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Summary

The type specimens of all species described under the family Clambidae were studied. In the present paper holotypes are confirmed and lectotypes designated where necessary. The systematic position of the species is clarified and a new species described.

The taxonomic status of the family has changed remarkably since it was established by Thomason in 1859. Later authors of the last century placed the group under the family Silphidae or Anisotomidae (Leiodidae) until it was restored again as an independent family in the suborder Staphylinoidea. More recent work by Crowson (1960) resulted in the transfer of the family to the superfamily Eucinetoidea, sub-order Polyphaga.

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By S. ENDRÖDY-YOUNGA

F.A.O. Entomologist[1]

ABSTRACT

ENDRÖDY-YOUNGA, S. 1973. A revision of the described Australian and New Zealand species of the Family Clambidae (Coleoptera) with description of a new species. *Rec. S. Aust. Mus.*, 17 (1): 1-10.

The type specimens of all species described under the family Clambidae were studied. In the present paper holotypes are confirmed and lectotypes designated where necessary. The systematic position of the species is clarified and a new species described.

INTRODUCTION

The taxonomic status of the family has changed remarkably since it was established by Thomson in 1859. Later authors of the last century placed the group under the family Silphidae or Anisotomidae (Leiodidae) until it was restored again as an independent family in the suborder Staphylinoidea. More recent work by Crowson (1960) resulted in the transfer of the family to the superfamily Eucinetoidea, suborder Polyphaga.

The members of this family can easily be recognized by the small size (0·7-2·0 mm) and convex shape, by the rolled up resting position when the clypeus is curled under the pronotum (most of the specimens are mounted in this position) and by the extremely enlarged hind coxal plate. Other characters are: head very broad, nearly as broad as pronotum, broadly rounded in front; pronotum large, convex, not deeply excised in front to accommodate a narrow head as with many Anisotomidae; scutellum triangular with sides about equal (in the similar shaped Cybocephalidae the scutellum is very broadly obtuse-angled); antennae consisting of two enlarged basal and two club segments with usually six funicular segments (four only in the Palaearctic genus *Loricaster* Muls. & Rey); tarsal formula 4-4-4; tibiae simple, not serrate in contrast to Anisotomidae.

I wish to express my gratitude to the colleagues who supplied material and enabled me to study the type specimens, notably the late Mr. H. M. Hale, Dr. E. D. Giles, Mr. G. F. Gross and Mr. N. McFarland of the South Australian Museum, Adelaide; Dr. J. W. Evans of the Australian Museum, Sydney; Mr. R. D. Pope and Miss C. M. F. von Hayek of the British Museum (Natural History), London.

SYSTEMATIC TREATMENT

Key to Genera

1. Front and basal margins of pronotum meet in a sharp angle, not forming laterally a straight or arcuate margin (Fig. 1 A). Eyes free at the side of the head (Fig. 1 A). Metasternum evenly convex for its whole length (Fig. 1 D). Abdomen of 6 segments
Calyptomerus Redtenbacher

Pronotum with distinct, straight or arcuate lateral margin (Fig. 1 B). Eyes completely enclosed in the disc of the head or only free behind (Fig. 1 B, C). Surface of metasternum sharply angled along the arcuate transversal crest (Fig. 1 E). Abdomen of 5 visible segments 2

2. Eyes framed in front by an extension of clypeus (temporal margin) but free behind (Fig. 1 C). Penis between bilobed or deeply emarginated parameres .. .. *Sphaerothorax* Endrödy-Younga

Eyes completely framed by the temporal margin of clypeus and divided into a dorsal and a ventral half. Parameres fused into a single plate with pointed, arcuate or emarginate apex
Clambus Fischer von Waldheim

Genus CALYPTOMERUS Redtenbacher, 1849

Calyptomerus Redtenbacher, 1849, Fauna Austriaca, Käfer, p. 18, 159; Endrödy-Younga, 1959, Opusc.Ent. 24: 84-85; 1961, Acta Zool.Acad.Sci.Hung., 7: 401-412.

Comazus Fairmaire & Laboulbene, 1854-56, Faune Ent.Fr.,Col., 1: 312, 328.

