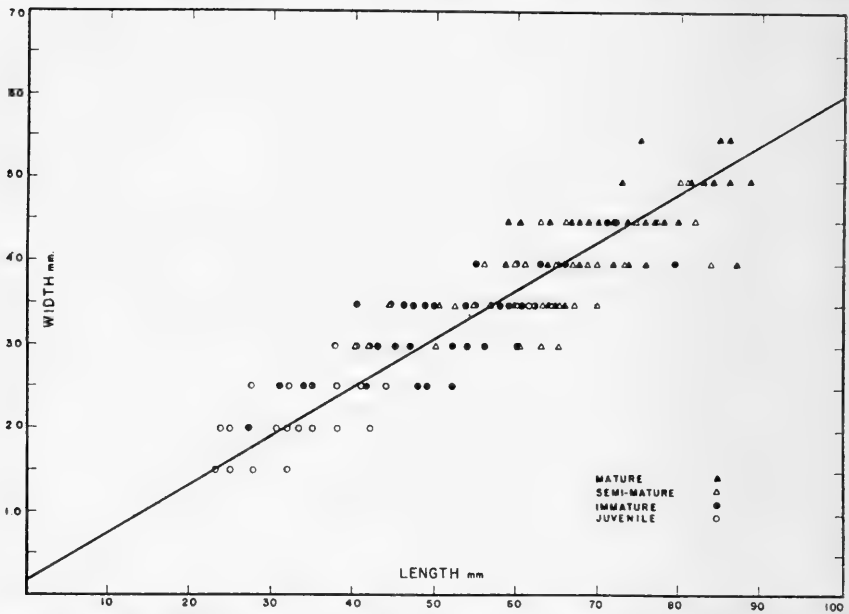


FIGURE 1.—Relation of length to diameter in specimens of *Pheretima hupeiensis* preserved in 4 percent formalin.

are obtained for the Asiatic specimens: Chen 4.3–4.6, Kobayashi 3.3. These forms appear more slender than the Pelham stock.

Avel (1929) has shown that size variation in *Allolobophora* is dependent on nutrition, and Pickford (1937) says that because of this factor it would be impossible to indicate a size range for a species that would have taxonomic significance. This is further substantiated by the apparent larger size of the oriental population of *P. hupeiensis*.

WEIGHT: A group of 162 worms collected from the nursery plot at Pelham on Aug. 22, 1952, were classified into the four categories of maturity and weighed. The range was from 898 mg. for a mature worm to 41 mg. for a juvenile. The means and their standard deviations are listed in table 1. The mean value for juveniles is 103 mg., with no weights above 223 mg. being recorded for this category. It is probable that somewhere between these values the majority of the population will develop prominent male papillae. The figures for

mature individuals give a mean of 562 mg. with a minimum weight of 302 mg., and it is between these values that most worms become fully clitellate. As the semimature and immature categories are continually shifting, it would be difficult to analyze them satisfactorily unless weights were taken at frequent intervals from population samples distributed over a period of several years. Such a project is very important, but would have to be carried out on a more readily available species of worm than *P. hupeiensis*, which has been subjected to routine extermination over its recorded range in the United States.

SEGMENTS: Michaelsen (1895) described *P. hupeiensis* as having 129 segments and again (1899) as having segments ranging in number from 119 to 132. Chen (1933) gives numbers from 110 to 128, and Kobayashi (1938) indicates a range of 97 to 132 for his Korean collections. Counts made on preserved material from the Pelham collection show no correlation between the degree of sexual maturity and number of segments. The average for 22 juveniles was 125 segments, and for 39 adults it was 126, with a range of 119 to 130 for the entire series studied.

The whole problem of whether or not earthworms continue adding segments during life has been discussed by Gates (1948). After a study of a number of megascolecid, lumbricid, and glossoscolecid species he concludes that postembryonic growth generally involves the production of new segments, although segment production does not take the same form in every case nor is it uniform throughout the three families. Because no specimen of *P. hupeiensis* has been found to date that can definitely be regarded as newly hatched, it is impossible to state whether new segments are added after hatching. However, since juveniles and fully mature specimens possess about the same number of segments, few if any additions are made after the worms have attained a length of 35 mm. Careful dissection of juvenile specimens in the region of the anal segment revealed nothing that suggested that this segment was not fully differentiated.

SETAE: The numerous setae, which are weakly sigmoid in shape and about 0.2 mm. in length, are perichaetous, as each segment has an equatorial band of setae passing around it. Michaelsen found 72 setae on segment 25, and Chen (1933) gives numbers ranging from 68 to 88 for the same segment with 14 to 22 between the spermathecal pores of segment 8 and 10 to 16 between the male pores on segment 18. Gates (1935) records 85 setae on segment 20, and 18 on segment 18 between the male pores.

In the specimens of *P. hupeiensis* in the Pelham collection, setal numbers averaged about 8 between the spermathecal pores of segment 8, with a range from 4 to 13; 12 between the male pores of segment 18,

with a range of 8 to 16; and 79 around the circumference of segment 30, with a range of 74 to 84 (table 1). In mature specimens a few setae were usually seen on the ventral surface of the clitellum. The wide range in setal number is due in part to the fact that setae are continually being lost and replaced.

PROSTOMIUM: The small prostomium overhangs the mouth and is epilobous, according to the terminology of Stephenson (1930), in that it is well subdivided from, but with its posterior portion extending into, segment 1. In preserved specimens the prostomium is withdrawn and not easily examined.

DORSAL PORES: In 39 mature specimens collected at Pelham the first dorsal pore appeared on intersegmental furrow 11/12 and, in all observations made since, this has been found to be a very constant character. Michaelsen (1895, 1899) notes the first dorsal pore on intersegmental furrow 12/13, as does Gates (1935). However, Chen (1931, 1933) and Gates (1939) record the first dorsal pore on 11/12. Dorsal pores are present in the dorsal midline at all intersegmental furrows beginning with 11/12 in the Pelham specimens, although they may be obscured in furrows 14/15 and 15/16 by the clitellum.

It is through the dorsal pores that coelomic fluid is ejected when the worm is irritated. In *P. hupeiensis* the peculiarly pungent odor of the coelomic fluid, described by Gates (1935) as being similar to that of "carrots freshly dug," is an important diagnostic character.

MALE REPRODUCTIVE SYSTEM: The male reproductive system is holandric. Paired testes are situated in segments 10 and 11, attached to the posterior face of septa 9/10 and 10/11 close to the ventral nerve cord and directly in front of their corresponding spermiducal funnels. The latter have highly folded, ciliated margins, each passing immediately into a vas deferens in the following segment. Two pairs of large seminal vesicles are located in segments 11 and 12, probably arising as

ABBREVIATIONS USED ON FIGURES

| | | | | | |
|------------------|-----------------|-------------------|---------------------|-------------------|--------------------|
| ac. gl. | accessory gland | lat. oes. | lateral oesophageal | sp. | spermathecae |
| amp. | ampulla | v. | vessel | su. i. v. | supraintestinal |
| ant. lo. | anterior loop | l. gl. | lymph gland | | vessel |
| bu. | buccal chamber | l. m. | longitudinal muscle | s. v. | seminal vesicles |
| cae. | caecum | m. s. | muscle strand | t. | testis |
| c. m. | circular muscle | o. | ovary | t. s. | testes sacs |
| div. | diverticulum | oes. | oesophagus | v. d. | vas deferens |
| d. v. | dorsal vessel | o. f. | oviducal funnel | v. n. | ventral nerve cord |
| e. | epidermis | ph. | pharynx | v. v. | ventral vessel |
| gizz. | gizzard | p. gl. | prostate gland | w. t. s. | wall of testis sac |
| ht. | heart | s. | septa 11/12 | | |
| int. | intestine | s. f. | spermiducal funnel | | |

septal pouches from septa 10/11 and 11/12. Each communicates directly with and receives the spermatozoa of the segment in front. The seminal vesicles when full of developing sperm are large and distended, passing dorsally around the gut to the dorsal blood vessel.

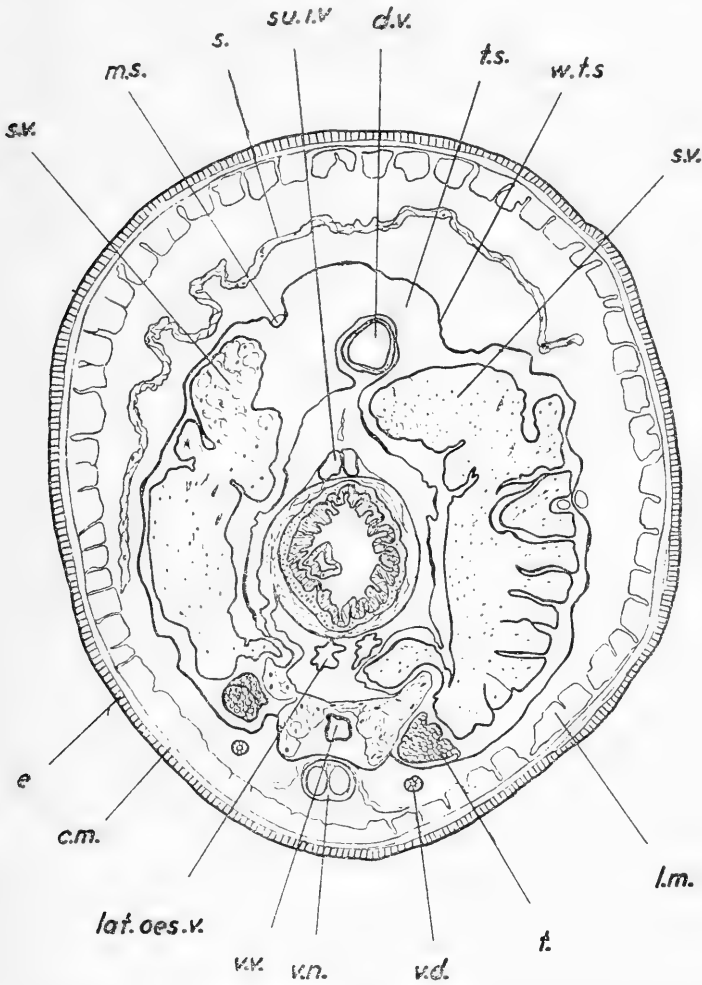


FIGURE 2.—*Pheretima hupeiensis*; semidiagrammatic view of a section through segment 11 showing the annular shape of the testes. For explanation of abbreviations see facing page.

The small, narrow vesicles described by Chen (1933) were undoubtedly not seasonally mature or had been shrunk during preservation.

In *P. hupeiensis* the testes, funnels, and seminal vesicles of segments 10 and 11 and the seminal vesicles of segment 12 are partitioned from the coelomic cavity by large, thin-walled sacs. These are commonly called testis sacs, but Kobayashi (1938) has questioned the propriety

of calling the posterior sac by this name as there are no testes present in segment 12. He proposes terming this structure a "membranous sac." The testis sacs of segments 10 and 11 are very large, extending laterally almost to the body wall and medially to the esophagus to enclose the male organs and hearts of their corresponding segments. Sections of the Pelham specimens show that the sacs are unpaired and annular, as each is continuous dorsally and ventrally with its member of the opposite side (fig. 2). This is in agreement with Chen (1933). Gates (1935, 1939) describes the sacs as U-shaped with no dorsal connection, and it is possible that a degree of variability may exist as to the shape of these structures. The membranous sac of segment 12 is similar in structure to the testis sacs, but only encloses the seminal vesicles of its segment.

The vas deferens from each testis extends posteriorly to form a close contact with the other spermatic duct of its side in segment 13. Although the two ducts maintain their individuality throughout, this can only be seen in sectioned material. The spermatic ducts pass posteriorly, lateral to the nerve cord, until they communicate with the common prostatic-spermatic ectal duct.

The pair of prostate glands, lying in segments 17 to 19 and penetrating septa 17/18 and 18/19, are large flattened structures usually composed of two or more irregular lobes (fig. 3). In life they are milky white in color, and bulk large during sexual maturity so that they can be seen as large masses through the body wall of fully clitellate specimens. From the two major lobes ducts emerge and pass ventrally to unite with the two spermatic ducts of a side in the common prostatic-spermatic ectal duct. This heavy structure coils once and opens through the body wall at the male pore in segment 18. Accessory glands are located just anterior and posterior to the base of the above duct in segments 17 and 19, opening on the external genital papillae.

Externally the male pores open ventrally on small, raised tubercles in line with the setae of segment 18 (fig. 4, *a*). The two pairs of flattened genital papillae are situated close to the intersegmental furrows 17/18 and 18/19 just medial to the male pores. In all of the specimens from Pelham and in the accounts of other authors no variation in the appearance and location of the male reproductive organs, with the exception of the testis sacs, has been noted.

FEMALE REPRODUCTIVE SYSTEM: The ovaries are situated on the posterior face of septum 12/13 just lateral to the ventral nerve cord. They are white in color and are composed of a large number of digital processes arranged so as to resemble a fan. The paired oviducal funnels are large, convoluted structures in segment 13 facing the ovaries and communicating posteriorly with the short oviducts that pass through the body wall in segment 14 to the single female pore

(fig. 3). This pore opens on a raised circular papilla in the ventral midline of segment 14 just posterior to intersegmental furrow 13/14 (fig. 4,a).

The clitellum consists of a smooth, slightly swollen girdle in segments 14 to 16 that passes uniformly around the body. The position of this structure is constant.

In *P. hupeiensis* the typical arrangement of the spermathecae is as follows: The first pair is located in segment 7, while segment 8 contains the posterior two pairs (fig. 3). Each spermatheca is composed of a long, oblate ampulla, which is not clearly differentiated from its

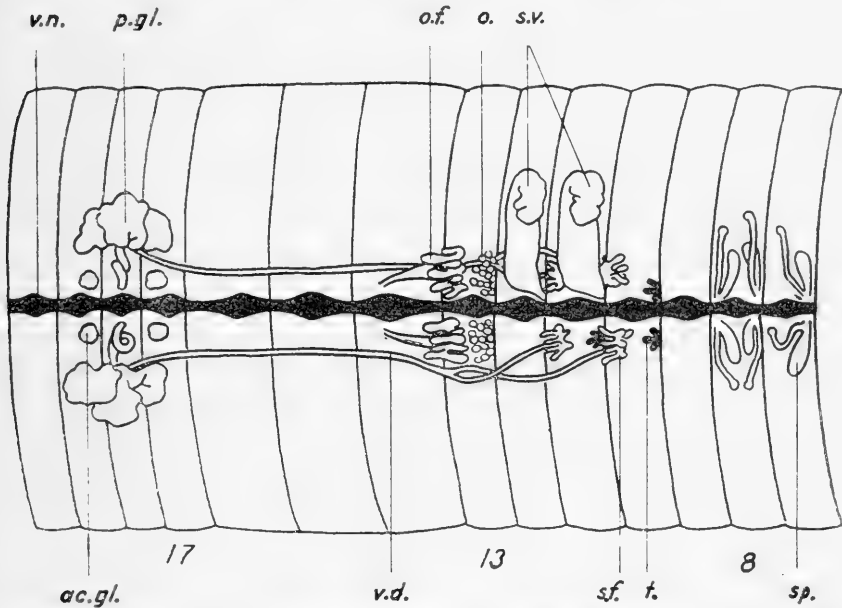


FIGURE 3.—Diagram of the reproductive system of *Pheretima hupeiensis*. For explanation of abbreviations see page 54.

duct. From the base of the duct a long diverticulum extends for about twice the length of the ampulla, terminating in a small, spherical chamber. Below the chamber, the lumen of the diverticulum is highly convoluted for about half its length before it straightens into a tube leading directly to the duct of the ampulla (fig. 4,b). The spermathecae described by Chen (1933) as spatulate and highly wrinkled were obviously in a collapsed condition.

Although many animals show the typical arrangement described above, it is quite common to find individuals with an entire spermatheca transferred to an adjacent segment. However, no more nor less than three pairs of spermathecae have been described in a single

specimen. The external order of the spermathecal pores, which are located by pairs just posterior to the intersegmental furrows 6/7, 7/8, and 8/9 on either side of the ventral midline, is constant regardless of internal conditions (fig. 4,a). Michaelsen (1895) noted only two pairs of spermathecae in the type from Hupei Province, but in 1899 he redescribed the specimen as possessing three pairs. No variation in the spermathecal number has been described by other investigators.

SEPTA: Only the first three septa are lacking in *P. hupeiensis*. Septum 4/5 is extremely fine, while septa 5/6 to 8/9 are heavy and muscular as are those of the genital segments, but to a lesser extent. Bahl (1950) noted that in *Pheretima posthuma* all septa past 14/15 are perforated by numerous small apertures surrounded by muscular sphincters. Careful examination of the septa of *P. hupeiensis* failed to disclose any such structures other than the septal sphincter surrounding the ventral nerve cord foramen.

DIGESTIVE TRACT: The mouth opens into a small buccal chamber located in segments 1 and 2, and is lined with columnar epithelium surrounded by a heavy mass of muscle. The pharynx of segments 3 to 5 is characterized by a dorsal mass of muscular tissue that serves to compress its lumen dorsoventrally. The dorsal surface of the pharynx is covered with numerous pharyngeal glands.

The oesophagus extends from segment 5 to 16. The gizzard is situated in segment 8. That Chen (1933) describes it in segments 8 and 9 may be a result of the fact that the gizzard gives the appearance of extending into segment 9 because of the cone-shaped septum 8/9 that overlaps it for about half its length. The gizzard is surrounded by a thick wall of circular muscle fibers and is bound internally by a cuticle secreted by the gut epithelium. The oesophagus broadens in segment 9 and continues through segment 13 to its junction with the intestine. Examination of the oesophagus indicated that in *P. hupeiensis* calciferous glands are wanting.

The intestine occupies the entire length of the worm beyond septum 13/14 to the terminal anus (fig. 4,c). A pair of simple intestinal caeca appear as lateral projections of the intestinal wall in segment 27, although a few cases observed had the caecum originating in segment 28. Those of the type are located in segment 26.

HEARTS: The paired lateral hearts are located in segments 10 to 13 (fig. 4,c). The hearts of segment 10 are very stout and lack commissural connections to the suprainestinal blood sinus. The following three pairs join the dorsal and ventral blood vessels and have commissural connectives with the blood sinus of segments 11 to 13, and may be termed lateral-oesophageal hearts to differentiate them from the simple lateral hearts of segment 10 according to Bahl (1921). In

segment 9 a pair of heavy but nonpulsating vessels connect the supra-intestinal blood vessel with the lateral-oesophageal vessels on each side. Two pairs of similar vessels occurring in segments 10 and 11 of *Pheretima posthuma* are termed "anterior-loops" by Bahl (1921).

EXCRETORY SYSTEM: The excretory system is similar to that of *P. posthuma* described by Bahl (1921, 1950). The system is mero-nephric in that it is composed of several types of nephridia, and that

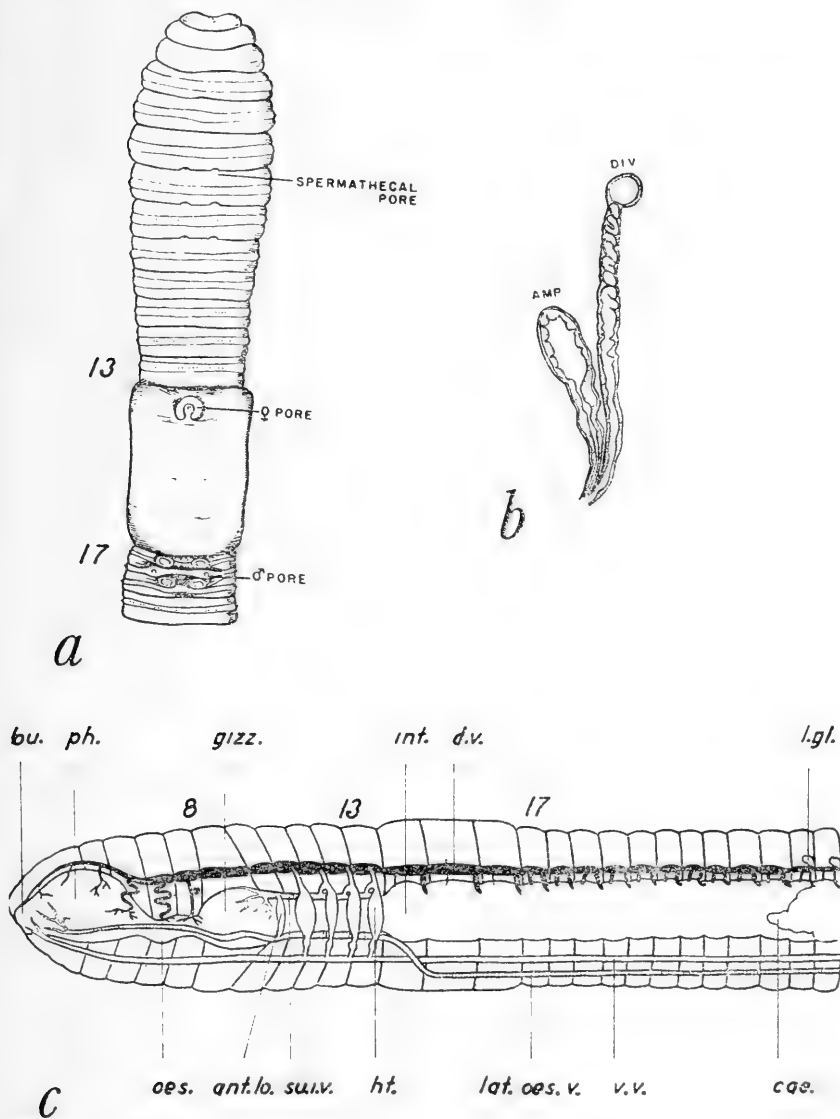


FIGURE 4.—*Pheretima hupeiensis*: a, external sexual characters; b, a spermatheca; c, digestive system and hearts. For explanation of abbreviations see page 54.

numerous nephridia are present in most segments. The following classification follows that of Bahl (1924, 1926, 1950).

The integumentary nephridia are extremely small, ranging from 0.25–0.5 mm. in length, and are scattered over the interior face of the body wall in all but the first two segments. As no collecting funnel is present and each nephridium communicates directly to the exterior through its nephridiopore, they are termed exonephric micronephridia. In *P. hupeiensis* there are about 175 such micronephridia per segment in the region posterior to the intestinal caeca.

The septal nephridia are distributed over the anterior and posterior faces of all septa behind 15/16, close to the body wall. The nephrostome is well developed, consisting of from 10 to 12 marginal cells composing a funnel and six closely compacted cells forming the ventral lip. The excretory products, carried by a series of collecting ducts, are discharged into the gut. The septal nephridia are classified as enteronephric meganephridia. There are 70 to 80 such meganephridia per segment in the region just posterior to the caeca.

The pharyngeal nephridia, which lack collecting funnels, are enteronephric micronephridia. They are composed of large masses of interconnected nephridia scattered over the lateral pharyngeal walls. Excretory products are discharged from the collecting ducts into the lumen of the pharynx.

DISCUSSION: In all major respects the Pelham population of *P. hupeiensis* is in taxonomic agreement with the type specimen as described by Michaelsen. The first dorsal pore of the type is located at intersegmental furrow 12/13, while it was found at 11/12 in all the Pelham animals. The pair of intestinal caeca which occur either in segment 27 or 28 in the Pelham worms is recorded in segment 26 of the type. Size variations are of course to be anticipated because of nutritional differences, etc., as is the relation between absolute size and the degree of sexual maturity. Segment and setal numbers show a narrow range of variation considering their large numbers. The spermathecal ampulla and diverticulum may or may not penetrate adjacent septa, but as the position of the external pores is constant, their internal arrangement is of minor importance.

The Pelham population shows a high degree of uniformity. Only the position of the caeca was subject to meristic translocation and, except in one specimen which possessed a supernumerary female pore, no homoeotic duplications were observed. *P. hupeiensis* is in close taxonomic agreement with its genus, its species characters falling within the generic range of variability as given by Stephenson (1930).

DIAGNOSTIC CHARACTERS: External: Color pale green to deep olive with a distinct purple or black line on the dorsal midline extending from the posterior margin of the clitellum to the anal segment.

Preserved animals are light gray and the dorsal line is seldom discernible. Odor pungent. Length 40 to 222 mm.; diameter 1 to 6 mm.; weight 320 to 898 mg.; segments 97 to 138 in number. First dorsal pore on intersegmental furrow 11/12 and 12/13. Prostomium small and epilobous. Perichaetous, the setae varying in number from 4 to 22 between the spermathecal pores on segment 8; 8 to 18 between the male pores on 18; 66 to 88 on 25; 74 to 84 on 30. Clitellum smooth, white and annular on segments 14 to 16. Male pores on

TABLE 1.—Means for the various measurements made on the anatomy of *Pheretima hupeiensis*

| Character | Sexual development | Number | Mean | Standard deviation |
|---------------------------------------|--------------------|--------|----------|--------------------|
| | | | (mm.) | |
| Length | Mature | 39 | 73.2 | 7.1 |
| | Semimature | 46 | 67.2 | 10.8 |
| | Immature | 55 | 54.8 | 10.6 |
| | Juvenile | 22 | 35.0 | 9.6 |
| Width | Mature | 39 | 4.4 | 1.1 |
| | Semimature | 46 | 3.9 | 1.3 |
| | Immature | 55 | 3.4 | 1.0 |
| | Juvenile | 22 | 2.2 | 0.5 |
| | | | (mg.) | |
| Weight | Mature | 61 | 562.0 | 135.6 |
| | Semimature | 38 | 514.1 | 139.6 |
| | Immature | 18 | 276.8 | 89.3 |
| | Juvenile | 34 | 103.5 | 56.4 |
| | | | (number) | |
| Segments | Mature | 39 | 126.0 | 2.6 |
| | Juvenile | 20 | 125.3 | 2.8 |
| Setae | | | | |
| Segment 8 between spermathecal pores. | Mature | 39 | 8.7 | 2.07 |
| Segment 18 between male pores. | Mature | 39 | 12.0 | 2.44 |
| Segment 30 entire segment. | Mature | 10 | 79.5 | 3.30 |

small raised papillae on segment 18 just lateral to the two pairs of genital papillae on 17 and 19; single round female pore ventral on segment 14; three pairs spermathecal pores opening on small, flat papillae just posterior to intersegmental furrows 6/7 to 8/9.

Internal: All septa present beginning with 4/5; 5/6 to 8/9 are very heavy and muscular. Each septa has a single sphinctered aperture surrounding the ventral nerve cord foramen. Gizzard in segment 8, or possibly in 8 and 9; intestine begins in segment 14; one pair of intestinal caeca in 27 or 28. Paired lateral hearts in segments 10 to

13, the pair in segment 10 being stout and lacking commissural connectives. Excretory system meronephric. Exonephric integumentary micronephridia in all but the first two segments; enteronephric meganephridia on all septa behind 15/16; enteronephric micronephridia on the lateral walls of the pharynx. Male reproductive system holandric. Paired testes and spermiducal funnels in segments 10 and 11; paired seminal vesicles in segments 11 and 12. Testes and funnels of segment 10 and testes, funnels, and seminal vesicles of segment 11 enclosed in large membranous testis sacs that may be annular or U-shaped. Seminal vesicles of segment 12 enclosed in a membranous sac. Prostate gland well developed in segments 17 to 19, with a large coiled prostatic-spermatic ectal duct in segment 18; accessory glands small, located near end of duct in segments 17 and 19. One pair of ovaries and oviducal funnels in segment 13. Internal arrangement of spermathecae variable; typically the first pair is located in segment 7, while segment 8 contains the posterior two pairs. Spermathecal ampulla long and oblate; diverticulum twice the length of ampulla, its coiled duct terminating in a small round chamber.

TYPE: *Perichaeta hupeiensis* Michaelsen (1895), Hamburg Museum.

SUMMARY: The anatomy of *Pheretima hupeiensis* Michaelsen, a megascolecid earthworm indigenous to the far east, has been redescribed on specimens collected in Westchester County, N. Y., where it occurs as a peregrine. A constant isometric relationship exists between length and width when worms are preserved under standard conditions. The population shows a high degree of uniformity. The only characters showing variation are the intestinal caeca, which may arise in segments 27 or 28, and the spermathecae, which are constant in number but vary in their position relative to the adjacent septa.

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SOME POLYCLAD FLATWORMS FROM POLYNESIA
AND MICRONESIA

By LIBBIE H. HYMAN

The Indo-Pacific area is commonly stated to be the richest in marine littoral invertebrates of any place on the globe and no doubt the Turbellaria share in this exuberance, but little has been done on Indo-Pacific members of this group except in the order Polycladida and even this group has been collected only sporadically. Most of the descriptions of Indo-Pacific polyclads are old and inadequate, so subsequent recognition is difficult if not impossible unless the original specimens can be recovered, and some collections from the area, as those of the *Siboga* and of Semper in the Philippines (mentioned by Stummer-Traunfels, 1933), have never been described in print, although Stummer-Traunfels published colored figures of some of the species.

The present study concerns a small collection of polyclads from tropical islands of the central and western Pacific sent for determination by the U. S. National Museum. As I have recently published a glossary of terms and full definitions of subordinal, familial, and generic categories (Hyman, 1953), it appears unnecessary to repeat these definitions here. Definitions will be given only for categories not appearing in that publication.

Order POLYCLADIDA

Suborder ACOTYLEA

Section CRASPEDOMMATA

Family DISCOCELIDAE Laidlaw, 1903

DEFINITION: Craspedommata with eyes, apart from the marginal band, limited to definite cerebral and tentacular clusters; tentacles wanting or rudimentary; penis massive, muscular, lobulated, depending vertically from the dorsal wall of the male antrum; penis edged with numerous small prostatic apparatuses, which may also be present in the antral wall; Lang's vesicle present, usually crescentic.

Genus *Discocelis* Ehrenberg, 1832

Thalamoplana Laidlaw, 1904, p. 132.

DEFINITION: Discocelidae without prostatic vesicle or antral pockets occupied by a large prostatoid.

TYPE SPECIES: *Planaria lichenoides* Mertens, 1832.

Discocelis insularis, new species

FIGURES 1,a,b; 2,a,c

MATERIAL: Two specimens of this species were taken by J. P. E. Morrison at night, Sept. 2, 1952, in Raroia Atoll, Tuamotu Islands.

EXPLANATION OF FIGURES

- | | |
|-------------------------------------|--------------------------------------|
| 1, marginal eyes | 22, cerebro frontal eyes |
| 2, cerebral eye cluster | 23, brain |
| 3, tentacular eye cluster | 24, mouth |
| 4, uteri | 25, prostatic vesicle |
| 5, pharynx | 26, prostatic duct |
| 6, male apparatus | 27, spermiducal bulbs |
| 7, male gonopore | 28, penis sheath |
| 8, Lang's vesicle | 29, penis papilla |
| 9, sperm ducts | 30, vaginal duct |
| 10, seminal vesicle | 31, vaginal pore |
| 11, ejaculatory duct | 32, tentacles |
| 12, male antrum | 33, tubercles |
| 13, penis | 34, common sperm duct |
| 14, prostatic apparatuses | 35, female antrum |
| 15, muscular pocket | 36, accessory prostatic vesicles |
| 16, female gonopore | 37, cirrus sac |
| 17, vagina | 38, teeth in cirrus sac |
| 18, cement glands | 39, copulatory bursa |
| 19, entrance of oviduct into vagina | 40, spermiducal vesicle inside bursa |
| 20, duct of Lang's vesicle | 41, sucker |
| 21, anterior horn of Lang's vesicle | |

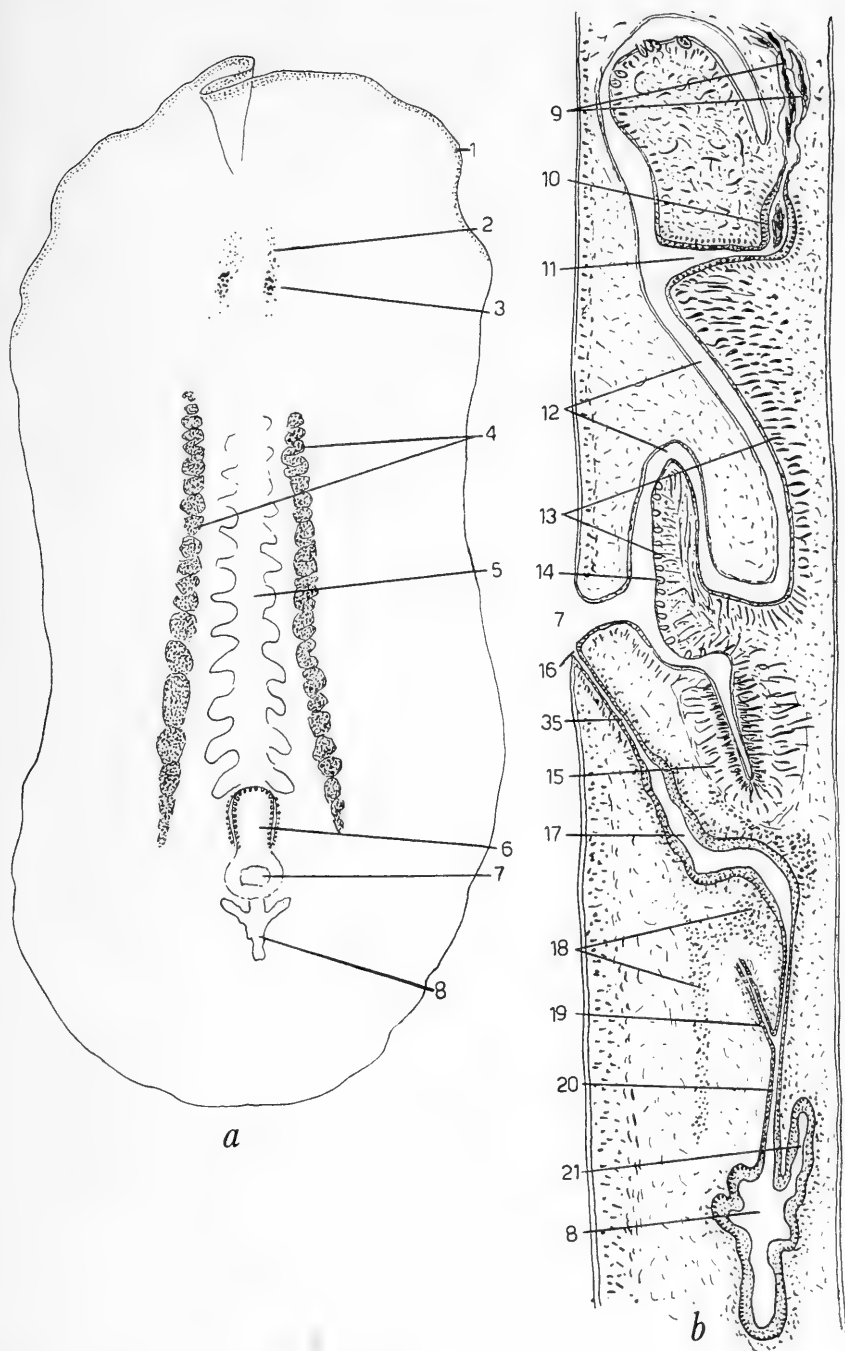


FIGURE 1.—*Discocelis insularis*: a, entire worm as cleared whole mount; b, sagittal view of copulatory apparatuses. (For explanation see facing page.)

WHOLE MOUNT FEATURES: The body appears of elongated oval form with rounded ends (fig. 1,*a*) but both specimens were distorted by fixation. The larger specimen is 20 mm. long by 8 mm. wide. The color is indeterminable, apparently a light brown with fleckings of darker brown. Around the anterior margin is a narrow band of small eyes, about two eyes deep. Well back from the anterior margin are found the remaining eyes, in the form of tentacular and cerebral clusters. An enlarged view of these eyes is given in figure 2,*a*, drawn with the aid of a camera lucida. The narrow elongate pharynx occupies the central part of the body and to either side of it are seen the coiled uteri stuffed with eggs. Immediately behind the rear end of the pharynx is located the massive penis, and behind this the irregular Lang's vesicle may be dimly seen.

COPULATORY APPARATUS: As the taxonomy of polyclads is based on the details of the copulatory apparatus, it becomes necessary to examine this apparatus in sagittal serial sections. The copulatory region of both specimens was removed and sectioned, but neither series of sections was entirely satisfactory as the ventral wall was found injured in both cases. The sagittal view in figure 1,*b* was constructed with the aid of both series of sections.

The penis depends from the roof of the male antrum as a massive irregular body of somewhat oval shape, and is housed in a male antrum that also is shaped very irregularly. The penis appears centrally depressed with a thickened periphery. This central part is devoid of the small prostatic apparatuses characteristic of the family. The sperm ducts approach the anterior end of the penis dorsally and unite to a common sperm duct that shows a small enlargement containing sperm. From this enlargement the ejaculatory duct descends and opens into the anterior part of the male antrum without the formation of any definite penis papilla. A prostatic vesicle is also absent. The thickened periphery of the penis is beset with numerous small prostatic apparatuses that appear in median sagittal section only at the two ends of the penis and are best represented in parasagittal section as in figure 2,*c*. They are all alike morphologically and of about the same size, although some anterior ones are slightly larger. Their histology has been repeatedly illustrated and hence need not be given here. In this species, prostatic apparatuses are absent from the antral wall. The penis is fairly muscular with fibers in various directions. Behind the penis there is present a muscular pocket of the male antrum devoid of prostatic apparatuses. The male antrum opens near its posterior end by a rather wide gonopore.

Shortly behind the male gonopore, the female gonopore opens narrowly. From it the vagina ascends with a decided posterior slant

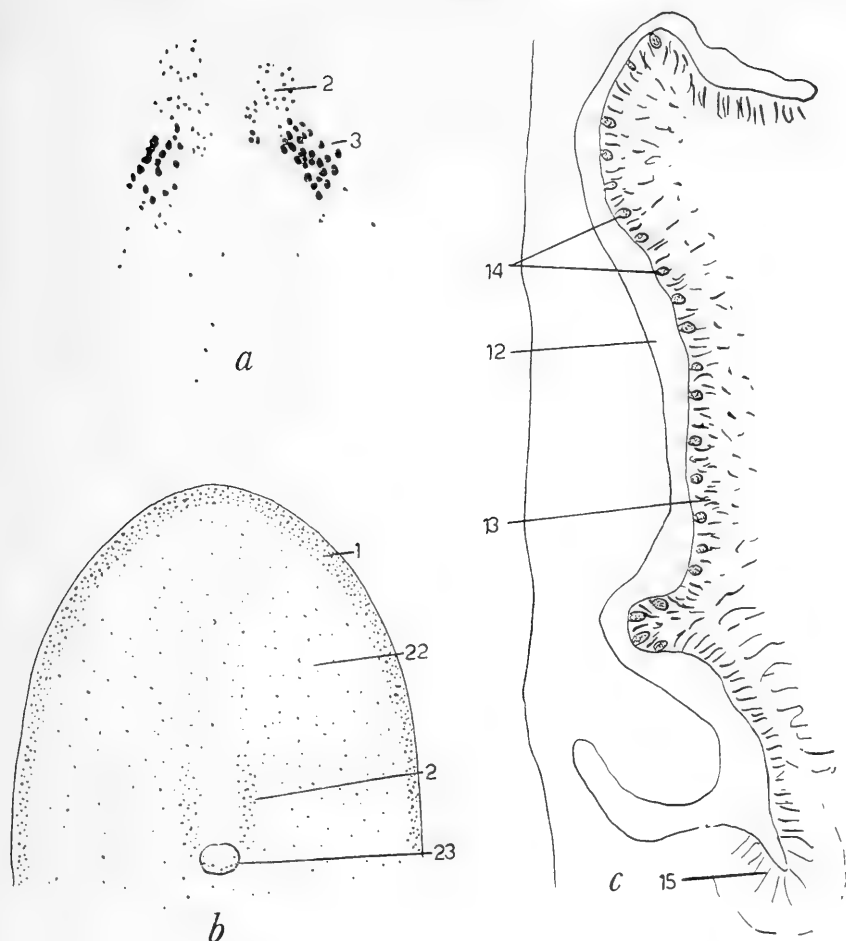


FIGURE 2.—*a*, Enlarged view of tentacular and cerebral eyes of *Discocelis insularis*; *b*, enlarged view of anterior end of juvenile latorcestid; *c*, parasagittal view of penis of *D. insularis*. (For explanation see page 66.)

and parallels the wall of the muscular pocket of the male antrum mentioned above. It then arches posteriorly and narrows to a straight slender tube that continues posteriorly after receiving into its ventral wall the common oviduct, and finally opens into a large Lang's vesicle of irregular form lined by a tall epithelium. Because of poor histological preservation it was difficult to determine whether the Lang's vesicle sends forward a pair of horns as usual in the genus, but this seemed to be the case. The irregular form of the Lang's vesicle is unusual in the genus.

DIFFERENTIAL DIAGNOSIS: Of the six described species of *Discocelis*, the gonopores are separate in only one, namely *D. herdmani* (Laidlaw), 1940. The present species differs from *herdmani* in the eye pattern, the very long female canal, and the irregular Lang's vesicle.

HOLOTYPE: One whole mount, minus the copulatory apparatus and sections of the copulatory apparatus (six slides), has been deposited in the U. S. National Museum (No. 25939).

REMARKS: The type species, *D. lichenoides*, is very poorly known and the genus is, in fact, based on Lang's (1884) description of *D. tigrina* (Blanchard). This situation could easily give rise to nomenclatorial difficulties. The family definition here given excludes *Semonia*, for it appears to me undesirable to include in the family genera that lack the characteristic provision of the male apparatus with numerous small prostatic structures. The family is then limited to the genera *Discocelis*, *Adenoplana* Stummer-Traunfels, 1933, and *Coronadena* Hyman, 1940.

Family LATOCESTIDAE Laidlaw, 1903

Juvenile latocestid

FIGURES 2,*b*; 3,*a*

MATERIAL: One small, juvenile specimen collected at Saipan in the Marianas by P. E. Cloud on May 6, 1949.

WHOLE MOUNT FEATURES: The worm has the typical appearance of a latocestid, long and slender with rounded ends; it is 11 mm. long by 2.5 mm. wide (fig. 3,*a*). The color appears a dirty white. The marginal band of eyes could not be traced with certainty around the posterior end, but it appeared to stop at about the level of the mouth. As usual in the family, the anterior end is strewn with small eyes to the level of the brain (fig. 2,*b*). Directly in front of the brain they are aggregated into two linear cerebral clusters. The pharynx is in the posterior body half and broadens posteriorly where it terminates in a rounded part bearing the mouth.

COPULATORY APPARATUS: As usual in the family, the copulatory apparatus is located in the short posterior region between the posterior end of the pharyngeal cavity and the posterior body margin. The female pore was detectable here in the whole mount, but sections of this postpharyngeal region revealed only traces of the copulatory apparatus. The specimen is thus immature and cannot be placed generically, although it is highly probable that it belongs to *Latocestus*. The eye pattern appears different from that of described species of *Latocestus*.

The specimen mounted whole plus the sections of the postpharyngeal region has been returned to the U. S. National Museum (No. 25940).

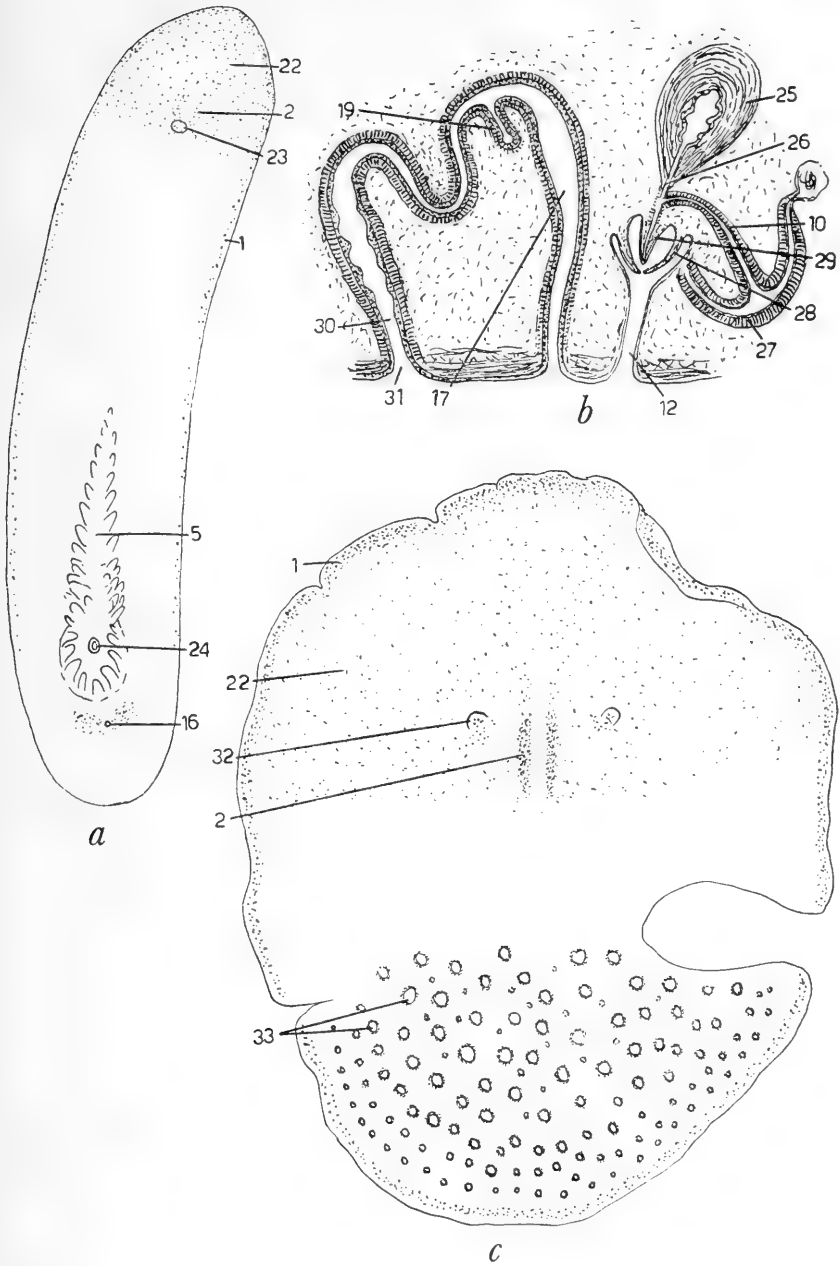


FIGURE 3.—*a*, Juvenile latocestid, view of entire cleared worm; *b*, *Ommatoplana oceanica*, sagittal view of copulatory apparatuses; *c*, same, view of cleared holotype. (For explanation see page 66.)

Family STYLOCHIDAE Stimpson, 1857

Genus *Ommatoplana* Laidlaw, 1903

Mexistylochus Hyman, 1953, p. 291.

DEFINITION: Stylochidae of oval form and stiff consistency; dorsal surface usually covered with tubercles; with numerous cerebro frontal eyes; mouth at the posterior end of the pharyngeal cavity; male apparatus as in *Stylochus* but penis sheath present; female apparatus with a vaginal duct, opening separately to the exterior well behind the female gonopore.

TYPE SPECIES: *Ommatoplana tuberculata* Laidlaw (1903b).

Ommatoplana oceanica, new species

FIGURE 3,b,c

MATERIAL: Two specimens, both damaged, are present in the material, collected by P. E. Cloud at Saipan in the Marianas Islands May 6, 1949. One specimen was represented by the posterior half only and this has been sectioned sagittally. The other specimen, retained as a whole mount, has a piece missing from one side.

WHOLE MOUNT FEATURES: The whole mount is represented in figure 3,c. The form is broadly oval, 17 mm. long by 12 mm. wide. The dorsal surface is studded with low tubercles or warts that are larger centrally and diminish in size to the periphery, although very small warts also occur between the larger ones. The color appears light brown, possibly white in life, with dark brown or black tubercles. The margin is completely encircled by a band of eyes, broader anteriorly. There is present a pair of small tentacles rather far back from the anterior margin, and the small eyes in and around the tentacles may be regarded as tentacular clusters. There are two elongated cerebral clusters of many small eyes. The entire anterior part of the body, comprising well over one-third of the body surface, is dotted with small eyes extending to the marginal band. The pharynx could not be seen in the whole specimen, but in sections it appears elongated and somewhat posteriorly located. The intestinal branches appear anastomosed into a small-meshed network. The mouth could not be seen on the whole mount, but sections showed that, as in the type species, it is located at the posterior end of the pharyngeal cavity which leads to it by a narrow tube.

HISTOLOGY: Much of the description of the type species is devoted to the general histology and a good figure is given of the general appearance of a section. As shown in this figure, the dorsal tubercles

occur between the basement membrane of the epidermis and the subepidermal musculature or, in short, the epidermis is elevated into a hillock, thinned at the summit, by each tubercle. The tubercle consists of an amorphous fibrous material with a number of nuclei; in the present species its periphery is filled with dark pigment granules. Both the dorsal and ventral musculature, especially the latter, are strongly developed in *Ommatoplana*. The tubercles lie directly upon the dorsal subepidermal musculature, which probably has some relation to the tubercles, but I was not able to see any strands of tissue extending from the interior of the tubercles through the muscle layer to the parenchyma, as described by Laidlaw (1903b). The muscle layers of the ventral musculature do not seem to correspond in the present species with those described by Laidlaw for *tuberculata*, but it is not clear that the arrangement of the muscle layers is of taxonomic significance. Under the thick basement membrane of the ventral epidermis is a thin layer of circular muscles, followed by a heavy longitudinal layer. This is followed by two layers of diagonal muscles at right angles to each other and, finally, the innermost layer is again a thick stratum of longitudinal fibers. However, I have only longitudinal sections available, and possibly transverse sections would reveal further details.

COPULATORY APPARATUS: All parts of the apparatus were found but, as a fold is present at the site of the apparatus making it impossible to obtain sagittal sections, the spatial relations of parts is difficult to ascertain. Figure 3,b is therefore to be regarded as pieced together from sections that cut the apparatus diagonally. The copulatory apparatus is plainly that of a member of the Stylochidae. The apparatus lies at the posterior end of the pharynx with the male apparatus, in fact, beneath the last pharyngeal folds; however, the spatial relation to the mouth was not clear. The sperm ducts, coming from in front, acquire muscular walls, becoming spermiducal bulbs. These unite with the seminal vesicle, forming a tripartite structure; all three parts are closely similar histologically and are provided with a fairly thick wall of circular muscle fibers. The tubular median part, which is the true seminal vesicle, continues posteriorly to the penis, narrowing to an ejaculatory duct, and before reaching the penis papilla it joins the prostatic duct from the prostatic vesicle. The latter is an oval body with a thick muscular wall of fibers paralleling its external contour and a relatively small lumen lined by a wavy epithelium. Prostatic glands are not in evidence. The prostatic duct, encircled by circular muscle fibers, joins the ejaculatory duct and the common duct extends through the penis papilla to its tip. The penis papilla

is small, somewhat slender, and is housed in a part of the male antrum (penis pocket) separated from the general male antrum by a penis sheath, a circular fold with rather thin margins projecting into the male antrum. Distal to the penis sheath the male antrum proceeds as a somewhat elongated tube to the male gonopore.

The female gonopore occurs not far behind the male pore and leads into a tubular vagina invested with a layer of circular fibers. The vagina proceeds dorsally, widening considerably, then curves backward, receiving the common oviduct at the curve. It then continues posteriorly and downwards as a vaginal duct. This duct makes a loop and proceeds, widening somewhat, to the vaginal pore in the midventral wall, somewhat farther behind the female gonopore than the latter is from the male gonopore. The vaginal duct is heavily muscularized with circular fibers.

DIFFERENTIAL DIAGNOSIS: *Ommatoplana oceanica* differs from other known species of the genus in the presence of tentacles and in the black color of the tubercles.

HOLOTYPE: One whole mount deposited in the U. S. National Museum (No. 25941); also, one set of sagittal sections of the copulatory region.

REMARKS: If I am correct in assigning this species to *Ommatoplana*, then *Ommatoplana* is a stylochid, not a cryptocelid as supposed by Bock (1913). Certainly, because of the loss of important sections, the original description of *Ommatoplana* does not furnish the necessary information to decide to what family of the Craspedommata it belongs. It is further evident that *Mexistylachus* Hyman, 1953, is a synonym of *Ommatoplana*. As the combination *Ommatoplana tuberculata* already exists, it becomes necessary to suggest a new specific name for my species *Mexistylachus tuberculatus*, and I propose *mexicana*. The genus *Ommatoplana* then comprises at present the species *tuberculata* Laidlaw, 1903, *mexicana*, new name, *levis* (Hyman, 1953) and the present *oceanica*. The last three species are very similar as to eye arrangement but, according to Laidlaw's figure, *tuberculata* differs decidedly in this respect. The peculiar disposition of the cerebro frontal eyes in this figure, without bilateral arrangement or cerebral or tentacular clusters, suggests some abnormality or injury in the specimen in question. *O. levis* differs from the other three species in lacking the characteristic dorsal tubercles. The great similarity of the copulatory apparatus in the three species in which it is fully known is very surprising. Anastomosis of the intestinal branches into a fine-meshed network appears characteristic of the genus. *Ommatoplana* is very close to *Cryptophallus* but differs from it in the well developed, though small, prostatic vesicle and in the separate opening of the vaginal duct.

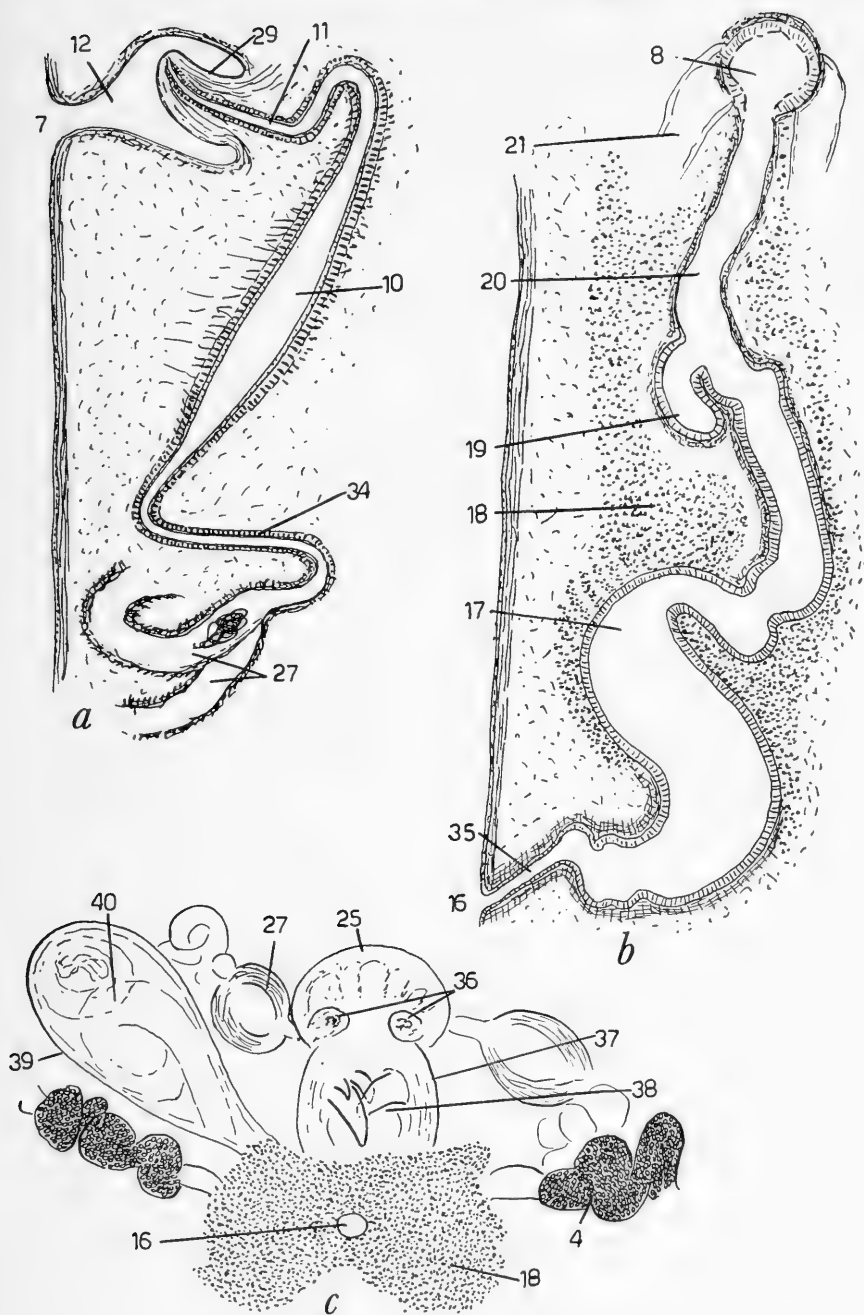


FIGURE 4.—*Euplana gigas*, sagittal view of male copulatory apparatus; *b*, same, of female copulatory apparatus; *c*, copulatory apparatus of *Paraplanocera oligoglana*, as seen from above in cleared specimen, ventral view, showing teeth in the cirrus sac. (For explanation see page 66.)

Section SCHEMATOMMATA

Family LEPTOPLANIDAE Stimpson, 1857

Genus *Euplana* Girard, 1893*Euplana gigas* (Schmarda), 1859

FIGURE 4, a, b

Leptoplana gigas Schmarda, 1859, p. 17.

Leptoplana subviridis Plehn, 1896, p. 330.

Leptoplana pardalis Laidlaw, 1902, p. 287.

Discoplana subviridis Bock, 1913, p. 220.

Discoplana gigas Stummer-Traunfels, 1933, p. 3494.

Susakia badiomaculata Kato, 1934, p. 125.

MATERIAL: A total of seven specimens in four different vials is present in the material, collected during July and August 1951 by A. H. Banner and D. W. Strasburg in Onotoa Atoll, Gilbert Islands.

WHOLE MOUNT FEATURES: Despite the several descriptions and figures of this species in the literature, it does not appear superfluous to give a résumé of the characters. This is a very large species; the original specimen of Schmarda measured 140 mm. long when extended, presumably alive, and even after preservation the specimen is stated by Stummer-Traunfels, who reexamined Schmarda's material, to be 100 mm. in length. No subsequent describer has had specimens of any such size; mostly they do not exceed 50 mm. in length, preserved. The shape is obovate, broadest anteriorly and gradually tapering to a bluntly pointed posterior end. The color pattern is distinctive; on a white to buff ground are evenly scattered clusters of dark brown spots. Both the shape and the color pattern are well represented in the colored figures of Laidlaw and Kato. The original colored figure of Schmarda does not appear to me very typical in either respect. The largest of my specimens has more spots than in any of the figures in the literature. These spots are not evenly distributed but are much more thickly placed in the periphery of the worm, giving this specimen a darker appearance than the others. On the other hand, my smallest specimen appears white without any dark dots. The eye arrangement is accurately represented by Meixner (1907), Stummer-Traunfels, and Kato.

COPULATORY APPARATUS: Sagittal sections have been made of the copulatory apparatus of two specimens. Apparently there are some small differences in this apparatus in specimens from different regions. Plehn's figure is highly schematic. Meixner and Stummer-Traunfels figure only the male system and the latter found the female system damaged in the Schmarda specimen. Consequently,

the best figure of the copulatory apparatus is that of Kato which, however, also seems a little schematized. Therefore, I present figures of the copulatory apparatus of one of my series of sections. As the male and female systems are very far apart in this species, as shown in Kato's figure, one cannot represent them on one drawing except on a reduced scale. Consequently the male apparatus is shown in figure 4,*a* and the female apparatus in figure 4,*b*. These may be compared with figures in the literature. It appears superfluous to describe them in detail, but the following points shall be noted. The penis papilla is smaller in my specimens than in the ones represented by Meixner; I do not find the wide muscular provision around the distal part of the seminal vesicle that is depicted by Meixner and Stummer-Traunfels; I do not find the prostatic glands depicted by these two authors as occurring in the wall of the male antrum, further not recorded by Kato; and in my smallest specimen (length, 16 mm.) the anterior horns of Lang's vesicle are definitely wanting, so apparently they are present only in the more mature worms. The terminal parts of the spermiducal vesicles acquire muscular walls and hence are to be regarded as spermiducal bulbs. These pursue a tortuous course in the larger specimens. They unite to a common sperm duct that descends and then enters the fusiform seminal vesicle, which ascends diagonally and narrows to an ejaculatory duct that after a forward bend enters the conical penis papilla. The anterior horns of Lang's vesicle could not be successfully traced in the larger specimen; they are shown in figures in the literature.

SPECIMENS: Most of the specimens have been returned to the U. S. National Museum. One specimen with typical color pattern has been deposited in the American Museum of Natural History.

REMARKS: *Euplana gigas* is evidently spread throughout the whole of the vast Indo-West Pacific area and is one of the most common polyclads of that region. It has been recorded from Somaliland on the eastern coast of Africa, Ceylon, the Maldiv Islands, Timor, Funafuti, the Moluccas, and Japan, to which list may be added the present record of the Gilbert Islands. The species is apparently absent from the Hawaiian Islands, where its place is taken by another large species of *Euplana* Girard (Hyman, 1954).

Family PLANOCERIDAE Lang, 1884

Genus *Paraplanocera* Laidlaw, 1903

Paraplanocera oligoglana (Schmarda), 1859

FIGURE 4,*c*

Stylochus oligoglenus Schmarda, 1859, p. 34.

Stylochus amphibolus Schmarda, 1859, p. 34.

Planocera olygoglena Lang, 1884, p. 444.

Planocera amphibola Lang, 1884, p. 444.

Planocera discus, Willey, 1897, p. 155.

Paraplanocera laidlawi Jacobowa, 1906, p. 115.

Paraplanocera discus Bock, 1913, p. 246.

Paraplanocera oligoglena Stummer-Traunfels, 1933, p. 3487.

MATERIAL: One specimen collected by S. F. MacNeil on a reef flat, Kwajalein Atoll, South Loi Island, Marshall Islands, no date.

WHOLE MOUNT FEATURES: The specimen is broadly oval, 18 mm. long and 16 mm. wide. The copulatory apparatus as seen in the whole mount is shown in figure 4,c. This agrees with the copulatory apparatus of *P. oligoglena* except that in addition to the two large teeth in the cirrus sac characteristic of this species there are two additional smaller teeth. Puzzling coils were further seen in the copulatory bursa. It was therefore thought necessary to section the copulatory apparatus. This showed complete agreement with *oligoglena* in all details, apart from the extra teeth in the cirrus sac; the coils in the bursa were found to be those of the right spermiducal vesicle that had somehow got pushed into the bursa. As I have recently described this species in great detail (Hyman, 1953), further description here appears superfluous.

SPECIMEN: The specimen as whole mount minus the copulatory apparatus and serial sections of the copulatory apparatus (seven slides) have been returned to the U. S. National Museum.

REMARKS: *Paraplanocera oligoglena* is cosmopolitan in Indo-Pacific tropical and subtropical waters. It has been recorded from Ceylon, New Britain, New Caledonia, Gulf of California, Hawaii (Hyman, 1954), and now from the Marshall Islands. Records from several other places in the Indian and Pacific Oceans are given by Prudhoe (1945), but some uncertainty exists as to the specific identification and the number of valid species of the genus. No species of the genus has been taken in the Atlantic Ocean.

Suborder COTYLEA

Family PSEUDOCERIDAE Lang, 1884

Genus *Pseudoceros* Lang, 1884

Pseudoceros micronesianus, new species

FIGURE 5

MATERIAL: This species is represented by two specimens—a larger one taken by P. E. Cloud in a lagoon near Managaha Island, west of Saipan, June 20, 1949, and a smaller one collected by A. H. Banner, at Onotoa Atoll, Gilbert Islands, July 29, 1951.

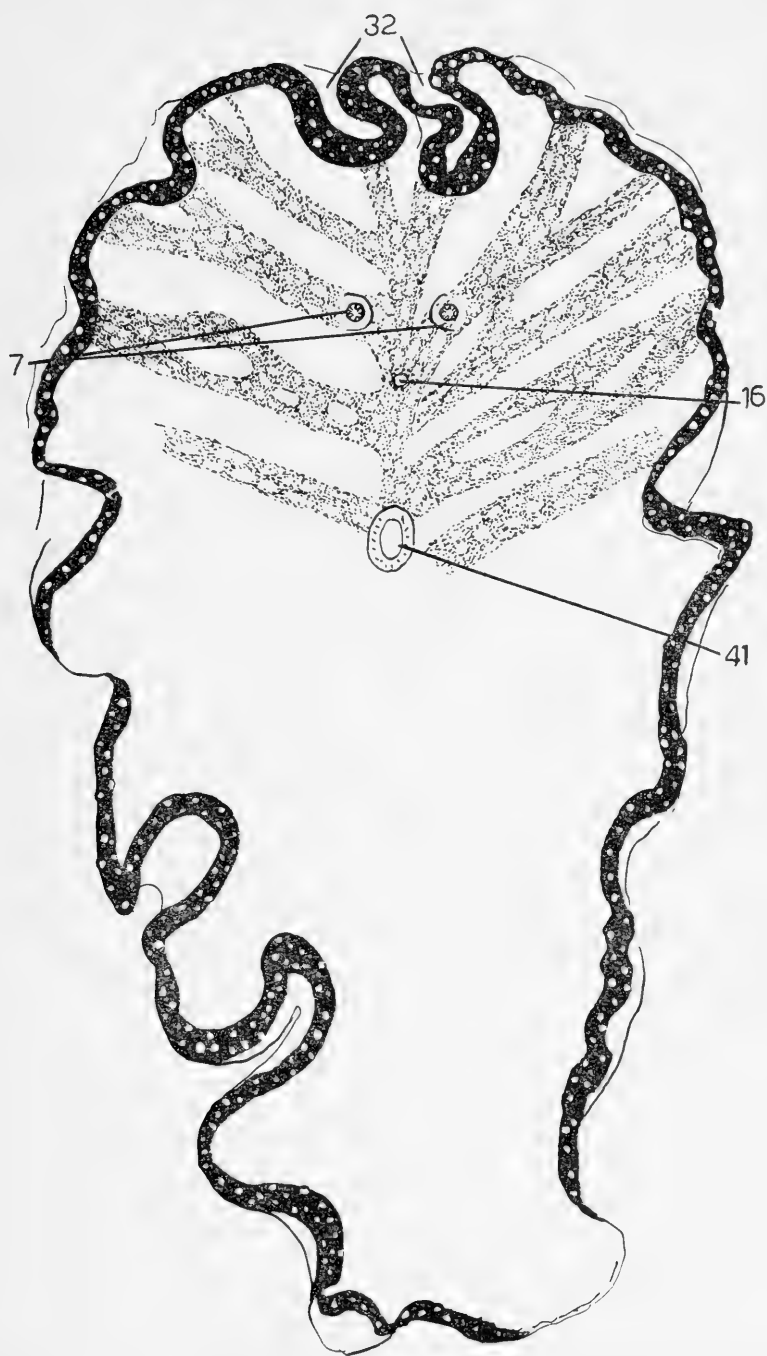


FIGURE 5.—*Pseudoceros micronesianus*, view of holotype in alcohol. (For explanation see page 66.)

WHOLE MOUNT FEATURES: The larger specimen is 27 mm. long by 16 mm. wide, broad anteriorly and narrower posteriorly (fig. 5) but it obviously has been distorted by fixation. The margins are ruffled and much damaged. At the anterior end are the usual two tentacles formed by upfoldings of the margin. On account of the black color here, the eyes on the tentacles could not be seen, and the same is true of the cerebral eye cluster. The ground color appeared to be a pinkish orange; there is a dense black border dotted with white dots. On the dorsal surface is a pattern of dark bars arching transversely from a middorsal strip of the same color. This dorsal pattern is also liberally strewn with spaces of the same color as the background. The pattern was intact only in the anterior part of the worm and was more or less destroyed by injury posteriorly; consequently, it is not certain that the same pattern obtained over the entire dorsal surface, although this appeared to be the case. The pharynx was not clearly evident but appeared small and of rounded shape with a few heavy folds. The male apparatuses are double in this species, and two hillocks bearing the male pores are clearly in evidence at the posterior border of the pharynx as shown in figure 5. Shortly behind the male pores, in the median ventral line, is seen the female gonopore, and some little distance behind that is found the sucker.

The smaller specimen is of more rounded oval shape, about 12 mm. long. It seems probable that it is the same species as the larger one, although I am a little uncertain of this. There is the same black border with white dots as in the preceding specimen, and on the dorsal surface there are black markings similar to the foregoing with many open spaces in them. But here again the dorsal pattern is much damaged and distorted. The two male pores are in evidence.

DIFFERENTIAL DIAGNOSIS: *Pseudoceros micronesianus* differs from other species of the genus in the color pattern.

HOLOTYPE: The larger specimen, preserved in alcohol, is made the holotype (USNM 25947). The smaller specimen is also in alcohol in the U. S. National Museum.

REMARKS: The numerous species of the genus *Pseudoceros*, most of which inhabit the Indo-Pacific region, are at present distinguishable almost wholly by the color pattern. In the absence of accurate color notes accompanying the specimens, it is very difficult to identify the species of this genus or to determine with certainty whether a new species is at hand. Often the colors, very brilliant in life, disappear altogether on preservation. I have, with some hesitation, considered these specimens as representing a new species because what remains of the color pattern appears to differ from that of previously described species. The present species is one of those with a pair of male

apparatuses; others have but a single male apparatus, medianly placed. However, even this information is lacking from many of the old descriptions. It is desirable to figure the details of the copulatory apparatus as a further aid to identification, despite the fact that such details are very similar throughout the genus. However, as the copulatory apparatus in the *Cotylea* is near the anterior end, sectioning it destroys the most important part of the specimen and it can be done profitably only if several specimens are available. As I could not be sure that the smaller specimen here is identical with the larger one, I thought it useless to section the smaller one. Both, therefore, have been preserved intact.

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BITING LICE OF THE GENUS *SAEMUNDSSONIA*
(MALLOPHAGA: PHILOPTERIDAE) OCCURRING ON TERNS

By RONALD A. WARD¹

Recently Clay (1949) contributed to the elucidation of the systematics of the species of the genus *Saemundssonina* occurring on terns. The present study undertakes to further amplify our knowledge of this group by a restudy of Kellogg's specimens and the examination of additional unstudied material. In it the known species are redescribed where necessary, *Saemundssonina brevicornis* (Giebel) is removed from synonymy and is considered as a distinct species, and two new species are described—*S. parvigenitalis* from *Sterna forsteri* Nuttall, and *S. petersi* from *Sterna f. fuscata* Linné.

I am indebted to the following people and institutions for the loan of specimens (the abbreviations following the names are used throughout the paper to indicate where the material is deposited): Dr. G. F. Ferris, Stanford Natural History Museum (SNHM); Dr. Henry Dietrich, Department of Entomology, Cornell University (CU); Dr. E. A. Chapin, U. S. National Museum (USNM); Harold S. Peters, U. S. Fish and Wildlife Service, Atlanta, Ga. (HSP); Dr. E. H. Bryan, Jr., Bernice P. Bishop Museum (BPBM); Dr. C. H. Curran, American Museum of Natural History (AMNH); Rupert Wenzel, Chicago Natural History Museum (CNHM); and Richard B. Fischer, Department of Ornithology, Cornell University. For advice on certain nomenclatorial problems, I wish to thank Dr. A. E. Emerson of the University of Chicago and Mr. R. L. Araujo of the Instituto Biológico, São Paulo, Brazil.

On the basis of the male genitalia, three main groups of species of *Saemundssonina* may be considered. One group, consisting of *S. meridiana*, *S. petersi*, and *S. snyderi*, has genitalia resembling those found on the gulls; another group, *S. lobaticeps* and *S. hopkinsi*, has

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8. Paramere 0.28 to 0.30 mm. in length **snyderi** (Kellogg and Paine)
 Paramere 0.22 to 0.26 mm. in length **petersi**, new species
9. Clypeal signature 0.16 to 0.18 mm. in width; 4 to 9 setae on margin of abdominal sternite VI **laticaudata** (Rudow)
 Clypeal signature 0.14 to 0.16 mm. in width; 2 to 5 setae on margin of abdominal sternite VI **brevicornis** (Giebel)
10. Details of endomere and paramere head as in illustrations by Clay (1949, figs. 16, 22, 23) **sternae** (Linné)
 Details of endomere and paramere head as in illustrations by Clay (1949, figs. 17, 24, 25) **lockleyi** Clay

FEMALES

1. Hyaline anterior margin of head medianly emarginate 2
 Hyaline anterior margin of head not emarginate 3
2. Width at temples usually less than 0.72 mm.; setae lateral to last abdominal sternite, 5 to 7 in number **lobaticeps** (Giebel)
 Width at temples usually greater than 0.73 mm., setae lateral to last abdominal sternite 3 (occasionally 4) in number **hopkinsi** Clay
3. Thoracic sternal plate with 2 setae on both the anterior and posterior margins 4
 Thoracic sternal plate with setae only on posterior margin 5
4. Cephalic index less than 1.03; length of abdominal sternite VII (at midline) greater than 0.08 mm **snyderi** (Kellogg and Paine)
 Cephalic index greater than 1.03; length of abdominal sternite VII (at midline) 0.06 to 0.08 mm **meridiana** Timmermann
5. Sternite VII with posterolateral angles free or partially fused to subgenital plate **sternae** (Linné), **lockleyi** Clay, **brevicornis** (Giebel), and **petersi**, new species
 Sternite VII with posterolateral angles fused to subgenital plate 6
6. Width at temples greater than 0.63 mm **laticaudata** (Rudlow)
 Width at temples less than 0.62 mm 7
7. Width at temples 0.52 to 0.59 mm.; width of clypeal signature 0.12 to 0.14 mm **melanocephalus** (Burmeister)
 Width at temples 0.58 to 0.61 mm.; width of clypeal signature 0.14 to 0.18 mm **parvigenitalis**, new species

Saemundssonina sternae (Linné)

- Pediculus sternae* Linné, 1758, p. 616. Hosts: "Habitat in Sternis, Laris." = *Sterna h. hirundo* Linné.
- Nirmus fornicatus* Olfers, 1816, p. 89. Hosts: "Hab. in laris et sternis."
- Docophorus 5-maculatus* Piaget, 1885, p. 9. Host: *Hirundo urbica* (error) = *Sterna hirundo* Linné.
- Docophorus melanocephalus* Kellogg and Chapman, 1902, p. 20 [nec Burmeister]. Host: *S. forsteri* (error) = ? *S. h. hirundo* Linné.
- Philopterus melanocephalus* Peters, 1928, p. 225; 1936, p. 17 (part) [nec Burmeister]. Host: *S. h. hirundo* Linné.
- Saemundssonina sternae* (Linné), Clay, 1949, p. 4, figs. 1-6, 16, 22, 23. Hosts: *S. h. hirundo* Linné and *Gelochelidon n. nilotica* (Gmelin).

This species has been adequately characterized by Clay. Material studied from two forms of the Sterninae not available to her seem also to fall within the range of this species. Specimens from *Sterna*

d. dougalli Montagu and *Gelochelidon nilotica aranea* (Wilson) show a distribution of setae within that of material from the type host, with the exception of tergite VI of the male which has between 4 to 8 setae in contrast to the 8 to 10 listed by Clay. However, an examination of a few of the neoparatypes shows that some of the specimens have as low as 6 setae on this segment, and American specimens from the type host have as few as 5 setae on tergite VI. As far as measurements are concerned, the material studied is similar to *sternae*, with the exception of head width measurements on males from *Gelochelidon*, which have a slightly wider range at the high end. Unfortunately, insufficient material is available to determine if these differences are real or not. On host material identified as *Sterna forsteri* Nuttall specimens have been found that fit *sternae* perfectly and also fit a new species, *parvigenitalis*. In a brief study of some ornithological literature, it has been noticed that *Sterna forsteri* has often been confused with *S. hirundo*. This may explain the apparent occurrence of two species of *Saemundssonina* on a single host species.

MATERIAL EXAMINED: 3♂♂ and 1♀ (neoparatypes) ex *Sterna h. hirundo* Linné, Great Britain, Kent (AMNH); 3♂♂ and 2♀♀ ex above host, Virginia, Cobbs Island, H. S. Peters, coll. (HSP); 1♂ and 5♀♀ ex above host, Ohio, Buckeye Lake, M. B. Trautman, coll. (HSP); 4♂♂ and 1♀ ex roseate tern (*S. d. dougalli* Montagu), British West Indies, Caicos Islands, Fort George Cay, H. S. Peters, coll. (USNM, Bishopp No. 15155); 1♂ and 1♀ ex gull-billed tern (*Gelochelidon nilotica aranea* (Wilson)), British West Indies, Bahama Islands, Fortune Island, H. S. Peters, coll. (USNM, Bishopp No. 15100); 1♂ and 1♀ ex above host, British West Indies, Caicos Islands, Fort George Cay, H. S. Peters, coll. (USNM, Bishopp No. 15154); 2♂♂ and 3♀♀ ex above host, British West Indies, Grand Caicos Island, H. S. Peters, coll. (USNM, Bishopp No. 15164); 1♂ ex *Sterna forsteri* Nuttall (error) = *S. h. hirundo* Linné, Louisiana, Grand Bayou (CU); 1♂ and 1♀, host as above, Minnesota, Leech Lake (SNHM, Kellogg No. 689a); 1♂ and 1♀, host as above, Georgia, Savannah, I. R. Tompkins, coll. (CU).

Saemundssonina lockleyi Clay

Saemundssonina lockleyi Clay, 1949, p. 11, figs. 17, 24, 25. Type host: *Sterna vittata georgiae* Reichenow; also recorded from *S. v. bethunei* Buller and *S. paradisaea* Pontopiddan.

As previously, no emendations are necessary to the original description.

MATERIAL EXAMINED: 2♂♂ and 3♀♀ ex *Sterna paradisaea* Pontopiddan, Alaska, Salmon Creek, R. B. Williams, coll. (det. T. Clay)

(USNM); 2♂♂ and 3♀♀ ex above host, Labrador, Turnerick, J. L. Austin, Jr., coll. (HSP); 2♂♂ and 2♀♀ ex *S. vittata bethunei* Buller, Campbell Island (det. T. Clay) (AMNH).

***Saemundssonina melanocephalus* (Burmeister)**

(*Docophorus melanocephalus* Nitzsch, 1818, p. 290, nomen nudum.)

Docophorus melanocephalus Burmeister, 1838, p. 426. Hosts: "Auf mehrern *Sterna* und *Larus* Arten."

Nirmus melanocephalus Giebel, 1861, p. 315. Host: *Sterna minuta*=*S. a. albifrons* Pallas.

Philoferus melanocephalus Peters, 1936, p. 17 (part) [nec Burmeister]. Host: *S. antillarum antillarum* (Lesson)=*S. albifrons antillarum* (Lesson).

Saemundssonina melanocephalus (Burmeister), Clay, 1949, p. 11, figs. 8, 11, 19, 28, 29. Host: *S. a. albifrons* Pallas.

A series of *Saemundssonina* from the least tern has been compared with a pair of neoparatypes. No differences may be ascertained, except for a slightly smaller head width in two of the females.

MATERIAL EXAMINED: 1♂ and 1♀ (neoparatypes) ex *Sterna a. albifrons* Pallas (AMNH); 2♀♀, South Carolina, Charleston, E. B. Chamberlain, coll. (USNM, Bishopp No. 19900); 3♂♂ and 7♀♀, above locality, H. S. Peters, coll. (HSP, Bishopp No. 20971); 1♀, Cuba, Isle of Pines, H. S. Peters, coll. (USNM, Bishopp No. 15469); 1♂ and 1♀, British West Indies, Bahama Islands, Acklin Island, H. S. Peters, coll. (USNM, Bishopp No. 15090); 1♂ and 3♀♀, British West Indies, Grand Caicos Island, H. S. Peters, coll. (USNM, Bishopp No. 15168).

The above lots, except for the type material, are all from least terns (*Sterna albifrons antillarum* (Lesson)).

***Saemundssonina parvigenitalis*, new species**

Philoferus melanocephalus Peters, 1936, p. 17 (part) nec Burmeister. Host: *Sterna forsteri* Nuttall.

MALE: Head width is similar to that of *melanocephalus*. Chaetotaxy as in *sternae*, with exception of tergite V, which has 8 to 10 setae. Parameres differ in shape from those hitherto reported from the Sterninae (fig. 1,a) and are markedly smaller in length (0.10 to 0.13 mm.). Endomeres as in figure 1,h, with a basal, median fusion. Mesosomal setae apparently absent (fig. 1,i).

FEMALE: May be distinguished from *melanocephalus* by the slightly greater width of the head (0.59 to 0.62 mm.) and clypeal signature (0.14 to 0.18 mm.). Thoracic sternal plate with two setae on posterior margin. Abdominal chaetotaxy as in *sternae*. Sternite VII has the posterolateral angles fused to the subgenital plate. There are three to four setae present on each side of the last sternal plate.

TYPE MATERIAL: USNM 62279, 1 ♂ (holotype), 1 ♀ (allotype), and 1 ♂ (paratype with damaged parameres) ex Forster's tern (*Sterna forsteri* Nuttall), Louisiana, Northshores, F. M. Carroll, coll. (USNM, Bishopp No. 30439).

Paratypes as follows, all from the type host: 2 ♂ ♂ and 1 ♀, Virginia, Wachapreague, M. B. Trautman, coll. (HSP); 1 ♂ and 1 ♀, South Carolina, Georgetown, H. S. Peters, coll. (HSP); 1 ♂ and 3 ♀♀, Florida, Pinellas County, W. G. Fargo, coll. (USNM, Bishopp No. 15604); 5 ♀♀, Florida, Pass-a-Grille, W. G. Fargo, coll. (USNM, Bishopp No. 15605); 1 ♂, Louisiana, Grand Bayou (CU); 1 ♂ (damaged) and 1 ♀, New York, Long Island, Orient (CU).

Saemundssonina laticaudata (Rudow)

Docophorus laticaudatus Rudow, 1869, p. 12. Host: *Sterna cantiaea* = *Thalasseus s. sandvicensis* (Latham).

Docophorus melanocephalus Kellogg, 1896, p. 99, pl. 4, fig. 6 (part) [nec Burmeister]. Host: *Sterna maxima* = *Thalasseus m. maximus* (Boddaert).

Philopterus melanocephalus Peters, 1936, p. 17 (part) [nec Burmeister]. Host: *Thalasseus m. maximus* (Boddaert).

Saemundssonina laticaudata (Rudow), Clay, 1949, p. 14, figs. 7, 18, 26, 27. Hosts: *T. s. sandvicensis* (Latham), *T. bengalensis par* (Mathews and Iredale), *T. bergi velox* (Cretzschmar), *T. b. bergi* (Lichtenstein), *T. m. maximus* (Boddaert), and *T. eurygnatha* (Saunders).

Thirty specimens have been studied from *Thalasseus m. maximus* (Boddaert), and cannot be separated by any criteria from the material described by Clay. However, material from *T. sandvicensis acufavidus* (Cabot) proves to be distinct from that on *T. s. sandvicensis* (Latham), and is redescribed as the species next discussed, *S. brevicornis* (Giebel).

MATERIAL EXAMINED: 1 ♂ and 1 ♀ ex *Thalasseus bergi velox* (Cretzschmar), Red Sea (T. Clay, det.) (AMNH); 1 ♀ ex *T. bergi cristatus* (Stephens), Solomon Islands, Guadalcanal, W. J. Beecher, coll. (CNHM).

The following lots are all from the royal tern (*T. m. maximus* (Boddaert)): 4 ♂ ♂ and 4 ♀♀, Georgia, Isle of Hope, I. R. Tompkins, coll. (USNM, Bishopp No. 19614); 1 ♂ and 2 ♀♀, South Carolina, Cape Island, G. R. Lunz, Jr., coll. (USNM and HSP, Bishopp Nos. 20413 and 20419); 1 ♂ and 1 ♀, Louisiana, New Orleans, F. M. Carroll, coll. (USNM, Bishopp No. 20378); 1 ♀, Florida, Pass-a-Grille, W. G. Fargo, coll. (USNM, Bishopp No. 8247); 3 ♀♀, Florida, 5 miles west of Clearwater, R. B. Fischer, coll.; 1 ♂ and 13 ♀♀, California, Pacific Grove (SNHM, Kellogg Nos. 53a and 2060); 5 ♂ ♂ and 2 ♀♀, California, Bay of Monterey (SNHM, Kellogg No. 50, and CU, Kellogg No. 65).

Saemundssonina brevicornis (Giebel)

Docophorus brevicornis Giebel, 1874, p. 112. Host: *Sterna acuflava*=*Thalasseus sandvicensis acuflavus* (Cabot).

MALE: This may be separated from *laticaudata* by the lesser width of the clypeal signature (0.14 to 0.16 mm.) and also by the lower number of setae (2 to 5) on the sixth abdominal tergite. Slight differences exist in chaetotaxy between this species and *laticaudata* (ex *T. m. maximus*) as shown in table 1.

FEMALE: Similar to *laticaudata*, except for the feature (in all specimens examined) of the separation of sternite VII from the subgenital plate. Three setae on each side of the last sternite. Abdominal chaetotaxy as in *sternae* (Clay, 1949, p. 10, table 1).

Neotypes are erected for this species, as Giebel's type in Germany was destroyed during World War II.

TABLE 1.—Dorsal chaetotaxy of *Saemundssonina brevicornis* and *S. laticaudata*

| | <i>S. brevicornis</i> | <i>S. laticaudata</i> |
|-------------|-----------------------|-----------------------|
| Pterothorax | 15-18 | 16-19 |
| Abdomen II | 2- 4 | 4- 6 |
| “ III | 6- 9 | 7- 9 |
| “ IV | 8-12 | 10-12 |
| “ V | 5-10 | 8-11 |
| “ VI | 2- 5 | 6- 9 |
| “ VII | 4 | 4- 7 |

TYPE MATERIAL: Neotype ♂ (the specimen with genitalia contained within the abdomen) and neallotype ♀ (to the left of the neotype as viewed through the microscope) ex Cabot tern (*Thalasseus sandvicensis acuflavus* (Cabot)), British West Indies, Ragged Islands (Bishopp No. 15031). Neoparatypes as follows: The remaining single ♂ and ♀ on the above slide; 3 ♂♂ and 3 ♀♀, British West Indies, Turks Islands, Sand Cay (Bishopp No. 15207); 2 ♂♂ and 3 ♀♀, British West Indies, Little Inagua Island (Bishopp No. 15247); 1 ♂ and 2 ♀♀, British West Indies, Bahama Islands, Ragged Island, South Channel Cay (Bishopp No. 15042); 1 ♂, Cuba, Rum Cayo (Bishopp No. 15460). All the above specimens were collected by H. S. Peters and are deposited in the U. S. National Museum.

Saemundssonina meridiana Timmermann

Philopterus melanocephalus Peters, 1936, p. 17 (part) [nec Burmeister]. Host: *Sterna anaethetus melanoptera* Swainson.

Saemundssonina meridiana Timmermann, 1950, p. 1, fig. 1. Host: *S. anaethetus melanoptera* Swainson.

MALE: This species may be readily recognized by its head width and elongate parameres; both of which are greater than those of any other species found on terns. Mesosomal structures as in figure 1, e.

One striking feature of this species is that both sexes have a pair of both anterior and posterior setae on the thoracic sternal plate. Dorsal chaetotaxy as in *S. petersi*.

FEMALE: As in the male, this species is characterized by its greater size. Dorsal chaetotaxy as in table 3. Sternite VII is free from the subgenital plate. There are 3 to 4 setae on each side of the last sternal plate.

MATERIAL EXAMINED: All specimens ex bridled tern (*Sterna anaethetus melanoptera* Swainson). 1 ♂ and 1 ♀, British West Indies, Bahama Islands, North Elbow Cay, Cay Sal Bank, H. S. Peters, coll. (USNM, Bishopp No. 15014); 2 ♂♂ and 1 ♀, British West Indies, Turks Island, Long Cay, H. S. Peters, coll. (HSP, Bishopp No. 15205); 2 ♂♂, South Carolina, Orangeburg, E. B. Chamberlain, coll. (USNM, Bishopp No. 19713); 1 ♂ and 1 ♀, New York, Long Island, L. Wilcox, coll. (USNM); 2 ♀♀, Alabama, Fairhope, Mrs. W. H. Edwards, coll. (USNM, Bishopp No. 19680).

***Saemundssonina petersi*, new species**

Docophorus melanocephalus Kellogg and Kuwana, 1902, p. 462 (part) [nec Burmeister]. Hosts: *Sterna fuliginosa* = *S. fuscata crissalis* (Lawrence) and *Nesominus macdonaldi* Ridgway (straggler).

Docophorus melanocephalus Kellogg, 1906, p. 316 (part) [nec Burmeister]. Hosts: *Sterna fuliginosa* = *S. fuscata crissalis* (Lawrence) and *Anous stolidus galapagensis* Sharpe (straggler).

Philopterus snyderi Ferris, 1932, p. 71, fig. 20 [nec Kellogg and Paine]. Host: *Sterna fuscata oahuensis* Bloxham.

Saemundssonina snyderi Thompson, 1948, p. 199 (part) [nec Kellogg and Paine]. Host: *S. fuscata oahuensis* Bloxham.

This species has had a confusing nomenclatorial history for 50 years. The types of *Saemundssonina peristicta* (Kellogg and Kuwana) have been examined, and compared with material from *Sterna fuscata* Linné. It is clearly evident that *peristicta* is not the species of *Saemundssonina* found on *Sterna fuscata* as Clay (1949, p. 15) assumes. The status of *Saemundssonina peristicta* (Kellogg and Kuwana) is discussed by the author in another paper (Ward, 1953).

Specimens have been studied from two subspecies of *S. fuscata* other than the nominate host. No valid statistical differences have been found in comparing measurements or chaetotaxy counts for the separation of subspecies.

MALE: Closely allied to *meridiana* and *snyderi*. Head not as wide as in *meridiana*. Dorsal chaetotaxy as in table 2. Genitalia as in figure 1, *b, d, f*. Parameres 0.22 to 0.26 mm. in length; with a basad concavity on the inner face, forming almost a right angle with the shaft as in *meridiana* and *snyderi*. Endomere with a terminal, lightly sclerotized, evenly rounded process. Mesosomal setae linearly arranged on at least one side.

FEMALE: Sternite VII free or partially fused to subgenital plate. May not be reliably separated from *sternae*, *lockleyi*, or *brevicornis*.

TABLE 2.—Dorsal chaetotaxy of *Saemundssonina petersi*, new species. (Specimens from *Sterna fuscata crissalis*, *S. f. oahuensis*, and *S. f. fuscata* are included.)

| | Male | Female |
|-------------|-------|--------|
| Pterothorax | 13-17 | 14-17 |
| Abdomen II | 2- 4 | 2- 3 |
| “ III | 7-10 | 7-10 |
| “ IV | 8-13 | 10-12 |
| “ V | 9-12 | 10-13 |
| “ VI | 4- 7 | 6-12 |
| “ VII | 4 | 6-10 |

TYPE MATERIAL: All specimens in the type series are from the sooty tern (*Sterna f. fuscata* Linné). 1 ♂ (holotype, USNM 62280) and 1 ♀ (allotype), Bahama Islands, North Elbow Cay, Cay Sal Bank, H. S. Peters, coll. (USNM, Bishopp No. 15009). Paratypes as follows: 2 ♂♂ and 2 ♀♀, above locality and coll. (USNM, Bishopp Nos. 15009-10); 12 ♂♂ and 11 ♀♀, British West Indies, Caicos Islands, Six Hills Cay, H. S. Peters, coll. (USNM, Bishopp Nos. 15211-12, 15221); 1 ♀, Virgin Islands, St. Thomas (CNHM).

OTHER MATERIAL EXAMINED: 1 ♀ ex *Sterna fuscata oahuensis* Bloxham, Hawaii, Moku Manu, off Oahu, L. Kartman, coll. (USNM); 1 ♂ and 1 ♀ ex above host, Laysan Island, Tangier Exped., coll. (BPBM). 1 ♂ and 1 ♀ ex *Sterna fuliginosa* (= *S. fuscata crissalis* (Lawrence)), Clipperton Island (SNHM, Kellogg No. 1060b); 1 ♂ ex *Nesominus macdonaldi* (error) (= *S. fuscata crissalis*), Galápagos Islands, Gardner Island (SNHM, Kellogg No. 991); 1 ♂ ex *S. fuliginosa* (= *S. fuscata crissalis*), Lat. 1° N., Long. 93° W., R. Beck, coll. (SNHM, Kellogg No. 1463c); 1 ♂ ex *Solpinctes guadalupensis* (error) (= *Sterna fuscata crissalis*), Guadalupe Island (SNHM, Kellogg No. 1083b); 2 ♂♂ and 3 ♀♀ ex *Anous stolidus galapagensis* (error) (= *Sterna fuscata crissalis*), Galápagos Islands, off Culpepper Island, R. Beck, coll. (SNHM, Kellogg No. 1438a); 1 ♂ and 2 ♀♀ ex *Anous stolidus* (error) (= *Sterna fuscata crissalis*), R. Beck, coll. (SNHM, Kellogg No. 1484b).

This species is named in honor of H. S. Peters, who has carefully collected and mounted many of the specimens studied in this paper.

Saemundssonina snyderi (Kellogg and Paine)

Decophorus snyderi Kellogg and Paine, 1910, p. 124, figs. 1, 2. Host: *Sterna lunata* Peale.

Saemundssonina snyderi (Kellogg and Paine), Thompson, 1948, p. 199 (part). Host: *Sterna lunata* Peale.

MALE: Head width is similar to that of *petersi*. Dorsal chaetotaxy also as in *petersi*. As in *meridiana*, the thoracic sternal plate has both anterior and posterior setae in both sexes. In some cases, however, only one anterior and two posterior setae are present. Gen-

italia as in figure 1, *c, g*. The parameres are intermediate in length between those of *petersi* and *meridiana* (0.28 to 0.30 mm.). The mesosomal setae are linearly arranged on at least one side.

FEMALE: Dorsal chaetotaxy as in table 3. Sternite VII is free from the subgenital plate and is slightly longer at the midline than in *meridiana*.

TABLE 3.—Dorsal chaetotaxy of *Saemundssonina meridiana* and *S. snyderi*.

| | ♀ <i>meridiana</i> | ♀ <i>snyderi</i> |
|-------------|--------------------|------------------|
| Pterothorax | 13-18 | 13-16 |
| Abdomen II | 4-7 | 2-6 |
| “ III | 8-12 | 10-12 |
| “ IV | 12-13 | 11-12 |
| “ V | 10-14 | 11-13 |
| “ VI | 11-13 | 9-13 |
| “ VII | 10-13 | 9-11 |

In the original description, no specimens were designated as types. A male specimen (the only intact individual containing the genitalia within the abdomen) is designated as lectotype. The remaining 2♂♂ (one with genitalia dissected out, and the other with extruded genitalia) and 3♀♀ are designated as paralectotypes.

MATERIAL EXAMINED: 3♂♂ and 3♀♀ ex *Sterna lunata* Peale, Laysan Island, J. D. Snyder, coll. (labeled “Type”) (SNHM, Kellogg No. 1324); 1♀ ex above host and locality, *Tanager* Exped., coll. (BPBM).

Saemundssonina lobaticeps (Giebel)

Docophorus lobaticeps Giebel, 1874, p. 109. Hosts: *Sterna hirundo* and *S. fessipes* = *Chlidonias n. nigra* (Linné).

Docophorus pustuliferus Picaglia, 1885, p. 84. Host: *Hydrochelidon surinamensis* = *Chlidonias nigra surinamensis* (Gmelin).

Philoptyerus melanocephalus Peters, 1928, p. 225; 1936, p. 17 (part) [nec Burmeister]. Host: *Sterna hirundo* Linné (straggler) = *Chlidonias nigra surinamensis* (Gmelin).

Saemundssonina lobaticeps (Giebel), Clay, 1949, p. 15, figs. 9, 12, 14, 20, 30, 31. Hosts: *Chlidonias nigra nigra* (Linné) (type host); also, *C. h. hybrida* (Pallas), *C. hybrida indica* (Stephens), and *C. leucoptera* (Temminck).

Specimens have been seen from the type host of *pustuliferus*. Minute differences exist, such as in the head width and chaetotaxy (see table 4). However, these differences are of no significance. At the present time, it seems best to consider *pustuliferus* as a synonym of *lobaticeps*.

MATERIAL EXAMINED: 2♂♂ and 1♀ ex black tern (*Chlidonias nigra surinamensis* (Gmelin)), Minnesota, St. Anthony Park (USNM); 4♂♂ and 1♀ ex above host, Nebraska, Hackberry Lake, G. E. Hudson, coll. (CU); 1♂ and 1♀ ex *Sterna albifrons antillarum* (Lesson) (straggler from *Chlidonias nigra surinamensis*), Cuba, Isle of Pines,

H. S. Peters, coll. (USNM, Bishopp No. 15469); 1♂ ex *Sterna h. hirundo* Linné (straggler from *Chlidonias nigra surinamensis*), Ohio, Sandusky, H. S. Peters, coll. (HSP); 2♂♂ ex *S. h. hirundo* (straggler

TABLE 4.—Dorsal chaetotaxy of *Saemundssonina lobaticeps* (Giebel).

| | Male | Female |
|-------------|-------|--------|
| Pterothorax | 15-20 | 17-21 |
| Abdomen II | 6-9 | 8 |
| “ III | 9-12 | 13 |
| “ IV | 10-14 | 10-15 |
| “ V | 8-14 | 11-15 |
| “ VI | 4-7 | 10-14 |
| “ VII | 4-9 | 9-10 |

from *Chlidonias nigra surinamensis*), South Carolina, Georgetown, H. S. Peters, coll. (HSP).

Saemundssonina hopkinsi Clay

Saemundssonina hopkinsi Clay, 1949, p. 18, figs. 10, 13, 15, 21. Host: *Sterna aurantia* Gray.

No new material referable to this species was observed during the present study.

MATERIAL EXAMINED: 1♂ (paratype), ex *Sterna aurantia* Gray, India, Deccan (T. Clay, det.) (AMNH).

TABLE 5.—Measurements of types of species of *Saemundssonina*, in millimeters.

| | Male | | | | | | | |
|---------------------------|--------|------|------|------|-------|------|------|------|
| | Length | | | | Width | | | |
| | A | B | C | D | A | B | C | D |
| Head | 0.54 | 0.65 | 0.62 | 0.65 | 0.50 | 0.62 | 0.56 | 0.62 |
| Signature | | | | | 0.13 | 0.16 | 0.13 | 0.15 |
| Prothorax | 0.13 | 0.16 | 0.17 | 0.17 | 0.27 | 0.33 | 0.31 | 0.32 |
| Pterothorax | 0.18 | 0.21 | 0.24 | 0.21 | 0.37 | 0.46 | 0.40 | 0.44 |
| Abdomen | 0.63 | 0.88 | 0.66 | 0.84 | 0.62 | 0.73 | 0.66 | 0.71 |
| Total | 1.32 | 1.74 | 1.54 | 1.72 | | | | |
| Paramere | 0.11 | 0.26 | 0.24 | 0.30 | | | | |
| | Female | | | | | | | |
| | Length | | | | Width | | | |
| | A | B | C | D | A | B | C | D |
| Head | 0.60 | 0.71 | 0.65 | 0.67 | 0.59 | 0.68 | 0.64 | 0.69 |
| Signature | | | | | 0.14 | 0.17 | 0.16 | 0.16 |
| Prothorax | 0.15 | 0.18 | 0.16 | 0.18 | 0.31 | 0.37 | 0.33 | 0.36 |
| Pterothorax | 0.24 | 0.27 | 0.23 | 0.27 | 0.40 | 0.49 | 0.46 | 0.49 |
| Abdomen | 0.84 | 1.12 | 0.99 | 1.11 | 0.71 | 0.84 | 0.83 | 0.87 |
| Total | 1.66 | 2.06 | 1.84 | 2.06 | | | | |
| Sternite VII (midline) | 0.10 | 0.11 | 0.07 | 0.09 | | | | |

[Explanation: A, *parvigenitalis* (♂ holotype, ♀ allotype); B, *brevicornis* (♂ neotype, ♀ neallotype); C, *petersi* (♂ holotype, ♀ allotype); D, *snyderi* (♂ lectotype, ♀ paralectotype)]

TABLE 6.—Measurements of males in species of *Saemundsonia* (in mm. except for cephalic index).

| Species | Host | Signature width Mean Range | Head width Mean Range | Cephalic index Mean Range | Paramere length Mean Range | No. Speci- mens |
|----------------|------------------------------------|----------------------------------|-----------------------------|---------------------------------|----------------------------------|-----------------------|
| sternae | <i>Sterna h. hirundo</i> | 0.15 0.14-0.16 | 0.54 0.52-0.56 | 0.93 0.90-0.96 | 0.24 0.22-0.26 | 11 |
| | <i>S. d. dougalli</i> | 0.14 0.14-0.15 | 0.54 0.53-0.55 | 0.94 0.92-0.97 | 0.23 0.22-0.24 | 3 |
| | <i>Gelocheidon nilotica aranea</i> | 0.16 0.16 | 0.58 0.57-0.59 | 0.97 0.96-0.97 | 0.24 0.23-0.25 | 4 |
| lockleyi | <i>S. paradisaea</i> | 0.15 0.14-0.17 | 0.54 0.51-0.56 | 0.91 0.89-0.93 | 0.24 0.23-0.25 | 4 |
| | <i>S. vittata bethunei</i> | 0.15 0.15 | 0.55 0.55-0.56 | 0.95 0.94-0.95 | 0.24 0.24-0.25 | 2 |
| melanocephalus | <i>S. a. albifrons</i> | 0.13 | 0.52 | 0.96 | 0.14 | 1 |
| | <i>S. albifrons antillarum</i> | 0.12 0.12-0.13 | 0.51 0.49-0.52 | 0.92 0.89-0.96 | 0.17 0.16-0.18 | 6 |
| parvigenitalis | <i>S. forsteri</i> | 0.14 0.13-0.15 | 0.51 0.49-0.53 | 0.92 0.85-0.94 | 0.11 0.10-0.13 | *8 |
| laticaudata | <i>Thalasseus bergi velox</i> | 0.16 | 0.62 | 0.94 | 0.27 | 1 |
| | <i>T. m. maximus</i> | 0.17 0.16-0.18 | 0.62 0.61-0.65 | 0.95 0.93-0.98 | 0.27 0.26-0.29 | 11 |
| brevicornis | <i>T. sandvicensis acutiflavus</i> | 0.15 0.14-0.16 | 0.61 0.58-0.63 | 0.93 0.91-0.95 | 0.26 0.24-0.30 | 9 |
| meridiana | <i>S. anaethetus melanoptera</i> | 0.15 0.15-0.17 | 0.63 0.62-0.64 | 0.99 0.96-1.01 | 0.35 0.34-0.37 | 6 |
| petersi | <i>S. f. fuscata</i> | 0.15 0.13-0.16 | 0.58 0.55-0.59 | 0.93 0.90-0.93 | 0.24 0.22-0.25 | 15 |
| | <i>S. fuscata crissalis</i> | 0.14 0.14-0.15 | 0.59 0.56-0.60 | 0.94 0.91-0.96 | 0.25 0.23-0.26 | 7 |
| | <i>S. f. oahuensis</i> | 0.15 0.14-0.15 | 0.57 0.56-0.57 | 0.90 0.90 | 0.24 0.24-0.25 | 2 |

| | S. lunata | 0. 15 | 0. 15-0. 16 | 0. 61 | 0. 57-0. 62 | 0. 96 | 0. 94-0. 98 | 0. 29 | 0. 28-0. 30 | 3 |
|------------|-----------------------|-------|-------------|-------|-------------|-------|-------------|-------|-------------|----|
| snnyderi | | | | | | | | | | |
| lobaticeps | Chlidonias leucoptera | 0. 14 | | 0. 60 | | 1. 00 | | 0. 24 | | 1 |
| | C. nigra surinamensis | 0. 13 | 0. 12-0. 14 | 0. 56 | 0. 54-0. 58 | 0. 99 | 0. 95-1. 03 | 0. 20 | 0. 18-0. 22 | 10 |
| hopkinsi | S. aurantia | 0. 17 | | 0. 65 | | 1. 12 | | 0. 30 | | 1 |

*Parameres measured on only 7 specimens.

TABLE 7.—Measurements of females in species of *Saemundssonina* (in mm. except for cephalic index).

| Species | Host | Signature width | | Head width | | Cephalic index | | Sternite VII length at midline | | No. Specimens |
|----------------|-------------------------------------|-----------------|-----------|------------|-----------|----------------|-----------|--------------------------------|-----------|---------------|
| | | Mean | Range | Mean | Range | Mean | Range | Mean | Range | |
| sternae | <i>Sterna h. hirundo</i> | 0.17 | 0.16-0.18 | 0.64 | 0.62-0.65 | 1.00 | 0.95-1.05 | 0.10 | 0.10-0.11 | 11 |
| | <i>S. d. dougallii</i> | 0.16 | | 0.62 | | 0.99 | | 0.09 | | 1 |
| | <i>Gelocheidon nilotica aranea</i> | 0.17 | 0.16-0.18 | 0.66 | 0.64-0.68 | 1.00 | 0.99-1.02 | 0.11 | 0.10-0.11 | 5 |
| lockleyi | <i>S. paradisaea</i> | 0.17 | 0.17 | 0.61 | 0.59-0.62 | 0.92 | 0.90-0.95 | 0.10 | 0.09-0.10 | 6 |
| | <i>S. vittata bethunei</i> | 0.17 | 0.17 | 0.62 | 0.62 | 0.97 | 0.95-0.98 | 0.10 | 0.10-0.11 | 2 |
| melanocephalus | <i>S. a. albifrons</i> | 0.14 | | 0.59 | | 0.95 | | 0.11 | | 1 |
| | <i>S. albifrons antillarum</i> | 0.13 | 0.12-0.14 | 0.56 | 0.52-0.58 | 0.96 | 0.92-1.00 | 0.10 | 0.09-0.11 | 14 |
| parvigenitalis | <i>S. forsteri</i> | 0.16 | 0.14-0.18 | 0.60 | 0.58-0.62 | 0.96 | 0.93-0.99 | 0.11 | 0.10-0.13 | 9 |
| laticaudata | <i>Thalasseus bergi velox</i> | 0.18 | | 0.68 | | 0.96 | | 0.09 | | 1 |
| | <i>T. bergi cristatus</i> | 0.16 | | 0.65 | | 1.00 | | 0.08 | | 1 |
| | <i>T. m. maximus</i> | 0.18 | 0.16-0.19 | 0.68 | 0.65-0.71 | 0.98 | 0.96-1.00 | 0.09 | 0.08-0.11 | 12 |
| brevicornis | <i>T. sandvicensis aculflavidus</i> | 0.17 | 0.15-0.18 | 0.66 | 0.63-0.69 | 0.96 | 0.94-0.99 | 0.10 | 0.08-0.11 | 10 |
| meridiana | <i>S. anaethetus melanoptera</i> | 0.16 | 0.15-.017 | 0.72 | 0.70-0.75 | 1.07 | 1.04-1.09 | 0.07 | 0.06-0.08 | 5 |
| petersi | <i>S. f. fuscata</i> | 0.17 | 0.16-0.18 | 0.67 | 0.64-0.70 | 0.97 | 0.93-0.99 | 0.07 | 0.06-0.08 | 14 |
| | <i>S. fuscata crissalis</i> | 0.16 | 0.15-0.16 | 0.69 | 0.65-0.71 | 0.99 | 0.97-1.01 | 0.07 | 0.06-0.08 | 6 |
| | <i>S. fuscata oahuensis</i> | 0.16 | 0.15-0.16 | 0.67 | 0.66-0.67 | 0.97 | 0.96-0.97 | 0.07 | 0.06-0.07 | 2 |

| snyderi | S. lunata | 0. 17 | 0. 16-0. 18 | 0. 69 | 0. 68-0. 71 | 1. 01 | 0. 98-1. 03 | 0. 09 | 0. 09-0. 10 | 4 |
|------------|-----------------------|-------|-------------|-------|-------------|-------|-------------|-------|-------------|---|
| lobaticeps | Chlidonias leucoptera | 0. 14 | 0. 14 | 0. 68 | 0. 68-0. 69 | 1. 11 | 1. 09-1. 12 | 0. 10 | 0. 09-0. 11 | 2 |
| | C. nigra surinamensis | 0. 15 | 0. 14-0. 16 | 0. 66 | 0. 65-0. 68 | 1. 06 | 1. 04-1. 07 | 0. 11 | 0. 10-0. 11 | 3 |

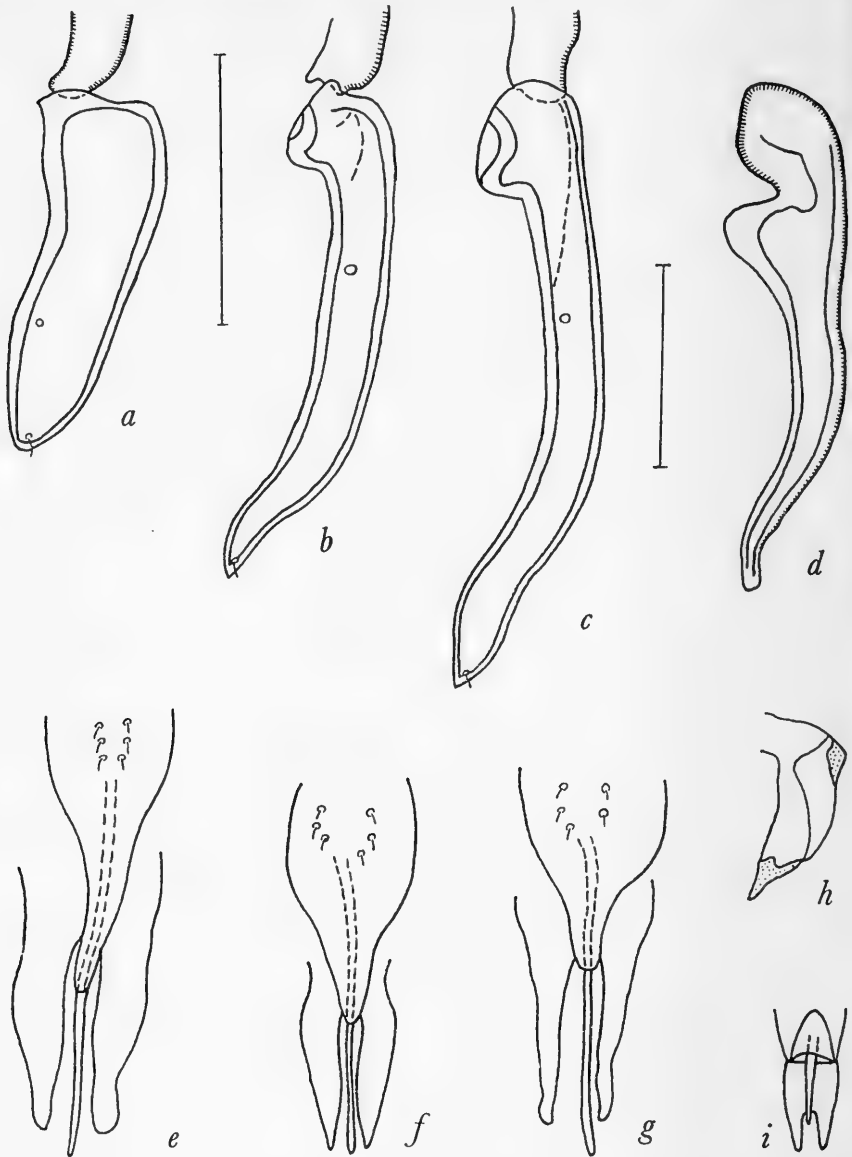


FIGURE 1.—*a*, *Saemundssonina parvigenitalis*, paramere (holotype); *b*, *S. petersi*, paramere (holotype); *c*, *S. snyderi*, paramere (lectotype); *d*, *S. petersi*, endomere (holotype); *e*, *S. meridiana*, mesosome (holotype); *f*, *S. petersi*, mesosome (holotype); *g*, *S. snyderi*, mesosome (lectotype); *h*, *S. parvigenitalis*, endomere (holotype); *i*, *S. parvigenitalis*, mesosome (holotype). The vertical line to the right of figure *c* represents 0.10 mm. Figure *b* is drawn to the same scale. The scale of the remaining figures is represented by the line to the right of figure *a* and is also equivalent to 0.10 mm.

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THREE MIOCENE PORPOISES FROM THE CALVERT CLIFFS,
MARYLAND

By REMINGTON KELLOGG

I. LOPHOCETUS PAPPUS, NEW SPECIES

During August 1933, a section of the rostrum of a porpoise that differed from the more commonly found types with elongated rostra, particularly *Eurhinodelphis* (Kellogg, 1925), *Schizodelphis* (True, 1908) and *Zarhachis* (Kellogg, 1924), was found near Governor's Run, Md. Inasmuch as Cope and Leidy had applied generic and specific names to vertebrae and teeth from the Miocene Calvert formation, it seemed desirable to await further material before an attempt was made to determine the allocation of the newly found porpoise. Fortunately, the skull, mandibles, and vertebrae of another specimen were located in July 1939. A critical examination of the vertebrae and teeth has convinced the writer that this form is not represented among the types of previously described porpoises deposited in the Academy of Natural Sciences of Philadelphia.

Although the affinities of the Miocene *Lophocetus* are somewhat uncertain, the conformation of the skull and the relationships of its component bones suggest that it is rather closely allied to the Iniidae. The periotic bones of both *Inia* and *Lipotes* are highly modified and exhibit slight resemblance to one another in outward appearance. The periotic of *Lophocetus* differs in many details from that of either of these Recent genera.

Porpoises now allocated to the family Iniidae were well represented and widely distributed during the Miocene and Pliocene. Nevertheless, the two known living forms are widely separated geographically, the South American *Inia geoffrensis* being restricted to the Amazon and the Orinoco Rivers and their larger tributaries, and the Chinese *Lipotes vexillifer* being known only from Tung Ting Lake, Yangtze River. Both of these Recent genera are confined to fresh water. During the Miocene and Pliocene, some at least were inhabitants of estuaries and others presumably were part of the pelagic fauna.

Genus *Lophocetus* Cope

Lophocetus Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 19, pp. 144, 146, December 1867.

GENOTYPE: *Delphinus calvertensis* Harlan.

DIAGNOSIS: Skull strongly constructed, rostrum (389 mm.) equivalent to not more than three-fifths of the length of the skull (estimated 630 mm.); vertex of skull elevated, elongated and comprised by the large nasal bones, the exposed posterointernal angles of the frontal bones and the apex of the supraoccipital; nasals large, elongated anteroposteriorly and deeply depressed internally; no pronounced thickening of supraorbital processes of frontals and overlying maxillary plates; zygomatic processes elongated and relatively slender; rostrum attenuated toward anterior extremity, with distal one-third slightly bent upward; mesorostral gutter on anterior one-half of its length roofed over by close approximation of premaxillaries; posterior end of each premaxillary upturned, forming an oblique crest, and is pinched in externally below crest; maximum transverse expansion of premaxillaries immediately in front of nasal passages; 3 teeth located in distal end of each premaxillary; 23 to 24 teeth located in each maxillary; large lachrymal wedged in against preorbital portion of supraorbital process and overlying ascending plate of maxillary, the antero-posterior diameter apparently greater than transverse; jugal ankylosed to lachrymal; palatines extending forward almost to level of hindmost alveolae.

Mandibles robust, with symphysis equivalent to one-third of the length of each ramus; symphysis ankylosed, slightly narrowed at anterior extremity, semicircular in cross section anteriorly, and with anterior half of its length bent upward; lateral surfaces of symphysis rugose; opposite free hinder portions of mandibles form an acute angle at level where they ankylose as symphysis; 26 teeth in each mandible; 14 teeth located on each mandible posterior to hinder end of symphysis; 12 teeth located on each ramus anterior to hinder end of symphysis; roots of teeth on symphysis implanted obliquely in alveolae, which

slope more backward than inward; diameters of alveolae diminish more markedly toward hinder end of tooth series than anteriorly.

Lophocetus calvertensis (Harlan)

Delphinus calvertensis Harlan, Bull. Proc. Nat. Inst. Promotion Sci. Washington, No. 2, pp. 195-196, 1842.

TYPE SPECIMEN (USNM 16314): Incomplete skull, lacking both zygomatic processes as well as supraorbital processes of frontals and distal end of rostrum; left periotic; atlas, axis, third, fourth, fifth, sixth, and seventh cervical and first and second dorsal vertebrae. Collector, Francis Markoe, Jr., October-November 1841.

HORIZON AND LOCALITY: Cove Point, Calvert County, Md. St. Marys formation.

Lophocetus pappus, new species

FIGURE 1; PLATES 1-11

INDIVIDUAL 1

TYPE SPECIMEN (USNM 15985): Skull which lacks basicranium, occipital condyles, supraoccipital, right squamosal and right zygomatic process; right and left mandibles; 75 detached teeth; left periotic; right tympanic bulla; atlas; 3 cervicals; 4 dorsals; and portions of 10 ribs. Collector, A. C. Murray. July 9, 1939.

HORIZON AND LOCALITY: In compact sandy blue clay of Zone 11 (1 foot below base of Zone 12), about 8 feet above base of cliff, approximately nine-tenths of a mile north of mouth of Parker Creek, Calvert County, Md. Calvert formation, upper Miocene.

INDIVIDUAL 2

REFERRED SPECIMEN (USNM 20659): Section of rostrum (225 mm. in length), basal portion of left scapula, anterior dorsal vertebra (incomplete), terminal caudal, and right periotic. Collectors, Remington Kellogg, C. Lewis Gazin, and Raymond M. Gilmore, Aug. 17, 1933.

HORIZON AND LOCALITY: In sandy clay of Zone 14 (about 3 feet above contact with Zone 13), approximately 956 yards north of old pier at end of Governor's Run Road (see U. S. Geol. Surv. Prince Frederick Quad.), Calvert County, Md. Calvert formation, upper Miocene.

SKULL

Aside from differences in the conformation of the nasal bones, and the amount of exposure of the frontals on the vertex, the skull of *Lophocetus pappus* seems to differ from that of *Lophocetus calvertensis*

(Case, 1904, pp. 26-27, pl. 16) chiefly in the slightly larger dimensions. The St. Marys porpoise has slightly longer and more elevated nasal bones, a narrower vertex, and a more deeply depressed maxillary on each side of the vertex.

DORSAL VIEW: The skull (pl. 1) of this porpoise differs markedly from those of all porpoises previously described from the Calvert formation. Some resemblance to *Diochotichus vanbenedeni* (Moreno, 1892, pl. 11; True, 1910, pl. 1) and *Squalodelphis fabianii* (Dal Piaz, 1916) is exhibited by this skull, but it can be distinguished readily from the former by the absence of a pair of foramina for the olfactory nerves on the posterior wall of the nasal passages, by the elongated vertex composed of the nasal bones and the exposed posterointernal angles of the frontals, by the absence of any pronounced thickening of the supraorbital processes and the overlying maxillary plates, by the shape of the relatively slender zygomatic processes, and by the greater number of teeth.

The form of the rostrum is somewhat similar to that of *Squalodon* (Kellogg, 1923, pl. 1), the widest portion being at the level of the antorbital notches. The lateral swelling at the base of the rostrum extends forward for a distance of about 70 mm. beyond the antorbital notches. In an interval of 130 mm. the rostrum diminishes in width from 105 mm. to 48 mm.; the attenuation of the slightly longer terminal portion of the rostrum is more gradual. The narrow antorbital notches are bounded externally by the lachrymal and by the preorbital apophysis of the overlying maxillary.

The premaxillaries are more or less flattened on the basal portion of the rostrum, but become more convex anterior to the level of the hinder end of the tooth row. Near the distal end of the rostrum, the outer surface of each premaxillary slopes steeply from the inner to the outer margin. The inner margins of the opposite premaxillaries seem to have been in contact for a distance of about 20 mm. in front of the nasal passages, and after spreading slightly apart gradually converge at a point 150 mm. distant and then, closely approximated, parallel one another to the extremity of the rostrum. The convex portion of each premaxillary commences to widen transversely at about the level of the antorbital notches and attains its maximum width on the rostrum at about the level of the penultimate alveola. Behind the level of the antorbital notches, the premaxillaries exhibit the maximum transverse expansion in front of the nasal passages. Opposite the nasal passages each premaxillary is noticeably elevated above the corresponding maxillary, the convex outer portion sloping to the line of sutural contact with the latter. The posterior end of each premaxillary is upturned, forming an oblique crest, and is

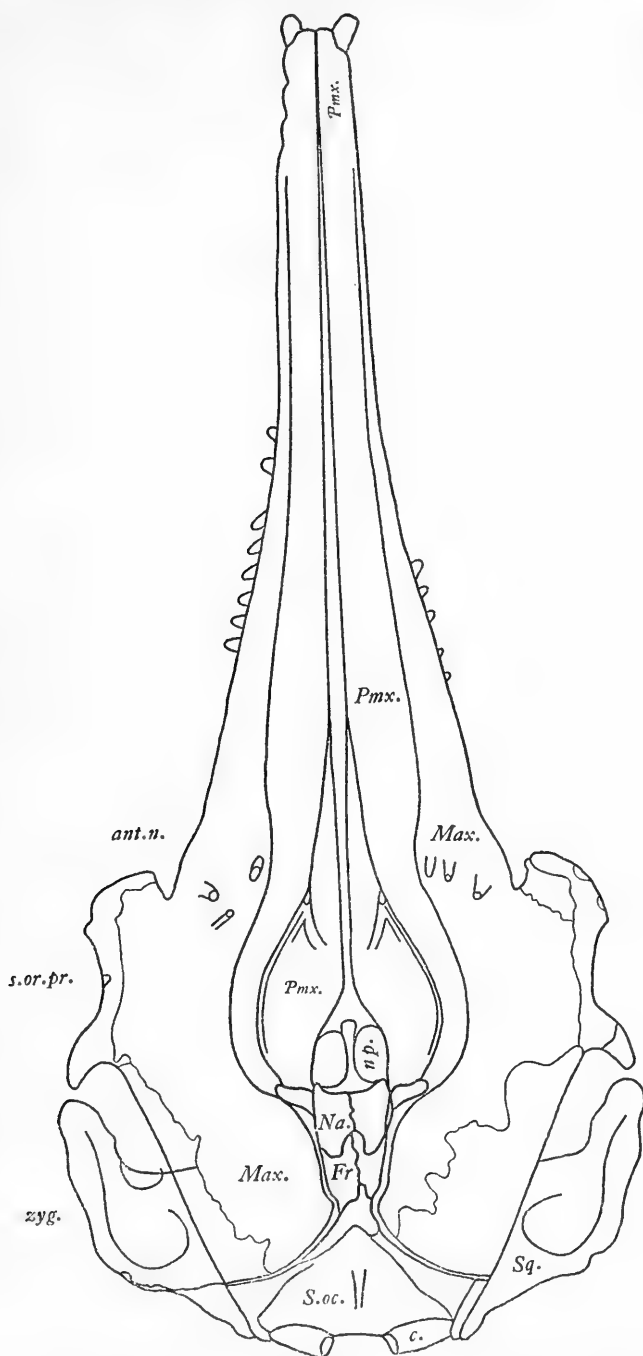


FIGURE 1.—Dorsal view of skull of *Lophocetus pappus*, with restored posterior end of braincase. Abbreviations: ant. n., antorbital maxillary notch; c., occipital condyle; Fr., frontal; Max., maxillary; Na., nasal; np., nasal passage; Pmx., premaxillary; Sq., squamosal; S.oc., supraoccipital; s.or.pr., supraorbital process of frontal; zyg., zygomatic process.

pinched in externally below this crest. The posterior end of each premaxillary is in contact with the upturned inner edge of the corresponding ascending plate of the maxillary and internally for a distance of about 15 mm. abuts against the corresponding nasal bone. The premaxillary foramina are elongated and are situated slightly behind the level of the antorbital notches. Two narrow grooves lead from each of these premaxillary foramina, the outer one extending obliquely backward and outward, and the inner shorter one curving backward and inward to near the internal edge of this bone. Commencing at about the level of this premaxillary foramen and extending backward is a shallow groove which follows more or less the curvature of the outer edge of the premaxillary about 14 mm. inside the latter.

With the exception of a short interval in front of the nasal passages where the inner margins of the premaxillaries are almost if not in actual contact, the mesorostral gutter seems to have been almost completely roofed over by the close approximation of the opposite inner margins of these elongated bones. On the distal 230 mm., the premaxillaries meet on the midline of the palatal surface of the rostrum, and constitute the floor and sides of the mesorostral gutter; behind this point the vomer and the premaxillaries contribute to its formation. The vomer increases in width from its anterior end to in front of the nasal passages where it is applied to the lateral surfaces of the presphenoid. The presphenoid appears to be rather porous and forms a plug at the hinder end of the mesorostral gutter.

As in the Recent South American river porpoise *Inia geoffrensis* (USNM 239667, ♂), the mesethmoid is limited to the median longitudinal strip of bone which constitutes the dorsal portion of the wall between the nasal passages. The mesethmoid also sheathes the dorsal and upper halves of the lateral faces of the laterally compressed presphenoid and on the inner wall of each nasal passage meets edge to edge the corresponding wall of the troughlike vomer in which the presphenoid rests. All traces of sutures that mark the contact of the mesethmoid with the laterally placed ectethmoids have disappeared with ankylosis. These fused ethmoid bones form a continuous sheet of bone, now destroyed dorsally, that overspread the ventral halves of the anterior faces of the nasals and completely closed the area through which the olfactory nerves formerly passed.

A U-shaped anterior border of the combined nasal passages is formed by the close approximation of the internal edges of the opposite premaxillaries. At the level of the vertex, the posterior wall of each nasal passage is approximately on a line with the ends of the post-orbital projections of the supraorbital processes. The posterior wall of each nasal passage does not descend obliquely as in *Inia*, but about

half way in its height is deflected forward horizontally in consequence of the bulging forward of the anterior wall of the braincase, and then drops almost vertically to the interpterygoid space. The shelf that is thus formed in each passage some 25 mm. below the level of the premaxillary on the anterior rim is approximately equivalent in size to the circumference of the corresponding nasal passage; the almost vertical lower portion of each passage is for the most part hidden when viewed from above.

The maxillaries and premaxillaries constitute the major portion of the dorsal surface of the skull. For a distance of 30 mm. in front of the antorbital notch, the outer border of the maxillary is compressed dorsoventrally and also is concavely depressed dorsally in the region between the antorbital notch and the maxillary foramina. Immediately in front of this basal swelling, the maxillary from a side view abruptly increases in dorsoventral diameter, the convex curvature of the upper surface becomes flattened, and the slope from the premaxillary-maxillary suture gradually becomes steeper. As a result of the attenuation of the rostrum, the maxillary decreases in breadth and depth anteriorly, and is barely visible from a dorsal view near its distal end. Posterior to the antorbital notch, the maxillary expands horizontally and overspreads the frontal bones. This thin ascending maxillary plate, however, does not completely sheath the supraorbital process of the frontal, a strip of the outer border of the latter 10 to 17 mm. in width being exposed above the orbit. In front of the orbit and external to the antorbital notch, the antero-external angle of the ascending plate of each maxillary is produced, forming an apophysis, which overspreads the underlying enlarged lachrymal bone. This flattened lachrymal bone is actually wedged in between the preorbital portion of the supraorbital process and the overlying ascending plate of the maxillary. The maximum width of the ascending plate of the maxillary seems to have been attained at the level of the antorbital notch, but this is uncertain in view of the apparent incompleteness of the outer border of the ascending plate of both maxillaries (fig. 1) above the temporal fossae. The posterior borders of the maxillaries are thrust backward against the curved dorsal crest of the supraoccipital and consequently the postero-internal border of each maxillary is bent upward for a height of approximately 22 mm., the dorsal edge projecting slightly above the level of the postero-internal angles of the frontals, which are exposed on the vertex. The thin and transversely curved ascending plates of the maxillaries and the corresponding underlying lateral extensions of the frontals probably did not completely roof over the temporal fossae (fig. 1). As regards curvature, each maxillary is

strongly depressed behind the level of the nasal passages and there is also a concave depression on each behind the level of the center of the orbit. Although the outer border of the ascending plates of both maxillaries are incomplete, there is no indication from the curvature of the portions preserved that these plates were bent upward externally as in the case of *Inia*. Two large and one small foramina, that connect with the infraorbital system, are present in each maxillary at about the level of the antorbital notches.

From a dorsal view the frontals are largely concealed by the over-spreading ascending plates of the maxillaries, the slender posterior ends of the premaxillaries, and the nasals. They are suturally united posteriorly with the supraoccipital. Medially, the opposite frontals meet edge to edge on the vertex, constituting a subcutiform area with apex forward. The vertex is elevated, relatively small in area, quadrangular in outline, and is constituted posteriorly by the postero-internal angles of the frontals and anteriorly by the nasals. Laterally, each frontal sends out a thin platelike extension which underlies at least in part the horizontally expanded ascending plate of the maxillary. Further forward, this portion of the frontal is considerably thickened to form a complete osseous roof for the orbit.

The nasals are rather large and irregular in shape; they constitute the upper portion of the posterior wall of the nasal passages. Dorsally, the nasals are deeply excavated internally, the surface of each sloping obliquely downward from the rounded outer border to the midline. Anteriorly, the posteroexternal angle of each is prolonged forward. The vertical diameter of the right nasal near the anterior end is 22.5 mm.

LATERAL VIEW: Aside from the rather robust rostrum and the relatively low vertex, the skull as viewed from the side (pl. 2, fig. 1) is characterized by a relatively small braincase, by the small orbit, by the laterally flattened and upwardly curved zygomatic process, and by the presence of 26 to 27 robust teeth in each upper jaw, of which 3 are lodged in the premaxillary. A tooth slightly larger than the others projects forward and downward from the extremity of the premaxillary. In *Inia geoffrensis*, the anteriormost tooth in the premaxillary is almost vertical. At the base the depth of the rostrum is approximately one half the corresponding width. For approximately 30 mm. in front of the antorbital notch, the ventral surface of the maxillary slopes downward and backward from the outer margin, and the upper surface slopes from the premaxillary-maxillary suture to the outer edge. The basal swelling on the dorsal surface of the maxillary that extends forward about 70 mm. in front of the antorbital notch is rather strongly convex. Beyond this basal section,

the upper surface of the maxillary slopes from the premaxillary suture to the alveolar margin, becoming steeper anteriorly as the maxillary decreases in depth, and near its extremity is almost vertical. Near the middle of the rostrum (the 14th alveola counting forward) the dorsolateral face of the maxillary has approximately the same depth as that of the premaxillary, but from this point forward it gradually diminishes in height while the premaxillary increases. The extremity of the rostrum is formed entirely by the premaxillaries. From a lateral view the alveolae are visible for most of the length of the tooth row, the hindermost alveola being located 52 mm. in advance of the antorbital notch. The terminal 100 mm. of the rostrum is bent slightly upward, and the basicranial axis is bent downward from that of the rostrum.

At approximately the level of the 16th alveola counting forward, a small foramen is located in the premaxillary-maxillary suture from which a shallow groove extends forward about 3 mm. above the latter on the lateral face of the premaxillary and disappears about 55 mm. behind the extremity of the rostrum. On the terminal 160 mm. of both premaxillaries are a number of small scattered nodules about 2 mm. in diameter and shallow grooves which suggest that the end of the rostrum may have been covered with close-fitting tough skin.

The dorsal surfaces of the nasal bones are the highest points on the dorsal profile. From the anterior ends of these bones to and slightly beyond the anterior end of the presphenoid, the premaxillaries slope strongly downward. The depressed maxillaries, however, slope more gradually from the transverse crest of the supraoccipital to the base of the rostrum.

On its external border, the supraorbital process of the frontal is rather thin. The anterior angle or preorbital projection is a slight enlargement, about 20 mm. in depth, but the posterior angle or postorbital projection is prolonged downward, forming a slender process which seemingly did not come in contact with the zygomatic process. The maximum anteroposterior diameter of the left supraorbital process is 90 mm., and the corresponding diameter of the orbit is 60 mm.

The flattened lachrymal bone, whose anteroexternal diameter is 43 mm. on the right side, is closely appressed to the anterior face of the supraorbital process and is overspread by the anteroexternal angle of the ascending plate of the maxillary, its narrowed inner end being wedged in against the supraorbital process and the maxillary.

The slender styliiform process of the jugal that extends below the orbit from the antorbital notch to the anterior face of the zygomatic process is missing.

Originally, the temporal fossa seems to have been relatively short (120± mm.) and high (90± mm.), and it is apparent that its length

was at least twice that of the orbit. Superiorly, the temporal fossa is bounded by the thin platelike lateral extension of the frontal that underlies the platelike ascending process of the maxillary; and presumably posteriorly the temporal fossa is bounded by the lambdoid crest that follows the lateral margin of the supraoccipital. In this fossa, the parietal is united anteriorly and superiorly with the frontal, posteriorly with the supraoccipital, and inferiorly with the squamosal. There is no evidence that the parietal participated in the formation of the vertex.

As compared with that of *Inia geoffrensis*, the laterally flattened zygomatic process is shorter and less robust; it is thickened dorsoventrally and its anterior extremity is obliquely truncated. The ventral margin is regularly curved and the postglenoid process is relatively short. The greatest length of the left zygomatic process on its articular face is 81 mm. and the greatest depth at its anterior extremity is 28 mm.

VENTRAL VIEW: The ventral surface of the rostrum (pl. 3) is formed mainly by the maxillae, which meet mesially at the level of the anterior margins of the palatines and continue forward in contact for a distance of 60 mm. and then for an interval of 75 mm. are separated by the axial ridge of the vomer. Behind the level of the 10th alveolae counting backward from the first, the maxillae increase in width markedly toward the antorbital notches, the palatal surface becoming increasingly convex. The ventral orifice of the infraorbital canal is located in the maxilla internal to the inner end of the lachrymal. There were 24 teeth in the right maxilla, 23 in the left maxilla, and 3 in each premaxilla.

On each side of the palate the presence of a thin groove, commencing at the level of the anterior end of the ventral axial ridge of the vomer and extending forward to the fourth alveola counting backward from the first, suggests that a narrow strip of each premaxilla, 6 mm. in width anteriorly and 4 mm. posteriorly, may have separated the maxillae on the distal portion of the rostrum.

The dorsoventrally flattened lachrymal is wedged in against the maxilla and the supraorbital process of the frontal and is partially overspread ventrally by a thin plate of the latter. Ventrally, the lachrymal externally and the jugal internally contribute to the formation of the antorbital notch.

The basal portion of the jugal on the left side is preserved, and it is so intimately ankylosed to the large lachrymal bone that the exact limits of these two bones cannot be determined. The slender styliiform process of the left jugal, however, was not found.

The basicranium and the lateral walls of the braincase are missing; consequently, accurate comparisons cannot be made. The relations and structural peculiarities of the pterygoids and palatines in the region of the narial passages appear to correspond more closely to *Inia* than with other recent porpoises.

Each palatine bone is mortised into the ventral surface of the corresponding maxilla and posteriorly overspreads the ventral trough of the vomer, forming the internal surface of the triangular depression in front of the corresponding narial passage. The broken edges of the palatine on each side suggest that a thin external plate of this bone partially, at least, may have overspread this depression. The palatines extend forward almost to the level of the hindmost teeth.

On the palatal surface, the lateral wall, at least, and also probably the ventral wall, of the ventral portion of each narial passage were formed by the pterygoids.

The hinder portion of the vomer, which normally widens horizontally and sheaths the basisphenoid behind the narial passages, is destroyed. Externally on each side the vomer meets the pterygoid edge to edge and contributes the internal and anterior surfaces of each narial passage.

On the left side the squamosal is suturally united with the lower border of the parietal and its lateral projection or zygomatic process forms the articular surface for the lower jaw. The glenoid articular surface on the ventral face of the zygomatic process is strongly concave, curving upward and forward. The external border of the glenoid facet follows the outer curvature of the zygomatic process, but the external border of at least the posterior half of this surface is set off by a deep groove on the squamosal that undercuts the internal and posterior borders of the facet. The posterior half of the glenoid facet is noticeably widened, and the anterior half is progressively narrowed toward the extremity of the zygomatic process.

POSTERIOR VIEW: With the exception of the left zygomatic process, the adjoining portion of the squamosal, and the apex of the supraoccipital, all of the posterior wall of the braincase is missing.

The referred specimen (USNM 20659) consists of a distal section of the rostrum (pl. 11, fig. 1) of a smaller individual measuring 225 mm. in length. Comparison with the skull suggests that the two anterior-most pairs of alveolae are missing on this rostral fragment, since the groove on the lateral surface below the premaxillary disappears at about the level of the third pair of alveolae counting backward from the extremity. On the left side, eight alveolae occupy an interval of 122 mm.

MEASUREMENTS OF SKULL (IN MILLIMETERS)

| | Lophocetus pappus (USNM 15985) | Lophocetus calvertensis (USNM 16314) |
|--|---|---|
| Greatest length (occipital condyles to extremity of rostrum, as preserved) | | 374. + |
| Apex of supraoccipital to extremity of rostrum, as preserved | 563. 0 | 315. + |
| Posterior end of ascending plate of left maxillary to extremity of rostrum | 567. 0 | 342. + |
| Length of rostrum (level of maxillary ant-orbital notches to extremity of rostrum) | 389. 0 | |
| Breadth of rostrum at base (between maxillary antorbital notches) | 154. 0 | |
| Breadth of rostrum at level of anterior margins of alveolae of 15th pair of teeth (counting forward) | 45. 5 | |
| Breadth of rostrum 25 mm. behind anterior end | 30. 0 | |
| Length of left zygomatic process (post-glenoid process to extremity) | 83. 5 | |
| Height of skull (basisphenoid to nasals) | | 140. 0 |
| Greatest breadth of skull across preorbital angles of supraorbital processes | 238. 0 | |
| Greatest breadth of skull across postorbital angles of supraorbital processes | 254. 0 | |
| Apex of supraoccipital to anterior margin of left nasal | 49. 0 | 49. 0 |
| Posterior end of ascending plate of left maxillary to level of hinder wall of nasal passages | 80. 0 | 83. 0 |
| Distance between outside margins of premaxillaries at level of anterior margins of nasal passages | 107. 0 | 107. 0 |
| Greatest breadth of right premaxillary in front of nasal passages | 51. 0 | 53. 0 |
| Greatest breadth of left premaxillary at maxillary antorbital notch | 31. 0 | |
| Length of frontal plate of left maxillary | 174. 0 | |
| Distance between inner margins of maxillaries at vertex | 28. 0 | 23. 0 |
| Greatest anteroposterior diameter of left supraorbital process | 90. 0 | |
| Greatest length of exposed portion of frontal on vertex | | 27. 0 |
| Greatest anteroposterior diameter of right nasal | 25. 0 | 40. 5 |
| Transverse diameter of right nasal | 16. 5 | 20. 0 |
| Greatest transverse diameter of the two nasals | 33. 5 | 42. 5 |
| Least breadth of cranium between temporal fossae | | 120. 0 |

| | | |
|--|-------|-------|
| Greatest breadth of braincase across parietals | | 134.0 |
| Distance from apex of supraoccipital to upper margin of foramen magnum | | 118.0 |
| Height of foramen magnum | | 33.± |
| Width of foramen magnum | | 32.0 |
| Greatest distance between outside margins of occipital condyles | | 95.0 |
| Greatest height of right condyle | | 50.0 |
| Greatest breadth of right condyle | | 38.0 |
| Right upper jaw, 27 alveolae in an interval of | 360.0 | |
| Left upper jaw, 25 alveolae in an interval of | 353.0 | |
| Left maxillary, 1st to 9th alveola (counting forward) | 93.0 | 86.5 |
| Right maxillary, 1st to 15th alveola (counting forward) | 161.0 | |
| Left maxillary, 14th to 23d alveola (counting forward) | 162.0 | |
| Left maxillary, anteroposterior diameter of 23d alveola | 14.0 | |
| Distance between inner margins of alveolae of hindmost teeth in opposite maxillaries | 96.5 | 80.0 |
| Distance between inner margin of 15th alveola in right maxillary and 14th alveola in left maxillary (counting forward) | 31.0 | |
| Distance from right antorbital notch to posterior margin of hindmost alveola in right maxillary | 50.5 | |

The outer surface of the premaxillary is convex and the maxillary increases in depth anteroposteriorly as on the skull. The relations of the bones comprising the ventral surface of this rostral fragment correspond rather closely with those noted on the skull.

MANDIBLES

The mandibles (pl. 4) of this fossil porpoise exhibit many of the characteristic inid features, including the firmly ankylosed symphysis. They differ from those of *Inia geoffrensis* by having a relatively shorter symphysis, a more gradual slope from the vertex of the coronoid process to the hindmost alveola, and more than twice the number of teeth situated behind the level of the hinder end of the symphysis.

On these fossil mandibles the symphysis is equivalent to 33 percent of the length of the left ramus in contrast to 57 percent for *Inia*. The symphyseal portion of the mandibles as well as the interval between the tooth rows are relatively wider than in *Inia*, and the anterior

half of the symphysis curves distinctly upward in contrast to the general downward slope of the corresponding portion of the mandibles of *Inia*. The anterior end of the symphysis is obliquely truncated in a dorsoventral direction. The opposite free posterior portions of the mandibles come together at a 28-degree angle at the symphysis.

About 61.5 percent of the total length of the left mandible is occupied by the tooth row in contrast to 66 percent for *Inia*. The number of alveolae, however, is approximately the same in these fossil and Recent porpoises. The fossil mandibles have 26 alveolae in each ramus, the five alveolae at the anterior end of each ramus being somewhat larger than the others. The tendency toward the antero-posterior elongation of the alveolae in the symphyseal region, so noticeable in *Sauroctetes argentinus* (Rovereto, 1915, pl. 2, fig. 1; Burmeister, 1871) and to a lesser degree in *Goniodelphis hudsoni* (Kellogg, 1944, pl. 1, fig. 1; Allen, 1941), is hardly discernible. The alveolae in the left mandible measure from 8 to 15 mm. anteroposteriorly and from 8 to 12 mm. transversely. The 17 alveolae on the hinder portion of each mandibular tooth row are separated by rather thin septa, while those situated near the middle of the symphysis are separated by intervals of 5 to 7 mm. The presence of 14 teeth in each ramus behind the level of the hinder end of the symphysis readily distinguishes these mandibles from those of *Inia geoffrensis* (USNM 49582). As a result of the lengthening of the symphysis on the mandibles of *Inia*, there are only 5 teeth in the left ramus and 6 teeth in the right ramus posterior to the hinder end of the symphysis, although there are 27 teeth in each mandible.

Opposite alveolae at hinder end of symphysis are separated by an interval of 26 mm.; the corresponding interval between the 25th alveolae (counting forward from hindmost) is 11 mm. The symphysis is semicircular in cross section.

On the outer surface of the left mandible (pl. 4, fig. 2), and about 16 mm. below the rim of the ninth alveola (counting forward from the hindmost) is a foramen of moderate size. The next external nutrient foramen is smaller and is located about 14 mm. below the septum separating the 15th and 16th alveolae. Two small foramina, one situated above the other, are located 10 mm. below the rim of the 19th alveola. The anteriormost foramen is located 17 mm. below the rim of the 21st alveola. From each of these alveolae shallow grooves of varying lengths extend forward. The anterior 175 mm. of the outer surface of the left ramus is quite rough and nodular, indicating that at least this portion of the ramus was covered with a tight-fitting skin.

The conformation of the posterior portions of the mandibles of this fossil porpoise insofar as preserved are somewhat similar to

that of *Inia*. The dorsal border of the coronoid process is thickened as in *Inia*. The distance from the apex of the coronoid process to the hindmost alveola on the left ramus, however, amounts to about 30.5 percent of the total length, while in *Inia* it is equivalent to about 23.5 percent of the total length. The external face of the posterior end of the left mandible is convex except for the shallow concavity below the apex of the coronoid process. The dorsoventral axis of the condyle is oblique, and its external border is projected beyond the level of the outer face of the ramus.

About 35 mm. behind the hindmost alveola and on the internal surface of the ramus is the usual orifice for the large dental canal. Posterior to this orifice the proximal end of the ramus consists mainly of a thin outer shell, with the addition of thin internal shelving strips that merge posteriorly with the upper and lower borders.

MEASUREMENTS OF MANDIBLES, USNM 15985 (IN MILLIMETERS)

| | Right | Left |
|--|--------|--------|
| Length of mandible, condyle to anterior end | | 540. 0 |
| Length of mandible as preserved, anterior end to broken hinder end | 520. 0 | |
| Greatest length of ankylosed symphyseal portion of rami | 179. 0 | 179. 0 |
| Transverse diameter of ankylosed mandibular symphysis at level of hinder end | 55. 0 | |
| Vertical diameter of ankylosed mandibular symphysis at level of hinder end | 32. 2 | |
| Transverse diameter of ankylosed mandibular symphysis at anterior end | 33. 8 | |
| Vertical diameter of ankylosed mandibular symphysis at anterior end | 22. 0 | |
| Height of mandible through coronoid process | 82. 0+ | 98. 0 |
| Height of condyle | | 36. 5 |
| Breadth of condyle | | 37. 8+ |
| 26 alveolae in an interval of | 328. 0 | 332. 0 |
| 14 hinder alveolae (1st to 14th) in an interval of | 156. 0 | 152. 0 |
| 12 anterior alveolae (15th to 26th) in an interval of | 170. 0 | 180. 0 |

PERIOTIC

The left periotic (pl. 5, figs. 1, 4) differs from that of *Lophocetus calvertensis* (pl. 5, figs. 3, 6; USNM 16314) in that there is no osseous projection below the cerebral orifice of the aquaeductus vestibuli, the dorsoventral diameter of the extremity of the anterior process is considerably less, the fossa for the head of the malleus is less vertical in position, the anteroposterior diameter of the less noticeably inflated pars cochlearis is considerably less, and the depression on the

anterior process for the reception of the uncinatè process of the outer lip of the bulla has a somewhat different conformation.

The articular facet on the ventral surface of the posterior process is incomplete on all sides. This facet is shallowly concave on the basal half and the articular surface slopes from the outer to the anterior margin. Two low ridges extending from the outer to the inner margin are present on the hinder half of this facet. The anterior face of the posterior process is excavated; the external face has been sheared off; and the posterior face is irregular in contour.

As regards the ventral aspect of the pars cochlearis, the resemblance to *Lophocetus calvertensis* is not very close, since the latter is noticeably larger and the curvature of this surface is more regularly convex. The facet for the accessory ossicle or uncinatè process of the tympanic bulla on the ventral surface of the anterior process is deeply concave and is limited internally by a deep narrow groove. The fenestra rotunda is roughly subtriangular in outline and larger than the fenestra ovalis. The foot plate of the stapes completely fills the ovoidal fenestra ovalis and is held in position by narrow internal ledges on the anterior and posterior walls. Within the fenestra ovalis are the orifices of the small semicircular canals that open into a circular depression in the vestibule opposite to the epitympanic orifice of the aquaeductus Fallopii; a larger orifice situated at the posterointernal angle of the vestibule is the terminus of the aqueduct leading from the foramen rotundum and the scala vestibuli.

The epitympanic orifice of the aquaeductus Fallopii is small and the narrow groove for the facial nerve, which leads from it, is definitely limited by the thin rim of the fenestra ovalis and the projecting ledge formed by the internal margin of the fossa for the head of the malleus, but posterior to these structures its course along the internal and posterior faces of the posterior process is less sharply defined. The elongate fossa for the stapedial muscle, which is located in a depression behind the fenestra ovalis and internal to the groove for the facial nerve, is rather deep and somewhat rugose. Along the internal margin of the stapedial fossa a low thin-edged crest is developed on the ventro-external angle of the pars cochlearis, which extends backward to the base of the posterior process. The depth of the posterior face of this periotic (11.5 mm.), as measured from the stapedial fossa to the dorsal face above the cerebral orifice of the aquaeductus vestibuli, is somewhat less than the corresponding measurement of the periotic of *Lophocetus calvertensis* (12.1 mm.).

Between the rounded tuberosity or swelling, on which the fossa for the head of the malleus (pl. 5, fig. 1) is located, and the anterior margin of the articular facet on the posterior process the ventral surface of the

external denser portion of the periotic is deeply excavated, but is almost shut off internally from the epitympanic recess by a thin osseous crest which constitutes the external boundary of the small fossa incudis. The fossa incudis, which receives the crus breve of the incus, is shallowly concave anteriorly and terminates in a small deep pit on the anterointernal angle of the posterior process.

The anterior process is compressed from side to side, almost triangular in cross section and is bent inward, terminating in a ventral, upwardly curved point. The main articular surface on the anterior process for the accessory ossicle or uncinat process of the tympanic bulla is elongated and concavely curved in an anteroposterior direction. This articular area occupies more than half of the ventral surface of the anterior process. A fingerlike osseous projection, which arises between the pars cochlearis and the narrow deep groove which marks the internal limit of the facet for the above-mentioned accessory ossicle, is no doubt fortuitous.

The cerebral face of the pars cochlearis (pl. 5, fig. 4) is broken off, exposing the scala vestibuli and the scala tympani. Consequently, the conformation of the internal acoustic meatus cannot be determined. A rather broad channel for the facial nerve leads to the orifice of the aquaeductus Fallopii at the anteroexternal angle of the internal acoustic meatus. The flattened foramen singulare is situated behind the low ridge which separates the spiral tract from the orifice of the aquaeductus Fallopii.

The tractus spiralis foraminosus forms two circular depressions, the hinder one being much deeper than the anterior one. The cerebral orifice of the aquaeductus cochleae is also broken off, but obviously was quite small, judging from the diameter of the aqueduct. Outside of the internal acoustic meatus and near its posteroexternal angle is the slitlike orifice of the aquaeductus vestibuli that opens into a rather deep triangular fossa.

External to the internal acoustic meatus, the cerebral face of the outer denser portion of the periotic is noticeably flattened and forms an obtuse angle with the shallowly concave external face. On the posterior face of this denser portion and above the hinder end of the stapedia fossa is a rather large depression, subtrapezoidal in outline.

The posterior process of the right periotic (USNM 20659) referred to this species is essentially complete and the structures on the cerebral face are undamaged. The articular facet (pl. 5, fig. 2) on the ventral face of the somewhat elongated and distally truncated posterior process of this right periotic is shallowly concave on the basal portion and slopes from the distal extremity to the anterior margin. A few shallow grooves traverse this facet in an oblique direction.

The ventrointernal border of this facet projects inward and contributes the floor for the facial canal. A rather distinctly margined subpyriform excavation, which is located on the internal side and at the base of the ventral surface of the anterior process, constitutes the fossa for the reception of the head of the malleus. In contrast, the corresponding fossa on the left periotic associated with the skull is shallower.

The fossa incudis occupies the same location as on the left periotic, but is narrower and more elongated and is continued downward on the anteroexternal angle of the posterior process.

On the cerebral face of this right periotic (pl. 5, fig. 5) the internal acoustic meatus is somewhat compressed from side to side and elongated, and terminates in a narrow slitlike channel for the passage of the facial nerve. This channel leads to the entrance of the aquaeductus Fallopii and is slightly constricted medially by a narrow lip projecting from the pars cochlearis. The small orifice for the foramen singulare is situated posterior to the low osseous ridge between the spiral tract and the entrance to the aquaeductus Fallopii.

The tractus spiralis foraminosus is well defined with a minute foramen centrale at the anterior end. Outside and posteroexternally to the rim of the internal acoustic meatus is the small orifice of the aquaeductus vestibuli that opens into a deep ovoidal fossa. There is an interval of 4.2 mm. between it and the cerebral orifice of the aquaeductus cochleae. The cerebral orifice of the aqueduct of the cochlea is slightly larger than that for the vestibule and opens into the groove on the posterior face of the pars cochlearis at least 3 mm. below the rim of the internal acoustic meatus. On the posterior face of the periotic and above the posterior margin of the stapedia fossa there is a shallow circular depression approximately 5 mm. in diameter.

MEASUREMENTS OF THE PERIOTICS (IN MILLIMETERS)

| | <i>L. calvertensis</i> (USNM 16314) Left periotic | <i>L. pappus</i> (USNM 15985) Left periotic | <i>L. pappus</i> (USNM 20659) Right periotic |
|---|---|---|--|
| Breadth of periotic at level of fenestra ovalis (as measured from external face above groove to internal face of pars cochlearis) | 20. 1 | 19. 5 | 18. 5 |
| Greatest length of periotic (tip of anterior process to tip of posterior process) | 32. 2 | 31. 4+ | 31. 5 |

| | | | |
|---|------|------|------|
| Greatest dorsoventral depth of periotic (as measured from most inflated portion of tympanic face of pars cochlearis and groove to most projecting point on cerebral face) | 15.4 | 13.1 | 12.0 |
| Distance between fenestra rotunda and tip of anterior process | 21.0 | 20.0 | 17.3 |
| Distance between fenestra rotunda and anteroexternal angle of posterior process | 15.2 | 13.5 | 15.6 |
| Distance between epitympanic orifice of aquaeductus Fallopii and tip of anterior process | 16.6 | 16.0 | 14.0 |

TYMPANIC BULLA

The right tympanic bulla (pl. 6, figs. 4, 5) lacks the posterior process and most of the thin outer lip, including the uncinat process. The sigmoid process is preserved, but the intervening portion of the outer lip is missing and consequently its position cannot be determined with accuracy.

The ventral and external surfaces of this tympanic bulla are somewhat roughened but are not as nodular as the ventral face of the bulla of *Inia geoffrensis*. The configuration of the involucrum, however, is quite unlike that of *Inia geoffrensis*, and is somewhat similar to that of *Lipotes vexillifer*.

The anterior end of the tympanic bulla is flattened, forming a narrow lip which projects forward, and the thin outer lip is sufficiently complete to indicate the size and direction of the anterior outlet of the eustachian canal. The involuted thicker portion of the tympanic bulla is depressed below the level of the arching thin outer lip and is abruptly attenuated about 10 mm. behind the anterior outlet of the Eustachian canal. The surface of the involucrum is slightly roughened, convex from side to side, and depressed opposite the sigmoid process.

The ventral surface of the tympanic bulla is somewhat flattened on the anterior 15 mm. of its length. A large deep groove behind this flattened area divides the ventral surface longitudinally.

MEASUREMENTS OF RIGHT TYMPANIC BULLA OF USNM 15985 (IN MILLIMETERS)

| | |
|--|------|
| Greatest length of bulla | 38.0 |
| Greatest depth of bulla on internal side (ventral face to dorsal face of involucrum) | 14.0 |
| Greatest width of involucrum | 11.1 |

TEETH

During the removal of the matrix, 75 detached teeth were found near the skull and mandibles. The detached teeth range from 19.8 to

34.6 mm. in total length and the roots of the same teeth from 16 to 26 mm. With the exception of the pair of teeth at the extremity and seven additional teeth on each side, the teeth were dislodged from the alveolae on both sides of the rostrum. Fortunately, differences in the size, depth, and conformation of the empty alveolae made it possible to place with reasonable certainty the teeth found in the adjacent matrix in the corresponding alveolae. Nevertheless, no teeth were found that matched five alveolae on each side of the rostrum, although it is quite likely that two additional teeth for which the crowns alone were found were originally lodged in the rostrum.

In the mandibles, however, all of the teeth except one in the left mandible were dislodged from the alveolae. When the teeth were fitted to the corresponding mandibular alveolae, no teeth were found for two alveolae in the right mandible and one in the left mandible.

The dental formula was originally:

$$\begin{array}{r} \text{R. 27—L. 26} \\ \hline \text{R. 26—L. 26} \end{array}$$

Although the crowns of most of the teeth in both the upper and lower jaws were worn to varying degrees, some at least are sufficiently complete to show that the crowns curved inward toward the apex. The inner surface of the crown above the base was somewhat rugose, although the black enamel elsewhere on the crown is essentially smooth. None of these teeth exhibit any trace of accessory cusps or tubercles. The basal margin of the enamel crown is irregularly curved, but no cingulum is developed. The root on most of the teeth appears to have been slightly constricted immediately below the enamel crown. The extremities of the roots of most of the teeth are bent backward. All of the teeth in the rostrum with the exception of four or five of the posterior ones have the roots noticeably expanded below the crown and tapered toward the extremity.

On this fossil skull the anterior teeth and their alveolae are the largest in each tooth row; the teeth and their alveolae progressively diminish in size toward the posterior end of the tooth row. The teeth and alveolae of *Inia geoffrensis*, however, increase in size from the anterior to near the posterior end of the tooth row and the anterior teeth have rather small recurved crowns with rugose or finely striated enamel. The seven hindmost teeth of *Inia* have the crowns and the roots widened transversely, the enamel crown of each consisting of an outer low blunt pointed cusp and a flattened rugose internal shelf that occupies about half of the transverse width of the crown.

The 10 anterior teeth on each side of the rostrum are separated by interspaces of varying widths, and the remainder of the teeth are

rather closely approximated. The interspace on the right side between the fifth and sixth alveolae, counting backward from the anteriormost alveola, is 8 mm., between the sixth and the seventh alveolae it is 4 mm. On the right side of the rostrum the alveolae of the 20 posterior teeth counting forward from the hindmost one are separated by rather thin septa (1 mm. or less).

The anteriormost tooth on each side of the rostrum has the apex of the crown worn off obliquely and the posterior surface of the crown deeply grooved from occlusion with the corresponding tooth in the mandible. Each of these large teeth is placed obliquely in the alveola at the extremity of the premaxilla, and projects forward and downward. These anteriormost teeth diverge from one another toward their apices. The worn enamel crown of the anteriormost tooth on the right side measures 14 mm. in length and 10 mm. in diameter at the base. The ratio of the length of the enamel crown to the whole tooth varies considerably in the upper tooth row, being equivalent to nearly half the total length on the largest anterior teeth and about one-third the total length on the larger teeth near the posterior end of the tooth row. With the exception of five teeth at the anterior end of the tooth row and six at the posterior end, the enamel crowns of most of the remaining teeth are worn down to the roots. The tooth at the posterior end of the right upper tooth row is the smallest, measuring 19.7 mm. in length; the maximum diameter of the root is 5.8 mm. The longest anterior teeth (the fourth on left side and the fifth on right side) have a length of 31 mm., and a root with a maximum diameter of 11.8 mm. The three anterior teeth on each side are lodged in the premaxillae.

The anterior mandibular teeth average smaller than the corresponding ones in the rostrum. Behind the three anterior teeth on the right side, the crowns of at least nine of the succeeding teeth were worn down to the roots, although only four on the opposite side were worn to the same extent. The anteriormost pair of teeth were worn obliquely from occlusion with the corresponding upper teeth. On the left side the second, third, fourth, and fifth teeth counting backward from the first are sufficiently complete to show that the enamel crowns curved inward and backward toward their apices. The enamel crown of the second tooth measures 11.5 mm. in length and 7.6 mm. in breadth at the base; the total length of the tooth is 31.3 mm. Twelve teeth were located in the symphyseal portions of the right and left mandibles. The posterior tooth in the left mandible is the smallest in this tooth row, measuring 26 mm. in length; the crown length is 7.5 mm., the greatest breadth of crown at base is 6.2 mm; and the greatest breadth of root is 8 mm.

CERVICAL VERTEBRAE

Of the seven vertebrae normally comprising the cervical series of a cetacean, only four (pl. 7) were found associated with the skull and mandibles. No evidence of ankylosis exists on any of these cervicals.

The axis, the third to seventh cervicals, and the first and second dorsal vertebrae of *Lophocetus calvertensis* are for the most part concealed by matrix. The ventral surfaces of these centra are somewhat eroded and only small remnants of the lower transverse processes are preserved. All of these vertebrae are sufficiently complete, however, to assist with the allocation of the cervicals of *L. pappus*. The dorsal portions of the neural arches of the fourth to seventh cervicals of *L. calvertensis* are fairly complete and are relatively narrower antero-posteriorly than those of the Calvert Miocene porpoise. The antero-posterior diameters of the centra of the fifth, sixth, and seventh cervicals of this Calvert porpoise are likewise greater than those of corresponding cervicals of the St. Marys porpoise. The fifth and sixth cervicals of *L. calvertensis* agree with those of *L. pappus* in having lower transverse processes, and the seventh seems to possess on each side a single upper laterally projecting transverse process.

ATLAS: In general form the atlas (pl. 7, fig. 1) differs from that of *Eurhinodelphis cocheteuxi* (Abel, 1931, pl. 19) in having vestigial upper transverse processes, a broader and longer hyapophysial process, and a wider neural canal. The reduction of the upper transverse processes, the enlargement of the lower transverse processes, the greater antero-posterior diameter of the roof of the neural arch (completely enclosing the vertebrarterial canals), and the widened hyapophysial process distinguish this atlas from that of *Inia geoffrensis*. The atlas of *Lophocetus calvertensis* resembles that of *L. pappus* in essential details, but is slightly wider, the posterior facets for articulation with the axis are considerably larger, the large vertebrarterial canals do not pierce the roof of the neural arch and are bounded in part by the dorso-internal edges of the anterior facets for articulation with the condyles, and the roof of the neural arch is more strongly arched.

The lower transverse processes are normal in size, truncated obliquely at extremity, but only vestiges of the upper processes persist. These lower processes are short, dorsoventrally compressed, and project downward and backward. The facets for articulation with the occipital condyles are concave, broader above than below, and separated ventrally by an interval of 11 mm. The roof of the neural arch is not elevated medially, the anteroposterior diameter near the low crestlike neural spine measuring 25.5 mm., and is pierced on each side by a vertebrarterial canal. The posterior articular facets

(pl. 7, fig. 5) are subovoidal in outline, convex from side to side, slightly concave dorsoventrally, and are set off from the posterior face of the centrum by distinct margins. The hyapophysial process is rather large, flattened dorsoventrally, and noticeably rugose dorsally along lateral and hinder borders. On the dorsal surface of the hyapophysial process, and at the base of the somewhat pyriform neural canal, there is a concave heart-shaped facet for articulation with the odontoid process of the axis.

For comparison, the measurements, in millimeters, of the atlas of *Lophocetus calvertensis* are as follows: Greatest distance across atlas between outside margins of anterior articular facets, 93; across posterior facets, 96.5; distance across atlas between tips of transverse processes, 121+; and greatest transverse diameter of neural canal anteriorly, 38.

FIFTH CERVICAL: Unlike the fifth cervical of *Inia geoffrensis*, this vertebra (pl. 7, fig. 3) lacks the downwardly projecting, elongated, and rather robust lower transverse processes. It is distinguished also by the fusion of the thin upper transverse process with the thicker lower one, completely enclosing on each side the large vertebrarterial canal, and by downward projection of the short ventrally directed process that arises near the base of the lower transverse process. The centrum is rather thin (16 mm.), the dorsal portion of the slightly elevated neural arch is narrow, and the neural spine is reduced to a low crest. The prezygapophysial facets slope obliquely downward from outer to inner margins. The postzygapophysial facets are rather large, and are placed obliquely on the postero-superior border of the pedicle of the neural arch.

SIXTH CERVICAL: The transverse processes of this cervical (pl. 7, fig. 2) are incomplete distally but otherwise are well preserved. The enlargement and elongation of the lower transverse processes at once distinguish this vertebra from that of *Inia*. The upper transverse process apparently tapered to a thin distal end and may have partially inclosed the large lateral vertebrarterial canal. The lower transverse process is directed downward and backward but exhibits an irregular conformation, although somewhat flattened dorsoventrally and expanded near extremity. The centrum is slightly thicker than that of the fifth cervical. The prezygapophysial and postzygapophysial facets slope obliquely from outer to inner margins. The neural spine is a low crest, and the dorsal portion of the neural arch is slightly elevated.

SEVENTH CERVICAL: In contrast to the sixth cervical, the antero-posteriorly flattened transverse processes (pl. 7, fig. 4) are directed outward from the dorsal half of the lateral face of the centrum and

are attenuated toward extremity. A small elongated vertebrarterial canal perforates the base of the right transverse process. The enlargement of these upper transverse processes and the absence of the lower transverse processes also distinguish this cervical from the sixth cervical. In development these upper transverse processes resemble somewhat those on the seventh cervical of *Inia*, which, however, has a long slender neural spine (58 mm.) and large lateral vertebrarterial canals. The pedicles of the neural arch are wider than those of the sixth cervical. The prezygapophysial facets slope less steeply from outer to inner margins than on the sixth cervical and the postzygapophysial facets are unusually elongated (24.5 mm.). The neural spine is reduced to a low crest.

MEASUREMENTS OF CERVICAL VERTEBRAE (IN MILLIMETERS)

| | Atlas | C.5 | C.6 | C.7 |
|---|-------|------|------|-------|
| Greatest vertical diameter of articular surface for condyle (right) | 49.0 | | | |
| Greatest transverse diameter of articular surface for condyle (right) | 32.5 | | | |
| Least anteroposterior diameter of dorsal face of neural arch | 25.8 | 11.5 | 9.5 | 12.5 |
| Least anteroposterior diameter of pedicle of neural arch | | 12.0 | 14.8 | 20.5 |
| Greatest height (vertically) of vertebra (tip of neural spine to ventral face of centrum) | 84.0 | 63.5 | 63.5 | 62.5 |
| Anteroposterior diameter of centrum | | 16.0 | 17.5 | 18.0 |
| Distance across vertebra between tips of transverse processes (parapophyses) | 113.5 | 94.5 | 84.+ | 111.5 |
| Distance across vertebra between tips of upper transverse processes (diapophyses) | | | 71.0 | |
| Distance between tip of prezygapophysis and tip of postzygapophysis | | 27.7 | 28.3 | 34.8 |
| Transverse diameter of neural (spinal) canal anteriorly | 35.0 | 26.0 | 29.0 | 31.0 |
| Maximum height of neural (spinal) canal anteriorly | 37.5 | 17.5 | 17.5 | 19.0 |
| Greatest distance across vertebra between outside margins of anterior articular facets | 88.0 | | | |
| Greatest distance across vertebra between outside margins of posterior articular facets | 82.0 | | | |

DORSAL VERTEBRAE

With the exception of the neural spines and the extremities of the prezygapophyses, all four dorsal vertebrae (USNM 15985) associated with the skull and mandibles are otherwise essentially complete.

Another vertebra (USNM 20659), which was associated with a section of the rostrum, represents the second in the dorsal series. The position of these vertebrae in the dorsal series here adopted is based on the structural features of the dorsal vertebrae of *Inia geoffrensis* as well as on the articular relations of the ribs associated with this fossil. All of these vertebrae have the epiphyses firmly ankylosed to the centrum, indicating that the porpoise was fully mature.

These vertebrae may be distinguished from the corresponding vertebrae of *Inia geoffrensis* by the wider interval separating opposite prezygapophysial facets, the larger neural canal, and the location of the articular facet for the capitulum of the corresponding rib on the centrum at the upper posteroexternal angle. They differ also from the corresponding vertebrae of *Eurhinodelphis* in that the pedicles of the neural arches and the prezygapophyses are more noticeably robust, the neural canals are narrower, and the anterior surfaces of the centra are narrower. The centra increase in length from the second to the tenth in the series. The width of the interval separating the prezygapophysial facets decreases markedly from the second to the tenth dorsal. These prezygapophysial facets are rather large and slope steeply from outer to inner margins. On four of these dorsals the diapophyses are relatively short, and the facet for articulation with the tuberculum of the corresponding rib, with the exception of the fourth dorsal, is situated behind the level of the anterior surface of the centrum. The facets for the tuberculum of the corresponding ribs are noticeably elongated dorsoventrally on the second and fourth dorsals, but progressively widen anteroposteriorly to the tenth dorsal. The postzygapophysial facets do not differ markedly from one another on the fourth, sixth, and eighth dorsals. On each side of the centrum of the fourth and sixth dorsals at the upper posteroexternal angle there is a large facet for the accommodation of the capitulum of the following rib. This facet, however, is not present on the eighth dorsal. On the corresponding vertebrae of *Inia*, however, these facets are located on the upper anteroexternal angle of the centrum.

SECOND DORSAL: When this vertebra (USNM 20659) was found the neural spine, the left half of the neural arch, and a portion of the left side of the centrum had been broken off while exposed on the face of the cliff. The centrum (pl. 11, fig. 3) is approximately the same size as that of the second dorsal of *Lophocetus calvertensis*. This second dorsal, however, differs from the corresponding dorsal of *Inia* in having a wider neural canal, slightly longer diapophyses with the dorsoventrally elongated facet for the tuberculum located obliquely on the posterior half of the extremity of the latter, and widely separated prezygapophysial facets, the distance between their outer margins

being estimated as 70 mm. The right pedicle of the neural arch is robust and the roof of the neural arch was apparently rather narrow anteroposteriorly, inasmuch as the distance from the anterior margin of the neural arch to the posterior margin of the postzygapophysial facet is 24.5 mm. The prezygapophysial facets are distinctly impressed on the dorsal surface of the diapophyses and slope from the outer to the inner margin. The postzygapophysial facets are elongated (17.5 mm. in length) and slope obliquely downward and inward. The large facet for the capitulum of the third rib is located obliquely on the centrum at the upper posteroexternal angle.

Other measurements, in millimeters, for the second dorsal are as follows: Greatest anteroposterior diameter of centrum, 26.5; greatest transverse diameter of posterior face of centrum, 46+; greatest vertical diameter of anterior face of centrum, 31.5.

FOURTH DORSAL: This vertebra (pl. 8, figs. 2, 6) differs from the corresponding dorsal of *Inia* in having a more nearly circular instead of subpyriform neural canal, a pronounced widening of the posterior surface as contrasted with the anterior surface of the centrum, steeply sloping prezygapophysial facets, the long axis of the facet for the tuberculum on the diapophysis nearly vertical, and the large facet for capitulum of fifth rib located obliquely on the centrum at the upper posteroexternal angle. From the corresponding vertebra of *Eurhinodelphis* this dorsal is distinguished by having shorter diapophyses, a more nearly circular neural canal, and the posterior surface of the centrum noticeably wider than the anterior face. Although the neural spine is broken off at the base, the position and curvature of the anterior edge suggest that it was rather broad anteroposteriorly. The backwardly projecting dorsal portion of the neural arch is elongated anteroposteriorly (36 mm. medially) and rather wide (42 mm.). The neural arch is robust, with a short diapophysis on each side which bears a pyriform articular facet for the tuberculum of the fourth rib. The prezygapophysial facets are somewhat concave anteroposteriorly and slope steeply from outer to inner margins. The postzygapophysial facets are elongated and slope obliquely downward and inward.

SIXTH DORSAL: Compared with the fourth dorsal, the backwardly projecting dorsal portion of the neural arch is considerably narrower and longer anteroposteriorly (40 mm.), the centrum is longer, and the prezygapophyses are more elongated and narrower. The short diapophyses (pl. 8, figs. 1, 5) do not differ markedly either in position or in size from those on the fourth dorsal, and the facets for the tubercula of the sixth ribs are noticeably constricted ventrally. The concave prezygapophysial facets are shorter and narrower dorsoventrally than on the fourth dorsal, although the conformation and size of the

postzygapophysial facets are quite similar to those on the latter. The facet for the capitulum of the seventh rib is large and situated on the centrum at the upper posteroexternal angle. The anterior surface of the centrum is narrower than the posterior surface.

EIGHTH DORSAL: The prezygapophyses (pl. 9, figs. 3, 4) are separated by a shorter interval, the neural canal is noticeably smaller, and the backwardly projecting dorsal portion of the neural arch is very narrow and more noticeably attenuated than on the sixth dorsal. The anterior and posterior surfaces of the centrum are approximately the same width.

The anteroposterior diameter of the basal portion of the neural spine exceeds that of the corresponding dorsal of *Eurhinodelphis*, but is approximately equal to that of *Inia*. The short diapophyses differ very slightly in position from those of the sixth dorsal, although the facets for articulation with the tubercula of the eighth ribs are almost triangular in outline. The concave prezygapophysial facets are small, measuring about 16 mm. anteroposteriorly, and slope very abruptly from outer to inner margins. The somewhat curved and slender prezygapophyses project about 17 mm. beyond the anterior margins of the ventrally situated articular facets. The postzygapophysial facets are similar in outline to those of the sixth dorsal, but are shorter. The centrum lacks any indication of a facet for the capitulum of the ninth rib. On the centrum of the corresponding dorsal of *Inia*, however, the large facet for the capitulum of the eighth rib is located on the upper anteroexternal angle of the centrum and is continuous with the facet for the tuberculum.

TENTH DORSAL: The eighth and ninth dorsal vertebrae of *Inia* have the single large facet for the combined tuberculum and capitulum of the corresponding rib located for the most part on the lateral surface of the pedicle of the neural arch. On the tenth dorsal of *Inia*, however, this facet is located largely below the level of the dorsal surface of the centrum. The transverse processes of these vertebrae of *Inia* are very short. This fossil vertebra (pl. 9, figs. 5, 6) thus differs from the tenth dorsal of *Inia* in having the single large concave articular facet for the combined tuberculum and capitulum of the corresponding rib located laterally on the rather robust transverse process, which projects outward from the pedicle of the neural arch at a lower level than on the eighth dorsal. The distance from the inner surface of the pedicle of the neural arch to extremity of the transverse process is 27 mm. The anteroposterior diameter of the neural spine at the base is greater, the neural canal is narrower, and the prezygapophysial facets are much more closely approximated than on the eighth dorsal. The concave prezygapophysial facets slope abruptly

from outer to inner margins. The postzygapophysial facets are much smaller and less sharply outlined than those of the eighth dorsal. A slight increase in the length of the centrum also distinguishes this vertebra from that of the eighth dorsal; the transverse width of the posterior surface (40.5 mm.) of the centrum is only slightly greater than the corresponding measurement of the anterior surface (39.5 mm.)

MEASUREMENTS OF DORSAL VERTEBRAE (IN MILLIMETERS)

| | D.4 | D.6 | D.8 | D.10 |
|--|------|------|-------|-------|
| Greatest vertical height of vertebra, ventral face of centrum to tip of neural spine | 78.+ | 80.+ | 102.5 | 119.+ |
| Vertical height of neural spine, dorsal surface of neural canal to tip of neural spine | | | 53.+ | 70.5 |
| Greatest anteroposterior diameter of centrum | 38.5 | 40.5 | 42.0 | 47.8 |
| Greatest transverse diameter of anterior face of centrum | 37.5 | 38.5 | 40.0 | 39.5 |
| Greatest vertical diameter of anterior face of centrum | 26.5 | 32.6 | 34.2 | 35.0 |
| Greatest vertical diameter of neural (spinal) canal anteriorly | 29.0 | 28.0 | 25.0 | 24.0 |
| Greatest transverse diameter of neural (spinal) canal anteriorly | 32.0 | 30.5 | 28.0 | 25.5 |
| Least anteroposterior diameter of pedicle of neural arch | 16.5 | 16.0 | 17.7 | 23.8 |
| Distance across vertebra between outer ends of diapophyses | 84.8 | 80.7 | 74.5 | 81.7 |
| Greatest distance between outer margins of prezygapophysial facets | 49.5 | 50.± | 35.2 | 23.± |
| Greatest distance between outer margins of postzygapophysial facets | 41.5 | 30.0 | 17.5 | |
| Distance between tip of metapophysis and posteroventral angle of neural spine | 63.5 | 67.0 | 69.5 | 67.+ |

CAUDAL VERTEBRAE

The terminal caudal (USNM 20659), probably the third or fourth (pl. 11, fig. 2) from the distal end of the vertebral series, resembles the corresponding vertebra of *Inia geoffrensis*. The dimensions in millimeters are as follows: Greatest width, 34; vertical diameter of anterior surface, 18; and anteroposterior diameter, 15. Short, blunt upper and lower processes are formed on each side by the medial side to side constriction of the centrum. The anterior surface of the

centrum is shallowly concave, and the posterior surface convex. The centrum is pierced dorsoventrally by a pair of canals, the dorsal orifices of which are 9 mm. apart.

RIBS

Although all of the ribs (pl. 10) associated with these skeletal remains are more or less incomplete, there is evidence that this fossil porpoise possessed at least 10 pairs of ribs and possibly 13, of which the first pair are short and robust. When these ribs are arranged in what appears to be their normal position, the abrupt downward bending of the shaft behind the neck is seen to diminish from the anterior to the posterior end of the series.

For the first rib (pl. 10, fig. 1) on the left side only a section of the curved portion of the shaft behind the tuberculum was found. The neck is flattened, and relatively deep behind the tuberculum of which only the hinder border of this articular surface is preserved. The downward bending of the shaft of the rib behind the tuberculum apparently was not as abrupt as on the corresponding rib of *Inia*.

The right and left second ribs (pl. 10, figs. 2, 7) both lack their distal extremities, but are otherwise somewhat similar to the ribs of *Inia*. The necks of these ribs are short, the capitular portion being slightly bent upward. The tuberculum is elongated, with greatest width posteriorly (11.5 mm.) and attenuated anteriorly. Between the tuberculum and the angle the posterosuperior margin overhangs interruptedly the posterior surface of the shaft. The downward bending of the flattened shaft is more pronounced than on the succeeding ribs.

Only the proximal end of the third rib (pl. 10, fig. 10) on the right side was found. The neck is narrower and slightly longer than that of the second rib. The convex capitulum is subovoidal in outline. The tuberculum is elongated, subpyriform in outline, and concave from end to end.

The necks of the right and left fourth ribs (pl. 10, figs. 3, 8) are slender, less flattened, and more elongated than that of the third rib. The capitulum is broken off on the left rib and is incomplete ventrally on the right rib, but was obviously smaller than that of the third rib. The slightly convex tuberculum is extended anteriorly on the neck. Between the tuberculum and the angle the shaft of this rib is antero-posteriorly flattened, but becomes more nearly ovoidal in cross section toward the broken distal end. The angle overhangs the posterior face of the shaft.

The fifth rib (pl. 10, fig. 4) on the left side is characterized by a slender neck, an expanded capitulum, and an elongated tuberculum

which is concave from end to end, and wider posteriorly than anteriorly. The shaft of the rib is flattened anteroposteriorly between the tuberculum and the angle, almost ovoidal in cross section near the middle of its length, and noticeably flattened near the extremity. The length of this rib in a straight line is 306 mm.

The neck of the sixth rib (pl. 10, fig. 5) resembles that of the fifth rib, and the shaft is similarly flattened between the tuberculum and the angle. The capitulum is rounded. The tuberculum unfortunately was destroyed during excavation of this specimen.

A single-headed rib (pl. 10, fig. 9) lacking the distal end may have articulated with the tenth dorsal. The proximal articular surface of this rib is somewhat convex, the shaft is thickened between this facet and the angle, and below the angle it is distinctly flattened on the outer surface for a distance of about 60 mm.

Another single-headed rib (pl. 10, fig. 6) from the posterior end of the series on the right side has a large proximal articular surface, a sharp crest approximately 30 mm. in length on the anterosuperior margin behind the articular head, and an ill-defined angle below which the shaft becomes progressively flattened and develops a ridge on the anterior and posterior margins.

SCAPULA

It will be noted that the lower portion of this left scapula (USNM 20659) is quite unlike the scapula of *Inia geoffrensis*. The neck of this scapula (pl. 11, fig. 4) is short and rather broad and the glenoid cavity for the head of the humerus is rather shallow. The lower or axillary margin is directed backward and slightly upward from the short neck. The direction and length of this margin suggests that the upper portion of the scapula was rather broad. Since the external surface of this bone is slightly depressed posterior to the assumed position of the spine, a shallow postscapular fossa is indicated. The basal portion of the acromion process is rather broad. The laterally flattened coracoid process lacks the distal end and is directed inward and apparently slightly upward from the neck of the scapula.

II. PELODELPHIS GRACILIS, NEW GENUS, NEW SPECIES

Our present knowledge of the cetacean fauna of the Calvert formation of Maryland indicates that in addition to the more frequently occurring long-beaked porpoises of the genera *Eurhinodelphis*, *Schizodelphis*, and *Zarhachis*, at least one other porpoise with a lengthened rostrum was present during that period in the Chesapeake area. It is now certain that remains of a number of genera and several families of Cetacea were present in the marine Miocene Calvert formation.

The possibility exists, however, that one of the names given by either Leidy or Cope to vertebrae or teeth from the Miocene formations of Maryland or Virginia may be applicable to this previously unrecognized long-beaked porpoise. Until a skull is found with at least some associated vertebrae and teeth that are satisfactory for comparison with these type vertebrae and teeth, the identity of some of the forms described by Leidy and Cope will remain questionable.

The porpoise hereinafter described was characterized by larger teeth than any of the above mentioned long-beaked genera, although the total length of the skull was unquestionably shorter. Comparative measurements suggest that the total length of the skull did not exceed 630 mm. Not one of the European Miocene porpoises heretofore described agrees with the mandible of this Calvert porpoise in essential characters.

Three of the European forms, however, deserve some comment. As regards the type mandible of *Palaeoziphius scaldensis* (Abel, 1905, p. 91, fig. 15) which was found in the excavations at Antwerp in deposits of Bolderian age, the alveolae, in addition to being slightly larger (12 were located on the symphysis in an interval of 168 mm. as compared to 16 on the mandible hereinafter described), appear also to have been separated by thicker septa. Although the width (44 mm.) of the posterior end of the symphysis of *Palaeoziphius scaldensis* is less than that (52.5 mm.) of this Calvert specimen, the variation in the transverse diameter of both specimens 168 mm. anterior to the posterior end of the symphysis is not more than 2 mm. The opposite free hinder portions of the mandible of the Belgian *Palaeoziphius* form an acute angle at the level where they ankylose as the symphysis, whereas in the Calvert specimen the rami form a rather wide blunt angle. In addition the anterior end of the symphysis of the Belgian specimen is more noticeably bent upward and the furrow or groove on the lateral surface of each ramus according to Abel is deep and anteriorly bifurcated. The symphysis of this type mandible is incomplete anteriorly.

The ankylosed mandibles found in a marl pit of Helvetian age at Montfort near Dax, Landes Department, France, which constitute the type of *Champsodelphis lophogenius* (Valenciennes, 1862; Type, No. 11731, Lab. Paléont., Mus. Nat. Hist. Nat., Paris) are characterized in part by a slightly narrower width (43.2 mm.) at the posterior end of the symphysis, although the vertical diameter (42.6 mm.) of the left mandible at the hindmost alveola is identical. However, the angle (Van Beneden and Gervais, 1874, pl. 57, fig. 10a) formed by the opposite mandibles behind the point where they ankylose to constitute the symphysis is acute, in contrast to the more rounded angle

exhibited by Calvert mandibles. Although the alveolae were more widely spaced, the teeth were somewhat smaller in size since 10 alveolae in the left mandible occupy an interval of 114 mm.

The mandible from the shell marl (Falun) of Helvetian age at Salles, Gironde Department, France, referred to *Champsodelphis dationum* by Gervais (1859, pp. 305-306), is slightly smaller than that of this Calvert specimen, since the height of the left mandible at the posterior end of the symphysis is stated to be 28 mm. and at posterior alveola 35 mm. The illustration for this mandible (Gervais, 1859, pl. 83, fig. 1) shows that the intervals between the alveolae were wider and that the teeth were smaller—12 alveolae were located in an interval of 111 mm.

