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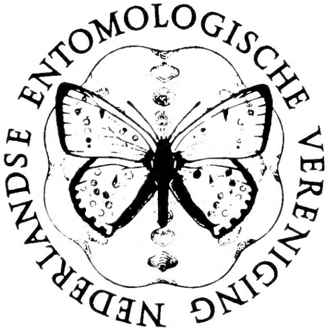

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The article of De Jong (pt. 3) has its own index at the end of the article (p. 139), but nevertheless the primary references have been incorporated below. Of the article of Kielland (pt. 4) only the names of genera and new taxa have been included here.

* Een sterretje duidt een naam nieuw voor de wetenschap aan
* An asterisk denotes a name new to science

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PSENINI FROM SRI LANKA (HYMENOPTERA, SPHECIDAE, PEMPHREDONINAE)

by

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With 16 text-figures

Abstract

This review of the Psenini from Sri Lanka is based mainly on material collected under the auspices of the "Biosystematic Studies of the Insects of Ceylon" project of the Smithsonian Institution, Washington, D.C. Three new forms are described: *Psenulus genalis* and *P. maculatus keiseri* from Sri Lanka, *P. carinifrons taprobanensis* from Sri Lanka and South India. Supplementary descriptions of previously recorded species are also given.

Thus far four species were recorded from Sri Lanka (formerly Ceylon), namely *Psen (Psen) matalensis, Psen (Psen) nitidus, Psenulus ceylonicus* and *Psenulus nietneri,* seven specimens in total. During the recent "Biosystematic Studies of the Insects of Ceylon" project of the Smithsonian Institution, Washington, D.C., 51 fresh specimens were collected. In addition I was able to study 19 Psenini from various other museums, partly received through the kind offices of Dr. K. V. Krombein, Washington, D.C., and Prof. Dr. J. van der Vecht, Putten, Netherlands. One new *Psenulus* and two new subspecies of *Psenulus* are now described from Sri Lanka. The new subspecies *Psenulus carinifrons taprobanensis* occurs both in South India and in Sri Lanka, seven specimens being recorded from Sri Lanka, four from the continent.

I am grateful to the Naturhistorisches Museum, Basle (NMB; via J. van der Vecht), British Museum (Natural History), London, C. R. Vardy (BM), National Colombo Museum, Colombo (NCM; via K. V. Krombein and J. van der Vecht), Idaho University, Moscow, Idaho, A. R. Gittins (IU), Lund University, Lund (LU; via J. van der Vecht), Oregon State University, Corvallis, G. R. Ferguson (OSU), Entomology Research Institute, Ottawa, L. Masner and C. M. Yoshimoto (CNC), H. and M. Townes, Ann Arbor (HT) and the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM) for the loan of material. My special thanks are due to Dr. Karl V. Krombein, Principal Investigator of the project, for entrusting the study of the Psenini to me. Mrs. C. van Driel-Murray kindly read and corrected the English text.

The following species are at present known from Sri Lanka:

Psen (*Psen*) *nitidus nitidus* Van Lith	9 ♀, 3 ♂
* *Psen* (*Psen*) *elisabethae madrasiensis* Van Lith	1 ♀
Psen (*Psen*) *matalensis* Turner	35 ♀, 5 ♂
* *Psenulus genalis* sp. nov.	2 ♀
Psenulus nietneri Van Lith	1 ♀
* *Psenulus puncticeps* (Cameron)	1 ♀
* *Psenulus exiguus* Van Lith	2 ♀
* *Psenulus maculatus keiseri* subsp. nov.	4 ♀
Psenulus ceylonicus Van Lith	6 ♀
* *Psenulus pulcherrimus* (Bingham)	1 ♂
* *Psenulus carinifrons taprobanensis* subsp. nov.	4 ♀, 3 ♂

All these species except *P. nietneri* are represented in the material recently collected for the Smithsonian Institution. Those marked with an asterisk are new to the fauna of Sri Lanka.

Psen matalensis, *Psenulus ceylonicus* and *Psenulus maculatus keiseri* are probably endemic. *Psenulus genalis* and *Psenulus nietneri* are known from Sri Lanka only, but the number of specimens is too small to enable any conclusions to be drawn. Most of the material has been collected in the southern half of the island. Only twelve males have been taken against 65 females; the males of three species and one subspecies, all *Psenulus*, are still unknown.

Psen (Psen) nitidus nitidus Van Lith

Van Lith, 1959: 28—30 (Java, Krakatau, Bangka, Sri Lanka); 1968: 105—106 (South India, Sumatra). Bohart & Menke, 1976: 166.

New records from Sri Lanka: Western Province, Colombo District, 1 ♀, Kalatuwawa Reservoir, 300 ft, 19 Sept. 1970, O. S. Flint Jr.; 1 ♀, Labugama Reservoir Jungle, 13—14 Oct. 1973, K. V. Krombein, P. B. Karunaratne, P. Fernando, J. Ferdinando; 1 ♀, Labugama Reservoir, 16 Febr. 1975, K. V. Krombein, P. B. Karunaratne, P. Fernando, S. Karunaratne (USNM). Central Province, 1 ♀, Katugastota, 1600 ft, 31 Aug. 1967, P. B. Karunaratne (CNC); Kandy District, 1 ♀, Kandy, Peak View Motel, 1800 ft, 15—24 Jan. 1970, Davis and Rowe (USNM); 1 ♂, Kandy, Udawattekelle Forest, 23 Febr. 1974, P. J. Chandler (BM); Matale District, 1 ♀, Enselwatta, above 2500 ft elevation, 19—20 Oct. 1976, G. F. Hevel, R. E. Dietz, S. Karunaratne, D. W. Balasooriya (USNM). Southern Province, Galle District, 2 ♀ and 2 ♂, Kanneliya Jungle, 11—16 Jan. 1975, one of the ♂ taken at white light, K. V. Krombein, P. B. Karunaratne, P. Fernando, N. V. T. A. Weragoda (USNM).

Bingham (1897) recorded a female from Pundaloya which he identified as *Psen orientalis* Cameron but which was later (Van Lith, 1959) recognized as *P. nitidus*. The occurrence of the species in Sri Lanka has now been amply confirmed.

The nominate subspecies is also known from South India and has been found as far eastward as Java. There seems to be no difference between the material from

Sri Lanka and that from Malang, Java, the type-locality. The labrum and the greater part of the mandibles are reddish in the female only, in the male these parts are dark.

Psen (Psen) elisabethae madrasiensis Van Lith

Van Lith, 1965: 31—32 (*Psen* (*Psen*) *elisabethae* subsp.); 1968: 107 (*Psen* (*Psen*) *elisabethae madrasiensis*; South India, Madras State). Bohart & Menke, 1976: 166.

First record from Sri Lanka: Sabaragemuwa Province, 1 ♀, Belihuloya, Ougaldown Estate, 4000 ft, 6 Sept. 1928 (NCM).

The petiole of this female is 5.8 times as long as wide in the middle. In the females from Madras — Nilgiri Hills and Anamalai Hills — the petiole is about five times as long as broad.

The nominate subspecies is found in Java and Sumatra.

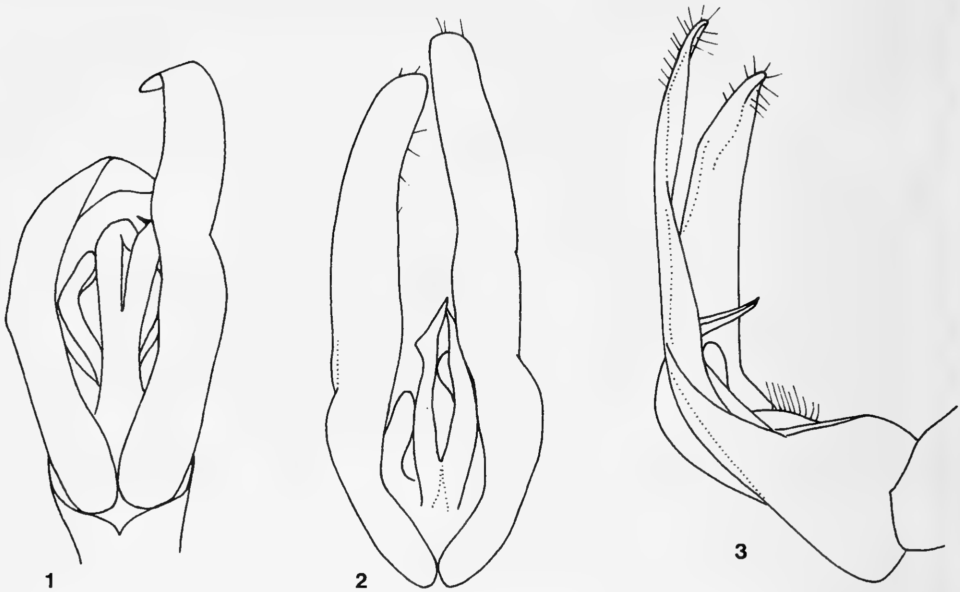
Psen (Psen) matalensis Turner
(figs. 1—3)

Turner, 1912: 362—363. Van Lith, 1965: 55-56. Bohart & Menke, 1976: 166.

Two females and one male have earlier been recorded from Sri Lanka, Matale, 2000 feet (Turner, 1912; Van Lith, 1965).

New records from Sri Lanka: Central Province, Kandy District, Kandy, Udawattakele (Sanctuary), 2100 ft, 1 ♀, 11 Febr. 1975, No. 21175A, K. V. Krombein; 10 ♀, 9—13 Febr. 1975, K. V. Krombein, P. B. Karunaratne, P. Fernando, S. Karunaratne; 8 ♀, 5—15 July, 20—30 July and 2—13 Aug. 1976, S. Karunaratne; Udawattakele, 1700 ft, 2 ♀, 29—30 May 1976, 1800 ft, 3 ♀, 3—5 June 1976, K. V. Krombein, P. B. Karunaratne, S. Karunaratne, D. W. Balasooriya (USNM); Nuwara Eliya District, 1 ♀ and 2 ♂, Nuwara Eliya, 25 April 1923; 2 ♀, Nuwara Eliya, Elk Plains, 5 May 1923 (NCM); 1 ♂, Kanda-ela Reservoir, 5—6 mi southwest Nuwara Eliya, 6200 ft, 10—21 Febr. 1970, Davis and Rowe; 1 ♀, Ohiya, 5500 ft, 1 June 1976, K. V. Krombein, S. Karunaratne, D. W. Balasooriya (USNM); 1 ♀, Hakgala, 9 May 1927 (NCM). Sabaragamuwa Province, Balangoda, 1 ♀, 7 June 1935 (NCM). Southern Province, Galle District, 1 ♀, Kottawa Forest Reserve, Hiniduma, 11 March 1972, K. V. Krombein and P. B. Karunaratne; 2 ♀, Kanneliya Jungle, 13—16 Aug. 1972, K. V. Krombein and P. B. Karunaratne (USNM). 1 ♂, without data (NCM).

Female. — Extent of red colour on gaster somewhat variable. Hind margin of first tergite usually red on apical sixth of segment. Second tergite with large lateral red marks and red sides, in one case almost entirely red. Second sternite entirely, or basal ⅔, red. Ventral plate of petiole entirely red or with red margin only. In fresh specimens legs deep black except for fore and mid tarsi and foreside of fore and mid tibiae. In some of the females second recurrent vein of fore wings interstitial instead of ending in third submarginal cell. In one case this vein interstitial in one wing only. Petiole slightly over 1½ times length of first tergite, in dorsal aspect.



Figs. 1—3. *Psen* (*Psen*) *matalensis* Turner, ♂, genitalia, dorsal, posterior and lateral aspect.

Male. — At least fore and mid legs more reddish-brown than in female. In one of the two males from Nuwara Eliya second tergite almost entirely red. Sternites 3—4 apically with golden-brown fasciculate hairs.

Genitalia (figs. 1—3) pale brown; stipes long, no distinct membraneous extension on inner side of apical part, volsellae long.

This seems to be an endemic species.

Psenulus genalis sp. nov.

(figs. 4—9)

Female. — Length about 5 mm. Head and thorax black; mandibles before apex reddish, palpi yellowish-brown. Underside of antennae including scape yellowish-brown, dorsal side dark brown. Femora except apices black, fore and mid tibiae and tarsi yellowish-brown, mid tibiae of paratype with black streak on outer side. Hind tibiae black with yellowish-brown base, tarsal segments 2—4 brown. Petiole including ventral plate, first tergite except for narrow reddish hind margin and sternites 3—6 or 4—6 black, remaining parts of gaster dark red. Veins of wings blackish.

Clypeus dull, broad anterior margin depressed and shining, medially narrowly protruding, not distinctly emarginate or bidentate (fig. 4). Frontal carina broadened between antennae into an elongated lozenge. This lozenge dorsally reaches depression of anterior ocellus, ending below in a short transverse carina (fig. 4). Frons densely rugoso-punctate, vertex punctate, interstices a few times size of punctures. Occipital carina ending below in hypostomal carina, dorsally strongly crenulate (fig. 5). Sides of head with sharp oblique carina, originating on vertex and ending near mandibles (fig. 6). Genae with sharp transverse carinae on either side of oblique carina. Upper part of sides of head densely punctate and striato-punctate. Antennae short, clavate, third segment almost 1½ times as long as broad at apex, segments 4—8 about quadrate, segments 9—11 broader than long, segment 12 more than 1½ times as long as broad at base.

Pronotal corners rounded. Scutum shining, distinctly punctate, interstices from once to twice as large as punctures. Prescutal sutures on posterior half not sharply defined, almost reaching hind margin. Scutellum shining, sparsely punctate. Metanotum finer, more densely punctate. Enclosed area of propodeum shining, much concave with a few lateral oblique carinae (fig. 7), central part wide. Propodeum dorsally with irregular, very fine oblique striae, lower half more coarsely irregularly reticulato-carinate. Longitudinal groove on back of propodeum reduced to two large alveoles, which are distinctly separated. Propodeum postero-laterally with broad alveolate band. Sides of propodeum posteriorly coarsely reticulato-carinate, anteriorly finely striato-punctate. Mesopleura shining, finely punctate, interstices slightly smaller to slightly larger than punctures. Mesosternum laterally somewhat rugoso-punctate, medially with short transverse rugae. Anterior plate of mesepisternum weakly rugoso-punctate. Anterior oblique suture foveolate, widened dorsal part with a few transverse carinae. Second submarginal cell dorsally open, upper side about $^2/_5$ or $^1/_3$ of lower abscissa. First recurrent vein ending in second submarginal cell near RS, second recurrent vein ending well in third submarginal cell (fig. 8). Petiole almost cylindrical, at least 1½ times as long as first tergite in dorsal aspect, sides slightly flattened, anteriorly a short latero-dorsal carina. First tergite much convex in lateral view (fig. 9). Tergites shining, minutely punctate, no distinct pygidial area. Sternites slightly stronger punctate.

Pubescence whitish, longer on vertex, on face and pronotum more silvery, mostly appressed. Margins of sternites 2—3 with very short hairs, margins of sternites 4—5 with some long, stiff, whitish hairs. Sixth sternite densely pale golden pubescent. Epicnemial areas below with patch of dense, short, yellowish pubescence. Petiole with latero-dorsal row of very fine and very short hairs, laterally and ventrally a few long erect hairs.

Male unknown.

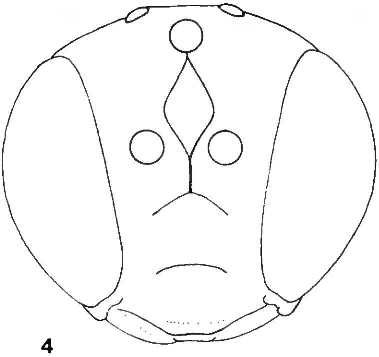
Sri Lanka: 1 ♀, holotype, Northern Province, Mannar District, 0.5 mi northeast Kokmotte Bungalow, Wilpattu National Park, 21—25 May 1976, K. V. Krombein, P. B. Karunaratne, S. Karunaratne, D. W. Balasooriya; 1 ♀, paratype, Southern Province, Hambantota District, Palatupana Tank, 3—4 Febr. 1975, Malaise trap, K. V. Krombein, P. B. Karunaratne, P. Fernando, E. G. Dabrera (USNM).

P. genalis is closely related to *P. yoshimotoi* Van Lith (1969) from Borneo, which has the same oblique carina on the sides of the head. However, its petiole has no dorsal carinae and the second submarginal cell is not triangular.

Psenulus nietneri Van Lith

Van Lith, 1972: 167—168, ♀ (Sri Lanka).

The single female known is labelled "Ceylon, coll. Nietner" (ZMB), no further data. Closely related to *P. puncticeps*. No fresh material collected.



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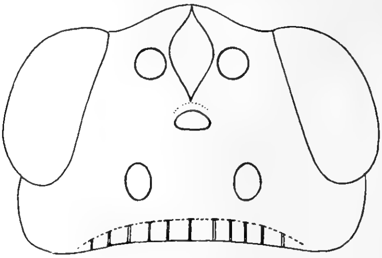

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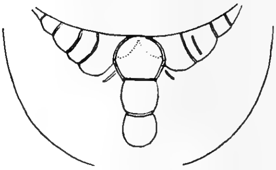

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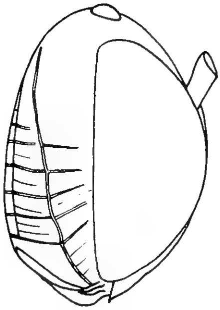

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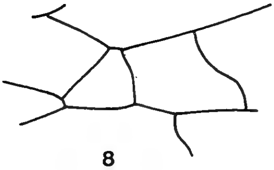

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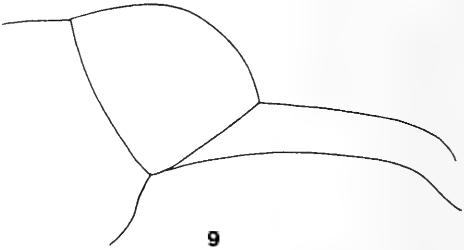

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Figs. 4—9. *Psenulus genalis* sp. nov., ♀, holotype, 4—6; head in frontal, dorsal and lateral aspect; 7, propodeum, dorsal aspect; 8, second and third submarginal cells of fore wing; 9, petiole and first gastral tergite.

Psenulus puncticeps (Cameron)

Cameron, 1907: 91 (*Psen puncticeps*; Bombay, India). Rohwer, 1923: 595—596 (*Diodontus antennatus*; Singapore). Van Lith, 1962: 44—46 (*Psenulus antennatus*; Malaya, Java, Bali); 1973: 136—137 (*Psenulus puncticeps*; Nepal); 1976: 99 (Laos, Flores). Bohart & Menke, 1976: 173.

First record from Sri Lanka: Northern Province, 1 ♀, Vavuniya District, Parayanalankulam Irrigation Canal, 25 mi northwest Medawachchiya, 100 ft, 20—25 March 1970, Davis and Rowe (USNM).

This female is very similar to specimens from Java, but first gastral tergite red, outer side of mid tibiae and base of hind tibiae more whitish than yellowish. Antennae reddish, flagellum darkened dorsally. Vertex distinctly punctate, between ocelli and oculi moreover distinctly striate.

P. puncticeps occurs in South India as well. I have seen a female from Nilgiri Hills, Moyar Camp, 2900 ft, May 1954, P. S. Nathan (OSU, ex collection G. R. Ferguson).

Psenulus exiguus Van Lith

Van Lith, 1976: 99—101, ♀ and ♂ (Laos, Malaya).

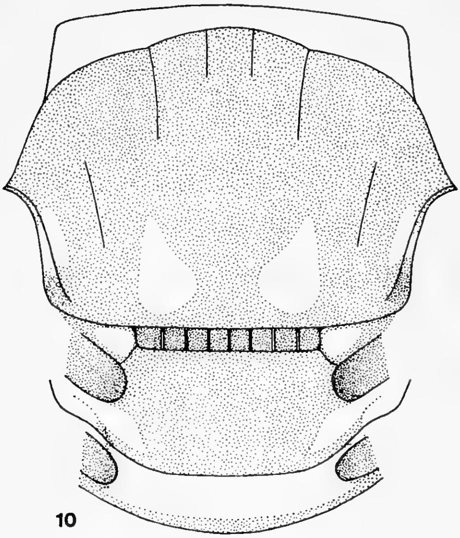
First records from Sri Lanka: Northern Province, 1 ♀, Mannar District, 0.5 mi northeast Kokmotte Bungalow, Wilpattu National Park, 21—25 May 1976, K. V. Krombein, P. B. Karunaratne, S. Karunaratne, D. W. Balasooriya. Eastern Province (southern part), 1 ♀, Amparai District, Lahugala Tank, 14—15 June 1976, Malaise trap, K. V. Krombein, P. B. Karunaratne, S. Karunaratne (USNM).

These females are somewhat more brightly coloured than the holotype described from Laos. Pronotal tubercles yellowish-white instead of brownish-yellow. Fore and mid tibiae not yellowish-brown but distinctly yellowish-white on outer side, also basitarsi yellowish-white. Hind basitarsus yellowish-brown, tarsal segments 2—4 dark brown. Petiole including ventral plate, greater part of first tergite and of fourth sternite black. Petiole more slender. Length 5.5—6 mm.

P. exiguus is very similar to *puncticeps* but is much smaller (*puncticeps* length 7—7.5 mm) and its gaster is more slender.

Psenulus maculatus keiseri subsp. nov.
(figs. 10—11)

Female. — Length about 8 mm. Head black; mandibles except for tips, scape of antennae except for small black spot dorsally, underside of pedicel and of flagellum yellow, apical half of flagellum somewhat reddish below. Flagellum dorsally dark brown. Thorax (fig. 10) black, following parts yellow: pronotum dorsally, pronotal tubercles, tegulae partly, two small narrow marks along tegulae, two triangular marks in front of scutellum, greater part of axillae, metanotum, four large oblong marks on back of propodeum (fig. 11), a small mark in upper corner of anterior plate of mesepisternum. Central part of scutellum reddish in holotype, black or with small irregular yellow marks in paratypes; postero-lateral margins of scutellum more or less yellow. Basal ⅔ of fore and mid femora black, at least on posterior surface, on foreside at least a narrow yellow streak; trochanters, tibiae and tarsi of fore and mid legs yellow. Hind trochanters mostly black, dorsal half of femora black with reddish median line above, lower half of femora yellow. Hind tibiae and tarsi reddish-brown, underside of tibiae slightly darkened in holotype, more distinctly brown in paratypes which have also bases of hind tarsal segments brown. Petiole with yellowish-red base, apical half brown in holotype, almost black in paratypes. Gastral segments reddish, base of first tergite dorsally brown.



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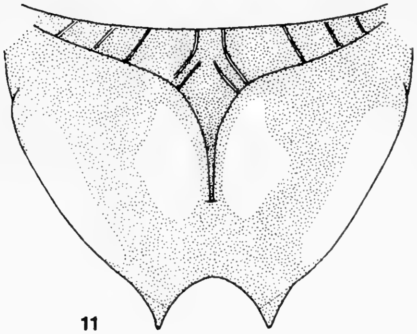

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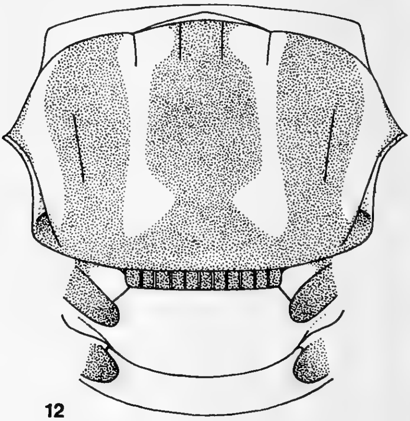

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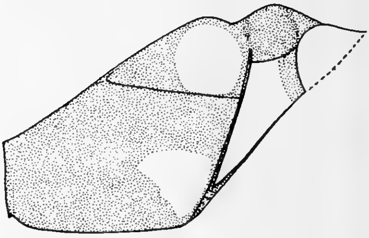

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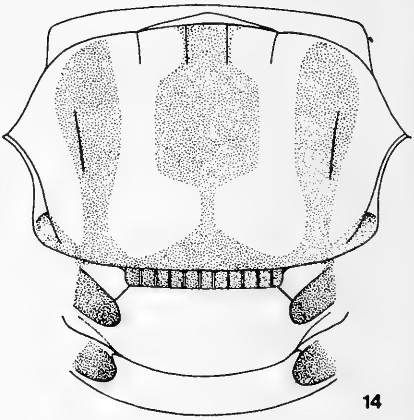

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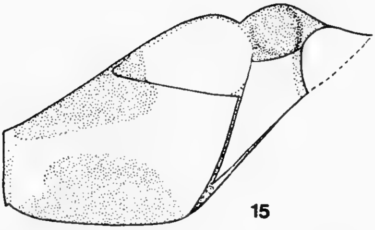

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Figs. 10—11. *Psenulus maculatus keiseri* subsp. nov., ♀, holotype, thorax, dorsal aspect, propodeum, posterior aspect. Figs. 12—15. *Psenulus ceylonicus* Van Lith, ♀. 12—13, usual colour form, thorax, dorsal aspect, mesopleura, lateral aspect; 14—15, same parts of paler form from Uda Walawe.

Clypeal margin distinctly bidentate. Interantennal carina sharp, a transverse carina below antennae. Frons and vertex very finely punctate, scutum, scutellum and mesopleura finely punctate, interstices mostly a few times size of punctures.

Base of hind tibiae with three long spines on outer side. First recurrent vein ending in first, second recurrent vein ending in third submarginal cell.

Pubescence on face and temples silvery, mostly appressed, on vertex and on thorax whitish.

Male unknown.

Sri Lanka: Southern Province, 1 ♀, holotype, Tanamalwila, 7 Jan. 1954, F. Keiser (NMB), 1 ♀, paratype, Katagemuwa, 26 March 1935 (NCM). Northern Province, Mannar District, 1 ♀, paratype, 0.5 mi northeast Kokmotte Bungalow, Wilpattu National Park, 21—25 May 1976, 1 ♀, paratype, same locality, Malaise trap, 22—25 May 1976, K. V. Krombein, P. B. Karunaratne, S. Karunaratne, D. W. Balasooriya (USNM).

P. maculatus keiseri is easily recognized as a representative of the *tuberculifrons* group because of the three long spines on the base of the hind tibiae. It shows the same structure and sculpture as the nominate form from Malaya (Van Lith, 1962). The colour-marking, however, is somewhat different. The underside of the antennae is completely yellow or yellowish-red, at most the underside of the last segment is darkened. The axillae are more yellow whilst the fore and mid femora are darker than in the nominate subspecies. As in the latter form, the yellow marking of the scutellum is subject to variation. The base of the petiole is much paler.

Psenulus ceylonicus Van Lith
(figs. 12—15)

Van Lith, 1972: 195 (Sri Lanka; Kandy). Bohart & Menke, 1976: 172.

New records: Sabaragamuwa Province, 2 ♀, Belihuloya, 15—20 July 1968, P. B. Karunaratne (CNC); 1 ♀, Ratnapura District, Uda Walawe, 300 ft, in scrub-thorn forest, 1 Aug. 1973, Malaise trap, Ginter Ekis (USNM). Western Province, 1 ♀, Colombo District, Padukka-Ingiriya Road, Kuruna Timber Reserve, 18 Jan. 1975, K. V. Krombein, P. B. Karunaratne, P. Fernando, N.V.T.A. Weragoda (USNM).

In the female from Uda Walawe the yellow marking on the scutum is more extended (fig. 14). Moreover, a large yellow mark behind the anterior oblique suture is connected with a smaller yellow mark along the hind margin of the mesopleuron (fig. 15). The usual form is somewhat darker (figs. 12—13). As a rule the first recurrent vein of the fore wings is about interstitial; in the female from Kuruna Timber Reserve this vein ends distinctly in the first submarginal cell. Hind margin of sternites 4—5 densely yellowish pubescent.

Male unknown.

P. ceylonicus was described after two females from Kandy and is probably endemic. It is the most western representative of the group of *P. interstitialis*, which group extends eastwards to the Solomon Islands.

Psenulus pulcherrimus (Bingham)
(fig. 16)

Bingham, 1896: 443 (*Psen pulcherrimus*; Tenasserim). Van Lith, 1962: 101 (*Psenulus pulcherrimus*); 1969:

200 (Vietnam); 1973: 140—141 (Nepal); 1976: 115—117 (*Psenulus pulcherrimus pulcherrimus*; Laos, Thailand, Malaya, Singapore). Bohart & Menke, 1976: 173.

First record from Sri Lanka: Southern Province, Galle District, 1 ♂, Kanneliya, 200 ft, black light, 15—17 Oct. 1976, G. F. Hevel, R. E. Dietz, S. Karunaratne, D. W. Balasooriya (USNM).

This male is somewhat darker than the males of the nominate form I have seen from Nepal and southeastern Asia.

Marks along tegulae small. Posterior mark on scutum almost divided into two square marks. Scutellum black except for narrow yellow hind margin. Marks on back of propodeum reduced to two narrow oblong marks close to median longitudinal groove (fig. 16).

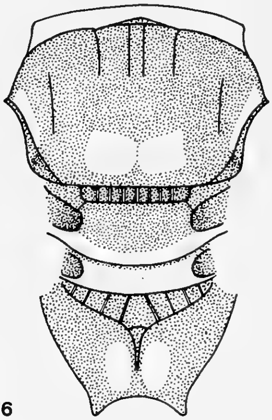

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Fig. 16. *Psenulus pulcherrimus* (Bingham), ♂, Sri Lanka, thorax, dorsal aspect.

Apical ⅔ of petiole and ventral plate of petiole blackish; narrow hind margin of ventral plate reddish. Base of first tergite blackish-brown, bases of sternites dark brown. Fore and mid femora dark brown on their posterior surface, hind femora almost entirely black, apical ⅔ of hind tibiae and hind tarsi dark brown.

Punctation of scutum rather strong. First recurrent vein of fore wings ending in first submarginal cell, very close to RS, second recurrent vein ending well in third submarginal cell.

Although the venation of the fore wings differs from the usual course, I believe this specimen has been correctly identified. As the series from Nepal and Laos show much variation in colour pattern, I hesitate to name the present material as a distinct subspecies. It is easily distinguished from the closely related *P. leucognathus* from South India (Van Lith, 1976).

Psenulus carinifrons taprobanensis subsp. nov.

Female. — Resembling nominate subspecies. Length about 7 mm. Basal ⅔ of second gastral tergite either entirely red or with two separate red spots. Fore and mid trochanters yellow, fore and mid femora yellow except for basal half which is black. Fore and mid tibiae and tarsi yellow, last segment of mid tarsi somewhat brownish. Hind trochanters and femora black, basal ⅗ of hind tibiae in dorsal view yellow; hind tarsi brown. Scape and underside of second antennal segment yellow, following segments blackish-brown above, reddish-brown below.

Propodeum smooth behind enclosed area, back shining, very finely punctate, dorso-laterally some fine or indistinct striation.

Male. — Gaster black, sometimes some indistinct reddish marking on base of second tergite. Legs as in female but basal ¾ of hind tibiae yellow in dorsal aspect. Hind basitarsi yellowish, or pale yellowish-brown, tarsal segments 2—4 pale brown, last segment brown.

Punctation of scutum coarser than in female. Declivous part of propodeum rather coarsely reticulato-carinate.

Sri Lanka: Western Province, 1 ♀, holotype, Yakkala, 18 mi NE Colombo, locality 11, indoors, 1—15 Febr. 1962; 2 ♂, allo- and paratype, Madinnagoda, 4 mi east Colombo, at light, 15 Febr. 1962, A. Perera, all Lund University Ceylon Expedition 1962, Brinck-Andersson-Cederholm (LU); 1 ♀, paratype, Colombo District, Labugama, 400 ft, 9 May 1976, K. V. Krombein, P. B. Karunaratne, S. Karunaratne, D. W. Balasooriya (USNM). Central Province, 1 ♀, paratype, Ambacotta, 14 Dec. 1953, F. Keiser (NMB); 1 ♂, paratype, Kandy District, Kandy, Udawattakele Sanctuary, 2100 ft, 16—31 Aug. 1976, S. Karunaratne (USNM). Southern Province, 1 ♀, paratype, Galle District, Udagama, Kanneliya Jungle, 400 ft, 6—12 Oct. 1973, K. V. Krombein, P. B. Karunaratne, P. Fernando, J. Ferdinando (USNM).

South India: Madras State, Coimbatore, 1 ♂, paratype, Sept. 1955, P. S. Nathan (Ferguson collection, OSU) (earlier recorded as *P. carinifrons* subsp. nov.?, Van Lith, 1966); 1 ♂, paratype, 1400 ft, April 1962 (CNC); 1 ♂, paratype, 1400 ft, Aug. 1972, T.R.S. Nathan (HT). Pondicherry State, Karikal, 1 ♂, paratype, Febr. 1962, P. S. Nathan (IU).

This subspecies differs from *P. carinifrons malayanus* Van Lith, 1969, another subspecies with black bases of fore and mid femora, in the reddish marked gaster of the female. Thus far this character appears to be a constant one. The hind basitarsi of the male of *malayanus* seem to be darker. The remaining known subspecies of *P. carinifrons*, including the nominate subspecies, have entirely yellow fore and mid femora.

P. carinifrons taprobanensis much resembles *P. xanthognathus centralis* from Palawan and Mindanao. This latter form also has a rather flat and finely punctate frons, but the dorsal side of fore and mid trochanters is brown whilst the yellow marking of pronotum and scutellum is often reduced.

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ON THE *STIGMELLA-NEPTICULA* CONTROVERSY (LEPIDOPTERA)

by

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With two plates

Ever since the genus *Stigmella* was first described by Schrank in 1802 and *Nepticula* by Von Heyden in 1843, both generic names have been in common use for the same group of leaf-mining micro-lepidoptera. This paper presents the case for and against each name, but since it is clear from the International Code of Zoological Nomenclature (1964) (subsequently referred to as the Code) which is correct, it is also a plea for conformity in future amongst leaf-miner specialists.

Monographs have been completed on the moths of this genus occurring in Canada and USA and are in preparation for Europe and South Africa. These publications, together with the leaf-miner volume of the Moths of North America, will adopt the recommendations made here.

My co-workers in this field concur with the principles of this paper and include Dr. Don. R. Davis, Chairman Department of Entomology, National Museum of Natural History, Smithsonian Institution, Washington D.C., USA, and my former research assistants M. J. Scoble, Department of Entomology, Transvaal Museum, Pretoria, South Africa and Philip J. Newton, Entomologist, Perifleur Ltd., Rustington, UK.

Although the name *Stigmella* (Schrank, 1802: 169) is older, *Nepticula* Heyden (1843: 208) has been used for generic descriptions twice as often during the past 134 years. The great majority of described species were originally combined with *Nepticula*.

In the early days *Nepticula* was probably used in ignorance of *Stigmella*, but latterly attempts have been made to discredit *Stigmella* on the grounds that it is a nomen dubium (e.g. Borkowski, 1972; Lempke, 1976) or a nomen nudum (e.g. Busck, 1913; Braun, 1917).

Heyden's description of *Nepticula* is very much more satisfactory and leaves one in no doubt regarding the group of insects to which the name refers. He further establishes the genus on a sound basis by assigning to it five species: *aurella* F., *argentipedella* Z., *centifoliella* Z., *sericopeza* A., and *cursoriella* Hdn. Unless otherwise stated the first species cited was often taken as type and *aurella* was subsequently designated type-species by Tutt (1899: 184).

This contrasts with the older *Stigmella*, the description of which is rather inadequate and no species are cited. The German description (Plate 1) and English translation are given because of their importance.

Schrank, 1802: 169	*Translation*
"Edelmotte. Fühlhörner: borstenförmig.	"Adult. Feelers: bristle-shaped.
Stigmella. Schnauzen: fehlen.	*Stigmella.* Snouts: missing.
Zunge: eingerollt.	Tongue: rolled
Flügel: die obern sehr schmal, eingerollt.	Wings: rolled, the upper ones very narrow.
Körper: Schmächtig.	Body: slender
Raupe: nackt.	Caterpillar: naked.
Ich meyne, dass die mir nicht hinlänglich bekannte Motte, welche die Rosenblätter gangweise minirt, hieher gehöre.	*I suppose that the moth, not sufficiently known to me, which causes gallery mines in the leaves of Roses, belongs here.*
Uebrigens bedürfen alle diese Mottenbestimmungen, die nur nach getrockneten Stücken gemacht sind, noch der Berichtigungen nach frischen und wo möglich, selbst erzogenen Stücken.	Further, all these moth diagnoses, which have been made only on dried specimens, ought to be corrected where possible on fresh material, and where possible on bred specimens".

The nearest Schrank goes to including a species here is his comment that the moth causes gallery mines on rose leaves. At least he categorically states that it is a moth and also refers to upper wings; therefore those who have said that the description might equally refer to a dipteran leaf-miner are out of order. Thirty pages earlier (page 139) Schrank, however, does name and describe a leaf-miner which mines roses: *Tinea rosella.* He does not specifically link *rosella* to *Stigmella* in print, but Walsingham's paper (1907: 1008) is of paramount importance in this connection. He says that the rose miner referred to in Schrank's generic description was the one he described earlier as *T. rosella*, and Schrank intended to cite the species name under the genus but somehow it was overlooked. This assertion looks highly probable. Plate 1 shows the relevant page of Schrank's generic description in the British Museum (Natural History) copy of "Fauna Boica". The hand written addition was made by Walsingham to show how Schrank intended it to read. With the amendment it now conforms to Schrank's usual layout — compare with the previous description of *Plutella xylostella.* Whether Walsingham knew somehow that Schrank had left out the type citation accidently or simply assumed it, does not matter a great deal, since he has, in effect, assigned a type-species by subsequent designation to an available genus and thus validated the use of *Stigmella* once and for all. It must be appreciated that from the point of view of nomenclature *Stigmella* Schrank is an available generic name originally without associated nominal species; and the first such nominal species that were subsequently and expressly referred to it are to be treated as the originally included nominal species. (See Code, Articles 69 (a) and 69 (a)(ii) which provides for the subsequent designation of type-species and Articles 11, 12 and 16 especially 11 (c)(i)).

Actually the first usage of *Stigmella* after Schrank, 1802, was by Oken (1815: 655, 677) and, in fact, he included the species *T. rosella* in the genus, but this work has been rejected for the purposes of nomenclature by the International Commission on Zoological Nomenclature, 1956, Opin. Decl. Int. Comm. Zool. Nom. 14 Opinion 417: 3. The next usage of *Stigmella* seems to have been Walsingham (1907) who not only included *Phalaena anomalella* Goeze, 1783 (= *rosella* Schrank, 1802), but designated the former as the type-species. So whether we like it or not, *Stigmella* is therefore valid and has priority over *Nepticula*. The only legitimate way for the proponents of *Nepticula* to further their cause is to make a case to the International Commission for the supression of *Stigmella*. Until this body rules otherwise *Stigmella* should be used as the valid name for the taxon, if *Stigmella* and *Nepticula* are considered to be congeneric.

Plate 2 is Schrank's original account of *T. rosella* which, as can be seen, suggests that he is providing a name for the species first described by DeGeer in 1752. DeGeer's account is very thorough and provides more information than is known for the majority of leaf-miners. It includes figures of the moth, pupa, cocoon, larva and leaf mines (see Plate 30 Figure 20 and Plate 31 Figures 13—21), but predates Linnaeus' tenth edition of *Systema naturae* (1758). Although DeGeer refers to his species again in 1771 (p. 495), it was Goeze who first named it in 1783 (p. 168) as *Phalaena (Tinea) anomalella*. Thus Schrank's name *T. rosella* is a junior synonym of *anomalella*. Therefore, *anomalella* is the legitimate type-species for *Stigmella*. Tutt (1899: 209) was the first to synonymise these names. There can be no doubt that Schrank and Goeze are referring to the same taxon because both cite DeGeer's rose leaf-miner as the insect they are naming.

It has already been suggested that *Stigmella* was not used in the early days because of ignorance of its existence. In fact, Heyden did not know of the work of DeGeer, Schrank or Goeze. If he had he would at least have included *anomalella/rosella* in his publication, and indeed would probably never have described *Nepticula*. In the early nineteenth century *Tinea, Microsetia* and *Lyonetia* were used for *Stigmella* species. Even after Walsingham (1907) *Stigmella* has not been used a great deal, although it is not true to say, as does Johansson (1971), that *Stigmella* was lost and forgotten for 132 years. Between 1802 and 1934, the period referred to, the name has been included in four significant contributions. In 1911, Walsingham described *Stigmella zizyphi* (1911: 190), and Hampson (1918: 336) and Fletcher (1929: 210) provided species lists under the name *Stigmella*. Johannson attributed the reintroduction of *Stigmella* to Fletcher and wrongly cited his 1929 publication as 1934, also overlooking Walsingham's papers (loc.cit.). Since that time *Stigmella* has been used in at least six substantial works so any suggestion that it is to be suppressed as a nomen oblitum is not tenable.

Until now *Nepticula* has always been used in North America, sometimes even for *Ectoedemia* and *Obrussa* species (e.g. Freeman, 1962: 522). Busck (1913: 103) and Braun (1917: 163) argued that *Stigmella* was a nomen nudum on the grounds that there were no included species, and no-one appears to have questioned their decision since. As previously pointed out the Code states that a uninominal genus-group published before 1931 without associated nominal species is acceptable for nomenclatorial purposes. It also provides for the subsequent designation of a type-species.

Janse (1948: 159) in South Africa adopted the name *Nepticula*, but his successor Vári (1955: 331, 1963: 66) switched to *Stigmella*.

Recently in Europe *Nepticula* has been used in preference to *Stigmella* by Klimesch (1951: 4), Johannson (1971: 241) and Borkowski (1972: 702). Klimesch does not seem to like using *Stigmella* on the grounds that there are no included species and objects to the citation of *anomalella* (Goeze) believing *centifoliella* (Zeller) to be just as applicable to Schrank's description.

Johannson's and Borkowski's preference for *Nepticula* is also based on supposed inaccuracies in Schrank's description. Johannson thinks that the moths in the *Nepticulidae* differ from the description of *Stigmella*. He points out that the palps are present and well developed whilst Schrank says they (Schnauzen) are absent. I wonder if Schrank meant that they were absent in DeGeer's figure or were missing in his own material. Johannson is not right in saying that the tongue is absent, nor Borkowski in saying that it is vestigial. Schrank described it (Zunge) as rolled, and indeed it is present but minute and apparently functional (Downes, 1968).

Secondly Johannson says that "In the case [where] description and type disagree the written definition is decisive." This is not necessarily so. Article 61 of the Code indicates that the type is the objective definition of a taxon and does not change, whereas the limits of the taxon are subjective and liable to change. Each case must be taken on merit.

Borkowski does not subscribe to the view that *Stigmella* is a nomen nudum, but contests it on similar grounds to Johannson and says that Schrank's second paragraph (italics, page 14) is conjecture on Schrank's part, and cannot be taken as definitive. Indeed he believes the rose miner, or at least the Nepticulidae leaf-miners, do not have characters agreeing with the generic diagnosis of *Stigmella*. Thus he rejects *Stigmella* as a nomen dubium on the grounds that it is not attributable to any known taxon. None of the early authors seem to have had any doubt, and in any case, *Stigmella* has never been used to refer to any taxon other than these leaf-miners. Schrank's description of *rosella*, together with its reference to DeGeer's paper, and Walsingham's designation of a type-species no longer makes a nomen dubium admissable.

It is certainly true that *Nepticula* has been better defined and substantiated than *Stigmella*, and these authors have rightly highlighted some of the problems. However, they have all either been unaware of Walsingham's (1907) paper or have failed to realise its importance in validating *Stigmella*. To discard *Stigmella* stands in contradiction to the rules of the Code and we are not free to select which name we please.

It is my current view that *Stigmella* and *Nepticula* are congeneric. In this circumstance, and in view of the foregoing evidence, I recommend that *Stigmella* Schrank, 1802, be universally accepted for this group of leaf-miners and that *Nepticula* Heyden, 1843, be reduced to a junior subjective synonym. The type-species of *Stigmella* is *anomalella* Goeze, 1783.

Turning now to the family name, prior to 1854 these leaf-miners were either misplaced in other families, or simply referred to as the Nepticulae. Stainton (1854a: 295, 1854b: 166) seems to have been the first person to give this group a family name: Nepticulidae. Stigmellidae was not used until it was adopted by Hampson in 1918: 387, as the family name based on the oldest genus, a procedure which would have been correct in his day. However, applying the present Code and the principle of priority to family-group names, we must adopt Nepticulidae.

For a variety of reasons, and sometimes the wrong ones, the name Nepticulidae has met with greater universal acceptance than the generic name.

Following this, the use of Nepticuloidea as the superfamily name is the logical consequence and has been demonstrated by Braun (1923: 17), Karsholt and Schmidt Nielsen (1976: 17) and others.

Some of the principal users of Stigmellidae as the family name have been Hampson (1918), Fletcher (1929), Beirne (1945), Vári (1963), also Klimesch (1948) and Borkowski (1969, 1970) before they changed their minds about the generic name.

Before committing these views to print I have discussed the matter with three entomological commissioners of the International Commission on Zoological Nomenclature from both Europe and North America. They were unanimous in their view that on the basis of the above evidence, *Stigmella* is the valid name for the genus, and Nepticulidae is the correct family-group name.

ADDITIONAL NOTES

1. Zeller (1848: 301) cites Heyden as the author of *Nepticula* but calls it a new genus. This may account for some writers giving Zeller as the author of *Nepticula* (e.g. Stainton, 1854; Meyrick, 1895; Gerasimov, 1937).
2. Stainton published two relevant works in 1854. Although the preface in "List of British Animals in the collection of the British Museum, XVI Lepidoptera" gives 23 May, it is clear that Stainton did not expect it to be published earlier than "*Insecta Britannica*, Lepidoptera Tineina VIII" which has the later preface date of 1 July. This is assumed because Stainton gives in the "List", page numbers and references to taxa — even new species — described in "Insecta Britannica". The List was published on 13 August but no precise date has been found for the other work. The List has, for some reason, often been overlooked and therefore this problem has not always been appreciated. In this paper I give it as 1854b to preserve the chronology which Stainton expected and until the matter has been clarified.
3. Kirby (1897: 313) attributes *Nepticula* to Zeller (1848) and synonymises it with *Microsetia* Stephens (1834), the older name. The problem is that Kirby gives *Nepticula microtheriella* as the type of *Microsetia*, unaware that Westwood (1840) had already designated a type, viz., *Phalaena (Tinea) stipella* Linnaeus sensu Hübner (= *Tinea sexguttella*) (see Sattler, 1973: 224). Walsingham (1907: 1009) linked this Linnaeus type with *Aphelosetia* (now = *Elachista*) but *Microsetia* Stephens is now regarded as a Gelechiid genus. Tutt (1899) synonymised *Microsetia* Stephens sensu Kirby with *Nepticula*.

4. Beirne (1945: 197, 201) divided *Stigmella* into two genera, namely "*Stigmella* Heyden" (wrong author given) with type-species *anomalella* and *Nepticula* Heyden, type-species *aurella* Fabricius. This classification based on the male genitalia has not been accepted by those who have made more extensive studies (Borkowski, 1972; Emmet, 1976; Wilkinson and Scoble, in press).
5. Kloet and Hincks (1972: 2) retained Beirne's division with *Stigmella* and *Nepticula* as two separate genera. However, Borkowski (1972: 702) did not agree with this and again amalgamated them under the name *Nepticula*. As *Stigmella* is the older name it is recommended that this be reversed.
6. Although Zeller (1948) attributes the species *centifoliella* (see page 17) to Heyden it is nevertheless an original Zeller description and species, and is accepted as such in current check-lists.
7. The author of *Nepticula acetosae* (type-species of *Johanssonia* Borkowski) is always given as Stainton 1854a: 303. However, this is not the first use of the name. Shield, in the Zoologist (1853: 4153) writes "*Nepticula Acetosae* Stainton n.sp. larvae in the leaves of *Rumex Acetosella* July, October and November" in "List of Micro-Lepidoptera taken in the vicinity of Dublin during the year 1853" and dated 12 November 1853. Stainton does not mention the species in his paper a few pages earlier in the same journal (1853: 3952—3960). Considering this and note 2 it seems that the publication of *Insecta Britannica* VIII must have been delayed.

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GENERIC SYNONYMY AND SELECTED REFERENCES

Stigmella Schrank, 1802: 169. Type-species by subsequent designation (Walsingham, 1907: 1008), *Phalaena (Tinea) anomelella* Goeze, 1783: 168. = *Tinea rosella* Schrank, 1802: 139.

Stigmella Schrank; Oken, 1815: 655, 677.

Stigmella Schrank; Walsingham, 1907: 1008.

Stigmella Schrank; Hampson, 1918: 387.

Stigmella Schrank; Fletcher, 1929: 210.

Stigmella Schrank; Gerasimov, 1937: 89.*

Stigmella "Heyden"; Beirne, 1945: 197.† Incorrect author given by Beirne. Incorrectly synonymised with *Nepticula* Heyden by Borkowski, 1972: 702.

Stigmella Schrank; Klimesch, 1948: 49.

Stigmella Schrank; Vári, 1955: 331.

Stigmella Schrank; Vári, 1963: 66.

Stigmella Schrank; Borkowski, 1969: 96.

Stigmella Schrank; Emmet in Heath, 1976: 213.

Nepticula Heyden, 1843: 208. Type-species by subsequent designation (Tutt, 1899: 184), *Tinea aurella* Fabricius, 1755: 666 (syn. by Walsingham, 1907: 1008).

Nepticula Heyden; Zeller, 1848: 301.*

Nepticula Heyden; Stainton, 1853: 3952.

Nepticula Heyden; Stainton, 1854a: 295.*

Nepticula Heyden; Stainton, 1854b: 166.*

Nepticula Heyden; Herrich-Schäffer, 1855: 69.

Nepticula Heyden; Heinemann, 1862: 237.

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Nepticula Heyden; Tutt, 1899: 184.

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Nepticula Heyden; McDunnough, 1939: 107.

Nepticula Heyden; Beirne, 1945: 201.†

Nepticula Heyden; Janse, 1948: 159.

Nepticula Heyden; Klimesch, 1951: 4.

Nepticula Heyden; Johansson, 1971: 241.

Nepticula Heyden; Borkowski, 1972: 690.

Microsetia Stephens sensu Kirby, 1897: 313. Type-species subsequently incorrectly designated by Kirby as *Nepticula microtheriella* Stainton, 1854a: 302. (see note 3). (syn. by Tutt, 1899: 184).

Johanssonia Borkowski, 1972: 702. Type-species by original designation and monotypy, *Nepticula acetosae* Stainton, 1854a: 303. (syn. by Karsholt & Nielsen, 1976: 17 and 81, but retained as separate subgenus) (not syn. by Kloet & Hincks, 1972, see addenda).

* See additional note 1

† See additional notes 4 and 5

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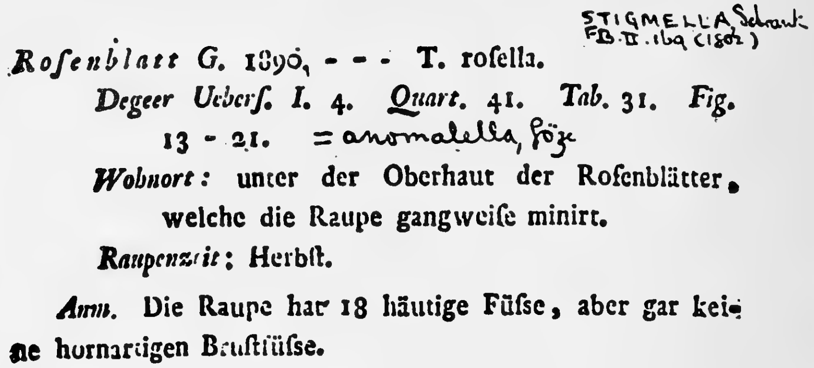


STIGMELLA Schrank FB. II. 169 (1802)

Roſenblatt G. 1890, - - - T. roſella.

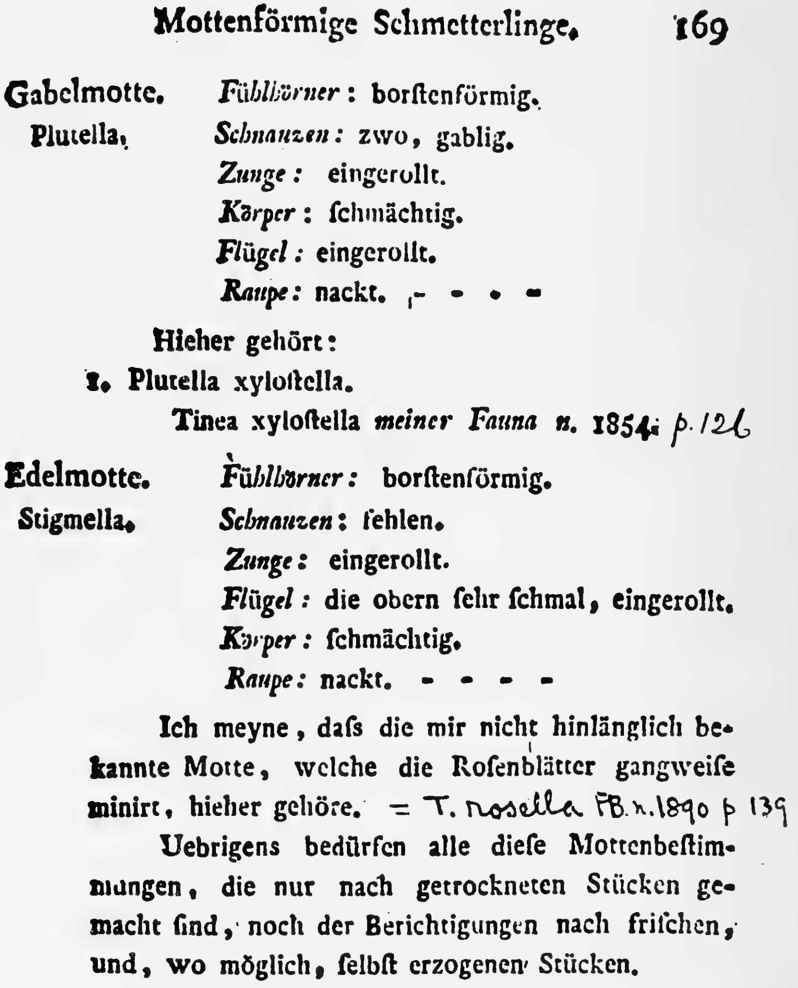
Degeer Ueberſ. I. 4. *Quart.* 41. *Tab.* 31. *Fig.* 13 - 21. = anomalella, Göze

Wohnort: unter der Oberhaut der Roſenblätter, welche die Raupe gangweiſe minirt.

Raupenzeit: Herbſt.

Anm. Die Raupe hat 18 häutige Füſse, aber gar keine hornartigen Bruſtfüſse.

Plate 1. Original account of *Tinea rasella* Schrank, 1802.



Mottenförmige Schmetterlinge. 169

Gabelmotte. *Fühlhörner:* borſtenförmig.
Plutella. *Schnauzen:* zwo, gablig.
Zunge: eingerollt.
Körper: ſchmächtig.
Flügel: eingerollt.
Raupe: nackt. - - - -

Hieher gehört:

1. Plutella xyloſtella.
Tinea xyloſtella *meiner Fauna n.* 1854. p. 126

Edelmotte. *Fühlhörner:* borſtenförmig.
Stigmella. *Schnauzen:* fehlen.
Zunge: eingerollt.
Flügel: die obern ſehr ſchmal, eingerollt.
Körper: ſchmächtig.
Raupe: nackt. - - - -

Ich meyne, daſs die mir nicht hinlänglich bekannte Motte, welche die Roſenblätter gangweiſe minirt, hieher gehöre. = T. rosella FB. n. 1890 p 139

Uebrigens bedürfen alle dieſe Mottenbeſtimmungen, die nur nach getrockneten Stücken gemacht ſind, noch der Berichtigungen nach friſchen, und, wo möglich, ſelbſt erzogenen Stücken.

Plate 2. Page 169 of the British Museum (Natural History) copy of Schranks "Fauna Boica".

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MONOGRAPH OF THE GENUS *SPIALIA* SWINHOE (LEPIDOPTERA, HESPERIIDAE)

by

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Rijksmuseum van Natuurlijke Historie, Leiden

With seven plates and 119 text-figures

ABSTRACT

The genus *Spialia* Swinhoe is distributed throughout the Afrotropical Region and in large parts of the Palaearctic and Oriental Regions. Of the 26 species, 18 are confined to the Afrotropical Region. The species are classified into seven species groups, which are mainly based on characters of the male and female genitalia. Two subspecies are described as new, viz., *Spialia colotes semiconfluens* and *Spialia depauperata australis*. A key to the species based on external characters is provided and drawings of the male and female genitalia, photographs of the skippers and distribution maps of the species are given.

A number of characters is analysed as to their plesiomorphous or apomorphous conditions, resulting in an outline of the evolutionary history and providing the phylogenetic arguments for the classification adopted. Combined with known ecological changes in the past, this outline affords a means for the reconstruction of the geographic history.

The genus is generally at home in dry open country. One species is restricted to the African forests; it is shown that this habitat preference is apomorphous with respect to the preference for open country. Due to the latter preference the development of the genus in Africa has been greatly influenced by the alternation of dry and wet periods in the past causing changes in the extent and continuity of the savanna area. Most, if not all, species existing at present originated during the Pleistocene. At various times and to various degrees *Spialia* species succeeded in invading areas outside the Afrotropics, giving rise to secondary radiation. Successful establishment in the Palaearctic was accompanied by a change to other food plants. Only one, apparently recent, re-invasion into Africa can be recognized, viz., by *S. doris*, a semi-desert species.

CONTENTS

1. INTRODUCTION

General

The genus *Spialia* has not yet been studied as a whole. This is probably due to the fact that its members are distributed over three zoogeographic regions, viz. the

Palaearctic, Oriental and Afrotropical Regions. So we have reviews of the Palaearctic species (e.g., Warren, 1926; Picard, 1947) and of the Afrotropical species (Higgins, 1924; Evans, 1937). Especially the last ones are interesting as the bulk of the species occurs in the Afrotropical Region. The last review, however, of the Afrotropical species is 40 years old. Apart from the fact that new information has become available, the female genitalia have never been described, so it does not seem superfluous to give a revision of the whole genus.

Preliminary to this paper I published a paper on the Palaearctic *Spialia* species (De Jong, 1974). As the variation and distribution of the Palaearctic species are far better known and their evolutionary and geographic history can far better be traced back than those of the Afrotropical species, a separate treatment seemed appropriate. For the sake of completeness, however, the Palaearctic species will also be dealt with in the present paper, although for details the reader is referred to my earlier paper on *Spialia*. I may also refer to that paper for notes on the distinction of subspecies and for methods and measurements.

The study of this genus is facilitated by the fact that many types are located in a single collection: the types of 37 of the 59 names applying to species and subspecies (including synonyms) are in the collection of the British Museum (Nat. Hist.), apart from a number of types of seasonal and individual varieties.

It is attempted to give a classification that reflects the phylogenetic relationships. In Chapter 4 the evolutionary history that forms the basis for the classification is dealt with. It is unfortunate that many parts of Africa have still been badly explored as to the Hesperiidae, thus making the study of the zoogeography of the genus difficult. Moreover, literature records on the distribution cannot always be relied on, as I found many misidentifications in the collections, even by Evans. This is undoubtedly partly due to the fact that good drawings of the genitalia do not exist, the drawings by Evans only giving a vague idea that they represent genitalia. Therefore, drawings of the male and female genitalia of all species are presented in the present paper. Photographs have been added of the upper and underside of all species, as I think a good photograph is more instructive than a page-long description. In this way I hope this paper will be a stimulus to fill the many gaps in our knowledge.

Delimitation of the genus *Spialia*

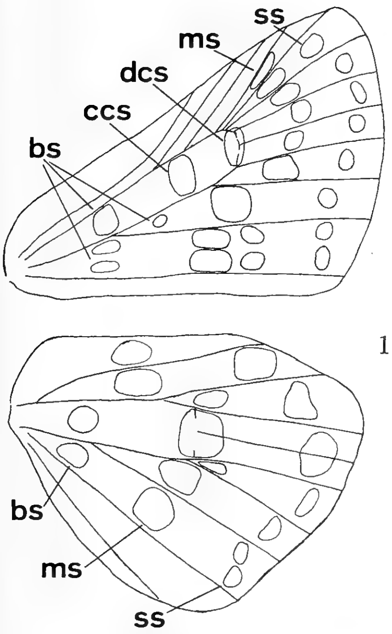
The genus *Spialia* Swinhoe, 1913 (type species *Hesperia galba* Fabricius, 1793, by original designation) comprises those black-and-white skippers that have the median spots in spaces 4 and 5 of the fore wing upperside (if present) in line with those in spaces 6 to 8, the median spot in space 2 of the fore wing upperside central between the central cell spot and the median spot in space 3 or nearer the latter, the termen of the hind wing evenly rounded without crenulation, no tibial hair tuft on the hind legs in the male and usually no costal fold in the male.

For more information on the differences and relationship with other genera, I may refer to a forthcoming paper on the generic classification of the *Pyrgus* group.

Wing markings

The wing markings of *Spialia* species are essentially the same as those of

Pyrgus species (see De Jong, 1972). In principle, each internervular space has three spots, viz., a basal, median and submarginal spot. In addition, there is a basal



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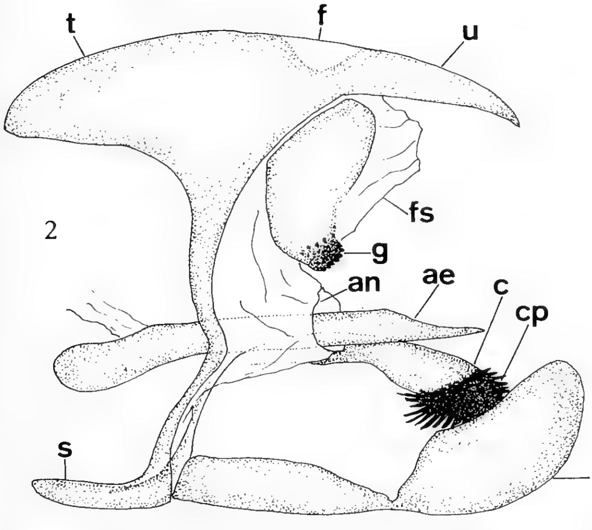

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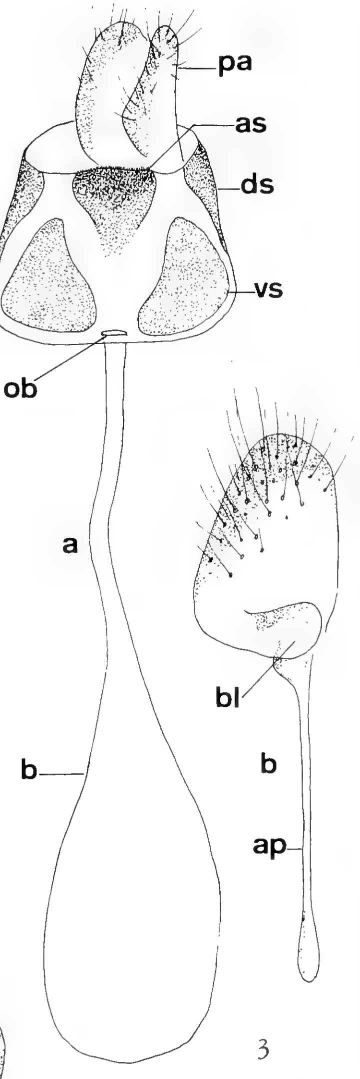

3

Figs. 1—3. Wing markings, male and female genitalia of *Spialia*. 1. Wing markings. bs, basal spots; ccs, central cell spot; dcs, discoidal spot; ms, median spots; ss, submarginal spots. 2. Male genitalia, lateral aspect (left valva removed). ae, aedeagus; an, anellus; c, costa; cp, costal process; cu, cucullus; f, fenestrula; fs, fultura superior; g, gnathos; s, saccus; t, tegumen; u, uncus. 3. Female genitalia; a, ventral aspect; b, papilla analis. ap, apophysis posterior; as, area spinulosa; b, bursa; bl, basal lobe; ds, dorsal sclerite of eighth abdominal segment; ob, ostium bursae; pa, papilla analis; vs, ventral sclerite of eighth abdominal segment.

cell spot, a central cell spot and a discocellular spot covering the discocellular veins. The markings may be very reduced, all basal spots may be absent and there are no submarginal spots in spaces 8 to 12. In space 1b of the fore wing the spots can often be seen divided into an upper and lower part, indicating the lost second cubital vein (if we consider veins 2 and 3 branches of the first cubital vein). Moreover, in this space the median spot is double, being divided into an inner and outer spot, which in their turn may be divided into an upper and lower part. So there may be four median spots in space 1b of the fore wing, the relative development of which is important in the distinction of some species. In *Spialia* one of these spots is always absent.

The markings of the hind wing are simplified as compared with those of the fore wing. The median spots on the underside of the hind wing are usually fused together and to the discocellular spot to form a more or less regular band (the median band) parallel to the termen. In a few species these spots are separate and in a few others the band is not parallel to the termen.

A diagram of the usual spots in *Spialia* is presented in fig. 1.

As the expression "median spot in space x" is unnecessarily long, it is abbreviated in this paper to "median spot x". The median spots in space 1b of the fore wing will be distinguished as the inner and outer median spots 1b and 1c, the latter designing the upper part. Median spot 1a (between vein 1 and dorsum) is always absent.

Genitalia

Male (fig. 2). Although relatively simply built, the male genitalia offer a good means for the identification of most species and much of the relationships between the species becomes clear when studying the male genitalia.

The uncus is rather short and entire, except in four species where it is bifid. The apex of the uncus is pointed or inflated. The junction of the uncus with the tegumen is often well visible as a narrow, more or less membranous suture and in some species this suture is broadened mid-dorsally to a triangular or quadrangular membranous area, called fenestrula (cf. Ogata et al., 1957). The gnathos is a simple sclerotized fold or, usually, has various spined structures in the ventral part; dorsally it is free or fused with the tegumen over some distance. The fultura superior is smooth or finely spined and often passes imperceptibly into the central part of the gnathos. The anellus is membranous or dorsally sclerotized and may bear strong spines. The aedeagus is variously built, with a smooth surface or with spines, crests, side-arms, etc., often characteristic of a species group.

The valvae have usually a little developed cucullus, that often forms a fold to envelop partly the costal process. In some species the cucullus is spined. The most strongly differentiated part of the valvae is the distal part of the costa that often forms a process with spines or long hairs and is important for the distinction of species and species groups.

Female (fig. 3). The eighth abdominal segment usually bears two dorsal sclerites, but in a few species there is only a single sclerite. In most species the dorsal sclerotization is free from the ventral sclerites. In principle, the ventral sclerotization consists of two plates mid-ventrally separated by a membranous region which is narrow near the ostium, but broadens caudally. This membranous area is often slightly sclerotized and finely spinose in a more or less triangular patch. The spines are especially visible along the caudal rim of the segment, where the membrane folds inward. The slightly sclerotized spined area is called "area spinulosa" here. In a number of species the area spinulosa is solidly sclerotized and fused with the ventral sclerites to a single ventral sclerite. If strongly sclerotized, the area spinulosa may lack the spines.

The ostium is situated close to the anterior edge of the eighth segment. The narrow antevaginal region is usually membranous, but the ventral sclerites may be fused here. The ductus bursae varies in length and is entirely membranous except for some sclerotization near the ostium in some species. Usually it passes gradually into the bursa copulatrix, which is without ornamentation, except in one species in which the bursa bears a field of fine spines. The papillae anales are variously shaped, in a number of species with a fold that partly or entirely covers the base of the apophyses posteriores; this fold is called the "basal lobe" here.

Distribution

It is obvious that the distribution of the *Spialia* species is only imperfectly known. Nevertheless, I am convinced that the distribution maps roughly indicate the ranges of the species and additional material will mainly fill in the details (especially in West Africa), rather than extending the known ranges.

Under the heading "Localities" in the treatment of the species the countries in the Afrotropical Region have been arranged from Sudan and Saudi-Arabia southward through East Africa to South Africa and from there northward through Central and Westcentral Africa to Senegal. The localities in each country have been listed alphabetically.

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2. KEY TO THE SPECIES AND CHECKLIST

The distinction of species groups proposed in this paper is based on the male and female genitalia. These groups can be recognized only incompletely by external characters. As it is quite well possible to identify the species by their external characters, it seems best not to bother with species groups in the key, otherwise the characters of the genitalia should be introduced in the key, diminishing its practical value (viz., identification of species). To facilitate reference to the descriptions in Chapter 3, the species group to which a species belongs, is mentioned in the key. In cases of uncertain identification the genitalia should always be referred to.

1. On fore wing upperside, central cell spot closer to discocellular spot than to basal cell spot, basal spots in spaces 9 and 10 usually well developed (lying over the central cell spot) (fig. 4); male with costal fold 2

— On fore wing upperside, central cell spot not closer to discocellular spot than to basal cell spot, or basal cell spot absent; no spots in spaces 9 and 10 4

2. Basal spot 7 on hind wing underside fused to median band along vein 7, so that basal spots 7 and 8 together with the median band form a Y; on fore wing upperside submarginal spots incomplete, often only 4 and 5 present (*asterodia* group) . . . . *kituina*

— Basal spot 7 on hind wing underside not fused to median band; on fore wing upperside submarginal spots well-developed 3

3. Median band on hind wing underside with irregular edges, parallel to the series of basal spots; fringes not conspicuously spotted on underside (*asterodia* group) . . . . *asterodia*

— Median band on hind wing underside very irregular, along vein 2 pointing basad and reaching series of basal spots; fringes conspicuously chequered black and white on underside (*asterodia* group) . . . . *agylla*

4. Submarginal spots 4 and 5 of hind wing not in line with other submarginal spots, being placed more basad (fig. 10); male with costal fold 5

— Submarginal spots 4 and 5 of hind wing in line with other submarginal spots; male without costal fold 6

5. Median band on hind wing upperside composed of separate spots (*colotes* group) . . . . *colotes*

— Median spots on hind wing upperside fused into a continuous band (*colotes* group) . . . . *confusa*

6. Median spot 6 on hind wing underside absent or very small, not connecting the large central spot to one of the spots in space 7 (figs. 11—13) 7

— Median spot 6 on hind wing underside present, connecting the central spot (in spaces 4—5) with one of the spots in space 7 (figs. 14—15) 13

7. Median band on hind wing underside directed towards inner spot in space 7 (fig. 11); fore wing upperside without basal cell spot; Palaearctic species 8

— Median band on hind wing underside directed towards outer spot in space 7, or towards a point central between the inner and outer spots in space 7 (fig. 12); fore wing upperside usually with basal cell spot, but this spot sometimes vaguely outlined; Palaearctic and Afrotropical species 9

8. Ground colour of hind wing underside red in various shades, from ochreous to a very vivid red; central spot of hind wing underside angular; Europe and North Africa (*sertorius* group) . . . . *sertorius*

— Ground colour of hind wing underside greenish or yellowish olive-grey (except in the Asian ssp. *carnea,* where it is red); central spot of hind wing underside rounded; E. Europe to E. Asia (*sertorius* group) . . . . *orbifer*

9. On hind wing underside, inner spot in space 7 central between basal cell spot and median spot 4—5 (= central spot); median band directed towards a point between inner and outer spots in space 7; Palaearctic species (*phlomidis* group) . . . . *osthelderi* and *geron*

— On hind wing underside, inner spot in space 7 closer to basal cell spot than to central spot; median band directed towards outer spot in space 7; Palaearctic and Afrotropical species 10

10. On hind wing underside basal spot 1c absent, median spot 6 present, but small; on fore wing upperside discocellular spot strongly curved and outer median spot 1b usually present; a subdesert species (*phlomidis* group) *doris*

— On hind wing underside basal spot 1c present, median spot 6 absent; on fore wing upperside discocellular spot usually less strongly curved or straight, outer median spot 1b usually absent 11

11. On hind wing underside median spots 1c—5, basal cell spot and basal spot 1c shining white, median spots 1c and 2 entirely fused, no spot between median and submarginal spots in space 1c (*dromus* group) . . . . *paula*

— All spots on hind wing underside plain white 12

12. No light spot at base of costa on fore wing upperside; hind wing underside without a spot between median and submarginal spots in space 1c, inner spot in space 7 usually narrow and irregular, submarginal spot 1c double, the upper part out of line, median spot 1c usually not joined to median spot 2 (*sertorius* group) . . . . *mafa*

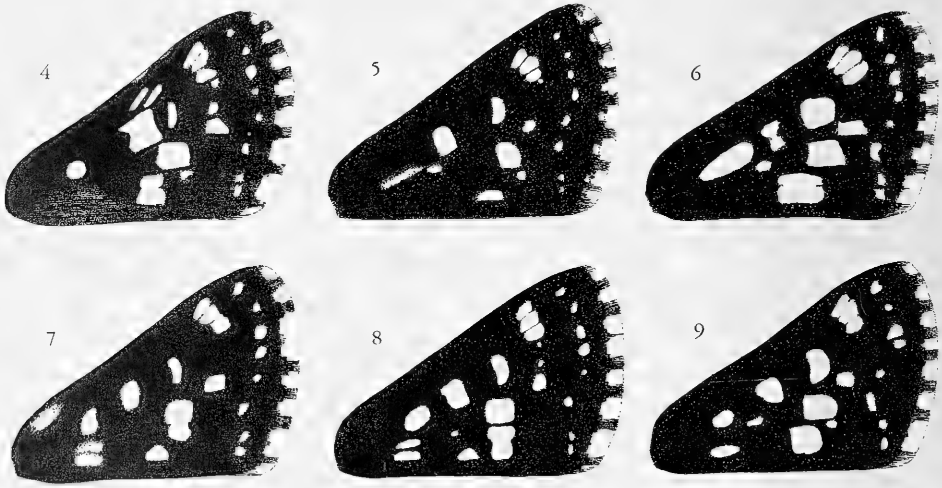
— Usually a light spot at base of costa on fore wing upperside (fig. 7); hind wing underside with a spot between median and submarginal spots in space 1c, inner spot in space 7 usually large and rounded, submarginal spot 1c usually single, median spot 1c joined to median spot 2 (*spio* group) .... *spio*

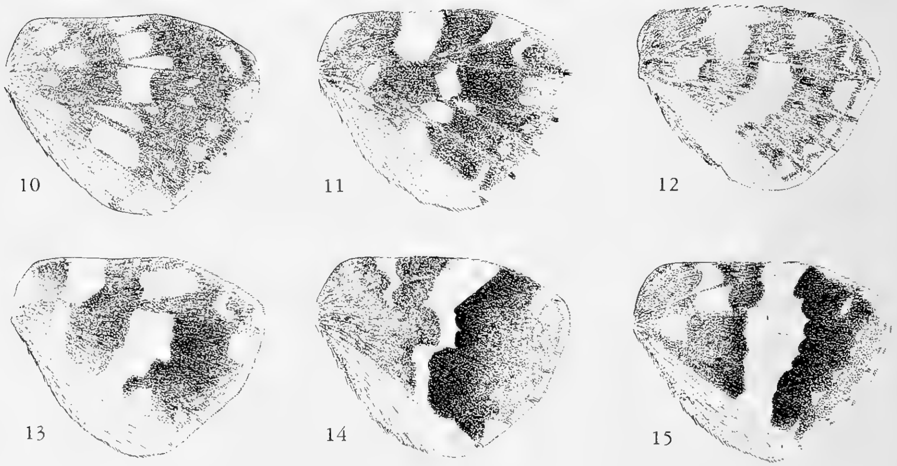
13. Median spot 6 on hind wing underside joins central spot to inner spot in space 7; Palaearctic species (*phlomidis* group) .... *phlomidis*

— Median spot 6 on hind wing underside joins central spot to outer spot in space 7; Afrotropical and Oriental species 14

14. Fore wing upperside without basal cell spot, at most some white scales forming a small dash against cubitus (fig. 5) 15

— Basal cell spot on fore wing upperside present (figs. 6, 8, 9) 20





Figs. 4—g. Upperside of right fore wing of *Spialia* species. 4, *S. asterodia*. 5, *S. zebra*. 6, *S. wrefordi*. 7, *S. spio*. 8, *S. diomus*. 9, *S. dromus*.

Figs. 10—15. Underside of left hind wing of *Spialia* species. 10, *S. colotes*. 11, *S. sertorius*. 12, *S. osthelderi*. 13, *S. spio*. 14, *S. nanus*. 15, *S. secessus*.

15\. Submarginal spots entirely absent on upper and underside of fore and hind wings; hind wing underside without basal spots or a very vague one in space 7 (*delagoae* group) .... *mangana*

— On upper and underside submarginal spots at least partly visible 16

16\. Hind wing underside without basal cell spot; median spot 6 on hind wing upperside absent or at most vaguely indicated 17

— Hind wing underside with basal cell spot; median spot 6 on hind wing upperside present or absent 18

17\. Median band on hind wing underside winding (fig. 14) (*delagoae* group) .... *nanus*

— Median band on hind wing underside straight (*delagoae* group) .. *delagoae*

18\. Submarginal spots on hind wing underside absent or very vaguely indicated along inner edge of light region along termen; median band slightly winding (*delagoae* group) .... *sataspes*

— Submarginal spots on hind wing underside present; median band straight 19

19\. On hind wing upperside median spots reduced, usually only 2 and 4—5 visible; length of fore wing usually less than 11 mm (*delagoae* group) .... *zebra*

— On hind wing upperside usually median spots 2—6 present in a more or less straight band that is crossed by veins 3, 4 and 6; length of fore wing usually more than 11 mm (*delagoae* group) .... *depauperata*

20\. On fore wing upperside, outer median spots 1b and 1c forming a bar from vein 1 to vein 2; inner median spot 1c absent and 1b usually smaller than one of the outer median spots (fig. 8); mid-tibiae spined (*spio* group) ...... *diomus*

— On fore wing upperside, outer median spot 1b absent; inner median spot 1b as large as or larger than outer median spot 1c, which may be absent; mid-tibiae without spines, except for the apical pair (as in all other species of the genus) 21

21\. Median band on hind wing underside ends on termen 22

— Median band on hind wing underside ends on dorsum 23

22\. Hind wing underside with a white streak from top of median band (median spot 7) to end of vein 5 at termen, veins lighter than ground colour; on hind wing upperside median band not divided by dark veins; on fore wing upperside submarginal spots complete, forming a sinuous series (angled at vein 5) (*dromus* group) .... *ploetzi ploetzi*

— White streak from top of median band to end of vein 5 on hind wing underside absent or scarcely visible and veins not lighter than ground colour; on hind wing upperside median band divided by dark veins; submarginal spots on fore wing upperside less conspicuous, not always complete, and series less sinuous (*dromus* group) .... *ploetzi occidentalis*

23\. Basal cell spot on fore wing upperside very large, about twice as long as broad, much larger than central cell spot (fig. 6); on hind wing upperside median spots very conspicuous, median spot 1c running from vein 1b to vein 2 (*dromus* group) .... *wrefordi*

— Basal cell spot on fore wing upperside much smaller, rounded and not larger than central cell spot; median spots on hindwing upperside smaller or less complete, median spot 1c rarely running from vein 1b to vein 2 24

24. Median spots on hind wing upperside incomplete, only 2 and 4—5 present and of the submarginal spots only 2 and 3 well developed, sometimes also 4 and 5 present as vague dots, very rarely a few white scales at place of submarginal spots 1b and 1c; median band on hind wing underside straight, outer margin finely dentate (spots slightly extended towards termen along veins) and along this margin ground colour darker (fig. 15) (*dromus* group) .. *secessus*

— On hind wing upperside median spots and usually also submarginal spots better developed; median band on hind wing underside more or less curved, outer margin not finely dentate nor contrasted by darkening of ground colour .. 25

25. On fore wing upperside inner median spots 1b and 1c well-developed, forming a bar from vein 1 to vein 2; outer median spot 1b absent, 1c a small dot at lower outer angle of median spot 2, or absent (fig. 9); median spots on upperside of hind wing fused into a continuous, characteristically curved white band; Ethiopian species (*dromus* group) .... *dromus*

— On fore wing upperside inner median spot 1b and outer median spot 1c well-developed, inner median spot 1c and outer median spot 1b absent (the latter rarely indicated as a white point close to the outer median spot 1c); median spots on hind wing upperside separated by ground colour along the veins; Oriental species (*sertorius* group) .... *galba*

Checklist of *Spialia* species

asterodia group	*asterodia*
	agylla
	kituina
spio group	*spio*
	diomus
phlomidis group	*phlomidis*
	osthelderi
	geron
	doris
colotes group	*colotes*
	confusa
sertorius group	*mafa*
	galba
	sertorius
	orbifer
dromus group	*wrefordi*
	paula
	secessus
	dromus
	ploetzi
delagoae group	*mangana*
	nanus
	delagoae
	zebra
	sataspes
	depauperata

3. THE *SPIALIA* SPECIES

The species groups recognized in this paper are pretended to be monophyletic subdivisions of the genus. They are based largely on the male and female genitalia. When studying the genitalia it soon became evident that a number of evolutionary trends could be found in the genus *Spialia*, these trends being represented by apparently autapomorphous character conditions of certain parts of the male and female genitalia. The intricacy of the genitalia makes them much more convenient for the study of phylogenetic relationships than the wing markings. Indeed, within the genus *Spialia* the latter vary mainly in the presence or absence and relative development of the spots. The absence of a particular spot in various species is a poor indication (or no indication at all) of relationship, as the loss of a spot may occur more than once independently. The presence of an additional spot would be a better indication, but in *Spialia* this seems to be realized in a single case only.

Thus, the three species of the *spio* group of Higgins (1924), which was based on the absence of median spot 6 on the underside of the hind wing, had to be placed in three different species groups in this paper while a number of other species groups recognized by Higgins could be united. The result of basing the genus groups on genital characters is that the classification shows the (supposed) interrelationships of the groups, while the exclusive use of characters of the wing markings results in a number of groups of which the interrelationships are quite obscure.

This does not mean, of course, that all characters of the wing markings are useless for the classification and as will be shown below, the position of certain spots is, in this respect, much more important than their presence or absence.

The phylogenetic implications will be dealt with in Chapter 4.

In the following, descriptions are given of all species groups as to their external characters, male and female genitalia. In the descriptions of the species these general features of the relevant species groups have not been repeated. Thus when a species has been identified by means of the key, the characters of its genitalia can be found in the combination of the characters of the relevant species group and of the species concerned (and, of course, by reference to the figures).

a. The *asterodia* group

External characters. — Upperside of fore wing with basal cell spot; central cell spot nearer to discocellular spot than to basal cell spot; basal spots in spaces 9 and 10 usually present as two white streaks lying over the central cell spot; submarginal spots present, but sometimes very incompletely developed. Underside of hind wing with all median spots present, forming an irregular band more or less parallel to the termen or fused with the basal spots in spaces 7 and 8 to form a Y; submarginal spots 4 and 5 in line with the other submarginal spots. Male with a costal fold (not very conspicuous).

Male genitalia. — Uncus deeply incised; junction with tegumen slightly marked, no fenestrula. Gnathos dorsally joined to tegumen over short distance, ventrally unspined, well sclerotized, the left and right parts ventrally connected by a (sometimes very narrow) membrane. Fultura superior smooth. Anellus membranous. Juxta may be hairy. Aedeagus straight, surface smooth. Saccus relatively long. Costal process of valva large, strongly spined and heavily sclerotized, more or less detached from costa or even attached to cucullus. Cucullus without fold covering costal process.

Female genitalia. — Segment 8 with a single, large, dorsal sclerite, separated by a membranous gap from the ventral sclerotization that is continuous antevaginally, but shows a large postvaginal membranous gap. On distal edge of postvaginal membrane no spines observable. Ductus long and imperceptibly passing into bursa. Beginning of ductus may be sclerotized. Bursa without sclerotization. Papilla analis without basal lobe; apophysis posterior longer than papilla, sharply bent at conjunction with papilla.

Spialia asterodia (Trimen)

Pyrgus asterodia Trimen, 1864. — Trans. ent. Soc. London (3) 2 : 178 (Plettenberg Bay, Cape Province). Holotype (♂) in the British Museum (Nat. Hist.), London.

Note. Trimen twice described this species as new, the first time in the above mentioned paper, the second time (1866) in his book "Rhopalocera Africae Australis", Part II. In his first description Trimen quoted as type locality only "Cape Colony", in his second description he mentioned Plettenberg Bay. The type specimen is labelled as coming from the latter locality.

External characters (pl. 1 figs. 1, 2). — The pronounced characters of the *asterodia* group, especially the position of the central cell spot, make a confusion with species of other groups improbable. The characters mentioned in the key will suffice to distinguish *asterodia* from the other species of the group, but we may add that *agylla,* the only species likely to be confused with *asterodia,* is on the average smaller: *asterodia* ♂ 9.8—12 mm, *agylla* ♂ 9.2—10.5 mm.

Apart from variation in size there is a slight variation in the extension of the spots and the ground colour of the underside of the hind wing may be darkened along the white spots. According to Swanepoel (1953) the spring specimens (August) have a darker underside of the hind wing than summer specimens (January).

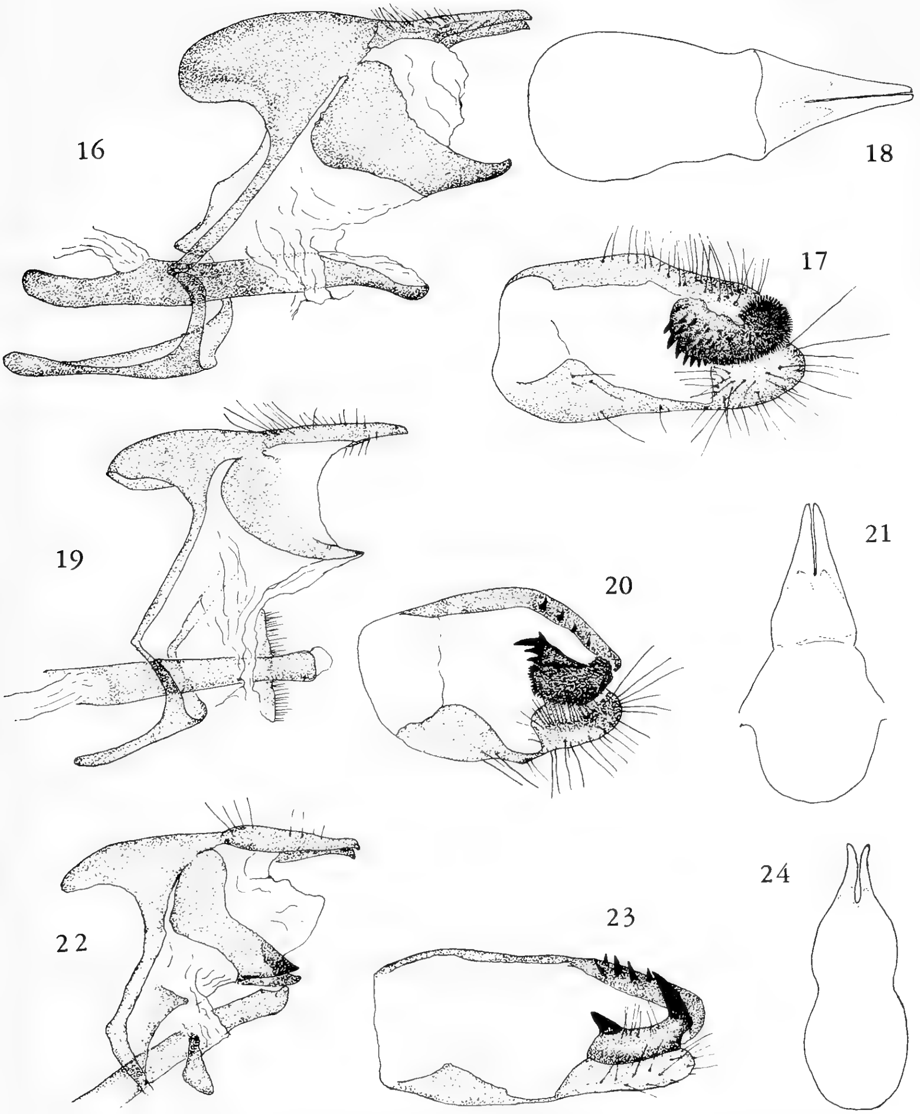
Male genitalia (figs. 16—18). — Two arms of uncus close together. Two parts of gnathos ventrally very close together. Costa of valva without spines. Costal process large, distally thickly beset with fine spines, more proximad the spines becoming larger and in the proximal part the spines coarse and large and directed downwards.

Female genitalia (figs. 25—27). — In addition to the group characters, the female of *asterodia* has the upper part of the ductus sclerotized. Antevaginal sclerotization appears slightly stronger than in *agylla.*

Ecology. — According to Swanepoel (1953) *asterodia* is a species of grasslands that ascends the Drakensberge to a height of more than 3000 m. It flies from August till March. Murray (1959) mentions as food plants various species of *Hermannia* (Sterculiaceae) and *Pavonia macrophylla* (Malvaceae).

Distribution (Map 1). — Confined to the southeastern part of Africa. In South Africa widely distributed through the southeastern, eastern and northeastern parts. Outside South Africa only known from Mozambique and Rhodesia.

Localities. — Rhodesia: Hillside (Bulawayo), Mashonaland, Salisbury (BM, NMB). Mozambique: Rikatla (24 km N of Lourenço Marques) (BM). South Africa. Cape Province: Addo, Assegaibosch, Brak River, Burghersdorp, Cape Town, Cathcart, Dordrecht, Grahamstown, Herd's Bay, Jefferey's Bay, Keurbooms River,

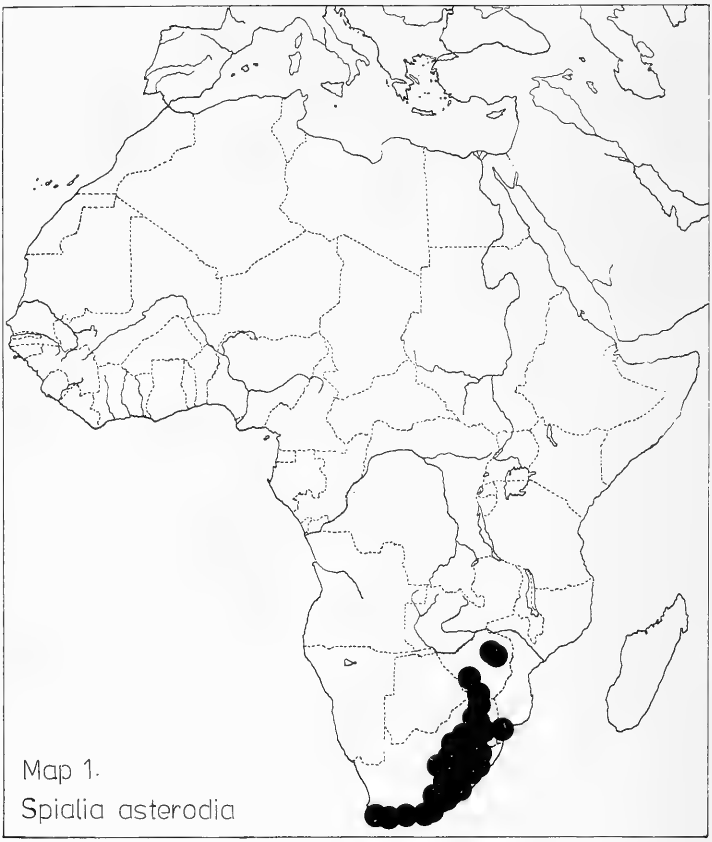


Figs. 16—24. Male genitalia, lateral aspect, valva, and dorsal aspect of tegumen and uncus. 16—18, *S. asterodia* (Natal). 19—21, *S. agylla* (Bloemfontein, S. Africa). 22—24, *S. kituina* (Voi, Kenya).

Kokstad, Plettenberg Bay, Port Elizabeth, Somerset East, Steynsburg, Swartkops, Swellendam (BM, CMP, MN, MNHN, NMB; Swanepoel, 1953). Orange Free State: Bethlehem, Bloemfontein, Kroonstad, Ladybrand, Lindley, Rouxville (MN, NMB; Swanepoel, 1953). Natal: Balgowan, Cleopatra, Estcourt, Greytown, Ladysmith, Loteni, Newcastle, Vrijheid (BM, MN, NMB; Swanepoel, 1953). Transvaal: Barberton, Ermelo, Graskop, Haenertsburg, Johannesburg, Lydenburg, Messina, Munnik, Pietersburg, Potchefstroom, Pretoria, Zoutpansberg (BM, CMP, NMB;

Swanepoel, 1953). Lesotho: Giant's Castle, Mamanthes, Maseru, Mokhotlong (NMB; Swanepoel, 1953).

Material examined. — 41 ♂, 35 ♀ : 39 ♂ (1 ♂ holotype), 34 ♀, South Africa (BM, CMP, MN); 1 ♂, 1 ♀, Mozambique (BM); 1 ♂, Rhodesia (BM).

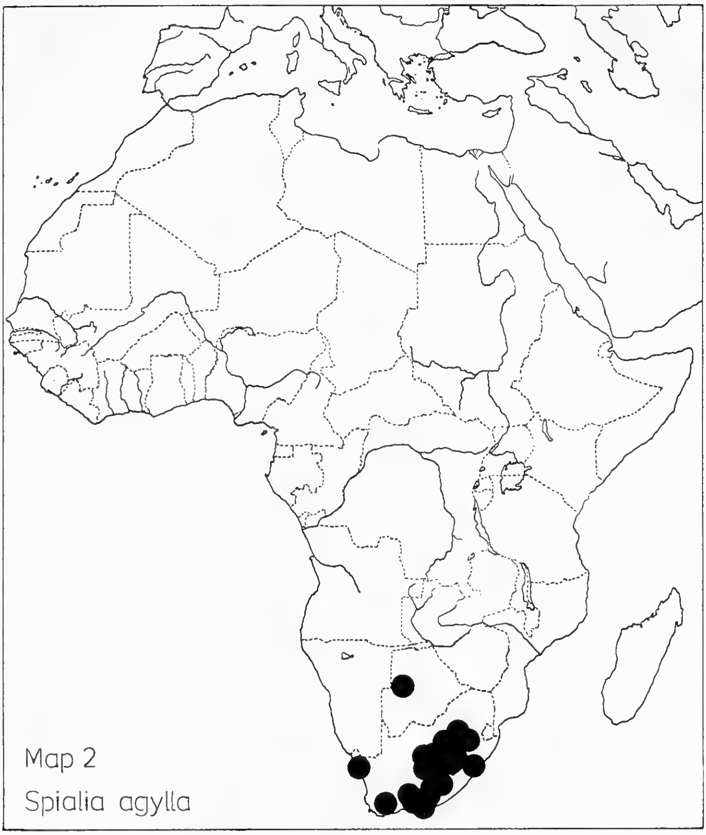


Spialia agylla (Trimen)

Pyrgus agylla Trimen, 1889. — South African Butterflies 3 : 286 (Griqualand West). See further under subspecies.

External characters (pl. 1 figs. 3, 4). — The characters mentioned in the key and under *asterodia* will suffice to distinguish this species. It varies in the same way as *asterodia*, but it is slightly smaller, ♂ 9.2—10.5 mm. One female in the BM has the median spot on the upper and underside of the hind wing much reduced. Swanepoel (1953) does not mention a seasonal variation.

Male genitalia (figs. 19—21). — Two arms of uncus less close together than in *asterodia*, more or less diverging. Two parts of gnathos ventrally clearly diverging. Costa of valva with spines in distal half along ventral edge. Costal process large,



more detached from costa than in *asterodia,* thickly beset with short spines of uniform length, with a dorsal, heavily sclerotized excrescence ending in a single very large spine, or one large and a few smaller spines, that all point towards the base of the valva (junction with vinculum) and not downwards.

Female genitalia (figs. 28, 29). — The only difference with *asterodia* seems to be a slighter sclerotization of the antevaginal region and the lack of sclerotization in the upper part of the ductus.

Ecology. — This species is found on mountains, mountain slopes and grassy plains, where it flies from August till April (Swanepoel, 1953). The food plants are said to be the same as for *asterodia* (Murray, 1959).

Distribution (Map 2). — Confined to southern Africa, where it is mainly found in the high uplands in the interior.

Geographic variation. — The recent discovery of this species in Namaqualand has led to the erection of a new subspecies. As the material of the new subspecies is limited and has been caught within three weeks, and as the differential characters are liable to environmental influences in other *Spialia* species, I consider the distinction of ssp. *bamptoni* tentative.

Spialia agylla agylla (Trimen)

Pyrgus agylla Trimen, 1889. — South African Butterflies 3 : 286 (Griqualand West, between Modder River and Riet River). Holotype (♂) in the British Museum (Nat. Hist.), London.

External characters. — Upper and underside of wings with size of spots more or less as in *asterodia*. Slightly larger than ssp. *bamptoni:* ♂ 9.2—10.5 mm.

Distribution. — The main range of the species, the uplands in the interior of South Africa. I also regard the specimens from Botswana as belonging to the nominate subspecies.

Localities. — South Africa. Cape Province: Aberdeen, Boschberg Mts, Burghersdorp, Cradock, Griqualand West, Hopetown, Kimberley, Klaarstroom, Matjesfontein, Murraysburg, Nauwpoort, Port Elizabeth, Queenstown, Somerset East, Steynsburg (BM, MN; Swanepoel, 1953). Orange Free State: Bethulie, Bloemfontein, Deelfontein, Ladybrand, Trompsburg (AMNH, BM, CMP, MN, MRAC; Swanepoel, 1953). Transvaal: Heidelberg, Johannesburg, Klipdrift, Standerton, Vaal River (BM; Swanepoel, 1953). Lesotho: Maseru, Leribe (Swanepoel, 1953). Botswana: Ghanzi (BM).

Material examined. — 38 ♂, 10 ♀ : 11 ♂ (1 ♂ holotype), 3 ♀, Cape Province (BM, MN); 25 ♂, 6 ♀, Orange Free State (AMNH, BM, CMP, MN, MRAC, NRS); 1 ♂, Transvaal (BM); 1 ♂, 1 ♀, Botswana (BM).

Spialia agylla bamptoni Vári

Spialia agylla bamptoni Vári, 1976. — Ann. Transvaal Mus. 30 : 123—124, figs. 3, 4, pl. 13 figs. 3, 4 (Hondeklipbaai, 1—18.xii.1974). Holotype (♂) in the Transvaal Museum, Pretoria.

External characters. — Spots on upper and underside of wings larger and more whitish than in ssp. *agylla,* ground colour of underside of hind wing also more whitish in the subbasal and submarginal areas. Slightly smaller than ssp. *agylla,* ♂ 9—10 mm.

Distribution. — Only known from the type-locality, Hondeklipbaai (Namaqualand Distr.) at the west coast of South Africa (Vári, 1976).

Material examined. — None.

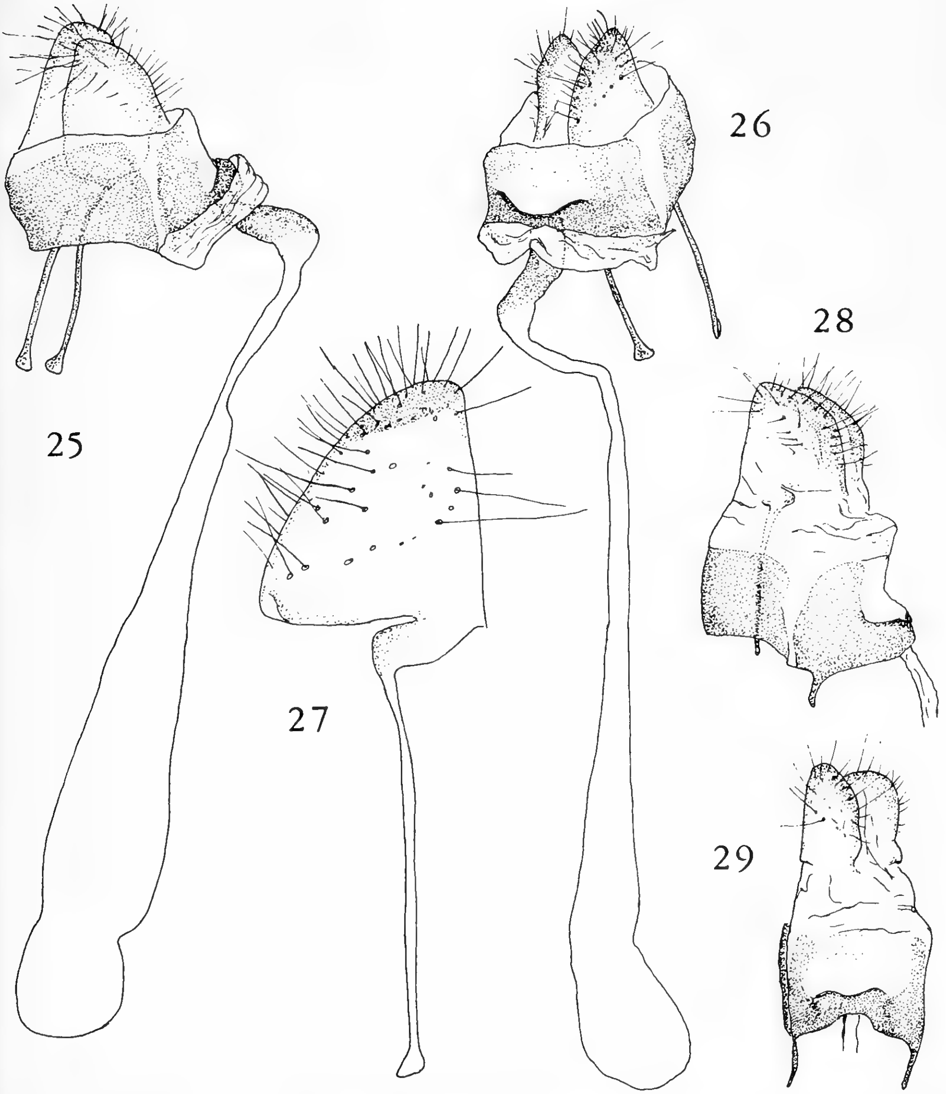
Spialia kituina (Karsch)

Hesperia kituina Karsch, 1896. — Ent. Nachr. 22 : 374—375 (Kitui, Kenya). Holotype (♂) in Zoologisches Museum der Humboldt Universität, Berlin.

Evans (1937) stated as type-locality "Zanzibar" and Dr. Hannemann kindly informed me that the type is labelled in the same way, but from Karsch' original description ("aus dem Sansibar-gebiete, von Kitui") it follows that the type-locality is not the present island of Zanzibar. At the time of Karsch the Sultanate of Zanzibar covered large parts of East Africa.

Pyrgus bettoni Butler, 1898. — Proc. zool. Soc. Lond. 1898 : 415, pl. 32 fig. 1 (Maungu Inkubwa, Kenya). Holotype (♂) in the British Museum (Nat. Hist.), London.

External characters (pl. 1 figs. 5, 6). — An unmistakable species. It has the position of the central cell spot, close to the discocellular spot, in common with *asterodia* and *agylla,* but it will at once be distinguished by the Y-shaped band on the underside of the hind wing. By this character it is also distinguished from all other *Spialia* species.



Figs. 25—29. Lateral and ventral aspect of female genitalia, and papilla analis. 25—27, *S. asterodia* (Natal). 28—29, *S. agylla* (Hopetown, S. Africa).

Male genitalia (figs. 22—24). — Higgins (1924) mentioned an undivided uncus, but in fact the uncus is deeply indented and the apices of the two parts diverge. Ventral parts of gnathos also diverging apically. Costa of valva with a few spines pointing upwards in the distal half. Costal process detached from costa, attached to undeveloped cucullus (at least, this process is supposed to be homologous with the costal process in the other *Spialia* species), strongly sclerotized, oblong, with a strong tooth at its proximal end and a very large tooth at its distal end protruding beyond the dorsal rim of the costa.

Higgins (1924) mentioned "elaborate interlocking terminal teeth". From his figure (pl. 9 fig. 1) it is clear that one of these teeth is the distal tooth of the costal process, while the other one is in fact the costa that is connected by a membrane (omitted in Higgins' figure) to the costal process.

Female genitalia. — Due to lack of material *kituina* is the only *Spialia* species of which the female genitalia could not be studied.

Map 3
Spialia kituina

Ecology. — In the Shimba Hills (SE. Kenya) specimens have been found in January, February, July, August and November (Sevastopulo, 1974). Food plants unknown. I found this species together with *Spialia zebra* along a dry, hot road near Ukunda (S. of Mombasa) in a rather open, more or less cultivated terrain in the beginning of November.

Distribution (Map 3). — Confined to Kenya. Higgins (1924) stated that there is a specimen in the British Museum (Nat. Hist.) from British Central Africa, but I could not find that specimen. Neave (1910) recorded a number of specimens from the Luangwa Valley (Zambia), which he hesitatingly placed as the wet-season form of *"Hesperia bettoni"*. The only specimens in the Neave collection in the Hope Department, Oxford, that come into consideration belong to *Spialia confusa confusa*.

Localities. — Kenya: Bura (Teita), Diani, Kaitir, Kangondi, Kibwezi, Kitui, Landjoro (Pori), Lokichogio, Lukenia, Makueni, Maungu Inkubwa, Mombasa, Mulango, Shimba Hills (Kakardara and Marere Forests), Taveta, Ukambani, Ukazzi Hill (Garissa Rd), Ukunda, Voi (AMNH, BM, CMP, ML, MN, MNHN; Higgins, 1924; Karsch, 1896; Sevastopulo, 1974).

Material examined. — 21 ♂ (1 ♂ holotype of *bettoni*), 5 ♀, Kenya (AMNH, BM, CMP, ML, MN, MNHN).

b. The *spio* group

External characters. — Upperside of fore wing with basal cell spot; central cell spot midway between basal cell spot and discocellular spot; no spots in spaces 9 and 10; submarginal spots usually well-developed. Median spots on underside of hind wing complete, forming a continuous band, or median spot 6 absent; submarginal spots 4 and 5 in line with the other submarginal spots; an additional spot between the submarginal and median spots in space 1c. Male without costal fold.

Male genitalia. — Uncus undivided, junction with tegumen well-marked and with fenestrula or almost invisible. Gnathos free from tegumen by a very narrow membranous gap; dorsally broad, ventrally narrower and with some spines, distally very gradually passing into the more or less spinulose membrane that joins the left and right parts of the gnathos. Anellus membranous, spinulose or smooth. Aedeagus straight, without marked spines. Saccus slightly shorter than or about as long as uncus. Costal process of valva a strongly spined structure in central part of costa or a finger-like excrescence of dorso-distal part of costa. Cucullus spined dorsodistally.

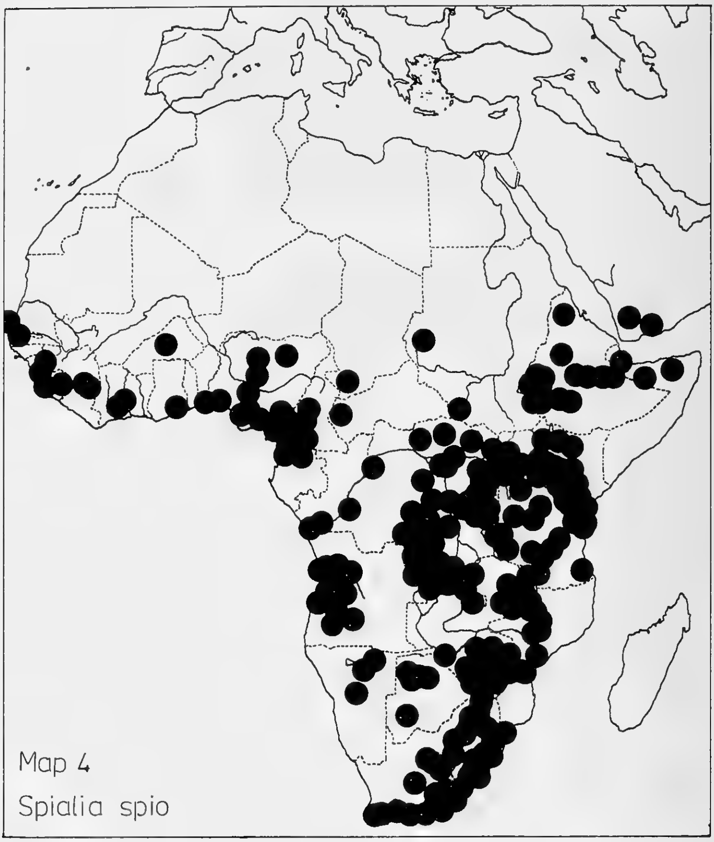
Female genitalia. — Segment 8 with two dorsal sclerites that extend far laterally; ventrally a single sclerite or two sclerites separated by a narrow membranous gap distally of the ostium. In the distal part the ventral surface bears a membranous or sclerotized flap that partly overlaps the spinulose area. This area is well-developed and not connected to the ventral sclerite(s). Antevaginally there is a strong sclerotization which may be divided into a left and right part, recalling the sclerotized "wings" in the *phlomidis* group. Upper part of ductus may be sclerotized. Bursa without sclerotizations. Papilla analis with basal lobe; apophysis posterior long, longer than papilla.

Spialia spio (Linnaeus)

Papilio spio Linnaeus, 1767. — Syst. Nat., Ed. XII, 1 (2) : 796 (Cape of Good Hope). Of the type only figures exist. Linnaeus referred to figures by Clerck, which were not published before 1882, when Aurivillius reproduced them. Only then it could be determined that the poor description by Linnaeus referred to the species that was generally known as *Papilio vindex* Cramer, 1782. Although this synonymy is undoubtedly correct, the figures of Clerck reproduced by Aurivillius are so bad as to lead Oberthür (1912) to consider *spio* and *vindex* separate species.

Papilio vindex Cramer, 1782. — Cramer, Uitlandsche Kapellen 4 : 122, pl. 353 figs. G, H (Cape of Good Hope). Type presumably lost.

External characters (pl. 1 figs. 7, 8). — A variable species, that is, however, usually not difficult to distinguish. To the characters mentioned in the key we may add the following notes. In rare cases the median spot 6 on the underside of the hind wing is faintly developed. The additional spot in space 1c on the underside of



the hind wing is not always well-developed. A useful distinguishing character can also be found on the upperside of the hind wing, where the submarginal spots 4 and 5 are fused to form a single large conspicuous spot in most specimens; this spot usually distinguishes *spio* from all other *Spialia* species.

From the two other widely distributed and common *Spialia* species in Africa, viz., *dromus* and *diomus, spio* is easily distinguished by the development of the median spots in space 1b on the upperside of the fore wing (figs. 7—9). In *spio,* inner median spot 1b and outer median spot 1c are always present and subequal, the other median spots in space 1b are absent. In *dromus* the inner median spots 1b and 1c are always both present and usually fused, outer median spot 1c is very small or absent, outer median spot 1b is always absent. In *diomus* the inner median spot 1b is present, but usually small, inner median spot 1c is always absent, the outer median spots 1b and 1c are always both present and usually fused. In other words, on the upperside of the fore wing, there is no white bar in space 1b extending from vein 1 to vein 2 in *spio,* such a bar is present and composed of the inner median spots in *dromus* and also present but composed of the outer median spots in *diomus*.

Further differences are the following. On the upperside of the hind wing median spot 6 is always absent in *spio* (in very few specimens represented by a few white scales), usually present but faintly developed in *diomus* and usually present as a clear spot in *dromus*. The series of submarginal spots on the upperside of the fore wing is much more sinuous in *dromus* (especially in spaces 2 and 3) than in *spio* and *diomus*. The black bar in the fringes of the fore wing at the end of vein 5 is always well-developed in *dromus*, variable, but often narrow in *diomus* and narrow or (in most cases) absent in *spio*.

There is a large variation in size, the males varying from 8.7 to 13.0 mm; in the development of the spots and in the ground colour of the underside of the hind wing, which varies from pale yellow to dirty green. In addition, there exists some variation in the wing shape. Usually the fore wings of the males are slightly more pointed than those of the females, but males with rounded and females with pointed wings also occur. Probably, temperature and humidity are largely responsible for these varieties. The described variation is not geographical.

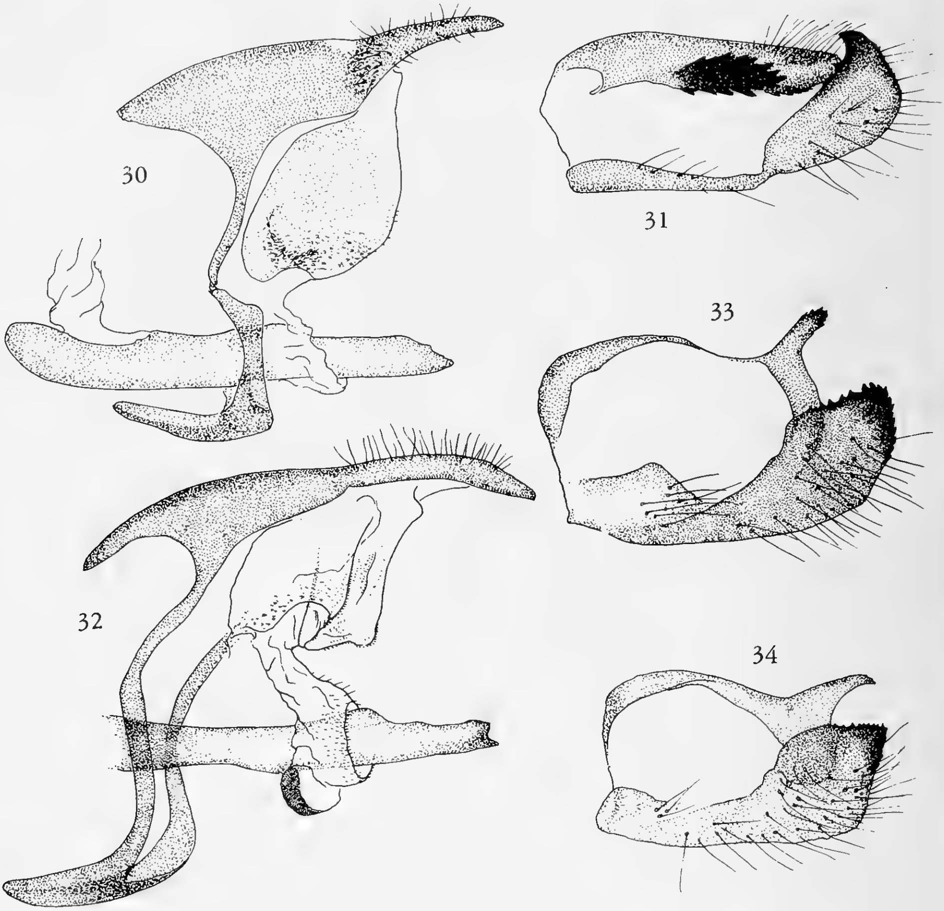
Male genitalia (figs. 30, 31). — A large fenestrula at junction of uncus and tegumen. Gnathos free from tegumen, distally gradually passing into fultura superior, which bears some small spines, ventrally forming a more or less triangular, slightly spined "head". Anellus membranous, smooth. Costal process of valva a strongly spined structure near the centre of the costa. Cucullus dorso-distally pointed, strongly sclerotized and with a strong tooth near the junction with the costa.

Female genitalia (figs. 35, 36). — Ventral sclerotization of segment 8 forming a single, not sharply defined sclerite with a sclerotized projecting flap that partly overlaps the area spinulosa which is pointed distally. Antevaginally with two strongly sclerotized and folded, wing-like structures. Papilla analis with small basal lobe, that scarcely covers the base of the apophysis posterior.

Ecology. — Although in South Africa *spio* is a species of open grounds (Swanepoel, 1953), at least in East Africa it seems to prefer fringes of dense scrub, sometimes occurring along forest paths (own observations; experiences of my friend, Mr. J. H. Lourens). Probably, it is a rather adaptable species, that can live where the vegetation structure is not too dense (closed forest) or too open (subdesert, desert). It may fly almost throughout the year, but this depends on local conditions. Recorded food plants are several *Hermannia* species (Sterculiaceae) and *Pavonia macrophylla* and *columella* (Murray, 1959), *Hibiscus aethiopicus* (Gifford, 1965), and *Sida* (Van Someren, 1939) (all Malvaceae).

Distribution (Map 4). — One of the most widely distributed African *Spialia* species, occurring throughout the Afrotropical Region in suitable habitats and penetrating the Arabian peninsula in the extreme south. Although the species is not known from large areas, this often appears to be the result of undercollecting rather than of true absence.

Localities. — Yemen: Wadi Dhar (6 mls NW of San'a) (BM; Gabriel, 1954). South Yemen: Hadramaut (BM). Somalia: Buran, 40 mls S of Buran, Holl-Holl (MN, MNHN; Talbot, 1932). Sudan: Bamaka, Jebel Marra (Darfur), Niurnya (BM). Ethiopia: throughout (BM, MNHN; Carpenter, 1935). Kenya: throughout (AMNH, BM, CMP, ML, MN, MNHN, NMB, USNM, ZSM). Uganda: throughout (AMNH, BM, CMP, ML, MN, MRAC). Tanzania: throughout (BM, ML, MN,



Figs. 30—34. Male genitalia, lateral aspect, and inside of right valva. 30—31. *S. spio* (S. Africa). 32—33, *S. diomus ferax* (Pretoria, S. Africa). 34, *S. diomus diomus* (Ukunda, Kenya).

MNHN, MRAC, ZSM; Aurivillius, 1910). Ruanda: Cyangugu, Rugege Forest (Lake Kivu) (BM, ML). Burundi: Butoni, Kibimba, Kitega, Misumba, Usumbura (MRAC). Malawi: throughout (BM, MNHN, NMB; Gifford, 1965). Zambia: Chingola, Fort Jameson, Kabompo River, Mid Luangwa Valley, Upper Luangwa Valley (BM, NMB). Rhodesia: throughout (MN, MNHN, NMB, USNM). Mozambique: Augustino Farm (Revue River), Delagoa Bay, Inhanucarara, Serra Rotanda, Siluve (Xiluvo) Hills (BM, MNHN, NMB, ZSM). Swaziland: Gollel (NMB). South Africa: throughout (AMNH, BM, CMP, ML, MN, MNHN, MRAC, NMB, USNM, ZSM; Swanepoel, 1953). Botswana: Kwaai River, Maun, 55 mls E of Maun, 25 mls E of Tsane (NMB). Namibia: Grootfontein, Okahandja, Omaramba-Oamatako (SMW; Trimen, 1891). Angola: Banga, Barraca (Quanza River), Benguela, Biho Distr., between Capelongo and Dongo, Cassualalla, Cubal River, Gauca, Huambo, Kuvali River, N'Dalla Tando, Omrora, Pacolo (Luanda), Pungo Adongo (BM, CMP, ML, MNHN; Trimen, 1891). Zaïre: throughout (AMNH, BM, CMP, MN, MNHN, MRAC, NMB, ZSM). Congo-Brazzaville: Fort Crampel (MNHN). Gabon: Oyem (MNHN). Rio Muni: Makomo Campo (ZSM). Central African Rep.: Boukoko M'Baiki, Oubangui (MNHN, MRAC). Chad: Bebedjia (Moundou) (ML). Cameroun: throughout central and southern parts (BM, CMP, MNHN, USNM). Nigeria: Afikpo, Akassa to Onitsha, Fumban, Kano, Lagos, Lokoja, Lower Niger, Ogruga, Zaria, Zungeru (NMB, BM). Dahomey: Porto Novo (MNHN). Ghana: Accra, Likpe, Gold Coast (BM, MRAC, USNM). Upper Volta: Pundu (ZSM). Ivory Coast: Bayota Forest (Gagnoa), Dimbokro (BM, MN). Liberia: Monrovia (Holland, 1896). Sierra Leone: Benikoro, Freetown, Sefadu, Yiraia (BM, ML, ZSM). Guinea: Conakry, Dalaba, Macenta, N'zérekoré (BM, MNHN). Gambia: Gambia (BM). Senegal: Dakar, Niokola Koba (BM, MNHN; Condamin, 1969).

Material examined. — 692 ♂, 384 ♀ : 1 ♂, Yemen (BM); 1 ♂, S. Yemen (BM); 3 ♂, Somalia (MN); 16 ♂, 9 ♀, Ethiopia (BM, MN); 3 ♂, 2 ♀, Sudan (BM); 82 ♂, 63 ♀, Kenya (AMNH, BM, CMP, ML, MN, USNM, ZSM); 37 ♂, 22 ♀, Uganda (AMNH, BM, CMP, ML, MN, MRAC); 106 ♂, 54 ♀, Tanzania (BM, ML, MN, MRAC, ZSM); 1 ♀, Ruanda (ML); 21 ♂, 7 ♀, Burundi (MRAC); 12 ♂, 9 ♀, Malawi (BM); 3 ♂, 2 ♀, Zambia (BM); 3 ♂, Rhodesia (MN, USNM); 9 ♂, 3 ♀, Mozambique (BM, ZSM); 110 ♂, 79 ♀, South Africa (AMNH, BM, CMP, ML, MN, MRAC, USNM, ZSM); 2 ♂, 2 ♀, Namibia (SMW); 10 ♂, 3 ♀, Angola (BM, CMP, ML); 204 ♂, 81 ♀, Zaïre (AMNH, BM, CMP, MN, MRAC, ZSM); 1 ♀, Rio Muni (ZSM); 1 ♂, Centr. Afr. Rep. (MRAC); 1 ♂, 1 ♀, Chad (ML); 41 ♂, 30 ♀, Cameroun (BM, CMP, USNM); 11 ♂, 6 ♀, Nigeria (BM); 2 ♂, 2 ♀, Ghana (BM, MRAC, USNM); 1 ♂, 1 ♀, Ivory Coast (BM, MN); 10 ♂, 4 ♀, Sierra Leone (BM, ML, ZSM); 1 ♂, 2 ♀, Guinea (BM); 1 ♀, Gambia (BM); 2 ♂, 1 ♀, Senegal (BM).

Spialia diomus (Hopffer)

Pyrgus diomus Hopffer, 1855. — Monatsber. K. Akad. Wiss. Berlin 1855 : 643 (Mozambique). For synonymy, see subspecies.

External characters (pl. 2 figs. 9—12). — An unmistakable species, distinguished by the following combination of characters:

1. On the upperside of the fore wing the outer median spots 1b and 1c are both present, forming a bar that extends from vein 1 to vein 2; inner median spot 1b present, 1c absent; submarginal spots well-developed; basal cell spot present (fig. 8).
2. On the underside of the hind wing the median band is entire, not broken at space 6. See also under *Spialia spio*.

Apart from the characters of the wing pattern *diomus* can be distinguished from all other *Spialia* species by the presence of spines on the mid-tibiae (besides the apical pair of spines).

There is a marked variation in the ground colour of the underside of the hind wing, from bright creamy yellow to deep olive-brown (sometimes dirty green). (See further under Geographic variation).

Male genitalia (figs. 32—34). — No fenestrula at junction of uncus and tegumen.

Gnathos free from tegumen, distally passing gradually into a finely spinulose, folded fultura superior, ventrally without differentiated "heads". Anellus membranous, spinulose. Costal process of valva a finger-like projection of the dorso-distal part of the costa. Cucullus strongly spined dorso-distally (with serrated edge).

Female genitalia (figs. 37, 38). — Ventral sclerotization of segment 8 consisting of two sclerites separated by a membranous region along the midline of the segment; tongue-like flap membranous, partly overlapping the area spinulosa, which is not pointed distally. Ventrally of the ostium there is a strongly sclerotized, irregular antevaginal plate. Papilla analis with a large basal lobe, covering half of the base of the papilla and the whole base of the apophysis posterior.

Ecology. — In many parts of its range a common species on open grounds. Swanepoel (1953) even states: "You cannot wander over the South African veld without meeting *diomus* almost everywhere . . .". In more or less forested areas *diomus* is scarce or absent and from own experience I think that it is much more confined to open grounds than *spio*.

S. diomus may be found throughout the year where it is not too dry or too cold seasonally. Recorded food plants are various species of *Hermannia* (Sterculiaceae) and *Pavonia macrophylla* (Malvaceae) (Murray, 1959).

Distribution (Map 5). — Distributed throughout the Ethiopian region where open grounds occur, but lacking in the extensively forested areas in the central and western parts of the Ethiopian region. Possibly continuously distributed from South Africa through Mozambique and Tanzania to Ethiopia, Sudan and Yemen. The apparent gap in the known distribution in Malawi and Mozambique may be due to undercollecting rather than to real absence. The same holds for the savanna-belt from Sudan to West Africa, where *diomus* is unknown from large regions, presumably as a result of incomplete exploration. Although I have seen specimens from various parts of West Africa, *diomus* was recorded neither by Berger (1962) from Guinea and Ivory Coast, nor by Lindsay & Miller (1965) from Liberia.

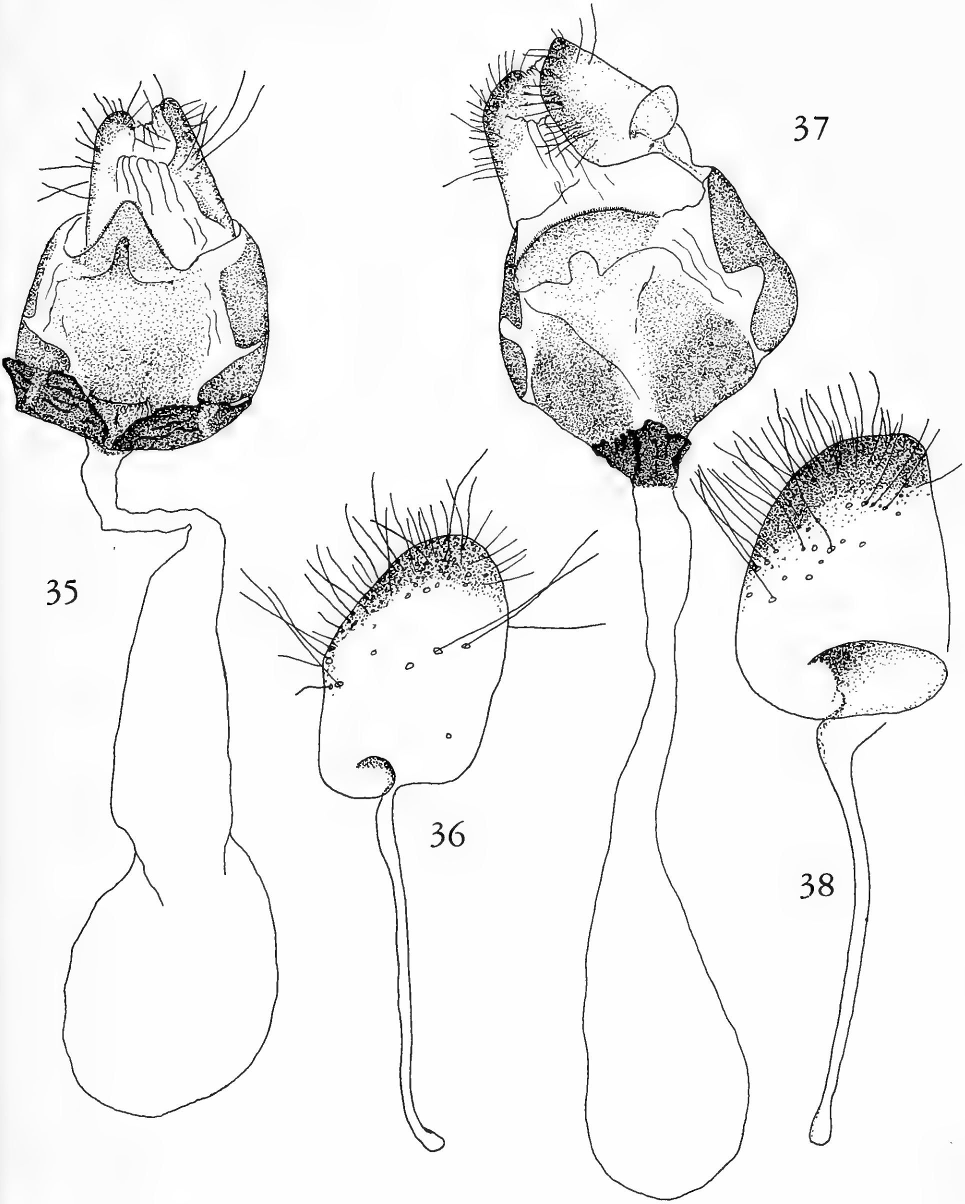
Geographic variation. — There is a marked difference between the forms found in the southern parts of Africa and in the rest of the Ethiopian region. The contact zone is obscure by lack of data, but may be running through Zambia, Malawi and Central Mozambique. The differences are found in the wing markings and male genitalia. Some authors (e.g. Oberthür, 1912; Higgins, 1924) regarded the differences too large to unite the forms into a single species, but a close examination reveals that the difference in the wing markings is not as large as would appear at first sight. But apart from this, there is no need for a specific separation as there is no evidence for geographic overlap of these forms.

Spialia diomus diomus (Hopffer)

Pyrgus diomus Hopffer, 1855. — Monatsber. k. Akad. Wiss. Berlin 1855 : 643 (Mozambique). The type appears to be lost; it is not in the Zoologisches Museum der Humboldt-Universität, Berlin.

Pyrgus machacoana Butler, 1899. — Proc. zool. Soc. London 1899 : 426, pl. 25 (Machakos, Kenya). Holotype (♂) in the British Museum (Nat. Hist.), London.

External characters (pl. 2 figs. 9, 10). — The main difference with ssp. *ferax* is found on the underside of the hind wing, where the median band is directed



Figs. 35—38. Female genitalia, ventral aspect, and papilla analis. 35—36, *S. spio* (Natal). 37—38, *S. diomus ferax* (Mozambique).

towards mid-dorsum by a strong curve of the band in space 2, caused by a shift of median spot 2 towards the base of space 2; median spot 1c is well-developed, but usually free from median spot 2, the additional spot in space 1c is well-developed, usually larger than the median spot, sometimes connected to median spot 2, but usually separated by dark scales along vein 2; the median band is broad in its upper part, especially in space 8 where it may almost touch the basal spot. The series of submarginal spots on the underside of the hind wing is more strongly curved and more irregular than in ssp. *ferax,* leaving a narrow, light-coloured region between the submarginal spots and the termen. The differences between the subspecies found on the underside of the hind wing are only weakly reflected on the upperside: only the shift of median spot 2 towards the wing base in ssp. *diomus* is usually visible, but this shift is sometimes also found in ssp. *ferax*.

Male genitalia (fig. 34). — The cucullus is broader and dorsodistally more pointed than in ssp. *ferax*.

Distribution. — The northern part of the range of the species, from West Africa to Ethiopia and Yemen. The southern limit is not exactly known, it may run through Zambia and Central Mozambique. In Mozambique ssp. *ferax* is known from the extreme south only, while the holotype of *diomus* originated from Mozambique. Lindsey & Miller (1965) concluded from the fact that Evans (1937) classified all material from Mozambique in the British Museum (Nat. Hist.) as ssp. *ferax,* while the type-locality of ssp. *diomus* is also Mozambique, that the correct name for the northern populations should be *machacoana,* "unless there is evidence that Hopffer's type was mislabelled geographically". As Hopffer clearly described and figured (Hopffer, 1862) the same form as *machacoana,* the name *diomus* cannot be replaced by *machacoana,* the latter being the junior synonym. Moreover, as all material of ssp. *ferax* in the British Museum (Nat. Hist.) originates from the extreme south, and the length of Mozambique (north-south) is about 2000 km, there is no reason to suppose that the type of ssp. *diomus* was mislabelled.

It is unfortunate that the species is not yet known from Malawi (Gifford, 1965), as it would be interesting to know whether ssp. *diomus* or an intermediate form occurs there. From Tanzania only ssp. *diomus* is known. Neave (1910) recorded "*Hesperia diomus* Hpff." from Zambia, but the two specimens from his collection (HDE) studied turned out to belong to ssp. *ferax*.

Localities. — Yemen: Hada (Gabriel, 1954). South Yemen: Aden, Dhala, Jebel Jihaf, Lahej, Laudar, Wadi Dareija (BM; Gabriel, 1954). Somalia: Gala River, Upper Sheikh (BM). Ethiopia: throughout (BM, MN, MNHN, MRAC; Carpenter, 1935). Sudan: Bahr-el-Ghazal, Darfur Prov., Dilling Forest Reserve, Gondokoro (White Nile), Kulme, Kurmuk (BM, MN). Kenya: throughout (AMNH, BM, CMP, ML, MN, MNHN, NMB, USNM, ZSM; Sevastopulo, 1974). Uganda: Arua, between Jinja and Busia, Busoga, Kafu River, Kakindu, Kampala, Kotido, Madi Opei, Metu Hills, Mtanda (AMNH, BM, NM, USNM). Tanzania: Dar es Salaam, Iringa, Kasulu, Katoto, Kifumbu, Kilema, Kilimanjaro West, Kiloa, Lake Manyara, Moshi, Mpapura, Mwanza, Ngorongoro, Pemba, Rulenge, Tange, Ukerewe, Usambara, Zanzibar (BM, ML, MN, MNHN, NMB, ZSM). Burundi: Kitega (MRAC). Zaïre: Kadjuju, Luna River, Nioka, Nyamunyunye, Rutshuri to Kabali, Usumbura to Schangugu (BM, MNHN, MRAC). Chad: Bebedjia (Moundou), Fort Archambault (ML, MNHN). Nigeria: Bida, Farniso, Kano, Lagos, Muri Prov., O'okemeji, Wurkum, Yelwa (BM). Upper Volta: Pundu (ZSM). Liberia: Zorzor (CMP). Guinea: Kouroussa, N'zérékoré (BM, MNHN). Gambia: Gambia (BM).

Senegal: Einaye, Melon à Kaolack, Oussouye Sandiala, Tabi près Bignona (BM, MNHN; Berger, 1968).

Material examined. — 134 ♂, 67 ♀ : 4 ♂, 1 ♀, South Yemen (BM); 1 ♂, 1 ♀, Somalia (BM); 9 ♂, 4 ♀, Ethiopia (BM, MN, MRAC); 5 ♂, Sudan (BM, MN); 56 ♂, 28 ♀, Kenya (AMNH, BM, CMP, ML, MN, USNM, ZSM); 10 ♂, 4 ♀, Uganda (AMNH, BM, MN, USNM); 22 ♂, 8 ♀, Tanzania (BM, ML, MN, ZSM); 11 ♂, 9 ♀, Burundi (MRAC); 5 ♂, 1 ♀, Zaïre (BM, MRAC); 4 ♂, 2 ♀, Chad (ML); 3 ♂, 5 ♀, Nigeria (BM); 1 ♀, Upper Volta (ZSM); 1 ♀, Liberia (CMP); 1 ♂, 1 ♀, Guinea (BM); 1 ♂, Gambia (BM); 2 ♂, 1 ♀, Senegal (BM).

Spialia diomus ferax (Wallengren)

Syrichtus ferax Wallengren, 1863. — Wien. ent. Monatschr. 1863: 137 (Kuisip River). Holotype (♂) in the Naturhistoriska Riksmuseet, Stockholm. The type-locality is generally known as the Kuiseb River, south of Swakopmund (Namibia).

The name was misspelled *"ferox"* by Holland (1896) and Oberthür (1912).

Pyrgus abscondita Plötz, 1884. — Mitt. naturw. Ver. Neu-Vorpomm. 15 : 21 (Africa). Type lost.

Higgins (1924), who treated *diomus* and *ferax* as distinct species, considered *abscondita* a synonym of *diomus*. This is, however, not in accordance with the rather bad reproduction of Plötz's figure by Aurivillius (1925). Evans (1937) treated *abscondita* as a senior synonym of *depauperata*. This cannot be correct, as Plötz mentioned a basal spot on the upperside of the hind wing, which is rarely or never present in *depauperata*. Moreover, the reproduction of Plötz's figure by Aurivillius (1925) shows the band of submarginal spots on the underside of the hind wing extending to the end of vein 8, while in *depauperata* it expires on the end of vein 7, and the median band in its upper part placed more basad than in *depauperata*, rather like *diomus ferax*.

Syrichthus lacreuzei Oberthür, 1912. — Et. Lép. Comp. 6 : 117, fig. 1332 (Zoutpansberg, South Africa). Holotype (♂) in the British Museum (Nat. Hist.), London.

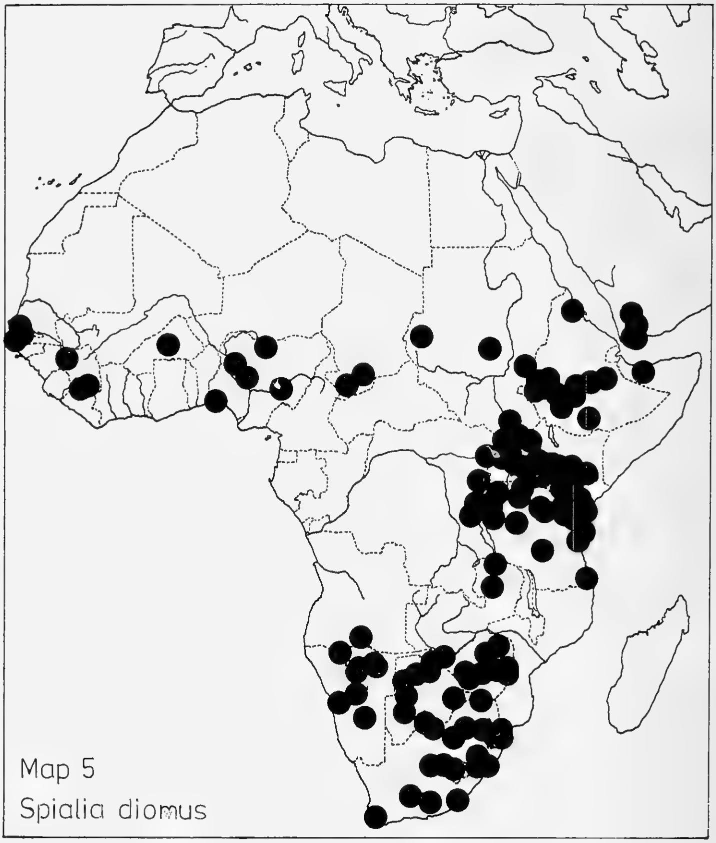
External characters (pl. 2 figs. 11, 12). — Median band of hind wing underside more regular, less broadening in its upper part and straighter than in ssp. *diomus*, directed towards tornus; median spot 2 in line with median spot 3 and connected with the additional spot in space 1c, which is obliquely extended towards the tornus; median spot 1c usually present, but weakly developed and free from median spot 2. Series of submarginal spots on the underside of the hind wing straighter and more regular than in ssp. *diomus;* the light-coloured area between the submarginal spots and the termen is narrow near the tornus, but broadens conspicuously towards the apex and is widest in space 6. See further under ssp. *diomus*.

Male genitalia (figs. 32, 33). — The cucullus is narrower, more rounded and more strongly spined than in ssp. *diomus*.

Distribution. — Southern Africa, north to Zambia and possibly Central Mozambique.

Localities. — Zambia: mouth Chambezi to Mansya River and Lake Young, high plateau S of Lake Tanganyika (HDE; Neave, 1910). Rhodesia: Buhera, Bulawayo, Matetsi, Mtoko, Mutambara, Nyamandhlovu, Salisbury, Selukwe, Strathmore Ranch (BM, CMP, MN, NMB). Mozambique: Delagoa Bay, Lourenço Marques, Shinawane (Xinavane) (BM, ML, MNHN, SMW, ZSM; Hopffer, 1855). Swaziland: Stegi (NMB). South Africa: throughout (AMNH, BM, CMP, ML, MN, MNHN, MRAC, NMB, NRS, USNM, ZSM; Swanepoel, 1953). Botswana: Kachikau, Kang Rd, 80 mls W of Kanye, Mafeking, Mahalapye, Maun, Nxai Pan, Okavango, Okwa, Sepopa, Tsane, Tsau (NMB, ZSM). Namibia: Kalidona, Kalkrand, Kano vlei, Kuiseb River, Okahandja, Omaramba-Oamatako, Otawi, Ovamboland, Tsumele (NMB, NRS, SMW, ZSM; Trimen, 1891; Wallengren, 1863). Angola: Ehanda (Trimen, 1891).

Material examined. — 92 ♂, 56 ♀ : 2 ♂, Zambia (HDE); 3 ♂, 1 ♀, Rhodesia (BM, CMP, MN); 5 ♂, 9 ♀, Mozambique (BM, ML, SMW, ZSM); 72 ♂, 44 ♀, South Africa (AMNH, BM, CMP, ML, MN, MRAC, NRS, USNM, ZSM); 1 ♂, Botswana (ZSM); 9 ♂, 2 ♀, Namibia (NRS, SMW, ZSM).

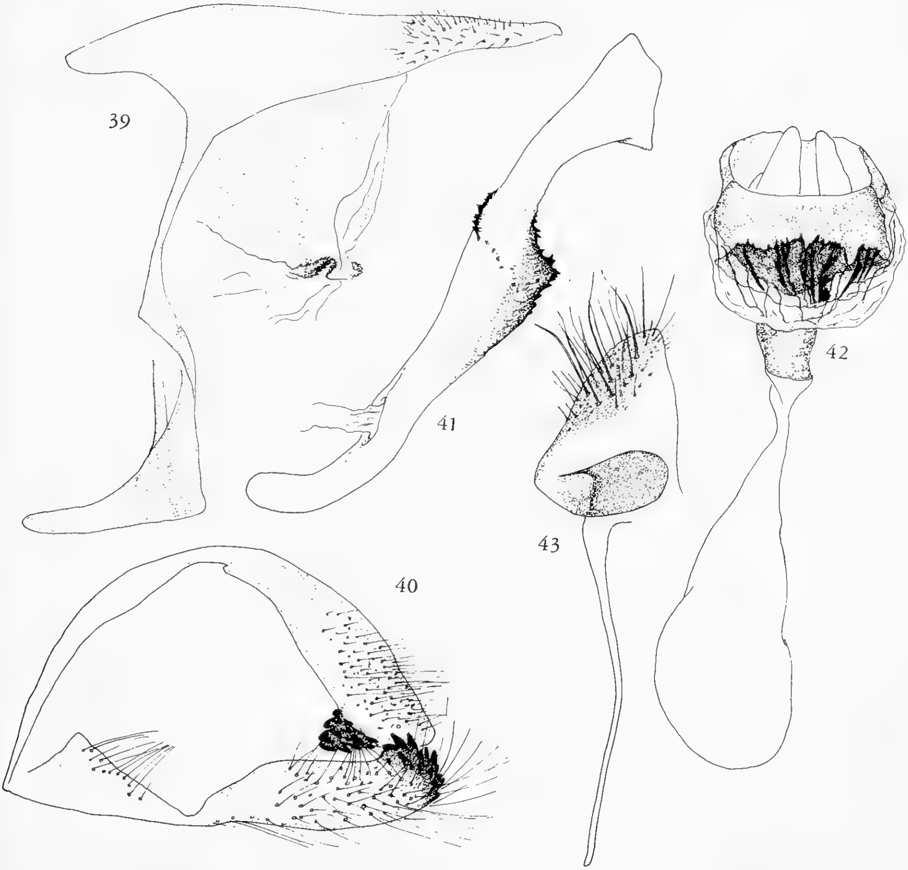


c. The *phlomidis* group

External characters (pl. 3). — Fore wing with basal cell spot on the upperside usually present, but vaguely outlined; central cell spot midway between basal cell spot and discocellular spot; submarginal spots usually all present and well-developed. On underside of hind wing usually all median spots present, but in most cases spot 6 not connected to inner or outer spot in space 7; submarginal spots 4 and 5 in line with the other submarginal spots. Male without costal fold.

Male genitalia (figs. 39—41). — Uncus undivided, junction with tegumen well visible but without fenestrula. Gnathos free from tegumen, dorsally broad, ventrally tapering to a small "head"; left and right part of gnathos joined by a more or less folded, usually finely spinulose membrane (fultura superior). Anellus membranous. Aedeagus with a strongly sclerotized and indented crest, latero-ventral in the middle, or a long, unindented branch in the same place, and with an extended apex. Saccus slightly shorter than uncus. Costa of valva broadening distally, in most species spined dorsally; costal process usually present as a ventrodistal excrescence of costa with strong spines. Cucullus spined dorso-distally, without fold covering part of the costal process.

Female genitalia (figs. 42, 43). — Segment 8 with two dorsal sclerites and two large ventral sclerites, which occupy the larger part of the ventral surface or are fused to a single large ventral sclerite. At the distal edge of the ventral side of segment 8 the area spinulosa may be visible. To the left and right of the ostium there is a heavily sclerotized and indented wing-like structure at the base of the segment. Ductus rather short, sclerotized in its upper part, rapidly broadening to



Figs. 39—41. Male genitalia, lateral aspect, aedeagus, and inside of right valva of *S. phlomidis* (Turkey).
Figs. 42—43. Female genitalia, lateral aspect, and papilla analis of *S. phlomidis* (Greece).

the oblong bursa, which does not bear any ornamentation. Papilla analis with basal lobe; apophysis posterior long, longer than papilla.

Identification. — *S. doris* is the only species of the *phlomidis* group that by its distribution can be confused with African *Spialia* species (especially *mafa* and *spio,* by the absence or poor development of median spot 6 on the underside of the hind wing), as *doris* penetrates the Afrotropical region in Sudan, Ethiopia, Somalia and Kenya. It is, however, recognized on the upperside of the fore wing by the vague outline of the basal cell spot and the usual presence of both outer median spots 1b and 1c (in *mafa* and *spio* the outer median spot 1b is always absent) and on the underside of the hind wing by the presence of a small median spot 6.

Note. — The species of the *phlomidis* group *(phlomidis, osthelderi, geron* and *doris),* which are mainly distributed in the eremic parts of the southern Palaearctic region, have been extensively dealt with in a previous paper (De Jong, 1974) and there is no need to repeat that treatment here. This is, however, a good opportunity to present photos of the species and to give the following corrections and additions.

Spialia phlomidis (Herrich-Schäffer)

Since my 1974 paper I could examine 90 additional specimens. They were mainly taken within the boundaries of the known distribution area, but two specimens greatly enlarged our knowledge of the distribution of this species, as they were taken in S. Iran and C. Asia, respectively. The additional localities are:

ssp. *phlomidis* (Herrich-Schäffer):
Bulgaria: Stanimaka (ZSM),
Greece: Kastoria, Mt. Chelmos, Zachlorou (near Kalavryta) (Christensen, LNK, ML, ZSM),
Turkey: Aksehir, Bulu, Cilician Taurus, Konia (LNK, ZSM),
South Russia: Eriwan (= Yerevan) (ZSM),
Iran: Golhak (near Teheran), Qader Abad Pass (Fars) (LNK, ML);
Central Asia: Alai Mts (ZSM).

ssp. *hermona* Evans:
Lebanon: Djezin (ZSM).

Spialia osthelderi (Pfeiffer)

Although the number of additional specimens examined is scarcely less than the number of specimens examined for my 1974 paper, only three localities of ssp. *gecko* can be added, all in Turkmenia: Askhabad, Merw (both ZSM) and Kara Kala (Kopet Dagh) (ML). These additions scarcely enlarge the known distribution area.

Spialia geron (Watson)

The known range of ssp. *struvei* is much extended by the capture of some specimens in E. Afghanistan, south of Safed Koh (4 ♂, 2 ♀, LNK). The male genitalia are typical of this subspecies, as are the fore wing lengths (♂ 13.5 — 14.2 mm, ♀ 14.2 — 14.3 mm). Wing length can, however, not be taken as a reliable character: smaller specimens of ssp. *struvei* do occur, as shown by two males from Dscharkent (Ili region) (ZSM), which measure 12.0 and 12.8 mm, respectively. These specimens differ further in having a dull greenish instead of yellowish underside of the hind wing. Their genitalia are of the usual *struvei* type. It is possible that on the whole the ground colour of the underside of the hind wing is more greenish in Central Asian specimens and more yellowish in Afghan specimens of ssp. *struvei,* but the material for comparison is too scanty to allow a definite statement.

The occurrence of ssp. *struvei* in Afghanistan makes it possible that the taxa known as ssp. *geron* and ssp. *struvei* are partly sympatric, as ssp. *geron* is known to occur at Arbarp (10 miles W of Kabul) (De Jong, 1974). A female from Tshehaltan (vicinity of Kabul; CN) measures 13.5 mm. For that reason it may belong to ssp. *geron,* but it can also be a small specimen of ssp. *struvei.* Unfortunately, I have not yet found characters to distinguish between ssp. *geron* and ssp. *struvei* in the female genitalia.

As the distance between the known populations of ssp. *struvei* and ssp. *geron* in Afghanistan is about 70 km, the sympatry of both forms cannot be said to be established at the moment and therefore they will provisionally be considered conspecific.

Also the range of ssp. *geron* is considerably more extensive than previously thought. In Coll. Brandt (NRS), 14 ♂ and 1 ♀ from Iran were arranged under *"osthelderi"*. The series turned out to consist of 5 ♂ of *S. osthelderi,* 4 ♂ and 1 ♀ of *S. doris,* and 5 ♂ of *S. geron.* Examination of the genitalia showed the *geron* specimens to belong to ssp. *geron.* The specimens originate from the following localities:

Iran: Fars, Shiraz, ca. 1600 m; Fars, road Shiraz—Kazeroun, Fort Sine—Sefid, ca. 2200 m; Balouchistan, Bender Tchahbahar (= Chah Bahar).

The fine spinules at the distal edge of the area spinulosa of the female genitalia in *S. geron* (cf. De Jong, 1974, fig. 11) is found in both subspecies. They seem to be absent from the edge in the other species of the *phlomidis* group and may help to distinguish *S. geron* from the very similar *S. osthelderi.*

Spialia doris (Walker)

Ssp. *doris.* On re-examination the only specimen from Kenya mentioned in my 1974 paper turned out to belong to *Spialia mafa.* Nevertheless, ssp. *doris* does occur in Kenya, according to a male caught in the semidesert area of the Northeastern Province along the Tana River between Garissa and Bura (AMNH). Further new localities of this subspecies are: El Ryadh (Saudi Arabia) (ZMB, ZSM), and the Mudugh region (Garoe, Galkayu) in Somalia (MN).

Dr. Nakamura (Williamsville, U.S.A.) kindly informed me that *S. doris* spreads northward through Israel at least as far as Herzelia, north of Tel Aviv, along the coastal sand dunes, while it also occurs in the central and northern parts of the Negev Desert. Besides *Convolvulus lanatus,* the species feeds on at least two or three more species of *Convolvulus* in Israel. The Israeli population is remarkably variable. I agree with Dr. Nakamura, that this may be due to the fact that ssp. *doris* and ssp. *amenophis* are largely intergrading in this area.

Another zone of intergradation between the last named subspecies may be found in North Sudan: a male and female from Ed Damer (Hudeiba; ZSM) are rather pale above and below, with large white markings, though not as large as usual in ssp. *amenophis*.

Ssp. *evanida*. The following two localities, both situated in the Prov. of Fars, S. Iran, can be added: Shiraz, Tchouroum (road Kazeroun—Bouchir) (NRS).

d. The *colotes* group

External characters. — Fore wing upperside with basal cell spot; central cell spot midway between basal cell spot and discocellular spot; no spots in spaces 9 and 10; submarginal spots well-developed. Median spots on underside of hind wing all present, separated or forming a continuous band, which is directed towards the dorsum; submarginal spots 4 and 5 out of line, about halfway median spots 4—5 and termen. Male with inconspicuous costal fold.

Male genitalia. — Uncus undivided; junction with tegumen slightly marked, no fenestrula. Gnathos dorsally joined to tegumen over short distance, ventrally passing into the membranous fultura superior, which is finely spinulose and folded lengthwise. Anellus with dorsal sclerotization. Aedeagus straight, surface smooth. Saccus well-developed, but shorter than uncus. Costa of valva of rather even width; costal process more or less ovoid, with spines in its ventral part, most spines pointing dorso-cephalad, but a smaller number of longer spines directed dorso-caudad. Cucullus well-developed, with a fold that partly conceals the costal process. A large, spinulose area in the membrane between costa and sacculus, joined to the costa.

Female genitalia. — Segment 8 with two dorsal and two ventral sclerites. Laterally, the dorsal and ventral sclerites almost fused, the ventral sclerites showing some small ridges at this place. Membranous postvaginal region with a slight, rather triangular sclerotization, imperceptibly passing into the deeply indented area spinulosa, which may be devoid of spines. Wall of ductus corrugated shortly before bursa, but without distinct sclerotization. No signum. Papilla analis slightly longer than broad, without basal lobe; apophysis posterior short, about as long as papilla.

Spialia colotes (Druce)

Pyrgus colotes Druce, 1875. — Proc. zool. Soc. London 1875: 416 (Angola). For synonymy, see subspecies.

External characters (pl. 2 figs. 13, 14). — This species is distinguished from all other *Spialia* species, except *confusa,* by the submarginal spots 4 and 5 of the hind wing not being in line with the other submarginal spots, but placed halfway between the median spots 4—5 and the termen. From *confusa* it can be separated by the median spots on the upperside of the hind wing being separated by the ground colour along the veins and placed more irregularly. The same difference is found on the underside of the hind wing, but in one subspecies of *colotes* the median spots are fused into a band, thus suggesting *confusa*. This band, however, has irregular sides, especially in spaces 2, 3 and 6, while it is straighter and with almost straight sides in *confusa*.

Male genitalia (figs. 44, 45). — Distal end of costa of valva rounded, not folding over costal process.

Female genitalia (figs. 47, 48). — Ventral sclerites of eighth abdominal segment touching antevaginally, but not fused. Distal rim of postvaginal area with minute spines (area spinulosa).

Ecology. — This species is mainly met with in dry, more or less wooded savanna, but I also took it in Kenya in a grassy glade in the Karura Forest near Nairobi. In Aden it has only been found above 2000 m, but in Africa it is usually found at lower altitudes.

In S. Africa *colotes* is on the wing from January to May (Swanepoel, 1953), but from localities further north I have seen specimens taken in all months, except June and July.

No food plants have so far been recorded.

Distribution (Map 6). — From Transvaal north to Angola, Ethiopia and Aden. Judging from the few localities known of this widespread species, it is a local species that possibly has been overlooked in large areas. The only country from where a reasonable number of localities are known, is Kenya.

Geographic variation. — The study of the geographic variation is hampered by the lack of material from large areas and the unequal representation from different regions, but according to the material available the following division can be made.

Spialia colotes colotes (Druce)

Pyrgus colotes Druce, 1875. — Proc. zool. Soc. Londen 1875: 416 (Angola). Holotype (♂) in the British Museum (Nat. Hist.), London.

Pyrgus nora Plötz, 1884. — Mitt. naturw. Ver. Neu-Vorpomm. 15 : 7 (Loango, Angola). Type lost. The unpublished coloured figure by Plötz was copied by Swinhoe (1908). It clearly represents the species described by Druce as *Pyrgus colotes*, as stated correctly by Swinhoe.

External characters. — Spots relatively small and widely separated; of the median spots on the upperside of the hind wing only spots 1c, 2 and 4—5 present. According to Higgins (1924), the ground colour of the upperside is rather paler brown than in ssp. *transvaaliae*, but I did not observe this difference. As large as ssp. *transvaaliae*, 9.6—11.7 mm.

A good figure of this subspecies is given by Oberthür (1912, fig. 1326).

Distribution. — Only known from Angola. Higgins (1924) mentioned this subspecies from Mombasa (Kenya). This record supposedly refers to an intermediate between ssp. *transvaaliae* and ssp. *semiconfluens*.

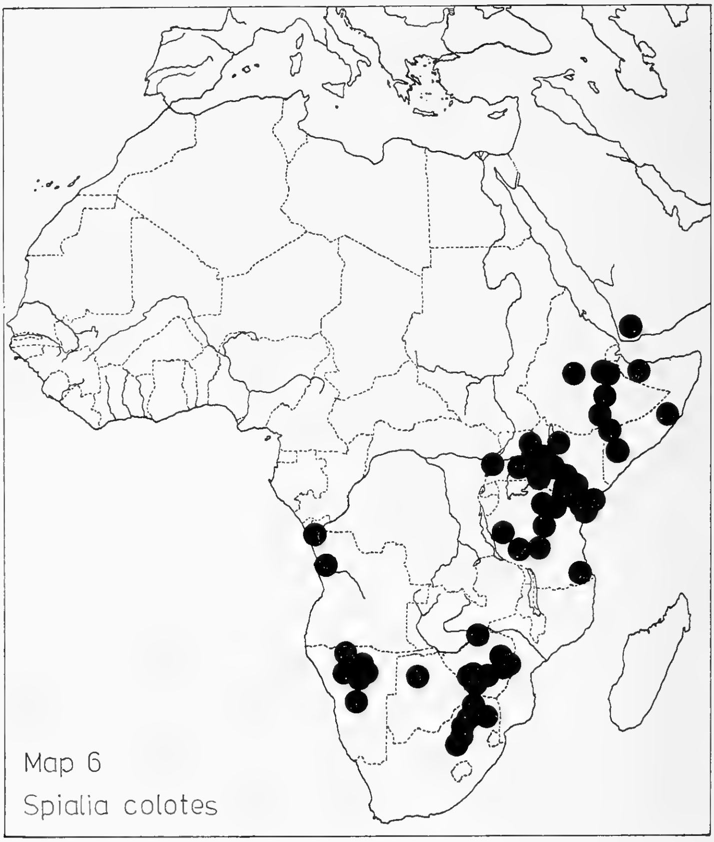
Localities. — Angola: Loango (Plötz, 1884; as *nora*); Barraca, Cuanza River (BM).

Material examined. — 6 ♂ (1 ♂ holotype), 1 ♀ , Angola (BM).

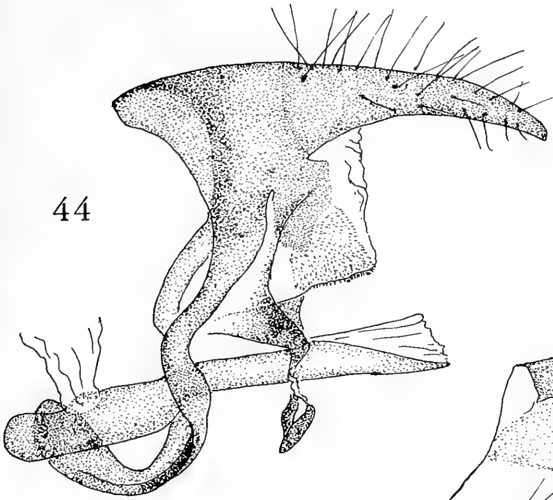
Spialia colotes transvaaliae (Trimen)

Pyrgus transvaaliae Trimen, 1889. — South African Butterflies 3: 286 (Transvaal). Holotype (♂) in the British Museum (Nat. Hist.), London.

External characters. — Spots large and prominent; on the upperside of the fore wing the inner median spots 1b and 1c fused into a single spot that is often the largest spot of the fore wing; on the upperside of the hind wing the median spots 1c, 2, 3 (usually), 4—5 and 6 present. On the underside of the hind wing the spots large, but well separated by the veins. ♂ 9.6—11.9 mm.



Distribution. — From Transvaal to Kenya and Uganda. In Kenya ssp. *transvaaliae* mainly inhabits the western and mountainous regions. In the drier eastern and southern parts it is replaced by ssp. *semiconfluens*, but many intermediate specimens can be found. In Uganda ssp. *transvaaliae* occurs in the wetter areas; in the dry northeastern part it encounters ssp. *semiconfluens*. Apparently intermediate populations are listed after ssp. *semiconfluens*, but intermediate specimens can also be found in other localities.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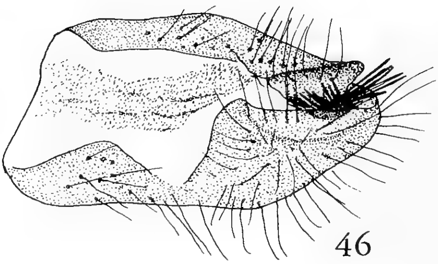
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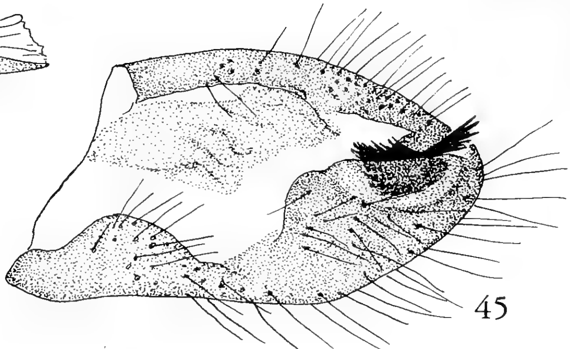
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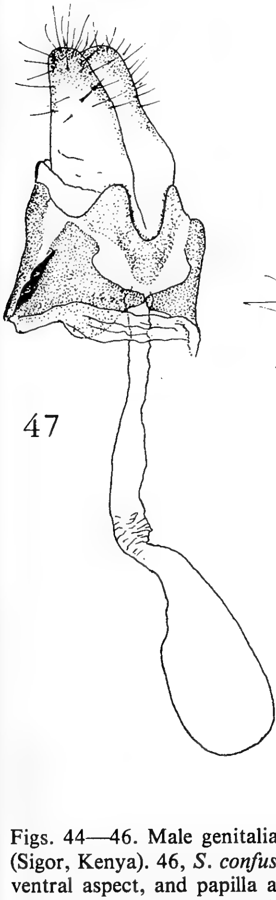
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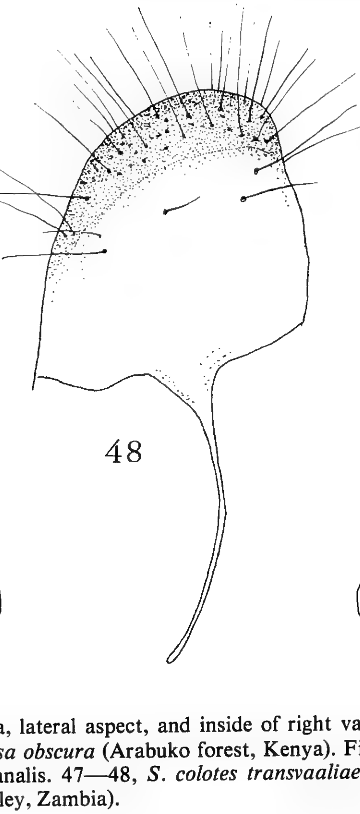
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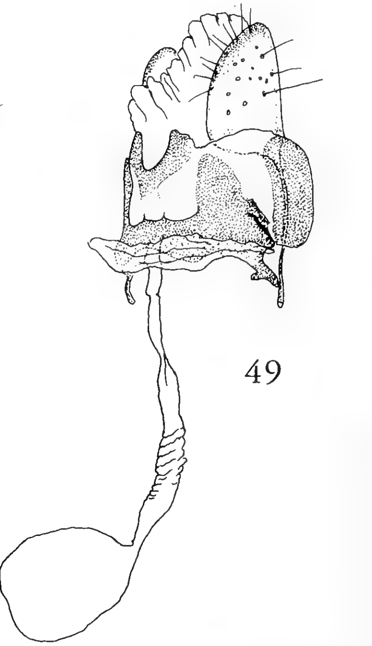
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Figs. 44—46. Male genitalia, lateral aspect, and inside of right valva. 44—45, *S. colotes transvaaliae* (Sigor, Kenya). 46, *S. confusa obscura* (Arabuko forest, Kenya). Figs. 47—49. Female genitalia, latero-ventral aspect, and papilla analis. 47—48, *S. colotes transvaaliae* (Arusha, Tanzania). 49, *S. confusa confusa* (Upper Luangwa Valley, Zambia).

Localities. — Kenya: Lake Baringo, Bura (Teita), Chawia Forest (Teita Hills), Chepalungu, Chyulu Hills, Mt. Elgon, Escarpement, Fourteen Falls, Gilgil, Karen, Karura Forest, Davirondo, Kima, Kisii, Kisumu, Kitui, Langata, Lumbwa, Mekueni, Maranga, Meru, Mombasa, Nairobi, Ngong, Shimba Hills, Sigor, Sultan Hamud, Teita Hills (AMNH, BM, CMP, ML, MN, NRS, USNM). Uganda: Bukedi, Bundibugyo, Jinja (AMNH, ML, NMB). Tanzania: Arusha Nat. Park, Chimala River, Great Craters, 60 mls S of Kondoa Irangi, Mt. Meru, Mkoe, Mpanda, Ruaha Nat. Park (BM, ML, MN, ZSM). Rhodesia: Chirundi, Dotts Drift, Filabusi, Gwanda, Matetsi, Matopos, Nyanadzi River, Odzi River, Rusape, Sabi Valley, West Nicholson (MN, NMB). South Africa. Transvaal: Blaauwberg, Dendron, Johannesburg, De Kroon, Leydsdorp, Pietersburg, Potchefstroom, Potgietersrust, Tubex, Vivo, Warmbaths (BM; Swanepoel, 1953). Botswana: Maun, 16 mls N of Maun (NMB). Namibia: Grootfontein, Grünfelde, Kalidona, Okahandja, Otjitambi, Tsumele, Waterberg, Windhoek (SMW, ZSM).

Material examined. — 124 ♂, 47 ♀: 99 ♂, 29 ♀, Kenya (AMNH, BM, CMP, ML, MN, NRS, USNM); 3 ♂, Uganda (AMNH, ML); 7 ♂, 3 ♀, Tanzania
Material examined. — 124 ♂, 47 ♀: 99 ♂, 29 ♀, Kenya (AMNH, BM, CMP); 10 ♂, 12 ♀, Namibia (BM, SMW, ZSM).

Spialia colotes semiconfluens subspec. nov.

External characters (pl. 2 figs. 13, 14). — On the upperside the spots are smaller than in ssp. *transvaaliae*, particularly the inner median spots 1b and 1c of the fore wing and the median spot 1c of the hind wing, but contrary to ssp. *colotes*, all spots of ssp. *transvaaliae* are present. On the underside of the hind wing the median spots are also smaller than in ssp. *transvaaliae*, but they are fused into a continuous band, usually with the exception of median spot 7 which is separated by dark scaling on vein 7. By the continuous band this subspecies is suggestive of *Spialia confusa*, but in that species the band is much more regularly shaped and the median spots are also fused into a continuous band on the upperside of the hind wing.

Ssp. *semiconfluens* is on the average slightly smaller than the other subspecies: ♂ 9.3—10.9 mm. In most specimens the ground colour of the upperside is rather paler brown than in ssp. *transvaaliae*.

Distribution. — Aden, Ethiopia and Somalia and southwards into Kenya and Uganda. In Kenya this subspecies flies especially in the dry east and southeast and is replaced by ssp. *transvaaliae* in the less dry mountainous regions and western part of the country. In Uganda ssp. *semiconfluens* is restricted to the dry north-eastern regions.

Material examined. — Holotype: ♂, Bihendula (Somalia), 4.xi.1949, K. M. Guichard. Paratypes: 1 ♂, Bihendula (Somalia), 1 v. 1949, K. M. Guichard; 1 ♂, Harar (Ethiopia), 23.xi.1939, R. E. Ellison; 1 ♂, W. Errer Valley (Ethiopia), 28.xi.1939, R. E. Ellison; 1 ♂, E of Errer Valley (Ethiopia), 19.xi.1939, R. E. Ellison; 1 ♀, Fich Shoa Prov. (Ethiopia), 8.v.1947, K. M. Guichard. All types in the British Museum (Nat. Hist.), London.

Further material. — 49 ♂, 20 ♀ : 3 ♂, 1 ♀, Somalia (Bardera, Bihendula, GanLibah, Haro-Bussar) (BM); 11 ♂, 5 ♀, Ethiopia (Dakotta Valley, Dire Dawa, Errer Valley, Fich, Harar, Mulata Mts) (AMNH, BM); 1 ♂, 2 ♀, South Yemen (Jebel Jihaf) (BM); 23 ♂, 10 ♀, Kenya (Kacheleba, Kenani, Kima, Kitui, Kulal, Makueni, Mutomo, Namanga, Ukazzi Hill (AMNH, MN); 11 ♂, 2 ♀, Uganda (Amudat, Kotido) (MN).

Material examined from populations intermediate between ssp. *transvaaliae* and ssp. *semiconfluens*. — 22 ♂, 4 ♀, Kenya (Besil, Kibwezi, Voi) (BM, ML).

Spialia confusa (Higgins)

Hesperia transvaaliae var. *confusa* Higgins, 1924. — Trans. ent. Soc. London 1924: 90 (SW shore Lake Nyassa). For synonymy, see subspecies.

External characters (pl. 2 figs. 15, 16). — Readily distinguished from all other *Spialia* species except *colotes* by the basad shift of the submarginal spots 4 and 5 of the hind wing. From *colotes* it can be separated by the median spots of the hind wing, which are fused into a continuous band, not only on the underside, but also on the upperside. The band on the underside of the hind wing is much more regularly shaped than in *colotes semiconfluens*. In rare doubtful cases the genitalia have to be checked for identification.

Male genitalia (fig. 46). — Distal end of costa of valva slightly protruding and folding over costal process.

Female genitalia (fig. 49). — Ventral sclerites of eighth abdominal segment broadly fused antevaginally. Sclerotization in postvaginal area slightly stronger than in *colotes*, without spines along distal edge.

Ecology. — Very little is known about this apparently rare species. Swanepoel (1953) found it in Natal "playing along a road that leads through the bush", and I took it along very dry, sandy roads in the Arabuko Forest near Malindi, Kenya. It is difficult to capture as it is a small and swift species, which frequently skips from sun-lit places into shadows and then appears to be lost.

It may be on the wing throughout the year, but I have not seen specimens or records from May and June.

According to Sevastopulo (1974) the larvae live on *Melhamia* (Sterculiaceae) and *Triumfetta* (Tiliaceae).

Distribution (Map 7). — This species has been observed over a wide range, from Natal to Kenya, in seven countries, but at relatively few localities.

Geographic variation. — There is some variation in the development of the spots, but in view of the scarce material any division into subspecies can only be provisional.

Spialia confusa obscura (Higgins)

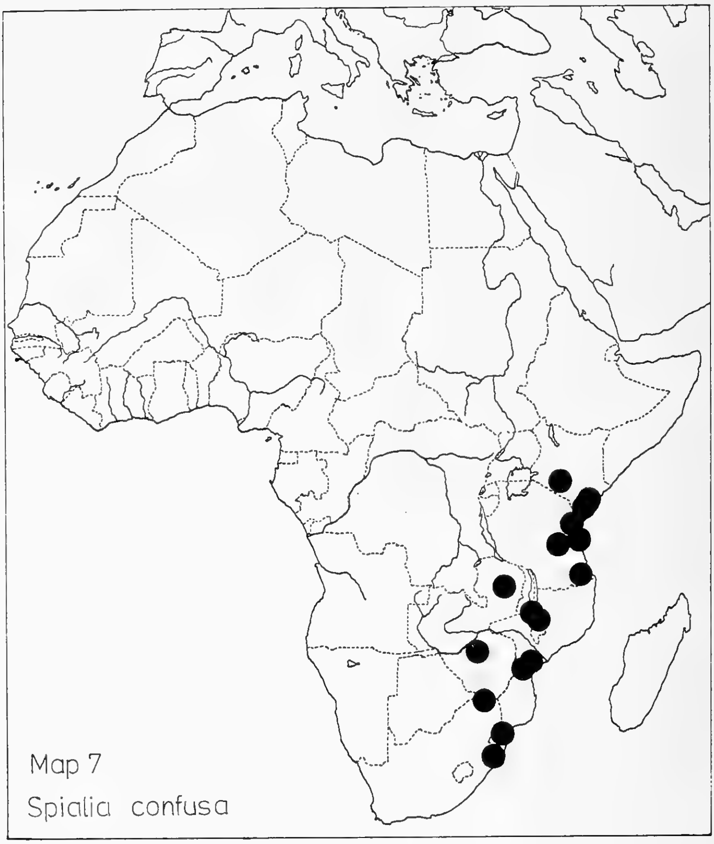
Hesperia transvaaliae var. *obscura* Higgins, 1924. — Trans. ent. Soc. London 1924 : 92—93 (Nairobi). Holotype (♂) in the British Museum (Nat. Hist.), London.

External characters (pl. 2 figs. 15, 16). — A dark form, with smaller spots. On the upperside of the fore wing the central cell spot vestigial or absent, on the upperside of the hind wing median spot 1c faint or absent. ♂ 8—10.2 mm.

Distribution. — The northern part of the range of the species, in Kenya and N. Tanzania.

Localities. — Kenya: Arabuko Forest, Nairobi, Rabai, Sokoke Forest, Shimba Hills (AMNH, BM, ML, MN; Sevastopulo, 1974). Van Someren (1939) mentioned *confusa* in a report on his expedition to the Chyulu Hills, but his specimens (in MN) turned out to belong to *S. colotes transvaaliae* with slight influence of ssp. *semiconfluens*. Tanzania: Amani, Dar-es-Salaam, Paga Hill (BM, MN).

Material examined. — 17 ♂, 3 ♀ : 14 ♂ (1 ♂ holotype), 2 ♀, Kenya (AMNH, BM, ML, MN); 3 ♂, 1 ♀, Tanzania (BM, MN).



Spialia confusa confusa (Higgins)

Hesperia transvaaliae var. *confusa* Higgins, 1924. — Trans. ent. Soc. London 1924 : 90 (SW shore Lake Nyasa, between Ft. Johnston and Monkey Bay). Holotype (♂) in the British Museum (Nat. Hist.), London.

Hesperia transvaaliae var. *fasciata* Higgins, 1924. — Trans. ent. Soc. London 1924 : 90—91 (between Ft. Mangoche and Chikala Boma, Malawi). Holotype (♀) in the British Museum (Nat. Hist.), London. Evans (1937) incorrectly stated the type to be a male.

External characters. — Spots larger than in the foregoing subspecies; on the upperside of the hind wing median spot 1c well-developed. ♂ 9.8—10.9 mm.

The type of *fasciata* is not clearly different from that of *confusa*, except for the median band on the hind wing, which is rather narrower. There is no apparent reason to rank *fasciata* otherwise than as a forma of ssp. *confusa*.

Distribution. — The southern part of the range of the species, from C. Tanzania and N. Zambia to Natal.

Localities. — Tanzania: Mikumi Nat. Park, Mkami, Mkoe (ML, ZSM). Zambia: Upper Luangwa Valley, Petauke (BM, HDE; Neave, 1910, as *"Hesperia bettoni"*). Malawi: between Ft. Johnston and Monkey Bay, between Ft. Mangoche and Chikala Boma (BM). Rhodesia: Sanyati Valley (= Umniati R.) (NMB). Mozambique: Delagoa Bay, Inhaminga, Siluve (= Xiluvo) Hills (BM, NMB, USNM, ZSM). South Africa. Natal: False Bay, Hluwehluwe, Messina, Zulu (NMB, NRS; Swanepoel, 1953).

Material examined. — 18 ♂, 5 ♀ : 3 ♂, 1 ♀, Tanzania (ML, ZSM); 2 ♂, 1 ♀, Malawi (1 ♂ holotype *confusa*, 1 ♀ holotype *fasciata*) (BM); 5 ♂, 3 ♀, Zambia (BM, HDE); 6 ♂, Mozambique (BM, USNM, ZSM); 1 ♂, South Africa (NRS).

e. The *sertorius* group

External characters. — Fore wing with or without basal cell spot on upperside; if basal cell spot present, then central cell spot about midway between basal cell spot and discocellular spot or slightly closer to basal cell spot; no spots in spaces 9 and 10; submarginal spots usually all present, but may be vague. Median spots on underside of hind wing form a continuous band or spot 6 is absent; submarginal spots 4 and 5 in line with the other submarginal spots. Male without costal fold.

Male genitalia. — Uncus undivided; at junction with tegumen in some species with large fenestrula. Gnathos dorsally not fused to tegumen, well sclerotized, ventrally forming enlarged and spined "heads"; left and right part of gnathos ventrally united by a usually smooth membrane. Anellus membranous. Aedeagus more or less straight, surface smooth. Saccus relatively short, shorter than uncus. Costa of valva narrow; costal process well developed, more or less oval, ventrally with spines which are directed dorso-distad. Cucullus dorsally excavated or with a small fold that partly overlaps the costal process. A hairy fold in the membrane between costa and cucullus.

Female genitalia. — Segment 8 with two dorsal sclerites, medially separated by a membrane, and two ventral sclerites, united antevaginally by a narrow sclerotization. Dorsal and ventral sclerites more or less fused. Postvaginally a membranous region with a proximally narrow, distally broadening sclerite, which at the distal edge of the segment passes into the spinoluse region, or without this sclerite so that the area spinulosa can be seen as a dark patch in the membranous distal part of the ventral surface. Ductus gradually broadening into bursa. Ductus and bursa without ornamentation, or bursa with a finely spinulose area. Papilla analis with basal lobe; apophysis posterior long, longer than papilla.

Superspecies *Spialia mafa*

External characters. — Fore wing with a basal cell spot on the upperside. Median spots on the underside of the hind wing complete or spot 6 is absent.

Male genitalia. — A large fenestrula at the junction of uncus and tegumen. Heads of gnathos larger than in superspecies *Spialia sertorius*. Costa of valva continued beyond the costal process as a finger-shaped projection. Hairy fold at the inside of the valva obvious, oblique, wavy or branched.

Female genitalia. — Dorsal sclerites of eighth abdominal segment fused to the ventral sclerites along the proximal edge of the segment, leaving a wide membranous area, or connecting sclerotization between dorsal and ventral sclerites more extensive, enclosing a membranous area. Bursa copulatrix with or without ornamentation.

Ecology. — Food plants: Malvaceae.

Distribution. — Very widely distributed, from South Africa through East Africa, Saudi-Arabia and India to Hainan. It replaces the superspecies *Spialia sertorius* in the Old World Tropics.

Spialia mafa (Trimen)

Pyrgus mafa Trimen, 1870. — Trans. ent. Soc. London 1970 : 386, pl. 6 fig. 12 (Maseru, Basutoland). For synonymy, see under subspecies.

External characters (pl. 4 figs. 25, 26). — From the other species of the *sertorius* group, *mafa* is easily distinguished by the combination of the presence of a basal cell spot on the upperside of the fore wing and the absence of median spot 6 on the underside of the hind wing. The other *Spialia* species, which almost or entirely lack median spot 6 on the underside of the hind wing and occur in the Ethiopian region, are *doris, paula* and *spio*. The differences with these species have been outlined in the key and it is unnecessary to repeat them here.

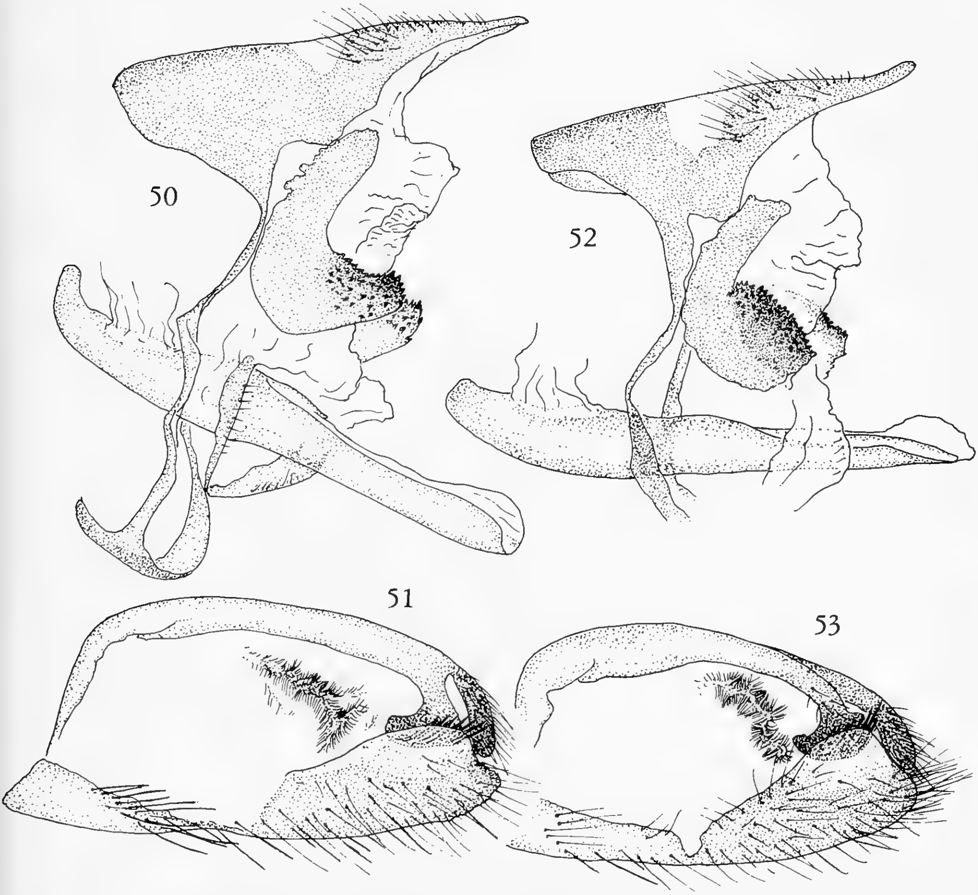
There is some variation in the extension of the spots. On the upperside of the hind wing the median spots 1c—5 are usually present, 6 is always absent. The ground colour of the underside of the hind wing is lighter or darker yellowish or brownish.

See further under Geographic variation.

Male genitalia (figs. 50, 51). — At junction of uncus and tegumen a large fenestrula. Spined heads of gnathos rather slender, less than half of entire gnathos. Costal process of valva situated before distal end of costa. Distal part of costa looks like a finger-shaped projection of the costa instead of being the costa itself. Cucullus with short fold covering ventral part of costal process. On the inside of the valva, between costa and cucullus, a large, branched fold, very thickly beset with short hairs.

Female genitalia (figs. 54, 55). — Dorsal sclerites of segment 8 more or less fused with ventral sclerites, enclosing a small, membranous area. Ventral sclerites antevaginally conjoined by a narrow sclerotization, postvaginally separated by a narrow membranous strip. This strip widens distally and passes into the non-sclerotized area spinulosa, which has a more or less straight distal edge. Bursa without ornamentation. Papilla analis rather narrow, apex rounded.

Ecology. — Like most other *Spialia* species, *mafa* prefers more or less open country, but judging from its distribution it largely avoids low-lying areas, being mainly found in hilly or mountainous regions. In Kenya I took this species in open places in a more or less wooded area up to 2000 m (between Nanyuki and Naro Moru) and Gabriel (1954) recorded specimens from Yemen captured up to more than 2500 m. According to Swanepoel (1953) it is a scarce and local species, at least in South Africa.



Figs. 50—53. Male genitalia, lateral aspect, and inside of right valva. 50—51, *S. mafa higginsi* (Kenya). 52—53, *S. galba galba* (Ceylon).

In appropriate places *mafa* may be on the wing throughout the year, but in many areas adults are absent or very scarce in June, July and August.

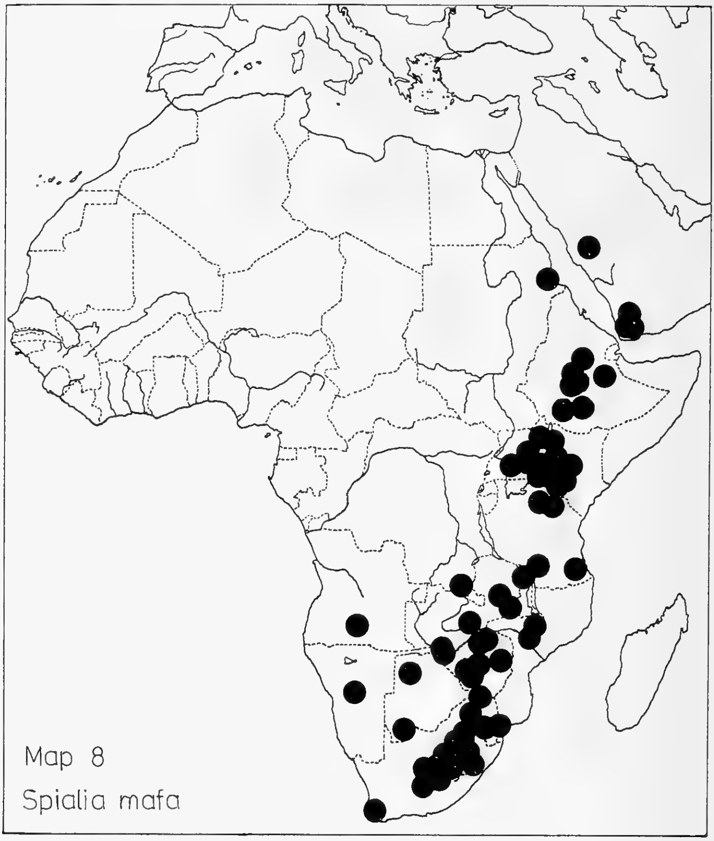
The only recorded food plant is *Hibiscus aethiopicus* L. (Malvaceae) (Murray, 1959).

Distribution (Map 8). — South and East Africa, not known from Angola, and Zaïre except for the extreme south. Distributed from Cape Town and SW Africa to Ethiopia and Sudan, and extending into the Arab peninsula, where it occurs as far east as Oman.

Geographic variation. — There is a marked geographic variation in the size of the specimens and the development of the spots. Two subspecies are distinguished.

Spialia mafa higginsi Evans

Spalia mafa higginsi Evans, 1937. — Catal. Afric. Hesp. : 62 (Mumias, Kenya). Holotype (♂) in the British Museum (Nat. Hist.), London.



External characters (pl. 4 figs. 25, 26). — The original description reads: "Below, the markings are broader and on the hind wing the basal spot in space 7 and the discal spot in space 1c are not detached as in *mafa*". These differences are rather slight, but more conspicuous differences can be found in the following characters:

1. ssp. *higginsi* is smaller than ssp. *mafa*, ♂ (8.5—) 9.2—10.7 (—11.3) mm, ♀ 9.8—11.3 (—12.6) mm, as against ssp. *mafa* ♂ 9.9—11.7 mm, (9.1—) 10.2—12.5 mm. This difference is conspicuous if one can compare long series of both subspecies;
2. in ssp. *mafa* the median spot 5 on the underside of the hind wing is almost always extended basad, just above the continuation of vein 5 in the cell; this is almost never, and certainly never conspicuously the case in ssp. *higginsi*.

Distribution. — The northern part of the range of the species. The southern limit presumably runs through Malawi, Zambia and S. Zaïre. As most specimens examined from Zambia show characters of ssp. *mafa,* all specimens from this country have provisionally been listed under that subspecies. Additional material will possibly indicate a transition zone. The specimens examined from S. Zaïre are listed under the present subspecies, but they probably also belong to the transition zone.

Localities. — Saudi-Arabia: Ashaira (BM). Oman: Khasab, Nizwa area, Rostaq (Larsen, 1977). Yemen: Hada, San'a, Suq-es-Sabt (N of Ibb) (BM, ZSM; Gabriel, 1954). South Yemen: Dhala, Jebel Jihaf (BM; Gabriel, 1954). Sudan: Erkowit (Prov. Kassala) (ZSM). Ethiopia: Addis Abeba, Burdji, Daroli, Dessiè, Getri, Harar, Jowaha, Negelli, Ft. Zuguala (BM, MN, ZSM). Kenya: Besil (= Bissil), Broderick Falls, Bura (Teita), Campi-ya-Moto, Escarpment, Gilgil, Ilala, Kabarnet, Kedai, Kima, Kitale, Mazoe Valley, Meru Distr., Migori Valley, Mirua Valley, Mt. Kenya, Muruanysigar Mt. (Turkana), Nairobi, Naro Moru, Ngong Escarpment, Olkasale, Rumuruti, Saboti Hill, Soi, Stony Athi, Subukia, Thomson Falls (AMNH, BM, ML, MN, MNHN, USNM). Uganda: Entebbe, Koki Country, Siroko River, Tororo, Queen Elisabeth Park (AMNH, BM, CMP, MN). Tanzania: Chukwe (Mpanda), District of Great Craters, Njombe, Tendaguru (BM, ML). Zaïre: Kapiri, Musonoie (BM, MRAC). Malawi: Cholo (CMP).

Material examined. — 104 ♂, 44 ♀ : 1 ♂ Saudi-Arabia (BM); 7 ♂, 2 ♀, Yemen (MB, ZSM); 4 ♂, 4 ♀, South Yemen (BM); 2 ♂, Sudan (ZSM); 11 ♂, 3 ♀, Ethiopia (BM, MN, ZSM); 64 ♂ (1 ♂ holotype of *higginsi*), 29 ♀, Kenya (AMNH, BM, ML, MN, USNM); 8 ♂, 6 ♀, Uganda (AMNH, BM, CMP, MN); 4 ♂, Tanzania (BM, ML); 2 ♂, Zaïre (BM, MRAC); 1 ♂, Malawi (CMP).

Spialia mafa mafa (Trimen)

Pyrgus mafa Trimen, 1870. — Trans. ent. Soc. London 1870 : 386, pl. 6 fig. 12 (Maseru, Basutoland). Holotype (♂) in the British Museum (Nat. Hist.), London.

Hesperia oberthüri Aurivillius, 1925. — In: Seitz, Macrolepidoptera of the World 13 : 565 (Kimberley). Holotype (♀) in the British Museum (Nat. Hist.), London. This name was given to a figure of *mafa* by Oberthür, which was incorrectly named *transvaaliae.* The figured specimen is in the BM. Preoccupied by *Hesperia oberthüri* Leech, 1891 (now placed in the genus *Pyrgus*).

Pyrgus aurivillii Shepard, 1935. — Lepid. Catalogus, Pars 69 : 496. Replacement for *Hesperia oberthüri* Aurivillius.

External characters. — The differences with ssp. *higginsi* have been dealt with under that subspecies.

Distribution. — The southern part of the range of the species, from S. Zaïre, Zambia and Malawi southwards.

Localities. — Zambia: Chilanga, Fort Jamieson, Livingstone, Luangwa Valley (BM, MN; Neave, 1910). Malawi: Florence Bay, Ruo Valley (BM; Gifford, 1965). Rhodesia: Bulawayo, Darwendale, Essexvale, Hope Fountain, Matetsi, Matope Hills, Odzi, Salisbury, Selukwe, Umtali, X-mas Pass (BM, CMP, MN, NMB). Mozambique: Rikatla (24 km N of Lourenço Marques) (BM). Botswana: Sepopa, Tshabong (NMB). South Africa. Transvaal: Balfour, Barberton, Crocodile River, Dendron, Germiston, Haenertsburg, Johannesburg, Limpopo River, Messina, Pietersburg, Potchefstroom, Pretoria, Rustenburg, Shilouvane (BM, CMP, MN, NMB; Swanepoel, 1953; Trimen, 1870). Natal: Bergville, Estcourt, Frere, Greytown, Howick, Impenza, Ladysmith, Loesskop, Middle Rest, Montello, Muden, Newcastle, Pitzkop, Tugela River, Weenen (AMNH, BM, MN, MRAC; Swanepoel, 1953). Orange Free State: Bethulie, Bloemfontein, Ladybrand, Vaal River (AMNH, BM, MRAC, NMB; Swanepoel, 1953). Cape Province: Barkly District, Brakfontein, Burghersdorp, Cape Town, Durbansville, Katzenberg, Kimberley, Lions Head, Malmesbury, Mamre, Maseru, Melkbosch, Stellenbosch, Tijgerberg (BM, ML, MN, MNHN, MRAC, NMB; Swanepoel, 1953). Lesotho: Koro Koro, Maseru, Namanthes (BM, NMB; Swanepoel, 1953; Trimen, 1870). Namibia: Niangana, Okahandja (SMW). Angola: Ehanda (Trimen, 1891).

Material examined. — 73 ♂, 56 ♀ : 4 ♂, 1 ♀, Zambia (BM); 1 ♂, 1 ♀, Malawi (BM); 5 ♂, 1 ♀, Rhodesia (BM, CMP, MN); 1 ♂, Mozambique (BM); 62 ♂ (1 ♂ holotype *mafa*), 49 ♂, South Africa (AMNH, BM, CMP, ML, MRAC); 4 ♀, Namibia (SMW).

Spialia galba (Fabricius)

Hesperia galba Fabricius, 1793. — Entomologia Systematica 3 : 352 (Tranquebar).

External characters (pl. 4 figs. 27, 28). — From the other species of the *sertorius* group *galba* is easily distinguished by the combination of a well-marked basal cell spot on the upperside of the fore wing and an unbroken, rather regular median band on the underside of the hind wing. As *galba* is the only real Oriental species of the genus, confusion with other *Spialia* species is unlikely. However, in the extreme west of the Oriental Region distributional overlap with *zebra* and *doris* does not seem impossible and it may be convenient to mention some differences.

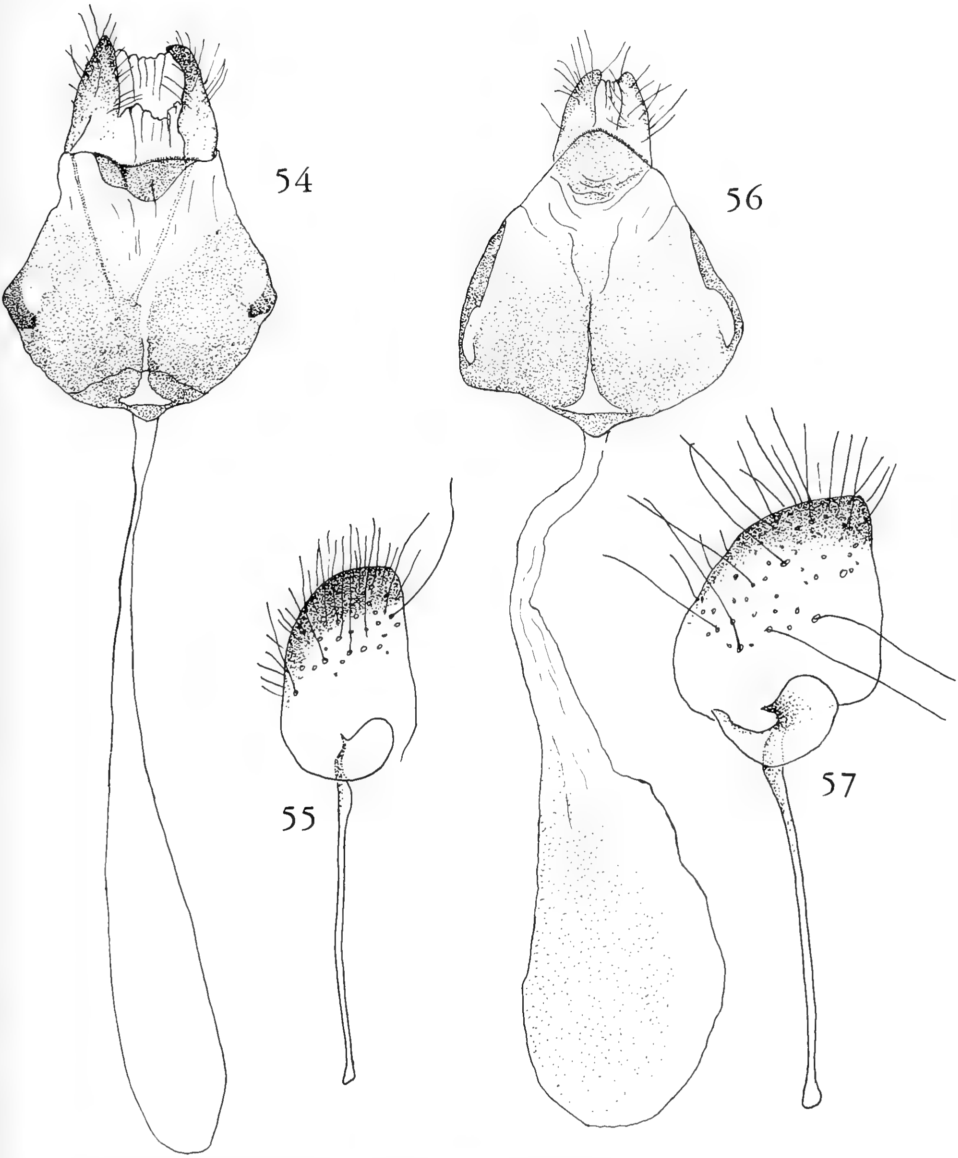
From *zebra, galba* is distinguished by the presence of a well-marked basal cell spot on the upperside of the fore wing, and from *doris* by the unbroken median band on the underside of the hind wing.

There is some variation in the development of the spots and in the size (♂ 9.4—11.8 mm), but the variation does not appear geographic, except for the variation mentioned under Geographic variation.

Swinhoe (1913) thought *"Pyrgus evanidus* Butler" to be "undoubtedly the extreme cold-weather form of *galba*". However, *"Pyrgus evanidus*" is considered a subspecies of *Spialia doris* (cf. De Jong, 1974).

Male genitalia (figs. 52, 53). — Very large fenestrula at junction of uncus and tegumen. Gnathos with large ventral "heads", occupying more than half of the entire gnathos. Costal process of valva placed before distal end of costa; continuation of costa finger-shaped, longer than in *mafa*. Cucullus with narrow fold, just covering ventral side of costal process. Between costa and cucullus a winding, but unbranched hairy fold on the inside of the valva.

Female genitalia (figs. 56, 57). — Dorsal sclerites of segment 8 along proximal edge fused with ventral sclerites. Ventral sclerites conjoined antevaginally by a narrow sclerotization. Postvaginally there is a triangular membranous area, distally enclosed by the ventral sclerites, which fuse while the sclerotization weakens. Distal edge of ventral sclerites vague, sclerotization passing into membrane that forms a pointed area spinulosa. Bursa with large area of small spines. Papilla analis rather



Figs. 54—57. Female genitalia, ventral aspect, and papilla analis. 54—55, *S. mafa higginsi* (Kenya). 56—57, *S. galba galba* (Ceylon).

short and broad, less rounded than in *mafa,* slightly triangular; basal lobe large, curving.

Ecology. — *S. galba* can commonly be found throughout the year in all sorts of open country, but in some areas it is absent during the dry season. It ascends to 2400 m in the Himalayas (ZSM) and to 2600 m in South India (Wynter-Blyth, 1957), but in Ceylon it is rare above 1300 m (Woodhouse, 1950).

Recorded food plants are *Sida rhombifolia, Hibiscus* and *Waltheria indica* (all Malvaceae) (Swinhoe, 1913; Woodhouse, 1950).

Distribution (Map 9). — Throughout India and Ceylon. In the west it extends to Karachi and Chitral, in the east it penetrates Burma as far as the S. Shan States. A single specimen is known from eastern Thailand. Still further east it occurs isolated in the island of Hainan.

Geographic variation. — Over its large Indian area *galba* does not seem to vary geographically, but in the east two subspecies can be distinguished, one confined to Hainan, the other occurring in Burma. It is obscure how far the Burmese subspecies comes into contact with the nominate form from India. The single known specimen from Thailand cannot be distinguished from Indian specimens, so for the time being it is listed under the nominate subspecies.

Spialia galba galba (Fabricius)

Hesperia galba Fabricius, 1793. — Entomologia Systematica 3 : 352 (Tranquebar).
According to Zimsen (1964) the type material includes three specimens. One of these specimens (which are in the Universitetets Zoologiske Museum, Copenhagen), however, though bearing a label with *"H. Galba"* in probably Fabricius' handwriting, comes from West Africa ("Guinee") and belongs to *S. diomus*. The remaining two specimens do not bear locality labels, but as they belong to the only *Spialia* species known to occur at the type locality of *S. galba*, one of these specimens comes into consideration as type specimen. One specimen, labelled *"Galba"* in probably Fabricius' handwriting, lacks the abdomen. The other specimen, a male labelled "Mus. Seh. e T.L." (i.e. "Museum Sehestedt e Tønder Lund") is best fitted for lectotype designation, as Fabricius mentioned the specimen to be in the Sehestedt collection. I have labelled the specimen accordingly.

Pyrgus superna Moore, 1865. — Proc. zool. Soc. London 1865 : 792 (Calcutta). Holotype (♀) in the British Museum (Nat. Hist.), London.

External characters (pl. 4 figs. 27, 28). — On the upperside of the fore wing median spot 4 conspicuously smaller than median spot 3, or absent; submarginal spot 2 in line with the other submarginal spots. ♂ 9.4—11.8 mm. Larger and smaller specimens occur throughout the area. A very small specimen (♂) from the Himalayas (Simla) was named ab. *minuscula* by Reverdin (1933), a redundant name; the specimen is in the ZSM.

Distribution. — The western subspecies, occupying the whole range of the species west of Burma. As the single known specimen from Thailand cannot be distinguished from this subspecies, it is provisionally listed here.

Localities. — Pakistan: Chitral, Karachi (BM, LNK). India: throughout, from Kutch in the west to the Naga Hills in the east, and from Kashmir in the north to Madras in the south (AMNH, BM, ML, ZSM). Ceylon: throughout (AMNH, BM, CMP, ML, USNM). Nepal: Baklore (W. Terai), Bhainse Dobhan (Chisapani Garhi), Katmandu, Katmandu Valley, Magarkot Manbu, Rangit Valley, Rapti Valley, Sun Khosi Valley (AMNH, BM, ZSM). Sikkim: Sikkim (BM, UNSM). Bhutan: Bhutan (BM, USNM). Thailand: Khun Kaen (USNM).

Material examined. — 229 ♂, 163 ♀ : 6 ♂, 2 ♀, Pakistan (BM, LNK); 157 ♂, 118 ♀, India (AMNH, BM, CMP, ML, ZSM); 34 ♂, 24 ♀, Ceylon (AMNH, BM, CMP, ML, USNM); 19 ♂, 10 ♀, Nepal (AMNH, BM, NRS, ZSM); 11 ♂, 8 ♀, Sikkim (BM, USNM); 2 ♂, 1 ♀, Bhutan (BM, USNM); 1 ♂, Thailand (USNM).

Spialia galba shanta Evans

Spialia galba shanta Evans, 1956. — Ann. Mag. Nat. Hist. (12) 9 : 750 (Hsipaw, S. Shan States). Holotype (♂) in the British Museum (Nat. Hist.), London.

External characters. — On the upperside of the fore wing median spot 4 well-developed, as large as median spot 3; submarginal spot 2 in line with the other submarginal spots. ♂ 10.4—11.5 mm.

Distribution. — N. and S. Shan States, Burma.

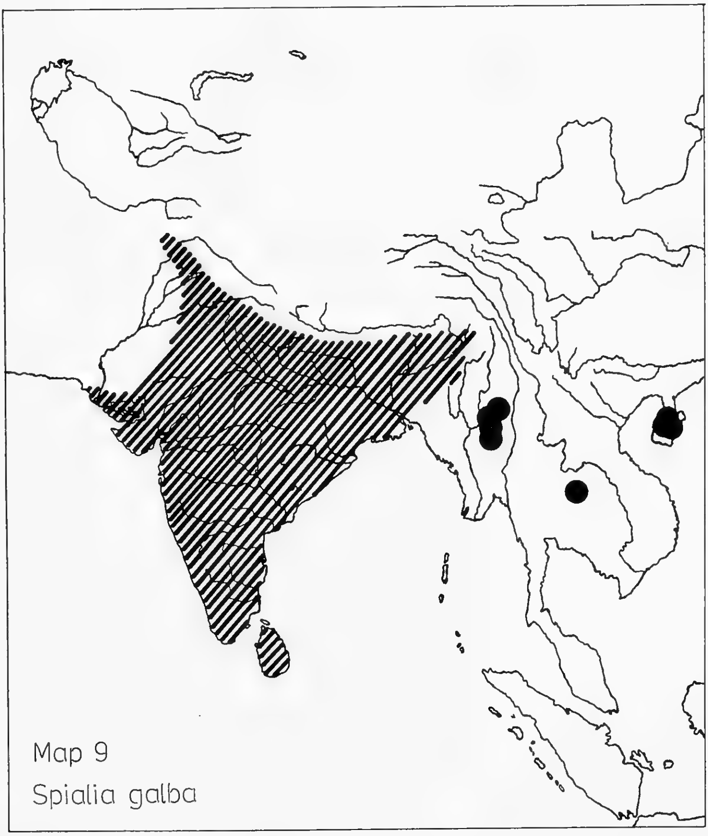
Localities. — Burma: Hsipaw, Maymyo, Tilin Yaw, Poungadaw nr. Thayetmyo, Myingyan, 40 km E. of Taunggyi (BM, NRS).

Material examined. — 7 ♂, 12 ♀, Burma (incl. ♂ holotype) (BM, NRS).

Spialia galba chenga Evans

Spialia galba chenga Evans, 1956. — Ann. Mag. Nat. Hist. (12) 9 : 750 (Kiung-Chow, Hainan). Holotype (♂) in the British Museum (Nat. Hist.), London.

External characters. — On the upperside of the fore wing median spots 3 and 4 equal, as in ssp. *shanta*, submarginal spot 2 placed further from termen than in



Map 9
Spialia galba

other subspecies, giving the submarginal series a much more sinuous aspect. ♂ 10.6—10.7 mm.

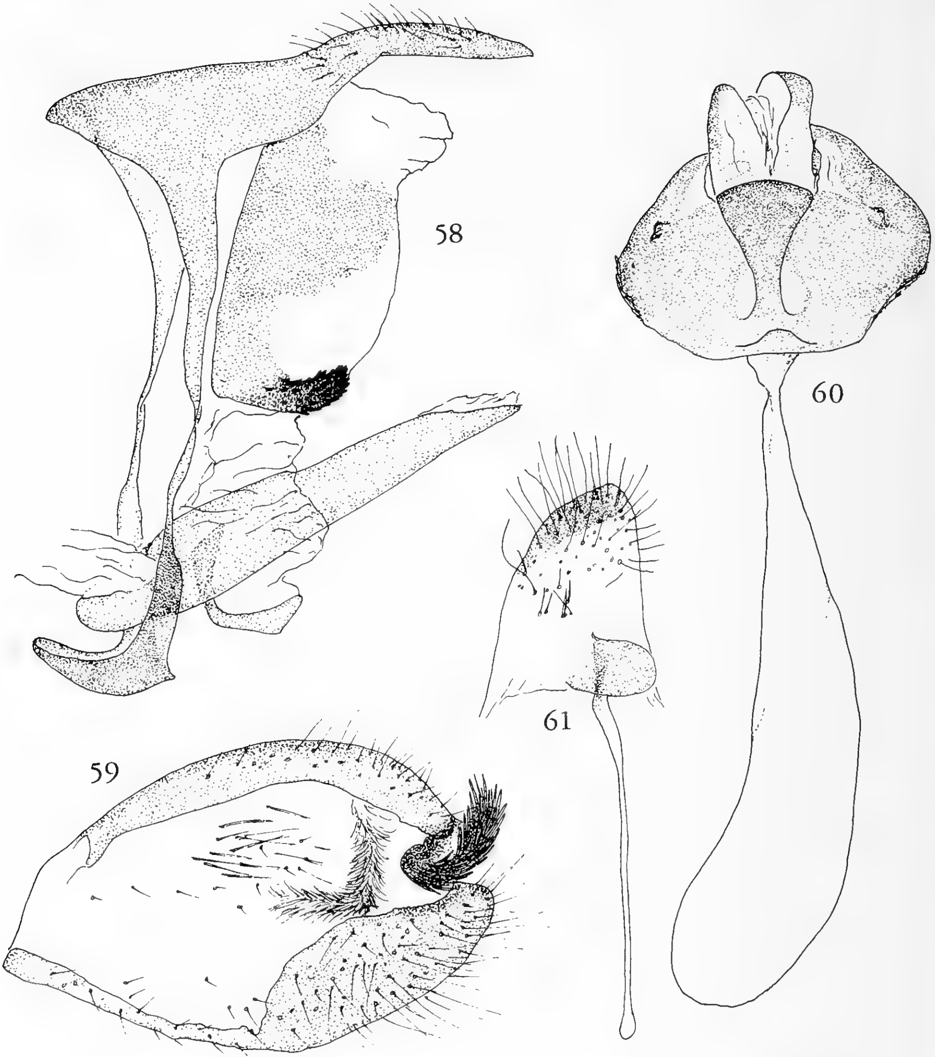
Distribution. — Hainan.

Localities. — Hainan: Cheng-Mai, Kiung-Chow, Porten, Youboi (BM).

Material examined. — 2 ♂, 3 ♀, Hainan (incl. ♂ holotype) (BM).

Superspecies *Spialia sertorius* (Hoffmansegg)

This superspecies has extensively been dealt with in my previous paper on



Figs. 58—59. Male genitalia, lateral aspect, and inside of right valva of *S. orbifer orbifer* (Greece). Figs. 60—61. Female genitalia, ventral aspect, and papilla analis of *S. sertorius sertorius* (Chiclana, S. Spain).

Spialia (De Jong, 1974). It may suffice to mention here only the characters by which the two constituting species are distinguished from other *Spialia* species and to give some new information on the distribution of the species.

External characters (pl. 4 figs. 29—32). — From the other species of the *sertorius* group, viz., *mafa* and *galba, sertorius* and *orbifer* are easily distinguished by the absence of a basal cell spot on the upperside of the fore wing, while this character in combination with the absence of median spot 6 on the underside of the hind wing and the direction of the median band towards the inner spot in space 7 separates *sertorius* and *orbifer* from all other *Spialia* species.

Male genitalia (figs. 58, 59). — No fenestrula at junction of uncus and tegumen. Gnathos with relatively narrow heads. Costal process of valva at distal end of costa. Cucullus dorsally hollowed to receive the costal process, but without definite fold. Hairy fold between costa and cucullus on inside of valva curved or angled, neither winded nor branched.

Female genitalia (figs. 60, 61). — Dorsal sclerites of segment 8 broadly fused to ventral sclerites; the enclosed membranous area between the dorsal and ventral sclerites found in *mafa* and *galba* reduced to a small pit at the top of a lateral bump. Antevaginally ventral sclerites connected by sclerotization that is continued over short distance into ductus. Postvaginally a wide membranous area, containing a large oblong sclerotization, which starts from the ductus and distally expands strongly before passing into the area spinulosa. Bursa without ornamentation. Papilla analis slightly pointed.

Ecology. — Food plants: Rosaceae.

Distribution. — The combined distribution areas of *sertorius* and *orbifer* comprise the greater part of the Palaearctic Region, from the Atlantic Ocean to Korea and the Amur Region, southwards to NW. Africa, Israel and N. Baluchistan, northwards to the Netherlands, C. Germany, C. Russia and into Siberia. The only other *Spialia* species, which occur within this area, belong to the *phlomidis* group.

Spialia sertorius (Hoffmansegg)

In my 1974 paper on *Spialia* I referred to a paper by Kauffmann (1955), who reported the occurrence of ssp. *sertorius* in Corsica, suggesting that ssp. *sertorius* and ssp. *therapne* are sympatric in this island. Recently I could study the material that prompted Kauffmann to the mentioned paper: 20 specimens in the ZSM, all bearing the following data: Evisa, 15.VI.—2.VII.1954, Leinfest. They are inseparable from ssp. *sertorius*. The long series, all from the same date and locality, suggests the presence of a prospering population. However, the prosperity of the population makes it improbable that it was not found before (and after as well). For this reason I have some doubts about the correctness of the labels.

Spialia orbifer (Hübner)

1. Ssp. *orbifer*. In addition to the 10 ♂ and 6 ♀ from Sicily mentioned in 1974, I have studied 4 ♂ and 1 ♀ from this island (ZSM). They confirm the idea

that there is no pure *orbifer* in Sicily, the female being similar to *sertorius*, the males being closer to *orbifer*. Their sizes fall within the limits mentioned in 1974 for Sicilian specimens.

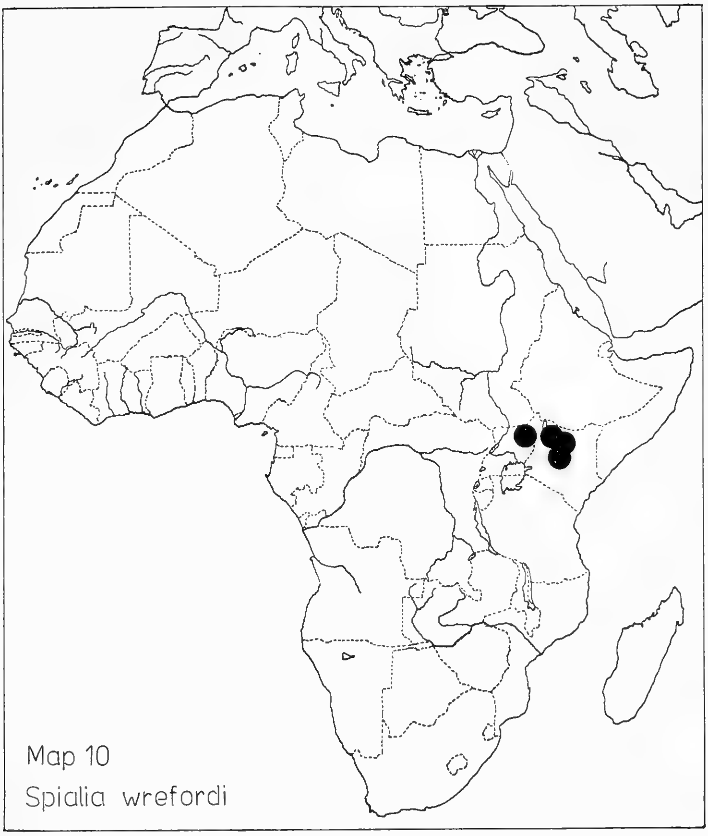
2. Ssp. *carnea*. The 55 additional specimens studied from Afghanistan demonstrate that this subspecies is rather well distributed in this country, but it is scarcely found below 2000 m. It appears that in most specimens the submarginal spot in spaces 4 and 5 on the underside of the hind wing is as large as in other subspecies of *orbifer*, contrary to what was stated in my 1974 paper. In a nice series of 24 ♂ and 2 ♀ from Badakhshan (CN) all males are dark due to almost complete absence of submarginal spots on the upperside, while these spots are well-developed in the two females. On the average the specimens are smaller than *carnea* specimens from other localities, the males measuring 11.8—13.5 mm. The ground colour of the underside of the hind wing is yellow or brown rather than red, and more or less strongly overshaded by black scales. The spots on the underside of the hind wing are well-developed, contrary to the upperside, where in most cases the median band is reduced to an exclamation mark: a white bar closing the cell and a white point in space 2.

f. The *dromus* group

External characters. — Basal cell spot on fore wing upperside present; central cell spot central between basal cell spot and discocellular spot; no spots in spaces 9 and 10; submarginal spots usually all present, but sometimes vague; outer median spot 1b absent, 1c absent or present; inner median spot 1b present, 1c rarely absent. Median spots on hind wing underside all present (except in *paula*, where median spot 6 is absent), forming a continuous band of very diverging shape and direction; submarginal spots 4 and 5 in line with the other submarginal spots. Male without costal fold.

Male genitalia. — Uncus undivided; junction with tegumen slightly marked, no fenestrula. Gnathos dorsally joined to tegumen over short distance, ventrally passing into a semiglobular fold, which is finely spinulose, thus suggesting sclerotization; the fold is medially uplifted, so that there is a left and right part. Anellus dorsally strongly sclerotized to form a roof or a winged structure over the aedeagus. Aedeagus straight or slightly S-shaped, surface smooth. Saccus relatively long. Costal process of valva well-developed, with long spines usually directed cephalad (towards base of valva) or cephalo-dorsad (spines upturned). Cucullus with a fold, that partly conceals the costal process.

Female genitalia. — Segment 8 with two dorsal and two ventral sclerites, separated by membranes. The ventral sclerites may touch each other, but are not conjoined. Membranous postvaginal region with a slight triangular sclerotization that usually imperceptibly passes into the area spinulosa. Ductus usually long and gradually passing into bursa. Bursa without ornamentation. Papilla analis without basal lobe; apophysis posterior usually longer than papilla.



Spialia wrefordi Evans

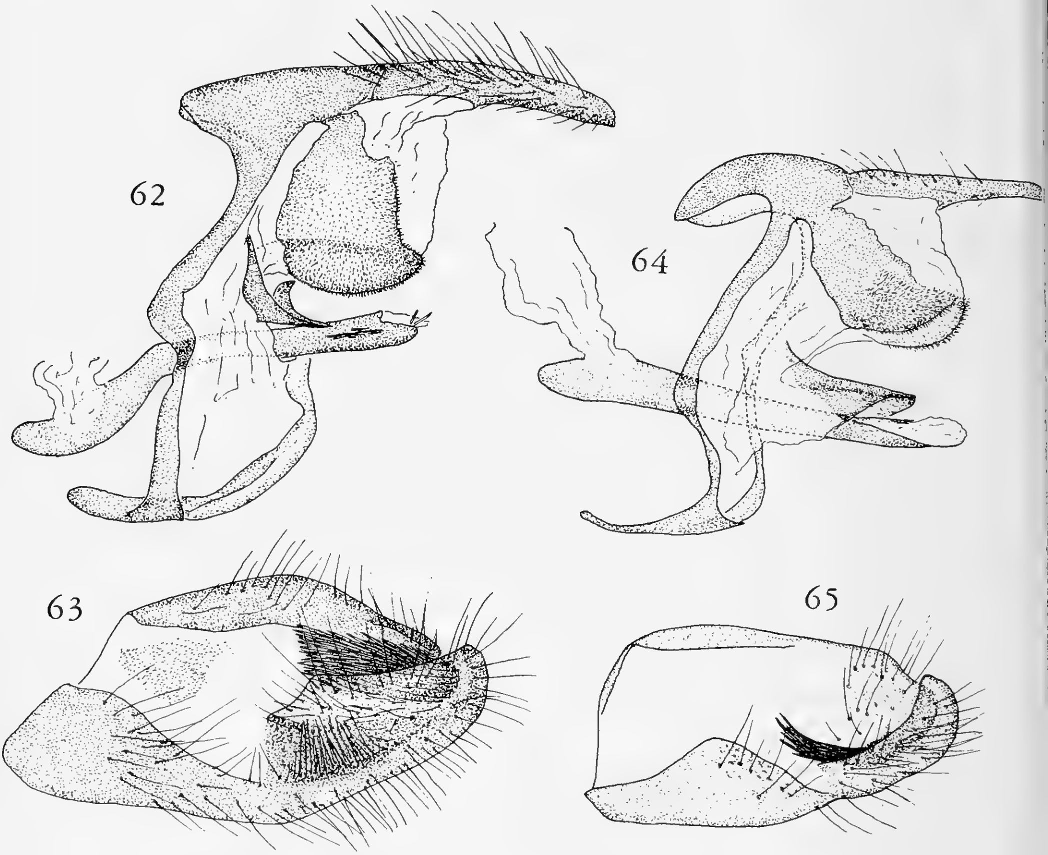
Spialia wrefordi Evans, 1951. — Ann. Mag. Nat. Hist. (12) 4 : 1270—1271 (Kotido, Karamoja, Uganda). Holotype (♂) in the British Museum (Nat. Hist.), London.

External characters (pl. 5 figs. 33, 34). — Easily recognized by the extensive spotting on the upper and undersides of the wings. The very large basal cell spot on the upperside of the fore wing (about twice as long as broad and much larger than the central cell spot) is found in no other *Spialia* species. On the upperside of the hind wing the most distinctive character, apart from the strong development of the spots, is the median spot 1c that runs from vein 1b to vein 2. On the underside of the hind wing the median band is more or less divided by darker veins, especially veins 4 and 7, so that the underside reminds of a strongly spotted *S. colotes*, but the submarginal spots 4 and 5 are not out of line as in that species. ♂ 8.5—11.7 mm, ♀ 10.5—13 mm.

Male genitalia (figs. 62, 63). — Dorsal sclerotization of anellus laterally upturned. Aedeagus S-shaped. Saccus distinctly shorter than uncus. Costal process with straight, horizontal spines, directed cephalad, not upturned. Near base of valva a spinulose area in the membrane between costa and sacculus.

Female genitalia (figs. 70, 71). — Area spinulosa deeply indented, forming a gap that is closed by the distinct, triangular, postvaginal sclerotization. Papilla analis short, broader than long; apophysis posterior short, slightly longer than length of papilla, slightly shorter than width of papilla.

Ecology. — Unknown. The known specimens have been caught during the months April, June and July. Apparently restricted to dry and hot areas.



Figs. 62—65. Male genitalia, lateral aspect, and inside of right valva. 62—63, *S. wrefordi* (Kotido, Uganda). 64—65, *S. paula* (Essexvale, Rhodesia).

