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A Review of Australian Copiphorini (Orthoptera : Tettigoniidae : Conocephalinae)

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Abstract

The Australian members of the tribe Copiphorini (Tettigoniidae) are reviewed and their relationship to the Indo-Pacific species clarified. The principal character used is the stridulatory file of the male. This permits clear distinction of species within the four genera *Pseudorhynchus, Euconocephalus, Ruspolia* and *Mygalopsis*. Seven new species are named: *P. raggei, P. selonis, E. broughtoni, R. marshallae, M. sandowi, M. marki* and *M. thielei*. All genera are keyed, all species described and synonyms given. Distribution patterns are noted but not discussed in any detail.

Introduction

The Australian Tettigoniidae have had scant taxonomic treatment in recent times. Riek (1976) has provided a review of one genus, *Tympanophora*, and a number of other families are at present under consideration. Studies on the ecology, behaviour and physiology of various genera of Tettigoniidae are becoming more numerous, and the present review stems from a need to bring some taxonomic order to one genus, *Mygalopsis*, which is receiving considerable attention from both ecologists and physiologists in Western Australia (Sandow and Bailey 1978; Bailey and Stephen 1978; Thiele and Bailey 1980).

The tribe Copiphorini was erected by Karny (1912) and includes four Australian genera: *Pseudorhynchus* Serville, *Euconocephalus* Karny, *Ruspolia* Schulthess (= *Homorocoryphus* Karny) and *Mygalopsis* Redtenbacher. These genera were reviewed in part, in a study of Malayan, Melanesian and Australian tettigoniids by Hebard (1922). He pointed to the poor treatment one genus had received from previous workers, notably *Euconocephalus*. 'The treatment by Redtenbacher (1891) ... is superficial, dogmatic and confusing. The work of several earlier authors was ignored and multitude of species described, the validity of many being more than doubtful. It is much to be regretted that Karny (1907, 1912) made no effort to clear up numerous Redtenbacherian errors.' Despite such criticism, this confusion was not substantially corrected in Hebard's work, mainly because there were few clear characters, apart from the stridulatory apparatus which was obviously not used at that time. Further, most of the type material was based on females, which added considerably to the confusion. A similar difficulty was experienced by the present author in his treatment of the African genus *Ruspolia*, which, again, was in confusion until the stridulatory apparatus was used as the principal taxonomic character (Bailey 1975).

Hebard (1922) concluded with eight species of *Euconocephalus* from Australasia. The Karny genus, *Homorocoryphus*, was synonymized with *Ruspolia* Schulthess

(Bailey 1975), and this Australian review includes one new species from this genus; however, a wider treatment of the Oriental Copiphorini might well see the related genus *Euconocephalus* also synonymized with it. This genus, with *Pseudorhynchus*, revised for Africa by Ragge (1969), will remain in speculative confusion until some worker attempts such a revision. The main difficulty in such a group is attempting to find a suitable character, because of the seemingly high amount of variation in the fastigium of the vertex in a number of widespread but related genera. Concealed genitalia may provide the necessary information for a clear species diagnosis; however, it was felt that as the revision was based on numerous old type-specimens such manipulation was not legitimate at this stage.

Any review suffers from limitations; that presented here attempts to concentrate on the Australian Copiphorini, with the result that important links with the Oriental, Indonesian and Pacific groups may have been overlooked or given too little attention, even though the Australian National Insect Collection holds substantial material. I have, however, attempted where possible to examine all related types from Papua New Guinea and the Indonesian Archipelago but often with limited supporting material. The reason for this restriction was primarily time; once a reviewer attempts to include these islands it becomes necessary to include the complete eastern distribution to the Pacific islands as well as westward to India. Where species have been described adequate reasons have been provided for new synonymies; in some cases, however, where material was insufficient or lacked a male specimen, new synonymies have been avoided (e.g. *P. inermis* Karny).

Nineteen species have been listed from this area in the four genera described. Despite strenuous efforts to obtain the type specimens, some were not available and others were reported on good authority as being lost. Some species, of which the types are lost, had sufficiently distinctive characters to be identified on the basis of the original description; in such cases neotypes have been designated. The temptation for any reviewer of a more or less homogeneous genus is to synonymize; I have done this in many cases, basing these synonymies on my own experience from the African genus *Ruspolia*, where a high degree of variation in any one species is likely. One clear basis for the establishment of a species is the song; such biological evidence was only available for the genus *Mygalopsis* and two species of *Pseudorhynchus*.

Summary of Previously Described Type Material

Conocephalus troudeti le Guillou, 1841, p. 294. **Paris**, MNHN. (Reported by M. Descamps in a personal communication as not being available and he presumes it is lost.)

Conocephalus alienus Walker, 1869, p. 324. **London**, BMNH. Examined.

Conocephalus insularis Walker, 1869, p. 325. **London**, BMNH. Examined.

Conocephalus extensor Walker, 1869, p. 329. **London**, BMNH. Examined.

Conocephalus remotus Walker, 1869, p. 331. **London**, BMNH. Examined.

Conocephalus hawaiiensis Perkins, 1899, p. 13. **London**, BMNH. Examined.

Conocephalus australis Bolívar, 1884, p. 90. **Brussels**. (Reported by l'Institute Royal des Science Naturelles de Belgique as not being in their possession and in their opinion should be considered lost.)

Conocephalus lineatipes Bolívar, 1890, p. 225. **Lisbon**. (Despite strenuous efforts to acquire this type-specimen it was not available at the time of this revision.)*

Conocephalus indicus Redtenbacher, 1891, p. 408. **Vienna**, NHMV. Examined.

Conocephalus cornutus Redtenbacher, 1891, p. 411. **Vienna**, NHMV. Examined.

Conocephalus mimeticus Redtenbacher, 1891, p. 411. **Hamburg**. Destroyed.†

Conocephalus longiceps Redtenbacher, 1891, p. 412. **Vienna**, NHMV. Examined.

Conocephalus vaginalis Redtenbacher, 1891, p. 426. **Hamburg**. Destroyed.†

Euconocephalus sulcatus Karny, 1907, p. 40. **Vienna**, NHMV. Examined.

Euconocephalus inermis Karny, 1907, p. 41. **Vienna**, NHMV. Examined.

Pseudorhynchus lessonii Serville, 1838, p. 511. **Paris**, MNHN. (Reported by M. Descamps (personal communication) as not being available and presumed lost.)

Pseudorhynchus froggatti Kirby, 1906, p. 239. (Type-specimen not located but species described on the basis of an excellent coloured line drawing by Froggat, 1904.)

Pseudorhynchus ? pauperculus Walker, 1869, p. 331. **London**, BMNH. Examined.

Mygalopsis ferruginea Redtenbacher, 1891, p. 253. **Vienna**, NHMV. Examined.

I have added to this list one *Euconocephalus* species, two *Pseudorhynchus* species, one *Ruspolia* species and three *Mygalopsis* species, all of which are housed in the Australian National Insect Collection, Canberra. In addition to material from the British Museum (Natural History) (BMNH), Naturhistorisches Museum, Vienna (NHMV), and Museum National d'Histoire Naturelle, Paris (MNHN), I have used material from the following Australian museums and collections: Australian National Insect Collection, Canberra (ANIC); Department of Entomology, University of Queensland (UQ); Queensland State Museum (QM); The Australian Museum, Sydney (AM); Department of Agriculture, Rydalmere, N.S.W. (AS); South Australian Museum, Adelaide (SAM); National Museum of Victoria, Melbourne (NMV); Waite Agricultural Research Institute, Adelaide (WIA); Western Australian Museum, Perth (WAM); University of Western Australia (UWA). I am grateful to the staff of these museums for their cooperation.

Methods

Ragge (1969) demonstrated that the nitrocellulose Pyroxylin, used as a film to form replicas of the stridulatory file on the ventral surface of the left forewing of *Pseudorhynchus*, was both efficient and stable. To this end the left forewing is raised or opened after its alary sclerites have been softened with 10% ammonia solution. Pyroxylin may then be painted on the cubito-anal area of the ventral surface; it dries within minutes. The film is then removed and mounted on a glass slide for subsequent microscopic examination. This technique has been used throughout this revision. Difficulty was experienced with the genus *Mygalopsis* where the pronotum extended over the short forewings. It was found impossible to open the forewings without extensive damage; hence in this genus specimens were completely relaxed in a humidifier and the abdomen was bent ventrally until the wings were partly opened.

*Portugal was under quite severe political unrest at the time of this revision and communication with the curator was at times impossible.

†Dr David Ragge (BMNH) attempted to locate this type material without success. It is reported on his authority after communication with Hamburg as being untraceable.

The Pyroxylin could then be applied under the wing surface. Certain paratype specimens have been left in this unusual position through fear of further damage. The holotypes of new species have not had the tooth number recorded, again through fear of chance damage from this rather stressful procedure. Fourteen file replicas have supplemented material from the type collections in each species. These were taken from J. D. Sandow's collection, which forms part of his thesis material.

The principal veins of the right forewing, which provide some species comparison and diagnosis, are shown in Fig. 35.

Songs of the two species of *Pseudorhynchus* and all four of the *Mygalopsis* species have been recorded. These were obtained in the field by aurally locating the singing male and then recording the song. The distance from microphone to insect was seldom more than 1 m. In all cases the microphone–tape-recorder combination could respond to the carrier frequency of the insect. Temporal analysis of the song was by standard oscillography, and the frequency spectrum was obtained through a Tektronix spectrum analyser.

Measurements are abbreviated as follows: TL, total length; FW, forewing length; PL, prothorax length; PW, prothorax width; FL, fastigium length; HL, hind femur length; T, number of teeth on stridulatory file; SF, file length; OL, ovipositor length.

Tribe **COPIPHORINI** Karny

The Copiphorini are characterized by their elongate, cone-shaped head and fastigium. The fastigium lacks any form of groove and is wider at its base than the base of the first antennal segment, differing in this respect from the Agroeciinae. The fastigium extends beyond the base of the antennae, which are between the eyes and do not have a pronounced margin. The general head shape is not horizontal but rather elongate on an obtuse angle with the thorax. The fore tibiae bearing the tympanal slits are usually not dorsally armed with spines, and the membranes lie within these slits. The hind femora are armed at least on one margin and the hind tibiae have spines on both sides. The forewings are occasionally short and in one genus brachypterous. The male stridulatory organ and the shape of the ventral surface of the fastigium are the most useful characters in the determination of species.

Key to Males and Females of the Known Australian and Papuan Genera of Copiphorini

1. Wings as long as or longer than the abdomen; hind wings well developed and, if short, without a secondary stridulatory organ on the ventral surface of the hind wings; hind femur distinctly saltatorial 2
   Brachypterous, hind wings with secondary stridulatory spines ventrally; hind femur very short, not saltatorial ..... *Mygalopsis* Redtenbacher (p. 1036)
2(1). Fastigium long, with pointed or slightly rounded tip, not blunt .... *Pseudorhynchus* Serville (p. 1018)
   Fastigium short, rounded and blunt-looking 3
3(2). Notch between the fastigium of the vertex and the frons clearly open with a small tubercle at the base of the fastigium ventrally. ..... *Euconocephalus* Karny (p. 1032)
   Notch between the fastigium and the vertex of the frons closed or if open not markedly so, no tubercle at the base of the fastigium. ..... *Ruspolia* Schulthess (p. 1035)

Genus **Pseudorhynchus** Serville

Pseudorhynchus Serville, 1838, p. 509. Type-species: *Pseudorhynchus sicarius* Serville [= *P. lanceolatus* (Fabricius)], by subsequent designation (Kirby, 1906, p. 237).

Diagnosis (Both Sexes)

Fastigium of the vertex pronouncedly elongate usually pointed at the tip, except in some Australian genera where it is slightly rounded, separated from the frons

by a clear notch, bearing a small tubercle ventrally at the base. Pronotum without lateral carinae, often with dorsolateral markings in place of carinae, this margin is seldom acute. The lateral pronotal lobes tend to be more elongate than deep without a strong posterior invagination of the hind margin. Prosternum with 2 well developed spines, fore coxae and hind femora with spines. Ovipositor as long as or slightly longer than the hind femur, straight.

Discussion

The known Australian members of this genus are all clearly separable from the other related genera of this subfamily. The fastigium is not as elongate as that of the African species (Ragge 1969), but substantially different from the other shorter-snouted African Copiphorines, *Lanista* Bolívar and *Plastocorypha* Karsch, in that the base of the fastigium is always broad, filling the available space between the base of the antennae. The shorter snout length of the Australasian species has produced some confusion between this genus and *Euconocephalus*, and in some oriental material it is difficult to distinguish between the long-snouted *Euconocephalus* and the short-snouted *Pseudorhynchus*. In my opinion a critical revision of the oriental Copiphorini may indicate that the species from this region currently placed in *Euconocephalus* and *Pseudorhynchus* would be better regarded as *Ruspolia*, leaving *Pseudorhynchus* as an African genus, characterized by the very long pointed snout.

All species are from the tropical coastal regions of Australia and the Indonesian archipelago. In species where flight is obviously weak, as reflected in the shape of the wings, such as in *P. mimeticus* Redtenbacher and *P. raggei*, sp. nov., the geographical range is restricted. Strong-flying species which are frequently caught in light traps, such as *P. lessonii* Serville and *P. selonis*, sp. nov., are ubiquitous throughout the northern part of Australia and in the Indonesian and Papuan islands as well as the Pacific groups.

The most useful characters for species determination in this genus are the male stridulatory apparatus and the shape of the fastigium. Unlike the African species, the shape of the external male genitalia proved of little value (cf. Ragge 1969), similar in this regard to *Ruspolia*, reinforcing the opinion that the so-called *Pseudorhynchus* of Australasia and the Orient may in fact be more closely allied to *Ruspolia* than to the African genus. The distribution of *Pseudorhynchus* is throughout the Old World tropics including Africa, the Orient, Australia and the Pacific Islands.