Small, convex, reddish brown with dense cover of long yellowish hairs. Body both in dorsal and in lateral view pear-shaped e.i. broadest and highest close to the shoulders. Head broad, clypeus broadly arcuate, in the middle finely emarginated. Eyes on the hind angle of head, free (Fig. 1 A) or shortly framed in front (the European *C. alpestris* Redtb.). Pronotum very broad and short, convex with sharp lateral angles (Fig. 1 A) instead of lateral margins. Metasternum gently convex between mesosternum and hind coxal plates (Fig. 1 D), not sharply

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13th August, 1974.

angled to form a transversal crest in the middle of metasternum. Antennae 10 segmented with two enlarged basal and two club segments. Male genitalia consisting of two basally fused parameres, a pointed tongue-shaped penis, and an open, ring-shaped basal plate.

The genus comprises four species, described from the Palaearctic and Nearctic regions (Alaska). One of the species however is also known from South Africa (Cape Province), and the same species was recorded more recently from Tasmania, where it was described as *Clambus corylophoides* Lea.

1. **Calyptomerus dubius** (Marsham, 1802)
(Fig. 1 A, 1 D, 2 G)

Scaphidium dubium Marsham, 1802, Ent.Brit. 1: 234.

Comazus enshamensis Stephens, 1829, Ill.Brit. Ent.Mandib., 2: 184; Johnson 1966, Entomologist's mon. Mag., 101: 186.

Calyptomerus troglodytes Fauvel, 1861, Ann. Soc.Ent.Fr., (4) 1: 576.

Clambus corylophoides Lea, 1912, Proc.Lin.Soc. N.S.Wales, 36: 458 (*syn.nov.*).

Calyptomerus dubius Endrödy-Younga, 1959, Opusc.Ent. 24: 84-85; 1961, Acta Zool. Acad.Sci.Hung., 7: 411-412.

Location of types:

Scaphidium dubium Marsham, British Museum?

Comazus enshamensis Stephens: without locality, British Museum, London. Lectotype designed by C. Johnson (1966).

Calyptomerus troglodytes Fauvel: location of type unknown.

Clambus corylophoides Lea: Lectotype ♂ and two paratypes: Hobart, Tasmania, A. M. Lea, in South Australian Museum, Adelaide.

C. dubius is the smallest species of the genus. Sculpture of dorsal surface fine, pubescence comparatively long and less dense than in other species. Apex of elytra truncate. Head broad, antennal fossa as long as the temporal margin of clypeus between eyes and side angle of antennal fossa. Eyes situated on the hind angle of head and completely free (Fig. 1 A). Surface of head shiny, with fine punctures at basis of hairs. Hairs longer and less dense than in other species, slightly elevated and forwardly directed. Pronotum broad and short, as long as head; front and basal margins joining laterally in a sharp angle (Fig. 1 A). Pubescence similar to that of the head but directed from the centre of disc towards the margins. Elytra hardly longer than combined breadth, at apex commonly truncate; laterally and at the suture finely margined. Microsculpture around scutellum very fine, laterally and towards apex more distinct. Pubescence similar to that of the pronotum, directed from base to apex. Ventral side with stronger microsculpture, pubescence shorter and denser than on dorsal surface. Male genitalia 0·3 mm and 0·12 mm broad, stout in comparison to other species of the genus. Parameres narrow, hardly longer than penis (Fig. 2 G).

Length: 1·1-1·6 mm—*breadth*: 0·6-0·8 mm.

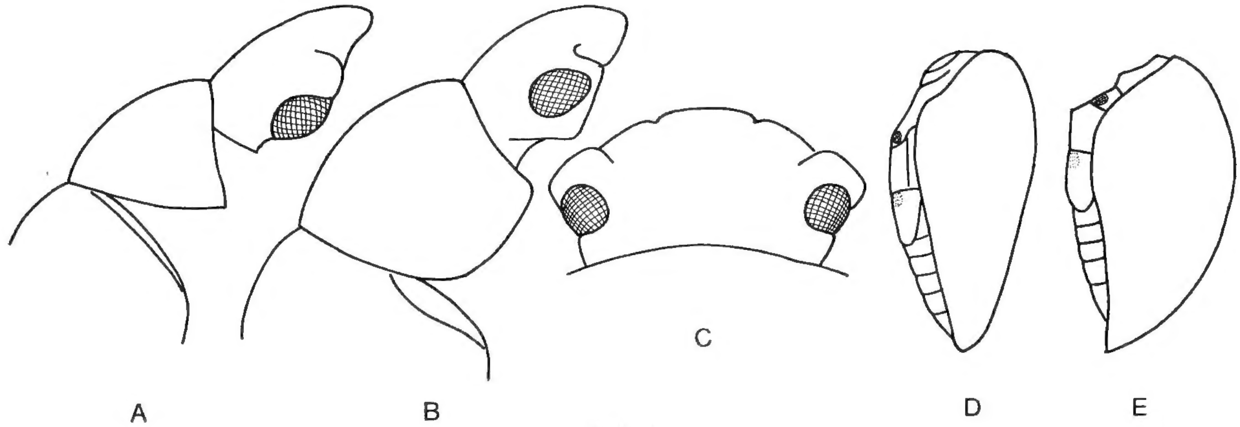

FIG. 1

A *Calyptomerus dubius* Marsh., head and pronotum in lateral view.
B *Clambus* sp. head and pronotum in lateral view.
C *Sphaerothorax suffusus* Broun: head, dorsal view.
D *Calyptomerus dubius* Marsh., body in lateral view (position of metasternum).
E *Clambus* sp., body in lateral view (position of metasternum).

Distribution: Europe (except northern areas), Morocco, South Africa (Cape Province), Tasmania. The origin of the South African and Tasmanian populations is not known; importation is likely but there is no evidence.

Three type specimens of *Clambus corylophoides* Lea in the South Australian Museum were examined. The male specimen, without head and pronotum, was dissected. The external characters as well as those of the male genitalia are identical with specimens of *Calyptomerus dubius* Marsh. from the Palaearctic and from South Africa; therefore *Clambus corylophoides* Lea has to be considered as a junior synonym of *Calyptomerus dubius* Marsh.

Genus **SPHAEROTHORAX** Endrödy-Younga, 1959

Sphaerothorax Endrödy-Younga, 1959, Opusc. Ent., 24: 88-89; 1960, Ann.Hist.Nat.Mus. Hung., 52: 241-244; 1965, Ann.Hist.Nat. Mus.Hung., 57: 259.

Type: *Clambus tasmani* Broun.

Morphologically this genus is intermediate between *Calyptomerus* and *Clambus*. It seems to be endemic to the Australian region.

Convex, especially in front; shiny reddish brown to almost black; some species with sparse and long setae on head, pronotum and elytra. Head narrower than pronotum, short, clypeus flatly arcuate in front. Antennal fossa far in front of eyes (like *Calyptomerus* but in contrast to *Clambus*). Eyes framed by temporal margin of clypeus but free at back, behind the temporal angle (Fig. 1 C). Pronotum longer and broader than head, as broad as elytra at shoulders. Lateral margin between front and hind angles distinct, more or less arcuate. Elytra convex, margined at the sides and from behind scutellum at suture. Metasternum large, with a sharp transverse crest about in the middle; hind part of metasternum horizontal, slightly convex transversally, front part almost vertically dropping to metasternum (Fig. 1 E). Mesosternum very small. Hind coxal plates large, much longer than hind part of metasternum. Abdomen five segmented. Antennae 10 segmented with two enlarged basal and two large club segments. Parameres bilobed, fused at base, penis varying in shape according to species.

The external characters of the species are not very marked and without comparative material it is difficult to distinguish the three species. The male genitalia however are very distinctive for each species.

*2

Key to Species

1. Horizontal, hind part of metasternum with clear-cut, large punctures for whole width. Minute pubescence of head and pronotum more visible. Subsutural margins of elytra visible close behind scutellum. Penis between the large and rounded parameres appearing thin and strongly curved (Fig. 2 C, D). 1·4-1·6 mm. Tasmania
   1. *Sphaerothorax tierensis* (Blackburn)

   Horizontal, hind part of metasternum without clear and distinct punctation in the middle. