

A World Classification of
the Harmacloninae,
a New Subfamily of Tineidae
(Lepidoptera: Tineoidea)

DONALD R. DAVIS

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ABSTRACT

Davis, Donald R. A World Classification of the Harmacloninae, a New Subfamily of Tineidae (Lepidoptera: Tineoidea). *Smithsonian Contributions to Zoology*, number 597, 81 pages, 346 figures, 8 maps, 1 table, 1998.—The systematics, phylogeny, morphology, and distribution are summarized for the newly proposed subfamily Harmacloninae. Synapomorphies distinguishing this subfamily from the sister group, Myrmecozelinae, include (1) unique wing coupling system consisting of raised scales along the ventral hindmargin of the forewing interlocking into similar scales along the dorsal subcostal area of the hindwing; (2) pretarsus without arolium and pseudempodial seta; (3) the presence of paired abdominal tympanic organs; (4) enlargement of the sternal apophyses on the second abdominal sternum; and (5) aedoeagus with a basal, midventral keel. Cladistic analysis of the 22 species, using the genus *Gerontha* of the Myrmecozelinae as an outgroup, resulted in the recognition of two monophyletic genera: *Micrerethista*, with 10 of the 11 recognized species concentrated in the Oriental/Australian regions and a single species from equatorial Africa, and *Harmaclona*, consisting of 11 pantropical species. The following taxa are described as new: *Micrerethista africana*, *M. bifida*, *M. denticulata*, *M. dissacca*, *M. fasciola*, *M. fusca*, *M. nigrapex*, *M. resima*, *Harmaclona afrotaphrantha*, *H. hexacantha*, *H. robinsoni*, *H. tetracantha*, and *H. triacantha*. Distribution maps and keys are provided for all species. Diagnostic characters of all taxa are fully illustrated by line drawings and photographs.

The vicariant distributions of certain Harmacloninae suggest a minimum age of more than 90 m.y. for the subfamily. If tympanic organs in Harmacloninae evolved primarily as a defense against insectivorous, echolocating bats, as has been proposed for other Lepidoptera, then this would indicate that echolocating bats must have appeared earlier than the Harmacloninae—at least by the beginning of the late Cretaceous.

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A World Classification of the Harmacloninae, a New Subfamily of Tineidae (Lepidoptera: Tineoidea)

Donald R. Davis

Introduction

Recent studies on the families Arrhenophanidae and Tineidae have necessitated a thorough review of the somewhat aberrant tineid genus *Harmaclona*. Originally described in the Tineidae (Busck, 1914), the genus was transferred by Fletcher (1929), for reasons unstated, to Arrhenophanidae. In the same reference, Fletcher retained *Ptychoxena* (later synonymized by Bradley under *Harmaclona*) in Tineidae. The first serious studies of *Harmaclona* were undertaken by Bradley (1953a,b, 1956). Bradley's decision to include *Harmaclona* in Arrhenophanidae was based upon the presence of a membranous invaginated pocket, or apotheca as Bradley (1951) termed it, in the male genitalia of both groups. Davis (1984:59, note 11), with some reservation, followed Bradley's decision but indicated that more study was needed. Later, in an abstract of a talk presented at the XVIII International Congress of Entomology, Davis (1988) proposed Harmaclonidae as a new family name for the complex. This name is unavailable, however, because no description accompanied it. Diakonoff (1968) retained *Harmaclona* in Tineidae as did Nielsen and Common (in CSIRO, 1991) and Robinson and Nielsen (1993) in their treatment of the Australian fauna. The latter two reviews also

illustrated for the first time the principal synapomorphy for the subfamily, the abdominal tympanic organs. The Harmacloninae are the only group within the Microlepidoptera (sensu Sharplin, 1964) known to possess auditory organs. As a result of the current world study, I recognize two genera and 22 species, including 13 previously undescribed species, within the Harmacloninae.

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ANIC	Australian National Insect Collection, CSIRO, Canberra, Australia.
BMNH	The Natural History Museum (formerly the British Museum (Natural History)), London, England.
BPBM	Bernice P. Bishop Museum, Honolulu, Hawaii, USA.
CNC	The Canadian National Collections, Biosystematic Research Institute, Agriculture Canada, Ottawa, Canada.
CU	Cornell University, Ithaca, New York, USA.
INBIO	Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica.
MNHP	Muséum National d'Histoire Naturelle, Paris, France.
RNHL	Nationaal Natuurhistorisch Museum, (formerly Rijksmuseum van Natuurlijke Historie), Leiden, Netherlands.
SMC	Collection of Sigeru Moriuti, Sakai, Osaka, Japan.
TMP	Transvaal Museum, Pretoria, South Africa.
UCB	Essig Museum of Entomology, University of California, Berkeley, California, USA.
UCVM	Instituto de Zoología Agrícola Facultad de Agronomía, Universidad Central de Venezuela, Maracay-Aragua, Venezuela.
UOP	University of Osaka Prefecture, Osaka, Japan.
USNM	Collections of the former United States National Museum, now deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.
VOB	Collection of Vitor O. Becker, Planatina, D.F., Brazil.

Biology

DISTRIBUTION

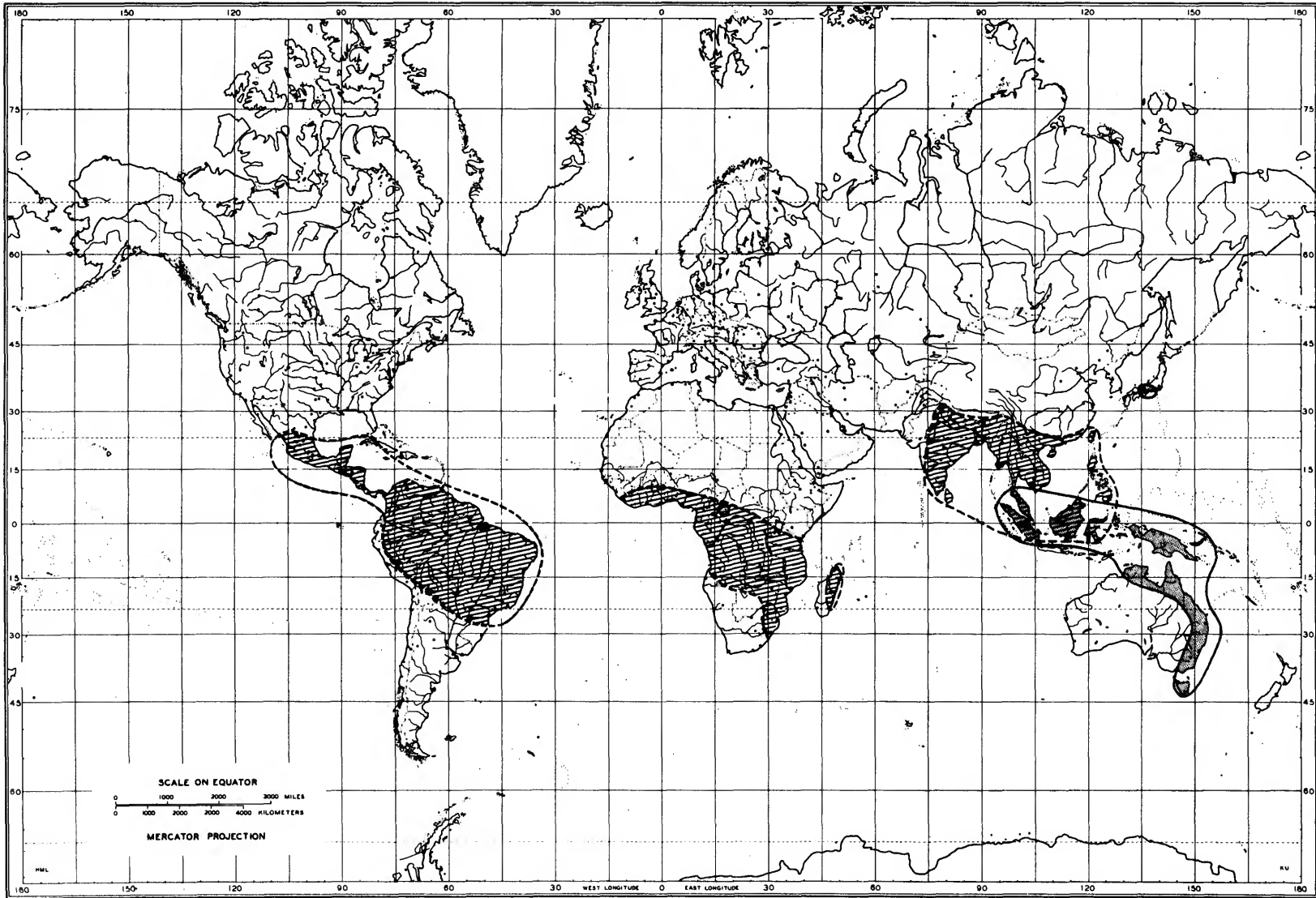
The Harmacloninae is predominantly a pantropical group, largely restricted to moist forests between latitudes 35°N and 45°S (Map 1) and occurring from sea level to over 2500 m (New Guinea). Of the two recognized genera, the genus *Harmaclona* has the broader distribution, with representatives in most major tropical/subtropical regions (Figures 1, 2) around the world. The genus is conspicuously absent from the Australian region, although two species occur widely through southern Asia from northern India south to Sri Lanka and east to Sulawesi and the Philippines with their eastern limits closely agreeing with Weber's line (Maps 1, 6) and Wallace's 1910 line (George, 1981). *Harmaclona* also ranges over most of the Neotropical region (Map 8), but it appears to be largely absent from the West Indies, except for one species (*H. cossidella*) recently collected in Cuba. Extensive collecting

over the last few decades in the moist forests of the Dominican Republic and Dominica has failed to turn up any *Harmaclona*. Five species of *Harmaclona* are known from the Ethiopian region from equatorial Africa south to Natal and Madagascar (Map 7). Two sister species, *H. berberea* and *H. malgassica*, are restricted to Madagascar. *Harmaclona natalensis* ranges widely through subsaharan Africa and also occurs in Madagascar. Its sister species is believed to be the more equatorially distributed *H. hilethera*. Although appearing depauperate from the scant data presented, the rain forests of equatorial Africa undoubtedly harbor more species that future collecting should reveal.

Prior to this study, no member of the resurrected genus *Micrerethista* was known to occur beyond the southern Oriental/Australian regions. A single species (*M. africana*) is reported herein from the Central African Republic. As one indication of how little that general area of Africa has been surveyed, a series of five specimens from La Maboké was found to represent three species of Harmacloninae, including *H. hilethera*, *H. afrotephrantha*, and the *Micrerethista* referred to above.

Micrerethista denticulata is the most widespread species of the genus in southern Asia, ranging from Thailand through Indonesia to southern Japan but absent from New Guinea (Map 3). The Papuan fauna consists of two unrelated species (*M. mochlacma* and *M. eustena*), each with its nearest sister species endemic to Australia (Map 4). *Micrerethista mochlacma* may also range as far west as Sumatra. In contrast to most insect groups (Taylor, 1972), the Torres Strait may have been an effective barrier for *Micrerethista*, although collecting records from the York Peninsula and southern New Guinea are inadequate at present. Four species of *Micrerethista* occur in Australia: three (*M. fasciola*, *M. fusca*, and *M. entripta*) are mostly confined to the wetter, more northeastern and tropical/subtropical Torresian Province (Spencer, 1896; Mackerras, 1970), and one (*M. nigrapex*) is largely restricted to the more temperate Bassian Province of southern Australia and Tasmania. *Micrerethista fasciola* and *M. fusca* belong to the same sister group as the Papuan *M. mochlacma*. *Micrerethista entripta* and *M. nigrapex* comprise another species group most allied to *M. eustena*. The latter group also includes at least one outlier member west of Wallacea, *M. species*, from Borneo. Three other, poorly documented species (*M. bifida*, *M. dissacca*, and *M. resima*) also occur west of Wallacea.

Our current knowledge of continental plate tectonics provides a time scale to which harmaclonine distributions may be referred. The present pantropical distribution of Harmacloninae infers a Gondwanian origin for the group. Phylogenetical analysis (Figure 91) suggests that ancestral Harmacloninae originated somewhere in eastern Gondwanaland and gradually spread westward. This is especially apparent for *Micrerethista*, with all known representatives except one (*M. africana*) largely occurring from southern Asia to Australia. *Harmaclona* may have appeared later and further westward, as suggested by their



MAP 1.—World distribution of *Hamaclona* (lined area enclosed by dashes) and *Micrerethista* (shaded area enclosed by solid line).



FIGURES 1, 2.—1, Rio Baria and environs of basecamp (see arrow), 140 m elev., Cerro de la Neblina, Territory of Amazonas, Venezuela; 2, clearing and UV light-trap site near Cerro de la Neblina basecamp. *Harmaclona cossidella* and *H. triacantha* were common here, perhaps attracted to a large accumulation of freshly cut trees.

present-day distribution west of Weber's line (Maps 1, 6). Because the breakup of eastern Gondwanaland is believed to have begun from approximately 125 m.y.a. with the separation of India from Antarctica + Australia (Powell et al., 1981) to 90 m.y.a. with the separation of Africa + India (Afroindia) (McKenna, 1973; Rosen, 1974), the minimum time frame for the origin of Harmacloninae should be prior to the latter period, or sometime between the Early and Late Cretaceous.

LIFE HISTORY

Little is known concerning the life history of this group of moths. Only a single rearing has been made of *H. tephrantha*

from a log of *Buchanania latifolia* Rozb. (Anacardiaceae; Fletcher, 1933). Larvae were found by C. Beeson at Dehra Dun, India, in association with a lymexylonid beetle, *Atratocerus*. Fletcher quotes Beeson as reporting the larval tunnels to be several inches long, black stained, and free of wood-dust. Prior to pupation the larva closes the tunnel with a thin operculum.

Considering their wood-boring habits, one can expect the larval feeding period to be rather lengthy for Harmacloninae as is generally true for other wood-boring moths. Another obvious and bothersome attribute of this habit is for the bodies of the adults to become greasy in most museum specimens as fat stored in the abdomen liquefies. In order to observe the wing pattern in greasy specimens, I have submerged the entire

pinned specimen in acetone for approximately 15 minutes, followed by simple air drying.

Adults are nocturnal and phototropic with a majority of the species apparently flying throughout the year in tropical areas. In more temperate parts of a species' range, the flight period tends to be seasonal. Robinson (in Robinson and Nielsen, 1993) has observed females ovipositing between the cork and glass in a collecting vial, with the eggs being covered by hairs from the female's corethrogyne. I have noted light-trap collected females of *H. cossidella* to extrude long tufts of tangled, nearly continuous corethrogyne hairs prior to death (Figures 121–123). Ultrastructural details of these hairs display a somewhat typical, although reduced, scale structure that differs from adjacent hair tufts comprising the corethrogyne (Figures 114–120) in being straight and not twisted and much greater in length. The precise origin and means for producing these tufts are unknown.

Phylogeny

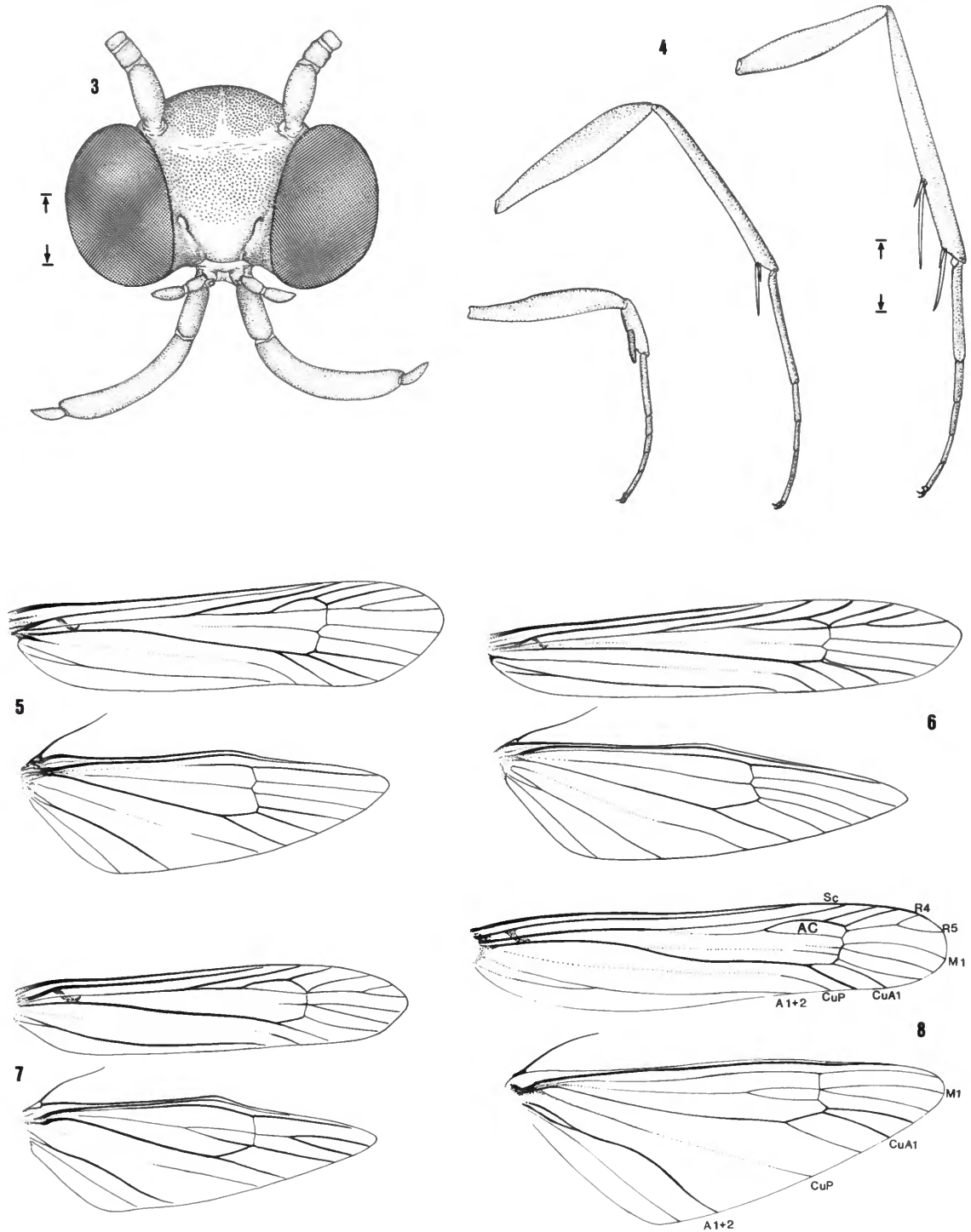
In the most recently published review of the subject to date, Robinson (in Robinson and Nielsen, 1993) recognized 11 subfamilies within the questionably monophyletic family Tineidae. Nine were believed to be monophyletic, and the remaining two, Meessiinae and Myrmecozelinae, were not defined by any known synapomorphies. The Myrmecozelinae, in particular, were believed to be polyphyletic; they may, however, contain a major monophyletic unit typified by *Myrmecozela* (type species: *ochraceella* Tengström) on the basis of certain shared male genital characters. *Harmaclona* most recently was grouped with the Myrmecozelinae (Robinson and Nielsen, 1993), more or less by default, because several characters excluded it from the other more well-defined subfamilies. Partially because I agree with Robinson regarding the polyphyly of the Myrmecozelinae, I believe it prudent and more informative to recognize *Harmaclona* along with its resurrected sister genus, *Micrerehista*, as a separate subfamily, defined by the following synapomorphies.

1. *Unique Forewing/Hindwing Secondary Coupling System*: Bradley (1953a) first described this very effective wing coupling system in *Harmaclona*. Coupling is accomplished by a single row of rigid, curved scales (Figures 84–87) that arise ventrally along the hind margin of the forewing and intermesh with scattered rows of more slender, rigid scales (Figures 88–90) that arise from the dorsal surface of the hindwing subcostal vein. The efficiency of this system becomes immediately apparent to anyone who attempts to set or spread the wings of a member of this group. A standard feature of these and other coupling scales (Davis, 1989) is the presence of nonarticulated (fused) longitudinal ridges that lack the overlapping scutes typical of most, more flexible Lepidoptera scales (Figure 83). Different scale coupling systems have evolved on the wings of other Tineidae (e.g., on the ventral surface of the forewing of *Pyloetis mimosae* (Stainton), but none are homologous with the harmaclonine type.

2. *Loss of Pretarsal Arolium and Pseudempodial Seta*: The associated loss of both the arolium and pseudempodial seta has been seldom reported in Lepidoptera. The loss of these structures in Harmacloninae may constitute an autapomorphy within Tineidae, although most tineid genera have not been thoroughly studied. Representative genera examined during this study in eight major tineid subfamilies (i.e., Meessiinae, Scardiinae, Nemapogoninae, Tineinae, Myrmecozelinae (Figures 49–57), Erechthiinae, Heiroxestinae, and Setomorphinae) revealed no loss of these structures. Within Setomorphinae, the arolium was found to vary from well-developed to reduced (in *Setomorpha*). Loss of one or both of these structures in moths has been noted in some Hepialidae (Nielsen and Robinson, 1983), some Cossidae (P. Gentili-Poole, pers. comm., 1995), and in Epipyropidae (Davis, unpubl.). In Cossidae (Hypoptinae) the development of the arolium is independent of the pseudempodial seta, with the latter persisting (although sometimes in a reduced state) following a loss of the arolium (Gentili-Poole, pers. comm., 1995). Reduction of the arolium has been reported only on the hindlegs of one other tineoid genus, *Ptilopsaltis* (Acrolophidae) (Davis et al., 1986). The loss or reduction of these pretarsal structures is probably associated with some specialization of the insects' life history: possibly as adaptations for better adherence to a rough surface (e.g., on tree bark) or to cling better to a mammalian phoretic host, as in the case of *Ptilopsaltis*.

3. *Abdominal Tympanic Organs*: Auditory organs have evolved in only about 15 of the 119 families of Lepidoptera (Cook and Scoble, 1992). Most of the families capable of hearing constitute the most speciose and successful lineages of the order. Until the discovery of abdominal tympanic organs in Harmacloninae (Maes, 1985; Davis and Heppner, 1987; Nielsen and Common in CSIRO, 1991; Robinson and Nielsen, 1993), such structures were believed to be absent among the Microlepidoptera. The alleged "prototympal organs" described by Clench (1957, 1959) in the cossid genera *Chilecomadia*, *Rhizocossus*, and *Pseudocossus*, have not been verified by later workers (Minet, 1983, 1991; Schoorl, 1990). The males of the oecophorid *Antaeotricha aequabilis* (Meyrick) possess paired, swollen cavities on the second abdominal sternum. These contain no tympanum, however, and are packed instead with long, pilliform scales. Most likely these organs provide an olfactory function, possibly as pheromone dispensers.

The function and morphology of auditory organs have been reviewed by numerous authors, including Bourgeois (1951), Cook and Scoble (1992), Forbes (1916), Hoy and Robert (1996), Kennel and Eggers (1933), Kiriakoff, (1963), Maes (1985), Minet (1983, 1985), Richards (1933), Scoble (1992), Sick (1935), Spangler (1988), and Treat (1963). In adult Lepidoptera the most common auditory organs (i.e., tympanic) are always paired, rarely dimorphic, and usually situated in a cavity within the base of a wing vein, on either side of the metathorax, or at the base of the abdomen. The basic structure



FIGURES 3-8.—Adult morphology. 3, head (0.5 mm). 4, legs (1 mm). 5-8, wing venation: 5, *Micrereithista mochlacma*; 6, *Micrereithista eustena*; 7, *Harnaclona hilethera*; 8, *Harnaclona cossidella* (AC = accessory cell). (Scale lengths in parentheses.)

of a tympanic organ consists of a thin, usually transparent membrane (tympanum) stretched across a cavity that is closely associated with one or more enlarged tracheal air chambers. Attached to the inner surface of the tympanum is a cord-like chordotonal stretch receptor, or scoloparium, that transmits sound vibrations of the membrane via an auditory nerve to the central nervous system. Depending upon the family, each chordotonal organ is composed of either 1, 2, or 4 sensory cells, or scolopidia (Surlykke, 1984; Scoble, 1992).

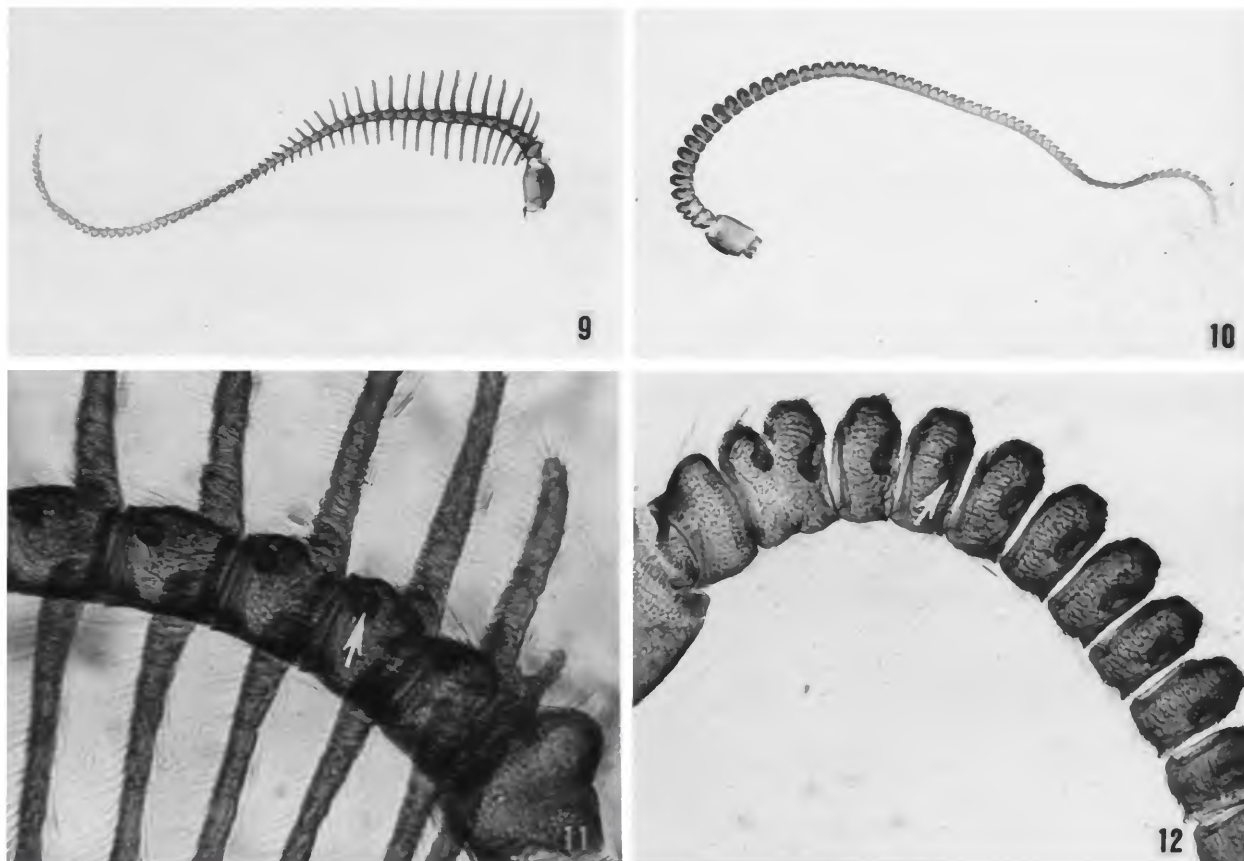
Tympanic organs may have developed in conjunction with certain pre-existing chordotonal organs that normally occur over an insect's body at key peripheral sites (Hoy and Robert, 1996). Kristensen (1984) has proposed that the ventral chordotonal organs present in the second abdominal segment of *Micropterix calthella* (L.) could be the precursor of the tympanal organs of those moth families that possess basal abdominal tympanic organs. It is believed that auditory organs originally evolved as a defensive mechanism against echolocating insectivorous bats (Spangler, 1988). Acoustic communication later became possible within a few groups with the development of sound producing structures. Diverse acoustical systems involving sound production have developed in several genera of Pyraloidea, Arctiidae, and Noctuidae (Gwynne and Edwards, 1986; Surlykke and Gogala, 1986; Spangler, 1988). Evidence for the use of tympanic organs in sexual communication has been established for certain noctuid and pyraloid species. In most species known to communicate, sound producing organs typically occur only on the males (Spangler, 1988), but in some Arctiidae both sexes are known to emit sounds (Sanderford and Conner, 1990, 1995). Female *Pyrrharctia isabella* (J.E. Smith) has been found to respond acoustically to male courtship pheromone (Krasnoff and Yager, 1988). In Arctiidae ultrasonic clicks are produced by pulsating striated tymbal organs on the thoracic metepisterna (Frazer and Rothschild, 1960; Blest et al., 1963). These clicks may protect the moths in three defensive ways: as deimatic sounds that startle attacking bats; by interfering with the bats' abilities to process echo information; and/or as aposematic sounds that warn bats of unpalatable prey (Dunning and Krüger, 1995).

The presence of tympanic organs in Harnacloninae marks the earliest known appearance of these structures in Lepidoptera. Why these organs should have developed only in this one small clade of a moderately large, archaic family among all of the approximately 65 extant families of Microlepidoptera is a mystery. They appear to serve a defensive function because no stridulatory (i.e., sound producing) structures have been observed. However, no species of Harnacloninae has been studied for possible sound production. If acoustical communication eventually is found to occur in harnaclonine moths, especially in association with a lack of response to bat signals, then this would constitute strong evidence against defensive benefits as being the primary selective pressure in the evolution of tympanic organs within Lepidoptera. Conversely, if harnaclonine auditory organs evolved as a defense against insectivorous bats as currently believed, then this would

indicate a comparable early origin for bats with echolocating capabilities. The fossil record of bats is among the poorest of all mammals (Yalden and Morris, 1975). The earliest fossil record, *Icaronycteris index* Jepson from the early Eocene (ca. 55 m.y.a.) Green River Formation of southwest Wyoming, represents a rather typical bat that probably possessed an echolocating ability (Jepson, 1966, 1970; Richarz and Limbrunner, 1993). The overwhelmingly dominant moth groups with tympanic organs generally exhibit more recent fossil histories, from the middle Eocene to early Oligocene (Labandeira, 1994). The earliest Pyraloidea are known from the Priabonian (35.4 m.y.a.; Jarzembowski, 1980); Geometroidea from the Lutetian (42.1 m.y.a.; Jarzembowski, 1980; Lewis, 1992; Wehr, in press); and the Noctuidae from the Rupelian (29.3 m.y.a.; Covell, 1991; Dmitriev and Zherikhin, 1988; Whalley, 1986; Wehr, in press). A questionable noctuid egg has also been reported from Late Cretaceous lagoonal sediments (ca. 75 m.y.a.) of Massachusetts, USA (Gall and Tiffney, 1983). Although no fossil record of the Harnacloninae is known, biogeographical evidence indicates that they were present in Gondwanaland before 90 m.y.a. As discussed previously under the section on "Distribution," this time period is suggested by the vicariant distributions of certain old world taxa, the genus *Micrerethista* in particular. It may be possible, therefore, that echolocating insectivorous bats had evolved as early as the Cenomanian, near the beginning of the Late Cretaceous.

As pointed out by Cook and Scoble (1992), tympanic anatomy has been separately described in several languages. Maes (1985) sought to standardize most terms using Latin descriptors. His terminology was largely followed by Cook and Scoble, and I will do likewise.

The tympanic organs of Harnacloninae are located at the base of the abdomen on the anterior half of the second sternum, in a position similar to those of Pyraloidea. They are equally well-developed in both sexes of all the known species. The general structure of the organs appears relatively simple, consisting of a pair of ventral tympana (Figures 100–102) without bulla tympani or firm-walled internal chambers. The tympana lie essentially open, only slightly covered along the anteromedial margins by a narrow, slightly raised rim of the fornix tympani (Figure 101). The tympanic membrane is extremely thin, transparent, and smooth, except for a minute midlateral ridge leading to a knob-like spinula (Figures 102–106) that marks the internal attachment of the scoloparium. The tympana are elliptical in outline and extend approximately half the length of the second sternite in both sexes. Immediately lateral to the tympana, the cuticle (conjunctiva) is folded into a series of minute wrinkles (Figures 101, 103). A shallow, external cavity is formed immediately anteroventral to the tympana by the concavity of the adjacent metacoxae. The inner surface of the metacoxal cavity is finely granulated and is partially covered with a smooth layer of slender scales. The abdomen is connected firmly to the thorax



FIGURES 9-12.—Antennal morphology. *Harmaclona cossidella*: 9, male; 10, female; 11, enlargement of Figure 9, showing spherical sensory cavities on flagellomeres 1-5 (see arrow); 12, enlargement of Figure 10, showing sensory cavities on flagellomeres 1-9 (see arrow).

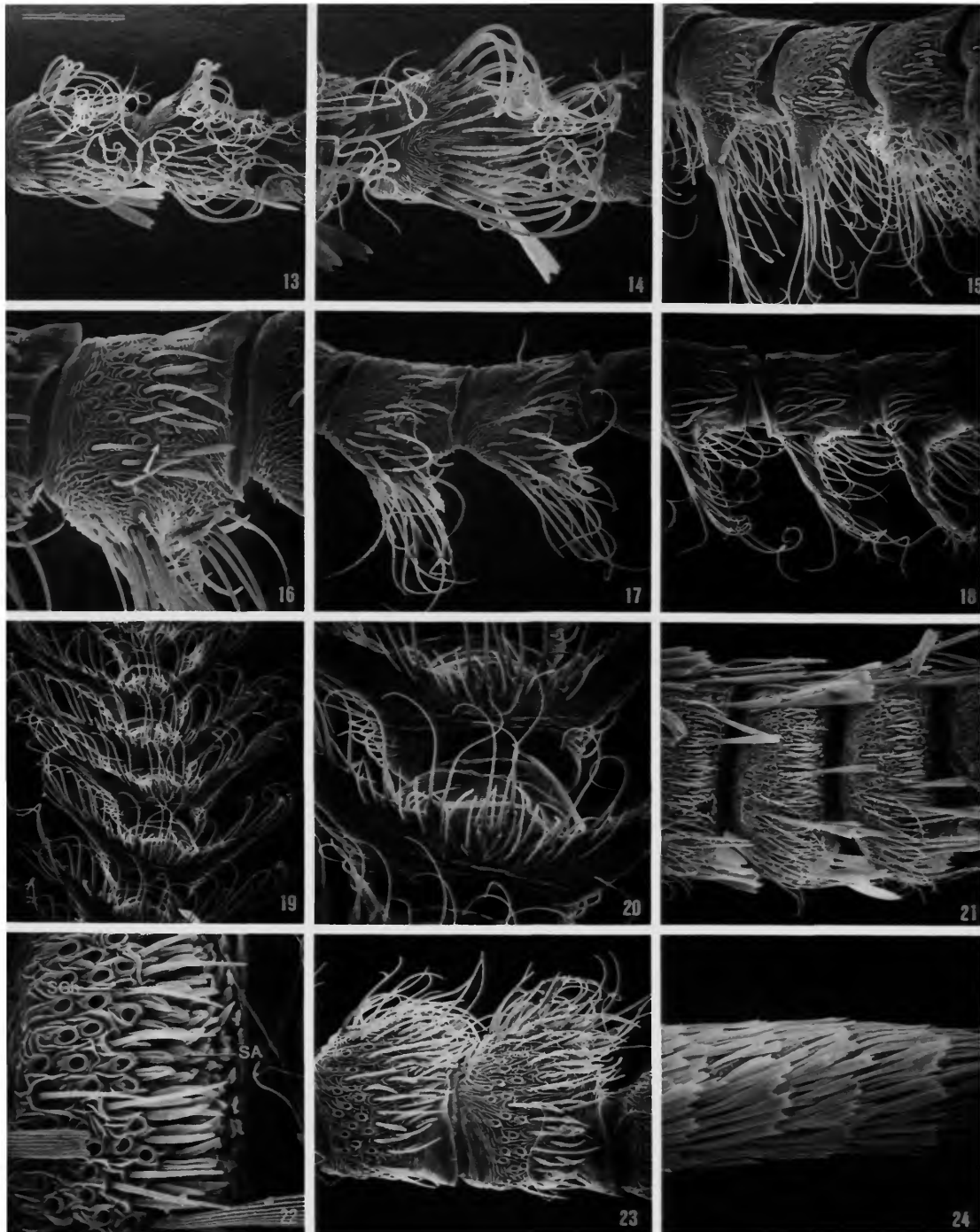
ventrally by a stout, median praecinctorium (Figure 100) extending from the metafurcal stem to the pons tympani of 2S. As a result, attempts to remove the abdomen for genitalic dissection often result in a break between the meso- and metathorax. A cursory examination of dried as well as cleared specimens revealed no evidence of firm-walled internal cavities or remnants of scoloparia attached to the tympanic spinula. Only a single specimen preserved in alcohol was available for study of internal tissues. Dissection of the abdomen revealed a single air chamber, lined with membrane, beneath the tympanic membrane. A broad, thin band of tissue, perhaps containing the scoloparium, was attached to the inner wall of the tympanic membrane in the area of the spinula (Figure 107).

4. *Enlargement of Sternal Apophyses*: The slender apophyses projecting anteriorly from abdominal sternum II constitute an important synapomorphy linking the Tineoidea, Gracillarioidea, Yponomeutoidea, and Gelechioidea (Brock, 1967; Kyrki, 1983; Minet, 1991). The highly modified,

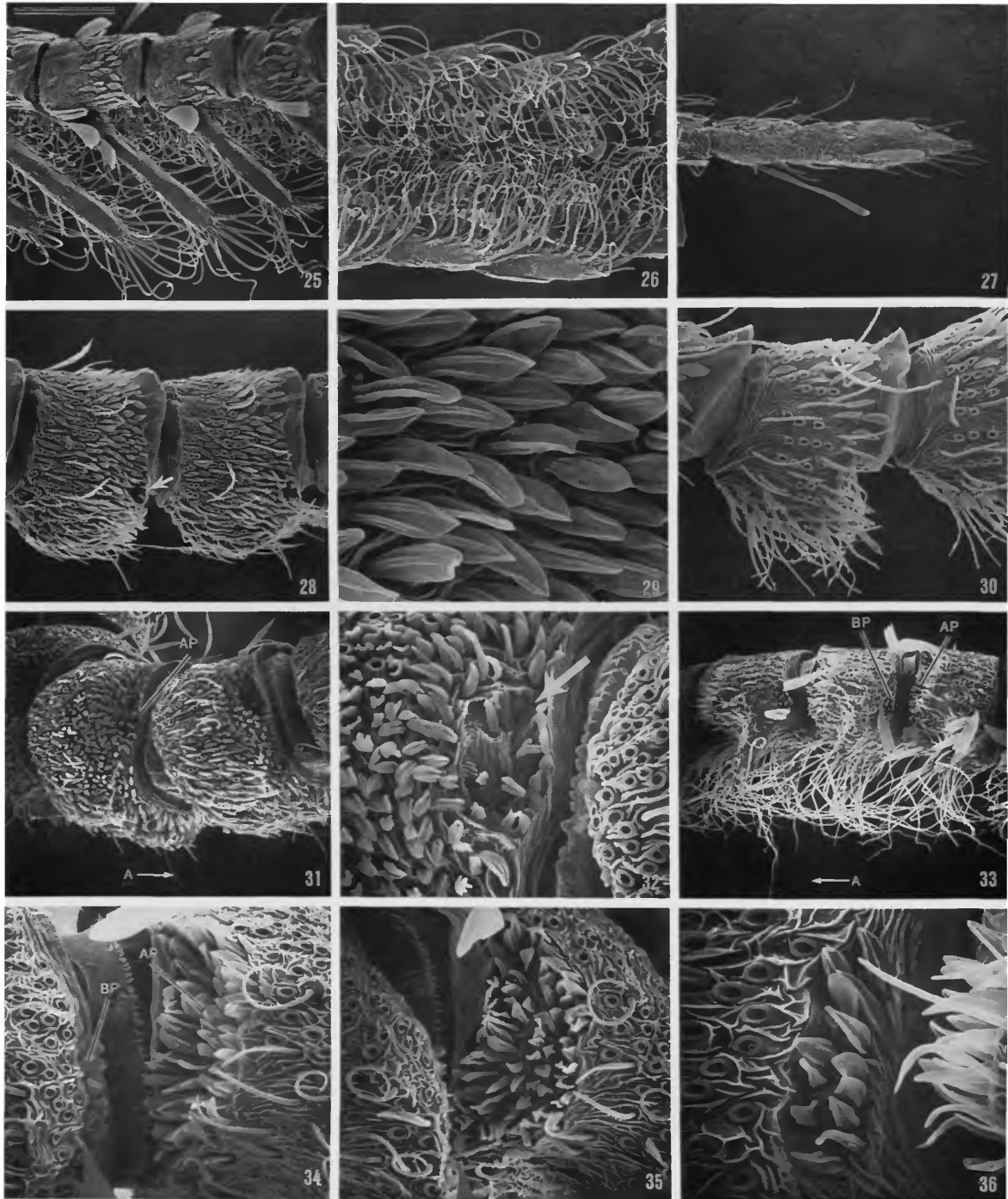
thickened apophyses (Figure 101) of Harmacloninae have developed probably in association with the tympanic organs for the attachment of strong muscles, possibly to facilitate greater movement of the abdomen.

5. *Aedoeagus with Basal Midventral Keel*: The ridge-like keel developed at the base of the aedoeagus (Figures 166, 184) in most Harmacloninae has been secondarily lost within both *Micrerethista* and *Harmaclona*. No trace of a keel exists in *Gerontha*, although a few Myrmecozelinae possess a ridge-like process near the base of the aedoeagus that joins the vinculum.

The loss of the spinose setae at the apex of the tarsomeres (Figure 69) may constitute another synapomorphy of Harmacloninae, although these typically nondeciduous setae are sometimes lost or have not been thoroughly examined in several tineid subfamilies. Zagulajev (1960, 1964, 1973, 1975) notes their presence in most Tineinae, Myrmecozelinae (Figures 67, 68), presence or absence in Nemapogoninae, and absence in Hapsiferinae and Scardiinae.

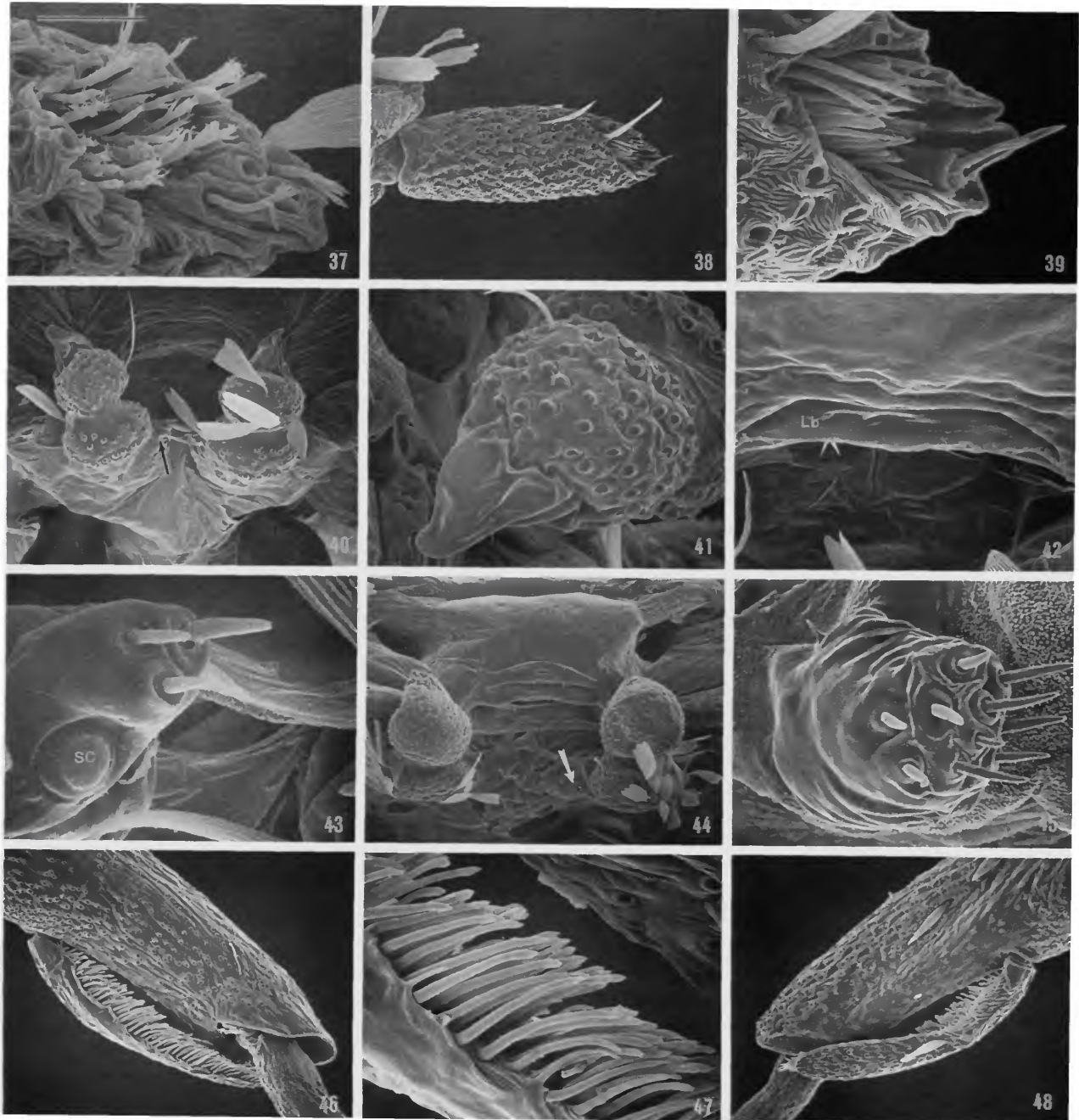


FIGURES 13–24.—Antennal morphology. *Micrerethista eustena*, ventral view: 13, flagellomeres 12–13 (75 μm); 14, detail of flagellomere 13 (50 μm). *Micrerethista* sp., female, lateral view: 15, flagellomeres 8–10 (86 μm); 16, segment near middle of flagellum, note sensillum coeloconicum (see arrow) (38 μm); 17, segments near apical one-third of flagellum (60 μm). *Harnaclona tephrantha*: 18, flagellomeres 13–15, lateral view (86 μm); 19, flagellomeres 11–15 of male, ventral view (120 μm); 20, detail of flagellomeres 11–12 in Figure 19 (50 μm); 21, flagellomeres 10–11 of female, lateral view (100 μm); 22, detail of flagellomere 10 showing sensilla chaetica (SCh) and sensilla auriculica (SA) (30 μm); 23, segments near apical one-third of flagellum, lateral view (60 μm). *Harnaclona cossidella*: 24, scale vestiture near middle of flagellum (100 μm). (Scale lengths in parentheses; bar scale for all photographs shown in Figure 25.)