Key to the Australian and Papuan species of *Pseudorhynchus* Serville

Males

1. Fastigium with black pigmentation at the tip or on the entire ventral surface 2
   Fastigium without black pigmentation ventrally 4
2(1). Small species, < 55 mm, slender; fastigium long and pointed (Fig. 2); forewings rounded at the tip, slender; stridulatory file short, < 70 teeth (Fig. 21). ..... *P. raggei*, sp. nov. (p. 1020)
   Usually longer than 55 mm, not markedly slender; fastigium as in Figs 3–5; forewings not pronouncedly tapered; stridulatory file with > 65 teeth 3
3(2). Fastigium as in Figs 3 and 4; stridulatory file as in Figs 16 and 23. Species contains 2 size morphs: (1) wings as long as or slightly longer than the abdomen, hind wings obviously short; (2) forewings extending beyond the position of the hind knees. Restricted in range to east coast of Australia. ..... *P. mimeticus* Redtenbacher (p. 1021)

Fastigium as in Fig. 5, stridulatory file as in Figs 15 and 22, does not contain 2 size morphs. From Papua New Guinea, Indonesia and possibly northern Australia. ..... *P. cornutus* Redtenbacher (p. 1024)

4(1). Fastigium distinctly elongate and pointed (Fig. 6); file short and rounded (Fig. 24). (Not known from Australia). ..... *P. inermis* Karny (p. 1025)

Fastigium not distinctly pointed (Figs. 7–10), tends to be flat and broad at the base; file not distinctly short. 5

5(4). Stridulatory file elongate and crescent-shaped, > 2·6 mm, teeth closer together at the median end of file (Fig. 24); cubito-anal margin of left forewing rounded (Fig. 18). ..... *P. selonis*, sp. nov. (p. 1026)

Stridulatory file bulbous, not elongate as viewed from the dorsal aspect (Fig. 17), < 2·5 mm, teeth unevenly spaced along its length (Fig. 25); cubito-anal area of left forewing not distinctly rounded (Fig. 17) ..... *P. lessonii* Serville (p. 1027)

Females

As with many Copiphorine genera the characters most used in species diagnosis are those of the male (e.g. Ragge 1969; Bailey 1975). Many females are indistinguishable on morphological grounds; for this reason emphasis is frequently placed on distribution data, which are often incomplete, and hence in this key some species are grouped.

1. Fastigium with black pigmentation at the tip or on the entire ventral surface. 2

Fastigium without black pigmentation ventrally. 4

2(1). Small species, < 55 mm, slender, fastigium long and pointed (Fig. 2), forewings tapered and rounded at the tips, restricted to the Northern Territory of Australia (based on present data). ..... *P. raggei*, sp. nov. (p. 1020)

Usually longer than 55 mm, not markedly slender, fastigium not as in Fig. 2, forewings not pronouncedly tapered, not restricted to the Northern Territory 3

3(2). Fastigium as in Figs 3 and 4, restricted to east coast of Australia, present in 2 morphs: (1) wings as long as or slightly longer than the abdomen, hind wings obviously short; (2) forewings extending beyond the position of the hind knees. Restricted in range to east coast of Australia. ..... *P. mimeticus* Redtenbacher (p. 1021)

Fastigium as in Fig. 5, does not appear in 2 wing morphs, on present data recorded from the Papuan and Indonesian islands ..... *P. cornutus* Redtenbacher (p. 1024)

4(1). Fastigium distinctly long and pointed (Fig. 6), on present data not recorded from Australia. ..... *P. inermis* Karny (p. 1025)

Fastigium not distinctly pointed, tendency to be flattened at the base (Figs 7–10), females on present data indistinguishable. ..... *P. lessonii* Serville (p. 1027)
P. selonis, sp. nov. (p. 1026)

Description of the Australian Species

Pseudorhynchus raggei,* sp. nov.

(Figs 2, 14, 21, 31, 40, 60)

Types

Australia: Holotype ♂, Northern Territory; Berrimah, 27.iii.1972. Paratypes: B. I. Bolton, 3 ♂, ANIC; 12°52′S., 132°50′E., 15 km E. of Mt Cahill, 8.iii.1973, K. H. L. Key, at light, 1 ♂, ANIC; Darwin, 28.iii.1972, B. C. Abbey, 2 ♂, ANIC; Pine Creek, from Prof. Spencer Coll. July-Aug. 1912, 2 ♂, NMV. New Guinea: Agenehambo, 15 miles E. of Popondetta, Northern District, 800 ft, Tilly lamp, late Oct., A. Chittleborough, 1 ♂, SAM.

*Named for Dr D. R. Ragge.

Species Diagnosis

Head elongate, slender with dorsal marking continuous with the dorsolateral margins of the pronotum. Fastigium of the vertex elongate, pointed, with distinct black pigmentation ventrally at the tip and the ventral tubercle pronounced (Fig. 2). Eyes spherical, mandibles yellow, dorsal aspect of the pronotum convergent towards the head and lateral keels shallow with hind margin invagination (Fig. 40). Fore tibiae with spines, fore knees of femora armed. Forewings rounded at the tips; male stridulatory rib oval (Figs 14, 21), with 48–70 teeth on the file (mean 57; $n = 9$). The mirror area of the right forewing oval, with a well developed cubital 'frame'; Cu_{2a} complete (Fig. 31).

Measurements (9 males)

	TL	FW	PL	PW	FL	HL	T
Holotype	52·0	35·0	8·2	5·4	5·0	21·6	70·0
Mean	49·5	34·0	8·3	5·13	4·7	20·2	57·0
SD	2·3	1·4	0·3	0·2	0·4	0·8	6·6
SE	0·8	0·5	0·1	0·1	0·1	0·3	2·3

Discussion

This species is highly restricted in its range, to the northern part of the Northern Territory (Fig. 60). Keast (1961) in dealing with the speciation of birds in Australia describes the classical refuge areas delineated by either rainfall or high terrain or both. The north-west areas of the Northern Territory are separated from the east of the continent by the dry coastal areas of the Gulf of Carpentaria. The formation of this barrier at the end of the Pleistocene could give some indication of the rate of speciation within this genus.

Such a restricted distribution could obviously be the result of a low level of collection in these parts; however, the occurrence of a highly restricted species sympatric with more widespread and vagile species, in this case *P. lessonii* and *P. selonis*, is reminiscent of the situation in the allied genus *Ruspolia* in East Africa (Bailey 1976). There *R. fuscopunctata*, a species similar in shape and size to *P. raggei*, is often restricted to rather specialized habitats and yet is sympatric with two or more widespread species, *R. differens* and *R. flavovirens*.

The black marking on the ventral surface of the fastigium may often be reduced to a small spot at the tip or in some cases may extend along the entire length of the fastigium. No females are available in the collection, but it is presumed that the characters of the fastigium and overall body shape of the male are repeated in the female, and that these are sufficiently different from similar geographical species for separation to be possible.

Pseudorhynchus mimeticus (Redtenbacher), comb. nov.

(Figs 1, 3, 4, 16, 23, 33, 39, 60)

Conocephalus mimeticus Redtenbacher, 1891, p. 41. Holotype ♂, Australia, Sydney (destroyed). Neotype ♂, Australia, Turramurra, New South Wales, 15.iv.1971, C. N. Smithers, Australian National Insect Collection, Canberra, here designated; examined.

Pseudorhynchus froggatti Kirby, 1906, p. 239. Holotype ♀, Australia, Sydney, Middle Harbour, present location unknown, misidentified by Froggatt (1904, p. 737) as *P. lessonii* Serville.

Diagnosis

Moderately robust species, most specimens dark brown, others dark olive green, fastigium long and pointed with black pigment ventrally (Figs 3, 4), pronotum without marked convergence anteriorly, more or less parallel-sided, small expansion of the dorsolateral margin at the posterior margin, side keels with a pronounced invagination (Fig. 39). Two morphs are present in this species, one with short wings and greatly reduced hind wings which are obviously non-functional for flight. The other morph with longer wings, extending beyond the position of the hind knees, and with the hind wings well developed. Forewings of the short-winged form often pointed. Costal margin of the left forewing tends to be quite long and not markedly rounded (Fig. 16), stridulatory rib as in Fig. 23, 71–89 teeth on the file (mean 76·6). Cu_{2a} parallel to Cu_2 and is complete (Fig. 33). Hind femora with ventral spines; the hind knees armed; ovipositor straight without expansion along its length.

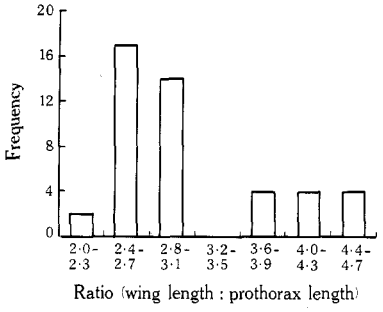


Fig. 1. Frequency distribution of the ratio of forewing length to prothorax length in *P. mimeticus*, demonstrating the two morphs.

Measurements

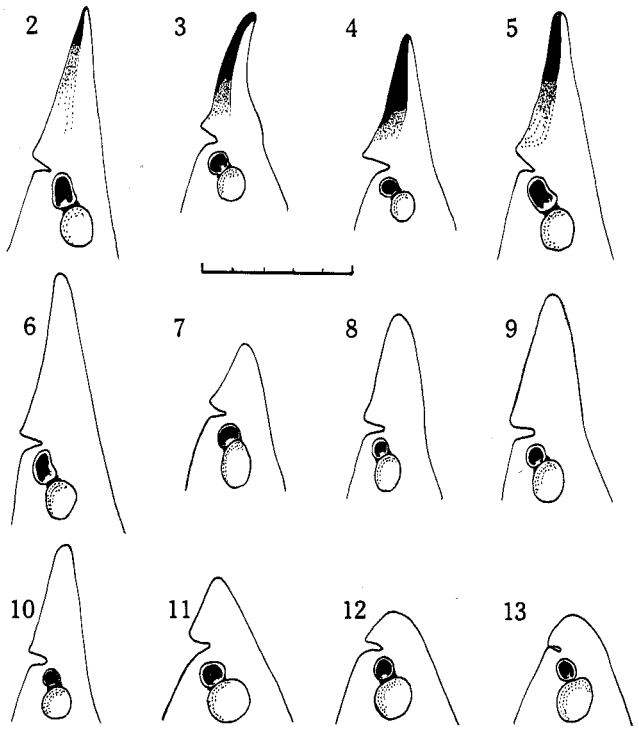
	TL	FW	PL	PW	FL	HL	N	OL
				Neotype				
	37·8	25·6	8·4	5·9	4·1	16·5	74	–
				14 males				
Mean	37·02	24·8	8·5	5·7	3·4	16·4	76·6	–
SD	4·83	3·1	0·5	0·4	0·3	0·9	5·9	–
SE	1·29	0·9	0·1	0·1	0·1	0·2	1·9	–
				26 females				
Mean	57·4	28·6	7·9	6·4	3·7	19·8	–	26·5
SD	5·4	6·1	2·3	0·4	0·5	2·4	–	2·9
SE	1·1	1·2	0·4	0·1	0·1	0·5	–	0·6

Material Examined

Queensland: Brisbane, 9.iii.1963, R. J. Elder, 1 ♀, UQ; 4.iv.1965, C. R. Hembrow, 1 ♀, BMNH; 1.iii.1959, K. Korbet, 1 ♀, UQ; 2.iv.1950, S. Barker, 1 ♀, UQ; 9.ii.1935, no collector, 1 ♀, UQ; 15.iv.1971, no collector, 1 ♀, UQ; 5.iv.1925, H. Hacker, 1 ♀, QM; 25.iii.1967, J. Monty, 1 ♀, UQ; 18.iii.1954, P. Lee, 1 ♂, ANIC; Feb. 1964, J. I. Calder, 1 ♀, UQ; 29.ii.1957, no collector, 1 ♀, UQ; Beerwah, 8.xi.1962, 1 ♀, UQ; Brookfield, 2.iv.1960, L. E. Williams, 1 ♀, UQ; Lake Clarendon, via Gatton, 17.iv.1971, B. K. Cantwell, 1 ♀, UQ; Dayboro, 27.i.1928, H. Hacker, 2 ♀, QM; Gailes, 11.ii.1963, A. Bartholomai, 1 ♂, QM; Nambour, 26.v.1951, 1 ♀, UQ; Mt Nebo, 23.iv.1954, T. Lawton, 1 ♀, ANIC; Mt Tamborine (loc. ?), 8.v.1943, N. B. Tindale, 1 ♂, SAM.

New South Wales: Cabramatta, 21.ii.1962, 1 ♀; 10.iii.1962, M. Nikitin, 1 ♀, BMNH; Clarence River, no data, BM 1902-144, W. W. Froggatt, 1 ♀, BMNH; Coffs Harbour, 5.ii.1968, B. C. Peters coll. 1 ♂, WIA; Gosford, 17.ii.1966, P. C. Hely, 1 ♀, AS; Huonbrook, near Mullumbimby, 27.ii.1965,

D. K. McAlpine, 1 ♀, AM; Gympie, 6.iii.1970, E. Dahms, 1 ♀, BMNH; NE of Kempsey, near Southwest rocks, Trial Bay Gaol, 30°53′S., 153°04′E., 3.i.1970, K. H. L. Key (Key's field notes trip 165, stop 17225·5), 1 ♂, BMNH; Heathcote, Mar. 1962, R. Richard, 1 ♀, AM; Port Hacking, Mar. 1927, N. B. Tindale, 2 ♂, SAM, BMNH; Richmond River, no data, BM 1902-144, W. W. Froggatt, 1 ♀, BMNH; Roseville, 30.iv.1966, C. E. Chadwick, 1 ♀, AS; Royal National Park, 5.iv.1969, C. E. Chadwick, (Hacking River 2-3 miles S of waterfall) 1 ♂, AS; Sydney, Turramurra, Feb. 1971, D. Clyne, 1 ♂, 1 ♀, ANIC; Sydney, Turramurra, 25.iv.1971, C. N. Smithers, 2 ♂, BMNH; Turramurra, 13.ii.1971, C. N. Smithers, 1 ♂, 3 ♀, AM; Tooloom scrub, via Urbenville, 25.ii.1973, G. B. Monteith, 1 ♂, UQ; no data, BM 1858, E. Damel, 1 ♂, BMNH.



Figs 2-13. Lateral profile of the fastigium of the vertex: *2, Pseudorhynchus raggei*; *3, P. mimeticus*, Turramurra, N.S.W.; *4, P. mimeticus*, Brisbane; *5, P. cornutus*; *6, P. inermis*; *7, P. lessonii*, Christmas I.; *8, P. lessonii*, Brisbane; *9, P. lessonii*, Stuarts Point, N.S.W.; *10, P. selonis*; *11, Euconocephalus broughtoni*; *12, E. indicus*; *13, Ruspolia marshallae*. Scale line, 5 mm.

Discussion

The range of this species appears to be restricted to the east coast of Australia, and as such it could be considered an isolated species related to the more tropical *P. cornutus* Redtenbacher. The two morphs overlap in their range, and measurements of forewing length show bimodality (Fig. 1). Until more detailed studies of this species are carried out with additional biological data, the morphs cannot be separated as species. The slightly longer file length in the long-winged form is probably a direct consequence of this difference in size.

The neotype is designated on the basis of the clear description and measurements given by Redtenbacher. This Redtenbacher type-specimen was housed in the Hamburg Museum during the war, and according to Dr D. Ragge it was destroyed as a result of Allied bombing. There are two Froggatt specimens in the British

Museum (Natural History); one male from Clarence River, N.S.W., and one female from Richmond River, N.S.W.; this with his very clear colour drawing of his misnamed *P. lessonii* (Froggatt 1904, p. 737) would clarify the synonymy of the Kirby name *froggatti*.

Pseudorhynchus cornutus (Redtenbacher)
(Figs 5, 15, 22, 32, 38, 60)

Conocephalus cornutus Redtenbacher, 1891, p. 411. Lectotype, ♂, Aru Island (= Kepulauan Aru), NHMV, here designated; examined.

Euconocephalus sulcatus Karny, 1907, p. 40. Holotype ♀, Papua New Guinea, NHMV; examined. Syn. nov.

Diagnosis

Head elongate, fastigium long, pointed and with black pigmentation on the ventral surface (Fig. 5). Eyes spherical and mandibles orange. The dorsal aspect of the pronotum converges anteriorwards; side keels with a marked posterior invagination (Fig. 38); forewings rounded at the tips. Male stridulatory rib as in Fig. 22, with 70–90 teeth (mean 84; $n = 13$). Cu_{2a} vein of right forewing complete, diagonal across the mirror (Fig. 32). Female ovipositor straight and broadening along its length.

Measurements

	TL	FW	PL	PW	FL	HL	T	OL
				Lectotype				
	51·5	35·1	8·4	5·7	4·5	20·0	81	–
				17 males				
Mean	53·2	37·6	8·6	5·1	4·0	20·1	84	–
SD	3·4	3·0	0·3	0·3	0·6	1·0	5·1	–
SE	0·8	0·7	0·1	0·1	0·1	0·2	1·5	–
				21 females				
Mean	61·7	43·6	8·8	6·9	4·2	23·6	–	24·7
SD	4·6	3·7	0·4	0·4	0·7	1·6	–	1·5
SE	1·0	0·8	0·1	0·1	0·1	0·3	–	0·3

Material Examined

New Guinea: Aitape, Oct.–Nov. 1936, L. E. Cheesman, 1 ♂; Kokoda, 1200 ft, May 1933, L. E. Cheesman, 2 ♂; Kokoda, 1200 ft, Oct. 1933, L. E. Cheesman, 1 ♂, 1 ♀; Kokoda, 1200 ft, Aug. 1933, L. E. Cheesman, 1 ♀; Madang District, Finistere Mts, Budemu, 4000 ft, 15–24.x.1964, M. E. Bacchus, 1 ♀; Madang District, Finistere Mts, Damanti, 3550 ft, 2–11.x.1964, M. E. Bacchus, 1 ♀; Toricelli Mts, 12 miles E. of Afua, 50–100 ft, 2.iv.1939, 1 ♀; 3–8.iv.1936, 1 ♂, 1 ♀, G. P. Moore; 15 miles, S. of Paup, Toricelli Mts, 1700 ft, 4–11.iii.1939, G. P. Moore, 1 ♂, 1 ♀.

Irian Jaya [Dutch New Guinea]: Cyclops Mts, Sabron, Camp 2, 2000 ft, July 1936, L. E. Cheesman, 1 ♂; Hollandia, 140°E., 3°10′S., 300–600m, Jan. 1937–8, W. Stuber, 2 ♀; Humboldt Bay District, 1937, W. Stuber, 1 ♀; Humboldt Bay District, Bewaru Mts, *c.* 400 m, Apr.–Aug. 1931, W. Stuber, 1 ♀.

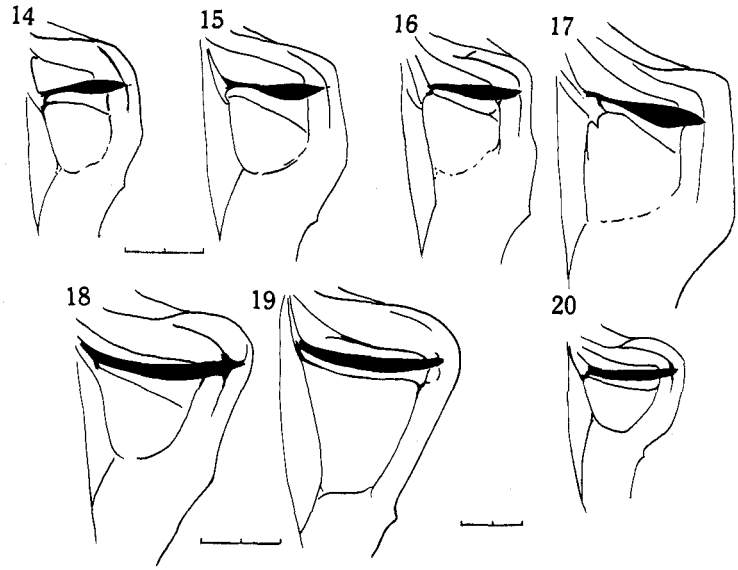
Solomon Islands. Guadacanal: night, jungle, 1000 ft, 5.iii.1934, W. G. P. Tatle, 1 ♀; Tanaru, 4.ix.1954, E. S. Brown, 1 ♀; Bonu, 1200 ft, 13.xii.1934, R. A. Lever, 1 ♂; Kakum, 19.v.1955, E. S. Brown, 1 ♀; Kakum, 12.iv.1956, E. S. Brown, 1 ♀; Honiara, Mt Austen, 10.ii.1962, P. J. M. Greenslade, 1 ♀. **Malaita:** Fulisago-Maelegwasu, 26.v.1955, E. S. Brown, 1 ♂; Baunani, 31.v.1955, E. S. Brown, 1 ♀. **Santa Isabel:** 2 miles E. of Raja, 3.x.1965, low vegetation, village garden, Royal Society Expedition, 1 ♀; Tatamba, 30.xi.1965, Royal Society Expedition, 1 ♂; Gatere, 20.ii.1956, E. S. Brown, 1 ♀. No data, BM 1907-247, Webster, 1 ♀.

Maluku Islands. Aru I.: Wokan, Dobbe, Sept. 1874, Challenger Expedition, 1 ♀.

Papua New Guinea. New Britain: 1930, collector unknown, 1 ♀. All in BMNH.

Discussion

P. cornutus is similar in many respects to *P. mimeticus*; however, close examination of specimens from Papua New Guinea, Indonesia and the Pacific group establishes the constancy of the diagnostic characters used for the Australian material. The principal features separating the two species, apart from their distribution, are the shape of the pronotal side keels (Fig. 38), the coloration of the fastigium, and, in the males, the slightly lower number of teeth on the file, which is characteristically oval in shape (Fig. 22). The dorsal aspect of the stridulatory rib and the cubito-anal area of the right forewing enhance this separation (Fig. 32). There seems little reason to suspect that the southward distribution of this species should be restricted to Papua New Guinea, indeed further collecting along the northern coast of Queensland might reveal an overlap of the distribution of *P. mimeticus* with *P. cornutus*.



Figs 14-20. Dorsal aspect of the cubito-anal region of the left forewing, emphasizing the shape of the raised stridulatory file: *14, P. raggei*; *15, P. cornutus*; *16, P. mimeticus*; *17, P. lessonii*; *18, P. selonis*; *19, Euconocephalus broughtoni*; *20, Ruspolia marshallae*. Figs 14–18 to same scale; Figs 19 and 20 to same scale; scale lines, 2 mm.

Pseudorhynchus inermis (Karny), comb. nov.

(Figs 6, 24)

Euconocephalus inermis Karny, 1907, p. 41. Lecotype, ♀, Papua New Guinea, Coll. Br.v.W. NHMV, here designated; examined.

Diagnosis

Long fastigium, pointed and without ventral black pigmentation (Fig. 6); a slight broadening at the base between the eyes, ventral tubercle well developed, eyes oval. The pronotum tends to converge towards the posterior margin as seen from the dorsal surface; side keels shallow without a pronounced angle at the dorsolateral margin. Wings well developed, stridulatory rib in male short (Fig. 24) with

evenly spaced teeth. Hind femora with well developed spines; hind knees armed; ovipositor straight without widening along its length.

Measurements

TL	FW	PL	FL	HL	SF	T	OL
			Lectotype female				
69·7	50·1	8·8	5·5	6·0	23·0	–	25·7
			Paralectotype male				
58·9	41·7	9·2	4·4	5·6	22·7	1·3	–

Material Examined

Lectotype; 1 ♂ paralectotype, New Guinea (?).

Discussion

This species is included in this review on the basis of two specimens from the Brunner von Wattenwyl collection. A more detailed examination of material from Papua New Guinea and Indonesia might lead to its being synonymized with *P. lessonii*, although on the evidence from the single male it would appear that the present separation is valid. The lack of fastigial pigmentation and the male file characters are sufficient to warrant this species being separate from the Papuan *P. cornutus*.

Pseudorhynchus selonis*, sp. nov.

(Figs 10, 18, 26, 58, 61)

Type

Holotype ♂, Northern Territory, 12°46′S., 132°39′E., 12 km NNW. of Mt Cahill, 20.v.1973, collector K. H. L. Key *et al.*, Key's field trip notes 183, stop 16904·8 (= trip 178 stop 57448·1), ANIC, Canberra.

Diagnosis

Fastigium of the vertex well developed but not markedly pointed, tending to be flat and broad at the base between the eyes, the ventral tubercle well developed, no ventral dark pigmentation (Fig. 10). Eyes oval, the pronotum convergent anteriorwards and not pronouncedly flared at the posterior dorsal margin, the side keels shallow and elongate rather than deep. Forewings long and slender, tending to be pointed at the tips. The male stridulatory rib characteristically crescentric with parallel sides to the file (Figs 18, 26). Cubito-anal area of left forewing rounded and broad (Fig. 18). Hind femora armed with spine ventrally. Song of male rather soft and fluted, with each tooth impact discrete, not resonant (Fig. 58).

Measurements (23 males)

	TL	FW	PL	PW	FL	HL	SF	T
Holotype	59·5	45·5	9·0	5·7	3·1	23·7	3·5	80
Mean	58·6	43·8	8·6	5·2	3·2	22·0	3·27	78·2[A]
SD	3·7	2·9	0·6	0·4	0·3	1·8	0·3	5·3
SE	0·8	0·6	0·1	0·1	0·1	0·4	0·1	1·4

[A]Mean of 16 males.

*The name *selonis* is merely an anagram of *lessoni*, an obviously related species.

Material Examined

Western Australia: Kimberley, Beverley Spring Station, 11–30.viii.1974, W. J. Bailey and K. T. Richards, 2 ♂, WJB sound recording collection, UWA; Kimberley, Kununurra, May 1975, from a culture in Perth, W. J. Bailey, 2 ♂, UWA; Kununurra, 21–22.viii.1975, sorghum, W. J. Bailey, 3 ♂, WJB sound recording collection, UWA; Kununurra, 9.xii.1974, W. J. Bailey, 3 ♂, WJB sound recording collection, UWA. **Northern Territory:** 12°25′S., 132°58′E., 1 km N. of Cahills Crossing, E. Alligator River, 29.v.1973, K. H. L. Key *et al.*, 4 ♂, ANIC; 12°48′S., 132°42′E., Nourlangie Creek, 8 km N. of Mt Cahill, 21.v.1973, K. H. L. Key *et al.*, 3 ♂, ANIC; Darwin, 29.iii.1972, J. C. Wombey, 1 ♂, ANIC. **Queensland:** Caboolture, 8.iii.1963, collector unknown, 1 ♂, UQ; Prince of Wales I., Torres Strait, 29.v.1969, A. Neboiss, 1 ♂, NMV; 2 miles ENE. of Rollingstone, 26.iv.1969, I. F. B. Common and M. S. Upton, 1 ♂, ANIC; Stewart River, Jan–Feb. 1927, Hale and Tindale, 2 ♂, SAM.

New Guinea: Maprik, 19.x.1957, 3 ♂; 17.x.1957, 1 ♂; 28.x.1957, 1 ♂, J. Smart, BMNH.

Christmas I.: Ross Hill, 12.ix.1908, Dr C. W. Andrews, 2 ♂, 1 ♀, BMNH; Flyingfish Cave, Aug. 1908, Dr C.W. Andrews, 2 ♂, BMNH; no data, 1906–66 same as for 1908 specimens, Dr C. W. Andrews, 2 ♂, BMNH.

Java: No data, BM 1860–15, collector unknown, presented East India Co., 1 ♂, BMNH.

Discussion

This species appears to be sympatric with *P. lessonii* throughout its range (Fig. 14), including the Christmas Is, where the series containing the neotype of *P. lessonii* was collected. I have made extensive collections in the Kimberley District of Western Australia (Bailey and Richards 1975) where both species were noted to be sympatric both in general distribution and in the plant communities from which they were collected. The situation resembles that of other Copiphorini, in particular certain species of the genus *Ruspolia* Schulthess (Bailey 1976) and *Mygalopsis* (pp. 1036–44). In East Africa the ubiquitous *R. flavovirens* Karny is often sympatric with *R. fuscopunctata* (Karny), and like *P. selonis* the latter has the same distinguishing character in that the file is broad and its teeth are evenly spaced, also the song has the same fluted character with discrete tooth impacts. Both species of *Pseudorhynchus* may occur within metres of each other, again parallelling the case in *Ruspolia*. Size can be affected by diet and food availability. Specimens from maturing flowering sorghum fields were substantially larger than those reared under laboratory conditions on grass. Similar size diversity is found in swarming and non-swarming specimens of *R. differens* (Serville). All insects I collected were from moderately hygrophylic habitats, or at least areas subject to seasonal flooding by the monsoon rains.

Pseudorhynchus lessonii Serville

(Figs 7–9, 17, 25, 34, 58, 61)

Pseudorhynchus lessonii Serville, 1838, p. 511. Types, Java, lost. Neotype ♂, Christmas Island, Coll. D. C. A. Gibson-Hill, No. 48, BMNH, here designated; examined.

Conocephalus roberti le Guillou, 1841, p. 294. Type-material, Hamoa, Hapai, lost, syn. nov. (based on synonymy previously established by Kirby (1907, p. 250) between *C. roberti* and *C. insularis* Walker).

Conocephalus insularis Walker, 1869, p. 325. Lectotype ♂, Hawaii, types series Navigator and Sandwich Islands, BMNH, here designated; examined.

Conocephalus extensor Walker, 1869, p. 329. Holotype ♀, locality unknown, BMNH; London, examined. Syn. nov.

Conocephalus australis Bolívar, 1884, p. 90. Type(s) not examined, synonymy by Karny (1912, p. 35), but on the basis of a Redtenbacher figure (1891) this looks closer to *Euconocephalus*.*

*9 ♂, 20 ♀, Solomon Is; 2 ♀, 2 ♂, New Hebrides; 6 ♀, Fiji; 4 ♂, 1 ♀, Tahiti; 10 ♂, 2 ♀, Society Is; 1 ♂, Marquesas Is; 2 ♂, 4 ♀, Samoa; 1 ♀, Tonga.

Conocephalus longiceps Redtenbacher, 1891, p. 412. Holotype ♂, New Caledonia, NHMV, examined. Syn. nov.

Diagnosis

Fastigium of the vertex well developed but not markedly pointed, flattened at the base between the eyes, ventral notch wide, without black pigmentation on ventral surface (Figs 7–9). Eyes tend to be more oval than round; pronotum convergent posteriorad as viewed from the dorsal aspect; in addition there are often striped markings in place of lateral carinae which are not markedly flared posteriorly, side keels shallow. Fore tibiae armed with spines ventrally, hind femora also armed. Forewings seldom pointed, in some forms the forewings flattened at the tip but this is not considered to be diagnostic of a second subspecies or race, as both wing forms are present in the same series. Male stridulatory rib oval or bulbous as seen from the dorsal aspect, costal margin tends to be straight (Fig. 17). Mean number of teeth on file 59·6 (SD 5·2), teeth unevenly spaced along the length of the file, being closer together at the median end (Fig. 25). Cubito-anal area of the right forewing with a well developed *Cu* vein forming the mirror-frame, Cu_{2a} close and parallel to Cu_2 (Fig. 24). Ovipositor long and straight, not expanded along the length.

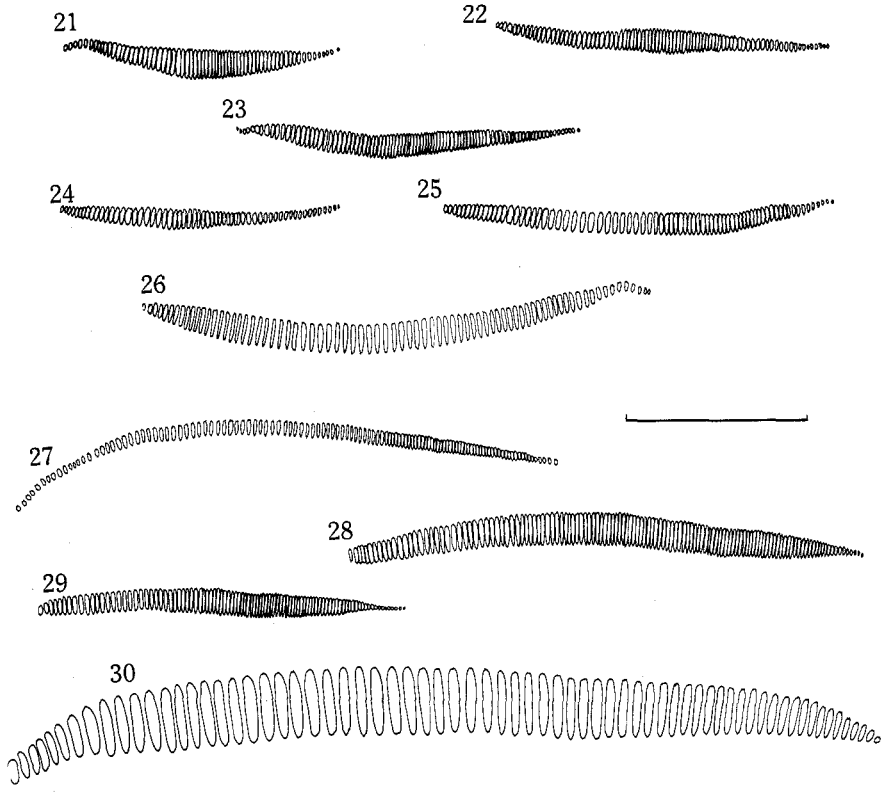
Measurements

	TL	FW	PL	PW	FL	HL	SF	T	OL
				Neotype					
	58·1	44·2	9·3	6·0	2·2	23·6	1·85	75	–
				57 males					
Mean	57·1	41·4	9·3	5·7	3·1	21·9	1·8	59·6	–
SD	3·6	3·5	0·9	0·4	0·5	1·7	0·2	5·2	–
SE	0·6	0·8	0·2	0·1	0·1	0·4	0·02	0·9	–
				20 females					
Mean	63·3	48·2	9·0	6·0	3·6	23·9	–	–	24·0
SD	5·7	1·0	0·2	0·1	0·1	0·7	–	–	2·6
SE	1·3	1·0	0·2	0·1	0·1	0·7	–	–	0·6

Material Examined

Australia. Western Australia: Beverley Spring, E. Kimberley, 11–30.viii.1974, W. J. Bailey and K. T. Richards, 14 ♂, 1 ♀, UWA; Kununurra, Kimberley, 21–22.viii.1975, W. J. Bailey, sorghum, 18 ♂, 1 ♀, WJB sound recording collection, UWA; Kununurra, Kimberley, 12.xii.1974, W. J. Bailey 5 ♂, WJB sound recording collection UWA; Prince Regent Reserve, 15°07′S., 125°33′E., in grass 16–21.viii.1974, 4 ♂, W. J. Bailey and K. T. Richards, UWA. **Northern Territory:** 12°25′S., 132°57′E., 1 km N. of Cahills Crossing, E. Alligator River, 29.v.1973, K. H. L. Key *et al.*, 4 ♂, 1 ♀, 8.iv.1973, M. S. Upton and J. E. Feehan, 1 ♀, ANIC; Nourlangie Creek, 8 miles N. Mt Cahill, 21.v.1973. K. H. L. Key *et al.*, trip 183, 1 ♂, ANIC; 12°17′S., 133°20′E., Cooper Creek, 11 km SW. of Nimbuwah Rock, 3.vi.1973, M. S. Upton and J. E. Feehan, 1 ♂, ANIC; Dair River Mission, 23.i.1974, J. Hutchinson, 1 ♀, ANIC; Darwin, 17.vii.1971, J. C. Le Souëf, 1 ♀, NMV; Darwin, 1.v.1972, B. C. Abbey, 7 ♀, ANIC; 15°05′S., 133°07′E., Elsey Creek, 19 km SSE. of Mataranka, 14.v.1973, M. S. Upton *et al.*, 1 ♂, ANIC; Groote Eylandt, no date, BM cat. 1925–380, G. H. Wilkins, 1 ♂, BMNH; 12°17′S., 133°13′E., 18 km NE. of Oenpelli, 1.vi.1973, 1 ♂, ANIC; ? U.A.R., 2.x.1961, C. S. Li, 1 ♂, ANIC. **Queensland:** Barron Falls near Kuranda, 12.xii.1955, 1 ♀, ANIC; Brisbane, Auchenflower, 21.iv.1971, J. Balderson, 1 ♀, ANIC; Brisbane, 26.xi.1960, B. Watkins, 1 ♀, UQ; Brisbane, 25.xi.1961, K. J. Coughan, 1 ♀, UQ; Brisbane, 20.iii.1971, 1 ♂, UQ; Brisbane, 21.iii.1970, B. Binnie, 1 ♀, UQ; Brisbane, 4.iv.1970, S. V. Tillack, 1 ♀, UQ; Brisbane, 15.iv.1978, Yule, 1 ♂, UQ; Acacia Ridge, Brisbane, 6.xi.1911, H. Hacker, 2 ♀, 2 ♂, QM; Brisbane,

4.xii.1907, Hamlyn-Harris, 1 ♀, QM; Brisbane, Hotel Regatta, 5.iv.1966, J. A. Grant, 1 ♂, BMNH; Bundaberg, 12–20.iv.1971, H. Frauca, 18 ♀, 8 ♂, ANIC; Watalgan Range, Bundaberg, 12–13.vi.1971, H. Frauca, 3 ♂, 1 ♀, ANIC; Broken River, Eungella Range, 9.vi.1971, E. C. Dahms, 1 ♂, QM; Cairns district, A. M. Lea, 1 ♂, SAM; Cairns, 9.xi.1969, A. Walford-Huggins, 1 ♀, BMNH; Cairns, Billingworth Coll. 1 ♂, 1 ♀, QM; Pine Creek near Cairns, 19.i.1962, E. B. Britton, 1 ♀, BMNH; Bribie I., 18–26.xii.1972, K. J. Kohout, 1 ♂, ANIC; Cardstone, 7.i.1962, Carne and Britton, 1 ♀, ANIC; 2 miles N. of Cooroy, 21.xii.1955, 1 ♀, ANIC; Clump Point, 6.iii.1964, I. F. B. Common and M. S. Upton, 1 ♂, ANIC; Cooktown, July 1970, J. C. Le Souëf, 1 ♂, NMV; Camp mile, Cooloola, 3–13.iii.1970,



Figs 21–30. Stridulatory file: *21, Pseudorhynchus raggei*; *22, P. cornutus*; *23, P. mimeticus*; *24, P. inermis*; *25, P. lessonii*; *26, P. selonis*; *27, Mygalopsis marki*; *28, Ruspolia marshallae*; *29, Euconocephalus indicus*; *30, E. broughtoni*. Scale line, 1 mm.

E. C. Dahms, 1 ♂, QM; 2 miles N. of Cunningham's Pass, Clayton's Creek, 31.iii.1966, J. A. Grant, 1 ♂, BMNH; Darnley I., Torres Straits, Aug. 1924, 1 ♂, SAM; Flying Fish Point, Innisfail, 23.iv.1958, T. G. Campbell, 1 ♀, ANIC; NW. Islet, Capricorn Group, Dec. 1925, A. Musgrave, 1 ♀, AM; Mt Molloy, 9.v.1974, H. H. Halfpopper, 1 ♂, ANIC; Paluma, 16.i.1970, Britton and Misko, 2 ♂, ANIC; Mt Coot-tha, 3.iii.1962, W. W. Strong, 1 ♂, UQ; Samford, 8.ix.1966, 1 ♂, UQ; Samford, 1.ix.1972, B. Persson, 1 ♀, ANIC; Stewart River, Jan–Feb. 1927, Hale and Tindale, 1 ♂, SAM; Meludam, 20.vi.1964, Ivy Su, on soybean, 1 ♀, BMNH; Dunk I., R. Macindae, 1 ♂, SAM; 10 miles NNW. of Proserpine, 28.ii.1962, Chinnick and Corby, 1 ♀, ANIC. **Australian Capital Territory:** Canberra, 17.viii.1961, R. Russel, 1 ♂, ANIC. **New South Wales:** Ashfield, 20.i.1964, D. A. Doolan, 1 ♂, 1 ♀, AS; Broadwater, July 1926, D. S. North, 1 ♂, AS; Cabramatta, 17.iii.1958, 1 ♀; 27.ii.1958, 1 ♀; 19.ix.1958, 1 ♀; 27.xi.1958, 1 ♀; 16.iii.1959, 1 ♂; 30.iii.1959, 1 ♂; 5.iv.1959, 1 ♂; 15.iv.1959, 1 ♀; 20.iv.1959, 1 ♂; 25.x.1959, 1 ♂; 7.iii.1960, 1 ♂ 1 ♀; 30.iii.1960, 1 ♂; 15.iv.1960, 1 ♂; 5–30.i.1963, 1 ♀; 14.viii.1963, 1 ♀; 17.iii.1964, 1 ♂; 25.xi.1965, 1 ♂, M Nikitin, BMNH; Casula, 20.ix.1957, 1 ♂; 10.ix.1961, 1 ♂, M Nikitin, BMNH; Dorrigo, 1700 ft, 11.xi.1961, I. F. B. Common and M. S. Upton, 1 ♀, ANIC; Epping, June 1923, H. McDonald, 2 ♂, 1 ♀, AM; Kempsey, 12–13.v.1956, R. Witchard,

4 ♀, AM; Lord Howe I., 6.iii.1961, T. H. Campbell, 1 ♀, ANIC; Lord Howe I., War Memorial, Sept. 1966, G. C. Webb, 2 ♂, ANIC; Merrylands, 25.ii.1971, A. Healy, 5 ♂, AM; Lake Paramatta, 27.ix.1975, M. L. Nikitin, 1 ♂, AS; Stuarts Point, 11.xi.1974, M. Casimir, 1 ♀, AS; Sydney, Jan. 1939, K. H. L. Key, 1 ♂, ANIC; Dee Why, Sydney, Dec. 1927, N. Fuller, 1 ♂, ANIC; Bronte, Sydney, 20.iii.1964, D. K. McAlpine, 1 ♀, AM; Turramurra, 19.iii.1971, H. G. Smithers, 1 ♂, AM.

Non-Australian material. Tonga: Tongatabu, July 1874, Challenger Coll., 1 ♀, BMNH; Tongatabu, no date, BM cat. 1882-60, Rev. Wyatt Gill, 1 ♀, BMNH; Raratonga, no date, BM cat. 1882-71 Rev. Wyatt Gill, 1 ♀, BMNH.

New Hebrides: Tanna, Port Resolution, Apr. 1875, W. W. Perry, 1 ♀, BMNH; Aneityum, Red Crest, 3 miles NE. of Anelgauhaut, 120 ft, June 1955, L. E. Cheesman, 1 ♀, 1 ♂, BMNH; Aneityum, Anelgauhaut Coast, Jan., July 1955, L. E. Cheesman, 1 ♀, BMNH.

Cocos Keeling I. June 1905, F. Wood-Jones, 1 ♀, BMNH.

Fiji. Lomaloma, 15.7.21 (NB this appears to be the collector's catalogue number; it is not the date), 27.vii.1927, Silvester Evans, 4 ♀, BMNH; Fiji, 25.viii.1915, R. Veitch, 1 ♀, BMNH; Kandara, Aug. 1874, Challenger Coll. 1 ♀, BMNH; Suva, no date, BM cat. 1924-160, presented by Telegraph Construction and Maintenance, 1 ♀, BMNH; Nadon, 25.viii.1915, R. Veitch, 1 ♀, BMNH; Kadni, 25.viii.1915, R. Veitch, 1 ♀, BMNH.

Sumatra. No date, B.M. 1879-55, Carl Bock, 1 ♀, BMNH; Fort de Kock, 920 km, 1924, 1 ♀; 1925, 1 ♂; 1 nymph, E. Jacobson, BMNH.

Samoa: Upolu, Malololelei, 25.iv.1924, Buxton and Hopkins, nymph, BMNH; Upolu, Apia, 10.iv.1924, Buxton and Hopkins, 4 ♀, BMNH; Tutuila, Pago Pago, Feb. 1924, J. Steffany, 1 ♂, BMNH; Aleipatu, Upolu, 4.v.1924, Buxton and Hopkins, 1 ♂, BMNH.

Papua New Guinea: Kokoda, 1200 ft, Aug. 1933, L. E. Cheesman, 1 ♀, BMNH.

Marquesas Is: Atuona, Hivaoa, 9.iii.1929, Mumford and Adamson, 1 ♀, BMNH; Nakuahiva, no data, BM. 1925-573, L. E. Cheesman, 1 ♂, BMNH; Bora Bora, 13.vi.1925, 1 ♂; 16.vi.1925, 5 ♂, 2 ♀; 15.vi.1925, 1 ♂; 6.vi.1925, 1 ♀, Miss Cheesman, BMNH; Raiatea, May 1925, Miss Cheesman, 1 ♀.

Tahiti: Valley Station Amalie, 1500 ft, 17.iv.1925, Miss Cheesman, 1 ♂, 1 ♀ BMNH; Patutna, 5.viii.1925, Miss Cheesman, 1 ♂; near Papeete, Mar.-Apr. 1925, Miss Cheesman, 1 ♂, BMNH; Lake Vaihina, 1500 ft, 19.vii.1925, Miss Cheesman, 1 ♂, BMNH.

Solomon Is. Guadalcanal: Tenaru, 20.i.1955, E. S. Brown, 1 ♀, BMNH; Berande, 26.viii.1934, H. T. Pagden, 1 ♀, BMNH; at light, Nov. 1932, R. A. Lever, 1 ♂, BMNH; Honiara District, 12.vii.1950, 1 ♀; 7.viii.1954, 1 ♀; 15.vii.1954, 1 ♀, BMNH; Kukum, 24.ix.1963, 1 ♂, E. S. Brown; 25.iii.1962, 1 ♂; 24.vi.1962, 1 ♂; 19.i.1963, 2 ♂; 18.ii.1963, 2 ♀; 24.iii.1963, 1 ♂; 27.iv.1963, 1 ♂, P. Greenslade, BMNH; 23.xii.1962, 1 ♀; 23.iii.1963, 1 ♂, M McQuillan, BMNH; Tenaru, 2.ii.1963, M. McQuillan, 1 ♂, BMNH; Highway 50, Themeda, 21.i.1963, M. McQuillan, 1 ♀, BMNH; Tsuaru, 5.viii.1954, E. S. Brown, 1 ♀, BMNH; Ilu, 1.ii.1963, M. McQuillan, 1 ♀, BMNH; Lunga, 20.viii.1954, E. S. Brown, 1 ♀, BMNH. **Bellona:** Henungdio, 30.x.1963, M. McQuillan, 1 ♂, BMNH. **Rua Vatu**, 22.vi.1954, E. S. Brown, 1 ♀, BMNH. **New Georgia:** no date, BM 1894-181, collector unknown, 1 ♀, BMNH; Gizo, 21.viii.1963, M. McQuillan, 1 ♀, BMNH.

Christmas I.: BM 1939-40, Dr C. A. Gibson-Hill, 4 ♂, 2 ♀, BMNH.

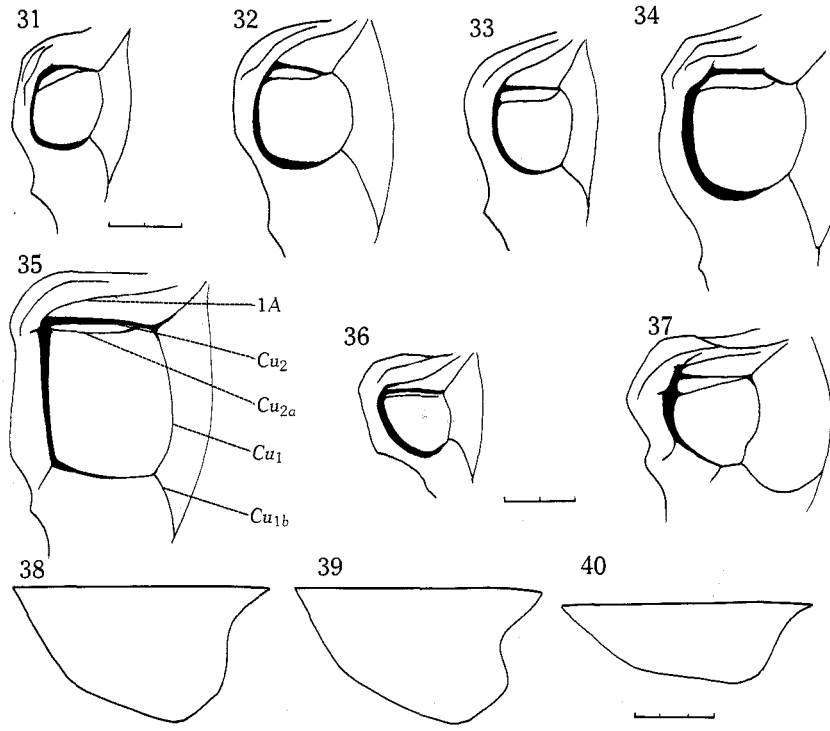
Malaya: Penang no date, BM 1896-126, collector unknown, 1 ♂, BMNH.

Named material of synonyms of *P. lessonii* in BMNH: no data, 1 ♀, *Conocephalus extensor* Walker, holotype; Java, 1 nymph, *C. alienus* Walker, holotype; Philippines, 1 ♂, *C. turpis* Walker, lectotype; no data, 1 ♀, *C. turpis* Walker, paralectotype; Sandwich Is, no data, Beechey, 1 ♂, *C. insularis* Walker, lectotype; no data, Beechey, 5 ♂, 3 ♀, *C. insularis*, paralectotypes; Navigator I., collector unknown, presented by Duke of Northumberland, 1 ♂, *C. insularis*, paralectotype.

Discussion

The neotype designated in this review is based on a series from Christmas I., collected by D. C. A. Gibson-Hill. There was no equivalent long series from Java, the locality of the Serville types, and it was considered that Christmas I. is sufficiently near to Java. Furthermore the neotype approximated the measurements given by Serville for the type-specimens he described (Serville designated both sexes).

P. lessonii is sympatric over most of its range with *P. selonis* (Fig. 61). The females of both species are inseparable on morphometric data and for this reason all females falling within the description of either *P. lessonii* or *P. selonis* have been ascribed to the former species. It is evident from habitat data that *P. lessonii* has a wider distribution than *P. selonis*; this was evident in the rather restricted collection I was able to make in the north Kimberleys. There *P. selonis* always occurred with *P. lessonii*, but *P. lessonii* frequently occurred without the sympatric species.



Figs 31–37. Ventral aspect of the cubito-anal region of the right forewing: *31, Pseudorhynchus raggei*; *32, P. cornutus*; *33, P. mimeticus*; *34, P. lessonii*; *35, Euconocephalus broughtoni*; *36, Ruspolia marshallae*; *37, Mygalopsis thielei*. Scale line, 2 mm.
Figs 38–40. Lateral keel extensions of the pronotum: *38, P. cornutus*; *39, P. mimeticus*; *40, P. raggei*. Scale line, 3 mm.

It is of interest that, again, the collection from Christmas I. by Gibson-Hill contains both species. *P. lessonii* appears to be the larger and more robust of the two species, and it is likely that it is the more active flyer, which may account for its more widespread distribution. As in *P. selonis*, size variation is high, as illustrated by the large values for standard deviations for this species.

High vagility and obvious variation in size, associated with the insect's nutrition, have led to the description of numerous nominal species, providing a parallel with the taxonomic history of the swarming East African *Ruspolia differens* (Serville) (Bailey 1975). The length of the fastigium is also highly variable (Figs 7–9), and examination of specimens from the westerly extent of the range through Indonesia and India will undoubtedly highlight this variation even further. (Cheesman (1927)

attempted to separate *australis* and *extensor* on the basis of fastigium length, but no reference is made to her having examined type material. I have seen her specimens in BMNH and am confident that they are *lessonii*.)

Genus **Euconocephalus** Karny

Euconocephalus Karny, 1907, p. 39 (as subgenus of *Conocephalus*). Type-species, '*Locusta acuminata* Fabricius' [= *Conocephalus nasutus* Thunberg].

Diagnosis (Both Sexes)

Fastigium of the vertex extending beyond the base of the antennae, not pointed or elongate, fastigium separated from the frons by a notch, the tubercle at the base of the fastigium small. Eyes spherical not oval, head not pronouncedly elongate, rounded. Pronotum with side keels deep rather than long, hind invagination of the pronotum marked in most species. Fore tibiae with spines ventrally, knees armed. Wings long, not brachypterous, male stridulatory rib characteristic for each species. Hind femora with spines ventrally, knees armed. Ovipositor long and straight.

Discussion

The three genera *Pseudorhynchus, Ruspolia* and *Euconocephalus* are separated primarily by the shape of the fastigium. In the revisions by both Redtenbacher and Karny this feature does not seem to have been accorded the same importance, despite the fact that Karny (1912) used this character in his key. This has led to considerable confusion, particularly between *Ruspolia* (= *Homorocoryphus*) and *Euconocephalus*. These two genera are separated on the basis of the notch at the base of the fastigium, which is the latter genus is open. Bailey (1975), dealing with the African *Ruspolia*, discovered that in some clearly recognized species the degree to which the notch was open was highly variable. A more thorough revision of both genera through the Old World may well reveal that this character is highly fickle and that the genera should be synonymized. I would condone such a synonymy.

Euconocephalus is a tropical and subtropical genus; there is only one species on the mainland of Australia with an extended range through Papua New Guinea. The second species described in this work appears to be more restricted, at least on the material available, to Indonesia and India. As this is essentially a revision of the Australasian Copiphorini this latter species has been treated with minimum comment.

Euconocephalus indicus (Redtenbacher)

(Figs 12, 29)

Conocephalus indicus Redtenbacher, 1891, p. 408. Lectotype ♂, Penang, Malaya, NHMV, here designated; examined.

Diagnosis

Fastigium of the vertex blunt, rounded, with the ventral notch clearly open, ventral tubercle small (Fig. 12). Pronotum converging towards the posterior margin

from the dorsal aspect, side keels deep and not markedly elongate. Forewings long with the tip rounded, male stridulatory rib long with parallel sides, teeth more or less evenly spaced (Fig. 29). Cubito-anal area of forewing not distinctly broadened or rounded. Hind femora armed both internally and externally on the ventral aspect. Ovipositor long and straight.

Measurements

Specimens from the Redtenbacher series.

TL	FW	PL	PW	FL	HL	SF	T	OL
			Lectotype					
52·6	41·5	8·1	5·8	1·5	24·0	1·8	91	–
			Penang female					
57·0	40·6	7·7	5·9	1·6	26·5	–	–	26·8
			Himalaya female					
62·6	50·6	8·6	6·6	1·5	30·7	–	–	30·1
			Sumatra female					
54·5	43·5	8·0	5·9	1·4	25·0	–	–	20·8

Material Examined

India: no data, Himalayas, Sharp, 1 ♂, BMNH.

Sumatra: Pasir Granting, west coast, 2°S., June 1914, collector unknown, 1 ♂, BMNH; Fort de Kock, 920 m, 1925, E. Jacobson, 1 ♂, 1 ♀, BMNH.

Singapore: no data, BM 1906-35, H. N. Ridley, 1 ♀, BMNH.

Discussion

This species is included in a review of Australian Copiphorini merely for convenience, as the type-material was available from Vienna. Further, the Sumatran specimen suggests that this species might well extend throughout Indonesia. I have not handled enough material to establish this fact, despite the large collection of Indonesian material available in the British Museum (Natural History).

Euconocephalus broughtoni*, sp. nov.

(Figs 11, 19, 30, 35, 62)

Types

Holotype ♂, Queensland, Gordonvale, M. F. Day, ANIC. Paratypes: 1 ♀, Forest Station, 2000 ft, Bulberin State Forest, via Many Peaks, Queensland, 12–15.iv.1974, G. B. Monteith; 1 ♀, Little Ramsey Bay, Hinchinbrook I., Queensland, 11–19.viii.1975, E. N. Marks; 1 ♀, Maprik, Papua New Guinea, 24.x.1957, J. Smart; 1 ♀, Tenaru, Guadalcanal, Solomon Is, 30.viii.1956, E. S. Brown; 1 ♂, Honiara, Guadalcanal, Solomon Is, 21.ii.1962, P. J. M. Greenslade.

*Named for Bill Broughton, whose introduction to the Tettigoniidae in 1964 has led to a continuing work on three continents.

Diagnosis

Fastigium of vertex short, slightly acute but not pointed, ventral notch between vertex and frons wide with a large tubercle (Fig. 13). Flagellum of antennae with black intersegmental annulations, frons broad and distinctly convex. Pronotum more or less parallel-sided as seen from the dorsal aspect, dorsal horizontal line clear, lateral side keels deep with distinct hind margin invagination. Cubito-anal area of left forewing broad, stridulatory file crescentic, sides parallel (Fig 20). Mirror area of right forewing characteristically oblong (Fig. 35). Hind femora with ventral spines ventral, hind knees armed, internal spine much longer than the external. Ovipositor short with distinct broadening along its length.

Measurements

TL	FW	PL	PW	FL	HL	SF	T	OL
			Holotype					
59·2	43·4	11·0	7·7	2·4	18·7	4·7	63	–
			Queensland					
59·6	43·3	10·6	7·9	2·1	18·5	–	–	17·1
62·5	45·5	11·0	8·4	2·3	19·3	–	–	17·0
			New Guinea					
52·0	37·5	8·3	7·2	2·0	15·3	–	–	16·3
			Solomon Is					
65·0	49·2	10·2	8·2	2·1	21·3	–	–	21·3
63·6	47·3	10·8	8·0	2·2	22·4	2·0	–	–

Discussion

I have examined material in the British Museum (Natural History) from China (*P. concisus* Walker) and India (*P. annulatus* Karny) superficially similar to the newly erected *E. broughtoni*, sp. nov. Both these named species are distinct, and the character of the file of *E. broughtoni* separates it from both. The black annulations on the flagellum of *P. annulatus* are similar to those on *E. broughtoni*, but the two species differ in other respects. *P. gigas* Redtenbacher from Burma is of similar shape but is more than twice the size. The closest identified material was *P. flavescens* Serville, which differs in the shape of the stridulatory rib, the mirror of the right forewing and the acuteness of the fastigium. Other type material examined which may be considered close to this species are *P. nobilis* and *P. crassiceps* De Haan (= *P. strenuus* Walker, type specimen examined). Again, confusion remains over the assignment of this species to *Euconocephalus*, despite the many related species from Asia appearing under *Pseudorhynchus*. It is my re-stated opinion that on the basis of fastigium shape these species should be relocated in *Euconocephalus*.

On the basis of the six specimens examined, *E. broughtoni* has a tropical distribution ranging from Queensland through Papua New Guinea to the Solomon Is (Fig. 62).

Genus **Ruspolia** Schulthess

Ruspolia Schulthess, 1898, p. 207. Type-species: *Ruspolia pygmaea* Schulthess, by monotypy.
Homorocoryphus Karny, 1907, p. 41. Type-species: *Gryllus nitidulus* Scopoli, by original designation. Synonymized by Bailey, 1975, p. 174.

Diagnosis (Both Sexes)

Fastigium of the vertex rounded and extending beyond the base of the antennae, without grooves and not narrower than the base of the antennae, notch between the vertex and the frons closed or if open not widely so and in most specimens of any series closed, without a pronounced tubercle at the base. Pronotum narrows anteriorwards, lateral side keels deep and not markedly elongate, slight to full invagination of the hind margin. Forewings generally long, cubital area of the right forewing membranous, similar area on the left forewing seldom so. Hind femur with ventral spines, hind knees usually armed. Ovipositor straight, slender and usually as long as the hind femur.

Discussion

The value of the shape of the notch at the base of the fastigium, classically used to differentiate *Ruspolia* from *Euconocephalus*, is of little value when one treats all known members of these two genera from the Orient. However, the one species of *Euconocephalus* from Australia is separable from the single species of *Ruspolia* by this character.

The only other species of *Ruspolia* from the Pacific is *Conocephalus remotus* (Walker) (= *C. hawaiiensis* Perkins, 1899, p. 13), (in fact a *Ruspolia* species on the basis of its size and fastigium shape) and this species is sufficiently distinct from *R. marshallae*. A likely confusion may be cleared at this point regarding the wrong identification of a so-called 'type' by G. M. Henry (label information, BMNH) as *C. interruptus* Walker. This specimen is female, whereas Walker's type-specimen was described by him as a green male from north Bengal (Walker 1869, p. 318), obviously not synonymous with any Australasian species.

Ruspolia marshallae*, sp. nov.

Figs 13, 20, 28, 36, 62)

Types

Queensland: Holotype, Blencoe Creek Falls, Kennedy, 7.iii.1960, C. Calder. Paratypes: 3 ♂, 1 ♀, QM; Brisbane, 19.ii.1936, C. F. Ashby, 1 ♂, ANIC; Brisbane, 14.iv.1947, C. N. Sturgess, 1 ♀, UQ; Johnstone River, Innisfail, Apr. 1973, R. Pini, 1 ♀, AM; Lamington National Park, 24.v.1961, 1 ♀, UQ; Mistake Mts, via Laidley, 3000–3500 ft, 10–11.ii.1973, B. Cantrell, 1 ♂, 1 ♀, UQ; Mt Meru, Lake Duluti [geographical position undetermined], 4600 ft, 29.x.1961, S. C. Dawkins, 1 ♀, AM. New South Wales: Huonbrook near Mullumbimby, 27.ii.1965, D. K. McAlpine, 2 ♀, AM.

Diagnosis

Fastigium of the vertex short and rounded, notch between the frons and vertex

*Named for Mrs Judith Marshall, of the British Museum (National History), for her assistance in this project as well as in the revision of African *Ruspolia*.

closed with no tubercle (Fig. 13). Side keels of the pronotum deep rather than elongate. Forewings long and rounded at the tip, stridulatory rib long, 121–40 teeth on the file, unevenly spaced along its length (Fig. 28). Cubital vein forming the mirror frame of the right forewing well developed, Cu_{2b} not visible or very weak, parallel with Cu_2 (Fig. 36). Ovipositor straight and long.

Measurements

	TL	FW	PL	PW	FL	HL	SF	T	OL
				Holotype					
	50·5	39·4	8·5	5·5	1·5	21·5	2·8	135	–
				4 males					
Mean	50·6	38·8	8·1	5·5	1·5	18·8	–	133·5	–
SD	0·8	0·9	0·3	0·3	0·1	5·6	–	8·6	–
SE	0·4	0·4	0·2	0·2	0·1	2·8	–	4·3	–
				11 females					
Mean	59·0	43·1	7·5	5·7	1·6	23·3	–	–	30·9
SD	6·6	3·9	0·7	3·9	0·2	2·6	–	–	4·3
SE	2·0	1·2	0·2	1·2	0·1	7·9	–	–	1·3

Discussion

This species extends from Cape York Peninsula through the tropical and subtropical parts of northern Queensland to Brisbane (Fig. 62). It is certainly distinct from other copiphorine species of that region. No information is available at present on its biology or song.

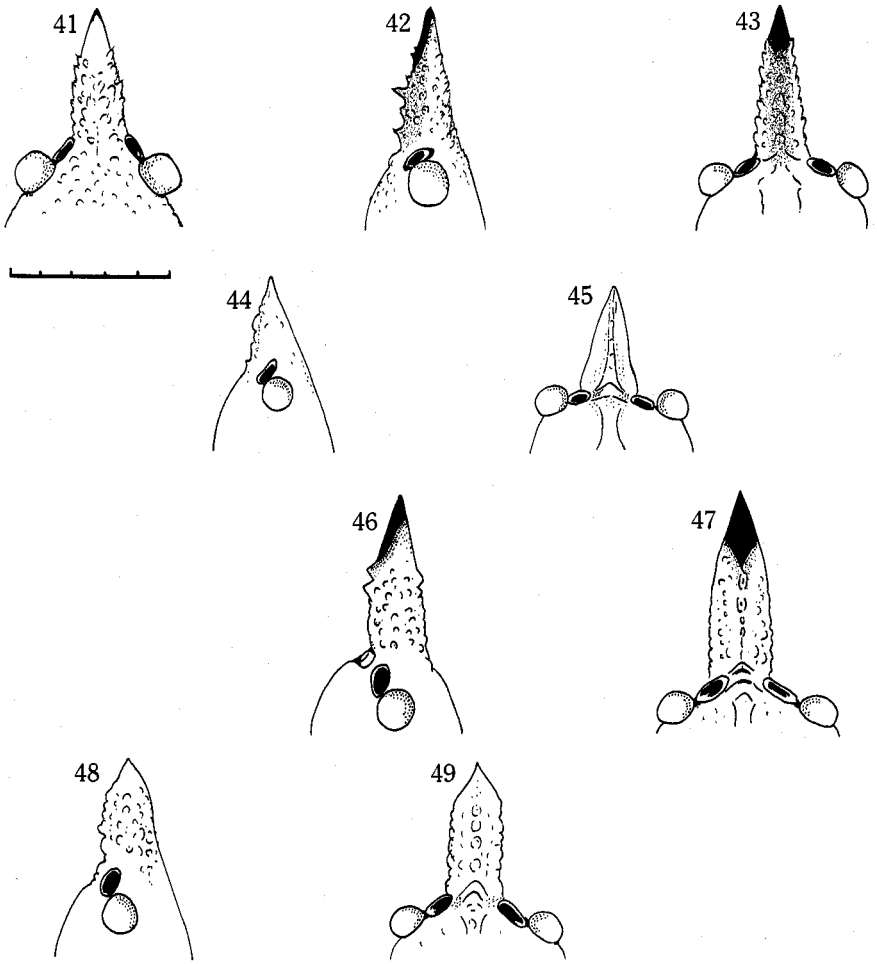
Genus **Mygalopsis** Redtenbacher

Mygalopsis Redtenbacher, 1891, p. 352. Type-species *Mygalopsis ferruginea* Redtenbacher [= *Pseudorhynchus ? pauperculus* Walker], by monotypy.

Diagnosis (Both Sexes)

Fastigium of the vertex pointed with the tip acute, highly nodulated with hairs between the nodules, notch between the frons and the vertex absent and no distinct tubercle associated with the fastigium. Head broad and distinctly convex, covered with small nodules and shallow pits, frons wide and highly convex, eyes small and spherical, not oval. Pronotum without lateral carinae, rounded, slightly ridged at the hind margin in some species, not consistent in all specimens and not diagnostic. Side keels triangular without a marked hind margin invagination. Forewings short, an entirely brachypterous genus. Stridulatory apparatus covered by the pronotum but not formed into a distinct shield. Right and left forewings membranous but the right more so than the left, with a distinct mirror region which tends to be broad. Area between the Cu_{1b} and Cu_1 greatly expanded (e.g. Fig. 37). Stridulatory rib long and curved. Hindwings much reduced, modified as a secondary stridulatory apparatus, used in the defensive response (Sandow and Bailey 1978). Veins separate and highly membranous, small spines ventrally which engage into a microscopic lattice of indentations on a limited area of the dorsum of the

abdomen (visible under SEM). Male genitalia globular with a single incurved spine, male subgenital plate with terminal spines or cerci. Ovipositor moderately curved. Fore tibiae with spines, knees of hind femora armed. Hind femora distinctly short, non-saltatorial, as long or slightly longer than the length of the prothorax. General shape of the body ovoid, not elongate.



41–49. Ventral, profile and dorsal aspects of the fastigium of the vertex of *Mygalopsis* spp.: *41–43, M. marki*; *44, 45, M. pauperculus*; *46, 47, M. thielei*; *48, 49, M. sandowi*. Scale line, 5 mm.

Discussion

This genus is endemic to Western Australia, occurring where the annual rainfall exceeds 450 mm. Such endemism may be a reflection of its low vagility, a peculiar feature reflected in the remarkably short hind femora. This characteristic is discussed in detail, in relation to its crypsis and defensive display, by Sandow and Bailey (1978). At the time of this revision the genus is undergoing a more thorough examination in respect of its species isolation and geographic variation throughout the south west of Australia. For this reason a full discussion of the biology and

species-isolating mechanisms has not been included. Data on morphometrics and song characteristics are directly attributable to the efforts of Mr Sandow, for which I am grateful.

Although there is good morphometric data to support the distinction of four species, song character in the male and the shape of the male genitalia are the most useful male diagnostic characters. Females of this highly cryptic genus are extremely difficult to find and hence rare in any collection. The length of the ovipositor is sufficient to define one species, but the others rely on differences in the shape of the fastigium and on distribution data.

Key to Males and Females of the known Australian Species of *Mygalopsis*

1. Smallest species; fastigium short with a small pointed protuberance apically (Figs 44, 45), not highly tuberculate; ovipositor short; subgenital plate (10th abdominal sternite) of the male as in Fig. 50; anal cerci and cercal process as in Fig. 54; song characteristics as in Fig. 59*b*; distribution SW. Western Australia, south of Cape Naturaliste (Fig. 63) ..... *M. pauperculus* (Walker) (p. 1038)

   Fastigium well developed, other characters not as above 2

2(1). Moderately large species; fastigium long (Figs 48, 49); ovipositor much longer than hind femur and curved; subgenital plate of the male as in Fig. 52; anal cerci and processes as in Fig. 56; song characteristics as in Fig. 59*d*; restricted to woodland areas, seldom near the coast (Fig. 63) ..... *M. sandowi*, sp. nov. (p. 1039)

   Not as above, ventral surface of the fastigium dark at least at the tip, mainly coastal in distribution 3

3(2). Medium size with 2 size morphs depending on the season during which the nymphs developed; fastigium as in Figs 41–43, grey or black pigmentation ventrally, at least apically but more often entire; subgenital plate of the male as in Fig. 51; anal cerci and processes as in Fig. 55; song characteristics as in Fig. 59*a*, coastal sand plain north of Cape Naturaliste (Fig. 63). ..... *M. marki*, sp. nov. (p. 1042)

   Medium to small size; fastigium as in Figs 46, 47, ventral aspect of the fastigium black at the tip, seldom entire; subgenital plate of the male as in Fig. 53; anal cerci and processes as in Fig. 57; song characteristics as in Fig. 59*c*, coastal species on the south coast of Western Australia (Fig. 63) ..... *M. thielei*, sp. nov. (p. 1044)

Mygalopsis pauperculus (Walker)

(Figs 44, 45, 50, 54, 59*b*, 63)

Pseudorhynchus ? pauperculus Walker, 1869, p. 331. Holotype ♀, New Holland, King George Sound, coll. Capt. Grey, BMNH; examined.

Mygalopsis ferruginea Redtenbacher, 1891, p. 352. Holotype ♀, Swan River, Western Australia, ? Daniel, NHMV; examined.

