The concealed copulatory structures of the *Pyrgomorphidae*

(Orth. Acridoidea)

PART V. TRIBES *SCHULTHESSIINI, TAPHRONOTINI, DICTYOPHORINI, TAGASTINI, PSEUDOMORPHACRIDINI, ATRACTOMORPHINI, SPHENARIINI* AND *OMURINI*

BY

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(Láms. I-VII).

Part I of this study (Kevan, Akbar and Chang, 1969) includes a general discussion of the acridoid male and female copulatory structures, with particular reference to the *Pyrgomorphidae* together with a glossary of terms, including those used herein. Part II (Kevan, Akbar and Chang, 1970) first discusses changes in the arrangement of tribes and genera that have been made in the *Pyrgomorphidae* since the preliminary one by Kevan and Akbar (1964) and, together with Parts III and IV (Kevan, Akbar and Chang, 1971, 1972) gives an account of the fifteen tribes constituting what has been termed Group 'A' of the family (Series I to IV) and the first five tribes of Group 'B' (tribes of Series V and VI). The present paper treats all the remaining tribes other than those of Series X *(Pyrgomorphini* and *Chrotogonini)*. Opportunity is also taken to present photographs of type material of species for which similar figures have not previously appeared, or which it is not proposed to illustrate elsewhere in connection with generic revisions.

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SERIES VII.

This Series comprises three tribes, *Schulthessiini, Taphronotini* and *Dictyophorini*, which differ considerably from each other in external morphology. Most occur in Africa south of the Sahara, but two genera *(Schulthessiini)* are from Madagascar and one from southern Asia. With the exception of the Malagasy genera all have a strongly rugose or tuberculate, or at least a saddle-shaped pronotum, and most of them tend to be of moderate to fairly large size for the family, often robust, or at least rather heavily built; the body form is neither compressed nor strongly depressed. Species with a distinctly fusiform body are usually fully alate, but robust forms with a short, blunt head frequently have much reduced wings, the tegmina being broadly rounded apically; strongly micropterous forms occur, but completely apterous species are unknown. The coloration is usually dark, even when green, and the abdomen often ringed with yellow or red. The inner margins of the mesosternal lobes nearly always diverge posteriorly and the interspace between them is widened distad. The Madagascar forms are quite atypical in appearance, superficially resembling *Atractomorphini* (Tribe 26, Series VIII) in being strongly fusiform, non-tuberculate and usually light green in colour; they differ externally from members of that tribe in that they have a slightly depressed body form (at least in females) and elongate hind tarsal segments.

Certain features of the phallic structures are shared by at least some members of all three tribes. For example, the lateral plates of the epiphallus may bear angular externolateral processes (a feature found also in Series X), and the aedeagal valves in all bear characteristic dorsal, lateral, or ventrolateral processes which are peculiar to this Series. The aedeagal sclerites are never divided or constricted apically. The spermatheca in all genera is without a distinct apical pocket, but bears an extensive spermathecal appendage subapically on the caecum; this varies from a simple convoluted tube, by way of forms with small secondary diverticula, to the most elaborate system known for the *Orthoptera*.

Tribe 21. Schulthessiini.

(Figs. 1, 2; Pl. I, figs. A, B).

Subfam. *Atractomorphinae* Bolívar, 1905, *Bol. Soc. esp. Hist. nat.*, V, 196 *(partim)* [see also Dirsh, 1963, *Bull. Brit. Mus. (nat. Hist.) Ent.*, XIV, 102 *(partim)*].

Sect. *Atractomorphae* Bolívar, 1909, *Gen. Ins.*, XC, 4, 38 *(partim)* [see also Dirsh, 1963, *Bull. Brit. Mus. (nat. Hist.) Ent.*, XIV, 102 *(partim)*].

Tribe *Atractomorphini* Rehn, 1953, *Locusts Grassh. Austral.*, II, 30 *(partim)*; Kevan and Banerjee, 1961, *Verh. XI. Int. Kongr. Ent., 1960*, I, 23, 24 *(partim)*; Kevan, 1961, *Ent. mon. Mag.*, XCVI, 204-207 *(partim)*; 1965, *Proc. XII. Int. Congr. Ent., 1964*, 442 *(partim)*.

Group *Atractomorphae* Johnston, 1956, *Annot. Cat. Afr. Grassh.*, 194 *(partim)*.

Tribe *Atractomorphini*, Subtribe *Schulthessiina* Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1509, fig. 2 (map), 1519, 1525.

External features: Body elongate-fusiform, sometimes slightly depressed (especially in females), integument finely and evenly rugose to rather smooth, colour predominantly rather uniformly bright green (brownish individuals occur), abdomen not annulated; antennae very slightly ensiform (especially in females), inserted distinctly in front of lateral ocelli; head acutely conical, frontal profile very oblique, fastigium of vertex acutely triangular; pronotum without dorsal tubercles or rugosities, not saddle-shaped, inferior margin of lateral lobe straight and granular; interspace between mesosternal lobes not widened distad; tegmina acutely pointed, fully developed or somewhat brachypterous, never greatly reduced; hind femur with external areas expanded and displaced subventrally; hind tarsal segments elongate.

Principal phallic characters: Epiphallus of conventional form but with well developed anterior projections, prominent pointed externolateral processes on the lateral plates and lophi strongly curved dorsolaterally; ectophallus elongate-pyriform, central membrane rather restricted, zygoma simple, broad, apically rounded, extending about halfway along the cingulum; suprazygomal plate undeveloped, basal emargination rather deep, broadly V-shaped, apodemal plates in lateral view pointed anteriorly, valves of cingulum bilobed, somewhat widely separated, rami of cingulum rather narrow but with broad suprarami, sheaths large, ventral process of cingulum wide and blunt; aedeagal sclerites rather short and straight, broad in dorsal view, endophallic

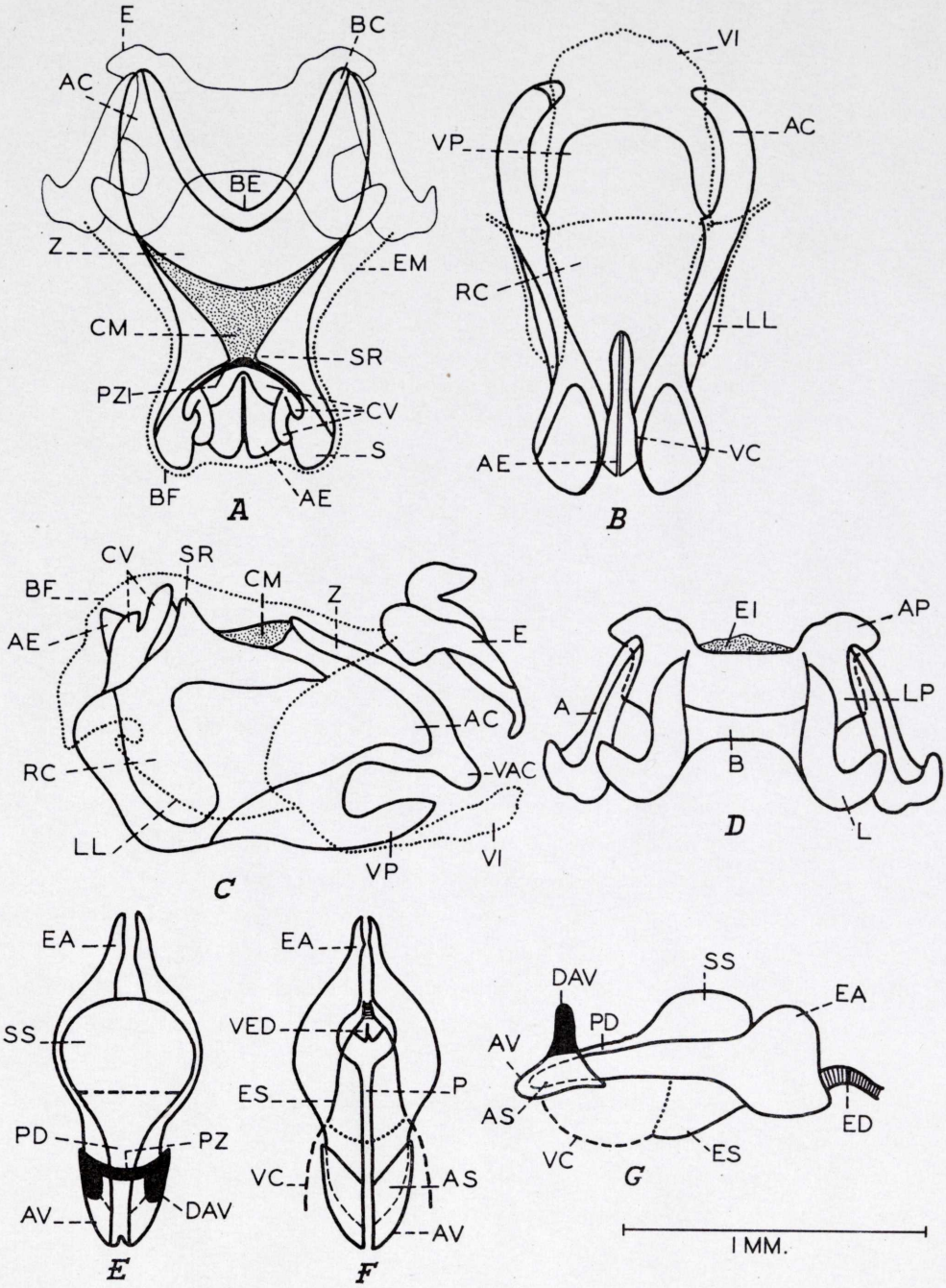


Fig. 1.—*Schulthessiini: Schulthessia biplagiata* Bolívar, phallic structures. *A*, phallic complex, dorsal; *B*, the same, ventral; *C*, the same, from the right; *D*, epiphallus, dorsal; *E*, endophallus, dorsal; *F*, the same, ventral; *G*, the same, from the right. For notation, see pp. 279-281.

apodemes rounded, slightly produced forwards ventrally, dorsal inflections not developed, spermatophore sac subspherical, gonopore situated behind the middle, pseudoarch narrow, transverse, aedeagal valves bluntly conical, broad in dorsal view and bearing large dorsal processes at the base.

Concealed female structures: Subgenital plate with posterior edge biarcuate, somewhat serrated, egg-guide narrowly triangular, columellae present, contact areas absent; spermatheca with vesicle and short caecum continuous, leading directly into a long, thick, convoluted appendage with a distinct apical bulb and with short secondary diverticula towards the lower end; spermathecal duct of moderate length, its terminal part only slightly dilated.

Distribution: Madagascar.

Included genera: Schulthessia Bolívar, 1905; *Buyssoneilla* Bolívar, 1905 (only female known; unknown to authors).

Species examined: Schulthessia biplagiata Bolívar, 1905 (northern and eastern Madagascar — Figs. 1, 2; Pl. I, figs. A, B) [Type species].

Other species: Buyssoniella madecassa Bolívar, 1905 (N. Madagascar) [Type species - unique female type lost].

This tribe is somewhat anomalous. Its strong superficial resemblance to *Atractomorpha* has led to its members being included hitherto in the *Atractomorphini,* but its phallic structures and spermatheca indicate no near relationship. The latter and the specialization of the aedeagal valves suggest affinity with the *Taphronotini,* although this is not very close. The only previously published information on the concealed copulatory structures is given by Kevan (1961) and Kevan and Banerjee (1961), who figure the epiphallus (and suggest the removal of the genus from the *Atractomorphini,* where it was at that time placed), and by Dirsh (1963) and Dirsh and Descamps (1968) who give sketches of the phallic structures and spermatheca of *Schulthessia biplagiata.*

Tribe 22. Taphronotini.

(Figs. 3-6; Pl. I, figs. C-F).

[Famille Acridites, Division] *Conophori* Audinet-Serville, 1838, *Hist. nat. Ins. Orth.* [= *Coll. Suites à Buffon* (7)], 566, 603 *(partim).*

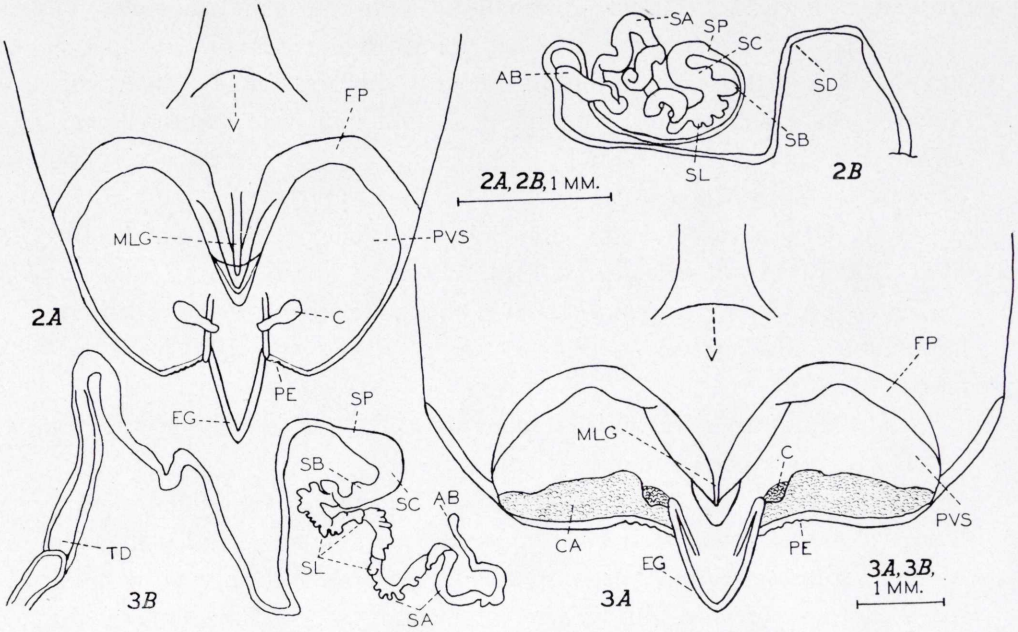
Geslacht *Acridium,* Groepen *Poecilocerus* [or] *Decticus* [*Taphronota* only] and *Phymateus* [or] *Petasia* [*Aularches* only] Haan, 1842, *In* Tem-

minck, *Verh. natuurl. Gesch. Ned. overz. Bezitt.*, XVIII (Zool. 7), 145 *(partim)*.

[Fam. *Acrididae*] Limited Fam. *Phymat[e]idae* Walker, 1870, *Cat. Derm. Salt. Brit. Mus.*, III, 539 *(partim)*.

Species *Poeciloceri* Stål, 1873, *Öfv. K. svensk. VetenskAkad. Förh.*, XXX (4), 51 *(partim)*.

Sub-tribus [and "sub-tribu"] *Petasiae* Bolívar, 1884, *An. Soc. esp. Hist. nat.*, XIII, 21, 25, 471 *(partim)*.



Figs. 2-3.—*Schulthessiini* and *Taphronotini (Aularchina)*, female structures: 2) *Schulthessia biplagiata* Bolívar; 3) *Aularches miliaris pseudopunctatus*, nov. sp. *A*, subgenital plate, dorsal; *B*, receptaculum seminis. For notation, see pp. 279-281.

Tribus *Pyrgomorphii*, Stirps *Phymateus*, Saussure, 1899, *Abh. Senckenb. Naturf. Ges.*, XXI, 643 *(partim)*.

Subfam. *Taphronotinae* Bolívar, 1904, *Bol. Soc. esp. Hist. nat.*, IV, 393 [see also Kevan & Akbar, 1964, *Canad. Ent.*, XCVI, 1508].

Sect. *Taphronotae* Bolívar, 1909, *Gen. Ins.*, XC, 3, 14; Willemse, 1930, *Tijdschr. Ent.*, LXXIII, 73.

Group *Taphronotae* Johnston, 1956, *Annot. Cat. Afr. Grassh.*, 138.

Tribe *Taphronotini* Kevan and Knipper, 1961, *Beitr. Ent.*, XI, 371, Kevan and Akbar, 1964, *Canad. Ent.*, LXXVI, 1509, fig. 3 (map), 1511, 1518, 1525, 1529; Kevan, 1965, *Proc. XII. Int. Congr. Ent., 1964*, 442.

External features: Body fusiform (African species) or robust and heavy (Asiatic species), not depressed; integument sometimes rather

rugose, colour usually predominently rather dark green or brownish, abdomen sometimes annulated with yellow or reddish; antennae filiform, rather long with elongate segments but terminal segment short, not inserted far in front of the lateral ocelli; head strongly conical (with a moderately long fastigium verticis in African species) or short and blunt (with a rather short fastigium in Asiatic species); pronotum strongly rugose or tuberculate or saddle-shaped, sometimes flat dorsally, inferior margin of lateral lobe not straight and granular, pronotal tubercles often sharply defined; tegmina and hind wings fully developed, hind wings orange or red, often infumated or greenish apically (African species), or infumated only (Asiatic species); hind femur slender, its external area not expanded or displaced, hind tarsal segment not elongate; ovipositor valves sinuate, not reduced.

Principal phallic characters: Epiphallus rather conventional, anterior projections well or moderately well developed and with blunt processes on the external margins of the lateral plates, lophi not strongly curved except for apical hooks which are dorsolaterally directed; ectophallus elongate pear-shaped, central membrane moderately extensive, zygoma broad with posterior margin sinuous or somewhat produced medially, not extending to the middle of the cingulum, suprazygomal plate very small (Asiatic species) or large and covering most of the zygoma (African species), basal emargination U-shaped, apodemal plates bluntly pointed or rounded anteriorly in lateral view, without ventral processes, valves of cingulum simple, small or broad and of moderate size, rami of cingulum of conventional form, suprarami insignificant, sheaths unremarkable, ventral process of cingulum rather narrow or acutely triangular; aedeagal sclerites rather straight and comparatively short, endophallic apodemes rounded in lateral view, not produced forwards ventrally, dorsal inflections poorly developed, spermatophore sac of moderate size, round or pyriform, gonopore before the middle, pseudoarch insignificant; aedeagal valves short, rather small, conical, slightly curved upwards and normally with small dorsolaterally directed spur-like processes about the middle.

Concealed female structures: Subgenital plate with posterior edge slightly serrated or smooth, egg-guide bluntly triangular with indications of columella-like structures at base, transverse contact areas present (Asiatic species) or absent (African species); spermatheca having a convoluted apical appendage with (Asiatic species) or without (African

species) numerous small lateral secondary diverticula; spermathecal duct of moderate length, without a prominent terminal dilation.

Distribution: Africa south of Sahara, southern Asia.

Members of this tribe (which seems to be most closely related to the next) are fairly readily recognizable, but the African and Asiatic members are rather dissimilar in outward appearance. The two groups are placed in separate monogeneric subtribes, as follows:

Subtribe *a.* AULARCHINA.

(Figs. 3, 4; Pl. I, figs. C-F).

Geslacht *Acridium*, Groep *Phymateus* [or] *Petasia* Haan, 1842, *In* Temminck, *Verh. natuurl. Gesch. Ned. overz. Bezitt.*, XVIII (Zool. 7), 145 *(partim)*.

Subtribe *Aularchina* Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1509, fig. 3 (map), 1518, 1525.

External features: Body heavy and robust, not fusiform, head short and blunt with short, broad fastigium verticis, pronotum not saddle-shaped nor distinctly flat dorsally, tegmina normally with pale spots, hind wings infumated, abdomen strongly annulated.

Principal phallic characters: epiphallus with rather deep bridge confluent with expanded bases of lateral plates, anterior projections not very prominent, appendices slender; ectophallus with suprazygomal plate small, valves of cingulum small; endophallus with spermatophore sac round.

Concealed female structures: Subgenital plate with transverse contact areas developed; spermathecal appendage with small, lateral secondary diverticula.

Distribution: Southern Asia.

Included genus: Aularches Stål, 1873.

Species examined: Aularches miliaris (Linnaeus, 1758) (Ceylon, India, Nepal, Sikkim, S. Tibet, Bangladesh, Andaman Is., Burma, Thailand, Malay Peninsula, Sumatra, Java, Bali, Cambodia, Laos, Vietnam, SW. and S. China [specimens allegedly from Amboina are known, but locality is questionable] — Figs. 3, 4) [Type species].

Other species: None described. Katiyar (1955, 1957), on the basis of the sculpturation of the egg and development, recognizes a second species from northern India, which he calls *A. punctatus* (Drury,

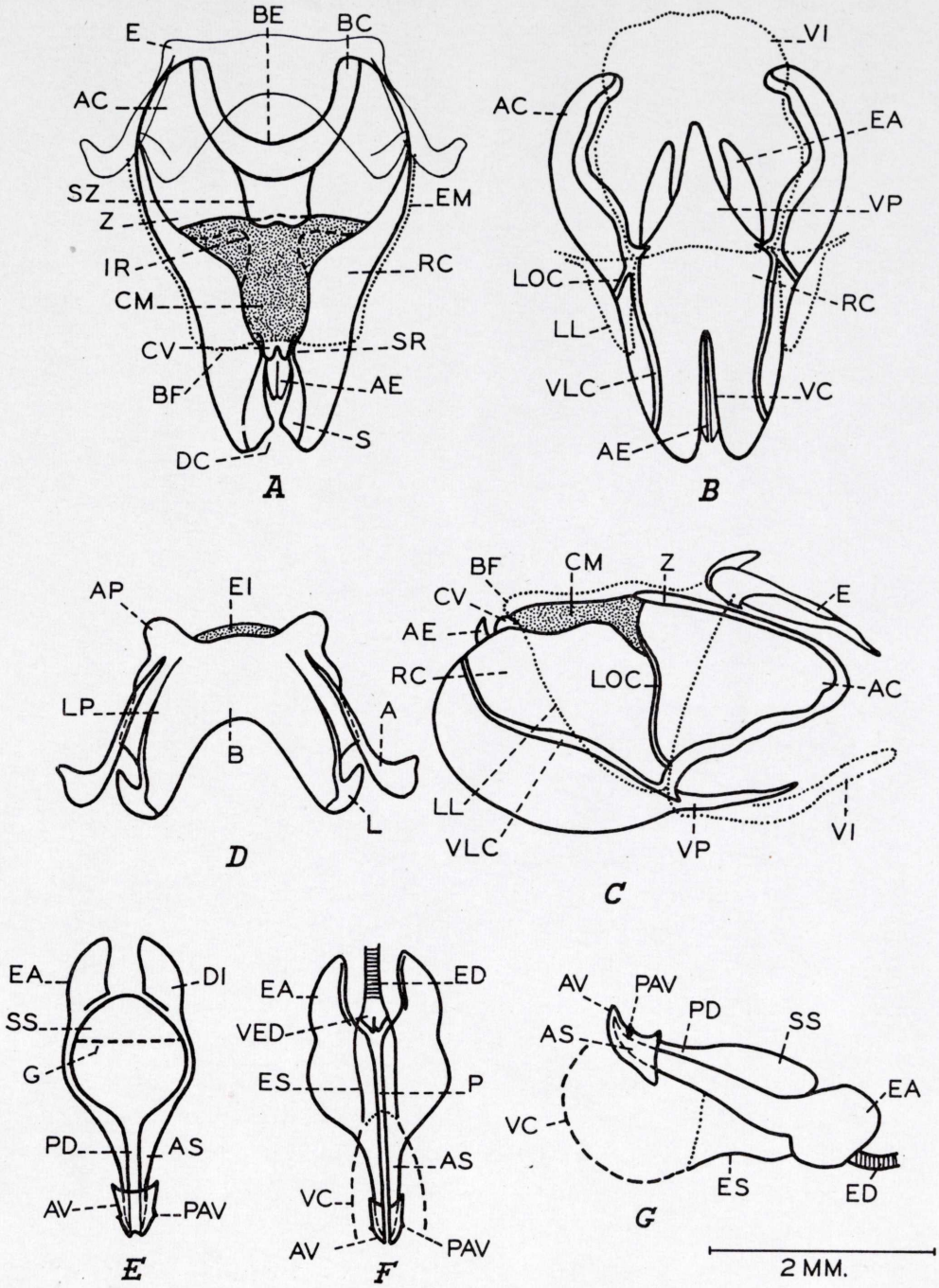


Fig. 4.—*Taphronotini (Aularchina): Aularches miliaris miliaris* (Linnaeus), phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

1773). The latter, however, is a synonym of *A. miliaris,* and Katiyar's northern form, if indeed it belongs to a distinct taxon, is without an available name that can appropriately be applied to it (Kevan, 1963 a). A preliminary examination of specimens of *Aularches* from all the regions referred to above has produced no conclusive morphological evidence that two species are involved. Forms from northern India (including Dehra Dun, the source of Katiyar's material), however, are distinguishable from more southerly and easterly material, although specimens of intermediate appearance occur over a wide area. An examination of the concealed copulatory structures of northern and southern Indian specimens shows some differences between the two, but there is considerable variation and it is not yet known if any differences observed are consistent. In order that the northern population may have a valid name, it is therefore proposed to recognize it here tentatively as a subspecies, the two being distinguishable as follows:

1. Size generally larger than indicated in Footnote [3]; dorsal surface and upper parts of lateral lobes of pronotum variably pigmented, frequently yellow anteriorly and posteriorly and blackish between, sometimes more suffused yellowish or reddish or entirely dark, even black; lower parts of lateral pronotal lobes and head yellow, only rarely reddish; tegmina usually olive-green, although sometimes brown or blackish, yellow maculations more or less round and well defined, often margined with darker colour; epiphallus usually more deeply excised (as in fig. 4*D)*; endophallus a little narrower in dorsal view (as in fig. 4*E)*; spermathecal appendage somewhat shorter and with fewer lateral diverticula (than in fig. 3*B)*; distribution other than that indicated below; [eggs and development as indicated by Katiyar (1955, 1957) for *A. miliaris*] ... ... **A. miliaris miliaris** (Linnaeus).

2. Size generally smaller, as indicated in Footnote [3]; dorsal surface and upper parts of lateral lobes of pronotum always rather uniformly dark, usually black; lower parts of lateral pronotal lobes and head variable in colour, but frequently reddish; tegmina brown or blackish, yellow maculations, particularly basally, less regularly rounded, less well defined and often confluent, without differentiated margins; epiphallus generally less deeply excised (than in fig. 4*D)* [?]; endophallus generally somewhat broader in dorsal view (than in fig. 4*E)*; spermathecal appendage rather longer and with more numerous lateral diverticula (as in fig. 3*B)*; N. Uttar Pradesh, Himayal Pradesh, Kash-

mir, Nepal, Sikkim, S. Tibet; [eggs and development as indicated by Katiyar (1955, 1957) for "*A. punctatus*"] ... ... **A. miliaris pseudopunctatus** Kevan n. ssp.[3].

The copulatory structures of *Aularches* have been little studied, but Dirsh (1956) gives a sketch of the epiphallus of *A. miliaris* (probably the new subspecies). Katiyar (1956) illustrates the spermatheca for the same subspecies.

Subtribe *b*. TAPHRONOTINA.

(Figs. 5, 6).

Taphronotini (partim): References given above in bibliography of tribal nomenclature from *Taphronotinae* Bolívar, 1904, onwards.

Subtribe *Taphronotina* Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1509, fig. 3 (map), 1518, 1525.

Included genus: Taphronota Stål, 1873 (including subgenus *Epamontor* Kirby, 1902, stat. nov., distinguishable by its openly reticulate

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[3] *Holotype* (Pl. I, figs. C, D): ♂, India [Uttar Pradesh], Dangari, 11-IX-1905 [author's collection, Lyman Entomological Museum]. *Allotype* (Pl. I, figs. E, F): ♀, India [Uttar Pradesh], Mussoorie, Dehra Dun, Elev. 5700 ft., 20-VIII-1930 [Academy of Natural Sciences, Philadelphia]. *Measurements:* length, ♂ 41.5, ♀ 48.0; pronotum, ♂ 10.5, ♀ 12.5; tegmen, ♂ 32.5, ♀ 40.5; hind femur, ♂ 20.0, ♀ 20.5 mm. Both specimens have the lower parts of the lateral pronotal lobes and head yellowish. *Paratypes:* India, same data as allotype but 14 & 22-VIII, 2 ♂♂ [Philadelphia]; as last 5 & 9-IX, 2 ♀♀ [author's collection and Philadelphia]. Nepal, Thari [NE. of Charikot], 4000 ft., 24-X-1960 (L. Swan), 1 ♂ [author's collection], 1 ♀ [California Academy of Sciences, San Francisco]; Bhaktapur, 7-VIII-1961 (P. N. Rana), 2 ♀♀ [U. S. National Museum, Washington and author's collection]; Kathmandu, 5-8-VIII-1962 (G. Ebert & H. Falkner), 1 ♀ [author's collection]. *Measurements:* length, ♂ 37-36, ♀ 48-49; pronotum, ♂ 9.5-11.5, ♀ 12.0-13.0; tegmen, ♂ 34.0-35.0, ♀ 40.0-41.0; hind femur, ♂ 17.5-21.0, ♀ 20.5-21.0 mm. The Thari and Katmandu specimens have the lower parts of the lateral pronotal lobe and head brick-red. Specimens are also known from the other territories listed in the above diagnosis, but, as they are not currently available, they cannot be included among the paratypes. They are from: Kashmir [only]; Himayal Pradesh, Kandahar, Simla Hills; Uttar Pradesh, Kumaon dist., Sanaswa; W. Nepal-Indian border, Pithoragarh-Kali R. area; Nepal, Katmandu, Nagarkot, Soondrijal, and Nepal [only]; Sikkim [only]; Tibet [only]. Intermediate material currently before the author is from: Shillong (Assam) [typical *miliaris* but for some confluent maculations; found with typical *miliaris*]; Nurbong, Darjeeling (N. Bengal) [very like Thari paratypes in size and colour, but ma-

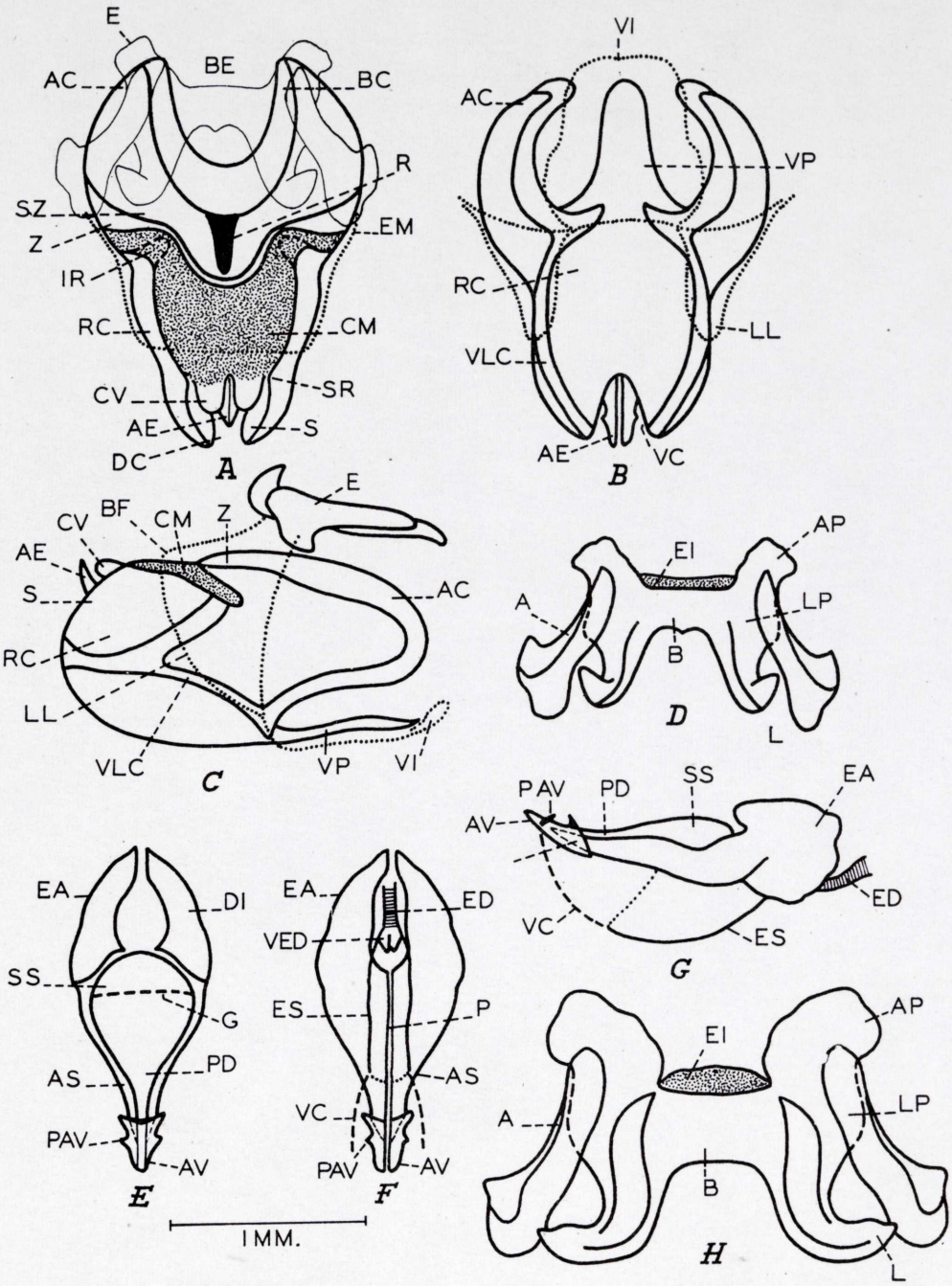

Fig. 5.—*Taphronotini (Taphronotina)*, phallic structures: *A-G, Taphronota (T.) f. ferruginea* (Fabricius), lettering as in fig. 1; *H, T. (Epamontor) staali* Bolívar, epiphallus, dorsal. For notation, see pp. 279-281.

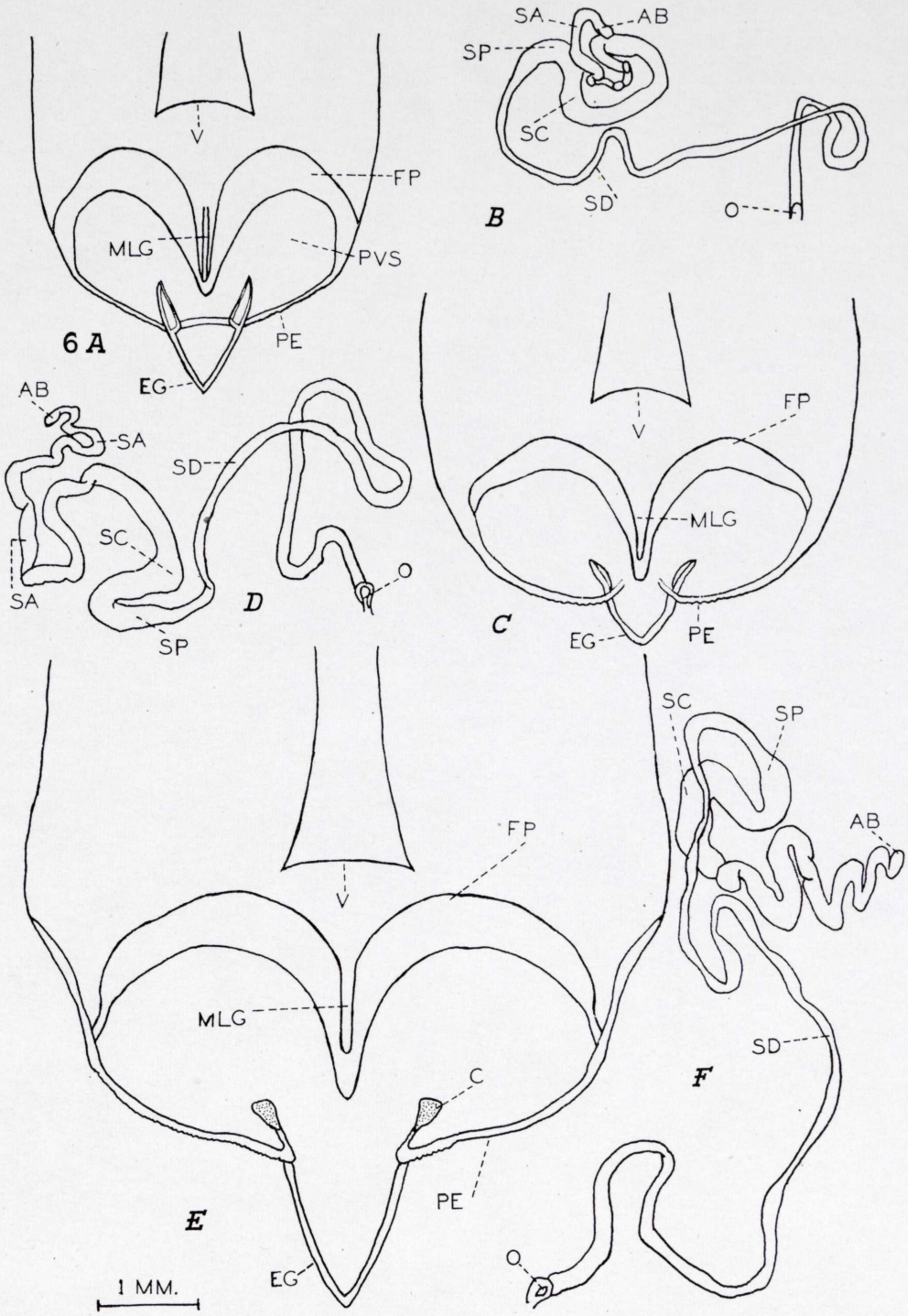

Fig. 6.—*Taphronotini (Taphronotina)*, female structures: *A, B, Taphronota (T.) f. ferruginea* (Fabricius); *C, D, T. (Epamontor) staali* Bolívar; *E, F, T. (T.) c. calliparea* (Schaum). *A, C, E,* subgenital plates, dorsal; *B, D, S,* receptacula seminis. For notation, see pp. 279-281.

tegminal venation and the sculpturation of the lateral pronotal lobes being typically similar to that of the pronotal disc).