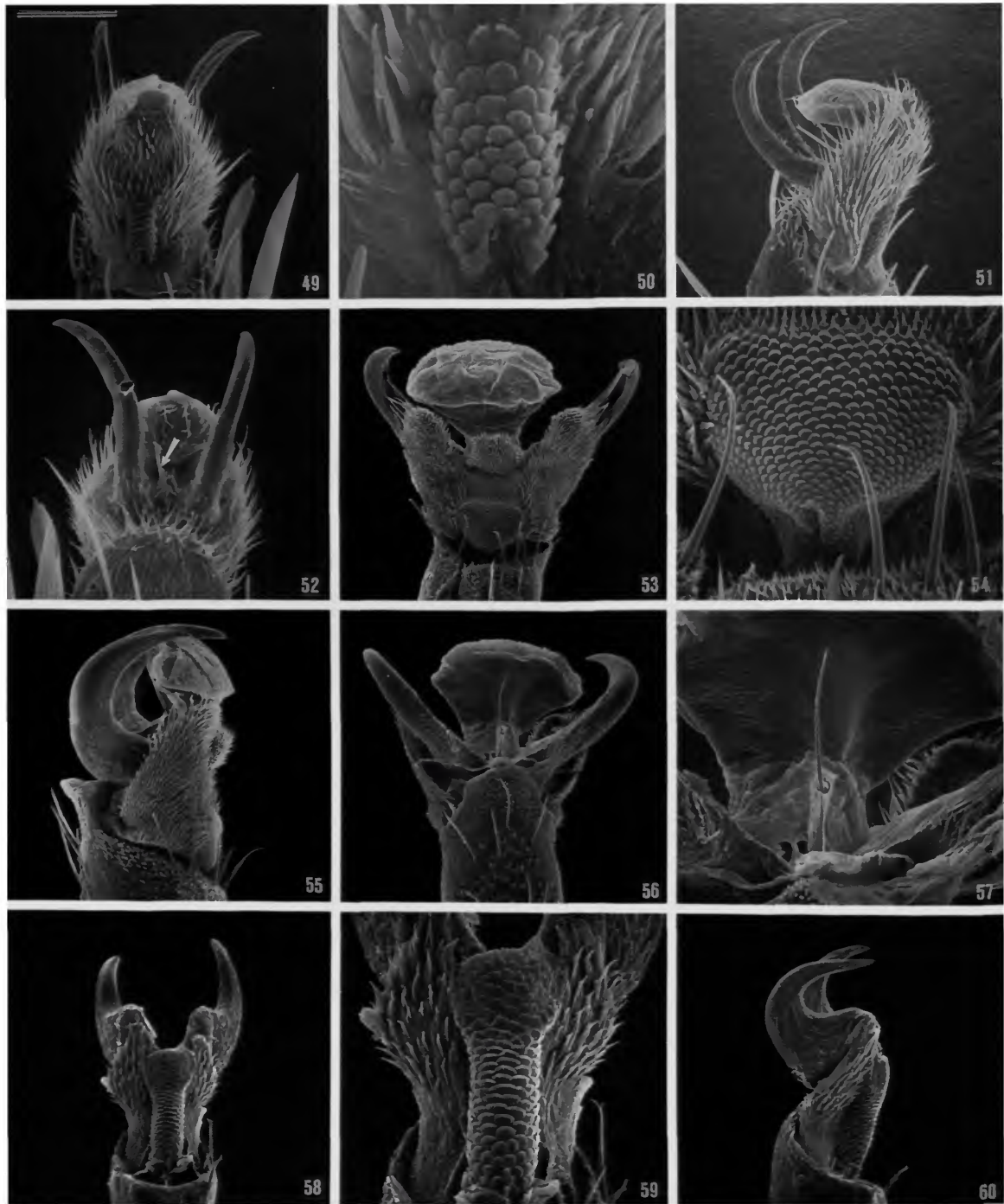


FIGURES 25–36.—Antennal morphology. *Harmaclona cossidella*: 25, dorso-lateral view of basal fourth of male flagellum (100 μ m); 26, ventral view of figure 25 (100 μ m); 27, male, apical flagellomere (75 μ m); 28, lateral view of female flagellomeres 15–16, note aperture of sensory cavity (see arrow) (86 μ m); 29, detail of sensilla auricillica in Figure 28 (12 μ m); 30, female, lateral view of apical one-fourth of flagellum (55 μ m); 31, female, apical sensory cavities (AP) of flagellomeres 5–6, arrow indicates direction of apex (A) (100

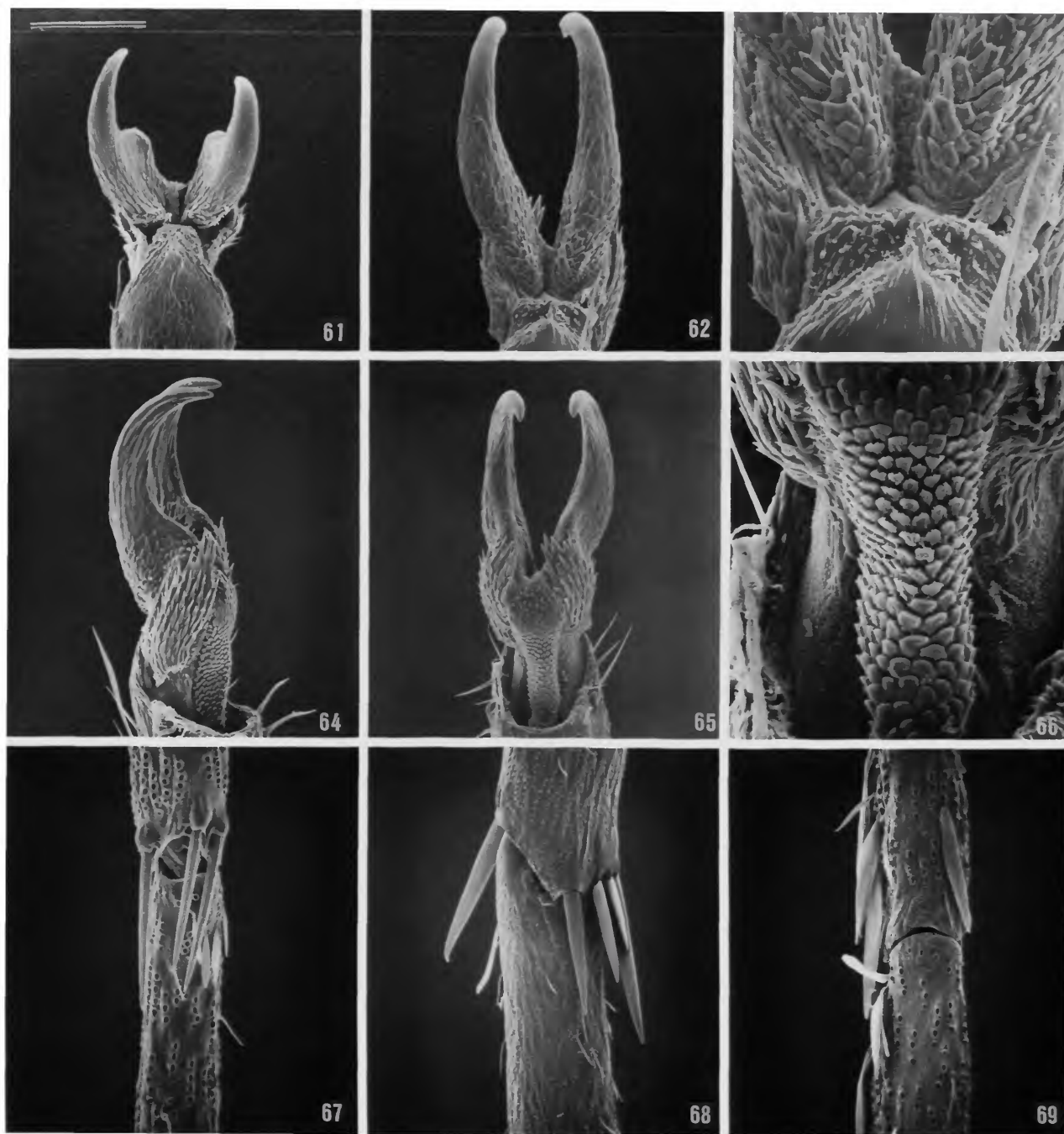
μ m); 32, sensory cavity (arrow) of flagellomere 5 (30 μ m). *Harmaclona malgassica*, male, lateral view: 33, flagellomeres 3–5 (120 μ m; AP = apical sensory cavity, BP = basal sensory cavity, arrow indicates direction of apex (A)); 34, detail of opposable apical sensory cavity (AP) and basal sensory cavity (BP, 38 μ m); 35, view of Figure 34 looking into apical sensory cavity (38 μ m); 36, detail of basal cavity of flagellomere 4 (20 μ m). (Scale lengths in parentheses; bar scale for all photographs shown in Figure 25.)



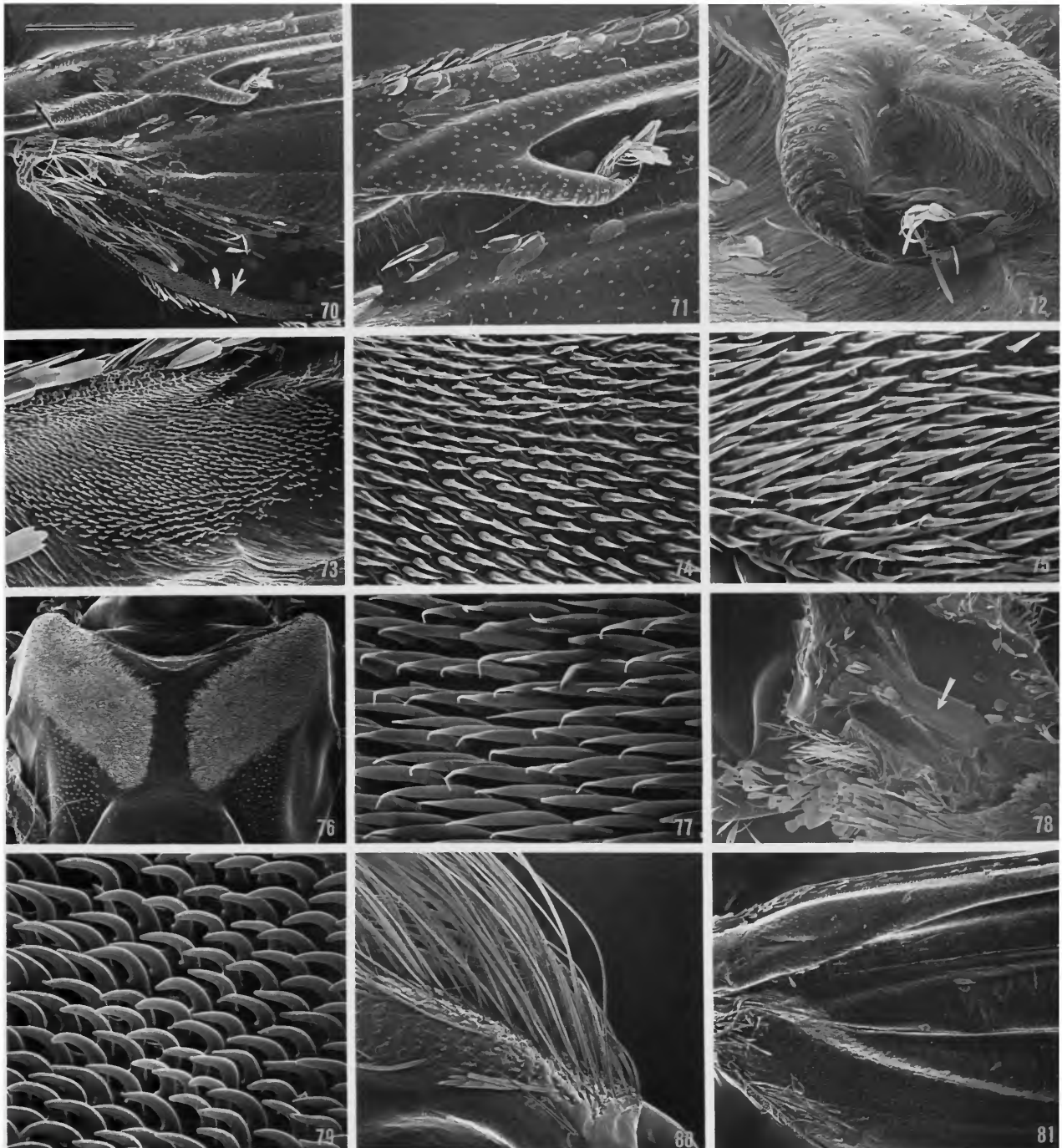
FIGURES 37–48. Morphology of mouthparts and legs. *Micrerethista eustena*: 37, sensory setae (Organ of vom Rath) at apex of labial palpus (17.6 μm). *Harmaclona cossidella*: 38, labial palpus (120 μm); 39, detail of sensory setae in Figure 38 (27 μm). *Micrerethista eustena*: 40, labial palpi and haustellum (arrow) (100 μm); 41, apex of second maxillary palpal segment (30 μm); 42, labrum (Lb, 38 μm); 43, haustellum (8.6 μm ; SC = sensillum campaniformium). *Harmaclona cossidella*: 44, labial palpi and haustellum (arrow) (176 μm); 45, haustellum (20 μm); 46, epiphysis, dorsal view (120 μm); 47, detail of epiphysial comb (27 μm); 48, epiphysis, ventral view (120 μm). (Scale lengths in parentheses; bar scale for all photographs shown in Figure 37.)



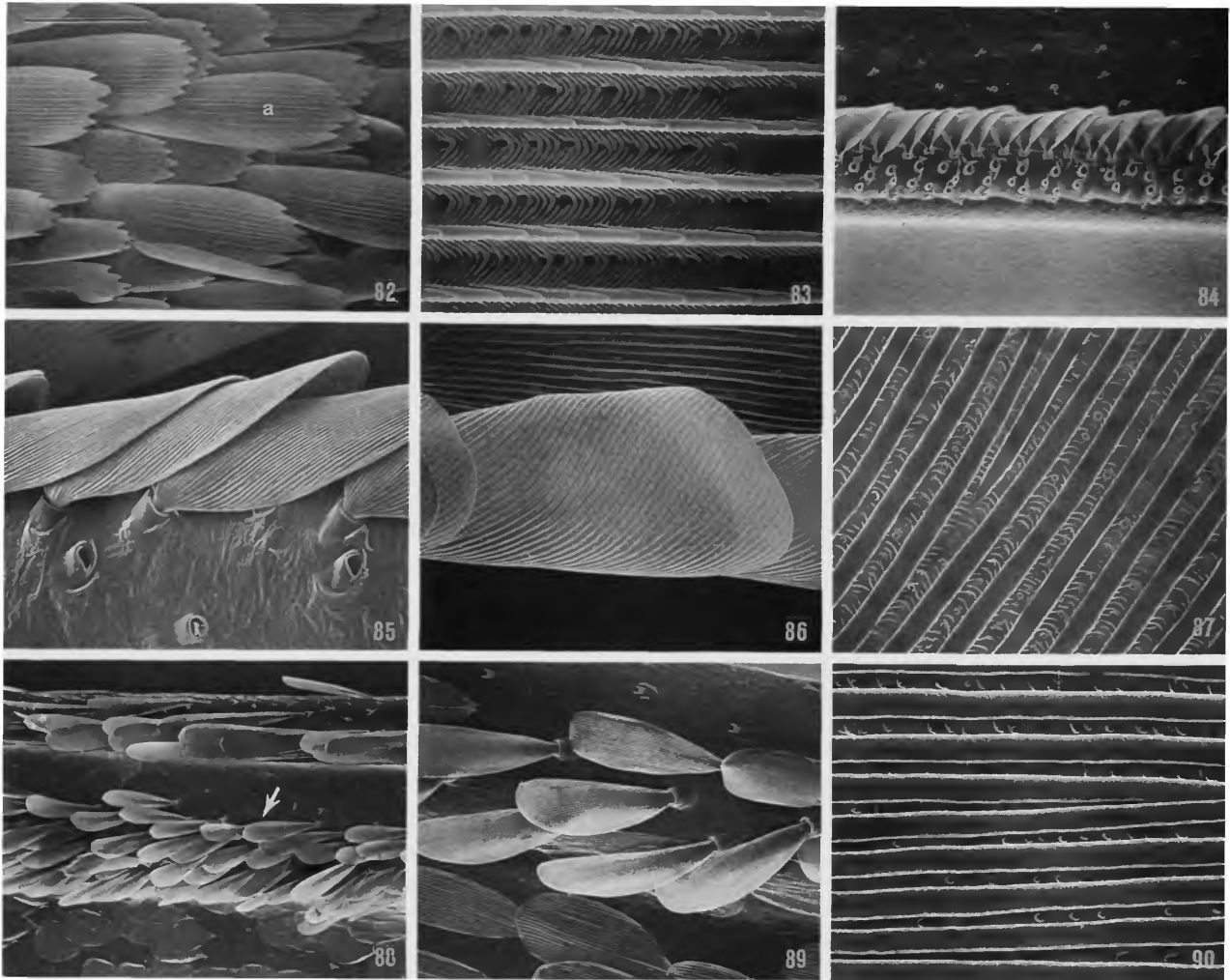
FIGURES 49–60.—Pretarsal morphology. *Myrmecozela ochraceella*: 49, ventral view (38 μm); 50, detail of unguitactor plate in Figure 49 (8.6 μm); 51, lateral view (38 μm); 52, dorsal view showing pseudempodial seta (see arrow) (30 μm). *Gerontha captiosella*: 53, ventral view (150 μm); 54, detail of unguitactor plate in Figure 53 (38 μm); 55, lateral view (120 μm); 56, dorsal view (150 μm); 57, detail of pseudempodial seta in Figure 56 (60 μm). *Micrerehista eustena*: 58, ventral view (60 μm); 59, detail of unguitactor plate in Figure 58 (27 μm); 60, lateral view (60 μm). (Scale lengths in parentheses; bar scale for all photographs shown in Figure 49.)



FIGURES 61–69.—Foreleg morphology. *Micrerethista eustena*, pretarsus: 61, dorsal view (60 μm). *Hamaclona cossidella*, pretarsus: 62, dorsal view (60 μm); 63, detail of Figure 62 showing absence of pseudempodial seta (23.1 μm); 64, lateral view (75 μm); 65, ventral view (75 μm); 66, detail of unguitactor plate of Figure 65 (20 μm). Spinose setae of first tarsomere: 67, *Myrmecozella ochraceella* (75 μm); 68, *Gerontha captiosella* (0.27 mm); 69, *Hamaclona cossidella* (86 μm). (Scale lengths in parentheses; bar scale for all photographs shown in Figure 61.)



FIGURES 70–81.—*Harnaclona cossidella*, wing/thorax coupling structures: 70, underside of male forewing showing frenulum, subhumeral (black arrow), and subanal (white arrow) locking spines (0.5 mm); 71, detail of frenulum (231 μ m); 72, distal view of frenulum (100 μ m); 73, subhumeral spines in Figure 70 (100 μ m); 74, detail of subhumeral spines (30 μ m); 75, detail of subanal spines in Figure 70 (30 μ m); 76, paired mesonotal patches of locking spines that couple with subanal forewing spines (0.33 mm); 77, detail of mesonotal spines in Figure 76 (15 μ m); 78, mesepimeral patch of locking spines (arrow) that couple with subhumeral spines of forewing (0.5 mm); 79, detail of mesepimeral spines in Figure 78 (100 μ m); 80, bristle-like scales at base of dorsal costal margin of female hindwing, note absence of frenulum (100 μ m); 81, underside of female forewing (0.75 mm). (Scale lengths in parentheses; bar scale for all photographs shown in Figure 70.)



FIGURES 82–90.—*Harmaclona cossidella*, wing scale morphology: 82, dorsal forewing scales from middle of discal cell (100 μ m); 83, ultrastructure of scale “a” in Figure 82 (3 μ m); 84, ventral hind margin of forewing showing strongly curved locking scales (100 μ m); 85, detail of hind margin locking scales in Figure 84 (20 μ m); 86, anteroventral view of locking scale in Figure 85 (15 μ m); 87, ultrastructure of locking scale in Figure 86 showing fused (without scutes) longitudinal ribs (3 μ m); 88, dorsal subcostal locking scales (arrow) of hindwing that couple with specialized forewing scales shown in Figures 84–87 (200 μ m); 89, detail of subcostal locking scales in Figure 88 (60 μ m); 90, ultrastructure of subcostal locking scale in Figure 89, showing fused longitudinal ribs (30 μ m). (Scale lengths in parentheses; bar scale for all photographs shown in Figure 82.)

The basalmost 5–15 flagellomeres of most *Harmaclona* possess a single, relatively large, spherical sensory cavity near the distal margin of each segment (Figures 11, 12). The organs are always lacking on the scape and pedicel. The cavities are developed in both sexes and may be more numerous in the female (e.g., on the first seven flagellomeres in male *H. cossidella* compared to on 14 or 15 in the female). The organs decrease in size from the first flagellomere distally, with the most distal in the series nearly imperceptible. On the first

flagellomere beyond the pedicel, a segment that is often incompletely divided (Figure 12), a smaller, more basal cavity is often present. In lateral view the sensory cavities appear as broadly oval to spherical invaginations (Figures 11, 12) up to $\frac{1}{3}$ the length of the flagellomere. Externally, the apparent openings of the cavities are associated with a dense field of slender, longitudinally grooved sensilla auricillica. These are concentrated within (Figure 35) and sometimes around (Figures 28, 32) a depression located along the distal rim on one

side of the flagellomere. A much smaller but similar concentration of sensilla auricillica is usually present on the opposable surface at the base of the adjacent flagellomere (Figures 34, 36). The size of the distal depression is restricted in most species, varying in width from about 0.25 the diameter of the flagellomere in *H. cossidella* (Figure 31) to more than 0.75 in *H. malgassica* (Figure 34). Because they appear to be lacking in other tineid genera, their development in *Harmaclona* may constitute an autapomorphy for that genus. Within *Harmaclona* the sensory cavities are presumed to have been secondarily lost in the South American *H. triacantha* and in two African sister species, *H. hilethera* and *H. natalensis*. The homologies of these supposed olfactory organs are unknown. I have not noted their presence in any other moth family.

PHYLOGENETIC ANALYSIS

A cladistic analysis was performed on the species of Harmacloninae using the Hennig86 program of J.S. Farris (1988). Character changes were plotted on the cladograms generated by Hennig86 with the software program CLADOS authored by K.C. Nixon (1995). A character matrix (Table 1) for 23 taxa (including the outgroup) and 32 characters was first arranged in a linear transformation series and then polarized using outgroup analysis (Watrous and Wheeler, 1981). The myrmecozeline genus *Gerontha* was used as the outgroup because of suspected close affinities to Harmacloninae (Robinson and Nielsen, 1993). A possible synapomorphy shared by these two groups is the presence of a single, elongate signum in the female, a condition also present in *Myrmecozela ochraceella*. It may also be of some significance that the larval biology of *Gerontha* resembles that of *Harmaclona*. Larvae of *Gerontha* have been reported boring in the dead wood of *Shorea robusta* A. DC., Dipterocarpaceae (Fletcher, 1933). Substitution of *Myrmecozela ochraceella* for *Gerontha* as the outgroup gave similar results with the minor exceptions that *Myrmecozela* showed more plesiomorphy for character 19 and more apomorphy for character 20.

The data matrix consisted of 19 binary and 13 multistate characters. Analysis of the data for 22 taxa (excluding *Micrerethista fusca*) by the implicit enumeration option (ie*) of Hennig86 resulted initially in 496 trees (length = 106; consistency index (ci) = 58; retention index (ri) = 79). Three iterations with successive weighting reduced these to three trees (length = 470, ci = 80, ri = 91). Much of the tree variation was the result of 13 of the 22 species being represented only by males. The inclusion of large numbers of missing data in a computational matrix often results in a large set of equally parsimonious alternative trees, some of them not supported by the available data in the matrix (Platnick et al., 1991). Consequently, the current phylogenetic analysis must be considered as only preliminary, with a more accurate analysis undoubtedly possible after the missing data can be included. *Micrerethista fusca* was excluded from the final analysis

because the male is unknown, and consequently nearly one-half of the characters are unknown. As tentatively indicated in Figure 91, a sister-group relationship between *M. fusca* and *M. fasciola* is supported by at least one synapomorphy (character 30: reduced ductus bursae), as well as by other shared similarities in wing banding and female genital morphology.

The three cladograms computed without *M. fusca* differed essentially in the relative positions of *Harmaclona natalensis* and its sister species *H. hilethera* (Figures 91-93). *Harmaclona hilethera* is believed to be the more derived (Figure 91) as suggested by its more apomorphic anellus—the most specialized form within the genus.

CHARACTERS USED IN THE ANALYSIS

HEAD

1. *Structure of basal third of male flagellum*. 0 = filiform; 1 = bifasciculate; 2 = bipectinate.
2. *Segmentation of maxillary palpus*. 0 = 5-segmented; 1 = 3-segmented. A reduction of maxillary palpal segments occurs in other Tineidae (e.g., in some Tineinae).
3. *Development of haustellum*. 0 = well-developed (0.5 or more the length of the labial palpus); 1 = vestigial. In Harmacloninae the haustellum is difficult to distinguish, even with SEM examination. Much of the structure bears relatively large sensory setae (Figures 43, 45).
4. *Development of mandible*. 0 = reduced; 1 = absent. The mandible is vestigial in all Tineidae but is usually present to some degree. No trace of it remains in the Harmacloninae.

FOREWING

5. *Development of specialized locking scales ventrally along hind margin*. 0 = absent; 1 = present. As discussed previously, this comprises a major synapomorphy for the Harmacloninae.

HINDWING

6. *Development of specialized locking scales dorsally along subcostal area*. 0 = absent; 1 = present. Another synapomorphy for the Harmacloninae and one together with character 5 above that functions as a secondary wing coupling device.
7. *Development of medial vein within discal cell*. 0 = forked; 1 = completely fused.

PRETARSUS

8. *Development of arolium*. 0 = present; 1 = absent. See previous discussion under subfamily synapomorphies.

TABLE 1.—Character coding for 23 taxa (including the outgroup and *Micrerethista fusca*). The latter taxon was omitted in computing a cladistic analysis of Harmacloninae and was subsequently inserted manually into the cladogram (Figure 91).

Taxa	Characters						
	1-5	6-10	11-15	16-20	21-25	26-30	31, 32
<i>Gerontha</i>	00000	00000	00000	00010	??000	21000	00
<i>africana</i>	11111	11111	11103	10001	12401	32???	??
<i>afrotephrantha</i>	21111	10111	11011	10011	00312	21???	??
<i>berberia</i>	21111	10111	11011	10011	02333	21???	??
<i>bifida</i>	11111	11111	11003	10201	14301	30???	??
<i>cossidella</i>	21111	10111	11012	12011	00238	21200	00
<i>denticulata</i>	11111	11111	11003	10001	12301	31101	11
<i>dissacca</i>	11111	11111	11003	10021	12301	41???	??
<i>entripta</i>	11111	11111	11003	10001	12201	21101	11
<i>eustena</i>	11111	11111	11103	10001	12301	01101	11
<i>fasciola</i>	11111	11111	11003	10101	12401	32110	01
<i>fusca</i>	11111	11111	11???	?????	?????	??100	01
<i>hexacantha</i>	21111	10111	11012	12011	00125	21???	??
<i>hilethera</i>	21111	10111	10011	12011	01404	21???	??
<i>malgassica</i>	21111	10111	11011	10011	02433	21???	??
<i>mochlacma</i>	11111	11111	11003	10201	12401	32110	01
<i>natalensis</i>	21111	10111	11011	10011	11324	21200	00
<i>nigrapex</i>	11111	11111	11003	10001	12201	11101	11
<i>resima</i>	11111	11111	11003	10111	13331	51???	??
<i>robinsoni</i>	11111	10111	11011	10211	02402	21200	00
<i>tephrantha</i>	11111	10111	11011	10211	02312	21200	00
<i>tetracantha</i>	21111	10111	11012	11011	00116	21200	00
<i>triacantha</i>	21111	10111	11012	12011	00137	21200	00

9. *Development of pulvillus*. 0 = well-developed; 1 = reduced. This is a difficult character to quantify, with various stages of reduction possible within the Tineidae. Pulvilli are well-developed in both *Myrmecozela* (Figures 49-51) and *Gerontha* (Figures 53-56), with the latter also possessing a prominent, median patch of spines between the pulvilli (Figure 53).

10. *Development of pseudempodial seta*. 0 = present; 1 = absent. Rarely is this prominent sensory seta reduced or absent in moths. (See previous discussion under subfamily synapomorphies.)

ABDOMEN

11. *Development of tympanum on second sternum*. 0 = absent; 1 = present. As discussed previously, this is a major synapomorphy for the Harmacloninae.

12. *Development of sternal apophyses*. 0 = slender; 1 = stout, often capitate. The short, stout apophyses of sternum II provide further evidence for the monophyly of Harmacloninae and may be autapomorphic within the Lepidoptera.

13. *Development of coremata in male*. 0 = present; 1 = absent. Coremata appear in several tineid genera and are normally present in Harmacloninae. They have been subsequently lost in at least two species of *Micrerethista*.

MALE GENITALIA

14. *Development of gnathos*. 0 = present; 1 = absent. The loss of the gnathos in *Harmaclona* is a diagnostic synapomorphy of the genus.

15. *Development of apotheca*. 0 = absent; 1 = well-developed (> 0.5 the length of valva); 2 = reduced (0.2-0.45 the length of valva). The apotheca (Bradley, 1951), a membranous invagination of the male diaphragma dorsal to the anellus (Figures 235, 236, Ap), occurs sporadically in several tineoid lineages, including the Harmacloninae. Within the latter it occurs only in the genus *Harmaclona* and has become secondarily reduced in the New World members of that genus. An apotheca also has developed in several Arrhenophanidae wherein it provides a unique function for storing the elongate, nonretractible vesica (Bradley, 1951; Davis in Davis and Robinson, in press). It is important to note that in Arrhenophanidae the apotheca is developed proportionately to the vesica and is absent in those species that lack nonretractible vesicae. I have observed similar invaginations in at least one species of neotropical *Diataga*, in the Chilean "*Tinea*" *isodonta* Meyrick, as well as in several undescribed species of Chilean Tineidae. Although the structure appears homologous in both families, it may have arisen more than once in response to other functions

(e.g., to accommodate the tip of the ovipositor in some species during copulation), particularly in those species whose males do not possess a nonretractible vesica.

16. *Development of anellus*. 0 = membranous; 1 = sclerotized tube.

17. *Apical development of anellus*. 0 = not developed (i.e., membranous); 1 = truncate-rounded; 2 = concave; 3 = moderately furcate (lateral arms < length of anellar tube, Figures 283, 295); 4 = deeply furcate (lateral arms > length of anellar tube, Figures 277, 303).

18. *Development of anterior margin of vinculum*. 0 = concave; 1 = truncate; 2 = V-shaped. Viewed ventrally, the anterior margin of the vinculum on either side of the median saccus may curve caudad (concave), extend approximately straight (truncate), or slope slightly anteriorly to saccus (V-shaped).

19. *Development of saccus*. 0 = short (< 0.3 the length of valva); 1 = long (> 0.3 the length of valva); 2 = secondarily lost. Although the saccus is long and slender in *Gerontha* (Moriuti, 1989), it is absent to short in *Myrmecozela* and most Myrmecozelinae.

20. *Apex of valva*. 0 = entire; 1 = divided. The apex of the valva is entire in *Gerontha* (Moriuti, 1989) and is rarely divided or deeply notched in Myrmecozelinae (Zagulajev, 1975).

21. *Length of ventral (saccular) lobe of valva*. 0 = long (> 0.81 the length of dorsal (cucullar) lobe); 1 = short (< 0.81 the length of dorsal lobe).

22. *Apex of ventral lobe of valva*. 0 = slender, acute (Figures 196, 267); 1 = slender, rounded (Figure 213); 2 = slender, truncate (Figures 158, 180); 3 = slender, bifid (Figure 171); 4 = moderately broad, acute (Figures 243, 261); 5 = broad, subacute (Figures 273, 279); 6 = with broad, truncate lobe (Figures 165, 255); 7 = broad with abruptly reduced acute lobe (Figures 285, 297); 8 = broad with abruptly rounded lobe (Figure 305). As is often true for male genital characters, some morphological states are difficult to define. Reference to pertinent illustrations are provided to help typify the foregoing states.

23. *Aedoeagus: development of basal keel*. 0 = absent; 1 = elongate (> 0.4 the length of aedoeagus); 2 = moderately long (0.3–0.4 the length); 3 = reduced (0.18–0.3 the length); 4 = secondarily lost. The presence of the basal midventral keel on the aedoeagus constitutes an autapomorphy for the Harmacloninae. The keel has been secondarily lost within both *Micrerethista* and *Harmaclona*.

24. *Aedoeagus: apex*. 0 = rounded; 1 = conical; 2 = attenuated (with vitta); 3 = bilobed; 4 = trilobed.

25. *Aedoeagus: small denticulate spines bordering peritreme*. 0 = absent; 1 = 6 or more pairs of denticles; 2 = 4–5 pairs; 3 = 2–3 pairs; 4 = 1 pair; 5 = denticles secondarily lost. The presence of multiple pairs of denticulate spines bordering the peritreme in members of

both *Micrerethista* and *Harmaclona* suggests this to be the plesiomorphic condition within Harmacloninae, with gradual reduction to complete loss to be more derived conditions.

26. *Aedoeagus: enlarged apical-subapical spines*. 0 = absent; 1 = 2 pairs of large spines; 2 = 1 pair of large spines; 3 = 1 pair of small spines. These spines have developed only in the New World members of *Harmaclona*, with maximum reduction occurring in *H. cosidella*.

27. *Aedoeagus: dorsal spines*. 0 = absent; 1 = 1 pair; 2 = single spine; 3 = secondarily lost. As proposed for character 26, the mid-dorsal spines are believed to have evolved only in the New World members of *Harmaclona*.

28. *Aedoeagus: lateral spine cluster containing 6 or more elongate spines*. 0 = absent; 1 = present and erect; 2 = present and appressed. This distinctive cluster of spines constitutes a synapomorphy of the *Micrerethista entripta* species group (Figures 91, 185, 188, 191).

FEMALE GENITALIA

29. *Development of antrum*. 0 = absent; 1 = short (length < twice the width); 2 = long (length > twice the width).

30. *Length of ductus bursae*. 0 = long (> length of anterior apophyses); 1 = reduced (< length of anterior apophyses).

31. *Development of spicule band within ductus bursae*. 0 = absent; 1 = present (Figure 327).

32. *Development of signum within corpus bursae*. 0 = present; 1 = absent. The slender, ridge-shaped signum of *Harmaclona* resembles that present in some species of *Gerontha* (Moriuti, 1989). Its absence in *Micrerethista* is a synapomorphy for that genus.

HARMACLONINAE, new subfamily

TYPE GENUS.—*Harmaclona* Busck, 1914.

ADULT.—Moths ranging in size from small to moderately large, with a forewing length of 4–18 mm; wings slender, devoid of microtrichia except on subhumeral (Figures 73, 74) and subanal regions (Figures 70, 75) of forewing; wings of both sexes with secondary locking mechanism consisting of stiff rows of scales from dorsal edge of forewing and subcostal area of hindwing. Pretarsus with arolium and pseudempodial seta absent. Male with a single, stout frenular bristle; female with 0–4 smaller frenular bristles. Male genitalia with short to elongate saccus; uncus-tegumen fused, hood-like; gnathos present (*Micrerethista*) or absent (*Harmaclona*); anellus forming a firm, sclerotized tube around aedoeagus; valva divided into a dorsal cucullar lobe and a ventral saccular lobe; aedoeagus with a basal midventral keel and without cornuti.

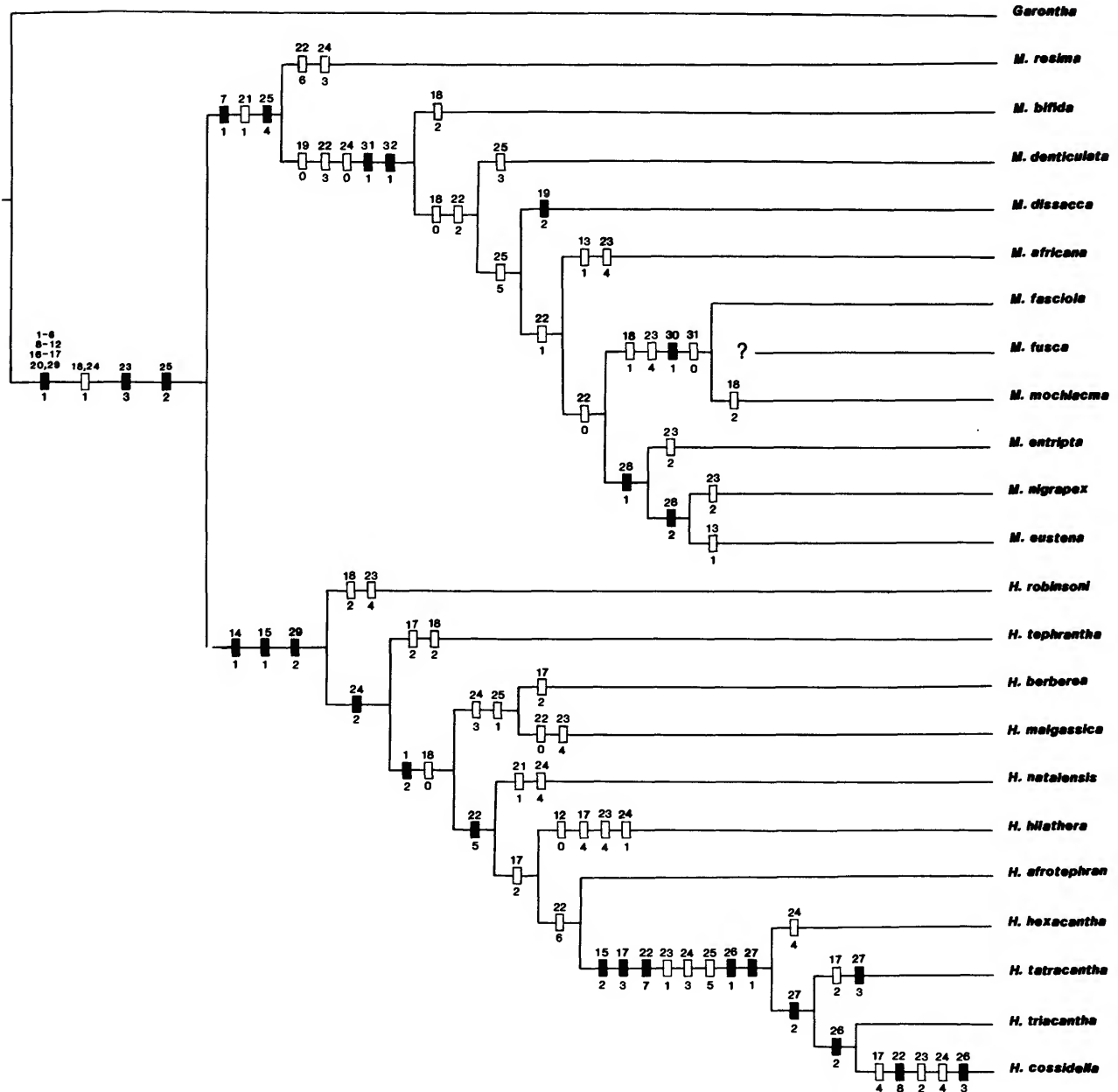
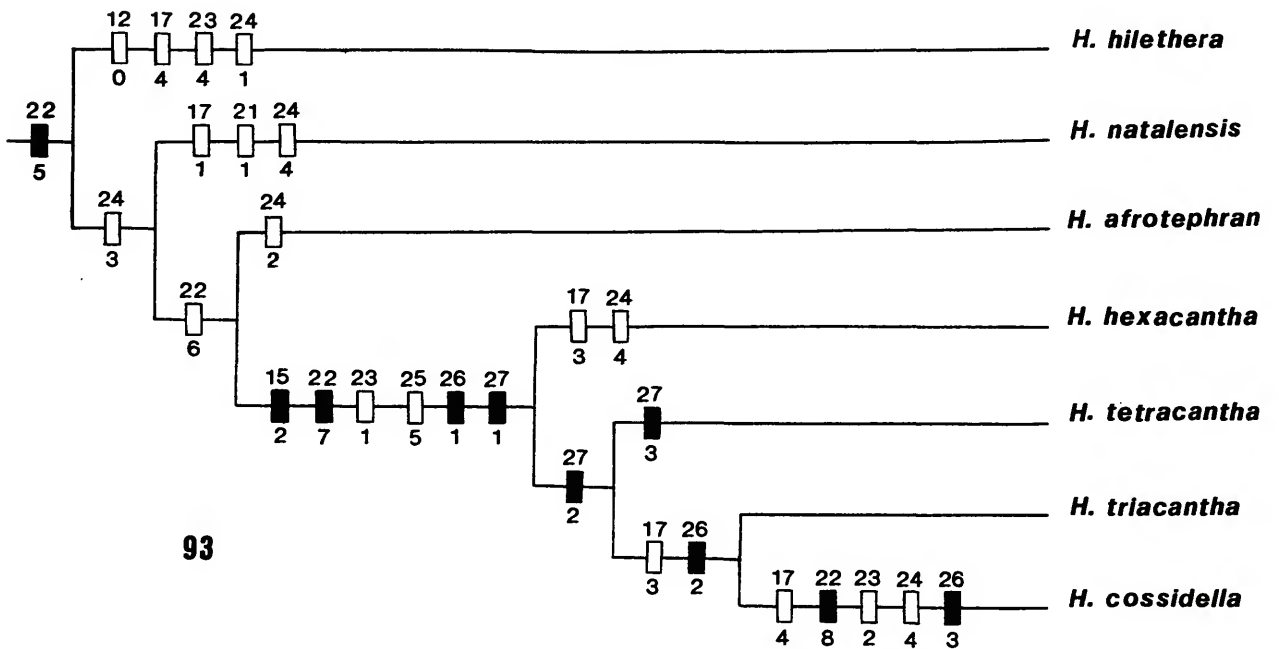
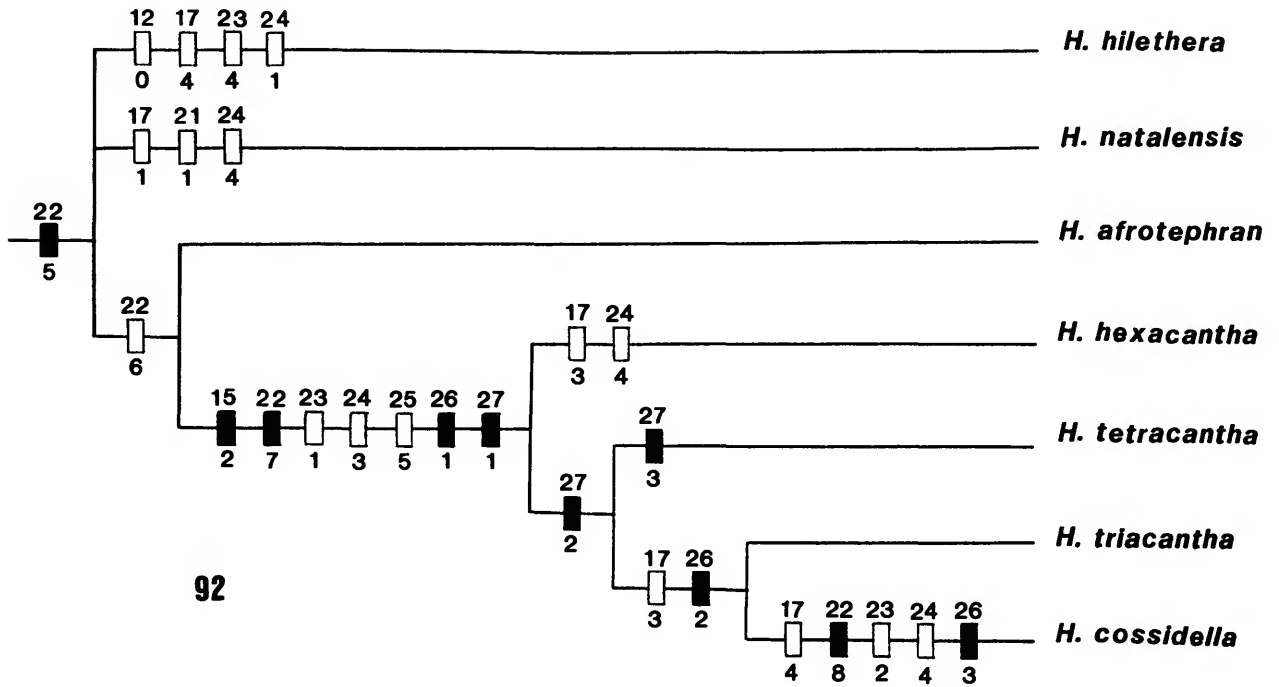


FIGURE 91.—Preferred cladogram for Harmacloninae and outgroup *Gerontha* (Myrmecozelinae). Bars indicate character-state transformations supporting nodes, with character number shown above and character state indicated below. Black bars represent unique, unreversed synapomorphies.

Female genitalia elongate, telescoping, with a pair of ventral pseudapophyses within A10; signum present (*Harmaclona*) or absent (*Micrerehista*).

Head: Vestiture generally rough, scales usually shorter and more appressed over frons, becoming abruptly erect and

piliform over vertex, with 2–5 dentate apices and mostly white with varying amounts of brown to fuscous subapical banding. Antenna short, 0.3–0.5 the length of forewing, 40–70-segmented; scape without specialized pecten but with a dense tuft of slender, mostly 2 or 3 dentate scales from anterior



FIGURES 92, 93.—Alternative tree configurations of Figure 91 showing relative positions of *Harmaclona natalensis* and *H. hilethera*.