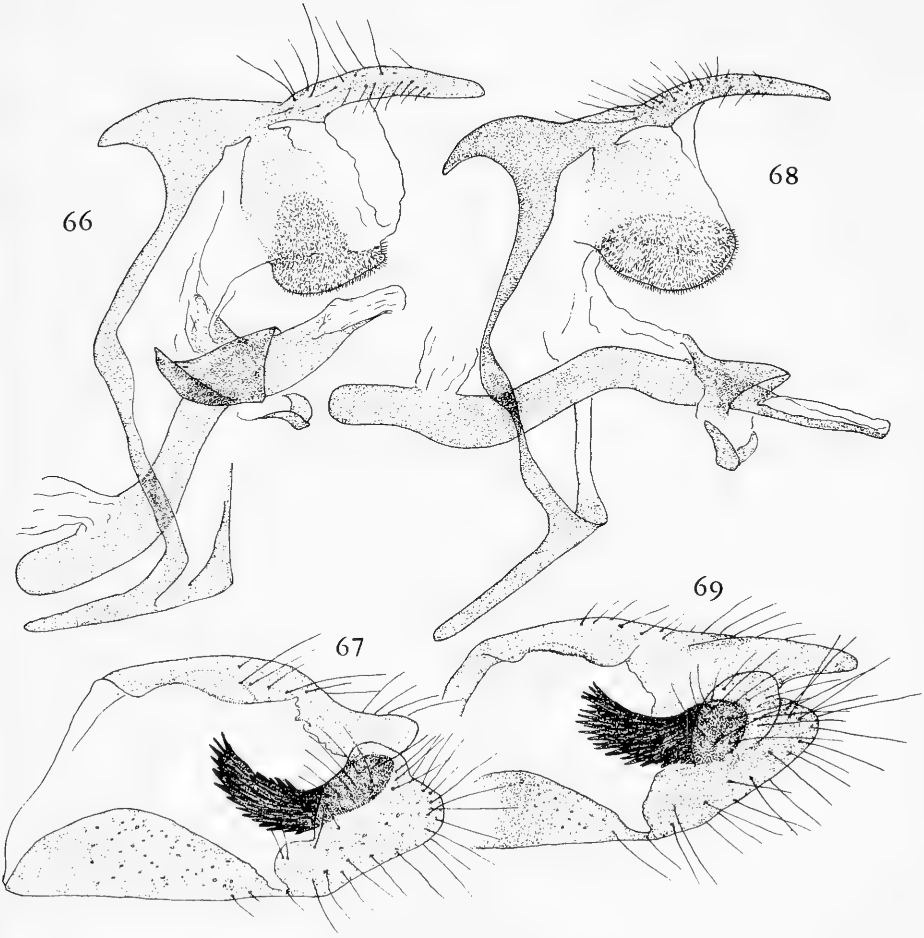
Distribution (Map 10). — Only known from four localities, viz., Kotido (Uganda, Karamoja), Samburu Game Reserve (Kenya, Rift Valley Prov.), Mt. Kulal and Mt. Marsabit (both Kenya, Eastern Prov.). Undoubtedly, this species is more widely distributed in the badly known dry northern parts of Uganda and Kenya.

Material examined. — 19 ♂, 12 ♀ : 18 ♂ (incl. holotype), 10 ♀, Uganda (AMNH, BM, ML, MN); 1 ♂, 2 ♀, Kenya (AMNH, BM, ML).

Spialia paula (Higgins)

Hesperia paula Higgins, 1924. — Trans. ent. Soc. London 1924 : 77, pl. 8 fig. 22 (Bulawayo, Rhodesia). Holotype (♂) in the British Museum (Nat. Hist.), London.

External characters (pl. 5 figs. 35, 36). — This species differs from the other species of the *dromus* group in the absence of median spot 6 on the underside of the hind wing. In this respect it may be confused with *mafa* and *spio,* though these species, and especially *spio,* are usually much larger. However, the shining white of most spots on the underside of the hind wing and the fusion of median spots 1c and 2 on the same wing make the distinction of *paula* not extremely difficult.



Figs. 66—69. Male genitalia, lateral aspect, and inside of right valva. 66—67, *S. ploetzi ploetzi* (Namwamba Valley, Uganda). 68—69, *S. ploetzi occidentalis* (Warri, Nigeria).

In the few specimens studied the length of the fore wing varies in the male from 8.4 to 9.1 mm, in the female from 10 to 10.2 mm.

Male genitalia (figs. 64, 65). — Dorsal sclerotization of anellus laterally bent downwards, forming a roof over the aedeagus. Aedeagus straight. Saccus slightly shorter than uncus. Costa of valva in distal part indistinctly delimited. Costal process narrow, curving upwards, so that the spines point cephalo-dorsad.

Female genitalia (figs. 72, 73). — Ventral sclerites of segment 8 very narrowly conjoined antevaginally. Weak triangular sclerotization in membranous postvaginal area, separated from slightly indented area spinulosa by a narrow membranous band. Papilla analis pointed, longer than wide; apophysis posterior much longer than papilla.

Ecology. — In S. Africa *paula* is on the wing from August to April (Swanepoel, 1953). It usually flies over grassy hill slopes. Food plants have not been recorded.

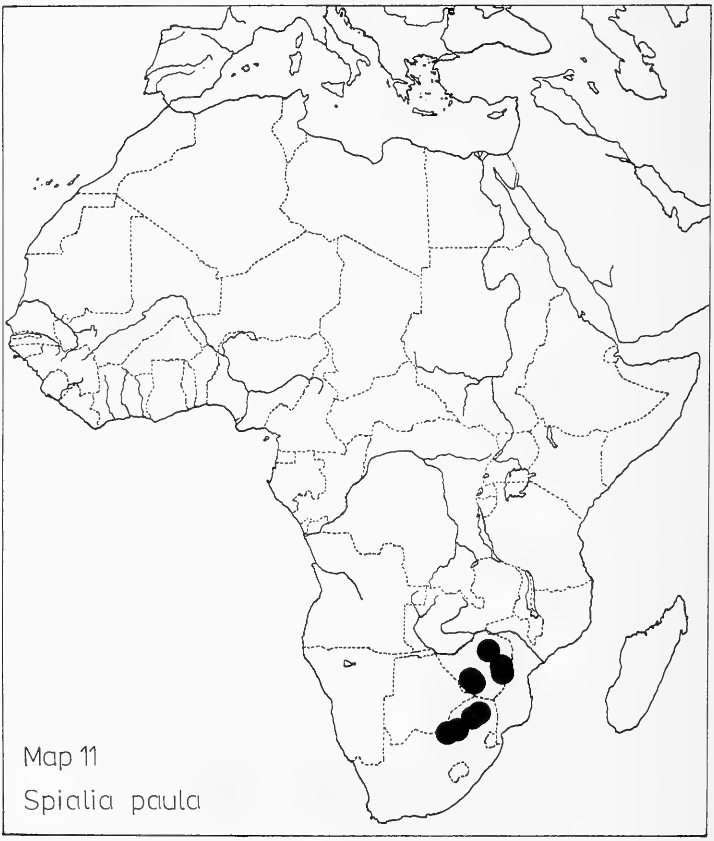
Distribution (Map 11). — A very restricted range, in Transvaal and Rhodesia.

Localities. — Rhodesia: Bulawayo, Essexvale, Filabusi, Gwanda, Penkridge, Salisbury, Umtali (BM, MN, MNHN, NMB). South Africa. Transvaal: Munnik, Pietersburg, Rustenburg, Swartruggens (NMB; Swanepoel, 1953).

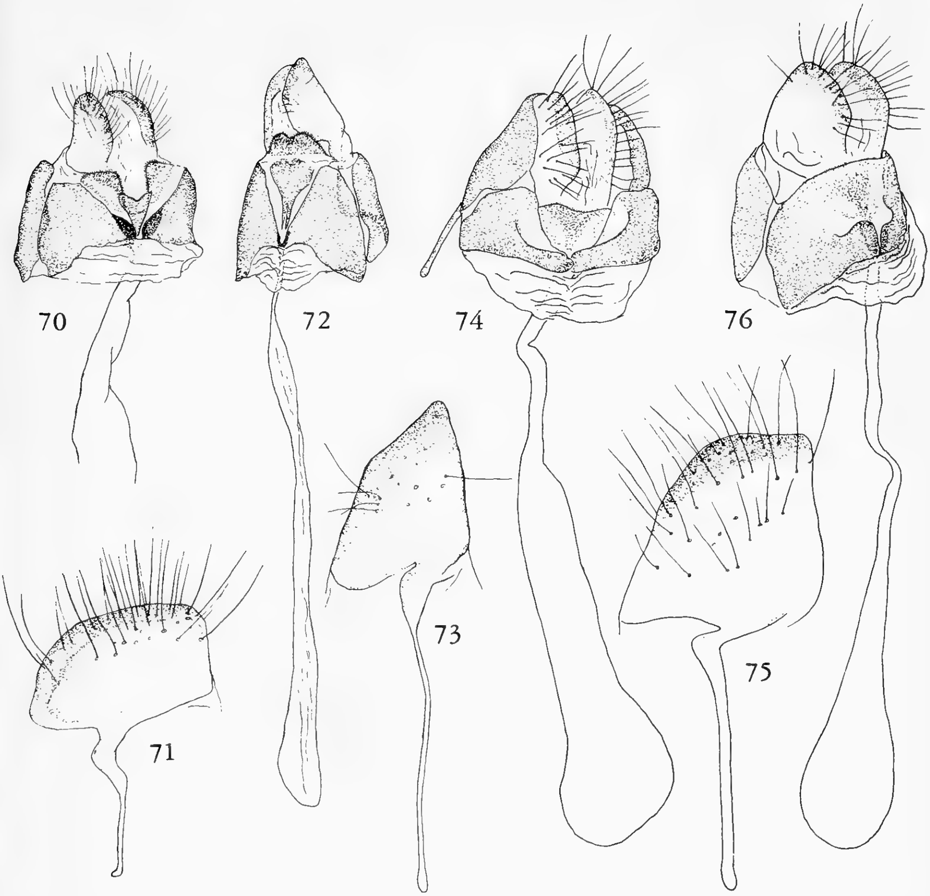
Material examined. — 4 ♂, 2 ♀ : 4 ♂ (incl. holotype), 1 ♀, Rhodesia (BM, MN); 1 ♀, South Africa (BM).

Spialia secessus (Trimen)

Pyrgus secessus Trimen, 1891. — Proc. zool. Soc. London 1891 : 102, pl. 9 fig. 22 (Omrora, Damaraland). Holotype (♂) in the South African Museum, Cape Town.



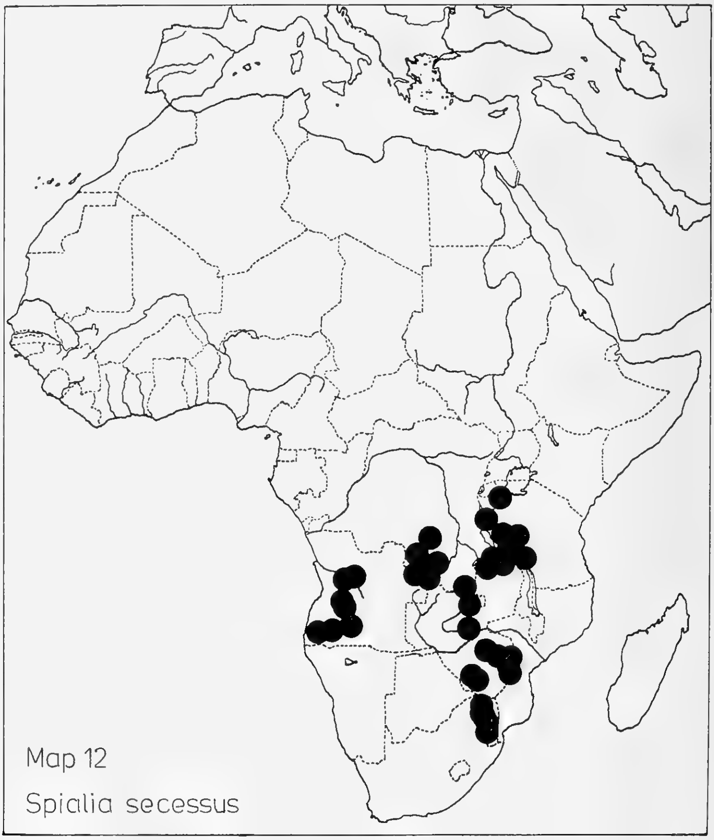
Hesperia secessa forma *trimeni* Aurivillius, 1925. — Hesperidae, in: A. Seitz, The Macrolepidoptera of the World 13 : 564, pl. 75d (Rhodesia). The type of *trimeni* is probably lost; the only *trimeni* in the Naturhistoriska Riksmuseet, Stockholm, is a male from Angola.



Figs. 70—76. Female genitalia, ventral and lateroventral aspect, and papilla analis. 70—71, *S. wrefordi* (Kotido, Uganda). 72—73, *S. paula* (Essexvale, Rhodesia). 74—75, *S. ploetzi ploetzi* (Namwamba Valley, Uganda). 76, *S. ploetzi occidentalis* (Bingerville, Ivory Coast).

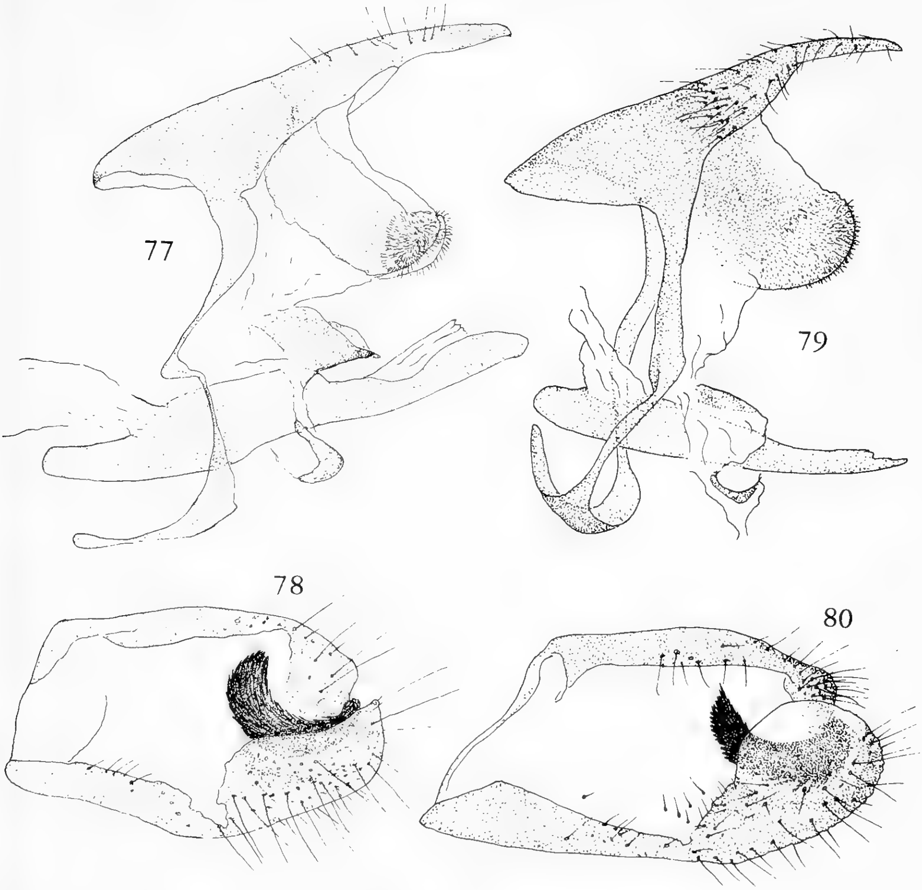
External characters (pl. 5 figs. 37, 38). — This species is unlike any other *Spialia* species on the underside of the hind wing, where the median band is straight and of even width throughout, with the outer margin finely denticulate (i.e. slightly produced along the veins); this denticulation is accentuated by a darkening of the ground colour along the outer margin of the band. The inner margin of the band is less clearly defined. The effect is difficult to express in words, but the photograph gives a good impression, and once having seen a real specimen, it is improbable that one confuses this species with any other *Spialia* species. Moreover, there are two colour forms, one of which is particularly distinct, because the band on the underside of the hind wing is brown instead of white; as the ground colour is also brown, the band is mainly distinguishable by the darkening of the ground colour along its outer margin.

The two colour forms have been named forma *secessus* Trimen (median band on hind wing underside brown) and forma *trimeni* Aurivillius (median band on hind wing underside white or cream-coloured). Aurivillius (1925: 564) supposed these forms to be the result of seasonal variation. This assumption is undoubtedly correct, as their ranges overlap completely and their flight periods are largely separated. However, while Aurivillius considered f. *trimeni* the wet season form, Evans (1937) mentioned f. *secessus* as such. I think Aurivillius was right. Almost all specimens of f. *secessus* examined were collected in July and August, while the bulk of f. *trimeni* examined date from October till February. In the distribution area of the species the rains usually occur in the latter period, while July and August are dry.



There are some exceptions, especially in f. *secessus* of which I have seen single specimens from January, May, June, September and October, while f. *trimeni* may appear as early as September and single specimens are known from April, May and June. Supposing these specimens are correctly labelled, they may be the result of microclimatic differences. The brown band of f. *secessus* occurs in various shades and specimens intermediate between f. *secessus* and f. *trimeni* occur, especially in April-May and September.

Male genitalia (figs. 77, 78). — Gnathos relatively narrow and double semiglobular spinulose fold smaller than in other species of the group. Dorsal sclerotization of anellus upturned laterally. Aedeagus rather thick in central part, laterally slightly expanded in distal part, but apex narrow. Saccus well-developed, but shorter than uncus. Costa of valva distally expanded, mainly in ventral direction. Costal process strongly upturned, spines pointing dorsad. Fold of cucullus not covering base of costal process.



Figs. 77—80. Male genitalia, lateral aspect, and inside of right valva. 77—78, *S. secessus* (Mpanda, Tanzania). 79—80, *S. dromus* (Tabora, Tanzania).

Female genitalia (figs. 81, 82). — Ventral sclerites of segment 8 widely separated near ostium. Sclerotization of postvaginal membranous region slight, but distinct, proximally continued over a short distance in dorsal side of ductus, distally passing into protruding, unindented area spinulosa. Papilla analis obtusely triangular; apophysis posterior nearly 1.5 times as long as papilla.

Ecology. — A species of grassy slopes, flying in probably two, maybe more generations, mainly from July to February, rarely from March to June. Food plants not recorded.

Distribution (Map 12). — From Tanzania and S. Zaïre to Transvaal and Natal.

Localities. — Tanzania: Butler South, Chala (Ufipa), Dunduma, Kampissa, Kasoje, Kassaka River, Katari, Kotuma, Lubalisi, Mahale, Mbisi Forest, Mbosi, Mpanda, Sibweza, Sitebi, Tungamu (Ngara), Wanzizi (BM, ML, MN, MRAC, ZSM). Zambia: L. Bangweolo (Luwingu), High Plateau south of Lake Tanganyika, Kafue Flats, Lofu River, Mporokoso, Ndola (BM, NRS, ZSM; Neave, 1910). Rhodesia: Bulawayo, Essexvale, Gurbi River, Headlands (E. Mashonaland), Hopefountain (nr. Bulawayo), Inyanga Mts., Melsetter, Odzani River (Umtali), Salisbury (BM, NMB). South Africa. Transvaal: Barberton, Graskop, Groenbult, Haenertsburg, Helpmekaar, Munnik, Nelspruit, Shilouvane, White River (BM; Murray, 1959; Swanepoel, 1953). Natal: Natal (BM). Angola: Bailundo, Bihe Distr., Capelongo-Dongo, Cauca, Chitau, Cubal River, Omrora (AMNH, BM, CMP, MNHN, NRS; Trimen, 1891). Zaïre: Bukama, Ditanto, Elisabethville, Kafakumba, Kambove (150—200 mls W of Kambove), Kapanga River, Kapelekese, Karavia, M'Pemba Zeo (Gandajika), Sando (BM, MRAC).

Material examined. — 102 ♂, 42 ♀ : 51 ♂, 18 ♀, Tanzania (BM, ML, MN, MRAC, ZSM); 5 ♂, 3 ♀, Zambia (BM, NRS, ZSM); 5 ♂, Rhodesia (BM, MN); 1 ♂, Natal (BM); 3 ♂, 7 ♀, Transvaal (BM); 7 ♂, 5 ♀, Angola (AMNH, BM, CMP, NRS); 30 ♂, 9 ♀, Zaïre (BM, MRAC).

Spialia dromus (Plötz)

Pyrgus dromus Plötz, 1884. — Mitt. Naturwiss. Ver. Neu-Vorpomm. 45 : 6 (Congo). Type(s) lost. Holland (1896) mistrusted the type-locality given by Plötz, because he supposed *dromus* not to occur "further north than Angola on the West Coast", a very incorrect supposition.

Pyrgus zaira Plötz, 1884. — Mitt. Naturwiss. Ver. Neu-Vorpomm. 45 : 6 (Congo). Type(s) lost.

Syrichthus melaleuca Oberthür, 1912. — Et. Lép. Comp. 6 : 113, fig. 1327 (Kitanga). Holotype (♂) in the British Museum (Nat. Hist.), London.

Syrichthus leucomelas Oberthür, 1912. — Et. Lép. Comp. 6 : 118, fig. 1308 (Mpala, L. Tanganyika). Holotype (♂) in the British Museum (Nat. Hist.), London.

Hesperia dromus var. *elongata* Higgins, 1924. — Trans. ent. Soc. London 1924 : 95 (Makindu, Kenya). Holotype (♂) in the British Museum (Nat. Hist.), London.

Hesperia dromus var. *meridionalis* Higgins, 1924. — Trans. ent. Soc. London 1924 : 95 (Zanzibar). Holotype (♂) in the British Museum (Nat. Hist.), London.

External characters (pl. 5 figs. 39, 40). — This species can be distinguished by the following combination of characters:

a. Fore wing upperside. — Basal cell spot well-defined, rounded; central cell spot midway between basal cell spot and discocellular spot; inner median spots 1b and 1c present, forming a bar from vein 1 to vein 2, outer median spots 1b and 1c absent or 1c visible as a small spot at the outer lower angle of median spot 2.

b. Hind wing underside. — Band of median spots continuous from vein 1b to costa, sharply bent basad in space 2.

The characters of the upperside of the fore wing will usually suffice to distinguish *dromus* from all other *Spialia* species.

There is much variation in the extension of the spots and some forms have received names. In forma *meridionalis* Higgins, the spots are reduced on the upperside and the submarginal spots may be entirely wanting. A specimen without median spots on the upperside of the fore wing except in space 1b, but with well-developed submarginal spots, was described as a new species, *melaleuca,* by Oberthür (1912), but the genitalia of this specimen clearly showed it to belong to *dromus,* of which it appears to be a unique aberration. Another aberrant male in the BM, from Natal, has the spots on the upperside of the hind wing wanting except for the basal cell and small submarginal spots, while most of the spots on the upperside of the fore wing are abnormally large, reminding of forma *taras* of *Pyrgus malvae* L.

A form with the band of median spots on the upperside of the hind wing distinctly continued across space 1c (as on the underside) was named "var. *elongata*" by Higgins (1924). This character is also found in the forma *leucomelas* that was described as a new species by Oberthür (1912) and only differs from *elongata* in the extremely broad band of median spots of the hind wing.

There is also much variation in the length of the fore wing, see under Geographic variation.

Male genitalia (figs. 79, 80). — Dorsal sclerotization of anellus flat or medially slightly depressed. Aedeagus straight, cylindrical. Saccus shorter than uncus. Costal process of valva long, upturned, with long spines pointing ventrad and cephalo-dorsad; fold of cucullus covers greater part of costal process, including its base.

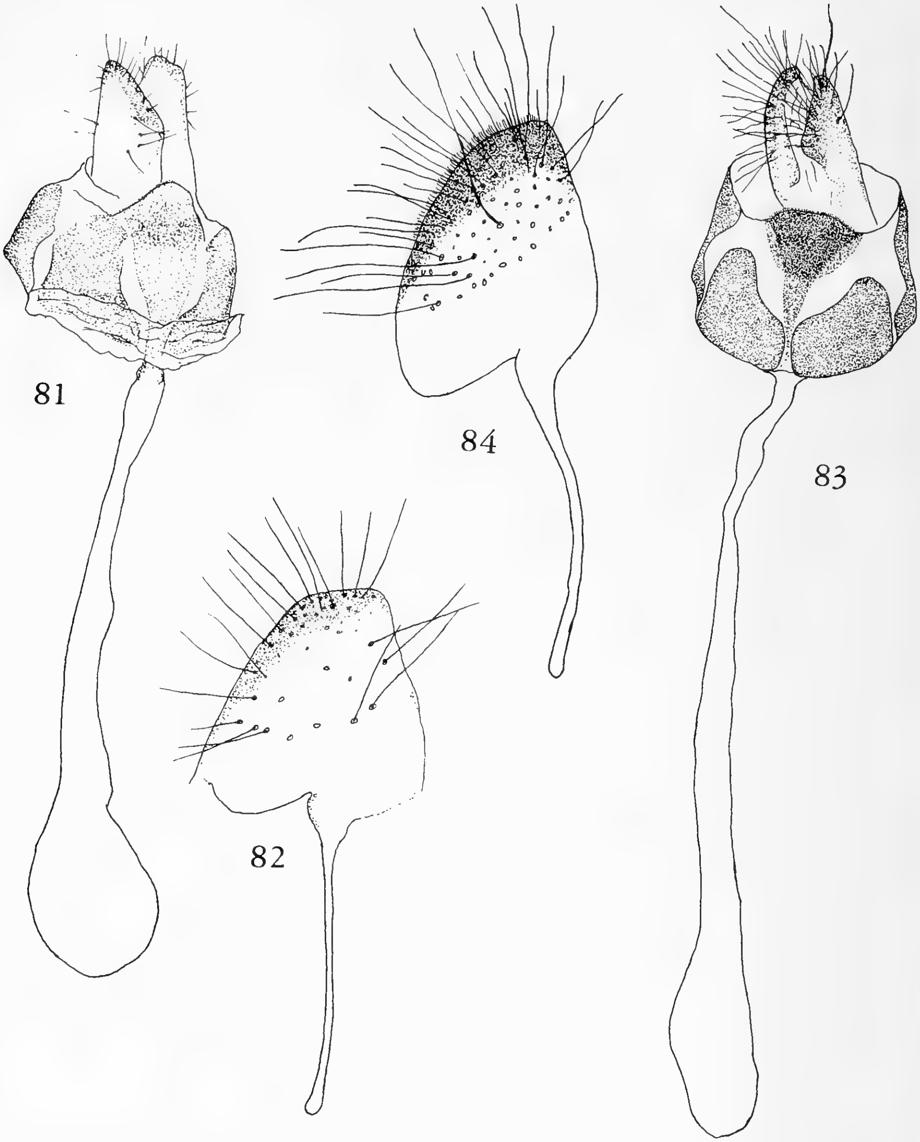
Female genitalia (figs. 83, 84). — Ventral sclerites of segment 8 well-defined, separated from each other and from the dorsal sclerites by a membranous gap. Postvaginal membranous region with triangular sclerotization that is especially distinct in its narrow part near the ostium and that passes into the unindented area spinulosa. Papilla analis rather triangular; apophysis posterior somewhat longer than papilla.

Ecology. — *S. dromus* is more at home in wooded areas than in open savanna and can particularly be encountered at forest fringes, along forest paths, etc., though not in dense forest. It has been found flying in all months of the year. Recorded food plants are *Triumfetta tomentosa* Boj. and *rhomboidea* Jacq. (Tiliaceae) (Murray, 1959; Gifford, 1965).

Distribution (Map 13). — One of the most widely distributed *Spialia* species in Africa, occurring from Natal to Ethiopia and Senegal. Although it is apparently less common than *diomus* in S. Africa, *dromus* appears to be the commoner species in the rest of Africa. It reaches its greatest abundance in Central and East Africa and it is outnumbered by *spio* in West Africa. The absence of records from many regions (e.g. Liberia, Lindsey & Miller, 1965; Guinea and Ivory Coast, Berger, 1962) is undoubtedly due to incomplete collecting.

Geographic variation. — There appears to be a slight clinal variation in the length of the fore wing (♂ 9.1—13.8 mm) and the extension of the white spots. In general, the larger and better marked specimens are found in the south, but there is very much overlap in the length of the fore wing and the extension of the spots in the various regions. Although specimens with large spots are most common in the southern part of Africa (north to Tanzania), the form *elongata* is most common in the western and northern parts of the distribution area. The large range of overlap makes it impossible to delimit subspecies.

Localities. — Ethiopia: Cherosh Wonz, Fich (Shoa Prov.), Gimera to N. end of L. Rudolf (BM; Carpenter, 1935). Sudan: Jebel Marra (W. Darfur), Talanya (Vambio) (BM). Kenya: throughout (AMNH, BM, CMP, ML, MN, MNHN).

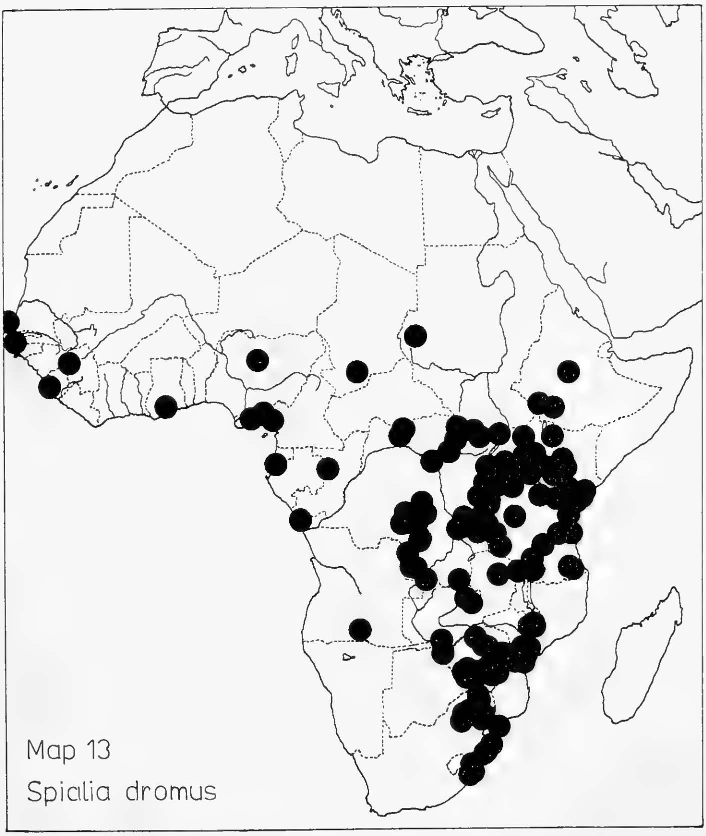


Figs. 81—84. Female genitalia, ventral aspect, and papilla analis. 81—82, *S. secessus* (Mpanda, Tanzania). 83—84, *S. dromus* (Natal).

Uganda: throughout (AMNH, BM, CMP, MN). Tanzania: throughout (AMNH, BM, ML, MN, MNHN, MRAC, NMB, ZSM). Rwanda: Kitengi, Ruhengeri (ML, MRAC). Burundi: Bukcba-Usumbura, Kitega, Muyaga (MRAC; Rebel, 1914). Zambia: throughout (BM, NMB, USNM, ZSM; Neave, 1910). Rhodesia: throughout (BM, ML, MRAC, NMB, USNM). Malawi: throughout (BM, CMP, NMB, USNM; Gifford, 1965). Mozambique: Amatonga Forest, Andrada, Delagoa Bay, Dondo Forest, Gorongoza, Inhaminga, Lourenço Marques, Salone Forest, Serra

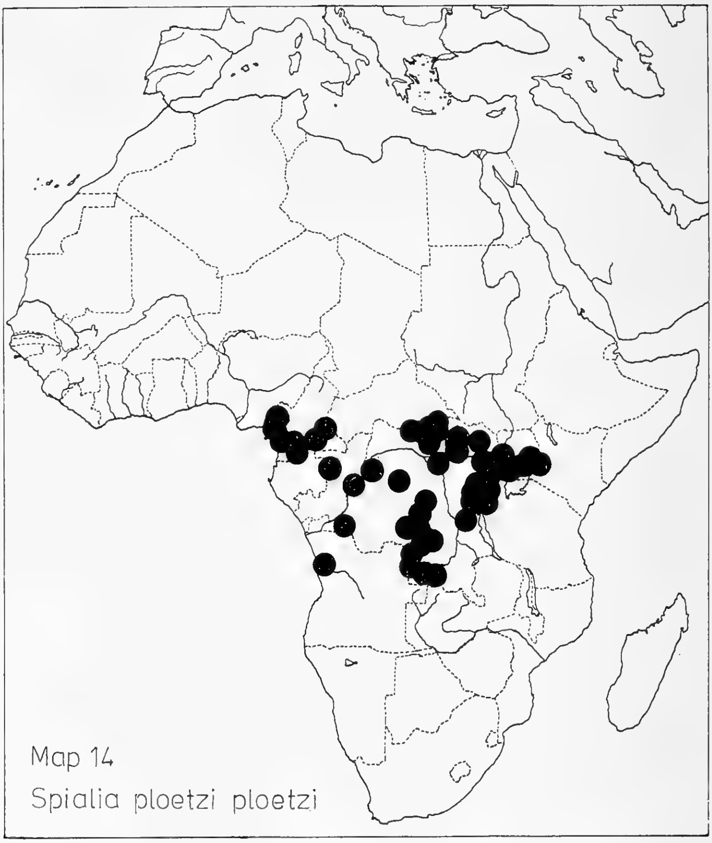
Rotanda (BM, ML, MNHN, NMB, ZSM). South Africa. Transvaal: Barberton, Chuniespoort, Graskop, Konatipoort, Louis Trichardt, Lydenburg Distr., Malta Forest, Mariepskop, Mica, Munnik, Nelspruit, Olifantsrivier, Pietersburg, Potgietersrust, Pretoria, Saltpan, Sibasa, Tubex, Warmbaths, Woodbush, Zoutpansberg (NMB; Swanepoel, 1953). Natal: Amahlongwa, Durban, Eshowe, Greytown, Hluhluwe, Howick, Isipingo, Ismont, Karkloof, Maritzburg, Umbloti, Umkomaas (AMNH, BM, CMP, ML, MNHN, MRAC, NMB, ZSM; Swanepoel, 1953). Angola: Ehanda (BM; Trimen, 1891). Zaïre: throughout (AMNH, BM, CMP, MNHN, MRAC; Holland, 1920). Congo-Brazzaville: Etoumbi (Berger, 1967). Gabon: Gabon River (Trimen, 1889). Tchad: Fort Archambault (MNHN). Cameroun: Bamenda (BM). Nigeria: Aba, Kaduna, Obuda Ranch (E. Nigeria) (BM, MN, ZSM). Ghana: Likpe (BM, MRAC). Sierra Leone: Sierra Leone (BM). Guinea: "Guinée française" (MNHN). Senegal: Dakar, Oussony, Sandiaba, Tabi près Bignona (BM, CMP, MNHN; Berger, 1968).

Material examined. — 618 ♂, 242 ♀ : 1 ♂, 1 ♀, Ethiopia (BM); 2 ♂, Sudan (BM); 102 ♂, 37 ♀, Kenya (AMNH, BM, CMP, ML, MN); 39 ♂, 13 ♀, Uganda (AMNH, BM, CMP, MN); 155 ♂, 52 ♀, Tanzania (AMNH, BM, ML, MN, MRAC, ZSM); 2 ♂, 1 ♀, Rwanda (ML, MRAC); 26 ♂, 14 ♀,



Map 13
Spialia dromus

Burundi (MRAC); 2 ♂, Zambia (USNM, ZSM); 12 ♂, 4 ♀, Rhodesia (BM, MN, USNM); 37 ♂, 16 ♀, Malawi (BM, CMP, USNM); 24 ♂, 9 ♀, Mozambique (BM, ML, ZSM); 55 ♂, 44 ♀, South Africa (AMNH, BM, CMP, ML, MRAC, ZSM); 18 ♂, 7 ♀, Angola (BM); 112 ♂, 31 ♀, Zaïre (AMNH, BM, CMP, MRAC); 1 ♂, Congo-Brazzaville (MRAC); 14 ♂, 5 ♀, Nigeria (BM, MN, ZSM); 3 ♂, 5 ♀, Ghana (BM, MRAC); 9 ♂, 3 ♀, Sierra Leone (BM); 4 ♂, Senegal (BM, CMP).


Map 14
Spialia ploetzi ploetzi

Spialia ploetzi (Aurivillius)

Hesperia Ploetzi Aurivillius, 1891. — Ent. Tidskr. 12 : 227 (Cameroun). For synonymy, see subspecies.

The nomenclatural and taxonomic confusions about this species have been dealt with in a previous paper (De Jong, 1977). The species shows a marked geographic variation. The subspecies recognized have generally been considered separate species and Higgins (1924) created a species group for them ("*Hesperia plötzi* group").

External characters. — On the underside of the hind wing the median spots in spaces 3 to 7 and the submarginal spots in spaces 1c and 2 conjoin to form an oblique white bar from about the middle of vein 8 to the termen in space 1c or 2. By this character *S. ploetzi* is easily distinguished from all other *Spialia* species. On the upperside of the hind wing the marked median band which is sharply broken along vein 3 by the direction of the median spot 4—5 and the basad shift of median spot 2, is distinctive. Length of fore wing 11.4 — 13 mm.

Male genitalia. — Spinulose area of gnathos extending dorsad to slightly beyond the middle of the gnathos. Dorsal sclerotization of anellus folded over aedeagus like a roof, but laterally bent upwards. Aedeagus long, S-shaped, surface smooth. Saccus about as long as uncus. Costa of valva extended distad. Costal process large, curving upwards, spines pointing cephalo-dorsad. Fold of cucullus covering about basal third of costal process.

Female genitalia. — Ventral sclerites of segment 8 touching near ostium, but not conjoined. Postvaginal membranous area wide, with slight triangular sclerotization that imperceptibly passes into area spinulosa. Latter with straight or slightly wavy distal edge. Papilla analis with obtuse apex; apophysis posterior less than 1.5 times as long as papilla.

Ecology. — *S. ploetzi* is the only *Spialia* species confined to the forest. Specimens are known from all months of the year. Food plants unknown.

Distribution. — Confined to the forest belt from Sierra Leone to Western Kenya. The southern limit appears to run through N. Angola, S. Zaïre and along the north side of Lake Tanganyika. East of this lake, *ploetzi* does not appear to occur south of Burundi. The northern limit presumably runs through the Central African Republic.

Geographic variation. — There is a marked variation in the extension of the spots, the male and female genitalia. Two subspecies can be recognized.

Spialia ploetzi ploetzi (Aurivillius)

Hesperia Ploetzi Aurivillius, 1891. — Ent. Tidskr. 12 : 227. Type locality: Cameroun, environs of Douala, see De Jong (1977). Lectotype (♂) in the Naturhistoriska Riksmuseet, Stockholm.

Hesperia zebra Rebel, 1914. — Ann. k.k. naturh. Hofmus. Wien 28 : 271—272, pl. 22 figs. 52, 53 (NW of Lake Tanganyika). Holotype (♂) in the Naturhistorisches Museum, Vienna. Junior primary homonym of *Hesperia zebra* Butler, 1888 (which is now also placed in *Spialia*).

Hesperia rebeli Higgins, 1924. — Trans. ent. Soc. London 1924 : 101. Replacement name for *Hesperia zebra* Rebel, 1914. Evans (1937) stated that the type of *rebeli* is in the British Museum (Nat. Hist.), and he labelled, indeed, a specimen from Uganda as type (nr. H. 892). This was, however, an incorrect action, for the type of *rebeli* Higgins should be the same as that of *zebra* Rebel, as Higgins only proposed a replacement name.

External characters (pl. 6 figs. 41, 42). — On the whole, this eastern subspecies is more extensively spotted than the western one. In detail, the differences are as follows:

1. on the upperside the spots are larger, especially the central cell spot on the fore wing and the submarginal spots on both wings;
2. on the fore wing the series of submarginal spots is less sinuous;
3. on the upperside of the hind wing the submarginal spots 5 and 6 are strongly developed, forming two white streaks (in the western form they are scarcely visible);

4. on the underside of the hind wing the submarginal spots 5 and 6 are fused into a white streak from median spot 7 to the end of vein 5 (this streak is at most faintly indicated in the western form);

5. in addition to this streak the veins are usually overlaid with light scales, so that the underside of the hind wing has a striped appearance;

6. median spot 2 on the underside of the hind wing is usually indistinct and sometimes absent (in the western form usually very distinct and often more conspicuous than the lower part of the median band).

According to Higgins (1924) the ground colour of the upperside is paler in the eastern form. I cannot confirm this observation, but it may be true for fresh material.

Eastern specimens of ssp. *ploetzi* generally have larger spots on the upperside, especially on the hind wing, and often a lighter ground colour on the underside of the hind wing, due to a denser light superscaling. There is, however, much overlap in these characters and it does not appear to be sensible to recognize further subspecies.

Male genitalia (figs. 66, 67). — Costa of valva not extending beyond tip of cucullus.

Female genitalia (figs. 74, 75). — Narrow, medio-proximal parts of ventral sclerites (i.e. the parts nearest the ostium) at least two times as long as broad.

Distribution (Map 14). — The eastern part of the range of the species, from W. Cameroun eastward. The westernmost localities known are Kumbo and Bamenda in W. Cameroun, close to the Nigerian frontier and formerly Nigerian territory. The easternmost localities are situated in the forest remains in the west of Kenya. In the Nairobi Museum there is a specimen labelled "W. Atomo, Mombasa"; I could not find W. Atomo on any map or in any gazetteer, the only name approaching it is Watamu, about 100 km north of Mombasa. It would be highly interesting if *ploetzi* really occurred there.

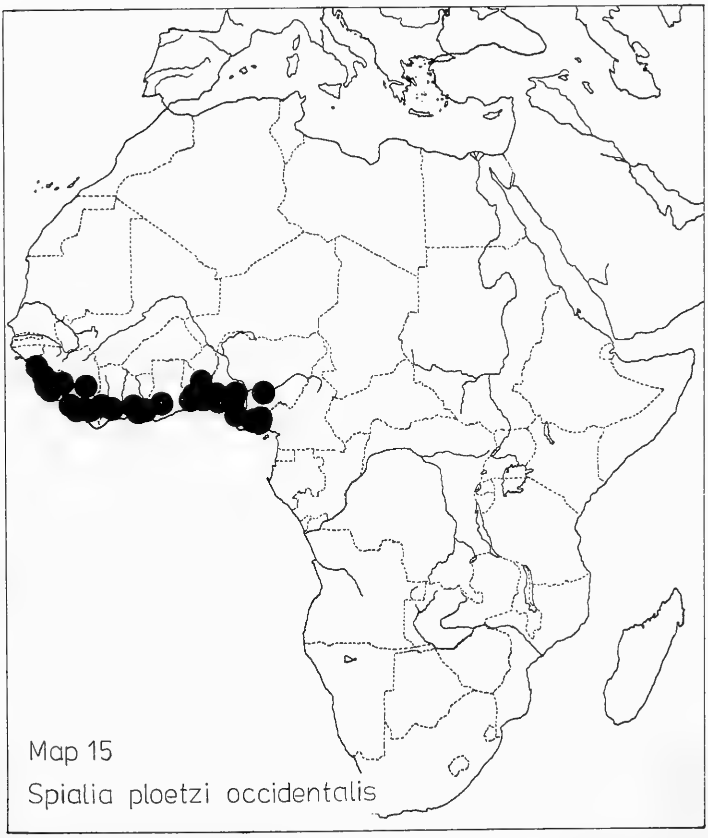
Localities. — Kenya: Kaimosi, Kakamega Forest, Malaba (Kabras), ? Mombasa (W. Atamo) (MN, USNM). Uganda: Bwamba Forest, Budongo Forest, Bufunbo Forest, Entebbe, Hoima, Impenetrable Forest, Jinja, Kalinzu Forest, Kamengo, Kanaba Gap, Katera, Kayonza Forest (Kigezi), Kazi, Mafuga Forest (Kigezi), Mbarara, Mt. Kokanjero, Muhende, Mulange, Namwamba Valley, Rutenga Forest (Kigezi), Toro (AMNH, BM, CMP, MN, MRAC, NMB). Rwanda: Cyangugu, Kisaba Forest (BM, ML). Burundi: Bugarama, Bulumbura, Bururi, Kitega, Ruvuvu River (BM, MRAC). Zaïre: Bambesa, Bena-Tshiadi, Bokala à Busanga, Buta, Dungu, Eala, Epulu Forrst, Gamangui, Goma-Rutshura, Itimbiri-Dingila, Itoko à Sombe, Kabongo, W. of Kambove, Kaniama, Kapanga, R. Kapelekese, Katako-Kahudi, Katako-Kombe, Lake Kivu, NW. of Lake Tanganyika, Lodja, Lowa-Nduba, Lufupa River, Lukolela, Luluabourg, Lusambo-Batempa, Mbudi, Medje, Moto, Nioka, Nyamunyunya (Mulungu), Omotumba, Paulis, Ruwenzori, Sandoa, Stanleyville, Tshibinda, Tshikunia, Tshiole, Uele, Utshudi, Yakoma (AMNH, BM, CMP, MN, MRAC, NMB, USNM; Heron, 1909; Higgins, 1924; Holland, 1920; Neave, 1910; Rebel, 1914). Angola: N'Dalla Tando (BM). Congo-Brazzaville: Etoumbi (MRAC; Berger, 1967). Gabon: Lastousville, Oyem (MNHN, MRAC).

Rio Muni: Nkolentangan (ZMHB). Central African Rep.: Boukolo M'Baiki (Oubangui-Chari) (MRAC). Cameroun: Akom, Bamenda, Batouri Distr., Bitye (Ja River), Buea, Bule Country, Chang, Ebogo s. le Nyong, Efulen, Ekutu, Elat, Kribi, Lolodorf, Lomié, Metet, Penderu, Sakbayeme (Sanaga River), Zoatoupsi (20 km W. of Yaoundé) (AMNH, BM, CL, CMP, MNHN MRAC, NMB, NRS, USNM, ZWM; Condamin, 1960).

Material examined. — 262 ♂, 69 ♀ : 4 ♂, 3 ♀, Kenya (MN, USNM); 85 ♂, 27 ♀, Uganda (AMNH, BM, CMP, MN, MRAC); 2 ♂, Rwanda (BM, ML); 6 ♂, 1 ♀, Burundi (BM, MRAC); 67 ♂, 21 ♀, Zaïre (AMNH, BM, CMP, MN, MRAC, USNM); 5 ♂, Angola (BM); 1 ♂, Congo-Brazzaville (MRAC); 2 ♂, Gabon (MNHN, MRAC); 1 ♂, Rio Muni (ZMHB); 1 ♂, Centr. Afr. Rep. (MRAC); 88 ♂, 37 ♀, Cameroun (AMNH, BM, CMP, MNHN, MRAC, NRS, USNM, ZSM).

Spialia ploetzi occidentalis De Jong

Spialia ploetzi occidentalis De Jong, 1977. — Ent. Ber., Amst. 37 : 43 (Ghana). Holotype (♂) in the Rijksmuseum van Natuurlijke Historie, Leiden; paratypes in the British Museum (Nat. Hist.), London, and the Naturhistoriska Riksmuseet, Stockholm. This subspecies is generally known in the literature as the species *Spialia ploetzi*.



Map 15
Spialia ploetzi occidentalis

External characters (pl. 6 figs. 43, 44). — Less extensively spotted than ssp. *ploetzi;* for details, see under that subspecies.

Male genitalia (figs. 68, 69). — Costa of valva projecting well beyond tip of cucullus.

Female genitalia (fig. 76). — Medio-proximal part of ventral sclerites about as long as broad.

Distribution (Map 15). — The western part of the range of the species, from Sierra Leone to E. Nigeria. Specimens of this subspecies recorded from localities further east are probably incorrectly labelled, see De Jong (1977).

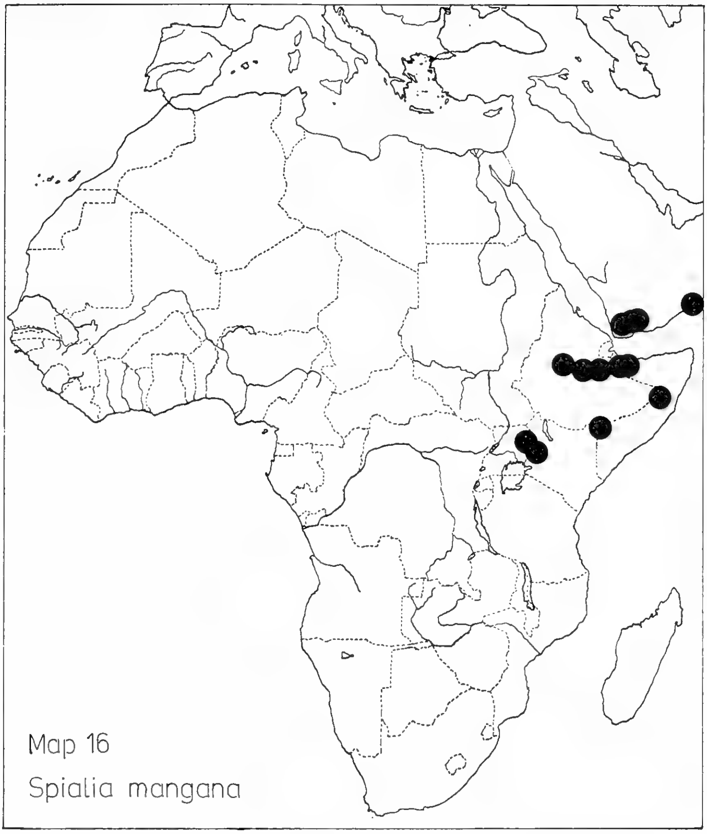
Localities. — Cameroun (?): "Cameroons" (MNHN). Nigeria: Afikpo, Anambara Creek, Cape Coast Castle, Ebele, Ibadan, Iporia-Ilara Div., Kabba Prov., Lagos, Lokkoh, Oban, Ogruga, Old Calabar, Oshodi, Warri (BM, CMP, MN, MNHN; Higgins, 1924). Dahomey: Porto Novo, Dahomey Interior (MNHN). Togo: Missahohé (= Misa-höhe) (ZSM). Ghana: Asuchari, Kumasi, Likpe, Odumase Swamp, Sunyani (BM, ML, MRAC). Ivory Coast: Abengourou, Abidjan, Adiopodoumé, Bingerville, Issia, Séleu (BM, MN, MNHN, MRAC; Berger, 1962). Liberia: Bigtown, Ganta, Harbel, Kpain, Maloubli, Monrovia, Penoke, Zorzor (BM, CMP; Lindsey & Miller, 1965; Picard, 1950). Sierra Leone: Freetown, Ka Yima, Moyamba, "Sierra-Leone" (BM, MNHN, NRS, ZSM; Holland, 1896). Guinea: Forecariah, Tondon (C. Dubreka) (BM, MNHN; Berger, 1962).

Material examined. — 108 ♂, 38 ♀ : 1 ♂, ? Cameroun (MNHN); 13 ♂, 9 ♀, Nigeria (BM, CMP, MN); 1 ♂ Togo (ZSM); 21 ♂ (incl. holotype of *occidentalis*) 5 ♀, Ghana (BM, ML, MRAC); 29 ♂, 9 ♀, Ivory Coast (BM, MN, MRAC); 10 ♂, 3 ♀, Liberia (BM, CMP); 31 ♂, 12 ♀, Sierra Leone (BM, NRS, ZSM); 2 ♂, Guinea (BM).

g. The *delagoae* group

External characters. — Fore wing without basal cell spot on upperside, at most some white scales forming a small dash along the cubital vein; central cell spot not remarkably close to end of cell; no spots in spaces 9 and 10; submarginal spots present or absent. Median band on underside of hind wing straight or winding, continuous from space 1c to space 8, more or less parallel to termen; submarginal spots 4—5 (if present) in line with the other submarginal spots. Male without costal fold.

Male genitalia. — Uncus undivided or bipartite apically; junction with tegumen indicated by a narrow, less strongly sclerotized band, medially broadening to a fenestrula. Gnathos dorsally joined to tegumen over a shorter or longer distance or free from tegumen, the dorsal edge often folding outwardly; broadly sclerotized, ventrally usually with stronger sclerotization and some short spines; left and right part of gnathos ventrally joined by a membrane that is usually smooth, but may be slightly spinulose and folding upward medially. Anellus with very strong dorsal sclerotization and spines. Juxta relatively large. Aedeagus straight or slightly curved, with ventral, cylindrical, spined excrescence in distal half; coecum short or absent. Saccus relatively short, i.e. shorter than uncus.

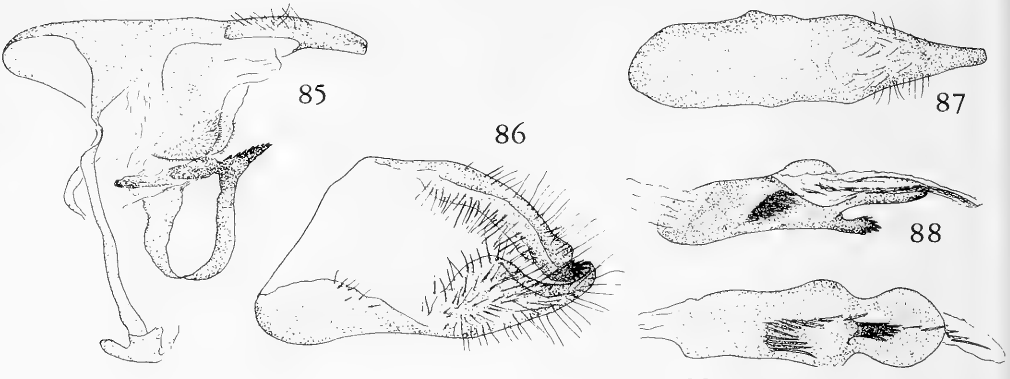


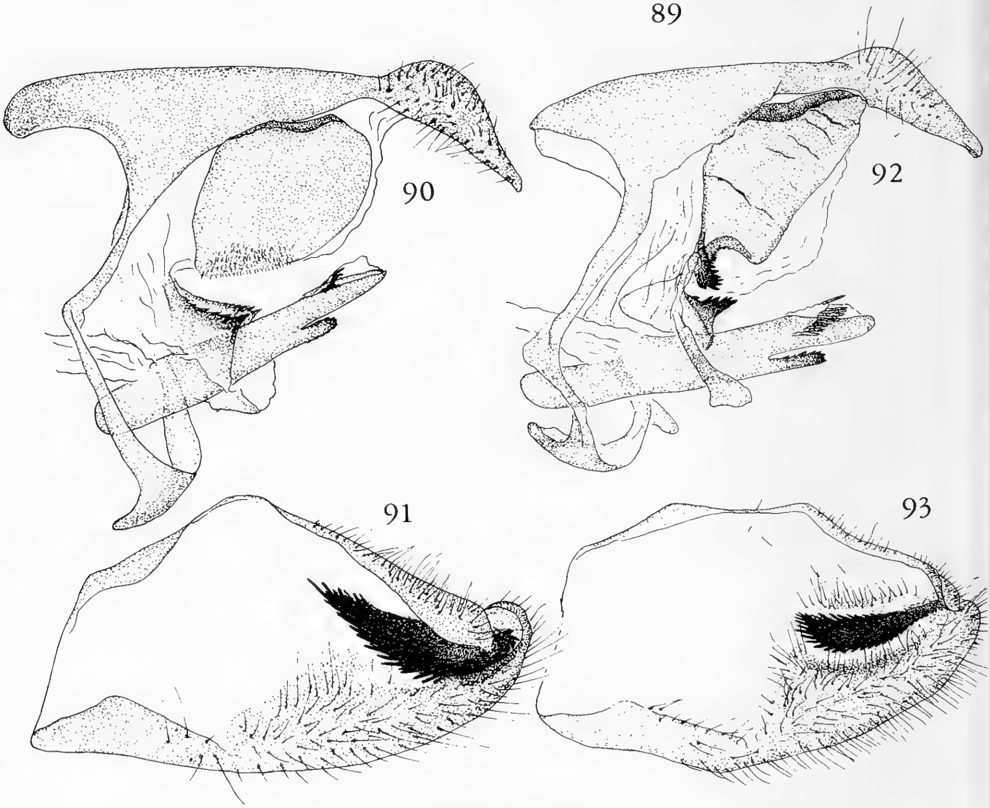
Costa of valva narrow; costal process various, usually well-developed. Cucullus excavated to receive costal process or forming a small fold, that does not cover the costal process.

Female genitalia. — Segment 8 with two small dorsal sclerites, which are invisible in ventral sight; ventral surface occupied by a single large sclerite covering the whole surface or with small membranous areas distally from the ostium to the left and to the right. In all but one species there is no noticeable sclerotization antevaginally. Just behind the ostium the sclerite may protrude in two small keels. Small spines of area spinulosa in some species visible at the distal edge of the ventral sclerite. Ductus long, gradually broadening into bursa; ductus and bursa without sclerotizations or spines. Papilla analis without basal lobe, short, broader than long; apophysis posterior short, about as long as or shorter than width of papilla.

Spialia mangana (Rebel)

Hesperia mangana Rebel, 1899. — Sber. Akad. Wiss. Wien 1899 : 360 (Ras Fartak, S. Yemen). Holotype (♀) in Naturhistorisches Museum Wien (Vienna, Austria).





Figs. 85—89. Male genitalia of *S. mangana* (Bihendula, Somalia). 85, lateral aspect. 86, inside of right valva. 87, dorsal aspect of uncus and tegumen. 88, lateral aspect of aedeagus. 89, ventral aspect of aedeagus. Figs. 90—93. Male genitalia, lateral aspect, and inside of right valva. 90—91, *S. nanus* (Sheldon, S. Africa). 92—93, *S. delagoae* (Muden, S. Africa).

External characters (pl. 6 figs. 45, 46). — An unmistakable species by the complete absence of basal and submarginal spots on the upper and underside of both wings. On the upperside the ground colour is evenly dark brown, on the underside of the hind wing the ground colour of the basal part is usually of a lighter shade than between the median band and the termen. A good figure was given by Rebel (1907).

There is much variation in size, ♂ 7.5 — 9.9 mm, ♀ 8.1 — 11 mm, but the material is too limited to show whether this variation is individual, seasonal or geographic.

Male genitalia (figs. 85—89). — At junction of uncus and tegumen a long, triangular fenestrula. Gnathos connected with tegumen by a membrane; ventrally a double, semiglobular, spinulose fold (cf. *dromus* group). Sclerotization in dorsal part of anellus forming a spined prong to the left and the right, ventrally conjoined to the juxta. Aedeagus short and broad, with a strong, spined excrescence medio-ventrally beyond the middle. Just beyond the ventral excrescence the aedeagus is constricted laterally and beyond this constriction it widens to a flat, almost circular apex; coecum absent. Costal process small, with a few short spines radiating distad. Cucullus excavated to form a narrow fold that scarcely covers a part of the costal process.

Female genitalia (figs. 94, 95). — Ventral sclerites of segment 8 conjoined antevaginally by a thick, bumpy sclerotization. Slight sclerotization in postvaginal area, the membranous area separating the ventral sclerites. Area spinulosa slightly indented at distal edge. Papilla analis dorso-distally rather pointed.

Ecology. — Nothing is known of the ecology of this possibly rare skipper. The studied specimens date from all months, except February and March.

Distribution (Map 16). — Confined to the southern part of the Arab peninsula, Ethiopia, Somalia, N. Kenya and N. Uganda.

Localities. — Yemen: Ta'izz (BM; Gabriel, 1954). South Yemen: Ahdaherma, Dhala, Jebel Jihaf, wadi east of Jebel Ma'fari, Moola Mutar, Ras Fartak (BM; Gabriel, 1954; Rebel, 1899, 1907). Ethiopia: Dire Daoua, Fich Shoa Prov., Meiso (BM, MNHN; Carpenter, 1935). Somalia: Bihendula, Galkayu, Gan Linah, Hargeisa, Mandera, Mudugh (BM, MN). Kenya: Kacheleba, Kenailmat (Suk) (BM, MN). Uganda: Cholol (Karamoja) (MN).

Material examined. — 19 ♂, 8 ♀ : 1 ♂, Yemen (BM); 3 ♂, 3 ♀, South Yemen (BM); 4 ♂, 2 ♀, Ethiopia (BM); 6 ♂, 2 ♀, Somalia (BM, MN); 3 ♂, 1 ♀, Kenya (MN); 2 ♂, Uganda (MN).

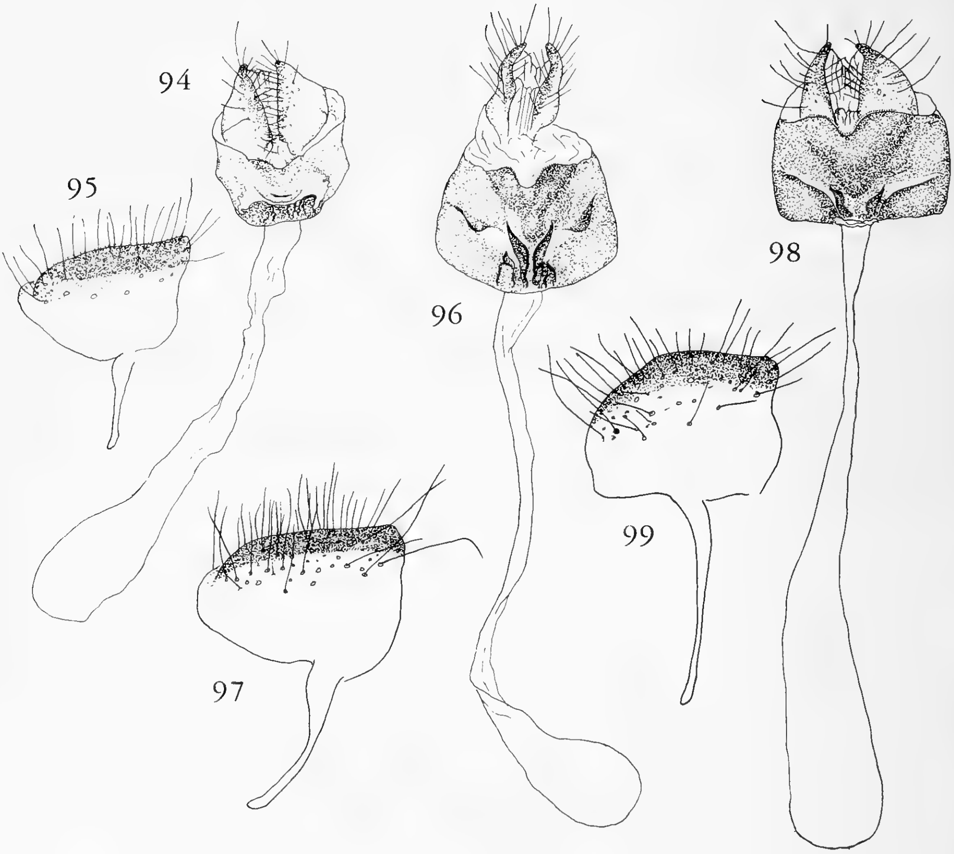
Spialia nanus (Trimen)

Pyrgus nanus Trimen, 1889. — South African Butterflies 3 : 290 (Malmesbury, Cape). Holotype (♂) in the British Museum (Nat. Hist.), London.

External characters (pl. 6 figs. 47, 48). — By the combination of the absence of a basal cell spot on the upperside of the fore wing and a continuous band of median spots on the underside of the hind wing, this species is easily recognized as a member of the *delagoae* group. The basal cell spot on the underside of the hind wing is absent or very faintly indicated, the median band is very winding and runs from the end of space 8 through a double curve to about the middle of the distal part of space 1c.

There is much variation in size (♂ 8.5 — 11 mm) and spotting. The submarginal spots on the upperside may be almost absent; the spots 2 and 4—5 and regularly also 1c and 3 of the median spots are present on the upperside of the hind wing. The ground colour of the underside of the hind wing varies from warm yellow to brown. Although there are two generations per year, Swanepoel (1953) does not mention seasonal variation.

Male genitalia (figs. 90, 91). — A triangular fenestrula at junction of uncus and tegumen. Uncus with a longitudinal keel. Gnathos not fused to tegumen, consisting of two sclerotized plates, which curve outside in the upper part, so that in dorsal view the gnathos protrudes laterally. In the ventral part of the gnathos the sclerotization is fainter and here is a finely spinulose area. Anellus with strong, dorsally spined sclerotization, partly surrounding the aedeagus and membranously connected with the juxta. Aedeagus straight, with short coecum and a relatively long, ventral, spined projection; large cornuti present. Costa of valva narrow; costal process much larger than costa, directed to base of valva, slightly bent upwards, strongly spined. Cucullus excavated, forming a very narrow fold that does not cover the costal process.



Figs. 94—99. Female genitalia, ventral aspect, and papilla analis. 94—95, *S. mangana* (Dhala, S. Yemen). 96—97, *S. nanus* (Paarde Berg, S. Africa). 98—99, *S. delagoae* (S. Africa).

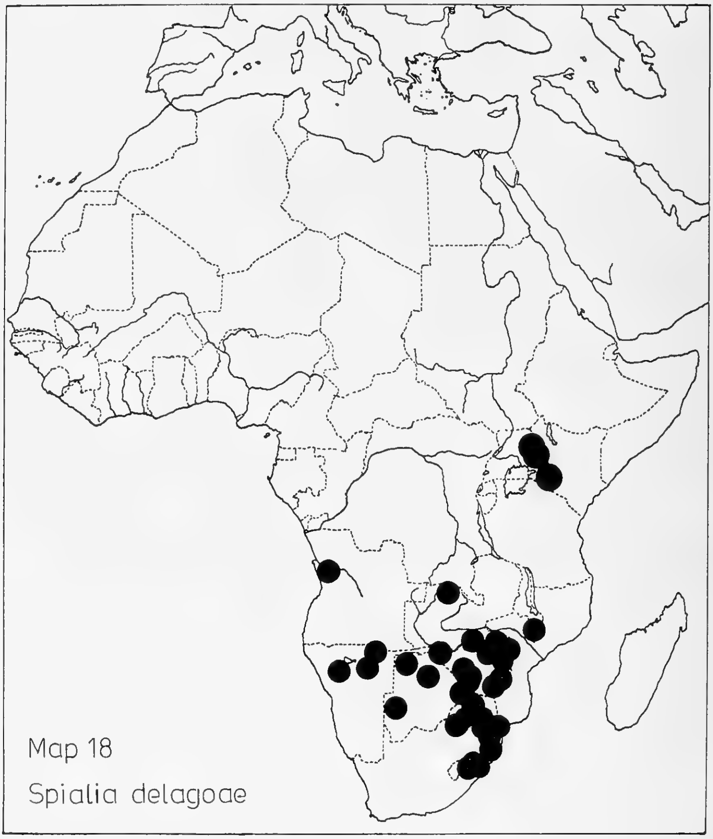
Female genitalia (figs. 96, 97). — Ventral sclerites of segment 8 not conjoined antevaginally, folded alongside the ostium to a few ridges. Postvaginally there is a short and narrow membranous area to the left and to the right of the ostium, enclosed by the ventral sclerites, which are fused and form small folds overlapping the end of the membranous areas. The ventral sclerites include the triangular postvaginal sclerotization. Area spinulosa deeply indented at distal edge. Papilla analis with upper edge rather straight.

Ecology. — This species is at home in the Karroo bushveld of the Cape Province, South Africa, where it can be found almost anywhere, on the flats and along mountain slopes. There are two generations per year, the main flight periods being September—October and March—April (Swanepoel, 1953). As food plants the following species have been recorded (Murray, 1959): *Hermannia* species (Sterculiaceae), *Pavonia macrophylla* and *Hibiscus aethiopicus* (Malvaceae).

Distribution (Map 17). — Confined to South Africa, where it has been found in the Cape Province and the western Orange Free State.

Localities. — South Africa. Cape Province: De Aar, Addo, Beaufort West, Bitterfontein, Calitzdorp, Cape Town, Carlton, Carnarvon, Clanwilliam, Colesberg, Cookhouse, Cradock, Deelfontein, Dunbrody, Graaf-Reinet, Kamieskroon,


Map 17
Spialia nanus



Katzenberg Hill, Kimberley, Klaver, Malmesbury, Mamre, Matjesfontein, O'okiep, Paarde Berg, Paarl, Prieska, Rosemead, Sheldon, Slang Hoek Mts., Somerset East, Springbok, Steynsburg, Uitenhage, Vanrhijnsdorp, Worcester (BM, CMP, ML, MN, MNHN, NMB; Swanepoel, 1953). Orange Free State: Bloemfontein (AMNH, BM, NMB; Swanepoel, 1953).

Material examined. — 27 ♂, 10 ♀, South Africa (AMNH, BM, CMP, ML).

Spialia delagoae (Trimen)

Pyrgus delagoae Trimen, 1898. — Trans. ent. Soc. London 1898 : 15 (Delagoa Bay). Holotype (♂) in the South African Museum, Cape Town.

External characters (pl. 7 figs. 49, 50). — This species closely resembles *nanus* by the absence of the basal cell spot on the underside of the hind wing, but the straight median band is a reliable differentiating character. Of the other species of the group, only *mangana* has no basal cell spot on the underside of the hind wing, but that species is easily distinguished by the absence of submarginal spots on upper and underside. The ground colour of the underside of the hind wing is usually dark olive-green. There is some variation in size (♂ 9.9 — 11.6 mm) and extension of spots. On the upperside of the hind wing the median spots 2 and

4—5 are always present, often also 3, sometimes 1c indicated by white scales, 6 always absent.

Male genitalia (figs. 92, 93). — Triangular fenestrula at junction of uncus and tegumen. Uncus with a longitudinal keel, in dorsal view apex slightly expanded. Gnathos dorsally strongly curved outward and projecting laterally; ventral sclerotization stronger than in *nanus,* forming a strongly spined ventral projection. Fultura superior smooth. Dorsal sclerotization of anellus consisting of a strongly spined, pointed structure to the left and to the right, the two parts connected by a strongly incurving, slightly sclerotized fold that is connected dorsally to the gnathos and the fultura superior. Aedeagus straight; coecum longer than thick; ventral projection large, 4—5 times as long as thick; apex flat, but not expanded; a series of subequal cornuti present. Costa of valva very narrow, distally slightly expanded. Costal process very large, almost straight, at apex slightly upturned, pointing towards base of valva, strongly spined. Cucullus hollowed to receive the costal process, not forming a fold.

Female genitalia (figs. 98, 99). — Very much like *nanus,* but sclerotized ridges near ostium smaller and no flaps of ventral sclerites overlying the end of the membranous strips; area spinulosa possibly somewhat wider. Apophysis posterior relatively long, longer than width of papilla.

Ecology. — In South Africa it is a species of the bushveld, that may be found sipping from wet mud or fresh baboon dung (Swanepoel, 1953). There are no records on its habitat in more northern areas. *S. delagoae* is on the wing throughout the year, but in South Africa it is most abundant in February-March and August-September. Food plants have not been recorded.

Distribution (Map 18). — From N. Kenya and N. Uganda to Transvaal and Natal. At the moment the northern populations appear much isolated.

Localities. — Kenya: Kacheleba, Kedong (MN). Uganda: Amudat (MN). Zambia: Solwezi (Higgins, 1924). Rhodesia: Bazely Bridge (SW. Umtali), Bulawayo, Chirinda Forest (Chipinga), Dotts Drift (Lower Sabi Valley), Essexvale, Guzi Forest, Gwanda, Inyanga Mts, Matetsi, Mtoko, Nyamadzi R., Nyamandhlovu, Odzi R., Salisbury, Sanyati Valley, Umtali, Vumba Mts, West Nicholson (BM, MN, NMB, USNM). Malawi: Mlanje (Gifford, 1965; Higgins, 1924). Mozambique: Delagoa Bay (BM, MNHN; Trimen, 1898). Botswana: Hothlotane, Macloutsi, 55 mls E. of Maun, Ngamiland, 55 mls W. of Tsane (BM, MNHN, NMB). Swaziland: Gollel (NMB). South Africa. Transvaal: Bandolierkop, Barberton, Chuniespoort, Dendron, Haenertsburg, Munnik, Ohrigstad, Palabora, Pietersburg, Rita, Shilouvane, Vivo, Warmbaths, Zoutpansberg (BM, CMP; Swanepoel, 1953). Natal: Estcourt, Hluhluwe, Kearsney, Letsibele, Mhlosinga, Middeldrift, Muden, Tugela R., Weenen (BM, CMP; Swanepoel, 1953). Cape Province: Lobabi (MN). Namibia: Groot-fontein, Okawango, Otjitambi, Ovikokonva (SMW). Angola: Dondo (Quanza River) (BM).

Material examined. — 49 ♂, 19 ♀ : 3 ♂, 1 ♀, Kenya (MN); 1 ♂, Uganda (MN); 14 ♂, 4 ♀, Rhodesia (BM, MN, USNM); 2 ♂, Mozambique (BM, MNHN); 1 ♂, Botswana (MNHN); 24 ♂, 10 ♀, South Africa (BM, CMP, MN); 3 ♂, 4 ♀, Namibia (BM, SMW); 1 ♂, Angola (BM).

Spialia zebra (Butler)

Pyrgus zebra Butler, 1888. — Ann. Mag. Nat. Hist. (6) 1 : 207—208 (Koteer, Chittar Pahar). For synonymy, see subspecies.

External characters (pl. 7 figs. 51, 52). — The presence of a basal cell spot and submarginal spots on the underside of the hind wing distinguishes this species from all other species of the group except *depauperata*. According to Higgins (1924) *zebra* (under the name *bifida*) and *depauperata* are almost indistinguishable, but in fact the identification is not very difficult if we pay attention to the following differences:

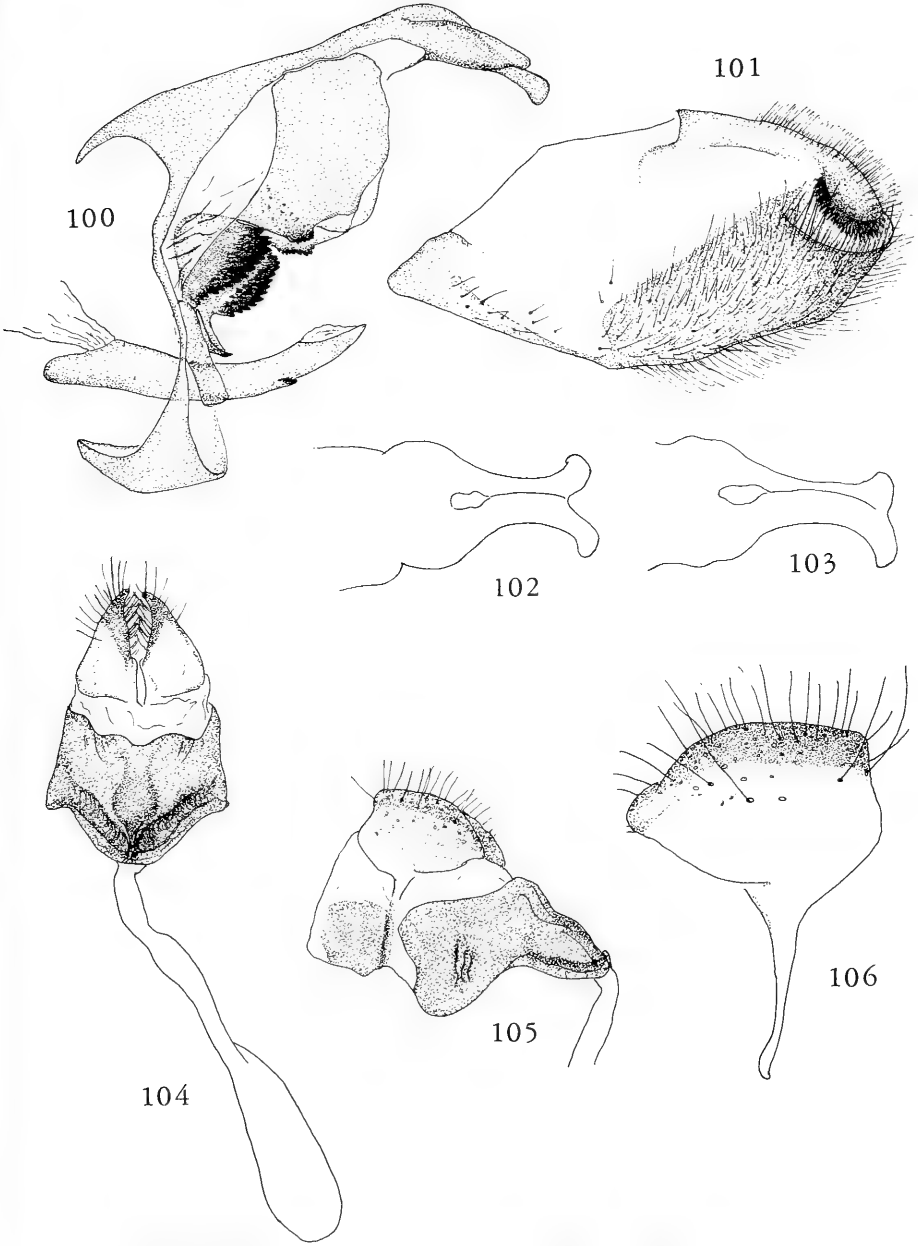
1. on the average, *zebra* is smaller, ♂ 9.7—11.5 mm, as against *depauperata* ♂ 10.4—13.8 mm;
2. in *zebra* the median spots 2 and 4—5 on the upperside of the hind wing are usually the only median spots present, although 3 may be more or less indicated; in *depauperata* the median spots on the upperside of the hind wing form a more or less straight band from vein 2 to vein 7, crossed by the dark veins 3, 4 and 6. I never met with serious difficulties in distinguishing between *zebra* and *depauperata*, but if one is not sure about the identification of a male, a clearing of the tip of the abdomen will soon reveal the difference in the uncus.

There is some variation in the extension of the spots. The submarginal spots on the upperside are sometimes very reduced, but always visible, at least in part. The ground colour of the underside of the hind wing is of a greyish green tinge.

Male genitalia (figs. 100—103). — Uncus bifid at apex, more or less hammer-like in dorsal (and ventral) view, left and right parts with slightly inflated apices. At proximal end of distinct, longitudinal keel of uncus, a small and more or less oblong fenestrula. Gnathos separated by very narrow membranous strip: ventrally slightly more strongly sclerotized and with some small spines, passing into an inwards sclerotized fold that forms a shallow sac and is flanked laterally by a large number of very coarse spines; more ventrally this sclerotization forms two small pointed processes, lying over the dorsal surface of the aedeagus, as in *depauperata*, but much smaller. Aedeagus gently curved upwards; coecum slightly longer than wide; ventral process small, inconspicuous, except for the short spines. Distal end of costa of valva covering part of costal process. Latter not very conspicuous, with radiating spines, in proximal part with some very coarse spines, but not such a distinct, separate proximal part as in *depauperata*.

Female genitalia (figs. 104—106). — Ventral sclerites of segment 8 fused into a single sclerite, postvaginally with a low elevation that is pear-shaped in ventral view. In the proximal part, to the right and to the left of the ostium, the sclerite is excavated; laterally it has a few narrow, protruding ridges. No membranous postvaginal area. Area spinulosa slightly indented at distal edge. Ductus plus bursa relatively short. Apophysis posterior not longer than width of papilla, relatively straight.

Ecology. — In Kenya I found this species rather numerous along dry paths in more or less open landscape, with scarce vegetation on coral rocks near Ukunda, south of Mombasa. The specimens were flying especially during the hottest time of the day and were not easy to collect, as they often flew very low, sometimes not



Figs. 100—103. Male genitalia of *S. zebra*. 100—102, lateral aspect, inside of right valva, and dorsolateral aspect of uncus, of ssp. *bifida* (Ukunda, Kenya). 103, dorsolateral aspect of uncus of ssp. *zebra* (Pakistan). Figs. 104—106. Female genitalia, ventral and lateral aspect, and papilla analis, of *S. zebra bifida* (Ukambani, Kenya).

more than a few centimeters above the ground. In Kenya, specimens have been found during all months of the year. In India, *zebra* appears to fly mainly in April, May and June, but the material is scarce.

Sevastopulo (1974) records *Melhamia* (Sterculiaceae) as food plant.

Distribution (Map 19). — Highly discontinuously distributed, in East Africa/South Yemen and Northwest Himalayas.

Geographic variation. — The African and Asian populations differ slightly in the male genitalia. Externally both forms are similar.

Spialia zebra zebra (Butler)

Pyrgus zebra Butler, 1888. — Ann. Mag. Nat. Hist. (6) 1 : 207—208 (Koteer, Chittar Pahar). Holotype (♂) in the British Museum (Nat. Hist.), London.

Hesperia hellas De Nicéville, 1889. — Journ. Bombay Nat. Hist. Soc. 4 : 177, pl. B (Campbellpore). Holotype (♂) may be in the collection of the Zoological Survey of India, Calcutta, but I could not get exact information.

Male genitalia (fig. 103). — Uncus apically slightly indented, the two parts of the apex projecting laterally, so that in dorsal view the uncus is more or less T-shaped.

Distribution. — Northwest Himalayas.

Localities. — Pakistan: Campbellpore; Koteer, Chittar Pahar; Punjab (Butler, 1888; De Nicéville, 1889; Swinhoe, 1913; BM).

Material examined. — 6 ♂ (incl. holotype), 1 ♀, Pakistan (BM).

Spialia zebra bifida (Higgins)

Hesperia bifida Higgins, 1924. — Trans. ent. Soc. London 1924 : 111—113 (Nairobi). Holotype (♂) in the British Museum (Nat. Hist.), London.

Male genitalia (fig. 102). — Uncus deeply indented apically, Y-shaped in dorsal view.

Distribution. — East Africa and South Yemen.

Localities. — South Yemen: Wadi Tiban (NW of Jebel Jihaf) (Gabriel, 1954; BM). Somalia: 20 miles S of Berbera, Bihendula (BM). Ethiopia: Bukuru Bridge (BM). Sudan: Tembura (BM). Kenya: Athi Bridge, Besil (= Bissil), Chepalungu, Diani, Elmenteita, Escarpment, Fourteen Falls, Gilgil, Hoey's Bridge, Kacheleba, Kakamega, Kangondi, Kibwezi, Kima, Kitale, Kitosh, Kitui, Landjoro, Lokichogio, Lucania, Machakos, Makindu, Makueni, Malaba, Mombasa, Mount Elgon, Mulango, Nairobi, Nairobi-Garissa Road, Nandi Plateau, Nanyuki, Ngong, Nyali, Ologorsailie, Shimoni, Sotik, Soy, Suna, Taveta, Trans Nzoia, Twiga, Ukunda, Upper Kuja Valley, Voi, Wangi, Watamu, Yala River (AMNH, BM, CMP, ML, MN, MNB, MNHN, NRS, USNM); Shimba Hills (Sevastopulo, 1974). Uganda: Kotido (MN). Tanzania: Dar-es-Salaam, Geita, Mount Meru, Oldeani, River Himo (BM, ML, MN, MNHN).

Neave (1910) recorded *zebra* from Zambia (Fort Jameson, Luangwa Valley), but this observation concerns *depauperata*, according to three specimens of Neave in the collection of the Hope Department of Entomology, Oxford.

Material examined. — 126 ♂, 56 ♀ : 1 ♀, South Yemen (BM); 2 ♂, Somalia (BM); 1 ♂, 1 ♀, Ethiopia (BM); 1 ♂, Sudan (BM); 116 ♂ (incl. holotype), 53 ♀, Kenya (AMNH, BM, CMP, ML, MN, MNHN, NRS, USNM); 1 ♂, Uganda (MN); 5 ♂, 1 ♀, Tanzania (BM, ML, MN, MNHN).

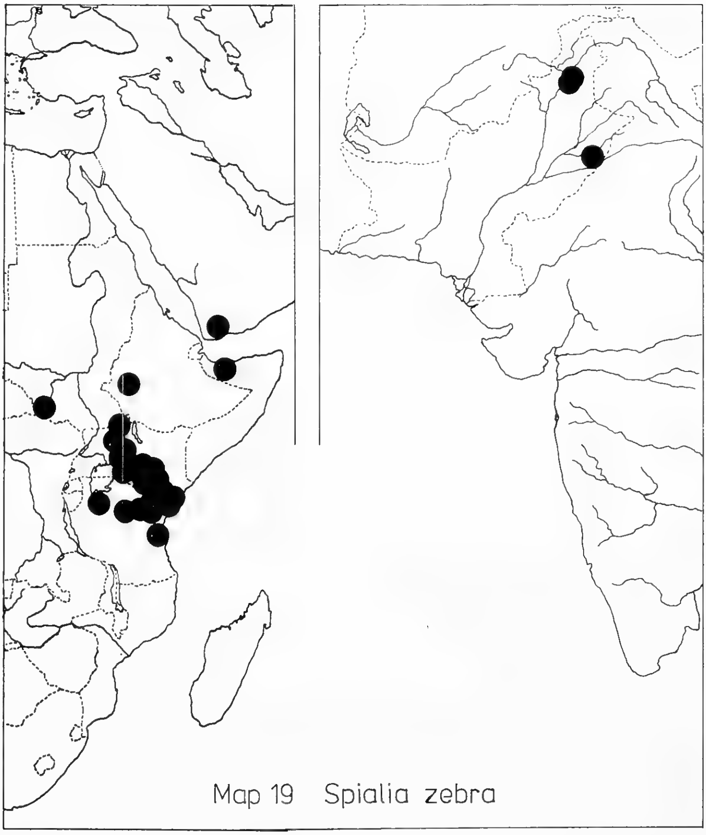
Note. During a recent examination of five males from Mount Elgon (Kenya) two males proved to have the uncus only slightly indented, thus being similar to ssp. *zebra*. More material from the northern part of East Africa as well as from Pakistan is needed to establish the constancy of the difference between the subspecies recognized.

Spialia sataspes (Trimen)

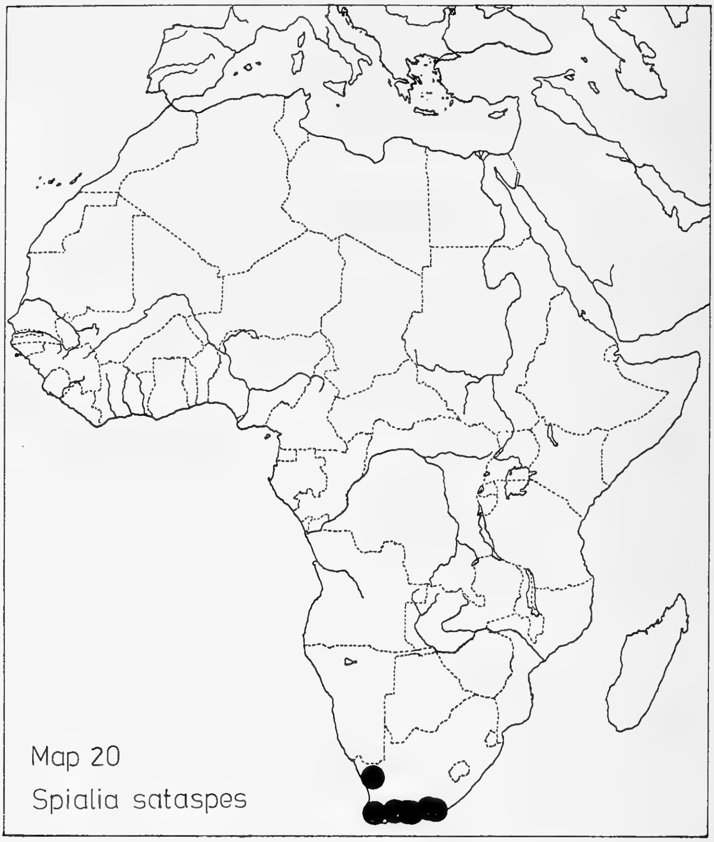
Pyrgus sataspes Trimen, 1864. — Trans. ent. Soc. London 1864 : 178—179 (Plettenberg, Cape Prov.). Holotype (♂) in the British Museum (Nat. Hist.), London.

Trimen (1866) described the same species under the same name again as new.

External characters (pl. 7 figs. 53, 54). — The main differentiating character of this species is the absence of submarginal spots on the underside of the hind wing. This is also the case in *mangana*, but that species lacks the basal cell spot on the underside of the hind wing. The lastmentioned character also distinguishes *sataspes* from *nanus* and *delagoae*. Difficulties may arise with specimens of *zebra* and *depauperata*, in which the submarginal spots on the underside of the hind wing are faint, but in such cases the less straight median band on the underside of the hind



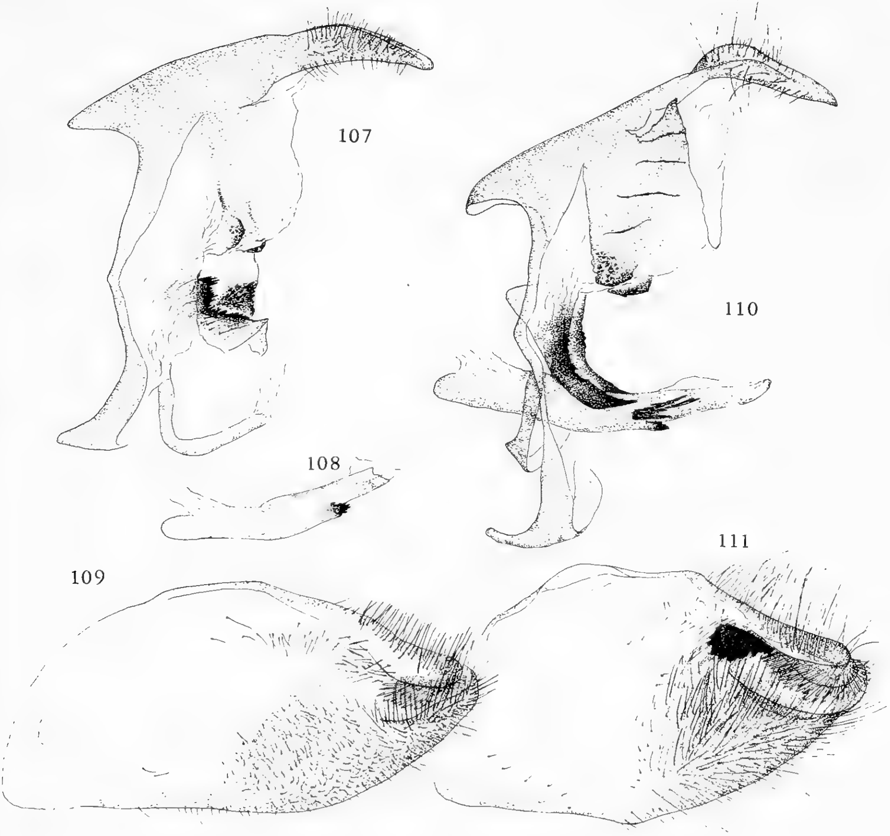
Map 19 Spialia zebra



wing in *sataspes* is helpful. In doubtful cases an examination of the genitalia is necessary.

There is little variation in size (♂ 9.1—11.5 mm) and in extension of the spots. Sometimes the submarginal spots on the upperside are absent. On the upperside of the hind wing the median spots 2 and 4—5 are always present and 1c and 3 are often indicated, while 6 is very rarely visible as a few white scales (contrary to *depauperata,* which usually has a distinct median spot 6). The ground colour of the underside of the hind wing is tawny.

Male genitalia (figs. 107—109). — Fenestrula at junction of uncus and tegumen relatively small. Uncus with longitudinal keel and slightly inflated apex. Gnathos fused to tegumen, not very much curving outward, ventrally somewhat extended to form a rounded sclerotized flap with a few small knobs. Fultura superior smooth, below gnathos passing into the extensive dorsal sclerotization of the anellus. This sclerotization curves inward proximad to form a shallow sac, laterally strongly spined, and then it folds roof-like over the aedeagus. Aedeagus slightly bent in the middle; coecum scarcely longer than wide; ventral process short, about as long as wide, with strong spines. Costa of valva expanding distally; costal process small, mainly consisting of a series of spines radiating from the ventro-distal end of the



Figs. 107—111. Male genitalia, lateral aspect, aedeagus, and inside of right valva. 107—109, *S. sataspes* (Cape Town, S. Africa). 110—111, *S. depauperata australis* (Muden, Natal).

costa. Cucullus broadly developed, dorsally excavated to receive the costal process.

Female genitalia (figs. 112—114). — Ventral sclerites of segment 8 fused into a single sclerite, covering the ventral and lateral parts of the segment. No antevaginal sclerotization. Just behind ostium two flap-like longitudinal outgrowths. Laterally a few very small folds. Area spinulosa broad, distal edge slightly impressed. Papilla analis much broader than long, apophysis posterior shorter than width of papilla.

Ecology. — Mainly found in grassy spots on mountain slopes, where it skips about and feeds on flowers. It is on the wing from the middle of October to February, and seems to be most abundant in November (Swanepoel, 1953). Food plants are *Hermannia* species (Sterculiaceae), *Pavonia macrophylla* and *Hibiscus aethiopicus* (Malvaceae) (Murray, 1959).

Distribution (Map 20). — Confined to South Africa, ranging from the Cape peninsula eastwards to the Grahamstown district and with a few localities outside this range. It was recorded by Butler (1901) from Mombasa, but this observation probably relates to *zebra*.

Localities. — South Africa. Cape Province: Addo, Assegaibosch, Bathurst, Brak R., Cape Town, Coega, Grahamstown, Knysna, Ladysmith, Lion's Head, Llandudno, Muizenberg, Outeniqua Mts, Plettenberg, Port Alfred, Port Elizabeth, Sea Point (Cape Town), Signal Hill, Simonstown, Springbok, St. James, Zwartkops (BM, MN, NMB; Swanepoel, 1953).

Material examined. — 21 ♂ (incl. holotype), 11 ♀, South Africa (BM, MN).

Spialia depauperata (Strand)

Hesperia ferax var. *depauperata* Strand, 1911. — Mitt. zool. Mus. Berlin 5 : 304 (Msamwia, between Lake Rukwa and Lake Tanganyika, S. Tanzania; not Msamusia, as stated by Evans, 1937).

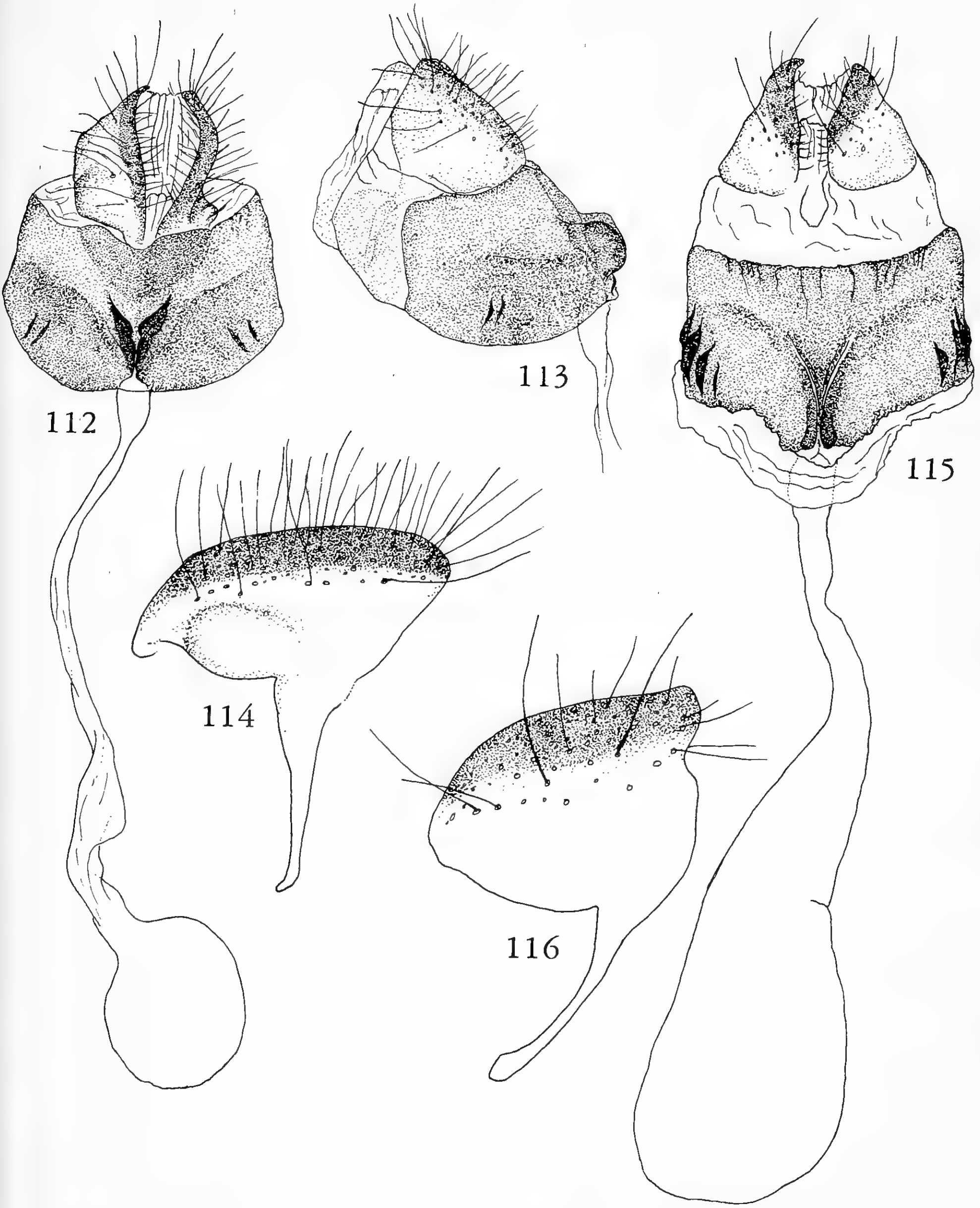
External characters (pl. 7 figs. 55, 56). — The largest species of the group; I saw only one specimen (♂) which was smaller than 10.8 mm, while the largest male measured 13.8 mm. Its size, in combination with the presence of the basal cell spot and the straight median band on the underside of the hind wing and the usual presence of median spot 6 on the upperside of the hind wing, will usually suffice to identify this species. See also *zebra* and *sataspes*. In doubtful cases a genital examination is necessary, but this will seldom be the case.

Part of the literature suggests difficulties in distinguishing between *depauperata* and *diomus ferax* and, actually, *depauperata* was originally described as a "variety" of *"Hesperia ferax"*. There will be no problems if one pays attention to the following points:

1. on the upperside of both fore and hind wing the basal cell spots are absent (at most indicated by a few white scales) in *depauperata*, well-developed in *diomus ferax*.
2. on the upperside of the fore wing only one of the outer median spots in space 1b (viz., spot 1c) is present in *depauperata*, sometimes scarcely visible; in *diomus ferax*, both outer median spots are present and form a bar from vein 1 to vein 2.
3. on the underside of the hind wing the series of submarginal spots starts at the end of vein 7 in *depauperata*, at the end of vein 8 in *diomus ferax;* the distal edge of the median band reaches the termen at the end of vein 8 in *depauperata*, but crosses vein 8 well before its end and runs to the costa in *diomus ferax*.

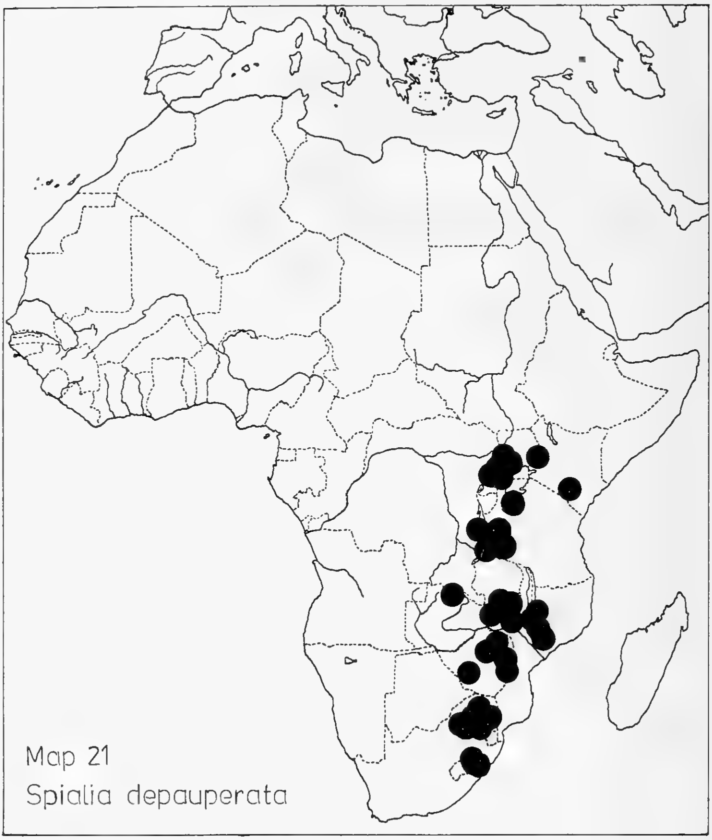
For variation, see subspecies.

Male genitalia (figs. 110, 111). — Uncus with high, longitudinal keel, apex usually more or less inflated. Relatively small fenestrula at junction of uncus and tegumen. Gnathos dorsally fused to tegumen, dorso-distal edge protruding; ventral part of gnathos somewhat more strongly sclerotized and with small, thick spines. Fultura superior smooth, passing into dorsal sclerotization of anellus. This sclerotization curves inward to form a shallow sac, and from there it extends as two strongly sclerotized and spined, oblong processes with a pointed apex on either side of the aedeagus. Aedeagus slightly bent in the middle, coecum shorter than wide, ventral process relatively small, somewhat longer than wide. Costa of valva expands distally and bears a twofold costal process. Distal part of costal process much as in *sataspes*, with radiating spines, but better developed; proximal part very heavily sclerotized, with serrated edge. Cucullus broadly developed, dorsally excavated to receive the costal process.



Figs. 112—116. Female genitalia, lateral and ventral aspect, and papilla analis. 112—114, *S. sataspes* (S. Africa). 115—116, *S. depauperata australis* (Muden, Natal).

Female genitalia (figs. 115, 116). — Ventral sclerites of segment 8 fused to a single sclerite. No antevaginal sclerotization. Postvaginally a narrow, V-shaped, membranous strip, flanked by slightly protruding sclerotization. Laterally some conspicuous, sclerotized folds. Distal edge of segment 8 straight. Papilla analis



rounded, nearly as long as broad; apophysis posterior slightly curving, about as long as papilla.

Ecology. — Mainly found on grassy hill-sides, where the skippers feed on flowers, but also found in the thorn bush. In S. Africa it is on the wing from July to April in two generations (Swanepoel, 1953). This may also be the case in the northern part of the range, but from there I have also seen specimens captured in May and June. Food plants have not been recorded.

Distribution (Map 21). — From Uganda and Kenya through eastern Africa south to Transvaal and Natal.

Geographic variation. — The width of the median band on the underside of the hind wing varies geographically, the northern populations showing a broader band. There is also some variation in the length of fore wing and the ground colour of the underside of the hind wing, but much overlap exists in these characters.

Spialia depauperata depauperata (Strand)

Hesperia ferax var. *depauperata* Strand, 1911. — Mitt. zool. Mus. Berlin 5 : 304 (Msamwia, between Lake Rukwa and Lake Tanganyika, S. Tanzania; not Msamusia, as stated by Evans, 1937). Holotype (♂) in the Zoologisches Museum der Humboldt-Universität, Berlin (labelled: S. Tanganyika, S. Ufipa, 25.1.09, Fromm.).

Syrichthus rehfousi Oberthür, 1912. — Ét. Lép. Comp. 6 : 117, fig. 1331 (Mpala, W. shore of Lake Tanganyika). Holotype (♂) in the British Museum (Nat. Hist.), London.

For the use of the name *abscondita* (see Evans, 1937) instead of *depauperata*, see synonymy of *diomus ferax*.

External characters (pl. 7 figs. 55, 56). — Median band on underside of hind wing broad, median spots 4—5 broader than width of ground colour in cell and usually also broader than width of ground colour between median and submarginal spots in spaces 4—5. This ground colour usually with a greenish tinge. ♂ (10.4—) 11.3—13.8 mm; the largest specimens are found in Malawi and S. Tanzania.

Distribution. — The northern part of the range, Uganda and Kenya southward to Zambia and Mozambique.

Localities. — Kenya: Kibwezi, Menfort, Mt. Elgon (BM, MN). Uganda: Ankole-Toro Border, SE. Ankole, W. Ankole, Kampala, Kafu R. nr. Hoima-Kampala Rd, Mbarara (S. Toro), Mulange (Mabira Forest), betw. Sezibwa R. and Kampala, Simba (W. Lake Victoria) (AMNH, BM). Tanzania: Geita, Mpanda, Ngamo, Ufipa, Wanzizi (BM, ML, MN). Zaïre: Ditanto, Marungu Plateau, Mpala (= Makowiri), Panda (BM, MRAC). Malawi: S. of Mangoche Mtn, Mlanje, Ncheu (BM, NMB; Gifford, 1965). Zambia: Petauke, Solwezi (BM, HDE; Neave, 1910, as *zebra*). Mozambique: Kola Valley, Tete to Ft. Jameson (Makanga Distr.) (BM, HDE; Neave, 1910, as *zebra*).

Material examined. — 45 ♂, 9 ♀ : 4 ♂, Kenya (BM, MN); 11 ♂, 1 ♀, Uganda (AMNH, BM); 14 ♂, 4 ♀, Tanzania (BM, ML, MN); 4 ♂ (incl. holotype *rehfousi*), Zaïre (BM, MRAC); 3 ♂, 1 ♀, Zambia (BM, HDE); 6 ♂, 3 ♀, Malawi (BM); 3 ♂, Mozambique (BM, HDE).

Spialia depauperata australis subspec. nova

Holotype (♀): Muden (Natal), 15.III.1948. British Museum (Nat. Hist.), London.

External characters. — Median band on underside of hind wing narrow, median spots 4—5 practically always narrower than width of ground colour in cell and between median and submarginal spots in spaces 4—5. This ground colour usually with a brownish tinge. ♂ 10.8—12.9 mm.

Distribution. — Transvaal and Natal, northwards probably to the Zambezi River.

Localities. — Rhodesia: Hunyani R. (Salisbury), Mtoko, Penkridge (Melsetter), Redbank (W. Matabeleland), Umtali, Vumba (BM, MN, NMB). South Africa. Natal: Estcourt, Ladysmith, Muden, Tugela, Weenen (BM, MN; Swanepoel, 1953). Transvaal: Letaba, Lydenburg, Munnik, Pietersburg, Potgietersrust, Warmbaths, Zoutpansberg (Swanepoel, 1953).

Material examined. — 44 ♂, 21 ♀ : 2 ♂, 1 ♀, Rhodesia (BM, MN). 42 ♂, 20 ♀ (incl. holotype), Natal (BM, MN, MRAC).

4. PHYLOGENY

Introduction

As said in the introduction to Chapter 3, the species groups recognized in this paper are thought to be monophyletic groups. Such a statement would have little value, if it was not accompanied by arguments. The argument for considering a group monophyletic (in the sense of Hennig, 1966) can only be the presence of an autapomorphy. Thus, in this chapter we shall investigate phylogenetically the various states of characters found in *Spialia* to find the arguments for the classification proposed in the previous chapter.

In a future paper I shall show that only few of the many arguments used in the literature to distinguish between plesiomorphous and apomorphous character states and to find monophyletic groups are supported by the evolutionary theory. Our present knowledge of *Spialia* allows the application of only three of these arguments, viz., (1) the argument of outgroup occurrence, (2) the argument of differentiation (complexity), and (3) the argument of vicariance. These arguments can be defined as follows:

(1) If in a monophyletic group a character occurs in more than one state, the state occurring also outside the group is considered plesiomorphous.

(2) If in a monophyletic group a phenocline of increasing differentiation or complexity can be distinguished, the evolution is supposed to have taken place in the direction of the strongest differentiation or the highest complexity, unless there are indications that reduction took place as a result of a particular mode of life.

(3) If in a monophyletic group of three or more species two species are vicarious, these species form a monophyletic subgroup (i.e. they are more closely related to each other than to any other species).

In the following lines these arguments will be applied to a number of characters. The outgroup is formed by the genera which are thought to be closely related to *Spialia,* viz., *Carcharodus, Gomalia, Celotes, Alenia, Syrichtus, Pyrgus* and *Heliopetes*. These genera, together with *Spialia,* are known as the *Pyrgus* group. Where appropriate, the outgroup will be extended to cover the whole subfamily Pyrginae or the whole family Hesperiidae.

In general the absence of a character in different species will not be taken as an indication of kinship relationship. This is based on the following reasoning. If a character arises, it can develop in a number of ways, each leading to a different type and representing a different evolutionary line, that theoretically can be traced back. A character can also be lost in different ways, each way representing a different evolutionary line, but as the result is the same in each way (loss of the character), the different evolutionary lines cannot be traced back.

Characters and character states

1. Wing markings

1.1. The central spot on the upperside of the fore wing is placed over or beyond the origin of vein 3 in *asterodia, agylla* and *kituina,* and before the origin of vein 3 in all other species of *Spialia*. The first condition is also found in *Syrichtus,* the latter in *Pyrgus*. So there is no clue to which condition is apomorphous and which plesiomorphous.

1.2. On the upperside of the fore wing there are no spots in spaces 9 and 10, except in *asterodia, agylla* and *kituina*. These spots are absent in the outgroup, except in *Pyrgus* and *Heliotepes*. In some *Syrichtus* species (*antonia, cribrellum*) the spots may be vaguely outlined. Also in a number of other genera of the subfamily Pyrginae there are spots in spaces 9 and 10. So there is no reason to consider the presence of these spots in some *Spialia* species otherwise than a plesiomorphous state. As said above, the absence of a character will not be considered proof of kinship relationship. Consequently, this character is not very well suited for our purpose.

1.3. The submarginal spots of the hind wing are in line, at equal distance from the termen, in all *Spialia* species except *colotes* and *confusa,* where the submarginal spots in spaces 4 and 5 are placed more basad. In the outgroup such a displacement is only found in various degrees in some *Syrichtus* species. As it may even vary within the species of *Syrichtus (poggei),* the presence of this character state in *Syrichtus* and *Spialia* seems to be due to the phenomenon known as the Law of Vavilov (cf. Vavilov, 1922), rather than to autapomorphy. Therefore, in *Spialia* the shift of the submarginal spots in spaces 4 and 5 towards the base can be considered apomorphous.

1.4. In the *Pyrgus* group the basal spots on the underside of the hind wing are always detached from the median spots, except in two *Spialia* species, viz., *phlomidis* and *kituina*. In *phlomidis* it is the median band that bends to the basal spot in space 7, in *kituina* it is the basal spot in space 7 that is elongated towards the central spot of the median band. These unique arrangements of the spots can only be considered apomorphous states that originated independently. Considering one of these arrangements plesiomorphous would force us to recognize a large number of parallel changes in the arrangements of the spots, viz., towards a disconnection of basal and median spots. Only if the connection of basal and median spots was also found outside the *Pyrgus* group, there could have been a reason for considering the disconnection apomorphous.

1.5. In two *Spialia* species, viz., *spio* and *diomus,* a spot occurs between the median spot and the submarginal spot in space 1c on the underside of the hind wing. The spot does not occur in other species of the *Pyrgus* group and for that reason its presence is considered apomorphous.

2. Legs

2.1. In all *Spialia* species the mesotibiae are unspined, except for the two terminal spines, but in *diomus* the mesotibiae are provided with a double row of spines. In the outgroup this character is only found in *Syrichtus cribrellum*. It is possible that this is the result of common ancestry, in which case the spined mesotibiae constitute the plesiomorphous state in *Spialia,* unless we assume that *cribrellum* is a descendant of *diomus*. There is no ground for the latter assumption. The alternative explanation is a parallel development. Knowledge about the function of the spines could support this explanation. Unfortunately, we do not have the slightest idea of their function. At the moment this character can be used in phylogenetic considerations only in connection with other characters.