Pelodelphis, new genus

DIAGNOSIS: Mandibles slender with elongated symphysis equivalent to less than one-half the length of each ramus when complete; symphysis ankylosed, tapering toward anterior extremity, approximately U-shaped in cross section about half way of its length, and with anterior half of its length bent upward; opposite free hinder portions of mandibles form a blunt angle at level where they ankylose as symphysis; probably 36 teeth in each mandible; 12 alveolae located on each mandible posterior to hinder end of symphysis; 21 alveolae located on preserved portion of left mandible anterior to posterior end of symphysis; roots of teeth on symphysis implanted obliquely in alveolae, which slope more backward than inward; anteroposterior diameter of each of two alveolae at hinder end of symphysis in right mandible, 9 mm.; transverse diameter of the same alveolae, 9 mm.; diameters of anterior alveolae approximately 1 mm. smaller; opposite alveolae at hinder end of symphysis separated by an interval of 22.5 mm.; corresponding interval between 16th alveolae (counting forward from hindmost at posterior end of symphysis) is 5.5 mm.

Pelodelphis gracilis, new species

PLATES 12-16

TYPE SPECIMEN (USNM 13471): Ankylosed mandibles lacking distal ends of both rami; hinder portion of right mandible incomplete. Collectors, Remington Kellogg, C. Lewis Gazin, and Raymond M. Gilmore, Aug. 11, 1933.

HORIZON AND LOCALITY: In sandy clay of Zone 14 (about 18 inches above contact with Zone 13), approximately 583 yards north of old pier at end of Governor's Run Road (see U. S. Geol. Surv. Prince Frederick Quad.), Calvert County, Md. Calvert formation, upper Miocene.

MANDIBLES

The anterior extremities of both mandibular rami (pl. 12, fig. 1) are broken off; the condyle and a portion of the ramus below and behind the coronoid process is missing on the right mandible; the left mandible is essentially complete except for the lower border in front of the condyle. In the present condition, the symphyseal portion (229 mm.) of the left mandible is shorter than the hinder free portion (307 mm.). The mandibles are firmly ankylosed throughout the length of the symphysis. A thin dorsal groove along the midline on the anterior half of the symphysis marks the ankylosis of the opposite mandibles. On the posterior half of the symphysis this groove is more or less obliterated. On the ventral face the line of fusion is indicated by a continuous narrow groove that extends medially the full length of the symphysis.

The symphyseal portion of the combined lower jaws tapers toward the anterior extremity, the transverse diameter diminishing from 52.5 mm. at the level of the posterior end to 25.4 mm. at the level of the 29th alveola, counting forward from the hindmost alveola in the ramus, although the dorsoventral reduction is less marked. From a lateral view (pl. 13, fig. 2) the ventral profile of the distal 130 mm. of the symphysis slopes slightly upward toward the missing anterior extremity. Between the tooth rows the dorsal surface of the symphysis is relatively smooth. No pits for the reception of the apices of the teeth in the upper jaws are present. The external face of the symphyseal portion of the right mandible is slightly convex, but slopes obliquely from the alveolar margin to the midline of the ventral surface. A cross section taken about half way of the length of the ankylosed symphyseal portions of the mandibles resembles a U, but is more nearly V shaped near the extremity.

The distance (117 mm.) from the posterior end of the symphysis to the posterior margin of the hindmost alveola on the right mandible is greater than the interval (77 mm.) between the opposite tooth rows at the level of this tooth. The angle formed by the diverging opposite rami behind the symphysis is approximately 30 degrees.

More than 33 alveolae were present on the left mandible when complete. If the extremity of the symphysis had been preserved the number of alveolae would be increased, probably at least to 36. This extinct porpoise had originally more than 21 teeth on each side of the ankylosed symphysis, as contrasted to 12 in the case of *Lophocetus pappus*, new species. The teeth on the anterior half of the symphysis were implanted opposite one another, the alveolae being separated by equivalent intervals from preceding and succeeding

alveolae. The maximum interval between alveolae is about 2 mm. The septa between the alveolae are in most instances complete. On the right mandible in front of the 29th tooth, counting forward from the hindmost, the alveolae were obliterated by exostosis. Except for a slight inward slope, the roots of the teeth were implanted nearly vertically in the alveolae behind the symphysis. Along the symphysis, however, the roots were implanted obliquely in the alveolae, sloping more backward than inward. The distance between opposite alveolae immediately in front of the posterior end of the symphysis is 22.5 mm., and 5.5 mm. at the level of the 29th alveolae, counting forward from the hindmost on the left mandible. In the right mandible, 12 alveolae (in an interval of 117 mm.) were located behind the level of the posterior end of the symphysis, and in the left mandible 11 alveolae (in an interval of 103.5 mm.) were so situated. The individual alveolae, which are essentially complete in preservation, vary in anteroposterior diameter from 6 to 9 mm., and in transverse diameter from 7 to 8.5 mm.

On the outer surface of the right mandible there are at least three nutrient foramina, and, from these grooves of varying lengths, extend forward. These nutrient foramina are located below the 8th, 10th, and 17th alveolae, counting forward from the hindmost, as well as other smaller foramina located anterior to these, but partially obscured by fractures. Nutrient foramina are located on the outer surface of the left mandible (pl. 12, fig. 2) below the 5th, 10th, 14th, and 20th alveolae. Commencing below the 20th alveola, there are in addition however, three narrow grooves, one above the other, that extend forward for at least 70 mm., but at a lower level on the outer face.

The dorsal edge of each mandible ascends gradually to the coronoid process, which has a thickened dorsal border. Although each coronoid process is bent inward, this condition may have resulted in part from crushing. The opposite coronoid processes are now separated by an interval of 102 mm. The distance from the apex of the coronoid process (163 mm.) to the hindmost alveola on the left mandible is equivalent to about 31 percent of the total length of the mandible as preserved.

Behind the hindmost alveola and on the inner face of each ramus there is a large orifice for the dental canal. Posterior to this point, the inner wall is reduced to a low thin strip along the ventral border of the mandible. The outer wall of the mandible in this region consists of a thin shell of bone that is now markedly convex except for the shallow concavity below and in front of the coronoid process.

The ventral margin of the left ramus is continued backward from the symphysis in a shallow curve toward the angle, the lower border being destroyed for a distance of 25 mm. anterior to the condyle.

The dorsoventral axis (37 mm.) of the condyle is directed obliquely outward and the external border of the condyle projects beyond the outer face of the ramus. The maximum transverse diameter of the condyle is 25.5 mm. In outline the condyle is almost lachrymi-form with median spur on outer side, and is directed more outward than downward.

MEASUREMENTS OF THE MANDIBLES (IN MILLIMETERS)

| | Right | Left |
|--|-------|-------|
| Length of mandible, as preserved, condyle to anterior end | | 525.+ |
| Length of mandible, as preserved, hinder end of coronoid process to anterior end | 477.+ | |
| Length of symphysis (as preserved) | 210.+ | 229.+ |
| Vertical diameter of mandible at hindmost alveola | 44.5 | 42.5 |
| Transverse diameter of mandible at posterior end of symphysis | 52.5 | |
| Vertical diameter of mandible at level of posterior end of symphysis | 29.5 | 29.5 |
| Transverse diameter of symphysis 50 mm. anterior to hinder end | 36.0 | |
| Transverse diameter of symphysis 100 mm. anterior to hinder end | 30.0 | |
| Transverse diameter of symphysis 150 mm. anterior to hinder end | 28.0 | |
| Vertical diameter of mandible through coronoid process | 75.+ | 85.5 |
| 12 posterior alveolae in an interval of | 116.5 | 112.0 |
| 30 alveolae located in an interval of | 306.0 | 307.0 |
| Anteroposterior diameter of largest alveola | 9.0 | 9.0 |
| Transverse diameter of largest alveola | 8.5 | 8.5 |
| Distance from posterior end of symphysis to posterior margin of hindmost alveola | 117.0 | 113.5 |
| Distance from apex of coronoid process to posterior margin of hindmost alveola | 151.0 | 154.0 |
| Distance that orifice of dental canal is located behind hindmost alveola | 10.± | 10.± |
| Distance from posterior end of symphysis to posterior surface of condyle | | 306.0 |
| Height of condyle | | 37.0 |
| Transverse diameter of condyle | | 25.5 |
| Distance between alveolae of opposite tooth rows at posterior end of symphysis | 27.5 | |
| Least distance between alveolae in tooth rows | 2.5 | 2.0 |

Referred Specimen I

USNM 10715: Right and left mandibles, essentially complete to posterior end of symphysis. Collector, William Palmer, January 1914.

HORIZON AND LOCALITY: In sandy clay of Zone 5 above oyster shell layer, 4 feet above beach level, South Chesapeake Beach, Calvert County, Md. Calvert formation, upper Miocene.

MANDIBLES

Although the dimensions of the preserved portions of these mandibles are slightly smaller than those of USNM 13471, their conformation as well as the size of the alveolae resemble rather closely the mandibles of the latter. These mandibles obviously belonged to an immature individual since the symphysis has not as yet ankylosed and the condyles are narrower. Approximately 43 mm. of the symphyseal region of the left mandible is preserved.

Two teeth were preserved *in situ* in the left mandible and one in the right mandible (pl. 13). In the left mandible, 11 alveolae (in an interval of 110 mm.) were located behind the level of the posterior end of the symphysis, and in the right mandible 12 alveolae (in an interval of 120 mm.) were so situated. The largest alveolae at the rim vary in anteroposterior diameter from 7 to 8 mm. and in transverse diameter from 6 to 8 mm. The roots of the teeth were implanted nearly vertically in the alveolae. The maximum interval between the alveolae is approximately 3.0 mm., but for most of them it is not more than 2 mm.

The distance from the posterior end of the symphysis to the hindmost alveola (110 mm.) on the left ramus is slightly less than the corresponding interval on USNM 13471, and the distance from the posterior end of the symphysis to the posterior face of the condyle (283 mm.) is also less than that of USNM 13471 (306 mm.).

On the outer surface of the right mandible (pl. 14, fig. 1) nutrient foramina, from which grooves of varying lengths extend forward, were located below the 6th, 8th, 12th, and 13th alveolae (counting forward from the hindmost). Nutrient foramina on the outer surface of the left mandible (pl. 14, fig. 2) are located below the 6th, 9th, and 12th alveolae.

The slope of the dorsal margin of each ramus from the coronoid process to the hindmost alveola corresponds closely with that of USNM 13471, although the dorsal border of this process is less noticeably thickened. The distance from the apex of the coronoid process of the left mandible to the hindmost alveola is 139 mm.

The large orifice for the dental canal on the inner surface of the mandible was located at least 35 mm. behind the level of the hindmost alveola. The ventral borders of both mandibles are incomplete in the region of the angle. Both condyles are unusually narrow, the transverse diameter being 16 mm., and the dorsoventral axis (33 mm.) of each condyle is directed obliquely outward.

MEASUREMENTS OF MANDIBLES (IN MILLIMETERS)

| | Right | Left |
|--|-------|-------|
| Length of mandible (as preserved) from condyle to anterior end | 318.+ | 321.+ |
| Length of symphysis (as preserved) | 39.+ | 43.+ |
| Vertical diameter of mandible at hindmost alveola | 38.5 | 38.5 |
| Transverse diameter of mandibles at posterior end of symphysis | | 40.± |
| Vertical diameter of mandible at level of posterior end of symphysis | 25.0 | 25.0 |
| Vertical diameter of mandible through coronoid process | 73.+ | 83.0 |
| 11 posterior teeth located in an interval of | 113.0 | 110.0 |
| 12 posterior teeth located in an interval of | 131.0 | 121.0 |
| Anteroposterior diameter of largest alveola | 8.0 | 8.0 |
| Transverse diameter of largest alveola | 7.0 | 7.0 |
| Distance from posterior end of symphysis to hindmost alveola | 115.0 | 110.0 |
| Distance from apex of coronoid process to hindmost alveola | | 139.0 |
| Distance that orifice of dental canal is located behind hindmost alveola | 35.± | 35.± |
| Distance from posterior end of symphysis to posterior surface of condyle | 282.0 | 283.0 |
| Height of condyle | 33.0 | 29.± |
| Transverse diameter of condyle | | 16.0 |
| Least distance between alveolae in tooth rows | 2.0 | 2.0 |

TEETH

The two teeth in the left mandible (the ninth and tenth, counting forward from the hindmost) have the apical portions of the crowns curved inward. The ninth tooth in the left mandible (pl. 16, fig. 9) has the basal 2 to 3 mm. of the enamel on the circumference of the crown ornamented with low tongue-like projections extending more or less vertically from the basal border, although this sculpturing is more pronounced on the internal than on the other faces. The anterior and posterior edges of the internal face are delimited by a low carina that extends to or nearly to the apex of the crown.

On the 10th tooth the anterior vertical carina is definitely on the anterior face of the crown, while the posterior carina delimits the internal face. The shallow grooves between the tongue-like projections from the basal circumference extend farther toward the apex of the crown on the internal face (pl. 16, fig. 10) than on the ninth tooth.

On both of these teeth the enamel on the apical portion of the crown is relatively smooth. The measurements of the ninth tooth in the left mandible are as follows: Height of crown, 10.5 mm.; antero-

posterior diameter of crown at base, 5.7 mm.; transverse diameter of crown at base, 5.6 mm.; maximum diameter of root, 7.0 mm.

The crown of the 10th tooth (counting forward from the hindmost) in the right mandible has been broken off except for a portion of the basal inner surface. The sculpturing this basal portion of the enamel surface agrees with the teeth in the left mandible.

Referred Specimen II

USNM 20732: Two dorsal and one caudal vertebrae, one anterior rib, eleven teeth, and left tympanic bulla. Collector, Norman H. Boss, July 1920.

HORIZON AND LOCALITY: Green marl, one mile south of Chesapeake Beach, Calvert County, Md. Calvert formation, upper Miocene.

TEETH

Eleven teeth were associated with the three vertebrae and one rib. Most of the teeth are essentially complete, although the crowns of four are worn to varying degrees. These teeth, unlike those of *Tretosphys gabbi* and *Delphinodon dividum*, have the enamel on the crown very lightly ornamented, and the anterior teeth have noticeably elongated and nearly straight roots.

To emphasize the differences existing between these teeth and those of *Tretosphys gabbi*, the most obvious characteristics of the latter may be summarized as follows: A number of the teeth possess a vertically directed denticulated carina on the outer surface of the crown, while others have the enamel on this surface ornamented with fine striae; the posterior teeth, at least, have a fairly large accessory cusp with a serrated cutting edge near the base of the posterior face; and the inner surfaces of the crowns of many of the posterior teeth are more noticeably rugose. In comparison to *Delphinodon dividum*, the teeth of this porpoise possess gibbous roots with a more pronounced curvature, and the posterior ones lack the strongly developed accessory cusps on the inner face of the crown.

On seven of the teeth the narrow basal border on the enamel of the inner face of the crown is slightly elevated and the irregular upper edge of this border appears to the eye to be indistinctly sculptured. The crown curves inward and is not markedly compressed antero-posteriorly. Two of the teeth have a pair of upwardly diverging carinae that originate on one tooth (pl. 16, figs. 1, 8) in a series of slightly elevated rugosities on the basal portion of the posterior face of the crown, and on the other tooth (pl. 16, figs. 2, 6) near the middle of the height of the posterior face of the crown. Both of these teeth

possess a small tubercle above the base of the crown on the posterior basal angle. One tooth (pl. 16, figs. 3, 7) has, in addition, a very small cusp above the basal cusp on the posterior face. With the exception of the elongated anterior teeth the outer face of the enamel crown of most of the teeth is lightly sculptured near the base. Four teeth have a faint carina on the outer face extending from the base toward the apex of the crown. On most of the teeth, however, the enamel on the crown above the lightly ornamented basal portion is relatively smooth (pl. 16, fig. 7). The ratio of the height of the enamel crown varies considerably, being equivalent to less than 18 percent of the length of the longest tooth and to less than 28 percent of the shortest tooth.

The roots of the two elongated teeth (pl. 16, fig. 5) are nearly straight, while those of the other teeth are more or less curved. The roots of the posterior teeth are expanded below the crown and taper toward the extremity. The swelling is most noticeable on the upper third of the root (pl. 16, fig. 3) of six of the teeth and on the upper half of the others (pl. 16, fig. 2). Most of the roots are compressed from side to side near the extremity. The elongated teeth were implanted presumably at the extremity of the rostrum, since similarly elongated teeth have been recorded for *Kentriodon pernix* (Kellogg, 1927, pl. 8, fig. 1).

Among the unfigured teeth there are four that exhibit deviations from those described above. Under visual examination the enamel on the crowns of these teeth appears to be rather smooth, but when magnified 4 to 10 times the ornamentation described below can be seen.

One complete tooth, 34 mm. in length, has the basal 3 mm. of the enamel on the circumference of the crown wrinkled or more precisely ornamented with low tongue-like projections extending more or less vertically from the basal margin, as well as a faint vertical carina on the posterior side of the internal face, and a similar carina on the anterior side of the external face. This ornamentation of the enamel around the basal circumference of the crown is similar to that of the teeth in the left mandible (pl. 16, figs. 9, 10).

Another essentially complete tooth, 31.5 mm. in length, although worn on the posterior face, has a similar but less well developed ornamentation on the circumference of the base of the crown, in addition to a number of fine irregular vertical carinae spaced approximately 2 to 3 mm. from one another on all sides of the preserved portion of the crown.

A somewhat longer tooth, 37 mm. in length and lacking the posterior half of the crown, has a carina on the anterior edge of the internal face and a faint oblique carina on the anterior face in addition to short

oblique wrinkles extending upward about 2 mm. above the basal margin.

A fourth tooth, 28 mm. in length and lacking the external face of the crown, possesses rugosities above the base on the anterior, internal, and posterior faces. At least four or five vertical carinae extend from these basal rugosities toward the apex of the crown.

MEASUREMENTS OF TEETH (IN MILLIMETERS)

| | Posterior (pl. 16, fig. 1) | Posterior (pl. 16, fig. 2) | Posterior (pl. 16, fig. 3) | Posterior (pl. 16, fig. 4) | Anterior (pl. 16, fig. 5) |
|--|----------------------------------|----------------------------------|----------------------------------|----------------------------------|---------------------------------|
| Greatest length (as preserved) | 34.2 | 33.4+ | 32.4+ | 29.5 | 45.6 |
| Length of root | 24.4 | 22.0+ | 21.8+ | 20.4 | 36.4 |
| Greatest diameter of root | 9.8 | 10.0 | 9.0 | 9.4 | 10.2 |
| Height of crown | 10.4 | 10.0 | 10.5 | 8.1 | 8.0 |
| Greatest anteroposterior diameter of crown | 5.3 | 5.2 | 6.8 | 4.9 | 5.2 |
| Greatest transverse diameter of crown | 6.2 | 6.1 | 7.0 | 5.0 | 4.5 |

TYMPANIC BULLA

This left tympanic bulla is slightly larger than that of *Kentriodon pernix* (Kellogg, 1927, p. 28, pl. 1, figs. 2, 5). It lacks most of the outer lip, its processes, and the posterior apophysis. When viewed from the ventral side, the posterior portion is seen to be characterized by a deep groove, the anterior portion is depressed on the outer half, and the profile of the inner surface is more convex than that of *Kentriodon pernix*. The conformation of the involucrem is similar to that of *K. pernix* except that it is more attenuated anteriorly. The greatest length of this bulla is 35 mm., and the greatest width of the involucrem posteriorly is 13 mm.

DORSAL VERTEBRAE

The two dorsal vertebrae associated with the eleven teeth resemble *Tretosphys gabbii* in the dorsoventral elongation of the neural canal. One of them (pl. 15, fig. 1) is considered to be the fourth in the dorsal series. This vertebra differs from the anterior dorsal of *T. gabbii* in having a larger centrum, more closely approximated prezygapophysial facets, more robust diapophyses, and a slightly narrower neural canal.

The deeply concave lateral surface of the centrum (pl. 15, fig. 4) is continuous with the depression on the outer surface of the pedicle of the neural arch. As contrasted with the anterior face of the centrum, the posterior face (pl. 15, fig. 7) is noticeably wider (39.5

mm.). Dorsally the centrum is deeply depressed, and medially a small foramen is located on each side of the thin longitudinal ridge. An elongated facet for the capitulum of the following rib is located on the upper posteroexternal angle of the centrum.

The diapophyses are rather large and the subpyriform facet for the tuberculum of the corresponding rib slopes obliquely downward and inward. The prezygapophysial facets are ovoidal in outline, elongated anteroposteriorly (17 mm.), closely approximated to one another, and slope very slightly from outer to inner margins. The postzygapophysial facets are narrow (maximum width 9 mm.), elongated anteroposteriorly (20 mm.), and slope slightly toward inner margins.

The neural spine is broken off above the base and the backwardly projecting dorsal portion of the neural arch is relatively wide posteriorly (28 mm.). The anterior edge of each pedicle of the neural arch is nearly vertical, while the posterior edge slopes upward and forward. The neural canal is narrow and high.

The eighth dorsal (pl. 15, fig. 5) has incomplete metapophyses, the neural spine is imperfectly preserved, and the postzygapophysial facets are broken off.

The interval between the inner margins of the prezygapophysial facets appears to have exceeded that of the fourth dorsal, the neural canal is also wider (22.5 mm.), the backwardly projecting dorsal portion of the neural arch is very narrow, and the width of the posterior face (pl. 15, fig. 8) of the centrum is approximately the same as the anterior face.

The centrum is slightly longer (45 mm.) than broad (41.5 mm.), its ventral keel is rounded, and its lateral surface curves concavely from end to end. The deeply depressed dorsal surface of the centrum is divided longitudinally by a thin ridge.

The diapophyses (or coalesced diapophysis and merapophysis of Abel, 1931) have a deep ovoidal depression on the anterior surface and a similar slightly shallower depression on the posterior surface. The subpyriform lateral facet for the head of the corresponding rib is concave and projects below the dorsal surface of the centrum.

The neural canal is somewhat ovoidal in outline (pl. 15, fig. 2). Although the anterior and posterior edges of the neural spine are eroded, it would appear that it was directed nearly vertically and that it did not slant backwards.

CAUDAL VERTEBRA

With the exception of the distal portion of the neural spine, the metapophyses, the transverse processes, and a portion of the right side of the anterior epiphysis, this caudal (pl. 15, fig. 3) is in a fair

state of preservation. Judging from the dimensions of the centrum and the shape of the neural spine, it seems to be the sixth in this series.

The lateral surfaces of the centrum (pl. 15, fig. 6) are depressed above and below the transverse processes. The convex anterior and posterior surfaces of the centrum appear to have been of nearly equal width. Between the anterior and posterior descending processes the ventral surface of the centrum is deeply depressed and two small foramina are located near the middle of this ventral groove. The posterior facets for the chevron bones are placed obliquely on the posterior surfaces of the large descending processes, but unfortunately the surfaces where the anterior facets were located are eroded.

The right transverse process was broad (36 mm.) at the base and the basal foramen is minute; the corresponding foramen on the left transverse process is normal in size. The pedicles of the neural arch are relatively broad (minimum anteroposterior diameter of right, 31.5 mm.) in comparison to the length of the centrum (58 mm.), and the neural spine is slightly wider near its base than the pedicle. The narrow neural canal measures 14 mm. in height anteriorly.

MEASUREMENTS OF VERTEBRAE (IN MILLIMETERS)

| | D.4 | D.8 | Ca. |
|---|------|------|------|
| Greatest anteroposterior diameter of centrum | 38.5 | 45.0 | 58.0 |
| Greatest vertical diameter of centrum anteriorly | 32.5 | 35.5 | 50.0 |
| Greatest transverse diameter of centrum anteriorly | 33.5 | 41.0 | 50.0 |
| Greatest vertical diameter of neural canal anteriorly | 34.5 | 29.5 | 14.0 |
| Greatest transverse diameter of neural canal anteriorly | 19.0 | 23.0 | 4.0 |
| Least anteroposterior diameter of pedicle of neural arch | 16.0 | 21.0 | 29.0 |
| Distance across vertebra between outer ends of diapophyses | 68.0 | | |
| Distance across vertebra between outer ends of transverse processes | | 75.5 | 71.+ |
| Greatest distance between outer margins of prezygapophysial facets | 28.0 | | |
| Greatest distance between outer margins of postzygapophysial facets | 28.0 | | |

RIB

The neck of the first rib on the left side is flattened, relatively deep, and bears an elongated or ovoidal capitular facet at the extremity. The larger tubercular facet is also elongated and is subtriangular in outline. The rather wide and flattened shaft terminates in a slightly thickened distal end. Between the tuberculum and the angle the widened dorsal edge of the shaft slopes obliquely from posterior to

anterior margin. Behind the level of the tuberculum the shaft is abruptly bent downward.

The length of this rib in a straight line from tuberculum to distal end of shaft is 165 mm.; greatest breadth of shaft at angle, 35 mm.; and greatest breadth of shaft near middle of its length, 26 mm.

III. IDENTITY OF *TRETOSPHYS GABBII* (COPE)

During the year 1868, Prof. E. D. Cope received a miscellaneous collection of vertebrae and other skeletal fragments from a Maryland correspondent, Dr. James T. Thomas. Included among these bones was the caudal vertebra on which Cope based the name *Delphinapterus gabbii*. Cope did not designate a precise locality. From residents of Charles County information has since been obtained relative to the location of the residence of Dr. Thomas near the Patuxent River. Although it can not now be stated with certainty, in all probability this type vertebra and the other specimens described by Cope were found by slaves who were digging shell marl on the De la Brooke estate.

No specimens referable to this species were received by the United States National Museum until 1918, when Dr. Rodney B. Harvey excavated the specimen hereinafter described in the cliff south of Chesapeake Beach, Md.

Genus *Tretosphys* Cope

Tretosphys Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 20, p. 186, 1868.

GENOTYPE: *Delphinapterus gabbii* Cope. (Designated by Hay, U. S. Geol. Surv. Bull. 179, p. 591, 1902.)

DIAGNOSIS: Mandibles strong, with symphysis firmly ankylosed, V-shaped in cross section, attenuated gradually toward anterior end and with anterior half of its length bowed upward; lateral surfaces of symphysis rugose; opposite free hinder portions of mandibles form an acute angle at level where they ankylose as symphysis; 14 teeth located on left mandible anterior to posterior end of symphysis; 2 teeth directed forward and upward at extremity of each ramus; roots of other teeth on symphysis implanted obliquely in alveolae, which slope more noticeably backward than inward; alveolae relatively large, closely approximated, those in right ramus larger than those in left ramus, and consequently teeth in the two rows were not opposite; teeth single rooted; anterior teeth have relatively smooth enamel on anteroposteriorly flattened crowns that curve inward and backward; teeth from near middle of tooth rows have enamel on outer surface of crown ornamented with fine striae; crowns

of posterior teeth variable, but wider anteroposteriorly in proportion to height; some have a fairly large accessory cusp with denticulated cutting edge at base posteriorly, others have three or more tubercles, one above the other, and many have a rugose or coarsely sculptured internal face.

Basihyal almost hexagonal; thyrohyals dilated beyond basal constriction and tapering toward extremity; stylohyal somewhat flattened and curved slightly from end to end; olecranon process of ulna elongated, with deep notch between it and shaft; dorsal and lumbar vertebrae characterized by high neural canals.

***Tretosphys gabbii* (Cope)**

PLATES 17-21

Delphinapterus gabbii Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 20, p. 191, 1868.

T[retosphys] gabbii Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 20, p. 191, 1868.

TYPE SPECIMEN (USNM 11234): An imperfectly preserved anterior caudal vertebra that lacks the neural spine and transverse processes. Collector, James T. Thomas.

MEASUREMENTS OF TYPE SPECIMEN (Case, 1904, p. 9)

| | |
|---|----------|
| Anteroposterior diameter of centrum | 52.6 mm. |
| Transverse diameter of anterior face of centrum | 40.7 |
| Vertical diameter of anterior face of centrum | 37.4 |
| Transverse diameter of neural canal at base | 4.3 |

HORIZON AND LOCALITY: Probably excavated by slaves of Dr. Thomas in marl bed on De la Brooke estate, about 1 mile east of Patuxent, Charles County, Md. Calvert formation, upper Miocene.

REFERRED SPECIMEN (USNM 10709): Ankylosed symphysis of mandibles, length 170 mm.; section of the left mandible posterior to symphysis, with 3 teeth, length 66 mm.; section of right maxillary, with 3 teeth, length 138.5 mm.; 2 pieces of premaxillary; 54 detached teeth; basihyal, left thyrohyal, and incomplete left stylohyal; fourth dorsal and an anterior lumbar vertebrae; left ulna; proximal end of radius; 1 carpal; 1 phalange; and 4 rib fragments. Collector, Dr. Rodney B. Harvey, June 23, 1918.

HORIZON AND LOCALITY: In a yellowish white diatomite with considerable content of fine grained sand, presumably referable to Zone 5, about six feet above the oyster (*Ostrea percrassa*) layer, one-half mile south of old Chesapeake Beach wharf (and 135 yards south of Marinelli's place), Calvert County, Md. Among the diatoms recognized by Paul S. Conger in the matrix are: *Coscinodiscus obscurus* A. Schmidt, *Coscinodiscus lewisianus* Greville, *Coscinodiscus perforatus* Ehrenberg, *Actinoptychus undulatus* (Bailey?), *Actinocyclus monili-*

formis Ralfs, *Melosira sulcata* Ehrenberg, and *Sceptroneis caduceus* Ehrenberg. Calvert formation, upper Miocene.

MANDIBLES

The mandibles (pl. 17, fig. 1) are represented by a fairly complete symphysis and a 69 mm. fragment of the left ramus posterior to the hinder end of the symphysis. The upward curvature of the anterior end as well as the greater length of the symphysis distinguish these mandibles from those of *Delphinodon dividum*. Since the braincase and the hinder portions of both mandibular rami were not preserved, no estimate can be made of the total length of either mandible. Other Calvert Miocene porpoises, with the exception of *Zarhachis*, *Schizodelphis*, *Eurhinodelphis*, and related forms, have 11 to 14 teeth located in each mandibular ramus behind the fork of the symphysis. On this basis each mandible may have held from 25 to 28 teeth.

Although the symphyseal portion of the mandibles is firmly ankylosed, a narrow groove extending the length of the symphysis marks the contact of the opposite rami dorsally and ventrally. The anterior half of the symphysis is bowed upward and its anterior end is obliquely truncated. There are 16 alveolae in the left mandibular ramus, of which 14 are located on the symphysis. The alveolae diminish in size toward the anterior extremity, although those in the right mandible average larger. Two teeth were directed forward and upward at the extremity of each ramus. The largest alveola (the fifth counting forward from hinder end of symphysis) in the right mandible measures 9.5 mm. anteroposteriorly and 8 mm. transversely. At the alveolar border the alveolae on the symphysis are separated by thin septal walls and the alveolae in the two series are not located opposite one another.

The dorsal surface of the symphysis is relatively flat transversely to and including the anterior end, the interval between opposite alveolae being 20.5 mm. at the level of the third pair of teeth (counting forward from posterior end of symphysis) and 13 mm. at level of 11th pair of teeth.

The largest nutrient foramen is located on the outer surface of the left mandible (pl. 17, fig. 2) 14 mm. below the rim of the fourth alveola (counting forward from posterior end of symphysis). Smaller foramina are discernible below the sixth and seventh alveolae. A larger foramen is located on the right and left mandibles below the 11th alveolae within 3 mm. of the midline of the ventral face of the symphysis. Short grooves extend forward from each of these foramina. A cross section of the symphysis resembles a wide, open V.

The depth of the left mandible in its present condition at the posteriormost alveola was approximately 40 mm., although crushing may have distorted the ramus to some extent. The opposite free posterior portions of the mandibles come together at an acute angle (25°) at the symphysis.

MEASUREMENTS OF MANDIBLES (IN MILLIMETERS)

| | |
|---|-------|
| Greatest length of ankylosed symphyseal portion of mandibular rami | 147.0 |
| Greatest length of right mandibular ramus, including symphysis | 170.0 |
| Transverse diameter of ankylosed symphysis at posterior end | 43.0 |
| Vertical diameter of ankylosed symphysis at level of posterior end | 27.0 |
| Transverse diameter of ankylosed symphysis 20 mm. behind anterior end | 28.0 |
| Vertical diameter of ankylosed symphysis 20 mm. behind anterior end | 23.0 |
| Interval containing 14 alveolae in left mandibular ramus (counting forward from hindmost) | 146.0 |

ROSTRUM

The rostrum (pl. 17, fig. 3) is represented by a 136 mm. piece of the posterior palatal portion of the right maxillary, a 70 mm. piece of the right premaxillary, and a 115 mm. piece of the left premaxillary. The roots of three teeth are in place in the maxillary, but lack crowns. On this portion of the maxillary there were at least six alveolae anterior to these teeth and three alveolae posterior to them. Inasmuch as the inner margin of this right maxillary is complete, the width of the rostrum at the level of the anterior ends of the palatine bones can be estimated as approximately 85 mm. The tapering maxillary fragment also indicates that the palate narrowed rapidly anteriorly.

TEETH

These teeth (pls. 20, 21) are somewhat similar to those of *Delphinodon dividum* described and figured by True (1912, pp. 171-174, pl. 19, figs. 1, 2; pl. 26, figs. 1-20). They differ in part from the teeth of *D. dividum* in being larger and in having the crowns of the long anterior teeth more noticeably compressed anteroposteriorly. Further comparison is not necessary with most of the species described from the Miocene of either Maryland or Virginia.

There are 54 fairly complete teeth, though none are entirely so. The enamel on the inner surface of the crowns is somewhat variable in ornamentation. Nevertheless, this ornamentation of the enamel on the crown, with other characters, serve as an indication of the position of the teeth in the jaws. They group themselves naturally as follows:

Eighteen are posterior teeth with accessory cusps and tubercles, of which three were in place in the mandible. On most of these teeth the apex of the crown curves inward and backward. Five teeth, presumably from near the middle of the tooth rows, have the enamel on the outer surface of the crown ornamented with fine striae. There are 28 anterior teeth having crowns with nearly smooth enamel, although a number of them have a fine, vertically directed carina on the outer surface.

The anteriormost teeth (pl. 21, figs. 7, 8) are characterized by an elongated root, high anteroposteriorly compressed and inwardly recurved crown, and several irregular striae on the basal half of the outer face.

A few of the posterior teeth (pl. 20, figs. 2, 6; pl. 21, fig. 2) possess a thin denticulated and curved carina on the external face of the crown extending to or almost to apex of the main cusp in addition to one or more accessory tubercles on the posterior face as well as a row of fine denticles. Other posterior teeth (pl. 20, fig. 4; pl. 21, fig. 3) are characterized in part by the presence on the posterior face of a fairly large accessory cusp that has a denticulated cutting edge and one or more smaller tubercles. This posterior cusp varies considerably in size and shape, but is set off sharply from the main cusp of the crown. At least three of these teeth (pl. 20, fig. 7) have three or more small tubercles, one above the other, on the posterior cutting edge. One tooth has a well defined and distinct cusp above the base of the crown on both the anterior and posterior faces. The ornamentation of the enamel on the inner face of the crown of these posterior teeth (pl. 21, figs. 3-5) is rugose to a varying degree. On most of these teeth the rugosities on the enamel of the inner face terminate about 2 mm. above the base of the crown and are arranged in more or less vertical striae, of which there are on some teeth five or six. On others there is a less definite arrangement of these minute denticles. Several teeth have the enamel (pl. 20, fig. 3) on the inner face of the crown ornamented with minute denticles, the sculpturing being rather coarse above the relatively smooth base of the crown. The enamel on the outer face of the crown is either relatively smooth or rather faintly striated. The teeth located near the posterior end of the tooth rows have shorter and wider crowns than the anterior teeth, and the apical portion of the main cusp is curved either backward or inward.

There is an evident transition to a few intermediate teeth (pl. 21, figs. 1, 6). On these teeth the development of the tubercles is much less obvious, the crown is longer and differently curved as well as compressed or flattened in an anteroposterior direction. The enamel on the crowns of most of these teeth is somewhat smoother than on the posterior teeth and the crowns are longer and rather slender.

The outer face of the crown has two or more obliquely directed striae that do not extend to the apex of the main cusp. Two teeth (pl. 20, fig. 2) have a lightly denticulated carina on the posterior face of the crown and a small tubercle at the basal angle; the enamel is smooth, not rugose. The external carina does not bifurcate on either tooth.

As regards most of the anterior teeth, the crowns are anteroposteriorly flattened, the more or less conical apices of the main cusps are incurved, and the enamel is rather smooth internally. The anterior and posterior faces are flat, as if the adjoining teeth were crowded or touching one another in the tooth row. On some of these teeth there is one long and occasionally two or more shorter striae on the outer face of the crowns curving in the direction of the apex.

Immediately below the enamel on the base of the crown and above the enlargement, the root on some of the teeth is slightly constricted. The tapering and variously shaped roots of most of the teeth are more or less curved and most of them are strongly bent backward near their extremities. The majority of these teeth have the apices of the crowns, as well as some of the cusps, well worn. On some of the teeth, portions of the enamel surface were chipped off during excavation, and on others the enamel was worn off prior to burial.

A short section of the left mandible has three molars in place, the posterior one being probably the last of the series and the smallest. This tooth has the summit of the crown broken off, but it is decidedly smaller than either of the other two. The crown was small and no cusps were present. The two teeth in front of this tooth, each of which has the apex of the main cusp worn off, had small curved crowns with a well defined cusp on the posterior face of the crown. The second tooth possesses, in addition, four minute tubercles on the anterior face, and the third tooth has a cluster of tubercles on the internal face.

A 136 mm. section of the maxillary has three teeth in place, but all three have the crowns broken off. These three teeth occupy an interval of 27 mm. Although the remainder of the alveolae are incomplete, it is evident that eight teeth were located in an interval of 80 mm.

MEASUREMENTS OF TEETH (IN MILLIMETERS)

| | An- terior (Pl. 21, fig. 7) | An- terior (Pl. 21, fig. 8) | Me- dian (Pl. 21, fig. 6) | Pos- terior (Pl. 20, fig. 6) | Pos- terior (Pl. 20, fig. 2) | Pos- terior (Pl. 20, fig. 1) | Pos- terior (Pl. 20, fig. 3) | Pos- terior (Pl. 20, fig. 5) | Pos- terior (Pl. 20, fig. 8) |
|---|--------------------------------------|--------------------------------------|------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Greatest length (as preserved) | 40.5 | 38.0 | 34.3 | 20.0+ | 26.3 | 23.8+ | 26.0+ | 26.0 | 23.5+ |
| Length of root | 29.2 | 27.0 | 25.0 | 10.5+ | 16.5+ | 15.5+ | 18.0 | 18.5 | 16.4+ |
| Greatest diameter of root | 8.2 | 7.8 | 8.3 | | 5.4 | 6.0 | 7.2 | 6.0 | 7.2 |
| Height of crown | 11.3+ | 10.0 | 8.5 | 10.0 | 9.5 | 7.7 | 8.0 | 7.8 | 7.7 |
| Greatest anteroposterior diameter of crown | 5.8 | 5.5 | 6.2 | 6.0 | 5.4 | 6.0 | 7.5 | 7.4 | 6.0 |
| Greatest transverse diameter of crown | 6.9 | 6.8 | 6.8 | 5.8 | 6.0 | 6.0 | 6.5 | 6.0 | 6.7 |

HYOID BONES

The basihyal, the left thyrohyal, and the portions of the left stylohyal were associated with pieces of the skull. These hyoid bones resemble somewhat those of *Delphinodon dividum* (True, 1912, pl. 25, figs. 5, 18).

The central basihyal (pl. 18, fig. 1) is almost hexagonal, rather thin dorsoventrally, and dorsally exhibits a concave curvature from side to side. The ventral surface is raised transversely to form a poorly defined ridge. The ceratohyals were not preserved but were attached to two short irregular projections on the anterior border.

The rather broad and dorsoventrally compressed lateral wings (thyrohyals), which were not ankylosed to the basihyal, curve upward and backward but are not bent downward distally. The left thyrohyal (pl. 18, fig. 2) is thickened at the base where attached to the basihyal, dilated medially, more or less flattened on the ventral face, and tapers toward the extremity.

The left stylohyal (pl. 18, fig. 3) is represented by five fragments, which, when fitted together, indicate a length of 105 mm. It is widened near the middle and curved slightly from end to end. The anterior face is rounded and the posterior face is compressed, imparting a somewhat ovoidal shape to the stylohyal in cross section near the middle of its length. The rugose, dorsoventrally compressed distal end of the stylohyal normally fits into a depression on the ventral border of the exoccipital, and the elliptical proximal end has its long axis at right angles with the shaft of the bone. At 35 mm. from the proximal end, the stylohyal was at least 12 mm. thick.

MEASUREMENTS OF THE HYOID BONES (IN MILLIMETERS)

| | |
|---|-------|
| Greatest anteroposterior diameter of basihyal | 45.0 |
| Greatest transverse diameter of basihyal | 56.0 |
| Greatest length of left thyrohyal | 81.0 |
| Greatest width of left thyrohyal beyond base | 28.0 |
| Greatest length of stylohyal | 105.± |
| Greatest width of stylohyal | 19.0 |

VERTEBRAE

Two vertebrae which are characterized by unusually high and narrow neural canals were found associated with the mandibles and other skeletal elements. One of them is an anterior dorsal vertebra (pl. 19, fig. 1), possibly the fourth or the fifth. This vertebra differs from the corresponding dorsal vertebrae of *Delphinodon dividum* in having a relatively high and narrow neural canal and a relatively longer centrum (length, 35 mm.) as compared to its width anteriorly

(33 mm.). The ventral surface and the lower portion of the right side of the centrum is missing, the hinder portion of the left diapophysis is broken off, and the neural spine is incomplete. The posterior surface (36 mm.) is slightly wider than the anterior surface (33 mm.) of the centrum, the prezygapophysial facets are flattened and slope slightly from the external to the internal margins, the long axis of the facet for the tuberculum on the diapophysis is nearly horizontal, and the facet for the capitulum of the following rib is located on the centrum at the upper posteroexternal angle. Although the neural spine is broken off above the base, the curvature of the posterior edge suggests that it was quite similar in conformation to that of *Delphinodon dividum*. The backwardly projecting dorsal portion of the neural arch is elongated anteroposteriorly (31 mm.) and relatively wide (approximately 30 mm.). The postzygapophysial facets are elongated anteroposteriorly and slope obliquely downward and inward. The slope from the dorsoexternal margin of the diapophysis to the inner margin of the prezygapophysial facet is more noticeably oblique, as contrasted with the horizontal position of these surfaces of *Delphinodon dividum*. The diapophysis on each side of the neural arch bears a broad ovoidal articular facet for the tuberculum of the corresponding rib. The pedicles of the neural arch slope obliquely upward and forward. The deeply concave lateral surface of the centrum is continuous with the depressed outer face of the pedicle of the neural arch. The epiphyses are relatively thin, firmly ankylosed, and concave centrally. The dorsal surface of the centrum is depressed and a minute foramen is located on each side of the thin longitudinal median ridge. The other vertebra is an anterior lumbar (pl. 19, fig. 2) that lacks the anterior epiphysis, transverse processes, metaphyses, and the entire neural spine with the exception of the anterior basal angle. The centrum is longer than broad, its ventral keel is quite sharp and curves concavely from end to end, and the epiphyseal ridges radiate outward from the center of its concave anterior and posterior ends. The transverse processes were approximately 29 mm. broad at the base.

The pedicles of the neural arch are broad (minimum anteroposterior diameter 24.5 mm.), rather flat externally, with concave anterior and posterior margins, and slightly inclined forward. Above the level of the transverse process, and for the most part posterior to the hinder margin of the pedicle of the neural arch, the lateral surface of the centrum is depressed to form a fairly large shallow concavity. Below the transverse process the lateral surface of the centrum is markedly concave from end to end.

The neural canal is narrow and rather high. The dorsal surface of the centrum is depressed medially, and also laterally on each side of the median thin longitudinal carina.

The type is an anterior caudal vertebra, probably the second or third, that lacks the neural spine and the transverse processes except for their basal portions. The anteroposterior diameter of the centrum (52.6 mm.) is greater than its transverse width anteriorly (40.7 mm.). The vertical diameter of the anterior face of the centrum is 37.4 mm. Viewed from the side the lateral surface of the centrum is seen to be depressed between the base of the transverse process and the base of the pedicle of the neural arch, and the ventral profile is markedly concave. On the ventral surface of the centrum two parallel ridges bound a longitudinal groove approximately 8 mm. in width. Each of these ridges is widened posteriorly for articulation with the corresponding chevron bone. A shallow groove extends backward from near the anterior epiphysis above the base of the transverse process but becomes indistinct posterior to the middle of the latter. The basal portions of the transverse processes furnish some indication of their conformation. At the base, the right transverse process is approximately 28 mm. wide. When complete, these transverse processes may have resembled those of the corresponding vertebrae of *Delphinodon dividum*. The neural canal was narrow and rather low, about 8 mm. in height. The pedicles of the neural arch are flat externally, and at the base occupy less than half the length of the centrum. The epiphyses are relatively thin, firmly ankylosed to the centrum, and concave centrally.

A posterior dorsal vertebra (pl. 19, fig. 3), presumably the ninth in the series, that agrees with *Tretosphys gabbii* in size and general characteristics was found by Norman Boss during August 1913 in Zone 11 four feet above the shell band (Zone 10), 1½ miles south of Chesapeake Beach, Calvert County, Md. This vertebra lacks both epiphyses, and the transverse processes and the metapophyses are incomplete.

The posterior surface of the centrum is approximately the same width as the anterior surface, the metapophyses are rather short and slender, and the prezygapophysial facets are reduced in size. The neural spine is rather broad near base (35 mm.), and commencing about 25 mm. above the level of the metapophyses tapers rapidly to extremity. The pedicles of the neural arch are rather broad, and are not noticeably inclined forward. The centrum is longer than broad. Below the transverse process the lateral surface of the centrum is concave from end to end and the ventral surface is pinched-in to form an anteroposterior ridge. The dorsal surface of the centrum is depressed medially, and also laterally on each side of the median

thin longitudinal carina. In height and shape the neural canal of this vertebra conforms to its position between the anterior dorsal and the anterior lumbar vertebrae.

MEASUREMENTS OF VERTEBRAE (IN MILLIMETERS)

| | Anterior dorsal | 9th dorsal | Anterior lumbar |
|---|--------------------|--------------------|--------------------|
| Greatest anteroposterior diameter of centrum | 35. 0 | 41. 5 ² | 51. 5 |
| Greatest vertical diameter of centrum | 29. 0 ¹ | 28. 5 ² | 36. 5 ³ |
| Greatest transverse diameter of centrum | 33. 0 ¹ | 35. 5 ² | 37. 5 ³ |
| Greatest vertical diameter of neural canal anteriorly | 34. 0 | 32. 5 | 22. 0 |
| Greatest transverse diameter of neural canal anteriorly | 27. 0 | 18. 5 | 17. 0 |
| Least anteroposterior diameter of pedicle of neural arch | 13. 0 | 23. 5 | 24. 5 |
| Distance across vertebra between outer ends of diapophyses | 68. 0 | | |
| Distance across vertebra between outer ends of transverse processes | | 56. 0+ | |
| Greatest distance between outer margins of prezygapophysial facets | 36. 0 | | |
| Greatest distance between outer margins of postzygapophysial facets | 29. 5 | | |

1, anteriorly; 2, both epiphyses missing; 3, posteriorly.

FORELIMB

The forelimb is represented by the left ulna, an incomplete proximal end of the radius (pl. 18, fig. 5), one carpal bone (pl. 18, fig. 6), and one phalange (pl. 18, fig. 7). On the proximal end of the radius, the articular surface for the humerus is depressed medially and rounded off internally and the shaft is compressed from side to side, but the facet for articulation with the ulna is broken off. The length of the phalange is 33 mm., the minimum anteroposterior diameter of the shaft 20 mm., and the thickness 7 mm. The measurements of the carpal bone are: Transverse diameter, 27 mm.; vertical diameter, 24.5 mm.; and maximum thickness, 13 mm.

ULNA

The shaft of this left ulna (pl. 18, fig. 4) is quite straight, not noticeably compressed from side to side, and almost elliptical in cross section near the middle of its length. Although the distal end is broken off, the curvature of the anterior and posterior faces indicates considerable expansion distally. The posterior edge of the shaft is rather sharp, while the somewhat rounded anterior face has a shallow groove commencing about 15 mm. below the radial facet and becoming deeper distally. The olecranon is rather large and well developed, pointed dorsally and prolonged ventrally, and its posterior edge is nearly

straight, differing in these respects from that of *Delphinodon dividum* (True, 1912, pl. 25, fig. 4). The sigmoid cavity is rather large, the narrower dorsal portion being bent almost at right angles to the broader ventral articular surface. On the anterior face of the shaft and contiguous with the sigmoid cavity there is a deep facet with a prominent knob at its lower edge for articulation with the radius.

MEASUREMENTS OF ULNA (IN MILLIMETERS)

| | |
|-------------------------------|--------|
| Greatest length of ulna | 104. + |
| Width of ulna near middle | 21. 5 |
| Thickness of ulna near middle | 13. 5 |
| Length of olecranon process | 44. 5 |

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PLATES 1-21



Lophocetus pappus, new species (USNM 15985); Dorsal view of skull.



1



2

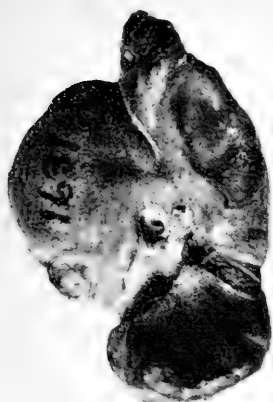
Lophoectus pappus, new species (USNM 15985): 1, lateral view of skull and left mandible; 2, lateral view of skull.



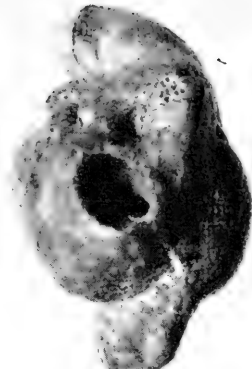
Lophocetus pappus, new species (USNM 15985): Ventral view of skull.



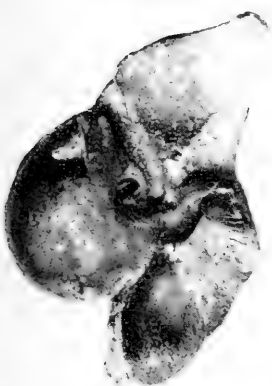
Lophocetus pappus, new species (USNM 15985): 1, dorsal view of mandibles; 2, lateral view of left mandible.



3



6



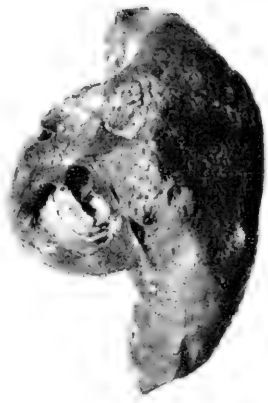
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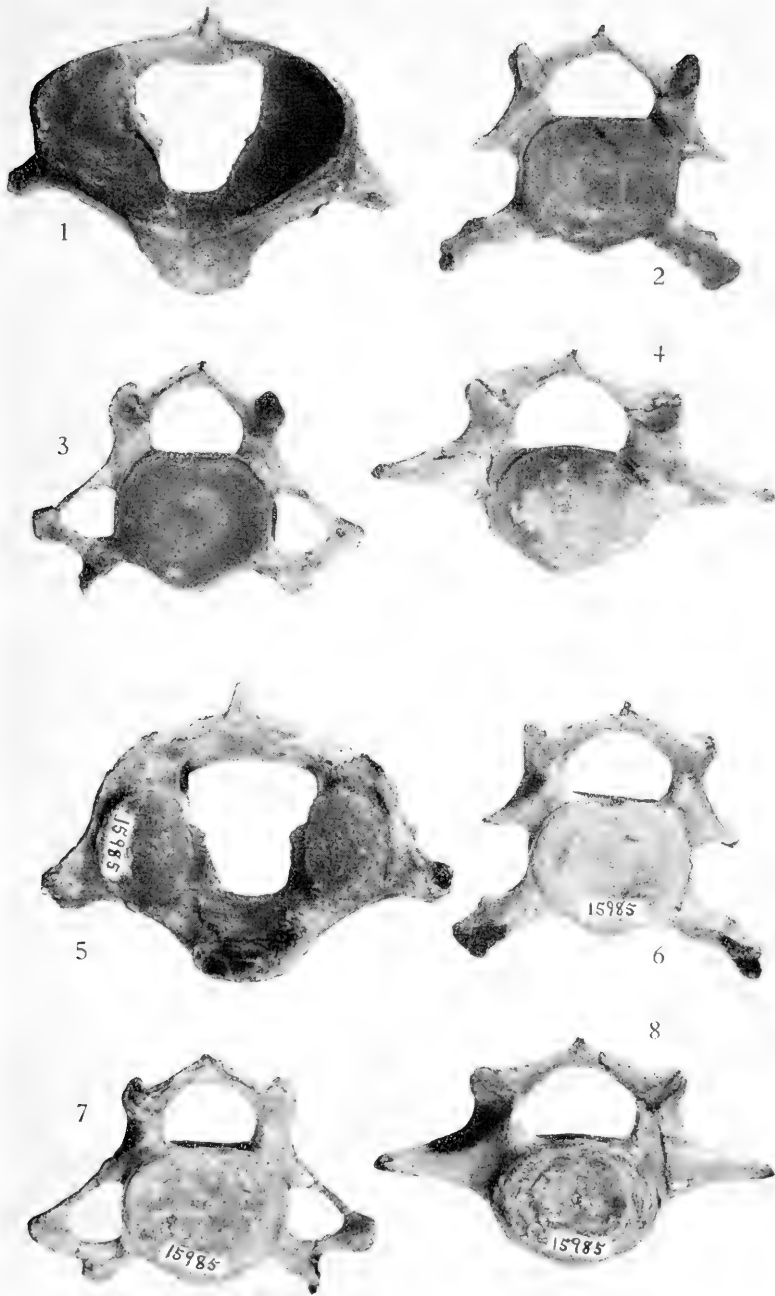


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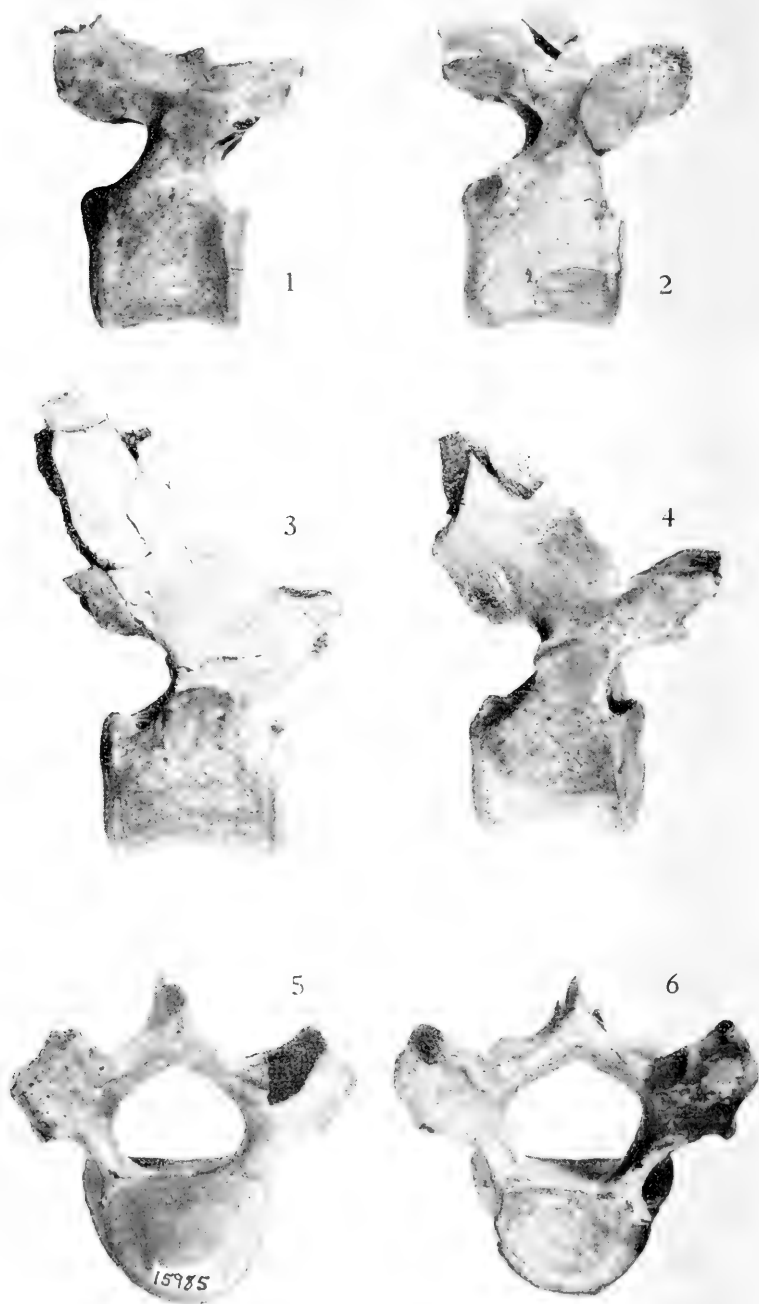
Periotics of *Lophocetus pappus*, new species, and *L. calvertensis* (Harlan): 1, tympanic or ventral view, left periotic, *L. pappus* (USNM 15985); 2, same, right periotic, *L. pappus* (USNM 20659); 3, same, left periotic, *L. calvertensis* (USNM 16314, type); 4 cerebral or internal view, left periotic, *L. pappus* (USNM 15985); 5, same, right periotic, *L. pappus* (USNM 20659); 6, same, left periotic, *L. calvertensis* (USNM 16314, type).



Lophocetus pappus, new species, and *L. calvertensis* (Harlan): 1, external view, left periotic, *L. pappus* (USNM 15985); 2, same, right periotic (USNM 20659); 3, external view, left periotic, *L. calvertensis* (USNM 16314, type); 4, ventral view, right tympanic bulla, *L. pappus* (USNM 15985); 5, dorsal view, right tympanic bulla, *L. pappus* (USNM 15985).



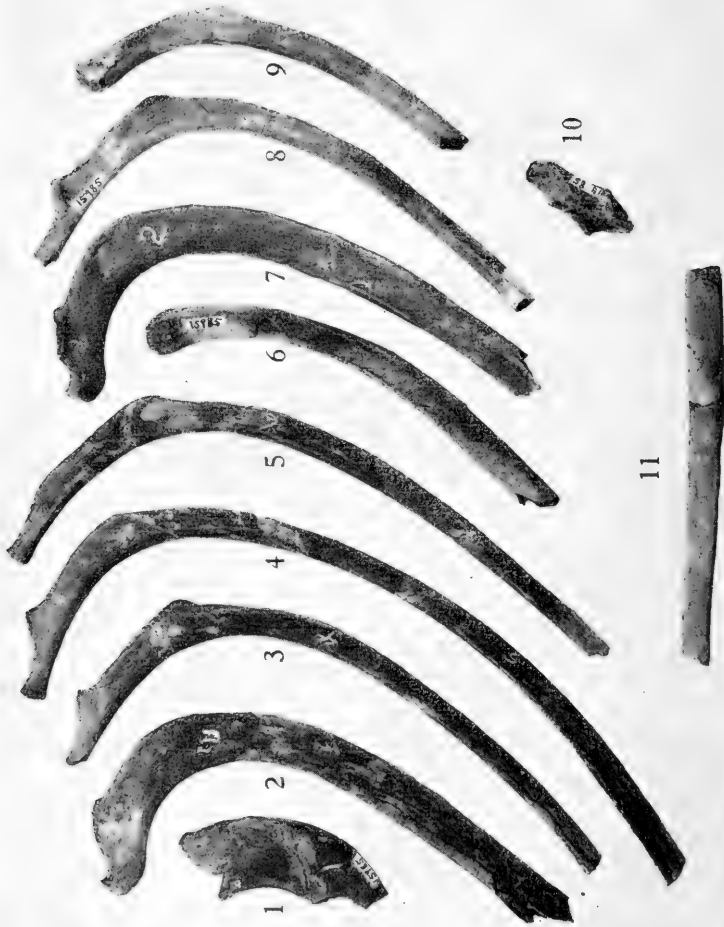
Lophocetus pappus, new species (USNM 15985); 1, anterior view, atlas; 2, same, sixth cervical vertebra; 3, same, fifth cervical vertebra; 4, same, seventh cervical vertebra; 5, posterior view, atlas; 6, same, sixth cervical vertebra; 7, same, fifth cervical vertebra; 8, same, seventh cervical vertebra.



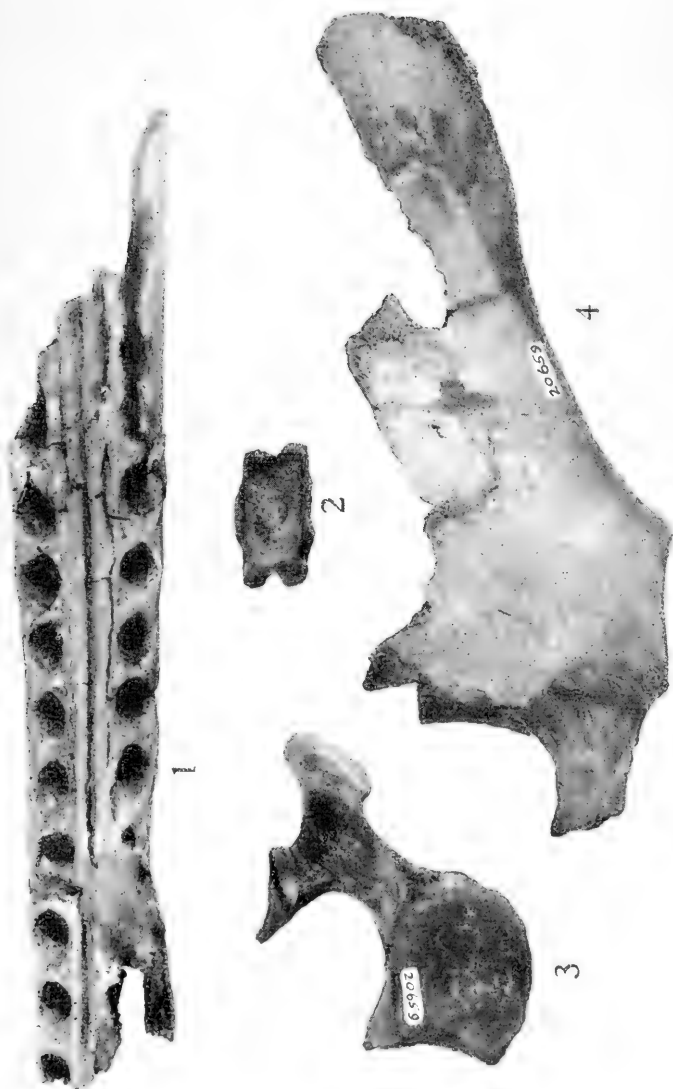
Lophocetus pappus, new species (USNM 15985): 1, lateral view, sixth dorsal vertebra; 2, same, fourth dorsal vertebra; 3, same, tenth dorsal vertebra; 4, same, eighth dorsal vertebra; 5, anterior view, sixth dorsal vertebra; 6, same, fourth dorsal vertebra.



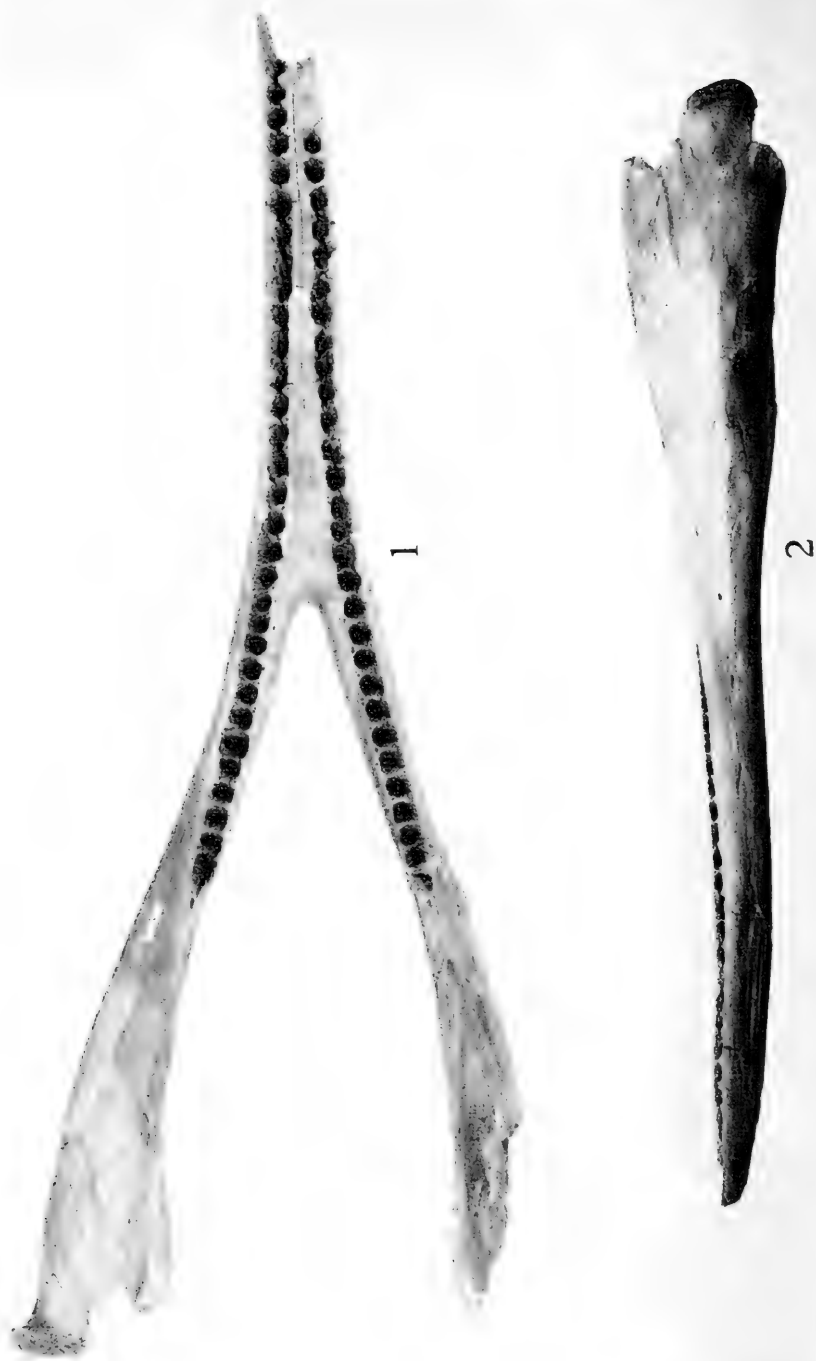
Lophocetus pappus, new species (USNM 15985): 1, posterior view, fourth dorsal vertebra; 2, same, sixth dorsal vertebra; 3, anterior view, eighth dorsal vertebra; 4, posterior view, eighth dorsal vertebra; 5, posterior view, tenth dorsal vertebra; 6, anterior view, tenth dorsal vertebra.



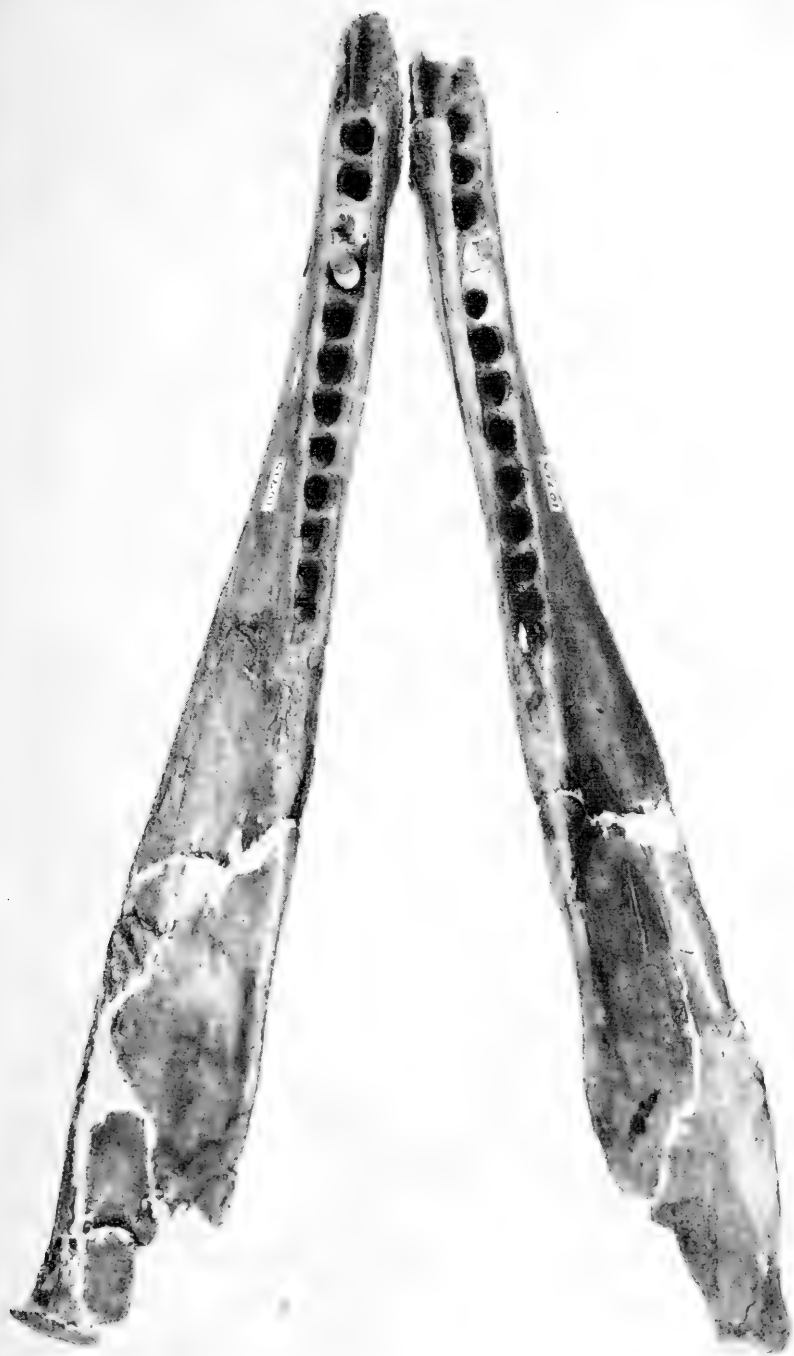
Ribs of *Lophocetus pappus*, new species (USNM 15985): 1, first rib, left; 2, second rib, left; 3, fourth rib, left; 4, fifth rib, left; 5, sixth rib, left; 6, posterior rib, right; 7, second rib, right; 8, fourth rib, right; 9, tenth rib (?), left; 10, third rib, right.



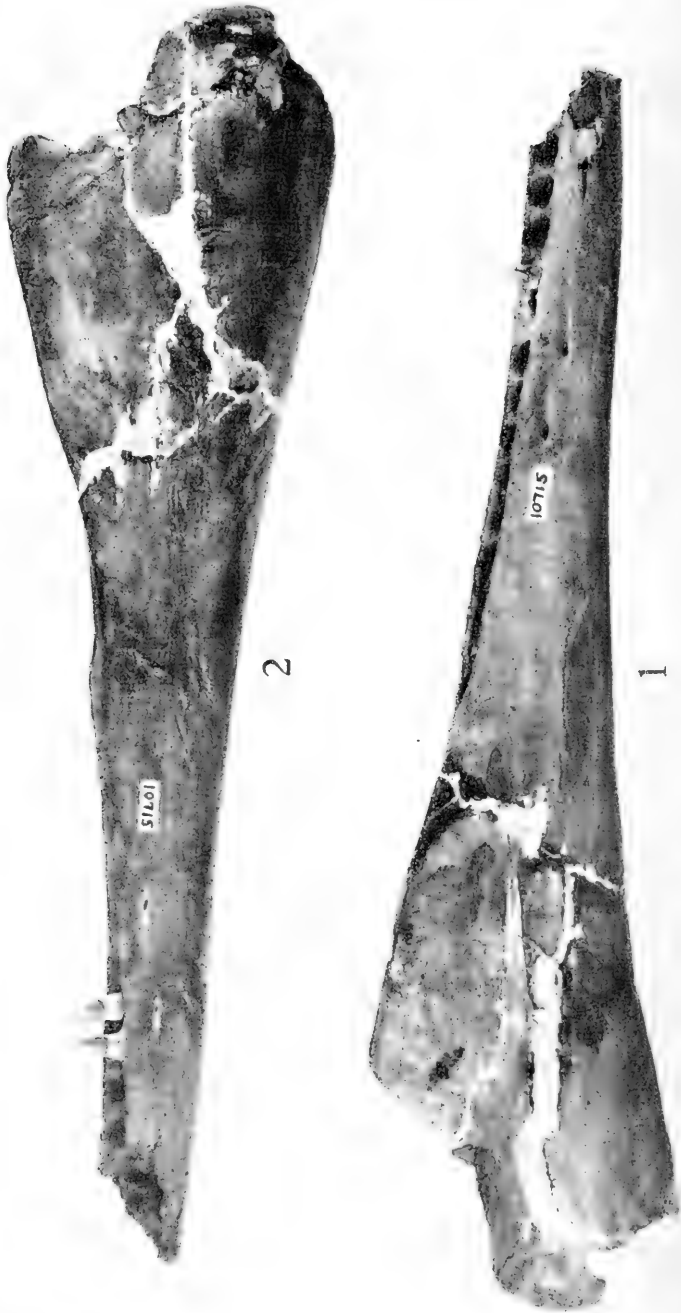
Specimens (USNM 20659) referred to *Lophocetus pappus*, new species: 1, portion of rostrum; 2, posterior caudal vertebra; 3, anterior view of second dorsal vertebra; 4, left scapula.



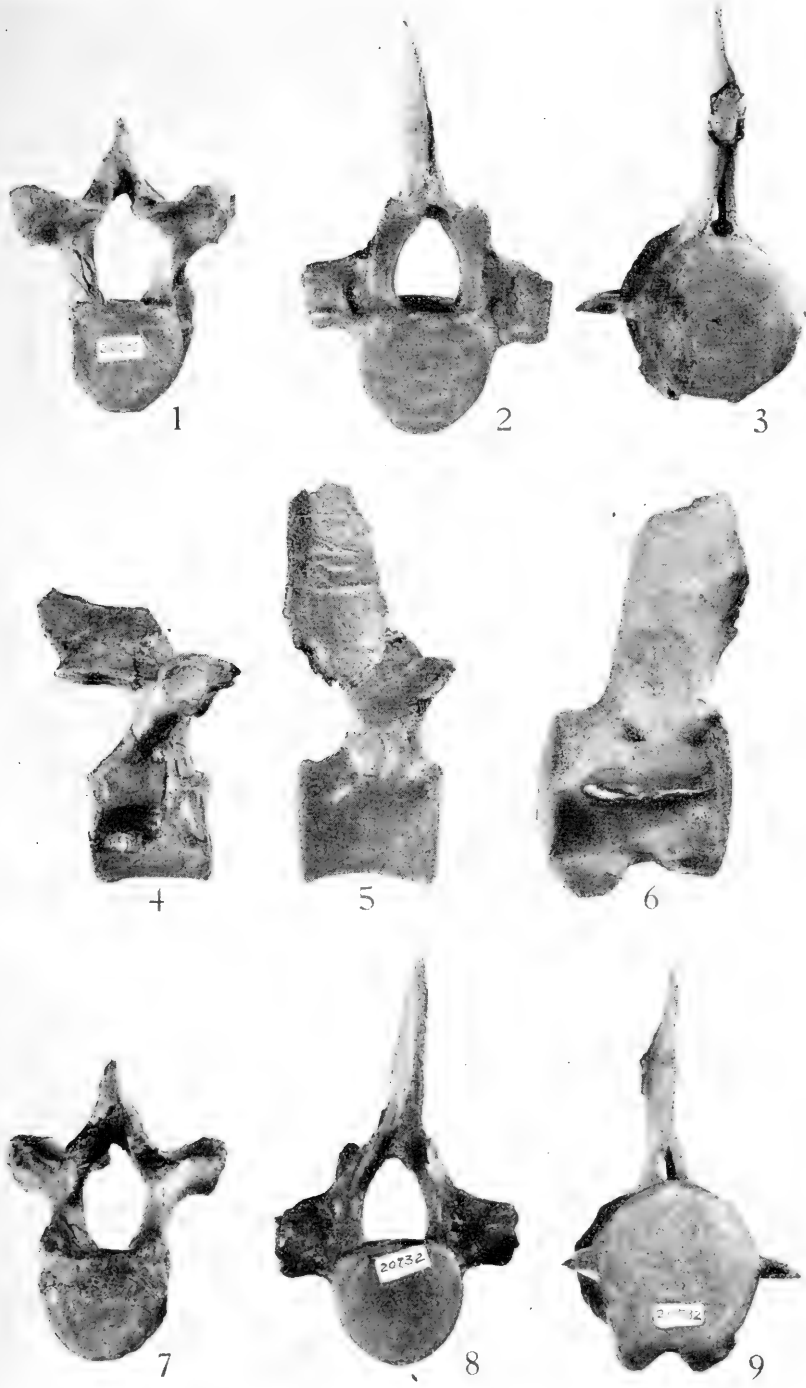
Pelodolphis gracilis, new genus, new species (referred specimen, USNM 13471): 1, dorsal view of mandibles; 2, lateral view, left mandible.



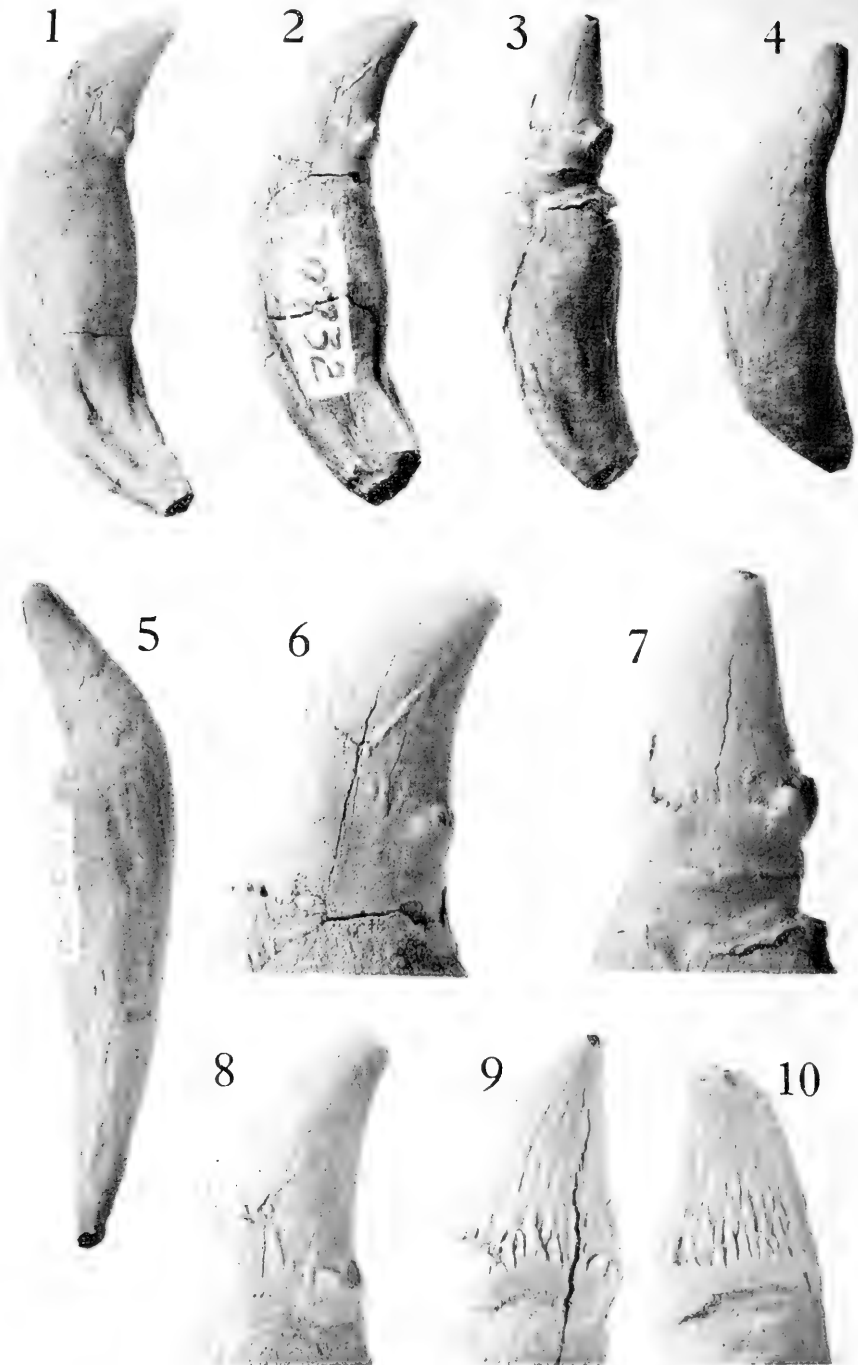
Pelodolphis gracilis, new genus, new species (type, USNM 10715): Dorsal view of mandibles.



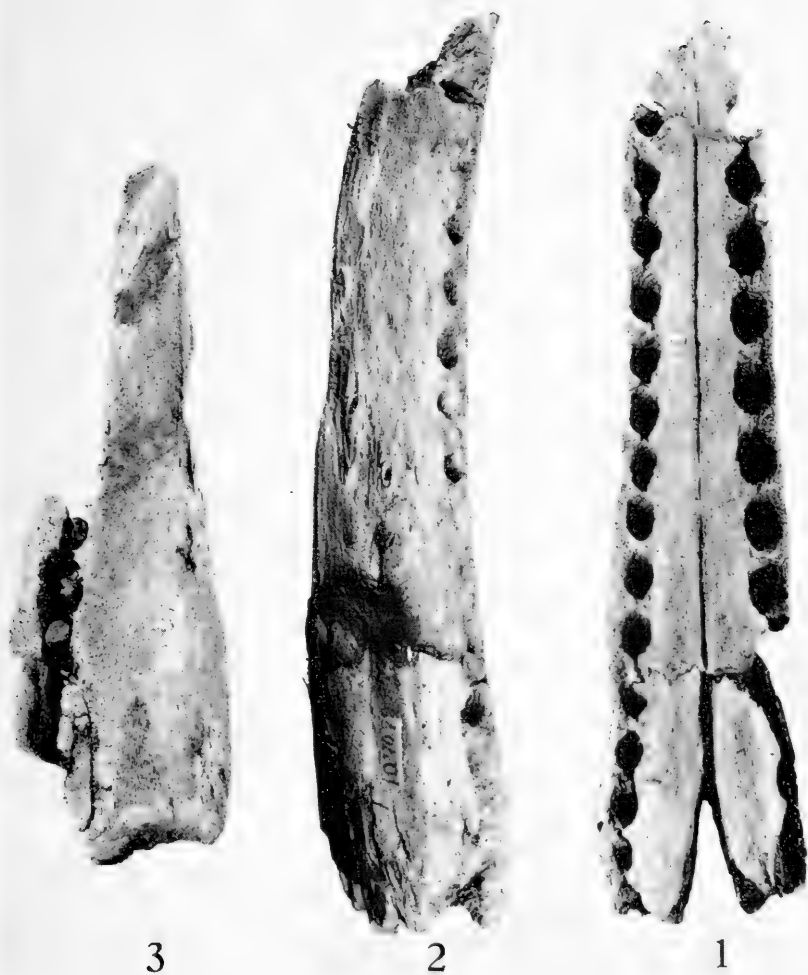
Pelodolphis gracilis, new genus, new species (referred specimen, USNM 10715): 1, lateral view, right mandible; 2, lateral view, left mandible.



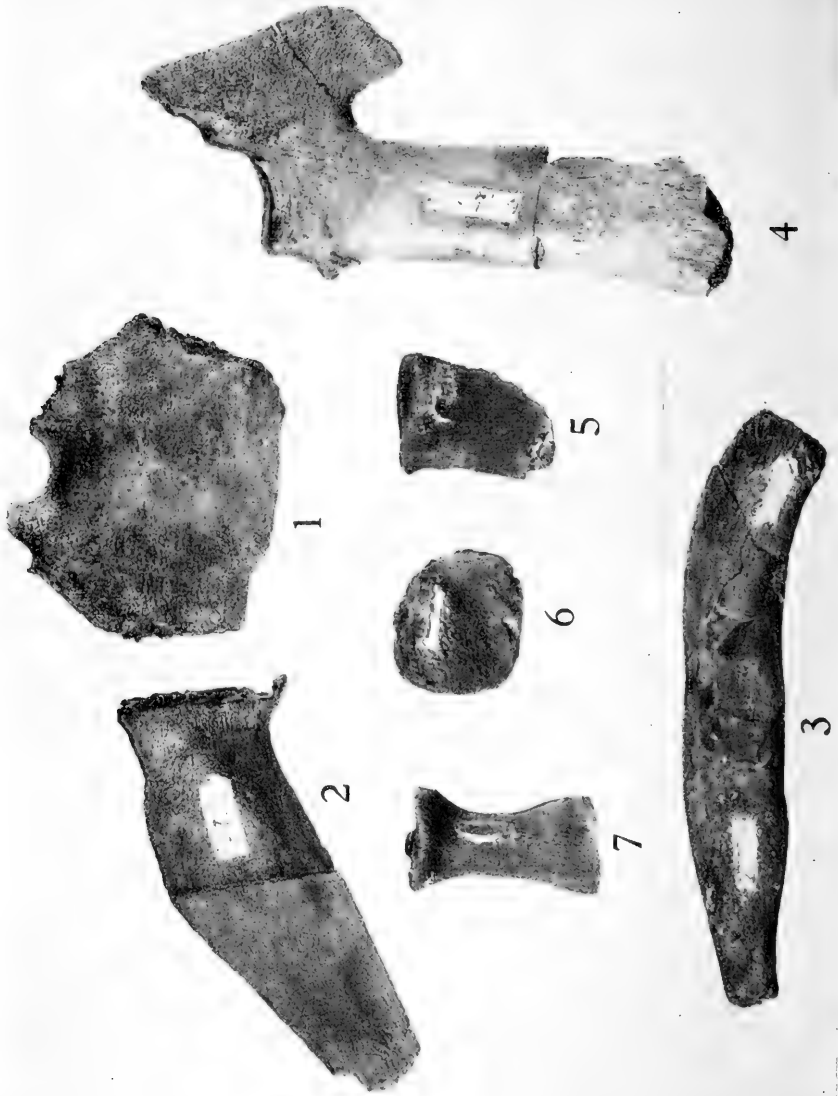
Pelodelphis gracilis, new genus, new species (referred specimen, USNM 20752): 1, anterior view, fourth dorsal; 2, same, eighth dorsal; 3, same, sixth caudal; 4, lateral view, fourth dorsal; 5, same, eighth dorsal; 6, same, sixth caudal; 7, posterior view, fourth dorsal; 8, same, eighth dorsal; 9, same, sixth caudal.



Pelodelphis gracilis, new genus, new species (figs. 1-8, USNM 20732; 9, 10, USNM 10715): 1, posterior tooth, posterior view; 2, same; 3, same, internal view; 4, same, external view; 5, anterior tooth, internal view; 6, posterior tooth, posterior view (enlargement of fig. 2); 7, posterior tooth, internal view (enlargement of fig. 3); 8, same, posterior view (enlargement of fig. 1); 9, ninth tooth (counting from hindmost) of left mandible, internal view; 10, tenth tooth (counting from hindmost) of left mandible, internal view. (1-5 \times 2; 6-10 \times 4.)



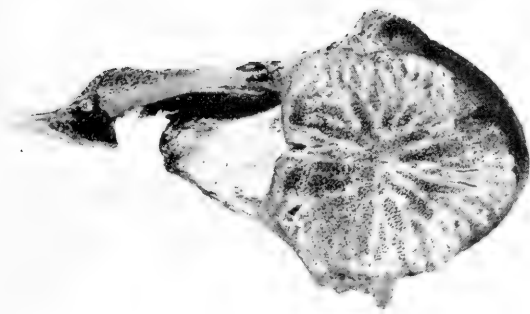
Tretosphys gabbi (Cope) (USNM 10709): 1, dorsal view, symphysis of mandibles; 2, lateral view, symphyseal portion of left mandible; 3, ventral view, right maxillary.



Tretosphys gabbi (Cope) (USNM 10709): 1, basihyal; 2, left thyrohyal; 3, left stylohyal; 4, left ulna; 5, radius; 6, carpal; 7, phalange.



1



2

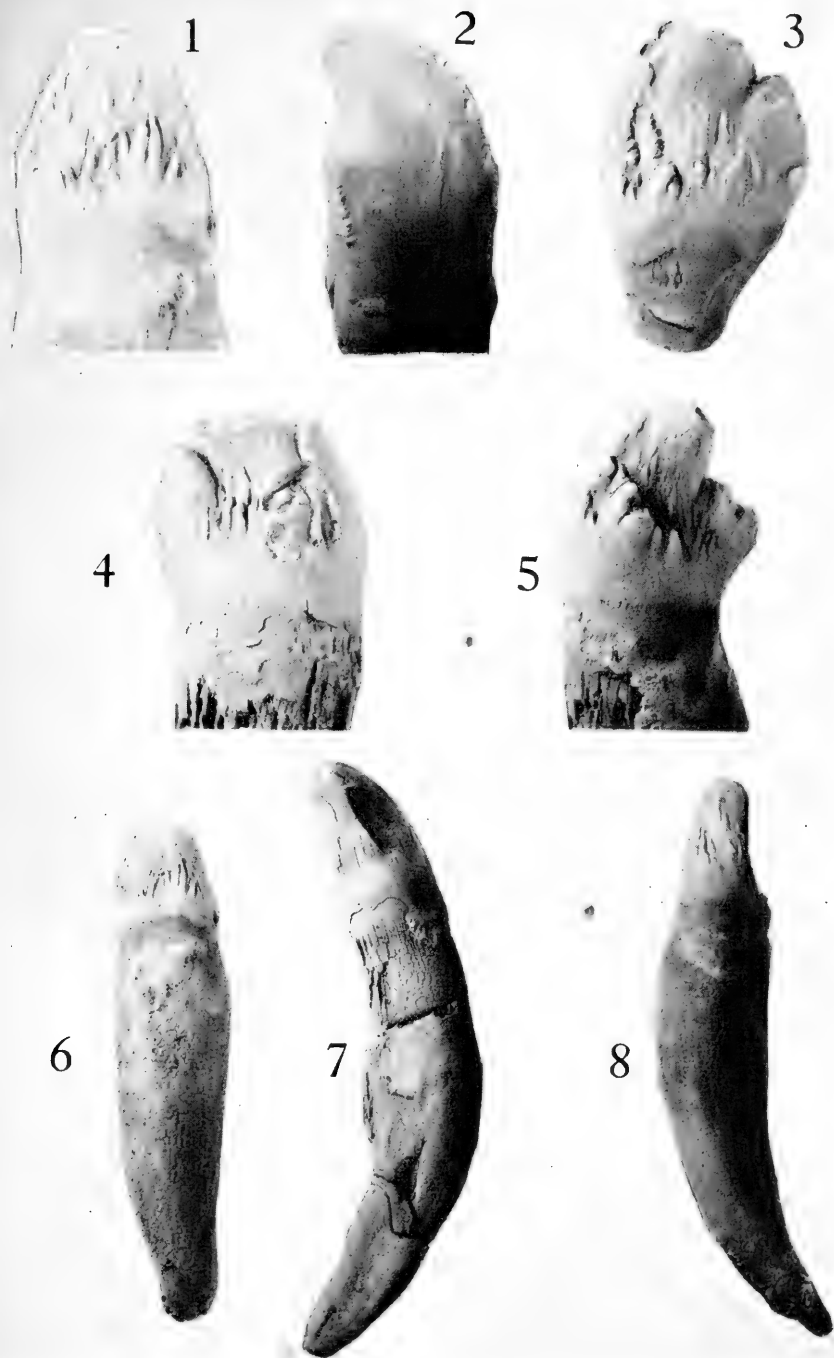


3

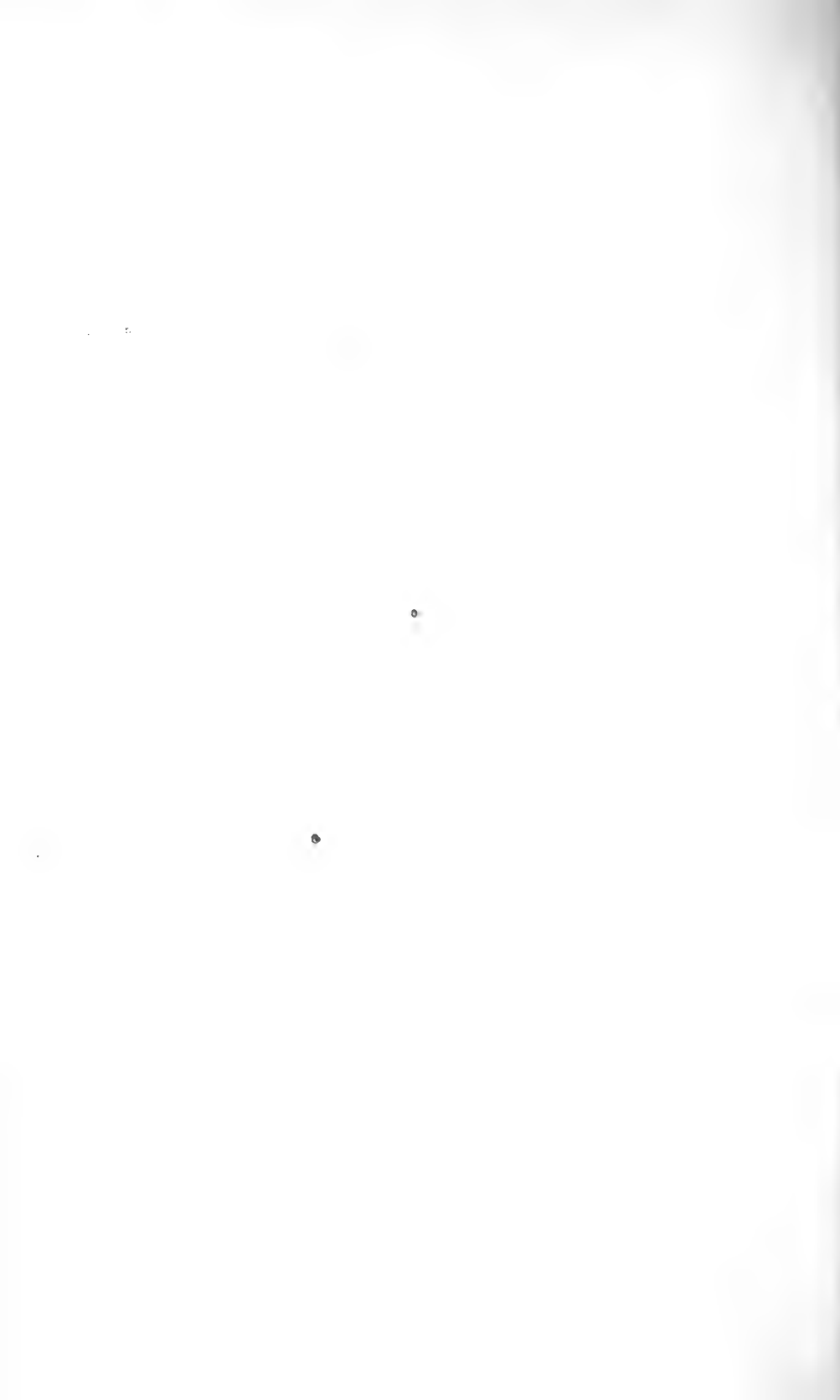
Trectosphys gabbi (Cope): 1, anterior view, dorsal vertebra (USNM 10709); 2, anterior view, lumbar vertebra (USNM 10709); 3, anterior view, dorsal vertebra (USNM, uncataloged).



Eight posterior teeth ($\times 2$) of *Tretosphys gabpii* (Cope) (USNM 10709): 1, 3-5, 7, 8 are internal views; 2, posterior view; 6, external view.



Eight teeth of *Tretosphys gabii* (Cope) (USNM 10709): 1, tooth from middle portion of tooth row, anterior view (enlargement of fig. 6); 2, posterior tooth, posterior view (enlargement of fig. 2, pl. 20); 3, posterior tooth, internal view (enlargement of fig. 4, pl. 20); 4, posterior tooth, internal view (enlargement of fig. 1, pl. 20); 5, posterior tooth, internal view (enlargement of fig. 1, pl. 20); 6, tooth from middle portion of tooth row, anterior view; 7, tooth from anterior portion of tooth row, internal view; 8, tooth from anterior portion of tooth row, external view. (1-5 \times 4, 6-8 \times 2.)



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A REVIEW OF THE NEW WORLD FLIES OF THE GENUS
CONOPS AND ALLIES (DIPTERA: CONOPIDAE)

By SIDNEY CAMRAS

The present study is based mainly on a fine collection of New World Conopinae that had been accumulated by R. C. Shannon and eventually acquired by the U. S. National Museum (USNM). Most of the specimens had been collected by Shannon himself at Maracaju, Mato Grosso, Brazil. He had been actively studying this material, and many manuscript names for new species are attached; but he never published on this group. Wherever possible I have used his names for the new species.

The last study of the Neotropical members of this group was by Kröber (1939, *Ann. Mag. Nat. Hist.*, ser. 11, vol. 4, pp. 454-468). In this work Kröber referred many species for the first time to *Physoconops* from *Conops*; but many species were not then available to him and their position could not be determined. Aczél (1950, *Acta Zool. Lilloana*, vol. 9, pp. 49-61) reviewed the Neotropical members of the family and assigned a few more species; and Parsons (1948, *Ann. Ent. Soc. America*, vol. 41, pp. 226-230), reviewing the Nearctic Conopidae, removed those species formerly in *Conops* to *Physoconops*. In this paper I have been able to locate most of the others, but the position of a few must still remain in doubt.

Early in the present study several structural characters were found for grouping related species. These have proved so useful

that I feel they should be recognized in subgeneric categories. Eventually most of them will prove to be of generic importance; but until a worldwide study is made, and until the family is better known, it is better to retain the present level of generic division.

Acknowledgment is made to the following individuals and institutions for the loan of specimens, information on types, and other assistance and advice. Without their generosity this work could not have been accomplished.

C. W. Sabrosky, U. S. Department of Agriculture; H. Oldroyd, British Museum (Natural History) (BM); C. H. Curran, American Museum of Natural History (AMNH); S. L. Tuxen, Universitet Zoologiske Museum, Copenhagen (UZM); H. Mayer, Naturhistorisches Museum, Vienna (NMV); E. Séguy, Muséum National d'Histoire Naturelle, Paris (MHNP); P. J. Darlington, Jr., Museum of Comparative Zoology (MCZ); R. H. Beamer and J. Hall, Snow Museum, University of Kansas; P. D. Hurd, Jr., University of California, Berkeley (UCB); and H. Dybas, E. Ray, and R. Wenzel, Chicago Natural History Museum (CNHM).

Key to genera of New World Conopinæ

1. Face not grooved, sharply keeled **Tropidomyia** Williston
Face with grooves, separated by a shallow keel 2
2. Cheeks wide, equal to one-half eye-height **Mallochoconops**, new genus
Cheeks much narrower than one-half eye-height 3
3. Posterior femur thickened and angulated at base; anterior cross-vein much beyond middle of discal cell **Physocephala** Schiner
Posterior femur normal; anterior cross-vein near middle of discal cell . . . 4
4. Vertex with distinct ocellar swelling; second abdominal segment, especially in male, relatively long and narrow **Physoconops** Szilady
Vertex without ocellar swelling; second abdominal segment short and wide. **Conops** Linné

Genus *Conops* Linné

Conops Linné, *Systema naturae*, ed. 10, p. 604, 1758.

Most of the species formerly placed here belong to *Physoconops*, which is much more common than *Conops* in the New World.

Information on the types of the following species indicates that they belong to *Physocephala*.

Conops cayennensis Macquart, *Diptères exotiques*, vol. 2, suppl. 3, p. 12, 1843. Cayenne. (Type in MHNP.)

Conops flavifrons Walker, *List of the specimens of dipterous insects in the collection of the British Museum*, vol. 3, p. 672, 1849. Pará. (Type not found.)

Conops aurifrons Walker, *List of the specimens of dipterous insects in the collection of the British Museum*, vol. 4, p. 1158, 1849. (Type in BM. A synonym of *C. flavifrons*.)

Conops punctum Bigot, Ann. Soc. Ent. France, ser. 6, vol. 7, p. 46, 1887. "Amér. mér." (Type in BM.)

Conops soror Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 131, 1915. México. (Type in NMV.)

The following species have not been seen, and have not been reidentified since originally described. I have not been able to locate the types. They may belong to *Physoconops* or *Physocephala*.

Conops dimidiatipennis Sichel, Ann. Soc. Ent. France, ser. 4, vol. 2, p. 120, 1862. Montevideo.

Conops ephippium Macquart, Diptères exotiques, suppl. 3, p. 11, 1847. "Amér. mér."

Conops flaviceps Macquart, Diptères exotiques, vol. 2, p. 14, 1843. "Amér. sept."

Conops sericeus Olivier, Encyclopédie méthodique, vol. 6, p. 111, 1791. Cayenne.

The remaining species, which definitely belong to this genus, fall into the following well marked subgenera.

Key to subgenera of *Conops*

1. Occiput with hornlike swellings **Ceratoconops**, new subgenus
- Occiput without hornlike swellings 2
2. Head about half as long as high; male abdomen pointed.
 - Sphenoconops**, new subgenus
 - Head more than half as long as high; male abdomen rounded. **Conops** Linné

Subgenus *Conops* Linné

Conops Linné, Systema naturae, ed. 10, p. 604, 1758.

The type of *Conops* was designated as *flavipes* by Curtis in 1831. In this species abdominal segment 2 is slightly longer than abdominal segment 3, the distal margin of the abdominal segment 2 is slightly wider than the proximal margin, and the base of segment 3 is about three-fourths its distal width.

Kröber has designated *macrorhynchus* (= *vesicularis*) as the type. In that species the shape of abdominal segments 2 and 3 is about the same, but there are usually three or four propleural bristles, instead of two or three as in *flavipes*.

The new species described below agrees with the above species in the shape of abdominal segments 2 and 3, but there is only one large and one very small propleural bristle.

Conops (Conops) verus, new species

DESCRIPTION: Male: Length 13 mm. Front dark yellow, upper third black with black vertical midline dividing at base of antennae. Vertex dark yellowish, face yellow, parafacials and lower two-thirds of grooves black with yellowish pollen. Cheeks entirely black extend-

ing upward for one-third the length of the face. Occiput black with yellow pollen on the orbitals. Antennae black, segment 1 and narrow basal margin of segment 3 reddish. Segment 1 about four times as long as wide; segment 2 twice the length of segment 1; segment 3 $1\frac{1}{2}$ times segment 1, relatively slender. Arista 3-segmented, segment 2 moderately produced laterally. Proboscis black, $1\frac{1}{2}$ times height of head.

Thorax entirely black with faint yellow pollen on the dorsum, somewhat more marked medial to the humeri and on the scutellum. Coxae black with yellowish pollen. Femora black with reddish at base and apex. Tibiae mostly reddish, tarsi mostly reddish, the distal segments more blackish, claws black, pulvilli reddish.

Wings with pattern extending to vein 3 and the vena spuria, with a narrow margin before veins 4, 5, and 6. Pattern rufous on the basal half, more blackish on the distal half, especially between veins 2 and 3 and vena spuria. Costal cell and remainder of wing nearly hyaline. Halteres reddish black, especially at the tip.

Abdomen black with narrow distal margins of golden pollen on segments 1-3. Segments 4-6 are nearly entirely covered with golden pollen. Genital segments black and reddish.

TYPE: Holotype, male (USNM 62423), Rio Claro, São Paulo, Brazil, October 1939, Claretiano.

REMARKS: This is the only true *Conops* that I have seen from the Neotropical region. Perhaps Kröber identified a specimen of this species as *hermanni* when he placed that species in *Conops*, and then redescribed *hermanni* as *perbellum* in *Physoconops*.

Conops (Conops) bermudensis Parsons

Conops bermudensis Parsons, Psyche, vol. 47, p. 28, 1940.

This species has not been seen at this time, but presumably belongs to the typical subgenus. It is a species with spots on the anterior orbital margins at the frontofacial junction. This is a frequent character among the Old World *Conops*. The only New World species with this character that I have seen is *Tropidomyia bimaculata*. This is the only member of the genus *Conops* that occurs in the Nearctic region.

Conops (Conops) pruinus Bigot

Conops pruinus Bigot, Ann. Soc. Ent. France, ser. 6, vol. 7, p. 46, 1887.

This species was described as questionably from Central America. The type is in the British Museum, and from information supplied by Oldroyd it belongs to *Conops*. It keys out to *gracilis*, but that species is a *Physoconops*. Being a *Conops*, there is a good possibility that it is not a Neotropical species.

***Ceratoconops*, new subgenus**

This subgenus is characterized by bilateral swellings on the occiput midway between the vertex and the inferior margin of the eye. The posterior margin of the eye is markedly indented, but the triangular smooth area is not large. Only one propleural bristle is present. The abdomen of the male has segment 2 as wide at the base as at the apex. This segment is about twice as long as wide and about equal to abdominal segment 3. The proximal width of abdominal segment 3 is about two-thirds the distal width of that segment. The length of the head is nearly equal to the height of the head.

TYPE: *Conops ornatus* Williston.

***Conops (Ceratoconops) ornatus* Williston**

Conops ornatus Williston, Kansas Univ. Quart., vol. 1, p. 46, 1892.

One cotype male labeled "Corumba, May" (in AMNH), was loaned for examination. The location of the other cotype is unknown. It is not at the University of Kansas, nor are the types there of any of the other species described by Williston at that time.

RANGE: Brazil (Mato Grosso).

***Sphenoconops*, new subgenus**

This subgenus is most distinctive in the male sex by the pointed wasplike abdomen. In the female there is a marked invagination at the base of the theca where the tip of the male would fit; but this depression is also found in some of the females of species with the male abdomen rounded as usual.

This subgenus also differs in the flattened shape of the head and the relatively long antennae, which lack a lateral process on the arista. The shape of the abdominal segment 2 is also characteristic, having the proximal width much less than the distal width.

TYPE: *Conops nobilis* Williston.

***Conops (Sphenoconops) brunneosericeus* Kröber**

Conops brunneosericeus Kröber, Stettiner Ent. Zeit., vol. 98, p. 100, 1937.

The specimens examined differ from the original description in having antennal segment 3 much shorter than antennal segment 2. Otherwise the description agrees rather well.

RANGE: Brazil.

MATERIAL EXAMINED: Brazil: Itatiaya, Rio de Janeiro, 700 m., Mar. 5, 1934, J. F. Zikan, 1 male (USNM); Palmeiras, Rio de Janeiro, Sept. 20, 1938, Jan. 7, 1939, S. Lopes, 2 females (USNM); São Paulo, Dec. 1932, J. Lane, 1 female (USNM).

Conops (Sphenoconops) velutinus Kröber

Conops velutinus Kröber, Arch. Naturg., vol. 81, Abt. A, Heft. 5, p. 146, 1915.

The type (in USNM) has been examined. This species is very closely related to *brunneosericeus*.

RANGE: Argentina (Mendoza).

Conops (Sphenoconops) nobilis Williston

Conops sericeus Walker, Insecta Saundersiana, Diptera, vol. 4, p. 256, 1852 (preoccupied).

Conops argentifacies Williston, Kansas Univ. Quart., vol. 1, p. 43, 1892 (in key).

Conops nobilis Williston, Kansas Univ. Quart., vol. 1, p. 45, 1892.

Conops palliditarsis Kröber, Konowia, vol. 6, p. 139, 1927.

The type of *sericeus*, a female, is in the British Museum. Oldroyd has supplied information indicating that it belongs here; however the name is preoccupied by *Conops sericeus* Olivier. Williston used the name *argentifacies* in his key, but described the species under *nobilis*.

RANGE: México, Costa Rica, Brazil, and Bolivia.

MATERIAL EXAMINED: Brazil: Chapada, Mato Grosso, Jan., 1 female (AMNH, cotype, labeled *argentifacies*). Bolivia: Reyes, October, W. M. Mann, 1 male (USNM). México: North Yucatán, Gaumer (Kröber det.: *magnus*?; species No. 4 of Williston in *Biologia Centrali-Americana*), 1 female (BM). Ahuacatlán, Nayarit, July 18-22, 1951, P. D. Hurd, 1 female (UCB).

Mallochoconops, new genus

Similar to *Conops* and *Physoconops*, but differing from all of the other members of the subfamily in having very wide cheeks, half the size of the eye-height. Ocellar swelling absent. Abdominal segments 2 and 3 elongated. Proboscis short, about equal to the head height.

TYPE: *Microconops atratulus* Malloch.

This genus differs from *Microconops* Kröber in having a more slender abdomen, shorter proboscis, and no ocellar swelling in addition to the wider cheeks. The ocellar swelling in *Microconops* is very distinct. The differences in the length of the abdominal segments 2 and 3 in *Microconops fasciatus* Kröber mentioned by Malloch are due to the difference in sex.

There is a superficial resemblance to the new subgenus *Gyroconops*, agreeing with it in the short proboscis, the interruption of the wing pattern (very faint in *atratulus*) in the middle of the first posterior cell, the long third antennal segment, and the dark coloration. However, besides the wider cheeks, the head is not as long, and the vertex does not extend anteriorly more than usual.

Mallochoconops represents one type of intergrade between *Conops* and *Physoconops*, lacking the ocellar swelling as in the former, and having the narrower abdominal base of the latter. *Microconops* represents another type of intergrade, having the wider abdominal base of *Conops* and the ocellar swelling of *Physoconops*.

Genus *Physoconops* Szilady

Physoconops Szilady, Ann. Hist.-Nat. Mus. Nat. Hungarici, vol. 24, p. 588, 1926.

Most of the New World species formerly placed in *Conops* belong here. The species fall into the following subgenera.

Key to the subgenera of *Physoconops*

1. Third antennal segment more than two-thirds of second; front shorter than wide 2
 Third antennal segment less than two-thirds of second 5
2. Vertex large, as long as front **Gyroconops**, new subgenus
 Vertex small, much shorter than front 3
3. Abdominal apex unusual, pointed in male, slightly S-shaped in female.
 Shannonoconops, new subgenus
 Abdominal apex normal 4
4. Third antennal segment relatively thick, and usually longer than second; dark pattern in first posterior cell narrow; pollinose pleural stripe joining spot medial to humerus **Aconops** Kröber
 Third antennal segment relatively slender, rarely longer than second, and thick; dark pattern in first posterior cell, if present, is relatively wide; if suggestive of above, pleural stripe not joining humeral spot.
 Pachyconops, new subgenus
5. Vertical swelling triangular, pointed anteriorly; front shorter than wide.
 Kroeberoconops, new subgenus
 Vertical swelling rounded; front as long as wide or longer.
 Physoconops Szilady

***Pachyconops*, new subgenus**

Similar to the subgenus *Physoconops*, but having the front shorter than wide, and having antennal segment 3 about equal to segment 2. The triangular polished space on the posterior margin of the eye is very small or absent.

TYPE: *Physoconops bulbirostris* (Loew).

This subgenus contains several diverse elements, but enough intergradation to prohibit any subdivision at this time. Some of the females have a very long robust theca, and in others it is short. The species with the short theca usually lack the triangular mark of the eye. The species with the short theca also usually have the abdominal segments 2 and 3 longer and the remainder of the abdomen more slender.

Phyoconops (Pachyconops) shannoni, new species

DESCRIPTION: Male: Length 10½ mm. Front and vertex brownish yellow. A small spot above base of antennae and center of ocellar swelling black. Face and cheeks yellow, the orbital margin slightly pollinose. Antennae dark brown. Segment 2 about twice the length of segment 1. Segment 3 1½ times segment 1. Arista 3-segmented, the second segment slightly produced ventrally. Proboscis dark brown, nearly twice the length of the head. Occiput more yellowish at vertex. Posterior orbital stripe white pollinose. Thorax blackish brown. Humeri slightly reddish, the dorsum covered with fine golden pollen. A very distinct gold pollinose stripe originating medial of the humeri, extending posteriorly behind the humeri and connected with a distinct gold pollinose pleural stripe extending to the middle coxae. Pronotum and metanotum dorsally and laterally gold pollinose. Legs dark brownish, the coxae and tibiae partly yellow pollinose. Basal third of tibiae, basal tarsi, base of the claws, and pulvilli yellow. Wings with brownish dark pattern extending to the third vein, paler at the costa. Slight dark clouding along vena spuria and fifth vein. Calypters yellow; halteres yellow, brownish at the base and tip. Abdomen black, brownish on segments 2 and 3 and genitalia. Yellow at distal margin of segment 2. Golden pollinose at distal margins of all the segments and covering most of segment 6.

Female: Length 9½ mm. Similar to the male. Antennal segments 2 and 3 nearly equal. The wing more hyaline. Pollinose posterior margins of abdominal segments less distinct and absent on the terminal segments. Theca relatively small.

Variation (in paratype): Tip of abdomen missing. Similar to male, but base of antennal segment 3 reddish. Black of front more extensive.

TYPES: Holotype, male (USNM 62424); allotype, Maracaju, Mato Grosso, Brazil, May, 1937, R. C. Shannon. Paratype: Same data.

REMARKS: One more specimen referred here provisionally, from Argentina (Tucumán), differs in having the front entirely dark reddish with the black spot limited to the swelling at the origin of the antennae. The humeri are more reddish in greater contrast with the black of the thorax. Length 10 mm.

This species is related to *pictifrons*, and with it differing from all the other members of the subgenus in having the first posterior cell hyaline. In addition to having less black on the front, this species differs from *pictifrons* in the absence of any black on the oral keel.

Phyoconops (Pachyconops) pictifrons (Kröber)

Conops pictifrons Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 133, 1915.

RANGE: México to Panamá.

MATERIAL EXAMINED: México: Frontera, Tabasco, Mar. 3, Townsend, 1 male (USNM). Panamá: Nata, September 1946, N. L. H. Krauss, 1 male (USNM); Barro Colorado, Dec. 1, 1930, H. F. Schwartz, 1 male (AMNH).

Physoconops (Pachyconops) gracilis (Williston)

Conops gracilis Williston, Trans. Connecticut Acad. Arts Sci., vol. 6, p. 337, 1885.

This species replaces *brachyrhynchus* in the western United States, and differs typically in being predominately reddish with pleural stripe golden, front entirely yellow, and absence of spot in facial grooves. However, most specimens show a trace of the spot in the facial grooves and in some it is very distinct. The pleural stripe may be whitish as in the specimen from México (Fresnillo), which is also rather dark in general with a prominent groove spot. However, the front is entirely yellow in that specimen.

Kröber used this name for *townsendi* (= *auratus*) and some specimens of *rufus*. His records of this species from Brazil and Chile apparently belong to *rufus*.

RANGE: United States: Colorado, New Mexico, Arizona, California. México. Colombia.

MATERIAL EXAMINED (Neotropical): México: Fresnillo, Zacatecas, 7,000 ft., Aug. 15, 1947, Michener, 1 male (AMNH). Colombia: Cauca Valley, Cali District, 3,260 ft., 1935, H. F. Schwartz, 1 male (AMNH).

Physoconops (Pachyconops) brachyrhynchus (Macquart)

Conops brachyrhynchus Macquart, Diptères exotiques, vol. 2, p. 315, 1848.

Conops xanthopareus Williston, Trans. Connecticut Acad. Arts Sci., vol. 4, p. 332, 1882.

Conops fenestratus Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 134, 1915.

This predominantly dark species is rather variable, and the two sizes of theca (very small or moderate) suggests that two species may be involved. The front is partly dark, but in some specimens the front is nearly entirely yellow, and in others an indistinct T-pattern is formed. The pleural stripe is ordinarily white, but may be yellow. The dark mark on the facial grooves may be completely absent.

In rare cases, antennal segment 3 is longer than segment 2, and quite robust, thus agreeing with the subgenus *Aconops*; but the other characters of that group are, of course, absent.

RANGE: Massachusetts to northern Florida (Gainesville), west to Wyoming and Texas.

Physoconops (Pachyconops) floridanus, new species

DESCRIPTION: Male: Length $10\frac{1}{2}$ mm. Front and vertex blackish brown, darker at ocellar swelling, in front of vertex, and above anten-

nae. Face and cheeks reddish, orbital margins yellow pollinose. Facial grooves blackish. Antennal segment 1 yellowish, reddish distally. Segment 2 blackish, about twice length of segment 1. Segment 3 reddish proximally, black distally, about equal to segment 2. Arista dark on first and second segments, distal segment (3) yellow, segment 2 only slightly produced. Proboscis yellowish, black at tip, reddish at base. Occiput blackish, yellowish below. Postorbital stripe white pollinose. Triangular mark on posterior margin of eye practically absent. Thorax black. Humeri, scutellum, and parts of the pleurae reddish. Whitish pollinose mark medial to the humeri. Whitish pleural stripe relatively indistinct. Coxae blackish, femora reddish. Tibiae yellow proximally, reddish distally. Tarsi black, yellow on segment 1, pulvilli, and claws except tips. Wings with brown pattern extending to third vein and vena spuria, more yellowish in costal and subcostal cells. First basal cell very slightly clouded, remainder of wing hyaline, except stripe anterior to the fifth vein. Calypters yellowish, halteres yellow, tips orange. Abdominal segment 1 black. Segment 2 and base of segment 3 reddish. Junction of segments 2 and 3 yellow pollinose. Narrow distal yellow pollinose margins on segments 3-5. Genitalia dark reddish.

TYPE: Holotype, male (author's collection ex. Univ. California, Davis collection), Cocoa, Fla., July 1944, G. E. Bohart.

REMARKS: This species is related to *brachyrhynchus*, but differs in having the dark front and facial grooves, and the reddish face, humeri, scutellum, legs, and abdominal segments 2, in great contrast with the very blackish thorax, distal abdomen, and tarsi. The female should have the small theca of *brachyrhynchus*.

***Physoconops (Pachyconops) cubanus* Parsons**

Physoconops cubanus Parsons, Psyche, vol. 47, p. 35, 1940.

This species belongs to the *brachyrhynchus* group, having the small theca and the wing pattern extending into the first posterior cell. Because of the rufous on the wing pattern it superficially resembles *pictus*, but it is otherwise unrelated.

RANGE: Cuba.

MATERIAL EXAMINED: Cuba: Guabairo, Sept. 2, 1930, R. Dow, 1 female (paratype, MCZ); Soledad, Aug. 27, 1929, J. G. Meyers, 1 male (BM).

***Physoconops (Pachyconops) pallifrons* (Coquillett)**

Conops pallifrons Coquillett, Proc. Ent. Soc. Washington, vol. 6, p. 92, 1902.

Conops palpifrons (authors, error).

This species is closely related to *brachyrhynchus* and *gracilis*, differing primarily in having a stripe of black on the cheeks.

The paratype female lacks the black on the cheeks and, in my opinion, does not belong to this species. Rather, I believe it belongs to the subgenus *Aconops*, and it is provisionally referred to *longistylus*, although it may represent a new species.

RANGE: México, Nicaragua.

MATERIAL EXAMINED: Nicaragua: Chinandega (USNM), 1 male (type). México: San Rafael, Vera Cruz, July 3, Townsend, 1 male (paratype, USNM); Cuernavaca, Sept. 4, 1922, E. G. Smyth, 1 (abdomen off) (USNM).

Physoconops (Pachyconops) gracilianus, new species

DESCRIPTION: Male: Length 15 mm. Front dark yellowish with an indistinct narrow blackish brown stripe in front of the vertex connected with a narrow line that extends downward past the base of the antennae. Vertex dark yellow, the ocellar swelling black. Face and cheeks entirely yellow, the facial grooves and anterior orbitals whitish pollinose. Antennal segment 1 light brownish, segments 2 and 3 black, reddish below and on arista. Segment 2 about twice length of segment 1, segment 3 equal to segment 2. Proboscis black, brownish in the middle, $1\frac{1}{2}$ times head height. Occiput blackish above, yellowish below. Posterior orbitals white pollinose. Thorax black, the humeri and scutellum reddish. Pale yellow pollinose medial to the humeri, on the scutellum, and a vertical stripe on the pleurae. Anterior and middle coxae dark reddish covered with whitish pollen. Femora reddish, posterior one darkened. Tibiae yellowish at base, dark reddish distally. Tarsi blackish, the first reddish. Pulvilli and claws, except the black tip, yellow. Wings with dark pattern extending to the third vein and the vena spuria, paler in the costal and subcostal cells and apex of the wing. Remainder of the wing hyaline except along fifth vein. Calypters and halteres yellow. Segments 1 and 2 of the abdomen black, the remainder dark reddish. Junction of segments 2 and 3 with a moderately wide yellow pollinose band. Narrower distal margins of segments 3 and 4 gold pollinose. Segments 5 and 6 nearly covered with golden pollen. Genitalia dark reddish.

Female: Length 12 mm. Similar to the male. The theca moderate in length and rather robust, yellow anteriorly.

Variation (in paratype): Length 14 mm., otherwise similar to the male.

TYPES: Holotype, male (USNM 62425). Allotype, Cuernavaca, Morelos, México, September 1923, E. G. Smyth. Paratype: 1 male, same data (author's collection).

REMARKS: This species is related to *brachyrhynchus* and *gracilis*, but the distal abdomen is reddish with segments 1 and 2 black. In *gracilis* if there is black on the abdomen it is on the distal segments;

and in *brachyrhynchus* if abdominal segment 2 is black the remainder of the abdomen is black. In addition, the theca is larger and more robust than in *gracilis* and *brachyrhynchus*, but not as long as in *excisus* or *bulbirostris*.

Physoconops (Pachyconops) pictus (Fabricius)

Conops pictus Fabricius, Entomologia systematica, vol. 4, p. 39, 1794.

This distinctive species has a very large theca that is reddish with golden pollen. There is sometimes slight darkening on the medial side of antennal segment 3. The color of the basal cells is as dark as the remainder of the wing pattern. The dorsum of the thorax has the yellow extending back partly dividing the black into three stripes, and forming one large or two smaller yellow spots.

RANGE: Cuba, Haiti, Puerto Rico.

MATERIAL EXAMINED: Cuba: Havana, T. Barbour, 2 females (MCZ, USNM); Vinales, Pinar del Río, Aug. 27-31, 1951, P. Vaurie, 1 male (AMNH). Haiti: Manneville, Sept. 16-17, 1934, Darlington, 1 male (USNM). Puerto Rico: Isabela, June 26, 1948, Oakley and Mills, 1 male (USNM); Bayanon, Dec. 25, 1934, Anderson and Lesesne, 1 female (author's collection).

Physoconops (Pachyconops) ramondi (Bigot)

Conops ramondi Bigot, Diptera, in de la Sagra, Historia . . . natural de la Isla de Cuba, pt. 2, vol. 7, p. 808, 1857.

This species differs immediately from *pictus* by the very large size. The thorax is rufous with small dark markings. The third antennal segment is dark reddish with some black laterally and mostly blackish medially. The abdomen is dark reddish with very little golden pollen. The theca is large as in *pictus*, and the basal cells are as dark as the rest of the wing pattern. The postoccipital stripe is absent in this species as well as in *pictus*.

RANGE: Cuba.

MATERIAL EXAMINED: Cuba: Guantánamo, June 21, 1910, 1 female (MCZ).

Physoconops (Pachyconops) bahamensis Parsons

Physoconops bahamensis Parsons, Psyche, vol. 47, p. 29, 1940.

This species has not been examined but presumably belongs to this subgenus. It is known only from the type female. It appears to be related to *guianicus*, and has the same large theca. In the original description the second abdominal segment was omitted. Darlington informs me that it is reddish brown.

RANGE: Bahama Islands.

***Physoconops (Pachyconops) gracilior* (Kröber)**

Conops gracilior Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 150, 1915.

RANGE: Brazil (Santa Catarina), Paraguay.

MATERIAL EXAMINED: Paraguay: Kröber collection, 1 male, 1 female (cotypes, USNM).

***Physoconops (Pachyconops) crudus* (Walker)**

Conops cruda Walker, List of the specimens of dipterous insects in the collection of the British Museum, vol. 3, p. 671, 1849.

This species has not been identified since originally described. Judging from Kröber's redescription it belongs to this subgenus and is related to *guianicus*. The origin of the type is not known, but Kröber felt that it is a Neotropical species.

***Physoconops (Pachyconops) guianicus* (Curran)**

Conops guianica Curran, Bull. Amer. Mus. Nat. Hist., vol. 66, p. 417, 1934.

RANGE: British Guiana, Venezuela, Colombia, Brazil, Perú.

MATERIAL EXAMINED: British Guiana: Kartabo, June 30, 1924, 1 female (type, AMNH). Venezuela: Las Adjuntas, 959 m., July 4, 1926, H. E. Box, 1 female (USNM). Colombia: Don Diego, Magdalena, 100 ft., May, H. H. Smith, 1 female (author's collection, ex Carnegie Mus.). Brazil: Campinas, Goyaz; collectors, Borgmeier, Lopes, and Spitz, 2 males, 1 female (USNM); Maracaju, Mato Grosso, May, 1937, R. C. Shannon, 2 males, 1 female (USNM). Perú: Pucallpa, May 21, 1951, J. M. Schunke, 1 female (author's collection).

***Physoconops (Pachyconops) grandis* (Williston)**

Conops grandis Williston, Kansas Univ. Quart., vol. 1, p. 44, 1892.

RANGE: Brazil (Mato Grosso).

MATERIAL EXAMINED: Brazil: Chapada, 1 male (cotype, Williston collection, AMNH); 1 female (probably a cotype, Williston collection, AMNH); Chapada, 1 male (probably a cotype, in USNM but with AMNH label).

***Physoconops (Pachyconops) rufus* (Williston)**

Conops rufus Williston, Kansas Univ. Quart., vol. 1, p. 44, 1892.

This species resembles *townsendi* (= *auratus*), but the pollen behind the vertex is relatively indistinct. Kröber's records of *gracilis*, from Chile in 1915, apparently belong to this species. He also correctly identified this species from Brazil at that time, but in his last work (1939) he incorrectly used this name for a species of *Physocephala*.

RANGE: Brazil, Chile.

MATERIAL EXAMINED: Brazil: Chapada, January, 1 male, 1 female (cotypes, AMNH); Maracaju, May 1937, R. C. Shannon, 2 females

(USNM); Mogy Mivim, São Paulo, November 1939, Pereira, 1 female (USNM).

***Physoconops (Pachyconops) bulbirostris* (Loew)**

Conops bulbirostris Loew, Neue Beiträge zur Kenntniss der Dipteren, No. 1, p. 30, 1853.

Conops sequax Williston, in Godman and Salvin, Biologia Centrali-Americana, Diptera, vol. 3, pt. 1, p. 80, 1892.

This species has been recorded from South America, but I have not seen any from south of México. The variation includes the characters of *sequax*.

RANGE: New Jersey to Florida west to Indiana and Texas. México (Jalisco, Vera Cruz, Yucatán). Brazil? Bolivia? Paraguay?

***Physoconops (Pachyconops) travassosi*, new species**

DESCRIPTION: Male: Length 14 mm. Vertex and front blackish, slightly reddish in front of ocellar swelling. Face yellowish, cheeks and parts of lower face blackish. Facial grooves and orbital margins yellow pollinose. Antennae blackish, reddish at base of antennal segment 3 and distal arisal segment. Segment 2 twice the length of segment 1. Segment 3 about equal to segment 2. Arisal segment 2 only slightly produced. Proboscis black, nearly twice height of head. Occiput black, yellowish below. Postorbital stripe grayish pollinose with indistinct postvertical pollinose stripe. Thorax black, faintly yellow pollinose especially on coxae and metanotum. Legs black, faintly yellow pollinose, tibiae yellowish proximally and distally. Tarsi and base of claws dark yellowish. Pulvilli bright yellow. Wings with dark brownish pattern, extending to the fifth vein proximally and vena spuria distally, completely filling first basal cell. Remainder of wing hyaline except stripe along fifth vein. Calypters dark yellow with blackish margin. Halteres yellow, brownish at tip. Abdomen black, narrow yellow pollinose at distal margins of segments 1 and 2. Apex of abdomen grayish pollinose. Segment 6 more elongated than usual. Genitalia dark reddish.

Female: Length 13½ mm. Similar to the male. Face darker, more reddish. The theca very long, yellowish anteriorly distally.

Variation (in paratypes): Length 12 to 14½ mm. Front more blackish in one female. Face darker, more reddish in one male; bright yellowish in one female.

TYPES: Holotype, male (USNM 62426), Maracaju, Mato Grosso, Brazil, May 1937, R. C. Shannon. Allotype (USNM), E. Lefevre, São Paulo, Brazil, Sept. 1, 1937, Travassos, Lopes, and Oiticica. Paratypes: Brazil: 1 male, same data as holotype; 1 female (USNM), Palmiras, Rio de Janeiro, 1940, Lopes; 1 female (USNM), Salobra,

Mato Grosso, July 1939; 1 female (USNM), Campinas, Goyaz, January 1936, R. Spitz.

REMARKS: This species has a relatively elongated abdominal tip in the male, thus showing a tendency toward the subgenus *Shannonconops*. Otherwise it is very similar to *Physoconops magnus*, which also has the elongated sixth abdominal segment. However, it is smaller than *magnus*; and differs from it, in the female, by having the long theca and abdominal segments 2 and 3 nearly as wide as long. In the female of *magnus*, the theca is relatively short and the abdominal segments 2 and 3 are elongated, segment 2 being about twice as long as wide. *Magnus* also has three propleural bristles to the usually one or sometimes two in *travassosi*.

This name was selected by Shannon to honor the Brazilian entomologist Lauro P. Travassos.

Physoconops (Pachyconops) costaricensis (Kröber)

Conops costaricensis Kröber, Konowia, vol. 6, p. 135, 1927.

RANGE: Costa Rica, Panamá.

MATERIAL EXAMINED: Costa Rica: San José, La Caja farm, 1 male (author's collection, ex Steyskal collection), June 1928, Schmidt. Panamá: Barro Colorado, Canal Zone, 1 female (AMNH), Dec. 1 1930, H. F. Schwartz.

Physoconops (Pachyconops) magnus (Williston)

Conops magnus Williston, Kansas Univ. Quart., vol. 1, p. 43, 1892.

This species is very similar to *travassosi* in the male, but the female is very different, having a relatively short theca. The abdomen of the female also has segments 2 and 3 elongated, so that segment 2 is about twice as long as wide. The specimens seen have three propleural bristles.

RANGE: Brazil (Mato Grosso).

MATERIAL EXAMINED: Brazil: Chapada, 1 male, 1 female (cotypes, AMNH).

Physoconops (Pachyconops) connectens, new species

DESCRIPTION: Male: Length 12 mm. Front yellowish, darker in center. Vertex dark yellowish. Ocellar swelling black. Face yellow, cheeks black. Orbital margins yellow pollinose. Antennae dark yellowish, blackish dorsally. Segment 2 nearly twice length of segment 1. Segment 3 equal to segment 2. Second arisal segment slightly produced medially. Proboscis reddish, black at base and tip, about 1½ times head height. Occiput blackish, postorbitals yellow pollinose, with distinct postvertical connecting stripe. Thorax black. Gold pollinose line medial to the humeri extending into a

distinct gold pollinose pleural stripe. Postnotum gold pollinose dorsally and laterally. Coxae gold pollinose on black. Femora reddish, posterior blackish. Tibiae yellowish proximally, dark reddish distally. Tarsi blackish, yellowish on segment 1. Pulvilli and claws except tips yellow. Wings with brown pattern extending to fifth vein and vena spuria, the costal cells and first basal cells more yellowish. Remainder of wings hyaline except along fifth and sixth veins. Calypters and halteres yellow. Abdomen black with a wide distal gold pollinose margin on segments 1-4. Segments 5 and 6 nearly entirely gold pollinose. Genitalia dark reddish.

Female: Length 13 mm. Similar to the male. Antennal segment 2 twice length of segment 1 and slightly longer than segment 3. Posterior femur as reddish as the others. Basal cells of wing nearly hyaline. Theca long and robust, entirely black except slight yellowish tip.

Variation (in paratypes): Length 13 to 14½ mm. Legs paler in one. In the other specimen, posterior femur as reddish as the other femora, abdominal segment 2 yellowish laterally, genitalia nearly entirely black.

Types: Holotype, male (F. Johnson collection, AMNH), Rabinal, Guatemala, 3,000 ft., July 2, 1947, C. and P. Vaurie. Allotype (author's collection), Tehuacán, Puebla, México, June 23, 1951, P. D. Hurd. Paratypes: México: 1 male (USNM), Isthmus of Tehuantepec, Sumichrast, 1 male (UCB), Lagunilla, Hidalgo, June 14, 1951, P. D. Hurd.

Remarks: This species combines characteristics of both *excisus* and *townsendi* (= *auratus*). Populations located between the ranges of *excisus* and *townsendi* (= *auratus*) may also resemble this species. Kröber (Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 139, 1915) identified this species and intermediates between *excisus* and *townsendi* (= *auratus*) as *auratus*. At this time it might be well to comment on some other identifications by Kröber in that paper. His *gracilis* (p. 139) consists of *rufus* and *townsendi* (= *auratus*). His *xanthopareus* is *gracilis* (p. 135), and he renamed *xanthopareus* (= *brachyrhynchus*) as *fenestratus* (p. 134).

The records of *gracilis* from Chile, therefore, belong to *rufus*. His record of *excisus* from México probably belongs to *connectens*. Some of the specimens from Texas and Kansas that he lists as *excisus* and *auratus* probably represent intermediates between *excisus* and *townsendi* (= *auratus*).

***Physoconops (Pachyconops) townsendi*, new name**

Conops auratus Townsend, Trans. Amer. Ent. Soc., vol. 27, p. 161, 1901. (Preoccupied by *Conops aurata* Walker, 1871.)

C. auratus was used by Kröber for *connectens*, and *gracilis* was used for this species. Recognition of *connectens*, and the distinction of *townsendi* (= *auratus*) from *rufus* should clear up the confusion of names.

RANGE: Texas, New Mexico, Arizona, California.

***Phyoconops (Pachyconops) excisus* (Wiedemann)**

Conops excisus Wiedemann, *Aussereuropäische zweiflügelige Insecten*, vol. 2, p. 234, 1830.

Conops sugens Weidemann, *Aussereuropäische zweiflügelige Insecten*, vol. 2, p. 236, 1830.

This species belongs to a well defined group characterized by a very distinct uninterrupted postvertical pollinose stripe connecting the postorbitals. The group includes *townsendi*, *connectens*, and *parsonsi*, all of which replace each other in range. Some of the other species of the subgenus, especially *bulbirostris* and *costariensis*, may have a very distinct postvertical stripe, but it is usually interrupted in the center.

RANGE: New York to Florida, west to Colorado and Oklahoma.

***Phyoconops (Pachyconops) parsonsi*, new species**

DESCRIPTION: Female: Length 13 mm. Front blackish, slightly reddish near antennae. Vertex reddish, yellow anterolaterally. Ocellar swelling black. Face reddish yellow, facial grooves more yellowish. Cheeks black. Orbital margins gold pollinose. Antennae black, reddish at base of segment 3, segment 1 yellow. Segment 2 twice length of segment 1. Segment 3 about equal to segment 2. Second arisal segment slightly produced medially. Proboscis reddish yellow, black proximally and at tip, $1\frac{3}{4}$ times head height. Occiput black. Postorbitals gold pollinose with very distinct postvertical connecting stripe. Thorax black, humeri and area medially gold pollinose, connected with very distinct gold pollinose pleural stripe. Spots at base of wings and most of metanotum, gold pollinose. Coxae black, gold pollinose anteriorly. Femora and tibiae reddish yellow. Tarsi blackish, claws (except tips) and pulvilli reddish yellow. Pattern of wing rufous becoming blackish distally, extending between first and third vein and vena spuria. Remainder of wings nearly hyaline, except along fifth vein. Calypters yellow, halteres brownish yellow. Abdominal segments 1 and 2 black with distal gold pollinose margin. Remainder of abdomen dark reddish, with dark distal margins. Theca large and reddish.

Male: Length $14\frac{1}{2}$ mm. Similar to the female, but having the front mostly dark yellow, with a small incomplete black medial stripe above the base of antennae. The costal cells and first basal cells of the wings are yellow. Abdominal segments 5 and 6 are reddish black, the genitalia reddish. Abdominal segment 6 faintly yellow pollinose.

TYPES: Holotype, female (USNM 62427), Buenos Aires, Trinidad Mountains, Cuba, C. T. Parsons, June 17-23, 1939. Allotype, (USNM), Havana, Cuba, Baker.

REMARKS: This species was recognized as new by Parsons, but he was not certain that it might not be a variation of *pictus*. The grouping of the species in this genus reveals, however, that this species could not possibly be a variation of *pictus* because of the distinct pollinose postvertical stripe.

This species differs from *cubanus* by the larger theca of the female, although it is not as large as in *pictus*. The male is very similar to the male of *cubanus*; but, since *cubanus* belongs to the *brachyrhynchus* group, it lacks the distinct pollinose postvertical stripe, the facial grooves are darkened near the oral margins, and the cheeks are entirely yellowish. In addition, the humeri are yellow. The male of *parsonsi*, on the other hand, belonging to the *excisus* group, has the distinct postvertical stripe, black on the cheeks, and no trace of darkening in the facial grooves at the oral margins. The humeri, while covered with yellow pollen, are black underneath.

Physoconops (Pachyconops) pullipes (Eymelt)

Aconops pullipes Eymelt, Senckenbergiana, vol. 25, p. 53, 1942.

This species has not been seen, but it appears to belong to this subgenus. Although described under *Aconops*, the illustration of the antennae as well as the description clearly indicate that it does not belong to the subgenus *Aconops* as defined here.

RANGE: Brazil (Espírito Santo).

Shannoconops, new subgenus

Similar to the subgenus *Pachyconops* in all respects except for the shape of the terminal segments of the abdomen in both sexes.

The male has abdominal segment 6 elongated so that it is longer than wide, and terminates in a relatively sharp point. Superficially, the abdomen resembles that of the subgenus *Sphenoconops* of the genus *Conops*.

Contrary to the female of *Sphenoconops* which is relatively normal in appearance, the female of this subgenus is very peculiar. Abdominal segment 6 is narrower at the base than at the apex, and the resulting segment 7 is elongated. The posterior outline of segment 7 is semi-S-shaped, being concave above and convex below.

TYPE: *Physoconops apicalis*, new species.

Physoconops (Shannoconops) apicalis, new species

DESCRIPTION: Male: Length 14½ mm. Front and vertex black, slightly yellowish in front of ocellar swelling. Face and cheeks,

including facial grooves, blackish. Facial ridges yellowish brown at base of antennae. Orbital margins yellow pollinose. Antennae black. Segment 3 dark reddish. Segment 2 nearly twice length of segment 1. Segment 3 nearly equal length of segment 2. Proboscis blackish, yellow in the middle, about $1\frac{1}{4}$ head height. Thorax black, faint yellowish pollinose. Coxae and legs black, yellowish pollinose, tarsi more yellowish. Pulvilli and base of claws yellow. Wings with dark brown pattern extending to the fifth vein and vena spuria, paler apically. Remainder of wing hyaline except stripe along fifth vein. Calypters yellow, halteres yellow with brown tips. Abdomen black with narrow yellow pollinose margin between segments 2 and 3. Distal abdomen faint gray pollinose. Segment 6 produced distally to a point, longer than wide. Genitalia dark yellowish.

Female: Length 15 mm. Similar to the male. Antennae more blackish. Segment 3 equal to segment 2. Face with more yellowish dorsally. Facial grooves more yellowish ventrally. Wings darker, the hyaline areas brownish. Genital segments very distinctive. The theca is very large and thick at the base. Abdominal segment 6 is narrower at the base than at the apex. Transverse segment 7 is concave above posteriorly.

TYPES: Holotype, male (USNM 62428), Maracaju, Mato Grosso, Brazil, May 1937, R. C. Shannon. Allotype (AMNH), Achinamiza, Perú, Oct. 8, 1927, H. Bassler.

Subgenus *Aconops* Kröber

Aconops Kröber, Arch. Naturg., vol. 83, Abt. A, Heft 7, p. 142, (1917) 1919.

Wing pattern extending into first posterior cell only narrowly along the third vein. Pollinose mark medial to the humeri extending into the distinct pleural stripe. Antennal segment 3 relatively robust; usually much thicker and as long or longer than segment 2.

While none of the above characters are peculiar to this group, the combination will easily distinguish its members. Originally this name was used to separate the species with an elongated antennal segment 3, but the present study shows that this results in an unnatural grouping.

TYPE: *Conops antennatus* Kröber.

Physoconops (Aconops) longistylus (Kröber)

Conops longistylus Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 149, 1915.

This species is characterized by the partly blackish front and yellow cheeks. By analogy with related forms the long third antennal segment is considered variable. The female cotype of *pallifrons* is referred here as a well marked variety, but may be a new species.

RANGE: México (Guerrero), Nicaragua, Costa Rica, Brazil (Santa Catarina).

MATERIAL EXAMINED: México: Chilpancingo, Guerrero, 4,600 ft., June, H. H. Smith, 1 (male, wrong abdomen, BM). Nicaragua: San Marcos, Baker, 1 female (USNM, cotype of *pallifrons*).

Physoconops (Aconops) costatus (Fabricius)

Conops costatus Fabricius, *Systema antliatorum*, p. 175, 1805.

Information on the type kindly supplied by S. L. Tuxen enables the identification of this species for the first time since originally described.

RANGE: Colombia, Brazil (Bahia).

MATERIAL EXAMINED: Brazil: Bahia, June 10, 1929, R. C. Shannon, 1 male (USNM). Colombia: Río Frío, Magdalena, Aug. 21, 1927, G. Salt, 1 male (AMNH).

Physoconops (Aconops) antennatus (Kröber)

Conops antennatus Kröber, *Arch. Naturg.*, vol. 81, Abt. A, Heft 5, p. 150, 1915.
Aconops syrphoides Blanchard, *Anal. Soc. Cient. Argentina*, vol. 126, p. 351, 1938.

The front of this species is rather variable, the dark pattern being reddish, black, or both. Unlike *longistylus* and *costatus*, the cheeks are black.

RANGE: Brazil (Bahia), Argentina (Mendoza).

MATERIAL EXAMINED: Argentina: Mendoza, 1 male, 1 female (USNM). Brazil: Bahia, May, R. C. Shannon, 1 male (USNM).

Gyroconops, new subgenus

This subgenus is immediately recognized by the large vertical swelling extending halfway from the occiput to the base of the antennae. It is covered with many short hairs, as is the dorsum of the thorax. The length of the head is greater in proportion to the height, and the base of the abdomen is wider than in other *Physoconops*. The propleural ridge frequently has more than one bristle.

TYPE: *Physoconops sylvovus* (Williston).

REMARKS: This group was recognized as distinct by Shannon, and the name used is taken from his manuscript labels.

Physoconops (Gyroconops) abbreviatus, new species

DESCRIPTION: Male: Length 6 mm. Front black. Face and cheeks yellow. Oral keel black. Orbitals white pollinose. Antennae black, yellowish proximally on segment 3 and distally on segment 2. Segment 2 twice length of segment 1. Segment 3 slightly longer than segment 2. Proboscis black, yellowish distally, 1½ times head height. Thorax black, faint white pollinose with indistinct pleural stripe.

Coxae black, white pollinose. Legs brownish. Apex of femora, base of tibiae, claws (except tips), and pulvilli yellow. Wings with dark pattern from costa to third vein terminating abruptly at the end of the second vein. First posterior cell entirely hyaline. Apex of submarginal cell slightly darkened. Remainder of wing hyaline. Calypters and halteres yellow. Abdomen black. Yellow band at junction of segments 2 and 3. Tip of abdomen with very short whitish hairs giving a pollinose appearance. Genitalia black.

TYPES: Holotype, male (BM), Xucumanatlan, Guerrero, México, 7,000 ft., July, H. H. Smith.

REMARKS: This specimen was listed by Kröber (Ann. Mag. Nat. Hist., ser. 11, vol. 4, p. 467) as *abruptus?*

This species is very similar to *ocellatus* and *sylvosus*, but it is immediately distinguishable by having the first posterior cell hyaline.

***Physoconops (Gyroconops) sylvosus* (Williston)**

Conops sylvosus Williston, Trans. Connecticut Acad. Arts Sci., vol. 4, p. 329, 1883.

Conops arizonicus Banks, Ann. Ent. Soc. Amer., vol. 9, p. 191, 1916.

The face is black on one specimen (USNM) from Florida (no locality), but I believe it is a melanism.

RANGE: United States: Massachusetts to Florida, west to Nebraska and California. México: Baja California, Guerrero, Puebla.

***Physoconops (Gyroconops) ocellatus* (Giglio-Tos)**

Conops ocellatus Giglio-Tos, Boll. Mus. Zool. Univ. Torino, vol. 7, No. 132, 1892.

Conops parvus Williston, Kansas Univ. Quart., vol. 1, p. 46, 1892.

RANGE: México, Brazil.

MATERIAL EXAMINED: Brazil: Chapada, 1 male (AMNH, cotype); Nova Teutonia, Feb. 4, 1939, F. Plaumann, 1 male (BM). México: "Hd. R. Piedras Verdes," Sierra Madre, Chihuahua, Aug. 16, Townsend, 1 female (USNM).

***Kroebroconops*, new subgenus**

Similar to the subgenus *Pachyconops* but having the vertex triangular in shape rather than rounded anteriorly and having antennal segment 3 about half the length of segment 2 rather than about equal to the length of segment 2. There is also a slight indentation at the junction of the face and front on the orbital margin which is not seen in any of the other members of the genus.

TYPE: *Physoconops hermanni* (Kröber).

***Physoconops (Kroebroconops) rufipennis* (Macquart)**

Conops rufipennis Macquart, Diptères exotiques, vol. 3, suppl. 3, p. 10, 1843.

This species is located here on the basis of the one specimen seen, which had been so determined by Kröber. The other records of this

species based on sporadically determined specimens must be verified. The type is in the Paris museum (MHNP) and Séguy informs me that it is from Brazil.

RANGE: Brazil, Argentina, Uruguay, Costa Rica? Puerto Rico?

MATERIAL EXAMINED: Argentina, 1904, O. W. Thomas, 1 male (BM).

***Physoconops (Kroeberconops) hermanni* (Kröeber)**

Conops hermanni Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 145, 1915.

Physoconops perbellum Kröber, Ann. Mag. Nat. Hist., ser. 11, vol. 4, p. 467, 1939.

RANGE: Argentina (Mendoza).

MATERIAL EXAMINED: Argentina: Mendoza, 1 male, 1 female (cotypes, USNM).

Subgenus *Physoconops* Szilady

This subgenus is characterized by the narrow front, short antennal segment 3, and relatively prominent triangular mark on the posterior margin of the eye. It is more specialized from the primitive *Pachyconops* than any of the other subgenera, yet shows more intergradation and is less distinctive superficially.

TYPE: *Physoconops obscuripennis* (Williston) (= *brachyrhynchus* of Szilady, nec Macquart).

***Physoconops (Physoconops) abruptus* (Kröeber)**

Conops abruptus Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 144, 1915.

RANGE: Brazil (Santa Catarina, Mato Grosso), Paraguay, Argentina.

MATERIAL EXAMINED: Argentina: Mendoza, 1 male, 1 female (cotypes, USNM). Paraguay: Villarica, Jan. 1939, F. Shade, 1 female (author's collection, ex Sabrosky collection). Brazil: Maracaju, May 1937, Shannon, 2 females (USNM); Nova Teutonia, 300-500 m., Jan. 25, 1952, F. Plaumann, 1 male, 1 female (author's collection).

***Physoconops (Physoconops) gilmorei*, new species**

DESCRIPTION: Male: Length 10½ mm. Front and ocellar swelling opaque black. Vertex dark brownish. Face opaque black extending into a line on the cheeks. Cheeks and facial grooves and anterior orbitals yellow pollinose. Antennae black, segment 3 reddish, segment 2 about 2½ times segment 1, segment 3 somewhat longer than segment 1. Arista apparently 2-segmented. Occiput black, yellowish below, postorbitals yellow pollinose. Large triangular space at posterior margin of the eye. Proboscis dark brown, about 1¾ times

head height. Thorax black, very faint whitish pollinose; with golden pollinose spot medial to the humeri. Legs black, coxae yellow pollinose. Tibiae yellow at base. Claws (except tip) and pulvilli yellow. Wings with dark pattern extending to the third vein more yellowish anterior to second vein. The black between the second and third veins is interrupted beyond the end of the second vein, but extends faintly along the third vein to the tip of the cell posteriorly. Remainder of wing hyaline except mark at base of vena spuria and along fifth vein. Calypters and halteres yellow. Abdomen black, yellowish at base of segment 3. Wide gold pollinose distal margins on segments 1-5. Remainder of abdomen entirely gold pollinose. Genitalia reddish black.

Variation (in paratypes): Length $9\frac{1}{2}$ to $12\frac{1}{2}$ mm. One similar to the type with black on face becoming reddish ventrally. One similar to the type but pattern in submarginal cell completely hyaline distal to interruption of the dark pattern. One similar to the type but most of front dark yellowish and no black on the face (teneral?). One similar to the type but face dark reddish instead of black. Interruption of wing pattern in submarginal cell complete. The wing pattern anterior to second vein nearly hyaline. Two similar to the type but black of face replaced by reddish yellow.

Types: Holotype, male (USNM 62429), Maracaju, Mato Grosso, Brazil, May 1937, R. C. Shannon. Paratypes: Brazil: 3 males (USNM), same data as holotype; 1 male (USNM) Goyaz, Nov. 1932, Spitz; Paraguay: 2 males (author's collection ex Sabrosky collection), Villarica, January 1939, F. Schade.

REMARKS.—This species is related to *abruptus* but differs in having the front entirely black, the black extending in some specimens onto the face. In the "teneral" specimen, the black of the front is confined to the transverse line in front of the vertex. No female has been seen, but it should resemble the female of *abruptus* except for the color of the front and face.

This name was used by Shannon for his good friend and colleague, Raymond W. Gilmore, a mammalogist who was with him in Brazil.

Phyoconops (Phyoconops) fronto (Williston)

Conops fronto Williston, Trans. Connecticut Acad. Arts Sci., vol. 6, p. 378, 1885.

Conops pulchellus Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 7, p. 134, 1915.

Conops argentifacies Van Duzee, Proc. California Acad. Sci., vol. 16, p. 574, 1927.

Conops fraterculus Van Duzee, Proc. California Acad. Sci., vol. 16, p. 575, 1927.

Conops rubicundulus Van Duzee, Proc. California Acad. Sci., vol. 16, p. 576, 1927.

This species shows considerable variation geographically but is usually easily distinguished. Western specimens have the front averaging narrower, and usually entirely bright yellow. Eastern

specimens frequently have an indistinct dark midline on the front; and the hyaline areas of the wing may be so brownish as to resemble *obscuripennis* superficially. One specimen from México has an indistinct T-pattern on the front.

RANGE: United States: Massachusetts to Florida, west to Washington and California. México: Chihuahua, Zacatecas, Jalisco.

Phyoconops (Phyoconops) nigrimanus (Bigot)

Conops nigrimanus Bigot, Ann. Soc. Ent. France, ser. 6, vol. 7, p. 38, 1887.

Conops striatifrons Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 132, 1915.

Conops limwa Brimley, Ent. News, vol. 38, p. 235, 1927.

This distinctive species is related to *fronto*. I have not seen any specimens from west of the Atlantic Coast States.

RANGE: New Jersey to Florida (Gainesville), west to Nebraska and Texas.

Phyoconops (Phyoconops) peruvianus, new species

DESCRIPTION: Female: Length 9 mm. Vertex reddish. Ocellar swelling black, front yellow with distinct black T-pattern. Face and cheeks yellow. Orbitals and facial grooves yellow pollinose. Occiput blackish above, yellow below. Postorbitals yellow pollinose. Antennae black. Segment 2 is $2\frac{1}{2}$ times segment 1. Segment 3 somewhat longer than segment 1. Proboscis black, yellow in the center, $1\frac{1}{2}$ times head height. Thorax black, faint gold pollinose spot medial to the humeri. Legs black, golden pollinose at the coxae, yellowish at base of tibiae. Claws (except tips) and pulvilli yellow. Wing with pattern extending to third vein, yellowish in costal, subcostal, and distal marginal cells. Remainder of wing hyaline except stripe along fifth and sixth veins. Calypters yellow, halteres yellow with tips reddish brown. Abdomen black, golden pollinose distal margins on segments 1 and 5. Yellow band at base of segment 3, remainder of abdomen yellow pollinose. Theca black, moderately long but thin.

TYPE: Holotype, female (author's collection), Pucallpa, Perú, Feb. 1, 1951, J. M. Schunke.

REMARKS: This species is similar to *angustifrons*, but has the black T-front of *abruptus*. It is therefore close to *nigrimanus*, differing mainly in having black instead of reddish legs, but there is a wide interruption in range.

Phyoconops (Phyoconops) angustifrons (Williston)

Conops angustifrons Williston, Kansas Univ. Quart., vol. 1, No. 1, p. 44, 1892.

Phyoconops pulvillatus Eymelt, Senckenbergiana, vol. 25, p. 54, 1942.

Eymelt correctly recognized that Kröber had described two species under this name, but described the wrong one. A cotype in the American Museum of Natural History collection has been examined.

RANGE: Texas (Brownsville), México (Vera Cruz), Trinidad, Brazil, Paraguay.

Phyoconops (Phyoconops) inornatus (Williston)

Conops inornatus Williston, Kansas Univ. Quart., vol. 1, No. 1, p. 45, 1892.

The two cotypes of *inornatus* have been examined and the name is hereby restricted to the male, which was described first. The female belongs to the new species *infuscatus*.

RANGE: Brazil.

MATERIAL EXAMINED: Brazil: Chapada, 1 male (cotype, AMNH); Annapolis, Goyaz, Nov. 20, 1936, 1 female (USNM); Maracaju, May 1937, Shannon, 3 males (USNM).

Phyoconops (Phyoconops) infuscatus, new species

DESCRIPTION: Male: Length $9\frac{1}{2}$ mm. Front opaque black. Vertex blackish red. Face and cheeks blackish, reddish toward base of antennae. Facial grooves and orbital margins yellow pollinose. Antennae yellowish brown, darker dorsally. Segment 2 nearly three times length of segment 1. Segment 3 equal to segment 1. Proboscis black, $1\frac{3}{4}$ times head height. Occiput blackish above, narrowly yellowish below. Postorbitals yellow pollinose. Thorax black, faintly yellowish pollinose, more marked medial to the humeri, on the scutellum and metanotum, and above the coxae. Legs brownish black. Yellowish at base and tips of femora, tarsi (except sides), claws (except tips), and pulvilli. Wing with dark brown pattern extending from costa to fifth vein, paler at apex of wing and in distal submarginal cell along the third vein. Remainder of wing hyaline except streak along vena spuria, fifth and sixth veins, and base of anal cell. Calypters dark yellow. Halteres dark yellow, brownish at tips. Abdomen black, segment 2 dark reddish, narrow yellowish border between segments 2 and 3. Distal gray pollinose margins on abdominal segments very faint. Segment 6 gray pollinose. Genitalia reddish black.

Female: Length $10\frac{1}{2}$ mm. Similar to the holotype male, but face yellowish. Second antennal segment $2\frac{1}{2}$ times the first. The black confined to the cheeks. Theca long reddish black.

Variation (in paratypes): Length 8 to $10\frac{1}{2}$ mm. One male, similar to the holotype male, but face yellowish with narrow margin of black extending ventrally from the front and dorsally from the cheeks, but not quite meeting. Second antennal segment $2\frac{1}{2}$ times the first.

One male, similar to the holotype, but face partly yellowish. The dark areas darker. Abdominal segment 2 nearly black. Second antennal segment $2\frac{1}{2}$ times the first. One specimen (abdomen missing), similar to the holotype, but face partly dark reddish. Second antennal segment $2\frac{1}{2}$ times the first. One male, similar to the holotype, but with black areas darker and abdominal segment 2 more brownish. Face partly yellowish, along the grooves. Facial grooves and anterior orbits quite dark beneath the pollen. Second antennal segment $2\frac{1}{2}$ times the first. One male, similar to the holotype, but front and vertex reddish (teneral?). Face reddish. Facial grooves blackish, below the yellow pollen. Black areas darker, especially tarsi; black of wings paler. One male, similar to the holotype, but black areas much darker, more extensive. Face very black in appearance due to dark under pollen of orbits and facial grooves. Abdominal segment 2 black.

TYPES: Holotype, male (USNM 62430). Allotype, Maracaju, Mato Grosso, Brazil, May 1937, R. C. Shannon. Paratypes: Brazil: 2 males, 1 female, 1 (abdomen off), same data; 1 male (USNM), Rio Claro, São Paulo, July 1939, Claretiano; 1 male (author's collection), Nova Teutonia, Oct. 21, 1951, F. Plaumann; 1 male (author's collection), Nova Teutonia, Dec. 9, 1951, F. Plaumann.

REMARKS: One specimen (USNM) from Brazil (Maracaju, May 1937, R. C. Shannon), is referred here but may represent a new species. It is much larger in size (14 mm.), the face is dark yellowish, more distinct from the black of the front, and the cheeks have the dark area narrower. Antennal segment 3 is reddish brown in more contrast with the dark segment 2. The black pattern of the wing fills the submarginal cell completely and extends partly into the first posterior cell in the proximal half.

This species is related to *discalis*, differing immediately by the absence of pollinose bands on the abdominal segments. The first basal cell averages darker than in all the other species of this group.

***Phyoconops (Phyoconops) aureoscutellatus* (Kröber)**

Conops aureoscutellatus Kröber, Stettiner Ent. Zeit., vol. 98, p. 96, 1937.

This species has not been seen but presumably it belongs here. It was described as being similar to *angustifrons* except for the yellow scutellum.

RANGE: Costa Rica.

***Phyoconops (Phyoconops) discalis* (Williston)**

Conops discalis Williston, in Godman and Salvin, Biologia Centrali-Americana, Diptera, vol. 3, p. 80, 1892.

Conops formosus Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 124, 1915.

Conops brachyrhynchus var. *semifuscus* Banks, Ann. Ent. Soc. Amer., vol. 9, p. 192, 1916.

The male cotype (AMNH) from Teapa, Tabasco, México, has been examined. Williston's description of the male as "face blackish, in the depression yellowish" does not fit this specimen and may be an error. The face is yellow, with darker yellowish grooves and brown cheeks. There may be another cotype male which belongs to what I am considering a melanistic form. This form (*formosus* Kröber) has the face black, but the grooves are yellowish. The type of *formosus* in the Vienna Naturhistorisches Museum, Vienna, has been checked for me by Dr. Helmut Mayer.

Recent examination of a large series of specimens from México reveals so much intergradation between this species and *semifuscus* that the latter can no longer be maintained. In South America, typical *discalis* is again replaced by a yellow-cheeked form which is almost indistinguishable from *semifuscus*.

RANGE: United States (Texas, Utah, New Mexico, Arizona), México, Guatemala, Costa Rica, Brazil, Bolivia, Paraguay, Argentina.

Physoconops (Physoconops) obscuripennis (Williston)

Conops obscuripennis Williston, Trans. Connecticut Acad. Arts Sci., vol. 4, p. 328, 1882.

Conops brachyrhynchus (Authors, not Macquart).

Conops foxi Van Duzee, Proc. California Acad. Sci., vol. 16, p. 574, 1927.

The western variation (*foxi*) has the posterior margin of the wing hyaline and is relatively paler brown behind the third vein.

RANGE: Massachusetts to Florida, west to British Columbia, Washington, Colorado, and Texas.

Physoconops (Physoconops) nitens, new species

DESCRIPTION: Male: Length 9 mm. Front opaque black, somewhat reddish below. Vertex blackish red, slightly yellow pollinose in front of ocellar swelling. Face reddish yellow with a narrow black margin extending to the cheeks. Facial grooves dark, cheeks yellowish pollinose, and orbits golden yellow pollinose. Antennae yellow on segments 1 and 2, narrowly black dorsally on segment 2. Antennal segment 3 rufous. Arista rufous except for black on the tip. Proboscis blackish, $1\frac{1}{2}$ times head height. Occiput blackish, yellow pollinose narrowly below on the orbital margin and below the vertex. Thorax black, faintly yellow pollinose more distinct medial to the humeri, propleurae, at base of wings, on metanotum, and lower pleurae. Legs reddish brown, yellowish on anterior femora, base and tip of midfemur and posterior femur, basal third of tibiae, tarsi except sides, claws except tips, and pulvilli. Wings with pattern not as dark as usual, extending from costa to third vein. Very faint at first basal cell and paler in submarginal cell distally along the third vein. Remainder of

wing hyaline. Calypters yellowish. Halteres yellowish, tips brown. Abdomen black, segment 2 reddish black. Yellow band at junction of segments 2 and 3. Narrow yellow pollinose distal margins on segments 3-5. Segments 6 and 7 nearly entirely gold pollinose. Genitalia reddish black.

Female: Length $8\frac{1}{2}$ mm. Similar to the holotype male, but more blackish. Black on face more extensive. Facial grooves dorsally with bilateral shiny spot. Rufous on face confined to bilateral spot below base of antennae. Checks rufous, theca long, blackish. Abdominal segment 2 black.

Variation (in paratypes): Length $7\frac{1}{2}$ -10 mm. One male, similar to the type, but black more extensive. Cheeks blackish. Antennal segment 2 twice length of segment 1. One male similar to the holotype male but antennal segments 1 and 2 as rufous as segment 3. Front yellowish except stripe above base of antennae giving the black pattern a T shape. Hyaline area of wings darker, so that pattern extends into first basal cell, but is paler than in submarginal cell. One male, similar to the holotype male, but black areas darker. One male, similar to the holotype male, but antennae more rufous, dark areas more blackish. Black of face extends as a narrow stripe onto the cheeks. One male, similar to the holotype male, but reddish on front more yellowish giving the black a T shape. Pollen on abdomen relatively indistinct. One male, similar to the type, but black areas darker, front with dark yellowish red leaving a black T. One male, similar to the type, but with yellowish rim on front leaving black T. Antennae more rufous.

TYPES. Holotype, male (USNM 62431), Maracaju, Mato Grosso, Brazil, May 1937, R. C. Shannon. Allotype (BM), Nova Teutonia, Santa Catarina, Brazil, June 3, 1939, F. Plaumann. Paratypes: Brazil: 2 males (BM), Nova Teutonia, June 12, 1939, F. Plaumann; 1 male (BM), Nova Teutonia, June 6, 1937, F. Plaumann; 1 male (BM), Nova Teutonia, June 2, 1939, F. Plaumann; 1 male (AMNH), Nova Teutonia, June 5, 1939, F. Plaumann; 1 male (AMNH), Nova Teutonia, May 30, 1939, F. Plaumann; 1 male (AMNH), Nova Teutonia, F. Plaumann.

REMARKS: This very distinctive new species is immediately recognizable by the yellowish rufous antennae.

Physoconops (Physoconops) varipes (Kröber)

Conops angustus var. *varipes* Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 153, 1915.

This form has not been seen, but is here considered a full species. It is related to *discalis*, *infuscatus*, and *angustus*, but has a black T pattern on a yellow front.

RANGE: Paraguay.

***Physoconops (Physoconops) angustus* (Kröber)**

Conops angustus Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 152, 1915.

This name is used here for a form related to *nigromarginatus* as distinguished from the *discalis-infuscatu*s group. In *nigromarginatus*, the front is usually narrower, the first basal cell is entirely hyaline, and the theca is short; while in the *discalis-infuscatu*s group the front is wider, the first basal cell usually partly or entirely clouded, and the theca is relatively long.

RANGE: Argentina and Brazil.

MATERIAL EXAMINED: Brazil: Nova Teutonia, Sept. 4, 1938, F. Plaumann, 1 female (BM).

***Physoconops (Physoconops) nigromarginatus* (Kröber)**

Conops nigromarginatus Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 151, 1915.

This species is somewhat variable over its extensive range, but represents a distinct entity, easily recognized by the dark first posterior cell and very hyaline basal cells. The relatively narrow front distinguishes it (and *angustus*) from the *discalis-infuscatu*s group as well as from the *anthreas-ornatifrons* group. From the *angustifrons* group it is readily distinguished by the dark cheeks.

RANGE: México, Brazil, Bolivia.

MATERIAL EXAMINED: Bolivia: Mapiri, 1 male (cotype, USNM). Brazil: Campinas, Goyaz, Jan. 2, 1936, Burgmeyer and S. Lopes, 1 female (USNM); Rio de Janeiro, Dec. 12, 1915, J. G. Foetterle, 1 male, 1 female (USNM); Grajahú, Rio de Janeiro, Aug. 20, 1939, July 18, 1937, Sept. 22, 1937, S. Lopes, 1 male, 2 females (USNM); Bóia Vista, Tapajós, Pará, Townsend, 1 female (USNM). México: San Rafael, July 1, Townsend, 1 male (USNM).

***Physoconops (Physoconops) anthreas* (Williston)**

Conops anthreas Williston, in Godman and Salvin, Biologia Centrali-Americana, Diptera, vol. 3, p. 80, 1892.

Conops mexicanus Kröber, Arch. Naturg., vol. 81, Abt. A, Heft 5, p. 128, 1915.

This and the following species are closely related, and intergradation probably will be found. They have a relatively wider front than the *nigromarginatus* and *angustifrons* groups, and a dark first posterior cell and short theca in contrast to the *discalis-infuscatu*s group.

RANGE: México.

MATERIAL EXAMINED: México: Atoyac, Vera Cruz, April, H. H. S., 1 male (cotype, AMNH).

Physoconops (Physoconops) ornatifrons (Kröber)

Conops ornatifrons Kröber, Arch. Naturg., vol. 81, Abt A, Heft 5, p. 148, 1915.

The cheeks are black in this species, but in some individuals, especially females, the black may be restricted to a small mark.

RANGE: Venezuela, Brazil, Perú.

MATERIAL EXAMINED: Venezuela: Antimano, June 12, 1926, H. Box, 1 female (USNM). Brazil: Maracaju, July 1937, R. C. Shannon, 1 male (USNM); May, 1937, R. C. Shannon, 23 males, 2 females (USNM); Rio de Janeiro, H. S. Lopes, 1 male (USNM); Campinas, Goyaz, collectors Borgmeier and Lopes, 1 male (USNM); Nova Teutonia, June 3, 1939, F. Plaumann, 3 males (AMNH); Nova Teutonia, June 3, 1939, June 1, 1939, F. Plaumann, 4 males, 1 female (BM); Amazon, 1 specimen (abdomen off, BM). Perú: Ucayali R., 1 male (cotype, USNM); Chosica, May 9, Townsend, 1 male (USNM); Verrugas Canyon, July 9, 1913, Townsend, 1 male (USNM); Lima, January 1949, Aguilar, 1 male (USNM).

Key to New World species of *Conops*, *Mallochoconops*, and *Physoconops*

1. Wing pattern rufous to reddish brown at least at base 2
Wing pattern black to yellowish brown, or absent 10
2. Head entirely reddish or yellowish 3
Head with some black 5
3. Larger, 20–21 mm. *P. ramondi* (Bigot)
Smaller, 10–12 mm. 4
4. Abdominal segment 2 entirely or partly black. *P. pictus* (Fabricius)
Abdominal segment 2 entirely reddish *P. rufipennis* (Macquart)
5. Face with black 6
Face yellow. 7
6. Abdomen with yellow at junction of segments 2 and 3 . *P. hermanni* (Kröber)
Abdomen with yellow at distal margins of most segments.
C. verus, new species
7. Cheeks dark; complete postvertical pollinose stripe.
P. parsonsi, new species
Cheeks yellow; no complete postvertical stripe 8
8. Front entirely dark *P. pallipes* (Eymelt)
Front mostly yellowish 9
9. Distal abdominal segments dark reddish *P. cubanus* Parson
Distal abdominal segments black *P. bahamensis* Parson
10. Wing without dark pattern; hyaline or yellowish brown anteriorly. . . . 11
Wing with dark pattern or entirely dark 13
11. Head with black spot at frontofacial junction . . . *C. bermudensis* Parson
Head without such spot 12
12. Antennal segment 3 much longer than segment 2 . *M. atratulus* (Malloch)
Antennal segment 3 much shorter than segment 2 . *P. inornatus* (Williston)
13. Wing pattern interrupted in submarginal cell, but may be dark distally; not extending beyond third vein 14
Wing pattern filling submarginal cell, but may gradually pale distally. . . 16
14. Front entirely black, or partly reddish 15
Front yellow with dark T-pattern or midline *P. abruptus* (Kröber)

15. Antennal segment 3 much shorter than segment 2 . *P. gilmorci*, new species
 Antennal segment 3 as long as segment 2 *P. abbreviatus*, new species
16. Face entirely black, may have yellow pollen in certain lights 17
 Face with yellow at least in grooves 19
17. Thorax dark, with faint white pollinose midstripe *C. nobilis* Williston
 Thorax without white midstripe 18
18. Thorax reddish with golden pollen *C. brunneosericeus* Kröber
 Thorax dark with reddish markings *C. velutinus* Kröber
19. Face predominantly black, but may be covered with light pollen 20
 Face predominantly yellow or reddish 26
20. Size, 18–25 mm. *P. magnus* (Williston)
 Size, 12–15 mm. 21
21. First basal cell dark 22
 First basal cell nearly or entirely hyaline 24
22. Facial grooves entirely or partly black; genital segments unusual.
P. apicalis, new species
 Facial grooves predominantly yellow pollinose; genital segments normal . . 23
23. Antennal segment 3 nearly equal segment 2 *P. travassosi*, new species
 Antennal segment 3 much shorter than segment 2.
P. infuscatus, new species
24. Antennal segment 3 at least three-fourths of segment 2; front wider than
 high *P. costaricensis* (Kröber)
 Antennal segment 3 at most two-thirds of segment 2; front not wider than
 high 25
25. First posterior cell mostly dark *P. nigromarginatus* (Kröber)
 First posterior cell hyaline *P. discalis* (Williston)
26. Front entirely black 27
 Front with yellow or reddish 45
27. Cheeks black or brownish, darker than face. 28
 Cheeks same as face, but may have small dark area 36
28. Antennal segments 2 and 3 subequal. 29
 Antennal segment 3 much shorter than segment 2 31
29. First posterior cell mostly dark 30
 First posterior cell hyaline except for anterior margin.
P. antennatus (Kröber)
30. Most segments of abdomen with posterior pollinose margin.
P. bulbirostris (Loew)
 Only segments 1 and 2 with pollinose margin *P. travassosi*, new species
31. First posterior cell mostly dark 32
 First posterior cell mostly hyaline 34
32. Pollinose pleural stripe separated from humeral spot.
P. nigromarginatus (Kröber)
 Pollinose pleural stripe connected with humeral spot. 33
33. Yellow pollen on front diffuse. *P. anthreas* (Williston)
 Yellow pollen on front distinct, forming two spots which may be joined.
P. ornatifrons (Kröber)
34. First basal cell as dark as wing pattern *P. infuscatus*, new species
 First basal cell hyaline, or paler than wing pattern 35
35. First basal cell usually partly darkened; male with distinct abdominal rings;
 theca long *P. discalis* (Williston)
 First basal cell entirely hyaline; male with indistinct abdominal rings; female
 theca short *P. angustus* (Kröber)
36. Antennal segment 3 longer or about equal to segment 2 37
 Antennal segment 3 distinctly shorter than segment 2 41

37. Antennal segment 3 much longer than segment 2 . *P. ocellatus* (Giglio-Tos)
 Antennal segment 3 not longer than segment 2 38
38. Wing pattern interrupted by transverse hyaline stripe.
 P. sylvosus (Williston)
 Wing pattern not interrupted 39
39. Large species, 19–23 mm. *P. grandis* (Williston)
 Smaller species, 13–18 mm. 40
40. Legs dark *P. guianicus* (Curran)
 Legs rufous *P. floridanus*, new species
41. First posterior cell hyaline 42
 First posterior cell darkened 43
42. Wing pattern distinctly paler anterior to second vein. Cheeks never with
 any black *P. angustifrons* (Williston)
 Wing pattern not much paler before second vein . . . *P. discalis* (Williston)
43. Front and vertex entirely dark 44
 Yellow markings at junction of front and vertex . . *P. ornatifrons* (Kröber)
44. Wing pattern diffuse *P. obscuripennis* (Williston)
 Dark of wing distinct from hyaline areas . . . *P. nigromarginatus* (Kröber)
45. Front with sharply defined T-shaped pattern 46
 Front without sharply defined T-shaped pattern . . . 53
46. Antennal segment 3 much longer than segment 2 . . *P. costatus* (Fabricius)
 Antennal segment 3 not longer than segment 2 47
47. Antennal segment 3 nearly equal to segment 2, at least three-fourths . . . 48
 Antennal segment 3 much shorter than segment 2, less than two-thirds . . 49
48. Front nearly filled by T pattern *P. pictifrons* (Kröber)
 Front not nearly filled by T pattern *P. gracilior* (Kröber)
49. Posterior femur mostly reddish *P. nigrimanus* (Bigot)
 Posterior femur mostly black 50
50. Cheeks yellow 51
 Cheeks dark 52
51. Antennae dark *P. peruvianus*, new species
 Antennae rufous *P. nitens*, new species
52. Antennae reddish *C. ornatus* (Williston)
 Antennae dark *P. varipes* (Kröber)
53. First posterior cell without dark pattern; except along vena spuria, and some-
 times at very base. 54
 First posterior cell with some of dark pattern 56
54. Antennal segment 3 as long as segment 2 *P. shannoni*, new species
 Antennal segment 3 much shorter than segment 2 55
55. Cheeks yellow *P. fronto* (Williston)
 Cheeks dark *P. infuscatus*, new species
56. Cheeks dark 57
 Cheeks yellowish 62
57. Complete distinct postvertical pollinose stripe. 58
 No complete distinct postvertical stripe 60
58. Thorax and abdomen mostly rufous *P. townsendi*, new name
 Thorax and abdomen mostly dark 59
59. Abdomen with golden pollen *P. connectens*, new species
 Abdomen with grayish yellow pollen *P. excisus* (Wiedemann)
60. Reddish species *P. rufus* (Williston)
 Dark species 61
61. Pleural stripe connected with humeral spot *P. antennatus* (Kröber)
 Pleural stripe not connected with humeral spot . . . *P. pallifrons* (Coquillett)

62. Front dark with yellow in center **P. crudus** (Walker)
 Front light with dark medially or dorsally 63
63. Antennal segment 3 relatively robust, usually longer than segment 2.
 P. longistylus (Kröber)
 Antennal segment 3 relatively slender, rarely longer than segment 2 64
64. Distal abdominal segments dark reddish **P. gracilianus**, new species
 Distal abdominal segments black 65
65. Facial grooves entirely dark **P. floridanus**, new species
 Facial grooves pale, but may have dark spot 66
66. Reddish species **P. gracilis** (Williston)
 Dark species 67
67. First basal cell dark; theca long; facial grooves unmarked.
 P. bahamensis Parsons
 First basal cell hyaline; theca short; facial grooves usually with dark mark.
 P. brachyrhynchus (Macquart)



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POPULATIONS OF THE BERYCOID FISH FAMILY
POLYMIXIIDAE

By ERNEST A. LACHNER

The contributions in this study are the presentation of data mainly from heretofore unreported collections warranting the recognition of three species of *Polymixia*, new evidence establishing two species in Atlantic waters, and great extensions of the geographic distributions of all forms.

This family, with a single genus, has had seven nominal forms referred to it. Nineteenth century interest in exploration and natural history accounted for the almost simultaneous descriptions of two species from each of two different geographical areas, *Polymixia nobilis* Lowe (1836) from Madeira and *Nemobrama webbia* Valenciennes (1843) from a contiguous area, the Canary Islands, and *P. lowei* Günther (1859) and *Dinemus venustus* Poey (1860) from Cuba. There is disagreement in the literature on the exact dates of publication of the descriptions of *P. nobilis* and *N. webbia*. Some authors have given 1838 for the former. Valenciennes's "Icthyologie," in Baker-Webb and Berthelot, "Histoire Naturelle des Îles Canaries," volume 2, part 2, has been listed under several dates and more generally by some as 1836-44. There is no question of priority, for Valenciennes mentions *nobilis* in his study. I follow Neave (1940) for my dates of these references.

The osteology, anatomy, and classification of the berycoid fishes have been generally treated by Starks (1904) and Regan (1911). The Polymixiidae, possessing a unique pair of chin barbels, were incorrectly related to the Mullidae by many earlier workers owing to this superficial character. Several distinct fossil genera are known dating as early as the Cretaceous, but only one living genus exists. David (1946, p. 63) described a new fossil genus, *Parapolymixia*, based on scales from the California Eocene, but the differences when compared to *Polymixia* are not explicit and may represent only a specific level of differentiation.

Collections and methods

A total of 277 specimens were available for study from the eastern and western Atlantic Ocean and the western Pacific Ocean. I have also seen or have had examined for me the types of six of the seven nominal forms. All collections and types are listed by geographic areas in the descriptions of the respective species.

I am greatly indebted to several of my colleagues who generously made available to me collections and certain information. Special thanks are due William C. Schroeder, Museum of Comparative Zoology (MCZ), for making available the extensive collections from Cuban waters taken by him on the *Atlantis* expedition under the joint auspices of Harvard University and the University of Havana, and also specimens taken in deep waters off Long Island, N. Y., by the Woods Hole Oceanographic expeditions (*Captain Bill II*), as well as other miscellaneous specimens and types of *Dinemus venustus* Poey in the Museum of Comparative Zoology. My appreciation is also extended to: Dr. Reeve M. Bailey, Museum of Zoology, University of Michigan (UMMZ), for the loan of specimens from Japan; Loren P. Woods, Chicago Natural History Museum (CNHM), for data from specimens from Madeira, the Gulf of Mexico, and Japan; John T. Nichols, American Museum of Natural History, New York (AMNH), who made available the types of *P. nobilis virginica* Nichols and Firth and a specimen from Japan; Alwyne C. Wheeler, British Museum (Natural History) (BM), for providing me with data from the types of *P. nobilis* Lowe, *P. lowei* Günther, and *P. japonica* Günther, data from several specimens from Madeira, St. Helena, and Japan, and an X-ray photograph of the type of *japonica*. All other collections listed, including the type of *P. berndti* Gilbert, are in the U. S. National Museum (USNM). Isaac Ginsburg, U. S. Fish and Wildlife Service, made available 50 specimens of *lowei* (USNM 157749-54) from the Gulf of Mexico taken by the U. S. Fish and Wildlife Service Exploratory Fishing Vessel *Oregon*. Dr. Fenner

Chace, division of marine invertebrates, U. S. National Museum, presented me with considerable literature on the distribution of marine invertebrates in the Atlantic Ocean.

The method of recording counts and measurements of several characters require explanation because they present certain specific or unique problems in this group. The last ray of the SOFT DORSAL FIN is nearly divided to its base and may be erroneously interpreted as two. One must be especially cautious when the fins are badly frayed and torn. All rays of the PECTORAL FIN were counted. The VERTICAL SCALE ROWS were counted by noting the oblique rows on the body above the lateral line, commencing with the row at the junction of the lateral line and the gill opening, and counting posteriorly to the end of the hypural plate. This count was less variable than counting the scales along the lateral line and can be made with greater accuracy. The LATERAL LINE PORES were counted from the upper edge of the gill opening to the end of the hypural plate. The TOTAL NUMBER OF GILL RAKERS recorded includes all developed rakers on the upper and lower limbs of the first right arch. Several depressed, usually elongate rudiments occur adjacent to the last, small, pointed raker on the lower arch. These were omitted from the count for two or more may be coalesced. A small tubercle may also occur adjacent to the last, small, raker on the lower arch. When this tubercle was higher than the diameter of its base it was considered as a raker and included in the count, and when smaller it was considered as a rudiment. There is a reduction in the number of gill rakers with increase in body size, giving rise to the negatively skewed curve as shown by the frequency distribution of the total number of gill rakers of *lowei* from Cuba in table 2. This is due to the presence of a larger number of small specimens. The positively skewed curve shown for the same species from the Gulf of Mexico was caused by the great number of large specimens. The longest measurement of the UPPER JAW was taken because the jaw has a cleft at the symphysis. The LENGTH OF THE PECTORAL FIN was measured from the tip of the longest ray to the anteriormost portion of its base. All measurements of the LENGTH OF A FISH refer to the standard length. In the numerical data given in the description, the mean is listed first, and it is followed by the range of variation for each character showing interspecific differences.

Diagnostic characters

The species have differentiated almost entirely in meristic characters. The data are tabulated in the form of frequency distributions in tables 1 to 6, and in most cases are segregated by localities.

The number of dorsal fin rays and the total number of gill rakers proved to be the most critical characters in the separation of the species. The interesting negative correlation between these two characters accounts for the greater departure between the frequency distributions of *nobilis* and *lowei* when a character index is formed by subtracting for each individual specimen the total number of gill rakers from the number of soft dorsal fin rays (table 3). Each of these characters or their combination expressed as an index did not completely separate all specimens of the three species, small overlaps occurring among the distributions. The exact nature of these overlaps and other reasons for the recognition of the species are discussed under the description of each species.

The number of anal fin rays may prove to be of value in separating eastern and western populations of *nobilis* (table 5). Four specimens from Madeira had an anal fin ray count of 17 to 18, and five from Cuba had only 16 rays. No doubt larger collections will reveal some overlap, but this is sufficient indication that some differentiation has occurred between these populations. This character is certainly not very variable, judged from the nature of the modality of specimens of *lowei* from Cuba and the Gulf of Mexico. I hesitate to name this Cuban population because of lack of sufficient material and because all three species are not completely separable in themselves. The divergence of the characters in the various populations is quite irregular and difficult to evaluate in respect to the real biological differentiation. The single specimen from the Hawaiian Islands has a higher anal ray count than the 25 specimens from Japan and the Philippine Islands. Here again is a suggestion of population divergence, but any reliable allocation of rank must await additional collections.

Evidence of differentiation between the Japanese and Philippine populations of *japonica* is shown in the tabular data on the number of pectoral fin rays, lateral line pores, and vertical scale rows and the length of the chin barbel, but these require substantial verification.

Geographic distribution

The family has a global distribution in tropical and semitropical waters where they are generally taken near some continental land mass at depths of 150 to 350 fathoms, although some have been captured in less than 50 fathoms. The species are considerably more widely distributed than previously reported. The eastern Atlantic form, *nobilis*, is reported for the first time from the western Atlantic. The distribution of the western Atlantic form, *lowei*, is now more widely known from the Gulf of Mexico and as far north along the Atlantic

shelf as New York. The Pacific species, *japonica*, is now reported from the Philippine Islands (not included in Herre's 1953 checklist), but not yet known from Indo-Australian waters (Weber and de Beaufort, 1929, p. 215).

In the future, in concentrated collecting such as was done in Cuban waters by the *Atlantis* expedition, all the species may be found to be more widely distributed than now known, as well as being locally abundant. The capture in one net haul in Cuban waters of more than 300 specimens of *lowei*, heretofore reported as rare, actually shows how inadequately the seas have been sampled (see discussion, *P. lowei*).

The geographic distribution of *nobilis* is of interest in view of its possible differentiation in the eastern and western Atlantic faunas.

