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THE TAXONOMY AND BIOGEOGRAPHY OF THE GENUS *THAUMASTOPSALTRIA* KIRKALDY, 1900 (HOMOPTERA, TIBICINIDAE)

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ABSTRACT

The taxonomic concept of the genus *Thaumastopsaltria* Kirkaldy is redefined on the basis of the shape of postclypeus and the length of the ovipositor. Tegmen venation is shown to be unreliable for this purpose. *T. nana* (Jacobi) does not fit this new concept and is, pending its transfer to another genus, not included in this revision. The genus now consists of a monophyletic group of seven species, for which a key to the males is presented. Two species (*T. adipata* (Stål) and *T. globosa* (Distant)), are redescribed, while five (*T. sicula*, *T. lanceola*, *T. pneumatica*, *T. sarissa* and *T. spelunca*) are described as new. *T. glauca* Ashton is brought into the synonymy of *T. globosa*. *Thaumastopsaltria* belongs to a group of New Guinean and Australian genera, defined previously as the "*Baeturia* and related genera complex", and is probably closely related to *Aedeastria* De Boer and *Cystosoma* Westwood of that complex. The distribution of shared characters is discussed. *Thaumastopsaltria* is mainly distributed in New Guinea, with only one species in New Britain and one ranging from southern New Guinea to northern Queensland. Distribution maps are presented. Biogeographic patterns are discussed in relation to a preliminary phylogeny of the genus and the geological history of the area. Some common distribution patterns are recognized from comparison with distributions of other taxa of cicadas.

INTRODUCTION

The New Guinean Tibicinidae can be roughly subdivided into three groups: the Prasiini, the Cicadettini and a complex of genera centred around *Baeturia* Stål, the "*Baeturia* and related genera complex." (De Boer, 1990). *Thaumastopsaltria* Kirkaldy belongs to the latter group because of the shape of the aedeagus (De Boer, 1990), and the present publication forms part of a revision of this complex of genera.

Thaumastopsaltria was proposed by Kirkaldy (1900) as a new name for *Acrilla* Stål, 1863 (type species *A. adipata*), that was preoccupied by *Acrilla* Adams, 1860, a mollusc genus. The genus was discriminated on account of eleven apical areas in the tegmen and seven apical areas in the wing (Distant, 1906).

Metcalf's catalogue (1963) lists four species of *Thaumastopsaltria*: *T. adipata* (Stål, 1863), *T. glauca* Ashton, 1912, *T. globosa* Distant, 1897 and *T. nana* (Jacobi, 1903). Comparison of these species

shows that the number of apical areas in the tegmen varies strongly (between 10 and 15) within the individual species and often differs between left and right tegmen of a single specimen. Moreover, several species belonging to a variety of other genera have comparable numbers of apical areas in the tegmen. The number of apical areas in the wing is variable also (between 6 and 10), seven being more an exception than the rule within *Thaumastopsaltria*.

Postclypeus shape and length of ovipositor provide less ambiguous criteria to define a monophyletic genus *Thaumastopsaltria*. Following these criteria, five new species can be added to the genus. However, *T. nana* that was placed in *Thaumastopsaltria* on account of nine apical areas in the tegmen, does not fit these new criteria and should be excluded from the genus. The description of a new genus including *T. nana* is in preparation.

Thaumastopsaltria is mainly a New Guinean genus, though its distribution includes Waigeu, Misoöl, New Britain, Buka, Fergusson I., Normanby I., and northern Queensland. The distribution of the New Guinean species reflects the geological history of the island, separating northern New Guinean species from southern New Guinean species, a pattern found in many other groups of cicadas.

MATERIAL AND METHODS

The material examined for this study comes from the following institutions:

AMNH	American Museum Natural History, New York
AMS	Australian Museum, Sydney
BMNH	Natural History Museum (formerly: British Museum (Natural History), London
BPBM	Bernice P. Bishop Museum, Honolulu
CSIRO	Commonwealth Scientific and Industrial Research Organisation, Australian National Insects collection, Canberra
MNHB	Museum für Naturkunde der Humboldt Universität, Berlin
MSNG	Museo Civico di Storia Naturale "G. Doria", Genova

MVM	Museum of Victoria, Melbourne
MZB	Museum Zoologicum Bogoriense, Bogor
MZS	Musée Zoologique de l' Université et de la Ville, Strasbourg
NCSU	North Carolina State University Insect Collection, Raleigh
RMNH	Nationaal Natuurhistorisch Museum (formerly Rijksmuseum van Natuurlijke Historie), Leiden
SMD	Staatliches Museum für Tierkunde, Dresden
SMN	Staatliches Museum für Naturkunde, Stuttgart
ZIM	Zoologisches Institut und Zoologisches Museum, Hamburg
ZMA	Instituut voor Taxonomische Zoölogie (Zoölogisch Museum), Amsterdam
ZML	Zoologiska Institutionen Zoologiska Museet, Lund

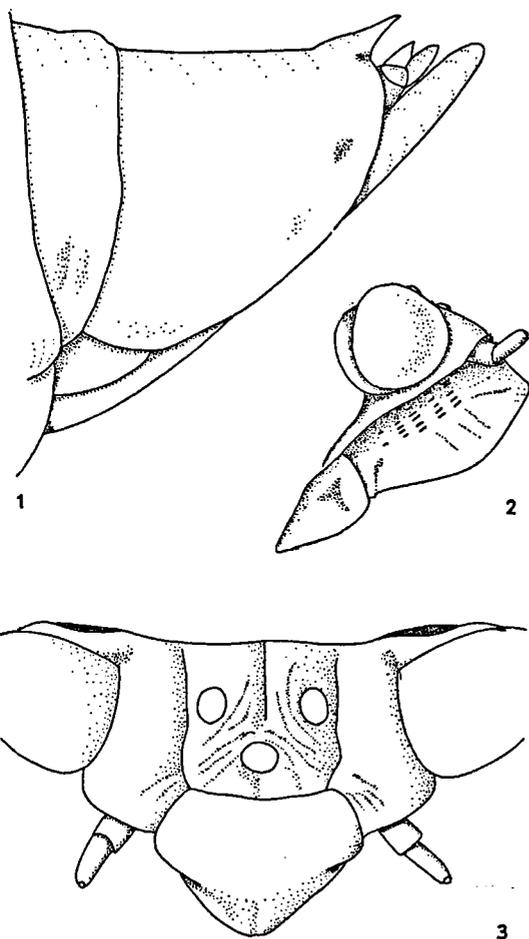
The following geographical sources have been used: The Times Atlas of the World (1968), Papua New Guinea a travel survival kit by Tony Wheeler, 1988, Lonely Planet Publications, Victoria, Australia and a "List of New Guinea localities" published by the Bishop Museum (1966).

After overnight softening, male genitalia were examined by pulling out the pygofer with a sharp needle inserted between pygofer and 8th abdominal segment. The aedeagus was pulled out at the same time, by inserting the needle between the claspers. For all specimens body length and tegmen length were measured; other measurements are based on a maximum of ten specimens.

PHYLOGENY

The phylogenetic position of *Thaumastopsaltria*

As discussed elsewhere (De Boer, 1990) *Thaumastopsaltria* belongs to a group of genera centred around *Baeturia* Stål, 1866, on account of an S-shaped aedeagus with winged lateral crests. Other taxa that belong to this complex are: *Aedeasuria* De Boer, 1990; *Chlorocysta* Westwood, 1851; *Cystopsaltria* Goding & Froggatt 1904; *Cystosoma* Westwood, 1842; *Glaucopsaltria* Goding & Froggatt, 1904; *Gymnotympana* Stål, 1861; *Owra* Ash-



Figs. 1-3. 1, *T. spelunca*, female genital segment, paratype Mt. Sinnewit; 2, *T. sarissa*, head in lateral view, holotype; 3, *T. globosa*, head in dorsal view, Garaina.

ton, 1912; *Scottotympana* De Boer, 1991; *Venustria* Goding & Froggatt, 1904 and several undescribed groups of species. The phylogenetic position of *Thaumastopsaltria* within this complex is not yet clear, but a preliminary subdivision was made, based on male operculum shape (De Boer, 1991), that grouped *Thaumastopsaltria*, *Aedeastria*, *Chlorocysta* and *Cystosoma*, versus *Baeturia*, *Gymnotympana*, *Venustria*, and *Scottotympana*.

Some preliminary studies of male genitalia of the Australian genera of the complex suggest a monophyletic origin for *Cystopsaltria* and *Cystosoma* and for *Chlorocysta*, *Glaucopsaltria*, and *Owra*. *Thaumastopsaltria* shares a deeply furrowed and

wrinkled vertex, and a medially furrowed pronotum with *Aedeastria*, *Cystopsaltria* and *Cystosoma*. The angularly swollen postclypeus, the strongly bent proximal spine on the fore femur as found in almost all *Thaumastopsaltria* species, and the narrow tymbal cavity as found in some *Thaumastopsaltria* species and the two *Cystosoma* species, might indicate a close relationship with the *Cystopsaltria*-*Cystosoma* group.

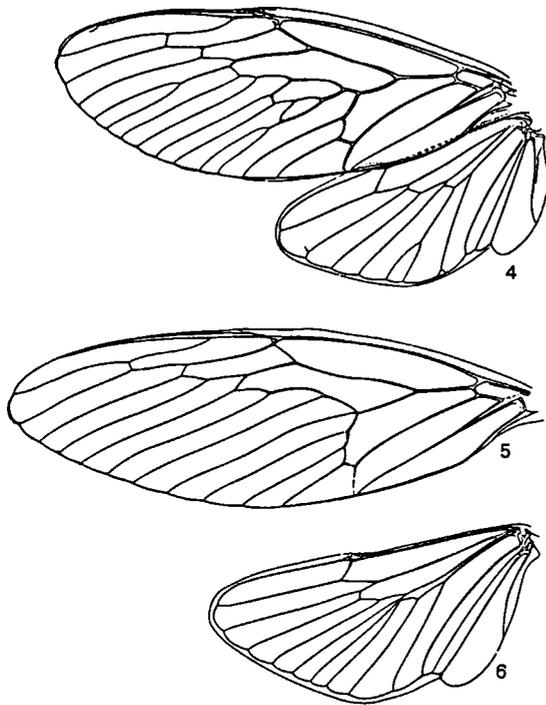
The monophyly of *Thaumastopsaltria*

Two characters, angularly swollen postclypeus and length of ovipositor, are regarded as apomorphic for *Thaumastopsaltria*; these characters being shared by all the species. Characters of tegmen venation and male pygofer might also be apomorphic for the genus, though they are not present in all species. These characters and their distribution are discussed separately below.

The *Thaumastopsaltria* postclypeus is distinctly protruding in dorsal view, with the anterior margin forming an obtuse angle at apex (fig. 3). In lateral view the postclypeus is very broad and angular, with the anterior margin (lateral view) forming an obtuse angle with dorsal plane of postclypeus, obtusely bent at mid point (more convexly rounded in *T. pneumatica*) and straight to anteclypeus (fig. 2). The lateral surfaces of the postclypeus are slightly concave and show several rows of short parallel ridges in a broad band along the lorum.

In *Aedeastria*, and several related species groups, the postclypeus is much shorter in lateral view, generally forming a sharp anterior angle with the dorsal plane, and running straight or slightly concave to anteclypeus (cf. De Boer, 1990). Many species of *Baeturia* have a ventrally swollen postclypeus, with a strongly convex anterior margin (lateral view), which is concavely bent towards anteclypeus (cf. De Boer, 1982; 1986; 1989; 1991). The postclypeus of *Cystosoma* and *Cystopsaltria* closely resembles that of *Thaumastopsaltria* in lateral view, but is more strongly protruding, slightly swollen laterally and does not have rows of short parallel ridges (unpublished).

Females of *Thaumastopsaltria* are characterized



Figs. 4-6. 4, *T. spelunca*, left tegmen and wing, female paratype Mt. Sinnewit; 5, *T. pneumatica*, left tegmen, male paratype; 6, *T. pneumatica*, left wing, male paratype.

by a very long ovipositor, the ovipositor sheath reaches well beyond apex of caudodorsal beak (fig. 1). In related species the ovipositor sheath generally reaches to, or only just beyond the apex of caudodorsal beak. An exception is *Gymnotympana rubricata* Distant, 1897, in which the ovipositor is even longer than in *Thaumastopsaltria*.

The numbers of apical areas in the tegmen (11) and in the wing (7) have been used to separate *Thaumastopsaltria* from other genera, but these features are only found in the holotype of *T. adipata*, the type-species of the genus.

Wings with seven apical areas sporadically occur in several of the species, though most specimens have the usual 6. The only exception is *T. pneumatica* with 7-10 apical areas in the wing.

The tegmen of *T. sicula* has 8 apical areas, a condition widely distributed in related genera. In all other *Thaumastopsaltria* species, tegmen venation tends to be very variable, even within individuals. In these species, the number of apical ar-

reas varies between 10 and 15, while almost all specimens have 1-5 additional "subapical" areas between apical and ulnar areas (fig. 4). However, all of the apical areas are not always adjacent to the ulnar or subapical areas; sometimes they are formed by a more distal splitting of veins.

Apical and ulnar areas of the tegmen tend to be very long and slender, which to a lesser extent also applies to *T. sicula*. Especially the first apical area is very long, and is partly parallel-sided between costa and 1st ulnar area. The base of the 1st apical area lies at about 1/3 of the length of the 1st ulnar area, and is proximal to the base of the 3rd apical area (fig. 4). In related taxa, the first apical area usually narrows gradually to its base, directly proximally to the base of the 2nd apical area, and the base of the 1st apical area lies at about 2/3 of the length of the 1st ulnar area and aligns about level with the base of the 3rd apical area (cf. de Boer, 1991 fig. 5). The tegmina are often reddish or greenish tinged in *Thaumastopsaltria*, but nevertheless remain hyaline and have a very narrow hyaline border along the hind margin.

A variable tegmen venation also occurs in some species, of related genera, but in other aspects the tegmen of such species is always quite different from that of *Thaumastopsaltria*. Since other, mainly genital, characters suggest that these species do not form a monophyletic group, it is concluded that this aberrant venation developed independently in these genera, and that the variable venation found in *Thaumastopsaltria* must possibly be regarded as apomorphic for the genus, and lost in *T. sicula*.

Gymnotympana olivacea Distant, 1905, and three related undescribed species have a variable tegmen venation similar to that of *Thaumastopsaltria*, with 10-13 apical, and 1-5 subapical areas. Not all apical areas are adjacent to ulnar or subapical areas, the first apical area gradually narrows to its base, which aligns near the base of the third apical area. The *Gymnotympana* tegmen further differs from that of *Thaumastopsaltria* by a broad hyaline border along its hind margin.

The tegmen venation of *Chlorocysta*, *Glaucopsaltria* and *Owra* is also very variable with 11-13, in *Owra* 9-10, very short apical areas and a more or

less continuous band of 4-10 subapical areas.

In the genus *Baeturia* an undescribed species was found in which the number of apical areas varies between 10 and 14. However, this *Baeturia* species has no subapical areas, and the first apical area, though very long and slender, has its base at about the same level as the third.

Most similar to the *Thaumastopsaltria* tegmen is that of *Baeturia viridicata* Distant, 1897. Though this species has only 8 apical areas and no subapical areas, the first apical area is very similarly shaped to that of most *Thaumastopsaltria* species, with its base distinctly proximally to that of the third. Furthermore, the *viridicata* tegmen is slightly tinged with red.

In most *Thaumastopsaltria* species the pygofer lobe is distinctly inflated towards the ventral margin. This inflation is strongest, almost globular, in *T. pneumatica* (fig. 19) and *T. sarissa* (fig. 69), but hardly recognizable in *T. adipata* and *T. lanceola*. The globular swelling is believed to be unique for *Thaumastopsaltria*, and must possibly be regarded synapomorphic for the entire genus.