3. Secondary sexual characters

3.1. A costal fold in the fore wing, with specialized scales, is present in the males of five *Spialia* species, viz. *asterodia, agylla, kituina, colotes,* and *confusa.* In the outgroup a costal fold is absent in *Alenia,* one species of *Syrichtus* and a few species of *Pyrgus.* The character appears to be a characteristic of the subfamily Pyrginae, though it is absent in many species. Its intricacy suggests that it is an autapomorphy of the Pyrginae, that was lost independently in many cases. Thus the presence of a costal fold is considered here a plesiomorphy of *Spialia.*

Table 1. Families of food plants of *Spialia* species.

	Malvaceae	Sterculiaceae	Tiliaceae	Convolvulaceae	Rosaceae	unknown
asterodia	X	X				
agylla	X	X				
kituina						X
spio	X	X				
diomus	X	X				
phlomidis				X		
osthelderi						X
geron						X
doris				X		
colotes						X
confusa		X	X			
sertorius					X	
orbifer					X	
mafa	X					
galba	X	X				
wrefordi						X
paula						X
secessus						X
dromus			X			
ploetzi						X
mangana						X
nanus	X	X				
delagoae						X
zebra		X				
sataspes	X	X				
depauperata						X

Table 2. Families of food plants of the genera of the *Pyrgus* group. The Sterculiaceae and Tiliaceae, food plants of a number of *Spialia* species and closely related to the Malvaceae, have been omitted (see table 1).

	Malvaceae	Rosaceae	Convolvulaceae	Labiatae	Cistaceae	Acanthaceae
Celotes	X					
Carcharodus	X			X		
Gomalia	X					
Alenia						X
Syrichtus				X		
Spialia	X	X	X			
Pyrgus	X	X			X	
Heliopetes	X					

4. Ecology

4.1. All species of *Spialia,* as all species of the outgroup, are at home in open formations, though they may penetrate forests along paths, etc. There is only one exception, viz., *ploetzi.* This species is confined to the lowland evergreen forest. On the basis of outgroup comparison this habitat preference is considered apomorphous.

4.2. The food plants of Hesperiidae are only very incompletely known, but the little that is known appears to be interesting. Table 1 summarizes the families of the food plants of the *Spialia* species as far as known and table 2 gives the families of the food plants per genus of the *Pyrgus* group. From these tables it appears that the Malvaceae are the original food plant family of the *Pyrgus* group, as species of this family are used as food by species of almost all genera of the *Pyrgus* group. This idea is supported by the fact that Malvaceae are food plants of small and divergent genera like *Gomalia, Celotes* and *Alenia.* The divergence of these genera suggests that they departed since long from their common ancestor. It is very unlikely that they all independently adopted Malvaceae as food plants.

The *Spialia* species feeding upon Malvaceae usually also feed upon Sterculiaceae. These families are closely related and together with the Tiliaceae and some other families they form the order Malvales. As the food plants are incompletely known, the order Malvales instead of the family Malvaceae is considered here to contain the original food plants of the *Pyrgus* group (and of *Spialia*). It follows that the adaptation to Convolvulaceae and Rosaceae by some *Spialia* species is an apomorphous character state.

5. Male genitalia

5.1. A fenestrula is present in nine *Spialia* species, viz., *spio, mafa, galba, mangana, nanus, delagoae, sataspes, zebra* and *depauperata*. In the outgroup it is only found in *Syrichtus cribrellum*. This suggests that the presence of this character is an apomorphy in the *Pyrgus* group and a plesiomorphy in *Spialia*. However, a fenestrula occurs erratically outside the *Pyrgus* group, even in the subfamily Hesperiinae. Thus it may be an apomorphous state in the Hesperiidae that was secondarily lost on many occasions independently. The alternative explanation implies a parallel development (e.g. due to the Law of Vavilov). However it may be, the species of the *Pyrgus* group are all very similar, so that the idea that they are closely related, seems a good working hypothesis. If in such a group of species a character occurs in only few species, the presence of that character in these species seems to be due to common ancestry rather than to parallelism. This may be interesting for the relationship between *Syrichtus* and *Spialia*, but it implies that the presence of a fenestrula in *Spialia* is a plesiomorphous state that is of little use in the reconstruction of the phylogeny.

Though the presence of a fenestrula may have little value for the present study, its further development may be useful. In *Spialia galba* and *mafa*, namely, the fenestrula is very large, much larger than in any other species of the *Pyrgus* group. Therefore this excessive development of the fenestrula is considered apomorphous.

5.2. The uncus of the Hesperiidae exhibits a great variety of shapes and dimensions. In four *Spialia* species, viz., *delagoae, zebra, sataspes* and *depauperata*, the apex is inflated. This character does not occur in any other species of the *Pyrgus* group, nor in any other Hesperiid species examined by me. Therefore, I consider the presence of this character the apomorphous state.

5.3. An indented or bipartite uncus occurs in many Hesperiidae, in the Pyrginae as well as in the Hesperiinae. The same genus may have species with an entire and with a bipartite uncus, e.g. *Celaenorrhinus, Pyrgus*. Both types of uncus may even occur with a single species (*Pyrgus malvae*, see De Jong, 1972). The partition is very variable, suggesting that it arose several times independently. In *Spialia* two types of indentation occur:

1. in *asterodia, agylla* and *kituina* the uncus is bipartite, the two parts lying more or less parallel. This is a usual type in the *Pyrgus* group, being found in *Pyrgus, Heliopetes* and *Celotes*, though the parts are not always parallel. At the moment there is no reason not to consider this type an apomorphous state within the *Pyrgus* group, and thus a plesiomorphous state in *Spialia;*
2. in *zebra* the uncus is shallowly indented and the two parts are widely diverging, giving the uncus the shape of a Y or T. This type is unique and must be considered an apomorphous state.

5.4. There is a keel running dorso-centrally over the uncus in five *Spialia* species, viz., *nanus, delagoae, zebra, sataspes* and *depauperata*. This character is absent in all other species of *Spialia* and the other genera of the *Pyrgus* group. Therefore, its presence is considered to represent the apomorphous state.

5.5. The gnathos occurs in very different types in the Hesperiidae. Warren (1957), studying the gnathos ("lateral apophyses") of *Pyrgus* species, thought it to be the original tenth abdominal segment with sclerites of the twelfth segment, but his argumentation is little convincing. I very much doubt if the gnathos is homologous in all Lepidoptera where it occurs. If a gnathos is developed to some extent, it appears to have a distinct function, being an extra grip during copulation. As it apparently has adaptive value, it may be expected that adaptive radiation has occurred and that more or less similar types originated more than once from the same basic structure.

Confining ourselves to the *Pyrgus* group, the following phenocline can be observed:

a. sclerotization of fultura superior from right and left sides of tegumen downwards (towards aedeagus sheath);

b. differentiation of ventral parts of downward sclerotizations (sclerotization stronger and better defined, development of spines, etc.);

c. sclerotization gets detached from tegumen (greater freedom of movement).

Stage c occurs only in conjunction with stage b. Applying the argument of differentiation the phenocline can be read phylogenetically in the direction a → b → c. Reading it in the reverse direction would imply that from a great variety of forms (and how would they have originated?) reduction took place to a slight sclerotization of the fultura superior and eventually to a fusion of this sclerotization with the tegumen. Such a development would make little sense and is difficult to understand.

In *Spialia* the following types are found:

1. stage a: *colotes, confusa, paula, wrefordi, secessus, dromus, ploetzi;*

2. stage b: 1. ventral parts strongly sclerotized but smooth: *asterodia, agylla, kituina;* 2. ventral parts spined, no definite protrusions, dorsal parts broad: *sataspes, depauperata;*

3. stage c: 1. ventral parts spined but no definite protrusions ("heads"): *spio, diomus, mangana, zebra, nanus;* 2. ventral parts forming definite, spined protrusions ("heads"): *phlomidis, osthelderi, geron, doris, galba, mafa, sertorius, orbifer, delagoae.*

5.6. In some species of the *Pyrgus* group the fultura superior is densely set with long, but weak spines (sometimes more looking like hairs), especially in the medioventral part. This is found in a number of species of *Syrichtus* and *Spialia,* so that it appears that it is a plesiomorphous state in *Spialia.* It is usually found in conjunction with gnathos stage a, suggesting that it has the same function as the spined heads of the gnathos found in stage b. The extension of the spines varies from an undefined area to a well-defined area covering two semiglobular membranous folds in the ventral part of the fultura superior, in connection with the rather undefined gnathos. As the latter situation is a further differentiation, it is supposed here to be apomorphous. It is found in *paula, wrefordi, secessus, dromus* and *ploetzi,* and to some extent in *mangana.*

5.7. In some *Spialia* species sclerotization occurs in the dorsal parts of the aedeagus sheath. This is unusual in the *Pyrgus* group. As the sclerotization is a further differentiation and the two types of sclerotization found in *Spialia* do not occur in the outgroup, they are supposed to have originated independently from the unsclerotized stage. The two types are:

1. rather well defined sclerite dorsally over aedeagus. This sclerite is not flat, but gutter-like (*wrefordi, secessus, dromus, colotes, confusa*) or roof-like (*paula, ploetzi*). The relationship between these subtypes is not clear at the moment and they are considered as belonging to the same type till more can be said about their relationship;
2. dorso-laterally, to the right and to the left, a strongly sclerotized and spined protuberance; the aedeagus sheath membrane between the right and left parts more or less strongly sclerotized. This is found in *mangana, nanus, delagoae, zebra, sataspes,* and *depauperata*. This type looks like a further differentiation of the first type. Support for this suggestion must be looked for in the distribution of other characters.

5.8. In the *Pyrgus* group the surface of the aedeagus is smooth or at most with fine spines, except in some *Spialia* species. According to the argument of outgroup comparison, the presence of outgrowths in *Spialia* is apomorphous. Three types are found:

1. *delagoae* type — a short, ventral cylindrical, spined excrescence: *mangana, nanus, delagoae, zebra, sataspes, depauperata;*
2. *phlomidis* type — a lateroventral, strongly sclerotized, dentate ridge: *phlomidis, osthelderi, doris;*
3. *geron* type — a lateroventral, long, cylindrical, smooth excrescence, giving the aedeagus a forked appearance: *geron*.

The *phlomidis* and *geron* types look dissimilar, except that the position of the excrescence (to the left) is identical. However, all other characters (see, e.g. the female genitalia, below) point to a close relationship of the species exhibiting these types of aedeagus and for that reason the long excrescence of the *geron* type of aedeagus is considered here a further differentiation of the *phlomidis* type (see also De Jong, 1974).

The *delagoae* type appears to be a development that is quite independent from the other types. It is, indeed, difficult to imagine a relationship between these types, not only the form but even the position of the outgrowth being dissimilar. In view of the present knowledge we can only consider the *delagoae* type an independent line of evolution.

5.9. In all species of the *Pyrgus* group the aedeagus is straight or very slightly bent, except in the *Spialia* species *wrefordi* and *ploetzi*, where it is clearly bent to a more or less S-shaped structure. Because of its distribution in the *Pyrgus* group the bent condition is considered apomorphous.

5.10. In all species of the *Pyrgus* group the aedeagus has a well-defined coecum, except in a number of *Spialia* species, where the coecum is shortened. These species are: *delagoae, nanus, zebra, sataspes, depauperata,* and *mangana*. In the last species the coecum is practically lost. As the differences in length of the coecum between the species are often very slight, an arrangement of the species in a phenocline would be rather arbitrary, except for the extreme condition found in *mangana*.

Because of the state of this character in the outgroup, the tendency to shorten the coecum must be considered apomorphous.

5.11. The valvae have a clear function during copulation: they clasp the end of the female abdomen. For a better grip the inside is often provided with prominent outgrowths, spines, haires, etc. This is the general picture throughout the Lepidoptera. Often various types of ornamentation of the inside of the valvae can be found within a group of genera or even within a genus. So three types can be found in *Spialia,* all referring to the differentiation of the costa:

1. *phlomidis* type — distal end of costa more or less widened, ventrally usually with a strongly spined outgrowth or dorsally with a finger-like excrescence: *phlomidis, geron, osthelderi, doris, spio, diomus;*
2. *kituina* type — ventro-distally a heavily sclerotized appendix with at least two heavy spines: *asterodia, agylla, kituina;*
3. *sertorius* type — ventro-distally a more or less differentiated appendix that is not more heavily sclerotized than the remainder of the costa and bears long, relatively soft spines: remainder of *Spialia.*

The *kituina* and *sertorius* types are sufficiently differentiated to consider them to represent two different, independent evolutionary lines: they are so much complicated that a single origin of each of both types can be accepted and they differ so much that a development of one type into the other is difficult to imagine. As these types are unique in the Hesperiidae, they are both considered apomorphous, but it is not easy to find the respective sister groups with the plesiomorphous state. The *phlomidis* type is rather varied and relatively simple. It comes closest to what is found in the other genera of the *Pyrgus* group, especially *Syrichtus* and *Carcharodus.* For this reason it is supposed to have departed not far from the ancestral type of *Spialia.* It is too varied to be simply considered the plesiomorphous state of one or both of the other types. The species, however, with this type of costal development can, as a group, quite well be considered the sister group of the group of species exhibiting one of the other types.

5.12. Within the *kituina* and *sertorius* types mentioned in 5.11. a phenocline of increasing complexity can be observed. As the primitive state of these types is supposed to have been rather simple (see above) and there is no reason to suppose that reduction took place (that would even be inconceivable in the *kituina* type, see below), the phenoclines may represent phyloclines. The clines are as follows:

1. *kituina* type — a. costa smooth (except for costal process), costal process relatively little differentiated (*asterodia*); b. costa with some short spines, costal process more differentiated (*agylla*); c. costa with some short spines, costal process gets loose from costa and joins cucullus (*kituina*). If *asterodia* had developed its costal process from the type found in *kituina,* i.e. through reduction of the costal process of *kituina,* then the latter would have rejoined the costa before further reduction, an inconceivable development. As the costal process in *kituina* cannot be said to be more differentiated than that in *agylla* (it is only dissimilar and has another position), it is quite well possible to suppose that *kituina* arose from an *asterodia*-like ancestor, independent from *agylla.* In that case the spines on the costa in *kituina* and *agylla* represent a parallel development.

2. *sertorius* type — a. costal process relatively small, rounded, with spines radiating to the ventral side (*mangana, zebra, sataspes, depauperata*); b. costal process elongate towards base of valva, spines radiating to the ventral side, but spines directed to the base of the valva predominant (*wrefordi*); c. costal process elongated, straight or curved upwards, all spines directed to the base of the valva (*paula, secessus, dromus, ploetzi, nanus, delagoae*). Starting from a), a second phenocline of the *sertorius* type of costal process can be observed, in which the connection between the costal process and the costa narrows, so that the costal process looks more separate, while the spines are not radiating, but directed basad and distad (*colotes, confusa*) or distad only (*sertorius, orbifer, mafa, galba*). As both phenoclines show an increasing differentiation, they are considered to represent phyloclines.

5.13. There are some further developments of the costa, which for their uniqueness in the *Pyrgus* group are considered apomorphous. They are:

1. In *ploetzi* the costa is extended distally over the cucullus.
2. In *confusa* the costa has grown fold-like over the costal process.
3. In *osthelderi, geron* and *doris* the costa is spined dorsally.

5.14. The cucullus is far less differentiated than the costa in *Spialia*. There are only two remarkable differentiations:

1. In the species with a costal process, except in *mangana, nanus, delagoae, zebra, sataspes* and *depauperata*, the cucullus is extended at the inside into a thin fold that more or less covers the costal process. Outside *Spialia* a cucullus fold occurs only in *Carcharodus alceae*, be it in another form. As *C. alceae* is in all other aspects very different from *Spialia*, the common possession of a cucullus fold is supposed to be a parallelism. Not only for the outgroup comparison, but also for the fact, that the cucullus fold appears to be correlated with the costal process, the presence of the fold is considered apomorphous. It would be interesting to know the function of the fold. If the costal process has developed as an extra grip during copulation, the cucullus fold must again reduce its effect.
2. In *doris* the cucullus is divided into two parts, apparently an apomorphous condition as it is a further differentiation of the cucullus, that does not occur elsewhere in the *Pyrgus* group. The division of the cucullus found in some members of *Syrichtus* is of another type (see a forthcoming paper on the genera of the *Pyrgus* group).

6. Female genitalia

6.1. The eighth abdominal segment is strongly modified in connection with the genitalia, especially the ventral part. The dorsal part is much less modified and in *Spialia* we can distinguish between two different types of sclerotization, viz., a) a single sclerite (tergite) covering the greater part of the dorsal area (*asterodia, agylla, kituina*), and b) two smaller sclerites, mid-dorsally separated by a membranous area (all other *Spialia* species). The first type is found in the outgroup in *Carcharodus, Celotes* and *Alenia*, and also outside the outgroup (e.g. *Erynnis, Xenophanes, Lobocla*). For this reason, and because a single tergite most closely corresponds with what must have been the original shape of the eighth tergite in females, the first type is considered plesiomorphous.

6.2. The dorsal sclerites of the eighth abdominal segment are never fused to the ventral sclerites in the *Pyrgus* group, except in the *Spialia* species *sertorius, orbifer, mafa,* and *galba,* while in *colotes* and *confusa* the dorsal and ventral sclerites practically touch. Thus, in *Spialia* there is a phenocline in the fusion of the dorsal and ventral sclerites, with three stages, viz., a. not fused; b. touching; c. fused. As the first stage is the usual one in the *Pyrgus* group (and outside), the phenocline a → c is supposed to represent a phylocline in the same direction.

6.3. The development of the ventral sclerites of the eighth abdominal segment is too varied to discover a certain line of evolution in it. If, e.g., the ventral sclerites are fused postvaginally, it cannot be determined whether this is due to extension of the sclerites or to an extending sclerotization of the postvaginal membrane. Therefore, the characters of the ventral sclerites are left out of consideration here (see, however, the discussion of the *delagoae* group).

6.4. In a number of *Spialia* species there is a distinct area spinulosa, viz., *spio, diomus, colotes, mafa, galba, sertorius, orbifer, wrefordi, paula, secessus, dromus,* and *ploetzi,* and in a few others there may be some indistinct spines postvaginally. An area spinulosa is also found in the outgroup, in *Syrichtus* and *Carcharodus*. Therefore I consider its presence a plesiomorphous condition. With increasing sclerotization of the postvaginal area the spines seem to tend to disappear. As the sclerotization probably evolved along different lines (see 6.3.), the absence of spines in different species is not necessarily an autapomorphy.

6.5. A unique development in the *Pyrgus* group, and probably outside as well, is the presence of strongly sclerotized, serrated "wings" at the proximal edge of the ventral side of the eighth abdominal segment in the *Spialia* species *phlomidis, osthelderi, geron, doris, spio,* and *diomus*. In the last two species there is only a weak development of these structures. Thus, there is a phenocline as follows: a. no "wings"; b. small, indistinct "wings"; and c. large "wings". In view of the absence of these structures outside *Spialia* their presence is supposed to be apomorphous and the phenocline is considered to represent a phylocline in the direction a → c.

6.6. In two *Spialia* species, viz. *spio* and *diomus,* the postvaginal area is provided with a tongue-like outgrowth that partly covers the area spinulosa. Outside *Spialia* a similar structure is only found in *Carcharodus lavatherae*. For the rest, *C. lavatherae* and the *Spialia* species are so dissimilar that it seems most plausible, that the outgrowth arose independently in *Carcharodus* and *Spialia,* just as sclerotization in the same area must have arisen more than once. Consequently, the presence of this outgrowth in *Spialia* is considered apomorphous.

6.7. The ductus bursae is smooth and more or less straight in all species of the *Pyrgus* group, except in two *Spialia* species, viz., *colotes* and *confusa,* where it is distinctly bent shortly before the bursa; the wall is corrugated at this place. In view of the distribution of this character its presence is considered the apomorphous condition.

6.8. In all species of the *Pyrgus* group the bursa copulatrix is without ornamentation, except for *Spialia galba,* which has a large, finely spined area in the bursa. Apparently an apomorphous character state.

6.9. Ten *Spialia* species have a basal lobe on the papilla analis. In the *Pyrgus*

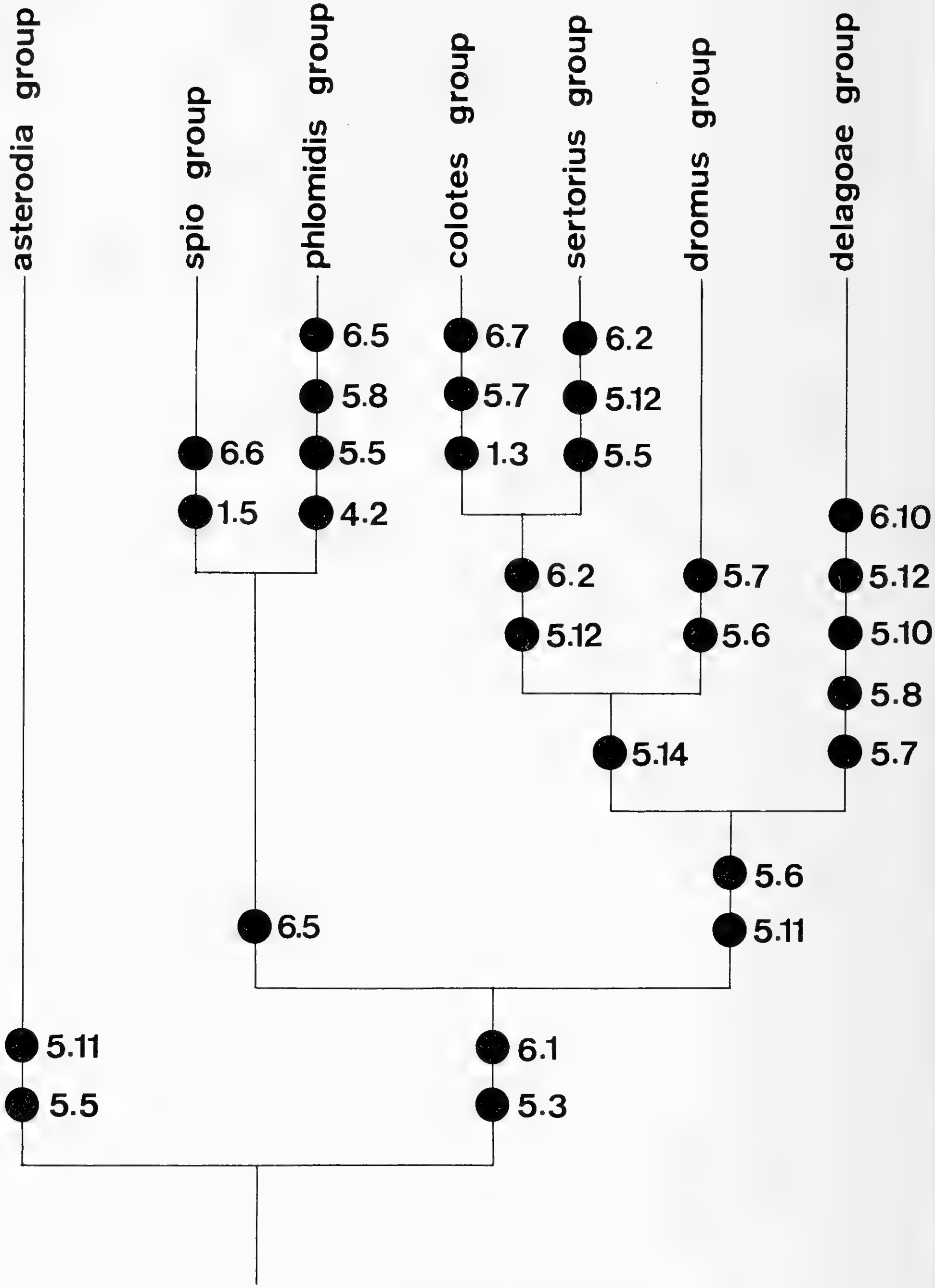


Fig. 117. Supposed evolution of *Spialia*. Black dots indicate apomorphous character conditions, the plesiomorphous condition of the same characters is supposed to be present in the sister groups. The numbers refer to the paragraphs in the text where the relevant characters are discussed.

group a basal lobe is further found in *Carcharodus* (one species only), *Alenia* and *Syrichtus*. If the presence of a basal lobe is not plesiomorphous in *Spialia*, then the structure arose so often independently that it is of little use for phylogenetical considerations.

6.10. Although the papillae anales are variously shaped in the *Pyrgus* group and for that reason are difficult to interpret phylogenetically, an exception must be made for the remarkably shaped papillae anales of the *Spialia* species *mangana, nanus, delagoae, zebra, sataspes,* and *depauperata,* with their short and broad body, and short, curved apophyses posteriores, giving the appearance of a quite distinct type of structure. I cannot do otherwise than considering this type apomorphous in relation to the type found in the other *Spialia* species.

The above considerations are the arguments for the reconstruction of the phylogeny as shown in fig. 117. For the sake of surveyability the diagram has been drawn up to the level of the species groups recognized in this paper, to show the phylogenetic basis for the division into species groups. The further development will be dealt with below for each species group separately and further diagrams will be provided for the *dromus* and *delagoae* groups. For diagrams of the *phlomidis* and *sertorius* groups the reader may be referred to my earlier paper (De Jong, 1974). The other species groups consist of so few species that the diagrams would have no meaning at all.

The phylogeny of the species groups

The *asterodia* group

Starting from the supposed monophyly of *Spialia* (see Introduction and a future paper on the genera of the *Pyrgus* group) the remainder of *Spialia* is considered the sister group of the *asterodia* group. Autapomorphies of the latter are the smooth, well-defined, heavily sclerotized gnathos and the peculiar shape of the costal process of the valvae.

It is surprising that the characters by which the species can so easily be distinguished, viz., the position of the central cell spot on the upperside of the fore wing and the presence of a costal fold at the fore wing in the male, cannot on the basis of our present knowledge be considered autapomorphies of the group. By these characters and by the single eighth tergite of the female abdomen and the bipartite uncus in the male genitalia, the group stands out as having retained a relatively large proportion of primitive character states, though it has developed some pecularities of its own. In all, it gives the impression of a group of which the ancestor has departed since long from the main stem of *Spialia*.

The development of the group seems to have been greatly influenced by the division of the original distribution area into two parts. This resulted in two species in South Africa (*asterodia* and *agylla*) that are very similar, and one divergent species in East Africa (*kituina*). The close resemblance between *asterodia* and *agylla* suggests that they originated after the separation of the East African population. Autapomorphies of *kituina* are the position of the costal process of the valva and the peculiar Y-mark on the underside of the hind wing. For *asterodia* +

agylla no autapomorphies can be listed at the moment. See also the discussion under 5.12.

The sister group of the *asterodia* group

The monophyly of this group is based on two autapomorphies, viz., the undivided uncus of the male and the double tergites of the eighth abdominal segment of the female. If this is correct, the group must have had a relatively simply built valval costa, which only differentiated after the next cleavage of the phylogenetic line. This cleavage gave rise to the ancestor of both the *spio* and *phlomidis* groups and to the ancestor of the remainder of *Spialia.*

In the line leading to the *spio* and *phlomidis* groups the male genitalia remained relatively simple, the main differentiation affecting the gnathos, but a remarkable development took place in the female genitalia, viz., the development of antevaginal, free sclerotizations ("wings"). If such sclerotizations arose more than once in *Spialia,* it can hardly be assumed that they would be of the same type. Therefore, the monophyly of the *spio* + *phlomidis* group is considered rather well established, though based on a single autapomorphy.

In the line leading to the remainder of the genus the main development took place in the male genitalia, where the costa developed a special, spined structure, viz., the costal process, and the gnathos became increasingly differentiated. The costal process is basically so uniform in the different species, that it does not seem too risky to accept it as an autapomorphy of the four remaining species groups.

One may wonder if it is not significant that the development of the female genitalia in one line and of the male genitalia in the other both seem to serve a better grip during copulation. If this is true, then it is understandable that in different lines male and female genitalia evolve in an inversely proportional way. At the moment this is pure speculation, but it may point to an important field of research, viz., the exact use of the various parts of the genitalia during copulation.

The *spio* group

The species in this group, *spio* and *diomus,* are considered sister groups because of two apomorphies which are both supposed to have arisen only once, viz., the presence of a tongue-like postvaginal structure in the female and the presence of an extra spot between the median and submarginal spots in space 1c on the underside of the hind wing. Another shared character, which cannot however be called an apomorphy, is their almost pan-Afrotropical distribution. For the rest they are rather divergent, especially in the male genitalia, suggesting that their origin is not very recent. As the male genitalia of *spio* most closely resemble those of the sister group of the *spio* group, it appears that *diomus* has drifted farther away from the ancestral condition. This being so, the spines on the mesotibiae of *diomus* are rather a new development than a relic from ancient times.

This group is an example of the influence of phylogenetic considerations on classification. Higgins (1924) thought the differences in the wing markings too large to unite *spio* and *diomus* into a single group. Instead, he placed *mafa* and *paula* with *spio,* as these species lack the median spot 6 on the underside of the hind wing. As said before, absence of a character in different species should not be taken as an indication of kinship relationship, as loss of a character may easily occur more than once by different causes. Thus, the typologically based group *spio* + *mafa* + *paula* is replaced by the phylogenetically based group *spio* + *diomus*.

The *phlomidis* group

The monophyly of this group is well established by the shared possession of four apomorphies, viz., food plants (Convolvulaceae), differentiation of gnathos, ornamentation of aedeagus, and large, winged, antevaginal sclerotizations. The further development of the group was treated in an earlier paper (De Jong, 1974) and there is no need to repeat the discussion here.

The sister group of the *spio* + *phlomidis* group

It seems that after the first cleavage of this group two sister groups originated with highly different rates of evolutionary change. While the line giving rise to the *delagoae* group apparently only split further after having obtained a number of new character conditions, so that the species share a large number of apomorphies, the other line split already after a single new development, viz., an excavation of the dorsal part of the cucullus resulting in a fold that partly covers the costal process. As a result, the *colotes* + *sertorius* + *dromus* group looks less homogeneous than the *delagoae* group. This is, of course, not an unexpected statement, as the heterogeneity of the first group was the first reason for a division into three species groups; it only shows the evolutionary background of this arrangement. In fact the possession of a cucullus fold was not an entirely new development of the *colotes* + *sertorius* + *dromus* group. It apparently started with a hollowing of the dorsal part of the cucullus. This development must have started before the cleavage with the *delagoae* line was finished, as the excavation of the cucullus can also be seen in the *delagoae* group. But the character attained full development only in the other line (see, however, the discussion on the *sertorius* group).

After cleavage of the *colotes* + *sertorius* + *dromus* line the costal process of the valva, still a rather undifferentiated excrescence with spines, begins to contract to an oval shape in one of the sister groups, the *colotes* + *sertorius* group, while also a tendency develops for the dorsal and ventral sclerites of the eighth abdominal segment of the female to fuse. By these two new developments the monophyly of the *colotes* + *sertorius* group is rather well established. There is, however, one difficulty. If the reconstruction of the phylogeny given here is correct, then the dorsal sclerotization of the aedeagus sheath found in the *colotes* and *dromus* groups must have arisen twice. Making, for the sake of this character, the *colotes* + *dromus* group sister group of the *sertorius* group, would compel us to accept an independent development of the differentiation of the costal process and the tendency to fusion of the ventral and dorsal sclerites of the eighth abdominal segment of the female in the *colotes* and *sertorius* groups. Just one parallel development against two. I have thought it wisest to choose for parsimony here and to attribute the occurrence of sclerotization of the aedeagus sheath in two species groups to the Law of Vavilov.

Yet another character may seem to couple the *colotes* and *dromus* groups, viz., the spined fultura superior. In the *colotes* group, however, this character appears to exist in a primitive stage, much like the condition it must have had before the *dromus* group and even the *delagoae* group branched off, and different from the large semiglobular folds characteristic of the *dromus* group.

It may be remarked that the above reasoning were superfluous if the *colotes, sertorius* and *dromus* groups were united into one species group, as sister group of the *delagoae* group. This would, however, only have moved back the problems to the moment the development within the combined group had to be dealt with.

The *colotes* group

Leaving the dorsal sclerotization of the aedeagus sheath out of consideration, the monophyly of the group is sufficiently established by the corrugation and bend of the ductus bursae and the inward shift of the submarginal spots 4 and 5 of the hind wing. A diagnostic character of the group is further the presence of a costal fold at the fore wing in the male. However, as said before, this character has a very scattered distribution throughout the Pyrginae and the genetics ruling its development are not yet understood, making it worthless at the moment for phylogenetic studies.

The most remarkable new development within the group is the fold that from the costa of the valva extends over the costal process in *confusa*. However, as the group consists of only two species, *colotes* and *confusa,* the further development of the group is of little interest from the phylogenetic point of view.

The *sertorius* group

Autapomorphies of this group are in the male the differentiation of the ventral part of the gnathos into spined heads and the differentiation of the costal process with spines directed only distad, and in the female the fusion of the dorsal and ventral sclerites of the eighth abdominal segment. These apomorphies appear enough to establish the monophyly of the group firmly. It is therefore surprising to find that in two of the four species of the group, viz., *sertorius* and *orbifer,* the cucullus fold is not much developed, suggesting a rather primitive state of this character, dating from before the cleavage with the *delagoae* group. If on the ground of this character *sertorius* and *orbifer* were left out of the group and placed as a group that originated before or shortly after the cleavage that gave rise to the *delagoae* group, then all the autapomorphies of the "old" *sertorius* group, of the *sertorius* + *colotes* group and of the *colotes* + *sertorius* + *dromus* group were based on parallel developments and no true autapomorphies. It seems more plausible that the cucullus fold was reduced in *sertorius* and *orbifer,* as a secondary development.

The group falls apart into two apparently monophyletic groups, viz., 1. *sertorius* + *orbifer* — autapomorphies: larval food plants belong to Rosaceae, almost complete fusion of dorsal and ventral sclerites of eighth abdominal segment in the female;

2. *mafa* + *galba* — autapomorphy: very large fenestrula. The dorsal and

ventral sclerites of the eighth abdominal segment of the female are only partly fused, not over their whole length.

For further details on the development of the group (also subspecific) the reader is referred to De Jong (1974).

A remarkable feature of this group is the allopatry of all species (*sertorius* and *orbifer* may overlap to a small extent). This is partly due to colonization from Africa across the Saharo-Arabian eremic zone, which made a subsequent sympatry very difficult. This will be dealt with in the next chapter.

The *dromus* group

The autapomorphies of this group are found in the male genitalia: the large, semiglobular, spined folds of the fultura superior and the elongated costal process. The female genitalia do not yield characters that at the moment can be interpreted phylogenetically, with exception of the very deeply incised area spinulosa in *wrefordi,* a unique and for that reason supposedly apomorphous character state.

For the reconstruction of the phylogeny of the group the following characters can be used:

a. costal process — plesiomorphous: *wrefordi;* apomorphous: *paula, secessus, dromus, ploetzi* (see above, 5.12);

b. costa of valva — the distal end of the costa is usually rounded in *Spialia,* but in *secessus* and *dromus* it is more or less angulated, and in *ploetzi* it is elongated (see 5.13). This is a phenocline leading to an increasing differentiation and, for that reason, considered to represent a phylocline. In *paula* the dorsal ridge of the costa slopes gently down distally and the costa is only vaguely outlined ventrally;

c. area spinulosa — this part of the female genitalia shows some variation in the *Pyrgus* group, especially with regard to the distal rim being arched, straight or slightly indented. In view of this variation the situation in *wrefordi* (an almost bipartite area spinulosa) can only be considered apomorphous;

d. habitat preference — the only *Spialia* species (virtually the only species of the *Pyrgus* group) that is confined to the forest, is *ploetzi.* This preference is considered apomorphous (see 4.1);

e. seasonal dimorphism — although in species of the *Pyrgus* group with more than one generation per year the adults may vary seasonally, the dimorphism found in *secessus,* in which the white of the spots on the underside of the hind wing is entirely replaced by brown in the dry season, is unique. For this reason the dimorphism of *secessus* is considered apomorphous.

On the basis of these characters the reconstruction of the phylogeny of the group in fig. 118 has been made. The following comments may be added:

1. The aedeagus is distinctly bent in *wrefordi* and *ploetzi.* This was considered apomorphous (see 5.9.). On the basis of the other characters, however, we must conclude that it is a parallel development in these species.

2. The monophyly of *secessus* and *dromus* is not very well established, as it is not based on autapomorphies. Although these species have abundantly differ-

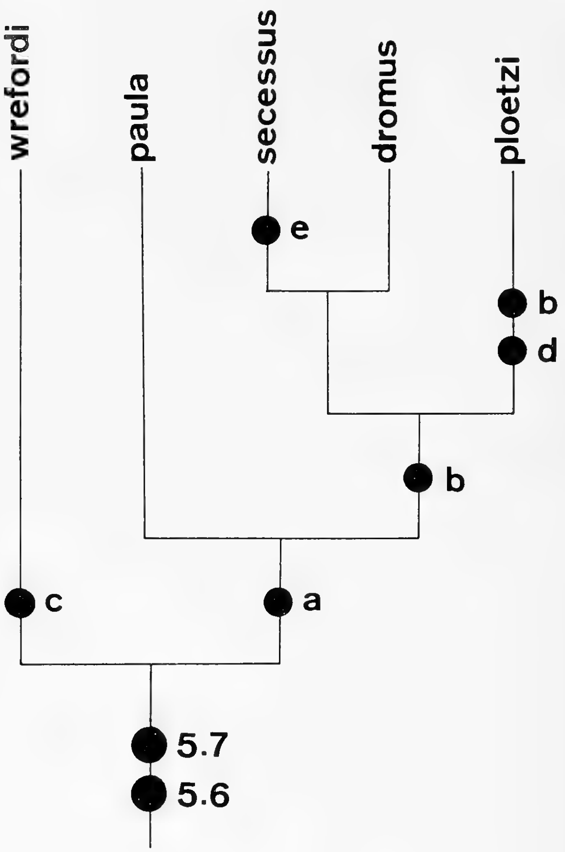


Fig. 118. Supposed evolution of the *Spialia dromus* group. Only apomorphous conditions have been indicated (see also fig. 117). Numbers and letters refer to the relevant paragraphs in the text.

ent wing markings, their male and female genitalia are much alike and on the basis of the present knowledge it cannot be stated whether this is due to symplesiomorphy or synapomorphy. At the moment the reconstruction of the phylogeny as given in fig. 118 seems the most probable one. It may be remarked that, if it turns out that the similarity of *secessus* and *dromus* is due to symplesiomorphy, this does not a priori imply that *secessus* and *dromus* are no sister groups.

The *delagoae* group

The species of this group share relatively many apomorphies, indicating that their ancestor had already departed far from the ancestor of the *colotes* + *sertorius* + *dromus* + *delagoae* group before it split further to the present situation. For the reconstruction of the phylogeny of the group the following apomorphous character states can be used:

a. apex of uncus more or less inflated: *nanus, delagoae, zebra, sataspes, depauperata* (in *nanus* more rounded than inflated) (see 5.2).

b. uncus bifid: *zebra* (see 5.3.).

c. uncus with a longitudinal, dorsal ridge: *nanus, delagoae, zebra, sataspes, depauperata* (see 5.4).

d. ventral differentiation of gnathos. The kind of gnathos found in the *delagoae* group is unique. There appears to be a phenocline of increasing differentiation from a *dromus*-like gnathos (*mangana*) through the ventrally still undifferentiated gnathos of *nanus* to a stronger differentiation in the ventral parts. Two types can be distinguished: 1. gnathos ventrally strongly sclerotized with some tubercles or short spines (*zebra, sataspes, depauperata*), and 2. gnathos ventrally with a strongly spined excrescence (*delagoae*). Both types may have arisen from the same undifferentiated *nanus*-like type.

e. costal process. The costal process occurs in two forms in the *delagoae* group, viz., as a rather undifferentiated outgrowth of the costa with radiating spines (*mangana, zebra, sataspes, depauperata*), and as an elongated excrescence of the costa, directed towards the base of the valva (*nanus, delagoae*). As explained in 5.12 the first type represents the plesiomorphous type. The simplest development of the costal process is found in *mangana*. In view of the occurrence of other plesiomorphous character states in *mangana* (gnathos, see above; female genitalia, see below), we may suppose that the simplicity of the costal process of *mangana* is not due to reduction, but represents a very primitive state. The elongated form of the costal process of *nanus* and *delagoae* reminds of the costal process of the *dromus* group. This can, however, only be due to convergence, unless all apomorphous characters shared by *nanus* and *delagoae* with the other species of the *delagoae* group, are due to convergence. Moreover, the costal process of *nanus* and *delagoae* extends from a very narrow, reduced costa, as in the other species of the *delagoae* group, and not from a well developed or even expanded costa as in the *dromus* group. Thus, the elongated costal process of *nanus* and *delagoae* is considered an apomorphous state.

A remarkable development is found in *depauperata:* apart from the usual costal process there is an extra, strongly sclerotized outgrowth with a serrated edge at the ventral side of the costa, close to the costal process. Such a unique development can only be considered apomorphous, no similar structures being known.

f. Under 6.3. it was stated that the sclerotization of the ventral side of the eighth abdominal segment of the female is too varied to be of use for phylogenetic considerations. An exception, however, must be made for the *delagoae* group. In all *Spialia* species (as in other species of the *Pyrgus* group) some part of the postvaginal area is membranous. In the *delagoae* group there is an increasing sclerotization of the postvaginal area, starting from a central sclerotization, as in *mangana* that fuses with the ventral sclerite, as in *nanus, delagoae, zebra* and *sataspes,* and leads to an almost entirely sclerotized ventral side of the eighth abdominal segment, as in *depauperata,* where the area spinulosa is entirely incorporated in the sclerotization and has lost its fine spines. In view of the development of the female genitalia in the other *Spialia* species and outside *Spialia,* the progressing sclerotization of the postvaginal area in the *delagoae* group must be considered to represent a progressing apomorphy.

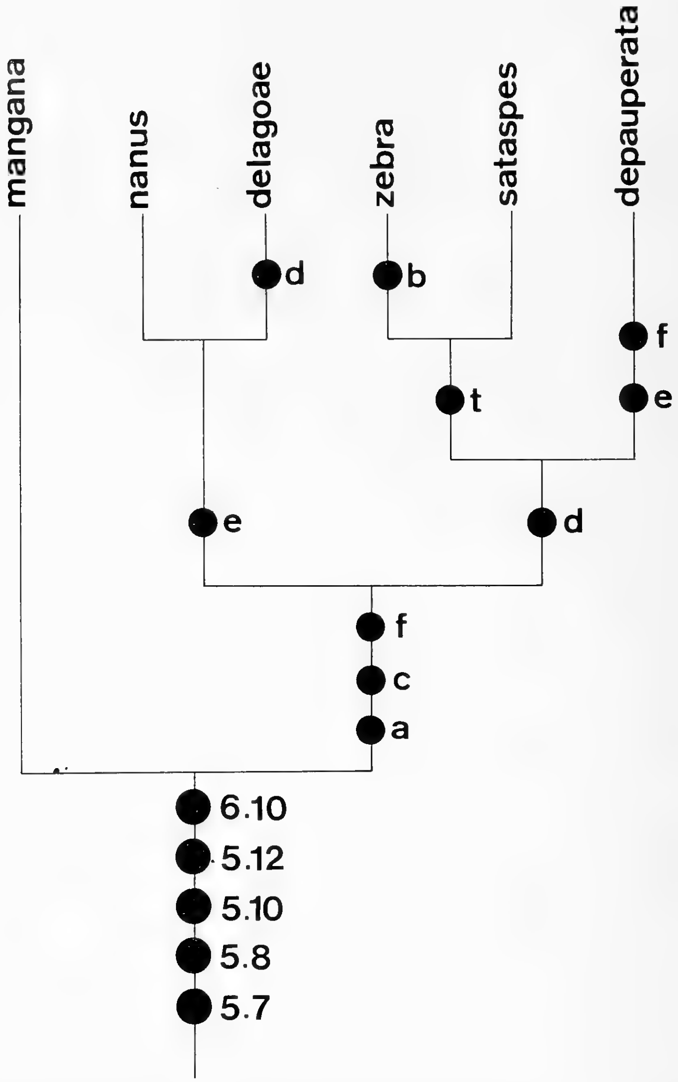


Fig. 119. Supposed evolution of the *Spialia delagoae* group. Only apomorphous conditions have been indicated (see also fig. 117). Numbers and letters refer to the relevant paragraphs in the text; t refers to the general discussion of the evolution of this group.

The reconstruction of the phylogeny of the group in fig. 119 is based on the above considerations. It may seem surprising that no apomorphies have been indicated for *mangana*, suggesting that this species has remained unchanged after the ancestor of the other species split off. This is improbable; there are several characters that in *mangana* undoubtedly occur in an apomorphous state, but this state becomes apparent only after *mangana* has been placed as sister group of the remainder of the *delagoae* group and, for that reason, cannot be used as argument for the drawing-up of the phylogeny. Such apomorphies are: 1. gnathos free from tegumen; 2. apex of aedeagus flattened and wide, spoon-like; 3. coecum virtually absent (see 5.10); 4. strong antevaginal sclerotization; 5. complete lack of submarginal spots on all wings.

Also the supposed monophyly of *zebra* and *sataspes* calls for explanation. It is difficult to give a single autapomorphous character state of these species. They are, however, so similar in a number of characters, that there is a fair chance that at least one of the characters occurs in an (aut-)apomorphous state in *zebra* and *sataspes*. Such characters are: 1. extension and shape of sclerotization in dorsal part of aedeagus sheath and in membrane between aedeagus sheath and gnathos; 2. short, slightly bent aedeagus; 3. short ventral process of aedeagus; 4. length of coecum; 5. apparent absence of cornuti; 6. general shape and development of valva. Further, if the monophyly of *zebra, sataspes* and *depauperata* is correct, the geographic vicariance of *zebra* and *sataspes* may be an indication of their close relationship, but the same applies to *sataspes* and *depauperata*.

5. GEOGRAPHIC HISTORY

As there are many factors that may influence the distribution history of a species, it is usually little rewarding to study the history of a single species if it is not possible to compare it with the history of the fauna the species belongs to. Thus in Europe, where the history of the fauna is relatively well-known, a study of the distribution history of a single species may yield some results. In tropical Africa, however, where the knowledge of the faunal history is extremely fragmentary, we can only hope to get some results by studying geographic patterns of distribution and evolution. A pattern, however, implies repetition and thus, it emerges only when many species can be compared. For that reason the genus *Spialia,* including only 26 species of which 20 occur in tropical Africa, does not seem an appropriate subject for a study of the geographic history. It appears, however, that even from the relatively few species a pattern of distribution and speciation arises that is worth discussing, as it may have some bearing on the general history of the fauna of open formations (the usual habitat of *Spialia* species).

Distribution patterns

In Chapter 4 it was supposed that the preference for forest in *Spialia ploetzi* is a recent development, coinciding with other recent developments in the same species. The other *Spialia* species have, as a group, occupied all areas with open formations throughout Africa, as far as there is some vegetation, as well as the warmer parts of the Palaearctic and part of the Oriental Region. The ten species occurring outside the Afrotropics (including SW. Arabia) belong to three species groups. Their distributions are as follows:

phlomidis group. Three species from SE. Europe to C. Asia, one species, viz., *doris,* from Kenya through the Middle East to Pakistan, and isolated in Morocco.

sertorius group. Two species in the Palaearctic, viz., *sertorius* and *orbifer,* forming a superspecies; one species in the Oriental Region, viz., *galba,* forming a superspecies with the fourth member of the species group, *mafa,* which occurs from S. Africa through E. Africa to E. Arabia (Oman).

delagoae group. Six species from S. Africa to Kenya; one of these, *zebra,* in E. Africa and Pakistan, and another, *mangana,* extending from E. Africa into Arabia as far east as Ras Fartak, halfway along the outher coast.

The pattern that emerges from these distribution data shows a contact between the Afrotropics and the areas outside through Arabia and not via West Africa. The Arabian connection is still more obvious, if we consider that three more species (*spio, diomus,* and *colotes*) extend from Africa into SW. Arabia, though without crossing the Arabian desert belt. This pattern agrees well with what is found in other butterflies (De Jong, 1976), but it does not explain why there is no connection between the Afrotropics and the Palaearctic in West Africa. In principle there are two possible explanations for the absence of a West African connection in *Spialia,* viz., (1) *Spialia* species once crossed the Western Sahara, but became extinct in Northwest Africa because of adverse climatic conditions, and (2) *Spialia* species never crossed the Western Sahara. The following arguments are in favour of the latter explanation:

1. In the West African open formations only three *Spialia* species occur, viz., *spio, diomus* and *dromus.* These species also occur in East Africa, where nine more species occur. So if only the number of species is considered, the chance of a West African connection is smaller than that of an Arabian connection.

2. The *Spialia* species that occur in West Africa have a very wide distribution in Africa, indicating that they are not very dainty in the choice of their habitats. Nevertheless, there are no traces of a crossing of the eastern part of the Saharo-Arabian desert belt by these species. If they were not able to traverse the desert belt in the east, where many other species succeeded, why should they have succeeded in the west?

3. There is no differentiation between the populations of *spio, diomus,* and *dromus* in West and East Africa, though there have existed important geographic barriers between West and East African open formations (see below). It means that the species came to West Africa only recently and too late to make use of the opportunities provided by the humid Postglacial Climatic Optimum to cross the Western Sahara, or that they are so eclectic that the barriers mentioned are no real barriers to them. In the latter case, however, we should expect that they made use of the opportunities to cross the Saharo-Arabian desert belt in the east (see also under Speciation patterns).

It may be thought that the occurrence of two other *Spialia* species, viz., *sertorius* and *doris,* in Northwest Africa made it impossible to *spio, diomus* and *dromus* to establish themselves in that area, but as the food plants of *sertorius* and *doris* are quite different from those of the Afrotropical *Spialia* species, this is very improbable.

As said above nine of the twelve *Spialia* species in East Africa, and more precisely in Uganda and Kenya, do not occur northwest of that area. This can only be understood by supposing the existence of an effective barrier between the open formations in East Africa and north of the belt of lowland evergreen forest. It must have been so effective that only three species succeeded in crossing it and so eventually reached West Africa, apparently in a recent time (see above). If we consider that the lowland forest extends as far east as West Uganda, and may have extended to West Kenya in rather recent times, it seems most plausible to look for the barrier in the area between the lowland forest and the Ethiopian highlands, the area that connects the East African plains with the open formations north of the forest belt. Here we find at the present time a very extensive swamp area, the Sudd region (Sudd is an Arabic word meaning "blockage", and relates to the difficult passage for boats), extending west and east of the White Nile in Southern Sudan and covering about 40.000 km^2 of permanent swamp, while about twice that area is flooded by seasonal inundation (Beadle, 1974; Rzóska, 1976). It is through broad water courses and lakes (Lake Albert, Lake Kioga) connected to Lake Victoria and the lowland forest belt. Such an area must be an effective barrier to the drought-loving *Spialia* species. Moreover, at least during the last 40.000 years the level of Lake Turkana (= Lake Rudolf) in North Kenya has changed repeatedly and has been up to 80 m above the present level, causing an overflow to the northwest, to the present Lotigipi Swamp (Livingstone, 1976). This swamp may have drained into the White Nile by way of the present Kenamuke Swamp and Pibor River, thus much extending the barrier to the *Spialia* species at times.

The age of the swampy region is, however, uncertain. According to Livingstone (1976: 27), "the deposits of the existing "Sudd", the Upper Nile Swamps, though presumably dating only from times since the end of the last interpluvial, deserve careful stratigraphic investigation." Moreover, at present a zone of deciduous savanna woodland extends to the southwest of the flood region (Rzóska & Wickens, 1976). Although a more humid period could easily have led to a connection between the lowland forest and the swamps, it is difficult to understand how conditions drier than at present, or even the present condition can have brought about the development of a barrier to expansion to the northwest. So for the time being we must be content with the presumption that the swamps of Southern Sudan, in combination with the Ethiopian highlands, the lowland forest belt, and unknown factors have acted as a barrier to *Spialia* species for such a long time, that the evolution of the genus took mainly place in East and South Africa. It is interesting to note that in the area concerned (i.e. Southern Sudan) overlap occurs of the faunas of the Sudanese and Somali zones (Carcasson, 1964). It implies that the area acted as a barrier to other animals as well, but it does not solve the problem of what exactly formed the barrier.

Speciation patterns

Starting from a speciation sequence as described in Chapter 4, a distinct geographic pattern of speciation arises from the north—south vicariance of sister groups at various taxonomic levels. The following vicariances can be distinguished:

1. at the species group level: *phlomidis* group north of the Saharo—Arabian desert belt (with slight penetration into the Afrotropics by *doris*), *spio* group south of the desert belt;

2. at the species level: *asterodia* + *agylla* in southern Africa, *kituina* in East Africa; *mafa* + *galba* south and east of the Saharo-Arabian desert belt, *sertorius* + *orbifer* north of it; *mafa* in Africa, *galba* in the Orientalis; *wrefordi* in East Africa, its sister group further south (with secondary expansion to the north); *paula* in southern Africa, its sister group further north (with secondary expansion to the south); *mangana* in East Africa and SW. Arabia, its sister group in southern Africa (with secondary expansion to the north); *nanus* in South Africa, *delagoae* further north; *sataspes* in South Africa, *zebra* in East Africa and Pakistan;

3. at the subspecies level: *diomus ferax* in southern Africa, *diomus diomus* further north; *colotes transvaaliae* from South to East Africa, *colotes semiconfluens* in Northeast Africa; *confusa confusa* from southern Africa to Tanzania, *confusa obscura* in N. Tanzania and Kenya; *mafa mafa* from South to Central Africa, *mafa higginsi* in East Africa; *depauperata australis* in southern Africa, *depauperata depauperata* in East Africa.

This pattern suggests a repeated fragmentation of the open formations, and agrees with the current idea of speciation by geographic isolation (allopatric speciation). It is only remarkable that the pattern is still so well discernible, though the isolation of the fragments may have been initiated long ago. However, as long as our knowledge of the exact ecological requirements of the species is so fragmentary, there is little use in speculating on the reasons for particular distributions, and we can only speak in general terms. It is, moreover, plausible that during speciation ecological requirements change in the same way as morphological characters, so that the barrier to range extension can be different before and after the speciation has taken place. Only two kinds of barriers will have been effective for all *Spialia* species (except for the forest species *ploetzi*), viz., desert and dense forest.

The Afrotropical Region

As no past or present east—west extension of desert conditions across the whole African continent south of the Sahara is known, a major factor in the disruption of the distribution of *Spialia* species in the Afrotropics must have been the extension of forests across the continent during wetter and/or colder periods in the Pleistocene (Carcasson, 1964; Moreau, 1966; van Zinderen Bakker, 1967). If only the forest formed the barrier, the subsequent retreat of the forest must have allowed range extensions of the *Spialia* species, obscuring the area of the previous isolation. We can imagine that in this way the following sister group originated: *spio—diomus, colotes—confusa,* and *secessus—dromus,* and possibly also *colotes* group—*sertorius* group, all broadly sympatric because the barriers to their distribution are only or mainly dense forest and desert. The restricted range of some other species, however, indicate that not only dense forest, but also some kinds of open formations act as a barrier. At least in East Africa the species concerned are restricted to dry areas (*kituina, wrefordi, mangana,* and *zebra*), while their sister groups are, or presumably have been, confined to grasslands in southern Africa. If we suppose that the ancestors of these groups of sister species had similar (though probably not identical) ecological requirements, the existence in the past of a corridor of dry savanna from East to South Africa must be presumed. Such a condition can have existed during dry periods. Hamilton (1974) supposed that a connection was possible for the last time 25.000 — 12.000 BP. In view of the further differentiation of the southern sister groups, especially those of *mangana* and *wrefordi,* dry conditions enabling the north—south connection must have also existed much earlier.

It must be noted here that the disjunction concerned shows some resemblance to the well-known Somalia-SW. Africa disjunctions of arid flora and fauna. Indeed, at least two species, viz. *mangana* and *wrefordi,* are confined to the dry thornbush habitat. However, the sister groups of the northern species are not restricted to or do not at all occur in the arid SW. African (Namibia) habitat. Thus, the ancestors of the pairs of sister groups showing north—south vicariance may have become adapted to a richer vegetation than found in the arid Somali zone, with greater possibilities for north—south connections. In that case the present habitat preference of *wrefordi* and *mangana* would be a secondary development. In favour of this idea is also the supposed further development of their respective sister groups. In both cases the sister groups not only differentiated, but also extended northwards, eventually reaching the less differentiated *wrefordi* and *mangana.* Possibly, the northern species could not keep up the competition with the new arrivals and were chased away into less hospitable land.

There are only five *Spialia* species that show subspecific variation in Subsaharan Africa. In three of them, viz., *diomus, mafa,* and *depauperata,* the zone of contact between the northern and southern subspecies is situated somewhere in Zambia-Malawi. This pattern may indicate a common history of the species concerned, which was influenced by the extension of lowland forest to the east and/or the extension of montane biota in East Africa during the late Pleistocene (cf. Moreau, 1966). For *mafa,* however, it is not likely that montane biota acted as a barrier, as this species is well capable of living in the present montane belt in Kenya.

The fact that there is a clear north—south vicariance of subspecies in *diomus* that does not occur in the two other wide-ranging *Spialia* species, *spio* and *dromus,* is a reflection of differences in habitat preference: *diomus* prefers more open and drier conditions than the other species and is for that reason more liable to range fragmentation during humid periods. It is therefore remarkable, that not only *spio* and *dromus,* but also *diomus* do not show subspecific differences between the populations of West and East Africa, though the swampy Sudd region in Southern Sudan must have acted as a barrier during humid periods. Moreover, further west another, probably still more effective, barrier existed during humid periods, viz., a much extended Lake Chad (Megachad), at its greatest extension stretching from the lowland forest to the Tibesti Mountains in the Central Sahara. The last expansion of the lake occurred no longer than 5.400 years ago (Beadle, 1974). The absence of traces of the isolating effect of these barriers in the populations of *diomus* in West and East Africa can only be understood by supposing that *diomus* entered West Africa only after the blockade caused by these barriers was removed.

A special problem is posed by the origin of the forest species *Spialia ploetzi,* as it is difficult to understand the advantage of an adaptation to a completely different habitat, except for reasons of competition. Unfortunately, the problem of change of habitat preference from savanna to forest (and vice versa) has not yet attained attention from the evolutionary point of view, though it must have acted a part in many more lepidopterous genera: of the 63 larger genera of African butterflies listed by Carcasson (1964), 33 have representatives in the forest as well as in open formations. For the time being we must be content with signalizing the problem.

Another point is the subspecific differentiation of *ploetzi.* The boundary between the two subspecies is at or close to the Cameroun—Nigerian border, apparently west of the Cameroun highlands. A similar situation is found in the Satyridae *Bicyclus ignobilis* (Butler) and *B. sanaos* (Hewitson) (Condamin, 1973) and will undoubtedly occur in many other Lepidoptera as well. The origin of this type of differentiation is uncertain and may be complex. The Cameroun highlands, though not acting as a barrier now, may have done so during a colder period, but that does not explain why the highlands are now populated by the eastern form. On the other hand, a dry period would have reduced and fragmented the West African forest area, so that there was no forest left between the River Niger and the Cameroun highlands (see, e.g., Booth, 1958). According to van Zinderen Bakker (1967) a dry, as well as cold period in West Africa was at least partly coeval with the Last Würm Maximum. It is therefore plausible to suppose that the subspecific differentiation of *ploetzi* dates from that time. We shall leave the speculation on the history of this species at that, as it falls outside the scope of the general history of *Spialia.*

The Saharo-Arabian desert zone

The Saharo—Arabian belt of desert has exercised much influence on the history and evolution of *Spialia.* According to Moreau (1952, 1966), the climate of the Suez and Red Sea areas and Arabia seems to have been similar to that of the present day since post-Miocene times, with a somewhat more abundant vegetation during humid periods in mountainous areas. I have not found observations on how far the Nile Valley can have acted as a corridor for north—south exchange since the Miocene, but as the Red Sea area was probably never better than semiarid, the Nile Valley may never have been more than a relatively narrow corridor of riverine forest with a belt of wooded savanna passing into semidesert with increasing distance from the river. Consequently, during the period we may suppose *Spialia* to have evolved to the present situation, the contact between the African and Eurasian faunas of open formations more humid than semidesert was repeatedly broken and re-established, and there are no indications of a connection over a broad front. A broad front connection existed in the Western Sahara up to about 5.000 years ago, but apparently *Spialia* did not play a part in it (see above).

Leaving the Western Sahara out of consideration, three corridors leading out of and into the Afrotropics were open during humid periods:

1. Nile Valley and mountains west of the Red Sea. For an interesting discussion of climatic and faunistic changes, see Rzóska e.a. (1976).
2. Mountains east of the Red Sea. Higher and more contiguous than the mountains west of the Red Sea. For the relative importance of this corridor, see De Jong (1976).
3. Elevated southern rim of the Arabian Peninsula. According to Moreau (1966) this area may have had a savanna-like vegetation during humid periods. The importance of this corridor is illustrated by the fact that almost half of the species of Rhopalocera occurring in Eastern Oman have an Afrotropical or Indo-Afrotropical distribution (Larsen, 1977). The general lowering of the sea level during the glacial periods must have drained the shallow Persian Gulf, allowing a faunal exchange over land between the Afrotropical and Oriental Regions.

The contact across the eastern part of the Saharo—Arabian desert zone is illustrated by the following pairs of vicarious taxa: *spio* group — *phlomidis* group, superspecies *mafa* — superspecies *sertorius, mafa* — *galba;* and by the occurrence of two species, viz., *zebra* and *doris,* north as well as south of the desert belt. The divergence of the degree of differentiation after severing of the contact, ranging from hardly any differentiation to species group level, suggests that the desert belt was crossed several times, in agreement with what is found in other butterflies (De Jong, 1976).

In view of the present distribution of the relevant taxa, the corridors were equally important. The first two corridors were used by the ancestor of the *sertorius* group, probably by the ancestor of the *spio* + *phlomidis* group, and by *doris* and *mafa,* while the third corridor was not only used by *zebra* and the ancestor of superspecies *mafa,* but to some extent also by *mafa* and *mangana.* It is interesting to note that the present distribution of *doris* and *mafa* clearly shows that these species used the corridors east as well as west of the Red Sea. As *mafa* availed itself also of the opportunity given by the third corridor, it can be called the most expansive *Spialia* species. The ancestors of superspecies *mafa* and of the entire *sertorius* group were apparently also expansive, so that one wonders whether such a trait could be hereditary.

As *mafa* and *mangana* have not completed the crossing of the desert belt, the direction of their expansion is easily detectable: apparently they came from Africa. For the other groups concerned the direction of spread cannot be inferred directly from the present distribution and some reasoning is needed to find plausible solutions, as follows. The sister group of *zebra,* and all successive sister groups when going down along the phylogenetic tree of the *delagoae* group (fig. 119) are African. If we do not conclude from this that the occurrence of *zebra* in Pakistan is due to an invasion from Africa, we are forced to assume that almost all species of the *delagoae* group originated from invasions from the east, successively *mangana, nanus* + *delagoae, depauperata,* and *sataspes,* while a fifth invasion brought *zebra* to Africa. This is less plausible than the assumption of an African origin of *zebra.* Reasoning along the same lines leads us to the conclusion that *doris (phlomidis* group) is a Palaearctic intruder in Africa, while *galba* and superspecies *sertorius* (both *sertorius* group) originate from a northward traverse of the desert belt (or rather from two African intrusions, the first bringing the ancestor of the *sertorius* group to the Palaearctic, where it differentiated into the ancestor of superspecies *sertorius*). For the further geographic and evolutionary history of the *phlomidis* and *sertorius* groups the reader is referred to De Jong (1974).

The last pair of vicarious taxa (*spio* group — *phlomidis* group) can also be supposed to have an African origin, for if the origin was Palaearctic, at least one more crossing of the desert belt would be needed to explain the cleavage of *the spio* + *phlomidis* group and its sister group (fig. 117). Moreover, starting from the assumption that the original food plants of *Spialia* belong to the Malvales (see Chapter 4), the change to Convolvulaceae in the *phlomidis* group, being an adaptation to Palaearctic conditions, would have been reversed in the *spio* group, if the latter originated from a Palaearctic intrusion. This is not a plausible explanation of the present situation. Also when applying the rule of parallelism of chorological and morphological progression, the *phlomidis* group, having more apomorphous characters than the *spio* group, must be considered the chorologically most progressed group. I quite agree with Hennig (1960), that the applicability of this rule is limited, but at least it does not contradict the other arguments.

Humid periods that opened the corridors occurred more than once in the past, for the last time during the Postglacial Climatic Optimum, which ended about 5.000 years ago. From this last opportunity may date the occurrence of *mafa* in Oman. Though mainly living in the highland grasslands in East Africa, the occurrence of *mafa* as far north as Erkowit in Sudan and Ashaira in Saudi-Arabia, and as far east as Oman, where it lives in an Acacia desert landscape, indicates that a relatively small climatic change may enable the species to avail itself of the corridors. For *doris,* which can live in wadi's as far as its food plant (*Convolvulus lanatus*) occurs, a still slighter increase of the humidity was needed to open the corridors. One may even wonder how far the present conditions prevent *doris* from crossing the desert belt.

In view of the differentiation of *galba,* superspecies *sertorius* and the *phlomidis* group, their ancestors must have left Africa during one or more humid periods before the Last Glacial Period. Supposing that speciation in superspecies *sertorius* and the *phlomidis* group took place under the influence of the glaciations in the Western Palaearctic by way of isolations in refugial areas, both taxa must have experienced at least two or three glaciations (see De Jong, 1974). It cannot be stated at the moment whether the three glacial phases of the Last Glacial (Würm) were enough for this development, but together with the two glacial phases of the preceding Riss glacial period (see, e.g., De Lattin, 1967; Moreau, 1955; West, 1968), they certainly were, so that the occurrence of *Spialia* in the Palaearctic does not need to date further back than some 200.000 years.

Contrary to the ancestor of superspecies *sertorius* and probably the ancestor of the *phlomidis* group, the ancestor of *galba* apparently used the eastern route, across the Persian Gulf, as did *zebra*. The best opportunities were provided during glacial periods, when the Persian Gulf was drained. Therefore, the occurrence of these species in India and Pakistan, respectively, is probably not of postglacial age. The wide distribution and differentiation of *galba* suggests that its ancestor arrived in Asia much earlier than *zebra,* as said above.

6. GENERAL OUTLINE OF THE EVOLUTION OF *SPIALIA*

In Chapters 4 and 5 the phylogeny and geographic history of *Spialia* have been discussed. In the present chapter we shall combine the conclusions into a general outline of the evolution of the genus.

The origin of the genus could not be discussed in the foregoing chapters, as that can only be done by searching for sister groups (according to the method of Hennig, 1966) and, for that reason, needs a comparison with other genera. In advance of a future revision of the genera of the *Pyrgus* group, it may suffice here to state that the ancestor of *Spialia* probably came from the steppes of Central and Western Asia. When and how it arrived in Africa is unknown. Its subsequent development and differentiation took place mainly in Africa. It indicates that there was a rather effective barrier to northward expansions from the very beginning of the genus *Spialia*. Apparently this barrier was the main factor underlying the geographic isolation that led to the origin of the genus. The only possible barrier that comes into consideration is the Saharo-Arabian arid zone. While, however, the main differentiation of *Spialia* took place in the savannas of Eastern and Southern Africa, some other barrier or a combination of barriers must have prevented *Spialia* from occupying the savannas north of the region of the lowland evergreen forest up to a rather recent time. A possible barrier was (and is) the swampy condition of the Upper Nile region (Sudd), but other, unknown, factors must have played a part as well.

The differentiation led in the first place tot the development of three types of male genitalia, especially with regard to the development of the costa of the valva, coinciding with three types of female genitalia, which are, however, less well defined. The three types are represented in the present taxa by the *asterodia* group, the *spio* + *phlomidis* group, and the remainder of the genus, respectively. Each type is distributed at least in Southern and Eastern Africa, obscuring the geographic isolation underlying the origin of the differentiation. The early development of the genus took place in a savanna habitat under not too dry conditions. The present occurrence of some *Spialia* species in dry savanna or semidesert appears a rather recent development, as undoubtedly is the adaptation of one species (*ploetzi*) to the lowland evergreen forest. The preference for open formations made the ancestors of the present *Spialia* species liable to fragmentation of their ranges by expansion of the forest biota across the African continent. As the occurrence of such expansions can be considered well established and similar expansions of the arid biota are not known, the differentiation of *Spialia* must, in the first place, be attributed to pluvial and/or cold periods that enabled a large-scale extension of the lowland evergreen forest or the montane forest.

The expansions of the forest resulted mainly in the open formations being divided into northern and southern parts. This pattern is still visible in the vicariance of a number of apparent sister groups in *Spialia,* which have been listed in Chapter 5. The fact that the vicariances occur at different taxonomic levels, from subspecies to species group, and the fact that the present distributions of the vicarious groups point to barriers at various places, indicate that the fragmentation of the open formations has occurred repeatedly.

Although periods with large-scale extension of forests are known to have occurred during the Pleistocene, data on the Tertiary climate are very uncertain. The highest number of successive cleavages needed to understand the present differentiation, is eight (viz., in the line leading from the ancestor of *Spialia* to the sister groups *zebra* and *sataspes*). It implies that the development of *Spialia* may mainly, if not entirely, have taken place in the Pleistocene and there is certainly no reason to look for the origin of *Spialia* in a period prior to the Pliocene.

The barriers that kept *Spialia* in Eastern and Southern Africa remained rather effective. The correctness of the assumption, that the arid condition of the Saharo-Arabian desert belt was a main factor inhibiting northward range extension, is indicated by the fact that only species capable of living under dry conditions succeeded in escaping the boundaries of the Afrotropics. Opportunities for such escapes were provided several times during the Pleistocene by increased humidity, for the last time only 7.000—5.000 BP (Postglacial Climatic Optimum). With regard to the opportunities there is no reason to suppose that the occurrence of *Spialia* species outside the Afrotropics dates back from a time prior to the Pleistocene.

The northward expansions took place after the initial three types had differentiated into the ancestors of the present species groups (the differentiation took mainly place in one of the types), a further reason to suppose that only in rather recent times, i.e. in Late Pleistocene, the Palaearctic and Oriental Regions were invaded. If there were earlier invasions, they have left no traces. For an explanation of the differentiation outside Africa it is not necessary to assume that the relevant invasions occurred earlier than the last or at most the one-but-last interglacial period, as the climatic changes since then were sufficient to be responsible for the development of the present differentiation. Consequently there are three kinds of evidence for a geologically spoken, recent occurrence of *Spialia* outside Africa, viz., (1) the advanced state of the differentiation in Africa, (2) the opportunities given, and (3) the differentiation outside Africa.

It is remarkable that the establishment of *Spialia* in the Palaearctic was accompanied by a change of food plants, from Malvaceae or related families to Rosaceae and Convolvulaceae. This may be due to competition. The Malvaceae are supposed to be the original food plants of the *Pyrgus* group. As the ancestor of *Spialia* most probably came from the Palaearctic, a return to the Palaearctic can be supposed to have caused competition, unless the food plants were changed. In this connection the common and wide-spread Palaearctic *Carcharodus alceae* (Esper), a multivoltine species of the *Pyrgus* group and living on various Malvaceae, comes in mind, but we shall not speculate here further on this subject, leaving it for a future discussion on the history of the *Pyrgus* group. Only one more remark about food plants. The faunal exchange between Africa and the areas outside was largely unidirectional as far as *Spialia* is concerned, viz., out of Africa. Only one successful re-invasion of Africa took place, viz., of *doris*. The success of the establishment of *doris* in Africa south of the desert belt may be due, apart from its preference for dry conditions, to the food plant (*Convolvulus*) being entirely different from the food plants of African *Spialia* species.

The connection between Africa and the areas outside was established only by way of the Nile Valley, the Red Sea area and the southern rim of the Arabian Peninsula. This is the more remarkable as the eastern part of the Saharo-Arabian desert belt is supposed to have been always drier than the western part, which was covered by a mediterranean type of vegetation only 7.000—5.000 years BP. The absence of a western connection is probably due to the late arrival of *Spialia* in the West African savannas, as indicated by the absence of differentiation between the populations in East and West Africa of the three species (*spio, diomus,* and *dromus*) that occur in West Africa, while one of these species (*diomus)* does show subspecific variation in Subsaharan Africa, and by the number of cleavages of the evolutionary line since the beginning of the genus, needed for *dromus* (seven), showing that this species itself is young and thus its occurrence in West Africa cannot be old. The main factor that kept *Spialia* so long out of West Africa, probably was the swampy condition of the Upper Nile region, connecting the lowland evergreen forest and the Ethiopian highlands, but other, unknown factors must also have played a part.

7. LITERATURE

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Generic names have been added to specific names not belonging in *Spialia*. Page numbers in bold type refer to descriptions.

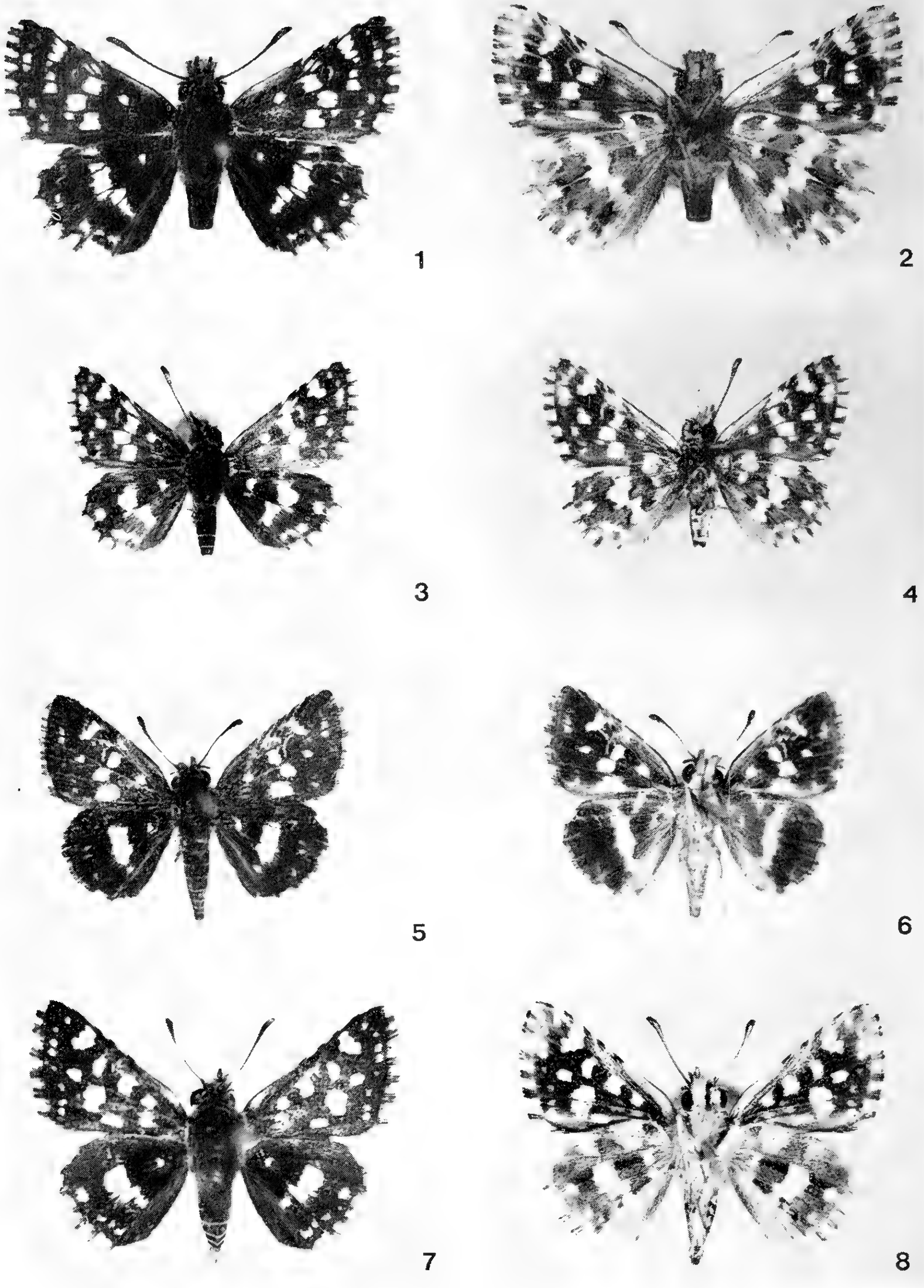

Plate 1.

Figs. 1—8. Upper (left) and underside (right) of *Spialia* species. 1—2, *S. asterodia* (Natal). 3—4, *S. agylla* (Bloemfontein, S. Africa). 5—6, *S. kituina* (Ukunda, Kenya). 7—8, *S. spio* (Naro Moru, Kenya).

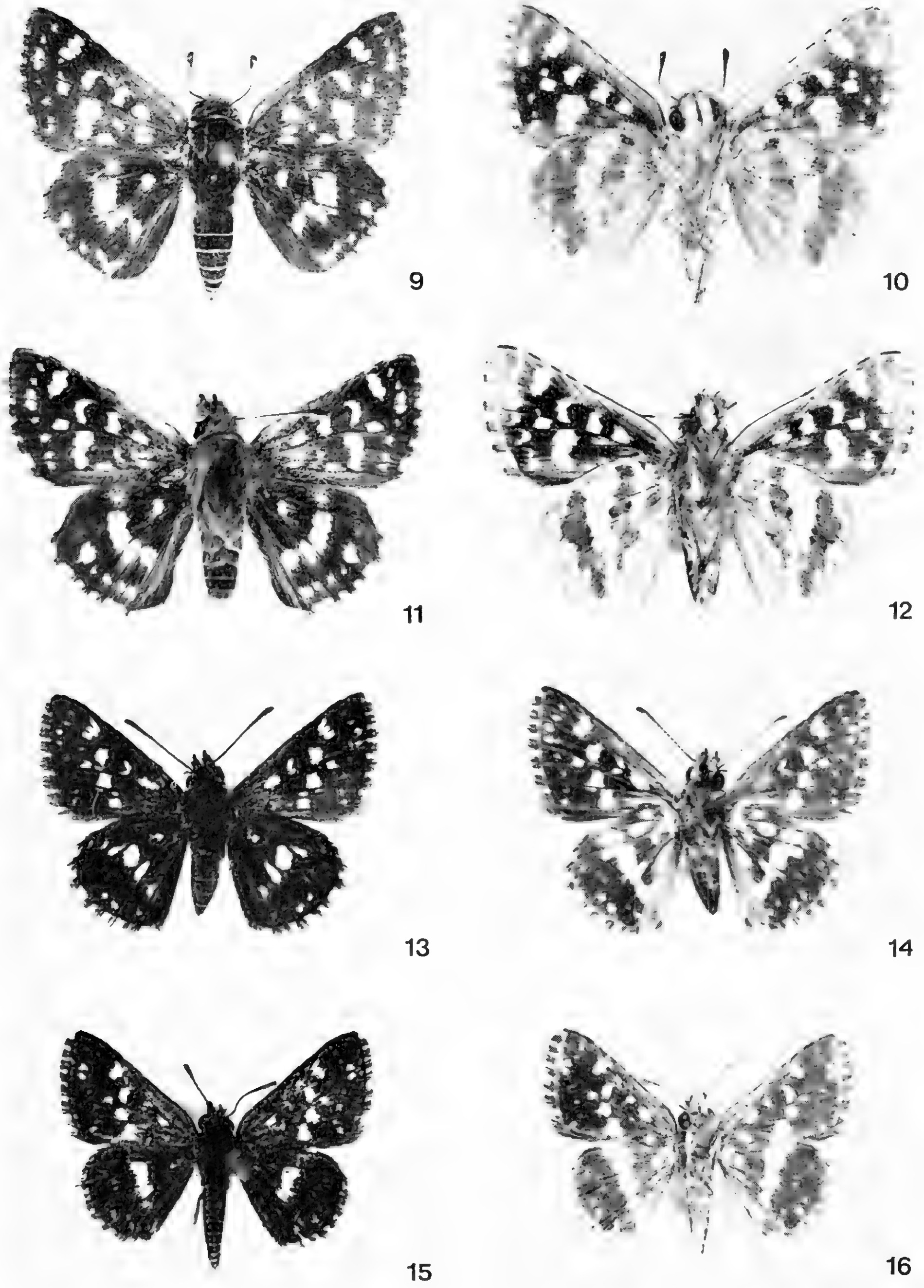

Plate 2.

Figs. 9—16. Upper (left) and underside (right) of *Spialia* species. 9—10, *S. diomus diomus* (Ukunda, Kenya). 11—12, *S. diomus ferax* (Sheldon, S. Africa). 13—14, *S. colotes semiconfluens* (Bihendula, Somalia). 15—16, *S. confusa obscura* (Arabuko Forest, Kenya).


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Plate 3.

Figs. 17—24. Upper (left) and underside (right) of *Spialia* species. 17—18, *S. phlomidis hermona* (Mt. Hermon). 19—20, *S. osthelderi gecko* (Kopet Dagh, Turkmenia). 21—22, *S. geron struvei* (Kotgai, E. Afghanistan). 23—24, *S. doris evanida* (Karachi, Pakistan).

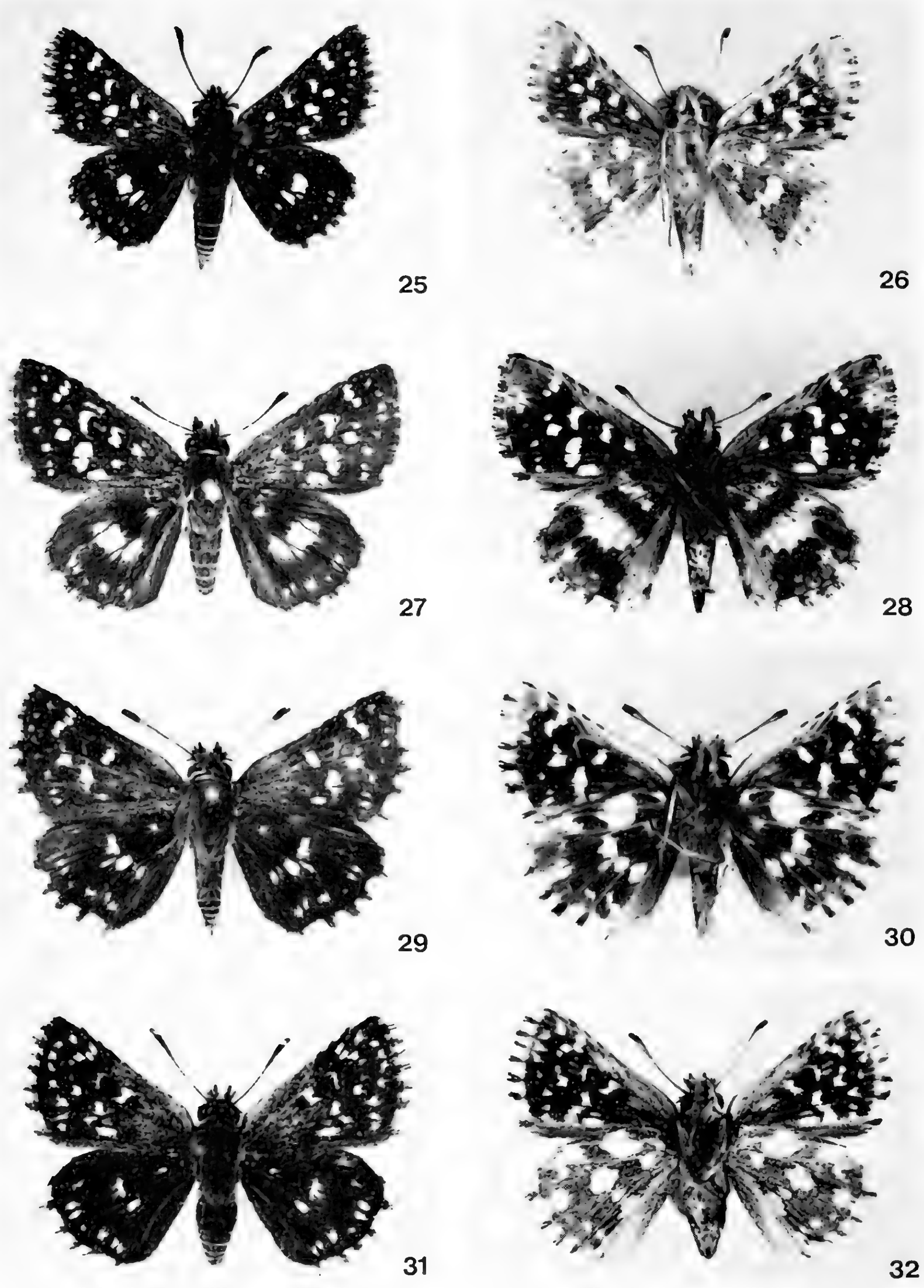

Plate 4.

Figs. 25—32. Upper (left) and underside (right) of *Spialia* species. 25—26, *S. mafa higginsi* (Naro Moru, Kenya). 27—28, *S. galba galba* (Haldumulla, Ceylon). 29—30, *S. sertorius sertorius* (Switzerland). 31—32, *S. orbifer orbifer* (Sarajevo, Jugoslavia).


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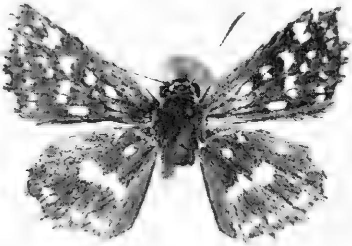
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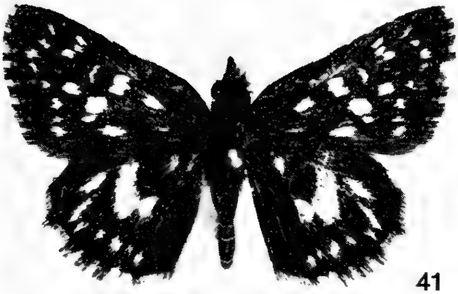
Plate 5.

Figs. 33—40. Upper (left) and underside (right) of *Spialia* species. 33—34, *S. wrefordi* (Samburu N. P., Kenya). 35—36, *S. paula* (Essexvale, Rhodesia). 37—38, *S. secessus* f. *trimeni* (Mpanda, Tanzania). 39—40, *S. dromus* (Mpanda, Tanzania).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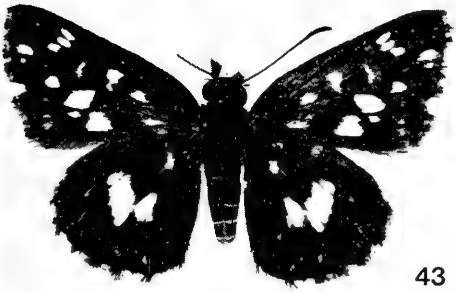
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Plate 6.

Figs. 41—48. Upper (left) and underside (right) of *Spialia* species. 41—42, *S. ploetzi ploetzi* (Bitje, Cameroun). 43—44, *S. ploetzi occidentalis* (Warri, Nigeria). 45—46, *S. mangana* (Dire Daoua, Ethiopia). 47—48, *S. nanus* (Sheldon, S. Africa).

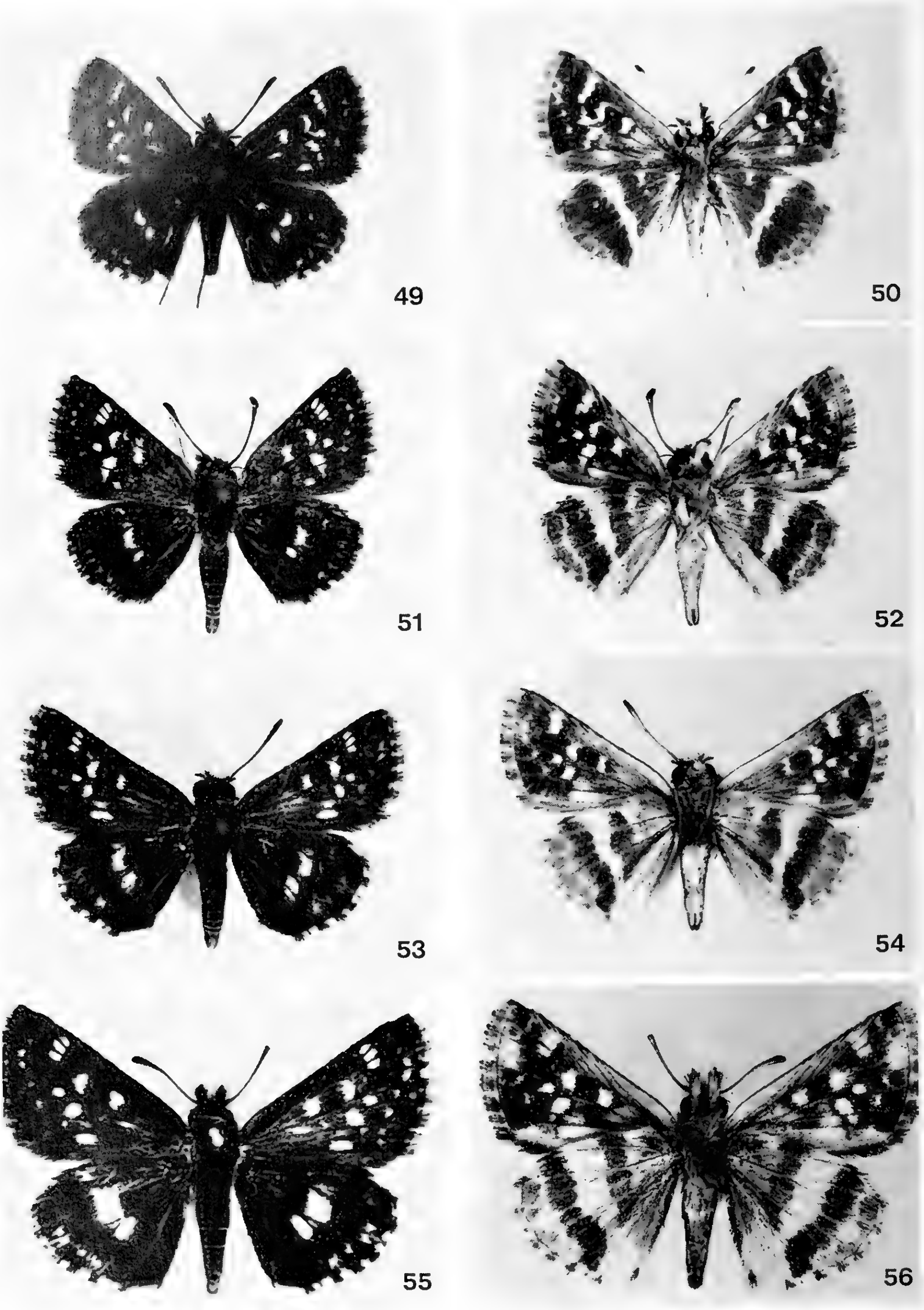

Plate 7.
Figs. 49—56. Upper (left) and underside (right) of *Spialia* species. 49—50, *S. delagoae* (Muden, Natal). 51—52, *S. zebra bifida* (Ukunda, Kenya). 53—54, *S. sataspes* (King Williamstown, S. Africa). 55—56, *S. depauperata depauperata* (Mlanje, Malawi).

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J. KIELLAND. — A provisional checklist of the Rhopalocera of the eastern side of Lake Tanganyika, p. 147—237, text-figs. 1—36, pls. 1—14.

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A PROVISIONAL CHECKLIST OF THE RHOPALOCERA OF THE EASTERN SIDE OF LAKE TANGANYIKA

by

JAN KIELLAND

4916 Boröy, Norway

With 36 text-figures and 14 plates

INTRODUCTION

The following list is in the first place based on collections made by the author, and mainly concerns the districts of Kigoma, Mpanda and Ufipa. However, in order to make the data of butterflies known from this area more complete, it includes as many records as possible, made by other collectors. These are as follows: The Kyoto University African Primate Expedition, that collected for several years at Mukuyu and Mihumu about 60 to 80 km to the south of Kigoma; Miss Goodall, who collected at Gombe Stream north of Kigoma; T.H.E. Jackson's African collector, Watulege, who collected in some places around Mpanda and Kigoma, including the Mahale mountain range; and finally Major Graham's African collector, who trapped *Charaxes* in the Mukuyu area.

In the present paper 733 species of butterflies have been listed, but more thorough collecting will probably produce many more. I would estimate the total number of species existing in this area at between 800 and 850. About 170 are new records for Tanzania and probably over 30 of them are new for East Africa.

In order to study the genitalia, specimens have been dissected of the majority of the more difficult groups, such as *Syntarucus, Axiocerses,* the *Teriomima* group, *Lachnochnema,* the *Iolaus* group, *Oboronia, Anthene, Uranothauma, Cacyreus* and others of the Lycaenidae, *Neptis* (Nymphalidae) and *Ypthima* and *Neocoenyra* (Satyridae) and several groups of the Hesperiidae and Pieridae. Much help with the identification has earlier been received from Dr. R. H. Carcasson; some Lycaenidae have been checked by Dr. H. Stempffer and Dr. G. E. Tite. Dr. M. Condamin has checked most of the material of the genus *Bicyclus* (Satyridae). Many of the *Charaxes* have been examined by the late Dr. van Someren.

For the nomenclature, Wallace Peters' checklist (1952) has been followed to a great extent, but whenever appropriate, newer works have been consulted.

DESCRIPTION OF THE RESPECTIVE AREAS (text-figs. 1 and 2, pls. 1-3)

The region dealt with in the present paper is illustrated in text-figs. 1 and 2. Two main conditions have been taken into account in drawing the boundaries for the recorded areas namely topography and geology. These are two important factors for the lepidopterological fauna; in this respect reference can also be made to my two papers in "Atalanta" (later "Atalanta Norvegica") of 1968 and 1969.

The area between Malagarazi river (south of Kigoma) and Burundi, is not very well known to me, and except for Gombe Stream, there are few records of butterflies here. For that reason I have not taken the trouble to divide the area into numbered zones and the collecting places from this area will be named in full. The same applies to the Ufipa district and the very rarely investigated parts of eastern Mpanda.

From the area north of Kigoma, I have only records of part of Goodall's and of my own collection at Gombe Stream near Lake Tanganyika and scattered collecting from the Uwinza-Kibondo road. The Gombe Stream area, with mountains rising rather steeply up from the lake-shore, contains scattered riverine forests in the valleys and *Brachystegia* woodland on the ridges and mountain slopes. The highest ridge,

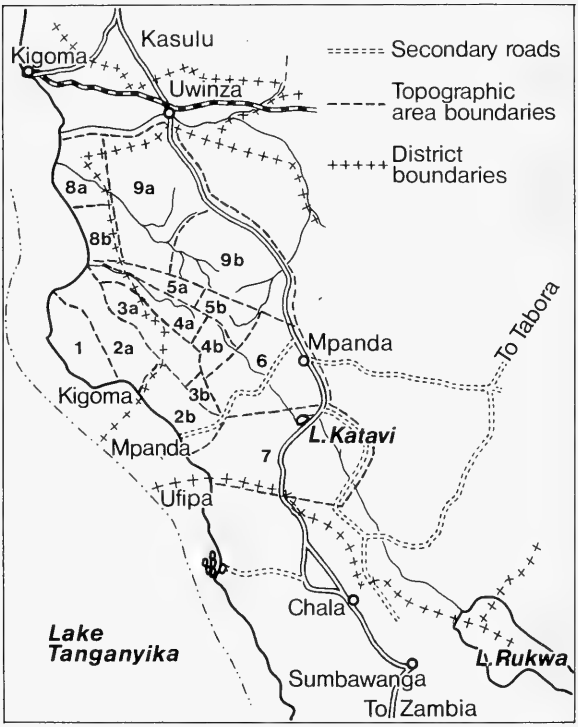


Fig. 1. Topographical areas; for explanation, see text.

extending parallel to the lake-shore, is mainly covered by open grassland. There are some interesting finds of butterflies. The hills further inland are mostly devoid of woodland and forest, due to the trees being cut down for firewood or on behalf of cultivation. This part, except the Park itself, is much more densely populated than the country to the south of Kigoma.

Area 1. The Mahale ridge, including Mt. Kungwe, is the highest mountain range on this side of Lake Tanganyika. Area 1 which comprises this mountainous peninsula, is a basement area of uniform gneiss (Mahale gneiss), bordering the complex basement formations to the east. The Mahale gneiss is very poor in mica and garnet, while in the other basement areas mica bearing schists with garnets are predominant.

This is a very interesting area with great variation in flora; there is forest in patches, from the lakeshore, as at Kasoge, to an altitude of more than 2300 m at Sisaga Mt. and Kungwe Mt.; there is also open montane grassland and mountain shrubs and woodland in lower altitudes. Numerous rivulets descend from the steep mountain sides. A wild and magnificent landscape. I have made 14 short safaris to this mountain, but I am sure that my collections are far from complete. The mountain area can only be reached on foot, or by boat from the lake.

Area 2a and b. This is low, undulating country situated between Lake Tanganyika and Mahale on one side and the Wanzizi-Kakungu scarp on the other. Area 2a is the moister part with more permanent water courses, heavily flanked by riverine forest and large areas of bamboo. The vegetation of 2b is largely woodland of savanna-like character. There are some concentrations of bamboo in the moister area close to the mountain range of 3a and 3b.

Area 3a and b. This is a mountainous area stretching in the Kigoma and Mpanda district, and including the Kakungu-Mweze-Wanzizi escarpment, and the Lubalizi and Utinta valleys. Utinta cuts through the highlands at an altitude of 1200-1300 m and is therefore a natural border between 3a and 3b. Area 3a is the highest part, with mountain tops of 1800-1900 m, and a large area, viz., Sitwe, Ngondo and the Karobwa-Kakungu Mts., is covered with montane grassland and solid bamboo with more or less scattered, stunted, deciduous trees and shrubs. There are numerous small permanent water courses with rich riverine vegetation. Part of the Mweze Mt. itself and also Karobwa Mt. are clothed with evergreen montane forest up to the top.

The Mweze-Sitwe grassland enjoys a very rich Lycaenid fauna and here the collecting is very good after the grass is burnt in August to September and perhaps in October if the rain is late.

Area 3b is a hilly country, most of which is heavily covered with *Brachystegia* woodland. Some rare Lycaenids emerge here after the rain has started in October to November. The only place with open grass, is the very top of the ridge of the Wanzizi hills at 1550-1600 m. Here are also large patches of forests climbing the hillsides and bordering the grassland on top.

Area 4a and b. The Luegele valley, situated in 4a, is the more interesting area, with rather extensive forest remnants. Area 4b, the Katuma valley, is largely dominated

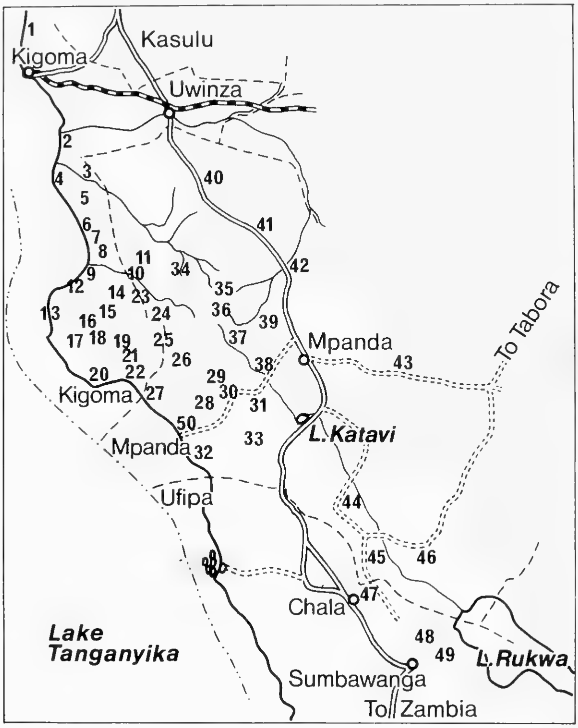


Fig. 2. Localities.

1. Gombe Stream National Park 800—1600 m.
2. Muhanga 900 m.
3. Mihumu 900—1000 m.
4. Mukuyu 800—900 m.
5. Kararumpeta Mt. ridge 1500—1600 m.
6. Helembe 800 m, Kefu forest 900 m, Kasha forest 1000 m.
7. Kapalamasenga, Mugondozi rivers 900—1000 m.
8. Mugombazi river ca. 1000 m.
9. Bulimba 800—1000 m.
10. Luegele river ca. 1100 m, Luntampa, Kapapa 1100—1200 m.
11. Ntakatta forest 1200—1500 m.
12. Logoza-Mgambo 800 m.
13. Kasoje (Kasoge) forest 800—1000 m.
14. Lubalizi river 1100—1300 m.
15. Karobwa-Kakungu Mts. 1700—1900 m.
16. Kasja 1100—1200 m.
17. Ujamba 2000 m, Mahale ridge 2000—2500 m.
18. Lukandamira 1600—1800 m.
19. Masaba ca. 1200 m.
20. Kibweza-Karia 800 m.
21. Ugaraba, Yampehu ca. 1100 m.
22. Kabakaranga 900 m.
23. Ngondo 1700—1800 m.
24. Mweze Mt. 1900 m, Sitwe 1600—1800 m.
25. Mkulya river 1400—1500 m.
26. Luega river 1200 m.
27. Lower Luega 800—1000 m.
28. Wanzizi hills 1400—1600 m, Mabwe 1200 m.
29. Lugalla hills 1200—1400 m.
30. Sibweza ca. 1100 m.
31. Nkungwe 1100—1200 m.
32. Karema, Sangu 800 and 900 m.
33. Kansanga 1100—1200 m.
34. Mt. Ipumba 1900 m.
35. Mt. Sitebi 1900—2000 m.
36. Kampisa river 1500—1600 m. Ntobo river, Upper Katuma river 1600 m.
37. Katuma village 1100 m.
38. Iloba 1000 m.
39. Katuma-Mpanda road ca. 1300 m.
40. Busondo ca. 1400 m.
41. Mishamu ca. 1200 m.
42. Nyamanzi river ca. 1200 m.
43. Uruwira plateau forest islands ca. 1300 m.
44. Useqya ca. 1000 m.
45. Kanindi, Mamba ca. 1000 m.
46. Rungwa ca. 900 m.
47. Mbuzi Mt. 2000 m.
48. Chulwe Mt. ca. 1900 m.
49. Mbizi forest 2000—2200 m.
50. Ikola, 800 m.

by heavy and open woodland, with riverine forests descending the gullies from the sandstone ridge. Most of the original forest along the Katuma river was destroyed by the local population in previous times. At present, most of the area is uninhabited.

Area 5a and b. The greater part of this area is occupied by a highland country situated inside the sandstone area, at the junction of this and the basic formations to the south, at 4a and b (only the Kapalamagulu Mt. near the lake is not sandstone but noritic gabro). The conspicuous feature of this section is the high ridge commencing close to Lake Tanganyika at Mt. Kapalamagulu, stretching eastwards towards Mt. Sifuta and Mt. Sitebi (2000 m) at 5b, which is the higest part of the ridge. The lower stretch, closer to the lake, varies between 1200-1500 m and is mostly covered with woodland and some forest. Mt. Kapalamagulu, however, is covered with grasslands and for the greater part devoid of trees. The gullies and valleys of the eastern section of 5a are more heavily clothed with riverine forests and the largest of these is the Ntakatta impenetrable forest and thickets which cuts diagonally through the mountain range. But the lower part of this forest has been reduced by the local inhabitants since I first saw it over 20 years ago. The highest part of the sandstone ridge with bare, grass covered mountain slopes and ridges, is poor in butterflies during the rains, but ideal collecting ground for Lycaenids after the grass is burnt, in August to September. So far, the most important collecting ground the writer has found on this high sandstone area, is the Kampisa valley and Mt. Sitebi. The forests are easily accessable on foot, as this is far from any human occupation and big game have trampled plenty of paths inside.

Area 6. The northern and western part of area 6 is characterized by *Brachystegia* clothed hills passing into savanna and plains further south-east. Here we approach a dryer region with little or no evergreen trees.

Area 7. This is also a typical woodland and savanna country with low hills merging with plains which mostly become flooded during the rainy season. It is a hot and arid place during the dry spell.

Area 8a and b, and 9a and b. This part consists of sandstone formations with numerous mesas and ridges reaching a height of up to 1600 m. The general direction of these ridges is NE-SW, approximately parallel to the lake. From the lake-shore at 780 m, the country rises abruptly to a low ridge of about 1000 m; behind the ridge it drops again to about 900 m, and rises gradually toward the east, broken by many gullies and ridges. The coastal sections 8a and b are the best known parts of the area. The most important collecting places are invariably the small remnants of evergreen forest, which for the greater part are situated along water courses, of which the Lugufu valley is a good example and probably the most interesting. Close to the coast near Mukuyu and Helembe, there are also several evergreen forests away from the streams, covering hills and valleys to the extent of one or two square miles, in patches. These coastal forest remnants consist of shorter, more stunted trees and more heavily covered with lianas than is usual further inland. These remnants and the forest relics on top of many of the mountains are a good indication of a former well developed primeval forest, covering most of the country to the east of Lake Tanganyika. Their decline is mainly due to the present drier climate. As the trees are not fire resistant, as is the woodland vegetation, they easily perish in the frequent grass fires during the dry season.

The inhabitants of this part of Tanzania apply shifting cultivation, that is, they seldom stay in one spot for more than two to five years, then shift to another place where they again cut down and burn another stretch of forest for cultivation. These evergreen forests hardly ever grow up again after they have been cut down and abandoned. This is first of all due to the yearly grass fires that destroy all regrowth of these types of trees. The only spots where I have seen partial or complete regrowth of evergreen forest in the areas of Mpanda, Kigoma and Ufipa, are clearings inside the Kasoge forest at Lake Tanganyika, west of Mt. Kungwe. The humidity here is higher than elsewhere and grass fires are less frequent.

The coastal evergreen forests of 8a and b become very arid in the dry season and towards the end of it, in September and October, very few butterflies are seen. But during the rains and early dry season, June-July to August, they abound.

Lugufu is the largest river south of Malagarasi and its tributaries from Mihumu upstream are richly bordered with riverine trees. Mihumu is situated at 900 m, surrounded by hills up to 1300 m. These hills are all covered with woodland of the same type as the rest of area 8a, 8b. A fairly high mountain area, the Kararumpeta range (1600 m) stretches south-west of Mihumu. This range rises very steeply from the Wazizi river, which runs to the north on the east side. The western sides slope less steeply towards the low hills parallel to the lake. There is no, or very little forest growth along the Wazizi; it was probably destroyed by earlier cultivation, but high up in the Kararumpeta range, evergreen trees clothe the river gullies. The vegetation on top is partly grass, partly bamboo and woodland. Where the mountain slope is not too steep for trees, woodland is dominant.

South of Kararumpeta, in area 8b, stand Mkuyu Mt. (Mkuyu Mt. as indicated on maps, is not correct; the local name is "Sifumbi", but I have not found this name on any map). Its vegetation is poor looking stunted woodland on sandstones and shales. Further on lies a flat country covered by equally small-growing, scattered, deciduous trees. This flatland between Mkuyu Mt. and the long sandstone ridge at 5a, 5b lies at an average altitude of 1100 m and is crossed by small rivers running west towards the lake. Some of these rivers are bordered by a rather well-developed forest vegetation with a butterfly fauna that is similar to that of the forests to the north, though somewhat poorer in species.

Area 9a, 9b, east of 8a, 8b west of the Uwinza road, consists of rather high country of mesas and numerous gullies covered with more or less heavy woodland of a more robust character than further west. The rainfall is probably higher and the soil not so poor. The rivers are furnished with some forest, where it has not been destroyed by man. At present, people are only cultivating some places along the road and the vast area between this and the lake shore is devoid of roads and tracks and almost completely uninhabited, mainly due to poor soil, and partly to inaccessibility.

East of the Mpanda-Uwinza road. The country here has been very little explored. The western part consists mainly of sandstone formations and is hilly with steep gullies. The only section I have collected in, is along the Mpanda-Tabora road. The area is completely uninhabited and the only people who travel here outside the road, are occasional hunters and honey gatherers. Tsetse flies abound and water is scarce, making this part of the country difficult for collectors.

Southern Mpanda and Rukwa. South of area 7 and east of the Rukwa escarpment are large sedimentary plains with savanna woodland and open grass, often flooded in the rainy season. There is no riverine forest as far as I have seen. It is a poor habitat for butterflies.

The Ufipa Plateau. This plateau culminates in the Liambalamfipa mountain chain crowning the steep escarpment, dropping down into the Rukwa depression. To the west, the plateau slowly descends towards Lake Tanganyika. The southern-most part of Ufipa is lower country dominated by smaller hills clothed with open woodland. In this southern area I have not collected so far. The high plateau is not so richly provided with permanent water sources as is the Mahale-Mweze-Sitebi area and there are only few forest remains. This is most certainly due to the early destruction of riverine vegetation and forest as a whole by the local inhabitants. Indeed, this is a situation which threatens the entire area, if the present rate of forest destruction is allowed to continue. The main forest remains are those at Mbizi Mt., near Sumbawanga and Mbuzi Mt. near Chala. The Chala Mt. itself, is sparingly clothed with riverine forest on top.

The areas in which comparatively thorough collecting has been done, are as follows (the best known areas first): 6, 3b, 3a, 5a, 5b, 1, 2a, 2b, 4a, 4b. Area 7 is little known, but has more or less the same ecology as the neighbouring areas 6 and 2b, with hardly any difference in the fauna. Areas 8 and 9 are both poorly collected, but 8 has recently been better explored and many new finds for Kigoma have turned up. The area north of 8 and 9 has been little examined by the writer except for the Gombe Stream National Park north of Kigoma. Ufipa has been investigated sporadically in the Chala and

Table 1. Composition of the butterfly fauna of Western Tanzania and its distribution over the different areas. Areas 7, 9a and 9b left out for reasons given in the text. U = Ufipa, G = Gombe; D = doubtful locality. For other explanation, see text.

Area	1	2a	2b	3a	3b	4a	4b	5a	5b	6	8a	8b	U	G	D
Papilionidae	17	15	12	17	13	14	11	16	17	13	16	16	10	9	
Pieridae	40	31	27	43	38	39	26	39	34	44	33	38	35	22	
Danaidae	7	5	3	7	4	7	3	8	6	3	8	7	3	3	
Satyridae	31	24	19	29	24	29	19	28	26	22	25	27	14	15	
Nymphalidae	119	83	52	111	75	116	52	135	102	82	122	123	49	76	1
Acraeidae	36	17	14	28	29	31	7	34	22	25	36	32	19	14	
Libytheidae	1	1		1	1	1		1	1	1	1	1		1	
Riodinidae	1														
Lycaenidae	98	64	43	118	82	76	29	109	120	115	90	109	67	54	3
Hesperiidae	81	57	32	84	68	67	22	75	91	88	54	78	42	52	2
Total	431	297	202	438	334	380	169	445	419	393	385	431	239	246	6

Sumbawanga area and also to some extent below the escarpment near Lake Rukwa. The number of species occurring in areas 2b and 4b cannot very well be compared with those of the other localities, as only sporadic collecting has been done here while walking through them to get to more interesting places. They are, however, certainly not so rich as most of the other localities. The distribution of the recorded butterfly fauna over the different areas is summarized in table 1.