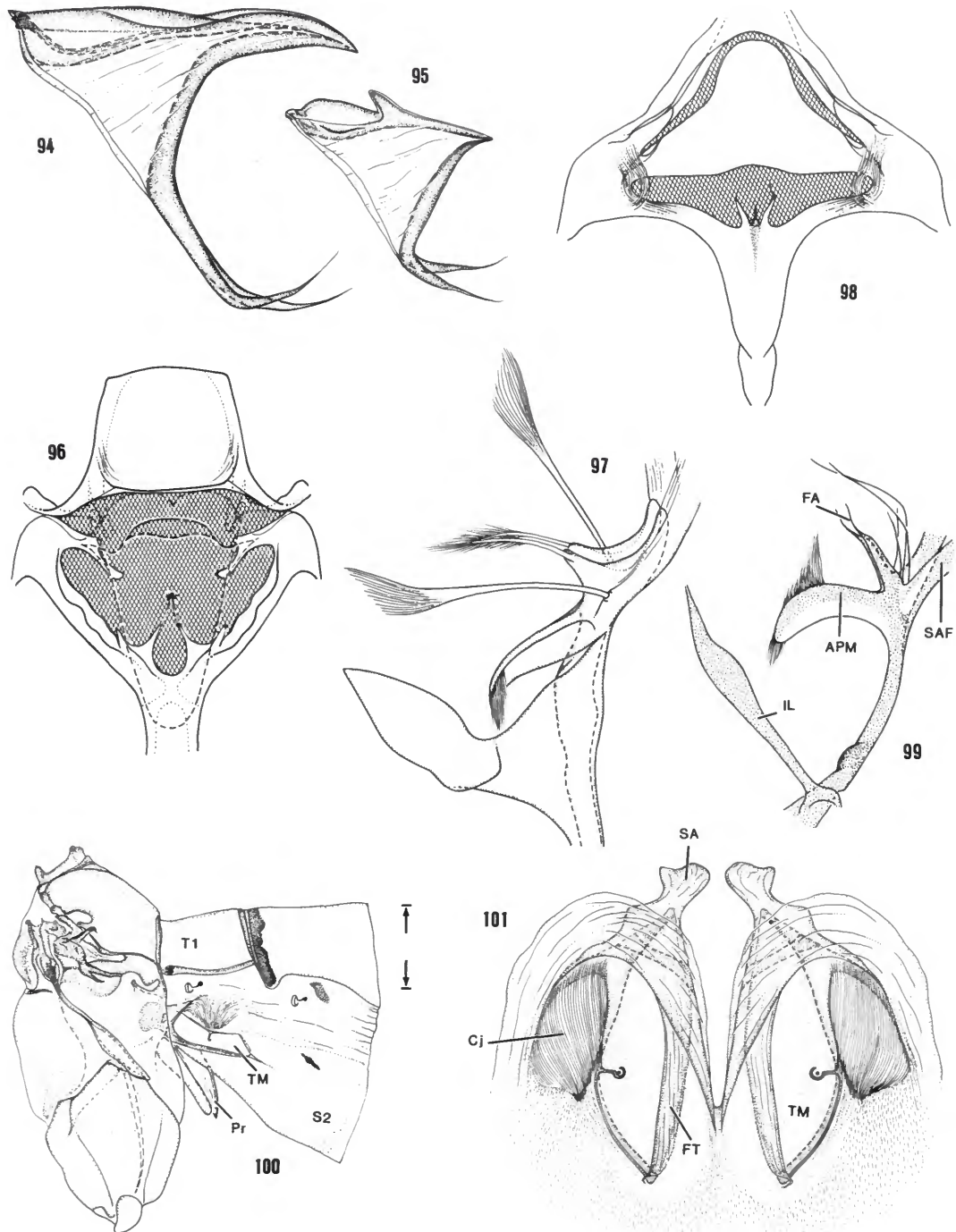
margin; flagellum sexually dimorphic, with basal 0.3–0.5 bifasciculate to bipectinate in male (Figure 9), bifasciculate, rarely shortly bipectinate, to filiform in female (Figures 10, 15); distal flagellomeres usually filiform to slightly bifasciculate in both sexes; a single row of slender scales dorsally on each flagellomere (Figure 24); naked ventrally except for elongate sensilla trichodea in male and shorter sensilla in female; sensilla attaining greatest length on pectinations; a moderate to dense concentration of short, slender sensilla auricillica typically around distal $\frac{1}{3}$ of each flagellomere (Figures 22, 28); sensilla coeloconica uncommon (Figure 16), absent on many segments; basal 5–15 flagellomeres with or without a solitary spherical sensory cavity (Figures 11, 12) at distal margin of each segment of both sexes in *Harmaclona*; sensory cavities absent in *Micrerethista*. Compound eye round, large; interocular index 1.6–1.9; eye index 0.75–0.8. Ocelli absent. Labrum greatly reduced (Figures 42, 44); pilifers absent. Mandibles absent. Maxilla greatly reduced (Figures 40, 41, 44), with short 2-segmented palpus not exceeding first (I) segment of labial palpus in length; haustellum vestigial, nearly absent, represented by small lobe at inner base of palpus bearing ~3–10 short apical sensilla (Figure 45) and sometimes a single sensillum campaniformium (Figure 43). Labial palpus 3-segmented, segment III greatly reduced; length ratios from base: 1 : 2.35 : 0.55; vestiture mostly white, variably irrorated with subapically banded brown scales; segment II predominantly brown to fuscous laterally, irrorated with white-tipped scales; a series of long dark brown piliform scales arising mostly laterally and apically from II.

Thorax: Dorsum generally similar to head in color; mesoscutellum typically with a semi-erect, median tuft of dark brown to fuscous scales projecting caudally. Forewings (Figures 5–8) slender, length ranging from 4.2–5.2 the width. Discal cell elongate, approximately 0.75 the length of forewing. Radius 5-branched, R4 and R5 forked ~0.4–0.6 their length, rarely fused. Accessory cell present. Media 3-branched, with all veins arising separate, rarely connate; base of M usually preserved and simple, rarely with vestigial fork. 1A and 2A separate (forked) at base. Male retinaculum (Figures 71, 72) a slender, coiled, ventral lobe from base of Sc. A small subhumeral field of microtrichia present (Figures 70, 73) that engages similar area on mesepimeron (Figures 78, 79). Subanal field of microtrichia also present (Figures 70, 75) that engages similar area on mesonotum (Figures 76, 77). Hindwing slightly broader than forewing. Male frenulum composed of a single stout bristle; female frenulum absent in New World *Harmaclona* (Figure 88), consisting of 2–4 smaller bristles in all Old World species. Costal margin either straight or slightly protruded just beyond middle. Sc running closely parallel to costa and terminating near apical $\frac{1}{5}$; a scattered linear band of partially erect, stiff scales (Figures 88, 89), extending dorsally along much of length of Sc, that interlock with corresponding row of ventral scales along hind (dorsal) margin of forewing (Figures 84–86); both sets of scales with longitudinal ribs

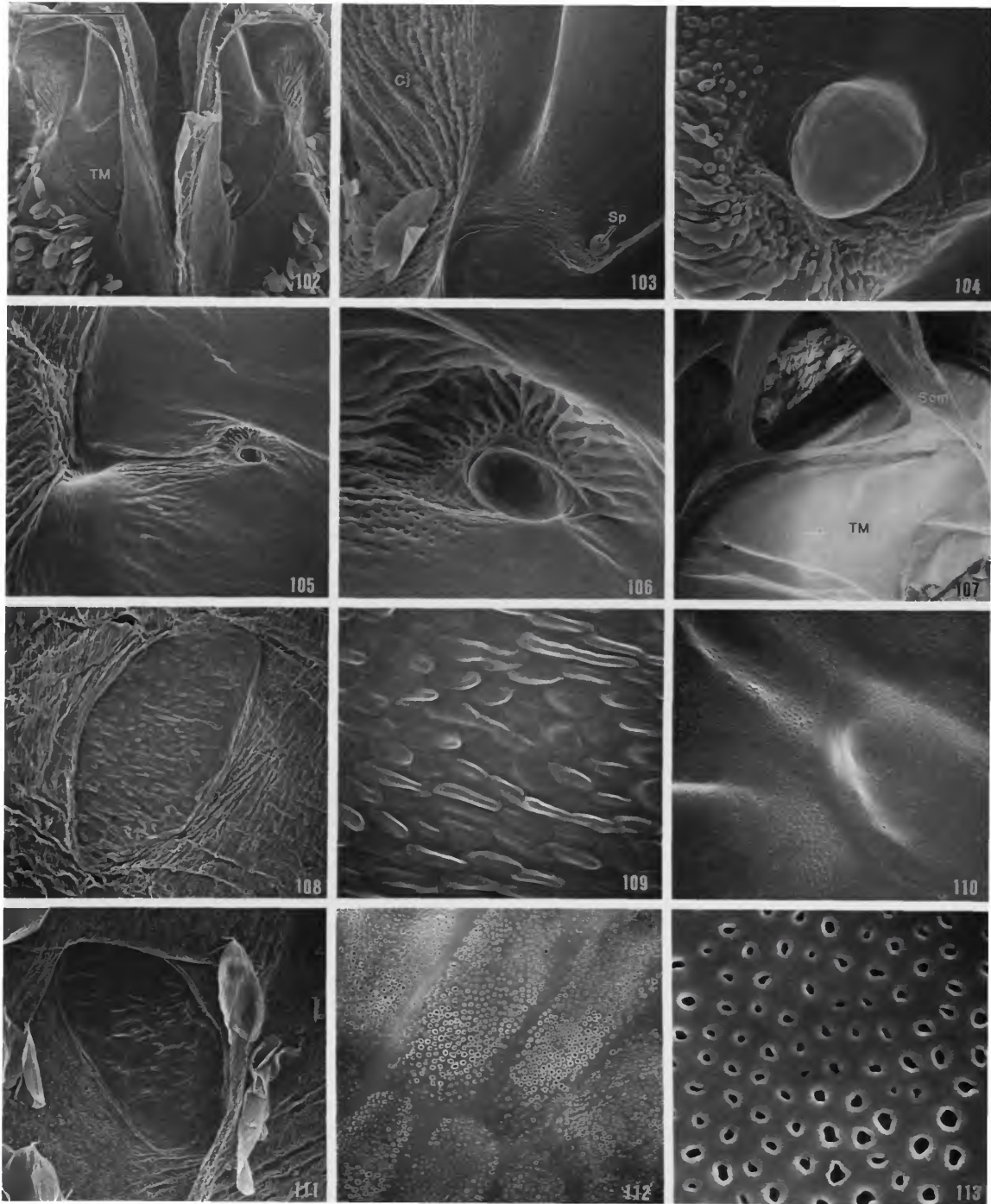
entire (Figures 87, 90). Media 3-branched, all veins usually arising separate or connate from cell; M1 and M2 rarely forked (in *H. hilethera*); media forked within discal cell of *Harmaclona* (Figures 7, 8), fused in *Micrerethista* (Figures 5, 6). Prosternum with a triangular, dorsal process (Figure 95). Mesofurcasternum (Figure 96) with paired lateral and mesal arms of similar size; anterior process curved ventrad, ~1.2 the length of lateral arms. Metafurcasternum (Figures 98, 99) with apophyses elongate, free, and tapering, arising from juncture of secondary arms of furcasternum and directed anterodorsally; lamina of secondary furcal arms reduced. Thoracic–abdominal intersegmental membrane thickened to form a paired praecinctorium extending from stem of metafurcasternum to the pons tympani of S2 (Figure 100). Foreleg with epiphysis pectinated, well-developed (Figures 4, 46–48), ~0.5–0.6 the length of tibia; foretibia short, approximately equal to first tarsomere; midleg with single pair of short, unequal spurs; hindleg with two pairs of spurs, at distal apex and at distal $\frac{1}{3}$ of tibia; spinose setae absent from apices of tarsomeres (Figure 69). General color of legs similar to that of body, white irrorated with brown to fuscous, except with forelegs more uniformly darker.

Abdomen: Generally light gray to light brown dorsally, occasionally with pale golden luster, often irrorated with brown to fuscous, subapically banded scales; venter predominantly white, less irrorated with darker scales; vestiture of A7–A8 of male usually white to cream. Sternites more sclerotized than tergites. Second sternum similar in both sexes, elongate, length nearly 1.5 width, bearing a pair of elliptical and open tympanic organs $\frac{1}{2}$ length of sternum; sternal rods greatly enlarged, capitate. A2 with a pair of tuberculate plates that are lacking on other segments; ventral pair on S2, along lateral margin; dorsal pair (Figures 108–113) in pleural membrane near lateral margin of T2 and caudad to spiracle; cuticle of plates with numerous, minute, oval pore discs (Figures 110, 112); pore discs slightly variable, smooth to slightly raised, with pores sometimes reduced or absent from central raised area. Sternal warts absent. Male with a pair of small coremata arising from shallow pockets along lateral margin of S8 (Figures 124, 125, 251); scales of coremata slender, short, protruding slightly from shallow pocket. Female with a complex whitish to pale brown corethrogyne arising from T7, consisting of a dense mat of 2 or 3 types of piliform scales; outer scales more densely matted and cylindrical, not twisted (Figure 115), with an underlying layer of pleated, slightly flattened and twisted scales (Figures 118–120); often intermixed with corethrogyne, especially laterally, are elongate piliform scales with spatulate apices (Figures 114, 117).

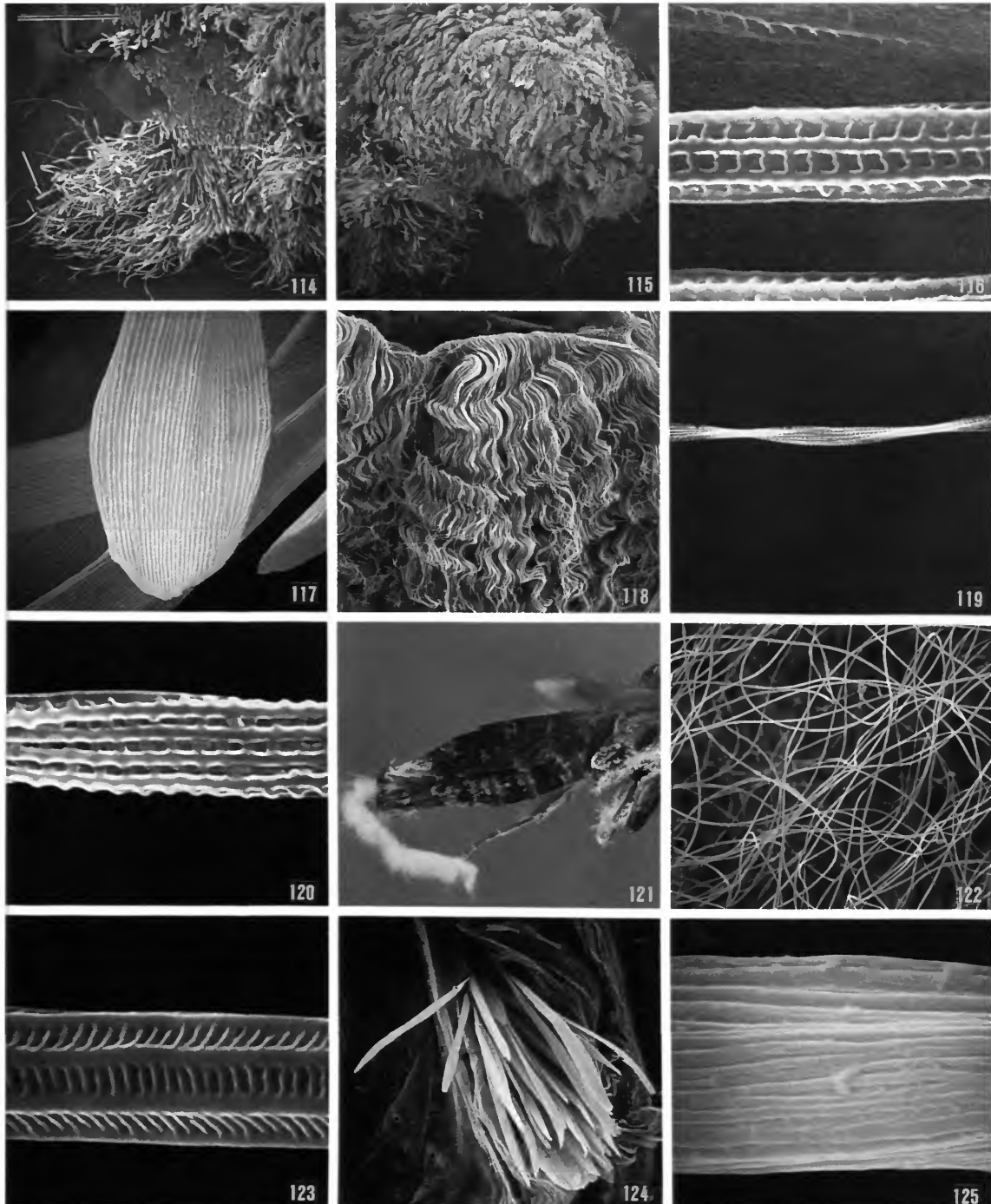
MALE GENITALIA.—Uncus and tegumen fused, relatively broad and hood-like. Vinculum laterally fused to tegumen, a narrow to moderately broad ring ventrally, usually abruptly narrowing to a short to elongate, rod-like saccus. Gnathos consisting of a pair of curved arms in *Micrerethista*, absent in



FIGURES 94-101.—Thoracic and abdominal morphology. *Gerontha captiosella*: 94, lateral view of prosternum. *Harmaciona cossidella*: 95, lateral view of metafurcasternum; 96, caudal view of mesothorax; 97, lateral view of mesofurcasternum; 98, caudal view of metafurcasternum; 99, lateral view of metafurcasternum (APM = anteromedial process of metafurcasternum, FA = furcal apophysis, IL = intercoxal lamella of basisternum, SAF = secondary arms of furcasternum); 100, lateral view of metathorax and abdominal segments A I and A II showing position of tympanum on A II (Pr = praecinctorium, S = sternum, T = tergum, TM = tympanic membrane); 101, paired tympanic organs on A II (Cj = conjunctiva, FT = fornix tympani, SA = sternal apophysis).



FIGURES 102–113.—*Harnaclona cossidella*, abdominal morphology: 102, sternum 11 with paired tympanal organs (43 μm ; TM = tympanic membrane); 103, external detail of right tympanum (100 μm ; Cj = conjunctiva, Sp = spinula); 104, detail of tympanic spinula in Figure 103 (13.6 μm); 105, internal detail of left tympanum (cleared with KOH; 75 μm); 106, internal view of spinula (20 μm); 107, internal view of untreated tympanic membrane (TM) showing attachment of scoloparium (Scm) to spinula (60 μm). Tuberculate plates of second abdominal segment: 108, dorsopleural plate (100 μm); 109, detail of Figure 108 showing raised pore discs (25 μm); 110, detail of pore discs in Figure 109 (3.8 μm); 111, dorsopleural plate (100 μm); 112, pore discs in Figure 111 (4.3 μm); 113, detail of pores in Figure 112 (750 nm). (Scale lengths in parentheses; bar scale for all photographs shown in Figure 102.)



FIGURES 114–125.—*Harnaclona cossidella*, abdominal scale structure: 114, seventh sternum of female (1.36 mm); 115, seventh tergum of female (slightly overlaps Figure 114) showing outer mat of corethrogyne hairs (1.36 mm); 116, ultrastructure of outer hairs in Figure 115 (750 nm); 117, spatulate scale from seventh sternum and pleura in Figure 114 (see arrow) (25 μ m); 118, inner layer of plaited corethrogyne hairs (231 μ m); 119, detail of Figure 118 showing twisted hair (4.3 μ m); 120, ultrastructure of Figure 119 (750 nm); 121, female abdomen with linear extrusion of corethrogyne; 122, detail of extruded mat in Figure 121 showing extremely long hairs (43 μ m); 123, ultrastructure of hair in Figure 122 (750 nm); 124, corematis from eighth sternum of male (86 μ m); 125, ultrastructure of corematal scale (2.5 μ m). (Scale lengths in parentheses; bar scale for all photographs shown in Figure 114.)

Harmaclona. Subscaphium usually distinct. An invaginated, mostly membranous pouch (apotheca) between subscaphium and anellus often developed in *Harmaclona*, absent in *Micrerethista*. Valvae divided into a distinct cucullar or dorsal lobe and a ventral or saccular lobe; latter rarely subdivided (in *M. bifida*); ventral lobes usually fused mesally for ~0.4–0.5 their length, almost completely fused in *M. resima*. Anellus forming a firm, sclerotized ring around aedeagus, fused laterally with mesal bases of valvae. Juxta absent. Aedeagus mostly cylindrical, usually with a slender midventral keel arising from base; anterior margin of keel flared laterally in *M. dissacca*; subapex of aedeagus usually armed with an assortment of small to large exogenous spines or teeth, rarely with an extended, slender process (vitta, Figures 245, 258); cornuti absent.

FEMALE GENITALIA.—Ovipositor elongate, telescoping, posterior apophyses greatly lengthened, up to 3 times length of anterior apophyses. A slender pair of pseudapophyses extending the length of A10. Eighth sternum usually with a pair of short, setose lobes on either side of ostium. Caudal margin of ostium varying from concave to convex; ductus bursae usually elongate, more than twice length of anterior apophyses in most species; antrum triangular to cylindrical, variable in length; junction with ductus seminalis usually near anterior end of antrum; ductus bursae and corpus bursae usually entirely membranous except for slender band of spicules extending length of ductus from antrum to corpus bursae in some species of *Micrerethista*; a single, elongate, irregularly spined signum (Figures 320, 337) present in *Harmaclona*; signum absent in *Micrerethista*.

Key to the Genera of Harmacloninae

- Hindwing with base of media undivided within discal cell [Figure 5]. Male genitalia [Figure 163] with gnathos present; apotheca absent; ventral saccular lobe of valva reduced, less than 0.75 the length of dorsal cucullar lobe. Female genitalia without signum *Micrerethista*
- Hindwing with base of media divided within discal cell [Figure 8]. Male genitalia [Figure 241] without gnathos; apotheca often well-developed, 0.24–0.8 the length of valva; ventral saccular lobe well-developed, 0.84–1.05 the length of dorsal cucullar lobe. Female genitalia with single, elongate, spinose signum [Figure 337] *Harmaclona*

***Micrerethista* Meyrick**

Micrerethista Meyrick, 1938:527 [type species: *Micrerethista mochlacma* Meyrick, 1938:527, by original designation].—Diakonoff, 1955:131; 1968:272 [synonym of *Harmaclona*].—Nye and Fletcher, 1991:190.—Robinson and Nielsen, 1993:236 [synonym of *Harmaclona*].

Syncopacma Meyrick, 1938:527 [type species: *Syncopacma capnozona* Meyrick, 1938:527, by original designation and monotypy, name preoccupied by *Syncopacma* Meyrick, 1925:72].—Nye and Fletcher, 1991:293.—Robinson and Nielsen, 1993:237 [synonym of *Harmaclona*].

Lophosettia Fletcher, 1939:25 [objective replacement name for *Syncopacma* Meyrick, 1938].—Nye and Fletcher, 1991:177.—Robinson and Nielsen, 1993:237 [synonym of *Harmaclona*].

Harmaclona Nielsen and Common in CSIRO, 1991:821, 850 [not Busck, 1914].—Robinson and Nielsen, 1993:236 [in part].

ADULT.—Forewing length 4–15.5 mm.

Head: Vestiture as described for subfamily. Antenna 45–65-segmented; flagellomeres slightly bifasciculate over basal 1/2 in male, mostly filiform in female and over distal 1/2 in male; flagellomeres without spherical sensory cavities.

Thorax: Forewing and hindwing with base of media simple in discal cell. Frenulum usually consisting of 2–4 bristles.

Abdomen: As described for subfamily, except with coremata absent on A8 of male of *M. africana* and *M. eustena*.

Male Genitalia: Vinculum usually abruptly constricted to

form slender, short saccus; saccus 0.13–0.29 the length of valva or absent in *M. dissacca*. Gnathos divided to partially fused, consisting of paired, slender arms connected by membrane. Apotheca absent. Ventral (saccular) lobe of valva often reduced, 0.46–0.8 the length of dorsal (cucullar) lobe. Aedeagus with midventral keel present or absent; apex either with or without subapical spines, when present often arising as 1–3 small pairs or as longer spines in clusters.

Female Genitalia: Mostly as described for genus. Ductus bursae usually elongate and exceeding length of anterior apophyses, sometimes much shorter; a slender band of spicules often extending the length of ductus from antrum to corpus bursae. Signum absent.

DISCUSSION.—Meyrick (1938) proposed the monobasic genus *Syncopacma* on the same page as *Micrerethista*. Both the genus and species, *S. capnozona* Meyrick, have been found to be synonyms of *M. mochlacma* Meyrick, respectively. The descriptions of the latter preceded *Syncopacma* on the page, and thus, *Micrerethista* has priority. Irrespective of page priority, *Syncopacma* Meyrick (1938) is not available because it is a junior homonym of *Syncopacma* Meyrick, 1925 (Fletcher, 1939).

Diakonoff (1968) synonymized *Micrerethista* under *Harmaclona*, and this was followed by Robinson and Nielsen

(1993). I recognize *Micrerethista* as a valid genus on the basis of the following characters that are shared by all 11 recognized species and that serve to distinguish the group from *Harmaclona*: hindwing with the base of media undivided within the discal cell; gnathos present in the male genitalia; and signum

absent in the female. Another tendency apparent in most *Micrerethista* is for the ventral lobe of the valva to be more reduced than in *Harmaclona*. A possible twelfth species of *Micrerethista* from Borneo is briefly described herein but is not named.

Key to the Species of *Micrerethista*

(Based primarily on the male genitalia)

1. Aedoeagus of male simple, without apical spines [Figures 222, 228] and without basal midventral keel. Female with ductus bursae entirely membranous and without spicules 2
Apex of aedoeagus variously spined, with a few minute spines to clusters of large spines; midventral keel present at base [Figures 166, 184]. Ductus bursae with slender band of spicules extending down one side from antrum to corpus bursae [Figure 323] 5
2. Head predominantly fuscous, lightly irrorated with white. Forewing of similar fuscous color, lightly traversed by numerous fine, irregular pale gray lines creating a faint barred pattern [Figure 136] *M. fusca*, new species
General body color paler, mostly various shades of gray or light brown, finely irrorated with brown to fuscous, with irregular spots or fascia of light brown to fuscous across forewing [Figures 140–142] 3
3. Distribution Africa. Vinculum with anterior margin deeply concave on either side of saccus [Figure 211]; caudal margin convex. Ventral lobe of valva with rounded apex [Figure 213] *M. africana*, new species
Distribution Australia to Indonesia. Vinculum with anterior margin nearly truncate to broadly V-shaped; caudal margin nearly truncate. Ventral lobe of valva more acute [Figures 230–234] 4
4. Distribution Indonesia and New Guinea. Forewing pattern variable but with little or no barred pattern [Figures 140–142]. Anterior margin of vinculum variable, broadly V-shaped [Figure 224] to slightly concave. Base of aedoeagus cylindrical [Figure 229] *M. mochlacma*
Distribution Australia. Forewing distinctly barred with numerous, slender, brownish fascia [Figures 138, 139]. Anterior margin of vinculum nearly truncate [Figure 217]. Base of aedoeagus expanded [Figure 223] *M. fasciola*, new species
5. Male with ventral lobe of valva deeply divided at apex [Figure 171] *M. bifida*, new species
Apex of ventral lobe of valva acute to subtruncate, not divided 6
6. Male genitalia without distinct saccus *M. dissacca*, new species
Saccus present 7
7. Male with saccus bent sharply dorsad 90° to longitudinal axis of genitalia [Figure 164] *M. resima*, new species
Saccus mostly parallel to longitudinal axis 8
8. Aedoeagus with 1–3 pairs of small spines around phallosome [Figures 179, 181]. Saccus short and stout, length no more than 1.5× width [Figure 175] *M. denticulata*, new species
Aedoeagus with a pair of subapical, lateral spine clusters [Figure 185]. Saccus more slender, length at least 2× width 9
9. Aedoeagus with subapical spine clusters erect [Figures 185, 198]. Female with caudal margin of ostium deeply concave [Figure 324] *M. entripta*, new combination

- Subapical spines of aedoeagus more appressed. Caudal margin of ostium truncate or nearly so 10
10. Distribution Australia. Apex of forewing distinctly tipped with fuscous [Figure 134]. Subapical spines of aedoeagus relatively short, directed distad [Figures 188, 204]. Female with antrum moderately elongate-triangular [Figure 326] *M. nigrapex*, new species
- Distribution New Guinea. Forewing variably marked with brownish to fuscous streaks and spots but not dark tipped. Subapical spines of aedoeagus longer, directed more ventrad [Figures 192, 209]. Antrum shorter, more quadrate [Figure 328] *M. eustena*

***Micrereithista resima*, new species**

FIGURES 127, 163–168; Map 2

MALE (Figure 127).—Forewing length 8 mm.

Head: White, lightly irrorated with dark brown subapically banded scales; scales slender, mostly 3 or 4 dentate. Antenna 58-segmented, 0.5 the length of forewing; structure as described for genus. Labial palpus as described for subfamily.

Thorax: Dorsum probably as described for subfamily (largely denuded in holotype). Forewings partially rubbed but appearing mostly white with scattered irroration of brown to fuscous banded scales; a small patch of fuscous scales at apex of discal cell; termen predominantly fuscous, banded with white, becoming more white at tornus. Hindwing pale grayish brown.

Abdomen: As described for subfamily; coremata present.

FEMALE.—Unknown.

MALE GENITALIA (Figures 163–168).—Anterior margin of vinculum nearly truncate, slightly rounded, with a slender rim projecting anterior to base of saccus; saccus V-shaped, ~0.52 the length of valva, bent sharply dorsad 90° to longitudinal axis of genitalia; base of saccus with a narrow, transverse aperture opening ventrally (Figure 163); valva with dorsal lobe slender, width 0.15 its length, apex slightly upturned; ventral lobe 0.29 the length of dorsal lobe, fused with opposite member nearly their entire length; apex strongly melanized, nearly truncate. Aedoeagus with apex smooth except for a pair of minute short spines at lateral margins of phallotreme; phallotreme a circular apical opening; venter of distal 1/2 of aedoeagus mostly concave and membranous, becoming flatter toward base; ventral keel short, 0.22 the length of aedoeagus, but well-rounded ventrally; base of aedoeagus cylindrical and slightly compressed; ejaculatory duct not coiled.

HOLOTYPE.—♂; THAILAND: Nakhon Si Thammarat, Khao Luang N[atational] P[ark], Khao Bang Phra, 150 m, 18 Aug 1990, I. Kitching & A. Cotton, slide BMNH 27891, (BMNH).

FLIGHT PERIOD.—August (one record).

DISTRIBUTION (Map 2).—Known only from the type locality located in the province of Nakhon Si Thammarat in southern Thailand.

ETYMOLOGY.—The specific name is derived from the Latin *resimus* (turned up, bent back), in reference to the unique

position of the dorsally directed saccus in the male genitalia (Figure 164).

DISCUSSION.—This species and *M. denticulata* are the only *Micrereithista* known to occur in Thailand. The male genitalia of *M. resima* are the most apomorphic within the genus and show little affinity to any other species group. The aedoeagus resembles the *denticulata* group slightly in possessing minute apical spines on an otherwise smooth surface and a distinct ventral keel. The moderately concave ventral surface of the distal one-half of the aedoeagus in *M. resima* is unique. Other distinctive features are the sharply reflexed saccus, the ventral slit-like opening into the saccus (whose function is unknown), a slender rim-like extension of the vinculum (or possibly the sclerotized caudal margin of the eighth sternite) anterior to the base of the saccus, the medially fused ventral lobes of the valvae, as well as the strongly sclerotized, truncated rugosity of the apex of the ventral lobes.

***Micrereithista bifida*, new species**

FIGURES 128, 169–174; Map 2

MALE (Figure 128).—Forewing length 5.4–6.0 mm.

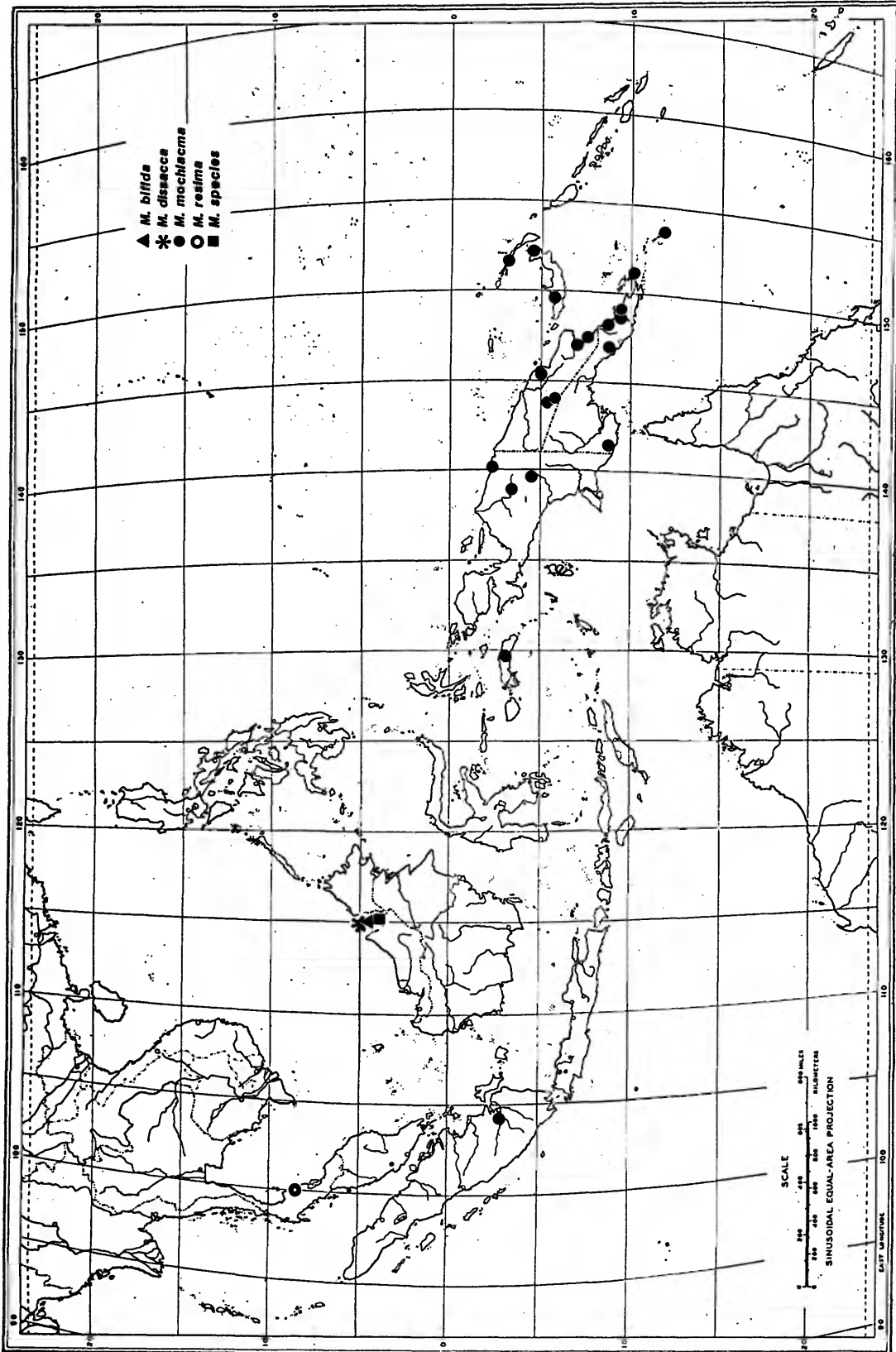
Head: Similar in color to *M. denticulata*. Antenna 48–58-segmented, 0.5 the length of forewing; flagellomeres bifasciculate. Labial palpus as described for subfamily.

Thorax: Similar in color to *M. denticulata*. Forewing white to pale gray, lightly irrorated with brownish fuscous tipped scales forming a lightly barred pattern; a conspicuous blackish, transverse spot at apex of discal cell, as well as a less distinct, more distal subterminal arch. Hindwing pale gray with pale golden luster.

Abdomen: Legs and abdomen as described for *M. denticulata*; coremata present on A8.

FEMALE.—Unknown.

MALE GENITALIA (Figures 169–174).—Anterior margin of vinculum V-shaped. Saccus short, ~0.25 the length of valva, tapering to an acute apex. Valva with dorsal lobe moderately slender, width ~0.3 its length; apex slightly upturned; ventral lobe ~0.5 the length of dorsal lobe. Aedoeagus with a single pair of small spines along dorsal rim of phallotreme; phallotreme extended anteroventrally ~2× the diameter of



MAP 2.—Distribution of *Micrerehista bifida*, *M. dissacca*, *M. mochlaema*, *M. resima*, and *M. species*.

aedoeagus; ventral keel slightly reduced, ~0.2 the length of aedoeagus; base of aedoeagus cylindrical and slightly compressed; ejaculatory duct not coiled.

HOLOTYPE.—♂; BRUNEI: Rampayoh River, 300 ft [90 m], 21–24 Sep 1992, G. Robinson, LP [= helicopter landing point] 195, GR [= grid reference] 960 785, lowland dipterocarp forest, slide BM 27886, (BMNH).

PARATYPES.—Same data as holotype: 1♂, slide BM 27890, (BMNH). Rampayoh R[iver], 300 ft [91.4 m]; 3♂, 11–19 Mar 1989, G. Robinson, LP 195, GR 960 785, slides BM 27901, 27904, USNM 31564, (BMNH, USNM).

FLIGHT PERIOD.—September (based upon only 5 specimens).

DISTRIBUTION (Map 2).—Known only from the type locality, a lowland dipterocarp forest along the Rampayoh River, Brunei.

ETYMOLOGY.—The specific name is derived from the Latin *bifidus* (forked, two-clefted) in reference to the apomorphic, furcate apex of the ventral lobe of the male valvae.

DISCUSSION.—Superficially this species is inseparable from *M. denticulata* and *M. dissacca*, with which it is also at least partially sympatric. The three species can be reliably separated only after genitalic examination. *Micrerethista bifida* is the only species of Harmacloninae in which the apex of the ventral (saccular) lobe of the male valva is divided. The aedoeagus of this species most resembles that of *M. denticulata* in possessing small subapical spines and a similar anteroventral extension of the phallotreme. The subapical spines are more removed from the rim of the phallotreme in *M. bifida* and consist of a single pair of approximately equal spines. The ventral keel is also more reduced in this species.

Micrerethista denticulata, new species

FIGURES 129–131, 175–184, 321, 322; Map 3

MALE (Figures 129–131).—Forewing length 4–7.8 mm.

Head: White to pale gray, heavily irrorated with dark brown to fuscous, subapically banded scales; scale apices 2 or 3 dentate. Antenna ~45–57-segmented, 0.4 the length of forewing; flagellum with dorsum entirely covered with broad white scales over basal 1/3, becoming grayish brown and more slender over distal 2/3; white scales slightly irrorated with dark apices; basal flagellomeres bifasciculate, with a pair of slightly raised tubercles ventrally, bearing a cluster of 5 or 6 elongate sensilla trichodea 1–2× diameter of flagellomere in length; apical flagellomeres gradually becoming more filiform over distal one-half. Labial palpus similar to head in color except covered laterally with more fuscous scales; 5–6 fuscous piliform scales arising laterally and concentrated around apex of second segment.

Thorax: Dorsum similar to head in color except darker, with more fuscous-tipped scales and a few scattered, pale golden brown scales; a raised cluster of more elongate, darker

scales on mesoscutellum. Venter similar to head in color. Forewing white to light gray with variably scattered, fuscous-tipped scales forming a barred or spotted pattern; costal area usually the palest, with heavier irroration of fuscous posterior (dorsal) to radius and with largest fuscous spot at distal end of cell; darker area usually with scattered, broad, pale golden brown scales; hind (dorsal) margin with a pair of small tufts near basal 1/3 and 2/3; fringe with series of fuscous banded, white scales and a single prominent, subterminal band. Hindwing paler, usually gray, sometimes with a pale golden luster. Legs as described for subfamily.

Abdomen: Pale grayish brown dorsally, irrorated with dark brown; venter white, less irrorated with dark-tipped scales. Coremata present on A8.

FEMALE.—Length of forewing 6–9.5 mm.

Head: Similar to male in color. Antenna ~52–59-segmented, 0.33 length of forewing; flagellum similar to male except not as fasciculate and with shorter sensilla trichodea, approximately equal in length to diameter of flagellomere.

Thorax: Similar to male in color pattern.

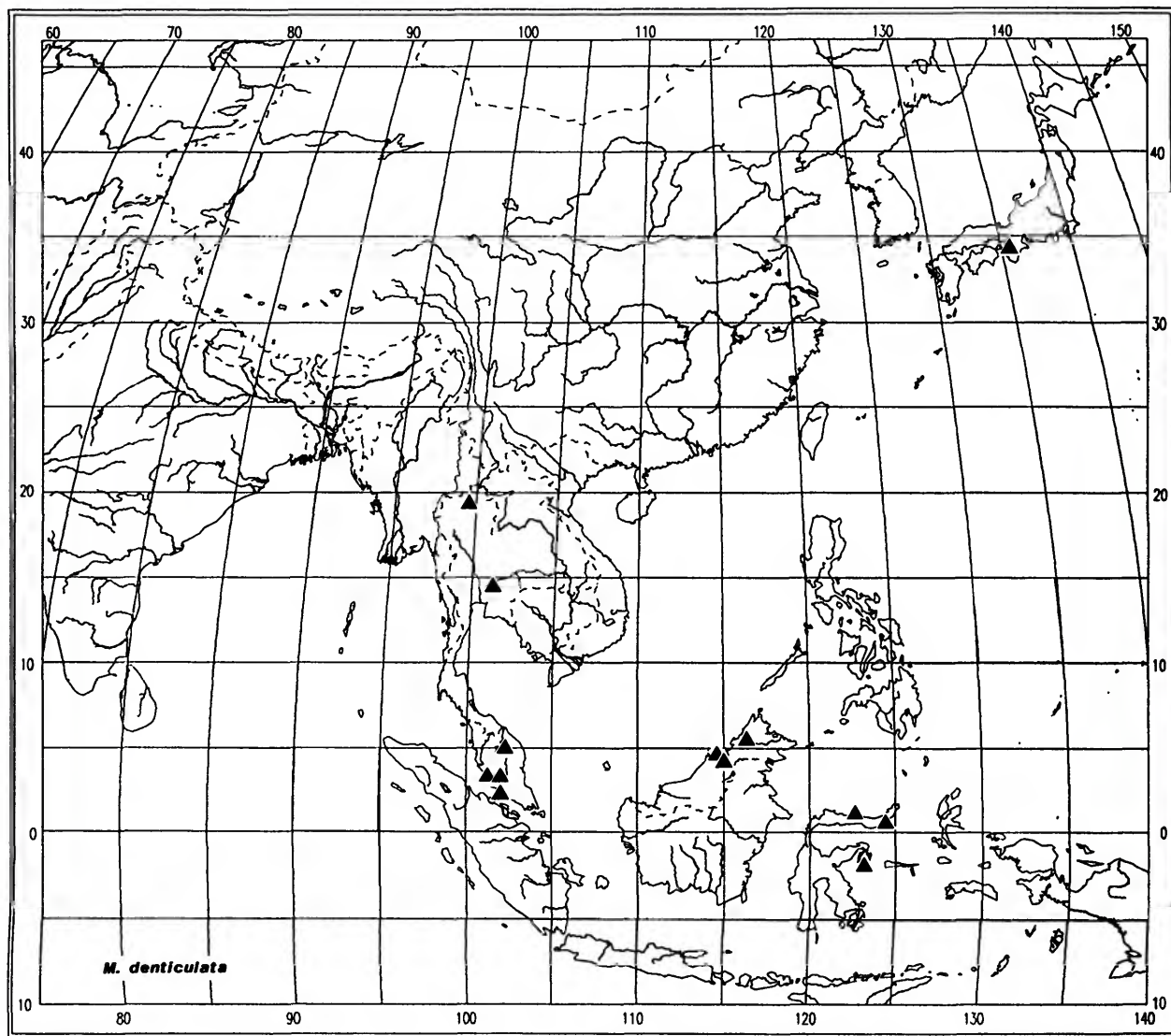
Abdomen: Similar to male in color except A7 entirely covered with long white scales that overlie dense, pale grayish corethrogyne.

MALE GENITALIA (Figures 175–180).—Anterior margin of vinculum slightly concave on either side of saccus, the latter usually slender, sometimes broad with width about 0.5 length; length ~0.15 the length of valva. Valva with dorsal lobe moderately slender at base, width less than 0.25 length; apex slightly upturned; ventral lobe ~0.55 the length of dorsal lobe. Aedoeagus with 1–3 pairs of minute spines along lateral rim of phallotreme; basal keel well developed, ~0.28 the length of aedoeagus; base of aedoeagus cylindrical; ejaculatory duct not coiled.

FEMALE GENITALIA (Figures 321, 322).—Ventral margin of ostium V- to U-shaped. Antrum gradually flared caudally, short, ~0.15 the length of entire ductus bursae, length nearly twice width; ductus bursae with a slender, linear band of spicules from below antrum to corpus, expanding in width near junction with corpus.

HOLOTYPE.—♂; THAILAND: Doi Pui, Chiang Mai, 1300 m, 1–4 Sep 1987, Moriuti, Saito, Arita, & Yoshiyasu, slide DRD 3917, (UOP).

PARATYPES.—BRUNEI: Bt Bedawan, 1700 ft [578 m]: 1♂, slide BM 26087, (BMNH). Labi Road at mile 5, 15 m: 1♂, 20 Dec 1979, R. Fairclough, secondary vegetation, (BMNH). Lamunin, Sg Burong, water tanks, 60 m: 1♂, 17–30 Sep 1992, G. Robinson, disturbed lowland forest, slide BM 27878, (BMNH). Mumong, 3 m: 1♂, 26 Nov 1979, R. Fairclough, secondary & coastal vegetation, slide BM 27617, (BMNH). Rampayoh R[iver], 300 ft [91.4 m]: 3♂, 1♀, 11–19 Mar 1989, G. Robinson, LP [= helicopter landing point] 195, dipterocarp forest, slides BM 26073, 27596, 27903, (BMNH); 150 ft [45.7 m]: 3♂, 1♀, 11–15 Apr 1988, G. Robinson, LP 291B, GR [= grid reference] 951 801, lowland dipterocarp forest, slide BM

MAP 3.—Distribution of *Micrerethista denticulata*.

27599, (BMNH). Telisai, 100 ft [30.5 m]: 5♂, 1♀, 13 Feb 1982, G. Robinson, kerangas forest, slides BM 27601, 27608, 27900, USNM 30829, (BMNH, USNM). INDONESIA: Sulawesi Utara: Danau Mooat, near Kotamobagu, 1200 m: 2♂, 1♀, 20–22 Oct 1985, Roy. Ent. Soc. Project Wallace, slides BM 27609, 27610, 27899, (BMNH). Dumoga-Bone National Park, “Clarke” Camp, 1140 m: 2♂, Mar 1985, 1♂, Oct 1985, lower montane forest, slides BM 27611, 27907, (BMNH); “Edwards” Camp, 664 m: 2♂, Mar 1985, slide BM 27635, 1♂, Oct 1985, lowland forest, (BMNH); G. Mogogonipa summit, 1008 m: 1♀, Oct 1985, slide USNM 30834, (USNM); “Hog’s Back” Camp, 492

m: 1♂, Oct 1985, slide BM 27613, (BMNH); Plot B, 300 m: 1♂, Sep 1985, lowland forest, slide BM 27615, (BMNH). Peleng Island, 1°20’S, 123°10’E, Luksag, 300 m: 1♂, 25 Feb–4 Mar 1986, S. Nagai, slide DRD 3719, (UOP). JAPAN: Honshu: Osaka Prefecture: Iwawakisan: 1♂, 24 Jul 1966, T. Saito, slide DRD 3721, (UOP). Mt. Makio: 1♂, 22 Jun 1982, K. Yasuda, slide 3860, (SMC); 1♀, 13 Aug 1979, K. Yasuda, slide DRD 3863, (SMC); 1♀, 14 Aug 1982, K. Yasuda, slide DRD 3864, (SMC). MALAYSIA: Kedah: Gunong Jerai, 950 m: 1♂, 15–17 Aug 1991, G. Robinson, upper montane podocarp forest with *Agathis*, (BMNH). Sabah: Gunong Monkobo, 116.56E, 5.48N,

975 m: 4♂, 7–13 Aug 1987, K. Tuck, dipterocarp forest, slides BM 26088, 27614, 27898, (BMNH). Lahad Datu, Danum Valley Field Centre: 1♂, 10–11 May 1989, K. Tuck, steep partly logged valley near 63 km marker, slide BM 27883, (BMNH). Selangor: Bangi, UKM Campus, 70 m: 1♂, 25–26 Jul 1991, G. Robinson, lowland dipterocarp forest, (BMNH). Fraser's Hill, Jeriau Road, 1140 m: 1♂, 5–12 Aug 1986, G. Robinson, slide BM 27616, (BMNH). Fraser's Hill, Gap, 850 m: 1♂, 2–3 Nov 1989, G. Robinson & M. Tobin, slide BM 27884, (BMNH). THAILAND: Chiang Mai: Doi Pui, 1300 m: 3♂, 1–4 Sep 1987, Moriuti et al., slides DRD 3861, USNM 29966, (UOP, USNM). Ranong: Na Kha, ~250 m: 1♂, 15 Oct 1985, Kuroko, Moriuti, Saito, and Arita, slide USNM 31770, (USNM).