In-group relationships

Here, some characters are discussed that are shared by several species of *Thaumastopsaltria*. Though it is not always clear whether these characters are apomorphic or plesiomorphic, they do suggest some possible relationships within the genus. When appropriate, the distribution of these characters in other genera is also discussed. Such characters might contribute to a phylogenetic reconstruction of the "*Baeturia* and related genera complex" as a whole, and determine the position of *Thaumastopsaltria* within this complex.

Tymbal

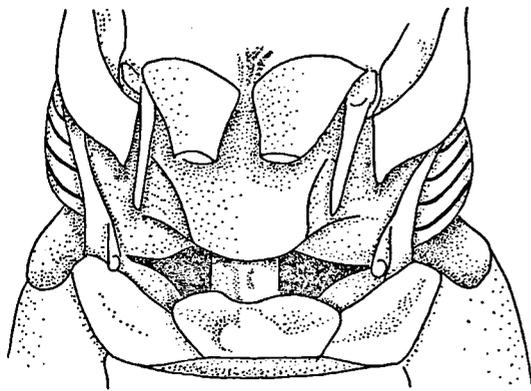
T. sicula and *T. spelunca* share a fairly small tymbal. The tymbal extends in lateral view over about 2/5 of body width at tymbal level. In all other species of *Thaumastopsaltria* the tymbal is distinctly larger, extending over about 3/5 of body width. The small tymbals are possibly synapomorphic, but similar differences can be observed in several related genera (unpublished).

Male operculum and tymbal cavity.

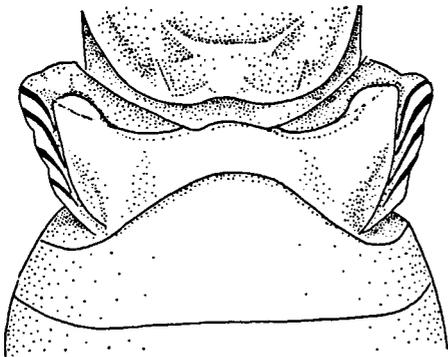
The opercula of most *Thaumastopsaltria* species are of fairly uniform angular and oblong shape and similar in size. The operculum of *T. adipata* is more rounded than in other species and that of *T. sicula* is distinctly shorter.

Much larger differences exist in the extent to which opercula cover the tymbal cavity in ventral view. In *T. adipata*, *T. globosa*, *T. lanceola*, *T. pneumatica*, and *T. sarissa*, the operculum does not cover the tymbal cavity and exposes a whitish and wrinkled membranous structure, which Myers (1928) calls a "folded membrane." This is not due to operculum size, but caused by a greater distance between thorax and abdomen; the 1st and 2nd sternites are not adjacent in these species. In the two other species, where the 1st and 2nd sternites are adjacent, the gap between operculum and abdomen is much smaller and the folded membrane is completely, or almost completely, hidden under the operculum (compare for example figs. 23 and 34). Both these characters appear in several related species groups.

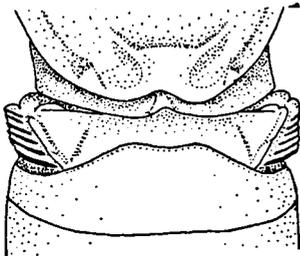
The tymbal cavity is very narrow in *T. adipata*, *T. globosa*, *T. lanceola*, *T. pneumatica*, and *T. sarissa*, the tergite part between the auditory capsule and sternite 2 is very short (fig. 23). The literature is very vague as to what this sclerotized part represents. Apparently it forms one part with the auditory capsule, and seems separated from the tergite as well as the sternite. Kramer (1950) however, states that the auditory capsule lies on "the ventrolateral portion of the second abdominal tergite." Hence this sclerotized part is here alluded to as a tergite part. The narrow ridge that normally runs along this tergite part is very weak in these five species. In *T. spelunca* the cavity is slightly broader and the ridge more distinct, but in *T. sicula* the distance between the auditory capsule and sternite 2 is much longer, while the ridge is very distinct (compare figs. 23 & 57). Most of the related genera have a tymbal cavity as wide as that in *T. sicula*, with a distinct ridge along the tergite margin, but the tymbal cavity of the two *Cystosoma* species is very narrow and resembles that of the other *Thaumastopsaltria* species.



7



8



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Figs 7-9. 7, *T. globosa*, male opercula in ventral view, Bisianumu; 8, *T. globosa*, 1st tergite in dorsal view, Bisianumu; 9, *T. sicula*, 1st tergite in dorsal view, paratype Waigeu.

Male abdomen

T. adipata and *T. pneumatica* share a strongly inflated abdomen; the sharp fold, which is normally found between tergites and sternites, has almost disappeared between sternite 7 and tergites 7-8, due to this inflation. The species of *Cystosoma* and *Glaucopsaltria* have a similarly, often even stronger, inflated abdomen. The abdomen of *T. sicula* is hardly inflated and this species is much smaller than other members of *Thaumastopsaltria*.

The proximal margin of the second abdominal tergite of *T. sicula* is slightly concave middorsally (fig. 9). In the other species this margin is convex (fig. 8), while the 2nd tergite is much longer middorsally than in *T. sicula*; these character states are widely distributed in related species groups.

In *T. sicula* and *T. spelunca*, as in most of the related genera, auditory capsules are distinctly swollen and elevated relative to the connecting bar between abdomen and tymbal. The auditory capsules of *T. adipata*, *T. globosa*, *T. lanceola*, *T. pneumatica*, and *T. sarissa* are not swollen and hardly elevated relative to the connecting bar (fig. 23). This character state is also found in *Chlorocysta*, *Glaucopsaltria* and *Owra*.

Male pygofer

T. sarissa shares a similar, though much larger, angular lateral protrusion on the lateral pygofer lobes with *T. globosa*. In other species the protrusion is more swollen and bluntly rounded, though variable in size and shape.

In *T. globosa*, *T. spelunca*, *T. lanceola* and *T. sarissa* the caudodorsal beak is very slender in lateral view. In other *Thaumastopsaltria* species the beak is much broader towards its base, it is extremely broad and truncate in *T. sicula*. The shape of beak is very variable in related species groups.

Shape of clasper

T. adipata and *T. pneumatica* share a hook-shaped clasper, with a slender and downwardly directed apical part. This apical part is sharply pointed and slightly hollow at the side directed towards the interior of the pygofer (figs. 15, 20). The clasper of the five other *Thaumastopsaltria* species is characterized by a sharply pointed ventromedial protrusion (figs. 29, 39, 48, 65, 71). This protrusion is interpreted as homologous with the inner side of the apical part of the clasper of *T. adipata* and *T. pneumatica*; it is unique for these five species. The protrusion is laminose and triangle-shaped in *T. globosa*, *T. spelunca* and *T. sicula*, but very slender and lance-shaped in *T. lanceola* and *T. sarissa*. The claspers of *T. globosa*, *T. spelunca* and *T. sicula* have a very distinct ventral hollow, dome-shaped in the first two, elongate in the latter species. The claspers of *T. lanceola* and *T. saris-*

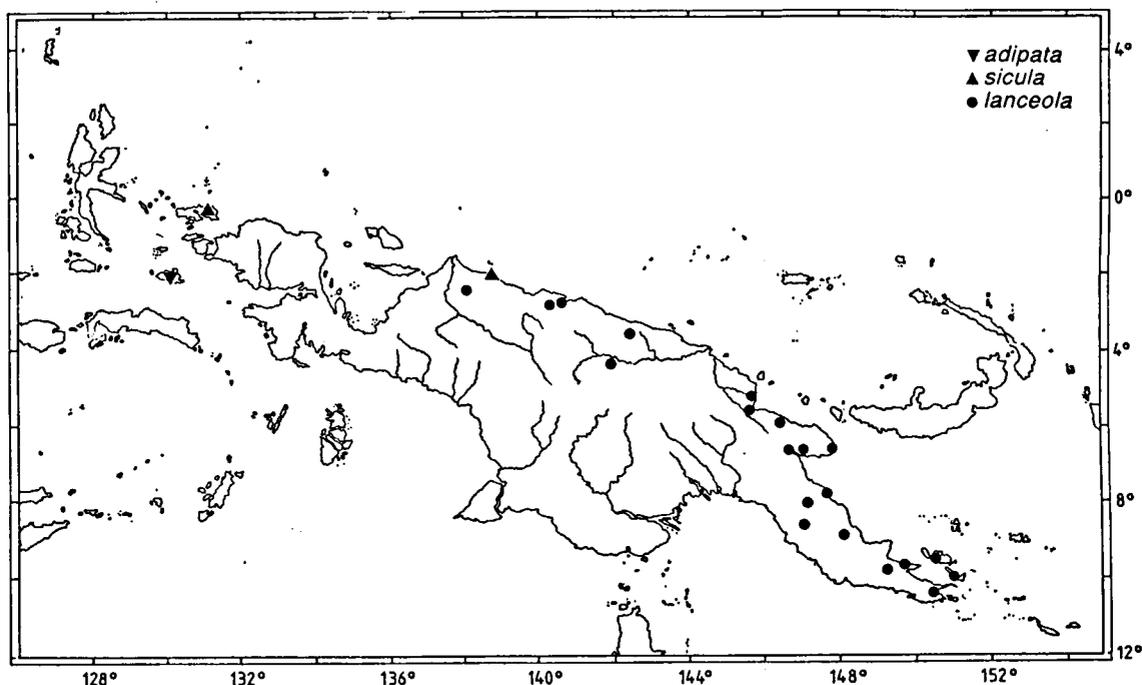


Fig. 10. Localities of *Thaumastopsaltria adipata*, *T. lanceolata*, and *T. sicula*.

sa are more massive, the former without clasper hollow, the latter with a shallow and slender hollow in its apical part.

Claspers similar to those of *T. adipata* and *T. pneumatica* are found in several related species groups, e.g. the genus *Gymnolympna*. The sharply pointed ventral protrusions of the other species must almost certainly be regarded as synapomorphous.

The lateral protrusion of the *T. pneumatica* and *T. spelunca* clasper (figs. 20, 29) is certainly not unique for these species, and is probably homologous with the smaller lateral lobes of the claspers of *T. adipata* and *T. globosa* (figs. 15, 36).

Aedeagus

T. globosa, *T. spelunca* and *T. sicula* share a very similar aedeagus, narrowing close to its apex and, in lateral view, slightly pointed at its apex (compare figs. 31, 38, 55). This feature is most probably synapomorphous. The broad aedeagus of *T. lanceola* and the strongly bent aedeagus of *T. sarissa* are probably unique for those species. An aedeagus-shape as in *T. adipata* (fig. 16) and *T. pneumatica* (fig. 21) resembles that of several relat-

ed species groups.

The aedeagi of all species of *Thaumastopsaltria*, except that of *T. adipata*, have a single or paired dorsal crest. However, similar crests can be found in many other genera.

BIOGEOGRAPHY

Thaumastopsaltria is centred in New Guinea, but its area of distribution also includes New Britain, Bougainville, Fergusson Island and Normanby Island, northern Queensland, and Misoöl (figs 10, 11). Most species are found on the Papuan peninsula, though only *T. pneumatica* is endemic there. *T. adipata* is believed to be endemic on Misoöl based on statements in the literature and a locality label "M", however, this requires confirmation (see remarks under that species). The supposed close relationship between *T. adipata* and *T. pneumatica* from Mt. Dayman on the Papuan peninsula seems in contrast with the fact, that these species come from the two extreme ends of the distribution area of the genus.

A very similar, but wider distribution is record-

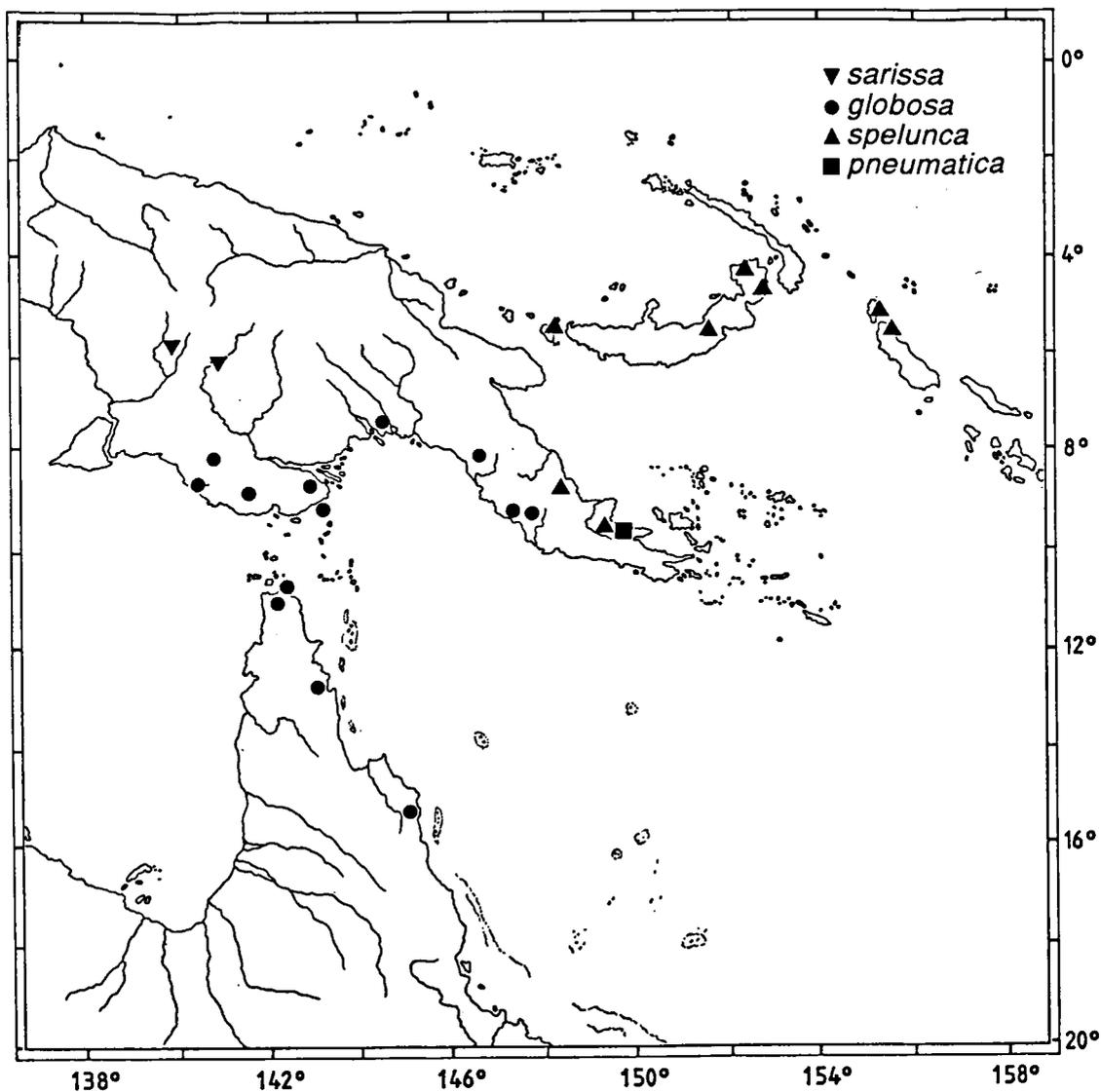


Fig. 11. Localities of *Thaumastopsaltria globosa*, *T. sarissa*, *T. spelunca*, and *T. pneumatica*.

ed for the cicada genus *Diceropyga* Stål, 1870. This genus has a monophyletic group of three species in Maluku; several species in northern New Guinea, the Papuan peninsula and Bismarck Archipelago; and one species in southern New Guinea and northern Queensland. However, *Diceropyga* extends beyond the New Guinean region to the Solomon Islands with seven endemic species (Duffels, 1977).

Neither *Thaumastopsaltria* or *Diceropyga* are recorded from Cendrawasih (= Vogelkop peninsula) or from the central mountain ranges of New

Guinea, apart from one specimen of *T. sarissa* from a low altitude in the Star Mountains. Species occur either north or south of the central mountain ranges, with none occurring on both sides.