The various literature on inshore fishes indicate that differentiation of populations between these two general faunal areas may be expected at all degrees to the specific level; some apparently show no differentiation. Actually, no detailed taxonomic study has been completed of any natural group of fishes wherein the species are supposed to inhabit both faunal areas. Some authors have published accounts and lists (Norman, 1935, p. 56) of species common to both faunas, but these should be regarded with considerable skepticism in the absence of critical data. A number of marine invertebrates are apparently common to both faunas. For those interested in comparative geographical distributional patterns the following will be of interest. Holthuis: 1952, page 15, *Pontonia domestica*, Madeira, Bahamas, and Atlantic coast of the United States from South Carolina to Louisiana; and 1947, page 77, *Rhynchocinetes rigens*, Madeira, Bermuda. Schmitt: 1935, page 128, *Penaeus brasiliensis*, from about Long Island Sound to Brazil, West Africa, Puerto Rico, St. Thomas; and page 217, *Hippa cubensis*, Florida to Brazil, West Indies, West Africa, Ascension Island, Puerto Rico, St. Thomas. Rathbun: 1933, page 49, *Callinectes marginatus*; page 68, *Chlorodiella longimana*; page 69, *Menippe nodifrons*; page 86, *Grapsus grapsus*; page 87, *Goniopsis cruentata*; and page 89, *Pachygrapsus gracilis*; all more or less with the same type of distribution as those above. No outstanding population differentiation in these invertebrate forms was noted.

Genus *Polymixia* Lowe

Polymixia Lowe, 1836, p. 198 (type species, *Polymixia nobilis* Lowe).

Nemobrama Valenciennes, 1843, p. 40 (type species, *Nemobrama webbia* Valenciennes).

Dinemus Poey, 1860, p. 161 (type species, *Dinemus venustus* Poey).

Body moderately elongate; compressed; lateral line complete; teeth in villiform bands on both jaws and on vomer and palatines; dorsal

and anal fins comparatively long with several spines graduated in size and many rays; pelvics i,6; caudal i,8+8,i; paired chin barbels nearly as long as head; 4 branchiostegals; large ctenoid scales with several rows of ctenii and about 4 to 6 radiating folds in basal region but not reaching focus.

The species of *Polymixia* are distinguished by the following key:

- 1a. Dorsal fin rays IV or V, 34 to 37, usually 36; total number of gill rakers 11 to 13, usually 11 or 12. Eastern Atlantic, Cuba **P. nobilis** Lowe
- 1b. Dorsal fin rays V or VI, 26 to 32, usually 29; total number of gill rakers 14 to 21, usually 17 to 20. Western Atlantic **P. lowei** Günther
- 1c. Dorsal fin rays V or VI, 29 to 35, usually 30; total number of gill rakers 12 to 14, usually 13. Western Pacific **P. japonica** Günther

It is not possible to distinguish the extreme variants of *japonica* using the meristic characters of this key. The discussions in the descriptions of each species give an interpretation of the possible speciation and population divergence in the family.

Polymixia nobilis Lowe

Polymixia nobilis Lowe, 1836, p. 198, pl. 4 (type locality, Madeira).—Günther, 1859, p. 17.—Goode and Bean, 1895, p. 243, fig. 241 (in part).—Fowler, 1936, p. 538, fig. 254.

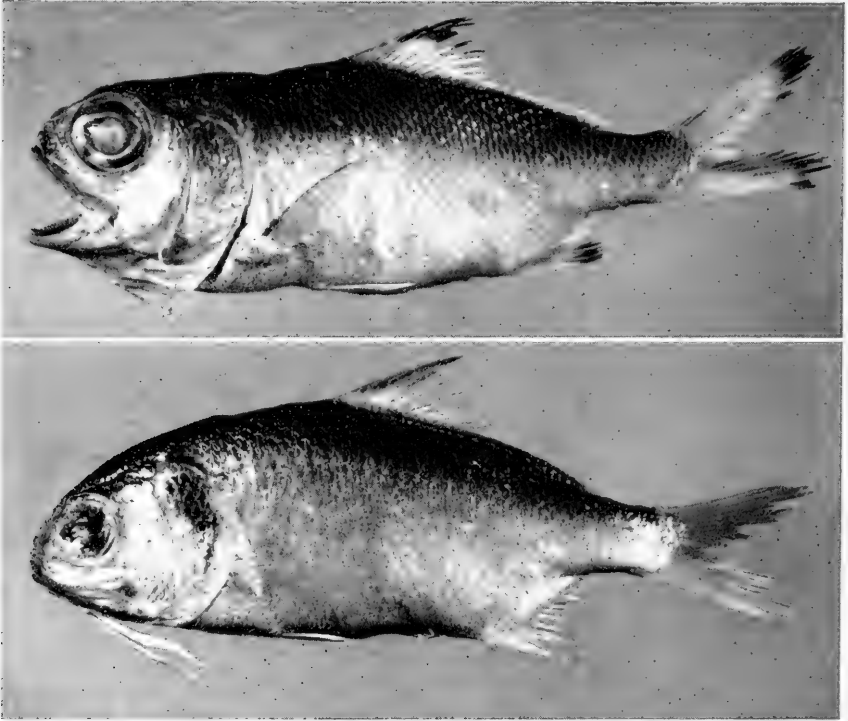
Nemobrama webbia Valenciennes, 1843, p. 41, pl. 8 (type locality, Canary Islands).

Dinemus venustus Poey, 1860, p. 161 (type locality, Cuba) (in part).

Fourteen specimens ranging in standard length from 102 to 380 mm. were examined from the following localities: Madeira (8 specimens), USNM 23324, CNHM 47977 and 47978, BM 1855.11.29.10 (holotype), 1862.4.22.17, 1862.4.22.18, and 1895.5.28.1, MCZ 31510; St. Helena (1 specimen), BM 1867.10.83; Cuba (5 specimens), MCZ 21812 (paratype of *Dinemus venustus* Poey, 191 mm. standard length), and 4 specimens, MCZ 39168, from *Atlantis* Station 3439.

DESCRIPTION: The characters distinguishing this species are the greater number of soft dorsal fin rays, 36.1: 34–37, and the lower number of gill rakers, 11.7: 11–13. The dorsal spines range from IV to V. Other characters of lesser importance but showing interspecific differences are: Soft anal rays 16.6: 16–18; pectoral rays 16.7: 16–18; lateral line pores 33: 32–34; gill rakers short, longest raker 34 to 42 percent of diameter of orbit (table 7). A comparison of additional characters with *lowei* and *japonica* is given in tables 4 and 6.

In several specimens the dorsal fin was tipped with a prominent black blotch; anal and caudal fins usually somewhat dusky; body pale or dusky over a light silvery-gold; scales above lateral line area with posterior portion blackish. The possibility of sexual dimorphism in coloration could not be studied due to the few specimens and their poor condition.



Sexual dimorphism in coloration in specimens of *Polymixia lowei* from Cuba, collected by William C. Schroeder on *Atlantis* Expedition. Top, male, 137 mm. in standard length, from Station 3439; bottom, female, 143 mm., from Station 2981c.

GEOGRAPHIC DISTRIBUTION: Madeira Islands, Canary Islands, St. Helena, Cuba.

DISCUSSION: This species is apparently considerably rarer in the West Indian waters than *lowei*. Of 154 specimens of both species captured and preserved from Cuban waters by the *Atlantis* Expedition, only four, or 2.6 percent, proved to be *nobilis*. These four specimens were taken in water 295 fathoms in depth. Two of the specimens were taken in a haul with *lowei*.

Although Poey (1860) probably was not aware of the description of *lowei* (Günther, 1859) when he described *venustus*, he failed to recognize specific differences, since part of his type material (MCZ 21812, 2 specimens) represents specimens of *nobilis* and *lowei*.

Günther (1859) distinguished *lowei* from *nobilis* on the basis of six less rays in the dorsal fin, but when he had what he presumed to be intermediate material from the Pacific and Indian Oceans he later (1887, p. 34) lumped all into a single species, Goode and Bean (1895) and others followed this procedure.¹

Smith (1949) referred to his Natal specimens as *nobilis*. His figure 283 shows 29 soft dorsal rays, which is out of the range for this species. Dorsal fin rays ranging from V, 27 to V, 38 were listed, but this range was probably summarized from the literature. No specimens from the Indian Ocean were available for my study. It appears that specimens from this area may represent *japonica*.

The higher anal fin ray count in specimens from Madeira compared to those from Cuba may show a real divergence in these populations when larger collections become available.

Polymixia lowei Günther

PLATE 1

Polymixia lowei Günther, 1859, p. 17 (type locality, Cuba); 1887, p. 34 (in part. — Rivero, 1936, p. 57).

Dinemus venustus Poey, 1860, p. 161 (type locality, Cuba) (in part).

Polymixia nobilis Goode and Bean, 1895, p. 243 (in part).

Polymixia nobilis virginica Nichols and Firth, 1936, p. 2 (type locality, Cape Henry, Va.).

A total of 235 specimens ranging in standard length from 60 to 198 mm. were examined from the following localities: Cuba (152 specimens), BM 1852.9.13.216 (holotype), MCZ 21812 (paratype of *Dinemus venustus* Poey, 134 mm. standard length), and 150 MCZ

¹ While this paper was in press Maul published an account (Bol. Mus. Municipal do Funchal, Madeira, No. 7, art. 17, pp. 9-11, 1954) in which he recognized two species on the basis of a higher dorsal count in *nobilis*, 40 to 42 (spines plus rays), compared to 35 in *lowei*, and that the body of *nobilis* was "rather deep." The range of variation of the dorsal rays is considerably greater than Maul indicates and the amount of separation much closer. I find the depth of the body to vary considerably in respect to size and to some extent sex, the females being somewhat deeper. I did not find any notable differentiation in body depth when comparing specimens of equal size of these species. However, *nobilis* appears to attain a much larger size and, consequently, greater depth.

TABLE 3.—Frequency distribution of a character index formed by subtracting for each individual specimen the total number of gill rakers from the number of soft dorsal fin rays

| Species | Locality | Character Index | | | | | | | | | | | | | | | | | | | | |
|-----------------------|------------------|-----------------|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| <i>nobilis</i> | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| <i>lowei</i> | | 1 | - | 9 | 32 | 71 | 33 | 43 | 13 | 9 | 3 | 5 | 2 | - | - | - | - | - | - | - | - | 6 |
| <i>japonica</i> | Japan..... | - | - | - | - | - | - | - | - | - | - | - | - | 3 | 1 | 2 | 2 | 3 | 1 | - | - | - |
| | Philippines..... | - | - | - | - | - | - | - | - | - | - | - | 11 | 1 | 1 | - | - | - | - | - | - | - |
| | Hawaii..... | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - |

TABLE 4.—The number of vertical scale rows in species of Polymixia

| Species | Locality | Vertical scale rows | | | | | | | | | | | | | | | | | | | | |
|-----------------------|------------------|---------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|
| | | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | | | | |
| <i>nobilis</i> | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| <i>lowei</i> | | - | - | - | 1 | 1 | 2 | 3 | 1 | 4 | 6 | 5 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| <i>japonica</i> | Japan..... | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Philippines..... | 1 | 1 | - | - | 2 | 2 | - | - | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| | Hawaii..... | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

specimens taken on Harvard-Havana *Atlantis* Expedition from Stations 2950, 2961D, 2962, 2963C, 2980B, 2981C, 2982, 2982A, 2983, 2987, 2987A, 3324, 3328, 3386, 3389, 3393-94, 3401, 3416, 3421-23, 3427-28, 3430-32, 3435-39, 3478; Jamaica (1 specimen), MCZ 33858; Virgin Islands (7 specimens), USNM 102151-157, Johnson-Smithsonian Expedition; Gulf of Mexico (58 specimens), USNM 157752 and 157753 (8 specimens off Pensacola, Fla.), USNM 117089, from stomach of *Paralichthys oblongus* at 168 fathoms, 117090, 117091, and 157751 (19 specimens from near Tortugas, Fla.), USNM 157749 and 157754 (25 specimens off Mississippi), USNM 157750

TABLE 7.—The longest gill raker of the first right arch expressed as a percentage of the diameter of the orbit in *Polymixia nobilis* and *P. lowei*. (Numbers in parentheses refer to *P. nobilis*.)

| Standard length (mm.) | Percent | | | | | | | | | | | | |
|--------------------------|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 34-35 | 36-37 | 38-39 | 40-41 | 42-43 | 44-45 | 46-47 | 48-49 | 50-51 | 52-53 | 54-55 | 56-57 | 58-59 |
| 60-99..... | - | - | - | - | - | - | 1 | 1 | 2 | 2 | - | 1 | 1 |
| 100-139..... | - | - | (1) | - | - | 4 | 3 | 5 | 4 | 3 | - | - | - |
| 140-179..... | - | (1) | 1 (1) | 1 | 3 | 1 | 2 | 3 | 1 | 1 | 1 | - | - |
| 180-219..... | (1) | - | - | - | 1 (1) | - | - | - | - | - | - | - | - |

(2 specimens off Corpus Christi, Tex.), CNHM 46388 (4 specimens from various areas of Gulf of Mexico); Atlantic Coast (17 specimens), AMNH 13569 (2 specimens, south-southeast of Cape Henry, Va., cotypes of *Polymixia nobilis virginica* Nichols and Firth), MCZ 37702 (14 specimens, 40°03'N., 70°25'W.), and MCZ 37411 (1 specimen, 40°02'N., 70°24'W.).

DESCRIPTION: This species is distinguished by the low number of soft dorsal fin rays, 28.7: 26-32, and the high gill raker count, 18.8: 14-21. The dorsal spines range from V to VI. Other characters showing some interspecific differences are: Soft anal rays 15: 13-17; pectoral rays 15.8: 15-17; lateral line pores 33.4: 31-36; gill rakers long, longest raker 39 to 58 percent of diameter of orbit. A comparison of the length of head, barbel, pectoral fin, upper jaw, diameter of orbit, and vertical scale rows with the other species is given in tables 4 and 6.

Sexual dimorphism in coloration is markedly evident, the most pronounced being the intense black on the outer portion of the longest rays of the anal fin and lobes of the caudal fin in the males, pale or slightly dusky in the females. Coloration of the males usually larger than 120 mm. standard length: outer one-third to one-half of the dorsal fin between 4th and 5th spine and the first 6 rays prominent black, some whitish below this spot or blotch, remainder of fin pale;

outer third of first 7 or 8 rays of anal fin heavy black, remainder pale; tips of outer rays of caudal fin black; pectoral fin pale to transparent; 1st and 2d ray of pelvic fin slightly milky, remainder pale or clear; snout and interorbital portion of head with enlarged or swollen, pale or milky jellylike tissue; barbel pale, some dusky near base; jaws dusky; iris silvery to light golden; body above lateral line darker, particularly predorsal area, due to heavier blackish pigmentation on posterior portion of scale just before ctenii; body below lateral line pale, silvery or light blue iridescence; a stripe of silvery along lower part of caudal peduncle, on each side, joining anteriorly on belly between bases of pelvic fins. Coloration of gravid females ranging in standard length from 127 mm. or larger: dorsal fin with some dusky or blackish at outer portion of longest rays; anal fin pale, in some slightly milky; caudal fin sometimes dusky at tips of outer rays; pectoral and pelvic fins clear or pale; body generally lighter and more silvery. Juvenile specimens, 60 to 70 mm. in standard length, could not be sexed using a binocular microscope, but some had the dorsal, anal, and caudal rays tipped in dusky, more so than in the larger, gravid females. These specimens were probably males commencing to develop the definitive adult coloration.

GEOGRAPHIC DISTRIBUTION: West Indies, Gulf of Mexico, Atlantic shelf of United States north to Long Island, N. Y.

DISCUSSION: Poey's (1860) account of *venustus* included one of the diagnostic characters, a dorsal fin ray count of V,28, but his illustration, plate 14, figure 1, is only an un-descriptive line drawing. On the basis of his description and one cotype (MCZ 21812, 134 mm. standard length) I place *venustus* in the synonymy of *lowei*. The other cotype of *venustus* (also MCZ 21812) represents *nobilis*. Data for the two cotypes of *P. nobilis virginica* Nichols and Firth (AMNH 13569, 96 and 98 mm. standard length, dorsal fin rays V,28 and V,29; anal fin rays IV,15; pectoral rays 15; lateral line pores 34; gill rakers total 17 and 20) shows no real departure from specimens of *lowei* from other localities and it is, therefore, also placed in the synonymy of *lowei*. The meristic data of great interest in *lowei* and *nobilis*, since both occur together, is the negative correlation between the total number of gill rakers and the number of soft dorsal fin rays. *P. lowei* with a lower number of dorsal rays has a higher number of gill rakers (tables 1 and 2).

The frequency distributions of the total number of gill rakers in *lowei*, segregated by locality, shows the mode of specimens from Cuba to fall on 20 while it is 17 for those from the Gulf of Mexico. A minor population divergence should not be associated with this difference. It is due to the decrease in the number of gill rakers with increase in size. This regression is shown in crude form in

table 8. Specimens from the Gulf of Mexico attained a larger average size and consequently had fewer rakers.

Throughout its range, *Polymixia* has been reported as quite rare. Rivero (1936) reported two specimens of *lowei* from Cuba and mentioned the rarity of the species. We now can report *lowei* as being

TABLE 8.—A crude regression analysis showing decrease in the number of gill rakers with increase in size in *Polymixia lowei*.

| Standard length in mm. | Total number of gill rakers | | | | | | | |
|------------------------|-----------------------------|----|----|----|----|----|----|----|
| | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 60-99..... | - | - | - | 9 | 16 | 18 | 46 | 5 |
| 100-139..... | - | 1 | 3 | 3 | 15 | 1 | 30 | 8 |
| 140-179..... | - | 4 | 1 | 9 | 11 | 3 | 3 | - |
| 180-219..... | 1 | 1 | - | - | - | - | - | - |

relatively common. Although 150 specimens were captured and saved by the Harvard-Havana *Atlantis* Expedition, many specimens were discarded for lack of adequate storage facilities. William Schroeder, Woods Hole Oceanographic Institution ichthyologist attending this expedition, informed me that one trawl haul yielded more than 300 specimens. This haul could have contained *nobilis* as well as *lowei*, but most of the specimens probably represented the latter species.

There is considerable variability in the depth of water in which *Polymixia* is taken. This data is summarized for *lowei* in western

TABLE 9.—Depth of water, in fathoms, in which *Polymixia lowei* was taken.

| Locality | 0-49 | 50-99 | 100-149 | 150-199 | 200-249 | 250-299 | 300-349 |
|---------------------------|------|-------|---------|---------|---------|---------|---------|
| Cuba..... | - | - | - | 10 | 115 | 23 | 1 |
| Gulf of Mexico..... | 15 | - | 1 | 8 | 26 | 1 | - |
| U. S. Atlantic Coast..... | - | 2 | 15 | - | - | - | - |

Atlantic waters in table 9, several localities segregated. In Cuban waters *lowei* was almost consistently taken at 200 to 300 fathoms. The specific localities of the stations listed for the Cuban specimens are given by Chace (1940).

Polymixia japonica Günther

Polymixia japonica Günther, 1877, p. 436 (type locality, off Inoshima, Japan).—Steindachner and Döderlein, 1883, p. 221, pl. 4, fig. 2.—Jordan and Fowler, 1902, p. 18.—Tanaka, 1913, p. 218, pl. 59, fig. 221.—Jordan and Hubbs, 1925, p. 209.

Polymixia nobilis Günther, 1887, p. 34.—Kamohara, 1952, p. 29, fig. 22.

Polymixia berndti Gilbert, 1905, p. 616, pl. 78 (type locality, Honolulu, T. H.)

A total of 28 specimens ranging in standard length from 94 to 171 mm. were examined from the following localities: Japan (14 speci-

mens), UMMZ 142823 and 164783 (2 specimens), USNM 38829, 57595, 71273, 148777, 148778, 151797 (totaling 7 specimens), CNHM 55422 (3 specimens), AMNH 1963 (1 specimen), BM 1880.5.1.3 (holotype, *Polymixia japonica* Günther, Inoshima, Japan; *Challenger* Expedition); Philippine Islands (14 specimens), USNM 98857-98861 (13 specimens, collected by *Albatross* Expedition at Capitancillo Island and Tagola Point Light; Hawaii, USNM 51607 (holotype, *Polymixia berndti* Gilbert, Honolulu).

DESCRIPTION: Soft dorsal fin rays 31.2: 29-35; dorsal spines V or VI; total number of gill rakers 13.1: 12-14; soft anal rays 15.3: 14-17; pectoral rays 15.9: 15-17; lateral line pores 32.2: 29-34. A comparison of the length of head, barbel, pectoral fin, upper jaw, diameter of orbit, and vertical scale rows among two Pacific populations is given in tables 4 and 6.

Specimens from Japan and Hawaii with a large black spot or blotch on outer third of longest rays of dorsal fin in the area of the first six rays. This conspicuous black spot dusky in Philippine specimens, not nearly as evident as in specimens from Japan. This difference may be due to the poor condition and preservation of the Philippine specimens and not a population divergence, for all specimens had frayed fins. Anal and caudal fins pale or with some dusky, particularly on the margin of the caudal; pectoral fin pale; pelvic pale with some whitish on edge of outer rays. Coloration of head and body as in Atlantic forms.

Günther (1887) reported on specimens from Japan, but his illustration, plate 1, figure B, probably represents *nobilis* because the dorsal fin has 36 soft rays. Steindachner and Döderlein (1883), no doubt, inadvertently omitted the barbels from their plate 4, figure 2.

GEOGRAPHIC DISTRIBUTION: Japan, Philippines, and Hawaiian Islands. *Polymixia* has been reported from the Andaman Sea (Alcock, 1889, p. 381 and 1891, p. 23) and Natal, East Africa (Barnard, 1925, p. 359; Smith, 1949, p. 149), but I am unable to determine what form is represented in these areas since the reported descriptions are incomplete and no specimens were available for my examination.

DISCUSSION: The differentiation of *Polymixia* in the Pacific area is not as clear cut compared with the Atlantic forms, but I allocate the rank of species to *japonica* owing to the nature and measure of strong divergence among the three forms.

P. japonica has differentiated considerably, although incompletely, in certain meristic characters, but in varying proportions from *lowei* and *nobilis*. It occupies an intermediate position in a comparison of frequency distributions of the most critical meristic characters, the number of dorsal fin rays and the total number of gill rakers (tables

1 and 2). On the basis of my limited material, counts of the number of soft dorsal fin rays reveal that 83 percent of all specimens of *nobilis* and *japonica* are "identifiable" (portions of the frequency distributions of each species showing no overlap), whereas only 43 percent of the specimens of *lowei* and *japonica* are similarly identifiable. Using the total number of gill rakers as a criterion to distinguish these species, only 25 percent of all specimens of *nobilis* and *japonica* can be segregated, and 97 percent of *lowei* and *japonica*. A slightly higher percentage of specimens are distinguishable by using a character index (table 3) formed by subtracting the total number of gill rakers for each individual specimen from the number of soft dorsal fin rays. With this method 85 percent of all specimens of *nobilis* and *japonica* are separable and 97 percent of *lowei* and *japonica* are separable. If we consider differentiation among these forms on the basis of these percentages only, *nobilis* and *japonica* might be considered subspecifically distinct, and *lowei* and *japonica* as having reached a specific level of differentiation. Thus, these data suggest that *nobilis* and *japonica* are more closely related than are *lowei* and *japonica*. This may be an erroneous assumption, for the close relationship of *japonica* with each of these species involves different sets of characters. Also, if two extreme variant specimens (table 3) were removed (one representing a specimen of *nobilis* and one a specimen of *japonica*) the three forms would be completely separable.

P. japonica occasionally has a sixth dorsal spine, the total number ranging from V to VI as in *lowei*, but *nobilis* occasionally has one less spine, the total number ranging from IV to V.

This measure of strong divergence in *japonica* leads one to conclude that the principal problem yet to be solved is the determination of the exact nature of divergence among the Pacific and Indian oceanic populations. This opinion is supported by the following factors: (1) *lowei* and *nobilis* definitely react as species where they have been found together in Cuban waters, (2) *japonica* is geographically isolated from the Atlantic forms, and (3) populations of *japonica* show partial differentiation in some erratic frequency distributions of meristic characters, being not nearly as stable as Atlantic populations. However, this determination must await additional exploration and study.

The Philippine specimens of *japonica* show some differentiation on a racial level from the Japanese specimens in the number of dorsal fin rays, lateral line pores, and vertical scale rows and in the length of the barbel. These differences require much verification before any conclusions can be formed regarding their real significance.

I find that the primary characters listed by Gilbert (1905, p. 616) distinguishing *berndti* from *japonica* (longer maxillary, larger scales,

bluntly rounded snout and more slender body) cannot even be considered as minor variations because all of them are similarly represented in the range of variation of characters for specimens I have examined from Japan and the Philippine Islands. Some of the more important ones are compared in tables 4 and 6.

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CONTRIBUTIONS TO THE NOMENCLATURE, SYSTEMATICS,
AND MORPHOLOGY OF THE OCTOCORALLIA

By FREDERICK M. BAYER

This paper records certain information resulting from work done toward preparation of the chapter on Octocorallia for the "Treatise of Invertebrate Paleontology." Regrettably, it must include material of very diverse nature—nomenclature, systematics, morphology, phylogeny, and paleontology. Likewise regrettably, the diagnoses of new taxonomic units must for the present be of a brief and preliminary nature. It is hoped that each may be suitably expanded in future treatments.

The field work at Arno and Ifaluk was supported by funds from Contract N7-onr-29104 (NR 388-001) by the Office of Naval Research, Department of the Navy, and National Academy of Sciences.

Order **ALCYONACEA** Lamouroux, 1816

Family **ALCYONIDAE** Lamouroux, 1812

Genus ***Sphaerella*** Gray, 1869

Lobularia Ehrenberg, 1834, p. 281; Tixier-Durivault, 1948, p. 1; not Lamarck 1816, p. 412.

Sphaerella Gray, 1869, p. 122. (Type species: *Alcyonium tuberculosum* Quoy and Gaimard=*Lobularia tuberculosum* (Quoy and Gaimard) Tixier-Durivault, 1948, by monotypy.)

Microspicularia Macfadyen, 1936, p. 28. (Type species: *Alcyonium pachyclados* Klunzinger, by original designation.)

I am in agreement with Utinomi (1953) and Macfadyen (1936) that the name *Lobularia* Lamarck cannot be used for the Indo-Pacific genus of Alcyoniidae to which it is usually applied. Macfadyen's replacement was scarcely necessary, however, because earlier names were available. J. E. Gray, in 1869, established the genus *Sphaerella* for a single species, *Alcyonium tuberosum* Quoy and Gaimard, from Tonga. Tixier-Durivault (1948) redescribed Quoy and Gaimard's type specimen and made it clear that *A. tuberosum* is a *Lobularia* sensu Ehrenberg, thus defining Gray's genus. Inasmuch as the name *Sphaerella* has some 67 years' priority over *Microspicularia*, I advocate its use. Since none of the original three species of *Lobularia* Lamarck, 1816, belongs to *Lobularia* sensu Tixier-Durivault and other authors, that name is absolutely inadmissible regardless of which of the three species is taken as its genotype.

Order GORGONACEA Lamouroux, 1816

Suborder SCLERAXONIA Studer, 1887

Family ANTHOTHELIDAE Broch, 1916

Subfamily Spongiodermatinae Aurivillius, 1931

Tripalea, new genus

Suberia Studer, 1878, p. 666 (part).

The valid type designation for Studer's genus *Suberia* seems to be that of Nutting, 1911 (p. 13), selecting *Suberia köllikeri*, a species shown by Kükenthal to be a *Semperina*. *Suberia* is thus a subjective junior synonym of *Semperina*, and *Suberia clavaria* Studer (which is not congeneric) is left without a genus. For this species I therefore establish the genus *Tripalea*, which may be briefly diagnosed as follows:

Monomorphic Scleraxonia with the medullar zone perforated throughout by gastrodermal solenia; a single ring of wide boundary canals separating medulla from cortex. Cortex with two distinct layers, the inner and thicker one very open and spongy with the walls of its spacious lacunae containing few spicules; the outer and thinner layer compact, densely packed with spicules different from those of the inner layer, extending into the inner cortex as an investment of the gastric cavities, which continues as a sheath around the major gastrodermal canals.

TYPE SPECIES: *Suberia clavaria* Studer, 1878 = *Tripalea clavaria*, new combination. Colonies simple, clavate, arising from an encrusting base. The spicules of the thin outer cortex are short capstans; of the

lacunar walls of the inner layer, longer spindles with simple, conical processes or complex tubercles; of the medulla, irregular rods often with forked ends.

DISTRIBUTION: Eastern coast of South America.

Family CORALLIIDAE Lamouroux, 1812

Genus *Corallium* Cuvier, 1798

The *E. W. Scripps*, research vessel of the Scripps Institution of Oceanography, on a recent cruise obtained specimens of two species of precious corals from deep water off Guadalupe Island. These specimens, which were kindly submitted by Robert H. Parker of Scripps Institution, represent the first find of the genus *Corallium* in North American waters.

Corallium imperiale, new species

PLATE 2, c-h

DESCRIPTION: Colony large, spread in one plane, abundantly branched in a subpinnate fashion. Main branches practically circular in cross section, about 5 mm. in diameter; end twigs slender, about 1.5 mm. in diameter; axis very weakly and obscurely striated. Autozooids restricted to one face of the colony, their calyces tall, cylindrical, 8-ribbed; the tentacles are fully retractile, but in preservation may remain exsert. The calyces are about 2.5 mm. tall, up to 3 mm. if the tentacles are not fully retracted, and 1.5 mm. in diameter. Siphonozooids forming small, irregular verrucae between the autozooids. On the naked back face of the colony the surface of the coenenchyme shows a predominantly longitudinal and parallel system of narrow ridges, here and there with cross-connections or densely anastomosing, that marks the presence of the coenenchymal solenial network.

Spiculation consists predominantly of 8-radiates and double clubs in the general coenenchyme and calyces, and irregularly spinous rods in the tentacles. The so-called double clubs or opera-glasses (pl. 2, d), actually asymmetrical derivatives of the 8-rotate capstan, are very abundant; they average 0.05–0.06 mm. in length. The 8-radiates of typical form (pl. 2, e) attain a length of 0.08–0.09 mm., and occasional atypical examples (pl. 2, g) may reach 0.1 mm. Crosses (pl. 2, f) are not uncommon. In the distal part of the calyces a few rods (pl. 2, h) 0.10–0.11 mm. in length may be found, and this type of spicule is the predominant one in the tentacles. Small 8-rotate capstans also occur in the tentacles, where the spicules are irregularly packed, extending as points into the bases of the pinnules.

In color the colony is a rich pink (approximately "vinaceous pink" of Ridgway), coenenchyme and axis being colored alike.

HOLOTYPE: USNM 50110. Southwest of Guadalupe Island, lat. 27°23' N., long. 119°19' W., 1,000–2,000 meters, Scripps Institution Pelagic Area Studies Cruise, Apr. 24, 1954.

REMARKS: *Corallium imperiale* seems to be closely allied to *C. bōshūense* Kishinouye and *C. sulcatum* Kishinouye, from Japan, but differs from both in the absence of massive, irregular sclerites and the predominance of double clubs rather than 8-radiates. *Corallium imperiale* differs further from *C. sulcatum* in its less profuse branching and more prominent autozooids (pl. 2,c), and from *C. bōshūense* in its lack of compression of the branches and its rich pink color.

Corallium ducale, new species

PLATE 1

DESCRIPTION: Colony spread in one plane, openly branched laterally and dichotomously. Branches round or slightly compressed at right angles to the plane of branching, the largest nearly 10 mm. in diameter. The terminal twigs are 1.5–2.0 mm. in diameter. Axis faintly striated; in the terminal portions it shows low surface irregularities and is distinctly granulated. The autozooids are restricted to one face of the colony, their calyces short cylindrical or blunt conical, distinctly 8-ribbed (pl. 1,n); the tentacles are fully retractile and none remain exert in preservation. The calyces are 1.5 mm. or less in height, and up to 2.0 mm. in diameter at the base, more or less tapering apically. The siphonozooids form small, hemispherical or irregular calyces near the autozooids. The coenenchyme of the back face of the colony is wrinkled by an anastomosing reticulum of narrow ridges marking the presence of the solenial system, and there are sinuous grooves on the coenenchyme between the autozooids.

The spiculation consists of abundant double clubs (pl. 1,a) derived from radiate forms by asymmetrical development of two radii, measuring 0.060–0.085 mm. in length; 6-, 7-, and 8-radiates (pl. 1,b–d) up to 0.1 mm. in length, some of which may show a considerable subdivision of the radii or are otherwise misshapen (pl. 1,e–g); crosses (pl. 1,h); massive, irregular bodies (pl. 1,i–k); slender, spinous rods (pl. 1,l) in the pharyngeal region and oral disk; and abundant stouter rods (pl. 1,m) in the tentacles.

In color the colony is a dark pink, tending more toward red than does the color of *C. imperiale*; in alcohol, the axis is of a richer and deeper color than the rind.

HOLOTYPE: USNM 50111. Southwest of Guadalupe Island, lat. 27°23' N., long. 119°19' W., 1,000–2,000 meters, Scripps Institution Pelagic Area Studies Cruise, Apr. 24, 1954.

REMARKS: The massive, irregular sclerites of *Corallium ducale* resemble those of *C. bōshūense* and *C. sulcatum* from Japan. From both of those species *C. ducale* differs widely in its open, lateral-dichotomous plan of ramification, lower autozooid calyces, and presence of both 6- and 7-radiates as well as the usual 8-radiate forms.

Family PARISIDIDAE Aurivillius, 1931

It is quite clear from the descriptions of fossil Isididae that the species involved are usually not attributable to *Isis* in a strict sense nor even, in many cases, to the family Isididae. Some of the fossil species referred to *Isis* seem to belong rather to the Parisididae (suborder Scleraxonia), which are characterized by strong radial ridges on the ends of the internodes. Thin sections of the fossils have been neither illustrated nor described, and until such sections are studied it cannot definitively be stated that these species are unquestionably scleraxonians. Every available clue indicates that they are, however, and I therefore reassign those species which have been sufficiently well illustrated to warrant the change.

Parisis danae (P. M. Duncan)

Isis Danae Duncan, 1880, p. 108, pl. 28, figs. 1-3.

Radial ridges on ends of the internodes increasing in number by intercalation rather than by dichotomy. Ramification from distal ends of internodes. A large species; axis up to 1.2 inches in diameter.

The intercalary increase of the radial lamellae may indicate a genus distinct from *Parisis*.

HORIZON AND LOCALITY: Gáj series (Miocene): Naigh-Nai Valley; 5 miles northwest of Tong; Tandra Ráhim Khan (Sind).

Parisis compressa (P. M. Duncan)

Isis compressa Duncan, 1880, p. 109, pl. 28, figs. 4, 5.

Radial ridges on ends of internodes increasing in number by dichotomy. Branches large, laterally coalescent.

HORIZON AND LOCALITY: Gáj series (Miocene): Tandra Ráhim Khán (Sind).

Parisis sp.

Isis sp. 1, Duncan, 1880, p. 109, pl. 28, figs. 8-9.

The illustrations of this fossil given by Duncan distinctly recall the Recent *Parisis fruticosa* Verrill, but identity of the fossil with the modern species must be verified by further study of specimens.

HORIZON AND LOCALITY: Gáj series (Miocene): Naigh-Nai Valley, southwest of Sehván (Sind).

Parisia ?brevis (D'Achiardi)

?*Isis brevis* D'Achiardi, 1868, p. 75, pl. 1, figs. 1a, 1b.

Isis brevis Reuss, 1869, p. 292, pl. 28, figs. 14-16.

Reuss' specimens are clearly referable to *Parisia*, and his figures correspond very closely with *P. fruticosa* Verrill. The identity of Reuss' material with D'Achiardi's is still open to question.

HORIZON AND LOCALITY: Terebratulineschichten von San Martino (Reuss); Sassello (Miocene); Castelgomberto (Oligocene) (D'Achiardi); all Italy.

Suborder HOLAXONIA Studer, 1887

Family PLEXAURIDAE Gray, 1859

Genus *Eunicea* Lamouroux, 1816

Because doubtful species are excluded from consideration in the subsequent designation of generic types, the usually accepted type species of *Eunicea* (*Gorgonia succinea* Pallas, 1766; designated by Kükenthal, 1917, p. 335) is ruled out. Lamouroux himself considered *Eunicea succinea* "une espèce douteuse." Inasmuch as no other type designation appears to have been made, I here select *Eunicea mammosa* Lamouroux, 1816, as genoelectotype of *Eunicea* Lamouroux, 1816.

Rumphella, new genus

PLATE 2, a, b

Plexaurids with moderately thick branches often terminally clavate, calyces low or absent, anthocodiae armed with a crown and points. Base of axis secondarily enlarged to form a dense calcareous mass, especially in old specimens. Cortical spicules in the form of spindles and clubs; the clubs are symmetrical wart-clubs only, derived from capstans. There are no long rods as in *Hicksonella* Nutting; no thorny clubs as in *Psammogorgia* Verrill; no large spheroids as in *Euplexaura* Verrill; no foliate clubs and torches as in *Plexaura* Lamouroux. Spicules of the inner cortex never purple or lavender.

TYPE SPECIES: *Plexaura aggregata* Nutting, 1910a = *Rumphella aggregata*, new combination (pl. 2, a, b). Syntype, USNM 43461, Flores Sea and environs, station data illegible (*Siboga* Exped.).

REMARKS: Also referable to *Rumphella* are *Gorgonia antipathes* variety β , Esper, 1792 (including also *Plexaura antipathes* Klunzinger, 1877 and *Euplexaura antipathes* Hiles, 1899) and *Gorgonia suffruticosa* Dana, 1846. Esper's, Klunzinger's, and Hiles' specimens seem to represent a single species in all probability identical with the *Coralium nigrum* of Rumphius and the *Gorgonia antipathes* of Linnaeus.

Esper's typical *G. antipathes*, which had purple spicules in the inner cortex, is the West Indian species that Houttuyn, P. L. S. Müller, and Esper himself had called *Gorgonia porosa*.

IFALUKELLIDAE, new family

Holaxonia in which the axis is strongly calcified, its core not chambered; calcareous material not oriented in a radial pattern; concentric layers nearly smooth. Spicules in the form of minute calcareous corpuscles, oval or elongate, usually with a median constriction, their sculpture irregularly granular; length 0.025–0.07 mm.

Ifalukella, new genus

Colonies low, arborescent, finely branched in an irregular, lateral pattern. Axis calcareous, brittle, spirally ridged, arising from a massive calcareous base onto which the ridges extend as high crests with lobed or strongly lacinated edges that may produce small twigs, some of which may develop into full-sized colonies. Coenenchyme thin; polyps unarmed. Spicules very small, up to 0.035 mm. in length, of characteristic outline.

TYPE SPECIES: *Ifalukella yanii*, new species.

Ifalukella yanii, new species

PLATE 3, a-c

DESCRIPTION: Scrubby little colonies reaching a height of 15 cm. but averaging only 8–10 cm. Terminal branchlets up to 10 mm. in length, very slender, 0.25–0.30 mm. in diameter, acutely pointed (the apex of the twig shown in plate 3, a is atypical). Polyps small, fully retractile into low verrucae about 0.1 mm. in height, arranged in loose, irregular spiral rows. Coenenchyme thin; endoderm packed with zooxanthellae. Spicules in the form of oval rods and disks up to 0.035 mm. in length, very scarce (pl. 3, b).

HOLOTYPE: USNM 50142. Ifaluk Atoll, central Caroline Islands: seaward reef beyond breaker-line in 15–20 feet of water. Collected Oct. 8, 1953, by Yaniseiman, schoolteacher of Ifaluk, able interpreter and aide to the Ifaluk Atoll Survey team of the Pacific Science Board.

REMARKS: The genus *Ifalukella* is apparently related to *Plumigorgia* Nutting, which differs in its regular, pinnate plan of branching and (in all specimens seen thus far) weaker development of the base of attachment. Nutting placed his genus in the family Gorgonellidae (now Ellisellidae) and was followed by Stiasny, 1940. *Plumigorgia*, like *Ifalukella*, shows no trace of the radial orientation of axis calcification which is characteristic of the Ellisellidae, and can hardly

be assigned to that family. Because of this fact, as well as the similarity of their spicules, it is clear that *Plumigorgia* should be reassigned to the Ifalukellidae.

Genus *Plumigorgia* Nutting, 1910

Plumigorgia hydroides Nutting

PLATE 3,*f,g*

Plumigorgia hydroides Nutting, 1910b, p. 32, pl. 9, figs. 3, 3a, pl. 11, fig. 4 (Pearl Bank, Sulu Archipelago; Biaru Island, northern Celebes).—Stiasny, 1940, p. 248, fig. 0, pl. 11, figs. 22, 23 (Binongko, Toekang Besi Islands).

In this species the calyces are biserial along the branches and twigs (pl. 3,*f*). The photographs published by Nutting and by Stiasny give a good idea of the general appearance of the colonies. The spicules are rather thin and scale-like, and their median constriction is slight (pl. 3,*g*).

The U. S. Fish Commission steamer *Albatross* dredged typical specimens at Station 5321, off Ibugos Island in the China Sea, in 26 fathoms, Nov. 9, 1908.

Plumigorgia wellsii, new species

Plate 3,*d,e*

DESCRIPTION: Colony about 22 cm. in height, flexible, regularly pinnately branched. Terminal twigs slender, about 0.5 mm. in diameter. Polyps on all sides, retractile within low verrucae. The spicules are characteristically small, strongly constricted rodlets (pl. 3,*e*) measuring 0.045–0.065 mm. in length; some are so constricted as to suggest a pair of tangent disks. Spicules of the verrucae sometimes in eight interseptal bands, sometimes not clearly so. Tentacles unarmed. On the branchlets there are small areas free of spicules, suggesting the presence of siphonozooids, but histological confirmation of these structures has not yet been made.

HOLOTYPE: USNM 49798. Arno Atoll, Marshall Islands, from coral knoll in southeast corner of lagoon, 10–18 fathoms. Collected July 31, 1950, by John W. Wells, Arno Atoll Survey team, Pacific Science Board.

REMARKS: *Plumigorgia wellsii* is a species larger and stouter than *P. hydroides*, from which it differs further in the general distribution of autozooids and in the shape of its spicules.

Family ELLISELLIDAE Gray, 1859

=Elliselladae Gray; Gorgonellidae Auctt.

NOMENCLATURE: The nomenclature of the genera usually called *Gorgonella* Valenciennes and *Scirpearia* Cuvier is rather tangled. The

type species of the former appears to be *Gorgonia sarmentosa* Esper (Nutting, 1910b, p. 7; Verrill, 1912, p. 390; also it is clear that Gray in 1859 considered this species to be the type, but he did not clearly designate), which is a gorgoniid and not a gorgonellid in the usual sense. The name *Gorgonella* therefore is not available for the genus to which it is usually applied, and the next available name must be employed. This is *Verrucella* Milne Edwards and Haime, 1857 (type species: *Gorgonia flexuosa* Lamarek, 1816=*Gorgonia umbraculum* Ellis and Solander, 1786=*Verrucella umbraculum*, here designated).

Scirpearia has long been a subject of debate and should almost certainly apply to a pennatulid rather than to a gorgonacean. It probably will never be known exactly what *Scirpearia* Cuvier is. The first subsequent generic name available for a member of this genus as commonly defined is *Ellisella* Gray, 1858 (type species: *Gorgonia elongata* Pallas, 1766=*Ellisella elongata*; by subsequent designation, Nutting, 1910b, p. 31). The family name established by Gray will replace the nominal family Gorgonellidae Valenciennes.

STRUCTURE OF THE COLONIAL AXIS: In 1865 A. von Kölliker described certain structural features of gorgonacean axes that seem worthy of closer study. He noted that the axis of gorgonellids (now ellisellids), with the exception of *Junceella*, showed a distinct radial pattern in cross section. The thin sections prepared in the course of the present study confirm Kölliker's observations and demonstrate the occurrence of the radial pattern of calcification in *Junceella* also, thus making it universally characteristic of the family Ellisellidae. Moreover, it was observed that the axis structure of this family is similar to that of the Isididae, which is also radial, but distinctly different from that of the Chrysogorgiidae, Primmoidae, and Ifalukellidae, which are never so. Thus, in respect to axial structure, the former two families have more in common with the pennatulids than with other gorgonacean families.

When transverse, longitudinal, and tangential thin sections are examined by polarized light it can be seen that although the calcareous units (sclerodermites) of the axis are built up in layers concentric with the axis core, they are arranged in a distinctly radial fashion and grouped in irregular, interlocking rays or sectors whose component calcareous fibers are of different optical orientation. Representatives of all genera were examined and found to have similar structure. The so-called chrysogorgiid genus *Riisea*, which has spicules like those of the ellisellid genus *Nicella*, was examined and found to have axis structure (pl. 5,a,b) like *Nicella* and unlike Chrysogorgiidae (pl. 4,c,d). *Riisea* is thus to be reckoned among the Ellisellidae where Kölliker placed it, close to *Nicella*, and not among the Chrysogorgiidae

where Wright and Studer, Versluys, and all subsequent modern authors have arranged it.

The radial orientation of the calcareous material in the ellisellid axis differs markedly from the situation seen in the families Primnoidae and Chrysogorgiidae, in which the calcareous material permeates imbricating, concentric lamellae and there is no evidence of radial arrangement. The accompanying photomicrographs of axis thin sections permit comparison of calcification as seen in Ellisellidae (pl. 5) with that of Chrysogorgiidae (pl. 4, *c, d*) and Primnoidae⁵ (pl. 4, *e, f*).

Family ISIDIDAE Lamouroux, 1812

STRUCTURE OF THE COLONIAL AXIS: Although the axes of Isididae differ widely from those of Ellisellidae in their articulation of alternating horny and calcareous segments, they are similar in having the calcareous material radially oriented.

In *Isis hippuris* Linnaeus, the calcareous fibers are united into bundles, much like the sclerodermites of stony corals, radiating outward from the central core (pl. 6, *a, b*). The fibers diverge outward from the center of the sclerodermites (pl. 6, *c, d*) in much the same way the fibers of the coenenchymal spicules diverge outward from the spicule core, and I suggest that the sclerodermites of *Isis* are actually highly modified spicules. This suggestion is corroborated by a comparison of the axis of *Isis* with that of *Parisis*, an undisputed scleraxonian with spicules in the horny nodes. In that genus we see similar but shorter sclerodermites radiating out from the axis core; the secondary thickening consists of sclerodermites oriented longitudinally (pl. 4, *b*) and continuous with the spicules imbedded in the horny nodes (pl. 4, *a*).

In the translucent, glassy axis of *Primnoisis* (pl. 6, *e*) the radial sclerodermites extend from the axis core to its surface as more or less regular prismatic rays, just as in the Ellisellidae. In *Acanella* and *Keratoisis* the orientation of calcareous elements is clearly radial but individual sclerodermites are obscured.

Order PENNATULACEA Verrill, 1865

STRUCTURE OF THE COLONIAL AXIS: Since nothing of pennatulids but the axial rod is ordinarily fossilized, intrinsic features of these structures must be sought for generic separation of fossil material. External form and sculpture are too variable to be of use, so internal structure and system of calcification is the last resort. Thin sections of the axis show that its pattern of calcification (pl. 7) is strongly suggestive of the Ellisellidae (as Kölliker pointed out) and Isididae: Longer or shorter, continuous or interrupted prismatic or irregularly

columnar sclerodermites radiate outward from a distinct core composed of granular calcareous material intermixed with abundant organic matter. Samplings were made of genera in various pennatulacean families and were found all to agree in basic pattern. Differences in detail were noted among the various families and genera, indicating that it may someday be possible to place any pennatulid axis in its proper genus without recourse to gross colonial morphology.

The genus *Stylatula* shows very long columns of irregular circumference radiating virtually without interruption from the core of the axis to its outer surface (pl. 7, *a-c, e*). The fibers of the sclerodermites converge instead of diverging as they do in the Isididae. A system of minute radial tubules extending from core to surface (the "uncalcified radial strands" of Kölliker) can be distinguished (pl. 8, *a*). Although these tubules seem to have contained organic matter, I do not believe they are uncalcified strands, but actually canaliculae, a clue to the function of which may be found in a statement by Marshall and Marshall (1882, p. 5). In their discussion of the axis of *Funiculina* these authors say: "As the stem grows in thickness by the addition of successive lamellae on its exterior, and as the proportions between the hard outer rind and the soft core are much the same in both young and old specimens, it is clear that the process of deposition of calcareous lamellae on the outside must be accompanied by absorption of the calcareous matter previously deposited in the more central portion." For such a process to take place, communication from the core to the outside would be necessary, and in the system of tubules we may have that means of communication. The organic material that they contain may be the remains of scleroclastic cells which would probably be necessary for removal of calcareous material from the core of the axis.

Four species of *Stylatula* (including *S. elongata*, the type species) from widely separated localities were found to have practically identical structure.

The closely related genus *Virgularia*, on the other hand, has the sclerodermites short and much interrupted (pl. 7, *f*). In other genera, the radial units resemble more closely those of ellisellids, or show various modifications.

In an effort to determine the systematic position of *Graphularia*, a section was examined and found to conform in most respects with the structure of *Stylatula*. The core (blackened perhaps by carbonization of the organic matter) is wider in proportion to the cortical zone, and the radial columns are shorter and thicker (pl. 7, *d*). The tubules seen in Recent *Stylatula* are present also in *Graphularia*, and contain a black material that may be carbonized organic substances. It is

evident that *Graphularia* is very close to *Stylatula* and should be removed from the Pennatulidae, in which the axis structure is clearly different in detail.

When the axis structure of all modern pennatulids has been studied, it may be possible to reinterpret the fossil genera and to assign them to their proper positions in the biological system.

SUMMARY OF AXIS STRUCTURES

Among the gorgonians with calcified axes, the calcareous material is oriented in two different ways. In the families Chrysogorgiidae, Ifalukellidae, and Primmoidae it permeates the scale-like or lamellar horny sclerodermites, which are concentrically deposited and tightly imbricated in each layer. No trace of radial orientation can be seen either in transverse or in longitudinal sections. In the Ellisellidae (pl. 8, *b*) and Isididae, the former with a continuous and the latter with an articulated axis, the calcareous fibers are radially oriented and grouped to form sclerodermites more or less suggestive of those seen in the massive coralla of the Scleractinia. The sclerodermites forming the calcareous axis internodes of the scleraxonian *Parisid* (pl. 8, *e*) are radially arranged immediately adjacent to the axis core and assume a longitudinal direction (but still in radial rows corresponding to the surface grooves) in the secondary thickening of the axis. They are continuous with the spicules of the horny nodes and are nothing more than modified spicules. The axis of *Isis* (pl. 8, *c-d*) differs only in the predominantly radial arrangement of sclerodermites, which are not essentially different from those of *Parisid*, and in the absence of spicules from the horny nodes. The axis structure of the Pennatulacea corresponds very closely with that of the Ellisellidae and Isididae.

In those forms with radial orientation of the calcareous fibers the axis substance is concentrically stratified and it therefore is apparently deposited by the cells of a continuous tissue, the axis epithelium, just as it is in other gorgonaceans. It seems necessary to suppose that groups of adjacent axoblasts in the axis epithelium are functioning as units for longer or shorter periods, depositing the radially oriented sclerodermites. The relationship of the horny material to the calcareous substance has yet to be thoroughly investigated, but it appears that any scleroblast has the ability to produce both substances.

PHYLOGENETIC IMPLICATIONS

Assuming that the sclerodermites of the Isididae are structurally the same as those of the Parisididae, and from all indications such is indeed the case, the articulate Holaxonia and Scleraxonia are phylogenetically close rather than far separated as end-points of different

lines of evolution. The isidids could have arisen from articulate scleraxonians by elimination of the spicules from the horny axis segments. Extending this theory, it is possible that the ellisellids arose from ancestral isidids by elimination of the horny nodes. That such an evolutionary trend actually existed is intimated by *Moltkia*, an articulated form (Isididae? I have not examined its axis structure) from the Danian formations of northern Europe, in which the horny nodes are overgrown by the calcareous internodes and the axis articulation is consequently obliterated.

The phylogenetic significance of the similarity of axis structure of the Pennatulacea and the ellisellid gorgonians remains to be determined. It seems to speak as strongly for the origin of the Pennatulacea from gorgonacean ancestors as other features do for its descent from alcyonacean stock. However, the Pennatulacea seems to be a very old group, antedating any known Gorgonacea.

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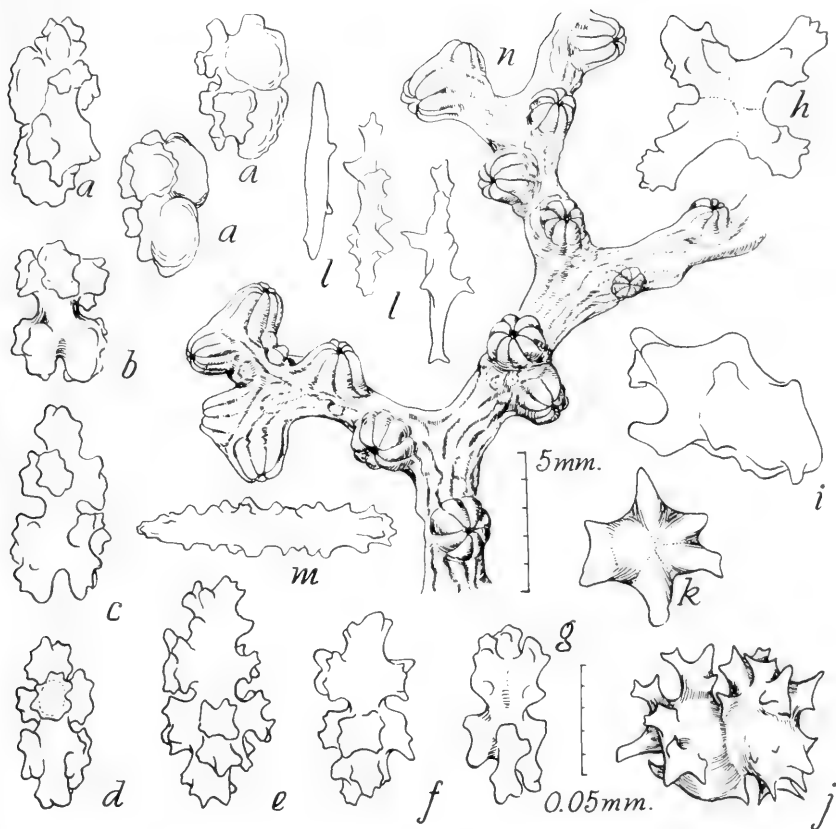
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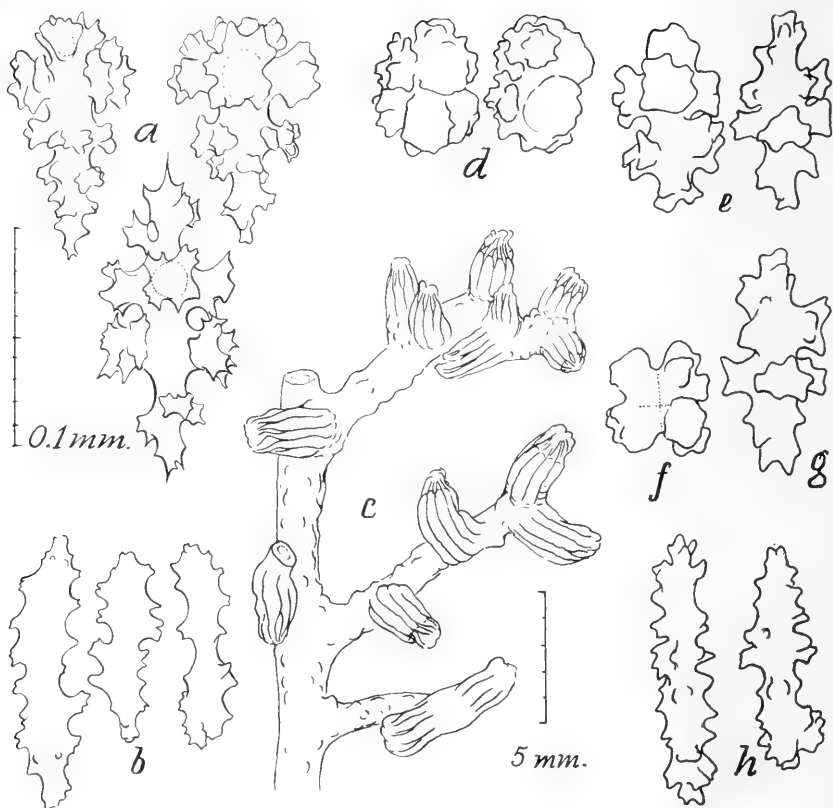
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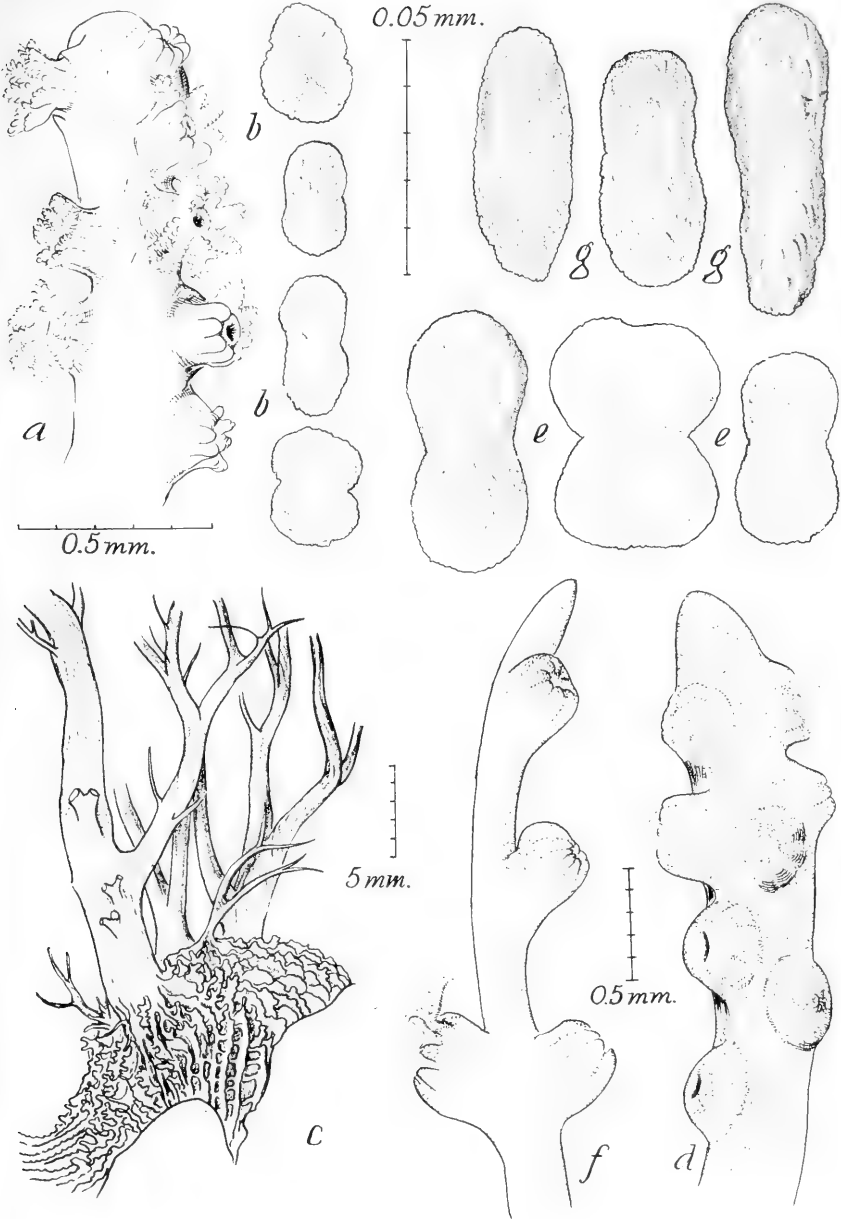
PLATES 1-8



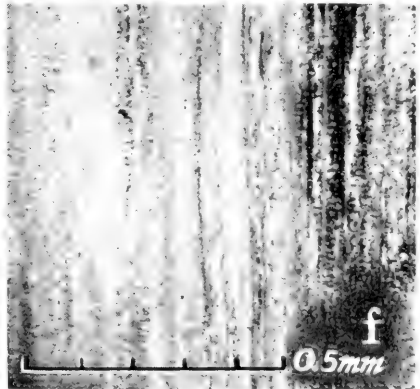
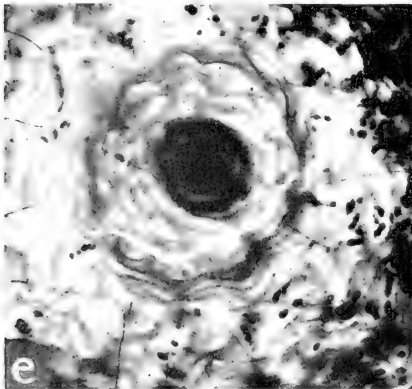
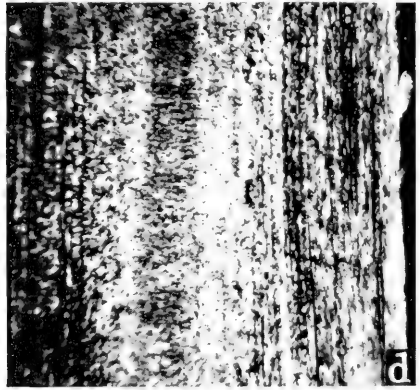
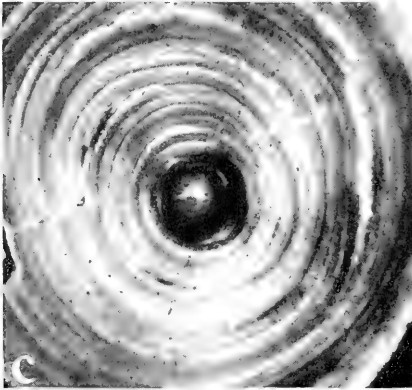
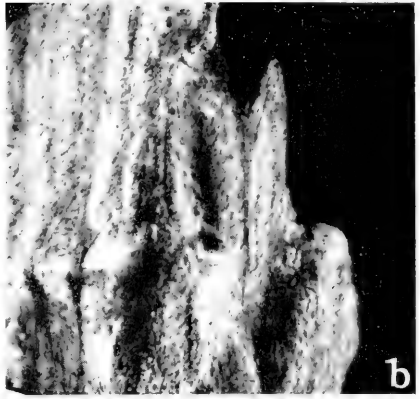
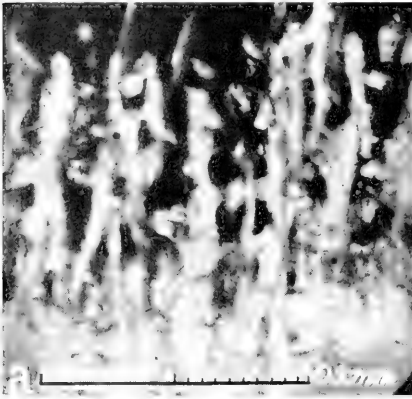
Corallium ducale, new species: a, double clubs; b, 6-radiate; c, 7-radiate; d, 8-radiate; e-g, irregular radiates; h, cross; i-k, irregular sclerites; l, spindles of oral disk and pharynx; m, spindle of tentacles; n, branch. The 5 mm. scale applies to n only; the 0.05 mm. scale applies to all spicules.



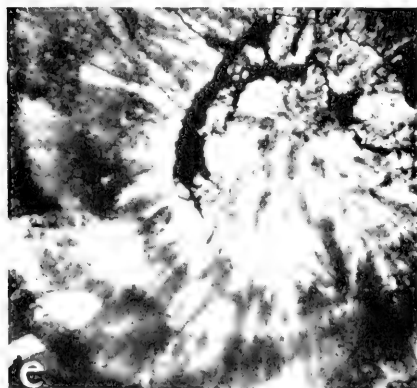
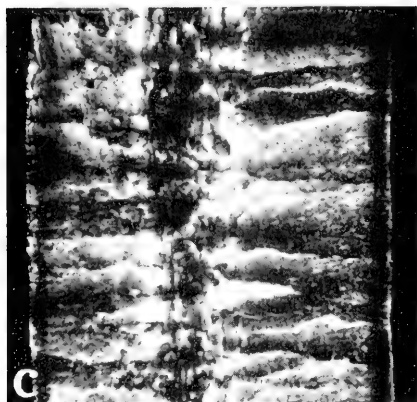
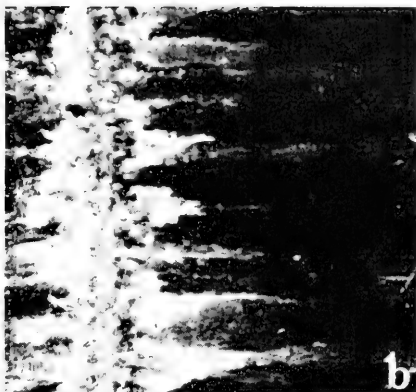
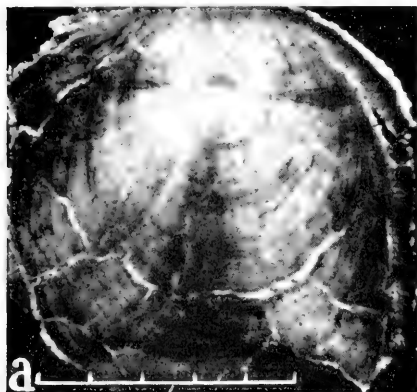
Rumphella aggregata (Nutting): *a*, two clubs and a capstan spindle from cortex; *b*, flat rod of crown and points. *Corallium imperiale*, new species: *c*, branch; *d*, double clubs; *e*, octoradiates; *f*, cross; *g*, atypical radiate; *h*, spindles from tentacles. The 0.1 mm. scale applies to all spicules; the 5 mm. scale to *c* only.



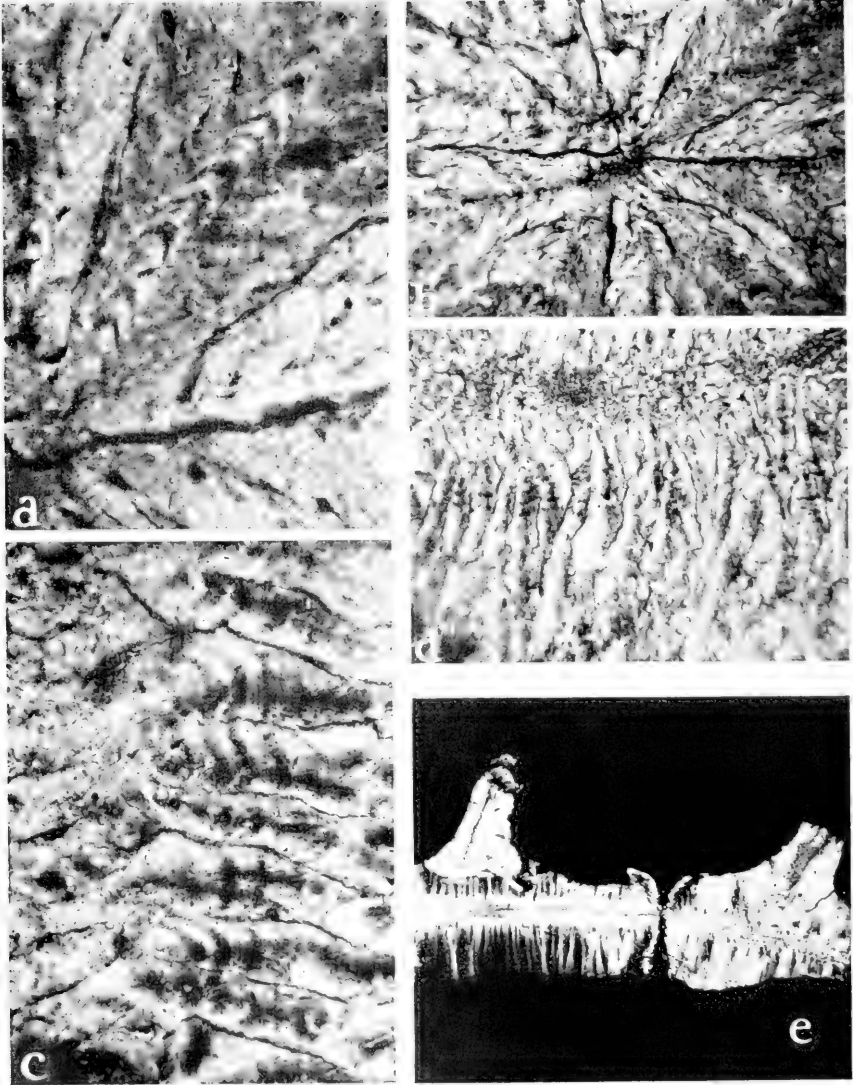
Ifalukella yanii, new genus, new species: a, tip of branch; b, spicules; c, the colonial base. *Plumigorgia wellsi*, new species: d, tip of branch; e, spicules. *Plumigorgia hydroides* Nutting: f, tip of branch; g, spicules. Scale between f and d applies to both; the 0.05 mm. scale applies to all spicules.



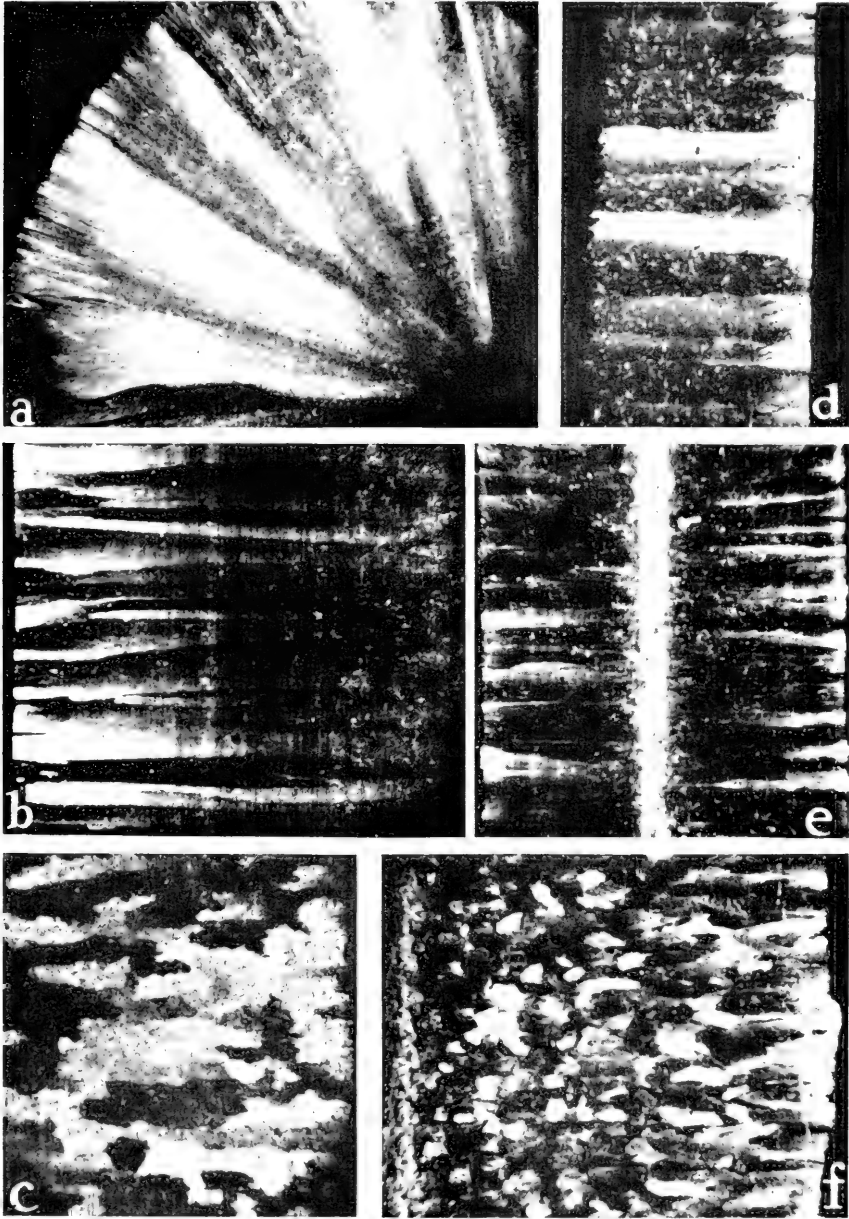
Parisis fruticosa Verrill: *a*, longitudinal section of axis at junction of node and internode; *b*, sclerodermites of internode, longitudinal section. *Metallogorgia melanotrichos*: *c*, transverse section of axis; *d*, longitudinal section of axis. *Caligorgia kinoshitae*: *e*, transverse section of axis; *f*, longitudinal section of axis.



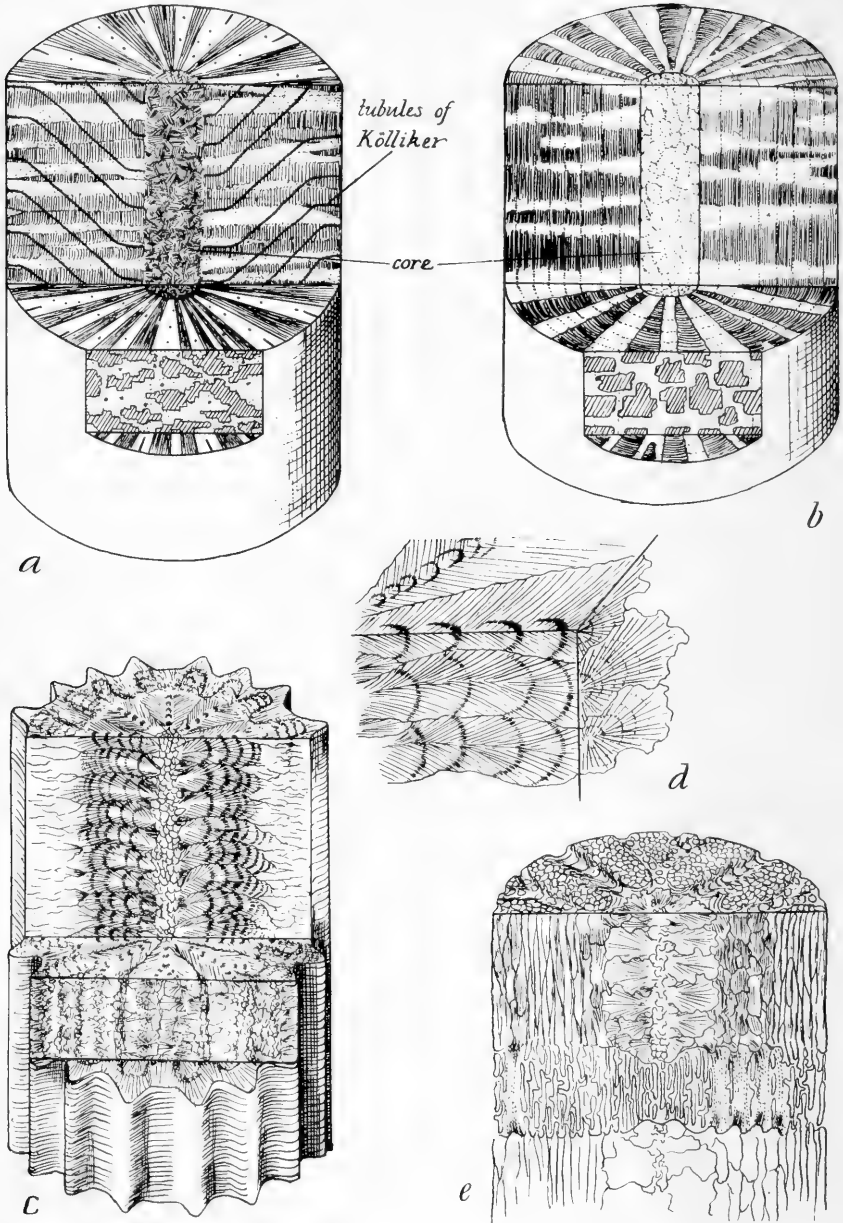
Thin sections of ellisellid axes: *a, b, Riisea*, transverse and longitudinal; *c, Verrucella*, longitudinal; *d, Clenocella*, longitudinal; *e, f, Junceella*, transverse and longitudinal.



Thin sections of isidid axes: *a-d*, *Isis hippuris*, *a* and *b* transverse, *c* and *d* longitudinal; *e*, *Primnoisis antarctica*, longitudinal.



Thin sections of pennatulid axes: a-c, *Stylatula* in transverse, longitudinal and tangential sections; d, *Graphularia zetherelli*; e, *Stylatula elongata*; f, *Virgularia*.



Diagrams of axis structure: a, *Stylatula*; b, *Ellisellidae*; c, *Isis*; d, sclerodermites of *Isis*; e, *Parisis*.



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**BRYOZOA OF THE UNITED STATES NAVY'S 1947-1948
ANTARCTIC EXPEDITION, I-IV ¹**

By **MARY D. ROGICK ²**

Introduction

The U. S. Navy's 1947-48 Antarctic Expedition brought back a sizable collection of Bryozoa that was turned over to the U. S. National Museum. The specimens to be discussed in these and subsequent papers of the Antarctic series are from this collection, which consists of one endoproct species and more than 100 ectoproct species, some of which are new.

Because of the large amount of interesting material in the collection it was found necessary to break up the work into a series of papers, of which the first four are contained here: I. *Barentsia discreta*; II. Family Cellariidae; III. Family Sclerodomidae; IV. Families Umbonulidae and Smittinidae.

The writer expresses deepest appreciation to the U. S. National Museum (USNM) for the loan of the collection and to the National Science Foundation for the research grant that so greatly aided these

¹ I, *Barentsia discreta*, pages 224-227 and plates 1, 2; II, Family Cellariidae, pages 228-252 and plates 3-11; III, Family Sclerodomidae, pages 253-270 and plates 12-18; IV, Families Umbonulidae and Smittinidae, pages 271-313 and plates 19-35.

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studies. Grateful acknowledgment is also made to the following: Comdr. David C. Nutt, USNR, who represented the Smithsonian Institution on the expedition and who was in charge of the biological collection; Dr. R. S. Bassler, Dr. Fenner A. Chace, Jr., and Dr. Waldo L. Schmitt, of the Smithsonian Institution, for all their efforts and for the privilege of examining the collection; to Mother M. Regis Manion of the College of New Rochelle for her aid with the formulation of Latinized names of the new species and genera; to the librarians of the American Museum of Natural History (AMNH) and the College of New Rochelle for their gracious and untiring help; and to Dr. William Beebe of the New York Zoological Society for the loan of valuable library sources.

The bryozoan specimens were collected by the U. S. Navy ships *Edisto* (AG-89) and *Burton Island* (AG-88) between Dec. 30, 1947, and Feb. 22, 1948. Commander Nutt has roughly divided the collection work into three phases and areas: first phase, Wilkes Land, Dec. 25, 1947, to Jan. 20, 1948; second phase, Ross Sea area, from Jan. 26, 1948, to Feb. 6, 1948; and third phase, Peter I Island and Marguerite Bay, Feb. 15-23, 1948. The locations of these areas are shown on plate 3.

COLLECTING STATIONS

- No. 11: Lat. 66°38' S., long. 90° E.; about 8-12 miles from Kaiser Wilhelm II coast. Bottom dredge haul 50 yds; 150 fathoms; water 29° F.; in shore ice, Dec. 30, 1947. Small vial of specimens.
- No. 44: Lat. 65°25' S., long. 101°13' E.; 100 fathoms; water 30° F.; Jan. 14, 1948. Pint jar of specimens.
- No. 45: Lat. 65°25' S., long. 101°13' E.; bottom dredge haul 100 fathoms; water 30° F.; Jan. 14, 1948. Vial of specimens.
- No. 101: Off Cape Royds, Ross Island; dredge haul; 58 fathoms; Jan. 29, 1948. Small jar of specimens.
- No. 104: Off Cape Royds, Ross Island; dredge haul 58 fathoms; Jan. 29, 1948. This site yielded a large number and variety of species. Quart jar of specimens.
- No. 115: Lat. 66°31' S., long. 110°26' E., off Knox Coast; vertical tow net haul; 100 fathoms; Jan. 19, 1948.
- No. 115: Off Point 13, Lat. 66°31' S., long. 110°26' E.; island off Knox Coast; vertical tow net haul from bottom; 100 fathoms; Jan. 19, 1948. Two small jars of specimens.
- No. 148: Peter I Island; 30 fathoms; water 29.16° F.; Feb. 15, 1948. Small jar.
- No. 149: Peter I Island; bottom dredge haul "A" from 30 fathoms; water 29.6° F.; Feb. 15, 1948. A small rock to which were attached holdfasts and colonies of Bryozoa.
- No. 161: Peter I Island; bottom dredge haul "B" from 30 fathoms; water 29.6° F.; Feb. 15, 1948. Small vial.

- No. 162: Peter I Island, bottom dredge haul "B" from 30 fathoms; water 29.6° F.; Feb. 15, 1948. Small jar of specimens.
- No. 163: Peter I Island; bottom dredge haul "B" from 30 fathoms; water 29.6° F.; Feb. 15, 1948. Quart jar of specimens.
- No. 177: Marguerite Bay; dredge haul 115 fathoms; water 30.2° F.; Feb. 18, 1948. Small vial of specimens.
- No. 180: Marguerite Bay, bottom dredge haul 85–105 fathoms; water 30.2° F.; Feb. 19, 1948. A small vial of Bryozoa and a small jar of Pterobranchiae.
- No. 181: Marguerite Bay, bottom dredge haul 85–105 fathoms; water 30.2° F.; Feb. 19, 1948. A tiny box of dry specimens.
- No. 184: Marguerite Bay, bottom dredge haul 85–100 fathoms; water 30.2° F.; Feb. 19, 1948. A large stone.
- No. 189: Marguerite Bay; bottom dredge haul from 35 fathoms; water 30° F.; Feb. 20, 1948. Small vial.
- No. 190: Marguerite Bay; bottom dredge haul from 35 fathoms; water 30° F.; Feb. 20, 1948. Half-pint jar of Bryozoan specimens and a small vial of Pterobranchiae.
- No. 192: Marguerite Bay; bottom dredge haul from 35 fathoms; water 30° F.; Feb. 20, 1948. Small vial.
- No. 193: Marguerite Bay; bottom dredge haul from 35 fathoms; water 30° F.; Feb. 20, 1948. Small vial.
- No. 194: Marguerite Bay; bottom dredge haul from 35 fathoms; water 30° F.; Feb. 20, 1948. Small vial.
- No. 225: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F.; Feb. 22, 1948. Small vial.
- No. 226: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F.; Feb. 22, 1948. A small vial and a pint jar of specimens.
- No. 229: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F.; Feb. 22, 1948. Small vial.
- No. 230: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F.; Feb. 22, 1948. Small jar.
- No. 233: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F., Feb. 22, 1948. Small vial.
- No. 234: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F.; Feb. 22, 1948. Pint jar of specimens.
- No. 236: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F., Feb. 22, 1948. Small vial.
- No. 238: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F., Feb. 22, 1948. Half pint jar.
- No. 240: Marguerite Bay; bottom stones from a bottom dredge haul from 40 fathoms; water 30° F., Feb. 22, 1948.
- No. 243: Marguerite Bay; Feb. 22, 1948. A small vial of Bryozoa which had been entangled with a large starfish.

A vial marked "from Case No. 1" and 19 small stones which the author arbitrarily marked Nos. 2 to 10 and 12 to 21, inclusive, were included in the lot of specimens shipped from the Antarctic area. The collecting data on them were missing.

I. *BARENTSIA DISCRETA*

PLATES 1, 2

The only entoproct collected by the U. S. Navy's 1947-48 Antarctic Expedition was *Barentsia discreta* (Busk, 1886) from Marguerite Bay, off Palmer Peninsula, Antarctica, a new locality for the species and its southernmost record to date. The *Barentsia* specimens were unusually large and robust.

In this paper O'Donoghue's *B. robusta* and Johnston and Angel's *B. intermedia* and *B. antarctica* are considered to be synonyms of *B. discreta* and to be similar in measurements to the Marguerite Bay specimens. Ecological and distributional data from almost all the taxonomic papers on this species have been extracted and brought together here. The species has an extraordinary range in latitude and longitude, being found in Tropic, Temperate, and Frigid Zones and from the Arctic to the Antarctic, from lat. 77°53' N. to lat. 68°30' S. The colder water specimens are larger and more robust in almost every particular than those found in warmer waters. Measurements are given for various structures of the Marguerite Bay specimens. The Marguerite Bay specimens grew on hydroid stems and on the bryozoans *Cellarinella* and *Phylactella lyrulata*.

TAXONOMY AND MORPHOLOGY: The partial synonymy of *Barentsia discreta*, which belongs to the family Pedicellinidae, is as follows:

Ascopodaria discreta Busk 1886, p. 44.

Pedicellina australis Jullien 1888, p. 13.

Ascopodaria macropus Ehlers 1890, p. 143.

? *Barentsia misakiensis* Oka 1895, p. 81.

Barentsia timida Verrill 1900, p. 594.

Ascopodaria macropus Robertson 1900, p. 345.

Barentsia discreta Waters 1904, p. 99.

Barentsia robusta O'Donoghue 1924, p. 21.

Barentsia intermedia Johnston and Angel 1940, p. 225.

Barentsia antarctica Johnston and Angel 1940, p. 226.

Ascopodaria discreta Kluge 1946a, p. 150.

Oka's *B. misakiensis* has long been considered a synonym for *B. discreta* by most able workers, although the seeming linear regularity of the stalk pores of his figure 2 is a bit disquieting.

O'Donoghue's *B. robusta* and Johnston and Angel's *B. intermedia* and *B. antarctica* are merely variable individuals of *B. discreta*, not separate species or even new varieties. A close study of their measurements, descriptions, and illustrations does not reveal any valid or fixed character on which to retain them as new species. Their measurements fall within the range for *B. discreta*, their appearance agrees

with *B. discreta*, and their erection was based on characters which vary so much that it is my sincere opinion that *B. robusta*, *B. intermedia*, and *B. antarctica* are synonyms of *D. discreta*. *Barentsia*, as an intensive study of many living colonies of *B. laxa* showed (Rogick, 1948), can vary tremendously in length. Johnston and Angel's studies of *B. antarctica* were of necessity based on 14 stalks and 4 admittedly immature calyces, the former a very variable feature as to length and the latter not developed far enough (might even have been regenerating heads) to be of great value in determining final tentacle number.

Barentsia discreta consists of upright, stalked, calyx-topped, yellowish zooids that are connected basally with others by narrow stolons.

In side view the calyx is broadly oval, with the anterior surface shorter and more curved than the posterior surface (pl. 1, A, D). The tentacle number extremes vary from 12 (Jullien) to 29 (Harmer), depending upon the age and size of calyx. In the U. S. Navy's specimens the tentacles were badly tangled or contracted, but one calyx had 17 tentacles. On another calyx 14 tentacles were counted on one side but it was impossible to tell how many were on the opposite side. Calyx dimensions as well as other measurements are given in table 1. The calyx is deciduous and breaks off easily, but stalks may regenerate new ones, thus accounting for unusually small heads with a small number of tentacles on very long stalks, as in Johnston and Angel's *B. antarctica*.

Barentsia discreta is recognized by the peculiarity of its stalk. The stalk consists of two parts—the shorter, thick, basal musclium and the much longer, slender, pedicel-peduncle. The musclium (pl. 1,A,B) is a flexible, barrellike, muscular cylinder found in varying degrees of contraction (wrinkling or smoothness). It is topped by a thin, hard, chitinous, conical cap from which the long, slender, characteristically marked shaft continues (pl. 1,E). The shaft consists of the long rigid proximal peduncle and the short flexible distal pedicel, the two merging almost imperceptibly into each other. An incomplete septum separates the narrow peduncle from the flared cap covering the musclium. The peduncle wall has a thin outer and thicker inner cuticle (Ehlers, 1890, pl. 2, fig. 22). Small cone-shaped pits occur in scattered and irregular manner in the inner cuticle layer (pl. 1,E) and are the key character for this species. The pedicel is soft, contractile, thinner-walled, and lacks the pores or pits.

Two to five stolons lead outward from below the musclium base, the majority of them at right angles to each other (pl. 1,B). The stolons are separated from the musclium by incomplete septa and are of variable length.

The measurements for the Antarctic (Marguerite Bay) specimens (table 1) are larger for every part when compared with measurements given for *Barentsia discreta* by Busk, Harmer, Marcus (1937), Oka, Osburn (1944), and Zirpolo. They are approached closely by figures given by Verrill, and Johnston and Angel, and are exceeded in the case of total combined length of calyx and stalk only by Kluge's fine

TABLE 1.—*Dimensions, in millimeters, of parts of Antarctic Barentsia discreta from Marguerite Bay*

| <i>Part and dimension</i> | <i>Minimum</i> | <i>Average</i> | <i>Maximum</i> |
|--|----------------|----------------|----------------|
| Musclium length | 0.555 | 0.855 | 1.147 |
| Musclium diameter | .259 | .324 | .407 |
| Combined pedicel-peduncle length | 3.071 | 4.496 | 5.920 |
| Peduncle or pedicel diameter | .037 | .068 | .086 |
| Calyx height | .555 | .736 | .925 |
| Calyx anteroposterior length | .500 | .642 | .814 |
| Pedicel, peduncle, and musclium (calyx excluded) combined length | 3.848 | 4.910 | 6.475 |
| Stolon diameter | .058 | .083 | .115 |

Arctic specimens. The total length or height of a zoid should include calyx, stalk (pedicel-peduncle), and musclium. However, because many of the Marguerite Bay specimens had either lost their heads or because some of the calyx-topped stalks were broken away from the musclium, it was not possible to get very many readings of complete, intact specimens.

On the basis of comparison of all recorded measurements for this species it can be concluded that the amount of variation in size of each individual part (calyx, stalk, musclium) is very considerable, for a bryozoan, anyway. For example, the total height or combined length of a *B. discreta* zoid (calyx, stalk, musclium) ranges from 1.584 mm. (Harmer, 1915) to 8.755 mm. (Kluge, 1946a). The very largest specimens however did come from the colder-zone waters (Arctic and Antarctic), although Verrill's Bermuda specimens were good-sized and larger than those reported from Tropical and Temperate Zones by other authors. Since this is a species found in such widely differing climatic areas and since it also occurs so near to some of our fine marine laboratories, it would be an excellent species for further ecological and physiological research.

ECOLOGY AND DISTRIBUTION: *Barentsia discreta* was taken in 1948 in bottom dredge hauls from a depth of 35 fathoms at Station 190 on Feb. 20, at Station 234 from 40 fathoms on Feb. 22, and at Station 243 on Feb. 22. Commander Nutt and Chief Electrician Layton were the actual collectors. Water temperature in the first two stations was 30° F. The *B. discreta* from Station 243 was entangled on

a large starfish. All three stations were from Marguerite Bay, an inlet of Antarctica on the west coast of Palmer Peninsula in the South Pacific between Adelaide and Alexander I Islands, lat. 68°30' S., long. 68°30' W. The amount of material collected at Station 190 was a half-pint jar containing about 33 different bryozoan species; the amount from Station 234 was a pint jar containing about 24 bryozoan species. Some of the *Barentsia* specimens from Station 190 grew on a bryozoan, *Phylactella lyrulata* Calvet 1909, and some of those from Station 234 grew on hydroid stems and rootlet fibers of a bryozoan, *Cellarinella*. The total amount of *Barentsia* isolated from these collections amounted to only a small vial.

Barentsia discreta presents a most interesting worldwide distribution (pl. 2). It has been reported from Tropical, Temperate and Frigid Zone waters, with the largest specimens coming from the colder waters. It grows in such diverse places as the North and South Atlantic, North and South Pacific, Arctic and Indian Oceans; the Mediterranean, South China, Caribbean, Java, and Ceram Seas; and the Gulf of Mexico, Long Island Sound, and Chesapeake Bay. Citations are given in the explanation of plate 2.

The quantity of material collected from most stations was rather small, except at San Pedro, Calif., where Robertson found it to be abundant.

The depths at which it has been reported range from 0 to 164 fathoms or from 0 to about 300 meters.

The substrates on which it grows also are diverse: the plants *Caulerpa* (Ehlers, 1890, p. 143) and *Posidonia cavolini* (Zirpolo, 1927, p. 413); the hydroid *Sertularia* (Thornely, 1924, p. 20); the gastropod *Priene cancellata* (Waters, 1904, p. 100); the parchment tubes of *Chetopterus* (annelid) (Jullien, 1888, p. 14); the bryozoans *Adeonella*, *Lepralia celleporoides*, *Retepora* (Harmer, 1915, p. 30), *Amathia alternata* (Osburn, 1932, p. 442), *Bowerbankia* (Jullien, 1888, p. 14) *Menipea* (Thornely, 1924, p. 20), and on the *Cellarinella* and *Phylactella lyrulata* of the present study. Marcus has recorded it from unidentified algae, corals, hydroids, bryozoans, shells, tunicates, and stones. The species seems to adapt itself readily to various substrates and because of its wide distribution should make an excellent form for experimentation.

II. FAMILY CELLARIIDAE

PLATES 3-11

The present study deals with the ectoproct Bryozoa of the order Gymnolaemata, suborder Cheilostomata, family Cellariidae that were collected by the Antarctic expedition.

The collection includes more than 100 ectoproct species, but only 10, belonging to the family Cellariidae, are discussed in this paper. The other species are reserved for succeeding papers.

Of the 10 cellariid species treated here, 7 are new. A new genus is created to receive three of these new species. One genus is redefined.

The measurements included in the taxonomic discussions are based on 10 readings unless otherwise specified.

Taxonomic Discussion

The family Cellariidae was erected by Thomas Hincks (1880, p. 103) to include those Cheilostomata having zooecia that are "usually rhomboidal or hexagonal, disposed in series round an imaginary axis, so as to form cylindrical shoots. Zoarium erect, calcareous, dichotomously branched." Hincks also noted the jointed condition of the colonies but doubted whether that character was sufficiently important to include in the diagnosis of the family. Canu and Bassler (1917, pp. 32-33) gave the following definition of the family Cellariidae based on the revisions and additional work of authors since Hincks.

The whole frontal wall of the zooecia is a cryptocyst and they have a well chitinized, bilaminar, simple operculum with a straight or concave proximal margin. Within the proximal and sometimes also within the distal margin of the aperture is placed a pair of (or sometimes a single broad) supporting teeth. The subopercular area of the avicularia has an unusually strongly developed, sometimes almost complete cryptocyst. The ovicells are endotoichal. (After Levinsen, 1909.)

The expedition yielded ten species of Cellariidae, of which seven are new. These ten species are as follows:

- Cellaria moniliorata*, new species
- Cellaria vitrimuralis*, new species
- Cellaria wandeli* Calvet, 1909
- Cellariaeforma coronata*, new genus, new species
- Cellariaeforma extentamuralis*, new species
- Cellariaeforma parvimuralis*, new species
- Mawsonia extensalata*, new species
- Mawsonia membranacea* (Thornely), 1924
- Melicerita latilaminata*, new species
- Melicerita obliqua* (Thornely), 1924

Genus *Cellaria* Ellis and Solander, 1786

Harmer (1926, p. 335) characterized the genus *Cellaria* (in which he also included *Melicerita* as a synonym) as follows:

Typically jointed, but occasionally unjointed, the zooecia usually opening all round the cylindrical internodes, which may, however, be flattened. Body cavities pear-shaped . . . produced proximally into a narrow, tubular portion, which reaches the distal part of the orifice of the preceding zoecium in the same longitudinal row. Outlines of zooecia hexagonal, pentagonal, or lozenge-shaped. Horizontal cryptocyst not definitely marked off from the lateral walls which are recumbent and usually overlap parts of the adjoining zooecia. Opesia greatly reduced, hardly larger than the orifice, the distal margin semicircular, the convex proximal border formed by a small median process, at the sides of which are a pair of condyles, sometimes accompanied by a second pair of distally situated teeth. Avicularia with undivided opesia, or with opesiules separated from it.

As Harmer stated (1926, p. 335) the genus *Cellaria* is a difficult one. Hastings (1946, pp. 233–239) cited the need for a revision and careful reexamination of the species of the genus. Livingstone (1928, pp. 39, 42) created two new genera, *Mawsonia* and *Pseudocellaria*, out of *Cellaria*. *Mawsonia* seems more justifiable as a separate genus than *Pseudocellaria*. Brown (1952, p. 164), with some hesitation, includes *Pseudocellaria* in the synonymy of *Melicerita*, a decision which appears proper. It is rather difficult to find characters which sharply differentiate *Cellaria*, *Cellariaeforma*, *Mawsonia*, and *Melicerita* from each other. The shape of the aperture and the avicularia seem to be the most usable features.

The genus *Cellaria*, in the writer's opinion, should be revised to exclude *Mawsonia*, *Melicerita*, and the new genus *Cellariaeforma*.

EMENDED DIAGNOSIS: Zoaria free, erect, usually jointed and usually branched. Branches cylindrical, generally dichotomous. Zooecia arranged in series of rhombi or hexagons around the branch axis, presenting a sculptured surface pattern of great beauty. Very regular areolation, which varies from rhomboidal to hexagonal. Orifice (space closed by operculum) somewhat reniform in shape and wider than long. A pair of condyles often present, one near each proximal corner of the orifice. The avicularia are vicarious and in general have a rather triangular mandible which in the majority of species is longer than wide, sometimes considerably so.

***Cellaria moniliorata*, new species**

PLATES 5,F–I; 6,A–L

DIAGNOSIS: Colony erect, calcareous, fragile, articulated; composed of slender cylindrical internodes which arise dichotomously at the yellow chitinous joints or nodes. Articulation nodate (see Busk, 1884, pp. 85–86, and Hastings, 1946, p. 234). Transparent, punctae-covered hexagonal zooecia arranged in series of four around branch.

Zoecial walls salient, flaring outward from the centrally depressed cryptocyst area. Parenthesis-like cryptocyst ridges beaded. Zoecial orifice protruding and cellariaeform; its upper lip hemispherical and beaded, its lower lip convex and smooth. Zoecial orifice set a considerable distance away from the distal arched wall. Ovicells form a gently rounded bulge under the frontal and lateral walls of the neighboring distal zoecia. Ooeciopore slitlike, somewhat crescentic. Avicularia much smaller than zoecia, vicarious, with smaller triangular mandible, longer than wide. The species is named for the beading on its upper lip, although other characters like the nature of the avicularia, beaded cryptocyst lines, and general appearance set it apart from other *Cellaria* species.

COLONY: Some colony sprigs are about 4 cm. long and openly branched. The colony color is a translucent glassy white, with a slightly yellowish tint. The zoecia are calcareous while the nodes or joints are chitinous. The growth habit is erect, free, the branching loose and dichotomous. The slender branches which range in length from about 5 to 13 mm. are the internodes. They arise at the very short, tangled radicle nodes or joints. This condition is called nodate articulation. Zoids are arranged in successive linear series of four around the imaginary longitudinal axis of the branches. The surface face of each series fits in a zig-zag fashion into the surface face of the next series because the frontal surface of each zoecium is hexagonal. The branches are cylindrical, and zoids open out on each face of the cylinder. The cylinder is roughly either 4- or 8-sided in cross section, depending upon the level at which the cut is made. If the branch is sectioned near the midregion of a series of four zoids abreast, then the cylinder will be approximately 4-sided. If sectioned near the proximal or distal ends of a series of four zoids, the cylinder will be roughly 8-sided, because the cut is made through zig-zagging zoids of two successive series. The nonfertile branches are slender, with a diameter of 0.317 to 0.461 mm. (average 0.422 mm.). Branches bearing ovicells are a bit stouter and more bumpy than nonfertile branches. The diameter of the ovicelled branches ranges from 0.432 to 0.533 mm. (average 0.458 mm.). The branches have a slightly wavy outline in side view because the distal arches of the zoids in each series project outward more prominently than the midregions of the zoids.

ZOOECIA: A thin salient line encloses each zoecium. Zoecia appear superficially hexagonal, with the distal region somewhat, and the proximal region especially, coming to a sharp point and arranged in a transverse row or series of four around the branch. The projecting distal zoecial corner varies in shape from a sharply pointed, rooflike structure to a more gently pointed arch, being angular in

nonfertile and more curved in ovicelled zooecia. There is considerably more length to each zooecium than appears at the surface because the proximal part of each zoid is narrowed and considerably extended to fit neatly between and beneath the side walls of the next proximal row of zooecia. Zooecial measurements are as follows: length of external (surface) face 0.490 to 0.662 mm. (average 0.619 mm.); width of external surface face 0.230 to 0.317 mm. (average 0.281 mm.); genuine over-all, internal and external length of zooecia 0.835 to 1.181 mm. (average 1.094 mm.).

The zooecial frontal surface, a cryptocyst, is pebbled or covered with small, well spaced bumps. The cryptocyst is somewhat pan-shaped, the central frontal area depressed or flattened while the side walls arise upward and outward at an angle (pl. 6,C). The walls also are pebbled. Two conspicuous, beaded ridges, curved like parentheses, arise from the frontal (CR in pl. 6,B). They begin in the arched or gabled distal walls, at each side and above the zooecial orifice, then curve convexly along the frontal surface, near each lateral wall, but do not meet proximally. These cryptocyst ridges are present on the frontal of this species as well as the inconspicuous delicate smaller parenthesis-shaped chitinous rods or trabeculae which Busk (1884) cites as occurring at the two sides of the operculum in some other species (pl. 5,H).

ZOOECIAL ORIFICE: The orifice through which the tentacles are extruded and which is closed by an operculum is of typical *Cellaria* form, arched in a semicircle distally, broadly and slightly concave proximally, with two teeth or condyles, one in each corner (pl. 5,H). The upper lip or distal arch presents a hooded and beaded appearance (pl. 6,L). The lower lip is smooth and protruded as in a pout. The whole orifice is raised above the cryptocyst frontal area like a dormer window (pl. 6,D). The arched distal walls of the zoid meet rooflike above the projecting orifice (pl. 6,H). The orifice is closed by a smooth chitinous operculum which is lightly reinforced around the edge (OP in pl. 6,C). Orifice length varies from 0.038 to 0.054 mm. (average 0.048 mm.) in midline and the width ranges from 0.115 to 0.130 mm. (average 0.121 mm.). Its total, over-all, boxed-in length varies from 0.058 to 0.072 mm. (average 0.063 mm.).

OVICELLS. The ovicells (OV in pl. 6,B) are endotoichal with distal end slightly truncate. They form low mounds, longer than wide, around the branch (pl. 6,A). Their length is from 0.187 to 0.259 mm. (average 0.232 mm.). Their width is from 0.187 to 0.216 mm. (average 0.197 mm.). They are buried under the flaring walls of the three adjacent zoids (the two lateral and the parent-proximal zoids). These walls meet in a thin salient line, like an inverted

Y or T over the ovicell front (MR in pl. 6,B). A transverse banana-shaped oeciopore (pl. 6,B) opens into the ovicell. The oeciopore length from 0.014 to 0.029 mm. (average 0.023 mm.); width from 0.086 to 0.101 mm. (average 0.097 mm.). There is a sizable strip of cryptocyst between the oeciopore and the zooecial orifice. The zooecial walls which meet over the front of the ovicell are beaded or pebbled. There are no pores in the frontal of the zoids or in the ovicell frontal.

AVICULARIA: The avicularia are few, vicarious, smaller than the regular zoids (autozoids), and placed longitudinally above the distal arch of a zooecium between the side walls of the two zooecia of the next series (pl. 6,D-F). Their shape varies somewhat from spindle to pentagonal, with length greater than width. Their over-all dimensions are: length from 0.187 to 0.317 mm. (average 0.236 mm.); width 0.101 to 0.173 mm. (average 0.127 mm.). They are bordered by a salient line. The avicularial beak is acutely triangular and raised at the distal tip. Its opening or opesia is pointed distally and is set off from the proximal hemispherical space on each side by a toothlike ledge. The mandible is an elongate triangle (pl. 6,K). The avicularium does not replace a zooecium in a series but is inserted between them (pl. 6,D). The proximal avicularial surface is beaded or pebbled (pl. 6,E).

RADICLES: Radicles are transparent, yellow chitinous tubes arising either freely from the front of the zoids or located in a tangled mass at the joints. The former are long, slender, single or double tubules which spring out from the front of the zooecium, through the cryptocyst, below the zooecial orifice and pass downward to form rootlets or holdfasts near the base of the colony (pl. 6,I,J). They begin to branch tortuously a short distance from the zoid front. The second group of radicles, those located at the joints or nodes, form a compact tangled yellow mass at the point of dichotomous bifurcation of a branch. They sprout from the zooecia at the node (pl. 5,I).

TYPES: Holotype, USNM 11210; paratypes, USNM 11211.

ECOLOGY: Other forms may grow on this *Cellaria*—namely, Foraminifera and Bryozoa like *Cellepora* and *Hippothoa distans*. Its rootlets or radicles may adhere to other Bryozoa. *Cellaria moniliorata* was collected at Antarctic Stations 104 and 115. The amount of material collected was a small vial containing numerous colony fragments.

Cellaria vitrimuralis, new species

PLATES 4; 5, A-E

DIAGNOSIS: Colony erect, calcareous, fragile but more robust than *Cellaria moniliorata*, articulated, composed of slender internodes which

arise dichotomously at the yellow chitinous nodes. Articulation tubulate (see Busk, 1884, pp. 85-86; Hastings, 1946, p. 234). Crystal-clear smooth thin-walled zooecia arranged in transverse series of five around the branch. Sometimes tiny tubercles occur on the cryptocyst, set far apart. Zooecial walls salient, ribbonlike. Fertile zooecia nearly rhombic, nonfertile ones hexagonal. Zooecial orifice cellariae-form, very close to the distal arch of the zooecial wall. Its distal or upper lip is hemispherical; lower lip faintly convex, with a condyle at each proximal corner. Parenthesis-like chitinous rods at side of zooecial orifice and also faint thin cryptocyst ridges present. Ovicells broadly truncate distally, roughly quadrangular in front view. Oocypore oval or ellipsoidal. Avicularia vicarious, as large as the autozoids which they replace in the transverse series. Mandible large, triangular. The species is named for the transparent crystallike beauty of its walls.

COLONY: The colony color is a translucent glassy white with a slight yellow tint. Zooecia lightly calcified, nodes chitinous but covered for a time at least by the calcareous zooecial bases (pl. 5,E). The growth habit is like that of *Cellaria moniliorata*, free, erect, with branching loose and dichotomous (pl. 4,D). The slender branches range in length from 7 to 14 mm. Some colony fragments are 56 mm. long but that is only part of the possible colony length. Articulation is tubulate, a condition where the internal chitinous joints are straight, yellow to amber colored tubes or cores covered by zooecial walls and where the cluster of tangled radicle fibers is absent (pl. 5,E).

Zooecia are arranged in successive linear transverse series of five around the imaginary longitudinal axis of the branch (pl. 4,F,I). Occasionally a branch will have a series of four zooecia but the 5-zooecia series is the rule. Successive series fit into each other in zig-zag fashion so that if a transverse cut is made through a branch in a midseries region the branch is 5-sided, but if made in the zig-zag region the branch is 10-sided (pl. 4,F,I). A zoid opens out on each face. Branches are quite uniform in diameter throughout their extent and everywhere in the colony, ranging in thickness from 0.590 to 0.742 mm. (average 0.667 mm.). Even fertile, ovicelled branches do not seem very much larger in diameter than nonfertile ones (compare figures H and J of pl. 4). Areolation is nearly rhombic in fertile branches but very regularly hexagonal in nonfertile branches (pl. 4,I,J).

ZOOECIA: The surface faces of zooecia in nonfertile branches are sharply hexagonal, with clear-cut razor-edge outlines (pl. 4,I). They are longer than wide. The fertile zoids, because of the ovicells which are buried under the side and front walls of neighboring zoids, assume a more nearly rhombic or diamond shape in frontal aspect (pl. 5,A).

Measurements of the external, visible frontal surface of nonfertile zooecia are: length from 0.677 to 0.936 mm. (average 0.788 mm.); width 0.288 to 0.461 mm. (average 0.366 mm.). Measurements for actual zooecial length are much greater (0.864 to 1.44 mm., average 1.076 mm.) because so much of the proximal part of a zoecium is hidden beneath and between the side-front walls of neighboring zooecia. Zooecial walls are of crystal clarity, smooth and shiny (pl. 5,A). Zooecial outlines are sometimes marked by a sizable salient razor-thin lamella (w in pl. 5,A) which looks like a glass partition. Occasional twigs may have a few tiny tubercles or bumps, very far apart. Cryptocyst ridges are nearly straight, thin, barely noticeable in this species. They are shown in plate 4,I in nearly all zooecia. They converge proximally but they do not meet. There also occur delicate, short, inconspicuous parentheses around the zooecial orifice (pl. 4,C,H). These are called chitinous rods by Busk.

ZOOECIAL ORIFICE: The orifice is set very close to the distal arch of the zoid wall and its dimensions are: length from 0.086 to 0.115 mm. (average 0.098 mm.); width 0.144 to 0.173 mm. (average 0.163 mm.). It is hemispherical; its proximal border is very faintly concave (pl. 4,C). There are two small conical condyles, one at each proximal corner. A small shallow sinus also is at each corner. An operculum fits very snugly into the orifice and its outline is the same as that of the orifice (PR in pl. 4,H; pl. 5,B-D). The operculum is smooth and nearly flat on the external side. From its hemispherical rim a broad flange extends inward (F in pl. 5,D). To the two lateral sides of the flange are attached two calcified scapula-shaped plates containing fiber bundles, giving the operculum the appearance of a drawbridge (pl. 5,B, and MP in pl. 5,D).

OVICELLS: The ovicells are endotoichal, with truncated ends and gently curving sides, giving them a somewhat rectangular appearance (ov in pls. 4,J and 5,A). Their dimensions are: length from 0.259 to 0.360 mm. (average 0.310 mm.); width 0.230 to 0.288 mm. (average 0.261 mm.). The ovicell opens to the outside by an elliptical ooeciopore (op in pl. 4,J), which is from 0.043 to 0.065 mm. (average 0.054 mm.) long and from 0.058 to 0.115 mm. (average 0.096 mm.) wide. The ooeciopore is located very close to the distal lip of the zooecial orifice, much closer than in *Cellaria moniliorata*. The side and frontal walls of the three neighboring zoids cover the frontal surface of the ovicell, meeting in a salient X suture on the ovicell (pl. 4,J).

AVICULARIA: The avicularia (pl. 4,A,B,E) are vicarious, about the size of the autozooids. They are from 0.734 to 0.922 mm. (average

0.805 mm.) long and 0.230 to 0.389 mm. (average 0.333 mm.) wide. They may occur singly or in 2's or 3's on a stalk in the same series. Their raised subtriangular beaks point distally and are raised in the form of an inverted V at the distal half or third of the avicularium (r in pl. 4,A). The greater part of the avicularial opening or opesia is covered by a triangular mandible. The dimensions of this triangular space are: length from 0.374 to 0.418 mm. (average 0.389 mm.); width 0.130 to 0.173 mm. (average 0.154 mm.). This triangular space is set off from the lower sunken hemispherical proximal opening by the two conspicuous ledge-like condyles (pl. 4,A, and L in pl. 4,B) on which the mandible articulates. This proximal hemispherical part is called the "area" in Canu and Bassler's works (1920, p. 62) and is depressed in *Cellaria vitrimuralis*.

The elongate, subtriangular mandible is directed distally. Its dimensions, based on only three readings, are: length from 0.158 to 0.346 mm. (average 0.300 mm.); width 0.202 to 0.216 mm. (average 0.206 mm.). Its edge is chitin-reinforced. There is a thinner, more transparent large central area in the mandible. From the basal corners of the mandible two converging chitinous bars or sclerites (s in pl. 4,B) encroach upon this central area. There is a prominent sharp tooth or spike turned inward from the mandible apex (pl. 4,G). From the center of the basal bar, which marks the broad end of the mandible, projects inward a small curved process. Two bundles of muscle fibers attach above this basal median process, one on each side (pl. 4,A, and v in pl. 4,B).

The avicularia take the place of the regular zoids in a series (pl. 4,H).

RADICLES: Extremely thin-walled, transparent, pale yellow tubules exit through the frontal wall of some of the zoids (pl. 4,I). These radicles are often quite long. Their diameters increase until they become one-half to three-fourths the diameter of the zoecial branches. They are directed proximally. Joints or nodes are more deeply colored (deep yellow to amber) than are the frontal radicles (pl. 5,E). The nodes seem to be part of the inner zoecial wall and are straight. No tangle of radicle fibers occurs at the joints between branches in this species.

TYPES: Holotype, USNM 11213; paratypes, USNM 11214.

ECOLOGY: The branches of *Cellaria vitrimuralis* were generally free of overgrowing organisms, but occasionally Foraminifera, cyclostomatous Bryozoa and *Hippothoa* would be found attached to them. *Cellaria vitrimuralis* was collected at Antarctic Station 104. The amount of material available for study was a very small jar which contained numerous colony fragments.

Cellaria wandeli Calvet

PLATE 7, A, B

Cellaria wandeli Calvet, 1909, p. 23, pl. 2, figs. 3-6.

TAXONOMY: This species fits most uncomfortably in this genus, yet there seems to be no other place to rightly put it, at the moment. Its avicularia are similar to those of the genus *Cellaria* but its orifice and operculum are a bit distorted and do not quite fit the generic description, being longer than wide and somewhat more like those of *Mawsonia*.

COLONY: The material consists of seven tiny, ivory colored fragments, not one of them more than 7 mm. long. They are calcareous, cylindrical, slender, ranging in diameter from 0.648 to 0.885 mm. (average 0.754 mm.). Areolation appears to be mostly rhomboid. Zoids are 4-6-sided. The number of zoids in a transverse series around the imaginary longitudinal axis of the stalk appears to be five. In Calvet's original description of this species there was no mention of the number of zoids in a series nor were any measurements given. Calvet's excellent illustrations (1909, pl. 2, fig. 3) were of a young colony whereas the figures shown here are of older individuals.

ZOOECIA: The zooecia are longer than wide. Their length ranges from 0.734 to 0.850 mm. (average 0.785 mm.); their width from 0.302 to 0.389 mm. (average 0.347 mm.). The few fragments of the present collection contained zoids which were mostly rhombic. The zooecial corners are quite pointed. The walls fuse together externally to form a thin, knife-like edge which is a bit jagged or rough. The walls are slightly crinkled or marked with faint vertical grooves. The walls are salient, tall, flared like the sides of a pan from the flattened depressed frontal surface. The zooecial frontal is flattened except for the orifice which is salient. Cryptocyst ridges and chitinous parentheses rods were absent from these specimens.

ZOOECIAL ORIFICE: The zooecial orifices are longer than wide, measuring 0.130 to 0.151 mm. (average 0.138 mm.) in length and 0.086 to 0.115 mm. (average 0.102 mm.) in width. They are wider proximally than distally. The distal end is curved convexly. The two lateral sides pinch in slightly in their midsection, then diverge proximally. The lower lip is narrow, spoutlike, salient. On each side of it is a deep sinus. Back of the sinuses, within the orifice, are two condyles for the articulation of the operculum. The cryptocyst just beneath the proximal lip is depressed. The operculum was not seen.

OVICELLS: The ovicells are not raised above the margin of the zooecia. Only one ovicell has a well curved, crescentic opening (all the other ovicell openings are rounded), whether incomplete or eroded

could not be ascertained. Measurements of the rounded openings are: length 0.058 to 0.144 mm. (average 0.103 mm.) and width 0.058 to 0.101 mm. (average 0.084 mm.). Calvet's specimens (1909, pl. 2, fig. 3) had crescent-shaped ovicell openings but he stated (1909, p. 24) that the concavity becomes almost rectilinear, thus somewhat approximating the condition of the U. S. Navy expedition's specimens. The ovicells are located between the zooeial orifice and the distal arch of the zooeial wall.

AVICULARIA: The avicularia are set at a slight slant at the proximal border of a zooeium. Their dimensions are: greater diameter (length) 0.216 to 0.22 mm. (average 0.26 mm.); lesser diameter 0.158 to 0.202 mm. (average 0.177 mm.). The beak is directed diagonally with respect to the longitudinal axis of the zooeia. Mandibles were not seen.

DISTRIBUTION: Specimens were collected at Antarctic Station No. 44 from a depth of 100 fathoms. Calvet reported the species from Booth-Wandel Isle at a depth of 40 fathoms. He pictured it accurately but gave no measurements for it.

Genus *Cellariaeforma*, new genus

DIAGNOSIS: Colony erect, free, cylindrical, calcareous. No colony fragments were long enough to indicate if the colony was capable of branching and in what manner. Zooecia arranged in transverse series around the imaginary longitudinal axis of the stalk. Zooecia of considerable length, the proximal part always hidden beneath and between the side walls of neighboring proximal zoids. Areolation rhombic to hexagonal. Zooeial orifice slightly salient, wider than long, angular, distal border and lateral walls straight, proximal border concave. Two proximal condyles and two distal teeth in orifice. Space between distal rim of orifice and distal arch or cornice of zooeial wall considerable. Avicularia small, vicarious, resembling those of *Melicerita* more than those of *Cellaria*. Avicularian mandible wider than long and with a broadly curved border.

The genus name indicates its very close resemblance to *Cellaria*. The genotype of the new genus is *Cellariaeforma parvimuralis*.

***Cellariaeforma coronata*, new species**

PLATE 8,C

DIAGNOSIS: Characters like those of the genus plus the following ones. Zooecia arranged in transverse series of four or five around the imaginary longitudinal axis of the stalk. Areolation hexagonal. Visible zooeial side walls obliquely flared. Cryptocyst sometimes tuberculate. Prominent cryptocyst ridges meet to enclose a large frontal area, like a garland around a neck, hence the species

name. Conspicuous parenthesis-shaped chitinous rods enclose the orifice. Zooecial orifice slightly salient. Operculum covers even the orifice rim amply. Two small diagonal sclerites present on the operculum. No avicularia were seen. Description is based on only one branch of a colony.

COLONY: Only a single small cylindrical fragment of the basal part of a colony was available. It is about 1 mm. thick and 14 mm. long. The ivory-colored sprig terminates in a tangle of chitinous radicle fibers which arise from the calcareous zooecia near the base. The areolation is hexagonal, but an occasional zooecium seems rhombic. Zoids occur in a transverse series of four or five around the long axis of the branch.

ZOOECIA: The zooecia are longer than wide; their proximal ends are well hidden beneath and between the side walls of the neighboring proximal zoids. The visible surface area is shorter than the actual zooecial length as is true for all the species of this genus. The measurements for this visible frontal surface of the zooecium are: length from 0.547 to 0.720 mm. (average 0.667 mm.); width 0.418 to 0.461 mm. (average 0.439 mm.). The zooecia are hexagonal but an occasional one is rhombic. Their distal arches or cornices are not sharply pointed but arched gently. The side walls or zooecial mural rims are raised, thin, and slanted from vertically to obliquely. In some places delicate lines or creases appear in the walls, as if due to a series of low tubercles arranged in rows or due to the irregularities in calcification of the walls. A delicate, flat, parchmentlike membrane covers some of the zooecia, obscuring their skeletal characteristics. The cryptocyst in some zooecia is smooth, in others covered with small, irregular, somewhat closely placed tubercles, giving it a gently pebbled appearance. Scarcely noticeable tubercles sometimes are so lined up along the flaring side walls that the latter may have a faintly crinkled or lined aspect. Other decorations of the zooecial frontal include the very pronounced chitinous rods parenthesizing the orifice on the parchment membrane, and the cryptocyst ridge. The latter varies in completeness in the different zoids but eventually assumes a horse-shoe shape or gives the impression of a garland around the orifice. Its distal edges begin near the lateral walls of the orifice.

ZOOECIAL ORIFICE: Because opercula are present the shape of the orifice is somewhat obscured. The opercula appear very slightly larger than the orifices and measure from 0.094 to 0.122 mm. (average 0.108 mm.) in length and from 0.122 to 0.144 mm. (average 0.137 mm.) in width. They are chitinous and have a faintly roughened or pebbled appearance. None was dissected away to reveal the orifice or for detailed study because of fear of damaging the lone sprig of

material. The distal edge of the operculum is nearly straight to gently convex, the two lateral sides are nearly parallel and the proximal border is slightly concave. Two short, obliquely set sclerites are placed a short distance from the lateral walls. The operculum seems to have a chitinous flange that fits inside the orifice.

The orifice itself seems to be very much like that of the other species in this genus. It is nearly straight distally, its two lateral sides are almost parallel, and its proximal border is concave and bordered by a curved lip. The two proximal condyles are visible sometimes through the operculum. The distal teeth may be present although they were not clearly seen. The orifice of this species is not raised quite as much from the frontal zooecial surface as are those of other species in this genus. The orifice is located about its own length away from the distal arch or cornice.

OVICELLS: The ovicells are placed between the orifice and the distal cornice, occupying the whole area and sometimes extending beyond but under the cornice, to fit partly between and beneath the side walls of the distal zoids. The ovicell shapes vary from a very broad oval to a rounded-corner triangle. The exposed ovicell wall in some cases is tubercled, as is the cryptocyst. The side walls of the ovicell begin at the distal corners of the zooecial orifice, meeting the ends of the cryptocyst ridges. The ovicell side walls are salient but not highly so. They meet the extended corners of the side walls of the zoid to form the distal cornice of the individual. The dimensions of the ovicells are: length from 0.101 to 0.137 mm. (average 0.115 mm.); width 0.173 to 0.202 mm. (average 0.179 mm.).

AVICULARIA: None was seen on the small sprig.

RADICLES: The chitinous rootlets sprout from the midfrontal face as in the other species of this genus, and grow in a downward (proximal) direction, toward the base of the colony. Their diameter is 0.050 to 0.072 mm. (average 0.067 mm.).

TYPE: Holotype, USNM 11219.

ECOLOGY: This species occurred at Antarctic Station 104. No other species of animals were growing on the single sprig.

Cellariaeforma extentamuralis, new species

PLATES 7,I; 8,A,B

DIAGNOSIS: Characters same as those of the genus, plus the following features. Areolation and external faces of the zooecia rhombic to hexagonal. Areolation heavy, coarse, visible to the naked eye. Zooecia arranged in transverse series of six or seven around the longitudinal axis of the branch. Cryptocyst not tuberculate. Zooecial side walls flare outward obliquely very conspicuously above the general

level of the zooeccial front and are marked with faint lines. Lateral sides of the zooeccial orifice straight and nearly parallel. The species is named mostly for this conspicuous flaring of the walls, although that feature is present to some extent in a few other species.

COLONY: There are only nine small ivory-colored scraps, none continuous and none more than 12.5 mm. long, so a complete colony was not available for study. The pieces are slender, rod-shaped, 0.696 to 1.253 mm. (average 1.032 mm.) in diameter. The areolation is rhombic to hexagonal and evident even to the naked eye. The surface of the colony is marked like a fine file by the raised zooeccial walls.

ZOOECIA: The external visible frontal surface of the zooeccia measures 0.648 to 0.835 mm. (average 0.747 mm.) in length and 0.403 to 0.576 mm. (average 0.504 mm.) in width. The zooeccia are rhombic to hexagonal and shaped somewhat like an angular pan; the frontal cryptocyst is depressed except for a slightly salient orifice, the ovicell walls, and the zooeccial walls. The zooeccial walls flare conspicuously and somewhat obliquely outward, framing the frontal area. The mural rims of neighboring zoids meet and fuse in a raised knife-edge. Faint transverse lines or creases give the mural rims a delicately crinkled appearance. These creases appear to be due partly to small irregularities in the thickness of calcification and also sometimes to a few small, very low tubercles lined up transversely. The mural rims are crumbly, jagged or uneven. The zooeccial wall is quite opaque. Some of the specimens were a bit difficult to study because of fine chalky accumulations on their surface, as if covered lightly by debris. Also, some of the sprigs appear a bit eroded as if some chemical had affected the calcareous surface.

ZOOECIAL ORIFICE: The dimensions of the zooeccial orifice are: length from 0.101 to 0.130 mm. (average 0.120 mm.); width 0.158 to 0.187 mm. (average 0.173 mm.). The zooeccial orifice is raised sharply from the frontal. Its distal border is straight. The lateral walls are straight and nearly parallel. The proximal border is concave because of the convex curvature of the lower lip. Two prominent condyles project into the orifice near the proximal corners. Opposite them, from a ledge located inside the distal rim of the orifice, are two distal triangular or broadly pointed teeth. These arise from a prolongation of the two corners of the calcareous ledge. The ledge does not reach the lateral walls. The proximal teeth also are borne on a ledge which is part of the lower lip. No opercula were seen.

OVICELLS: All the ovicells seen are imperfect, as if the front had been broken away at least in part, leaving only the ovicell cavity. This cavity measures 0.173 to 0.202 mm. (average 0.180 mm.) in

length and 0.158 to 0.216 mm. (average 0.185 mm.) in width, and is broadly oval in outline. Part of the ovicell cavity remains hidden beneath and between the side walls of the neighboring distal zooecia. Since no soft parts were found on the zooecia and ovicells it could not be determined with certainty if the front of the ovicell was calcareous or membranous.

AVICULARIA: Only a few avicularia were seen and none with mandibles in place. They are small, vicarious, and resemble those of *Cellariaeforma parvimuralis*. The few seen are broadly spindle-shaped to pentagonal, obliquely placed near the distal end of a zooecium. The avicularia measure from 0.274 to 0.288 mm. (average 0.285 mm.) along the longer diameter and from 0.187 to 0.216 mm. (average 0.196 mm.) along the shorter diameter.

TYPES: Holotype, USNM 11245; paratypes, USNM 11246.

ECOLOGY: The specimens came from Antarctic Stations 44 and 45. No other organisms grew on the colony scraps.

Cellariaeforma parvimuralis, new species

PLATE 7,C-H

DIAGNOSIS: Characters as in the genus, plus the following. Zooecia in transverse rows of five or six around the longitudinal axis of the branch. Areolation usually rhombic, occasionally tends toward hexagonal. Zooecial orifice very angular, lateral sides diverging proximally. Zooecial frontal surface flattened, the side walls very thin and slightly salient. The cryptocyst is closely tubercled. Pronounced cryptocyst ridges and parenthesis lines around the orifice lacking, although some do show very faint cryptocyst elevations, which are deeply curved, parenthesis-like. Zooecial walls quite opaque. The species is so named because of its small, not very high, walls.

COLONY: There are only seven small fragments of this ivory-colored species available. Not one of these is a complete colony. Three erect stalks are held together at the base by a cluster of yellow chitinous rootlets. Although no joints are present in the fragments it is quite possible that the mature or full-length colonies might be jointed. The stalks are cylindrical. Their diameters range from 0.792 to 1.138 mm. (average 0.959 mm.). The longest fragment is 13 mm. Zooecia occur in transverse series of five or six around the longitudinal axis of a branch. Areolation is rhomboidal, with rhombi with some tendency toward hexagonal in some areas.

ZOOECIA: Most of the zooecia are rhombic or diamond shaped but some are 5- or 6-sided, with one or two of the sides very short. The corners are generally sharp, the distal arch a bit more curved than the

other corners. The visible frontal surface of the zooecia measures 0.662 to 0.806 mm. (average 0.752 mm.) in length and 0.518 to 0.576 mm. (average 0.552 mm.) in width. The zooecial surface is quite flat except for the salient zooecial orifice and the very thin, slightly raised, low side walls. The two most depressed areas of the zoids are the ovicell and the space just below the lower lip. The cryptocyst covering the front of the zoid is tubercled but the tubercles, though numerous and quite close together, are small so that the front still appears flat, though of a pebbled texture. Many zooecia do not seem to have cryptocyst ridges but some do show faintly raised parentheses-like ridges which begin at the sides of the orifice, near the ovicell walls. The zooecial walls are quite opaque and the hidden underlying parts of the zooecia could not be made out accurately.

ZOOECIAL ORIFICE: The angular orifice is slightly salient. It is from 0.086 to 0.115 mm. (average 0.105 mm.) long and from 0.173 to 0.187 mm. (average 0.183 mm.) wide, and is placed about three-tenths of the zooecial length from the distal edge of the zoid, leaving a wide strip of cryptocyst between it and the distal wall arch. The external, distal border of the orifice is straight, as are the two lateral walls which diverge somewhat proximally. The lower lip is curved to give the orifice a concave outline. Two conspicuous conical condyles are located at the proximal corners. Two smaller condyles or processes are beneath the distal lip. These distal processes are not teeth but are prolonged corners of a calcareous plate or ledge which hangs down into the orifice. The lower border of this plate is concave, the two corners prolonged to form the so-called teeth. The operculum fits the orifice snugly. It is angular, yellow, and chitinous, with distal edge straight, distal corners gently curved, and lateral sides diverging slightly proximally. Its proximal border is concave and its rim is reinforced with chitin.

OVICELLS: These are located largely between the distal lip of the zooecial orifice and the distal zooecial arch. They are basinlike. Whether they are merely incomplete, not yet bridged over by a calcareous front, or are fully formed and covered only by a membranous frontal wall is not certain. One zoid on a single cyclostome-supporting branch appears to suggest the latter alternative. The ovicell surface is depressed and faintly, closely tuberculate (pl. 7,E) like the rest of the zooecial frontal. Its side walls are faintly raised and shaped like parentheses. The cavity of the ovicell measures 0.187 to 0.216 mm. (average 0.200 mm.) in length and 0.209 to 0.245 mm. (average 0.225 mm.) in width.

AVICULARIA: The avicularia (pl. 7,C,H) are small and vicarious and resemble in some respects those of *Melicerita latilaminata* (pls.

10,D; 11,D). It is a bit difficult to decide just where to take the length and width measurements of *Cellariaeforma parvimuralis* avicularia because of the difference in orientation of the lengthwise direction of the mandible and of the outer avicularial surface. In other words, the longitudinal axis of the mandible does not coincide with the longitudinal axis of the rest of the avicularium (pl. 7,H). Where it is uncertain as to which is the length and which is the width, these terms will not be used; instead, the more suitable terms "longer diameter" and "shorter diameter" will be used. Measurements for the whole visible avicularium were obtained from only three specimens: longer diameter from 0.230 mm. to 0.288 mm. (average 0.259 mm.); shorter diameter from 0.216 to 0.259 mm. (average 0.230 mm.). The outer avicularial opesia or opening measures 0.072 to 0.094 mm. (average 0.079 mm.) in length and 0.158 to 0.187 mm. (average 0.178 mm.) in width. The proximal median notch of the inside avicularian opening measures 0.029 to 0.043 mm. (average 0.034 mm.) in length and 0.043 mm. in width. The shape of the avicularia is a bit hard to determine because of so little material but those few examined seemed pentagonal and wedged between four zooids. The outer avicularian opening is spindle shaped but deeper within it is a proximal ledge which has a sizable notch in it (pl. 7,C). Mandibles were not observed. The avicularian openings are oriented diagonally with respect to the longitudinal axis of the zoecia.

RADICLES: These may arise singly from the zoecial front but some zooids have as many as two or three coming through the cryptocyst and growing proximally (pl. 7,F). They are chitinous, sturdy, yet of small diameter, from 0.050 to 0.079 mm. (average 0.059 mm.).

TYPES: Holotype, USNM 11217; paratypes, USNM 11218.

ECOLOGY: Only seven small fragments of this species were collected from Antarctic Station No. 104. Some of the colonies were invaded by large dark *Folliculina*-like protozoans whose shells protruded from the bryozoan's zoecial orifices. Another growth proved to be a cyclostomatous bryozoan.

Genus *Mawsonia* Livingstone, 1928

DIAGNOSIS: Colony consists of a cylindrical sprig which may branch dichotomously. Internodes fused. Zoecia arranged in series around the longitudinal axis of the sprig. Zoecial walls flare outward noticeably around the depressed cryptocyst, framing it like a picture. Orifice longer than wide, a truncate oval, its distal end steeply arched, its proximal end flattened and provided with two conspicuous condyles at or near the corners. Avicularia generally large, vicarious, with a more or less sharply pointed long beak and mandible.

GENOTYPE: *Mawsonia membranacea* (Thornely, 1924). Type by original designation by Livingstone.

Mawsonia extensalata, new species

PLATES 8,D-F; 9,A-E

DIAGNOSIS: Colony cylindrical, branching dichotomously. Zoecia arranged in transverse series of 11 to 13 (or possibly more) around the longitudinal axis of the branch with great preciseness so that every other row is in alignment. Cryptocyst closely tubercled and projected outward into two huge wings, one on each side of the depressed orifice. These outward projecting wings give the species its name. Orifice longer than wide, curved distally, sides nearly parallel, proximal border very slightly concave. Two very prominent conical proximal condyles borne on a ledge growing from the inner side of the lower lip. Operculum, shaped like the orifice, possesses an inner chitinous flange especially prolonged at the two sides. Ovicells endotoichal, helmet shaped. Avicularia vicarious, as large as autozoecia, and with the pointed beak distally directed. Mandible large, subtriangular, keeled, falciform, and with a median peg projecting from its proximal border.

COLONY: The colony is sturdy and calcareous, branching dichotomously. The cylindrical branches are about 24 mm. long and from 1.792 to 2.106 mm. (average 2.001 mm.) in diameter. No visible joints occur at the branching but two of the short terminal branches show a slight constriction at the joint. An occasional inconspicuous transverse line, reminiscent of the constrictions found in the genus *Cellarinella* but not so wide, so constricted, or so pronounced, occurs along the branches of this species. Although there are variations and masking factors, areolation was more or less hexagonal. The zoecia are regularly arranged in transverse rows of 11 to 13 around the longitudinal axis of the branch (pl. 8,D). These figures, 11 to 13, are from counts made at the ends of two branches. Mathematical calculations show 14 to 15 zoids to be possible in a transverse series elsewhere along the stalk. The successive transverse rows are placed with such preciseness that the zoecia of every other row (i. e. first and third rows, second and fourth rows, etc.) are in perfect linear alignment with each other, giving the branch the appearance of a very fine file to the unaided eye. The roughness of the surface is due to the huge extended cryptocyst wings which project in pairs from the zoecia (pl. 8,D,E).

ZOOECIA: Zoecia are hexagonal in most cases although some are almost square. They are from 0.504 to 0.749 mm. (average 0.652 mm.) long, and from 0.346 to 0.562 mm. (average 0.505 mm.) wide.

The mural rims (external wall boundaries) of young zoecia (pl. 9,B). are thin and salient but become depressed in older ones as calcification becomes heavier. As calcification progresses, raised cryptocyst ridges which form a horseshoe-shaped arch (pl. 9,B) above and around the orifice change to two winglike projections or alae, one on each side of the orifice, like the blinders on a harness (pl. 8,E). They jut out so prominently that they are the most conspicuous characters of the colony, being recognizable even to the unaided eye. Their height is from 0.158 to 0.230 mm. (average 0.199 mm.), their thickness at the tip is from 0.043 to 0.058 mm. (average 0.053 mm.) and their length is from 0.259 to 0.331 mm. (average 0.305 mm.). Their edges are beaded. They are transversely striated, almost fluted at the edge. The parallel striations are due to the alignment of small tubercles into close rows along these alae (pl. 8,E). Parenthesis-like chitinous lines were not seen about the orifice. The rest of the frontal is depressed but closely tuberculate. The mural rim in older zoecia is depressed. The cryptocyst slopes up from it a bit and then slopes gently down to the depressed central region in which is located the orifice. The orifice is a slight distance from the distal mural arch or cornice and occupies a considerable amount of the frontal area (pl. 9,B). The orifice length is about one-third to two-fifths that of the visible zoecial length.

ZOOECIAL ORIFICE. The orifice is longer than wide, curved distally, the lateral sides about parallel, the proximal edge slightly concave. Deep within it and arising from a calcareous ledge that originates inside the proximal orifice border are two prominent conical condyles (pl. 9,B). These fit into oval depressions of the operculum (pl. 9,D,E). The operculum is from 0.216 to 0.259 mm. (average 0.238 mm.) long and from 0.130 to 0.173 mm. (average 0.156 mm.) wide. The chitinous operculum completely fits the orifice. Its inner border has a partial flange extending into a heavier flange for muscle attachment at the two nearly parallel sides (pl. 9,E). At the two proximal corners are the oval transparent areas or depressions for the condyles. The heavy chitinous flange thins out at the distal and proximal borders of the operculum.

OVICELLS: The ovicell is salient, endotoichal, shallow, tipped back a bit, shaped externally like an acorn cup or Viking helmet and covered with small, closely set tubercles (pl. 8,E). It nestles partly between and beneath the side walls of the neighboring zoids in such a way that the cryptocyst ridges, or alae, of the neighboring zoids form a pair of wings on the ovicell. The opening into the ovicell is broadly ellipsoidal and some distance above the orifice of the zoecium. The ovicell length is difficult to estimate because of the overgrowth of neighboring zoecia but it seems to be from 0.216 to 0.331 mm.

(average 0.288 mm.) while the width is from 0.173 to 0.288 mm. (average 0.222 mm.).

AVICULARIA: The avicularia (pl. 8, D-F) are vicarious, replacing an autozoid in the regular transverse series. Their length is 0.619 to 1.101 mm. (average 0.796 mm.) and their width is 0.331 to 0.432 mm. (average 0.400 mm.). They are a bit longer and narrower than the autozoids, are diamond shaped, and have the beak directed distally. The beak part occupies a considerable section of the avicularian area and projects frontally. The rim of the proximal part of the avicularium is raised and beaded, enclosing a flat, notched shelf into which fits a chitinous peg from the mandible. The mandible (pl. 9, A, C) is subtriangular in full face but the apex curves like a sickle along the grooved beak. The proximal mandibular border is a bit wavy and from it projects a chitinous peg. Along the midline is a chitin-reinforced keel which terminates at one end in the sickled tip and at the other end divides into two chitinous sclerites which diverge toward the two basal corners. The length of the mandible is from 0.518 to 0.691 mm. (average 0.606 mm.); the width is from 0.274 to 0.346 mm. (average 0.307 mm.).

TYPES: Holotype, USNM 11220; paratypes, USNM 11221.

DISTRIBUTION: This species was collected at Antarctic Stations 45 and 190. The specimen from Station 190 is a single, handsome, dichotomously branching sprig, while Station 45 yielded only two small fragments. Specimens were covered with fine algal debris.

Mawsonia membranacea (Thornely)

Plates 9, F-M; 10, A

Cellaria membranacea Thornely, 1924, p. 9, fig. 2.

Mawsonia membranacea Livingstone, 1928, p. 39.

DIAGNOSIS: Colony club shaped. Zoecia arranged around the stalk in irregular series of 10 or 11 in the present collection specimens. Zoecial orifice as in genus. Salient cryptocyst ridges and chitinous parenthesis lines present. Their end points do not meet at bottom. Avicularia vicarious, as large as the autozoids. Mandible large, keeled, falciform, triangular in face view, well reinforced with chitin, and provided with a proximal median process. The mandibular keel curved at the tip of the beak. Ovicells endotoichal, according to Livingstone (1928, p. 39).

COLONY: This species is represented by a single, 9-mm.-long, ivory colored, club-shaped fragment in the present collection. Its proximal part is a mass of thin transparent chitinous rootlets. Areolation of the colony is of the hexagonal type described by Hastings (1946, p. 235).

ZOOECIA: Zooecia are heavily calcified, especially around the edge or mural rim. Some are pentagonal, others hexagonal, and are arranged horizontally about the stem in a series of 10 or 11 zoids (pl. 9,M). In younger or less heavily calcified zooecia the mural rim is gently raised (pl. 9,H) but in most zooecia the calcification process is so advanced that the zooecial boundaries are depressed grooves (pls. 9,G,M; 10,A) and the frontal surfaces are slanted downward toward the mural rim. Zooecial length varies from 0.584 to 0.869 mm. (average 0.692 mm.) and width from 0.490 to 0.585 mm. (average 0.542 mm.). Raised cryptocyst ridges, somewhat beaded in spots, are present in some very old zoids (pls. 9,G; 10,A). Also, delicate, gently curved parentheses lines are present near each side of the aperture (pl. 9,G). They are thin yellow lines which do not meet at the top or bottom. In some zooecia and avicularia the cryptocyst may be faintly tuberculate.

ORIFICE: The zooecial orifice is a longer-than-wide truncate oval with two strong teeth placed at or near its two proximal corners (pl. 10,A). It is placed in a slightly depressed frontal area some distance away from the distal edge of the zooecium. The condyles or teeth articulate with the oval transparent areas on the operculum (pl. 9,G).

OPERCULUM: The operculum has the shape of the orifice (pl. 9,G). Its length varies from 0.202 to 0.230 mm. (average 0.215 mm.) and its width from 0.130 to 0.158 mm. (average 0.149 mm.). The curved rim is chitin-reinforced. The proximal boundary is hard to distinguish. A sclerite extends from the outer border of each of the two oval transparent articular areas into which the orifice teeth fit.

OVICELLS: No ovicells were seen in the sample. Livingstone (1928, p. 39) stated that they were endotoichal.

AVICULARIA: The avicularia are vicarious, replacing a zooecium in the horizontal series (pl. 9,M). Their shape varies from a diamond to an elongated pentagon (pl. 9,J-L), and their size is comparable to that of the zooecia. Avicularian length ranges from 0.664 to 0.837 mm. (average 0.774 mm.) and width from 0.316 to 0.411 mm. (average 0.363 mm.). The tip of the acutely triangular pointed beak is raised frontally (pl. 9,K,M). The opesia has a median proximal sinus bordered on each side by a ledge (pl. 9,J,K) with which the mandible articulates.

MANDIBLE: The falciform mandible is sharply pointed, triangular in outline, with the distal tip curved inward (pl. 9,F,I,J). A pronounced keel and other chitinous reinforcements near the base, as well as the median peg which fits into the opesial notch, are characteristic of the mandible. The mandible is large, measuring from 0.403 to 0.461 mm. (average 0.437 mm.) in length and from 0.187 to 0.246 mm. (average 0.208 mm.) in width.

RADICLES: The rootlets (pl. 9,M) are very thin-walled, tubular, and usually of small diameter except for one which is unusually wide. The diameters of these extremes, based on five readings, range from 0.072 to 0.547 mm. (average 0.202 mm.). The radicles grow proximally, forming a tangled bundle below.

DISTRIBUTION: Thornely (1924, p. 9) described this species from Commonwealth Bay, Station 11, 351 fathoms. The U. S. Navy specimens came from Antarctic Station 44.

Genus *Melicerita* Milne-Edwards, 1836

DIAGNOSIS: Colony erect, usually compressed or flattened, bilaminate, although in one species it may appear somewhat clavate and slightly pinched in or nodulated here and there. Zooecia hexagonal and arranged in transverse rows. Zooecial orifice crescent shaped, wider than long and provided with two teeth or condyles, one near each proximal corner. In some species of this genus there may be two more teeth, these latter placed on the distal wall of the orifice, making a total of four. Avicularia are vicarious and good sized but with comparatively small mandibles. Mandible arc shaped, very short and much broader than long.

The type species, as given by both Brown (1952) and Lagaaij (1952) is *Melicerita charlesworthii* Milne-Edwards, 1836.

***Melicerita latilaminata*, new species**

PLATES 10,B-J; 11,A-F

DIAGNOSIS: Colony erect, calcareous, flattened, bilaminate, and dichotomously branched. Fronds broad. Cryptocyst beaded, translucent to opaque, depressed centrally. Modified parentheses lines and cryptocyst ridges present. Thin, slightly salient mural rim. Zooecial orifice broad, but short, and somewhat crescent shaped, with two prominent blunt condyles, one near each proximal corner. Orifice some distance away from the distal cornice. Ovicells endotoichal, inconspicuous, placed distally to the orifice. Their pore is small and crescent shaped. Avicularia large, but smaller than zooecia. Mandible a short wide arc, with a small median proximal tab which fits into a small, similarly shaped notch in the avicularium. Radicles spring from the front of some zooecia. Areolation hexagonal. The species is named for its broad flat fronds.

COLONY: About 17 small fragments of this species are in the collection, none of them very large and none a complete colony. The largest fragment measures 17 mm. in length, and the widest region of any fragment measures 9 mm. The "colonies" are nonencrusting. They begin as a slender erect stalk from which radicles sprout down-

ward to attach to the substratum or other objects. The stalks quickly widen into a very flat, bilaminar blade which is broad but thin (pl. 10,B,C). Zooecia open out on the two faces of the frond. The number of zooecia in a horizontal row on one face varies from 3 to 18 (pl. 10,D,J). One of the fragments is dichotomously branched but no joints or nodes were seen in it (pl. 10,B). Areolation is hexagonal (pl. 10,D,J).

ZOOECIA: The visible frontal surface of the zooecia is hexagonal and quite angular, measuring from 0.518 to 0.677 mm. (average 0.579 mm.) in length and from 0.310 to 0.432 mm. (average 0.372 mm.) in width. However, there is more to a zooecium than this hexagonal front. A considerable stretch of the proximal part of each zooecium is hidden between the two zooecia directly below it (pls. 10,F; 11,B). Therefore, the total length of a zooecium (including both the visible and the hidden parts) ranges from 0.878 to 1.210 mm. (average 1.056 mm.). This hidden proximal part is long and narrower than the visible frontal hexagon. The body cavity is long, narrow, and somewhat spoon shaped in front view (pl. 10,F).

The proximal-distal walls between successive zooecia are porous (pls. 10,E; 11,C). One pore plate has 18 small pores, others have less.

The cryptocyst varies from translucent to nearly opaque, is calcareous, covered with small, rather closely spaced tubercles (pl. 11,D), and is gently convex, depressed centrally about the zooecial orifice. The orifice rim is slightly salient. The mural rims also are thin, narrow, well defined salient lines. Two distinct parenthesis-shaped chitinous lines about the orifice curve slightly outward and in reverse as they approach the center of the cryptocyst front (pl. 10,F). Cryptocyst ridges, also parentheses shaped but on a larger scale, are rather inconspicuous (pl. 11,D).

ZOOECIAL ORIFICE: The zooecial orifice is some distance away from the distal cornice of the frontal wall, in a depressed region of the cryptocyst, and is somewhat crescent shaped but with the ends gently curved instead of sharply pointed (pl. 10,F, and OR in pl. 11,D). It is about three times wider than its central line length and about twice as wide as its all-inclusive, boxed-in length. Its dimensions are: over-all length from 0.094 to 0.130 mm. (average 0.107 mm.); length in midcentral line from 0.058 to 0.072 mm. (average 0.066 mm.), and width from 0.158 to 0.230 mm. (average 0.196 mm.). Its smooth rim is salient. The lower lip is curved slightly outward like the lip of a pitcher. Two proximal condyles are inside the orifice. No distal teeth were seen.

The operculum is the same shape as the orifice, which it fits snugly. It is a translucent yellow, with a pebbled surface (pl. 10,G). One of the marginal zooecia (along the edge of the blade) has an unusually

large orifice and operculum. The measurements of this very large specimen are: over-all boxed-in operculum length 0.115 mm., width 0.317 mm.

OVICELLS. These occur between the zoecial orifice and the distal cornice of the frontal wall. Their shapes vary from oval to sub-triangular, with frontal wall not much elevated above the level of the orifice and not higher than the mural rim. Dimensions: length from 0.115 to 0.158 mm. (average 0.135 mm.); width from 0.166 to 0.230 mm. (average 0.194 mm.). The thin-walled, distally placed oeciopore is small and crescent shaped, measuring 0.022 to 0.043 mm. (average 0.035 mm.) in length and from 0.086 to 0.101 mm. (average 0.095 mm.) in width. Its lower lip is beaded but its upper lip is not (pl. 10,F).

AVICULARIUM: The avicularia are vicarious and not numerous. Although good sized, they are not as large as the zoecia (pl. 11,D). They measure from 0.346 to 0.490 mm. (average 0.423 mm.) in length and from 0.245 to 0.403 mm. (average 0.292 mm.) in width. The size of the opesia into which the mandible fits is 0.086 to 0.101 mm. (average 0.097 mm.) long and from 0.144 to 0.187 mm. (average 0.167 mm.) wide. The chitinous mandible is wider than long, distally curved in a broad shallow arc and provided with a straight proximal border from which a small median tab projects into the corresponding notch in the opesia (pls. 10,H; 11,E,F). The mandibular rim is chitin-reinforced and a thinner circular area is present in the mid-region of the mandible.

RADICLES: The rootlets are yellow to amber colored and translucent; slender, cylindrical to gnarled, and rigid-walled. They sprout from the frontal surface of the zooids and make their way toward the base of the colony (pl. 10,B,J). Their diameter is fairly uniform throughout, ranging from 0.058 to 0.076 mm. (average 0.072 mm.).

TYPES: Holotype, USNM 11223; paratypes, USNM 11224.

DISTRIBUTION: This species occurred at Antarctic Station 104. No other species were growing over the colony fragments.

Melicerita obliqua (Thornely)

PLATE 11,G-I

Aspidostoma obliquum Thornely, 1924, pp. 16-17, fig. 4.

Pseudocellaria obliqua Livingstone, 1928, p. 42.

DIAGNOSIS: Colony flattened, nodulated, somewhat club shaped. Zooecia arranged in rows about it. Areolation and zooecia hexagonal. Crescentic orifice often placed obliquely, frontal depressed just beneath the lower lip. Operculum yellow and of same shape as the orifice. Cryptocyst and orifice rim granulated or beaded. Avicularia not observed. Ovicells large, imbedded between the two distal zooecia.

Ovicell opening narrow, arched and placed just above the margin of its zooecium.

COLONY: Only two fragments, one 8 mm. and the other 10 mm. long, were found in the U. S. Navy collection. Their breadth varies from 1.079 to 1.479 mm. (average 1.299 mm.). Neither is branched. The two stalks are faintly nodulated. The nodulation consists of a mere pinching in or creasing of the proximal part of the zoids (pl. 11,G). The two fragments are too small to give a true picture of the frequency pattern of nodulation. In some areas, every other transverse series of zooecia is creased, then follow three to five transverse series with no nodulation. There is no difference in color of the "nodes" and "internodes."

ZOOECIA: Thornely did not mention the number of zooecia in each transverse series or on each face, and no measurements were given for the species. In the U. S. Navy specimens there are six zooecia in each transverse row, three opening out on one face, three on the other. The zooecia are calcareous, translucent, rather thin-walled and of a pale yellowish color. They are hexagonal, with distinctly angular corners and straight sides. Dimensions: length from 0.749 to 0.950 mm. (average 0.857 mm.); width from 0.446 to 0.619 mm. (average 0.533 mm.). Their frontal surface is slightly concave or depressed but especially so just beneath the lower lip (pl. 11,H). Also, the frontal surface and the orifice rim are beaded or covered with fine low tubercles placed close together. A thin, salient line outlines the zooecia. Radicles sprout from the front of some zooecia (pl. 11,G,I).

ZOOECIAL ORIFICE: The zooecial orifice is located some distance below the uppermost peak of the hexagon, the distance in some cases being almost twice the total length of the orifice. Many of the orifices obliquely placed, some tipped to the right, some to the left, and a few not oblique at all but set symmetrically (pl. 11,G,H). They are crescent shaped, slightly salient, and with beaded rim. The lower lip is thrust upward and forward as if in a pout (pl. 11,I). Immediately beneath it is a depressed area. Because the orifices are closely covered by a bright yellow, translucent to opaque operculum, the interior of the orifices is not clearly visible. In some zoids however, there appears to be a proximal calcareous ledge bearing two condyles. Operculum dimensions: length from 0.101 to 0.122 mm. (average 0.114 mm.); width from 0.187 to 0.216 mm. (average 0.202 mm.). The length was measured from the level of the two corners to the highest point in the midline.

OVICELLS: No ovicells were seen in the U. S. Navy specimens. However, Thornely (1924, p. 16) gave an adequate picture and description of them. She described them as large, embedded between

and under the two next distal zooecia, and opening to the outside by an arched ooecial pore just above the margin of the zooecium. Measurements were not given.

AVICULARIA: Avicularia were not found either by Thornely or by the present writer, although it may be that had material been more plentiful avicularia might have been found. Brown (1952, pp. 165-166) discussed and illustrated a species, *Melicerita angustiloba* Tenison-Woods, which very closely resembles *M. obliqua* except that the former is a much smaller species and has a different type of ooeciopore.

RADICLES: Chitinous tubules, cylindrical, thin-walled, transversely striated, arise from some of the zooecia (pl. 11,G,I). They emerge through the frontal below the orifice, enlarging in diameter a short distance out from the zoid. Measurements had to be made on flattened tubes at their thickest points. This diameter varies from 0.446 to 0.590 mm. (average 0.504 mm.).

DISTRIBUTION: The U. S. Navy specimens were collected at Antarctic Station 44 from a depth of 100 fathoms. Thornely's specimens came from Commonwealth Bay, Station 12, at 110 fathoms.

III. FAMILY SCLERODOMIDAE

PLATES 12-18

The six species discussed in this study belong to the family Sclerodomidae Levinsen, 1909, genus *Cellarinella*. The genus has been reported by only four authors to date and all specimens have been from Antarctic collections. This article adds six new Antarctic species. The four previously known species did not occur in the collection of the U. S. Navy's 1947-48 expedition.

TAXONOMY AND MORPHOLOGY: Vigneaux (1949, pp. 17, 23) has introduced a much-needed reclassification of families and genera which would require critical study of a number of related species that time does not permit at present. He erected a new family, Lepraliellidae, to accommodate *Cellarinella*. However, Levinsen's classification, although not perfect yet, is based on very scholarly and thorough morphological studies and it is followed for the present.

Characteristics of the family are discussed in detail by Levinsen in his monograph (1909, pp. 301-304). He stated (p. 301): "The very small distal wall is provided with a number of small uniporous rosette plates and the lateral walls with a varying number of rosette plates with few (two or three) pores. There is a membranous or weakly chitinized operculum and a more or less well developed peristome . . ."

On the basis of the material examined in the 1947-48 collection the following amendments or modifications of his family diagnosis can be made. First, his "distal wall" is the end wall which separates one zoecium from the next one in the same linear series. It could be called the proximal wall or the distal wall, depending upon one's point of view or if describing the walls of a single zoecium. At any rate, this distal-proximal wall may consist of a sieve plate, i. e., a plate or wall containing a number of small pores (pls. 12,I,J; 13,C; 14,K; 15,F,G; 16,F; 17,F). Second, the rosette plates or pore plates of the lateral walls may sometimes contain more than two or three pores (pls. 12,I; 15,G,H; 17,C). Third, an operculum could not be found in any of the material.

Genus *Cellarinella* Waters, 1904

Zoarium calcareous, "nodulated," ranging from spindly or slender sprigs to heavy, flattened, fan-shaped bilaminar slabs. Branching sparse and dichotomous. Stalks elliptical to flattened strips in cross section, with zoecia opening on all faces. Ovicells hyperstomial.

Operculum lacking. Zoecial boundaries externally undistinguishable and unmarked. Frontal wall thick, heavily calcified and channeled. Lateral and back walls thin. End wall a porous plate with two calcareous processes leaning over the plate. Primary orifice wider than long, its proximal border modified or interrupted by an oral ledge. Avicularia of two kinds, one external, the other internal; both near the orifice, either below or to one side.

The four previously known species of this genus, all from the Antarctic, are *Cellarinella dubia* Waters 1904, *C. foveolata* Waters 1904, *C. nodulata* Waters 1904, and *C. watersi* Calvet 1909. Since its original description by Waters in 1904, the genus *Cellarinella* has been reported only in the papers of Calvet (1909), Thornely (1924), and Livingstone (1928) until the present record.

Levinsen's genus *Sclerodomus* (1909) has some of the same characteristics as *Cellarinella*, such as internal avicularium, externally undefinable zoecial boundaries, a channeled, heavily calcified frontal wall, and porous end wall. Because the 1947-48 collection yielded some intermediate forms it was thought best to retain Waters' names for *Cellarinella* and *Systemopora* as well as Levinsen's *Sclerodomus* but to modify or restrict one of them slightly. During the study of the six species of the 1947-48 collection the problem arose whether a new genus was needed to accommodate those species whose colonies formed heavy, bilaminar, fan-shaped yet dichotomously branched slabs (*C. njegovanae*, *C. roydsi*, and *C. watersi*). *C. nutti* is intermediate between the heavy slablike species and the spindly or tapelike species (*C. dubia*, *C. foveolata*, *C. laytoni*, *C. margueritae*, *C. nodulata*, and *C. rossi*). However, there were too few fully grown or complete colonies in some of the species to show the amount of possible variation in colony form to warrant erecting a new genus on growth form alone.

The genus appears to be very homogenous. Differences between species are rather slight insofar as individual zoids are concerned but are sometimes considerable when the zoarial growth habit and general colony appearance are considered. Their zoids show close relationship in that all have internal avicularia, external avicularia, frontal oral ledge, sieve plate end wall with two calcareous processes over it, a few rosette plates and numerous single pores definitely placed linearly in the lateral walls, a thick porous channeled frontal wall, and no visible external zoecial boundaries.

The orientation of the avicularia, both internal and external, and of the frontal oral ledge were found to be important in distinguishing one species from another. Previous authors have overlooked these characters or else have paid them scant attention; consequently, previously described species need be reexamined for these characters.

In the succeeding discussion of species the maximum-minimum-average measurements for particular parts or structures are based on 10 readings unless otherwise specified.

Cellarinella margueritae, new species

PLATE 12

DIAGNOSIS: Zoaria narrow, flattened, ribbonlike bilaminar strips, with some zooids opening out along the edges also. Two mucros, one in front of each proximal corner of the orifice. External avicularium along median side of one of the mucros, arranged at an approximate right angle to the longitudinal axis of the zooid. Internal avicularium slants obliquely distally. External avicularial mandible wider than long. Mandibles of both triangular and with a hooked tip. Orifice hemispherical distally, only slightly curved upward proximally because of the inner frontal oral ledge.

C. margueritae is so named because it was collected at Marguerite Bay, Antarctica. It differs from *C. nodulata*, depicted in Waters' monograph (1904, pl. 8, fig. 6a), in the number and position of mucros and the location of the external avicularium. In *C. nodulata* the mucus is central or median in location and the avicularium is decidedly lateral in position, at the very corner of the orifice, and directed obliquely upward and outward. In *C. margueritae* the mucros are two in number and lateral in position. The external avicularium extends from the midline outward, transversely.

ZOARIUM: 16 ivory-colored, calcareous, hard fragments of this species were found. The longest is 47 mm. Width is up to 4 mm. in some. Thickness of blade is about 2 mm. Judging from the presence or absence of the thin parchmentlike membranous covering over the colony some of the colonies were living, some dead, at the time of collection. The zoarium consists of a bilaminar, nodulated, flattened, narrow blade roughly resembling a tapeworm (pl. 12,A). Branching is sparse and dichotomous. Nodes and internodes differ in external appearance only in that the nodes are a bit more pinched-in and lack orifices, thus looking less pitted than the internodes. The nodes are not jointed or flexible but are of the same calcareous construction as the internodes. The internodes are from 4 to 8 mm. long. There are from 3 to 11 vertical rows of zooids in an internode. The number of zooids in a horizontal row across one face of an internode ranges from 5 to 10. The slightly prickly feel of the colony surface is due to the projecting mucros, usually two per zooid.

ZOOECIA: The only external indication of a zooecium is the orifice with its neighboring structures, the two mucros and the external avicularium. All other parts of the zooecium and its neighbors are

covered by a thick, channeled, heavily calcified frontal wall that hides all zooecial boundaries. The thickness of this wall is 0.230–0.504 mm. (average 0.334 mm.). The pores seen on the internal surface of the colony frontal (pl. 12, H) do not correspond in position to the pores seen on the external surface (pl. 12, B). The closely spaced frontal pores (pl. 12, B) are the external terminals of the channels (pl. 12, J). The internal pores (pl. 12, H) are the internal terminals of some of the channels. The channels diminish or deviate in their course (pl. 12, J) so that a good part of the internal frontal wall is imperforate.

Because external boundaries of zooecia are lacking, external measurements are somewhat approximate; nevertheless, measurements of zooecial length were made from orifice to orifice in a vertical series. By this method zooecial length was 1.37–2.02 mm. (average 1.65 mm.). These compare closely with the fewer measurements made on the internal surface of zooecia. Zooecial width (distance between the lateral walls) based on internal measurements was 0.302–0.389 mm. (average 0.363 mm.). Zooecial thickness (distance from the back wall to the external frontal surface) was 0.677–1.094 mm. (average 0.857 mm.). The side and back walls of zooecia are very thin, ranging from 0.007 to 0.022 mm. (average 0.014 mm.). The back walls are long, narrow, and nearly rectangular. The side walls are wider (pl. 12, I, J) and provided with bordering rows of single pores (pl. 12, H) and a few more medianly placed multiporous rosette plates (pp of pl. 12, I). The end wall is of variable thickness. Its edges are thicker than the multiporous central part (pl. 12, I, J and sp of pl. 12, J). Two irregular, heavily calcified processes (pl. 12, I and pl. 12, K) slant a bit over this proximal wall sieve plate. Their function is not known but it is possible that they serve for muscle attachment.

AVICULARIA: The internal avicularium is well hidden. It is not visible from the outside because of its low oblique position inside the zoid (pl. 12, D, H, I). It is placed below the side and corner of the orifice. Its pointed, curved beak points obliquely upward away from the frontal (pl. 12, E). It is on the side diagonally opposite the external avicularium. For example, if the internal avicularium is on the left side of the midline the external avicularium would be on the right, and vice versa (pl. 12, D). This condition and arrangement is found also in *C. roydsi*. Dimensions of the internal avicularia of *C. margueritae*: total length 0.187–0.230 mm. (average 0.204 mm.); total width 0.101–0.158 mm. (average 0.127 mm.); beak length 0.115–0.144 mm. (average 0.138 mm.); mandible length 0.108–0.130 mm. (average 0.117 mm.); mandible width 0.094–0.115 mm. (average 0.103 mm.). The total length and width and beak dimensions are based on only seven readings each, the mandible length on five and its

width on three readings. The internal avicularial mandible is of similar shape and appearance as mandibles of external avicularia (pl. 12,F).

The external avicularium is placed transversely beneath the orifice and to one side of the midline with the hemispherical (back) area in or touching the midline (pl. 12,C,D,G). A mucro tips its beak forward (pl. 12,D). Another mucro grows at its base, on the opposite side of the midline (pl. 12,B,D). The avicularial beak makes an approximate 110° angle with the semicircular area back of the mandible (pl. 12,G). External avicularium measurements: total length 0.216–0.288 mm. (average 0.264 mm.); total width 0.158–0.187 mm. (average 0.174 mm.); beak length 0.130–0.187 mm. (average 0.160 mm.); mandible length 0.101–0.122 mm. (average 0.133 mm.); mandible width 0.115–0.144 mm. (average 0.133 mm.).

All zooids had external avicularia.

FRONTAL ORAL LEDGE: A gently curved ledge (pl. 12,C–E, and FL of pl. 12,I) shields the internal avicularium from the outside. It is placed diagonally at a slight angle to the frontal surface (pl. 12,C, and FL of pl. 12,D). The angle is much smaller in this species than in *C. roydsi*. Compare the orifices and oral ledges of plate 12,B, with plate 17,A, and plate 12,C with plate 17,E.

ORIFICE: The shape of the zoecial orifice varies according to the degree of frontal wall calcification and development of frontal oral ledge and mucros. In the primary orifice the distal border is deeply curved but less than semicircular. The proximal border is faintly arched (pl. 12,C), but soon becomes obscured by the growth of the frontal oral ledge, the two umbos or mucros, and the external avicularium. The primary aperture is a bit smaller than the secondary aperture and both are wider than long. Primary orifice length is 0.173–0.230 mm. (average 0.192 mm.) and width is 0.245–0.302 mm. (average 0.269 mm.). Secondary orifice length is 0.202–0.266 mm. (average 0.236 mm.), its width 0.259–0.389 mm. (average 0.320 mm.).

OVICELLS: Ovicells were not distinguishable externally. From the internal aspect they are globular and hyperstomial.

TYPES: Holotype, USNM 11227; paratypes, USNM 11228.

ECOLOGY: The species was collected by the 1947–48 expedition at Station 234 in the Marguerite Bay area, Antarctica. Growing on living colonies of *C. margueritae* were bits of sponge, a calcareous worm tube, and some cyclostomatous bryozoans.

Cellarinella rossi, new species

PLATE 13

DIAGNOSIS: Zoarium narrow, flattened, ribbonlike, bilaminate, with some zooids opening along the edges also. Two mucros present, the naked one being considerably closer to one corner of the orifice than

the avicularium-bearing mucro which points away from the other orifice corner. The suboral external avicularium is placed on the median to oral side of this farthest mucro, so points at an angle of approximately 30° downward and outward away from the orifice. The inner avicularium is placed more or less transversely at the inner side-front of the zoid, so it cannot be seen from the outside. External avicularial mandible about as long as wide. Proximal border of primary orifice divided and considerably distorted by a vertical, diagonally directed frontal oral ledge. The most distinctive feature is the presence of an extensive projecting peristomial cap. The secondary orifice is sometimes very asymmetrical.

The species is named *C. rossi* because it was collected near Ross Island, Antarctica.

ZOARIUM: Only five sprigs, the longest of which is 28 mm. long, are in the collection. The colony varies in color from a light dull tan to ivory. The sprigs are narrow, tapelike, bilaminar, and one shows the beginning of another branch. The colony surface is slightly roughened, like a file, by the mucros. Orifices make tiny pits, just visible to the naked eye. Colony width varies from 2 to 4 mm. and its thickness is about 1 mm. at the tip of the sprig. The longest sprig has about six nodes. The nodes (pl. 13,A) are not flexible but are similar to those of the preceding species. The number of linear rows of zooecia in an internode (area between nodes) ranges from 3 to 11, while the number of rows of zooecia across one face of the colony, from edge to edge of an internode, varies from 6 to 13.

ZOOECIA: Zooecial boundaries are externally unmarked. Approximate zooecial length, externally, from one orifice to the next was 1.08–2.160 mm. (average 1.606 mm.). Internally the zooecia are shaped like inverted flasks (pl. 13,C). The channeled frontal wall is 0.202–0.374 mm. (average 0.274 mm.) thick at the upper center of the zooecium. The deviating and variable channels terminate in external frontal pores (pl. 13,B,D,H–J) of 0.022–0.122 mm. diameter at one end and some of them in internal frontal and lateral pores at the other end (pl. 13,C). Lateral and back walls are very thin, 0.014–0.022 mm. Lateral walls have a few large rosette plates near the mid-region and numerous single pores along the edge bordering the frontal wall. The back walls are flat, the lateral walls curve a bit, and the frontal inner wall curves considerably. Zooecial dimensions, as measured from the inner surface: width, from side wall to side wall, 0.187–0.389 mm. (average 0.299 mm.); thickness, from back wall to outside of front wall, 0.518–0.720 mm. (average 0.619 mm.). The two calcareous processes over the end wall appear to be thinner than those of the preceding species (see pls. 12,I,K; 13,C).

Two colonies obviously collected in a living state were covered with a thin, light tan, parchment membrane. The frontal pores and channels were plugged with a brown substance. The membrane was stretched tightly over the colony in dried specimens. It apparently wears off or disintegrates from dead colonies.

AVICULARIA: Internal avicularia, though present, cannot be seen from any position on the outside because they are placed below and laterally to the rim of the orifice and because their beak is turned more laterally than obliquely, so the wall must be broken away to see them. The internal avicularium is a pointed oval with a triangular mandible that has a hooked tip. It has a hooked beak like the external avicularium although plate 13,E does not show it developed yet. The mandible closely resembles those of the external avicularium (pl. 13,F,G). Dimensions of one internal avicularium: total length 0.158 mm.; total width 0.101 mm.; beak length 0.101 mm.

The external avicularia are sharply pointed ovals cradled between two mucros below and to one side of the orifice (pl. 13,D,I-K). The two mucros vary in size; sometimes one, sometimes the other, is larger. One mucro is nearer the orifice corner than the other. The back area of the external avicularium rests against its base. The other mucro pushes the avicularial beak forward and tends to surround the avicularium, building up its walls (pl. 13,J,K). The external avicularium is always below and to one side of the orifice. Its beak usually points at about a 30° angle away from the lower edge of the orifice (pl. 13,K). External avicularium dimensions: total length 0.202–0.346 mm. (average 0.291 mm., based on 20 readings); total width 0.130–0.288 mm. (average 0.206 mm., from 20 readings); beak length 0.122–0.245 mm. (average 0.187 mm.); mandible length 0.108–0.144 mm. (average 0.123 mm.); mandible width 0.094–0.144 mm. (average 0.126 mm.). An old worn sample from which plate 12,K was drawn has some rather large external avicularia and also some smaller ones as in plate 13,D. An occasional avicularium points not downward but as in plate 13,J.

FRONTAL ORAL LEDGE: The oral ledge extends diagonally across the proximal border of the orifice at a greater angle with respect to the plane of the orifice and the internal avicularium (pl. 13,E,K) than in any of the other five new species.

ORIFICE: The most conspicuous feature of this species is the projecting visorlike peristome which shades the orifice (pl. 13,H-J). It may be worn down or broken off in some specimens, as happens also to the mucros. The peristome protects the three sides of the orifice. No zoids were found in which the peristome completely encircled the orifice. Waters (1904, p. 57) mentioned a "raised cap over the distal end" of the oral aperture of *Cellarinella foveolata* and also pictured it

(pl. 5, fig. 2a). However, *C. rossi* and *C. foveolata* differ in type of suboral avicularia and in mandibular shape, and the mucros seem to be absent from *C. foveolata*, at least they are not mentioned or figured by Waters.

The distal border of the primary orifice and the peristome arch in a neat semicircle. The proximal border of the orifice is distorted by the vertical-diagonal oral ledge (pl. 13,E,K) which interrupts it and helps to form a channeled groove that leads down from the orifice corner toward the nearest mucro (pl. 13,I). When the colony is old and the mucros, oral ledge, and oral channel well developed, the orifice looks very asymmetrical because one corner of it is pulled downward out of shape by the channel (pl. 13,B,I).

Dimensions of primary orifice: length 0.166–0.230 mm. (average 0.202 mm.); width 0.216–0.288 mm. (average 0.229 mm.).

OVICELLS: Ovicells are present on some zooecia (pl. 13,H), absent on others (pl. 13,I). They are globose, covered over by the secondary calcified frontal layer and so are not easily distinguished from the surrounding zooecial fronts. Although pores may be present around and over much of the ovicell they do not perforate the ovicell frontal wall. Sometimes the pores outlining or over the ovicell may be larger than surrounding ones but that is not constant. Measurements of five ovicells: length about 0.259–0.331 mm. (average 0.288 mm.); width about 0.288–0.432 mm. (average 0.360 mm.).

TYPES: Holotype, USNM 11229; paratypes, USNM 11230.

ECOLOGY: This species was collected at Antarctic Stations 44 and 104, off Cape Royds, Ross Island. No other species grew on the "living" colonies but dead colonies had some encrusting cheilostome and cyclostome Bryozoa. Some of the external avicularial mandibles were clamped tightly shut over long, fine, delicate rods which were either of sponge or alcyonaria.

Cellarinella nutti, new species

PLATE 14

DIAGNOSIS: Zoarium nodulated, bilaminar, flattened; seemingly transitional between the tapelike and slab species. Branching dichotomous. Internal avicularium transversely placed across the inner frontal wall at the level of the orifice so that its side wall shows readily from the outside. External avicularium, when present, points obliquely down and forward. Frontal oral ledge tangentially placed at side-back of the internal avicularium, high enough to show from the front. "Naked" back mucro near midline and nearest the orifice; forward, aviculariate mucro farther away from the midline and from orifice.

The species is named in honor of Comdr. David C. Nutt, who collected the Bryozoa of the expedition.

ZOARIUM: This species is represented by five calcareous, ivory-colored colony fragments; the three largest range from 20 to 24 mm. in length (pl. 14,A). The two smallest scraps are apparently basal, very much worn down and therefore of questionable identity. No measurements or drawings were made from these two fragments. None of the fragments is a complete, fully grown colony. The shape of the most perfect and symmetrical fragment (pl. 14,A) is somewhat flabellate or slablike. The other two sizable fragments are broken-off pieces neither basal nor terminal but cut at the branching zone, irregular and rather tapelike. Nodes occur about 3 to 6 mm. apart. They are neither flexible nor real joints, simply slightly depressed bands from which orifices are absent (pl. 14,A,B). There are 4 to 8 linear rows along an internode (between nodes) and 8 to 17 rows across one face of an internode (from side to side). Although the colony is bilaminate and most of the zooecia open out on the two flat faces, a few zoids open out on the thin edge also (pl. 14,G). Colony surface is pitted (pl. 14,B). The large holes are the orifices, the small ones are channeled frontal pores. The frontal pores are 0.014–0.058 mm. (average 0.040 mm.) across.

ZOOECIA: Zooecia are long and narrow. Length, based on external measurements, 1.08–2.059 mm. (average 1.670 mm.); width 0.238–0.360 mm. (average 0.285 mm.).

The zooecial surface is sometimes slightly ridged, especially about the orifice (pl. 14,E,H) and near the mucros (pl. 14,C). The side and back walls of the zooecia are thin. The front wall is channeled and 0.202–0.403 mm. (average 0.249 mm.) thick. The lateral walls have the customary appearance of other species in this genus, namely, a few large multiporous rosette plates along their midregion and one or two rows of small single pores along their frontal borders (pl. 15,H).

AVICULARIA: The internal avicularium cannot be recognized as such until the zooecium is tipped forward in order to look down into the orifice. The internal avicularium is placed transversely across the inner lower border of the orifice so that part of its side wall shows from the outside (pl. 14,E,F,H,K). It is sometimes slanted a bit to the left, sometimes to the right, so that in front view it is not horizontal. Its beak is slightly hooked. Measurements of the internal avicularium: total length 0.202–0.216 mm. (average 0.209 mm.); total width 0.086–0.144 mm. (average 0.109 mm.); beak length 0.130–0.158 mm. (average 0.143 mm.).

The external avicularium is directed obliquely downward at a considerable angle away from the orifice proximal border. It is near the midline (pl. 14,F–H,K), cradled between two mucros. The posterior

muero is nearest the orifice and nearest the midline but still diagonally across from the anterior muero. The posterior muero is a bit to one side of the back area of the external avicularium (pl. 14,C,K). The anterior muero, near the avicularial beak, is deflected away from the midline. In heavily calcified or old specimens the external avicularium may be deeply sunken and the mucros worn down or obliterated (pl. 14,D). In the few fragments of this species, external avicularia usually were present on the lower two or three rows of an internode and generally absent from the upper rows of an internode. Whether this is typical for the species or peculiar to the few fragments on hand is not certain at present. However, this condition does not seem to exist in the other five species. If an external avicularium is absent its anterior muero is also absent, leaving only the muero nearest the orifice. Dimensions of external avicularia: total length 0.144–0.187 mm. (average 0.169 mm.); total width 0.115–0.130 mm. (average 0.122 mm.); beak length 0.101–0.173 mm. (average 0.140 mm.); back area length 0.050–0.072 mm. (average 0.058 mm.).

FRONTAL ORAL LEDGE: At one side of the internal avicularial back area is a frontal ledge (FL of pl. 14,K) that shows from the front or outside as a partition across the base of the orifice (pl. 14,C,H,K). In plate 14,E,F it is small and poorly developed. *Cellarinella nutti* is intermediate between the two extremes, *C. rossi* and *C. njegovanae*, in the angle that the oral ledge makes with the plane of the frontal surface.

ORIFICE: The primary orifice is greater than a semicircle. Its lower border is interrupted by the internal avicularium and the oral ledge. It is 0.173–0.216 mm. (average 0.193 mm.) long and 0.230–0.259 mm. (average 0.246 mm.) wide. The secondary orifice is somewhat more orbicular (pl. 14,B) unless it begins to encompass some of the external avicularial zone (pl. 14,D). If nearly orbicular, and without the external avicularium beneath, it measures 0.216–0.288 mm. (average 0.233 mm.) long and 0.216–0.259 mm. (average 0.228 mm.) wide. If it grows down to enclose part of the external avicularium, as in plate 14,D, it measures 0.288–0.374 mm. (average 0.343 mm.) long and 0.216–0.288 mm. (average 0.238 mm.) wide.

OVICELL: Not observed.

TYPES: Holotype, USNM 11231; paratypes, USNM 11232.

ECOLOGY: This species was collected at Antarctic Stations 44, 104, and 234. No other species were growing on the colonies.

Cellarinella njegovanae, new species

PLATES 15; 16,A–I

DIAGNOSIS: Zoarium bilaminate, nodulated, slablike and flattened. Branching dichotomous. Internal avicularium obliquely placed below

the corner of the orifice so as not to show from the outside. Two external avicularia, each set obliquely below the lower corner of the orifice, with beaks pointing diagonally upward and outward. Mucros absent. Primary orifice crescentic. Secondary orifice varies in shape from an inverted triangle to a more transverse slit, depending upon degree of overgrowth. Oral ledge, gently arched, forms the proximal border of the primary orifice and is nearly parallel with the frontal plane.

The species is named in honor of the writer's mother, whose maiden name was Njegovan.

ZOARIUM: The amount of material collected was four fair-sized pieces and some smaller fragments. Figures A and B of plate 15 represent the larger pieces. One was 33 mm. long. The zoarium is ivory-colored, heavily calcified, with chitinous rootlets sprouting from some of the basal zoids. An internode may have 2 to 18 rows of zoids along its length and 12 to 25 rows of zoids across its width, on one face. These counts were made on the broader blades and not on the narrow base. The colony surface is punctured by numerous channeled pores (pls. 15,C,D,H; 16,I). The zoecial orifices are visible to the naked eye.

ZOECIA: Externally, zoecial boundaries are not distinct (pls. 15,C; 16,A); but internally and in cross section they are (pls. 15,D,H; 16,H). Approximate zoecial length, by external measurement from one orifice to the next orifice in line, 1.075–1.523 mm. (average 1.315 mm.), comparing favorably with that of a single zoid measured from the inside, 1.368 mm. Zoecial width, from inside measurements, 0.360–0.605 mm. (average 0.431 mm.).

Frontal walls are very thick, lateral and back walls are thin. As seen from the inner surface zoecia are shaped like inverted flasks. Their bulging upperpart is devoid of pores except at the sides; the narrow proximal part has a number of pores (pls. 15,D,E; 16,I). These pores open into some of the frontal channels. The back wall of the zoecium is flat (pls. 15,H; 16,H). The side wall has a few elliptical rosette plates near its midline (pl. 15,G,H). These may have up to 14 pores. Pore chamber length is 0.137–0.202 mm. (average 0.164 mm.) long and 0.086–0.137 mm. (average 0.111 mm.) wide (only four readings). In addition to these pore chambers, or rosette plates, the side wall also has a number of single pores, arranged roughly in two or three rows along the edge nearest the frontal wall (pl. 15,G,H). The end wall has the usual sieve plate and two calcareous processes, the latter a bit more elaborate than in the other species (pls. 15,G; 16,H).

In the node region the zoecial cavities are very greatly reduced by the encroachment of the walls (pl. 16H.).

AVICULARIA: An internal avicularium is present but does not show from the outside because it is placed low and obliquely, a bit to the side, as in plate 15,D. It has a hooked beak and triangular mandible, which also is hooked at the tip. The internal avicularium is 0.238 mm. long and 0.144 mm. wide, based on one reading. Its beak is about 0.17 mm. long.

External avicularia occur in pairs generally. However, an occasional zoid is found which has a single external avicularium at the usual location. Mucros are absent. An external avicularium leans against each lower corner just below the primary orifice. The avicularium is bent so that the beak and the back area are in different planes. This is most accurately shown in only one drawing (pl. 16,A, lower row of zoids, second avicularium from the left), although it is the common condition. The external avicularium normally points obliquely upward and outward. Its beak and mandible are hooked and triangular (pl. 16,A,B). External avicularium measurements: total length 0.158–0.202 mm. (average 0.171 mm.); total width 0.115–0.137 mm. (average 0.121 mm.); mandible length 0.072–0.101 mm. (average 0.088 mm), width 0.101–0.122 mm. (average 0.109 mm.).

FRONTAL ORAL LEDGE. The frontal oral ledge is parallel to the plane of the orifice (pls. 15,D,E,G; 16,C,I). Plate 16,D shows a young orifice that has not yet developed the ledge.

ORIFICE: The young, just-forming primary orifice is nearly hemispherical (pl. 16,D). A fully formed primary orifice, complete with oral ledge as its proximal boundary, is crescentic (pls. 15,D; 16,C). As calcification of the frontal wall proceeds, the primary orifice is deeply buried and can no longer be fully studied from the front (pls. 15,G; 16,A). There is a gradual overgrowth that eventually results in a secondary orifice whose distal wall is either straight or arched gently forward and whose sides lead down to the external avicularia, thus enclosing an area shaped like an inverted triangle (pl. 16,A). The upper surface of the overhanging upper edge may be tubercled. Dimensions of the orifices: primary orifice length 0.130–0.187 mm. (average 0.156 mm.), width 0.245–0.317 mm. (average 0.284 mm.); secondary orifice length 0.144–0.245 mm. (average 0.190 mm.), width, 0.202–0.360 mm. (average 0.301 mm.).

Ovicells: Present on some zoecia, not on others. It is difficult to tell externally in heavily calcified pieces whether an ovicell is present, but it is easy enough in very young zoids. Where the frontal wall has not become too thick the ovicell outlines are barely visible (pl. 15,E). In older zoids the frontal over the ovicells becomes thick (pl. 15,G) and they are harder to recognize. They are covered by a secondary porous or channeled layer but their own inner wall is not

porous. A prominent ledge (BL of pl. 15,G) juts out from the back wall where the ovicell joins its zooecium. This back ledge arises from the end wall region of the zoid behind the ovicell (pl. 15,G). This condition obtains for other species of this genus also (pls. 12,D; 14,K; 17,C,F). The ovicells are globular. Their dimensions, from broken colony fragments and based on three readings only: length 0.346–0.360 mm. (average 0.350 mm.); width 0.331 mm.

TYPES: Holotype, USNM 11235; paratypes, USNM 11236.

ECOLOGY: This species was collected at Antarctic Stations 44, 45, and 104. Also growing on the colonies were a worm tube and a cyclostomatous bryozoan.

Cellarinella roydsi, new species

PLATES 16,J,K; 17,A–I

DIAGNOSIS: Zoarium a heavily calcified, nodulated, flattened, bilaminate slab. Shape flabellate. Branching dichotomous. Two mucros below the orifice cradle an external avicularium which is transversely placed across the front of the zooecium from the midline outward. Mucros in front of and below the orifice, lateral, not median, to it. Internal avicularium obliquely oriented and placed high enough so its strongly curved beak shows in the orifice, from the outside. The diagonally directed frontal oral ledge also shows from the outside.

The species is named after its collection site, Cape Royds, Ross Island.

ZOARIUM: Eight good-sized chunks (as in pl. 16,J,K,) ranging from 29 to 54 mm. in height, from 5 to 37 mm. in width, and from $1\frac{1}{2}$ to about $2\frac{1}{4}$ mm. in thickness, were in the collection. There were also a few smaller fragments.

The colony is ivory-colored, nodulated. Nodes are approximately one-half to 1 mm. long, internodes 2 to 10 mm. long. The number of rows of zooecia across the face of an internode, from one side edge to the other, is about 20 to 88. The number of rows of zooecia along an internode (longitudinally), from one node to the next, is about 6 to 14.

Rootlets are present on some of the fragments. They sometimes branch.

The zoarium is bilaminate and flattened, with most of the zooecia opening out on the two faces and a few on the edges also.