FLIGHT PERIOD.—Adults have been collected in every month of the year except January and May. Collecting records from Japan include only the summer months, June, July, and August. In the more tropical portions of its range, the species probably flies every month.

DISTRIBUTION (Map 3).—This species ranges widely through southeast Asia from Thailand and Malaysia, eastward to Sulawesi, and north to Honshu, Japan.

ETYMOLOGY.—Derived from the Latin *denticulatus* (with small teeth), in reference to the small spines bordering the phallotreme.

DISCUSSION.—The principal apomorphy of this species, the denticulate phallotreme of the aedeagus, easily distinguishes it from most Harnacloninae. Males with reduced phallotreme teeth may resemble the smooth condition occurring in *Micrerethista mochlacma*, but the latter lacks the prominent, basal keel of the aedeagus present in *M. denticulata*. The aedeagus most resembles that of *M. bifida* and *M. dissacca*. These two species are easily recognized by other genitalic apomorphies—in particular, the bifid ventral lobe of the valva in *M. bifida* and the absence of a distinct saccus in *M. dissacca*. The female genitalia resemble *M. fasciola* but differ in possessing a proportionately longer ductus bursae.

Micrerethista dissacca, new species

FIGURES 126, 156–162; Map 2

MALE (Figure 126).—Forewing length 5.1 mm.

Head: Similar in color to *M. denticulata*. Antenna 47-segmented, 0.5 the length of forewing, flagellomeres bifasciculate. Labial palpus as described for subfamily.

Thorax: Similar in color to *M. denticulata*. Forewing white to pale gray, lightly irrorated with fuscous-tipped scales forming a lightly barred pattern similar to *M. bifida*; a distinct blackish, transverse spot at apex of discal cell, as well as a more irregular, dark subterminal arch distad to discal spot. Hindwing similar to *M. bifida*, pale gray with pale golden luster.

Abdomen: Legs and abdomen as described for *M. denticulata*; coremata present on A8.

FEMALE.—Unknown.

MALE GENITALIA (Figures 156–162).—Anterior margin of vinculum sinuate, with moderately broad, truncate, median region. Saccus absent. Valva similar to *M. denticulata*, with dorsal lobe moderately slender, width 0.25 its length; apex slightly upturned; ventral lobe subacute, bluntly rounded, 0.28 the length of dorsal lobe. Aedeagus with two pairs of largely fused, subapical spines laterally; phallotreme round with V-shaped melanization ventrally; ventral keel moderately short, ~0.2 the length of aedeagus, but projecting ventrally a distance equal to its length; anterior margin of keel flared laterally (Figure 162); ejaculatory duct not coiled.

HOLOTYPE.—♂; BRUNEI: Rampayoh River, 300 ft [90 m], 21–24 Sep 1992, G. Robinson, LP [= helicopter landing point] 195, GR [= grid reference] 960 785, lowland dipterocarp forest, slide BM 27886, (BMNH).

FLIGHT PERIOD.—September (based on a single specimen).

DISTRIBUTION (Map 2).—Known only from the type locality, a lowland dipterocarp forest along the Rampayoh River, Brunei.

ETYMOLOGY.—The specific name is derived from the Latin prefix *dis* (without) and *saccus* (sack), in reference to the apomorphic loss of a tubular saccus in the male genitalia.

DISCUSSION.—The only reliable means for distinguishing this species from either *Micrerethista bifida* or *M. denticulata* is by means of male genital characters. *Micrerethista dissacca* is the only harnaclonine to have lost the saccus and to possess a flanged ventral keel on the aedeagus (Figure 162). The subapical spines on the aedeagus also differ from those of either *M. denticulata* or *M. bifida* in being distinctly lateral and arising more distad from the phallotreme.

Micrerethista africana, new species

FIGURES 137, 211–216; Map 7

MALE (Figure 137).—Forewing length 5.5 mm.

Head: Similar in color and scale dentation to *M. denticulata*. Antenna 47-segmented, ~0.4 the length of forewing; color and structure similar to *M. denticulata*.

Thorax: Similar to *M. denticulata*, generally darker than head. Forewing generally dark brownish gray, faintly irrorated with white, becoming more white toward apex; costal margin mostly dark brownish fuscous, with a U- to V-shaped white band from cell to distal $\frac{2}{3}$ of costa; termen predominantly grayish white, with a more or less distinct fuscous band of dark, narrowly white-tipped scales around margin; fringe beyond fuscous band heavily suffused with paler brownish fuscous scales tipped with white. Hindwing similar in color to *M. denticulata*.

Abdomen: As described for subfamily except coremata absent as in *M. eustena*.

FEMALE.—Unknown.

MALE GENITALIA (Figures 211–216).—Tegumen and

vinculum with lateral and ventral margins more elongate, thus forming a broader ring around ventral $\frac{1}{2}$ of genital capsule (Figure 212); anterior margin of vinculum more deeply concave on either side of saccus than in *M. denticulata*. Saccus more slender, ~ 0.29 the length of valva. Valva with dorsal lobe relatively slender at base, width less than 0.4 its length; ventral lobe ~ 0.64 the length of dorsal lobe, with apex narrowly rounded. Aedoeagus without basal keel; apex a simple, smooth, tubular opening with a pair of elongate, piliform spines projecting; one pair possessing a minutely bifid apex (Figure 215).

HOLOTYPE.—♂; CENTRAL AFRICAN REPUBLIC: La Maboké, 3°54'N, 17°53'E, 10 Aug 1970, J. Boudinot, slide 3984, (MNHP).

FLIGHT PERIOD.—August (single record).

DISTRIBUTION (Map 7).—Known only from the type locality, which is in southwestern Central African Republic.

ETYMOLOGY.—The species name is derived from the Latin *Africanus* (African).

DISCUSSION.—The discovery of this unique specimen marks a major extension in the geographical range of the genus *Micrerethista*. This is the first record of the genus outside the southern Oriental–Australian regions. Superficially this species resembles *M. denticulata* in color and small size. It differs in lacking the coremata on A7 of the male (as does *M. eustena* from New Guinea) and in several features of the male genitalia, particularly the aedoeagus. The latter is similar to that of *M. mochlacma* in lacking a basal, midventral keel and in the absence of any apical, exogenous spines. The significance of the minute, piliform spines projecting from the phallotreme of *M. africana* will have to be evaluated after more males become available for study.

Micrerethista fasciola, new species

FIGURES 138, 139, 217–223, 331, 332; Map 4

MALE (Figure 138).—Forewing length 4.8–7.5 mm.

Head: As described for subfamily, mostly white, finely irrorated with fuscous; scales mostly 3 or 4 dentate. Antenna 51–55-segmented, 0.4–0.5 the length of forewing; basal $\frac{1}{4}$ – $\frac{1}{3}$ white irrorated with fuscous dorsally; apical $\frac{3}{4}$ – $\frac{2}{3}$ light golden brown; basal segments not distinctly bifasciculate, relatively smooth, but with paired clusters of elongate sensilla trichodea arising ventrally, ~ 1.2 – 1.4 the diameter of flagellomere.

Thorax: Dorsum white, heavily irrorated with brown and fuscous, with a prominent tuft of dark-tipped scales at caudal margin of mesoscutellum. Forewing partly white, densely traversed by multiple, irregular bands of pale golden brown and fuscous-tipped scales; fuscous scaling concentrated at wing base, basal $\frac{2}{5}$ and $\frac{3}{5}$, the latter two at same level as tufts on dorsal margin; apical $\frac{1}{3}$ of wing usually devoid of dark scaling but finely banded with light brown; fringe heavily irrorated

with fuscous and usually with a thin submarginal, fuscous line around termen. Hindwing uniformly light golden brown to gray. Legs as described for genus.

Abdomen: Light golden brown dorsally, white irrorated with light brown ventrally; coremata present.

FEMALE (Figure 139).—Forewing length 6.5–9.5 mm.

Head: Similar to male. Antenna 50–57-segmented, similar to male except with sensilla slightly shorter, ~ 0.75 – 1.0 the diameter of flagellomere in length.

Thorax: Similar to male in pattern; frenulum variable, usually with 2–3 slender bristles.

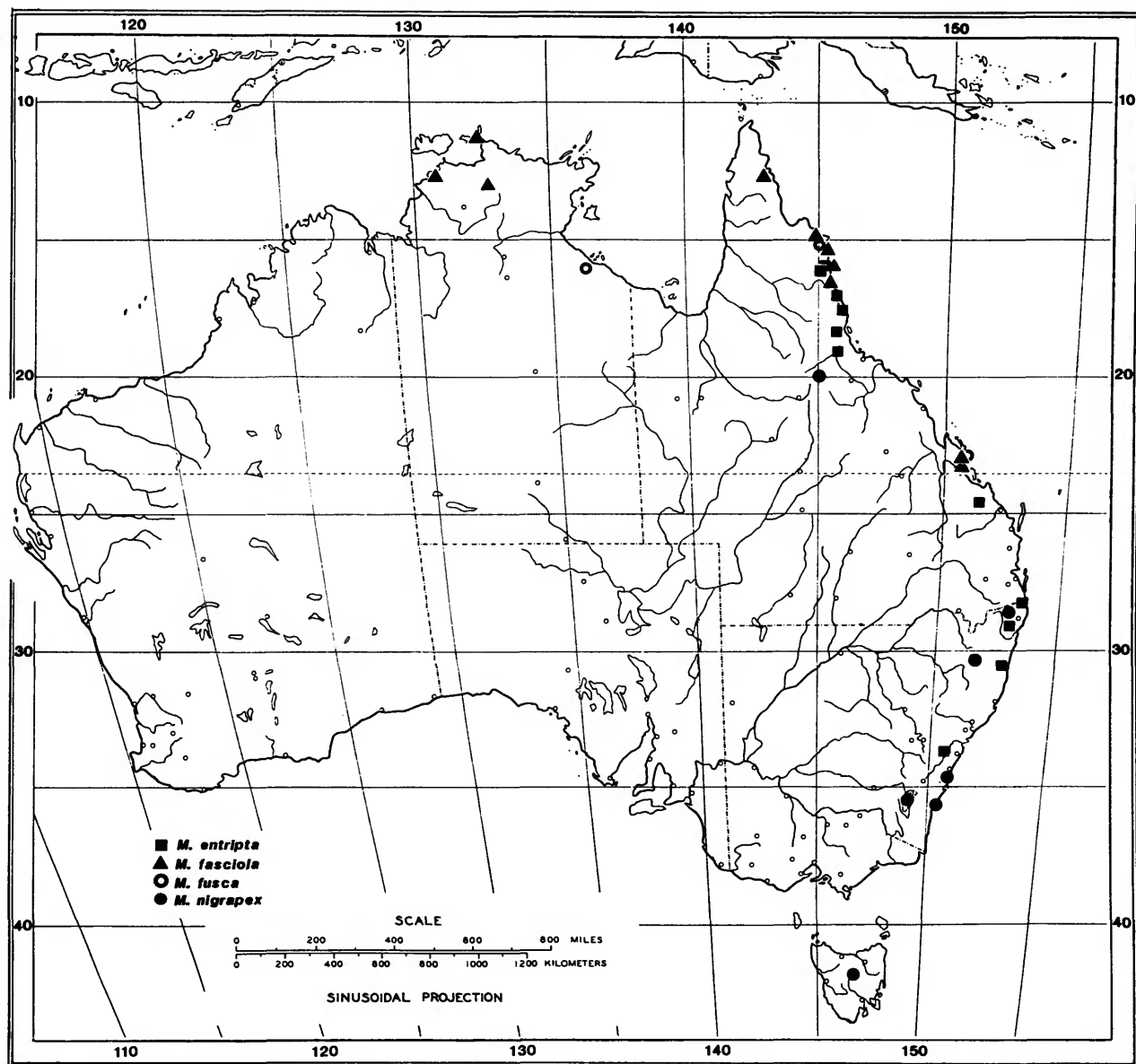
Abdomen: Similar to male in color except with long whitish scales over A7.

MALE GENITALIA (Figures 217–223).—Anterior margin of vinculum nearly truncate to sinuate, with short, slender, acute saccus; the latter ~ 0.14 the length of valva. Valva with dorsal cucullar lobe moderately broad and tapering to a subacute, nearly straight apex, lobe ~ 0.55 the length of valva; greatest width at base ~ 0.5 its length; ventral lobe ~ 0.57 the length of dorsal lobe. Aedoeagus simple, without subapical spines, similar to *M. mochlacma* except with base laterally flared to approximately twice the width of aedoeagus at midlength, roughly an inverted Y-shape; basal midventral keel absent; ejaculatory duct short, straight.

FEMALE GENITALIA (Figures 331, 332).—Caudal margin of ostium truncate. Antrum slightly V-shaped; length $\sim 1.5\times$ the width of aperture. Ductus bursae short, less than $\frac{1}{2}$ the length of anterior apophyses; spicules absent.

HOLOTYPE.—♂; AUSTRALIA: Moses Creek, 4 km N by E of Mt. Finigan, 15°47'S, 145°17'E, Queensland, 15 Oct 1980, E. Edwards, (ANIC).

PARATYPES.—AUSTRALIA: Northern Territory: Cobourg Peninsula, Black Point, 11°09'S, 132°09'E: 1♂, 1♀, 24–25 Jan 1977, E. Edwards, (ANIC). Cobourg Peninsula, Smith Point, 11°07'S, 132°08'E: 1♂, 26 Jan 1977, E. Edwards, (ANIC). East Alligator River, 1 km N of Cahills Crossing, 12°25'S, 132°58'E: 3♂, 31 Oct 1972, Common, Edwards, & Upton, slide ANIC 1036, (ANIC). Howard Springs, 16 mi [26 km] S of Darwin: 1♂, 4 Mar 1967, M. Upton, (ANIC). Humpty Doo: 1♀, 17 Feb 1959, E. Boarema, light trap, (ANIC); 1♀, 6 Apr 1959, I. Common, (ANIC). Queensland: Cairns: 1♀, Nov 1906, F. Dodd, (BMNH). Cape York, Bamaga: 1♂, 28 Mar 1964, Common & Upton, (ANIC). Cape York, Red Is. Point: 1♂, 29 Mar 1964, Common & Upton, (ANIC). Cooktown, 5 km SE by S of, 15°30'S, 145°16'E: 1♂, 19 May 1977, Common & Edwards, (ANIC). Cooktown, 29 km NW by N of, 15°75'S, 145°06'E: 1♀, 18 May 1977, Common & Edwards, slide ANIC 1038, (ANIC). Cooktown, Annan River, 3 km W by S of Black Mt.: 1♂, 27 Sep 1980, E. Edwards, (ANIC). Cooktown, 3 km S by W of, Keatings Gap, 19°30'S, 145°15'E: 3♂, 16 May 1977, Common & Edwards, slide USNM 30831, (ANIC, USNM). Cooktown, near, Shiptons Flat, 15°47'S, 145°14'E: 2♀, 18–19 Oct 1980, E. Edwards, (ANIC). Hope Vale Mission, 14 km W by N of, 15°16'S, 144°59'E: 1♂, 2♀, 8–10 Oct 1980, E.



MAP 4.—Distribution of *Micrerethista entripta*, *M. fasciola*, *M. fusca*, and *M. nigrapex*.

Edwards, slides ANIC 1037, USNM 31447, (ANIC, USNM). Kuranda, 16°49'S, 145°38'E: 1♂, 13 Sep 1977, I. Common, slide DRD 3982, (ANIC); 1♀, 13 Mar 1906, 1♀, 23 Sep 1906, 3♀, 2-11 Oct 1906, 3♀, 2-23 Nov 1906, 1♀, 5 Dec 1906, F. Dodd, slides BMNH 2558, 2559, 27636, (BMNH). Moses Creek, 4 km N by E of Mt. Finnigan: 1♀, 15 Oct 1980, E. Edwards, slide USNM 31782, (USNM). Mt. Webb National Park, 15°04'S, 145°09'E: 5♂, 29 Sep-3 Oct 1980, E. Edwards, slide DRD 3849, (ANIC). Quin Park, Claudia River, 12°43'S,

143°17'E: 1♀, 14 Feb 1985, Edwards & Hacobian, (ANIC). Rockhampton: 1♂, 17 Mar 1958, I. Common, (ANIC). Stuart, 1 mi [1.6 km] SSW of: 1♂, 20 Mar 1967, M. Upton, (ANIC). Yeppoon: 1♂, 18 Dec 1964, 1♂, 2 Jan 1965, I. Common, (ANIC).

FLIGHT PERIOD.—Adults have been encountered in most months of the year, with a relatively lengthy absence occurring from June through August.

DISTRIBUTION (Map 4).—This species is endemic within the

Torresian faunal province of Australia, with all records thus far limited to the Northern Territory and Queensland.

ETYMOLOGY.—The specific name is derived from the Latin *fasciola* (diminutive of *fascia*; band, stripe) in reference to the characteristic, finely banded condition of the forewings.

DISCUSSION.—The distinctly brownish banded forewings of this species along with its Australian distribution are usually sufficient for recognition. The male genitalia closely resemble those of its Papuan sister species, *M. mochlacma*, except for the broader base of the aedoeagus in *M. fasciola*. The female genitalia of these two species can be distinguished by the shorter ductus bursae of *M. fasciola*.

Micrerethista fusca, new species

FIGURES 136, 329, 330; Map 4

MALE.—Unknown.

FEMALE (Figure 136).—Forewing length 5.8–7.1 mm.

Head: Predominantly fuscous irrorated with white; scales variable, with one or more, broad subapical fuscous bands and with white bases and white apical margins, mostly 2–4 dentate; frons sometimes with more white scaling. Antenna 41–46-segmented, 0.3–0.4 the length of forewing; scape and dorsum of basal 5 or 6 flagellomeres similar to vertex in color, flagellum gradually becoming light brown over distal $\frac{3}{4}$; flagellum moniliform, with dense bands of sensilla trichodea ventrally, ~ 0.7 –1.0 the diameter of flagellomere in length. Labial palpus similar to vertex in color, with predominantly dark scales heavily banded with fuscous, except for entirely white dorsal scaling.

Thorax: Predominantly fuscous lightly irrorated with white toward scale bases. Forewing predominantly dark gray to fuscous with multiple, narrow, irregular bands of pale gray to white traversing wing from base to apex; fringe mostly fuscous, finely irrorated with pale gray to white. Hindwing gray, with basal area and fringe slightly paler gray. Fore- and midlegs mostly fuscous finely irrorated with pale gray to brown. Hindleg with femur and tibia predominantly light golden brown; tarsal segments more heavily irrorated with fuscous.

Abdomen: Light fuscous irrorated with pale gray dorsally, more grayish white ventrally and over A7.

FEMALE GENITALIA (Figures 329, 330).—Caudal margin of ostium convex. Antrum U-shaped; length $\sim 1.25\times$ the greatest width. Ductus bursae short, approximately $\frac{1}{2}$ the length of anterior apophyses; antrum subquadrate, slightly tapered anteriorly; linear band of spicules absent.

HOLOTYPE.—♀; AUSTRALIA: Yeppoon [near Rockhampton], Queensland, 4 Dec 1964, I. Common, slide DRD 3869, (ANIC).

PARATYPES.—AUSTRALIA: Northern Territory: Borroloola, 12 km NNE of, 15°58'S, 136°21'E: 1♀, 1 Nov 1975, E. Edwards, (ANIC). Queensland: Hope Vale Mission, 7 km N of, 15°14'S, 145°07'E: 1♀, 4 Oct 1980, E. Edwards, slide USNM

31780, (USNM). Yeppoon [near Rockhampton]: 1♀, 14 Dec 1964, I. Common, (ANIC).

FLIGHT PERIOD.—Adults have been collected only from the first of November to the middle of December.

DISTRIBUTION (Map 4).—This species is endemic within the Torresian faunal province of Australia, with all records limited to the coasts of the Northern Territory and Queensland.

ETYMOLOGY.—The specific name is derived from the Latin *fusca* (dark, dusky), in reference to the generally dark color of the adult.

DISCUSSION.—Except for its overall darker color, the fine reticulate banding of this species resembles that of *M. fasciola*. Females of these two species can be distinguished by the more quadrate antrum and convex caudal margin of the ostium in the genitalia of *M. fusca*. Discovery of the male should reveal more evidence to link this species to the *mochlacma* group.

Micrerethista mochlacma Meyrick

FIGURES 5, 140–142, 224–234; Map 2

Micrerethista mochlacma Meyrick, 1938:527.—Diakonoff, 1955:132.—Robinson and Nielsen, 1993:236.

Syncopacma capnozona Meyrick, 1938:527 [new synonymy].—Robinson and Nielsen, 1993:237.

MALE (Figures 140–142).—Forewing 6–14 mm.

Head: Mostly white, lightly irrorated with subapically dark brown banded scales; scales slender, predominantly 2 or 3 dentate. Antenna 58–66-segmented, 0.4–0.5 the length of forewing; color and structure as described for *M. fasciola*.

Thorax: Dorsum as described for *M. fasciola*. Forewing variably marked, white with varying amounts of brown to fuscous irroration, often in small concentrations to impart general barred pattern; a large fuscous spot sometimes present along basal $\frac{1}{3}$ of hind margin; irregular transverse bands of brown less commonly present at distal $\frac{1}{3}$; pattern on apical $\frac{1}{5}$ of forewing either continuous and similar to basal portion or sometimes forming an ocellate pattern as follows: a conspicuous, transverse, usually concave, fuscous subapical bar near termination of discal cell; immediately distal to latter, another more continuous, concave, fuscous fascia tends to largely outline a small to large, white apical spot (Figure 141); fringe with two tiers (rows) of white to light brown scales tipped with dark brown to fuscous. Hindwing uniformly cream to brown with a slight golden iridescence.

Abdomen: Light golden brown to medium brown dorsally, white irrorated with light brown ventrally; coremata present.

FEMALE.—Unknown.

MALE GENITALIA (Figures 224–234).—Anterior margin of vinculum moderately variable, slightly concave to V-shaped, with short, slender to slightly tapered saccus, the latter ~ 0.13 –0.15 the length of valva. Valva variable (Figures 226, 230–234); dorsal lobe moderately broad to slender, greatest width 0.3–0.37 the length of lobe, apex subacute to moderately

rounded; ventral lobe 0.2–0.57 the length of dorsal lobe. Aedeagus simple, without subapical spines; apex round to subacute, with sclerotized rim of phallosome deeply divided ventrally approximately $\frac{1}{2}$ length of aedeagus; base cylindrical, not flared laterally as in *M. fasciola*, without ventral keel; ejaculatory duct relatively short, not coiled.

HOLOTYPE.—♂; PAPUA NEW GUINEA: Mafulu, 4000 ft [1220 m], (BMNH), (*M. capnozona*).

LECTOTYPE.—♂; PAPUA NEW GUINEA: Mt. Tafa, 8500 ft [2590 m], (BMNH), (*M. mochlacma*).

FLIGHT PERIOD.—Adults apparently fly throughout the year.

DISTRIBUTION (Map 2).—This species may range widely through the Indonesian archipelago from western Sumatra to New Britain. Most records are from New Guinea where *M. mochlacma* occurs from near sea level to over 2600 meters. Until further collecting substantiates the sole record from Sumatra, the latter will remain questionable.

MATERIAL EXAMINED.—INDONESIA: Irian Jaya: Cyclops Mts, Sabron, Camp 1, 1200 ft [370 m]: 1♂, 15 May 1936, L. Cheesman, slide BMNH 27603, (BMNH). Kuala Kencana, near sewage plant, PTFI plot 6, 100 m: 1♂, 13 Mar 1997, S. Miller et al., mercury vapor light, lowland rainforest, (BPBM). Mist Camp [21 km SW Bernhard Camp], 1800 m: 2♂, 12–15 Jan 1935, L. Toxopeus, (RMNH). Mt. Goliath, 4°40'S, 139°52'E, 5000–7000 ft [1520–2130 m]: 1♂, Meek, slide BMNH 19339, (BMNH). Seram: Kanikeh base camp, 850 m: 1♂, Aug–Sep 1987, J. Holloway and D. Jones, bamboo and secondary forest, slide BMNH 27892, (BMNH). [?] Sumatra: Lebong Tandai (western Sumatra), 2°59'S, 104°23'E: 1♂, 1920–1923, B. Brooks, slide BMNH 2223, (BMNH). PAPUA NEW GUINEA: Central District: Mt. Tafa, 8°30'S, 147°11'E, 8500 ft [2590 m]: ♂ (lectotype), Mar 1934, L. Cheesman, slide BMNH 2504, (BMNH). East New Britain District: Mt. Sinewit, 4°39'S, 151°59'E, 3500 ft [1070 m]: 4♂, 27 Jun–17 Sep 1963, W. Brandt, slides DRD 3793, 3794, 3852, 3867, (ANIC). Madang District: Madang, Brahman Mission, 200 m: 5♂, 11–15 Oct 1992, V. Becker, slides USNM 31445, 31448, (USNM). Kau Wildlife Area, Baitabag Village, 11 km NW of Madang, 40 m: 2♂, 3 May 1994, J. Somp, slide DRD 3998, (BPBM). Milne Bay District: Normanby Island: Wakaiuna, Sewa Bay: 1♂, 23 Oct 1956–11 Jan 1957, W. Brandt, slide DRD 3854, (ANIC). Sudest Island [= Tagula Island], 11°30'S, 153°30'E, Mt. Riu, 2000 ft [610 m]: 1♂, Apr 1916, Eichhorn Bros., slide BMNH 2223, (BMNH). Morobe District: Buso, coast: 1♂, 20 Sep 1979, J. Martin, slides BMNH 26260, 27604, (BMNH). Morobe, Biaro Road, 2000 m: 1♂, 25 Sep 1992, slide USNM 31446, (USNM). New Ireland District: New Ireland, Lelet Plateau, Schleinitz Mts., 3000 ft [910 m]: 3♂, 2 Oct–15 Dec 1959, W. Brandt, slides DRD 3797, 3858, 3866, (ANIC). Northern District: Hydrographer Mts., 8°55'S, 148°20'E, 2500 ft [760 m]: 1♂, Jan–May, 1918, Eichhorn Bros., slide DRD 3855, (CU). Kumusi River, 8°28'S, 148°15'E: 1♂, A. Meek, slide BMNH 27602, (BMNH). Mufulu [? Mafuia], 9°4'S, 149°6'E, 4000 ft [1220 m]: ♂ (holotype, *M. capnozona*), Dec

1933, L. Cheesman, (BMNH). Western District: Rouku, Morehead River: 1♂, 19 Mar–23 May 1962, W. Brandt, slide DRD 3853, (ANIC). Western Highlands District: Kandep, 8000–8500 ft [2440–2590 m]: 1♂, 23 Dec 1961–14 Feb 1962, W. Brandt, slide USNM 30826, (USNM). Mt. Hagen Range, Murrumbidgee Pass, 8700 ft [2650 m], 5°52'S, 144°13'E: 2♂, 27 Oct–20 Dec 1961, W. Brandt, (ANIC). Western New Britain District: Talesea [sic, probably Talasea], 5°27'S, 149°40'E: 4♂, 25 Feb 1925, AFE, slides BMNH 2208, 2660, 2664, (BMNH).

DISCUSSION.—Notable variation is evident among the predominantly New Guinean specimens currently assigned to *M. mochlacma*, particularly in their forewing pattern and in the structure of the male valva. Some specimens resemble the lectotype of *M. mochlacma* (Figure 140) in possessing varying manifestations of a subapical ocellate spot on the forewing (Figure 141). This pattern gradually disperses to a more uniformly marked forewing like that of the holotype of *M. capnozona* (Figure 142). Similarly, both lobes of the valvae display an unusual range in relative length and width (Figures 226, 230–234). No correlation among the observed variation was noted in the moderately large sample examined. In this typically homogenous-appearing subfamily, the male genitalia, especially the aedeagus, provide the most diagnostic characters for species distinction. Because the aedeagus in the *mochlacma* complex exhibit strong uniformity, only one species, including the synonymized *M. capnozona*, is recognized in this complex.

Another phenomenon that cannot be explained at present is the absence of females within what would appear to be a moderately large ($n = 35$) and diverse (geographically and chronologically) series. Possibly the flight activity of the female differs from that of the male.

The sister species of *M. mochlacma* is the Australian *M. fasciola*. In addition to its more uniform, banded pattern, *M. fasciola* differs in possessing a broader base to the aedeagus.

One of the syntypes of *M. mochlacma*, erroneously sexed as a female, was found to be a male of *M. eustena*.

Micrerethista entripta (Meyrick), new combination

FIGURES 132, 133, 185–187, 194–198, 323, 324; Map 4

Mesopherna entripta Meyrick, 1917:88.—Fletcher, 1933:80 [synonym of *Ptychoxena tephrantha* Meyrick].—Bradley, 1953a:66.

Harmaclona entripta (Meyrick).—Robinson and Nielsen, 1993:242.

MALE (Figure 132).—Forewing length 6–10.5 mm.

Head: As described for subfamily; scales mostly 3–5 dentate. Antenna 55–58-segmented, 0.5 the length of forewing; dorsum of basal $\frac{1}{3}$ white irrorated with fuscous, apical $\frac{2}{3}$ brown; darker annuli not evident; basal $\frac{1}{3}$ of flagellomeres bifasciculate, with elongate sensilla trichodea $\sim 1.25 \times$ diameter of flagellomere.

Thorax: Light gray, heavily irrorated with fuscous. Forewing generally pale whitish gray, especially along costal $\frac{1}{2}$ and

around subterminal area, with remaining areas from apex of discal cell to wing base usually darker gray; entire wing usually overlaid with a dense scattering of small, dark gray to fuscous transverse spots, often imparting a barred pattern; as many as 12 spots spaced along costal margin; termen with a narrow, dark gray border, with 4 or 5 fuscous spots usually discernible; fringe gray with dark fuscous-tipped scales. Hindwing uniformly light gray. Legs as described for genus.

Abdomen: Pale buff dorsally, white ventrally, sometimes with slightly darker suffusion or irroration; coremata present.

FEMALE (Figure 133).—Forewing length 8.4–13 mm.

Head: Similar to male in color. Antenna similar to male in color and segmentation but with flagellomeres smoother, not bifasciculate; sensilla trichodea shorter, less than diameter of flagellomere in length.

Thorax: Similar to male in color pattern; frenulum consisting of two slender bristles.

Abdomen: As described for genus; similar to male in color except with elongate whitish scales over A7.

MALE GENITALIA (Figures 185–187, 194–198).—Anterior margin of vinculum concave on either side of short, slender saccus, the latter ~0.13 the length of valva. Valva with dorsal lobe very slender, ~0.5 the length of valva; greatest width of lobe at base ~2.2 its length; apex of dorsal lobe rounded, slightly upcurved; ventral lobe ~0.8 the length of dorsal lobe. Aedoeagus with a dense cluster of 9–11 subapical spines arising laterally and perpendicular (Figures 185, 186, 198); midventral groove extending ~0.5 the length of aedoeagus (Figures 185, 198); basal midventral keel well developed and rounded; ~0.31 the length of aedoeagus; ejaculatory duct curved, not spiraled.

FEMALE GENITALIA (Figures 323, 324).—Caudal margin of ostium deeply concave. Antrum U- to V-shaped, slightly longer than broad. Ductus bursae elongate, as long or longer than anterior apophyses, slender, with a dense lining of spicules extending throughout most of length; spicules largely restricted to one side in anterior 1/2 of ductus.

LECTOTYPE.—♀; AUSTRALIA: Cairns, (BMNH).

FLIGHT PERIOD.—Adults have been collected in every month of the year except February, June, July, August, and December.

DISTRIBUTION (Map 4).—Largely endemic to the Torresian faunal province of Australia, particularly the eastern borders of New South Wales and Queensland, from near sea level to 1500 m.

MATERIAL EXAMINED.—AUSTRALIA: New South Wales: Dorrigo National Park: 2♀, 18 Mar 1969, V. Robinson, (ANIC). Mt. Keira: 1♂, 9 Jan 1964, V. Robinson, (ANIC). Richard Range S. F., Cambridge Plateau, Casino: 1♂, 8 Mar 1986, 1♂, 5 Apr 1987, east, Willan, Badans & Hacobian, (ANIC). Upper Allyn River, 1500 ft [450 m]: 1♀, 11 Nov 1960, Common & Upton, (ANIC). Queensland: Cairns: 1♀ (lectotype), Oct 1906, F. Dodd, slide BM 2214, 1♀ (paralectotype),

Nov 1906, F. Dodd, slide BM 2237, (BMNH). Bulburin State Forest, Many Peaks: 2♂, 2–5 Apr 1972, S. Monteith, slide DRD 3938, (ANIC); via Many Peaks, Forest Station, 2000 ft [609.6 m]: 1♂, 2–5 Apr 1972, S. Monteith, slide DRD 3982, (ANIC). Cooktown, 3 km NE of Mt Webb, 15°03'S, 145°09'E: 1♂, 2 Oct 1980, E. Edwards, (ANIC). Near Cooktown, Shiptions Flat: 1♂, 17 Oct 1980, E. Edwards, slide USNM 30827, (USNM). Coolangatta: 1♀, 18 Apr 1915, (BMNH). Hope Vale Mission, 14 km W by N of: 3♂, 8–9 Oct 1980, E. Edwards, slide USNM 31444, (ANIC, USNM). Kuranda: 1♀, 11 Sep 1906, F. Dodd, slide BM 27605, (BMNH): 2♀, Oct 1906, F. Dodd, slide H33, (ANIC). Kuranda, 1 mi [1.6 km] E of: 1♂, 1♀, 2 May 1955, I. Common, slide USNM 31781, (ANIC, USNM). Kuranda, 2.5 km N of: 2♀, 11 Sep 1985, I. Common, (ANIC). Mission Beach, near Tully: 1♀, 24–28 Nov 1967, R. Dobson, (ANIC). 3 km W of Mission Beach: 1♀, 1 Sep 1985, I. Common, (ANIC). Moses Creek, 15°47'S, 145°17'E, 4 km N by E of Mt. Finnigan, 360 m: 2♂, 4♀, 14–15 Oct 1980, E. Edwards, slides ANIC 1131, 1132, DRD 3871, (ANIC). Mossman, 3 mi [4.8 km]: 1♂, 17 Apr 1964, Common & Upton, slide ANIC 1415, (ANIC). Mt. Bellenden-Ker, Base Cableway, 17°14'S, 145°54'E, 80 m: 3♂, 1♀, 17–29 Oct 1981, E. Edwards, (ANIC). Centre Peak, 17°16'S, 145°51'E, 0.5 km WSW of Mt. Bellenden-Ker, 1500 m: 1♂, 2 Nov 1981, E. Edwards, (ANIC). Lower slopes, Mt. Bellenden-Ker, 17°16'S, 145°53'E, 500 m: 1♂, 21 Oct 1981, E. Edwards, (ANIC). Mt. Webb National Park, 15°04'S, 145°07'E: 2♂, 29 Sep 1980, E. Edwards, (ANIC). National Park, 3000 ft [914.4 m]: 1♂, 3 Apr 1921, 1♀, 3 May 1929, slides H31, H32, (ANIC). Paluma, 6 km NW by W of, Birthday Creek, 18°59'S, 146°10'E: 1♂, 25 Sep 1980, E. Edwards, (ANIC).

DISCUSSION.—The most diagnostic features of this species are the relatively elongate, erect spines arising laterally below the apex of the aedoeagus and the more slender, sinuate dorsal (cucullar) lobe of the valva. The female of *M. entriptia* differs from both *M. nigrapex* and *M. eustena* in the more deeply concave margin of the ostium (Figure 324).

Micrerethista nigrapex, new species

FIGURES 134, 188–190, 199–204, 325, 326; Map 4

MALE.—Forewing length 7–10.8 mm.

Head: As described for subfamily; scales mostly 3 or 4 dentate. Antenna 56–65-segmented, 0.5 the length of forewing; dorsum of basal 1/3 white with narrow subapical ring of fuscous, irrorated with fuscous over scape; apical 2/3 mostly brown; basal segments not distinctly bifasciculate, relatively smooth, but with paired clusters of elongate sensilla trichodea arising ventrally, ~1–1.2 the diameter of flagellomere.

Thorax: White, densely but finely irrorated with fuscous. Forewing similarly marked, with mostly white scales possessing narrow, subapical bands of fuscous, thereby imparting a predominantly uniform, pale grayish appearance to most of

wing under low magnification; largely fuscous to black scales concentrated along termen and fringe and lightly scattered over remainder of wing, sometimes creating a faint barred pattern; costal spots generally indistinct. Hindwing uniformly light gray. Legs as described for genus.

Abdomen: Pale buff dorsally, white and finely irrorated with fuscous ventrally; coremata present.

FEMALE (Figure 134).—Forewing length 8–10.2 mm.

Head: Similar to male. Antenna similar to male but with sensilla much more reduced, ~0.5 the diameter of flagellomere in length.

Thorax: Similar to male in color pattern; frenulum consisting of two slender bristles.

Abdomen: Similar to male in color except with long whitish scales slightly suffused with gray over A7.

MALE GENITALIA (Figures 188–190, 199–204).—Anterior margin of vinculum concave on either side of short, stout saccus, the latter ~0.21 the length of valva. Valva with dorsal lobe moderately slender, ~0.4 the length of valva; greatest width of lobe at base ~0.4 its length; apex of lobe tapered and slightly upcurved; ventral lobe ~0.75 the length of dorsal lobe. Aedoeagus with a dense cluster of 10–13 subapical spines arising laterally and directed caudad (Figures 188, 189, 203, 204); midventral groove greatly reduced to absent (Figure 188); basal midventral keel well developed, longer than high, length ~0.34 the length of valva; base of aedoeagus cylindrical; ejaculatory duct curved, not spiraled.

FEMALE GENITALIA (Figures 325, 326).—Caudal margin of ostium subtruncate, indistinctly concave. Antrum V-shaped, sometimes slightly constricted immediately within aperture; length ~2–3× width. Ductus bursae very elongate, ~2–2.5× the length of anterior apophyses, with a dense band of spicules extending down one side of ductus to corpus bursae.

HOLOTYPE.—♂; AUSTRALIA: Depot Beach, 10 mi [16 km] NE of Bateman's Bay, New South Wales, 6 Jan 1968, I. Common, (ANIC).

PARATYPES.—AUSTRALIA: Australian Capital Territory: Black Mt.: 2♂, 5–14 Feb 1955, I. Common, light trap, (ANIC). Five Fords, Condor Creek, 2500 ft [760 m]: 2♂, 5 Feb 1958, I. Common, slide ANIC 1127, (ANIC). Lee's Springs, 1 mi [1.6 km] N of: 1♂, 30 Jan 1957, I. Common, (ANIC). New South Wales: Bateman's Bay: 1♂, 12 Jan 1969, V. Robinson, (ANIC); Same data as holotype: 1♂, slide USNM 31771, (USNM). Minnamurra Falls: 1♂, 10 Dec 1972, V. Robinson, (ANIC). Mt. Keira: 1♂, 31 Jan 1964, V. Robinson, (ANIC). Mt. Keira, Wollongong: 2♂, 20–22 Dec 1980, J. Powell, (UCB). Wiangaree State Forest: 1♀, 26 Jan 1977, Hacobian, Robinson, and Goodman, slide ANIC 1128, (ANIC). Wilton, CSIRO Experimental Farm: 1♂, 21 Jan 1974, 1♂, 26 Jan 1978, 1♂, 6 Feb 1964, V. Robinson, slide ANIC 1130 W, (ANIC). Queensland: Evelyn Scrub, Huberton Hills: 1♂, 2♀, 21–29 Dec 1910, slides BM 2242, 2246, 2247, (BMNH). Tasmania: Mt. Nelson, 200 m: 1♀, 14 Jan 1981, P. McQuillan, slide USNM 31769, (USNM).

FLIGHT PERIOD.—In contrast to the other members of this genus that occur in more tropical, moist habitats, this species appears to be strongly seasonal and has only been collected from December 10 to February 14.

DISTRIBUTION (Map 4).—Restricted mostly to the Bassian Province of southeastern Australia, from southern Queensland south to Tasmania.

ETYMOLOGY.—The species name is derived from the Latin *nigra* (black, dark) and *apex* (top), in reference to the characteristically dark-tipped forewings of this species.

DISCUSSION.—*Micrerethista nigrapex* is most allied to another Australian species, *M. entripta*, as evidenced by several shared characters of the male and female genitalia: in particular, the presence of subapical spines and the relatively large basal keel of the aedoeagus and the elongate ductus bursae with spicules restricted to a linear band. It is easily distinguished from *M. entripta* by the shorter length, more appressed and different (caudal) orientation of the aedoeagal spines, the reduction of the midventral aedoeagal groove, and by the more truncate margin of the ostium. Undamaged specimens of *M. nigrapex* can be recognized superficially by their dark-tipped but otherwise relatively uniform, grayish forewings.

Micrerethista eustena Diakonoff

FIGURES 6, 13, 14, 37, 40–43, 58–61, 135, 191–193, 205–210, 327, 328; Map 5

Micrerethista eustena Diakonoff, 1955:133.

MALE (Figure 135).—Forewing length 7–15 mm.

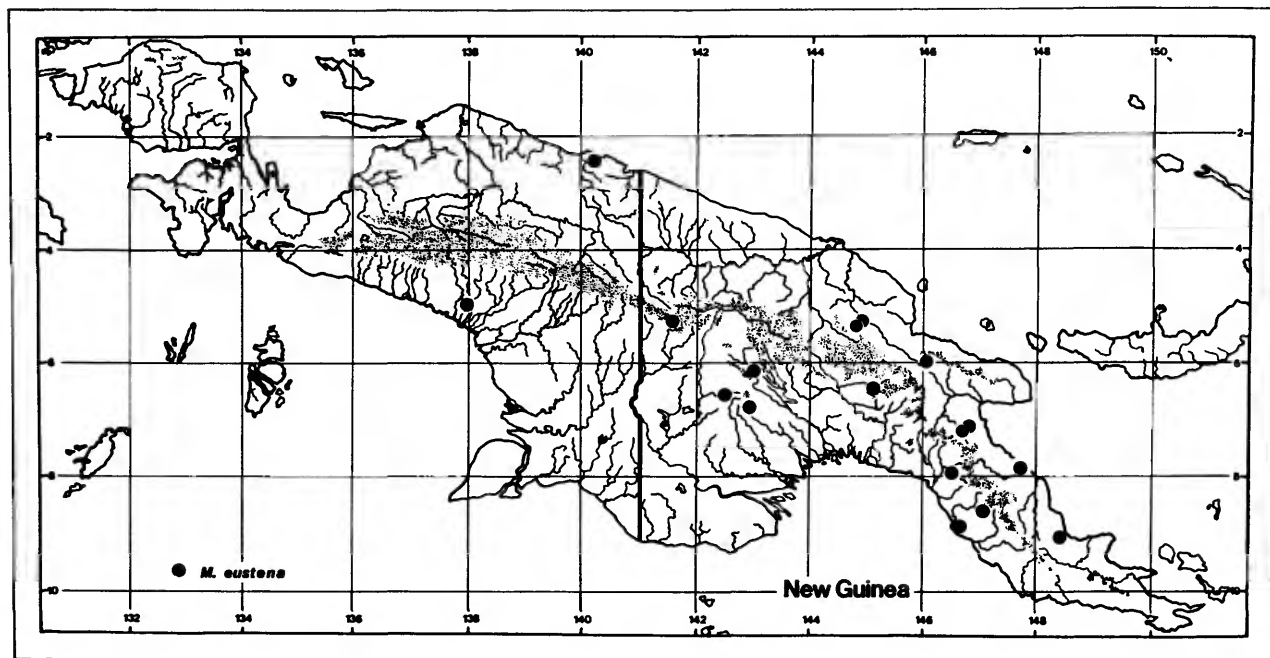
Head: As described for subfamily; scales 2–4 dentate. Antenna 54–60-segmented, 0.4 the length of forewing; dorsum of basal $\frac{1}{4}$ white, lightly irrorated with fuscous; apical $\frac{3}{4}$ brown; slightly bifasciculate over basal $\frac{1}{3}$; sensilla trichodea elongate, 1.0–1.5× the diameter of flagellomere in length.

Thorax: Variably marked, usually white irrorated with fuscous, sometimes heavily suffused with dark brown. Forewing slender, usually with largely white to light gray costal area with up to five costal spots on distal fourth; caudal $\frac{1}{2}$ of wing including discal cell darker gray with scattered, small, often transverse spots of fuscous, frequently imparting a barred pattern; a small to large, sometimes diffused, fuscous spot usually evident at apex of discal cell; termen sometimes bordered with fuscous but less so than in *M. nigrapex*; fringe often suffused with dark brown to fuscous. Hindwing light gray, usually with pale golden brown luster. Legs as described for subfamily.

Abdomen: As described for subfamily except coremata absent on A8; pale grayish white dorsally, white ventrally.

FEMALE.—Forewing length 7–15.5 mm.

Head: Similar to male in color. Antenna similar to male in color and segmentation but with flagellomeres filiform and with sensilla trichodea short, less than diameter of flagellomere in length.



MAP 5.—Distribution of *Micrereithista eustena*.

Thorax: Similar to male in color pattern. Frenulum consisting of three bristles.

Abdomen: As described for genus; similar to male in color.

MALE GENITALIA (Figures 191–193, 205–210).—Anterior margin of vinculum concave before tapering to short saccus, the latter ~ 0.14 the length of valva. Valva with dorsal lobe elongate and slender, ~ 0.6 the length of valva; greatest width of lobe at base ~ 0.25 its length; ventral lobe ~ 0.61 the length of dorsal lobe. Aedoeagus with 6–8 elongate subapical spines arising laterally and curving ventrad (Figures 192, 209); basal midventral keel well-developed, ~ 0.29 the length of aedoeagus; base of aedoeagus cylindrical; ejaculatory duct spiraled, with 6–14 tight coils.

FEMALE GENITALIA (Figures 327, 328).—Caudal margin of ostium nearly truncate. Antrum subquadrate, nearly as broad as long, tapering slightly anteriorly, then truncate, very short, length less than 0.04 the length of ductus bursae. Ductus bursae with a dense lining of spicules from caudal $\frac{1}{7}$ into corpus bursae; spicules restricted to one side of ductus from midlength to corpus.

HOLOTYPE.—♂; INDONESIA: Sigi Camp, 1500 m, Irian Jaya, (RNHL).

FLIGHT PERIOD.—Adults have been collected in every month of the year except November, indicating that this species flies throughout the year, at least at some localities.