The distribution of the species of *Thaumastopsaltria* show some interesting patterns, many of which are found in several other groups of cicadas.

T. sarissa is restricted to southern New Guinea. Compared to northern and central New Guinea, the south has very few endemic species. *Baeturia*

brongersmai Blöte, 1960 from Tanah Merah and *B. lorentzi* De Boer, 1992, from Lorentz River are the only other cicada species known to be endemic in southern New Guinea.

T. globosa is one of the few cicada species with a distribution encompassing southern New Guinea as well as northern Queensland. Its distribution is very similar to that of *Lembeja paradoxa* Karsch, 1890, which is known from southeastern New Guinea, on both sides of the Gulf of Papua, and Cape York Peninsula (De Jong, 1982). *D. subapicalis* (Walker, 1868), the *Diceropyga* species alluded to above, has a similar distribution, but is more widely distributed into south-western New Guinea (Duffels, 1977).

T. lanceola is widely distributed in northern New Guinea, including the Huon and Papuan peninsulas, and *T. spelunca* is recorded from the Papuan peninsula, New Britain and Bougainville. These distributions can be explained from the complex geological history of New Guinea. New Guinea was formed after repeated collisions, since the Mid-Miocene, of the Australian continent with an oceanic island arc, known as the Outer Melanesian Arc (Hamilton, 1979; Holloway, 1979; 1984; Pigram & Davies, 1987). The northern mountain ranges of New Guinea, the northern parts of Cendrawasih including Waigeu Island, the Huon and Papuan peninsulas, the Bismarck Archipelago and the Solomon Islands are all of Outer Melanesian Arc origin. The central mountain ranges arose, following the first collisions of parts of this oceanic island arc with the leading edge of the Australian continent.

This Outer Melanesian Arc formed an important route of dispersal for Asian biota invading the Pacific; subaerial remnants of this arc can be recognized as areas of endemism for several groups of organisms (Duffels, 1986; Duffels & De Boer, 1990). In this light, *T. lanceola* and *T. spelunca* have a typical Outer Melanesian Arc distribution.

The disjunction in the distribution of *Thaumastopsaltria*, caused by its absence in Cendrawasih, is a common pattern found in several groups of cicadas that have a wide distribution in Maluku and New Guinea (Duffels & De Boer, 1990). The explanation of this pattern must presumably be

found in a different geological history of that area. Cendrawasih in itself is a composite area. Only its most northern parts (Tamrau, which is related to Waigeu Island, and Arfak) originate from the Outer Melanesian Arc, but the greater part is of continental (Australian) origin (Hamilton, 1979; Pigram & Panggabean, 1984). Hamilton (1979) supposed that Cendrawasih had rotated clockwise northward, from a position close to the Australian continental plate, but recent studies indicate a more eastern origin. In this model Cendrawasih is composed of two micro-continents (Misoöl and Kemum) that rifted from the Australian plate, moved to the west, and collided again (in late Miocene) with the continent at their present position. Pigram & Panggabean (1984) proposed for the Misoöl terrane (which includes the Kumawa and Onin peninsulas of Cendrawasih) an origin in central Papua New Guinea, and for Kemum possibly as far east as north Queensland.

It now becomes clear, that *T. sicula* also has an Outer Melanesian Arc distribution (fig. 10), though it might be expected that the species is present in the Tamrau area as well. It is unlikely, however, that the possible eastern origin of the Misoöl terrane can form an explanation for the distributions of *T. adipata* and *T. pneumatica*. No geological reconstruction suggests that Misoöl has ever been adjacent to terranes now forming the eastern part of the Papuan peninsula. Furthermore, the rifting of Misoöl is dated in the early Mesozoic, which must be long before the evolution of *Thaumastopsaltria*.

TAXONOMY

Thaumastopsaltria Kirkaldy, 1900

Type species: *T. adipata* (Stål, 1863)

Acrilla Stål, 1863: 575; Walker, 1868: 95; Marshall, 1873: 351; Distant, 1892, 1903, 1915: 103, 151; Breddin, 1901: 200-201; Jacoby, 1903: 14; Kuhlitz, 1905: 79; Schulze, Kükenthal & Heider, 1926: 37; Neave, 1939: 41; Esaki & Miyamoto, 1975: 638;

Thaumastopsaltria Kirkaldy, 1900: 242; Waterhouse, 1902: 372; Kirkaldy, 1904: 283; Distant, 1905: 213; Distant,

1906: 154, 159; Horváth, 1913: 427; Ashton, 1914: 351; Kato, 1932: 184; Imhof, 1933: 306; Schulze, Kükenthal & Heider, 1938: 3445; Neave, 1940: 455; Kato, 1956: 70; Metcalf, 1963: 258-259; Esaki & Miyamoto, 1975: 638; Duffels, 1977: 205, 207; Boulard, 1979: 46; Holloway, 1979: 235; Duffels & v.d. Laan, 1985: 249; De Boer, 1990: 64; Moulds, 1990: 191; De Boer, 1991: 2; De Boer, 1992: 164.

DESCRIPTION

The museum specimens used for this study are predominantly of a light brown colour, and missing any distinct markings. Some specimens are olive-green tinged. No fresh material has been examined, possibly all specimens are olive-green when alive (see Moulds, 1990).

Head (fig. 3) broad and short, 2.0-2.6 x as broad as long. Postclypeus broad and angularly protruding in dorsal view, its anterior margin forming an obtuse angle medially; angularly swollen in lateral view (fig. 2), with broad band of short parallel ridges along the lorum. Vertex broad, only slightly elevated, with small ocelli wide apart; 1.6-2.3 x as broad as long. Distance between eyes 1.0-1.4 x length of head and 1.3-1.7 x postclypeus width. Distance between lateral ocelli 1.5-2.7 x width of frontal ocellus and 0.8-1.4 x distance between lateral ocellus and eye. Fore femur with row of three spines, diminishing in length towards tibia. Proximal spine strongly bent, often closely adjacent to femur. Tegmina slender and often reddish tinged, with narrow subcostal area and long slender apical areas; first apical area extremely long, its base lies proximad relative to that of 3rd apical area. Very narrow hyaline border along hind margin of tegmen. Tegmina, apart from *T. sicula*, with variable venation and 10-15 apical areas. Wings with 6 or 7 apical areas (in *T. pneumatica* 7-10). Tymbal with 6 transverse sclerotized ridges (7-8 in *T. sicula*). Male operculum very small. Basal part of operculum slightly vaulted, but strongly elevated laterally, forming a crest around rectangular distolateral corner. Lateral part of this crest in males of most species very short and forming a broad, bluntly rounded protuberance, in females more elongate. Distal part of this crest amplifies medi-

ally to angular distal part of operculum. Lateral margin of distal part forming a obtuse angle with crest of basal part, close to distolateral corner of basal part. Male operculum not, or only partly, covering tymbal cavity in ventral view, medial margin not reaching meracanthus (fig. 7). Meracanthus reaching far beyond distal margin of operculum. Distal part of female operculum smaller than that of male, but similarly shaped. Ovipositor sheaths reaching well beyond apex of caudodorsal beak. Pygofer lobe often inflated towards ventral margins. Pygofer opening V-shaped at base; ventral margins of pygofer converge to a sharp angle. Claspers short, bending around aedeagus, supporting aedeagus in upright position. Aedeagus slightly S-curved, with long stretched lateral crests and in most species a single or pair of middorsal crests.

KEY TO THE MALES

(Females are very similar and often cannot be attributed to species except by locality).

- 1a Venation of tegmina regular, with 8 apical areas. Body length under 17.5 mm *T. sicula*
- 1b Venation of tegmina variable, with 10-15 apical and often several subapical areas. Body length over 17.5 mm 2
- 2a Clasper hook-shaped, sharply bent down to pointed apex. Abdomen strongly inflated, fold between sternites and tergites absent at eighth segment. Caudodorsal beak stout in lateral view 3
- 2b Clasper not hook-shaped, but with long and pointed medial protrusion. Abdomen less inflated, with sharp fold between sternites and tergites of all segments. Caudodorsal beak slender in lateral view 4
- 3a Clasper with bluntly rounded, thorn-shaped lateral protrusion and convex distal margin (fig. 20). Tegmina about as long (0.9-1.0 x) as body length. Vertex with shallow furrows. Operculum angular, oblong (fig. 23). Distance between operculum and abdomen about 0.8 x operculum length. Pygofer lobe distinctly swollen towards ventral margin (fig. 19) *T. pneumatica*
- 3b Clasper with small and bluntly rounded lateral protrusion and with straight distal margin (fig. 15). Tegmina distinctly shorter (0.8 x) than body length. Vertex deeply furrowed. Operculum broad, sickle-shaped (fig. 18). Distance between operculum and abdomen about

- 1.5 x operculum length. Pygo-fer lobe hardly swollen towards ventral margin (fig. 12) *T. adipata*
- 4a Clasper with large dome-shaped ventral hollow and triangular laminose medial protrusion. Aedeagus abruptly narrowing near apex and straight or slightly curved upwards at apex5
- 4b Clasper hollow very small or absent. Clasper with very slender, lance-shaped medial protrusion. Aedeagus not abruptly narrowing near apex and curved downwards towards apex6
- 5a Clasper with globular dorsal protrusion and distinct, angular, lateral protrusion. Distomedial edge of clasper hollow curved outwards (fig. 29). Tymbal small, less than half as wide as body-width. Operculum partly, or completely covering tymbal cavity in ventral view. Distal part of operculum ovably rounded and slightly longer than basal part (fig. 34). Margin of 1st sternite adjacent, or almost so, to 2nd sternite. Lateral lobes of pygofer with rounded, and swollen protuberances*T. spelunca*
- 5b Clasper smoothly rounded, without distinct dorsal or lateral protrusions. Distomedial edge of clasper hollow not curved outwards (fig. 39). Tymbal large, more than half as wide as body-width. Operculum not covering tymbal cavity in ventral view. Distal part of operculum angular and shorter than basal part. Considerable distance between 1st and 2nd sternite (fig. 41). Lateral lobes of pygofer curving outwards into flattened, rectangular protuberances*T. globosa*
- 6a Clasper finger-shaped and straight, but curving mesiad at apex (fig. 63). Aedeagus very broad, slightly curved downwards towards apex. Lateral lobes of pygofer with slender elongate protuberances. Pygofer lobe hardly swollen towards ventral margin*T. lanceola*
- 6b Clasper triangular, strongly curved laterad (fig. 71). Aedeagus slender, strongly curved downwards towards apex. Lateral lobes of pygofer curving laterad, and forming very broad flattened rectangular protuberances. Pygofer lobe globularly swollen towards ventral margin*T. sarissa*

DESCRIPTION OF THE SPECIES

Thaumastopsaltria adipata (Stål, 1863)
(figs. 10, 12-18)

Acrilla adipata Stål, 1863: 575; Walker, 1868: 95, Pl. 3 fig. 7; Distant, 1892: xiv, 151, Pl. xv figs. 18, 18 a-b; Distant, 1897: 383; Jacobi, 1903: 14.

Thaumastopsaltria adipata; Kirkaldy, 1900: 242; Distant,

1905: 216; Distant, 1906: 159; Metcalf, 1963: 259.
Thaumastopsaltria [sic] *adipata*; Kato, 1932: 185.

Identification of the holotype.-

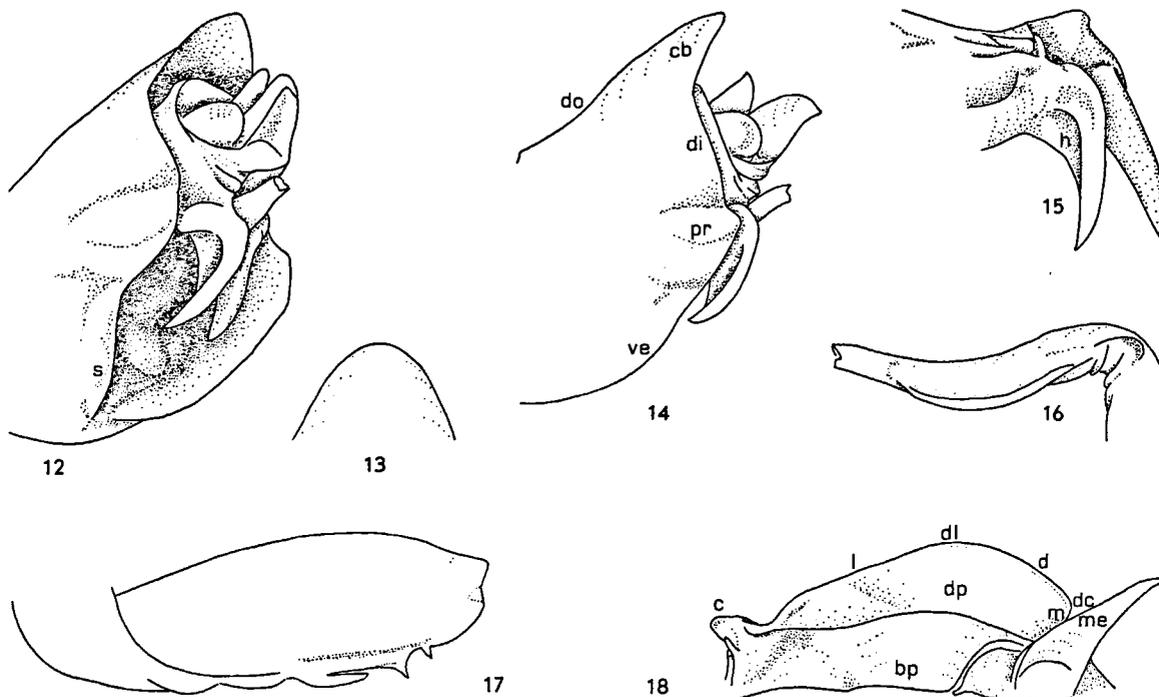
A male in the BMNH is the only known specimen of this species. It bears the following labels: "Type" [round label, red margin]; "SYNTYPE" [round label, blue margin]; "adipata Stål" [written, probably in Stål's hand]; "67 / 66" [written, round blue label]; "M" [written, round label].

Several inconsistencies with regard to the literature might give reason to doubt the identity of this specimen as holotype. The only information Stål gives with its description (1863) is: "Insula Mysol" and "Coll W.W. Saunders". No allusion is made to the existence of syntypes. According to Stål, the monotypic genus *Acrilla* is characterized by 11 apical areas in the tegmen and 7 apical areas in the wing.

Both Walker (1868) and Distant (1892) illustrate *Acrilla adipata*. Walker's figure (1868, Pl. 3 Fig. 7) closely resembles the BMNH "type" specimen, with a large inflated abdomen and the tegmina shorter than body length; in addition the wings of the depicted specimen have 7 apical areas as stated by Stål. The tegmina, however, are quite different from what Stål records and from the specimen at hand; the left tegmen shows 9 apical areas and the right tegmen 10. Furthermore, the ulnar areas and 1st apical area of the depicted specimen are much shorter than in the BMNH type. Distant's figure (1892, Tab. xv fig. 18 a-b) too, closely resembles the BMNH type. The figure only shows the left tegmen and wing; the tegmen has eleven, but the wing only six apical areas.

Distant (1892) remarks that the type of *A. adipata* comes from the Wallace collection and was in fact collected by Mr. Charles Allen, an assistant of Wallace. However, according to notes in the BMNH, material with the label "67 / 66" was purchased of Mr. Saunders, which agrees with Stål's description. The label "M" presumably stands for Misoöl.

Unfortunately, the BMNH specimen misses the apical parts of both wings, though the remnants of the right wing indicate possibly seven apical areas.



Figs. 12-18. *Thaumastopsaltria adipata*: 12, pygofer aslant; 13, caudodorsal beak in dorsal view; 14, pygofer in lateral view; 15, claspers; 16, aedeagus; 17, fore femur; 18 operculum.