Every species collected in Ufipa, at Gombe and in area 6 have been recorded, but I may have forgotten to make a note of some species observed in other areas. It is very difficult to remember each time all the species which has been taken in each locality, as very numerous safaris have been made.

GENERAL ECOLOGY

A great problem for the continued existence of the fauna of evergreen forests of western Tanzania is the old habit of the native population of shifting cultivation and their reluctance to use other habitats. It would be less serious if the forest vegetation grew up again after the cultivated land has been abandoned, but unfortunately, this

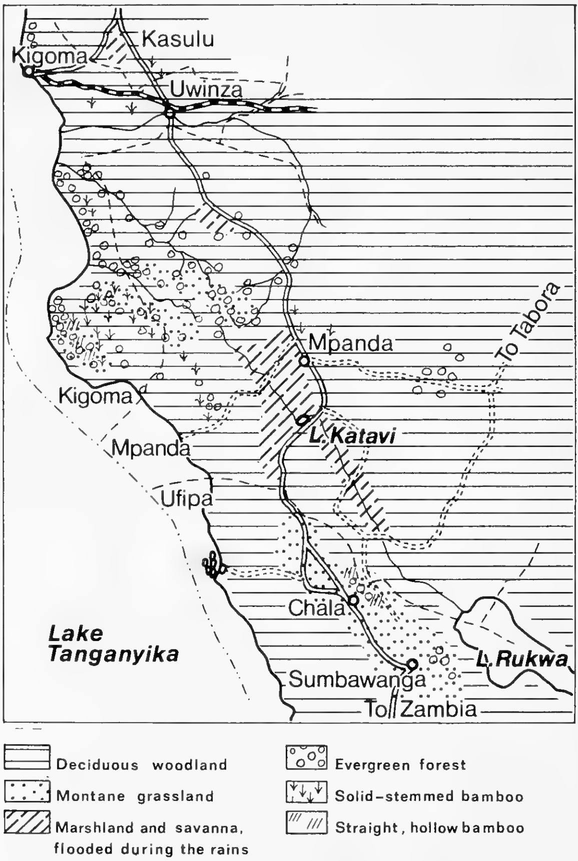


Fig. 3. Map of vegetation types. White areas along the lake shores are open or cultivated areas.

happens very seldom and only in certain circumstances. The only place where I have seen regrowth of evergreen forest is in the Mahale area, particularly in places where cleared farm land is surrounded by forest, and fire and elephant grass is prevented from getting in. Also the high humidity of the Mahale area stimulates forest growth.

It is generally presumed that the grass fires prevent the regrowth of forest vegetation. However, this is certainly not the only reason. During 20 years of observation in this area, I have had the opportunity to notice that a cleared forest area hardly ever returns to its original state. In a very short time it is covered by huge elephant grass. The only places where this may not happen, are the cleared areas surrounded by forest where the elephant grass more or less is prevented from intruding. Regrowth of forest also occurs in the higher altitudes of the Mahale ridge, from 2000-2500 m, which are far less suited for elephant grass than the lower altitudes and where the virility of the montane forest vegetation is stronger than that of the grasses.

When I first visited the Kabezi (1500-1600 m) at Lukandamira 20 years ago, that valley was covered by forest with only small cleared patches. Since then, a large part of the forest has been cleared and then left to bush. This area is now covered by enormous elephant grass and is moist all the year round. The greater part of this grassland is never burnt, but there is no sign of forest growth. This is not surprising. The root system of this particular grass covers the ground like a thick carpet and, in my opinion, must prevent any attempt of forest growth.

The comparatively great density of species of Lepidoptera in the western part of Tanzania, is mainly due to its earlier connection with rainforests of Zaire before the formation of Lake Tanganyika, and the influence of elements from north, south and east. Another favourable condition is the variation of environment (see Kielland, 1968). There are four main types of habitat, viz., forest, woodland, montane grassland and marshy ground (text-fig. 3).

Forest. The forest of Ufipa, Mpanda and Kigoma and for that matter the whole of Tanzania, is in no way of great extension. It consists of scattered remnants of evergreen, or rain forests. The largest remnant in western Tanzania is at Kasoge, at the foot of Mt. Kungwe. There are several types of evergreen forests:

1. Lowland forest: The low level forests of this region starts at just below 800 m which is the level of Lake Tanganyika. The upper boundary of low altitude forest of tropical Africa reaches approximately 1600 m. This boundary descends, if one moves away from the equator. In South Africa it reaches see level just north of the Cape Province. The sylvan fauna of Western Tanzania is most abundant at 800-1000 m, and here most of the lowland forest species occur. From 1000 m the species density decreases slowly. At about 1300-1400 m a gradual change in the vegetation occurs and consequently, the lepidopterous fauna changes.

As I pointed out previously (Kielland, 1969) the lowland forests of the sandstone area north of the Luegele-Katuma rivers, differ markedly from those of the complex basement formations to the south. Through investigation, it was noted that a considerable number of butterflies common to the forests of the sandstone area, did not occur on the other geological formations or were very rare, and vice versa. Again, the lowland forests on the west side of the Mahale Mt. contained species of its own.

The similarity of a large part of the lepidopterous fauna to that of the lowland forests of Zaire, suggests a similarity in the flora as well. This has lately been shown, to a certain extent, by the discovery of several plants of typical West African status in Western Tanzania.

2. Highland forest. The typical montane forest of the Mahale range, Sitebi Mt., Kakungu-Mweze highlands and the highland of the Ufipa plateau, commences at about 1400-1600 m after a gradual change of lowland forest. This intermediate stage from 1400-1600 m contains a mixture of both low and high level vegetation. Above 1600 m the lepidopterous fauna is markedly different and reduced in numbers of species and this reduction continues upwards.

The character of the montane forests is remarkably homogenous in the three districts, as is the case in the whole of Central Africa. They differ, however, in certain aspects. Very noticeable in the Ufipa montane forests (Mbizi forest, Chala forest) are the dominating, very large *Euphorbia*'s, while this particular species does not occur in the Mpanda-Kigoma area. At the Mahale ridge, above 1800 m, a large bamboo is associated with all the forests. The Mbizi and Chala forests do not contain bamboo, but in the forests of Mbuzi Mt. a hollow bamboo occurs, that is different from that on Mt. Mahale. There is some introduced bamboo at Sumbawanga.

A conspicuous tree of the Sitebi-Sifuta range above 1800 m is a *Podocarpus* species. (According to members of the Japanese expedition there are also a few *Podocarpus* on Mt. Mahale). Here also a long, extremely slender bamboo, quite distinct from that of Mahale abounds, from 1500 m upwards. Curiously enough, this species only occurs within a few square miles around the Sitebi Mt.

3. Dry evergreen forest. Apart from the above two types of evergreen forest, a third kind must be mentioned, which is encountered in a few places in Mpanda and Kigoma. It consists of a dryer kind of evergreen trees and large shrubs, often quite densely entwined with lianas. The canopy trees are much smaller than those of the common rain and riverine forests, and consists to a large extent of distinct species.

I have so far only encountered these evergreen thickets or forests in the sandstone formations. The best example is on the sandstone plateau just east of Uruwira, (see text-figs. 2 and 3). Here, these thickets are scattered over a flat area in pockets of up to a few hundred yards in diameter, surrounded by *Brachystegia* woodland. These dry evergreen forests have an affinity to the Zambezian "Mateshi" which is related to *Cryptosepalum* forest of that country and Angola (Cottrell, 1966). According to Cottrell, the Zambia dry evergreen forests probably harbour one species of butterfly endemic to this vegetation. So far, I have seen no indication of endemism in the dry evergreen forest of the Uruwira plateau, but the area is small and the existence of endemic species is not likely.

There are indications of a similar type of vegetation on the plateau near Mishamu on the Uwinza-Mpanda road. At Mihumu, between some of the numerous riverine forests, the whole area is clothed with semi-evergreen thickets and small trees, related to the *Cryptosepalum* forest. Also at Luntampa, in area 4a, isolated patches of similar dry evergreen forest occur. This is slightly inside the basic formations. The semi-evergreen vegetation contains comparatively few creepers and lianas and differs somewhat from the Uruwira forests.

The dry evergreen forests discussed above, are first of all the home of butterflies confined to a mixed habitat of forest and woodland. True forest species do not seem to breed in this kind of vegetation.

Woodland. This type of habitat covers at least 90% of the three districts, Mpanda, Kigoma and Ufipa. It contains a large number (200-300) of tree species of deciduous character. The woodland is normally open, poor in lianas, but with a rich growth of grasses varying in height from 2 to 4 m or more in the savannas and valleys, to 30 cm high or so on the hills. At higher altitudes as at Sitwe, about 1600-1700 m, and Ufipa at 1700-1900 m, there is often a kind of deciduous vegetation of stunted trees and shrubs, of mostly the same species or species related to those occurring at lower altitudes, but much smaller.

On the Ufipa plateau there are some kinds of vegetation which do not occur in the Mpanda-Kigoma highland and vice versa. The butterfly fauna also differs to some extent.

The species density of butterflies in woodland is lower than in the evergreen forests. On the other hand, particular species are often more numerous and it is in the open country or woodland that we get most of the migratory species, which may occur in millions.

There is a pronounced seasonal variation in species, due to several factors, or several factors that influence each other. Every year most of the woodland grasses are burnt early in the dry season, in June-July. This provokes a sudden germination of flowering herbs of great variety and also the emergence of several species of Lycaenids which may breed on these plants or visit their flowers. These insects can be found for only one or two months, e.g. several species of *Lepidochrysops, Euchrysops* and *Aloeides*. After the rain starts in October-November and the grasses begin to grow, other short-lived species of Lycaenids emerge.

The great contrast of the dry and rainy seasons in woodland country, stimulates two distinctly different broods in a species, a wet and a dry season form (w.s.f. and d.s.f., respectively), sometimes so unlike each other as to be taken for two different species, such as: *Precis octavia sesamus* w.s.f. *natalensis* and *P. octavia sesamus* d.s.f. *sesamus*, many species of the Satyridae, particularly the genus *Bicyclus* and also the Pierid genus *Colotis*. This seasonal variation in species is far more pronounced in woodland than in true forest, because in the latter, the environmental condition is much more homogenous due to the heavy evergreen canopy which helps to keep the humidity fairly high, even in the dry season.

The woodlands of hills and savannas differ slightly. Certain species of trees, shrubs and grasses are found on the hills, while other types prefer the savannas. Many butterflies frequent the hills and are seldom or never met with down in the valleys and on the savannas. The following are some examples typical for *Brachystegia* clothed hills: *Lepidochrysops solwezii, L. anerius, L. parsimon, L. gigantea, L. dollmani, L. intermedia, Mimacraea marshalli, Cnodontes vansomereni* and *Precis touhilimasa*.

Although many butterflies occur in savanna country, very few, if any are really confined to this habitat. Nearly all are met with in other habitats as well.

Open montane grassland. There are numerous indications that this kind of grassland has developed in place of a former, much more extensive montane forest. The Ufipa plateau is by far the most extensive area of open montane grassland. This plateau is comparatively densely inhabited by people engaged in both agriculture and cattle farming. By burning and clearing, the forest has greatly diminished in favour of open grass. Species typical for montane grassland are: *Euchrysops subpallida, E. messapus, Lepidochrysops mpanda, L. cupreus, Eicochrysops mahallakoaena, E. nandianas, Lycaena abbotii, Acticera stellata* and *Colias electo*.

On the high ridges of the Mahale Mt. open grassland has developed comparatively recently. This can easily be seen, as most of the grassy ridges still carry numerous scattered forest trees, in clumps or isolated, even in the most exposed places far away from the main forest.

The Lycaenid fauna is very poorly developed in this Mahale grassland. The genera *Spindasis, Lepidochrysops* and *Aloeides,* so well represented in the Sitwe-Mweze highland, are conspicuously absent here. The Sitwe-Mweze grass country is older and much more mixed with herbs and scattered, dwarfed, deciduous trees and shrubs which seem to be advancing into the grassland. The ridge of the Wanzizi hills is clothed with open grassland of the same character as that of Sitwe, but the Lycaenidae are not as richly represented, probably due to the area being much smaller and isolated from Sitwe.

Swamps. Only few butterflies, whose foodplant grow in water or mud, are confined to this type of habitat. The most common species seen in swamps and other wet places, near riverbanks etc., are *Ypthimomorpha itonia* and *Metisella midas,* both in high and low level swamps, *Mylothris bernice rubricosta* in low to medium altitude swamps, the less common *Syntarucus pulchra* along swampy lake shores and rivers and in the highlands of Ufipa; *Mashuna upemba* was taken on swampy ground.

For the area dealt with in the present work, there is no noticeable "short rainy season", as in the northern part of Tanzania. The rain normally starts in the middle of October to early November and carries on until late April to early May, with somewhat less rain in January-February, but seldom with more than two weeks pause in January. The Mahale Mt. enjoys higher rainfall than the surrounding areas and the rain often starts earlier and lasts longer, with scattered showers even in the dry season.

SYSTEMATIC PART

Family Papilionidae
Subfamily Papilioninae

In continental Africa this subfamily is represented by two genera, viz., *Papilio* Linnaeus and *Graphium* Scopoli. In the area dealt with, 13 species of *Papilio* and 9 species of *Graphium* are known.

Papilio antimachus Drury, 1782. This species has not been taken so far, but I have good reason to believe that this giant occurs in the forests of the Sitebi mountain area of Mpanda. Observed and described by one of my African collectors.

Papilio dardanus dardanus Brown, 1776, with several female forms. A forest species, flying in most of the riverine forests of Mpanda and Kigoma. Record: All the investigated areas, except very high mountains (800-1700 m).

Papilio jacksoni kungwe Cottrell, 1963. High level forests of Mpanda and Kigoma. Record: 1, 3a, 3b, 5a, 5b (1400-2200 m). General distribution: Ssp. *jacksoni* Sharpe, highland forest of Kenya and Uganda; ssp. *ruandana* Le Cerf, Kivu province of Zaire to Ruanda and western part of Uganda; ssp. *nyika* Cottrell, Nyika Plateau of Malawi; ssp. *hecki* Berger, Nioka in Zaire; ssp. *kungwe* is endemic to mountains of Mpanda and Kigoma.

Specimens differing from ssp. *kungwe* have been collected by me at Mbuzi Mt., Chulwe Mt. and Mbizi forest in Ufipa and by Carcasson in the Mbizi forest (1900-2200 m).

Papilio zoroastres joiceyi Gab., 1945. Forests of Kigoma and Mpanda. A fairly wide range in altitude. *P. zoroastres joiceyi* generally replaces *P. jacksoni* in lower altitude forests; however, this is only partly the case in our area. In the Wanzizi hills both species fly together at all levels where they occur, from 1400 m to the ridge at 1600 m. At Lukandamira, Mahale, ssp. *joiceyi* reaches the 1700 m level. Record: 1, 2a, 3a, 3b, 4a, 5a, 8a, 8b, Gombe (800-1700 m).

Papilio cynorta cynorta Fabricius, 1793. So far, the only Tanzanian records are from forests of the sandstone formations between Kigoma and south to Ntakkatta on the sandstone ridge, except for a single specimen taken at Kasoge. Record: 1, 5a, 8a, 8b (800-1400 m). General distribution: West Africa to Zaire and Uganda and an isolated race in Ethiopia.

Papilio nobilis Rogenhofer, 1891. One male taken at Mkulya riverine forest, a few taken at Kampisa and at Ntakatta. Record: 3a, 5a, 5b (1300-1700 m).

Papilio hesperus Westwood, 1843. Not uncommon in forests and at riversides of Mpanda and Kigoma. Rarely going up to 1500 m, as at Kampisa, and 1700 m near Mt. Sitebi. Record: 2a, 3a, 4a, 5a, 5b, 6, 8a, 8b (900-1700 m).

Papilio constantinus mweruanus Joicey & Talbot, 1927. One ♂ taken on the shore of Lake Tanganyika at Kibweza Point. At Ikola by T. H. E. Jackson's collector Watulege. Record: 1, 2b, observation at Gombe (780 m). General distribution: ssp. *constantinus* Ward, Kenya coast, Morogoro in Tanzania and Zambia; ssp. *monticolus* Le Cerf, Kenya Rift Valley at Kedong; ssp. *mweruanus* J. & Ta., Victoria Falls in Zambia.

Papilio mackinnoni Sharpe, 1891. Ssp. intermediate between ssp. *theodori* Riley and ssp. *benguella* R. & T. Local in montane forests of Mpanda and Kigoma. Taken in the Mweze forest, Wanzizi and at Kampisa. Record: 3a, 3b, 5b (1400-2000 m). General distribution: ssp. *theodori,* Nyika Plateau in Malawi; ssp. *mackinnoni,* Uganda and Kenya; ssp. *benguellae,* Rhodesia and Katanga.

Papilio phorcas congoanus Rothschild, 1896. ♀ forms *congoanus* and *thersandroides* Aur. Common in forests and heavy woodland of Mpanda and Kigoma. Record: widely distributed (800-1800 m).

Papilio nireus nireus Linnaeus, 1758. Common in forests and woodland of Mpanda, Kigoma and Ufipa, often visiting flowers in open grassland. Record: widespread (800-2000 m).

Note. Ssp. *lyaeus* Doubleday occurs in eastern and northern part of Tanzania.

Papilio bromius Doubleday, 1845. Ssp. *interjacens* Storace, and transition to *chrapkowskoides* Storace: common in forests of Mpanda and Kigoma; record: widespread (800-2000 m). Ssp. *ufipa* Carcasson, 1960: montane forests of Ufipa only; record: Chala Mt., Mbizi Mt., Mbuzi Mt. (2000-2200 m). The author examined two males kindly presented by Prof. Lindroth from Lund Univeristy, Sweden, taken 9. v. 1951, at Milepa, Rukwa. This is at a much lower altitude.

Papilio demodocus demodocus Esper, 1798. Common in most habitats, but prefering woodland and open grassland. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, 9b and Chala to Sumbawanga in Ufipa, Gombe (800-2000 m).

Papilio ophidicephalus ophidicephalus Oberthür, 1878. Riverine forests of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, 9b and Chala in Ufipa (800-2000 m at Mahale).

Graphium ridleyanus White, 1843. Low level forests of Kigoma. Local. Record: 1 at Kasoge, 2a at Masaba, 4a, 8a, 8b and just south of Kigoma (800-1200 m).

Graphium angolanus angolanus Goeze, 1779. Savanna and woodland throughout Mpanda, Kigoma and Ufipa. Record: widespread (800-1700 m).

Graphium taboranus Oberthür, 1886. Savanna and woodland of Mpanda. Scarce in the western area, more common further east. Record: 5b, 6, 9a, 9b and west of Uruwira (1000-1600 m).

Graphium tynderaeus Fabricius, 1793. Riverine forest of Mkulya in Kigoma, close to boundary of Mpanda. Only one record, 1954 (1450 m). General distribution: Nigeria to the eastern part of Zaire, Ituri forest. The recorded specimen is the only one known from East Africa.

Graphium leonidas leonidas Fabricius, 1793. Common in woodland of Mpanda, Kigoma and Ufipa. Record: widespread (800-1700 m).

Graphium almansor kigoma Carcasson, 1964. Common in forests and forest margins of Kigoma as far north as Malagarazi river and the north-eastern part of Mpanda. One specimen was taken at Sibweza. This specimen is similar to the nominate race, but is probably the d.s.f. of ssp. *kigoma*. Record: 1, 3a, 4a, 5a, 5b, 6, 8a, 8b (800-1500 m).

Since Carcasson described ssp. *kigoma*, a large number of specimens has been collected throughout its range and they clearly show that ssp. *kigoma* is represented by two distinct forms, a d.s.f. and a w.s.f. As the description of ssp. *kigoma* was based on the w.s.f. (pl. 4 figs. 13, 14), it would seem appropriate to describe the d.s.f. here:

Graphium almansor kigoma Carcasson, dry season form (pl. 4 figs. 15, 16). Usually smaller, fore wing narrower and more incised at the distal margin; all white markings of fore wing considerably reduced, appearance rather similar to the nominotypical race. The white discal spot widely separated from the spot in 3 and not noticeably tapering towards costa, almost rectangular in shape; also the apical spot less tapering towards costa than in the w.s.f.; usually there is a small white spot near apex of cell. Hind wing pale median area much larger than in the w.s.f., reaching end of discoidal cell; distal margin very irregular and smudged; postdiscal and submarginal streaks absent, except for faint streaks in space 5. Fore wing spots in 1a and 1b and hind wing pale area creamy, not white as in the w.s.f..

Graphium almansor wranghami ssp. nov. Corresponds with ssp. *kigoma* Carc. and differs from ssp. *almansor* H. and ssp. *uganda* Lathy in the great difference between the two seasonal forms.

Wet season form (pl. 5 figs. 17, 18). All pale markings ochreous as in ssp. *uganda,* but inner cell spot of the fore wing closer to cubitus and the spot in 3, but not contiguous with it as in the w.s.f. of ssp. *kigoma;* the cell spot is divided into 3 or 4 spots, tapering towards costa, but much smaller than in the w.s.f. of ssp. *kigoma;* apical spots well developed, but slightly smaller than in ssp. *kigoma;* submarginal, internervular spaces paler than the ground colour. In other races there are no distinct paler areas of the submargin, apart from the white dots; spots in 1a and 1b as in ssp. *kigoma.* Hind wing pale median area narrow as in ssp. *kigoma;* distal margin irregular, but well defined and not smudged; a row of clearly defined, double discal streaks and a row of indistinct, submarginal streaks. In ssp. *uganda* the submarginal streaks are clearest, the discal ones are seldom developed at all. Size as in ssp. *kigoma.*

Dry season form (pl. 5 figs. 19, 20). Usually smaller; shape of fore wing narrower and more deeply incised at the distal margin as in the d.s.f. of ssp. *kigoma;* pale markings of all wings white; no paler submarginal areas apart from the very small white dots in 2 and 3; sometimes there is also a small discal spot in 2. The cell spot is contiguous and rectangularly shaped, almost reaching costa, but separated from cubitus and the spot in space 3. There is a clearly defined white dot near apex of the cell, that is missing in the w.s.f. Hind wing pale median area white, but otherwise as in the d.s.f. of ssp. *kigoma*, much wider than in the w.s.f. of ssp. *wranghami;* discal and submarginal streaks absent; sometimes there are traces of streaks in area 5. Underside pale area more whitish than in the d.s.f. of ssp. *kigoma* and the distal part of the wing grayer and not rufous as in *kigoma.*

Female unknown.

Habitat. Riverine forest and along the lake shore. Record: Gombe Stream north of Kigoma (800 m).

Holotype (w.s.f.): Tanzania, Kigoma, Gombe Stream Nat. Park, December 1972, J. Kielland. Paratypes (w.s.f.): Same data and collector, 5 ♂ . Paratypes (d.s.f.): Same data 4 ♂.

I have the pleasure to dedicate this new race to Mr. Richard Wrangham, Ass. Director of Gombe Stream Research Station, who gave me accommodation and permission to collect in the Park area. Holotype and 2 paratypes in the National Museum, Nairobi, 2 paratypes in the British Museum (Nat. Hist)., London, and 5 paratypes in J. Kielland collection.

Graphium antheus Cramer, 1775. Forests, woodland and savanna throughout Mpanda and Kigoma. Record: widespread (800-1700 m).

Graphium policenes Cramer, 1775. Forests and woodland of Mpanda and Kigoma. Very common in forests. Record: widespread (800 tot 1700 m).

Graphium porthaon tanganyikae ssp. nov. (pl. 6 figs. 21-24). Male: Differs from the east coast races in the darker ground colour, and in the reduced submarginal spots of the hind wing; in one ♂ there are no spots or only a very faint dot in space 2; in another, 3 submarginal spots in 2, 3, and 4. The distance from the discal long spot in 2 to the submarginal spot in 2 is greater than in the coastal races. The fore wing subbasal streak is constantly narrow and the submarginal streaks are straight. Female: Same differences as in the male. Underside darker; red and black markings better developed than in the coastal races. A very local race, flying sparingly in the forests of

Kasoge, Kefu, Mihumu and Mukuyu in Kigoma. Found in glades and flying along footpaths of low level forest. Record: 1, 8a, 8b (800-1000 m). General distribution: Ssp. *porthaon* Hew., Mozambique; form *vernayi* van Son, 1936, coastal Kenya and Tanzania, inland to Morogoro and Mikumi Nat. Park. There is very little difference between *porthaon* and *vernayi.*

Holotype ♂ . Tanzania, Kigoma, Kasoge, 27.x.1969, J. Kielland; Allotype ♀ : idem, but Kefu forest, 12.xi.1972. Paratypes: Tanzania, Kigoma, Kasoge, 2.xi.1969, J. Kielland, 1 ♂ , idem but November, 1969, 1 ♂ , idem, but Kefu, 12.iv. 1971, 10 ♂ . Holotype and allotype in the British Museum (Nat. Hist.), London, paratypes in J. Kielland collection.

Family Pieridae
Subfamily Pierinae

Appias sylvia luvuensis Joicey & Talbot, 1927. Common in forests of Mpanda and Kigoma. Record: 1, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, 9a, 9b, Gombe (800-1500 m). Form *nyasana* Butler, 1896: forests of Mpanda and Kigoma, flying together with *luvuensis.*

Appias phaola phaola Doubleday, 1847. Forests of Kigoma at Mukuyu, Mihumu and Kefu near Helembe and upper part of the Ntakatta forest, in the sandstone area only. Record: 5a, 8a, 8b, Gombe (800-1000 m, 1500 m at Ntakatta).

Appias sabina sabina Felder, 1865. Forests of Helembe and at the sandstone ridge. Record: 1, 4a, 5a, 8a, 8b, Gombe (800-1600 m).

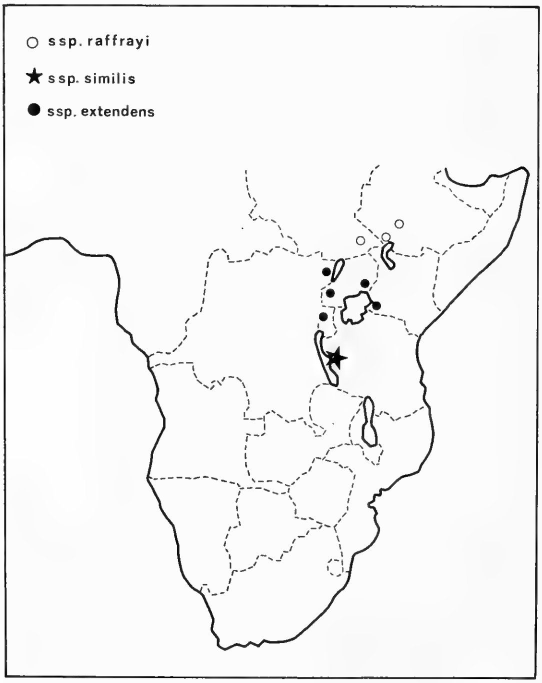


Fig. 4. Distribution of subspecies of *Belenois raffrayi* Sh.

Appias sabina udei Suffert, 1904. Forests of Mpanda and Kigoma, south of the sandstone ridge. Ssp. *udei* mixes with ssp. *sabina* at Luntampa and at Mahale; probably the two races meet there (800-1500 m).

Appias epaphia epaphia Cramer, 1779. Forests and woodland of Kigoma at Mukuyu and Kefu forest at Helembe. One specimen taken at Sibweza, April 1971, and one at Ntakatta. Rare. Record: 5a, 6, 8a, 8b (900-1500 m).

Belenois (Anaphaeois) gidica westwoodi Wallengren, 1853. Open country and woodland of Mpanda and Kigoma. Very common. Record: widespread (800-1700 m).

Belenois (Anaphaeois) creona severina Stoll, 1781. Open habitats and woodland of Mpanda, Kigoma and Ufipa. Very common. Record: widespread (800-1600 m).

Belenois (Anaphaeois) aurota aurota Fabricius, 1793. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-1700 m).

Belenois raffrayi similis ssp. nov. (pl. 7 figs. 25, 26). Male. Closest to ssp. *raffrayi* Obth. from Ethiopia and Sudan, from which it differs in the fore wing central white area, which is slightly more extended by reduction of the basal blue dusting and the apical black patch. The apex of the fore wing is slightly more pointed and outer margin a little concave at vein 3 and 4; in most specimens there is a submarginal blue spot in 7. Underside fore wing, white area extended to the black marginal line in internervular space in 1b, the outer part lightly sprinkled with grayish black scales; in most specimens the apical black area does not reach the discoidal cell, which is outlined in black. The specimens from the dry season have the distal black area in both wings more reduced.

Female. Hardly distinguishable from the nominotypical subspecies.

Habitat. Montane forests and forest margins of Mpanda and Kigoma.

Record: Mt. Sitebi-Ipumba-Ntakatta; Mweze Highland and Mt. Mahale (1500-2000 m) (text-fig. 4).

Holotype ♂ : Tanzania, Mpanda, Mt. Sitebi, 2000 m, 1.v. 1970, J. Kielland; Allotype ♀ : Same place and collector, 2.v.1970; Paratypes: Same, but from 1 to 3 May, 1970, 6♂, same, but Mt. Ipumba, 5 and 7.v.1970, 2♀; Kigoma, Mweze, August 1970, 1♀; Kigoma, Lukandamira, August 1970, 1♀; Sitebi, May 1970, 1♀; Sitebi, September 1970, 1♂; Mahale, August 1970, 1♂; Mweze, Augut 1970, 2♂. Holotype and allotype in National Museum, Nairobi, paratypes in the National Museum, Nairobi, the British Museum (Nat. Hist.), London and in J. Kielland collection.

Belenois zochalia agrippinides Holland, 1896, form *tanganyikae* Lanz, 1896. Open country and woodland of Mpanda, Kigoma and Ufipa. Common. Record: 3a, 3b, 5b, 6, 8a, 8b, Chala, Mbuzi Mt. (1000-1900 m).

Belenois crawshayi Butler, 1893. Open woodland and forest margins of Kigoma and Mpanda. Very common in the sandstone area, less common elsewhere. Record: 3a, 4a, 5a, 6, 8a, 8b (800-1400 m).

Belenois victoria Dixey, 1915. Rather common, but local in forests of Mpanda and Kigoma. The males gathering in numbers on wet sand. Female extremely rare. Record: 1, 3a, 4a, 5a, 5b (1100-1700 m).

Belenois subeida instabilis Butler, 1888. Woodland and savanna of Mpanda, Kigoma and Ufipa. Record: 3a, 3b, 4a, 5a, 5b, 6, Gombe, Chala (1000-1800 m).

Belenois calypso welwitschi Rogenhofer, 1889. Common in woodland of Mpanda, Kigoma and Ufipa. Record: widespread (800-1700 m).

Belenois calypso butyrosa Talbot,1943. This race seems to be confined to forest and forest margins, while *welwitschi* occurs in open habitats and woodland. Kigoma in the sandstone area. Record: 8a, 8b (800-1000 m). General distribution: Forests of Uganda.

Belenois thysa thysa Hopffer, 1855, forms *macularia* Aur., 1910, and *alarmi* Suffert, 1904. Rather common in woodland and savanna of Kigoma and Mpanda. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m.)

Belenois rubrosignata kongwana Talbot, 1943. Woodland and savanna of Mpanda, Kigoma and Ufipa. Common. Record: 2a, 3a, 3b, 4a, 5a, 6, 8b, Chala, Gombe (800-1900 m).

Belenois theora concolor Aurivillius, 1898, and ♀ f. *sulfurea* Talb., 1943. Woodland and forest margins of Mpanda and Kigoma. Not common. Record: 3b, 4a, 5a, 6, 8a, 8b, 9b (900-1500 m).

Belenois solilucis Butler, 1874. Forests of Mpanda and Kigoma and northwards to Biharamulo and Geita. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 8a, 8b, Biharamulo, Gombe (800-1600 m). The Mpanda-Kigoma specimens approach the large W. African race. Specimens from Biharamulo and Geita are smaller and similar to the Uganda forms.

Dixeia dixeyi Neave, 1904. Two males from the Luntampa forest in Kigoma and one male from Mantena near Sibweza. Very rare. Record: 4a, 6 (ca. 1200 m).

Dixeia pigea pigea Boisduval, 1836. Chala in Ufipa. Record: Chala (ca. 1800 m).

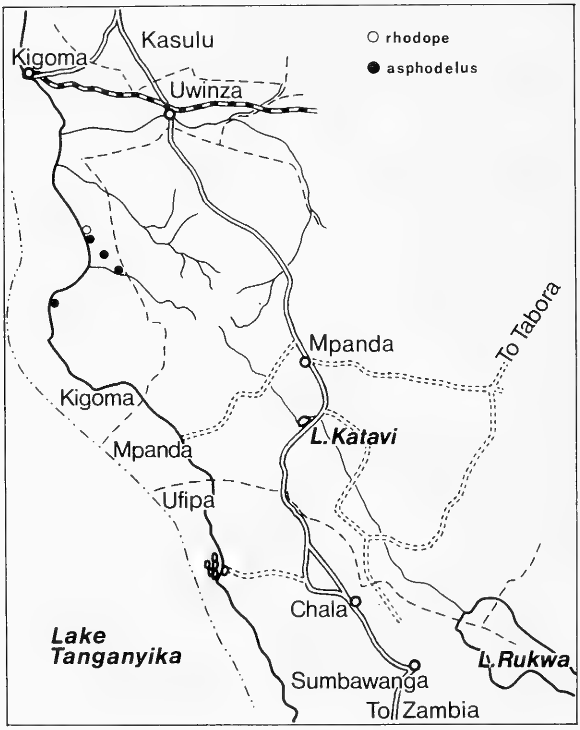


Fig. 5. Distribution of *Mylothris* species.

Dixeia pigea astarte Butler, 1899. Common in woodland and savanna of Mpanda and Kigoma. Record: 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6 (800-1700 m).

Mylothris dollmanni Riley, 1921. One male taken at Chala in Ufipa, August 1973. A rare species. Record: Chala (1800 m).

Mylothris chloris agathina Cramer, 1779. Woodland, savanna and forests of Mpanda, Kigoma and Ufipa. Very common. Record: Widespread (800-2000 m).

Mylothris citrina Aurivillius, 1898. Recorded by T. H. E. Jackson. Taken by his African collector, Watulege, at Mahale Mt. Not seen by the present author. Record: 1. Altitude not specified.

Mylothris poppea rhodesiana Riley, 1921. Woodland, savanna and forest margins of Mpanda, Kigoma and Ufipa. Rather common. Record: 1, 3a, 3b, 4a, 5a, 5b, 6, Chala, Mbuzi Mt. (1000-2000 m).

Mylothris sulphurea basalis Aurivillius, 1907. One male taken in the Kasha forest near Kefu, January 1973. Record: 8b (1000 m). There is one female from Katanga in the National Museum, Nairobi. The species also occurs in eastern Tanzania.

Mylothris rhodope rhodope Fabricius, 1775 (text-figs. 5, 9). Kefu forest at Helembe, Kigoma Distr. Very local, but common at Helembe. Record: 8b (900 m). General distribution: W. Africa to Zaire, ssp. *rhodope*; Uganda and Kenya, ssp. *uniformis* Talbot, 1944.

Mylothris asphodelus Butler, 1888 (text-figs. 5, 10). Local. In the Kasoge forest, Luntampa and forests around Helembe. Record: 1, 4a, 8b (800-1200 m).

Mylothris spec. (text-figs. 8, 11). One female very similar to females of *hilara* Karsch was taken in a riverine forest at Mihumu, one male taken in the Kefu forest. There is another female in the National Museum, Nairobi, from Mukuyu taken by the Japanese expedition. Record: 8a, 8b (900 m). Probably a new species.

Mylothris ertli Suffert, 1904, stat. nov. (*Mylothris yulei* Butler, 1897, ssp. *ertli* Suffert 1904) (text-figs. 7, 11). Common at Kampisa, Mt. Sitebi and upper reaches of the Katuma river. Also taken at Mt. Mahale, Luntampa forest and Ntakatta. Record: 1, 4a, 5a, 5b, Gombe (1200-2000 m).

Differs from *M. yulei* in a much better developed apical patch on fore wing upperside; a slightly more extended and stronger basal yellow area in both wings; underside apical area of fore wing and entire hind wing with more or less strong yellow suffusion; the marginal spots better developed in both wings. The female has less strong, but more extended yellow basal patch on the wings and more rounded wings than the male.

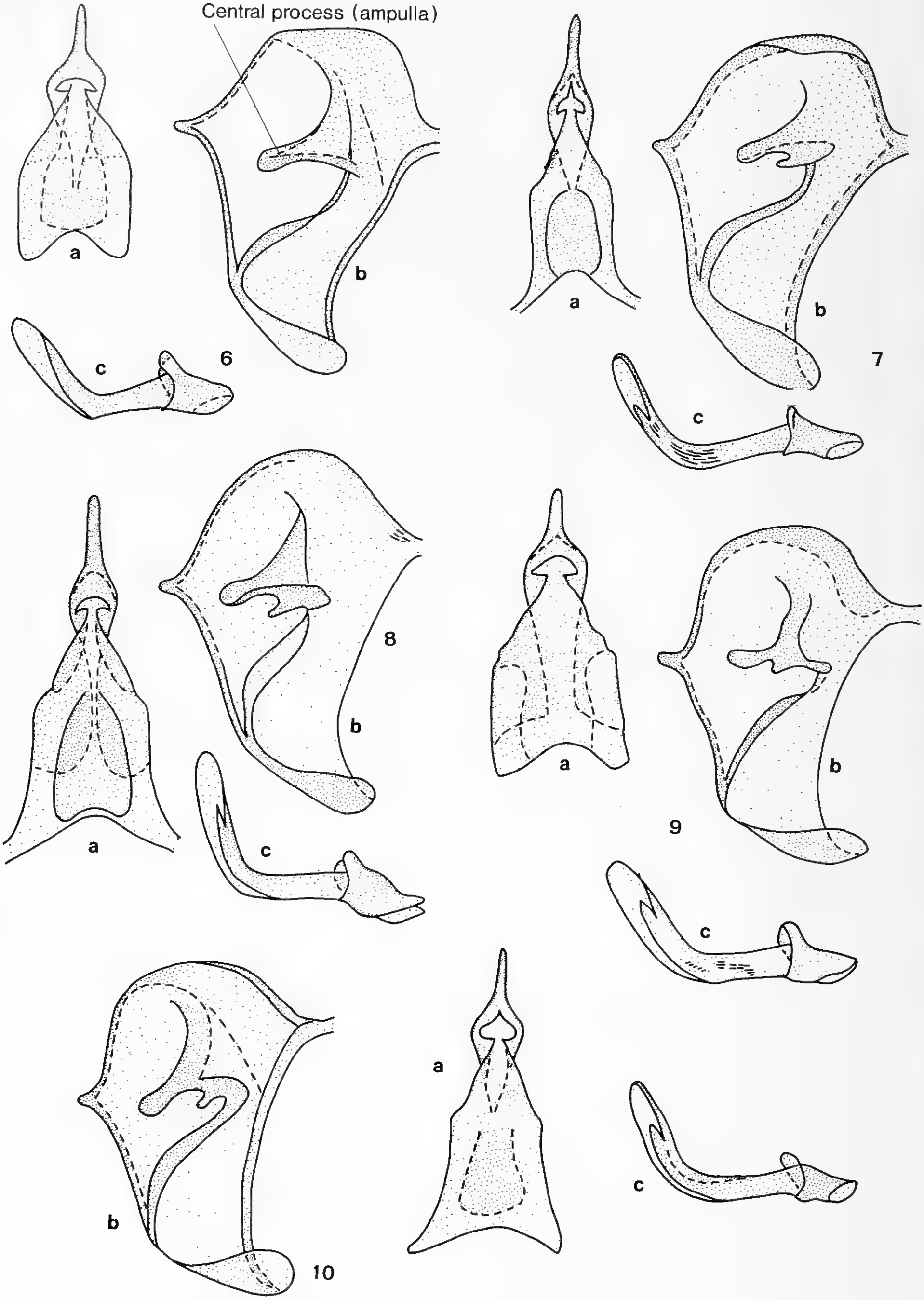
Genitalia ♂ : Tegumen-uncus longer and narrower than in *M. yulei*; aedeagus slightly more slender; valva differs in having a double central process (ampulla), a smaller lobe is attached ventrally to the large lobe, in *M. yulei* the process is single.

The double lobed ampulla is characteristic for the *M. rhodope* group and would suggest that *ertli* is more closely related to this group than to *M. yulei*.

Mylothris yulei yulei Butler, 1897 (text-figs. 6, 11). Common in forest margins of Kigoma and Mpanda. Record: widespread (800-1800 m).

The *Mylothris rhodope—yulei* group is very complex and highly in need of revision.

Mylothris sagala narcissus Butler, 1888. Montane forests of Mpanda, Kigoma and Ufipa. Record: 1, 3a, 3b, 4b, 5b, Mbizi forest, Chala Mt., Mbuzi Mt. (1500-over 2200 m). Specimens from Mahale, Sitebi and Ufipa differ from each other and



Figs. 6—10. Male genitalia of *Mylothris* species. a, tegumen-uncus; b, valva; c, aedeagus. 6. *M. yulei yulei* Butl., Kampisa, Mpanda, no. 1048. 7. *M. ertli* Suffert, Ujamba, Mahale, Kigoma, no. 1167. 8. *M.* spec., Kefu forest, Helembe, Kigoma, no. 1031. 9. *M. rhodope* F., Kefu forest, Kigoma, no. 1019. 10. *M. asphodelus* Butl., Kefu forest, Helembe, Kigoma, no. 1027.

may constitute separate races. There is some variation in the female signa.

Mylothris bernice rubricosta Mabille, 1890. Along rivers and on swampy ground of Mpanda, Kigoma and Ufipa. Common. Record: 2a, 2b, 5b, 6, Chala (800-1700 m).

Leptosia medusa marginea Mabille, 1890. Forests of Mpanda and Kigoma. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 6, 5a, 8a, 8b, 9b, Gombe (800-1500 m).

Leptosia wigginsi Dixey, 1916. Forests of Kigoma from Malagarazi to Luegele rivers. Rather common. Record: 2a, 3a, 4a, 5a, 8a, 8b (800-1200 m). General distribution: Uganda.

Leptosia alcesta alcesta Stoll, 1782. Forests and heavy shrubs and woodland of Mpanda and Kigoma. Common. Record: 1, 2a, 3a, 3b, 5a, 6, 9b (800-1200 m).

Leptosia nupta Butler, 1873. Very common in the Ntakatta forest. Also taken sporadically at Kefu and at Kasoge. Record: 1, 5a, 8b (800-1600 m).

Leptosia hybrida Bernardi, 1951. One female taken in the Kefu forest in Kigoma. Record: 8b (900 m). General distribution: From W. Africa to Zaire and Uganda. The author has also collected this species in the Ngara District of north-western Tanzania.

Pinacopteryx eriphia eriphia Wallengren, 1857. Open habitats and savannas of Ufipa, Mpanda and Kigoma. Uncommon. Record: 2a, 4a, 6, 8b, Chala, Sumbawanga (900-1900 m).

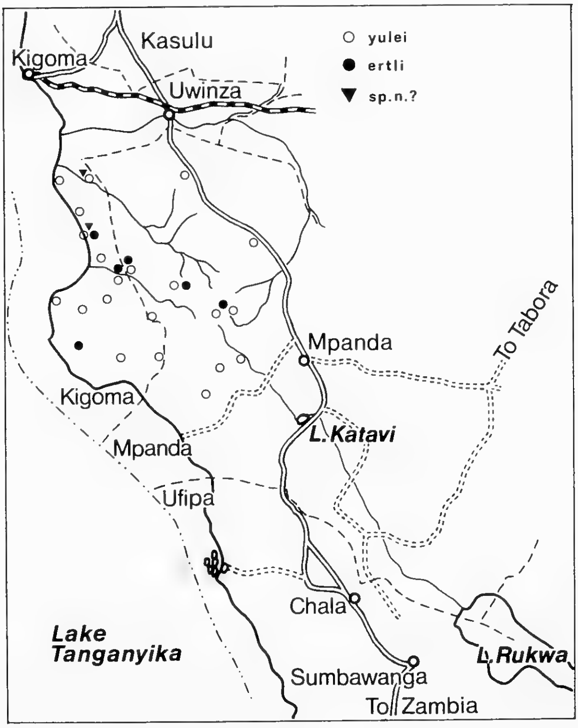


Fig. 11. Distribution of *Mylothris* species.

Subfamily Teracolinae

Colotis calais (?) *crowleyi* Sharpe, 1898. Open habitats and savanna of Mpanda and Ufipa. From northern Mpanda at Sibweza, one specimen only. In the Rukwa depression and Ufipa very common. Record: 6, Mpimbwe, Rungwa near Lake Rukwa (800-1200 m).

Colotis aurigineus aurigineus Butler, 1883. Open habitats of Ufipa and Mpanda in the south. Record: Chala, Sumbawanga, Rukwa basin (800-2000 m).

Colotis vesta mutans Butler, 1877. Open habitats of Ufipa and Mpanda in the south. Record: Chala, Mpimbwe, Sumbawanga, Rungwa (800-1700 m).

Colotis celimene anima Hewitson, 1862. Woodland and open habitats of Ufipa and Mpanda. Rare. Record: 2b, 6, Chala (800-1700 m).

Colotis ione Godart, 1819. Savanna of southern Mpanda. One male only, October 1970. Record: Mpimbwe (ca. 900 m).

Colotis regina Trimen, 1863. Woodland of Mpanda. Kigoma and Ufipa. Common. Record: 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Chala (800-1600 m, 1800 m at Chala).

Colotis hetaera Gerstaecker, 1871. One record from Nkungwe, 1955, and one from Sibweza, 1971. Record: 6 (1100-1200).

Colotis elgonensis nobilis Carcasson, 1960. Forests and forest margins of Mpanda and Kigoma. One record from Mbuzi Mt., Ufipa. Not uncommon in the two first areas. Record: 1, 3a, 3b, 5a, 5b, Mbuzi Mt. (1300-2200 m). Rather high altitude species.

Colotis hildebrandti Staudinger, 1885. Open habitats and woodland of Mpanda and Ufipa. Not common. Record: 1, 2b, 4b, 5b, 6, Chala (900-1700 m).

Colotis danae annae Wallengren, 1857. Woodland of Mpanda, Kigoma and Ufipa. Not very common. Record: 2a, 2b, 3a, 3b, 4a, 4b, 6, 7, Chala, Rukwa basin (800-1700 m).

Colotis eucharis incretius Butler, 1881. Woodland and savanna of Mpanda and Kigoma. Common. Record: 2a, 2b, 3a, 3b, 4a, 4b, 6, 7 (800-1400 m).

Colotis antevippe zera Lucas, 1852. Open habitats and woodland of Mpanda, Kigoma and Ufipa. Common. Record: widespread in Mpanda and Kigoma, Chala in Ufipa (800-1900 m).

Colotis evenina xantholauca Sharpe, 1904, d.s.f. *xantholauca,* w.s.f. *sipylus* Swin., 1884. Common in woodland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Chala, Rukwa basin, Gombe (800-1800 m).

Colotis evippe omphale Godart, 1819. Open habitats and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-1900 m).

Colotis pallene Hopffer, 1855. Recorded from 35 miles north of Mbeya.

Colotis evagore antigone Boisduval, 1836. Open habitats and woodland of Mpanda, Kigoma and Ufipa. Common. Record: 3a, 3b, 4b, 6, Chala, Rukwa basin (800-1800 m).

Colotis eris eris Klug, 1829. Open habitats and woodland of Mpanda, Kigoma and Ufipa. Common. Record: widespread (800-1800 m).

Colotis subfasciatus ducissa Dognin, 1891. Open habitats and woodland of Mpanda and Kigoma. Common. Record: 3a, 3b, 4a, 4b, 5b, 6, 8a, 8b (800-1300 m).

Eronia cleodora cleodora Hübner, 1822. Savanna-like woodland in Mpanda at Nkungwe and Mpanda township. Rare. Record: 6 (1000-1200 m).

Eronia leda Boisduval, 1847. Woodland and forest of Mpanda and Kigoma. Common. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6 (800-1600 m).

Nepheronia pharis Boisduval, 1836. Forests of Kigoma in the sandstone area only, north of Mugombazi. Record: 8a, 8b at Mukuyu, Mihumu, Helembe forests (800-1000 m).

Nepheronia thalassina Boisduval, 1836. Forest and woodland of Mpanda and Kigoma. Rather common. Record: widespread, 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, (800-1700 m).

Nepheronia argia argia Fabricius, 1775. Forests and dense woodland of Mpanda and Kigoma. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1800 m).

Subfamily Coliadinae

Colias electo pseudohecate Berger, 1940. Open grassland on mountains of Ufipa, Mpanda and Kigoma. Common. Record: 1, 3a, 5a, 5b, Chala to Sumbawanga (1500-2300 m).

Catopsilia florella Fabricius, 1775. Almost any habitat of Mpanda, Kigoma and Ufipa. Record: everywhere (800-2200 m).

Eurema hecabe senegalensis Boisduval, 1836.
Open habitats and woodland of Mpanda, Kigoma and Ufipa. Common. Record: widespread (800-2000 m).

Eurema brenda Hewitson, 1847. Heavy woodland and forest of Mpanda and Kigoma. Common. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-2000 m).

Eurema brigitta brigitta Cramer, 1780. Open habitats and woodland of Mpanda, Kigoma and Ufipa. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Chala, Gombe (800-2000 m).

Eurema hapale Mabille, 1885. Forest and swampy ground of Mpanda, Kigoma and Ufipa. Very common. Record: widespread (800-2000 m).

Eurema desjardinsii regularis Butler, 1876. Very common in woodland, savanna and forest margins of Mpanda, Kigoma and Ufipa. Record: widespread (800-2000 m at Mt. Sitebi). In my opinion *E. mandarinula* Holland, 1892, is a form of *E. desjardinsii*, restricted to lower altitudes.

Eurema punctinotata Butler, 1895. Forests and open habitats of mountains in Ufipa and Kigoma. Record: 1 at Mahale Mt.; Mbizi forest in Ufipa; local (1700-2200 m). *E. punctinotata* is found only in the more humid, high altitudes above 1600 m. There is no great difference between dry and wet season forms.

Family Danaidae

Danaus chrysippus Linnaeus, 1758. Forms *chrysippus, alcippus* Cramer, 1777, *dorippus* Klug, 1845, and *albinus* Lang, 1896. Common and widespread everywhere in open and wooded habitats. Record: widespread (800-2200 m).

Danaus limniace petiverana Doubleday & Hew., 1847. Forest and woodland throughout Mpanda, Kigoma and Ufipa. Record: everywhere except high mountains (800-1600 m).

Danaus formosa formosa Godman, 1880. Forests of Kigoma and Mpanda. Also met with in open habitats. Record: 1, 5b, 8a (800-2000 m). In the Mahale area it is found at both low and high altitudes. Up to 1000 m at Mukuyu and Mihumu. In the Sitebi Mt., only taken at 1900-2000 m.

Amauris niavius niavius Linnaeus, 1758. Common in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 8a, 8b, 9b, Gombe (800-1600 m).

Amauris tartarea tartarea Mabille, 1876. Forests of Mpanda and Kigoma. Common. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m).

Amauris egialea mukuyuensis Carcasson, 1964. An uncommon species, in forests of Kigoma. Record: 1, 3a, 4a, 5a, 8a, 8b (800-1200 m, 1600 m at Lukandamira).

Amauris echeria mpala Talbot, 1940. Mahale area in Kigoma, Mweze and Kampisa in Mpanda. In forests. Common. Record: 1, 2a, 3a, 4a, 5a, 5b (1200-2000 m).

Amauris albimaculata magnimakula Rebel, 1914. In the Mihumu forest of Kigoma. Very rare. Record: 8a (ca. 900 m).

Amauris crawshayi oscarus Thurau, 1903. A rare species in forests of Mpanda and Kigoma. Record: 5a, 8a, 8b (900-1500 m).

Amauris ansorgei junia Le Cerf, 1920. Rather common in the Mbisi Forest, Ufipa (2000-2300 m), February 1978.

Family Satyridae

Melanitis leda africana Frühstorfer, 1908. Very common in woodland of Mpanda and Kigoma. Record: widespread (800-1500 m, 2000 m at Ujamba, Mahale).

Melanitis libya Distant, 1882. Forests and woodland of Mpanda and Kigoma. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, 9a, 9b (800-2200 m). Common at Mahale and surrounding areas. Further east more scarce in the lowland, but plentiful at high altitudes. At high altitude of Mahale flying exclusively in the bamboo mixed forest.

Melanitis parmeno parmeno Doubleday & Hewitson, 1851. Common in forests of Mpanda and Kigoma. In Mpanda mainly at higher levels, in Kigoma common at all altitudes. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, at Kigoma (Miss Goodall) (800-2000 m). General distribution ssp. *parmeno*: Uganda, Ghana, Angola.

Melanitis chelys Fabricius, 1793, forms *chelys* and *minchini* Heron, 1909. Common in dense forests of Kigoma and Mpanda. Record: 1, 4a, 5a, 8a, 8b (800-1600 m).

Bicyclus sebetus sebetus Hewitson, 1877. Dense, low level forest of Kigoma and Mpanda in the north-west. Record: 1, 3a at Lubalizi, 4a at Luntampa, 5a at Ntakatta, 8a, 8b (800-1400 m). Very common at Kasoge and in the sandstone area. Elsewhere scarce.

Bicyclus sambulos Hewitson, 1877. Ssp. intermediate between ssp. *sambulos* and ssp. *cyaneus* Condamin, 1961. Forests of Kigoma. Not rare in the Kasoge and Kefu forests. Elsewhere scarce. Record: 1, 3a, 4a, 5a, 8a, 8b (800-1400 m). General distribution: Uganda and Zaire.

Bicylcus mandanes Hewitson, 1876. Common in forests of Kigoma and Mpanda to Biharamulo Distr., Kahama Distr. Record: 1, 2a, 3a, 4a, 5a, 8a, 8b, Biharamulo and Kahama Districts (800-1700 m).

Bicyclus auricrudus fulgidus Fox, 1963. Common in forests of Kigoma. Flying together with *B. mandanes*. Record: 1, 2a, 3a, 4a, 5a, 8a, 8b, Gombe (800-1500 m). General distribution: Zaire to Uganda and Kenya; ssp. *auricrudus* in Nigeria.

Bicyclus mesogena uganda Riley, 1926. In the Kasoge forest only. Record: 1 (800-1000 m). General distribution: Uganda and Kenya.

Bicyclus sandace Hewitson, 1877. Forests of Kigoma and Mpanda. Sometimes also in heavy woodland. Common. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Kibondo, Gombe (800-1700 m). General distribution: Nigeria, Zaire to Uganda.

Bicyclus jefferyi Fox, 1963 (= *addendus* Cond. & Fox, 1964, = *miriam* Fab., 1793). Forests, riversides and heavy woodland of Mpanda and Kigoma. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b (800-1800 m, 2000 m at Mt. Sitebi).

Bicylcus safitza Westwood, 1850. Almost any wooded habitat and forest of Mpanda, Kigoma and Ufipa. Record: widespread (800 to 1800 m).

Bicyclus campus campus Karsch, 1893. Forest and woodland of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8b (800-2000 m).

Bicyclus dentata Sharpe, 1898. Montane forests of Mpanda and Kigoma. The Mahale Mt. and the Sitebi-Ipumba range. Locally very common. Record: 1, 5b (1500-2200 m).

Bicyclus cooksoni Druce, 1905. Forest and woodland of Mpanda, Kigoma and Ufipa. Rather common. Record: 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Chala (1000-1800 m). General distribution: Zambia, Katanga.

Bicyclus cottrelli cottrelli van Son, 1952. Common in woodland and forest in Mpanda and Kigoma. Record: 3a, 3b, 4a, 5b, 6, Gombe (1000-1500 m). General distribution: Zambia to Kahama in Tanzania.

Bicyclus ena Hewitson, 1877. Woodland of Mpanda and Kigoma. Not common. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8b, 9a, 9b (800-1700 m).

Bicyclus angulosus selousi Trimen, 1895. Common in woodland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8b, Chala, Gombe (800-2000 m). Some specimens are transitional to ssp. *angulosus*.

Bicyclus campinus campinus Aurivillius, 1901. Woodland and forest of Mpanda and Kigoma. Mainly lower altitudes. Record: 1, 2a, 2b, 3a, 3b, 4a, 6 (800-1500 m).

Bicyclus vansoni Condamin, 1965. Very common in woodland and forest margins of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, 9a, 9b, Chala, Gombe (800-2000 m).

Bicyclus anynana anynana Butler, 1879 (= *vicaria* Thurau, 1903). Common in woodland of Mpanda and Kigoma. Record: all investigated areas in Mpanda and Kigoma (800-1600 m).

Bicyclus vulgaris Butler, 1868. Common in forests and woodland of Mpanda and Kigoma. Record: 1, 2a, 3a, 4a, 5a, 5b, 8a, 8b, 9a, Gombe (Miss Goodall) (800-1500 m). General distribution: Uganda.

Bicyclus funebris funebris Guerin, 1844, d.s.f. *nebulosa* Felder, 1867, w.s.f. *agraphis* Karsch, 1893. Common in forests and heavy woodland of Kigoma and north-western part of Mpanda. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 8a, 8b, Gombe (800-1500 m, 1700 m at Lukandamira). The southern-most record is the Wanzizi Hills.

Bicyclus saussurei saussurei Dewitz, 1879. Taken in a riverine forest near Kibondo. One male only. General distribution: Uganda, Katanga, Zambia, and Ngara Distr. of Tanzania.

Bicyclus similis Condamin, 1963. Dry and wet season forms taken in the Mahale mountain area. First taken by T.H.E. Jackson's African collector, Watulege. Record: 1(1600-2300 m). This species is endemic to the Mahale area and no trace of it has been found outside this mountain. It is common at high levels, becoming rarer down to 1600 m.

Henotesia perspicua Trimen, 1873, w.s.f. *perspicua*, d.s.f. *maevius* Staudinger, 1887. Very common in woodland and savanna of Mpanda and Kigoma. Also Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, 9b, Chala, Gombe (800-2000 m).

Henotesia simonsii Butler, 1877, w.s.f. *victorina* Westwood, 1881, d.s.f. *simonsii*. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-1800 m).

Henotesia spec. Common, but confined to the Mahale area at high elevations. Frequents montane forests and forest margins. Wet and dry season forms occur. Record: 1 (1500-2200 m). The description of this new species may be undertaken later on, as a revision of the whole genus is needed. It is closely related to *H. ubenica* Thurau, 1903, but the genitalia differ. A species with similar genitalia occurs at Kitcheche and Ankole — Toro, Uganda. However, this seems to constitute a separate race, distinct from the Mahale population. Specimens similar to the Uganda form have been taken at Ngara in northeast Tanzania by the present author.

Aphysoneura pigmentaria latilimba Le Cerf, 1919. Forests and forest margins of Mpanda, Kigoma and Ufipa. High altitude species. Common, but local. Mainly in bamboo country. Record: 1, 5a, 5b, Mbizi forest, Chala, Mbuzi Mt. (1400-above 2000 m).

Physcaenaura pione Godman, 1880. Common in woodland and savanna of Mpanda and Kigoma. Wet season only, from late December to April. Record: 2b, 3a, 3b, 4a, 4b, 6 (800-1300 m).

Neita victoriae Aurivillius, 1898 (= *Neocoenyra victoriae* Aur.). Occurring in woodland at Sibweza, Mpanda Distr. Also taken near Uwinza and at Biharamulo north of Kibondo. Uncommon. Record: 6, 9a, Biharamulo (1050-1400 m).

Neocoenyra Butler, 1885.

This genus is represented by two or three *gregorii*-like species in this area. One is *N. kivuensis* Seydel, 1929, described from Kivu in Zaire. The genitalia in this genus are of the "grayhound" type and the species are very difficult to separate from each other. The whole genus is in need of revision.

Ypthima Hübner, 1818.

At present the writer makes a special study of this genus and a revision of the continental African group will be submitted later. For the time being the following species from western Tanzania are briefly listed.

Ypthima granulosa Butler, 1883 (= *cataractae* van Son, 1955). Occurring at Kasulu and at Mihumu. Record: 8a, Gombe, Kasulu (900 at Mihumu, 800-1200 at Gombe, not certain at Kasulu).

Ypthima impura Elwes & Edwards, 1893. Very common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4b, 5a, 5b, 6, 8b, Sumbawanga, Chala, Gombe (800-1800 m).

Ypthima pupillaris Butler, 1888 (= *gazana* van Son, 1955). Common in *Brachystegia* woodland and savanna of Mpanda, Kigoma and Ufipa. Preferring higher altitudes. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, Chala, Sumbawanga (1100-2000 m).

Ypthima albida albida Butler, 1888. One male taken at a small river just north of Kibondo. Common at Bukoba and Ngara. Record: Kibondo.

Ypthima rhodesiana Carcasson, 1964. Common in woodland and savanna of Mpanda and Kigoma. Record: 2a, 3a, 3b, 4b, 5b, 6, 8a, 8b (1000-1500 m).

Ypthima antennata van Son, 1955. In rocky places and grassland of the Sitebi Mt. and near Uwinza. In sandstone area only. Record: 5a, 5b, Uwinza (1200-2000 m).

Ypthima spec. Savanna and woodland of Mpanda, Kigoma and Ufipa, in the Rukwa basin and at Chala. Record: 2a, 3a, 3b, 4a, 4b, 6, 8a, 8b, Kansindi near Usewia, Rukwa basin, Chala, Mbuzi Mt. (800-1200 m, 2000 m in Ufipa). This new species will be described in another paper.

Ypthimomorpha itonia Hewitson, 1865. Common in savannas, particularly swampy places and riversides of Mpanda, Kigoma and Ufipa. Record: widespread (800-1800 m).

Mashuna upemba Overlaet, 1955. Two males and one female were taken flying low over marshy ground near Chulwe Mt. in Ufipa. Record: Chulwe Mt. (ca. 1900 m). General distribution: Upemba Park in Katanga and Angola Highland.

Family Nymphalidae

Subfamily Charaxidinae

Euxanthe crossleyi ansorgei Rothschild & Jordan, 1900. Widespread, but not very common. In forests and along rivers of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1600 m). General distribution: Nigeria to Uganda and western Kenya.

Charaxes varanes vologeses Mabille, 1876. Common in open woodland and savanna of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Chala, Gombe (800-2000 m).

Charaxes fulvescens monitor Rothschild, 1900. Very common in forests and riverine thickets of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-2000 m).

Charaxes acuminatus Thurau, 1903. Observed at Mbuzi Mt. in Ufipa (2000 m).

Charaxes candiope candiope Godart, 1824. Common in forests and riverine forests of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Mbuzi Mt., Gombe (800-2000 m).

Charaxes protoclea Feisthamel, 1850; ssp. *azota* Hewitson, 1877; ssp. *catenaria* Rousseau-Decelle, 1934. In the Mpanda area this species occurs commonly on *Brachystegia* clothed hills. In the better forested areas further north, as in Kigoma area, it is mostly a forest dweller and is seldom met with in woodland. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe, Ufipa at foot of escarpment (800-

1700 m, 2000 m at Mt. Sitebi). Specimens agree with both races and must be regarded as transitional.

Charaxes boueti macclouni Butler, 1895. Exceedingly common in areas with bamboo, the larval foodplant, but also taken at Sibweza more than 10 miles from nearest bamboo growth. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Namanyere and Chala in Ufipa (800-2000 m). The high level Mahale specimens are larger and brighter than those in the lowland.

Charaxes cynthia mukuyu van Someren, 1969. This race is endemic to the area between Burundi and the sandstone ridge at Ntakatta. Fairly common at Mihumu, but extremely scarce elsewhere. Record: 5a, 8a, 8b (800-1500 m). General distribution: Other races from eastern Kenya, Uganda across central Africa to Ivory Coast.

Charaxes lucretius maxima van Someren, 1971. Very common in the Kasoge forest, very rare elsewhere. Record: 1, 3a, 4a, 5a, 8a, 8b, Gombe (800-1400 m).

Charaxes jasius saturnus Butler, 1865. Common in open woodland and savanna of Mpanda, Kigoma and Ufipa. Seldom met with in forest. Record: widespread (800-2000 m).

Charaxes castor castor Cramer, 1775. Common in open woodland and forests of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 8a, 8b, Gombe (800-2000 m).

Charaxes castor flavifasciatus Butler, 1876. In the Rukwa valley in Ufipa and South Mpanda. Record: Muze (ca. 1000 m). Ssp. *flavifasciatus* probably merges with ssp. *castor* further north.

Charaxes brutus natalensis Staudinger, 1886. Widespread, but not very common in Mpanda and Kigoma. Preferring forest but one specimen also taken in open woodland at Nkungwe. Record: 1, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m).

Charaxes ansorgei kungwensis van Someren, 1967. Very rare. Records from the montane forests of Mt. Mahale only. Record: 1 (2000-2200 m). During 14 trips to the Mahale Mt., only a few males and one female were obtained in banana traps. Most were taken at the remote Sisaga Mt. General distribution: Other races from Kenya to Uganda, at the northern end of Lake Tanganyika and Northern Malawi. From Tanzania, races have been recorded from Kilimanjaro, Usambara, Uluguru and Njombe to Mbeya. Ssp. *kungwensis* was first taken by T. H. E. Jackson's collector Watulege.

Charaxes ansorgei ufipa ssp. nov. (pl. 8 figs. 27-30). Male. Upperside discal band of fore wing rather narrow and with outer border straighter and less incised at the veins than in other races, much less than in ssp. *kungwensis* van Som. and ssp. *levicki* Poult. (the latter comes from Southern Highlands in Tanzania). The discal band is not as dark as that of ssp. *levicki,* but slightly darker than in ssp. *kungwensis;* basal area as dark as that of ssp. *levicki,* slightly darker than in ssp. *kungwensis.* Hind wing submarginal spots well developed in 4 to 7, but no spots in 2 and 3. In the nominotypical race, which it otherwise rather closely resembles, the hind wing submarginal spots are faint, but present also in 2 and 3, except for one specimen in the National Museum, Nairobi. Length of fore wing: 41 mm.

Female. Differs from ssp. *kungwensis* in a darker brown, basal area of the fore wing; the creamy, discal band is broadening towards the hind margin, not parallel in area

1 and 2 as in ssp. *kungwensis;* the shape of the fore wing is more falcate and the outer margin less concave. Hind wing with pronounced submarginal spots in 5 to 7; the green marginal stripe at tornus is hardly discernible. Underside wings as ssp. *kungwensis*.

Habitat: Montane forests of Mbuzi Mt. in Ufipa.

Holotype ♂ : Tanzania, Ufipa, Mbuzi Mt., 2000 m, October 1971, J. Kielland. Allotype ♀ : Same, but May 1972; Paratypes: 1 ♂ and 1 ♀ May 1972; 1 ♂ October 1971.

Holotype and allotype are deposited in the National Museum, Nairobi, paratypes in J. Kielland collection.

Charaxes pollux pollux Cramer, 1775. In riverine forests of Mpanda and Kigoma. Rather common. Record: 1, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-2000 m).

Charaxes druceanus proximans Joicey & Talbot, 1922. Not common and local in open country and forest margins of Mpanda, Kigoma and one record from Ufipa. Record: 1, 2a, 3a, 4a, 5a, Gombe, Mbuzi Mt. (1200-2000 m).

Charaxes eudoxus mechowi Rothschild,1899 (according to M. Plantrou). Taken in banana traps at Mihumu, Kasoge, Luntampa, Ntakatta and Kampisa forests. Rather rare and local. Record: 1, 3a, 4a, 5a, 5b, 8a, 8b, Biharamulo (800-1500 m). General distribution: Zaire to Uganda and Kenya. Also taken in Zambia.

Charaxes numenes aequatorialis van Someren, 1972. Very local in low level forests of Kasoge, Luntampa, Lubalizi, Mukuyu, Kefu, Ntakatta and Mihumu. Not taken south of Lubalizi. Record: 1, 3a, 4a, 5a, 8a, 8b, Gombe (800-1500 m). General distribution: W. Africa to Zaire, Ethiopia, Uganda and Kenya.

Charaxes bohemani Felder, 1859. Common in open woodland and savanna throughout Mpanda and Kigoma. Not in forest. Record: widespread (800-1600 m, 2000 m at Mt. Sitebi).

Charaxes smaragdalis kigoma van Someren, 1964. In forests of Kigoma at Mukuyu, Kefu, Ntakatta and north of Kigoma to Burundi. South of Kigoma very rare. Record: 5a, 8a, 8b, Gombe (Miss Goodall), Burundi (800-1500 m). General distribution: represented by a number of races, scattered from western Kenya and Uganda, over Zaire and W. Africa, to Ivory Coast.

Charaxes tiridates tiridatinus Röber, 1936. In forests of Mpanda and Kigoma. Rare south of Luegele river, where it occurs as far south as Sibweza, in area 6. It is common north of Luegele. Record: 1, 3a, 4a, 5a, 6, 8a, 8b, North of Kigoma (800-1500 m).

Charaxes bipunctatus ugandensis van Someren, 1972. Fairly common in the Ntakatta forest, but not found outside this forest. Record: 5a (1200-1500 m). General distribution: W. Africa to Zaire, Uganda and western Kenya.

Charaxes xiphares brevicaudatus Schultze, 1914. Taken in two forest remains of the Sitebi Mt., upper reaches of Katuma and at Ihassa Mt. near Ntakatta. All in banana traps. Rare. Record: 5a, 5b (1600-2000 m). General distribution: races are known from South Africa to northern Kenya and from Cameroun. Ssp. *maudei* J. & Tal., 1918, occurs at the east coast of Tanzania; ssp. *kilimensis* van Som. at Kilimanjaro; ssp. *kiellandi* Plantrou, 1976, at Mt. Oldeani, and there are earlier records of ssp. *brevicaudatus* from Iringa and Mbeya.

Charaxes ameliae amelina Joicey & Talbot, 1925. A forest species, but often flying in open woodland. Rather common in Kigoma and the north-western part of Mpanda. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1600 m, 2000 m at Mt. Sitebi).

Charaxes imperialis ugandicus van Someren, 1972. Very rare and local in forests of Mpanda and Kigoma, at Kasoge, Ujamba river, Kampisa, Lubalizi, Kefu, Mihumu and Ntakatta. Record: 1, 3a, 5a, 5b, 8a, 8b (800-1500 m). General distribution: W. Africa, Zaire to Uganda.

Charaxes pythodorus pythodorus Hewitson, 1873. Uncommon in forests of Kigoma and Mpanda. Wanzizi, Kampisa, Sitebi, Ntakatta, Luntampa, Ujamba riv. at 1300 m, Lukandamira, Kefu, Mihumu. Record: 1, 3a, 3b, 4a, 5a, 5b, 8a, 8b (800-1600 m, 2000 m at Mt. Sitebi). General distribution: from Kenya, Uganda to the eastern part of Zaire, western Zambia and Angola; ssp. *occidens* van Someren, 1963, W. Africa; ssp. *pallida* Carpenter, 1934, central Tanzania, and *nesaea* G. Smith, 1889, east coast of Kenya and Tanzania.

Charaxes eupale latimargo Joicey & Talbot, 1921. Riverine forests of Mpanda and Kigoma. Not uncommon, but difficult to trap with bait. Record: 1, 5a, 5b, 8a, 8b, Gombe (800-1500 m).

Charaxes dilutus dilutus Rothschild, 1898. Forests and riverine forests of Mpanda and Kigoma. Not uncommon. One record from Sibweza. Same habitats as *C. eupale*. Record: 1, 3a, 4a, 5a, 5b, 6, 8a, 8b (800-1700 m).

Charaxes jahlusa kigomaensis van Someren, 1975 (= *kigoma* v. Som., 1974). In forests of Kasoge, Mihumu and Mukuyu in Kigoma, Ntakatta in Mpanda. Uncommon. Record: 1, 5a, 8a, 8b, Gombe (800-900 m, 1500 m at Ntakatta). General distribution: Ethiopia and East Africa to Mozambique, Rhodesia and South Africa.

Charaxes pleione bebra Rothschild, 1900. Taken in the Mukuyu forest, Kefu and Ntakatta. Very local. Record: 5a, 8a, 8b (800-900 m, 1500 m at Ntakatta). General distribution: W. Africa to Zaire, east to Uganda and West Kenya.

Charaxes zingha Stoll, 1780. Low altitude forests. Not taken south of Kefu forest. Very local. Record: 8a, 8b (800-900 m). General distribution: W. Africa to Zaire, east to Uganda.

Charaxes etesipe etesipe Godart, 1823. Kasoge and Kefu forest in Kigoma. Uncommon. Record: 1, 8b (900 m).

Charaxes etesipe tawetensis Rothschild, 1894. This subspecies was taken in the Luntampa forest, and Lubalizi and probably meets ssp. *etesipe* in this area. Record: 3a, 4a (1200 m).

Charaxes penricei tanganyikae van Someren, 1966. Rare in woodland and savanna of Mpanda. In the Kigoma area taken in forests only. Rarely attracted to banana bait. Record: 1, 3a, 4a, 4b, 5a, 6, 8a, 8b, Ugala river, Gombe (800-1300 m). At Mihumu ♀ form *caerulescens* van Someren, 1969, first taken by Zuzuki. General distribution: ssp. *tanganyikae* from Mbeya along the east side of Lake Tanganyika to south Burundi, thence west to Mwanza south of Lake Victoria.

Charaxes achaemenes achaemenes Felder, 1867. Very common throughout Mpanda, Kigoma and Ufipa, in open woodland and savanna. Record: widespread (800-1500 m, 2000 m at Mt. Sitebi).

Charaxes anticlea adusta Rothschild, 1900. Forests of Kigoma at Kasoge, Lubalizi, Mihumu, Kefu, Luntampa, Ntakatta and Mukuyu. Not common. Record:

1, 3a, 4a, 5a, 8a, 8b, Gombe (800-1500 m).

Charaxes baumanni whytei Butler, 1893 (cline to ssp. *baumanni*). Forests and riverine forests of Mpanda, Kigoma and Ufipa. Rather high level species. Local, but common at Wanzizi and Kampisa. Record: 1, 3a, 3b, 5a, 5b, Chala, Mbuzi Mt. (1200-2000 m, rare below 1500 m). General distribution: several races from Uganda in the north to Rhodesia in the south.

Charaxes guderiana guderiana Dewitz, 1879. Very common in woodland and savanna throughout Mpanda, Kigoma and Ufipa. Record: widespread (800-1800 m).

Charaxes etheocles carpenteri Poulton, 1919. Forests of Kigoma and at Wanzizi in Mpanda. Very rare in Mpanda, but more common in Kigoma. Record: 1, 2a, 3b, 4a, 5a, 5b, 8a, 8b, Mbuzi Mt. in Ufipa (800-2000 m).

Charaxes grahamei van Someren, 1969. Not uncommon in the forests of Kasoge, Kefu, Ntakatta and Mihumu. Not yet taken south of Kasoge, and north of Kigoma. Rarely obtained on banana bait, but males frequently on animal droppings. Females difficult to obtain. Record: 1, 5a, 8a, 8b (800-1000 m, 1500 m at Ntakatta). This species, first obtained by the Japanese Primate Exp. from Kyoto, is most certainly endemic to the recorded area. At Mihumu form *lacteata* van Someren, 1969.

Charaxes howarthi Minig, 1976. The commonest of the black *Charaxes* in this area. In woodland and forest throughout Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, 9a, 9b, Chala, Gombe (800-1500 m, 2000 m at Sitebi).

Charaxes pseudophaeus van Someren, 1957 (= *Ch. manica* ♀ f. *pseudophaeus* van Som. & Jackson, 1957). Uncommon in woodland of Mpanda and Kigoma. Record: 2a, 2b, 5a, 5b, 6, 7 (900-1500 m). I am not certain of the validity of this species.

Charaxes (?) *aubyni* Poulton, 1925. A male was taken in a banana trap at Gombe Stream Nat. Park north of Kigoma, December 1972. Record: Gombe (900 m). Underside much darker than in *aubyni*; possibly a new species.

Charaxes fionae Henning, 1977. Open woodland of Mpanda, Kigoma and Ufipa. More common in the south. Record: 2b, 5b, 6, Ufipa, Kigoma, Gombe (800-1600 m, 2000 m at Mbuzi Mt.).

Charaxes cedreatis Hewitson, 1874. ♀ forms *vetula* R., 1900, *cedreatis* H., *inexpectata* v. Som., 1969. Rather common in open woodland and forests of Kigoma and Mpanda. Record: 1, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b (800-2000 m).

Charaxes chepalungu van Someren, 1969. A few records from Kigoma and Mpanda. One male also taken south of Biharamulo. Record: 4a, 6, 8a, 8b, Biharamulo (900-1200 m). General distribution: east of Lake Victoria.

Charaxes ethalion nyanzae van Someren, 1967. ♀ forms *ethalion* B. and *rosae* B., 1895. Common in open woodland, savanna and forest of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m).

Charaxes ethalion nyasicus van Someren, 1975 (= *nyasana* van Som., 1967). Occurring in the Ufipa area and probably the southern part of Mpanda. Record: Rukwa basin (ca. 1000 m).

Charaxes nichetes pantherina R.-Decelle, 1934. Uncommon in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1500 m).

Charaxes zelica toyoshimai Carcasson, 1964. Known from forests of Mukuyu, Mihumu, Kefu and Ntakatta in the sandstone area. Record: 5a, 8a, 8b (800-900 m, 1500 m at Ntakatta). First obtained by the Japanese Expedition from Kyoto.

Charaxes laodice Drury, 1782. Very local. Taken in low level forests at Kasoge, Mukuyu, Mihumu, Kefu, Luntampa, Ntakatta and Lubalizi. Also a tattered male taken at Gombe. Record: 1, 3a, 4a, 5a, 8a, 8b, Gombe (800-1200 m, 1500 m at Ntakatta).

Charaxes zoolina zoolina Westwood, 1850. A male (w.s.f.) was taken in the Rukwa basin in savanna at Muze (ca. 1000 m).

Palla publius kigoma van Someren, 1975. Flying in forests of Kigoma, Mukuyu and Kefu forests. Uncommon and very local. Record: 8a, 8b (800-900 m).

Palla ussheri interposita Joicey & Talbot, 1925. Flying in low level forests of the Kigoma area; Mukuyu, Mihumu and Kefu forests. Sandstone area only. Uncommon. Record: 8a, 8b (800-950 m). The two *Palla* species were first collected by the Japanese Expedition.

Subfamily Nymphalinae

Cymothoe theobene theobene Doubleday, 1848. The commonest *Cymothoe* species, in riverine forests and heavy woodland and shrub throughout Mpanda and Kigoma. Also one female taken near Chala in Ufipa at 1800 m. Some melanistic females are nearly uniformly brown above. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Chala, Gombe (800 to over 1800 m).

Cymothoe egesta confusa Aurivillius, 1887. Forests of Mpanda and Kigoma; rather uncommon. Record: 1, 3a, 3b, 4a, 5a, 8a, 8b (800-1500 m).

Cymothoe lurida azumai Carcasson, 1964. Riverine forests of Mpanda and Kigoma. Rather common. Record: 1, 2a, 3a, 4a, 5a, 8a, 8b (800-1500 m).

Cymothoe herminia johnstoni Butler, 1902. Rather common in forests of Mpanda and Kigoma. Record: 1, 3a, 3b, 4a, 5a, 8a, 8b (800-1500 m).

Cymothoe coranus Grosse-Smith, 1889. A few specimens taken in forests of Mpanda and Kigoma. Rare. One record from Wanzizi, from Kasoge, Ntakatta, Mihumu, Kefu and Gombe. Record: 1, 3b, 5a, 8a, 8b, Gombe (800-1450 m).

Cymothoe caenis Drury, 1773. Low to rather high altitude forests of Mpanda and Kigoma. Not uncommon. Record: 1, 3a, 5a, 6, 8a, 8b (800-1600 m). At Kasoge ♀ f. *rubida* Holl., 1920, and *conformis* Aur., 1898; at Lukandamira ♀ f. *caenis;* at Sibweza ♀ f. *rubida.*

Cymothoe sangaris Godart, 1823; ssp. near *luluana* Overlaet, 1945. Forests of Mpanda and Kigoma. More common in the sandstone area than south of the Luegele river. At Wanzizi one record only. Record: 3a, 3b, 4a, 5a, 5b, 8a, 8b (800-1500 m).

Pseudathyma plutonica expansa ssp. nov. (text-fig. 29, pl. 9 figs. 31-33). Several males and females were taken, November 1971, along a forest river in the Ntakatta forest. A few more specimens were taken in February and in November 1972. Record: 5a (1400-1500 m).

Male. Upperside fore wing discal white spots wider than in ssp. *plutonica,* particularly the spots from 2-6; all pale markings creamy, with only slight greenish tint; hind wing band generally wider and its outer border incised at the ribs, making a wavy outline; in ssp. *plutonica* the border is smooth, the inside less rounded, more uneven.

Underside white markings as above, otherwise like the nominate race. Length of fore wing 23 to 24 mm. Genitalia as in ssp. *plutonica*.

Female. As the male, but larger and the pale markings white and more extended. Length of fore wing 26-27 mm. Genitalia as in ssp. *plutonica*.

Holotype ♂ : Tanzania, Mpanda, Ntakatta forest, 1500 m, November 1971, J. Kielland. Allotype ♀ : Same data and collector. Paratypes: 6 ♀ and 6 ♂ , same data.

Holotype, allotype and paratypes are deposited in the National Museum, Nairobi. Other paratypes in the British Museum (Nat. Hist.), London, and J. Kielland collection.

This race has so far only been taken in the Ntakatta forest (Mpanda), close to the Kigoma border, in sandstone formations. Early rainy season only.

Euryphura spec. A few specimens taken in the following places: Kasoge, Ntakatta, Kefu, Kasha and at Mihumu. Rare. Record: 1, 5a, 8a, 8b (800-1400 m). Occurrence February, April, September, October, November. The species was not represented in the National Museum, Nairobi, and is probably undescribed.

Crenidomimas concordia Hopffer, 1855. Common in open woodland of Mpanda and Kigoma. Record: 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, 9a, 9b (800-1600 m).

Euryphene itanii Carcasson, 1964. Flying close to the ground in dense forests of Kigoma. Probably also in Mpanda in the north. Common. At low levels. Record: 1, 2a, 3a, 4a, 5a, 8a, 8b (800-1500 m).

Euphaedra spatiosa Mabille, 1877. Forests of Kigoma and Mpanda in the northwest. Common. Record: 1, 2a, 3a, 4a, 5a, 5b, 8a, 8b, Gombe (800-1400 m). Common in low forests, rapidly becoming scarcer at higher levels.

Euphaedra medon fraudata Thurau, 1903. Common in forests and forest margins of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Gombe (800-1700 m).

Euphaedra sarcoptera nipponicorum Carcasson, 1965. Forests of Kigoma. Rare. Records from Mihumu, Kapalamasenga river, Mugondozi river, Kefu forest, upper part of Lukoma river near Mt. Karobwa. Record: 2a, 8a, 8b (900-1100 m). Collected in March, June, September, October, November.

Euphaedra phosphor Joicey & Talbot, 1921 (= *ceres* Fabr. ssp. *phosphor*). Low altitude riverine forests of Mpanda and Kigoma. Common. Record: 1, 2a, 3a, 4a, 5a, 8a, 8b, Gombe (800-1200 m, 1700 at Mahale).

Euphaedra nigrobasalis Joicey & Talbot, 1921. Probably an undescribed race. Not uncommon in forests of Mpanda and Kigoma. Record: 1, 2, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1500 m). Recorded as *cooksoni katangensis* Talbot, 1927, by Carcasson (1966). According to M. Clifton (National Museum, Nairobi) this is *E. nigrobasalis*.

Euphaedra cyanea Holland, 1920 (= *E. xypete* Hew. f. *cyanea*). So far only a few males taken in the Kefu forest at Helembe. All in one year, 1970. Not seen since. January and March. Record: 8b (950 m). Differs from typical *cyanea* and is probably a new race.

Euphaedra coprates Druce, 1875 (= *E. eleus* Drury f. *coprates*). Forests of Kigoma. Uncommon. Mukuyu, Mihumu, Kefu, Zanza river, Lubalizi, Luntampa, Ntakatta. Record: 3a, 4a, 5a, 8a, 8b (800-1200 m, 1500 m at Ntakatta). Mentioned by Carcasson (1966) as *Najas eleus*. This species differs considerably from *eleus* and probably is a new race of *coprates*. Confirmed by M. Clifton (Nairobi).

Euphaedra zaddachi Dewitz, 1879. Forests of Mpanda and Kigoma. Not uncommon. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m).

Euphaedra mardania Fabricius, 1793 (= *Euryphene mardania* Fabr.), a new subspecies. Common in low level forests and forest margins of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 4a, 5a, 5b, 8a, 8b, Gombe (800-1200 m, 1500 m at Kampisa). This race is recorded from Ukerewe Island in Lake Victoria and at Abercorn in Zambia.

Euphaedra sophus ochreata Carcasson, 1961. Forests of Mpanda and Kigoma. Rather common in medium altitude forests of Wanzizi, less common further to the north, e.g. at Sitwe, Kampisa, Lukandamira. In the sandstone formations it occurs in low level forests. Not so in the basement area, except at Luntampa which borders on the sandstone. Record: 1, 3a, 3b, 4a, 5a, 5b (900-2000 m).

Hamanamida daedalus Fabricius, 1775. Ubiquitous, throughout Mpanda, Kigoma and Ufipa. In open woodland, savanna, forest and montane grassland. Record: widespread (900-2200 m).

Aterica galene galene Brown, 1776. Very common in forest, bush and heavy woodland throughout Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Pseudargynnis hegemone nyassae Bartel, 1905. Along rivers, forest margins and areas flooded during the rainy season in Mpanda and Kigoma. Record: 1, 2a, 3a, 4a, 5a, 5b, 6, 8a, 8b, 9a (800-1500 m).

Catuna crithea Drury, 1773. Dense forests of Kigoma and possibly Mpanda in the north, fluttering close to the ground and settling in spots of sun. Record: 1, 2a, 3a, 4a, 5a, 8a, 8b (800-1300 m, 1850 m in the Karobwa forest). The Karobwa forest is high altitude forest, completely separated from lower forests by open grassland and woodland further down. Also taken at Lukandamira, 1700 m.

Pseudacraea semire Cramer, 1779. Scarce. In forests of Mpanda and Kigoma. Record: 1, 5a, 5b, 8a, 8b, Gombe (800-1500 m).

Pseudacraea boisduvali trimeni Butler, 1874. Forests and heavy woodland of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b (800-1500 m).

Pseudacraea eurytus Linnaeus, 1758. Forests of Kigoma and Mpanda: Lubalizi, Luntampa, Kasoge, Mihumu, Kefu, Ntakatta. Record: 1, 3a, 4a, 5a, 8a, 8b (800-1500 m). The following forms occur: *kunovoides* Carp., 1930, *conradti* Obert., 1893, *opisthoxantha* Carp., 1924, *hobleyi* Neave, 1904, *bicolor* Aur., 1898, *ruhama* Hew., 1872, ♀ f. *terra* Neave, 1904, ♀ f. *simulator* B., 1873, ♀ f. *poggeoides* Poult., 1913, ♀ f. *fulvaria* B., 1874, ♀ f. *tirikensis* Neave, 1904, f. *terra* ab. *impleta* Grünb., 1910, ♂ f. *jacksoni* Carp., 1949, ♀ f. *grisea* Carp., 1949.

Pseudacraea poggei Dewitz, 1879, forms *poggei* and *carpenteri* Poult., 1918. Woodland in Mpanda and Kigoma. Not common. Record: 6, 8a (800-1400 m).

Pseudacraea lucretia expansa Butler, 1887, with ♀ f. *heliogenes* Butler, 1896. Common in forests and heavy woodland throughout Mpanda and Kigoma. Record: widespread (800-2000 m).

Pseudacraea deludens deludens Neave, 1912. Montane forests of Mahale in Kigoma and Sitebi in Mpanda. Record: 1, 5b (1600-2000 m). Three specimens from Mahale in December and June; eight specimens from Sitebi in September, 1970.

Subfamily Neptidinae

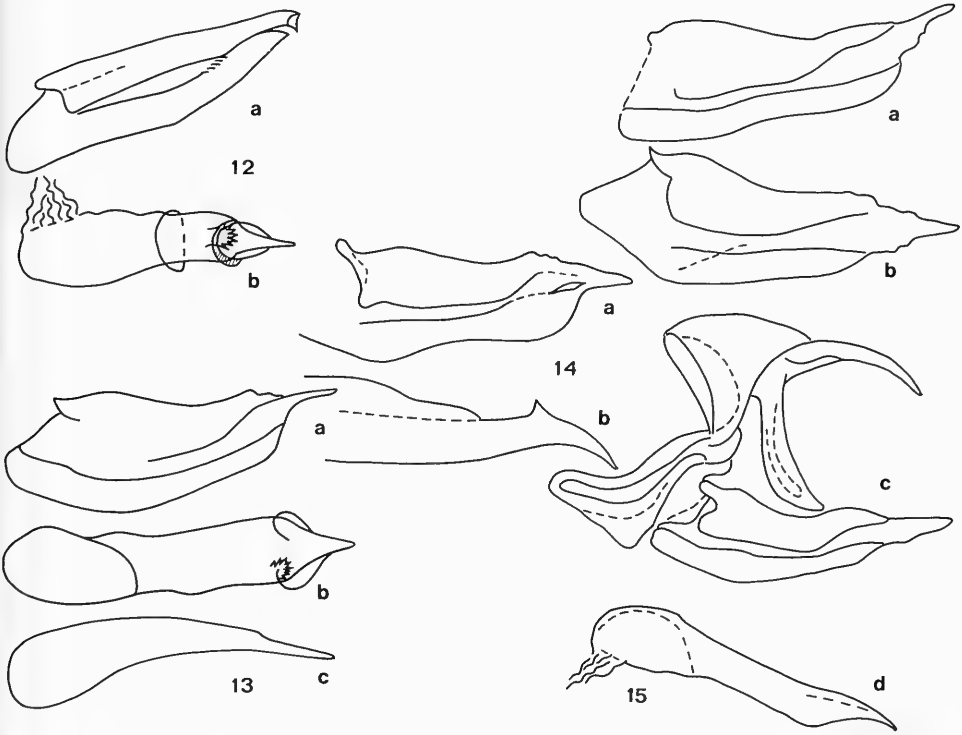
Neptis saclava marpessa Hopffer, 1855. Common in forests, woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread, also at Gombe (800-2000 m).

Neptis nemetes nemetes Hewitson, 1868 (text-fig. 12). Forests of Kigoma and Mpanda. Very common in the sandstone formations, but much scarcer in the basement area. Record: 4a, 5a, 6, 8a 8b, Biharamulo (800-1200 m, 1500 m at Ntakatta).

Neptis serena Overlaet, 1955 (text-fig. 13). Woodland, savanna and forest throughout Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, 9a, 9b, Ufipa, Gombe (800-1800 m).

Neptis laeta Overlaet, 1955 (text-fig. 14). Same habitats as above. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, 9a, 9b, Ufipa, Gombe (800-2200 m).

Neptis kiriakoffi Overlaet, 1955 (text-fig. 15). Woodland, savanna and riverine forest of Mpanda and Kigoma. Very common. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, 9a, 9b (800-2000 m).



Figs. 12—15. Male genitalia of *Neptis* species. 12, *N. nemetes* Hew., Mihumu, Kigoma, no. 480; a, valva, lateral aspect; b, aedeagus. 13, *N. serena* Ovlt., Sibweza, Mpanda, no. 182; a, valva, lateral aspect; b, aedeagus; c, valva, dorsal aspect. 14, *N. laeta* Ovlt., Sibweza, Mpanda, no. 271; a, valva, lateral aspect; b, valva, dorsal aspect. 15, *N. kiriakoffi* Ovlt.; a, typical valva, Sibweza, Mpanda, no. 179; b, atypical valva, Morogoro, no. 347; c, atypical valva, Sibweza, Mpanda, no. 481; d, aedeagus.

Neptis gratiosa Overlaet, 1955 (text-fig. 16). Stunted woodland at rather high altitude at Kampisa and at Ngondo and Mweze. Very local. Record: 3a, 5b (1500-1700 m).

Neptis penningtoni van Son, 1953 (text-fig. 17). *Brachystegia* hills of Mpanda and Kigoma. Not common. Record: 1, 3a, 4a, 5b, 6 (900-1700 m).

Neptis jordani Neave, 1910 (text-fig. 18). Riversides and marshy woodland. Common. Record: 1, 2a, 2b, 4a, 4b, 5a, 8a, 8b (800-1200 m).

Neptis alta Overlaet, 1955 (text.-fig. 19). *Brachystegia* hills of Mpanda and Kigoma. Common. Record: 1, 2b, 3a, 3b, 5a, 5b, 6, 8a, 8b (1000-1600 m, 1900 m at Mt. Sitebi).

Neptis metanira conspicua Neave, 1904 (= *nysiades* Hew. f. *conspicua*) (text-fig. 20). Forests of Mihumu, Kefu, Luntampa, Lubalizi. Rare. Record: 3a, 4a, 5a, 8a, 8b (800-1200 m, 1500 m at Ntakatta).

Neptis puella Aurivillius, 1894 (text-fig. 21). Forests of Lubalizi, Kefu, and a forest near Mt. Sitebi. Rare. Record: 3a, 5a, 5b, 8b (900-1700 m). General distribution: Ivory Coast, Cameroun to Zaire and Uganda.

Neptis trigonophora vansomereni Eltringham, 1929 (text-fig. 22). Rather common in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, (800-1500 m).

Neptis strigata Aurivillius, 1894 (text-fig. 23). Not uncommon in forests of Kigoma and Mpanda. Record: 1, 3a, 4a, 5a, 8a, 8b (800-1500 m).

Neptis nicoteles Hewitson, 1874 (text-fig. 24). Forests at Helembe, Mukuyu, Luntampa, Lubalizi, Ntakatta. Rare. Record: 3a, 4a, 5a, 8a, 8b (800-1200 m, 1500 m at Ntakatta). General distribution: Nigeria, Cameroun and Zaire to Uganda.

Neptis melicerta Drury, 1773 (text-figs. 25, 28). Mukuyu forest, Kefu forest, Mugondozi river. Sandstone area only. Record: 5a, 8a, 8b (800-1400 m).

Neptis carcassoni van Son, 1959 (= *melicerta* Dr. ssp. *carcassoni*) (text-figs. 25, 28). Evergreen forests of Mpanda and Kigoma. Particularly in the sandstone area. Record: 1, 3a, 4a, 5a, 5b, 6, 8a, 8b, 9b, Gombe (800-1500 m).

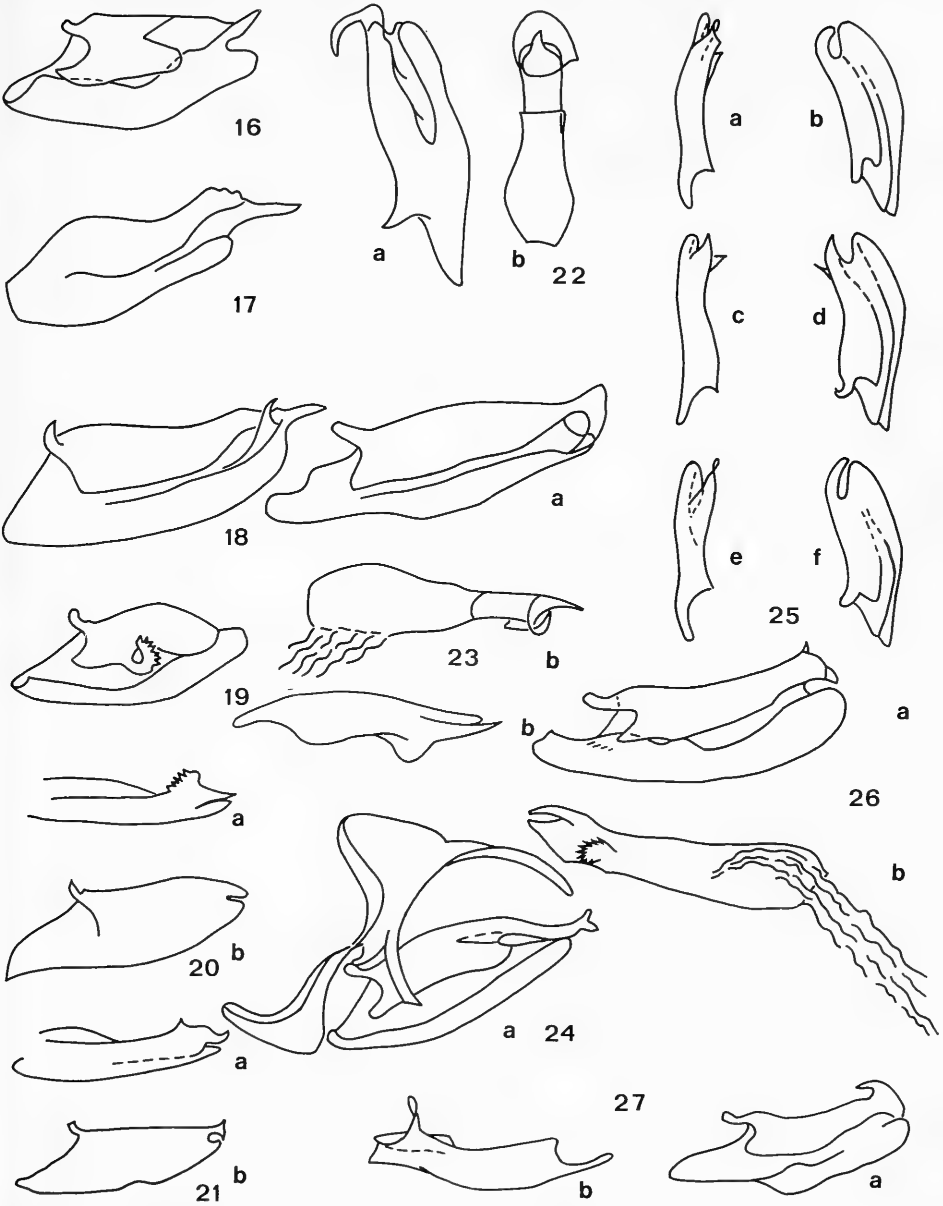
N. melicerta and *N. carcassoni* overlap considerably and should be recorded as separate species. Except in area 5a (Ntakatta) *N. goochi* is only overlapped by *carcassoni* and could be considered a race of *melicerta;* however, the genitalia of all three differ as shown in text-fig. 25.

Neptis goochi Trimen, 1879 (= *melicerta* Dr. ssp. *goochi*) (text-figs. 25, 28). Forests of Mpanda and Kigoma. Common. Record: 1, 3a, 4a, 5a, 6, 8b (1000-1500 m).

Neptis occidentalis occidentalis Rothschild, 1918 (text-fig. 26). Forests of Mweze and Mahale in Kigoma. Not common and very local. Record: 1, 3a (1600-2000 m).

Neptis ochracea reducta ssp. nov. (text-fig. 27, pl. 9 figs. 34-36). Montane forests of Mpanda and Kigoma. Not uncommon. Record: 1, 3a, 5a, 5b (1500-2000 m).

Differs from the nominotypical race in reduction of the fore wing spots in space 1. In all males examined the spots are reduced to a streak along the hind margin; in one specimen hardly discernible. In ssp. *ochracea* there are two long spots in space 1b, usually conjoined and almost confluent with the spots 3 and 4, forming a band. The yellow band of the hind wing is very variable, in most specimens



Figs. 16—27. Male genitalia of *Neptis* species. 16, *N. gratiosa* Ovlt., Mweze, Mpanda, no. 613; valva, lateral aspect. 17, *N. penningtoni* van Son, Sibweza, Mpanda, no. 186; valva; lateral aspect. 18, *N. jordani* N., Sibweza, Mpanda, no. 183; valva, lateral aspect. 19, *N. alta* Ovlt., Sibweza, Mpanda, no. 242; valva, lateral aspect. 20, *N. mentanira conspicua* N., Mukuyu, Kigoma, no. 763; a, valva, dorsal aspect; b, valva, lateral aspect. 21, *N. puella* Aur., Lubalizi, Kigoma, no. 762; a, valva, dorsal aspect; b, valva, lateral aspect. 22, *N. triogonophora vansomereni* Eltr., Sibweza, Mpanda, no. 475; a, valva, lateral aspect; b, aedeagus. 23, *N. strigata* Aur., Kigoma, no. 486; a, valva, lateral aspect; b, aedeagus. 24, *N. nicoteles* Hew., Ntakatta forest, Mpanda, 1500 m, no. 1464; a, gentitalia in lateral view with aedeagus and left valva removed; b, valva in dorsal aspect. 25, *N. melicerta melicerta* Dr., a, valva, dorsal aspect; b, valva, lateral aspect; *N. carcassoni* stat. n., c, valva, dorsal aspect; d, valva, lateral aspect; *N. goochi* Trim.; e, valva, dorsal aspect; f, valva, lateral aspect. 26, *N. occidentalis occidentalis* Roth., Mweze forest, Kigoma, no. 488; a, valva, lateral aspect; b, aedeagus. 27, *N. ochracea reducta* ssp. n., Lukandamira, Mahale, Kigoma, no. 791; a, valva, lateral aspect; b, valva, dorsal aspect.

much reduced and separated in space 1b, in others wider and conjoined. The females have much wider and paler hind wing bands and the fore wing pale spots less reduced.

Habitat. Montane forests and riverine forests in western Tanzania.

Holotype ♂ : Tanzania, Mpanda, Mt. Sitebi, 2000 m, 2. v. 1970, J. Kielland. Allotype ♀ : Tanzania, Kigoma, Sitwe, 1700 m, 20. viii. 1960, J. Kielland. Paratypes: Tanzania, Kigoma, Lukandamira, 1600 m, August 1970; 3 ♂ , 2 ♀ , same, but October 1969; Mt. Sitebi, 1.v. 1970, 1 ♂ ; Mpanda, Katuma, July 1972, 1 ♂ ; Sitwe, 29. ix. 63, 1 ♂ . All. J. Kielland.

Holotype, allotype and paratypes in the National Museum, Nairobi; further paratypes in the British Museum (Nat. Hist.), London, and J. Kielland collection.

Neptis incongrua Butler, 1896. Flying sparingly in the Mbisi Forest, Ufipa (2300 m); one female taken February 1978.

Subfamily Marpesiinae

Cyrestis camillus camillus Fabricius, 1781. Forests of Mpanda and Kigoma. Particularly along streams. Record: 1, 2a, 3a, 4a, 5a, 5b, 8a, 8b (800-1500 m).

Subfamily Eunicinae

Sallya pechueli Dewitz, 1879. One male taken by T. H. E. Jackson's collector

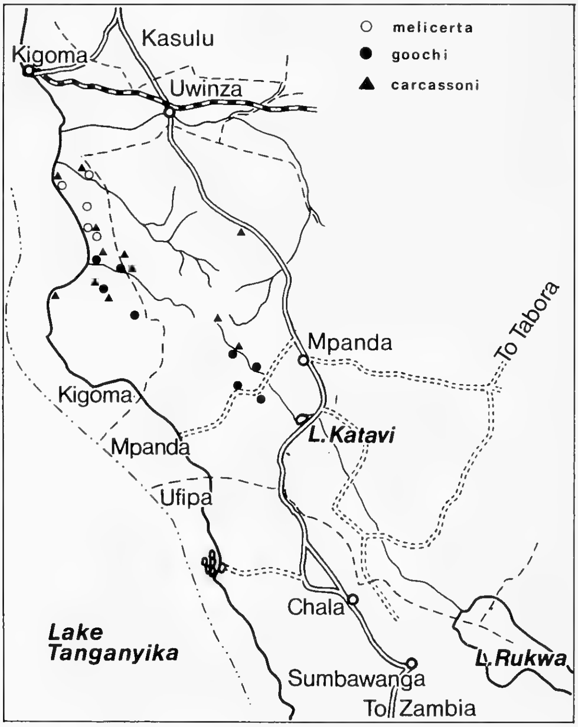


Fig. 28. Distribution of *Neptis* species.

Watulege in the Mpanda area. One male taken by me at Luegele in Kigoma, 1. xii. 1970, in open woodland. Record: 4a, Mpanda area (1100 m).

Sallya amulia rosa Hewitson, 1877. Woodland and swampy ground of Mpanda and Kigoma. Record: 3a, 4a, 5a, 5b, 6, 8a, 8b (800-1300 m). Very common in certain places of area 8a, 8b, particularly on hills near Helembe, in the dry season. Further south less common and local.

Sallya occidentalium occidentalium Mabille, 1876. Very local in forests of Mpanda and Kigoma. Record: 1, 4a, 5a, 5b, 8a, 8b (800-1500 m).

Sallya moranti dubiosa Strand, 1911. Forests and woodland of Mpanda and Kigoma. Common. Record: 1, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1500 m, 1900 m at Sitebi).

Sallya spec. Some males and females, closely related to *moranti,* were sent to the late Mr. Peter Muteshi who was revising *Sallya* at the National Museum, Nairobi. Mr. Muteshi was about to describe it as a new species. Forests of Luntampa, Lubalizi, Kefu, Mukuyu, Ntakatta. Record: 3a, 4a, 5a, 8a, 8b (800-1200 m).

Sallya boisduvali boisduvali Wallengren, 1857. Forests and woodland of Mpanda and Kigoma. Rather common. Record: 3a, 3b, 5a, 5b, 6, 8a, 8b, 9b, Gombe (800-2000 m).

Sallya boisduvali omissa Rothschild, 1918. Record: Kasoge forest at 1 (800 m).

Sallya garega garega Karsch, 1892. Forests of Mpanda and Kigoma. Not very common. Record: 1, 3a, 3b, 4a, 5a, 5b, Gombe (1500 m).

Sallya umbrina Karsch, 1892. Common in forests and woodland of Kigoma and Mpanda, Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 8a, 8b, Gombe (800-1600 m).

Subfamily Eurytelinae

Byblia acheloia acheloia Wallengren, 1857. Very common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-2000 m).

Mesoxantha ethosea reducta Rothschild, 1918. Low level forests of Kigoma and probably Mpanda in the north. Often occurring in small colonies. Local. Record: 1, 3a, 4a, 5a, 8a, 8b (800-1500 m).

Ariadne enotrea suffusa Joicey & Talbot, 1921. Forests and heavy woodland and shrub in Mpanda and Kigoma. Common. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Biharamulo, Gombe (800-1500 m).

Ariadne enotrea archeri Carcasson, 1958. From Lubalizi, Sibweza, Kampisa and other places. A doubtful subspecies since ssp. *suffusa* is found in the same areas.

Ariadne pagenstecheri Suffert, 1904. Forests of Mpanda and Kigoma. Common. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6 (1200-2300 m). A rather high altitude species. At Kampisa, 1500 m, *A. enotrea* and *A. pagenstecheri* fly together. In most other places they are not seen together. *A. pagenstecheri* more often flies at higher altitudes, while *A. enotrea* frequents lower levels.

Neptidopsis ophione ophione Cramer, 1777. Very common in forests and woodland of Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Eurytela hiarbas hiarbas Drury, 1782. Forests throughout Mpanda, Kigoma and Ufipa. Common. Record: widespread (800-2200 m).

Eurytela dryope angulata Aurivillius, 1898. Common in forests and heavy woodland of Mpanda, Kigoma and Ufipa. Record: widespread (800-1700 m, 2000 m in Ufipa).

Subfamily Vanessinae

Kallima rumia rattrayi Sharpe, 1904. Forests of Kigoma and Mpanda. Locally common. Record: 1, 2a, 3a, 4a, 5a, 5b (800-1400 m, 1600 m at Lukandamira and 1700 m at Mt. Ipumba). Differs somewhat from ssp. *rattrayi* and may constitute an undescribed race.

Kallima cymodoce Cramer, 1777, form *lugens* Schultze, 1912. Flying in low altitude forests of Kigoma, in the sandstone area only. Local and uncommon. Mihumu, Kapalamasenga river, Mubondozi river, Kefu. Record: 8a, 8b (900-1100 m).

Kallima ansorgei Rothschild, 1899. The Ntakatta forest only. Very local. Record: 5a (1200-1500 m). *K. ansorgei* and *K. rumia* fly together, while neither of these have been taken further inside the sandstone area where *K. cymodoce* occurs. Ntakatta is situated on the border between sandstone and basement formations.

Apaturopsis cleocharis Hewitson, 1873. One specimen was observed by the author in the Mukuyu forest in Kigoma. Record: 8a (800 m).

Hypolimnas misippus Linnaeus, 1764; ♀ forms: *misippus, inaria* Cr., 1779, and *alcippoides* B., 1883. Common in woodland and open habitats of Mpanda and Kigoma. Record: widespread (800-1500 m).

Hypolimnas monteironis Druce, 1874. Luntampa and Ntakatta forests only. Very rare and local. Record: 4a, 5a (1200-1500 m). This is probably an undescribed race.

Hypolimnas dinarcha Hewitson, 1865. Kigoma area. Mukuyu forest, 1♂, November; Luntampa forest, May, June and March, a few specimens; Ntakatta forest 1♂. Very rare and local. Record: 4a, 5a, 8a (800-1200 m). Intermediate between the W. African and the Uganda race.

Hypolimnas dubius dubius Polisot de Beauvais, 1805. Common in forests of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b (800-1700 m). Forms: *dubius, damoclina* T., 1869, *anthedon* Dbl., 1845.

Salamis temora Felder, 1867. Dense forests of Kigoma and the Ntakatta in Mpanda. Record: 1, 4a, 5a, 8a, 8b, Gombe (800-1200 m, 1600 m at Lukandamira).

Salamis parhassus Drury, 1782; forms: *parhassus* and *aethiops* de Beauvais, 1805. Very common in forests and heavy woodland of Mpanda and Kigoma. Record: widespread (800-2200 m).

Salamis anacardii Linnaeus, 1764. Common in woodland, savanna and forest margins of Mpanda and Kigoma. Record: widespread (800-1600 m).

Salamis cacta cacta Fabricius, 1793. Not common in forests of Mpanda and Kigoma, Mihumu, Kefu, Ntakatta, Lubalizi, Luntampa. Record: 3a, 4a, 5a, 8a, 8b (800-1250 m).

Precis cloanthe Cramer, 1781. Very common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Precis touhilimasa Vuillot, 1892. *Brachystegia* woodland of Mpanda, Kigoma and Ufipa. Preferring hills. Record: 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, Chala (1000-1800 m).

Precis artaxia Hewitson, 1864. *Brachystegia* woodland, savanna and grassland of

Mpanda, Kigoma and Ufipa. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Chala (800-1900 m). Forms: *artaxia* (d.s.f.) and *nobilitata* Thur., 1905 (w.s.f.). The latter is smaller than *artaxia* and occurs during the start of the rains, in Nov. to Dec. Only tattered specimens of this form have been taken early January. The form *artaxia* emerges late December and continues to emerge during the rainy season, until May-June. From then on, during the dry season few specimens seem to emerge. Specimens are increasingly tattered as the dry spell continues, until late October.