DISTRIBUTION (Map 5).—Known only from New Guinea, at elevations from ~ 365 to nearly 2600 m.

MATERIAL EXAMINED.—INDONESIA: Irian Jaya: Camp 1, 1200 ft [365 m], Sabron, Cyclops Mts: 1♂, 1♀, 15 May 1936, L. Cheesman, slide BM 2680; Camp 2, 2000 ft [600 m]: 2♂, Jun 1936, slide BM 2225; 5♂, 5♀, Jul 1936, L. Cheesman, slides BM 2220, 2221, 2238, 2662, 2681, 2683, (BMNH). Sigi Camp, 1500 m: 1♂ (holotype), 1♀ (allotype), 19 Feb 1939, L. Toxopeus, slides 1148, 1149, (RNHL). Waigeu Camp Nok, 2500 ft [760 m]: 3♂, 1♀, Apr 1938, at light, (BMNH). PAPUA NEW GUINEA: Central District: Mt. Tafa, 8°38'S, 147°11'E, 8500 ft [2590 m]: 1♂ (♀ [sic] syntype of *M. mochlacma*), Mar 1934, L. Cheesman, slide BMNH 2529, (BMNH). Eastern Highlands District: Daulo Pass, 8000 ft [2440 m]: 1♂, 22 Jul 1974, E. Classey, (BMNH). Mt. Michael, Frigano, 7000 ft [2130 m]: 1♂, 26–29 Jun 1974, slides USNM 31185, 31186, (USNM). Madang District: Gabumi, 2000 ft [610 m], Finisterre Range: 1♂, 1♀, 23 Jun–21 Jul 1958, W. Brandt, slide DRD 3856, (ANIC). Morobe District: Morobe, Biaro Road, 2000 m: 6♂, 1♀, 25 Sep 1992, V. Becker, PNG 2332, (VOB, USNM). Wau, 1200 m: 1♂, 1–10 Aug 1983, S. & P. Miller, montane forest, (USNM); 1♂, 8–14 Dec 1976, Hevel & Dietz, Mer. vapor light, slide USNM 29890, (USNM); 1♀, 5 Jun 1962, J. Sedlaek, Mer. vapor trap, (BPBM); 1000 m: 2♂, 1♀, 17–30 Sep 1992, V. Becker, PNG 1014, (VOB, USNM); 6 km NE Wau Airport, S slope Mt. Missim, 1050 m: 1♂, 22 Feb 1990, Orsak & Somp, at black light, slide DRD 3803, (BPBM). Northern District: Augobunga [?Augobunga] River, affl. of St. Joseph River, 8°50'S, 146°34'E, 6000 ft [1830 m] upwards: 1♂,

Nov 1904–Feb 1905, (BMNH). Biagi, Mambre [Mambare] River, 8°05'S, 146°34'E, 5000 ft [1520 m]: 1♂, 1 Apr 1906, A.S. Meek, (BMNH). Hydrographer Mts., 8°55'S, 148°20'E: 2♂, Feb 1918, Eichhorn Bros., slide BMNH 2222, (BMNH); 2500 ft [760 m]: 2♀, Jan–May 1918, Eichhorn Bros., slides DRD 3870, 3999, (CU). Southern Highlands District: Ambus Lodge, 6700 ft [2040 m], near Tari: 2♂, 2–11 Jan 1986, D. Agassiz, slide BM 27593, (BMNH). Bosavi, 2300 ft [700 m]: 1♂, 6 Jan 1986, D. Agassiz, (BMNH). Lake Kutubu, 2800 ft [850 m]: 1♂, 15 Jan 1986, D. Agassiz, slide USNM 30830, (USNM). Tari, 5300 ft [1620 m]: 1♂, 17 Jan 1986, D. Agassiz, (BMNH). Tari, near: 1♂, 11 Jan 1986, D. Agassiz, (BMNH). West Sepik District: Telefomin (Feramin), 5°8'S, 141°31'E, 4700 ft [1430 m]: 1♂, 2 May–18 Jun 1959, W. Brandt, slide DRD 3859, (ANIC). Western Highlands District: Jimi River, 4700 ft [1430 m]: 1♂, 2♀, 16 Jul–21 Sep 1961, W. Brandt, slides DRD 3795, 3796, 3868, (ANIC). Kandep, 8000–8500 ft [2440–2590 m]: 3♂, 23 Dec 1961–14 Feb 1962, W. Brandt, slide DRD 3857, (ANIC).

DISCUSSION.—The most reliable characters for distinguishing this species are the ventrally directed, subapical spines of the male aedeagus, accompanied by the tightly coiled ejaculatory duct, and the short, nearly quadrate antrum of the female genitalia. Of particular significance is the absence of coremata on A8, this species being one of two members of the subfamily to have lost these organs in the male, the other being *M. africana* from the Central African Republic. *Micrerethista eustena* also differs significantly from its nearest allies, *M. entripta* and *M. nigrapex*, in distribution, with the latter two restricted to eastern Australia and *M. eustena* endemic to New Guinea.

Micrerethista species

FIGURES 15–17, 143, 333, 334; Map 2

At least one other undescribed species of *Micrerethista* is known from the island of Borneo (Malaysia) in addition to *M. bifida*, *M. denticulata*, and *M. dissacca*. Unfortunately, this is represented by a single female with partially denuded wings (Figure 143). It was collected in lower montane forests, 1000 m, at site 14 February Camp 2.5, in Gunong Mulu National Park, Sarawak, 1977–1978, by J.D. Holloway et al. (BMNH). The forewings are 9 mm in length and, although worn, still display a prominent, transversely elongate fuscous spot at the apex of the discal cell. In contrast to the weakly bifasciculate to mostly filiform antennal segments of other female *Micrerethista*, the basal segments of this specimen are more bipectinate (or strongly bifasciculate) (Figures 15–17). The female genitalia (Figures 333, 334, slide BMNH 26082) most resemble those of the *entripta* species group, especially the Australian *M. nigrapex*, but differ in having a proportionately shorter ovipositor (segments A8 to A10 in particular) and a less abruptly tapered antrum (Figure 334). Similar to other members of the *entripta* species group, the ductus bursae of this

species contains a linear band of spicules extending the length of the tube.

Because of the relatively poor condition of this unique specimen, it has not been named. Possibly this represents the opposite sex of one of the species currently known only from males (e.g., *M. resima*).

Harmaclona Busck

Harmaclona Busck, 1914:63 [type species: *Harmaclona cossidella* Busck, 1914:63, by original designation].—Walsingham, 1914:354.—Fletcher, 1929:104.—Bradley, 1953a:62.—Diakonoff, 1968:272.—Nye and Fletcher, 1991:142.—Davis, 1992:5, 63.—Robinson and Nielsen, 1993:236.

Ptychoxena Meyrick, 1916:615 [type species: *Ptychoxena tephrantha* Meyrick, 1916:615, by monotypy].—Fletcher, 1929:192.—Bradley, 1953a:62 [synonym of *Harmaclona*].—Diakonoff, 1955:132; 1968:272 [synonym of *Harmaclona*].—Nye and Fletcher, 1991:263.—Davis, 1992:63.—Robinson and Nielsen, 1993:236.

ADULT.—Forewing length 5.3–18 mm.

Head: Vestiture as described for subfamily. Antenna 40–70-segmented; flagellomeres of basal $1/3$ – $1/2$ shortly bipectinate in male, bifasciculate to filiform in female, with distal $1/2$ – $2/3$ predominantly filiform in both sexes; basal flagellomeres usually with spherical sensory cavities.

Thorax: Forewing usually with base of media simple within discal cell; rarely with rudimentary fork (Figure 8). Hindwing with medial vein forked within cell; M1 and M2 usually separate or connate, stalked in *H. hilethera* (Figure 7); CuA2 absent in *H. hilethera*. Frenulum absent in New World females, consisting of 2–5 bristles in Old World females.

Abdomen: As described for subfamily.

MALE GENITALIA.—Vinculum usually abruptly constricting to form slender saccus, more gradually tapering in *H. tephrantha* and *H. robinsoni*. Saccus short to long, 0.25–1.0× the length of valva. Gnathos absent. Apotheca well developed, 0.24–0.8 the length of valva. Ventral (saccular) lobe of valva well developed, ranging from 0.84 to 1.05 the length of dorsal (cucular) lobe. Aedeagus often with midventral keel at base, keel secondarily reduced or absent in several species; apex variably spined, with an elongate, strap-like extension (vitta) from dorsal rim of phallosome in *H. afrotephrantha* and *H. tephrantha*.

Female Genitalia: Largely as described for subfamily. Ductus bursae completely membranous, without spicules. Corpus bursae with a single, elongate signum in the form of a spinose ridge (Figures 320, 337).

DISCUSSION.—Demonstrating a broad pantropical distribution, *Harmaclona* is the more widespread of the two genera in the subfamily. Its members are distinguished from *Micrerethista* by the forking of the medial vein within the discal cell, the absence of the gnathos in the male genitalia, and by the presence of a signum in the female. In addition, the ventral lobe of the valva in the male genitalia is usually more developed than in *Micrerethista*.

The New World species are characterized in part by the loss

of the frenulum in the female, which is present in all Old World species of both genera. My earlier statement, that the frenulum was absent in all female *Harmaclona* (Davis and Heppner, 1987), was a generalization based upon a study of only New World material. I did not state that a frenulum was absent in both sexes of *Harmaclona* as reported by Robinson and Nielsen (1993).

The male aedoeagi of *H. afrotaphrantha* and *H. tephrantha* are unusual in possessing a long ribbon-like, spinose process distal to the phallotreme (Figures 245, 258, 311, 312). Philpott (1928) figured a similar but more filamentous process, which he termed the "vitta," arising from the left distal apex of several New Zealand Carposinidae.

The morphology of the female genitalia in *Harmaclona* generally shows more homogeneity than in *Micrerethista*, with the result that it may not be possible to identify all females. The known American species are distinguishable from one another on the basis of structural details within the antrum and caudal lobes of sternum VIII. The caudal lobes of the neotropical species are similar as a group in being nearly contiguous. Females of both south Asian *Harmaclona* are likewise distinctive, with the setose lobes of sternum VIII reduced and widely separated. The sole African species with associated females, *H. natalensis*, possesses the shortest antrum in the genus and is very similar to the Asian species in having the setose lobes of VIII reduced and widely separated.

Key to the Species of *Harmaclona*

(Based primarily on the male genitalia)

1. Distribution Old World. Male genitalia with well developed apotheca equalling or exceeding length of saccus [Figures 235, 236]. Female with 2-4 frenular bristles 2
 Distribution New World. Male genitalia with apotheca reduced, less than one-half the length of saccus [Figure 290]. Female lacking frenular bristles 8
2. Distribution southern Asia. Vinculum gradually narrowing to saccus [Figures 235, 241] 3
 Distribution Ethiopian. Vinculum abruptly narrowing, often slightly concave on either side of juxta [Figure 259] 4
3. Aedoeagus with elongate vitta from apex of aedoeagus [Figures 245, 311]. Saccus short, ~0.25 the length of valva. Female genitalia with caudal margin of ostium convex [Figure 338]; antrum elongate, ~0.3 the length of entire ductus bursae *H. tephrantha*
 Aedoeagus without vitta [Figure 238]. Saccus elongate, ~0.5 the length of valva. Caudal margin of female ostium concave [Figure 336]; antrum shorter, less than 0.2 the length of ductus bursae *H. robinsoni*, new species
4. Apex of aedoeagus minutely bifid 5
 Apex of aedoeagus acute or rounded 7
5. Apical region of aedoeagus slightly expanded laterally [Figure 263]. Anellus elongate, with deep ventral cleft [Figure 259] *H. berberea*
 Apical region of aedoeagus not expanded, with sides parallel. Anellus shorter, more tubular [Figure 265] 6
6. Apex of aedoeagus convex between lateral processes [Figure 276]. Valva with distal lobes broad [Figure 273] *H. natalensis*
 Apex of aedoeagus concave between lateral processes [Figure 269]. Valva with slender distal lobes [Figure 267] *H. malgassica*
7. Apex of aedoeagus with elongate slender vitta [Figure 258]. Anellus a short tube without caudal processes [Figure 253] *H. afrotaphrantha*, new species
 Apex of aedoeagus broadly acute, without vitta [Figure 282]. Anellus with a pair of elongate caudal processes [Figure 277] *H. hilethera*
8. Caudal margin of male anellus concave, not deeply lobed [Figure 289]. Apex of aedoeagus with two pairs of elongate, ventrally directed spines [Figure 293] *H. tetracantha*, new species
 Anellus with a pair of long, caudal lobes [Figures 283, 303]. Apex of aedoeagus variously armed with other than two pairs of spines 9

- 9. Apical region of aedoeagus with two pairs of moderately broad, lateral spines and one pair of broad, dorsal spines [Figure 288] *H. hexacantha*, new species
Aedoeagus with fewer than three pairs of apical spines 10
- 10. Apex of aedoeagus with a pair of long, usually bicuspid spines [Figure 300]. Apex of ventral (saccular) lobe of valva more rounded [Figure 297]. Female genitalia with caudal end of antrum abruptly flared [Figure 344] *H. triacantha*, new species
Apex of aedoeagus subtruncate, only slightly produced at lateral angles [Figure 318]. Apex of ventral lobe of valva with a small irregular knob [Figure 305]. Antrum gradually broadened at caudal end [Figure 346] *H. cossidella*

***Harmaclona robinsoni*, new species**

FIGURES 144, 235–240, 314–316, 335, 336; Map 6

MALE (Figure 144).—Forewing length 5.3–8.5 mm.

Head: Vestiture similar to *H. tephrantha*. Antenna 45–55-segmented, 0.4–0.5 the length of forewing; vestiture of antenna and labrum as described for *H. tephrantha*; basal 5 or 6 flagellomeres with spherical sensory cavities.

Thorax: Vestiture of thorax and wings similar to *H. tephrantha* but with faint barred pattern of forewing usually more evident than longitudinal streaks.

Abdomen: Legs and abdomen as described for *H. tephrantha*.

FEMALE.—Forewing length 6.2–8.4 mm.

Head: As described for male. Antenna ~0.4 the length of forewing, 47–58-segmented, otherwise similar to female *H. tephrantha*.

Thorax: Similar to male in color and pattern; frenulum usually with 2, rarely up to 5 bristles.

Abdomen: Similar to female *H. tephrantha*.

MALE GENITALIA (Figures 235–240, 314–316).—Tegumen broad, tapering gradually to narrowly rounded apex. Vinculum broadly V-shaped as in *H. tephrantha*, gradually narrowing to elongate saccus, the latter ~0.5 the length of valva. Apotheca well developed, ~0.8 the length of valva. Dorsal lobe of valva slender, length ~3–4× width; ventral lobe ~2.7× the width at base and 0.9× the length of dorsal lobe, tapering to moderately broad triangular apex. Aedoeagus with dorsal rim of apex subacute, not extended as in *H. tephrantha*, typically with a single pair, rarely two pairs, of short, dorsal spines and 2–5 pairs of smaller, lateral spines; midventral keel absent.

FEMALE GENITALIA (Figures 335, 336).—Ventral margin of ostium slightly concave. Antrum shorter and tapered more gradually than in *H. tephrantha*, ~0.18 the length of entire ductus. Signum a narrow elliptical plate bearing 1 or 2 irregular rows of 12–15 minute spines.

HOLOTYPE.—♂; BRUNEI: Bt Bedawan, 1700 ft [518.2 m], 20–24 Apr 1988, G. Robinson, LP [helicopter landing point] 263, GR [grid reference] 343 958, ridge dipterocarp forest, slide BM 26092, (BMNH).

PARATYPES.—BRUNEI: Badas, 50 ft [15.2 m]: 1♂, 25 Feb

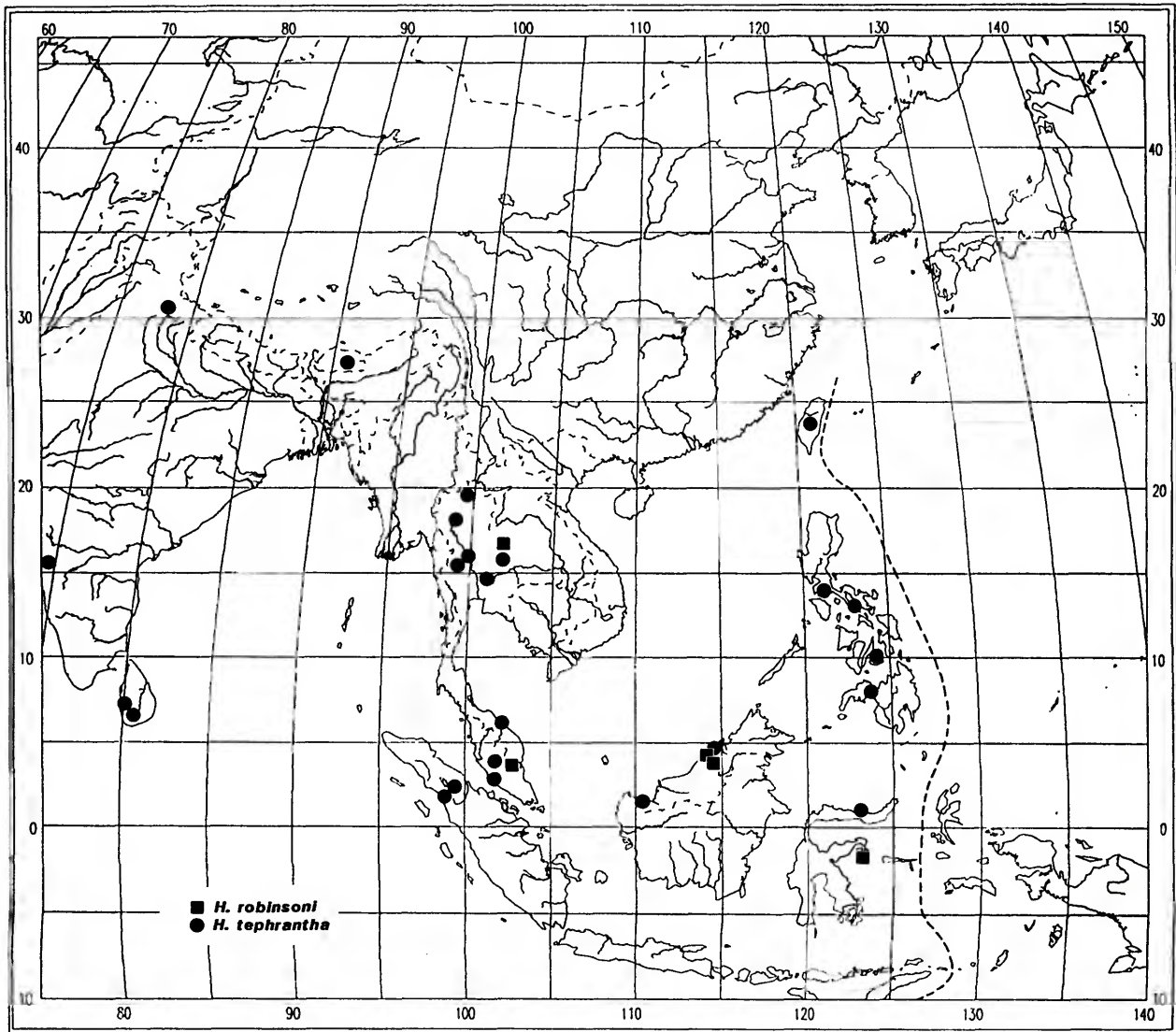
1982, G. Robinson, swamp forest and secondary vegetation, slide BM 27600, (BMNH); 100 ft [30.5 m]: 5♂, 25–26 Feb 1982, G. Robinson, *Agathis* forest, slide BM 26075, (BMNH); same data: 1♂, slide USNM 31193, (USNM). Same data as holotype: 2♂, slides BM 27628, 27629, (BMNH). Rampayoh R[iver], 300 ft [91.4 m]: 9♂, 4♀, 11–19 Mar 1989, G. Robinson, LP 195, GR 960 785, lowland dipterocarp forest, slides BM 26081, 27597, 27621, 27623, 27905, 27906, (BMNH). Rampayoh River (north), 400 ft [121.9 m]: 1♂, 1–3 Mar 1982, G. Robinson, LP 195, lowland forest, slide BM 27595, (BMNH). Seria, 20 ft [6.1 m]: 1♂, 11 Feb 1982, G. Robinson, coastal swamp forest, slide BM 26086, (BMNH). WEST MALAYSIA: West Pahang: Genting Tea Estate, 2000 ft [609.6 m]: 1♂, 28 Aug 1976, slide BM 26089, (BMNH). EAST MALAYSIA: Sarawak: Gunong Mulu Nat. Park, site 14, camp 2.5, 1000 m: 1♂, Feb 1978, J. Holloway et al., slide BM 26076, (BMNH). Santubong Mt, 300 m: 1♀, 9 Sep 1981, Oxford Far East Exp., slide BM 27627, (BMNH). INDONESIA: Sulawesi: Pelang I., Luksag, ~300 m: 1♂, 25 Feb–4 Mar 1986, S. Nagai, slide DRD 3719, (UOP). THAILAND: Chaiyapumh Dist.: Phu Khiao, 800 m: 1♂, 2–4 May 1986, M. Allen, slide BM 26090, (BMNH).

FLIGHT PERIOD.—Adults have been collected in almost every month from February through September, suggesting that this stage may be active throughout the year.

DISTRIBUTION (Map 6).—This species ranges west of Weber’s line from Malaysia and Thailand east through Indonesia to Brunei.

ETYMOLOGY.—This species is named in honor of Gaden S. Robinson who, as a result of his extensive fieldwork in southeast Asia over the past decade, has collected much of the Asian material examined in this study.

DISCUSSION.—*Harmaclona robinsoni* is easily distinguished from its sister species, *H. tephrantha*, on the basis of male and female genital characters. Of greatest significance is the absence of a vitta, a chitinous, apical extension of the aedoeagus beyond the phallosome, which is well-developed in *H. tephrantha*. The aedoeagus of *H. robinsoni* also lacks the basal keel that is present in a reduced state in *H. tephrantha*. The female antrum is also diagnostic in being less elongated and more tapered in *H. robinsoni* (Figure 336). Size difference



MAP 6.—Distribution of *Harmaclona robinsoni* and *H. tephrantha*. Weber's line indicated by dash marks.

between the two species is significant, although the forewing lengths of the males and probably the females do overlap.

Harmaclona tephrantha (Meyrick)

FIGURES 18–23, 145, 146, 241–252, 309–313, 337, 338; Map 6

Ptychoxena tephrantha Meyrick, 1916:616.—Turner, 1923:192.—Fletcher, 1929:192; 1933:80.

Harmaclona tephrantha (Meyrick).—Bradley, 1953a:65.—Diakonoff, 1968:273.—Davis, 1992:64.—Robinson and Nielsen, 1993:236.—Davis, 1994:117.—Robinson et al., 1994:33.—Robinson and Tuck, 1996:9.

MALE (Figures 145, 146).—Forewing length 7–14 mm.

Head: Vestiture white, irrorated with subapically dark brown banded scales; scale apices 3–6 dentate. Antenna ~47–56-segmented, 0.3–0.4 the length of forewing; scape smoothly scaled dorsally, rough ventrally; flagellum with dorsum of basal $\frac{1}{3}$ covered with white scales irrorated with subapically dark brown banded scales; distal $\frac{2}{3}$ covered dorsally with more slender brownish scales; entire venter devoid of scales; each flagellomere bifasciculate, with a pair of raised tubercles ventrally, bearing a cluster of elongate sensilla trichodea (Figures 19, 20) slightly exceeding diameter of flagellomere; fascicula and sensilla gradually becoming

more reduced toward apex of antenna; basal 5 flagellomeres with spherical sensory cavities. Labial palpus moderately smooth scaled, same color as head except covered laterally with more elongate, dark fuscous scales mostly tipped with white and a few erect, fuscous, piliform scales projecting mostly laterally.

Thorax: Dorsum similar in color to head; a small cluster of more elongate erect scales on mesoscutellum. Venter entirely white or irrorated with dark brown as in head. Forewing pattern variable, usually white to pale gray, irrorated with dark brown tipped or subapically banded scales; costal area often lighter, with 4–5 minute, fuscous spots usually evident along distal $\frac{1}{4}$ to apex; discal area usually appearing darker, more heavily irrorated with brown to fuscous from base of wing through discal cell sometimes to termen; numerous small clusters of broad, pale golden brown scales scattered through discal streak; dark-tipped scales tending to form either a faint barred pattern or 1–3 longitudinal, mostly interrupted streaks; a small, transverse dark spot usually present at apex of discal cell; hind (dorsal) margin with a small tuft of dark-tipped scales near basal $\frac{1}{3}$; apex of wing beyond cell often with 2 or 3 short, transverse dark bars across radial veins; termen usually with a dark fuscous terminal band; fringe with a dark fuscous basal band and a broader, usually paler, distal band consisting of slender, multibanded scales. Hindwing paler, light gray, slightly darker, more brown along margin. Legs mostly white irrorated with fuscous except for forelegs that are mostly dark brownish fuscous to black; dorsum of mid- and hindlegs more darkly irrorated, predominantly white ventrally and medially.

Abdomen: Dorsum white to gray, heavily irrorated with brown to fuscous-tipped scales; venter mostly white, with less dark irroration; A8 with long white scales largely covering genitalia.

FEMALE (Figure 146).—Length of forewing 10–16 mm.

Head: Similar to male in color. Antenna ~61–67-segmented, 0.33 the length of forewing; scape similar to male; flagellum smoother, not fasciculate, with basal $\frac{1}{3}$ covered dorsally and ventrally with slender, mostly white to cream scales; venter with short sensilla trichodea less than diameter of flagellomere in length.

Thorax: Similar to male in color and pattern. Frenulum consisting of two bristles.

Abdomen: Similar to male in color except A7 entirely covered by long white scales that overlie dense, light brownish corethrogyne.

MALE GENITALIA (Figures 241–249, 309–313).—Tegumen broad, caudal apex either tapering gradually or abruptly. Vinculum broadly V-shaped, anterior margin not concave; saccus relatively short, ~0.25 the length of valva. Apotheca well developed, ~0.55× the length of valva. Dorsal lobe of valva slender, tapering slightly to broadly rounded apex; ventral lobe approximately twice the width at base and 0.94× the length of dorsal lobe, gradually tapering to a slender uncinete to broadly triangular apex. Aedoeagus with dorsal rim

of apex greatly extended into an elongate, laterally spinose vitta (Figures 245, 309–312), 0.3–0.4 the length of tubular base; dorsal keel greatly reduced in height, ~0.22 the length of aedoeagus.

FEMALE GENITALIA (Figures 337, 338).—Ventral margin of ostium distinctly convex. Antrum cylindrical, elongate, ~0.3 the length of entire ductus bursae. Signum a narrow elliptical plate bearing an irregular row of 20–35 minute spines.

LECTOTYPE.—♂; SRI LANKA: Maskeliya, (BMNH).

HOST.—Anacardiaceae: *Buchanania latifolia* Rozb., (Fletcher, 1933).

FLIGHT PERIOD.—Adults have been collected in 9 of the 12 months of the year. They probably fly nearly every month at some localities.

DISTRIBUTION (Map 6).—Widely distributed west of Weber's line through southern Asia in generally lowland (0–1300 m), mixed forests from northern India south to Sri Lanka, eastward through Thailand and Indonesia as far as Sulawesi and the Philippines. Because of their biogeographical significance, literature records from Bhutan (Meyrick, 1916) and India (Dehra Dun; "Sambarni" [= Sâmbârâni, North Kanara, 15°15'N, 74°46'E], Fletcher, 1933) were also plotted on Map 6 even though no specimens from these localities were examined during this study.

MATERIAL EXAMINED.—BRUNEI: Badas, 100 ft [30.5 m]: 1♂, 25–26 Feb 1982, G. Robinson, *Agathis* forest, slides BM 27625, 27641, (BMNH). Bt Bedawan, 1700 ft [520 m]: 1♂, 20–24 Apr 1988, G. Robinson, LP [= helicopter landing point] 263, dipterocarp forest, slide BM 3798, (BMNH). Mumong, 3 m: 2♂, 26 Dec 1979, R. Fairclough, secondary coastal vegetation, (BMNH). Rampayoh River (north), 400 ft [120 m]: 1♂, 1–3 Mar 1982, G. Robinson, lowland forest, slide BM 26080, (BMNH). Rampayoh River, 100 ft [30.5 m]: 1♂, 1♀, 11–19 Mar 1989, G. Robinson, LP 195, lowland dipterocarp forest, slides BM 26074, 27619, (BMNH). Rampayoh River, 300 ft [90 m]: 5♂, 2♀, 21–24 Sep 1992, G. Robinson, LP 195, lowland dipterocarp forest, slides BM 27879, 27881, (BMNH). Ulu Temburong, 300 m: 1♀, 2 Oct 1980, M. Allen, rainforest, (BMNH); 300 m: 2♂, 26–30 Apr 1989, M. Allen & K. Tuck, LP 296, (BMNH). Ulu Temburong, Kuala Belalong FSC, 100 m: 2♂, 4–16 Jul 1991, G. Robinson, lowland dipterocarp forest, slide BM 27882, (BMNH). Telisai, 100 ft [30.5 m]: 7♂, 1♀, 13 Feb 1982, G. Robinson, kerangas forest, slides BM 26077, 27594, 27640, (BMNH). INDONESIA: Java: Bonan Dolok: Siboga, 500 m: 1♂, 19–20 Jun 1930, d. Meer Mohr, (RNHL). Kalimantan "O. Borneo": Midden: 1♀, 8 Sep 1925, (RNHL). Sulawesi Utara: Dumoga-Bone National Park: Base Camp area, 190 m: 1♂, Sep 1985, H. Barlow, Roy. Ent. Soc. Project Wallace, slide BM 27626, (BMNH); lowland forest, 200–300 m: 1♀, Feb 1985, 3♂, 1♀, Mar 1985, slides BM 26084, USNM 30832, (BMNH, USNM); "Hog's Back" Camp, 492 m: 6♂, Sep 1985, 4♂, 1♀, H. Barlow, lowland forest, slides BM 26085, 27620, USNM 30828, (BMNH, USNM); Plot A, 200 m: 1♀, Sep 1985, lowland forest, (BMNH); Rothamsted

light trap site 1, 200 m: 1♀, Feb 1985, 1♀, May 1985, H. Barlow, (BMNH). MALAYSIA: Sarawak: Semongkok, Kuching: 1♂, 3–9 Feb 1976, E. Classey, slide BM 27894, (BMNH). Selangor: Bangi, UKM Campus, 70 m: 1♂, 25–26 Jul 1991, G. Robinson, lowland dipterocarp forest, slide 27893, (BMNH). Fraser's Hill, Gap, 850 m: 3♂, 2–3 Nov 1989, G. Robinson & M. Tobin, slide BM 27885, (BMNH). West Pahang: Genting Tea Estate, 2000 ft [610 m]: 1♂, 20 Jul 1979, H. Barlow, (BMNH). PHILIPPINES: Luzon: Klondyke, 800 ft [240 m], Benguet: 1♂, 16 Mar 1912, A. Wileman, slide BM 26079, (BMNH). Mt. Makiling [near Los Baños]: 3♂, C. Baker, slides USNM 31190, 31191, (USNM). Mindanao: Kolabugan, Lanao Plains: 3♂, 15 May–23 Jun 1914, A. Wileman, slide BM 26078, (BMNH). South Catobato, Maitum, Gasy, 700 m: 2♀, 12–13 Aug 1985, M. Owada, slide USNM 29967, (SMC, USNM). Palawan: Languan (seaside, north Palawan): 1♂, 26–31 Aug 1985, M. Owada, slide DRD 3720, (SMC). SRI LANKA: Colombo District: Labugama, 400 ft [120 m]: 3♂, 24 Aug 1973, G. Ekis, at black light, slides USNM 29843, 31184, (USNM). Nuwara Eliya District: Maskeliya: 1♂ (lectotype), Dec 1906, Alston, slide BM 2207, (BMNH). TAIWAN: 1♂, S. Issiki. Sun Moon Lake, 760 m: 2♂, 20–25 Jun 1980, D. Davis, slide USNM 30529, (USNM). THAILAND: Chaityaphum: Chulabhorn Dam, 700 m: 1♂, 14 Aug 1987, Moriuti et al., slide DRD 3723, (UOP). Chanthaburi: Khao Soi Dao, 400 m: 1♂, 7 Jun 1983, 7–8 Oct 1985, Kuroko et al., (UOP). Chiang Mai: Doi Pui, 1300 m: 1♂, 26–27 Oct 1985, Moriuti et al., slide 3862, (UOP). Doi Suthep-Pui National Park, 1100 m: 2♂, 1♀, 12 Sep 1988, M. Allen, slide BM 27880, (BMNH); road to Monthatarn waterfall, 650 m: 1♂, 5–10 Oct 1994, I. Kitching et al., slide BM 27902, (BMNH). Samoeng/Hang Dong Rd, km 15, 700 m: 2♂, 5–12 Jun 1988, A. Cotton & I. Kitching, slide BM 27896, (BMNH). Loei: Phu Rua, 800 m: 7♂, 15–19 Aug 1987, Moriuti et al., slides USNM 29932, 31773, (UOP, USNM). Nakhon Nayok: Khao Yai, 800 m: 1♂, 14 Jun 1983, 1♂, 11–19 Sep 1985, 2♂, 1♀, 9–25 Aug 1987, 1♂, 23 Sep 1987, Moriuti et al., slides DRD 3722, 3724, (UOP). Narathiwat, km 17 on Ban Tabing Tingngi to Sri Sakhon Rd, 250 m: 1♂, 19 Aug 1990, A. Cotton & I. Kitching, slide BM 27895, (BMNH).

DISCUSSION.—Initially Meyrick (1916) described this species based on an assortment of three species from Asia, Africa, and South America (Bradley, 1953a). Currently I recognize it as one of two species of *Harmaclona* restricted to southern Asia. The relatively large series examined displayed appreciable but probably normal variation of male genital morphology. Most specimens exhibited a form "A," represented by the lectotype from Sri Lanka. This form is typified by valvae with slender ventral lobes (Figure 244), ninth tergum (tegumen) gradually tapering caudally, vinculum more V-shaped, and aedeagus with a moderately broad vitta (Figure 312). Form "B" (Figures 241–247) possesses valvae with more broadly tapered ventral lobes, tegumen broader, abruptly narrowing caudally, vinculum truncate, and aedeagus with a more

slender vitta. These variates follow no geographic pattern, with both types frequently overlapping (e.g., in Sri Lanka). Moreover, some characters, particularly the valvae, occasionally exhibit intermediacy.

Harmaclona tephrantha may be separated from its sister species, *H. robinsoni*, by its generally larger size and by male and female genital characters discussed under *H. robinsoni*. It also resembles the central African species, *H. afrotephrantha*, in the possession of an elongate vitta. These two species may be easily distinguished by the shorter saccus of male *H. tephrantha* as well as by the different form of their valvae.

I have reported on an interesting bilateral gynandromorph of this species that was collected in Dumoga-Bone National Park in Sulawesi Utara, Indonesia (Davis, 1994). This specimen was found to be almost evenly divided into a masculine right side and feminine left side (Figure 146). For example, the right forewing is smaller, measuring 10 mm long and 2.0 mm broad at its greatest width, compared to 11.2 mm and 2.6 mm respectively for the female left forewing. As anticipated, the male right hindwing possesses a single, stout frenulum, with two smaller frenula present on the feminine left side. The abdominal segments are similarly dimorphic, with the seventh tergum reduced (Figure 250) and exhibiting a partial corythogyne on the left side. The eighth sternum is greatly reduced on the feminine left half and only slightly reduced on the male right half along with a single corematis (Figure 248). As is often true in bilateral gynandromorphs (Kusnezov, 1916), the genitalia were not equally divided but displayed a predominance of male characters (Figures 248, 249). Both valvae were represented as well as a small "valvoid." The female half showed no such duplication. The unpaired organs (e.g., aedeagus and bursa copulatrix) appeared relatively normal, although noticeably shortened.

Harmaclona berberea Bradley

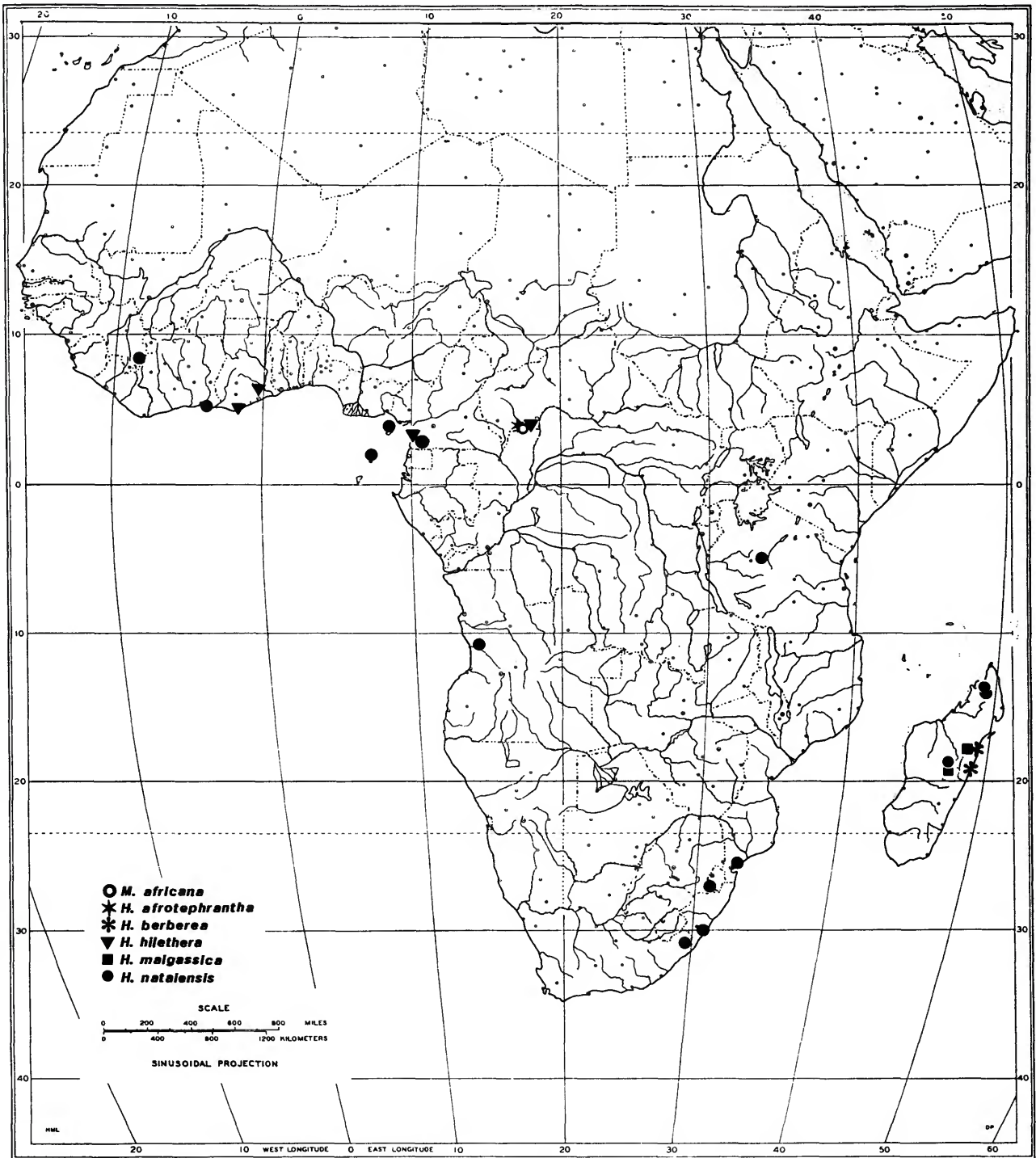
FIGURES 148, 259–264; Map 7

Harmaclona berberea Bradley, 1956:134.—Viette, 1990:25.

MALE (Figure 148).—Forewing length 9.5 mm.

Head: Almost entirely white, faintly irrorated with light brown mostly over vertex and with heavier suffusion of light brown across occiput. Antenna 47-segmented, ~0.35 the length of forewing; dorsum of basal $\frac{1}{3}$ white irrorated with fuscous, distal $\frac{2}{3}$ becoming abruptly brown; basal $\frac{1}{2}$ bifasciulate, gradually becoming serrulate over distal $\frac{1}{2}$; basal 7 flagellomeres with spherical sensory cavities. Labial palpus mostly white, lightly irrorated with light brown; contrastingly dark brownish fuscous dorsolaterally with slight suffusion of light brown.

Thorax: Similar to *H. cossidella*. Forewing mostly white, faintly irrorated with light brown; dorsal $\frac{2}{3}$ with pale golden brown luster as in *H. cossidella*; a series of 4 small fuscous spots along subapex of costa and 3 or 4 larger fuscous spots at



MAP 7.—Distribution of *Micrerethista africana*, *Harmaclona afrothrantha*, *H. berbera*, *H. hilethera*, *H. malgassica*, and *H. natalensis*.

termen that extend into mostly white fringe at 4 points along outer margin of wing. Hindwing pale brownish gray with a faint golden luster; fringe mostly pale buff, but white along costal margin. Legs mostly white, faintly irrorated with brown; tarsi darker, more brown.

Abdomen: Scale color not examined (on slide).

FEMALE.—Forewing length 10.2 mm. Body color similar to male. Abdomen not studied; it was missing from the one specimen available.

MALE GENITALIA (Figures 259–264).—Anterior margin of vinculum slightly concave on either side of elongate saccus, the latter ~0.4 the length of valva. Apotheca well developed, approximately $\frac{1}{2}$ the length of valva. Valva (Figure 261) relatively slender, with slender dorsal lobe of constant width to rounded apex; ventral lobe ~1.6× the width, 0.9× the length of dorsal lobe at base, then tapering to an acute, triangular apex. Anellus a simple tube, with ventral margin deeply V-shaped (Figure 259); caudal arms absent. Aedoeagus with basal keel reduced, ~0.28 the length of entire aedoeagus; distal $\frac{1}{4}$ slightly spatulate with a serrulate, bifid apex and 6 pairs of serrations along broadest region of lateral margins (Figures 263, 264).

HOLOTYPE.—♂; MADAGASCAR: env. de Ranomafana, 700 m, district d' Ifanadiana (NMHP).

FLIGHT PERIOD.—Poorly sampled; records from October to November, February, and March.

DISTRIBUTION (Map 7).—Known only from the rainforest along the eastern escarpment of Madagascar at elevations around 700 m.

MATERIAL EXAMINED.—MADAGASCAR: Ifanadiana: near Ranomafana, 700 m: 1♂ (holotype), 31 Mar 1955, P. Viette, slide 4291, (NMHP). Toamasina: Station Perinet, 149 km E of Tananarivo: 1♀, Jan 1933, 1♂, 20 Oct–10 Mar, 1930, d'Olsoufieff, (BMNH).

DISCUSSION.—This seldom-collected species is known from only three specimens, including one female with a missing abdomen. It is most allied to *H. malgassica*, but differs in possessing a broader, more spatulate apex to the aedoeagus as well as a more ventrally developed basal keel. In addition, the caudal opening of the anellus is more elongated and ventrally incised than in *H. malgassica*.

Harmaclona malgassica Bradley

FIGURES 33–36, 149, 265–270; Map 7

Harmaclona malgassica Bradley, 1956:133.—Viette, 1990:25.

MALE (Figure 149).—Forewing length 8–12 mm.

Head: Similar in color to *H. cossidella*; mostly white, irrorated with brownish fuscous; scales mostly 3, rarely 4 dentate. Antenna 50–59-segmented, ~0.35 the length of forewing; color and structure as in *H. cossidella*; basal 11 or 12 flagellomeres with spherical sensory cavities (Figures 33–36). Labial palpus mostly fuscous laterally; apical segment heavily suffused with brown.

Thorax: Similar to *H. cossidella*. Forewing appearing generally gray, with costal $\frac{1}{3}$ white, finely irrorated with brown; dorsal $\frac{2}{3}$ predominantly pale golden brown; costal margin and termen without fuscous spots; fringe heavily suffused with brown around termen, gradually becoming more white basad to tornus. Hindwing uniformly pale golden brown; fringe mostly lighter brown becoming whiter along costal margin. Legs with approximately equal mixture of white and brownish fuscous irroration, except more heavily irrorated with fuscous over tarsi.

Abdomen: Similar to *H. cossidella* in color.

FEMALE.—Unknown.

MALE GENITALIA (Figures 265–270).—Anterior margin of vinculum deeply concave on either side of elongate, slender saccus, the latter ~0.44 the length of valva. Apotheca well developed, approximately $\frac{1}{2}$ the length of valva. Valva (Figure 267) relatively slender, similar in form to *H. berberea*; ventral lobe slender, approximately equal in width at base, 0.84 as long as dorsal lobe, and tapering to an acute, slightly curved apex. Anellus a short tube similar to that of *H. berberea* but with dorsocaudal margin less extended and ventrocaudal margin not as deeply incised. Aedoeagus very slender; basal keel not developed; distal end slender, terminating in a pair of spinose processes, with a row of ~5–6 minute spines continuing laterally down distal $\frac{1}{8}$ of aedoeagus.

HOLOTYPE.—♂; MADAGASCAR: Analamazoatra Forest, 910 m, env. de Perinet, (HNMP).

FLIGHT PERIOD.—The relatively few records available suggest an extended emergence period for this species, from February to April, and November.

DISTRIBUTION (Map 7).—Known only from the rainforest along the eastern escarpment of Madagascar at elevations around 900 m.

MATERIAL EXAMINED.—MADAGASCAR: Toamasina: Analamazoatra Forest, near Perinet, 910 m: 1♂ (paratype), 13 Mar 1955, (BMNH), 1♂ (paratype), 17 Mar 1955, (BMNH), 1♂ (holotype), 19 Apr 1955, (MNHP), 1♂ (paratype), 24 Nov 1954, (MNHP), 1♂ (paratype), 26 Nov 1954, (USNM), P. Viette, slides BM 4289, 4290, USNM 29866. Route d'Anosibe [? Andasibe], km 57: 1♂ (paratype), 15 Feb 1955, P. Viette, (MNHP).

DISCUSSION.—This species is very similar to and perhaps largely sympatric with *H. berberea*. *Harmaclona malgassica* can be distinguished from the latter by two characters of the male aedoeagus: the loss of the basal midventral keel and the slender, versus spatulate, distal end. Furthermore, the dorsocaudal margin of the anellus is not as elongated in *H. malgassica*.

Harmaclona natalensis Bradley

FIGURES 150, 271–276, 339–341; Map 7

Harmaclona natalensis Bradley, 1953b:767.—Janse, 1968:95.—Viette, 1990:25.

Harmaclona natalensis [sic] Bradley, 1956:132.

MALE.—Forewing length 10–14 mm.

Head: Mostly white, irrorated with subapically dark brown to fuscous-banded scales; scales mostly with 3 or 4 dentate apices. Antenna 50–59-segmented, 0.33–0.39 the length of forewing; vestiture and structure as described for *H. hilethera*; flagellum without spherical sensory cavities. Labial palpus as in *H. hilethera* but more heavily irrorated with dark brown to fuscous.