Lettering: bp = basal part of operculum; c = crest around distolateral corner of basal part of operculum; cb = caudodorsal beak; d = distal margin of operculum; dc = distomedial corner of operculum; di = distal margin of pygofer; dl = distolateral corner of operculum; do = dorsal margin of pygofer; dp = distal part of operculum; h = clasper hollow; l = lateral margin of operculum; m = medial margin of operculum; me = meracanthus; pr = protuberance on lateral lobe of pygofer; s = swelling on ventral margin of pygofer; ve = ventral margin of pygofer.

It is very probable that this specimen is in fact Stål's type, or, possibly, one of more syntypes. Not only does the identification label match Stål's handwriting, the size of the specimen, with a bodylength of 33.6 mm (the largest specimen of *Thaumastopsaltria*) quite agrees with the 32 mm given by Stål. The specimen is here regarded as the holotype of *A. adipata*.

T. adipata can be recognized by its size, its (as its name suggests) large and inflated abdomen and its relatively short tegmina. The eyes are larger compared to vertex width, than in other species of this genus, and the diverging furrows of the vertex are more prominent.

DESCRIPTION

Body light yellow-brown, mesonotum more grey-brown. Abdomen 2.3 x as long as head and thorax. Tegmen 0.8 x as long as body length.

Head: Postclypeus slightly angularly protruding in dorsal view, its anterior margin almost continuous with margins of vertex lobes. Vertex with deep medial furrow and very prominent diverging furrows between ocelli; triangular anterior part of vertex, between diverging furrows and postclypeus, slightly depressed relative to other parts of vertex; smooth and not wrinkled between ocelli. Distance between eyes 1.2 x length of head and 1.6 x width of eye. Head 2.2 x as broad as distance between eyes.

Legs: Fore femur with row of three sharply pointed spines, diminishing in length towards ti-

bia. Proximal spine strongly bent and adjacent to femur, much shorter than distance to middle spine (fig. 17).

Tegmina and wings: Hyaline. Tegmen with 11 apical areas. First apical area 1.9 x as long as second. Wings damaged but probably with 7 apical areas.

Tymbal organs: Tymbals large, extending over 3/5 of body width in lateral view. Five transverse sclerotized ridges spanning the tymbal from dorsal to ventral margin and a 6th, most proximal, ridge only spanning about 3/4 of tymbal width. Five short but very distinct intercalary ridges seem to form a band across the tymbal.

Operculum and tymbal cavity (fig. 18): Operculum not covering tymbal cavity and leaving folded membrane exposed. Gap between operculum and abdomen very wide, more than 1.5 x operculum length. Distal part of operculum short, about as long as basal part, and angular, erect laterally, but more curved towards body medially. Lateral margin weakly convex, though strongly convex towards base, forming an almost right angle with crest of basal part, and convexly bent into short and weakly convex distal margin. Medial margin straight, distomedial corner almost rectangular. Meracanthus almost twice as long as operculum, but not reaching beyond folded membrane. Tymbal cavity narrow; tergite part between auditory capsule and sternite 2 quite short and curved inwards, with weak crest along its margin.

Abdomen: Light ochraceous, with vague pattern of darker longitudinal streaks. Abdomen strongly inflated, to such extent that the otherwise sharp fold between tergites and sternites is almost absent between 8th sternite and 7th and 8th tergite. Proximal margin of tergite 2 convex middorsally. Auditory capsules not swollen and hardly elevated relative to connecting bar between abdomen and tymbal.

Genitalia: Pygofer in lateral view as in fig. 14. Dorsal margin slightly concave, convexly bending into stout and short caudodorsal beak. Distal margin slightly convex between beak and lateral lobe, making an obtuse angle with margin of beak. Lateral lobe of pygofer with rounded lateral protuberances. Pygofer lobe slightly swollen

towards ventral margin, near base of pygofer opening (fig. 12). Caudodorsal beak in dorsal view (fig. 13) very stout and broadly rounded at apex. Claspers (fig. 15) hook-shaped and diverging towards sharply pointed apices. Clasper bending mesiad around aedeagus, and, distally of aedeagus, sharply bending downwards, forming a long straight and slender apical part. Apical part of clasper with distinct clasper hollow. Clasper with small rounded and elongate lateral protuberance at proximal end of clasper hollow, almost touching lateral lobe of pygofer. Aedeagus (fig. 16) slightly curved and smooth dorsally, without dorsal crest; lateral crests of aedeagus very slender. Apical part of aedeagus missing.

Measurements: Body length 33.6 mm; tegmen length 27.3 mm; head length 1.8 mm; pronotum length 2.5 mm; mesonotum length 5.7 mm; head width 4.7 mm; width of pronotal collar 6.3 mm.

Distribution (fig. 10): The only specimen known supposedly comes from Misoöl Island, Irian Jaya.

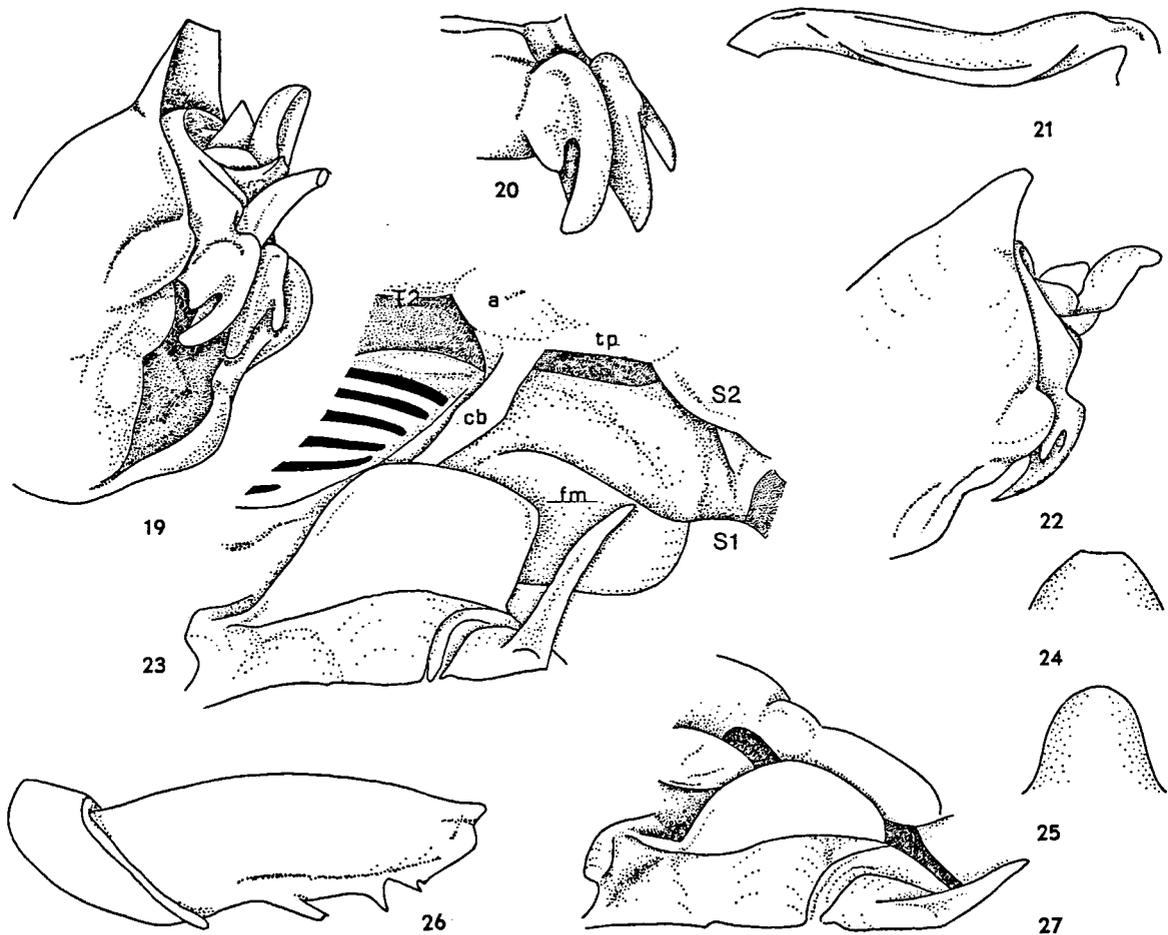
***Thaumastopsaltria pneumatica* n. sp**
(figs. 5-6, 11, 19-27)

Holotype: " Mt. Dayman / Maneau Range / 1550 m N. slope No5 / June 30-July 13, 1953 / Papua, New Guinea" [print]; "Geoffrey M. Tate / Collector" [print]; "AMNH / New York" [print], ♂, AMNH. Paratypes: same data as holotype 2♂, 2♀, AMNH; 1♂, ZMA.

T. pneumatica closely resembles *T. adipata* in size and general aspect. The species is easily recognized by the high number of apical areas in the wing (7-10) and by the large pointed and downwards bent lateral protrusion on the clasper. Apart from this protrusion, the clasper is very similar to that of *T. adipata*.

DESCRIPTION

Body of males red-brown, with large and inflated abdomen. Females much shorter than males, but with equally large head and thorax. Abdomen of males 1.9-2.2 x as long as head and thorax, of females 1.2-1.3 x. Tegmina of males 1.0-1.1 x as



Figs. 19-27. *Thaumastopsaltria pneumatica*: 19, pygofer aslant, holotype; 20, claspers, holotype; 21, aedeagus, paratype; 22, pygofer in lateral view, holotype; 23, male operculum, paratype; 24, male caudodorsal beak in dorsal view, holotype; 25, female caudodorsal beak in dorsal view, paratype; 26, fore femur, male paratype; 27, female operculum, paratype. Lettering: a = auditory capsule; cb = connecting bar between tymbal and abdomen; fm = folded membrane; S1 = 1st sternite; S2 = 2nd sternite; T2 = 2nd tergite; tp = tergite part between auditory capsule and 2nd sternite.

long as body length, of females 1.4 x.

Head: Postclypeus angularly protruding in dorsal view, its anterior margin continuous with anterior margins of vertex lobes. Postclypeus swollen in lateral view, but less angular than in other *Thaumastopsaltria* species; anterior margin (lateral view) convex. Vertex smooth, not wrinkled between ocelli; furrows in vertex less prominent than in *T. adipata*. Distance between eyes 1.2-1.3 x length of head and 1.9-2.0 x width of eye. Head 1.9-2.2 x as broad as distance between

eyes.

Legs: Fore femur with row of three sharply pointed spines, diminishing in length towards tibia. Proximal spine slightly bent, making an angle of about 45° with femur (fig. 26), but in one specimen sharply bent and adjacent to femur. Proximal spine shorter than distance to middle spine.

Tegmina and wings: Hyaline, tegmina with a slight reddish glow. Tegmina (fig. 5) with 12-14 apical areas. At least 12 (sometimes 13) of apical

areas are adjacent to ulnar areas; other apical areas are formed by a more distal splitting of veins. First apical area 1.6-1.9 x as long as second. Wing venation (fig. 6) very variable, with 7-10 apical areas, often variable within individuals.

Tymbal organs: Tymbals quite large, extending over 1/2, to 3/5 of body width in lateral view. Five transverse sclerotized ridges spanning the tymbal from dorsal to ventral margin, and a 6th, most proximal, ridge only spanning about 3/4 of tymbal width. Intercalary ridges almost completely embedded in main ridges.

Opercula and tymbal cavity: Male operculum (fig. 23) not covering tymbal cavity and leaving folded membrane largely exposed. Gap between operculum and abdomen wide, but narrower than in *T. adipata* and about 0.8 x as wide as operculum length. Distal part of operculum angular, oblong and longer than basal part, with slightly convex margins. Lateral margin forming an almost right angle with crest of basal part. Distolateral and distomedial corners almost rectangular. First and second sternite not adjacent. Meracanthus reaching beyond operculum. Tymbal cavity narrow; tergite part between auditory capsule and sternite 2 quite short and curved inwards, with weak crest along margin. Female operculum (fig. 27). Basal part with elongate crest around distolateral corner. Distal part rather large, almost as long as basal part, and nearly sickle-shaped, with almost continuously rounded margins.

Abdomen: Male abdomen light brown with ventrolateral row of slightly darkened patches. Abdomen strongly inflated, as in *T. adipata*, so that the otherwise sharp fold between sternites and tergites is almost absent between 8th tergite and 7th and 8th sternite. Proximal margin of tergite 2 strongly convex middorsally. Auditory capsules not swollen and hardly elevated relative to connecting bar between abdomen and tymbal. Female abdomen red-brown. Female caudodorsal beak in dorsal view (fig. 25) broad and short, rounded at apex.

Male genitalia: Pygofer in lateral view as in fig. 22. Dorsal margin almost straight, continuous with broad and truncate caudodorsal beak. Distal margin slightly convex between beak and lat-

eral lobe. Lateral lobe of pygofer with angularly rounded and weakly swollen lateral protuberance, almost laminae in one specimen. Pygofer lobe forming an angular and inwards curved corner just under this protuberance. Pygofer lobe strongly, globularly, inflated towards base of ventral margin. Caudodorsal beak in dorsal view (fig. 24) very broad, short and truncate or slightly concave at apex. Claspers (fig. 20) hook-shaped as in *T. adipata*, but more rounded, with convex dorsal margin, and diverging towards sharply pointed apices. Dorsal corners of claspers bending mesiad around aedeagus. Apical part of clasper with weakly convex distal margin and distinct, sharply edged, clasper hollow. Clasper forming a large downwards bent thorn-shaped lateral protrusion, reaching down to about half-length of clasper hollow. Aedeagus (fig. 21) slightly S-curved, more strongly bent down near apex. Lateral crests of aedeagus very slender. Aedeagus with pair of short and very slender middorsal crests.

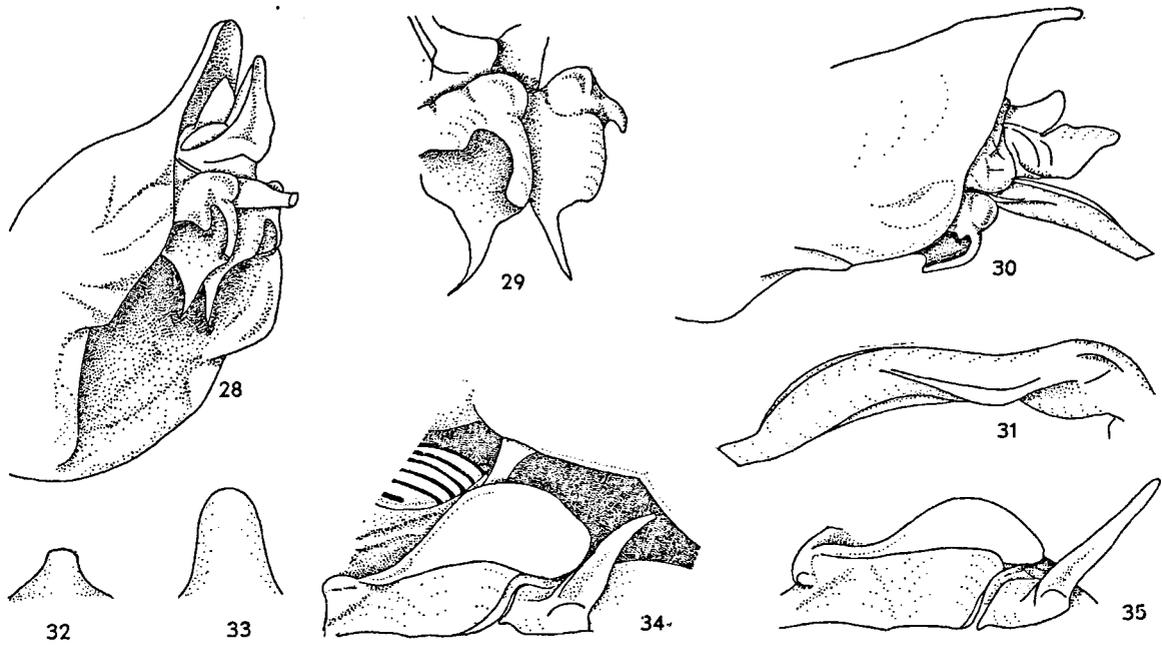
Measurements: Body length ♂: 28.2-31.5 mm, ♀: 22.3-25.0 mm; tegmen length ♂: 30.0-32.8 mm, ♀: 24.3-34.4 mm; head length ♂: 1.8-2.0 mm, ♀: 1.8-2.1 mm; pronotum length ♂: 2.5-2.6 mm, ♀: 2.2-3.0 mm; mesonotum length ♂: 4.9-5.2 mm, ♀: 5.3-5.7 mm; head width ♂: 4.5-4.8 mm, ♀: 4.6-5.4 mm; width of pronotal collar ♂: 6.5-7.2 mm, ♀: 6.7-7.6 mm.