ZOOECIA: Zooecial boundaries are not definable externally. External measurements, taken from orifice to orifice in the same linear series, gave approximate lengths of 1.008 to 1.944 mm. (average 1.513 mm.). Zooecial width, based on inside measurements, 0.302–0.576 mm. (average 0.383 mm.). Zooecial thickness (distance from

the back wall to the outside frontal surface), 0.763–1.109 mm. (average 0.933 mm.).

The zooecial walls are as in other species of the genus (pl. 17, C, F). The back wall has occasional small pores, very few in number. The side wall has rosette plates, and a couple of rows of single pores at its frontal border. Side wall 0.007–0.014 mm. (average 0.010 mm.) thick. Channeled frontal wall 0.144–0.446 mm. (average 0.301 mm.) thick; its frontal pores irregular and 0.029–0.079 mm. (average 0.055 mm.) in diameter.

AVICULARIA: An internal avicularium is obliquely placed to one side of the orifice high enough for the tip of its hooked beak to show a little from the outside (pl. 17, A–G). In fact, it is almost vertical in orientation. Dimensions: total length 0.187–0.288 mm. (average 0.247 mm.); total width 0.122–0.158 mm. (average 0.142 mm.); beak length 0.115–0.187 mm. (average 0.157 mm.); mandible length 0.115–0.144 mm. (average 0.126 mm.), width 0.108–0.130 mm. (average 0.107 mm.).

A sharply pointed external avicularium, transversely placed, is cradled between two mucros. Its back area is usually on or near the imaginary midline which passes through the orifice. Its bent and hooked beak rests against one of the mucros (pl. 17, A, E, H), which is farther away from the midline than the "naked" mucro, which is very near or in front of the corner of the orifice. An occasional zoid has two external avicularia (pl. 17, G) with a mucro between them. Likewise, a rare zoid may lack the external avicularium. Measurements for external avicularia: total length 0.187–0.259 mm. (average 0.233 mm.); total width 0.115–0.202 mm. (average 0.159 mm.); beak length 0.130–0.158 mm. (average 0.144 mm.); mandible length 0.101–0.130 mm. (average 0.114 mm.); mandible width 0.115–0.173 mm. (average 0.134 mm.).

FRONTAL ORAL LEDGE. The frontal oral ledge cuts diagonally outward across the floor of the primary orifice (pls. 17, A–C, E–G). Its plane is at a considerable angle to the plane of the internal avicularium. However, this angle is not as great as in *C. rossi* (see pl. 13, E, K) but is greater than in the other four species of the collection.

ORIFICE: The orifice is arched distally and a bit lopsided rather than a perfect semicircle. Also, to add to the distortion, the curved oral ledge gives the orifice a crescentic shape and makes it appear set somewhat obliquely into the frontal surface (pl. 17, A, B). A shallow groove appears between the internal avicularium (pl. 17, F) and the oral ledge, outward. The primary orifice is 0.202–0.288 mm. (average 0.243 mm.) long and 0.267–0.389 mm. (average 0.332 mm.) wide. The secondary orifice is a bit larger: length 0.245–0.317 mm. (average

0.287 mm.), width 0.288–0.389 mm. (average 0.341 mm.). The front of the ovicell encroaches on the peristomeal passageway, as shown in side view in plate 17,C and in front view in plate 17,B.

OVICELL: Ovicells are globular and not easily distinguished externally except for their frontal wall, which intrudes upon the orifice (pl. 17,B,C). Measurements for ovicell interiors: length 0.360–0.504 mm. (average 0.428 mm.), width 0.331–0.432 mm. (average 0.370 mm.).

TENTACLE NUMBER: Some zooids were killed in an expanded condition. Their extended tentacles were dried on the colony surface, around the orifice. The tentacles numbered 20 on one zooid and approximately that, so far as could be determined, on a second.

TYPES: Holotype, USNM 11239; paratypes, USNM 11240.

ECOLOGY: This species was collected at Antarctic Stations 104, 190, and 234. Some of the living fragments were encrusted with a sponge, some with other Bryozoa such as *Barentsia discreta*, *Phylactella lyrulata*, and *Smittina* sp.

Cellarinella laytoni, new species

PLATE 18

DIAGNOSIS: Zoarium somewhat cylindrical but with a definitely serrated appearance caused by the excessively large mucros. Occasionally nodulated. Branching sparse. Zooecia open on all sides of the stalk. Two unusually prominent mucros, one at each proximal corner of the orifice, form a projecting platform below and in front of the orifice. Frontal ridges converge toward the mucros. One micro supports the external avicularium, on its median side. External avicularium beak points transversely outward or slightly distally (upward). Internal avicularium obliquely placed below one corner of the orifice within the zooecium, its curved beak just barely visible from the outside. Frontal oral ledge reduced, barely recognizable. Mandible of external avicularium longer than wide and not so strongly hooked at the tip as is the internal avicularial mandible.

The species is named in honor of Mr. Layton, who assisted Comdr. Nutt in the collection of some of the Bryozoa.

ZOARIUM: The collection yielded nine ivory-colored fragments, of which the longest is 27 mm. Some are about 2 mm. in diameter. The sprigs have a jagged or serrate outline because of the huge projecting mucros (pl. 18,A,B). Zooecia open on all sides (pl. 18,E). Nodes (pl. 18,F) are more frequent or recognizable in the younger than in the older fragments. The colony surface is pitted with channeled pores as in the preceding species. In some places, especially about the mucros, converging ridges groove the surface (pl. 18,A,C).

ZOOECIA: Approximate external zooecial length measurements, from orifice to succeeding orifice: 1.296–1.728 mm. (average 1.492 mm.). The zooecial front is somewhat bracket-shaped (pl. 18,A,B). Immediately below the orifice the two mucros jut out with their cradled external avicularium to form a broad, irregular shelf in front of and below the orifice (pl. 18,C–E). From there on downward (proximally) the zooecial frontal slopes gradually inward toward the orifice of the zooecium below (pl. 18,A). The front wall is much thicker than the side or back walls. The process of zooecial development and calcification can best be observed in the incomplete, forming zooecia at the tip of the colony (pl. 18,B). The thin, smooth, innermost calcareous layer forming the front of the zooecium is the olocyst. Over it, beginning around the areolar pores, spreads the channeled porous tremocyst whose thickness increases with age. The number of pores is considerably reduced over the ovicell. Thus, it is possible to recognize ovicelled zooids from sterile ones. A few zooids developed chitinous rootlets (pl. 18,F,G).

AVICULARIA: Each zooid has an internal and an external avicularium. Occasionally a zooid will show two instead of one external avicularium (pl. 18,G). The base or back area of the external avicularium is on or near the midline. The beak rests against the inner side of one of the mucros. This points it obliquely forward and somewhat distally. The placement of the external avicularium therefore ranges from transverse to a slight oblique distal inclination that sometimes amounts to a 30° or 40° angle. Measurements from the external avicularia: total length 0.144–0.230 mm. (average 0.189 mm.); total width 0.101–0.144 mm. (average 0.118 mm.); mandible length 0.101–0.130 mm. (average 0.112 mm.); mandible width 0.086–0.101 mm. (average 0.097 mm.); beak length 0.115–0.158 mm. (average 0.140 mm.).

The internal avicularium is placed obliquely below and to the side of a corner of the orifice (pl. 18,C–E). The tip of its strongly hooked beak is just barely visible from the outside and points upward and outward, somewhat. The internal avicularial mandible is triangular, strongly hooked, and chitinized (pl. 18,I). The external avicularial mandible is a bit more rounded at the tip and only slightly hooked (pl. 18,H). Measurements for internal avicularia: beak length 0.144 mm.; mandible length 0.086–0.130 mm. (average 0.115 mm.), width 0.072–0.122 mm. (average 0.103 mm.). Beak length and mandible width are from only three readings, mandible length from six.

FRONTAL ORAL LEDGE: A thin, long rim acts as the oral ledge in this species. It extends from the side of the inner avicularium to the opposite side of the orifice (see pl. 18,C–E). It is so thin and narrow that it could easily be overlooked.

ORIFICE: The primary orifice is gently arched distally. It is so deeply set back of the mucros that its proximal border is completely hidden from view. Nonovicelled zooids (lowest one in pl. 18,A) show pores along the peristomie; ovicelled zooecia generally show none or exceedingly few, but have the ovicell frontal projecting down into the peristomial canal a bit. Dimensions of the primary orifice: length 0.173–0.230 mm. (average 0.192 mm.), width 0.302–0.331 mm. (average 0.320 mm.).

OVICELLS: An ovicell forms a low, scarcely recognizable mound above the orifice. When observed from the inside the ovicells are globular. Only two were measured: lengths 0.374 and 0.403 mm., widths 0.346 and 0.374 mm.

TYPES: Holotype, USNM 11243; paratypes, USNM 11244.

ECOLOGY: This species was dredged at Antarctic Station 104. Only a few zooids of a cheilostome and a cyclostome (Bryozoa) and a calcareous worm tube grew on some colonies.

DISCUSSION

The six species of the 1947–48 collection were extremely bothersome because of the great similarity between them. They have the following structures or characteristics in common:

Thick channeled porous frontal wall.

Thin back and side walls.

Side wall has a few longitudinal rows of single pores along its frontal border and several multiporous rosette plates further in.

Two types of avicularia, one inside the zooecial cavity near the orifice, the other outside, also near the orifice. They are similar in appearance but differ in location and orientation.

End wall with a sieve plate and two calcareous processes.

Ovicell hyperstomial and immersed, difficult to see from the outside.

Presence of a frontal oral ledge which modifies the proximal border of the arched primary orifice.

Colony with nodes and internodes.

Triangular mandible in avicularia.

The same six species of the 1947–48 collection differ on the following specific points:

Orientation of the internal avicularium.

Orientation of the external avicularium.

Number of external avicularia per zooid.

Presence or absence of peristomial cap or visor.

Orientation of the frontal oral ledge.

General appearance of the colony or the growth form that it assumes.

Number and location of the mucros.

The internal avicularium is horizontal in position in *C. nutti* and *C. rossi*. It is oblique in position in the other four new species.

As for the orientation of the external avicularium, in *C. roydsi* it is horizontal or nearly so. In *C. laytoni* and *C. margueritae* it tends to point a bit more obliquely upward from horizontal. In *C. nješovanae* it is much more oblique, pointing upward at a considerable angle from horizontal. In *C. rossi* it points obliquely downward at a very slight angle from the horizontal. In *C. nutti* it points downward and forward at a very considerable angle from the horizontal.

The normal number of external avicularia per zoid is two in *C. nješovanae* and one in the other five new species, although occasional zoecia do break the rule.

A very prominent peristomial cap or visor occurs in *C. rossi*. It is absent in *C. laytoni*, *C. margueritae*, *C. nutti*, and *C. roydsi*. In *C. nješovanae* the secondary orifice is formed by an extraordinary downward growth of the frontal wall, reminding one of a face mask.

The orientation of the frontal oral ledge is another important species character. The oral ledge is parallel with the zoecial middle front in *C. nješovanae*. In *C. laytoni* it is parallel with only one-half the frontal and with one side, following the curve of the zoecial orifice. In *C. margueritae* and *C. nutti* the ledge cuts across or encroaches upon the proximal border of the primary orifice at a very slight angle. The ledge cuts diagonally across the proximal border of the primary orifice at a very considerable angle in *C. rossi* and *C. roydsi*.

In general zoarial characters, i. e., gross appearance of the colony, three distinct types are evident. One is the serrate cylinder or column, as represented by *C. laytoni*; a second is the narrow, flattened, tapelike colony as represented by *C. margueritae* and *C. rossi*; and a third type is the heavy, bilaminar, flattened, flabellate or fan-shaped slab as represented by *C. nješovanae*, *C. roydsi*, and *C. watersi*. *Cel-
larinella nutti* was intermediate between the slab and tape species.

IV. FAMILIES UMBONULIDAE AND SMITTINIDAE

PLATES 19-35

This fourth article on the Bryozoa collected by the U. S. Navy's 1947-48 Antarctic Expedition discusses 16 species and subspecies, one from the family Umbonulidae and 15 from the family Smittinidae. Of these, only 5 have been previously described, the remaining 11 are new. Other species which in the past have been included among the Smittinidae but which are now known to belong to other families have been left for later papers in this series.

In the case of new species, complete morphological data is given on any structure which could be of taxonomic importance; in the case of previously reported species, old descriptions have been augmented wherever possible by new, additional data. The family Smittinidae is one of especial difficulty because of the seemingly great variability of its species. Moreover, over the years, the emphasis has changed on what should be considered important or good diagnostic features, so that it is not uncommon to find an old species description, sometimes unaccompanied by a figure, which is so general that it will fit a large number of related species just as easily as it will fit its own.

The aims of this article are to present the range of variation of the species, to depict the diagnostic features to the fullest degree, to add ecological data, and, wherever possible, to compare the Antarctic Bryozoa with closely related Bryozoa from other localities because the Antarctic forms exhibit some unusual features that may be of evolutionary or taxonomic significance if found to apply to groups other than the Bryozoa.

All illustrations were drawn with the aid of a camera lucida unless otherwise stated in the captions. Measurements are based on 10 samples unless otherwise specified in the lists.

ABBREVIATIONS USED IN LISTS OF MEASUREMENTS

| | |
|--|--|
| Z-L, zooecial length (from proximal to distal end). | B-L, beak length. (Where an avicularial mandible is lacking it may still be desirable to measure the avicularial beak or space normally occupied by a mandible.) |
| Z-W, zooecial width (at widest point). | |
| Z-H, zooecial height (from back wall to front wall). | Pr-Or-L, primary orifice length, inside measurement. |
| Av-L, avicularia, total length (including both mandibular or beak and back areas). | Pr-Or-W, primary orifice width, inside measurement. |
| Av-W, avicularia, width at widest point. | |

| | |
|---|--|
| Se-Or-L, secondary orifice length. (Usually this is an inside measurement, especially if the peristome is of any thickness, but if the peristome is exceedingly thin and elevated and invariable in thickness throughout the colony it might be an outside measurement from proximal to distal border.) | ZC-W, zooecial cavity, width, inside measurements. |
| Se-Or-W, secondary orifice width. | FW-T, frontal wall thickness. |
| Se-Or-Si-D, secondary orifice including sinus depth. | LW-T, lateral wall thickness. |
| Se-Or-Si-W, secondary orifice including sinus, width at top. | M-L, mandible length. |
| Ly-L, lyrula length or height. | M-W, mandible width. |
| Ly-W, lyrula width. | Op-L, operculum length or height. |
| Pe-D, depth of the peristomial cavity (distance between primary and secondary orifices). | Op-W, operculum width. |
| Ov-L, ovicell length. | CS-L, compensation sac area length as marked on inner wall of the zooecial frontal. |
| Ov-W, ovicell width. | CS-W, compensation sac area width as marked on inner frontal wall. |
| ZC-H, zooecial cavity height (from back to frontal wall; in zooecia which have very thick walls, inside measurements). | OS-L, oral spine length. |
| | OS-T, oral spine thickness or diameter. |
| | PN-L, peristomial notch or sinus, length or height. |
| | PN-W, peristomial notch or sinus, width at widest part just short of the tip or end. |
| | AP-D, areolar pore diameter at widest. |

Family UMBONULIDAE

Family Umbonulidae was established for *Umbonula* species by Canu (1904, p. 18) without a formal description (Hastings 1949b, pp. 526-527). Since then its characteristics have been formally stated by Osburn (1952, p. 298) and Bassler (1953, p. G196). Hastings, in comparing the genera *Umbonula* and *Hippopleurifera*, suggests that the two are related closely enough to be put into the same family—Umbonulidae of Canu. At present these are the only two genera in the family.

Osburn sets down the family characters thus: Frontal "a pleurocyst, with strong costules and large pores; the aperture large, suborbicular or subquadrangular, without cardelles or very small ones . . . peristome low or wanting . . . ovicell large and hyperstomial or wanting." Bassler states them as follows: "Like Petraliidae but with prominent umbo on zooecial front below aperture and median avicularium; cardelles and lyrules absent." Under Petraliidae he gives the zooecial frontal as a tremocyst and for *Umbonula* as a pleurocyst.

The above family descriptions have to be modified somewhat because some of the *Hippopleurifera* and *Umbonula* species do not conform to the above-stated family characteristics—the former in its frontal and the latter in regard to avicularial position and presence of a simulating median denticle.

Hippopleurifera apparently may have either a pleurocyst or a tremocyst (Osburn, 1952, pl. 35, fig. 7; pl. 36, fig. 1; and Hastings, 1949, pl. 12). Two *Umbonula* species may have a median process which might pass for a lyrula. *Umbonula arctica* (Sars) 1850 has a median process of a size varying from a point (Osburn, 1952, pl. 36, fig. 6) to a sizable toothlike mucro (Robertson, 1908, pl. 23, fig. 78). *Umbonula dentata* (Waters) 1904 is midway between these two extremes, having a delicate, bifid, incurving denticle simulating a lyrula or mucro. In view of the above deviations it is believed the family should be characterized as follows.

DIAGNOSIS: Frontal a tremocyst or pleurocyst. Pleurocyst sometimes forms areolae, costulae, and a prominent umbo. Umbo occasionally directed orally, like a median denticle. Orifice large, suborbicular to subquadrangular. Peristome poorly developed or absent. Avicularia either single, median and below, or lateral or about, with respect to the orifice. Ovicell hyperstomial and usually perforated.

Brown (1952, pp. 288-289) does not recognize the family Umbonulidae but includes *Umbonula* with *Escharoides* and *Exochella* in the family Exochellidae.

The taxonomic status of the Umbonulidae should be more carefully studied, particularly in its relationship to the Petraliidae, Exochellidae, and Smittinidae, because it is not yet clearly defined and because some of its species intergrade with the other families. Incidentally, for many years *Umbonula* has been classed with the Smittinidae.

Genus *Umbonula* Hincks, 1880

Umbonella Hincks, 1880, pp. 316-317, text.

Umbonula Hincks, 1880, atlas, pl. 39 (Hincks used the name *Umbonella* in the text, then discovered it was preoccupied and corrected it in the atlas).—Canu and Bassler, 1920, p. 494.—Hastings, 1944, pp. 273-284; 1949a, pp. 205-211.—Lagaaij, 1952, p. 90.—Brown, 1952, pp. 288-289, 304-308.—Bassler, 1953, p. G196.

The above synonymy refers to significant papers only.

REMARKS: Hincks' original description of the genus is as follows: ". . . primary orifice suborbicular or subquadrangular, lower margin slightly curved inwards, peristome not elevated, no secondary orifice; a prominent umbo (? avicularian cell) immediately below the mouth, supporting an avicularium . . . encrusting."

To this Canu and Bassler formally add "frontal is a pleurocyst with costules surrounded by areolae . . . 20-30 tentacles . . . neither lyrula nor cardelles." To this Brown (p. 305) adds "ovicells with radiating pores or finely perforate." Lastly, Lagaaij adds "Avicularia paired, lateral to the orifice, or single, embedded in the distal slope of the umbo."

Umbonula patens (Smitt) pictured by Osburn (1952, pl. 36, fig. 3) has an imperforate ovicell but other *Umbonula* species seem to agree with Brown's characterization of the ovicell. No complete, undamaged ovicells were found on *U. dentata*, so that species still needs clarification on that point.

DIAGNOSIS: Zooecia encrusting. Frontal an areolate pleurocyst. Ovicell hyperstomial. Peristome poorly developed. Sometimes an aviculiferous suboral umbo, sometimes avicularia are paired and lateral. *Lytula* absent or sometimes simulated by a median frontal process. Orifice large, subcircular to subquadrangular.

TYPE SPECIES: Hastings (1944), after a detailed study of the literature and a careful examination of old museum collections of *Umbonula verrucosa* (= *Cellepora verrucosa* Esper 1790), erected *Umbonula ovicellata* Hastings 1944 as the type species.

Umbonula dentata (Waters)

PLATE 19

Smittia dentata Waters, 1904, p. 71, pl. 4, fig. 8.—Brown, 1952, p. 307.

DIAGNOSIS: Zooecia encrusting, ovate to hexagonal. Frontal convex, areolated. Orifice large, depressed; with a median variable bidentate process. Two small oval avicularia, obliquely placed, one at each proximal corner of the orifice, have hemispherical mandible directed upward and outward. A third similar avicularium sometimes on proximal frontal, directed toward nearest orifice(?). Ovicell hyperstomial but no further data on it available at present.

Measurements: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|------------------------------|--------------------------------------|
| Z-L, 0.807-1.109 (0.929) | Ly-L, 0.022-0.058 (0.037) |
| Z-W, 0.576-0.634 (0.593) | Ly-W, 0.029-0.063 (0.046) |
| Av-L, 0.095-0.108 (0.102) | Ov-L, 0.288-0.346 (0.320, only four) |
| Av-W, 0.072-0.086 (0.081) | Ov-W, 0.360-0.432 (0.387, only four) |
| Pr-Or-L, 0.187-0.245 (0.216) | Op-L, 0.130-0.144 (only 2) |
| Pr-Or-W, 0.202-0.230 (0.219) | Op-W, 0.187-0.216 (only 2) |
| Se-Or-L, 0.216-0.230 (0.219) | M-L, 0.042-0.052 (0.046) |
| Se-Or-W, 0.194-0.245 (0.220) | M-W, 0.056-0.065 (0.058) |

ZOARIUM: Zoarium white, encrusting, rather thin-walled. Waters described the species from only one piece, a fragment which lacked ovicells. The U. S. Navy collection material also consisted of one piece of about 20 fairly good zooids growing on another species and only a few broken or incomplete ovicells were present, although on none had the frontal wall become fully formed.

ZOOECIA: Zooecia ovate to hexagonal, their vertical walls somewhat curved rather than angular planes. Frontal wall strongly convex,

granular, with a row of large areolae separated from each other by short ridges at the periphery. Periphery depressed, with an occasional salient mural rim. Central area of front moundlike, better calcified and more elevated than the rest of the zoecium. Zoecial boundaries distinct.

AVICULARIA: Two small oval avicularia usually present and always in the same position, one at each proximal corner of the orifice. An occasional zoecium may lack one of these. The oral avicularia are obliquely mounted on a small mound with their beaks pointing upward and outward. A third avicularium is sometimes found on the frontal, at the proximal end of the zoid (pl. 19,C), similar in appearance to the oral ones and pointing toward the nearest orifice. Only two such avicularia are in the fragment, both incomplete. Waters' specimens apparently lacked them, since he does not mention them. Mandibles of both types are similar, hemispherical and reinforced with a chitinous rim.

ORIFICE: The large variable primary orifice is often more angular than rounded, appearing quadrangular to hexagonal in some zoids. Distally it is rounded. Proximally it is straighter and more contracted. A small thin bidentate process (?lyrula or umbo) slants inward from the center. Secondary orifice lepralioid. The three bordering zoecial frontal walls aid in the formation of the short distal and lateral peristome. The primary orifice is depressed below the level of the rest of the frontal wall. The operculum is chitin-rimmed around its upper hemispherical border but the boundaries of its thin lower border could not be determined readily on our specimens.

OVICELLS: Waters' specimens lacked ovicells. The current specimens have young, salient, globose, hyperstomial ovicells whose frontal wall has not yet been put in. So, the ovicell frontal remains undescribed until more material is found.

DISTRIBUTION AND ECOLOGY: The present specimen grew on a heavy mushroom-shaped species collected from Marguerite Bay, Station 180, in an 85–105-fathom dredge haul. Waters' specimens were on a stone from a greater depth (500? meters) some distance south and west (lat. 70°00' S., long. 80°48' W.) of the U. S. Navy specimens.

AFFINITIES: Waters felt that this species closely resembled *Mucronella bicuspis* Hincks 1883, now *Umbonula* (Brown, 1952, p. 305). Brown (p. 307) felt that Waters' *Smittia dentata* is not a *Smittina* but might possibly be an *Umbonula*.

A species very close to *U. dentata* but differing in the orientation of the two avicularia and in the width and stoutness of the "lyrula" is *U. arctica* (Sars) 1850, pictured by Osburn (1952, pl. 36, fig. 6) and Robertson (1908, pl. 23, fig. 78).

Family SMITTINIDAE

Smittiidae Levinsen, 1902, p. 26.

Smittinidae Levinsen, 1909, pp. 335-336.—Canu and Bassler, 1920, pp. 453-455.—Vigneaux, 1949, pp. 91-92.—Brown, 1952, p. 311.—Osburn, 1952, p. 390.

The above synonymy refers to significant references only.

REMARKS: Some of the species of this family have at one time or another occupied positions in various families including the Escharidae, Escharellidae, Exochellidae, Mucronellidae, etc. However, all the Antarctic species discussed below can be comfortably contained in the family Smittinidae.

Levinsen, in 1902, defined Smittiidae as possessing "Hyperstomial ooecia, generally with pores; both the distal wall and the lateral walls with a number (ca. 4-8) of single pored rosette plates." Later, in 1909, he extended the definition "The zooecia are seldom provided with 1-8 spines. A vestibular arch is wanting or weakly developed. The avicularia are rarely lateral and a median symmetrically or asymmetrically placed avicularium appears most frequently. The ooecia have as a rule a calcified, very rarely membranous ectooecium, which is usually provided with pores. Rosette plates with one or several pores, more lately pore chambers."

Canu and Bassler (1920, p. 453) add these features to the family diagnosis: ". . . ovicell . . . hyperstomial . . . opens into the peristomie. The peristome is produced and channeled in front. The operculum . . . lower edge is straight or slightly curved inward and hardly separated from the ectocyst." The frontal wall layers, particularly the pleurocyst, are mentioned by Canu, Bassler, Osburn, and others.

Brown (1952, p. 311) gives the most concise statement of family characteristics: "Ascophora possessing a median lyrula and lateral condyles in the primary orifice. Peristome often raised and channelled proximally to accommodate an oral avicularium which may, however, be frontal. Oral spines usually present. Ovicell with or without a porous ectooecium. Frontal wall evenly perforate or with marginal areolae."

Bassler (1953, p. G207) recently made a very important move to replace the family Smittinidae by family Mucronellidae Levinsen 1902 (p. 26), listing 23 genera (pp. G207-210) under it. Most of these genera can be conveniently divided into three major groups on the basis of their frontal wall: olocyst, pleurocyst or tremocyst. Those with an olocyst are listed as *Cysticella*, *Hemicyclopora*, and *Jaculina*, while those with a pleurocyst are *Mucronella*, *Palmicellaria*, *Parasmittina*, *Porella*, *Rhamphostomella*, *Rimulostoma*, *Smittoidea*, *Bryocryptella*, and *Marquetta*. Some *Rhamphostomella* are also listed by

Osburn and others as having only an olocyst. Many of the above (with pleurocyst) may have areolar pores, and some might even have occasional pores elsewhere over the front. Those genera with a tremocyst (frontal perforated more or less all over with pores, rather than only with areolae) are *Codonellina*, *Cyphonella*, *Plagiosmittia*, *Schizosmittina*, *Smittina*, and *Smittinella*.

Osburn (1952, p. 392) gave a key to nine smittinid genera which covers all but one (*Smittinella*) of the genera to be discussed in the present study.

Genus *Mucronella* Hincks, 1877

Mucronella Hincks, 1877, p. 526 (defines genus); 1879, p. 162; 1880, p. 360.—Levensen, 1902, p. 26 (erects family); 1909, pp. 336, 343 (places part of Hincks, *Mucronella* under *Discopora*, family Smittinidae).—Canu and Bassler, 1920, pp. 474–475.—Brown, 1952, pp. 297, 337, 380.—Bassler, 1953, p. G207.

The above synonymy refers to significant references only.

REMARKS: *Mucronella* at present is in a very controversial state because of the recent excellent publications by Bassler (1953), Brown (1952), and Lagaaij (1952). The controversy is over whether *Berenicea immersa* Fleming 1828 (unillustrated and most uncritically defined) is the same as *Lepralia peachii* Johnston (1847, pl. 55, figs. 5, 6), and whether genus *Escharella* Gray 1848, whose genotype is the questionable *B. immersa*, is a valid genus.

Bassler considers *Lepralia peachii* Johnston 1847 (now *Mucronella peachii*) the type species of the genus *Mucronella*. Brown detaches some of the *Mucronella* species (as has been the custom among various workers) to other genera: *Escharella*, *Escharoides*, *Exochella*, *Petraliella*, *Umbonula*, etc. Whether he still retains the original genus *Mucronella* is not clear. At any rate he consigns *Lepralia peachii* Johnston 1847 to *Berenicea immersa* Fleming 1828 as a synonym and uses *B. immersa* as the type species of the genus *Escharella* Gray 1848. But Bassler (1935, p. 105; 1953, p. G235) maintains that *Escharella* is an unrecognized and unacceptable genus because its genotype, *B. immersa* Fleming 1828, is a doubtful species. Following is Fleming's original description of *B. immersa*, from page 533 of both his first (1828) and his second (1842) editions: "Cells forming an even, rough crust; the mouths declining, small, with a blunt tooth on the proximal margin. On shells and corallines from deep water. Crust rather thick, of a brownish colour; the divisions of the cells indistinct, the cells themselves being only a little elevated towards the aperture; the whole surface minutely granular." Johnston's account and illustrations of *L. peachii* are more precise. It would seem that Fleming's *B. immersa* might be considered a dubious name.

This genus is represented by one species in the present Antarctic collection.

DIAGNOSIS: Zoarium encrusting; frontal areolate; avicularia absent; primary orifice smittinoid, with lyrula; secondary orifice with peristome; umbo sometimes present; ovicell hyperstomial and imperforate.

GENOTYPE: *Lepralia peachii* Johnston, 1847 (p. 315).

Mucronella crozetensis (Waters)

PLATE 20

Mucronella ventricosa var. *multispinata* Busk, 1884, pp. 160-161, pl. 22, fig. 11.

Smittia crozetensis (new name) Waters, 1904, p. 64, pl. 8, fig. 15a,b.

Mucronella crozetensis, Canu and Bassler, 1920, p. 475.—Livingstone, 1928, p. 66.

DIAGNOSIS: Zoarium encrusting. Zooecia ovate or hexagonal, narrowing suddenly upward to the narrow elevated peristome. Stout pointed mucro in front of small lyrula. Lyrula bifid, trifid, or with more points projecting in various planes. No cardelles. Primary and secondary orifices otherwise nearly circular and small. Pleurocyst frontal with one or two rows of tiny slitlike peripheral pores. Base partly membranous, partly calcareous. Ovicell small, globose, non-porous, slanting back from peristome. Peristomial spines usually 6 to 8, the bases of some encroaching on the ovicell front.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|---------------------------------------|--------------------------------------|
| Z-L, 0.432-1.11 mm. (0.802) | Se-Or-W, 0.115-0.144 (0.135, inside) |
| Z-W, 0.346-0.740 mm. (0.579) | Ov-L, 0.230-0.274 (0.258) |
| Pr-Or-L, 0.115-0.130 (0.117) | Ov-W, 0.252-0.389 (0.318) |
| Pr-Or-W, 0.122-0.158 (0.139) | Ly-L, 0.022-0.043 (0.038) |
| Se-Or-L, 0.202-0.252 (0.224, outside) | Ly-W, 0.040-0.069 (0.047, at base) |
| Se-Or-W, 0.209-0.259 (0.233, outside) | Ly-W, 0.058-0.086 (0.069, at top) |
| Se-Or-L, 0.101-0.130 (0.114, inside) | |

ZOARIUM: Dull, white to ivory, encrusting, attached to a rocky substratum by calcareous zooecial rims and membranous bases.

ZOOECIA: Distinct, ovate to hexagonal, highly convex, mound-shaped, porcellanous. Mural rims depressed. Each zooecium arises from a base that is centrally membranous and peripherally calcareous (pl. 20, H). The membranous bases of neighboring zoids are connected by numerous, slender, yellow to brown canals (pl. 20, D,K). Waters did not report them for *M. crozetensis* but in *Lepralia frigida* did find only one tube to each neighboring zoid (1904, p. 47, pl. 8, fig. 9). *Mucronella crozetensis* has 5 to 10 tubules connecting with each neighboring zoid. In *Mucronella*, canals leaving the distal half of a zoid have constrictions within the confines of that zoid, but those leaving the proximal half of the same zoid do not have them (pl. 20,K). Several small fiber bundles (parietal muscles?) attach to the basal membrane at the more distal sides.

The zoecial frontal wall is an olocyst overlaid by a pleurocyst. The olocyst, seen in one zoid only (from "Rock 7") is a beautiful smooth glistening white, with tiny bordering pores. The pleurocyst is thick and patterned (pl. 20, A,G,H). It has one or two alternating rows of tiny slitlike peripheral pores which perforate the thick wall. The peristome, mucro, and ovicell are the most elevated parts of the frontal surface.

AVICULARIA: Absent.

ORIFICE: Both the primary and secondary orifices are very small, nearly circular, and well raised above the rest of the frontal surface. They are frontal in position, some distance from the distal end of the zoecium. The thick but short peristome supports a mucro that is a stout spike or flattened triangle (pl. 20,F,H). Delicate, hollow, hyaline spines, usually 6 to 8 in number, arise from the thickened basal supports (pl. 20,C,H). When an ovicell is present the peristome continues at least partly across the ovicell rim and carries with it these spine bases (pl. 20,E,G). A small lyrula, occasionally simple but usually with several peaks and points projecting in various planes, is in the primary orifice just back of the mucro (pl. 20,A,D,I,J). Figure B is the most typical one. The lyrula of one young zoid (from Station 44) was typically trifid when viewed from the front but when the same zoid was tipped forward the lyrula looked flat as in *Mucronella ventricosa*.

OVICELLS: Nonporous, globose, comparatively small, thick-walled and pushed back from the peristome. Their surface is roughened. Peristomial spine bases may encroach upon their frontal rim.

DISTRIBUTION AND ECOLOGY: A rock from Station 184, bryozoan crusts of a reteporid and *Smittina abditavicularis* from Station 44, and a rock arbitrarily labeled No. 7 (station unknown) are substrates for *Mucronella crozetensis* of the U. S. Navy collection.

This species has been previously reported by Busk, Waters, and Livingstone. Its longitudinal range so far extends from 89°15' W. (Waters) to 101°13' E. (Station 44), and its latitudinal range is from 46°47' S. (Busk) to 71°19' S. (Waters). It has been collected at depths from 80 to 210 fathoms (Busk).

Its substrates, in addition to gravel and rocks, include other Bryozoa (reported by Rogick) and a valve of *Terebratula* (reported by Busk).

AFFINITIES: This species is most closely related to if not an actual variety of *Mucronella ventricosa* (Hassall) as pictured by Hincks (1880, pl. 50, figs. 6-8) except for some differences in appearance and number of oral spines; size, number of rows, and position of frontal pores; and texture of pleurocyst and, especially, the lyrula. Osburn's (1933, pl. 15, fig. 7) *Mucronella ventricosa* has the same textured

pleurocyst as *M. crozetensis* but its orifice differs. Waters (1899, p. 9; 1904, p. 64) discusses the affinities and reason for the change of name from Busk's original identification to the present species name.

Genus *Parasmittina* Osburn, 1952

Parasmittina, Osburn, 1952, pp. 392, 411-412.—Bassler, 1953, p. G208.

Osburn erected this genus for those species of *Smittina* having an areolated pleurocyst; well developed lyrula, cardelles, and peristome; perforated ovicell; and avicularium variously placed but never median, suboral, or with central bilaterally symmetrical avicularial chamber. He designates the type species as *Lepralia jeffreysi* Norman 1876 (now *Parasmittina*).

Parasmittina hymanae, new species

PLATE 21

DIAGNOSIS: Zoarium encrusting. Zooecial boundaries distinct. Convex frontal an areolate beaded pleurocyst. Avicularium broadly oval or elliptical, always placed over a corner areolar pore. Some zooids without avicularia, others with one, two, or three. Mandibles thumb-nail shaped, with broadly chitinized border. Ovicells non-porous, globose, but bordered by areolar pores. Peristome incomplete distally in ovicelled zooecia but complete in nonovicelled zooecia. Peristome raised, with flat frontal mucro bordered by a sinus on each side. Primary orifice hemispherical, with a medium-sized lyrula and cardelles. Operculum approximately hemispherical, with reinforced sides and edge. Compensation sac occupies most of the frontal area.

Parasmittina hymanae is named in honor of the distinguished zoologist Dr. Libbie Hyman of the American Museum of Natural History.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|---|------------------------------------|
| Z-L, 0.835-1.224 (0.983) | Ly-W, 0.050-0.058 (0.056, at tip) |
| Z-W, 0.590-0.821 (0.716) | Ly-W, 0.050-0.072 (0.069, at base) |
| Av-L, 0.115-0.144 (0.123) | Ov-L, 0.302-0.360 (0.358) |
| Av-W, 0.072-0.101 (0.084) | Ov-W, 0.346-0.418 (0.403) |
| Pr-Or-L, 0.101-0.144 (0.119, four readings) | Op-L, 0.115-0.158 (0.138) |
| Pr-Or-W, 0.144-0.202 (0.180, four readings) | Op-W, 0.180-0.223 (0.206) |
| Se-Or-L, 0.130-0.173 (0.146) | M-L, 0.058-0.072 (0.061) |
| Se-Or-W, 0.144-0.166 (0.154) | M-W, 0.055-0.072 (0.063) |
| Ly-L, 0.014-0.029 (0.023) | CS-L, 0.374-0.662 (0.497) |
| | CS-W, 0.288-0.533 (0.388) |
| | AP-D, 0.043-0.072 (0.059) |

ZOARIUM: The ivory-colored zoarium forms a dense crust on rocks. The convexity of the individual zooecia gives it a bumpy appearance. The largest colony is 3 cm. in diameter.

ZOOECIA: The large, distinctly outlined hexagonal zooecia have a thick frontal that is a smooth areolate olocyst covered by a closely and beautifully beaded areolate pleurocyst. It is convex, sloping upward from all sides to the elevated peristome. A row of rounded, regularly spaced areolar pores is set close to the thin mural rim. The frontal between the pores is not noticeably ribbed. The rest of the frontal surface is not porous. The compensation sac area occupies about four-fifths of the inner zooecial frontal surface. On the under zooecial surface from three to five (usually four) large oval dietellae are present in the distal half of the zoids.

AVICULARIA: One to three broadly elliptical avicularia may occur on some zoids, or be entirely absent. They are always peripheral in location, developing on the corner areolar pores and not occurring elsewhere on the frontal (pl. 21,D,E). The avicularial chamber is small. The short, broad, thumb-nail shaped mandibles are reinforced by a wide chitinous border and always oriented outward, toward the zooecial periphery (p. 21,G). The beak is slightly longer than the more hemispherical back area (pl. 21,B,C).

ORIFICE: The frontally elevated orifice is a short distance from the zooecial distal border. A collarlike peristome hides much of the primary orifice, which is hemispherical, smittinoid, and provided with a low medium-wide lyrula and cardelles. The hemispherical operculum has lateral sclerites (pl. 21,H,I). There is no oral avicularium. The peristomial collar is broadly notched frontally in two places. Between these two gaps it rises into a lip or mucro (pl. 21,D). In nonovicelled zoids the collar is complete distally, but in ovicelled zooecia the ovicell interrupts it (pl. 21,D).

OVICELL: The salient, globose, nonporous ovicell has a beautifully beaded surface. It is outlined by a row of areolar pores which perforate the frontal of the surrounding zoid but not the ovicell itself. Neither the peristome nor the walls of the neighboring zoids encroach upon its surface.

DISTRIBUTION AND ECOLOGY: The holotype of this species (USNM 11296) is from Station 184 (Marguerite Bay); paratypes were found on Rocks 8, 18, 19 (stations unknown). Numerous Foraminifera are incorporated into the zooecial bases or overgrown by specimens from Rock 19. Some of the zooecia have several brown bodies inside.

AFFINITIES: This is a handsome species, reminding one more of the genus *Mucronella* than of *Smittina* except for the presence of the avicularia.

Genus *Rhaphostomella* von Lorenz, 1886

Rhaphostomella von Lorenz, 1886, p. 11.—Hincks, 1889, pp. 424–426.—Canu and Bassler, 1920, pp. 476–477.—Lagaaij, 1952, p. 102.—Osburn, 1952, pp. 424–425.—Bassler, 1953, p. G208.

REMARKS: Hincks quotes fully von Lorenz's original diagnosis of the genus and adds the following: "Zooecia oval, the walls thin, of delicate shining material, smooth (frequently traversed by radiating costae) entire (destitute of pores); orifice ample, arched above, lower margin straight or slightly curved, within it a median denticle, below it or upon it an aviculiferous rostrum. Ooecium semicircular or subrescentic, perforated."

Canu and Bassler add that there is a lyrula and a pleurocyst and that the hyperstomial ovicell is closed by the operculum.

Lagaaij states that previous workers, as Waters, noted areolar pores which were not a feature of the original generic characterizations, thus necessitating a modification of Hincks' and Lorenz's diagnoses. Another necessary modification is that the ovicell sometimes is imperforate (as in the *R. ovata* (Smitt) of Osburn). *Rhaphostomella bassleri*, new species, has a single small frontal pit on the ovicell ectooecium, which in advanced calcification is calcified (i. e., the pit), and the ovicell is outlined by some areolar pores which do not penetrate the ovicell proper. *Rhaphostomella costata* von Lorenz 1886 is the genotype (Canu and Bassler, 1920, p. 477).

Rhaphostomella bassleri, new species

PLATE 22

DIAGNOSIS: Zoarium encrusting to foliaceous, unilaminar. Zooecia suddenly convex. Distal walls a modified inverted V. Mural rims thin, not salient. Frontal areolated. Areolae numerous, medium sized, close together and almost tubular on one side because frontal rises upward so fast. Interareolar costae short. Primary orifice smittinoid, with cardelles and a low broad lyrula. Operculum hemispherical. Secondary orifice lepralioid to faintly trifoliate, obscured by a large, cone-shaped aviculiferous mucro. Pointed avicularium on one side of the mucro. One or two other smaller mucronate avicularia often present in various positions on frontal. Mandible triangular, with hooked tip. Two frontal pores present below and to the back side of the oral avicularial chamber. Ovicells globose, nonporous, tipped forward partly over the orifice.

Rhaphostomella bassleri is named in honor of Dr. R. S. Bassler of the Smithsonian Institution, to whom bryozoologists owe an immense debt of gratitude.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see page 271).

| | |
|---|---|
| Z-L 0.851-1.184 (1.019) | Av-L 0.144-0.187 (0.160, oral avic.) |
| Z-W 0.481-0.888 (0.683) | Av-W 0.086-0.101 (0.094, oral avic.) |
| Pr-Or-L 0.173-0.216 (0.189) | M-L 0.094-0.173 (0.112, oral avic.) |
| Pr-Or-W 0.209-0.230 (0.218) | M-W 0.065-0.094 (0.077, oral avic.) |
| Ly-L 0.014-0.029 (0.027) | Av-L 0.115-0.158 (0.139, frontal avic.) |
| Ly-W 0.086-0.115 (0.100) | Av-W 0.058-0.101 (0.078, frontal avic.) |
| Op-L 0.158-0.187 (0.173) | M-L 0.058-0.066 (0.059, frontal avic.) |
| Op-W 0.228-0.266 (0.251) | M-W 0.050-0.072 (0.063, frontal avic.) |
| Se-Or-L 0.158-0.230 (0.194) | Ov-L 0.296-0.407 (0.353) |
| Se-Or-W (anterior) 0.180-0.238 (0.198) | Ov-W 0.370-0.481 (0.429) |
| Se-Or-W (posterior) 0.230-0.302 (0.275) | |

ZOARIUM: Some zoarial fragments encrust other Bryozoa and rocks while other fragments (edges of colonies) form free, flat, thin, foliaceous, unilaminar chips. They are ivory-colored, often well calcified. Some contain polypides and ovicells with pale orange-colored embryos. Colonies in the collection are not complete; the biggest fragment, from Station 190, measures 18 mm. by 24 mm.

ZOOECIA: Zooecial shapes vary considerably. Zooecia are usually hexagonal, with the distal half of the zooecium generally broader and rounder than the proximal half, and with the distal walls curved from an arch to a modified inverted V (pl. 22,B,C,N). Sometimes even a gap occurs in the distal wall (pl. 22,N). The curved-to-angular lateral walls have five to seven pore plates. Zooecial frontal boundaries are distinct because of the single row of rounded, numerous, closely set areolar pores which are placed so close to the mural rim and because of the sudden convexity of the zooecia. The areolar pores are more or less tubular in appearance, the lateral wall of the tube short, the mesial wall longer, because of the sudden rise of the frontal zooecial wall. The rest of the frontal is nonporous except for two, occasionally three, pores transversely or obliquely placed below and to one side of the oral mucro (pl. 22,A-C,O). These two pores are always present at the base of the oral avicularial chamber but not elsewhere and not in connection with the frontal avicularia.

The olocyst is thin, smooth, areolated. The pleurocyst, also areolated, is thicker, and granular to beaded. The ribs between the areolae are prominent but short, and not continuing up very far along the side of the zoid.

AVICULARIA: Two types of avicularia, the oral and the frontal, may occur. The oral is present on every completed zooecium (pl. 22,D,E). One or two frontals may occur on some zoids (pl. 22, A-C), or entirely absent on others (pl. 22,D,O). The oral avicularium varies from considerably larger down to frontal avicularium size. The avicularial chamber is large in the oral type (pl. 22,L) and small in the

frontal type (pl. 22,C). Otherwise, in avicularial shape and mandibular appearance the two types are quite similar or intergrade into each other. The oral avicularium is mounted on the side of the mucro, facing either to the left or to the right, with beak pointing outward (pl. 22,D,F). Sometimes the mucro and beak have a slightly curved tip. The mucro houses the avicularial chamber. The frontal avicularia also are mounted along the side of a smaller umbo. They generally face toward the middle of the zoecium (pl. 22,A) although some variations occur. They may be located anywhere on the frontal but usually are on the proximal half of the zoid, only rarely near the peristome.

The oral mandible is roughly triangular, gently curved, and has a hooked beak (pl. 22,G,I,J). Its outer border is more chitinized than the central area. The frontal avicularium mandible is similar in appearance.

ORIFICE: The orifice is nearly terminal. Its distal peristomial wall is formed in part by the next distal zoecium. The primary orifice is usually obscured or hidden by the peristome and aviculiferous mucro. It is a bit wider than long, smittinoid, with cardelles and a low broad lyrula (pl. 22,E,L). Its operculum is thin and lightly chitinized. The secondary orifice varies from lepralioid (pl. 22,B) to approximately trifoliate (pl. 22,O). Its anter is hemispherical, its poster is much wider and flatter. The oral avicularium-bearing mucro projects prominently in front of it. The peristome is highest at the sides of the orifice and low at the proximal corners. No spines were seen about the orifice.

OVICELLIS: Salient, nonporous, globose, well calcified, tipped forward, partly overhanging the orifice. Some have a shallow oval or almond-shaped depression (pl. 22,A,O) near the border. Areolar pores of the next distal zoid sometimes outline the ovicell but do not perforate the ovicell wall. Ovicell surface is granular to beaded, occasionally a bit grooved. Embryos present in ovicells collected from Station 190.

DISTRIBUTION AND ECOLOGY: The holotype of this species (USNM 11289) comes from Station 190; paratypes were taken at Station 44 and from Rocks 3 and 7 (locality unknown). Stations 44 (lat. 65° 25' S., long. 101° 13' E.) and 190 (Marguerite Bay) are a considerable distance apart. No entire colonies are in the lot, only pieces, the biggest of which is 18 mm. by 24 mm. The piece from Station 44 grows on *Cellarinella rossi* (see p. 260). The three pieces from Station 190 are free, foliaceous chips, with polypides and embryos. On back of these colony pieces, but not on the face, grow a calcareous worm tube and various Bryozoa (*Ramphonotus inermis*, *Membraniporella* zoid, ancestrula, and an attachment rootlet) as well as sponge spicules. The specimens encrusting Rocks 3 and 7 were removed by calcining.

AFFINITIES. Osburn (1952, p. 425) mentions two broad groups of *Rhampostomella* species. One group has a strongly ribbed frontal wall, frontal avicularia, no cardelles, and a primary orifice which is strongly arcuate, sometimes having a lyrula. The second group has a plain, thinner frontal wall, without prominent costules, with frontal avicularia wanting, and primary orifice with distinct lyrula and cardelles. The Antarctic species *R. bassleri* is intermediate between the two groups. It favors the second group but has frontal avicularia and short costules.

Genus *Smittina* Norman, 1903

Smittia Hincks (preoccupied), 1879, p. 160; 1880, pp. 340-341.—Levinsen, 1902, p. 26.—Waters, 1904, p. 61.

Smittina Norman, 1903, p. 120.—Levinsen, 1909, p. 339.—Canu and Bassler, 1920, p. 457 (genotype as *Lepralia reticulata* MacGillivray, 1842 (cf. *Smittoidea*)).—Lagaaij, 1952, p. 94.—Brown, 1952, pp. 319-320 (sets genotype as *Lepralia landsborovii* Johnston 1847 and chooses neotype (cf. *Smittoidea*)).—Osburn, 1952, pp. 390-391 (splits genus into 3 genera, retaining *S. landsborovii* for *Smittina* proper).—Bassler, 1953, p. G209.

The above synonymy refers to significant papers only.

REMARKS: Hincks (1880) stated: "The cardinal character of this genus is the elevated secondary orifice, produced and channeled in front. The dentate lower margin is common to it." This still holds. The genus, as newly restricted by Osburn, is characterized below.

DIAGNOSIS: Frontal a tremocyst, hyperstomial ovicell with pores; lyrula, cardelles and peristome present; a symmetrically developed median suboral avicularium included either within the peristomial fold, spanning it, below it, or sometimes even fitting into a gap in the peristome.

The genotype is *Lepralia landsborovii* Johnston (1847, p. 310, pl. 54, fig. 9).

Smittina abditavicularis, new species

PLATE 23

Porella malouinensis Livingstone, 1928, pl. 6, fig. 7; pl. 7, fig. 2; text fig. 15, pp. 66-68.

DIAGNOSIS: Zoarium encrusting. Zooecia elongated, boxlike. Frontal a thick, nearly flat tremocyst. Secondary orifice clithridiate, primary orifice smittinoid, with small lyrula and sizable cardelles; a small oval oral avicularium obliquely placed inside between the two orifices. Ovicell unknown.

The species is named for its hidden avicularium, from the Latin "abditus" (hidden, secret, removed) and "avicula" (diminutive of bird).

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|---|---|
| Z-L, 1.238-1.872 (1.594) | Se-Or-L, 0.202-0.274 (0.246, including sinus) |
| Z-W, 0.619-0.864 (0.729) | Se-OR-W, 0.173-0.202 (0.189) |
| Z-H, 0.533-1.022 (0.749) | Pe-D, 0.259-0.360 (0.317) |
| Av-L, 0.058-0.086 (0.073) | ZC-H, 0.389-0.619 (0.475) |
| Av-W, 0.043-0.065 (0.055) | ZC-W, 0.490-0.590 (0.539) |
| B-L, 0.036-0.050 (0.043) | Ly-L, 0.022-0.036 (0.025) |
| Pr-Or-L, 0.158-0.187 (0.169) | Ly-W, 0.036-0.050 (0.044) |
| Pr-Or-W, 0.230-0.259 (0.243) | FW-T, 0.216-0.346 (0.277) |
| Se-Or-L, 0.173-0.209 (0.190, excluding sinus) | LW-T, 0.043-0.072 (0.061) |

ZOARIUM: The zoarial surface is a pale buff. The heavy, sturdy zoarium is encrusting, unilaminar, tending sometimes to several layers in thickness when zoids overgrow an older layer. Where a second layer grows over another layer of this species the new layer neglects to put in its own dorsal wall but uses the frontal wall of the underlying layer as a back for its new zoids. No soft polypide parts are in the material. The few pieces found fragment easily.

ZOOECIA: The zooecia are large, long and boxlike. A thin, faintly salient rim outlines zooecial boundaries here and there, most frequently around the orifice. Zooecial boundaries are also marked by marginal pores that are slightly larger than the other frontal pores, which are quite uniform in size and distance from each other.

The frontal is a thick tremocyst, its external surface dusted over with buff.

The thick lateral and end walls are perforated by pore plates (pl. 23,B). The lateral walls have 6 to 8 of these. Livingstone's specimens had 5 to 7. Some of these pore plates are punctured by 4 to 7 smaller pores. The back and front walls are gently convex but the latter sometimes flatten out completely except for the pores and the raised orifice. The side walls are straight.

AVICULARIA: Only one kind of avicularium, the oral, is present. It is visible only in dissected zoids or at the broken ends of the colony as it is small and too deep within the peristomie to be seen from the outside. Moreover, it is located back of the narrow sinus and obliquely oriented. No mandibles are in the present material, but Livingstone describes them as being rounded-triangular.

ORIFICE: The orifice is nearly terminal. The frontal of the next distal zoid helps to form its distal wall (pl. 23,C,D). Its sides are in contact with frontal extensions from the neighboring rows of zoids. The orifice is elevated above the rest of the frontal surface. The primary and secondary orifices look quite different, the secondary

being clithriate (pl. 23,C,D), the primary smittinoid (pl. 23,E,F,H). The primary orifice cannot be seen from the outside except in damaged or dissected zooids because of the depth of the peristomie (pl. 23,B,E,G). No opercula are in the present collection. The small toothlike lyrula and cardelles are firm and sturdy.

OVICELLS: None has been found to date.

DISTRIBUTION AND ECOLOGY: A small amount of old material, including the holotype (USNM 11312), came from Station 44 (lat. 65°25' S., long. 101°13' E.). Part of it grew on a reteporid bryozoan. In turn, over it grew *Lacerna hosteensis*, *Microporella trinervis*, *Mucronella crozetensis*, *Smittoidea ornatipectoralis*, *Smittina canui*, *Microporella* sp., sponge, and Foraminifera.

This species has been previously reported under the name of *Porella malouinensis* by Livingstone (1928, pp. 9, 68) from lat. 66°32' S., long. 141°39' E., at 157 fathoms. Vigeland (1952, pl. 3, fig. 1) apparently had the correct *Porella malouinensis* of Jullien (1888) but included Livingstone's above-named species in his synonymy.

AFFINITIES: *Porella malouinensis*, as pictured and described by Jullien (1888, p. 57, pl. 3, fig. 6), is a *Smittina*, with a good-sized elliptical oral avicularium placed centrally in the wide sinus of a large orifice. Its mandible is directed more or less forward. Also, the peristomial sinus is wide enough and the avicularium is so close to the edge that the avicularium can be readily seen without tilting the zoecium. The specimen that Livingstone identified and pictured as *Porella malouinensis* is really *Smittina abditavicularis*, new species. In *S. abditavicularis* the sinus is very narrow and the orifice is small and deep; therefore, it is extremely difficult to see the avicularium or even suspect its presence without much specimen-maneuvering and hunting for cross or end sections. Moreover, the avicularium is very small and obliquely directed in the center of the peristomie instead of being turned directly outward. Also it is more oval than rounded. Jullien did not describe the lyrula, cardelles, or shape of the primary orifice. Without such data or without a picture of these parts it is difficult to identify some of the Smittinidae. Finally, Jullien (p. 57) described the *P. malouinensis* ovicell as hemispherical, granular around the periphery, and bearing a group of punctae on the flattened surface. Neither Livingstone's nor the present author's specimens had ovicells.

Smittina alticollarita, new species

PLATE 24

DIAGNOSIS: Zoarium white, encrusting. Zooecial frontal a gently convex, thick, roughly granular tremocyst. Thin salient mural rims.

Frontal pores rounded, medium sized, spaced fairly well apart. Trisectional peristomial collar sometimes flares out excessively. Peristome with fair-sized sinus in which is set a broadly oval avicularium. Avicularia set at an angle against the frontal, with broader end proximal. Lyrula medium sized. Tall ledges (cardelles) extend high, halfway up the primary orifice sides, separated from the lyrula by a sinus. Ovicells, opercula and mandibles unknown.

Smittina alticollarita is named for its excessive, elevated, flaring collar or peristome, from the Latin "altus" (high) and "collaris" (collar).

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 721).

| | |
|------------------------------|------------------------------|
| Z-L, 0.864-0.936 (0.889) | Pr-Or-W, 0.173-0.187 (0.176) |
| Z-W, 0.504-0.619 (0.573) | Se-Or-L, 0.158-0.216 (0.177) |
| Av-L, (0.072, four readings) | Se-Or-W, 0.158-0.202 (0.174) |
| Av-W, 0.058-0.065 (0.061) | Ly-L, 0.029-0.036 (0.030) |
| Pr-Or-L, 0.122-0.130 (0.128) | Ly-W, 0.058-0.072 (0.061) |

ZOARIUM: The white, smooth-textured, fine-patterned holotype colony is 9 mm. by 10 mm. and consists of about 100 hexagonal zooecia which are large enough to see with the unaided eye and which form a thick-walled heavy crust on the substratum. The zoarium is without mandibles, ovicells, or soft polypide remains.

ZOOECIA: The zooecial frontal is a gently convex tremocyst, more often roughly granular than beaded, although both textures may occur on the same zoid. The frontal pores are rounded, of uniform size, fairly well spaced from each other, the peripheral pores being no larger than the more central ones. The mural rims are thin salient threads. The most elevated part of the frontal is the peristome.

AVICULARIA: Present in some zooecia and absent from others. Although few are present they appear to be of uniform size and in the same location. They are placed neither vertically nor horizontally but at an angle to the frontal, in the gap formed by the two approaching ends of the peristomial collar. Their proximally directed beak is longer than the membranous avicularial back area. The mandible, judging from the shape of the beak, should be thumb-nail shaped.

ORIFICE: The orifice is frontal. Its distal wall is formed with the aid of the next distal zoid. The peristome is raised distally, in the young zoids like a head shawl (pl. 24,C). It shows considerable variation in the same colony (holotype)—from the simple thin collar through various intermediate stages (pl. 24,A,D,F) to a 3-lobed moderately thickened elevated collar (pl. 24,B). There is even a higher peristome on an old, 2-zoid paratype (pl. 24,E).

The secondary orifice is pear shaped, the sinus being the narrower part. The medium-wide proximal sinus is really an interruption in the peristome where the avicularium, if present, is placed.

The primary orifice is smittinoid, its distal half a wide low arc, its sides narrowed by tall palisade ledges or cardelles, its proximal wall with a distinct, squared lyrula separated on each side from the cardelles by a medium-sized sinus. The lyrula is only a short distance from the oral avicularium and peristomial sinus and can be easily seen from the outside, thus differing markedly from *Smittinella rubrilingulata*, whose lyrula is buried deep in the orifice.

The operculum is delicate, only lightly chitinized around the rim.

Features making this species distinct from others of the *Smittina* in the collection are the height of the cardelles compared with the lyrula and the considerably elevated, petallike, trilobate peristome.

OVICELLS: Unknown.

DISTRIBUTION AND ECOLOGY: Both the holotype (USNM 11316) and paratype are from Station 44. The former consists of about 100 zooids and encrusts a reteporid bryozoan which, in turn, is growing over a colony of *Emballotheca phylactelloides*. A calcareous worm tube, a hydroid stalk, and Foraminifera grow over the *Smittina*. The paratype is an old ivory-colored scrap of two zooids.

AFFINITIES: The absence of an ovicell makes determination of relationships a bit difficult. However, in the form of the excessively developed peristome this species resembles *Peristomella monstrosa* Kluge 1946 but differs from it in having a tremocyst, while *P. monstrosa* has a solid nonporous frontal (pleurocyst?). *Smittina alticollarita* resembles Osburn's (1952, pl. 47, fig. 1) specimen of *Smittina landsborovii* as to aperture shape but the avicularia of the two species are different. Also, *S. alticollarita* has a more elevated, petallike peristome. Jullien (1888, pp. 54-55, pl. 2, fig. 4) described a *Smittia purpurea* which has a porous frontal, raised mural rims, and a pronounced peristomial collar, but its avicularium differs from that of *Smittina alticollarita* in being within the peristomial boundaries, enclosed by the peristome frontally. Brown (1952, p. 323) comments that Jullien's *S. purpurea* is not the *S. landsborovii* var. *purpurea* of Hincks, 1881.

Smittina canui, new species

PLATE 25

DIAGNOSIS: Zoarium encrusting. Zoecial frontal wall a tremocyst with many medium-sized pores. Raised peristome interrupted proximally by a small elliptical oral avicularium. Mandible tongue shaped. Secondary orifice shaped like a sector of a circle. Primary orifice smittinoid, with broad low lyrula and cardelles. Ovicell thick, globose, and perforated by many medium-sized pores.

This species is named in honor of Dr. F. Canu who, in collaboration with Dr. Bassler, produced a number of excellent bryozoan monographs that have been of immense service to all present-day bryozoologists.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|------------------------------|------------------------------|
| Z-L, 0.778-1.080 (0.962) | Se-Or-L, 0.127-0.158 (0.143) |
| Z-W, 0.504-0.734 (0.638) | Se-Or-W, 0.144-0.173 (0.158) |
| Av-L, 0.058-0.094 (0.074) | Ly-L, 0.017-0.029 (0.024) |
| Av-W, 0.043-0.058 (0.054) | Ly-W, 0.086-0.101 (0.093) |
| M-L, 0.029-0.050 (0.040) | Ov-L, 0.288-0.360 (0.318) |
| M-W, 0.029-0.037 (0.035) | Ov-W, 0.331-0.403 (0.360) |
| Pr-Or-L, 0.101-0.130 (0.118) | Op-L, 0.115 (Only one) |
| Pr-Or-W, 0.171-0.187 (0.177) | Op-W, 0.173 (Only one) |

ZOARIUM: The encrusting zoarium grows over other Bryozoa. It is white, shiny, and rather smooth. The zooecia are large enough to see with the unaided eye.

ZOOECIA: Large, longer than wide and mostly hexagonal, with walls more gently curved than angular. Zoecial boundaries are usually distinct. A slim, slightly raised mural rim is often present (pl. 25,D,E), but due to the convexity of the frontal surface these are pushed down into the "valleys" at the sides of the zooecia so that they are at a lower level than the rest of the frontal. The frontal is a fairly thick tremocyst, punctured by numerous medium-sized rounded pores placed relatively equidistant from each other. The frontal between the pores is granular or beaded. The most elevated part is the peristome, which is very similar in side view to that of *Smittina ordinata*.

The lateral and back walls are thinner than the frontal. Where a few zoids are free from the substratum the back walls appear gently convex and entire. The lateral walls have five or six multiporous pore plates in a line near the base. The distal walls also are porous. One zoid had three plates that were not as large as the side-wall pore plates.

AVICULARIUM: No avicularia other than the oral ones are present. Every zoid has them, except the very youngest which have not yet completed growth.

The small elliptical avicularium is cradled in the depressed incomplete part of the peristome. It is tipped forward and downward by a small curved ledge or hillock (pl. 25,K) so that it is situated roughly a 45° angle away from the dorsal surface, along the longitudinal axis. The mandibular part is longer than the subhemispherical membranous area. The mandible is tongue shaped, with parallel sides and a curved tip.

ORIFICE: The elevated orifice is nearly terminal. No oral spines are in the present colonies. The secondary and primary orifices are different in shape. The former is somewhat like the sector of a circle; plate 25,B is most typical of it. It is less elithridiate than that of *S.*

ordinata and *S. alticollarita*. Its curved distal third is formed by the frontal wall of the next distal zoid. The other two sides may be straight in young zoids, or curve inward in older zoids, depending upon the thickness of the growing, encroaching peristomial walls. The primary orifice is smittinoid, wider than long, with a wide low lyrula and fairly prominent cardelles that sometimes show and sometimes do not. Few opercula are present. Between the primary and secondary orifices is the small oral avicularium.

OVICELL: The ovicells are globose, moderately salient and thick-walled. They are met at the sides by the heightening peristome (pl. 25,E). They are punctured by pores similar to those of the zoecial front. The pores are over most of the ovicell surface, not restricted to a central porous area that Busk (1884, p. 151) describes for *S. smittiana*, a closely related species. The ovicell is comparatively large.

DISTRIBUTION AND ECOLOGY: Only three fragments of partial colonies are in the collection. A paratype from Station 226 measures 4 by 7 mm. The holotype (USNM 11304) from Station 44 is growing over a retepore, in close proximity to a colony of *Smittina exertaviculata*. Another specimen from Station 44 is growing partly over *Microporella trinervis*, which in turn is supported by other bryozoan species (*Smittina oblongata* and the retepore). This patch measures about 10 mm. by 36 mm. and represents the growing edges of possibly two colonies.

AFFINITIES: This species resembles *S. smittiana* Busk (1884, p. 151, pl. 17, figs. 3,3a,3b) in the following ways: Both have a wide low lyrula (some differences however); primary and secondary orifices of both species agree; both have an oral avicularium enclosed within the peristome; both have a tremocyst; and the zoecial width is the same in both although the length of some of Busk's specimens appears to be twice that of mine.

The two species differ in the following ways: Shape and relative size of the oral avicularium; extent of perforation of the ovicell; and occurrence of salient mural rims in *S. canui*, sometimes encroaching upon or over the ovicell, but not in *S. smittiana*.

Busk (1884, p. 151) gives an ambiguous account of the lyrula and does not figure it. Canu and Bassler (1920, pp. 458-459, fig. 132m) picture it but their figure also reveals an oral avicularium which is proportionately much smaller with respect to the lyrula than is true for *S. canui*. Busk describes the avicularium as round, but that of *S. canui* is longer than wide. The avicularium figured by Canu and Bassler also is longer than wide. In *S. canui*, the ovicell is perforated all over, while in *S. smittiana* the perforations are restricted to a reni-

form or oval area on the front. Busk obscurely describes five converging triangular openings within the reniform area but does not picture them on the ovicell in his figures 3a and 3b. Nothing comparable to them is present in *S. canui*. Moreover, the ovicells of the latter appear to be much larger proportionately than do those of *S. smittiana*.

Lastly, slightly salient mural rims occur around the zooecia of *S. canui*, sometimes even encroaching partly over the ovicell front (pl. 25,E), while Busk says that his zooecia are not separated by septal ridges (mural rims).

Smittina canui at first glance might be mistaken for dead white colonies of *S. ordinata* except for the difference in the degree of ovicell perforation.

Another species showing close relationship to *S. canui* is the *Smittina landsborovi* pictured in Osburn's monograph (1952, pl. 47, fig. 2). Both have a small oral avicularium, frontal and ovicell perforated, and broad lyrula. Osburn's specimen differs from *S. canui* in the shape of the secondary orifice, thinness and shortness of peristome, and extension of peristome over the front of the ovicell.

Smittina exertaviculata, new species

PLATE 26

DIAGNOSIS: Zoarium encrusting, rather heavy-bodied. Mural rims thin, slightly salient. Zooecial front convex, punctured by numerous, closely set pores. Nonporous peristome flared laterally. Secondary aperture somewhat reniform or shaped like a horse's hoof, with an elevated, bent, spatulate avicularium set into the hilum area. Avicularium medium sized. Primary orifice with low broad lyrula and two inconspicuous cardelles. Ovicell globose, with a porous frontal area and a secondarily encrusted peripheral area.

This species is named for the projecting nature of its avicularium from the Latin "excertus" (projecting, protruding) and "avicula" (diminutive for bird).

MEASUREMENTS: The minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|---------------------------|------------------------------|
| Z-L, 0.818-1.079 (0.947) | Pr-Or-W, 0.202 (Only two) |
| Z-W, 0.539-0.835 (0.680) | Se-Or-L, 0.158-0.259 (0.216) |
| Av-L, 0.086-0.115 (0.095) | Se-Or-W, 0.212-0.245 (0.217) |
| Av-W, 0.058-0.086 (0.070) | Ly-L, 0.029-0.033 (0.030) |
| M-L, 0.086 (Only one) | Ly-W, 0.072-0.102 (0.095) |
| M-W, 0.050 (Only one) | Ov-L, 0.288-0.403 (0.349) |
| Pr-Or-L, 0.137 (Only two) | Ov-W, 0.317-0.374 (0.340) |

ZOARIUM: The ivory-colored calcareous zoarium grows over other bryozoan species as well as its own kind.

ZOOECIA: The more or less hexagonal zooecia are rather heavy-bodied, i. e., thick-walled. A faintly raised mural rim outlines the gently convex frontal wall. Where the frontal wall bulges more prominently, the mural rims lose their salient appearance and slope gradually down to meet the walls of the neighboring zoids, thus forming a "valley" between zoids. The frontal wall is punctured by numerous, evenly spaced pores set closely together everywhere except in the peristomial region. The slightly beaded peristome rises above the rest of the frontal, flaring outward and interrupted or straddled by the peristomial or oral avicularium.

AVICULARIUM: Only one type—the medium-sized, peristomial, spatulate type—occurs. It is always present and in the same location, set in the middle of the peristomial proximal rim. The spatulate mandibular section is larger and bent at the pivot or cross bar in a different plane than the smaller subhemispherical back avicularial area (pl. 26,A,E,G). The spatulate mandible has a basal and peripheral chitin reinforcement (pl. 26,G). The avicularial chamber is placed between the lyrula and the peristome. The two planes of the avicularial surface (the mandibular and back areas) are both at varying slants with respect to the plane of the zooecial frontal, so the avicularial surface is bent or bevelled.

ORIFICE: The primary orifice is well hidden by the projecting peristome and avicularium. It has a low, medium-wide lyrula and cardelles (pl. 26,B). The peristomie or passageway between the primary and secondary orifices is long and somewhat reniform on end because of the avicularial chamber. The proximal half of the peristome often appears slightly wider than the distal half. The side walls sometimes pinch inward medially to give the secondary orifice an almost trifoliate appearance. The distal peristome wall is made up largely from the wall of the next zoid in the series (pl. 26, A,B). In ovicelled zoids the lateral peristome walls grow upward onto the sides of the ovicell. No opercula were found.

OVICELL: Few ovicells are in the colonies. They are globose, salient, smooth frontally, and punctured by about 16 casually distributed elliptical or oval pores over the thin smooth frontal area. The periphery of the ovicell is a bit thicker, rougher and crusty.

DISTRIBUTION AND ECOLOGY: The holotype (USNM 11314) is from Station 45 and consists of a scrap of about three dozen zoids, some overlapping others, growing around a stalk of "*Smittia*" *inclusa* Waters 1904 (= *Clithriellum inclusum*). The paratypes consist of more zoids encrusting other Bryozoa (a retepore, *Mucronella crozetensis*, and *Smittina abditavicularis*) from Station 44. No soft poly-pide parts are in the specimens.

AFFINITIES: *Smittina excertaviculata* is like the fossil Australian species *Porella punctata* MacGillivray (1895, p. 91, pl. 12, figs. 8, 10, 11) in the shape and general appearance of the secondary orifice but differs from it in having a much more densely punctured frontal. In this respect, *S. excertaviculata* resembles another fossil, *Smittia crib-raria* MacGillivray 1885 (1895, p. 93, pl. 12, figs. 16-17), but differs from this earlier species in the shape of the secondary orifice. Ovicells were unavailable for description in both fossil species. *Smittina excertaviculata* thus seems to be more closely related to the Australian fossil forms than to more recent species.

Smittina obicullata, new species

PLATE 27

DIAGNOSIS: Colony unilaminar to bilaminar, encrusting or erect, forming broad blades. Zooecial frontal gently convex or flattened except for the frontally projecting peristome and elevated suboral avicularium. Frontal sometimes granular, perforated by numerous pores. Mural rims thin and salient. Secondary orifice outlined by a partial peristome, raised highest in front and less at sides. Peristome broadly notched medially. Primary orifice broadly curved, wider distally. Two cardelles and a low, broad, truncated lyrula. A small, rounded to elliptical avicularium below peristomial notch in some zooids. Mandible nearly hemispherical, with a pair of converging sclerites. Ovicell thin-walled, smooth, globose, punctured by several pores and encroached upon by the peristome and neighboring zooids at the sides.

The name of this species derives from the Latin "obicis" (barrier, bar, wall) and "ulus" (diminutive) because of the peristome, which forms a small barrier or wall in front of the primary orifice.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|------------------------------|--------------------------------------|
| Z-L, 0.864-1.101 (1.001) | Pr-Or-W, 0.173-0.230 (0.202) |
| Z-W, 0.418-0.518 (0.446) | Se-Or-L, 0.158-0.230 mm. (0.193 mm.) |
| Ov-L, 0.274-0.317 (0.295) | Se-Or-W, 0.202-0.259 (0.237) |
| Ov-W, 0.288-0.360 (0.347) | PN-L, 0.050-0.122 (0.084) |
| Av-L, 0.144-0.173 (0.159) | PN-W, 0.043-0.086 (0.066) |
| Av-W, 0.115-0.144 (0.134) | Ly-L, 0.022-0.029 (0.027) |
| M-L, 0.072-0.101 (0.094) | Ly-W, 0.058-0.086 (0.073) |
| M-W, 0.079-0.122 (0.104) | Op-L, 0.209-0.223 (0.216) |
| Pr-Or-L, 0.144-0.173 (0.152) | Op-W, 0.122-0.144 (0.131) |

ZOARIUM: Zoaria a dull ivory or grayed buff color and up to 3.5 by 4 cm. in size. They form broad-bladed bilaminar chips after arising from the unilaminar encrusting (substratum) layer. The

colony texture is rather smooth but has a faintly embossed surface where ovicells occur in rows or patches. The thickness of a bilaminate blade is from 0.547 to 1.08 mm. (average 0.772 mm.).

ZOOECIA: The zooecia are of four types, those with or without ovicells and those with or without avicularia. Both some of the ovicelled and some of the nonovicelled zoids have suboral avicularia; others lack them. The zooecia are 4- to 6-sided, longer than wide and faintly outlined by their thin salient mural rims. The frontal surface looks like a coarse woven mesh because it is perforated by numerous, large, closely set pores and is also pebbled between the pores. It is flattened to gently convex except in the peristome and avicularial regions, which protrude or are elevated. The frontal wall is thicker than the side and back walls. The side walls are perforated by about six large pores.

AVICULARIUM: Only one type of avicularium, the suboral, is present. It may be lacking in about half the zoids of some colonies. There is never more than one per zoid. When present, these broadly elliptical to nearly rounded avicularia always occur in the same position and orientation—in the midline, immediately below the peristomial sinus, with the mandible pointing proximally. The area back of the cross bar and mandible is very short and curved. The mandibular area and mandible are a bit longer than a hemisphere. The avicularium is elevated above the general frontal surface. The mandible is parallel with the frontal surface but the back area may in some instances slant downward, distally. The mandible has two converging sclerites (pl. 27, E).

ORIFICE: The orifice is at the extreme frontal-distal edge of the zoecium. Its distal border is the wall of the next neighboring zoid. The secondary orifice is bordered by a partial peristome. The primary orifice is deeper. The peristome is mostly frontal. It consists of two more or less elevated and prolonged tabs or processes between which is located the wide sinus or notch. The tabs are sometimes parallel, sometimes almost meeting at the tips (pl. 27,C). As a result, the sinus is sometimes fingerlike, sometimes nearly circular. The peristome projects outward at an angle from the frontal surface, like the spout of a pitcher. The secondary orifice is more or less hemispherical distally and deeply sinuate proximally, roughly resembling the side view of a mushroom. The primary orifice is broadly curved distally and provided with a wide low truncated lyrula and two cardelles proximally. It is wider distally than proximally. The chitinous operculum is rather thin and delicate. Two curved lateral sclerites, one on each side, serve for muscle attachment (pl. 27,D).

OVICELL: The smooth, thin-walled ovicells are globose but not excessively salient. The peristome and neighboring zooecia encroach upon their sides. The frontal wall of the ovicell slopes down into the orifice and forms a straight line across the upper part of the orifice. The distal half of the ovicell wall is punctured by up to about 15 medium-sized pores.

DISTRIBUTION AND ECOLOGY: The holotype (USNM 11300) is from Station 190. Other colonies are from Stations 226 and 234. Polypide remains are in some of the zooids. Diatoms, Foraminifera, sponges, hydroids, sandy worm tubes and Bryozoa are found on some of the colonies.

AFFINITIES: *Smittina obicullata* is similar to *Smittia monacha* Jullien (1888, pp. 52-53, pl. 2, figs. 1-3) and *Smittia jacobensis* Busk (1884, p. 153, pl. 19, figs. 7a,b) but differs from them in the shape of the secondary orifice, the direction (location) from which the approximating peristomial processes originate, and in the precise location of the avicularium. Its secondary orifice is shaped like a mushroom or shovel, while that of *S. monacha* is more or less circular, and that of *S. jacobensis* is elongate, like a vertical row of parentheses. In both *S. monacha* and *S. jacobensis* the peristomial bridge originates from the sides (lateral walls) of the peristome, while in *S. obicullata* it originates from the proximal wall. Lastly, in both *S. monacha* and *S. jacobensis* the peristomial bridge formed by the approximating tabs arches directly over the partly hidden avicularium like a bridge spanning water, while in *S. obicullata* the avicularium is exposed to full view outside the peristomial boundaries and the "bridge" arches over the peristomial sinus distal to the avicularium.

Smittina oblongata, new species

PLATE 28

DIAGNOSIS: Zoarium encrusting. Zoecial front gently convex and decorated by small, widely and irregularly spaced pores. Collar-like peristome is interrupted by a deep, wide, median, angular notch inside of which is a wide, truncated lyrula bordered by two wedge-shaped lateral cardelles. A thin salient edge outlines zoecial boundaries. Immersed ovicells with a few irregular pores present. Some zooecia with a long narrow spatulate suboral avicularium medially and longitudinally placed just beneath (almost touching) the peristomial notch. Beak proximal. Zooecia rectangular.

This species was named *S. oblongata* because of its very long, narrow avicularia and zooecia, from the Latin "oblongus" (somewhat long, oblong).

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 721).

| | |
|--|------------------------------|
| Z-L, 1.440-1.92 (1.744) | Se-Or-W, 0.187-0.216 (0.206) |
| Z-W, 0.440-0.520 (0.488) | Pr-Or-L, 0.144-0.173 (0.153) |
| Av-L, 0.331-0.360 (0.350) | Pr-Or-W, 0.202-0.216 (0.215) |
| Av-W, 0.115-0.130 (0.129) | Ly-L, 0.029-0.043 (0.032) |
| B-L, 0.259-0.266 (0.265, three readings) | Ly-W, 0.101-0.122 (0.110) |
| Se-Or-L, 0.173-0.230 (0.203) | |

ZOARIUM: Ivory-colored, flat and smooth. One colony fragment appears to be bilaminar.

ZOOECIA: A thin salient edge outlines the boundaries of the long, narrow, boxlike zooecia. Various kinds of zooecia are present: ovicelled, nonovicelled, and those with or without avicularia. The raised, collar-like peristome is the most elevated part of the zooecial front. The frontal wall is slightly convex and much thicker than the flat lateral and back walls. It is a tremocyst perforated by small, irregularly scattered and widely spaced pores, not areolate in nature. Deviations from this condition occur in some zooecia through greater calcification, which leads to an almost complete obliteration of the pores or to a roughening of the frontal surface by low bumps, closely set together. Lateral walls are punctured by four or five large pores. The proximal wall has two pores.

AVICULARIUM: Not all zooecia have avicularia. In one colony only 3 out of 29 zooids had avicularia. Not more than one occurs per zooid. All the observed avicularia are of one type, long, narrow, spatulate; and in one location, suboral, external, median. They are oriented with the mandible pointing proximally, are placed close to the peristomial notch, and are rounded at both ends. Their long sides are parallel. Their proportion of length to width is almost 3:1. No mandibles are available.

ORIFICE: The orifice is practically terminal, at the distal-frontal edge of the zooid. A raised peristome arches about three-fourths of the way around the opening. The other fourth is the notch or interruption in the peristome. Deeper within the peristomie is the primary aperture.

The secondary aperture is nearly circular, except for the notch or gap. The peristomial wall is formed cooperatively by its own and adjacent distal zooid (pl. 28,G). The primary orifice is smittinoid, gently arched distally; proximally it has a wide low median lyrula, some distance to each side of which is a wedge-shaped cardelle.

Opercula unobserved.

OVICELL: Only two easily distinguishable ovicells are in the samples. They are somewhat flattened, globose, and perforated by a few irregular pores. They did not have an avicularium suborally, but whether this is a constant or variable feature cannot be determined because of lack of material.

DISTRIBUTION AND ECOLOGY: Station 44 yielded the holotype (USNM 11311) and a few other colony fragments without soft or chitinous parts. No other species were growing over them.

AFFINITIES: This species is similar to *Smittia antarctica* Waters (1904, pp. 65-66, pl. 4, figs. 1a-h). It differs from Waters' species chiefly in the location of the avicularium. Waters pictures the avicularium a considerable distance away from the orifice, while in *S. oblongata* the avicularium is close to the peristomial notch—in fact intrudes upon it (pl. 28, C). Also, the interior of the avicularial beak seems to be different in the two forms. No opening is shown in the apparently flat floor of the beak in Waters' species, while there is a sizable opening and a keeled floor in *S. oblongata*. A third point of difference is in the number of lateral wall pores. Waters mentions 10 pore plates while *S. oblongata* has 4 or 5. A fourth point of difference is in the shape of the zooecia. Waters' specimens are hexagonal, while those of the current species are rectangular. This may not be a very important difference since so little material is available.

Smittina ordinata (MacGillivray)

PLATES 29, 30

Smittia ordinata MacGillivray, 1895, p. 93, pl. 12, figs. 18, 18a, 19.

DIAGNOSIS: Zoarium small, encrusting. Zooecial frontal convex, granulated to beaded and punctured by numerous evenly and closely set pores. The short heavy peristome interrupted frontally by a notch that cradles the small oval to almost round oral avicularium. No other avicularia. Mandible spatulate. Up to four transitory spines about the orifice in only the very youngest zoids. Secondary orifice clithridiate. Primary orifice with weak lyrula and cardelles. Globose granulated ovicell, punctured by a pore near the midregion (and an occasional peripheral pore), but pores may be obliterated by advancing calcification, which also flattens the ovicells, and the frontal.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|------------------------------|----------------------------------|
| Z-L, 0.547-0.893 (0.668) | Ov-L, 0.230-0.259 (0.249) |
| Z-W, 0.353-0.504 (0.388) | Ov-W, 0.259-0.288 (0.271) |
| Av-L, 0.058-0.086 (0.075) | Op-L, 0.092-0.096 (two readings) |
| Av-W, 0.046-0.058 (0.056) | Op-W, 0.138-0.173 (two readings) |
| Pr-Or-L, 0.086-0.101 (0.095) | M-L, 0.036-0.055 (0.050) |
| Pr-Or-W, 0.137-0.147 (0.142) | M-W, 0.036-0.050 (0.043) |
| Se-Or-L, 0.144-0.173 (0.153) | CS-L, 0.317-0.374 (0.340) |
| Se-Or-W, 0.122-0.144 (0.137) | CS-W, 0.295-0.432 (0.356) |
| Ly-L, 0.022-0.029 (0.023) | OS-L, 0.216 |
| Ly-W, 0.043-0.072 (0.054) | OS-T, 0.014 |

ZOARIUM: The colony forms a flat, nearly circular crust on rocks and other surfaces. Its color varies from dull tan to rose to pale lavender and occasionally even a dull green. The color may vary even in the same colony. The color is due to the thin film of organic matter that covers the otherwise white calcareous skeleton. The largest colony, from Station 240, measures 12 by 15 mm. and has more than 600 zoids. The convex frontal of the zoids gives a young colony a gently mammilated surface. The surfaces of older colonies are flattened by secondary calcification that reduces the saliency of the ovicells and zooecial frontals. The surface pattern is relatively fine and quite regular. Chitinous parts (opercula and mandibles) are present but ovicells are empty and polypides are absent.

ZOOECIA: Are 4-, 5-, or 6-sided. Those which begin a new radiating row are wedge shaped or 3-sided. In the very young zooecia the mural rim may be slightly salient in places but it generally sinks down to form a valley between zooecia whose frontals rise convexly. These valleys become shallower as the colony ages and secondary calcification sets in.

The thick zooecial frontal is a beaded or granular tremocyst. Its pores are medium sized, rounded, numerous, fairly close together, and rather evenly distributed. No conspicuous areolae are present, although occasional edge pores are slightly larger than the more central ones, particularly in the vicinity of the ovicell. An umbo or mucro is lacking. The compensation sac occupies most of the inner frontal surface. The peristome and ovicell are the most elevated parts of the frontal surface and are thin in young zoids, thick in old ones. Only rarely are peristomial spines found on any zoids, and then only on a few very young marginal ones. They are delicate, long, hollow, hyaline, and 2-4 in number.

AVICULARIA: Small oval avicularia occur within the peristomes of all zooecia and are the only type present. They are lodged within the peristomial notch at approximately a right angle to the longitudinal zooecial axis. Their spatulate mandibles are chitinized as shown in plate 29, I-L.

ORIFICE: The clithriate or pear-shaped secondary orifice is nearly terminal and surrounded by a medium high, thick-walled peristome. The distal peristome wall is formed from the walls of the next distal zooecium. The lateral peristome walls are formed by its own zoid. The peristome is interrupted frontally by a sinus in which nestles the oral avicularium. An anomaly, the presence of two oral avicularia within the peristomie of two nearby zoids, occurred in a colony from Station 240. Because of the convergent nature of the peristome walls, the primary orifice is difficult to see. The wider-than-long primary orifice has a medium-sized, weak, low lyrula and two prominent car-

delles generally, but variations occur even in the same colony as regards the prominence and width of the lyrula and the presence or absence(?) (at least the visibility) of the cardelles. The cardelles are two small blunt pegs placed some distance from the lyrula, at the lower corners of the orifice. However, it is not possible to see them in all orifices. Whether they are absent or just directed inward, out of sight, could not be determined without damaging the colonies.

The operculum is considerably wider than long. Its distal arch is broad and low, being much wider than the proximal border, which is drawn out into two chitinized points from which a reinforced edge continues distally.

OVICELL: Numerous ovicells are present. Young ones are gently salient, globose, and provided with a membrane-plugged central pore, while older ones are practically level with the frontal surface of the next distal zoid. Their surfaces are gently beaded or granular. Nearly half of the ovicells have a single small oval frontal pore, variously placed—sometimes centrally, sometimes more distally or laterally. A few ovicells in the same colony may have an occasional extra, smaller, irregularly placed pore. The remaining ovicells in a colony may lack the central pore because advancing calcification has obliterated it. Some of the ovicells are bordered by a few large pores that are a part of the frontal surface of the surrounding or next distal zoid. In summary, the commonest ovicell frontal condition in a well calcified colony is either solid or punctured by a single pore. In old colonies there is a fusion of the frontal layer of the ovicell with the frontal of the next zoid, so there is no outward sign of demarkation between the two except that the zoecial frontal is uniformly porous while that of the ovicell is not.

In a young colony of only about 50 zooids, growing on the back of a *Phylactella lyrulata* colony from Station 226, ovicells already had made their appearance, indicating that early sexual reproduction occurs in this species. This colony also had a zoid with two peristomial spines.

DISTRIBUTION AND ECOLOGY: A few small colonies were taken from Stations 104, 184, 226, 240 and Rock 6 (station unknown). They grew on various substrates: stones or pebbles as Rock 6 and Stations 184, 226, 240; Alcyonaria spicules at Station 226; other Bryozoa at Station 104, and *Phylactella lyrulata* at Station 226.

AFFINITIES: It is with some hesitation that these Antarctic specimens are assigned to the same species as MacGillivray's Australian fossil species (*S. ordinata*) originally described from Schnapper Point, Muddy Creek, and Moorabool deposits whose age is variously given as Eocene, Oligocene, or early Miocene (MacGillivray, 1895, p. 2). Following is an abridged version of MacGillivray's (p. 93) description of *S. ordinata*: "Zoecia . . . separated laterally by deep furrows . . .

thyrostome somewhat pyriform with a rounded sinus below; a quadrate median denticle, having in front a small avicularium within the lower edge of the peristome. Ooecia small, rounded, subimmersed in the zooecium above." His ovicell apparently is imperforate (pl. 12, fig. 19) or, at most, provided with only occasional pores (if three shaded spots on the sketch can be interpreted as pores). He also omits mention of the shape of the avicularium and mandible and gives no measurements.

The Antarctic specimens are in closer agreement with the Australian fossil form than with recent species. Six recent species with which it might be confused because of the ovicell or possibly other features are *Porella concinna* (Osburn, 1910, pl. 27, fig. 67a; cf. comment in his 1933 paper, p. 46, on this species), *Porella purpurea* (Canu and Bassler, 1929, pl. 43, fig. 1), *Schizoporella perforata* (Canu and Bassler, 1929, pl. 35, fig. 9), *Smittina bella* (Osburn, 1952, pl. 47, fig. 5), *Smittina novanglia* (Osburn, 1933, pl. 13, figs. 7, 8), and *Stomachetosella sinuosa* (Osburn, 1952, pl. 34, fig. 3).

Accounts of two other species gave the writer much difficulty during the identification of *S. ordinata*. They are *Smittia graciosa* Busk (1884, p. 154, pl. 22, fig. 13) and *Porella concinna* Hincks (1880, pp. 323-326, pl. 46, figs. 7, 9, var. *gracilis*). Busk's *S. graciosa* sample was without ovicells and their absence in his description was a stumbling block. Hincks' *P. concinna* is an assemblage of several species that are impossible to sort out without adding further confusion.

Genus *Smittinella* Canu and Bassler, 1934

Smittinella Canu and Bassler, in Bassler, 1934, p. 408 (genus defined).—Bassler, 1935, p. 202; 1953, p. G209.—Brown, 1952, p. 333.

REMARKS: Canu and Bassler erected the genus for those species of *Smittina* having a tremocyst and a "deep vertical proximal sinus of the peristomice which is covered by the peristome which is thus pierced by a spiramen" (Bassler, 1953, p. G209). Brown modifies the description somewhat by stating that the sinus is not always cut off or occluded by the growth of the lateral denticles. However, he believes in retention of the genus because of the deep shaftlike sinus between the primary and secondary orifices and because of the absence of frontal avicularia from the sinus. *Eschara tatei* Tenison-Woods (1877, p. 149, fig. 15) is given as the genotype by both Bassler and Brown.

It is with some hesitancy that the Antarctic specimen is put in this genus. However, in view of its deep, well defined peristomial groove and its lower, well hidden lyrula and primary orifice (and to date the absence of any positive avicularium) it was thought practical to list it as a *Smittinella*.

Smittinella rubrilingulata, new species

PLATE 30

DIAGNOSIS: Zoarium small, rose colored, encrusting. Zoecia convex, hexagonal, their frontal surfaces a beaded tremocyst with marginal pores somewhat larger than the other frontal pores. Depressed mural rims. A small, pointed, deeply colored process in peristomie, between the lyrula and external peristomial notch. Primary orifice deeply set, with a larger elliptical anter and a narrower, shallow poster. A medium-sized lyrula is bordered on each side by a very narrow sinus. Lyrula hidden from view by the median triangular process. Secondary orifice clithridiate. Peristome thin, elevated, collarlike, interrupted frontally by a prominent notch. Two parallel lateral peristomial ledges form a downward slanting channel between the secondary orifice and the lyrula. Ovicell beaded, globose, salient, with a single membrane-covered pore a bit above the frontal edge. No avicularia found.

The name of this species is derived from the Latin "rubra" (red) and "lingula" (diminutive of tongue), because of the deeper coloring about the triangular oral process.

Measurements: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|------------------------------------|-------------------------------|
| Z-L, 0.648-0.950 (0.824) | Ov-L, 0.288 (One reading) |
| Z-W, 0.562-0.706 (0.629) | Ov-W, 0.360 (One reading) |
| Se-Or-L, 0.130-0.158 (0.143) | Op-L, 0.115-0.144 (0.129 mm.) |
| Se-Or-W, 0.133-0.202 (0.158) | Op-W, 0.166-0.180 (0.174 mm.) |
| CS-L, 0.432-0.493 (Four readings) | Ly-L, 0.014-0.036 (0.026 mm.) |
| CS-W, 0.518-0.533 (Three readings) | Ly-W, 0.036-0.065 (0.047 mm.) |

ZOARIUM: Only small colonies consisting of few zooids were found encrusting a large rock from Station 184. Colonies are lavender or rose colored and so similar in general appearance to those of young *Smittina ordinata* (MacGillivray) that it is easy to confuse them. They look lavender on the rock but rose colored when viewed by transmitted light on prepared slides. Polypide remains occur in some zoecia.

ZOOECIA: Distinct, hexagonal, and not heavily calcified. The most intensely colored part of a zoecium is the triangular-pointed process just back of the peristomial notch. This concentration of intense color is an easy and sure way of distinguishing between *Smittina ordinata* and *Smittinella rubrilingulata*, but specimens must be removed to slides for this criterion to be used.

The zoecial frontal is a very convex, beaded tremocyst with the marginal pores a bit larger than the other numerous, uniformly small, rounded, well spaced frontal pores. The frontal wall slopes up to the

elevated peristome. The mural rims are depressed or inconspicuous. Internally, the compensation sac occupies most of the frontal surface. On the basal surface, brownish membranous tubes connect neighboring zooecia (pl. 31,K), from 2 to 5 penetrating each wall of the hexagonal zoid.

AVICULARIA: No avicularia are present in the small amount of young material at my disposal. However, the peristome does show a deeply colored reddish triangular process between the lyrula and the external peristomial notch (pl. 31, A,C,F-I). This process is similar, except for its intense color and its sharpness, to the broader colorless ledge which supports the oral avicularia of *Smittina ordinata* and *Smittina canui*. Moreover, in one zooecium (pl. 31,I) it appears to connect with a presumable or potential avicularial chamber. However, its true nature must await examination of more material.

ORIFICE: The elevated orifice is frontal and surrounded by a thin collarlike peristome which is notched medially. The peristomial distal wall is distinct in the youngest zoids but in older zoids the next distal zooecium fuses with it.

The primary orifice is set so deeply inside the peristome that its lyrula is not visible easily from the outside. Consequently, one could very readily mistake this species for a *Schizoporella*. The primary orifice is wider than long, broadly arched distally, more contracted and shallower proximally. The lyrula and its two narrow bordering sinuses occupy this narrower proximal part. A pointed, deeply colored reddish process protrudes in front of and above the lyrula (pl. 31,A,C,H,I). Its point is close to the notch and visible from the outside (frontally). Its role is not clear at present.

There was not enough material for an adequate study of the operculum other than to measure it.

The chief feature which determined the placement of this species into the genus *Smittinella* is the deep channel which slopes downward from the secondary orifice to the primary orifice, parallel with the peristomial notch. Its side walls are the two ledges that reinforce the sides of the notch (pl. 31,B,C,F).

OVICELLS: The only ovicell found is pictured in plate 31,D,H. It is hyperstomial, tipped slightly back and beaded. Its single frontal pore is membrane-covered and has decorated edges, thus differing slightly from those of *Smittina ordinata*. Also, the peristome gives an indication of possibly encroaching upon the frontal surface of the ovicell.

DISTRIBUTION: This species is represented by several small colonies, including the holotype (USNM 11309), which encrusted a rock from Station 184 in Marguerite Bay.

AFFINITIES: *Smittinella rubrilingulata* agrees more closely with Johnston's description (1847, p. 310), and fairly so with his figures (pl. 54, fig. 9), of his *Lepralia landsborovii* 1847 than do most of the species subsequently allocated to that elusive form. He describes the aperture (p. 310) as "somewhat prominent, oblique, patulous, unarmed, circular, situated on the proximal side, and in the center of this sinus there is usually a small mucro." In his figures the aperture appears to be much larger in proportion to the rest of the zooecia than is the case in *S. rubrilingulata*. Also, ovicells are lacking in his material. He cited the species as rare. Subsequent bryozoologists, in great and earnest respect for the early workers, have attempted to reconcile later finds and possibly a number of different species with the early descriptions; consequently, in the cases of *Lepralia landsborovii* (*Smittina*) and *Lepralia reticulata* (*Smittoidea*) the synonymy or misidentification is truly chaotic. Brown (1952, pp. 319-320) has attempted to clear up the matter of *S. landsborovii* by reexamination of museum material, selection of a neotype, and a redefinition of the species. Johnston did not mention or figure either the ovicell, avicularium, or lyrula (if such were present in his material)—three very essential features in the accurate determination of a smittinid species. Brown has added these features to the revised description. *Smittinella rubrilingulata* does not agree with Brown's description of *Smittina landsborovii* in regard to its ovicell and also because an oral avicularium has not yet been found. Moreover, the primary orifice and peristomial channel of *S. rubrilingulata* are distinctive or unusual features, hence it was thought best to make the Antarctic form a new species rather than to call it another dubious *S. landsborovii*.

Genus *Smittoidea* Osburn, 1952

Smittoidea Osburn, 1952, pp. 392, 408.—Bassler, 1953, p. G209.

REMARKS: Osburn erected this genus for those *Smittinas* having an areolate granular pleurocyst, a porous ovicell, well developed lyrula and cardelles, and a median suboral avicularium that is either enclosed within the peristomial sinus or very close to it. The avicularial chamber is symmetrical, i.e., developed from an areolar pore on each side of the aperture. Osburn lists the genotype as *Smittoidea prolifica* Osburn but Bassler considers *S. prolifica* synonymous with *Lepralia reticulata* Johnston, 1847, and lists the latter as the genotype for *Smittoidea*. The illustrations of *S. prolifica* (Osburn, pl. 48, fig. 7) and *L. reticulata* (Johnston, pl. 55, fig. 10) seem to be in fairly close agreement except that Johnston's figure is quite diagrammatic or "stylized" and could fit several closely related species.

Smittoidea evelinae (Marcus)

PLATE 32

Smitlina evelinae Marcus, 1937, pp. 109-110, pl. 22, figs. 58A,B.

Smitlina acaroenis Brown, 1952, pp. 329-331, fig. 253 (not synonymy).

DIAGNOSIS: Zoarium chalice or trumpet shaped. Zooecial frontal convex, bordered by one or two rows of areolae and a salient mural rim. A few small pores outline the umbo which bears the small rounded median oral avicularium. Avicularium perpendicular to the zooecia frontal plane, at right angles to the longitudinal axis; semicircular mandible directed forward. No avicularia located elsewhere. Two prominent lateral cardelles separated from the low medium-sized lyrula by a broad sinus. Ovicell globose, its frontal surface thin and smooth, perforated by several irregular pores; its peripheral surface granular to pebbly, nonporous, and thicker.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|------------------------------|------------------------------|
| Z-L, 0.851-1.332 (1.085) | Av-L, 0.072-0.086 (0.082) |
| Z-W, 0.518-0.740 (0.644) | Av-W, 0.058-0.079 (0.066) |
| Ov-L, 0.444-0.555 (0.509) | Se-Or-L, 0.173-0.216 (0.180) |
| Ov-W, 0.481-0.555 (0.513) | Se-Or-W, 0.216-0.281 (0.249) |
| Pr-Or-L, 0.173-0.187 (0.183) | Op-L, 0.151-0.180 (0.167) |
| Pr-Or-W, 0.216-0.266 (0.242) | Op-W, 0.187-0.230 (0.213) |
| Ly-L, 0.025-0.036 (0.030) | M-L, 0.043-0.050 (0.046) |
| Ly-W, 0.083-0.101 (0.095) | M-W, 0.058-0.072 (0.070) |

ZOARIUM: The largest colony, from Station 234, measures 56 mm. in height, 40 mm. across its widest part, and 15 mm. in its narrowest diameter. It is ivory colored, rather lightweight, brittle, thin-walled, and shaped like a trumpet or chalice. It is unilaminar, with zooecia all facing outward. Its inner (basal) surface is faintly ridged transversely and sometimes encrusted with other species. Worm tubes may be present on both frontal and back surfaces. Polypides and embryos occur in many zooecia and ovicells, respectively.

ZOOECIA: The large zooecia vary from wedge shaped to hexagonal and are bordered by a thin salient line. Their walls are thin, the thickest being the gently convex frontal. One or two rows of large, irregular areolar pores border the otherwise externally pebbled or granular frontal. The internal surface of the frontal wall is smooth and punctured by the same pores. A suddenly projecting mucro or umbo supports the oral avicularium of some zooecia but not of others in the same colony. In some zooecia of the same colony the frontal wall curves inward in this area, toward the avicularium (pl. 32,A), so that there is no umbo but the avicularium rests on this inwardly

rolled front. When an umbo is present (pl. 32,D,G,H,J) it may resemble an abbreviated spout. It is granulated, broadly rounded, with its base surrounded by a row of 3 to 6 widely spaced tiny pores (pl. 32,E).

About 5 to 7 pore plates occur in the lateral walls.

AVICULARIA: Only one kind of avicularium was found. It is almost always present and always in the same location, within the peristome border, median, proximal and just external to the lyrula. It is small, elliptical, and set into the peristomie in a plane vertical or at right angles to the frontal plane. Its mandible is hemispherical and chitin-reinforced both around the periphery and about the median lucida.

ORIFICE: The shape but not the size of the secondary orifice is different from that of the primary orifice. The secondary orifice is roughly hoe shaped—a round-cornered rectangle whose basal line sags a bit downward to accommodate the oral avicularium. The peristome is slight. The primary orifice is somewhat elliptical. Two blunt cardelles project laterally toward the medium-sized lyrula. A lightly chitinized operculum closes the primary orifice. It is wider distally than proximally.

OVICELL: The salient ovicells when seen from the front are globose. In side view their porous frontal is somewhat flattened. Their primary calcareous layer is shiny, smooth, entire except for the front face which is punctured by a number of small irregular pores. The secondary peripheral layer is thicker, rough, granular to pebbly, nonporous, and horseshoe shaped. It encroaches upon the sides and distal rim of the primary layer, leaving exposed the porous frontal area of the latter. Where the colony is heavily calcified the zoid frontal wall thickens very much as does the encircling crust around the ovicell but the perforated plate over the front of the ovicell remains fragile, thin and porous, with the yellow to brownish embryos shining through (in colonies from Station 234 especially). Raised mural rims may be seen traversing the peripheral layer (cf. pl. 32,A).

DISTRIBUTION AND ECOLOGY: Two large handsome colonies (pl. 32,B,I) and a few scraps came from Station 234. Smaller fragments came from Stations 226 and 230. The two large colonies had other forms growing on them or on their dorsal surface—sponge spicules, calcareous worm tubes, *Ramphonotus inermis*, *Beania*, etc.

Marcus reported the species from Isle of Palmas, Santos, Brazil, remarking that it grew on algae and solid substrates (1937, pp. 109–110).

Brown reported *S. acarоensis* (the part recorded in foregoing synonymy under *S. evelinae*) from fossil deposits collected at Castlecliff, New Zealand (1952, pp. 330–331).

AFFINITIES: The Antarctic specimens very closely resemble in general appearance those of Brown and Marcus but differ from those of

both in general size. The length and width of the zoecia, ovicell, and operculum of the Antarctic specimens are about double the corresponding dimensions of Brown's sample. Brown's (1952, p. 330) measurements, in millimeters, are: zoecial length, 0.52–0.60; zoecial width, 0.29–0.31; orifice length, 0.17–0.19; orifice width, 0.15–0.16. Marcus does not give measurements but does include scales on the plates, and by use of these scales his material seems to have the following approximate millimeter measurements: zoecial length, 0.38–0.50; zoecial width, 0.23–0.35; ovicell length, 0.18–0.20; ovicell width, 0.23; operculum length, 0.08; operculum width, 0.11; lyrula length, 0.04; lyrula width, 0.06; mandible 0.04 by 0.08. Therefore, the Antarctic specimens would appear to be about double the zoecial, ovicell, and operculum figures of Marcus but approach closely his figures in the size of the mandible and lyrula. In both the Brazilian (Marcus') and the Antarctic specimens the median denticle or process is lacking in the cross bar (pivot) of the avicularium, but whether the denticle is an important character is uncertain. The significant difference between *S. evelinae* and Levinsen's *S. acaroenensis* is in the size and orientation of the avicularium and the nature of the distal orifice border. Levinsen (1909, pl. 18, fig. 12) shows a very large avicularium apparently placed flat on the zoecial front, somewhat as in *Smittoidea ornatipectoralis brevior*, parallel to the frontal plane. But in *Smittoidea evelinae* the avicularium is smaller and placed at a right angle to the frontal plane, horizontally within the peristomial boundary, with the mandible forward. Also, the avicularium and lyrula are about the same width. Some of the inside measurements of avicularia from the Antarctic sample may even be slightly narrower than the lyrula.

Another point of difference between *S. acaroenensis* and *S. evelinae* is in the nature of the distal orifice border. Levinsen pictures and cites it as serrate but in *S. evelinae* it is smooth.

MacGillivray (1895, p. 92, pl. 12, fig. 13) described a Tertiary fossil, *Porella innocua*, from Victoria, Australia, which is very similar to *S. evelinae*, differing from it only in the shape of the orifice which appears longer and more square in *P. innocua*. His figure is too vague to show the oral avicularia and he characterizes them as small.

Lastly, Kluge (1946, pl. 2, fig. 8) pictures a *Smittina glaciata* (Waters) 1900 that is very similar to *Smittoidea evelinae* in all respects except that in some zooids its avicularium may rise up on a conical peak.

Smittoidea ornatipectoralis, new species

PLATE 33

DIAGNOSIS: Zoarium encrusting. Zoecial frontal gently convex, bordered by areolae and ending at edges in a thin salient rim. Secondary orifice a low peristome with wedge-shaped median frontal

sinus below which, in a loop of the pleurocyst, is a large, external, pear-shaped frontal avicularium. The avicularium is mounted on a mound of varying prominence and outlined by a line leading to the peristomial notch. A few frontal pores, spaced far apart, encircle the avicularial mound. Primary orifice with low wide lyrula and two large, blunt cardelles. Ovicells globose, with a few pores outlining the frontal area. Mandibular area large and oval.

This species is named for the decorative effect of its frontal avicularium, from the Latin "ornatus" (decorated, adorned) and "pectoris" (chest).

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|---|---|
| Z-L, 1.427-2.001 (1.696) | Se-Or-W, 0.259-0.317 (0.280) |
| Z-W, 0.522-0.999 (0.745) | Se-Or-Si-D, 0.072-0.115 (0.092) |
| Av-L, 0.331-0.461 (0.400) | Se-Or-Si-W, 0.058-0.101 (0.073 mm.) |
| Av-W, 0.202-0.274 (0.232) | Ly-L, 0.029-0.043 (0.031) |
| B-L, 0.259-0.317 (0.294) | Ly-W, 0.079-0.101 (0.090) |
| Pr-Or-L, 0.230 (Two readings) | Ov-L, 0.547-0.562 (Three intact ovicells) |
| Pr-Or-W, 0.259 (Two readings) | Ov-W, 0.504-0.547 (Three intact ovicells) |
| Se-Or-L, 0.187-0.259 (0.222, excluding sinus) | |

ZOARIUM: The zoarium is encrusting and of ivory color. It is brittle and fragments easily.

ZOOECIA: A salient rim outlines zooecial boundaries. Zooecia are very large, considerably longer than wide, and 4-6-sided. Two kinds are present, those with ovicells and those without. The latter are in the majority. The frontal wall is gently convex except in a few zooecia where the avicularial mound develops into an excessive bulge (pl. 33,F). The frontal is a pleurocyst, with areolae, short interareolar ribs, a pebbled surface, and a few small widely spaced pores around the avicularial mound. The areolar pores are large and close together. Some zooecia have a smooth rather than a pebbled surface. The lateral walls are thinner. A line of rounded pores (sometimes as many as 10) of fairly uniform size and equal spacing can be seen in the lateral walls.

AVICULARIUM: A single avicularium is present on each zooecium, with position and orientation identical in all cases. The avicularium is cradled on a mound in the midline just proximal to the peristomial notch. The pleurocyst forms a loop around it and continues distally on each side beyond it to form the peristome (pl. 33,A). The avicularium is large and pear shaped. Its small, subcircular distal part is called the "back area." Its shallow, wide, oval, large, proximal part is the "beak, rostrum or mandibular area." A short pivot bar separates the two across the top. The avicularium is longitudinally placed and occupies a considerable part of the frontal surface. It lies

parallel to the frontal zooecial plane. Its rostral floor is crescentic (pl. 33,E). No soft or chitinous parts (mandibles and opercula) are present in the zoids.

ORIFICE: The orifice is nearly terminal, at the zoid edge. A short peristome forms a partial collar frontally and laterally. It is a bit taller in front than at the sides. Medially it is notched. The low medium-wide lyrula of the primary orifice is just back of (internal to) the peristomial notch. The cardelles are sturdy and placed on the side walls. The primary orifice is well shielded by the peristome.

OVICELLS: The globose salient ovicell partly overhangs the orifice. It is slightly roughened peripherally and thinner and flatter centrally. A few pores border the frontal area. Occasional smaller ones may be distributed haphazardly over the thin frontal. The oral border of the ovicell is faintly curved.

DISTRIBUTION: The holotype (USNM 11307) is from Station 45 and the paratype is from Station 44. The holotype fragment originally measured 8 by 9.5 mm. but subsequently fragmented. The paratype consists of a few loose zoids and a few growing on another bryozoan encrustation.

AFFINITIES: *Smittoidea ornatipectoralis* seems to be related to the fossil *Porella concinna* which MacGillivray reported and figured (1895, pl. 12, fig. 6) from Australia, but differs from the illustrated specimen in two ways. The avicularium in MacGillivray's species is placed much higher in the peristome, widely interrupting the peristomial collar; and in his species the areolae are few in number and far apart. He mentions (p. 91) that one of his Muddy Creek specimens had very large median avicularia and that the mandible was very large, much expanded inferiorly, and extended half way down the zooecium.

Andersson (1902, pl. 30, fig. 5, pp. 546-547) describes a *Smittia palmata* var. *sinuosa* which has a very large frontal avicularium but which differs in shape from the Antarctic species. His variety further differs from *S. ornatipectoralis* in the shape of the secondary orifice, which is almost lemon shaped, and in the greater extent of the ovicell porous plate.

Smittoidea ornatipectoralis brevior, new subspecies

PLATE 34

DIAGNOSIS: Zoarium encrusting. Zooecial frontal gently convex, bordered by areolae and ending at edges in a thin salient rim. Secondary orifice a low peristome with a wide frontal sinus or interruption. Primary orifice with a low, medium-wide lyrula and two laterally originating heavy blunt cardelles. A small to medium-sized broadly

oval suboral avicularium is mounted on a mound of varying prominence and outlined by a line leading to the peristomial notch. A few (about 6) small, widely spaced pores encircle the aviculiferous mound. Ovicells globose, but damaged (or frontals missing), so data on them is incomplete.

This subspecies is named for its similarity to the species and its smaller avicularia, from the Latin "brevis" (short).

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

| | |
|---|---|
| Z-L, 0.922-1.340 (1.068) | Se-Or-L, 0.216-0.259 (0.228, including notch) |
| Z-W, 0.348-0.766 (0.593) | |
| Av-L, 0.122-0.288 (0.212) | PN-L, 0.036-0.072 (0.053) |
| Av-W, 0.094-0.202 (0.140) | PN-W, 0.043-0.072 (0.053) |
| Pr-Or-L, 0.173-0.202 (0.188) | Ly-L, 0.029-0.043 (0.035) |
| Pr-Or-W, 0.209-0.230 (0.220) | Ly-W, 0.072-0.101 (0.086) |
| Se-Or-L, 0.158-0.216 (0.186, excluding notch) | Ov-L, 0.533-0.562 (0.518, only 3) |
| Se-Or-W, 0.202-0.274 (0.225) | Ov-W, 0.475-0.518 (0.499, only 3) |
| | M-L, 0.079-0.202 (0.138) |
| | M-W, 0.079-0.173 (0.120) |

ZOARIUM: Encrusting and of ivory color. The holotype, which has polypide remains within, is rather fragile and fragments easily. It originally measured 9 by 9 mm. Another colony which is overgrown by other calcareous Bryozoa is more sturdy.

ZOOECIA: A salient rim outlines the zoecial boundaries. Although zoecia are large, they are smaller than those of *S. ornatipectoralis*. The zoecia are 4-6-sided and longer than wide. Two kinds are present—those with and those without ovicells, but they do not differ otherwise. A few zoecia overgrow others to form a second layer. The zoecial frontal is a convex pleurocyst and pebbled in texture. Ribs separate the closely set areolae. The avicularial mound is raised above the zoecial frontal and is punctured by up to three pairs of small pores around its base.

AVICULARIUM: A single suboral avicularium is present on each zoecium with position and orientation identical in all cases. The avicularium is cradled in the midline, just proximal to the peristomial notch. It is flat against the chest, so to speak, or in a plane parallel with the frontal surface. The pleurocyst forms a loop around it and continues distally on each side beyond to form a peristome, but the open end of the loop is wider in this variety than in the typical species. The avicularia are very broadly oval and of medium size. They are smaller than those of the typical species. The back area is a low wide arc, and consequently the pivot bar is longer, relatively, than in the typical species. The mandibular part is broad and not very long. Moreover, the opening in the rostral floor is of a slightly different shape from that of the typical species. The chitin-rimmed

mandible is a truncated oval. It has a U or Y shaped reinforcement about the center.

ORIFICE: The primary and secondary orifices of this variety are similar in appearance to, but smaller than, those of the typical species. Moreover, the peristomial notch does not taper so much to a wedge but is more open than in the typical form.

The operculum is irregularly reinforced with chitin. A definite chitinous band, like a thin wire, extends about three-fourths of the way around the operculum. At the sides are parenthesis-shaped sclerites which curve slightly inward from this band. A broad sheet of chitin begins to grow inward (i. e., across the operculum) from the peripheral band. It grows faster from the sides until the thickened strips meet in the opercular central area, in the oldest opercula (cf. pl. 34,C-E).

OVICELLS: No complete ovicells, only beginning ones, are on the holotype. Three fully developed, globose, but broken ovicells are on a paratype from Station 44. The ovicell frontal surface is missing from these, however.

DISTRIBUTION AND ECOLOGY: The holotype (USNM 11318) is from Station 226, the paratype from Station 44. Some of the holotype zooids have polypide remains in them.

AFFINITIES: This variety is very similar to the typical *S. ornatipectoralis*, differing only in its smaller, differently proportioned avicularia, the broader peristomial notch, smaller size of both orifices, and smaller zoecia, although the last is not an important character.

Smittoidea reticulata (?) (Johnston)

PLATE 35

Lepralia reticulata. Johnston, 1847, p. 317, pl. 55, fig. 10.—Busk, 1854, pl. 90, fig. 1 (not pl. 93, figs. 2-4 or pl. 102, fig. 1).

Smittoidea prolifica? Osburn, 1952, pl. 48, figs. 7, 8 (considered by Bassler, 1953, p. G209, to be a synonym for *S. reticulata*).

The above is a partial synonymy only.

REMARKS: The identification of the Antarctic specimens of this form is very uncertain for two reasons. First, there is not enough whole material, ovicells, or completed peristome to make identification absolutely certain. Second, *Smittoidea reticulata* is one of the most scrambled species in the family because its original hazy description by MacGillivray (1842, pp. 467-468) is not accompanied by a figure. Johnston (1847) at least figures it diagrammatically, without ovicells and with a hole for the avicularium. Busk (1854, pl. 90, fig. 1, pl. 93, figs. 2-4, pl. 102, fig. 1), in his handsomely illustrated catalog, had five figures, presumably of *L. reticulata*, but un-

fortunately none of these (except pl. 90, fig. 1, also without ovicells, unfortunately) seems to agree with Johnston's figure. Brown (1952, p. 330) is of the opinion that Busk's plate 102, figure 1 is possibly Brown's *Smittina acaroenensis*, but Brown's *S. acaroenensis* appears to be *Smittoidea evelinae* Marcus 1937 rather than Levinsen's *S. acaroenensis*. Hincks (1880, pl. 48, figs. 1-5) beautifully figured *Smittia reticulata* but only his figure 2 approaches that of Johnston's figure 10 and Busk's plate 90, figure 1.

Canu and Bassler in their genuinely helpful and monumental 1920 monograph reproduced Hincks' plate 48, figures 1, 4, 5 as the *Smittina reticulata* MacGillivray.

Brown (1952, pp. 329-330) has valiantly attempted to unravel some of the tangled skein but the task has been difficult.

Osburn's *Smittoidea reticulata* (1952, pl. 48, figs. 9, 10) appears to differ somewhat from the species listed above. His *Smittoidea prolifica*, however, does come closer to Johnston's figure than does his *reticulata*.

Lastly, Bassler (1953, p. G209) considers *S. prolifica* Osburn a synonym of *Lepralia reticulata* Johnston, 1847.

Regardless of how great the confusion is, so long as each writer adequately illustrates his finds there is hope of eventually stabilizing the synonymy.

DIAGNOSIS (of the present Antarctic specimen only): Frontal an areolated pleurocyst. Primary orifice small, as long as wide, smittioid, with low medium-wide lyrula, lateral cardelles, and a small oval avicularium in front of the lyrula, within the peristome, i. e., in a widely open peristomial loop. Other avicularia, ovicell, and ultimate appearance of secondary orifice and peristome unknown because of paucity of material.

Measurements: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271). The measurements are based on only two or three readings because of so little material.

| | |
|---------------------------|------------------------------|
| Z-L, 0.792-0.994 (0.912) | Ly-L, 0.029 |
| Z-W, 0.475-0.850 (0.655) | Ly-W, 0.072 |
| Av-L, 0.115-0.122 (0.119) | Pr-Or-L, 0.158-0.187 (0.173) |
| Av-W, 0.079-0.101 (0.090) | Pr-Or-W, 0.173-0.187 (0.181) |

ZOOECIA. Only pieces of 11 broken zooecia mounted on a slide after having been removed from a rock from Station 184 could be found. Of these pieces three frontals had orifices and two had incomplete avicularia. The zooecia are of considerable size. Their distal walls are curved, the lateral walls curved to angular. The frontal walls are areolated and roughened (a pleurocyst). The areolae are of varying shapes.

AVICULARIA: The only two avicularia present are damaged or incomplete; they are shown in plate 35, B, D. They are oral, oval, median, and tipped forward a bit, within the peristomic. The avicularial chamber is symmetrical, small, and median.

ORIFICE: The primary orifice curves deeply distally, is flatter laterally, has a shallower proximal curve, and a low, medium-sized lyrula. At the sides are two blunt, thin cardelles. The secondary orifice is not complete in the available specimens. However, what there is of it appears to be elevated at the sides and proximal corners and at the sides and beak tip of the avicularium, confining the avicularium to the peristomie and separating it from the rest of the frontal surface. The length of the incomplete secondary orifice is 0.317–0.331 mm.

OVICELLS: Not seen.

Distribution: The Antarctic specimen is from a rock from Station 184, Marguerite Bay

Waters (1904, p. 62) reported a *Smittia reticulata* "with avicularia slightly longer than is usual in the European form," from the Antarctic, but since it is not figured it is uncertain as to what species he had. It cannot be the present form, however, because of his notation of the avicularia.

Thornely (1924, p. 14) also reported but did not figure a *Smittia reticulata* with wide spatulate avicularia and squarish orifice, from the Antarctic. Here again, the identity of the species is open to serious question. It probably is not the same as that of Waters and definitely is not the present form.

Since the present material is so fragmentary it, too, is of questionable determination, but the specimens do seem to agree rather closely with Dr. Osburn's *S. prolifica*, which Dr. Bassler has declared to be synonymous with *S. reticulata*. Therefore the specimens are being so identified. Osburn's specimens are from various California and eastern Pacific localities.

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PLATES 1—35

PLATE 1

Barentsia discreta Busk

(All figures drawn with aid of camera lucida)

FIGURE A: One zoid, drawn from the right side. Rigid peduncle shows a faint annulation or incipient joint (J), lacking in peduncles of other zoids in the collection sample. Scale *a*.

FIGURE B: Basal part and flexible musclia of two zoids. Left musclium rests on base of our stolons; right one shows two stolons. Scale *a*.

FIGURE C: Soft, flexible, muscular pedicel; top of rigid peduncle; and base of fleshy calyx. Scale *c*.

FIGURE D: Calyx as seen from left side. Structures topping the stomach were difficult to distinguish and are not pictured very well here. Darkest area is location of liver and gonads and is the ambiguous area referred to. Lophophore contracted and curved over so tentacles are tangled in vestibule. Scale *b*.

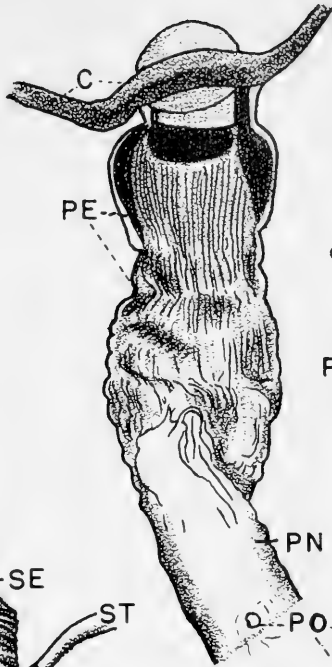
FIGURE E: Enlargement of annulated peduncle region of figure A. Thick inner chitinous cuticle layer is interrupted by the irregularly spaced "pores" (PO) which characterize peduncle of *Barentsia discreta*. Outer chitinous layer very thin and barely indicated by light colored wrinkling in annular region (J). Scale *c*.

Key to abbreviations

C, calyx
CU, inner chitinous cuticle layer
ES, esophagus
GA, stomach
IN, intestine
J, incipient joint or annulation
M, musclium

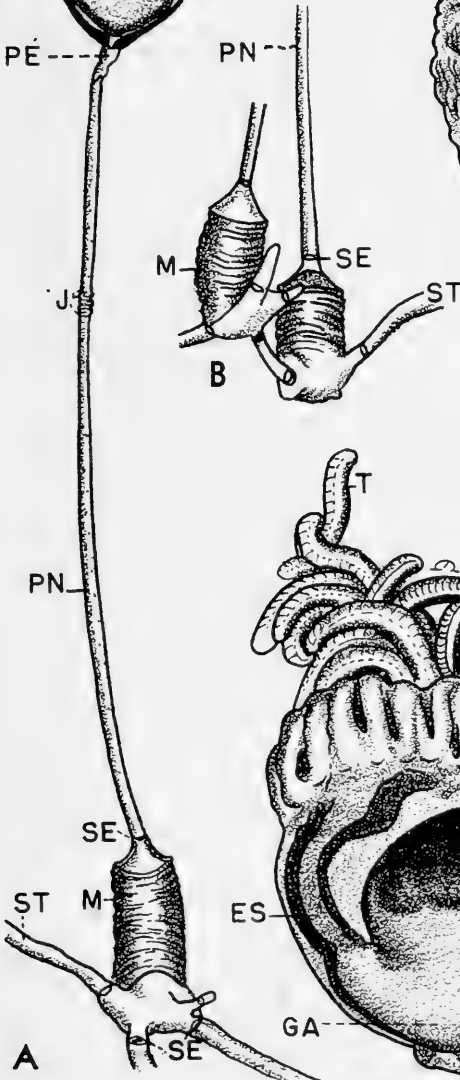
PE, pedicel part of stalk
PN, peduncle part of stalk
PO, pore or gap in inner cuticle layer
R, rectum
SE, septum
ST, stolon
T, tentacles

a 1.0 MM.



0.05 MM. c

0.3 MM. b

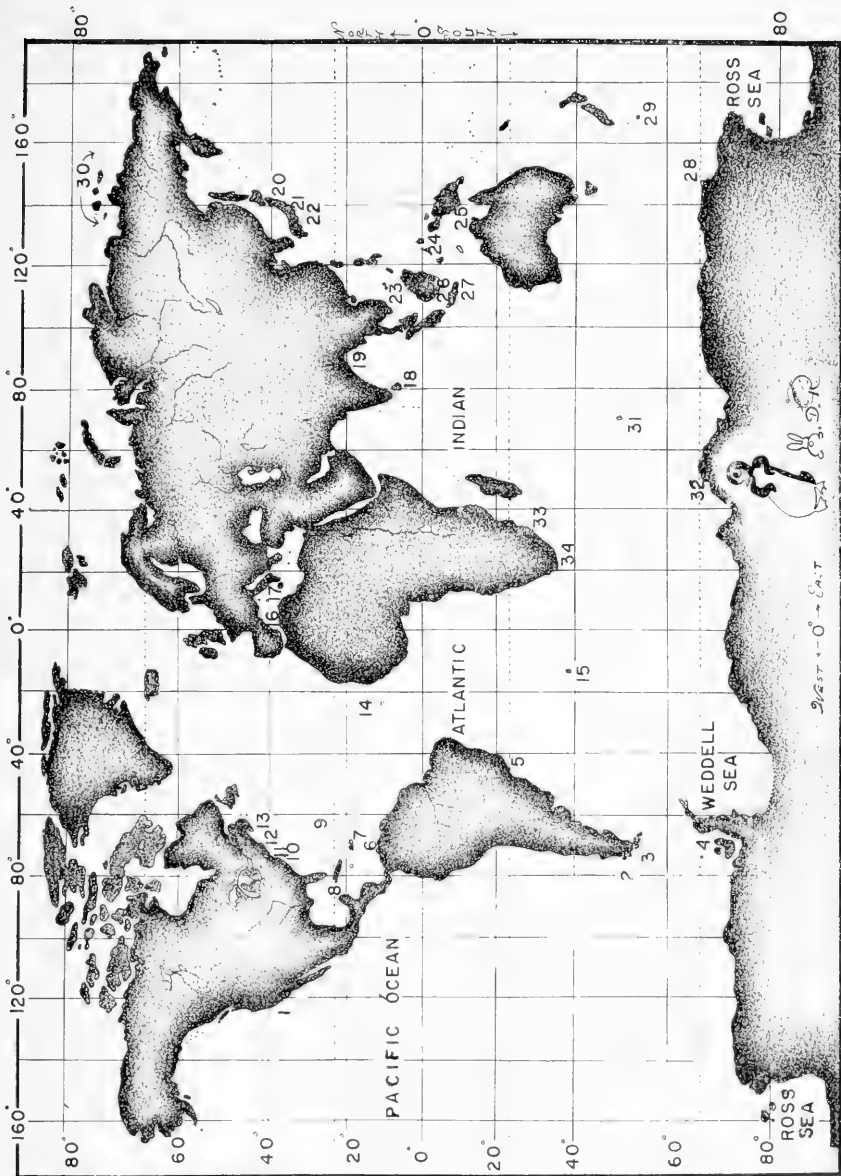


EXPLANATION ON OPPOSITE PAGE

PLATE 2

Map of world showing wide distribution of *Barentsia discretta*. Numbers 1 through 34 indicate collection locations. Localities and reporting author are cited in the following list. Abbreviations: "m." for meters and "fath." for fathoms.

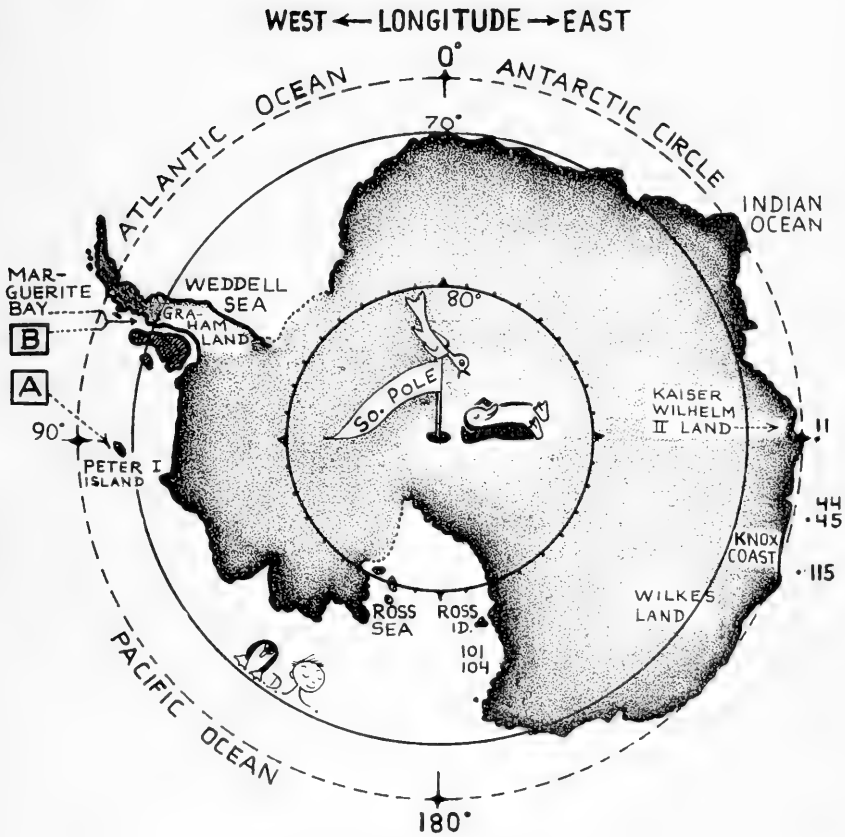
1. Roberson (1900), San Pedro, Calif.
2. Waters (1904), Magellanes, Chili.
3. Jullien (1888), Ile Hoste, Cape Horn, 26 fath.
4. Present report (Rogick), Stations 190, 234, 243, in Marguerite Bay, Antarctica, lat. 68°30' S., long. 68°30' W.; 35-40 fath. Collectors David C. Nutt and Mr. Layton.
5. Marcus (1937), Bay of Santos, Brazil, 20 m.
6. Osburn (1947), 2 miles southwest of Cape da Vela, Caribbean Sea, 21-22 fath.
7. Osburn (1940), Guanica Harbor, Puerto Rico, 5-10 fath.
8. Osburn (1912; 1914), Tortugas, Fla., 18 fath.
9. Osburn (1940), Verrill (1900), Bermuda.
10. Osburn (1912), Beaufort, N. C.
11. Osburn (1932; 1944), near mouth of Chesapeake Bay, 47.75 m.
12. Hutchins (1945), Long Island Sound, Conn.
13. Osburn (1912; 1932), Woods Hole, Vineyard Sound, and Buzzards Bay, Mass.
14. Waters (1918), Cape Verde Islands, 10 fath.
15. Busk (1886), Tristan da Cunha, 100-150 fath.
16. Ehlers (1890), Cartagena, Spain.
17. Zirpolo (1927), Gulf of Naples, Italy.
18. Thornely (1905), Ceylon.
19. Annandale (1912), Port Canning, India.
20. Toriumi (1949), Pacific Coast of Miyagi Prefecture; Mawatari (1948) and Toriumi (1951) from Matsushima Bay. All in Northern Honshu, Japan.
21. Oka (1895), south of Tokyo, Japan, 40-53 fath.
22. Mawatari (1952), Kii Peninsula, Japan.
23. Kirkpatrick (1890), Tizard Bank, South China Sea, 27 fath.
24. Harmer (1915), off western tip of Dutch New Guinea, 32 m.
25. Harmer (1915), southwest of Dutch New Guinea, 57 m.
26. Harmer (1915), Makassar, Celebes, 0-36 m.
27. Harmer (1915), Suleyer, Celebes, 0-36 m.
28. Thornely (1924), Commonwealth Bay, off Adelle Land, Antarctica, 25-30 and 55 fath.; Johnston and Angel (1940), Commonwealth Bay off King George V Land, Antarctica, 15-25 fath.
29. Marcus (1921; 1939), Campbell Island.
30. Kluge (1946a), Gorbunov (1946), Arctic Ocean.
31. Johnston and Angel (1940), Royal Sound, Kerguelen Island, 91 m.
32. Johnston and Angel (1940), off Enderby Land, 300 m.
33. O'Donoghue (1924), off Illovo River, Natal, east coast, 27 fath.
34. O'Donoghue (1924), Cape Infanta, 30-40 fath.



EXPLANATION ON OPPOSITE PAGE

PLATE 3

Map of Antarctic Continent showing location of the numbered collecting stations from which Bryozoa were taken by the U. S. Navy's 1947-48 Antarctic Expedition. Boxed letter A, directed at Peter I Island, shows location of collecting stations 148, 149, 161, 162 and 163. Boxed letter B, directed at Marguerite Bay, shows location of collecting stations 179, 180, 181, 184, 189, 190, 193, 194, 225, 226, 229, 230, 233, 234, 236, 238, 240 and 243.



EXPLANATION ON OPPOSITE PAGE

PLATE 4

Cellaria vitrimuralis, new species

(All figures except D and F drawn with aid of camera lucida)

FIGURE A: Avicularium, with mandible (M) in place. Seen from slight side-angle that shows protrusion and prominence of rostrum (R) into which mandible fits, and ledges (L) against which the mandible base articulates. Bladelike wall of avicularium evident at bottom left and top. Drawn to scale *a*.

FIGURE B: Avicularium seen from front. Note muscles (c) and sclerites (s) or reinforcements of mandible, its distal position and relatively large size. Drawn to scale *a*.

FIGURE C: Orifice (o), showing the two proximal denticles (y) and overhanging distal wall or "cornice" (κ). At each side of orifice are the two parentheses lines (p) and external to them are the cryptocyst ridges. Drawn to scale *a*.

FIGURE D: Free-hand habit sketch. Colony jointed and branching dichotomous.

FIGURE E: View of another avicularium, showing more extensive reinforcement of mandible and two lines representing cryptocyst ridges. Drawn to scale *a*.

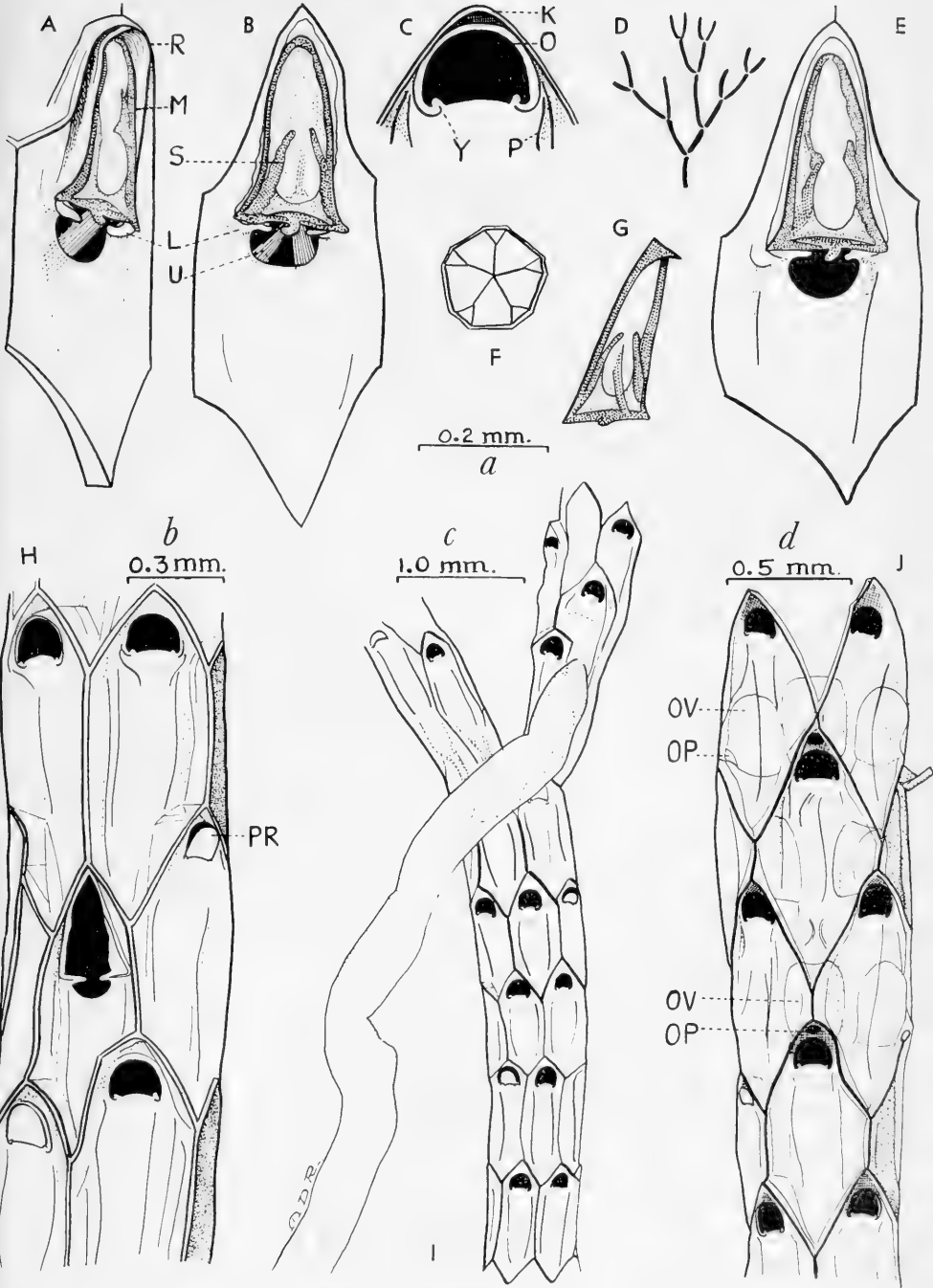
FIGURE F: Cross section of a branch, showing pentamerous arrangement of zooids. Cut was made through two series of zooids, i. e., where two series overlap. Free-hand sketch.

FIGURE G: Avicularian mandible, from inner side, showing hooked or pointed terminal end and three sclerites at basal end. Drawn to scale *a*.

FIGURE H: Colony fragment. Full view of five autozooids and one avicularium. Avicularium replaces a regular autozoecium in the transverse series. Transparent side walls show through frontal walls and thus account for the number of longitudinal lines in the figure. None of the zoecia here pictured has an ovicell. A few opercula are in place (pR). Drawn to scale *b*.

FIGURE I: Colony fragment, showing zone of dichotomous branching and single large tubular radicle "fiber" or tube which arises from frontal surface of a zoecium. The zoecia in this fragment do not have ovicells. Drawn to scale *c*.

FIGURE J: Colony fragment from an ovicelled branch. The large globular endotoichal ovicells (ov) show through the transparent zoecial walls. Ovicell opening (op) is directly above zoecial orifice. Drawn to scale *d*.



EXPLANATION ON OPPOSITE PAGE

PLATE 5

Cellaria vitrimuralis, new species, and *C. moniliorata*, new species

(All figures except figure F drawn with aid of camera lucida)

FIGURE A: *Cellaria vitrimuralis*, new species. Enlargement of portion of ovicelled colony, showing length of proximal parts (pz) of some zooecia and distal parts of others, salient thin glasslike walls (w), frontal transparency, and relation of the ovicells (ov) to the zooecia. Hexagonal areolation is plain and superficial. Inner walls (L) of zooids do not parallel the outer hexagonal pattern (w). Scale *a*.

FIGURE B: *C. vitrimuralis*. A slightly tipped frontal, top, and one side view of an operculum and its attached musculature, flattened plates and flange or rim. Scale *b*.

FIGURE C: *C. vitrimuralis*. Frontal view of operculum, with one of muscle plates showing, the other having been broken off in dissection. Scale *b*.

FIGURE D: *C. vitrimuralis*. Operculum from the right side, showing the muscle plate (MP) and the flange (F). Scale *b*.

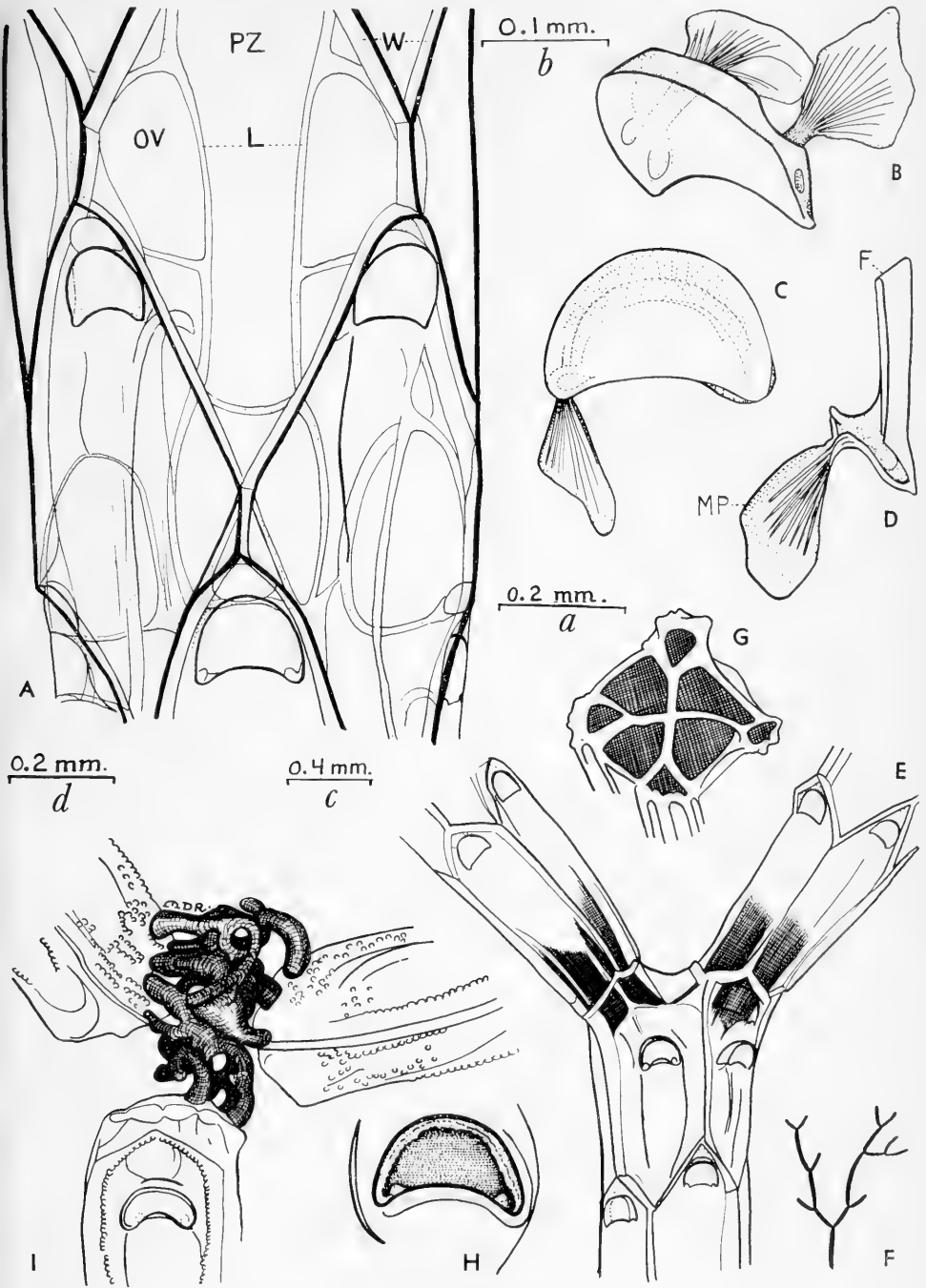
FIGURE E: *C. vitrimuralis*. View of nonovicelled fragment of colony and of joint or node area. The deep yellow or amber color of inner walls at joints shows through transparent outer wall. No tangle of rootlets present at intersection of branches of this species. Scale *c*.

FIGURE F: *Cellaria moniliorata*, new species. Free-hand sketch of growth habit.

FIGURE G: *C. moniliorata*. Stereogram of broken end of branch. Zooecia grouped in transverse linear rows of four. At this level the four larger zooecial cavities belong to the zooecia of one series while the four smaller cavities belong to zooecia of a second series.

FIGURE H: *C. moniliorata*. Operculum in place in orifice. Parenthesis-shaped sclerites on each side of the orifice. Rim of orifice indicated.

FIGURE I: *C. moniliorata*. Node of colony showing tangle of yellow radicle fibers at junction of the three internodes. Zooecial surface pebbled or covered over with small beadlike bumps. Beaded cryptocyst ridges show best in right-hand branch and in basal zooid. Scale *d*.



EXPLANATION ON OPPOSITE PAGE

PLATE 6

Cellaria moniliorata, new species

(Figures drawn with aid of camera lucida)

FIGURE A: Part of fertile branch showing every zoecium topped by endotoichal ovicell. Ovicells give branch a swollen look. Frontal walls of neighboring distal zooecia meet in salient suture over each ovicell. Zooecia are in series of four around the branch. Scale *a*.

FIGURE B: Enlargement of part of the branch in figure A showing beaded cryptocyst ridges (CR), orifices, ovicell openings, and three ovicells (OV). Mural rim (MR) smooth, thin, and slightly raised. Scale *b*.

FIGURE C: Part of nonfertile branch showing autozooids in series of four and in hexagonal areolation. Two lower zooecia have opercula (OP) in place in orifice. Scale *a*.

FIGURE D: Part of nonfertile branch showing three autozooecia and one avicularium inserted between them. Scale *b*.

FIGURE E: Avicularium with beaded frontal, raised beak narrowed and slightly curved. Scale *b*.

FIGURE F: Avicularium of figure D enlarged. Scale *d*.

FIGURE G: Branches, meeting at a node with its tangle of radicle fibers. Basal branch narrows a bit in this specimen. Scale *c*.

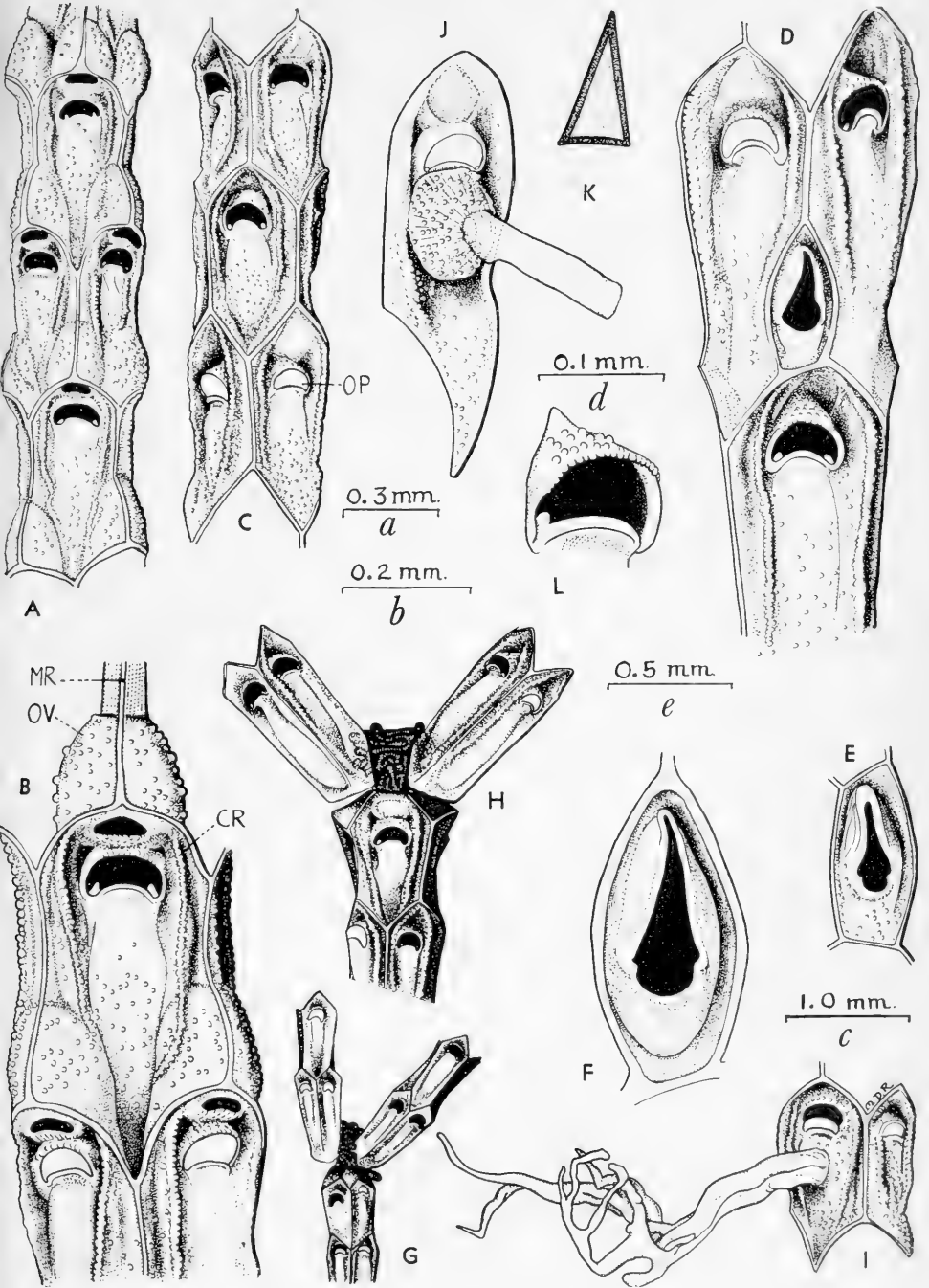
FIGURE H: Node with its tangle of chitinous radicle fibers. Tip of basal branch in this colony widened a bit at joint. Scale *e*.

FIGURE I: Branching, tangled, double radicles growing from front of an autozoid. Scale *a*.

FIGURE J: Zoid with single radicle growing from its front. Volcano-shaped raised front is calcareous; tube itself is chitinous. Scale *b*.

FIGURE K: Mandible of an avicularium. Scale *d*.

FIGURE L: Zooecial orifice showing beaded upper lip and smooth pouting lower lip. Scale *d*.



EXPLANATION ON OPPOSITE PAGE

PLATE 7

Cellaria wandeli Calvet, *Cellariaeforma parvimuralis*, new species, and
C. extentamuralis, new species

(Figures drawn with aid of camera lucida)

FIGURE A: *Cellaria wandeli*. Fragment of branch showing the strong areolation and several avicularia proximal to the zooecia. Ovicells above orifice and none of ovicell openings are perfect as the colony appears to be an old one. Scale *a*.

FIGURE B: *Cellaria wandeli*. Fragment of branch showing (from top to bottom) proximal part of a zooecium, an avicularium, an ovicell, and the elongate horseshoe-shaped zooecial orifice. Scale *b*.

FIGURE C: *Cellariaeforma parvimuralis*, new species. Avicularium. Scale *b*.

FIGURE D: *Cellariaeforma parvimuralis*. Cross section of a branch showing 10 zoid cavities. Scale *c*.

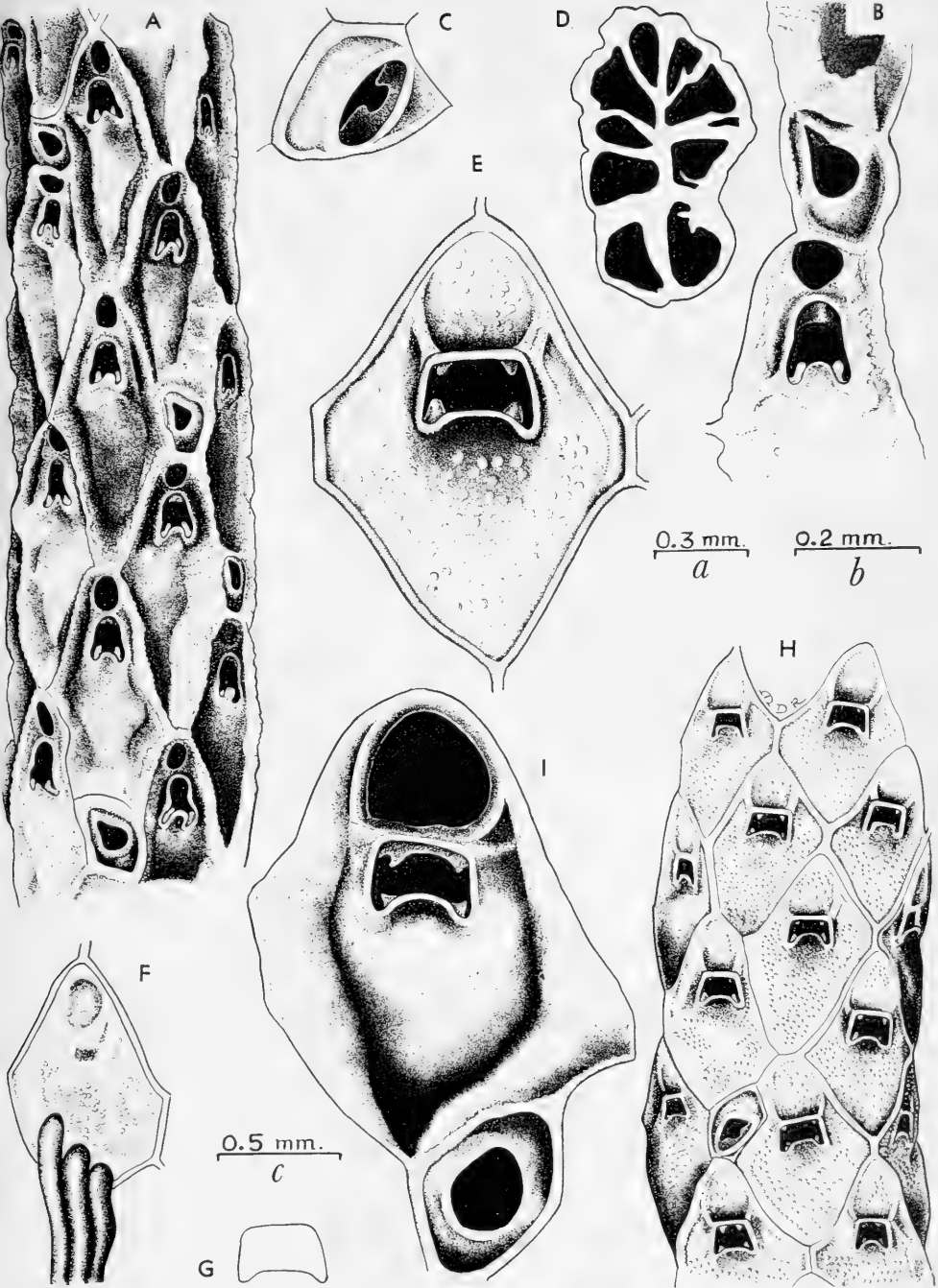
FIGURE E: *Cellariaeforma parvimuralis*. Single zooecium, showing detail of frontal and orifice. Scale *b*.

FIGURE F: *Cellariaeforma parvimuralis*. One of basal zooecia from which arise three radicle fibers. Frontal of zooecium was obscured by debris and orifice could not be plainly seen. Scale *a*.

FIGURE G: *Cellariaeforma parvimuralis*. Operculum from specimen, not dissected out. Scale *b*.

FIGURE H: *Cellariaeforma parvimuralis*. Branch fragment, showing single avicularium in relation to zooecia. Scale *c*.

FIGURE I: *Cellariaeforma extentamuralis*, new species. Ovicelled zooecium and avicularium. Scale *b*.



EXPLANATION ON OPPOSITE PAGE

PLATE 8

Cellariaeforma extentamuralis, new species; *C. coronata*, new species; and
Mawsonia extensalata, new species

(Figures drawn with aid of camera lucida)

FIGURE A: *Cellariaeforma extentamuralis*, new species. Low power view of branch having zooecia with ovicells and avicularia. Scale *a*.

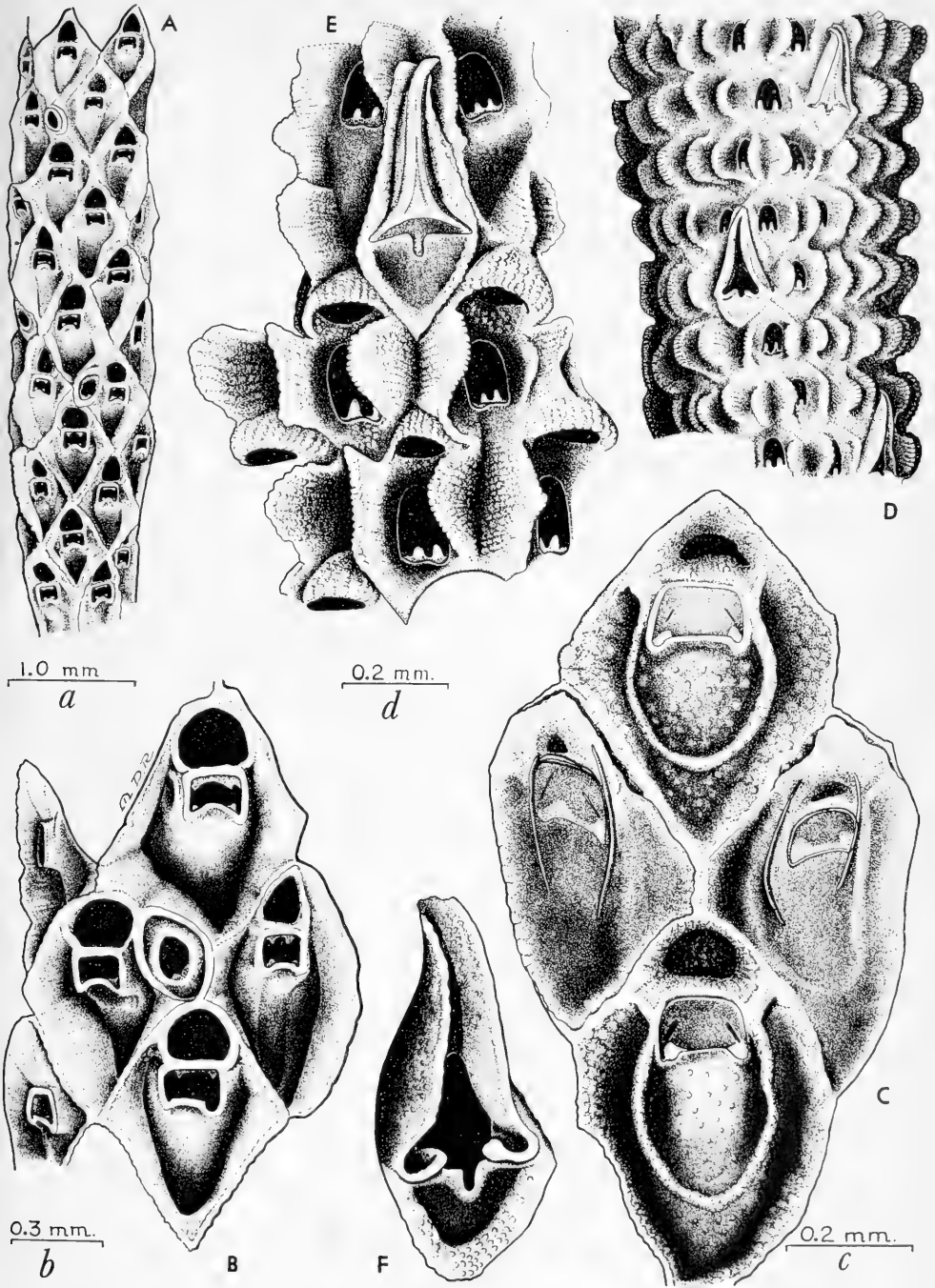
FIGURE B: *Cellariaeforma extentamuralis*. Several ovicelled zooecia surrounding an avicularium. Scale *b*.

FIGURE C: *Cellariaeforma coronata*, new species. Four zooecia. Upper and lower zooecia show complete horseshoe-shaped cryptocyst ridge on calcareous frontal surface. Two lateral zooecia covered by parchmentlike membrane having parentheses-shaped lines about the orifice. Membrane is shown peeling off in places; the calcareous cryptocyst is beneath it. Scale *c*.

FIGURE D: *Mawsonia extensalata*, new species. A branch showing prominent flaps or cryptocyst extensions that give it a rough file-like appearance, and three large triangular-beaked avicularia. Scale *a*.

FIGURE E: *Mawsonia extensalata*. Several fertile zooecia and an avicularium. Ovicells are widely open considerable distance above zooecial aperture. Cryptocyst flaps meet directly over ovicells. Scale *b*.

FIGURE F: *Mawsonia extensalata*. An avicularium. Triangular beak has a slightly curved tip. Scale *d*.



EXPLANATION ON OPPOSITE PAGE

PLATE 9

Mawsonia extensalata, new species, and *M. membranacea* Thornely

(Figures drawn with aid of camera lucida)

FIGURE A: *Mawsonia extensalata*, new species. View of outer surface of avicularian mandible showing sharp knife-edge keel and curved tip. Scale *a*.

FIGURE B: *Mawsonia extensalata*. A fairly young zooecium. Depressed area between orifice rim and distal zooecial wall fills in and becomes heavily calcified in older zooecia, merging with the curved cryptocyst ridges. Scale *a*.

FIGURE C: *Mawsonia extensalata*. Avicularian mandible. Scale *a*.

FIGURE D: *Mawsonia extensalata*. Operculum tilted slightly to show reinforcements. Scale *b*.

FIGURE E: *Mawsonia extensalata*. Operculum seen from inner surface. Flange around inner rim is especially extended at the two sides into areas for muscle attachment. Scale *b*.

FIGURE F: *Mawsonia membranacea*. Side view of avicularian mandible showing the curved tip. Scale *c*.

FIGURE G: *Mawsonia membranacea*. Zooecium. Operculum is in the orifice, and has two light-colored or thinner oval areas for articulation with orificial condyles. Prominent smooth parentheses lines immediately enclose the orifice on two sides; around them curve the prominent, roughened, calcified, cryptocyst ridges. Scale *a*.

FIGURE H: *Mawsonia membranacea*. An older zooecium. Not many zooecia in the colony have such sharply raised mural rims. The two orificial condyles show plainly because operculum is missing. Scale *a*.

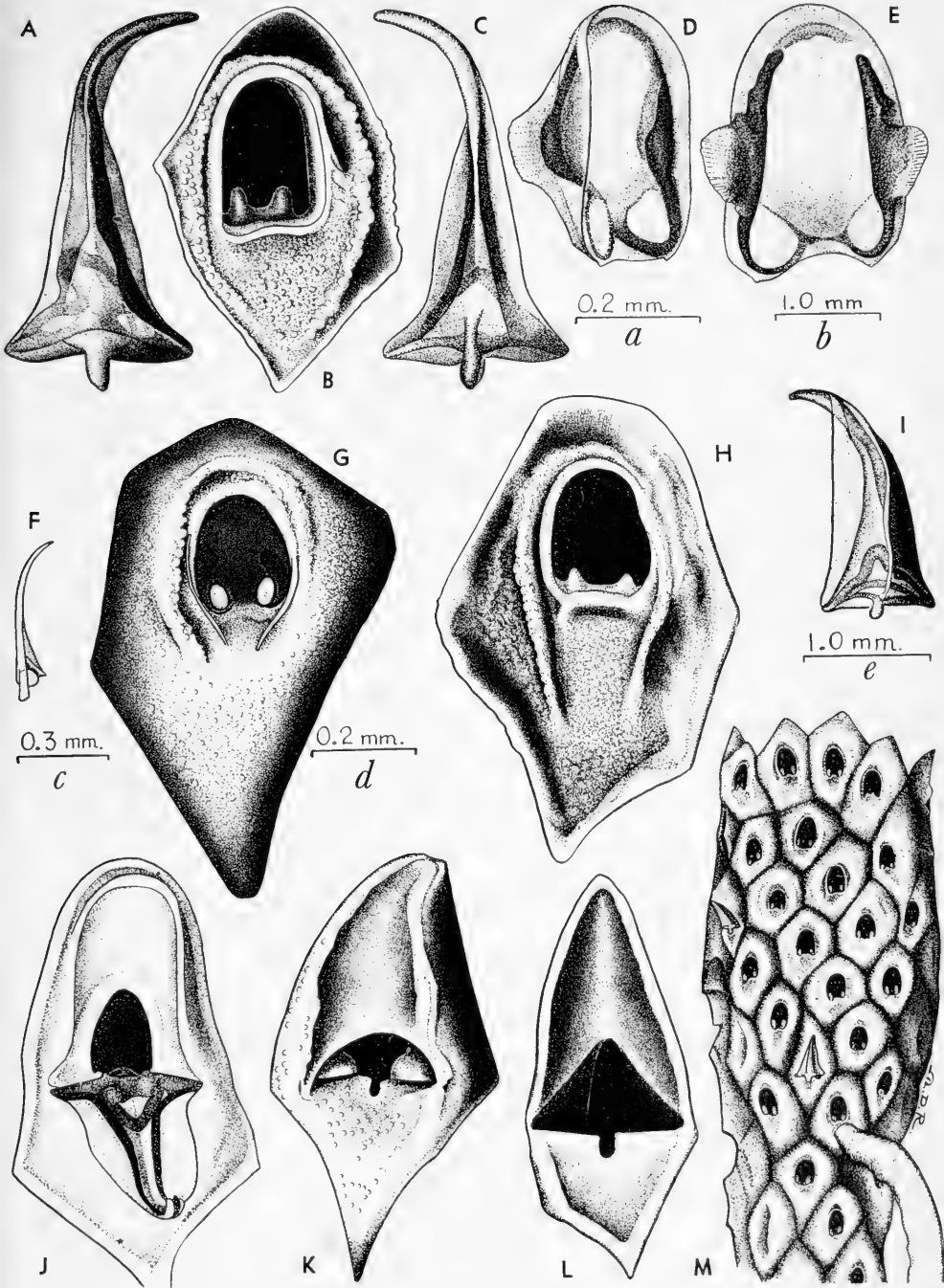
FIGURE I: *Mawsonia membranacea*. Outside view of avicularian mandible. Scale *a*.

FIGURE J: *Mawsonia membranacea*. Avicularium and mandible. Scale *a*.

FIGURE K: *Mawsonia membranacea*. Typical avicularium showing an odd opesia or opening to interior. Scale *a*.

FIGURE L: *Mawsonia membranacea*. An avicularium. Scale *d*.

FIGURE M: *Mawsonia membranacea*. Upper two-thirds of the only colony fragment of the species showing arrangement of zooecia and avicularia. From one zooecium springs a thin-walled rootlet. An avicularium is directly above, to the left of the same zooecium. Scale *e*.



EXPLANATION ON OPPOSITE PAGE

PLATE 10

Mawsonia membranacea Thornely and *Melicerita latilaminata*, new species

(All figures except B and C drawn with aid of camera lucida)

FIGURE A: *Mawsonia membranacea*. Six zooecia and an avicularium. Scale *a*.

FIGURE B: *Melicerita latilaminata*. Free-hand sketch of a colony, showing beginning of dichotomous branching and several rootlets sprouting from near base. Area between the two dotted lines is shown in figure D.

FIGURE C: *Melicerita latilaminata*, new species. Cross section diagram of a branch to show its flatness and bilaminate character.

FIGURE D: *Melicerita latilaminata*. Enlargement of approximate dotted area of colony shown in figure B. Zooecia are more or less hexagonal. Here and there are smaller pentagonal or hexagonal avicularia, four of which are pictured. Many zooecia have a small crescent-shaped ovicell opening above the larger but similarly shaped zooecial orifice. Scale *b*.

FIGURE E: *Melicerita latilaminata*. Inner porous end wall of a zooecium. These porous plates form distal-proximal walls of zooecia. Scale *c*.

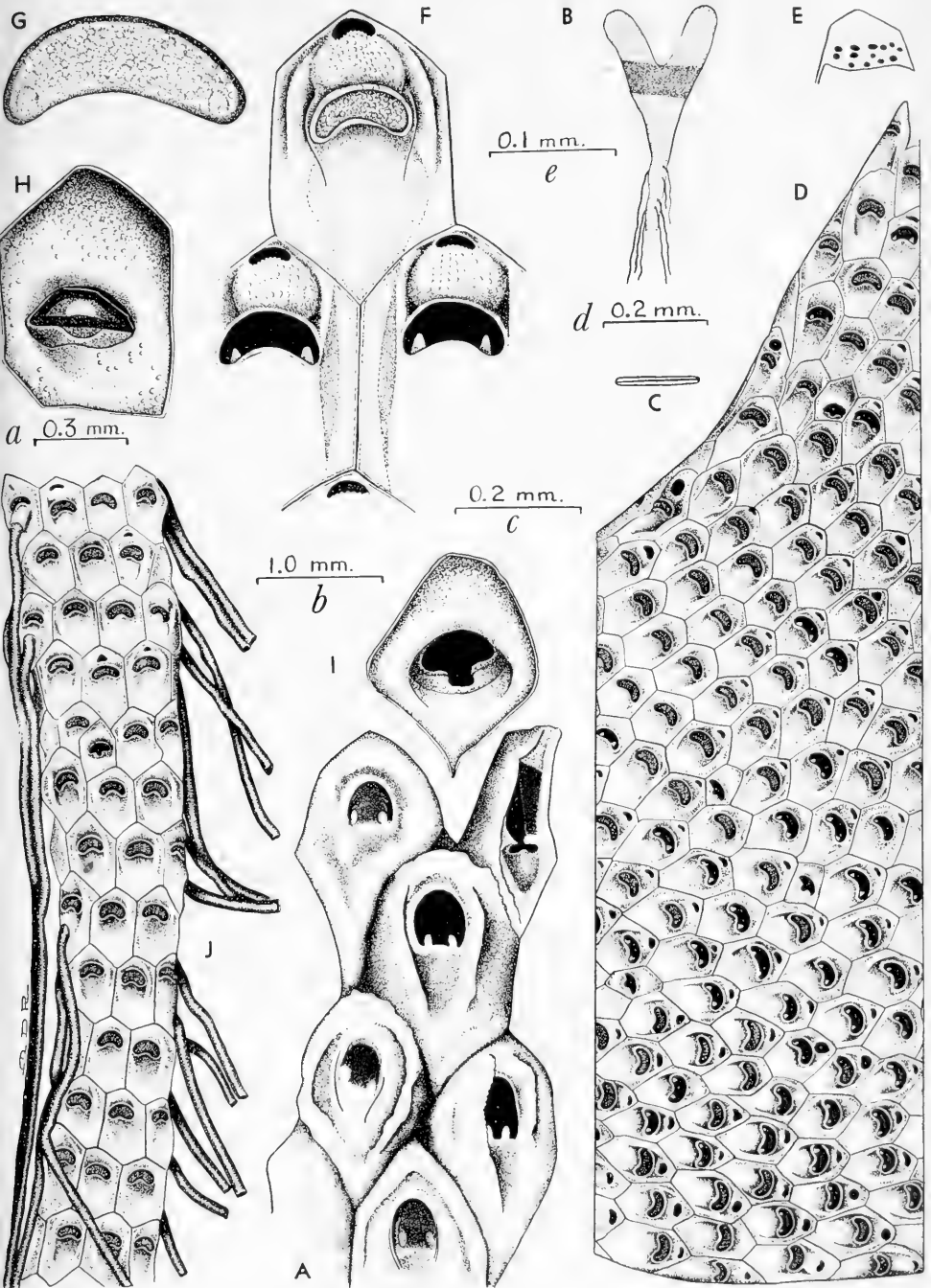
FIGURE F: *Melicerita latilaminata*. One complete zooecium and parts of three others. Dotted lines show location and extent of body cavity of upper zooecium. External areolation or pattern formed by the frontal surface of the various zooecia overlies and obscures the true zooecial shape. Upper zooecium has an operculum in place over the orifice, while the two lateral zooecia show the pair of orificial condyles. Small crescent-shaped ovicell openings are at distal end of each zooecium. Parentheses lines appear around orifice of upper zooecium. Scale *d*.

FIGURE G: *Melicerita latilaminata*. Operculum, its surface faintly pebbled. Scale *e*.

FIGURE H: *Melicerita latilaminata*. An avicularium with mandible in place showing reinforcements of mandible; heaviest reinforcement is the encircling bar. Scale *c*.

FIGURE I: *Melicerita latilaminata*. An avicularium from which mandible has been removed to show shape of opening and the condyles, with which the mandible articulates. Scale *d*.

FIGURE J: *Melicerita latilaminata*. Basal region of colony with numerous rootlets sprouting from zooecial fronts. Rootlets are considerably longer than shown. Colony is narrowest here in basal region (compare with figure B). Scale *b*.



EXPLANATION ON OPPOSITE PAGE

PLATE 11

Melicerita latilaminata, new species, and *M. obliqua* Thornely

(Figures drawn with aid of camera lucida)

FIGURE A: *Melicerita latilaminata*, new species. Zooecium from which has sprouted a chitinous rootlet (R). Scale *a*.

FIGURE B: *Melicerita latilaminata*. Parts of two zooecia, with an ovicell chamber (o) in front of one and above the other. Only the concealed proximal part of upper zooecium and the exposed distal frontal part (ZF) of lower zooecium are shown. Proximal zooecial cavity (zc) is narrower than exposed frontal surface (ZF) and extends for considerable distance. Pores (p) are seen occasionally in the walls. Scale *a*.

FIGURE C: *Melicerita latilaminata*. Pore plate from distal-proximal wall between two successive zooecia. Scale *c*.

FIGURE D: *Melicerita latilaminata*. Two ovicelled zooecia and an avicularium. Zooecial orifice (OR) shows the two condyles. Ovicell opening (OP) has a slightly beaded lower border. Avicularian mandible (M) is in place. Scale *a*.

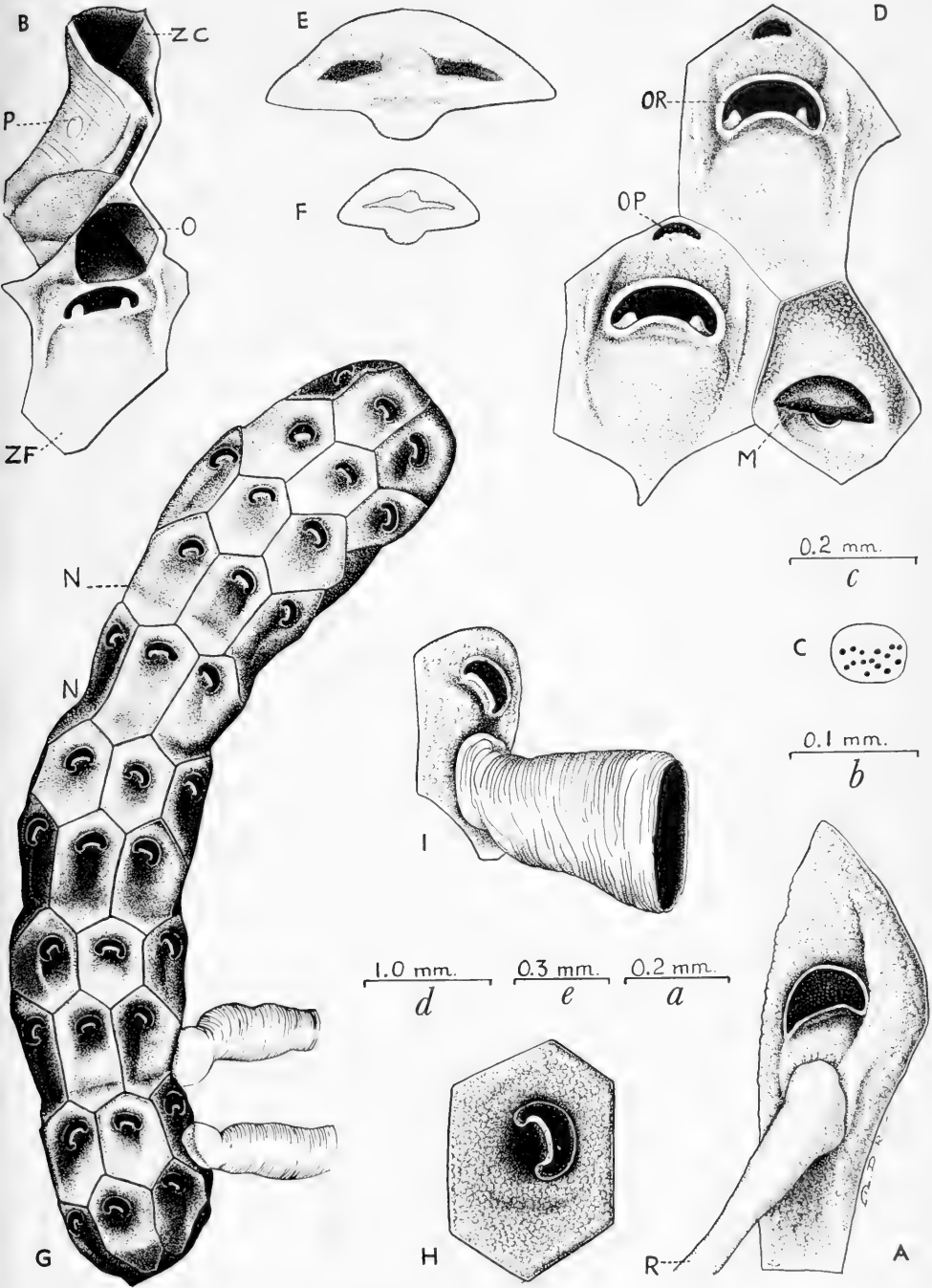
FIGURE E: *Melicerita latilaminata*. A heavily chitinized mandible. Scale *b*.

FIGURE F: *Melicerita latilaminata*. Another avicularian mandible. Scale *c*.

FIGURE G: *Melicerita obliqua*. One of two incomplete colonies. Two radicles are near the base. Four nodulations (N) occur along the stem. Scale *d*.

FIGURE H: *Melicerita obliqua*. Single zooecium showing key character of this species, an obliquely set orifice. Scale *e*.

FIGURE I: *Melicerita obliqua*. Zooecium, showing a thin-walled transversely grooved (striated or wrinkled) rootlet springing from frontal. Scale *e*.



EXPLANATION ON OPPOSITE PAGE

PLATE 12

Cellarinella margueritae, new species

(All figures except figure A were drawn with aid of camera lucida)

FIGURE A: A typical colony, 47 mm. long. Nodes are white, undotted; internodes are stippled. The dots represent orifices.

FIGURE B: Part of internode showing orifices of six zooecia. Three zooecia have external avicularia pointing to the left, three to the right. Two mucros, one with an avicularium, the other without, or "naked," are under each orifice, to the side. Scale *a*.

FIGURE C: A young, lightly calcified zoid tipped forward so interior of orifice can be seen better. Umbos not well developed yet. Diagonal oral ledge deep within the orifice shows, as does external suboral avicularium. Scale *b*.

FIGURE D: Looking down into primary orifice of a young zoid reveals relative position of back ledge, frontal oral ledge, internal avicularium, external avicularium, and mucros. Scale *b*.

FIGURE E: Internal avicularium with opened mandible and diagonal frontal oral ledge as seen from inside of zooecium. Compare with figure H for approximate position in a zooecium. Scale *c*.

FIGURE F: Two external avicularial mandibles with hooked tips and thinner oval area or lucida. Scale *c*.

FIGURE G: Orifice, mucros, and external avicularium. The two crossing dotted lines enclose the approximately 110° angle at which the avicularium is bent.

FIGURE H: Interior of a broken-away frontal wall shows several zooecial cavities and parts of two ovicelled zoids. The internal avicularia are obliquely directed. Two ovicells are exposed, also the very thick frontal wall, porous in places. Scale *a*.

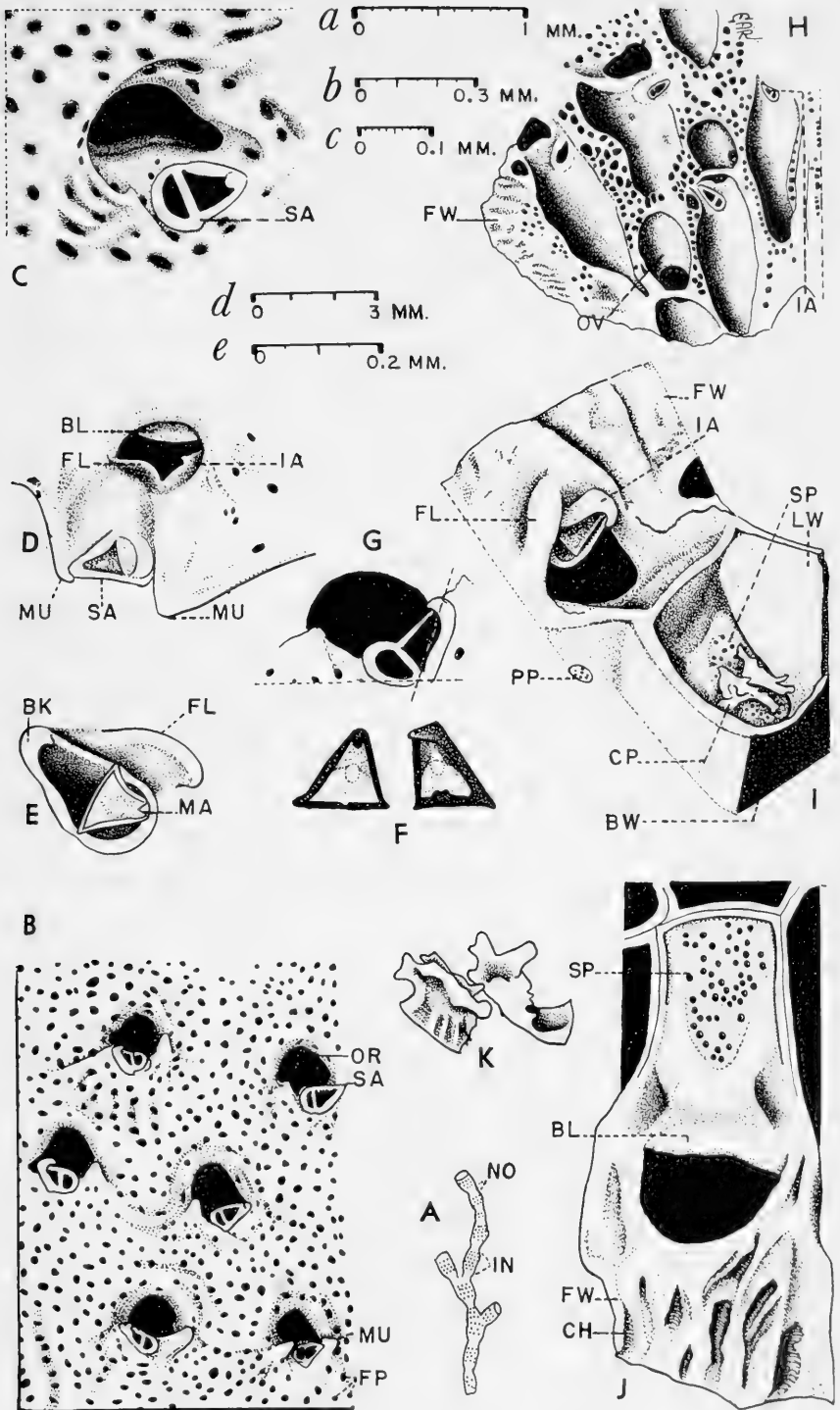
FIGURE I: Transverse section stereogram through parts of three zooecia. Zoid at extreme left is cut through to show diagonal frontal oral ledge and inner avicularium. Lower right zoid is cut to show deep down its end (proximal) wall with sieve plate, over which project two calcareous processes. Pore plate identifies lateral wall. Scale *b*.

FIGURE J: Transverse section through a zooecium at level of sieve plate and back ledge, looking up at distal or end wall. Note thickness of frontal wall as compared with other walls, also its channeled nature. Scale *b*.

FIGURE K: Set of old, heavily calcified processes which occur over a sieve plate in end wall of a zooecium. Scale *c*.

Abbreviations used on plates 12-18

| | |
|--|--|
| AC, avicularial chamber | LW, lateral wall |
| AR, areolar pores | MA, mandible |
| BC, zooecial cavity | MS, muscle fibers |
| BK, beak of avicularium | MU, mucro or umbo |
| BL, back ledge | NO, node |
| BW, back wall | NZ, nonovicelled zoid |
| CH, channels or canals leading in from frontal pores | OL, olocyst |
| CP, calcareous processes | OR, orifice or zooecial aperture |
| CR, chitinous rootlets | OV, ovicell |
| FL, frontal oral ledge | PP, pore plate or rosette plate |
| FP, frontal pores | PV, peristomial visor |
| FW, frontal walls | SA, external avicularium |
| IA, internal avicularium | SL, second calcareous layer or tremocyst |
| IN, internode | SO, secondary orifice |
| | SP, sieve plate of end wall |



EXPLANATION ON OPPOSITE PAGE

PLATE 13

Cellarinella rossi, new species

(For explanation of abbreviations see key for plate 12. All figures drawn with aid of camera lucida)

FIGURE A: Colony sprig showing two internodes and nodes. Scale *d* of plate 12.