Thorax: Similar to *H. hilethera* but with darker irroration. Forewing generally light to dark gray, lightly irrorated with brownish fuscous, often with faint, longitudinal bands of alternating predominantly white or pale golden brown between major veins; the latter usually associated with thin lines of mostly fuscous scales following most of the length of the subcostal, medial, and anal veins, with the former two often faintly forked and fading before the termen; subterminal area mostly white lightly irrorated with brown, with an irregular, partially interrupted, dark brown band from apex to tornus; most scales of band faintly irrorated with white apices; termen with a predominantly brownish fuscous border from mostly white apex to mostly white tornus; outer scales of termen generally paler, with equal mixture of grayish white to brownish fuscous scales. Hindwing mostly pale golden brown, slightly transparent, with a narrow band of darker brown scales bordering entire outer margin; outermost fringe pale buff to nearly white. Legs as described for subfamily; tarsi mostly brownish fuscous, lightly irrorated with light brown to white.

Abdomen: As described for *H. cossidella*.

FEMALE (Figure 150).—Forewing length 12.6–18 mm.

Head: Similar to male in color. Antenna 58–65-segmented, similar to male except flagellum filiform and with much shorter sensilla that are less than $\frac{1}{2}$ the diameter of flagellomere in length.

Thorax: Similar to male in pattern; frenulum consisting of two slender bristles.

Abdomen: Similar to male in color except with long pale brownish scales over A7.

MALE GENITALIA (Figures 271–276).—Anterior margin slightly concave on either side of relatively short saccus, the latter ~ 0.25 the length of valva. Apotheca well developed, nearly 0.8 the length of valva. Valva (Figure 273) similar to that of *H. hilethera* but with dorsal lobe broader and not tapered until rounded apex; ventral lobe with broadly tapered apex, $\sim 1.2\times$ the width at base and $0.85\times$ as long as dorsal lobe. Anellus a relatively broad, short cone, without caudal arms. Aedoeagus with reduced basal keel ~ 0.15 the length of entire aedoeagus; apex broad, with a short pair of slender, lateral processes (Figure 276); lateral subapical margins of phallosome with a row of 3 or 4 minute spines.

FEMALE GENITALIA (Figures 339–341).—Caudal margin of ostium slightly convex with a minute median indentation. Antrum composed of two distinct sections, a broader, nearly quadrate portion caudally that abruptly narrows slightly to a

more elongate section that gradually tapers anteriorly. Ductus bursae slender, elongate, ~ 0.7 the length of anterior apophyses; spicules absent. Corpus bursae elliptical, with an elongate, spicate signum bearing 8–14 variable, stout spines.

HOLOTYPE.—♂; SOUTH AFRICA: Umkomaas, Natal, (BMNH).

FLIGHT PERIOD.—Adults have been collected over much of the year from November through May, with a notable absence from June to October.

DISTRIBUTION (Map 7).—This species ranges widely through west Africa south through Angola and Tanzania to South Africa. It also occurs along the eastern escarpment of Madagascar.

MATERIAL EXAMINED.—ANGOLA: 7 mi [11.3 km] W of Gabela: 1♂, 16–18 Mar 1972, (BMNH). CAMEROON: Fernando Poo: 1♀, Dec 1926–Jan 1927, J. Nicholls, (BMNH). Johann-Albrechts Höhe: 3♀, 1898, L. Conradt, slides BM 2217, 18647, 19326, (BMNH). Lölodorf: 1♂, 24 May 1995, (BMNH). GHANA: Ashanti (West Africa): 1♀, Jan 1910, slide BM 27887, (BMNH). GUINEA: Beyla: 1♀, Jul 1928, CLC, (BMNH). IVORY COAST: Bingerville: 1♀, 1915, G. Melou, (BMNH). MADAGASCAR: Toamasina: Route d'Anosibe [? Andasibe], km 57: 1♂, 16 Feb 1955, P. Viette, slide 4288, (MNHP). Station Perinet, 149 km E of Tananarivo: 1♂, 1♀, Dec 1932, N. d'Olsoufieff, slide 2722, (BMNH). Near Perinet, 910 m, Analamazoatra Forest: 1♂, 1♀, 17 Jan 1955, P. Viette, slides DRD 3725, USNM 29867, (MNHP, USNM). MOZAMBIQUE: Delagoa Bay [Lourenço Marques]: 1♀, Monteiro, slide BM 2218, (BMNH). PRINCIPE ISLAND: 1♀, 12 Dec 1932, W. Tams, slide BM 5386, (BMNH). SOUTH AFRICA: Natal: 1♀, (BMNH); Umkomass: 1♂ (holotype), 18 Jan 1914, A. Janse, slide BM 2983; 1♂, 12 Jan 1914, A. Janse, slide DRD 3713, (CNC); 1♂ (paratype), 22 Jan 1914, A. Janse, (TMP). Transkei: Port St. John: 1♂, 1–17 Mar 1924, R. Turner, (BMNH). TANZANIA: Amani (Mal Inst. Amani): 1♀, Jan, 1♂, 1♀, Apr 1965, slide BM 27888, 1♀, Nov, (BMNH).

DISCUSSION.—Ranging through much of the remnant moist forests of sub-Saharan Africa from Cameroon to the southern coasts of South Africa to Madagascar, this species is the most common, widespread *Harmaclona* in Africa. The most diagnostic feature of the species is the bicornate apex of the male aedoeagus. It may also be distinguished from its nearest ally, *H. hilethera*, by the more reduced anellus.

Harmaclona hilethera Bradley

FIGURES 7, 151, 277–282; Map 7

Harmaclona hilethera Bradley, 1953a:65.

MALE (Figure 151).—Forewing length 6.6–10.2 mm.

Head: Vestiture mostly white, irrorated with subapically dark brown-banded scales; scales moderately slender with apices 2–4 dentate. Antenna 48–53-segmented, 0.5 the length of forewing; scape smoothly scaled dorsally, rough ventrally with irregular tuft of slender, erect, 2 or 3 dentate scales of same

color as head; flagellum with basal $\frac{2}{3}$ covered dorsally with moderately broad, white scales and scattered dark brown-tipped scales, gradually transforming into a sparse covering of very slender, uniformly brown scales over distal $\frac{1}{3}$; basal $\frac{2}{3}$ of flagellum shortly bipectinate, with pectinations gradually reducing to bifasciculate condition over distal $\frac{1}{3}$; flagellomeres without spherical sensory cavities. Labial palpus with second segment moderately rough dorsally and laterally; scales predominantly fuscous with faint whitish to gray tips over lateral surface, and white irrorated with subapically dark brown-banded scales ventrally and mesally.

Thorax: Dorsum similar to head vestiture except scales usually broader and shorter, with a raised cluster of dark brown to fuscous-tipped scales posteriorly on mesoscutellum. Venter mostly white, slightly irrorated with dark-tipped scales. Forewing predominantly covered with broad, uniformly white scales with scattered patches of white scales possessing narrow, subapical, brown to fuscous bands; banded scales often arranged to form short, transverse bars; bands becoming broader in scales toward termen where the pattern coalesces to form a narrow fuscous band along base of marginal fringe; a small tuft of dark-tipped scales present near basal $\frac{1}{3}$ of dorsal margin. Hindwing pale gray over basal $\frac{2}{3}$, becoming gradually darker over distal $\frac{1}{3}$ and with a slight bronzy luster. Legs predominantly white irrorated with dark brown-tipped scales except with foreleg mostly fuscous and slightly irrorated with white particularly over venter of tarsal segments.

Abdomen: Grayish brown with slight bronzy luster dorsally; predominantly white ventrally with a sparse irroration of dark brown-tipped scales.

FEMALE.—Unknown.

MALE GENITALIA (Figure 277–282).—Anterior margin slightly concave on either side of moderately long saccus, the latter ~ 0.33 the length of valva. Apotheca well developed, ~ 0.7 the length of valva. Valva (Figure 279) similar to that of *H. natalensis* but with dorsal lobe more slender and tapering; ventral lobe with broadly tapered apex, $\sim 2\times$ the width at base and $0.86\times$ the length of dorsal lobe. Anellus with greatly elongate caudal arms, nearly 0.4 the length of valva. Aedoeagus without basal keel; apex broadly triangular, with ~ 4 pairs of minute, lateral serrations.

HOLOTYPE.—♂; Bibianaha, Gold Coast [Ghana], (BMNH).

FLIGHT PERIOD.—The few specimens collected thus far indicate an extended emergence period for the species, with records from January to March and from August to November.

DISTRIBUTION (Map 7).—Ranging through equatorial Africa from Ghana to the Central African Republic.

MATERIAL EXAMINED.—CAMEROON: Lölodorf: 3♂ (paratypes), 1894–1895, slides BM 2236, 2528, 2668, 19336; 1♂ (paratype), 24 Feb 1895; 1♂ (paratype), 12 Mar 1895, L. Conradt, (BMNH). CENTRAL AFRICAN REPUBLIC: La Maboké: 3♂, 7–9 Aug 1970, J. Boudinot, slide DRD 3712, (MNHP). GHANA (Gold Coast): Bibianaha, 700 ft [210 m]: 1♂

(holotype), 23 Oct–3 Nov 1911, H. Spurrell, slide BM 2224; 1♂ (paratype), 1912, H. Spurrell, (BMNH).

DISCUSSION.—At least two apomorphies of the male genitalia easily distinguish this species from all other *Harmaclona*. The greatly elongated anellus, especially the long caudal arms that extend to the apex of the tegumen, is particularly distinctive. Likewise, the lanceolate apex of the aedoeagus is unique for the genus. *Harmaclona natalensis* appears to be the nearest relative, at least on the basis of their similar valvae.

Harmaclona afrotephrantha, new species

FIGURES 147, 253–258; Map 7

MALE (Figure 147).—Forewing length 11.5 mm.

Head: Similar in color to *H. tephrantha*; scale apices mostly 3–5 dentate. Antenna ~ 60 -segmented, 0.42 the length of forewing; similar to *H. tephrantha* in color, more similar to *H. cossidella* in structure, shortly bipectinate over basal $\frac{1}{2}$ with elongate sensilla trichodea; basal 7 or 8 flagellomeres with spherical sensory cavities.

Thorax: Similar to *H. tephrantha* in color. Forewing with costal $\frac{1}{2}$ predominately white finely irrorated with dark brown-tipped scales; dorsal $\frac{1}{2}$ largely suffused with pale golden brown; apical $\frac{1}{4}$ of costal margin with up to 4 faint brownish fuscous spots; apex of wing distad of cell more heavily irrorated with dark brown and golden brown; termen with a dark brown border to tornus; fringe mostly dark brown with heavy mixture of varying shades of paler brown becoming whiter basad along outer dorsal margin near tornus. Hindwing pale golden brown.

Abdomen: Legs and abdomen similar in color to *H. tephrantha*.

FEMALE.—Unknown.

MALE GENITALIA (Figures 253–258).—Tegumen gradually tapering to broadly rounded apex. Anterior margin of vinculum slightly concave on either side of long slender saccus, the latter ~ 0.53 the length of valva. Apotheca well developed, ~ 0.73 the length of valva. Valva (Figure 255) with broad, bluntly rounded apex; ventral lobe nearly as broad at base and $0.9\times$ as long as dorsal lobe, with a bluntly rounded lobe from apex. Anellus a moderately short tube, tapering to an acute, anterior end. Aedoeagus with ventral keel moderately well developed, $\sim \frac{1}{4}$ the length of entire aedoeagus (Figure 256); apex extended as in *H. tephrantha* to form a slender, elongate, minutely spinose vitta $\sim \frac{1}{4}$ the length of entire aedoeagus; lateral margins immediately basad to vitta bordered with 4–6 small spines.

HOLOTYPE.—♂; CENTRAL AFRICAN REPUBLIC: La Maboke, $3^{\circ}54'N$, $17^{\circ}53'E$, 7 Aug 1970, J. Boudinot, slide DRD 3715, (MNHP).

FLIGHT PERIOD.—August (single record).

DISTRIBUTION (Map 7).—Known only from the type, which was collected in southwestern Central African Republic.

ETYMOLOGY.—The species name is derived from the Latin

afra (African) added to the name of an allied species, *tephrantha*.

DISCUSSION.—The male genitalia of this species resembles that of the southeast Asian *H. tephrantha* in one obvious synapomorphy, the presence of an elongate vitta. They are the only two species in the *Harmacloninae* to share this feature. In other male genital characters, particularly in the concave anterior margin of the vinculum and the elongate saccus, *H. afrotephrantha* appears more allied to some of the African species, notably *H. malgassica*. The male antennae of *H. afrotephrantha* also resemble the other African *Harmaclona* in their basal pectination, as compared to the bifasciculate condition in *H. tephrantha* and its sister species *H. robinsoni*.

Harmaclona hexacantha, new species

FIGURES 152, 283–288; Map 8

MALE (Figure 152).—Forewing length 13.6 mm.

Head: Similar to *H. cossidella* in color except occipital brownish band not evident; scales mostly 2 or 3 dentate. Antenna 55-segmented, similar to *H. cossidella* in color and structure; basal 7 flagellomeres with spherical sensory cavities.

Thorax: Similar to *H. cossidella* in color. Forewing pale whitish gray, irrorated with brown to fuscous with numerous, small, fuscous spots arranged longitudinally along costa and major veins as in *H. cossidella*; dorsal $\frac{1}{2}$ of wing with suffusion of pale golden brown; fringe predominantly brownish fuscous, with a fuscous, subterminal line along upper $\frac{1}{2}$ of termen and an outer fuscous line bordering entire terminal margin. Hindwing pale gray, with a slight purplish luster, semitransparent, becoming darker brown over apical $\frac{1}{3}$ and along fringe; scales relatively broad, partly transparent. Legs as described for subfamily.

Abdomen: Similar to *H. cossidella*.

FEMALE.—Unknown.

MALE GENITALIA (Figures 283–288).—Anterior margin of vinculum deeply concave on other side of elongate saccus, the latter nearly 0.9 the length of valva (Figure 283). Apotheca reduced, ~ 0.24 the length of valva. Valva (Figure 285) with dorsal lobe slender, tapering; ventral lobe $\sim 2.1\times$ the width, $0.93\times$ the length of dorsal lobe, and terminating abruptly in a triangular, subacute apex. Anellus with 2 relatively stout, elongate, caudal arms ~ 0.35 the length of entire anellus. Aedoeagus with elongate basal keel ~ 0.4 the length of entire aedoeagus (Figure 286); distal $\frac{1}{5}$ with 3 pairs of relatively prominent spinose processes (Figures 287, 288): an apical, laterally divergent pair, a shorter, ventrolateral pair, and a more basal, mid-dorsal pair.

HOLOTYPE.—♂; ARGENTINA: Misiones, Arroyo Saura, 9 km N of L. N. Alem, Misiones Prov., 20 Nov 1973, O. Flint, USNM 29865, (USNM).

FLIGHT PERIOD.—November (single record).

DISTRIBUTION (Map 8).—Known only from the province of Misiones, located in northeastern Argentina.

ETYMOLOGY.—The specific name is derived from the Greek *hex* (six) and *akantha* (thorn, prickle), in reference to the three pairs of spines on the apical region of the aedoeagus.

DISCUSSION.—This species closely resembles *Harmaclona cossidella* in size and color. Males are easily distinguished from that species and all other *Harmaclona* by the heavily armed aedoeagus that bears three pairs of stout exogenous spines. Only a single specimen has been collected, which was from a wet, second growth lowland forest located in the extreme northeastern corner of Argentina.

Harmaclona tetracantha, new species

FIGURES 153, 289–294, 342, 343; Map 8

MALE (Figure 153).—Forewing length 8.4–11.3 mm.

Head: Similar to *H. cossidella* in color, with pale brownish occipital band sometimes evident; scales 2–4 dentate. Antenna 44–70-segmented, ~ 0.33 – 0.38 the length of forewing, otherwise similar to *H. cossidella* in color and structure; basal 8 or 9 flagellomeres with spherical sensory cavities.

Thorax: Mesonotum similar in color to *H. cossidella*. Forewing similar in color to *H. cossidella*, mostly white to pale gray irrorated with light brown to fuscous over costal $\frac{1}{2}$; dorsal $\frac{1}{2}$ strongly suffused with pale golden brown; fringe as in *H. cossidella*. Hindwing as described for *H. cossidella*. Legs as described for genus.

Abdomen: Light golden brown dorsally, white ventrally irrorated with brownish fuscous.

FEMALE.—Forewing length 11 mm.

Head: Similar to male. Antenna 56-segmented, similar to male in color but mostly filiform, with much shorter sensilla trichodea less than 0.5 the diameter of flagellomere in length.

Thorax: Similar to male in pattern; frenulum absent.

Abdomen: Similar to male in color except with long, light brown scales over A7.

MALE GENITALIA (Figures 289–294).—Anterior margin of vinculum slightly concave on other side of elongate saccus, the latter ~ 0.7 the length of valva (Figure 289). Apotheca reduced, ~ 0.3 the length of valva. Valva (Figure 291) with slender, rounded dorsal lobe; ventral lobe nearly $4\times$ the width, $0.9\times$ the length of dorsal lobe, and abruptly tapering to mesally curved terminal lobe. Anellus with a pair of short, conical, caudal lobes less than 0.15 the length of entire anellus. Aedoeagus with elongate basal keel nearly 0.4 the length of entire aedoeagus (Figure 292); distal end with a pair of ventrally curved and laterally divergent, apical spines and a subapical pair of ventrolateral spines approximately the same length as apical pair (Figures 293, 294).

FEMALE GENITALIA (Figures 342, 343).—Similar to *H. cossidella* except with ostium more broadly rounded and paired lobes at caudal margin of sternum VIII slanted mesally (Figure



MAP 8.—Distribution of *Harmaclona cossidella*, *H. hexacantha*, *H. tetracantha*, and *H. triacantha*.

343) instead of parallel. Signum with ~24 small to minute spines.

HOLOTYPE.—♂; BRAZIL: Acailândia, 150 m, Maranhao, 19–27 Nov 1990, V. Becker and G. Dubois, slide DRD 4000, (VOB).

PARATYPES.—BRAZIL: Maranhao: same data as holotype: 3♂, 1♀, slides USNM 31435, 31450, (USNM, VOB). Pará: Capitão Poço, [SE of Belém]: 1♂, 29–31 Jan 1984, V. Becker, slide DRD 3741, (VOB). Marabá, 5°21'S, 49°7'W, 50 m: 1♂, 9 Jan 1977, V. Becker, slide USNM 29865, (USNM).

FLIGHT PERIOD.—Sampling insufficient; records thus far for only November and January.

DISTRIBUTION (Map 8).—Known only from the states of Maranhao and Pará, Brazil, in lowland, Amazonian forest.

ETYMOLOGY.—The specific name is derived from the Greek *tetra* (four) and *akanthos* (thorn, prickle), in reference to the four relatively large spines at the distal end of the aedeagus.

DISCUSSION.—This species can be distinguished easily from *H. cossidella* and the other neotropical members of the genus by characters of the male genitalia, notably the reduced caudal arms of the anellus and the four prominent spines located at the distal end of the aedeagus. The female genitalia are characterized by the inward-slanted lobes of the caudal margin of sternum VIII.

Harmaclona triacantha, new species

FIGURES 154, 295–302, 344; Map 8

MALE (Figure 154).—Forewing length 5.8–8.5 mm.

Head: Similar to *H. cossidella* in color except occipital brownish band not evident; scales mostly 2–4 dentate. Antenna 40–49-segmented, otherwise similar to *H. cossidella* in color and structure; flagellomeres without spherical sensory cavities.

Thorax: Mesonotum similar in color to *H. cossidella*. Forewing predominantly pale gray irrorated with brown and fuscous, the latter tending to concentrate in small, transverse spots thereby imparting a faint barred pattern to forewing; an irregular narrow streak of white usually distinct along subcostal margin; fringe heavily suffused with fuscous, a narrow, dark fuscous line around most of subterminal margin. Hindwing similar to *H. cossidella*. Legs as described for subfamily.

Abdomen: Light to medium brown dorsally, white irrorated with brownish fuscous ventrally.

FEMALE.—Forewing length 12–13 mm.

Head: Similar to male. Antenna 56-segmented, similar to male except flagellum filiform, with much shorter sensilla trichodea less than 0.5 the diameter of flagellomere in length.

Thorax: Similar to male in pattern; frenulum absent.

Abdomen: Similar to male in color except with long whitish to pale brown corythogyne scales over A7.

MALE GENITALIA (Figures 295–302).—Vinculum broadly Y-shaped, with elongate saccus approximately equal to valva in length. Apotheca moderately long, ~0.43 the length of valva.

Valva (Figure 297) with dorsal lobe slender, tapering; ventral lobe ~3× as broad, 0.93× as long as dorsal lobe, and abruptly tapering to a narrowly rounded apex. Anellus with 2, moderately long caudal arms, ~0.33 the length of entire anellus. Aedeagus with elongate basal keel, ~0.42 the length of entire aedeagus (Figure 298); apex with a divergent pair of either acute or minutely bidentate apical arms and a single, shorter, mid-dorsal spine (Figures 299, 300); even smaller dorsal spines sometimes present near or on bases of terminal arms (Figures 301, 302).

FEMALE GENITALIA (Figure 344).—Similar to *H. cossidella* except with caudal end of antrum abruptly flared (Figure 344). Paired setose lobes at caudal margin of sternum VIII more reduced than in either *H. cossidella* or *H. tetracantha*. Signum with 23–25 spines.

HOLOTYPE.—♂; FRENCH GUIANA: Piste de la Montagna des Singes, km 30, 5°05'N, 52°42'W, 150 m, at light in logged rain forest, 28 Jan 1983, J.-F. Landry, slide USNM 31540, (USNM).

PARATYPES.—BRAZIL: Espirito Santo: Linhares, 40 m: 1♂, 20–29 Feb 1992, V. Becker, slide DRD 3978, (VOB). Rondonia: Porto Velho, 180 m: 7♂, 24 Apr–12 May 1989, V. Becker, slides USNM 31437, 31442, (VOB, USNM). FRENCH GUIANA: Maroni River: 1♀, no date, Le Moul, slide BM 2209, (BMNH). Piste Isnard, km 35, near Crique Portal, 5°15'N, 53°51'W: 1♂, 17 Jan 1983, J.-F. Landry, at light in pristine-logged rain forest, slides USNM 29872, 29891, (USNM). St Jean de Maroni: 1♂, slide BM 23671, (BMNH); 1♀, W. Schaus, slide 31539, (USNM). PERU: Madre de Dios: Rio Tambopata Reserve, 30 air km SW of Pto. Maldonado, 290 m: 1♂, 21–25 Nov 1979, J. Heppner, in subtropical moist forest, slide USNM 29883, (USNM). VENEZUELA: Amazonas: Basecamp, 140 m, Cerro de la Neblina, 0°50'N, 66°44'W: 1♂, 4–12 Feb 1984, D. Davis, slide USNM 29888; 1♂, 24 Nov–1 Dec 1984, R. Brown, slide USNM 29868, (USNM).

FLIGHT PERIOD.—Adults of this poorly sampled species probably emerge throughout the year, as is true for *H. cossidella*. Capture records include November–February and April–May.

DISTRIBUTION (Map 8).—This species ranges widely through the lowland tropical rainforests of Amazonia from southern Venezuela and French Guiana to eastern Peru south to Espirito Santo of southeastern Brazil.

ETYMOLOGY.—The specific name is derived from the Greek *tri* (three) and *akantha* (thorn, prickle), in reference to the three primary spines at the apex of the aedeagus.

DISCUSSION.—Except for its generally smaller size, which nevertheless varies considerably, slightly worn specimens of *H. triacantha* cannot be distinguished from those of *H. cossidella* without dissection. Specimens of the former in better condition tend to display the darker forewing scales in a more barred pattern compared to the more linear arrangement of *H. cossidella*. Male specimens of *H. triacantha* can be easily identified by its mostly three-spined apex of the aedeagus.

The female genitalia of *H. triacantha* are characterized by the abruptly flared caudal end of the antrum and by the reduced caudal lobes of sternum VIII.

***Harmaclona cossidella* Busck**

FIGURES 8–12, 18–32, 38, 39, 44–48, 62–66, 69, 82–90, 95–125, 155, 303–308, 317–320, 345, 346; Map 8

Harmaclona cossidella Busck, 1914:63.—Walsingham, 1914:354.—Bradley, 1953a:64.—Diakonoff, 1968:272.—Davis, 1984:25.

Ptychoxena tephrantha Meyrick, 1916:616 [in part]; 1930:266 [misidentification].

MALE.—Forewing length 8–13 mm.

Head: White finely irrorated with brownish fuscous; a narrow transverse band of brownish suffusion often present across occiput; scales mostly 2–4 dentate. Antenna 48–51-segmented, ~0.35 the length of forewing; basal $\frac{1}{3}$ white irrorated with fuscous dorsally, gradually becoming mostly brown over distal $\frac{2}{3}$; basal $\frac{3}{5}$ shortly bipectinate gradually becoming bifasciculate to filiform over distal $\frac{2}{5}$; venter with elongate sensilla trichodea exceeding diameter of flagellomere in length; basal 7 flagellomeres with spherical sensory cavities (Figures 9, 11). Labial palpus white irrorated with brownish fuscous with laterodorsal piliform scales mostly suffused with brown.

Thorax: White finely irrorated with fuscous and with brownish to fuscous suffusion across mesonotum and tegulae; mesoscutellar caudal tuft mostly fuscous. Forewing predominantly pale gray with faint golden brown luster except over whitish costal margin; most scales finely tipped with brown with small concentrations of fuscous spots along costa and major veins to form broken lines; fringe pale gray irrorated with brown to fuscous with a dark fuscous subterminal line around apical $\frac{1}{2}$ of termen. Hindwing pale gray, semitransparent, becoming darker brown over apical $\frac{1}{4}$ and along fringe, mostly covered with broad, transparent scales. Legs as described for genus.

Abdomen: Light golden brown dorsally, white ventrally with suffusion of brown to fuscous laterally and medially.

FEMALE (Figure 155).—Forewing length 10–17 mm.

Head: Similar to male. Antenna 57–68-segmented, similar to male except flagellum filiform, with much shorter sensilla trichodea less than 0.5 the diameter of flagellomere in length; basal 14 or 15 flagellomeres with spherical sensory cavities (Figures 10, 12).

Thorax: Similar to male in pattern; frenulum absent.

Abdomen: Similar to male in color except with long, whitish to pale brown scales over A7.

MALE GENITALIA (Figures 303–308, 317–319).—Anterior margin of vinculum deeply concave on either side of moderately long saccus, the latter ~0.66 the length of valva (Figure 303). Apotheca reduced, ~0.25 the length of valva. Valva (Figure 305) with dorsal lobe slender, tapering; ventral lobe ~3× as broad, 1.05× as long as dorsal lobe, and terminating in a small, apical knob. Anellus with 2 long caudal arms ~0.55

the length of entire anellus. Aedoeagus with well-developed basal keel, ~0.38 the length of entire aedoeagus (Figure 306); apex roughly truncate with a distinct median notch (Figures 308, 319) and a single, short mid-dorsal spine.

FEMALE GENITALIA (Figures 320, 345, 346).—Caudal margin of ostium slightly concave, with a low, rounded median lobe. Antrum gradually tapering anteriorly, relatively long, ~0.22 the length of entire ductus bursae, with a pair of tapered, thickened, internal rods. Caudal margin of sternum VIII with a pair of prominent, parallel lobes, each bearing 3–5 elongate setae (Figure 346). Ductus bursae elongate, ~2× the length of anterior apophyses; spicules absent. Corpus bursae oval, with an elongate, spicate signum (Figure 320) bearing ~23–25 short, stout spines.

HOLOTYPE.—♀; PANAMA: Ahajuelo, type no. 16767, (USNM)

FLIGHT PERIOD.—Adults apparently fly throughout the year as evidenced not only by records over the entire range of the species but, more significantly, by capture data at a single locality in Costa Rica.

DISTRIBUTION (Map 8).—This species ranges widely over most of the Neotropical region from central Mexico (Sinaloa and Tamaulipas) to southern Brazil (Santa Catarina) and to Cuba in the Greater Antilles.

MATERIAL EXAMINED.—BELIZE: Rio Temash, 16°00'N, 89°00'W: 1♂, Jul 1934, J. White, (BMNH). BOLIVIA: Yungas de Coroico, 16°10'S, 67°44'W, 1800 m: 1♂, Oct 1906–Mar 1907, O. Garlepp, slide 26069, (BMNH). BRAZIL: Alagoas: Ibatiguara, 400 m: 7♂, 10–20 Feb 1994, V. Becker, USNM slide 31679, (VOB, USNM). Amazonas: Fonte Bôa: 1♀, Oct 1906, S. Klages, (BMNH). Reserva Ducke, km 26, Manaus-Itacoatiara Highway: 1♀, 18 May 1972, E. & E. Munroe, (CNC). Bahia: Camacã, 400–700 m: 1♂, 21–30 Sep 1991, V. Becker, slide USNM 31440, (USNM); 600 m: 1♂, 2 Mar 1994, V. Becker, (VOB). Distrito Federal: Planaltina, 15°37'S, 47°40'W, 1000–1100 m: 1♂, 23 Sep 1976, 1♂, 1♀, 16 Oct 1990, USNM slide 31680, 2♂, 23–25 Nov 1976, 1♂, 15 Dec 1976, V. Becker, (VOB, USNM). Goiás: Goiás, 15°56'S, 50°8'W, 500 m: 2♂, 13–15 Oct 1984, V. Becker, slide DRD 3739, (VOB). Mato Grosso do Sul: Chapada dos Guimaraes, 800 m: 1♂, 26 Oct 1993, V. Becker, (VOB). Rio Brilhante, 21°48'S, 54°33'W: 1♀, 25 Jan 1971, 1♂, 23–27 Oct 1970, V. Becker, (VOB). Maranhão: Açailândia, 150 m: 1♂, V. Becker, slide USNM 31441, (USNM). Minas Gerais: Belo Horizonte, 19°54'S, 43°56'W, 800 m: 1♀, 6 Oct 1977, V. Becker, (VOB). San Jancinho Valley [probably São Jacinto], 10°55'S, 45°35'W: 1♀, Feb 1908, S. Birch, (BMNH). Sete Lagoas, 19°28'S, 44°14'W, 720 m: 1♂, 25 Mar 1969, V. Becker, (VOB). Unai, 16°23'S, 46°53'W, 700 m: 1♂, 16 Oct 1988, V. Becker, slide USNM 31438, (USNM). Pará: Belém, 1°27'S, 48°29'W, 20 m: 1♂, Jan 1984, V. Becker, slide DRD 3980, (VOB). Capitão Poço, [SE of Belém]: 1♂, 1♀, 28–31 Jan 1984, 1♂, 1♀, 19–22 Nov 1984, V. Becker, (VOB, USNM). Igarapé Açu, 1°7'S, 47°37'W: 1♀, 2 Jan 1984, V. Becker,

- (VOB). Marabá, 5°21'S, 49°7'W, 50 m: 6♂, 9 Jan 1977, V. Becker, slide DRD 3740, (VOB). Paraná: Castro: 5♂, 4♀, 1892–1898, Jones, (BMNH). Guaraquecaba, 25°17'S, 48°21'W: 1♂, 9 Dec 1970, V. Becker, (VOB). Porecatu, 22°43'S, 51°24'W: 1♂, 1♀, 20 Oct 1970, V. Becker, (VOB). Rio Grande do Norte: Pipa, 20 m: 1♂, 28–31 Mar 1994, V. Becker, USNM slide 31681, (USNM). Rondônia: Ariquemes, 9°56'S, 63°04'W: 3♂, 13–16 Apr 1989, V. Becker, slide USNM 31436, (VOB, USNM). Cacaúlândia, 10°20'S, 62°54'W, 140 m: 1♂, Nov 1991, slide USNM 31439, (USNM), 1♂, Nov 1994, V. Becker, (VOB). Pôrto Velho, 180 m: 8♂, 3♀, 24 Apr–12 May 1989, V. Becker, slides DRD 3981, USNM 31405, (VOB, USNM). Santa Catarina: Brusque, 27°6'S, 48°5'W, 50 m: 1♂, 2♀, 28 Dec 1969, V. Becker, (VOB). Joinville, 26°18'S, 48°50'W, 50 m: 1♂, 6 Dec 1969, V. Becker, (VOB). Nova Bremen, 26°20'S, 49°10'W, 250 m: 1♂, 22 Nov 1934, 1♂, 1 Dec 1936, F. Hoffman, (BMNH); 1♀, 20 Nov 1934, F. Hoffman, (CU); 1♂, 12 Feb 1936, 1♂, 20 Oct 1936, 2♂, 1♀, 1–13 Dec 1936, F. Hoffman, (USNM). Nova Teutonia, 27°11'S, 52°23'W: 1♂, no date, F. Hoffman, slide 4945, (RMNH). São Paulo: Jacupiranga, 800 m: 1♂, 8 Feb 1993, V. Becker, slide USNM 31657, (USNM). São Paulo: 1♂, 1♀, 1895, E. Jones, slide BMNH 26070, (BMNH). COSTA RICA: Cartago: Juan Viñas: 1♀, Jun, W. Schaus, (USNM). Turrialba, 9°54'N, 83°41'W: 1♀, 20 Feb 1972, V. Becker, (VOB); 1♂, 2♀, 10 Mar 1973, 2♂, 25 Mar 1973, 3♂, 4♀, 20 Apr 1972–1973, 5♂, 2♀, 10 May 1973, 2♂, 20 May 1972, 8♂, 1♀, 10 Jun 1972, 1♂, 11 Jul 1973, 8♂, 6♀, 15 Jul 1971–1973, 3♂, 25 Jul 1972, 5♂, 3♀, 5 Aug 1971, 5♂, 1♀, 20 Aug 1971–1972, 10♂, 3♀, 25 Aug 1971, 1♂, 2♀, 10 Sep 1971, 1♂, 25 Sep 1972, 1♂, 1♀, 20 Oct 1972, 2♀, 25 Nov 1971, V. Becker, (VOB). Guanacaste: Estac. Mengo, SW side Volcan Cacao, 1100 m: 1♀, Jun 1988, Janzen & Hallwachs, (INBIO). Estac. Ptila, 9 km S of Sta. Cecilia, 700 m: 1♂, 18–23 Jul 1993, F. Quesada, 1♂, Oct 1993, C. Moraga, 1♂, Nov 1989, Moraga & Rios, (INBIO). Santa Rosa National Park, 300 m: 1♀, Jan 1983, 1♂, 7–8 Jan 1983, 2♀, Feb 1983, 1♂, 18 Apr 1986, 1♂, 8–10 Jun 1980, 1♀, 16–18 Jul 1979, 1♀, Aug 1984, 4♀, Nov 1982, 2♂, 1♀, 13–18 Nov 1979, 1♂, 12 Dec 1979, Janzen & Hallwachs, (INBIO, USNM). Tierras Morenas, 685 m: 3♂, 2♀, Mar 1994, G. Rodriguez, (INBIO). Heredia: Estac. Biol. La Selva, 10°24'N 84°01'W, 50–150 m: 1♂, Jan 1993, (INBIO). Limón: Cerro Tortuguero, Par. Nac. Tortuguero, 0–100 m: 1♂, 2♀, Mar 1991, J. Solomo, 3♂, Jun 1992, R. Delgado, (INBIO). Manzanillo, RNFS Gandoco y Mananillo, 0–100 m: 1♀, 24 Sep–13 Oct, 1♀, 24 Sep–13 Oct 1992, F. Quesada, (INBIO). Sixola River: 1♀, Apr 1907, 1♀, Sep, W. Schaus, (USNM). Puntarenas: Bosque Esquinas, Peninsula de Osa: 1♂, Apr 1994, M. Segura, (INBIO). Estac. Esquinas, Peninsula de Osa: 1♂, Oct 1993, M. Segura, (INBIO). Estac. Quebrada Bonita, Res. Biol. Carara, 50 m: 1♀, Mar 1994, 1♂, Aug 1989, J. Saborio, (INBIO). Estac. Sirena, Par. Nac. Corcovado, 0–100 m: 2♀, Jan 1994, 1♀, Mar 1991, 2♀, Apr 1992, 1♀, Jun 1992, 1♀, Jul 1992, 1♀, Nov 1991, G. Fonseca, (INBIO). Fila Esquinas, 35 km S Palmar Norte, 8°45'N, 83°20'W, 150 m: 1♂, 7–8 Jan 1983, Janzen & Hallwachs, (USNM). Quepos, Par. Nac. Manuel Antonio, 120 m: 1♂, 1991, 1♂, Nov 1991, 1♀, Nov 1992, 1♂, Dec 1990, G. Varela & R. Zuniga, (INBIO). Rancho Quemado, Peninsula de Osa, 200 m: 1♂, Mar 1992, 1♂, Aug 1991, 1♂, Oct 1992, 1♂, 1991, F. Quesada, (INBIO). San Jose: Estac. Bijagual, Res. Biol. Carara, 500 m: 1♂, Sep 1990, R. Zuniga, (INBIO). CUBA: Viñales: 4♂, 26–29 Sep 1989, V. Becker, (VOB, USNM). ECUADOR: Napo: Misahuallí, 450 m: 2♀, Dec 1992, V. Becker, (USNM). FRENCH GUIANA: Cayenne: St. Laurent du Maroni: 1♂, no date, 1♀, Nov, Le Moul, (BMNH). St. Jean du Maroni: 2♂, 2♀, no date, slide BM 23670, (BMNH). Nouveau Chantier: 1♀, Oct, Le Moul, (BMNH). Piste Isnard, km 35, near Crique Portal, 5°15'N, 53°51'W, 1♀, 17 Jan 1983, J.-F. Landry, at light in pristine-logged rain forest, slide USNM 29891, (USNM). GUATEMALA: 1♂, (BMNH). Izabal: Cayuga: 1♂, 4♀, no date, W. Schaus, 1♀, Apr, W. Schaus, (USNM); 1♀, Sep, slide BM 2684, (BMNH); 1♀, no date, Schaus & Barnes, slide 4944, (RMNH). Chejel: 1♂, 1♀, Jul, slides BM 2216, 19338, (BMNH). GUYANA: Mazaruni Potaro: Essequibo River, Moraballi Creek: 2♀, 23–30 Oct 1929, (BMNH). Essequibo, Picsewana Is., 6 mi [9.7 km] S. Wineperu: 1♀, 8–16 Mar 1969, W. Duckworth, (USNM). Mackenzie, Demerara River: 1♀, 24 Jun 1927, (CU). MEXICO: Sinaloa: 5 mi [8 km] N Mazatlán: 1♂, 28 Jul 1964, Chemsak and Powell, at light, (UCB). Tamaulipas: El Encino, 250 m: 1♂, 4–13 Aug 1988, V. Becker, slide DRD 3979, (VOB). Veracruz: Jalapa: 1♀, W. Schaus, (USNM). Misantla: 2♀, no date, 2♀, May 1909–1911, 1♀, Sep 1914, 1♀, Nov 1911, R. Müller, (USNM). Playa Azul: 1♀, 14–19 Aug 1976, J. Hafemik & R. Garrison, (UCB). Orizaba: 2♀, (paratypes), W. Schaus, slide USNM 22327, (USNM). PANAMA: Alhajuelo: 1♀ (holotype), 1911, A. Busck, USNM type 16767, (USNM). Canal Zone: Barro Colorado Island, Gatun Lake: 1♀, 5 Apr 1924, slide 2206, (CU); 1♀, 25–30 Mar 1964–1965, 1♀, 10–17 May 1964, W. Duckworth, (USNM). Cabima: 3♂ (paratypes), May 1911, A. Busck, (USNM). Colón: Porto Bello: 1♂, Oct 1912, G. Cleveland, (BMNH); 5♂ (paratypes), Oct 1912, 1♂, 1♀ (paratypes), Dec 1912, G. Cleveland, (USNM). PARAGUAY: Paraguari: Cerro Acahay, 25°53'S, 57°08'W: 1♂, 13–14 Mar 1986, Pogue & Solis, (USNM). PERU: Cuzco: Pilcopata, 600 m: 5♂, 1♀, 11–14 Dec 1979, J. Heppner, premontane moist forest, (USNM). Loreto: Callicebus Research Station, Mishona, Rio Nanay: 3♀, 10–17 Jan 1980, J. Heppner, tropical wet forest, (USNM). Madre de Dios: Rio Tambopata Reserve, 30 air mi [48.3 km] W Pto Maldonado, 290 m: 1♂, 6–10 Nov 1979, 1♂, 21–25 Nov 1979, 1♀, 26–30 Nov 1979, J. Heppner, subtropical moist forest, (USNM). SURINAM: Aroewarwa Creek, Maroewym Valley: 2♀, Mar 1905, S. Klages, (BMNH). Baboenhol, Suriname River: 1♀, 18–24 Aug 1980, (BMNH). Coebiti: 1♂, 4–14 Aug 1980, slide BM 23668, (BMNH). TRINIDAD: Simla, Arima Valley: 13♂, 13–26 Feb 1966, W. Duckworth, slides USNM 22326, 29514, 29565, (USNM). VENEZUELA: Amazonas: Basecamp, 140 m, Cerro de la Neblina, 0°50'N, 66°9'44"W: 4♂, 32♀, 4–29 Feb 1984, 1♂,

23♀, 1–10 Mar 1984, Davis & McCabe, (USNM); 1♀, 20–24 Mar 1984, Flint & Louton, (USNM). San Carlos de Rio Negro, 6 km E: 3♀, 23 Nov 1984, R. Brown, (USNM). Bolivar: El Bochinche Res. Forestal Imataca., 200 m: 1♂, 6–13 Dec 1974, (UCVM). Mt. Roraima: 1♀, 10–18 Sep 1974, B. Ridout, (BMNH). Guarico: Hato Masaguarai, 45 km S Calabozo, 75 m, 8°57'N, 67°58'W: 1♀, 10 Jul 1989, M. Epstein, UV light, gallery forest, (USNM).

DISCUSSION.—This species is the most widespread, commonly encountered member of the subfamily. Its known distribution (Map 8) virtually encompasses the Neotropical region. Superficially inseparable from three other previously

unknown neotropical species, the males of *Harmaclona cossidella* can be distinguished by the subtruncate, slightly trifid apex of the aedoeagus and by the small, apical knob on the otherwise broadly rounded ventral (saccular) lobe of the valvae. The female genitalia are characterized by the small, knob-like, parallel lobes at the caudal margin of sternum VIII.

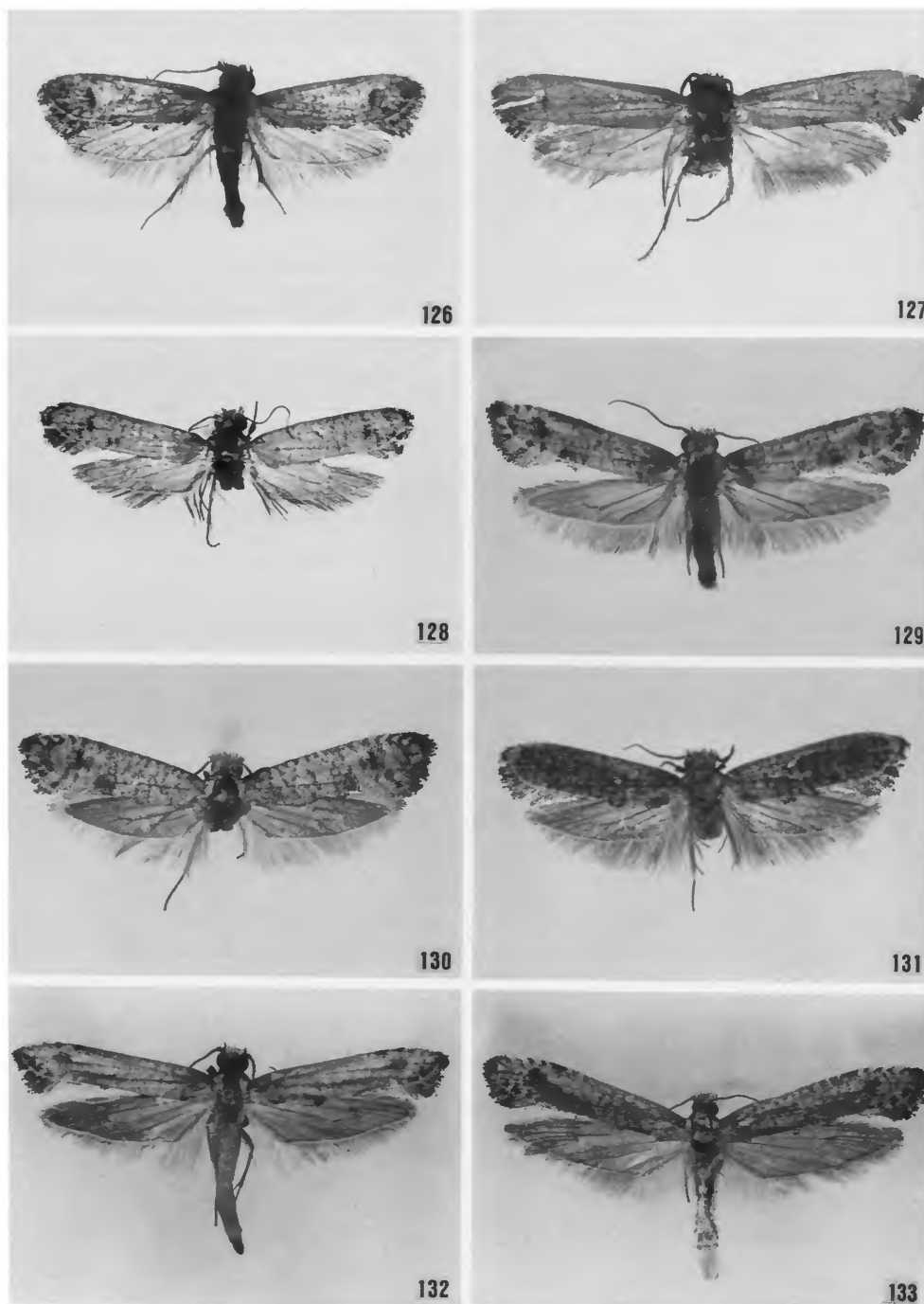
In addition to the holotype, the type series was found to comprise 12 paratypes, not including a single misidentified specimen each of *Diataga leptosceles* Wlsm. (Tineidae) and *Oestomorpha allora* Wlsm. (Gelechiidae) that Busck had labelled with the same type number "16767" as the rest of the series.