Species and subspecies examined: Taphronota (T.) ferruginea ferruginea (Fabricius, 1781) [= *thaelephora* (Houttuyn *in* Stoll', 1813) = *ornata* (Burmeister, 1838) = *gabonica* Karsch, 1888] [4] (Guinea to W. Kenya - figs. 5 A-G, 6 A, B); *T. (T.) f. apicornis* (Fairmaire, 1858), stat. nov. [form with violet, blue, blue-black, not red hind tibiae = *pulchripes* (Walker, 1870)] (Cameroons to N. Angola, W. and C. Zaïre Republic); *T. (T.) merceti* Bolívar, 1904 [= *splendens* (Giglio-Tos, 1907), syn. nov. = *corallipes* Sjöstedt, 1929, syn. nov. = *nigripes* Sjöstedt, 1929, syn. nov. = *pallidipes* Dirsh, 1963 *(nomen nudum* attributed to Kevan)] (E. Guinea, Cameroons to W. and C. Zaïre Republic); *T. (T.) occidentalis* Karsch, 1892 [= *rostrata* Saussure, 1899] (W. Cameroons), *T. (T.) calliparea calliparea* (Schaum, 1853) [= *cincta* (Burmeister, 1838, *nec* Fabricius, 1793) [5] = *porosa* (Stål, 1855) = var. *poultoni* Bolívar, 1904 (purple-brown colour phase) = *vinacea* Sjöstedt, 1929 *(partim)* = var. *immaculata* Sjöstedt, 1929] (southern and eastern Africa, fig. 6 E, F) [Type species]; *T. (T.) c. dimidiata* Bolívar, 1904, stat. nov. [= *subverrucosa* of Kevan (1962), *nec* Saussure = *amaranthina* Bolívar, 1904 = *sabauda* (Giglio-Tos, 1907), syn. nov. = *vinacea* Sjöstedt, 1929 *(partim)*] (Guinea to N. Angola and northern East Africa; hind wing-tip more infumated than typical *calliparea* and tegmen seldom more than 1.6 times as long as hind femur); *T. (T.)* n. sp. *a* (Kivu, Rwanda); *T. (T.)* n. sp. *b.* (NE. Tanzania); *T. (Epamontor) cacuminata* Karsch, 1893 (Nigeria, Ghana); *T. (E.) staali* [6] Bolívar, 1884 [= *antennalis* (Kirby, 1902) = *staali maior* Ramme, 1929, syn. nov.] (southern and eastern Africa — Figs. 5*H*, 6*C*, *D*) [Type species of subgenus].

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cu'ations small and even]; near Borio (NE. Bihar-W. Bengal border) [dark with a few confluent maculations, but large] and S. Nepal. Other known intermediates are not presently available for study, but they include old specimens allegedly from Calcutta.

[4] *T. subverrucosa* Saussure, 1899, s. str., is also a synonym (syn. nov.); it was misidentified by Kevan (1962) and subsequently.

[5] Dirsh (1966, 1970) used the name *T. cincta* (Burmeister), but as this was based on a misidentification of *Gryllus cinctus* Fabricius (= *Phymateus cinctus)* and not proposed as a new species by Burmeister, it is not a valid senior synonym of *calliparea.* This was discussed by Kevan (1962), but the point was apparently not taken by Dirsh, who has been followed by other authors.

[6] Originally spelt *Ståli;* diacritical marks not now permitted; 'å' = 'aa' in longhand.

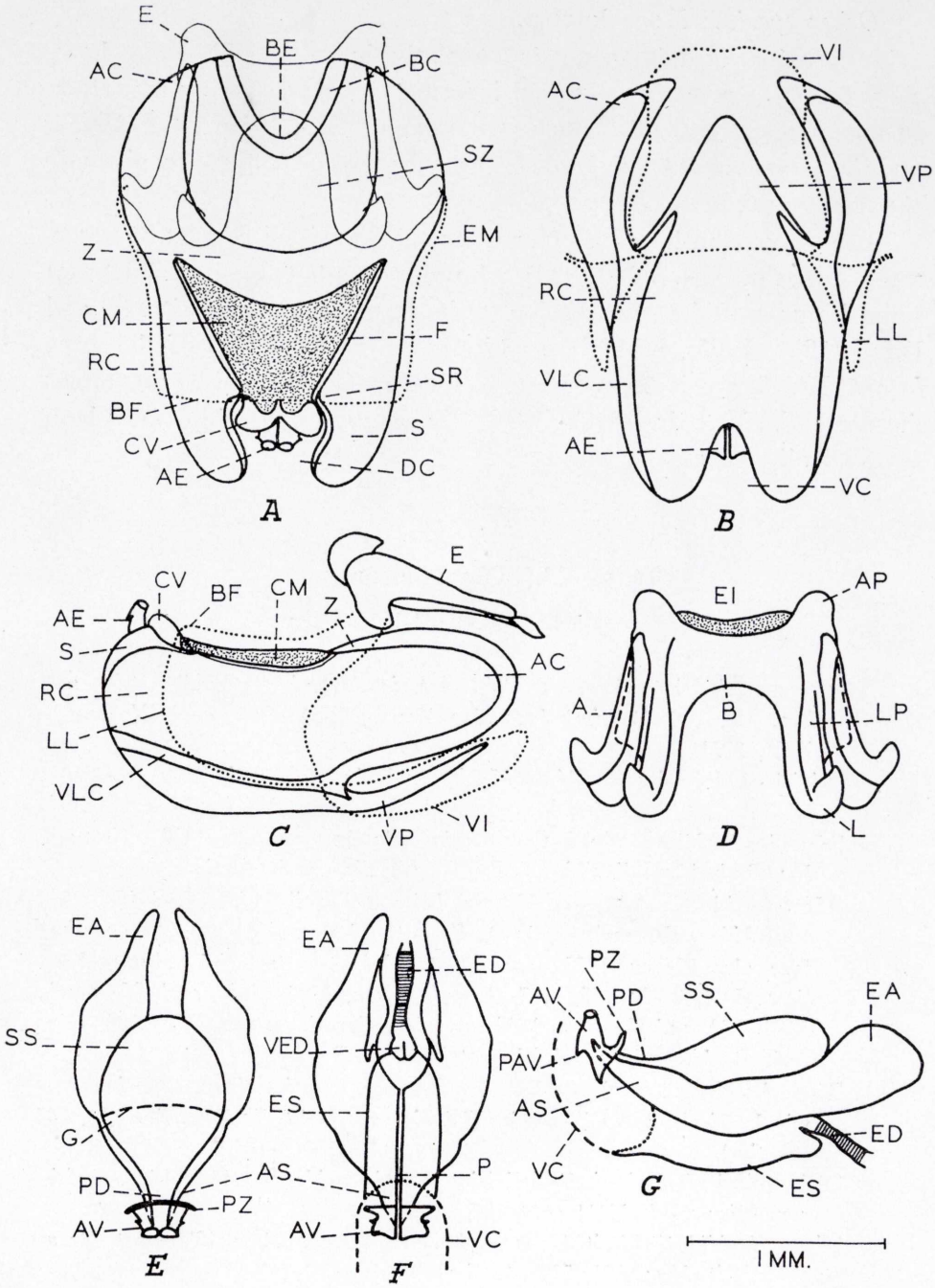

Fig. 7.—*Dictyophorini: Maura rubroornata* Stål, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

Other species: None known.

A revision of this genus is currently in press. To date, however, the most recently published information on synonymy is scattered and not entirely satisfactory (see Kevan, 1955, 1956, 1962, 1963 b and *in* Kevan and Roy, 1971). Some figures of types are given in the first two references cited.

The only published information on the concealed copulatory structures is that of Agarwala (1954), who mentions but does not illustrate) some features of the subgenital plate in *Taphoronota c. calliparea,* and Dirsh (1956, 1965), who gives a sketch of the epiphallus of the same form. His figure is reproduced by Uvarov (1966), and again, under the name *T. cincta,* by Dirsh (1970). Kevan (in press) illustrates both sexes of all species.

Tribe 23. Dictyophorini.

(Figs. 7-18, Pl. II-IV).

[sous-genre] Dictyophores Brullé, 1835, *in* Audouin et Brullé, *Hist. nat. Ins.,* IX, 220 *(partim)* [see also Kevan, 1964, *Bull. zool. Nomencl.,* XXI, 377].

[Division] Pétasies Brullé, 1835, *in* Audouin et Brullé, *Hist. nat. Ins.,* IX (5): 220 [see also Kevan, 1964, *Bull. zool. Nomencl.,* XXI, 377].

[Famille Acridites, Division] *Conophori* Audinet-Serville, 1838, *Hist. nat. Ins. Orth.* [=*Coll. Suites à Buffon* (7)], 366, 603 *(partim).*

[Unterfamilie Conophoren], Unterabtheilung *Poeciloceridae* (Sektion *Phymat[e]idae)* Burmeister, 1840, *Z. ent.* (Germar), II, 45, 46 *(partim)* [see also Kevan 1953, *Spec. Pap. Univ. Nottm. Sch. Agric. Zool. Sect.,* I, 1, 2, 3, 4, 5, 6, 7, 9, *and* Kevan, 1964, *Bull. zool. Nomencl.,* XXI, 378, *and* Kevan and Akbar, 1964, *Canad. Ent.,* XCVI, 1506 - also spelt *Poekiloceridae* and *Phymateidae*].

[Geslacht *Acridium,* Groep] *Phymateus* [or] *Petasia,* Haan, 1842 *in* Temminck, *Verh. natuurl. Gesch. Ned. Overz. Bezitt.,* XVIII (Zool. 7), 145 *(partim).*

[Subfamily] *Conophori,* [Subdivision] *Xiphoceridae* Scudder, 1868, *Smithson. Misc. Coll.,* VIII (189), 87 *(partim).*

[Fam. *Acrididae*] Limited Fam. *Phymat[e]idae* Walker, 1870, *Cat. Derm. Salt. Brit. Mus.,* III, 539 *(partim).*

Fam. *Phymat[e]idae* Walker, 1871, *Cat. Derm. Salt. Brit. Mus.,* V (Suppl. 3), 101 *(partim).*

Species *Poeciloceri* Stål, 1873, *Öfv. K. svensk. VetenskAkad. Förh.,* XXX (4), 51 *(partim).*

Sub-tribus [and "sub-tribu"] *Petasiae* Bolívar, 1884, *An. Soc. esp. Hist.*

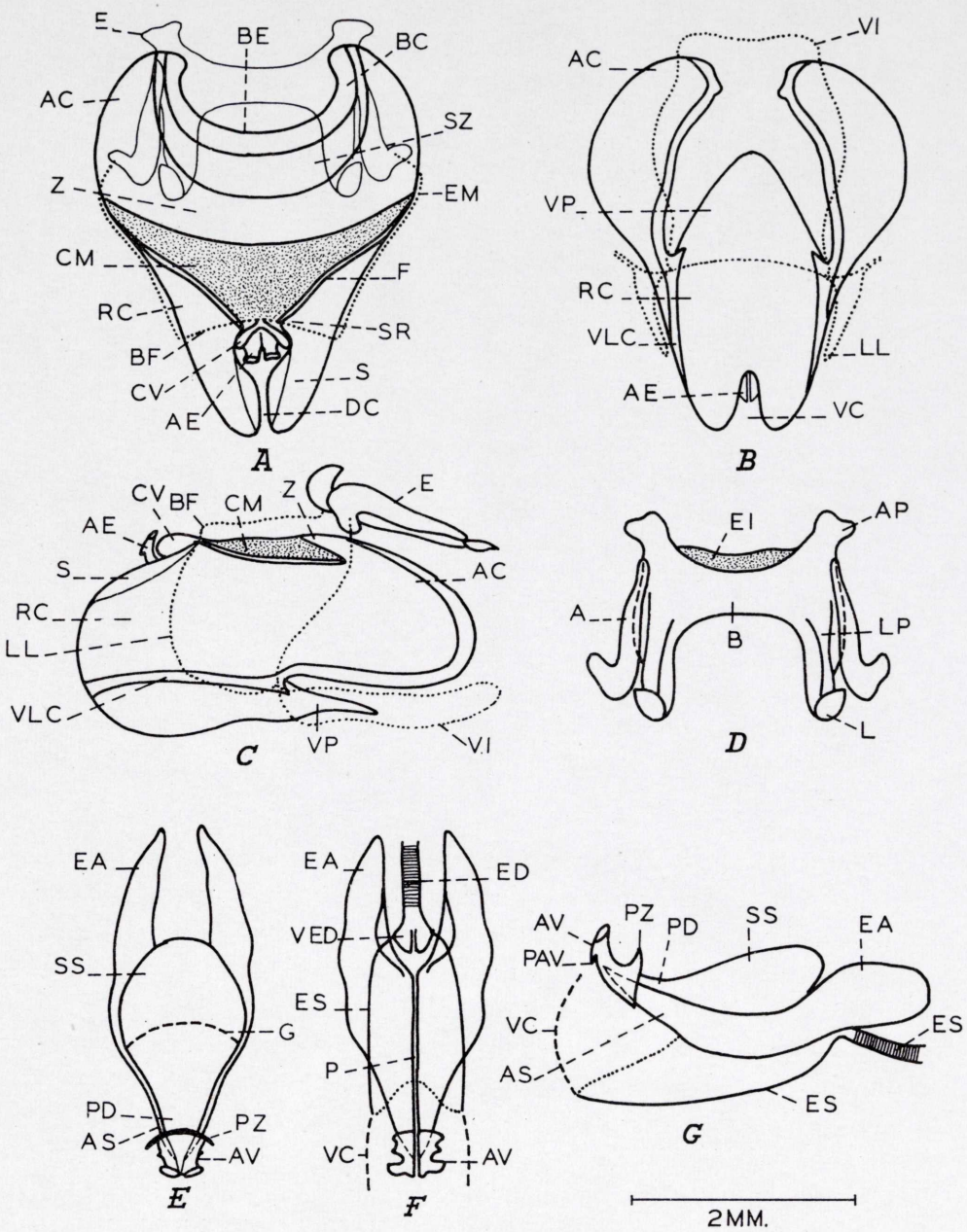

Fig. 8.—*Dictyophorini: Parapetasia femorata* Bolívar, phallic structures. *A-G*, as in fig. 1. For notation, see pp. 279-281.

nat., XIII, 21, 25, 471 *(partim)* [see also Kevan, 1964, *Bull. zool. Nomencl.*, XXI, 377, *and* Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1508].

Tribus *Pyrgomorphii*, Stirps *Phymateus* Saussure, 1899, *Abh. Senckenb. Naturf. Ges.*, XXI, 443 *(partim)*.

Subfam. *Dictyophorinae* Kirby, 1902, *Proc. zool. Soc. London*, 1902, 97; 1902, *Trans. ent. Soc. London*, 1902, 85 [see also Kevan, 1964, *Bull. zool. Nomencl.*, XXI, 377].

Subfam. *Tapesi[i]nae* Bolívar, 1904, *Bol. Soc. esp. Hist. nat.*, III, 308 [see also Kevan, 1964, *Bull. zool. Nomencl.*, XXI, 377, *and* Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1508].

Sect. *Tapesiae* Bolívar, 1909, *Gen. Ins.*, XC, 3, 10 [see also Kevan, 1964, *Bull. zool. Nomencl.*, XXI, 377, *and* Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1508]; Chopard, 1921, *Voy. Babault. Afr. or. angl., Orth.*, 52.

Tribe *Tapesi[i]ni* Rehn, 1953, *Grassh. Locusts Austral.*, II, 21 [see also Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1512].

Group *Dictyophori* Johnston, 1956, *Annot. Cat. Afr. Grassh.*, 123.

Tribe *Dictyophorini* Kevan and Knipper, 1961, *Beitr. Ent.*, XI, 371; Kevan, 1964, *Bull. zool. Nomencl.*, XXI, 382; Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1507, fig. 1 (map), 1512, 1518, 1524, 1525; Melville (for International Commission on Zoological Nomenclature) 1971, *Bull. zool. Nomencl.*, XXVIII, 89.

Note: names based on *Dictyophorus* Thunberg, 1815, and *Petasia* Audinet-Serville, 1831 *(nec* Stephens, 1828) prior to *Petasiae* Bolívar, 1884, should not be regarded as being co-ordinate with the tribal name —see Kevan (1964).

External features: Body robust and heavy to subfusiform, not depressed; integument rugose, colour not distinctly green, predominantly dull, sometimes with bright yellow, orange or red markings, abdomen often annulated; antennae filiform, rather short with short subtransverse segments, the last (or last few fused) elongate, not inserted far in front of lateral ocelli; head varying from rather blunt to conical, fastigium of vertex variable; pronotum strongly rugose or tuberculate, not usually (although occasionally) saddle-shaped, not flat dorsally, inferior margin of lateral lobe not straight and granular, prosternal tubercle usually wart-like or rounded; tegmina and hind wings very frequently reduced, sometimes minute, hind wings red with black borders, occasionally almost entirely blackish; hind femur slender, its external area not expanded or displaced; hind tarsal segments not elongate; ovipositor valves somewhat reduced, scarcely sinuate.

Principal phallic characters: Epiphallus rather conventional, usually

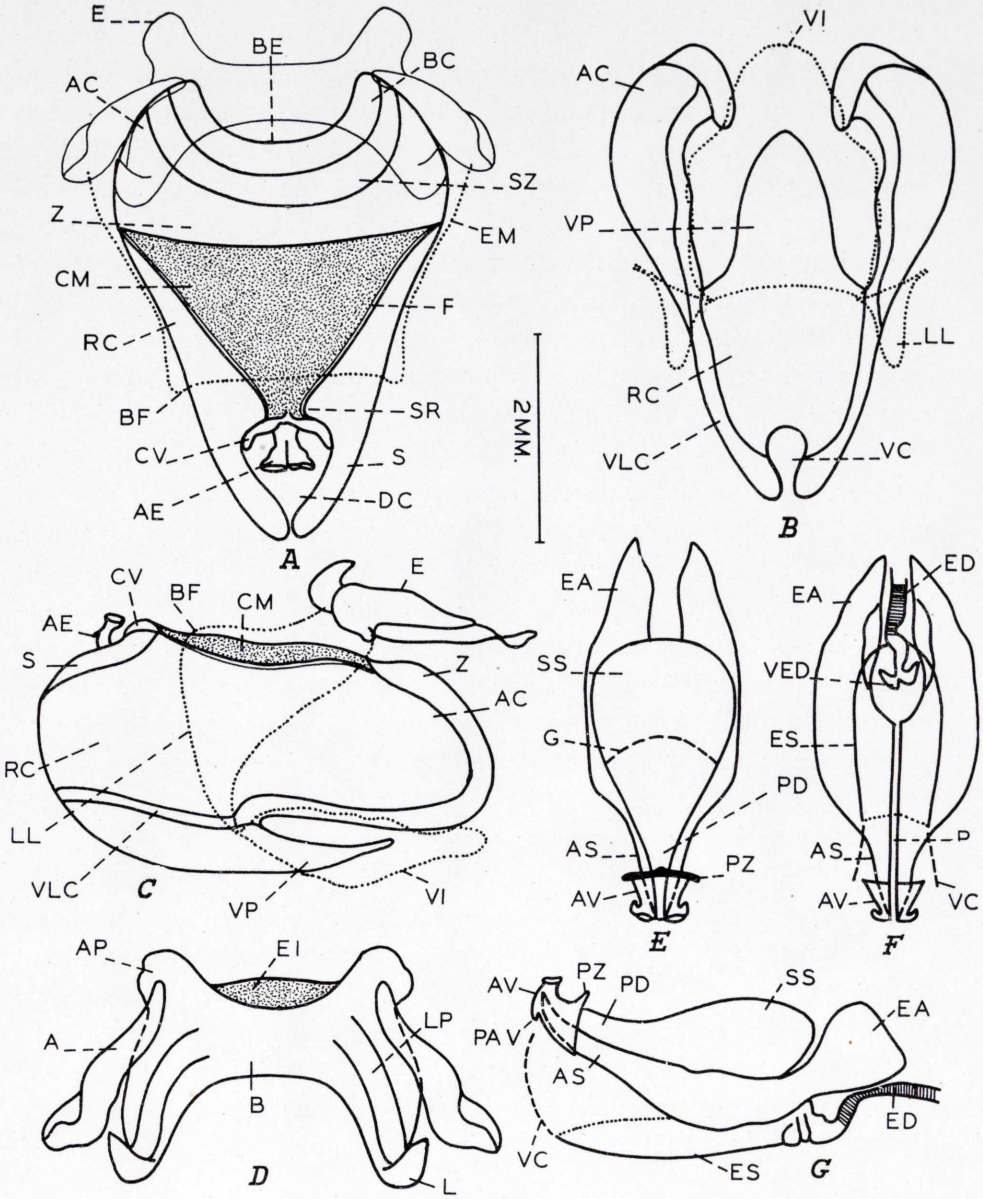

Fig. 9.—*Dictyophorini: Camoensia insignis* Bolívar, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

with fairly prominent anterior projections, lateral plates with external margins somewhat expanded but only occasionally bearing angular processes, lophi comparatively slender and little curved, hooks dorsally or dorsolaterally directed; ectophallus broadly pyriform, central membrane usually fairly extensive, triangular or subtriangular, marked off laterally from the rami of the cingulum by characteristic marginal furrows, zygoma usually broadly transverse, not usually extending halfway along the cingulum, posterior margin transverse or somewhat convex, occasionally irregular, suprazygomal plate usually widely rounded and considerably shorter than the zygoma, occasionally produced distally and surpassing the zygoma, basal emargination usually rounded and rather shallow, wide or narrow, apodemal plates usually rounded in lateral view, occasionally with anterior blunt points which are probably homologous with ventral processes, valves of cingulum of moderate size, usually narrow and divergent in dorsal view, occasionally broader, rami of cingulum rather broad in dorsal view with well developed suprarami, sheaths well developed, ventral process of cingulum broadly triangular; aedeagal sclerites stout and curved, endophallic apodemes rather narrow in lateral view, not produced forwards ventrally, dorsal inflections not developed, spermatophore sac rather large, usually ovoid, occasionally pyriform, gonopore at or beyond the middle, pseudoarch small, distinct, transverse, aedeagal valves very short with button-like apices and small, ventrolaterally directed processes in the distal parts.

Concealed female structures: Subgenital plate with posterior edge rounded, slightly serrated or smooth; egg-guide prominent, usually rather narrowly triangular, with columellalike thickenings at the base, contact areas not or poorly developed; spermatheca lacking an apical pocket or distinct caecum, latter confluent with spermathecal vesicle and appendage, caecal area and at least the lower part of the appendage with secondary diverticula, latter varying from simple pouches to elongate, even complexly branched tubules unique among *Orthoptera;* spermathecal duct rather short with an elongate, terminal, thickened region.

Distribution: Africa south of Sahara.

Included genera: Maura Stål, 1873; *Parapetasia* Bolívar, 1884; *Camoensia* Bolívar, 1882; *Loveridgacris* Rehn, 1954; *Dictyophorus* Thunberg, 1815 (including subgenus *Tapesiella* Kevan, 1953).

Species examined: Maura rubroornata (Stål, 1855) [= *pyrrhomela*

(Walker, 1870) = *satanas* (Gerstaecker, 1873), syn. nov. = *rugulosa* and var. *brevipennis* Bolívar, 1884 = *monacha* (Gerstaecker, 1889), syn. nov. = *brevipennis* Saussure, 1889, syn. nov. = *rugulosa* var. *lugubris* Schulthess, 1899, syn. nov. = *atriceps* Kirby, 1902, syn. nov. = *flavomaculata* Kirby, 1902, syn. nov. = *selysi* Bolívar, 1904, syn. nov.] (southern parts of Africa — Figs. 7, 13*C, D)* [Type species [7]] ; *M. marshalli* Bolívar, 1904 (S. C. Africa) ; *M. bolivari* Kirby, 1902 [= *modesta* Bolívar, 1904 = *clavata* Bolívar, 1911 = *antennata* Bolívar, 1912 = *M. sobrina* Bolívar, 1912 = *fitzgeraldi* Dirsh, 1954, syn. nov. = *eichleri* Liana, 1966, syn. nov.; these are all merely various micropterous forms of the strongly brachypterous *M. bolivari*] (Malawi, N. Zambia, SW. Tanzania, SE. Congo) ; *M. lurida* (Fabricius, 1781) [= *M. hecate* (Gerstaecker, 1869), syn. nov. = *apicalis* Bolívar, 1884 = *flavifrons* Bolívar, 1894 (brachypterous ♂ form), syn. nov. = *venusta* Bolívar, 1904, syn. nov.] (West to East Africa) ; *Parapetasia femorata* Bolívar, 1884 (SE. Nigeria to Gabon — Figs. 8, 14, Pl. II, figs. A, B) [Type species] ; *Camoensia insignis* Bolívar, 1882 (Angola — Figs. 9, 15; Pl. II, figs. E, F; Pl. III, figs. A, B) [Type species] ; *Loveridgacris impotens* (Karsch, 1888) (E. Tanzania, SE. Kenya — Figs. 10, 16) [Type species] ; *Dictyophorus (D.) spumans* (Thunberg, 1789) (southern Africa — Figs. 11, 17; Pl. III, figs. E, F ; Pl. IV) [Type species] ; *D. (Tapesiella) griseus griseus* (Reiche and Fairmaire, 1850) [for synonymy, see Dirsh (1970) ; there are, however, several recognizable forms with differing tegminal lengths, and *oberthueri* appears to have subspecific status (see below) — the specimen upon which Dirsh based the synonymy of the West African with other forms being typical of neither] (E. C. & SE. Africa — Figs. 12, 18) [Type species of subgenus].

Other species and subspecies: Parapetasia calabarica Rehn, 1953 (SE. Nigeria) ; *P. rammei* Sjöstedt, 1923 (Cameroons — P. II, figs. C, D) [8] ; *Loveridgacris ulugurensis* Rehn, 1953 (E. Tanzania) [9] ; *Dictyophorus (Tapesiella) griseus oberthueri* (Bolívar, 1894) [= *cuisinieri* (Carl, 1916), syn. nov.] (West Africa); *D. (T.) karschi* (Bolívar, 1904) [= *lugubris* (Ramme, 1929)] (E. Zaïre to Cameroons).

There is considerable need of a revision of this tribe, particularly in

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[7] Stål (1873) states that the type species is *rubroornata* (by monotypy). Kirby (1910) designates *H. modesta* as the type species, but this is clearly typographical error (No. 7 instead of No. 8 on his list), as *modesta* was not an originally included species.

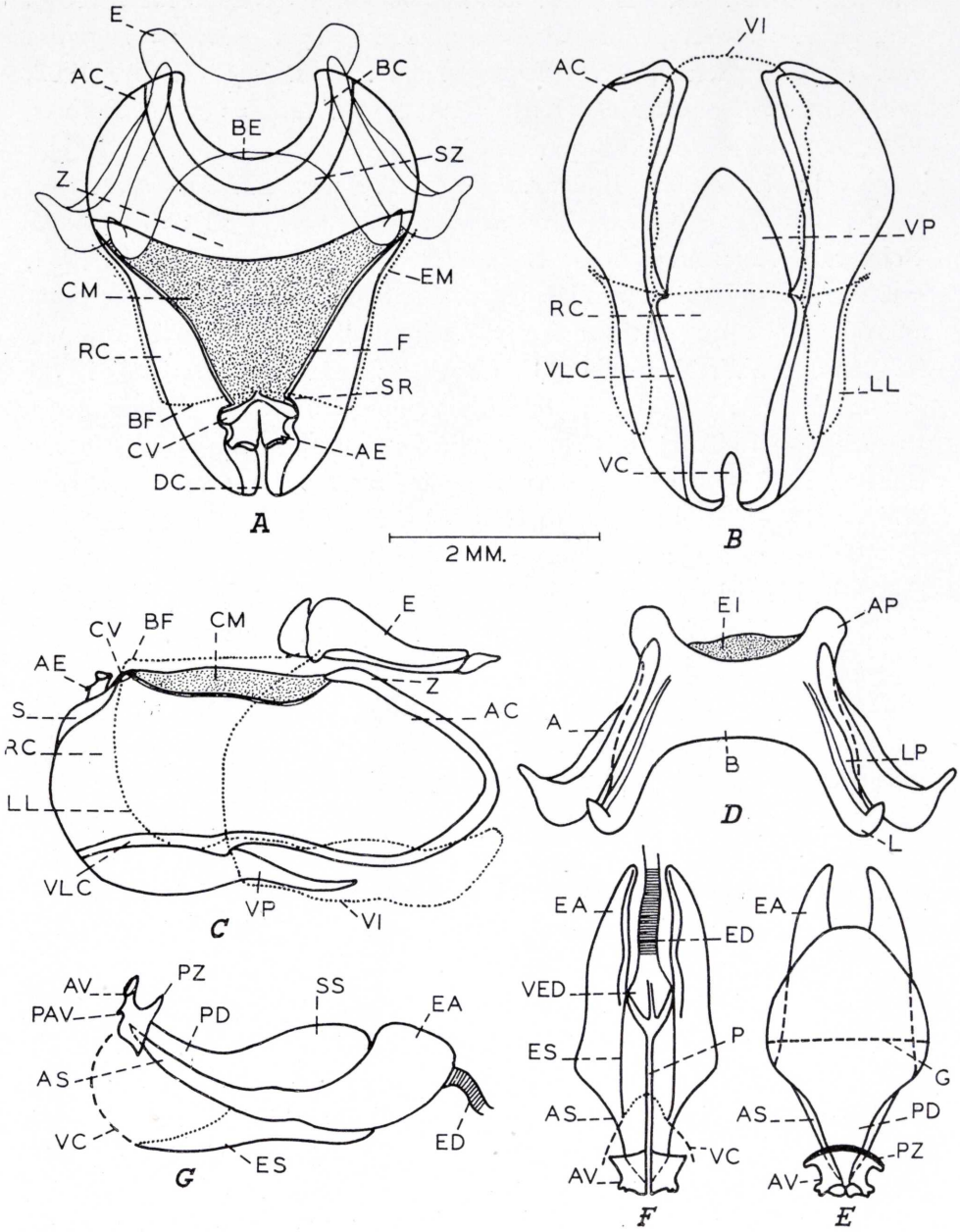


Fig. 10.—*Dictyophorini: Loveridgacris impotens* (Karsch), phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

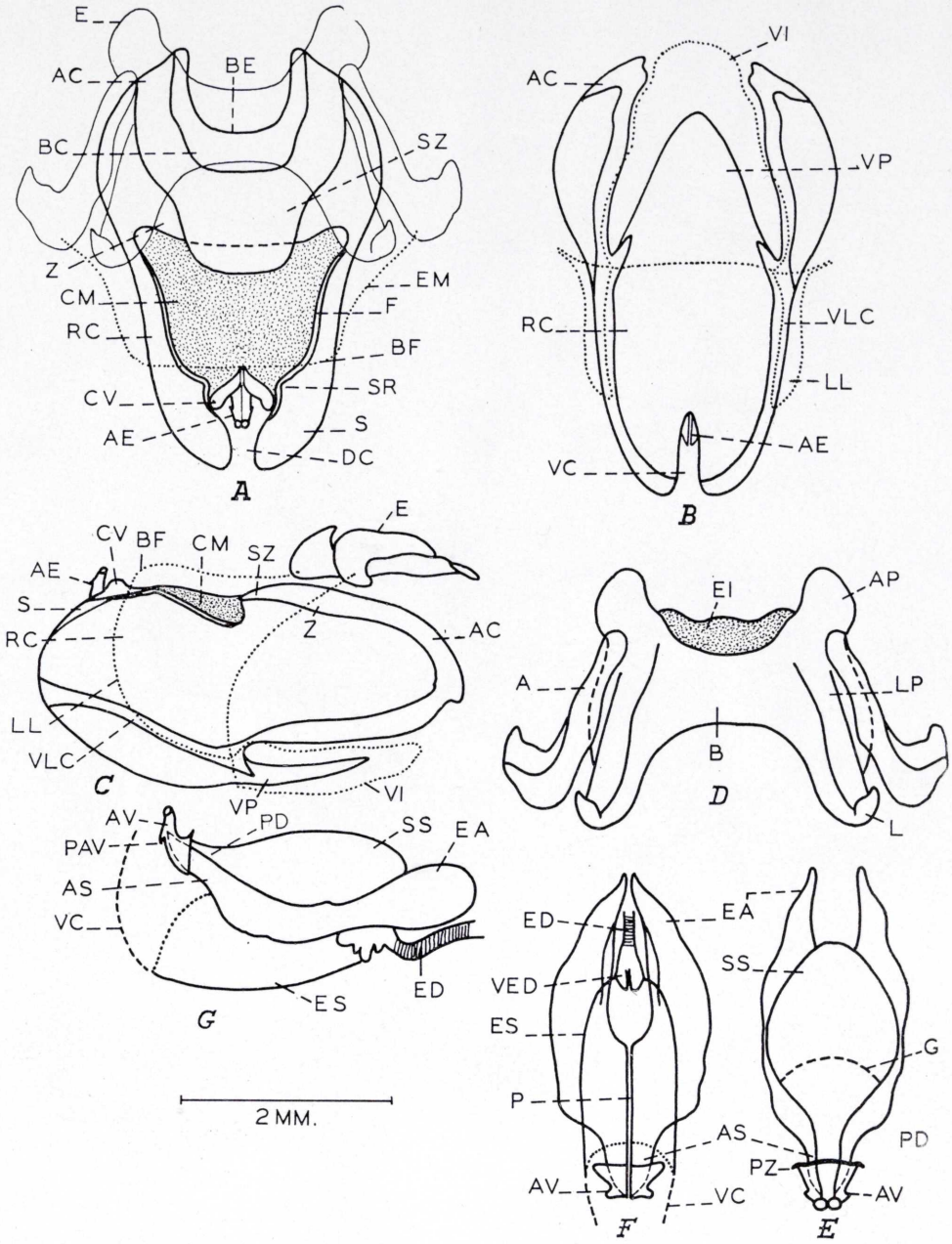


Fig. 11.—*Dictyophorini: Dictyophorus (D.) spumans* (Thunberg), phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