Precis stygia gregorii Butler, 1895. Common in forests of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1800 m).

Precis natalica natalica Felder, 1860. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-1700 m).

Precis terea elgiva Hewitson, 1864. Very common in forests and woodland of Mpanda, Kigoma and Ufipa. Record: widespread (800-2000 m).

Precis archesia Cramer, 1779; forms *archesia* (d.s.f.), intermediate f. *chapunga* Hew., 1864, *pelasgis* Gt., 1819 (w.s.f.). Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-1800 m).

Precis sinuata Plötz, 1880. Forests and woodland of Kigoma and Mpanda. Rather common. Record: 1, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, 9a, 9b, Gombe (800-1500 m).

Precis tugela Trimen, 1879. Forests and woodland of Mpanda and Kigoma. Rather common. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6 (800-2000 m).

Precis rauana (?) *kakamega* Carcasson, 1961. Not uncommon in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b (1200-2000 m).

Precis actia Distant, 1880; forms: *actia* (d.s.f.), *furcata* R. & Jordan, 1903 (w.s.f.). Woodland and savanna of Mpanda, Kigoma and Ufipa. Common. Record: widespread (800-2000 m).

Precis pelarga Fabricius, 1775; forms: *leodice* Cr., 1777 (d.s.f.), *harpyia* F., 1781 (d.s.f.), *pelarga* (w.s.f.). Flying in woodland of Mpanda, Kigoma and Ufipa. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8b, Kishi in Ufipa, Gombe (800-1600 m).

Precis ceryne Boisduval, 1847; forms: *ceryne* (w.s.f.), *tukuoa* Wall., 1857 (d.s.f.). Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-2000 m).

Precis antilope Feisthamel, 1850; forms: *antilope* (d.s.f.), *simia* Wall., 1857 (w.s.f.). Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8b, Rukwa basin, Gombe (800-1700 m).

Precis cuama Hewitson, 1864. Taken in stunted woodland at Kampisa in Mpanda. Very rare. Record: 5b (1500 m).

Precis octavia sesamus Trimen, 1883; forms: *sesamus* (d.s.f.), *natalensis* St., 1885 (w.s.f.), intermediate f. *transiens* Wich., 1918. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-2100 m).

Precis sophia infracta Butler, 1888. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Often flying in swampy areas and along river banks. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Chala, Gombe (800-1800 m).

Precis westermanni westermanni Westwood, 1870. Two males taken Jan. 1973 in the Ntakatta forest at a riverbed. Record: 5a (1400 m). General distribution: W. Africa to Uganda and Kenya. Haldane (1969) recorded it from Ngara Distr. south of Bukoba, Tanzania.

Precis oenone oenone Linnaeus, 1764 (= *clelia* Cr., 1775). Common in open habitats and woodland of Mpanda, Kigoma and Ufipa. Record: widespread (800-2000 m).

Precis hierta hierta Fabricius, 1798 (= *cebrene* T., 1870). Open habitats and woodland of Mpanda, Kigoma and Ufipa. Common. Record: widespread (800-2000 m).

Precis orithya madagascariensis Guenee, 1864. Common in open habitats and woodland of Mpanda, Kigoma and Ufipa. Record: widespread (800-2000 m).

Vanessula milca latifasciata Joicey & Talbot, 1928. Common in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 4a, 5a, 5b, 6, 8a, 8b, 9b (800-1500 m).

Vanessa cardui Linnaeus, 1758. Ubiquitous in all open and wooded habitats of Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Antanartia hippomene hippomene Hübner, 1806. Forests of Kigoma, Mpanda and Ufipa. Not uncommon in highland. Record: 1, 3a, 5b, Mbizi Mt., Chala, Mbuzi Mt. (1500-2300 m).

Antanartia schaenia dubia Howarth, 1966. Forests of Mpanda, Kigoma and Ufipa. High altitude. Record: 1, 3a, 5b, Mbizi forest, Chala Mt., Mbuzi Mt. (1700-2300 m).

Antanartia delius Drury, 1782. Record: Gombe (900 m).

Subfamily Argynnidinae

Lachnoptera iole Fabricius, 1781. Ssp. intermediate between *iole* and *ayresii* Trimen, 1879. Common in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, 9b (800-1500 m).

Phalanta columbina columbina Cramer, 1779. Common in forests of Mpanda, Kigoma and Ufipa. Record: widespread (800-1800 m).

Phalanta phalantha aetiopica Rothschild & Jordan, 1903. Common in woodland, savanna and open habitats of Mpanda, Kigoma and Ufipa. Record: widespread (800-1600 m).

Issoria excelsior katangae Neave, 1910. Forests and forest margins surrounded by open grassland in Ufipa. Record: Mbizi forest in Ufipa (2000-2300 m).

Family Acraeidae

Bematistes vestalis Felder, 1865. Forests of Kigoma in the sandstone area only. Very local. Record: 8a, 8b (800-1100 m).

Bematistes alcinoe camerunica Aurivillius, 1893. A rare species occurring in the Kasoge forest, Kefu, Luntampa and at Mihumu. September and January. Record: 1, 4a, 8a, 8b (800-950 m).

Bematistes umbra macarioides Aurivillius, 1893. A rare species, mainly in dense forest of the sandstone area. Mihumu, Kefu, Ntakatta, Luntampa, Lubalizi. January, February, April, September. Record: 3a, 4a, 5a, 8a, 8b (800-1400 m). General distribution: From Ivory Coast to Nigeria, Cameroun and Zaire. Ssp. *macarioides* from Central Zaire.

Bematistes aganice montana Butler, 1888. Rather common in forests and heavy woodland of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b (800-

1600 m). Females with very narrow fore wing white band occur at 2000 m on Mt. Sitebi.

Bematistes scalivittata Butler, 1896. One female taken in the Mbisi Forest, Ufipa (2200 m), February 1978.

Bematistes quadricolor itumbana Jordan, 1910. In montane forest of the Mahale Mt. only, at Lukandamira. Very rare. Several males and one female taken August 1970 and August 1971. Record: 1 (1600-2000 m).

Bematistes poggei poggei Dewitz, 1879. Not uncommon in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b (800-2000 m).

Bematistes macarista Sharpe, 1906. Locally common in forests of Mpanda and Kigoma. Record: 1, 3a, 4a, 5a, 8a, 8b, Gombe (800-1500 m).

Bematistes persanguinea Rebel, 1914. Two males taken in the Mihumu forest, Kigoma. September 1968. Very rare. Record: 8a (900 m). General distribution: Kayonza forest, Uganda; Kasai in Zaire.

Bematistes epiprotea Butler, 1874. Dense forests of Kigoma in the sandstone area only. Mukuyu, Mihumu, Kefu, Mugondozi, Mugombazi, northern Ntakatta. Rather common. Record: 5a, 8a, 8b (800-1100 m, 1400 m at Ntakatta).

Bematistes epaea lutosa Suffert, 1904. Rather common in forests of Kigoma and Mpanda. Record: 1, 3a, 4a, 5a, 8a, 8b (800-1200 m, 1500 m in the Ntakatta forest). Differs slightly from typical ssp. *lutosa*. In the Kasekera forest at Gombe the author has taken a male and a female of another race of *epaea*, differing from ssp. *lutosa*.

Acraea pentapolis epidica Oberthür, 1893. Very common in the Kasoge forest from July to October, but not taken anywhere else in the study area. Its foodplant, a *Myrianthus* species, is plentiful in this forest, but very scarce elsewhere. Record: 1 (800-1600 m). The only other place where a few *Myrianthus* trees have been noticed, is at Mihumu and in a forest west of Mt. Kakungu. In February 1978, larvae of *pentapolis* were observed on a *Myrianthus* tree at Mihumu (area 8a).

Acraea cerasa kiellandi Carcasson, 1964. Not common. In forests of Mpanda and Kigoma. Record: 3a, 3b, 5a (1200-1500 m).

Acraea quirina quirina Fabricius, 1781. Forests of Kigoma and Ntakatta in Mpanda. Record: 1, 5a, 8a, 8b, Gombe (800-1400 m).

Acraea kraka Aurivillius, 1893. Fifteen specimens were taken along a riverbed in the Ntakatta forest, in half shade, September 1973, and a few more in 1974. Although Ntakatta has been extensively collected by the writer for several years, none had been seen before.

Acraea terpsichore neobule. Doubleday, 1847. Woodland of Mpanda, Kigoma and Ufipa. Not uncommon. Record: 2a, 3a, 3b, 6, Rukwa basin (800-1200 m).

Acraea admata Hewitson, 1865. Forests of Kigoma and Mpanda at Ntakatta. Common. Record: 1, 4a, 5a, 8a, 8b (800-1200 m, 1500 m at Ntakatta).

Acraea zetes zetes Linnaeus, 1758. Not very common. In woodland of Mpanda, Kigoma and Ufipa. Record: 1, 3b, 4a, 5a, 5b, 6, 8a, 8b, Chala, Gombe (800-2000 m).

Acraea anemosa Hewitson, 1865. Very common in savanna and woodland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Chala (800-1200 m, 1800 m at Chala).

Acraea pseudolycia astrigera Butler, 899. Not common in savanna of Mpanda and Kigoma, more common in Ufipa. Record: 3a, 3b, 4a, 6, 8a, 8b, Chala, Rukwa basin (800-1700 m).

Acraea egina harrisoni Sharpe, 1904. Common in forest, open woodland and grassland of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, 9b, Gombe (800-2000 m).

Acraea cepheus abdera Hewitson, 1852. Forests of Mpanda and Kigoma. Rare. Mukuyu, Kasoge, Wanzizi. Record: 1, 3b, 8a (800-1500 m).

Acraea guillemei Oberthür, 1893. Savanna and woodland of Mpanda. Rare. Simbo, Kaliangkulukulu, Kabungu, Kapanda, Sibweza, Nkungwe. Record: Area 6 only (1000-1200 m). Wet season only. January to April. Not found on hills.

Acraea chambezi Neave, 1910. Montane grassland of the Sitebi Mt. and Mt. Ipumba at Mpanda. September 1970 and 1973. First East African records. Record: 5b (2000 m). General distribution: Zambia.

Acraea periphanes Oberthür, 1893. Rather common. Locally very common in woodland and savanna of Mpanda and Kigoma. Record: 1, 3a, 3b, 4a, 4b, 5a, 6, 8a, 8b (800-1300 m, 1700 m at Lukandamira). Forms with and without strong fore wing apical black patch. Also a form lacking discal spots on the fore wing particularly in the females.

Acraea acrita taborensis Le Deux, 1932. Very common in woodland and savanna of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Gombe (800-2000 m).

Acraea chaeribula Oberthür, 1893. Wooded savanna of Mpanda at Sibweza, Wanzizi and on flats south-west of Wanzizi. Rare and very local. August to September. Record: 2b, 3b, 6 (1100-1600 m).

Acraea leucopyga Aurivillius, 1904. One male taken at Chala in Ufipa, May 1972. Open country. Record: Chala (1800 m). General distribution: Southern Tanzania and Tunduma near Mbeya, Zambia and Malawi.

Acraea caldarena caldarena Hewitson, 1877. Common on savanna of Mpanda and Ufipa. Also taken at Mt. Sitebi. Record: 3b, 5b, 6, Chala (1000-1300 m, 2000 m at Sitebi).

Acraea pudorella pudorella Aurivillius, 1898. Not uncommon in woodland and savanna of Mpanda and Ufipa. Record: 6, Chala (ca. 1100 m, 1800 m at Chala).

Acraea rhodesiana Wichgraf, 1909. A single male taken in open woodland at Sibweza. Record: 6 (1100 m). General distribution: Rhodesia. One specimen labelled Dar es Salaam in the National Museum, Nairobi.

Acraea oncaea Hopffer, 1855. Woodland of Mpanda and Kigoma. Common in the Lubalizi valley, rare elsewhere. One record from Ikola by T. H. E. Jackson. Record: 1, 2b, 3a, 4a, Gombe (800-1700 m).

Acraea natalica natalica Boisduval, 1847. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-1600 m).

Acraea anacreon bomba Grosse-Smith, 1898. Common in most habitats of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Sumbawanga, Chala, Mbuzi Mt., Gombe (800-1900 m).

Acraea rahira rahira Boisduval, 1833. Not uncommon in swampy plains and riversides of Mpanda and also at Lukandamira in Kigoma. Record: 1, 6, 7 (800-1100 m, 1600 m at Lukandamira).

Acraea encedon Linnaeus, 1758; forms *daira* G. & Salvin, 1884; *infuscatoides* Le D., 1931; *lycioides* Le D., 1931. Very common in most habitats of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Chala, Gombe (800-1700 m).

Acraea goetzi Thurau, 1903. Forest margins and grassland of Ufipa highland. Common. Record: Mbizi forest, Chulwe Mt., Chala Mt., Mbuzi Mt. (1600-2000 m).

Acraea bonasia bonasia Fabricius, 1775. Forests of Mpanda and Kigoma. Not common. Local. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b (800-2000 m).

Acraea sotikensis sotikensis Sharpe, 1891. Common in forests of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 8a, 8b, 9b, Chala, Mbizi Mt. (800-2200 m).

Acraea cabira Hopffer, 1855. Heavy woodland and forest margins of Mpanda, Kigoma and Ufipa. Common. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, 9a, Chala, Gombe (800-2000 m).

Acraea acerata Hewitson, 1874. Common in woodland and riverine forests of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, Chala, Mbuzi Mt. (800-1700 m, 2000 m in Ufipa).

Acraea eponina Cramer, 1780. Very common in most habitats of Mpanda, Kigoma and Ufipa. Record: widespread (800-2000 m).

Acraea ventura Hewitson, 1887. Not uncommon in forests, grassland along rivers and open woodland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 5a, 5b, 6, 9b, Mbuzi Mt. (1000-1700 m, 2000 m at Mbuzi Mt.).

Acraea pharsalus pharsalus Ward, 1871. Common in forests and heavy woodland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, Kigoma, 8b, Mbuzi Mt. (800-2000 m).

Acraea perenna perenna Doubleday & Hewitson, 1847. Common in forests and heavy woodland of Mpanda and Kigoma. Record: 1, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-2000 m).

Acraea peneleos pelasgius Grosse-Smith, 1900. Forests of Kigoma and probably Mpanda in the north. Not common. Record: 1, 8a, 8b (800-1000 m). General distribution: Cameroun to Zaire, Uganda and W. Kenya.

Acraea penelope penelope Staudinger, 1896. Forests of Kigoma and probably Mpanda in the north. Rare. Record: 8a (900 m). General distribution: Zaire to Uganda and W. Kenya.

Acraea ntebiae kigoma ssp. nov. (pl. 10 figs. 37-42). Differs from the nominate subspecies in the very variable colour of the underside; in some males the colour is as in the nominate subspecies, in others ochreous brown; upperside fore wing median spots creamy, in some of the females hind wing ground colour orange red and the spots in the fore wing space 2 and cell red. Females with ground colour invading the broad, black marginal band in streaks nearly to the margin.

Habitat. Forests of the Mahale Mt. Mainly at high levels.

Holotype ♂. Tanzania, Kigoma, Lukandamira, 1600 m, 17. viii. 1970, J. Kielland. Allotype ♀ : as holotype. Paratypes: 4 ♂ and 7 ♀ same data; 2 ♂ same, but 1.xi. 1972; 1 ♂ Kigoma, Ntondo, August 1971. Holotype, allotype and paratypes in the National Museum, Nairobi; further paratypes in the British Museum (Nat. Hist.), London, and J. Kielland collection.

Acraea servona rhodina Rothschild & Jordan, 1905. Forests of Mpanda and Kigoma. Not very common. Record: 3a, 4a, 5a, 5b, 8a, 8b (800-1500 m).

Acraea oreas oreas Sharpe, 1891. Forests of Mpanda, Kigoma and Ufipa. Rather common. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 8a, 8b, Mbizi forest, Gombe (800-2000 m).

Acraea cinerea Neave, 1904. Collected by the Japanese expedition at Mahanga in Kigoma, by T. H. E. Jackson's African collector Watulege at Mahale. Record: 1, 8a. Altitude not specified.

Acraea quirinalis Grosse-Smith, 1900. A few specimens taken in the Ntakatta forest flying along a riverbed and settling on wet sand. Very rare. Record: 5a (1400-1500 m). General distribution: Forests from eastern Zaire to Uganda, W. Kenya and Tanzania in the Usukuma area.

Acraea amicitiae amicitiae Heron, 1909. Montane forest of the Mahale Mt. only. Record: 1 (1600-2000 m). General distribution: Burundi and Ruanda to W. Uganda.

Acraea alciope alciope Hewitson, 1852. Forests of Mpanda and Kigoma. Not common. Record: 3a, 3b, 4a, 5a (1200-1500 m).

Acraea jodutta jodutta Fabricius, 1793. Forests of Mpanda and Kigoma. Not common. Record: 1, 3a, 3b, 4a, 5a, 8a, 8b (800-1600 m).

Acraea esebria Hewitson, 1861. Forests of Kigoma and Mpanda. Common. Record: 1, 3a, 3b, 4a, 5a, 8a, 8b, Gombe (800-1600 m).

Acraea lycoa bukoba Eltringham, 1911. Rather common in forests of Mpanda and Kigoma. Record: 1, 3a, 4a, 5a, 8a, 8b (800-1300 m).

Acraea johnstoni johnstoni Godman, 1885. Common in forests of Mpanda. Kigoma and Ufipa. Record: 1, 3a, 3b, 4a, 4b, 5a, 5b, Chulwe Mt. (800-2000 m). Form *octobalia* Karsch, 1894, at Lukandamira and Ntondo.

Pardopsis punctatissima Boisduval, 1833. In woodland at Sibweza, along the Uwinza road, Luntampa and at Mihumu. Very local and sporadic. Record: 4a, 6, 8a, 9a, 9b (1060-1400 m).

Family Libytheidae

Libythea labdaca labdaca Westwood, 1851. Forests of Mpanda and Kigoma. Not common. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1800 m).

Family Riodinidae

Abisara neavei mahale ssp. nov. (text-fig. 30, pl. 14 figs. 54, 55). Resembling the Cameroun race *latifasciata* Riley, 1931, in the wide, white discal band of both wings, but in ssp. *mahale* the band is still wider, the hind wing ocellar yellow ring is situated further from the margin, 0.8-1.1 mm in *mahale*, 0.5-0.6 mm in other subspecies. On the underside of fore and hind wing subbasal and subtornal bands narrower and fainter than those of the nominate race. The sexes are similar, but the wings of the female are broader and more rounded than in the male. Length of fore wing ♂ 21 to 22 mm, ♀ 21.5 mm. Genitalia ♂ same as ssp. *neavei*.

Habitat. A somewhat weak, skipping flight amongst forest undergrowth, on which it frequently settles.

Holotype ♂ : Tanzania, Kigoma, Kasoge, 7.vi.1968, J. Kielland. Allotype ♀ : as holotype, 26.x.1967. Paratypes: 8 ♂ and 1 ♀ of same data and collector. Holotype, allotype and paratypes in the National Museum, Nairobi, further paratypes in the British Museum (Nat. Hist.), London, and J. Kielland collection. This subspecies is very common in the Kasoge forest on the western slope of Mt. Kungwe in the Mahale Mt. range (800-1600 m) and has been taken at all times of the year. On the eastern slope of the Mahale Mt. only a few specimens were collected at Lukandamira, 1600 m. Away from Mahale, no trace has so far been found of this race.

Family Lycaenidae

Recent authors tend to divide this very large group of Rhopalocera into many subfamilies; H. K. Clench (see Fox et al., 1965) even divides them into three separate families, viz., Liptenidae, Liphyridae and Lycaenidae. There are still many uncertainties and disagreements amongst specialists regarding the classification of the Lycaenidae. In the following classification I have followed Eliot (1973), who divided the family into 8 subfamilies of which 6, namely Lipteninae, Liphyrinae, Miletinae, Theclinae, Lycaeninae and Polyommatinae are represented in Africa.

Subfamily Lipteninae

Alaena aurantiaca Butler, 1883. Occurring in the Ufipa area and also taken by the Japanese Exp. at Mihumu and by the author near Mugombazi river. Very rare and local. Record: 8a, 8b, Ufipa (in Kigoma 900-1200 m; in Ufipa not specified). General distribution: Zambia.

Alaena kiellandi Carcasson, 1965. Very local, but sometimes rather common in Mpanda and Ufipa. Mainly taken in December and a second generation sometimes occurs in March. In open woodland, settling on rocks and grass. Sibweza, Sitwe, Lugala Hill, Lungerengere, Chala. Record: 3a, 6, Chala in the ravine of Mtozi river (1100-1600 m).

Alaena reticulata Butler, 1896. Montane grassland of Mt. Sitebi in Mpanda, 3 ♂ and 1 ♀ , 20.xii. 1970. Record: 5b (1950 m). General distribution: Mbeya in Tanzania and Malawi.

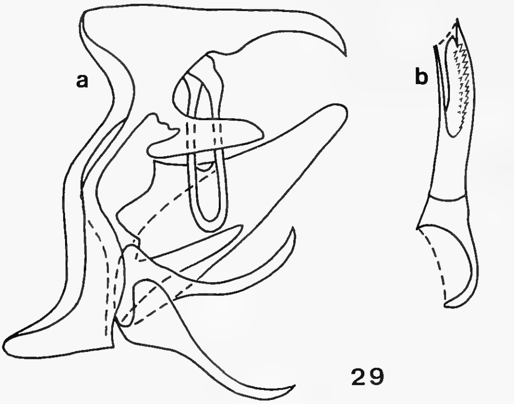
Alaena bicolora Bethune Baker, 1924. Recorded by T. H. E. Jackson. Taken by his collector Watulege in the Mpanda area. Record: no place or altitude specified.

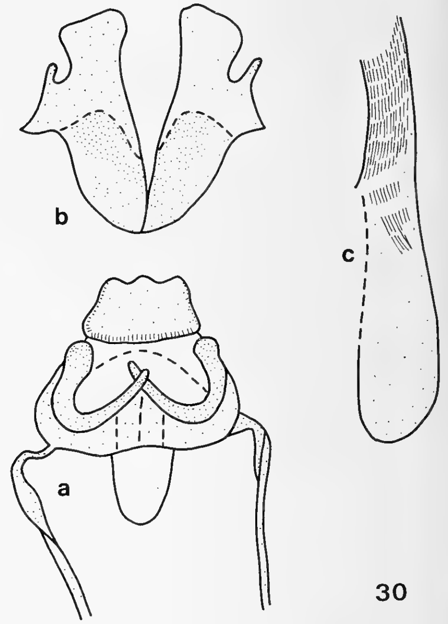
Alaena spec. Two males and one female taken flying in a rocky place on a *Brachystegia* clad hill close to Ntakatta. Record: 5a (1300 m).

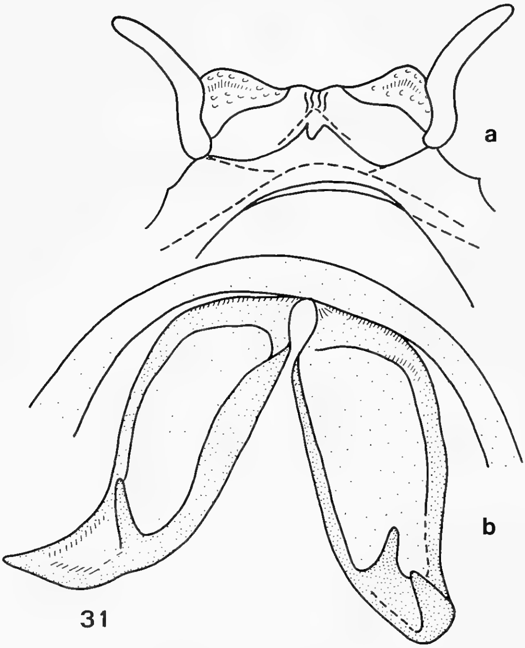
Pentila inconspicua Hamilton H. Druce, 1910. Common in forests in Kigoma. Record: 2a, 3a, 4a, 5a, 8a, 8b (1000-1500 m).

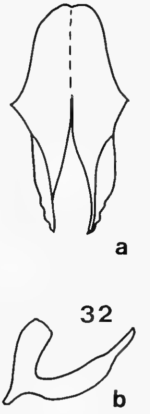
Pentila nyassana clarensis Neave, 1903. Common in heavy woodland, forest margins and clearings of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1500 m).

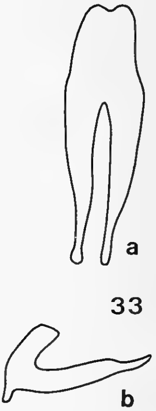
Telipna sanguinea kigoma ssp. nov. (pl. 11 figs. 43-45). Closest to the nominotypical race from W. Africa and Zaire, but larger in both sexes; wings, upperside ground colour paler; size of the subapical white patch of the fore wing intermediate between ssp. *sanguinea* and ssp. *depuncta* Talb., 1937, from Uganda. The apical black area more extended than in the other two races; inner margin of the black area irregular and sharply angled basad, along vein 2, more so than in ssp. *sanguinea*. Underside hind wing differs from the nominate race in the two long, costal transverse streaks which are situated a little further apart. In the female the streaks are

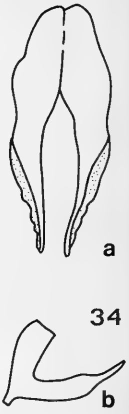












Figs. 29—34. Male genitalia of Nymphalidae and Lycaenidae. 29, *Pseudathyma plutonica expansa* ssp. n., holotype, Ntakatta forest, Mpanda, 1400 m, no. 1424; a, genitalia without aedeagus; b, aedeagus. 30, *Abisara neavei mahale* ssp. n., holotype, Kasoge, Mahale, Kigoma, no. 510; a, tegumen-uncus; b, valva; c, aedeagus. 31, *Iolaphilus montana* sp.n., paratype, Ujamba, Mahale, Kigoma, 2000 m, no. 406; a, tegumen-uncus; b, valva. 32, *Virachola diocles* Hew., Chala, Ufipa, no. 1407; a, valva; b, subunci. 33, *Virachola lorisona* Hew., Uluguru Mt., Morogoro, no. 1620; a, valva; b, subunci. 34, *Virachola ufipa* sp. n., paratype, Chala, Ufipa, no. 1408; a, valva; b, subunci.

more extended towards the tornus, only 1.5 mm from the marginal, black border area; in the females of the two other races this distance is 4 mm. Length of fore wing ♂ 25 mm, ♀ 28 mm.

Habitat. Riverine forest, particularly close to rivers, in half shade. Sitting for long periods on the vegetation and flying up only when disturbed. The flight is rather weak and reminds of the black and red Arctiid moths. Flight period from early rainy season in November till the end of the rains in early May. Record: 3a, 4a, 5a, 8a, 8b (900-1400 m).

Holotype ♂ : Tanzania, Kigoma, Lubalizi, 6.iii. 1970, J. Kielland. Allotype ♀ : Same, but 11.iii.1970. Paratypes: Same, but 7.iii.1970, 2 ♂ ; same, but March 1970, 2 ♀ ; Kefu, February 1972, 3 ♂ , 1 ♀ ; same, but January 1972, 1 ♂ ; same, but April 1972, 1 ♀; same, but January 1973, 2 ♀ ; Ntakatta, 11.vi. 1974, 1 ♀ ; Mihumu, 18. xi. 1971, 1 ♀ . Holotype, allotype and paratypes in the National Museum, Nairobi, further paratypes in the British Museum (Nat. Hist.), London, and in J. Kielland collection.

Ornipholidotos peucetia peucetia Hewitson, 1866. Local, but sometimes common in heavy woodland and forest of Mpanda and Kigoma. Record: 2a, 6, 8a (800-1200 m).

Ornipholidotos overlaeti Stempffer, 1947. Very local and scarce in riverine forests of Lubalizi, Ntakatta and Kefu. Rainy season only. Record: 3a, 5a, 8a, 8b (900-1200 m). General distribution: Kenya and Uganda to Zaire.

Mimacraea krausei obsolescens Hawker Smith, 1926. Not uncommon, but local, in riverine forests of Mpanda and Kigoma. Record: 2b, 3a, 4a, 6, 8a (900-1350 m). Ovipositing on tree-trunks five feet above the ground. This species was listed as *M. skoptoles* Ham. H. Druce by Carcasson (1966) and by Kielland (1968). According to Stempffer it should be *krausei*.

Mimacraea marshalli marshalli Trimen, 1898. Not uncommon, but local in *Brachystegia* woodland of Mpanda and Ufipa. Record: 3b, 5a, 6, 9b, Chala (1200-1700 m).

Baliochila hildegarda Kirby, 1887 (= *Teriomima aslauga* Trim. f. *hildegarda*). Not uncommon in woodland of Mpanda and Kigoma. Record: 2a, 3a, 3b, 4a, 4b, 5a, 5b, 8a, 8b (800-1500 m). Very variable and easily mistaken for other species. Reliable identification only by dissection of the genitalia. The uncus of specimens from western Tanzania differs somewhat from those of specimens from the eastern, central and southern part of the country. It possibly indicates that several races are involved.

Baliochila lipara Stempffer & Bennet, 1953. One female taken by the Japanese Exp., December 1961, at Mukuyu. Record: 8a (ca. 900 m). General distribution: Rhodesia, Zambia, Malawi, Kenya and East Tanzania.

Cnodontes vansomereni Stempffer & Bennet, 1953. In woodland and savanna of Mpanda. Not common. Record: 6 (1050-1200 m).

Toxichitona gerda Kirby, 1890. In montane forest at Mt. Sitebi in Mpanda. One specimen only, sent to Dr. Stempffer in Paris. Record: 5b (1900 m). General distribution: Uganda.

Liptena xanthostola Holland, 1890. Common in riverine forests of Kigoma and Mpanda. Record: 2a, 3a, 4a, 5a, 8a, 8b (900-1500 m). General distribution: W. Africa to Zaire and Uganda.

Liptena ideoides Dewitz, 1886. Bushland along forest margins of Kigoma and into

Mpanda at Luegele river. Not uncommon. Record: 1, 2a, 3a, 4a, 5a, 8b (900-1400 m).

Liptena ilma ugandae Stempffer, 1964. In dark places of the Kasoge forest only. Record: 1 (800-1000 m). General distribution: ssp. *ugandae*, Uganda; ssp. *ilma*, W. Africa to Zaire. The Kasoge specimens differ somewhat from ssp. *uganda*.

Larinopoda tera Hewitson, 1873. Flying locally in unergrowth of forest at Mihumu, Kefu and Mugondozi rivers. Sandstone area only. Record: 8a, 8b (800-1000 m). General distribution: W. Africa to Uganda.

Epitola miranda vidua Talbot, 1935. One female, June 1968, in riverine forest of Lubalizi; one male Kefu forest, February 1971; one male, Ntakatta forest. Record: 3a, 5a, 8b (800-1600 m). General distribution: ssp. *vidua*, Uganda to Moyen Congo; ssp. *miranda*, Ivory Coast.

Epitola pseudoconjuncta Jackson, 1962. A few specimens taken in the following forests: Lubalizi, Kasha near Kefu, Ntakatta. Early morning and sometimes late afternoon. Record: 3a, 5a, 8b (1000-1500 m).

Epitola kamengensis Jackson, 1962. January 1962 1 ♂ taken in a Lubalizi forest, other specimens observed; also males observed whirling over tops of bushes at forest margin at Kapapa. Sent to Dr. Carcasson. Record: 3a, at 4a observed, 8b (1200 m). General distribution: Uganda, W. Kenya. Early morning.

Epitola katera Jackson, 1962. One male taken February 1973 at the edge of the Kefu forest, Kigoma and observed in the Ntakatta forest, early morning. High flying species in tree tops and very difficult to catch. Record: 5a observed, 8b (900 m, 1400 m at Ntakatta). As the specimen taken differs somewhat from *katera*, it may represent a new race, or even an undescribed species.

Deloneura ochrascens littoralis Talbot, 1935 (acc. to Carcasson, pers. comm.). Not common. In woodland of Mpanda and Kigoma; Nkungwe, Simbo, Ntakatta, Mihumu, Mugombazi. Record: 5a, 6, 8a, 8b (900-1700 m).

Deloneura subfusca Hawker Smith, 1933 (= *innesi* van Son, 1949). Woodland at Simbo in Mpanda. Very rare. Record: 6 (1200 m). General distribution: Katanga and Malawi.

Hewitsonia similis ugandae Jackson, 1962. One female taken in a Mihumu forest. Record: 8a (900 m). General distribution: Ivory Coast, Gabon, Ghana, to Zaire and Uganda.

Subfamily Liphyrinae Doherty, 1889

Euliphyra species near *leucyanea* Hewitson, 1874. One female at riverine forest margin, Lubalizi (3a), 1150 m, 30.xi.1970. The specimen flew before sunrise and showed a peculiar behaviour. It soared up from the ground into the air and then fluttered down like a dead leaf. It is larger than *E. leucyanea*, ground colour upperside sooty brown with a pale area in the middle of the fore wing; colour and shape of the hind wing as in *E. leucyanea;* underside similar to that of *E. leucyanea*, but bands narrower and tending to be divided into round spots, while in *E. leucyanea* the bands are more contiguous. *E. leucyanea* occurs from Sierra Leone to Cameroun.

Aslauga vininga Hewitson, 1875. One male May 1971, several males and two females May 1972, taken in the Kefu forest. Settling on forest vegetation. Record: 8b (800-900 m). General distribution: West Africa to Uganda. The Tanzania specimens are larger than specimens from other parts of Africa.

Aslauga lamborni Bethune Baker, 1913. One female taken in the Kasekera forest at Gombe, December 1972; one female at Ntakatta. Record: 5a, Gombe (900 and 1400 m). General distribution: W. Africa to Uganda.

Aslauga purpurascens marshalli Butler, 1898. Not uncommon in woodland of Mpanda and Kigoma. One female taken in riverine forest of Lubalizi. Record: 3a, 4a, 4b, 5b, 6, 8b (1000-2000 m).

Subfamily Miletinae Corbet, 1939

Spalgis lemolea H. H. Druce, 1890. Common in heavy woodland and forest of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Biharamulo (800-1700 m).

Spalgis jacksoni Stempffer, 1967 (acc. to Stempffer). Flying along a stream in the Kasha forest north of Kefu; settling on leaves of small trees and on wet sand; January 1972 and 1973. Record: 8b (1000 m). General distribution: Bwamba forest and Mongiro in Uganda.

Lachnocnema bibulus Fabricius, 1793. Common in *Brachystegia* woodland of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, 9a, 9b, Gombe (800-1700 m).

Lachnocnema durbani Trimen, 1887. In woodland and riverine forests of Mpanda and Kigoma. Not common. Record: 1, 3a, 4a, 5a, 5b, 8a, 8b (800-1600 m).

Lachnocnema spec., probably *divergens* Gaede, 1915. A male and a female of a larger species taken at Simbo in Mpanda. Sent to Dr. Stempffer in Paris. Record: 6 (1100 m). General distribution of *L. divergens*: Uganda, Kenya, and Amani in Tanzania.

Subfamily Theclinae Swainson, 1831

Myrina silenus ficedula Trimen, 1879. Near *Ficus* trees at Sibweza and in open grassland near Mweze. Record: 1, 3a, 4a, 5a, 5b, 6, Ufipa, Gombe (800-1750 m).

Oxylides faunus albata Aurivillius, 1895. Rather common in forests of Mpanda and Kigoma. Particularly in the sandstone area. Record: 1, 2a, 4a, 5a, 5b, 8a, 8b (800-1500 m). General distribution: Zaire to Uganda.

Aphnaeus orcas Drury, 1782, ssp. near *hollandi* Butler, 1902. Flying sparingly in forests of Mpanda and Kigoma, Kasoge, Ntobo river near Mt. Sitebi, Lubalizi, Mihumu, Ntakatta. Record: 1, 3a, 5a, 5b, 8a (800-2000 m).

Aphnaeus marshalli Neave, 1910. Taken by the Japanese Exp. at Mihumu and one male at Kampisa by the writer. Extremely rare. Record: 5b, 8a (ca. 900 m). General distribution: Rhodesia to Zambia and Katanga.

Aphnaeus eriksoni kiellandi Stempffer, 1973. Mainly in open habitats of Mpanda and Kigoma and one male at Chala in Ufipa. Mt. Sitebi, Mt. Kafulungu. Also taken on *Brachystegia* clad hill at Nkungwe on flowering shrub. Not uncommon. Record: 3a, 4a, 5b, 6, Chala (1150 m at Nkungwe, 1900 m at Kafulungu and Sitebi).

Aphnaeus flavescens flavescens Stempffer, 1954. One large female taken on wet sand at Lubalizi river, September 1971. This is an extremely rare species. Record: 3a (1150 m). The specimen is larger than the types; length of forewing 23.5 mm.

Spindasis natalensis Westwood, 1852. *Brachystegia* woodland of Mpanda. Not uncommon. Record: 3b, 6 (1000-1500 m).

Spindasis nyassae Butler, 1884. Woodland of Mpanda at Nkungwe. Record: 6 (1100 m).

Spindasis victoriae Butler, 1884. Woodland of Mpanda and Kigoma. Common. Record: 3a, 4a, 5b, 6, 8a, 8b, Gombe (900-2000 m).

Spindasis apelles Oberthür, 1878. Mainly open montane habitats, but also woodland of Mpanda, Kigoma and Ufipa. Common. Record: 1, 2b, 3a, 3b, 5a, 5b, 8a, 8b, Mbuzi Mt., Chala (900-2000 m).

Spindasis nairobiensis Sharpe, 1904. Woodland of Mpanda and Kigoma. Uncommon. Record: 2b, 3a, 3b, 5b, 6, 8a, 8b (900-2000 m).

Spindasis mozambica Bertoloni, 1851. Woodland and open grassland of Mpanda. Kigoma and Ufipa. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Chala, Gombe (900-2000 m).

Spindasis trimeni Neave, 1910. Common in woodland of Mpanda, Kigoma and also taken at Muze in Ufipa. Record: 3a, 3b, 5b, 6, Muze (1000-2000 m).

Spindasis homeyeri Dewitz, 1886. Open habitats and woodland of Mpanda, Kigoma and Ufipa. Rather common. Record: 1, 3a, 3b, 5b, 4a, 8b, Ufipa highland (900-2000 m).

Spindasis ella Hewitson, 1865. Savanna and *Brachystegia* woodland of Mpanda at Nkungwe. Rare. Record: 6 (1050 m).

Spindasis brunnea Jackson, 1965. (Carcasson, personal communication). Taken in open habitat at Lubalizi river and at Sitebi Mt., 1 ♂ and 1 ♀. Record: 3a, 5b (1200 and 1700 m).

Spindasis menelas H. H. Druce, 1907. Riverine forest. One female taken on vegetation at Katuma river near Mt. Sifuta. Extremely rare; known from Nigeria. Male unknown. Record: 5b.

Spindasis crustaria Holland, 1890. Evergreen forests at Kasoge, Mihumu and Gombe. Record: 1, 8a, Gombe (800-950 m).

Lipaphnaeus loxura Rebel, 1914. Common in the Kasoge forest of Kigoma, but elsewhere scarce. Record: 1, 4a, 5a, Gombe (800-1700 m).

Lipaphnaeus aderna spindasoides Aurivillius, 1915. Forests of Mahale, Sitebi and Mbuzi Mt. in Ufipa. Local. Record: 1, 5b, Mbuzi Mt. (1600-2000 m).

Chloroselas argentea Riley, 1932. Woodland of Mpanda. Uncommon. Record: 5b, 6, 7 (1000-1500 m). General distribution: Rhodesia.

Chloroselas minima Jackson, 1965. Woodland of Mpanda. Rare. Record: 6, 7 (900-1100 m).

Chloroselas overlaeti Stempffer, 1956. Taken by T. H. E. Jackson's collector Watulege in Mpanda, by Zuzuki of the Japanese Exp. at Mihumu and by the writer near Kigoma. Very rare. Record: 8a, Mpanda, Kigoma just east of town (altitude not specified).

Chloroselas pseudozeritis tytleri Riley, 1932. This species occurs in Zambia and northern and eastern parts of Tanzania and probably also in Mpanda and Kigoma areas. Likely habitat: the Rukwa valley.

Axiocerses bambana Smith, 1900. Woodland and savanna of Mpanda, Kigoma and

Ufipa. Very common. Record: widespread (800-2000 m). Numerous specimens of *bambana* have been dissected. *A. bambana* is very variable and the genitalia also vary to some extent, but apparently not in accordance with external variation. It is therefore not probable that this name covers more than one species. Specimens examined from other parts of Tanzania, viz., Oldeani, Arusha, Singida, Morogoro, Mikumi, Ruaha and Ngara, were all *bambana*.

Axiocerses amanga Westwood, 1881. Woodland and savanna of Mpanda, Kigoma and Ufipa. Less common than *A. bambana*. Record: widespread (800-1700 m).

Aloeides conradsi angoniensis Tite & Dickson, 1973. Open habitats of Mpanda and Kigoma. Particularly at high levels, in August to September. Very rarely taken in the rainy season. Record: 2a, 3a, 3b, 5a, 5b, 6, 8a, at the ridge of Kararumpeta Mt. (1000-2000 m).

Aloeides molomo kiellandi Carcasson, 1961. Open montane grassland of Mpanda and Kigoma. Locally common. August to September only. Record: 2a, 3a, 3b, 4a, 5b (1200-2000 m).

Iolaus bolissus aurora Clench, 1964. Riverine forests and forest margins of Mpanda and Kigoma. Not uncommon. Record: 1, 3a, 4a, 5a, 5b, 8a, 8b (800-1700 m). General distribution: Uganda to Zaire, W. Africa and Angola.

Stugeta bowkeri subinfuscata Grünberg, 1910. Scarce in woodland of Mpanda and Kigoma. Record: 3a, 6, 8b (1000-1700 m).

Argiolaus crawshayi littoralis Stempffer, 1958. One female July 1970, Chala; one female May 1971, Ntondo at Mahale. Record: 1, Chala (1700 m).

Argiolaus silas silarus H. H. Druce, 1885. Woodland and forest margins of Mpanda. Record: 3b, 5a, 6 (1050-1400 m).

Iolaphilus paneperata Druce, 1890. Riverine forests of Mugondozi, Mihumu and Ntakatta. Rare. Record: 5a, 8a, 8b (1000-1400 m). General distribution: W. Africa to Zaire.

Iolaphilus trimeni Wallengren, 1875. *Brachystegia* hills at Nkungwe in the Lubalizi valley and at Mt. Sitebi. Rare. Record: 3a, 5b, 6 (1150-2000 m).

Iolaphilus ndolae Stempffer, 1958. One male of this rare species was taken in a montane forest of the Mbizi Mt., 10 miles east of Chala. The female has not yet been described. Record: Mbuzi Mt. (2000 m), August 1973. General distribution: Zambia.

Iolaphilus montana spec. nov. (text-fig. 31, pl. 11 figs. 46-49). Male. Underside body white; legs white; head black above, white below, one faint white spot on vertex top, one faint white spot just above each eye; frons black, edged with white, finely dorsad, broadening ventrad; palpi second segment very long, first and second segment white, last segment black, finely sprinkled with white near base laterally and ventrally; all segments narrowly black dorsally; antennae missing. Upperside fore wing iridescent greenish blue, black border indented, at vein 2 two mm wide, in 1b three mm, broadening apically, 1.5 mm wide at basal half of costa. Inner margin lobed just opposite sexual spot of hind wing; basal part of costa strongly convex. Upperside hind wing iridescent greenish blue, costa and margins black, 1.5 mm wide; a red, black bordered, tornal spot, a blue streak in 2, a brown androconial patch partly in subcostal area partly in cell. Underside fore wing white, an ochreous submarginal line slightly curving inwardly towards apex; margin finely bordered in black; cilia white and sprinkled with black; an ochreous sexual hair tuft in space 1b.

Underside hind wing white; a straight, ochreous line from red submarginal spot in 2 to vein 8, at 2/3 from base to apex; a wavy, black subtornal line from vein 1b to near vein 2; a tornal red and black spot and a submarginal red spot in 2; a faint dusty submarginal area, widest in 4 and 5. Length of fore wing 20 mm.

Genitalia. Uncus composed of two triangular lobes, separated by a gentle median depression; in the middle of this, two small rounded knobs; subunci robust, gently curved, bluntly tipped; vinculum broad, one to two small triangular dentations near tegumen; valva ovaloid, tapering to a blunt apical tooth; two-third from base on the ventral margin, an equally blunt, inwardly directed, strong tooth; aedeagus widely open dorsally; vesica enclosing one long, spine-like cornutus; a short, thorny protuberance apically on the right side; lower fultura very robust.

Female. Head and palpi as in the male; antennae black. Upperside fore wing dark sky-blue basally up to middle of cell and along hind margin, invading 1b; a large median, white area, invaded by blue scales, particularly along the veins; costa black; apex and outer margin broadly black.

Upperside hind wing ground colour sky-blue, darker close to base and paler distally; costa and inner half of area 6 whitish gray; apex and margin black; a large red blotch in 1b, conjoining another in 2; anal lobe carmine red; discal black spots in 1b, 2, 3, 4 and 5 in a straight line; the area between the discal spots and the black margin, whitish blue; a long, black, white bordered tail at vein 1b. The specimen is very worn along the edges and the tail at vein 3 is missing; the margin forms a tooth at vein 3.

Underside wings as in the male; the wavy, black, subtornal line extended in area 2 as a separate streak. Length of fore wing 23.5 mm.

Habitat. Frequents the margins of montane forests. Rare and local. Record: 1, 3b, 5b (1450-2200 m).

Holotype ♂ : Tanzania, Mpanda, Wanzizi Hills, 1450 m, J. Kielland. Allotype ♀ : Same, but Mt. Sitebi, 2000 m. Paratypes: Kigoma, Mahale, Ujamba, 2000 m, 1♂; Kigoma, Sisaga Mt, 2200 m, November 1971, 1♀ ; Mpanda, Kampisa, 1500 m, August 1973, 1♂ , same, but July 1972, 1♀ . All J. Kielland. Holotype and allotype in the National Museum, Nairobi, paratype ♂ in the British Museum (Nat. Hist.), London, and other paratypes in J. Kielland collection.

Philiolaus parasilanus parasilanus Rebel, 1914. Three males and one female taken on bushes in woodland close to a riverine forest at Mihumu, November 1971. Record: 8a (ca. 900 m). General distribution: W. Africa and Zaire to Uganda and Kenya.

Aphniolaus pallene Wallengren, 1857. Woodland and savanna of Mpanda and Kigoma. Not common. Record: 2b, 3a, 3b, 6, 8a, 8b (1000-1600 m).

Epamera violacea Riley, 1928. Riverine forest margins at Kampisa, Mt. Sitebi, Mt. Ipumba. Very local. Record: 5b, 8b (900-2000 m). General distribution: Angola to Zaire, Rhodesia and Malawi.

Epamera scintillans Aurivillius, 1905. Wooded hills of Nkungwe in Mpanda. Rare. Record: 6 (1150 m). General distribution: W. Africa to Uganda and Sud Bahr el Ghasal.

Epamera australis Stevenson, 1937. One female taken at forest margin of Wanzizi Hills. Record: 3b (1500 m). General distribution: Rhodesia and Zambia to Zaire.

Epamera pseudopollux Stempffer, 1962. Forest margins of Kampisa, Sitebi and

Ipumba Mts. Very local. Record: 5b (1500-2000 m). General distribution: Kigezi in Uganda.

Epamera pseudofrater Stempffer, 1962. Forests of Mihumu, Kefu, Ntakatta, Kampisa, Mahale. Rare. Record: 1, 5a, 5b, 8a, 8b (900-1600 m). General distribution: Kigezi and Kayonza forests in Uganda.

Epamera sidus Trimen, 1864. Woodland and open grassland of hills and mountains. Record: 5a, 5b, 6, 8a, 8b (900-1900 m).

Epamera alienus alienus Trimen, 1898. Two males taken on summit of Mt. Sitebi, in open short grassland with stunted and scattered vegetation, September 1970 and September 1971. Record: 5b (2050 m). General distribution: From Transvaal to Rhodesia, Zambia, Mozambique, Malawi and Songea in Tanzania; ssp. *bicaudatus* Aur., 1905, from Cameroun, Nigeria and Upper Volta; ssp. *uganda* St., 1953, from Uganda and Kenya.

Epamera aphnaeoides aphnaeoides Trimen, 1873. One female taken at Mtozi river near Chala in Ufipa. Record: Chala (1700 m).

Epamera fontainei Stempffer, 1956. One male and one female taken in the Kefu forest. February 1972. Extremely rare. Record: 8b (900-1000 m). General distribution: W. Africa to Zaire.

Etesiolaus catori cottoni Bethune Baker, 1908. Forest margin in the Lubalizi valley, 1♂, 2.viii.1970; Ntakatta forest, 1♂, February 1972. Extremely rare. Record: 3a, 5a (1150-1500 m). General distribution: Zaire to Uganda and at Usambara in Tanzania.

Hemiolaus caeculus caeculus Hopffer, 1855. Woodland of Mpanda and Kigoma. Locally common. Record: 3a, 6, 8b (1000-1200 m).

Hypolycaena hatita ugandae Sharpe, 1904. Rather common in forests of Mpanda and Kigoma. Record: 1, 2a, a, 3b, 4a, 5a, 5b, 8a, 8b, 9b, Gombe (800-1600 m, 2000 m at Mt. Sitebi).

Hypolycaena antifaunus latimacula Joicey & Talbot, 1921 (1924). Common in forests and also in heavy woodland of Mpanda and Kigoma. Record: 1, 2a, 3a, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1500 m). General distribution: W. Africa to Uganda.

Hypolycaena nigra Bethune Baker, 1914. Forests of the sandstone area. Mukuyu, Kefu, Mugondozi, Ntakatta. Record: 4a, 5a, 8a, 8b (850-1000 m). General distribution: W. Africa to Uganda.

Hypolycaena dubia Aurivillius, 1895. Several males and females taken in riverine forests at Mukuyu, Kefu, Kasoge, Ntakatta, Luntampa and Gombe. Not common. Record: 1, 4a, 5a, 8a, 8b, Gombe (800-1300 m). General distribution: W. Africa to Zaire and Uganda.

Hypolycaena liara plana Talbot, 1935. Common in forests and heavy woodland of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1600 m, 2000 m at Mt. Sitebi). Form *obscura* St., 1947, occurring at Kasoge, Kefu, Luntampa and at Gombe. This form is nearly always smaller than the typical form.

Hypolycaena auricostalis Butler, 1897. Common in woodland and open grassland of Mpanda, Kigoma and Ufipa. Particularly at higher levels. Record: 1, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Chala, Mbuzi Mt. (1050-2000 m).

Hypolycaena philippus Fabricius, 1793. Very common in open habitats and woodland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Ufipa, Gombe (800-1800 m).

Hypolycaena buxtoni buxtoni Hewitson, 1874. Common in open habitats and woodland of Mpanda, Kigoma and Ufipa. Record: 1, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Ufipa, Gombe (900-2000 m).

Hypomyrina nomenia nomenia Hewitson, 1874. Rather common in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m).

Actis mimetica mimetica Karsch, 1895 (= *perigrapha* Karsch, 1895). In riverine forests of Mpanda and Kigoma. Sitebi, Utobo river near Sitebi, Ntakatta and Lukandamira. Uncommon. Record: 1, 5a, 5b (1400-1700 m). General distribution of ssp. *mimetica*: Uganda and Kenya.

Hypocopelates otraeda otraeda Hewitson, 1863. Not uncommon in forests of Mihumu, Mukuyu to Mugombazi and a few specimens taken in the Ntakatta forest. Sandstone area only. Record: 5a, 8a, 8b (800-1100 m, 1500 m in the Ntakatta forest). General distribution: Zaire to Uganda; ssp. *modesta* Talbot, 1935, Ivory Coast to Cameroun.

Hypocopelates kafuensis Neave, 1910. *Brachystegia* woodland of Mpanda and Kigoma. Common. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b (800-1600 m, 2000 m at Mt. Sitebi).

Pilodeudorix camerona Plötz, 1880. Not uncommon in woodland and forest margins of Mpanda and Kigoma. Record: 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (900-2000 m).

Pilodeudorix diyllus orientalis Stempffer, 1957. Rather uncommon in woodland and forest margins of Mpanda and Kigoma. Record: 6, 8a, 8b (1000-1200 m). General distribution: Nominotypical race from W. Africa; ssp. *orientalis* from Katanga to Uganda.

Pilodeudorix zeloides Butler, 1901 (= *P. zela zeloides* Hewitson, 1869). Open habitats of Sitwe, Sitebi and Mahale, on stunted trees and bushes. Uncommon. Record: 1, 3a, 5b, Gombe (900-1900 m). General distribution: Rhodesia to Malawi.

Pilodeudorix caerulea caerulea H. H. Druce, 1890. Not uncommon in woodland of Mpanda and Kigoma. Record: 2a, 3a, 3b, 4a, 5a, 5b, 6, 8b (1000-1500 m, 2000 m at Mt. Sitebi).

Pilodeudorix zelomina Rebel, 1914. Three females taken December 1970 in a forest at Mt. Sitebi. Record: 5b (1900 m). General distribution: Burundi, Uganda.

Diopetes corruscans Aurivillius, 1897. Females rather common in the Kefu forest; males rarely seen. Also taken at Mugondozi river and in the Ntakatta forest. Sandstone and bordering area only. Record: 5a, 8b (900-1300 m). General distribution: Cameroun, Gabun.

Diopetes deritas Hewitson, 1874. Open habitats and forest margins of Mpanda and Kigoma. Rare. Record: 1, 3b, 5b, 8a, 8b (900-1600 m). General distribution: Zaire to Uganda.

Virachola odana H. H. Druce, 1887. Females locally common in forests of Kigoma; males very rarely seen. One male taken near Sibweza, in woodland. Record: 1, 2a, 3a, 4a, 5a, 5b, 6, 8a, 8b (800-1000 m, 2000 m at Mt. Sitebi). General distribution: Kenya and Uganda to W. Africa.

Virachola diocles Hewitson, 1869 (text-fig. 32). Rather common on *Brachystegia* hills of Mpanda and Kigoma. Also Ufipa. Record: 3a, 3b, 6, 8a, Chala (1000-1200 m, 1800 m at Chala).

Virachola lorisona Hewitson, 1862 (text-fig. 33). Rather common on wooded hills and forest margins of Mpanda and Kigoma. Record: 4a, 4b, 5a, 5b, 6, 8a, 8b (800-1900 m).

Virachola ufipa spec. nov. (text-fig. 34, pl. 12 figs. 50, 51, pl. 13 figs. 52, 53). Somewhat between *V. diocles* Hew. and *V. lorisona* Hew., with forewing red area reaching hind margin, but somewhat restricted; underside more like that of *V. diocles* than that of *V. lorisona*. The latter has much cleared markings.

Description. Antenna brown, white ringed; club brown, underside white at base; eyes hairy; frons dark brown with white lateral stripes which continue as almost a complete circle around the eyes; palpi black dorsally, white ventrally and laterally, third joint thin, as long as second joint, first joint as long as second and third combined.

Male. Tip of abdomen red; upperside fore wing black; red area hardly reaching cell and vein 3, basally not reaching base of vein 2, reaching hind margin; the outer black margin 3 mm wide at middle of area 1b, curved basad like a wedge in space 1a, leaving a 2.5 mm gap of red area, which is extended as a fine line along the margin to near tornus. Upperside hind wing red; lower part of cell black and gray, hairy; outer margin narrowly black, cilia black, a black androconial patch at base of vein 7; the tornal lobe red, bordered black, hairy; a tail at vein 1b. Underside fore wing silvery grayish, the red area of the upperside somewhat shining through; discal spots contiguous, same shade as ground colour, outlined with dark gray and white on both sides; spots in 5 and 6 a little displaced towards margin, otherwise discal spots almost a straight line; there are faint submarginal spots outlined in white; a white outlined patch at end of cell; the hair pencil is dark brown. Underside hind wing ground colour as fore wing; discal spots irregularly placed particularly those in area 2 and 3 which are placed on edge and a little towards base; the discal spots are outlined in darker gray and white; the space between the discal and submarginal spots is whitish; a narrow whitish stripe along margin, then a very fine blackish stripe; cilia pale gray with a darker median stripe; there is a red lunule with black center near margin in space 2; the lunule in 1b is red with a small blue dot distad; also a red patch in 1a proximad of the black lobe; some blue scales between the black lobe and the red patch, also a few blue scales at the tip of the lobe; a rectangularly shaped and white bordered spot at the end of cell, one spot in the cell, one basal spot in 7 and a faint spot just below the cell touching the cell spot. Length of fore wing 14.8 to 15.8 mm.

Female. Fore wing brown with median, pale area as in *lorisona;* hind wing basal part, costal fold and costa to vein 6 are brown; the rest of the wing up to distal part of the cell pale violet blue with strongly marked, dark veins; a tail at vein 2; the spot of the underside in area 2 shining faintly through; there is a brown submarginal line and a blackish marginal line; cilia on both wings white.

Underside whitish gray; fore wing discal spots very faint, almost invisible, but this may be an individual variation; there is an even, one mm wide submarginal band and an equally wide marginal line, the outer border of this is finely black; hind wing as in the male, but the lunules are yellowish, not red. Length of fore wing 17.5 mm.

Genitalia ♂: Very similar to the genitalia of *V. diocles;* valva longer and more slender as shown in the figures (text-fig. 34 vs. 32).

Habitat. Open woodland. Record: Chala in Ufipa (1800 m).

Holotype ♂ : Tanzania, Ufipa, Chala, August 1973, J. Kielland. Allotype ♀ : idem. Paratype: Same, but May 1972, 1 ♂. Holotype and allotype in the National Museum, Nairobi, paratype in J. Kielland collection.

Virachola dinochares Smith, 1877. Locally common in woodland of Mpanda, Kigoma and Ufipa. Record: 3a, 3b, 5a, 5b, 6, 7, 8a, 8b, Chala (800-1600 m, 2000 m at Mt. Sitebi).

Virachola antalus antalus Hopffer, 1855. Very common in woodland and savanna and open grassland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, 9a, 9b, Chala, Gombe (800-2200 m).

Virachola vansoni Pennington, 1948. Woodland and *Brachystegia* hills and montane grassland of Mpanda, Kigoma and Ufipa. Not uncommon. Record: 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Rungwa, Chala (900-2000 m). General distribution: described from Zululand and recorded from Malawi.

Very difficult to separate from *V. penningtoni* van Son, 1939, and *V. magdae* Gifford, 1953. Identified by Dr. H. Stempffer. This species was taken by the author also in the Singida area, N. E. of Tabora and in Ruaha Nat. Park.

Virachola penningtoni van Someren, 1939. Among specimens sent to Dr. Stempffer for determination, one female and one male appears to belong to this species. Taken in woodland and montane grassland. Record: 5b at Sitebi, Rukwa basin (900-2000 m).

Capys catharus Riley, 1932. Open habitats at Sitwe, Mahale, Luntampa and Sitebi. Not common. Record: 1, 3a, 4a, 5a, 5b (1200-1900 m). General distribution: Malawi and Katanga.

Capys disjunctus Trimen, 1895. Open grassland at Mt. Sitebi, Mahale and at Gombe. Record: 1, 5b, Gombe (1500-2300 m).

Capys connexivus Butler, 1897. Open and wooded habitats of Mpanda, Kigoma and Ufipa. Rather common. Record: 1, 3a, 5b, Kishi, Chala (1200-2000 m).

Capys brunneus Aurivillius, 1915. One male taken in woodland at Lubalizi in Kigoma, March 1971. Record: 3a (1200 m).

Subfamily Lycaeninae Leach, 1815

Lycaena abbotii Holland, 1892. Montane grassland of Ufipa. Here common. Record: Sumbawanga area, Chala, Mbuzi Mt. (1800-2100 m). *L. abbotii* is by some authors considered a race of *L. phlaeas* Linnaeus, 1761. The latter occurs at Ngara District, north of Kigoma.

Subfamily Polyommatinae Swainson, 1827

Anthene (Cupidesthes) leonina Bethune Baker, 1903. One female from the Mihumu forest, one female Kefu forest, one female Kasoge and one male from a stream-bed near Kasangatongwe N.W. of Ikola. Record: 1, 2b, 8a, 8b (800-900 m). General distribution: W. Africa to Zaire and Uganda.

Anthene (Cupidesthes) isobelae Jackson, 1965. Forests and woodland of Mpanda and Kigoma. Very rare. Sibweza and Mihumu. Record: 6, 8a (900-1100 m). General distribution: Uganda.

Anthene (Cupidesthes) irumu Stempffer, 1948. On wet sand in the Kefu forest, Kasoge forest, on bushes at Luntampa and Ntakatta. Also on wet river sand at upper Katuma. Record: 1, 4a, 5a, 5b, 8b (800-1600 m). General distribution: Central African Rep. to Zaire.

Anthene (Cupidesthes) wilsoni Talbot, 1935. A very large species. A female was taken in open vegetation near a riverine forest at Mihumu, November 1971. Record: 8a (ca. 900 m). General distribution: Ethiopia, Sudan to Kenya.

Anthene rubricinctus jeanneli Stempffer, 1961. Woodland and riverine forests of Mpanda and Kigoma. Common. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1600 m).

Anthene anadema H. H. Druce, 1890. Rather common in forests of Kigoma and Mpanda. Record: 1, 4a, 5a, 5b, 8a, 8b, Gombe (800-1600 m).

Anthene ligures Hewitson, 1874. Forests and heavy woodland of Mpanda and Kigoma. Record: 1, 3a, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1600 m).

Anthene hobleyi Neave, 1904. Montane forests on the Mahale Mt. Only place recorded, but common here. Record: 1 (1700-2200 m).

Anthene barnesi Stevenson, 1940. Forest of Mbuzi Mt. in Ufipa. Rare. Record: Mbuzi Mt. (2000 m).

Anthene definita Butler, 1899. Woodland and savanna of Mpanda, Kigoma and Ufipa. Common. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Ufipa, Gombe (800-2000 m).

Anthene indefinita Bethune Baker, 1910. Common in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1600 m).

Anthene sylvanus Drury, 1773. Forests of Mpanda and Kigoma. Not uncommon. Record: 1, 2a, 3a, 3b, 4a, 5a, 8b (800-1700 m).

Anthene alberta Bethune Baker, 1910. Common in forests of Mpanda and Kigoma. Particularly in the sandstone area. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b (800-1600 m).

Anthene schoutedeni Hulstaert, 1924. Forests of Mpanda and Kigoma. Rather common. Record: 1, 2a, 3a, 3b, 4a, 5a, 8a, 8b (900-1600 m).

Anthene lemnos Hewitson, 1878. Forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5b (800-1800 m).

Anthene princeps Butler, 1876. Woodland and savanna of Mpanda, Kigoma and Ufipa. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe, Biharamulo, Mbizi forest, Chala (800-2200 m).

Anthene liodes liodes Hewitson, 1874. Less common. In forests of Mpanda and Kigoma. Record: 1, 3a, 5a, 6, 8a, 8b (800-1300 m). Rather low altitude.

Anthene butleri livida Trimen, 1881. Two males only at Nkungwe in Mpanda. Woodland. Record: 6 (1000 m).

Anthene nigropunctata Bethune Baker, 1910. Woodland of Mpanda and Kigoma. Uncommon. Record: 3a, 4a, 5b, 6, 7, 8b, Biharamulo (800-1200 m).

Anthene otacilia Trimen, 1868. Woodland of Mpanda, Kigoma and Ufipa. Not common. Record: 1, 3a, 3b, 6, 8b, Gombe, Chala, Mbuzi Mt. (800-1500 m, 1800 m at Mt. Chala).

Anthene talboti Stempffer, 1936. Woodland of Mpanda and Kigoma. Not common. Record: 3a, 5b, 6 (1000-1600 m). Pupae taken on species of Mimosaceae.

Anthene amarah Guerin, 1847. Very common in woodland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Chala (800-1800 m).

Anthene lunulata Trimen, 1894. Common in woodland, savanna and open grassland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, 9a, Gombe, Ufipa (800-2000 m).

Anthene larydas Cramer, 1780. Very common in woodland and forests of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, 9a, 9b, Gombe (800-1700 m).

Anthene crawshayi crawshayi Butler, 1899. Common in woodland and savanna of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 5b, 6, 8a, 8b, Gombe (800-1500 m).

Anthene gemmifera Neave, 1910. Wooded hills of Mpanda and Kigoma. Very local. Record: 3a, 5a, 5b, 6, 8b (1000-1700 m).

Anthene staudingeri Smith & Kirby, 1894. A few males and one female taken at a riverbed inside the Ntakatta forest. Record: 5a (ca. 1500 m). General distribution: W. Africa to Zaire and Uganda.

Anthene phoenicis Karsch, 1893. Forests and heavy woodland of Mpanda, Kigoma and Ufipa. Not common. Record: 2a, 4a, 5a, 5b, 6, 8b, Chala (1000-1600 m). General distribution: W. Africa to Uganda and Zambia.

Anthene hades Bethune Baker, 1910. Forests and woodland of Mpanda, Kigoma and Ufipa. Common. Record: 1, 2a, 3a, 4a, 5a, 5b, 6, 8a, 8b, Gombe, Chala (800-2000 m). General distribution: W. Africa to Zaire.

Anthene lamias Hewitson, 1878. Riverine forest near Mugombazi river and at Kasoge in Kigoma, at Kampisa in Mpanda. Rare. Record: 1, 5b, 8b (800-1500 m). General distribution: W. Africa to Zaire and Uganda.

Cupidopsis cissus Godart, 1824. Most open habitats of Mpanda, Kigoma and Ufipa. Common. Record: widespread (800-2200 m).

Cupidopsis jobates Hopffer, 1855. Open habitats and woodland of Mpanda, Kigoma and Ufipa. Less common than *C. cissus*. Record: 3a, 3b, 5a, 5b, 6, 8b, Ufipa (1000-1800 m).

Pseudonacaduba sichela Wallengren, 1857. Very common in woodland and forest of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Chala, Gombe (800-2000 m).

Pseudonacaduba aethiops Mabille, 1877. One male taken on the Katuma-Mpanda road; one male at Sibweza and several males in the Kasoge and Kefu forests. Local and uncommon. Record: 1, 3a, 4a, 5a, 6, 8b (800-1400 m). General distribution: W. Africa to Uganda and Kenya.

Lampides boeticus Linnaeus, 1767. Ubiquitous. Throughout Mpanda, Kigoma and Ufipa (780-2200 m).

Uranothauma antinorii Oberthür, 1883. Common in woodland and forests of Mpanda, Kigoma and Ufipa. Particularly in the Mahale area. Record: 1, 4b, 5a, 5b, 8a, 8b, Gombe, Mbuzi Mt. (800-2000 m).

Uranothauma lunifer Rebel, 1914. Montane forest of the Mahale Mt. Male not uncommon. June to November. Record: 1 (1600-2200 m).

Uranothauma poggei Dewitz, 1879. Woodland of Mpanda and Kigoma. Common. The whole year. Record: 1, 2b, 3a, 5b, 6, 8a, 8b, Gombe (800-2000 m).

The genitalia of *U. poggei* and *U. lunifer* are identical. There is, however, no doubt that they are separate species. *U. lunifer* lives in montane forest; *U. poggei* is much more adapted to woodland and is generally found at lower levels, but it flies together with *U. lunifer* over the whole range of the latter. The external characters are constant in both species.

Uranothauma nubifer Trimen, 1895. Heavy woodland and forest of Mpanda, Kigoma and Ufipa. Mostly at higher altitudes. The whole year. Common. Record: 1, 3a, 3b, 4b, 5b, 6, Sumbawanga, Chala, Mbuzi Mt. (1200-2000 m).

Uranothauma delatorum Heron, 1909. Forests of the Mahale Mt., Mt. Sitebi and Mbuzi Mt. in Ufipa. Record: 1, 5b, Mbuzi Mt. (1600-2000 m).

Uranothauma falkensteini Dewitz, 1879. Forest of Kasoge and at Katuma river and Gombe. Very local. The whole year. Record: 1, 6, Gombe (800-1200 m).

Uranothauma titei Cottrell, [1968]. Close to *U. vansomereni* Stempffer, 1951. Very common in woodland and savanna of Mpanda, Kigoma and at Biharamulo. A female taken at high altitude on Mt. Karobwa. Elsewhere at much lower levels. The whole year. Record: 2b, 3a, 3b, 4b, 5b, 6, Biharamulo (1000-1200 m, 1700 m at Karobwa). Dr. Cottrell wrote me in 1968 that he was naming this species *U. titei*. Its publication, however, has not been confirmed.

Phlyaria cyara Hewitson, 1876. South of Kigoma only taken in the Kasoge forest; north of Kigoma common in the Kasekera forest at Gombe. Record: 1, Gombe (800-1700 m).

Phylaria heritsia intermedia Tite, 1958. Common in forest margins of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8b, Gombe (800-1700 m).

Cacyreus audeoudi Stempffer, 1936. Scarce in forests of the Mahale area, Ntakatta and Luntampa forest. Record: 1, 4a, 5a (800-1600 m).

Cacyreus virilis Aurivillius, 1924. Forests and heavy woodland of Mpanda, Kigoma and Ufipa. Common. Record: 1, 3a, 5a, 5b, 6, 9a, Mbizi forest, Chala Mt., Mbuzi Mt. (1000-2200 m).

Cacyreus lingeus Cramer, 1781. Very common in woodland and forests of Mpanda Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 7, 8a, 8b, Mbizi forest, Chala, Mbuzi Mt., Gombe (800-2000 m).

Cacyreus palemon Cramer, 1782. Forests and forest margins of Ufipa. Common. Record: Mbizi forest, Chulwe Mt., Chala, Mbuzi Mt. (2000 m).

Harpendyreus major Joicey & Talbot, 1924. Montane vegetation, forest margins and clearings of the Mahale Mt. and Ufipa highland. Locally common. Record: 1, Mbizi forest, Chulwe Mt. Chala Mt., Mbuzi Mt. (1600-2200 m).

Harpendyreus juno Butler, 1896. A few specimens taken on grassland near the Mbisi Forest, Ufipa (2200 m), February 1978.

Syntarucus pirithous Linnaeus, 1767. Very common in all habitats of Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Syntarucus jeanneli Stempffer, 1935. Very common in all habitats of Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Syntarucus babaulti Stempffer, 1935. Common in most habitats of Mpanda and Kigoma. Record: 1, 3a, 3b, 5a, 5b, 8a, 8b, Gombe (800-2000 m).

Syntarucus marginalis Aurivillius, 1925. Mpanda and Ufipa in open habitats. Very rare. Record: 6, Sumbawanga (800-2000 m).

Syntarucus brevidentatus Tite, 1958. Woodland and open habitats of Mpanda and

Kigoma. Not common. Record: 5b, 6, Gombe (1000-1500 m).

Syntarucus pulcher Murray, 1874. Marshy habitats of Mpanda. Very rare inland, but more common along marshy shores of Lake Tanganyika during the dry season. Record: 2b, 6, 7 (776-1100 m).

Castalius hintza Trimen, 1864. Scarce in woodland of Mpanda, Kigoma and Ufipa. Record: 6, 8b, Chala (1000-1800 m).

Castalius calice calice Hopffer, 1855. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-2000 m).

Castalius melaena Trimen, 1887. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: 3a, 3b, 5b, 6, Ufipa (800-1800 m).

Castalius margaritaceus Sharpe, 1891. Very common in forests of Mpanda, Kigoma and Ufipa. Both high and low level. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b (800-2200 m). The specimens from this area are rather similar to *C. carana* Hew., 1876, in external characters, but the genitalia correspond with that of *margaritaceus*. It is very common in all forests south of Kigoma and also occurs at the Ngara District, south of Bukoba.

Tarucus sybaris Hopffer, 1855. *Brachystegia* woodland and savanna of Mpanda, Kigoma and Ufipa. Not common. Record: 1, 6, Chala (800-1800 m).

Zizeeria knysna Trimen, 1862. Very common in woodland and open grassland of Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Zizina antanossa Mabille, 1877 (= *otis* Fabr., 1787). Open grassland of Mpanda, Kigoma and Ufipa. Less common. Record: 3a, Mbizi forest, in open grassland, Mbuzi Mt., Gombe (1500-2100 m).

Zizula hylax Fabricius, 1775 (= *gaika* Trim., 1862). Very common in woodland and open grassland of Mpanda, Kigoma and Ufipa. Record: widespread (800-1900 m).

Acticera lucida Trimen, 1883. Common in open habitats and woodland of Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Acticera stellata Trimen, 1883. Montane grassland of Ufipa. Record: Near Sumbawanga, Chala and Mbuzi Mt. (2000 m).

Azanus mirza Plötz, 1880. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-1900 m).

Azanus moriqua Wallengren, 1857. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-1900 m).

Azanus natalensis Trimen, 1887. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-1900 m).

Azanus jesous Guerin, 1847. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-1900 m).

Azanus ubaldus Cramer, 1782. Woodland and savanna of Mpanda. Not common. Record: 3b, 6 (1100-1600 m).

Eicochrysops mahallakoena Wallengren, 1857. Open montane grassland of Mpanda, Kigoma and Ufipa. Common only in Ufipa. Record: 3a, 5b, Sumbawanga (1700-2000 m).

Eicochrysops nandianus Bethune Baker, 1906. Montane grassland in Ufipa. Record: Sumbawanga, Mt. Chulwe (1900 m).

Eicochrysops messapus Godart, 1819. Open habitats of Mpanda, Kigoma and Ufipa. Common. Record: 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Ufipa, Gombe (900-2000 m).

Eicochrysops hippocrates Fabricius, 1793. Swampy land and riverine thickets of Mpanda and Kigoma. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m).

Lepidochrysops dollmani Bethune Baker, 1922. *Brachystegia* hills of Wanzizi. Extremely rare. November-December only. Record: 3b (1250-1400 m). General distribution: Rhodesia, Zambia.

Lepidochrysops cinerea cinerea Bethune Baker, 1922. Woodland and open grassland of Mpanda and Kigoma. Locally common. Record: 2a, 3a, 3b, 5a, 5b, 8a, 8b (1000-2000 m). The species normally occurs in *Brachystegia* woodland, 1000-1400 m, from late October to early December. In August and September specimens are found in a quite different habitat, viz., montane grassland, between 1700 and 2000 m. At this time of the year no specimens are found in the other habitat. It is, therefore, probable that specimens from the two different habitats belong to two different species. But they cannot be separated on the basis of external or genital characters. The genitalia of the Tanzania specimens differ somewhat from Kenya *cinerea*.

Lepidochrysops plebeja proclus Hulstaert, 1924. *Brachystegia* hills of Mpanda. Local, in November-December. Record: 3b, 5b, 6 (1100-1600 m).

Lepidochrysops solwezii Bethune Baker, 1922. *Brachystegia* hills of Mpanda and Kigoma. Common in November to December. Record: 2a, 3b, 4a, 5a, 5b, 6, 8a, 8b (900-1700 m).

Lepidochrysops mpanda Tite, 1961. Open montane grassland of Mweze and at Sitebi Mt. August to September. Record: 3a, 5b (1700-2000 m). Endemic to this area.

Lepidochrysops intermedia cottrelli Stempffer, 1954. Common on a *Brachystegia* hill near Ntakatta. A few specimens taken further north and at Lubalizi. November only. Record: 3a, 4a, 5a, 8b (1000 to 1400 m). General distribution: Ndola in Zambia and Malawi.

Lepidochrysops anerius kiellandi Stempffer, 1973. Woodland of Mpanda and Kigoma. Sometimes common. November only. Record: 2a, 3b, 5a, 5b, 8a, 8b (900-1400 m). General distribution: Nominotypical race described from Elisabethville in Zaire. November 1971 this species was very abundant between Ntakatta and Mugombazi river. Other years uncommon.

Lepidochrysops spec. *Brachystegia* woodland of Sibweza, Mabu, Wanzizi, Kampisa, Ngondo. October to November. Not common. Record: 3a, 3b, 5b, 6 (1000-1600 m).

Lepidochrysops spec. Three males taken in open, montane grassland on Mt. Chala, October 1971, and a series was taken at the same place in September 1973. Record: Chala Mt., observed at Mbuzi Mt. (2000 m). Flying time: (August) September to early October. Apparently a new species.

Lepidochrysops inyangae Pinhey, 1945. One male taken at Kabakaranga, November 1958; one female on a *Brachystegia* clad hill just north of Ntakatta. November only. Record: 2a, 5a (900-1400 m). General distribution: the species was only known from Inyanga in Rhodesia.

Lepidochrysops spec. Open habitats of Chala in Ufipa. Record: Chala (1700-1800 m).

Lepidochrysops gigantea Trimen, 1898. Woodland in hilly country of Mpanda and Kigoma. Rather common. October to January. Record: 2a, 3a, 3b, 5a, 5b, 6, 8b (1000-1600 m).

Lepidochrysops cupreus Neave, 1910. Montane grassland of Mpanda. Local. August to September. Record: 3a, 5a, 5b (1600-2000 m).

Euchrysops barkeri Trimen, 1893. Common in woodland and savanna of Mpanda and Kigoma. Record: 2a, 3a, 3b, 4a, 5a, 5b, 6, 7, 8a, 8b (800-1600 m).

Euchrysops dolorosa Trimen, 1887. Open habitats of Mpanda and Kigoma. Rather common. Mainly in the dry season. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6 (1000-2000 m).

Euchrysops subpallida major Bethune Baker, 1922. Open, montane grassland of Mpanda, Kigoma and Ufipa. Locally common. Record: 1, 3a, 5a, 5b, Mt. Chulwe, Mbuzi Mt. (1600-2000 m).

Euchrysops mauensis Bethune Baker, 1923 (Det. by Dr. Stempffer). Montane grassland of Kigoma, Mpanda and Ufipa. Record: 1, 3a, 5a, 5b, Mbuzi Mt. (1500-2000 m).

Euchrysops albistriatus koena Strand, 1911. On grassland with scattered shrubs and trees at Mweze highland and at Lublizi. April and August. Record: 3a (1200-1700 m). General distribution: W. Africa to Uganda.

Euchrysops malathana Boisduval, 1833. Very common in open habitats and woodland of Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Euchrysops brunneus Bethune Baker, 1922. Taken at Masaba in Kigoma in open habitats. Very rare. Record: 2a (1300 m).

Euchrysops osiris Hopffer, 1855. Very common in open and wooded habitats of Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Euchrysops spec. Small species with rather pointed fore wing and dark underside, taken in open, stunted woodland at Kampisa in Mpanda. Record: 5b (1500 m).

Euchrysops spec. Small, light gray species with tails, taken in *Brachystegia* woodland at Wanzizi. Record: 3 b (1500 m).

Thermoniphas fontainei Stempffer, 1956. Kasoge forest only. Particularly along water courses. Not common and very local. Dry season. Record: 1 (800-900 m). General distribution: Moyen Congo to Katanga in Zaire.

Oboronia punctatus Dewitz, 1879. Dense forests of Kasoge, Mihumu, Kefu, Lubalizi. Local, but rather common. Record: 1, 3a, 8a, 8b (800-900 m). General distribution: W. Africa to Uganda.

Oboronia gussfeldti Dewitz, 1879. Several specimens flying amongst vegetation along Masale River, west of Mt. Karobwa. Record: 2a (1300 m); one female taken in the riverine forest, January 1978.

Athysanota ornata vestalis Aurivillius, 1895. Forests of Kigoma and Mpanda. Record: 1, 3a, 4a, 5a, 8a, 8b, Gombe (800-1400 m). General distribution: W. Africa to Uganda.

Freyeria trochylus Freyer, 1845. Open habitats and woodland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4a, 5b, 6, 7, 8b, Ufipa (1000-2000 m).

Family Hesperiidae
Subfamily Coeliadinae

Coeliades chalybe Westwood, 1852. Occurring in some evergreen forests of Kigoma and extending into Mpanda. Mugondozi river, Kefu, Luntampa, Ntakatta and observed at lower Ujamba, Mahale. Record: 1 (observed), 3a, 4a, 5a, 8b (1000-1400 m). General distribution: W. Africa and Angola to Zaire, Uganda and N. W. Kenya.

Coeliades libeon Druce, 1875. Woodland and forest of Mpanda and Kigoma. Common. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m). All specimens collected south of the sandstone ridge are of the form *libeon*, while all the ones collected and observed north of the ridge (Kefu Forest) belong to the smaller form *brussauxi* Mabille, 1877, without a purple sheen and more distinct white tornal border on the hind wing.

Coeliades anchises Gerstaecker, 1871. Taken on flowers on and near the beach of Gombe Stream Nat. Park. Also in open woodland. Record: Gombe (800-1000 m).

Coeliades forestan forestan Cramer, 1782. Very common in most habitats of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Chala, Gombe (800-2100 m).

Coeliades pisistratus Fabricius, 1793. Forest margins at Luntampa, Kampisa, Sibweza, Wanzizi and in Ufipa. Uncommon. Record: 1, 3a, 3b, 5b, 6, Mbuzi Mt. (1000-1700 m).

Coeliades sejuncta Mabille & Vuillot, 1891. In the sandstone area and border area to the basement formations. Rather uncommon. Record: 5b, 8a, 8b (800-1500 m).

Coeliades hanno Plötz, 1879. Taken in riverine forest at Kampisa, Luntampa, Mt. Ipumba and at Gombe, where it was rather common at the time of collecting in December 1972. Record: 1, 4a, 5a, 5b, Gombe (800-1700 m).

Subfamily Pyrginae

Celaenorrhinus proxima proxima Mabille, 1877. Not common in forests of Mpanda and Kigoma. Record: 1, 3a, 3b, 4a, 5a, 8a, 8b (800-1700 m).

Celaenorrhinus homeyeri Plötz, 1880. Katuma riverine forest of Mpanda, forests of Mugombazi, Mihumu, Kefu of Kigoma. Not common. Record: 5a, 5b, 6, 8a, 8b (800-1000 m, 1700 m near Mt. Sitebi). General distribution: W. Africa to Zaire, Uganda and Rhodesia.

Celaenorrhinus galenus Fabricius, 1793. Most specimens belong to the form *galenus*. Very common in forests of Mpanda and Kigoma. Record: widespread (800-2100 m).

Celaenorrhinus bettoni Butler, 1902. Rather common in forests of Mpanda and Kigoma. Record: 1, 3a, 3b, 4a, 5a, 5b, 8a, 8b (800-1700 m).

Tagiades flesus Fabricius, 1781. Very common in woodland and forests of Mpanda, Kigoma and Ufipa. Record: widespread (800-2000 m).

Eagris lucetia Hewitson, 1876. Common in forests of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 8b, Mbuzi Mt., Gombe (800-1600 m, 2000 m at Mbuzi Mt.).

Eagris decastigma purpura Evans, 1937. Several males taken in the Kefu and Kasha forests of Kigoma. November to February. Extremely local and rare. Record: 8b (900-1000 m). General distribution: Uganda and Kenya; nominotypical race from W. Africa to Zaire.

Calleagris lacteus lacteus Mabille, 1877. Forests of Kasoge, the Mahale ridge, Kefu and Mihumu. Very rare. Record: 1, 5a, 8a, 8b (800-2200 m).

Calleagris jamesoni Sharpe, 1890; forms: *jamesoni* and *gava* Evans, 1937. Common in woodland and savanna of Mpanda and Kigoma. Record: 2a, 3a, 3b, 5a, 5b, 6 (1000-1600 m).

Calleagris hollandi Butler, 1896. Uncommon and very local in woodland of Mpanda and Kigoma. Dry season from May onwards. Record: 2a, 5b, 6, 8a (1000-1200 m). General distribution: Angola to Katanga, Zambia, Malawi and Uganda.

Eretis umbra maculifera Mabille & Bouillet, 1916. Ufipa plateau in open grassland. Common. Record: Chala Mt., Mbizi Mt. (2000 m).

Eretis lugens Rogenhofer, 1891. Common in forests of Mpanda, Kigoma and Ufipa Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe, Mbuzi Mt., Kibondo (800-2100 m).

Eretis melania Mabille, 1891. Common in woodland and forests of Mpanda, Kigoma and Ufipa. Record: 1, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Chala, Mbuzi Mt. (1000-2000 m).

Eretis mitiana Evans, 1937. Lukandamira forest at Mahale. From May to Ocotber. Record: 1 (1600 m). General distribution: W. Africa to Uganda and Kenya.

Sarangesa laelius Mabille, 1877. Common in woodland of Mpanda, Kigoma and Ufipa, Record: 1, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Chala (800-1700 m).

Sarangesa lucidella lucidella Mabille, 1891. Woodland of Mpanda at Mtikimu. Record: 6 (1100 m).

Sarangesa phidyle Walker, 1870. Mpanda area in the south. Record: Rukwa basin (800-1000 m).

Sarangesa seineri tanga Evans, 1937. Woodland of Mpanda and Kigoma. Rather common. Record: 2b, 3b, 4a, 4b, 5a, 6, Gombe (800-1500 m).

Sarangesa motozi Wallengren, 1857; forms: *motozi* and *pertusa* Mabille, 1891. Common in woodland and open habitats of Mpanda, Kigoma and Ufipa. Record: 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Rukwa basin (900-1500 m).

Sarangesa ruona Evans, 1937. In forests of Wanzizi and woodland at Sibweza. Also taken in the Rukwa basin and by Dr. Goodall at Gombe. Record: 3b, 6, Rukwa basin, Gombe (800-1500 m). General distribution: Ukerewe Island, Tanzania; Zambia and Malawi.

Sarangesa maxima Neave, 1910. Mpanda area and open habitats at Sumbawanga. Record: Mpanda, Sumbawanga (1000-1900 m). General distribution: Katanga, Zambia.

Sarangesa astrigera Butler, 1893; forms: *astrigera* and *neavei* Riley, 1921. Common in woodland of Mpanda and Kigoma. Record: 2b, 3a, 3b, 4a, 5a, 5b, 6, 7, 8a, 8b (900-1600 m).

Sarangesa haplopa Swinhoe, 1907. Woodland of Mpanda and Ufipa. Not common. Record: 3a, 4a, 6, Chala (1060-1900 m).

Sarangesa tricerata Mabille, 1891. Woodland of Mpanda and Kigoma. Uncommon. Record: 3b, 6 (1000-1500 m). General distribution: W. Africa to Zaire.

Sarangesa maculata Mabille, 1891. Common in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1600 m).

Sarangesa brigida atra Evans, 1937. Dense woodland at Sibweza. Very rare.

December 1970, January and April 1971. Record: 6 (1000 m).

Netrobalane canopus Trimen, 1864. Common in thickets and forest margins of Mpanda and Kigoma. Record: 3a, 3b, 4a, 5a, 5b, 6, 8b, 9a, Gombe (1000-1600 m).

Caprona pillaana Wallengren, 1857. Common in woodland of Mpanda, Kigoma and Ufipa. Record: 6, Chala, 8b (1000-1900 m).

Abantis tettensis Hopffer, 1855. Two males taken drinking water at Sibweza. Extremely rare. Record: 6 (1060 m). Not seen for many years.

Abantis bismarcki arctomarginata Lathy, 1901. One specimen taken at forest margin of a Lubalizi riverine forest. Record: 3a (1200 m). General distribution: ssp. *bismarcki*, W. Africa to Kenya; ssp. *arctomarginata*, Zaire to Zambia and Malawi. Note: *arctomarginata* is a subspecies of *bismarcki*, according to Berger.

Abantis zambesiaca Westwood, 1874. Woodland of Mpanda and Kigoma. Common. Record: 2b, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b (800-1900 m).

Abantis paradisea paradisea Butler, 1870. Rather common in woodland of Mpanda and Kigoma. Record: 3a, 4a, 5a, 5b, 6, 8a, 8b (800-1500 m).

Abantis venosa venosa Trimen, 1889. Common in open woodland of Mpanda and Kigoma. Record: 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m).

Spialia zebra bifida Higgins, 1925. Open grassland of Sitwe (Mweze). One record only, October 1958. Record: 3a (1700 m). General distribution: Kenya to S. Sudan; Ruaha in Tanzania.

Spialia depauperata Strand, 1911. Common in open habitats of Mpanda, Kigoma and Ufipa. Record: 3a, 3b, 5b, 6, Chala, Mbuzi Mt. (1000-2000 m). General distribution: Geita in Tanzania, Natal to Uganda.

Spialia colotes transvaaliae Trimen, 1889. Woodland of Mpanda at Sibweza only. Rare. Record: 6 (1000-1200 m).

Spialia secessus Trimen, 1891. Common in woodland of Mpanda, Kigoma and Ufipa. Record: 3a, 3b, 4b, 5b, 6, Lake Katawi, Mbizi forest, Mbuzi Mt. (1000-2200 m).

Spialia dromus Plötz, 1884. Common in woodland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Biharamulo, Gombe, Mbuzi Mt. (800-2000 m).

Spialia spio Linnaeus, 1767. Common in woodland and open habitats of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Chala (800-1700 m).

Spialia diomus ferax Wallengren, 1863. Open grassland in Ufipa. Record: Mbisi Mt. (2200 m). One female taken February 1978. Underside markings correspond with ssp. *ferax* and it is probably the first record of this race from Tanzania. General distribution: ssp. *ferax* from South Africa to Zambia, ssp. *diomus* Hopff., 1855, from Tanzania, Kenya and Uganda to Ethiopia and Yemen.

Spialia mafa higginsi Evans, 1937. Open habitats of Kigoma, Mpanda and Ufipa. Uncommon. Record: 1, 3a, 3b, 5b, Chulwe Mt., Chala Mt. (1200-2000 m).

Gomalia elma Trimen, 1862. Forests of Mpanda, Kigoma and Ufipa. Common. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8b, Chala Mt., Mbuzi Mt. (800-2200 m).

Subfamily Hesperiinae

Metisella midas midas Butler, 1893. Very common in Mpanda, and Ufipa on swampy grassland. Mainly in the wet season. Record: 3a, 3b, 4a, 4b, 5a, 5b, 6, Gombe, Mbizi forest, Chulwe Mt., Chala Mt. (900-2200 m).

Metisella orientalis Aurivillius, 1925. Common in highlands of Mpanda, Kigoma and Ufipa. Frequenting forest glades. Scarcer lower down. Mainly in the wet season. Record: 1, 2a, 2b, 3a, 4a, 5a, 5b, Mbizi forest, Mbuzi Mt., Chala Mt. (1150-2200 m).

Metisella trisignatus tanga Evans, 1937. Swampy forest glades of Mpanda and Kigoma. Locally common. Wet season. Record: 1, 3b, 5b, 6 (1000-2200 m).

Metisella kambove kambove Neave, 1910. Very common during the wet season in Mpanda and also Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, Gombe (1000-1600 m). General distribution: Zaire to Zambia.

Metisella carsoni Butler, 1898. Montane grassland of Kampisa, near Ntakatta and the Mahale ridge. Local and rare. Wet season only. Record: 1, 5a, 5b (1500-2200 m). General distribution: recorded from Fwambo in Tanzania.

Metisella formosus linda Evans, 1937. Woodland and savanna of Mpanda and Kigoma. Very common in the wet season. Record: 2a, 5b, 6, 8a, 8b (1000-1400 m).

Metisella willemi Wallengren, 1857. Common in woodland of Mpanda, Kigoma and Ufipa. Record: 1, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8b, 9b, Gombe, Chala (1000-1800 m).

Tsitana wallacei Neave, 1910. Savanna and open woodland of Mpanda and Kigoma. Rather rare and local. Record: 2b, 6, 8b, (1000-1450 m).

Isoteinon punctulata Butler, 1895. Common in the wet season in woodland and open habitats of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 4a, 6, 8b, 9a, 9b, Gombe (1000-1700 m).

Ampittia capenas blanda Evans, 1946. Very common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-1600 m).

Kedestes mohozutza Wallengren, 1857. One male taken at riverside in Mbisi Forest, Ufipa (2200 m), February 1978.

Kedestes wallengrenii wallengrenii Trimen, 1883. Common in woodland and open habitats of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8b, Gombe, Chala, Mbuzi Mt. (1000-2200 m).

Kedestes paola paola Plötz, 1884. Two males taken settling on bare ground near a riverine forest at Mt. Sitebi. Open grassland. July 1972. Record: 5b (1750 m). General distribution: Angola and Zaire to Zambia; ssp. *protensa* Butler, 1901, W. Africa to S. Sudan, Uganda, and East Tanzania.

Gorgyra aretina Hewitson, 1878. Forests of Kigoma from Lubalizi to Mihumu. Rather common. Record: 1, 3a, 4a, 5a, 8a, 8b, Gombe (800-1300 m, 1700 m at Ntondo). General distribution: W. Africa to Uganda and Kenya.

Gorgyra mocquerysii Holland, 1896. Taken in the Kasoge forest, Mkulya riverine forest, Kefu, Mukuyu and Ntakatta forests and at riverine forest of Kampisa. Rather rare. Record: 1, 3a, 5a, 5b, 8a, 8b (800-1500 m). General distribution: W. Africa and Angola to Uganda.

Gorgyra diva Evans, 1937. Woodland at Sibweza in Mpanda. Rare. Record: 5a, 6, 8b, Gombe (800-1500 m).

Gorgyra subfacatus Mabille, 1889. Not uncommon in forests of Mpanda and Kigoma at Gombe, Kefu and Ntakatta. Record: 5a, 8b, Gombe (900-1400 m). General distribution: Usambara in Tanzania and W. Africa.

Gorgyra minima Holland, 1898. Woodland of Mpanda at Sibweza and Kapanda. Rare. Record: 6 (ca. 1100 m). General distribution: W. Africa to Uganda and Kenya.

Gorgyra johnstoni Butler, 1893. Common in woodland and riverine forest of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b (800-1700 m).

Gorgyra bibulus Riley, 1929. Forests and forest margins of Mpanda and Kigoma. Local. Record: 1, 3a, 5a, 5b (1500-2000 m). General distribution: W. Africa to Uganda and Kenya.

Gorgyra kalinzu Evans, 1946. Forests of Kigoma and at Ntakatta and Mt. Sitebi in Mpanda. Uncommon and very local. Record: 5a, 5b, 8a, 8b (900-1900 m). General distribution: Uganda and Kasai in Zaire.

Note: According to De Jong (pers. comm.) the Tanzania specimens differ considerably from the Uganda specimens and belong either to a new race or a new species.

Teniorhinus ignita Mabille, 1877. Open woodland and forests of Kigoma and Mpanda. Not common except in certain forests of the sandstone formations as at Mugondozi and Kasha forest. Record: 2a, 6, 8a, 8b (800-1100 m). General distribution: W. Africa to Uganda and Zambia.

Teniorhinus harona Westwood, 1881. Common in *Brachystegia* woodland of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m).

Teniorhinus herilus Hopffer, 1855. One record from Ugala Hills near Sibweza, a few from the Rukwa valley and from Kasoge. Rare. Record: 1, 6, Kipenzi at the foot of Ufipa escarpment (800-1250 m).

Pardaleodes incerta incerta Snellen, 1872. Common in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1600 m).

Pardaleodes sator Westwood, 1852; form *pusiella* Mabille, 1877. The Kasoge forest only. Not uncommon. Record: 1 (800 m). General distribution: W. Africa to Uganda and Kenya.

Pardaleodes bule Holland, 1896. Kasoge forest and Gombe Stream only. Rather common at Kasoge. Record: 1, Gombe (800 m). General distribution: W. Africa to Zaire, Uganda and Kenya. In Tanzania at Dodoma.

Xanthodisca vibius vibius Hewitson, 1878. Not uncommon in forests of Kigoma from Lubalizi to Mihumu and at Ntondo near Mahale. Record: 1, 3a, 4a, 5a, 8a, 8b (900-1700 m).

Acada biseriatus Mabille, 1898. Very common in *Brachystegia* woodland of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b (800-1700 m).

Osmodes thora Plötz, 1884. Kasoge forest and at Gombe only. Not uncommon at Kasoge. Record: 1, Gombe (800-900 m). General distribution: W. Africa to Zaire, Uganda and Kenya.

Parosmodes morantii Trimen, 1873. Common in *Brachystegia* woodland and savanna of Mpanda and Kigoma. Record: 2a, 3a, 3b, 4a,4b, 5a, 5b, 6, Gombe (800-1500 m).

Acleros placidus Plötz, 1879. Kasoge forest and at Gombe only. Record: 1, Gombe

(800-1300 m). General distribution: W. Africa to Zaire, S. Sudan, Uganda and Kenya.

Acleros ploetzi Mabille, 1879. Common in forests and forest margins of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 8a, 8b, Gombe (800-1600 m).

Acleros neavei Evans, 1937. In the Kasoge forest and forests of the sandstone area. Record: 1, 5a, 8a, 8b (800-1400 m). General distribution: Uganda and Zaire.

Acleros mackenii Trimen, 1868. Very common in woodland and forest margins of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Mbuzi Mt. (800-2000 m).

Acleros spec. Riverine forests of Mpanda and Kigoma. Rather common. Record: 1, 3a, 3b, 4a, 5a, 5b (1100-1500 m). Also known from Katanga by R. H. Carcasson (pers. comm.).

Acleros substrigatus Evans, 1946. Riverine forest of Mweze highland. One record only: 1 ♀, October 1958. Record: 3a (1700 m).

Semalea pulvina Plötz, 1879. Common in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 8a, 8b (800-2000 m).

Semalea sextilis Plötz, 1886. Forests of Mpanda at Wanzizi. Very rare. Record: 3b (1500 m). General distribution: W. Africa to Zaire and Uganda.

Semalea arela Mabille, 1891. Rather common in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 4a, 4b, 5a, 5b, 8a, 8b (800-2000 m).

Hypoleucis tripunctata draga Evans, 1937. Forests of Kasoge, Luntampa and Ntakatta. Uncommon. Record: 1, 4a, 5a (800-1300 m). General distribution: Zaire to Uganda and Kenya; ssp. *tripunctata* in W. Africa.

Hypoleucis ophiusa ophir Evans, 1937. Forests of Kigoma and Mpanda in the northwest: Kasoge, Luntampa, Kefu, Mugondozi, Ntakatta, Mihumu. Not common. Record: 1, 4a, 5a, 8a, 8b (800-1600 m). General distribution: Uganda; ssp. *ophiusa* in W. Africa.

Meza larea Neave, 1910. *Brachystegia* woodland of Mpanda, Kigoma and Ufipa. Not uncommon. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8b, Chala (1000-1700 m). General distribution: Zaire, Zambia and Malawi.

Meza mabea Holland, 1894. Two males taken in the Kefu forest; several males at Lubalizi and in the Ntakatta forest. Very rare and local. Record: 3a, 5a, 8b (900-1500 m). General distribution: W. Africa to Cameroun. This is probably the first record from eastern Africa.

Meza cybeutes pallida Holland, 1894. Forest margins at Lubalizi, Luntampa, Kampisa and Ntakatta. Local and rare. Record: 3a, 4a, 5a, 5b (1200-1500 m). General distribution: Angola and Zaire to Uganda; ssp. *cybeutes* occurs from W. Africa to Zaire.

Andronymus neander neander Plötz, 1884. Common in heavy woodland and forest margins of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 7, 8a, 8b, Gombe (800-1600 m).

Andronymus caesar philander Hopffer, 1855. Very common in heavy woodland and forest margins of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1500 m).

Andronymus hero Evans, 1937. In riverine forests around Helembe, Mugondozi, Zanza, Mihumu, Ntakatta, Lubalizi. Local and uncommon. Record: 3a, 5a, 8a, 8b (900-1400 m). General distribution: W. Africa to Angola and Zaire. Probably first record from east Africa.

Andronymus helles Evans, 1937. From Kefu forest to Ntakatta. Very local and uncommon. Record: 5a, 8b (900-1400 m). General distribution: W. Africa to Zaire and Malawi.

Andronymus marina Evans, 1937. Taken in the Ntakatta forest, Kefu and at Mihumu. Very local and rare (900-1600 m). General distribution: Toro and Mabira forests in Uganda.

Andronymus fenestrella Bethune Baker, 1908. In dense thickets of riverine forests of Mpanda and Kigoma. Not uncommon. Record: 2a, 3a, 3b, 4a, 5a, 5b, 8a, 8b (900-1700 m). General distribution: W. Africa to Zaire, Uganda and Malawi.

Chondrolepis niveicornis Plötz, 1883. Common in woodland and forests of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8b, Mbuzi Mt. (800-2200 m). Specimens from western Tanzania are considerably larger than specimens from Kilimanjaro, Arusha, Oldeani and east Tanzania. Genitalia identical.

Chondrolepis leggei Heron, 1909. A single male taken in the Lukandamira forest, foot of Mahale. Record: 1 (1600 m). General distribution: Zaire to Uganda and Kenya.

Zophopetes dysmephila Trimen, 1868. Near riverine forest at Kampisa. Flying at dusk, after sundown. Males seen whirling in very rapid flight above a young, wild date palm; females visiting flowers on herbs. April, July and September. Record: 5b (1500 m). General distribution: S. Africa and Mozambique to Malawi, Uganda and Senegal.

Zophopetes cerymica nobilior Holland, 1896. One male taken on flowering tree, early morning at Gombe. Lush lake-shore vegetation. Record: Gombe (800 m). General distribution: S. Africa, W. Africa, Mozambique, Malawi and Uganda.

Gamia shelleyi Sharpe, 1890. In the half-shade of thick forest at Luntampa, Lubalizi, Ntakatta and lower Ujamba at foot of Mahale Mt. Rare. Record: 1, 2a, 3a, 4a, 5a (1200-1300 m).

Artitropa reducta Aurivillius, 1925. Kasoge forest and Kefu forest. Very rare. Record: 1, 8b (800-900 m). General distribution: Cameroun to Zaire, Kenya, Uganda and Malawi. According to Berger *reducta* is a true species.

Artitropa cama Evans, 1937. Taken on bushes at a forest river in the Kefu forest. One female March 1971; one male April 1972. Extremely rare and local. Record: 8b (900 m). General distribution: Cameroun. Probably first record from East Africa.

Artitropa milleri milleri Riley, 1925. Taken June 1971 and 1972 at upper reaches of Katuma river, between Mts. Sifuta and Sitebi; at Ntakatta February 1972. On flowers in forest. Record: 5a, 5b (1400-1600 m).

Gretna carmen capra Evans, 1937. Rare in the Kefu and Kasoge forests. North of Kigoma, at Gombe, it seems more common. Habit of settling on the bark of bare tree trunks, where it blends perfectly. Record: 1, 4a, 5b, 8b, Gombe (800-900 m). General distribution: the coast of Kenya and Tanzania.

Caenides leonora Plötz, 1879. A single male taken in the Kasoge forest, February 1971, very early in the morning. Record: 1 (800 m). General distribution: W. Africa to Zaire and Uganda; ssp. *dux* Evans, 1937, from Zaire and Malawi.

Caenides stoehri halma Evans, 1937. One specimen came to light at about 9 p.m.

in a forest at Luntampa. Also taken at Lubalizi and Ntakatta in dense forest, in daytime. April, September and November. Record: 3a, 4a, 5a (1200-1300 m). General distribution: Uganda, Kenya and at Mpala west of Lake Tanganyika; nominotypical race in W. Africa and Zaire.

Caenides dacela Hewitson, 1876. Forests of Kigoma and Mpanda. Not common. Record: 1, 4a, 5a, 8a, 8b (800-1300 m). General distribution: W. Africa to Zaire and Uganda.

Caenides hidarioides Aurivillius, 1896. Mukuyu forest in Kigoma and in the Ntakatta forest in shady places. Rare. Record: 5a, 8a (800-1500 m). General distribution: Sierra Leone and Ghana to Zaire. This is probably the first record from East Africa.

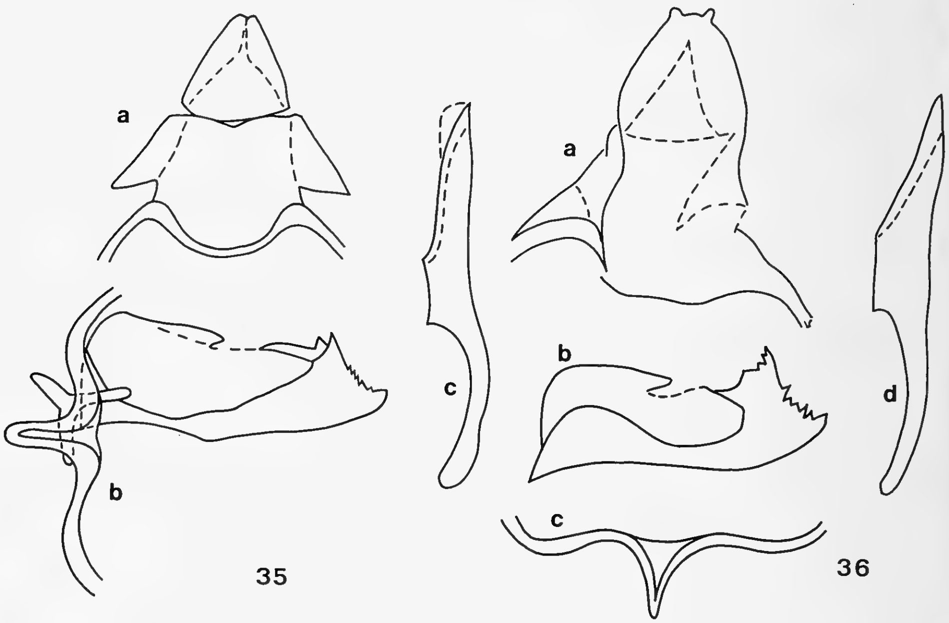
Monza alberti Holland, 1896. Forests of Mpanda and Kigoma. Record: 1, 3b, 5b (800-1500 m).

Monza cretacea crola Evans, 1937. Common in forests and heavy woodland of Mpanda and Kigoma. Record: 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m).

Monza punctata Aurivillius, 1910. Forests of Mpanda and Kigoma. Record: 1, 5b (1500-1700 m).

Fresna netopha Hewitson, 1878. Forest margins and forests of Mpanda and Kigoma. Not uncommon. Record: 1, 3a, 5a, 5b, 8b, Kibondo, Gombe (900-1500 m). General distribution: W. Africa to Uganda and Kenya.

Fresna nyassae nyassae Hewitson, 1878; forms: *nyassae, ennuari* Riley, 1921, and *plata* Evans, 1937. Common in woodland of Mpanda and Kigoma. Record: 2a, 3a, 3b,



Figs. 35—36, Male genitalia of *Platylesches* species. 35, *P. ayresii* Trim., Katuma river, Mpanda, 1600 m, no. 1090; a, tegumen-uncus; b, valva and saccus; c, aedeagus, 36. *P. langa* stat. n., Katuma river, Mpanda, 1600 m, no. 1099; a, tegumen-uncus; b, valva; c, saccus; d, aedeagus.

4a, 4b, 5a, 5b, 6, 8b, Gombe by Goodall (800-1500 m).

Fresna cojo Karsch, 1893. Two males taken in the Kefu forest February and April; several males and a female taken at Lubalizi riverine forest on bean flowers and in the Ntakatta forest, January 1974. Also August to September. A rare species. Record: 3a, 5a, 5b, 8b (900-1500 m). General distribution: Sierra Leone to Nigeria and recorded from Kenya. A typical forest species.

Platylesches galesa Hewitson, 1877. Common in woodland and forests of Mpanda and Kigoma. Record: 1, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8b (800-1600 m).

Platylesches ayresii ayresii Trimen, 1889 (text-fig. 35). Sixteen males taken on wet sand at upper Katuma river near Kampisa, June 1971 and June 1972. Record: 5b (1600 m). This species, which Evans thought to be conspecific with his *P. ayresii langa*, does in fact fly together with *langa* in the recorded area. By dissecting the genitalia of both species, it was found that the uncus in *ayresii* was much narrower distally than in *langa* and that in dorsal view the two distal protuberances were much closer together; the valva with bipectinate dorso-distal process and less serrated distad (figs. 35 and 36); the saccus is more sharply tapering in *langa*. In *langa* the underside of the hind wing is only partly striated and the rest evenly sprinkled with white. General distribution: According to Evans (1937) Mozambique to South Africa.

Platylesches langa stat. nov. (*Platylesches ayresii langa* Evans, 1937) (text-fig. 36). Common in woodland and forests of Mpanda, Kigoma and Ufipa. Record: 3a, 4a, 4b, 5b, 6, Chulwe Mt., Mbuzi Mt. (1000-2000 m).

Platylesches robustus Neave, 1910. Forests and woodland of Mpanda, Sibweza, Wanzizi, Kampisa, Lubalizi, Katuma. Locally common, particularly at Katuma. Record: 3a, 3b, 5b, 6 (1060-1600 m). General distribution: S. Africa to Zaire, Zambia and Malawi. One record from Geita in Tanzania and from Ngara.

Platylesches shona Evans, 1937. Forest at Kampisa in Mpanda. Very rare. Record: 5b (1500 m). General distribution: Zaire to Rhodesia and Zambia.

Platylesches moritili Wallengren, 1857. Rather common in woodland and riverine forests of Mpanda and Kigoma. Record: 1, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe, Kibondo (800-1700 m).

Platylesches fosta Evans, 1937. Taken at Kampisa, Ujamba at Mahale, Sitwe, Ufipa. Highland forest margins. Uncommon. Record: 1, 3a, 5b, Mbuzi Mt. (1500-2000 m). General distribution: known from Toro and Mpanga forests in Uganda.

Platylesches picanini Holland, 1894. Forests of Mpanda and Kigoma. Rather common. Record: 1, 3a, 3b, 4a, 5a, 5b, 6, 8b, Gombe (800-1500 m, 2000 m at Mt. Sitebi).

Platylesches rasta anka Evans, 1937. Montane forests of Mpanda, Kigoma and Ufipa. Not uncommon. Record: 1, 5a, 5b, Mbizi forest, Mbuzi Mt. (1600-2100 m). General distribution: Nominotypical race from Malawi and east Tanzania as at Usambara and Mulundwe hill in Mikumi Nat. Park; ssp. *anka* described from W. Ankole and Mpanga forest in Uganda.

Platylesches affinissima Strand, 1920. A small species closely resembling *affinissima*, taken west of Mt. Karobwa, in the Kefu forest, at Mugombazi river, Ntakatta, Kampisa and Lukandamira. Everywhere very rare. Record: 1, 2a, 5a, 5b, 8b (900-1700 m). General distribution: Sierra Leone, Gambia, Central African Republic and Malawi. This species has always been taken in forests.

Platylesches tina Evans, 1937. Thirteen males taken on wet sand, in riverine forest along the upper reaches of the Katuma river near Kampisa, July 1972. Record: 5b (1600 m). General distribution: Malawi.

Brusa saxicola Neave, 1910. Woodland of Mpanda and Kigoma. Rather common in the rainy season. Record: 1, 2a, 2b, 3a, 3b, 5a, 6, 8b, 9b (900-1700 m).

Brusa allardi Berger, 1967. Open rocky country of the Sitebi Mt. and near Mbizi and at Chala Mts. Common in the dry season, but very local. According to Berger also from Yampehu (Ugaraba) in Kigoma. All the specimens examined by the writer from the Yampehu area were *saxicola;* also the habitat in that area differs considerably (*Brachystegia* woodland) from the typical habitat of *allardi* (montane grassland with rocky outcrops). Record: (2a), 5b, Chala Mt., Mbizi Mt. (1800-2100 m, Yampehu 1200 m). Always settling on rocks or bare ground. September 1970, 50 specimens were collected at Mt. Sitebi, all on rocks, one specimen observed at Mbizi Mt. on rocks; several specimens taken on Mt. Chala on rocks. The flight is rapid, but short and the insect difficult to detect. When settling, it seems to disappear due to its cryptic markings and colour blending with the rocks.

Zenonia zeno Trimen, 1864. Very common in most habitats of Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Zenonia anax Evans, 1937. Woodland and forest margins of Mpanda and Kigoma. Less common, but sometimes abundant at Mt. Sitebi. Record: 2a, 3a, 3b, 4a, 5a, 5b, 6 (1000-2000 m). General distribution: Katanga to Malawi.

Pelopidas mathias Fabricius, 1798. Common in woodland of Mpanda, Kigoma and Ufipa. Record: 1, 3a, 3b, 6, 8b, Gombe, Chala (1000-2000 m).

Pelopidas thrax inconspicua Bertolini, 1850. Common in woodland of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 5a, 5b, 6, 7, 8b, Gombe (800-1500 m).

Borbo lugens Hopffer, 1855. Common in forests of Mpanda and Kigoma. Record: 1, 2a, 3a, 4a, 5a, 8a, 8b, Gombe (800-2000 m).

Borbo fatuellus Hopffer, 1855. One of the commonest skippers in Mpanda and Kigoma. In most habitats, but particularly woodland. Record: widespread (800-2000 m).

Borbo fallax Gaede, 1916. Woodland of Mpanda and Kigoma. Less common. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 6, 8b, Gombe (800-1700 m).

Borbo fanta Evans, 1937. Common in woodland of Mpanda and Kigoma. Also open habitats at Mahale. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 6, 8b, Gombe (800-2000 m). General distribution: W. Africa to Zaire.

Borbo sirena Evans, 1937. Woodland of Mpanda and Kigoma, Sibweza and Ujombe. Rare. Record: 2b, 6 (1000-1200 m). General distribution: Zaire to Uganda, Kenya and Zambia.

Borbo perobscura Hamilton Druce, 1912. Forests and forest margins of Mpanda, Kigoma and Ufipa. Rather common. Record: 2a, 3a, 4a, 5a, 6, 8a, Muze (800-1500 m).

Borbo detecta Trimen, 1893. Common in woodland of Mpanda and Kigoma. Record: 2a, 3a, 3b, 4a, 5a, 5b, 6, 8b, Gombe (1000-1600 m).

Borbo micans Holland, 1898. Riverine forests and marshy habitats of Mpanda and Kigoma. Record: 1, 2a, 3a, 3b, 4a, 4b, 5a, 5b, 6, 8a, 8b, Gombe (800-1700 m).

Borbo borbonica borbonica Boisduval, 1833. Common in woodland and open habitats of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8b, Mbuzi

Mt., Gombe (800-2200 m).

Borbo gemella Mabille, 1884. Common in woodland of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, Chala (800-1800 m).

Borbo holtzii Plötz, 1883. Very common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: widespread (800-2200 m).

Borbo kaka Evans, 1946. A few specimens taken in the Kefu forest, Kasoge, Luntampa, Ntakatta and at Lukandamira. Record: 1, 4a, 5a, 8b (900-1700 m). General distribution: Katera and Kayonza forests in Uganda; Kakamega forest in Kenya.

Parnara naso monasi Trimen, 1889. Very common in forests and woodland of Mpanda and Kigoma. Record: 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 8b, Gombe (800-1500 m).

Gegenes pumilio gambica Mabille, 1878. Common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 5b, 6, 8b, Ufipa (800-2000 m).

Gegenes niso brevicornis Plötz, 1884. Very common in woodland and savanna of Mpanda, Kigoma and Ufipa. Record: 1, 2a, 2b, 3a, 3b, 4a, 5a, 5b, 6, 7, 8b, Chala, Gombe (800-1700 m).

Gegenes hottentota hottentota Latreille, 1823. In woodland and savanna at Sibweza and Chala. Uncommon. Record: 6, 7, Chala (1060-1800 m).

SPECIES ERRONEOUSLY RECORDED FROM WESTERN TANZANIA

Liptena homeyeri Dewitz, 1884. Recorded by Stempffer, Bennet & May (1974) from "Tanzania, Mpala". This locality is in Zaire, north-west of Lake Tanganyika.

Aphnaeus brahami Lathy, 1903. Recorded by Stempffer (1954) from "Tanganyika, Mpala", which is in Zaire, north-west of Lake Tanganyika.

SPECIES AND SUBSPECIES DESCRIBED FROM THE STUDY AREA OR ITS VICINITY

Carcasson (1966), in his account of the Japanese collection from the Kigoma area, mentions 19 species and subspecies described from this area and its vicinity. Since then the following taxa have been described (an asterisk indicates that the taxon is described in the present paper):

**Graphium almansor wranghami* Kielland, 1978
**G. porthaon tanganyikae* Kielland, 1978
Charaxes cynthia mukuyu van Someren, 1969
C. lucretius maxima van Someren, 1971
C. ansorgei kungwensis van Someren, 1967
**C. ansorgei ufipa* Kielland, 1978
C. jahlusa kigomana van Someren, 1971
C. numenes aequatorialis van Someren, 1972
C. imperialis ugandicus van Someren, 1972
C. bipunctatus ugandensis van Someren, 1972
C. chepalungu van Someren, 1969
C. grahamei van Someren, 1969
Palla publius kigoma van Someren, 1969
**Pseudathyma plutonica expansa* Kielland, 1978

Neptis ochracea reducta Kielland, 1978
Belenois raffrayi similis Kielland, 1978
Acraea ntebiae kigoma Kielland,1978
Abisara neavei mahale Kielland, 1978
Virachola ufipa Kielland, 1978
Iolaphilus montana Kielland, 1978
Aphnaeus erikssoni kiellandi Stempffer, 1973
Lepidochrysops anerius kiellandi Stempffer, 1973
L. intermedia cottrelli Stempffer, 1954
Telipna sanguinea kigoma Kielland, 1978

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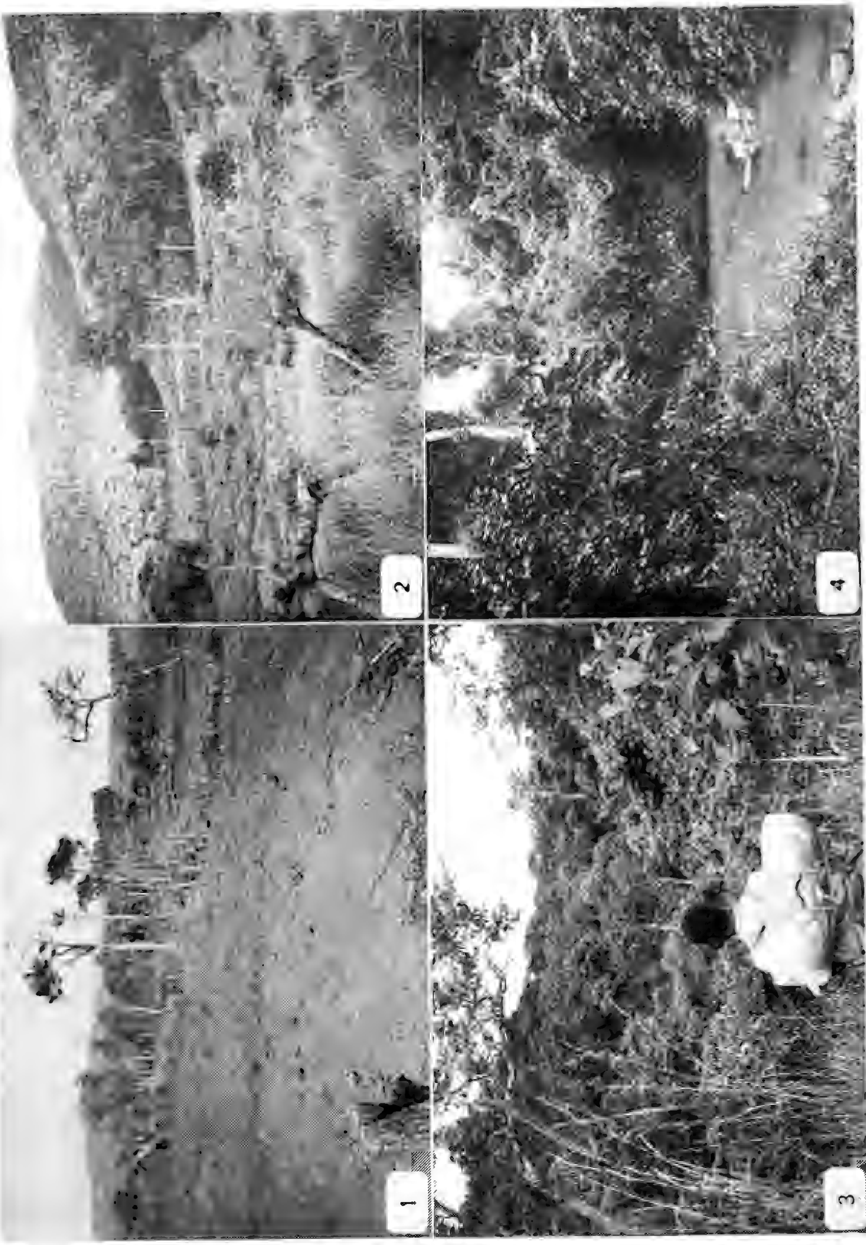

Plate 1.-Fig. 1. West of Mt. Karobwa; destruction of virgin forest in favour of agriculture. Fig. 2. Mukuyu; evergreen forest cleared for agriculture, then abandoned after a couple of years. Fig. 3 Fefu forest, seen from woodland ridge. Fig. 4. Kefu forest (Helembe); river with thick, tangled vegetation

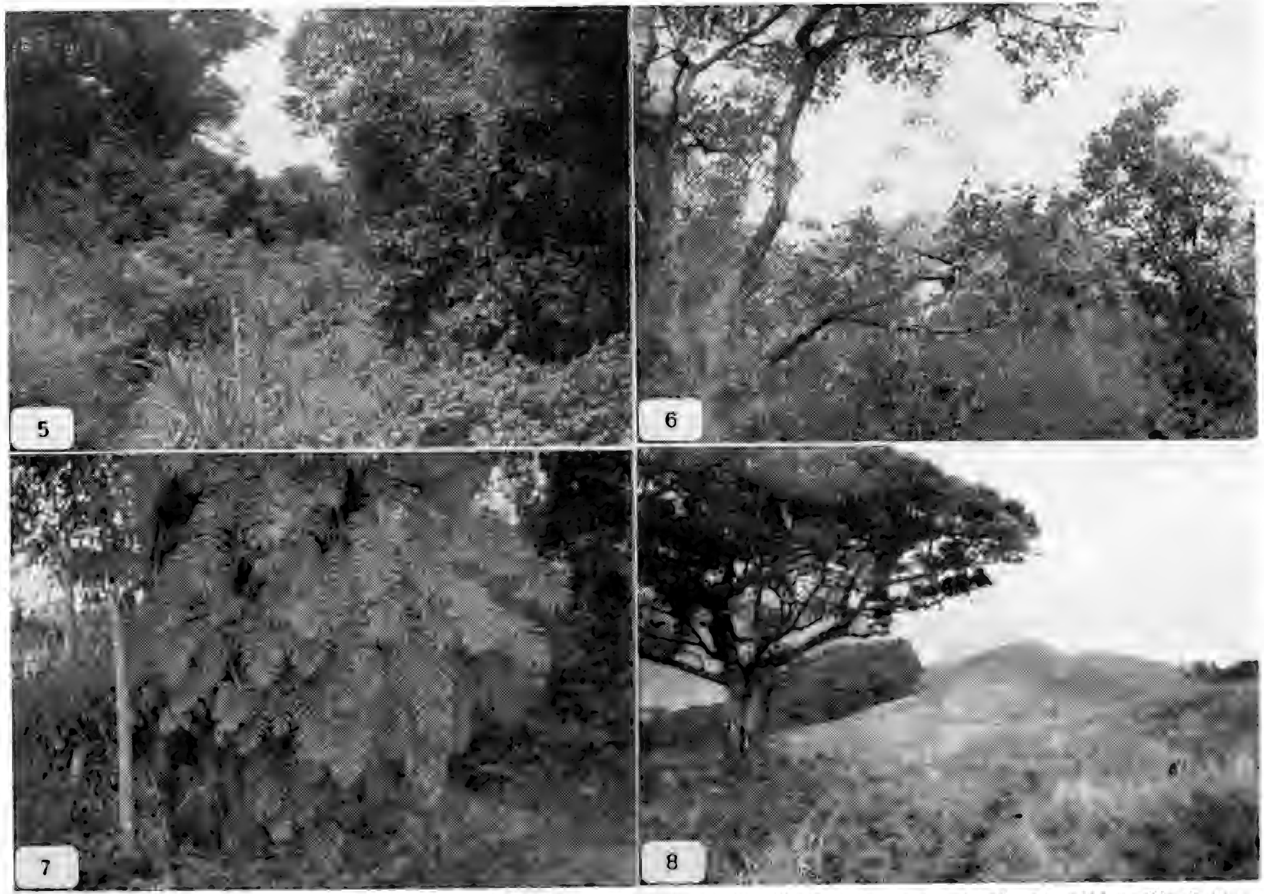

Plate 2, Fig. 5. Kampisa: riverine forest, 1500 m, glade. Fig. 6. Kampisa valley; thin bamboo in reverine forest, 1500 m. Fig. 7. Mt. Sitebi; montane forest, 1900 m. Fig. 8. Mt. Mahale; montane grassland and forest at 2000 m, scattered forest trees surviving in the open area.

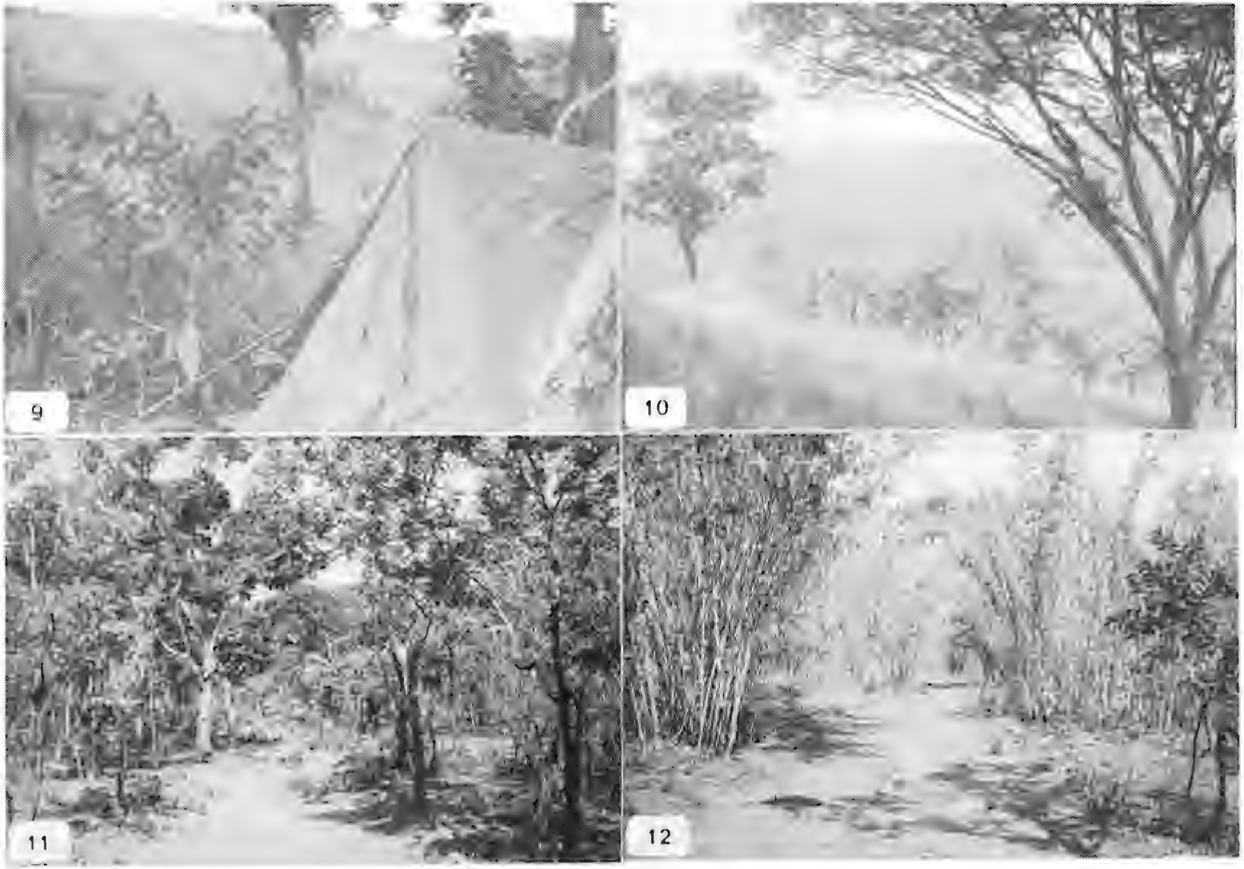

Plate 3. Fig. 9. Kampisa camp; beyond montane grassland towards Mt. Sitebi. Fig. 10. Kampisa valley; seen from hill clothed with *Brachystegia*, beyond Mt. Sifuta. Fig. 11. Simbo; open woodland at 1000 m. Fig. 12. Utinta valley; bamboo with woodland at 1200 m.

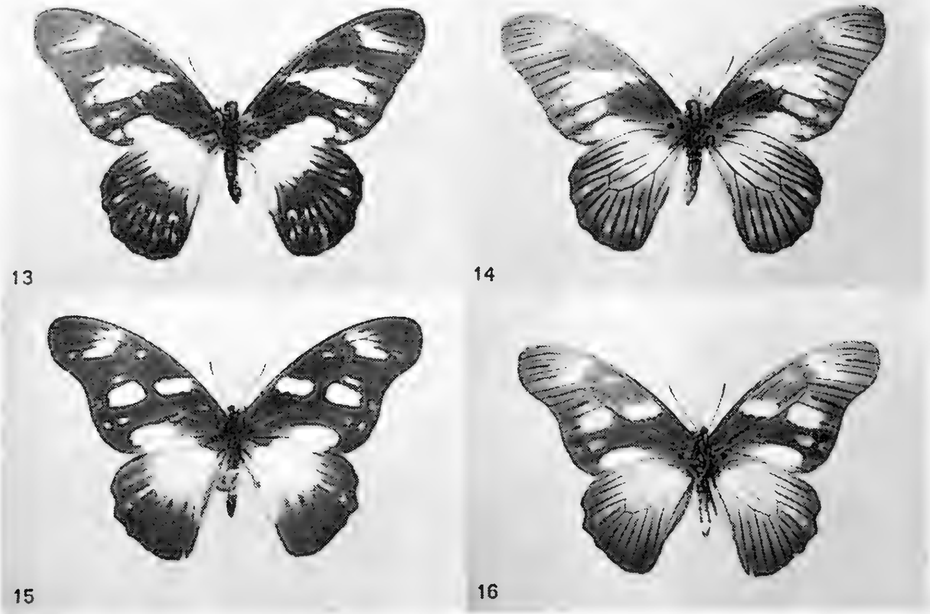

Plate 4. Figs. 13—16. *Graphium almansor kigoma* Carcasson, male, upper- and underside. 13—14, wet season form; 15—16, dry season form.

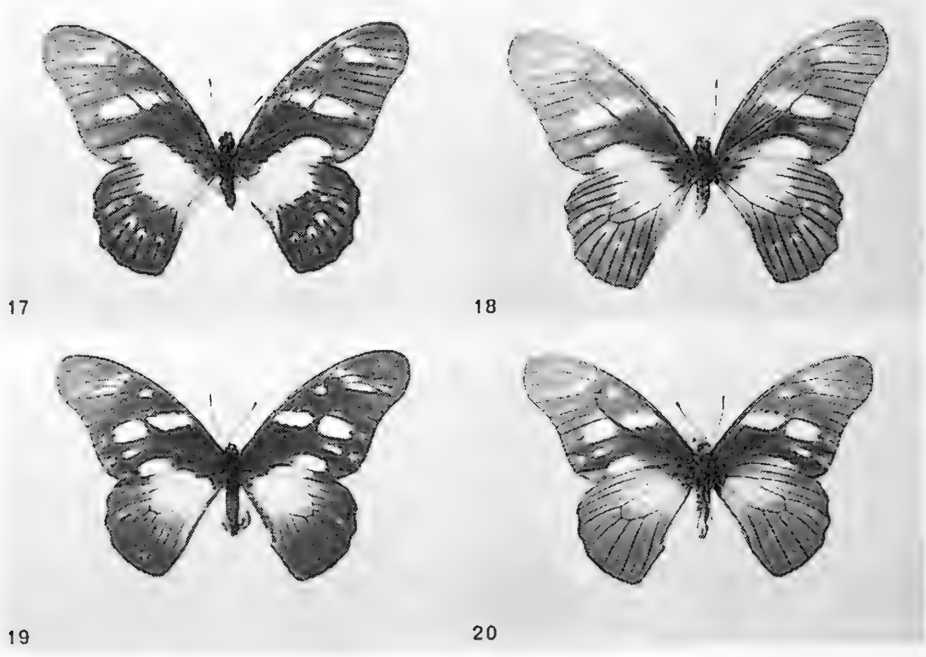

Plate 5. Figs. 17—20. *Graphium almansor wranghami* ssp. n., male, upper- and underside. 17—18, wet season form; 19—20, dry season form.

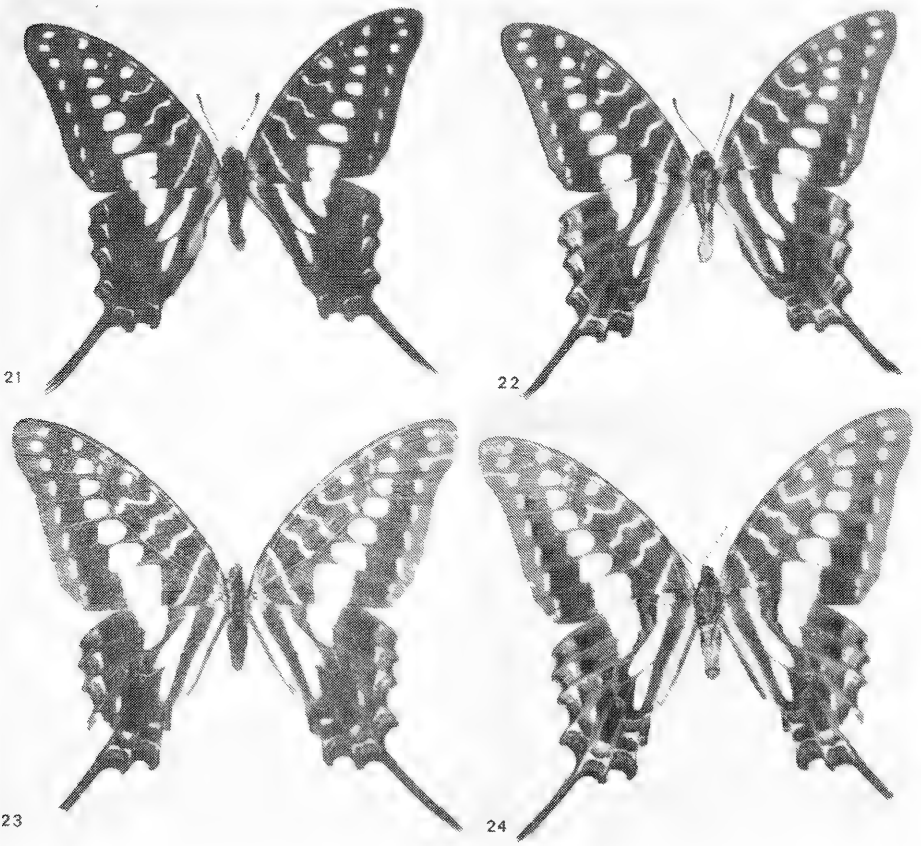

Plate 6. Figs. 21—24. *Graphium porthaon tanganyikae* ssp.n., upper- and underisde. 21—22, male; 23—24, female.

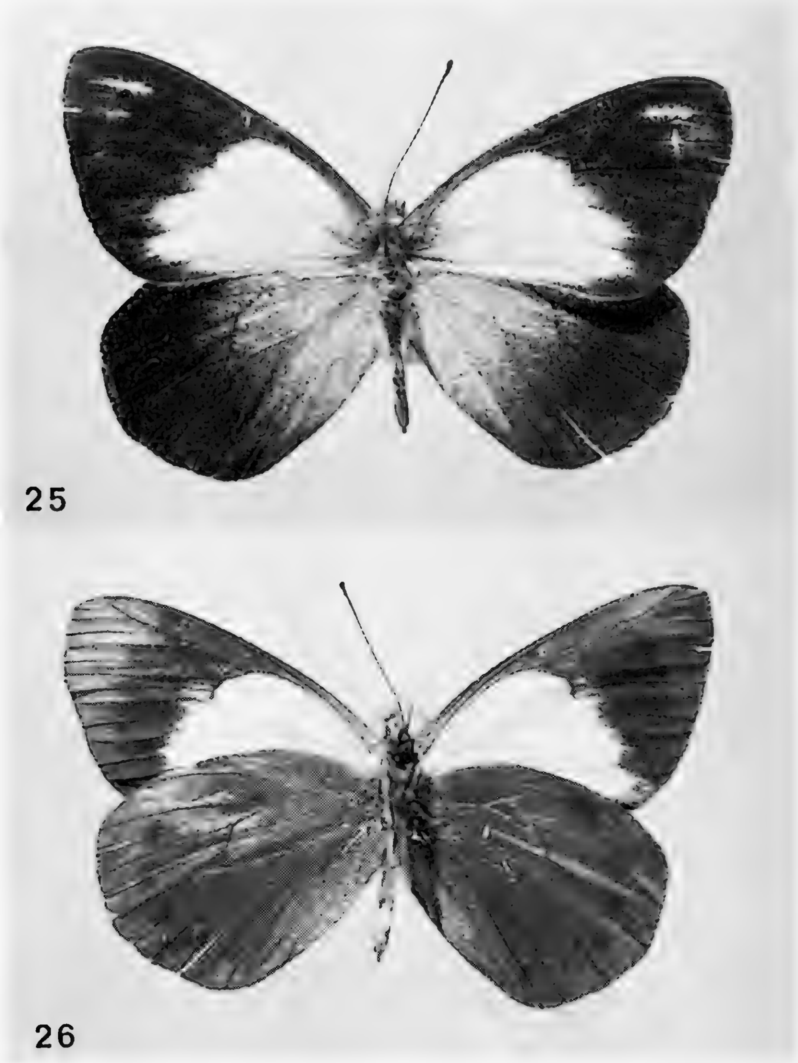

Plate 7. Figs. 25—26. *Belenois raffrayi similis* ssp. n., male, upper- and underside.

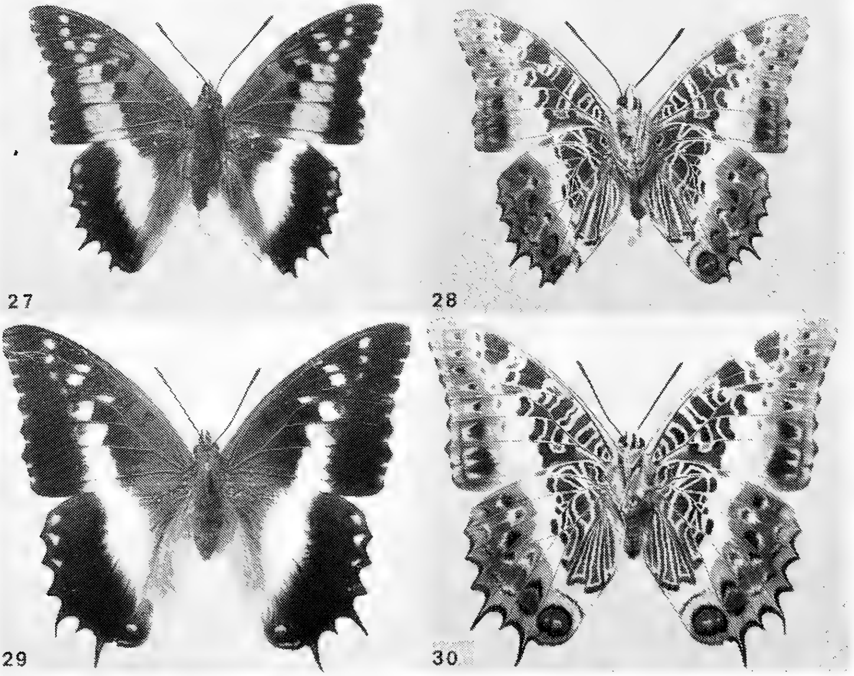

Plate 8. Figs. 27—30. *Charaxes ansorgei ufipa* ssp. n., upper- and underside. 27—28, male; 29—30, female.

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Plate 9. Figs. 31—33. *Pseudathyma plutonica expansa* ssp.n. 31—32, male, upper- and underside; 33, female, upperside. Figs. 34—36. *Neptis ochracea reducta* ssp. n. 34, female, upperside; 35—36, male, upper- and underside.

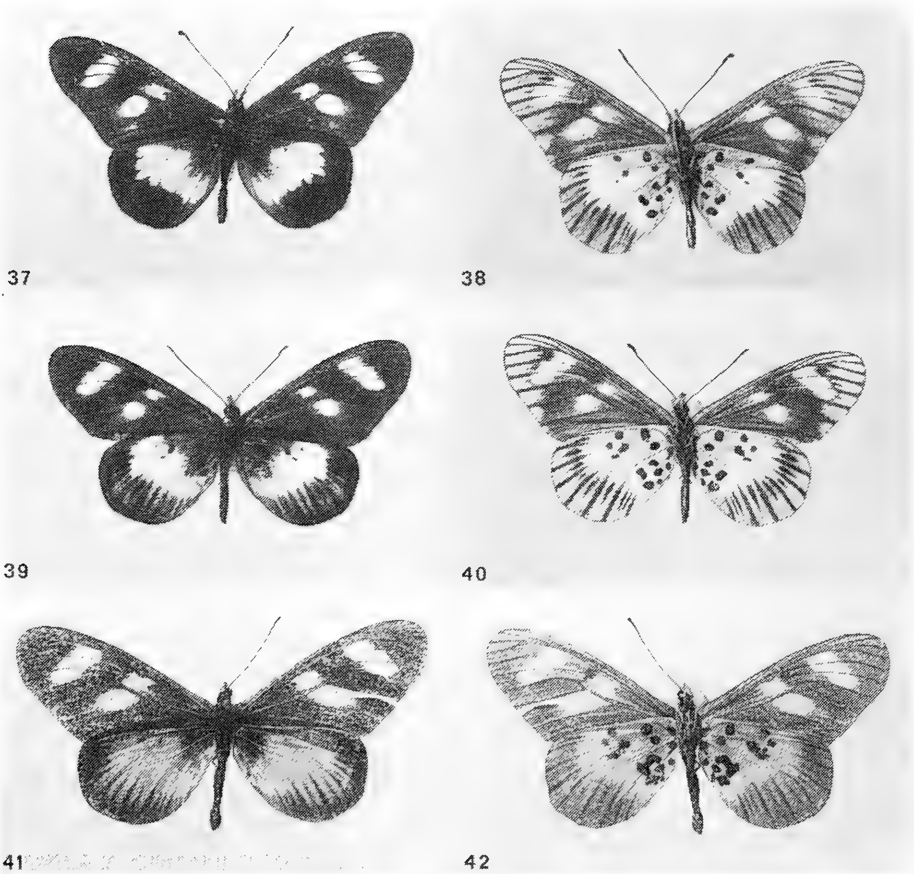

Plate 10. Figs. 37—42. *Acraea ntebiae kigoma* ssp.n., upper- and underside. 37—38, male; 39—40, female; 42—42, female form.


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Plate 11. Figs. 43—45. *Telipna sanguinea kigoma* ssp.n. 43—44, male, upper and underside; 45, female. Figs. 46—49, *Iolaphilus montana* sp.n., upper- and underside. 46—47, male; 48—49, female.

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Plate 12. Figs. 50—51. *Virachola ufipa* sp.n., upperside. 50, male, holotype; 51, female, allotype.

Plate 13. Figs. 52—53. *Virachola ufipa* sp.n., underside. 52, male, holotype; 53, female, allotype.

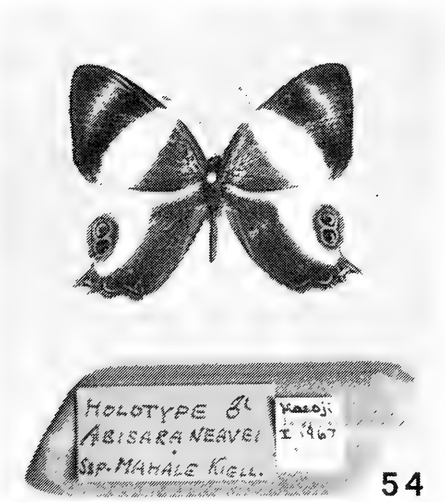

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Plate 14. Figs. 54—55. *Abisara neavei mahale* ssp. n., upperside. 54, male, holotype; 55, female, allotype.

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BEITRAG ZUR KENNTNIS DER NEPTICULIDENFAUNA VON ANATOLIEN UND DER INSEL RHODOS (LEPIDOPTERA, NEPTICULIDAE)

von

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Mit 82 Figuren

ABSTRACT

In this paper the author gives a report of 30 Nepticulid species found in Anatolia and the Island of Rhodes during several journeys from 1964—1977. Among the mentioned species there are 11 new ones: *Nepticula macrolepidella* (on *Quercus macrolepis*), *N. embonella* (on *Pyrus spinosa*), *N. azaroli* (on *Crataegus azarolus*), *N. pyrellicola* (on *Rhamnus pyrellus*), *N. amygdali* (on *Prunus dulcis*), *N. muricatella* (on *Sanguisorba muricata*), *N. styracicolella* (on *Styrax officinalis*), *Trifurcula* (*Ectoedemia*) *aegilopidella* (on *Quercus macrolepis*), *T.* (*Fedalmia*) *trilobella* (on *Salvia triloba*), *T.* (*F.*) *albiflorella* (on *Nepeta nuda albiflora*) and *T.* (*Fomoria*) *deschkai* (on *Hypericum hircinum* and *H. crispum*). Detailed descriptions of the new species are given together with drawings of the genitalia of the imagines and their mines.

EINLEITUNG

Die diesem Beitrag zugrunde liegenden Aufsammlungen und Beobachtungen sind das Ergebnis mehrerer Reisen nach Anatolien (1964, 1966: Ende Mai bis Mitte Juni; 1968: Anfang Juli; 1970: Ende Mai bis Anfang Juni) und Rhodos (1971—1977, zwei- bis dreiwöchige Aufenthalte, in der Hauptsache Ende August bis Anfang Oktober, dreimal Mai bis Mitte Juni).

Während auf den anatolischen Reisen der Lichtfang im Vordergrund der Sammeltätigkeit stand, konzentrierte sich bei den Besuchen von Rhodos das Interesse auf die Suche nach blattminierenden Lepidopteren. Von den dabei festgestellten Arten sollen hier die Nepticuliden behandelt werden, über die aus den besuchten Gebieten wie überhaupt aus dem kleinasiatischen und dem ägäischen Raum nur sehr spärliche Nachweise vorliegen. Die Aufsammlungen enthalten insgesamt 30 Arten, darunter 11 noch unbeschriebene.

In den meisten Fällen konnte die Bestimmung der Arten auf Grund von Zuchten, nur bei wenigen Arten mit Hilfe von Minen allein durchgeführt werden. Soweit bei den erzielten Imagines beide Geschlechter oder nur ♂ vorlagen, wurden Genitaluntersuchungen, dazu oft auch von der nächstverwandten Art, vorgenommen und bei den Beschreibungen ausgewertet. Genitaluntersuchungen unterblieben in den Fällen, in denen nur weibliches Material zur Verfügung stand, da dieses bekanntlich bei vielen Arten noch keine befriedigenden Auswertungsmöglichkeiten bietet. So fehlt derzeit u.a. noch die Möglichkeit der Sichtbarmachung feinster Details der Strukturen der Bursa copulatrix, die Unterscheidungsmerkmale bieten könnten.

Einige der bemerkenswertesten Ergebnisse der Aufsammlungen mögen hier erwähnt werden. So vor allem die Auffindung einer *Nepticula*-Art an *Styrax officinalis* L., offenbar der ersten an einer Styracacee. Die systematische Stellung der Art bleibt vorläufig noch unklar, da nur zwei ♀ vorliegen.

Interessant war auch die Feststellung, daß offenbar *Quercus macrolepis* Kotschy (= *aegilops* L.) eine eigene Lepidopterenfauna zu haben scheint, wie man auf Grund der Blattminierer und der Bewohner der charakteristischen großen Eichelbecher annehmen kann. So wurden u.a. in den Blättern zwei neue Nepticuliden (*N. macrolepidella* und *T. aegilopidella*) gefunden, daneben konnten aber keine weiteren, von anderen weichblätterigen Eichen bereits bekannte Nepticuliden festgestellt werden. *Quercus ehrenbergi* Kotschy hat dagegen drei *Nepticula* (s.l.) -Arten mit europäischen Eichen gemeinsam.

Eine an *Pistacia lentiscus* L. gefundene *Weberina*-Art wird vorläufig noch zu der aus dem Mittelmeergebiet bekannt gewordenen *Weberina minimella* (Rebel) (= *lentiscella* Groschke) gestellt — trotz einiger anatomischer Unterschiede. Zur Klärung der Frage, ob es sich nur um zwei differenzierte Formen oder distincte Arten handelt, sind weitere Beobachtungen und Untersuchungen notwendig. In der Nomenklatur werden hier im allgemeinen die von Johansson (1971) gemachten Vorschläge berücksichtigt, die eine Teilung der Familie Nepticulidae in zwei große Genera (*Nepticula* und *Trifurcula*) mit einer Unterteilung des letzteren vorsieht. Diese scheint wenigstens vorläufig die beste Lösung zu Gunsten einer leichten Übersicht zu sein.

In Dankbarkeit gedenkt Verfasser der unermüdlichen Mithilfe seiner unvergeßlichen Frau, der tatkräftigen Unterstützung in botanischen Belangen durch Frau Dr. F. Sorger und Herrn H. Metlesics, Wien, und der kameradschaftlichen Unterstützung und Hilfe seiner Freunde E. Arenberger, der Ehegatten Ing. W. und G. Glaser, der Herren G. Deschka und R. Johansson.

SYSTEMATISCHER TEIL

Es werden zuerst die bereits bekannten Arten behandelt, darauf folgen die Neubeschreibungen.

Nepticula aurella (Fabricius, 1775)
(Fig. 1, 2)

Tinea aurella Fabricius, 1775: 666.
Nepticula aurella; Staudinger & Rebel, 1901: 224. Beirne, 1945: 203. Johansson, 1971: 243.
Stigmella aurella; Hering, 1957: 909.

Rhodos, Mt. Smith und Straße nach Kalithea, 6. vi.1974, verlassene Minen an *Rubus fruticosus* agg. zwischen Gebüsch. Die beobachteten Minen weisen teilweise

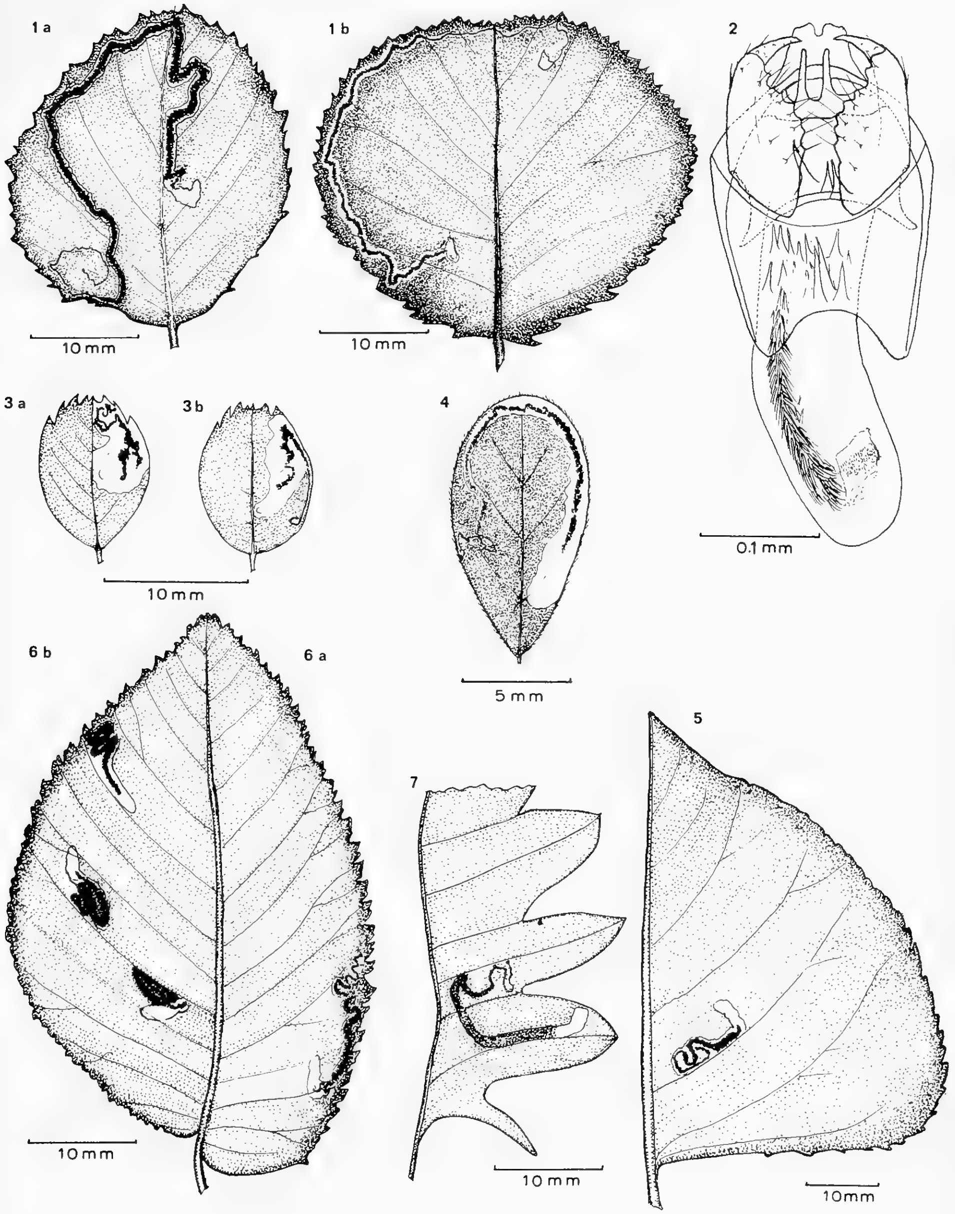

Fig. 1—2. *Nepticula aurella* F. 1a, b: Minen an *Rubus fruticosus* agg., Rhodos, Kalithea, 6 vi. 1974; 2: ♂ Kopulationsapparat, GU/Kli-324, Italia, Liguria, Bordighera, ex l. 13.xi.1938, *Rubus fruticosus* agg. Fig. 3—4. *N. mespilicola* Frey, Minen an (3) *Amelanchier parviflora* Boiss. und (4) *Cotoneaster racemiflora* C. Koch, beide Anatolia, NW-Ende des Beysehir gölü, 18.vi.1966. Fig. 5. *N. trimaculella* Hw., Mine an *Populus italica* Moench, Rhodos, Paradissi, 28.viii.1973. Fig. 6. Minen an *Ulmus glabra* Huds. (?), Rhodos, Rodini, 21.x.1971, von (6a) *N. ulmivora* Fologne und (6b) *N. viscerella* Stt. Fig. 7. *N. basiguttella* Hein., Mine an *Quercus ehrenbergi* Kotschy, Anatolia, Mut, 8.vii.1968.

eine kräftige, teils eine aufgelockerte, den Gang bis auf einen schmalen Rand erfüllende Kotspur auf. Eiablage oberseitig (Fig. 1 a, b). Aus derartigen Minen wurden aus verschiedenen Gebieten des Mittelmeerraumes Imagines erzielt, die als *Nepticula aurella* (F.) im Sinne Beirnes (1945) anzusehen sind. Charakteristisch für diese Art ist im männlichen Genitale die Bewehrung des Aedoeagus, die u.a. aus einer schmalen, fuchsschwanzartigen Gruppe von Cornuti besteht (Fig. 2).

Verbreitung: Spanien, Frankreich, England, Irland, teilw. in den Skand. Ländern, Mitteleuropa, SO-Europa und Nordafrika, Italien.

Nepticula mespilicola Frey, 1856
(Fig. 3, 4)

Nepticula mespilicola Frey, 1856: 392. Staudinger & Rebel, 1901: 224.
Stigmella mespilicola; Hering, 1957: 77.

Anatolia, NW-Ende des Beysehir gölü, ca 1100 m, 18.vi.1966, zahlreiche verlassene und eine besetzte Mine an *Amelanchier parviflora* Boiss. Daraus schlüpfte am 4.vii.1966 eine weibliche Imago, die sich von mitteleuropäischen Stücken dieser Art nicht unterscheidet. Die Mine (Fig. 3) erscheint fast platzartig, sie verläuft stark gewunden am Blattrand und weist eine kräftige Kotlinie auf. Eiablage auf der Blattoberseite.

Am selben Standort wurden gleichzeitig an *Cotoneaster racemiflora* C. Koch elf verlassene Gangminen (Fig. 4) gefunden, die mit Vorbehalt zu *N. mespilicola* gezogen werden. Auch bei diesen ist die Eiablage oberseitig, der Verlauf der Minen ist aber weniger stark gewunden, auch sind sie schmäler. Diese Merkmale dürften aber auf die verschiedene Konsistenz der Substrate zurückzuführen sein.

Nepticula paliurella (Gerasimov, 1937)

Stigmella paliurella Gerasimov, 1937: 285; 1952: 251. Hering, 1957: 737 (=? *zizyphi* Walsingham, 1911: 190).
Nepticula paliurella; Klimesch, 1940: 177—179, 188—189.

Anatolia, Mut (Mersin), 8.vi.1966. Verlassene Minen an *Paliurus spina-christi* Mill. Eine ostmediterrane Art.

Nepticula trimaculella (Haworth, 1829)
(Fig. 5)

Tinea trimaculella Haworth, 1829: 583.
Nepticula trimaculella; Staudinger & Rebel, 1901: 228.
Stigmella trimaculella; Hering, 1957: 810.

Rhodos, Paradissi, 28.viii.1973. Nur drei verlassene Minen an *Populus italica* Moench; darunter eine stark gewundene, in sich verschlungene (Fig. 5). Die Minen entsprechen mitteleuropäischen dieser Art.

Verbreitung: Europa bis in die Skandinavischen Länder. England.

Nepticula ulmivora Fologne, 1860
(Fig. 6a)

Nepticula ulmivora Fologne, 1860: 92. Klimesch, 1975a: 6—8 (= *ulmifoliae* Hering, = *ulmicola* Hering).
Nepticula ulmifoliae Hering, 1931: 531—532.
Nepticula ulmicola Hering, 1932a: 568.
Stigmella ulmivora; Beirne, 1945: 199. Hering, 1957: 1089. Gustafsson, 1975: 3—4.
Stigmella ulmifoliae; Hering, 1957: 1089.
Stigmella ulmicola; Hering, 1957: 1089.

Rhodos, Rodini. Im Juni 1976 und im September 1972 und 1973 sowie im Oktober 1971 verlassene Minen an *Ulmus glabra* Huds. (?) sowohl im schattigen Parkgelände als auch außerhalb desselben an Straßenrändern nicht selten (Fig. 6a). In stark besonnten Blättern wurden Minen festgestellt, die die Merkmale der Hering'schen Minenform *ulmicola* aufwiesen: an einer Blattrippe angelehnt, gerade verlaufend, mit kompakter Kotablage. In Schattenblättern kommen dagegen längere Minen mit aufgelockertem, halbkreisförmig abgelagerten Kot und stark gewundene Minen zarterer Kotlinie vor (f. *ulmifoliae* Her.). Imagines wurden nicht gezüchtet.

Nepticula viscerella Stainton, 1853
(Fig. 6b)

Nepticula viscerella Stainton, 1853: 3958. Klimesch, 1975a: 2—4 (= *tauromeniella* Groschke).
Nepticula tauromeniella Groschke, 1944: 117—118.
Stigmella viscerella; Beirne, 1945: 199. Hering, 1957: 1090.
Stigmella tauromeniella; Hering, 1957: 1090.

Rhodos, Rodini, 21.x.1971 (verlassene Minen), 22.ix.1972 besetzte Minen, Imagines daraus 10.x.1972 und 13.iv.1973; 31.viii.1973 besetzte Mine, Imago daraus 24.ix.1973; 1.vi.1973 besetzte Mine, 24.ix.1973 Imago. Die Minen an *Ulmus glabra* Huds.(?)

Die Minen (Fig. 6b) entsprechen vollständig jenen, die Groschke (1944) veranlaßte, eine neue Art — *tauromeniella* — anzunehmen. Sie sind infolge des dickblätterigen Substrates auffallend kurz, in ihren Gangwindungen derart zusammengedrängt, daß Einzelheiten nicht mehr wahrgenommen werden können. Aus derartigen Minen wurden Imagines erzielt, die sich von mitteleuropäischen *N. viscerella* Stt. nicht unterscheiden lassen (Klimesch, 1975).

Verbreitung: Lokal in ganz Europa, einschl. England. Fehlt in den Skand. Ländern. Die Art scheint in südlichen Ländern häufiger aufzutreten.

Nepticula basiguttella Heinemann, 1862
(Fig. 7)

Nepticula basiguttella Heinemann, 1862: 258. Staudinger & Rebel, 1901: 221. Johansson, 1971: 256—258 (= *cerricolella* Klim.).
Stigmella basiguttella; Hering, 1957: 869.
Stigmella cerricolella Klimesch, 1946: 160—162. Hering, 1957: 869.

Anatolia, Mut (Mersin), 8.vii.1968. Zwei verlassene Minen an *Quercus*

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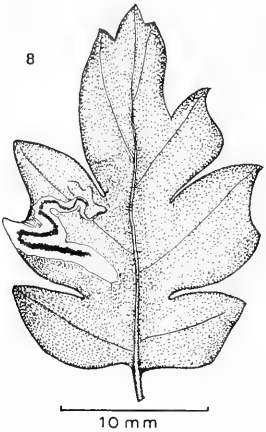

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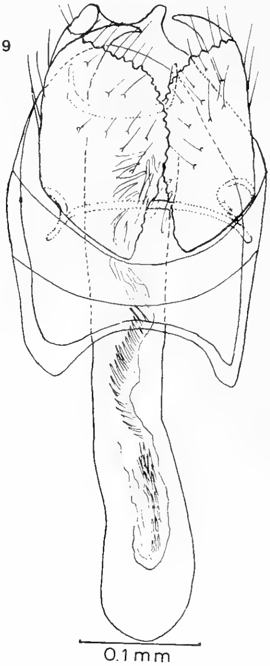

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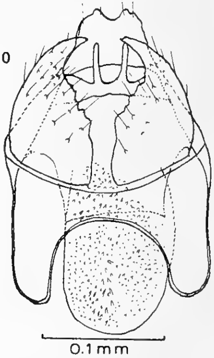

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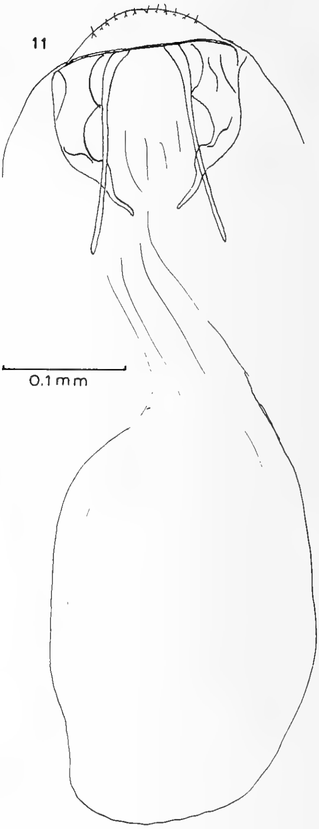

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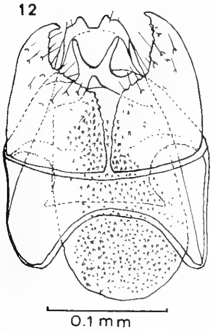

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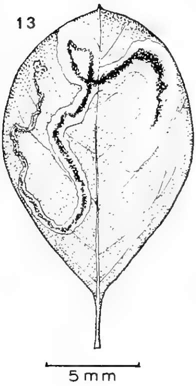

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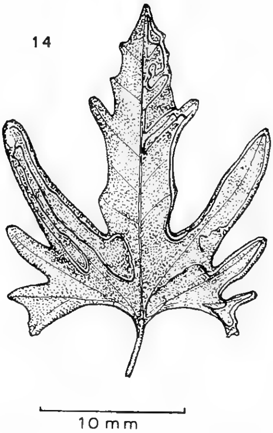

Fig. 8—9. *N. samiatella* Z. 8: Mine an *Quercus ehrenbergi* Kotschy, Anatolia, Kizilcahamam, 1.vii.1968; 9: ♂ Kopulationsapparat, GU/Kli-4109, dieselben Daten, ex l. 1.vii. 1968. Fig. 10—13. *N. rhamnophila* Ams. 10: ♂ Kopulationsapparat, Holotypus, GU/Kli-721 (Coll. Amsel), Palaestina, Tabgha, See Genezareth, ex l. 24.iii.1933, *Rhamnus palaestina* Boiss.; 11: ♀ Kopulationsapparat, Allotypus, GU/Kli-722, dieselben Daten, ex l. 29.iii.1933; 12: ♂ Kopulationsapparat, GU/Kli-1251, Rhodos, Lindos, ex l. 8.xi.1971, *Rhamnus oleoides* L.; 13: Mine an *Rhamnus oleoides* L., Rhodos, Lindos, 23.x.1971. Fig. 14. *N. freyella* Heyd., Minen an *Convolvulus althaeoides* L., Rhodos, Kalithea, 1.ix.1973.

ehrenbergi Kotschy. Die Minen (Fig. 7) weisen die für *basiguttella* charakteristischen Merkmale auf: Gangminen, in denen der dunkelgrüne, später dunkelbraune Kot den Fraßgang vollständig ausfüllt, ohne Ränder freizulassen. Eiablage oberseitig.

Eine an verschiedenen Eichenarten durch ganz Europa verbreitete Art.

Nepticula samiatella (Zeller, 1839)
(Fig. 8, 9)

Lyonetia samiatella Zeller, 1839: 215.
Nepticula samiatella; Johansson, 1971: 256—258.

Es unterbleibt die Anführung weiterer Zitate, da sämtliche Autoren (Herrich-Schäffer, Heinemann-Wocke, Stainton u.a.) die Art nicht richtig erkannt, sie vielmehr mit den nahestehenden, besonders mit *atricapitella* Hw. und *ruficapitella* Hw. vermischt haben. Erst Johansson (1971) gelang es, die Art einwandfrei festzulegen.

Anatolia, Kizilcahamam, im ausgedehnten, aus *Quercus ehrenbergi* Kotschy bestehendem Eichenbuschwald sowohl Minen (1.vii.1968) als auch Imagines am Licht. Die Imagines wurden durch GU 4109 und 4110/Kli als zu *samiatella* Z. gehörig bestätigt.

Außerdem liegen vom gleichen Fundort 4 von Holzschuh, Wien, am Licht erbeutete ♂ vor (GU 1314), die sich ebenfalls als *N. samiatella* Z. erwiesen.

Die Mine ist hinsichtlich der Dichte und Breite der Kotablage etwas veränderlich. Meist handelt es sich um Gangminen mit kräftiger, aufgelockerter Kotlinie, die breite Ränder des Ganges freiläßt (Fig. 8). Eiablage oberseitig. Raupe hellgelb, Kopf hellbraun.

Die männlichen Imagines besitzen keine Duftschuppen auf den Hinterflügeln. Das männliche Genitale (Fig. 9) ist ausgezeichnet durch einen langgestreckten Aedoeagus, der eine schmale Reihe kräftiger Cornuti besitzt.

Nepticula rhamnophila Amsel, 1935
(Fig. 10—13)

Nepticula rhamnella ssp. *rhamnophila* Amsel, 1935: 317.
Stigmella rhamnophila; Hering, 1957: 890.

Rhodos, Lindos, 23.x.1971, zahlreiche verlassene und bezetzte Minen an *Rhamnus oleoides* L. Sträuchern an felsigen Stellen. Imagines (11 ♂, 14 ♀) daraus 5—14.xi.1971.

Anatolia, Kizilcahamam, 29.v.1970, einige besetzte Minen an *Rhamnus* spec. im Buschwaldgebiet, Imagines daraus (3 ♀) 10.vi.1970, die in den äußeren Merkmalen mit *N. rhamnophila* übereinstimmen.

Die Minen (Fig. 13) verlaufen meist am Blattrand, sie sind stark gewunden und enden oft platzartig. Kotlinie kräftig, breit, anfangs den Gang fast gänzlich ausfüllend, später breite Ränder aufweisend. In kleinen Blättern nimmt die Mine das ganze Blatt ein. Das Blatt wird durch einen Schlitz in der Oberseite verlassen. Eiablage meist unterseitig. Kokon weiß, zart.

Die Imagines von *N. rhamnophila* weisen gegenüber der sehr nahestehenden *N. rhamnella* H.-S. in beiden Geschlechtern schwarzbraune, leicht violett glänzende Vorderflügel auf, während bei *rhamnella* das ♂ etwas heller getönt erscheint als das ♀. Die Kopfhaare der *rhamnophila* sind heller als die der *rhamnella*. Die Genitalunterschiede (Fig. 10, 11, 12) sind geringfügig. Sie liegen in der Hauptsache in der flacheren Einbuchtung des Uncus und der Bewehrung des Aedoeagus, der bei *rhamnella* außer zahlreichen verstreuten Cornuti noch eine Cornutalplatte besitzt.

Zu *N. rhamnophila* Ams. dürften auch zwei am NW-Ende des Beysehir gölü (Anatolien, Isparta) an *Rhamnus rhodopaeus* Velenovsky gefundene, verlassene Minen gehören (14.vi.1966).

Nepticula freyella Heyden, 1858
(Fig. 14—16)

Nepticula freyella Heyden, 1858: 175. Staudinger & Rebel, 1901: 225.
Stigmella freyella; Hering, 1957: 321.

Rhodos, Kremasti und Kalithea, an Straßenrändern und Brachen, zahlreiche besetzte Minen Ende August und anfangs September 1973. Die Imagines erschienen vom 9. bis 14.ix.1973 und stimmen völlig mit solchen aus Mitteleuropa überein. Das männliche Genitale ist ausgezeichnet durch einen bogenförmigen, gezähnten Uncus, zwei freie Gnathosäste, ventral grob gezähnte Valven, die in einen nach innen gerichteten Fortsatz enden. Aedoeagus mit zahlreichen verstreuten Cornuti bewehrt (Fig. 15). Die Bursa copulatrix des weiblichen Genitale besitzt kein Signum; die Bursawand weist keine Struktur auf (Fig. 16).

Die Mine (Fig. 14) ist stark gewunden mit meist zarter Kotlinie. Eiablage unterseitig. Raupe gelb mit brauner Kopfkapsel. Futterpflanzen: *Convolvulus arvensis* L. und *C. althaeoides* L.

Verbreitung: Mittel- und Osteuropa, Corsica, Nordafrika.

Nepticula aceris Frey, 1856
(Fig. 17, 18)

Nepticula aceris Frey, 1856: 386. Staudinger & Rebel, 1901: 222.
Nepticula szoecsi Klimesch, 1955: 423—424.
Stigmella aceris; Hering, 1957: 20—21.

Anatolia, Kizilcahamam, Buschwaldgebiet, 3.vi.1970, zahlreiche besetzte Minen an *Acer tataricum* L., aus denen vom 15—17.vi.1970 19 Imagines schlüpften. Während ein Teil der Tiere in ihren äußeren Merkmalen mitteleuropäischen Stücken gleichen, weisen 8 Exemplare die für *N. szoecsi* Klim. (1955) charakteristischen bindenlosen Vorderflügel auf. Angesichts der völligen Übereinstimmung der Genitalien (Fig. 18) beider Formen besteht kein Zweifel,

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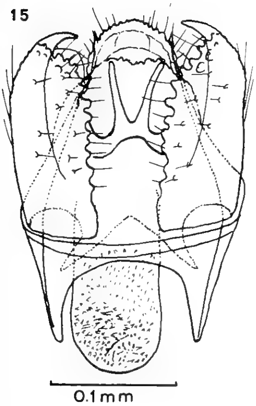

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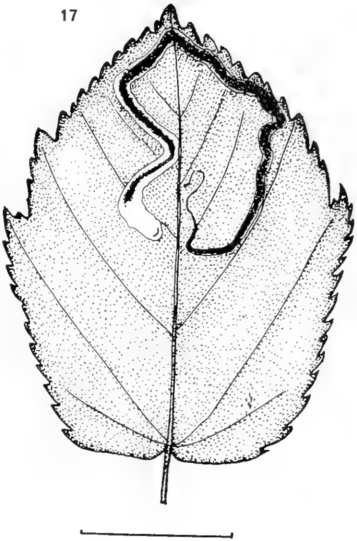

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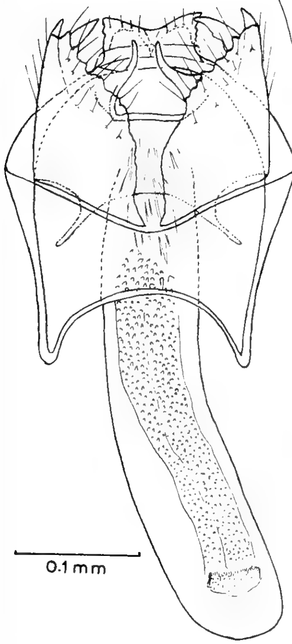

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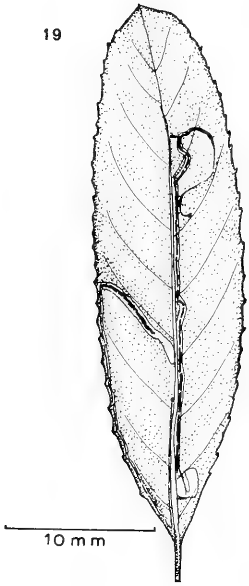

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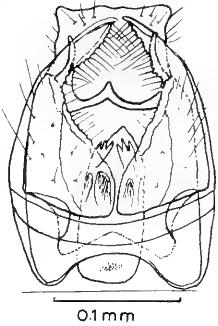

Fig. 15—16. *Nepticula freyella* Heyd. 15: ♂ Kopulationsapparat, GU/Kli-1323, Rhodos, Kalithea, ex l. 10.ix.1973, *Convolvulus althaeoides* L.; 16: ♀ Kopulationsapparat, dieselben Daten. Fig. 17—18. *N. aceris* Frey. 17: Mine an *Acer tataricum* L., Anatolia, Kizilcahamam, 3.vi.1970; 18: ♂ Kopulationsapparat, GU/Kli-4100, dieselben Daten, ex l. 16.vi.1970. Fig. 19—20. *N. nivenburgensis* Preiß. 19: Minen an *Salix alba* L. (?), Rhodos, Kalithea, 1.ix.1973; 20: ♂ Kopulationsapparat, GU/Kli-4129, dieselben Daten, ex l. 15.ix.1977.

daß wir es nur mit einer Art zu tun haben. Diese scheint jedoch in Ungarn und in Anatolien zeichnungslose Formen zu entwickeln.

Die Mine (Fig. 17) beginnt aus einem auf der Blattunterseite abgelegten Ei als zarter sowohl in der Blattspreite als auch am Blattrand verlaufender Gang. Dieser erweitert sich rasch und weist eine breite, nur sehr schmale Ränder freilassende, in Querbögen abgelagerte Kotspur auf. Der Kot ist ursprünglich dunkelgrün, von der Farbe des Parenchyms, dunkelt aber bald bis schwärzlichbraun. Das Blatt wird von der Raupe durch einen Schlitz in der Oberseite verlassen. Raupe lebhaft grün. Kokon weiß, zart.

Nepticula nivenburgensis Preißecker, 1942
(Fig. 19—21)

Nepticula nivenburgensis Preißecker, 1942: 208—211. Hering, 1943: 273—278.
Stigmella nivenburgensis; Hering, 1957: 928.

Rhodos, Straße nach Kalithea, Mine an *Salix alba* L. (?), ex l. 19.ix.1973; weitere Minen am gleichen Fundort: eine am 3.vi.1974 (Imago daraus 23.vi.1974), zahlreiche Minen 1—5.ix.1977 (Imagines 15—24.ix.1977).

Gangmine (Fig. 19), meist unterseitig beginnend, zart, vielfach an eine Rippe angelegt, daher wenig auffallend, mit scharfer, unterbrochener, den Gang anfangs ganz ausfüllender, ca ⅓ der Gangbreite ausmachender Kotlinie. Während die Mine anfangs im Schwammparenchym verläuft, nimmt sie im zweiten Abschnitt beide Parenchyme in Anspruch, nicht selten verläuft sie jedoch durchwegs unterseitig. Preißecker (1942) beschreibt die Mine sehr eingehend, er erwähnt jedoch nicht, wo die Raupe die Mine zur Verpuppung verläßt. Bei den Zuchten von Rhodos wurde bisher nur ein unterseitiges Verlassen des Blattes beobachtet. Ei unterseitig, Raupe hellgelb.

Die rhodischen, ausschließlich durch Zuchten erhaltenen Exemplare stimmen in allen Merkmalen mit mitteleuropäischen überein.

N. nivenburgensis ist auf Grund der männlichen Genitalien leicht zu erkennen. Sie gehört in die Verwandtschaft der *N. luteella* und *N. glutinosae*, die im männlichen Genitale durch einen verbreiterten, apical flachen Uncus und einen kurzen, mit gruppenspezifischen Cornuti bewehrten Aedoeagus ausgezeichnet sind (Fig. 20). Am weiblichen Genitale (Fig. 21) fällt die Bursa copulatrix durch feine Querwülste skulpturierte Bursawand auf. Es ist ein Signum vorhanden, das aus einer langgestreckten, ovalen, randgekerbten Platte besteht, die an die Signa der trifurculoiden Gruppe erinnert, aber keine wabenförmige Struktur aufweist. Bei einem anderen Präparat (GU 4131/Kli) wurde neben der einen Platte noch eine zweite festgestellt.

Auf Grund der Minenfunde und der Zuchtergebnisse sind zweifellos zumindest zwei Generationen anzunehmen, dabei sind die im Frühjahr auftretenden Raupen der ersten Generation weitaus seltener als die der Herbstgeneration.

Verbreitung: die Art wurde aus dem östl. Nieder-österreich (Umgeb. v. Wien) beschrieben, sie wurde auch in Ungarn (Szöcs) gefunden und in Oberitalien (Klimesch) festgestellt. Es scheint sich demnach um eine südöstlich verbreitete Art zu handeln.

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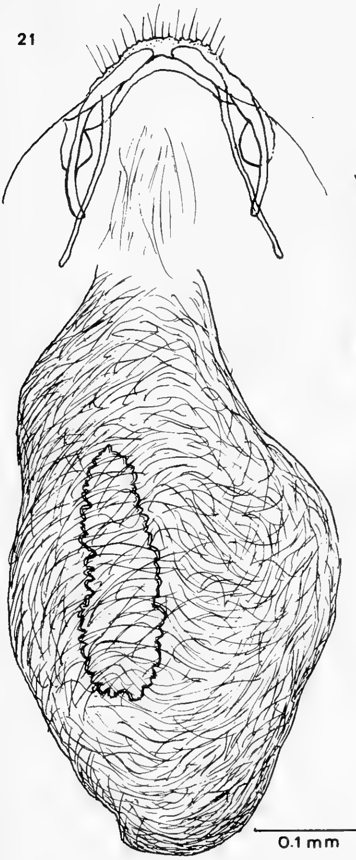

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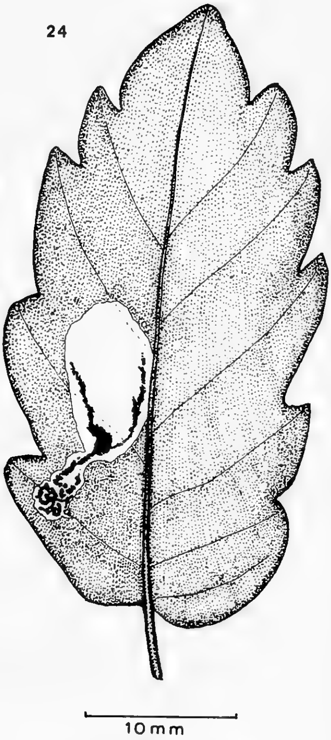

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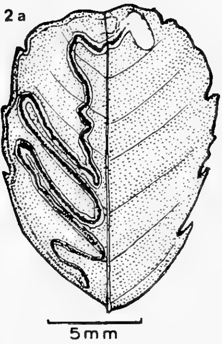

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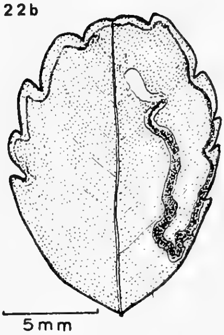

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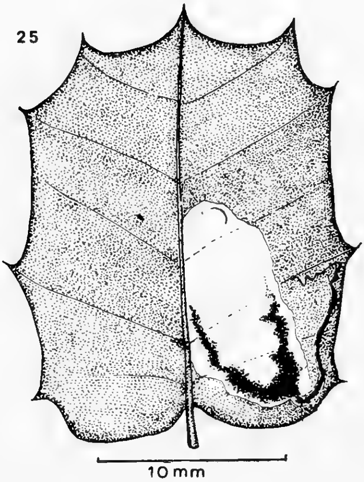

Fig. 21. *Nepticula nivenburgensis* Preiß., ♀ Kopulationsapparat, GU/Kli-4130, Rhodos, Kalithea, ex l. 15.ix.1977, *Salix alba* L. (?). Fig. 22a, b. *N. promissa* Stgr., Minen an *Rhus coriaria* L., Rhodos, Mt. Smith, 25.v.1974. Fig. 23—24. *Trifurcula* (*Ectoedemia*) *caradjai* (Hering). 23: Mine an *Quercus ehrenbergi* Kotschy, Anatolia, Mut, 8.vii.1968; 24: Mine an *Quercus* sp. (*pubescens*?), Rhodos, Salakos, 29.viii.1973. Fig. 25. *T.* (*E.*) spec. pr. *suberis* (Stt.), Mine an *Quercus coccifera* L., Rhodos, Trianta, 2.ix.1973.

Nepticula promissa Staudinger, 1870
(Fig. 22)

Nepticula promissa Staudinger, 1870: 325. Staudinger & Rebel, 1901: 228. Klimesch, 1942: 395—396.
Stigmella promissa; Hering, 1957: 781.

Rhodos, Mt. Smith, 10.v.1975, besetzte Minen an *Rhus coriaria* L., aus denen vom 25—29.v.1977 drei weibliche Imagines erzielt wurden.

Die Mine ist in ihrem Verlauf und in der Kotspur sehr variabel, bald dem Blattrand folgend, bald in der Blattspreite (Fig. 22a, b). Die Kotablage kann breit, aufgelockert, in Querbögen oder zarter, kompakt sein und kann in ein und derselben Mine abändern. Demnach kann der Kot die Mine fast ganz erfüllen oder breite Ränder freilassen. Hering (1957) ist geneigt, in den Minen mit zarter Kotlinie eine noch unbeschriebene Art zu sehen.

Ei unterseitig, Raupe grün mit brauner Kopfkapsel, Kokon hellbraun.

An *Pistacia atlantica* Desf. wurden am gleichen Standort sowohl im Mai als auch im September-Oktober nicht selten verlassene und nur einmal zwei besetzte Minen (mit grünen Raupen) mit zarter Kotspur gefunden, die nach Ansicht des Verfassers zu *N. promissa* Stgr. gehören dürften. Eine mediterrane Art, die bis ins südliche Mittel-Europa und Süd-Ungarn reicht.

Trifurcula (Ectoedemia) caradjai (Hering, 1932)
(Fig. 23, 24)

Nepticula caradjai Hering, 1932b: 16. Groschke, 1944: 118—119.
Stigmella caradjai; Hering, 1957: 867.

Anatolia, Mut (Mersin), 8.vii.1968, besetzte Minen an *Quercus ehrenbergi* Kotschy; Imagines daraus vom 5—11.viii.1968, 3 ♀ die mit solchen aus dem Mittelmeergebiet (aus *Quercus pubescens* agg.) übereinstimmen.

Die charakteristische Mine (Fig. 23) beginnt mit kurzen, ganz mit Kot erfüllten Windungen, die alsbald in einen ovalen bis kreisrunden Platz übergehen, in dem der Kot im unteren Teil bald wolkig aufgelockert, bald kompakt zusammenhängend an den Seiten abgelagert wird. Ei auf der Blattunterseite.

Rhodos, Salakos, 26.viii.1973, einige verlassene und wenig besetzte Minen an *Quercus pubescens* agg. (?) (Fig. 24) mit oberseitiger Eiablage. Imagines daraus (2 ♀) am 2.v.1974.

Die Art ist wie auch die übrigen Vertreter dieser Gruppe einbrütig. Die anatolischen Funde lassen aber auf eine — wenigstens teilweise — zweite Generation schließen.

Eine mediterrane Art, die am Alpenostrand bis über Wien hinaus nach Norden vordringt.

Trifurcula (Ectoedemia) species
(Fig. 25)

Rhodos, Rodini, 1.ix.1973 und Trianta, 30.viii.1973 und 1977. Neben zahlreichen, vor mehr oder minder kurzer Zeit von den Raupen verlassenen Platzminen an *Quercus coccifera* L. wurden auch einige besetzte gefunden. Daraus entwickelten sich eine Imago am 16.ix.1973 sowie weitere am 24.iv und 4.v.1974, sämtliche ♀. Diese entsprechen in ihren äußeren Merkmalen und im Habitus der an weichblätterigen Eichen lebenden *T. caradjai* Hering, an welche Art auch die Minen erinnern.

Die Mine (Fig. 25) beginnt als gewundener, ganz mit Kot erfüllter Gang, erweitert sich aber später zu einem Platz, in dem die Kotablage an dessen Basis erfolgt. Eiablage oberseitig.

Die Mine ähnelt auch sehr jener der einbrütigen, im Februar an *Quercus suber* L. und *Q. ilex* L. vorkommenden *Trifurcula* (*Ectoedemia*) *suberis* Stt. Die Imago der letzteren ist aber wesentlich robuster als jene der rhodischen Art. Erst bei Vorliegen eines zahlreicheren Zuchtmaterials in beiden Geschlechtern kann die an *Quercus coccifera* L. gebundene Species geklärt werden.

Trifurcula (Ectoedemia) terebinthivora Klimesch, 1975
(Fig. 26—28)

Trifurcula (*Ectoedemia*) *terebinthivora* Klimesch, 1975b: 19—23.

Anatolia, Mut (Mersin), 8.vii.1968, zahlreiche verlassene Minen an *Pistacia terebinthus* L. Anatolia, Kanlidivane, in einem Buschwaldgebiet an der Straße Silifke-Mersin, 31.v.1970, mehrere, meist erst halbentwickelte Minen an dem gleichen Substrat. Imagines daraus 24—30.vi.1970. Rhodos, Lindos, 20.x.1971, zahlreiche verlassene alte Minen an *Pistacia terebinthus* L.

Mine (Fig. 26) anfangs stark gewundener Gang zwischen zwei Nebenrippen, von schwarzem Kot fast ganz erfüllt. Später Platz mit dicht wolkig abgelagertem Kot, der nur im letzten Abschnitt breitere Ränder freiläßt. Raupe fast farblos, glasig erscheinend, mit schwarzbrauner Kopfkapsel. Kokon dunkelgrau. Eiablage auf der Blattunterseite, meist an der Mittelrippe.

Männlicher Kopulationsapparat (Fig. 27). Vinculum schmal, flach ausgeschnitten, Ventralarme der Transtillae relativ lang. Valven mit leicht konkavem Ventralrand; sie enden in einen einwärts gerichteten Fortsatz. Pseuduncus schwach sklerotisiert, plattenförmig. Uncus schwach gewölbt, apical gezähnt. Gnathosäste apical verschmolzen. Aedoeagus lang, mit einer Cornutalplatte und zwei dornartigen Cornuti.

Weiblicher Kopulationsapparat (Fig. 28). Das Signum der Bursa copulatrix besteht aus zwei langgestreckten Platten mit unregelmäßig sechseckiger wabenähnlicher Struktur.

Trifurcula (Ectoedemia) groschkei (Skala, 1943) comb. nov.
(Fig. 29—34)

Nepticula groschkei Skala, 1943: 86.
Stigmella groschkei; Hering, 1957: 1117. Klimesch, 1948: 77—78.

Rhodos; Feraklos, Lindos, Kalathos, Massari, Archangelos, Salakos und

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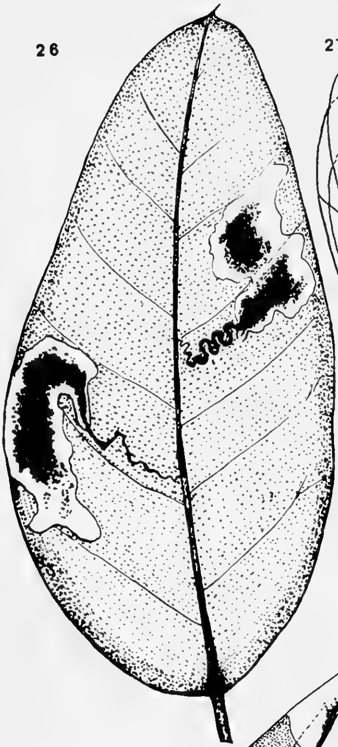

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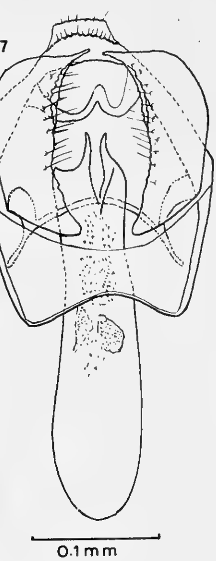

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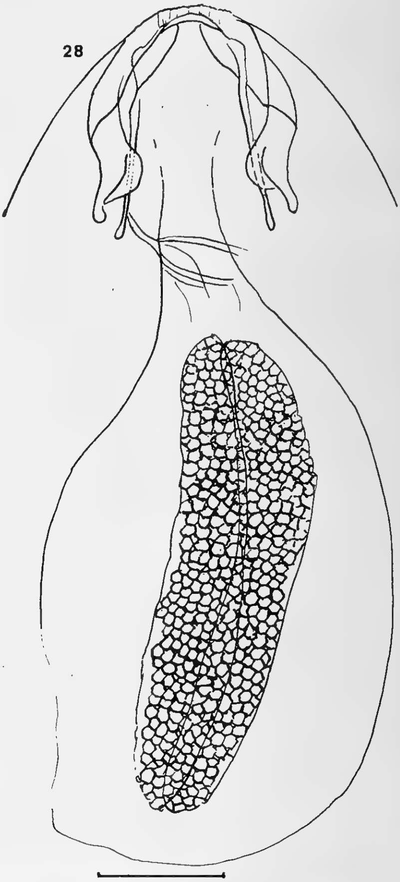

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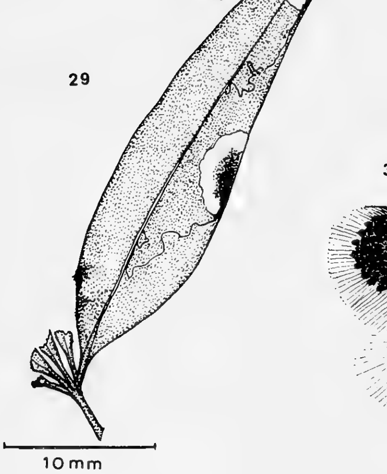

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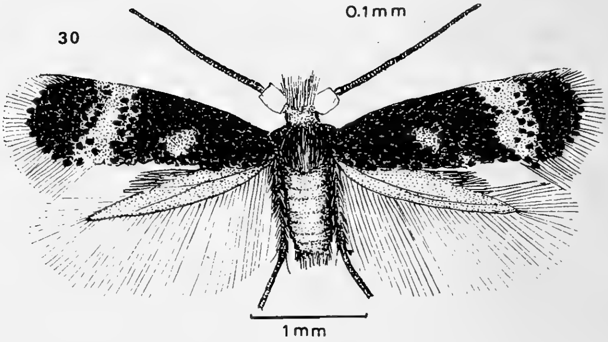

Fig. 26—28. *Trifurcula* (*Ectoedemia*) *terebinthivora* Klim. 26: Minen an *Pistacia terebinthus* L.; Anatolia, Kanlidivane (Mersin), 31.v.1970; 27: ♂ Kopulationsapparat, GU/Kli-1137, dieselben Daten, ex l. 30.vi.1970; 28: ♀ Kopulationsapparat, GU/Kli-1138, dieselben Daten. Fig. 29—30. *T.* (*E.*) *groschkei* (Skala). 29: Minen an *Vitex agnus-castus* L., Rhodos, Kremasti, 3.ix.1973; 30; ♂ Imago, Italia, Liguria, Quiliano (Savona), ex l. 5.v.1945, *Vitex agnus-castus* L.

Kremasti, an Straßenrändern, in trockenen Bachbetten und an Ufern sowie in der Nähe des Meeresstrandes an *Vitex agnus-castus*, Ende August bis Oktober, meist verlassene Minen. Aus den wahllos eingetragenen Blättern, die feucht gehalten wurden, entwickelten sich in der Folge im Laufe von 8—10 Tagen einzelne Minen. Ein Teil der Imagines entwickelte sich noch im September, während die Mehrzahl der Kokons überwinterte.

Die Mine (Fig. 29) beginnt als zarter Gang aus einem wahrscheinlich unterseits abgelegtem Ei; sie zeigt eine unterbrochene schwarze Kotlinie, die die Ränder freiläßt. In der zweiten Phase entwickelt sie sich zu einem rundlichen Platz, meist zwischen Mittelrippe und Blattrand, seltener in der Blattspitze. Die Kotablage ist hier zentral, entweder wolkig aufgelockert oder kompakt. In dickeren Blättern ist die Mine häufig unterseitig, sonst beiderseitig. Die blaßgrünliche Raupe mit hellbrauner Kopfkapsel verläßt die Mine stets durch einen Schlitz auf der Blattunterseite. Kokon rund bis schwach oval, olivbräunlich. Mehrbrütig.

Die Imagines sind etwas kleiner als solche von Italien (Ligurien, Quiliano-Savona) (Fig. 30, 31) und etwas weniger deutlich gezeichnet. In den Genitalien (Fig. 32, 33, 34) stimmen jedoch beide Populationen überein. Die systematische Stellung der Art ist noch etwas unsicher. Auffällig ist beim ♀ das Fehlen einer wabenförmigen Struktur der ovalen, randgekerbten Sigma (Fig. 34).

Verbreitung: Bisher wurde *T. groschkei* in Sizilien (Locus classicus), Ligurien, Dalmatien, Albanien, Griech. Mazedonien und Peloponnes festgestellt. Vergeblich suchte nach ihr Verfasser in der Schlucht des Torrente de Parreis auf Mallorca (Balearen) und bei Port Bou; an beiden Stellen kommt die Futterpflanze häufig vor. Es könnte sich demnach um eine ostmediterrane Art handeln.

Trifurcula (Weberina) platani (Müller-Rutz, 1934) comb. nov.
(Fig. 35)

Weberina platani Müller-Rutz, 1934: 122—123; 1936: 672. Klimesch, 1940: 191—192.
Niepeltia platani; Hering, 1957: 789.

Rhodos, Stadtgebiet, einzelne verlassene Minen an *Platanus orientalis* L., Oktober 1971. Petaloudes, 28.viii.1973, verlassene Minen, darunter nicht selten auch solche mit zarter Kotlinie. Funtukli, 19.x.1971, einzelne leere Minen, alle an *Platanus orientalis* L.

Aus dem unterseitig abgelegten Ei entwickelt sich eine meist sehr stark gewundene Gangmine. Kotablage in Halbkreisbögen, zuerst dunkelgrün, dann dunkelbraun nachdunkelnd, den Gang ganz erfüllend (Fig. 35a), an gleiche Erscheinungen wie bei *N. aceris* Frey an *Acer*-Arten erinnernd. Nicht selten wurden aber auch Minen mit sehr zarter Kotlinie, sich oft in ihren stark gewundenen Verlauf kreuzend, gefunden (Fig. 35b). Auch hier befindet sich die Eischale auf der Blattunterseite. Selten wurde eine vollständige Entwicklung der Mine im Schwammparenchym festgestellt. In allen Fällen verläßt aber die Raupe das Blatt durch einen Schlitz in der Blattoberseite. Hering (1957) zieht die Mine mit zarter Kotspur zu einer noch unbeschriebenen Art. Zur Bestätigung dieser Ansicht wären Imagines aus Zuchten notwendig.

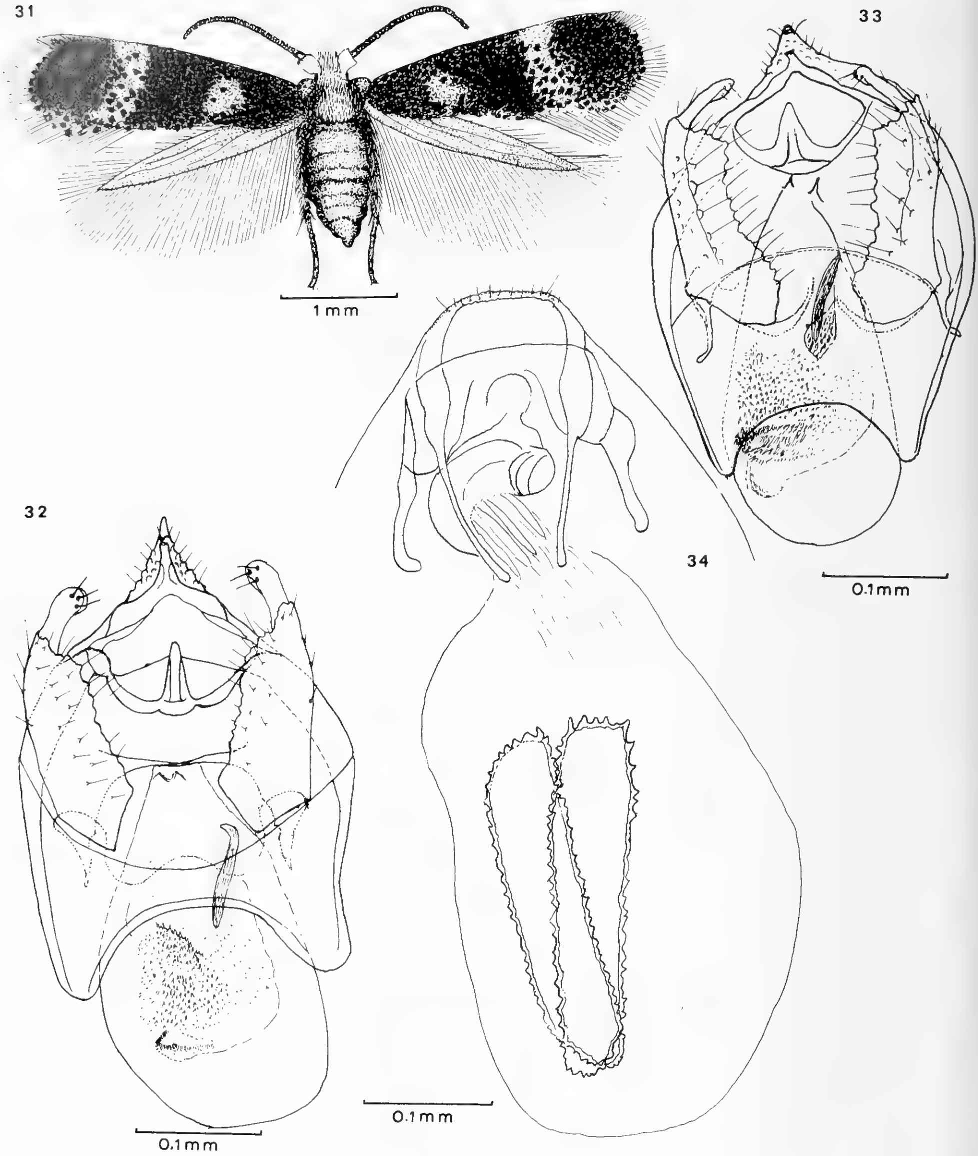

Fig. 31—34. *Trifurcula* (*Ectoedemia*) *groschkei* (Skala). 31: ♀ Imago, Italia, Liguria, Quiliano (Savona), 5—20.v.1945; 32: ♂ Kopulationsapparat, GU/Kli-211, dieselben Daten, ex l. v.1945; 33: ♂ Kopulationsapparat, GU/Kli-4132, Rhodos, Lindos, ex l. 22.ix.1977; 34: ♀ Kopulationsapparat, GU/Kli-1317, Italia, Liguria, Quiliano (Savona), ex l. 16.ix.1944; alle auf *Vitex agnus-castus* L.

Eine mediterrane Art, die auch noch im südlichen Mitteleuropa (Tessin und Trentino) vorkommt.

35 b 35 a

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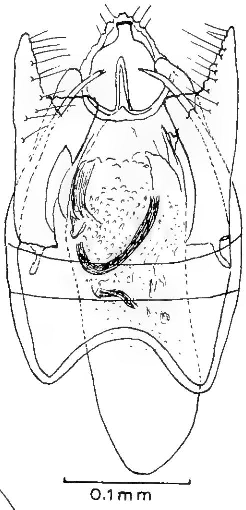

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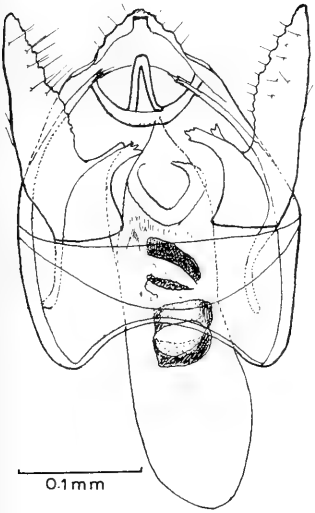

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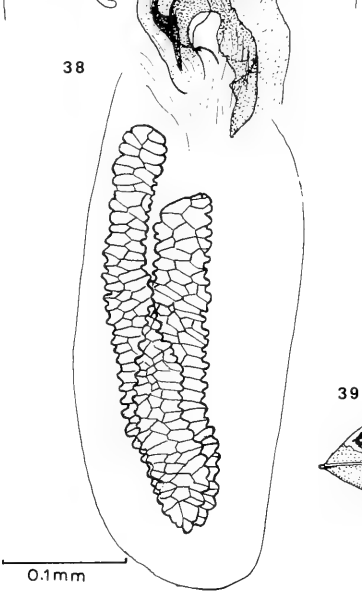

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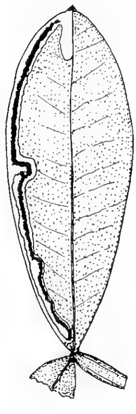

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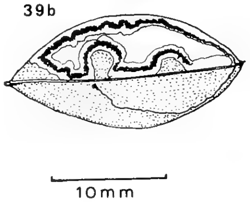


Fig. 35a, b. *Trifurcula* (*Weberina*) *platani* (M.R.), Minen an *Platanus orientalis* L., Rhodos, Petaloudes, 28.viii.1973. Fig. 36—39. *T.* (*W.*) *minimella* (Rbl.). 36: ♂ Kopulationsapparat, GU/Kli-4108, Rhodos, Rodini, ex l. 8.xi.1972; 37: ♂ Kopulationsapparat, Mallorca, Palma Nova, ex l. 7.ix.1968; 38: ♀ Kopulationsapparat, GU/Kli-1312, Rhodos, Rodini, ex l. 27.x.1972; 39b: Minen, Rhodos, Rodini, 22.ix.1972; alle auf *Pistacia lentiscus* L.

Trifurcula (Weberina) minimella (Rebel, 1926) comb. nov.
(Fig. 36—39)

Nepticula minimella Rebel, 1926: (106)—(110).
Nepticula species; Klimesch, 1942: 396.
Weberina lentiscella Groschke, 1944: 115—117.
Niepeltia lentiscella; Hering, 1957: 781.

Rhodos, Rodini, zahlreiche Minen, darunter mehrere besetzte, an *Pistacia lentiscus* L.-Büschen an durch Trockenmauern geschützten Stellen, 22.ix.1972; Imagines daraus 27.x—8.xi.1972 (5 ♂, 6 ♀).

Aus dem oberseitig abgelegten Ei entwickelt sich die sehr charakteristische Mine als fadendünner Gang, meist am Blattrand oder diesem zustrebend, mit mehr oder wenigen Windungen. Später erfolgt die Kotablage in einer sehr breiten, kompakten Spur, die nur geringe Ränder freiläßt (Fig. 39a und 39b).

Die Imagines von Rhodos sind durchwegs kleiner als solche von den Balearen (Mallorca): 4.25 mm zu 5 mm Flügelspannung; auch sind sie dunkler getönt, besonders die ♀. Dies gilt auch für die Duftschuppen auf den Hinterflügeln des ♂, die bei den rhodischen Tieren dunkler braun gegen hell rostfarben bei den mallorquinischen erscheinen. Noch auffallender sind Verschiedenheiten in den Genitalien (bes. beim ♂) von Tieren beider Gebiete: männliche rhodische Stücke weisen am Ventralrand der Valven bei ⅓ (Fig. 36) einen kräftigen Vorsprung auf, bei mallorquinischen Exemplaren ist dagegen bei ¾ ein fingerförmiger, gezähnter Fortsatz vorhanden (Fig. 37). Auch die Bewehrung des Aedoeagus ist bei beiden Formen einigermaßen verschieden: bei der rhodischen sind zahlreiche kleine höckerartige Cornuti und zwei grössere, stabförmige, etwas gebogene sichtbar, während die mallorquinische in der Hauptsache zwei Cornutalplatten besitzt. Der weibliche Kopulationsapparat der rhodischen Form (Fig. 38) weist in der Struktur der Signa reticulata der Bursa copulatrix kleinere und gestrecktere Wabenzellen auf als bei der mallorquinischen Form.

Auf Grund dieser Feststellungen dürfte man bei der Form von Rhodos zumindest eine Subspecies der *T. minimella* Rbl. annehmen können. *Trifurcula* (*Weberina*) *minimella* wurde von Rebel (1926) auf Grund eines von Nowak bei Sucurac (Dalmatien) gefangenen ♂ beschrieben. Die Etikette des betr. Tieres lautet “Sucurac, 9.23, Nowak”. Dieses Stück (Holotypus) wurde anatomisch untersucht (GU/Kli-446a in Coll. Mus. Vind.) und völlige Übereinstimmung mit der Form von Mallorca festgestellt. Bedauerlicherweise ist das Typenmaterial der *Weberina lentiscella* Groschke nach einer Mitteilung des Museums für Naturkunde in Stuttgart, wo Groschkes Sammlung aufbewahrt war, verschollen. Groschke hat aber Minen, die vom Verfasser bei Zaton-Gruž (Dalmatien) an *Pistacia lentiscus* L. gesammelt wurden (Klimesch, 1942) als zu seiner *Weberina lentiscella* gehörig anerkannt (Groschke, 1944). Aus mit diesen übereinstimmenden, auf Mallorca gesammelten Minen erhielt Verfasser Imagines, auf die die Beschreibung Groschkes (1944) in allen Punkten paßt, die genitaliter auch der *W. minimella* Rbl. entsprechen und daher nichts mit jenen von Rhodos zu tun haben. Es kann somit daraus mit Sicherheit die Synonymie der *Weberina lentiscella* Groschke mit *W. minimella* Rebel gefolgert werden.

Daher wurde aus dem mallorquinischen Material ein Neotypus (♂) und ein Paratypus (♀) ausgewählt. Das betreffende Typenmaterial trägt folgende Bezettelung: "♂ Ins. Baleares, Mallorca, Palma Nova, ex l. 26.6.1968, Mine an *Pistacia lentiscus,* 10.3.1968, Zucht No. 972, J. Klimesch". ♀ die gleichen Daten, aber mit Schlüpftag der Imago "25.8.1968".

Über die Generationen der Rhodos-Form läßt sich mangels entsprechender Beobachtungen nichts aussagen. Das durch Zucht erzielte Imagines-Material entwickelte sich im Verlaufe von 4—5 Wochen, während die am 10—12.iii.1968 auf Mallorca eingesammelten Raupen die Falter von Ende April bis Ende August 1968 ergaben.

NEUBESCHREIBUNGEN

Nepticula macrolepidella spec. nov.

(Fig. 40—45)

In die *ruficapitella* Hw.-Gruppe gehörig, von allen europäischen Arten aber äußerlich auffällig verschieden.

Fühler beim ♂ bis fast 3/4 der Vorderflügellänge reichend, gelblichgrau bis graubraun, die einzelnen Glieder nicht deutlich hervortretend, beim ♀ kürzer, etwas über 1/2. Augendeckel groß, weiß.

Kopfhaare bei beiden Geschlechtern im Gesicht hellgelblich bis bräunlich, im Nacken dunkelbraun bis schwarz. Nackenschöpfe gelblichweiß, beim ♀ zuweilen dunkelbraun. Maxillarpalpen lang, hellgelblich; Labialpalpen kürzer. Thorax und Abdomen gelblichgrau, die Tegulae gelblich, mehr oder weniger stark von schwarzen Schuppen bedeckt. Beine hellgelb, beim ♂ die Tarsen des 3. Beinpaares grau gefleckt.

Feinschuppig. Expansion 4—4.5 mm. Vorderflügel-Grundfarbe hellgelb, stellenweise dicht mit schwarzbraunen Schuppen bedeckt. Die Grundfarbe tritt an der Basis, am Vorderrand und in einem Streifen am Innenrand nach der Mitte ungetrübt hervor. Die restlichen Teile der Vorderflügel sind mehr oder minder stark schwarzbraun beschuppt (Fig. 40—41). Seltener kommen stärker verdunkelte Stücke — bei beiden Geschlechtern — vor, stets aber bleibt an der Basis, am Vorder- und Innenrand eine gelbliche Aufhellung. Vorderflügelfransen gelblichgrau, nicht scharf vom Flügelgrund abgesetzt, um den Tornus am Innenrand dunkler grau. Hinterflügel grau mit hellgrauen Fransen.

Kopulationsapparat. Das männliche Genitale zeigt die typische Bauart der *ruficapitella*-Gruppe (Fig. 42). Vinculum anal flach ausgeschnitten. Uncus doppelzackig, median flach gekerbt. Gnathosäste voneinander getrennt. Valven mit gerade verlaufendem Ventralrand, distal mit zwei einwärts gekrümmten, spitzen Vorsprüngen, von denen der untere kräftig ausgebildet ist. Aedoeagus sehr kräftig, mit zahlreichen Cornuti, die lateral von kürzeren, kleineren begleitet werden. Charakteristisch sind vier sehr große, bis zur halben Länge des Aedoeagus reichende Cornuti im unteren Teil.

Beim Weibchen (Fig. 43) sind die vorderen Gonapophysen gestreckt, am

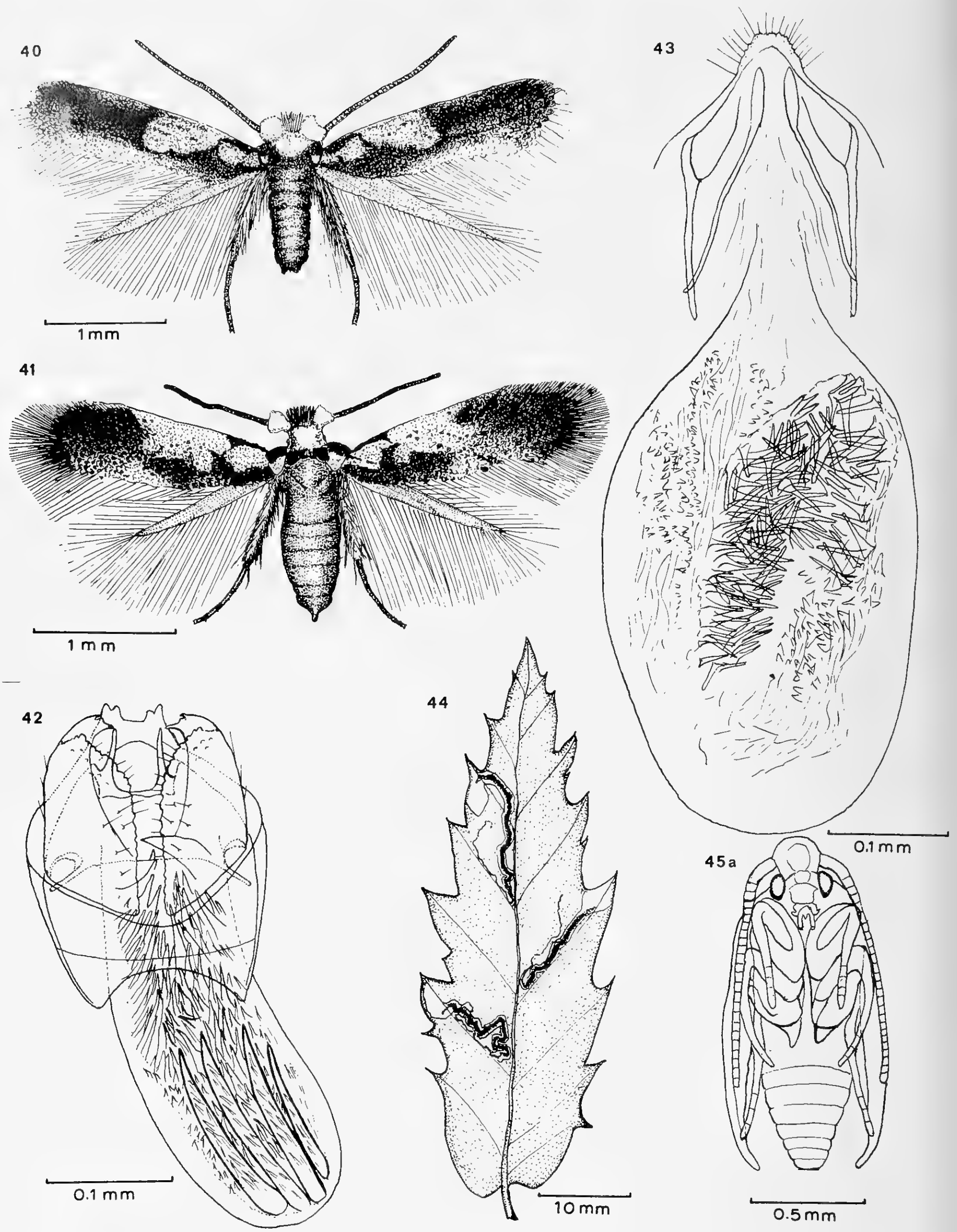


Fig. 40—45a. *Nepticula macrolepidella* spec. nov. 40: ♂ Imago, Rhodos, Kremasti, ex l. 24.ix.1973, *Quercus macrolepis* Kotschy; 41: ♀ Imago, dieselben Daten, ex l. 17.ix.1973; 42: ♂ Kopulationsapparat, GU/Kli-1304, dieselben Daten, ex l. 20.ix.1973; 43: ♀ Kopulationsapparat, GU/Kli-1300, Rhodos, Rodini, ex l. 11.x.1972, *Quercus macrolepis* Kotschy; 44: Minen an *Q. macrolepis* Kotschy, Rhodos, Rodini, 22.ix.1972; 45a: ♂ Puppe in Ventralansicht, aus Zucht, Rhodos, Kremasti, ix.1973, *Q. macrolepis* Kotschy.

oberen Ende verbreitert, die hinteren stabförmig. Das Signum der Bursa copulatrix besteht aus einer nach innen gerichteten, im oberen Abschnitt gebogenen Reihe kräftiger Stacheln. Lateral befinden sich außerdem kleinere Felder von kurzen Stacheln und Höckern.

Die neue Art weist keine näheren Beziehungen zu den übrigen Arten der *ruficapitella*-Gruppe auf.

Futterpflanze: *Quercus macrolepis* Kotschy (= *aegilops* L.).

Mine. Aus dem oberseitig abgelegten Ei entwickelt sich eine beiderseitige Gangmine, die zuerst mit kompakt abgelagertem Kot ganz erfüllt ist. Später lockert sich die Kotspur auf und läßt mehr oder minder breite Ränder in der Mine frei. Die Mine erinnert (Fig. 44) sehr an die der *ruficapitella*-Gruppe. Meist e twickeln sich nur einzelne Minen im Blatt. An einem völlig verstaubten *Quercus macrolepis*-Strauch an einem Straßenrand bei Kremasti (Rhodos) konnte ein Massenvorkommen der Mine anfangs September 1973 beobachtet werden. In den einzelnen, ganz vom Straßenstaub bedeckten Blättern konnten mindestens 5—10 Minen festgestellt werden. Bei entsprechender Feuchthaltung entwickelten sich in den folgenden Tagen noch weitere Minen!

Raupe hellgelb, Kopfkapsel braun. Kokon sehr zart, durchscheinend, hellgelb, oval.

Puppe (Fig. 45) der Bauart der Pupa libera, also mit frei beweglichen Gliedmaßen angehörend; sie ist flach mit deutlich sichtbaren Maxillarpalpen und Coxen. Stigmen vom 1. Hinterleibssegment bis zum 5. Dorsal ab dem 3. Abdominalsegment je 16 kurze, kleine, in Reihen angeordnete Dornen.

Der Beschreibung liegen 111 Imagines zu Grunde, die folgende Bezettelung tragen: 68 ♂, 41 ♀ = "Mine an *Quercus macrolepis,* 3.9.1973, Zucht Nr. 1084, Rhodos, Kremasti, ex 1. 15.—26.9.1973, J. Klimesch". Der Holo- und ein Paratypus tragen folgende Etiketten: "Mine an *Quercus macrolepis,* 22.9.1972, Zucht Nr. 1054, Rhodos, Rodini, ex 1. 15.10.1972".

Nepticula embonella spec. nov.
(Fig. 46, 47, 49)

In die *oxyacanthella*-Gruppe gehörig, der *N. pyri* Glitz zunächst verwandt.

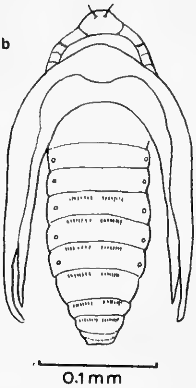
Fühler schwarzbraun, beim ♂ bis ½ der Vorderflügellänge reichend, beim ♀ etwas kürzer. Maxillarpalpen gelblich, ebenso die kürzeren Labialpalpen.

Kopfhaare bei beiden Geschlechtern von rostfarben bis dunkelbraun und schwarz variierend, Nackenschöpfe hellbraun. Augendeckel gelblichweiß. Thorax und Abdomen dunkelgrau, unterseits heller. Beine hellgrau.

Eine kleine Art: Expansion 2.5—3 mm. Glattschuppig. Vorderflügel einfarbig dunkelgraubraun mit mattem Glanz. Fransen dunkelgrau, um den Apex heller mit licht glänzenden Enden. Hinterflügel grau mit helleren Fransen, die am Innenrand dunkler erscheinen. Unterseite aller Flügel grau.

Kopulationsapparat. Männchen (Fig. 46): Vinculum relativ schmal, flach ausgeschnitten. Valven mit bauchig verlaufendem Ventralrand und einem

45b



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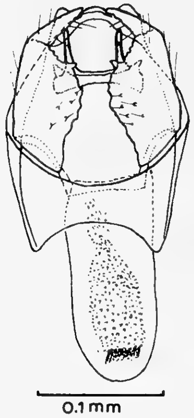

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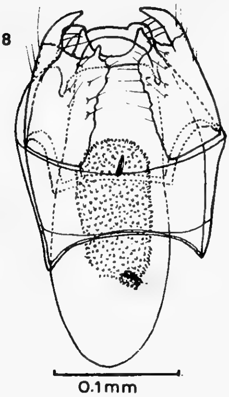

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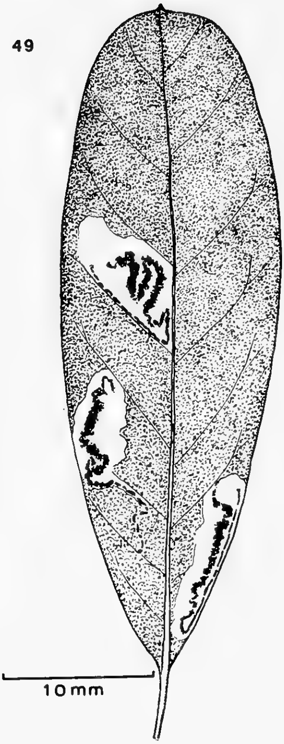

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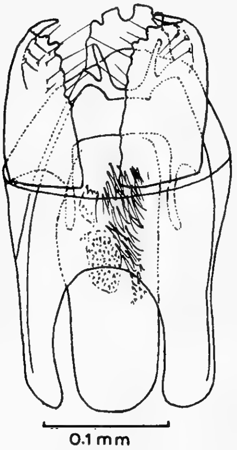

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Fig. 45b. *Nepticula macrolepidella* spec. nov., ♂ Puppe in Dorsalansicht, aus Zucht, Rhodos, Kremasti, ix.1973, *Q. macrolepis* Kotschy. Fig. 46—47, 49. *N. embonella* spec. nov. 46: ♂ Kopulationsapparat, GU/Kli-1307, Rhodos, Embonas, ex l. 13.ix.1973, *Pyrus spinosa* Forsk.; 47: ♀ Kopulationsapparat, GU/Kli-4103, dieselben Daten, ex l. 20.iii.1974; 49: Minen an *Pyrus spinosa* Forsk., selben Fundort, 29.viii.1973. Fig. 48. *N. pyri* Glitz. ♂ Kopulationsapparat, GU/Kli-1249, Austria sup., Umg. v. Linz, ex l. 14.ix.1935, *Pyrus communis* agg. Fig. 50—51. *N. azaroli* spec. nov. 50: ♂ Kopulationsapparat, GU/Kli-1262, Anatolia, NW-Ende d. Beysehir gölü, 14.vi.1966; 51: ♀ Kopulationsapparat, GU/Kli-4102, Rhodos, Mt. Smith, ex l. 18.ix.1973; beide an *Crataegus azarolus* L.

zahnartigen Vorsprung im oberen Teil sowie einem fingerartigen Fortsatz im apicalen Bereich. Gnathos mit zwei distalen Ästen. Aedoeagus mit einer Gruppe verstreuter kleiner Cornuti und einem Cornutalfeld.