FIGURE B: Enlargement of internode showing six zooecia. Some frontal pores are in slight swirling grooves. Zooecial boundaries indeterminable externally. Scale *a* of plate 12.

FIGURE C: Zoid frontal wall as seen from inside. Central area of upper frontal expanded and imperforate, lower frontal narrower and perforated by many frontal pores. Two small calcareous processes project over a sieve plate in end wall. Region of orifice, oral ledge, and internal avicularium were obscured by broken fragments so are blacked out here. Scale *b* of plate 12.

FIGURE D: The strongly arched peristome is flanked on one side by a very tall, sharply pointed, naked mucro; on the other by a lower, avicularium-bearing mucro. Lower proximal edge of orifice is asymmetrical. Scale *b* of plate 12.

FIGURE E: Inner surface of zoid, in vicinity of orifice, shows shape and size of internal avicularium and its position relative to diagonal frontal oral ledge. Scale *c* of plate 12.

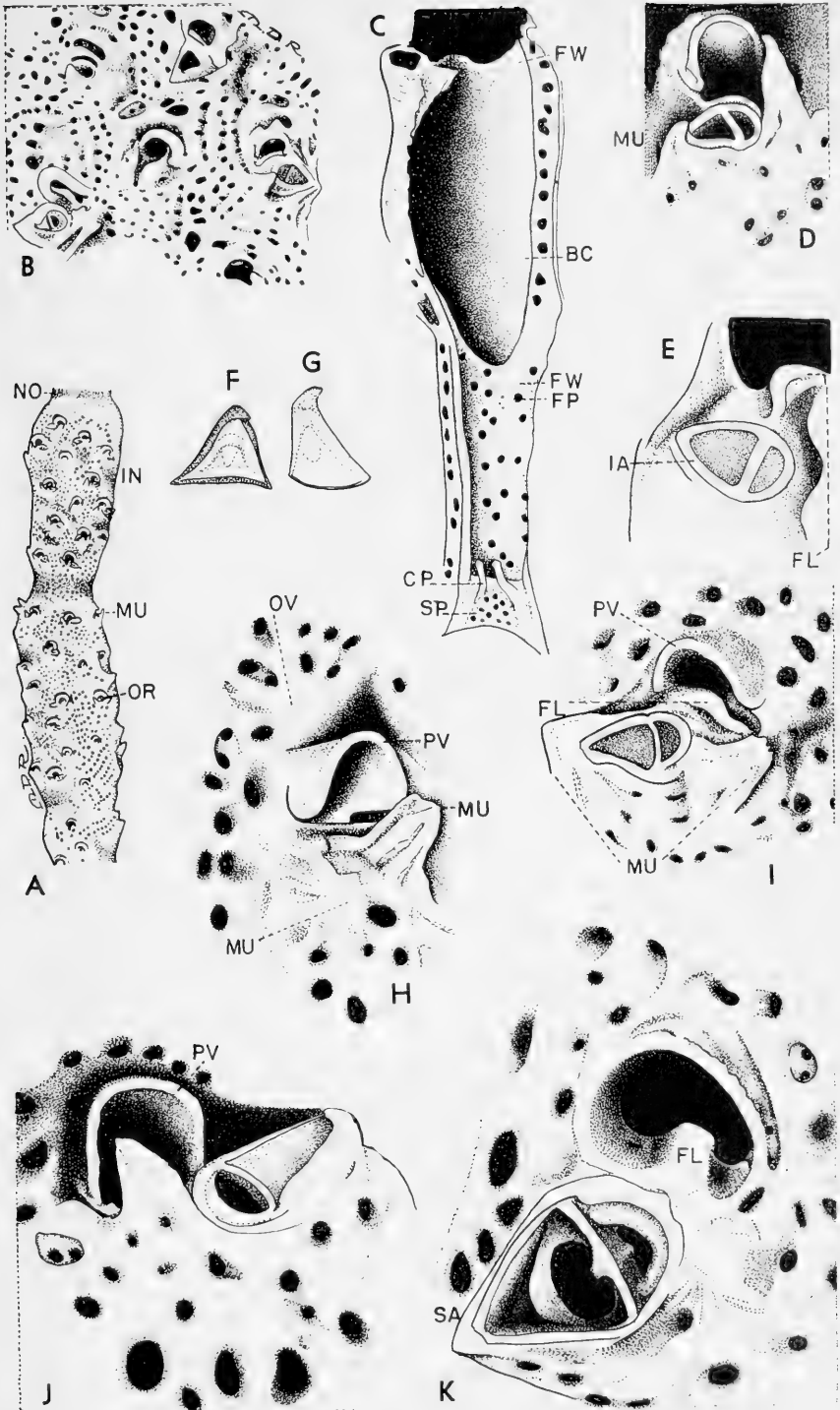
FIGURES F, G: Two external avicularial mandibles drawn directly from their places in the colony (i. e., not dissected out). Rims and curved tips are chitin-reinforced. Scale *c* of plate 12.

FIGURE H: Peristomial area seen from side. A very well developed, calcareous, visorlike peristome shades the orifice. To one side of it is a prominent mucro. The other mucro is barely indicated diagonally downward from the left. Above the peristome is nonporous area under which lies the ovicell. Peristomeal visor extends considerably beyond primary orifice. Scale *b* of plate 12.

FIGURE I: View, slightly from the side, of nonovicelled zoid tipped downward to show asymmetrical orifice with its diagonal frontal oral ledge that contributes to the almost channeled effect at lower right corner. The "channel" is on same side of longitudinal midline as internal avicularium and on opposite side of midline from the external avicularium. Peristome in this zoid is not so well developed as that in figure H but still is of considerable size. Scale *b* of plate 12.

FIGURE J: Nonovicelled zoid tipped backward and a bit sideways to show shape of stout bare mucro and medium-sized peristome. Avicularium-bearing mucro may be on either right or left side of orifice. Here it is shown at opposite side from those in figures D and I. The avicularium does not point downward in this zoid. This avicularium direction is not common. Scale *c* of plate 12.

FIGURE K: Nonovicelled zooecium tipped forward so interior of orifice is visible. The peristome is worn down or broken off in this well calcified specimen; diagonal frontal oral ledge is quite thick. The internal avicularium, not visible, is behind and below this ledge but is invisible from this view; a mucro is over this area. External avicularium is heavily calcified and has a strong cross-bar against which the mandible would normally rest. One of the larger avicularia of the colony. Scale *c* of plate 12.



EXPLANATION ON OPPOSITE PAGE

PLATE 14

Cellarinella nutti, new species

(For explanation of abbreviations see key for plate 12)

FIGURE A: The broadest, most perfect colony fragment, 20 mm. long. Its orifices are represented by dots.

FIGURE B: Enlargement of node and surrounding internode areas of colony in figure A, showing 12 orifices, 5 above node area and 7 below. Scale *a*.

FIGURE C: More detailed view of three zooecial orifices. The large external avicularium is cradled between two mucros. Within the orifice is visible the partial partition composed of side wall of internal avicularium and inner frontal oral ledge. Scale *c*.

FIGURE D: Three old heavily calcified zooids near base of colony shown in figure A. External avicularium is deeply sunken in this part of colony. Scale *a*.

FIGURE E: Another orifice from the colony in figure A, tipped forward about 45° so its internal avicularium can be seen. An external avicularium is lacking in this zooid. Scale *d*.

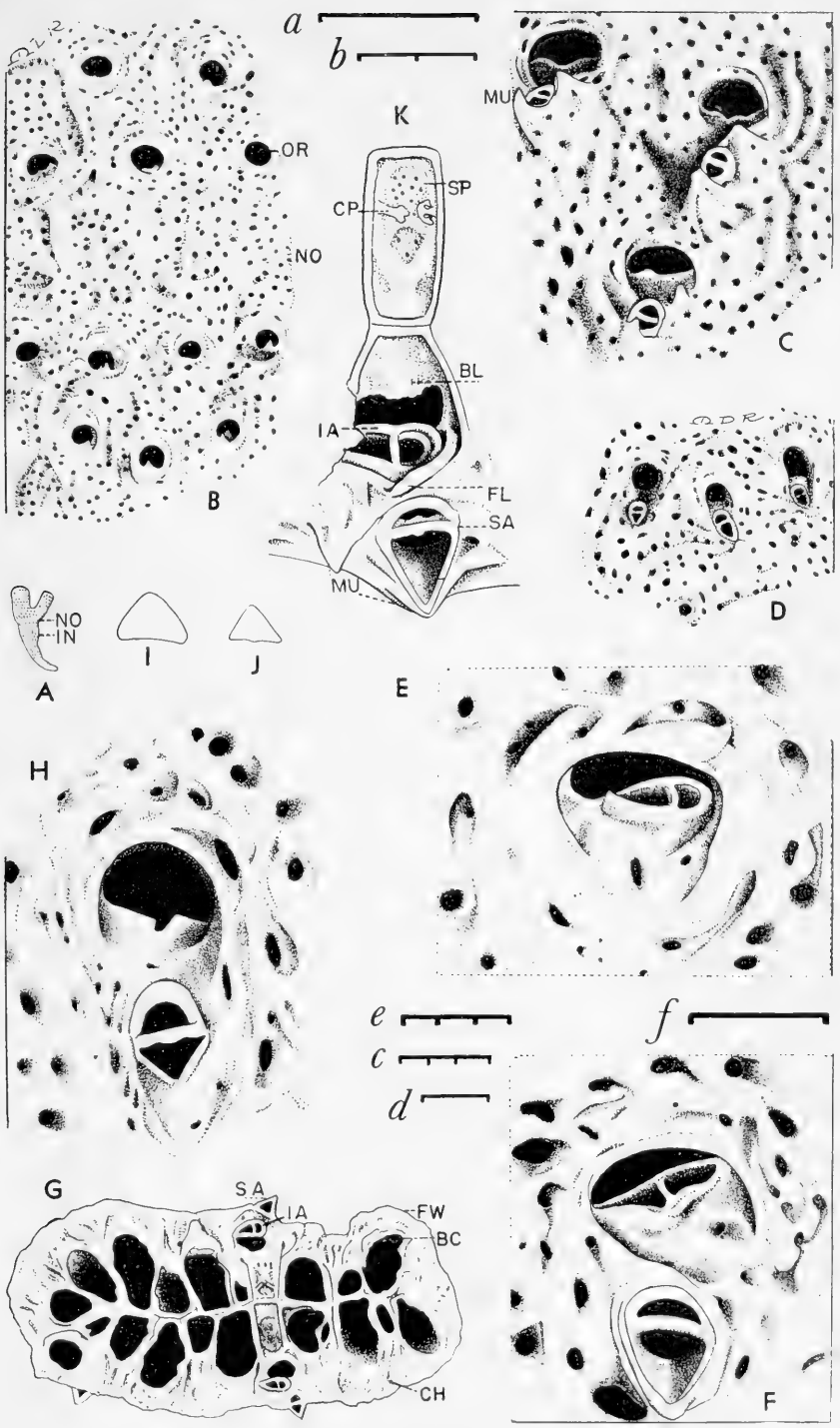
FIGURE F: Another zooid from colony of figure A: tipped to show external and internal avicularia. Latter is propped against inner oral ledge. Scale *d*.

FIGURE G: End view of colony fragment cut through at an internode, showing zooecial cavities of 21 or 22 zooids and end walls of two more. Back and side walls are thin, frontal walls thick. Triangular beaks of three external avicularia jut out from frontal wall. Between the two transversely placed internal avicularia are end walls and sieve plates of two more zooecia. Corrugations of frontal wall are channels leading to some of external and internal pores. This figure shows the bilaminate arrangement of the zooecia with most zooecia opening out on the two faces and relatively few on the edge. This is characteristic of the broad blade, slablike species of this genus. Scale *a*.

FIGURE H: Looking head-on at an orifice (not tilted). Within orifice is proximal partition formed by side walls of internal avicularium and frontal oral ledge. From this view the external avicularium is considerably foreshortened. It is also on an umbō which was difficult to show because of the angle. Scale *b*.

FIGURES I, J: Mandibles of two external avicularia. Details of chitin-reinforcement, lucida, and curvature not shown as specimens were not dissected out. Scale *d*.

FIGURE K: Transverse section through two zooecia. Lower one is cut at level of its external and internal avicularia, zooecial cavity, front oral and back ledges. Upper one is cut at level of end or proximal wall with its two calcareous processes and the sieve plate. Scale *b*.



EXPLANATION ON OPPOSITE PAGE

PLATE 15

Cellarinella njegovanae, new species

(For explanation of abbreviations see key for plate 12. All figures drawn with aid of camera lucida)

FIGURE A: A typical, flattened, slablike, branched colony. Nodes are left white, internodes are dotted. Dots represent orifices. Chitinous rootlets are near colony base. Scale *a*.

FIGURE B: Another, smaller colony. Scale *a*.

FIGURE C: Enlargement of part of internode showing 14 orifices, each with pair of suboral external avicularia. Scale *a* of plate 12.

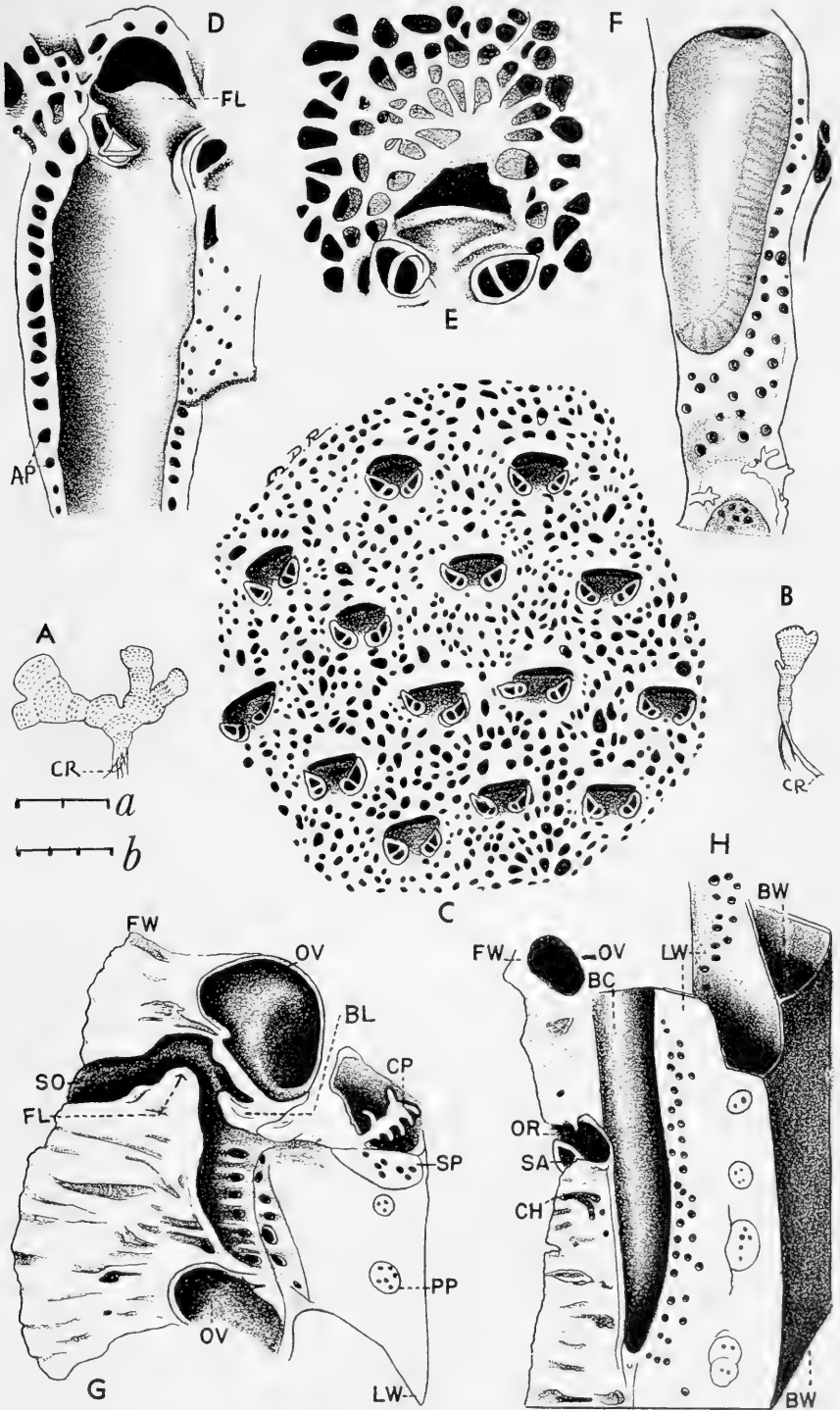
FIGURE D: Inner surface of frontal wall of a zoid. The obliquely placed internal avicularium with its hooked, gaping mandible is at upper left in the cavity. Frontal oral ledge is high and hides the internal avicularium from external view. At midright is stretch of porous wall belonging to another zoecium. Scale *b* of plate 12.

FIGURE E: A young, not-too-heavily calcified, ovicelled zoid. Part of upper lip or distal border of orifice is damaged, broken away. Because of light calcification the ovicell chamber is faintly visible beneath frontal pores. Scale *b* of plate 12.

FIGURE F: Inner frontal surface of young, lightly calcified zoid. Upper frontal is smooth-walled and expanded. The lower frontal is narrower and porous. Two calcareous processes overhang the basal sieve plate. Scale *b* of plate 12.

FIGURE G: Sagittal section of heavily calcified, ovicelled zoecium. Frontal wall is of variable thickness; compare with figures E and H. Scale *b* of plate 12.

FIGURE H: A stereogram of parts of three zoids, showing differences between the thin, smooth, and relatively nonporous back walls, the thin, porous lateral walls, and the thick, channeled frontal walls. The few large rosette plates are characteristic of lateral walls, which also have numerous pores arranged in a few rows near edge next to frontal wall. Scale *b*.



EXPLANATION ON OPPOSITE PAGE

PLATE 16

Cellarinella njegovanae, new species, and *C. roydsi*, new species

(For explanation of abbreviations see key for plate 12. All figures drawn with aid of camera lucida)

FIGURE A: *Cellarinella njegovanae*, new species. Three zooids of medium calcification. Upper lip of orifice forms a faintly bulging horizontal pebbled roof over the deeply buried oral ledge, here heavily shaded. Scale *b* of plate 12.

FIGURE B: *C. njegovanae*. External avicularial mandible with hooked tip, and oval lucida area. Scale *c* of plate 12.

FIGURE C: *C. njegovanae*. Young zoid. Arched distal lip is characteristic of a young orifice. Compare with orifices of older zooids shown in figure A. Scale *e* of plate 12.

FIGURE D: *C. njegovanae*. Primary orifice of a just-forming zoid, which is so young that external avicularia are not yet formed. Zoid is located at distal growing tip of colony. Scale *e* of plate 12.

FIGURE E: *C. njegovanae*. End walls of two zooids. A pair of heavily calcified processes arch over sieve plates, which are here heavily shaded but not shown in detail. Scale *b* of plate 12.

FIGURE F: *C. njegovanae*. Sieve plate as seen from underside, the side away from the pair of calcareous processes. Scale *b* of plate 12.

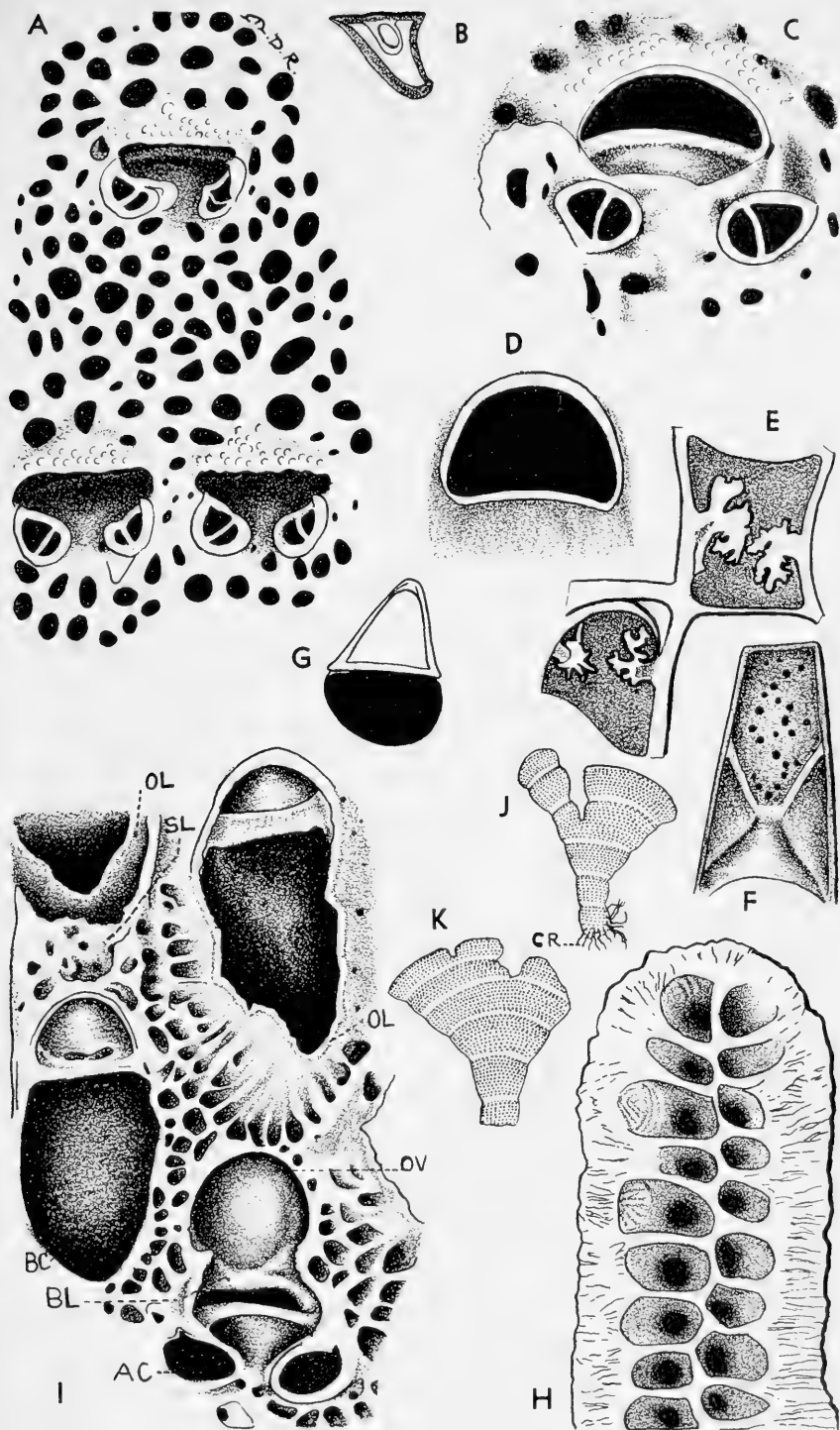
FIGURE G: *C. njegovanae*. External avicularial mandible. Back area shown in solid black for comparison of size and shape. Scale *c* of plate 12.

FIGURE H: *C. njegovanae*. Cross section of part of branch cut at node, showing the bilaminar, flattened character of the colony. Chief difference between sections made at level of an internode (pl. 14, fig. G) and at a node (present figure) is in the reduction of zoecial cavity diameter at node. Only an 18-zoid fragment of the 27-zoid branch cross section is shown here. Scale *a* of plate 12.

FIGURE I: *C. njegovanae*. A few incomplete zooids in process of formation and the calcification of frontal wall. Lowest zoecium has advanced to stage where suboral avicularial chambers are already outlined. Ovicells are forming on the three biggest zoecia. The frontal wall still incomplete. Two upper zooids are in early stages of frontal wall formation. Frontal wall here consists of two layers. Primary layer, olocyst, is thin, smooth, shiny; secondary layer, tremocyst, is rougher, thick, and porous. Scale *b* of plate 12.

FIGURE J: *Cellarinella roydsi*, new species. A flat, broad, branching colony with chitinous rootlets at its base. Scale *a* of plate 15.

FIGURE K: *C. roydsi*. Another, broader, slab that is broken off at basal end and at right branch. Scale *a* of plate 15.



EXPLANATION ON OPPOSITE PAGE

PLATE 17

Cellarinella roydsi, new species

(For explanation of abbreviations see key for plate 12. All figures drawn with aid of camera lucida)

FIGURE A: Part of node, internode, and lateral border of a colony. Mucros jut out prominently from frontal just under orifices. External avicularia missing from two lowest zooecia. Frontal oral ledge and internal and external avicularia show clearly in most of zooids. Scale *a* of plate 14.

FIGURE B: Two young, lightly calcified zooids. Zoid at right shows partially calcified ovicell wall within the orifice. This wall calcifies by degrees and in sections, as shown. Scale *e* of plate 14.

FIGURE C: Sagittal section through upper part of ovicelled zoid and parts of its neighbors. Lower lateral wall has two types of perforations—rosette plates and rows of single pores. Scale *c* of plate 14.

FIGURE D: Sagittal section through an ovicell, orifices, internal avicularial chamber, and the peristomie (the heavily stippled passageway between primary and secondary orifices). Although this colony fragment was completely dry, the mandibular muscles in avicularial chamber were still plainly discernible. Scale *d* of plate 14.

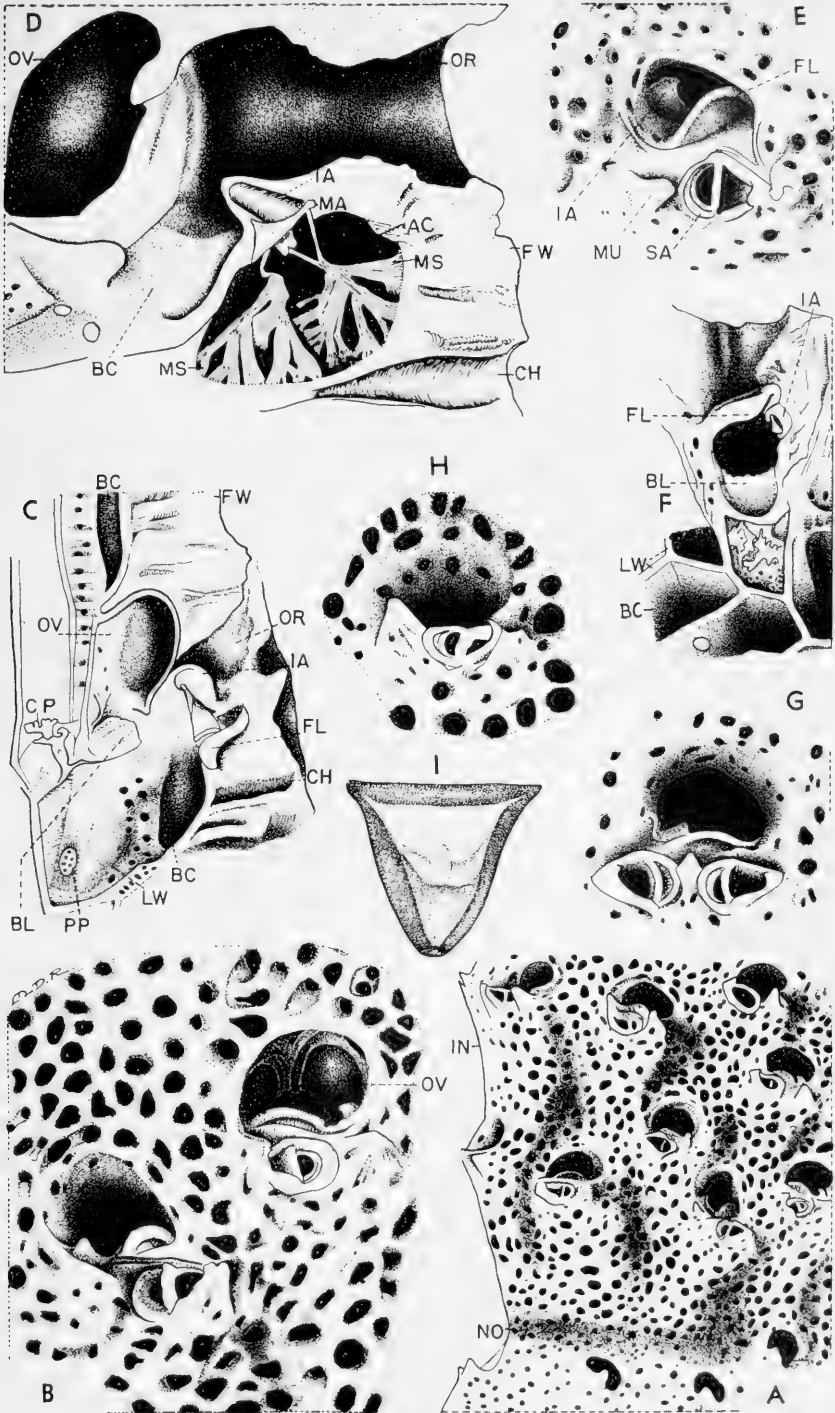
FIGURE E: Looking down into orifice of a young, lightly calcified zoid to show key characters—the diagonally directed frontal oral ledge and the prominent, highly placed curved beak of internal avicularium. Scale *e* of plate 14.

FIGURE F: A cross section of several zooecia. The uppermost zoid, just under frontal wall, is cut through the level of frontal oral ledge, back ledge, and internal avicularium. Zoid beneath it is cut at level of its proximal end wall, sieve plate, and two calcareous processes. The other boxlike zooids are cut at various levels between the preceding two. Scale *c* of plate 14.

FIGURE G: A young, lightly calcified zoid with two external avicularia and a mucro between them. This is a rather uncommon condition, the rule being the presence of one external avicularium. Zoid has been tipped forward so its orifice can be more plainly seen. Scale *e* of plate 14.

FIGURE H: Another very young, lightly calcified zoid seen from front. Lateral position of the nonaviculariate mucro and transverse direction of the suboral external avicularium are typical for species. Avicularial beak is pointed and hooked. Scale *e* of plate 14.

FIGURE I: Mandible of an external avicularium. A slight hook is barely indicated at tip. Varying degrees of chitinization, the darkest parts are the most heavily chitinized. Scale *f* of plate 14.



EXPLANATION ON OPPOSITE PAGE

PLATE 18

Cellarinella laytoni, new species

(For explanation of abbreviations see key for plate 12. All figures drawn with aid of camera lucida)

FIGURE A: Part of an internode. Bottom zoid is without an ovicell, but the five zooids above it show ovicells. Zooids open on all faces of the sprig. Suboral region, with its two mucros, juts out prominently in this species. Degree of calcification is medium. Scale *a* of plate 12.

FIGURE B: Young, incompletely calcified zooids from tip of a branched colony. The smooth frontal olocyst is encroached upon by the secondary, ridged, porous layer (tremocyst) in the areolar pore region. The strong ribs between the areolar pores, so prominent in the bottom right zoid, become overgrown and indistinguishable with further calcification. The typical prowlike suboral bulge is a key character of this species and shows well on lower right zoid. Scale *a*.

FIGURE C: Top view of primary orifice of a young zoid near the growing tip of the colony. Beak and mandible of internal avicularium show better here than in figure D, but the external avicularial mandible is dried and a bit twisted out of position here so is not typical. Scale *e* of plate 12.

FIGURE D: Another young zoid. Avicularial mandible inside orifice is shown from the side; it was heavily stippled to distinguish it. Base of external avicularium straddles the midline. Scale *e* of plate 12.

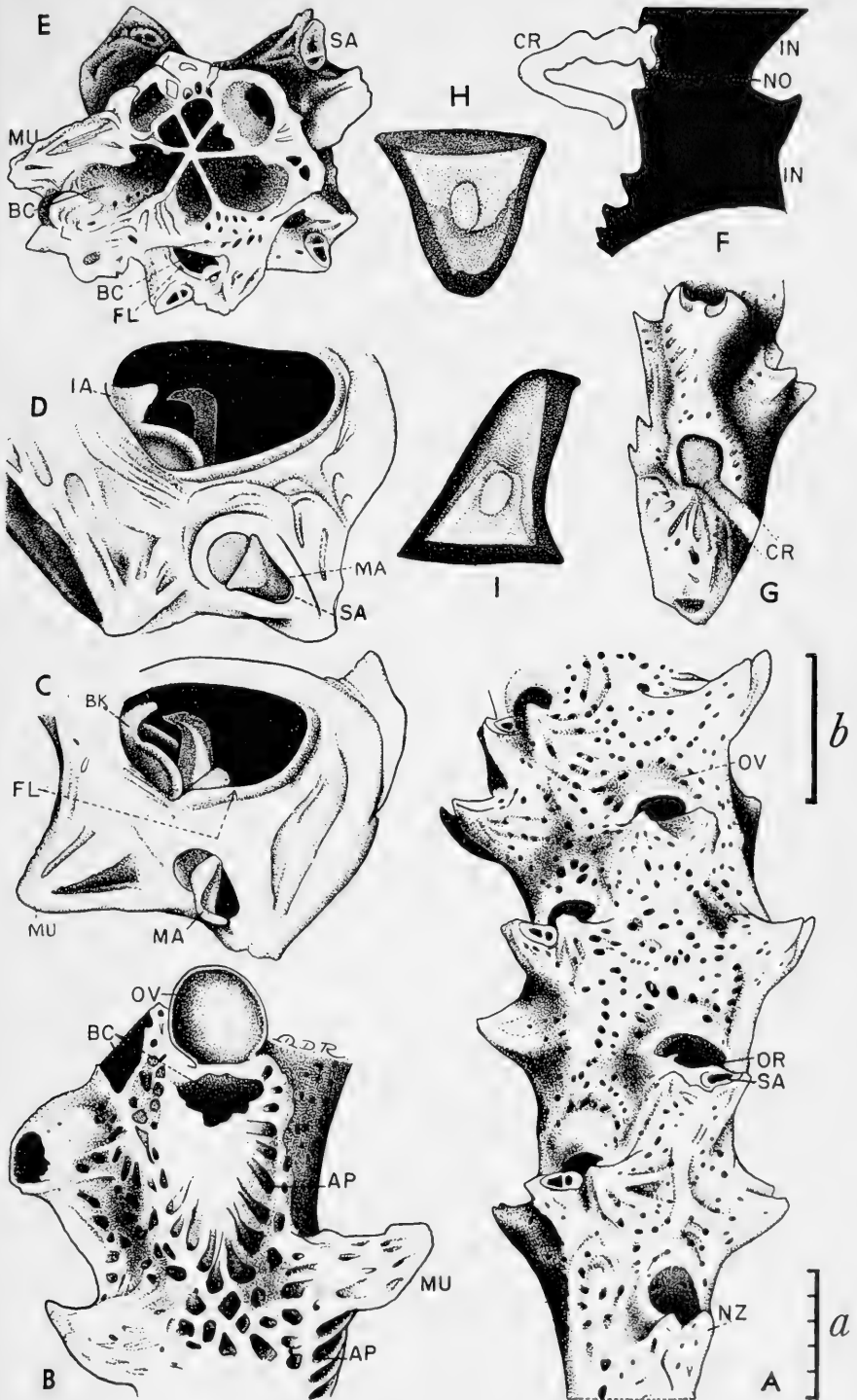
FIGURE E: Top end view of a sprig, showing two tiers of zooecia. Areolar pores are visible on the sprawling zoid at left. Scale *a* of plate 12.

FIGURE F: Part of a sprig which had a "node" and a chitinous rootlet. Scale *a* of plate 12.

FIGURE G: Base of a fragment with broken-off radicle fiber or rootlet; above that a zoid with two external avicularia, an uncommon condition. Scale *a* of plate 12.

FIGURE H: Mandible of an external avicularium. Scale *b*.

FIGURE I: Mandible of an internal avicularium. Scale *b*.



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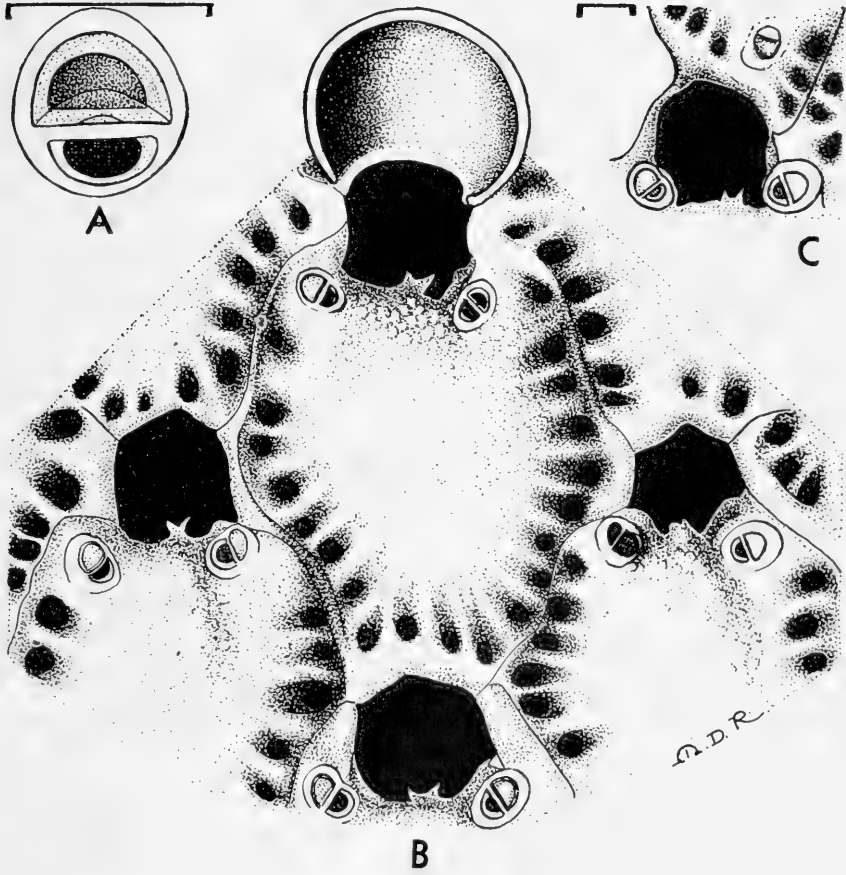
PLATE 19

Umbonula dentata (Waters)

FIGURE A: Avicularium from side of orifice. Hemispherical mandible is lightly stippled and posterior membranous area is blacked in heavily. Drawn to the 0.1 mm. scale above.

FIGURE B: Orifice of four zooids, one of them ovicelled. Ovicell incomplete, immature. Bifid denticle and the pair of avicularia at orifice corners are the species' characteristics. Drawn to the 0.1 mm. scale at upper right.

FIGURE C: A damaged or incomplete frontal avicularium, with mandible deeply immersed, distal to the zoocial orifice, on the next zooid. Same scale as figure B.



EXPLANATION ON OPPOSITE PAGE

PLATE 20

Mucronella crozetensis (Waters)

FIGURE A: Three zooecia. The peripheral frontal pores, one or two rows, have been enlarged a bit to show them better. Usually they are mere slits, like tiny pin-pricks. Scale *c*.

FIGURE B: A lyrula of three points and a flat plane where the straight line is. Thickened centrally and longitudinally. Scale *e*.

FIGURE C: Peristomial fragment, with bases of two hollow hyaline spines. Scale *e*.

FIGURE D: A calcareous zooecium seen from underneath. The heavy black dots above orifice are spine bases. The heavily stippled radiating canals, yellow or brownish and membranous in actual specimens, connect the mostly torn off membranous base of this zooecium with neighboring zooecia. Scale *d*.

FIGURE E: An ovicelled zoid with 8 peristomial spines. Ovicell slants back from the peristome. Zooecial peripheral pores shown at sides. Scale *b*.

FIGURE F: Another ovicell, uncalcined and tipped forward to show the very long and pointed suboral mucro that characterizes young zooecia. The lateral peristomial rim was too obscured and vague to show if and how many peristomial spines were present, so the rim was left unadorned. Other zooecia of the same colony had spines. Scale *a*.

FIGURE G: Another ovicelled zoid showing texture of the frontal, peripheral pores, and the proportion and position of the ovicell with respect to rest of zoid. Scale *c*.

FIGURE H: Side view of 3 uncalcined zoids and the membranous (cross-hatched) base of a fourth surrounded by a calcareous rim. The membranous canals or interzooecial connections shown in figures D and K pass through this calcareous border to neighboring zoids. Scale *f*.

FIGURE I: Peristome, secondary orifice, 7 oral spine bases, and a split 5-point lyrula, seen from the outside. Scale *a*.

FIGURE J: Primary and secondary orifices, 8 oral spine bases, and a 4-point lyrula, seen from the inside. Scale *a*.

FIGURE K: Enlargement of the membranous base canals, such as shown in figure D, where the corners of 3 zooecia meet. The 2 lateral zooecia show the canals constricted at the zooecial distal halves. Canals of the proximal corner (upper middle zoid) are not constricted. Scale *g*.

NOTE: Figures F and H are from natural unremoved specimens; the others are from calcined and slide-mounted material. Figure F is of material from Station 44, figures E and G from rock at Station 184; all others from "Rock 7," station unknown. Each scale represents 0.2 mm.

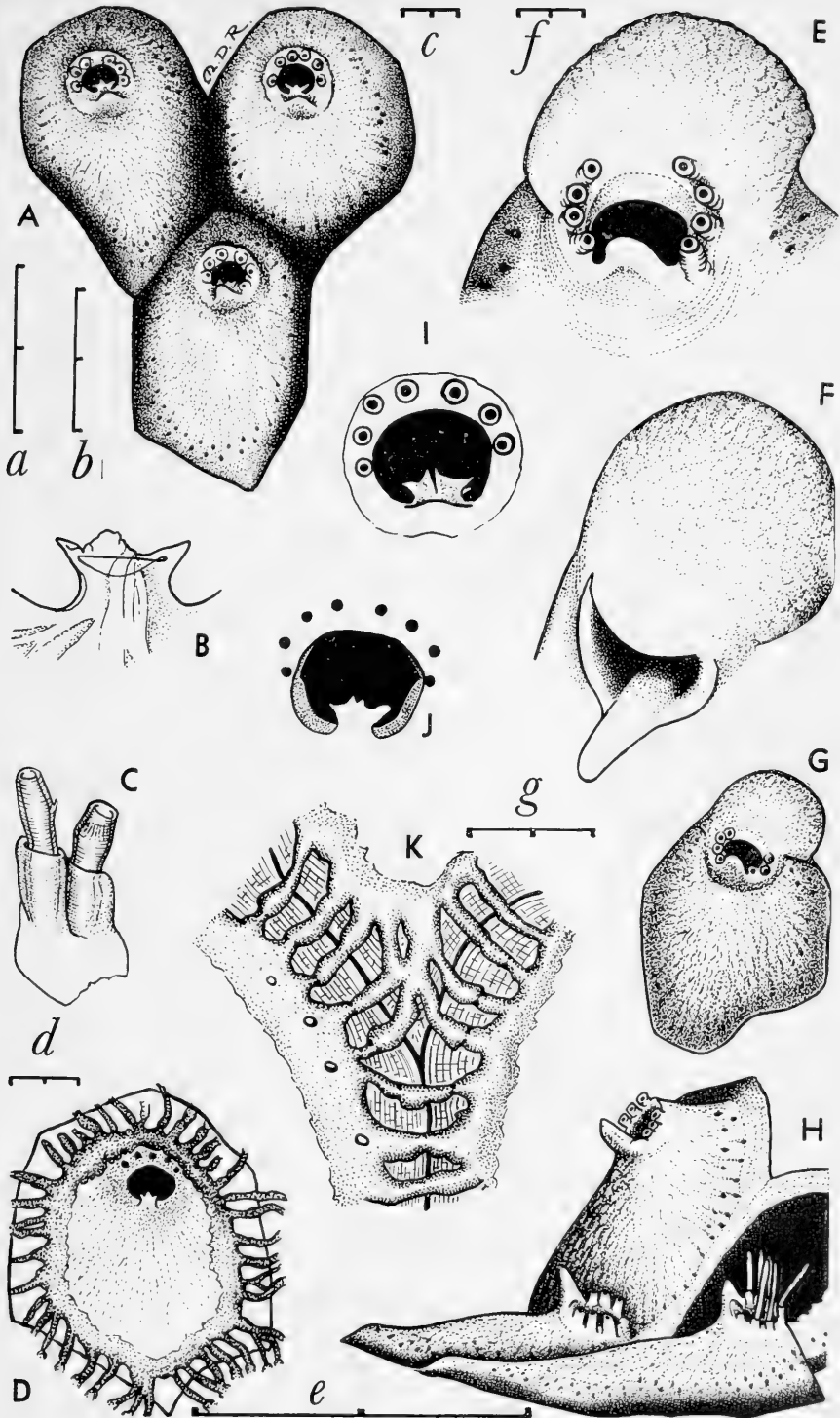


PLATE 21

Parasmittina hymanae, new species

FIGURE A: Primary and secondary orifices showing cardelles, mucro, and lyrula. Drawn to the 0.1 mm. scale at right.

FIGURES B and C: Two frontal avicularia showing variations in shape and proportions. Same scale as figure G.

FIGURE D: Ovicelled and nonovicelled zoecia. Zoecium at left shows the flat upright mucro bordered by a peristomial sinus on each side. Avicularium at left belongs to a neighboring zoecium. Ovicelled zoecium has an avicularium in typical position covering an areolar pore. Ovicell bordered by areolar pores which do not pierce its inner wall. Cardelles do not show. Peristome complete distally in nonovicelled zoecia but incomplete in ovicelled ones. Drawn to the 0.2 mm. scale below.

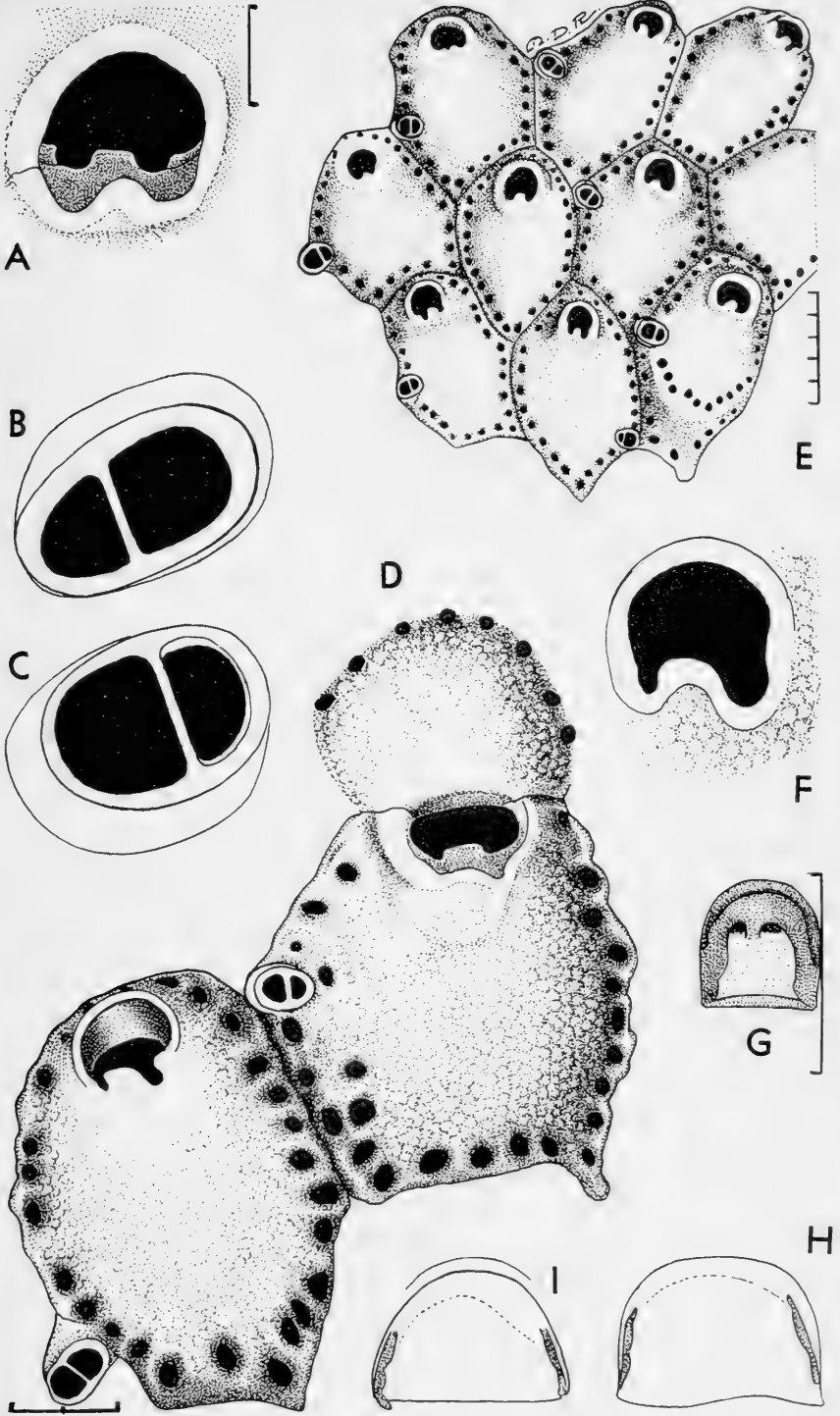
FIGURE E: Ten nonovicelled zoecia, some with avicularia, some without. The two rows of areolar pores on the zoid at lower right show regeneration or a second growth after something had interrupted the initial effort. The avicularia always occupy a lateral, peripheral, and corner position over an areolar pore. Drawn to the 0.5 mm. scale at right.

FIGURE F: Secondary orifice and surrounding beaded surface. Same scale as figure A.

FIGURE G: Mandible. The two darkest patches are sites for muscle attachment. The stippled pointed projection between them is missing in younger mandibles and is merely a case of advanced chitinization. Drawn to the 0.1 mm. scale at right.

FIGURES H and I: Two opercula of slightly differing shape. Same scale as figure A.

NOTE: Figures A-F are from a calcined specimen (slide) of Station 184 material. Figures G, H are from "Rock 19" and figure I from "Rock 8", stations unknown.



EXPLANATION ON OPPOSITE PAGE

PLATE 22

Rhamphostomella bassleri, new species

FIGURE A: Ovicelled zoocidium with two central frontal avicularia in addition to the customary oral one. Above it is part of a zoocidium that has a single frontal avicularium in the lower position. Note the two small, round pores generally associated with the oral avicularial chamber, below and to the back of it. Drawn to the 0.3 mm. scale at left.

FIGURE B: Nonovicelled zoocidium with two frontal avicularia in still different positions. Only the secondary orifice shows in this as well as in figures A and C. Same scale as figure A.

FIGURE C: Another zoocidium with two frontal avicularia placed very proximally. The oral avicularium faces in the opposite direction from the preceding two figures. Same scale as figure A.

FIGURE D: Side view of two zoocidia; lower one with the oral avicularium facing observer, upper left one with the avicularium also mounted on a mucro but facing away from observer with only the mucro showing. Same scale as figure A.

FIGURE E: Looking down into the primary orifice of a zoid. Upper left part of primary orifice is obscured by a growing peristome. Lyrula and cardelle are typical. Oral avicularium is just below the lyrula, externally. Drawn to the 0.2 mm. scale at left.

FIGURE F: Oral avicularium with open mandible obstructing the secondary orifice. Same scale as figure G.

FIGURE G: Oral mandible. Drawn to the 0.1 mm. scale at right.

FIGURE H: Operculum flattened out. Same scale as figure G.

FIGURE I: A smaller oral mandible showing the typical tip curvature. Same scale as figure G.

FIGURE J: Another small oral mandible. Drawn to the 0.1 mm. scale at right.

FIGURE K: Frontal avicularium. Mandible heavily outlined. Drawn to the 0.1 mm. scale at right.

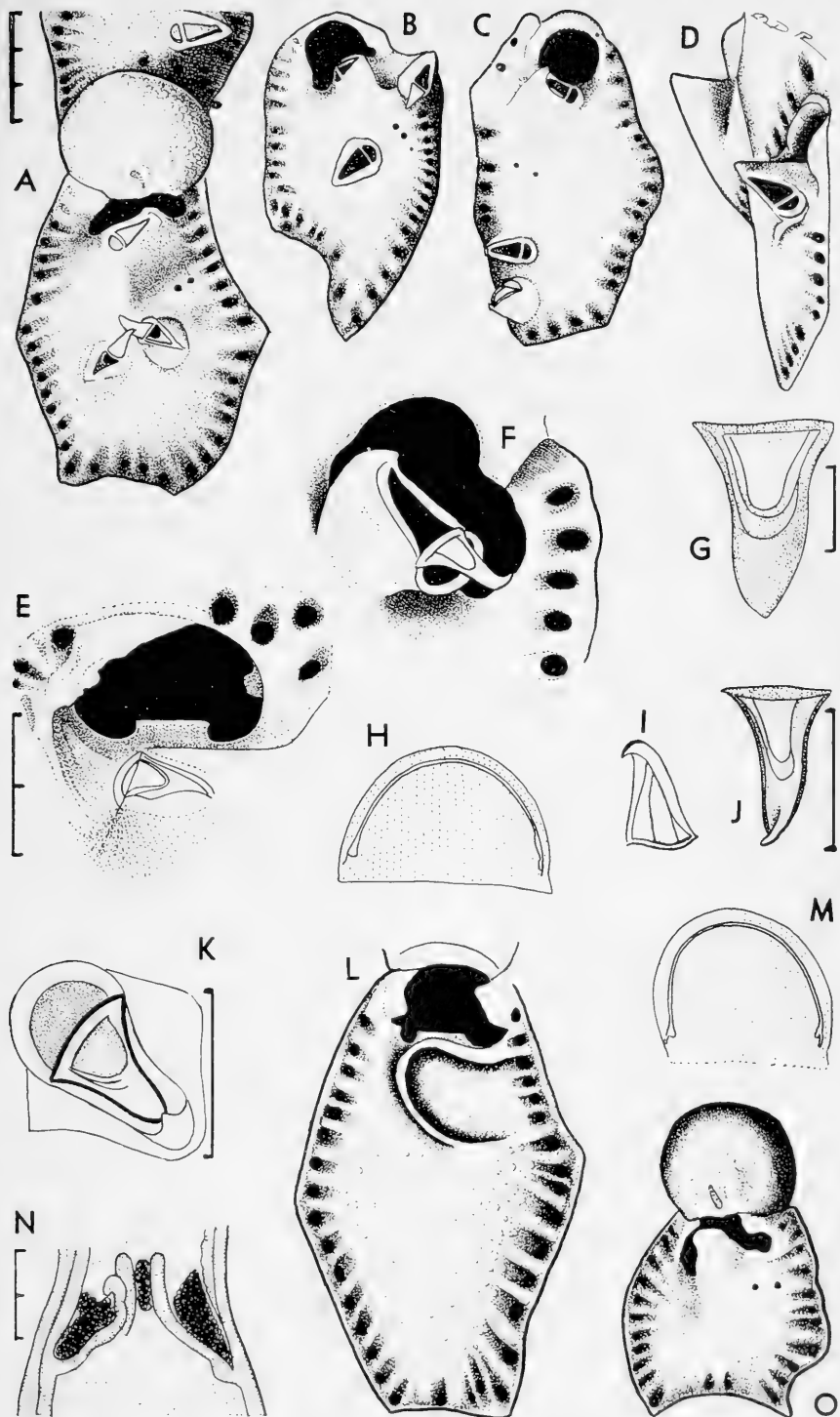
FIGURE L: Nonovicelled young zoid showing part of the primary orifice, the growing lateral wings of the peristome and the beginning of the unilateral oral avicularial chamber. Same scale as figure N.

FIGURE M: Another operculum, not flattened out but in normal position on zoid. Lower border of membrane is indefinite. Same scale as figure G.

FIGURE N: Interzoocial distal wall, somewhat inverted V-shape. Cellular debris (dark material) found in a number of zoids in adoral chambers. Drawn to the 0.2 mm. scale at left.

FIGURE O: Ovicelled zoid without any frontal avicularium. Oral avicularium hidden by position of the mucro. Secondary orifice typical. Low oval frontal pit or depression present on some of the ovicells. Same scale as figure A.

NOTE: Figures A, B, C, and O are from paratype colonies encrusting "Rock 3." Figures D-N are from free foliaceous holotype colony from Station 190.



EXPLANATION ON OPPOSITE PAGE

PLATE 23

Smittina abditavicularis, new species

FIGURE A: Dorsal, attached wall of several zoids. Zoid walls are sharply defined in contrast to the frontal surface as seen in figure D. Drawn to the scale at left.

FIGURE B: A cross section through three zoids. Frontal wall is at top, dorsal wall at bottom. Zoocelial cavity shown in solid black. Middle zoid is cut through the peristomial region with the interzoocelial communicating pores exposed. Multiporous plate at extreme left still has its four small pores intact. The peristomial lining is shinier and smoother than rest of zoocelial wall. Drawn to the scale above.

FIGURE C: Enlargement of orifice region. Thin salient mural rims converge toward the clithridiate secondary orifice. Frontal wall (tremocyst) is porous, beaded, and thick. Drawn to the scale at left.

FIGURE D: Small area of colony showing fused frontal wall of a number of zoids. Here and there raised mural rims can be seen, especially about orifice. Where mural rims are obliterated zoocelial boundaries can be identified because marginal frontal pores are often slightly larger and more in alignment than those elsewhere. Drawn to the scale at left.

FIGURE E: A cross section through the peristome, looking down on the primary orifice, shown in black, which is bordered by a small median lyrula and two broad cardelles. Between the lyrula and secondary orifice, in the peristomial floor, is the obliquely oriented median oral avicularium, the exact boundaries of which are shown somewhat indefinitely. Same scale as figure C.

FIGURE F: Lyrula and cardelles from inner, dorsal aspect. Black area is the primary orifice. Drawn to scale at left.

Figure G: Somewhat lateral view of peristomial canal and primary orifice (in black) toward which the small lyrula and one big cardelle point. Oral avicularium diagrammatic because its beak shape could not be seen too clearly. Secondary orifice to left of avicularium. Same scale as figure F.

FIGURE H: Primary orifice, lyrula, and cardelles. Cardelle at left damaged and incomplete. Same scale as figure F.

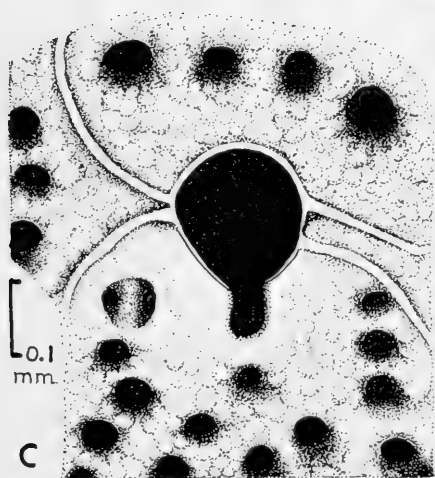
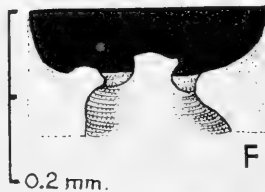
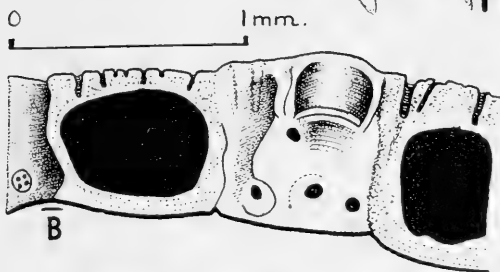
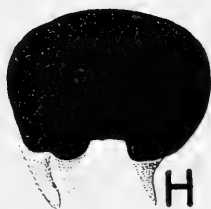
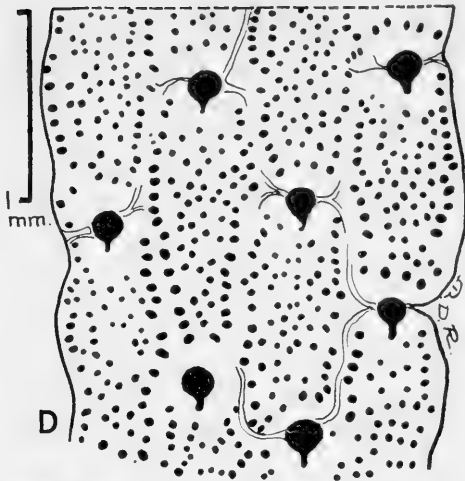
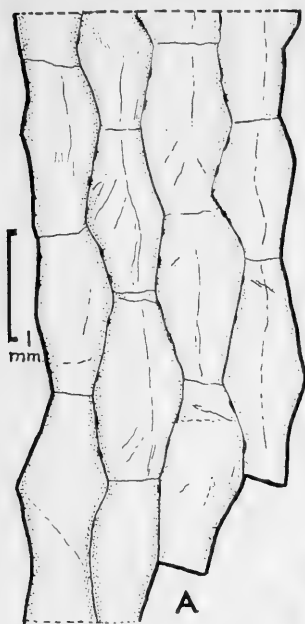


PLATE 24

Smittina alticollarita, new species

FIGURE A: Primary orifice with a young lyrula that is narrower than the ordinary lyrula, and the usual tall cardelles. Peristome not yet fully developed in height. From holotype colony. Drawn to the scale below figure F.

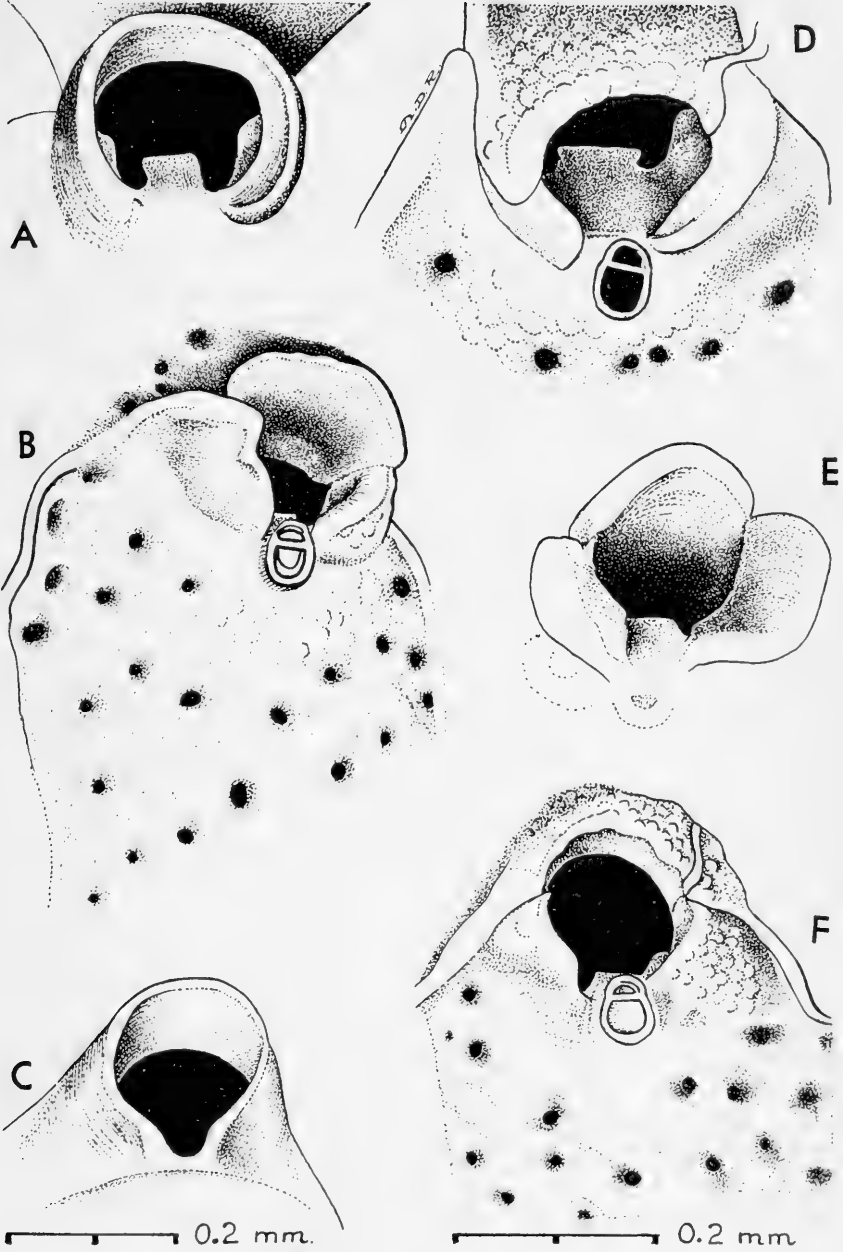
FIGURE B: Upper part of a zoid from the same colony; peristome trilobate and elevated; avicularium in characteristic position in peristomial gap. Same scale as figure C.

FIGURE C: A very young, unthickened peristome, pear-shaped secondary orifice, and peristomial sinus. From holotype. Drawn to the scale immediately below.

FIGURE D: Older zoid from the same colony, having wider lyrula, a tall cardelle, and an oral avicularium. The right third of the peristome is beginning to flare out. Drawn to the scale below figure F.

FIGURE E: Flared, elevated, trilobate peristome of paratype. The primary orifice is not pictured exactly because it was debris-choked. Two faintly defined hemispherical structures (?), one below the peristomial gap and the other to one side (dotted), occur on a single paratype zoid but are so vaguely defined that it is not possible to tell if they are avicularia or merely worn, roughened parts of the frontal. In all other respects the paratype agrees with the holotype. Drawn to the scale below figure F.

FIGURE F: Another zoid from the holotype colony showing a wider peristomial gap than in figure C. Same scale as figure C.



EXPLANATION ON OPPOSITE PAGE

PLATE 25

Smittina canui, new species

FIGURE A: A young zoid tipped forward to show the lyrula and avicularium. Mandible in place. Peristome incomplete as yet on left side, exposing avicularial tip. Scale *a*.

FIGURE B: Most typical shape of mature secondary orifice. Lyrula broad. Beak tip of avicularium not fully exposed. Scale *b*.

FIGURE C: Young primary orifice showing part of one cardelle and the wide lyrula. Avicularial chamber has not yet formed on this individual, which is at the growing edge of the colony. Scale *a*.

FIGURE D: Somewhat lateral view of young ovicelled zoid. Mandible in place on avicularium. Distinct transverse groove associated with development of avicularial chamber still shows on this zoid just below peristome. Groove becomes obliterated externally in older zoids due to increasing calcification. Peristome has not yet encroached upon sides of ovicell (cf. figure E). Scale *a*.

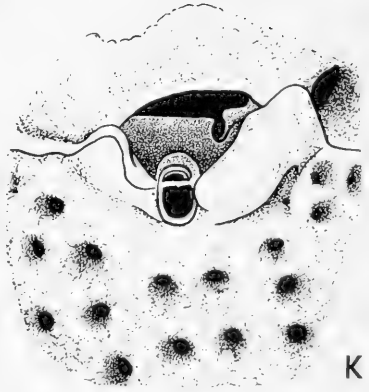
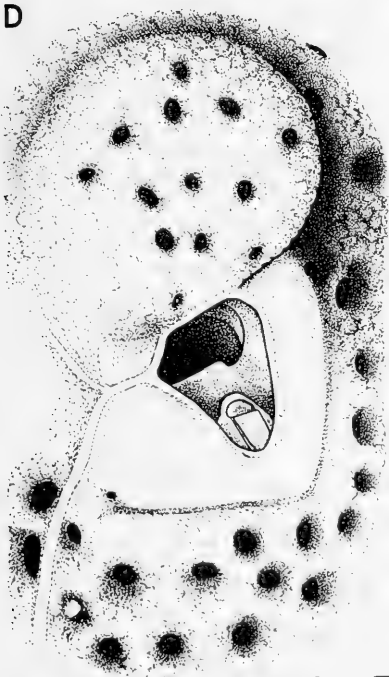
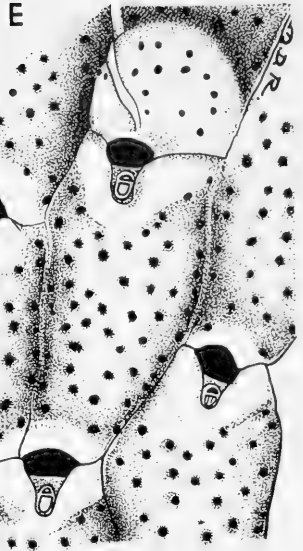
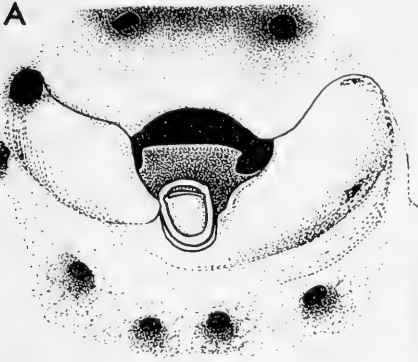
FIGURE E: Growth habit. One zoid ovicelled. Ovicell marked by a raised mural rim growing over it. Some ovicells show this feature, others do not. Left bottom zoid has two zoid rows arising from it while right zoid has one. Scale *c*.

FIGURE F: The secondary, heavily calcified, smaller, somewhat misshaped aperture of an old zoid. Scale *b*.

FIGURE G: Operculum. Scale *a*.

FIGURES H, I, J: Secondary orifices, variations in shape and size. The two lines extending from each are mural rims or zoecial boundaries. Scale *b*.

FIGURE K: Orifice of another young zoid tipped to show one cardelle and part of the lyrula. The orifice is a bit lopsided because the peristome is not yet symmetrically completed. Avicularial chamber groove still present. Supporting the avicularium is a small curved raised ledge, seemingly tilted forward. Scale *a*.



0 a 0.2 mm. 0 b 0.2 mm. 0 c 0.2 mm.

EXPLANATION ON OPPOSITE PAGE

PLATE 26

Smittina exertaviculata, new species

FIGURE A: Note convexity of frontal and protrusion of peristome and avicularium. Drawn to adjacent scale.

FIGURE B: Primary and secondary orifices. The broad lyrula and one cardelle show deep into orifice. The distal third of peristome wall formed by distal zooecium. Drawn to adjacent scale.

FIGURE C: Secondary orifice of nonovicelled zoid showing avicularium dipping down a bit past the peristome. Same scale as figure F.

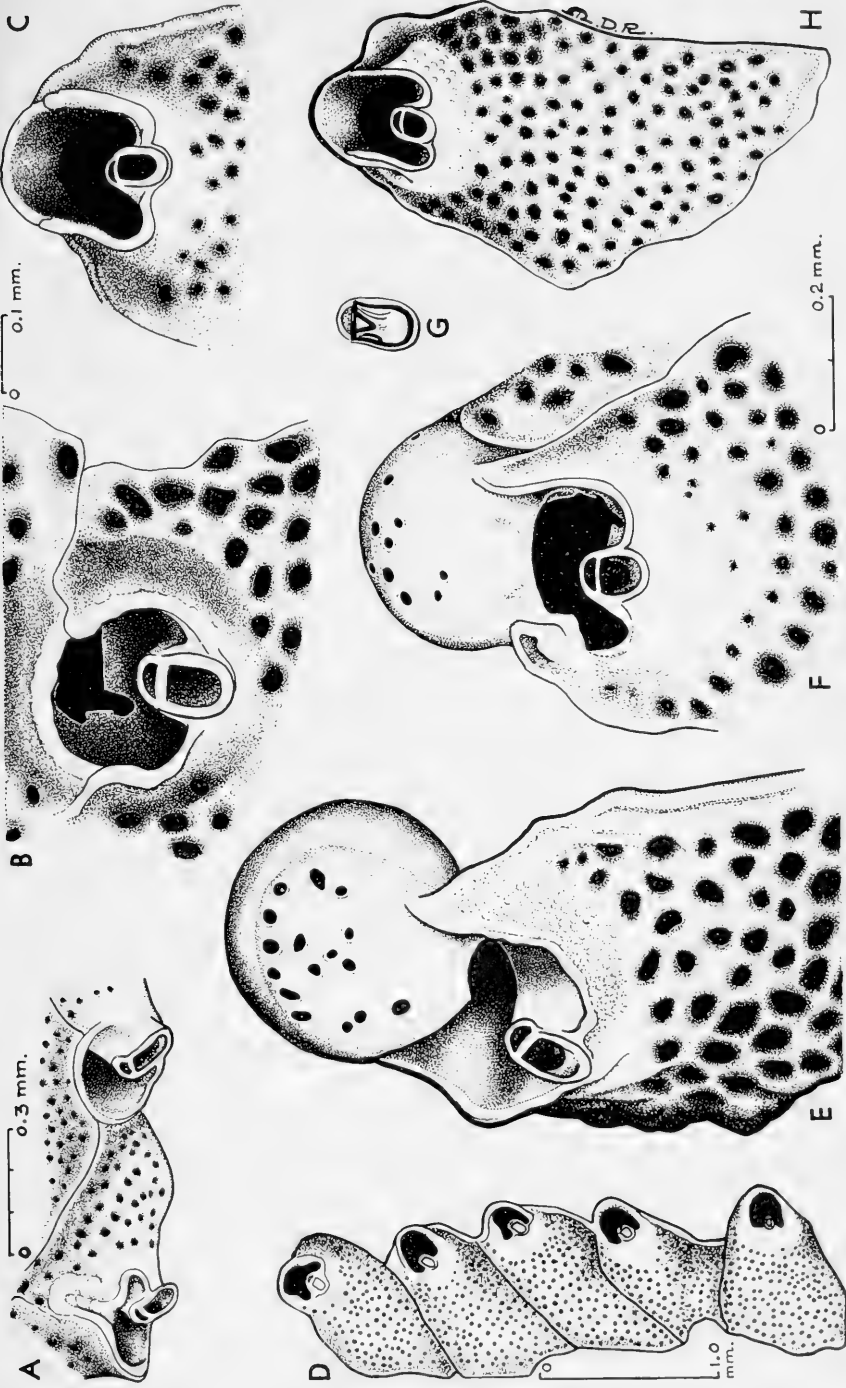
FIGURE D: Growth habit of 5 nonovicelled zooecia showing elevation of the peristomial area, the protruding avicularia, and the dense porosity of the frontal. Drawn to adjacent scale.

FIGURE E: Side view of an ovicelled zoid. The characteristic "break" of the avicularial face into two different planes at the pivot (transverse bar) is evident, as is also the gently rounded ridge that leads from the avicularium toward the primary orifice. The crescent-shaped, peripheral, nonporous part of the ovicell wall is a bit thicker than the porous part. Ovicells on the paratype are more encrusted, especially in the peripheral area, than on the holotype here shown. Same scale as figure B.

FIGURE F: Another ovicelled zoid, drawn from a different angle, is tipped too far back to show the thicker, nonporous peripheral ovicell wall. Peristomial wings encroach upon the ovicell sides. One corner of lyrula barely visible. Drawn to adjacent scale.

FIGURE G: A spatulate mandible in place on avicularium. Same scale as figure B.

FIGURE H: A nonovicelled zooecium drawn in its entirety. The avicularium does not extend down quite as far in this zoid as in figures A-C. Same scale as figure A.



EXPLANATION ON OPPOSITE PAGE

PLATE 27

Smittina obicullata, new species

FIGURE A: An old zooecium. Ovicell is partly overgrown by a secondary calcified layer which encroaches first laterally, then more distally across the ovicell. Higher elevation of suboral avicularium above the rest of frontal surface is difficult to show in a frontal view. From Station 234. Drawn to the scale between this figure and figure F.

FIGURE B: Freehand view of an ovicelled zooecium, from the side. The globose, porous ovicell at left is being encroached upon at the sides by secondary calcification. Collared peristome projects forward and upward, with sinus forming a wide gap in it frontally above the avicularium. Avicularium is on a small plateau of varying elevation above the rest of porous front. Mandibular area approximately parallel with the zooecial base.

FIGURE C: Six zooecia of holotype colony from Station 190 showing four zooecial possibilities or conditions: zooecia with or without ovicells or avicularia. Peristome variable but above the avicularium. Drawn to scale at left.

FIGURE D: An operculum with two lateral sclerites for muscle attachment. From Station 226. Same scale as figures A and F.

FIGURE E: Mandible. Darker parts are more heavily chitinized than paler parts. Mandibular pivot shown in white across top. From Station 226. Drawn to the scale directly above.

FIGURE F: Oblique view of an operculum and one bundle of muscle fibers attached to the sclerite region. Second muscle bundle is broken off and its stub is at lower right. From Station 226. Drawn to the scale at left.

FIGURE G: Bilaminar holotype colony. Drawn to the scale at left.

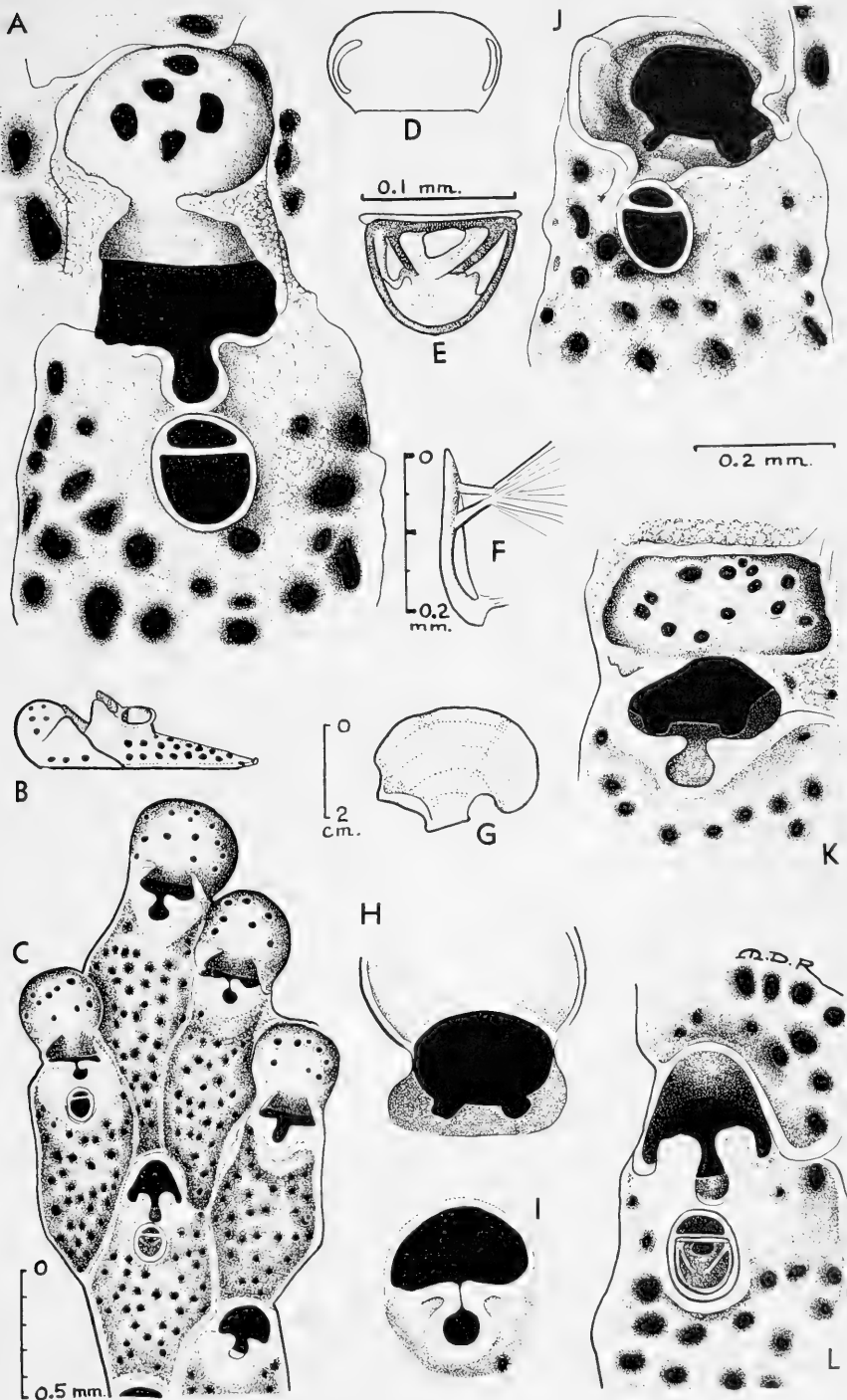
FIGURE H: Primary orifice and unfinished ovicell of a young holotype zoid. Same scale as figure J.

FIGURE I: Secondary orifice of a young holotype zoid. Here the peristomial wings nearly touch above the sinus (cf. sinus in figures A, J-L). Same scale as figure J.

FIGURE J: Old zooecium with worn-down peristome, from same calcined colony as figure A; tipped to show primary orifice, lyrula and cardelles. Drawn to the scale below.

FIGURE K: Ovicelled zooecium showing increasing secondary calcification at lower corner and distal surface of the ovicell. Zoid and ovicell are in a colony concavity so ovicell frontal seems proportionately much shorter than those of figures A and C. From holotype. Drawn to scale above.

FIGURE L: Zoid with unusually tall peristomial wings and a mandible in place on avicularium. From holotype. Same scale as figure J.



EXPLANATION ON OPPOSITE PAGE

PLATE 28

Smittina oblongata, new species

FIGURE A: A zooecium showing height of upright peristomial collar and depth of its wide notch. Zooecium tipped away from the observer so wide inner tooth or lyrula is not visible from this angle. Scale *c*.

FIGURE B: Shallow, spatulate, suboral avicularium. Drawn to scale *d*.

FIGURE C: Four zooecia, one with suboral avicularium in typical position and orientation. Number, size, and distribution of frontal pores depend on degree of zoid calcification. Scale *b*.

FIGURE D: Sterogram of two zooecia, seen from the side. Back wall (heavily stippled, to left) is flat and thin; side wall, also thin, has pores, 4 belonging to upper zoid, 5 to lower. Sides of frontal wall are roughened or lined irregularly. Scale *a*.

FIGURE E: Ovicelled zooecium. This figure is incomplete and imperfect because lower part of ovicell, orifice, and peristomial area were obscured by debris, indicated by the cross-hatching over that area. Also, zooecium was at a broken-off edge of the colony and ovicell had lost part of its secondary calcification layer. Scale *c*.

FIGURE F: Primary orifice, median lyrula, and two wedge-shaped cardelles. Scale *d*.

FIGURE G: Zooecium with heavily calcified peristome, deeply located lyrula, wide peristomial notch or sinus. Scale *d*.

FIGURE H: Cross section through a zooecium showing relative thickness of walls. Basal and side walls are thin, frontal wall thicker, mural rim or border thin and raised. Zooecial cavity shown in black. Scale *c*.

NOTE: Figures A, D-H are from paratypes; B, C from the holotype.

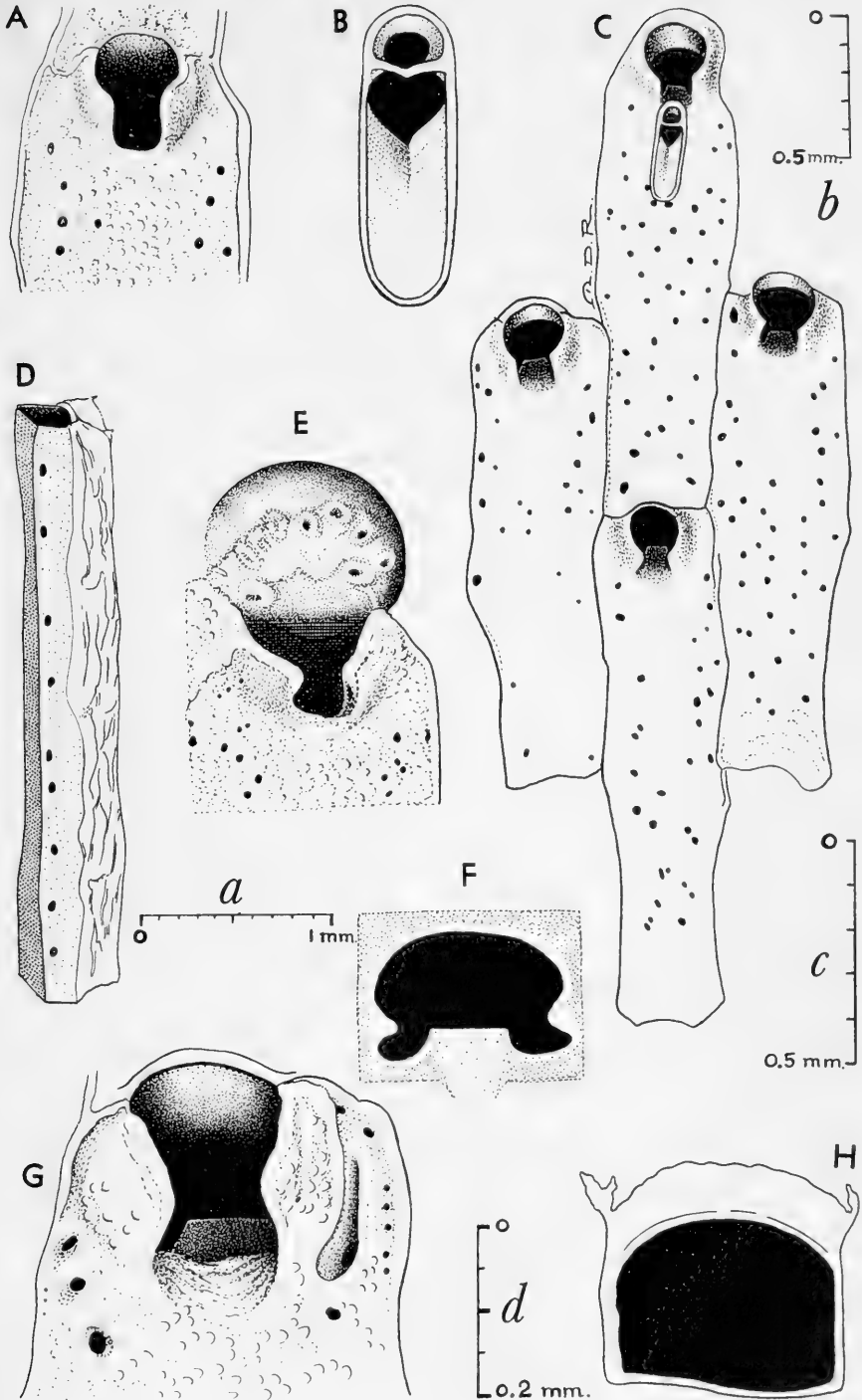


PLATE 29

Smittina ordinata (MacGillivray)

FIGURE A: Side view of two zooids. Protrusion of peristome and ovicell rim is characteristic. Drawn to scale at left.

FIGURE B: Zoecium tipped forward to show lyrula, cardelles, and oral avicularium. Drawn to scale at left.

FIGURE C: Operculum. Same scale as figure D.

FIGURE D: Another operculum from the same colony. Drawn to scale below.

FIGURE E: Colony, showing ovicelled and nonovicelled zoecia. Drawn to scale at left.

FIGURES F-I: Range of secondary orifice variation in the same colony. Oral avicularium is present in the first three but does not show because of angle at which viewed. Perhaps the most typical orifice is figure G. All drawn to scale below.

FIGURE J: An anomaly, two oral avicularia, was found in two neighboring zooids. Same scale as figure B.

FIGURE K: Mandible. Same as figure D.

FIGURE L: Mandible and covering over the membranous back area of avicularium. Same scale as figure K.

FIGURE M: Young, recently formed zoid with narrower lyrula and no cardelles yet. Same scale as figure B.

NOTE: Figures C, D, K, and L are from Station 226 balsam slide preparations. The rest are from Station 240. Figures A and J are from uncalcined colonies, the remainder are from calcined material.

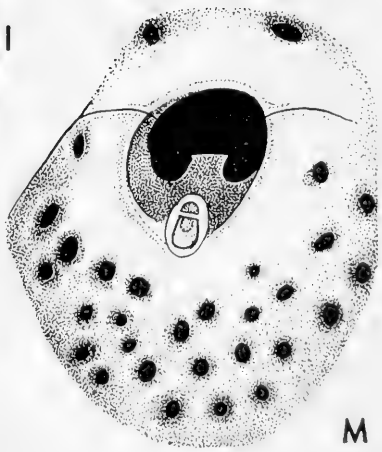
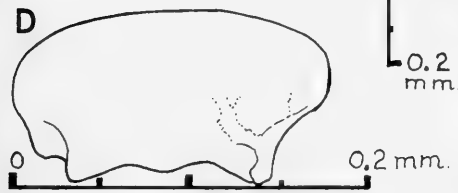
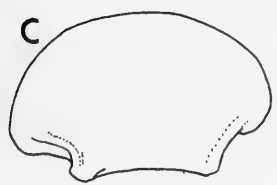
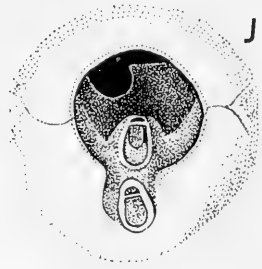
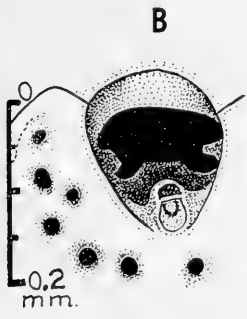
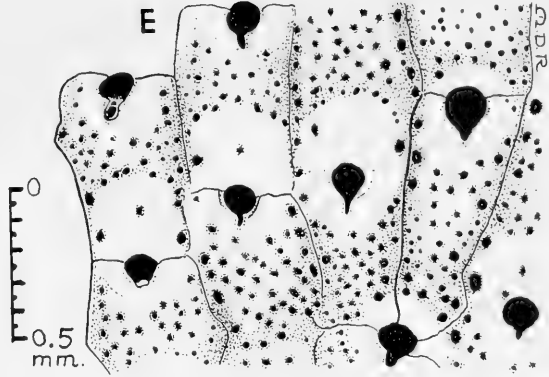
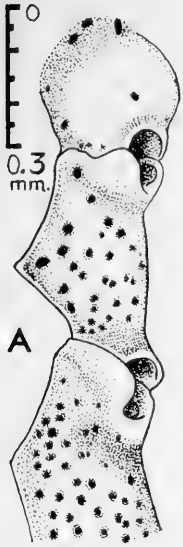


PLATE 30

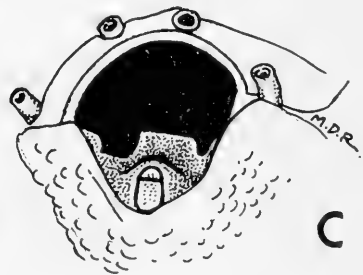
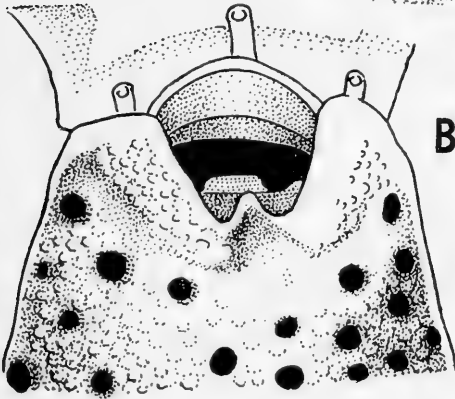
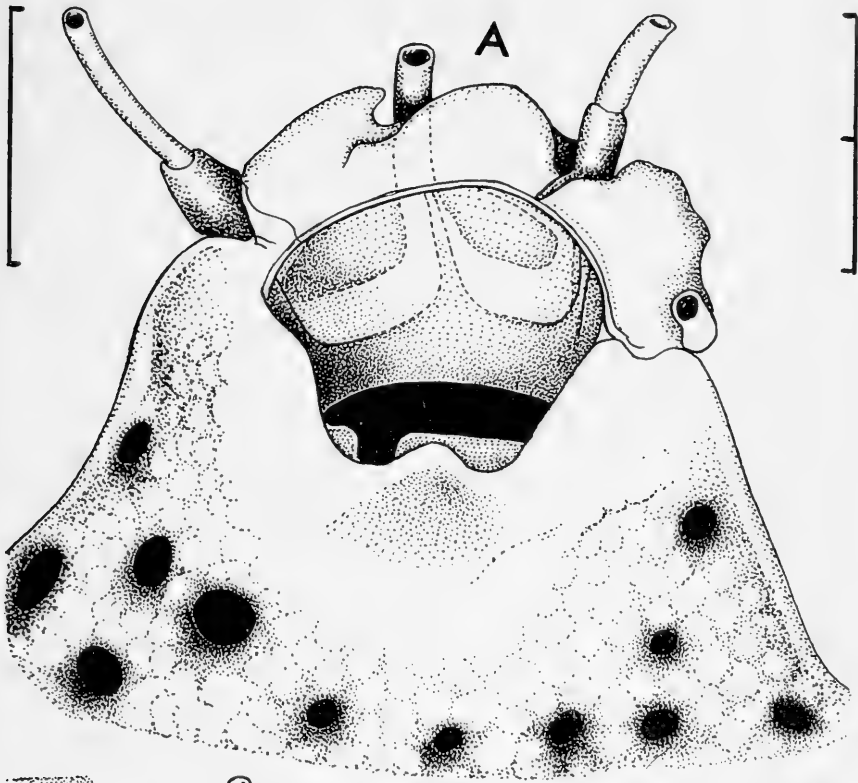
Smittina ordinata (MacGillivray)

FIGURE A: Very young zoid with four oral spines, lyrula, cardelle, and an incomplete peristome. The spine bases extend into the calcifying peristomial band at this still-transparent wall stage. Peristome incomplete proximally, lacking avicularium. Triangular ledge against which the avicularium would have rested is in front of the lyrula. Drawn to the 0.1 mm. scale at upper left.

FIGURE B: Another young zoid but with three spines, lyrula, cardelle, and frontally incomplete peristome. Avicularial chamber develops in shaded frontal area under the incurved triangular peak. Drawn to the 0.2 mm. scale at upper right.

FIGURE C: Another young zoid, with four spines and oral avicularium. The latter leans against the triangular oral process shown in preceding figures. Same scale as figure B.

NOTE: The material figured on this plate is from Station 226.



EXPLANATION ON OPPOSITE PAGE

PLATE 31

Smittinella rubrilingulata, new species

FIGURE A: The peristomial sinus, its two supporting ledges, lyrula, and small triangular ante-lyrula process (support for a probable future avicularium?). Drawn to the 0.1 mm. scale at right.

FIGURE B: Tangential view of secondary orifice, peristome, sinus and one of its supporting ledges. Drawn to the 0.1 mm. scale at left.

FIGURE C: Inside view of the lyrula, the reddish ante-lyrula triangular process, the two lateral supporting peristomial ledges, and (blackened-in) peristomial sinus. Same scale as figure A.

FIGURE D: Three zooecia and ovicell. Drawn to the 0.3 mm. scale at left.

FIGURE E: Side view of peristome and sinus. Same scale as figure B.

FIGURE F: Another inside view of the lyrula, lateral peristomial ledges, ante-lyrula process, and porous frontal. Same scale as figure B.

FIGURE G: Looking into the primary (blackened-in) and secondary orifices. Lyrula in the background. Same scale as figure B.

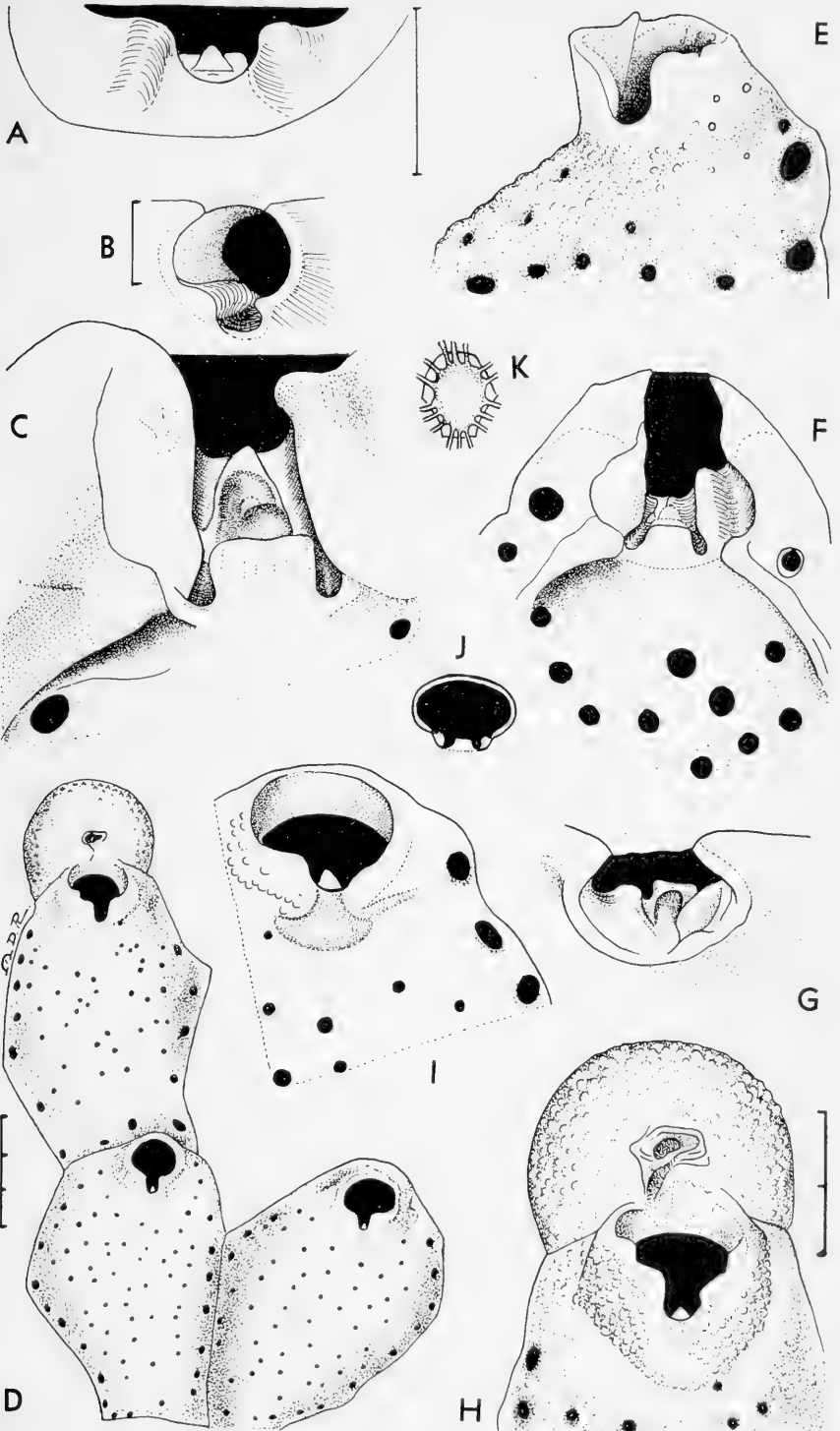
FIGURE H: Ovicell and peristome detail. Drawn to the 0.2 mm. scale at right.

FIGURE I: Detail of peristome, possible avicularial chamber? (the stippled, axe-shaped central area), and its ante-lyrula tip. The tip is usually a deep rose color, i. e., the most intense color of the zoid is concentrated about this tip, inside the orifice. Peripheral pores are generally somewhat larger than the other frontal pores. Same scale as figure B.

FIGURE J: Freehand, reconstructed diagram of primary orifice as seen from the inner surface. Distal vestibular arch is a larger ellipse than the proximal part housing the lyrula. The two knobs at the corners are not cardelles but the ends of the supporting peristomial sinus ledges.

FIGURE K: Freehand diagram of undersurface of a zooecium, showing exact distribution of membranous interzooecial connections. These tubules are wider and less numerous than those of *Mucronella crozetensis* (cf. plate 20, figures D,K).

NOTE: The material figured on this plate is from Station 184.



EXPLANATION ON OPPOSITE PAGE

PLATE 32

Smittoidea evelinae (Marcus)

FIGURE A: One complete nonovicelled zooecium, parts of four other zooecia, and two ovicells, all well calcified. Drawn from calcined specimen from Station 230 to scale at upper left.

FIGURE B: The largest, hollow, trumpet-shaped colony from Station 234. On its inner surface are calcareous worm tubes and bryozoan colonies (as *Ramphonotus inermis*, etc.). Drawn to scale at left.

FIGURE C: Mandible from colony in figure B. Chitinous reinforcements in white, thinner parts stippled. Both the lower hemispherical mandible and upper membranous covering of the avicularial-back-membranous area are shown for size comparison. Drawn to scale at left.

FIGURE D: Primary and secondary crifices tipped forward to show relation of horizontal avicularium to lyrula and peristome. Gentle curvature of distal border not seen because of tipping. Drawn from material from Station 230 to the scale at right.

FIGURE E: Four zooecia and two incomplete ovicells of which only the inner lining shows. One to two rows of frontal alveolar pores are indicated. Drawn from the colony shown in figure A to the scale at upper left.

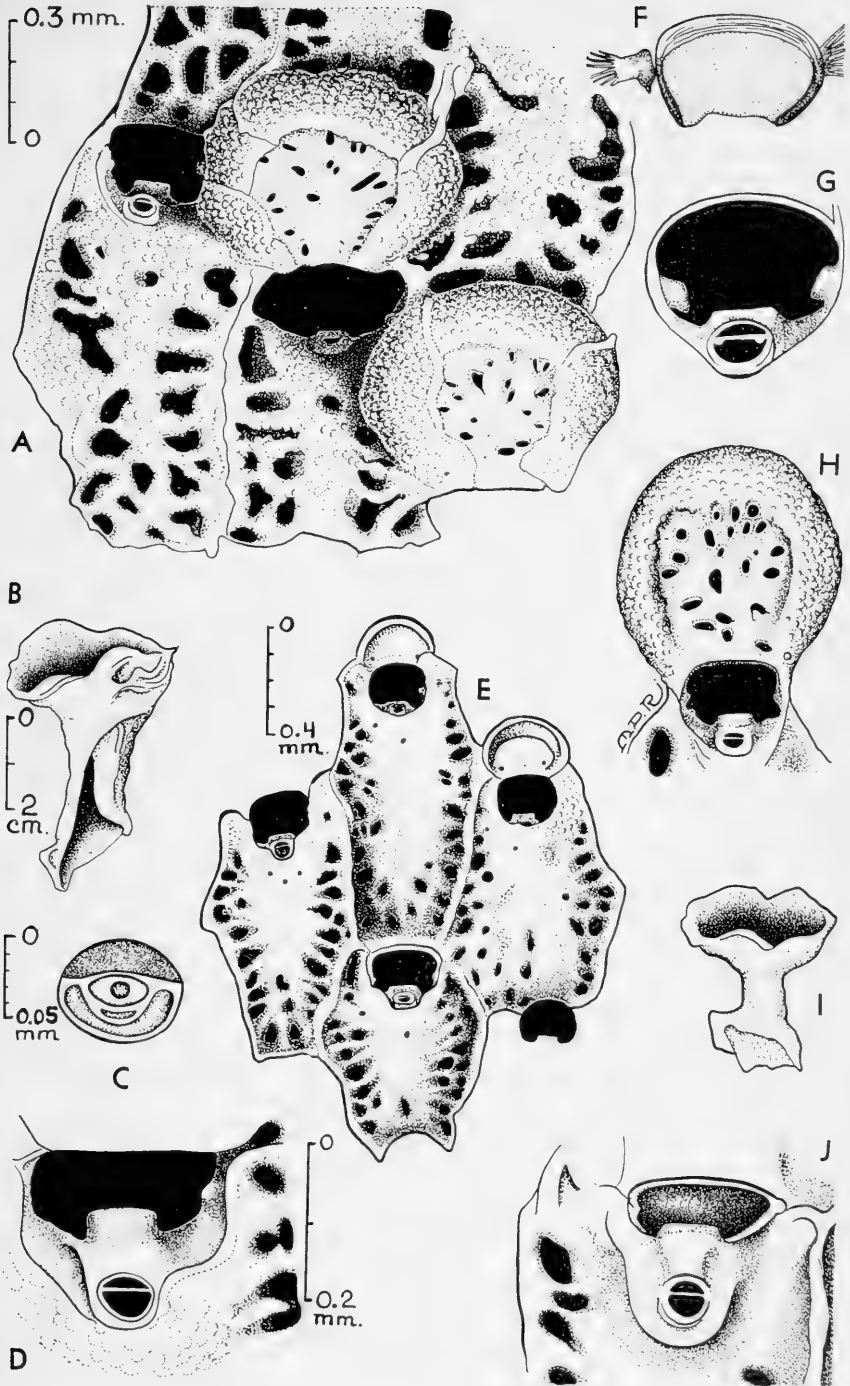
FIGURE F: Operculum, its marginal reinforcements and occlusor muscles. Drawn from colony shown in figure B to the same scale as figure D.

FIGURE G: Primary orifice, two cardelles, lyrula, and oral avicularium within bounds of the peristome. From colony shown in figure B. Same scale as figure D.

FIGURE H: Less heavily calcified ovicell than in figure A. Same scale as figure A.

FIGURE I: Another colony from Station 234. Its wide but thin, flattened stem is solid, the zooecia growing back to back, in bilaminate fashion. The unilaminar sides flare out into shape of a cup. Inside the cup grow *Ramphonotus inermis* and calcareous worm tubes. Same scale as figure B.

FIGURE J: Zooecium tipped forward to show lyrula, oral avicularium, operculum covering the orifice, and an extended platform on which the oral avicularium rests. This zooecium is tipped so far forward that the operculum (heavily stippled) is very foreshortened. Drawn from fragment from Station 234 to same scale as figure D.



EXPLANATION ON OPPOSITE PAGE

PLATE 33

Smittoidea ornatipectoralis, new species

FIGURE A: Ovicelled zoid tipped slightly forward to better depict the lyrula, cardelles, and primary orifice. Suboral avicularium is always close to peristomial notch, which is always between it and the lyrula. Drawn to scale at right.

FIGURE B: Nonovicelled zoid. Peristomial notch shows but the lyrula and cardelles are hidden behind it because zoid is not tipped forward. Drawn to scale at left.

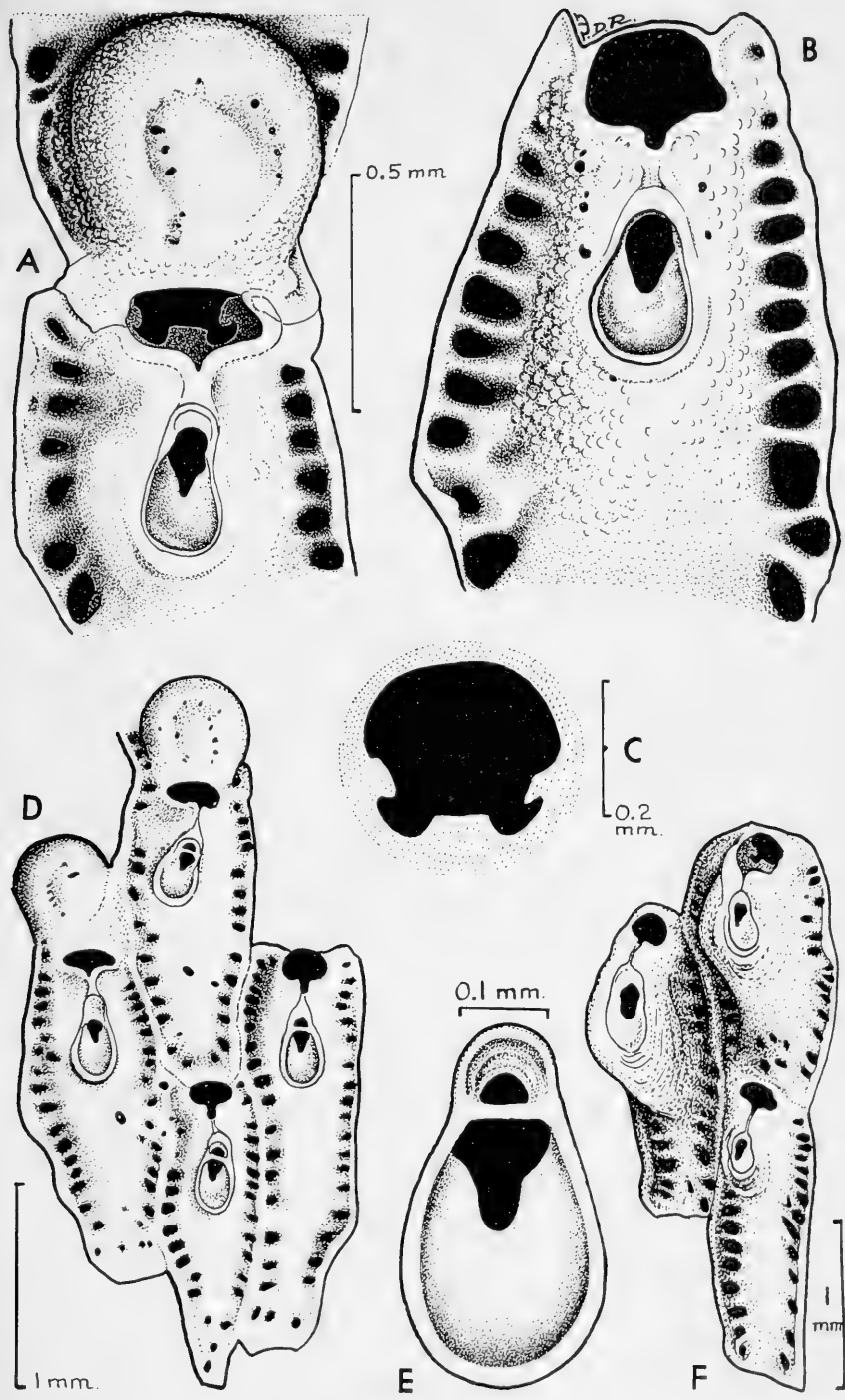
FIGURE C: Primary orifice (blacked in) with median lyrula and the two cardelles. Drawn to scale at right.

FIGURE D: Four zoids, two ovicelled, two not, with raised mural rims and large suboral avicularia. Drawn to scale at left.

FIGURE E: A suboral avicularium. The pivotal bar separates the very small nearly hemispherical membrane-covered area from the very large, broad, oval mandibular (beak) part. An extensive mandibular shelf forms a floor under most of beak. Floor buckles upward in central region then dips down like a trough peripherally; in other words, convex. This condition not shown here but is in figures A, B, and D. Drawn to scale above.

FIGURE F: Tangential view of three zoids with varying degrees of frontal wall protrusion in suboral avicularium region. Ordinarily, the mound bearing the avicularium is very small. Drawn to the 1 mm. scale at right.

NOTE: Figures A-E drawn from holotype from Station 45; figure F from calcined paratype from Station 44.



EXPLANATION ON OPPOSITE PAGE

PLATE 34

Smittoidea ornatipectoralis brevior, new subspecies

FIGURE A: One of the largest avicularia. Note the broad, short distal area and relatively longer pivotal bar in this subspecies as compared with the avicularia of the preceding form (cf. pl. 33, E). Drawn to scale at right.

FIGURE B: A chitin-reinforced mandible of one of the smaller avicularia. It measures 0.158 mm. X 0.187 mm. More heavily chitinized parts are darkened. Same scale as figure A.

FIGURE C: The operculum and its musculature. The more heavily chitinized parts are darkened. Same scale as figure A.

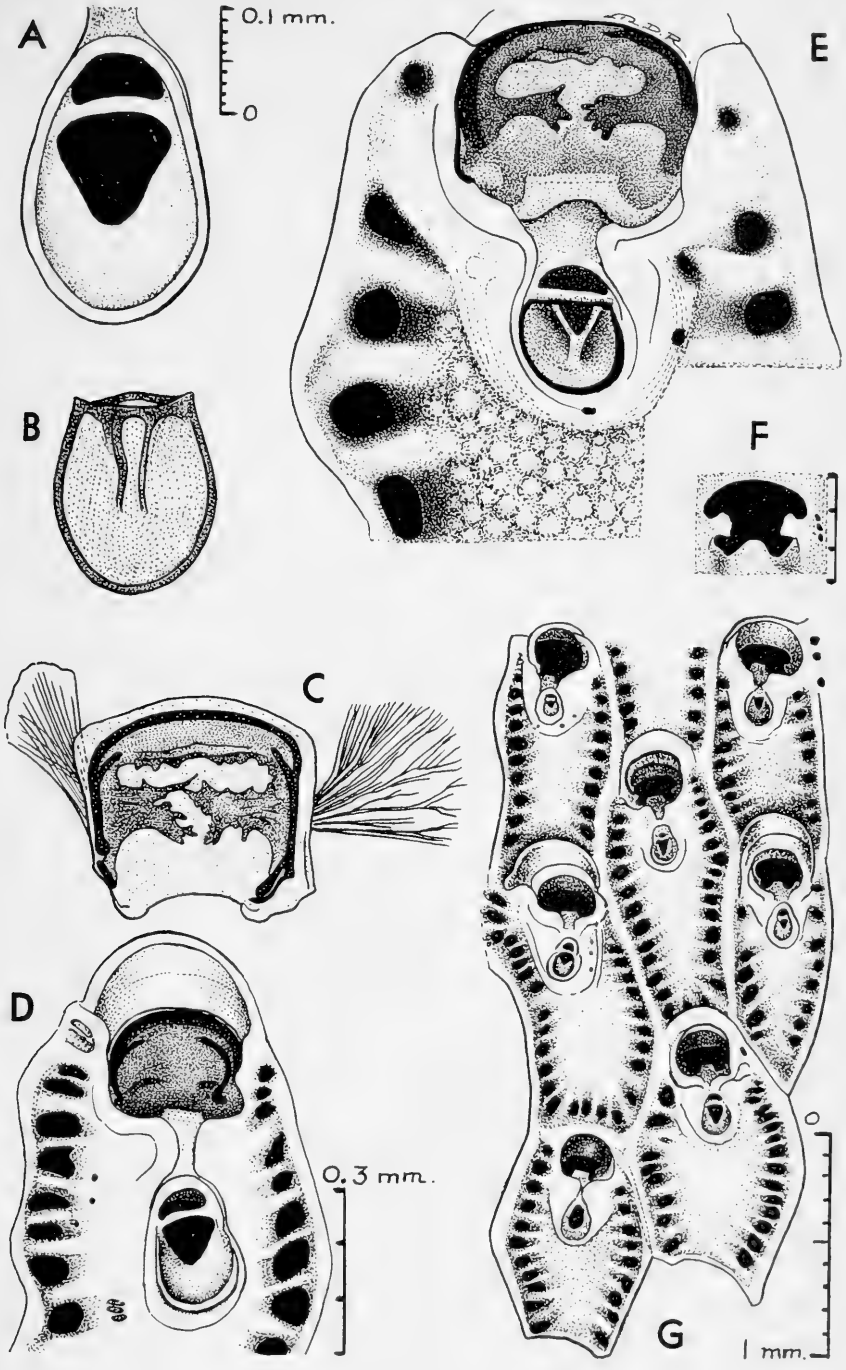
FIGURE D: A zoid beginning to form an ovicell, which is very incomplete as yet. An operculum covers the orifice, its sclerites very evident; lyrula also visible. This is one of the largest avicularia seen in this form. Drawn to the scale at right.

FIGURE E: Another zoid, which has both operculum and avicularial mandible in place. Raised plateau on which suboral avicularium is mounted is outlined or punctured by occasional small pores, three of which are here pictured (two at right and one below). Opercular chitinous reinforcements are not as advanced as those of figure C. The broad median lyrula and one cardelle are visible through the operculum. The mandibular sclerites form a Y here and are better developed than those of figure B. Same scale as figure A.

FIGURE F: The primary orifice, two inwardly directed cardelles, and worn-down lyrula of an older zoid, seen from the inside. Drawn to the 0.3 mm. scale at right.

FIGURE G: Seven zoecia, some of which are beginning to form ovicells. Drawn to the scale at lower right.

NOTE: Figure F is from a colony from Station 44. Remaining figures are from the holotype from Station 226.



EXPLANATION ON OPPOSITE PAGE

PLATE 35

Smittoidea reticulata (Johnston) (?)

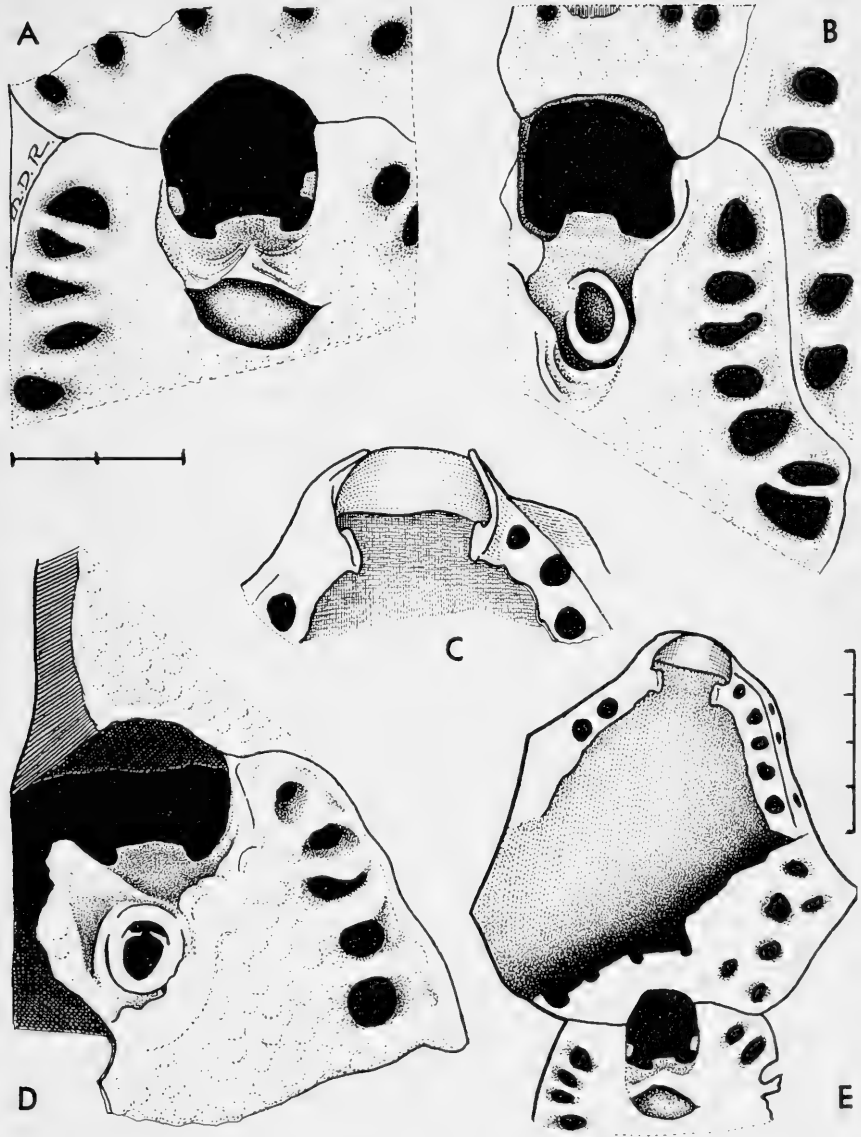
FIGURE A: Young zoid with incomplete avicularial chamber and unformed peristome. Drawn to the 0.2 mm. scale below.

FIGURE B: Primary orifice and partly formed peristome enclosing the broken incomplete oral avicularium. Cardelles do not show in this zoid because they have been torn away with the peristomial lining (cf. figure C). Same scale as figure A.

FIGURE C: A mere shell of distal end of zooecium. The areolar pores, back wall, peristomial lining and two cardelles, which arise from the peristomial lining, are present. Same scale as figure A.

FIGURE D: A damaged zooecium. Above the orifice are proximal and side walls of the next distal zoid. Same scale as figure A.

FIGURE E: Damaged shell of a zooecium and orifice of another incomplete one (the same as pictured in figure A). Upper zoid has cardelles and distal peristomial lining. Drawn to the 0.4 mm. scale at right.



EXPLANATION ON OPPOSITE PAGE

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**TYPE SPECIES OF THE GENERA AND SUBGENERA OF
PARASITIC WASPS COMPRISING THE SUPERFAMILY
PROCTOTRUPOIDEA (ORDER HYMENOPTERA)**

By C. F. W. MUESEBECK¹ and LUELLE M. WALKLEY¹

Introduction

The International Commission on Zoological Nomenclature emphasized the importance of genotype fixation by the adoption of an amendment to Article 25 of the Rules, effective Jan. 1, 1931, requiring that the description of any new genus be accompanied by "a definite, unambiguous designation of the type species." The steady and rapid expansion of our knowledge of insects has resulted in increasingly critical taxonomic study with constant adjustment of concepts at all levels of classification. Since the genus is one of the most significant of the various categories involved, it must be nicely defined in order that classifications may be developed on solid bases and the nomenclature will be as stable as possible. Essentially the definition of the genus must be based

¹ U. S. Department of Agriculture, Entomology Research Branch, Insect Identification and Parasite Introduction Section.

on its type species, a requirement which has often been ignored in the past, with the result that erroneous generic concepts have gradually become widely accepted in certain cases. Sometimes it is difficult and time consuming to ascertain the type species of a given genus. Much searching of the literature may be necessary, and the required literature is not always at hand. For these reasons the availability of genotype catalogs, prepared after exhaustive searching and thorough study, should have a stabilizing influence and should aid in the gradual betterment of our classifications.

Students of Hymenoptera are not in agreement concerning the limits of the Proctotrupoidea, and we recognize the difficulties in justifying the inclusion in this superfamily of such isolated groups as the Evaniidae, the Gasteruptiidae, and the Aulacidae. Nevertheless, for the purposes of this catalog we have considered it most practical to include them under the superfamily name Proctotrupoidea as was done in "Hymenoptera of America North of Mexico, Synoptic Catalog" (U. S. Dept. Agr., Agr. Monogr. 2, 1951). The present paper contains 735 generic and subgeneric names published through 1953 (a few later), including 72 that are errors or emendations of previously published names, and including also the following new names proposed to replace pre-occupied names: *Aulacomastus*, *Dorachia*, *Eccinetus*, *Nesopria*, and *Philoplanes*. Omitted are the following errors, most of them obviously typographical, that have appeared in the Zoological Record; in each case the year cited is the year covered by the particular volume of the Zoological Record and not the year of its publication.

| ERROR | CORRECT NAME |
|--|------------------------------|
| <i>Acanthoscelis</i> , 1893, Ins. p. 215 | <i>Acanthoscelio</i> Ashmead |
| <i>Aclysta</i> , 1913, Ins. p. 311 | <i>Aclista</i> Foerster |
| <i>Alacinus</i> , 1908, Ins. p. 300 | <i>Aulacinus</i> Westwood |
| <i>Anommatrum</i> , 1913, Ins. p. 312 | <i>Anommatium</i> Foerster |
| <i>Aritomellus</i> , 1939, Ins. p. 303 | <i>Atritomellus</i> Kieffer |
| <i>Ashmeadopsia</i> , 1914, Ins. p. 200 | <i>Ashmeadopria</i> Kieffer |
| <i>Carina</i> , 1905, Ins. p. 222 | <i>Carinia</i> Kieffer |
| <i>Catoteleia</i> , 1925, Ins. p. 336 | <i>Calotelea</i> Westwood |
| <i>Christoteleia</i> , 1914, Ins. p. 200 | <i>Chrestoteleia</i> Kieffer |
| <i>Cineta</i> , 1913, p. 313 | <i>Cinetus</i> Jurine |
| <i>Coelogaster</i> , 1893, Ins. p. 216 | <i>Coelopelta</i> Ashmead |
| <i>Erimicrops</i> , 1913, Ins. p. 320 | <i>Trimicrops</i> Kieffer |
| <i>Heteroteleia</i> , 1920, Ins. p. 182 | <i>Holoteleia</i> Kieffer |
| <i>Hoplotileia</i> , 1914, Ins. p. 201 | <i>Hoploteleia</i> Ashmead |
| <i>Lagnyodes</i> , 1906, Ins. p. 308 | <i>Lagnyodes</i> Foerster |

| | |
|--|--------------------------------|
| <i>Loxotropa</i> , 1869, p. 321 | <i>Loxotropa</i> Foerster |
| <i>Limnodytes</i> , 1902, Ins. p. 200 | <i>Limnodytes</i> Marchal |
| <i>Loxotraba</i> , 1906, Ins. p. 308 | <i>Loxotraba</i> Foerster |
| <i>Lygocerus</i> , 1878, Ins. p. 154 | <i>Lygocerus</i> Foerster |
| <i>Mista</i> , 1921, Ins. p. 163 | <i>Miota</i> Foerster |
| <i>Onyteleia</i> , 1910, Ins. p. 304 | <i>Oxyteleia</i> Kieffer |
| <i>Parabalus</i> , 1910, Ins. p. 305 | <i>Parabaecus</i> Kieffer |
| <i>Paramegischia</i> , 1882, Ins. p. 139 | <i>Pammegischia</i> Provancher |
| <i>Paramesus</i> , 1907, Ins. p. 288 | <i>Paramesius</i> Westwood |
| <i>Paratrimorus</i> , 1910, Ins. p. 305 | <i>Paratrimorus</i> Kieffer |
| <i>Phaenomorphus</i> , 1919, Ins. p. 167 | <i>Phaenoserphus</i> Kieffer |
| <i>Procinctus</i> , 1914, Ins. p. 203 | <i>Procinetus</i> Kieffer |
| <i>Prophanus</i> , 1923, Ins. p. 205 | <i>Prophanurus</i> Kieffer |
| <i>Protimorus</i> , 1908, Ins. p. 304 | <i>Protrimorus</i> Kieffer |
| <i>Psilonima</i> , 1913, Ins. p. 318 | <i>Psilomma</i> Foerster |
| <i>Telemonus</i> , 1888, Ins. p. 201 | <i>Telenomus</i> Haliday |
| <i>Teleus</i> , 1908, Ins. p. 305 | <i>Teleas</i> Latreille |
| <i>Xestonatus</i> , 1926, Ins. p. 338 | <i>Xestonotus</i> Foerster |

We have seen the original publications for all the references cited. However, we have not succeeded in ascertaining the precise dates of publication of two papers by Kieffer that contain supposedly new generic names published elsewhere by him at about the same time. In *The Transactions of the Linnean Society of London*, series 2, Zoology, volume 15, pages 43–80, Kieffer published as new 11 generic names in the Proctotrupoidea, some of which were apparently validated earlier in his generic classification of the Diapriidae, published in Wytzman's "Genera Insectorum" (fasc. 124). The latter work carries the date 1911, and in later publications Kieffer used 1911 in references to it. Neave's "Nomenclator Zoologicus," however, gives 1912 as the year of publication, and that is probably correct. It seems that the volume appeared very early in 1912, early enough to antedate the other paper mentioned above, which was published in March 1912. Accordingly we have treated the "Genera Insectorum" publication as the earlier.

There is also uncertainty as to the exact date of publication of a paper by Kieffer in *Annales de la Société Scientifique de Bruxelles* (vol. 33, 1909) which contained descriptions of five new species of *Paraclista*, a genus Kieffer described as new in André's "Species des Hyménoptères d'Europe & d'Algérie" (vol. 10, p. 476). The publication date given for that section of André's volume 10 is Sept. 15, 1909; and since the Smithsonian Institution's copy of the other paper is stamped as having been received Oct. 4, 1909, the two may have appeared at virtually the same time. In the absence of precise information concerning the date

of publication of the paper in *Annales de la Société Scientifique de Bruxelles*, and since Kieffer clearly intended it should be so, we are considering the paper in André's volume 10 to have priority.

We have not attempted to show all published generic synonymy but have given only that which is generally accepted and with which we agree. The type citations are shown in the original combinations even where the author designating a type used a different generic name.

Literature citations to periodicals are abbreviated but citations to separate works are given in full with one exception: André, *Species des Hyménoptères d'Europe & d'Algérie*. Kieffer's work published in it is cited so frequently that the citation is abbreviated as Kieffer *in* André, *Spec. Hym. Eur. Alg.*

Superfamily PROTOTRUPOIDEA

Abothropria Kieffer

1913. Kieffer, *in* Alluaud and Jeannel, *Voyage . . . en Afrique Orientale*. *Insectes hyménoptères*, vol. 1, p. 23.

TYPE: *Abothropria nigra* Kieffer, 1913, by monotypy and original designation.

Acanopsilus Kieffer

1908. Kieffer, *in* André, *Spec. Hym. Eur. Alg.*, vol. 10, pp. 364, 426.

TYPE: *Acanopsilus clavatus* Kieffer, 1908, by monotypy.

Acanosema Kieffer

1908. Kieffer, *in* André, *Spec. Hym. Eur. Alg.*, vol. 10, pp. 360, 367, 407. Four species.

TYPE: *Acanosema rufum* Kieffer, 1908, by original designation.

Acanthinevania Bradley

1908. Bradley, *Trans. Amer. Ent. Soc.*, vol. 34, pp. 163, 172. Thirty-two species and one variety.

TYPE: *Evania princeps* Westwood, 1841, by original designation.

Acanthobetyla Dodd

1926. Dodd, *Trans. Roy. Soc. South Australia*, vol. 50, p. 299.

TYPE: *Acanthobetyla mirabilis* Dodd, 1926, by monotypy and original designation.

Acantholapitha Cameron

1912 (July). Cameron, *Soc. Ent.*, vol. 27, no. 15, p. 70. No species.

1912 (Aug.). Cameron, Soc. Ent., vol. 27, no. 16, p. 74. One species.

TYPE: *Acantholapitha nigricollis* Cameron, 1912. First included species.

Acanthomiota Jansson

1942. Jansson, Ent. Tidskr., vol. 63, p. 210.

TYPE: *Acanthomiota oxylaboides* Jansson, 1942, by monotypy.

Acanthopria Ashmead

1896. Ashmead, Proc. Zool. Soc. London, 1895, p. 804.

TYPE: *Acanthopria crassicornis* Ashmead, 1896, by monotypy and original designation.

Acanthopsilus Kieffer

1908. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 380, 394.

TYPE: *Oxylabis marshalli* Kieffer, 1907, by monotypy.

Proposed as a subgenus of *Oxylabis* Foerster.

Acanthoscelio Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 210, 211, 236. Two species.

TYPE: *Acanthoscelio americanus* Ashmead, 1893, by original designation.

Acanthoserphus Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, p. 384.

TYPE: *Acanthoserphus albicoxa* Dodd, 1915, by monotypy and original designation.

Acanthoteleia Kieffer

1910. Kieffer, Ann. Soc. Ent. France, vol. 78, 1909, p. 311.

TYPE: *Acanthoteleia nigriclavus* Kieffer, 1910, by monotypy.

Acerota Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, p. 107. No species.

1887. Ashmead, Can. Ent., vol. 19, p. 128. Two species.

TYPE: *Acerota caryae* Ashmead, 1887. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 707. *Acerota evanescens* Kieffer, 1914, designated by Kieffer, 1914, in André, Spec. Hym. Eur. Alg., vol. 11, p. 369, was included later.

Acidopria Kieffer

1913. Kieffer, *Insecta*, vol. 3, p. 442. Three species.

TYPE: *Acidopria variicornis* Kieffer, 1913. Designated by Kieffer, 1916, *Das Tierreich*, Lief. 44, p. 165.

Acidopsilus Kieffer

1909. Kieffer, *Ann. Soc. Sci. Bruxelles*, vol. 33, p. 340.

TYPE: *Acidopsilus longicornis* Kieffer, 1909, by monotypy.

Aclista Foerster

1856. Foerster, *Hymenopterologische Studien*, Heft 2, pp. 128, 131, 133, 134, 135. No species.

1873. Marshall, *A catalogue of British Hymenoptera*; *Oxyura*, p. 9. Three species, one of them doubtfully included.

TYPE: *Acoretus scutellaris* Thomson, 1858. Designated by Muesebeck and Walkley, 1951, in Muesebeck, et al., *U. S. Dept. Agr., Agr. Monogr. No. 2*, p. 685.

Aclistoides Dodd

1916. Dodd, *Trans. Roy. Soc. South Australia*, vol. 40, p. 11.

TYPE: *Aclistoides retractus* Dodd, 1916, by monotypy and original designation.

Acoloides Howard

1890. Howard, *Insect life*, vol. 2, p. 269.

TYPE: *Acoloides saitidis* Howard, 1890, by monotypy.

Acolomorpha Dodd

1914. Dodd, *Can. Ent.*, vol. 46, p. 60.

TYPE: *Acolomorpha minuta* Dodd, 1914, by monotypy and original designation.

Acolus Foerster (= *Holacolus* Kieffer; *Holalcus* Risbec, error)

1856. Foerster, *Hymenopterologische Studien*, Heft 2, pp. 100, 102. No species.

1859. Thomson, *Öfv. Vet.-Akad. Förh.*, vol. 15, 1858, p. 422. Two species.

TYPE: *Acolus opacus* Thomson, 1859. Designated by Ashmead, 1903, *Journ. New York Ent. Soc.*, vol. 11, p. 90. *Acolus xanthogaster* Ashmead, 1893, designated by Brues, 1908, in Wytsman, *Genera insectorum*, fasc. 80, p. 16, and *Acolus piceiventris* Kieffer, 1908, designated by Kieffer, 1910, in Wytsman, *Genera insectorum*, fasc. 80B, p. 102, were included later. *A. piceiventris* was described by Kieffer from a specimen in the Foerster collection and is the species upon which the genus was based. However, in a recent decision (*Bull. Zool. Nom.*, vol. 4, 1950, pp. 160, 346)

the International Commission on Zoological Nomenclature agreed that only the first species referred to a genus described without originally included species shall be eligible for type designation.

Isogenotypic with *Holacolus* Kieffer.

Acoretus Haliday

1857. Haliday, Nat. Hist. Rev., vol. 4, Proc. p. 169.

TYPE: *Belyta rufopetiolata* Nees, 1834, by monotypy.

Proposed as a subgenus of *Belyta* Jurine. Considered synonym of *Achista* Foerster.

Acropiesta Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 129, 135. No species.

1883. Cameron, Trans. Ent. Soc. London, 1883, p. 195. One species doubtfully included and therefore not available as type.

1893. Ashmead, U. S. Nat. Mus. Bull. 45, p. 353. Two species.

TYPE: *Acropiesta flavicauda* Ashmead, 1893. Designated by Muesebeck and Walkley, 1951, in Muesebeck, et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 689. *Acropiesta collaris* Foerster, designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 353, was a nomen nudum.

Acutibaesus Meunier [fossil]

1916. Meunier, Zeitschr. Deutschen Geol. Gesellsch., vol. 68, pp. 392, 395.

TYPE: *Acutibaesus bellicosus* Meunier, 1916, by monotypy.

Adelioneiva Fischer

1940. Fischer, Rev. de Ent., vol. 11, p. 397.

TYPE: *Adelioneiva concolor* Fischer, 1940, by monotypy and original designation.

Adeliopria Ashmead

1902. Ashmead, Biol. Bull., vol. 3, p. 15.

TYPE: *Adeliopria longii* Ashmead, 1902, by monotypy and original designation.

Aegyptoscelio Priesner

1951. Priesner, Bull. Inst. Fouad I du Desert, vol. 1, p. 133.

TYPE: *Aegyptoscelio frequens* Priesner, 1951, by monotypy and original designation.

Afrevania Benoit

1953. Benoit, Rev. Zool. Bot. Africaines, vol. 48, p. 259.

TYPE: *Afrevania leroyi* Benoit, 1953, by monotypy and original designation.

Agonophorus Dahlbom

1858. Dahlbom, Öfv. Vet.-Akad. Förh., vol. 14, 1857, p. 289.
No species.

No species have been referred to this genus up to the present time.

Aholcus Kieffer

1913. Kieffer, in Alluaud and Jeannel, Voyage . . . en Afrique Orientale. Insectes hyménoptères, vol. 1, p. 4.

TYPE: *Aholcus monticola* Kieffer, 1913, by monotypy and original designation.

Aleria Marshall

1874. Marshall, Ent. Monthly Mag., vol. 10, p. 208.

TYPE: *Aleria flavibarbis* Marshall, 1874, by monotypy.

Considered synonym of *Scelio* Latreille.

Allogryon Kieffer

1910. Kieffer, in Wytzman, Genera insectorum, fasc. 80B, p. 95. Thirty-two species.

TYPE: *Prosacantha caraborum* Riley, in Ashmead, 1893. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 697.

Proposed as a subgenus of *Hoplogryon* Ashmead. Considered synonym of *Trimorus* Foerster.

Allomicrops Kieffer

1914. Kieffer, Das Tierreich, Lief. 42, pp. xv, 69, 138.

TYPE: *Ceraphron abnormis* Perkins, 1910, by monotypy.

Allophanurus Kieffer

1912. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, pp. 8, 11. Two species.

TYPE: *Telenomus vibius* Walker, 1838. Designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 23.

Alloteleia Kieffer

1917. Kieffer, Brotéria, Rev. Luso-Brazileira, Zool. ser., vol. 15, p. 59.

TYPE: *Alloteleia appendiculata* Kieffer, 1917, by monotypy and original designation.

Allotropa Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 106, 109.

TYPE: *Inostemma mecrida* Walker, 1835, by monotypy.

Amblyaspis Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 107, 112. Three species included by bibliographic reference.

TYPE: *Platygaster tritici* Curtis, 1831. Designated by Kieffer, 1926, *Das Tierreich*, Lief. 48, p. 611. *Amblyaspis aliena* Foerster MS., designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 266, and by Fouts, 1924, Proc. U. S. Nat. Mus., vol. 63, art. 15a, p. 3, was a nomen nudum taken from a label on a specimen in the Foerster collection.

Amblyconus Kieffer

1913. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, p. 221. No species.

1914. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, p. 325. One species.

TYPE: *Amblyconus quadridens* Kieffer, 1914. First included species.

Amblyscelio Kieffer

1913. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, pp. 225, 258.

TYPE: *Amblyscelio striaticeps* Kieffer, 1913, by monotypy.

Amitus Haldeman (= *Elaptus* Forbes)

1850. Haldeman, Amer. Journ. Sci., ser. 2, vol. 9, p. 109.

TYPE: *Amitus aleurodinis* Haldeman 1850 (= *Amitus corni* Haldeman, error), by monotypy.

Isogenotypic with *Elaptus* Forbes through synonymy.

Anaclista Kieffer

1916. Kieffer, *Das Tierreich*, Lief. 44, pp. xxv, 352, 462. Two species.

TYPE: *Aclista holotoma* Kieffer, 1909, by original designation.

Anacoryphe Debauche

1947. Debauche, Bull. Ann. Soc. Ent. Belgique, vol. 83, p. 274.

TYPE: *Anacoryphe orchymonti* Debauche, 1947, by monotypy and original designation.

(*Anaulacus* Semenov, not MacLeay, 1825, replaced by *Semenowia* Kieffer, 1903, also preoccupied) = *Semenovius* Bradley

1903. Semenov, Rev. Russe Ent., vol. 3, p. 173. Two species, one of them doubtfully included.

TYPE: *Aulacus sibiricola* Semenov, 1894. Designated by Bradley, 1908, Trans. Amer. Ent. Soc., vol. 34, p. 120.

Anectadius Kieffer

1905. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 29, p. 187. Two species.

TYPE: *Anectadius striolatus* Kieffer, 1905. Designated by Kieffer, 1926, *Das Tierreich*, Lief. 48, p. 608.

Anectata Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 129, 136. No species.

1887. Ashmead, Can. Ent., vol. 19, p. 198. One species.

TYPE: *Anectata hirtifrons* Ashmead, 1887. First included species.

Considered synonym of *Aclista* Foerster.

Aneurhynchus Westwood (= *Mythras* Haliday, in Curtis, nomen nudum; *Mithras* Agassiz, emendation; *Mythras* Brullé; *Aneurhynchus* Maneval and *Aneurhynchus* Brullé, emendations)

1832. Westwood, Journ. London Edinburgh Phil. Mag., ser. 3, vol. 1, p. 129.

TYPE: *Aneurhynchus galesiformis* Westwood, 1832, by monotypy.

Mythras Haliday, in Curtis, nomen nudum, was validated by Brullé, in Lepeletier, 1846, Histoire naturelle des insectes, Hyménoptères, vol. 4, p. 612, through citation as a synonym of *Aneurhynchus*.

Aneurobaeus Kieffer

1912. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, pp. 87, 91.

TYPE: *Baeus apterus* Bugnion and Popoff, 1910, by monotypy and original designation.

Aneuron Brues

1910. Brues, Bull. Wisconsin Nat. Hist. Soc., vol. 8, p. 49.

TYPE: *Aneuron anormis* Brues, 1910, by monotypy and original designation.

Considered synonym of *Platygaster* Latreille.

Aneuropria Kieffer

1905. Kieffer, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, vol. 2 (42), p. 35. No species.

1911. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 898. One species.

TYPE: *Aneuropria clavata* Kieffer, 1911. First included species.

Aneuroscelio Kieffer

1913. Kieffer, in Alluaud and Jeannel, Voyage . . . en Afrique Orientale. Insectes hyménoptères, vol. 1, p. 14.

TYPE: *Aneuroscelio rufipes* Kieffer, 1913, by monotypy and original designation.

(*Aneurhynchus* Berland, emendation) = *Aneurhynchus* Westwood

1940. Maneval, in Berland, Faune de la France, vol. 7, Hyménoptères, p. 103.

(*Aneurynchus* Brullé, emendation) = *Aneurhynchus* Westwood

1846. Brullé, in Lepeletier, Histoire naturelle des insectes. Hyménoptères, vol. 4, p. 612.

(*Anisoptera* Herrich-Schaeffer, not Berthold, 1827) = *Laches* Gistel

1840. Herrich-Schaeffer, Nomenclator entomologicus, Heft 2, pp. 57, 69.

TYPE: *Anisoptera egregia* Herrich-Schaeffer, 1840, by monotypy.

Considered synonym of *Psilus* Panzer.

Anommatium Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 130, 131, 140. No species.

1904. Mayr, Verh. Zool.-Bot. Gesellsch. Wien, vol. 54, p. 592. One species.

TYPE: *Anommatium ashmeadi* Mayr, 1904. First included species.

Anopedias Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 108, 114. No species.

1859. Thomson, Öfv. Vet.-Akad. Förh., vol. 16, p. 79. Three species.

TYPE: *Anopedias obscurus* Thomson, 1859. Designated by Ashmead, 1903, Journ. New York Ent. Soc., vol. 11, p. 97. *Anopedias lacustris* Kieffer, 1926, designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 701, was included later. *Anopedias tritomus* Thomson, 1859, was designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 716, through oversight of Ashmead's 1903 citation.

Considered synonym of *Leptacis* Foerster.

Anoxylabis Kieffer

1909. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 33, p. 343.

TYPE: *Anoxylabis laticeps* Kieffer, 1909, by monotypy.

Antarctopria Brues

1920. Brues, in Tillyard, Australasian Antarctic Expedition . . . Scientific reports, ser. c, vol. 5, pt. 8, p. 17; Brues, *ibid.*, app. A, p. 27.

TYPE: *Antarctopria latigaster* Brues, 1920, by monotypy and original designation.

Anteris Foerster (= *Auteris* Ashmead, error; *Trichacolus* Kieffer)
1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 101, 103. No species.

1859. Thomson, Öfv. Vet.-Akad. Förh., vol. 15, 1858, p. 421. Two species.

TYPE: *Anteris bilineatus* Thomson, 1859, by present designation. *Anteris rufitarsis* Foerster MS., designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 224, was a nomen nudum. *Anteris virginiensis* Ashmead, 1893, designated by Brues, 1908, in Wytsman, Genera insectorum, fasc. 80, p. 36, and *Anteris simulans* Kieffer, 1908, designated by Kieffer, 1910, in Wytsman, Genera insectorum, fasc. 80B, p. 80, were included later. *A. simulans* was described by Kieffer from the specimen in the Foerster collection upon which the genus was based, but under the recent modification of Opinion 46 by the International Commission on Zoological Nomenclature (Bull. Zool. Nomencl., vol. 4, 1950, pp. 160, 346) only the first included species shall be eligible for designation as type of a genus described without contained species.

Isogenotypic with *Trichacolus* Kieffer.

Anteromorpha Dodd

1913. Dodd, Trans. Roy. Soc. South Australia, vol. 37, pp. 131, 145. Two species.

TYPE: *Anteromorpha australica* Dodd, 1913, by original designation.

Antropria Kieffer

1910. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 694, 743.

TYPE: *Antropria pedestris* Kieffer, 1910, by monotypy.

Antrosclio Kieffer

1913. Kieffer, in Alluaud and Jeannel, Voyage . . . en Afrique Orientale. Insectes hyménoptères, vol. 1, p. 15.

TYPE: *Antrosclio lucifugax* Kieffer, 1913, by monotypy and original designation.

Aparamesius Kieffer

1913. Kieffer, Insecta, vol. 3, p. 436. Four species.

TYPE: *Aparamesius carinatus* Kieffer, 1913, by original designation.

Apegus Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 101, 104.

TYPE: *Apegus leptocerus* Foerster, 1856, by monotypy.

Apegusoneura Cameron

1912. Cameron, Soc. Ent., vol. 27, No. 15, p. 69. Three species.

TYPE: *Apegusoneura striolatus* Cameron, 1912. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 703.

Considered synonym of *Hoploteleia* Ashmead.

Aphanogmus Thomson

1858. Thomson, Öf. Vet.-Akad. Förh., vol. 15, pp. 287, 305. Five species.

TYPE: *Aphanogmus fumipennis* Thomson, 1858. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 132.

Aphanomerella Dodd

1913. Dodd, Mem. Queensland Mus., vol. 2, p. 339.

TYPE: *Aphanomerella ovi* Dodd, 1913, by monotypy and original designation.

Aphanomerus Perkins

1905. Perkins, Haw. Sugar Planters Assoc. Exp. Sta., Div. Ent., Bull. 1, pp. 200, 201. Four species.

TYPE: *Aphanomerus bicolor* Perkins, 1905, by original designation.

(Aphanurus Kieffer, not Looss, 1907) = **Microphanurus** Kieffer

1912. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, pp. 10, 69. Nineteen species, one of them doubtfully included.

TYPE: *Teleas semistriatus* Nees, 1834, by original designation.

Apteroscelio Kieffer

1913. Kieffer, in Alluaud and Jeannel, Voyage . . . en Afrique Orientale. Insectes hyménoptères, vol. 1, p. 17.

TYPE: *Apteroscelio montanus* Kieffer, 1913, by monotypy and original designation.

Aradophagus Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 138, 166.

TYPE: *Aradophagus fasciatus* Ashmead, 1893, by monotypy.

Aratala Dodd

1927. Dodd, Mem. Queensland Mus., vol. 9, p. 74.

TYPE: *Aratala globiceps* Dodd, 1927, by monotypy and original designation.

Archaebelyta Meunier [fossil]

1923. Meunier, Misc. Ent., vol. 26, No. 11-12, p. 84.

TYPE: *Archaebelyta superba* Meunier, by monotypy.

Archaeoscelio Brues [fossil]

1940. Brues, Proc. Amer. Acad. Arts Sci., vol. 74, p. 88.
Two species.

TYPE: *Archaeoscelio rugosus* Brues, 1940, by original designation.

(Artibolus Haliday) = **Synacra** Foerster

1857. Haliday, Nat. Hist. Rev., vol. 4, Proc. p. 173. Two species.

TYPE: *Diapria brachialis* Nees, 1834, by present designation.

Proposed as a subgenus of *Platymischus* Westwood. Isogenotypic with *Synacra* Foerster.

Ashmeadopria Kieffer

1912. Kieffer, in Wytzman, Genera insectorum, fasc. 124, 1911, pp. 8, 10, 59. Fifty-five species.

TYPE: *Diapria verticillata* Latreille, 1805. Designated by Mani, 1941, Catalogue of Indian insects, Pt. 26, Serphoidea, p. 44.

Considered synonym of *Trichopria* Ashmead.

Asolcus Nakagawa

1900. Nakagawa, Spec. Rep. Imp. Agric. Exp. Sta., Japan, 6, p. 17.

TYPE: *Asolcus nigripedius* Nakagawa, by monotypy.

Asolenopsia Kieffer

1921. Kieffer, An. Soc. Cient. Argentina, vol. 91, p. [36].

TYPE: *Asolenopsia rufa* Kieffer, 1921, by monotypy and original designation.

Atelopsilus Kieffer

1908. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 360.

TYPE: *Pantolyta brunnea* Ashmead, 1893, by monotypy and original designation.

Proposed as a subgenus of *Rhynchopsilus* Kieffer.

Atomopria Kieffer

1910. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 695. No species.

1911. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 875. Two species.

TYPE: *Atomopria rufithorax* Kieffer, 1911. Designated by Kieffer, 1911, in André, Spec. Hym. Eur. Alg., vol. 10, p. 875.

Atrichopria Kieffer

1910. Kieffer, Ent. Rundschau, vol. 27, p. 55. Two species.

TYPE: *Atrichopria rufa* Kieffer, 1910. Designated by Kieffer, 1912, in Wytsman, Genera insectorum, fasc. 124, 1911, p. 54.

Atritomellus Kieffer (= *Atritomus* Foerster, 1878, not Reitter, 1877).

1914. Kieffer, Das Tierreich, Lief. 42, pp. xv, 139, 141.

TYPE: *Atritomus coccophagus* Foerster, 1878, by substitution of *Atritomellus* for *Atritomus* Foerster.

(Atritomus Foerster, not Reitter, 1877) = **Atritomellus** Kieffer

1878. Foerster, Verh. Naturh. Ver. Preuss. Rheinl., vol. 35, p. 56.

TYPE: *Atritomus coccophagus* Foerster, 1878, by monotypy and original designation.

Aulacinus Westwood

1868. Westwood, Trans. Ent. Soc. London, 1868, p. 331.

TYPE: *Aulacus (Aulacinus) moerens* Westwood, 1868, by monotypy.

Proposed as a subgenus of *Aulacus* Jurine.

Aulacites Cockerell [fossil]

1916. Cockerell, Proc. U. S. Nat. Mus., vol. 51, p. 102. Two species.

TYPE: *Aulacites secundus* Cockerell, 1916, by original designation.

Aulacofoenus Kieffer

1911. Kieffer, Ann. Soc. Ent. France, vol. 80, p. 177.

TYPE: *Hyptiogaster szepligetii* Kieffer, 1904, by monotypy and original designation.

Aulacomastus, new name (= *Aulacostethus* Philippi, 1873, not Waterhouse, 1869, not Uhler, 1871; *Aulacosthethus* Schletterer, error; *Aulacostathus* Dalla Torre, error; *Aulacosthetus* Kieffer, error)

TYPE: *Aulacostethus rubriventer* Philippi, 1873, by substitution of *Aulacomastus* for *Aulacostethus* Philippi.

Aulacopria Kieffer

1904. Kieffer, Bull. Soc. Hist. Nat. Metz, vol. 23, p. 54.

TYPE: *Aulacopria formicarum* Kieffer, 1904, by monotypy.

(Aulacostathus Dalla Torre, error for *Aulacostethus* Philippi) = **Aulacomastus**, new name

1902. Dalla Torre, Catalogus hymenopterorum, vol. 3, pt. 2, p. 1062.

- (*Aulacostethus* Philippi, not Waterhouse, 1869, not Uhler, 1871)
= *Aulacomastus*, new name
1873. Philippi, Stett. Ent. Zeit., vol. 34, p. 302.
TYPE: *Aulacostethus rubriventer* Philippi, 1873, by monotypy.
- (*Aulacostethus* Schletterer, error for *Aulacostethus* Philippi)
= *Aulacomastus*, new name
1890. Ann. Naturh. Hofmus. Wien, vol. 4, p. 523.
- (*Aulacosthetus* Kieffer, error for *Aulacostethus* Philippi) = *Aulacomastus*, new name
1912. Kieffer, Das Tierreich, Lief. 30, p. 370.
- Aulacus** Jurine
1807. Jurine, Nouvelle méthode de classer les hyménoptères et les diptères, p. 89.
TYPE: *Aulacus striatus* Jurine, 1807, by monotypy.
- Aulatopria** Brèthes
1927. Brèthes, Rev. Indus. Agr. Tucumán, vol. 17, pp. 163, 164.
TYPE: *Aulatopria tucumana* Brèthes, 1927, by monotypy.
Also published later in 1927, Bull. Ent. Res., vol. 18, p. 206, as English translation.
- Austronia** Riek
1955. Riek, Australian Journ. Zool., vol. 3, p. 263. Three species.
TYPE: *Austronia nitida* Riek, 1955, by original designation.
- Austroscelio** Dodd
1914. Dodd, Proc. Roy. Soc. Queensland, vol. 26, p. 93. Three species.
TYPE: *Sparasion nigricoxa* Dodd, 1914, by original designation.
- Austroserphus** Dodd
1933. Dodd, Proc. Linn. Soc. New South Wales, vol. 58, p. 275.
TYPE: *Austroserphus albofasciatus* Dodd, 1933, by monotypy and original designation.
- (*Auteris* Ashmead, error) = *Anteris* Foerster
1903. Ashmead, Journ. New York Ent. Soc., vol. 11, p. 92.
- Auxopaedeutes** Brues
1903. Brues, Trans. Amer. Ent. Soc., vol. 29, p. 126.
TYPE: *Auxopaedeutes sodalis* Brues, 1903, by monotypy.
- (*Axestonotus* Kieffer, new name for *Xestonotus* Foerster, 1856, not Leconte, 1853) = *Xestonotidea* Gahan
1926. Kieffer, Das Tierreich, Lief. 48, pp. xxxi, 561, 625.
TYPE: *Xestonotus andriciphilus* Ashmead, 1887, by substitution of *Axestonotus* for *Xestonotus* Foerster.

Bactropria Kieffer

1910. Kieffer, Ann. Soc. Ent. France, vol. 78, 1909, p. 339.

TYPE: *Bactropria brasiliensis* Kieffer, 1910, by monotypy.

(Baeceura Ashmead, error) = **Baeoneura** Foerster

1887. Ashmead, Ent. Amer., vol. 3, p. 99.

Baeomorpha Brues [fossil]

1937. Brues, in Carpenter, Univ. Toronto Stud., Geol. ser., vol. 40, p. 41.

TYPE: *Baeomorpha dubitata* Brues, 1937, by monotypy and original designation.

Baeoneura Foerster (= *Baeceura* Ashmead, error)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 100, 102. No species.

1887. Ashmead, Ent. Amer., vol. 3, p. 99. Two species.

TYPE: *Baeoneura floridana* Ashmead, 1887, by present designation.

Considered synonym of *Macroteleia* Westwood.

Baeoneurella Dodd

1914. Dodd, Trans. Roy. Soc. South Australia, vol. 38, p. 124. Four species.

TYPE: *Baeoneura giraulti* Dodd, 1913, by original designation.

Considered synonym of *Eumicrosoma* Gahan.

Baeus Haliday (= *Hyperbaeus* Foerster)

1833. Haliday, Ent. Mag., vol. 1, p. 270.

TYPE: *Baeus seminulum* Haliday, 1833, by monotypy.

Bakeria Kieffer

1905. Kieffer, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, vol. 2 (42), p. 34. No species.

1906. Kieffer, Berliner Ent. Zeitschr., vol. 50, 1905, p. 282. One species.

TYPE: *Bakeria complanata* Kieffer, 1906. First included species.

(Balyta Ashmead, error) = **Belyta** Jurine

1893. Ashmead, U. S. Nat. Mus. Bull. 45, p. 366.

Baryconus Foerster (= *Hoploteleia* Ashmead)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 101, 104. No species.

1887. Ashmead, Ent. Amer., vol. 3, p. 118. One species.

TYPE: *Baryconus floridanus* Ashmead, 1887. First included species. *Baryconus oecanthi* Riley, in Ashmead, 1893, designated by Brues, 1908, in Wytzman, Genera insectorum, fasc. 80, p. 31, and *Baryconus rufipes* Kieffer, 1903, designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 480, were included later.

Isogenotypic with *Hoplosteleia* Ashmead.

Baryteleia Kieffer

1926. Kieffer, Das Tierreich, Lief. 48, pp. xxix, 273, 544.
Three species.

TYPE: *Macroteleia nigriceps* Kieffer, 1905, by original designation.

Basalys Westwood

1833. Westwood, London Edinburgh Phil. Mag., ser. 3, vol. 3, p. 343.

TYPE: *Basalys fumipennis* Westwood, 1833, by monotypy.

Bebelus Gistel (= *Oxyurus* Lamarck, 1817, not Rafinesque, 1810)

1848. Gistel, Naturgeschichte des Tierreichs, p. x.

TYPE: *Sparasion frontalis* Latreille, 1805, by substitution of *Bebelus* for *Oxyurus* Lamarck.

Considered synonym of *Sparasion* Latreille.

(*Belita* Haliday, emendation) = *Belyta* Jurine

1857. Nat. Hist. Rev., vol. 4, Proc. p. 169.

Belyta Jurine (= *Belita* Haliday, emendation; *Balyta* Ashmead, error)

1807. Jurine, Nouvelle méthode de classer les hyménoptères et les diptères, p. 311.

TYPE: *Belyta bicolor* Jurine, 1807, by monotypy. *Belyta iridipennis* Lepeletier and Serville, 1825, was designated by Blanchard, 1849, in Cuvier, Règne animal [ed. 3], Insectes, text vol. 2, p. 156; atlas, pl. 115, fig. 6 (Blanchard erroneously cited Curtis as author of *iridipennis* in plate legend and Walker on plate itself).

(*Betula* Ashmead, error) = *Betyla* Cameron

1902. Ashmead, Journ. New York Ent. Soc., vol. 10, p. 245.

Betyla Cameron (= *Betula* Ashmead, error)

1889. Cameron, Mem. Proc. Manchester Lit. Phil. Soc., ser. 4, vol. 2, p. 12.

TYPE: *Betyla fulva* Cameron, 1889, by monotypy.

Bothriopria Kieffer

1905. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 29, pp. 132, 134.

TYPE: *Bothriopria saussurei* Kieffer, 1905, by monotypy.

Bracalba Dodd

1930. Dodd, Proc. Roy. Soc. Queensland, vol. 42, p. 78.
Three species.

TYPE: *Bracalba laminata* Dodd, 1930, by original designation.

Brachevania Turner

1927. Turner, Ann. Mag. Nat. Hist., ser. 9, vol. 20, p. 553.

TYPE: *Brachevania kristenseni* Turner, 1927, by monotypy and original designation.

Brachinostemma Kieffer

1916. Kieffer, Zentralbl. Bakt. Parasitenk. Infektionsk. Abt. 2, vol. 46, p. 551.

TYPE: *Brachinostemma mediterranea* Kieffer, 1916, by monotypy and original designation.

Brachygaster Leach (= *Coranila* Westwood; *Semaeodogaster* Bradley)

1815. Leach, in Brewster, Edinburgh Encyclopaediae, vol. 9, p. 142.

TYPE: *Evania minuta* Olivier, 1791, by monotypy.

Isogenotypic with *Semaeodogaster* Bradley.

Brachyscelio Brues [fossil]

1940. Brues, Proc. Amer. Acad. Arts Sci., vol. 74, p. 76.
Two species.

TYPE: *Brachyscelio cephalotes* Brues, 1940, by original designation.

(Brachyscelio Risbec, not Brues, 1940) = **Pachyscelio** Risbec

1950. Risbec, Contribution à l'étude des Proctotrupidae. Trav. Lab. Ent. Sect. Soudan. Rech. Agron., p. 614.

TYPE: *Brachyscelio jeanneli* Risbec, 1950, by monotypy.

Brachyserphus Hellén

1941. Hellén, Notulae Ent., vol. 21, p. 42. Two species.

TYPE: *Codrhus parvulus* Nees, 1834, by original designation.

Bruchiola Kieffer

1921. Kieffer, An. Soc. Cient. Argentina, vol. 91, p. 40.

TYPE: *Bruchiola formicaria* Kieffer, 1921, by monotypy.

Bruchopria Kieffer

1921. Kieffer, An. Soc. Cient. Argentina, vol. 91, p. 38. Two species.

TYPE: *Bruchopria pentatoma* Kieffer, 1921, by original designation.

Bruesopria Wing

1951. Wing, Trans. Roy. Ent. Soc. London, vol. 102, p. 195.
Two species.

TYPE: *Bruesopria seeversi* Wing, 1951, by original designation.

Brunnicophilus Nixon

1931. Nixon, Ent. Rec. Journ. Variation, vol. 43, p. 83.

TYPE: *Brunnicophilus donisthorpei* Nixon, 1931, by monotypy and original designation.

(*Cacellus* Ashmead, new name for *Cacus* Riley, 1893, not Gistel, 1848, not Selys, 1854, not Costa, 1857) = *Oethecoctonus* Ashmead

1913. Ashmead, Journ. New York Ent. Soc., vol. 11, p. 92.

TYPE: *Cacus oecanthi* Riley, in Ashmead 1893, by substitution of *Cacellus* for *Cacus* Riley.

Unnecessarily proposed for *Cacus* Riley. *Oethecoctonus* Ashmead, 1900, had already been published as a replacement name.

(*Cacus* Riley, not Gistel, 1848, not Selys, 1854, not Costa, 1857) = *Oethecoctonus* Ashmead

1893. Riley, in Ashmead, U. S. Nat. Mus. Bull. 45, pp. 209, 210, 211, 223.

TYPE: *Cacus oecanthi* Riley in Ashmead, 1893, by monotypy and designation of Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 223.

Caenoteleia Kieffer

1926. Kieffer, Das Tierreich, Lief. 48, pp. xxix, 266, 550.

TYPE: *Caloteleia elegans* Perkins, 1926, by monotypy.

(*Calliceras* Nees (= *Hadroceras* Foerster, new name) = *Ceraphron* Jurine

1834. Nees, Hymenopterorum ichneumonibus affinium, monographiae, vol. 2, p. 278. Ten species.

TYPE: *Calliceras sulcata* Nees, 1834. Designated by Mani, 1941, Catalogue of Indian insects, part 26, Serphoidea, p. 37. *Ceraphron carpenteri* Curtis, 1829, designated by Westwood, 1839, An introduction to the modern classification of insects, vol. 2, generic synopsis p. 77, was not among the originally included species.

Isogenotypic with *Ceraphron* Jurine through synonymy.

Calliscelio Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 209, 218.

TYPE: *Calliscelio laticinctus* Ashmead, 1893, by monotypy and original designation.

(*Callitelea* Agassiz, emendation) = *Calotelea* Westwood

1946. Agassiz, Nomenclator zoologicus. Index universalis, pp. 60, 61.

Calogalesus Kieffer

1912. Kieffer, in Wytzman, Genera insectorum, fasc. 124, 1911, pp. 6, 43.

TYPE: *Calogalesus parvulus* Kieffer, 1912, by monotypy.

Also described as new by Kieffer, 1912, Trans. Linn. Soc. London, ser. 2, Zool., vol. 15, p. 73.

Caloptenobia Riley

1878. Riley, Ann. Rep. U. S. Ent. Comm., Dep. Int., No. 1, p. 306.

TYPE: *Caloptenobia ovivora* Riley, 1878, by monotypy.

Considered synonym of *Scelio* Latreille.

Calotelea Westwood (= *Callitelea* Agassiz, emendation; *Caloteleia* Ashmead, emendation) [fossil]

1837. Westwood, in Hope, Trans. Ent. Soc. London, vol. 2, p. 55.

TYPE: *Calotelea aurantia* Hope, 1837, by monotypy.

(*Caloteleia* Ashmead, emendation) = *Calotelea* Westwood

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 209, 210, 212.

Camptopsilus Kieffer

1908. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 359, 366. No species.

1909. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 33, p. 339. One species.

TYPE: *Camptopsilus nigriceps* Kieffer, 1909. First included species.

Camptoteleia Kieffer

1913. Kieffer, Insecta, vol. 3, p. 387. Two species.

TYPE: *Camptoteleia carinata* Kieffer, 1913. Designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 379.

Carabiphagus Morley

1929. Morley, Trans. Suffolk Nat. Soc., vol. 1, p. 40.

TYPE: *Proctotrupes laevifrons* Foerster, 1861, by monotypy. Considered synonym of *Phaenoserphus* Kieffer.

Cardiopria Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 398, 429.

TYPE: *Cardiopria ventralis* Dodd, 1915, by monotypy and original designation.

Cardiopsilus Kieffer

1908. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 360, 405.

TYPE: *Cardiopsilus productus* Kieffer, 1908, by monotypy.

Carinafoenus Crosskey

1953. Crosskey, Trans. Roy. Ent. Soc. London, vol. 104, pp. 355, 358. Five species.

TYPE: *Foenus rufus* Westwood, 1841, by original designation.

Carinia Kieffer

1905. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 29, p. 140.

TYPE: *Carinia nitida* Kieffer, 1905, by monotypy.

(*Catillus* Foerster, not Brongniart, 1822) = *Piestopleura* Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 107, 111, 144.

TYPE: *Platygaster catillus* Walker, 1834 (= *Catillus walkeri* Foerster, 1856), by monotypy.

Ceranogmus Risbec

1953. Risbec, Bull. Inst. Français d'Afrique Noire, vol. 15, p. 560.

TYPE: *Ceranogmus testaceus* Risbec, 1953, by monotypy.

Ceraphron Jurine (= *Calliceras* Nees (= *Hadroceras* Foerster, new name); *Cerataphron* Schulz, emendation)

1807. Jurine, Nouvelle méthode de classer les hyménoptères et les diptères, p. 303. Two species.

TYPE: *Ceraphron sulcatus* Jurine, 1807. Designated by the International Commission on Zoological Nomenclature, 1946, under suspension of the Rules, Opinion 174, p. [497]. All prior type designations were set aside by this opinion.

Isogenotypic with *Calliceras* Nees through synonymy.

Ceraphron Panzer

1805. Panzer, Faunae insectorum Germaniae initia . . . , Heft 97, No. 16.

This name has been suppressed by the International Commission on Zoological Nomenclature under suspension of the Rules (Opinion 174, 1946).

Cerapsilon Haliday

1829. Haliday, in Curtis, A guide to an arrangement of British insects, column 109.

TYPE: *Psilus sericeicornis* Spinola, 1808, by monotypy. Eight names were listed but seven of them were nomina nuda.

(*Cerastopsilus* Kieffer, error) = *Ceratopsilus* Kieffer

1913. Kieffer, Insecta, vol. 3, pp. 461, 490.

Ceratacis Thomson

1859. Thomson, Öfv. Vet.-Akad. Förh., vol. 16, pp. 69, 78.

TYPE: *Ceratacis flavipes* Thomson, 1859, by monotypy.

Considered synonym of *Leptacis* Foerster.

(*Cerataphron* Schulz, emendation) = *Ceraphron* Jurine

1906. Schulz, Spolia hymenopterologica, p. 152.

Ceratobaeoides Dodd

1913. Dodd, Mem. Queensland Mus., vol. 2, p. 337. Two species.

TYPE: *Ceratobaeoides hackeri* Dodd, 1913, by original designation.

Ceratobaeus Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 167, 175. Two species.

TYPE: *Ceratobaeus cornutus* Ashmead, 1893, by original description.

Ceratopria Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 407, 428. Six species.

TYPE: *Ceratopria longiceps* Ashmead, 1893, by original designation. *Ceratopria longicornis* Ashmead, designated by Ashmead, 1903, Journ. New York Ent. Soc., vol. 11, p. 31, was an error for *Ceratopria longiceps* Ashmead.

Considered synonym of *Trichopria* Ashmead.

Ceratopsilus Kieffer (= *Cerastopsilus* Kieffer)

1913. Kieffer, Insecta, vol. 3, pp. 462 (fig. 12), 493.

TYPE: *Ceratopsilus rufipes* Kieffer, 1913, by monotypy and original designation.

Ceratoteleia Kieffer

1908. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 32, p. 121. Thirteen species.

TYPE: *Caloteleia grenadensis* Ashmead, 1895. Designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 501.

Chaetanteris Priesner

1951. Priesner, Bull. Inst. Fouad I du Desert, vol. 1, p. 136.

TYPE: *Chaetanteris serraticeps* Priesner, 1951, by monotypy and original designation.

Chalcidopterella Enderlein

1909. Enderlein, Stett. Ent. Zeit., vol. 70, p. 262. Two species.

TYPE: *Evaniellus chalcidipennis* Enderlein, 1905, by original designation.

(Cheirocerus Ashmead, lapsus) = **Lygocerus** Foerster

1881. Ashmead, Trans. Amer. Ent. Soc., vol. 9, Mon. Proc. p. xxxiv.

(Chlidonia Herrich-Schaeffer, not Lamouroux, 1824, not Huebner, 1825)

1838. Herrich-Schaeffer, in Panzer, Faunae insectorum Germaniae initia . . . , Heft 157, No. 24. Eight species.

TYPE: *Chlidonia moniliata* Herrich-Schaeffer, 1838. Designated by Viereck, 1914, U. S. Nat. Mus. Bull. 83, p. 31.

Viereck followed Dalla Torre, 1898, Catalogus hymenopterorum, vol. 4, p. 228, in synonymizing *Chlidonia* with *Hormius* Nees, 1818 (Braconidae), on the incorrect supposition that *Chlidonia moniliata* Herrich-Schaeffer was identical with *Bracon moniliatus* Nees, the type of *Hormius*.

Although *Chlidonia* Herrich-Schaeffer is preoccupied it is not renamed since it is considered a synonym of *Spilomicrus* Westwood.

Chrestoteleia Kieffer (= *Crestoteleia* Kieffer, error)

1913. Kieffer, Insecta, vol. 3, p. 388.

TYPE: *Chrestoteleia bakeri* Kieffer, 1913, by monotypy and original designation.

Chromoteleia Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 209, 211, 219.

TYPE: *Chromoteleia semicyanea* Ashmead, 1893, by monotypy and original designation.

Cinetus Jurine (= *Cinntus* Curtis, error)

1807. Jurine, Nouvelle méthode de classer les hyménoptères et les diptères, p. 310. No species.

1825. Lepeletier and Serville, Encyclopédie Méthodique, Zool., vol. 10, p. 210. One species.

TYPE: *Cinetus iridipennis* Lepeletier and Serville, 1825. First included species. Also designated by Kieffer, 1910, Genera insectorum, fasc. 107, p. 36. *Cinetus gracilipes* Curtis, 1831, designated by Curtis, 1831, British entomology, vol. 8, folio 380, was included later. *Belyta bicolor* Jurine, 1807, was erroneously designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 682.

(*Cinntus* Curtis, error) = **Cinetus** Jurine

1829. Curtis, A guide to an arrangement of British insects, column 109.

Clinopria Kieffer

1905. Kieffer, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, vol. 2 (42), pp. 30, 37.

TYPE: *Clinopria fusca* Kieffer, 1905, by monotypy.

Codrus Panzer

1801. Panzer, Faunae insectorum Germaniae initia . . . ,

Heft 85. No. 9. Two species.

TYPE: *Codrus niger* Panzer, 1801. Designated by Morice and Durrant, 1915, *Trans. Ent. Soc. London*, 1915, p. 435. *Codrus apterygynus* Haliday, 1839, designated by Ashmead, 1893, *U. S. Nat. Mus. Bull.* 45, p. 344, was not originally included.

Coelopelta Ashmead

1893. Ashmead, *U. S. Nat. Mus. Bull.* 45, pp. 263, 264, 289.

TYPE: *Coelopelta mirabilis* Ashmead, 1893, by monotypy and original designation.

Coelopria Kieffer

1910. Kieffer, in André, *Spec. Hym. Eur. Alg.*, vol. 10, pp. 716, 747.

TYPE: *Coelopria maura* Kieffer, 1910, by monotypy.

Coenopria Kieffer

1905. Kieffer, *Ann. Soc. Sci. Bruxelles*, vol. 29, p. 132.

TYPE: *Coenopria fuscipennis* Kieffer, 1905, by monotypy.

Cologlyptus Crawford

1910. Crawford, *Proc. U. S. Nat. Mus.*, vol. 38, p. 123.

TYPE: *Cologlyptus kiefferi* Crawford, 1910, by monotypy and original designation.

Conostigmoides Dodd

1914. Dodd, *Trans. Roy. Soc. South Australia*, vol. 38, pp. 88, 94.

TYPE: *Eumegaspilus erythrothorax* Ashmead, 1893, by monotypy and original designation.

Conostigmus Dahlbom

1858. Dahlbom, *Öfv. Vet.-Akad. Förh.*, vol. 14, 1857, p. 291. No species.

1907. Kieffer, in André, *Spec. Hym. Eur. Alg.*, vol. 10, p. 80. Many species.

TYPE: *Megaspilus alutaceus* Thomson, 1858. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., *U. S. Dept. Agr., Agr. Monogr. No. 2*, p. 670.

Proposed as a subgenus of *Megaspilus* Westwood.

Copelus Provancher

1881. Provancher, *Nat. Canadien*, vol. 12, p. 206.

TYPE: *Copelus paradoxus* Provancher, 1881, by monotypy. Considered synonym of *Helorus* Latreille.

Coptera Say

1836. Say, *Boston Journ. Nat. Hist.*, vol. 1, p. 281.

TYPE: *Coptera polita* Say, 1836, by monotypy. Considered synonym of *Psilus* Panzer.

(Coranila Westwood) = Brachygaster Leach

1843. Westwood, Trans. Ent. Soc. London, vol. 3, p. 240.

TYPE: *Evania minuta* Olivier, 1791. *Coranila* Leach MS. was validated and its type fixed by Westwood through citation as a synonym of *Brachygaster* Leach.

Corynopria Haliday

1857. Haliday, Nat. Hist. Rev., vol. 4, Proc. p. 170. Three species.

TYPE: *Diapria petiolaris* Nees, 1834. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 676.

Proposed as a subgenus of *Diapria* Latreille. Considered synonym of *Monelata* Foerster.

Cracinopria Fouts

1924. Fouts, Proc. Ent. Soc. Washington, vol. 26, p. 162. Four species.

TYPE: *Trichopria marylandica* Fouts, 1920, by original designation.

Crassifoenus Crosskey

1953. Crosskey, Trans. Roy. Ent. Soc. London, vol. 104, p. 355. Two species.

TYPE: *Gasteruption macronyx* Schletterer, 1889, by original designation.

Cremastobaeus Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 210, 211, 228.

TYPE: *Cremastobaeus bicolor* Ashmead, 1893, by monotypy and original designation.

Cremastoscielio Dodd

1913. Dodd, Trans. Roy. Soc. South Australia, vol. 37, pp. 131, 156. Two species.

TYPE: *Cremastoscielio flavipes* Dodd, 1913, by original designation.

(Crestoteleia Kieffer, error) = Chrestoteleia Kieffer

1916. Kieffer, Brotéria, Rev. Luso-Brazileira, Zool. ser., vol. 14, p. 181.

Cryptoserphus Kieffer

1907. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 288. No species.

1908. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 313. Ten species.

TYPE: *Serphus (Cryptoserphus) longicalcar* Kieffer, 1908. Designated by Kieffer, 1908, in André, Spec. Hym. Eur. Alg., vol. 10, p. 314.

Proposed as a subgenus of *Serphus* Schrank.

Cyathopria Kieffer

1909. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 33, p. 383.

TYPE: *Cyathopria rufiventris* Kieffer, 1909, by monotypy.

Cyphacolus Priesner

1951. Priesner, Bull. Inst. Fouad I du Desert, vol. 1, p. 123.

TYPE: *Cyphacolus veniprivus* Priesner, 1951, by monotypy and original designation.

(Dasynopeas Apstein, error) = **Disynopeas** Kieffer

1926. Apstein, in Kieffer, Das Tierreich, Lief. 48, p. 879.

Dendrocerus Ratzeburg

1852. Ratzeburg, Die Ichneumonien der Forstinsecten . . . , vol. 3, p. 180.

TYPE: *Dendrocerus lichtensteinii* Ratzeburg, 1852, by monotypy.

(Deraiodontus Bradley, error) = **Deraiodontus** Bradley

1901. Bradley, Trans. Amer. Ent. Soc., vol. 27, p. 321.

Deraiodontus Bradley (= *Deraiodontus* Bradley, error)

1901 (May). Bradley, Ent. Student, vol. 2, p. 29. No species.

1901 (Nov.). Bradley, Trans. Amer. Ent. Soc., vol. 27, pp. 320, 321. Three species.

TYPE: *Aulacus montanus* Cresson, 1879. Designated by Bradley, Trans. Amer. Ent. Soc., vol. 27, p. 321.

Considered synonym of *Pristaulacus* Kieffer.

Diapria Latreille (= *Tropidopria* Ashmead; *Tropidobria* Brèthes, error)

1796. Latreille, Précis caractères génériques des insectes . . . , p. 110. No species.

1802. Latreille, Histoire naturelle . . . crustacés et des insectes, vol. 3, p. 309. Two species.

TYPE: *Ichneumon conicus* Fabricius, 1775. Designated by Latreille, 1810, Considérations générales . . . des insectes, p. 436. *Psilus elegans* Jurine, 1807, designated by Westwood, 1839, An introduction to the modern classification of insects, vol. 2, generic synopsis p. 75, and *Diapria verticillata* Latreille, 1805, designated by Ashmead, 1903, Journ. New York Ent. Soc., vol. 11, p. 31, were included later.

Isogenotypic with *Tropidopria* Ashmead.

Dibaryconus Kieffer

1926. Kieffer, Das Tierreich, Lief. 48, pp. xxvii, 270, 486. Four species.

TYPE: *Baryconus sordidus* Dodd, 1914, by original designation.

Dichacantha Kieffer

1908. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 32, pp. 118, 147.
TYPE: *Trimorus luteus* Cameron, 1888, by monotypy and original designation.

Considered synonym of *Scelio* Latreille.

Dichognus Thomson (= *Dichognus* Ashmead, error)

1858. Thomson, Öfv. Vet.-Akad. Förh., vol. 15, pp. 287, 301.
TYPE: *Dichognus dimidiatus* Thomson, 1858, by monotypy.

(Dichognus Ashmead, error) = **Dichognus** Thomson

1903. Ashmead, Journ. New York Ent. Soc., vol. 11, p. 34.

Dichoteleas Kieffer

1907. Kieffer, Berliner Ent. Zeitschr., vol. 51, p. 297.
TYPE: *Dichoteleas rugosus* Kieffer, 1907, by monotypy.

Dicroscelio Kieffer

1913. Kieffer, in Alluaud and Jeannel, Voyage . . . en Afrique Orientale. Insectes hyménoptères, vol. 1, p. 16.
TYPE: *Dicroscelio flavipes* Kieffer, 1913, by monotypy and original designation.

Dicroteleia Kieffer

1908. Kieffer, Leyden Mus. Notes, vol. 30, p. 92.
TYPE: *Dicroteleia rugosa* Kieffer, 1908, by monotypy.

Digalesus Kieffer

1914. Kieffer, Philippine Journ. Sci., vol. 9, p. 303.
TYPE: *Digalesus flavipes* Kieffer, 1914, by monotypy and original designation.

Dilapitha Kieffer

1914. Kieffer, Philippine Journ. Sci., vol. 9, p. 293. Two species.
TYPE: *Dilapitha albipes* Kieffer, 1914, by original designation.

Dilobopria Kieffer

1914. Kieffer, Insecta, vol. 4, p. 190.
TYPE: *Dilobopria rufipes* Kieffer, 1914, by monotypy and original designation.

Diphora Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 130, 140.
TYPE: *Diphora westwoodii* Foerster, 1856, by monotypy.

Diphoropria Kieffer

1905. Kieffer, Bull. Soc. Hist. Nat. Metz, vol. 24, p. 103.
TYPE: *Diphoropria rufipes* Kieffer, 1905, by monotypy.

Diplatygaster Kieffer

1926. Kieffer, *Das Tierreich*, Lief. 48, pp. xxxvi, 563, 843.

TYPE: *Platygaster formicarius* Kieffer, 1904, by monotypy.

Disaulacinus Kieffer

1910. Kieffer, *Bull. Soc. Ent. France*, 1910, p. 350. No species.

1911. Kieffer, *Ann. Soc. Ent. France*, vol. 80, pp. 214, 224. One species.

TYPE: *Disaulacinus flavimanus* Kieffer, 1911. First included species.

Discelio Kieffer

1908. Kieffer, *Ann. Soc. Sci. Bruxelles*, vol. 32, pp. 116, 124. Two species.

TYPE: *Scelio thoracicus* Ashmead, 1900. Designated by Kieffer, 1926, *Das Tierreich*, Lief. 48, p. 343.

Considered synonym of *Scelio* Latreille.

Disognus Foerster

1856. Foerster, *Hymenopterologische Studien*, Heft 2, p. 99.

TYPE: *Proctotrupes areolator* Haliday, 1839, by monotypy.

Disphaeron Dahlbom

1837. Dahlbom, *Isis*, Heft 3, column 175.

TYPE: *Aulacus arcticus* Dahlbom, 1837 (= *Disphaeron arcticus* Dahlbom, 1837), by monotypy.

Dahlbom described *Aulacus arcticus* from the Zetterstedt collection and stated that it had been labeled *Disphaeron arcticus* by Zetterstedt. Thus he validated the name *Disphaeron*.

Considered synonym of *Aulacus* Jurine.

Dissacolus Kieffer

1926. Kieffer, *Das Tierreich*, Lief. 48, pp. xvii, 133, 155.

TYPE: *Acolus bidentatus* Dodd, 1914, by monotypy.

Dissolcoides Dodd

1913. Dodd, *Arch. Naturg.*, vol. 79, A6, p. 179.

TYPE: *Dissolcoides exsertus* Dodd, 1913, by monotypy and original designation.

Dissolcus Ashmead

1893. Ashmead, *U. S. Nat. Mus. Bull.* 45, pp. 138, 164.

TYPE: *Dissolcus nigricornis* Ashmead 1893, by monotypy and original designation.

Dissoxylabis Kieffer

1909. Kieffer, *Ann. Soc. Sci. Bruxelles*, vol. 33, p. 342.

TYPE: *Dissoxylabis hirtipes* Kieffer, 1909, by monotypy.

Disynopeas Kieffer (= *Dasynopeas* Apstein, error)

1916. Kieffer, Zentralbl. Bakt. Parasitenk. Infektionskr., Abt. 2, vol. 46, p. 591.

TYPE: *Disynopeas lasiopterae* Kieffer, 1916, by monotypy and original designation.

Doddiella Kieffer

1913. Kieffer, Bol. Lab. Zool. Portici, vol. 7, p. 109.

TYPE: *Doddiella nigriceps* Kieffer, 1913, by monotypy and original designation.

Dolichofoenus Kieffer

1910. Kieffer, Ann. Soc. Ent. France, vol. 79, p. 77. Two species.

TYPE: *Foenus raphidioides* Westwood, 1851, by original designation.

Dolichopria Kieffer

1910. Kieffer, in Wissenschaftliche Ergebnisse der deutschen Zentral-Afrika-Expedition 1907-08 . . . , vol. 3 (Zool.), Lief. 2, p. 99.

TYPE: *Dolichopria gracilis* Kieffer, 1910, by monotypy.

Dolichotrypes Crawford and Bradley

1911. Crawford and Bradley, Proc. Ent. Soc. Washington, vol. 13, p. 124.

TYPE: *Dolichotrypes hopkinsi* Crawford and Bradley, 1911, by monotypy and original designation.

Considered synonym of *Leptacis* Foerster.

Doliopria Kieffer

1910. Kieffer, Ent. Rundschau, vol. 27, No. 8, p. 48. No species.

1910. Kieffer, Ent. Rundschau, vol. 27, No. 9, p. 54. One species.

TYPE: *Doliopria flavipes* Kieffer, 1910. First included species.

Dorachia, new name (= *Rhacodia* Herrich-Schaeffer, 1838, not Huebner [1825])

TYPE: *Diapria striolata* Nees, 1834, by substitution of *Dorachia* for *Rhacodia* Herrich-Schaeffer.