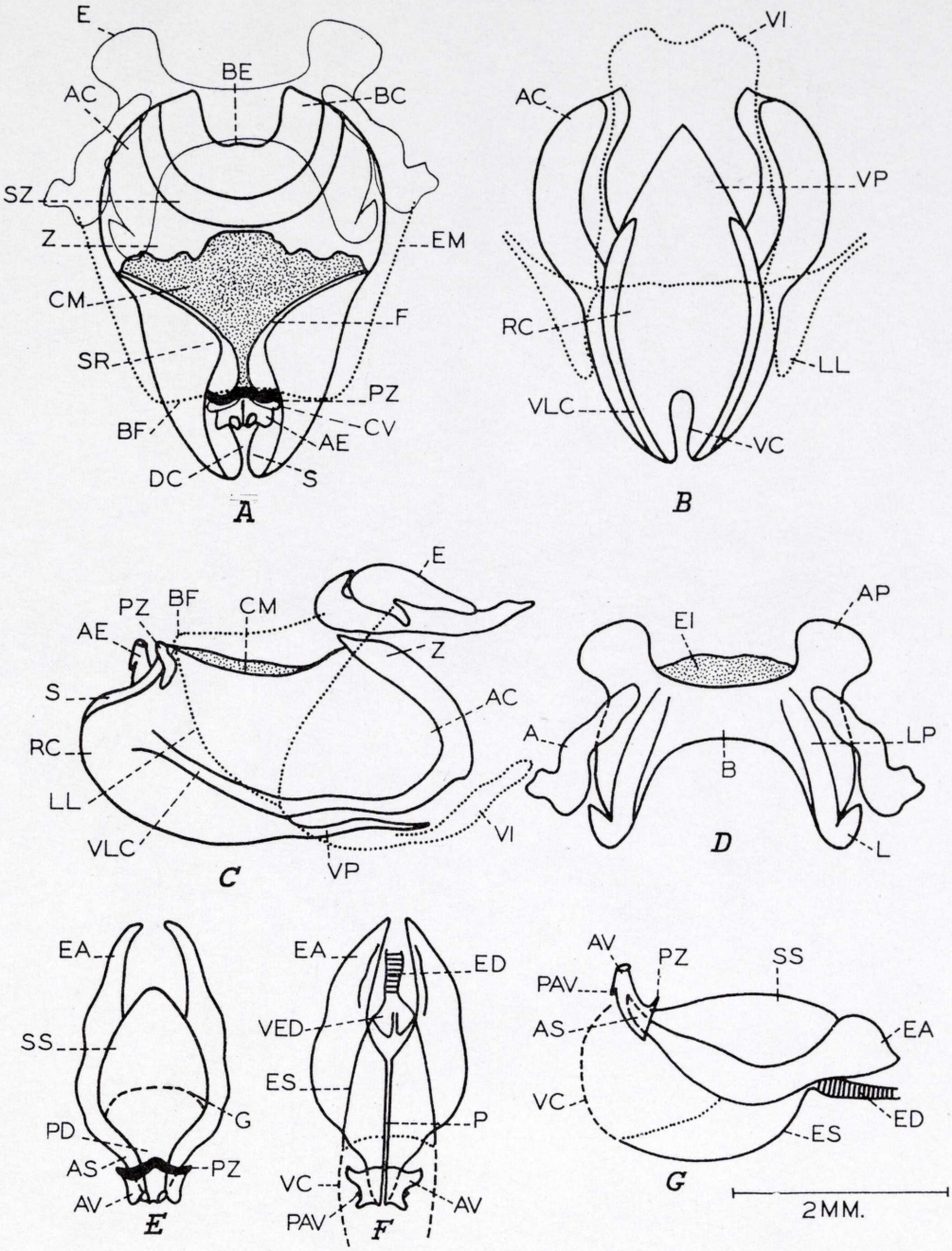
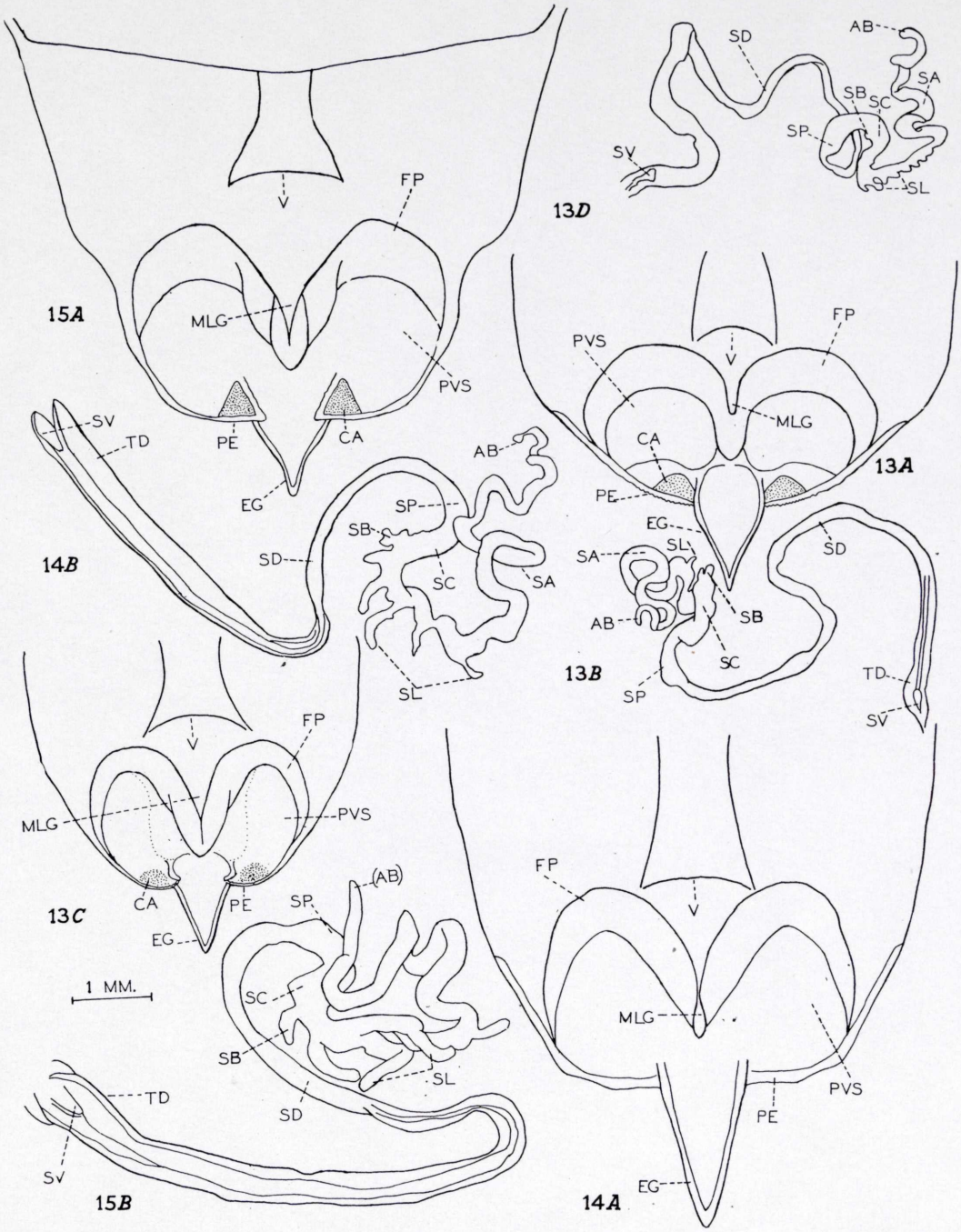
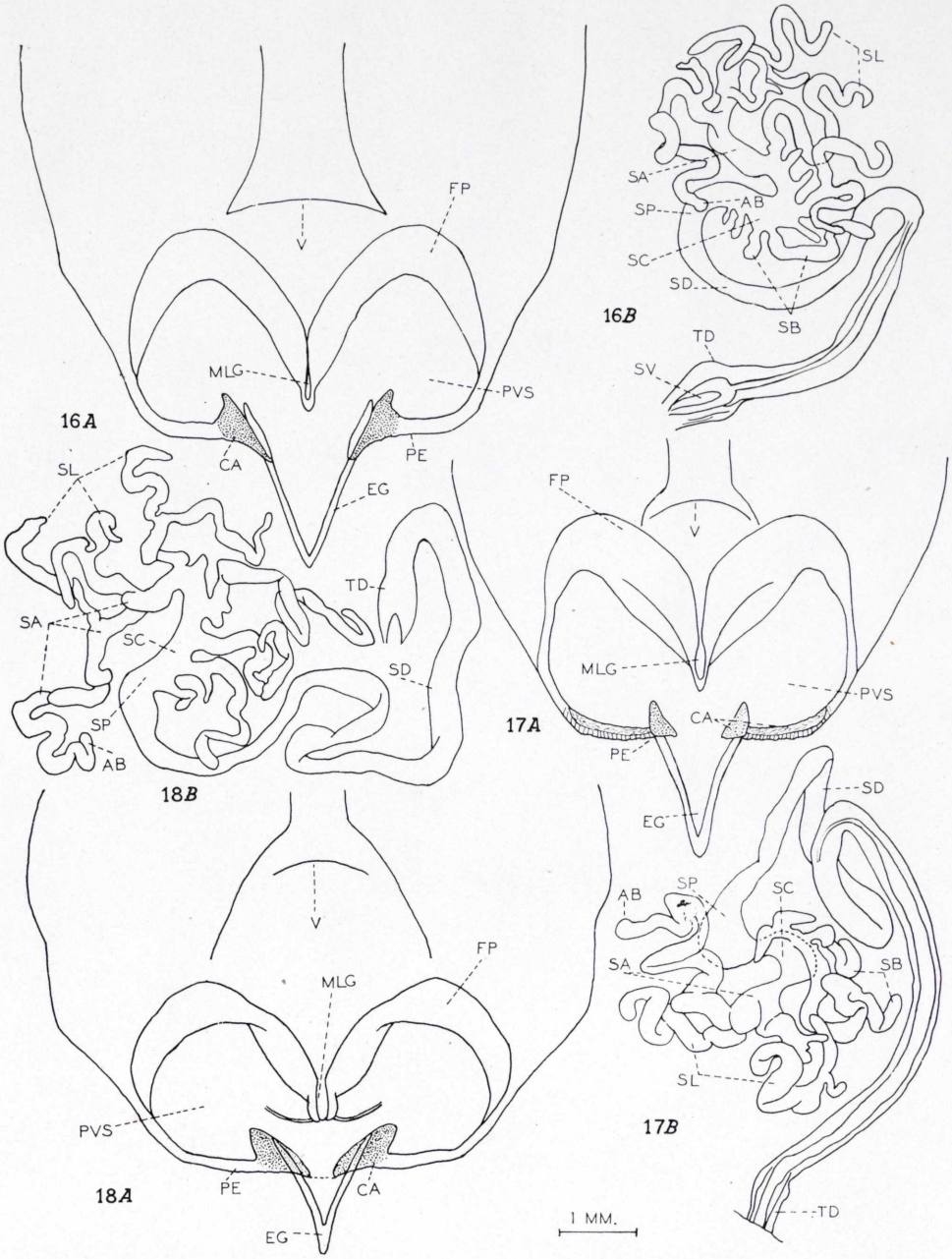


Fig. 12.—*Dictyophorini: Dictyophorus (Tapesiella) g. griseus* Reiche & Fairmaire, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.



Figs. 13-15.—*Dictyophorini,* female structures: 13) *A, B, Maura lurida* (Fabricius); *C, D, M. rubroornata* Stål; 14) *Parapetasia femorata* Bolívar; 15) *Camoensia insignis* Bolívar, *A-D* as fig. 6. For notation, see pp. 279-281.



Figs. 16-18.—*Dictyophorini,* female structures: 16) *Loveridgacris impotens* (Karsch); 17) *Dictyophorus (D.) spumans* (Thunberg); 18) *D. (Tapesiella) g. griseus* (Reiche & Fairmaire). *A, B,* as in figs. 2-3. For notation, see pp. 279-281.

the genus *Maura,* and some of the synonymies indicated should not be regarded as final. Wing polymorphism and colour variation has greatly confused the picture in the past. The only recent works on the group, apart from that of Kevan (1963 a), who discusses in detail and figures the types of *Dictyophorus (D.) spumans* and many of its synonyms, are those of Rehn (1953) and Akbar and Kevan (1964) regarding *Parapetasia* and *Loveridgacris.* Even in these two genera, the validity of the species recognized is now strongly challenged [8], [9]. Dirsh (1962, 1966, 1970) has synonymized many of the species of *Dictyophorus (Tapesiella)* and *Maura,* but the geographical significance of the various forms requires further investigation. Dirsh (1970) also gives a key (of sorts) to the species of *Maura,* but this is only partially valid. Unlike Dirsh *(ll. cc.),* we prefer, for the present, to regard *Tapesiella* as meriting subgeneric status. *Dictyophorus, s. str.,* and *Camoensia* present no special taxonomic problems as only one species is recognized in each, although that of the former, in particular, is highly variable.

Slifer (1940) was the first to provide information on the concealed copulatory structures of this group, when she illustrated the spermatheca of "*Tapesia intermedia*" (i. e., *Dictyophorus (Tapesiella) g. griseus).* Agarwala (1952, 1954) illustrates or mentions the female subgenital structures of the same species under the same name. For the males, Roberts (1941) mentions that he studied the phallic complex of *Dictyophorus* sp. — presumably *D. (D.) spumans* — but he gives no further information; Dirsh (1956), however, gives a sketch of the epiphallus of "*Tapesia*" *spumans.* Dirsh (1953, 1954, 1965, 1970) also sketches the epiphalli of *Maura rugulosa* [= *rubroornata*] and *M. bolivari* (as *fitzgeraldi),* and Liana (1966) repeats his figure of the latter, together with one of the epiphallus of *M. eichleri* [= *bolivari*], showing an alleged difference between species, which, however, seems merely be due to individual variation or a difference in preparation. Akbar and Kevan (1964) give the most detailed figures in their illustrations of the phallic structures of *Loveridgacris impotens.* Some of these are repeated here in a modified form.

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[8] *P. calabarica* and *P. rammei* are almost undoubtedly mere forms of *P. femorata* with more or less reduced tegmina respectively — syn. nov.

[9] This now seems to be an undoubted synonym of *L. impotens* — syn. nov.

Series VIII.

This Series includes three not very closely related tribes of superficially rather similar appearance, all of which occur in southeast Asia, although one is much more widespread in the Old World and includes a peculiarly (tropical) African subtribe. All members are distinctly fusiform or elongate-fusiform in shape, some being somewhat depressed. The head is always strongly conical and the frons very oblique, but only slightly concave, in profile. None is adorned with large tubercles, bosses, or other exaggerated ornamentation. The inferior margin of the lateral pronotal lobe is usually rather straight. Tegmina and hind wings are well developed in most forms even if somewhat abbreviated; the African *Occidentosphenina (Atractomorphini),* however, are apterous. The tegmina when present are always tapered, though not necessarily acutely so. In coloration, green predominates, although brownish individuals occur. If developed, the hind wings are usually purplish or pinkish to bright red, at least at their bases; sometimes they are clear hyaline or, occasionally, infumated. All members of the Series have distinctive features in the phallic complex. *Tagastini* have elongate, divided aedeagal sclerites projecting beyond the aedeagal valves; the others have characteristic epiphalli — anchor-like in *Atractomorphini,* or with wing-like lateral plates and bifid lophi in *Pseudomorphacridini.* The last tribe also has peculiarly down-curved aedeagal sclerites and valves. The concealed female copulatory structures are variable, but the subgenital plate usually has distinct columellae. The spermatheca is either simple, with or without an apical pocket, or *(Atractomorphini)* of a characteristic (primitive?), 'double' form unlike anything found in other *Pyrgomorphidae.*

Tribe 24. Tagastini.

(Figs. 19-23, Pl. V).

[Geslacht *Acridium*] Groep IV. *Pyrgomorpha* Haan, 1842, *In* Temminck, *Verh. natuurl. Gesch. Ned. overz. Bezitt.,* XVIII (Zool. 7), 145 [no "Groep IV", 142 *(partim)*].

[Famille des Acridides *(Acrididae)*] Truxalites.—*Truxalidae* Blanchard, 1853, *In* Hombron and Jacquinot, *Voy. Pôle Sud, Astrolabe et Zélée,* IV (Zool.), 366 *(partim).*

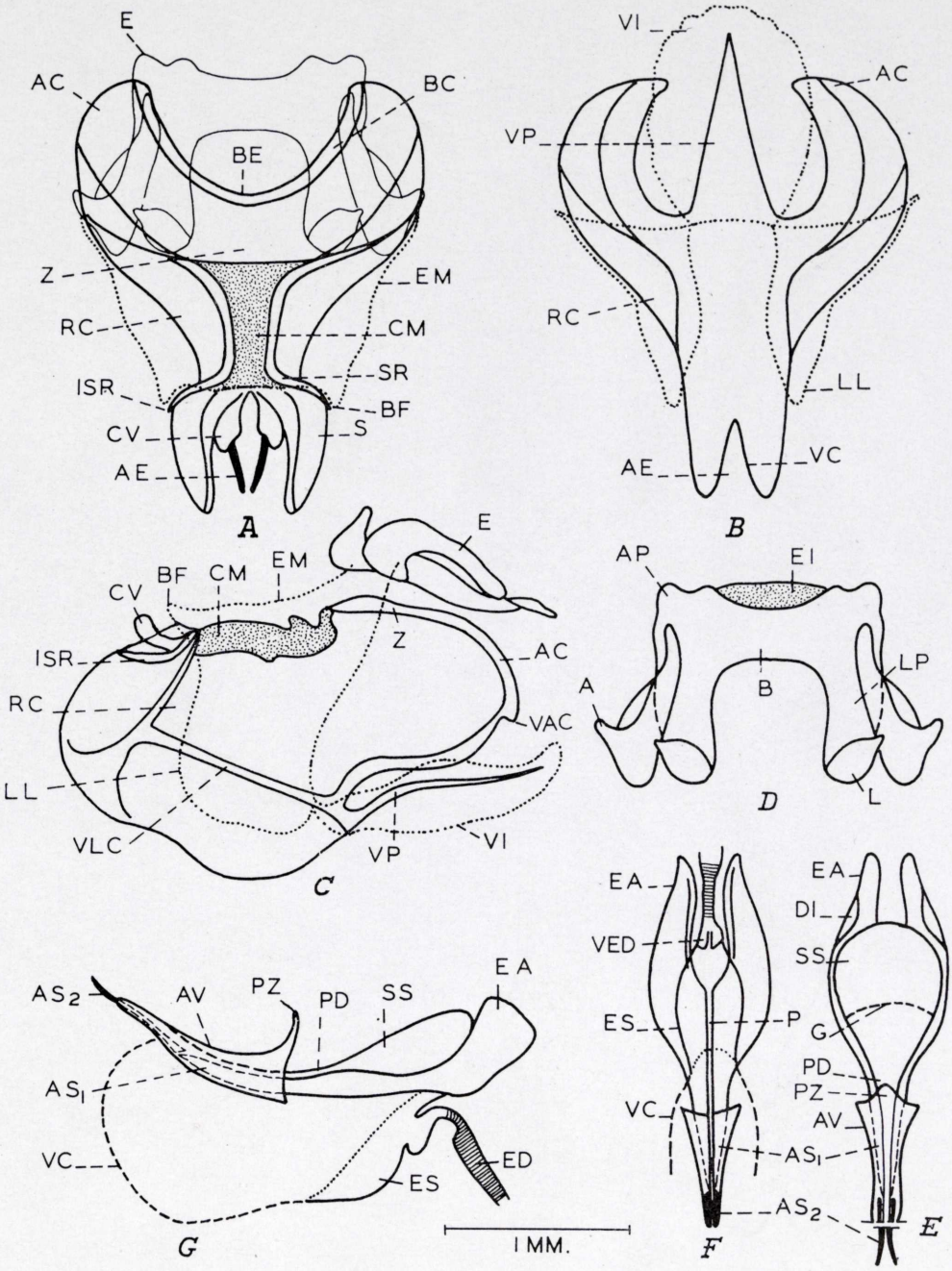


Fig. 19.—*Tagastini: Annandalea robinsoni* Bolivar, phallic structures. *A-G*, as in fig. 1. For notation, see pp. 279-281.

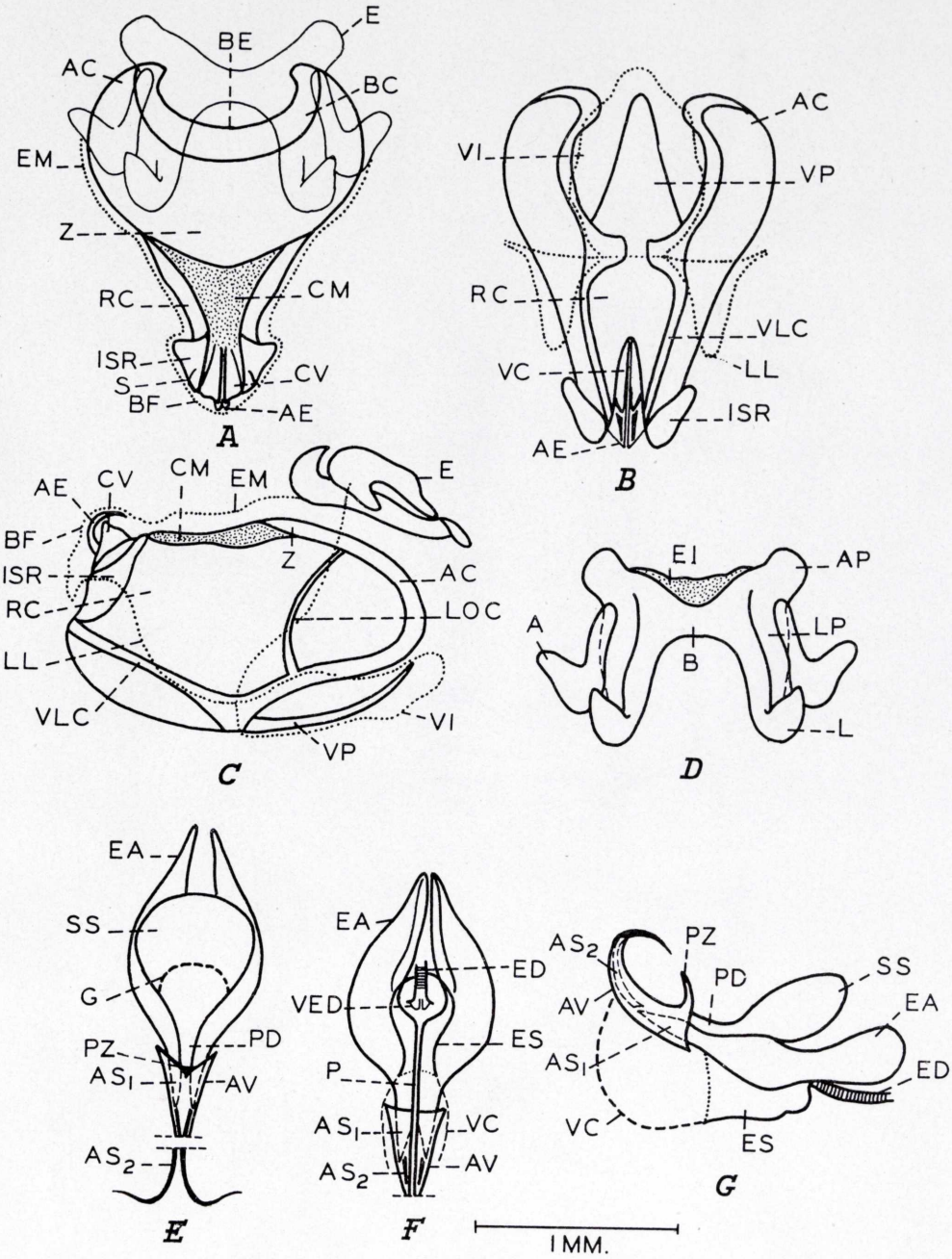
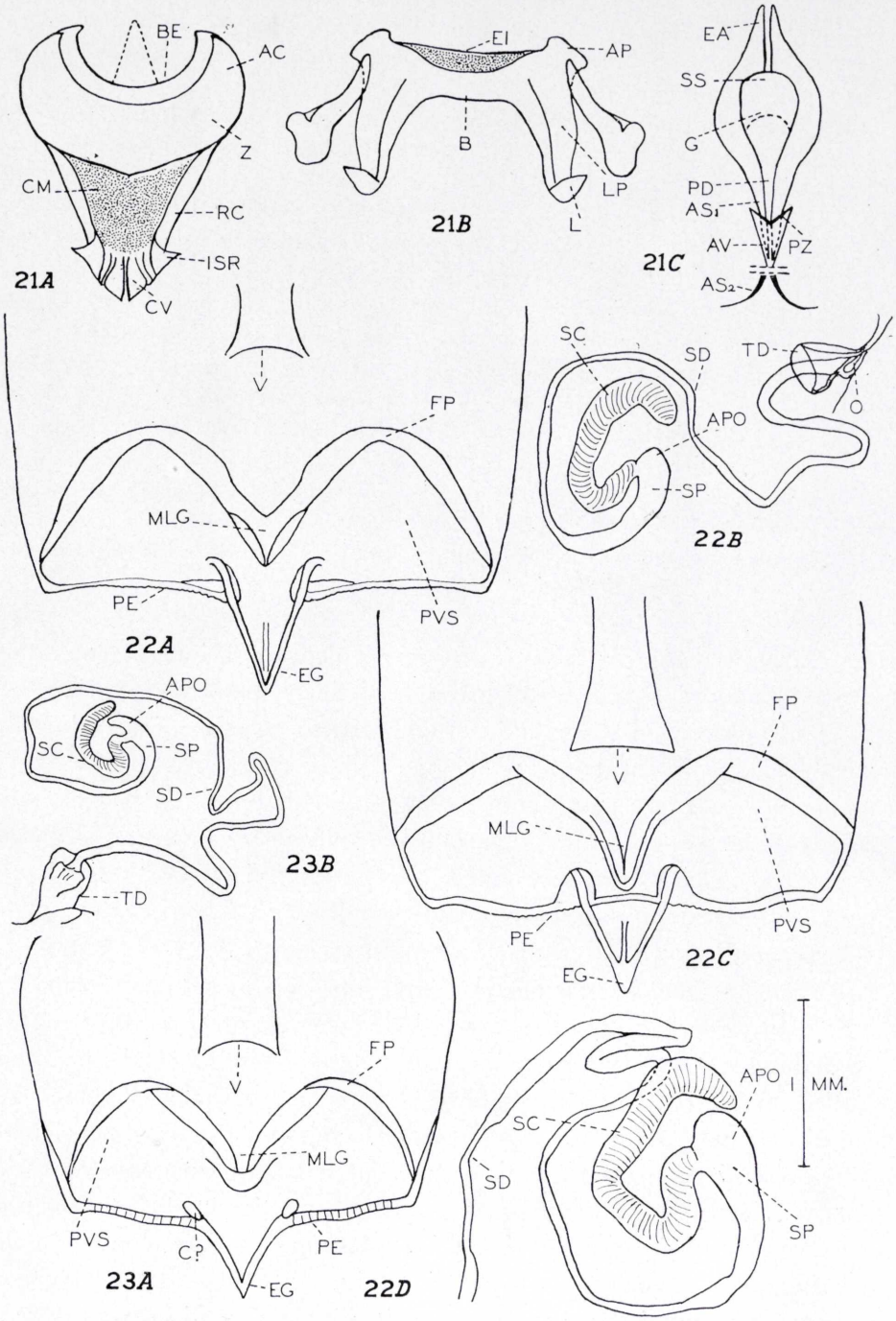


Fig. 20.—*Tagastini: Tagasta marginella* (Thunberg), phallic structures. *A-G*, as in fig. 1. For notation, see pp. 279-281.



Figs. 21-23.—*Tagastini*, male (21) and female (22, 23) structures: 21) *Tagasta celebesica* (Karsch), holotype (*A*, ectophallus; *B*, epiphallus; *C*, endophallus; all dorsal); 22) *A*, *B*, *T. marginella* (Thunberg); *C*, *D*, *T. indica indica* Bolívar (*A-D*, as in fig. 6); 23) *Annandalea haematoptera* (Haan) (*A*, *B*, as in figs. 2-3). For notation, see pp. 279-281.

[Fam. *Acrididae*] Limited Fam. *Tryxalidae* Walker, 1870, *Cat. Derm. Salt. Brit. Mus.*, III, 494 *(partim)* [included what is now *Tagasta marginella* (Thunberg)].

[Fam. *Acrididae*] Limited Fam. *Xiphoceridae* Walker, 1870, *Cat. Derm. Salt. Brit. Mus.*, III, 520 *(partim)* [included what is now *Annandalea haematoptera* (Haan)].

Sub-tribus (or "sub-tribu") *Atractomorphae* Bolívar, 1884, *An. Soc. esp. Hist. nat.*, XIII, 20, 22, 59 *(partim)* [see also Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1508].

Subfam. *Tagastinae* Bolívar, 1905, *Bol. Soc. esp. Hist. nat.*, V, 111 *(partim)* [see also Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1508].

Sect. *Tagastae* Bolívar, 1909, *Gen. Ins.*, XC, 4, 36; Carl, 1916, *Rev. suisse Zool.*, XXIV, 465; Willemse, 1930, *Tijdschr. Ent.*, LXXIII, 74; 132, *Mém. Mus. Hist. nat. Belg.* (hors Série), IV (3), 44; Kevan and Banerjee, 1961, *Verh. XI. Int. Kongr. Ent. 1960*, I, 23.

Tribe *Tagastini* Rehn, 1951, *Ent. News*, LXII, 242, 244; Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1509, fig. 2 (map), 1520, 1525, 1528; Kevan, 1965, *Proc. XII. Int. Congr. Ent. 1964*, 442; 1966, *Pacif. Ins.*, VIII, 397; 1969, *Orient. Ins.*, II, 141.

External features: Body fusiform, not depressed, integument rather smooth, colour predominently green, sometimes streaked or variegated; antennae filiform, not usually inserted distinctly in front of lateral ocelli; head conical, frons strongly oblique, slightly concave in profile, fastigium of vertex not very acute; pronotum with inferior lobe of lateral lobe not remarkably straight nor finely and evenly granular; tegmina tapering, but not acutely pointed, sometimes rather short but always reasonably well developed; hind femur with external area not expanded or displaced subventrally; male cerci not specialized.

Principal phallic structures: Epiphallus of conventional form, anterior processes prominent or small, lophi dorsolaterally directed; ectophallus acutely pyriform with a very broad base, central membrane rather restricted, zygoma very broad, more or less rounded distally not extending more than half-way along the cingulum, suprazygomal plate undeveloped, basal emargination wide but not deep, apodemal plates in lateral view rounded anteriorly, sometimes with small anterior processes, valves of cingulum fairly large, simple, rather elongate, rami of cingulum strongly convergent distally, suprarami with inflections which may be rather prominent, sheaths large or small, ventral process of cingulum elongate-triangular; aedeagal sclerites slender, their apices elongate and separated off from the main part of the sclerites, projecting beyond the aedeagal valves, endophallic apodemes small and sim-

ple, dorsal inflections not well developed, spermatophore sac pyriform, gonopore behind the middle, pseudoarch small, aedeagal valves elongate-conical or curved strongly upwards at their apices.

Concealed female structures: Subgenital plate with posterior edge transverse, almost smooth, egg-guide triangular, columellae present or reduced, contact areas absent; spermatheca simple, with an apical pocket and a C- or G-shaped caecum, spermathecal duct of moderate length, terminal dilation short and prominent.

Distribution: Southeast Asia.

Included genera: Annandalea Bolívar, 1905; *Tagasta* Bolívar, 1905.

Species examined: Annandalea robinsoni Bolívar, 1905 (Malay Peninsula — Fig. 19; Pl. V, figs. A, B) [Type species]; *A. haematoptera* (Haan, 1842) (Java — Fig. 23; Pl. V, figs. C-H); *Tagasta marginella* (Thunberg, 1815) [= *concolor* (Karsch, 1888)] (Java, Sumatra, Malay Peninsula — Figs. 20, 22 *A, B); T. indica indica* Bolívar, 1905 [= *T. tonkinensis* Bolívar, 1905] (NE. India, Bangladesh, Burma, S. & C. Thailand, Indo-China — Fig. 22 *C, D); T. celebesica* (Karsch, 1888) (Celebes — Fig. 21).

Other species and subspecies: Tagasta indica mutata Rehn, 1953 (N. Thailand); *T. insularis* Bolívar, 1905 (Lombok, Lesser Sunda Is.); *T. anoplosterna* (Stål, 1877) (N. Philippines); *T. striatipennis* Ramme, 1941 [? = *anoplosterna,* subspecie] (Luzon, Philippines); *T. inornata* (Walker, 1870) (Philippines [? S.]); *T. hoplosterna* (Stål, 1877) (S. Philippines) [Type species]. *T. ornata* is probably not congeneric with the others.

This tribe exhibits a peculiar feature in the aedeagal sclerites, namely, that the apices form long slender structures that are distinctly separated off from the rest of the sclerites. No other member of Group 'B' possesses such separate apical structures; comparable, but shorter, structures are found otherwise only in a few tribes of Group 'A', namely, *Fijipyrgini, Mitricephalini* and *Geloiini.* Whether this is a relict character, indicating an ancient common origin for these tribes, is debatable. Although *Tagastini* and *Fijipyrgini* may conceivably be distantly related (Kevan, 1966 a), any connection with the other tribes must be remote. It is not, however, believed that divided aedeagal sclerites represent similar secondary developments in several tribes independently, but the primitive condition for the *Pyrgomorphidae.* The nearest relatives of the *Tagastini* seem to be the *Pseudomorphacridini,* which may be derived from them.

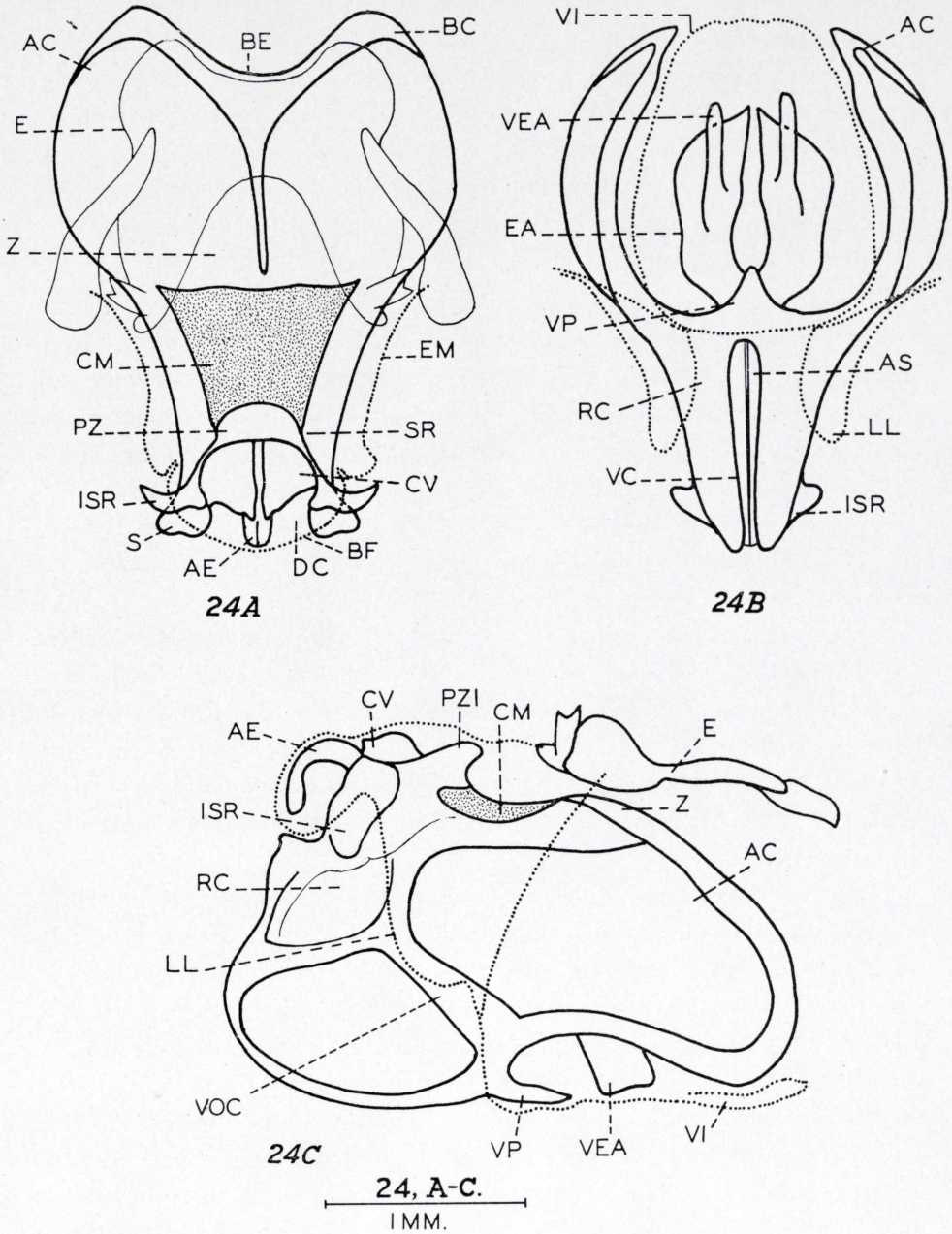
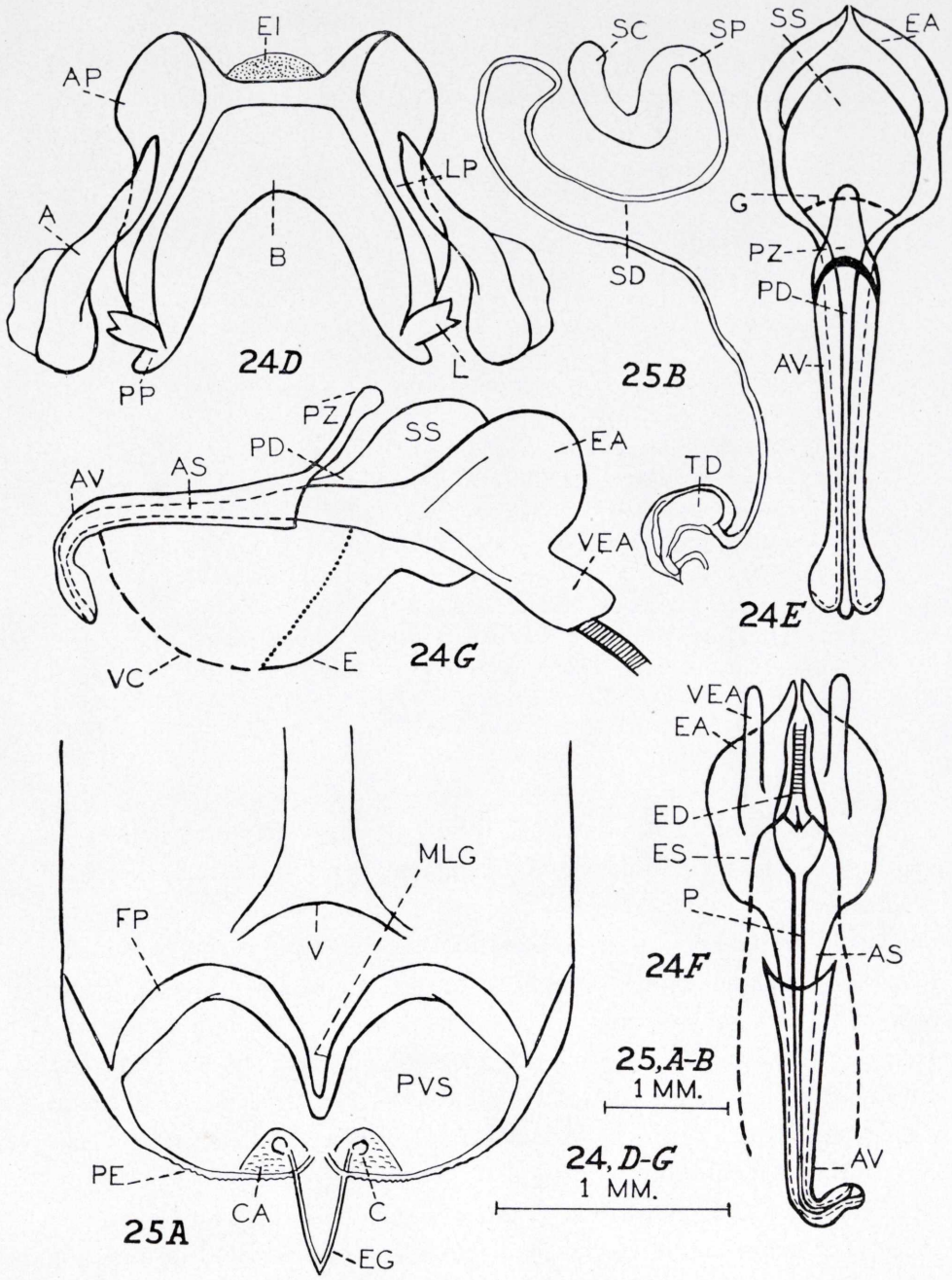


Fig. 24 a.—*Pseudomorphacridini: Pseudomorphacris brachyptera* Kevan, holotype, phallic structures, A-C as in fig. 1. For notation, see pp. 279-281.