Diagnosis

A generally small species with a short fastigium, pointed at the apex and slightly tuberculate (Figs 44, 45). Stridulatory file curved, with 82–145 teeth. Male genitalia distinct, cerci with inner surface auriculate, groove beneath cercal process narrow, inner spine well developed, not heavily pigmented in the specimens examined (Fig. 54). Subgenital plate narrow without a deep terminal invagination, spines distinct and elongate (Fig. 50). Ovipositor short and curved. Song a continuous series of chirps each of 5–8 syllables (Fig. 59*b*). Restricted to the south-west of Western Australia and the Stirling Ranges (Fig. 63).

Measurements

	TL	FW	PL	PW	FL	HL	T	OL
				Holotype				
	35·1	5·0	6·5	5·6	2·5	8·5	–	13·1
				14 specimens				
Mean	28·7	7·8	8·1	6·2	2·6	9·6	118·7	15·5
SD	4·3	0·8	1·1	0·8	0·3	0·8	16·6	4·5
SE	1·1	0·2	0·3	0·2	0·1	0·2	4·4	1·2

Material Examined

Western Australia: Albany, Lake William, Jan. 1974, A. R. Main, 1 ♂, 1 ♀, UWA; Albany, 13.viii.1913, L. McK. Burns, 1 ♀, WAM; Augusta, 21–23.i.1966, J. A. Grant, 1 ♀, BMNH; Dillons Bay, 10.i.1976, 1 ♂; 16.v.1978, 2 ♂, J. D. Sandow, WJB sound recording collection, UWA; Broke Inlet, 13.iii.1976, J. D. Sandow, 1 ♂, UWA; Dunsborough, 25.iv.1976, J. D. Sandow, 4 ♂, UWA, 3 ♂, BMNH; Doubtful Island Bay, 17.v.1978, J. D. Sandow, 1 ♂, UWA; Dunsborough, 24.iv.1976, J. D. Sandow, 2 ♂, UWA; Cape Hamelin, 25.ii.1976, J. D. Sandow, 2 ♂, UWA, 1 ♂, BMNH; New Holland, King George Sound, no date, G. Grey, 1 ♂, BMNH; Margaret River, 30 km E. of township, 23.iv.1976, J. D. Sandow, 3 ♂, UWA, WJB sound recording collection; Cape Naturaliste, 25.ii.1976, J. D. Sandow, 1 ♂, BMNH, 3 ♂, UWA, WJB sound recording collection; 16 miles S. Nornup, 12.xi.1958, E. F. Riek, 1 ♂, ANIC; Bedelup Falls, 13.x.1958, E. F. Riek, 1 ♂, ANIC; Cape Riche, 16.i.1978, W. J. Bailey, 3 ♂, UWA, WJB sound recording collection; Stirling Ranges, 13.xii.1975, W. J. Bailey, 3 ♂, UWA, WJB sound recording collection.

Discussion

The type locality is clearly King George Sound on the south coast of Western Australia, and the type-specimen fits the characteristics of other specimens from that area. The synonymy of *M. ferruginea* Redtenbacher (Kirby 1906, p. 235) was based on a specimen from the Brunner von Wattenwyl collection, presumably collected by Daniel. Much of the Western Australian material collected around that period was loosely designated 'Swan River', implying the Swan River Colony which covered most of the south-west of the State. Because there is no black pigmentation on the ventral surface of the fastigium, and the fastigium itself is short, I agree with the Kirby synonymy. This has the practical advantage of allowing a male holotype to be designated for the west coast species, *M. marki*, sp. nov., thus removing any further confusion over the taxonomy within the genus. It has already been stated that the female characters are weak, and this synonymy obviates the use of a female type specimen.

M. pauperculus is restricted to the south-west of the State in mainly coastal areas of dune scrub; however, it does appear sporadically inland, particularly along the old Pleistocene coastline, exemplified by the Stirling Ranges (Fig. 63).

Mygalopsis sandowi*, sp. nov.

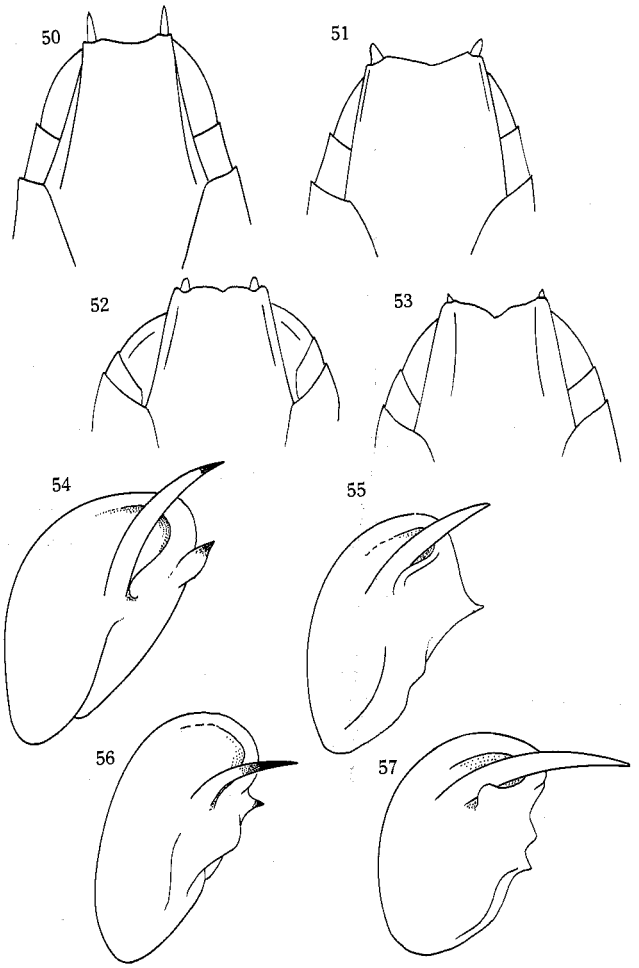
(Figs 48, 49, 52, 56, 59*d*, 59*e*, 63)

Types

Holotype ♂, Dunsborough, Western Australia, 24.iv.76, J. D. Sandow (song recording Nos 24.4.1, WJB collection), ANIC. Paratypes: Western Australia: Dunsborough, 23.iv.1976, J. D. Sandow, 1 ♂ UW, 1 ♂ BMNH; Forest Grove, 25.ii.1976,

*Named for Mr J. D. Sandow.

J. D. Sandow, 1 ♂, UWA; Gipsy Hill, Perth, 27.iii.1976, W. J. Bailey, 1 ♂, UWA; Jacoby National Park, 13.x.1977, J. D. Sandow, 3 ♂, UWA; head of Margaret River, 16.i.1976, J. D. Sandow, 1 ♂, BMNH; Mundaring, 15.i.1978, 6 ♂, 4.xii.1977, 3 ♂, J. D. Sandow, UWA; 16 miles S. of Nornup, 12.xi.1958, E. F. Riek, 1 ♂, ANIC; Stirling Ranges, Dec. 1975, 1 ♂, 14.xii.1975, 1 ♂, 12.i.1978, 1 ♂, W. J. Bailey, UWA, WJB sound recording collection; Stirling Ranges, 4.xi.1977, J. D. Sandow, 3 ♂, UWA; Whittakers Mill, 15.ii.1938, R. Howson, 1 ♀, WAM.



Figs 50–53. Subgenital plate of *Mygalopsis* spp.: *50, M. pauperculus*; *51, M. marki*; *52, M. sandowi*; *53, M. thielei.*

Figs 54–57. Posteroventral aspect of the left terminal abdominal tergite and cerci of *Mygalopsis* spp.: *54, M. pauperculus*; *55, M. marki*; *56, M. sandowi*; *57, M. theilei.*

Diagnosis

Medium to large species of *Mygalopsis*. Ventral surface of abdomen without

dark brown or purple pigmentation, fastigium long, highly tuberculate (Figs 48, 49), without pigmentation ventrally, or if present slight. Stridulatory file curved, with 115–131 teeth. Male genitalia distinctive, style with pigmented tip in addition to that on the internal spine, auricular groove open (Fig. 56), subgenital plate with a small notch apically between the 2 styles, styles very small (Fig. 52). Ovipositor characteristically long and curved. Ventral sternites of the abdomen, in fresh specimens, distinctly purple in colour. Song a series of chirps of variable length, comprising 10–20 groups of 3 syllables each (Figs 59*d*, 59*e*). Essentially a forest species occurring along the Darling Scarp and the Stirling Ranges (Fig. 63).

Measurements

	TL	FW	PL	PW	FL	HL	T	OL
				Holotype				
	34·6	13·7	11·5	8·4	3·6	15·2	135	–
				9 specimens				
Mean	37·5	12·6	11·0	8·3	4·0	13·8	125·3	26·7[A]
SD	8·3	1·2	0·9	0·4	0·4	1·2	5·8	5·1
SE	2·6	0·4	0·3	0·1	0·1	0·4	1·6	1·8

[A]Mean of 14 males.

Discussion

This species is sympatric in the south with *M. pauperculus*, and rarely so with *M. marki* further north. Its habitat range, unlike those of these two species, tends to be in the forested areas on the Darling Scarp, extending southwards to the Stirling Ranges. Its sympatry is most evident with both *M. pauperculus* and *M. marki* around the Busselton are Cape Naturaliste areas of the coast, where all three species may be collected within a very limited geographical areas, but with *M. marki* showing distinct parapatry with *M. pauperculus*. The ovipositor in the specimens examined appears to be consistently longer than those of both other species and the size range tends to be more constant, i.e. there is not the size dimorphism noted in *M. marki*.

Mygalopsis marki*, sp. nov.

(Figs 27, 41–43, 51, 55, 59*a*, 63)

Types

Holotype ♂, Jandakot, Zoology Department Reserve, Western Australia, 26.xi.75, J. D. Sandow (song recording No. 26.11.5, WJB collection), ANIC. Paratypes: Western Australia: Alfred Cove, Perth, 3.iii.1964, 1 ♂, UWA; City Beach, Perth, Sept. 1978, W. J. Bailey, 2 ♂, UWA; Busselton, Jan. 1974, 3 ♂, 25.iv.1976, 3 ♂, W. J. Bailey, UWA; Cockleshell Gully, 12.v.1976, J. D. Sandow, 2 ♂, BMNH, 4 ♂, UWA, WJB sound recording collection; N. end Dunn's Rock, Dunsborough, 25.iv.1976, J. D. Sandow, 2 ♂, UWA; Eneabba, 11.v.1976, 1 ♂, BMNH, July 1976, 1 ♂, BMNH, J. D. Sandow; 7 km N. by W. of Eneabba, 29°45′S., 115°15′E., 1.v.1971, Key, Upton and Mitchell (Key's field notes, trip 170, stop 47616.8), 2 ♂,

*Named for Mark Bailey, whose ability to hear high-frequency sounds compensates for an equivalent reduction in my own sensitivity.

ANIC; Jandakot, 26.xi.1975, 1 ♂, BMNH, 2 ♂, UWA, May 1978, 3 ♀, UWA, J. D. Sandow, WJB sound recording collection; Jandakot, 3.iii.1974, 8 ♂, 21–22.x.1975, 1 ♂, WJB sound recording collection, W. J. Bailey, UWA; Capel District, 18 miles S. of Bunbury, 7.i.1957, A. Snell, 1 ♂, AM; Jurien Bay, 24.vi.1974, W. J. Bailey, 2 ♂, UWA; King's Park, Perth, Cat. 5.xi.1931, WAM; Trigg, Feb. 1974, W. J. Bailey, 2 ♂, UWA; S. of Pinnacles, 13.v.1976, J. D. Sandow, 1 ♂, UWA; Victoria Park, Perth, no date, reg. 10.iii.1937, 1 ♀, WAM; Yarloop, 14.iv.1948, M. Landwehr, 1 ♀.

Diagnosis

Size very variable, possibly indicating the availability of food to the developing nymphs; individuals caught after developing in winter often larger than those collected in autumn after the dry summer. Colour of ventral surface of abdomen puce in brown forms and reddish brown in green forms. Fastigium prominent, tuberculate, with black pigmentation restricted to the apex of the ventral surface

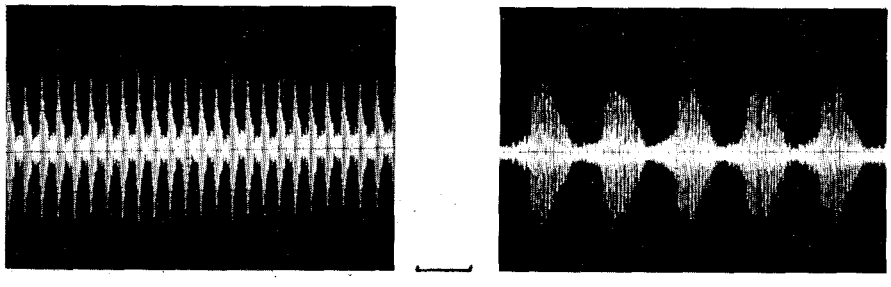


Fig. 58. Oscillographic analysis of the songs of the two sympatric *Pseudorhynchus* species, *P. lessonii* (left) and *P. selonis* (right). Time marker, 0·01 s.

or more often entire; when it is restricted to the tip the rest of the vertex is grey (Figs 41–43). Stridulatory file curved, with 115–138 teeth (Fig. 27). Male genitalia distinctive; style process without a darkened tip; auricular fold narrow; a single median spine (Fig. 55). Subgenital plate broad and without a deep apical invagination (Fig. 51). Ovipositor short and curved. Song relatively long chirps usually comprising 20–50 syllables (Fig. 59*a*). A coastal species, ranging from the Irwin River southwards to Cape Naturaliste (Fig. 63).

Measurements

	TL	FW	PL	PW	FL	HL	T	OL
				Holotype				
	34·0	9·5	9·1	7·5	4·7	10·2	–	–
				9 specimens				
Mean	35·2	12·2	10·3	7·8	5·2	11·5	125·4	31·0
SD	2·5	2·2	0·9	0·6	1·6	1·0	7·4	5·0
SE	0·8	0·7	0·3	0·2	0·5	0·3	2·0	1·7

Discussion

This species appears to be restricted in its range to the coastal dune scrub and

surrounding jarrah–banksia woodlands north of Cape Naturaliste. Its habitat is typically in dune acacias and eucalypts but extends into woodland areas, particularly those where jarrah has been extensively felled in the past. It does not occur eastwards of the scarp. This species is at present being studied in some detail in relation to the function of the song in the spacing of males in a population (Thiele and Bailey 1980), the neuroethology of sound reception (Bailey and Stephen 1978), and the structure of populations in relationship to species isolation (by J. D. Sandow). It has been the lack of clear taxonomy in this genus, and in particular for this species, that has stimulated this revision.