Duarina Dodd

1926. Dodd, Proc. Linn. Soc. New South Wales, vol. 51, p. 377.

TYPE: *Duarina venustella* Dodd, 1926, by monotypy and original designation.

Duta Nixon

1933. Nixon, Ann. Mag. Nat. Hist., ser. 10, vol. 12, p. 306.

TYPE: *Holoteleia tenuicornis* Dodd, 1920, by monotypy and original designation.

Dyscritobaeus Perkins

1910. Perkins, Fauna Hawaiiensis, vol. 2, p. 621.

TYPE: *Dyscritobaeus comitans* Perkins, 1910, by monotypy.

Eccinetus, new name (= *Procinetus* Kieffer, 1910, not Foerster, 1868).

TYPE: *Cinetus radiatus* Kieffer, 1905, by substitution of *Eccinetus* for *Procinetus* Kieffer.

Echinoteleas Risbec

1954. Risbec, Bull. Inst. Français d'Afrique Noire, vol. 16, p. [1035].

TYPE: *Echinoteleas auratus* Risbec, by monotypy and original designation.

Ecitonetes Brues

1902. Brues, Amer. Nat., vol. 36, p. 370.

TYPE: *Ecitonetes subapterus* Brues, 1902, by monotypy.

Ectadius Foerster (= *Polymecus* Foerster)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 108, 113, 114, 144.

TYPE: *Platygaster craterus* Walker, 1835, by monotypy.
Considered synonym of *Leptacis* Foerster.

Efflatounina Priesner

1951. Priesner, Bull. Inst. Fouad I du Desert, vol. 1, p. 126.

TYPE: *Efflatounina gryontoides* Priesner, 1951, by monotypy and original designation.

(Elaptus Forbes) = *Amitus* Haldeman

1885. Forbes, Rep. Illinois State Ent., No. 14, 1884, p. 110.

TYPE: *Elaptus aleurodis* Forbes, 1885, by monotypy.

Isogenotypic with *Amitus* Haldeman through synonymy.

Evidently error for mymarid genus *Alaptus* Westwood to which Forbes wrongly considered his species to belong. Moreover, *Elaptus* Forbes is preoccupied by *Elaptus* Pascoe, 1867, in Coleoptera.

Electrofoenus Cockerell [fossil]

1917. Cockerell, Amer. Journ. Sci., vol. 44, p. 364.

TYPE: *Electrofoenus gracilipes* Cockerell, 1917, by monotypy and original designation.

Electroteleia Brues [fossil]

1940. Brues, Proc. Amer. Acad. Arts Sci., vol. 74, p. 80.

TYPE: *Electroteleia stigmatica* Brues, 1940, by monotypy and original designation.

Elgonia Risbec

1950. Risbec, Contribution à l'étude des Proctotrupidae. Trav. Lab. Ent. Sect. Soudan. Rech. Agron., p. 549.

TYPE: *Elgonia maxillosa* Risbec, 1950, by monotypy.

Considered synonym of *Apegus* Foerster.

Elysoceraphron Szelényi

1936. Szelényi, Ann. Mus. Nat. Hungarici, vol. 30, Zool., p. 64.

TYPE: *Elysoceraphron hungaricus* Szelényi, 1936, by monotypy and original designation.

Embidobia Ashmead

1895. Ashmead, Journ. Trinidad Field Nat. Club, vol. 2, p. 264.

TYPE: *Embidobia urichi* Ashmead, 1895, by monotypy.

Encyrtoscelio Dodd

1914. Dodd, Proc. Roy. Soc. Queensland, vol. 26, p. 119.

TYPE: *Encyrtoscelio mirissimus* Dodd, 1914, by monotypy and original designation.

Enneascelio Kieffer

1910. Kieffer, Bull. Soc. Ent. France, 1910, p. 293.

TYPE: *Enneascelio exaratus* Kieffer, 1910, by monotypy and original designation.

Again described as new by Kieffer, 1912, Trans. Linn. Soc. London, ser. 2, Zool., vol. 15, p. 54.

Entomacis Foerster (= *Glyphidopria* Haliday)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 121, 123. No species.

1873. Marshall, A catalogue of British Hymenoptera; Oxyura, p. 10. Two species.

TYPE: *Diapria* (*Glyphidopria*) *platyptera* Haliday, 1857. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 673. *Hemilexis* (*Entomacis*) *cordata* Kieffer, 1911, designated by Kieffer, 1916, Das Tierreich, Lief. 44, p. 40, was included later.

Isogenotypic with *Glyphidopria* Haliday.

Entomia Herrich-Schaeffer (= *Entomius* Haliday, emendation)

1840. Herrich-Schaeffer, Nomenclator entomologicus, Heft 2, p. 127; pl. 6, fig. 21.

TYPE: *Entomia campanulata* Herrich-Schaeffer, 1840, by monotypy.

Considered synonym of *Ismarus* Haliday.

(Entomius Haliday, emendation) = **Entomia** Herrich-Schaeffer

1857. Haliday, Nat. Hist. Rev., vol. 4, Proc. p. 169.

Designation of *Ismarus halidayi* Foerster, 1850, as type by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 681, was unnecessary since *Entomia* Herrich-Schaeffer is a valid name and not a nomen nudum as previously supposed.

Entomopria Kieffer

1912. Kieffer, in Wytsman, *Genera insectorum*, fasc. 124, 1911, pp. 4, 18.

TYPE: *Corynopria solida* Thomson, 1858, by monotypy.

Again described as new by Kieffer, 1912, *Trans. Linn. Soc. London*, ser. 2, Zool., vol. 15, p. 68.

Eoxestonotus Debauche

1947. Debauche, *Bull. Ann. Soc. Ent. Belgique*, vol. 83, p. 267. Two species.

TYPE: *Eoxestonotus pini* Debauche, 1947, by original designation.

Considered synonym of *Xestonotidea* Gahan.

(Epimeces Westwood, not Billberg, 1820) = **Parepimeces** Kieffer

1833. Westwood, *Mag. Nat. Hist.*, vol. 6, p. 421. Two species.

TYPE: *Epimeces ensifer* Westwood, 1833, by elimination. In establishing *Sactogaster*, Foerster, 1856, *Hymenopterologische Studien*, Heft 2, p. 113, transferred to it *Epimeces ventralis* Westwood, 1833, leaving only *ensifer* Westwood in *Epimeces*.

Epinomus Ghesquière

1948. Ghesquière, *Rev. Zool. Bot. Africaines*, vol. 40, p. 324.

TYPE: *Epinomus anoplocnemidis* Ghesquière, 1948, by monotypy and original designation.

(Episceuastes Gistel) = **Pelecinius** Latreille

1848. Gistel, *Naturgeschichte des Tierreichs*, p. x.

TYPE: *Ichneumon polycerator* Fabricius, 1776, by substitution of *Episceuastes* for *Pelecinius* Latreille.

Unnecessarily proposed for *Pelecinius* Latreille which Gistel thought to be preoccupied by *Pelecinius* Moench in botany.

Eremioscelio Priesner

1951. Priesner, *Bull. Inst. Fouad I du Desert*, vol. 1, p. 129.

TYPE: *Eremioscelio cydnoides* Priesner, 1951, by monotypy and original designation.

(Eriodorus Agassiz, error) = **Erodorus** Walckenaer

1846. Agassiz, *Nomenclator zoologicus. Index universalis*, p. 143.

Eriopria Kieffer

1910. Kieffer, in André, *Spec. Hym. Eur. Alg.*, vol. 10, pp. 693, 744. Three species, one of them doubtfully included.

TYPE: *Eriopria nigra* Kieffer, 1910. Designated by Kieffer, 1912, in Wytsman, *Genera insectorum*, fasc. 124, 1911, p. 31.

Eritrissomerus Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 263, 264, 298.

TYPE: *Eritrissomerus cecidomyiae* Ashmead, 1893, by monotypy and original designation.

Erodorus Walckenaer (= *Eriodorus* Agassiz, error)

1802. Walckenaer, Faune Parisienne, Insectes, vol. 2, p. 47.

TYPE: *Erodorus bimaculatus* Walckenaer, 1802, by monotypy.

Considered synonym of *Proctotrupes* Latreille.

Eufoenus Szépligeti

1903 (August). Szépligeti, Ann. Mus. Nat. Hungarici, vol. 1, p. 365. Four species.

TYPE: *Gasteruption antennale* Schletterer, 1889. Designated by Bradley, 1909, Deut. Ent. Zeitschr., 1909, p. 38.

Considered synonym of *Hyptiogaster* Kieffer, which was published Mar. 6, 1903.

Euhoplopria Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 399, 414. Three species.

TYPE: *Euhoplopria carinatifrons* Dodd, 1915, by original designation.

Eulagynodes Girault

1917. Girault, New Javanese Hymenoptera, p. 9. (Private publication.)

TYPE: *Eulagynodes bicolor* Girault, 1917, by monotypy and original designation.

(*Eumegaspilus* Schulz, emendation) = *Eumegaspilus* Ashmead

1906. Schulz, Spolia hymenopterologica, p. 152.

***Eumegaspilus* Ashmead (= *Eumegaspilus* Schulz, emendation)**

1888. Ashmead, Can. Ent., vol. 20, pp. 43, 49. Two species.

TYPE: *Eumegaspilus canadensis* Ashmead, 1888. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 670. *Eumegaspilus erythrothorax* Ashmead, 1893, designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 119, was not originally included (see *Conostigmoides* Dodd).

Considered synonym of *Conostigmus* Dahlbom.

Eumicrosoma Gahan

1913. Gahan, Proc. U. S. Nat. Mus., vol. 46, p. 442.

TYPE: *Eumicrosoma beneficum* Gahan, 1913, by monotypy and original designation.

Euplacopria Ferrière

1929. Ferrière, Zool. Anz., vol. 82, p. 157.

TYPE: *Euplacopria mutilata* Ferrière, 1929, by monotypy.

Eurostemma Szelényi

1938. Szelényi, *Folia Ent. Hungarica*, vol. 3, pp. 99, 102.

TYPE: *Inostemma europus* Walker, 1838, by monotypy and original designation.

Euxestonotus Fouts

1925. Fouts, *Proc. Ent. Soc. Washington*, vol. 27, p. 98.
Four species.

TYPE: *Platygaster error* Fitch, 1861, by original designation.
Considered synonym of *Xestonotidea* Gahan.

Evania Fabricius (= *Evenia* Schletterer, error)

1775. Fabricius, *Systema entomologiae* . . . , p. 345. Two species.

TYPE: (*Sphex appendigaster* Fabricius) = *Ichneumon appendigaster* Linnaeus. Designated by Latreille, 1810, *Considérations générales . . . des insectes*, p. 436.

Evaniella Bradley

1905. Bradley, *Can. Ent.*, vol. 37, p. 64. Three species.

TYPE: (*Evania unicolor* Ashmead, 1901, not Say, 1859) = *Evaniella semaeoda* Bradley, 1908, by original designation.

Evaniellus Enderlein

1905. Enderlein, *Zool. Anz.*, vol. 28, pp. 700, 701, 714. Four species.

TYPE: *Evaniellus peruanus* Enderlein, 1905, by original designation.

Evaniscus Szépligeti

1903. Szépligeti, *Ann. Mus. Nat. Hungarici*, vol. 1, pp. 375, 378.

TYPE: *Evaniscus tibialis* Szépligeti, 1903, by monotypy.

(*Evenia* Schletterer, error) = *Evania* Fabricius

1889. Schletterer, *Ann. Naturh. Hofmus.*, vol. 4, p. 118.

Exallonyx Kieffer

1904. Kieffer, *Bull. Soc. Hist. Nat. Metz*, vol. 23, p. 34.
Eleven species.

TYPE: *Exallonyx formicarius* Kieffer, 1904, by original designation.

Considered synonym of *Codrus* Panzer.

Fahringeria Kieffer

1921. Kieffer, *Brotéria*, *Rev. Luso-Braziliera*, *Zool. ser.*, vol. 19, p. 68.

TYPE: *Fahringeria synergorum* Kieffer, 1921, by monotypy.

(*Foenus* Couper, error) = *Foenus* Fabricius

1870. Couper, *Can. Ent.*, vol. 2, p. 110.

Fidiobia Ashmead (= *Rosneta* Brues)

1894. Ashmead, Journ. Cincinnati Soc. Nat. Hist., vol. 17, p. 170.

TYPE: *Fidiobia flavipes* Ashmead, 1894, by monotypy.

Isogenotypic with *Rosneta* Brues through synonymy.

(Foenus Fabricius; *Feonus* Couper, error; *Phoenus* Schletterer emendation) = **Gasteruption** Latreille

1798. Fabricius, Supplementum entomologiae systematicae, pp. 210, 240. Two species.

TYPE: *Ichneumon jaculator* Linnaeus, 1758. Designated by Latreille, 1810, Considérations générales . . . des insectes, p. 436. *Ichneumon assectator* Linnaeus, 1758, was designated by Curtis, 1832, British entomology, folio 423.

Isogenotypic with *Gasteruption* Latreille.

Fusicornia Risbec

1950. Risbec, Contribution à l'étude des Proctotrupidae. Trav. Lab. Ent. Sect. Soudan. Rech. Agron., p. 606.

TYPE: *Fusicornia bambeyi* Risbec, 1950, by monotypy.

Galesimorpha Brues [fossil]

1910. Brues, Bull. Comp. Zool., vol. 54, p. 12.

TYPE: *Galesimorpha wheeleri* Brues, 1910, by monotypy and original designation.

(Galesus Haliday) = **Psilus** Panzer

1829. Haliday, in Curtis, A guide to an arrangement of British insects, column 108.

TYPE: *Psilus cornutus* Panzer, 1801, by monotypy. Three names were listed but two of them were nomina nuda. *Galesus fuscipennis* Curtis, 1831, designated by Kieffer, 1912, in Wytzman, Genera insectorum, fasc. 124, 1911, p. 40, was one of the nomina nuda.

Isogenotypic with *Psilus* Panzer.

(Gasteruptionia Dominique, emendation) = **Gasteruption** Latreille

1893. Dominique, Bull. Soc. Sci. Nat. Ouest France, vol. 3, p. 198.

Gasteruption Latreille (= *Gastryptium* Agassiz, *Gasteryption* Schletterer, *Gasteruptionia* Dominique, *Hyptiagaster* Dominique, *Gasteruptionium* Schulz, *Gastrhyptionium* Schulz, emendations; *Foenus* Fabricius)

1796. Latreille, Précis caractères génériques des insectes, p. 113. No species.

1802. Latreille, Histoire naturelle . . . crustacés et des insectes, vol. 3, p. 329. Two species by bibliographic reference through synonymy of *Gasteruption* with *Foenus*.

TYPE: *Ichneumon jaculator* Linnaeus, 1758. Designated by Westwood, 1839, An introduction to the modern classification of insects, vol. 2, generic synopsis p. 56, in his treatment of *Foenus* Fabricius. *Ichneumon assec-tator* Linnaeus, 1758, was designated by Mani, 1939, Catalogue of Indian insects, pt. 24, Evaniidae, p. 9.

Isogenotypic with *Foenus* Fabricius.

(*Gasteruption* Schulz, emendation) = *Gasteruption* Latreille 1906. Schulz, Spolia hymenopterologica, p. 133.

(*Gasteryption* Schletterer, emendation) = *Gasteruption* Latreille 1890. Schletterer, Ann. Naturh. Hofmus., vol. 4, p. 375.

(*Gastrhyption* Schulz, emendation) = *Gasteruption* Latreille 1911. Schulz, Zool. Ann., vol. 4, p. 55.

Gastrotrypes Brues

1922. Brues, Proc. Amer. Acad. Arts Sci., vol. 57, p. 270. Two species.

TYPE: *Gastrotrypes spatulatus* Brues, 1922, by original designation.

Gastroxylabis Ogloblin

1954. Ogloblin, Rev. Chilena Ent., vol. 3, 1953, p. 69. Two species.

TYPE: *Gastroxylabis rubrosignata* Ogloblin, 1954, by original designation.

(*Gastryptium* Agassiz, emendation) = *Gasteruption* Latreille

1846. Agassiz, Nomenclator zoologicus. Index universalis, pp. 159, 160.

Geodiapria Kieffer

1910. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 707. No species.

1911. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 896. One species.

TYPE: *Geodiapria longiceps* Kieffer, 1911. First included species.

Gita Nixon

1933. Nixon, Ann. Mag. Nat. Hist., ser. 10, vol. 12, p. 309.

TYPE: *Gita infortunata* Nixon, 1933, by monotypy and original designation.

(*Glyphidopria* Haliday) = *Entomacis* Foerster

1857. Haliday, Nat. Hist. Rev., vol. 4, Proc. p. 172. Two species.

TYPE: *Diapria* (*Glyphidopria*) *platyptera* Haliday, 1857. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 673.

Proposed as a subgenus of *Diapria* Latreille. Isogenotypic with *Entomacis* Foerster.

Glyptonota Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 122, 126. No species.

1893. Ashmead, U. S. Nat. Mus. Bull. 45, p. 401. One species.

TYPE: *Glyptonota nigriclavata* Ashmead, 1893. First included species.

Glyptoteleia Kieffer

1926. Kieffer, Das Tierreich, Lief. 48, pp. xxvii, 272, 487.

TYPE: *Baryconus bisulcatus* Kieffer, 1910, by monotypy.

Govinda Nixon

1933. Nixon, Ann. Mag. Nat. Hist., ser. 10, vol. 12, p. 465. Five species.

TYPE: *Govinda mila* Nixon, 1933, by original designation.

Gryon Haliday

1833. Haliday, Ent. Mag., vol. 1, p. 271.

TYPE: *Gryon misellus* Haliday, 1833, by monotypy.

Gryonella Dodd

1914. Dodd, Trans. Roy. Soc. South Australia, vol. 38, pp. 75, 84. Two species.

TYPE: *Gryonella crawfordi* Dodd, 1914, by original designation.

Gryonoides Dodd

1920. Dodd, Trans. Ent. Soc. London, 1919, p. 360. Three species.

TYPE: *Gryonoides pulchellus* Dodd, 1920, by original designation.

(Habropelta Schulz, emendation) = **Habropelte** Thomson

1906. Schulz, Spolia hymenopterologica, p. 152.

Habropelte Thomson (= *Habropelta* Schulz, emendation)

1858. Thomson, Öfv. Vet.-Akad. Förh., vol. 15, pp. 287, 288. Three species.

TYPE: *Ceraphron tibialis* Boheman, 1832. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 104. *Ceraphron scutellaris* Boheman (cited as "Dalb." by Ashmead), 1832, of which *Ceraphron tibialis* Boheman is considered a synonym, was designated by Ashmead, 1903, Journ. New York Ent. Soc., vol. 11, p. 33.

Considered synonym of *Megaspilus* Westwood.

Habroteleia Kieffer

1905. Kieffer, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, vol. 2 (42), p. 14.

TYPE: *Habroteleia flavipes* Kieffer, 1905, by monotypy.

(Hadroceras Foerster, new name for *Calliceras* Nees) = **Cera-phron** Jurine

1840. Foerster, Beiträge zur Monographie der Pteromalinen Nees, Heft 1, p. xliv.

TYPE: *Calliceras sulcatus* Nees, 1834, by substitution of *Hadroceras* for *Calliceras* Nees.

Unnecessarily proposed for *Calliceras* Nees, 1834, which Foerster thought to be preoccupied by *Callicera* Meigen, 1822.

Hadronotellus Kieffer

1917. Kieffer, Ent. Medd., ser. 2, vol. 11, p. 341.

TYPE: *Hadronotellus pedester* Kieffer, 1917, by monotypy and original designation.

Considered synonym of *Hadronotus* Foerster.

Hadronotoides Dodd

1913. Dodd, Arch. Naturg., vol. 79, A6, p. 171.

TYPE: *Hadronotoides pentatomus* Dodd, 1913, by monotypy and original designation.

Hadronotus Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 101, 105. Two names, both nomina nuda.

1861. Foerster, Programm der Realschule zu Aachen . . . , p. xli. One species.

TYPE: *Hadronotus exsculptus* Foerster, 1861. First included species. *Hadronotus laticeps* Foerster, designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 229, was a nomen nudum. *Hadronotus laticeps* Kieffer, 1908, designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 453, and by Mani, 1941, Catalogue of Indian insects, Pt. 26, Serphoidea, p. 26, was included later.

Hadrophanurus Kieffer

1926. Kieffer, Das Tierreich, Lief. 48, pp. xvi, 15, 130.

TYPE: *Telenomus* (?) *pennsylvanicus* Ashmead, 1893, by monotypy and original designation.

Helorus Latreille

1802. Latreille, Histoire naturelle . . . crustacés et des insectes, vol. 3, p. 309.

TYPE: *Helorus ater* Latreille, 1802, by monotypy. *Sphex anomalipes* Panzer, 1798, of which *Helorus ater* is

considered a synonym, was designated by Latreille, 1810, *Considérations générales . . . des insectes*, p. 437.

Hemifoenus Kieffer

1911. Kieffer, *Ann. Soc. Ent. France*, vol. 80, pp. 177, 182.

TYPE: *Hemifoenus brevithorax* Kieffer, 1911, by monotypy.

Hemigalesus Kieffer

1913. Kieffer, *Insecta*, vol. 3, p. 433. Four species.

TYPE: *Hemigalesus niger* Kieffer, 1913, by original designation.

Hemilexis Foerster

1856. Foerster, *Hymenopterologische Studien*, Heft 2, pp. 122, 123, 127. No species.

1887. Ashmead, *Can. Ent.*, vol. 19, p. 196. One species.

TYPE: *Hemilexis (mellipetiola!) = mellipetiolata* Ashmead, 1887. First included species. *Diapria (Glyphidopria) platyptera* Haliday, 1857, designated by Ashmead, 1903, *Journ. New York Ent. Soc.*, vol. 11, p. 29, and *Hemilexis californica* Ashmead, 1893, designated by Kieffer, 1916, *Das Tierreich*, Lief. 44, p. 46, were included later.

Hemilexodes Ashmead

1893. Ashmead, *U. S. Nat. Mus. Bull.* 45, pp. 386, 399.

TYPE: *Hemilexodes floridana* Ashmead, 1893, by monotypy and original designation.

Hemilexomyia Dodd

1920. Dodd, *Proc. Linn. Soc. New South Wales*, vol. 45, p. 443.

TYPE: *Hemilexomyia abrupta* Dodd, 1920, by monotypy and original designation.

Hemimorus Cameron

1912. Cameron, *Soc. Ent.*, vol. 27, No. 17, p. 77.

TYPE: *Hemimorus clavicornis* Cameron, 1912, by monotypy. Considered synonym of *Trimorus* Foerster.

Hemisius Westwood

1833. Westwood, *London Edinburgh Phil. Mag.*, ser. 3, vol. 2, p. 445.

TYPE: *Hemisius minutus* Westwood, 1833, by monotypy.

Heptascelio Kieffer

1916. Kieffer, *Brotéria*, *Rev. Luso-Brazileira*, *Zool. ser.*, vol. 14, p. 58.

TYPE: *Heptascelio lugens* Kieffer, 1916, by monotypy and original designation.

Heterogryon Kieffer

1926. Kieffer, *Das Tierreich*, Lief. 48, pp. xxvi, 271, 446, 448. Fourteen species.

TYPE: *Plastogryon sagax* Kieffer, 1908, by present designation.

Proposed as a subgenus of *Plastogryon* Kieffer.

Heteropria Kieffer

1905. Kieffer, *Ann. Mus. Civ. Stor. Nat. Genova*, ser. 3, vol. 2 (42), pp. 23, 36.

TYPE: *Heteropria compressipes* Kieffer, 1905, by monotypy.

Hexapria Kieffer

1905. Kieffer, *Ann. Mus. Civ. Stor. Nat. Genova*, ser. 3, vol. 2 (42), pp. 27, 34.

TYPE: *Hexapria fuscoclavata* Kieffer, 1905, by monotypy.

(Holacolus Kieffer; *Holalcus* Risbec, error) = *Acolus* Foerster

1912. Kieffer, in André, *Spec. Hym. Eur. Alg.*, vol. 11, pp. 89, 94, 106. Two species.

TYPE: *Acolus opacus* Thomson, 1859, by present designation. Isogenotypic with *Acolus* Foerster.

(Holalcus Risbec, error for *Holacolus* Kieffer) = *Acolus* Foerster

1950. Contribution à l'étude des Proctotrupidae. *Trav. Lab. Ent. Sect. Soudan. Rech. Agron.*, p. 577.

Holoteleia Kieffer

1908. Kieffer, *Ann. Soc. Sci. Bruxelles*, vol. 32, pp. 120, 169. Four species.

TYPE: *Baryconus (Holoteleia) bicolor* Kieffer, 1908, by original designation. This name, preoccupied by *Baryconus bicolor* Harrington, 1889, has been replaced by *Holoteleia nigriceps* Kieffer, 1926.

Proposed as a subgenus of *Baryconus* Foerster.

Homophanurus Kieffer

1912. Kieffer, in André, *Spec. Hym. Eur. Alg.*, vol. 11, pp. 9, 36.

TYPE: *Homophanurus hofmanni* Kieffer, 1912, by monotypy.

Hoplogryon Ashmead

1893. Ashmead, *U. S. Nat. Mus. Bull.* 45, pp. 181, 200. Nine species.

TYPE: *Prosacantha minutissima* Ashmead, 1887, by original designation.

Considered synonym of *Trimorus* Foerster.

Hoplopria Ashmead

1893. Ashmead, *U. S. Nat. Mus. Bull.* 45, pp. 385, 386, 388.

TYPE: *Hoplopria pulchripennis* Ashmead, 1893, by monotypy and original designation.

Hoplopriella Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 399, 416. Thirteen species.

TYPE: *Hoplopriella bicoloricornis* Dodd, 1915, by original designation.

(Hoploteleia Ashmead) = **Baryconus** Foerster

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 210, 211, 227.

TYPE: *Baryconus floridanus* Ashmead, 1887, by monotypy and original designation.

Isogenotypic with *Baryconus* Foerster.

(Hymnocampsis Szelényi, error) = **Hypocampsis** Foerster

1938. Szelényi, Folia Ent. Hungarica, vol. 3, p. 100.

(Hyperbaeus Foerster) = **Baeus** Haliday

1856. Foerster, Hymenopterologische Studien, Heft 2, p. 144.

TYPE: *Baeus seminulum* Haliday, 1833, by substitution of *Hyperbaeus* for *Baeus* Haliday.

Unnecessarily proposed for *Baeus* Haliday which Foerster thought to be preoccupied by *Baea* Commerson in botany.

Hypocampsis Foerster (= *Hymnocampsis* Szelényi, error)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 108, 115. No species.

1859. Thomson, Öfv. Vet.-Akad. Förh., vol. 16, pp. 70, 82. Three species.

TYPE: *Hypocampsis hyalinata* Thomson, 1859. Designated by Ashmead, 1903, Journ. New York Ent. Soc., vol. 11, p. 98. *Hypocampsis compressicornis* Thomson, 1859, was designated by Debauche, 1947, Bull. Ann. Soc. Ent. Belgique, vol. 83, p. 283. Szelényi, 1938, Folia Ent. Hungarica, vol. 3, p. 100, maintained that the species upon which Foerster founded *Hypocampsis* is *Platygaster contorticornis* Ratzeburg, 1844, and that is apparently correct, but under a recent decision of the International Commission on Zoological Nomenclature (Bull. Zool. Nom., vol. 4, 1950, pp. 160, 346) only the first species to be included shall be eligible for designation as type of a genus originally published without included species.

Hyptia Illiger (= *Hyptiam* Schuckard, error)

1807. Illiger, in Rossi, Fauna Etrusca sistens Insecta, vol. 2, p. 82; Illiger, Magazin für Insektenkunde, vol. 6, p. 192.

TYPE: *Evania petiolata* Fabricius, 1798, by monotypy.

In Fauna Etrusca . . . Illiger wrote “. . . quod *Hyptiam* voco,” which accounts for Shuckard's adoption of that spelling.

(*Hyptiagaster* Dominique, emendation) = **Gasteruption** Latreille 1893. Dominique, Bull. Soc. Sci. Nat. Ouest France, vol. 3, p. 198.

(*Hyptiam* Shuckard, error) = **Hyptia** Illiger

1841. Shuckard, Entomologist, vol. 1, pp. 117, 120.

Illiger, 1807, in Rossi, Fauna Etrusca, II, p. 82, wrote “. . . quod *Hyptiam* voco,” which accounts for Shuckard's adoption of that spelling.

Hyptiagaster Kieffer

1903 (March 6). Kieffer, Bull. Soc. Ent. France, 1903, pp. 93, 94. Eleven species.

TYPE: *Gasteruption crassiceps* Schletterer, 1889, by original designation. *Gasteruption antennale* Schletterer, 1889, was designated by Kieffer later in 1903, in André, Spec. Hym. Eur. Alg., vol. 7 bis, p. 381, and *Foenus australis* Westwood, 1843, was designated by Crosskey, 1953, Trans. Ent. Soc. London, vol. 104, p. 363.

See *Eufoenus Szépligetii*, which was published August 1903 and is considered a synonym of *Hyptiagaster* Kieffer.

(*Hyptiagaster* Mani, error) = **Hyptiogastrites** Cockerell [fossil]

1939. Mani, Catalogue of Indian insects, Pt. 24, Evaniidae, p. 2.

Hyptiogastrites Cockerell (= *Hyptiagaster* Mani, error) [fossil]

1917. Cockerell, Ann. Ent. Soc. Amer., vol. 10, p. 19.

TYPE: *Hyptiogastrites electrinus* Cockerell, by monotypy.

Idiotypa Foerster (= *Mionopria* Haliday)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 122, 125. No species.

1873. Marshall, A catalogue of British Hymenoptera; Oxyura, p. 11. Two species.

TYPE: *Diapria (Mionopria) maritima* Haliday, 1857. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 403.

Isogenotypic with *Mionopria* Haliday.

Idris Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 102, 105.

TYPE: *Idris flavicornis* Foerster, 1856, by monotypy. *Idris laeviceps* Ashmead, 1893, designated by Brues, 1908, in Wytzman, Genera insectorum, fasc. 80, p. 41, was included later.

Immsia Cameron

1913. Cameron, Indian For. Rec., 1912, vol. 4, p. 104.

TYPE: *Immsia carinifrons* Cameron, 1913, by monotypy.

Considered synonym of *Microphanurus* Kieffer.

Inocerota Szelényi

1939. Szelényi, Ann. Mus. Nat. Hungarici, vol. 32, Zool., p. 121. Two species.

TYPE: *Inocerota discessus* Szelényi, 1939, by original designation.

Inostemma Haliday

1833. Haliday, Ent. Mag., vol. 1, p. 270.

TYPE: *Psilus boscii* Jurine, 1807, by monotypy.

Interaulacus Bradley

1908. Bradley, Trans. Amer. Ent. Soc., vol. 34, pp. 120, 123.

TYPE: *Interaulacus kiefferi* Bradley, 1908, by monotypy and original designation.

Iphitrachelus Walker

1835. Walker, Ent. Mag., vol. 3, p. 273.

TYPE: *Iphitrachelus lar* Walker, 1835, by monotypy.

Ismarus Haliday

1835. Haliday, Ent. Mag., vol. 2, p. 467.

TYPE: *Cinetus dorsiger* Curtis, 1831, by monotypy.

Isoeybus Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 108, 114. Five species, one of them included by bibliographic reference.

TYPE: *Platygaster grandis* Nees, 1834. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 327. *Platygaster cotta* Walker, 1835, was designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 709, through oversight of Ashmead's citation.

Isolia Foerster

1878. Foerster, Verh. Naturh. Ver. Preuss. Rheinl., vol. 35, p. 46. No species.

No species have been referred to this genus up to the present time. *Isolia*, accordingly, remains a genus dubium.

Isorhombus Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 107, 112, 113. No species.

1887. Ashmead, Can. Ent., vol. 19, p. 129. One species.

TYPE: *Isorhombus hyalinipennis* Ashmead, 1887. First included species.

Considered synonym of *Platygaster* Latreille.

(*Isostasis* Provancher, error) = *Isostasius* Foerster

1887. Provancher, Additions et corrections au volume II de la fauna entomologique du Canada . . . Hyménoptères, p. 183.

***Isostasius* Foerster (= *Isostasis* Provancher, error)**

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 106, 109.

TYPE: *Platygaster punctiger* Nees, 1834, by monotypy.

***Kiefferopria* Brèthes**

1927. Brèthes, Ent. Mitt., vol. 16, p. 333.

TYPE: *Kiefferopria horni* Brèthes, 1927, by monotypy.

***Labidopria* Wasmann**

1925. Wasmann, Abh. Theor. Biol., Heft 19, p. 94.

TYPE: *Labidopria longicornis* Wasmann, 1925, by monotypy.

***Labolips* Haliday**

1857. Haliday, Nat. Hist. Rev., vol. 4, Proc. p. 173.

TYPE: *Labolips innupta* Haliday, 1857, by monotypy.

***Laches* Gistel (= *Anisoptera* Herrich-Schaeffer, 1840, not Berthold, 1827)**

1848. Gistel, Naturgeschichte des Thierreichs, p. viii.

TYPE: *Anisoptera egregia* Herrich-Schaeffer, 1840, by substitution of *Laches* for *Anisoptera* Herrich-Schaeffer.

Considered synonym of *Psilus* Panzer.

***Lagynodes* Foerster**

1840. Foerster, Beiträge zur Monographie der Pteromalinen Nees, Heft 1, p. xliv.

TYPE: *Lagynodes rufus* Foerster, 1840, by monotypy. *Ceraphron pallidus* Boheman, 1832, was designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 120.

***Lamproteleia* Kieffer**

1910. Kieffer, Bull. Soc. Ent. France, 1910, p. 293. Two species.

TYPE: *Lamproteleia fasciatipennis* Kieffer, 1910, by original designation.

Described again as new by Kieffer, 1912, Trans. Linn. Soc. London, ser. 2, Zool., vol. 15, p. 63.

***Lapitha* Ashmead**

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 209, 211, 222.

TYPE: *Lapitha spinosa* Ashmead, 1893, by monotypy and original designation.

***Lapithoides* Nixon**

1933. Nixon, Ann. Mag. Nat. Hist., ser. 10, vol. 12, p. 549.

TYPE: *Lapithoides semiramis* Nixon, 1933, by monotypy and original designation.

Leaiopria Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 398, 426.

TYPE: *Leaiopria termitarii* Dodd, 1915, by monotypy and original designation.

Ledouxopria Risbec

1953. Risbec, Bull. Inst. Français d'Afrique Noire, vol. 15, p. 551.

TYPE: *Ledouxopria africana* Risbec, 1953, by monotypy.

Lepidopria Kieffer (= *Lepidoria* Brues, error)

1910. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 695. No species.

1911. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 869. One species.

TYPE: *Lepidopria pedestris* Kieffer, 1911. First included species.

(*Lepidoria* Brues, not Mulsant and Verreaux, 1866, error) =

Lepidopria Kieffer

1916. Brues, Psyche, vol. 23, p. 126.

Lepidoscelio Kieffer

1905. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 29, p. 129.

TYPE: *Lepidoscelio fuscipennis* Kieffer, 1905, by monotypy.

Leptacis Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 107, 112. Four species.

TYPE: *Ichneumon tipulae* Kirby, 1798. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 270.

Leptorhaptus Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 129, 137. No species.

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 346, 349. Two species.

TYPE: *Leptorhaptus conicus* Ashmead, 1893. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 685. *Leptorhaptus abbreviatus* Foerster, designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 350, was a nomen nudum.

Leptoteleia Kieffer

1908. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 32, pp. 120, 163.

TYPE: *Baryconus oecanthi* Riley, in Ashmead, 1893, by monotypy through bibliographic reference.

(*Limnodytes* Marchal, not Duméril and Bibron, 1841) = **Tiphodytes** Bradley

1900. Marchal, Bull. Soc. Ent. France, 1900, p. 328. Nomen nudum.

1900. Marchal, Ann. Soc. Ent. France, vol. 69, pp. 172, 174.

TYPE: *Limnodytes gerriphagus* Marchal, 1900, by monotypy and original designation.

(*Linkia* Kieffer, error, not Nardo, 1834) = **Linkiola** Kieffer

1910. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 702.

Linkiola Kieffer (= *Linkia* Kieffer, error, 1910, not Nardo, 1834)

1910. Kieffer, Ent. Rundschau, vol. 27, p. 39.

TYPE: *Linkiola crassipes* Kieffer, 1910, by monotypy.

In 1912, in Wytzman, Genera insectorum, fasc. 124, 1911, p. 26, Kieffer shows *Linkia* to have been an error for *Linkiola* Kieffer. It was inadvertently published before *Linkiola* but is preoccupied.

Liophanurus Kieffer

1912. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, pp. 9, 61. Thirty-seven species, three of them doubtfully included.

TYPE: *Telenomus spilosomatis* Ashmead, 1893, by original designation.

Considered synonym of *Telenomus* Haliday.

Lipoglyptus Crawford

1910. Crawford, Proc. U. S. Nat. Mus., vol. 38, p. 123.

TYPE: *Lipoglyptus primus* Crawford, 1910, by monotypy and original designation.

Lithobelyta Cockerell [fossil]

1921. Cockerell, Ann. Mag. Nat. Hist., ser. 9, vol. 7, p. 22.

TYPE: *Lithobelyta reducta* Cockerell, 1921, by monotypy.

(*Loboscelidea* Rye, emendation) = **Loboscelidia** Westwood

1876. Rye, in Zool. Rec., vol. 11, 1874, p. 552.

Loboscelidia Westwood (= *Loboscelidoidea* Rye, emendation; *Loboscelidea* Rye, emendation)

1874. Westwood, Thesaurus entomologicus oxoniensis . . . , p. 171.

TYPE: *Loboscelidia rufescens* Westwood, 1874, by monotypy.

(*Loboscelidoidea* Rye, emendation) = **Loboscelidia** Westwood

1876. Rye, in Zool. Rec., vol. 11, 1874, pp. 365, 552.

Lophopria Kieffer

1910. Kieffer, in Wissenschaftliche Ergebnisse der deutschen Zentral-Afrika-Expedition 1907-08 . . . , vol. 3 (Zool.), Lief. 2, p. 97.

- TYPE: *Lophopria crassiclava* Kieffer, 1910, by monotypy.
(*Loxoptera* Mani, error) = *Loxotropa* Foerster
1941. Mani, Catalogue of Indian insects, Pt. 26, Serphoidea, pp. 39, 40, 41, 47.
- Loxotropa** Foerster (= *Loxoptera* Mani, error)
1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 122, 123, 126.
TYPE: *Psilus antennatus* Jurine, 1807, by monotypy. *Loxotropa acolutha* Foerster, designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 412, was a nomen nudum. *Diapria dispar* Nees, 1834, was designated by Mani, 1941, Catalogue of Indian insects, Pt. 26, Serphoidea, p. 47.
- Lygocerus** Foerster (= *Cheirocerus* Ashmead, error)
1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 97, 99. No species.
1868. Marshall, Ent. Monthly Mag., vol. 5, p. 158. Five species.
TYPE: *Ceraphron ramicornis* Boheman, 1832. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 107.
- Lyteba** Thomson
1858. Thomson, Öfv. Vet.-Akad. Förh., vol. 15, pp. 155, 180.
TYPE: *Belyta bisulca* Nees, 1834, by monotypy.
Considered synonym of *Oxylabis* Foerster.
- Macrogyron** Nixon
1936. Nixon, Ann. Mag. Nat. Hist., ser. 10, vol. 17, No. 97, p. 116. No species.
1936. Nixon, Ann. Mag. Nat. Hist., ser. 10, vol. 17, No. 98, p. 185. Three species.
TYPE: *Macrogyron pluto* Nixon, 1936. Designated by Nixon, 1936, Ann. Mag. Nat. Hist., ser. 10, vol. 17, No. 98, p. 185.
- Macrohynniss** Foerster
1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 129, 136. No species.
1904. Mayr, Verh. Zool.-Bot. Gesellsch. Wien, vol. 54, p. 593. One species.
TYPE: *Macrohynniss lepidus* Mayr, 1904. First included species.
- Macrostigma** Rondani
1877. Rondani, Boll. Soc. Ent. Italiana, vol. 9, p. 184.
TYPE: *Macrostigma aphidum* Rondani, 1877, by monotypy.

Macroteleia Westwood (= *Macrotelia* Agassiz)

1835. Westwood, Proc. Zool. Soc. London, vol. 3, p. 70.

TYPE: *Macroteleia cleonymoides* Westwood, 1835, by monotypy.

(Macrotelia Agassiz, emendation) = **Macroteleia** Westwood

1846. Agassiz, Nomenclator zoologicus. Index universalis, p. 221.

Mallateleia Dodd

1913. Dodd, Trans. Roy. Soc. South Australia, vol. 37, pp. 131, 151.

TYPE: *Mallateleia giraulti* Dodd, 1913, by monotypy and original designation.

Mallateleioides Dodd

1913. Dodd, Trans. Roy. Soc. South Australia, vol. 37, pp. 131, 152.

TYPE: *Mallateleioides splendida* Dodd, 1913, by monotypy and original designation.

Malvina Cameron

1889. Cameron, Mem. Proc. Manchester Lit. Phil. Soc., ser. 4, vol. 2, p. 13.

TYPE: *Malvina punctata* Cameron, 1889, by monotypy.

Mandraka Risbec

1953. Risbec, Mem. Inst. Scient. Madagascar, vol. 3, p. 343.

TYPE: *Mandraka pauliani* Risbec, by monotypy.

Mantara Dodd

1920. Dodd, Trans. Ent. Soc. London, 1919, p. 379.

TYPE: *Mantara bifurcata* Dodd, 1920, by monotypy and original designation.

Mantibaria Kirby

1900. Kirby, in Andrews, A monograph of Christmas Island . . . , p. 82.

TYPE: *Mantibaria anomala* Kirby, 1900, by monotypy.

Marshalliella Kieffer

1913. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, p. 222, pl. 8, fig. 6.

TYPE: *Marshalliella oxygaster* Marshall, 1913, in Kieffer, by monotypy.

Martinica Risbec

1950. Risbec, Contribution à l'étude des Proctotrupidae. Trav. Lab. Ent. Sect. Soudan. Rech. Agron., p. 533.

TYPE: *Martinica antillensis* Risbec, 1950, by monotypy.

(Megacolus Priesner, not Cameron, 1903) = **Philoplanes**, new name

1951. Priesner, Bull. Inst. Fouad I du Desert, vol. 1, p. 121.
 TYPE: *Megacolus desertorum* Priesner, 1951, by monotypy and original designation.

(*Megalospilus* Schulz, emendation) = *Megaspilus* Westwood

1906. Schulz, Spolia hymenopterologica, p. 152.

Megaplastopria Ashmead

1903. Ashmead, Journ. New York Ent. Soc., vol. 11, p. 31.

TYPE: *Megaplastopria brasiliensis* Ashmead, 1903, by monotypy and original designation.

Megaspilidea Ashmead

1888. Ashmead, Can. Ent., vol. 20, pp. 48, 49.

TYPE: *Megaspilidea minuta* Ashmead, 1888, by monotypy. Considered synonym of *Ceraphron* Jurine.

Megaspilodes Ashmead

- 1888 (March). Ashmead, Can. Ent., vol. 20, p. 48. Two names, one of them a nomen nudum.

TYPE: *Ceraphron armatus* Say, 1836, by monotypy. Also designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 671, who at that time thought both originally included names to be valid. Ashmead intended to establish *Megaspilodes* as a monotypic genus with *fuscipennis* Ashmead as type but unfortunately the paper in which he first described the genus was not published until June, 1888 (Kans. State Agr. College Bull. No. 3, App. p. ii).

Considered synonym of *Megaspilus* Westwood.

Megaspilus Westwood (= *Megalospilus* Schulz, emendation)

1829. Westwood, in Stephens, The nomenclature of British insects . . . , p. 37. Sixteen names, thirteen of them nomina nuda.

TYPE: *Ceraphron dux* Curtis, 1829. Designated by Westwood, 1839, An introduction to the modern classification of insects, vol. 2, generic synopsis p. 77. *Ceraphron abdominalis* Boheman, 1832, designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 112, was not originally included.

Merriwa Dodd

1920. Dodd, Trans. Ent. Soc. London, 1919, p. 332.

TYPE: *Merriwa quadridentata* Dodd, 1920, by monotypy and original designation.

Mesaulacinus Martynov [fossil]

1925. Martynov, Bull. Acad. des Sci. U. R. S. S., ser. 6, vol. 19, p. 757.

TYPE: *Mesaulacinus oviformis* Martynov, 1925, by monotypy.

Mesohelorus Martynov [fossil]

1925. Martynov, Bull. Acad. des Sci. U. R. S. S., ser. 6, vol. 19, p. 758.

TYPE: *Mesohelorus muchini* Martynov, 1925, by monotypy.

Mesoteleia Kieffer

1917. Kieffer, Brotéria, Rev. Luso-Braziliera, Zool. ser., vol. 15, p. 51.

TYPE: *Mesoteleia pallida* Kieffer, 1917, by monotypy and original designation.

Metaclisis Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 106, 109.

TYPE: *Metaclisis areolatus* Foerster, 1856, by monotypy.

Metanopedias Brues

1910. Brues, Bull. Amer. Mus. Nat. Hist., vol. 28, p. 79.

TYPE: *Metanopedias sicarius* Brues, 1910, by monotypy.

Meuselia Kieffer

1909. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 33, p. 391. Two species.

TYPE: *Meuselia fuscicornis* Kieffer, 1909, by original designation.

Micraulacinus Kieffer

1910. Kieffer, Bull. Soc. Ent. France, 1910, p. 350. No species.

1911. Kieffer, Ann. Soc. Ent. France, vol. 80, pp. 214, 219. One species.

TYPE: *Micraulacinus elegans* Kieffer, 1911. First included species.

Micrevania Benoit

1952. Benoit, Mém. Inst. Sci. Madagascar, ser. E., vol. 1, p. 273. Two species.

TYPE: *Micrevania minuscula* Benoit, by original designation.

Microceraphron Szelényi

1935. Szelényi, Allattani Közlemények, vol. 32, pp. 140, 142.

TYPE: *Microceraphron subterraneus* Szelényi, 1935, by monotypy.

Microgalesus Kieffer

1912. Kieffer, in Wytsman, Genera insectorum, fasc. 124, 1911, pp. 6, 43.

TYPE: *Microgalesus quadridens* Kieffer, 1912, by monotypy.
Again described as new by Kieffer, 1912, Trans. Linn. Soc.
London, ser. 2, Zool., vol. 15, p. 74.

Microphanurus Kieffer (= *Aphanurus* Kieffer, 1912, not Looss,
1907)

1926. Kieffer, Das Tierreich, Lief. 48, pp. xv, 16, 91.

TYPE: *Teleas semistriatus* Nees, 1834, by substitution of
Microphanurus for *Aphanurus* Kieffer.

(**Microps** Haliday, not Dahl, 1823, not Wagler, 1828, not Wagler,
1830)

1833. Haliday, Ent. Mag., vol. 1, p. 272.

TYPE: *Microps rubi* Haliday, 1833, by monotypy.

Although preoccupied, *Microps* Haliday is not renamed since
it is considered a synonym of *Lagynodes* Foerster.

Microteleia Kieffer

1910. Kieffer, in Voeltzkow, Reise in Ostafrika 1903-05,
vol. 2, Heft 5, p. 531.

TYPE: *Microteleia nitida* Kieffer, 1910, by monotypy.

(**Microtelenomus** Kieffer, error) = **Mirotelenomus** Dodd

1926. Kieffer, Das Tierreich, Lief. 48, pp. 15, 19.

Mimopria Holmgren

1908. Holmgren, Zool. Anz., vol. 33, p. 346.

TYPE: *Mimopria ecitophila* Holmgren, 1908, by monotypy.

(**Mionopria** Haliday) = **Idiotypa** Foerster

1857. Haliday, Nat. Hist. Rev., vol. 4, Proc. pp. 170, 172.

TYPE: *Diapria (Mionopria) maritima* Haliday, 1857, by mon-
otypy.

Proposed as a subgenus of *Diapria* Latreille. Isogenotypic
with *Idiotypa* Foerster.

Miota Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp.
131, 141. No species.

1890. Ashmead, Colorado Biol. Assoc. Bull. No. 1, p. 12.
One species.

TYPE: *Miota glabra* Ashmead, 1890. First included species.
Miota compressa Kieffer, 1910, designated by Kieffer,
1910, in Wytzman, Genera insectorum, fasc. 107, p.
40, was included later.

Considered synonym of *Cinetus* Jurine.

Miotella Kieffer

1909. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 33, p. 379.

TYPE: *Miotella tenuicornis* Kieffer, 1909, by monotypy.

Miramblyaspis Dodd

1914. Dodd, Arch. Naturg., vol. 79, A8, p. 91 (published February 1914).

TYPE: *Miramblyaspis mirabilis* Dodd, 1914, by monotypy.

Again described as new by Dodd, December 1914, Ent. News, vol. 25, p. 455, with the single species, *Miramblyaspis mirabilis* Dodd, designated as type. This was evidently the original description but it happened to be published later.

Mirobaeoides Dodd

1914. Dodd, Trans. Roy. Soc. South Australia, vol. 38, pp. 59, 74.

TYPE: *Mirobaeoides tasmanicus* Dodd, 1914, by monotypy and original designation.

Mirobaeus Dodd

1914. Dodd, Trans. Roy. Soc. South Australia, vol. 38, pp. 59, 73.

TYPE: *Mirobaeus bicolor* Dodd, 1914, by monotypy and original designation.

Mirotelenomus Dodd (= *Microtelenomus* Kieffer, error)

1913. Dodd, Trans. Roy. Soc. South Australia, vol. 37, pp. 158, 173.

TYPE: *Mirotelenomus abnormis* Dodd, 1913, by monotypy.

Misocyclops Kieffer

1914. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, pp. 353, 362, Pl. xiii, figs. 4, 5.

TYPE: *Platygaster ornatus* Kieffer, 1914, by monotypy.

(Mithras Agassiz, emendation of *Mythras* Haliday, nomen nudum) = **Aneurhynchus** Westwood

1846. Agassiz, Nomenclator zoologicus. Index universalis, pp. 235, 244.

Mythras Haliday was validated by Brullé, in Lepeletier, 1846, Histoire naturelle des insectes, Hyménoptères, vol. 4, p. 612, through citation as a synonym of *Aneurhynchus* Westwood.

Monelata Foerster (= *Monoleta* Maneval, error)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 123, 127. No species.

1873. Marshall, A catalogue of British Hymenoptera; Oxyura, p. 13. Three species.

TYPE: *Diapria parvula* Nees, 1834. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 441.

Moninostemma Kieffer

1914. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, p. 357.

TYPE: *Inostemma festus* Walker, 1839, by monotypy and original designation.

Monocrita Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 106, 109.

TYPE: *Inostemma atinas* Walker, 1835, by monotypy.

(Monoleta Maneval, error) = **Monelata** Foerster

1940. Maneval, in Berland, Faune de la France, vol. 7, Hyménoptères, pp. 102, 103, 106.

Monomachus Klug

1841. Klug, in Germar, Zeitschr. Ent., vol. 3, p. 378.

TYPE: *Pelecinus fuscator* Perty, 1833, by monotypy. (*Monomachus gladiator* (Klug) Westwood) = *Monomachus gladiator* Brullé, 1846, designated by Ashmead, 1902, Journ. New York. Ent. Soc., vol. 10, p. 243, was included later.

Monoteleia Kieffer

1926. Kieffer, Das Tierreich, Lief. 48, pp. xxix, 272, 545. Three species.

TYPE: *Macroteleia grenadensis* Ashmead, 1900, by original designation.

Monoxylabis Kieffer

1909. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 33, p. 345.

TYPE: *Monoxylabis flavimanus* Kieffer, 1909, by monotypy.

Myrmecopria Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 407, 446.

TYPE: *Loxotropa mellea* Ashmead, 1887, by monotypy and original designation.

(Mythras Brullé, validation of *Mythras* Haliday, nomen nudum)

= **Aneurhynchus** Westwood

1846. Brullé, in Lepeletier, Histoire naturelle des insectes. Hyménoptères, vol. 4, p. 612.

TYPE: *Aneurhynchus galesiformis* Westwood, 1832. *Mythras* Haliday MS. was validated and its type fixed by Brullé through citation as synonym of *Aneurhynchus* Westwood.

(Mythras Haliday, nomen nudum; *Mithras* Agassiz, emendation)

= **Aneurhynchus** Westwood

1829. Haliday, in Curtis, A guide to an arrangement of British insects, column 108.

Validated by Brullé, 1846, in Lepeletier, Histoire naturelle des insectes. Hyménoptères, vol. 4, p. 612, through citation as a synonym of *Aneurhynchus* Westwood.

Nanopria Kieffer

1913. Kieffer, in Alluaud and Jeannel, Voyage . . . en Afrique Orientale. Insectes hyménoptères, vol. 1, p. 26.

TYPE: *Nanopria fuscipes* Kieffer, 1913, by monotypy and original designation.

Nardo Nixon

1938. Nixon, Ann. Mag. Nat. Hist., ser. 11, vol. 1, p. 278. Two species.

TYPE: *Nardo cumaeus* Nixon, 1938, by original designation.

Nasdia Nixon

1942. Nixon, Ann. Mag. Nat. Hist., ser. 11, vol. 9, p. 462.

TYPE: *Nasdia prosper* Nixon, 1942, by monotypy and original designation.

Neanteris Szelényi, nomen nudum

1937. Szelényi, in Moczar, A Koszegi Muz. Kozlemenyei, Pubs. Musei Ginsiensis, ser. 1, no. 5, p. 73.

Cited with *impiger* Szelényi, new species, also a nomen nudum.

Neaulacus Bradley

1908. Bradley, Trans. Amer. Ent. Soc., vol. 34, pp. 119, 121, 126. Five species, one of them doubtfully included.

TYPE: *Aulacus occidentalis* Cresson, 1879, by original designation.

Proposed as a subgenus of *Pristaulacus* Kieffer.

Neivapria Borgmeier

1939. Borgmeier, Rev. de Ent., vol. 10, p. 543.

TYPE: *Neivapria penicillata* Borgmeier, 1939, by monotypy and original designation.

Neobetyla Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 389, 396. Two species.

TYPE: *Neobetyla pulchricornis* Dodd, 1915, by original designation.

Neoceraphron Ashmead (= *Neocerataphron* Schulz, emendation)

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 123, 136.

TYPE: *Ceraphron macroneurus* Ashmead, 1887, by monotypy.

(Neocerataphron Schulz, emendation) = **Neoceraphron** Ashmead

1906. Schulz, Spolia hymenopterologica, p. 152.

Neodiapria Kieffer

1916. Kieffer, *Das Tierreich*, Lief. 44, pp. xxi, 346.

TYPE: *Tropidopria erynniae* Kieffer, 1910, by monotypy.

Neolygocerus Ishii

1951. Ishii, *Oyo-Dobutsugaku-Zasshi* (Japanese Soc. Applied Zool.), vol. 16, p. [93].

TYPE: *Neolygocerus koyamae* Ishii, 1951, by monotypy.

Neopria Dodd

1915. Dodd, *Trans. Roy. Soc. South Australia*, vol. 39, pp. 398, 429. Three species.

TYPE: *Neopria trifoveata* Dodd, 1915, by original designation.

Neoscelio Dodd

1913. Dodd, *Trans. Roy. Soc. South Australia*, vol. 37, pp. 131, 138.

TYPE: *Neoscelio gloriosus* Dodd, 1913, by monotypy and original designation.

Neoteleia Dodd

1913. Dodd, *Arch. Naturg.*, vol. 79, A6, p. 169.

TYPE: *Neoteleia punctata* Dodd, 1913, by monotypy and original designation.

Neotelenomus Dodd

1913. Dodd, *Trans. Roy. Soc. South Australia*, vol. 37, pp. 158, 171. Five species.

TYPE: *Neotelenomus anthereae* Dodd, 1913, by original designation.

Nesopria, new name (= *Tropidopsis* Ashmead, 1893, not Brauer and Bergenstamm, 1890)

TYPE: *Tropidopsis clavata* Ashmead, 1893, by substitution of *Nesopria* for *Tropidopsis* Ashmead.

Neuraulacinus Kieffer

1910. Kieffer, *Bull. Soc. Ent. France*, 1910, p. 350. No species.

1911. Kieffer, *Ann. Soc. Ent. France*, vol. 80, pp. 214, 216. Three species.

TYPE: *Neuraulacinus braconiformis* Kieffer, 1911. Designated by Kieffer, 1911, *Ann. Soc. Ent. France*, vol. 80, p. 217. *Neuraulacinus vespiformis* Kieffer, 1911, was designated by Kieffer, 1912, *Das Tierreich*, Lief. 30, pl. 358.

Neurocacus Kieffer

1913. Kieffer, *Insecta*, vol. 3, p. 428.

TYPE: *Neurocacus philippinensis* Kieffer, 1913, by monotypy and original designation.

Neurogalesus Kieffer

1907. Kieffer, Berliner Ent. Zeitschr., vol. 51, 1906, p. 298.

TYPE: *Neurogalesus carinatus* Kieffer, 1907, by monotypy.

Neuropria Kieffer

1904. Kieffer, Bull. Soc. Hist. Nat. Metz, vol. 23, p. 53.

TYPE: *Neuropria sociabilis* Kieffer, 1904, by monotypy.

Neuroscelio Dodd

1913. Dodd, Arch. Naturg., vol. 79, A6, p. 170.

TYPE: *Neuroscelio nervalis* Dodd, 1913, by monotypy and original designation.

Neuroteleia Kieffer

1910. Kieffer, Bull. Soc. Ent. France, 1910, p. 293. Two species.

TYPE: *Neuroteleia rufa* Kieffer, 1910, by original designation.

Again described as new by Kieffer, 1912, Trans. Linn. Soc. London, ser. 2, Zool., vol. 15, p. 61.

Nirupama Nixon

1935. Nixon, Trans. Roy. Ent. Soc. London, vol. 83, p. 93. Two species.

TYPE: *Nirupama morpheus* Nixon, 1935, by original designation.

Nothoserphus Brues

1940. Brues, Proc. Amer. Acad. Arts Sci., vol. 73, p. 263.

TYPE: *Nothoserphus mirabilis* Brues, 1940, by monotypy and original designation.

Notilena Brèthes

1913. Brèthes, An. Mus. Nac. Hist. Nat. Buenos Aires, vol. 24, p. 84.

TYPE: *Notilena gallardi* Brèthes, 1913, by monotypy and original designation.

Notoxoides Ashmead

1903. Ashmead, Journ. New York Ent. Soc., vol. 11, p. 30.

TYPE: *Notoxoides brasiliensis* Ashmead, 1903, by monotypy and original designation.

Notoxopria Kieffer

1910. Kieffer, Ent. Rundschau, vol. 27, p. 39.

TYPE: *Notoxopria rufa* Kieffer, 1910, by monotypy.

Nyleta Dodd

1926. Dodd, Trans. Roy. Soc. South Australia, vol. 1, p. 300.

TYPE: *Nyleta striaticeps* Dodd, 1926, by monotypy and original designation.

Odontacolus Kieffer

1910. Kieffer, Bull. Soc. Ent. France, 1910, p. 294.

TYPE: *Odontacolus longiceps* Kieffer, 1910, by monotypy and original designation.

Again described as new by Kieffer, 1912, Trans. Linn. Soc. London, ser. 2, Zool., vol. 15, p. 54.

Odontaulacus Kieffer

1903. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 7 bis, p. 382. Two species.

TYPE: *Aulacus rufitarsis* Cresson, 1864. Designated by Bradley, 1908, Trans. Amer. Ent. Soc., vol. 34, p. 120. *Aulacus editus* Cresson, 1880, was designated by Kieffer, 1912, Das Tierreich, Lief. 30, p. 365.

Odontofoenus Kieffer

1910. Kieffer, Ann. Soc. Ent. France, vol. 79, p. 77.

TYPE: *Gasteruption humerale* Schletterer, 1889, by monotypy and original designation.

Odontopria Kieffer

1905. Kieffer, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, vol. 2(42), pp. 24, 34, 39. Two species.

TYPE: *Odontopria temporalis* Kieffer, 1905. Designated by Kieffer, 1912, in Wytsman, Genera insectorum, fasc. 124, 1911, p. 29.

Odontopsilus Kieffer

1909. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 33, p. 341.

TYPE: *Odontopsilus tenuicornis* Kieffer, 1909, by monotypy.

Odontoscelio Kieffer

1905. Kieffer, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, vol. 2(42), p. 13.

TYPE: *Odontoscelio striatifrons* Kieffer, 1905, by monotypy.

Oethecoctonus Ashmead (= *Cacus* Riley, 1893, not Gistel, 1848, not Selys, 1854, not Costa, 1857; *Cacellus* Ashmead)

1900. Ashmead, Can. Ent., vol. 32, p. 368.

TYPE: *Cacus oecanthi* Riley, 1893, by substitution of *Oethecoctonus* for *Cacus* Riley.

Oleisoprister Bradley

1901. Bradley, Trans. Amer. Ent. Soc., vol. 27, pp. 320, 324. Five species.

TYPE: *Aulacus firmus* Cresson, 1879, by original designation.

Opazon Haliday

1857. Haliday, Nat. Hist. Rev., vol. 4, Proc. p. 170.

TYPE: *Belyta* (*Opazon*) *parvula* Haliday, 1857, by monotypy. *Belyta* (*Opazon*?) *ciliata* Thomson, 1858, was desig-

nated by Kieffer, 1916, *Das Tierreich*, Lief. 44, p. 378, since he considered *B. (O.) parvula* Haliday a nomen nudum.

Proposed as a subgenus of *Belyta* Jurine.

Opisthacantha Ashmead (= *Raia* Ashmead)

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 209, 211, 221.

TYPE: *Opisthacantha mellipes* Ashmead, 1893, by monotypy and original designation.

Oreiscelio Kieffer (= *Oreiscelio* Kieffer, emendation)

1910. Kieffer, Bull. Soc. Ent. France, 1910, p. 293.

TYPE: *Oreiscelio sechellensis* Kieffer, 1910, by monotypy and original designation.

(**Oreiscelio** Kieffer, emendation) = **Oreiscelio** Kieffer

1912. Kieffer, Trans. Linn. Soc. London, ser. 2, Zool., vol. 15, p. 58. Emendation of *Oreiscelio* Kieffer, and described as new. The type species was also emended to read *Oreiscelio seychellensis* Kieffer, 1910.

(**Orthopria** Kieffer) = **Planopria** Kieffer

1911. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 983, 984. Twenty-two species, 16 of them included by bibliographic reference.

TYPE: *Diapria californica* Ashmead, 1893. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 678.

Proposed as a subgenus of *Trichopria* Ashmead. Isogenotypic with *Planopria* Kieffer, 1908.

Oxylabis Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 128, 130, 133, 139. Two species.

TYPE: *Cinetus picipes* Nees, 1834. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 681. *Belyta bisulca* Nees, 1834, designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 357, was not originally included.

Oxyphanurus Kieffer

1926. Kieffer, *Das Tierreich*, Lief. 48, pp. [xiii], 19.

TYPE: *Telenomus charmus* Walker, 1839, by monotypy.

Oxypria Kieffer

1908. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 32, p. 37.

TYPE: *Oxypria thoracica* Kieffer, 1908, by monotypy.

Oxyscelio Kieffer

1907. Kieffer, Zeitschr. Hym. Dipt., vol. 7, p. 310.

TYPE: *Oxyscelio foveatus* Kieffer, 1907, by monotypy.

Oxyteleia Kieffer

1908. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 32, p. 118. Four species.

TYPE: *Caloteleia bidentata* Kieffer, 1905. Designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 516.

(**Oxyurus** Lamarck, not Rafinesque, 1810, not Lamarck, 1816) = **Bebelus** Gistel

1817. Lamarck, Histoire naturelle des animaux sans vertèbres, vol. 4, p. 128. Seven species.

TYPE: *Sparasion frontalis* Latreille, 1805. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 701.

Considered synonym of *Sparasion* Latreille.

Pachyscelidris Szelényi

1941. Szelényi, Zool. Anz., vol. 134, pp. 158, 163.

TYPE: *Pachyscelidris aptera* Szelényi, 1941, by monotypy and original designation.

Pachyscelio Risbec (= *Brachyscelio* Risbec, 1950, not Brues, 1940)

1954. Risbec, Bull. Inst. Français d'Afrique Noire, vol. 16, p. 552.

TYPE: *Brachyscelio jeanneli* Risbec, 1950, by substitution of *Pachyscelio* for *Brachyscelio* Risbec.

Palaeoteleia Cockerell [fossil]

1915. Cockerell, Proc. Acad. Nat. Sci. Philadelphia, vol. 66, 1914, p. 637.

TYPE: *Palaeoteleia oxyura* Cockerell, 1915, by monotypy.

Palpoteleia Kieffer

1926. Kieffer, Das Tierreich, Lief. 48, pp. xxix, 272, 547. Five species.

TYPE: *Psiloteleia atra* Kieffer, 1926, by original designation.

Pammegischia Provancher

1882. Provancher, Nat. Canadien, vol. 13, p. 302.

TYPE: *Pammegischia burquei* Provancher, 1882, by monotypy.

Considered synonym of *Aulacus* Jurine.

Pantoclis Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 129, 137. No species.

1861. Foerster, Programm der Realschule zu Aachen, p. xliii. One species.

TYPE: *Pantoclis barycera* Foerster, 1861. First included species. *Belyta brevis* Nees, 1834, designated by Ash-

mead, 1893, U. S. Nat. Mus. Bull. 45, p. 366, was included later.

Considered synonym of *Aclista* Foerster.

(*Pantolysa* Foerster, error) = *Pantolyta* Foerster

1861. Foerster, Programm der Realschule zu Aachen, p. xliii.

Pantolyta Foerster (= *Pantolysa* Foerster, error)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 128, 130, 135, 136. No species.

1861. Foerster, Programm der Realschule zu Aachen, p. xliii. One species.

TYPE: *Pantolyta atrata* Foerster, 1861. First included species. *Belyta heterocera* Haliday, 1857, designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 383, and *Pantolyta pallida* Kieffer, 1908, by Kieffer, 1908, in André, Spec. Hym. Eur. Alg., vol. 10, p. 428, were included later.

Pantolytoidea Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 389, 390. Four species.

TYPE: *Pantolytoidea splendida* Dodd, 1915, by original designation.

Pantolytomyia Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 389, 395.

TYPE: *Pantolytomyia ferruginea* Dodd, 1915, by monotypy and original designation.

Pantopiasta Maneval

1939. Maneval, Bull. Soc. Ent. France, vol. 44, pp. 169, 170.

TYPE: *Cinetus flaviventris* Thomson, 1858, by monotypy and original designation.

Parabaeus Kieffer

1910. Kieffer, Bull. Soc. Ent. France, 1910, p. 294.

TYPE: *Parabaeus ruficornis* Kieffer, 1910, by monotypy and original designation.

Also described as new by Kieffer, 1912, Trans. Linn. Soc. London, ser. 2, Zool., vol. 15, p. 53.

Parabetyla Brues

1922. Brues, Psyche, vol. 29, pp. 222, 224.

TYPE: *Parabetyla spinosa* Brues, 1922, by monotypy and original designation.

Paraclista Kieffer

1909 (September 15). Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 476. Four species.

TYPE: *Belyta brachyptera* Thomson, 1858. Designated by Kieffer, 1910, in Wytsman, *Genera insectorum*, fasc. 107, p. 23.

Kieffer described five new species in this genus in *Ann. Soc. Sci. Bruxelles*, vol. 33, p. 390, 1909, received by the Smithsonian Institution, Washington, D. C., Oct. 4, 1909, but precise date of publication is unknown.

Proposed as a subgenus of *Belyta* Jurine.

Paracodrus Kieffer

1907. Kieffer, in André, *Spec. Hym. Eur. Alg.*, vol. 10, pp. 272, 273. Three species.

TYPE: *Paracodrus bethyliformis* Kieffer, 1907, by original designation.

(*Paracyclops* Maneval, not Claus, 1893) = *Urocyclops* Maneval 1936. Maneval, *Bull. Ann. Soc. Ent. Belgique*, vol. 76, p. 56.

TYPE: *Paracyclops bettyae* Maneval, 1936, by monotypy and original designation.

Parafoenus Kieffer

1910. Kieffer, *Bull. Soc. Ent. France*, 1910, p. 350. No species.

1911. Kieffer, *Ann. Soc. Ent. France*, vol. 80, pp. 213, 215. One species.

TYPE: *Parafoenus formosus* Kieffer, 1911. First included species.

Paragryon Kieffer

1908. Kieffer, *Ann. Soc. Sci. Bruxelles*, vol. 32, pp. 189, 199. Six species, five by bibliographic reference.

TYPE: *Paragryon pedestris* Kieffer, 1908. Designated by Kieffer, 1926, *Das Tierreich*, Lief. 48, p. 234.

Paramesius Westwood

1832. Westwood, *London Edinburgh Phil. Mag.*, ser. 3, vol. 1, p. 129.

TYPE: *Paramesius rufipes* Westwood, 1832, by monotypy.

Paranteris Kieffer

1910. Kieffer, *Bull. Soc. Ent. France*, 1910, p. 292. Six species.

TYPE: *Paranteris nigriclava* Kieffer, 1910, by original designation.

Again described as new by Kieffer, 1912, *Trans. Linn. Soc. London*, ser. 2, *Zool.*, vol. 15, p. 65.

Parapegus Kieffer

1908. Kieffer, *Ann. Soc. Sci. Bruxelles*, vol. 32, pp. 148 (footnote), 149. Two species.

TYPE: *Apegus (Parapegus) punctatus* Kieffer, 1908. Designated by Kieffer, 1910, in Wytzman, *Genera insectorum*, fasc. 80B, p. 86.

Proposed as a subgenus of *Apegus* Foerster.

Parascelio Dodd

1920. Dodd, *Trans. Ent. Soc. London*, 1919, p. 341.

TYPE: *Parascelio undulatus* Dodd, 1920, by monotypy and original designation.

Paraspilomicrus Johnston and Tiegs

1921. Johnston and Tiegs, *Proc. Roy. Soc. Queensland*, vol. 33, pp. 103, 104, 123.

TYPE: *Paraspilomicrus froggatti* Johnston and Tiegs, 1921, by monotypy and original designation.

Paratelenomus Dodd

1914. Dodd, *Proc. Roy. Soc. Queensland*, vol. 26, p. 121.

TYPE: *Telenomus bicolor* Dodd, 1914, by monotypy and original designation.

Paratelopsilus Whittaker

1930. *Proc. Ent. Soc. Washington*, vol. 32, p. 73.

TYPE: *Paratelopsilus canadensis* Whittaker, 1930, by monotypy and original designation.

Paratrimorus Kieffer

1908. Kieffer, *Ann. Soc. Sci. Bruxelles*, vol. 32, pp. 117, 146.

TYPE: *Paratrimorus perplexus* Kieffer, 1908, by monotypy.

Parepimeces Kieffer (= *Epimeces* Westwood, 1833, not Billberg, 1820)

1926. Kieffer, *Das Tierreich*, Lief. 48, pp. xxxiv, 563, 760.

TYPE: *Epimeces ensifer* Westwood, 1833, by substitution of *Parepimeces* for *Epimeces* Westwood.

Parevania Kieffer

1907. Kieffer, *Berliner Ent. Zeitschr.*, vol. 51, 1906, p. 270.

TYPE: *Parevania semirufa* Kieffer, 1907, by monotypy.

(Paridris Brèthes, not Kieffer, 1908)

1917. Brèthes, *An. Zool. Aplicada*, vol. 4, p. 27.

TYPE: *Paridris chilensis* Brèthes, 1917, by monotypy.

No replacement name has been published and none appears needed since the genus is considered a synonym of *Telenomus* Haliday.

Paridris Kieffer

1908. Kieffer, *Ann. Soc. Sci. Bruxelles*, vol. 32, p. 122. Three species.

TYPE: *Idris laeviceps* Ashmead, 1893. Designated by Kieffer, 1926, *Das Tierreich*, Lief. 48, p. 421.

Parinostemma Kieffer

1914. Kieffer, *in* André, Spec. Hym. Eur. Alg., vol. 11, p. 355.

TYPE: *Inostemma quinda* Walker, 1842, by monotypy and original designation.

Paroxylabis Kieffer

1907. Kieffer, Brotéria, Rev. Sci. Nat., Zool. ser., vol. 6, p. 16.

TYPE: *Paroxylabis semirufa* Kieffer, 1907, by monotypy. Again described as new by Kieffer, 1908, *in* André, Spec. Hym. Eur. Alg., vol. 10, pp. 359, 367.

Passalida Brèthes

1914. Brèthes, Nunquam otiosus, Buenos Aires, p. 2.

TYPE: *Passalida spinifera* Brèthes, 1914, by monotypy and original designation.

Considered synonym of *Amitus* Haldeman.

Pegoteleia Kieffer

1926. Kieffer, Das Tierreich, Lief. 48, pp. xxviii, 272, 510. Fourteen species.

TYPE: *Baryconus calopterus* Kieffer, 1910, by original designation.

Pelecinopteron Brues [fossil]

1933. Brues, Bernsteinforschungen, Heft 3, 1932, pp. 17, 19.

TYPE: *Pelecinopteron tubuliforme* Brues, 1933, by monotypy and original designation.

Pelecinius Latreille (= *Episceuastes* Gistel)

1800. Latreille, *in* Duméril, Bull. Sci. Soc. Philom. Paris, vol. 2, No. 44, p. 155. Two species, one of them included by bibliographic reference.

TYPE: *Ichneumon polycerator* Fabricius, 1776. Designated by Latreille, 1810, Considérations générales . . . des insectes, p. 436. Latreille considered *Ichneumon polyturator* Drury, 1773, and *I. polycerator* Fabricius as the same species but he used the Fabrician name.

(Pentacantha Ashmead, not Stål, 1871) = **Propentacantha** Kieffer

1888. Ashmead, Can. Ent., vol. 20, p. 51.

TYPE: *Pentacantha canadensis* Ashmead, 1888, by monotypy. Considered synonym of *Trisacantha* Ashmead.

Pentapria Kieffer

1905 (October). Kieffer, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, vol. 2 (42), p. 34. No species.

1905 (November). Kieffer, Bull. Soc. Hist. Nat. Metz, ser. 2, vol. 12, p. 105. One species.

TYPE: *Pentapria conjugens* Kieffer, 1905. First included species. *Pentapria punctaticeps* Kieffer, 1906, designated by Kieffer, 1912, in Wytsman, Genera insectorum, fasc. 124, 1911, p. 34, was included later.

Petalosema Kieffer

1926. Kieffer, Das Tierreich, Lief. 48, pp. xxiv, 267, 358. Five species.

TYPE: *Chromoteleia rufithorax* Kieffer, 1907, by present designation.

Pezopria Kieffer

1910. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 697, 712. No species.

1911. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, p. 885. One species.

TYPE: *Pezopria fuscicornis* Kieffer, 1911. First included species.

Phaedroteleia Kieffer

1916. Kieffer, Brotéria, Rev. Luso-Brazileira, Zool. ser., vol. 14, p. 182. Two species.

TYPE: *Phaedroteleia armata* Kieffer, 1916. Designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 418.

Phaenopria Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 407, 436. Eight species.

TYPE: *Phaenopria minutissima* Ashmead, 1893, by original designation.

Phaenoserphus Kieffer

1908. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 289, 298. Thirteen species and three varieties, as well as two species included doubtfully.

TYPE: *Proctotrupes curtipennis* Haliday, 1839. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 664.

Proposed as a subgenus of *Serphus* Schrank.

Phanuromorpha Dodd

1926. Dodd, in Kieffer, Das Tierreich, Lief. 48, p. 556. Nomen nudum.

Still a nomen nudum.

Phanuromyia Dodd (= *Pharunomyia* Dodd, error)

1914. Dodd, Proc. Roy. Soc. Queensland, vol. 26, p. 121.

TYPE: *Pharunomyia* (!) *rufobasalis* Dodd, 1914, by monotypy and original designation.**Phanuropsis** Girault

1916. Girault, Entomologist, vol. 49, p. 198.

TYPE: *Phanuropsis semiflaviventris* Girault, 1916, by monotypy and original designation.**Phanurus** Thomson

1860. Thomson, Öfv. Vet.-Akad. Förh., vol. 17, pp. 169, 172. Ten species.

TYPE: *Phanurus angustatus* Thomson, 1860. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 139.Considered synonym of *Telenomus* Haliday.**(Pharunomyia** Dodd, error) = **Phanuromyia** Dodd

1914. Dodd, Proc. Roy. Soc. Queensland, vol. 26, p. 121.

Philolestes Kieffer

1922. Kieffer, An. Soc. Cient. Argentina, vol. 94, p. 205.

TYPE: *Philolestes rufus* Kieffer, 1922, by monotypy and original designation.**Philolestoides** Ferrière

1929. Ferrière, Zool. Anz., vol. 82, p. 160.

TYPE: *Philolestoides wasmanni* Ferrière, 1929, by monotypy.**Philoplanes**, new name (= *Megacolus* Priesner, 1951, not Cameron, 1903)TYPE: *Megacolus desertorum* Priesner, 1951, by substitution of *Philoplanes* for *Megacolus* Priesner.**Phoenoteleia** Kieffer

1916. Kieffer, Brotéria, Rev. Luso-Brazileira, Zool. ser., vol. 14, p. 62.

TYPE: *Phoenoteleia rufa* Kieffer, 1916, by monotypy and original designation.**(Phoenus** Schletterer, emendation of *Foenus* Fabricius) = **Gasteruption** Latreille

1890. Schletterer, Ann. Naturh. Hofmus. Wien, vol. 4, p. 375.

Piestopleura Foerster (= *Catillus* Foerster 1856, not Brongniart, 1822)

1856. Foerster, Hymenopterologische Studien, Heft 2, p. 144.

TYPE: *Platygaster catillus* Walker, 1835, by substitution of *Piestopleura* Foerster for *Catillus* Foerster.**Plagioscelio** Kieffer

1916. Kieffer, Brotéria, Rev. Luso-Brazileira, Zool. ser., vol. 14, p. 185. Two species.

TYPE: *Plagioscelio rufescens* Kieffer, 1916, by original designation.

Planopria Kieffer (= *Orthopria* Kieffer)

1908. Kieffer, Bull. Soc. Hist. Nat. Metz, vol. 25, p. 19. Sixteen species included by bibliographic reference.

TYPE: *Diapria californica* Ashmead, 1893. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 678.

Isogenotypic with *Orthopria* Kieffer. Considered synonym of *Trichopria* Ashmead.

(**Planopria** Kieffer, 1910, not Kieffer, 1908) = **Planopriella** Kieffer

1910. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 695. No species.

1911. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 895. One species.

TYPE: *Planopria pedestris* Kieffer, 1911. First included species.

Planopriella Kieffer (= *Planopria* Kieffer, 1910, not Kieffer, 1908)

1912. Kieffer, in Wytsman, Genera insectorum, fasc. 124, 1911, pp. 4, 48.

TYPE: *Planopria pedestris* Kieffer, 1911, by substitution of *Planopriella* for *Planopria* Kieffer, 1910.

Plastobelyta Kieffer

1906. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 30, p. 116.

TYPE: *Plastobelyta gallicola* Kieffer, 1906, by monotypy. Doubtfully referred to the Proctotrupoidea.

Plastogryon Kieffer

1908. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 32, pp. 119, 141. Four species and one variety.

TYPE: *Plastogryon foersteri* Kieffer, 1908. Designated by Brues, 1908, in Wytsman, Genera insectorum, fasc. 80, p. 51.

Plastomicrops Kieffer

1906. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 30, p. 145. One species and one variety.

TYPE: *Plastomicrops acuticornis* Kieffer, 1906, by present designation.

Platyceraphron Kieffer

1906. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 30, p. 141. Two species.

TYPE: *Platyceraphron muscidarum* Kieffer, 1906, by present designation.

Platygaster Latreille

1809. Latreille, Genera crustaceorum et insectorum . . . , vol. 4, p. 31.

TYPE: *Scelio ruficornis* Latreille, 1805, by monotypy. "*P. rufipes* Latr.," cited as type by Ashmead, 1903, Journ. New York Ent. Soc., vol. 11, p. 98, was undoubtedly a lapsus for *ruficornis*.

Platygastoides Dodd

1913. Dodd, Can. Ent., vol. 45, p. 346.

TYPE: *Platygastoides mirabilis* Dodd, 1913, by monotypy and original designation.

Platyllostropa Szelényi

1938. Szelényi, Ann. Mus. Nat. Hungarici, vol. 31, Zool., p. 126.

TYPE: *Platyllostropa gallicola* Szelényi, 1938, by monotypy and original designation.

Platymischoides Ashmead

1901. Ashmead, Fauna Hawaiiensis, vol. 1, p. 296.

TYPE: *Platymischoides molokaiensis* Ashmead, 1901, by monotypy.

Platymischus Westwood

1832. Westwood, London Edinburgh Phil. Mag., ser. 3, vol. 1, p. 128.

TYPE: *Platymischus dilatatus* Westwood, 1832, by monotypy.

Platyscelio Kieffer

1905. Kieffer, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, vol. 2 (42), p. 11.

TYPE: *Platyscelio pulchricornis* Kieffer, 1905, by monotypy.

Platystasius Nixon

1937. Nixon, Ann. Mag. Nat. Hist., ser. 10, vol. 19, p. 372. Two species.

TYPE: *Platystasius strangaliophagus* Nixon, 1937, by original designation.

Platyteleia Dodd

1913. Trans. Roy. Soc. South Australia, vol. 37, pp. 131, 153.

TYPE: *Platyteleia latipennis* Dodd, 1913, by monotypy and original designation.

Platytelenomus Dodd

1914. Dodd, Ent. News, vol. 25, p. 126.

TYPE: *Platytelenomus planus* Dodd, 1914, by monotypy and original designation.

Plesiobaenus Kieffer

1913. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, pp. 229, 282.

TYPE: *Plesiobaenus hospes* Kieffer, 1913, by monotypy.

Pleuropria Kieffer

1905. Ann. Soc. Sci. Bruxelles, vol. 29, pp. 132, 136.

TYPE: *Pleuropria maculipennis* Kieffer, 1905, by monotypy.

Plutofoenus Kieffer

1911. Kieffer, Ann. Soc. Ent. France, vol. 80, p. 177.

TYPE: *Gasteruption paraguayense* Schrottky, 1906, by monotypy and original designation.

Plutopria Kieffer

1910. Kieffer, Ent. Rundschau, vol. 27, p. 48.

TYPE: *Plutopria luctuosa* Kieffer, 1910, by monotypy.

Polydiapria Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 398, 427.

TYPE: *Polydiapria atriceps* Dodd, 1915, by monotypy and original designation.

Polygnotus Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 108, 115.

TYPE: *Platygaster striolatus* Nees, 1834, by monotypy and original designation.

Considered synonym of *Platygaster* Latreille.

(*Polymecus* Foerster) = *Ectadius* Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, p. 144.

TYPE: *Platygaster craterus* Walker, 1835, by substitution of *Polymecus* Foerster for *Ectadius* Foerster.

Unnecessarily proposed for *Ectadius* Foerster which Foerster considered preoccupied by *Ectadium* E. Meyer in botany.

Polypeza Foerster (= *Propantolyta* Kieffer)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 123, 127. No species.

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 385, 387. One species.

TYPE: *Polypeza pergandei* Ashmead, 1893. First included species. *Polypeza foersteri* Kieffer, 1910, designated by Kieffer, 1910, in André, Spec. Hym. Eur. Alg., vol. 10, p. 718, was included later.

Isogenotypic with *Propantolyta* Kieffer.

Polypria Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 399, 410.

TYPE: *Polypria nigriventris* Dodd, 1915, by monotypy and original designation.

Pristaulacus Kieffer

1900. Kieffer, Ann. Soc. Ent. France, vol. 68, 1899, p. 813.
Four species.

TYPE: *Pristaulacus chlapowskii* Kieffer, 1900. Designated by Kieffer, 1903, in André, Spec. Hym. Eur. Alg., vol. 7 bis, p. 455.

Pristomicrops Kieffer

1906. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 30, p. 146.

TYPE: *Pristomicrops clavatus* Kieffer, 1906, by monotypy.

Probaryconus Kieffer

1908. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 32, pp. 118, 165, 168.

TYPE: *Baryconus (Probaryconus) spinosus* Kieffer, 1908, by monotypy.

Proposed as a subgenus of *Baryconus* Foerster.

Probelyta Kieffer

1909. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 33, p. 364.

TYPE: *Probelyta alticola* Kieffer, 1909, by monotypy.

Probetyla Brues

1922. Brues, Psyche, vol. 29, p. 222.

TYPE: *Probetyla subaptera* Brues, 1922, by monotypy and original designation.

Procacus Kieffer

1910. Kieffer, Ann. Soc. Ent. France, vol. 78, 1909, p. 319.

TYPE: *Procacus striatigena* Kieffer, 1910, by monotypy.

(Procinetus Kieffer, not Foerster, 1868) = **Eccinetus**, new name

1910. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 638 (footnote).

TYPE: *Cinetus radiatus* Kieffer, 1905, by monotypy and original designation.

(Proctotripes Provancher, error) = **Proctotrupes** Latreille.

1883. Provancher, Petite faune entomologique du Canada . . . , p. 558.

(Proctotropis Gistel, emendation) = **Proctotrupes** Latreille.

1848. Gistel, Naturgeschichte des Thierreichs, p. 143.

Proctotrupes Latreille (= *Serphus* Schrank, suppressed; *Proctotrupes* Rafinesque, emendation; *Proctotrypes* Agassiz, emendation; *Proctotropis* Gistel, emendation; *Proctotripes*, error)

1796. Latreille, Précis caractères génériques des insectes . . . , p. 108. No species.

1802. Latreille, Histoire naturelle . . . crustacés et des insectes, vol. 3, p. 308. One species.

TYPE: *Proctotrupes brevipennis* Latreille, 1802. First included species. Designated by the International Commission on Zoological Nomenclature under suspension of the Rules, Opinion 178, 1946, p. [547]. *Codrur pallipes* Jurine, 1807, designated by Latreille, 1810, *Considérations générales . . . des insectes*, p. 437, *Codrur niger* Panzer, 1801, designated by Westwood, 1839, *An introduction to the modern classification of insects*, vol. 2, generic synopsis p. 76, *Ichneumon gravidator* Linnaeus, 1758, designated by Curtis, 1839, *British entomology*, vol. 16, folio 744, and *Proctotrupes areolator* Haliday, 1839, designated by Blanchard, 1849, *in* Cuvier, *Règne animal* [ed. 3], *Insectes*, text vol. 2, p. 156; atlas, pl. 115, fig. 4, were included later.

(*Proctotrypes* Agassiz, emendation) = *Proctotrupes* Latreille.

1846. Agassiz, *Nomenclator zoologicus. Index universalis*, p. 309.

(*Proctrupes* Rafinesque, emendation) = *Proctotrupes* Latreille

1815. Rafinesque, *Analyse*, p. 125.

Proctotrypites Meunier [fossil]

1919. Meunier, *Jahrb. Preuss. Geol. Landesanst. Bergakad.*, Berlin, vol. 39, pt. 1, Heft 1, p. 145.

TYPE: *Proctotrypites rottensis* Meunier, 1919, by monotypy.

Prodendrocerus Kieffer

1907. Kieffer, *in* André, *Spec. Hym. Eur. Alg.*, vol. 10, p. 11. No species.

1909. Kieffer, *in* Wytsman, *Genera insectorum*, fasc. 94, p. 6. One species.

TYPE: *Dendrocerus ratzeburgi* Ashmead, 1904. First included species.

Prolapitha Kieffer

1908. Kieffer, *Ann. Soc. Sci. Bruxelles*, vol. 32, p. 117.

TYPE: *Prolapitha nigriceps* Kieffer, 1908, by monotypy and original designation.

Proleptacis Kieffer

1926. Kieffer, *Das Tierreich*, Lief. 48, pp. xxi, 562, 632. Four species.

TYPE: *Leptacis foersteri* Kieffer, 1914, by original designation.

Promeuselia Kieffer

1910. Kieffer, *in* Wytsman, *Genera insectorum*, fasc. 107, pp. 4, 15, 16.

TYPE: *Rhynchopsilus clausus* Kieffer, 1908, by monotypy.
Proposed as a subgenus of *Rhynchopsilus* Kieffer.

(Propantolyta Kieffer) = Polypeza Foerster

1910. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 697, 709.

TYPE: *Polypeza pergandei* Ashmead, 1893, by monotypy and original designation.

Isogenotypic with *Polypeza* Foerster.

Propentacantha Kieffer (= Pentacantha Ashmead, 1888, not Stål, 1871)

1926. Kieffer, Das Tierreich, Lief. 48, pp. xxi, 173, 241.

TYPE: *Pentacantha canadensis* Ashmead, 1888, by substitution of *Propentacantha* for *Pentacantha* Ashmead.

Considered synonym of *Trisacantha* Ashmead.

Propentapria Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 399, 425.

TYPE: *Propentapria multifoveata* Dodd, 1915, by monotypy and original designation.

Prophanurus Kieffer

1912. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, pp. 9, 37. Twenty species, one of them doubtfully included.

TYPE: *Teleas phalaenarum* Nees, 1834, by original designation.

Considered synonym of *Telenomus* Haliday.

Proplatygaster Kieffer

1904. Kieffer, Rev. Chilena, vol. 8, p. 144.

TYPE: *Proplatygaster rufipes* Kieffer, 1904, by monotypy.

Proplatyscelio Brues [fossil]

1940. Brues, Proc. Amer. Acad. Arts Sci., vol. 74, p. 85.

TYPE: *Proplatyscelio depressus* Brues, 1940, by monotypy and original designation.

Propsilomma Kieffer

1916. Kieffer, Das Tierreich, Lief. 44, pp. xxiv, 351, 422.

TYPE: *Psilomma columbianum* Ashmead, 1893, by monotypy.

Prosacantha Nees

1834. Nees, Hymenopterorum ichneumonibus affinium, monographiae, vol. 2, p. 294. Three species.

TYPE: *Prosacantha longicornis* Nees, 1834. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 185.

Prosactogaster Kieffer

1914. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, pp. 352, 362, pl. 13, figs. 6 and 7, pl. 17, figs. 5-7. Two species.

TYPE: *Platygaster lineatus* Kieffer, 1906, by present designation. *Prosactogaster floricola* Kieffer, 1916, designated by Kieffer, 1916, Zentralbl. Bakt. Parasitenk. Infektionsk., Abt. 2, vol. 46, p. 570, and *Prosactogaster umbraculi* Kieffer, 1916, designated by him, 1926, Das Tierreich, Lief. 48, p. 762, were included later.

Prosamblyaspis Kieffer

1926. Kieffer, Das Tierreich, Lief. 48, pp. xxx, 561, 610.

TYPE: *Amblyaspis flavosignatus* Kieffer, 1912, by monotypy.

Prosanteris Kieffer

1908. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 32, pp. 121, 136. Nine species.

TYPE: *Anteris nigriceps* Ashmead, 1893. Designated by Kieffer, 1910, in Wytsman, Genera insectorum, fasc. 80B, p. 87.

Prosapegus Kieffer

1908. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 32, pp. 121, 147.

TYPE: *Anteris elongata* Ashmead, 1887, by monotypy and original designation.

Prosevania Kieffer

1911. Kieffer, Ann. Soc. Ent. France, vol. 80, p. 157. Three species.

TYPE: *Evania (Prosevania) afra* Kieffer, 1911. Designated by Viereck, 1914, U. S. Nat. Mus. Bull. 83, p. 123. *Evania (Prosevania) subtangens* Kieffer, 1911, was designated by Hedicke, 1939, Hymenopterorum catalogus, pars 9, p. 28, who probably considered Viereck's "monobasic" designation invalid.

Proposed as a subgenus of *Evania* Fabricius.

Prosinostemma Kieffer

1914. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, pp. 356, 378.

TYPE: *Prosinostemma nigerrima* Kieffer, 1914, by monotypy.

Prosoxylabis Kieffer

1909. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 33, p. 344.

TYPE: *Prosoxylabis maculipennis* Kieffer, 1909, by monotypy.

Prosparasion Kieffer

1913. Kieffer, Boll. Lab. Zool. Portici, vol. 7, p. 190.

TYPE: *Prosparasion coeruleum* Kieffer, 1913, by monotypy and original designation.

Prospilomicrus Kieffer

1910. Kieffer, in Voeltzkow, Reise in Ostafrika, 1903-05, vol. 2, Heft 5, p. 532. Two species.

TYPE: *Prospilomicrus fuscicornis* Kieffer, 1910, by original designation.

Also published by Kieffer Mar. 1, 1910, without included species, in André, Hym. Eur. Alg., vol. 10, pp. 702, 710.

Prosynacra Kieffer

1905. Kieffer, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, vol. 2, pp. 35, 37. No species.

1910 (January 28). Kieffer, Boll. Lab. Zool. Portici, vol. 4, p. 108. One species and one nomen nudum.

TYPE: *Prosynacra nigriceps* Kieffer, 1910. First included species. Kieffer actually based this genus on *Prosynacra giraudi* Kieffer, which he designated as type in 1912, in Wytzman, Genera insectorum, fasc. 124, p. 13, 1911; but unfortunately the description of this species was not published until Mar. 1, 1910.

Prosynopeas Kieffer

1916. Kieffer, Zentralbl. Bakt. Parasitenk. Infektionskr., Abt. 2, vol. 46, p. 554. Two species.

TYPE: *Synopeas* (*Prosynopeas*) *dactylidis* Kieffer, 1916. Designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 694.

Proposed as a subgenus of *Synopeas* Foerster.

Protelenomus Kieffer

1908. Kieffer, Bull. Soc. Hist. Nat. Metz, vol. 25, p. 6.

TYPE: *Protelenomus flavicornis* Kieffer, 1908, by monotypy.

Proteroscelio Brues [fossil]

1937. Brues, in Carpenter, Univ. Toronto Studies, Geol. ser., No. 40, p. 39.

TYPE: *Proteroscelio antennalis* Brues, 1937, by monotypy and original designation.

Protofoenus Cockerell [fossil]

1917. Cockerell, Ann. Ent. Soc. Amer., vol. 10, p. 19.

TYPE: *Protofoenus swinhoei* Cockerell, by monotypy.

Protrimorus Kieffer

1908. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 32, p. 146.

TYPE: *Trimorus americanus* Ashmead, 1893, by monotypy.

Prozelotypa Kieffer

1909. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 33, p. 367.

TYPE: *Prozelotypa longicornis* Kieffer, 1909, by monotypy.

Pseudanteris Fouts

1927. Fouts, Proc. Ent. Soc. Washington, vol. 29, p. 177.

TYPE: *Pseudanteris insignis* Fouts, 1927, by monotypy and original designation.

Pseudaphanomerus Széleányi

1941. Széleányi, Zool. Anz., vol. 134, p. 160.

TYPE: *Pseudaphanomerus hyalinatus* Széleányi, 1941, by monotypy and original designation.

(Pseudevania Kieffer, error) = **Zeuxevania** Kieffer

1903. Kieffer, Zeitschr. Hym. Dipt., vol. 3, p. 111.

Pseudobaeus Perkins

1910. Perkins, Fauna Hawaiiensis, vol. 2, p. 620.

TYPE: *Pseudobaeus peregrinus* Perkins, 1910, by monotypy.

Pseudoceraphron Dodd

1924. Dodd, Trans. Roy. Soc. South Australia, vol. 48, p. 175.

TYPE: *Pseudoceraphron pulex* Dodd, 1924, by monotypy and original designation.

Pseudofoenus Kieffer

1902. Kieffer, in Wytsman, Genera insectorum, fasc. 2, p. 6. Three species, two of them doubtful.

TYPE: *Gasteruption pedunculatum* Schletterer, 1889. Designated by Kieffer, 1903, in André, Spec. Hym. Eur. Alg., vol. 7 bis, p. 381.

Pseudotelenomus Costa Lima

1928 (Sept.). Costa Lima, Compt. Rend. Soc. Biol., vol. 99, p. 880.

TYPE: *Pseudotelenomus pachycoris* Costa Lima, 1928, by monotypy and original designation.

Again described as new by Costa Lima, December 1928, Bol. Mus. Nac. Rio de Janeiro, vol. 4, p. 52.

Psilacolus Kieffer

1908. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 32, pp. 179, 180. Two species included by bibliographic reference.

TYPE: *Acolus xanthogaster* Ashmead, 1893. Designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 152.

Considered synonym of *Acoloides* Howard.

Psilanteris Kieffer

1916. Kieffer, Brotéria, Rev. Luso-Brazileira, Zool. ser., vol. 14, p. 177. Five species.

TYPE: *Anteris bicolor* Kieffer, 1908, by original designation.

Psilaulacus Kieffer

1910. Kieffer, Bull. Soc. Ent. France, 1910, p. 350. No species.

1911. Kieffer, Ann. Soc. Ent. France, vol. 80, pp. 215, 230. One species.

TYPE: *Psilaulacus annulatus* Kieffer, 1911. First included species.

(*Psilloma* Cameron, error) = *Psilomma* Foerster

1881. Cameron, Trans. Ent. Soc. London, 1881, p. 557.

Psilobaeus Kieffer

1926. Kieffer, Das Tierreich, Lief. 48, pp. xvii, 132, 151.

TYPE: *Baeus curvatus* Kieffer, 1910, by monotypy.

Psilomma Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 128, 130, 132. No species.

1861. Foerster, Programm der Realschule zu Aachen, p. xliii. One species.

TYPE: *Psilomma fusciscapis* Foerster, 1861. First included species. *Psilomma tenuicornis* Kieffer, 1908, designated by Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, p. 419, was included later. *P. tenuicornis* was described from the specimen in the Foerster collection upon which the genus was based, but under a recent decision of the International Commission on Zoological Nomenclature (Bull. Zool. Nom., vol. 4, 1950, pp. 160, 346) only the first species to be included shall be eligible for designation as type of a genus originally published without included species.

Psilommella Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 389, 392.

TYPE: *Psilommella petiolata* Dodd, 1915, by monotypy and original designation.

Psilopria Kieffer

1905. Kieffer, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, vol. 2 (42), pp. 29, 35, 37.

TYPE: *Psilopria rufitarsis* Kieffer, 1905, by monotypy.

Psiloteleia Kieffer

1910. Kieffer, in Voeltzkow, Reise in Ostafrika, 1903-05, vol. 2, Heft 5, p. 530.

TYPE: *Psiloteleia striatigena* Kieffer, 1910, by monotypy.

Psilus Panzer (= *Galesus* Haliday)

1801. Panzer, Faunae insectorum Germaniae initia . . . , Heft 83, No. 11.

TYPE: *Psilus cornutus* Panzer, 1801, by monotypy.

Isogenotypic with *Galesus* Haliday.

Pycnaulacus Cushman

1930. Cushman, Proc. U. S. Nat. Mus., vol. 76, art. 25, 1929, p. 17.

TYPE: *Pycnaulacus brevicaudus* Cushman, 1930, by monotypy and original designation.

Considered synonym of *Aulacus* Jurine.

(*Raia* Ashmead, not Cuvier, 1798, not Delaroché, 1809) = *Opisthacantha* Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, p. 221.

TYPE: *Opisthacantha mellipes* Ashmead, 1893. *Raia* Ashmead was validated and its type fixed by Ashmead through citation as a synonym of *Opisthacantha* Ashmead. Although it is preoccupied a new name is not required.

(*Rhacodia* Herrich-Schaeffer, not Huebner [1825]) = *Dorachia*, new name

1838. Herrich-Schaeffer, in Panzer, Faunae insectorum Germaniae initia . . . , Heft 157, No. 23. Five species.

TYPE: *Diapria striolata* Nees, 1834, by present designation.

Rhacoteleia Cameron

1905. Cameron, Spolia zeylanica, vol. 3, No. 10, p. 72.

TYPE: *Rhacoteleia pilosa* Cameron, 1905, by monotypy.

Considered synonym of *Hoploteleia* Ashmead.

Rhopalopria Kieffer

1912. Kieffer, in Wytsman, Genera insectorum, fasc. 124, 1911, pp. 8, 61.

TYPE: *Rhopalopria vulgaris* Kieffer, 1912, by monotypy.

Also described as new by Kieffer, 1912, Trans. Linn. Soc. London, ser. 2, Zool., vol. 15, p. 71.

Rhynidinofoenus Bradley

1909. Bradley, Deutsche Ent. Zeitschr., 1909, pp. 38, 39. Two species.

TYPE: *Rhynidinofoenus kaweahensis* Bradley, 1909, by original designation.

Rhynchopria Kieffer

1910. Kieffer, in Wissenschaftliche Ergebnisse der deutschen Zentral-Afrika-Expedition . . . , vol. 3 (Zool.) Lief. 2, p. 99.

TYPE: *Rhynchopria tritoma* Kieffer, 1910, by monotypy.

Rhynchopsilus Kieffer

1908. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 360, 400. Two species.

TYPE: *Rhynchopsilus apertus* Kieffer, 1908. Designated by Kieffer, 1910, in Wytsman, *Genera insectorum*, fasc. 107, p. 15.

Rielia Kieffer

1910. Kieffer, *Boll. Lab. Zool. Portici*, vol. 4, p. 107.

TYPE: *Rielia manticida* Kieffer, 1910, by monotypy.

Considered synonym of *Mantibaria* Kirby.

Rieliomorpha Dodd

1913. Dodd, *Trans. Roy. Soc. South Australia*, vol. 37, pp. 131, 155.

TYPE: *Rieliomorpha mantis* Dodd, 1915, by monotypy and original designation.

Considered synonym of *Mantibaria* Kirby.

Roena Cameron

1905. Cameron, *Rec. Albany Mus.*, vol. 1, p. 225.

TYPE: *Roena cariniscutis* Cameron, 1905, by monotypy.

Romilius Walker

1842. Walker, *Ann. Mag. Nat. Hist.*, vol. 10, p. 274. Two species.

TYPE: *Romilius zotale* Walker, 1842. Designated by Kieffer, 1910, in Wytsman, *Genera insectorum*, fasc. 80B, p. 70.

Ropronia Provancher (= *Roptronia* Ashmead, error)

1886. Provancher, *Additions et corrections au volume II de la faune entomologique du Canada . . . Hyménoptères*, pp. 152, 154.

TYPE: *Ropronia pediculata* Provancher, 1886, by monotypy.

(**Roptronia** Ashmead, error) = **Ropronia** Provancher

1898. Ashmead, *Proc. Ent. Soc. Washington*, vol. 4, p. 132.

(**Rosneta** Brues) = **Fidiobia** Ashmead

1908. Brues, *Bull. Wisconsin Nat. Hist. Soc.*, vol. 6, p. 157.

TYPE: *Rosneta tritici* Brues, 1908, by monotypy and original designation.

Isogenotypic with *Fidiobia* Ashmead, 1895, through synonymy.

Sacespalus Kieffer

1917. Kieffer, *Brotéria, Rev. Luso-Brazileira, Zool. ser.*, vol. 15, p. 61.

TYPE: *Sacespalus rugosiceps* Kieffer, 1917, by monotypy and original designation.

Sactogaster Foerster

1856. Foerster, *Hymenopterologische Studien, Heft 2*, pp. 108, 113. Six species.

TYPE: *Epimeces ventralis* Westwood, 1833. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 284. *Sactogaster pisi* Foerster, 1856, was designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 659.

Scapopria Kieffer

1913. Kieffer, Insecta, vol. 3, p. 441.

TYPE: *Scapopria atriceps* Kieffer, 1913, by monotypy and original designation.

Sceliacantha Dodd

1913. Dodd, Arch. Naturg., vol. 79, A6, p. 173.

TYPE: *Sceliacantha quadrispinosa* Dodd, 1913, by monotypy and original designation.

Sceliacanthella Dodd

1913. Dodd, Arch. Naturg., vol. 79, A6, p. 174.

TYPE: *Sceliacanthella parvipennis* Dodd, 1913, by monotypy and original designation.

Scelio Latreille (= *Scelionus* Rafinesque, emendation; *Serlion* Say, error; *Scelion* Blanchard, emendation)

1805. Latreille, Histoire naturelle . . . crustacés et des insectes, vol. 13, p. 226. Three species.

TYPE: *Scelio rugosulus* Latreille, 1805. Designated by Latreille, 1810, Considérations générales . . . des insectes, p. 436.

Scelioliria Brèthes

1916. Brèthes, An. Mus. Nac. Buenos Aires, vol. 27, p. 413.

TYPE: *Scelioliria mariae* Brèthes, 1916, by monotypy and original designation.

Sceliomorpha Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 210, 211, 239. Two species, one of them doubtfully included.

TYPE: *Sceliomorpha longicornis* Ashmead, 1893, by original designation.

(Scelion Blanchard, emendation) = **Scelio** Latreille

1849. Blanchard, in Cuvier, Règne animal [ed. 3], insectes, text vol. 2, p. 157; atlas, pl. 116, fig. 4.

(Scelionus Rafinesque, emendation) = **Scelio** Latreille

1815. Rafinesque, Analyse, p. 125.

Sceliotrachelus Brues

1908. Brues, in Wytsman, Genera insectorum, fasc. 80, p. 13.

TYPE: *Sceliotrachelus braunsi* Brues, 1908, by monotypy and original designation.

Schizogalesus Kieffer

1911. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 832, 833. Fifteen species and one variety.

TYPE: *Galesus* (*Schizogalesus*) *punctatus* Kieffer, 1911. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 675.

Proposed as a subgenus of *Galesus* Curtis. Considered synonym of *Psilus* Panzer.

Schizopria Kieffer

1912. Kieffer, in Wytsman, Genera insectorum, fasc. 124, 1911, pp. 5, 17. Two names, both nomina nuda.

1912. Kieffer, Trans. Linn. Soc. London, ser. 2, Zool., vol. 15, p. 68. Two species.

TYPE: *Schizopria fallax* Kieffer, 1912. Designated by Kieffer, 1916, Das Tierreich, Lief. 44, p. 38.

Scorpioteleia Ashmead

1897. Ashmead, Can. Ent., vol. 29, p. 53.

TYPE: *Scorpioteleia mirabilis* Ashmead, 1897, by monotypy.

Scyphodon Brues

1925. Brues, Treubia, vol. 6, p. 93.

TYPE: *Scyphodon anomalum* Brues, 1925, by monotypy and original designation.

Doubtfully referred to the Proctotrupoidea.

(*Semaeodogaster* Bradley, new name for *Brachygaster* Stephens, 1829, not Meigen, 1826) = **Brachygaster** Leach

1905. Bradley, Can. Ent., vol. 37, p. 63. Two species.

TYPE: *Evania minuta* Olivier, 1791. Present designation. Bradley erroneously considered *Brachygaster* Leach, 1815, to be a nomen nudum, and to have been first validated by Stephens, 1829.

Isogenotypic with *Brachygaster* Leach.

(*Semaeomya* Enderlein, error) = **Semaeomyia** Bradley

1909. Enderlein, Stett. Ent. Zeit., vol. 70, p. 259.

Semaeomyia Bradley (= *Semaeomya* Enderlein, error)

1908. Bradley, Trans. Amer. Ent. Soc., vol. 34, pp. 163, 180. Fifteen species.

TYPE: *Semaeomyia kiefferi* Bradley, 1908, by original designation.

Considered synonym of *Brachygaster* Leach.

Sembilanocera Brues [fossil]

1940. Brues, Proc. Amer. Acad. Arts Sci., vol. 74, p. 70.

TYPE: *Sembilanocera clavata* Brues, 1940, by monotypy and original designation.

Semenovius Bradley (= *Semenovia* Kieffer, 1903, not Weise, 1889)

1908. Bradley, Trans. Amer. Ent. Soc., vol. 34, pp. 120, 123.

TYPE: *Aulacus sibiricola* Semenov, 1894, by substitution of *Semenovius* for *Semenovia* Kieffer.

(***Semenovia*** Kieffer, 1903, not Weise, 1889, new name for *Anaulacus* Semenov, 1903, not MacLeay, 1825) = **Semenovius** Bradley

1903. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 7 bis, pp. 382, 720.

TYPE: *Aulacus sibiricola* Semenov, 1894, by substitution of *Semenovia* for *Anaulacus* Semenov.

(***Serlion*** Say, error) = **Scelio** Latreille

1828. Say, Contr. Maclur. Lyc. Philadelphia, vol. 1, p. 80.

Serphites Brues [fossil]

1937. Brues, in Carpenter, Toronto Univ. Studies, Geol. ser., No. 40, p. 33.

TYPE: *Serphites paradoxus* Brues, 1937, by monotypy and original designation.

(***Serphus*** Schrank) = **Proctotrupes** Latreille

1780. Schrank, Schrift. Berlin. Gesellsch. Naturf. Freunde, vol. 1, p. 307.

Suppressed in favor of *Proctotrupes* Latreille by the International Commission on Zoological Nomenclature, 1946, under suspension of the Rules (Opinion 178). Established originally as a monobasic genus with *Serphus brachypterus* Schrank, 1780, as type.

Shreemana Nixon

1933. Nixon, Ann. Mag. Nat. Hist., ser. 10, vol. 12, p. 300.

TYPE: *Shreemana sera* Nixon, 1933, by monotypy and original designation.

(***Sinaris*** Gregor, error) = **Synarsis** Foerster

1939. Gregor, Sborn. Ent. Odd. Nár. Mus. Praze, vol. 17, p. 132.

Solenopsia Wasmann

1899. Wasmann, Zoologica, Stuttgart, Heft 26, pp. 53, 126.

TYPE: *Solenopsia imitatrix* Wasmann, 1899, by monotypy.

Solenopsiella Dodd

1915. Dodd, Trans. Roy. Soc. South Australia, vol. 39, pp. 398, 428.

TYPE: *Solenopsiella distincta* Dodd, 1915, by monotypy and original designation.

(*Sparaison* Brues, error) = *Sparasion* Latreille

1908. Brues, in Wytzman, *Genera insectorum*, fasc. 80, pp. 41, 56.

Sparasion Latreille (= *Sparaison* Brues, error)

1802. Latreille, *Histoire naturelle . . . crustacés et des insectes*, vol. 3, p. 316.

TYPE: *Sparasion cephalotes* Latreille, 1802, by monotypy. *Ceraphron cornutus* Jurine, 1807, designated by Latreille, 1810, *Considérations générales . . . des insectes*, p. 436, and *Sparasion frontalis* Latreille, 1805, designated by Curtis, 1830, *British entomology*, vol. 7, folio 317, were included later.

Spilomicrus Westwood

1832. Westwood, *London Edinburgh Phil. Mag.*, ser. 3, vol. 1, p. 129.

TYPE: *Spilomicrus stigmatalis* Westwood, 1832, by monotypy.

Stictoteleia Kieffer

1926. Kieffer, *Das Tierreich*, Lief. 48, pp. xxix, 272, 546. Two species.

TYPE: *Macroteleia virginiensis* Ashmead, 1893, by original designation.

Streptopria Maneval

1939. Maneval, *Bull. Soc. Ent. France*, vol. 44, p. 168.

TYPE: *Streptopria rozieri* Maneval, 1939, by monotypy and original designation.

Styloclista Dodd

1915. Dodd, *Trans. Roy. Soc. South Australia*, vol. 39, p. 389.

TYPE: *Styloclista notabilis* Dodd, 1915, by monotypy and original designation.

(*Stylidodon* Ashmead, error) = *Stylidolon* Ashmead

1902. Ashmead, *Journ. New York Ent. Soc.*, vol. 10, p. 245.

Stylidolon Ashmead (= *Stylidodon* Ashmead, error)

1897. Ashmead, *Can. Ent.*, vol. 29, p. 53.

TYPE: *Stylidolon politum* Ashmead, 1897, by monotypy.

Stylopria Kieffer

1914. Kieffer, *Philippine Journ. Sci.*, vol. 9, p. 307.

TYPE: *Stylopria rufa* Kieffer, 1914, by monotypy and original designation.

Styloteleia Kieffer

1916. Kieffer, *Brotéria, Rev. Luso-Brazileira, Zool. ser.*, vol. 14, p. 184.

TYPE: *Styloteleia rufescens* Kieffer, 1916, by monotypy and original designation.

Symphytoria Kieffer

1910. Kieffer, in André Spec. Hym. Eur. Alg., vol. 10, pp. 694, 739. Five species.

TYPE: *Symphytoria fulva* Kieffer, 1910. Designated by Kieffer, 1912, in Wytsman, Genera insectorum, fasc. 124, 1911, p. 32.

Synacra Foerster (= *Artibolus* Haliday)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 128, 130, 134. No species.

1873. Marshall, A catalogue of British Hymenoptera; Oxyura, p. 10. One species but two names, one of them validated in synonymy.

TYPE: *Diapria brachialis* Nees, 1834. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 400.

Isogenotypic with *Artibolus* Haliday.

Synarsis Foerster (= *Sinaris* Gregor, error)

1878. Foerster, Verh. Naturh. Ver. Preuss. Rheinl., vol. 35, p. 57.

TYPE: *Synarsis pulla* Foerster, 1878, by monotypy and original designation.

Synopeas Foerster (= *Synopias* Ashmead, error)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 108, 114. No species.

1859. Thomson, Öfv. Vet.-Akad. Förh., vol. 16, p. 71. Thirteen species.

TYPE: *Synopeas inermis* Thomson, 1859. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., U. S. Dept. Agr., Agr. Monogr. No. 2, p. 716. *Synopeas prospectus* Foerster, 1861, designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 285, *Synopeas melampus* Foerster, 1861, designated by Ashmead, 1903, Journ. New York Ent. Soc., vol. 11, p. 97, and *Platygaster sosis* Walker, 1835, designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 667, were included later.

Considered synonym of *Leptacis* Foerster.

(Synopias Ashmead, error) = **Synopeas** Foerster

1896. Ashmead, Proc. Zool. Soc. London, 1895, p. 802.

Syntelesia Fouts

1927. Fouts, Proc. Ent. Soc. Washington, vol. 29, p. 178.

TYPE: *Syntelesia coracina* Fouts, 1927, by monotypy and original designation.

Szepligetella Bradley

1908. Bradley, Trans. Amer. Ent. Soc., vol. 34, pp. 163, 172.

TYPE: *Evania sericea* Cameron, 1883, by monotypy and original designation.

Tanyzonus Marshall

1892. Marshall, Ent. Monthly Mag., vol. 28, p. 276.

TYPE: *Tanyzonus bolitophilae* Marshall, 1892, by monotypy.

Teleas Latreille (= *Telias* Leach, emendation)

1809. Latreille, Genera crustaceorum et insectorum . . . , vol. 4, p. 32. Four species.

TYPE: *Scelio clavicornis* Latreille, 1805. Designated by Latreille, 1810, Considérations générales . . . des insectes, p. 436.

Telenomoides Dodd

1913. Dodd, Trans. Roy. Soc. South Australia, vol. 37, pp. 158, 168. Seven species.

TYPE: *Telenomoides flavipes* Dodd, 1913, by original designation.

Considered synonym of *Hadronotus* Foerster.

Telenomus Haliday

1833. Haliday, Ent. Mag., vol. 1, p. 271. Four species.

TYPE: *Telenomus brachialis* Haliday, 1833. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 142.

(Telias Leach, emendation) = **Teleas** Latreille

1815. Leach, in Brewster, Edinburgh encyclopaediae, vol. 9, p. 145.

(Telopsilus Dalla Torre, emendation) = **Telospilus** Dahlbom

1898. Dalla Torre, Catalogus hymenopterorum, vol. 5, p. 522.

Telospilus Dahlbom (= *Telopsilus* Dalla Torre, emendation)

1858. Dahlbom, Öfv. Vet.-Akad. Förh., vol. 14, 1857, p. 290. No species.

No species have been referred to this genus up to the present time.

Tetrabaeus Kieffer

1912. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, p. 87.

TYPE: *Aphanomerus americanus* Brues, 1908, by monotypy and original designation.

Tetraconus Szépligeti

1903. Szépligeti, Ann. Mus. Nat. Hungarici, vol. 1, pp. 388, 389.

TYPE: *Tetraconus mocsáryi* Szépligeti, 1903, by monotypy.

Tetramopria Wasmann

1899. Wasmann, *Zoologica*, Stuttgart, Heft 26, pp. 56, 127.
Two species.

TYPE: *Tetramopria aurocincta* Wasmann, 1899. Designated by Ashmead, 1903, *Journ. New York Ent. Soc.*, vol. 11, p. 31.

Tetrapsilus Kieffer

1908. Kieffer, in André, *Spec. Hym. Eur. Alg.*, vol. 10, pp. 367, 397.

TYPE: *Tetrapsilus filicornis* Kieffer, 1908, by monotypy. Considered synonym of *Zygotia* Foerster.

Tetraulacinus Kieffer

1910. Kieffer, *Bull. Soc. Ent. France*, 1910, p. 350. No species.

1911. Kieffer, *Ann. Soc. Ent. France*, vol. 80, pp. 214, 224. One species.

TYPE: *Pristaulacus rufobalteatus* Cameron, 1907. First included species.

Thaumatevania Ceballos

1935. Ceballos, *Eos*, vol. 10, 1934, p. 233.

TYPE: *Thaumatevania ensifera* Ceballos, 1935, by monotypy and original designation.

Thelepte Nixon

1931. Nixon, *Eos*, vol. 7, p. 379.

TYPE: *Thelepte serapis* Nixon, 1931, by monotypy and original designation.

Therinopsilus Kieffer

1909. Kieffer, *Ann. Soc. Sci. Bruxelles*, vol. 33, p. 365. Two species.

TYPE: *Therinopsilus pubescens* Kieffer, 1909. Designated by Kieffer, 1910, in Wytsman, *Genera insectorum*, fasc. 107, p. 14.

(Thliboneura Thomson) = *Trichosteresis* Foerster

1858. Thomson, *Öfv. Vet.-Akad. Förh.*, vol. 15, pp. 287, 288. Four species.

TYPE: *Ceraphron glaber* Boheman, 1832. Designated by Muesebeck and Walkley, 1951, in Muesebeck et al., *U. S. Dept. Agr., Agr. Monogr. No. 2*, p. 671.

Isogenotypic with *Trichosteresis* Foerster.

Thomsonina Hellén

1941. Hellén, *Notulae Ent.*, vol. 21, p. 40.

TYPE: *Proctotrupes boops* Thomson, 1858, by monotypy and original designation.

Thoron Haliday

1833. Haliday, Ent. Mag., vol. 1, p. 271.

TYPE: *Thoron metallicus* Haliday, 1833, by monotypy.

Tiphodytes Bradley (= *Limnodytes* Marchal, 1900, not Duméril and Bibron, 1841)

1902. Bradley, Can. Ent., vol. 34, p. 179.

TYPE: *Limnodytes gerriphagus* Marchal, 1901, by substitution of *Tiphodytes* for *Limnodytes* Marchal.

Tomoteleia Kieffer

1917. Kieffer, Brotéria, Rev. Luso-Brazileira, Zool. ser., vol. 15, p. 50.

TYPE: *Tomoteleia trifasciata* Kieffer, 1917, by monotypy and original designation.

Trachelopteron Brues [fossil]

1940. Brues, Proc. Amer. Acad. Arts Sci., vol. 74, p. 86.

TYPE: *Trachelopteron angulipenne* Brues, 1940, by monotypy and original designation.

Trichacis Foerster (= *Trichasis* Thomson, emendation)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 108, 115. Three species.

TYPE: *Platygaster pisis* Walker, 1835. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 294. *Platygaster remulus* Walker, 1835, was designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 711.

Trichacoides Dodd

1914. Dodd, Ent. News, vol. 25, p. 416.

TYPE: *Trichacoides scutellaris* Dodd, 1914, by monotypy and original designation.

(*Trichacolus* Kieffer) = *Anteris* Foerster

1912. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, pp. 89, 107. Two species.

TYPE: *Anteris bilineatus* Thomson, 1859, by present designation.

Isogenotypic with *Anteris* Foerster.

Trichanteris Kieffer

1910. Kieffer, in Wytsman, General insectorum, fasc. 80B, p. 88.

TYPE: *Prosanteris foveatifrons* Kieffer, 1908, by monotypy. Proposed as a subgenus of *Prosanteris* Kieffer.

(*Trichasis* Thomson, emendation) = *Trichacis* Foerster

1859. Thomson, Öfv. Vet.-Akad. Förh., vol. 16, pp. 70, 78.

Trichasius Provancher

1887. Provancher, Additions et corrections au volume II de de la faune entomologique du Canada . . . Hyménoptères, p. 209.

TYPE: *Trichasius clavatus* Provancher, 1887, by monotypy.

Trichofoenus Kieffer

1910. Kieffer, Ann. Soc. Ent. France, vol. 79, p. 77. Four species.

TYPE: *Gasteruption merceti* Kieffer, 1904, by original designation.

Tricholeptacis Kieffer

1914. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, p. 357.

TYPE: *Amblyaspis verticillatus* Ashmead, 1894, by monotypy and original designation.

Trichopria Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 407, 431. Nine species.

TYPE: *Trichopria pentaplasta* Ashmead, 1893, by original designation.

Trichosteresis Foerster (= *Thliboneura* Thomson)

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 97, 99. Two species.

TYPE: *Ceraphron glaber* Boheman, 1832. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 107. *Trichosteresis foersteri* Kieffer, 1907, designated by Kieffer, 1909, in Wytzman, Genera insectorum, fasc. 94, p. 14, was not originally included.

Isogenotypic with *Thliboneura* Thomson.

Trichoteleia Kieffer

1910. Kieffer, in Voeltzkow, Reise in Ostafrika, 1903-05, vol. 2, Heft 5, p. 530.

TYPE: *Trichoteleia albidipes* Kieffer, 1910, by monotypy.

Triclavus Brèthes

1916. Brèthes, An. Mus. Nac. Buenos Aires, vol. 27, p. 411.

TYPE: *Triclavus bonariensis* Brèthes, 1916, by monotypy.

Trigonfoenus Kieffer

1911. Kieffer, Ann. Soc. Ent. France, vol. 80, p. 177.

TYPE: *Gasteruption trianguliferum* Kieffer, 1911, by monotypy and original designation.

Trimicrops Kieffer

1906. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 30, p. 142. One species and two varieties.

TYPE: *Trimicrops claviger* Kieffer, 1906, by present designation.

Trimorus Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 101, 104. Two species.

TYPE: *Gryon nanno* Walker, 1836. Designated by Ashmead, 1903, Journ. New York Ent. Soc., vol. 9, p. 87. *Gryon nanno* Walker and *Gryon phlias* Walker, 1836, were both cited as type by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 138.

Triognus Marshall

1874. Marshall, Ent. Ann., 1874, p. 134.

TYPE: *Triognus furcifer* Marshall, 1874, by monotypy. Considered synonym of *Lagynodes* Foerster.

Triplatygaster Kieffer

1913. Kieffer, Brotéria, Rev. Luso-Brazileira, Zool. ser., vol. 11, p. 178.

TYPE: *Platygaster contorticornis* Ratzeburg, 1844, by monotypy.

Proposed as a subgenus of *Platygaster* Latreille.

Trisacantha Ashmead (= *Trissacantha* Ashmead, emendation)

1887. Ashmead, Ent. Amer., vol. 3, p. 117.

TYPE: *Trisacantha americana* Ashmead, 1887, by monotypy.

Trisinostemma Kieffer

1914. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 11, p. 357.

TYPE: *Inostemma braesia* Walker, 1839, by monotypy and original designation.

(*Trissacantha* Ashmead, emendation) = **Trisacantha** Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 180, 182.

Trissevania Kieffer

1913. Kieffer, in Alluaud and Jeannel, Voyage . . . en Afrique Orientale, Insectes hyménoptères, vol. 1, p. 33.

TYPE: *Trissevania anemotis* Kieffer, 1913, by monotypy and original designation.

Trissolcus Ashmead

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 138, 161. Six species.

TYPE: *Trissolcus brochymenae* Ashmead, 1893, by original designation. *Telenomus (euschristus!)* = *euschisti* Ashmead, 1888, was designated by Kieffer, 1926, Das Tierreich, Lief. 48, p. 126.

Trissoscelio Kieffer

1917. Kieffer, Brotéria, Rev. Luso-Brazileira, Zool. ser., vol. 15, p. 52. Three species.

TYPE: *Trissoscelio nigriceps* Kieffer, 1917, by original designation.

Triteleia Kieffer

1906. Kieffer, Berliner Ent. Zeitschr., vol. 50, 1905, p. 264.

TYPE: *Triteleia punctaticeps* Kieffer, 1906, by monotypy.

Tritopria Kieffer

1910. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 717, 748.

TYPE: *Tritopria lusitanica* Kieffer, 1910, by monotypy.

Tropaulacus Bradley

1908. Bradley, Trans. Amer. Ent. Soc., vol. 34, pp. 120, 125.

TYPE: *Tropaulacus torridus* Bradley, 1908, by monotypy and original designation.

(***Tropidobria*** Brèthes, error for *Tropidopria* Ashmead) = **Diapria** Latreille

1927. Brèthes, Ent. Mitt., vol. 16, p. 334.

(***Tropidopria*** Ashmead; *Tropidobria* Brèthes, error) = **Diapria** Latreille

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 406, 407, 416. Five species.

TYPE: *Ichneumon conicus* Fabricius, 1775, by original designation.

Isogenotypic with *Diapria* Latreille.

Tropidopsilus Kieffer

1908. Kieffer, in André, Spec. Hym. Eur. Alg., vol. 10, pp. 358, 366. No species.

1909. Kieffer, Ann. Soc. Sci. Bruxelles, vol. 33, p. 338. One species.

TYPE: *Tropidopsilus laticeps* Kieffer, 1909. First included species.

(***Tropidopsis*** Ashmead, not Brauer and Bergenstamm, 1889) = **Nesopria**, new name

1893. Ashmead, U. S. Nat. Mus. Bull. 45, pp. 386, 402.

TYPE: *Tropidopsis clavata* Ashmead, 1893, by monotypy and original designation.

Urocyclops Maneval (= *Paracyclops* Maneval, 1936, not Claus, 1893)

1936. Maneval, Bull. Ann. Soc. Ent. Belgique, vol. 76, p. 142.

TYPE: *Paracyclops bettyae* Maneval, by substitution of *Urocyclops* for *Paracyclops* Maneval.

Uroscelio Kieffer

1914. Kieffer, Philippine Journ. Sci., vol. 9, p. 291.

TYPE: *Uroscelio luteipes* Kieffer, 1914, by monotypy and original designation.

Uroteleia Brues [fossil]

1940. Brues, Proc. Amer. Acad. Arts Sci., vol. 74, p. 87.

TYPE: *Uroteleia synthetica* Brues, 1940, by monotypy and original designation.

Vanhornia Crawford

1909. Crawford, Proc. Ent. Soc. Washington, vol. 11, p. 63.

TYPE: *Vanhornia eucnemidarum* Crawford, 1909, by monotypy and original designation.

Vardhana Nixon

1933. Nixon, Ann. Mag. Nat. Hist., ser. 10, vol. 12, p. 320.

TYPE: *Vardhana selene* Nixon, 1933, by monotypy and original designation.

Vectevania Cockerell [fossil]

1922. Cockerell, Can. Ent., vol. 54, p. 33.

TYPE: *Vectevania vetula* Cockerell, 1922, by monotypy.

Viennopria Jansson

1953. Jansson, Ent. Tidskr., vol. 74, p. 105.

TYPE: *Viennopria priesneri* Jansson, 1953, by monotypy.

Xanthopria Brues

1915. Brues, Psyche, vol. 22, p. 9. Two species.

TYPE: *Xanthopria opaca* Brues, 1915, by original designation.

Xenomerus Walker

1836. Walker, Ent. Mag., vol. 3, pp. 342, 355.

TYPE: *Xenomerus ergenna* Walker, 1836, by monotypy.

Xenopria Fouts

1939. Fouts, Proc. Ent. Soc. Washington, vol. 41, p. 260.
Three species.

TYPE: *Xenopria columbiana* Fouts, 1939, by original designation.

Xenoteleia Kieffer

1913. Kieffer, Insecta, vol. 3, p. 390.

TYPE: *Xenoteleia flavipennis* Kieffer, 1913, by monotypy and original designation.

Xenotoma Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 129, 137. No species.

1861. Foerster, Programm der Realschule zu Aachen, p. xliv. One species.

TYPE: *Xenotoma nigricoxis* Foerster, 1861. First included species. *Belyta bicolor* Jurine, 1807, as identified by Nees, 1834, designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 362, was included later.

Considered synonym of *Aclista* Foerster.

Xestonotidea Gahan (= *Xestonotus* Foerster, 1856, not Leconte, 1853; *Axestonotus* Kieffer)

1919. Gahan, Proc. U. S. Nat. Mus., vol. 56, p. 524.

TYPE: *Xestonotus andriciphilus* Ashmead, 1887, by substitution of *Xestonotidea* for *Xestonotus* Foerster. *Xestonotidea foersteri* Gahan, 1919, was wrongly designated by Gahan, 1919, Proc. U. S. Nat. Mus., vol. 56, p. 524.

(*Xestonotus* Foerster, not Leconte, 1853) = **Xestonotidea** Gahan

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 107, 112. No species.

1887. Ashmead, Can. Ent., vol. 19, p. 128. One species.

TYPE: *Xestonotus andriciphilus* Ashmead, 1887. First included species. *Xestonotus refulgens* Foerster, designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 265, was a nomen nudum.

Xyalopria Kieffer

1907. Kieffer, Berliner Ent. Zeitschr., vol. 51, 1906, p. 300.

TYPE: *Xyalopria nigriceps* Kieffer, 1907, by monotypy.

Zacranium Ashmead

1901. Ashmead, Fauna Hawaiiensis, vol. 1, p. 295.

TYPE: *Zacranium oahuense* Ashmead, 1901, by monotypy.

Zacrita Foerster

1878. Foerster, Verh. Naturh. Ver. Preuss. Rheinl., vol. 35, p. 46.

TYPE: *Zacrita longicornis* Foerster, 1878, by monotypy and original designation.

Zelotypa Foerster

1856. Foerster Hymenopterologische Studien, Heft 2, pp. 130, 141. No species.

1890. Ashmead, Colo. Biol. Assoc. Bull. 1, p. 12. One species.

TYPE: *Zelotypa coloradensis* Ashmead, 1890. First included species.

Considered synonym of *Aclista* Foerster.

Zeuxevania Kieffer (= *Pseudevania* Kieffer, error)

1902. Kieffer, in Wytsman, Genera insectorum, fasc. 2, pp. 2, 4.

TYPE: *Evania dinarica* Schletterer, 1886, by monotypy.

Zygota Foerster

1856. Foerster, Hymenopterologische Studien, Heft 2, pp. 128, 131, 133, 135. No species.

1873. Marshall, A catalogue of British Hymenoptera; Oxyura, p. 9. Two species.

TYPE: *Belyta abdominalis* Nees, 1834. Designated by Ashmead, 1893, U. S. Nat. Mus. Bull. 45, p. 372.

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THE SPONGILLA-FLIES, WITH SPECIAL REFERENCE TO
THOSE OF THE WESTERN HEMISPHERE
(SISYRIDAE, NEUROPTERA)

By SOPHY I. PARFIN* and ASHLEY B. GURNEY†

Introduction

The spongilla-fly adults are small, dull-colored Neuroptera, similar to the brown lace-wings (Hemerobiidae) in appearance (pl. 3, fig. 4). The larvae are regarded as parasitic on fresh-water sponges. They undoubtedly serve as food for fish and higher aquatic animals and probably have been frequently mistaken for certain crustaceans such as *Cyclops*, which they strongly resemble in manner of swimming. They are of particular interest phylogenetically because they are the only truly aquatic larvae at present known among the Neuroptera, *sensu strictu*.¹

The Sisyridae are widely distributed and have been taken in North America (United States, southern Canada, Alaska), Central America (British Honduras, Honduras, Panamá), South America (Brazil, British Guiana, Chile, Perú, Surinam, Venezuela), the West Indies (Cuba), Europe (Great Britain to Russia, Scandinavia to Spain), Africa (Anglo-Egyptian Sudan, Natal, South Africa, and Madagascar), Asia (China, India, Japan), the Philippine Islands, and Australia. Those in the Western Hemisphere have never previously had a comprehensive treatment including genitalic studies. There also has never been a publication in the English language treating the world genera. At the present time, the Sisyridae of the Western Hemisphere

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¹ The larvae of the Osmyliidae, the closest larval relatives of the spongilla-flies, are only semiaquatic, without tracheal gills, and occur in wet places such as the margins of streams, where they may be found in damp moss feeding on dipterous larvae. The Osmyliidae have been taken in South America, Europe, Asia, Africa, Australia, and New Zealand.

comprise 2 genera and 17 species, of which 8 species are here described as new (tables 1, 2). The distribution of those in the Western Hemisphere is shown on maps (figs. 1, 2).

In the first part of this paper, the literature concerning the history, biology, immature stages, sponge hosts, and enemies of the Sisyridae is brought together, in conjunction with some original observations. The second part deals with the taxonomy of the family, with a key to the genera of the world, and a revision of the species of Sisyridae in the Western Hemisphere. A discussion of the wing venation and terminology used in this paper is included in the section on wing morphology (p. 450).

Previous taxonomic treatments of the family include monographs by Navás (1935) (reviewed by Lestage, 1935), and Krüger (1923) on the world fauna, and a revision of the Nearctic Sisyridae by Carpenter (1940). An extensive treatment of the British species has been given by Killington (1936, 1937).

TABLE 1.—*Genera of Sisyridae in the world*

| <i>Genus</i> | <i>Distribution</i> | <i>Page</i> |
|-------------------|--|-------------|
| <i>Sisyra</i> | Cosmopolitan | 456 |
| <i>Climacia</i> | North, Central, and South America | 480 |
| <i>Sisyrina</i> | India | 517 |
| <i>Sisyrella</i> | Japan | 518 |
| <i>Neurorthis</i> | Algeria, Australia, Balearic Islands, Bulgaria, Corsica, Italy, Japan, Sardinia, Sicily, Spain | 520 |
| <i>Rophalis</i> | Baltic amber (fossil) | 522 |

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TABLE 2.—*Species of Sisyridae in the Western Hemisphere.*

| Genus | Species | Distribution | Page |
|------------------------------|---------------------------------|-------------------------------|------|
| <i>Sisyra</i> | <i>apicalis</i> Banks | United States, Cuba, Panamá | 471 |
| | <i>fuscata</i> (Fabricius) | United States, Canada, Alaska | 468 |
| | <i>vicaria</i> (Walker) | United States, Canada | 460 |
| | <i>nocturna</i> (Navás) | British Honduras | 476 |
| | <i>panama</i> , new species | Panamá | 474 |
| | <i>minuta</i> Esben-Petersen | Brazil | 478 |
| <i>Climacia</i> | <i>arcolaris</i> (Hagen) | United States, Canada | 486 |
| | <i>californica</i> Chandler | United States | 491 |
| | <i>chapini</i> , new species | United States | 495 |
| | <i>tenebra</i> , new species | Honduras | 501 |
| | <i>striata</i> , new species | Panamá | 499 |
| | <i>basalis</i> Banks | British Guiana | 504 |
| | <i>bimaculata</i> Banks | British Guiana, Surinam | 507 |
| | <i>carpenteri</i> , new species | Paraguay | 511 |
| | <i>chilena</i> , new species | Chile | 515 |
| | <i>nota</i> , new species | Venezuela | 503 |
| <i>townesi</i> , new species | Brazil, Perú | 509 | |

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HISTORY

When the family "Hemerobida" was proposed by Leach (1815, p. 138) it was not restricted to the Hemerobiidae as defined today, but even included some Chrysopidae. Banks (1905, p. 23) subdivided the Nearctic Hemerobiidae into three subfamilies, one of which was the Sisyrinae; this included genera now placed in three distinct families, *Polystoechotes* (Polystoechotidae), *Lomamyia* (Berothidae) and *Sisyra* and *Climacia* (Sisyridae). Handlirsch (1906, p. 42) established the family Sisyridae without mentioning any genera; later (1907, p. 908) he included the fossil genus *Sisyra* (*Rophalis*). Banks (1913, p. 211), disregarding Handlirsch's family, included *Sisyra* and *Climacia* in the tribe Sisyriini of the subfamily

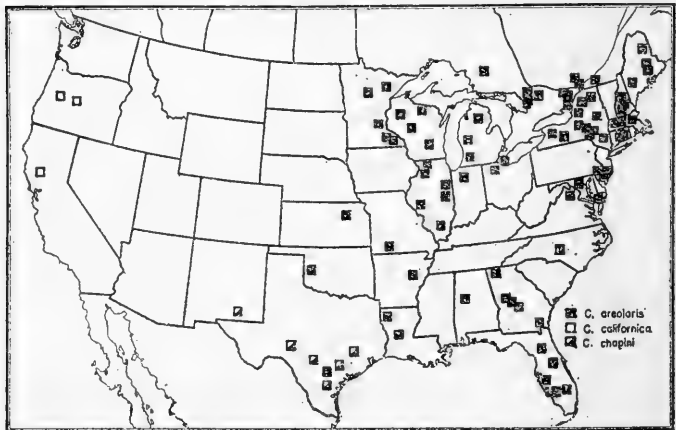
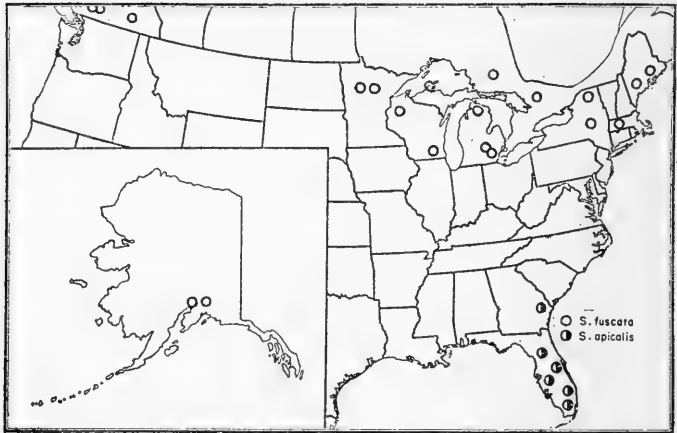
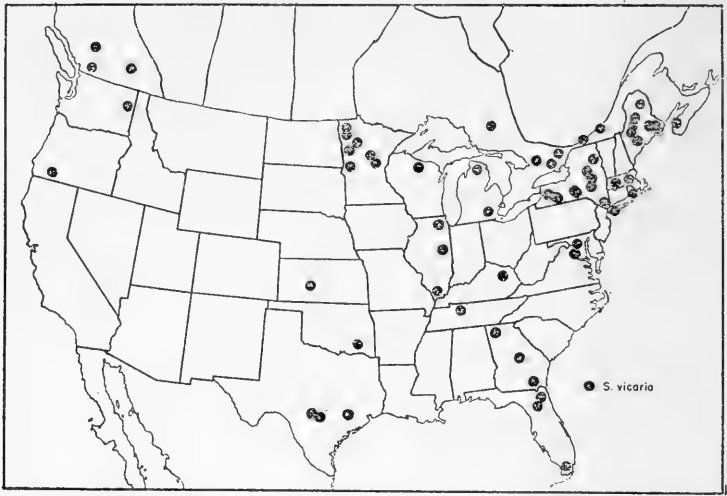


FIGURE 1.—Explanation on facing page.



FIGURE 2.—Neotropical distribution of Sisyridae (specimens examined): *Climacia* and *Sisyra*. (Note: *S. apicalis* also is found in Panamá.)

Osmylinae and placed *Neurorthus* and *Sisyrella* in the subfamily Hemerobiinae of the Hemerobiidae. Nakahara (1914, p. 489) also placed *Sisyra* and *Climacia* in the tribe Sisyridae of the subfamily Osmylinae, and (1915, p. 14) erected the Neurorthini as a tribe of the subfamily Hemerobiinae and included in it the three genera, *Neurorthus* Costa, *Nosybus* Navás, and *Sisyrella* Banks; later Navás (1929, p. 69) transferred *Nosybus* to the Berothidae, and (1935, p. 40) *Sisyrella* to the "Sisyridae" of the Sisyridae. Krüger (1923, p. 25 et seq.) accepted five genera for the Sisyridae—*Sisyra*, *Sisyrella*,

FIGURE 1.—Distribution of Sisyridae in North America (specimens examined): Top, *Sisyra vicaria* (Walker); middle, *S. fuscata* (Fabricius) and *S. apicalis* Banks; bottom, *Climacia areolaris* (Hagen), *C. californica* Chandler, and *C. chapini*, new species.

Climacia, *Rophalis*, and *Neurorthus*—without designating tribes. Navás (1935, p. 16) divided the Sisyridae into three tribes, "Neurorthinos" (*Neurorthus*), "Sisirinos" (*Sisyra*, *Sisyrella*), and his proposed "Climacinos" (*Climacia*). *Sisyrina* Banks would appear to belong to the "Sisirinos" of Navás; however, the tribes will not be differentiated in this revision.

The Sisyridae are represented in Tertiary deposits of Baltic amber in the Lower Oligocene (*Rophalis*, *Sisyra*?) (see Killington, 1936, p. 5). Handlirsch (1908, p. 1252) concluded from paleontological evidence that the Sisyridae arose from the stem which also gave rise to the present-day families—Coniopterygidae, Hemerobiidae, Berothidae, and Dilaridae. Handlirsch also believed that the other families, including the Osmylidae, arose on six other branches from the main stem. Tillyard's earlier work (1916, p. 272), based principally on the wing venation of fossil and recent groups, suggested that a reduced remnant of the osmyloid stem had thrown off the aquatic Sisyridae and reached the extreme limits of reduction in the Coniopterygidae with their reduced venation. Later (1926, p. 312) he divided the Planipennia into five superfamilies, the Sisyridae being included with the Dilaridae, Psychopsidae, Berothidae, Hemerobiidae, Chrysopidae, Mantispidae, Polystoechotidae, and Osmylidae in the superfamily Hemerobioidea. Carpenter (1940, p. 194) followed this classification in his revision of the Nearctic Hemerobiidae, Berothidae, Sisyridae, Polystoechotidae, and Dilaridae, although he recognized that the families do not form a natural group by themselves. Eventually Tillyard (1932, p. 29) considered the Sisyridae to be a specialized side-branch distinct from both the Dilaridae and Hemerobiidae, with the Ithonidae, Dilaridae, and Hemerobiidae representing one line of evolution, the Prohemerobiidae and the Psychopsidae specialized side-branches, the Berothidae the oldest existing family of Planipennia, and the position of the Coniopterygidae "still as much a mystery as ever, there being no close connections between these highly reduced forms and other Planipennia, either fossil or recent." Withycombe (1925, p. 402), basing his conclusions on the study of the immature stages, divided the Neuroptera into five somewhat different superfamilies and included the Sisyridae and Osmylidae on the same offshoot, with the Dilaridae, Berothidae and Mantispidae, and Myiodactylidae on three later offshoots of the same stem in the Osmyloidea. Although there is a considerable difference in appearance in the adults of the Osmylidae and Sisyridae, Withycombe (*ibid.*, p. 400) believed the Sisyridae to have had osmyloid ancestors, which went into deeper water as larvae and then took to preying upon fresh-water sponges, at the same time developing longer jaws and abdominal tracheal gills and losing the labial palpi; in addition, there was reduction of the two claws into a single claw,

which Withycombe (1925, p. 362) could not explain, although he (1923, p. 505) suggested that the reduction took place by fusion of the two claws laterally rather than by the loss of one.

BIOLOGY

LIFE HISTORY

Although Degeer described a sisyrid, "*Hemerobe velu noir*," in 1771 (p. 713), it was not known until almost 60 years later that the larva was aquatic. Hogg (1841, pp. 390-392; 1843, p. 446) first brought the sisyrid larva (although unrecognized as such) in the fresh-water sponge (*Spongilla fragilis*) to the attention of the Linnean Society of London in a paper read in 1838, while a discussion was raging as to whether sponges belonged to the plant or animal kingdom. Westwood (1839, p. 200; 1839a, p. 380) presented a description of the larva in a London entomological society meeting in December 1838 and published (1840, p. 586) a description; later (1842, pp. 105-108, pl. 8, figs. 1-12) he gave the larva the name of *Branchiotoma spongillae*. Rambur (1842, p. 415) stated that the larva of *Sisyra* was aquatic and (ibid., p. 416) remarked that *Sisyra fuscata*² was taken around ponds. Grube (1843, p. 336, footnote) referred the larva to *Sisyra*, mentioning *fuscatus*. Haliday (1848, pp. xxxi-xxxii) compared *Branchiotoma spongillae* with the larva of *Hemerobius* and, noting the frequency of the adults of *Sisyra fuscata* about the places where the sponge-inhabiting larvae were found, suggested that *B. spongillae* was the larva of *fuscata*. Westwood (1848, p. 557) was almost convinced that the "spongilla insect" was the larva of *Sisyra fuscata*. Walker (1853, p. 296) doubtfully placed *B. spongillae* in synonymy with *fuscata*; Brauer (1855, p. 703) questioned the larva of *Sisyra*. Hagen (1851, pp. 185-186) suggested that *B. spongillae* was probably *Sisyra fuscata*, that (1858, p. 25) the larva of *Sisyra* lives in water, and associated (1866, p. 388) *Branchiotoma spongillae* with *Sisyra fuscata*. Withycombe reared two British species of *Sisyra* (see p. 433), and Killington (1932, pp. 31-33; 1936, pp. 226-241) and Kimmins (1944, p. 18) supplemented his observations on the bionomics of the British species.

The first important contribution to the knowledge of the life history of the Nearctic Sisyridae was made by Needham (1901, p. 552), who discussed *Sisyra vicaria* (Walker) (= *umbrata* Needham) and *Climacia areolaris* (Hagen) (= *dictyona* Needham). Later, Old (1933, pp. 681-684) presented a brief general study of the biologies of *Sisyra* and *Climacia*. The most detailed account of the life history of *Climacia areolaris* was given by Brown (1952, pp. 130-160). Balduf (1939) summarized the literature on the bionomics of the Nearctic Sisyridae.

² *S. terminalis* Curtis (= *S. fuscata* Rambur not Fabricius) according to McLachlan (1881a, p. cxxiii).

The eggs are elongate oval, pale yellowish (whitish when freshly laid), have a small disclike micropylar knob which is flatter than and a chorion which is smoother than those of *Hemerobius*. They are approximately 0.35 mm. in length in *Sisyra fuscata*, *S. terminalis* (Withycombe, 1923, p. 520), and *Sisyra* sp. (ibid., 1925, p. 310) and 0.34 by 0.16 mm. in *Climacia areolaris* (Brown, 1952, p. 138). The eggs are usually laid in clusters (averaging 2 to 5 with a maximum of 20 for *areolaris* and 1 to 12 for *Sisyra* (probably *fuscata*)) in depressions on objects overhanging fresh water, such as branches, leaves, wood-piles, docks, etc. They are covered by a whitish silken web of three to four layers, spun as a superposed series of Z's in *areolaris* (Brown, 1952, p. 155) or by a method wherein the female spins a few parallel strands, then shifts her position slightly and spins a few more strands, crossing the first strands, and so on (Withycombe, 1923, p. 520). The ninth sternite of the female contains the opening to the cement gland and is also used for locating crevices in which to deposit eggs.

Hatching usually takes place within eight days to two weeks, the incubation period being partially dependent upon the temperature. At eclosion, blood is forced into the labrum-clypeus and through the pumping and swelling of the underlying tissues, the amniotic egg-burster is pressed against the chorion, rupturing it longitudinally. The egg-burster is long and slender, and possesses a serrate cutting edge, with the teeth towards the base longer and narrower. The larva usually sheds its amniotic skin while working its way out of the shell and pushing through the layer of silk. The larva then drops into the water and forces its way through the surface film of the water, sometimes with difficulty, by bending the tip of the abdomen up over the back to the head, so that the anterior portion of the larva is propelled through the film as the larva straightens out. Then it sinks slowly and drifts along with the head, legs, and tip of abdomen bent under ventrally. A gas bubble or bubbles, possibly serving as a hydrostatic organ, in the gut of the thorax has been thought to control the specific gravity (Withycombe, 1923, pp. 520-521; Brown, 1952, pp. 140-141). The larva swims from time to time by curving the abdomen ventrally, then jerking it out straight and moving the legs simultaneously. Eventually it settles upon a sponge and feeds intermittently by inserting its mandibles and maxillae and sucking the fluids. After feeding, it may clean the antennae and mouthparts with the forelegs, similar to other Neuroptera. Under normal conditions it does not readily leave the sponge before becoming a mature larva.

There are three instars, with the first molt of *Climacia areolaris* taking place at about the end of the first week. When the third-

instar larva is ready to pupate, it crawls to some object upon which it may emerge from the water. It may wander for several hours after leaving the water, occasionally as far as 50 feet or as high as 12 feet, before spinning its cocoon on an appropriate substrate. Brown (1952, p. 149) noted that from about four to eight hours elapsed from the time *areolaris* left the water until it finished its spinning. It spent from 30 to 60 hours in the cocoon as a prepupa before pupating. Needham (1901, p. 556) observed that two larvae of *vicaria* (= *umbrata*) spent at least 12 hours in spinning their cocoons and remained prepupae ("inactive larvae") for 24 hours before pupating. Sisyrid cocoons have been recorded on the bark of trees (crevices), boat hulls, spiderwebs, grass blades and stems, *Scirpus* culms, pine needles, docks, bridges, woodpiles, undersides of stones above water, fibers of hemp rope, corpses or exuviae of other insects (as those of dragonfly naiads and mayfly subimagines), and sometimes adjacent to gyrenid cocoons.

The cocoons of *Sisyra vicaria* and the majority of those of *Climacia areolaris* examined appeared similar and almost single-layered in structure, with the double layer difficult to discern (pl. 3, fig. 6). On the surface of the cocoon may be seen coarse, widely spaced, irregular strands of silk, almost interwoven into the cocoon itself. The strands are frequently pale greenish on the specimens of *vicaria* and yellowish on those of *areolaris* examined; and yellowish on *fuscata* and *terminalis* cocoons, according to Withycombe (1923, p. 523).

Of 19 specimens of *areolaris*, with cocoons from which they emerged (kindly sent by Dr. Hungerford), only three made cocoons which showed the artistic, loose, hemispherical outer net of a widely spaced hexagonal mesh and the whitish inner cocoon of finer, more compact texture attributed to this species (= *dictyona*) by Needham (1901, pp. 559, 560, pl. 12) (pl. 3, fig. 7). The specimens were collected by Hungerford in Cheboygan County, Mich., from July 22 to 26. The 16 specimens without the outer net appear slightly broader, with rounded ends, and more whitish than the *vicaria* cocoons, which are tapered slightly at one end; however, it is realized that type of substrate and age may have some effect on the shape and color of the cocoons. A cocoon of *fuscata* from Holland possessed an outer open net similar to but with smaller and less regularly hexagonal spaces than those of *areolaris*. It is slightly yellowish. The inner cocoon is white, parchmentlike and oval. Killington (1936, pl. 4, fig. 3) showed a photograph of a cocoon of a European specimen of *fuscata* with a similar outer net.

Brown (1952, p. 148) has pointed out that when the *areolaris* larva chooses a cocoon site lacking an adequate substrate (as grass blades and stems, etc.), or sometimes when the substrate is adequate, the

outer net may be omitted. Whether or not this is true of species of *Sisyra* is yet to be investigated, although it seems possible.

According to Brown (1952, p. 147), the *areolaris* larva accomplishes the spinning of the outer cocoon by first securing a firm foothold; then partially withdrawing its head within the prothorax, it moves its abdomen from side to side, at the same time ejecting from the spinneret the viscid silk. This silk is looped in an arc to the other side, forming a loose, usually hemispherical net. After this, the larva spins the smaller inner cocoon, which is anchored by five or six strands to the outer cocoon or substrate, by first spinning at one end, and then reversing its position and spinning at the opposite end. At pupation the last larval skin is pushed into the posterior end of the cocoon.

A series of 28 cocoons, probably mainly *vicaria*, collected at Nigger Creek, near Douglas Lake, Mich., on *Scirpus* and *Eleocharis* stems (kindly sent by Dr. Spangler) ranged from 3.5 to 5.3 mm. in length (averaging 4.5 mm.), and from 1.7 to 2.4 mm. in width (averaging 2 mm.). The outer net of the cocoon of the specimen of *areolaris* photographed measured 5.5 by 3.9 mm., the inner cocoon 4 by 2.6 mm. The cocoon of the specimen of *fuscata* from Holland (reared by L. F. Byars) measured 5.5 by 3.5 mm., outer net, and 3.5 by 2.5 mm., inner cocoon.

Most adults of *areolaris* emerge at the end of the fifth or sixth day (Brown, 1952, p. 150), while some individuals of *Sisyra* or *Climacia* take as long as 14 days (Needham, 1901, p. 557, 11 days; Withycombe, 1925, p. 523, about two weeks; Old, 1933, p. 682, 8 to 14 days). After first freeing the antennae and other appendages, the pupa bites and forces its way out of the cocoon. The pupa often leaves the cocoon completely before shedding its skin, but sometimes sheds it within after biting an escape hole and only partially emerging. A dark brown fecal pellet enclosed in a peritrophic membrane is deposited within the first one or two hours following emergence. Mating, which is lateral in position, may occur several hours to two weeks after emergence, sometimes in flight, usually in the evening or on a cloudy day. A yellowish white spermatophore, less than 1 mm. in diameter in *Climacia* (Brown, 1952, p. 154), is deposited on the tip of the female abdomen, sometimes after three to five minutes. Withycombe (1923, p. 524) described the spermatophore of *Sisyra* as being "apparently spherical, but slightly lobate." Oviposition takes place in the evening, often only a few hours after pairing, and as many as 45 or more eggs can be laid overnight by a single female.

Brown (1952, p. 153) found pollen grains, which might have been consumed along with nectar, in the fecal pellets of *areolaris* and noted that under laboratory conditions, on a restricted diet of gumdrops and water, the adults of *areolaris* died within two to three weeks, with

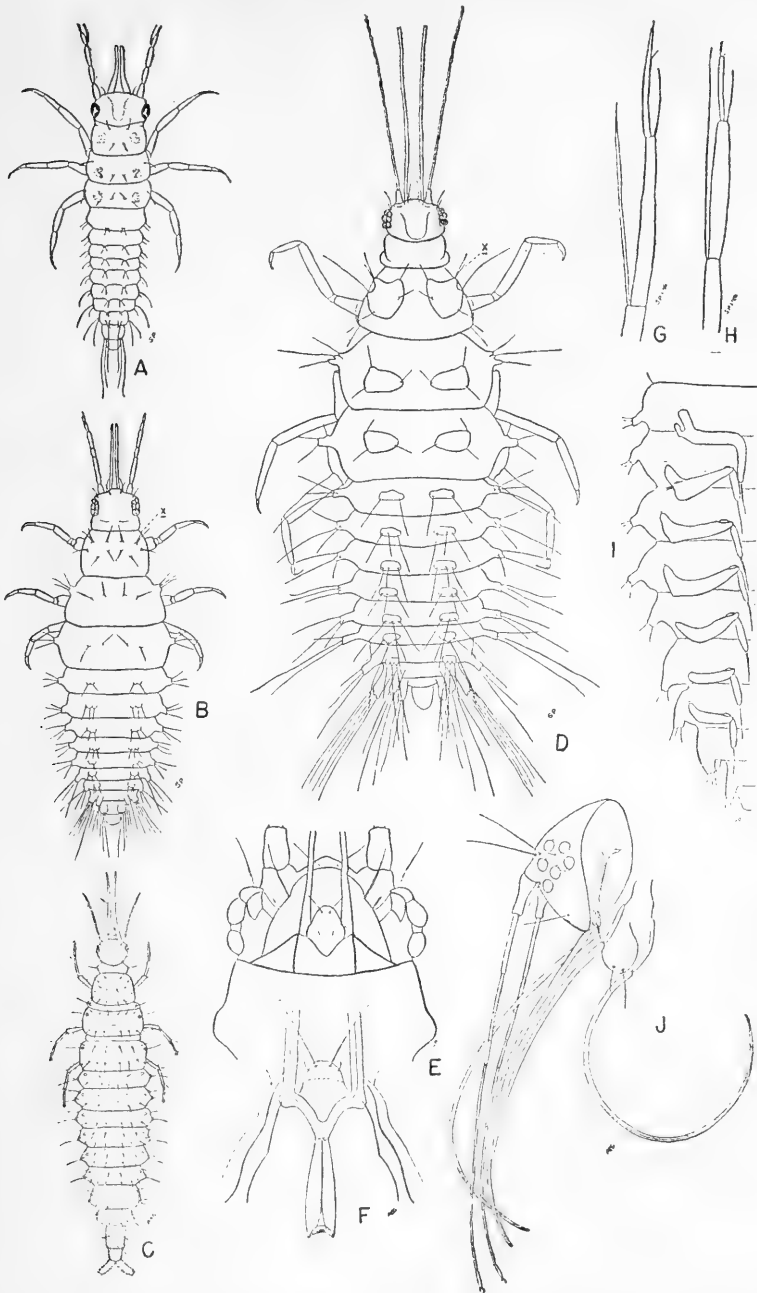


FIGURE 3.—Larvae. A, B, E, F, H, J, *Climacia areolaris* (Hagen): A, 1st-instar larva; B, 2d-instar larva, showing seta *x*; E, 3d-instar larva, head, ventral view; F, same, head dissected, ventral view of bases of mouthparts; H, same, antenna, terminal segments; J, same, head, lateral view of left side and internal view of bases of mouthparts. C, *Osmylus*, 3d-instar larva (adapted from Killington, 1936, pl. 9, fig. 1). D, *Sisyra vicaria* (Walker), 3d-instar larva, showing seta *x*; G, same, antenna, terminal segments; I, same, tracheal gills.

a few living a fourth week. Tjeder (1944, p. 203) observed an adult male of *S. fuscata* first remove and grasp several eggs of *Sialis lutaria* L. (Sialidae) attached to *Carex*, and then feed on them. The adults are typically nocturnal or crepuscular, attracted to light, and may also be taken by beating the shrubs and trees overhanging water in which certain fresh-water sponges abound.

Brown estimated three broods of *areolaris* in the summer in the Put-in-Bay region, Ohio, but did not study the overwintering stage. Needham (1901, p. 560) suggested two broods a year for this species (= *dictyona*) at Saranac Inn, N. Y., based on the presence of adults during the latter part of June and August and their absence in July. On Juanita Island, at Lake George, N. Y., he found adults during the latter part of July and the whole of August (Needham, 1925, p. 116). Withycombe (1923, p. 523) estimated several broods per year in England, the main one in May and June; he also found sisyrid larvae throughout the winter. Killington (1936, pp. 147, 235-236) stated that in England *S. fuscata* overwintered in the prepupal stage within the cocoon and that eggs were laid in May and June and again in August and September. There, most of the larvae from eggs of the earlier oviposition become full-grown by autumn, then leave the water and pass the winter in the prepupal stage within the cocoon, whereas a smaller number of larvae mature quickly in a few weeks and produce a second brood in August and September, with the larvae from this second brood also overwintering in the prepupal stage. The overwintered prepupae pupate in April, May, and June. Berg (1948, p. 144) noticed that the adults of *S. fuscata* were found in Denmark from the close of May to the end of August, being commonest in July and August.

LARVAE

The fusiform sisyrid larva differs from the larvae of other families of Neuroptera in the apparent absence of the labial palpi and empodium, and the presence of only one tarsal claw on each leg. The mandibles and maxillae are straight, similar in form, although the mandibles are broader at the base and have small setae at the apices. In all instars the head is rounded. The first-instar larva differs considerably from the second- and third-instar larvae in the absence of tracheal gills, broad head in comparison with the thorax, and the shorter antennae.

The immature stages of only two of the genera, *Sisyr*a and *Climacia*, have been treated in the literature. Needham (1901, pp. 552-554, 559, 560, pl. 12) first discussed the larvae, pupae, and cocoons of the Nearctic *Sisyr*a *vicaria* (Walker) (= *umbrata* Needham) and *Climacia areolaris* (Hagen) (= *dictyona* Needham). Anthony (1902, pp. 615-631), a student of Needham, gave a detailed account of the mor-

phology and anatomy of the larva and pupa of the former species. The most complete account of the immature stages of a Nearctic sisyrid is that presented by Brown (1952, pp. 130-160), who described and figured all of the larval stages of *C. areolaris*. Withycombe (1923, pp. 519-524) has published an extensive study of the

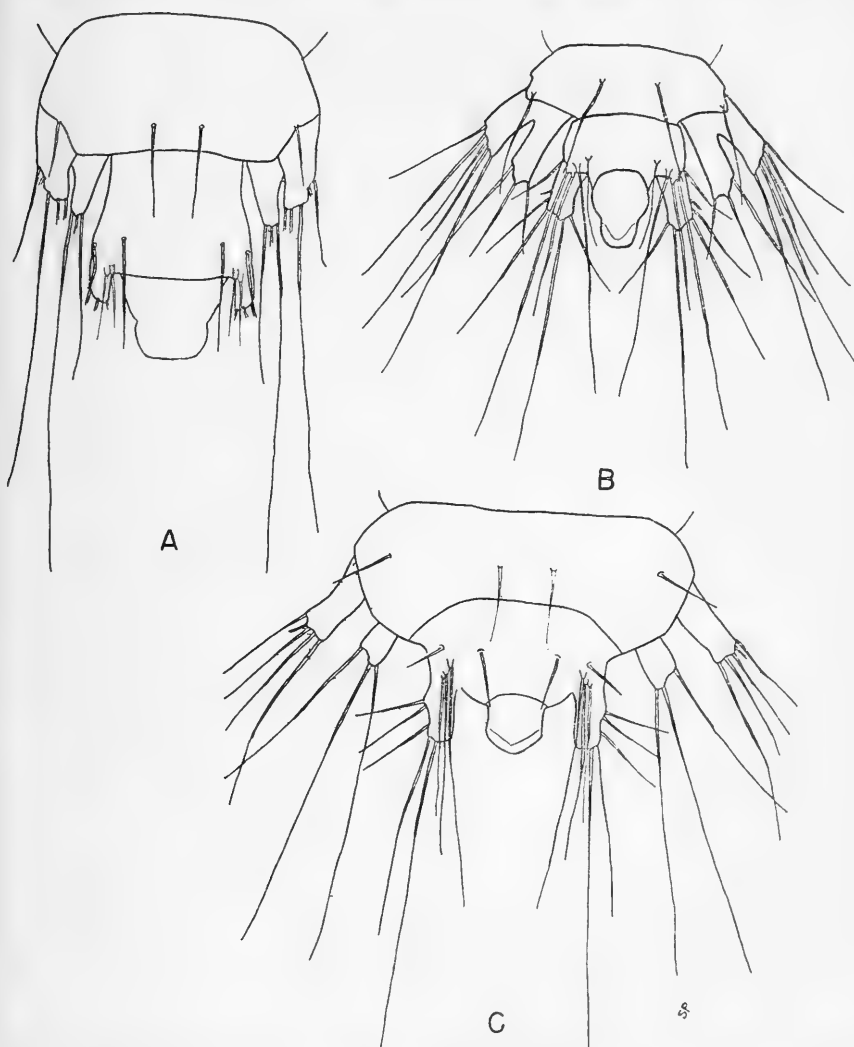


FIGURE 4.—Terminal abdominal segments 8-10 of sisyrid larvae, ventral view: A, *Sisyra vicaria* (Walker); B, *Climacia californica* Chandler; C, *Climacia areolaris* (Hagen).

immature stages of two British species of *Sisyra*—chiefly *fuscata* (Fabricius) but also *terminalis* (Curtis)—which he did not separate, and (1925, pp. 331-333) of *fuscata*. Chandler (1953, p. 184) made a brief statement concerning the third-instar larva of *C. californica*

Chandler. Lestage (1921, pp. 337-339) also described the third-instar larva of *S. fuscata*, and the anatomy of this species is treated by Lampe (1911). Other larval descriptions include those by Needham (1909, p. 206) and Annandale (1906, p. 187) on *Sisyra indica* Needham of India by Esben-Petersen (1933, pp. 628-629) on two larvae, *Sisyra* I and II, from Java. Navás (1925, p. 193, fig. 20; 1935, p. 45) discussed the larva which he named "*Sisyra Arndti*" in connection with *S. dalii* McLachlan.

Specimens of the immature stages of two species of *Sisyra* and two of *Climacia* have been made available for the present study. Data on these specimens are given below.

Sisyra vicaria: two third-instar larvae, pupae (from CU, *umbrata* Needham types and specimens), and cocoons (from P. J. Spangler); *S. fuscata*: two first-instar larvae (reared by C. L. Withycombe, 1922; in MCZ), one cocoon (from L. F. Byars); *Climacia areolaris*: first-, second-, and third-instar larvae, pupae (from H. P. Brown); third-instar larvae, pupae, and cocoons (from H. B. Hungerford); and *C. californica*: third-instar larvae (from H. P. Chandler).

Among the third-instar larvae from Hungerford are specimens of *C. areolaris* and *Sisyra* from Burt and Douglas Lakes, Mich. Adults of *S. vicaria* and *C. areolaris* have been examined from both these localities and of *S. fuscata* from around Douglas Lake. Since the two lakes are approximately 1½ miles apart, it seems probable that the larvae of both species of *Sisyra* are found in the lakes. Examination of the material available failed to reveal any specific differences, however.

Because of certain similarities between the third-instar larvae of *S. vicaria* and *C. californica*,³ it is difficult to find satisfactory characters for separating this genus from *Climacia* with the material at hand. The lack of second-instar material of *Sisyra* has made comparison of this instar with *Climacia* impossible. Furthermore, the first-instar larvae are so small that some of the characters can be seen only with a research microscope with a magnification of approximately 430×. Accordingly, the keys given below are not as analytical as desirable.

Key to first-instar larvae of *Sisyra* and *Climacia*

1. Head with vertex smoothly rounded, brown; pronotum with posterior pair of setae about same distance apart as anterior pair.

Sisyra fuscata (Fabricius)

Head with vertex less rounded, not usually brown; posterior pair of setae closer together than anterior pair (fig. 3,A). . *Climacia areolaris* (Hagen)

³ From Clear Lake, Calif., the type locality of *C. californica*, determined by H. P. Chandler.

Key to third-instar larvae of *Sisyra vicaria*, *Climacia areolaris*, and *C. californica*

1. Tubercles long, pronounced, with two or three small setalike acute projections at bases of setae (see fig. 5). ***Climacia areolaris*** (Hagen)
Tubercles shorter, with no small setalike acute projections at bases of setae 2
2. 10th abdominal segment large, usually over $\frac{1}{2}$ as wide as 9th segment; ventral median setae of 8th abdominal segment much closer together than setae of 9th segment; group of two setae on small papillae on each side on 9th segment ventrally (fig. 4,A) ***Sisyra vicaria*** (Walker)
10th abdominal segment of moderate size, less than $\frac{1}{2}$ as wide as 9th segment; ventral median setae of 8th segment only slightly closer together than those of 9th segment; group of three setae on small papillae on each side of 9th segment (fig. 4,B). ***Climacia californica*** Chandler

Note: In fully developed second-instar larvae of *areolaris*, the small setalike acute projections at bases of setae are visible.

FIRST-INSTAR LARVA (fig. 3,A): The newly hatched larva of *S. fuscata* is about 0.5 mm. long exclusive of mandibles and maxillae, with the jaws about 0.13 mm. long; that of *C. areolaris* is approximately 0.35 to 0.5 mm. long exclusive of jaws, with the jaws from 0.1 to 0.14 mm. in length. The head is almost the same width as the thorax and sometimes slightly broader. The antennae of both species are 5-segmented, with the basal segment broader and shorter than the second or third, the third longer than the second, the fourth narrower, the fifth segment very narrow, acute, and with an apical seta, and the third with a distal spine running parallel with the fourth and usually fifth segments. The jaws are short, stout, straight, slightly longer than the head, and about two-thirds as long as the antennae. The frontal suture, not always apparent, is linear, extending almost to the pronotal margin, where it meets the coronal suture.

The legs are similar and each bears a long, slightly curved, sharp, tapering claw almost as long as the tarsal segment, which approaches the tibia in length. Each thoracic segment bears a pair of dorsal blackish sclerites (sometimes more readily seen after treating the specimen with KOH solution).

In both genera there is a pair of anterodorsal setae on the vertex. Running the length of the thorax and abdomen are four rows of setae, two dorsal and two lateral (one on each side). On the pronotum are an anterodorsal and a posterodorsal pair of setae, the anterior pair more widely separated than the posterior pair, but closer in *areolaris* than in *fuscata*. On the mesothorax and metathorax are two posterodorsal pairs, with the setae more widely spaced than on the abdomen; laterally, there is one seta on each side. On each of the first eight abdominal segments is a pair of posterodorsal and a lateral papilla on each side, each bearing a pair of setae, which become longer towards

the tenth segment; on the eighth segment, the two dorsal papillae are longer than on the other segments and the setae are very long (median ones usually short); on the ninth segment is a posterior row of eight small papillae, each bearing a long seta and with the lateral setae usually closer together; tenth abdominal segment blunt, without setae.

The first-instar larvae of *S. fuscata* and *C. areolaris* could not be satisfactorily compared because the *areolaris* larvae were newly hatched, poorly fed, and consequently thin, with characteristics not yet fully visible, whereas those of *fuscata* were plump, well fed, and exhibited characters much more clearly. The head of *fuscata* was distinctly dark brown and appeared larger and longer in comparison with the thorax than that of *areolaris*, showing the frontal suture clearly and the vertex smoothly rounded.

Brown (1952, p. 143) noted that after the *areolaris* larva is fed for several days, the length of the body may be doubled, with the abdomen becoming especially enlarged.

SECOND-INSTAR LARVA (fig. 3,B): Specimens of *areolaris* examined ranged from 1.3 to 1.7 mm. long, exclusive of jaws, with the jaws about 0.5 mm. long. The antennae are composed of six segments, with the long seta arising at the end of the fourth segment and running parallel to the fifth and sixth segments, and with a small seta also arising from the distal end of the fifth; the second segment is the longest, the third short, the fourth longer than the third, and the fifth and sixth small, the sixth particularly narrowed. The mouthparts become longer and more flexible. The head is smaller in comparison with the rest of the body, which takes on a distinctly fusiform shape, widest at the metathorax and tapering anteriorly and posteriorly. The pronotal collar is beginning to become differentiated. The legs show a black ring around the distal ends of the femora and coxae and a shortening of the tarsus proportionally.

There is an additional pair of setae on the vertex just mesad of the eyes. On the dorsum of the pronotum are two pairs of five setae on small papillae, with papilla *x* (fig. 3,B) usually bearing two setae. Each of the two dorsal rows of small papillae on the mesonotum and metanotum and the first abdominal segment bears two pairs of setae, more widely spaced on the mesonotum and metanotum. On the second to seventh abdominal segments the two dorsal rows of papillae bear three setae each; on the eighth segment the two dorsal tubercles become longer and narrower, but still bear three setae each; on the ninth segment there are only two enlarged stout lateral tubercles, which bear three setae each. Each tubercle of the lateral row of tubercles on the mesothorax and metathorax, and on the first seven abdominal segments, bears three setae (which become progressively

longer towards the eighth segment), whereas those of the eighth segment become stout and bear five setae.

Ventrally on each of the first seven abdominal segments is a pair of jointed external tracheal gills containing two trunks that pass forward and medially, appearing to unite in the longitudinal center of the prothorax (according to Brown, 1952, p. 145).

THIRD-INSTAR LARVA (fig. 3,D): The specimen of *S. vicaria* from the Cornell collection measured 3.2 mm. exclusive of jaws, the jaws being 1.4 mm. long; the *Sisyra* specimens from Douglas Lake, Mich., ranged from 3.6 to 6.0 mm. exclusive of jaws, the jaws from 1.4 to 1.9 mm.; the larvae of *C. areolaris* ranged from 1.8 to 5.1 mm., the jaws being 0.9 to 1.1 mm.; those of *C. californica* ranged from 2.8 to 4.5 mm., with the jaws being 0.9 to 1.5 mm. in length. Withycombe (1923, p. 522) gave 5 mm. (exclusive of jaws) for a full-fed *S. fuscata* or *terminalis* larva. Berg (1948, p. 145) stated that the larvae of *S. fuscata* (probably third-instar) reached their largest size, 6.5 mm. (exclusive of jaws), in the autumn (Susaa River, Denmark). Both *vicaria* and *areolaris* larvae which recently molted were hardly longer than a full-grown second-instar larva. The tubercles and setae on the just-molted third-instar larvae appeared considerably longer than those on more fully fed or migrating larvae. The jaws are greatly lengthened, more slender in comparison with the rest of the body, more flexible, and can be readily bent at their apices.

The antennae are also greatly elongated and at times there is variation in the number of segments (one or two) and in the lengths of corresponding segments in the two antennae. The antennae of *vicaria* consist of 15 segments in one specimen examined; they are broken on all the other specimens. Anthony (1902, p. 620) found 16 segments in most specimens that she examined. The antennae of *areolaris* consist of about 16 segments, and there are about 14 in *californica*. The segments beyond the basal, with the exception of the apical ones, are of almost equal diameter, and show variations in length, although being almost equal. In one specimen of *areolaris* examined, there were 14 segments in the left antenna and 16 in the right, with the lengths as in table 3.

In both *Sisyra* and *Climacia* the three terminal segments bear one or two small spines, the antepenultimate segment bearing at its distal end the longest, which runs parallel with the last two segments (fig. 3, G, H). The penultimate segment also bears distally a shorter spine running parallel with but barely reaching the distal end of the last segment. At the distal end of the terminal segment are two spines, both shorter than the penultimate spine, the much shorter, minute one from the opposite side in *areolaris* and terminal in *vicaria*. The terminal segment appears to be longer, thicker, more curved,

and ending acutely in *Sisyra* and more bluntly in *Climacia*. Lestage (1921, fig. 101) has figured the terminal antennal segments of *S. fuscata*.

The pronotal collar (subsegment, pseudosegment) is distinct. The tubercles are longer, more elaborate on some of the segments. There are more body setae. Additional pairs on the head include one seta between the ocelli of each eye, a median pair on frons near vertex, and a pair on clypeus ventrally. Sometimes a sixth pair is visible on the vertex near the pronotum (*californica*).

Ventrally on the head, the more posterior setae adjacent to the eye appear small in *areolaris*, and larger in *californica* and *vicaria* (fig. 3, E). A third seta-bearing tubercle has been added on the plates of the two dorsal rows of setae of the mesonotum and metanotum in the four species (*vicaria*, *fuscata*, *areolaris*, *californica*). On the dorsal plates of the abdomen there is an additional pair of setae, one

TABLE 3.—Comparison of lengths of segments in right and left antennae of a third-instar larva of *Climacia areolaris*

| <i>Right antenna</i> | <i>Left antenna</i> |
|---|---|
| Segment 2 longest | Segment 2 equal to segments 2 plus 3 of right antenna |
| Segments 3-5, 9, 11-13 about equal, and one-third length of segment 2 | Segments 3, 6, 10, 11 shorter than segments 4, 5, 7-9 |
| Segments 6-8, 10, shorter than segments in above group | |
| Segment 14 second longest, about half length of segment 2 | Segment 12 second longest |
| Segment 15 tapered, acute apically, about half length of segment 14 | Segment 13 tapered, acute apically, about half length of segment 12 |
| Segment 16 very narrow, acute apically, about half length of segment 15 | Segment 14 very narrow, acute apically, about half length of segment 13 |

on either side of the median line. Thus, in the third-instar larva, the two dorsal rows of setae are borne on plates on the prothoracic and first seven abdominal segments, with five to six (the sixth seta, *x*, fig. 5, A-C) setae on the prothoracic plates and three each on the mesothoracic, metathoracic, and abdominal plates. On the eighth segment the dorsal setae are on enlarged tubercles, each bearing three long setae. On each side of the middorsal line of the eighth abdominal segment of *areolaris* is a seta on a distinct, minute tubercle. These were difficult to see in the *vicaria* and *californica* larvae; those of *vicaria* are not on tubercles, but sessile and short. The two lateral rows of tubercles bear three long setae each on the mesothoracic, metathoracic, and first seven abdominal segments. On the eighth segment, there is a pair of tubercles on each side, the larger of the two

bearing five long setae, and the smaller, three. On the ninth, the lateral tubercles are more complex, with three to five long setae. Ventrally, on the eighth and ninth segments, is a transverse row of four setae, the median pair closer together on the eighth segment than on the ninth (particularly close in *vicaria*); also on the ninth, small, narrow tubercles on each side ventrally bear long setae, usually two in *vicaria* and three in *californica* and *areolaris* (fig. 4). On the tenth segment, small hairs are visible and a pair of eversible abdominal appendages (rarely used, according to Withycombe, 1925, p. 332) are also present; the tenth segment is longest in *vicaria*.

The dorsal setal sclerites or plates are now clearly defined and assume shapes of specific importance. Those of *vicaria*, *areolaris*, and *californica* are compared in figure 5. It is seen that those of *vicaria* and *californica* closely approach each other in general, with those of the first three abdominal segments appearing more pedunculate in *vicaria*. Around the bases of the setae are found minute setalike projections in *areolaris*.

The folded, ventral, tracheal gills on the first seven abdominal segments of *vicaria* (fig. 3,1) were examined and described by Anthony (1902, pp. 618-619, fig. 5). Although Westwood (1842, pl. 8, fig. 210) figured the gills with five joints, Anthony found only three segments on the second to seventh pairs, but two on the first pair, which seemed to lose the articulation between the first and second segments. As pointed out by Anthony, the first pair has a basal hooklike projection, which gradually decreases in prominence, disappearing almost entirely on the gills of the posterior segments. On each pair of gills except the first, the first segment is shallowly notched at its articulation point with the second, with the basal end considerably longer and more curved than the distal. The point of attachment of the straight, shorter, second segment is at the notch. The gills are transparent, slender, acute distally and directed posteriorly while at rest. In life, they often extend beyond the abdomen almost as far as the long setae. Brown (1952, p. 145) noted that the gills are intermittently vibrated most of the time, so that the ventral surface of the body appears blurred.

The gills of *Climacia* appear to be similar in structure to those of *Sisyra*. On the specimens examined, they appeared sometimes with the first segments broad and the terminal ones either partially absorbed or missing. The spiracles can be seen anterior to each of the lateral tubercles on the first eight segments.

The color of the larva appears to vary from brownish to greenish, depending to a certain extent upon the sponge fed on. A faint indication of brownish black pigmentation along the middorsal line was visible on some of the specimens in the form of paired anterior spots.

Spots are broadest on the mesonotum and metanotum, and smaller and diverging on the abdominal segments. Brown (loc. cit.) observed that the details of the pattern differed among various individuals and

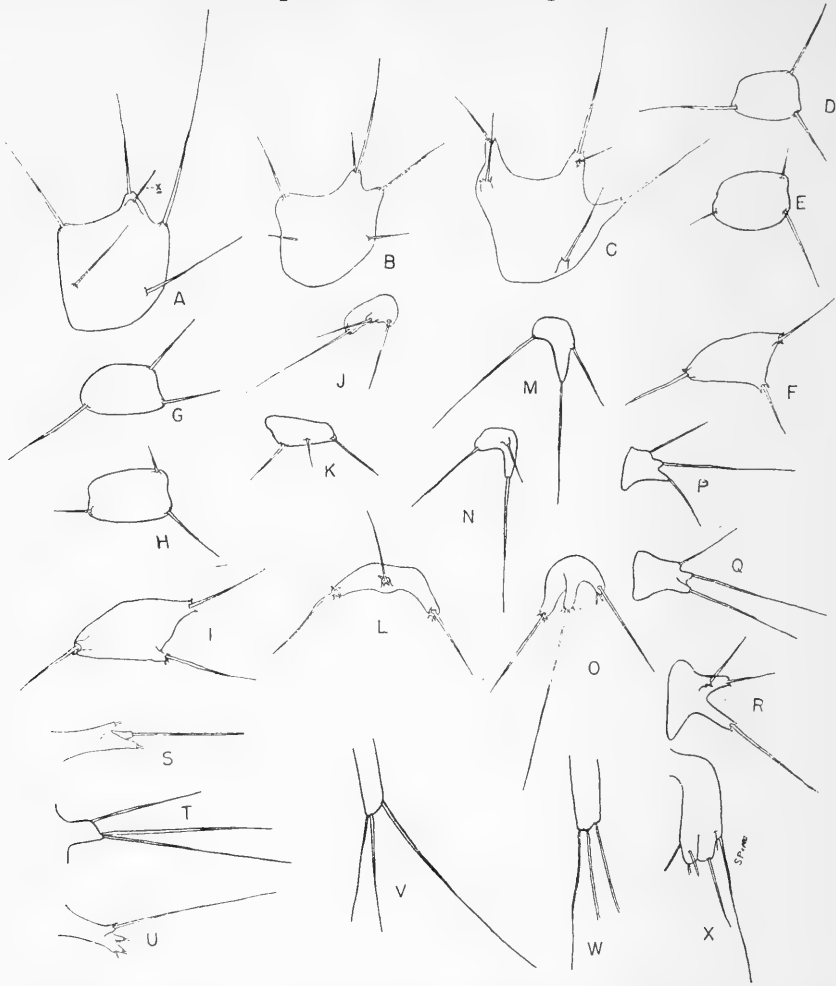


FIGURE 5.—Right dorsal plates and lateral tubercles of sisyrid larvae: *Sisyra vicaria* (Walker), A, D, G, J, M, P, S, V; *Climacia californica* Chandler, B, E, H, K, N, Q, T, W; *C. areolaris* (Hagen), C, F, I, L, O, R, U, X. A-C, dorsal pronotal plates showing seta *x*; D-F, dorsal mesonotal plates; G-I, dorsal metanotal plates; J-L, dorsal plates of second abdominal segments; M-O, dorsal plates of sixth abdominal segments; P-R, lateral mesonotal tubercles; S-U, lateral tubercles of sixth abdominal segments; V-X, dorsal tubercles of eighth abdominal segments.

that the gut contents often give the midthoracic area a reddish or orange appearance.

In addition to the presence of 5-segmented labial palpi, an empodium, and two tarsal claws, the larvae of the Osmylidae can be

separated from the sisyrid larvae, with which they appear to be closely allied, by the following characteristics: No tracheal gills in any instar; antennae 3-segmented, shorter than jaws in all instars; jaws curved slightly upwards and outwards; two transverse rows of setae on mesothorax, metathorax, and first eight abdominal segments; and tenth segment with pair of eversible processes covered with recurved hooks (fig. 3, c).

As in all Neuroptera (sensu strictu), the food of the larva is almost entirely fluid, and is sucked up through two tubes or canals formed by the closely appressed maxillae and mandibles, which are grooved on their inner surfaces. Each mandibulomaxillary canal so formed is open distally near the apex and proximally near the base (fig. 3, F, J). A transverse cleft ("mouth" in *Myrmeleon formicarius*, Lozinski, 1908, p. 477) between the bases of the jaws is kept shut by the close apposition of the labrum into a depression of the labium as pointed out in *Myrmeleon* by Lozinski and in *Dytiscus* (Coleoptera) by Snodgrass (1935, p. 287). The preoral food cavity (cibarium) just within the cleft is open not only at each end at the basal apertures of the canals but also internally at the true mouth (Snodgrass) leading into the stomodaeum. The anterior part of the stomodaeum is the pharynx, and it is the sucking pump with dilator and compressor muscles attached to it in *Myrmeleon* (the "pharyngeal pump" of the Neuroptera as of Withycombe, 1925, p. 368). Withycombe (1923, p. 503) speaks of the mouth being closed by a membrane or integument of the head immediately after hatching. The membrane is later retracted into the head. This bears investigation, since it may possibly be a condition present in other insects.