Figs. 24 b-25.—*Pseudomorphacridini: Pseudomorphacris brachyptera* Kevan: 24) holotype, phallic structures, *D-G* as in fig. 1; 25) paratype, female structures, *A-B* as in fig. 2. For notation, see pp. 279-281.

Members of this tribe are much in need of revision, although the two species of *Annandalea* are readily distinguishable from each other. There is no reasonably reliable publication treating *Tagasta* as a whole.

So far as published information on the concealed copulatory structures is concerned, this seems to be restricted to sketches of the epiphalli of *Annandalea robinsoni* and *Tagasta marginella* by Dirsh (1956).

Tribe 25. Pseudomorphacridini.

(Figs. 24-25).

Subfam. *Tagastinae* Bolívar, 1905, *Bol. Soc. esp. Hist. nat.*, V, 111 *(partim)*.

Sect. *Tagastae* Bolívar, 1909, *Gen. Ins.*, XC, 4, 36 *(partim)*.

Sect. *Atractomorphae* Carl, 1916, *Rev. suisse Ent.*, XXIV, 464 *(partim)*.

Tribe *Atractomorphini* Kevan, 1961, *Ent. mon. Mag.*, XCVI, 204, 205, 206, 207 *(partim)*; Kevan and Banerjee, 1961, *Verh. XI. Int. Kongr. Ent. 1960*, I, 23, 24 *(partim)*; Kevan, 1963, *Ent. mon. Mag.*, XCVIII, 209 *(partim)* [dubious position indicated].

Tribe *Pseudomorphacridini* Kevan and Akbar, *Canad. Ent.*, XCVI, 1509, fig. 2 (map), 1519, 1525; Roffey, 1965, *Expand. Progr. tech. Assist. F. A. O.* [*Publ.*] (THA/TE/PL), MMCIX, 44; Kevan, 1969, *Orient. Ins.*, II (1968), 141; Kevan, Akbar & Chang, 1969, *Eos*, Madrid, XLIV (1968), 234; 1970, *Ibid.*, XLV (1969), 176.

External features: Body rather robust, strongly fusiform, somewhat depressed, especially in females, integument very finely rugose, colour predominently green; antennae somewhat flattened at base, inserted only a short distance in front of lateral ocelli; head strongly conical, frons very oblique, rather straight in profile, fastigium of vertex acute; pronotum with inferior margin of lateral lobe very straight, finely and evenly granular, inferoposterior angle very acute; tegmina tapering but not strongly acute at apices, sometimes abbreviated; hind femur with external area strongly expanded and displaced subventrally; male cerci rather specialized.

Principal phallic characters: Epiphallus of specialized form, anterior processes broadly lobed, lateral plates broadly expanded and terminating in posterior processes at the base of which arise characteristic dorsolaterally directed bifid lophi; ectophallus rather acutely pyriform, central membrane of moderate extent, zygoma broad, covering the whole of the basal half of the cingulum, posterior margin truncated, suprazygo-

mal plate undeveloped but possibly represented by a spine-like thickening given off from the basal thickening of the cingulum, basal emargination shallow and wide, apodemal plates in lateral view rounded anteriorly, valves of cingulum large and broadly triangular, rami of cingulum moderately convergent distally, suprarami with distinct, projecting inflections, sheaths rather small, ventral process of cingulum greatly reduced; aedeagal sclerites rather long and slender, peculiarly curved downwards at their apices which are undivided, endophallic apodemes rather large and rounded in lateral view with large, forwardly-directed ventral processes but without dorsal inflections, spermatophore sac oval, gonopore posterior in position, only a short distance before the phallotreme duct, pseudoarch large, aedeagal valves long, forming sleeves around the aedeagal sclerites and similarly curved downwards apically.

Concealed female structures: subgenital plate rounded posteriorly, egg-guide narrowly triangular, small columellae present and associated with small sculptured areas on either side of the base of the egg-guide but the contact areas absent; spermatheca simple, S-shaped, without an apical pocket, the caecum short and undifferentiated from the spermathecal vesicle; spermathecal duct comparatively short, terminal dilation short and prominent.

Distribution: Continental Southeast Asia.

Included Genus: Pseudomorphacris Carl, 1916.

Species examined: Pseudomorphacris notata (Brunner von Wattenwyl, 1893) (Bangladesh to S. Burma) [Type species]; *P. hollisi* Kevan, 1969 (S. & C. Thailand to Indo-China); *P. brachyptera* Kevan, 1963 (N. Thailand — Figs. 24, 25).

Other species: None known.

The single genus constituting this tribe is somewhat anomalous, particularly as regards the epi- and endophalli. The cingulum, however, seems closer to that of *Tagastini* than to other tribes. In general external morphology there is a marked similarity to the genus *Atractomorpha* of the next tribe, but this is probably due mainly to convergent evolution as the unrelated *Schulthessiini* also show similar characters (the general body form, the straight, granulated inferior margin of the lateral pronotal lobe, and the expanded and displaced external area of the hind femur).

Illustrations of the epiphallus of *P. notata* are given by Kevan and Banerjee (1961) and by Kevan (1961, 1963 c, 1969). Kevan (1963 c) also illustrates that of *P. brachyptera;* Kevan (1969), in a recent revision, figures both male and female structures for all three species.

Tribe 26. Atractomorphini.

(Figs. 26-32; Pl. VII, figs. A-H).

[Famille *Acridites*] Division *Truxalides* Audinet-Serville, 1838, *Hist. nat. Ins. Orth.* [*Coll. Suites à Buffon* (7)], 565, 578 *(partim).*

[Geslacht *Acridium*] Groep II. *Truxalis* and Groep IV. *Pyrgomorpha* Haan, 1842, *In* Temminck, *Verh. natuurl. Gesch. Ned. overz. Bezitt.*, XVIII (Zool. 7), 144 [as *Truxalis* only], 145 [as *Pyrgomorpha* only], 146 (all *partim).*

[Famille des Acridides *(Acrididae)*] Truxalites.—*Truxalitae* Blanchard, 1853, *In* Hombron & Jacquinot, *Voy. Pôle Sud, Astrolabe et Zélée,* IV (Zool.), 366 *(partim).*

[Fam. *Acrididae*] Limited Fam. *Tryxalidae* Walker, 1870, *Cat. Derm. Salt. Brit. Mus.*, III, 494 *(partim).*

Fam. *Tryxalidae* Walker, 1871, *Cat. Derm. Salt. Brit. Mus.*, V (Suppl. 3), 101 *(partim).*

Sub-tribus [and "sub-tribu"] *Atractomorphae* Bolívar, 1884, *An. Soc. esp. Hist. nat.*, XIII, 20, 22, 59 *(partim)* [see also Dirsh, 1963, *Bull. Brit. Mus. (nat. Hist.) Ent.*, XIV, 102, *and* Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1508, 1511].

Tribus *Pyrgomorphii,* Stirps *Atractomorpha* Saussure, 1899, *Abh. Senckenb. Naturf. Ges.*, XXI, 639.

Subfam. *Atractomorphinae* Kirby, 1902, *Trans. ent. Soc. London,* 1902, 81; Bolívar, 1905, *Bol. Soc. esp. Hist. nat.*, V, 196 *(partim)* [see also Dirsh, 1963, *Bull. Brit. Mus. (nat. Hist.) Ent.*, XIV, 102, *and* Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1508].

Podsemeĭstvo *Atractomorphini* Yakobson, 1902, *In* Yakobson & Bianki, *Pryamokr. Lozhnosêtchatokr. Ross. Imp.*, 289.

Sect. *Atractomorphae* Bolívar, 1909, *Gen. Ins.*, XC, 4, 38 *(partim);* Carl, 1916, *Rev. suisse Zool.*, XXIV, 465 *(partim);* Willemse, 1930, *Tijdschr. Ent.*, LXXIII, 73; 1932, *Mém. Mus. Hist. nat. Belg.* (hors Série), IV (3) [2], 45.

Group *Atractomorphae* Powers, 1942, *J. Morph.*, LXXI, 526; Johnston, 1956, *Annot. Cat. Afr. Grassh.*, 194 *(partim).*

Tribe *Atractomorphini* Rehn, 1953, *Grassh. Locusts Austral.*, II, 19, 21, 24, 25, 26, 30 *(partim);* Kevan, 1961, *Ent. mon. Mag.*, XCVI, 204, 205, 206, 207 *(partim);* Kevan and Banerjee, 1961, *Verh. XI. Int. Kongr. Ent. 1960,* I, 23, 24 *(partim);* Kevan and Knipper, 1961, *Beitr. Ent.*, XI, 372; Kevan, 1963, *Ent. mon. Mag.*, XCVIII, 209 *(partim);*

Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1509, fig. 2 (map), 1511, 1512, 1519, 1525 *(partim)*; Kevan, 1965, *Proc. XII. Int. Congr. Ent., 1964,* 442 *(partim)*; Kevan and Banerjee, 1964, *Acrid. Abstr. (n. s.)*, 1965, 20 *(partim)*; Roffey, 1965, *Expand. Progr. tech. Assist. FAO.* [Publ.] (THA/TE/PL), MMIX, 44; Kevan, 1966, *Ent. Medd.*, XXXIV, 401; Akbar, 1966, *Sind. Univ. Res. J. (Sci.)*, II, 5; 1968, *Ibid.*, III, 126; Kevan, 1969, *Orient. Ins.*, II (1968), 141; Key, 1969, *Aust. J. Zool.*, XVII, 353, 412; Kevan, Akbar and Chang, 1969, *Eos*, Madrid, XLIV (1968), 218; 1970, *Ibid.*, XLV (1969), 176; 1971, *Ibid.*, XLVI (1970), 133.

Atractomorphae, 1961, Blackith and Verdier, *Bull. Soc. ent. Fr.*, LXV (1960), 266.

Rasrostranenii *Atractomorphini* Beĭ-Bienko, 1961, *Ent. Obozr.*, XL, 472 *(partim)*.

Occidentosphenini Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1509, fig. 2 (map), 1522, 1525.

External features: Body strongly fusiform to elongate-fusiform, short and robust to long and slender, depressed only in *Occidentosphenina*, integument very finely rugose (or granular in *Occidentosphenina)*, colour predominantly green, although brownish, greyish or even purplish individuals occur; antennae somewhat flattened at base, inserted well in advance of lateral ocelli (except in *Occidentosphenina)*; head strongly conical, fastigium of vertex rather long, or acute, or both; pronotum with inferior margins of lateral lobes very straight and finely granular, or, if not so *(Occidentosphenina)*, strongly divergent in dorsal view (especially in females); tegmina tapering, strongly acute at apices, or *(Occidentosphenina)* species apterous; hind femur with external area expanded and displaced subventrally, or not *(Occidentosphenina)*; male cerci simple.

Principal phallic characters: Epiphallus of specialized form, with bridge, lateral plates and lophi united to form a characteristic, broad, anchor-like structure quite unlike anything found in other tribes; ectophallus pyriform, central membrane moderately extensive, of somewhat variable shape, zygoma broad, covering the basal half of the cingulum, its posterior margin convex, suprazygomal plate distinct, shorter than zygoma and not very broad, basal emargination small and rather narrow, apodemal plates rounded anteriorly in lateral view, valves of cingulum fairly large and elongate or *(Occidentosphenina)* not apparent because of presence of very large pseudoarch, rami of cingulum rather strongly convergent distally, or not *(Occidentosphenina)*, suprarami without inflections, sheaths not, or not well developed,

ventral process of cingulum very large and broad, blunt or pointed; aedeagal sclerites moderately slender to short and stout, rather straight or weakly curved upwards apically, endophallic apodemes rounded in laterial view, without ventral processes, with or without dorsal inflections, spermatophore sac elongate-oval or transversely oval, gonopore slightly before the middle, pseudoarch poorly developed, or *(Occidentosphenina)* very large and crescentic in dorsal view, aedeagal valves varying from rather slender, conical and upwardly curved at the apices to large and cap-like.

Concealed female structures: Subgenital plate rounded distally with posterior edge serrated, egg-guide variably prominent, triangular, columellae present, contact areas not, or poorly indicated; spermatheca of a very characteristic dual nature, with a rather wide spermathecal appendage leading into the vestibule, the spermathecal vesicle and caecum forming a continuous S-shaped tube, little thicker than the appendage and with little or no indication of an apical pocket, secondary diverticula present or not; spermathecal duct rather long to quite short, terminal dilation variable but often quite large and prominent.

Distribution: Africa (except the north), Comoro Islands, Madagascar, southwestern, southern and eastern Asia as far north as Manchuria and northern Japan and including all the islands of the continental shelf and as far east as New Guinea, the Solomon Islands, northern and eastern Australia; introduced over the full range of the Hawaiian Group and in the Line Islands.

Members of this tribe have the widest distribution of any *Pyrgomorphidae.* The two included genera are of very different appearance (and only one of them is widely distributed), but they have two very distinctive features in common which seem to unite them into a single tribe: the characteristic anchor-like epiphallus and the equally characteristic 'double' spermatheca. Other less diagnostic genitalic features are the form of the subgenital plate and of the ventral process of the cingulum; cap-like aedeagal valves are found in both genera, although not in the majority of species of *Atractomorpha.*

Atractomorpha, on the basis of external morphology, has been grouped previously with the Malagasy *Schulthessiini* (Series VII) (e. g. by Bolívar, 1905, 1909; Kevan and Akbar, 1964) and with the S. American *Omurini* (Series IX) (e. g. by Bolívar, 1905, 1909), but the phallic structures and spermathecae of these tribes are quite dissim-

ilar from those of *Atractomorphini* so that they cannot be considered to be closely related. The two genera now grouped in the *Atractomorphini,* on the other hand, have not previously been associated with one another (see Kevan and Akbar, 1964). In view of their very different appearance, they are placed in two subtribes.

Subtribe *a.* ATRACTOMORPHINA.

(Figs. 26-30).

Tribe *Atractomorphini:* References given above in bibliography of tribal nomenclature, except for *Occidentosphenini.*

Subtribe *Atractomorphina* Kevan and Akbar, 1964, *Canad. Ent.,* XCVI, 1509, fig. 2 (map), 1519, 1525.

External features: Body fusiform to elongate-fusiform, not depressed, integument not granular; antennae inserted well in front of lateral ocelli; pronotum with inferior margin of lateral lobe very straight and granular; tegmina and wings fully developed; hind femur with external area distinctly expanded and displaced subventrally.

Principal phallic characters: Epiphallus with a narrower central portion and longer lophi than in next subtribe; ectophallus distinctly pyriform, valves of cingulum distinct, elongate, rami rather strongly convergent distally, ventral process of cingulum not half so long as the entire cingulum, often blunt; aedeagal sclerites of rather conventional form, without elaborate dorsal inflections, spermatophore sac elongate-oval, pseudoarch poorly developed, aedeagal valves variable, sometimes cap-like but more usually curved, subconical.

Concealed female structures: Various parts of receptaculum seminis, including spermathecal duct, somewhat longer than in the next subtribe (figs. *29B, 30B).*

Distribution: As given above for the tribe.

Included genus: Atractomorpha Saussure, 1862.

Species examined: Atractomorpha psittacina psittacina (Haan, 1842) (Philippines, Indonesia [E. to Lombok and Tukanbesi Is.], Malaysia, S. China, Indo-China to Burma); *A. p. affinis* Kevan and Chen, 1969 (N. Burma, Bangladesh, NE. India); *A. crenaticeps* (Blanchard, 1853) (New Guinea and associated islands, except S. of the central mountain chains, Bismarcks, Solomons); *A. similis* Bolívar, 1884 [= *australiana* Bolívar, 1905] (S. Moluccas, Timor, Tanimbar, Kei and Aru Is., S. and

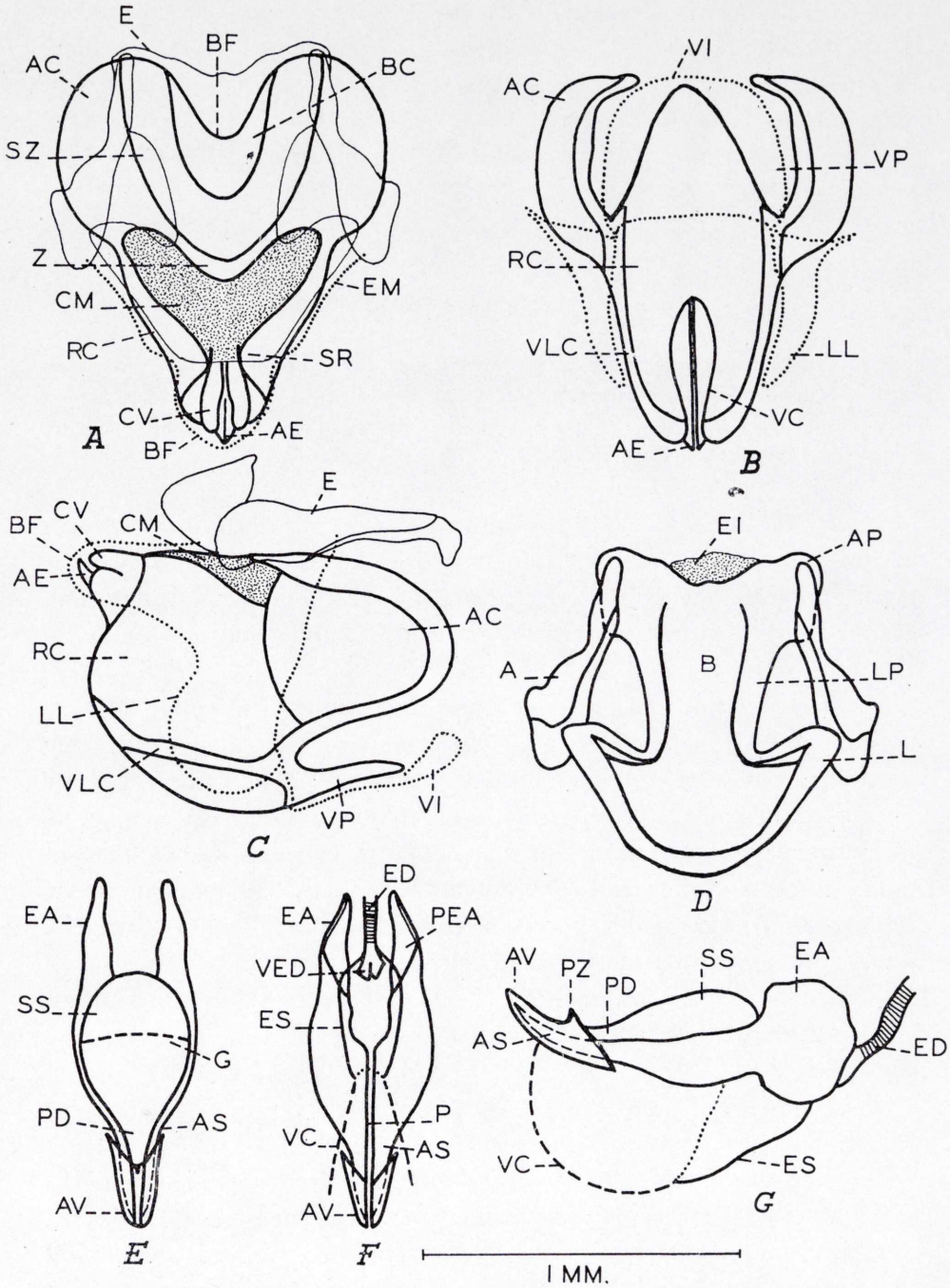
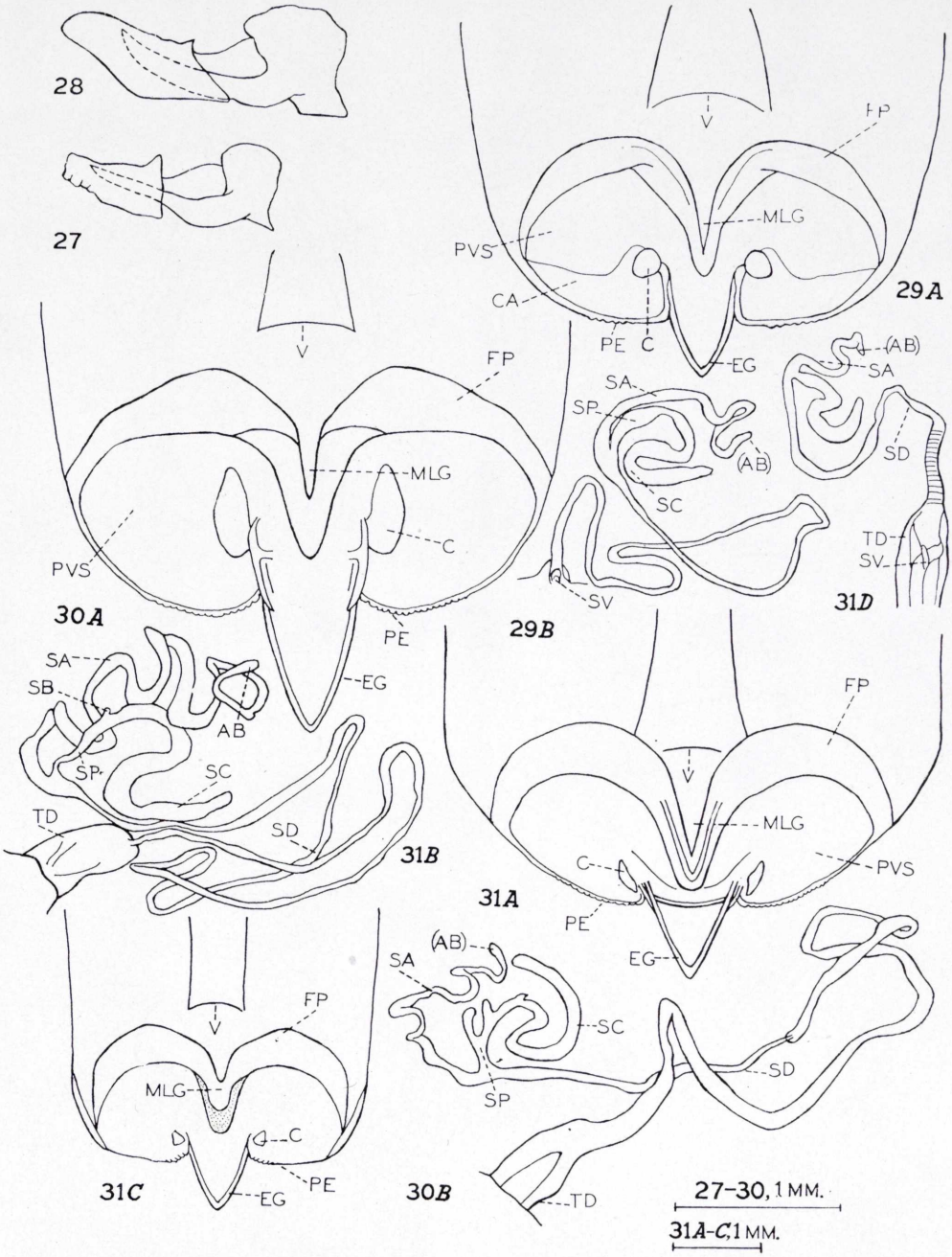


Fig. 26.—*Atractomorphini (Atractomorphina): Atractomorpha sinensis* Bolívar, phallic structures. *A-G*, as in fig. 1. For notation, see pp. 279-281.



Figs. 27-31.—*Atractomorphini (Atractomorphina* and *Occidentosphenina),* male (27, 28) and female (29, 31) structures: 27) *Atractomorpha aberrans* Karsch, endophallus from the right; 28) *A. rufopunctata* Bolívar, the same; 29) *A, B, Atractomorpha sinensis sinensis* Bolívar; 30) *A, B, A. lata* (Motschoulsky) [secondary diverticulum (SB) not always present]; 31) *A, B, Occidentosphena ruandensis* (Rehn); *C, D, O. uvarovi* (Rehn), paratype. *A-D,* as in fig. 6. For notation, see pp. 279-281.

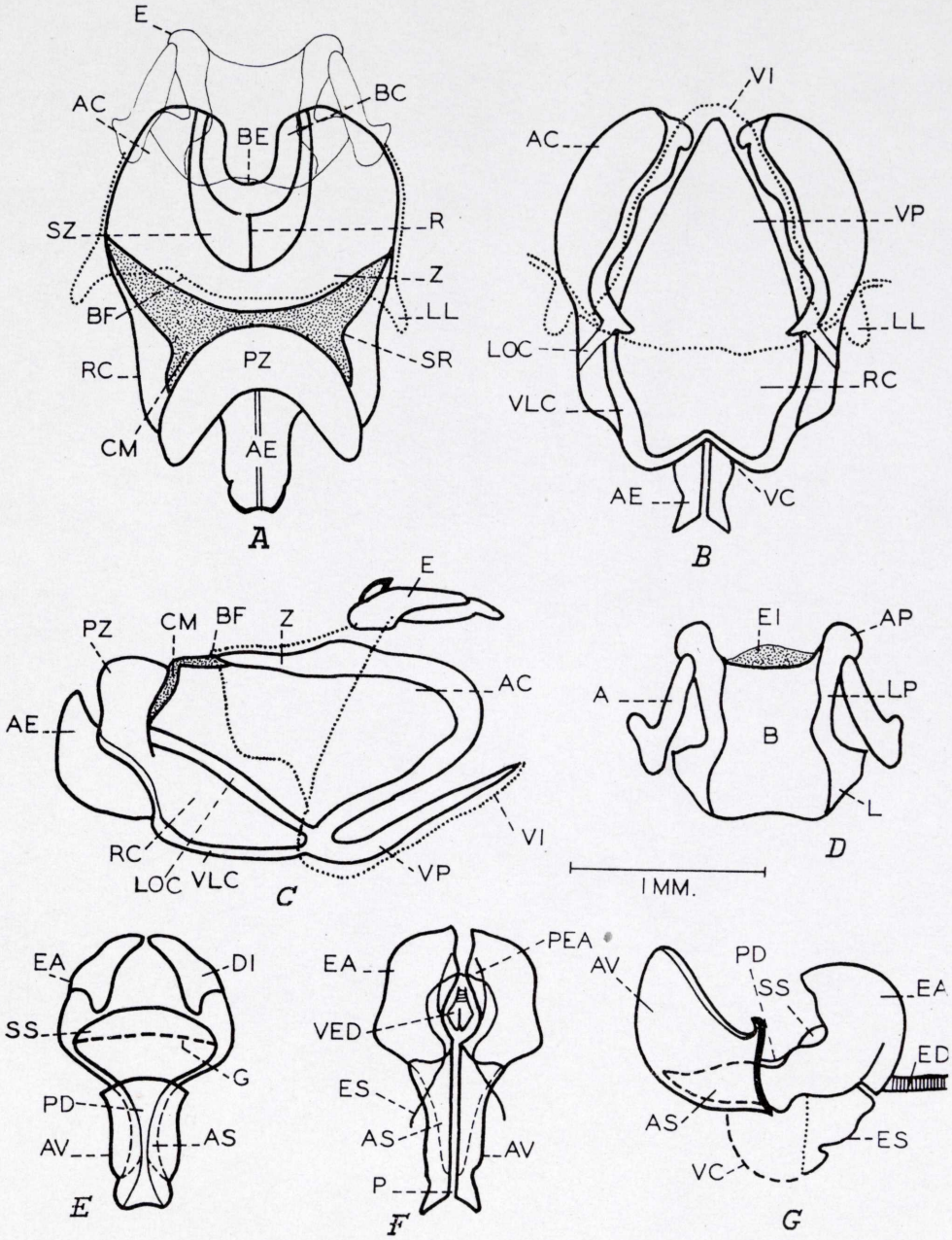


Fig. 32.—*Atractomorphini (Occidentosphenina): Occidentosphena ruandensis* (Rehn), phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

SE. New Guinea, N. and E. Australia); *A. australis* Rehn, 1907 (E. and SE. Australia); *A. lata* (Motschoulsky, 1866) [= *bedeli* Bolívar, 1884] (China excluding Taiwan, Korea, Japan including N. and C. Ryu-Kyu Is. — Fig. 30 *A, B); A. burri* Bolívar, 1905 (NE. India, Nepal and N. of Bangladesh to Indo-China and Malay Peninsula); *A. himalayica* Bolívar, 1905 (E. Himalayas); *A. rhodoptera* Karsch, 1888 (Sumatra and Java and associated islands, Lesser Sunda Is., ? Borneo, ? Celebes); *A. crenulata* (Fabricius, 1794) (Maldive Is., Ceylon, India, E. Nepal, Bangladesh to Indo-China) [Type species]; *A. angusta* Karsch, 1888 (Nepal and NE. India to Indo-China, Malay Peninsula and associated islands, Andaman Is., Sumatra and associated islands); *A. sinensis sinensis* Bolívar, 1905 (China, including Taiwan and associated islands, S. and C. Ryu-Kyu Is., N. Vietnam, introduced into Hawaiian and Line Is. — Figs. 26, 29 *A, B); A. s. montana* Kevan and Chen, 1969 (W. Himalayas); *A. acutipennis blanchardi* Bolívar, 1905 (Pakistan, E. and S. Afghanistan, S. Iran); *A. a. brevis* Uvarov, 1938 (SW. Arabian Peninsula); *A. a. acutipennis* (Guérin-Méneville, 1844) (Madagascar, Comoro Is.); *A. a. gerstaeckeri* Bolívar, 1884 (Africa S. of Sahara except extreme SW. and NE., north as far as N. Tchad); *A. aberrans* Karsch, 1888 (Angola and western Congo to SE. Nigeria — Fig. 27); *A. orientalis* Kevan and Chen, 1969 (E. Zaïre, N. Zambia, Rwanda, Burundi, Uganda, W. Kenia); *A. rufopunctata* Bolívar, 1894 (W. Nigeria to Sierra Leone — Fig. 28); *A. occidentalis* Kevan and Chen, 1969 (W. Ghana to W. Sierra Leone).

Other species: None known *(A. nipponica* Steinmann, 1967, allegedly from southern Japan, is almost certainly a mislabelled specimen of *A. aberrans).*

A preliminary, and partially unsatisfactory revision of *Atractomorpha* was given by Banerjee and Kevan (1960); further comments were made by Kevan (1963 a), but a more up-to-date revision is presented by Kevan and Chen (1969). This last reference includes, with the exception of "*A. nipponica*", illustrations of the phallic and female structures of all species of the genus, indicating the range of variation found.

Other works treating the concealed copulary structures are those of Roberts (1941), who illustrates the epiphallus and endophallus of "*A. ambigua*" [= *A. sinensis*], Dirsh (1956) [inaccurate], Kevan (1961), Kevan and Banerjee (1961), Slifer (1943), who figures the

spermatheca of the same species, and Dirsh (1965), who gives sketches of the epiphallus of *A. crenulata;* Banerjee and Kevan (1960), who outline the epiphallus of *A. lata* and *A. aberrans;* Banerjee and Kevan (1962), who refer to the epiphallus of the genus without illustrating it; Dirsh (1963) and Dirsh and Descamps (1968), who figure the phallic structures and spermatheca of *A. acutipennis acutipennis;* and Akbar (1966), who gives figures of both female subgenital plate and epiphallus of "*Atractomorpha*" (probably *A. acutipennis blanchardi)* [10].

Subtribe *b.* OCCIDENTOSPHENINA.

(Figs. 31-32; Pl. VII, figs. A-H).

Tribe *Occidentosphenini* Kevan and Akbar, 1964, *Canad. Ent.,* XCVI, 1509, fig. 2 (map), 1522, 1525.

External features: Body very strongly fusiform, rather robust and depressed, integument granular, antennae not inserted very far in front of lateral ocelli; pronotum in dorsal view strongly divergent behind, especially in female, inferior margins of lateral lobes not remarkably straight; apterous; hind femur with external area not distinctly expanded and displaced subventrally.

Principal phallic characters: With a wider central portion and shorter lophi than in last subtribe; ectophallus not distinctly pyriform, valves of cingulum not apparent owing to the presence of a very large pseudoarch, rami not strongly convergent, ventral process of cingulum more than half as long as the entire cingulum, pointed; aedeagal sclerites short and stout with rather elaborate dorsal inflections, spermatophore sac transversely oval, pseudoarch very large and crescentic in dorsal view, aedeagal valves very large and cap-like.

Concealed female structures: Various parts of receptaculum seminis, including spermathecal duct, somewhat shorter than in last subtribe (fig. 31 *B, D).*

Distribution: W. Cameroons, E. Zaïre, Rwanda, Burundi, W. Uganda.

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[10] Kevan and Chen (1969) have suggested that the phallic structures of *Atractomorpha* may continue to change morphologically after the adult stage is attained. This has now been proved experimentally for *A. s. sinensis* by Mr. S. K. Lee, assistant to Dr. Kevan (unpublished M. Sc. thesis, McGill University, Montreal).

Included genus: Occidentosphena Kevan, 1956.

Species examined: Occidentosphena ruandensis (Rehn, 1914) (E. Zaïre, Rwanda, Burundi, W. Uganda — Figs. 31 *A, B,* 32; Pl. VII, figs. A-D) [Type species]; *O. uvarovi* (Rehn, 1942) [= *granulata* (Chopard, 1945)] (W. Cameroons — Fig. 31 *C, D;* Pl. VII, figs. E-H).

Other species: None known.

Although the two members of this subtribe are superficially very different from those of the last — to the extent that they have not hitherto been regarded as being in any way closely related (see Kevan and Akbar, 1964), there can be little doubt of this relationship, for the concealed copulatory structures of both sexes have much in common. These structures have not previously been described for *Occidentosphena.*

No revision of this genus is called for as only two species are known to be involved, and these are readily distinguishable from each other (see Rehn, 1942).

Series IX.

Only two tribes make up this series. They differ considerably in their general outward appearance, as the members of one tribe tend to be rather stout and/or strongly fusiform, while those of the other are more elongate. All American members of Group 'B' of the *Pyrgomorphidae* belong to this Series, of which they constitute the majority. The remaining genera appear to represent relicts of a much more widely dispersed group, and are confined to restricted areas in the Old World. It would seem that the New World forms may be incursive into the Americas from Asia.

In South America, the only *Pyrgomorphidae* known belong to the present Series, so that they cannot be confused with members of other series (although there is a superficial resemblance between them and the Old World *Atractomorphini* and *Schulthessiini).* In Central America, Mexico, Socotra and in SW. China and SE. Tibet, all strongly fusiform or stout-bodied, flightless *Pyrgomorphidae* also belong to this Series, so that, again, there is no possibility of confusion. In East Africa and Madagascar (where the remaining members of the Series occur), the pyrgomorphid fauna is very diverse, so that in those areas there is posibility of confusion with tribes belonging to other series.