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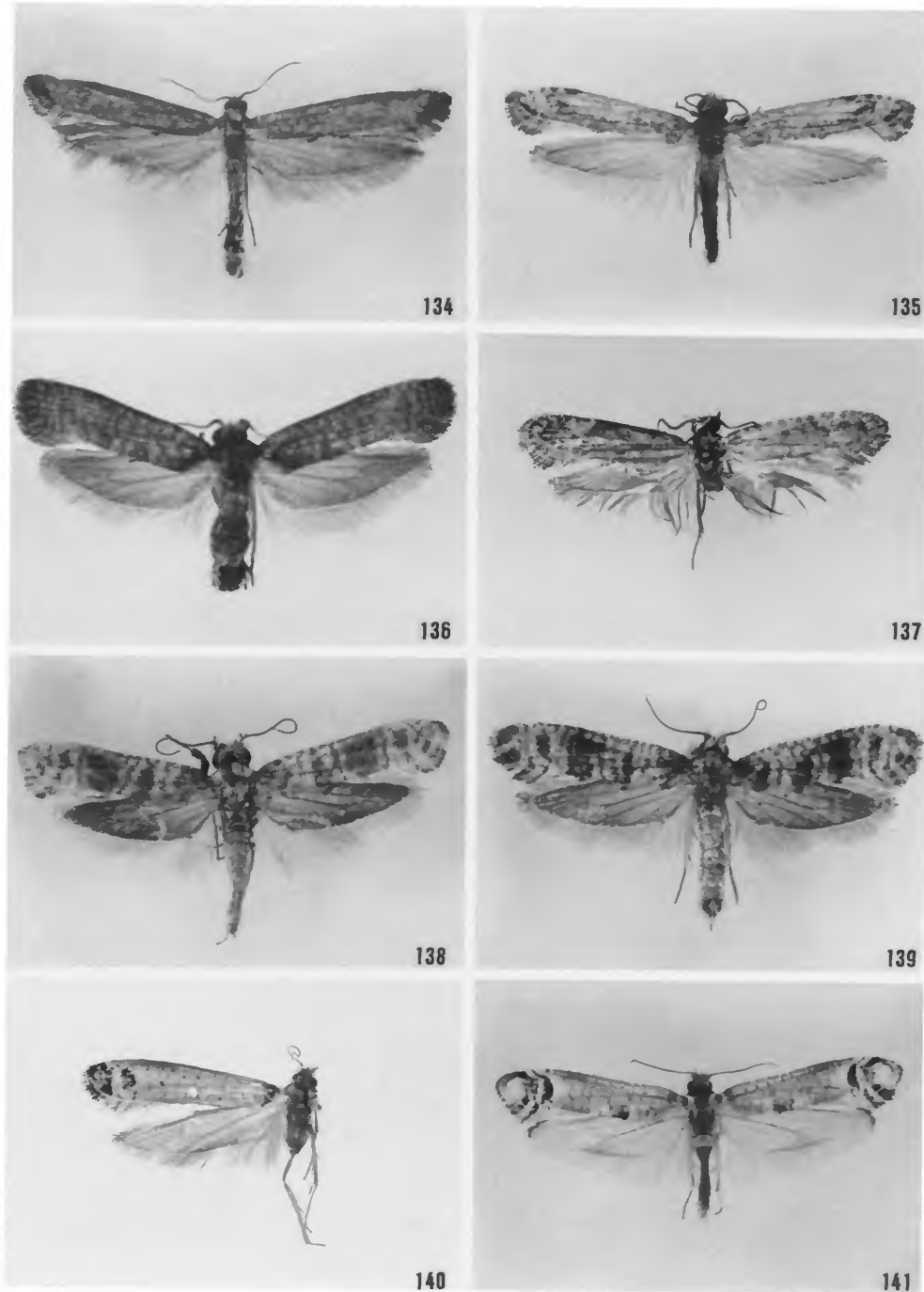
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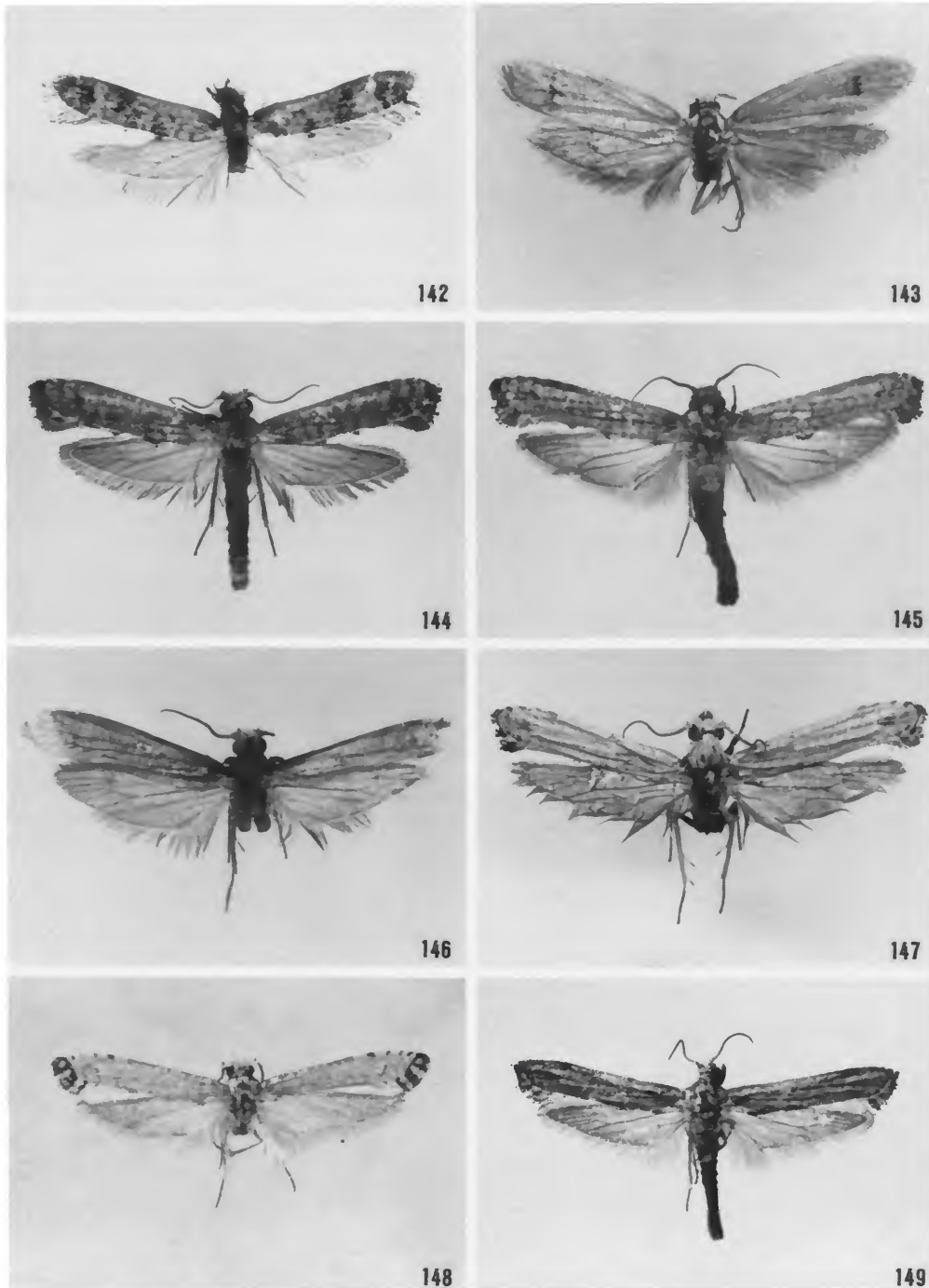
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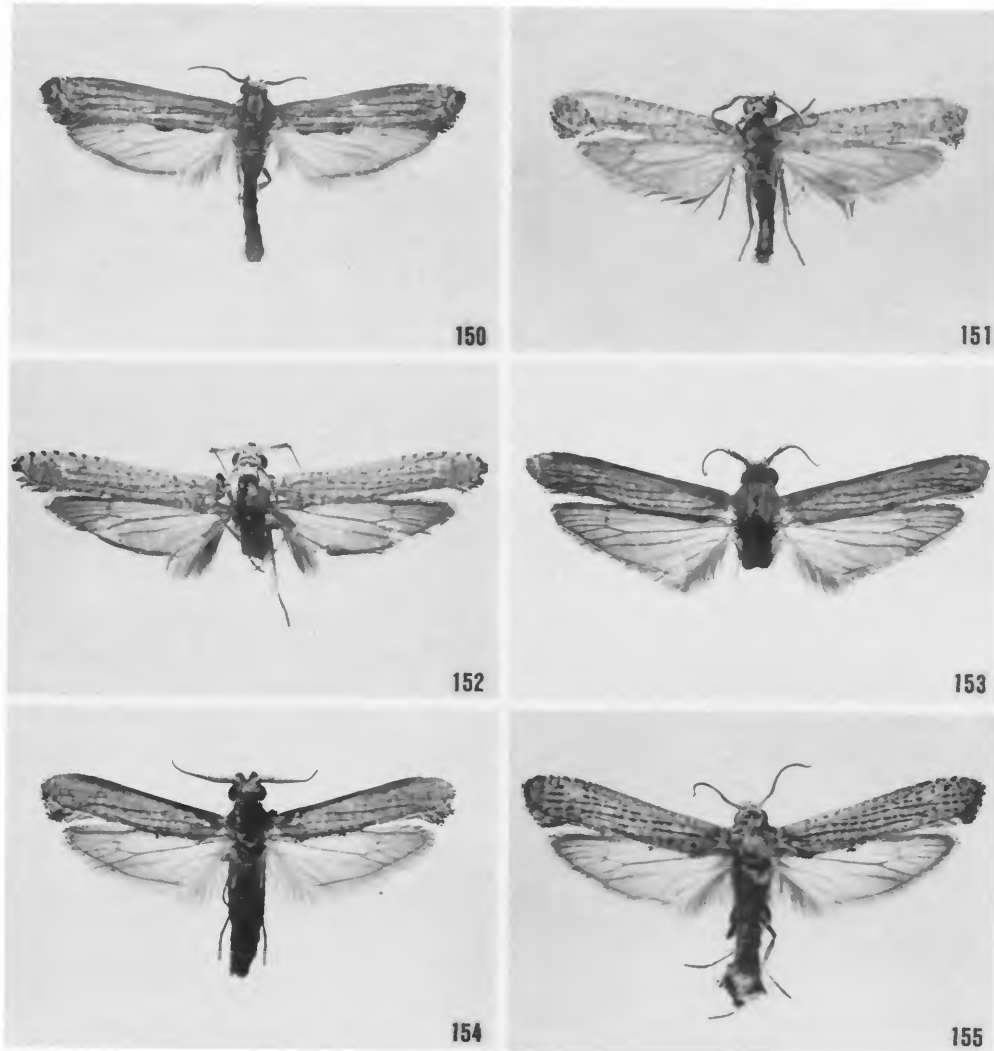
FIGURES 126–133.—Adults: 126, *Micrethista dissacca*, holotype ♂ (5.1 mm); 127, *M. resima*, holotype ♂ (8 mm); 128, *M. bifida*, holotype ♂ (6 mm); 129, *M. denticulata*, holotype ♂ (7.5 mm); 130, *M. denticulata*, paratype ♂ (6.9 mm); 131, *M. denticulata*, paratype ♀ (7 mm); 132, *M. entripta*, ♂ (8.5 mm); 133, *M. entripta*, ♀ (12 mm). (Length of forewing in parentheses.)



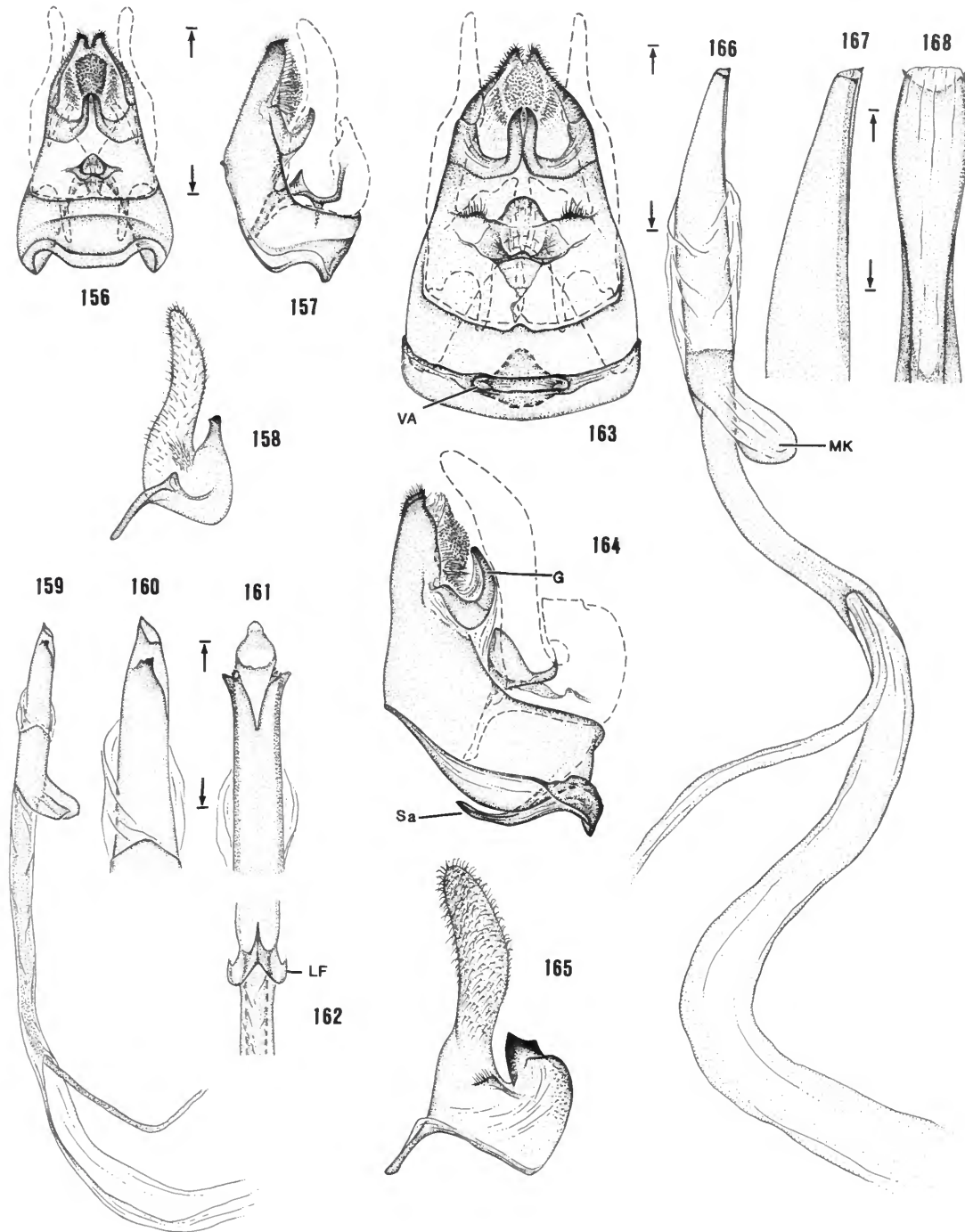
FIGURES 134-141.—Adults: 134, *Micrerehista nigrapex*, paratype ♀ (10 mm); 135, *M. eustena*, ♂ (7 mm); 136, *M. fusca*, holotype ♀ (8.1 mm); 137, *M. africana*, holotype ♂ (5.5 mm); 138, *M. fasciola*, paratype ♂ (5.8 mm); 139, *M. fasciola*, paratype ♀ (9 mm); 140, *M. mochlacma*, lectotype ♂ (12 mm); 141, *M. mochlacma*, ♂ (13 mm). (Length of forewing in parentheses.)



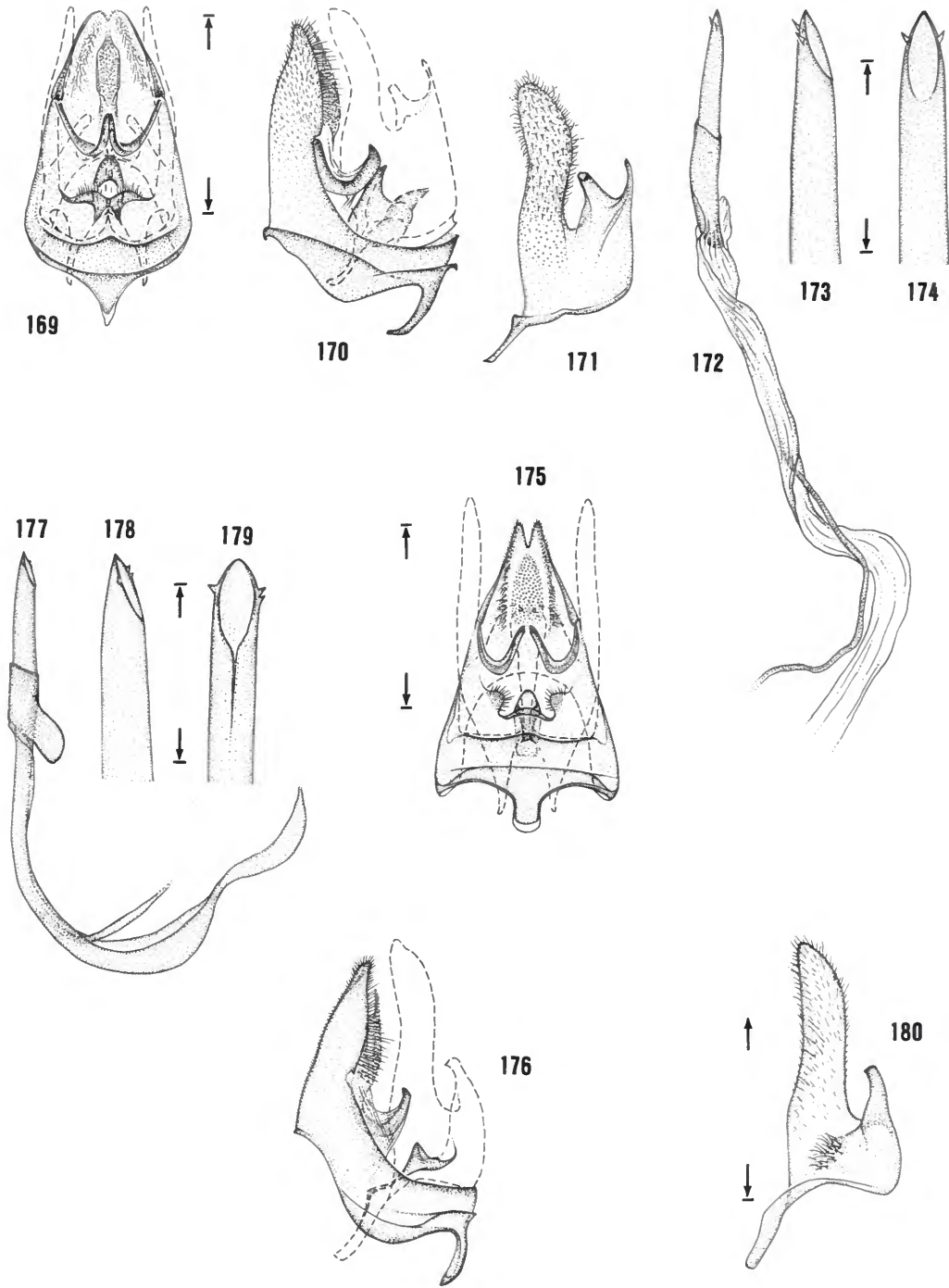
FIGURES 142-149.—Adults: 142, *Micrerethista mochlacma* (= ♂ holotype of *M. capnozona*, 7.9 mm); 143, *Micrerethista* species, ♀ (9 mm); 144, *Harmaclona robinsoni*, holotype ♂ (6.5 mm); 145, *H. tephrantha*, ♂ (12.1 mm); 146, *H. tephrantha*, ♂, bilateral gynandromorph with feminine left side (11.2 mm) and masculine right side (10 mm); 147, *H. afrotephrantha*, holotype ♂ (11 mm); 148, *H. berberea*, holotype ♂ (9.9 mm); 149, *H. malgassica*, holotype ♂ (10 mm). (Length of forewing in parentheses.)



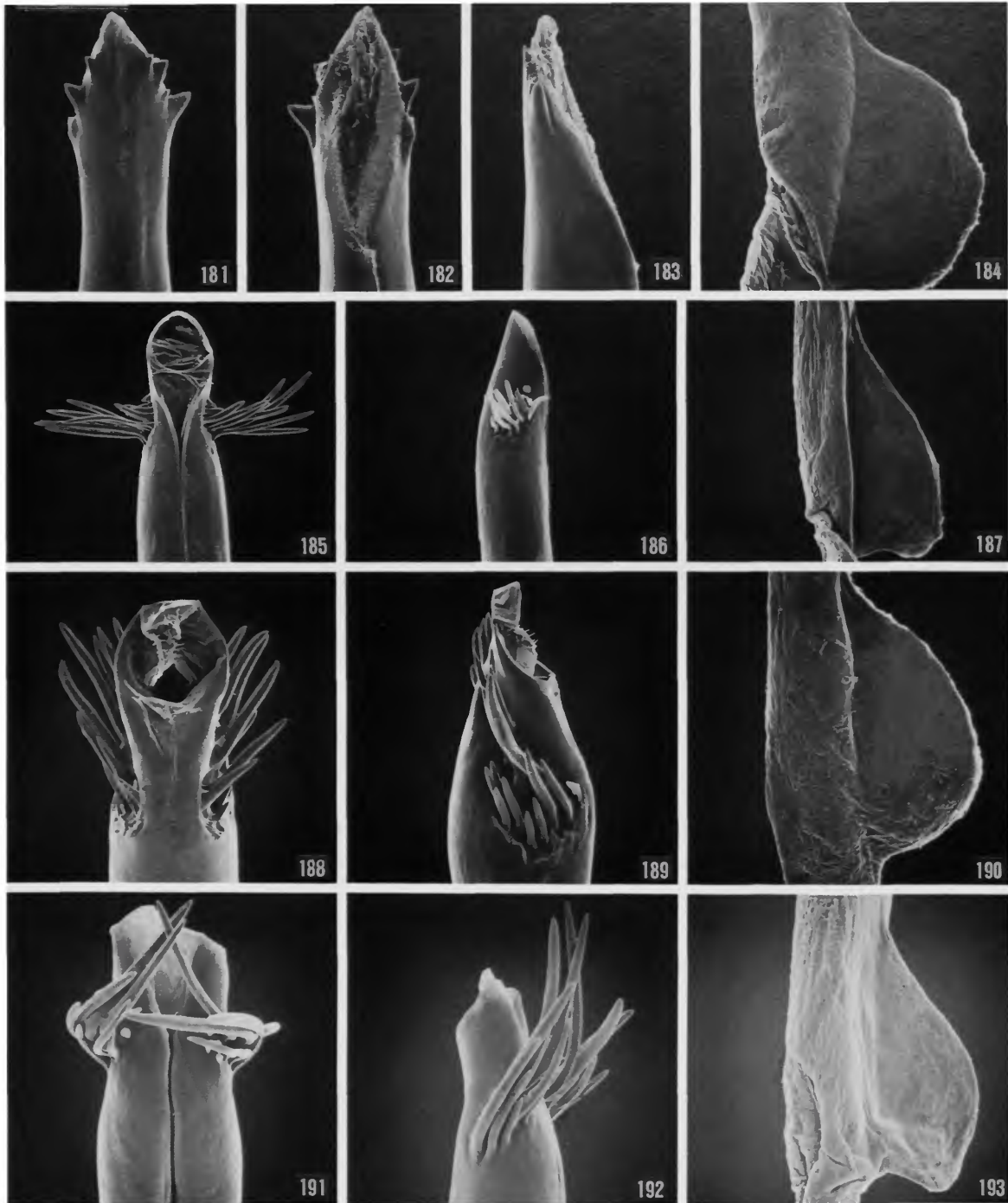
FIGURES 150–155.—Adults: 150, *Harmaclona natalensis*, ♀ (17 mm); 151, *H. hilethera*, ♂ (8 mm); 152, *H. hexacantha*, holotype ♂ (14 mm); 153, *H. tetracantha*, holotype ♂ (11.5 mm); 154, *H. triacantha*, holotype ♂ (8 mm); 155, *H. cossidella*, ♀ (15 mm). (Length of forewing in parentheses.)



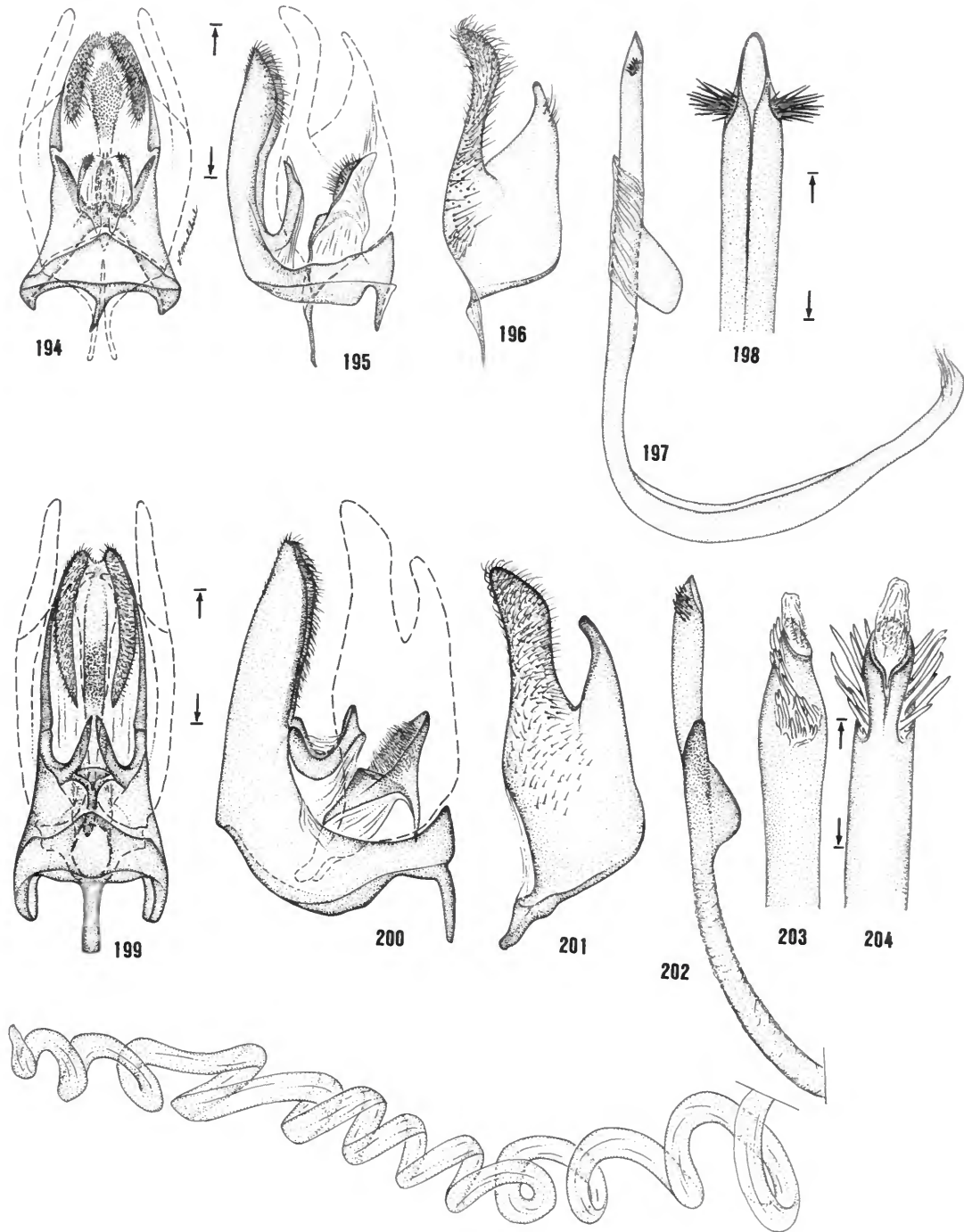
FIGURES 156-168.—Male genitalia. *Micrerethista dissacca*: 156, ventral view (0.5 mm); 157, lateral view; 158, valva, mesal view; 159, aedeagus, lateral view; 160, apex, lateral view of Figure 159 (0.25 mm); 161, apex, ventral view of Figure 159; 162, base, ventral view of Figure 159 showing flared midventral keel (LF = lateral flange of midventral keel). *Micrerethista resima*: 163, ventral view (0.5 mm; VA = ventral aperture); 164, lateral view (G = gnathos, SA = saccus); 165, valva, mesal view; 166, aedeagus, lateral view (MK = midventral keel); 167, apex, lateral view of Figure 166 (0.25 mm); 168, apex, ventral view of Figure 166. (Scale lengths in parentheses.)



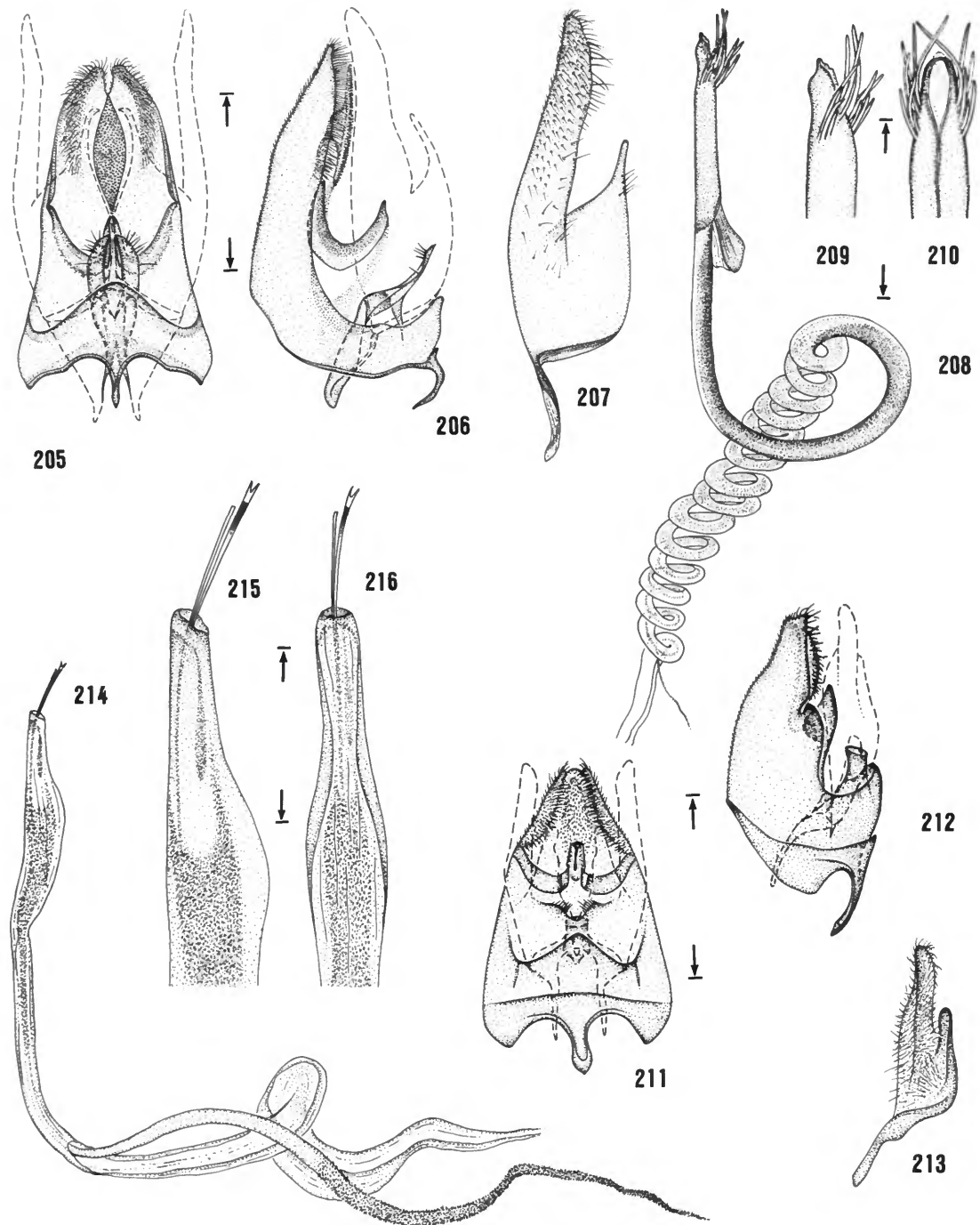
FIGURES 169-180.—Male genitalia. *Micrerethista bifida*: 169, ventral view (0.5 mm); 170, lateral view; 171, valva, mesal view; 172, aedeagus, lateral view; 173, apex, lateral view of Figure 172 (0.25 mm); 174, apex, ventral view of Figure 172. *Micrerethista denticulata*: 175, ventral view; 176, lateral view; 177, aedeagus, lateral view; 178, apex, lateral view of Figure 177 (0.25 mm); 179, apex, ventral view of Figure 177; 180, valva, mesal view. (Scale lengths in parentheses.)



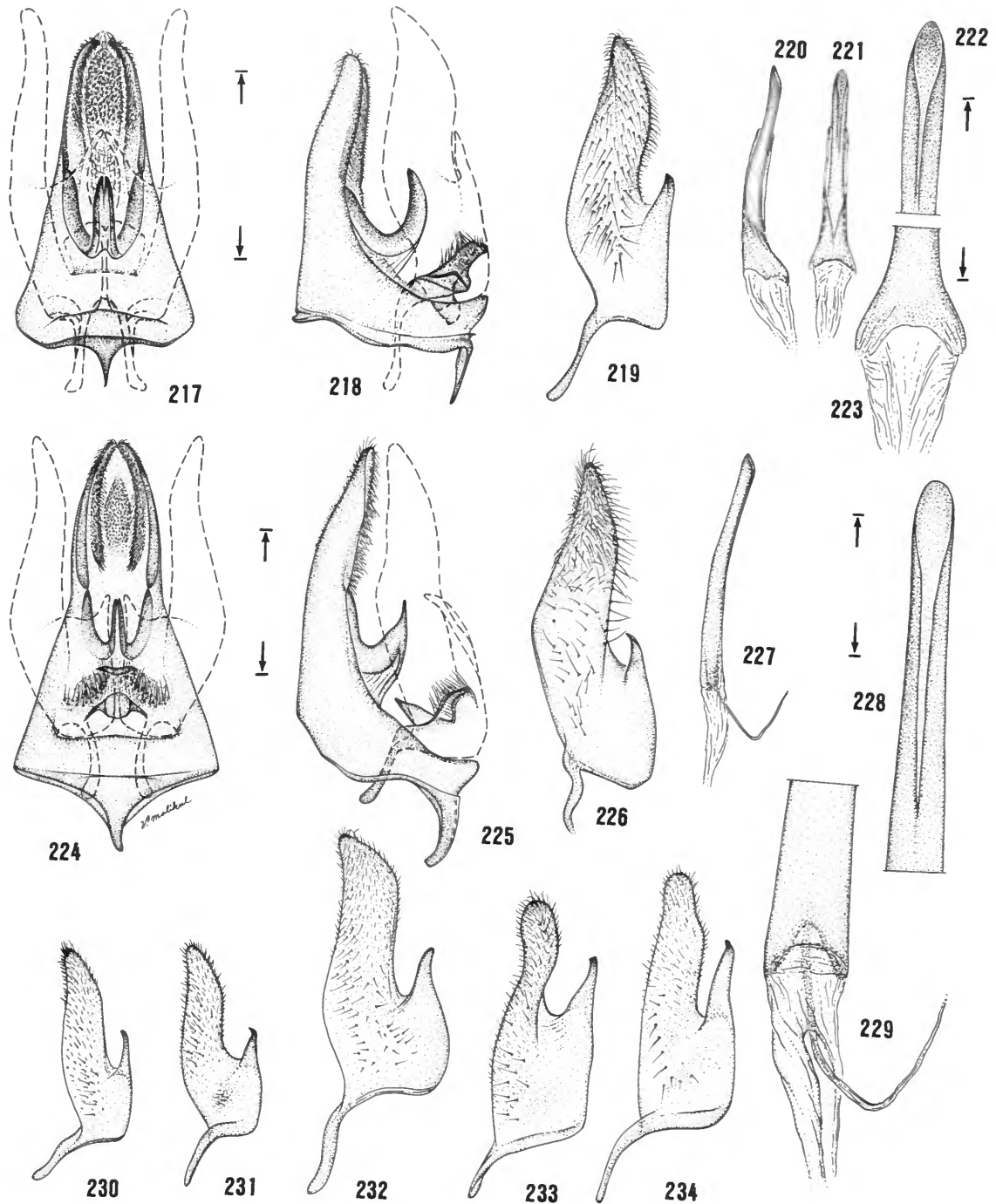
FIGURES 181–193.—Male aedeagi. *Micrereithista denticulata*: 181, apex, dorsal view (43 μm); 182, apex, ventral view (43 μm); 183, apex, lateral view (43 μm); 184, lateral view of basal midventral keel (43 μm). *Micrereithista entripta*: 185, apex, ventral view (86 μm); 186, apex, lateral view (86 μm); 187, lateral view of basal midventral keel (136 μm). *Micrereithista nigrapex*: 188, apex, ventral view (86 μm); 189, apex, lateral view (86 μm); 190, lateral view of basal midventral keel (136 μm). *Micrereithista eustena*: 191, apex, ventral view (50 μm); 192, apex, lateral view (50 μm); 193, lateral view of basal midventral keel (86 μm). (Scale lengths in parentheses; bar scale for all photographs shown in Figure 181.)



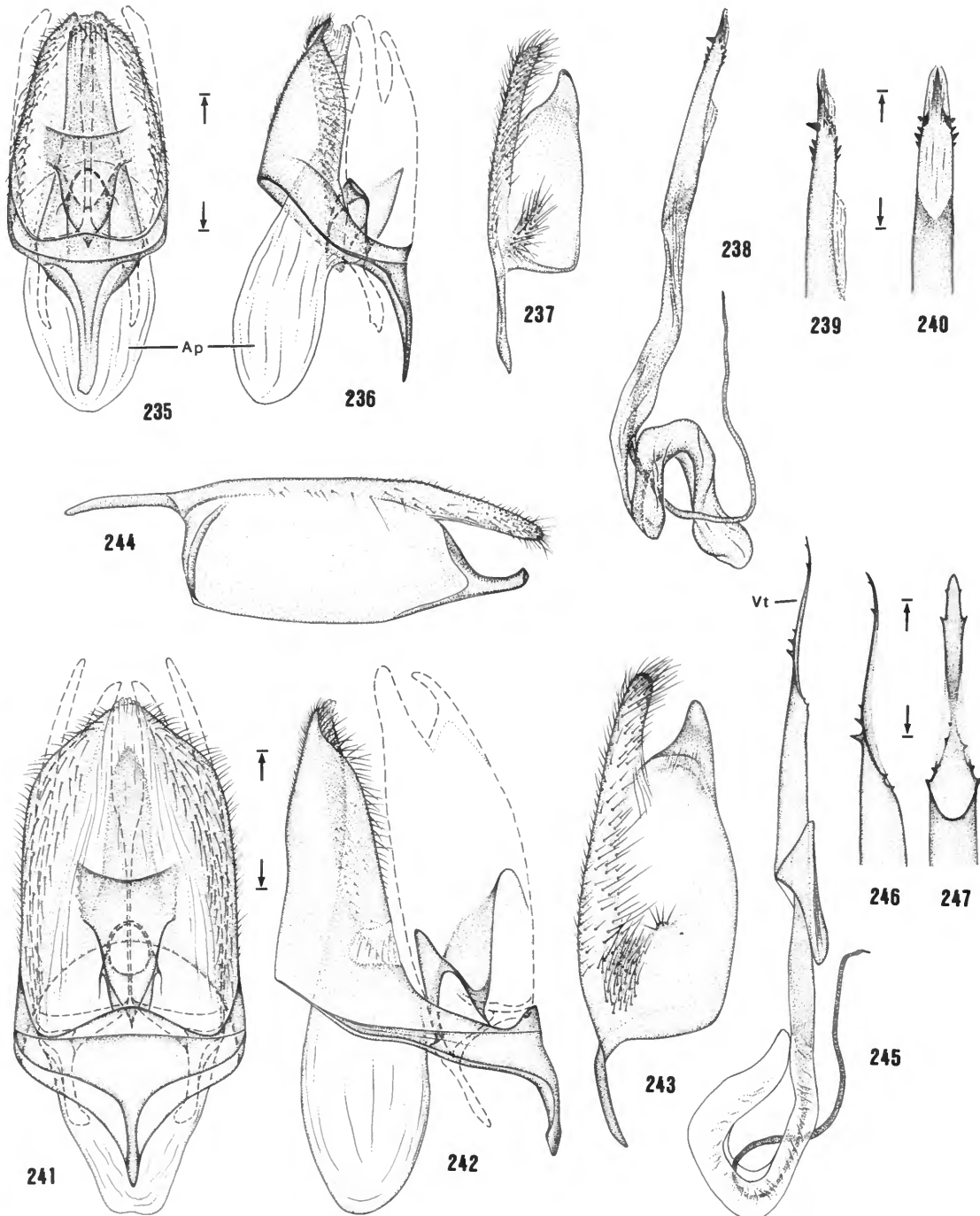
FIGURES 194–204.—Male genitalia. *Micrerethista entripta*: 194, ventral view (0.5 mm); 195, lateral view; 196, valva, mesal view; 197, aedeagus, lateral view; 198, apex, ventral view of Figure 197 (0.25 mm). *Micrerethista nigrapex*: 199, ventral view (0.5 mm); 200, lateral view; 201, valva, mesal view; 202, aedeagus, lateral view; 203, apex, lateral view of Figure 202 (0.25 mm); 204, apex, ventral view of Figure 202. (Scale lengths in parentheses.)



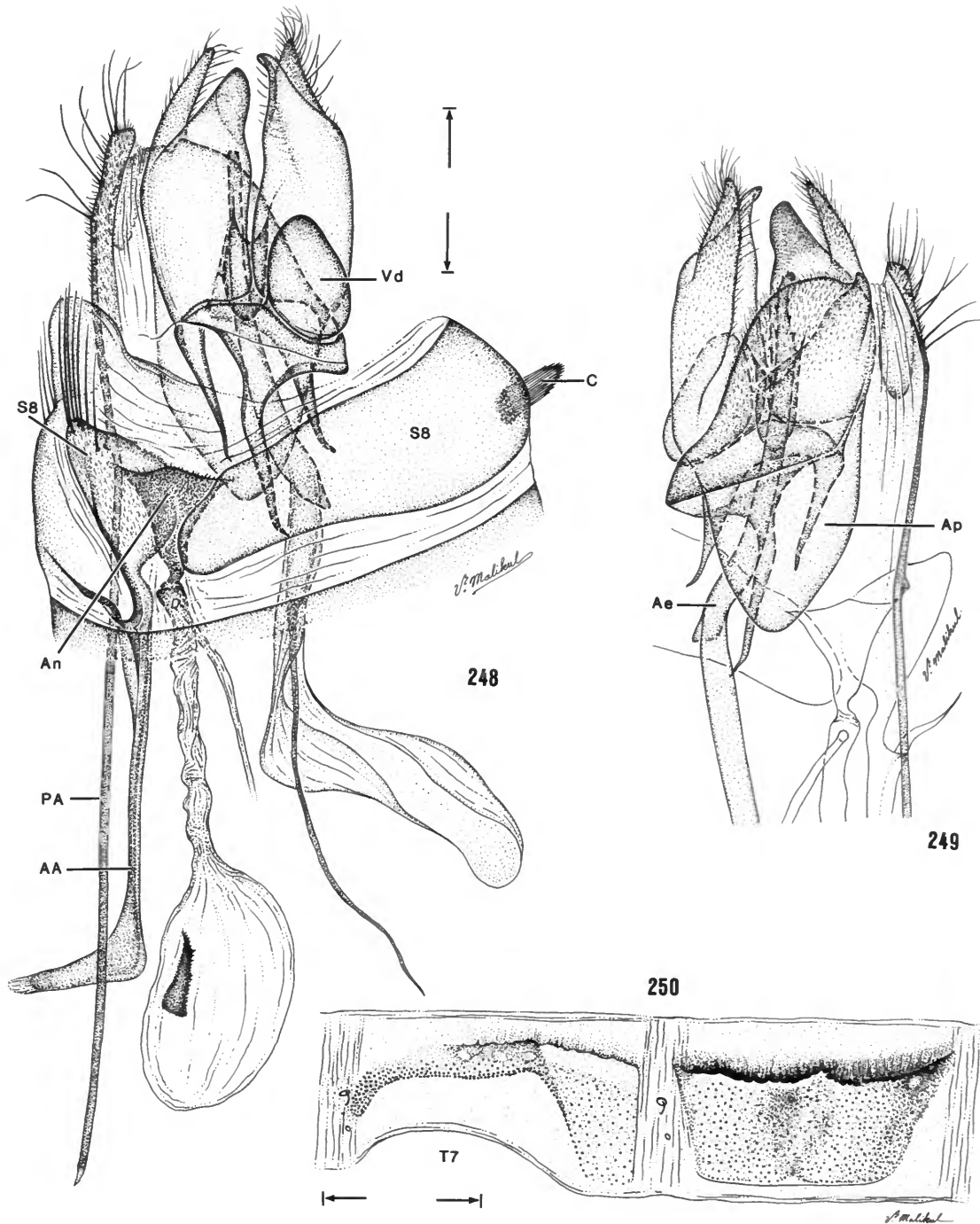
FIGURES 205-216.—Male genitalia. *Micrereithista eustena*: 205, ventral view (0.5 mm); 206, lateral view; 207, valva, mesal view; 208, aedeagus, lateral view; 209, apex, lateral view of Figure 208 (0.25 mm); 210, apex, ventral view of Figure 208. *Micrereithista africana*: 211, ventral view (0.5 mm); 212, lateral view; 213, valva, mesal view; 214, aedeagus, lateral view; 215, apex, lateral view of Figure 214 (0.25 mm); 216, apex, ventral view of Figure 214. (Scale lengths in parentheses.)