Distribution (fig. 11): The species is known only from Mt. Dayman on the Papuan peninsula.

Etymology: *Pneumaticos* (Gr.) means inflated and refers to the strongly inflated abdomen.

***Thaumastopsaltria spelunca* n. sp.**
(figs. 1, 4, 11, 28-35)

Holotype: "New Britain / Ti, Nakanai Mts. / vii-28-1956"; "E.J. Ford Jr. / Collector", ♂, BPBM. Paratypes: NEW BRITAIN: Bainings, St Paul's, Gazelle Pen., 350 m, 4.ix.1955, J.L. Gressitt, 1♂, BPBM; Illugi, Upper Warangoi, Gazelle peninsula, 230 m, 12-15.xii.1962, J. Sedlacek, 2♂, BPBM; Silanga, Nakanai Mts., 150 m, 2.viii.1956, E.J. Ford Jr., 1♂, ZMA; Mt. Sinewit, 3500 ft, 27.vi-17.ix.1963, W.W. Brandt, 2♂, 3♀, CSIRO. Other material: N. Guinea?, Coll C. et O. Vogt, Acq. 1960, 1♂ det. *Acnilla*, ZMA; PAPUA: NEW GUINEA (SE): Mt. Dayman,



Figs. 28-35. *Thaumastopsaltria spelunca*: 28, pygofer aslant, paratype Bainings; 29, clasper, paratype Bainings; 30, pygofer in lateral view, holotype; 31, aedeagus, Mt. Dayman; 32, male caudodorsal beak in dorsal view, Mt. Dayman; 33, female caudodorsal beak in dorsal view, paratype Mt. Sinnewit; 34, male operculum holotype; 35, female operculum, paratype Mt. Sinnewit.

Maneau Range, 2230 m, 28.iii.1953, Geoffrey M. Tate, 1♀, AMNH; same data but 20.viii.1953, 2♂, AMNH; Popondetta, 60 m, 3-4.ix.1963, J. Sedlacek, 1♀, BPBM; Popondetta, 25 m, iv.1966, Shanahan-Lippert, 1♀, BPBM; same data but v.1966, 1♂, 6♀, BPBM; 1♂, 1♀, ZMA; vi.1966, 8♀, BPBM; UMBOI I: Lablab, c 8 km WNW, 300 m, 8-19.ii.1967, G.A. Samuelson, 2♂, 2♀, BPBM. Probably belonging to this species: SOLOMON ISLANDS: BOUGAINVILLE: Torpanos, 6 km W. Tintutz, J. Sedlacek, 1♀, BPBM; BUKA: Hanam hafan [Hanahan?], Neupommern, N. Küste, Hamb. Südsee exped. G. Dunker, i-xi.1909, 1♀, ZIM.

T. spelunca is very similar to the foregoing species, but much smaller and less inflated. The species can be recognized by its large, cave-shaped clasper hollow, with incurved margins and sharply pointed laminose medial protrusion.

DESCRIPTION

Body of males light ochraceous to red-brown, often greenish tinged, especially towards end of ab-

domen. One male bicoloured; with green head and thorax, and brown abdomen. Females of about same size as males, but with more robust head and thorax and slightly longer tegmina. Females red-brown or bicoloured; with green head and thorax, and brown abdomen. Abdomen of males 1.3-1.6 x as long as head and thorax, of females 1.0-1.3 x. Tegmina of males 1.0-1.3 x as long as body length, of females 1.2-1.4 x.

Head: Postclypeus in dorsal view, in some specimens protruding beyond vertex lobes, with anterior margin forming almost right angle with anterior margins of vertex lobes; in others anterior margins of vertex lobes and postclypeus almost continuous. Vertex with distinct medial and diverging furrows, and in some specimens slightly wrinkled between ocelli (cf. fig. 3). Distance between eyes 1.1-1.3 x length of head and 2.0-2.4 x width of eye. Head 1.8-2.0 x as broad as distance between eyes.

Legs: Fore femur with row of three sharply pointed spines, diminishing in length towards tibia. Proximal spine strongly bent and adjacent

to femur (cf. fig. 17), but more erect in some females. Proximal spine generally shorter than distance to middle spine, though sometimes reaching to base of middle spine.

Tegmina and wings (fig. 4): Hyaline, tegmina often slightly reddish tinged. Tegmina with 10-15 apical areas and sometimes 1-3 small subapical areas between apical and ulnar areas. Only 10-13 apical areas are adjacent to ulnar areas; other apical areas are formed by a more distal splitting of veins. First apical area 1.7-1.9 x as long as 2nd. Wings with 6, sometimes 7, apical areas; the additional area not always reaches radial areas.

Tymbal organs: Tymbals very small, extending over about 2/5 of body width in lateral view. Five transverse sclerotized ridges spanning the tymbal from dorsal to ventral margin and a 6th, most proximal, ridge only spanning about 3/4 of tymbal width. Intercalary ridges almost completely embedded in main ridges.

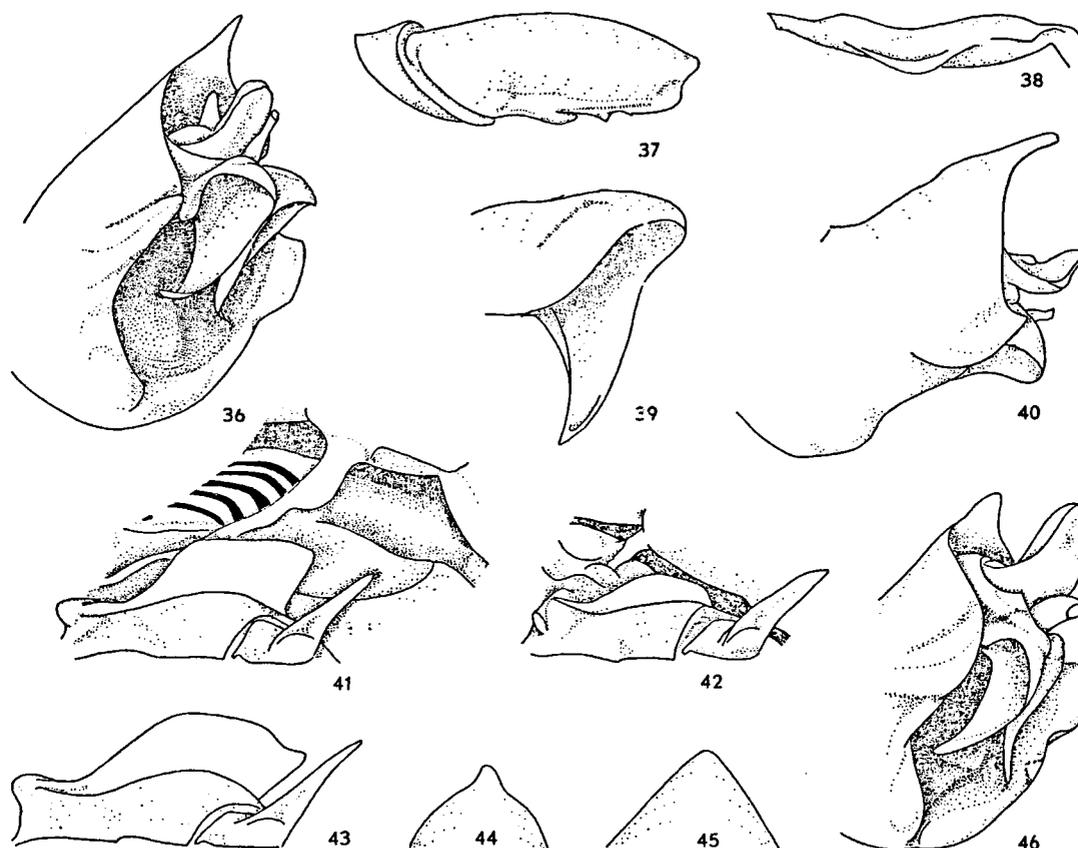
Opercula and tymbal cavity: Male operculum (fig. 34) of about the same size as in foregoing species but, especially in New Britain specimens, more rounded. Gap between operculum and abdomen much narrower than in both foregoing species, less than 0.5 x as wide as length of operculum, while the operculum sometimes reaches beyond anterior margin of abdominal segment 2. Distal part of operculum slightly longer than basal part, almost oval. Lateral margin straight, distal margin convex, medial margin convexly recurving to operculum base. New Guinean specimens with more oblong distal part, as in *T. pneumatica*. First sternite adjacent, or almost adjacent, to 2nd sternite. Meracanthus reaching beyond operculum and often beyond anterior margin of abdominal segment 2. Tymbal cavity slightly wider than in foregoing species; tergite part between auditory capsule and sternite 2 rather long, and with distinct ridge along its margin. Female operculum (fig. 35) very small. Distal part oval and much shorter than that of male. Lateral and distal margins almost straight, distolateral and distomedial corners rounded. Medial margin strongly recurving to operculum base.

Abdomen: Male abdomen moderately inflated,

unicolourous yellow to brown. Auditory capsules distinctly swollen and distinctly elevated relative to connecting bar between abdomen and tymbal. Female abdomen dark reddish brown. Ovipositor sheaths reaching distinctly beyond apex of caudodorsal beak (fig. 1). Caudodorsal beak in dorsal view (fig. 33) stout, rounded at apex.

Male genitalia: Pygofer in lateral view as in fig. 30. Dorsal margin almost straight or slightly concave, either continuous with, or angularly bending into, slender caudodorsal beak. Distal margin slightly convex between beak and lateral lobe. Lateral lobe of pygofer with small, globularly rounded lateral protuberance. Pygofer lobe forming a small, slightly inwardly curved, rectangular corner just ventral to this protuberance. Pygofer lobe distinctly inflated towards base of ventral margin, but less strongly inflated than in *T. pneumatica*. Caudodorsal beak in dorsal view (fig. 32) short and slender, either rounded or truncate at apex. Clasper (fig. 29) very characteristic, broad and short, with a large cave-like hollow. Clasper with globularly inflated dorsal swelling, flanking aedeagus. Ventral to this swelling, the clasper forms a long laminose medial, and a bluntly rounded thorn-shaped lateral protrusion, enclosing a large dome-shaped hollow. Distal margin of laminose medial protrusion strongly curved laterad, at edge of clasper hollow. Ventral to this curvature, the protrusion abruptly narrows to a slender, sharply pointed spine. The medial spines of both claspers diverge towards their apices. Aedeagus (fig. 31) very broad and slightly S-curved, strongly bent down at broad distal half, abruptly narrowing and angularly bending upwards, close to apex. Aedeagus with short and slender lateral crests along proximal half, a pair of slender middorsal crests following the downwards curvature of distal half, and a single midventral crest along convex part of curvature.

Measurements: Body length ♂: 17.7-22.1 mm (x 19.6 mm ± 1.5), ♀: 19.2-20.7 mm (x 20.0 mm ± 0.5); tegmen length ♂: 18.2-25.7 mm (x 22.6 mm ± 2.1), ♀: 23.8-27.8 mm (x 25.7 mm ± 1.3); head length ♂: 1.5-2.0 mm (x 1.7 mm), ♀: 1.5-2.0 mm (x 1.7 mm); pronotum length ♂: 2.0-2.4 mm (x 2.1 mm), ♀: 2.3-2.6 mm (x 2.5 mm); mesonotum length ♂: 3.8-4.6 mm (x 4.2



Figs. 36-46. *Thaumastopsaltria globosa*: 36, pygofer aslant, Bisianumu; 37, fore femur, male Daru; 38, aedeagus, Cooktown; 39, clasper, Bisianumu; 40, pygofer in lateral view, Bisianumu; 41, male operculum, Bisianumu; 42, female operculum, Erambu; 43, male operculum, Erambu; 44, male caudodorsal beak in dorsal view, Cooktown; 45, male caudodorsal beak in dorsal view, holotype; 46, pygofer from aslant, Iorabaiwa.

mm), ♀: 3.8-4.6 mm (x 4.2 mm); head width ♂: 3.6-4.1 mm (x 3.9 mm), ♀: 4.3-4.6 mm (x 4.4 mm); width of pronotal collar ♂: 5.0-6.1 mm (x 5.5 mm), ♀: 6.1-6.5 mm (x 6.4 mm).

Distribution (fig. 11): *T. spelunca* is recorded from New Britain, Umboi I. and the northeastern part of the Papuan peninsula. A female from Bougainville, Solomon Islands, probably belongs to this species, while another female presumably comes from Buka Island.

Etymology: *spelunca* (Lat.) means "cave" and refers to the cave-shaped clasper hollow.

***Thaumastopsaltria globosa* (Distant, 1897)**
(figs. 3, 7-8, 11, 36-49)

Acrilla globosa Distant, 1897: 383; Jacobi, 1903: 14;
Thaumastopsaltria globosa; Distant, 1906: 160; Metcalf, 1963: 259;
Thaumastopsaltria glauca Ashton, 1912: 225, Pl LI, Figs. 8, 8a-b, n. syn.; Ashton, 1914: 351; Metcalf, 1963: 259; Duffels & v.d. Laan, 1985: 249; Moulds, 1990: 191, pl. 22, figs 1, 1a.
Thaumastopsaltria [sic] *glauca*; Burns, 1957: 644.

Lectotype designations: *Acrilla globosa* was described from two specimens: a male from Pau-momu River and a female from Haveri. Both carry type labels. The male is designated lectotype; it bears the following labels: "Type" [round

label, red margin]; "SYNTYPE" [round label, blue margin]; "globosa Dist" [written]; "N Guinea SE / Paumomu riv. / LORIA, ix-xii '92" [print in black cadre]; "Distant Coll / 1911-383" [print]. This specimen is housed in the BMNH. The female, in the MSNG, becomes paralectotype.

Thaumastopsaltria glauca is also described from one male and one female. Both are in the collection of the AMS and both bear the following labels: "C. York / 1907 / Elgner" (written); *T. glauca* / Ashton / Type" (written); "Type" (print, red label); "K 67581" (written); "Ashton / Coll." (typewritten). The male is hereby designated lectotype, the female paralectotype.

Synonymy: Comparison of the lectotype of *T. glauca* with the lectotype of *T. globosa* revealed that they are conspecific; *T. glauca* Ashton is a junior synonym of *T. globosa*.