However, most Malagasy *Pyrgomorphidae* belong to Group 'A' (i. e., they have large, open metasternal pits), and the single Malagasy genus of the present Series can readily be distinguished from other species of Group 'B' because of its strongly fusiform, rather stout body, which is marked by contrasting, scattered black maculations (not stripes), combined with the possession of large, lobe-like, or occasionally fully developed tegmina. The mainland East African genus can be distinguished from other African *Pyrgomorphidae* by its very strongly fusiform, smooth body combined with an unusually long, acute fastigium of the vertex, reduced, ovate-lanceolate tegmina and a strongly contrasting colour pattern of dark green, yellow and black, and its strongly convex, posteriorly rounded pronotal disc which lacks lateral carinae.

The association of the subtribes here placed together, is largely owing to similarities in certain features of the cingulum (notably to strong inflections of the suprarami found in almost all genera). Although this character is demonstrated by certain other tribes, it would appear that the *Tagastini* (Series VIII) have the most comparable cingulum and may have a remote, common ancestry.

Tribe 27. Sphenariini.

(Figs. 33-46; Pl. VI).

[Famille Acrydides] Tribus *Truxalii* Saussure, 1859, *Rev. Mag. Zool.* (2), XI, 390 *(partim)*.

Mutici Scudder, 1868, *Smithson. misc. Coll.*, VIII (189), 87 *(partim)* [includes *Sphenarium*].

[Fam. *Acrididae*] Limited Fam. *Tryxalidae* Walker, 1870, *Cat. Derm. Salt. Brit. Mus.*, III, 494 *(partim)* [includes what is now *Sphenarium mexicanum*].

[Fam. *Acrididae*] Limited Fam. *Oedipodidae* Walker, 1870, *Cat. Derm. Salt. Brit. Mus.*, IV, 721 *(partim)* [*Sphenarium*].

Fam. *Oedipodidae* Walker, 1871, *Cat. Derm. Salt. Brit. Mus.*, V (Suppl. 3), 102 *(partim)* [*Sphenarium*].

Subfam. *Acridinae*, Group *Tryxalini* Thomas, 1873, *Rep. U. S. Geol. Surv. Terr.*, V (1), 41, 195 *(partim)*.

Sub-tribus [and "sub-tribu"] *Sphenariae* Bolívar, 1884, *An. Soc. esp. Hist. nat.*, XIII, 20, 24, 438 *(partim)* [see also Kevan, Singh and Akbar, 1964, *Proc. Acad. nat. Sci. Philad.*, CXVI, 232, *and* Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1508].

Sub-tribus [and "sub-tribu"] *Poecilocerae* Bolívar, 1884, *An. Soc. esp. Hist. nat.*, XIII, 20, 24, 447 *(partim)* [*Rubellia*].

Tribus *Pyrgomorphii,* Stirps *Sphenarium* Saussure, 1899, *Abh. Senckenb. Naturf. Ges.,* XXI, 641 *(partim)* [only genus mentioned does not belong to this tribe].

Tribus *Pyrgomorphii,* Stirps *Poecilocera* Saussure, 1899, *Abh. Senckenb. Naturf. Ges.,* XXI, 643 *(partim)* [*Rubellia*].

Subfam. *Sphenari*[*i*]*nae* Bolívar, 1904, *Bol. Soc. esp. Hist. nat.,* IV, 306 [see also Kevan, Singh and Akbar, 1964, *Proc. Acad. nat. Sci. Philad.,* CXVI, 232, *and* Kevan and Akbar, 1964, *Canad. Ent.,* XCVI, 1508].

Subfam. *Poecilocerinae* Bolívar, 1904, *Bol. Soc. esp. Hist. nat.,* IV, 432 *(partim)* [*Rubellia*].

Sect. *Sphenaria* Bolívar, 1909, *Gen. Ins.,* XC, 3, 8 [see also Kevan, Singh and Akbar, 1964, *Proc. Acad. nat. Sci. Philad.,* CXVI, 232].

Sect. *Poeciloceri* Bolívar, 1909, *Gen. Ins.,* XC, 4, 20 *(partim)* [*Rubellia; Sphenexia*].

Sphenarii Uvarov, 1925, *J. Asiat. Soc. Bengal* (n. s.), XX, 314, 330, 332, 334.

Group *Sphenarii* Uvarov, 1937, *J. Linn. Soc. Lond. (Zool.),* XL, 279, 280 *(partim);* Johnston, 1956, *Annot. Cat. Afr. Grassh.,* 121 *(partim).*

Group *Sphenaria* Powers, 1942, *J. Morph.,* LXXI, 526; Rehn, 1427, *Ent. News,* LVIII, 116.

Tribe *Sphenariini* Rehn, 1951, *Ent. News,* LXII, 242, 243, 244 *(partim);* 1953, *Trans. Amer. Ent. Soc.,* LXXIX, 100, 105; Uvarov, 1953, *Publ. cult. Diamant.,* XXI, 210; Kevan, 1959, *Ibid.,* XLIII, 22, 23 *(partim);* Kevan, Singh and Akbar, 1964, *Proc. Acad. nat. Sci. Philad.,* CXVI, 232, 233, 280; Kevan and Akbar, 1964, *Canad. Ent.,* XCVI, 1509, fig. 2 (map), 1517, 1525, 1528; Kevan, 1965, *Proc. XII Int. Congr. Ent., 1964,* 442; Akbar, 1966, *Sind Univ. Res. J. (Sci.),* II, 5; Kevan, 1966, *Canad. Ent.,* XCVIII, 1275; Kevan, Akbar and Chang, 1971, *Eos,* Madrid, XLVI (1970), 135; Kevan, 1973, *Canad. Ent.* CV, 1169, 1170.

Tribe *Rubelliini* Kevan and Akbar, 1964, *Canad. Ent.,* XCVI, 1509, fig. 2 (map); 1511, fig. 4 (map); 1523, 1525.

Tribe *Pyrgomorphini* Kevan and Akbar, 1964, *Canad. Ent.,* XCVI, 1509, fig. 3 (map); 1511, fig. 4 (map); 1523, 1526 *(partim)* [subtribe *Sphenexiina*].

External features: Body strongly fusiform to very short and robust occasionally somewhat depressed, integument comparatively smooth to strongly granular or distinctly rugose, colour variable; antennae cylindrical or slightly flattened at base, not inserted very far in front of lateral ocelli; head strongly acute to somewhat obtuse, fastigium of vertex rather long to quite short, pointed or blunt, pronotum strongly widened distad, inferior margin of lateral lobes sinuous, prosternal tubercle often slightly collar-like anteriorly, sternal lamina, particularly in females, very broad, anterior suture joining mesosternal pits sometimes obscure or lacking; tegmina rarely fully developed, but if so, not

acuminate, usually very small, tongue-like, sometimes larger, ovate-lanceolate, or absent; hind femur robust, of normal form; male cerci simple.

Principal phallic characters: Epiphallus usually with strongly transverse bridge and short, tapering, or broad, flat lateral plates, anterior processes lobe-like and usually divergent, lophi stout, dorsally or dorsolaterally directed; ectophallus broadly pyriform, central membrane somewhat variable in shape, but usually fairly extensive, zygoma broad, usually extending for at least half the length of the cingulum, its posterior margin usually convex or produced, suprazygomal plate of rather variable form, but always shorter than zygoma, sometimes not apparent, basal emargination variable in both width and depth but seldom large, apodemal plates in lateral view usually rounded, sometimes bluntly pointed or with small ventral processes, valves of cingulum simple, well developed but of somewhat variable form, rami of cingulum convergent to varying degrees, suprarami with distinct, often prominent and divergent inflections, sheaths rather poorly or not developed, ventral process of cingulum usually but not always rather short and broadly triangular or rounded anteriorly; aedeagal sclerites variable, sometimes strongly curved upwards apically, endophallic apodemes variously shaped, without ventral processes but typically with ventral inflections, dorsal inflections not usually strongly developed, spermatophore sac more or less spherical, occasionally pyriform, sometimes quite large, occasionally small, gonopore near or before the middle, pseudoarch variably developed, aedeagal valves varying from short and conical to long, slender and strongly curved upwards apically.

Concealed female structures: Subgenital plate with posterior edge usually crenulated or slightly serrated, biarcuate to transverse; egg-guide usually triangular, sometimes rather blunt, not very long, contact areas not, or poorly developed, but columellae often present; spermatheca variable, usually irregularly S-shaped with a distinct apical pocket and a C- or G-shaped caecum of approximately the same or greater width than the spermathecal vesicle, which is usually constricted at the union with the latter, occasionally with a long, coiled, or a vestigial, apical spermathecal appendage continuous with, and not well differentiated from, the caecum; spermathecal duct short to moderate in length, terminal dilation lacking or small.

Distribution: East Africa, Socotra, Madagascar, SW. China, SE. Tibet, Central America to Mexico.

This tribe, from its discontinuous geographical distribution, would seem to be of very ancient origin and the variable form of the spermatheca suggests this. The most primitive condition, with a long, coiled spermathecal appendage, is found in *Mekongiella* Kevan; this is reduced to a vestige in *Mekongiana* Uvarov, but absent in most genera; *Sphenarium* Charpentier, has the most advanced type of spermatheca in which the various parts are not well differentiated and in which the whole "head" is somewhat inflated. The aedeagal valves and sclerites also show a transition from the simple, short, conical type in *Rubellia* Stål, through slight upward curvature in *Yunnanites* Uvarov, to strongly and exaggeratedly curved conditions in *Prosphena* Bolívar and *Sphenarium*. Characteristic features of the phallic structures are the transverse bridge and short lateral plates of the epiphallus, the outwardly directed inflections of the suprarami of the cingulum, and the ventral inflections of the endophallic apodemes.

Rubellia was placed in an independent tribe by Kevan and Akbar (1964), but the form of the phallic structures seems to justify its reassociation with the *Sphenariini*. It is also notable that the spermatheca of *Rubellia* is very similar to that of *Yunnanites*. *Sphenexia* Karsch was also removed from the *Sphenariini* by Kevan and Akbar (1964) and, largely because of geographical considerations, but also because of the rather anomalous phallic structures, it was transferred to the *Pyrgomorphini* in a separate subtribe. However, although the phallic structures do not conform very well with those of other *Sphenariini*, they are broadly comparable, and sufficient grounds are provided by these and by external morphological characters, which are most similar to those of *Rubellia*, for returning it to the *Sphenariini*. The recent discovery of *Xenephias* Kevan (Kevan, 1973) adds weight to this conclusion.

The various genera from each of the four widely separated geographical areas occupied by the *Sphenariini* are here regarded as representing four distinct subtribes.

Subtribe *a*. RUBELLIINA.

(Figs. 33, 35; Pl. VI, figs. A-G).

Sub-tribus [and "sub-tribu"] *Poecilocerae* Bolívar, 1884, *An. Soc. esp. Hist. nat.*, XIII, 20, 24, 447 *(partim)*.

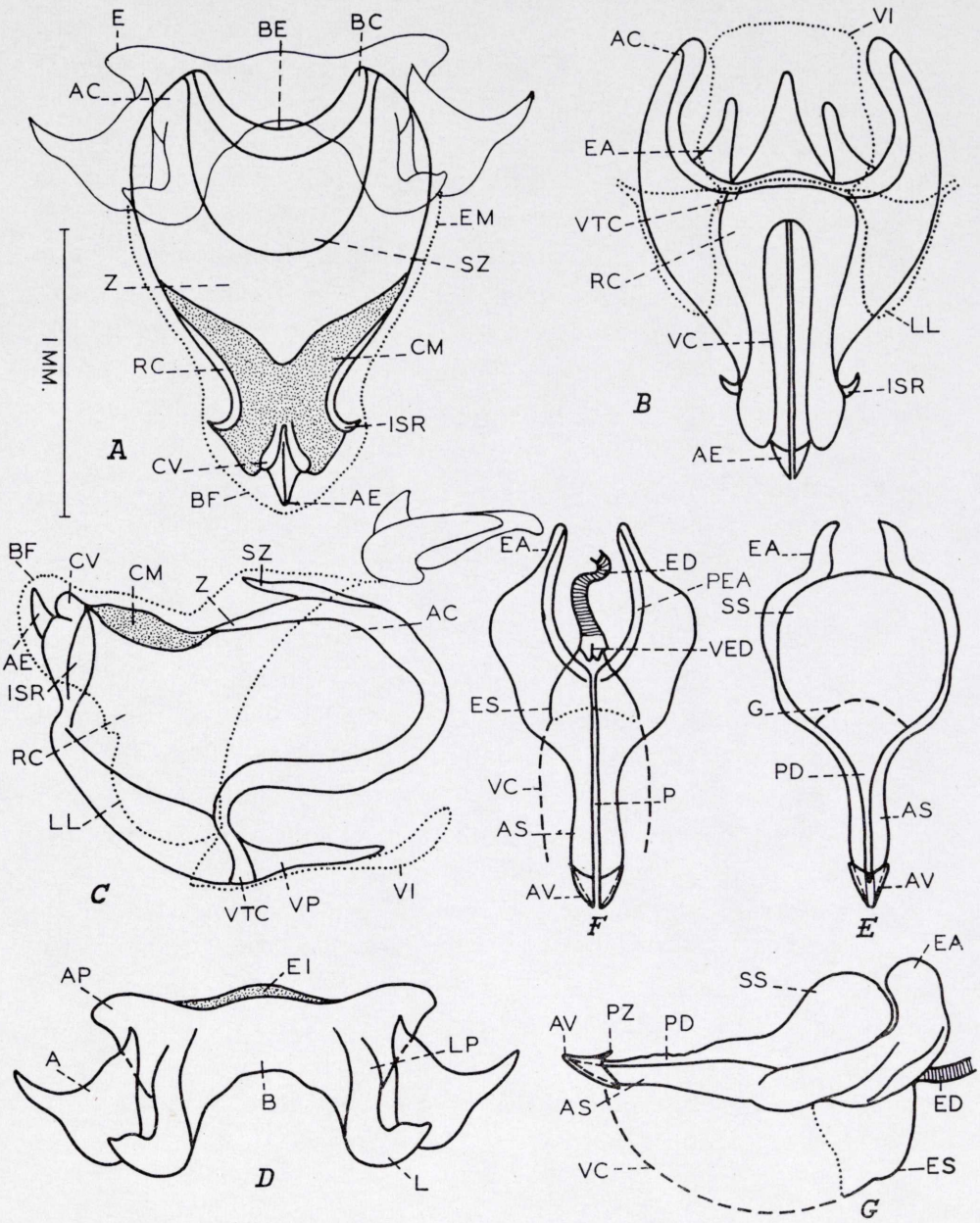


Fig. 33.—*Sphenariini (Rubelliina): Rubellia nigrosignata* Stål, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

Tribus *Pyrgomorphii,* Stirps *Poecilocera* Saussure, 1899, *Abh. Senckenb. Naturf. Ges.,* XXI, 643 *(partim)* [only *Rubellia* referred to].

Subfam. *Poecilocerinae* Bolívar, 1904, *Bol. Soc. esp. Hist. nat.,* IV, 432 *(partim).*

Sect. *Poeciloceri* Bolívar, 1909, *Gen. Ins.,* XC, 4, 20 *(partim).*

Group *Sphenarii* Johnston, 1956, *Annot. Cat. Afr. Grassh.,* 162 *(partim)* [no *Sphenariina* included].

Tribe *Rubelliini* Kevan and Akbar, 1964, *Canad. Ent.,* XCVI, 1509, fig. 2 (map), 1523, 1525; Kevan, 1973, *Ibid.,* CV, 1170.

External features: Body strongly fusiform, not depressed, integument comparatively smooth, colour green to orange-brown, variegated and extensively maculated with black, antennae cylindrical, head rather acutely conical, fastigium of vertex of moderate length, as long as wide, not sharply acute; lateral pronotal carinae absent; interspace between mesosternal lobes not widened behind, anterior suture joining metasternal pits present; tegmina and hind wings present, usually strongly abbreviated, tegmina ovate-lanceolate, not minute and scale-like, occasionally fully developed, hind wings reddish.

Principal phallic characters: Epiphallus with very transverse bridge, anterior processes very divergent and bluntly pointed, lateral plates broad at base, lophi dorsolaterally directed, appendices greatly expanded apically, suprazygomal plate short and broadly tongue-like, basal emargination rather wide and shallow, apodemal plates in lateral view without ventral processes, valves of cingulum finger-like, rami of cingulum very narrow in dorsal view, moderately convergent, inflections of suprarami small, prominent and curved outwards, sheaths not developed, ventral process of cingulum short, triangular, acute; aedeagal sclerites straight but abruptly narrowed in dorsal view, distal parts comparatively slender, endophallic apodemes small but upwardly produced in lateral view, without distinct dorsal inflections but with narrow, ventral inflections, spermatophore sac large, covering most of the basal part of the aedeagus, gonopore posterior, not far in front of the phallotreme duct, pseudoarch very small, aedeagal valves small, conical.

Concealed female structures: Subgenital plate with posterior edge transverse and serrated, egg-guide rather narrow, columellae not developed; spermathecal vesicle and apical pocket rather small, caecum G-shaped, of about same diameter as anterior end of vesicle, no spermathecal appendagge present.

Distribution: Madagascar.

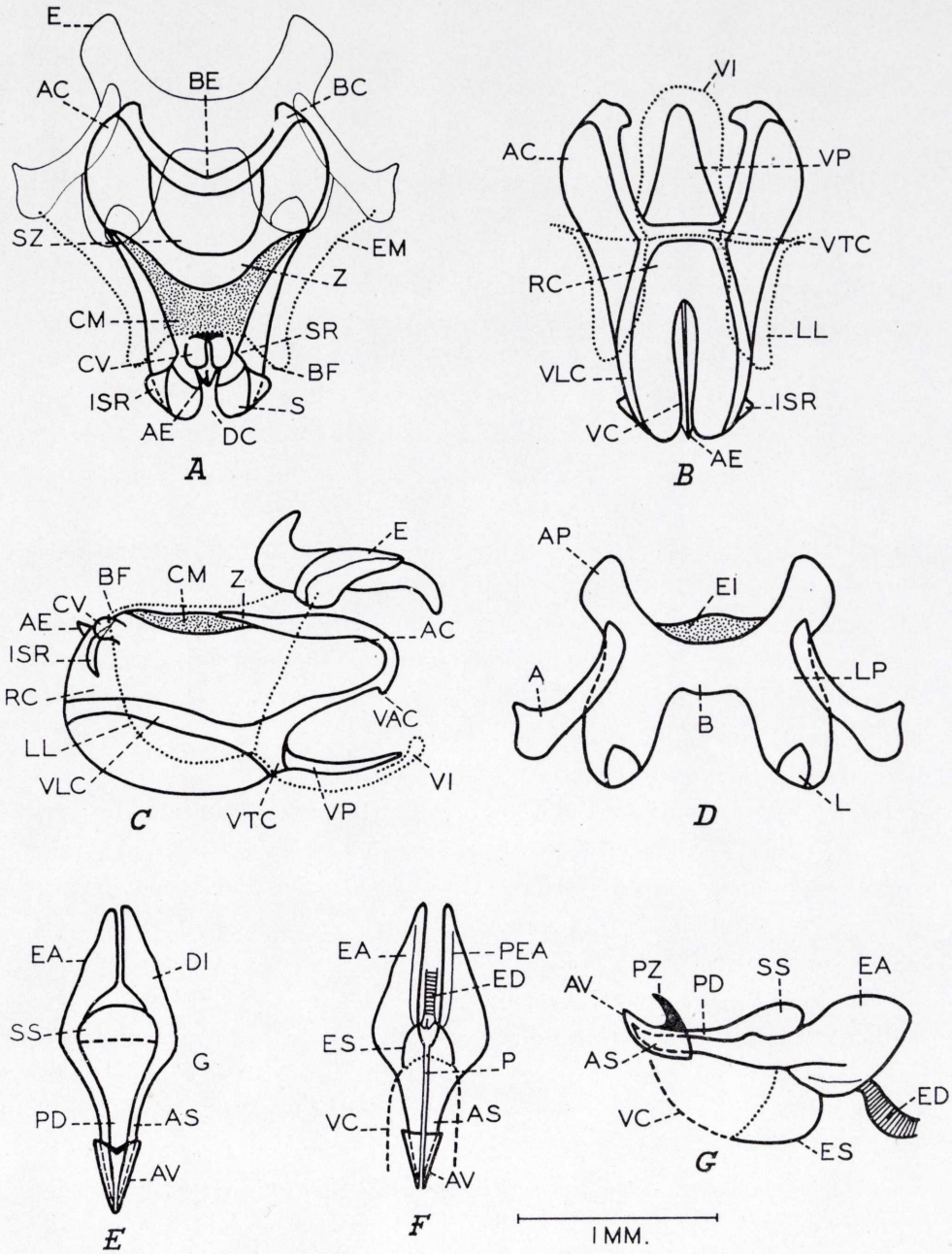


Fig. 34.—*Sphenariini (Sphenexiina): Sphenexia fusiformis* Karsch, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

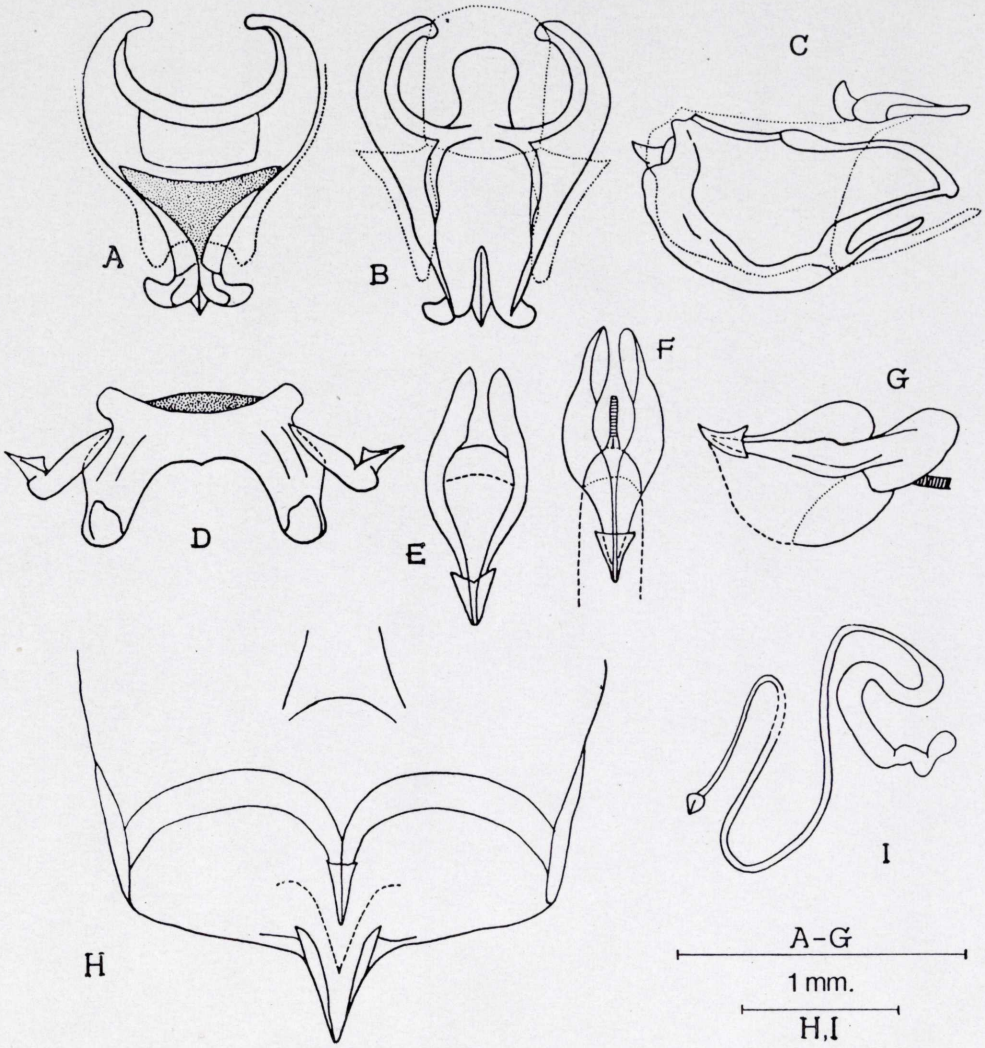


Fig. 34 (Suppl.).—*Sphenariini (Sphenexiina): Xenephias socotranus* Kevan, male and female structures. *A-G,* as in fig. 1 (*A*, omits epiphallus); *H,* female subgenital plate, dorsal; *I,* receptaculum seminis. For individual structures, see notation on fig. 34.

Included genus: Rubellia Stål, 1875.

Species examined: Rubellia nigrosignata Stål, 1875 (fairly widely distributed in Madagascar — Figs. 33, 35; Pl. VI, figs. A-G) [Type species].

Other species: None known.

With the removal of *brancsiki* from *Rubellia* to *Pseudorubellia* (Tribe *Chlorizeinini,* Series VI) by Dirsh (1963), who gives the most recent account of the genus, the subtribe is now monotypic. Its closest relationships, based on phallic and concealed female structures, appear to be with *Yunnanites* of the *Mekongianina* and with *Prosphena* of the *Sphenariina.* The external morphology, however, is closer to the next subtribe.

Dirsh *(l. c.)* and Dirsh and Descamps (1968) give some figures of the phallic complex and spermatheca of *R. nigrosignata,* but, otherwise, nothing has been published on the concealed copulatory structures.

Subtribe *b.* Sphenexiina.

(Figs. 34, 34 (Suppl.), 36; Pl. VI, figs. H, I).

Sect. *Poeciloceri* Bolívar, 1909, *Gen. Ins.,* XC, 4, 20 *(partim).*

Group *Sphenarii* Johnston, 1956, *Annot. Cat. Afr. Grassh.,* 162 *(partim)* [no *Sphenariina* included].

Tribe *Pyrgomorphini,* subtribe *Sphenexiina* Kevan and Akbar, 1964, *Canad. Ent.,* XCVI, 1509, fig. 3 (map), 1511, fig. 4 (map), 1523, 1526.

Tribe *Sphenariini,* subtribe *Sphenexiina;* Kevan, 1973, *Canad. Ent.,* CV, 1170.

External features: Body fusiform, sometimes very convex dorsally or slightly depressed, integument smooth or granular, colour dark green, variegated with yellow and black or mottley grey, brown or green, antennae subcylindrical or slightly flattened basally, head acutely conical, fastigium of vertex much longer than wide, acute, pronotum arched dorsally, disc without lateral carinae and with posterior margin rounded or transverse; interspace between mesosternal lobes not widened distad, anterior suture connecting metasternal pits present or not; tegmina and hind wings, *if* present, abbreviated [fully alate forms might be anticipated] with hind wings red *(Xenephias* is apterous).

Principal phallic structures: Epiphallus with a conventional, sometimes narrow bridge, anterior process rather prominent, divergent but not always strongly so, lateral plates flat and broad, lophi dorsally directed, appendices not greatly expanded apically; ectophallus with zygoma not quite reaching middle of cingulum, posterior margin convex, or transverse, suprazygomal plate rather small, narrower than basal thickening, basal emargination wide, apodemal plates in lateral view with small ventral processes, valves of cingulum thumb-like to rather broad and flat, rami of cingulum not unusually narrow in dorsal view, but distinctly convergent, inflections of suprarami expanded and directed outwards, sheaths present but small, ventral process of cingulum narrowly and bluntly triangular or rounded, aedeagal sclerites fairly straight, very slightly curved upwards apically, gradually narrowed in dorsal view, endophallic apodemes oval in lateral view, dorsal inflections moderately developed, ventral inflections present, spermatophore sac small, pyriform, leading into a rather wide phallotreme duct, gonopore before the middle of the sac, pseudoarch moderately well developed, aedeagal valves fairly small, conical, slightly curved upwards apically.

Concealed female structures: Subgenital plate with posterior edge transverse, rather smooth, egg-guide broad with convex margins, columellae not developed; spermatheca similar to that described for *Rubelliina,* but apical pocket not very distinct, with or without a small convoluted appendage.

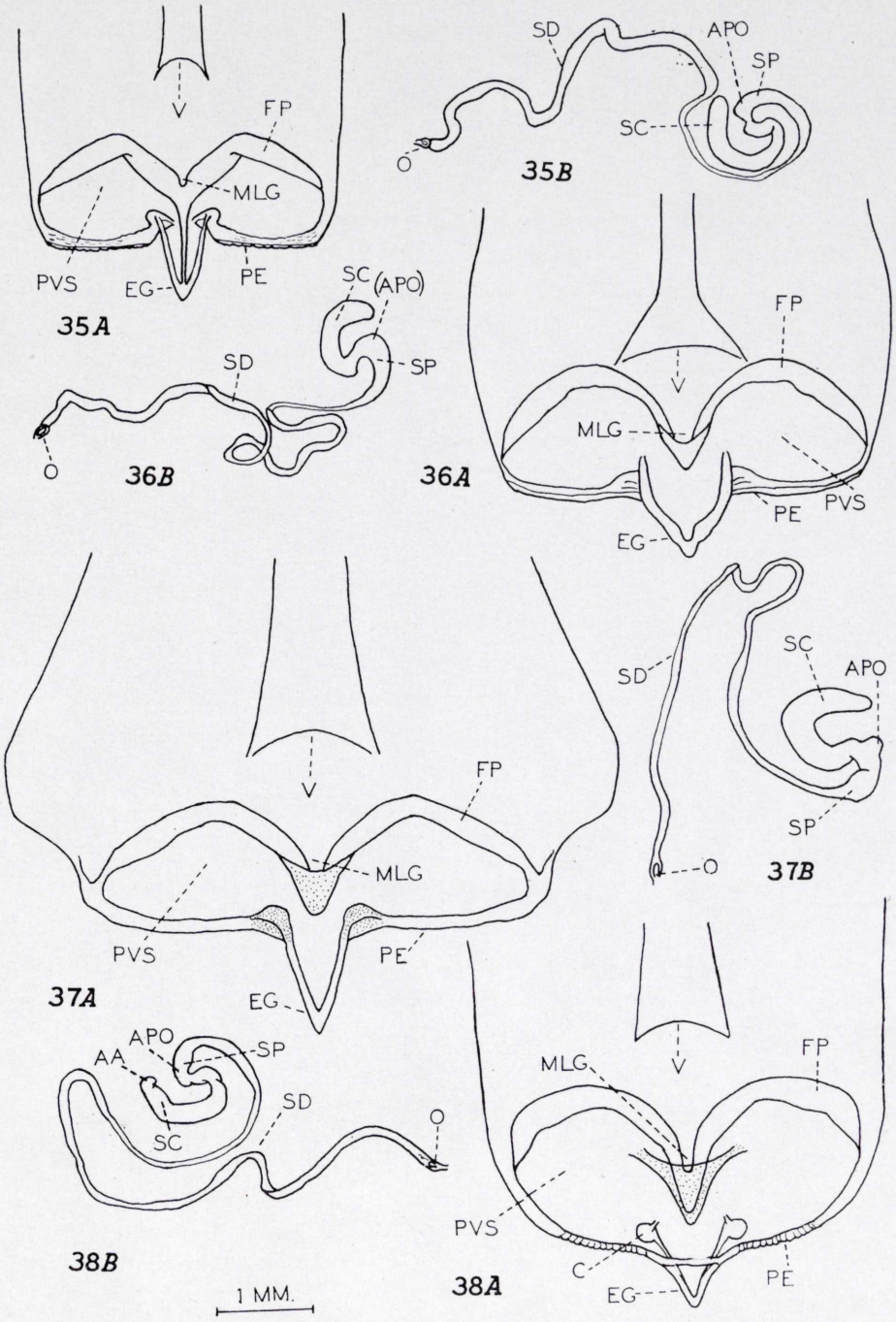
Distribution: East Africa, Socotra.

Included genus: Sphenexia Karsch, 1896; *Xenephias* Kevan, 1973.

Species examined: Sphenexia fusiformis Karsch, 1896 (E. Tanzania — Figs. 34, 36; Pl. VI, figs. H, I) [Type species]; *Xenephias socotranus* Kevan, 1973 (Socotra — fig. 34 [suppl.]) [Type species].

Other Species: None known.

As mentioned previouly, this subtribe was attached to the tribe *Pyrgomorphini* (Group X) by Kevan and Akbar (1964), although the single genus then known had been included in the *Sphenariini* by some authors. In external morphology this came closest to *Rubellia* which Kevan and Akbar *(l. c.)* had considered to form a separate tribe, but it also resembles *Chirindites* Ramme, an undoubted member of the *Pyrgomorphini* as now recognized. There are also resemblances in the form of the ectophallus to *Chirindites,* but these are mainly confined to the shape of the zygoma and central membrane and the inflections



Figs. 35-38.—*Sphenariini (Rubelliina, Sphenexiina* and *Mekongianina),* female structures; 35) *Rubellia nigrosignata* Stål; 36) *Sphenexia fusiformis* Karsch; 37) *Yunnanites coriacea* Uvarov; 38) *Mekongiana gregoryi* (Uvarov). *A, B,* as in figs. 2, 3. For notation, see pp. 279-281.

of the suprarami. None of these features, however, is peculiar to *Pyrgomorphini.* On the other hand, certain phallic characters of *Sphenexiina* are not found in *Chirindites* nor in other *Pyrgomorphini,* notably the elongate anterior processes, broad, flat lateral plates and short, dorsally directed lophi of the epiphallus, the small suprazygomal plate (narrower than the basal thickening), the small ventral processes of the apodemal plates, the broad valves of the cingulum and the small spermatophore sac. The aedeagus in dorsal view is also narrower than in most *Pyrgomorphini,* and the dorsal inflections much less well developed. Admittedly some of these features distinguish the *Sphenexiina* from other *Sphenariini* also, but the well developed valves of the cingulum and the presence of ventral processes on the apodemal plates of the cingulum are characters found in *Sphenariini* but not in *Pyrgomorphini.* The epiphallus, also, is quite similar to that of *Yunnanites;* the cingula of *Sphenexiina* and *Rubelliina* are, as a whole, readily derivable from a common pattern. Finally, the gross morphology of *Sphenexia* (the rather smooth integument and the *Rubellia*-like reduction of the tegmina) and the coloration are more in line with what is found in other *Sphenariini* than in any of the *Pyrgomorphini.* The nature of the female copulatory structures could place *Sphenexia* in either tribe, but the spermatheca of *Xenephias* could not.

The resemblance between *Sphenexia* and *Chirindites,* which was also placed in the *Sphenariini* by Uvarov (1937) and subsequent authors, is probably convergent, whereas the similarity to *Rubellia* may well be due to common ancestry.

No detail of the concealed copulatory structures has hitherto been published for *Sphenexia,* but those of *Xenephias* are illustrated by Kevan (1973), who discusses the relationships.

Subtribe *c.* Mekongianina.

(Figs. 37-42).

Mekongianina Kevan and Akbar, 1964, *Canad. Ent.,* XCIV, 1509, fig. 2 (map), 1517, 1525; Kevan, 1966, *Ibid.,* XCVIII, 1275, 1278, fig. 16 (map); Kevan, 1973, *Ibid.,* CV, 1170.