Weibchen (Fig. 47). Gonapophysen von der üblichen Bauart: die vorderen flächig verbreitert, die hinteren stabförmig. Die schwach sklerotisierte Bursa copulatrix weist kein Signum auf.

Die zunächst stehende *Nepticula pyri* Glitz ist größer (4.5—5 mm) und viel stärker, kupferig, glänzend.

Im männlichen Kopulationsapparat zeigt *N. pyri* vor allem Unterschiede im Gnathos, deren Äste hier kürzer und in der Basis breiter sind (Fig. 48). Im Aedoeagus ist die Zahl der verstreuten Cornuti größer, das Cornutalfeld kleiner.

Die Richtigkeit der Bestimmung der hier zum Vergleich mit der neuen Art herangezogenen *Nepticula pyri* Glitz-Stücke wurde von Herrn Roland Johansson durch Überprüfung und Vergleich mit *pyri*-Originalen in dankenswerter Weise bestätigt.

Futterpflanze: *Pyrus spinosa* Forsk. (= *amygdaliformis* Vill.). Aus dem meist unterseitig, seltener oberseitig abgelegten Ei entwickelt sich eine wenig gewundene, eine unterbrochene Kotspur aufweisende Gangmine, die sich in der zweiten Phase platzartig verbreitert und nun eine breite, aufgelockerte Kotlinie zeigt. Raupe grün mit hellbrauner Kopfkapsel. Kokon oval, von fester Konsistenz, dunkelbraun.

Bei der Zucht der Ende August 1973 eingetragenen Raupen schlüpften die Imagines bereits nach 8—10 Tagen, ein kleiner Teil entwickelte sich jedoch erst nach der Überwinterung im April 1974. Die Art ist sicher mehrbrütig. Fundorte: Buschwaldgebiete und Straßenränder bei Embonas, Lindos, Trianta auf Rhodos.

Bereits früher wurden anderwärts von der neuen Art meist leere Minen, nur einzeln aber besetzte gefunden. Es wurden keine Imagines erzielt. Hering hielt die Minen als zu *Nepticula minusculella* H.-S. gehörig. Folgende Fundorte wurden registriert: Mazedonien (Drenovo-Kavadarci, Stari Dojran, Ohrid-Sv. Stephan), Anatolien (Manisa). Der Beschreibung liegen 60 Exemplare zugrunde; sie tragen folgende Bezettelung: "Mine an *Pyrus spinosa,* 29.8.1973, Zucht Nr. 1078, ex 1. 10.—20.9.1973 und ex 1. 20.2.—20.3.1974, Rhodos, Embonas, J. Klimesch". Der Holotypus und die Paratypen wurden als solche unter diesem Material gekennzeichnet.

Nepticula azaroli spec. nov.

(Fig. 50, 51, 53)

In die *pomella*-Gruppe gehörig, der *N. pygmaeella* Hw. zunächst stehend.

Fühler dunkelgrau, beim ♂ etwas über 1/2 der Vorderflügellänge reichend, beim ♀ bis 1/2. Maxillarpalpen gelblich, ebenso die kürzeren Labialpalpen. Kopfhaare bei beiden Geschlechtern hell rostfarben, Nackenschöpfe lichter. Augendeckel gelblichweiß.

Thorax und Hinterleib dunkelgrau, unterseits hellgrau, glänzend. Beine grau, unterseits gelblichgrau.

Expansion 3—4 mm. Glattschuppig. Vorderflügel einfarbig dunkel aschgrau,

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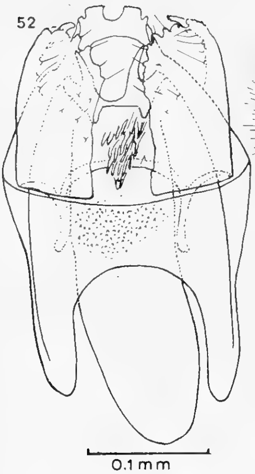

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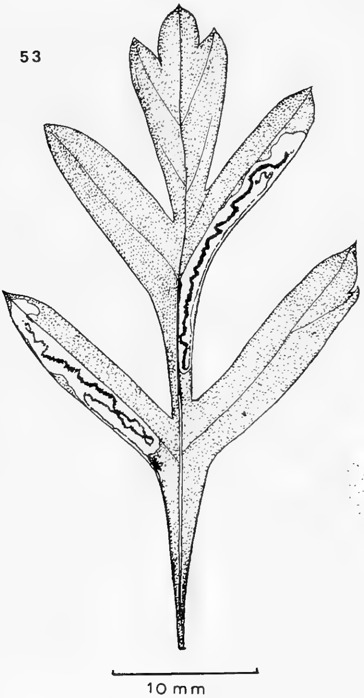

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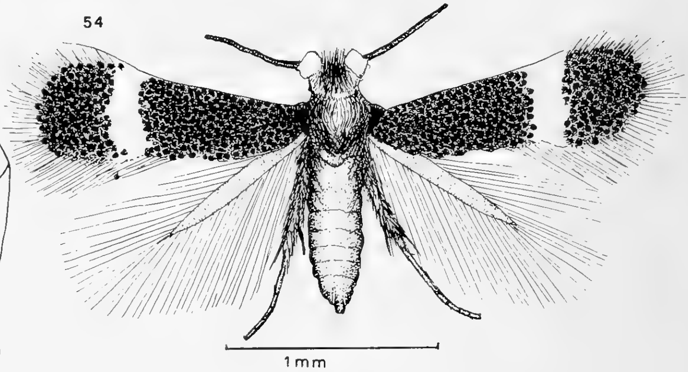

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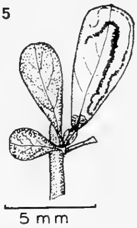

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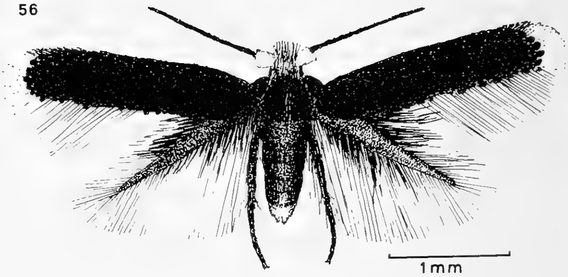

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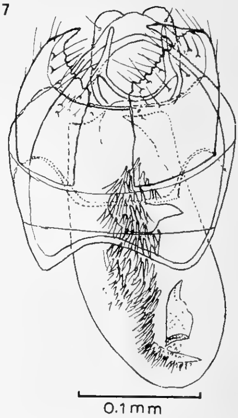

Fig. 52. *Nepticula pygmaeella* Hw., ♂ Kopulationsapparat, GU/Kli-1261, Austria inf., Dürnstein, ex l. 25.iii.1936, *Crataegus oxyacantha* L. Fig. 53. *N. azaroli* spec. nov. Mine an *Crataegus azarolus* L., Rhodos, Rodini, 4.ix.1973. Fig. 54—55. *N. pyrellicola* spec. nov. 54: ♀ Imago, Anatolia, Mut (Mersin), ex l. 19.vi.1966, *Rhamnus pyrellus* O. Schwarz; 55: Mine an *R. pyrellus* O.S., dieselben Daten, 6.vi.1966. Fig. 56—57. *N. amygdali* spec. nov. 56: ♂ Imago, Rhodos, Lindos, *Prunus dulcis* D. A. Webb, ex. l. 28.vi.1976; 57: ♂ Kopulationsapparat, GU/Kli-4121, dieselben Daten, ex l. 14.vii.1976.

matt glänzend. Fransen dunkelgrau, nicht vom Flügelgrund abgesetzt. Hinterflügel grau mit ebensolchen Fransen. Unterseite aller Flügel einfarbig grau.

Kopulationsapparat. Männchen (Fig. 50). Vinculum tief ausgeschnitten. Ventralrand der Valven fast gerade verlaufend, apical mit kurzem, nach innen gerichteten fingerförmigen Fortsatz. Uncus median ausgeschnitten, mit zwei lateralen Kerben. Aedoeagus mit drei Reihen kräftiger Cornuti und einer Cornutalplatte bewehrt.

Weibchen (Fig. 51). Die vorderen Gonapophysen flächig verbreitert, die hinteren stabförmig. Das Vestibulum bauchig erweitert. Die Bursa copulatrix verhältnismäßig klein, schwach sklerotisiert, ohne Signum oder sonstige erkennbare Struktur der Bursawand.

Nepticula azaroli steht der an *Crataegus oxyacantha* und *C. monogyna* lebenden *N. pygmaeella* Hw. sehr nahe, *N. pygmaeella* ist aber größer und robuster (Expansion 4.5—5.5 mm), hat dunkelbraune, matt violett schimmernde Vorderflügel und heller rostfarbene Kopfhaare.

Im männlichen Genitale fallen vor allem Unterschiede im lateralen Bereich des Uncus auf; dieser ist bei *azaroli* durch gerundete Höcker ausgezeichnet, bei *pygmaeella* (Fig. 52) sind diese deutlich mehr zugespitzt. Die Cornuti des Aedoeagus scheinen bei *pygmaeella* zahlreicher vorhanden zu sein als bei *azaroli*. Beim ♀ (Fig. 51) sind nach Johansson bei *azaroli* die vorderen Gonapophysen breiter, das Vestibulum erscheint stärker ausgebaucht als bei *azaroli*. Beiden Arten fehlt ein Signum, auch zeigt die Bursawand keine erkennbaren Strukturen.

Futterpflanze: *Crataegus azarolus* L. Die Mine beginnt häufig an einer Rippe aus einem unterseitig abgelegten Ei, meist an der Mittelrippe, zuerst als zarter mit schwarzem Kot ganz erfüllter Gang, dann platzartig verbreitert mit zentraler, aufgelockerter Kotlinie. Der Kot füllt hier die Mine nur zu 1/3—1/4 aus (Fig. 53).

Raupe hellgelb, Kopfkapsel braun, Kokon oval, flach, glatt, braun.

Fundorte. Anatolia, Mut (Mersin), einzelne besetzte Minen, 6.vi.1966, Imago daraus 20.vi.1966; NW-Ende des Beysehir gölü (Isparta), 1100 m, Minen 14.vi.1966, ex l. 29.vi.1966. Rhodos, Rodini, und Mt. Smith, nahe der Akropolis, Mitte Mai 1974 einzelne Minen, häufig dagegen im September 1972 und 1973. Aus letzteren wurden zahlreiche Imagines erzielt, die sich nach einer ca 10-tägigen Puppenruhe ausnahmslos noch im Herbst entwickelten, zu einer Zeit in der die Futterpflanze bereits ihr Laub abgeworfen hatte. Dies legt die Vermutung nahe, daß die ♀ der Herbstgeneration die Eiablage an den Knospen der Futterpflanze vollziehen dürften. Eine Überwinterung der Imagines erscheint wohl wenig wahrscheinlich. Ein Hochzeitsflug der Art wurde am 18.vi.1966 am NW-Ende des Beysehir gölü (Anatolien) bei Sonnenaufgang beobachtet: zahlreiche ♂ schwärmten bei völliger Windstille knapp über dem *Crataegus azarolus*-Gebüsch. Beim Lichtfang, der in nächster Nähe dieser Büsche ausgeführt wurde, erschienen niemals Imagines an der Leinwand.

Der Holotypus sowie der Paratypus und weitere Paratypen wurden unter den 88 Exemplaren der Zuchten ausgewählt. Die Tiere tragen folgende Bezettelung: "Mine an *Crataegus azarolus*, Zucht Nr. 1052, 22.9.1972, Rhodos, Rodini, ex l. 10.—11.10.1972 (4 ♂, 4 ♀)"; sowie "Zucht 1085, Mine 4.9.1973, *Crataegus azarolus*, Rhodos, Akropolis, ex l. 18.—30.9.1973 (34 ♂, 44 ♀), J. Klimesch."

Nepticula pyrellicola spec. nov.

(Fig. 54, 55)

Eine kleine, in die Verwandtschaft der *Nepticula crenulatae* Klim. gehörige Art. Da nur 2 ♀ vorliegen, ist die Beschreibung der Art als vorläufig zu werten.

Fühler bis 1/2 der Vorderflügellänge reichend, dunkelgrau, schwach geringt. Kopfhaare hell rostgelb, Nackenschöpfe weißlich. Augendeckel weiß. Maxillarpalpen weißlich wie auch die kleineren Labialpalpen.

Thorax und Hinterleib grau, unterseits etwas heller. Die gleiche Färbung weisen auch die Beine auf; die Hinterschienen und die Hintertarsen weißlich geringt.

Expansion 3 mm. Grobschuppig. Grundfarbe der Vorderflügel grau, dicht mit schwarzgrauen Schuppen bedeckt, nach 1/2 der Vorderflügellänge mit einer breiten, weißen median etwas eingeengten Querbinde. Fransen hellgrau, vom Flügelgrunde scharf abgesetzt, im Apex weißlichgrau, im Tornus am Innenrand dunkelgrau. Unterseite der Vorderflügel einfarbig dunkelgrau, am Innenrand etwas aufgehellt (Fig. 54). Die ähnliche *N. crenulatae* Klim. ist wesentlich dunkler und besitzt eine schmälere, matt silbern glänzende Querbinde.

Nepticula pyrellicola gehört in die Gruppe der an *Rhamnus*-Arten lebenden Species (*N. catharticella* Stt., *N. rhamnella* H.-S., *alaternella* Le Md.). Die Feststellung ihrer nächsten Verwandtschaft wird erst nach anatomischer Untersuchung des noch unbekannten ♂ möglich sein.

Futterpflanze: *Rhamnus pyrellus* O. Schwarz.

Mine. Aus dem unterseits abgelegten Blatt entwickelt sich die Mine zuerst oberseitig, anfangs sehr schwer erkennbar, meist am Blattrand, seltener in der Blattspreite, in grösseren Blättern erst im Endabschnitt stark gewunden. In kleineren Blättern nimmt die beiderseitige Mine die Blattfläche in mehreren Windungen fast ganz ein (Fig. 55). Kokon zart, weißlich.

Die Minen wurden zahlreich, doch nur zwei von Raupen besetzt, in der Ebene von Mut (Mersin, Anatolien) am 6.vi.1966 auf fast sterilem Boden, auf dem die Futterpflanze verstreut vorkommt, gefunden. Aus der Zucht (Nr. 890) schlüpften am 19. und 20.vi.1966 je ein ♀, die als Holo- und Paratypus der Beschreibung zugrunde gelegt wurden.

Nepticula amygdali spec. nov.

(Fig. 56—59)

In die *N. anomalella* Goeze-Gruppe gehörig.

Fühler schwarz, beim ♂ etwas über 1/2 der Vorderflügellänge reichend, beim ♀ bis 1/2. Maxillarpalpen gelblichweiß. Kopfhaare bei beiden Geschlechtern hell rostfarben. Nackenschöpfe weiß, ebenso die Augendeckel.

Thorax und Abdomen schwarz, Analende bei beiden Geschlechtern gelblich. Beine hellgrau, unterseits gelblichgrau, die Tarsen des 3. Beinpaares dunkel gefleckt.

Expansion: 3.5—4 mm. Grobschuppig. Vorderflügel-Grundfarbe bei beiden Geschlechtern dunkelgrau, dicht mit schwarzen Schuppen bedeckt, lediglich im Außenfeld und am Tornus ist die Grundfarbe noch schwach erkennbar. Fransen

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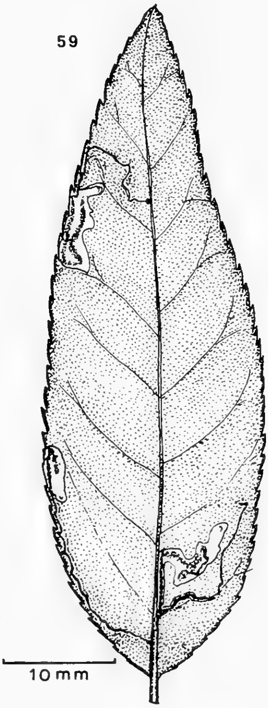

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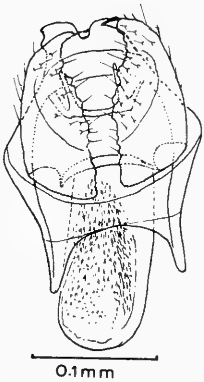

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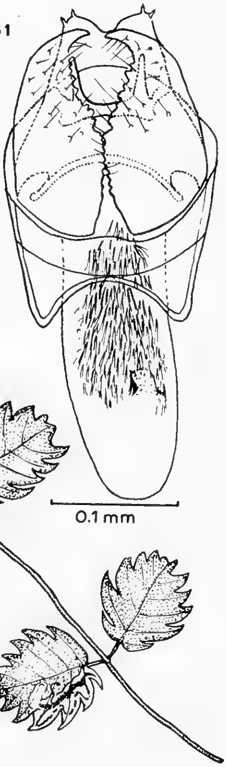

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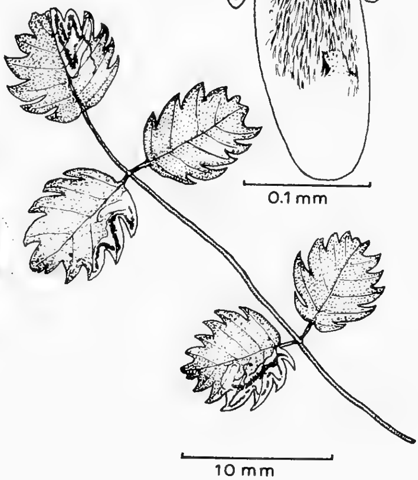

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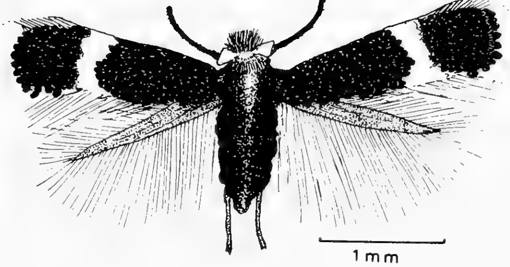


Fig. 58—59. *Nepticula amygdali* spec. nov. 58: ♀ Kopulationsapparat, GU/Kli-4128, Rhodos, Treas, *Prunus dulcis* D.A. Webb, ex l. 4.x.1977; 59: Minen an *P. dulcis* D.A.W., Rhodos, Lindos, 6. vi.1976. Fig. 60, 62. *N. muricatella* spec. nov. 60: ♂ Kopulationsapparat, GU/Kli-1321, Anatolia, Meram b. Konya, *Sanguisorba muricata* (Spach) Focke, ex l. 2.vii.1966; 62: Minen an *S. muricata* (S.) F., selben Fundort, 12.vi.1966. Fig. 61. *N. thuringiaca* Petry, ♂ Kopulationsapparat, GU/Kli-1246, Austria inf., Dürnstein, ex l. 17.iv.1936, *Potentilla verna* agg. Fig. 63. *N. styracicolella* spec. nov., ♀ Imago, Rhodos, Mt. Profitis Ilias, ex l. 25.iii.1973, *Styrax officinalis* L.

hellgrau, scharf vom Flügelgrund abgesetzt, im Tornus dunkelgrau. Hinterflügel bei beiden Geschlechtern dunkelgrau; beim ♂ treten am Vorder- und Innenrand bis ca. 1/2 der Flügellänge schwarze Duftschuppen auf. Fransen dunkelgrau, ebenso die Unterseite aller Flügel (Fig. 56).

Kopulationsapparat. Männchen (Fig. 57). Uncus flach ausgeschnitten, Gnathosäste von einander entfernt inseriert. Valven mit vortretendem Ventralrand. Vinculum schmal, flach ausgeschnitten. Aedoeagus mit einer dichten Reihe kräftiger Cornuti und einer Cornutalplatte bewehrt.

Weibchen (Fig. 58). Die Gonapophysen von der üblichen Bauart. An der Bursawand fällt eine körnige Struktur auf. Ein Signum fehlt.

Die systematische Stellung dieser isoliert stehenden Art ist derzeit noch unklar.

Futterpflanze: *Prunus dulcis* (Mill.) D. A. Webb (= *Amygdalus communis* L.).

Mine. Eiablage ober- oder unterseitig. Gangmine, vielfach unterseitig beginnend, fast immer an eine Blattader angelehnt verlaufend, Kotlinie unterbrochen, schwarz, den Gang fast vollständig ausfüllend. Die Mine ist daher in diesem Stadium schwer sichtbar. Im weiteren Verlauf ist die Mine vielfach gewunden mit aufgelockerter Kotlinie, die meist schmale Ränder freiläßt. Erst in diesem Stadium fällt die relativ kurze Mine auf. Die Raupe verläßt das Blatt auf der Blattoberseite (Fig. 59).

Raupe hellgelb mit deutlich grün durchscheinendem Rückengefäß; Kopfkapsel hellbraun. Kokon dünnhäutig, gelblichweiß.

Es können zumindest zwei Generationen angenommen werden. Besetzte Minen wurden im Juni und im September gefunden. Fundorte: Rhodos, Lindos, Treas, Salakos, Filerimos. Auf trockenen Steilhängen und an Rändern von Kulturzonen, meist an verwilderten Mandelbäumen.

Der Beschreibung liegen 55 Imagines (24 ♂, 31 ♀) zu Grunde; sie tragen folgende Daten: 22 ♂, 30 ♀ "Lindos, Minen 10.6.1976, Zucht Nr. 1144; 1 ♂ Lindos, Mine 5.6.1974, Zucht Nr. 1103, ex 1. 28.6.1974; 1 ♀ Filerimos, Mine 20.5.1976, ex 1. 24.6.1976". Aus dem Material von Lindos wurden der Holotypus und Paratypen ausgewählt.

Nepticula muricatella spec. nov.
(Fig. 60, 62)

In die Verwandtschaft von *N. thuringiaca* Petry gehörend.

Fühler beim ♂ etwas über 1/2 der Vorderflügellänge reichend, beim ♀ bis 1/2, grau, schwach heller geringt erscheinend. Kopfhaare gelblichbraun, beim ♂ etwas dunkler, grau getönt. Nackenschöpfe gelblich. Augendeckel weiß. Maxillarpalpen beim ♂ grau, beim ♀ gelblichweiß.

Thorax ockerbraun, Hinterleib graubraun, unterseits aufgehellt. Beine hellgrau, die Tarsenglieder des dritten Beinpaares leicht dunkler gefleckt.

Expansion: 4—4.75 mm. Glattschuppig. Vorderflügel bei beiden Geschlechtern einfarbig ockerbraun, beim ♂ manchmal etwas dunkler, grau getönt. Fransen hellgrau, nicht vom Flügelgrund abgesetzt. Hinterflügel grau, Fransen lichter.

Männlicher Kopulationsapparat (Fig. 60). Uncus gekerbt mit lateralen

Vorsprüngen. Gnathos mit zwei distanzierten Ästen. Verlauf des Ventralrandes der Valven gerade, apical mit einem einwärts gekrümmten Fortsatz. Transtillae kurz. Vinculum schmal, basal bogig ausgeschnitten. Aedoeagus mit zahlreichen kleinen Cornuti bewehrt.

Futterpflanze: *Sanguisorba muricata* (Spach) Focke.

Mine. Eiablage unterseitig. Gangmine, zuerst zart mit schwarzer, den Gang fast ganz ausfüllender Kotlinie, später stark verbreitert, dem Blattrand folgend und schließlich einen Teil der Blattspreite einnehmend mit kräftiger, etwas aufgelockerter Kotspur. Kleine Blätter werden vollständig ausgeweidet und lassen dann charakteristische Merkmale kaum mehr erkennen (Fig. 62). Zur Verwandlung verläßt die Raupe das Blatt auf der Oberseite. Raupe hellgelb, Kopfkapsel ebenso. Kokon zarthäutig, oval, hellbraun.

Die Minen wurden am 12.vi.1966 auf einem felsigen Standort an sehr geschützten Stellen zwischen vorspringenden Felsblöcken gefunden; die meisten Minen waren bereits verlassen, ebenso am 9.vii.1968 bei einem weiteren Besuch der Fundstelle: Meram bei Konya (Anatolien). Es wurden nach zweiwöchiger Puppenruhe 2 ♂ und 5 ♀ erzielt.

Die nahestehende *Nepticula thuringiaca* Petry ist etwas größer, robuster, dunkler, besonders im weiblichen Geschlecht, bei dem die Vorderflügel dunkelgrau-braun getönt sind. Das männliche Genitale der *N. thuringiaca* weist im apicalen Teil des flacher eingekerbten Uncus beiderseits je zwei zapfenartige Vorsprünge auf. Der kräftigere Aedoeagus besitzt dicht gestellte größere, dornenförmige Cornuti und eine Cornutalplatte (Fig. 61).

Das zur Beschreibung verwendete Material, aus dem der Holotypus und Paratypen ausgewählt wurden, weist folgende Bezettelung auf: 2 ♂ "ex l. 2.7.1966", 5 ♀ "ex l. 30.6., 1.7., 2.7.1966, Anatolia, Meram b. Konya, Mine 12.6.1966 an *Sanguisorba muricata,* Zucht Nr. 893".

Nepticula styracicolella spec. nov.

(Fig. 63, 64)

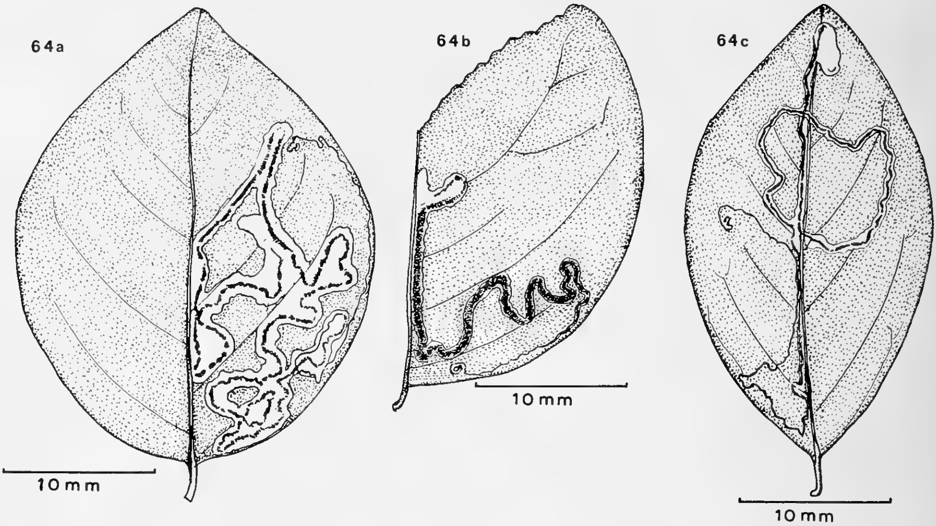
Da nur zwei ♀ vorliegen, kann über die systematische Stellung der neuen Art derzeit noch nichts ausgesagt werden.

Fühler nicht 1/2 der Vorderflügellänge erreichend, schwarz mit schwach hervortretenden Gliederenden. Kopfhaare hell rostfarbig, Nackenschöpfe hellgelb. Augendeckel gelblichweiß. Maxillarpalpen und Labialpalpen hellgelb.

Thorax und Hinterleib schwarz, metallisch glänzend, unterseits heller grau. Beine oberseits schwarz, unterseits heller, bräunlich.

Expansion: 4 mm. Grobschuppig. Vorderflügel schwarz, im basalen Teil mit metallischem, violetten Glanz, bei 3/4 der Vorderflügellänge eine schwach gebogene, stark metallisch glänzende, messingfarbene Querbinde. Fransen hellgrau, scharf vom Flügelgrund abgesetzt, um den Apex heller, weißlich, im Tornus dunkelgrau. Unterseite dunkelgrau. Hinterflügel grau mit ebensolchen Fransen.

Futterpflanze: *Styrax officinalis* L.



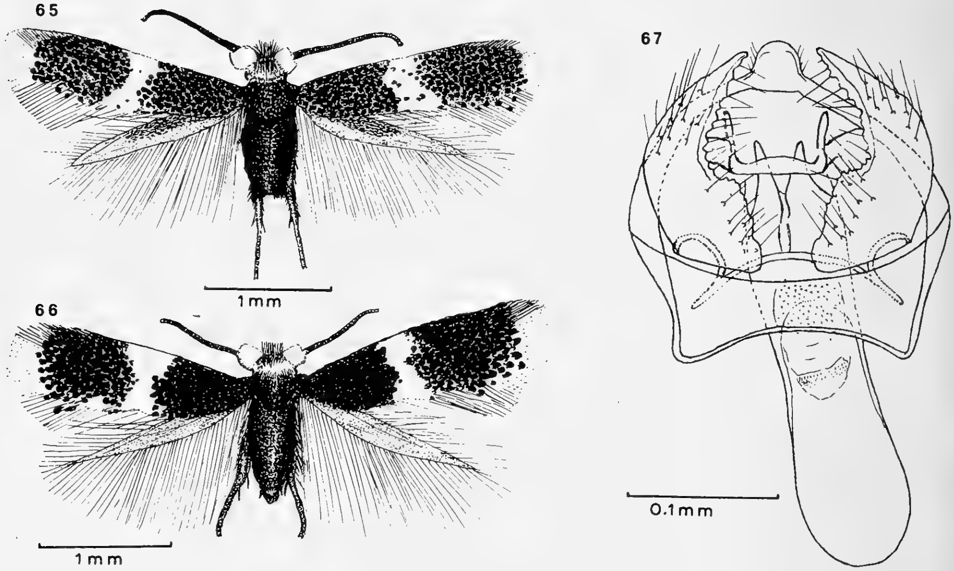


Fig. 64 a-c. *Nepticula styracicolella* spec. nov. Minen an *Styrax officinalis* L., Rhodos, Mt. Profitis Ilias, 19.x.1976. Fig. 65—67. *Trifurcula* (*Ectoedemia*) *aegilopidella* spec. nov. 65: ♂ Imago, Rhodos, Rodini, *Quercus macrolepis* Kotschy, ex l. 22.iv.1973; 66: ♀ Imago, dieselben Daten, ex l. 27.iv.1973; 67: ♂ Kopulationsapparat, GU/Kli-4107, dieselben Daten, ex l. 17.iv.1973.

Mine. Eiablage oberseitig, häufig an einem Blattnerv als schwarzer, punktartiger Höcker leicht erkennbar. Mine sehr variabel. In eünnen Schattenblättern ist sie sehr lang, stark gewunden (Fig. 64a, c), oft sich kreuzend, vielfach am Blattrand verlaufend, mit zarter, breite Ränder freilassender, öfters kurz unterbrochener schwarzer Kotlinie. In dickeren Blättern ist die Mine merklich kürzer, die Kotlinie kräftiger, häufig in Halbkreisbögen abgelagert und nur einen schmalen Rand des Ganges freilassend (Fig. 64b). Manchmal können beide Arten der Kotablage in ein und derselben Mine kombiniert auftreten, ähnlich wie z.B. bei *Nepticula tiliae* Frey. Fast immer findet sich nur eine Mine in einem Blatt, selten sind es zwei. Die Mine dieser Art ist mit ihrer Variabilität ein gutes Beispiel dafür, wie sehr Standort und Sonneneinstrahlung die Länge der Mine und die Art der Kotablagerung beeinflussen. Zur Verwandlung verläßt die Raupe die Mine durch einen halbkreisförmigen Schlitz auf der Blattoberseite. Die Raupe ist hellgelb mit hellbrauner Kopfkapsel. Kokon oval, hellbraun, von lockerem Gespinst umgeben.

Auf Rhodos wurde die Art an folgenden Orten festgestellt: im Petaloudes-Tal, das durch das massenhafte Vorkommen von *Callimorpha quadripunctaria* Poda Berühmtheit erlangt hat, Gräben bei Treas und Trianta, Funtukli und Mt. Profitis Ilias bei ca. 800 m. Die Standorte der Art bezw. ihrer Futterpflanze sind Gebüsche an Gräben und Bachläufen, wo sich *Styrax* in Gesellschaft von *Platanus orientalis, Myrthus italica* und *Laurus nobilis* findet; im Unterholz von Waldungen aus *Pinus halepensis* und *Cupressus*. Sie ist demnach in Höhenlagen von 20 bis ca 800 m verbreitet. Über die Generationsfolge (es sind wohl mindestens zwei anzunehmen) kann noch nichts ausgesagt werden. Besetzte Minen können von Ende Mai bis Ende September — stets sehr einzeln — gefunden werden.

Das zur Beschreibung verwendete Material (2 ♀) trägt folgende Bezettelung: "Rhodos, Petaloudes, ex l. 25.3.1973, aus Mine an *Styrax officinalis*, Zucht Nr. 1054 A, 25.9.1973"; gleicher Fundort, "11.6.1976", auf einem *Styrax*-Blatt bei der Eiablage gefangen. Die betr. Stücke wurden als Holo- und Paratypus gekennzeichnet.

Trifurcula (Ectoedemia) aegilopidella spec. nov.
(Fig. 65—69)

In die weitere Verwandtschaft der *Trifurcula* (*Ectoedemia*) *caradjai* Hering gehörige Art.

Fühler dunkelgrau, beim ♂ bis etwas über 1/2 der Vorderflügellänge reichend, beim ♀ bis 1/2. Kopfhaare bei beiden Geschlechtern hell rostgelb, Nackenschöpfe gelblich. Augendeckel gelblichweiß. Maxillarpalpen und Labialpalpen hellgelb.

Thorax und Abdomen schwarzbraun, ebenso die Beine. Unterseits sind alle diese Teile heller, gelblich.

Expansion 4—4.25 mm. Grobschuppig. Vorderflügel gestreckt, Grundfarbe gelblichweiß, dicht — besonders beim ♀ — mit schwarzen Schuppen bedeckt. Diese lassen die Grundfarbe — vor allem beim ♂ — etwas hervortreten, besonders im Bereich des Tornus. Bei 1/2 des Vorderflügels eine schwach schräg gestellte, beim ♂ häufig durch einzelne schwarze Schuppen getrübte, schmale, gelblichweiße Querbinde, die am Vorder- und am Innenrand etwas verbreitert ist. Beim ♀ tritt diese Binde, da dort die Deckschuppen dichter sind als beim ♂, schärfer hervor. Die hellgrauen, gelblich glänzenden Fransen des Außenrandes sind vom Flügelgrund scharf abgesetzt, sie sind im Tornus dunkler grau. Hinterflügel grau mit helleren Fransen; beim ♂ ist die Flügelfläche von der Basis

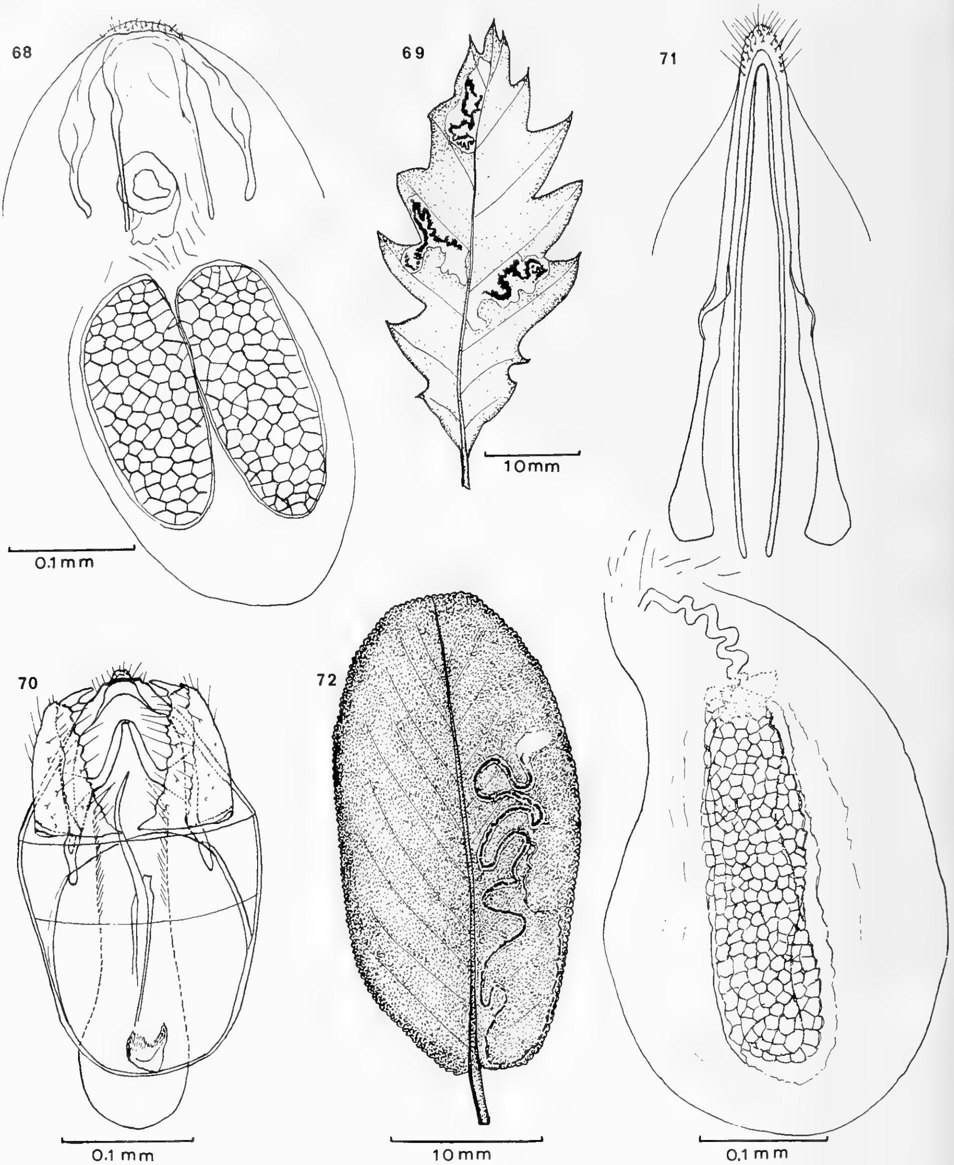


Fig. 68—69. *Trifurcula* (*Ectoedemia*) *aegilopidella* spec. nov. 68: ♀ Kopulationsapparat, GU/Kli-1309, Rhodos, Rodini, *Quercus macrolepis* Kotschy, ex l. 17.iv.1973; 69: Minen an *Q. macrolepis* Kotschy, derselben Ort, 22.ix.1972. Fig. 70—72. *T.* (*Fedalmia*) *trilobella* spec. nov. 70: ♂ Kopulationsapparat, GU/Kli-4065, Rhodos, Rodini, *Salvia triloba* L., ex l. 30.ix.1975; 71: ♀ Kopulationsapparat, GU/Kli-4096, dieselben Daten, ex l. 25.ix.1975; 72: Minen an *S. triloba* L., ex l. 22.v.1974.

bis etwa 1/2 von schmalen, dunkelgrauen Duftschuppen bedeckt; sie sind am dichtesten am Vorderrand inseriert, fehlen jedoch am Innenrand. Unterseite der Vorderflügel grau, beim ♂ median schwärzlich verdunkelt, an der Basis ein Büschel langer, gelblicher Dufthaare.

Männlicher Kopulationsapparat (Fig. 67). Uncus zungenförmig. Ventralrand der Valven flach ausgeschnitten. Gnathosäste von einander entfernt inseriert. Vinculum schmal, flach ausgeschnitten. Aedoeagus mit zahlreichen kleinen Cornuti und einer Cornutalplatte bewehrt.

Weiblicher Kopulationsapparat (Fig. 68). Vordere Gonapophysen flächig verbreitert, hintere stabförmig. Die dorsal auf dem Vestibulum zum Ductus bursae gelegene Platte ist schwach sklerotisiert, die beiden Fortsätze dagegen stärker. An der Wand der Bursa copulatrix befindet sich sowohl dorsal als auch ventral eine ovale Platte mit relativ großer wabenförmiger Struktur. Gegenüber den (entfernter) verwandten, ebenfalls an weichblätterigen Eichen lebenden Arten der *T. caradjai* Her. und *subbimaculella* Hw.-Gruppe erscheint *aegilopidella* viel kleiner, zarter und heller, beim ♂ durch Duftschuppen und im Genitale durch die weit voneinander entfernten Gnathosäste ausgezeichnet.

Futterpflanze: *Quercus macrolepis* Kotschy (= *aegilops* L.).

Mine. Eiablage oberseitig. Anfangsgang der Mine knäuelartig gewunden, Kotspur schwarz, zuerst kompakt, später mehr oder minder aufgelockert. In Schattenblättern ist die Mine gedehnt, im breiten, oft platzartig erscheinenden Gang läßt die aufgelockerte Kotlinie breite Ränder frei (Fig. 69). In den der Sonne stärker ausgesetzten, dickeren Blättern ist die Mine oft auffallend kurz, die Windungen der Kotlinie können dann kaum wahrgenommen werden; sie füllen die Mine völlig aus, ohne Ränder freizulassen. Raupe smaragdgrün mit brauner Kopfkapsel. Kokon oval, flach, braun. Besetzte Minen wurden nur im September (1972, 1977) gefunden. Einbrütigkeit ist daher anzunehmen.

Fundorte: Rhodos: Rodini, Kremasti, Treas.

Das durch Zucht erzielte Material (34 ♂, 71 ♀) trägt folgende Bezettelung: "Mine 22.9.1974 an *Quercus macrolepis*, Zucht Nr. 1054, ex 1. 17.—30.4.1973, Rhodos, Rodini; J. Klimesch." Aus diesem Material wurden der Holotypus, der Allotypus und weitere Paratypen ausgewählt.

Trifurcula (Fedalmia) trilobella spec. nov.

(Fig. 70—72)

In die Verwandtschaft der *T. rosmarinella* Chrét. gehörig.

Fühler beim ♂ ca. 3/4 der Vorderflügellänge erreichend, beim ♀ kaum merklich kürzer; dunkelbraun. Augendeckel gelblichweiß. Maxillarpalpen hellgelb. Kopfhaare hell rostfarben, ebenso die Nackenschöpfe.

Thorax lederfarben, Abdomen hellgelb, beim ♂ anal gestutzt, beim ♀ durch die hervortretende Legeröhre zugespitzt erscheinend. Beine gelblichbraun, unterseits lichter.

Expansion 5—5.5 mm. Grobschuppig. Vorderflügel gestreckt, Grundfarbe hellgelb, dicht mit dunkelbraunen Schuppen bedeckt, die nur im Tornus etwas spärlicher auftreten. Kein Sexualdimorphismus. Der Gesamteindruck der Vorderflügel ist — mit unbewaffnetem Auge betrachtet — dunkel lederbraun. Die hellgelben Fransen scharf abgesetzt, im Tornus etwas dunkler. Hinterflügel hellgrau mit hellgraugelblichen Fransen, die im Apex etwas dunkler sind.

Unterseite der Vorderflügel hellgrau, gegen den Apex dunkler, am Innenrand gelblich aufgehellt.

Männlicher Kopulationsapparat (Fig. 70). Pseuduncus schwach sklerotisiert, den spatelförmigen Uncus etwas überragend. Ventralrand der Valven schräg verlaufend mit einem nach innen gerichteten apicalen, fingerförmigen Fortsatz. Lateralarme der Transtillae kurz. Gnasthosäste apical verschmolzen. Aedoeagus kräftig, mit einem langen, stabförmigen, schwach gebogenen, zugespitzten Cornutus und einer Cornutalplatte bewehrt.

Weiblicher Kopulationsapparat (Fig. 71). Ausgezeichnet durch die langen Gonapophysen, die ein weites Herausstrecken des Ovipositors ermöglichen. Dadurch kann die Eiablage durch den dichten Haarfilz hindurch auf die Epidermis der Futterpflanze (*Salvia triloba* L.) erfolgen. Die Bursa copulatrix weist zwei langgestreckte Platten mit wabenförmiger Struktur auf, wie sie für die trifurculoiden Arten charakteristisch sind.

Die Bauart der Genitalien weist die neue Art in die Verwandtschaft der *T.* (*F.*) rosmarinella Chrét., *hamirella* Chrét. und *stoechadella* Klim. Unterschiede bestehen beim ♂ im Vinculum, im Verlauf des Innenrandes der Valven und in der Bewehrung des Aedoeagus, während beim ♀ die löffelartig verbreiterten Enden der vorderen Gonapophysen von denen der genannten Arten abweichen.

Äußerlich ist *trilobella* durch die dunklere, lederbraune Vorderflügel-Färbung von den genannten, bedeutend heller gelbbraunen Arten zu unterscheiden.

Futterpflanze: *Salvia triloba* L.

Mine. Gangmine (Fig. 72), lang, stark gewunden, sowohl am Blattrand als auch in der Blattspreite verlaufend. Die unregelmäßig kurz unterbrochene, schwarze Kotlinie nimmt bei der erwachsenen Raupe etwa 1/3 der Minenbreite ein. Eiablage meist oberseitig. Raupe gestreckt, hellgelb, mit brauner Kopfkapsel. Kokon oval, von fester Konsistenz, marginal mit einzelnen abstehenden Gespinstfäden.

Fundorte: Rhodos; Rodini, oberes Petaloudes-Tal bei der Kapelle Kalopetra, Mt. Smith bei Rhodos-Stadt auf gebüschreichen, schattigen Standorten.

Besetzte Minen wurden am 5. und 6. Mai 1975 gefunden, die Imagines schlüpften im Laufe des September 1975. Die Art ist sicher einbrütig. Die Minen entwickeln sich zu Beginn des Frühjahres in den jungen Blättern der beginnenden Vegetationsperiode, daher konnten anfangs Mai meist nur mehr verlassene Minen gefunden werden.

Hering führt in seinen Bestimmungstabellen (1957 : 933, Nr. 4558) an *Salvia* spec. eine Nepticuliden-Mine an; sie wird als Gangmine beschrieben mit einer schwarzen Kotlinie, die mehr als die halbe Gangbreite einnimmt. Ob es sich hier um die neue Art handelt, können nur Imagines aus Zuchten entscheiden.

Der Beschreibung liegen 44 Imagines (29 ♂, 15 ♀) zu Grunde. Diese tragen folgende Bezettelung: "Mine 6.—8.5.1975 an *Salvia triloba,* ex l. 16.9.—16.10.1975, Zucht Nr. 1133, Rhodos, Rodini, J. Klimesch". Aus diesem Material wurde der Holotypus, ein Allotypus und weitere Paratypen ausgewählt.

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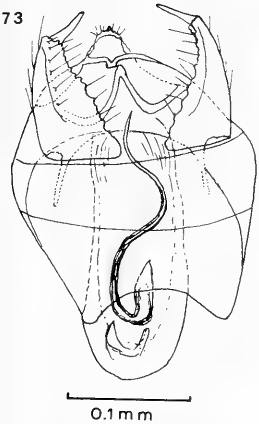

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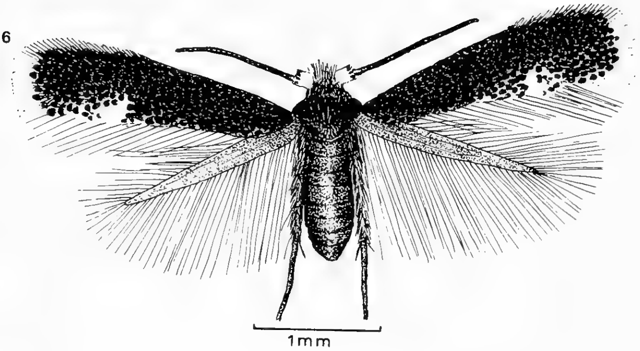

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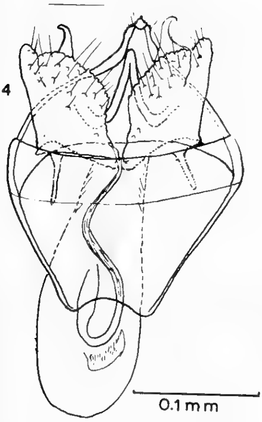

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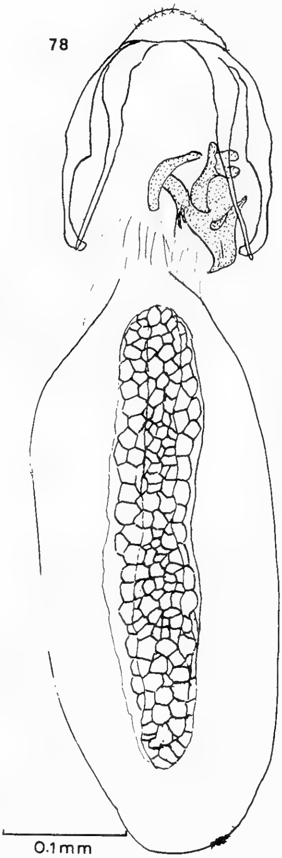

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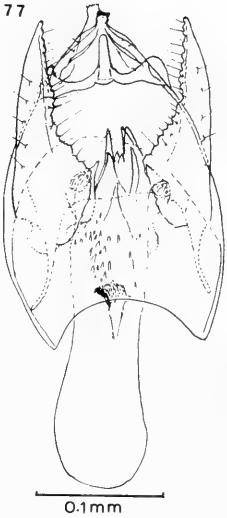

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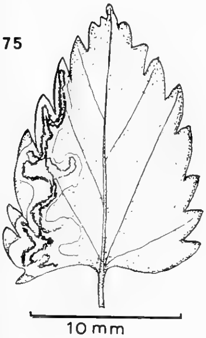

Fig. 73, 75. *Trifurcula* (*Fedalmia*) *albiflorella* spec. nov. 73: ♂ Kopulationsapparat, GU/Kli-1322, Anatolia, Meram p. Konya, ex l. 10.vii.1966, *Nepeta nuda albiflora* Gams; 75: Mine an *N. nuda albiflora* Gams, derselbe Ort, 12.vi.1966. Fig. 74. *T.* (*F.*) *saturejae* (Parenti), ♂ Kopulationsapparat, GU/Kli-1318, Italia, Piemonte, Susa, ex l. 8.vi.1966, *Calamintha nepeta* agg. Fig. 76—78. *T.* (*Fomoria*) *deschkai* spec. nov. 76: ♀ Imago, Rhodos, Mt. Smith, ex l. 3.x.1973, *Hypericum crispum* L.; 77: ♂ Kopulationsapparat, GU/Kli-1306, Rhodos, Etonas, ex l. 15.ix.1973, *Hypericum* spec.: 78: ♀ Kopulationsapparat, GU/Kli-4106, Rhodos, Rodini, ex l. 3.vi.1974, *Hypericum* spec.

Trifurcula (Fedalmia) albiflorella spec. nov.
(Fig. 73, 75)

In die Verwandtschaft der *T.* (*F.*) *saturejae* (Parenti) gehörig. Es liegen 3 ♂ vor.

Fühler etwas über 1/2 der Vorderflügellänge reichend, gelblichgrau, schwach geringt. Kopfhaare rostfarbig, Nackenschöpfe gelb. Augendeckel groß, weiß. Maxillarpalpen wie auch die Labialpalpen gelblich.

Thorax und Hinterleib graubraun, das Analende gelblich. Beine oberseitig gelblichgrau, die Tarsen des 3. Beinpaares dunkler gefleckt, unterseits wie auch das Abdomen gelblich.

Expansion: 4.25—5 mm. Grobschuppig. Vorderflügel-Grundfarbe hellgelb, dicht mit graubraunen Schuppen bedeckt. Am Innenrand tritt aber die Grundfarbe fleckartig hervor. Fransen weißlichgrau, vom Flügelgrund scharf abgesetzt. Unterseite hellgrau, am Vorderrand dunkler. Hinterflügel hellgrau mit lichteren Fransen.

Die nahe verwandte *Trifurcula* (*Fedalmia*) *saturejae* (Parenti) ist viel dunkler, schwarzgrau. Anatomisch sind beide Arten leicht durch die Struktur des männlichen Kopulationsapparates auseinanderzuhalten. Bei *T. albiflorella* (Fig. 73) verläuft der Ventralrand der Valven schräg, der apicale Fortsatz ist gerade, fingerförmig. Bei *T.* (*F.*) *saturejae* (Fig. 74) springt der Ventralrand bauchig vor, der apicale Fortsatz ist breiter und krallenartig gekrümmt.

Futterpflanze: *Nepeta nuda albiflora* Gams.

Mine. Die Stelle der Eiablage konnte nicht ermittelt werden. Die Mine (Fig. 75) stellt einen breiten Gang dar mit einer zentralen, aufgelockerten Kotlinie, die breite Ränder freiläßt; sie verläuft meist am Blattrand. Es wurde nicht untersucht, ob ähnlich wie bei *T.* (*F.*) *saturejae* auch Stengelminen oder kombinierte Stengel-Blattminen vorkommen.

Fundort. Felsiges Gelände bei Meram-Konya (Anatolien) auf einer durch vorspringende Felsblöcke geschützten Stelle. Der Beschreibung liegen 3 ♂ mit folgender Bezettelung zugrunde: "Mine 12.6.1966 an *Nepeta nuda albiflora,* Zucht Nr. 892, ex 1. 10.—11.7.1966, Anatolia, Meram p. Konya, J. Klimesch".

Trifurcula (Fomoria) deschkai spec. nov.
(Fig. 76—78)

In die Verwandtschaft der *T.* (*F.*) *septembrella* Stt. gehörend.

Fühler dunkel graubraun, kaum merklich dunkler geringt. Bei beiden Geschlechtern bis ca. 3/4 der Vorderflügellänge reichend. Kopfhaare bei beiden Geschlechtern rostbräunlich, Nackenschöpfe gelblichweiß. Augendeckel gelblichweiß, apical breit schwarzbraun gerandet. Maxillarpalpen und Labialpalpen weißlichgrau.Abdomen schwärzlichgrau, unterseits etwas lichter. Analende beim ♂ hellgrau. Beine schwarzgrau, unterseits lichter; die letzten zwei Tarsenglieder des 3. Beinpaares auch oberseits hellgrau.

Expansion je nach Substrat der Raupen: 3.75—4.25 mm (aus *Hypericum crispum* und *Hypericum* spec.), 4—4.75 mm (aus *Hypericum hircinum*) (Fig. 76). Kein

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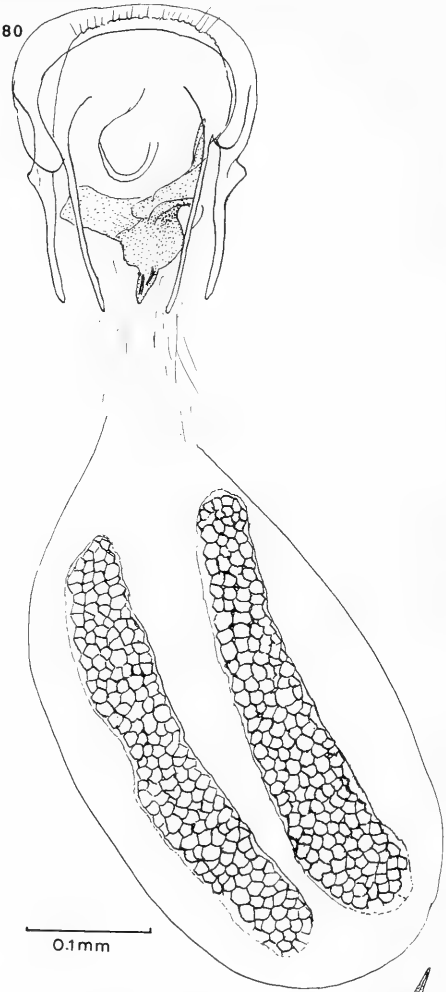

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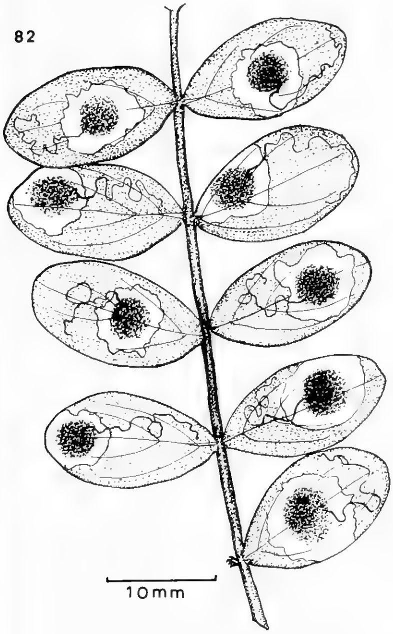

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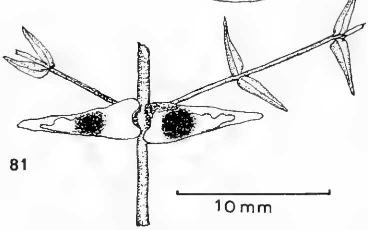

Fig. 79—80. *Trifurcula* (*Fomoria*) *septembrella* (Stt.). 79: ♂ Kopulationsapparat, GU/Kli-1310, Austria sup., Umg. v. Linz, ex l. 17.iii.1932, *Hypericum perforatum* L.; 80: ♀ Kopulationsapparat, GU/Kli-4105, dieselben Daten. Fig. 81—82. *T.* (*F.*) *deschkai* spec. nov. 81: Minen an *Hypericum crispum* L., Rhodos, Mt. Smith, 5.ix.1973; 82: Minen an *Hypericum* spec., Rhodos, Etonas, 31.viii.1973.

Sexualdimorphismus. Grobschuppig. Vorderflügel-Grundfarbe schiefergrau, dicht mit schwarzen Schuppen überdeckt; die Grundfarbe tritt nur im Außenfeld etwas zu Tage, besonders beim ♂. Im Tornus ein weißer Fleck am Innenrand. Fransen weißlich, glänzend, scharf vom Flügelgrund abgesetzt, im Tornus und am

Innenrand dunkelgrau. Hinterflügel dunkelgrau mit ebensolchen Fransen. Unterseite aller Flügel einfarbig dunkelgrau.

Männlicher Kopulationsapparat (Fig. 77). Pseuduncus schwach sklerotisiert, den Uncus überragend. Uncus gestutzt. Gnathosäste verschmolzen. Valven mit schräg verlaufendem Ventralrand. Arme der Transtillae lang ausgezogen, den Außenrand des Vinculums erreichend. Aedoeagus mit einer Gruppe von Cornuti und einer Cornutalplatte bewehrt.

Weiblicher Kopulationsapparat (Fig. 78). Die Signa der Bursa copulatrix bestehen aus zwei langgestreckten, an den Enden gerundeten Platten mit der für trifurculoide Arten charakteristischen Wabenstruktur.

Die nahestehende *T.* (*F.*) *septembrella* (Stt.) weist im männlichen Genitale (fig. 79) nur geringe Unterschiede auf. Sie bestehen hauptsächlich in der Bewehrung des Aedoeagus und in den Armen der Transtillae. Beim ♀ erscheint die Wabenstruktur der Signa reticulata kleiner als bei *deschkai.*

Auch die Unterschiede der äußeren Merkmale sind bei beiden Arten gering. *T.* (*F.*) *septembrella* (Stt.) ist größer (Expansion 5—6 mm), der weiße Fleck im Tornus ist meist deutlicher ausgeprägt, die Fransen am Außenrand sind matter, hellgrau, nicht glänzend weiß wie bei *T. deschkai.* Die Augendeckel sind meist nur wenig dunkel gerandet.

Futterpflanzen: *Hypericum hircinum* L., *Hypericum* spec. und *Hypericum crispum* L.

Mine. Eiablage unterseitig. Die meist stark gewundene, mit Kot fast ganz erfüllte Jugend-Gangmine geht häufig fast vollständig im späteren, pustelartigen Platz auf, in dem die Kotablage zentral erfolgt. An *Hypericum hircinum*-Blättern konnten nicht selten mehrere Minen in einem Blatt festgestellt werden. Bei dem schmalblätterigen *Hypericum crispum* werden nur die grösseren, im Innern einer Pflanze schattig gelegenen Hochblätter befallen (Fig. 81). Raupe hellgelb, Kopfkapsel braun. Kokon gestreckt, in einem mit Gespinst ausgekleidetem Teil der Mine, von der ein von der Raupe vorbereiteter, mit Gespinstfäden ausgekleideter Gang zur Schlupfstelle auf der Blattunterseite führt. Mehrere Generationen sind anzunehmen.

Fundorte: Rhodos: Ethonas b. Malona, Archangelos (an *H. hircinum* und spec.), Rodini (*H.* spec.), Rhodos, Stadtgebiet (*H. crispum* und *H.* spec.), Mt. Smith (*H. crispum*), Kremasti, Paradissi (*H. crispum*). Die Standorte der *T. deschkai* sind Brachfelder (*H. crispum*), schattige Gebüschränder (*H. hircinum*) und Straßenböschungen (*H.* spec.); sie besiedelt also ein durch extreme Verhältnisse gekennzeichnetes Verbreitungsgebiet, während die europäische *T. septembrella* Waldgebiete bevorzugt.

Die neue Art wurde von dem erfolgreichen Entomologen Gerfried Deschka durch den fast gleichzeitigen Fund von Minen an den drei Substraten entdeckt. Ihm sei deshalb die Art zugeeignet.

Der Beschreibung dienten 47 Exemplare mit folgender Bezettelung: "Mine an *Hypericum hircinum,* 31.8.1973, ex 1. 9.—13.9.1973", 4 ♂, 5 ♀, "Zucht Nr. 1080, Rhodos, Ethonas-Malona". Aus derselben Futterpflanze und vom gleichen Fundort: "Mine 22.5.1975, Zucht 1134A, ex 1. 11.—20.6.1975", 10 ♂, 5 ♀. Vom gleichen Fundort: "Mine an *Hypericum* spec. 31.8.1973, Zucht 1081, ex l. 10.—18.9.1973", 10 ♂, 9 ♀. "Rhodos, Mt. Smith, Mine 5.9.1973 an *Hypericum crispum,* Zucht 1081A, ex l. 29.9.—8.10.1973", 2 ♂, 2 ♀. Das Typenpaar (Holo- und Allotypus) wurde aus den aus *Hypericum hircinum* erzielten Züchtlingen von Ethonas 1973 ausgewählt; diese und alle übrigen Paratypen wurden entsprechend gekennzeichnet.

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EVOLUTION OF MECHANISMS TO CARRY POLLEN IN AGAONIDAE (HYMENOPTERA CHALCIDOIDEA)

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With 21 text-figures

Abstract

It is possible that the pre-agaonid wasps visited the pre-*Ficus* infloresсense in order to eat pollen. Later in the evolution of the pre-fig plant, the pre-agaonid started using the ovules for oviposition. Once the pre-fig evolved a closed inflorescense with very tight entrances, only the pre-agaonids which were more successful in penetrating the pre-figs, and those which carried more pollen to the interior of the pre-fig, were positively selected. Most of the pollen carried on the body and wings of the ancestral agaonids was probably rubbed off from the insect body. Those areas of the insect body which entered in least contact with the ostiolar scales must have carried some pollen to the interior of the receptacles. The areas of the wasps which probably were least cleaned off by ostiolar scales were the inner or medial sides of the coxae, the sternum, the neck, petiolar areas, and undoubtedly the buccal cavity and the digestive tract. Selection would favor those agaonids with more bristles on the mesosternum and coxae in addition to those which were efficient in carrying pollen in the buccal cavity or the digestive tract, if they regurgitated the pollen on the stigmata of the flowers. Four main systems of pollen transport seem to have evolved in the Agaonidae: 1) improved capacity to carry pollen in the buccal cavity and other hidden areas of the body, 2) hairiness of the mesosternum as well as the coxae, 3) mesosternal concavities (corbiculae or pollen pockets), and 4) corbiculae on the front coxae which are used to facilitate the transfer of pollen from the anthers to the sternal corbiculae or pockets and to carry pollen.

Concerning the trends in the evolution of the corbiculae, it is possible that the first structures, other than hairs or bristles, that the agaonids evolved to carry pollen were the sternal corbiculae. This idea is based on the fact that there are many agaonids without corbiculae, with only sternal corbiculae, and with sternal and coxal corbiculae. There is only one report of two agaonids with only coxal corbiculae.

The external corbiculae have apparently evolved in three different lines of the agaonids, whereas the coxal corbiculae seem to have evolved independently in four lines. It is not surprising to find such a high degree of convergence in organisms, such as the agaonids, which spend much of their lives in very similar environments (the interior of the syconium) and are apparently exposed to similar forces of selection.

Introduction

Man has wondered for many centuries about the function of the small insects (the agaonids) which penetrate and develop inside the fruits (syconia) of some varieties of the edible fig (*Ficus carica*) and in other species. Aristotle, circa 340 B.C., described a small creature called "psen" which pierced unripe figs and thus caused them to remain on the tree until mature. Theophrastus, a pupil of Aristotle, gave a clear account of caprification (pollination of the figs by the agaonids), but like his teacher he believed that the fig wasps nibbled at the cultivated figs and caused them to develop (Condit, 1947). During the twenty centuries following the time of Theophrastus, little was added to the store of information about fig pollination and fig wasps.

The prevailing view until 1969, which was based primarily on observations of *Blastophaga psenes*, the pollinator of the edible fig, was that pollination is effected by pollen grains adhering to the wasp's body surface and perhaps to its appendages (Müller, 1883; Eisen, 1896; Knuth, 1906; Baker, 1913; Pemberton, 1921; Buscalioni & Grandi, 1938). Other views generally supported the transport of pollen on the body surface (Wiebes, 1963; Hill, 1967; Galil & Eisikowitch, 1968).

Recently it has been found that in many other fig species the situation is not as simple as in the common fig. Independently and almost simultaneously, Ramírez (1969), in Costa Rica, and Galil & Eisikowitch (1969), in East Africa, found specific organs in some agaonids which serve for pollen transport from the mature figs to the young ones of several species of *Ficus*.

The object of this work is to try to explain the evolution, as well as the sequences and convergences, of the mechanisms to carry pollen in the Agaonidae (table 1).

MEANS OF POLLEN TRANSPORT

It is possible that most of the pollen carried on the body and wings of the ancestral agaonids was rubbed off when the wasps squeezed between the ostiolar scales. Those areas of the insect's body, however, which entered in less contact with the ostiolar scales must have carried some pollen to the interior of the receptacles. The areas of the wasps which probably were least cleaned off by ostiolar scales were: the inner or medial sides of the coxae, the sternum, the neck and petiolar areas, the wings, and undoubtedly the buccal cavity and digestive tract. On a population basis and presumably on an individual basis, selection should have favored those wasps that carried more pollen on the areas mentioned; as a consequence more efficient pollination was accomplished after the wasp entered the young inflorescences. Selection would therefore favor wasps with more bristles on the mesosternum and coxae in addition to those which were efficient in carrying pollen in the buccal cavity, other hidden areas of the body and digestive tract, if they regurgitated pollen on the stigmata of the flowers when they were ovipositing.

Four main systems of pollen transport apparently evolved in the Agaonidae: 1) Improved capacity to carry pollen in the buccal cavity, as well as in the digestive tract[1]). This system is probably derived from the pollen eating activity of the pre-agaonid wasps (Ramírez, 1976). To this group of wasps belong *Tetrapus* and

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[1]) According to Wiebes (1977b) "in many Agaonid species, pollen can sometines be found in small quantities on several places of the body, e.g., between the mouth parts or under the hypopygium . . ." Galil & Neeman (1977) showed for *Blastophaga psenes* (the pollinator of the edible fig) that the females carry pollen into intersegmental and pleural invaginations which form in the shrunken body following water loss.

Table 1. List of fig species groups with a list of the agaonid pollinators (modified from Hill, 1967) of each group, and the presence or absence of corbiculae

Subgenus	Section	Subsection	Agaonidae	Corbiculae		
				Absent	Sternal	Coxal
Urostigma	*Urostigma*		*Blastophaga* (Group E) (=*Platyscapa*)		+	+
	Leucogyne		*Maniella*		+	+
	Conosycea	*Conosycea*	*Blastophaga*		+	+ ?
			Deilagaon		+	
			Eupristina		+	+
			Waterstoniella	+		
			Waterstoniella		+	
		Dictyoneuron	*Waterstoniella*	+		
			Eupristina		+	+
		Benjamina	*Parapristina*		+	+
	Stilpnophylum		*Blastophaga clavigera* (=*Blastophaga* Group G)		+	+ ?
	Malvanthera		*Pleistodontes*	+		
			*Pleistodontes*1)		+	+ ?
	Galoglychia		*Agaon*		+	
			Alfonsiella		+	+
			Allotriozoon		+	
			Elisabethiella		+	+
			Paragaon		+	
	Americana		*Pegoscapus*		+	+
Pharmacosycea	*Oreosycea*		*Blastophaga* Group F		+	+
			Dolichoris		+	+
	Pharmacosycea		*Tetrapus*	+		
Ficus	*Ficus*		*Blastophaga* Group A	+		
	Rhizocladus		*Blastophaga* Group A	+		
	Kalosyce		*Blastophaga* Group A	+		
	*Sinosycidium*2)					
	Eriosycea		*Blastophaga* Group B		+	
	Sycidium	*Scabrae*	*Blastophaga* Group B		+	
		Varinga	*Blastophaga* Group B		+	
	Phaeopilosae		*Blastophaga* Group C		+	
	Paleomorphe	*Paleomorphe*	*Liporrhopalum*		+	
		Copiosae	*Blastophaga* Group D		+	
Sycomorus	*Adenosperma*		*Ceratosolen*		+	
	Neomorphe		*Ceratosolen*		+	
	Prostratae		*Ceratosolen*		+	
	Pungentes		*Ceratosolen*		+	
	Pseudopalmeae		*Ceratosolen*		+	
	*Rivulares*3)				+	
	Sycocarpus		*Ceratosolen*		+	
	Sycomorus		*Ceratosolen*		+	

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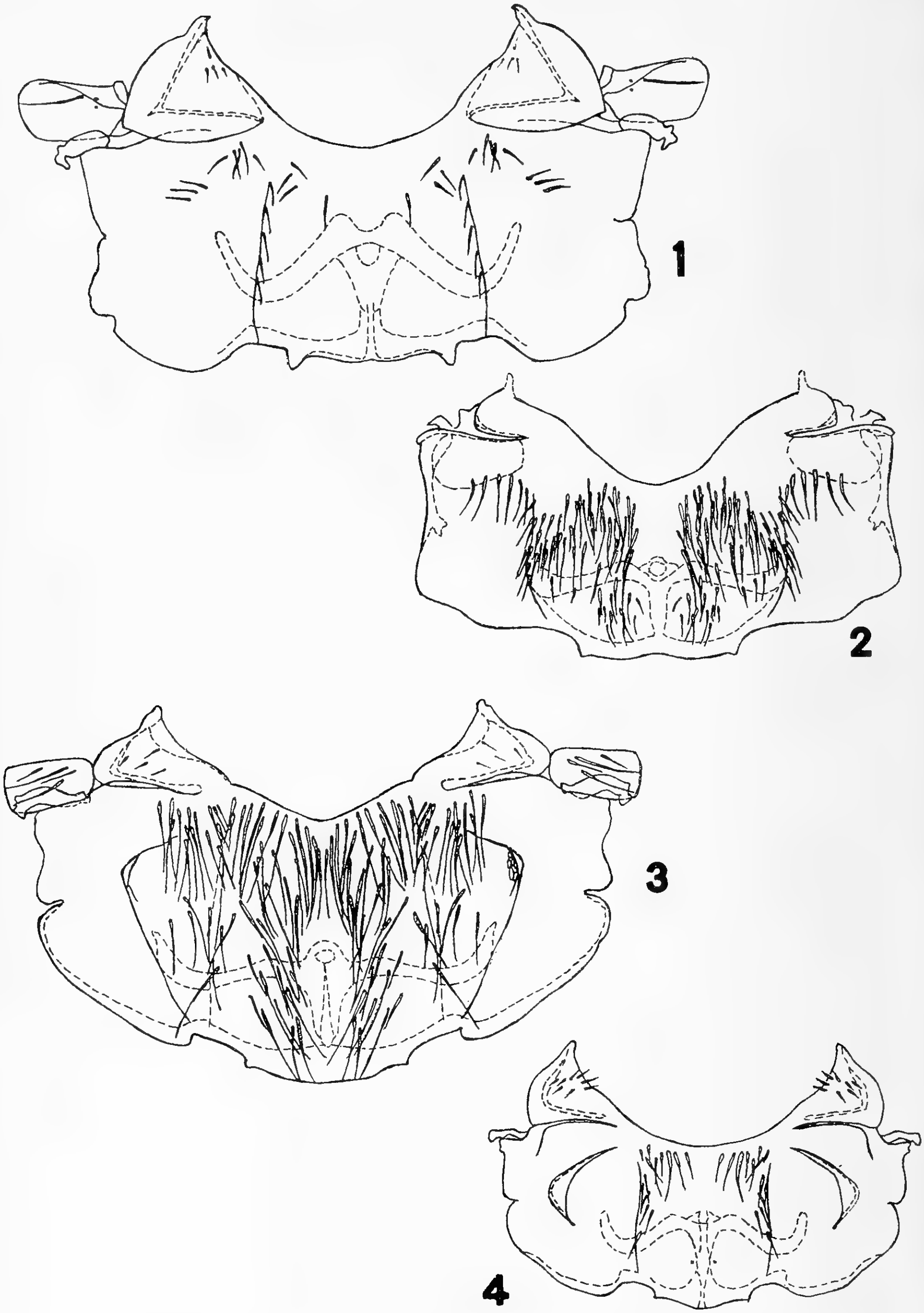
1) Wiebes (1977b) reports that two species of *Pleistodontes* have only coxal corbiculae

2) Probably pollinated by a wasp of *Blastophaga* Group A

3) Probably pollinated by a *Ceratosolen* wasp



Figs. 1—4. Mesosterna of: 1, *Blastophaga pumilae*, without corbiculae; 2, *B.* (*Waterstoniella*) *sundaica*, without corbiculae but with abundant sternal bristles; 3, *Deilagaon megarhopalus*, with incipient corbiculae (right corbiculae with some pollen); 4, *B.* (*Waterstoniella*) *masii*, with more developed corbiculae and less bristles than *Deilagaon megarhopalus* (fig. 3).

probably those *Blastophaga* that inhabit the figs of sections *Ficus*, *Kalosyce* and *Rhizocladus*. Section *Sinosycidum* is probably also pollinated by this type of wasp. 2) Hairiness of the mesosternum as well as of the coxae. This system of transportation of pollen is apparently found in *Blastophaga* (*Waterstoniella*) *sundaica* (fig. 2) and *Pleistodontes blandus* which possess mesosterna with abundant long bristles; however, much pollen was also found in their digestive tracts. 3) Sternal corbiculae, i.e., pollen carrying concavities in the mesosternum (figs. 3—10). 4) Corbiculae on the front coxae (figs. 16—20) which are used to facilitate the transfer of pollen from the anthers to the sternal corbiculae, as well as a means to carry pollen (Galil et al., 1973). In the forms with well-developed corbiculae, pollen is not found in the digestive tract.

Sternal corbiculae[1])

It isprobable that in some of the agaonids with hairy mesosterna (as in fig. 2) a small flange or tegulum evolved by mesal growth of the most lateral angle of the "pleural suture" (as in fig. 3). This tegulum formed a small cavity in which some pollen could be transported (as in fig. 3). This flange is hereafter referred to as the corbicular tegulum. A small tegulum which forms a small corbicula is still found in *Deilagaon megarhopalus* (fig. 3), *Blastophaga errata* and *Blastophaga* (*Waterstoniella*) *masii* (fig. 4). However, parts of the mesosterna of the latter two are covered with long bristles as in *Blastophaga* (*Waterstoniella*) *sundaica* (fig. 2) and *Pleistodontes blandus*, two wasps without sternal corbiculae.

Once the mesosternal tegulum formed a functional cavity to carry pollen, its enlargement was positively selected. Larger concavities were formed by progressive mesal growth of the tegulum. A small sternal corbicula accompanied by sparse sternal hairiness is found in *Blastophaga* (*Waterstoniella*) *masii* (fig. 4). The mesal extension of the corbicular tegulum to form a larger cavity was accompanied by the loss of more and more sternal bristles, as suggested by *Blastophaga* (*Pegoscapus*) *cumanensis* (fig. 6), *Blastophaga javana* (fig. 5) and *Blastophaga* (*Eupristina*) *adempta*. However, some of the sternal hairs were retained close to the sternal corbiculae and became specialized to rub the pollen from the arolia of the font legs and/or to hold the pollen in place in the corbiculae (fig. 6).

In other agaonids the corbicular tegulum continued to grow mesally until a much bigger cavity was formed. A wide, mesal corbicular opening is found in the corbiculae of wasps such as *Blastophaga gestroi*, *B. javana* (fig. 5) and *B. sumatrana*; in the subgenera *Pegoscapus* (fig. 6), *Eupristina* and *Parapristina*; in the genera *Maniella*, *Alfonsiella*, *Elisabethiella*, in the *Blastophaga* wasps (=*Platyscapa* of Wiebes, 1977a) inhabiting Old World section *Urostigma* for example, in *Blastophaga constabularis* (= *B. coronata*; Wiebes, 1963); in *Dolichoris vasculosae*; and probably in all of the *Blastophaga* wasps which inhabit Old World figs of section *Oreosycea*, subgenus *Pharmacosycea*.

In other wasps the corbicular tegulum grew mesally and ventrally until the corbiculae became almost closed. This condition is found in wasps such as *Agaon hamiferum modestum* (fig. 7) and *Allotriozoon prodigiosum*.

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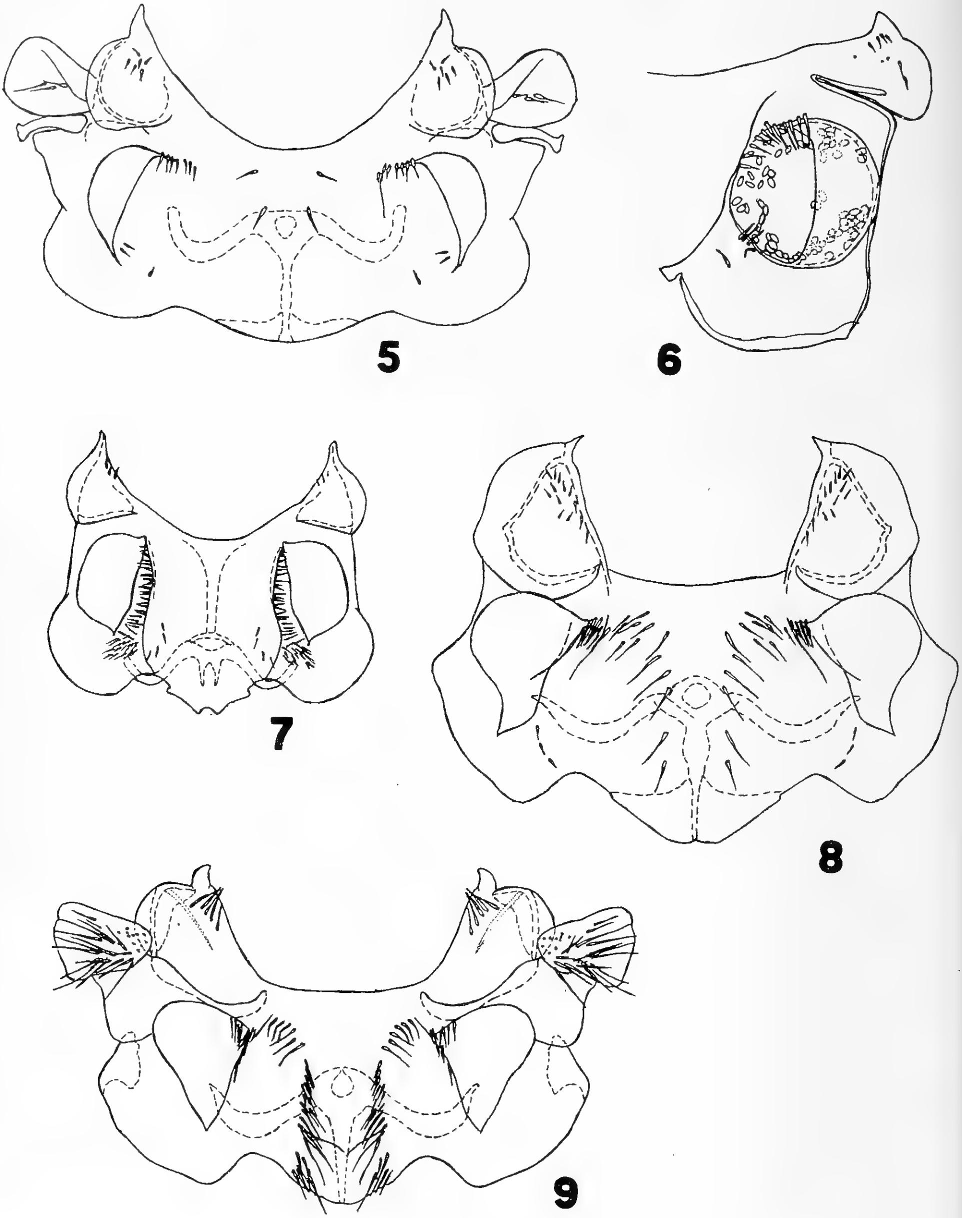
[1]) Mesothoracal pollen pockets of Galil & Eisikowitch (1969).



Figs. 5—9. Mesosterna of: 5, *Blastophaga javana*, with large, open sternal corbiculae and few mesosternal bristles; 6, *Blastophaga* (*Pegoscapus*) *cumanensis*, right side, showing corbicula with corbicular bristles and some pollen inside; 7, *Agaon hamiferum modestum*, with almost closed sternal corbiculae; 8, *Blastophaga jacobsi*, with closed sternal corbiculae; 9, *Ceratosolen pilipis*, with closed corbiculae (sternal pockets of Galil & Eisikowitch, 1969).

The maximum mesal and ventral growth of the corbicular tegulum occurs in *Blastophaga jacobsi* (fig. 8), in all wasps of the genus *Ceratosolen* (fig. 9), in *Liporrhopalum* (fig. 10), *Platyscapa quadraticeps* and probably *B. tentacularis*.

Galil & Snitzer-Pasternak (1970) report that the pollen pockets of *Platyscapa quadraticeps* are complex and highly specialized structures rather than mere

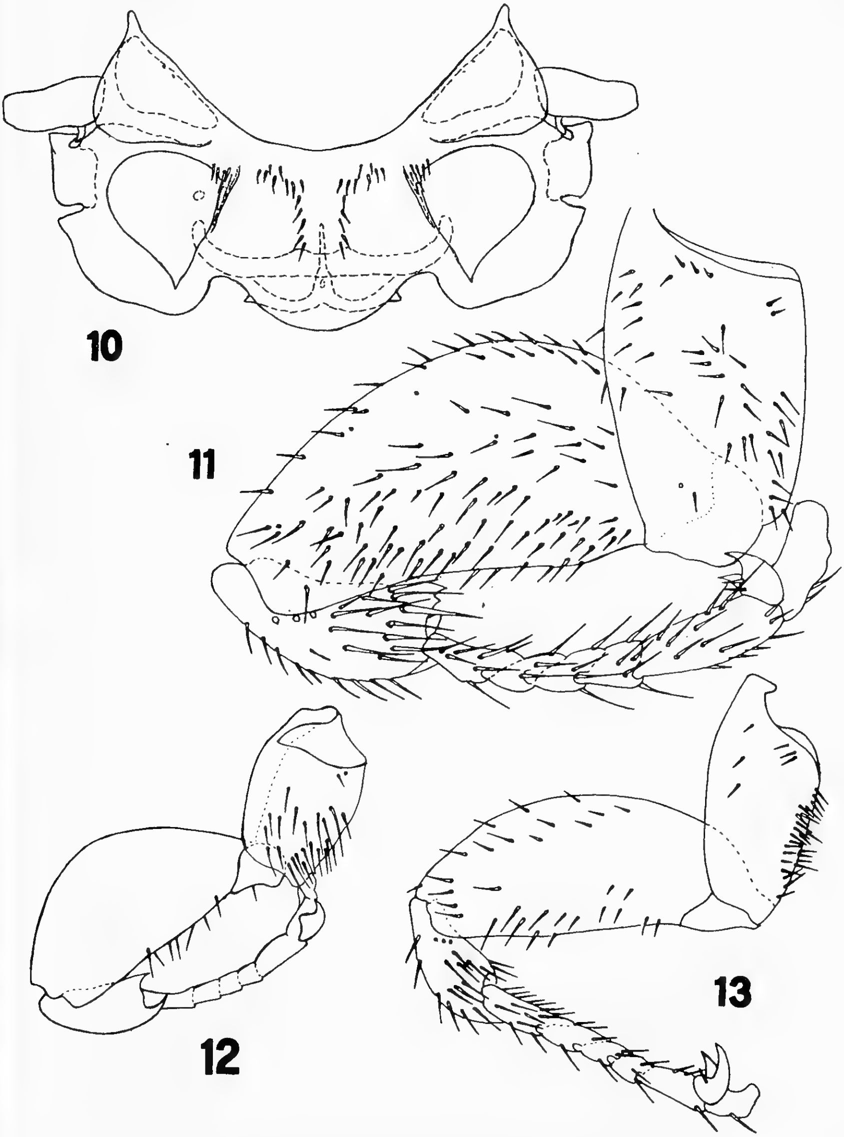
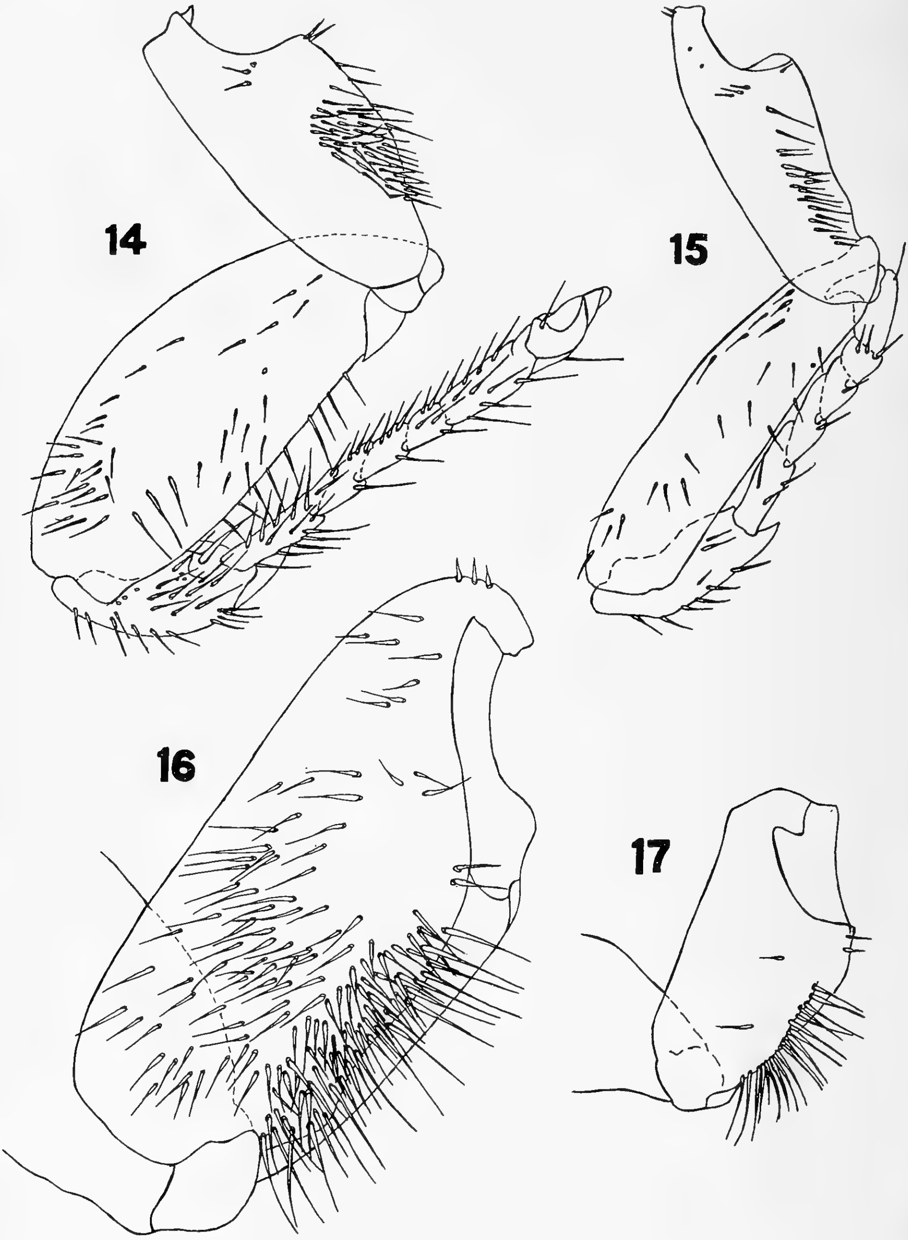


Fig. 10. Mesosternum of *Liporrhopalum mindanaensis*, with closed corbiculae. Figs. 11—13. Front legs of: 11, *Blastophaga psenes* (the pollinator of the edible fig), without coxal combs; 12, *Deilagaon megarhopalus*, with incipient sternal corbiculae (note the aggregation of coxal bristles); 13, *Blastophaga jacobsi*, with large, closed, sternal corbiculae (note the presence of coxal combs of bristles, which are probably used to move the pollen from the sternum to the corbiculae).

depressions covered by a fold of the body wall. Each pocket is a small saccular organ with well-defined openings. The two marginal exits are very narrow. The third opening is the largest and gaps widely when the adjacent sternum is touched



Figs. 14—15. Front legs of: 14, *Ceratosolen pilipis*, with closed, sternal corbiculae (note the coxal comb); 15, *Liporrhopalum mindanaensis*, with only sternal corbiculae. Figs. 16—17. Font coxae of: 16, *Blastophaga malabarensis*, with coxal corbiculae surrounded by abundant bristles; 17, *B. nervosae*, with coxal corbiculae and combs.

parallel to the inner border of the pocket and closes shortly afterwards. These observations have not been verified, but I have observed that in *Ceratosolen arabicus* and other *Ceratosolen* wasps the corbicular tegulum extends ventrally and touches the mesosternum. However, the corbicular tegulum is apparently not fused to it; thus a narrow slit is found along the entire mesal side of the structure. When the corbicula of a *Ceratosolen arabicus* was carefully pressed, pollen came out along the entire mesal slit or entrance of the structure. According to Wiebes (personal communication) there is some misunderstanding about the pocket of *Platyscapa quadraticeps*, there being not more than one opening for each pocket.

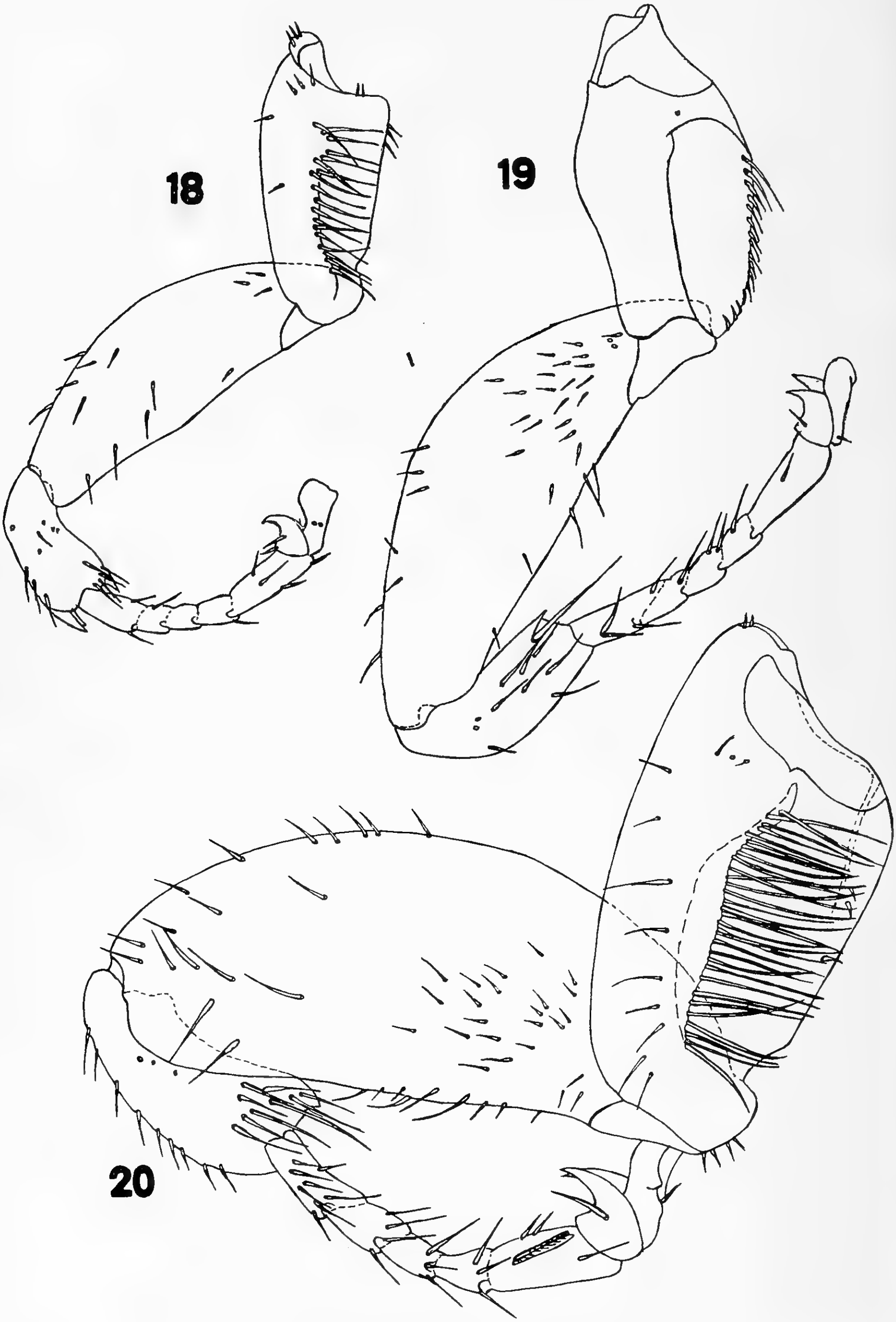
Coxal corbiculae

The front coxae of *Sycophaga sycomori* (a wasp that penetrates the fig in order to lay eggs, but which is not a pollinator) possess almost no hairs. The same condition is also found in *Blastophaga* (*Waterstoniella*) *sundaica*, although some thick bristles are found on the mesal side. The rest of the front legs of both species are also sparsely hairy. All the species of *Tetrapus*, in addition to *Pleistodontes plebejus*, also possess very smooth coxae.

From the supposedly condition of smooth legs, hairiness became more consipicuous in some agaonids. In *Blastophaga psenes* (fig. 11) the entire leg is hairier than those of the previously mentioned wasps; the hairs of the coxa of *Blastophaga psenes* are apparently randomly distributed over its entire surface (fig. 11). It is probable that hairiness of the mesal side of the coxa of some agaonids was positively selected because it favored pollen transport.

Although the fore coxal hairs of *Deilagaon megarhopalus* (fig. 12) are concentrated toward the mesal side, they occur without any noticeable pattern. However, in *Blastophaga jacobsi* (fig. 13), *Ceratosolen pilipes* (fig. 14) and most other *Ceratosolen* wasps, the fore coxal hairs are denser on the mesal side of the coxa, forming a well-defined mesal area of strong bristles which Galil & Eisikowitch (1969) call coxal combs. In other agaonids the coxal hairs also became concentrated, but instead of forming a random grouping they form well-defined rows. A similar condition is found in *Liporrhopalum mindanaensis* (fig. 15) and *Allotriozoon prodigiosum*. Grandi (1917: fig. IV, 3) also reports and illustrates the front coxa of *Blastophaga valentinae* as possessing a row of hairs similar to the one found on *Liporrhopalum mindanaensis*.

Another tendency in the evolution of the coxal structures to carry pollen was the formation of a mesal cavity. A primitive coxal corbicula completely surrounded and covered with hairs is found in *Blastophaga malabarensis* (fig. 16). The corbiculae and surrounding hairs of this species were found to be completely full of and covered with pollen. *Blastophaga nervosae* (fig. 17) has an incipient coxal corbicula, but possesses far fewer hairs than *Blastophaga malabarensis*. The coxal bristles of *Blastophaga nervosae* are organized in a more definite row (fig. 17); a similar condition is also found in *Platyscapa quadraticeps*. *Pleistodontes imperialis* (fig. 18) possesses a well-defined row of hairs located in a more dorsal position than those of *Blastophaga nervosae* (fig. 17). It is not sure if *Pleistodontes imperialis* has coxal corbiculae.



Figs. 18—19. Front legs of: 18, *Pleistodontes imperialis*, with open, sternal corbiculae and apparently incipient coxal corbiculae; 19, *Elisabethiella stueckenbergi*, with well developed coxal corbiculae and an outer coxal comb of bristles. Fig. 20. Front coxa of *Blastophaga boschmai*, with well developed coxal corbiculae and an inner comb of bristles.

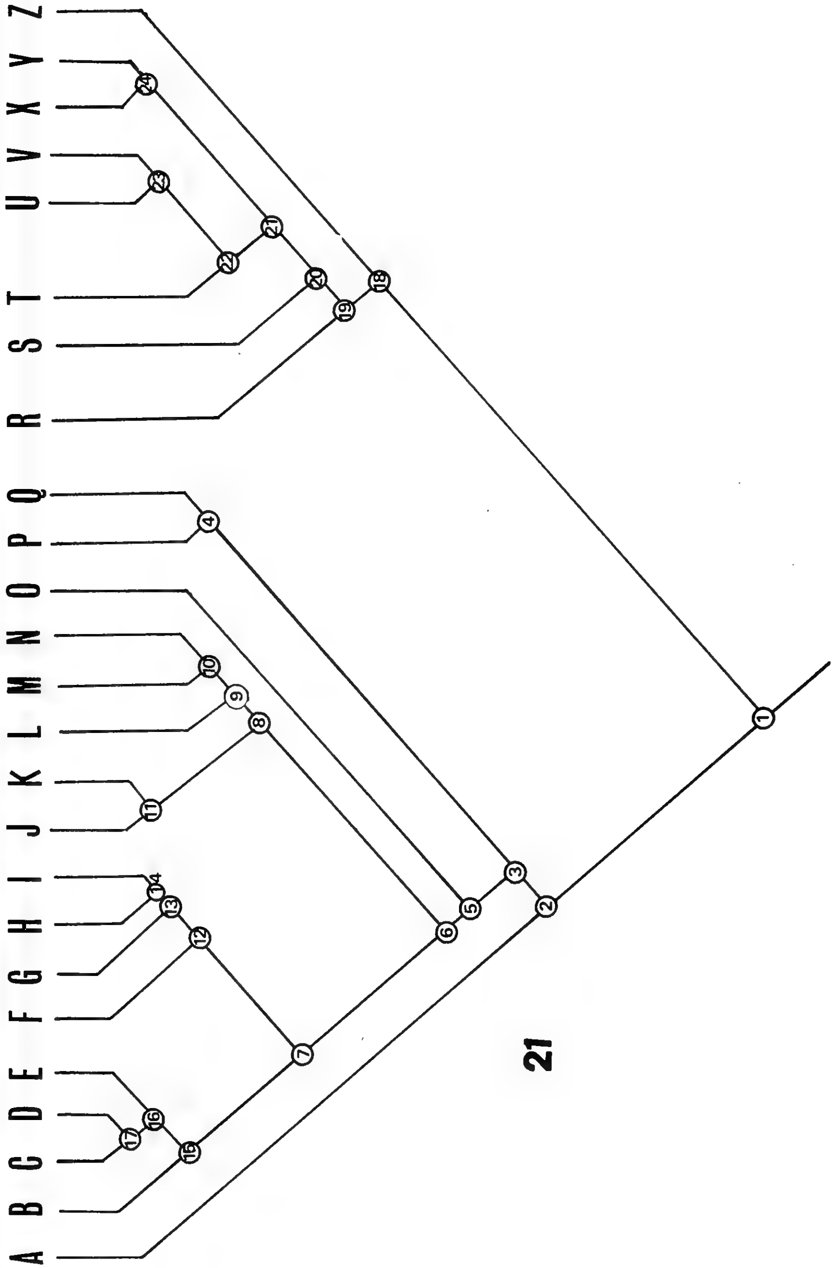


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Fig. 21. A cladogram for Agaonidae: A, *Tetrapus*; B, *Deilagaon* group; C, *Eupristina*; D, *Parapristina*; E, *Waterstoniella*; F, *Pegoscapus*; G, *Blastophaga* group G; H, *Maniella*; I, *Blastophaga* group E (= *Platyscapa*); J, *Alfonsiella*; K, *Elisabethiella*; L, *Allotriozoon*; M, *Paragaon*; N, *Agaon*; O, *Pleistodontes*; P, *Dolichoris*; Q, *Blastophaga* group C; T, *Ceratosolen* with short ovipositor; U, *Ceratosolen* with short ovipositor; V, *Ceratosolen* with long ovipositor; X, *Liporrhopalum*; Y, *Blastophaga* group D; Z, *Blastophaga* group A.

Once the coxal corbiculae evolved, there was a tendency to lose most of the bristles located inside the cavities and to organize the peripheral bristles into more definite rows or combs (figs. 17—20). Two tendencies in the formation of these rows of bristles are found. In some wasps, the corbicular cavity is fenced by a medial row of bristles, as in *Blastophaga nervosae* (fig. 17). In *Maniella delhiensis* the coxal cavity has a well-defined row of bristles on its mesal side, but some hairs are still present inside the corbicula. This condition attains its maximum expression in *Blastophaga boschmai* (fig. 20), in which the coxal cavity is very deep and its long bristles form a good barrier to hold the pollen in the corbicula. In other agaonids the corbicular bristles form a more ventral row of bristles. This feature is found in an incipient condition in *Blastophaga constabularis* (= *Platyscapa coronata*). A well-defined mesal row of ventral bristles is found in most New World wasps of the subgenus *Pegoscapus* and in the Old World *Blastophaga* (*Eupristina*) *adempta*, *Blastophaga* (*Parapristina*) *verticillata*, *Alfonsiella longiscapa* and *Elisabethiella stueckenbergi* (fig. 19).

TRENDS IN THE EVOLUTION OF THE CORBICULAE IN THE AGAONIDS

It is very well possible that the first structures, other than hairs or bristles, that the agaonids evolved to carry pollen were the sternal corbiculae. This idea is based on the fact that there are many agaonids without corbiculae, with only sternal corbiculae, and with sternal and coxal corbiculae; although Wiebes (1977b) reports that *Pleistodontes blandus* and *mandibularis* have only coxal corbiculae. However, it is possible that the ancestors of some agaonids evolved both kinds of corbiculae and that the coxal corbiculae were later lost in some; this is a very unlikely possibility. The agaonids which could have lost the coxal corbiculae would be the *Blastophaga* that inhabit the figs of sections *Eriosycea*, *Scabrae*, *Varinga*, *Phaepilosae* and *Copiosae* (sensu Ramírez, 1974) and also the wasps of the genera *Ceratosolen* and *Liporrhopalum*. Other agaonids which could have lost the coxal corbiculae and inhabit the figs of subgenus *Urostigma* are: *Agaon*, *Allotriozoon*, *Paragaon*, *Deilagaon megarhopalus*, the subgenus *Waterstoniella*, and the two wasps (*Blastophaga carlosi* and *B. mariae*) that pollinate *F. tuerckheimii* in Central America and Mexico. All of the wasps mentioned immediately above possess only sternal corbiculae. The question then arises: Did each of these structures evolve once or more than once in the history of the Agaonidae? This question is difficult to answer. However, based upon the morphology of some of the structures of each group of agaonids and the correlation of those structures with the presence or absence of corbiculae, it is here concluded that the sternal corbiculae, as well as the coxal ones, seem to have developed at least three or four times during the evolution of the agaonids. It is not surprising to find such a high degree of convergence in organisms, such as the agaonids, which spend much of their lives in very similar environments (the interior of the syconium) and are apparently exposed to similar forces of selection. Hill (1967: 53) notes that, presumably because of the uniformity of the micro-habitat, there is considerable convergence in various characters in the family Agaonidae.

Sternal corbiculae

These structures have apparently evolved in three different lines of the agaonids: 1) In the ancestor (fig. 21: 18 — 19) of the *Blastophaga* that live in the dioecious figs of sections *Copiosae*, *Eriosycea*, *Phaeopilosae* and *Sycidium* (all sensu Ramírez, 1974). This type of corbicula was inherited by *Ceratosolen* (fig. 9) and *Liporrhopalum* (fig. 10). In these two groups of wasps, as well as in *Blastophaga* group C (i.e., *Blastophaga jacobsi*) (fig. 21, S), the corbiculae are closed rather than open (fig. 5). 2) In the ancestor (fig. 20: 3 — 4) of *Dolochoris vasculosae* and *Blastophaga* group F (i.e. *Blastophaga boschmai*) which inhabit the figs of Old World section *Oreosycea* (subgenus *Pharmacosycea*). 3) In the ancestors of several of the agaonid groups which inhabit the figs of subgenus *Urostigma*.

First evolutionary line of sternal corbicûae

The evolution from *Blastophaga* without corbiculae to *Blastophaga* with open corbiculae and to *Blastophaga*, *Ceratosolen* and *Liporrhopalum* with closed sternal corbiculae agrees with the line of evolution postulated by Wiebes (1963: 105) for *Ceratosolen*. Wiebes states that the genus *Ceratosolen* appears to be a derivative of *Blastophaga* and seems to be still connected with it through the pollinators of subsection *Sycidum* (sensu Corner, 1965).

Second evolutionary line of sternal corbiculae

The second evolutionary line occurred in the ancestor (fig. 21: 3 — 4) of the agaonids which inhabit the Old World section *Oreosycea* of subgenus *Pharmacosycea*. This section of figs is inhabited by *Blastophaga* group F and one species of *Dolichoris* (*D. vasculosae*). These wasps are characterized by their open sternal corbiculae and the presence of coxal corbiculae.

Third evolutionary line of sternal corbiculae

The ancestors of some of the agaonid groups (fig. 21: 5 — 6) which inhabit the figs of subgenus *Urostigma* reflect a third evolutionary line. Considering the presence or absence of sternal corbiculae in the pollinators of subgenus *Urostigma*, we find several main groups of wasps. These are: 1) In *Pleistodontes*, *Pleistodontes imperialis* has sternal corbiculae and apparently coxal corbiculae (Ramírez, 1974). Wiebes (1977b) reports that *P. froggatti* and *regalis* have sternal corbiculae, while *P. imperialis* has sternal and coxal corbiculae. *P. blandus* and *mandibularis* have only sternal corbiculae, in *P. rennellensis* he also finds a very vague trace of sternal corbiculae. *P. longicaudus*, *plebejus*, *immaturus* and *rieki* have no coxal and sternal corbiculae (Wiebes, 1977b); 2) Two *Waterstoniella* species (*W. jacobsoni* and *W. sundaica*) (fig. 2), which do not have sternal corbiculae[1]; 3) Another *Waterstoniella* (i.e., *Blastophaga* (*W.*) *masii*) (fig. 4), as well as *Deilagaon megarhopalus* (fig. 3), which possess very small sternal corbiculae; 4) *Agaon* (fig. 7), *Allotriozoon* and *Paragaon*, which have only large sternal corbiculae; 5) *Alfonsiella* and *Elizabethiella*, which have large sternal as well as coxal corbiculae (fig. 19); and 6)

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[1] According to Wiebes (1976), "In some of the Blastophaginae, however, the sternal pollen-carying structures seem to be secondarily lost (e.g., in some *Waterstoniella*) or are in the process of becoming lost (as in *Waterstoniella masii*)."

The subgenus *Pegoscapus* (except *Blastophaga* (*P.*) *carlosi* and *B.* (*P.*) *mariae*), *Blastophaga clavigera* (*Blastophaga* group G), *Maniella delhiensis*, *Blastophaga* group E (= *Platyscapa* of Wiebes, 1977a) and *Eupristina* and *Parapristina*, which have coxal and sternal corbiculae.

Coxal corbiculae

These structures are found in some of the agaonid groups which inhabit the subgenus *Urostigma* and in those which inhabit the monoecious figs of section *Oreosycea* (fig. 21: P and Q). The groups of wasps which have coxal corbiculae and develop in the receptacles of subgenus *Urostigma* are: 1) *Alfonsiella* and *Elisabethiella* (fig. 19) found in section *Galoglychia*; 2) *Pegoscapus* (as in fig. 19) except *Blastophaga* (*P.*) *carlosi* and *B.* (*P.*) *mariae*, found in section *Americana*; 3) the *Blastophaga* found in sections *Stilpnophyllum* and *Urostigma*; 4) *Maniella* found in section *Leucogyne*; 5) *Eupristina* and *Parapristina* found in section *Conosycea*; and 6) *Blastophaga* and *Dolichoris vasculosae* which inhabit the figs of sections *Oreosycea* of subgenus *Pharmacosycea* (fig. 20). *Pleistodontes imperialis* also seems to have coxal corbiculae (fig. 18).

It seems that the coxal corbiculae have evolved four times in the symbionts of *Urostigma* as follows: 1) in the ancestor of *Alfonsiella* and *Elisabethiella* (fig. 21: 8 — 11); 2) in the ancestor (fig. 21: 7 — 12) of the agaonids which pollinate sections *Americana*, *Leucogyne*, *Stilpnophyllum* and *Urostigma*, i.e., wasps of the subgenus *Blastophaga*, the genus *Maniella* and the subgenus *Pegoscapus*; 3) in the ancestor (fig. 21: 16 — 17) of *Eupristina* and *Parapristina*; 4) in the ancestor (fig. 20: 3 — 4) of the wasps that pollinate the section *Oreosycea* of subgenus *Pharmacosycea* and apparently in *Pleistodontes imperialis* (fig. 18). Wiebes (1977b) reports that *P. blandus* and *mandibularis* have only coxal corbiculae.

Interrelation between sternal and coxal corbiculae

It seems that in most *Blastophaga*, as well as *Ceratosolen* and *Liporrhopalum*, that possess only sternal corbiculae, groups of ventral bristles are present on the coxae (figs. 13—15). Galil & Eisikowitch (1969) call these bristles " coxal combs" and state that during pollen loading the pollen is first deposited on the underside of the thorax and afterwards is pushed by the coxal combs into the sternal pockets. The coxal combs of the wasps mentioned could have evolved at the same time as the sternal corbiculae as a means to move the pollen from the venter of the thorax to the corbiculae. In 1971, Dr. Galil and the author further observed that several species of *Pegoscapus* used the coxal corbiculae bristles to move the pollen from the thorax to the sternal corbiculae although the coxal corbiculae are also used to carry pollen (Galil et al., 1973).

From these observations it seems likely that the sternal corbiculae and coxal bristles arose simultaneously, the latter to fill the former, and that coxal corbiculae arose later to increase the amount of pollen carried; although Wiebes (1977b) reports that "*Pleistodontes blandus* and *P. mandibularis* have only coxal corbiculae".

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