The midgut is a large sac closed at the posterior end and occupying the anterior two-thirds of the abdomen. The small amount of solid waste appears to be stored up in the posterior end of the midgut and deposited as a fecal pellet in a peritrophic membrane after the emergence of the adult.

The hind gut in *Sisyra vicaria* seems to be closed to any appreciable passage of solid excrement and to consist of almost a solid cord of atrophied cells that ends in the walls of a dilated silk receptacle, leading to the rectum, anus and spinneret, according to Anthony (1902, pp. 623-625). The thin walls of the silk receptacle have a cellular structure, similar to that of the Malpighian tubules from which the silk is spun through the anus. When the larva is about ready to secrete silk, the tubules are modified in their middle portions by the presence of larger, more irregularly shaped cells with ramified nuclei. The five tubules of *vicaria* (Anthony, 1902, p. 623) are attached at their anterior ends to the junction of the hind gut and midgut—with three of them also attached at the posterior end (apparently to the

hind gut just anterior to the silk receptacle) but the other two are attached at the anterior end only with their distal ends extending free in the body cavity. Fluid waste may possibly be drained off by the Malpighian tubules attached at both ends (which function throughout the larval life), the fluid probably being passed through the silk

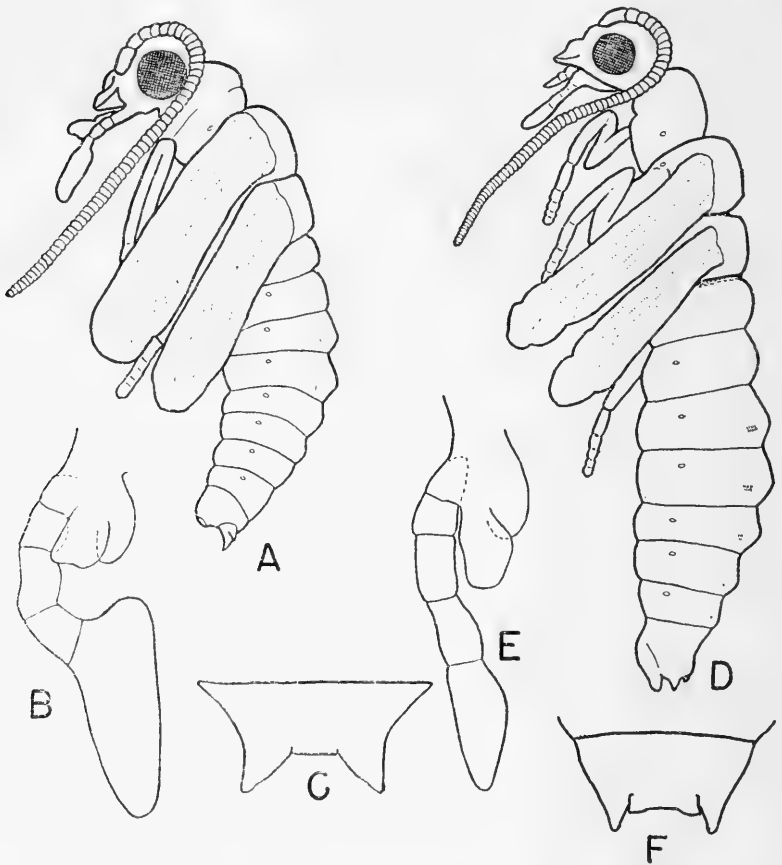


FIGURE 6.—Pupae of *Sisyra* and *Climacia*. A, *Sisyra vicaria* (Walker); B, same, maxillary palpus; C, same, tenth tergite, dorsal view; D, *Climacia areolaris* (Hagen); E, same, maxillary palpus; F, same, tenth tergite, dorsal view.

receptacle and the rectum. The spinneret occupies the last three abdominal segments in *vicaria*. Withycombe (1923, p. 524) recorded eight tubules usually (sometimes seven) in *fuscata* and *terminalis*, with six being looped as usual and the posterior two-thirds pigmented a dark brown (Withycombe, 1925, p. 368).

PUPAE AND COCOONS

The exarate pupa is typically neuropterous, slightly C-shaped, with the head and terminal segments of the abdomen bent ventrally (fig. 6). The antennae usually lie curved over the wings and the legs are drawn up. The eyes darken first within a day or two after pupation. The pupal mandibles are armed with a broad, blunt tooth on the inner surface and are more or less symmetrical.

Killington (1936, p. 133) noted that in *S. fuscata* each of the third to seventh abdominal segments bears a pair of (latero-) dorsal ridges with small sclerotized hooks; on the third to fifth segments the hooks are in double rows. The hooks of the anterior rows are anteriorly directed, while those of the posterior rows are posteriorly directed. There are approximately 24 hooks on the third and fourth segments; on the fifth the two ridges each carry about ten hooks; on the sixth and seventh segments each ridge usually bears three posteriorly directed hooks, with six (occasionally four) on each segment. On the pupae of *S. vicaria* and *C. areolaris* examined, hooks are also present, although it was not possible to accurately determine the number. There are setae on each side of the hooks.

A color pattern appears on some of the pupae and the sexes can be readily distinguished upon examination of the end of the abdomen.

In addition to the characters pointed out in the key, the wings of the fully developed pupa of *Climacia* appear longer in proportion to the width than in the *Sisyra* specimens examined.

The cocoons are described on page 429.

Key to pupae and cocoons of *Sisyra* and *Climacia*

1. Maxillary palpi with 5th or terminal segment broadly triangular, more than twice the width of the 4th; tips of foretarsi barely extending beyond maxillary palpi; cocoon usually close-woven, frequently appearing almost single-layered (*vicaria*) (fig. 6, A-C; pl. 3, fig. 6), but sometimes with an outer layer of irregularly and closely spaced open hexagonal mesh, separate from inner layer (*fuscata*) **Sisyra**
2. Maxillary palpi with 5th or terminal segment more cylindrical in shape, narrow, less than twice the width of 4th; tips of foretarsi usually extending beyond maxillary palpi; cocoon sometimes appearing single-layered, but other times with an outer tentlike layer of a strikingly artistic regularly and widely spaced hexagonal mesh (*areolaris*) (fig. 6, D-F; pl. 3, fig. 7) . . . **Climacia**

SPONGE HOSTS OF SISYRID LARVAE ⁴

Fresh-water sponges, which have thus far been reported to serve as hosts for sisyrid larvae, all belong to the family Spongillidae (class Desmospongeae, order Haplosclerinae). These are included in two

⁴ The approved names of the sponges have been obtained from Dr. F. A. Chace, Jr. (USNM), and Mrs. N. G. Benson (Nashville, Tenn.).

TABLE 4.—Records of fresh-water sponge hosts of sisyrid larvae

| Locality | Sponge | Sisyrid larva | References |
|---------------|--|--|--|
| United States | <i>Spongilla fragilis</i> Leidy | <i>Sisyrta ticaria</i> (Walker) <i>Climacia areolaris</i> (Hagen) | Needham, 1901, p. 5 [†] Brown, 1951, p. 103; 1952, p. 157 Needham, 1901, p. 560 Brown, 1949, p. 30; 1951, p. 103; 1952, p. 157 |
| Great Britain | <i>Meyenia fluviatilis</i> auctorum, sense of Carter (= <i>Ephydatia fluviatilis</i>) <i>Spongilla lacustris</i> Linné | <i>Sisyrta fuscata</i> (Fabricius) <i>Sisyrta terminalis</i> Curtis Sisyridae <i>Sisyrta fuscata</i> (Fabricius) <i>Sisyrta terminalis</i> Curtis Sisyridae | Withycombe, 1923, p. 521 Ibid. Killington, 1936, p. 235; Kimmins, 1944, p. 12 Withycombe, 1923, p. 523 Ibid. Killington, 1936, p. 235; Kimmins, 1944, pp. 11-12 |
| Denmark | <i>Meyenia fluviatilis</i> auctorum, sense of Carter (= <i>Ephydatia fluviatilis</i>) <i>Spongilla lacustris</i> Linné | <i>Sisyrta fuscata</i> (Fabricius) <i>Sisyrta fuscata</i> (Fabricius) | Berg, 1948, p. 144 Ibid. |
| India | <i>Spongilla alba</i> Carter <i>Spongilla carteri</i> Bowerbank | <i>Sisyrta indica</i> Needham <i>Sisyrta indica</i> Needham <i>Sisyrta</i> sp. (later described as <i>indica</i> by Needham) | Needham, 1909, p. 206 Ibid. Annandale, 1906, pp. 194-195 |
| Java | <i>Meyenia crateriformis</i> Potts (= <i>Ephydatia crateriformis</i>) <i>Spongilla carteri</i> Bowerbank | <i>Sisyrta</i> sp. (larva) Sisyridae (larva) | Esbén-Petersen, 1933, p. 626 Ibid. |

genera, *Meyenia* of the subfamily Meyeninae, and *Spongilla* of the subfamily Spongillinae (table 4).

Brown (1952, p. 157) noted that sponges from comparatively cool, clean Lake Erie yielded only *Climacia* larvae, whereas those from the warm, shallow, polluted Haunck's Pond (on Middle Bass Island) in Ohio yielded only *Sisyrta* larvae. Sponges occurred at depths ranging from just beneath the surface to over 6 feet. Those in well-lighted places were green; those farther down were yellowish brown. Hungerford collected both *Sisyrta* and *Climacia* larvae from Burt and Douglas Lakes in Michigan.

Old (1933, pp. 683-684), in his observations on the Sisyridae in Douglas Lake, Mich., mentions the sponges (*Ephydatia fluviatilis*, *Heteromeyenia repens*, and *H. argyrosperma*) on which he was unable to find any sisyrid larvae, but does not mention the species on which he *did* find them.

Wesenberg-Lund (1939, p. 23) remarked that the number of *Sisyrta* larvae living on large colonies of sponges is not great, hardly more than 10 to 15 individuals. Berg (1948, p. 22) noted that the number

TABLE 5.—Records of predators attacking *Sisyridae*

| Prey | Stage attacked | Predator | Reference |
|--|--|---|--------------------------------------|
| <i>Sisyra vicaria</i> (Walker) (= <i>umbribrata</i> Needham) | adult | tree frogs (in stomach) | Needham, 1905, p. 15 |
| <i>Sisyra fuscata</i> (Fabricius) | adult | <i>Scatophaga stercoraria</i> Linné (Diptera) | Killington, 1932, p. 32 |
| | adult (thorax and abdomen) | Trombidid or "Allothrombidid" mite larvae, determined from Berg's figures 59b,d, as <i>Microtrombidium</i> sp., family Trombididae, by E. W. Baker (USNM) | Berg, 1948, pp. 145-146, figs. 58-59 |
| <i>Climacia areolaris</i> (Hagen) | eggs and 1st-instar larvae | mites (Acarina) | Brown, 1952, p. 156 |
| | 1st-instar larvae | larger plankton feeders, as <i>Hydra</i> and <i>Utricularia</i> | Ibid. |
| | 3d-instar larvae | fish | Ibid. |
| | | centipedes (3 specimens of <i>Scutigera</i> were observed to feed on larvae at one time) | Ibid. |
| | | spiders (orb weaver observed to hold 2 larvae with feet while feeding on a third) | Ibid. |
| adult | ants Attidae (small gray jumping spiders; eat everything but wings) | Ibid. Ibid. | |

of *S. fuscata* larvae on a sponge colony is small in stagnant waters; however, in the Susaa River, Denmark, on a portion of a colony "only half as large as a hand," he found 25 larvae, and concluded that there were undoubtedly several hundred on the whole colony.

Navás (1935, pp. 76-78) has given a fragmentary list of a few sponges found in certain countries, but he has not correlated most of them with species of Sisyridae. Lestage (1921, p. 340) has stated that the larvae occur as parasites upon filamentous algae and bryozoans such as *Cristatella mucedo* in addition to the sponges. Wesenberg-Lund (1939, p. 385) mentioned that *Sisyra* larvae are often found on *Cristatella*. However, Brown (1952, p. 158) pointed out that third-instar *Climacia* larvae have been found upon algae-covered rocks and beneath bare rocks, but that they were not feeding. The fully grown third-instar larva leaves its host sponge and may wander about or hide in protected places during its last day in the water, and usually does not leave the water to look for a pupation site until evening. Consequently, he concluded that it is possible that such migrating or resting larvae, found upon algae or bryozoans, might have been the basis of Lestage's statement.

ENEMIES

In addition to unfavorable ecological conditions (including the physical factors of wind, water, temperature, sunlight, etc.), the Sisyridae, in fulfilling their role in the balance of nature, are subject in all stages of their development to the attacks of predators and parasites (tables 5, 6).

Family SISYRIDAE

Small, dull-colored spongilla-flies;⁵ larvae aquatic.

DIAGNOSIS (adult): Compound eyes large, widely separated, ocelli absent; antennae setose, approximately one-half the length of forewing, basal segment enlarged, flagellum moniliform and multisegmented; mandibles well developed, maxillary palpi 5-segmented and labial palpi 3-segmented with terminal segments expanded; prothorax broader than long, lateral margin without lobes; legs cursorial, fore-coxae elongate and free; abdomen cylindrical. Wings subequal, oval, apices usually rounded. Forewing: costal area narrow in general, particularly narrowed at base to about humeral cross-vein, then widened, and narrowed again just before pterostigma, costal cross-veins usually simple, rarely forked, pterostigmal cross-veins numerous, poorly defined; humeral cross-vein not recurrent; Sc with apical end weak, sometimes appearing fused with R1, at other times appearing free to margin or atrophied before margin, and connected by a radial cross-vein; Rs separating from R1 near base of wing; Rs coalesced with MA for a short distance, then separating, free stem of Rs with from one to two main branches; R1, Cu1 and branches of Rs and M usually with marginal forks, sometimes anal veins also, somewhat variable in extent; Cu1 with almost parallel branches to margin; Cu2 (usually simple, sometimes forked at margin) and usually three anal veins present; cross-veins few and specialized, gradates sometimes present. Hindwing: costal area narrow, cross-veins unforked, pterostigmal cross-veins numerous, poorly defined; MA coalesced with MP at base, then separating into a free, weakened, sometimes somewhat sinuate, elongate basal section, eventually coalescing with Rs for a longer distance than in forewing; Cu2 present and simple; fewer cross-veins than in forewing; gradates sometimes present. Membrane covered with microtrichia, longitudinal veins and costal cross-veins with both micro- and macrotrichia; trichosors present on distal portions of outer and inner margins; a fringe of setae along margins; some thyridia also present; coupling apparatus consisting of a reduced jugofrenate type; body covered with long setae.

⁵ Westwood (1848, p. 557) referred to the "spongilla insect" and Needham (1901, p. 560) subsequently suggested the common name of "spongilla flies." They have also been called "sponge flies."

TABLE 6.—Records of parasites attacking *Sisyridae*

| Prey | Stage attacked | Parasite | Reference |
|-----------------------------------|---|---|--|
| <i>Sisyra vicaria</i> (Walker) | prepupae or pupae in cocoons | <i>Eupteromalus</i> sp. (Hymenoptera, Pteromalidae) <i>Tetrastichus</i> sp. (Hymenoptera, Eulophidae) | Spangler, 1952-1953, in litt.* Ibid. |
| <i>Sisyra fuscata</i> (Fabricius) | prepupae mainly, a few pupae | white mold (fungus) <i>Eupteromalus</i> sp. (Hymenoptera, Pteromalidae) Hymenopteron | Killington, 1933, p. 85; 1936, pp. 173, 175 Withycombe, 1923, p. 523 Killington, 1933, p. 88 Withycombe, 1923, p. 523 |
| <i>Sisyra terminalis</i> Curtis | prepupae, pupae | white mold (fungus) Hymenopteron | Ibid. Ibid. |
| <i>Sisyra</i> | prepupae | hymenopterous parasite | Withycombe, 1923, p. 590 |
| <i>Sisyra</i> and <i>Climacia</i> | cocoons | Hymenopteron | Old, 1933, p. 682 |
| <i>Climacia areolaris</i> (Hagen) | eggs larvae pupae prepupae or pupae in cocoons | fungus "sewage fungus" in lab (possibly bacterial in nature) fungus <i>Sisyridivora cavigena</i> Gahan (Hymenoptera, Pteromalidae) | Brown, 1952, p. 156 Ibid. Brown, 1952, p. 157 Brown, 1951, pp. 103-110; 1952, p. 156 Gahan, 1951, pp. 100-102 |

*Of approximately 45 cocoons of mainly *Sisyra vicaria* (Walker) collected by Dr. Spangler in Nigger Creek at Mullet Lake, Cheboygan County, Mich., on July 30, 1952, at least 25 were parasitized by *Eupteromalus* sp. and one by *Tetrastichus* sp. The cocoons were collected within an area of about 20 sq. yds., mostly from the tops of *Scirpus* and *Eleocharis* stems (a few about 6 in. above the water line, some adjacent to gyrenid cocoons). In some instances a blackish mold appeared to have invaded the cocoons.

The adults of the Sisyridae can be distinguished from the Hemero-biidae as follows: In the Sisyridae, the forewing shows branches of Rs arising from a single Rs stem, whereas in the Hemero-biidae, the forewing shows two or more branches of R1 arising from the apparently fused stems of R1 and Rs. The adults of the Osmylidae are so different from the Sisyridae in appearance that there is no difficulty in distinguishing them, although the larvae are closely related. The osmylid adult is larger, possesses three ocelli on the vertex, has a

prothorax which is longer than wide, and has more numerous cross-veins and branches to Rs in the wings.

HEAD (fig. 8,A,I): Antennae (fig. 7,c,F) arising mesad of compound eyes and articulated to single antennal sclerite on lateral side of each socket, scape enlarged, pedicel smaller than scape and only slightly

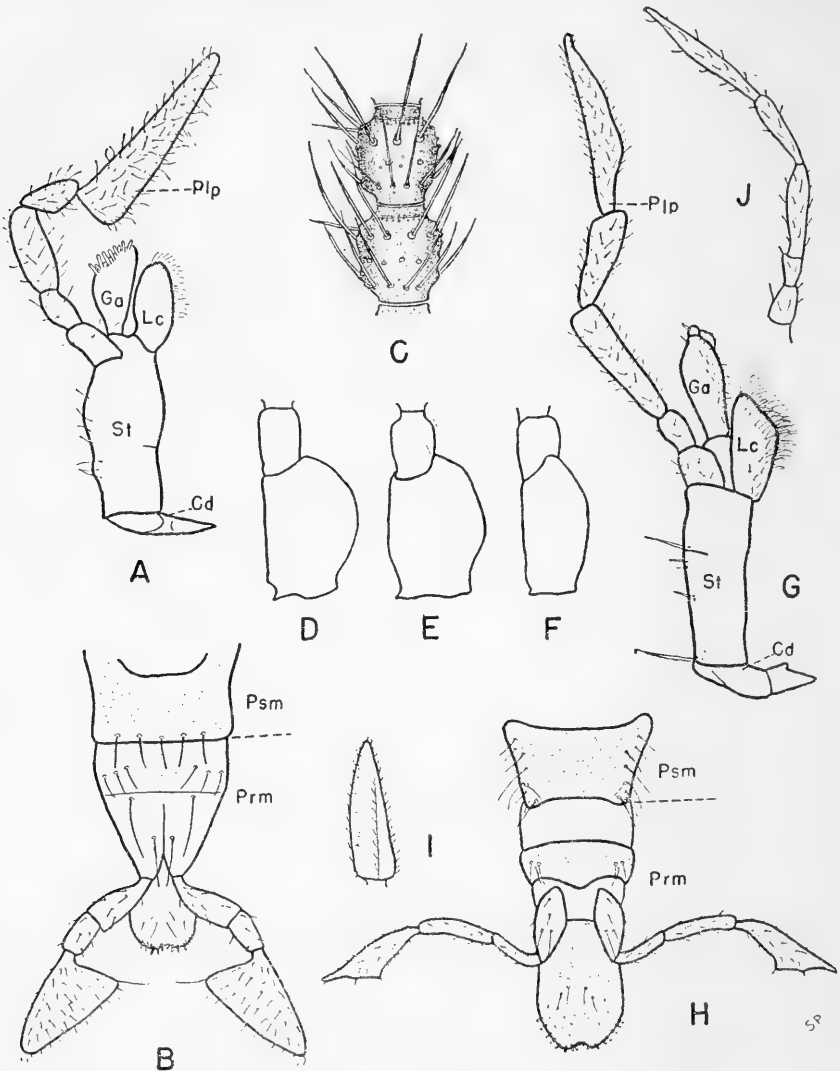


FIGURE 7.—Head appendages. A, *Sisyra vicaria* (Walker), maxilla with palpus; B, same, labium, ventral view; C, same, antennal segments eight and nine; D, same, basal antennal segment; E, *S. fuscata* (Fabricius), basal antennal segment; F, *S. apicalis* Banks, basal antennal segment; G, *Climacia areolaris* (Hagen), maxilla with palpus; H, same, labium, ventral view; I, *Sisyrina nirvana* Banks, terminal segment of maxillary palpus; J, *Neurorthus fallax* (Rambur), maxillary palpus. Abbreviations: Cd, cardo; Ga, galea; Lc, lacinia; Plp, palpus; Prm, prementum; Psm, postmentum; St, stipes.

larger than segments of flagellum (number variable, from about 40–70 segments, terminal segment more ovate with acute apex); vertex arched dorsally, with coronal or midcranial sulcus running from posterior margin of head to midvertex more pronounced in certain species (as *Sisyra vicaria*, fig. 9,A); postgena fused with gena, and postocciput fused with occiput; frons separated from genae laterally by the frontal sutures and anteriorly from the clypeus by the frontoclypeal sulcus or "suture," with frontal pits located at anterior ends of frontal suture; clypeus transverse, almost straight (*Sisyra*) or emarginate anteriorly, bearing setae; labrum (fig. 9,c,D) transverse, usually shorter than clypeus, almost straight, slightly rounded or emarginate anteriorly, lateral margins reaching posteriorly below anteclypeus, with setae, lower surface with one or two minute sensory groups; mandibles (fig. 9,E-H) asymmetrical, acute apically, outer margin convex, inner margin concave with left mandible usually having a more prominent subapical toothlike projection than the right, above which may be a row of short stout setae or small group of bristles on inner surface of each mandible, each mandible with condyle for articulation with postgena; maxillae (fig. 7,G,I,J) consisting of cardo (flexed mesally, with internal, oblique, strengthening ridge), stipes with 5-segmented maxillary palpus (the terminal segment largest and of distinctive shape in various genera), a heavily setose external galea and mesal lacinia; labium (fig. 7,B-H) consisting of the postmentum (somewhat concave posteriorly, slightly narrowed anteriorly), prementum (large, sometimes differentiated into posterior and anterior premental plates) with an anterior broad membranous ligula (notched slightly mesoanteriorly and covered with setae and sensory bristles) and 3-segmented labial palpus (third segment varied in shape in different genera); gular region membranous, transparent; labium and hypopharynx closely associated.

THORAX (fig. 8,B-E,J,K): Neck joining prothorax to head consisting of three pairs of sclerites—the precervicales (laterodorsal sclerites, small, situated just before anterior margin of pronotum), the laterocervicales (bent, with anterior portion running forward to unite with head), and the postcervicales (posterior to laterocervicales); prothorax with pronotum usually broader than long, sometimes with depressions, elevations, or grooves dorsally, sometimes overlapping the cervicales and dorsal portions of pleural sclerites (the epimeron and episternum, which are reduced and united to almost form a single plate, epimeron ventrally produced into a rounded process articulating with coxa), sternum mostly membranous except for a transverse basisternum between coxae, small trochantin just below ventral margin of episternum; mesothorax largest, mesonotum large, with scutum divided into two convex lobes by deep median sulcus

(suture), scutellum large, well developed, almost diamond shaped, with shield-shaped depression at apex, postscutellum with indication of median division; metanotum with anterior median depressed area, scutum almost divided into two, sometimes irregularly shaped lobes, shorter medially than mesoscutum, scutellum triangle shaped, smaller than that of mesoscutum with almost straight posterior margin, postscutellum almost hidden; pleura of both mesothorax and metathorax similar, the episternum divided into the anepisternum and katepisternum, separated by the pleural suture from the elongate epimeron; katepisternum with a small anteroventral trochantin; sternum of mesothorax and metathorax divided into two halves by a median longitudinal sulcus, the supraepisternum more medial, the infraepisternum more lateral.

LEGS (fig. 8, F-H): Metathoracic pair longer than prothoracic or mesothoracic pair; coxae free, forecoxae cylindrical, widely separated, mesothoracic and metathoracic coxae more widely spaced, broader, more truncate (mesothoracic coxae slightly longer), divided into a larger anterior coxa vera and a much smaller posterior basal meron; trochanters short, entire; femora elongate and cylindrical; tibiae slightly narrower basally and distally, of a length almost equal to or shorter than that of the femora in the prothoracic and mesothoracic legs, posterior tibiae almost $1\frac{1}{2}$ times the length of the femora; one spur on distal end of prothoracic tibiae and two on distal ends of mesothoracic and metathoracic tibiae; tarsi 5-segmented, the metatarsus (first segment) the longest, the fourth the shortest (*Sisyra*, *Climacia*), the fifth bearing a pair of strongly curved, simple claws, with a broad ventral padlike setose empodium between.

WINGS (figs. 10, 11): The wing venation terminology used in this revision is basically that of Martynov (1928, pp. 89-91) and Carpenter (1940, pp. 253-256). These investigators, along with Tillyard in his later views (1932, p. 29), and probably Lameere (1922, pp. 138-149), hold to the theory of the basal fusion or coalescence of MA with Rs, thus making MA what Killington (1936, p. 29) and Comstock (1918, p. 178) consider R5 without the fusion. Killington maintains that the base of M lies so close to R that there is difficulty in distinguishing these veins, and that R and M may be readily separated by a fold in the membrane between them. Like Comstock, he divided the media into M1, M2, M3, and M4 (corresponding veins considered branches of MP by Martynov and Carpenter). Carpenter (1940, pp. 194, 253) mentions that the free basal piece of MA—the faint, obliquely transverse vein appearing at the base of M just before it coalesces with R in the forewings of many Hemerobiidae and related families—is usually absent in the Sisyridae, in which family Rs arises near the base of the wing and coalesces with MA for a short

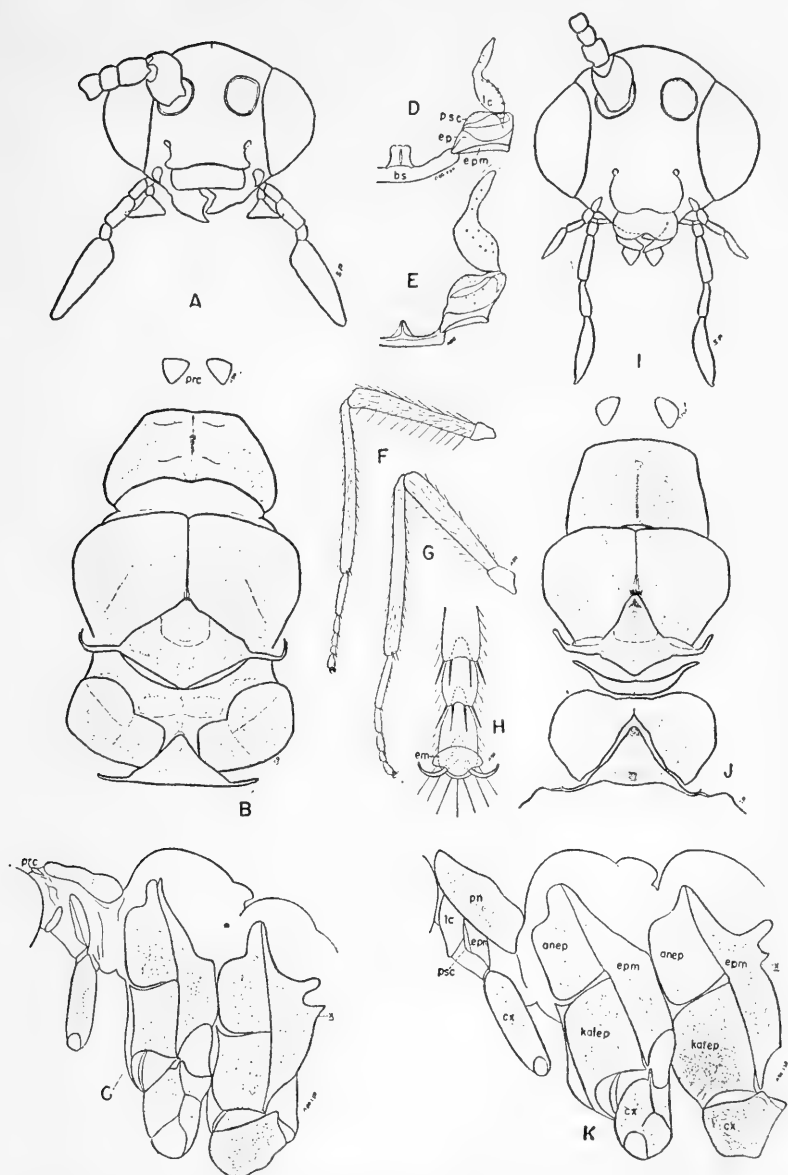


FIGURE 8.—Head and thorax of *Sisyra vicaria* (Walker), A–D, F, H, and *Climacia areolaris* (Hagen), E, G, I–K. *Sisyra vicaria*: A, head, anterior view; B, thorax, including precervicals of neck, dorsal view; C, thorax, lateral view; D, basisternite, from interior; F, metathoracic leg, cephalic face; H, terminal tarsal segments of metathoracic leg. *Climacia areolaris*: E, basisternite, from interior; G, metathoracic leg, cephalic face; I, head, anterior view; J, thorax, including precervicals of neck, dorsal view; K, thorax, lateral view. Abbreviations: anep, anepisternum; bs, basisternite; cx, coxa; em, empodium; ep, episternum; epm, epimeron; katep, katepisternum; lc, laterocervicale; pn, pronotum; prc, precervicale; psc, postcervicale; x, marking spot of indentation.

interval. Since the theory seems plausible, and in order to create less confusion with the identification of Nearctic Neuroptera, the principal features of Martynov's and Carpenter's terminology are used in this paper.

The labeling of some of the veins in this paper is provisional, but is done in order to facilitate the definition of a genus or species. Variations and abnormalities in the wing venation are frequently seen in the following: gradates in the "doubling" of certain cross-veins where a second is found adjacent to the normal one, the occasional absence of a cross-vein usually present, or addition of one not normally present; the relatively basal or distal position of a cross-vein; the direction of the cross-vein; the forking of a longitudinal vein far basad or distad of its usual point of forking; the addition of branches of longitudinal veins to the margin; and the difference of venation seen in the two wings of the same specimen. Color and size variations can also occur. The unstable nature of the veins should be taken into consideration when venation is used for the determination of a species.

The vague definition ascribed to the term "gradate veins" has also led to confusion. Gradate veins are supposed to run obliquely across the wing, usually in the distal half, and more or less parallel with the outer margin. Or, in the sense of Bradley (1939, p. 36), gradate veins are a series of cross-veins alternating with parts of longitudinal veins, forming a regular zigzag line across the wing. In this paper, those cross-veins considered gradates are those other than the basal series (as 1st r, basal m between MA and MP1+2, 1st m between MA and MP1+2 (M5 of Tillyard, 1919, p. 533), 1st and 2d m-cu between MP and Cu, cubital, cubito-anal and anal cross-veins). Specifically, the shorter inner gradate series will include 2d r, basal s, 1st r-m, 2d m between MA and MP1+2, 1st m between MP1+2 and MP3+4, and the usually longer outer gradate series, including 3d r, distal s, 2d r-m, 3d m between MA and MP1+2, m between MP1+2 and MP3+4, and 3d m-cu, when present.

A trichosor consists of a thickening of the membrane upon which stand several macrotrichia, somewhat elongate in form along the apical portion of the margin but becoming shorter and smaller towards the bases of the inner and costal margins, as of Killington (1936, pp. 34-35), or the marginal "dots and dashes" of Comstock (1918, p. 167). Thyridia—in the sense of a weakening of the vein because superposed by a concave fold or in the sense of small whitish or almost transparent spots, or the "bullae" of Comstock (1918, p. 81)—can be seen in the forewing at the point where MP forks basally, on the cubito-anal and anal cross-veins in the forewing, on the medial cross-vein, and on the radial, medial, and mediocubital cross-veins of the outer

gradates in the hindwing when they occur. The coupling apparatus consists of a convex jugal lobe on the forewing and a poorly developed humeral lobe bearing two bristles on the hindwing. In general, the costal cross-veins tend to be closer together toward the base of the wing.

A question which has arisen all through this investigation has been whether Sc and R1 are actually fused or coalesced distally before the pterostigma in all genera of the family. The original diagnoses of the family, as given by Handlirsch (1906, pp. 40-42; 1908, pp. 1251, 1292) do not mention the fusion as a characteristic of the family, although Tillyard (1916, p. 312; 1926, p. 316), Comstock (1918, p. 177), and Carpenter (1940, pp. 194, 253) state that the fusion does take place. Krüger (1923) has noted a difference in this point in regard to the different genera. In the present study of the wings of the four genera (*Sisyrta*, *Climacia*, *Neurorthus*, *Sisyrina*) there did appear to be a definite fusion in *Climacia*, but in *Sisyrta* and particularly *Neurorthus* there was some doubt (e. g., in a single specimen of *Sisyrta*, one wing might appear to show Sc and R1 fused, but the other might show them running free to the margin; or in certain species, as *panama*, Sc appears weak at the margin). In *Neurorthus*, Sc gives the appearance of being free at the apex and joined to R1 by a short subcostal cross-vein. In the specimen of *Sisyrina* examined, Sc seemed to atrophy at the apex. The terminal fork of R1 at the end of the pterostigma is weak, as are also the pterostigmal cross-veins in all genera.

ABDOMEN (fig. 12): 10-segmented; a pair of spiracles on each of first eight segments, the first pair the largest, closest to anterior margin, the other pairs smaller, located less anteriorly; first segment short, sternite and tergite reduced, only small sclerotized lateral pieces, rest membranous; second and third tergites usually small, second and third sternites usually larger than fourth to seventh tergites in the female and to eighth in the male, which are more uniform; transverse streaks ("secondary sutures" of Killington, 1936, p. 36) or sulci (for strengthening) present on second and third sternites, sometimes on fourth to sixth sternites, varying in stage of development, usually becoming shorter and weaker more distally, on second segment curved toward anterior margin.

Genital segments of male varying considerably in shape and size in different genera; ninth tergite divided or greatly weakened mid-dorsally, sometimes moved lateroventrally to tenth tergite and much smaller and more difficult to see (*Sisyrta*), almost fused with it (*S. minuta*), larger and almost as broad as tenth tergite (*Climacia*); ninth sternite located below ninth tergite, ventrally more or less convex, and with a pair of internal distally projecting processes (*Climacia*), or larger, more like eighth sternite (*Sisyrta*); tenth tergite

(two united epiprocts of Tjeder, 1954, p. 32) weak middorsally, bearing long setae, broad and of distinctive shape (*Climacia*), or a small, transverse band bearing a small group of trichobothria, and with long setae (*Sisyra*); tenth sternite almost striplike, posterior and posteroventral to tenth tergite, bearing long setae and broadening ventrally (*Climacia*) or moved dorsally and divided into a basal plate (gonarcus of Tjeder, *ibid.*, p. 28) and a distal pair of claspers (entoprocessus of Tjeder, *ibid.*, p. 30) (*Sisyra*); internal genital armature reduced; parameres between lateral halves of ninth and tenth tergites and above ninth sternite partially fused (*Climacia*) or free in the form of two sclerotized rods below basal plate (*Sisyra*); small, thin, V-shaped, keellike, transparent internal hypandrium present usually above eighth sternite and proximal portion of ninth sternite (*Sisyra*, similar to that of *Hemerobius*) (fig. 13,A,D).

Abdomen of female with first seven segments similar to those of male; genital tergites and sternites more similar in different genera and species in general than those of male, eighth tergite usually considerably developed laterally, broken middorsally and most often appearing fused midventrally (uncertain in *Sisyra panama*, *Sisyrina*) resembling a sternite, eighth pair of spiracles opening in the tergite; eighth sternite greatly reduced to a minute subgenital plate lying ventral to genital opening and between and ventral to bases of lateral halves of ninth tergite, called the gonapophyses (Killington, 1936, p. 64) with two elongate, lateral, posteriorly directed processes (fig. 24,B); ninth tergite divided into two large plates, moved lateroventrally to tenth tergite, with one or two thickened ridges or apodemes (usually posterior only, but both anterior and posterior present in *Sisyra vicaria*) for articulation with ninth sternite; ninth sternite elongate, movable, divided, attached ventrally to articulation ridge of ninth tergite, apex acute; tenth tergite entire, sometimes weakened middorsally, a transverse plate with a group of trichobothria, similar to that of male; genital pore located ventrally between the lateroventral halves of the ninth tergite.

The anus opens between the lateral portions of tenth tergite in the male, and in membrane just beyond tenth tergite in the female. The cement gland is long and oval with a short, slightly swollen duct in the female. In the male, the testes are fused and enclosed in one yellow oval scrotum (the shape sometimes varying) as in *Osmylus* (Withycombe, 1923, p. 524; 1925, p. 388), with the two vasa efferenti coming off from this ventrally at about the middle, or somewhat posteriorly. Vesiculae seminales are large and considerably lobate, but of a slightly different form from those of *Osmylus*. The remaining anatomy is of a neuropterous type in general.

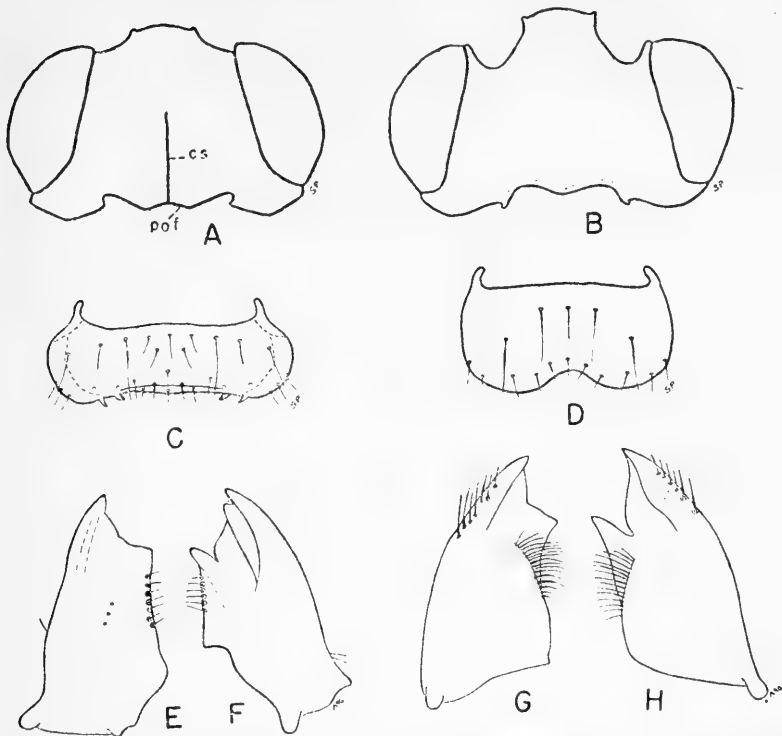


FIGURE 9.—Head and mouthparts of *Sisyra vicaria* (Walker), A, C, E, F, and *Climacia areolaris* (Hagen), B, D, G, H. A, B, posterior view of head, showing cranial sulcus (cs) and postoccipital margin of foramen (pof); C, D, labrum; E, G, right mandible, ventral view; F, H, left mandible, ventral view.

Key to the genera of Sisyridae

1. A series of outer gradate cross-veins present in fore- and hindwings . . . 2
- No series of outer gradate cross-veins present in either wing 4
2. Rs of fore- and hindwings usually with one main fork under or slightly basad of pterostigma; forewing with 3d A running into and uniting with 2d A near margin (North, Central, and South America) (p. 480).

Climacia McLachlan

Rs of fore- and hindwings usually with two main forks, both basad of pterostigma; forewing with 3d A not fusing with 2d A, but running to margin 3

3. Forewing usually with well-developed inner gradate series of 4-6 cross-veins below 2d r; Sc appearing to run free to margin, joined by a cross-vein to R1 (*Rophalis* Hagen, fossil in Baltic amber, p. 522). (Algeria, Australia, Balearic Islands, Bulgaria, Corsica, Italy, Japan, Sardinia, Sicily, Spain) (p. 520). *Neurorthus* Costa

Forewing usually with poorly developed inner gradate series of only two or three cross-veins; Sc indistinct in pterostigma (Southern India) (p. 517).

Sisyria Banks

4. Forewing with Sc appearing separate from R1 or to atrophy in pterostigma (Japan) (p. 518). **Sisyrella** Banks
 Forewing with Sc appearing to run into R1 or to be joined by a cross-vein, not atrophying in pterostigma (cosmopolitan) (p. 456). . . **Sisyra** Burmeister

NOTE: The status of three genera is not yet settled. Examination of the genotype of *Sisyrella* may disclose stronger characters for separating *Sisyra* and *Sisyrella*; however, *Sisyrella* appears to be a weak genus and perhaps is not distinct from *Sisyra* (see p. 519). The possibility of the synonymy of *Rophalis* and *Neurorthus* also has not been fully investigated (see p. 521).

Genus *Sisyra* Burmeister

Sisyra Burmeister, 1839, p. 975.—Banks, 1905, p. 25.—Navás, 1935, p. 40.—Killington, 1936, p. 228.—Carpenter, 1940, p. 253.

Brownish spongilla-flies.

GENOTYPE: *Hemerobius fuscatus* Fabricius (by subsequent designation by Banks (1905, p. 25)).

HEAD (figs. 7,A-F; 8,A; 9,A,C,E,F): Antennae with approximately 35-50 segments, two whorls of setae on all but first or basal segment, on which the setae are irregularly arranged; face shorter than in *Climacia*, clypeus and labrum with anterior margins almost straight, labrum approximately $3\frac{1}{2}$ times as broad as long, setose, and with anterior projections on both sides of center; postoccipital margin of foramen concave in center with two lateral convexities; median sulcus sometimes pronounced; maxillary palpi sometimes with first, second, and fourth segments shorter than the third (which is approximately $1\frac{1}{2}$ -2 times as long) and the fifth or terminal segment, which is almost twice as long as the third, broadest at base, narrowed and tapered to a point at apex; labium (fig. 7,B) with postmentum and prementum closely adjoined, at times prementum almost appearing divided into anterior and posterior plates, but differing from *Climacia*, which shows a distinct membrane between the postmentum and prementum, and another distinct membrane between the anterior and posterior plates of the prementum; labial palpi with third or terminal segment greatly enlarged, flattened, triangle shaped and very wide at base, the second small and subcylindrical, the first approximately $1\frac{1}{2}$ -2 times the length of the second, and narrowed proximally.

THORAX (fig. 8,B-D): Pronotum shorter, smaller, and more furrowed than in *Climacia*; bases of setae on laterocervicales stouter than in *Climacia*; median projection of basisternite quadrate; posterior margin of metepimeron with caudal indentation (*x*, fig. 8,c) less pronounced than in *Climacia*; mesonotum and metanotum with scutellum having a broader apex than and mesoscutellum with posterior lateral margins of apical shield-shaped depression longer than in *Climacia*; metascutum with halves more irregular and metanotum with center more depressed than in *Climacia*.

LEGS (fig. 8,F,H): Tibiae cylindrical, first tarsal segment the longest, particularly in metathoracic legs, where it is more than one-third the length of tarsus, fourth the shortest.

FOREWING (fig. 10,A): Costal area with approximately 11-16 costal cross-veins before pterostigma; subcostal area usually slightly narrower than the greatest width of costal area, with one basal subcostal cross-vein usually present below about the fourth to sixth costal cross-veins, and sometimes one appearing to be present distally connecting Sc to R1; coalescence of Sc with R1 at apex of wing below the pterostigma uncertain, sometimes Sc appearing to atrophy at the apex; Rs+MA separating off from R1 near base, Rs separating from MA slightly basad of 1st r; free stem of Rs with two main forks, R4+5 separating off at about longitudinal midpoint of wing, R2 and R3 forking a short distance beyond; MA usually dividing into two branches slightly basad (occasionally distad) of level of junction of Sc and R1; MP forking into MP1+2 and MP3+4 a short distance beyond separation of Rs from MA; MP1+2 and MP3+4 with terminal fork usually basad of level of junction of Sc and R1; Cu1 separating from Cu2 near base of wing; 1st and 3d A sometimes, and 2d A usually, with marginal forking, 3d A running free to margin; two or three radial cross-veins between R1 and Rs; one radiomedial cross-vein between Rs or R4+5 and MA, usually at base of R4+5; one medial cross-vein between MA and MP1+2; three mediocubital cross-veins between MP and MP3+4 and Cu1, the first basal, the second to Cu1 before branches, and third to branches; one cubital cross-vein between Cu1 and Cu2; one basal cubito-anal cross-vein between Cu2 and 1st A; one anal cross-vein between 1st and 2d A; no real gradates, inner series usually of two cross-veins (three in *panama*), 2d r and 1st r-m.

HINDWING (fig. 10,B): Costal area with approximately 9-12 costal cross-veins before pterostigma; subcostal area broader with an indistinct basal subcostal cross-vein; Sc usually appearing to be coalesced with R1 at apex; Rs after branching off from R1 near base, continuing free for a shorter distance than in *Climacia*, then coalescing with and finally separating from MA close to the longitudinal midpoint of wing, then proceeding anteriorly back toward R1, forking into two main forks, R4+5 near center of wing, and, a short distance beyond, R2 and R3, basad of pterostigma; MA separating off from MP closer to base than in *Climacia* into a free sinuate section, which curves toward and coalesces with Rs, then separates and forks at margin; MP forking into MP1+2 and MP3+4 usually basad of point of separation of Rs from MA; MP1+2 usually with terminal fork basad of level of point of coalescence of Sc and R1; Cu1 separating from Cu2 near base of wing; 1st A usually simple, 2d A usually with marginal forking; one or two radial cross-veins, the first distad of forking of R2 and R3,

the second below pterostigma, when present; one medial cross-vein between MA and MP1+2 slightly distad of separation of MA from Rs; one mediocubital cross-vein, usually connecting lower branch of MP3+4 to a terminal branch of Cu1, one cubito-anal cross-vein between Cu2 and 1st A near base; one anal between 1st and 2d A

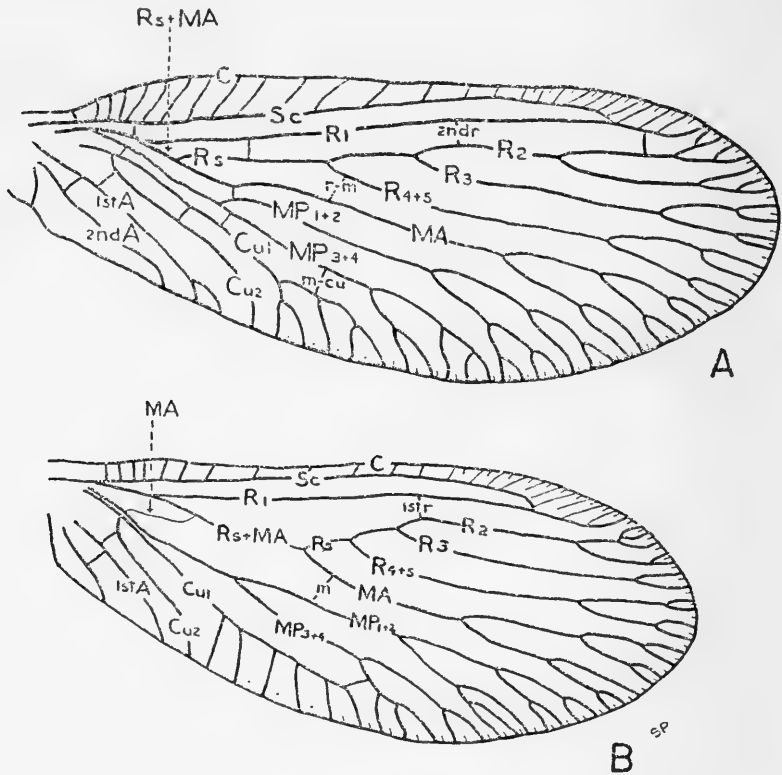


FIGURE 10.—Wing venation of *Sisyra vicaria* (Walker). A, forewing; B, hindwing. Abbreviations: C, costa; Sc, subcosta; R1, radius; R2, R3, and R4+5, branches of radial sector; Rs+Ma, radial sector and anterior media coalesced; MA, anterior media; MP1+2 and MP3+4, branches of posterior media; Cu1 and Cu2, branches of cubitus; A, anal vein; r, radial cross-vein; r-m, radiomedial cross-vein; m, medial cross-vein; m-cu, mediocubital cross-vein.

near base; no outer gradates, inner series of two cross-veins, 1st r and 1st r-m; thyridia apparent on 1st r-m.

MALE GENITALIA (fig. 14,A,B): Eighth tergite sometimes appearing divided into two dorsal plates; ninth tergite divided into two small parts, each half moved lateroventrally to tenth tergite; tenth tergite entire, broader than long, frequently shorter dorsomedially, large, with long setae and a group of from two to nine trichobothria on each side; ninth sternite large and appearing terminal ventrally, ventral to

ninth and tenth tergites; tenth sternite moved dorsally to a position posterior to tenth tergite and divided into an anterior transverse plate and a posterior pair of more heavily sclerotized claspers furnished with one or more dentate projections; two small heavily sclerotized parameres arising caudally below basal plate of tenth sternite, diverging and attached posteriorly to claspers.

FEMALE GENITALIA (fig. 14,c): Ninth tergite, the largest, divided in two, each part moved lateroventrally to the tenth tergite and of distinctive shape in the species, usually sloping posteroventrally to just before articulation point with ninth sternite, where there is a sharper slope; tenth tergite entire, transverse, frequently shorter dorsomedially, with group of trichobothria on each side; ninth sternite divided into two elongate movable upturned parts acute apically, tapering and bent posteriorly just before apex, with small narrow ventral projection, each articulated at base with posterior, more heavily sclerotized ridge of each half of ninth tergite; tenth sternite not yet accounted for and a morphological study is necessary.

BASAL ABDOMINAL SEGMENTS: Second tergite usually appearing as a row of setae; third tergite shorter medially so as to appear almost divided (*vicaria*, *fuscata*) or appearing as a row of setae (*apicalis*, *minuta*); fourth rectangular to oval (*fuscata*, *minuta*) or almost divided in two (*vicaria*, *apicalis*); sixth and seventh larger, more oval than second to fifth. Second and third sternites large, close together, with each half of dark streak beginning in posterolateral corners and running anteriorly to meet near anterior margin (a median dark point near concave anterior margin in *apicalis*, from which two short streaks diverge); third to fifth sternites with transverse streaks almost parallel and closer to anterior margin, streak faint in fifth; sixth and seventh sternites shorter and more narrow; eighth narrowest of sternites; pair of pale spots near posterior margin of second to sixth sternites sometimes prominent (*vicaria*, *fuscata*).

The genus *Sisyra* is cosmopolitan and 23 named species have been taken and recorded from various regions of the world (table 7).

Key to the species of *Sisyra* in the Western Hemisphere

1. Forewing usually with three radial cross-veins, 5 to 7 mm. long and at least 2 mm. wide, membrane appearing more or less uniform light brown in color; basal antennal segment broad (fig. 7,D,E; pl. 1, figs. 2, 3) (*vicaria* group, p. 460) 2
- Forewing usually with two radial cross-veins, smaller, 3-5 mm. long and usually less than 2 mm. wide, membrane sometimes appearing more or less distinctly streaked with brown between longitudinal veins (except in *minuta*); basal antennal segment more slender, elongate (fig. 7,F; pl. 1, figs. 1, 4, 5) (*apicalis* group, p. 471) 3

2. Male claspers long, wide at base, then sharply curved and gradually narrowed to a terminal point, basal plate about one-third as long as claspers; lateroventral halves of ninth tergite of female more or less triangle shaped, rounded ventrally and with one prominent sclerotized articulation ridge posteriorly; forewing usually with R2 not forked deeply, i. e., basal to or at level of point of junction of Sc and R1, apex oval, symmetrical with respect to longitudinal axis of wing, approximately 5 mm. long and 2 mm. wide; vertex, frons, antennae and thorax blackish; basal antennal segment with sharp inner curve (figs. 7, e, 13; pl. 1, fig. 2) **fuscata** (Fabricius) (p. 468)
- Male claspers short, squat, basal plate approximately as long as claspers; lateroventral halves of ninth tergite of female elongate, with both anterior and posterior sclerotized articulation ridges; forewing with R2 usually forked basal to point of junction of Sc and R1, apex more acute, less symmetrical, frequently more than 5 mm. long and 2 mm. wide; vertex yellow to yellowish brown with thin dark line encircling basal antennal segments, frons and antennae yellow to yellowish brown, basal segments of antennae dark brown with remaining segments yellow or brown to midpoint and then yellowish to apex; basal segment more smoothly curved on inner margin (figs. 7, d, 10, 14; pl. 1, fig. 3) **vicaria** (Walker) (p. 460)
3. Forewing with R1 bent at a strong angle at meeting point with Sc, then dipping and curving toward margin; membrane uniformly light brown, approximately 3.2 mm. long and 1.3 mm. wide; male claspers beaklike, sharply curved dorsoventrally to point; vertex and frons yellowish brown, antennae yellowish with basal two segments brown (fig. 15; pl. 1, fig. 6).
minuta Esben-Petersen (p. 478)
- Forewing with R1 not bent at an angle at meeting point with Sc, although curved and dipping somewhat; membrane with distinct intervenational streaking between longitudinal veins (pl. 1, figs. 1, 4, 5) 4
4. Antennae brownish black for basal 17 segments (approximately), then pale yellowish for about 15 segments, and fuscous for 5 or 6 terminal segments; forewing 3.7 to 5 mm. long and approximately 1.7 mm. wide; lateroventral halves of ninth tergite of female small, ovate; male claspers long, narrow, smoothly curved, distally of more or less even width (fig. 16; pl. 1, fig. 1).
apicalis Banks (p. 471)
- Antennae brown; forewing 3.8 to 4 mm. long, and approximately 1.4 mm. wide; lateroventral halves of ninth tergite of female "pear-shaped," elongate; male claspers stout, with long setae (fig. 17; pl. 1, fig. 4).
panama, new species (p. 474).

NOTE: Because of the discovery that the type of *nocturna* now consists only of a left forewing and right hindwing (both torn) which do not differ essentially from those of *apicalis* (r-m and s being variable to a certain extent), it is inadvisable to differentiate further between the two species here (see *nocturna*, p. 476, and *apicalis*, p. 471).

Sisyra vicaria (Walker)

FIGURE 14; PLATE 1, FIGURE 3

Hemerobius vicarius Walker, 1853, p. 297 (Georgia).

Sisyra vicaria Hagen, 1861, p. 197.—Banks, 1905, p. 25.—Carpenter, 1940, p. 254.

Sisyra umbrata Needham, 1901, p. 555, pl. 12 (figs. 6-8, 11), text figs. 33, 34b, 36 (Saranac Inn, N. Y.; Lake Forest, Ill.).—Banks, 1905, p. 25.

Head with vertex usually yellow, occasionally some brown, narrow median blackish streak over coronal sulcus from posterior margin to midvertex usually distinct, usually a narrow blackish ring around antennal sockets; face yellowish; palpi yellowish to brownish; basal two antennal segments usually brown, remaining segments yellowish to end or brown for 18 segments (approximately) and then yellowish to end (approximately 42–50 segments altogether); legs yellow with coxae brown and sometimes femora and tibiae with some brown; notum medium brown, pleura brown; abdomen brown.

FOREWING (pl. 1, fig. 3): Average length female 5.5 mm., male 5.4 mm., average width female 2.4 mm., male 2.3 mm.; apex slightly asymmetrical with respect to longitudinal axis of wing; membrane more or less uniformly light brown (with occasionally a few indications of faint light brown streaks particularly near cubital and medio-cubital areas toward inner margin); longitudinal and cross-veins brown; pterostigma slightly darker than membrane; R2 forked basad of or at level of junction of Sc and R1; R3 and R4+5 usually not forked as deeply from margin, although R4+5 sometimes with terminal fork near level of junction of Sc and R1; MP1+2 usually forking into two even branches to margin; Cu1 with three to five branches to margin; approximately 12–15 costal cross-veins before pterostigma; usually three radial cross-veins, 1st r above and usually near midpoint of free stem of Rs, 2d r above R2 near forking of R2 and R3, and 3d r below pterostigma to R2 or R2 terminal fork (in rare cases where fork is lacking); sometimes a 2d or even 3d (rarely) r-m present; marginal forking well-developed.

HINDWING (pl. 1, fig. 3): Average length female approximately 5 mm., male 4.6 mm., width female approximately 2.2 mm., male 2 mm.; membrane almost hyaline with pterostigma slightly darker brown than membrane; venation brown; R2, R3, and R4+5 usually with terminal forks distad of level of point of coalescence of Sc and R1; about three to seven branches of Cu1 to margin; two radial cross-veins, 1st r slightly distad of forking of R2 and R3 from Rs; 2d r to R2 or R2 fork under pterostigma near margin; marginal forking well developed.

MALE GENITALIA (fig. 14,A,B): Eighth tergite with central portion short; two parts of ninth tergite small, more or less triangle shaped; tenth sternite with basal plate almost as long as claspers; claspers short, squat, curved, with sharp angular drop to terminal conical narrow portion, which is about one-third as wide as broad basal part of clasper, two setalike projections at end of each clasper; parameres "boot shaped."

FEMALE GENITALIA (fig. 14,C): Eighth tergite longer just above spiracle, shorter just below spiracle, then lengthening ventrally;

TABLE 7.—*Species of Sisyra in the world*

| Zoogeographic Regions (Wallace) | Distribution | Species and original reference |
|---------------------------------|---|--|
| Neartic | North America United States United States; Canada; Alaska United States; Canada | <i>apicalis</i> Banks (1908, p. 261) <i>fuscata</i> (Fabricius) (1793, p. 84) <i>ticaria</i> (Walker) (1853, p. 297) |
| Neotropical | West Indies Cuba Central America Panamá British Honduras South America Brazil | <i>apicalis</i> Banks (1908, p. 261) <i>apicalis</i> Banks (ibid.); <i>panama</i> , new sp. <i>nocturna</i> Navás (1932, p. 115) <i>minuta</i> Esben-Petersen (1935, p. 152) |
| Palearctic | Europe Austria, Belgium, British Isles, Finland, France, Germany, Netherlands, Norway, Russia, Sardinia, Sweden, Switzerland Netherlands, Scandinavia to Spain and Portugal. Denmark, Finland, Germany Belgium, British Isles, Netherlands, Scandinavia to Spain and eastward to Carpathians; doubtfully recorded from Upper Egypt by Esben-Petersen (1915, p. 84)* China Chekiang, Chusan Japan** Kozuka Province Ohmi Province | <i>fuscata</i> (Fabricius) (1793, p. 84) <i>dalii</i> (McLachlan) (1866, p. 268) <i>jutlandica</i> Esben-Petersen (1915, p. 175) <i>terminalis</i> Curtis (1854, p. 56) <i>aurorae</i> Navás (1933, p. 13) <i>ozenumana</i> Nakahara (1914, p. 495) <i>yamamurai</i> Nakahara (1914, p. 496) |
| Ethiopian | Africa Cape Province; Natal Madagascar | <i>afra</i> Kimmins (1935, p. 561) <i>radialis</i> Navás (1910, p. 80) |
| Oriental | India Salsette Island Calcutta | <i>aquavivai</i> Navás (1929a, p. 52) <i>fasciata</i> Navás (1930, p. 44) <i>indica</i> Needham (1909, p. 206) |
| | East Indies Java | larva like <i>fuscata</i> (Esben-Petersen, 1933, p. 626) |
| | Philippine Islands Luzon | <i>rigana</i> Navás (1923, p. 8) <i>bakeri</i> Banks (1913, p. 215) |
| Australian | Australia Queensland Queensland; Northern Territory New South Wales New South Wales North Australia | <i>brunnea</i> Banks (1909, p. 76) <i>punctata</i> Banks (1909, p. 77) <i>brunnea</i> var. <i>rufistigma</i> Tillyard (1916, p. 314) <i>turneri</i> Tillyard (1916, p. 314) <i>esben-peterseni</i> Handschin (1935, p. 609) |

*One specimen of *Sisyra* sp. near *terminalis* from the Sudan has been examined (in CNHM).

**If the genus *Sisyrella* proves to be a synonym of *Sisyra* upon further investigation, the species *japonica* Nakahara (1914, p. 493) from Osaka and *nikkoana* Nakahara (1911, p. 398) from near Tokyo might also be included here.

ninth tergite with each lateroventral half large, longitudinally elongate, with one anterior and one posterior articulation ridge, dorso-proximal margin shaped like a bird's head, dorsal border gradually sloped from proximal to distal border, ventral margin rounded.

LECTOTYPE: A male (pinned) from Georgia (John Abbot); BM; by present designation.

LECTOALLOTYPE: A female (pinned) with same data; BM; by present designation.

Carpenter (1940, p. 254) mentioned two cotypes from Georgia.

Upon corresponding with D. E. Kimmins (BM), it was learned that the two specimens were male and female and the suggestion was made by Kimmins that the male be designated the lectotype. According to Kimmins, both are Abbot specimens and bear labels "with the word 'Type' within a green ring (the distinguishing mark of a Walker type), and a very small label 'Georgia.'"

Records⁶ show that John Abbot (1751-183(9)?) came from England to Virginia in about 1773, and arrived in Georgia about 1776. Most of his life was spent in Burke, Screven, and Bulloch Counties, although some time was spent in Savannah. He resided for several years at Jacksonborough (which town disappeared before 1880) on Beaver Dam Creek, in Burke County, part of which in 1793 was combined with part of Effingham County to form Screven County. In 1806 Abbot was listed as a taxpayer in Savannah. In 1820 he lived in Bulloch County on the west side of the Ogeechee River (across from Screven County and about a day's journey by wagon from Savannah).

The type material of *umbrata* in the Cornell University collection was examined and found to be identical with *vicaria*. This species was described from specimens collected at Lake Forest, Ill., June 1899, and at Saranac Inn, N. Y., June 28 to July 16, 1900 (Needham, 1901, p. 555). Since Needham did not designate a type for *umbrata*, a male from Lake Forest, Ill., June 2, 1899, is here designated the lectotype; and a female, bearing the same data is designated the lectoallotype. Lectoparatypes are designated as follows: 2 specimens (June 27, 1899), 1 wing (June 29, 1899) from Lake Forest, Ill., and 225 specimens (July 9, 1900) from Saranac Inn, N. Y. Topotypes from Lake Forest, Ill., include 2 larvae (July 2, 1899) and 60 specimens (July 4, 1900), "hatchery ceiling." Other vials containing specimens of *umbrata* which may have originally been type material are not included because of insufficient data.

In the Museum of Comparative Zoology there are two specimens (on the same pin) from Saranac Inn, N. Y., Aug. 8, 1900 ("cotypes," Carpenter, 1940, p. 255). These were examined and one (a male)

⁶ Bassett, Auk, vol. 55, pp. 244-254, 1938; Dow, Journ. N. Y. Ent. Soc., vol. 22, pp. 65-72, 1914; Allen, Trans. Amer. Phil. Soc., new ser., vol. 41, pp. 543-549, 1951.

was found to be *fuscata*, the other is a *vicaria*. Since the date does not fall within the dates published by Needham, the specimen of *vicaria* is here designated a topotype of *umbrata*. It is not surprising that one *fuscata* among hundreds of *umbrata* types should be overlooked. The "cotype" of *umbrata* from Mosholu, N. Y., mentioned by Banks (1905, p. 25) was not found labeled as a "cotype," but a specimen of *vicaria* from this locality was seen in the collection of the Museum of Comparative Zoology.

DISTRIBUTION (specimens examined): *United States*: Arizona. District of Columbia. Florida: Alachua County; Jacksonville; Paradise Key. Georgia: Dalton (7 miles south of Swamp Creek); Gordon;

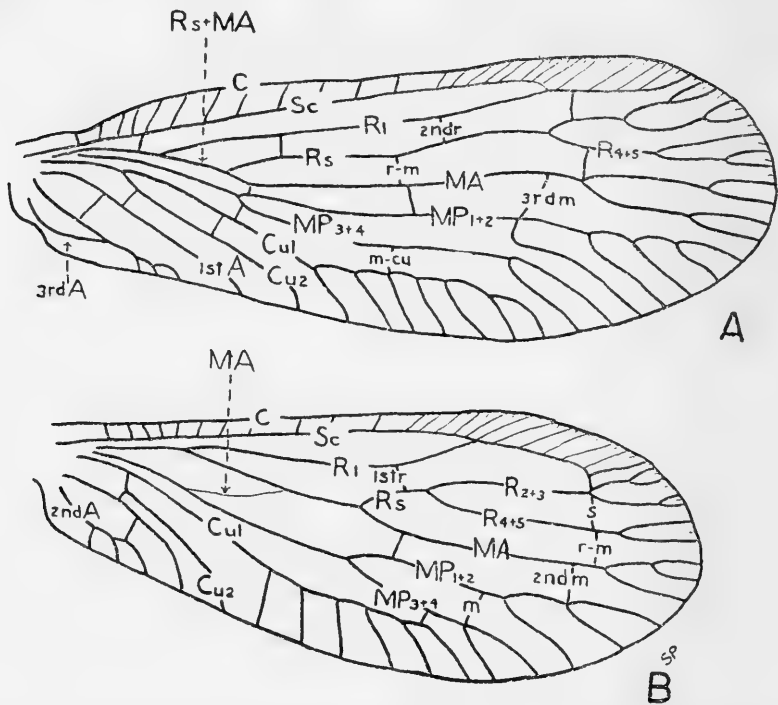


FIGURE 11.—Wing venation of *Climacia areolaris* (Hagen). A, forewing; B, hindwing. Abbreviations as in figure 10.

Okefenokee Swamp (Billy's Island). Illinois: Danville; Dunes Park; Karnak (Horseshoe Lake); Lake Forest; Mason County (Matanzas Lake); North Chicago; Rosecrans (Des Plaines River); Winnetka. Indiana: Shelby (around bayou of Kankakee River). Kansas: Hodgeman County. Kentucky: Carter County; Harlan County; Nolansburg. Maine: Augusta; Camp Colby; Chesuncook; Houlton; Jackman; Kokadjo; Millinocket; Oquossoc; Patten; Princeton; Seboomook; Tim Pond. Maryland: Cabin John; Great Falls; High

Island. Massachusetts: Holliston; Mount Toby; Revere Beach. Michigan: Ann Arbor; Cheboygan County (Burt Lake; Douglas Lake; Mullet Lake; Nigger Creek); Livingston County (E. S. George Reserve). Minnesota: Browns Valley; Cass County; Crookston; Florian (Tamarac River); Hallock; Isle; Itasca Park; Marshall County; Stephen (Tamarac River). New York: Canajoharie; Canadarago Lake; Hamburg; Herkimer; Ithaca; Long Island (Calverton and

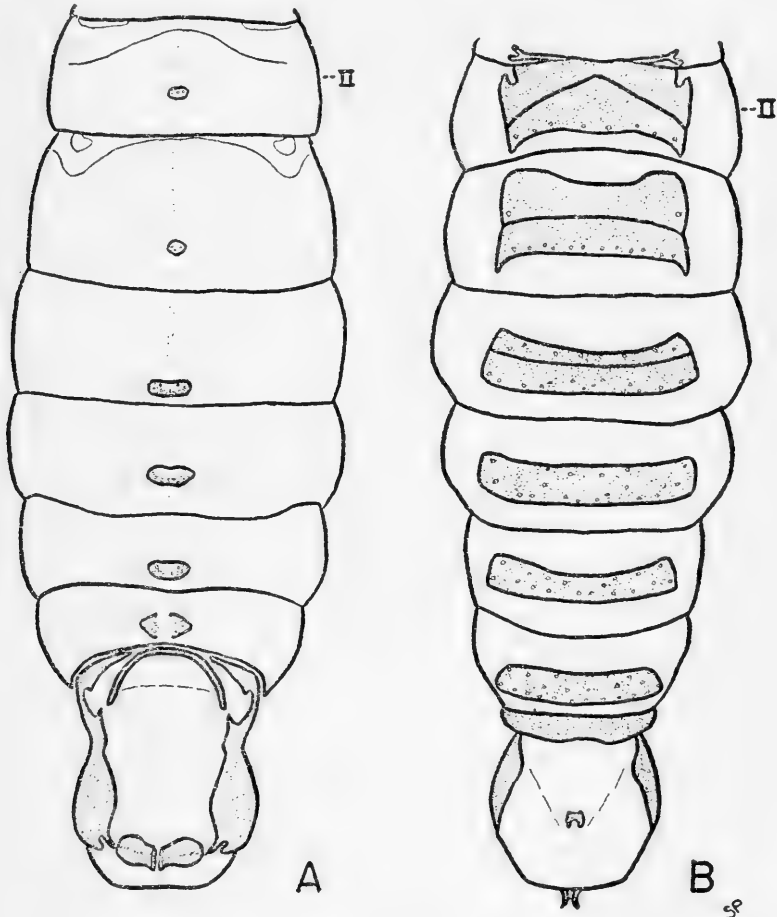


FIGURE 12.—Abdomen of *Climacia areolaris* (Hagen), female. A, dorsal view; B, ventral view.

Riverhead); Milford Center; Millwood; Mosholu; Mount Marcy (Heart Lake, altitude 2,150 ft.); Otsego Lake; Saranac Inn; Spencer; Sport Island (Sacandaga River); Sprakers; Tompkins County (McLean Bogs Reserve); Westchester County. Oklahoma: Albion. Oregon: Gold Hill. Rhode Island: Westerly. Tennessee: Clarksville. Texas: Colorado County; Hunt (Guadalupe River); San An-

tonio. Virginia: Great Falls. Washington: Chattaroy (Little Spokane River). Wisconsin: Boulder Junction (Nanotowish River below Boulder Lake); Trout River. Canada: British Columbia: Kaslo (Lilypad Lake); Lillooet (Seton Lake); Sardis (Cultus Lake). Nova Scotia: Annapolis Royal. Ontario: Biscotasing; Lake Muskoka; Ottawa; Rideau River (Black Rapids). Quebec: Knowlton; Lacolle.

The specimens examined were collected from April 9 to October 7. *S. vicaria* is the most common Nearctic species of *Sisyra*, although from the region west of the Rocky Mountains there are records only from Arizona, Oregon, Washington, and British Columbia.

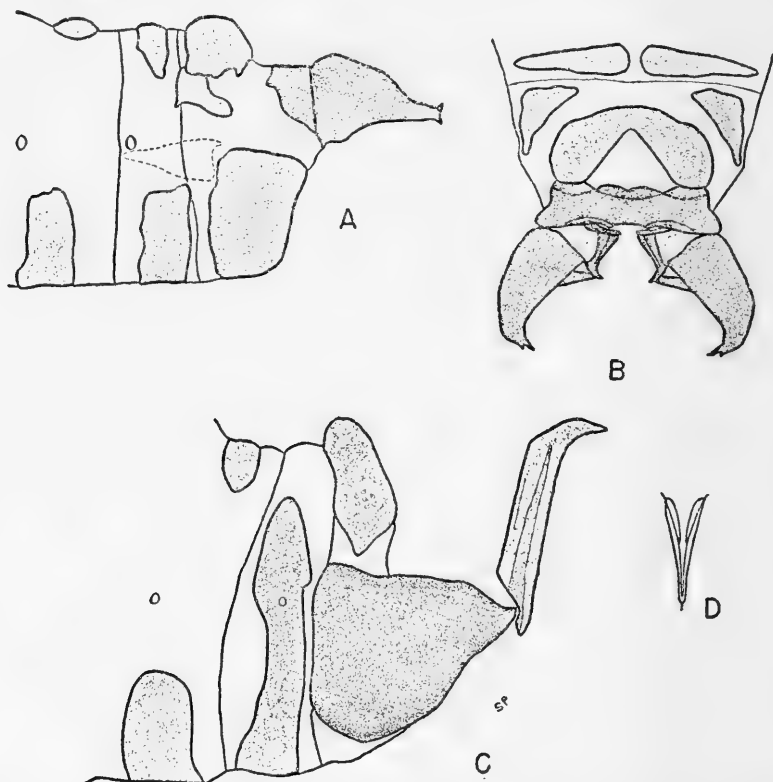


FIGURE 13.—Terminal abdominal segments of *Sisyra fuscata* (Fabricius). A, male, lateral view; B, male, dorsal view; C, female, lateral view; D, male, hypandrium.

S. vicaria and *S. fuscata* have been noted to coexist in the following localities: Augusta, Maine; Douglas Lake and Livingston County (E. S. George Reserve), Mich.; Cass County and Itasca Park, Minn.; Milford Center and Saranac Inn, N. Y.; and Biscotasing, Ontario. *S. vicaria* and *S. apicalis* have been taken from Paradise Key (Royal Palm State Park), Fla.

Specimens recorded as *vicaria* but which were not examined include those recorded by Carpenter (1940, p. 254) from North Carolina

(Raleigh) and Pennsylvania, and by Spencer (1942, p. 26) from Agassiz, British Columbia. Records for *vicaria* from localities from which specimens of *fuscata* have been examined include those by Banks (1905, p. 25) from Detroit, Mich., and by Carpenter (loc. cit.) from Kaslo, British Columbia; Go Home Bay, Ontario; and Detroit, Mich.

S. vicaria is readily distinguished from both *fuscata* and *apicalis* (with which it has been confused in North America) by the genitalia, larger size, color, and the usual position of the R2 terminal fork basad

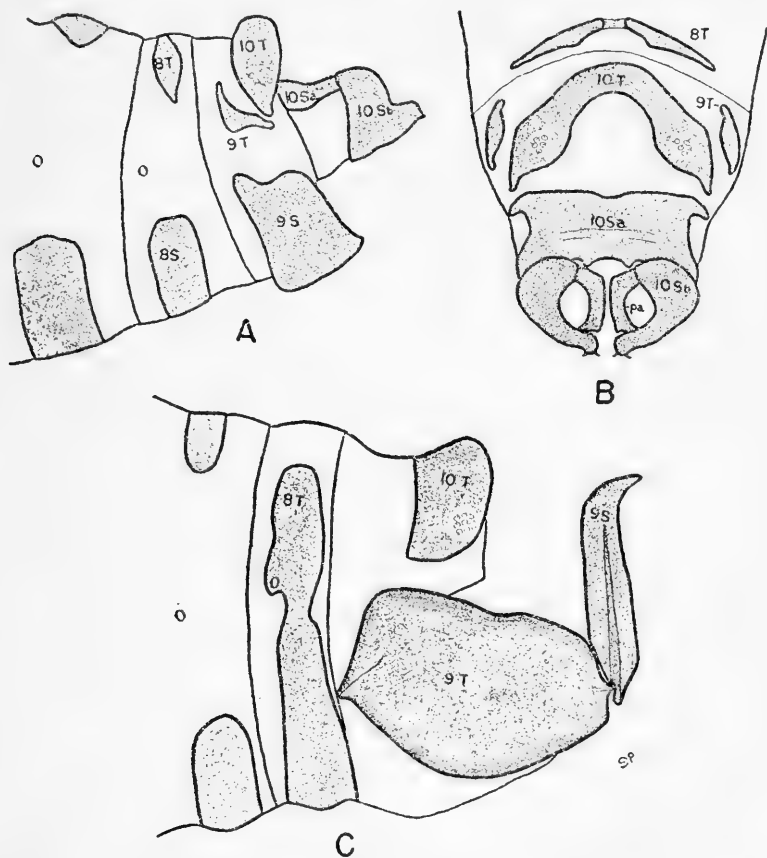


FIGURE 14.—Terminal abdominal segments of *Sisyra vicaria* (Walker). A, male, lateral view; B, same, dorsal view; C, female, lateral view. Abbreviations: pa, paremeres; S, sternite; Sa, anterior plate of sternite; Sb, claspers; T, tergite.

of the level of junction of Sc and R1 (in over 95 percent of specimens examined) in the forewing. It is also separated from *fuscata* through the more asymmetrical apex of the forewing, and from *apicalis* by the comparative lack of longitudinal intervenational streaking and the possession of 3d r in the forewing and 2d r in the hindwing.

Sisyrta fuscata (Fabricius)

FIGURE 13; PLATE 1, FIGURE 2

- Hemerobius fuscatus* Fabricius, 1793, p. 84 (Denmark).—Stephens, 1836, p. 114, pl. 30, fig. 4.—Walker, 1853, p. 296.
- Hemerobius nitidulus* Stephens (not Fabricius), 1836, p. 114 (England).—Hagen, 1858, p. 25.
- Hemerobius confinis* Stephens, 1836, p. 115 (England).—Hagen, 1858, p. 25.
- Sisyrta fuscata* Burmeister, 1839, p. 976.—Wesmael, 1841, p. 213.—Hagen, 1858, p. 25.—McLachlan, 1868, p. 167.—Navás, 1935, p. 43.—Killington, 1936, p. 230.
- Sisyrta fuscata* var. *nigripennis* Navás, 1935, p. 44.
- Sisyrta morio* Burmeister, 1839, p. 976 (Germany).—Hagen, 1866, p. 460.
- Sisyrta nigripennis* Wesmael, 1841, p. 213 (Belgium).—Hagen, 1866, p. 460.
- Branchiotoma spongillae* Westwood, 1842, p. 105, pl. 8 (larva only).—Hagen, 1851, pp. 185–186; 1866, p. 388.
- Hemerobius fumatus* Motschulsky, 1853, p. 20 (Russia).—Hagen, 1866, p. 412.

Head with vertex blackish brown, shining, narrow median blackish streak over coronal sulcus usually not pronounced; face blackish brown with the exception of the clypeus and labrum, which are yellowish; palpi brownish; antennal segments brownish black to black, of approximately 46 segments; legs yellowish to light brownish with mesothoracic and metathoracic coxae brown; thorax blackish brown; abdomen blackish brown.

FOREWING (pl. 1, fig. 2): Average length female 5 mm., male 4.7 mm., average width female 2.1 mm., male 2 mm.; apex rounded, oval; membrane more or less uniformly light brown (sometimes faint indications of light brown streaks, particularly near cubital area toward inner margin); longitudinal veins brown; pterostigma slightly darker than membrane; R2 usually not forked basad to level of junction of Sc and R1; R4+5 usually forked more deeply from margin than R3, distad to or at about level of junction of Sc and R1; MP1+2 usually forking into almost even branches to margin; Cu1 with 3–5 branches to margin; approximately 11–15 costal cross-veins before pterostigma; usually three radial cross-veins; 1st r above and near midpoint of Rs (occasionally near fork of R4+5 from Rs), 2d r usually above R2 near forking of R2 and R3 before fork (occasionally to Rs) and 3d r to R2 or R2 terminal fork, below pterostigma; marginal forking well-developed.

HINDWING (pl. 1, fig. 2): Average length female approximately 4.3 mm., male 4.2 mm., average width female 2 mm., male 1.8 mm.; membrane almost hyaline, tinted with light brown, pterostigma darker brown; R2, R3, and R4+5 with terminal forks usually distad of level of junction of Sc and R1; R2 and R4+5 usually forked more deeply than R3; MA forked basad of above point; Cu1 with about 4–6 branches to margin; usually two radial cross-veins, 1st r slightly

distad of forking of R2 and R3 from Rs; 2d r to R2 or R2 fork under pterostigma near margin; marginal forking well-developed.

MALE GENITALIA (fig. 13, A,B,D): Eighth tergite appearing divided in two with almost invisible median portion; two parts of ninth tergite small, irregularly shaped, usually with a narrow posteroventral projection; tenth tergite with irregular lateroventral margins; ninth sternite large, long, heavily setose, almost rectangular; tenth sternite with short basal plate, less than half as long as claspers; claspers moderately long, thick at base, with rounded curve preceding terminal

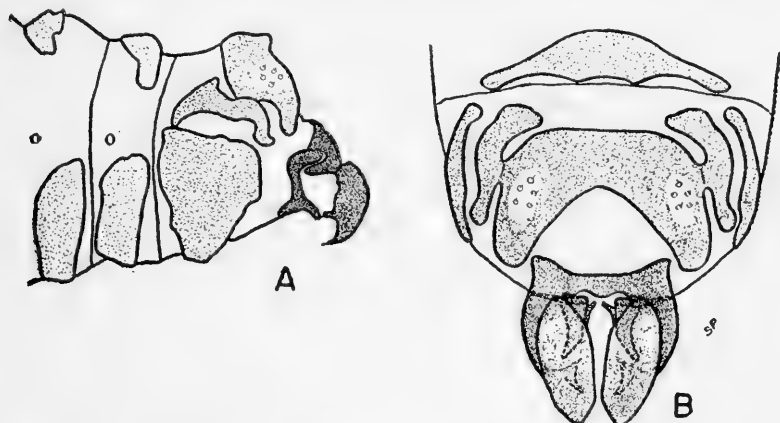


FIGURE 15.—Terminal abdominal segments of *Sisyra minuta* Esben-Petersen, male, holotype. A, lateral view; B, dorsal view.

portion which tapers almost to a point, two distal toothlike projections at end of each clasper; parameres "leglike," broad anterodorsally, then narrowing, becoming more twisted and diverging into terminal "foot" with "toes" pointing medially toward bases of claspers.

FEMALE GENITALIA (fig. 13, C): Eighth tergite short dorsally, lengthening above and shortening around spiracle and then gradually lengthening ventrally; ninth tergite with each lateroventral half large, more or less triangle shaped with one posterior articulation ridge, greatest width at proximal border, dorsal border sloping obliquely posteroventrally, ventral margin distinctly rounded; tenth tergite tapering strongly lateroventrally.

HOLOTYPE: A female (pinned), labeled *Hemerobius fuscatus* Fabricius; in Universitetets Zoologiske Museum, Copenhagen (Dania D. de Sehestedt).

The holotype, kindly examined by Dr. S. L. Tuxen of the Universitetets Zoologiske Museum, bears a label with only the name *H. fuscatus* on it. Dr. Tuxen wrote: "But that seems always to be the case when the insects were collected by Sehested(t) or Tønder Lund

themselves in Denmark, then they did not give the locality name on the label." Fabricius (1793, p. 84) gave "Habitat in Dania D (om) de Sehestedt" with his description.

The holotype has both metathoracic legs and the apices of all four wings missing; otherwise the specimen is in "good condition" according to Dr. Tuxen. A sketch of the forewing by Dr. Tuxen shows that R2 and R3 both have terminal forks distad to and MA at about the level of the junction of Sc and R1; r-m runs from R4+5 to MA.

DISTRIBUTION (specimens examined): *United States*: Maine: Augusta; Bar Harbor; Indian Town. Massachusetts: Mount Toby. Michigan: Detroit; Douglas Lake; Livingston County (E. S. George Reserve); Pinckney; Twin Lakes (Houghton County). Minnesota: Cass County; Itasca Park. New York: Milford Center; Saranac Inn; Sport Island (Sacandaga River). Wisconsin: Minong; Palmyra; Spooner (Namakagon River). *Canada*: British Columbia: Kaslo; Lillooet (Seton Lake). Ontario: Biscotasing; Go Home Bay; Honey Harbor; Lake of Bays. Quebec: Perkins Mills; Thunder River. *Alaska*: Chitina; Gulkana River; Matanuska.

S. fuscata is widely distributed and is the only sisyrind known at present to occur in both the Nearctic and Palaearctic regions. These represent the first Nearctic records. Thus far it has been taken in the northern part of the United States only as far west as Minnesota, but from coast to coast in southern Canada. In Europe its range is from Great Britain in the west across to and reaching Russia in the east, from Norway in the north down to Spain and Sardinia in the south. The adults examined were collected from May 30 to August 30 in North America.

The Alaskan specimens and some of the Palaearctic specimens examined were noted to possess somewhat longer and more slender claspers and to be somewhat darker. However, because of variations shown by individual specimens in each region, nominal varieties are not here recognized. Navás (1935, p. 44) recognized var. *nigripennis* Wesmael for the darker, more blackish forms of Europe.

The synonymy of *fuscata* is complicated. Degeer (1771, p. 713, pl. 22, figs. 8-11) described "*Hemerobe velu noir*," which Retzius (1783, p. 59) later placed under the name *Hemerobius niger*. Olivier (1792, p. 64) also gave a description for *Hemerobius niger* based on Degeer's species. Burmeister (1839, p. 976) placed Degeer's species in synonymy with *S. fuscata*. Walker (1853, p. 296) considered *niger* a synonym of *fuscata*. Since *Hemerobius niger* ("*Hemerobe velu noir*" of Degeer) was described in 1783, before Fabricius' description of *fuscatus* in 1793, the former would seem to be the valid name on the basis of priority. However, upon attempting to locate Degeer's

type of "*Hemerobe velu noir*," Dr. René Malaise of the Riksmuseum, Stockholm, kindly replied that "out of seven species labelled in the DeGeer collection under the genus *Hemerobe* the *velu noir* is the only one lacking an insect. The type must have been missing already when the collection was rearranged more than (one) hundred years ago (in 1844), as there is no pin-hole under the name." In this paper, *Hemerobius niger* is not recognized because of its doubtful status, but the well known name of *Sisyra fuscata* is recognized instead.

Concerning the other synonyms (*confinis*, *fumatus*, *morio*, *nigripennis*, and *nitidulus*) (Killington, 1936, p. 230; Navás, 1935, p. 43) it was not possible to procure the types and compare them, since they are variously located. The descriptions, however, appear to agree with *fuscata*. It is not definitely known whether Westwood's larva of *Branchiotoma spongillae* was compared with the other British species of *Sisyra* (*dalii*, *fuscata*, *terminalis*) and found to be *fuscata*.

S. fuscata, the darkest species of *Sisyra*, is readily distinguished from *vicaria* and *apicalis* by the characters pointed out in the key.

Sisyra apicalis Banks

FIGURE 16; PLATE 1, FIGURE 1

Sisyra apicalis Banks, 1908, p. 261 (Havana, Cuba).—Navás, 1935, p. 66.

Head with vertex from yellowish to dark brown, usually a narrow black ring around antennal sockets, coronal sulcus from posterior margin to midvertex sometimes indistinct; face light brown to yellowish; palpi yellowish to brownish; basal antennal segments light brown to blackish, the following 17 segments (approximately) blackish brown, the next 15 (approximately) yellow and the 3-5 terminal ones fuscous (about 36-38 segments altogether); legs yellow, with some brown occasionally, mesothoracic and metathoracic coxae brown, prothoracic coxae lighter; thorax dark brown; abdomen dark brown or blackish.

FOREWING (pl. 1, fig. 1): Average length female 4.4 mm., male 4.3 mm., average width female 1.7 mm., male 1.6 mm.; membrane with distinct brown intervenational streaks margined with pale adjacent to longitudinal veins; sectoral branches with terminal forks near margin usually far distad of level of junction of Sc and R1; MA with terminal fork which may be basad to above point; MP1+2 with even fork to margin; Cu1 with 4-6 parallel branches to margin; approximately 10-12 (11 most common) costal cross-veins before pterostigma; usually two radial cross-veins (rarely only one), or with a third cross-vein close to 2d r (irregular), 1st r usually basal to midpoint of free stem of Rs, 2d r near point of forking of R2 and R3; 1st r-m from R4+5 to MA (near where it separates from Rs), Rs, or to fork.

HINDWING (pl. 1, fig. 1): Average length female 3.8 mm., male 3.75 mm., average width female about 1.5 mm., male 1.4 mm.; membrane almost hyaline, faintly tinted with light brown at margin; pterostigma slightly darker than membrane; R2, R3, and R4+5 usually with terminal forks not basad of level of junction of Sc and R1; MA with deeper fork; MP1+2 with an irregular marginal fork usually; Cu1 with 5-7 branches to margin; usually one radial cross-vein, with position varying from point of forking of R2 and R3, along R2, or Rs just basad of fork.

MALE GENITALIA (fig. 16,A,B): Eighth tergite appearing almost divided in two; two parts of ninth tergite small, more or less rounded; ninth sternite moderately large, heavily setose; tenth sternite with basal plate short, about one-eighth as long as claspers, lateroventral margins tapering; claspers long, smoothly and gradually curved, of almost equal width from about two-thirds of length to end; both of parameres in two pieces, the basal piece much longer.

FEMALE GENITALIA (fig. 16, c); Eighth tergite short dorsally, lengthening to spiracle, then shortening ventrally, anterior and posterior margins irregular; ninth tergite with each lateroventral half ovate, longitudinally elongate, approximately three-fourths as broad as long, with one posterior sclerotized articulation ridge, dorsal border almost convex; ninth sternite with halves blunt at apex with thin dark brown line outlining dorsal margin of apex in form of a recurved hook.

HOLOTYPE: A female (pinned) from Havana, Cuba, collection of N. Banks; MCZ.

The holotype is complete except for a broken left antenna (of 11 segments; 36 in right antenna). The vertex is dark brown, and the basal two antennal segments are brown; in the forewing 1st r-m runs to R4+5 and Cu1 has five branches running to the margin. It was probably collected by C. F. Baker, according to Banks (1908, p. 261), although the label on the type did not state so.

ALLOTYPE: A male (pinned) from Soledad, near Cienfuegos, Cuba, "6-20-viii (N. Banks)"; MCZ; by present designation.

The allotype has both antennae broken (approximately four segments remaining in the left and five in the right) and the tip of the abdomen slightly mashed.

DISTRIBUTION (specimens examined): Cuba: Cayamas; Soledad (near Cienfuegos); Havana. Florida: Fruitville; Hardee County; Marion County; Palm Beach; Paradise Key; Winter Park. Georgia: near Savannah. Panamá: Canal Zone; Coclé; Pedregal; Tapagra; Tocumén.

The adults examined were collected from January through December 16. A male was taken at Miami on aircraft direct from Tegucigalpa to Miami on Mar. 4, 1954, indicating that this species is

probably found in Miami also. There is a possibility that *apicalis* may occur in other southern states and in other sections of Central America and the West Indies. It is uncommon in the United States.

This species belongs to that Neotropical group of *Sisyr*a—which contains the smaller species (*apicalis*, *nocturna*, *panama*, but not *minuta*)—characterized by having forewings which show distinct intervenational streaking, two radial cross-veins, and the basal segment of the antenna more smoothly curved on the inner margin and more elongate, and the venation slightly less extensive. The *apicalis*

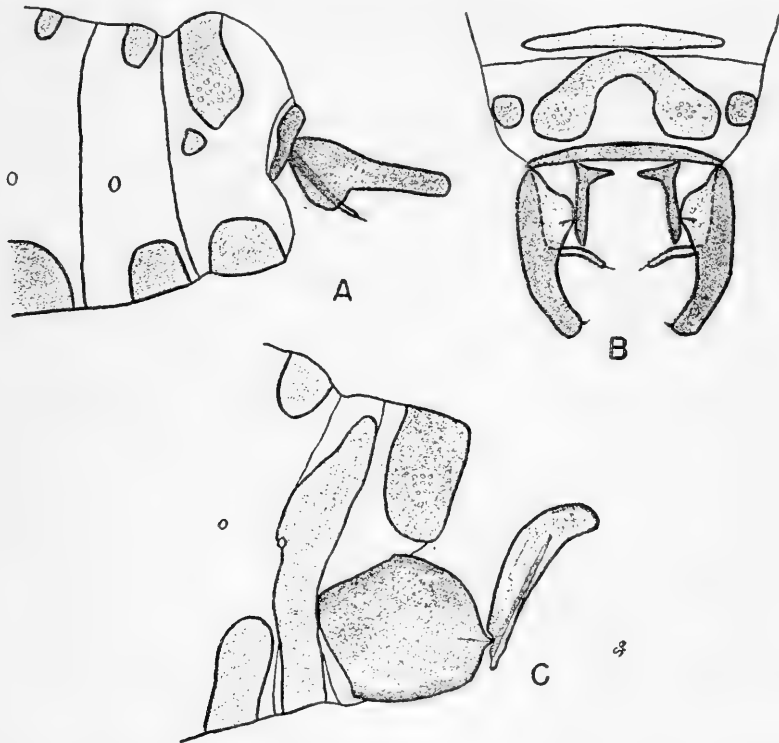


FIGURE 16.—Terminal abdominal segments of *Sisyra apicalis* Banks. A, male, lateral view; B, same, dorsal view; C, female, lateral view.

group might perhaps justifiably be placed in another genus; however, since the longitudinal veins, palpi, and other morphological features are otherwise so similar to *vicaria* and *fuscata*, they are left in *Sisyra*. *S. apicalis* can be separated from the other Neotropical species by the striking antennal coloration, the slightly larger size, and the genitalia.

Specimens of *apicalis* from Panamá are smaller (average wing length 3.7 mm., width 1.3 mm.) than the Florida specimens; also, the male claspers are slightly longer than in those from Florida.

Sisyra panama, new species

FIGURE 17; PLATE 1, FIGURE 4

FEMALE (holotype): Head with vertex yellowish brown with some dark brown behind antennae, narrow median blackish streak over coronal sulcus from posterior margin to midvertex pronounced; face yellow; palpi yellowish; basal antennal segment yellow dorsomedially and ventromedially, brown laterally, rest of antennae yellowish to light brown (of at least 36 segments); legs yellow to yellowish brown, mesothoracic and metathoracic coxae brown; thorax brown; abdomen brown.

FOREWING (pl. 1, fig. 4): Length 4 mm. width 1.4 mm.; apex rounded, oval; membrane with distinct intervenational brown streaks margined with pale adjacent to longitudinal veins; pterostigma brown, with faint elongate pale spot over central portion; Rs forking basad of longitudinal center of wing, first giving off R4+5, then R2+3, separating from Rs a short distance beyond, at about level of 2d r; sectoral branches forking near margin, far distad of level of junction of Sc and R1; MA, MP1+2, and MP3+4 with terminal forks at about or basad of junction of Sc and R1; MP1+2 with uneven fork to margin, the first branch far removed from the second; Cu1 with four branches to margin; 12 costal cross-veins before pterostigma in right wing, 11 in left; two radial cross-veins, 1st r slightly basad of midpoint of free stem of Rs, 2d r at about longitudinal midpoint of wing at forking of R2 and R3; one sectoral cross-vein from R4+5 to R3 slightly distad of separation of R2 and R3; one radiomedial cross-vein, 1st r-m from R4+5 to MA; marginal forking scantily developed.

HINDWING (pl. 1, fig. 4): Length 3.7 mm., width 1.3 mm.; membrane almost hyaline, tinted with brownish shading along apical margin, with light brown intervenational streaking along outer and inner margin to Cu1 branches; pterostigma brown; Rs giving off R4+5 slightly distad of center of wing, the R2 and R3 fork typically separating from Rs a short distance beyond; MA, MP1+2, and MP3+4 with usual deeper marginal forks; Cu1 with five branches to margin; one radial cross-vein, 1st r to R2; marginal forking scantily developed.

FEMALE GENITALIA (fig. 17,c): Eighth tergite shorter dorsally, lengthening around spiracular region and ventrally, anterior margin slightly convex; ninth tergite with each lateroventral half moderately elongate, more or less "pear shaped," broader at anterior margin, one posterior articulation ridge, basal and ventral borders rounded; tenth tergite shorter dorsally, with approximately seven trichobothria.

HOLOTYPE: A female (pinned) from Panamá, Caño Saddle, Gatún Lake, May 8, 1923 (R. C. Shannon); USNM 62258.

The holotype is lacking the left hindwing and tips of the antennae. Not all of the abdomen was dissected and the halves of the eighth tergite appear to have been accidentally broken posteroventrally. The right wings are on a slide.

Not to be confused with Canoa Saddles, Caño Saddle is sometimes given as Caño Saddles, and is located along the southwestern shore of Gatún Lake (about 7 miles southwest of Escobal and 13 miles southwest of Barro Colorado Island).

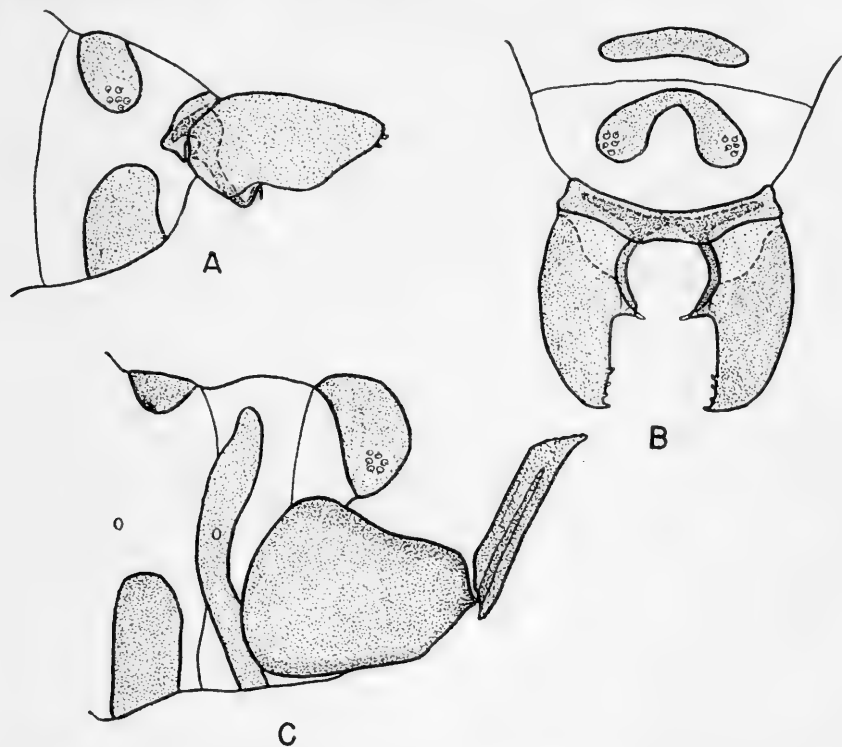


FIGURE 17.—Terminal abdominal segments of *Sisyra panama*, new species: A, male, allotype, lateral view; B, same, dorsal view; C, female, holotype, lateral view.

MALE (allotype): Similar to holotype. Forewing with r-m cross-vein between Rs and MA.

MALE GENITALIA (fig. 17,A,B): Tenth sternite with basal plate considerably shorter than claspers; claspers stout throughout length, with long setae and distal inner teeth; parameres with basal portions broadly triangular, distal portions narrow, caliperlike.

ALLOTYPE: A male from Farallón, Coclé Province, Panamá, Nov. 8, 1952, in light trap (F. S. Blanton); USNM.

The allotype is badly damaged. The antennae beyond the basal segments and three legs are missing. The right wings are on a slide, and the abdomen, left wings, head and thorax are in alcohol.

Sisyra panama is readily separated from *apicalis*, also found in Panamá, by the stouter male claspers, more pear-shaped lateroventral halves of the ninth tergite of the female, and brown antennae. The forewing differs from *apicalis* and *nocturna* in the more basal forking of R2+3 and pale area in the pterostigma. It is not known whether the sectoral cross-vein in both the holotype and allotype of *panama* is constant. *Sisyra panama* also differs from *apicalis* in the more extensive dark brown apical shading along the margin of the hindwing.

This is the third species of *Sisyra* to be recorded from Central America, the first, *nocturna*, having been taken in British Honduras, and the second, *apicalis*, in Panamá.

There is no difficulty in distinguishing *panama* from *minuta* (although similar in respect to the presence of the two radial cross-veins in the forewing and one in the hindwing) because of the dip where Sc approaches R1 apically, the absence of the brown streaking between the longitudinal veins, and the small size (3.2 mm. in *minuta*; 3.8–4 mm. for *panama*) in *minuta*.

Sisyra nocturna Navás

PLATE 1, FIGURE 5

Sisyra nocturna Navás, 1932, p. 115, fig. 76; 1932a, p. 155 (British Honduras); 1935, pp. 67–68, fig. 37.

Since the holotype (the only specimen of the species and kindly lent by Dr. Francisco Español Coll of Barcelona, Spain) consists only of a torn left forewing and a right hindwing, the original description is translated:

Body yellow.

Head fuscous above; eyes fuscous; palpi yellow.

Thorax with a broad longitudinal fuscous or fuscouslike band.

Apex of wings elliptical, strongly reticulated, rusty yellow hairs and fringe of the same color; stigma lightly rust-colored, divided by cross-veins.

Membrane of anterior wing (fig. 76) beyond the subcosta lightly stained with rust-color, pale adjacent to veins and branches, with pale rust-colored streaks between the veins and branches; costal area with 8–10 cross-veins, distal ones farther apart; radial sector arising near subcostal cross-vein, 3 long branches; procubitus divided beyond the place of the first branch of the sector, cubitus divided near base of wing; 2 radial cross-veins, one cross-vein between the first branch of the sector and the sector, 2 procubital, one cubital, with cubital cell 2a open.

Posterior wing paler, membrane only slightly stained with rust-color before the margins; radial sector with 3 branches, apex forked; procubitus forked at place of first branch; one intermediate cross-vein between the first branch and procubitus, one procubital, located far beyond intermediary.

Long. al. ant. 4'4 mm.

— — post. 3'6 mm.

Navás (1935, p. 67, fig. 37) translated the original description into Spanish with certain alterations and used the same figure. In the first line "with hairs of the same color" was added; second line, "head black above" instead of "fuscous." In the paragraph on the forewing, changes included: "beyond the radius" instead of "beyond the subcosta"; "between the veins," omitting "and branches"; omitted "3 long branches" and added "a cross-vein between the first and second branches"; "between the first branch of the sector and forking of the procubitus" instead of "between the first branch of the sector and the sector." In the paragraph on the hindwing, Navás omitted "radial sector with 3 branches, apex forked."

Examination of the type showed that the wings agreed essentially with the original description. The membrane of the forewing appears to be streaked from the subcosta to the inner margin as in the original description, not the radius as in the later description, and the costal area showed about 12 costal crossveins before the pterostigma. MA, MP1+2, MP3+4 have terminal forks basal to the level of junction of Sc and R1; MP1+2 has an even fork to the margin; there are five branches of Cu to the margin; 1st r is basad to the midpoint of the free stem of Rs, 2d r is near the longitudinal midpoint of wing at forking of R2 and R3; r-m is between Rs and MA; and 3d m-cu reaches Cu1 proximal to the fourth branch of Cu1. In the hindwing there is one radial cross-vein and seven branches of Cu1 to the margin.

Since neither of the wings is whole, it is not known how accurate the measurements of Navás are. The widths, however, appear to be about 1.8 mm. for the forewing and 1.7 mm. for the hindwing.

Neither collecting data nor type designation accompanied either description. In a supplement to the original in the same volume but in fascicle 4 of Brotéria, Navás (1932a, p. 155) included the following:

A la descripción de esta especie (p. 115) añádase lo siguiente: Patria. Honduras: Calas, 16-x-1893 atraído por la luz. Dr. Dampf leg.

Un ejemplar en muy mal estado que por esta razón había quedado en mi colección sin nombre, pero que ahora ha sido preciso describir de alguna manera.

Upon examination of the labels attached to the type specimen it was noticed that what apparently looked like "Calas" to Navás, appeared to be "Cacao," and that what Navás had interpreted as "1893," looked like "23" on the label. Investigation into the literature revealed that Alfonso Dampf had made collections at Río Cacao in British Honduras during the period of Oct. 15, 16, 18, 1925 (see E. Martini, Departamento de Salubridad Publ. Bol. Tecn., ser. A., No. 1, 65 pp., 11 figs., 1935). Dr. C. P. Alexander stated in a letter dated May 1952 that, after checking his earlier correspondence with Dampf, to the best of his knowledge Dampf was in British Honduras

only in 1925 or very late in 1924. Furthermore, in the supplement, Navás (1932, p. 155) stated that the specimen was caught "por la luz" when the label actually read "a la luz." Upon comparing the label with certain Dampf labels on mosquitoes in the U. S. National Museum, it appears possible that the locality label on the type could have been written by Navás himself, and not by Dampf. With the above evidence taken into consideration, the designation of the type locality is interpreted as follows:

HOLOTYPE: A specimen from Río Cacao, British Honduras, Oct. 16, 1925, at light (Dr. Alfonso Dampf); in the Instituto Municipal de Ciencias Naturales Museos, Barcelona, Spain.

Because the type specimen is reduced to the wings illustrated, it is impossible to check other features. Comparison of the descriptions with specimens of *apicalis* shows that the lengths of the forewings and hindwings, and color of the vertex are similar. The venation is also strikingly similar. Whether the broad longitudinal fuscous stripe over the thorax of *nocturna*, mentioned by Navás, is a significant character is not yet known; it has not been observed in the other species of *Sisyra*. It is possible that further collecting may show *nocturna* to be a synonym of *apicalis*.

Sisyra minuta Esben-Petersen

FIGURE 15; PLATE 1, FIGURE 6

Sisyra minuta Esben-Petersen, 1935, p. 152 (Taderinha, Brazil).

MALE (holotype): Head with vertex yellowish brown, narrow median blackish streak over coronal sulcus from posterior margin to midvertex distinct, narrow blackish ring around basal antennal segments; frons yellowish brown, clypeus and labrum yellow; palpi brownish; basal two antennal segments brown, rest yellow, of at least 31 segments; legs yellow; pronotum brown anteriorly, yellowish posteriorly, brown at anterior margin, with central blackish longitudinal streak, mesonotum and metanotum yellowish brown, mesothoracic and metathoracic pleura brownish yellow; abdomen brownish yellow.

FOREWING (pl. 1, fig. 6): Length 3.2 mm., width 1.3 mm.; membrane uniformly light brown with darker brown shading along apical margin; veins slightly darker than membrane with small black setal pits; R1 bent at an angle at junction with Sc, then dipping strongly toward R2; Sc appearing to run free to margin and joined by a cross-vein; sectoral branches and MA forking near margin far distad of level of junction of Sc and R1; MP1+2 and MP3+4 forked more deeply, usually basad of above point, MP1+2 with even fork to margin; Cu1 with two branches to margin; approxi-

mately nine costal cross-veins before pterostigma; two radial cross-veins, 1st r slightly distal to midpoint of free stem of Rs, 2d r slightly distal to longitudinal midpoint of wing; r-m from R4+5 to MA; marginal forking less extensive.

HINDWING (pl. 1, fig. 6): Length approximately 2.7 mm.; width 1.1 mm.; membrane almost hyaline, slightly tinted brownish, pterostigma slightly darker; sectoral branches with short terminal forks; MA, MP1+2 and MP3+4 with deeper marginal forks basad of level of point of coalescence of Sc and R1; Cu1 with three widely spaced branches to margin; marginal forking scanty.

MALE GENITALIA (fig. 15): Eighth tergite entire, broad, short, tapering lateroventrally; two parts of ninth tergite long, narrow, irregularly shaped, appearing almost united with tenth tergite; ninth sternite large, heavily setose, much longer laterodorsally than medioventrally; tenth sternite with basal plate about one-half length of claspers, anterior margin concave, lateral margins with deep incisions; claspers of moderate length, broad, shaped like a parrot's beak from lateral view, apices acute and directed medioventrally; parameres almost completely concealed by claspers, dorsal portion broad, central piece narrow and ventral portion tapering anteriorly and posteriorly.

HOLOTYPE: A male (pinned) from "Unt. Amaz. Taperinha b. Santarem, 1-10.viii.27, Zerny"; in Naturhistorisches Museum, Vienna, Austria.

Taderinha was misspelled to "Taperinha" on the type label. The collecting data for the type is thus interpreted: Brazil, Lower Amazons, Taderinha, near (approximately 20-25 miles east of) Santarem, August 1-10, 1927, collected by Dr. H. Zerny.

The holotype has the left antenna beyond the basal segment and the tip of the right antenna missing (31 segments remaining) and the right and left hindwings are torn below the apex. It was lent for study through the courtesy of Dr. Max Beier of the Naturhistorisches Museum.

The female is unknown.

This is the only South American species of *Sisyra* recognized thus far, and it is the smallest species. It is a very distinctive species, standing apart from others in a number of characters: its smallness, the angular bend and dip of R1 where it meets Sc, the free course of Sc to the margin, the two radial cross-veins coupled with the almost uniform membrane tinting and lack of intervenational streaking, the unusual male genitalia, and the entirety of the eighth tergite. Some of these features might suggest another genus. However, the palpi, pronotum, and venation in general are similar to other species of *Sisyra*. The angular bend of R1 under the pterostigma

appears to be so pronounced only in this species; since this is at present a unique specimen, the constancy of this character is unknown.

Genus *Climacia* McLachlan

Climacia McLachlan, 1869, p. 21.—Banks, 1905, p. 26.—Navás, 1935 p. 31.—Carpenter, 1940, p. 255.

Variegated spongilla-flies.

GENOTYPE: *Micromus areolaris* Hagen, by original designation of McLachlan (1869, p. 21).

HEAD (figs. 8,I; 9,B,D,G,H): Antennae sometimes with as many as 71 segments, two whorls of setae on all but basal segment, on which the setae are irregularly arranged; face longer than in *Sisyra*; clypeus sometimes giving appearance of being lobed; labrum usually bilobed, about $1\frac{1}{2}$ times as broad as long, setose (fig. 9,D); postoccipital margin of foramen convex medially, concave laterally on each side; maxillary palpi with basal two segments short, fourth slightly longer, third longer than first, second or fourth, fifth longest, narrow, more or less cylindrical, broadest at point about third of length, curved slightly laterally and acute at apex, galea terminally somewhat lobed, lacinia broader than that of *Sisyra*, stipes narrower and straighter than that of *Sisyra* (fig. 7,G); labium with postmentum and prementum distinctly separated by a membrane, and anterior and posterior plates of prementum also separated by a distinct membrane, anterior margin of posterior plate with median lobe, differing from *Sisyra* (fig. 7,H) labial palpi with third or terminal segment only slightly enlarged, more cylindrical, apex acute, similar to but smaller than terminal segment of maxillary palpi, second segment slightly longer than first; mandibles usually with a greater number of and longer bristles along both inner and apical surfaces than in *Sisyra* (fig. 9,G,H).

THORAX (fig. 8,E,J,K): Pronotum larger, smoother than that of *Sisyra*, and laterally more extended to overlap the cervicales and dorsal portions of pleural sclerites; laterocervicales larger and more prominent than in *Sisyra*, indentation (*x*, fig. 8,K) of posterior margin of metepimeron deeper than in *Sisyra*, median projection of basisternite triangular; mesonotum and metanotum with scutellum narrower anteriorly than in *Sisyra*, apical shield-shaped depression with posterolateral margins shorter than in *Sisyra*. Legs with tarsi having the first segment the longest, more than one-third the length of tarsus, fourth segment shortest. (Prothorax and neck illustrated by Cramp-ton, 1926, pl. 14, fig. 64.)

FOREWING (fig. 11): Costal area with approximately 11–14 costal cross-veins before the pterostigma; subcostal area moderately broad, with one basal subcostal cross-vein below about the third or fourth costal cross-veins; Sc appearing coalesced with R1 at apex of wing

below the pterostigma; Rs+MA separating off from R1 near base, Rs separating from MA slightly basad of 1st r; free stem of Rs with one main fork into R2+3 and R4+5 beyond longitudinal center of wing; MA dividing into two branches usually under pterostigma, but sometimes near center of wing; MP forking into MP1+2 and MP3+4 near level of point of separation of Rs from MA; MP1+2 and MP3+4 with terminal forks under pterostigma, usually at about level of point of coalescence of Sc and R1; Cu1 separating from Cu2 near base of wing; 1st and 3d A usually simple; 2d A usually with marginal fork; 3d A running into and coalescing with 2d A before margin; usually three (rarely two) radial cross-veins between R1 and Rs; two radiomedial cross-veins between Rs and R4+5 and MA; three medial cross-veins between MA and MP1+2 and one medial cross-vein between MP1+2 and MP3+4; three mediocubital cross-veins between MP and Cu1; one cubital cross-vein between Cu1 and Cu2; one basal cubito-anal cross-vein between Cu2 and 1st A; one anal cross-vein between 1st and 2d A; two series of gradate cross-veins, three inner gradates (2d r, 1st r-m, 2d m between MA and MP1+2), and five to eight outer gradates (3d r, 1st s, 2d s when present, 2d r-m, 3d m between MA and MP1+2, m between forking of MA when present, m between MP1+2 and MP3+4, 3d m-cu).

HINDWING (fig.11): Costal area with approximately 7-11 costal cross-veins basad of pterostigma; subcostal area broader than costal area, with one indistinct basal subcostal cross-vein; Sc appearing to be coalesced with R1 at apex; Rs, after branching off from R1 near base, proceeding for a longer distance than in *Sisyra*, then coalescing with MA and finally separating from MA at about center of wing, then proceeding anteriorly back toward R1; forking into one main fork of R2+3 and R4+5, usually at a point slightly basad of point of coalescence of Sc and R1 or under pterostigma; MA separating off from MP farther from costal margin of wing than in *Sisyra* into a free sinuate section, which curves toward and coalesces with Rs for a short distance, then separates and forks at margin; MP forking into MP1+2 and MP3+4 near center of wing at about point of separation of Rs from MA; MP1+2 usually with terminal fork at about level of point of coalescence of Sc and R1; MP3+4 frequently without terminal fork; Cu1 separating from Cu2 near base of wing, with almost parallel marginal branches; 1st A usually simple; 2d A usually with marginal fork; usually two radial cross-veins, the first basad of point of coalescence of Sc and R1, and the second usually below the pterostigma; one sectoral cross-vein between R2+3 and R4+5; one distal radiomedial cross-vein; three medial cross-veins, two between MA and MP1+2, one between MP1+2 and MP3+4; one mediocubital cross-vein to branches of Cu1; one cubito-anal cross-vein basally between Cu2 and 1st A; one anal cross-vein between

1st and 2d A; inner gradates of 1st r and 1st r-m, usually six outer gradates of 2d r, s, r-m, 2d m between MA and MP1+2, m between MP1+2 and MP3+4, m-cu; thyridia usually apparent in centers of radiomedial and medial cross-veins, and sometimes on sectoral cross-veins.

MALE GENITALIA (fig. 18,A-D): Eighth tergite longer dorsally, not as broad as ninth; ninth tergite divided mediodorsally, of diverse form; tenth tergite broader than long, divided mediodorsally into two lateral plates; eighth sternite about as long as or slightly shorter and narrower than seventh sternite, usually with an anterior group of very long setae projecting posteroventrally and with their bases hidden under posterior portion of seventh sternite; ninth sternite entire, ventral to ninth and tenth tergites, frequently with a pair of posteriorly projecting processes on inner surface, more or less embedded in a hyaline membrane; tenth sternite posterior and posteroventral to tenth tergite, in the form of narrow plates, usually broadening ventrally and internally, and covered with toothlike projections bearing long setae; parameres arising within the posterior part of the eighth, and the ninth and tenth tergites, partially fused, complex, usually bearing a median lobe or flap, which diverges abruptly anterodorsally from the posterior portion of plate, a pair of curved hooklike processes posteriorly.

FEMALE GENITALIA (fig. 18,E): Eighth tergite usually divided mid-dorsally and appearing fused midventrally; ninth tergite typically divided into two large plates, each moved lateroventrally to the tenth tergite, heavily sclerotized, usually longer than broad and with a posterior ridge for articulation with ninth sternite; tenth tergite entire, small, broader than long, thickly covered with long setae, frequently shorter dorsomedially; ninth sternite divided into two elongate movable upturned parts projecting and tapering more or less dorsally, usually bent posteriorly just before apex, each half articulated ventrally at posterior articulation ridge of ninth tergite, with small narrow ventral projection; tenth sternite not accounted for.

BASAL ABDOMINAL SEGMENTS. Second to fifth tergites usually smaller and shorter than sixth and seventh, often rounded (*chapini*, *nota*); fourth to seventh tergites sometimes oval (*carpenteri*, *chilena*, *nota*); second sternite large, usually with V-shaped streak, with each half beginning along lateral margins, sometimes just posterior to center (*basalis*, *carpenteri*, *chapini*) or in posterior corners (*nota*) and curving anteriorly to meet in point just before anterior margin; third sternite with streak with each half beginning in posterior corners and meeting other half in center of sternite so almost parallel with anterior margin; fourth sternite with streak usually almost parallel

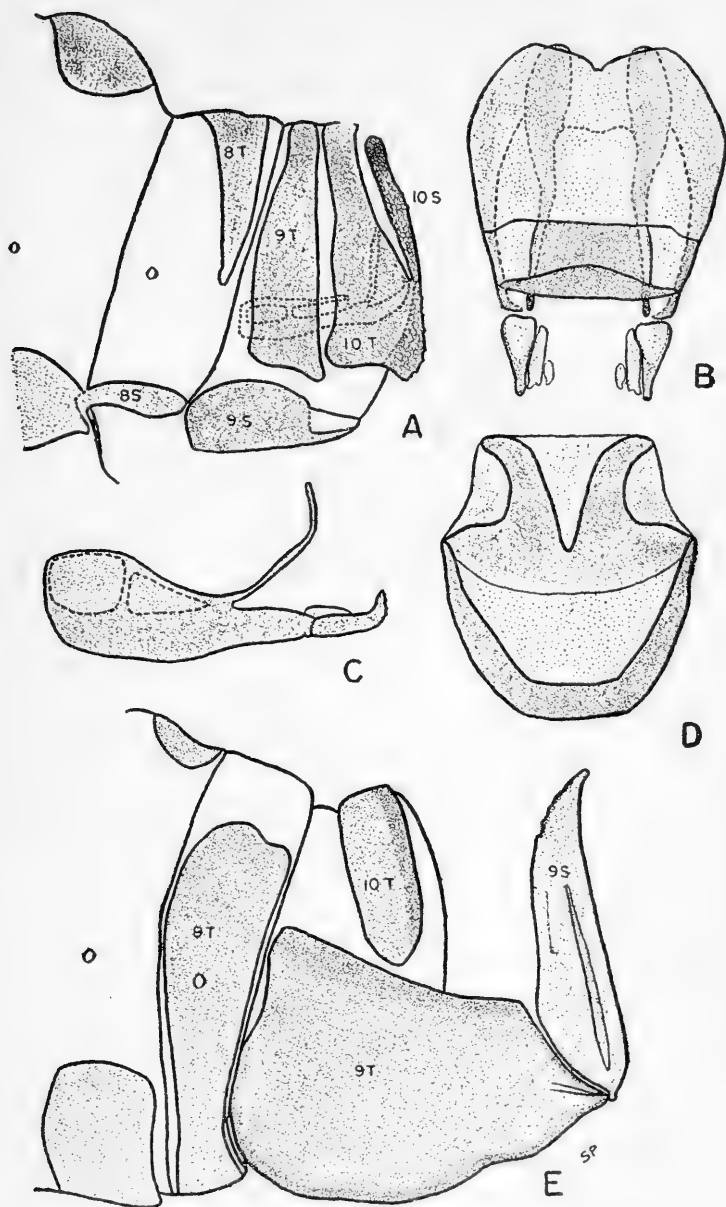


FIGURE 18.—*Climacia areolaris* (Hagen). A, terminal abdominal segments of male, lateral view; B, parameres, dorsal view; C, same, lateral view; D, ninth sternite of male, posteroventral view; E, terminal abdominal segments of female, lateral view. Abbreviations as in figure 14.

with anterior border; sometimes fifth (*nota*, *striata*) and sixth (*nota*) also with streaks. Second sternite of *areolaris* emarginate latero-dorsally and narrower medioventrally.

The genus *Climacia* is at present known only from the Western Hemisphere, and 11 species, 7 of them described herein, have been taken as follows: North America: *areolaris* (Hagen) (United States and Canada), *californica* Chandler (California, Oregon), *chapini*, new species (New Mexico, Texas). Central America: *tenebra*, new

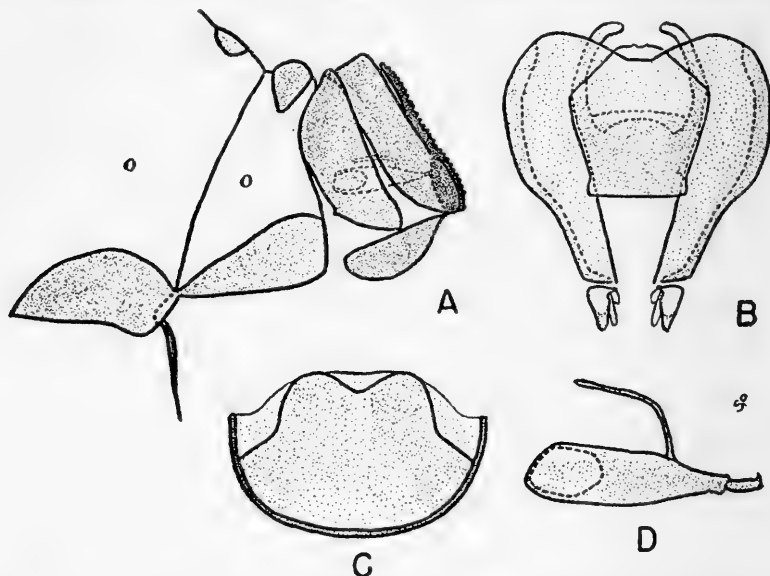


FIGURE 19.—Terminal abdominal segments of *Climacia striata*, new species, male, holotype. A, lateral view; B, parameres, dorsal view; C, ninth sternite, posteroventral view; D, parameres, lateral view.

species (Honduras), *striata*, new species (Panamá). South America: *basalis* Banks (British Guiana), *bimaculata* Banks (British Guiana, Surinam), *carpenteri*, new species (Paraguay), *chilena*, new species (Chile), *nota*, new species (Venezuela), *townesi*, new species (Brazil, Perú).

Key to the species of *Climacia* in the Western Hemisphere

1. A conspicuous radiomedial streak ⁷ in forewing (pl. 2). 2
 No conspicuous radiomedial streak in forewing 10
2. Radiomedial streak in forewing closely associated with other less pronounced dark intervenational streaking immediately adjacent to streak (pl. 2, figs. 1, 3-5) 3
 Radiomedial streak in forewing distinct from other dark intervenational streaking (pl. 2, figs. 2, 6-9). 6

⁷ The basal brownish black pigmentation found in the vicinity of R1, Rs, MA, or Rs+MA (sometimes extended anteriorly and posteriorly) in some species.

3. Forewing with 3d r close to 2d r and basad of point of coalescence of Sc and R1, with cell 2d R1 not more than two or three times as long as broad (pl. 2, figs. 3, 4) 4
 Forewing with 3d r usually under pterostigma or at level of point of coalescence of Sc and R1, not close to 2d r, cell 2d R1 more than three times as long as broad (pl. 2, figs. 1, 5) 5
4. Pale portion of pterostigma narrow, covering one or two costal cross-veins; wing membrane extensively brownish; face yellow, vertex yellow with small blackish spot immediately behind antennae; each half of ninth tergite of female a little over one-half as wide as long (fig. 20,A; pl. 2, fig. 4).
tenebra, new species (p. 501)
- Pale portion of pterostigma broader; wing membrane less brownish; face with longitudinal brownish streak, vertex brown; each half of ninth tergite of female two-thirds as wide as long (fig. 21; pl. 2, fig. 3).
californica Chandler (p. 491)
5. Forewing with pale area of pterostigma long (covering about seven costal cross-veins); 3d m between MA and MP1+2 long, usually obliquely directed basad; antennae brownish black; tenth tergite of male with ventral border widened, dorsal border narrow (fig. 18; pl. 2, fig. 1).
arcolaris (Hagen) (p. 486)
- Forewing with pale area of pterostigma short (covering about four costal cross-veins); 3d m between MA and MP1+2 shorter, usually directed distad; antennae with blackish band between two yellow portions; tenth tergite of male of almost uniform length dorsally and ventrally (fig. 19, pl. 2, fig. 5) *striata*, new species (p. 499)
6. Forewing with basal radiomedial streak longitudinally elongate (pl. 2, figs. 1-5, 8, 9) 7
 Forewing with basal radiomedial streak transversely elongate (pl. 2, figs. 6, 7). 9
7. Radiomedial streak short, straight, barely reaching 1st r; no pronounced spotting or streaking other than setal spots on longitudinal veins (pl. 2, fig. 9) *nota*, new species (p. 503)
 Radiomedial streak longer, more or less crescent shaped, reaching beyond 1st r; streaking or spotting other than setal spots may be present . . . 8
8. Radiomedial streak long, narrow, usually beginning from where Rs+MA and MP approach each other basally; anteposterostigmal spot usually pronounced; subcostal cross-vein dark; longitudinal veins without pronounced setal spots; each half of ninth tergite of female moderately elongate and broad (fig. 22,E; pl. 2, fig. 2) *chapini*, new species (p. 495)
 Radiomedial streak shorter, usually beginning from where Rs+MA separate from R1 basally; anteposterostigmal spot either absent or faint; subcostal cross-vein pale; longitudinal veins with pronounced setal spots; each half of ninth tergite of female more elongate, narrower (fig. 23,A; pl. 2, fig. 8).
basalis Banks (p. 504)
9. Forewing with basal radiomedial streak broad anteriorly, narrow posteriorly, directed basad; remainder of forewing clear except for anteposterostigmal spot (also broad anteriorly, narrow posteriorly); setal spots not pronounced; female with each half of ninth tergite considerably elongate and narrow (fig. 23,B; pl. 2, fig. 6) *bimaculata* Banks (p. 507)
 Forewing with basal radiomedial streak directed distad; indistinct anteposterostigmal spot; setal spotting pronounced; light brown intervenational streaking along inner and outer margins; female with each half of ninth tergite moderately elongate (fig. 24,B; pl. 2, fig. 7).
carpenteri, new species (p. 511)

spots; Rs usually forking into R2+3 and R4+5 below pterostigma slightly distad of or at about level of point of coalescence of Sc and R1; MA with terminal fork below pterostigma; MP1+2 usually forking proximal to or at about level of point of coalescence of Sc and R1, and forking into uneven fork, with first fork closer to stem and with first branch of first fork at an angle; Cu1 with four to six branches to margin (five most common); about 12 or 13 costal cross-veins before pterostigma; three radial cross-veins, 1st r usually basad of midpoint of free stem of Rs, 2d r to Rs, 3d r below pterostigma to Rs, R2+3 or to fork; 2d r-m usually slightly distad of 3d r (occasionally directly under) and Rs fork, the outer gradates (five) being irregular at this point; 2d m between MA and MP1+2 usually slightly distad of, occasionally directly under, 1st r-m; 3d m long, obliquely directed basad so as to make cell between 2d and 3d m as an inverted trapezoid; the inner gradates also in irregular series.

HINDWING (pl. 2, fig. 1): Average length of female 4 mm., male 3.8 mm., width of female 1.5 mm., male 1.4 mm.; membrane hyaline to yellowish; two prominent dark brown spots, the first larger (antepterostigmal spot) and the second smaller (postpterostigmal spot); faint brownish shading along about first four costal cross-veins; center of pterostigma with long yellowish portion covering seven to eight costal cross-veins; brownish veins include radial veins beyond basal forking of R, MA, distal portions of MP, cubital and anal veins (the basal portions of these veins and 1st m usually clear), the radial and anal cross-veins, outer gradates, and basal sinuous piece of MA; Rs usually forking into R2+3 and R4+5 at point basad of point of coalescence of Sc and R1; Cu1 with three to five branches reaching margin; six outer gradates, including a sectoral cross-vein.

MALE GENITALIA (fig. 18,A-D): Eighth tergite longer mediadorsally, tapering lateroventrally, not as broad as ninth tergite; ninth tergite shorter mediadorsally and about as long ventrally and as wide as tenth tergite; tenth tergite with mediadorsal border of each half short, the ventrolateral border widened and prolonged distally; ninth sternite with appearance of a pair of median laterally curved processes extending distally from inner surface; two halves of tenth sternite almost striplike, then turning inwardly and broadened ventrally, covered with coarse, toothlike, setae-bearing papillae; parameres with a more or less diamond-shaped flap projecting usually anterodorsally from median plate, anterior margin heart shaped, posterior hooks tripartite, largest process toward exterior, smallest medial.

FEMALE GENITALIA (fig. 18,E): Eighth tergite longer dorsally and shorter ventrally, anterior margin more or less convex; ninth tergite with each lateroventral half large, moderately elongate, anterior margin broadest with slight indentation near dorsal border, dorsal

border gradually sloped from proximal to distal border, ventral margin rounded, with a slight irregularity prior to articulation point.

NEOHOLOTYPE: A male (pinned) from Grant, Okla., July 1, 1937 (Standish and Kaiser); MCZ; designation by Carpenter (1940, p. 256).

ALLOTYPE: A female (pinned) with same collecting data as neoholotype; also MCZ; designation by Carpenter (*loc. cit.*).

Hagen (1861, p. 199) mentioned "Florida, in March (Osten Sacken)" in his original description of this species. Osten Sacken collected in Florida in March 1858, on his return from a trip to Cuba. He apparently returned from Cuba by way of New Orleans and Alabama, and, although specific Florida localities are not stated, he probably collected *areolaris* in northern Florida. (See Osten Sacken, C. R., Record of my life work in entomology, p. 7, 1903.)

Carpenter (1940, p. 256) stated that Hagen's single type of this species was probably destroyed when his collection was shipped from Europe to this country.

Both neoholotype (approximately 58 segments in both antennae) and allotype (about 57 segments in the left antenna and 56 in the right) are almost entire. The basal radiomedial streak stops at Rs, 3d r meets R2+3 just before the fork, Cu2 is clear at the margin in the forewings of both. The neoholotype shows four branches to Cu1 in the left forewing, the allotype five.

The type material of *dictyona* in the Cornell University collection was examined and the differences in the size and number of branches of Rs and Cu were found not to be of specific value when compared with *areolaris* (as was pointed out by Carpenter, 1940, p. 256). This species was described from specimens collected at Saranac Inn, N. Y., June 18 to July 1 and August 10 to 20 (Needham, 1901, p. 558). Since Needham did not designate a type for *dictyona*, the following are here designated:

LECTOTYPE: Male, June 28, 1900 (CU 50-20-32).

LECTOALLOTYPE: Female, same data as lectotype.

LECTOPARATYPES: 10 adults, same data, and 5 adults, same locality; CU 188, Sub 2. 3 specimens, same locality, Aug. 18, 1900, J. G. Needham, type 1670; MCZ.

TOPOYPES: 42 larvae and pupae, same locality, Aug. 8, 1900; CU.

It was not possible to locate the type of *Sisyrha lampra* Navás. However, the original description (Navás, 1914, pp. 60-61) appears to refer to *Climacia areolaris*, as shown by the "sectore radii unico" (single radial sector), broad subcosta, dark streak at the radial sector, and general coloration of the forewing, as well as by the six gradate veins in the hindwing (*Sisyrha* has no gradates in the hindwing). Later, Navás himself (1935, pp. 33-34) placed *lampra* in synonymy with *areolaris*. The treatment of *lampra* by Carpenter

(1940, pp. 254-255) as a synonym of *Sisyra vicaria* was not based on type examination, the type being unavailable.

DISTRIBUTION (specimens examined): *United States*: Alabama: 2.5 miles northwest of Moundville (Black Warrior River). Arkansas: Brasfield (Cache River). Colorado: Maple Bluff. Connecticut: Portland; Tolland; Union. Delaware Water Gap (between New Jersey and Pennsylvania). Florida: Alachua County (Lake Santa Fe); La Belle; Lake Harney; Lakeland (5 miles east of Big Creek); Punta Gorda; West Palm Beach. Georgia: Augusta; Blackshear; Clyde; 6 miles west of Concord; Dalton (7 miles south of Swamp Creek); Okefenokee Swamp (Billy's Island); 5.5 miles northeast of Perry (Tharpe's Pond); 5 miles southeast of Roberta (Beaver Creek). Illinois: Cedarville; Gilman; Hardin; Harrisburg; Kankakee (Kankakee River); Savanna. Indiana: Lake Maxinkuckee. Kansas: Manhattan. Louisiana: Forest Hill; Shreveport. Maine: Augusta; Caenis; Ellsworth; North Waterboro; Orono; St. Francis; Tim Pond; Warren; West Beach. Maryland: Plummers Island; Snow Hill. Massachusetts: Amherst; Framingham; Holliston; Lincoln; Mount Toby; Waltham. Michigan: Cheboygan County (Burt Lake; Douglas Lake); Houghton (along Keweenaw Waterway); South Haven; Twin Lakes (Houghton County); White Cloud (White River). Minnesota: Cook County (Pine Lake); 22 miles north of Duluth (Cloquet River); Houston County (Mississippi Bluff); Kawishiwi River; St. Louis County; Stillwater; west of Tower (Pike River); Wabasha. Mississippi: Natchez. Missouri: Hollister. New Hampshire: Bennington; Franconia; Squam Lake. New Jersey: Atsion; Riverton; Weymouth. New York: Clayton (Bluff Island); Hagaman; Hamburg; Hawkinsville (Black River); Hudson Falls; Ingham Mills; Juanita Island (Lake George); Kinderhook; Lima; Middleville; Milford Center; Mount Marcy (alt. 4,000 ft.); North Blenheim; Ogdensburg; Old Forge; Saranac Inn; Westchester County. North Carolina: Aberdeen. Ohio: Put-in-Bay (Lake Erie, South Bass Island). Oklahoma: Broken Bow; Grant; Sayre; Sherwood. Texas: Dallas County; Goliad. Virginia: Millsville (Milnesville?); Mount Vernon. Wisconsin: Merrill (Wisconsin River); Palmyra (river outlet of Spring Lake); Sayner (Plum Creek). *Canada*: Ontario: Biscotasing; Britannia; Burks Falls; Go Home Bay (Flat Rock Falls; Land Run Island); Honey Harbor; Maitland; Norway Point (Lake of Bays); Ottawa; Pelee Island; Waubamick. Quebec: Côteau du Lac; Gavreau Lake; Knowlton; Ste. Agathe des Monts; Vaudreuil.

The adults examined were collected from March 31 to October 10.

Northern females from Maine, Massachusetts, and New York had wings averaging 0.4 mm. longer than those of females from Florida

and Georgia. However, it was noted that a population of small specimens from Snow Hill, Md., collected in July, showed a range of from 3.7 to 4 mm. in length for the males and 4.2 to 4.4 mm. for the females. Some specimens from Florida, the state of Osten Sacken's type locality, showed a slight difference in the smaller size and the extension of the r-m streak from \bar{Sc} to R only, instead of almost to

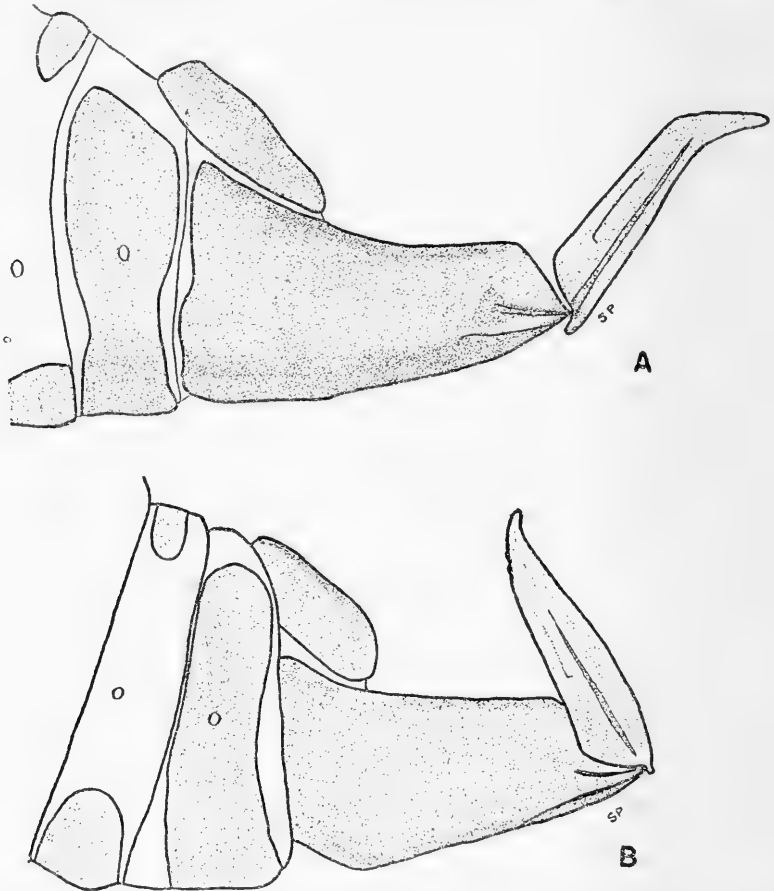


FIGURE 20.—Terminal abdominal segments of holotype, female, lateral view. A, *Climacia tenebra*, new species; B, *C. nota*, new species.

Rs. Those from La Belle tended to show reduced spotting between Sc and R1 at the point of their coalescence in the anteposterostigmal streak, whereas those from West Palm Beach and Punta Gorda had the usual spotting. However, these features did not appear to warrant subspecific designation.

This is the most common species of *Climacia* in the eastern half of the United States, and the only one east of the Mississippi River. It has been taken from Maine to Florida along the east coast, and

westward to Minnesota, Kansas, Oklahoma and eastern Texas. In the western part of the United States, it is replaced by *californica* in California and Oregon, and by *chapini* in New Mexico and central Texas. The specimens referred to *areolaris* from Texas (Columbus, Schwarz; unspecified locality, Belfrage) by McClendon (1906, p. 171), and from New Mexico (Eddy County) and Texas (Sutton County, Victoria) by Carpenter (1940, p. 256) were examined and found to be *chapini*; those referred to this species from the Deschutes River, near "Richmond," Oreg., by Carpenter (1942, p. 50) were apparently *californica*. It is likely that the "pair from Bosque County, Texas, taken by Mr. Belfrage (in August)," mentioned by McLachlan in his original description of the genus *Climacia*, but not examined, are also *chapini*.

Specimens which have been recorded as this species, but which were not examined, include those from Michigan (East Lansing and Silver City), Pennsylvania, Vermont (Carpenter, 1940, p. 256), Maine (Robinson Mountain, Mount Desert Region) (Procter, 1946, p. 42); and Valle de México, Lago de Xochimilco (Navás, 1928, p. 319).

In addition to the distinctive male genitalia, a notable character of *areolaris* that separates this species from other species of *Climacia* is the 3d m, which is usually long, slightly sinuous, and sharply obliquely directed basad, making cell 2d MA the shape of an inverted trapezoid. *C. areolaris* is further distinguished from *californica*, which closely resembles it in the forewing, by the comparatively long cell 2d R1, which is more than three times as long as wide; the broader pale area (covering seven to eight costal cross-veins) in the pterostigma of the forewing and hindwing; the color of the head; the lack of a basal radiomedial streak in the hindwing and the less extensive spotting in general in the forewing and hindwing; the greater number of branches to Cu1 in forewing and hindwing; and the genitalia. It is quite distinct from *chapini* also, which has the long crescent-shaped basal radiomedial streak and a different type of genitalia. From *striata* (Panamá), which also has a similar forewing, *areolaris* can be segregated by the broader pale area of the pterostigma in the forewing and hindwing, the less pronounced dark spotting, the antennae which are not banded, and the female genitalia.

Climacia californica Chandler

FIGURE 21; PLATE 2, FIGURE 3

Climacia californica Chandler, 1953, p. 182, fig. 1 (California).

Head with vertex medium to dark brown; face with longitudinal brown streak broadest on frons below antennae, almost reaching eyes, narrower on clypeus and labrum, genae and sides of streak buff-

colored; palpi brown; antennae blackish brown (over 50 segments); legs yellow with mesothoracic and metathoracic coxae dark brown; pronotum medium brown, mesothoracic and metathoracic scutelli blackish anteriorly, pleura dark brown; abdomen reddish brown dorsally, yellowish ventrally.

FOREWING (pl. 2, fig. 3): Average length female 4.8 mm., male 3.9 mm., average width female 1.7 mm., male 1.3 mm.; membrane almost

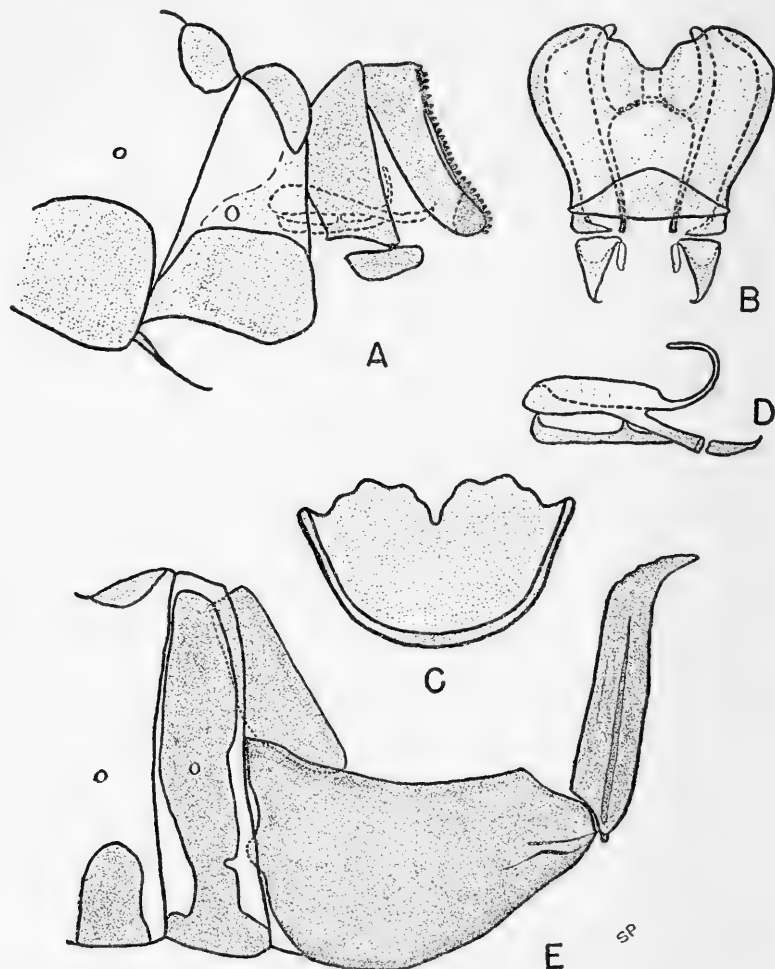


FIGURE 21.—*Climacia californica* Chandler. A, terminal abdominal segments of male, lateral view; B, parameres, dorsal view; C, ninth sternite of male, posteroventral view; D, parameres, lateral view; E, terminal abdominal segments of female, lateral view.

hyaline with three more prominent and one less conspicuous brownish areas, and three hyaline patches; the first prominent dark brown patch, the basal radiomedial streak, longest and beginning in subcostal space about where Sc and R almost meet basally and extending

laterally to level of about sixth costal cross-vein, then narrowing posteriorly to MP with a clear space next to Rs+MA; the second, the oblique antepterostigmal spot, directed basally, beginning and broadest at costa and narrowing to MP1+2, the two areas more or less interconnected by intervenational streaks from Rs to MP; the less prominent brownish area, beginning at dark postpterostigmal spot to basal branches of Cu1 and MP3+4, with apical portion along outer and inner margins of wing and region below radiomedial streak with light brownish streaks between longitudinal veins, darker spot over Cu1; narrow center of pterostigma between antepterostigmal and postpterostigmal spots yellowish covering three or four costal cross-veins; longitudinal and cross-veins in general pale in pale areas and dark in dark areas; Rs and MA forked below pterostigma near margin; MP1+2 with first branch forked frequently at an angle, closer to stem of MP than second fork; Cu1 with three to five branches to margin (three most often); three radial cross-veins, 1st r from R1 to Rs or Rs+MA, 2d r slightly distad of center of wing; 3d r distad of 2d r but before level of point of coalescence of Sc and R1, making cell 2d R1 between 2d r and 3d r usually not more than two or three times as long as wide; 2d r-m usually distad of 3d r between R2+3 and MA forks; 1st r-m usually directly above 2d m between MA and MP1+2, and basad of 2d m; 3d m between MA and MP1+2 basad of MP1+2 fork, close to 2d m, the cell between not more than three or four times as long as broad; five outer gradates in irregular series, usually no sectoral cross-vein; inner gradates also in irregular series.

HINDWING (pl. 2, fig. 3): Average length female 4.2 mm., male 3.4 mm., average width female 1.6 mm., male 1.2 mm.; membrane hyaline to yellowish; three dark brown spots, the first, basal from costa to Rs+MA, interconnecting with the second, the broad antepterostigmal spot, and the third a postpterostigmal spot, with light brownish shading distally along outer and inner margins from postpterostigmal spot to Cu2; pale area in pterostigma narrow, covering approximately four costal cross-veins; in general, longitudinal and cross-veins dark in dark areas and pale in pale areas, the pale and dark areas comparable to those in forewing; Rs usually forking into R2+3 and R4+5 basad of point of coalescence of Sc and R1; Cu1 with two or three branches to margin; six outer gradates.

MALE GENITALIA (fig. 21,A-D): Eighth tergite longer dorsally, with numerous setae laterally between tergite and sternite creating effect of long and broad sternite (lateral setae between tergites and sternites abundant); ninth tergite much shorter dorsally, anterior margin convex, posterior margin almost straight; tenth tergite with each half of almost uniform length throughout, slightly longer dorsomedially and with ventral border projected slightly posteroventrally; ninth sternite with a pair of irregularly margined blunt median processes extending

distally from inner surface; two halves of tenth sternite almost strip-like for a little more than half of width, then turning internally and broadening considerably ventrally, covered with coarse toothlike papillae-bearing setae; parameres with blunt flap projecting anterodorsally from median plate, posterior hooks bipartite, with smaller process medially, inner arms curved slightly anteromedially.

FEMALE GENITALIA (fig. 21,E): Eighth tergite narrowing considerably just before ventral margin, darkest brown ventrally, lighter around spiracle, anterior and posterior margins irregular; ninth tergite with each lateroventral half large, moderately elongate, anterior margin about two-thirds of length, irregular, dorsal margin slightly concave, ventral margin rounded.

HOLOTYPE: A male from Clear Lake, Lake County, Calif., May 19, 1949, elevation 1,318 feet (H. P. Chandler); CAS.

ALLOTYPE: A female with same data; CAS.

PARATYPES: 27 mounted specimens (16 males, 11 females) plus several in alcohol; CAS, USNM, MCZ, California Insect Survey, and Harley P. Brown collections.

The paratypes in the USNM differ in the number of branches of Cu1 in the forewing (three or four), and in the hindwing (two or three). One paratype has 3d r and 2d m missing in the forewing, and r-m basad instead of distad of s in the hindwing.

This species has also been taken in Oregon (Deschutes River, near Redmond, July 28, 1939, Schuh and Gray; Triangle Lake, Lane County, June 16, 1952, B. Malkin). Carpenter's (1942, p. 50) record of *areolaris* from the Deschutes River, near "Richmond," Oreg., applies to *californica*. The differences noted in the paratypes were also noted in the specimens from Oregon. Those from near Redmond tended to show the vertex and thorax a lighter brown in color.

This species resembles *areolaris*, *striata*, and *tenebra* most closely. The forewing of *californica* is similar to *tenebra*, but differs from *areolaris* and *striata* in the closeness of 2d r to 3d r, which is basad of the point of coalescence of Sc and R1. The forewing of *areolaris* differs from all three species in the longer sinuous 3d m between MA and MP1+2 (usually in vicinity of angular first fork of MP1+2); the longer pale area in the pterostigma; and the usually greater number of branches to Cu1 (may reach seven). The hindwing of *areolaris* differs in the longer pale portion of the pterostigma, the absence of a definite radiomedial streak, and usually greater number of branches to Cu1. Although the female genitalia of *californica* and *tenebra* are somewhat alike, the halves of the ninth tergite of *californica* are slightly shorter in comparison with the width, and the anterior margins differ; the eighth tergite is broader in *tenebra*. The genitalia of *areolaris* and *californica* are distinct.

In *striata*, the antennae are banded with a brownish black portion between the basal and distal yellow portions, whereas in *californica* the antennae are more or less solidly brownish black, sometimes becoming only slightly lighter toward the apex. The wings of *tenebra* have the greatest amount of brown on the membrane, and are the darkest of the species of *Climacia*. The notch in the anterior margin of the male parameres is shallower in *striata* than in *californica*.

Climacia chapini, new species

FIGURE 22; PLATE 2, FIGURE 2

MALE (holotype): Head with vertex yellow, faintly reddish in center, small brownish spot behind antennal socket adjacent to eye; face yellow; palpi yellow; basal antennal segment light yellowish brown (rest missing); legs yellow, faint brownish traces on coxae; pronotum yellowish with blackish brown mottling dorsally, indication of a short longitudinal dark brown narrow streak medially not reaching anterior or posterior margin, also a shorter posterolateral longitudinal streak on each side, mesonotum and metanotum yellowish brown dorsally, pleura with brown streaks particularly anteriorly, some yellow posteroventrally; abdomen yellowish.

FOREWING (pl. 2, fig. 2): Length 3.8 mm., width 1.6 mm.; membrane yellowish with three pronounced dark brown spots, the first the basal radiomedial streak, longitudinally elongate, crescent shaped, beginning about where R and M approach each other basally, with the anterior margin of streak running slightly anterior to Rs+MA and Rs to a point between 1st r and 1st r-m, the posterior margin running along Rs+MA and MA to slightly beyond 1st m, then curving back anteriorly to meet the distal end of anterior margin of streak; the second, the antepterostigmal spot from costa to subcosta; and the third, the dark brown intervenational anal streaking basally from near 2d A to margin; most longitudinal veins brown except for costal vein to and beyond antepterostigmal spot, R1 to just before 2d r, and short basal portions of MA from radiomedial streak to slightly before 1st r-m; MP, Cu1, Cu2, 1st, 2d and 3d A pale basally; inner and outer gradates and radial cross-veins brown, bordered, subcostal cross-vein brown; costal ends of costal cross-veins yellow, subcostal ends brown except for two basad of antepterostigmal spot; pterostigmal cross-veins in center, 1st m between MA and MP1+2, 1st and 2d m-cu, cubito-anal and anal cross-veins yellow; light brownish streaks between longitudinal veins from region of outer gradates to margin and from branches of Cu to margin; Rs forking into R2+3 and R4+5 basad of point of coalescence of Sc and R1; MP1+2 with first branch at angle, closer to stem of MP than second fork; R2+3 with terminal fork slightly distad of 3d r; Cu1 with four branches to margin in left wing, three in right; three radial cross-veins, 2d r to Rs before fork,

3d r to R2+3 below pterostigma, far distad of forking of R2+3 and R4+5 from Rs; both outer and inner gradates forming a regular series; three inner and six outer gradates, including a sectoral cross-vein.

HINDWING (pl. 2, fig. 2): Length approximately 3.6 mm., width 1.5 mm.; membrane almost hyaline with one brown antepterostigmal spot; rest of pterostigma yellowish; R1, short distal piece of Rs+MA,

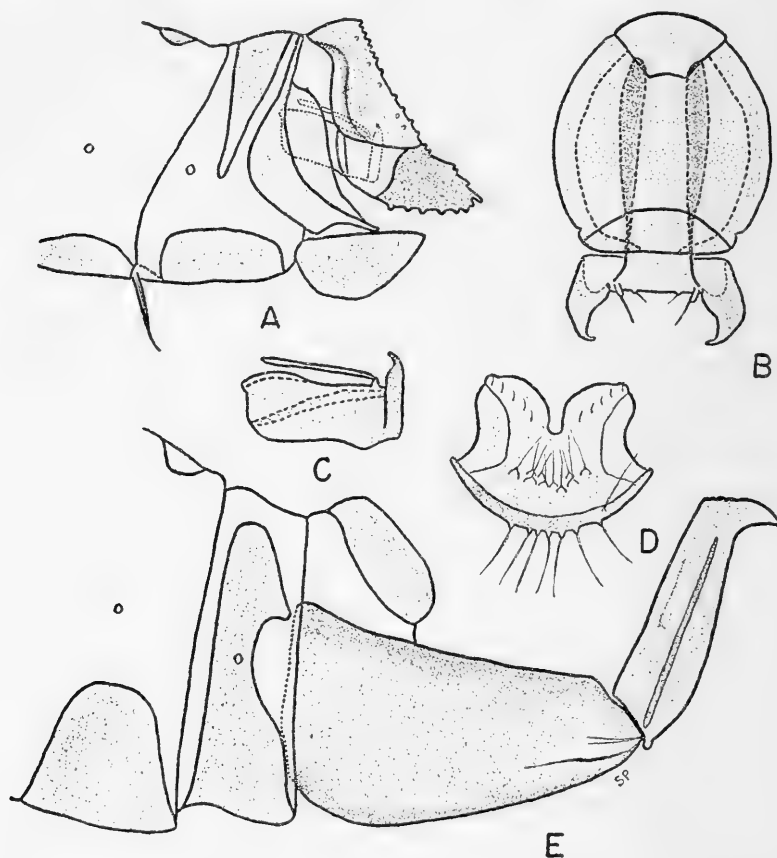


FIGURE 22.—*Climacia chapini*, new species. A, terminal abdominal segments of male, lateral view; B, parameres, dorsal view; C, same, lateral view; D, ninth sternite of male, posteroventral view; E, terminal abdominal segments of female, lateral view.

basal pieces of Rs after forking from R1 and from MA, distal ends of R2+3, R4+5, MA, branches of Cu1, radial cross-veins and outer gradates (of which s, r-m and m have pale areas in their centers) brownish, rest of veins yellow to hyaline; two branches of Cu1 to margin; six outer gradates.

MALE GENITALIA (fig. 22, A-D); Eighth tergite longer mediodorsally and narrowing lateroventrally, not as long as maximum length of ninth tergite; ninth tergite irregularly shaped, striplike dorsally, then

expanding lateroventrally with anterior and posterior margins convex in part, and then shortening again ventrally; tenth tergite with anterior border of each half more or less sinuate, with dark sinuous streak near anterior margin, posterior border straight, with coarse toothlike papillae bearing long setae, small hyaline anteroventral convex lobe with a small anterior light brown fingerlike projection; ninth sternite with a pair of median, bluntly rounded, dark, laterally curved processes which have rounded papillae in rows bearing long setae ventrally and a row of setae near dorsal margin of processes extending distally from inner surface; two halves of tenth sternite dark brown, triangle shaped ventrally, with long dentate processes bearing long setae distally; parameres with long flap projecting anterodorsally from median plate, anterior margin rounded, inner arms blackish, small elongate setigerous tubercles medial to hooks (single).

FEMALE (allotype): Similar to male except for the following: Vertex with yellowish brown extending between the antennal bases; face with a little yellowish brown, basal two antennal segments brown dorsally and yellow ventrally, lighter than the brownish black ones following (left antenna of 58 segments); pronotum with median dorsal streak broad, narrowing before posterior margin, mesonotum also with narrow dark streak; abdomen with transverse blackish streaks dorsally; forewing length 4.3 mm., width 1.7 mm., hindwing length 3.7 mm., width 1.6 mm., 3d r at fork of R2+3 in left wing, Cu1 with four branches to margin in right wing and three in left.

FEMALE GENITALIA (fig. 22,E): Eighth tergite shorter, rounded dorsally, with anterior margin almost straight and posterior border concave in part; ninth tergite with each lateroventral half large, elongate, anterior width almost one-half of and posterior width about one-fourth of length, dorsal margin sloping gradually posteroventrally, ventral margin curved; tenth tergite shorter mediodorsally.

HOLOTYPE: A male (pinned) from Columbus, Tex. (E. A. Schwarz) (Collection C. V. Riley); USNM 62262.

The date of collection is uncertain, but was probably in 1879 since Schwarz was in Columbus then. (See Proc. Ent. Soc. Washington, vol. 4, pp. 1-3, 1896.)

The holotype has the second left leg, the tarsi of the third left leg, and the antennae beyond the basal joints missing; the left forewing and hindwing are torn basally, and the left forewing is also torn near the apical margin, but the venation is distinct. The abdomen is preserved in glycerin.

ALLOTYPE: A female (in alcohol) from Corpus Christi State Park, Tex., 35 miles west of Corpus Christi, Oct. 6, 1951, at light (A. B. Gurney); USNM 62262.

The allotype is in two pieces, the anterior piece broken at the mesothorax and with the tip of the right antenna broken (of 36 seg-

ments) and possibly the left also (of 58 segments), left foreleg missing; posterior piece consisting of metathorax with third pair of legs, hindwings and abdomen.

PARATYPES: Seven. Texas: Seguin, Oct. 26, 1905, F. C. Pratt, 1 female (USNM); Victoria, June 14, 1907, J. D. Mitchell, 1 female (USNM); "Collection Belfrage," 1 female and 1 specimen with abdomen off⁸ (USNM); Sutton County, July 16, 1928, R. H. Beamer, 1 female (KU). New Mexico: Eddy County, July 12, 1927, R. H. Beamer, 1 male (MCZ) and 1 specimen with abdomen off (KU).

The paratypes show variation in the amount of yellowish brown on the vertex and face, streaking of the pronotum (including the presence or absence of the median dorsal streak), position of 3d r to R2 or R2+3 (R2+3 most common) or upper branch of R2+3 fork, presence of an additional s between R2+3 fork (occasionally), number of branches from Cu1 to margin (3 to 5); and the position of 2d r to Rs or R2+3 (Rs most common). The average length of the forewing in female 4.5 mm., in male 4 mm., width in female 1.7 mm., in male 1.5 mm.

The specimen recorded as *areolaris* from Columbus, Tex. (collected by Schwarz), by McClendon (1906, p. 171) is the holotype of *chapini*. Also, the Texas material collected by Belfrage and reported as *areolaris* by McClendon (loc. cit.) and specimens from Eddy County, N. Mex., and Bosque County, Sutton County, and Victoria, Tex., noted by Carpenter (1940, p. 256) as *areolaris* prove to be *chapini*.

The adults examined were collected from June 14 to October 26.

C. chapini resembles *C. basalis* of British Guiana very closely in the wing pattern, with the main differences being seen in the longer basal radiomedial streak, the usual occurrence of a pronounced anteptero-stigmal spot in both the forewing and hindwing, and the lack of dotted setal pits on the longitudinal veins of *chapini*. The latero-ventral halves of the ninth tergite of the female are more than half the length at anterior margin in *chapini*, but less than one-half the length in *basalis*.

This third species of *Climacia* to be found in the United States is easily distinguished from the other two species, *areolaris* and *californica*, through the wing markings and genitalia.

This species is named in honor of Dr. Edward A. Chapin, formerly curator of insects of the U. S. National Museum, whose generous and unselfish cooperation has assisted immeasurably with the completion and publication of this paper and numerous other entomological revisions.

⁸ It seems possible that these specimens originated in Bosque or McLennan Counties, Tex., since they were areas where Belfrage collected most, particularly in his later years. It has been emphasized by Geiser, however, that Belfrage collected in several other parts of Texas. The two specimens mentioned are part of the large collection of Texas insects purchased by C. V. Riley which is in the U. S. National Museum (Ent. News, vol. 44, pp. 127-132, 1933.)

Climacia striata, new species

FIGURE 19; PLATE 2, FIGURE 5

MALE (holotype): Head with vertex dark brown, shining, posterior portion with transverse yellow bar on each side extending from eye to central brown area; face yellow with median brown longitudinal streak extending from below antennal bases, narrower on frons and broadening at clypeus; palpi yellowish; basal antennal segment yellow, faintly brownish dorsally along apical margin, following six segments (approximately) yellowish (scape slightly darker), next 11–13 (approximately) brownish black, the terminal 42 yellowish (the transition between the preceding brownish black segments to the yellowish ones sharp), becoming slightly darker toward tip (left antenna of 63 segments); legs yellow, mesothoracic and metathoracic coxae brown, prothoracic coxae yellow; pronotum brown and yellowish brown mottled, with thin central blackish streak posteriorly; mesonotum and metanotum brown, slightly paler toward center, mesothoracic and metathoracic pleura brown; abdomen yellowish.

FOREWING (pl. 2, fig. 5): Length 3.9 mm., width 1.4 mm.; membrane with two interconnected prominent dark brown patches separated from a distal marginal brownish area by a large obliquely transverse hyaline area directed basally beginning at costa in center of pterostigma and extending to inner margin at Cu2, two additional basal hyaline areas; the first large dark brown patch, the basal radiomedial streak, longitudinally elongate and beginning at the costa at about the humeral vein and extending to about the fifth costal cross-vein, in the subcostal area from the subcostal cross-vein to just beyond 1st r, in the radial area from just beyond Rs+MA to slightly beyond 1st r; the second large patch, an oblique antepterostigmal spot, broadest at costa and narrowing around 2d r to near 2d m; the two patches interconnected with brownish intervenational raylike streaking between the longitudinal veins below R1, continuing in a curve to base at anal area, leaving an elliptical yellowish to hyaline spot basal to radiomedial streak; the marginal brownish area consisting of a less prominent dark brown postpterostigmal spot, and a second less prominent spot around the branches of Cu1, with intervenational brownish streaking along the outer (apical) and inner margins between the two spots; in general longitudinal and cross-veins pale in pale areas and brown in brownish areas; pterostigma with central yellowish to hyaline area covering about four cross-veins between antepterostigmal and postpterostigmal spots; Rs forking into R2+3 and R4+5 below pterostigma near margin distal to 3d r and point of coalescence of Sc and R1; MP1+2 with the first fork at an angle; Cu1 with three branches to margin in right wing and four in left wing; three radial cross-veins, 3d r under pterostigma to R2+3;

two series of gradates, three inner and five outer, in irregular series, 1st r-m slightly basal to 2d m in inner series, 3d m between MA and MP1+2 basal to 2d r-m, closest to 2d m, 3d m basal to first branch of MP1+2, and 2d r-m almost directly below 3d r and directed distally in outer series, no sectoral cross-vein.

HINDWING (pl. 2, fig. 5): Length 3.4 mm., width 1.3 mm.; membrane hyaline to yellowish or faintly tinted with light brownish, with three dark brown spots, the first spot over first five (approximately) costal cross-veins down to Rs near separation from R, the second and third brownish spots are the anteposterostigmal and postpterostigmal spots; hyaline areas small, pattern in general corresponding with forewing; pterostigma with narrow yellowish center; most longitudinal veins and costal cross-vein brown in areas tinted with light brown, pale in hyaline areas; radial cross-veins and outer gradates and anal cross-vein brown; 1st m between MA and MP1+2 pale; Rs forked slightly basad of point of coalescence of Sc and R1; Cu1 with two branches to margin; six outer gradates, including a sectoral cross-vein.

MALE GENITALIA (fig. 19); Eighth tergite small, longer medio-dorsally, tapering almost to point lateroventrally, not as broad as ninth tergite; ninth tergite very short dorsally, becoming as long as tenth tergite ventrally, anterior margin convexly curved, with small anterior process before ventral margin; tenth tergite with each half of approximately same length from dorsal border to two-thirds of width, with anteroventral border tapering slightly; ninth sternite with a pair of median rounded dark processes extending distally from inner surface; two halves of tenth sternite almost striplike for over one-half of width, then turning inwardly and broadening ventrally, armed with coarse toothlike papillae, bearing long setae; parameres with flap projecting anterodorsally from median plate more or less blunt at apex, anterior margin concave in center, posterior hooks tripartite, largest process toward exterior, inner arms slender and curved anteriorly, directed anteromedially.

HOLOTYPE: A male (pinned) from La Chorrera, Panamá, May 1916 (August Busck); USNM 62260.

The holotype has the left antenna beyond the basal segment broken off and mounted below the specimen (of 63 segments), the right antenna is also broken (18 segments remaining), and the third pair of legs is missing. The right pair of wings is mounted on a balsam slide.

The female is unknown.

This is one of two species of *Climacia* from Central America, the other being *tenebra*. Although the wings of both species are very similar, they have been separated on the basis of the location of 3d r under the pterostigma, the clear spot basally with the raylike streaking around it, the broader pale area in the pterostigma, and the color

of the vertex, face and antennae in *striata*. Both the forewing and male genitalia of *striata* are also very similar to those of *californica*. However, the two species can be separated by the following characteristics: The antennae, which are banded with a brownish black portion between a basal and distal yellow portion (the latter showing a sharp transition) in *striata*, and more or less solidly brownish black in *californica*; forewing, with pronounced raylike streaking around the basal hyaline spot and the apical and inner margins in *striata*, the location of 3d r below the pterostigma and distad of the point of coalescence of Sc and R1 in *striata* (before and close to 2d r in *californica*); the male parameres with the anterior margin having a more shallow notch in *striata*, but deeper and with an additional process each side of notch in *californica*, and the apparently tripartite hooks in *striata* as compared with the bipartite ones of *californica*. *C. striata* can be distinguished from *areolaris* by the antennae (brownish black becoming slightly lighter toward apex in *areolaris*), the narrower yellow portion of pterostigma in both forewing and hindwing, the broader anteposterostigmal streak, the radiomedial streak extended to the costa, 3d r-m short and directed slightly distad (long, oblique, frequently directed basad in *areolaris*), and the parameres with the narrower, frequently more curved arms and broader anterior notch in *striata*.

Climacia tenebra, new species

FIGURE 20,A; PLATE 2, FIGURE 4

FEMALE (holotype): Head with vertex yellow, a short, transverse, V-shaped spot just behind antennae not reaching lateral margins of head, another minute one on posterior margin of head; face yellow; maxillary palpi yellowish with terminal segments darker, labial palpi yellowish brown; antennae with basal two segments medium brown, following 17 brownish black (right antenna with 19 segments remaining); legs yellow, mesothoracic and metathoracic coxae brown; pronotum medium brown, mesonotum and metanotum yellowish brown, mesonotum blackish brown at anterior margin, mesothoracic and metathoracic pleura brown; abdomen yellowish.

FOREWING (pl. 2, fig. 4): Length 5 mm., width 1.9 mm.; membrane brownish mainly, blending into radiomedial streak, with some inter-venational streaks below and along apical margin to Cu1, large, obliquely transverse, hyaline or yellowish area directed basally, beginning and narrowest at costa covering two or three costal cross-veins in center of pterostigma and broadening and extending to Cu1, one smaller pale area at costa before pterostigma; venation deep brown

in brownish areas and pale in pale areas in general; venation similar to *striata* except 3d r close to 2d r before level of junction of Sc and R1, with cell 2d R1 between 2d r and 3d r not more than three times as long as wide; 1st r-m slightly distad of 2d m in inner series, 3d m between MA and MP1+2 considerably basad of 2d r-m, almost directly under 3d r; Cu1 with five branches to margin in right wing and six in left; three inner gradates in regular series, five outer gradates in irregular series.

HINDWING (pl. 2, fig. 4): Length 4.4 mm., width 1.8 mm.; color pattern similar to that of forewing but membrane lighter brown; hyaline area in pterostigma very narrow, narrower than in *striata*; r between R2+3 and R4+5 distad of 2d r, the outer gradates in irregular series.

FEMALE GENITALIA (fig. 20,A): Eighth tergite shortest dorsally, lengthening considerably to below spiracle where it shortens again; ninth tergite with each lateroventral half large, elongate, with one thick posterior articulation ridge, anterior margin irregular, slightly over one-half of length, dorsal margin concave, ventral margin slightly curved; tenth tergite shorter mediodorsally.

HOLOTYPE: A female (in alcohol) from Honduras, 12 kilometers west of Olanchito, June 20, 1949 (E. C. Becker); INHS.

The holotype has the antennae broken at the apices (18 segments remaining in the left antenna). The abdomen is in a small alcohol-filled vial.

This is the second species of *Climacia* taken in Central America thus far, the first being *striata*. *C. tenebra* has the darkest wings of the species of *Climacia* examined. It is similar to *striata* in general coloration and venation, but differs in the forewing in the closeness of 2d r to 3d r; the basal position of 1st r-m to 2d m between MA and MP1+2, the more narrow pale area in the pterostigma, the termination of the oblique hyaline streak at Cu1, the more extensive brownish color of the membrane, coupled with the lack of a basal clear area and a less streaked appearance around the radiomedial streak, and the color of the vertex and antennae. In the hindwing, the basal costal blackish brown spot is less pronounced in *tenebra*. *C. tenebra* resembles *californica* in the forewing in the closeness of 2d r to 3d r, but is separated on the basis of the more narrow pale area in the pterostigmal streak, more extensive brownish color of the membrane in the forewing, and in the less pronounced radiomedial streak in the hindwing. The yellowish vertex and face and the slightly longer, less rounded ventrally, more concave anteriorly lateroventral halves of the ninth tergite of the female also distinguish *tenebra* from *californica*.

Climacia nota, new species

FIGURE 20,B; PLATE 2, FIGURE 9

FEMALE (holotype): Head with vertex yellow, shining; face yellow, labrum with brownish toward anterior margin; palpi yellow; basal segment of antenna yellow, slightly brownish dorsolaterally toward second segment, second to fourth (approximately) segments yellowish brown, lighter than the following 20 (approximately) which are dark brown, the next 20 lighter brown (antennae broken, of at least 45 segments); legs yellow; pronotum yellowish dorsally, almost as long as wide, with irregular dark streaking, mesonotum and metanotum yellowish, darker laterally, pleura pale; abdomen yellowish.

FOREWING (pl. 2, fig. 9): Length 4+ mm. (apex broken), width 1.4 mm.; membrane yellowish with one prominent brownish black mark, a short, longitudinal, almost straight radiomedial streak, beginning a little basad of the point of separation of Rs and MA and extending basally between the two veins for about one-fourth of their lengths before 1st r-m, very little faint light brown streaking between the longitudinal medial veins distally from the outer gradates to margin; pterostigma yellowish; longitudinal veins yellowish or pale basally with short pieces of Sc and R1 just before coalescing brown, distal forks of Rs, MA, and MP from about 1st r-m and 1st m, Cu1 branches, and distal portions of anal veins darker in general, with macrotrichial pits bordered with brown; outer gradates brown, bordered, inner gradates in part brown, other cross-veins pale or yellowish; Rs forking basad of level of point of coalescence of Sc and R1; MA forking below above point; MP1+2 with first branch of first fork at angle, closer to main stem than second fork; Cu1 with four branches to margin; three radial cross-veins, the first just distad of end of radiomedial streak to Rs, the second at point of forking of R2+3 from R4+5, and the third below pterostigma at forking of R2+3; 2d m between MA and MP1+2 directly below 1st r-m; 3d m directly below 2d r-m from MA to MP1+2; three inner gradates and six outer gradates, including sectoral cross-vein.

HINDWING (pl. 2, fig. 9): Length approximately 3.5 mm., width 1.3 mm.; membrane unstreaked, almost hyaline; pterostigma pale yellowish; veins pale except for brownish short sections of R1 just before and beyond 1st r, both radial cross-veins, 2d and 3d A, which are darker; Rs forking into R2+3 and R4+5 at a point slightly basad of level of point of coalescence of Sc and R1; Cu1 with two branches to margin; six outer gradates.

FEMALE GENITALIA (fig. 20,B): Eighth tergite shorter dorsally; ninth tergite with each lateroventral half elongate, anterior margin more than one-half of and posterior margin about one-third of length,

dorsal margin curving slightly posteroventrally, ventral margin rounded, one posterior articulation ridge; tenth tergite shorter medially.

HOLOTYPE: A female (pinned) from the Orinoco River, Barrancas, Venezuela, Feb. 13-16 (N. A. Weber); MCZ.

Weber collected at Barrancas near the mouth of the Orinoco River at the head of the delta, inland from the lagoon west of the village in January and February 1935 (Bol. Ent. Venezolana, vol. 6, pp. 143-160, 1947).

The holotype has the right forewing, apex of left forewing, left metathoracic legs, and tips of the antennae missing (there being 45 segments remaining in left antenna and 44 segments in right). The left pair of wings is mounted in balsam on a slide, and the abdomen is in a vial containing glycerin pinned beneath the holotype.

The male is unknown.

The forewing of *nota* resembles closely that of *basalis* from the neighboring country of British Guiana. It has the shortest radio-medial streak of those species possessing one, and can be distinguished from *basalis* on this basis as well as because of the absence of anal streaking, comparative scarcity of intervenational streaking, and broader lateroventral halves of the ninth tergite of the female. The constancy of the position of 2d m directly below 1st r-m, and 3d m directly below 2d r-m will not be known until further collections of this species are made.

Climacia basalis Banks

FIGURE 23,A; PLATE 2, FIGURE 8

Climacia basalis Banks, 1913, p. 138 (British Guiana).—Navás 1933, p. 196, fig. 43; 1935, p. 37, fig. 19.

FEMALE: Head with vertex yellowish brown, shining; face yellowish, sometimes with reddish suffusion; palpi yellow; antennae with basal two segments yellowish brown, the following 30 (approximately) darker brown, the next 30 (approximately) yellowish to light brown with the transitions being gradual (of about 62 segments); legs yellow; pronotum yellowish dorsally, sometimes with a thin black median streak and other irregular streaking, mesonotum and metanotum yellowish, mesonotum sometimes with narrow black median streak, mesothoracic and metathoracic pleura with broad yellowish brown dorsoventral streaks, particularly anteriorly; abdomen yellow (with transverse blackish bands dorsally in pinned specimens).

FOREWING (pl. 2, fig. 8): Average length 4.5 mm., average width 1.8 mm.; membrane faintly tinted with yellow and with two brownish black areas; the first more prominent, the radiomedial streak, elongate, crescent-shaped, beginning slightly proximal to Rs+MA, but a little posterior to forking of Rs+MA from R1, then weakly curving and extending along Rs+MA and MA to about 1st m, from where it curves

toward costal margin again to a point slightly distad of 1st r, the second (less prominent), the brownish black area between 2d A and the margin, and between 1st and 2d A near inner margin; longitudinal intervenational light brown streaks usually from near inner gradates to margin; pterostigma yellowish, sometimes a small dark brown antepterostigmal spot; longitudinal veins yellowish except for distal portions which have setal pits bordered with brown and sometimes portion of R1 above 2d r which may be brownish; outer and inner

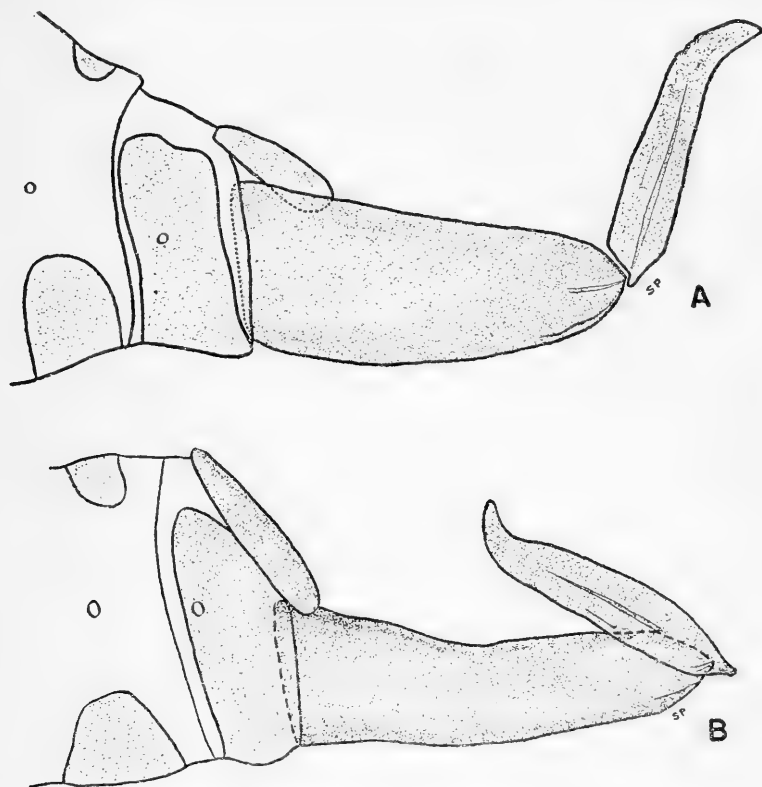


FIGURE 23.—Terminal abdominal segments of female, lateral view. A, *Climacia basalis* Banks, lectoparatype; B, *C. bimaculata* Banks, holotype.

gradates brown, bordered; basal and costal cross-veins yellow except for 1st r; Rs forked basad of level of point of coalescence of Sc and R1; MP1+2 with first fork with short stem; Cu1 with three to five branches to margin; three radial cross-veins, 3d r below pterostigma usually to R2+3; usually one sectoral cross-vein between R2+3 and R4+5 proximal to 3d r; outer and inner gradates forming a regular series, six outer gradates, including sectoral cross-vein.

HINDWING (pl. 2, fig. 8): Average length approximately 4.0 mm., width about 1.6 mm.; membrane almost hyaline; pterostigma yellow;

veins pale except for short sections of R just before and beyond, and Rs just beyond separation of R1 from Rs, of R1 just before coalescence of Sc and R1, and outer gradates (of which s, r-m, m have pale areas in centers); Rs usually forking into R2+3 and R4+5 at point basad of coalescence of Sc and R1; Cu1 with about two to three branches to margin; six outer gradates.

FEMALE GENITALIA (fig. 23,A): Eighth tergite of almost even length throughout width, moderately broad; ninth tergite with each lateroventral half considerably longitudinally elongate, with anterior width less than one-half of and posterior width approximately one-fourth of length, dorsal margin sloping posteroventrally, ventral border only slightly curved from anterior margin to just beyond midpoint, then curving more strongly posterodorsally to articulation point; tenth tergite slender, short, longer lateroventrally.

LECTOTYPE: A female (pinned) from Bartica, British Guiana, December (Parish); MCZ 11934; by present designation.

Since no type was designated in the literature for this species, a lectotype and lectoparatypes are here designated.

The lectotype has the antennae entire (with 71 segments in left and 70 in right); the forewing shows the radiomedial streak extending below Rs+MA, Rs forked beyond 2d r, four branches to Cu1, the portion of R1 above 2d r and 1st r-m pale, no antepetrostigmal spot; the hindwing shows two branches of Cu1 to margin. The mesothoracic right leg is missing.

LECTOPARATYPES: 10 females (pinned), with same data as lectotype; MCZ. 1 female (pinned), with same data; USNM. 1 female, with same data; CU.

The lectoparatypes show variation in the position of 2d r to Rs, R2+3, or the fork of R2+3 in the forewing; the number of branches from Cu1 (three to five in forewing and two or three in hindwing) to margin.

TOPOTYPE: 1 female (in alcohol), with slightly different data "Botica (*sic!*) Br. Guiana"; USNM. This may have been originally a cotype.

The male is unknown.

Navás (1933, p. 196; 1935, p. 38) has also recorded *basalis* from "Brazil, Corumba, Matto Grosso, Mus. de Hamburgo," but it has not been possible to procure this material in order to confirm the determination.

There is also a female (in alcohol, right wings on slide) which was found on a light socket on the steamship *Coppernane* from México on August 13, 1934. The specimen was intercepted at Philadelphia, Pa. The route of the ship is unknown, since the Philadelphia Quarantine and Customs records for 1934 have been destroyed.

H. S. Parish collected in December 1912 in Bartica, which is 40 miles up the Equessibo River, as evident from the account of his itinerary and the records of his crane-fly collections, quoted by Alexander. (Trans. Amer. Ent. Soc., vol. 40, pp. 223-255, 1914.)

This is one of two species of *Climacia*, the other being *bimaculata* Banks, with the same type locality data. The two are readily distinguishable by the occurrence of an elongate radiomedial streak in *basalis* in contrast to a transverse one in *bimaculata*.

C. basalis closely resembles *nota* from Venezuela, from which it is separated on the basis of the longer, more crescent-shaped radiomedial streak, the anal streaking and the more elongate lateroventral halves of the ninth tergite in *basalis*. The forewing of *basalis* is also similar to that of *chapini*, from the United States, but differs in the shorter and slightly broader basal radiomedial streak (which extends from about Rs+MA to slightly beyond 1st r in *basalis*, but from the junction of R and MP in *chapini*), the small or absent antepetrostigmal spot, the longer and narrower lateroventral halves of the ninth tergite of the female in *basalis*.

Climacia bimaculata Banks

FIGURE 23,B; PLATE 2, FIGURE 6

Climacia bimaculata Banks, 1913, p. 138 (Bartica, British Guiana).—Navás, 1935, p. 38.

FEMALE (holotype): Head with vertex shining, blackish brown, with color extending to a small point between antennal sockets; face yellowish brown; palpi yellowish; basal two antennal segments pale yellowish; legs pale yellowish; pronotum brownish yellow, with irregular brownish streaking and faint median dorsal streak, mesonotum and metanotum yellow dorsally, pleura yellowish; abdomen yellowish brown.

FOREWING (pl. 2, fig. 6): Length approximately 3.9 mm., width about 1.4 mm.; membrane yellowish with two distinctive large transverse dark brown spots, the first larger, the basal radiomedial streak running transversely across wing, beginning at about R1 where it is broadest, and extending posteriorly to Cu2, where it is considerably narrower, the second (the antepetrostigmal) spot, of the same general shape as the radiomedial streak, but beginning at costal margin, where it is broadest, and narrowing considerably below R1 to just before Rs; pterostigma yellowish behind antepetrostigmal spot; venation yellowish except for brownish outer gradates and 1st and 2d r; Rs forking into R2+3 and R4+5 basad of point of coalescence of Sc and R1; MP1+2 with first fork at a slight angle; Cu1 with three branches to margin in right wing, four in left; 1st r in radiomedial streak, 2d r just before point of coalescence of Sc and R1,

close to 3d r which is below pterostigma to R2+3; 2d m between MA and MP1+2 almost directly under 1st r-m; three radiomedial cross-veins; inner gradates in slightly irregular series, outer gradates in regular series, including a sectoral cross-vein.

HINDWING (pl. 2, fig. 6): Length approximately 3.4 mm.; width 1.3 mm.; membrane pale yellowish, with indistinct anteposterostigmal spot just before pterostigma, which is yellow, outlining ends of Sc and R1 at their point of coalescence; venation pale except for 1st r, short section of Rs before coalescing with MA, which are brown, with the margin of 1st A and the free piece of MA slightly dark also; Rs forking into R2+3 and R4+5 basad of point of coalescence of Sc and R1; two branches of Cu1 to margin; two radial cross-veins with 1st r just before the R2+3 fork, 2d r before terminal fork of R2; six outer gradates.

FEMALE GENITALIA (fig. 23,B): Eighth tergite of almost uniform length throughout width; ninth tergite with each lateroventral half considerably elongate, anterior width approximately one-third and posterior width one-fourth of length, dorsal margin slightly sloping posteroventrally, ventral margin almost straight, curving postero-dorsally to articulation point; tenth tergite considerably shorter dorsomedially.

HOLOTYPE: A female (in glycerin-filled vial) from Bartica, British Guiana, December; MCZ 11935.

The holotype is broken, with one part consisting of the head (with the antennae beyond the basal segments missing), the prothorax and mesothorax including left forewing (mesothoracic left leg and tibia and tarsi of right broken off), another part of the metathorax with the left hindwing (left metathoracic leg broken off) and a portion of the abdomen. The right wings are mounted on two separate slides.

This specimen was also apparently collected by H. S. Parish in 1912 when he visited Bartica at about the same time he collected *basalis*, although the collector's name is not found on the label attached to the pin (see p. 507). It was apparently originally described by Banks from a unique specimen.

In the Cornell University collection there is also a female, with the following data: "Zanderij 1, Boven Para District, Surinam, April 24, 1927, Cornell U, Lot 760, Sub. 38." This specimen has the antennae beyond the basal two antennal segments blackish brown and slightly paler apically.