External features: Body strongly fusiform to heavy and robust, sometimes depressed, integument slightly to strongly rugose or granulat-

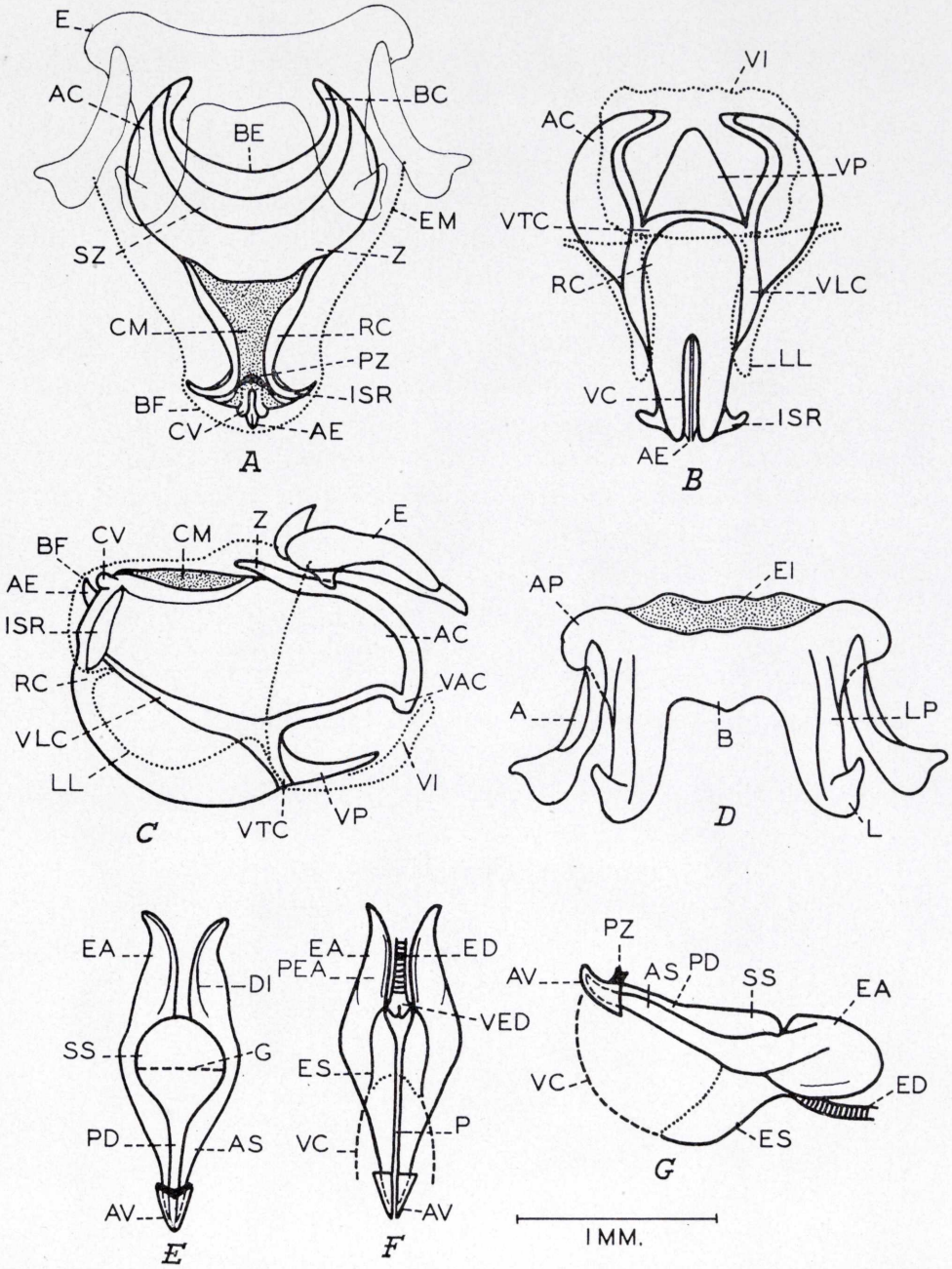


Fig. 39.—*Sphenariini (Mekongianina): Yunnanites coriacea* Uvarov, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

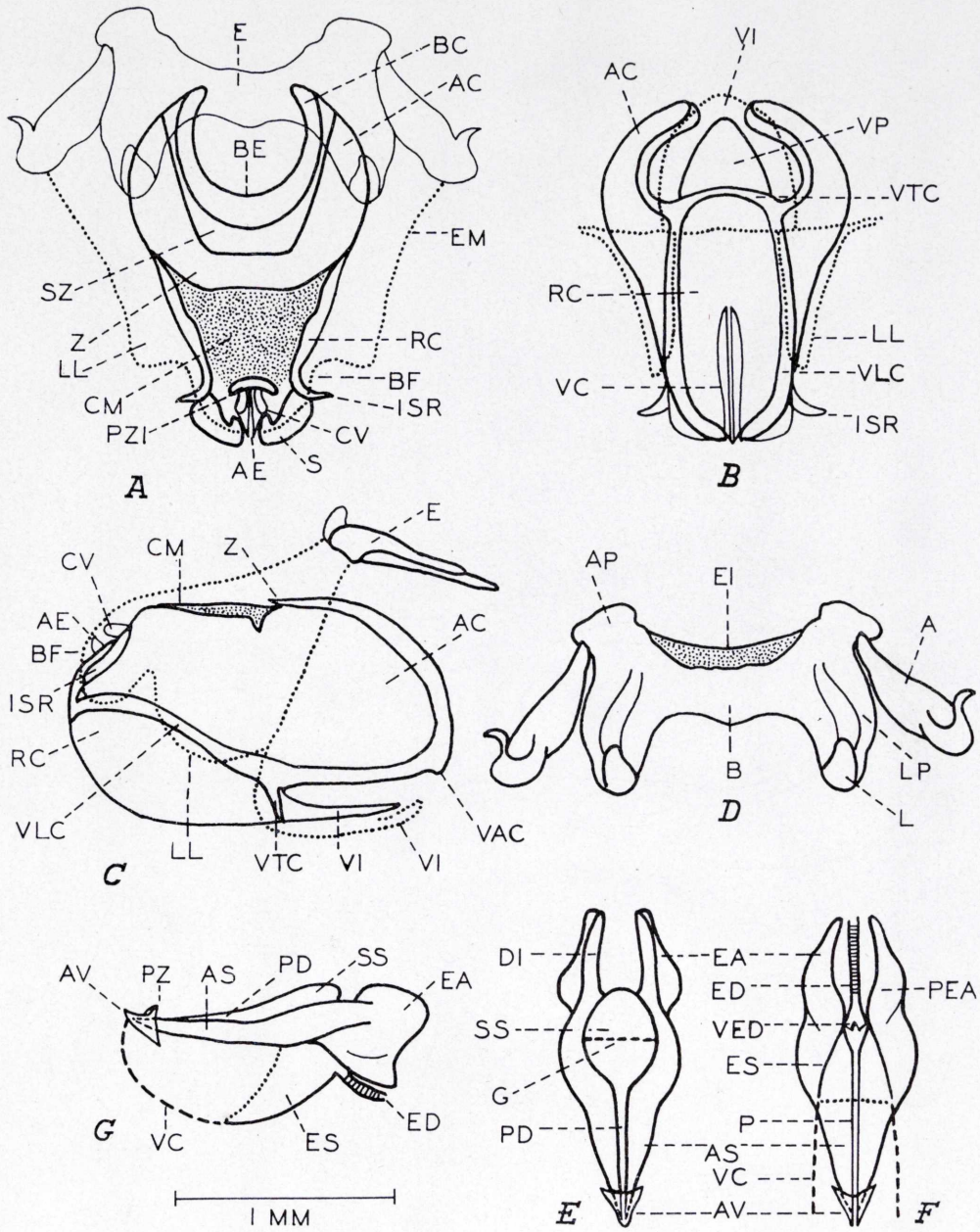


Fig. 40.—*Sphenariini (Mekongianina): Mekongiana gregoryi* (Uvarov), paratype, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

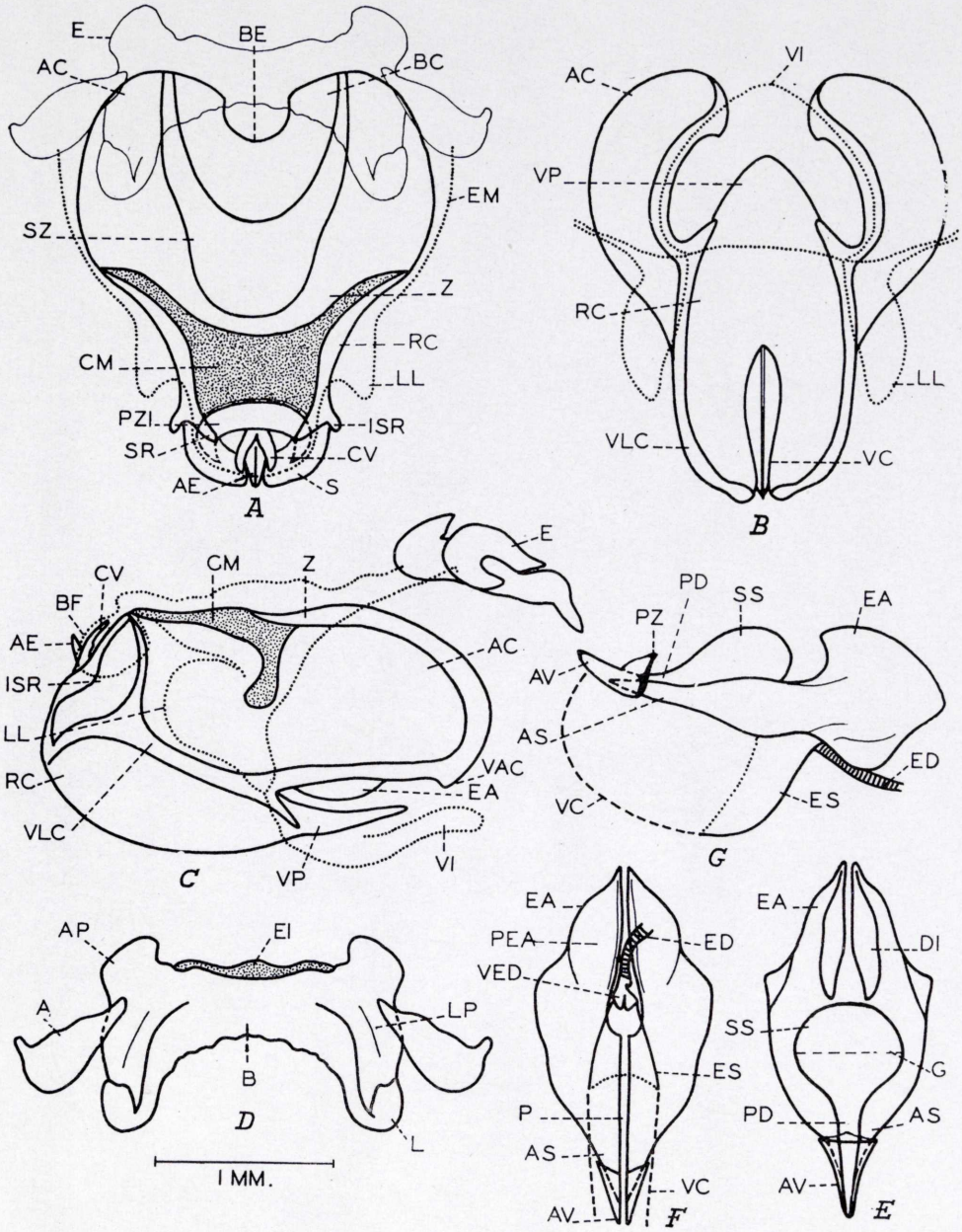


Fig. 41.—*Sphenariini (Mekongianina): Mekongiella kingdoni* (Uvarov), paratype, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

ed, colour variable, usually basically green to olive-grey, without extensive black maculations, antennae slightly depressed at the base; head short, fastigium of vertex short, not longer than wide; pronotal disc often with traces of lateral carinae; space between mesosternal lobes widened distad in females, sometimes quadrate in males, but never narrowed posteriorly, anterior suture joining metasternal pits often obscure or absent; tegmina and hind wings reduced to strap-like, tongue-like, or scale-like vestiges, or absent.

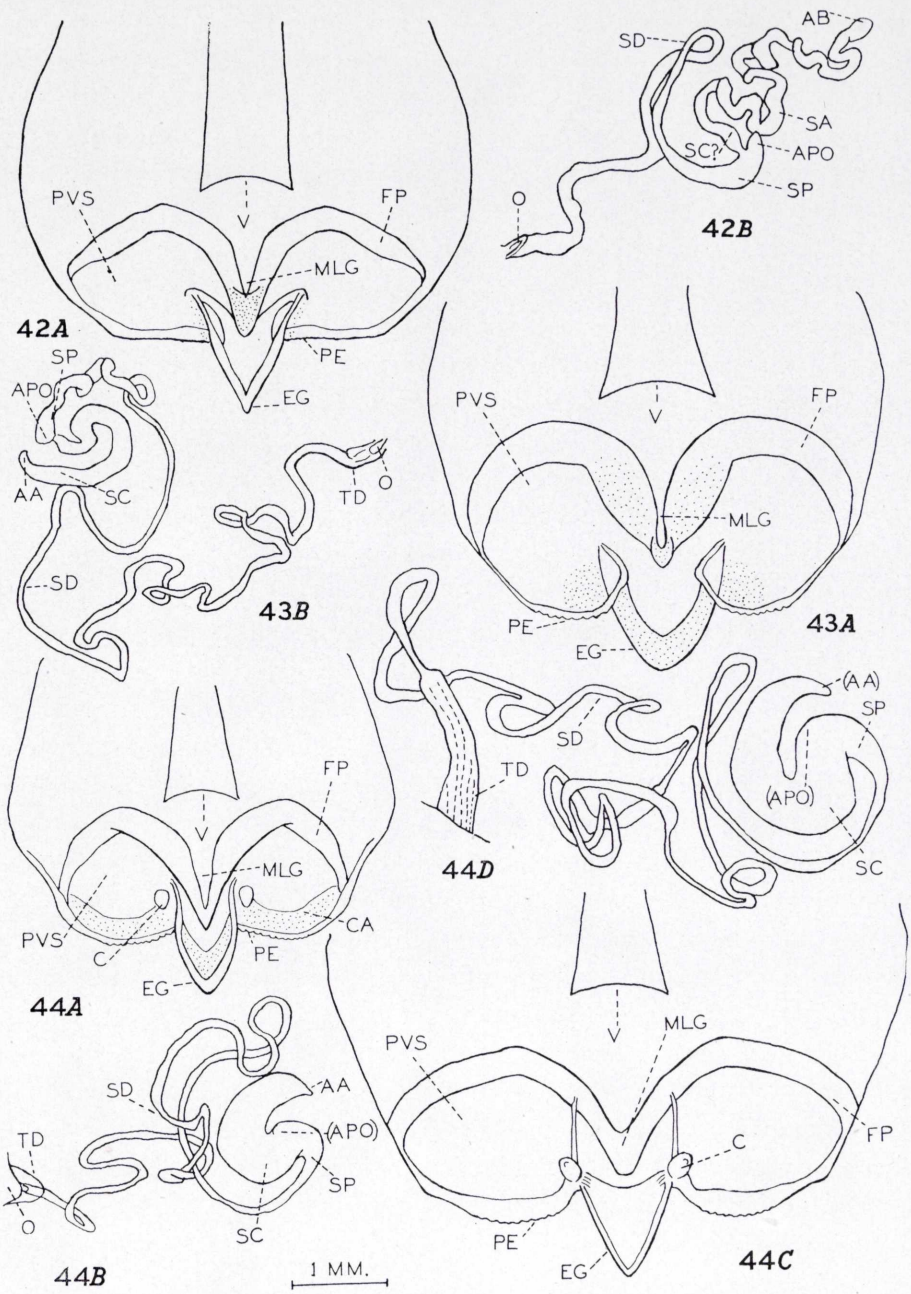
Principal phallic characters: Epiphallus strongly to very strongly transverse, anterior processes slightly to strongly divergent, rounded, lateral plates broad at base, lophi more or less dorsally directed, appendices heavy, but not greatly expanded apically; ectophallus with zygoma having a posterior margin broadly rounded or subtruncate in the middle, suprazygomal plate and basal emargination variable in shape, latter usually fairly wide or deep, apodemal plates in lateral view with at least traces of ventral processes, valves of cingulum finger-like, rami of cingulum narrow in dorsal view, moderately to strongly convergent, inflections of suprarami small and rather straight to large and strongly curved outwards, sheaths developed or not, ventral process of cingulum rather short and broadly triangular; aedeagal sclerites straight or nearly so apically, gradually narrowed in dorsal view, distal parts comparatively short and stout, endophallic apodemes rounded or quadrate in lateral view, with or without distinct dorsal and ventral inflections, the latter [contrary to the statement in the key of Kevan and Akbar (1964: 1517)] often outwardly directed, spermatophore sac comparatively small, gonopore about the middle, pseudoarch distinct, small to large, with an inflection, aedeagal valves small, conical or slightly curved upwards apically.

Concealed female structures: Subgenital plate with posterior edge rounded or truncate, crenulated or not, egg-guide small or of moderate size, triangular, columellae present or undeveloped; spermatheca as in the last subtribe or with a vestigial or a long convoluted spermathecal appendage having an apical bulb.

Distribution: SW. China; SE. Tibet.

Included genera: Yunnanites Uvarov, 1925; *Mekongiana* Uvarov, 1940; *Mekongiella* Kevan, 1966.

Specie examined: Yunnanites coriacea Uvarov, 1925 (S. Szechwan, E. Kweichow, Yunnan — Figs. 37, 39) [Type species]; *Mekongiana gregoryi* (Uvarov, 1925) (extreme NW. Yunnan — Figs. 38, 40)



Figs. 42-44.—*Sphenariini (Mekongianina* and *Sphenariina)*, female structures: 42) *Mekongiella kingdoni* (Uvarov), paratype; 43) *Prosphena scudderi* Bolívar; 44) *A, B, Sphenarium m. mexicanum* Saussure; *C, D, S. p. purpurascens* Charpentier. *A-D,* as in fig. 6. For notation, see pp. 279-281.

[Type species]; *Mekongiella kingdoni* (Uvarov, 1937) (SSE. Tibet — Figs. 41, 42) [Type species].

Other species: Mekongiella wardi (Uvarov, 1937) (extreme SE. Tibet).

Of the three included genera, *Yunnanites* is, in most respects, the least specialized. Its phallic structures also seem to be less modified than in any other member of the *Sphenariini*. The epiphallus is not quite so transverse and has longer, less broad lateral plates than in other genera, and the endophallus is simpler. The cingulum is reminiscent of the *Tagastini* (Series VIII), and the presence of ventral processes on its apodemal plates is presumably primitive. *Mekongiella* is undoubtedly the most specialized genus, but, on the other hand, its spermatheca retains the convoluted appendage such as occurs in other presumably ancient groups, such as the *Chlorizeinini* (Series VI).

The members of this subtribe have recently been reviewed by Kevan (1966), who illustrates the epiphallus, cingulum, endophallus and receptaculum seminis of the three species here studied. Dirsh (1956) figures the epiphallus of *Mekongiella kingdoni*.

Subtribe *d.* SPHENARIINA.

(Figs. 43-46).

Sphenariini (partim): References given above in bibliography of tribal nomenclature, except for those names based on *Poekilocerus, Pyrgomorpha* and *Rubellia*.

Subtribe *Sphenariina* Kevan and Akbar, 1964, *Canad. Ent.*, XCVI, 1509, fig. 2 (map), 1517, 1525; Kevan, 1966, *Ibid.*, XCVIII, 1275; Kevan, 1973, *Ibid.*, CV, 1170.

External features: Body very strongly fusiform, not depressed, integument rather smooth to finely granular, colour usually basically green or dark olive-purplish, but very variable, without extensive black maculations; antennae slightly depressed at the base; head conical to rather short, fastigium of vertex variable but usually about as long as wide, sometimes acute; pronotal disc with little or no trace of lateral carinae; space between mesosternal lobes transverse and widened distad; anterior suture joining metasternal pits present; tegmina and hind wings vestigial, tongue-like or strap-like, not scale-like, never absent.

Principal phallic characters: Epiphallus very transverse with very

short lateral plates, anterior processes strongly divergent, lobe-like, lateral plates broad at base, lophi laterally or dorsolaterally directed; appendices short and heavy, but not widely expanded apically; ectophallus with zygoma having posterior margin subconvex or rather irregularly produced, suprazygomal plate broad or undeveloped, apodemal plates in lateral view rounded or somewhat bluntly pointed, without ventral processes, valves of cingulum rather broad and flat, rami of cingulum, in dorsal view, wider than in other subtribes, moderately or little convergent, inflections of suprarami straight and somewhat divergent or inwardly directed, sheaths not developed, ventral process of cingulum of variable length, rounded anteriorly; aedeagal sclerites slightly or strongly curved upwards apically, gradually or somewhat abruptly narrowed, distal parts rather stout to quite slender, endophallic apodemes subquadrate and pointed dorsally in lateral view, with dorsal and ventral inflections, spermatophore sac of large to moderate size, gonopore somewhat behind the middle, pseudoarch large, aedeagal valves rather slender to very long, strongly curved upwards.

Concealed female structures: Subgenital plate with posterior edge biarcuate, somewhat serrated, egg-guide subtriangular with convex margins, contact areas absent or confined to a marginal band, columellae present or indicated; spermatheca as described for *Rubelliina*, or 'head' inflated and forming a short, undifferentiated 'S'.

Distribution: Costa Rica to Mexico.

Included genera: Prosphena Bolívar, 1884; *Sphenarium* Charpentier, 1842.

Species and subspecies examined: Prosphena scudderi Bolívar, 1884 (Costa Rica to Guatemala — Figs. 43-45) [Type species]; *Sphenarium purpurascens purpurascens* Charpentier, 1842 [= *planum* Bruner, 1906 (intermediate to subsp. *minimum*), syn. nov. = *bruneri* Bolívar, 1909, syn. nov.] (C. and S. Mexico from Hidalgo to Chiapas — Figs. 44 *C, D*, 46) [Type species]; *S. p. minimum* Bruner, 1906, stat. nov. [= *affine* Bruner, 1906, syn. nov.] (Mexico: C. Vera Cruz); *S. mexicanum mexicanum* Saussure, 1859 [= *crassipes* (Walker, 1870), syn. nov. = *ictericum* Gerstaecker, 1873, syn. nov.[11] = *marginatum* Bruner, 1906, syn.

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[11] Formerly regarded as a synonym of *S.* [*mexicanum*] *histrio* by Hebard (1932) and Márquez Mayaudón (1962), presumably on the basis of external features. In view of the variation in both forms, this minor error is understandable. We are indebted to Mr. Wayne Boyle, assistant to Dr. Kevan, whose

nov. = *bolivari* Bruner, 1906 (intermediate to subsp. *histrio)*, syn. nov.] (Mexico: Vera Cruz, Tabasco, and intermediates to subsp. *histrio* in Oaxaca); *S. m. histrio* Gerstaecker, 1873, stat. nov. [= *carinata* Bolívar, 1904 = *magnum* Márquez Mayaudón, 1962 (somewhat intermediate to typical subspecies), syn. nov.] (S. Mexico from Michoacan to Chiapas; W. Guatemala); *S. borrei* Bolívar, 1884 [12] (SW. Mexico: Nayarit, Jalisco, Michoacan); *S. rugosum rugosum* Bruner, 1906 (SC. Mexico from Colima and E. Jalisco to Puebla and N. and E. Guerrero); *S. r. barretti* Bruner, 1906, stat. nov. (Mexico: C. Guerrero); *S.* n. sp. *a* (Mexico: Oaxaca); *S.* n. sp. *b* (Mexico: NW. Guerrero).

Other species: None known.

Although *Prosphena* has been treated recently by Kevan, Singh and Akbar (1964), the taxonomy of *Sphenarium* has remained in a chaotic state, the synonymies indicated above being hitherto unpublished and still requiring documentation. The only recent publication on *Sphenarium* is that of Márquez Mayaudón (1962), but this does not include all species. He illustrates the entire phallic complex for *S.* [*mexicanum*] *histrio* and the epiphallus and endophallus of *S.* [*m.*] *mexicanum, S.* [*p.*] *purpurascens* and *S. magnum* [*S. mexicanum histrio*], together with the receptacula seminis for all four. Kevan, Singh and Akbar *(l. c.)* illustrate the phallic structures for *Prosphena scudderi.* Earlier works illustrating the concealed copulatory structures are those of Slifer (1940), who figures the spermatheca of *Sphenarium* sp. [= *m. mexicanum*], and Roberts (1941) who figures the epiphallus and endophallus of *S.* [*p.*] *purpurascens;* Dirsh (1956) gives sketches of the epiphallus of *S.* [*m.*] *mexicanum* and *P. scudderi;* Akbar (1966) illustrates the epiphallus and female subgenital plate of *Sphenarium* [*p. purpurascens*].

As noted under the *Rubelliina,* there are certain features of the phallic structures in *Prosphena* that show relationship with *Rubellia* — notably the epiphallus, spermatophore sac and spermatheca. There are other similarities between this genus and the *Mekongianina.* This suggests that the ancestral *Sphenariina* were originally incursive into America from Asia.

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study of the genitalia and other characters of *Sphenarium* (not yet published) has made it possible to present the various synonymies indicated.

[12] Not a synonym of *S. purpurascens* [*purpurascens*] as claimed by Márquez Mayaudón (1962).

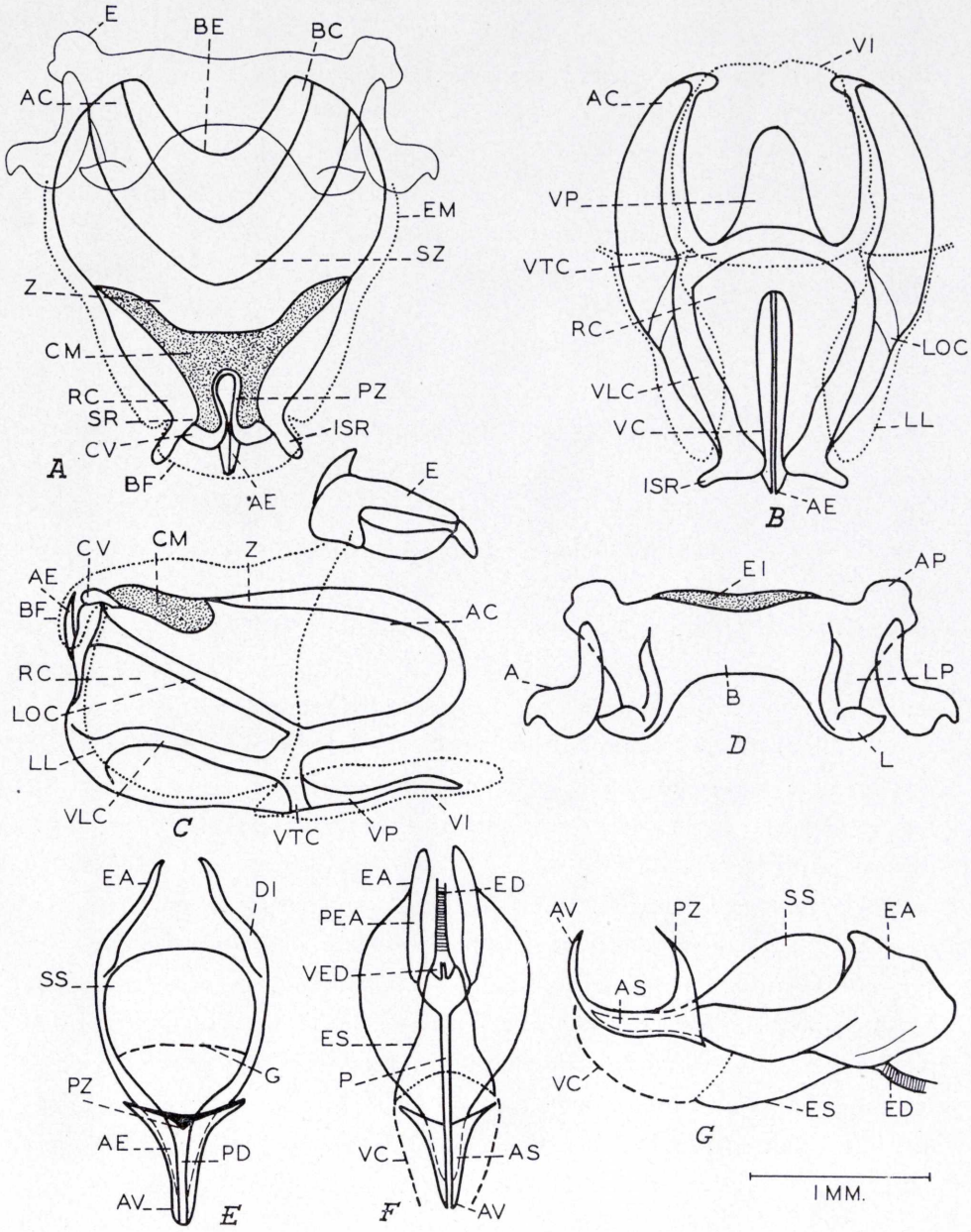


Fig. 45.—*Sphenariini (Sphenariina): Prosphena scudderi* Bolívar, phallic structures. *A-G*, as in fig. 1. For notation, see pp. 279-281.

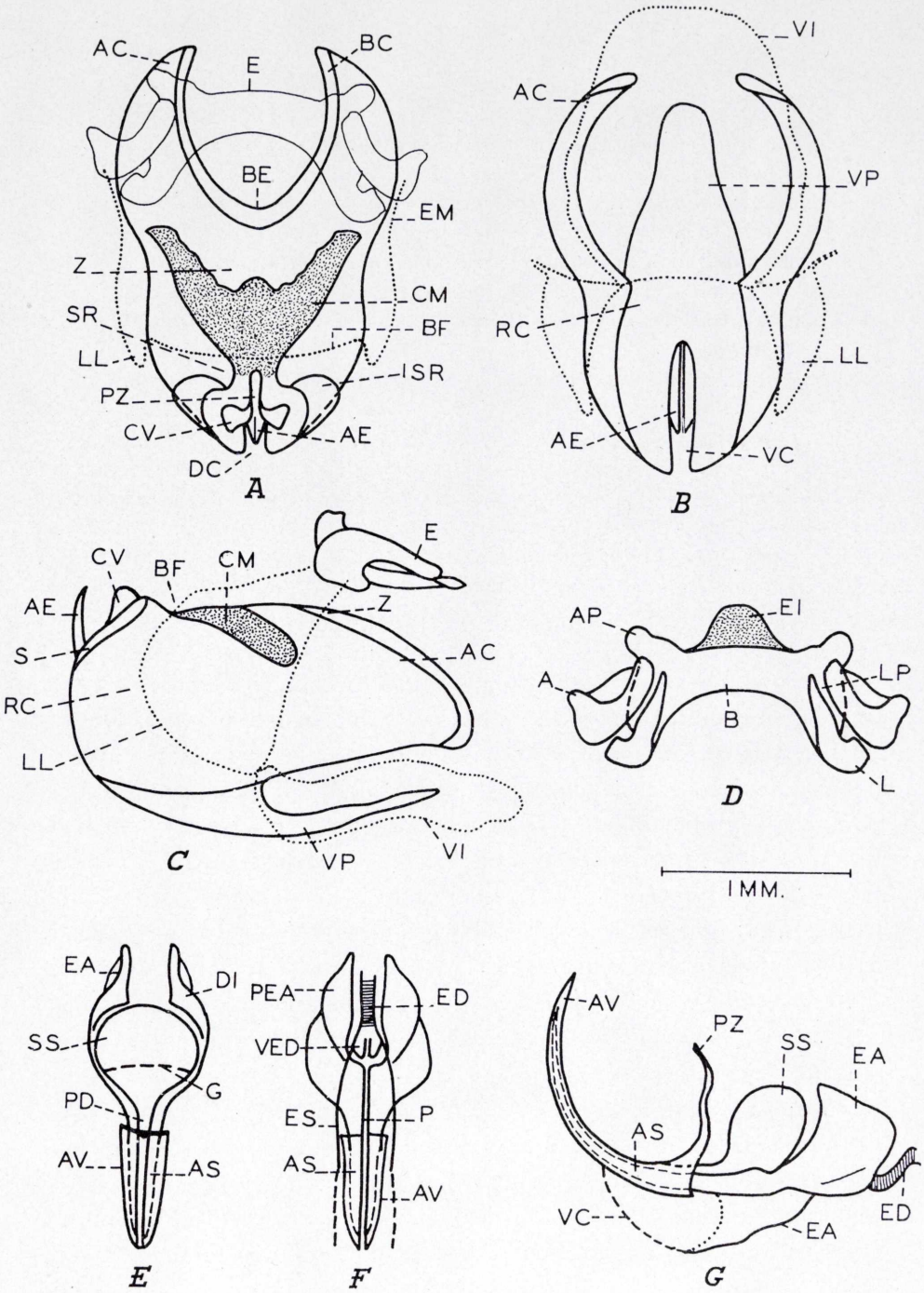


Fig. 46.—*Sphenariini (Sphenariina): Sphenarium p. purpurascens* Charpentier, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

TRIBE 28. OMURINI.

(Figs. 47-53).

[Fam. *Acrididae*] Limited Fam. *Tryxalidae* Walker, 1870, *Cat. Derm. Salt. Brit. Mus.*, III, 494 *(partim)*.

Fam. *Tryxalidae* Walker, 1871, *Cat. Derm. Salt. Brit. Mus.*, V (Suppl. 3), 101 *(partim)*.

Subtribus [and "sub-tribu"] *Atractomorphae* Bolívar, 1884, *An. Soc. esp. Hist. nat.*, XIII, 20, 22, 59 *(partim)*.

Subfam. *Atractomorphinae* Bolívar, 1905, *Bol. Soc. esp. Hist. nat.*, V, 196 *(partim)*.

Sect. *Atractomorphae* Bolívar, 1909, *Gen. Ins.*, XC, 4, 38 *(partim)*.

Tribe *Atractomorphini* Rehn, 1953, *Grassh. Locusts Austral.*, II, 30 *(partim)*.

Tribe *Omurini* Kevan, 1961, *Ent. mon. Mag.*, XCVI, 206; Kevan and Banerjee, 1961, *Verh. XI Int. Kongr. Ent. 1960*, I, 24; Kevan, Singh and Akbar, 1964, *Proc. Acad. nat. Sci. Philad.*, XCVI, 232; Kevan and Akbar, 1904, *Canad. Ent.*, XCVI, 1509, fig. 2 (map), 1511, fig. 4 (map), 1512, 1518, 1525, 1528; Kevan, 1965, *Proc. XII Int. Congr. Ent. 1964*, 442; 1966, *Trans. Amer. ent. Soc.*, XCII, 560.

External features: Body elongate-fusiform, sometimes strongly depressed, integument finely to rather coarsely rugose, if latter, longitudinally striated, antennae slightly to strongly flattened and expanded at base, inserted far in advance of lateral ocelli; head elongate-conical, frontal profile very oblique, fastigium of vertex much longer than wide, nearly or more than twice as long as an eye, usually acute, pronotum in dorsal view widened distad, inferior margin of lateral lobe straight or somewhat sinuous; interspace between mesosternal lobes with parallel or slightly convergent margins, not widened distad; tegmina, if present, acuminate, often somewhat reduced, or tegmina and hind wings absent; hind femur sometimes with external area expanded and displaced subventrally; male cerci simple.

Principal phallic characters: Epiphallus with a short, narrow bridge and rather long, narrow, parallel lateral plates, anterior processes lobe-like, divergent, appendices rather short, not reaching lophi, latter dorsolaterally directed; ectophallus elongate-pyriform, central membrane extensive, zygoma variable but covering most of the basal half of the cingulum, posterior margin somewhat produced, subtruncate or excised, suprazygomal plate, if apparent, broad and covering most of the zygoma but not extending beyond it, basal emargination fairly deep, horseshoe-

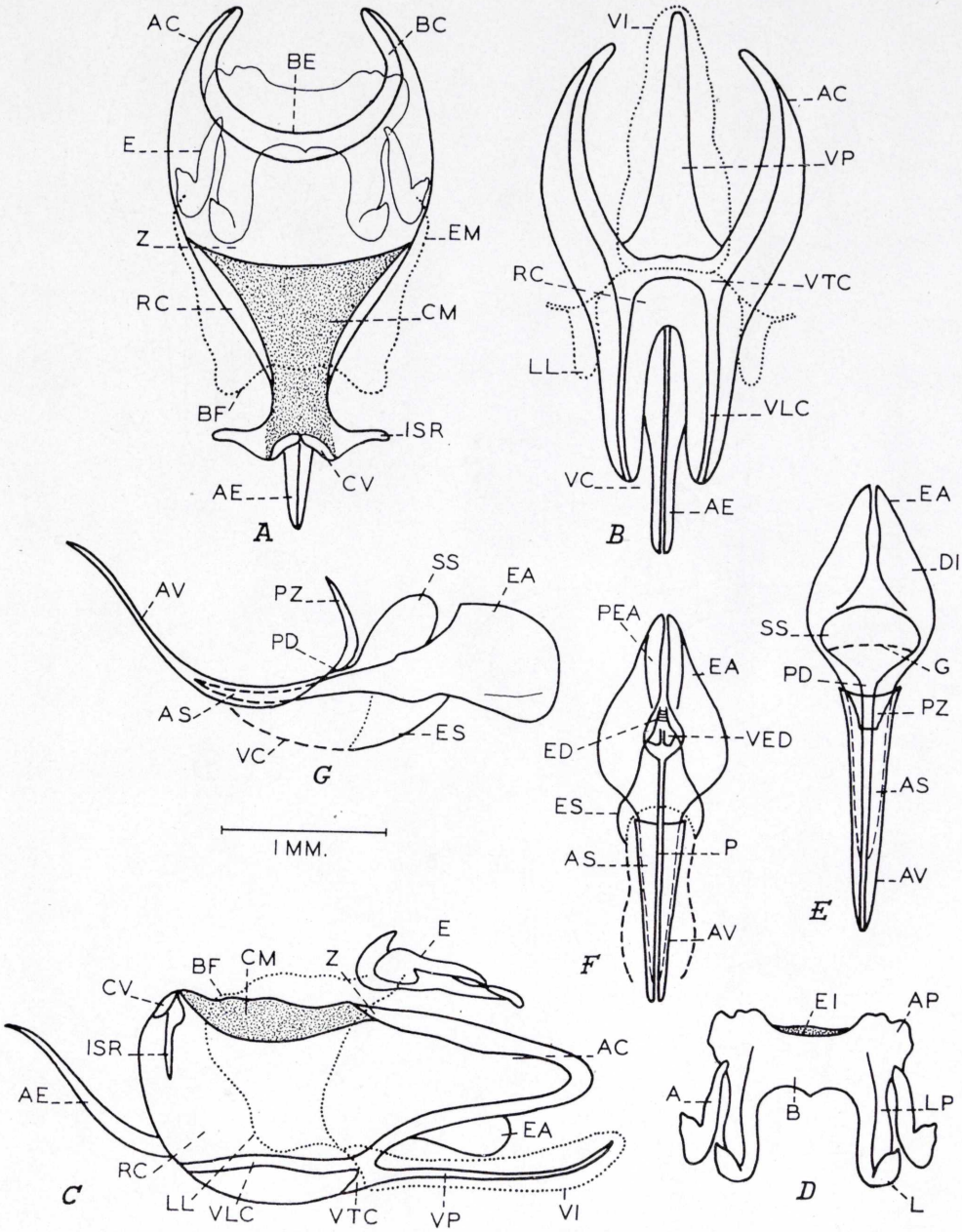


Fig. 47.—*Omurini: Minorissa pustulata* Walker, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

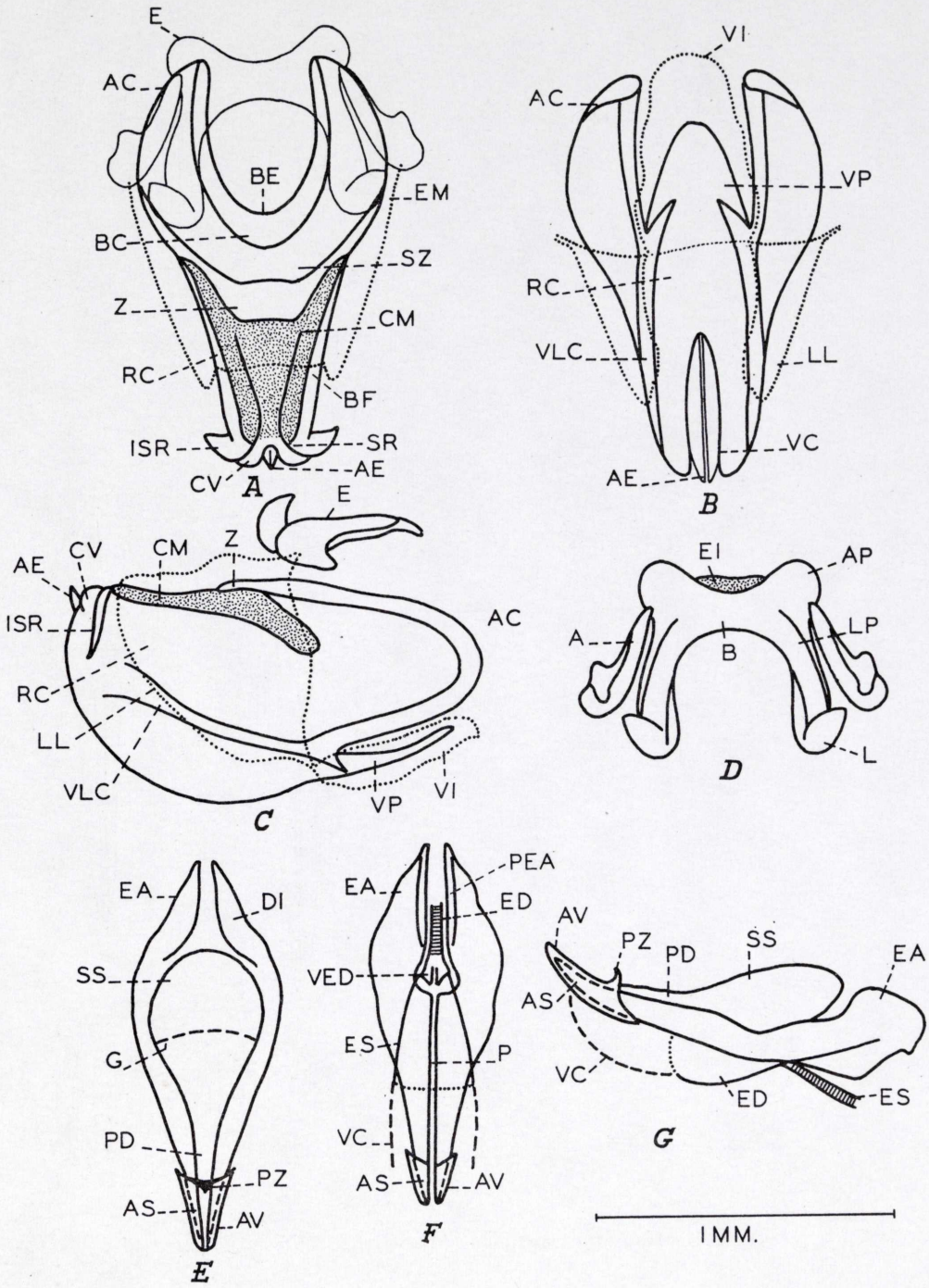


Fig. 48.—*Omurini: Algete brunneri* Bolívar, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.

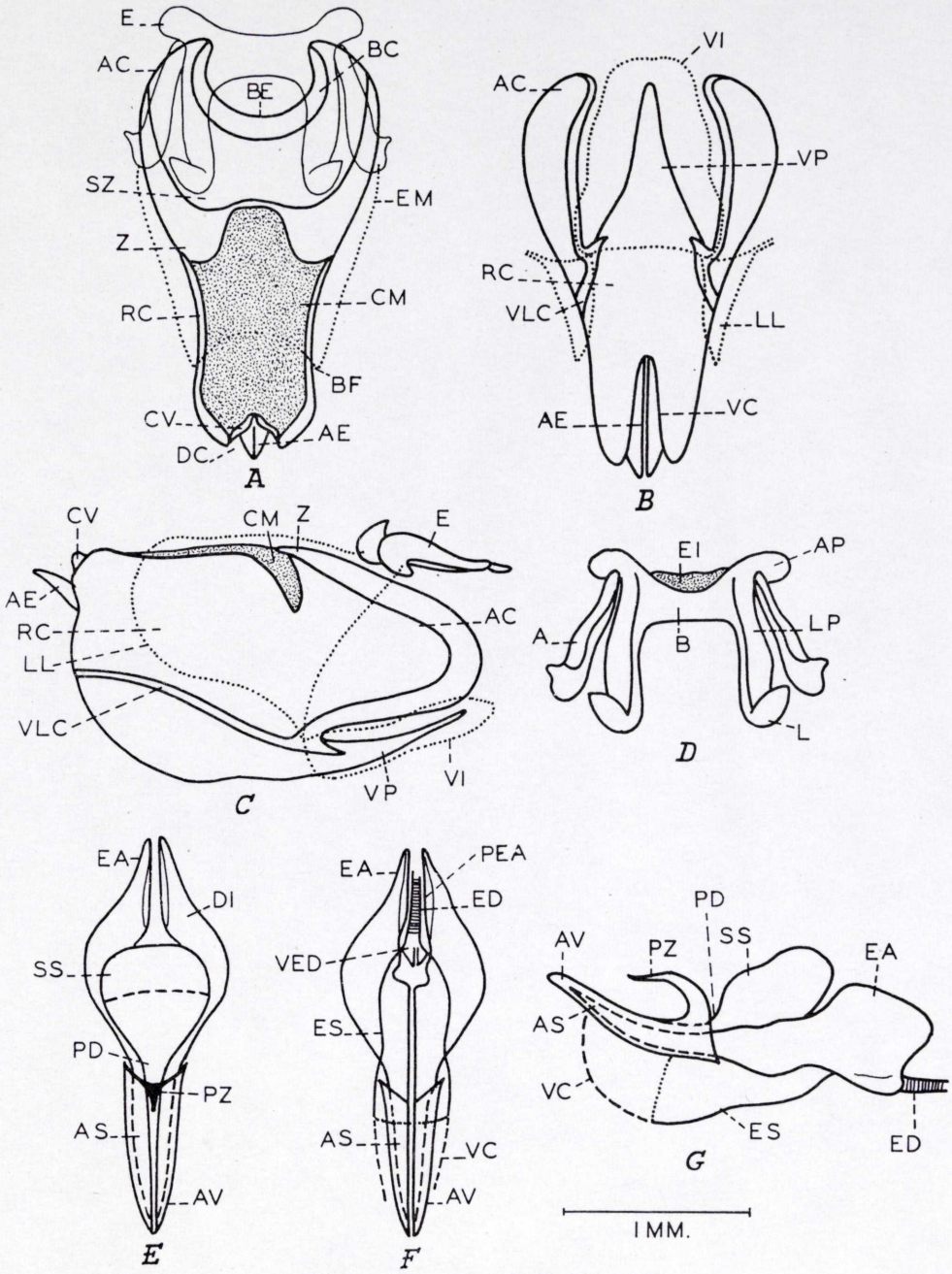
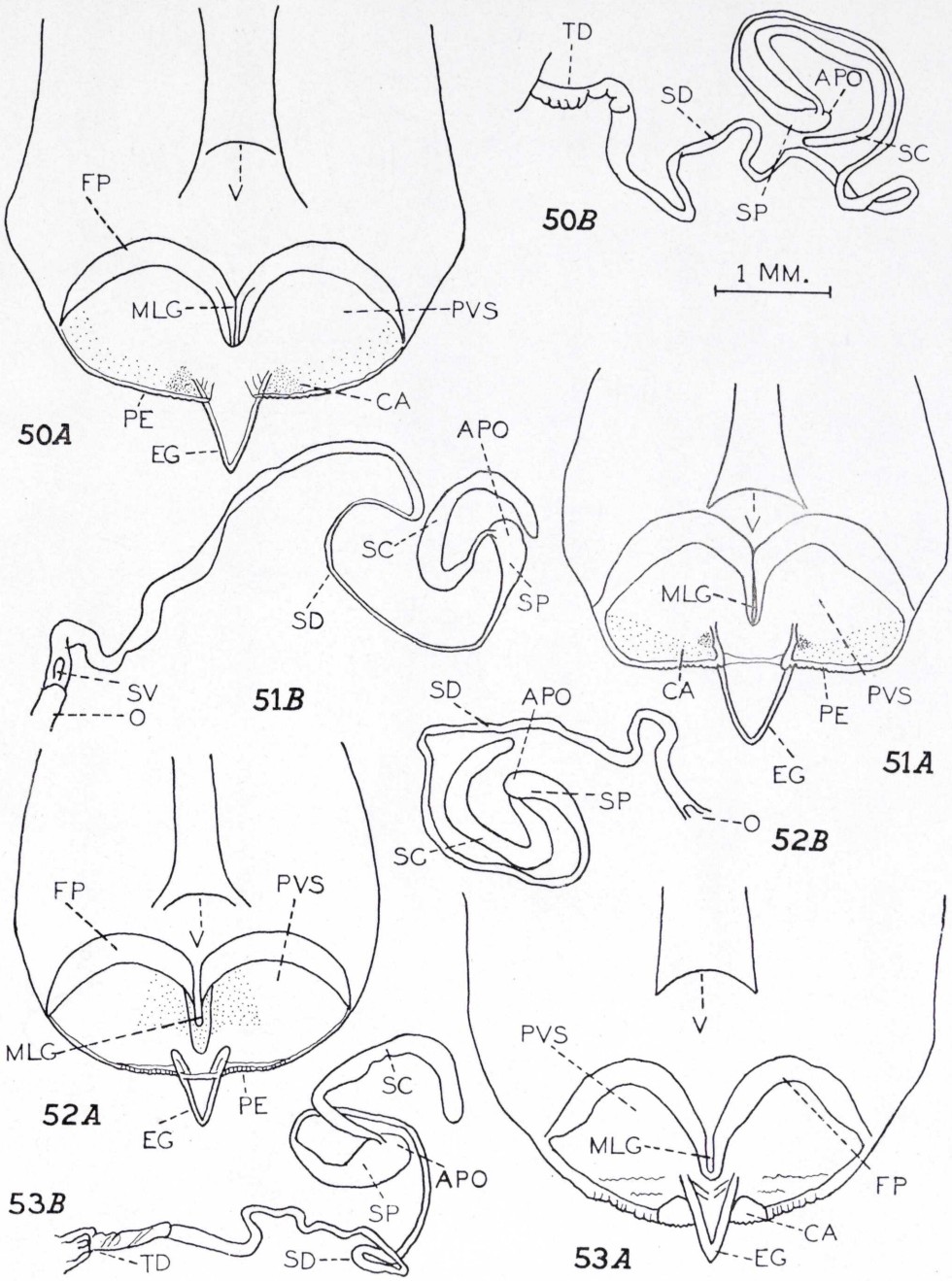


Fig. 49.—*Omurini: Omura congrua* Walker, phallic structures. *A-G,* as in fig. 1. For notation, see pp. 279-281.



Figs. 50-53.—*Omurini*, female structures: 50) *Minorissa pustulata* Walker; 51) *Deraspiella volxemi* (Bolívar), holotype; 52) *Algete brunneri* Bolívar; 53) *Omura congrua* Walker. *A, B,* as in figs. 2, 3. For notation, see pp. 279-281.

shaped or semicircular, apodemal plates in lateral view rather narrowly rounded or bluntly pointed, without ventral processes, valves of cingulum of small to moderate size, narrow and divergent, rami of cingulum very narrow in dorsal view, weakly or moderately convergent apically, suprarami with or without prominent, outwardly-directed inflections, sheaths not developed, ventral process of cingulum of variable form, often long and narrow; aedeagal sclerites rather narrow and straight usually with elongate apices, endophallic apodemes in lateral view irregularly rounded, sometimes with traces of ventral processes, dorsal inflections usually well developed, spermatophore sac never very large, pyriform or transversely oval, gonopore about or slightly beyond the middle, pseudoarch small to rather large, aedeagal valves narrow, slightly curved upwards, or moderate length to extremely elongate.

Concealed female structures: Subgenital plate with posterior edge rounded or subtruncate, crenulated; egg-guide triangular, usually rather small; contact areas not developed or only faintly indicated; columellae absent but thickened areas on either side of the base of the egg-guide usually indicated; spermatheca of characteristic form, spermathecal vesicle with a distinct but short apical pocket, spermathecal caecum rather long and narrow, roughly C-shaped, narrowing gradually to a very narrow connection with the apical part of the vesicle, so that caecum and vesicle are sharply differentiated; spermathecal duct rather short, terminal part not distinctly dilated, sometimes with small lobular pockets.

Distribution: Northern half of South America.

Included genera: Minorissa Walker, 1870; *Deraspiella,* Bolívar, 1905 [only female known]; *Algete* Bolívar, 1905; *Omura* Walker, 1870.

Species examined: Minorissa pustulata Walker, 1870 (Venezuela and eastern Colombia — Figs. 47, 50) [Type species]; *Deraspiella volxemi* (Bolívar, 1884) (C. Brazil — Fig. 51) [Type species]; *Algete brunneri* Bolívar, 1905 (NE. Brazil — Figs. 48, 52) [Type species]; *Omura congrua* Walker, 1870 (Amazon and Orinoco drainage systems from the Guianas and N. Brazil to E. Peru and N. Bolivia — Figs. 49, 53) [Type species].

Members of this tribe are very characteristic, being somewhat similar superficially to *Atractomorphini* (Series VIII), but their phallic structures and spermathecae are quite different from those of that tribe.

The structure of the cingulum, especially in *Algete,* is very similar to that of certain *Sphenariini,* notably *Yunnanites,* and it seems probable that the two tribes may have had a common ancestry. As with the subtribe *Sphenariina,* the ancestors of the *Omurini* were doubtless incursive into America with ancient sphenariine stock from Asia. Whether the Central and South American forms are the product of two separate incursions or of a single invasion is debatable. It would not, however, seem that one has been derived directly from the other. The least specialized genus of *Omurini,* from the point of view of external morphology, is *Minorissa* (among other things, it is fully alate), but it has highly specialized aedeagal valves and other phallic structures; *Algete* is much less advanced in the latter regard.

The *Omurini* have recently been monographed by Kevan (1966 b) [13], who illustrates the phallic structures of all species except *Deraspiella volxemi,* of which the male is unknown. Earlier illustrations of the epiphallus of *Omura congrua* are given by Roberts (1941), who figures the endophallus also, Dirsh (1956), whose figure seems to be erroneous, Kevan (1961) and Kevan and Banerjee (1961). The last two references also include figures of the epiphalli of *Minorissa pustulata* and *Algete brunneri.*

Addendum.

Since going to press, Key (1972) has given an account of the genitalic structures of all known species of *Psednurini,* a tribe already treated in Part II of this study (Kevan, Akbar and Chang, 1970). The species selected by us to illustrate *Propsednura (P. nana* Rehn) has been transferred to a new genus *Psedna* Key, 1972, of which it is the type species. Key also makes various changes in the synonymy of the *Psednurini,* erects a new species of *Propsednura* Rehn, *P. peninsularis,* and gives a photograph of the striking macropterous form of *P. nana*

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[13] It may be of interest to note that *Omura congrua* was among the earliest of *Pyrgomorphidae* to be illustrated — this was not indicated by Kevan *(op. cit.).* Houttuyn, 1766, *Natuurl. Hist. volg. Linnaeus,* I (10), 151, pl. LXXX, fig. 1, refers to it as "*Gryllus Locusta Nasutus,* meer naar de volgende Soort [*turritus*]". His identification was, of course, quite erroneous. Müller, 1774, *Linné's Natursyst.,* repeated the figure (pl. 10, fig. 1), which he calls (p. 418) "*Gryllus (Acrida) Nasutus,* Nebenart". This does not seem ever to have been noted previously.—D. K.

mentioned by us. For this last we propose the formal infrasubspecific name f. *macroptera*, nov., the holotype of which is the specimen figured by Key *(op. cit.)*. Apart from *Propsednura peninsularis*, of which no photograph is available to us, the only psednurine of which no photograph of a type specimen has hitherto been published is *Psednura pedestris* (Erichson). Due to unavoidable circumstances the publication of the accompanying photographs (Pl. VII, figs. I-L) has been delayed until now.

List of Abbreviations.

The following is a list, arranged alphabetically, of the abbreviations used in the illustrations; those for both sexes are combined in one list.

A, Appendix of epiphallus.
AA, an apical appendix of the spermathecal caecum.
AB, Apical bulb of spermathecal appendage.
AC, Apodemal plate of cingulum.
AE, Aedeagus.
AP, Anterior projection of epiphallus.
APO, Apical pocket of spermatheca.
AS, Aedeagal sclerite.
AS_1, the basal part of AS when separated from the apical part. (Probably equivalent in part to the Basal aedeagal sclerite of other families).
AS_2, the apical part of AS when separated from the basal part. (Probably equivalent to the Apical aedeagal sclerite of other families).
AV, Aedeagal valve.
B, Bridge of epiphallus.
BC, Basal thickening of cingulum.
BE, Basal emargination of cingulum.
BF, Basal fold of ectophallic membrane.
C, Columella of female subgenital armature.
CA, Contact area of female subgenital armature.
CM, Central membrane of ectophallus.
CV, Valve of cingulum.
DAV, Dorsal process of aedeagal valve *(Schulthessiini)*.
DC, Dorsal cleft of cingulum.
DI, Dorsal inflection of endophallic apodeme.

E, Epiphallus.
EA, Endophallic apodeme.
ED, Ejaculatory duct.
EG, Egg-guide.
EI, Epiphallic infold.
EM, Ectophallic membrane.
ES, Ejaculatory sac.
F, a marginal furrow separating suprarami and rami of cingulum *(Dictyophorini)*.
FP, Floor pouch of female genital chamber.
G, Gonopore (male).
IR, an internal inflected process on the ramus of the cingulum.
ISR, Inflection of ramus or supraramus.
L, Lophus of epiphallus.
LL, Lateral lobe of ectophallic membrane.
LOC, Lateral oblique thickening of cingulum.
LP, Lateral plate of epiphallus.
MLG, Median longitudinal groove of female genital chamber.
O, Orifice of spermathecal duct.
P, Phallotreme.
PAV, a lateral or ventrolateral process on an aedeagal valve *(Taphronotini* and *Dictyophorini)*.
PD, Phalotreme duct.
PE, Posterior edge of female subgenital plate.
PVS, Post-vaginal sclerite of female genital chamber.
PZ, Pseudoarch of ectophallus.
PZI, Posterior inflection of cingulum.
R, a longitudinal, mid-dorsal ridge sometimes present on the zygoma (more rarely on the suprazygomal plate) of the cingulum.
RC, Ramus of cingulum.
S, Sheath of ectophallus.
SA, Spermathecal appendage.
SB, Secondary diverticulum of caecum of spermatheca.
SC, Caecum of spermatheca.
SD, Spermathecal duct.
SL, Secondary diverticulum of spermathecal appendage.
SP, Spermathecal vesicle.
SR, Supraramus of cingulum.
SS, Spermatophore sac.

SV, Valve of spermathecal duct.
SZ, Suprazygomal plate of cingulum.
TD, Terminal dilation of spermathecal duct.
V, Vulva, or Opening of vagina, or Common oviduct, or Female gonopore.
VAC, Ventral process of apodemal plate of cingulum (? = vestige of true apodeme of cingulum; see AC).
VC, Ventral cleft of cingulum.
VEA, Ventral process of endophallic apodeme *(Pseudomorphacridini)*.
VED, Valve of ejaculatory duct.
VI, Ventral infold of ectophallic membrane.
VLC, Ventral longitudinal thickening of cingulum.
VP, Ventral process of cingulum.
VTC, Ventral transverse thickening of cingulum.
Z, Zygoma of cingulum.

References.

AGARWALA, S. B. D.
1952. A comparative study of the ovipositor in the *Acrididae* — II. [i]. *Ind. J. Ent.*, t. XIV, págs. 161-175.

AGARWALA, S. B. D.
1954. A comparative study of the ovipositor in *Acrididae* (Contd.), II. [iii]. *Ind. J. Ent.*, t. XV (1953), págs. 299-318.

AKBAR, S. S.
1966. Studies on the female copu'atory armature of six pyrgomorph genera *(Pyrgomorphidae, Acridoidea, Orthoptera)*. *Sind. Univ. Res. J. (Sci.)*, t. II, págs. 1-8.

AKBAR, S. S., and KEVAN, D. K. McE.
1964. Two subgenera of *Pyrgomorphidae (Orthoptera, Acridoidea)* raised to generic status on the basis of their phallic structures. *Ent. mon. Mag.*, t. XCIX (1963), págs. 90-95.

BANERJEE, S. K., and KEVAN, D. K. McE.
1960. A preliminary revision of the genus *Atractomorpha* Saussure, 1862 *(Orthoptera: Acridoidea: Pyrgomorphidae)*. *Treubia*, t. XXV, páginas 165-189.

BANERJEE, S. K., and KEVAN, D. K. McE.
1962. Notes on the morphology of *Atractomorpha* Saussure, 1862 *(Orth. Pyrgomorphidae)*. *Eos*, Madrid, t. XXVIII, págs. 415-433.

BOLÍVAR, I.
1889. Ortópteros de Africa del Museo de Lisboa (continuación). *J. Sci. Lisboa* (2), t. I, págs. 150-173.

BOLÍVAR, I.
1905. Notas sobre los Pirgomórfidos *(Pyrgomorphidae)*. X. Subfam. *Atractomorphinae. Bol. Soc. esp. Hist. nat.*, t. V, págs. 196-217.

BOLÍVAR, I.
1909. *Orthoptera* Fam. *Acridiidae* Subfam. *Pyrgomorphinae. Gen. Ins.*, t. XC, págs. i-ii, 1-58, lám. [I].

DIRSH, V. M.
1953. *Charilainae*, a new subfamily of *Acrididae (Orthoptera). Ann. Mag. nat. Hist.* (12), t. VI, págs. 161-173.

DIRSH, V. M.
1954. Five new African *Acrididae (Orthoptera), Ann. Mus. Congo, Tervuren in 4º (Zool.)*, t. I, págs. 348-355.

DIRSH, V. M.
1956. The phallic complex of *Acridoidea (Orthoptera)* in relation to taxonomy. *Trans. R. ent. Soc. Lond.*, t. CVIII, págs. 223-356 (incl. láms. 1-66).

DIRSH, V. M.
1962. Synonymic notes on African Acridoidea. *Rev. Zool. Bot. Afr.*, t. LXV, págs. 81-89.

DIRSH, V. M.
1963. The *Acridoidea (Orthoptera)* of Madagascar. III. *Pyrgomorphidae. Bull. Brit. Mus. (nat. Hist.) Ent.*, t. XIV, págs. 51-103.

DIRSH, V. M.
1965. *The African genera of Acridoidea.* Cambridge: xiv + 579 págs.

DIRSH, V. M.
1966. *Acridoidea* of Angola (I). *Publ. cult. Cia. Diam. Angola*, t. LXXIV, págs. 11-305.

DIRSH, V. M.
1970. *Acridoidea* of the Congo *(Orthoptera). Ann. Mus. Afr. Centr., in 8º (Zool.)*, t. CLXXXVII, págs. (1-18), 1-605.

DIRSH, V. M., and DESCAMPS, M.
1968. Insectes Orthoptères. *Acridoidea, Pyrgomorphidae* et *Acrididae. Faune Madag.*, t. XXVI, págs. iv + 312.

HEBARD, M.

1932. New species and records of Mexican *Orthoptera. Trans. Amer. ent. Soc.*, t. LVIII, págs. 201-371, láms. 17-21.

JOHNSTON, H. B.

1956. *Annotated Catalogue of African Grasshoppers,* Cambridge: xxii + 833 páginas.

KATIYAR, K. N.

1955. The life-history and ecology of the Northern Spotted Grasshopper, *Aularches punctatus* Drury *(Orthoptera: Acrididae). Agra. Univ. J. Res. (Sci.),* t. IV, págs. 397-413.

KATIYAR, K. N.

1956. On variation in the spermatheca of some Indian grasshoppers *(Orthoptera: Acrididae). J. zool. Soc. Ind.*, t. VIII, págs. 35-47.

KATIYAR, K. N.

1960. Ecology of oviposition and the structure of egg-pods and eggs in some Indian *Acrididae. Rec. Ind. Mus.*, t. LV (1957), págs. 29-68.

KEVAN, D. K. McE.

1955. A further contribution to our knowledge of the *Acrididae (Orthoptera)* of Angola. *Publ. cult. Cia. Diam. Angola,* t. XXIV, págs. 61-82.

KEVAN, D. K. McE.

1956. Results from the Danish Expedition to the French Cameroons 1949-50. XV. *Orthoptera: Acrididae. Bull. Inst. fr. Afr. Noire* (A), t. XVIII, págs. 960-977.

KEVAN, D. K. McE.

1961. Taxonomy and distribution of *Atractomorphini* and *Omurini,* trib. nov. *(Orth., Acridoidea, Pyrgomorphidae). Ent. mon. Mag.*, t. XCVI, págs. 204-207.

KEVAN, D. K. McE.

1962. *Pyrgomorphidae (Orthoptera: Acridoidea)* collected in Africa by E. S. Ross and R. E. Leech, 1957-1958, with descriptions of new species. *Proc. Calif. Acad. Sci.* (4), t. XXXI, págs. 227-248.

KEVAN, D. K. McE.

1963 a. *Pyrgomorphidae (Orthoptera, Acridoidea)* in the collection of C. P. Thunberg, Uppsala, with notes on type material of the species represented. *Ark. Zool.* (2), t. XVI, págs. 69-96, láms. V-XV.

KEVAN, D. K. McE.
1963 b. The genus *Pyrgophyma* Giglio-Tos, 1907 *(Acridoidea: Pyrgomorphidae). Proc. R. ent. Soc. Lond.* (B), t. XXXII, págs. 108-110

KEVAN, D. K. McE.
1963 c. Two little-known genera of *Pyrgomorphidae (Orth.)* from south-east Asia. *Ent. mon. Mag.,* t. XCVIII (1962), págs. 208-213.

KEVAN, D. K. McE.
1964. *Pamphagidae* Burmeister, 1840, and *Pyrgomorphidae* Brunner von Wattenwyl, 1874: proposed addition to the Official List of family-group names in zoology, and further proposals arising therefrom *(Insecta: Orthoptera).* Z. N. (S.) 1650. *Bull. zool. Nomencl.,* t. XXI, págs. 377-385.

KEVAN, D. K. McE.
1966 a. A new genus of *Pyrgomorphidae (Orthoptera: Acridoidea)* from Fiji. *Pacif. Ins.,* t. VIII, págs. 397-402.

KEVAN, D. K. McE.
1966 b. The *Pyrgomorphidae* of South America *(Orthoptera: Acridoidea). Trans. Amer. ent. Soc.,* t. XCII, págs. 557-584, láms. 26-28.

KEVAN, D. K. McE.
1969. A revision of the *Pseudomorphacridini (Orthoptera: Acridoidea: Pyrgomorphidae). Orient. Ins.,* t. II (1968), págs. 141-154.

KEVAN, D. K. McE.
1973 a. A new genus of *Pyrgomorphidae (Acridoidea: Orthoptera)* from the island of Socotra. *Canad. Ent.,* t. CV, 1169-1173.

KEVAN, D. K. McE.
1973 b. A Revision of the Genus *Taphronota* Stål, 1873 *(Orthoptera: Acridoidea: Pyrgomorphidae).* Publ. cult. Cia. Diam. Angola *(in press).*

KEVAN, D. K. McE., and AKBAR, S. S.
1964. The *Pyrgomorphidae (Orthoptera: Acridoidea):* Their systematics, tribal divisions and distribution. *Canad. Ent.,* t. XCVI, págs. 1505-1536.

KEVAN, D. K. McE., AKBAR, S. S., and CHANG, Y.-C.
1969. The concealed copulatory structures of the *Pyrgomorphidae (Orthoptera: Acridoidea).* Part I. General Introduction. *Eos,* Madrid, t. XLIV (1968), págs. 165-266.

KEVAN, D. K. McE., AKBAR, S. S., and CHANG, Y.-C.
1970. The concealed copulatory structures of the *Pyrgomorphidae (Orthopte-*

ra: Acridoidea). Part. II. Tribes *Fijipyrgini, Verduliini, Brunniellini, Psednurini, Mitricephalini, Geloiini, Sagittacridini, Gymnohippini* and *Malagasphenini. Eos,* Madrid, t. XLV (1969), págs. 173-228, lám. III.

KEVAN, D. K. McE., AKBAR, S. S., and CHANG, Y.-C.
1971. The concealed copulatory structures of the *Pyrgomorphidae (Orthoptera: Acridoidea).* Part. III. Tribes *Chapmanacridini, Ichthiacridini, Ichthyotettigini, Orthacridini, Popoviini* and *Nereiini. Eos,* Madrid, t. XLVI (1970), págs. 123-208, láms. II-VI.

KEVAN, D. K. McE., AKBAR, S. S., and CHANG, Y.-C.
1972. The concealed copulatory structures of the *Pyrgomorphidae (Orthoptera: Acridoidea).* Part. IV. Tribes *Desmopterini, Monistriini, Chlorizeinini, Poekilocerini* and *Phymateini. Eos,* Madrid, t. XLVII (1971), págs. 137-234, láms. II-IX.

KEVAN, D. K. McE., and BANERJEE, S. K.
1961. Taxonomy and distribution of Old World *Atractomorphini (Orthoptera: Acridoidea: Pyrgomorphidae). Verh. XI. Int. Kongr. Ent. Wien, 1960,* t. I, págs. 23-26.

KEVAN, D. K. McE., and CHEN, Y. K.
1969. A revised synopsis of the genus *Atractomorpha* Saussure, 1862 *(Orthoptera, Pyrgomorphidae),* with an account of the African *aberrans*-group. *Zool. J. Linn. Soc. Lond.,* t. XLVIII, págs. 141-198, láms. 1-7.

KEVAN, D. K. McE., and ROY, R.
1971. *Orthoptera Pyrgomorphidae, In* Le Massif des Monts Loma (Sierra Leone), I. *Mém. Inst. fond. Afr. Noire,* t. LXXXVI, págs. 261-264.

KEVAN, D. K. McE., SINGH, A., and AKBAR, S. S.
1964. A revision of the Mexican *Pyrgomorphidae (Orthoptera: Acridoidea).* I. Genera other than *Sphenarium. Proc. Acad. nat. Sci. Philad.,* t. CXVI, págs. 231-298 (incl. láms. I-VI).

KEY, K. H. L.
1972. A revision of the *Psednurini (Orthoptera: Pyrgomorphidae). Aust. J. Zool.,* t. XIV (Suppl.), págs. ii + 72.

KIRBY, W. F.
1910. *Orthoptera Saltatoria.* Part II. *(Locustidae* vel. *Acridiidae)* [with Additions and Corrections]. *Syn. Cat. Orth., London,* t. III, ix + 674 págs.

LIANA, A.
1966. *Maura eichleri* sp. n. *(Orthoptera, Pyrgomorphidae)* de la Zambia. *Bull. Acad. polon. Sci.* (2), t. XIV, págs. 487-490.

MÁRQUEZ M[AYAUDÓN], C.
1962. Estudio de las especies del género *Sphenarium* basado en sus genitalias. *(Acrididae, Orthoptera)*, con la descripción de una especie nueva. *An. Inst. Biol. Univ. Méx.*, t. XXXIII, págs. 247-258.

REHN, J. A. G.
1942. Notes on species of the locust genus *Parasphena*, with descriptions of three new species *(Orthoptera, Acrididae, Pyrgomorphinae)*. *Proc. Acad. nat. Sci. Philad.*, t. XCIV, págs. 287-306, láms. 26-27.

REHN, J. A. G.
1953. Records and descriptions of *Pyrgomorphinae*. *Trans. Amer. ent. Soc.*, t. LXXIX, págs. 99-150, láms. I-V.

ROBERTS, H. R.
1941. A comparative study of the subfamilies of the *Acrididae (Orthoptera)* primarily on the basis of their phallic structures. *Proc. Acad. nat. Sci. Philad.*, t. XCIII, págs. 201-246.

SJÖSTEDT, Y.
1932. Orthopterentypen im Naturhistorischen Reichsmuseum zu Stockholm: 2. *Acrididae. Ark. Zool.*, t. XXIV A (1), págs. 1-89, láms. 1-20.

SLIFER, E. H.
1940. The internal genitalia of female *Thrinchinae, Batrachotetriginae, Pamphaginae* and *Pyrgomorphinae (Orthoptera, Acrididae)*. *J. Morph.*, t. LXVI, págs. 175-195 (incl. láms. 1-5).

SLIFER, E. H.
1943. The internal genitalia of some previously unstudied species of female *Acrididae (Orthoptera)*. *J. Morph.*, t. LXXII, págs. 225-237.

STÅL, C.
1873. *Orthoptera* nova descripsit. *Öfv. K. svensk. VetenskAkad, Förh.*, t. XXX (4), págs. 39-54.

UVAROV, B. P.
1937. Grasshoppers *(Orthoptera, Acrididae)* collected by Captain F. Kingdon Ward in Tibet in 1935. *J. Linn. Soc. Lond. (Zool.)*, t. XL, págs. 279-282, lám. 5.

UVAROV, B. P.
1966. *Grasshoppers and Locusts: A Handbook of General Acridology*, Cambridge, t. I, xii + 481 págs. + 2 láms.

EXPLANATION OF PLATES I-VII

PLATE I:

Schulthessiini and *Taphronotini (Aularchina)*, types:

Figs. A, B.—*Schulthessia biplagiata* Bolívar, ♀ lectotype (Schulthess collection, Ent. Inst., Eidg. Tech. Hochschule, Zürich) [Johnston (1956) indicates that the type is in Zürich, and, as this is the only specimen in the collection referred by Bolívar (1905) it must be regarded as the lectotype; it bears three labels: (1) "Antongil", (2) "*Schulthessia biplagiata* Bol., Bol. det. 1901" (in red ink on white with black border), and (3) "Type" (square, in red on white with red border). It has the following measurements: length 33.5, pronotum 7.6, tegmen 27.0, hind femur 15.0, hind tibia 13.5, hind tarsus 6.2 mm. There are also two females paralectotypes in Geneva and one in Leningrad with the label "Antongil". In Paris there is a female paralectotype with the following labels: (1) "Sainte Marie de Madagascar" (blue Finot collection label), (2) "*Pyrgomorphidae Atractomorphae Atractomorph.* species nova 8 ♂, 16 ♀" (in Bolívar's handwriting); most of the series referred to on this label are either in the general collection or in the Finot collection, Paris. In the latter, also, are two males, paralectotypes, labelled "Baie d'Antongil", together with specimens from Maroancetra and Mont d'Ambre which are not types].

Figs. C, D.—*Aularches miliaris pseudopunctatus*, n. ssp. ♂ holotype [for details, see p. 213. Footnote 3].

Figs. E, F.—The same, ♀ allotype [for details see p. 213. Footnote 3].

PLATE 11:

Dictyophorini, types:

Figs. A, B.—*Parapetasia femorata* Bolívar, ♀ holotype (Vienna) [This specimen bears only two labels, "54/6687" and "6687", but below it, in the cabinet are two further labels: "*P. femorata* Bol." and "6687 Gabon"].

Figs. C, D.—*Parapetasia rammei* Sjöstedt, ♀ holotype (Stockholm) [This specimen bears three labels: (1) "Kamerun, Bare-Dshang, 2-6-XII-08, Riggenbach, s. g."; (2) "*Parapetasia rammei* Sj. det. Yngve Sjöstedt"; (3) "Cotypus" *(sic)* in red. In the original description, a ♀ with the above data is designated as "typ", and Johnston (1956) states that the type is in Stockholm. This being the only ♀ from Bare-Dshang, it would appear that it should not be regarded as a lectotype, but as the holotype, and that the ♀ in Berlin from Bangwe and the ♂ from Bamenda (dorsal photographs of Berlin specimens of both sexes are given with the original description) should be regarded as a paratypes, despite the above "cotype" label. This specimen has the lesser measurements given for the female in the original description]. *P. rammei* now seems to be no more than a form of *P. femorata* with rather larger tegmina and more extensive red pigment.