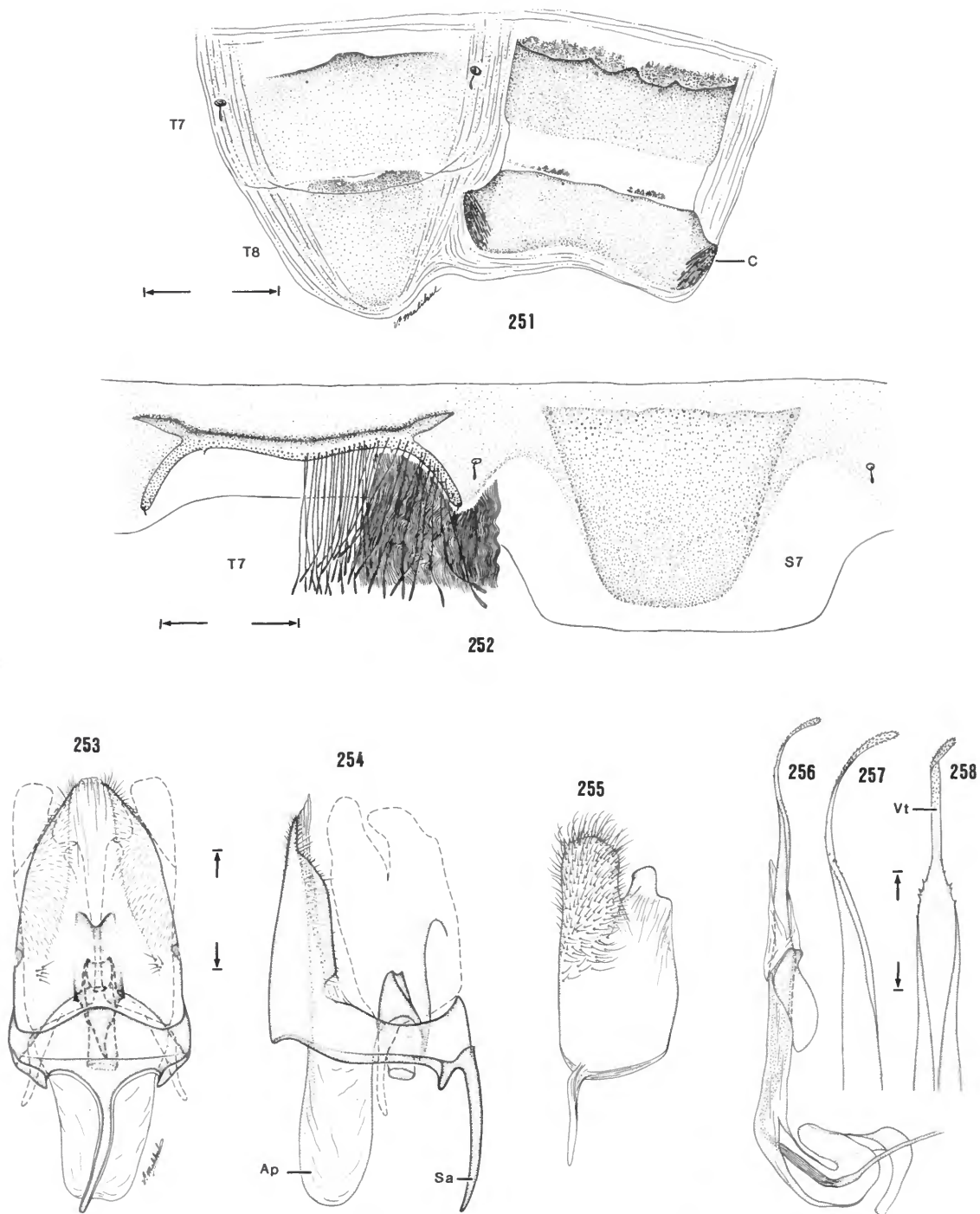
FIGURES 217-234.—Male genitalia. *Micrerethista fasciola*, 217, ventral view (0.5 mm); 218, lateral view; 219, valva, mesal view; 220, aedeagus, lateral view; 221, ventral view of Figure 220; 222, apex, ventral view of Figure 221 (0.25 mm); 223, base, ventral view of Figure 221. *Micrerethista mochlacma*: 224, ventral view (0.5 mm); 225, lateral view; 226, valva, mesal view, USNM 30826, Kandep, Papua New Guinea; 227, aedeagus, lateral view; 228, apex, ventral view of Figure 227 (0.25 mm); 229, base, ventral view of Figure 227. Valvae, mesal views (all drawn to same scale as Figure 226): 230, *M. capnozona*, holotype, BM 2505, Mafulu, Papua New Guinea; 231, *M. mochlacma*, BM 2660, Talesea, Papua New Guinea; 232, lectotype, BM 2504, Mt. Tafa, Papua New Guinea; 233, BM 2664, Talesea, Papua New Guinea; 234, BM 2208, Talesea, Papua New Guinea. (Scale lengths in parentheses.)



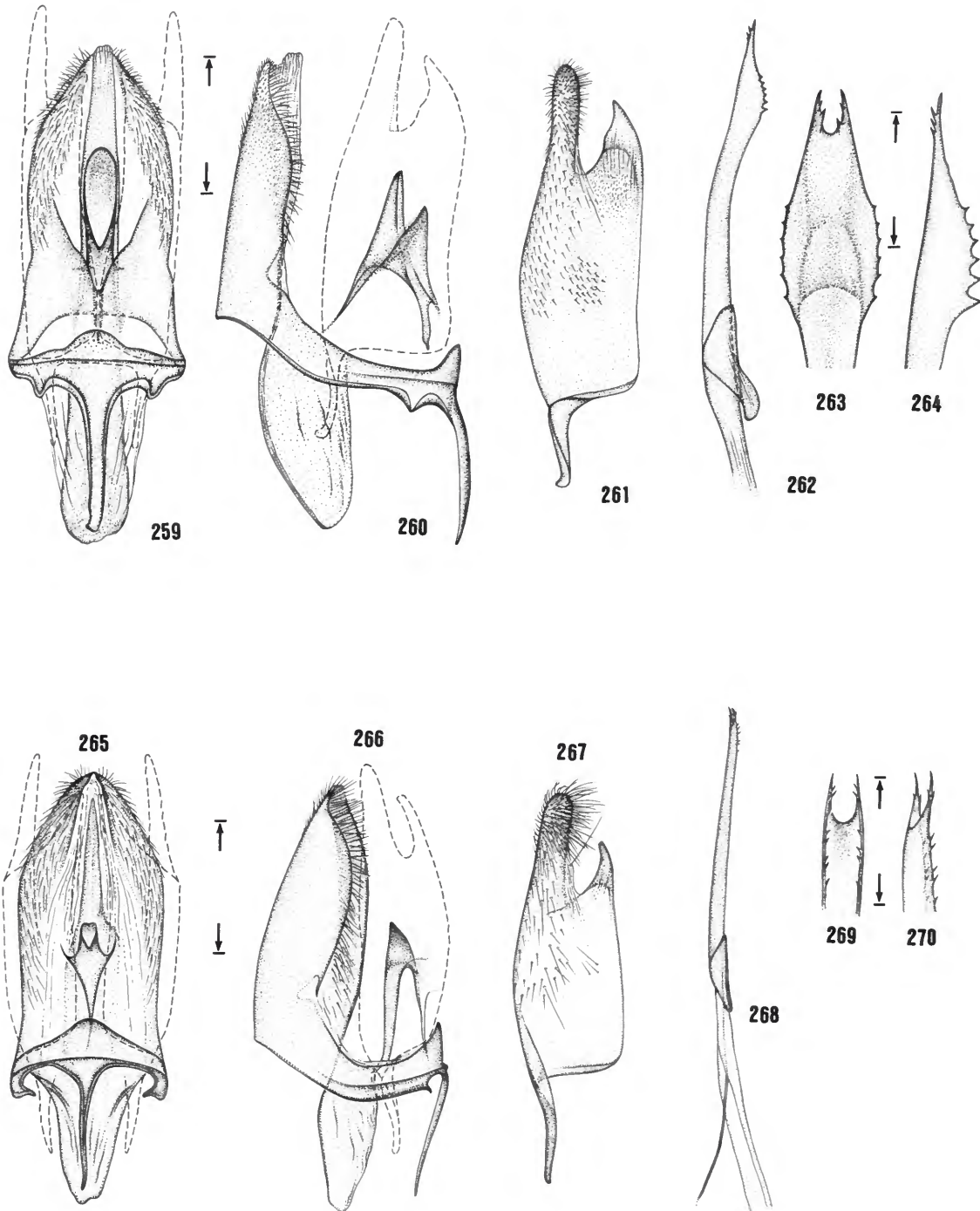
FIGURES 235-247.—Male genitalia. *Hamaclona robinsoni*: 235, ventral view (0.5 mm; Ap = apotheca); 236, lateral view; 237, valva, mesal view; 238, aedeagus, lateral view; 239, apex, lateral view of Figure 238 (0.25 mm); 240, apex, ventral view of Figure 238. *Hamaclona tephrantha*: 241, ventral view (0.5 mm); 242, lateral view; 243, valva, mesal view, USNM 29843, Labugama, Sri Lanka; 244, valva, mesal view, BM 27882, Ulu Temburong, Brunei; 245, aedeagus, lateral view (Vt = vitta); 246, apex, lateral view of Figure 245 (0.25 mm); 247, apex, ventral view of Figure 245. (Scale lengths in parentheses.)



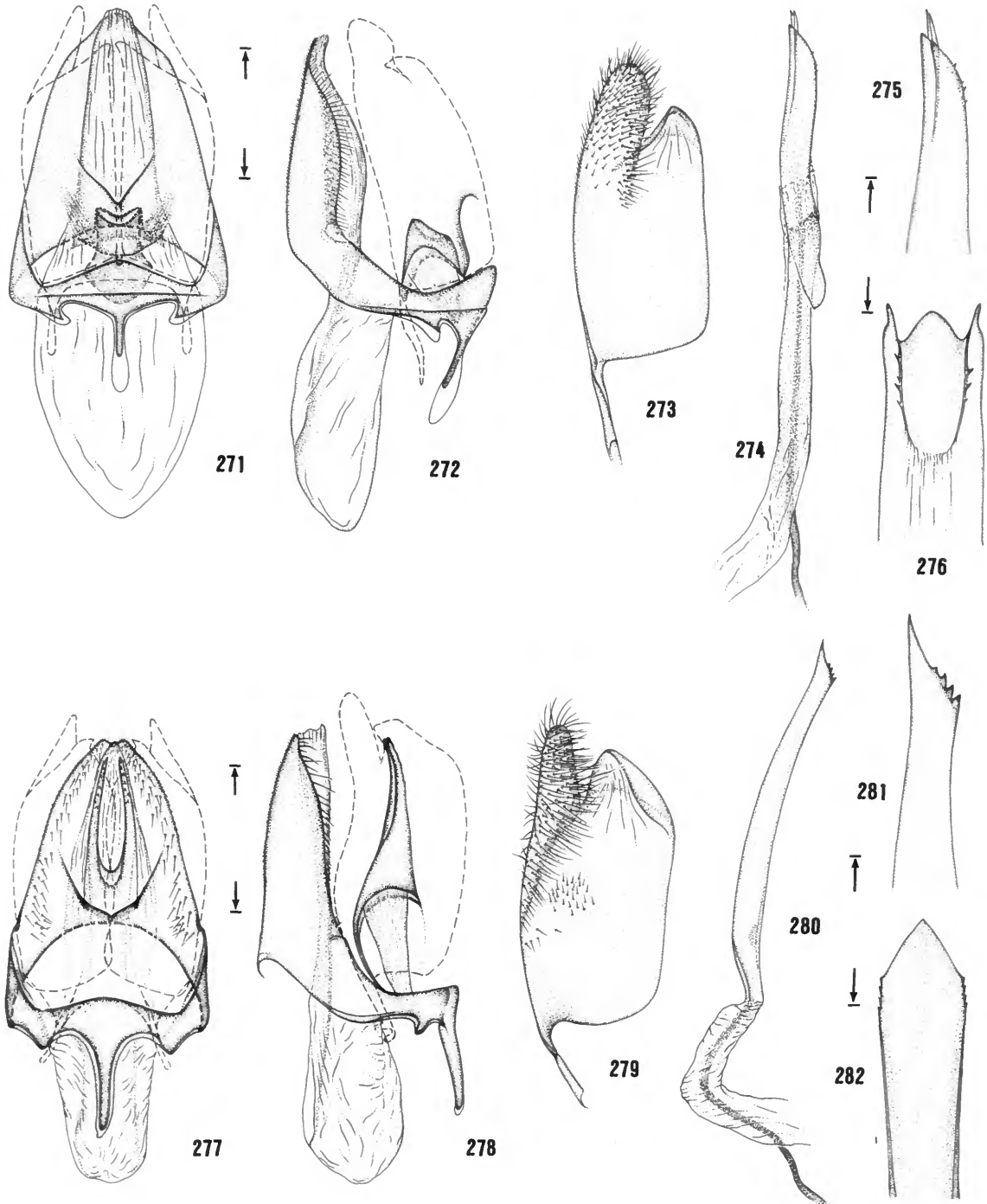
FIGURES 248-250.—*Harmaclona tephrantha*, bilateral gynandromorphic genitalia and pregenital abdominal segments: 248, genitalia and eighth sternum (S8), ventral view, with feminine left side and masculine right side (0.5 mm; AA = anterior apophysis, C = corematis, PA = posterior apophysis, S = sternum, Vd = valvoid); 249, genitalia, dorsal view (Ae = aedoeagus, Ap = apotheca); 250, seventh abdominal segment; see Figures 251 and 252 for normal condition (1 mm; T = tergum). (Scale lengths in parentheses.)



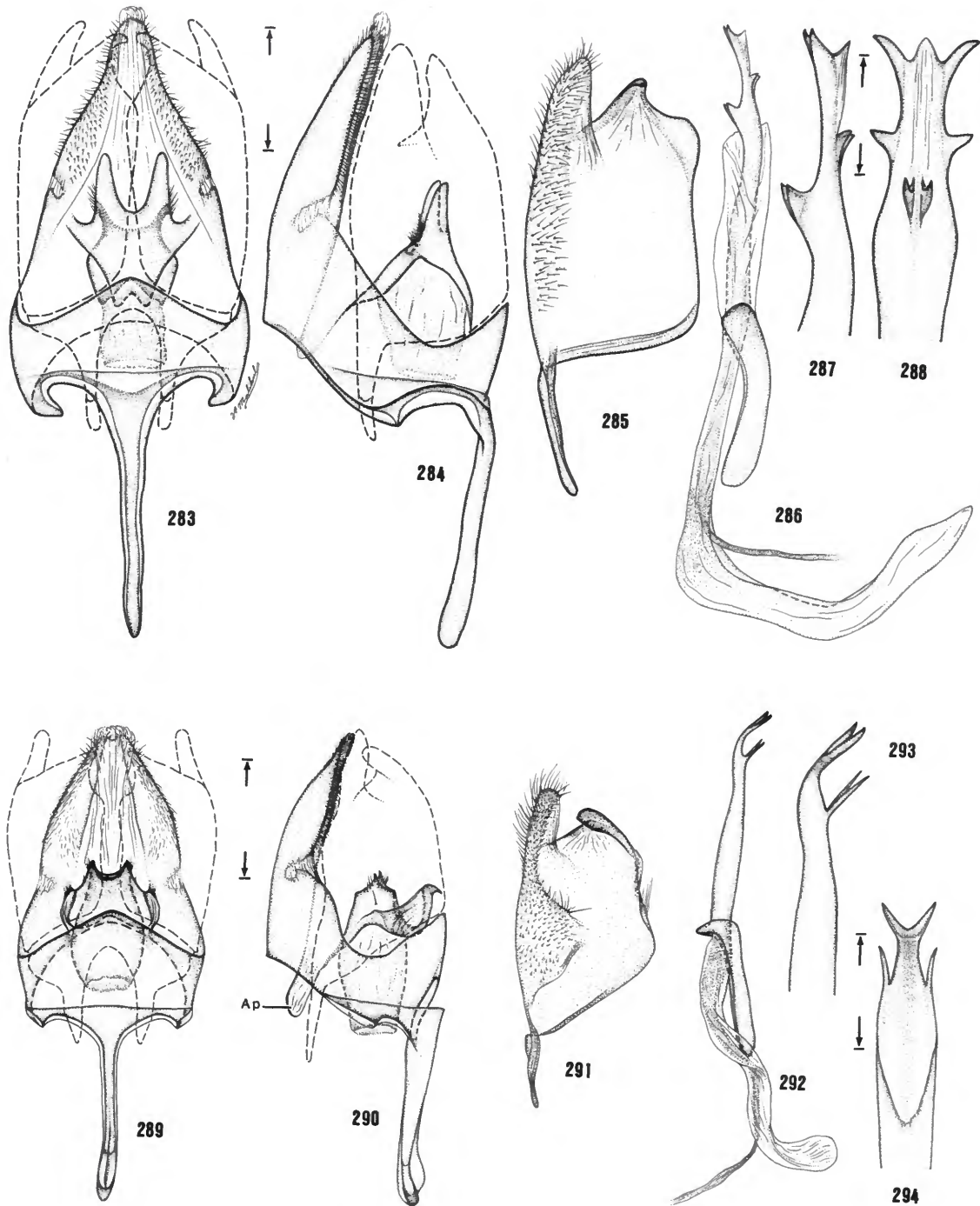
FIGURES 251–258.—Abdominal morphology and male genitalia. *Harnia tephrantha*: 251, abdominal segments 7 and 8 of male (1 mm; C = corematitis, T = tergum); 252, abdominal segment 7 of female (1 mm; S = sternum). *Harnia afrotephrantha*, male genitalia: 253, ventral view (0.5 mm); 254, lateral view (Ap = apotheca, S = saccus); 255, valva, mesal view; 256, aedoeagus, lateral view; 257, apex, lateral view of Figure 256 (0.25 mm); 258, apex, ventral view of Figure 256 (Vt = vitta). (Scale lengths in parentheses.)



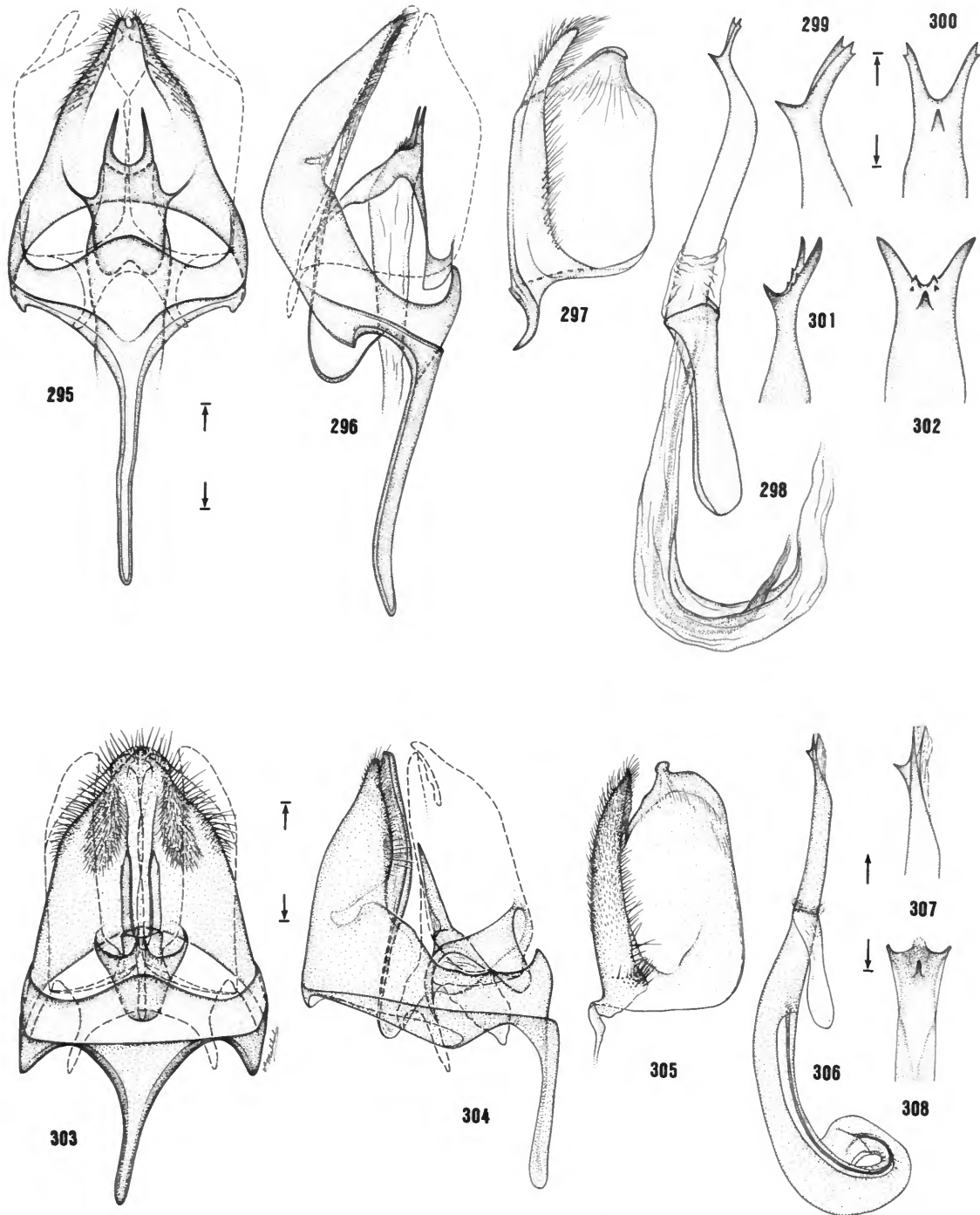
FIGURES 259-270.—Male genitalia. *Harmaclona berberea*: 259, ventral view (0.5 mm); 260, lateral view; 261, valva, mesal view; 262, aedoeagus, lateral view; 263, apex, ventral view of Figure 262 (0.25 mm); 264, apex, lateral view of Figure 262. *Harmaclona malgassica*: 265, ventral view (0.5 mm); 266, lateral view; 267, valva, mesal view; 268, aedoeagus, lateral view; 269, apex, ventral view of Figure 268 (0.25 mm); 270, apex, lateral view of Figure 268. (Scale lengths in parentheses.)



FIGURES 271-282.—Male genitalia. *Hamaclona natalensis*: 271, ventral view (0.5 mm); 272, lateral view; 273, valva, mesal view; 274, aedeagus, lateral view; 275, apex, lateral view of Figure 274 (0.25 mm); 276, apex, ventral view of Figure 274. *Hamaclona hilethera*: 277, ventral view (0.5 mm); 278, lateral view; 279, valva, mesal view; 280, aedeagus, lateral view; 281, apex, lateral view of Figure 280 (0.25 mm); 282, apex, ventral view of Figure 280. (Scale lengths in parentheses.)



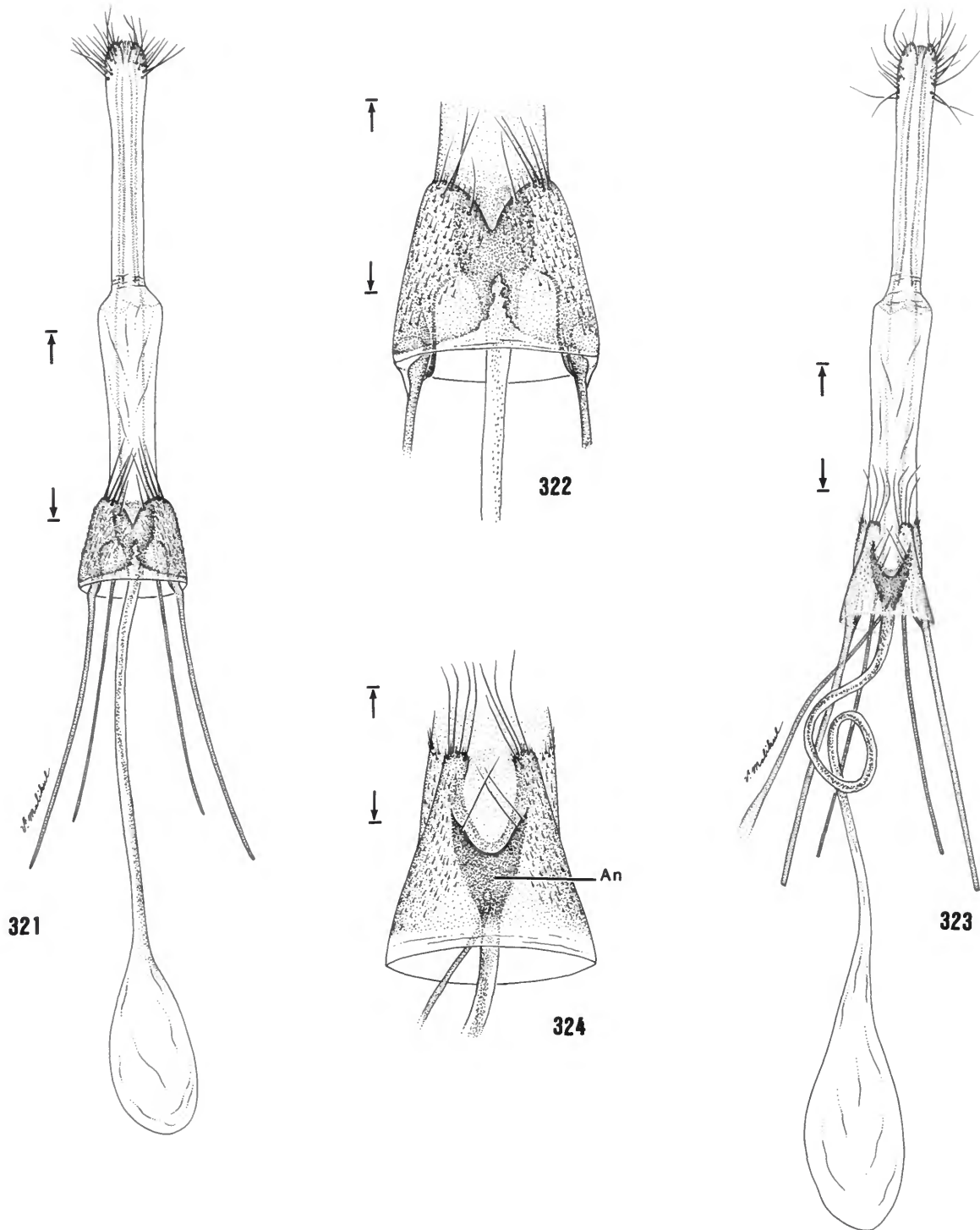
FIGURES 283-294.—Male genitalia. *Harmaclona hexacantha*: 283, ventral view (0.5 mm); 284, lateral view; 285, valva, mesal view; 286, aedeagus, lateral view; 287, apex, lateral view of Figure 286 (0.25 mm); 288, apex, ventral view of Figure 286. *Harmaclona tetracantha*: 289, ventral view (0.5 mm); 290, lateral view (Ap = apotheca); 291, valva, mesal view; 292, aedeagus, lateral view; 293, apex, lateral view of Figure 292 (0.25 mm); 294, apex, ventral view of Figure 292. (Scale lengths in parentheses.)



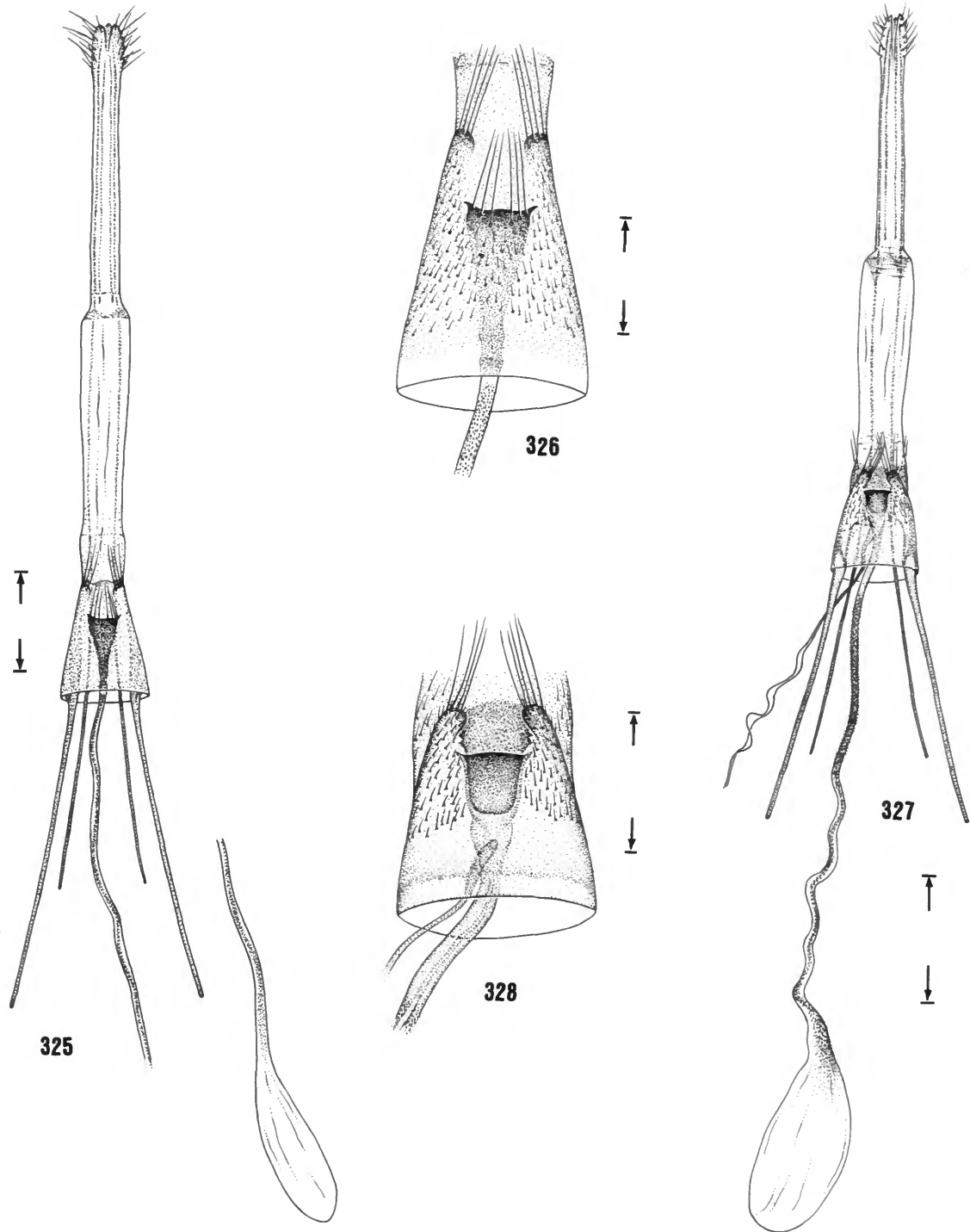
FIGURES 295-308.—Male genitalia. *Hamaclona triacantha*: 295, ventral view (0.5 mm); 296, lateral view; 297, valva, mesal view; 298, aedeagus, lateral view; 299, apex, lateral view of Figure 298 (0.25 mm); 300, apex, dorsal view of Figure 298; 301, apex, lateral view; 302, apex, dorsal view. *Hamaclona cossidella*: 303, ventral view (0.5 mm); 304, lateral view; 305, valva, mesal view; 306, aedeagus, lateral view; 307, apex, lateral view of Figure 306 (0.25 mm); 308, apex, dorsal view of Figure 306. (Scale lengths in parentheses.)



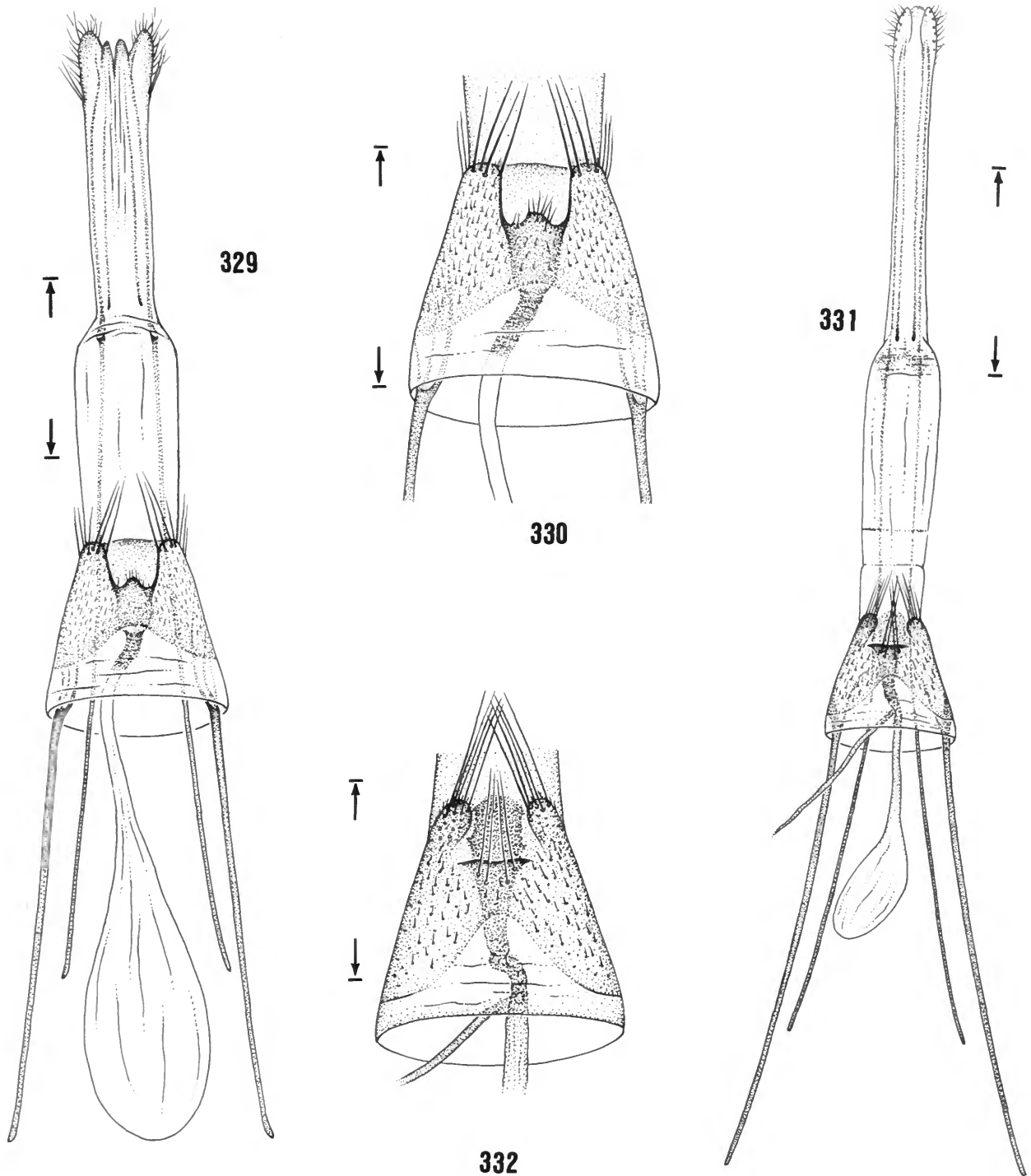
FIGURES 309–320.—Male aedocagi and female signum. *Harnaclona tephrantha*: 309, apex, ventral view, slender vitta (136 μ m; Ph = phallotreme, Vt = vitta); 310, apex near base of vitta, dorsal view (60 μ m); 311, apex, lateral view of Figure 309 (136 μ m); 312, apex, ventral view, broad vitta (200 μ m); 313, base, lateral view of reduced midventral keel (arrow) (136 μ m). *Harnaclona robinsoni*: 314, apex, ventral view (50 μ m); 315, apex, dorsal view (50 μ m); 316, apex, lateral view (50 μ m). *Harnaclona cossidella*: 317, apex, ventral view (60 μ m); 318, apex, dorsal view (60 μ m); 319, apex, lateral view (60 μ m); 320, signum from corpus bursae of female (136 μ m). (Scale lengths in parentheses; bar scale for all photographs shown in Figure 309.)



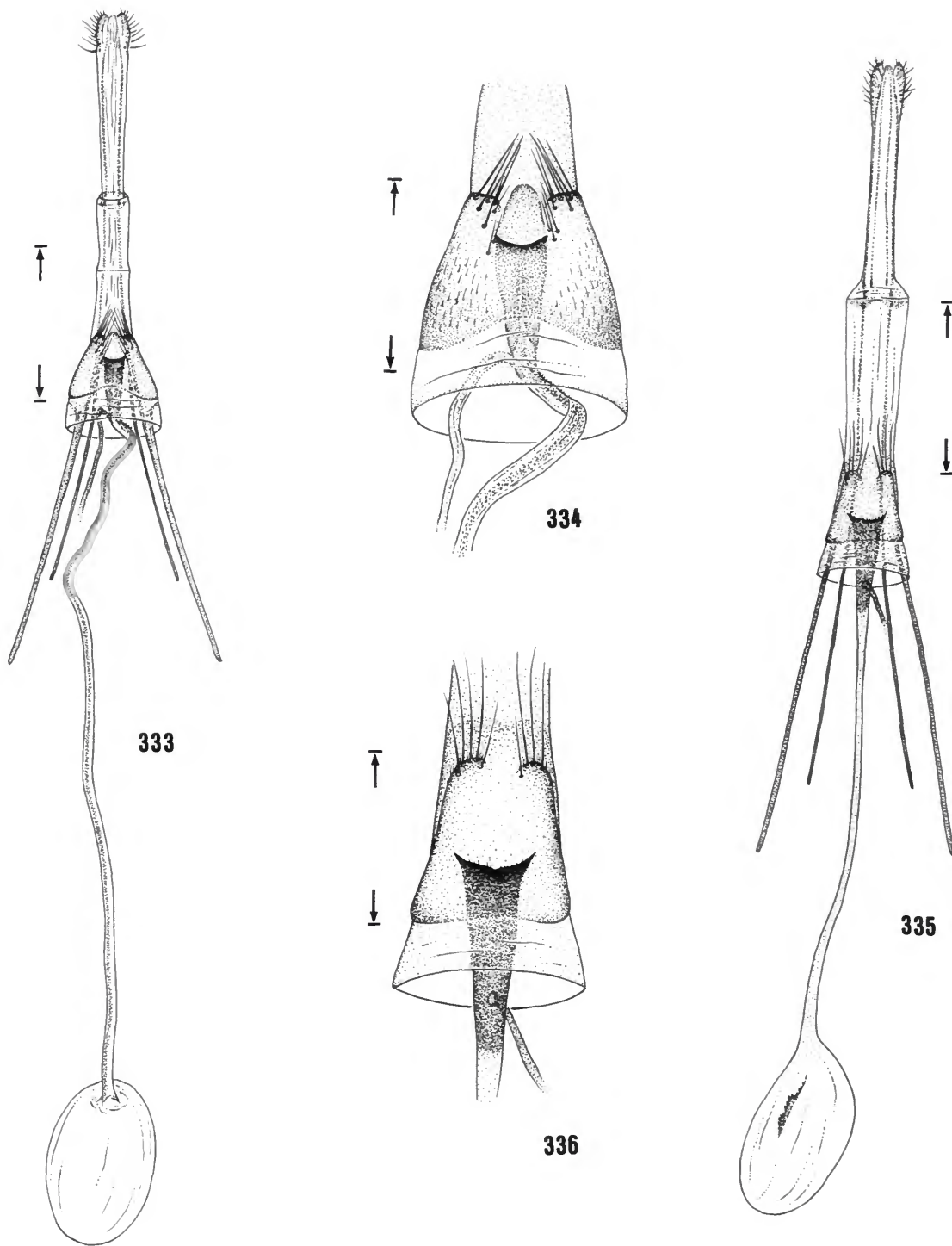
FIGURES 321-324.—Female genitalia. *Micrereithia denticulata*: 321, ventral view (1 mm); 322, antrum and eighth sternum (0.5 mm). *Micrereithia entripta*, 323, ventral view (1 mm); 324, antrum (An) and eighth sternum (0.5 mm). (Scale lengths in parentheses.)



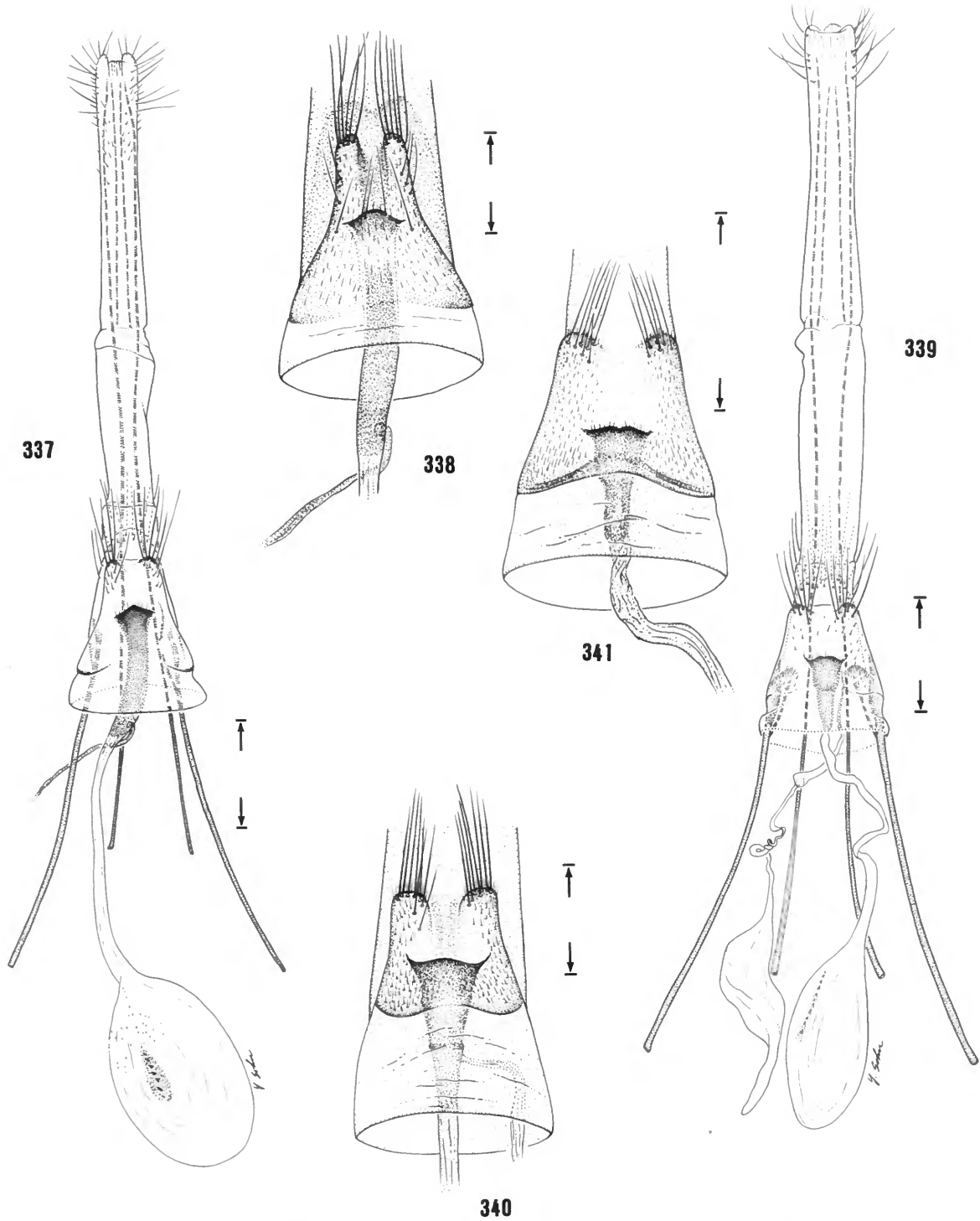
FIGURES 325-328.—Female genitalia. *Micrereithista nigrapex*: 325, ventral view (1 mm); 326, antrum and eighth sternum (0.5 mm). *Micrereithista eustena*: 327, ventral view (1 mm); 328, antrum and eighth sternum (0.5mm). (Scale lengths in parentheses.)



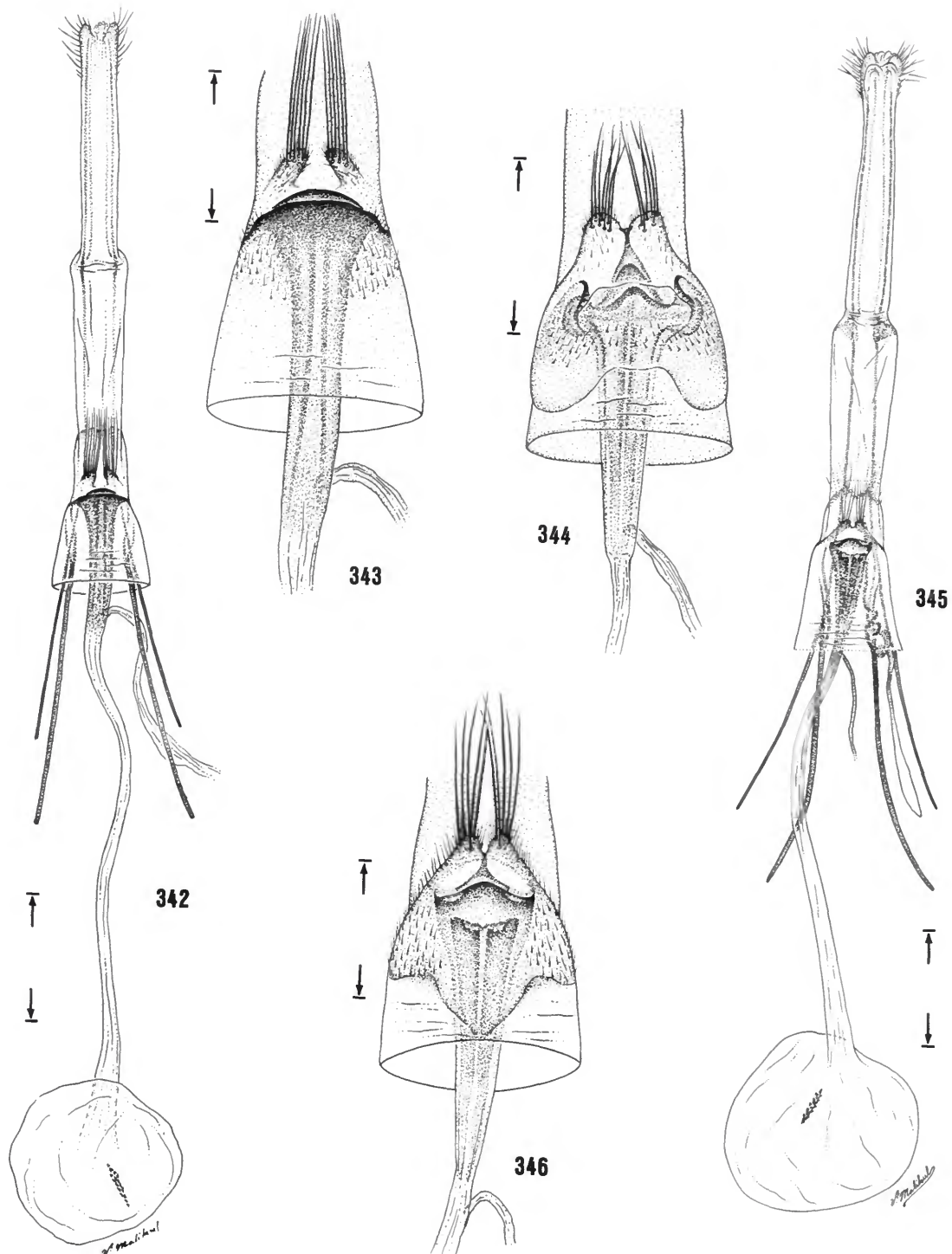
FIGURES 329-332.—Female genitalia. *Micrerethista fusca*: 329, ventral view (0.5 mm); 330, antrum and eighth sternum (0.5 mm). *Micrerethista fasciola*: 331, ventral view (1 mm); 332, antrum and eighth sternum (0.5 mm). (Scale lengths in parentheses.)



FIGURES 333-336.—Female genitalia. *Micrerethista* species, 333, ventral view (1 mm); 334, antrum and eighth sternum (0.5 mm). *Harmaclona robinsoni*: 335, ventral view (1 mm); 336, antrum and eighth sternum (0.5 mm). (Scale lengths in parentheses.)



FIGURES 337-341.—Female genitalia. *Harmaclona tephrantha*: 337, ventral view (1 mm); 338, antrum and eighth sternum (0.5 mm). *Harmaclona natalensis*: 339, ventral view (1 mm); 340, antrum and eighth sternum of Figure 339 (0.5 mm); 341, antrum and eighth sternum (0.5 mm). (Scale lengths in parentheses.)



FIGURES 342-346.—Female genitalia. *Harmaclona tetraacantha*: ventral view (1 mm); 343, antrum and eighth sternum (0.5 mm). *Harmaclona triacantha*: 344, ventral view of antrum and eighth sternum (0.5 mm). *Harmaclona cossidella*: 345, ventral view (1 mm); 346, antrum and eighth sternum (0.5 mm). (Scale lengths in parentheses.)

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