This species was collected in the two adjacent countries, British Guiana and Surinam. It is readily distinguishable from *basalis* through its transverse radiomedial streak and anteposterostigmal spot, and its even longer lateroventral halves of the ninth tergite in comparison with the width.

It is one of two species studied thus far possessing the transverse radiomedial streak. It can be separated from *carpenteri* from Paraguay, the other species, by the radiomedial streak, which is obliquely directed distad and of almost even length to MP, and the heavy setal spotting. The lateroventral halves of the ninth tergite in the female appear to resemble those of *basalis* and *carpenteri* most closely, but those of *bimaculata* are longer in comparison with the width. However, the hindwings are almost alike, with the holotype of *bimaculata* showing no radial cross-vein between R2+3 and R4+5 in either hindwing (possibly variable).

Climacia townesi, new species

FIGURE 24,A; PLATE 3, FIGURE 1

FEMALE (holotype): Head with vertex medium brown; face yellowish; palpi yellow; basal two antennal segments light brown, following segments dark brown for approximately two-thirds of length, intergrading into brownish yellow for slightly more than one-half of remaining third, the apical segments light brown; legs yellow with faint brownish shading on mesothoracic and metathoracic coxae; pronotum yellowish dorsally with reddish and blackish brown streaking, mesonotum and metanotum brownish yellow, mesothoracic and metathoracic pleura with brownish dorsoventral streaking, particularly anteriorly; abdomen yellowish.

FOREWING (pl. 3, fig. 1): Length 4.2 mm., width 1.6 mm.; membrane yellowish except for dark brown streaking along inner margin basally in the space from slightly posterior to 1st A to slightly anterior of 2d A with pale streak surrounding basal portion of 2d A, entire inner margin from Cu1 branches to base dark brown, broadest at base; slight indication of faint brownish intervenational streaking between longitudinal medial veins distally from outer gradates to margin; pterostigma yellowish; longitudinal veins yellow basally, light brown distally, both inner and outer gradates dark brown with outer gradates except for 3d r and 3d m-cu bordered, 2d r of inner gradates also faintly bordered, remaining cross-veins pale except for posterior half of anal cross-vein; Rs forking into R2+3 and R4+5 proximal to level of point of coalescence of Sc and R1; MP1+2 with first fork considerably nearer to stem than second fork; Cu1 with three branches to margin in left wing and four in right; three radial cross-veins with 3d r directed obliquely toward apical margin below pterostigma to about fork of R2+3; one sectoral cross-vein between R2+3 and R4+5; 2d m directly below 1st r-m; three inner gradates and six outer gradates, outer gradates in regular series.

HINDWING (pl. 3, fig. 1): Length 3.8 mm., width 1.5 mm.; membrane almost hyaline without maculations; pterostigma yellowish; outer

gradates and 1st r slightly darker than other cross-veins which are yellowish or pale; longitudinal veins yellow, darker around radial cross-veins and from outer gradates to margin; Rs forked almost under but slightly basad of level of point of coalescence of Sc and R1; Cu1 with two branches to margin; six outer gradates, including a sectoral cross-vein.

FEMALE GENITALIA (fig. 24,A): Eighth tergite slightly shorter medio-dorsally; ninth tergite with each lateroventral half large, considerably elongate, anterior margin about one-half and posterior width about one-third of length, dorsal margin sloping posteroventrally in a weak curve from anterior margin, ventral margin curving posteroventrally; tenth tergite tapering slightly lateroventrally.

HOLOTYPE: A female (in alcohol) from Corry River, Brazil, July 1 (Parish); MCZ.

The holotype has the tip of the right antenna missing (61 segments remaining in right antenna, 67 in left). The abdomen is in poor condition, but the genitalia are fairly well preserved and distinct.

PARATYPES: 40 females (37 pinned, 3 in alcohol), all collected by H. S. Parish. Brazil: "Corry" River, July 1 (22 in MCZ, 5 in USNM); "Santa Felipe," June 24 (1 in MCZ), June 26 (1 in USNM); Tapajos, June 30 (1 in MCZ, 1 in USNM), "June 31" (2 in MCZ). Perú: Iquitos, May 8 (1 in USNM), May 12 (1 in MCZ); Napo River, June 6 (1 in USNM), June 8 (2 in MCZ), June 16 (1 in MCZ, 1 in USNM).

The female paratypes differ in the forewing in the location of 3d r extending to the fork of R2+3, to one branch of the fork (R2), or to R2+3 (most often); 2d r to Rs or the fork of Rs (into R2+3 and R4+5) (rare); the branches of Cu1 from three to five (three most common). There is color variation in the face, which is sometimes brownish; the number of antennal segments averages 65, although from 58 to 67 were found. The average length of the forewing is 4.2 mm. and width 1.5 mm.; the average length of the hindwing is 3.7 mm., width 1.4 mm.

The male is unknown.

Adults have been collected from May 8 to July 1 in Brazil and Perú. It appears from the account of the itinerary of Parish up and down the Amazon River, as quoted by Alexander (Proc. Acad. Nat. Sci. Philadelphia, pp. 39-103, 1921) that Parish collected at the Tapajos (River) in 1919, and at Iquitos, the Napo River, "Santa Felipe," and the Corry River in 1920. It was not possible to locate the Corry River or Santa Felipe as such on maps of Brazil, but it is probable from the dates that the "Corry" River refers to the Coary (or Coari) River, and it is possible that "Santa Felipe" may either refer to a locality with a similar name (as São Felip(p)e, of which there are several in Brazil) or to a place not of sufficient importance to be in-

cluded on available maps. It might appear that more than six days (June 26–July 1) might be required to traverse the distance between those localities named São Felip(p)e found on the maps and the Coary River.

This South American species is easily distinguished from other species of *Climacia* by the absence of a basal radiomedial streak coupled with the heavy anal streaking. These features separate it from *nota*, which it closely resembles not only in the wing venation but also in the elongate lateroventral halves of the ninth tergite of the female. From *chilena*, which also has no radiomedial streak, it is recognizable by the lack of setal spotting on the longitudinal veins and the longer plates of the ninth tergite, as well as the heavy anal streaking. The location of 2d m under 1st r-m appears to be fairly constant.

This species is named in honor of Dr. Henry K. Townes of North Carolina State College, who in 1946 invited attention to the presence of *Sisyra apicalis* Banks in Florida. This suggestion led ultimately to this revision of the family from the Western Hemisphere.

Climacia carpenteri, new species

FIGURE 24,B; PLATE 2, FIGURE 7

FEMALE (holotype): Head with vertex brownish yellow, darker spot with a little reddish immediately behind antennae; face yellowish with a little reddish; palpi brownish yellow; antennae with basal two segments dark brown, rest blackish brown (31 segments in left antenna, 26 in right); legs brownish yellow, prothoracic femora with longitudinal reddish brown dorsal streak, metathoracic legs with distal ends of femora and basal ends of tibiae blackish to reddish brown; pronotum brown, lateral margins of mesonotum and metanotum darker brown, mesothoracic and metathoracic pleura with broad, anterior, longitudinal, blackish brown streaks; abdomen brownish with yellowish brown tergites and sternites.

FOREWING (pl. 2, fig. 7): Length 4.3 mm., width 1.6 mm.; membrane slightly yellowish with one larger and two smaller blackish brown spots, the first, the radiomedial streak, transversely elongate, more or less oblique, beginning at 1st r curving slightly basad along Rs and then directed distad along MA and 1st m between MA and MP1+2 for greater part of length, where there is an abrupt break, with spotting continuing along point of forking of MP1+2 and MP3+4, and Cu; the second, the small anteposterostigmal spot, slightly broader at costa and covering at least partially one costal and two pterostigmal cross-veins, with faint shading at end of subcostal space between Sc and R1; the third, the smaller postpterostigmal spot, at end of pterostigma; longitudinal intervenational streaking from outer

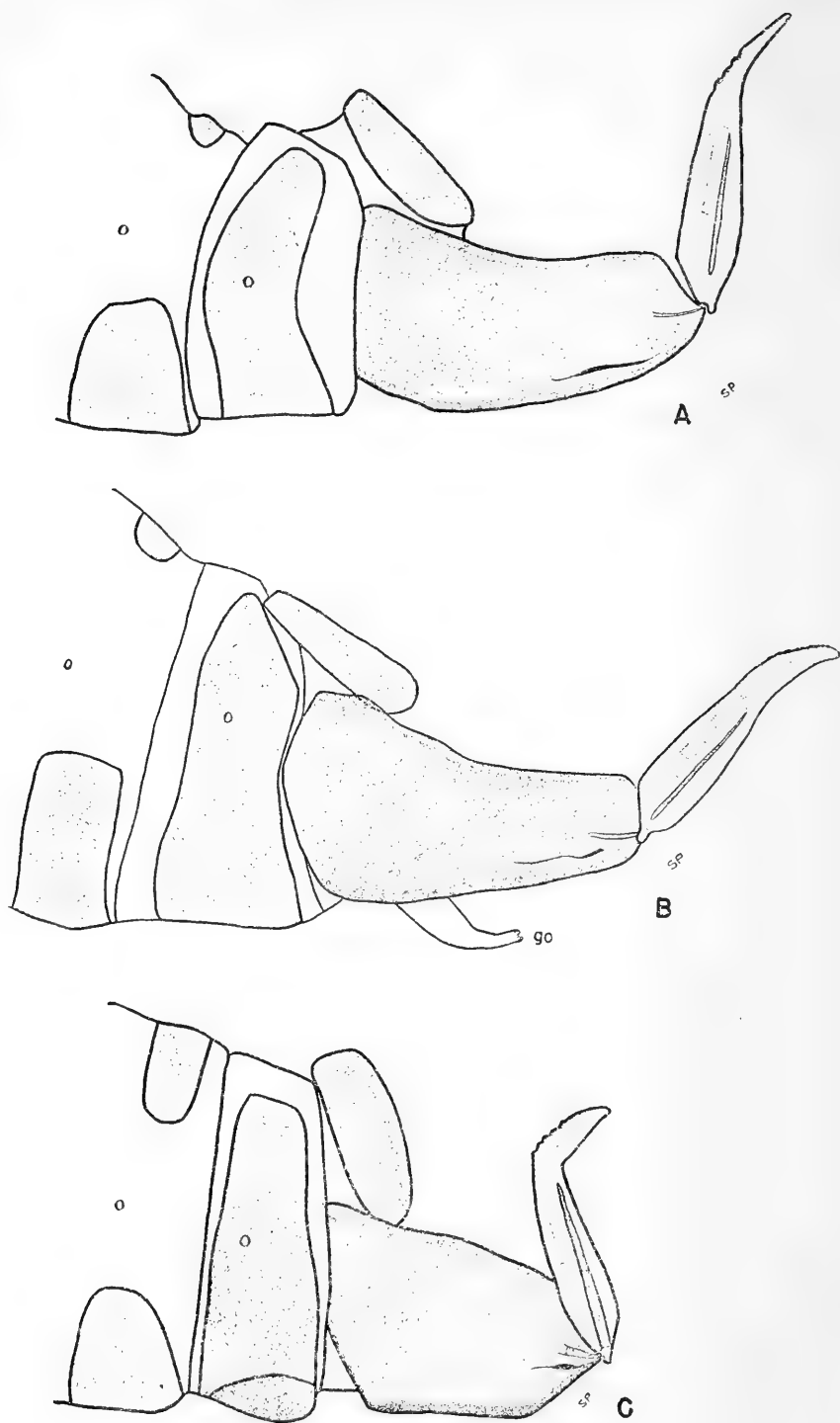


FIGURE 24.—Explanation on facing page.

gradates to margin and between branches of Cu1 to margin; longitudinal veins yellow with heavy dark brown setal spotting almost from base to margin except along C, Sc, and bases of R, M, and Cu; cross-veins heavily bordered in general except for those in basal clear area; pterostigma yellow between antepterostigmal and postpterostigmal spots; Rs forking into R2+3 and R4+5 basad of pterostigma at about point of 2d r in left wing and slightly distad in right wing; MP1+2 with two even forks; Cu1 with four branches to margin; approximately 10 costal cross-veins before pterostigma in right wing and 11 in left; three radial cross-veins, 1st r at point of forking of R from Rs; 1st r-m to free stem of Rs; 2d r-m below R4+5; 2d m almost directly under 1st r-m; 3d m basad of level of point of coalescence of Sc and R1 and forking of MP1+2; sectoral cross-vein slightly distad of 3d r, the outer gradates being slightly irregular at this point; the inner gradates also in irregular series, six outer and three inner gradates.

HINDWING (pl. 2, fig. 7): Length 3.8 mm., width 1.5 mm.; membrane almost hyaline; two small dark brown spots, the first, the faint antepterostigmal at end of subcostal space between Sc and R1, and the second, the postpterostigmal, at end of pterostigma, rest of pterostigma yellow, covering about eight cross-veins; approximately seven costal cross-veins before pterostigma; longitudinal veins yellow except for small section along R1 above 1st r, Rs from point of separation from MA to forking of R2+3 and R4+5, R2+3 basally before 2d r and distally under 2d r, and MP1+2 above and MP3+4 below 1st m which are brown; outer portions of R2+3, R4+5, radial veins and MA dotted with blackish brown setal pits from outer gradates to margin; 4th to 6th costal cross-veins and 1st and 2d r and outer gradates dark brown; Rs forking into R2+3 and R4+5 basad of level of point of coalescence of Sc and R1; Cu1 with three branches to margin; three radial cross-veins; six outer gradates in slightly irregular series, with s slightly distad of 2d r; inner gradates almost in regular series.

FEMALE GENITALIA (fig. 24,B): Eighth tergite much shorter dorsally, lengthening ventrally; ninth tergite with each lateroventral half large, elongate, with one posterior articulation ridge, anterior border convex and considerably wider than posterior, dorsal border sloping markedly and curving to about midway of length, then leveling off to just before articulation point with ninth sternite; tenth tergite short mediodorsally.

FIGURE 24.—Terminal abdominal segments of female, lateral view. A, *Climacia townesi*, new species, paratype; B, *C. carpenteri*, new species, holotype, showing gonapophyses (go); C, *C. chilena*, new species, holotype.

HOLOTYPE: A female (pinned) from Chaco, Paraguay (Fiebrig); in Naturhistorisches Museum, Vienna, Austria.

The holotype has both antennae broken at the tip, the right hindwing torn basally in the anal area, the left folded at the costal margin, and the right mesothoracic leg broken at the tarsus. The abdomen is in glycerin.

According to Horn and Kahle (Ent. Beihefte aus Berlin-Dahlem, vol. 2, 160 pp., 1935), Karl Fiebrig collected in Paraguay in the years 1906-1909.

PARATYPE: A female (pinned), same collecting data as holotype; USNM.

The paratype has the antennae broken beyond the basal segment, the abdomen mashed terminally, but recognizable, the frons covered with debris. The right wings are on a slide.

The paratype differs from the holotype as follows: The left forewing shows 2d r to R2+3 (instead of to Rs as in holotype), 3d r to the R2+3 fork (instead of to R2+3), 2d m almost directly under but slightly basad of 2d r-m (instead of slightly distad), 5 branches of Cu1 (instead of 4) to margin; the right forewing similar to left except 2d r to R2+3 fork, three branches of Cu1 to margin; forewing length 5 mm., width 1.8 mm., hindwing length 4.3 mm., width 1.8 mm. The legs of the paratype show more extensive longitudinal dark brown streaking, and the vertex has a transverse blackish band behind the antennae, which may be superficial.

The male is unknown.

This species most closely resembles *bimaculata* through the occurrence of the transverse radiomedial streak coupled with 1st m and cu also bordered, the anteposterostigmal spot, and character of genitalia. It differs in the less extensive radiomedial streak obliquely directed distad along MA, which with the bordered crossveins gives the effect of a parenthesis, and the less extensive anteposterostigmal spot, both of which are distinct and broad anteriorly and narrowed posteriorly in *bimaculata*. It also differs in the strongly dotted setal spots, longitudinal intervenational streaks reminiscent of *chilena*, and in the moderately elongate lateroventral halves of the ninth tergite of the female in contrast to the considerably elongate ones in *bimaculata*.

This interesting species from the center of South America is named in honor of Dr. Frank M. Carpenter, Professor of Entomology and Alexander Agassiz Professor of Zoology, Harvard University, who has made valuable contributions to the organization, knowledge, and modernization of the taxonomy of the Nearctic Neuroptera.

Climacia chilena, new species

FIGURE 24,C; PLATE 3, FIGURE 2

FEMALE (holotype): Head with vertex dark brown in center, some lighter brown laterally adjacent to eyes; face dark brown medially, paler laterally; palpi yellowish; antennae dark brown (broken, of at least 41 segments); legs yellow, coxae with a little brownish; pronotum with anterior third yellowish with a small dark brown spot on each side of central dark streak, posterior two-thirds brown with two narrow oblique yellowish spots, one on each side of central dark streak, mesonotum and metanotum brown, prothoracic pleura brown, mesothoracic and metathoracic pleura brown with yellow elongate streak medially and anteroventrally; abdomen yellowish.

FOREWING (pl. 3, fig. 2): Length 6 mm., width 2.2 mm.; membrane yellowish with no streaking other than faint brownish intervenational streaking from outer gradates, and distal portions of cubital and anal veins to margin; longitudinal veins yellowish basally with setal pits bordered with brown from about point of separation of Rs and MA from Rs+MA to margin; Sc from humeral vein to level of about 11th costal cross-vein, subcostal ends of most costal cross-veins brown; radial and cubital cross-veins, inner and outer gradates (except 1st r-m which is yellowish with brown setal pits), brown bordered; Rs forking far basad of point of coalescence of Sc and R1 near center of wing into R2+3 and R4+5; R2+3 forking under point of coalescence of Sc and R1; MA forking under pterostigma in left wing and basad of Rs fork into R2+3 and R4+5 in right wing; MP1+2 forking into almost equal forks near margin; Cu1 with four branches to margin in left wing and five in right wing; approximately 14 costal cross-veins before pterostigma; gradates in regular series, three inner and seven outer gradates in left wing, eight outer gradates in right wing, including an additional s between forking of R2+3, and an additional m between the fork of MA; three radial cross-veins, 1st r slightly distad of separation of Rs from MA, 2d r slightly distad of forking of R2+3 and R4+5 in right wing and basad in left wing; two radiomedial cross-veins. The right forewing is probably abnormal in its deep fork to MA and the crowding together of R2 and R3.

HINDWING (pl. 3, fig. 2): Length approximately 5 mm., width 2.2 mm.; membrane hyaline to yellowish; pterostigma yellowish; longitudinal veins, except for basal portion of costa, yellowish; entire length of Sc more or less (except base), short section of R1 from just before 1st r to point of coalescence of Sc and R1, short section of Rs+MA just before their separation, Rs beyond separation, very short basal portions of MA at separation from Rs, R4+5 at separation from R2+3, R2+3 to 1st r, and costal and radial cross-veins brownish;

outer gradates brown; Rs, shortly after separation from MA, forking into R2+3 and R4+5, considerably basad of point of coalescence of Sc and R1; R2+3 in right wing forking slightly distad of point of coalescence of Sc and R1 and with an additional sectoral cross-vein slightly basad of 2d r, in left wing R2+3 forking distad of 2d r and with an apparently abnormal loop ending at 2d r and with no additional s; 2d r basad of s between R2+3 and R4+5 in both hind wings (except additional abnormal cross-vein mentioned above); Cu1 with three branches to margin in right wing, and four in left; seven outer gradates in right hindwing, six in left; ten costal cross-veins before pterostigma.

FEMALE GENITALIA (fig. 24,c): Eighth tergite shorter dorsally, longer ventrally; ninth tergite with each lateroventral half large, moderately elongate, with one posterior thick articulation ridge, dorsal margin sloping gradually posteroventrally, anterior margin bent at approximately midpoint at an angle, then sloping posteroventrally, ventral margin straight for a short distance before curving postero-dorsally to articulation point; tenth tergite of almost equal length throughout, tapering slightly posteroventrally; ninth sternite with apex rather sharply bent and a group of about five setal pits in apical portion.

HOLOTYPE: A female (pinned) from Puerto Varas, Llanquihué, Chile, December 1926 (R. and E. Shannon); USNM 62259.

It is seen from the account of the South American itinerary of Shannon and Edwards (Edwards, *in* Alexander, *Diptera of Patagonia and South Chile*, pt. 1, p. xii, 1929) into the southern Andes region that collections at Puerto Varas were made on December 16.

The holotype has the left mesothoracic leg, the right antenna beyond the basal segment, and the tip of the left antenna missing (41 segments remaining in left antenna). The abdomen beyond the anterior portion of the third segment is in glycerin; the right pair of wings is mounted on a balsam slide.

The male is unknown.

This large species of *Climacia* is easily distinguished from most species by the absence of any basal radiomedial streak or other pronounced spotting in the forewing except the setal spotting. It is separated from *townesi*, which also has no radiomedial streak, through the bordered setal pits, basal position of 2d m in relation to 1st r-m, color of veins in the hindwing (darkening of veins in vicinity of 1st r), and the absence of the heavy anal streaking in *chilena*. *C. carpenteri* also has the bordered setal pits similar to those of *chilena*, but, in addition, possesses the radiomedial streak and anteposterostigmal spots. The pronotal coloration of *chilena* is distinctive.

Whether the more basal forking of R2+3, the forking of MA at the center of the wing, the additional s and m cross-veins of the right

forewing, and the comparatively deep forking of Rs into R2+3 and R4+5 from the margin in the right hindwing of the holotype of *chilena* are abnormalities cannot be definitely ascertained until further material is procured.

Genus *Sisyria* Banks

Sisyria Banks, 1939, p. 470. GENOTYPE: *Sisyria nirvana* Banks, by monotypy (Banks, loc. cit.).

Brownish spongilla-flies.

HEAD: Antenna with basal segment longer than broad, second segment only slightly longer than remaining segments of flagellum; face short; maxillary palpi with terminal segment long, broader basally, acute apically (fig. 7,1).

THORAX: Pronotum truncate, broader than long, anterior margin considerably shorter than posterior, transverse grooves; in general similar to *Sisyra*. Tarsi with basal segment more than one-third length of tarsi.

FOREWING (pl. 1, fig. 7): Costal area with about nine or ten costal cross-veins before the pterostigma; subcostal area almost as broad as broadest width of costal area, with a basal subcostal cross-vein below about fifth costal cross-vein and possibly another weak one below pterostigma; Sc atrophying at apical end with coalescence with R1 uncertain; Rs+MA separating off from R1 near base, Rs separating from MA basad of 1st r; free stem of Rs with two main forks, R4+5 separating off near longitudinal center of wing, with R2 and R3 forking slightly distad; MA forking under pterostigma; MP forking into MP1+2 and MP3+4 at base of wing and with terminal forks basad of pterostigma; Cu1 separating from Cu2 near base of wing; 3d A running free to margin; sometimes three radial cross-veins between R1 and Rs; two sectoral cross-veins, one between R2 and R3 and the second between R3 and R4+5; two radiomedial cross-veins; three medial cross-veins between MA and MP, one between MP1+2 and MP3+4; three mediocubital, one cubital, one cubito-anal and one anal cross-vein; two inner and seven outer gradates almost in regular series (except 1st s sometimes); thyridia present at point of forking of MP1+2 and MP3+4 and on outer gradates except 3d r and 3d m-cu.

HINDWING (pl. 1, fig. 7): Costal area with approximately eight costal cross-veins before pterostigma, with area immediately preceding pterostigma almost free of cross-veins; subcostal area broader than costal area with one basal subcostal cross-vein; Sc fading at apex, strong basally; Rs coalescing with MA for a longer distance than in forewing and separating from MA in center of wing and forking into two main forks, R4+5 near center of wing and a short distance beyond,

R2 and R3; MA separating off from MP at base into a free sinuate section, then coalescing with Rs; MP forking into MP1+2 and MP3+4 basad of center of wing; Cu1 separating from Cu2 near base of wing; anal veins simple; usually two radial cross-veins, sometimes both to R2; two sectoral cross-veins, one between R2 and R3 and one between R3 and R4+5; one radiomedial cross-vein; two medial cross-veins between MA and MP and one between MP1+2 and MP3+4; one mediocubital, one cubital, one cubito-anal and one anal cross-vein; seven outer gradates; thyridia on all outer gradates except 2d r and m-cu cross-veins.

MALE GENITALIA: Tenth sternite with claspers similar to those of *Sisyra*.

FEMALE GENITALIA: Similar in structure to *Sisyra*. Eighth tergite not appearing fused midventrally in *nirvana*; third sternite shorter than second; fourth to sixth sternites with posterior pale spots prominent.

In general, *Sisyrina* closely approaches *Sisyra*, the principal difference being the occurrence of a well-developed series of outer gradates in both the fore and hindwings. The termination of Sc (atrophying or free to margin) at the apex is also worthy of note.

The genus *Sisyrina* has thus far been taken in India only, and contains one species, *nirvana* Banks, from southern India (Nedungatu), which has been examined.

Genus *Sisyrella* Banks

Nopia Navás, 1910, p. 397 (not Walker, 1862, preoccupied in Lepidoptera). *Sisyrella* Banks, 1913, pp. 216, 218, new name, *Nopia* Navás.—Krüger, 1923, p. 45.—Navás, 1935, p. 70.

GENOTYPE: *Nopia nikkoana* Navás, by monotypy (Navás, 1910, p. 397).

It was not possible to procure for study any determined specimens belonging to this genus. The genera *Sisyra*, *Climacia*, and *Neurorthus* are so distinct from each other in regard to wing venation, palpi, and genitalia that the question arises as to whether the distinctive characters in *Sisyrella* are sufficient to warrant its designation as a separate genus. On this basis, it might seem that *minuta* and *panama*, and others of the *apicalis* group, might also be placed in different genera from *Sisyra*. The following description is based upon the works of Navás (loc. cit.).

HEAD: Maxillary palpi with terminal segment broader basally, tapering at apex; labial palpi with terminal segment triangle-shaped, similar to *Sisyra*.

FOREWING (pl. 1, fig. 8): Costal area with about ten cross-veins before pterostigma; subcostal area with one basal subcostal cross-vein;

Sc appearing separate from R1 or atrophying and indistinct at apex; Rs+MA separating off from R1 near base, Rs separating off at about the longitudinal midpoint of wing, R2 and R3 a short distance beyond; MA forking basad of level of point of junction of Sc and R1; MP forking into MP1+2 and MP3+4 with terminal forks basad of level of point of junction of Sc and R1; Cu1 separating from Cu2 near base of wing; three radial cross-veins between R1 and Rs, 1st r distad of forking of Rs from MA, 2d r distad of r-m; 3d r under pterostigma; r-m sometimes near point of separation of R4+5 from Rs; one medial cross-vein between MA and MP1+2 near forking of MP1+2 from MP3+4; three mediocubital cross-veins between MP and Cu1, the first basal, the second to Cu1 before branches, and third to branches; one cubital cross-vein; one basal cubito-anal cross-vein between Cu2 and 1st A; one anal cross-vein between 1st and 2d A; no real gradates; thyridia at point of separation of MP1+2 from MP3+4.

HINDWING (pl. 1, fig. 8): Costal area with at least six costal cross-veins basad of pterostigma, closer together basally; Sc with terminal end atrophied; Rs probably similar to *Sisyra*, separating from MA near midpoint of wing; MP forking into MP1+2 and MP3+4 as in *Sisyra*; one medial cross-vein between MA and MP1+2; one medio-cubital cross-vein; no real gradates.

A female sisyrid from Wakamatsu, Japan (Aug. 22, 1949, M. Kohno), kindly sent by Mrs. Gloyd and Dr. H. H. Ross (of INHS) appears to closely approach *Sisyrella japonica* (Nakahara), which Nakahara placed in the genus *Sisyra* (1914, pp. 492-493). Sc is atrophied at the apex in the forewing. Two features which were noted upon examination of the specimen but not mentioned in descriptions of *Sisyrella* or its species are the emarginate appearance of the clypeus anteriorly, and the considerably emarginate second abdominal sternite laterally and posteriorly, with the streak almost on the posterior margin. The length of the forewing is 5.5 mm., width 2.3 mm.; length of hindwing, 4.6 mm., width 2 mm. The membrane is light brownish.

According to the descriptions and figures of Navás, the chief distinction between *Sisyrella* and *Sisyra* seems to rest upon the more apparent separation of Sc and R1 at the apex. The separation of Sc and R1 also seems to occur in *Sisyra minuta*, and appears occasionally in certain specimens of *Sisyra*. It has not been possible to procure the genotype of *nikkoana* for study, and until further investigation reveals stronger characters, *Sisyrella* should be considered a doubtful genus, scarcely distinct from *Sisyra*.

There have been two species ascribed to this genus, both from Japan: *japonica* Nakahara (1914, p. 493) from Osaka and *nikkoana* Navás (1911, p. 398) from near Tokyo.

Genus *Neurorthus* Costa

Neurorthus Costa, 1863, p. 32.—Navás, 1935, p. 19.

Sartena Hagen, 1864, p. 41.—McLachlan, 1881, p. 89.

Large, multiveined spongilla-flies.

GENOTYPE: *Neurorthus iridipennis* Costa, by monotypy (Costa, 1863, p. 33).

HEAD: Antenna with basal segment sometimes almost as broad as long, slightly convex on inner margin, second segment shorter and considerably narrower than basal segment; segments of flagellum smaller; vertex convex, sometimes with large mound in center, median sulcus on vertex pronounced; face longer than in *Sisyra*, deep transverse frontoclypeal depression, anterior margin of clypeus almost straight; labrum bilobed with anterior median concavity, convex laterally; postoccipital margin of foramen slightly convex medially, concave laterally on each side; maxillary palpi with basal two segments short, third slightly longer than fourth, fifth narrow, cylindrical to midpoint, then tapering and narrowing considerably and acute at apex (fig. 7,J); labial palpi with terminal segment cylindrical, narrowing and acute at apex, sometimes extended.

THORAX: Pronotum narrower anteriorly, then broadening and rounded laterally, overlapping cervicales, posteriorly narrowing again, distinctively marked and grooved; mesothorax with prescutum large, almost same size as mesoscutellum; lateral lobes of mesoscutum slightly narrowed, oblique. Legs with first tarsal segment longest, fourth shortest.

FOREWING (pl. 3, fig. 3): Costal area with numerous, sometimes forked cross-veins, sometimes as many as 24 before pterostigma; subcostal area with a basal subcostal cross-vein, and apparently a second subcostal cross-vein under pterostigma; Sc and R1 appearing separate at apex, joined by the second subcostal cross-vein; Rs+MA separating off from R1 near base and coalesced for a longer distance than in *Sisyra*; free stem of Rs usually with two main forks, R4+5 separating off near longitudinal midpoint of wing, R2 and R3 forking a short distance beyond; basal piece of MA usually distinct at base, MA deeply forked, dividing into two branches at about or slightly basal to level of point of junction of Sc and R1; MP forking into MP1+2 and MP3+4 near separation of Rs from MA; MP1+2 and MP3+4 with terminal forks under pterostigma; Cu1 separating from Cu2 near base of wing; Cu1 with marginal branches frequently forked; Cu2 sometimes, 1st and 2d A usually, and 3d A sometimes forked; usually most veins forked at margin except Cu2 and some costal cross-veins; three radial cross-veins; usually one or two sectoral cross-

veins between R2 and R3, and between R3 and R4+5; two radio-medial cross-veins between R4+5 and MA, or MA fork; three medial cross-veins between MA and MP1+2; two medial cross-veins between MP1+2 and MP3+4; three mediocubital cross-veins between MP and MP3+4 and Cu1; one cubital and one cubito-anal cross-vein, one anal cross-vein between 1st and 2d A; outer gradates of about five to seven cross-veins, inner of five to seven cross-veins; thyridia at point of meeting of MP1+2 and 1st r-m.

HINDWING (pl. 3, fig. 3): Costal area with costal cross-veins before pterostigma numerous, sometimes more than 20; subcostal area with one or two subcostal cross-veins, more narrow than in *Sisyra*; Sc not appearing fused with R1 but seemingly connected by a subcostal cross-vein to R1 at apex; Rs after branching off from R1 near base, continuing free basally for a shorter distance than in *Climacia*, then separating and proceeding anteriorly back toward R1 and forking into two main forks, R4+5 and R2 and R3 a short distance beyond; MA separating off into a free oblique piece, shorter and straighter than that of *Sisyra* or *Climacia*; MP forking into MP1+2 and MP3+4 basad of point of separation of MA from Rs; Cu1 separating from Cu2 near base of wing, with several marginal branches; usually three radial cross-veins, two or three sectoral cross-veins, two radiomedial cross-veins, two medial between MA and MP1+2 and one between MP1+2 and MP3+4, one mediocubital, one cubito-anal, one anal between 1st and 2d A; outer gradates of approximately seven to eight cross-veins, inner gradates of two or three cross-veins; thyridia not pronounced.

MALE GENITALIA: Not studied, differing from other genera.

FEMALE GENITALIA: Eighth tergite divided middorsally, fused midventrally; ninth tergite divided in two, each part moved dorso-ventrally to tenth tergite, with long articulation ridge posteriorly; tenth tergite broader than long; ninth sternite divided into two broad elongate upturned parts terminating bluntly with median longitudinal streak, articulated at base to halves of ninth tergite; remaining tergites and sternites long and broad.

The position of *Neurorthus* in the Sisyridae is still not settled and it appears to be the only genus in the Sisyridae thus far showing the free basal piece of MA after it has separated from MP and before it has coalesced with R in the forewing, which is characteristic of many of the genera of the Hemerobiidae and related families (Carpenter, 1940, p. 194). Lestage (1924, p. 65; 1935, pp. 389-390) has also questioned its position in the Sisyridae. However, the character in the forewing, wherein all branches of Rs arise from a single Rs stem, is typically sisyrid. Although the life history of none of the species of *Neurorthus* has been worked out, some adults have been taken near

streams (Klapálek, 1917, p. 203; *iridipennis* in Algeria, McLachlan, 1898, p. 103).

The venation of the fossil *Rophalis* as drawn by Hagen ("*Sisyra relictata*," 1856, pl. 8, fig. 20) appears to be strikingly similar to that of the present-day *Neurorthus*. A photograph of the forewings and hindwings of a sisyrid fossil in Baltic amber (pl. 3, fig. 5) from the Kohlman collection was kindly sent by Dr. Rupert Wenzel of the Chicago Natural History Museum.

A portion of the collection of Baltic amber insects from Prussia assembled by Haren (interested in microscopy) during 1900–1920 was acquired by A. F. Kohlman (also interested in microscopy) and later purchased in 1953 by the Chicago Natural History Museum. Four of these photographs were included with the collection and were almost certainly taken by Haren himself (for stereoscopes), according to Dr. Wenzel. The main portion of the collection was acquired by the Museum of Comparative Zoology about 1938. Wenzel (1953, p. 6) concluded that since 99.5 percent of the Baltic amber (estimated between 30 and 35 million years old) comes from the Samland Peninsula north of Königsberg, Prussia, it is doubtful that any of the Kohlman specimens came from any other locality.

Unfortunately, the scientific value of the specimens was not recognized by the heirs of Kohlman after his death, and it is possible that the specimen photographed has been lost. It could not be located. The photo not only shows that the venation and other features (extruded mouthparts as seen on some specimens at MCZ; mound on head) do not differ appreciably from that of *Neurorthus*, but strongly resemble *fallax* (Rambur). Consequently, the question is raised as to whether the living genus *Neurorthus* is a synonym of the fossil genus *Rophalis*. If such proves to be the case upon actual study of the fossils, *Rophalis* (Hagen, 1856, p. 87) has priority over the present-day name *Neurorthus* (Costa, 1863, p. 32).

Neurorthus fallax was described by Rambur (1842, p. 422) in the genus *Mucropalpus*, in which other species were placed which now belong to other genera. Since Banks (1905, p. 29) designated *lutescens* Rambur (not Fabricius) (now *humulinus* Linné) as the type of *Mucropalpus*, the name is eliminated from further consideration in connection with species now placed in *Neurorthus*.

Five species have been recorded: *brunneipennis* Esben-Petersen (1929, p. 33) (Australia); *fallax* (Rambur) (Corsica; Sardinia); *fuscineris* Nakahara (1915, p. 16) (Japan); *iridipennis* Costa (1863, p. 33) (Algeria; Bulgaria; Italy; Sardinia; Spain); *punctatus* Nakahara (1915, p. 151) (Japan).

Genus *Rophalis* Hagen

Sisyra (*Rophalis*) Hagen, 1856, p. 87.

Rhopalis Hagen, 1866, p. 459.

Rhopalis Krüger, 1923, pp. 52, 83.

Sisyra Handlirsch, 1907, p. 908.

Fossil spongilla-flies.

GENOTYPE: *Sisyra* (*Rophalis*) *relicta* Hagen in Baltic amber, from the Lower Oligocene, designated by Hagen (1866, p. 459) by elimination (see Hagen, 1854, p. 228; 1856, p. 87, pl. 8, fig. 19; and Handlirsch, 1907, p. 908).

Numerous costal cross-veins before pterostigma; Sc not appearing coalesced with R1, but running free to margin in both wings; Rs of forewing and hindwing with two main forks far proximal to the pterostigma; inner and outer gradate series of cross-veins present in both forewing and hindwing (pl. 3, fig. 5). Maxillary and labial palpi with terminal segment long, narrow, and acute.

Although Hagen (1856, p. 87) gave no formal diagnosis of *Rophalis*, he recognized Erichson's unpublished manuscript designation of a new genus and species (*relicta*) on the labels of specimens from the collection of Berendt and Menge (about 1842, according to Hagen, 1866, p. 459). He was apparently the first to publish Erichson's name and drawings, at the same time noting a generic difference from *Sisyra*, with a description of Erichson's *relicta* (as *Sisyra* (*Rophalis*) *relicta*) and a new species *amissa* (*Sisyra* (*Rophalis*) *amissa*).

Both Hagen (1856, p. 87) and Krüger (1923, pp. 52, 57, 83) considered Erichson's figure of *Rophalis relicta* (Hagen, 1856, pl. 7, fig. 25) as erroneous. The designation as "*Sisyra relicta*" is used by Hagen (1856), for plate 8, figure 19. Hagen later (1866, p. 459) emended the spelling of "Rophalis" to "Rhopalis," one of the two spellings for the genus ("*Rhopalis*," "*Rhophalis*") which appeared on Erichson's labels, according to Krüger (1923, pp. 52, 83). Krüger gave the subgenus generic rank (as "*Rhophalis*").

The placing of a second fossil species, *Sisyra* (*Rophalis*) *amissa* Hagen (1856, p. 87, pl. 8, fig. 20) in this genus by Krüger (1923, p. 57) is questioned by Krüger himself (ibid., p. 84), who was of the opinion that the drawing is of a hindwing. Hagen, in 1856 and 1866, placed this species in *Sisyra*.

Because of the destruction of several European collections during World War II, the specimens seen by Hagen, Krüger, and Handlirsch are probably no longer available for study, and further recognition of the genus is dependent upon the acquisition of additional specimens.

The question as to whether *Rophalis* and *Neurorthus* are generically distinct is discussed under *Neurorthus* (p. 521).

A fossil fragment of the apical portion of a wing from the Oligocene (Gurnet Bay, Isle of Wight) has been identified as possibly belonging to the genus *Sisyra* (?) (*disrupta*) by Cockerell (1917, p. 381). This specimen, which is in the British Museum, was not examined for this study.

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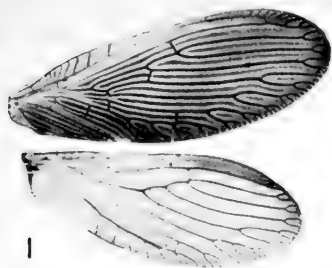
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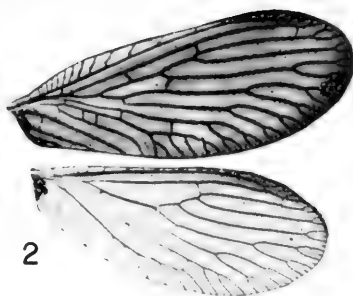
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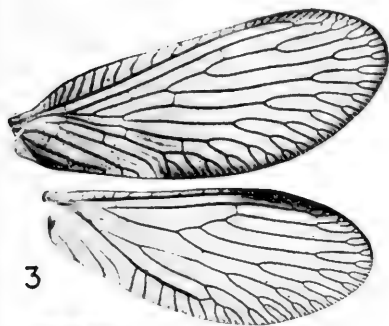
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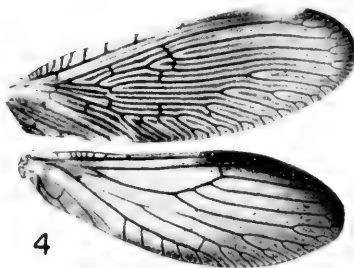
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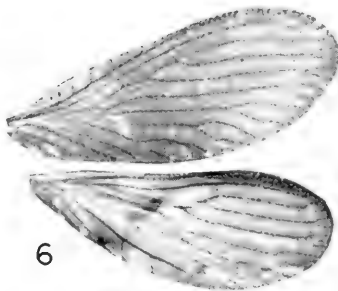
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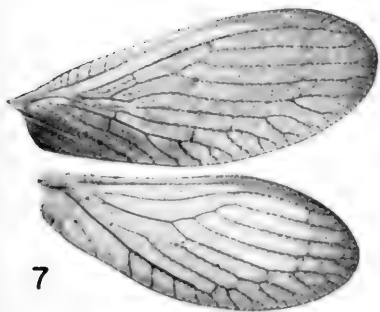
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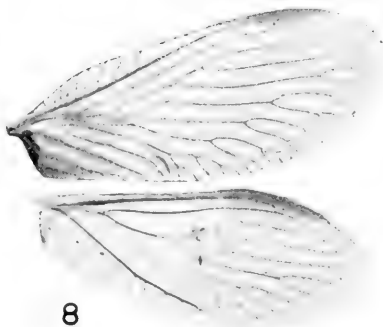
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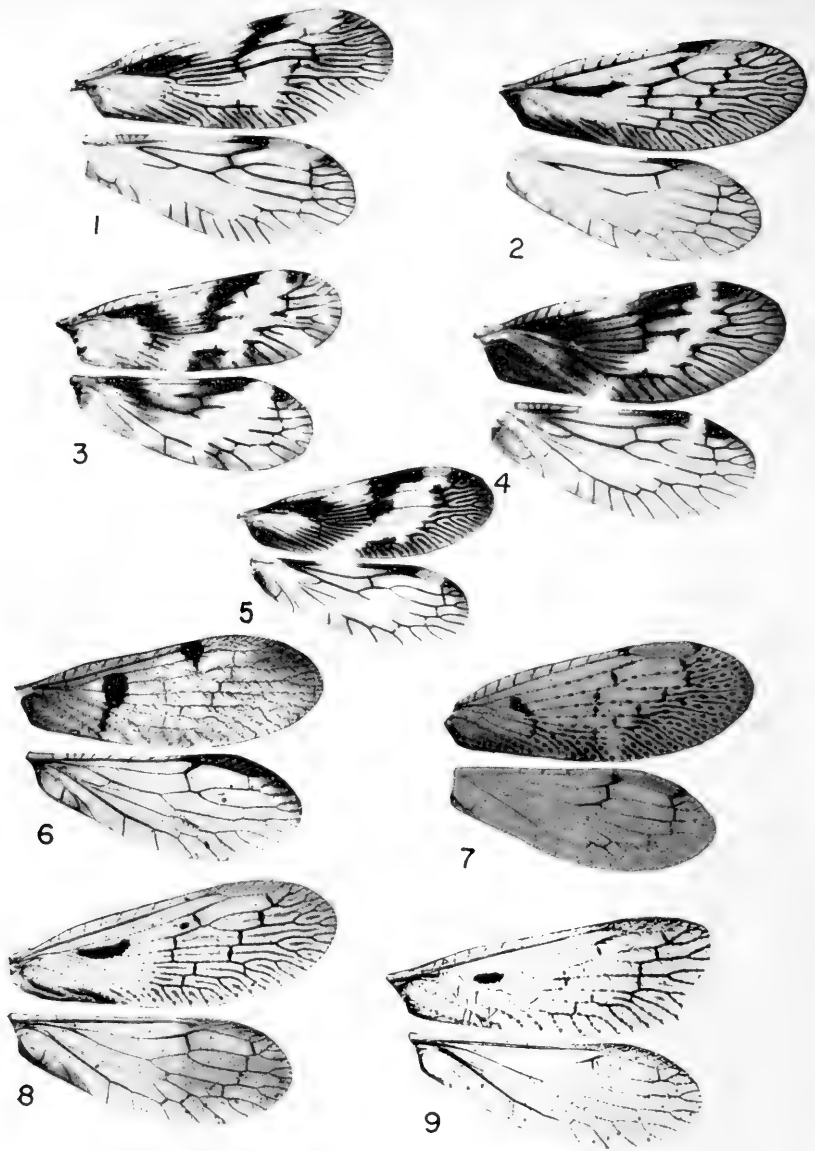


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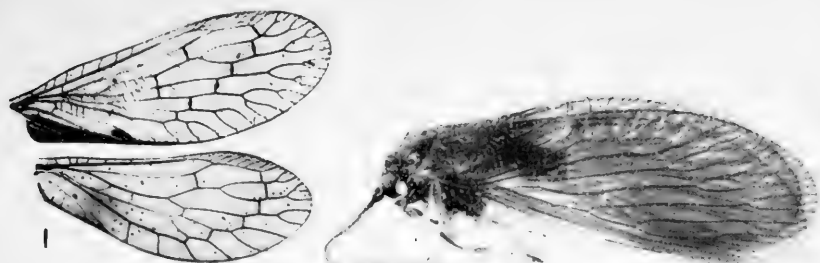


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Wings of *Sisyridae*; 1, *Sisyra apicalis* Banks; 2, *Sisyra fuscata* (Fabricius); 3, *Sisyra vicaria* (Walker); 4, *Sisyra panama*, new species, holotype; 5, *Sisyra nocturna* Navás, holotype; 6, *Sisyra minuta* Esben-Petersen, holotype; 7, *Sisyrina nirvana* Banks, paratype; 8, probably *Sisyrella*, near *japonica* (Nakahara). (Sizes of photographs do not correspond with relative sizes of specimens.)

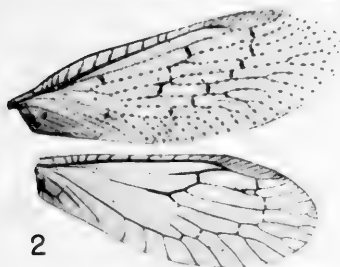


Wings of *Climacia*: 1, *areolaris* (Hagen); 2, *chapini*, new species, paratype; 3, *californica* Chandler; 4, *tenebra*, new species, holotype; 5, *striata*, new species, holotype; 6, *bimaculata* Banks, holotype; 7, *carpenteri*, new species, paratype; 8, *basalis* Banks, lectoparatype; 9, *nola*, new species, holotype. (Sizes of photographs do not correspond with relative sizes of specimens.)



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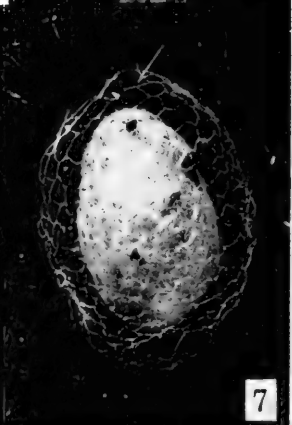
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Sisyrid wings and cocoons. 1, *Climacia townesi*, new species, paratype, wings; 2, *Climacia chilena*, new species, holotype, wings; 3, *Neurorthus fallax* (Rambur), wings; 4, *Sisyra vicaria* (Walker), wings in resting position; 5, fossil sisyrid in Baltic amber; 6, *Sisyra vicaria* (Walker), cocoon; 7, *Climacia areolaris* (Hagen), cocoon. (Sizes of photographs do not correspond with relative sizes of specimens.)



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MARINE POLYCHAETE WORMS FROM LABRADOR

By MARIAN H. PETTIBONE¹

This report on the polychaete fauna of Labrador is based on material collected by the *Blue Dolphin* Expeditions to Labrador and Newfoundland in 1949, 1950, 1951, and 1952 under the command of David C. Nutt. The collections were made between 51° and 60° north latitude, in the intertidal zone and in depths of from 4 to 125 fathoms, on bottoms of silt, mud, sand, rubble, pebbles, stones, and rocks, together with detritus, shells, corals, bryozoans, algae, worm tubes, and various combinations of these. The collections are deposited in the U. S. National Museum. Additional records for some of the Labrador species are cited from other collections in that museum.

This paper supplements to some extent the report on the polychaetes of Point Barrow, Alaska (Pettibone, 1954). Of the 68 species in the Labrador collections, 45 were found at Point Barrow. In the systematic portion below, only those literature references not mentioned in the earlier paper are cited; more complete synonymies for the species common to both regions will be found in the Point Barrow report.

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The polychaete fauna of Labrador is known only from a few scattered records. The most extensive single paper is the report by J. Percy Moore (1909b) on a collection of polychaetes dredged in 1908 by Owen Bryant off the coasts of Labrador, Newfoundland, and Nova Scotia; 38 of the 51 species mentioned in that report were found on the Labrador coast. Most of the collection was deposited in the National Museum and is referred to below. The *Blue Dolphin* collections nearly double the number of polychaete species known from Labrador.

The writer acknowledges her appreciation to the authorities of the Smithsonian Institution for allowing her to make use of the facilities of the National Museum, and especially to Dr. Waldo L. Schmitt and Dr. Fenner A. Chace, Jr., of the Department of Zoology staff there. Special thanks are also due to Mr. David C. Nutt of the Dartmouth College Museum for his helpful suggestions and assistance.

LIST OF STATIONS

The locations of the polychaete stations are shown in figure 1. They are listed below with temperatures (estimated yearly range in parentheses) and salinities, all of which were furnished by D. C. Nutt. The species found at each station are listed, with the number of specimens indicated in parentheses.

1. Strait of Belle Isle, 51°26.5' N., 56°52' W., 40 fms., June 27, 1949; 0.8° C. (−1.5 to 3.0), 32‰.

| | |
|---|--|
| <i>Harmothoë extenuata</i> (Grube) (5) | <i>Nereis pelagica</i> Linné (3) |
| <i>Eusyllis blomstrandii</i> Malmgren (9) | <i>Spirorbis spirillum</i> (Linné) (5) |

2. Strait of Belle Isle, 51°41.5' N., 56°20' W., 25 fms., coral and rock, July 1, 1949; −0.43° C.? (−1.6 to 1.0), 32‰.

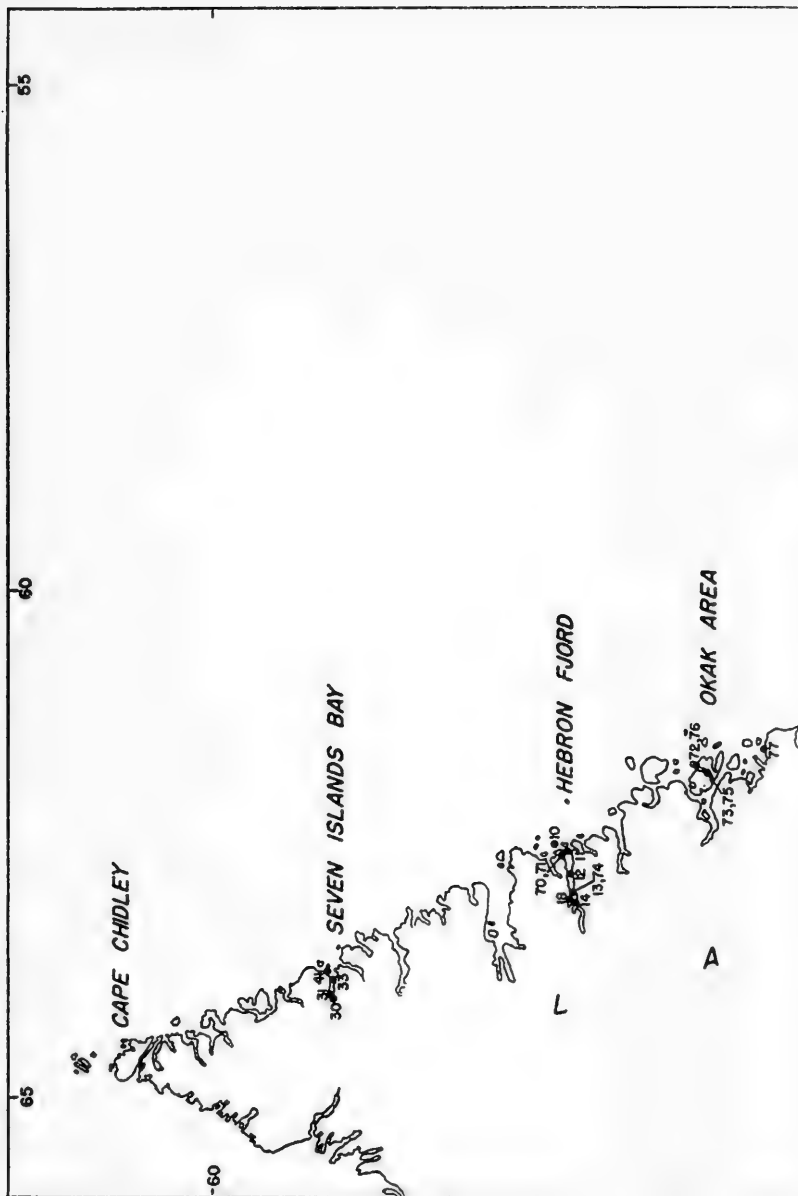
| | |
|--|---|
| <i>Eunoë oerstedii</i> Malmgren (1) | <i>Eusyllis blomstrandii</i> Malmgren (6) |
| <i>Harmothoë imbricata</i> (Linné) (1) | <i>Nereis pelagica</i> Linné (4) |
| <i>Harmothoë extenuata</i> (Grube) (5) | <i>Nothria conchylega</i> (Sars) (1) |
| <i>Autolytus fallax</i> Malmgren (1) | <i>Thelepus cincinnatus</i> (Fabricius) |
| <i>Sphaerosyllis erinaceus</i> Claparède (1) | |

3. Strait of Belle Isle, 51°39.7' N., 55°57.7' W., 30 fms., rock, July 1, 1949; 0.0° C. (−1.0 to 12), 32‰.

Thelepus cincinnatus (Fabricius) (1)

4. Strait of Belle Isle, 51°39.7' N., 56°08' W., 40 fms., rubble, July 1, 1949; −0.8° C. (−1.6 to 1.0?), 32.3‰.

| | |
|-------------------------------------|--|
| <i>Eunoë nodosa</i> (Sars) (2) | <i>Harmothoë extenuata</i> (Grube) (1) |
| <i>Eunoë oerstedii</i> Malmgren (1) | |





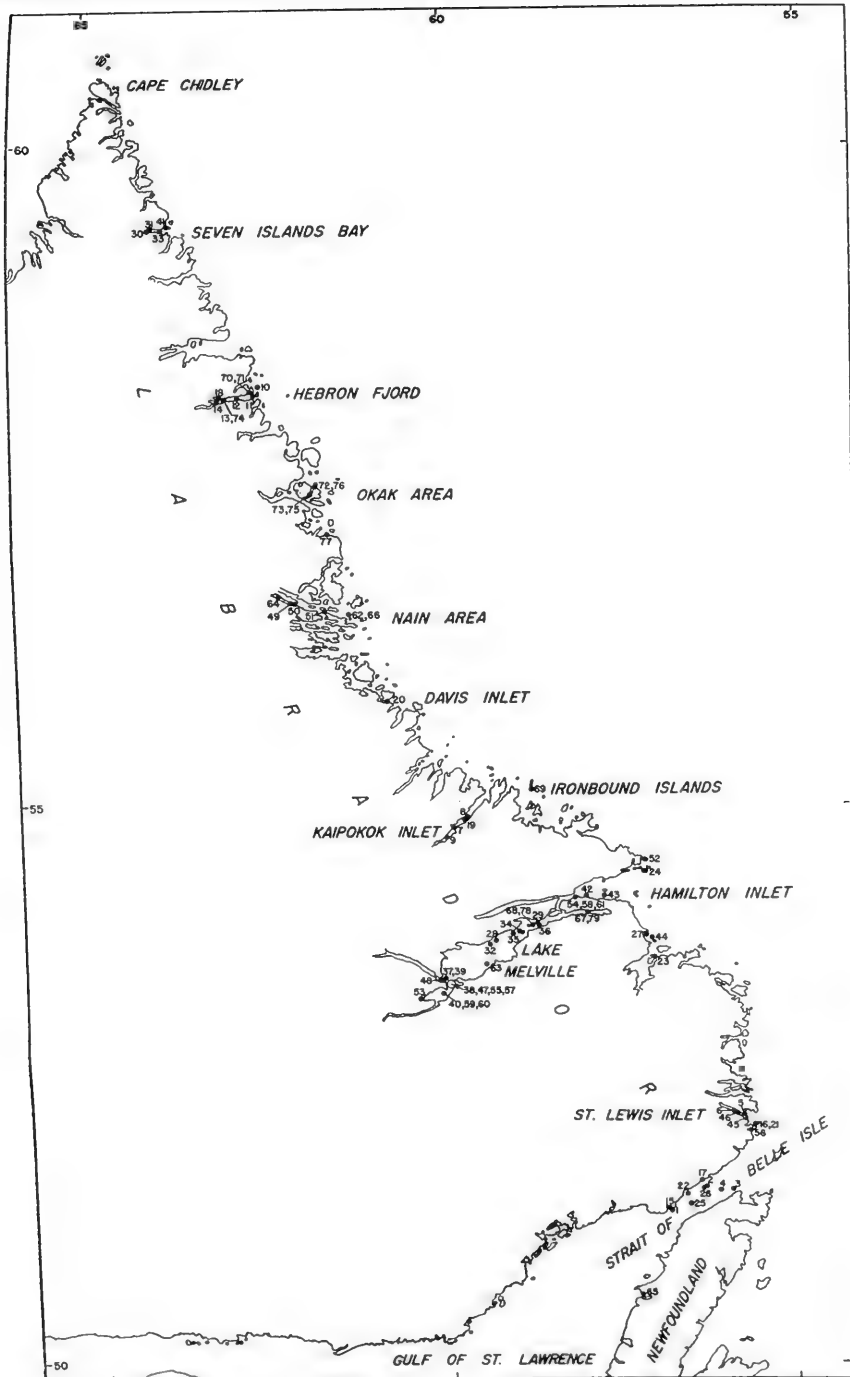


FIGURE 1.—Coasts of Labrador and Newfoundland showing the locations of the polychaete stations of the *Blue Dolphin* Labrador Expeditions of 1949 (Stations 1-27), 1950 (Stations 28-48), 1951 (Stations 49-66), and 1952 (Stations 67-79). (Prepared by D. C. Nutt.)



5. St. Lewis Inlet, 52°20.1' N., 55°49.4' W., 40 fms., mud, July 12, 1949; -1.2° C. (-1.6 to ?), 32.61‰.
- | | |
|--|---|
| <i>Arcteobia anticostiensis</i> (McIntosh) (1) | <i>Pectinaria hyperborea</i> (Malmgren) (8) |
| <i>Prionospio malmgreni</i> Claparède (1) | |
6. St. Lewis Inlet, 52°22.3' N., 55°56.7' W., 35 fms., soft mud, July 12, 1949; -1.34° C. (-1.6 to ?), 32.4‰.
- Harmothoë extenuata* (Grube) (1)
7. Kaipokok Inlet, 54°56.7' N., 59°43.2' W., 45 fms., silt, July 29, 1949; -1.8° C. (-1.8 to -1.6), 32.6‰.
- | | |
|---|--|
| <i>Antinoë badia</i> (Théel) (5) | <i>Nephtys ciliata</i> (Müller) (2) |
| <i>Harmothoë extenuata</i> (Grube) (4) | <i>Polycirrus medusa</i> Grube (1) |
| <i>Gattyana cirrosa</i> (Pallas) (2) | <i>Branchiomma infarcta</i> (Kröyer) (5) |
| <i>Castalia aphroditoides</i> (Fabricius) (1) | |
8. Kaipokok Inlet, 55°01.5' N., 59°33.3' W., 45 fms., silt, July 29, 1949; -1.85° C. (-1.8 to -1.6), 32.9‰.
- Castalia aphroditoides* (Fabricius) (1)
9. Kaipokok Inlet, 54°52.4' N., 59°50.3' W., 15 fms., silt, July 29, 1949; -1.1° C. (-1.8 to 0.0), 30.68‰.
- | | |
|--|--------------------------------------|
| <i>Harmothoë extenuata</i> (Grube) (1) | <i>Gattyana cirrosa</i> (Pallas) (2) |
|--|--------------------------------------|
10. Hebron Fjord, 58°14.8' N., 62°29.6' W., 60 fms., fine sandy mud, some rock, Aug. 7, 1949; -1.0° C. (-1.8 to 0.0), 32.5‰.
- | | |
|---|---------------------------------------|
| <i>Gattyana cirrosa</i> (Pallas) (3) | <i>Ampharete arctica</i> Malmgren (1) |
| <i>Gattyana amondseni</i> (Malmgren) (1) | <i>Pista flexuosa</i> (Grube) (3) |
| <i>Pectinaria hyperborea</i> (Malmgren) (7) | <i>Terebellides stroemii</i> Sars (1) |
11. Hebron Fjord, 58°11.4' N., 62°34.2' W., 95 fms., mud, Aug. 8, 1949; -1.8° C. (-1.8 to -1.8), 33‰.
- | | |
|--|---|
| <i>Antinoë badia</i> (Théel) (2) | <i>Chaetozone setosa</i> Malmgren (16) |
| <i>Eunoë nodosa</i> (Sars) (1) | <i>Brada inhabilis</i> (Rathke) (1) |
| <i>Arcteobia anticostiensis</i> (McIntosh) (6) | <i>Brada granosa</i> Stimpson (13) |
| <i>Gattyana cirrosa</i> (Pallas) (36) | <i>Pectinaria hyperborea</i> (Malmgren) (186) |
| <i>Gattyana amondseni</i> (Malmgren) (1) | <i>Sabellides borealis</i> Sars (1) |
| <i>Nephtys ciliata</i> (Müller) (2) | <i>Pista flexuosa</i> (Grube) (15) |
| <i>Cirratulus cirratus</i> (Müller) (1) | <i>Pista maculata</i> (Dalyell) (1) |
| | <i>Euchone papillosa</i> (Sars) (4) |
12. Hebron Fjord, 58°09' N., 62°45.7' W., 125 fms., mud, Aug. 8, 1949; -1.85° C. (-1.8 to -1.8), 33.1‰.

21. St. Lewis Inlet, Assizes Harbor, 52°15' N., 55°04' W., 6 fms., muddy sand and coral, July 15, 1949; 4.5° C. (−1.6 to 6.0), 29°/∞.

Harmothoë extenuata (Grube) (1)

22. Strait of Belle Isle, 2 miles off Anse au Loup, 51°36' N., 56°38' W., 30–40 fms., June 29, 1949; −0.5° C. (−1.2 to 2.0), 32°/∞.

Harmothoë extenuata (Grube) (1) *Eusyllis blomstrandii* Malmgren (2)
Autolytus alexandri Malmgren (1) *Nereis pelagica* Linné (3)

23. Hamilton Inlet, Cartwright Harbor, 53°43' N., 57°02' W., 6 fms., sand, mud, rock, much detritus, July 19, 1949; 9° C. (−1.6 to 10), 26°/∞.

Harmothoë imbricata (Linné) (1) *Melinna cristata* (Sars) (1)
Lumbrineris fragilis (Müller) (2) *Terebellides stroemii* Sars (1)
Prazillella praetermissa (Malmgren) (3) *Sabella crassicornis* Sars (1)

24. Hamilton Inlet, Indian Harbor, 54°27' N., 57°11' W., 6 fms., muddy, sandy, July 25, 1949; 6° C. (−1.8 to 8), 31°/∞.

Harmothoë imbricata (Linné) (1) *Nephtys ciliata* (Müller) (1)
Pholoë minuta (Fabricius) (4) *Capitella capitata* (Fabricius) (4)

25. Strait of Belle Isle, Centre Bank, 51°31' N., 56°35' W., 25–30 fms., small rocks, pebbles, June 29, 1949; −0.5° C. (−1.6 to 6.0), 32°/∞.

Harmothoë extenuata (Grube) (1)

26. Strait of Belle Isle, 3 miles off Red Bay, 30 fms., June 29, 1949; −0.5° C. (−1.6 to 1.0), 32°/∞.

Harmothoë extenuata (Grube) (1) *Eusyllis blomstrandii* Malmgren (3)

27. Hamilton Inlet, Trunmore Bay, 8 fms., sandy, July 25, 1949; 6° C. (−1.8 to 10), 30°/∞.

Nephtys longosetosa Oersted (14) *Pectinaria hyperborea* (Malmgren) (1)

28. Lake Melville, 53°52' N., 59°19' W., 30–35 fms., mud, July 11, 1950; −0.2° C. (−0.3 to 0.3), 27°/∞.

Antinoë badia (Théel) (1) *Branchiomma infarcta* (Krøyer)
Scalibregma inflatum Rathke (2) (2)

29. Lake Melville, 54°01.3' N., 58°41.7' W., 70 fms., mud, July 13, 1950; −0.9° C. (−0.1 to −0.9), 28.5°/∞.

Antinoë badia (Théel) (3) *Nereis zonata* Malmgren (11)
Phyllodoce groenlandica Oersted (1) *Aglaophamus malmgreni* (Théel) (1)
Paranaitis kosteriensis (Malmgren) (1)

30. Seven Islands Bay, 59°23.4' N., 64°03.2' W., 10-12 fms., stony, some mud, Aug. 10, 1950; 1.0° (-1.8 to 2.0), 31.6‰.
- | | |
|--|--|
| <i>Antinoë badia</i> (Théel) (1) | <i>Flabelligera affinis</i> Sars (1) |
| <i>Eunoë nodosa</i> (Sars) (1) | <i>Spirorbis spirillum</i> (Linné) (3) |
| <i>Harmothoë imbricata</i> (Linné) (3) | |
31. Seven Islands Bay, Kangalaksiorvik Fjord, 59°24' N., 64°01' W., 30 fms., mud, some rock, Aug. 8, 1950; -0.5° C. (-1.8 to 0.0), 32‰.
- | | |
|--|---|
| <i>Eunoë oerstedii</i> Malmgren (1) | <i>Sabellides borealis</i> Sars (1) |
| <i>Harmothoë extenuata</i> (Grube) (9) | <i>Pista maculata</i> (Dalyell) (8) |
| <i>Gattyana cirrosa</i> (Pallas) (3) | <i>Leaena abbranchiata</i> Malmgren (1) |
| <i>Flabelligera affinis</i> Sars (2) | <i>Euchone analis</i> (Krøyer) (4) |
| <i>Maldane sarsi</i> Malmgren (2) | <i>Spirorbis granulatus</i> (Linné) (1) |
| <i>Nicomache lumbricalis</i> (Fabricius) (2) | <i>Spirorbis spirillum</i> (Linné) (1) |
| <i>Pectinaria hyperborea</i> (Malmgren) (2) | |
32. Lake Melville, off Lowland Point, 53°50' N., 59°25' W., 20 fms., sand, mud, rock, July 25, 1950; 0.0° C. (0.0 to 1.0), 26‰.
- Branchiomma infarcta* (Krøyer) (1)
33. Seven Islands Bay, 59°24' N., 63°51' W., 50 fms., mud, some rock, Aug. 8, 1950; -1.3° C. (-1.8 to -1.0), 32.5‰.
- | | |
|--|---|
| <i>Antinoë badia</i> (Théel) (2) | <i>Pectinaria hyperborea</i> (Malmgren) (4) |
| <i>Eunoë nodosa</i> (Sars) (1) | |
| <i>Harmothoë imbricata</i> (Linné) (1) | <i>Pista flexuosa</i> (Grube) (5) |
| <i>Harmothoë extenuata</i> (Grube) (1) | |
34. Lake Melville, off St. Johns Island, 53°56.5' N., 58°58' W., 35 fms., mud, July 23, 1950; -0.5° C. (-0.5 to 0.2), 27.7‰.
- | | |
|-----------------------------------|---|
| <i>Nereis zonata</i> Malmgren (1) | <i>Spirorbis granulatus</i> (Linné) (1) |
|-----------------------------------|---|
35. Lake Melville, 53°56' N., 59°03' W., 45 fms., mud, July 12, 1950; -0.6° C. (-0.6 to 0.2), 27.8‰.
- Branchiomma infarcta* (Krøyer) (2)
36. Lake Melville, 53°56' N., 59°03' W., 65-100 fms., sandy mud, some rock, July 14, 1950; -0.8° C. (-1.2 to -0.2), 28.85‰.
- | | |
|--|------------------------------------|
| <i>Harmothoë extenuata</i> (Grube) (1) | <i>Ephesia gracilis</i> Rathke (1) |
| <i>Nereis zonata</i> Malmgren (1) | |
37. Lake Melville, west end, 53°32.2' N., 60°03' W., 55 fms., mud, July 8, 1950; -0.5° C. (-0.5 to -0.1), 27.9‰.
- | | |
|--|---|
| <i>Nicomache lumbricalis</i> (Fabricius) (1) | <i>Leaena abbranchiata</i> Malmgren (1) |
|--|---|
38. Lake Melville, west end, 53°28.8' N., 59°59.5' W., 15 fms., mud, Aug. 19, 1950; 1.0° C. (0.5 to 2.0), 25‰.

- | | |
|-----------------------------------|---|
| <i>Antinoë sarsi</i> Kinberg (1) | <i>Pista maculata</i> (Dalyell) (40) |
| <i>Nereis zonata</i> Malmgren (1) | <i>Leaena abranchiata</i> Malmgren (12) |
| <i>Pista flexuosa</i> (Grube) (3) | <i>Terebellides stroemii</i> Sars (1) |

39. Lake Melville, west end, 53°32' N., 60°03' W., 57 fms., mud, Aug. 19, 1950; -0.5° C. (-0.5 to -0.1), 27.9‰.

- | | |
|--|--|
| <i>Antinoë badia</i> (Théel) (2) | <i>Pista maculata</i> (Dalyell) (1) |
| <i>Aglaophamus malmgreni</i> (Théel) (8) | <i>Branchiomma infarcta</i> (Krøyer) (3) |

40. Greater Lake Melville area, Goose Bay, 53°21' N., 60°05' W., 30 fms., mud, July 7, 1950; 0.8° C. (0.8 to 1.5), 22.4‰.

- | | |
|-------------------------------------|--|
| <i>Antinoë badia</i> (Théel) (1) | <i>Branchiomma infarcta</i> (Krøyer) (6) |
| <i>Nereis zonata</i> Malmgren (5) | |
| <i>Pista maculata</i> (Dalyell) (6) | |

41. Seven Islands Bay, 59°25' N., 63°47' W., 50 fms., stony, Aug. 10, 1950; -1.3° C. (-1.8 to -1.0), 32.7‰.

- | | |
|---|-------------------------------------|
| <i>Pectinaria hyperborea</i> (Malmgren) (1) | <i>Sabellides borealis</i> Sars (1) |
|---|-------------------------------------|

42. Hamilton Inlet, off Nat's Discovery Point, 54°14.9' N., 58°01' W., 45 fms., stony, Aug. 27, 1950; 0.7° C. (-1.7 to 0.8), 32‰.

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|--------------------------------|--|
| <i>Eunoë nodosa</i> (Sars) (1) | <i>Harmothoë extenuata</i> (Grube) (9) |
|--------------------------------|--|

43. Hamilton Inlet, 54°15' N., 57°45' W., 30 fms., mud, stones, Aug. 27, 1950; 1.0° C. (-1.7 to 1.0), 32‰.

- | | |
|-------------------------------------|-------------------------------------|
| <i>Nephtys ciliata</i> (Müller) (4) | <i>Lysippe labiata</i> Malmgren (1) |
| <i>Laonice cirrata</i> (Sars) (1) | <i>Pista flexuosa</i> (Grube) (6) |

44. Hamilton Inlet, Cape Porcupine, off South Strand near Pigeon Island, 53°54' N., 57°04' W., 13 fms., sand, Aug. 27, 1950; 4-5° C. (-1.6 to 6.0), 32‰.

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|--|--------------------------------------|
| <i>Harmothoë imbricata</i> (Linné) (3) | <i>Gattyana cirrosa</i> (Pallas) (1) |
|--|--------------------------------------|

45. St. Lewis Inlet, St. Mary's Harbor, 10 fms., mud, sandstone, shell, Aug. 30, 1950; ?° C. (-1.6 to ?), ?‰.

- | | |
|--|---|
| <i>Eunoë nodosa</i> (Sars) (1) | <i>Pectinaria hyperborea</i> (Malmgren) (7) |
| <i>Harmothoë imbricata</i> (Linné) (1) | |
| <i>Lumbrineris fragilis</i> (Müller) (1) | |

46. St. Lewis Inlet, 52°21' N., 55°56.5' W., 35-40 fms., mud, Aug. 30, 1950; ?° C. (-1.6 to ?), ?‰.

- Antinoë badia* (Théel) (2)

47. Lake Melville, west end, 53°29' N., 59°58' W., 9-11 fms., mud, July 28, 1950; 2° C. (1.0 to 2.0), 15‰.

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|---|--|
| <i>Nereis zonata</i> Malmgren (1) | <i>Branchiomma infarcta</i> (Krøyer) (1) |
| <i>Pectinaria granulata</i> (Linné) (3) | |
| <i>Pista maculata</i> (Dalyell) (20) | |

48. Lake Melville, anchorage off Northwest River, 6-7 fms., sandy mud, Aug. 23, 1950; 8° C. (1.0 to 8.0), 8‰.
- Antinoë sarsi* Kinberg (5) *Pectinaria granulata* (Linné) (3)
Nephtys ciliata (Müller) (1)
49. Nain Bay, 35 fms., mud, Aug. 7, 1951; -1.0° C. (-1.4 to 0?), 31‰.
- Antinoë badia* (Théel) (3) *Pectinaria hyperborea* (Malmgren) (4)
Harmothoë extenuata (Grube) (2)
50. Nain Bay, 45 fms., mud, Aug. 7, 1951; -1.4° C. (-1.4 to -1.0), 31.5‰.
- Harmothoë imbricata* (Linné) (1) *Pectinaria hyperborea* (Malmgren) (1)
Harmothoë extenuata (Grube) (1) *Pista flexuosa* (Grube) (1)
51. Nain area, Strathcona Run off Nain, 55-60 fms., sandy mud, some stone, Aug. 5, 1951; 2.5° C. (? to 4.5), 30.75‰.
- Harmothoë extenuata* (Grube) (1)
52. Hamilton Inlet, Emily Harbor, 10 fms., mud, some rock, July 29, 1951; 4° C. (? -1.6 to 8.0), 30.5‰.
- Harmothoë imbricata* (Linné) (4) *Pista flexuosa* (Grube) (2)
Pectinaria granulata (Linné) (1) *Spirorbis spirillum* (Linné) (20)
53. Greater Lake Melville, Terrington Basin, 8 fms., mud, July 10, 1951; 6° C. (2.0 to 8.0), 10‰.
- Aglaothamus malmgreni* (Théel) (11) *Pista maculata* (Dalyell) (1)
54. Hamilton Inlet, Collinghams' Cove, 7 fms., mud, sand, Aug. 13, 1951; 4° C. (-1.5 to 6.0), 28‰.
- Harmothoë imbricata* (Linné) (1) *Nephtys ciliata* (Müller) (7)
55. Lake Melville, about 3 miles northeast of Sandy Point near entrance to Goose Bay, 17-19 fms., Aug. 26, 1951; 2.0° C. (0.5 to 2.5), 24‰.
- Antinoë sarsi* Kinberg (2) *Nereis zonata* Malmgren (2)
Antinoë badia (Théel) (1) *Scalibregma inflatum* Rathke (1)
Harmothoë extenuata (Grube) (2) *Pista maculata* (Dalyell) (10)
56. St. Lewis Inlet, Islet Bay, Schooner Cove, 15-20 fms., mud, stone, some rock, July 2, 1951; 1.0° C. (? to ?), 32‰.
- Harmothoë imbricata* (Linné) (1) *Pectinaria hyperborea* (Malmgren) (1)
57. Lake Melville, 53°30' N., 59°59' W., 40 fms., mud, July 10, 1951; 0.0° C. (0.0 to 0.0), 26.5‰.

- Aglaophamus malmgreni* (Théel) (3) *Pista flexuosa* (Grube) (1)
Nicomache lumbricalis (Fabricius) (2) *Pista maculata* (Dalyell) (4)
Leaena abranchiata Malmgren (6)
58. Hamilton Inlet, Collinghams' Cove, 15 fms., rock, stones, July 5, 1951; 3° C. (-1.5 to 5.0), 29°/∞.
- Harmothoë extenuata* (Grube) (1) *Eusyllis blomstrandii* Malmgren (1)
59. Greater Lake Melville, Goose Bay, 30 fms., Aug. 26, 1951; 1.1° C. (0.3 to 1.5), 21.73°/∞.
- Antinoë badia* (Théel) (2) *Pista maculata* (Dalyell) (3)
Nereis zonata Malmgren (1) *Branchiomma infarcta* (Kröyer) (1)
60. Greater Lake Melville, Goose Bay, 30 fms., mud, July 7, 1951; 1.4° C. (0.8 to 1.5), 21.9°/∞.
- Antinoë sarsi* Kinberg (4) *Pista maculata* (Dalyell) (5)
Antinoë badia (Théel) (3) *Branchiomma infarcta* (Kröyer) (1)
Nereis zonata Malmgren (3) (1)
Aglaophamus malmgreni (Théel) (5)
61. Hamilton Inlet, Collinghams' Cove, the Narrows, tide pool, July 19, 1951.
- Harmothoë imbricata* (Linné) (2)
62. Nain area, Strathcona Run off Nain, 60 fms., Aug. 8, 1951; 2.5° C. (? to 4.5), 30.75°/∞.
- Harmothoë imbricata* (Linné) (1) *Autolytus fallax* Malmgren (1)
Harmothoë extenuata (Grube) (2) *Nereis pelagica* Linné (1)
Gattyana cirrosa (Pallas) (1)
63. Lake Melville, south side, west of Eskimo Paps, 80 fms., Aug. 25, 1951; 0.7° C. (-0.6 to -1.0), 28.4°/∞.
- Antinoë badia* (Théel) (1) *Branchiomma infarcta* (Kröyer)
Aglaophamus malmgreni (Théel) (2)
(10)
64. Nain area, western end Nain Bay, 15-23 fms., Aug. 9, 1951; 0.5° C. (-1.5 to 3.0), 30.4°/∞.
- Harmothoë imbricata* (Linné) (4) *Harmothoë extenuata* (Grube) (3)
65. Newfoundland, Port Saunders, intertidal, June 28, 1951.
- Harmothoë imbricata* (Linné) (5) *Nereis virens* (Sars) (2)
66. Nain area, Ford Harbor, 40 fms., Aug. 6, 1951; 0.0° C. (-1.5 to 2.0), 31.8°/∞.
- Harmothoë imbricata* (Linné) (1) *Spirorbis spirillum* (Linné) (20)
Harmothoë extenuata (Grube) (2)

67. Lake Melville, The Backway, about 8 miles from east end, 54°06' N., 58°01' W., 15-16 fms., July 4, 1952; 0.0° C. (-0.6 to 2.0), 25.5‰.
- Harmothoë extenuata* (Grube) (1) *Branchiomma infarcta* (Krøyer) (5)
Nereis zonata Malmgren (6)
Nephtys ciliata (Müller) (1) *Spirorbis spirillum* (Linné) (3)
Brada villosa (Rathke) (1)
68. Lake Melville, shoal area between Gull Island and Neveisik Island, 53°59' N., 58°48' W., 18-20 fms., July 4, 1952; 1.0° C. (-0.6 to 4.0), 25.5‰.
- Harmothoë extenuata* (Grube) (5) *Pista maculata* (Dalyell) (1)
69. Ironbound Islands, southwest end of Kidlialuit Island, 55°07' N., 58°45' W., 4-7 fms., July 13, 1952; 1.0° C? (-1.8 to 8.0), 31‰.
- Arcteobia anticostiensis* (McIntosh) (1) *Phyllodoce mucosa* Oersted (2)
Pectinaria granulata (Linné) (1)
70. Hebron Fjord, Hebron Harbor, 4-8 fms., July 18, 1952; 4° C. (-1.8 to 6.0), 29‰.
- Harmothoë imbricata* (Linné) (7) *Harmothoë extenuata* (Grube) (2)
71. Hebron Fjord, Hebron Harbor, 12 fms., July 20, 1952; 2° C. (-1.8 to 4.0), 31.5‰.
- Harmothoë imbricata* (Linné) (4)
72. Okak area, channel east of Semekutak Island, about 5 miles north of Nutak, 4-15 fms., July 29, 1952; 3° C. (-1.6 to 6.0), 31‰.
- Nereis pelagica* Linné (1)
73. Okak area, Nutak Harbor just southwest of Cape Mugford, 3-3½ fms., July 29, 1952; 5° C. (-1.6 to 8.0), 30‰.
- Harmothoë imbricata* (Linné) (1) *Praxillella praetermissa* (Malmgren) (1)
74. Hebron Fjord, about 3 miles east of Freytag Inlet, 100 fms., July 31, 1952; -1.75° C. (-1.8 to -1.7), 32.8‰.
- Antinoë badia* (Théel) (1) *Pectinaria hyperborea* (Malmgren) (1)
Prionospio malmgreni Claparède (1)
75. Okak area, Nutak Harbor, 0-4 fms., Aug. 6, 1952; 6-7° C. (-1.6 to 8.0), 30‰.
- Harmothoë imbricata* (Linné) (4)
76. Okak area, channel east of Semekutak Island, about 5 miles north of Nutak, 4-15 fms., Aug. 9, 1952; 4° C. (-1.8 to 6), 30‰.
- Nereis pelagica* Linné (1)

77. Okak area, Kiglapait Harbor, about 15 miles northwest of Port Manvers, 3-5 fms., Aug. 10, 1952; 5° C. (-1.8 to 8), 30‰.
Harmothoë imbricata (Linné) (9) *Flabelligera affinis* Sars (1)
78. Lake Melville, shoal area west of Gull Island, 17-20 fms., Aug. 24, 1952; 3.5° C. (-0.6 to 4.0), 25‰.
Harmothoë extenuata (Grube) (5) *Nereis zonata* Malmgren (5)
79. Lake Melville, The Backway, about 8 miles from east end, 54°06.3' N., 58°01.1' W., 16-20 fms., Aug. 25, 1952; 2° C. (-0.6 to 2.0), 25‰.
Melaenis lovéni Malmgren (1) *Branchiomma infarcta* (Krøyer) (1)

DISTRIBUTION OF LABRADOR POLYCHAETES

The systematic, ecological, hydrographic, and geographic distributions of the Labrador polychaetes are summarized in table 1. The collections include 1,187 specimens representing 68 species and 22 families of Polychaeta. The Polynoidae are the most abundant as to number of species (11) as well as number of specimens (22 percent of the total number). The Terebellidae, Sabellidae, and Ampharetidae each have six species.

The Labrador polychaete stations may be subdivided, on the basis of the hydrographic data of temperature, depth, and salinity, into three main categories (see table 2 for summary of hydrographic data and station numbers):

- I. Permanent High Arctic: Marine environment where the waters are continuous with those of the Arctic Ocean and circumpolar areas (Labrador current water of Arctic origin). The water temperatures are below 0° C. (mostly around -1.8° C.) the year round, the depths are generally 30 to 50 fathoms, i. e., below the upper layers where summer warming takes place, and the salinity is about 32 ‰.
- II. High Arctic with Summer Warming: Marine environment where the Arctic waters are in the shallow coastal areas and would be effected by the warming of the surface layers. The range of temperatures throughout the year is -1.8 to 12° C., the depths mostly 4 to 40 fathoms, and the salinity mostly between 30 and 32 ‰.
- III. Special Conditions in Greater Lake Melville Estuary: Lake Melville is separated from Hamilton Inlet and the Atlantic Ocean by both a constriction and a sill (Nutt, 1953), resulting in a highly complicated exchange mechanism. The stations within Lake Melville may be subdivided into two categories:
 - (a) Permanent High Arctic but not quite as cold. It includes the deeper areas of 30 to 100 fathoms, with bottom temperatures mostly between -0.6 to 0.0° C., and salinities of about 28 ‰.
 - (b) Mostly above 0° C. with greater or lesser summer warming. It includes the shallower areas of mostly 15 to 30 fathoms, temperatures of mostly 0 to 2° C., and salinities of mostly 21 to 25 ‰.

TABLE 1.—*Distribution of species*—Continued

| Families and species | Page reference | Hydrographic distribution* | | | | | Ecological distribution | | | | Geographic distribution | | | | |
|---|----------------|----------------------------|----|---------|---------|-------------------|-------------------------|---------------------|---------------|--------------|---------------------------|-----------------------------|-------------------------------------|---------------------------|--|
| | | I | II | III (a) | III (b) | Gulf St. Lawrence | Mud (42 sp.) | Mud & rock (30 sp.) | Rock (18 sp.) | Sand (9 sp.) | Mainly Arctic (6 sp., 9%) | Arctic-boreal (95 sp., 37%) | Arctic-boreal-Antarctic (4 sp., 6%) | Mainly boreal (2 sp., 3%) | Arctic-boreal-Lusitanian (14 sp., 20%) |
| <i>Pherusa plumosa</i> (Müller) (5)..... | 563 | | | | | | X | | | | | | | | X |
| <i>Brada villosa</i> (Rathke) (1)..... | 564 | | X | | | | | | | | | | | | X |
| <i>Brada inabilis</i> (Rathke) (1)..... | 565 | X | | | X | | X | | | X | | | | | |
| <i>Brada granosa</i> Stimpson (13)..... | 565 | X | | | | | X | | | | X | | | | |
| SCALIBREGMIDAE (2 species; 3 specimens) | | | | | | | | | | | | | | | |
| <i>Scalibregma inflatum</i> Rathke (3)..... | 565 | | | X | | | X | | | | | | | | X |
| <i>Polyphysia crassa</i> (Oersted)..... | 566 | | | | | | | | | | | | | X | |
| OPHELIDAE (2 species; 4 specimens) | | | | | | | | | | | | | | | |
| <i>Travisia forbesii</i> Johnston (2)..... | 566 | | X | | | | | | X | | | | | | |
| <i>Ophelia limacina</i> (Rathke) (2)..... | 567 | | X | | | | | | X | | | | | | |
| CAPTELLIDAE (1 species; 4 specimens) | | | | | | | | | | | | | | | |
| <i>Capitella capitata</i> (Fabricius) (4)..... | 569 | | X | | | | X | | | | | | | | X |
| MALDANIDAE (3 species; 17 specimens) | | | | | | | | | | | | | | | |
| <i>Praxillella praetermissa</i> (Malmgren) (6)..... | 569 | | X | | | | X | | | | | | | | |
| <i>Maldane sarsi</i> Malmgren (2)..... | 569 | X | | | | | X | | | | | | | X | |
| <i>Nicomache lumbricalis</i> (Fabricius) (9)..... | 570 | X | | X | | | X | | | | | | | | X |
| PECTINARIIDAE (2 species; 314 specimens) | | | | | | | | | | | | | | | |
| <i>Pectinaria hyperborea</i> (Malmgren) (304)..... | 570 | X | X | | | | X | | | | | | | | X |
| <i>Pectinaria granulata</i> (Linné) (10)..... | 570 | | | | X | | X | X | | | | | | | X |

TABLE 2.—Summaries of the hydrographic data and the Labrador polychaete stations upon which they are based. (See fig. 1 for station locations)

| | I Permanent High Arctic | II High Arctic with summer warming | III Special conditions of temperature and dilution in Greater Lake Melville Estuary | |
|--------------------------------|---|--|--|---|
| | | | (a) Permanent High Arctic but not quite as cold; higher salinity | (b) Mostly above 0° C.; lower salinity |
| Bottom temperature in ° C. | Mostly -1.8..... Range: -1.85-0.0..... | Mostly -1.6-6.0... Range: -1.8-12.0... | Mostly -0.6-0.0... Range: -1.2-1.0... | Mostly 0.0-2.0. Range: -0.6-8.0. |
| Depth in fathoms..... | Mostly 30-50..... Range: 15-125..... | Mostly 4-40..... Range: 0-60..... | Range: 30-100..... Mostly 28..... | Mostly 15-30. Range: 6-40. |
| Salinity in ‰..... | Mostly 32..... Range: 30.68-33.12. | Mostly 30-32..... Range: 26-32.3.... | Mostly 28..... Range: 26.5-28.85.. | Mostly 21-25. Range: 8-26. |
| Stations: | | | | |
| Seven Islands Bay..... | 31, 33, 41..... | 30..... | | |
| Hebron Fjord..... | 10, 11, 12, 13, 14, 74. | 18, 70, 71..... | | |
| Okak area..... | | 72, 73, 75, 76, 77..... | | |
| Nain area..... | 49, 50..... | 51, 62, 64, 66..... | | |
| Davis Inlet..... | | 20..... | | |
| Kaipokok Inlet..... | 7, 8, 9, 19..... | | | |
| Ironbound Islands..... | | 69..... | | |
| Hamilton Inlet..... | | 23, 24, 27, 42, 43, 44, 52, 54, 58, 61. | | |
| Greater Lake Melville Estuary. | | | 28, 29, 34, 35, 36, 37, 39, 57, 63. | 32, 38, 40, 47, 48, 53, 55, 59, 60, 67, 68, 78, 79. |
| St. Lewis Inlet..... | 5, 6, 46..... | 16, 21, 45, 56..... | | |
| Strait of Belle Isle..... | | 1, 2, 3, 4, 15, 17, 22, 25, 26. | | |

The hydrographic distribution of the 65 polychaete species in the *Blue Dolphin* collections from Labrador (not including *Harmothoe impar* and *Polyphysia crassa* from the Owen Bryant collections from Labrador, and *Nereis virens* from Newfoundland only) are shown in table 1. Of the 44 species found only along the coast, inlets, and fjords (I or II or both, not in Lake Melville Estuary), 14 species were found only in I, 22 species only in II, and 8 species were in both I and II. Of the eight species found only in the Greater Lake Melville Estuary, three (*Phyllodoce groenlandica*, *Paranaitis kosleriensis*, *Ephesia gracilis*) were only in III(a), two (*Antinoë sarsi*, *Brada villosa*) only in III(b), and three (*Nereis zonata*, *Aglaophamus malmgreni*, *Scalibregma inflatum*) were in both III(a) and (b). Of the 13 species found in both the outer coast as well as in the Greater Lake Melville Estuary, three (*Antinoë badia*, *Harmothoe extenuata*, *Pista flexuosa*) were in all four areas (I, II, III(a), and III(b)); three (*Pista maculata*, *Leaena abbranchiata*, *Branchiomma infarcta*) in

I, III(a), and III(b); three (*Nephtys ciliata*, *Terebellides stroemii*, *Spirorbis spirillum*) in I, II, and III(b); a single species (*Pectinaria granulata*) in II and III(b); a single species (*Melaenis lovéni*) in I and III(b); and two species (*Nicomache lumbricalis*, *Spirorbis granulatus*) in I and III(a).

Family POLYNOIDAE

Genus *Melaenis* Malmgren, 1865

Melaenis lovéni Malmgren, 1865

Melaenis lovéni Wesenberg-Lund, 1953, p. 27.—Pettibone, 1954, p. 214.

One large specimen was 90 mm. long and 25 mm. wide, including setae.

NEW RECORDS: LABRADOR: Kaipokok Inlet and The Backway, Lake Melville, 16 to 45 fms., silt bottom; 2 specimens, Stations 19, 79.

DISTRIBUTION: Widely distributed in the Arctic. Also Bering Sea; off Labrador. In 1.7 to 111 fathoms.

Genus *Antinoë* Kinberg, 1855, sensu Malmgren, 1865

Key to the species of *Antinoë* from Labrador

1. Neurosetae of 2 kinds—with capillary tips and with slender, relatively obtuse and slightly curved ones. Anterior pair of eyes larger than posterior pair *A. sarsi*
- Neurosetae all with capillary tips. Anterior and posterior pairs of eyes rather small, subequal *A. badia*

Antinoë sarsi Malmgren, 1865

Antinoë sarsi not Moore, 1909b, p. 135 (= *A. badia*, examined in USNM).—Pettibone, 1954, p. 215.

Harmothoë sarsi Wesenberg-Lund, 1953, p. 23.

NEW RECORDS: LABRADOR: West end and Goose Bay, Lake Melville, 6 to 30 fms., on bottoms of mud; 12 specimens, Stations 38, 48, 55, 60.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Faroes to Great Britain, the Baltic; Labrador to Maine; Bering Sea; north Japan Sea. In 3 to 1,215 fathoms.

Antinoë badia (Théel, 1879)

Antinoë sarsi Malmgren, 1865, p. 75 (part).—Moore, 1909b, p. 135 (examined in USNM).

Polynoë badia Théel, 1879, p. 18, pl. 1, figs. 9–12.—Wirén, 1883, p. 390.

Harmothoë (*Antinoëlla*) *badia* Augener, 1928, p. 689; 1933, p. 199.

Antinoëlla badia Gorbunov, 1946, p. 38.—Zatsepin, 1948, p. 107, pl. 28, fig. 9b.

Harmothoë badia Wesenberg-Lund, 1950a, p. 7; 1950b, p. 22; 1951, p. 15; 1953, p. 21.

DESCRIPTION: Length 23–60 mm., width including setae 12–30 mm. Segments 35–37 (up to 70 mm. long, 39 segments (Augener, 1933)). Prostomium with delicate cephalic peaks; 4 eyes small, subequal. Antennae, dorsal cirri, parapodia, and general body shape similar to *A. sarsi*. Elytra thin, soft, smooth, with delicate short clavate papillae and scattered soft conical tubercles. Setae yellow or golden; neurosetae all with capillary tips. Color in alcohol: Reddish brown middorsally up to or including dorsal tubercles and elytophores; ventral surface reddish brown or without color; elytra brownish, especially medially and posteriorly.

PARASITES: One specimen had the parasitic copepod *Herpyllobius arcticus* Steenstrup and Lütken attached to the prostomium (identified by Paul Illg).

NEW RECORDS: LABRADOR: Seven Islands Bay, Hebron Fjord, Nain area, Kaipokok Inlet, Lake Melville, Goose Bay, St. Lewis Inlet, 10 to 100 fms., on bottoms of mud, silt, mud with rock; 30 specimens, Stations 7, 11, 28–30, 33, 39, 40, 46, 49, 55, 59, 60, 63, 74. FRANZ JOSEF LAND: Aberdore Channel east Alger Island, 10 fms., Baldwin-Zeigler Polar Expedition, 1901.

DISTRIBUTION: Widely distributed in the Arctic: Canadian Arctic, Davis Strait, Greenland, Jan Mayen, Norwegian Sea, Spitsbergen, Franz Josef Land, Novaya Zemlya, Kara Sea, Siberian Arctic. Also Iceland, Faroes, Skagerrak; Labrador; Bering Sea. In 10 to 1,956 fathoms.

Genus *Eunoë* Malmgren, 1865

Eunoë nodosa (Sars, 1860)

Eunoë nodosa Pettibone, 1954, p. 217, fig. 26, c.

Harmothoë (*Eunoë*) *nodosa* Wesenberg-Lund, 1953, p. 16 (part).

NEW RECORDS: LABRADOR: Seven Islands Bay, Hebron Fjord, Hamilton Inlet, St. Lewis Inlet, Strait of Belle Isle, 10 to 95 fms., on bottoms of mud, stones, rubble, and various combinations of stones, mud, rocks, sandstone, and shell; 7 specimens, Stations 4, 11, 30, 33, 42, 45.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Scandinavian coasts to English Channel; Hudson Bay to Massachusetts; Bering Sea; north Japan Sea. In 10 to 690 fathoms.

Eunoë oerstedii Malmgren, 1865

Eunoë oerstedii Pettibone, 1954, p. 219, fig. 26, d.

NEW RECORDS: LABRADOR: Seven Islands Bay, Strait of Belle Isle, 25 to 40 fms., on bottoms of coral and rock, rubble, and mud with rock; 3 specimens, Stations 2, 4, 31.

DISTRIBUTION: Widely distributed in the Arctic. Also from Norway to English Channel; Labrador to Massachusetts; Bering Sea to central California; Japan. In low water to 516 fathoms.

Genus *Harmothoë* Kinberg, 1857

Key to the species of *Harmothoë* from Labrador

1. Anterior pair of eyes anteroventral on prostomium (slightly posterior and lateral to cephalic peaks), not visible dorsally. Elytra with or without soft globular macrotubercles near posterior border *H. imbricata*
Anterior pair of eyes anterolateral on prostomium, visible dorsally 2
2. Elytra with macrotubercles globular, sausage-shaped, or elongate, rodlike, not wider at base and sharply set off from elytral surface . . . *H. extenuata*
Elytra with soft macrotubercles near posterior border, wider at base, not sharply set off from elytral surface. *H. impar*

Harmothoë imbricata (Linné, 1767)

Harmothoë imbricata Moore, 1909b, p. 134 (part; mixed with *H. extenuata*).—Wesenberg-Lund, 1953, p. 17.—Pettibone, 1954, p. 220, fig. 26,a,c.
Laenilla glabra Moore, 1909b, p. 135; not *L. glabra* Malmgren, 1865 (examined in USNM).

NEW RECORDS: LABRADOR: Seven Islands Bay, Hebron Fjord, Okak area, Nain area, Hamilton Inlet, Backway, Lake Melville, St. Lewis Inlet, Strait of Belle Isle. NEWFOUNDLAND. Intertidal to 60 fms., on bottoms of mud, sand, and various combinations of mud, sand, sandstone, rock, coral, shells, detritus, and in tide pool; 56 specimens, Stations 2, 23, 24, 30, 33, 44, 45, 50, 52, 54, 56, 61, 62, 64-66, 70, 71, 73, 75, 77.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland and Norway to Mediterranean and Adriatic; Labrador to New Jersey; Bering Sea to southern California; Japan. In low water to 2,030 fathoms.

Harmothoë extenuata (Grube, 1840)

Lagisca extenuata Wesenberg-Lund, 1953, p. 25.
Harmothoë extenuata Pettibone, 1954, p. 222.

NEW RECORDS: LABRADOR: Seven Islands Bay, Hebron Fjord, Nain area, Davis Inlet, Kaipokok Inlet, Hamilton Inlet, east and west ends Lake Melville, St. Lewis Inlet, Strait of Belle Isle, 4 to 100 fms., on bottoms of mud, silt, stones, rubble, and various combinations of mud, coral, sand, rocks, pebbles, stones; 73 specimens, Stations 1, 2, 4, 6, 7, 9, 14, 16, 20-22, 25, 26, 31, 33, 36, 42, 49-51, 55, 58, 62, 64, 66-68, 70, 78. Off Labrador: Egg Harbor, 7 fms.; 20 miles northeast Nain; shoal southeast of Nain; St. Pierre Harbor, 5 fms., all by Owen Bryant, 1908.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to Mediterranean and Adriatic; Hudson Bay to Chesapeake Bay; Bering Sea to southern California; north Japan Sea; South Africa. In low water to 1,000 fathoms.

Harmothoë impar (Johnston, 1839)

- Polynoë impar* Johnston, 1839, p. 436, pl. 22, figs. 3-9.—Théel, 1879, pp. 9, 15.
Evarne impar Malmgren, 1865, p. 71, pl. 9, fig. 7.—Verrill, 1881, p. 319.—Not McIntosh, 1900, p. 353, figs.—Not Southern, 1914, p. 53.
Harmothoë impar Moore, 1902, p. 270.—Not Alaejos y Sanz, 1905, p. 60, figs.—Ditlevsen, 1917, p. 12, fig. 1, pl. 2, fig. 16, pl. 3, fig. 11.—Eliason, 1920, p. 20.—Not Fauvel, 1923, p. 59, fig. 21, a-f.—Augener, 1928, p. 678; 1933, p. 197.—Annenkova, 1937, p. 151, pl. 1, figs. 4, 8; 1938, p. 135.—Gorbunov, 1946, p. 38.—Thorson, 1946, p. 48.—Not Zatsepin, 1948, p. 108, pl. 28, fig. 12, b-f, h.—Wesenberg-Lund, 1950a, p. 6; 1950b, p. 21; 1951, p. 14 (part); 1953, p. 19.
Harmothoë fragilis Moore, 1910, p. 353, pl. 29, figs. 29, 30, pl. 30, figs. 31-33; 1923, p. 256.
Harmothoë bonitensis Essenberg, 1917, p. 48, pl. 2, figs. 1-11.
Evarnella impar Chamberlin, 1920, p. 7.—Treadwell, 1937, p. 25 (part; examined in USNM).
Harmothoë impar var. *grandispina* Annenkova, 1937, pp. 152, 208, pl. 1, fig. 2; 1938, p. 135.
Harmothoë impar var. *parvispinosa* Annenkova, 1937, pp. 152, 209, pl. 2, fig. 10; 1938, p. 135.

DESCRIPTION: Segments 37-41. Body wide, flattened dorsoventrally, fragmenting easily. Prostomium with cephalic peaks prominent; eyes large, anterior pair dorsolateral in region of greatest prostomial width. Antennae and dorsal cirri with short papillae. Elytra with numerous conical microtubercles—some hooked, with short delicate scattered papillae on elytral border and surface, with large soft tubercles near external border, tubercles wider at the base and not sharply set off from elytral surface (may give border of elytra a scalloped effect). (The elytra differ thus from the description of *H. impar* as given by McIntosh (1900), Fauvel (1923), and others; this has been indicated previously by Ditlevsen (1917).) Noto- and neuropodia extend out into digitiform acicular lobes; tip of neuropodial lobe with tentacularlike process above the projecting aciculum. Notosetae distinctly stouter than neurosetae, with long spinous regions, with pointed to blunt bare tips. Neurosetae delicate, with long spinous regions, upper ones more slender, with entire tips; mostly with tips slightly hooked, with a secondary tooth or a remnant of it. Color in alcohol: Darkly pigmented dorsally, with wide transverse brown bands between the elythrophenes and dorsal tubercles, with an area without color middorsally and two transverse bands converging in the region of the elythrophenes and dorsal tubercles; elytra with mottled brownish coloration.

NEW RECORDS: LABRADOR: Halfway between Cape Mugford and Hebron, 60 fms., Owen Bryant, 1908. CANADIAN ARCTIC: Ducketts Cove, Hurd Channel, Melville Peninsula, 12 fms., 1933; east end Cobourg Island, Baffin Bay, 75°40' N., 78°50' W., 23-40 fms., 1935; south end Cobourg Island, 75°40' N., 78°58' W., 11-20 fms.; all by R. A. Bartlett. EAST COAST NORTH AMERICA: Off Nova Scotia, Maine, Massachusetts, 20-112 fms., U. S. Fish Commission (Verrill, identified).

DISTRIBUTION: Widely distributed in the Arctic. Also Danish Seas; Labrador to Massachusetts; southern California; north Japan Sea. In 1 to 1,611 fathoms.

Genus *Arcteobia* Annenkova, 1934

Arcteobia anticostiensis (McIntosh, 1874)

Eupolynoë anticostiensis Moore, 1909b, p. 136.

Arcteobia anticostiensis Pettibone, 1954, p. 225.

Four specimens were commensal in the sinuous tubes of the terebellid *Pista flexuosa* (Grube), one worm per tube; also one specimen was in a broken clay tube of a maldanid.

NEW RECORDS: LABRADOR: Hebron Fjord, Ironbound Islands, St. Lewis Inlet, 4-95 fms., on bottoms of mud, mud and rock; 9 specimens, Stations 5, 11, 14, 69.

DISTRIBUTION: Arctic Alaska; Labrador to Massachusetts; Bering Sea; north Japan Sea. In low water to 123.5 fathoms.

Genus *Gattyana* McIntosh, 1897

Key to the species of *Gattyana* from Labrador

1. Elytral microtubercles 1- to 4-pronged. Lower neurosetae with the bare distal tips not longer than the spinous regions *G. cirrosa*
- Elytra microtubercles conical and bifid. Lower neurosetae with the bare tips as long as or longer than the spinous regions *G. amondseni*

Gattyana cirrosa (Pallas, 1766)

Gattyana cirrosa Moore, 1909b, p. 135.—Wesenberg-Lund, 1953, p. 15.—Pettibone, 1954, p. 226, fig. 26,b.

NEW RECORDS: LABRADOR: Seven Islands Bay, Hebron Fjord, Nain area, Kaipokok Inlet, Hamilton Inlet, 13-125 fms., on bottoms of mud, silt, sand, and various combinations of mud, rock, pebbles, and sand; in old tubes of *Pectinaria*; in old clay tube of a maldanid; 68 specimens, Stations 7, 9-12, 14, 18, 31, 44, 62.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to France; Hudson Bay to Massachusetts; Bering Sea to Washington; north Japan Sea. In low water to 630 fathoms.

Gattyana amondseni (Malmgren, 1867)

Nychia amondseni Malmgren, 1867, p. 5, pl. 1, fig. 4.—Verrill, 1881, pp. 303, 306.—Webster and Benedict, 1884, p. 700.
Gattyana amondseni Moore, 1902, p. 259; 1908, p. 336; 1909b, p. 136.—Augener, 1928, p. 693; 1933, p. 204.—Thorson, 1946, p. 46.—Wesenberg-Lund, 1950a, p. 5; 1950b, p. 14; 1951, p. 10.

DESCRIPTION: Length 16–18 mm., width including setae 6–8 mm. (up to 29 mm. long, 11 mm. wide, Malmgren, 1867). Segments 35–36. Papillae on antennae, dorsal cirri, and elytra much shorter than on *G. cirrosa*. Elytra smooth, iridescent, with elytral fringe confined mostly to external border, not having the straggly appearance of *G. cirrosa*. Elytra whitish, uniformly tan, tan mottled with brown, or tannish with a darker spot over the place of attachment. Elytral microtubercles smaller than in *G. cirrosa*, conical and bifid.

NEW RECORDS: LABRADOR: Hebron Fjord, 60–95 fms., on bottoms of mud and fine sandy mud with rock; 2 specimens, Stations 10, 11. EAST COAST NORTH AMERICA: Off Nova Scotia, Massachusetts, Rhode Island, 13–90 fms., U. S. Fish Commission (Verrill, identified).

DISTRIBUTION: Scattered records in the Arctic: Baffin Bay, Davis Strait, West Greenland, Spitsbergen. Also west coast of Norway; Labrador to Rhode Island; southeastern Alaska and Gulf of Alaska. In 5 to 378 fathoms.

Family SIGALIONIDAE

Genus *Pholoë* Johnston, 1839*Pholoë minuta* (Fabricius, 1780)

Pholoë minuta Wesenberg-Lund, 1953, p. 28.—Pettibone, 1954, p. 230, fig. 26.f.

NEW RECORD: LABRADOR: Hamilton Inlet, 6 fms., mud and sand; 4 specimens, Station 24.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to northern France; Labrador to Rhode Island; Bering Sea to southern Oregon; north Japan Sea; South Africa. In low water to 1,254 fathoms.

Family PHYLLODOCIDAE

Both genera represented have the prostomium with 4 subulate frontal antennae, tentacular cirri 4 pairs on 3 tentacular segments, uniramous parapodia with compound setae.

Key to the genera of Phyllocididae from Labrador

1. First tentacular segment rudimentary dorsally, with 1 pair tentacular cirri lateral to prostomium; second segment distinct, with 2 pairs tentacular cirri; third segment distinct, with 1 pair tentacular cirri, 1 pair normal ventral

cirri, with the first setigerous lobes. Prostomium cordiform, with an occipital tubercle in the posterior notch (may be withdrawn).

Phyllodoce (Anaitides)

First 2 tentacular segments fused, well developed, encircle prostomium, with 3 pairs tentacular cirri; third tentacular segment distinct, with 1 pair tentacular cirri, 1 pair normal ventral cirri, with the first setigerous lobes. Prostomium oval or oval with a posterior extension, with or without an occipital tubercle **Paranaitis**

Genus *Phyllodoce* Savigny, 1817

Subgenus *Anaitides* Czerniavsky, 1882

Both species have the proboscis with 12 longitudinal rows of papillae basally, 6 on each side, 8 to 20 papillae per row.

Key to the species of *Phyllodoce* (*Anaitides*) from Labrador

1. Ventral cirri distally blunt or slightly pointed. Dorsal cirri subrectangular. ***P. groenlandica***
- Ventral cirri acutely pointed distally. Anterior dorsal cirri suboval, median ones subrectangular ***P. mucosa***

***Phyllodoce* (*Anaitides*) *groenlandica* Oersted, 1843**

Phyllodoce groenlandica Wesenberg-Lund 1953, p. 30.—Pettibone, 1954, p. 236, fig. 27,d,i.

Phyllodoce mucosa Moore, 1909b, p. 134; not *P. mucosa* Oersted, 1843 (examined in USNM).

NEW RECORD: LABRADOR: East end Lake Melville, 70 fms., mud; 1 specimen, Station 29.

DISTRIBUTION: Widely distributed in the Arctic. Also Ireland, Scandinavian countries to English Channel; Hudson Bay to Massachusetts; Bering Sea to Washington Sound; north Japan Sea. In low water to 800 fathoms.

***Phyllodoce* (*Anaitides*) *mucosa* Oersted, 1843**

Phyllodoce mucosa Malmgren, 1867, p. 21, pl. 2, fig. 7.—Webster and Benedict, 1887, p. 710.—Moore, 1909a, p. 336; not 1909b, p. 134.—Fauvel, 1923, p. 152, fig. 54,a-e.—Rioja, 1941, p. 682.—Berkeley and Berkeley, 1948, p. 46, fig. 68.—Wesenberg-Lund, 1950a, p. 10, pl. 1, fig. 3; 1950b, p. 34; 1951, p. 27. *Anaitides mucosa* Friedrich, 1939, p. 122.—Hartman, 1948, p. 19.—Zatsepin, 1948, p. 111, pl. 29, fig. 4,b-c.

NEW RECORDS: LABRADOR: Ironbound Islands, 4-7 fms.; 2 specimens, Station 69. EAST COAST NORTH AMERICA: Off Maine, Long Island Sound, Gulf of Mexico, in low water to 146 fms., U. S. Fish Commission.

DISTRIBUTION: Scattered records in the Arctic: Greenland (?), Barents Sea, Siberian Arctic. Also Iceland, Faroes, Danish and Swedish coasts to France, Mediterranean; Hudson Bay to Long Island Sound, Gulf of Mexico, Alaska to southern California and México. In low water to 245 fathoms.

Genus *Paranaitis* Southern, 1914

Paranaitis kosteriensis (Malmgren, 1867)

Anaitis kosteriensis Malmgren, 1867, p. 20.—Bergström, 1914, p. 156, fig. 52.

Paranaitis wahlbergi Southern, 1914, p. 67, pl. 8, fig. 16 (see Fauvel, 1923); not *Anaitis wahlbergi* Malmgren, 1865.

Phyllodoce (Anaitis) kosteriensis Fauvel, 1923, p. 157, fig. 56,a-c.

DESCRIPTION: Length 35 mm., width without setae 4 mm. (up to 85 mm. long, Bergström, 1914). Segments numerous, 82 (specimens from Labrador) to about 155 (Fauvel, 1923). Body rather slender, flattened dorsoventrally, slightly attenuated anteriorly and posteriorly. Prostomium oval, with a distinct posterior extension, usually with an occipital tubercle (not seen on specimen examined; hidden by tentacular segment?), with 4 short antennae and 2 large eyes each with a distinct lens. Tentacular cirri rather slender, longest reach setiger 4. Dorsal cirri large, imbricated, reniform, nearly symmetrical, easily detached. Distal tips of bifid setigerous lobe with upper lobe longer than the lower one. Color in alcohol: Without color or irregularly streaked deep purplish.

REMARKS: *P. kosteriensis* has been referred to *P. wahlbergi* Malmgren by Ditlevsen (1909, 1917), Southern (1914), and others; the two species appear to be distinct. In *P. wahlbergi* (specimens examined from Greenland and Canadian Arctic), the body is stouter (6–9 mm. wide without setae); the prostomium is oval, without distinct posterior extension, without occipital tubercle; the distal tips of the bifid setigerous lobes are subequal or upper lobes slightly longer.

NEW RECORD: LABRADOR: East end Lake Melville, mud, 70 fms.; 1 specimen, Station 29.

DISTRIBUTION: Sweden, Scotland, Ireland; Labrador. In 6 to 185 fathoms.

Family HESIONIDAE

Genus *Castalia* Savigny, 1820; emend. Fauvel, 1923

Castalia aphroditoides (Fabricius, 1780)

Castalia aphroditoides Wesenberg-Lund, 1953, p. 34.—Pettibone, 1954, p. 239, fig. 28,a,b.

NEW RECORDS: LABRADOR: Kaipokok Inlet, 45 fms., silt bottom; 2 specimens, Stations 7, 8.

DISTRIBUTION: Widely distributed in the Arctic. Also Bering Sea; Denmark; Hudson Bay to Labrador. In 2 to 75.5 fathoms.

Family SYLLIDAE

Genus *Autolytus* Grube, 1850*Autolytus alexandri* Malmgren, 1867

Autolytus alexandri Pettibone, 1954, p. 246.

NEW RECORD: LABRADOR: Strait of Belle Isle, 30-40 fms.; 1 specimen, Station 22.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Labrador to North Carolina; Bering Sea to Washington. In low water to 123.5 fathoms; sexual forms at surface.

Autolytus fallax Malmgren, 1867

Autolytus fallax Pettibone, 1954, p. 247, fig. 29,c-f.

NEW RECORDS: LABRADOR: Nain, Strait of Belle Isle, 25-60 fms., on bottoms of coral and rock; in transparent tube on old *Pectinaria* tube; 2 specimens, Stations 2, 62.

DISTRIBUTION: Widely distributed in the Arctic. Also Faroes; Labrador. In low water to 75.5 fathoms; sexual stolons at surface.

Genus *Sphaerosyllis* Claparède, 1863*Sphaerosyllis erinaceus* Claparède, 1863

Sphaerosyllis erinaceus Pettibone, 1954, p. 255, fig. 28,m.

A single specimen of 20 segments, 1.5 mm. long and 0.3 mm. wide without setae.

NEW RECORD: LABRADOR: Strait of Belle Isle, 25 fms., coral and rock; 1 specimen, Station 2.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Denmark to English Channel and the Baltic; Labrador to Massachusetts; Bering Sea; north Japan Sea. In low water to 75.5 fathoms; sexual forms at surface.

Genus *Eusyllis* Malmgren, 1867*Eusyllis blomstrandii* Malmgren, 1867

Eusyllis blomstrandii Wesenberg-Lund, 1953, p. 38.—Pettibone, 1954, p. 260, fig. 28,g-i.

Length 5.5-11 mm., width without setae 0.8-1 mm. Segments 47-52. Includes two epitokous females and a male, with 16 anterior unmodified setigers, 25-27 setigers with long capillary setae, and 5-8 posterior unmodified setigers.

NEW RECORDS: LABRADOR: Hamilton Inlet, Strait of Belle Isle, 15-30 fms., on bottoms of rock, stones, with bryozoans; 21 specimens, Stations 1, 2, 22, 26, 58.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Ireland to Mediterranean; Labrador to Maine; Bering Sea to Washington; north Japan Sea. In low water to 444 fathoms; sexual epitokes at surface.

Family NEREIDAE

Genus *Nereis* Cuvier, 1817

Key to the subgenera and species of *Nereis* from Labrador and Newfoundland

1. Three notopodial ligules in anterior segments. Dorsal ligules enlarged, foliaceous, lanceolate, with dorsal cirri emerging near bases of ligules. Paragnaths present on all 8 areas of proboscis *N. (Neanthes) virens*
Two notopodial ligules. Paragnaths of areas I or V or both missing (*N. (Nereis)*) 2
2. Parapodial ligules short, thick, evenly rounded. Paragnaths of distal ring: area I (mediodorsal), 2 in tandem (rarely 1 or 3). Paragnaths of basal ring: area V (dorsomedial), 0; area VI (dorsolateral), 4 in square or cross (rarely 3 or 5); VII–VIII (ventral), several continuous rows, diminishing in size progressively posteriorly. Uniformly purplish or reddish brown, not banded *N. (Nereis) pelagica*
Parapodial ligules triangular to conical, gradually tapering to a broad tip. Paragnaths of distal ring: area I, 0 or 1. Paragnaths of basal ring: area V, 0; area VI, 6–10 or more in oval mass; areas VII–VIII, continuous row of larger paragnaths followed by a wide band of small subequal ones. Transversely banded reddish brown or violet *N. (Nereis) zonata*

Nereis (Neanthes) virens Sars, 1835

Alitta virens Malmgren, 1865, p. 183; 1867, p. 56, pl. 3, fig. 19.

Nereis virens Webster and Benedict, 1884, p. 717; 1887, p. 724.—Sumner, Osburn, and Cole, 1913, p. 620.—Fauvel, 1923, p. 348, fig. 134,g-k.—Not Annenkova, 1938, p. 160.—Thorson, 1946, p. 69.—Not Berkeley and Berkeley, 1948, p. 62, fig. 92; 1954, p. 458.—Not Zatsepin, 1948, p. 119, pl. 30, fig. 4.—Wesenberg-Lund, 1951, p. 42.

Neanthes virens Hartman, 1944a, pp. 335, 339.

REMARKS: The Atlantic *N. virens* differs from the closely related Pacific *N. brandti* (Malmgren) as follows: In *N. virens*, the upper ligules are large, foliaceous, lanceolate almost from the first; in *N. brandti*, the upper ligules are small, conical on anterior segments, gradually becoming larger and foliaceous in middle and posterior segments. In *N. virens*, paragnaths of areas VII–VIII (ventral) of basal ring consisting of transverse band of 3 irregular rows; that of *N. brandti* consisting of about 8 rows, with the paragnaths larger anteriorly and getting smaller posteriorly.

NEW RECORDS: NEWFOUNDLAND: Port Saunders, intertidal; 2 specimens, Station 65. EAST COAST NORTH AMERICA: Off Newfoundland, Gulf of St. Lawrence, Nova Scotia, New Brunswick, Maine,

Massachusetts, Rhode Island, Connecticut, Long Island Sound; low water to 84 fathoms, U. S. Fish Commission.

DISTRIBUTION: Iceland (rare), Norway, Denmark to North Sea and France; Newfoundland to Virginia. Mainly littoral; up to 84 fathoms. (Records of *N. virens* from the Pacific, north Japan Sea, and Siberian Arctic are the closely related *N. brandti* (Malmgren).)

Nereis (Nereis) pelagica Linné, 1758

Nereis pelagica Moore, 1909b, p. 137.—Wesenberg-Lund, 1953, p. 40.—Pettibone, 1954, p. 264, fig. 30,a,b.

NEW RECORDS: LABRADOR: Okak area, Nain, St. Lewis Inlet, Strait of Belle Isle, 4–60 fms., on bottoms of sand, rock and coral; 14 specimens, Stations 1, 2, 16, 22, 62, 72, 76.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to Mediterranean; Hudson Bay to Long Island Sound; Bering Sea to Panamá; north Japan Sea to Japan; South Atlantic (Tristan da Cunha, Kerguelen, Magellan Straits). In low water to 609 fathoms. Variety *occidentalis* Hartman, off North Carolina, Florida, Louisiana, Texas, Puerto Rico; intertidal.

Nereis (Nereis) zonata Malmgren, 1867

Nereis zonata Wesenberg-Lund, 1953, p. 40.—Pettibone, 1954, p. 265, fig. 30,c,h,i.

NEW RECORDS: LABRADOR: Backway, east and west ends Lake Melville, Goose Bay, all in Greater Lake Melville area, 9–100 fms., on bottoms of mud and sandy mud with rocks; 37 specimens, Stations 29, 34, 36, 38, 40, 47, 55, 59, 60, 67, 78.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Faeroes; Hudson Bay to Labrador; Bering Sea to Oregon; north Japan Sea. In low water to 439 fathoms; epitokes at surface.

Family NEPHTYIDAE

Key to the genera of Nephtyidae from Labrador

1. Branchiae involute, long, cylindrical, curved or rolled in spiral toward lateral side of body **Aglaophamus**
- Branchiae recurved, cirriform, sickle-shaped, with convex side toward lateral side of body **Nephtys**

Genus *Aglaophamus* Kinberg

Aglaophamus malmgreni (Théel, 1879)

Nephtys longisetosa Malmgren, 1865, p. 106, pl. 12, fig. 20; not *N. longosetosa* Oersted, 1843.

Nephtys malmgreni Théel, 1879, p. 26, pl. 1, fig. 17, pl. 2, fig. 17.—Not Moore, 1908, p. 342.—Fauvel, 1923, p. 371, fig. 145,k.—Augener, 1928, p. 702.—Annenkova, 1931, p. 203; 1937, p. 164; 1938, p. 162.—Gustafson, 1936, p. 6.—

Friedrich, 1939, p. 123.—Berkeley and Berkeley, 1944, p. 2.—Gorbunov, 1946, p. 38.—Wesenberg-Lund, 1950a, p. 22; 1950b, p. 61; 1953, p. 45.
Aglaophamus malmgreni Hartman, 1950, pp. 116, 118.

DESCRIPTION: Length 70–120 mm., width including setae 13 mm. Tentacular segment with a noto- and neuropodial setigerous lobe, with a triangular ventral cirrus; dorsal tentacular cirri lacking. Parapodia with rami well separated, acicular lobes sharply conical; preacicular lamellae rudimentary; notopodial postacicular lamellae in anterior and median regions unequally bilobed—larger upper one (about length of acicular lobe) and small ventral one; about equally bilobed in posterior region; neuropodial postacicular lamellae rounded, shorter than acicular lobes. Setae long, flowing. Dorsal cirri long, digitiform. Ventral cirri sharply conical. Branchiae begin usually on setigers 11–13 (10–15), long, cylindrical, rolled in spiral toward inside (when preserved, may extend out, with tip hooked or curled inwardly); branchiae lacking on last 14–30 segments. Proboscis with the usual 22 terminal papillae—10 pairs bifid, a single dorsal and ventral one; with 14 longitudinal rows of subterminal papillae (with some additional scattered papillae more distally, 17–20 papillae per row (10–13 in Fauvel, 1923), decreasing in size basally; without an unpaired dorsal papilla. Color in alcohol: Deep reddish brown to buff.

NEW RECORDS: LABRADOR: East end, middle, and west end Lake Melville, Goose Bay, Terrington Basin; all in Greater Lake Melville area, 8–80 fathoms, on mud bottom; 38 specimens, Stations 29, 39, 53, 57, 60, 63.

DISTRIBUTION: Widely distributed in the Arctic: Siberian and western Canadian Arctic, Davis Strait, Greenland, Spitsbergen, Norway, Franz Josef Land, Barent Sea, Novaya Zemlya, Kara Sea, Siberian Arctic, Laptev Sea. Also south to Portugal and the Mediterranean, Gulf of St. Lawrence, Bering Sea, north Japan Sea. In 3 to 4,001 fathoms.

Genus *Nephtys* Cuvier, 1817

Nephtys longosetosa Oersted, 1843

Nephtys longosetosa Pettibone, 1954, p. 268, fig. 30,1.

NEW RECORD: LABRADOR: Hebron Fjord, 8 fms., sandy (1 station, 14 specimens); Station 27.

DISTRIBUTION: Widely distributed in the Arctic. Also south to France, Maine, Lower California and Panamá, north Japan Sea; Straits of Magellan. In low water to 528 fathoms.

Nephtys ciliata (Müller, 1789)

Nephtys caeca Moore, 1909b, p. 137; not *Nereis caeca* Fabricius, 1780.

Nephtys ciliata Monro, 1939, p. 346.—Wesenberg-Lund, 1953, p. 43.

Nephtys ciliata Pettibone, 1954, p. 270, fig. 30,n.

NEW RECORDS: LABRADOR: Hebron Fjord, Davis Inlet, Kaipokok Inlet, Hamilton Inlet, Backway, and west end Lake Melville, Strait of Belle Isle, 6 to 95 fms., on bottoms of mud, silt, rubble, muddy sand, rocks, pebbles with sand; 28 specimens, Stations 7, 11, 17, 18, 20, 24, 43, 48, 54, 67.

DISTRIBUTION: Widely distributed in the Arctic. Also south to France, Massachusetts, southern California, Japan and China. In low water to 500 fathoms.

Family SPHAERODORIDAE

Prostomium indistinct, covered with papillae. Eyes 2 or 4, under integument. Integument covered with small papillae and number of large spherical capsules. Parapodia uniramous, covered with papillae. Proboscis unarmed, globular.

Genus *Ephesia* Rathke, 1843

Ephesia gracilis Rathke, 1843

Ephesia gracilis Rathke, 1843, p. 176, pl. 7, figs. 5-8.—Webster and Benedict, 1887, p. 728.—Fauvel, 1923, p. 377, fig. 148,a-f.—Augener, 1928, p. 736.—Berkeley and Berkeley, 1944, p. 2.—Annenkova, 1937, p. 165; 1938, p. 163.—Gorbunov, 1946, p. 38.—Zatsepin, 1948, p. 122.—Wesenberg-Lund, 1950a, p. 22; 1950b, p. 63; 1951, p. 48; 1953, p. 46.

Sphaeordorum papillifer Moore, 1909a, p. 333, pl. 15, figs. 11, 12.

Ephesia papillifer Berkeley and Berkeley, 1948, p. 27.

DESCRIPTION: Body elongated, filiform, about 120 segments. Spherical capsules in two dorsolateral longitudinal rows; capsules with short terminal processes. Eyes 4. Setae simple.

NEW RECORDS: LABRADOR: East end Lake Melville, 65-100 fms., sandy mud, some rock; 1 specimen, Station 36. CANADIAN ARCTIC: Baffin Island, 66°43' N., 80°07' W., 1927., R. A. Bartlett. NORTH-WEST GREENLAND: 1 mile northwest of Conical Rock, 1940, R. A. Bartlett.

DISTRIBUTION: Widely distributed in the Arctic: Canadian Arctic, Greenland, Spitsbergen, Novaya Zemlya, Kara Sea, Siberian Arctic. Also Iceland, Norwegian coast to France, Mediterranean; Labrador to Maine; Bering Sea to southern California; north Japan Sea; Antarctic. In 25 to 723 fathoms.

Family ONUPHIDAE

Prostomium with 2 globular ventral palps, 7 antennae—2 frontal, ovoid, and 5 occipital with more or less ringed ceratophores. Anterior parapodia more or less modified. Pharynx with a labrum and 3-5 pairs of jaws and an unpaired piece. Tentacular segment achae-tous and apodous.

Genus *Nothria* Malmgren, 1867

Tentacular segment with two short tentacular cirri. Branchiae simple, cirriform.

Nothria conchylega (Sars, 1835)

Onuphis conchylega Sars, 1835, p. 61, pl. 10, fig. 28,a-e.—Chamberlin, 1920, p. 15.—Fauvel, 1923, p. 415, fig. 164,a-m.—Treadwell, 1937, p. 31.—Annenkova, 1937, p. 166; 1938, p. 166.—Berkeley and Berkeley, 1944, p. 3; 1948, p. 91, figs. 136-138.—Gorbunov, 1946, p. 39.—Zatsepin, 1948, p. 124, pl. 31, fig. 16.—Wesenberg-Lund, 1950a, p. 26; 1950b, p. 67; 1951, p. 53; 1953, p. 49.

Nothria conchylega Malmgren, 1867, p. 66.—Moore, 1909a, p. 138.—Hartman, 1944a, pp. 335, 340, not pl. 23, fig. 4; 1944b, p. 85, pl. 5, figs. 105-112, pl. 17, figs. 337, 338; 1945, p. 24.

DESCRIPTION: Branchiae begin on setigers 10-20. Anterior parapodia with presetal lamellar process and large amber-colored unidentate hooks. Without compound spinigerous setae. Tube free, greatly flattened, parchmentlike base covered with flat shell fragments and pebbles.

NEW RECORDS: LABRADOR: Strait of Belle Isle, on bottom of coral and rock, 25 fms.; 1 specimen, Station 2. EAST COAST NORTH AMERICA: Off Newfoundland, Nova Scotia, Maine, Massachusetts, Rhode Island, Delaware Bay, 18 to 430 fms., U. S. Fish Commission (Verrill, identified). WEST GREENLAND: Upernavik Harbor, 13 fms., and off Hare Island, 70°20' N., 56° W., 90 fms., 1884, U. S. S. *Alert*. BERING SEA: *Albatross* Station 3548, 54°44' N., 165°42' W., 91 fms., 1893.

DISTRIBUTION: Widely distributed in the Arctic: Siberian and Canadian Arctic, Davis Strait, Greenland, Jan Mayen, Spitsbergen, Novaya Zemlya, Kara Sea. Also Iceland, Faroes, Norway to France and Mediterranean; Labrador to Florida and West Indies; Bering Sea to British Columbia; north Japan Sea to Japan. In low water to 954 fathoms.

Family LUMBRINERIDAE

Genus *Lumbrineris* Blainville, 1828

Lumbrineris fragilis (Müller, 1776)

Lumbrineris fragilis Moore, 1909b, p. 138.—Pettibone, 1954, p. 275, fig. 31,h-n.

Lumbrineris hebes Moore, 1909b, p. 138; not *L. hebes* Verrill, 1879.

Lumbrinereis fragilis Treadwell, 1937, p. 31.

Lumbriconereis fragilis Wesenberg-Lund, 1953, p. 51.

NEW RECORDS: LABRADOR: Hebron Fjord, Hamilton Inlet, St. Lewis Inlet, 5-13 fms., on various combinations of mud, sand, sand-

stone, pebbles, rocks, shells, much detritus; 6 specimens, Stations 18, 23, 45.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Faroes, Norway to Azores and Mediterranean; Hudson Bay to Rhode Island; Bering Sea; north Japan Sea. In low water to 1,883 fathoms.

Family SPIONIDAE

Both genera represented have setiger 5 not modified, prostomium without frontal horns, with more than one pair of branchiae beginning on setiger 2, and with anal cirri.

Key to the genera of Spionidae from Labrador

1. Branchiae present on only few anterior segments, 3–11 pairs, often pinnate.
 - With hooded crotchets in both noto- and neuropodia **Prionospio**
 - Branchiae more than 11 pairs, not pinnate. Without hooded crotchets in notopodia of posterior segments **Laonice**

Genus *Prionospio* Malmgren, 1867

Prionospio malmgreni Claparède, 1868

Prionospio malmgreni Pettibone, 1954, p. 282, fig. 32,i-k.

NEW RECORDS: LABRADOR: Hebron Fjord, St. Lewis Inlet, 40–100 fms., mud; 2 specimens, Stations 5, 74.

DISTRIBUTION: Arctic Alaska to Washington; north Japan Sea; Iceland, Norway to Mediterranean; Labrador to Massachusetts; South Africa. In low water to 250 fathoms; surface.

Genus *Laonice* Malmgren, 1867

Laonice cirrata (Sars, 1851)

Nerine cirrata Sars, 1851, p. 207.

Scolecoplepis cirrata Malmgren, 1867, p. 91, pl. 9, fig. 54.

Scolecoplepis cirrata Verrill, 1881, pp. 298, 301, 304, 309, 312, 316.

Spionides foliata Moore, 1923, p. 182.

Spionides sacculata Moore, 1923, p. 184.

Laonice cirrata Fauvel, 1927, p. 38, fig. 12,a-c.—Annenkova, 1937, p. 169; 1938, p. 172.—Gorbunov, 1946, p. 38.—Zatsepin, 1948, p. 132, pl. 32, fig. 12.—Hartman, 1948, p. 36.—Hartman and Reish, 1950, p. 28.—Wesenberg-Lund, 1950a, p. 30; 1950b, p. 75; 1951, p. 68, fig. 6; 1953, p. 56. Berkeley and Berkeley, 1952, p. 26, figs. 49–51.

DESCRIPTION: Prostomium enlarged and rounded anteriorly, with two eyes and an occipital antenna, with a dorsal crest extending back about 30 segments. Branchiae cirriform, well separated from the

dorsal lamellae, folded back on dorsum, present on anterior 28-60 segments. With genital or interrampal pouches in which eggs may be present, formed by union of ventral lamellae, beginning on segments 25-50. Anus encircled by 8-14 cirri.

NEW RECORDS: LABRADOR: Hamilton Inlet, 30 fms., mud, stones; 1 specimen, Station 43. WEST COAST NORTH AMERICA: Washington and Puget Sounds, Washington, 10-165 fms., on bottoms of mud, rocks, mud with sand and kelp, M. H. Pettibone. EAST COAST NORTH AMERICA: Off Maine, Massachusetts, 22-68 fms., U. S. Fish Commission (by Verrill as *Scolecoclepis cirrata*).

DISTRIBUTION: Widely distributed in the Arctic: Davis Strait, Greenland, Spitsbergen, Novaya Zemlya, Kara Sea, Siberian Arctic. Also Iceland, Faroes, Norway to English Channel and Mediterranean; Labrador to Massachusetts; Alaska to southern California; north Japan Sea to Japan. In 5 to 891 fathoms.

Family CIRRATULIDAE

Genus *Cirratulus* Lamark, 1801

Cirratulus cirratus (Müller, 1776)

Cirratulus cirratus Moore, 1909b, p. 139.—Wesenberg-Lund, 1953, p. 61.—Pettibone, 1954, p. 286, fig. 33,a-c.

NEW RECORD: LABRADOR: Hebron Fjord, 95 fms., mud; 1 specimen, Station 11.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to France, Canary Islands; Hudson Bay to Massachusetts; Bering Sea to México; north Japan Sea to Japan, Manchuria; Falkland Islands, Magellan Straits, South Georgia, Kerguelen. In low water to 1,611 fathoms.

Genus *Chaetozone* Malmgren, 1867

Chaetozone setosa Malmgren, 1867

Chaetozone setosa Moore, 1909b, p. 139.—Wesenberg-Lund, 1953, p. 61.—Pettibone, 1954, p. 287, fig. 33,d.

NEW RECORDS: LABRADOR: Hebron Fjord, 95-125 fms., mud, in empty tubes of *Pectinaria* filled with soft mud; 46 specimens, Stations 11, 12.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to Canary Islands, Mediterranean, Adriatic, Gulf of Aden; Labrador to Massachusetts; Bering Sea to British Columbia; north Japan Sea; Falkland Islands, Magellan Straits, Kerguelen. In low water to 1,333 fathoms; surface.

Family FLABELLIGERIDAE (CHLORAEMIDAE)

Key to the genera of Flabelligeridae from Labrador

1. Body covered with a thick mucous mantle containing long pedunculate papillae. Neurosetae stout compound hooks, 1-2 per lobe. Setae of the first setiger numerous, long, directed anteriorly forming a cephalic cage enclosing the branchiae, etc. **Flabelligera**
Body without mucous mantle. Neurosetae simple or pseudocompound. Body covered with short to long papillae (rarely rugose only), papillae not pedunculate. 2
2. Setae of first setigers longer than the following, directed anteriorly forming a distinct cephalic cage **Pherusa**
Setae of first setigers not forming a distinct cephalic cage. **Brada**

Genus *Flabelligera* Sars, 1829*Flabelligera affinis* Sars, 1829

Flabelligera affinus Moore, 1909b, p. 143.

Flabelligera affinis Pettibone, 1954, p. 289, fig. 33, e-g.

NEW RECORDS: LABRADOR: Seven Islands Bay, Okak area, Davis Inlet, 10-30 fms., on bottoms of rubble and mud with rocks and stones; 5 specimens, Stations 20, 30, 31, 77.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to France, Mediterranean; Hudson Bay to Massachusetts; Bering Sea to southern California; north Japan Sea; Falkland Islands, Magellan Straits, South Georgia, South Africa, Australia. In low water to 889 fathoms; surface.

Genus *Pherusa* Oken, 1807*Pherusa plumosa* (Müller, 1776)

Amphitrite plumosa Müller, 1776, p. 216.

Siphonostomum asperum Stimpson, 1854, p. 31.

Trophonia plumosa Malmgren, 1867, p. 82.—Verrill, 1881, pp. 293, 294, 295, 299.—Webster and Benedict, 1887, p. 729.

Trophonia aspera Verrill, 1881, pp. 289, 295, 298, 304, 308, 312, 314.—Webster and Benedict, 1887, p. 730.—Moore, 1909b, p. 143.

Trophonia papillata Johnson, 1901, p. 416, pl. 12, figs. 122-123.

Stylarioides plumosa Eliason, 1920, p. 61.—Fauvel, 1927, p. 116, fig. 41, a-g; 1933, p. 48.—Okuda, 1937, p. 52, pl. 2, fig. c.—Annenkova, 1937, p. 175; 1938, p. 184.—Hartman, 1944c, p. 22.—Gorbunov, 1946, p. 39.—Zatsepin, 1948, p. 135, pl. 33, fig. 2.—Wesenberg-Lund, 1949, p. 334; 1950a, p. 35; 1950b, p. 83; 1951, p. 77; 1953, p. 65.—Berkeley and Berkeley, 1952, p. 9, fig. 7.

Stylarioides papillata Moore, 1923, p. 221.—Hartman, 1948, p. 40.—Hartman and Reish, 1950, p. 35.—Berkeley and Berkeley, 1952, p. 8.

Pherusa plumosa Støp-Bowitz, 1948a, p. 13, fig. 2; 1948b, p. 33.

DESCRIPTION: Body round, slightly flattened ventrally, inflated and abruptly attenuated posteriorly, up to 70 segments. Body covered

with elongated, cylindrical or capitate papillae agglutinated with mud and sand. Noto- and neurosetae on first three setigers capillary, ringed, iridescent, longer than the following, directed forward forming a cephalic cage. Neurosetae, beginning on setiger 4, hooked sigmoid crotchets of variable form; notosetae capillary.

NEW RECORDS: LABRADOR: Hebron Fjord, Strait of Belle Isle, 8-13 fms., soft mud, and sand with rocks, pebbles; 5 specimens, Stations 17, 18. EAST COAST NORTH AMERICA: Off Nova Scotia, Maine, Massachusetts, 18-96 fms., U. S. Fish Commission (by Verrill as *Trophonia aspera*). CANADIAN ARCTIC: Kneeland Bay in Fro-bischer Bay, Baffin Island, 17 fms., 1942, R. A. Bartlett. NORTH-WEST GREENLAND: 1 mile northwest of Conical Rock, 25-60 fms., 1940, R. A. Bartlett. WEST COAST NORTH AMERICA: *Albatross* Station 2845, Alaska Peninsula, 54°05' N., 164°09' W., 42 fms., 1888; Strait of Juan de Fuca, Washington and Puget Sounds, Washington, low water to 105 fms., M. H. Pettibone.

DISTRIBUTION: Widely distributed in the Arctic: Siberian and Canadian Arctic, Greenland, Spitsbergen, Barents Sea, Novaya Zemlya, Kara Sea. Also Iceland, Faroes, Norway to France, Adriatic, Iranian Gulf; Labrador to Massachusetts; West Indies, Venezuela; Alaska to Columbia; Okhotsk Sea to Japan, China. In low water to 1,611 fathoms.

Genus *Brada* Stimpson, 1854

Key to the species of *Brada* from Labrador

1. Notosetae well developed. Body covered with elongated cylindrical papillae encrusted with sand. Long fusiform papillae around the setal bundles
B. villosa
- Notosetae poorly developed, few or absent 2
2. Papillae very small, globular or cup-shaped, covered with thin layer of sand
B. inhabilis
- Papillae scattered, elongated, conical or cylindrical with small tip, covered by entire layer of sand (necessary to remove sand to see shape of papillae)
B. granosa

Brada villosa (Rathke, 1843)

Brada villosa Wesenberg-Lund, 1953, p. 67.—Pettibone, 1954, p. 290.

NEW RECORD: LABRADOR: Backway, Greater Lake Melville area, 15-16 fms.; 1 specimen, Station 67.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to Spain, Mediterranean, Adriatic, south Arabian coast; Hudson Bay to Rhode Island; Bering Sea to southern California; north Japan Sea to Japan; South Orkney and South Shetland Islands. In low water to 853 fathoms.

Brada inhabilis (Rathke, 1843)

Brada inhabilis Wesenberg-Lund 1953, p. 67.—Pettibone, 1954, p. 292, fig. 33,h.

NEW RECORD: Labrador: Hebron Fjord, 95 fms., mud; 1 specimen, Station 11.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to Danish waters; Labrador to Maine; Bering Sea to Gulf of Alaska; north Japan Sea. In low water to 609 fathoms.

Brada granosa Stimpson, 1854

Brada granosa Stimpson, 1854, p. 32, pl. 2, fig. 22.—Verrill, 1881, pp. 289, 308.—Webster and Benedict, 1887, p. 732, pl. 5, figs. 72-76.—Not Treadwell, 1937, p. 32 (= *B. inhabilis*).

Brada granulosa Hansen, 1882, p. 39, pl. 7, figs. 21-22.—Støp-Bowitz, 1948a, p. 47, fig. 13; 1948b, p. 46, fig. 18.—Wesenberg-Lund, 1951, p. 80.

Brada granulata Moore, 1909b, p. 143; not *B. granulata* Malmgren, 1867.

Brada inhabilis Annenkova, 1937, p. 176; 1938, p. 185.—Gorbunov, 1946, p. 39.—Zatsepin, 1948, p. 136; not *Siphonostoma inhabilis* Rathke, 1843.

NEW RECORDS: LABRADOR: Hebron Fjord, 95 fms., mud; 13 specimens, Station 11. EAST COAST NORTH AMERICA: Bay of Fundy, off Maine, Massachusetts, 18 to 253 fms., U. S. Fish Commission (identified by Verrill). WEST COAST NORTH AMERICA: Iliuliuk Harbor, Unalaska, 1871, and New Harbor, Unga Island, 1872, W. H. Dall.

DISTRIBUTION: Scattered records in the Arctic: Siberian Arctic, Spitsbergen. Also Iceland, Norway; Labrador to Massachusetts; southwestern Alaska; north Japan Sea. In 3 to 253 fathoms.

Family SCALIBREGMIDAE

Key to the genera of Scalibregmidae from Labrador and Nova Scotia

1. Body inflated anteriorly, abruptly attenuated on posterior half. Prostomium T-shaped, with frontal horns. Posterior parapodia with digitiform dorsal and ventral cirri (begin on setigers 16-18). Annuli 4 per segment. Pygidium with 4-5 filiform anal cirri **Scalibregma**
- Body short, fusiform. Prostomium bilobed, without frontal horns. Parapodia without dorsal and ventral cirri. Annuli 2 per segment. Pygidium without anal cirri **Polyphysia**

Genus *Scalibregma* Rathke, 1843*Scalibregma inflatum* Rathke, 1843

Scalibregma inflatum not Moore, 1909b, p. 143 (= *Polyphysia crassa*).—Wesenberg-Lund, 1953, p. 68.—Pettibone, 1954, p. 293, fig. 33,i-k.

NEW RECORDS: LABRADOR: Middle and west end Lake Melville, 17-35 fms., on bottoms of mud; 3 specimens, Stations 28, 55.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to France, Adriatic, Gulf of Oman; Labrador to Long Island Sound; Bering Sea to central California; north Japan Sea to Japan; New Zealand, Magellan Straits, South Georgia, Prince Edward Islands, Kerguelen. In low water to 1,333 fathoms; epitokes at surface.

Genus *Polyphysia* Quatrefages, 1865

Polyphysia crassa (Oersted, 1843)

Eumenia crassa Verrill, 1881, pp. 298, 304, 311.—Fauvel, 1927, p. 127, fig. 45,i-k.—Zatsepin, 1948, p. 136, pl. 33, fig. 9.—Wesenberg-Lund, 1950a, p. 37; 1950b, p. 88; 1951, p. 81; 1953, p. 71.

Scalibregma inflatum Moore, 1909b, p. 143; not *S. inflatum* Rathke, 1843.

Polyphysia crassa Støp-Bowitz, 1946a, p. 75, figs. 4-6; 1948b, p. 29, fig. 10.

DESCRIPTION: Branchiae 4 pairs (or 6?), arborescent, on setigers 2-5, first ones smaller, last ones larger (young without branchiae or small single lobes).

NEW RECORDS: EAST COAST NORTH AMERICA: Off Nova Scotia, Maine, Massachusetts, 56-110 fms., U. S. Fish Commission (identified by Verrill).

DISTRIBUTION: Widely distributed in the Arctic: Siberian Arctic, Greenland, Spitsbergen, Novaya Zemlya, Kara Sea. Also Iceland, Norway to England, Mediterranean; Gulf of St. Lawrence to Massachusetts. In 47 to 1,254 fathoms.

Family OPHELIIDAE

Key to the genera of Opheliidae from Labrador

1. Body rounded, cylindrical, grub-shaped, without ventral groove. Pygidium small, cylindrical, longitudinally furrowed. With paired lateral cirriform branchiae **Travisia**
Body rounded anteriorly on anterior half or third, with a deep ventral and two lateral grooves on posterior part. Pygidium with papillae—2 larger ventral ones and a dorsolateral cirlet of smaller ones. With paired lateral straplike branchiae (except on first 8-11 and few terminal segments).

Ophelia

Genus *Travisia* Johnston, 1840

Travisia forbesii Johnston, 1840

Travisia forbesii Malmgren, 1867, p. 75.—Not Murdoch, 1885, p. 154 (= *Travisia carnea*).—Chamberlin, 1920, p. 20.—Fauvel, 1927, p. 138, fig. 48,g-k.—Annenkova, 1938, p. 188.—Berkeley and Berkeley, 1942, p. 198.—Støp-Bowitz, 1946b, p. 26, fig. 1; 1948b, p. 10, fig. 2.—Zatsepin, 1948, p. 137, pl. 33, fig. 6.—Wesenberg-Lund, 1950a, p. 38; 1950b, p. 90; 1951, p. 82; 1953, p. 71.

DESCRIPTION: Segments 23-26. With conspicuous lateral lobes on two fleshy eminences on each side of posterior 9-11 segments, up to last segment (only one posterior segment without).

NEW RECORDS: LABRADOR: Strait of Belle Isle, 15–20 fms., sand; 2 specimens, Station 15. WEST COAST NORTH AMERICA: Washington Sound, low water, M. H. Pettibone; Chichagof Harbor, Attu Island, gravel and mud, 1873, and Chiachi Islands, Alaska, 20 fms., mud, 1874, W. H. Dall; Karluk, Alaska, Alaska Salmon Investigation, 1903.

DISTRIBUTION: Widely distributed in the Arctic: Siberian, Alaskan, and Canadian Arctic, Davis Strait, Greenland, Jan Mayen, Spitsbergen, Novaya Zemlya, Kara Sea. Also Iceland, Faroes, Norway to France; Labrador to Maine; South Africa; Bering Sea to Washington Sound; north Japan Sea. In low water to 1,501 fathoms.

Genus *Ophelia* Savigny, 1822

Ophelia limacina (Rathke, 1843)

Ammotrypane limacina Rathke, 1843, pp. 190, 202, pl. 10, figs. 4–8.

Ophelia limacina Verrill, 1881, pp. 289, 316, 319.—Not Webster and Benedict, 1884, p. 724 (= *O. bicornis*).—Fauvel, 1927, p. 132, fig. 46,i–l.—Treadwell, 1937, p. 32.—Annenkova, 1937, p. 177; 1938, p. 187.—Hartman, 1938, p. 107, figs. 55–58; not 1942b, p. 130 (= *O. denticulata*).—Berkeley and Berkeley, 1943, p. 130.—Støp-Bowitz, 1946b, p. 32, fig. 2; 1948b, p. 12, fig. 3.—Zatsepin, 1948, p. 137, pl. 33, fig. 5.—Wesenberg-Lund, 1950a, p. 37; 1950b, p. 88; 1951, p. 83.—Tebble, 1952, p. 561, fig. 4; 1953, pp. 362, 365.

Ophelia borealis Tebble, 1952, p. 553, figs. 1–3; 1953, pp. 362, 365.—Berkeley and Berkeley, 1954, p. 467.

Ophelia assimilis Tebble, 1953, p. 367.

DESCRIPTION: The two specimens from Labrador are 29–33 mm. long, 3.5–4 mm. wide, consisting of 33 setigerous segments: 10 prebranchial, 16 branchial, and 7 postbranchial. Ventral groove begins on setiger 7. The dorsolateral circling of anal papillae are rather long, the setae of the posterior segments are long, extending well beyond the posterior end of the body. The paired dorsolateral longitudinal ridges on the posterior five segments (setigers 29–33) are prominent.

REMARKS: Tebble (1952) has attempted to distinguish between *Ophelia borealis* Quatrefages (10 prebranchial setigers, typically 20 (16–20) branchial setigers, 6 (6–10) postbranchial setigers, 36 (34–36) total number of setigers, with dorsolateral circling of anal papillae long and thin, and with setae of posterior segments long, concealing the anal segment) and *O. limacina* (10 prebranchial setigers, typically 22 (18–23) branchial setigers, 7 (6–10) postbranchial setigers, 39 (38–39) total number of setigers, with dorsolateral circling of anal papillae short and blunt, and setae of posterior segments short). In the material examined by Tebble, the two groups could be separated and there were no intergradations. However in the material examined in the U. S. National Museum from Greenland, Canadian Arctic, Arctic Alaska, Labrador, Washington, Oregon, and central California there were all gradations from the typical *O.*

limacina to the typical *O. borealis*, as defined by Tebble, in the number of branchial, postbranchial, and total number of segments. The specimens from Labrador (16 branchial, 7 postbranchial, and 33 total setigers) and *O. assimilis* Tebble, 1953, from central California (19 branchial, 4 postbranchial, and 33 total setigers) appear to fall in place in the variable series. The dorsolateral anal papillae vary from short, rounded to longer, digitiform depending on the degree of contraction (indicated also by Hartman, 1938d, p. 107).

TABLE 3.—Summary of observations on *Ophelia limacina* (Rathke)

| Geographic location | Pre-branchial setigerous segments | Branchial setigerous segments | Post-branchial setigerous segments | Total number setigerous segments | Dorsolateral circlet anal papillae | Anal setae |
|---|-----------------------------------|-------------------------------|------------------------------------|----------------------------------|------------------------------------|----------------|
| Canadian Arctic..... | 10 | 24 | 6 | 40 | Short to rather long. | Short to long. |
| Greenland..... | 10 | 22 | 7 | 39 | Short..... | Short. |
| Central California..... | 10 | 23 | 6 | 39 | Long..... | Long. |
| Typical <i>O. limacina</i> according to Tebble, 1952. | 10 | 22 | 7 | 39 | Short, blunt..... | Short. |
| Canadian Arctic..... | 10 | (18-23) | (6-10) | (38-39) | | |
| Arctic Alaska, Washington.. | 10 | 22 | 6 | 38 | Short..... | Short. |
| Oregon..... | 10 | 21 | 6 | 37 | Long..... | Long. |
| Typical <i>O. borealis</i> according to Tebble, 1952, British waters, Atlantic. | 10 | 20 | 6 | 36 | Medium long..... | Short to long. |
| Labrador..... | 10 | 20 | 6 | 36 | Long, thin..... | Long. |
| <i>O. assimilis</i> Central California. | 10 | (16-20) | (6-10) | (34-36) | | |
| Labrador..... | 10 | 16 | 7 | 33 | Long..... | Long. |
| <i>O. assimilis</i> Central California. | 10 | 19 | 4 | 33 | Short..... | (?). |
| Range for material examined | 10 | 16-24 | 6-7 | 33-40 | Short to long.... | Short to long. |
| Range for <i>O. limacina</i> (incl. <i>O. borealis</i> , <i>O. assimilis</i>). | 10 | 16-24 | 4-7 | 33-40 | Short to long.... | Short to long. |

The setae of the posterior segments may be short (broken off?) to long. The observations are summarized in table 3. Thus I could not follow Tebble in considering *O. borealis* and *O. assimilis* valid species. The range for the material examined is 10 prebranchial, 16-24 branchial, 6-7 postbranchial, and 33-40 total setigers, with the dorsolateral anal papillae and setae of posterior segments short to long.

Ophelia denticulata Verrill, 1875 (type in USNM) should not be referred to *O. limacina* (Hartman, 1942b, p. 130). They may be distinguished as follows: in *O. denticulata* the deep ventral groove begins on setigers 9-10, in *O. limacina* it begins on setiger 7; in *O. denticulata* there are 9 prebranchial setigers instead of 10 as in *O. limacina*; in *O. denticulata* paired dorsal longitudinal ridges on posterior few segments are absent, present in *O. limacina*.

NEW RECORDS: LABRADOR: Strait of Belle Isle, 15-20 fms., sand; 2 specimens, Station 15. WEST GREENLAND: Off Conical Rock, 20-40 fms., 1938; 1 mile northwest of Conical Rock, 1940; west side

Wolstemholm Island, 1940—all by R. A. Bartlett; Upernivik Harbor, 13 fms., 1884, U. S. S. *Alert*. WEST COAST NORTH AMERICA: Chichagof Harbor, Attu Island, 5-7 fms., gravel and sand, 1873, W. H. Dall; *Albatross* Station 2879, off Washington, 48°53' N., 125°53' W., 34 fms., 1888; 5 miles off Moclips, Wash., 20 fms., 1940, and 7 miles south Cape Arago, Oreg., 32-35 fms., shale and coral, 1939, M. H. Pettibone; *Albatross* Station 4453, Monterey Bay, Calif., 49 fms., 1904.

DISTRIBUTION: Widely distributed in the Arctic: Siberian, Alaskan and Canadian Arctic, Davis Strait, Greenland, Spitsbergen, Barents Sea, Novaya Zemlya, Kara Sea. Also Iceland, Faroes, Norway to English Channel; Hudson Bay to Grand Manan; Alaska to southern California; north Japan Sea to Japan. In low water to 250 fathoms.

Family CAPITELLIDAE

Genus *Capitella* Blainville, 1823

Capitella capitata (Fabricius, 1780)

Capitella capitata Wesenberg-Lund, 1953, p. 74.—Berkeley and Berkeley, 1954, p. 465.—Pettibone, 1954, p. 298, fig. 33,r-u.

NEW RECORD: LABRADOR: Hamilton Inlet, 6 fms., muddy, sandy; 4 specimens, Station 24.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to France, Mediterranean, Black Sea; Hudson Bay to North Carolina, Texas; Bering Sea to southern California; north Japan Sea; Magellan Straits, South Georgia, Bouvet Island, South Africa, Kerguelen. In low water to 500 fathoms.

Family MALDANIDAE

Genus *Praxillella* Verrill, 1831

Praxillella praetermissa (Malmgren, 1865)

Praxillella praetermissa Moore, 1909b, p. 142.—Wesenberg-Lund, 1953, p. 82.—Pettibone, 1954, p. 303, fig. 34,b-f.

NEW RECORDS: LABRADOR: Okak area, Hamilton Inlet, Strait of Belle Isle, 5-8 fms., on bottoms of mud, sand, mud and rock with much detritus; 6 specimens, Stations 17, 23, 73.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Faroes to English Channel, Mediterranean; Labrador to Massachusetts; north Japan Sea. In 7 to 1,111 fathoms.

Genus *Maldane* Grube, 1860

Maldane sarsi Malmgren, 1865

Maldane sarsi Moore, 1909b, p. 142.—Wesenberg-Lund, 1953, p. 84.—Pettibone, 1954, p. 303, fig. 34,g,h.

NEW RECORD: LABRADOR: Seven Islands Bay, 30 fms., mud with rock; 2 specimens, Station 31.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to France; Labrador to Rhode Island, Louisiana, Mississippi, Texas; Bering Sea to southern California; north Japan Sea to Japan; south Arabian coast, Bay of Bengal, South Georgia, South Shetlands, Palmer Archipelago, south Australia. In low water to 1,771 fathoms.

Genus *Nicomache* Malmgren, 1865

Nicomache lumbricalis (Fabricius, 1780)

Nicomache lumbricalis Wesenberg-Lund, 1953, p. 79.—Pettibone, 1954, p. 305, fig. 34,i,j.

NEW RECORDS: LABRADOR: Seven Islands Bay, Hebron Fjord, west end Lake Melville, 30–125 fms., mud, and mud with rock; 9 specimens, Stations 12, 14, 31, 37, 57.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to English Channel, Santander; Labrador to Massachusetts; South Africa; Bering Sea to Lower California; north Japan Sea. In low water to 1,400 fathoms.

Family PECTINARIIDAE (AMPHICTENIDAE)

Genus *Pectinaria* Lamark, 1818

Subgenus *Cistenides* Malmgren, 1865

Pectinaria (Cistenides) hyperborea (Malmgren, 1865)

Cistenides hyperborea Wesenberg-Lund, 1953, p. 89.

Pectinaria (Cistenides) hyperborea Moore, 1909b, p. 140.—Pettibone, 1954, p. 314, fig. 35,c-h.

NEW RECORDS: LABRADOR: Seven Islands Bay, Hebron Fjord, Nain area, Hamilton Inlet, St. Lewis Inlet, Strait of Belle Isle, 8–125 fms., on bottoms of mud, sand, stones, and various combinations of mud, stones, rocks, shells; 304 specimens, Stations 5, 10–14, 17, 27, 31, 33, 41, 45, 49, 50, 56, 74.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to Danish waters, North Sea; Labrador to Massachusetts; Bering Sea to Alaska; north Japan Sea to Japan. In 1.5 to 379 fathoms.

Pectinaria (Cistenides) granulata (Linné, 1767)

Cistenides granulata Wesenberg-Lund, 1953, p. 88.

Pectinaria (Cistenides) granulata Pettibone, 1954, p. 312, fig. 35,i-k.

NEW RECORDS: LABRADOR: Davis Inlet, Ironbound Islands, Hamilton Inlet, west end Lake Melville, 4–12 fms., on bottoms of mud,

sandy mud, mud with rock, rubble; 10 specimens, Stations 20, 47, 48, 52, 69.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Faroes to Great Britain; Labrador to Long Island Sound; Bering Sea to western México; north Japan Sea. In low water to 190 fathoms.

Family AMPHARETIDAE

Key to the genera of Ampharetidae from Labrador

1. With a pair of large, recurved, dorsal hooked setae behind the branchiae.
Branchiae 8. Without paleae. Thoracic setigers 16 (first 2 may be small).
Melinna
Without pair of dorsal hooked setae posterior to branchiae 2
2. With well developed bundles of golden setae (paleae) on each side, anterior to branchiae. Branchiae 8. Thoracic setigers 14. Uncinigerous pinnules begin on setiger 3 **Ampharete**
Without paleae or paleae poorly developed (smaller and more delicate than notosetae, easily overlooked) 3
3. Uncinigerous pinnules begin on setiger 3. Branchiae 8. Thoracic setigers 13.
Paleae very reduced or absent **Sabellides**
Uncinigerous pinnules begin on setiger 4 4
4. Branchiae 8. Without paleae or paleae very small and delicate. Thoracic setigers 16 (first small, easily overlooked) **Lysippe**
Branchiae 6. Without paleae. Thoracic setigers 17 (first very small, easily overlooked) **Samytha**

Genus *Melinna* Malmgren, 1865

Melinna cristata (Sars, 1851)

Sabellides cristata Sars, 1851, p. 205.

Melinna cristata Malmgren, 1865, p. 371, pl. 20, fig. 50.—Verrill, 1881, pp. 298, 302, 305, 309, 312.—Webster and Benedict, 1884, p. 732; 1887, p. 748.—Moore, 1908, p. 349.—Fauvel, 1927, p. 237, fig. 83,i-n; 1933, p. 53.—Annenkova, 1937, p. 186; 1938, p. 199.—Zatsepin, 1948, p. 149, pl. 37, fig. 6.—Hartman and Reish, 1950, p. 42.—Wesenberg-Lund, 1950a, p. 49; 1950b, p. 114; 1951, p. 105; 1953, p. 93.—Berkeley and Berkeley, 1952, p. 70, figs. 143-145.

Melinna cristata heterodonta Moore, 1923, p. 212, pl. 17, fig. 25.

DESCRIPTION: Branchiae 8, united by a palmar membrane of variable height. Anterior few segments coalesced, forming a collette ventrally, with sides elevated in a lateral crest, and with a transverse dorsal fimbriated thoracic membrane (10-20 teeth). Abdominal region long, tapered posteriorly, about 50 segments. Pygidium without cirri. Tube of mud with few small pebbles.

NEW RECORDS: LABRADOR: Hamilton Inlet, 5-6 fms., sand, mud, rock, much detritus; 1 specimen, Station 23. EAST COAST NORTH AMERICA: Off Nova Scotia, Maine, Massachusetts, 6-374 fms., U. S. Fish Commission (identified by Verrill).

DISTRIBUTION: Widely distributed in the Arctic: Siberian Arctic, Greenland, Jan Mayen, Spitsbergen, Barents Sea, Novaya Zemlya, Kara Sea. Also Iceland, Faroes, Scandinavia to France; Hudson Bay to Massachusetts; Alaska to southern California; north Japan Sea, Manchuria; Antarctic. In 4 to 2,228 fathoms.

Genus *Ampharete* Malmgren, 1865

Key to the species of *Ampharete* from Labrador

1. Paleae slender, taper gradually. Anal cirri numerous. Tube membranous plus soft gray debris *A. acutifrons*
- Paleae stouter, taper rather abruptly, with short to long acuminate tips. Anal cirri 2. Tube of stiff, smooth, compact mud *A. arctica*

Ampharete acutifrons (Grube, 1860)

Ampharete acutifrons Wesenberg-Lund, 1953, p. 90—Pettibone, 1954, p. 316, fig. 36,b-d.

NEW RECORD: LABRADOR: Strait of Belle Isle, 8 fms., soft mud; 1 specimen, Station 17.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Swedish west coast to France, Mediterranean; Labrador to Maine; Bering Sea to southern California; north Japan Sea. In 1 to 1,333 fathoms.

Ampharete arctica Malmgren, 1865

Ampharete arctica Malmgren, 1865, p. 364, pl. 26, fig. 77.—Verrill, 1881, p. 312.—Moore, 1908, p. 348; 1923, p. 200.—Hessle, 1917, p. 97, fig. 9.—Augener, 1928, p. 777.—Gustafson, 1936, p. 9.—Annenkova, 1937, p. 188; 1938, p. 201.—Gorbunov, 1946, p. 39.—Zatsepin, 1948, p. 150, pl. 37, fig. 11.—Berkeley and Berkeley, 1952, p. 65, figs. 133-135.

Ampharete setosa Verrill, 1873, pp. 612, 416.—Hartman, 1944a, p. 20 (52), fig. 8 (figure as *A. grubei*).

Ampharete gracilis Verrill, 1881, pp. 302, 305, 309, 312.—Moore, 1923, p. 20; not *A. gracilis* Malmgren, 1865.

Ampharete finmarchica Verrill, 1881, pp. 298, 305, 309, 312.—Wesenberg-Lund, 1950a, p. 47; 1950b, p. 109; 1953, p. 90.

Ampharete groenlandica Treadwell, 1937, p. 33.

DESCRIPTION: Paleae about 20 in each semicircular group, taper rather abruptly, with short to long acuminate tips. Abdominal setigers 13 (may be 12). Neuropodial cirri inconspicuous.

NEW RECORDS: LABRADOR: Hebron Fjord, 60-65 fms., fine sand, mud, some rock; 1 specimen, Station 10. EAST COAST NORTH AMERICA: Off Maine, Massachusetts, 13-110 fms., U. S. Fish Commission (by Verrill as *A. gracilis*, *A. setosa*, *A. finmarchica*). WEST COAST NORTH AMERICA: Washington Sound, 12 fms., mud, M. H. Pettibone.

DISTRIBUTION: Widely distributed in the Arctic: Siberian and Canadian Arctic, Greenland, Spitsbergen, Barents Sea, Novaya

Zemlya, Kara Sea. Also Shetlands, Norway to Danish waters and Scotland; Hudson Bay to Massachusetts; Bering Sea to southern California; north Japan Sea to Japan. In 2 to 1,062 fathoms.

Genus *Lysippe* Malmgren, 1865

Lysippe labiata Malmgren, 1865

Lysippe labiata Malmgren, 1865, p. 367, pl. 26, fig. 78.—Annenkova, 1937, p. 189; 1938, p. 201.—Gorbunov, 1946, p. 39.—Zatsepin, 1948, p. 151, pl. 37, fig. 17.—Wesenberg-Lund, 1950a, p. 48; 1950b, p. 113; 1951, p. 105; 1953, p. 93.—Berkeley and Berkeley, 1952, p. 67, fig. 138.

DESCRIPTION: Peristomium forms a widely protruding collarlike lobe. Abdominal segments 14 (13–15?). Two short anal cirri. Without paleae (or very small and delicate).

NEW RECORDS: LABRADOR: Hamilton Inlet, Strait of Belle Isle, 8–30 fms., soft mud and mud with stones; 2 specimens, Stations 17, 43. EAST COAST NORTH AMERICA: Bedford Basin, Nova Scotia, 40 fms., U. S. Fish Commission (by Verrill).

DISTRIBUTION: Widely distributed in the Arctic: Siberian Arctic, Greenland, Spitsbergen, Barents Sea, Novaya Zemlya. Also Iceland, Denmark; Labrador to Nova Scotia; Alaska; north Japan Sea. In 1 to 433 fathoms.

Genus *Samytha* Malmgren, 1865

Samytha sexcirrata (Sars, 1856)

Samytha sexcirrata Malmgren, 1865, p. 370, pl. 20, fig. 49.—Verrill, 1881, pp. 298, 305, 309, 312.—Moore, 1909b, p. 140; not 1923, p. 214.—Chamberlin, 1920, p. 23.—Berkeley and Berkeley, 1944, p. 3.—Zatsepin, 1948, p. 151, pl. 37, fig. 19.

DESCRIPTION: Branchiae 6, in transverse row from a common base. Abdominal segments 13. With an anterior ventral collar below the prostomium.

NEW RECORDS: LABRADOR: Strait of Belle Isle, 8 fms., soft mud; 3 specimens, Stations 17. EAST COAST NORTH AMERICA: Off Georges Bank, 110 fms., U. S. Fish Commission (by Verrill).

DISTRIBUTION: Siberian and Alaskan Arctic; Norway; Labrador to Gulf of Maine; Alaska. In 8 to 110 fathoms.

Genus *Sabellides* Milne-Edwards, 1838, emend. Malmgren, 1865

Sabellides borealis Sars, 1856

Sabellides borealis Malmgren, 1865, p. 368, pl. 20, fig. 47.—Moore, 1909b, p. 139.—Gorbunov, 1946, p. 39.—Zatsepin, 1948, p. 151, pl. 37, fig. 15.—Wesenberg-Lund, 1950a, p. 47; 1950b, p. 111; 1951, p. 104; 1953, p. 92.

DESCRIPTION: Paleae very small, rudimentary (smaller than notosetae). Branchiae 8, in two groups. Oral tentacles pinnate. Abdominal segments 12, with neuropodial cirri. Two anal cirri. Tube muddy, gray, compact, smooth.

NEW RECORDS: LABRADOR: Seven Islands Bay, Hebron Fjord, 30–125 fms., on bottoms of mud, stones, and mud with rock; 12 specimens, Stations 11, 12, 31, 41.

DISTRIBUTION: Widely distributed in the Arctic: Siberian Arctic, Greenland, Spitsbergen, Barents Sea, Novaya Zemlya, Kara Sea. Also Iceland, Norway to England; Labrador. In 5 to 153 fathoms.

Family TERESELLIDAE

Genus *Pista* Malmgren, 1865

Both species have a single pair of branchiae, with large main stem and branched dichotomously. Cephalic ridge with numerous eye-spots. Two pairs large lateral lobes on segments 1 and 3 (anterior and posterior to branchial segment).

Key to the species of *Pista* from Labrador

1. Thoracic setigers 15. Tube of muddy sand in form of 2½ to 3 windings in horizontal plane, flattened oval in cross section *P. flexuosa*
- Thoracic setigers 16. Tube cylindrical, membranous, with small pebbles of varying sizes, debris, bryozoans, parts of other worm tubes, algae, etc. *P. maculata*

Pista flexuosa (Grube, 1860)

Terebella flexuosa Grube, 1860, p. 102, pl. 5, fig. 2.

Axione flexuosa Malmgren, 1865, p. 384, p. 24, fig. 68.—Moore, 1909b, p. 141.

Pista flexuosa Hesse, 1917, p. 162.—Annenkova, 1937, p. 191; 1938, p. 205.—Treadwell, 1937, p. 162.—Zatsepin, 1948, p. 155, pl. 38, fig. 10.—Wesenberg-Lund, 1950a, p. 52; 1950b, p. 120; 1953, p. 98.

Scione flexuosa Augener, 1928, p. 790.

Some specimens shared their curved tubes with the polynoid commensals, *Arcteobia anticostiensis*.

NEW RECORDS: LABRADOR: Seven Islands Bay, Hebron Fjord, Nain, Hamilton Inlet, west end Lake Melville, 10–125 fms., on bottoms of mud and mud with stones and rock; 40 specimens, Stations 10–12, 33, 38, 43, 50, 52, 57.

DISTRIBUTION: Widely distributed in the Arctic: Siberian and Canadian Arctic, Greenland, Spitsbergen, Novaya Zemlya, White Sea, Kara Sea. Also Labrador to Newfoundland; Okhotsk Sea to north Japan Sea. In 4 to 211 fathoms.

Pista maculata (Dalyeli, 1853)

Pista maculata Wesenberg-Lund, 1953, p. 97.—Pettibone, 1954, p. 323, fig. 36, k. 1.

NEW RECORDS: LABRADOR: Seven Islands Bay, Hebron Fjord, east and west ends Lake Melville, Goose Bay and Terrington Basin of Greater Lake Melville area, 8-125 fms.; on bottoms of mud, and mud with rock; 121 specimens, Stations 11, 12, 14, 31, 38-40, 47, 53, 55, 57, 59, 60, 68.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to English Channel; Hudson Bay to Maine; Bering Sea. In 3 to 1, 528 fathoms.

Genus *Leaena* Malmgren, 1865

Leaena abbranchiata Malmgren, 1865

Leaena abbranchiata Wesenberg-Lund, 1953, p. 99.—Pettibone, 1954, p. 325, fig. 37, a, b.

Some specimens had tubes of mud with bits of rock and were fastened to tubes of the terebellid *Pista maculata*.

NEW RECORDS: LABRADOR: Seven Islands Bay, west end Lake Melville, 15-55 fms., on bottoms of mud and mud with rock; 21 specimens, Stations 31, 37, 38, 57.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Faroes, Norway, Sweden, Finland; Hudson Bay to Labrador; south-western Alaska; Okhotsk Sea to north Japan Sea; Antarctic, South Georgia. In 5 to 1,975 fathoms.

Genus *Thelepus* Leuckart, 1849

Thelepus cincinnatus (Fabricius, 1780)

Thelepus cincinnatus Moore, 1909b, p. 141.—Wesenberg-Lund, 1953, p. 100.—Pettibone, 1954, p. 327, fig. 37,d.

NEW RECORDS: LABRADOR: Davis Inlet, Strait of Belle Isle, 12-30 fms., on bottoms of rock, rock and bryozoans, and rubble; 5 specimens, Stations 2, 3, 20.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to Portugal, Mediterranean, Adriatic; Labrador to Massachusetts; Bering Sea to Washington; Japan; Indian Ocean; Antarctic. In low water to 1,391 fathoms.

Genus *Polycirrus* Grube, 1851

Polycirrus medusa Grube, 1855

Polycirrus medusa Wesenberg-Lund, 1953, p. 102.—Pettibone, 1954, p. 328, fig. 37,e,f.

NEW RECORD: LABRADOR: Kaipokok Inlet, 45 fms., silt; 1 specimen, Station 7.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Swedish west coast to France, Mediterranean; Labrador to Maine; Bering Sea to Washington; Okhotsk Sea to north Japan Sea. In low water to 889 fathoms.

Genus *Terebellides* Sars, 1835

Terebellides stroemii Sars, 1835

Terebellides stroemii Moore, 1909b, p. 142.—Wesenberg-Lund, 1953, p. 105.—Pettibone, 1954, p. 330, fig. 37,j-m.

NEW RECORDS: LABRADOR: Hebron Fjord, Hamilton Inlet, west end Lake Melville, Strait of Belle Isle, 5-65 fms., on bottoms of mud and sandy mud with rock and much detritus; 5 specimens, Stations 10, 17, 23, 38.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to Portugal, Mediterranean, Adriatic, Black Sea; Hudson Bay to Long Island Sound; Gulf of Mexico, West Indies; Bering Sea to southern California, Panamá, Venezuela; north Japan Sea to Japan; Iranian Gulf; Indian Ocean; Antarctic. In low water to 1,611 fathoms.

Family SABELLIDAE

Genus *Sabella* Linné, 1767

Sabella crassicornis Sars, 1851

Sabella crassicornis Pettibone, 1954, p. 334, fig. 38,a-i.

Sabella fabricii Wesenberg-Lund, 1953, p. 106.

NEW RECORD: LABRADOR: Hamilton Inlet, 5-6 fms., sand, mud, rock, much detritus; 1 specimen, Station 23.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to France, Mediterranean; Hudson Bay to Massachusetts; Bering Sea to California, Central America; north Japan Sea to Japan. In low water to 230 fathoms.

Genus *Potamilla* Malmgren, 1865

Potamilla neglecta (Sars, 1851)

Potamilla neglecta Wesenberg-Lund, 1953, p. 107.—Pettibone, 1954, p. 335, fig. 38,j-n.

NEW RECORD: LABRADOR: Hebron Fjord, 125 fms., mud; 1 specimen, Station 12.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to France, Mediterranean, Adriatic, Cape Verde Islands; Labrador to Massachusetts; Bering Sea to California; north Japan Sea to Japan; Antarctic. In low water to 1,044 fathoms.

Genus *Branchiomma* Kölliker, 1858

Tori of thorax with a single row of avicular uncini, without hoelike setae. Branchial filaments with paired dorsal appendages (stylodes) on outer sides of branchial filaments.

***Branchiomma infarcta* (Kröyer, 1856)**

Sabella infarcta Kröyer, 1856, p. 21.

Dasychone infarcta Malmgren, 1865, p. 403, pl. 28, fig. 86.—Augener, 1928, p. 803, pl. 11, fig. 11.—Gustafson, 1936, p. 10.—Berkeley and Berkeley, 1943, p. 130; 1944, p. 5.—Gorbunov, 1946, p. 39.—Zatsepin, 1948, p. 160, pl. 39, fig. 1.—Wesenberg-Lund, 1950a, p. 57; 1950b, p. 130; 1951, p. 121; 1953, p. 107.

Branchiomma infarcta Johansson, 1927, p. 157.

DESCRIPTION: Collarette 4-lobed—2 ventral, 2 laterodorsal. Branchial filaments without eyespots, banded with pink. Tube membranous, free end covered with mud.

NEW RECORDS: LABRADOR: Kaipokok Inlet, Backway, east end, middle, and west end Lake Melville, Goose Bay, 9–80 fms., on bottoms of silt, mud, and sand with mud and rock; 43 specimens, Stations, 7, 28, 32, 35, 39, 40, 47, 59, 60, 63, 67, 79.

DISTRIBUTION: Widely distributed in the Arctic: Siberian and Canadian Arctic, Davis Strait, Greenland, Spitsbergen, Novaya Zemlya, Kara Sea. Also Iceland, Norway, Denmark Strait; Hudson Bay to Labrador; Bering Sea. In low water to 411 fathoms.

Genus *Chone* Kröyer, 1856***Chone dunéri* Malmgren, 1867**

Chone dunéri Wesenberg-Lund, 1953, p. 109.—Pettibone, 1954, p. 339, fig. 39,k,l.

NEW RECORD: LABRADOR: Strait of Belle Isle, 8 fms., 'soft mud; 2 specimens, Station 17.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to North Sea, Madeira, Mediterranean, Adriatic; Labrador; Florida; Perú. In 8 to 889 fathoms.

Genus *Euchone* Malmgren, 1865

Large ventral groovelike depression with flared sides on posterior segments. Collarette 2-lobed, with small midventral slit.

Key to the species of *Euchone* from Labrador

- Collarette obliquely slanted, longer ventrally. Branchial filaments end in long slender tips. Abdominal region with 2 pairs small ventral shields per segment ***E. papillosa***
- Collarette nearly straight. Branchial filaments end in short limbate tips. Abdominal region with one pair large ventral shields per segment . ***E. analis***

Euchone analis (Kröyer, 1856)

Euchone analis Wesenberg-Lund, 1953, p. 110.—Pettibone, 1954, p. 339, fig. 39,m,n.

NEW RECORD: LABRADOR: Seven Islands Bay, 30 fms., mud, some rock; 4 specimens, Station 31.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to Danish waters; Hudson Bay to Labrador; Bering Sea to British Columbia; north Japan Sea. In 2 to 389 fathoms.

Euchone papillosa (Sars, 1850)

Euchone papillosa Malmgren, 1865, p. 407, pl. 29, fig. 94.—Augener, 1928, p. 805.—Gustafson, 1936, p. 10.—Annenkova, 1937, p. 196; 1938, p. 215.—Gorbunov, 1946, p. 39.—Zatsepin, 1948, p. 163, pl. 39, fig. 11.—Wesenberg-Lund, 1950a, p. 59; 1950b, p. 132; 1951, p. 124; 1953, p. 111.

Euchone tuberculosa Malmgren, 1865, p. 407, pl. 29, fig. 92.—Moore, 1909b, p. 145.

DESCRIPTION: Collarlet notched midventrally. Tube thin, elongated, of silty mud, smooth, tough.

NEW RECORDS: LABRADOR: Hebron Fjord, 95–125 fms., mud; 14 specimens, Stations 11, 12. EAST COAST NORTH AMERICA: Bay of Fundy, U. S. Fish Commission (by Verrill as *E. tuberculosa*). WEST COAST NORTH AMERICA: *Albatross* Station 2848, Unalaska to Cook Island, 55°10' N., 160°18' W., 110 fms., 1888; *Albatross* Station 3311, Bering Sea, 53°59' N., 166°29' W., 85 fms., 1890.

DISTRIBUTION: Widely distributed in the Arctic: Siberian Arctic, Greenland, Spitsbergen, Novaya Zemlya, Kara Sea, Laptev Sea. Also Iceland, Norway to Danish waters; Labrador to Bay of Fundy; Bering Sea; north Japan Sea. In 2 to 1,611 fathoms.

Family SERPULIDAE

Genus *Spirorbis* Daudin, 1800*Spirorbis (Laeospira) granulatus* (Linné, 1767)

Spirorbis (Laeospira) granulatus Wesenberg-Lund, 1952, p. 12; 1953, p. 117.—Pettibone, 1954, p. 343, fig. 39, r-t.

NEW RECORDS: LABRADOR: Seven Islands Bay, east end Lake Melville, 30–35 fms., on bottoms of mud and mud with rock, on brachiopod shell; 2 specimens, Stations 31, 34.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to France; Hudson Bay to North Carolina; Alaska to British Columbia; north Japan Sea. In low water to 239 fathoms.

Spirorbis (Dexiospira) spirillum (Linné, 1758)

Spirorbis (Dexiospira) spirillum Moore, 1909b, p. 145.—Wesenberg-Lund, 1952 p. 9; 1953, p. 116.—Pettibone, 1954, p. 344, fig. 39,u-x.

NEW RECORDS: LABRADOR: Seven Islands Bay, Nain, Hamilton Inlet, Backway, Greater Lake Melville area, Strait of Belle Isle, 10-40 fms., on bottoms of stones, rocks, mud, on bryozoans, algae (spiny type and *Laminaria*), on sabellid worm tube; 52 specimens, Stations 1, 30, 31, 52, 66, 67.

DISTRIBUTION: Widely distributed in the Arctic. Also Iceland, Norway to France; Hudson Bay to Long Island Sound, southern Texas; Bering Sea to México; north Japan Sea to Japan. In low water to 305 fathoms.

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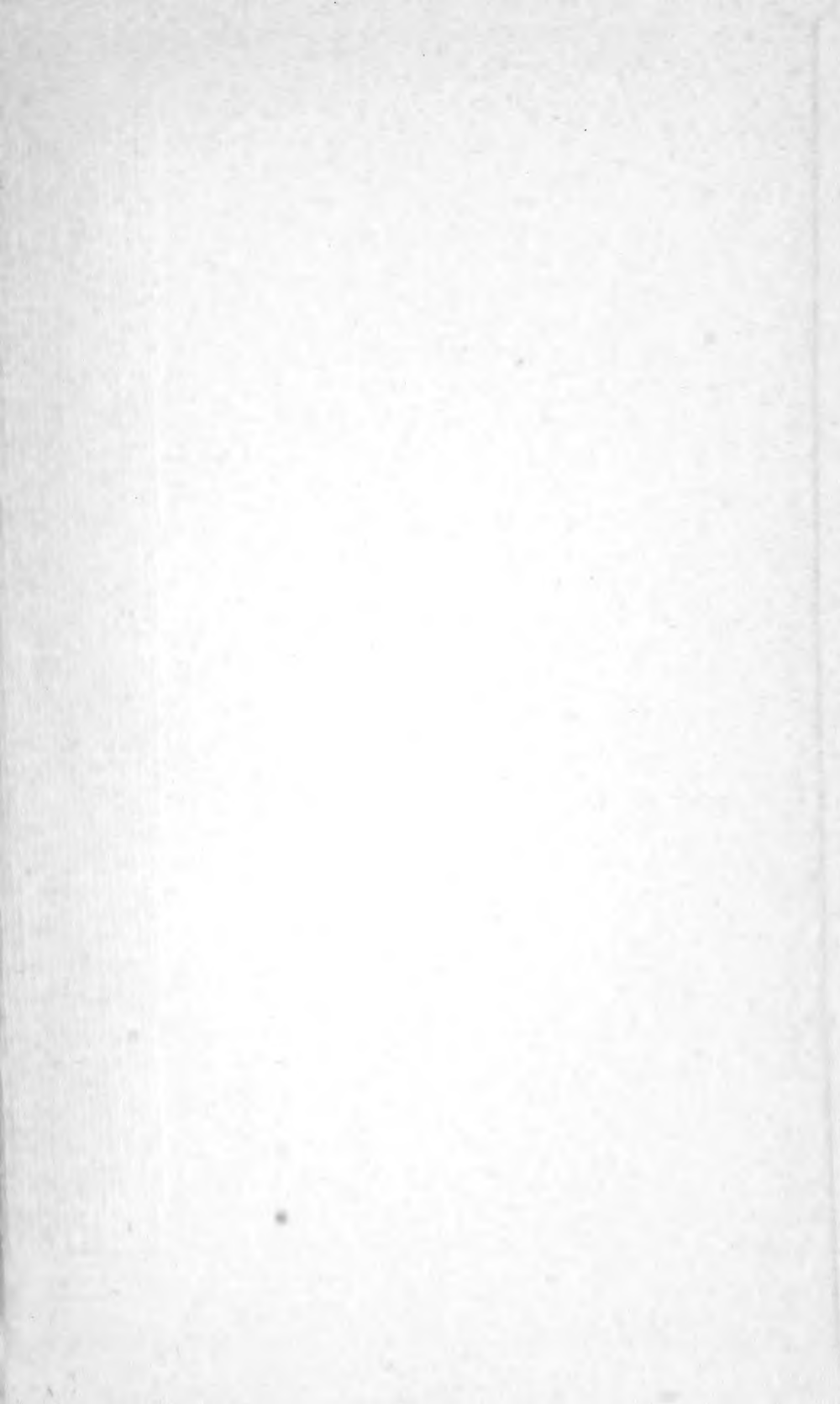
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