Figs. E, F.—*Camoensia insignis* Bolívar, ♂ lectotype (Lisbon University). [This specimen has measurements agreeing with those given in the original description, which, however, included specimens from three localities (presumably all males). The lectotype bears the labels "Humbe, Anchieta" and "*Camoensia insignis*" (? in Bolívar's handwriting); above the specimen is a cabinet label "Tipo"; there is also a second, better preserved ♂, similarly labelled, but larger (54 mm). In Madrid there is a ♀ with similar labels including "Tipo", but, as no ♀ was originally described, it is not a type; another small ♂ in Madrid and a ♀ in Paris (Pantel collection) also have similar data; the other syntypes (Quango, Capello e Ivens; Angola, Welwitsch) seem to have disappeared; only the data labels remain in Lisbon. Bolívar (1889) erred when he stated that no ♂ had previously been described; this, in turn misled Rehn (1953: 118n) in his discussion of the species.

PLATE III:

Dictyophorini, types:

Figs. A, B.—*Camoensia insignis* Bolívar, ♀ holotype of *C. insignis* var. *sculpturata* Bolívar, 1904 (Madrid) [This is merely a shrivelled alcohol-preserved specimen of *C. insignis* and deserves no special name — syn. nov. It is labelled "Africa, Anchieta" and "*C. carinata* Bol." (in Bolívar's hand); above the specimen is a cabinet label "*Camoensia insignis sculpturata* Bol." (also in Bolívar's hand)].

Figs. C, D.—*Loveridgacris impotens* (Karsch), ♂ holotype (Berlin) [The specimen has the data "Usegua (not Usegna), leg. C. W. Schmidt" and Karsch's determination label "*Petasia impotens*"; an alleged ♀ type in the Stockholm museum has no type status].

Figs. E, F.—*Dictyophorus (D.) spumans* var. *ater* (Saussure *in* Distant, 1892), ♂ holotype (London). [This specimen is 56.7 mm. in length and bears the labels: "*Petasia spumans* var. *ater* Dist." and "Pretoria (W. L. D.)". Kevan (1963 a) figures many other types referable to *D. spumans;* this figure and the following are given to complete the series].

PLATE IV:

Dictyophorini, types:

Figs. A, B.—*Dictyophorus (D.) spumans* var. *calceatus* (Bolívar, 1904), ♀ holotype (Madrid). [This specimen is labelled as follows: (1) "Damara"; (2) "*Petasia spumans* Thunb. var." (in Bolívar's hand); (3) "Tipo"; (4) *Dict. spumans calceatus* Bol. (cabinet label above specimen, not on it; in Bolívar's hand).

Figs. C, D.—*Dictyophorus (D.) spumans* var. *servillei* (Bolívar, 1904), ♂ lectotype (Madrid). [This specimen agrees in measurements with those given for the male in the original description. It bears the labels: (1) "Port Elizabeth Dr. Martin"; (2) "*Tapesia spumans* var. *Servillei* Bol." (in Bolívar's hand); (3) "Tipo". There is a ♀ paralectotype in Paris].

Figs. E, F.—*Dictyophorus (D.) spumans* var. *pulchra* (Bolívar, 1904), ♂ holotype (Hamburg). [This specimen bears the following labels: (1) "Marianhill Natal E. Heyne vend. 23-V-1900"; (2) "Type Bolivar 1904" (not in Bolívar's hand); (3) "*Tapesia spumans* Th. var. *pulchra* Bol." (in Bolívar's hand, to which has been added by another. "Ign. Bolivar determ. 1904"; (4) "23-VIII-22. Zurück von Y. Sjöstedt ohne Vermerk." The measurements are very slightly different from those given in the original description; length 42.5, pronotum 12.5, tegmen 24, hind femur 20 mm. There is also a ♀ in Madrid labelled: (1) "Port Elizabeth, Dr. Martin"; (2) "Tipo"; (3) "*Dict. spumans pulchra* Bol." (cabinet label above specimen, not on it; in Bolívar's hand). No ♀ was included in the original description so that this is merely an idiotype.

PLATE V:

Tagastini, types:

Figs. A, B.—*Annandalea robinsoni* Bolívar; ♂ holotype (Madrid). [This specimen measures 35 mm. from the apex of the fastigium verticis to the tips of the folded tegmina. Bolívar (1905) erroneously gives this as the body length which is 31 mm. at most, otherwise his measurements are approximately correct. The holotype bears the labels "*A. robinsoni* Bol. (in Bolívar's hand) and "8"; the other data given in the original description are not on the specimen. In Madrid there is also a larger ♂ (labelled "13") and a juvenile female (labelled "505") which appear to have been before Bolívar when he described the species, but they cannot be regarded as types as there is no indication of their existence in his description].

Figs. C-F.—*Annandalea haematoptera* (Haan), ♂ paralectotype (C, D) and ♀ lectotype (E, F) (Leiden). [These specimens both bear modern labels, "*Annandalea haematoptera* C. Willemse Det." and "Type". The female, which has a body length of 35 mm., also carries an older (but not original) label "Muller, Crawang" (= Krawang, Java), but Haan's original labels are no longer extant, although they are on some of his species. The ♀ is designated lectotype as it is the specimen figured by Haan. The ♂ measures 25 mm.].

Figs. G, H.—*Annandalea haematoptera* (Haan), ♂ labelled "*Poecilocera Fruhstorferi* m[ihi] W. Java" *(nomen nudum)* and "13392" by Brunner von Wattenwyl (Vienna). [This specimen, which measures 30.5 mm., was presumably to have been the type of a new species, but was never described. A further ♂ and a ♀ accompany this specimen].

PLATE VI:

Sphenariini, Rubelliina and *Sphenexiina,* types:

Figs. A, B.—*Rubellia nigrosignata* Stål, ♀ lectotype (Stockholm). [The original description indicates that both sexes were before the author. In the Stockholm Museum are 2 ♂♂ and 2 ♀♀ of this series, each bearing the labels "Madag[ascar]" and "Boucard". Of the females, this was selected by Sjöstedt (1932) as [lecto]type and a photograph of the lateral aspect is given by him. This specimen, which is 28 mm. long, also bears the labels "*Rubellia nigrosignata* Stål" and "Typus" (red)].

Figs. C, D.—*Rubellia nigrosignata* Stål, ♂ paralectotype (Stockholm). [This specimen measures 23 mm. and is labelled as indicated under figs. A, B].

Figs. E, F.—*Rubellia nigrosignata* f. *macroptera* Bolívar, 1904, ♀ lectotype (Paris). [This specimen has the following labels: (1) "Madagascar, Forêt Tamala, région de Ranomafana, Anjorojoro, Mars 1901 (Ch. Alluaud)"; (2) "*Rubellia macroptera* Bol. I. Bolivar det. 1903". The tegmina are 17 mm. long as described for the female. This specimen is designated as lectotype since it is the only one bearing Bolívar's own determination label].

Fig. G.—*Rubellia nigrosignata* f. *macroptera* Bolívar, ♂ paralectotype (Paris). [This specimen has the following labels: (1) "Madagascar"; (2) "Envoi Sikora"; (3) "*Rubellia macroptera* Bol." (on a bluish Finot collection label in Finot's handwriting). It forms the basis of Bolívar's description of the male. There are also additional specimens of each sex similarly labelled but, as there is no way of knowing whether Bolívar saw them, they can only be dubiously considered to be paralectotypes].

Figs. H, I.—*Sphenexia fusiformis* Karsch, ♂ holotype (Berlin). [This specimen is somewhat faded through alcohol preservation. It bears the locality label "Usáramo (Dr. Franz Stuhlmann)" and Karsch's determination label. The body length is 32 mm., as in the original description].

PLATE VII:

Atractomorphini - *Occidentosphenina* and *Psednurini* (Addendum), types:

Figs. A, B.—*Occidentosphena ruandensis* (Rehn): ♀ holotype of *Parasphena ruandensis* Rehn (Berlin).

Figs. C, D.—*Occidentosphena ruandensis* (Rehn): ♂ paratype for which measurements are given in the original description (Berlin). [This is one of a series from "Bugoie-Wald, Nordwest Ruanda" and has been labelled "Allotypus"; it is virtually, but not strictly an allotype as it was not so designated originally; other paratypes are in Berlin, Geneva, Philadelphia and London.

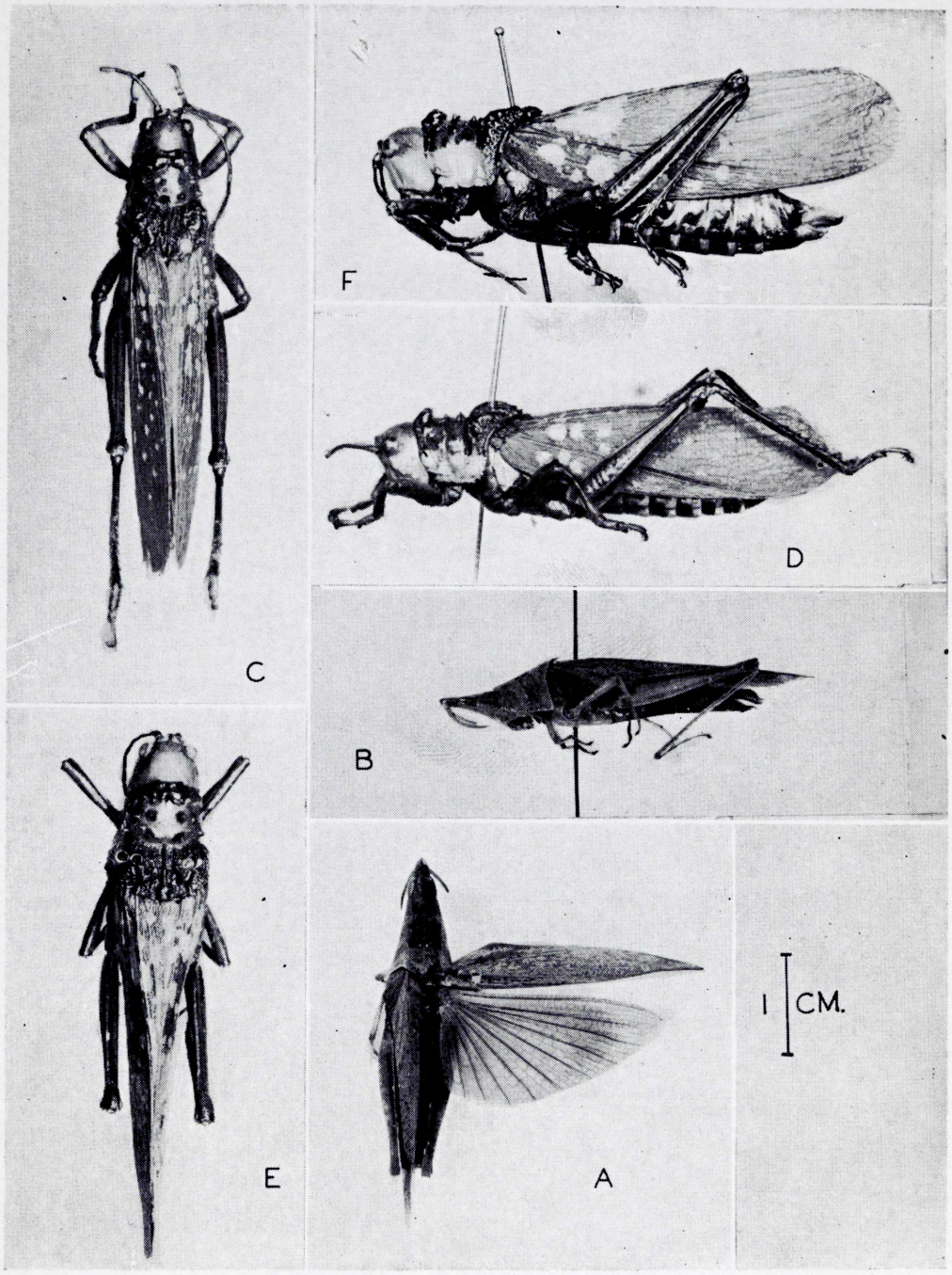
Figs. E, F.—*O. uvarovi* (Rehn): ♀ holotype of *Parasphena uvarovi* Rehn (Berlin). [A similar photograph was published with the description of the species but the present one is included for comparison with the next. This species is less well known than the last; apart from the type series and the two females mentioned below, we know only of two others: Cameroun, J. Carayon (no further data) 1 ♀ (Lyman Museum); Cameroun (Littoral) Reg. de Kribi, 1925, Dr. Gromier, 1 ♀ (Paris)].

Figs. G, H.—*O. uvarovi* (Rehn): ♀ holotype of *Parasphena granulata* Chopard (Paris) [This bears the following labels: (1) "Mts. Bambonoto, 2000 m. julliet 1939"; (2) "Museum Paris, P. Lepesme, R. Paulian, A. Villiers, Cameroun, 1939"; (3) "*Parasphena granulata* Chop. Type"; (4) "Type" (red); (5) "*Parasphena uvarovi* Rehn, L. Chopard det.". The single ♀ paratype is also in Paris].

Figs. I, J.—*Psednura pedestris* (Erichson): ♂ lectotype of *Mesops pedestris* Erichson (Berlin). [This specimen, which measures 32.5 mm. in length, bears the following labels: (1) "Terra v. Diem., Schayer"; (2) "*pedestris* Er., Vandiem[ensland], Schayer Orth.-Kat.-Nr.: 2127"; (3) "*Psednura pedestris* (Erichs), Ramme det."; (4) "*Psednura pedestris* (Erichs), K. H. L. Key, 1958 det.: Lectotype of *Mesops pedestris* Erichson, 1842, selected by K. H. L. Key, 1958"].

Figs. K, L.—*P. pedestris* (Erichson): ♀ paralectotype of *Mesops pedestris* (Berlin). [This specimen, which measures 51.0 mm., bears the following labels: (1), (2), as in lectotype (above); (3) "Genus *Moraba,* Yngve Sjöstedt"; (4) "*Psednura pedestris* (Erichs.) det. K. H. L. Key"; it is also labelled, erroneously, as the allotype. There are, in Berlín, three other ♀ ♀ syntypes (paralectotypes), from the same locality].

[Photos A-D, I-L, courtesy Dr. K. K. Günther, Berlin. It is regretted that for technical reasons it was not possible to present figs. A and B to the same scale as the others].



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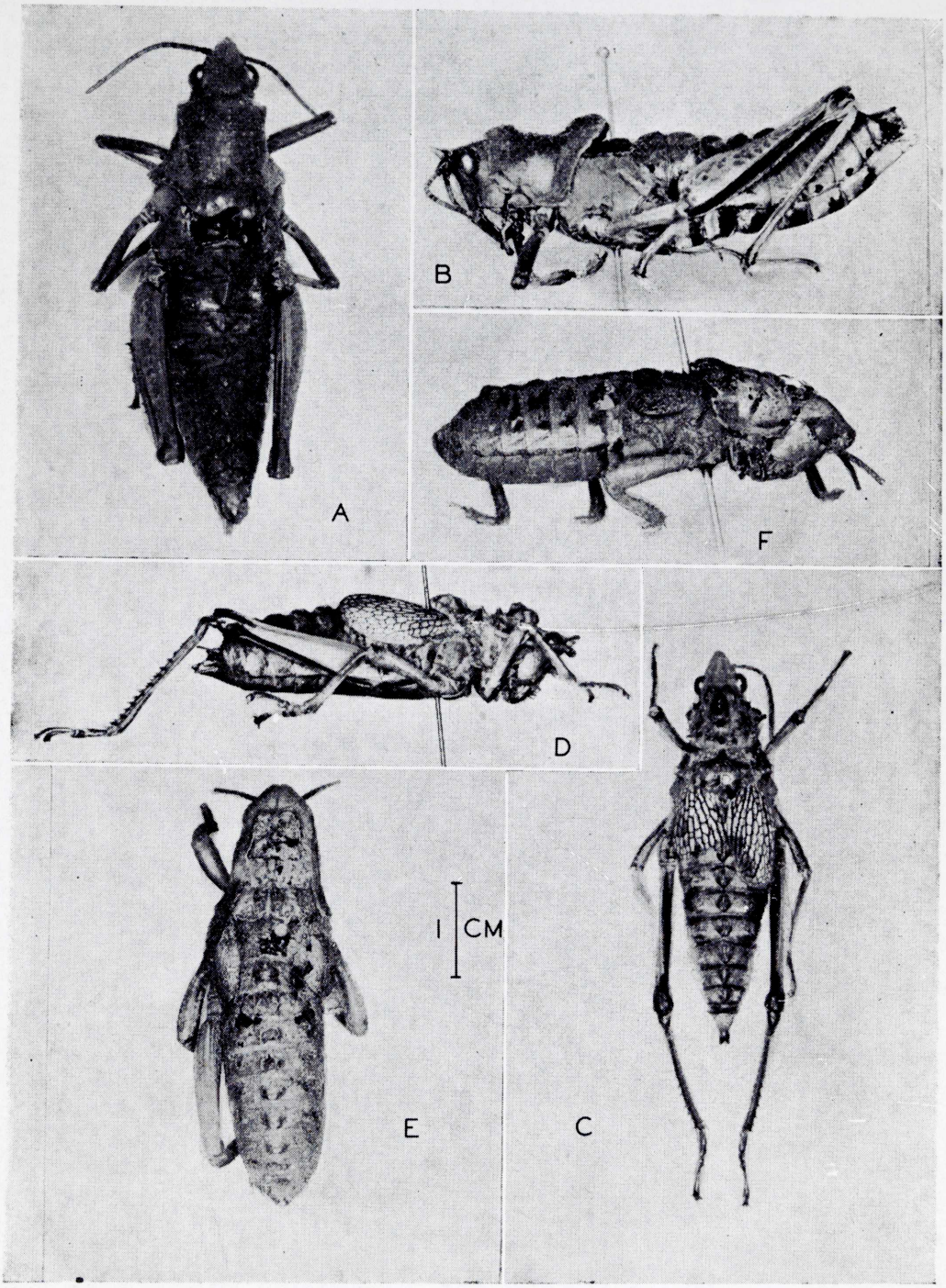

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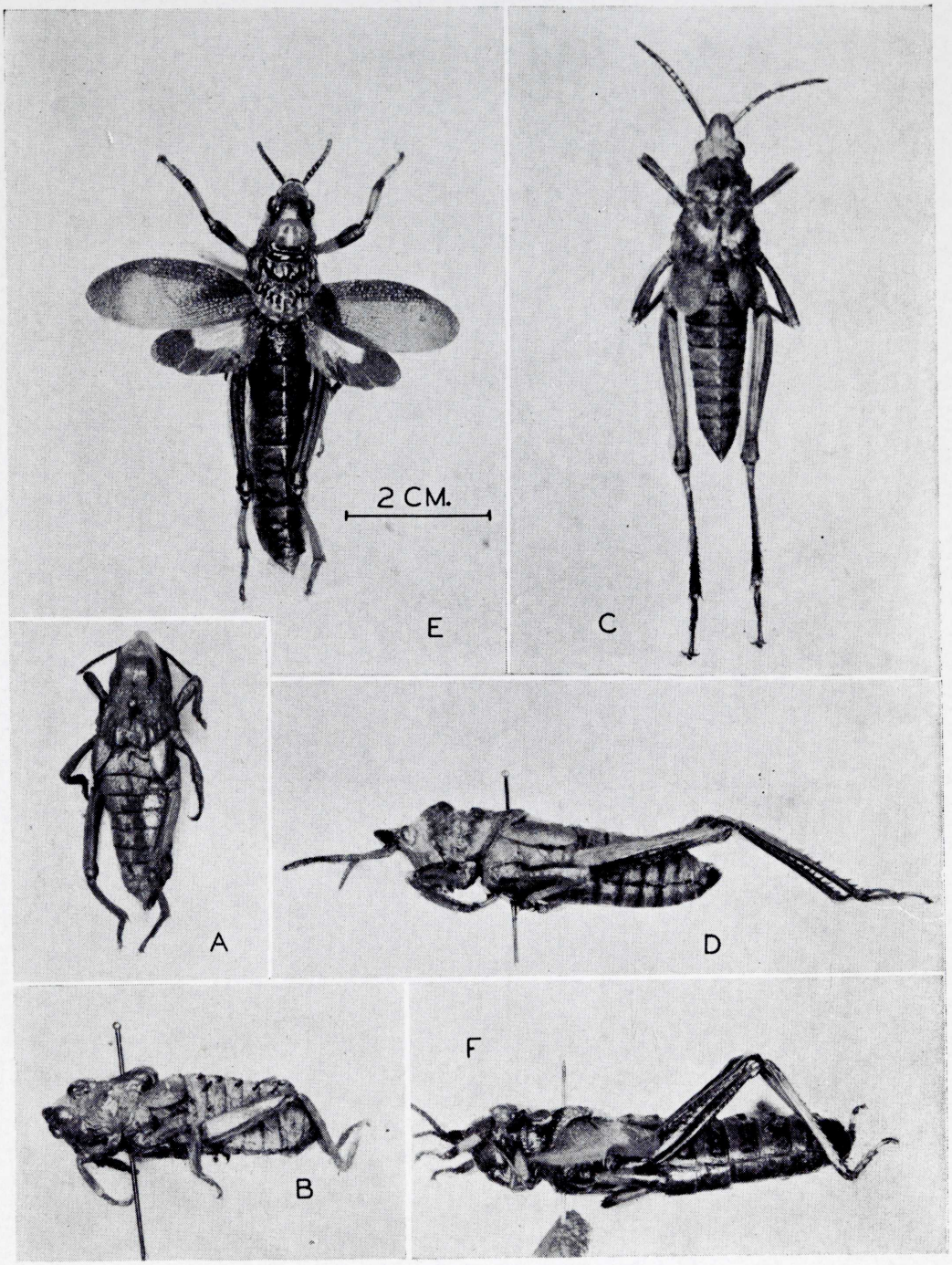

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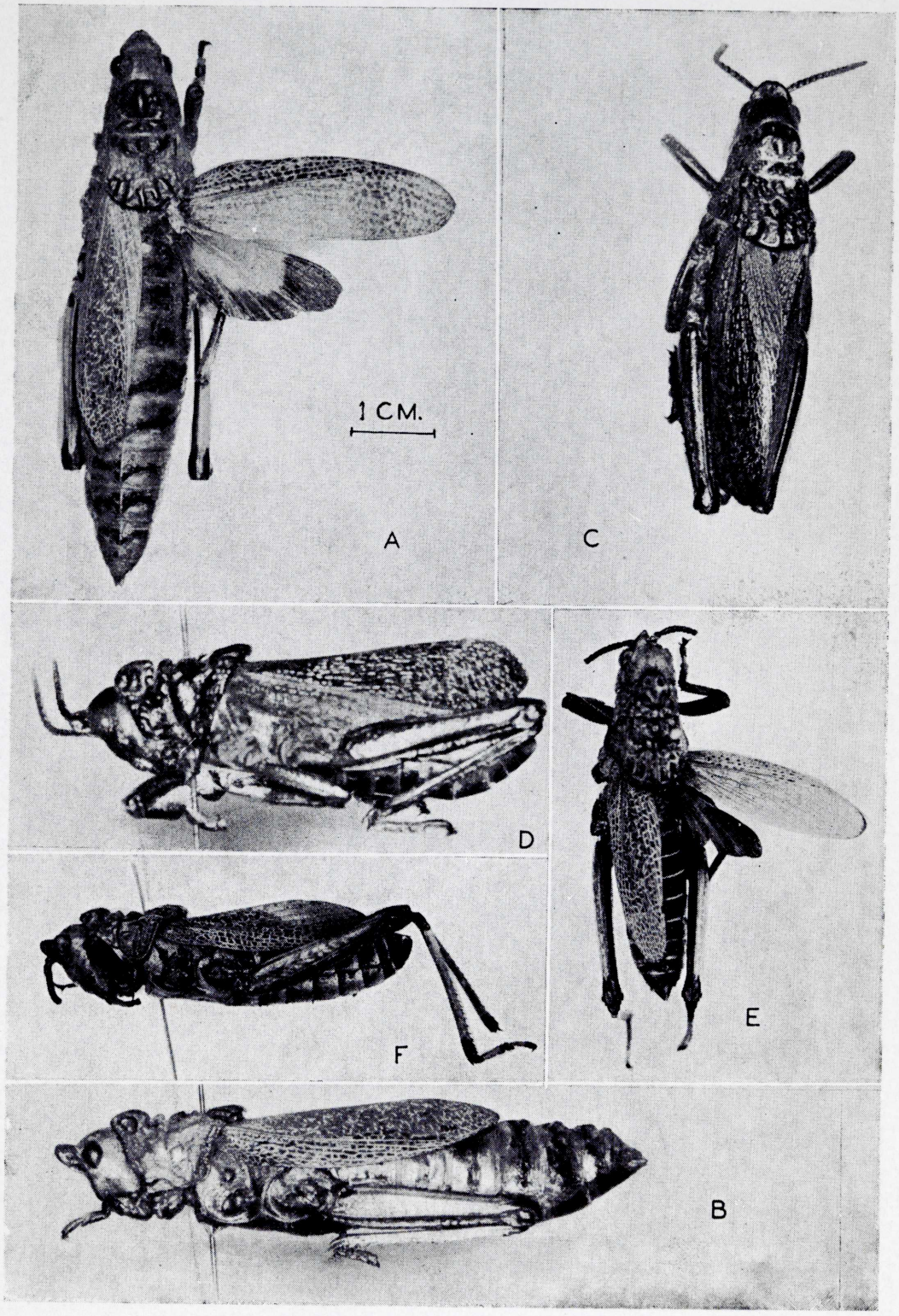

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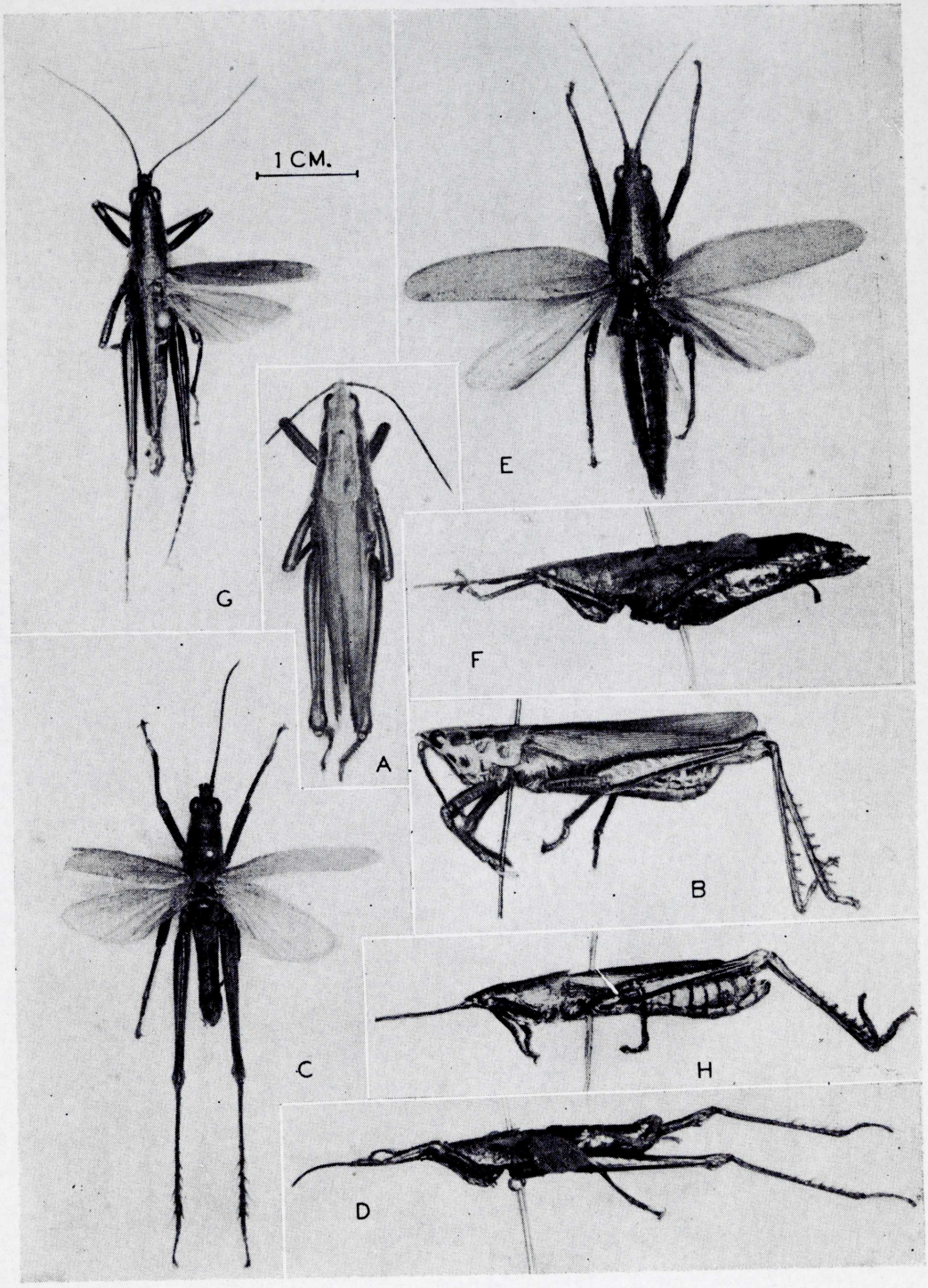

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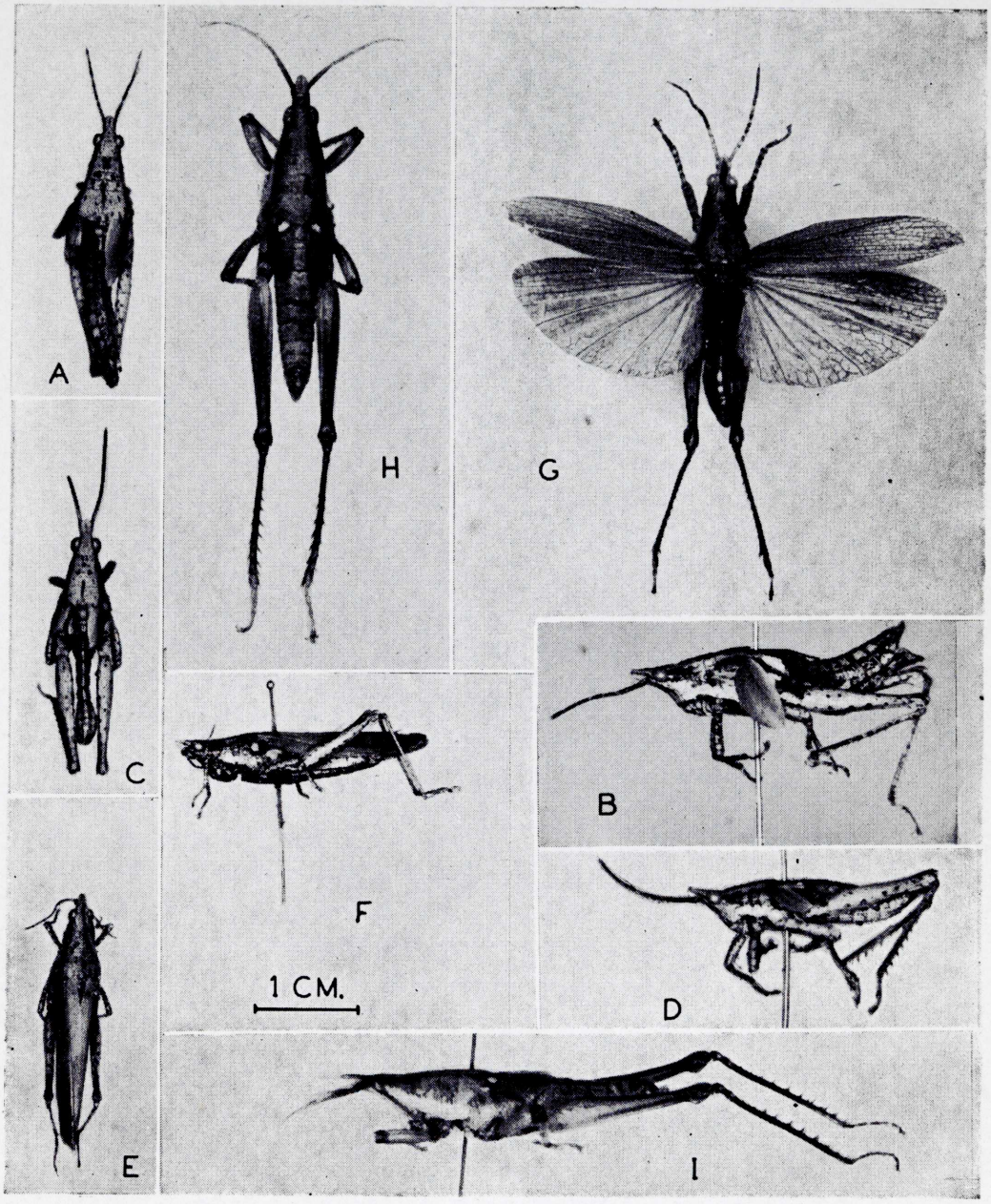

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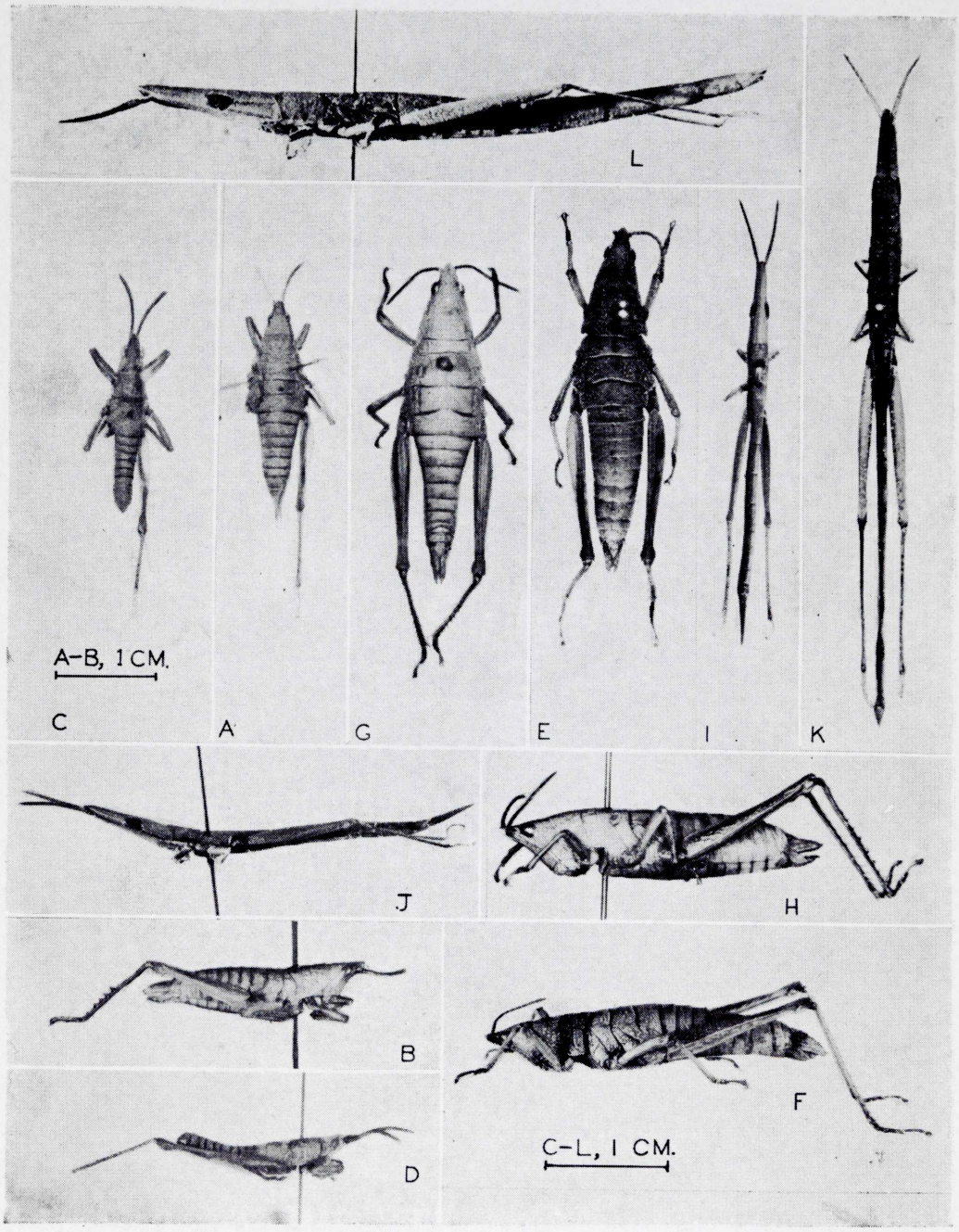

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