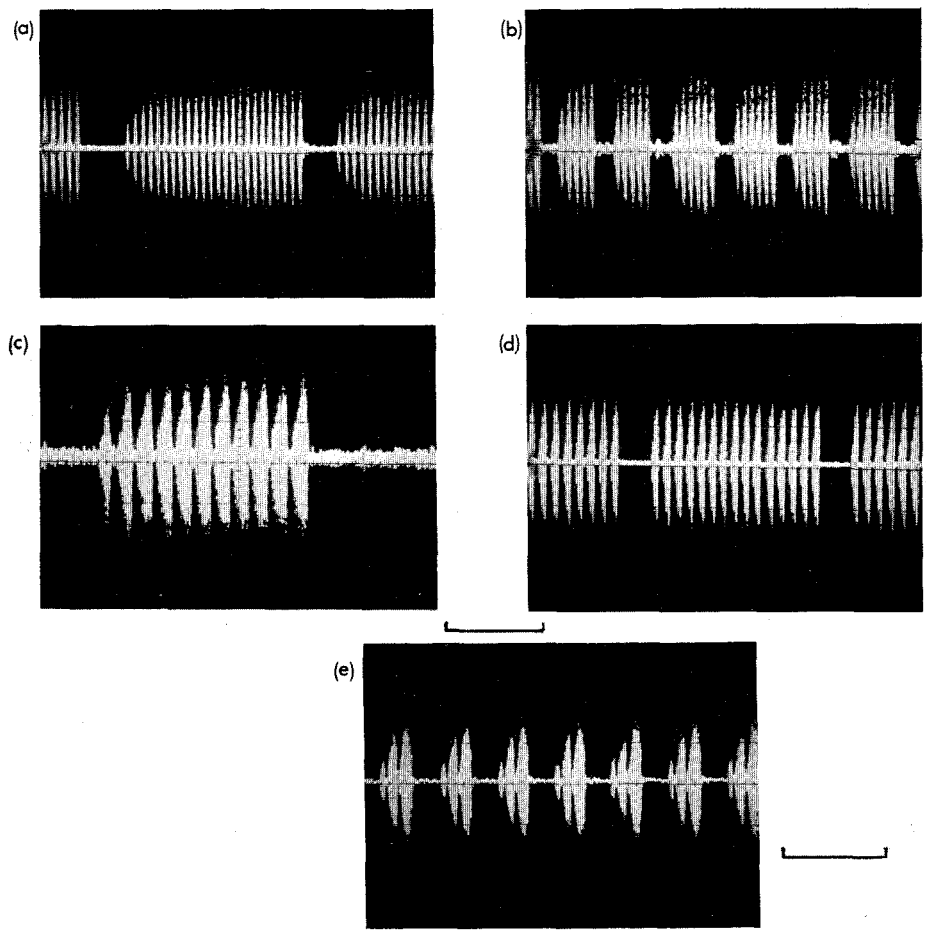


Fig. 59. Oscillographic analysis of the songs of *Mygalopsis* spp.: *(a) M. marki*; *(b) M. pauperculus*; *(c) M. thielei*; *(d) M. sandowi*; *(e) M. sandowi*, detail of triplet. Time markers, 1 s for *(a)–(d) and* 0·2 s for *(e)*.

M. pauperculus is sympatric with the forest species *M. sandowi* and parapatric with *M. marki*. The boundary of parapatry is close to Dunsborough, 10 km south-east of Cape Naturaliste. This is the only recorded case of parapatry in the Tettigoniidae.

As in many copiphorines, *Mygalopsis* has two predominant colour morphs, green

and brown, and it appears from the present available data that the green morphs tend to be the larger. This is the same phenomenon as that seen in *Ruspolia differens* (Bailey and McCrae 1978). Males may be heard singing all the year round in the northern parts of the range, around Jurien Bay.

*Mygalopsis thielei**, sp. nov.

(Figs 37, 46, 47, 53, 57, 59*c*, 63)

Types

Holotype ♂, Dillon's Bay, Western Australia, 10.i.76, collector J. D. Sandow (song recording No. 10.1.2 (WJB collection), ANIC. Paratypes: Western Australia: Dillons Bay, 10.i.1976, J. D. Sandow, 1 ♂, BMNH; Dunn's Rock, 14.v.1975, J. D. Sandow, 3 ♂, UW, 1 ♂, BMNH; Esperance, Jan. 1936, K. H. L. Key, 1 ♂, ANIC; Fitzgerald National Park, 18.v.1978, J. D. Sandow, 2 ♂, UWA; Hopetoun, 12.xi.1975, 1 ♂, BMNH, 3 ♂, UWA, Apr. 1977, 1 ♂, 2 ♀, UWA, 13.xi.1977, 3 ♂, 1 ♀, UWA; Point Malcolm, 12.x.1975, J. D. Sandow, 1 ♂, UWA; Masons Bay, 19.i.1978, W. J. Bailey, 4 ♂, 1 ♀, WJB recording collection, UWA.

Diagnosis

Medium to small species; fastigium long, tuberculate, black pigmentation ventrally beneath the tip (Figs 46, 47). Stridulatory file curved, with 119–132 teeth. Male genitalia distinctive, cercal process long and curved without a darkened tip, auricular fold narrow with a raised inner margin, the median spine not distinct and often divided (Fig. 57). Subgenital plate with deep median invagination, spine often small (Fig. 53). No distinct coloration on ventral sternites of abdomen. Song with a slower syllable rate than that of the other 3 species (Fig. 59*c*). Ovipositor length in 2 specimens considerably shorter than in *M. sandowi*, and close to the length of the hind femur. Coastal species, restricted to the south-east of the State (Fig. 63).

Measurements

	TL	FW	PL	PW	FL	HL	T	OL
				Holotype				
	32·6	12·2	11·9	8·1	5·1	12·1	–	
				9 specimens				
Mean	32·3	13·7	11·7	8·0	5·8	12·3	125·7	21·1[A]
SD	2·2	1·0	0·5	0·4	1·8	0·4	5·2	0·1
SE	0·7	0·3	0·2	0·1	0·6	0·1	1·4	0·1

[A]Mean of 3 specimens.

Discussion

This species appears to be related in terms of general morphology to the west coast species *M. marki*, but its song is distinct. The fact that the species are geographically separate may reflect the relatively recent speciation of this genus. Both species occupy the drier extremes of the range, one extending northwards, and the other eastwards along the south coastal strip to Israelite Bay. *M. thielei* is sympatric with *M. pauperculus* between Albany and Bremer Bay.

*Named for Mr D. Thiele.

Fig. 60. Distribution of *Pseudorhynchus raggei* (●), *P. mimeticus* (■) and *P. cornutus* (▼).

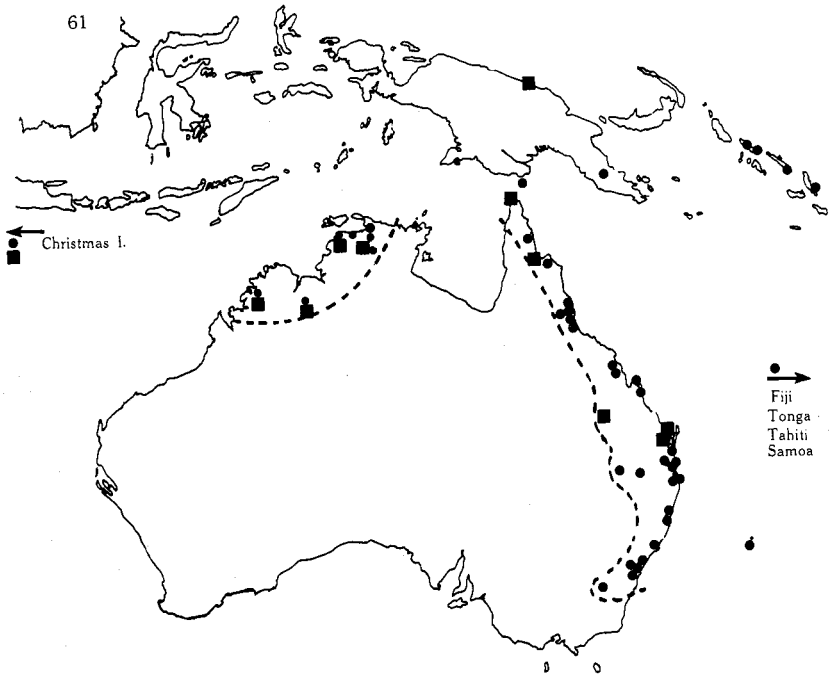


Fig. 61. Distribution of *Pseudorhynchus lessonii* (●) and *P. selonis* (□).

Fig. 62. Distribution of *Ruspolia marshallae* (●) and *Euconocephalus broughtoni* (◆).

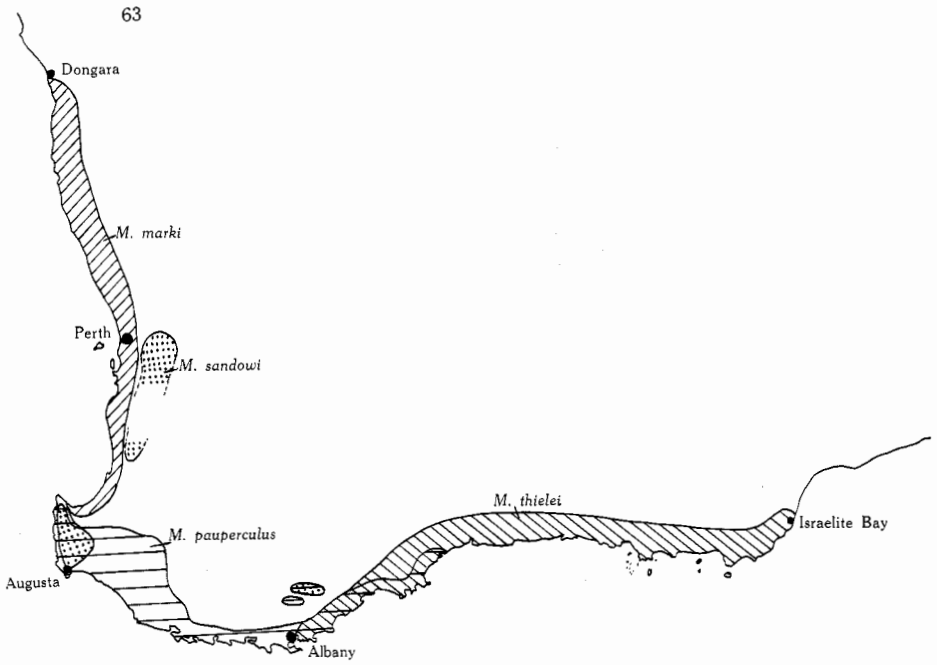


Fig. 63. Distribution of *Mygalopsis* spp. in Western Australia.

General Discussion

The Old World Copiphorini are essentially tropical and subtropical in distribution, being restricted to areas of high rainfall. The Australian distribution of this subfamily reflects the continent's previous Tertiary climate. The increasing aridity during the Quaternary has restricted the distribution to the coastal tropical and subtropical areas of the north and east. The exception is the genus *Mygalopsis*, which occurs in the wetter, more mediterranean climate of south-western Australia. In general terms the restriction would appear to be represented by the 400-mm isohyet and the 15°C isotherm. On the coast, distribution is often influenced by local rainfall. An illustration of this would be the extended distribution of *M. thielei* to the western limit of the arid Great Australian Bight.

P. lessonii and *P. selonis* are widespread throughout the Indonesian and Polynesian tropics. From my own experience of this species in the north-west Kimberley district, *P. selonis* has a more restricted range than *P. lessonii*; in addition, *P. lessonii* extends further south along the east coast than *P. selonis*. *P. raggei* has a highly restricted range in the wetter regions of the Northern Territory; *P. mimeticus* is similarly restricted to areas of southern Queensland and New South Wales.

The most interesting distribution pattern is that of the genus *Mygalopsis*. Affinities with this bizarre genus are difficult to find. Brachyptery is often associated in the copiphorines with isolation, particularly on highland areas, e.g. *Ruspolia pygmaea* Schulthess (Ethiopian highlands), *R. jaegeri* (Roy) (highlands of Sierra Leone), *R. brevipennis* (Chopard) (Guinean highlands), *R. sarae* Bailey (Angolan highlands), *R. lemairei* (Griffini) (high forests of Zaire) and *R. exigua* (Bolívar) (highlands of the East African rift). Of these species, that with the greatest affinity to *Mygalopsis* is *R. lemairei*, the range of which is totally restricted to forest regions. This may well have been the climate and vegetation type of the south-west of Australia during the late Tertiary. The genus could have become isolated well before this time and, if so, relatives should be present in the Indian and South African fauna. I have examined the British Museum (Natural History) material and can find no clear relationships.

Two basic species groupings occur within the genus, *M. marki* and *M. thielei* on the one hand, and *M. sandowi* and *M. pauperculus* on the other. Fig. 12 shows the classic distribution of pre-Pleistocene species in the south-west, particularly for *M. marki* and *M. thielei*, where an essentially coastal sandplain species has been divided into two by increasing aridity through the centre of this region. *M. pauperculus* is parapatric to *M. marki*, probably demonstrating a more recent separation of this coastal species from the less hygrophylic sandplain species. *M. pauperculus* is morphologically similar to the forest species *M. sandowi*, which appears to be restricted to the high-rainfall areas (over 1200 mm) of the State. It could hence be surmised that, of the two original species, one was restricted to subtropical but wet coastal heaths and the other to tropical forest (cf. *R. lemairei* in central Africa). With the progressive drying out of the heath areas, *M. marki* could have been separated from its sibling, *M. thielei*. However, no easy explanation is possible for speciation in the sympatric pair *M. sandowi* and *M. pauperculus*.

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