Material examined.- QUEENSLAND: C. York, 1907, Elgner, ♂ lectotype *T. glauca*, ♀ paralectotype *T. glauca*, AMS; Cooktown, 1♂, BMNH; Iron range, 3.i.1973, M.S. Moulds, ♀ *T. glauca* det. M.S. Moulds, ZMA; Lockerbie, Cape York, 31.iii.1964, I.F.B. Common & M.S. Upton, 1♂ *T. glauca* det. J.P. Duffels, CSIRO; IRIAN: NEW GUINEA (W): Erambu, 80 km ex Merauke, 29.i.1960, T.C. Maa, 1♂, ♀, BPBM; same data but 5.ii.1960, 1♂, BPBM; Merauke, 1904, Dr. Koch, 1♀, SMD; PAPUA: NEW GUINEA (SE): British New Guinea, R. Neill, 1921, Rothschild bequest, 1939-1, 1♂, BMNH; Bisianumu, 1600 ft, 27.i.1955, B. Clow, 1♂, MVM; Daru, 2.iv.1921, E.O. Pockley, 1♂, AMS; Ekeikei, iv.1903, Pratt, 1♀, BMNH; Haveri, vii-xi.1893, Loria, ♀ paralectotype *T. globosa*, MSNG; Iorabaiwa to Urikituru, 21.vi.1921, E.O. Pockley, 1♂, AMS; Kikori, Gulf Dist., sea level, 1956, P. Dawson, ♀, AMS; N| abre Duan? [poss. Mt. Duau], 6.iv.1921, E.O. Pockley, 1♂, AMS; Oriomo Riv. 5.ii.1964, H. Clissold, ♀, BPBM; same data but 6 km, 19.ii.1964, ♀, BPBM; Paumomu riv. ix-xii.1892, Loria, ♂ lectotype *T. globosa*, BMNH; Rouku, Morehead riv., 28.v.1962, W.W. Brandt, ♀, CSIRO.

T. globosa is closely related to *T. spelunca*, but *T. globosa* is distinctly larger and can easily be recognized by its short, smoothly rounded and dome-shaped claspers with broad, laminose and sharply pointed medial protrusion.

DESCRIPTION

Body of males ochraceous to red-brown, females reddish brown or olive green. Females smaller than males, but with relatively more robust head and thorax, and slightly longer tegmina. Abdomen of males 1.7-2.1 x as long as head and thorax, of females 1.2-1.3 x. Tegmina of males 0.9-1.1 x as long as body length, of females 1.2-1.4 x.

Head: Postclypeus in dorsal view angularly protruding beyond vertex lobes, its anterior margin forming an almost right angle with anterior margins of vertex lobes. Vertex with distinct medial and diverging furrows, in some specimens wrinkled, but generally smooth between ocelli. Distance between eyes 1.1-1.3 x length of head and 2.1-2.6 x width of eye. Head 1.8-1.9 x as broad as distance between eyes. Eyes of live specimens blood red (Moulds, 1990).

Legs: Femur (fig. 37) with three sharply pointed spines, diminishing in length towards tibia. Proximal spine strongly bent, adjacent to femur, shorter than distance to middle spine.

Tegmina and wings: Hyaline, tegmina in some specimens slightly reddish. Tegmina with 10-15 apical areas and sometimes 1-3 subapical areas, between apical and ulnar areas. Females tend to have more apical areas than males. Only 10-13 apical areas are adjacent to ulnar areas, other apical areas are formed by more distal splitting of veins. Wings with 6 or 7 apical areas.

Tymbal organs: Tymbals large, extending over about 3/5 of body-width in lateral view. Five transverse sclerotized ridges spanning the tymbal from dorsal to ventral margin and a 6th, most proximal, ridge only spanning about 3/4 of tymbal width. Intercalary ridges almost completely embedded in main ridges.

Opercula and tymbal cavity: Male operculum not covering tymbal cavity and leaving folded membrane largely exposed. Gap between operculum and abdomen very wide, about as wide as operculum length. Distal part of operculum in some specimens oblong, with almost straight margins and almost rectangular corners (fig. 41); in others slightly elongate, with a slightly convex distal margin, strongly concave near distomedial

corner (fig. 43). First sternite not adjacent to 2nd sternite. Meracanthus slightly longer than operculum, but not reaching beyond folded membrane. Tymbal cavity narrow; tergite part between auditory capsule and sternite 2 quite short and curved inwards, crest along margin often very weak. Female operculum (fig. 42) very small, distinctly smaller than that of male. Distal part of female operculum rounded, almost sickle-shaped.

Abdomen: Male abdomen ochraceous to brown, more inflated than in *T. spelunca*, but less so than in *T. adipata*; with sharp fold between sternites and tergites. Abdomen of most specimens with a ventrolateral row of vaguely darkened patches. Anterior margin of tergite 2 strongly convex. Auditory capsules not swollen and hardly elevated relative to connecting bar between abdomen and tymbal. Female abdomen yellow-brown. Female caudodorsal beak in dorsal view (fig. 49) very slender, triangular and almost pointed at apex.

Male genitalia: Pygofer in lateral view as in fig. 40. Dorsal margin slightly concave, angularly bending into straight and slender caudodorsal beak. Distal margin almost straight between beak and lateral lobe. Lateral lobe of pygofer strongly curved outwards, forming a flattened rectangular lateral protrusion similar to that of *T. sarissa* (fig. 70), but smaller. In the holotype this protrusion is not rectangular at its distal corner, but sharply pointed and elongate, distinctly reaching beyond pygofer margin. Pygofer not forming inwards curved angular protrusion as in foregoing species. Pygofer lobe distinctly, in some specimens almost globularly, inflated towards ventral margin, near base of pygofer. Caudodorsal beak in dorsal view (figs. 44, 45) very variable in width, but always pointed at apex. Clasper (fig. 39) short and broad as in *T. spelunca*, with a similarly large, dome-shaped hollow, but a less prominent, lobate, lateral protrusion. Clasper smoothly rounded dorsally, medially forming broad, triangular and sharply pointed, laminose protrusion. Distal margin of this laminose protrusion gradually bending into sharp edge of apically rounded clasper holow. The medial protrusions of both claspers diverge towards their

apices. Aedeagus (fig. 38) resembling that of *T. spelunca*, very slightly S-curved, abruptly narrowing and slightly bending upwards near apex. Aedeagus with short and slender lateral crests, and a pair of distinct, slender middorsal crests, forming an angular corner at distal ends.

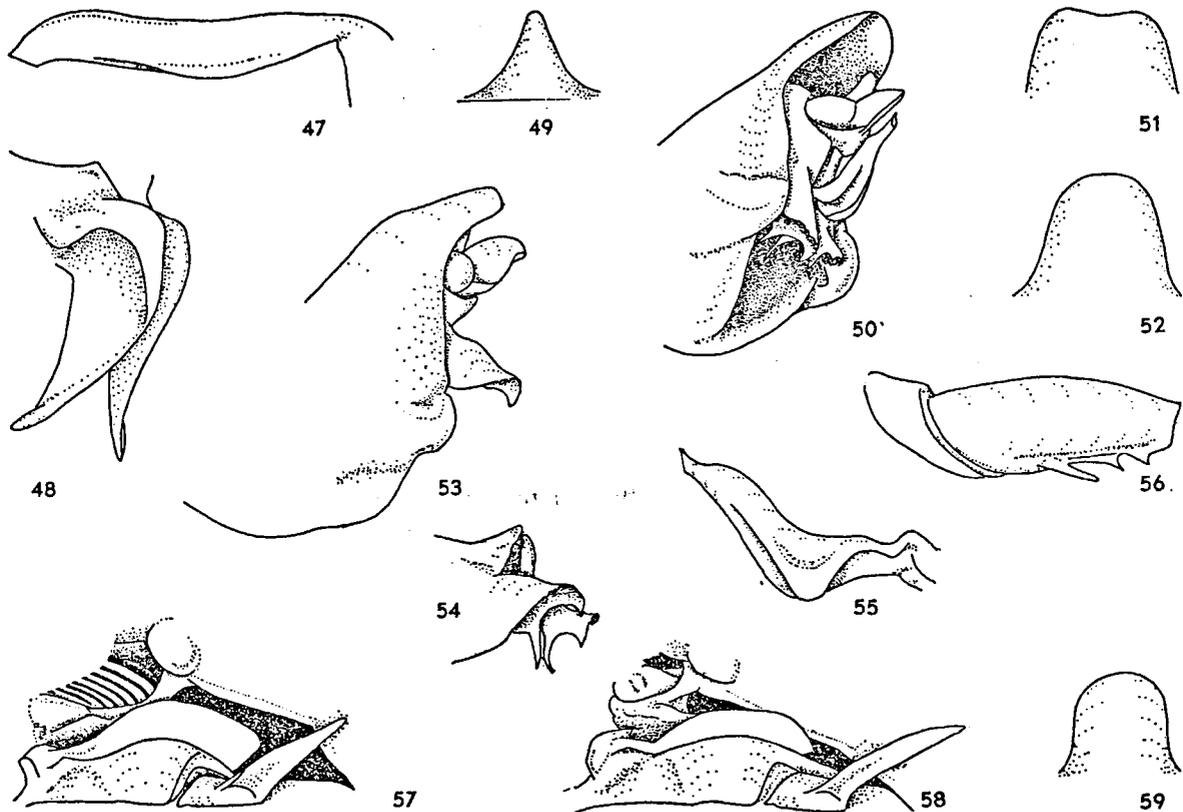
Measurements: Body length ♂: 20.8-26.3 mm (x 25.2 mm ± 1.4), ♀: 18.3-20.4 mm (x 19.1 mm); tegmen length ♂: 22.3-24.1 mm (x 23.4 mm ± 0.5), ♀: 21.8-25.5 mm (x 24.1 mm ± 1.2); head length ♂: 1.5-1.8 mm (x 1.7 mm), ♀: 1.7-1.9 mm (x 1.8 mm); pronotum length ♂: 1.7-2.3 mm (x 2.1 mm), ♀: 2.0-2.4 mm (x 2.2 mm); mesonotum length ♂: 3.7-5.1 mm (x 4.5 mm), ♀: 4.0-4.9 mm (x 4.4 mm); head width ♂: 3.4-4.1 mm (x 3.8 mm), ♀: 3.7-4.4 mm (x 4.1 mm); width of pronotal collar ♂: 5.0-6.0 mm (x 5.6 mm), ♀: 5.3-6.2 mm (x 5.9 mm). Moulds (1990) records tegmen lengths up to 31 mm.

Distribution (fig. 11): *T. globosa* is found in New Guinea and Australia. The species is recorded here from southwestern New Guinea, including the south coast of the Papuan peninsula, and northeastern Queensland. Moulds (1990) records the species from along the east coast of Cape York Peninsula, between Cape York and Daintree and from Groote Eylandt, Northern Territory.

Remark: The male, labeled: "British New Guinea, R. Neill, 1921", and the male from Iorabaiwa significantly deviate in genital structure. The pygofer (fig. 46) has broadly rounded and more swollen lateral protuberances; the clasper (fig. 48) is more slender, with a narrow hollow and distinct lateral protrusion; and the aedeagus (fig. 47) is much broader than in other specimens of *T. globosa*, curved down towards apex, and with a very weak dorsal crest. More material is needed to confirm the separate taxonomic position of these two specimens.

***Thaumastopsaltria sicula* n. sp.**
(figs. 9-10, 50-59)

Holotype: "N. DUTCH NEW GUINEA: / Waigeu. Camp Nok. / 2,500 ft. v.1938. / L.E. Cheesman. / B.M. 1938-593." (print) ♂, BMNH. Paratypes: same data as holotype,



Figs. 47-59. 47-49 *Thaumastopsaltria globosa*: 47, aedeagus, Iorabaiwa; 48, claspers, Iorabaiwa; 49, female caudodorsal beak, Iron ridge; 50-59 *Thaumastopsaltria sicula*: 50, pygofer aslant, paratype Bodem; 51, male caudodorsal beak in dorsal view, paratype Waigeu; 52, male caudodorsal beak in dorsal view, paratype Bodem; 53, pygofer in lateral view, paratype Waigeu; 54, claspers, paratype Waigeu; 55, aedeagus, paratype Waigeu; 56, fore femur, female paratype Waigeu; 57, male operculum, paratype Waigeu; 58, female operculum, paratype Waigeu; 59, female caudodorsal beak in dorsal view, paratype Waigeu.

1♂, 3♀, BMNH; Bodem, 11 km SE Oerberfaren [Oerbefareh], 100 m, 7-17.vii.1959, T.C. Maa, 1♂, BPBM.

T. sicula is quite different in general aspect from other *Thaumastopsaltria* species, it is much smaller, has 8 apical areas in tegmen and strongly differs in size and shape of tymbal cavity. Still, the species certainly belongs to *Thaumastopsaltria*. Not only does it share the angularly swollen postclypeus and the long ovipositor with other species of the genus, but its clasper bears a similar medial protrusion as in *T. globosa* and *T. spelunca*, while the aedeagus shares a similar apex with these species. Males can easily be recognized by the broad and truncate caudodorsal beak and strongly bent aedeagus.

DESCRIPTION

Body of males reddish brown, tinged with green. Females darker red-brown. Abdomen of males 1.3-1.4 x as long as head and thorax, of females 1.2-1.4 x. Tegmina of both, male and female, 1.2 x as long as body length.

Head: Postclypeus in dorsal view angularly protruding, its anterior margin almost continuous with anterior margins of vertex lobes. Vertex smoothly vaulted, not wrinkled near lateral ocelli. Diverging furrows very vague, almost obsolete. Distance between eyes 1.2-1.4 x length of head and 2.2-2.5 x width of eye. Head 1.8-1.9 x as broad as distance between eyes.

Legs: Fore femur with three sharply pointed

erect spines, diminishing in length towards tibia. Proximal spine shorter than distance to middle spine.

Tegmina and wings: Hyaline. Tegmina with 8 apical areas. First apical area 1.5-1.6 x as long as 2nd; its base lies distinctly proximad, relative to base of 3rd apical area. Wing with 6 apical areas.

Tymbal organs: Tymbals small as in *T. spelunca*, extending over about 2/5 of body-width in lateral view. Six or seven transverse sclerotized ridges spanning the tymbal from dorsal to ventral margin and a most proximal ridge spanning only about 3/4 of tymbal width. (The Waigeu paratype has one complete ridge more than the other specimens). Intercalary ridges not discernable.

Opercula and tymbal cavity: Male operculum (fig. 57) covering greater part of tymbal cavity. Gap between operculum and abdomen very narrow, folded membrane not visible in ventral view. Distal part of operculum much shorter than basal part and oblong, with almost straight margins. Distolateral corner rounded, distomedial corner almost rectangular. First sternite adjacent to 2nd sternite. Meracanthus reaching beyond proximal margin of abdominal segment 2. Tymbal cavity much broader than in other species of *Thaumastopsaltria*; tergite part between auditory capsule and 2nd sternite rather long, with distinct crest along margin. Female operculum (fig. 58) much shorter than that of male, its distal part very short and sickle-shaped, with very short straight medial margin and rectangular distomedial corner.

Abdomen: Male abdomen brown, caudal parts in two specimens tinged with olive-green. Abdomen not inflated. Anterior margin of 2nd tergite distinctly concave middorsally (fig. 9). Auditory capsules distinctly swollen and distinctly elevated relative to connecting bar between abdomen and tymbal (fig. 57). Female abdomen red-brown and longer than that of male. Female caudodorsal beak in dorsal view (fig. 59) very short and broad, almost square-shaped, but rounded at apex.

Male genitalia: Pygofer in lateral view as in fig. 53. Dorsal margin straight, angularly bending

into stout, straight and truncate caudodorsal beak. Distal margin slightly convex between beak and lateral lobe. Pygofer strongly curved inwards towards distal margin. Lateral lobe of pygofer with globularly swollen lateral protuberance. Pygofer lobe only slightly inflated towards strongly convex ventral margin. Caudodorsal beak in dorsal view (figs. 51, 52) broad and short, either slightly convex or concave at apex. Clasper (fig. 48) elongate and straight, with a large but shallow clasper hollow. The sharp and arched distal edge of clasper dentate, medially ending in sharply pointed tooth. Medial margin of clasper arching back from this tooth and bending into a longer laminose, and sharply pointed medial protrusion, at half-length of clasper. Aedeagus (fig. 55) very similar to that of *T. spelunca* and *T. globosa*, sharing an abruptly narrowing and slightly upwards bent apical part, but more strongly curved near base; distal part of aedeagus making almost right angle with proximal part. Lateral crests very broad, with greatest width at curve of aedeagus. Aedeagus with pair of slender dorsal crests, abruptly ending, there where aedeagus narrows to its apex.

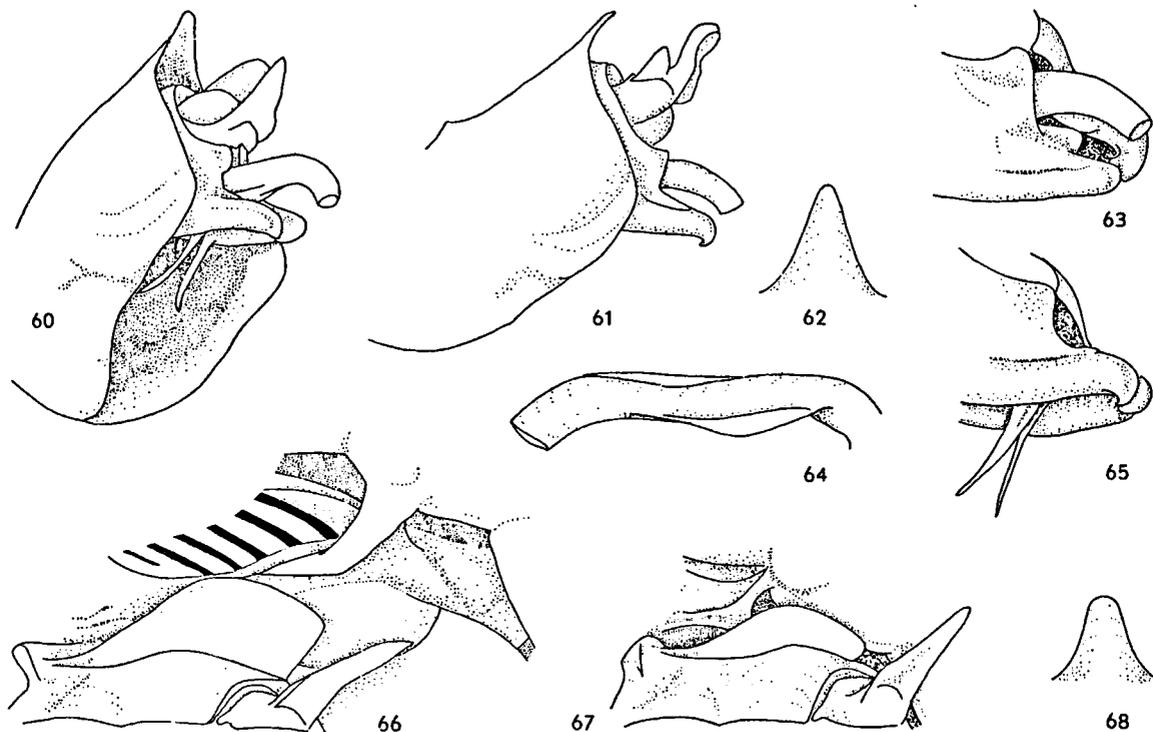
Measurements: Body length ♂: 15.3-17.4 mm (x 16.4 mm), ♀: 18.1-19.6 mm (x 19.1 mm); tegmen length ♂: 18.3-19.2 mm (x 18.8 mm), ♀: 21.8-23.1 mm; head length: ♂ 1.4-1.7 mm, ♀: 1.6-1.8 mm; pronotum length ♂: 1.9-2.0 mm, ♀: 2.4-2.6 mm; mesonotum length ♂: 3.4-3.9 mm, ♀: 3.6-4.5 mm; head width ♂: 3.5-3.9 mm, ♀: 3.9-4.4 mm; width of pronotal collar ♂: 4.6-5.1 mm, ♀: 5.2-6.3 mm.

Distribution (fig. 10): *T. sicula* is known from two localities: Bodem in north Irian Jaya and Waigeu Island.

Etymology: *Sicula* is the diminutive form of the word *sica* (Lat.) which means "dagger." The name refers to the small sharply pointed medial protrusion of clasper.

***Thaumastopsaltria lanceola* n. sp**
(figs. 10, 60-68)

Holotype: "Bainyik, TPNG / 21 Dec. 1963 / D.K. McAlpine" (print); "Austr Mus / Collection" (print, red label), ♂,



Figs. 60-68. *Thaumastopsaltria lanceola*: 60, pygofer aslant, paratype Popondetta; 61, pygofer in lateral view, paratype Popondetta; 62, male caudodorsal beak in dorsal view, paratype Popondetta; 63, claspers from above, paratype Popondetta; 64, aedeagus, paratype Popondetta; 65, claspers from below, paratype Popondetta; 66, male operclum, paratype Morobe Point; 67, female operculum, paratype Sewa Bay; 68, female caudodorsal beak in dorsal view, paratype Sewa Bay.

AMS. Paratypes: IRIAN: NEW GUINEA (W): Pionier Bivak, xii. 20.i.1921, W.C. v. Heurn, 1♂, MZB; PAPUA: NEW GUINEA (NE): Busu Riv., E of Lac, 100 m, 15.ix.1955, J.L. Gressitt, 1♂, BPBM; Busu Riv. 12 km, 21.ix.1956, E.J. Ford Jr., 1♂, BPBM; Finschhafen, viii-ix.1944, R. v. Song, 1♂, ZMA; Garaina, 800 m, 15.i.1962, J. Sedlacek, 1♂, BPBM; Garaina, 11-14.vii.1969, J.L. Gressitt, 1♂, ZMA; Lae, 26.xii.1963, D.K. McAlpine, 1♀, AMS; Morobe Point, Morobe Harbour, Morobe Dist., 20 m, 25.iv.1973, Thomas W. Davies, 1♂, CAS; PAPUA: NEW GUINEA (SE): Buri nr Samsambota, Popondetta Subdist., 31.x.1962, D.K. McAlpine, 1♂, AMS; Dawa Dawa, Milne Bay, 0-10 m, 2-6.xii.1956, L.J. Brass, 5th Archbold Exp. to New Guinea, 1♂, 1♀, AMNH; Mt. Dayman, Maneau Range, 700 m, 20-26.vii.1953, 1♂, AMNH; Jumbora, 60 m, 26.x.1963, H. Clissold, 1♂, BPBM; Mt. Lamington Dist., Northern Division, C.T. McNamara, 1♂, AMS; same data but 1925, 1♂ *Thaumastopsaltria* Det. A. Musgrave, AMS; same data but ii-ii.1929, 1♀, AMS; The Mangalase, SSW Popondetta, 2500-3000 ft, viii.1964, R. Pullen, 1♂, CSIRO; Milne

Bay, 1♀ det. *Acrilla globosa* Dist., ZML; Milne Bay, 1898-99, 1♂, 2♀, BMNH; Peria Creek, Kwagira riv., 14.viii-6.ix.1953, Geoffrey M. Tate, 2♀, AMNH; Popondetta, 25 m, vi.1966, Shanahan-Lippert, 2♂, BPBM; D'ENTRECASTEAUX ISLANDS: FERGUSSON I: Deidei, Gomwa Bay, 0-10 m, 2-6.vii.1956, L.J. Brass, 5th Archbold Exp. to New Guinea, 1♂, ANMH. Other material: Neu Guinea, 1♂ det. *Thaumastopsaltria globosa*, MZS; IRIAN: NEW GUINEA (W): Hollandia, 250 ft, 18.ix.1944, H. Hoogstraal, 1♀, NCSU; Ifar, 1955, R. v. Lutterveld, 1♀, RMNH; Sabron, Cyclops Mts. [Mt. Sabrong], 2000 ft, vii.1936, L.E. Cheesman, 2♀, BMNH; PAPUA: NEW GUINEA (NE): Butaweng, 8.x.1965, H. Pyka, 1♂, 2♀, SMN; Dorf Erima, 22.v.1896, Wilhelmsland exp., 1♀, MNHB; Fr. Wilhelmshafen, 1916, 1♂, SMD; Hunstein Mts. Camp 2 "Gita", 19-23.ix.1989, A. Allison et al., 1♀, BPBM; Kuminibus nr. Maprik, 13.xii.1963, D.K. McAlpine, 1♀, AMS; Saidor, Sibog vill., Finisterre Range, 27.v-5.vi.1958, W.W. Brandt, 1♀, BPBM; Sattelberg, 1909, H. Rolle, 1♀, SMD; Yagaum, Madang, 70 m, 20.vi.1965, H. Pyka, 1♀, SMN; PAPUA: NEW GUINEA

(SE): Dogon, Amazon Bay area, 2300 ft, 13.ix-11.xii.1962, W.W. Brandt, 1♀, CSIRO; Madew, St. Joseph Riv., 2000-4000 ft, 1909-21, W. Stalker, 1♀, BMNH; Milne Bay, 1♂, SMD; NORMANBY I: Waikiunga, Sewa Bay 25-30.x.1956, W.W. Brandt, 1♀, BPBM; same data but 5-9.xi.1956, 1♀; 21-30.xi.1956, 1♀; 11-20.xii.1956, 1♀, all BPBM; same data but 1-8.i.1957, 1♀, ZMA.

T. lanceola closely resembles *T. globosa* in size and general aspect. The species can easily be recognized however, by its massive and almost straight claspers, with slender medial protrusion, and its stout aedeagus.

DESCRIPTION

Body of males ochraceous to red-brown, females reddish brown or olive-green. Females smaller than males, but with relatively more robust head and thorax, and longer tegmina. Abdomen of males 1.7-2.1 x as long as head and thorax, of females 1.0-1.3 x. Tegmina of males 0.9-1.0 x as long as body length, of females 1.2-1.4 x.

Head: Postclypeus in dorsal view slightly protruding beyond vertex lobes, its anterior margin convexly curved at lateral corners and forming an almost right angle with anterior margins of vertex lobes. Vertex with distinct medial and diverging furrows, slightly wrinkled between ocelli (cf. fig. 3). Distance between eyes 1.1-1.2 x length of head and 2.0-2.6 x width of eye. Head 1.8-2.0 x as broad as distance between eyes.

Legs: Femur with three spines, diminishing in length towards tibia. Proximal spine often bluntly rounded at apex and strongly bent, generally adjacent to femur, and shorter than distance to middle spine.

Tegmina and wings: Hyaline, tegmina in some specimens slightly reddish. Male tegmina with 11-13 apical areas and sometimes a subapical area. Female tegmina more variable, with 10-15 apical areas and sometimes 1-3 subapical areas, between apical and ulnar areas. Both in male and female, not all apical areas are adjacent to ulnar areas, some apical areas are formed by more distal splitting of veins. Wings with 6 apical areas.

Tymbal organs: Tymbals large, extending over about 3/5 of body width in lateral view. Five transverse sclerotized ridges spanning the tymbal from dorsal to ventral margin and a 6th, most proximal, ridge only spanning about 3/4 of tymbal width. Intercalary ridges almost completely embedded in main ridges.

Opercula and tymbal cavity: Male operculum (fig. 66) as in *T. globosa*, not covering tymbal cavity and leaving folded membrane largely exposed. Gap between operculum and abdomen very wide, about as wide as operculum length. Distal part of operculum oblong, with almost straight margins and rectangular corners. First sternite not adjacent to 2nd sternite. Meracanthus slightly longer than operculum, not reaching beyond folded membrane. Tymbal cavity narrow; tergite part between auditory capsule and 2nd sternite quite short and curved inwards, with weak crest along margin. Female operculum (fig. 67) very small, distinctly smaller than that of male. Distal part, shorter than basal part, oblong, with angular distolateral corner. Lateral and distal margins almost straight, medial corner rounded, medial margin strongly recurving to operculum base.

Abdomen: Male abdomen ochraceous to brown, strongly inflated as in *T. globosa*, and with distinct fold between sternites and tergites. Abdomen of most specimens with ventrolateral row of vaguely darker patches. Anterior margin of tergite 2 strongly convex. Auditory capsules not swollen and hardly elevated relative to connecting bar between abdomen and tymbal. Female abdomen yellow-brown. Female caudodorsal beak in dorsal view (fig. 68) very slender, triangular and almost pointed at apex.

Male genitalia: Pygofer in lateral view as in fig. 61. Dorsal margin almost straight, continuous with straight and very slender caudodorsal beak. Distal margin slightly convex between beak and lateral lobe, concavely bent into margin of beak. Lateral lobe of pygofer with narrow elongate lateral protrusion. Pygofer lobe without angular corner ventral to this protrusion and only slightly swollen towards ventral margin. Caudodorsal beak in dorsal view (fig. 62) very slender and triangular, apically pointed. Clasper finger-shaped,

somewhat swollen and straight, though strongly curved mesiad near apex. Clasper without clasper hollow, forming a flat rectangular dorsomedial protrusion, supporting aedeagus (fig. 63), and a long and slender, downwards directed medial protrusion (fig. 65). The medial protrusions of claspers diverge towards their apices. Aedeagus (fig. 64) very broad, slightly S-curved, but strongly bent down towards apex, with broad lateral crests and a single broad middorsal ridge along concave part of curvature. Aedeagus not narrowing near apex, but with large circular pore.

Measurements: Body length ♂: 22.5-27.2 mm (x 25.2 mm ± 1.5), ♀: 18.7-22.3 mm (x 20.2 mm ± 1.1); tegmen length ♂: 23.7-27.2 mm (x 25.2 mm ± 1.4), ♀: 23.3-29.0 mm (x 26.1 mm ± 1.8); head length ♂: 1.7-2.1 mm (x 1.9 mm), ♀: 1.8-2.1 mm (x 2.0 mm); pronotum length ♂: 2.0-2.5 mm (x 2.2 mm), ♀: 2.2-2.7 mm (x 2.4 mm); mesonotum length ♂: 3.8-5.1 mm (x 4.7 mm), ♀: 4.2-5.4 mm (x 4.8 mm); head width ♂: 3.8-4.4 mm (x 4.2 mm), ♀: 4.1-4.8 mm (x 4.5 mm); width of pronotal collar ♂: 5.0-6.4 mm (x 5.9 mm), ♀: 5.6-6.9 mm (x 6.5 mm).

Distribution (fig. 10): *T. lanceola* is found along the northern mountain ranges of New Guinea, including Huon peninsula and the northern parts of the Papuan peninsula. The species is further recorded from Fergusson Island and Normanby Island of the D'Entrecasteau Islands.

Etymology: *Lanceola* is the diminutive form of the word *lancea* (Lat.) and refers to the lance-shaped medial protrusion of claspers.

***Thaumastopsaltria sarissa* n.sp.**
(figs. 2, 11, 69-76)

Holotype: "Boven Digoel- / gebied; 400 KM / ten N. v. Merauke" [print]; "Dr A. KALTHOFEN / legit. 1926 / Z Nw Guinea" ♂, ZMA. Paratypes: Kiunga, Fly R., 35 m, viii.1969, J. & M. Sedlacek, 3♂, 2♀, BPBM; Star range, 10 m, 8.ix.1959, Neth. New Guinea Exp., 1♂, RMNH.

T. sarissa is a medium-sized species, that can be recognized by the sharply outwardly bending claspers, with a long and slender medial protrusion,

and by its pygofer, with broad angular outwards curved lateral lobes.

DESCRIPTION

Body of males brown, females reddish brown or greenish, holotype discoloured by storage in alcohol. Females smaller than males, but with relatively more robust head and thorax, and longer tegmina. Abdomen of males 1.4-1.9 x as long as head and thorax, of females 1.3-1.4 x. Tegmina of males 1.0-1.1 x as long as body length, of females 1.2 x.

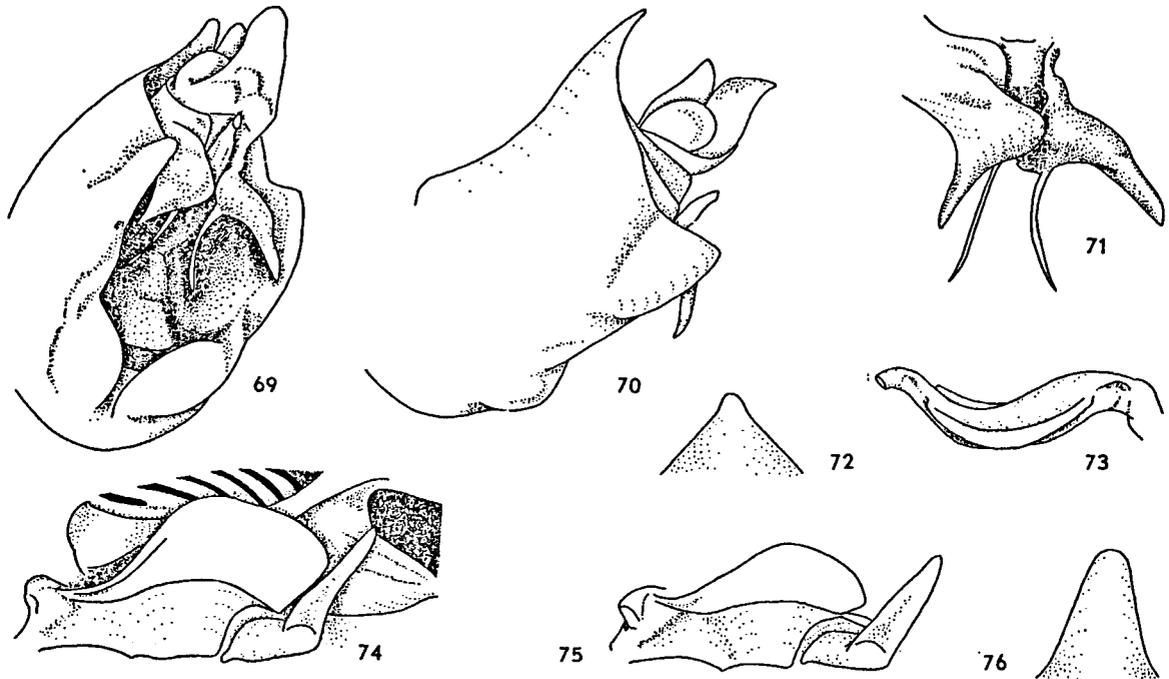
Head: Postclypeus in dorsal view angularly protruding beyond vertex lobes, its anterior margin forming an almost right angle with anterior margins of vertex lobes. Postclypeus angularly protruding in lateral view (fig. 2). Vertex with distinct medial and diverging furrows, slightly wrinkled between ocelli (cf. fig. 3). Distance between eyes 1.0-1.1 x length of head and 2.0-2.1 x width of eye. Head 1.9-2.0 x as broad as distance between eyes.

Legs: Femur with three spines, diminishing in length towards tibia. Proximal spine bluntly rounded at apex and strongly bent, often adjacent to femur, and distinctly shorter than distance to middle spine.

Tegmina and wings: Hyaline, tegmina in some specimens slightly reddish. Tegmina with 10-14 apical areas. Only 10-12 apical areas are adjacent to ulnar areas, other apical areas are formed by more distal splitting of veins. Wings with 6 apical areas. In one female, the vein between 2nd and 3rd apical area of right wing only separates proximal 1/3 of these areas.

Tymbal organs: Tymbals large, extending over about 3/5 of body-width in lateral view. Five transverse sclerotized ridges spanning the tymbal from dorsal to ventral margin and a 6th, most proximal, ridge only spanning about 3/4 of tymbal width. Intercalary ridges almost completely embedded in main ridges.

Opercula and tymbal cavity: Male operculum (fig. 74) not covering tymbal cavity and leaving folded membrane partly exposed. Gap between operculum and abdomen narrower than in *T. glo-*



Figs. 69-76. *Thaumastopsaltria sarissa*: 69, pygofer aslant, holotype; 70, pygofer in lateral view, holotype; 71, claspers, paratype Kiunga; 72, male caudodorsal beak in dorsal view, holotype; 73, aedeagus, paratype Kiunga; 74, male operculum, paratype Kiunga; 75, female operculum, paratype Kiunga; 76, female caudodorsal beak in dorsal view, paratype Kiunga.

bosa (fig. 41) but wider than in *T. spelunca* (fig. 34). Lateral crest of basal part in some specimens very short, forming a knobby protuberance at distolateral corner, in others elongate, running partly along lateral edge. Distal part of operculum angular, oblong. Lateral and medial margins straight, distal margin sometimes slightly convex. Distolateral corner rounded, distomedial corner almost rectangular. First sternite not adjacent to 2nd sternite. Meracanthus reaching just beyond operculum, but not beyond folded membrane. Tymbal cavity narrow; tergite part between auditory capsule and 2nd sternite quite short and curved inwards, with weak crest along margin. Female operculum (fig. 75) slightly smaller than that of male. Distal part oblong; distal margin convex mesiad, medial margin straight but very short. Distolateral corner rounded, distomedial corner rectangular.

Abdomen: Male abdomen moderately inflated and almost transparent. Abdomen slightly darkened in middorsal band and on segment 8. Ven-

tro-lateral row of vague patches on segments 3-7. Anterior margin of 2nd tergite strongly convex middorsally. Auditory capsules not swollen and hardly elevated relative to connecting bar between abdomen and tymbal. Female abdomen dark red-brown. Female caudodorsal beak (fig. 76) very stout, broad triangle shaped and rounded at apex.

Male genitalia: Pygofer in lateral view as in fig. 70. Dorsal margin concave, convexly bending into slender caudodorsal beak. Distal margin slightly convex between beak and lateral lobe, concavely bending into margin of beak. Lateral lobe of pygofer broad, rectangular and strongly curved outwards. Pygofer lobe without angular corner ventral to this protuberance, but globularly inflated towards base of ventral margin (fig. 69). Caudodorsal beak in dorsal view (fig. 72) broadly triangular, with slightly elongate narrow apical part, rounded at apex. Claspers (fig. 71) broadly rounded and somewhat swollen. Proximal part of clasper curving inwards, forming a

rounded corner, supporting aedeagus, distal part long, slender and strongly curving outwards to sharply pointed apex. Apical part of clasper with sharply edged and slender clasper hollow. Clasper with long and slender medial protrusion, curving outwards towards apex. Aedeagus (fig. 73) very short and strongly S-curved, with very broad wing-shaped lateral crests and distinct dorsal crest. Dorsal crest forked towards rectangular distal corners.

Measurements: Body length ♂: 21.8-23.1 mm (x 22.7 mm), ♀: 19.7 & 20.9 mm; tegmen length ♂: 22.4-25.0 mm (x 23.9 mm), ♀: 24.6 mm both; head length: ♂: 1.8-2.1 mm (x 1.9 mm), ♀: 1.9 & 2.1 mm; pronotum length ♂: 2.1-2.3 mm (x 2.2 mm), ♀: 2.3 & 2.4 mm; mesonotum length ♂: 3.8-4.8 mm (x 4.4 mm), ♀: 4.3 & 5.0 mm; head width ♂: 4.0-4.4 mm (x 4.2 mm), ♀: 4.4 & 4.5 mm; width of pronotal collar ♂: 5.3-6.1 mm (x 5.7 mm), ♀: 5.4 & 6.3 mm.

Distribution (fig. 11): Southwestern New Guinea, Fly River area.

Etymology: *Sarissa* (Gr.) is a macedonian lance. The name refers to the long and slender medial protrusion of claspers.

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REFERENCES

- ASHTON, H., 1912. Some new Australian Cicadidae. Proc. R. Soc. Vict. (N.S.) 24: 221-229.
- ASHTON, H., 1914. Catalogue of the Cicadidae in the South Australian Museum, with descriptions of several new species. Trans. R. Soc. S. Aust. 38: 345-358.
- BOER, A.J. de, 1982. The taxonomy and biogeography of the nasuta group of the genus *Baeturia* Stål, 1866 (Homoptera, Tibicinidae). *Beaufortia* 32: 57-78.
- BOER, A.J. de, 1986. The taxonomy and biogeography of the conviva group of the genus *Baeturia* Stål, 1866 (Homoptera, Tibicinidae). *Beaufortia* 36: 167-182.
- BOER, A.J. de, 1989. The taxonomy and biogeography of the bloetei group of the genus *Baeturia* Stål, 1866 (Homoptera, Tibicinidae). *Beaufortia* 39: 1-43.
- BOER, A.J. de, 1990. *Aedeastria*, a new cicada genus from New Guinea, its phylogeny and biogeography (Homoptera, Tibicinidae), preceded by a discussion on the taxonomy of New Guinean Tibicinidae. *Beaufortia* 40: 63-72.
- BOER, A.J. de, 1991. *Scottotympana*, a new cicad genus from New Guinea, with the description of three new species, their taxonomy and biogeography (Homoptera, Tibicinidae). *Beaufortia* 42: 1-11.
- BOER, A.J. de, 1992. The taxonomy and biogeography of the viridis group of the genus *Baeturia* Stål, 1866 (Homoptera, Tibicinidae). *Bijdr. Dierk.* 61 (3): 163-183.
- BOULARD, M., 1979. Révision de la faune cicadéenne des Iles Maurice et Rodriguez. *Bull. Soc. ent. Fr.* 84: 27-47.
- BREDDIN, G., 1901. Die Hemipteren von Celebes. Ein Beitrag zur Faunistik der Insel. *Abh. naturf. Gesellsch. Halle*, 24: 1-213.
- BURNS, A.N., 1957. Check list of Australian Cicadidae. *Ent. Arb. Mus. Georg Frey* 8 (2): 609-678.
- DISTANT, W. L., 1892. A monograph of Oriental Cicadidae, Parts 5-7: i-xiv, 97-158; Pls. x-xv (Trustees Indian Museum, London).
- DISTANT, W. L., 1897. Viaggio di Lamberto Loria nella Papuasias orientales, xvii. Additions to our knowledge of the Cicadidae of New Guinea. *Annali Mus. civ. Stor. nat. Giacomo Doria* (2) 17: 378-383.
- DISTANT, W. L., 1905. Rhynchotal notes. -XXXIV. *Ann. Mag. nat. Hist.* (7) 16: 203-216.
- DISTANT, W. L., 1906. A synonymic catalogue of Homoptera. Part 1. Cicadidae 1906: 1-207 (Trustees Indian Museum, London).

- DUFFELS, J.P., 1977. A revision of the genus *Diceropyga* Stål, 1870 (Homoptera, Cicadidae). *Monografieën ned. ent. Veren.* 8: 1-227.
- DUFFELS, J.P. & A.J. de BOER, 1990. Areas of endemism and composite areas in East Malesia. In: P. Baas, C. Kalkman & R. Geesink (eds.), *The plant diversity of Malesia: Proceedings of the Flora Malesiana symposium commemorating Professor Dr. C.G.G.J. van Steenis*, Leiden, August 1989: 249-272. (Kluwer Academic Publishers, Dordrecht).
- DUFFELS, J.P. & P.A. van der Laan, 1985. Catalogue of the Cicadoidea (Homoptera, Auchenorrhyncha) 1956-1980. *Series Ent.* 34: i-xvi, 1-414.
- ESAKI, T. & S. Miyamoto, 1975. Insects of Micronesia. Homoptera: Cicadidae. *Insects Micronesia* 6 (9): 633-656.
- HAMILTON, W., 1979. Tectonics of the Indonesian region. *Geol. Surv. prof. Pap.* 1078: i-ix, 1-345.
- HOLLOWAY, J.D., 1979. A survey of the Lepidoptera, biogeography and ecology of New Caledonia. *Series ent.* 15: i-xii, 1-588.
- HOLLOWAY, J.D., 1984. Lepidoptera and the Melanesian Arcs. In: F.J. Radovsky, P.H. Raven, and S.H. Sohmer (eds.), *Biogeography of the tropical Pacific*, proceedings of a symposium: 129-169. Association of Systematics Collection, Lawrence, U.S.A.
- HORVATH, G., 1913. Étude morphologique sur la construction de l'élytre des Cicadides. *Internatl. Congr. Ent. Trans.* 2: 422-432.
- IMHOF, O.E., 1933. Ailes des Cicadides. Type de la majorité. *Congr. Internatl. Ent. Compt. Rend.* 5: 303-308.
- JACOBI, A., 1903. Singcicaden von Ost-Neuguinea. *Gesell. Naturf. Freunde Berlin Sitzber.* 1903: 10-15.
- JONG, M.R. de, 1982. The Australian species of the genus *Lembeja* Distant, 1892 (Homoptera, Tibicinidae). *Bijdr. Dierk.* 52 (2): 175-185.
- KATO, M., 1932. *Monograph of Cicadidae* 1932: 1-450.
- KATO, M., 1956. The biology of cicadas. *Bull. Cicadidae Mus.*, 319 pp, 46 Pls, 139, Figs, Iwasaki Shoten, Jinbocho Kanda, Tokyo.
- KIKALDY, G. W., 1900. Bibliographical and nomenclatorial notes on the Rhynchota. No. 1. *Entomologist* 33: 238-243.
- KIKALDY, G. W., 1904. Bibliographical and nomenclatorial notes on the Hemiptera. No. 3. *Entomologist* 37: 279-283.
- KRAMER, S., 1950. The morphology and phylogeny of auchenorhynchous Homoptera (Insecta). *Illinois biol. Monogr.* 20 (4): i-vii, 1-111.
- KUHLGATZ, Th., 1905. Schädliche Wanzen und Cicaden der Baumwollstauden. *Berlin. zool. Mus. Mitt.* 3: 31-115.
- MARSHALL, A.F., 1873. Hemiptera. *Nomenclator Zoologicus continens nomina systematica generum animalium tam viventium quam fossilium, secundum ordinem alphabeticum disposita. Sub. auspicio et sumptibus C.R. Societatis Zoologico-Botanicæ 1873: i-iv, 1-482* [351-385].
- METCALF, Z.P., 1963. General catalogue of the Homoptera, VIII. Part 2. Tibicinidae: i-iv, 1-492. North Carolina State College, Raleigh, N.C.
- MOULDS, M.S., 1990. Australian cicadas: 1-217. New South Wales University Press, Kensington, N.S.W.
- MYERS, J.G., 1928. Cicadidae. *Insects of Samoa and other Samoan terrestrial Arthropoda* 2 (2): 55-65. Trustees of the British Museum, London.
- NEAVE, S.A., 1939. A-C *Nomenclator Zoologicus*. A list of names of genera and subgenera in zoology from the tenth edition of Linnaeus 1758 to the end of 1935 1: v-xiv, 1-957. The zoological society of London, London.
- NEAVE, S.A., 1940. Q - Z *Nomenclator Zoologicus* 4: 1-758. The zoological society of London, London.
- PIGRAM, C.J. & H.L. DAVIES, 1987. Terranes and the accretion history of the New Guinea orogen. *B.M.R. J. Aust. Geol. Geoph.* 10: 193-211.
- PIGRAM, C.J. & H. PANGGABEAN, 1984. Rifting of the northern margin of the Australian continent and the origin of some microcontinents in eastern Indonesia. *Tectonophysics*, 107: 331-353.
- SCHULZE, F.E., W. KÜKENTHAL and K. HEIDER 1926-1940. A-Zaphleg. *Nomenclator animalium generum et subgenerum. Im Auftrage der Preussische Akademie der Wissenschaften zu Berlin* 1 (1)-5 (25): 1-3692, I-CCCXLIV.
- STÅL, C., 1863. Hemipterorum exoticorum generum et specierum nonnullarum novarum descriptiones. *Roy. ent. Soc., London, Trans.* (3) 1: 571-603.
- WALKER, F., 1868. Catalogue of Homopterous insects collected in the Indian Archipelago by Mr. A.R. Wallace, with descriptions of new species. *Jour. Linn. Soc. London.* 10: 82-193.
- WATERHOUSE, C. O., 1902. *Index zoologicus. An alphabetical list of names of genera and subgenera proposed for use in zoology as recorded in the "Zoological Records" 1880-1900: together with other names not included in the Nomenclator Zoologicus of S.H. Scudder. Compiled (for the Zoological Society of London) by Charles Owen Waterhouse, and edited by David Sharp. London, 1902 8 vo, xii + 421 pp.*

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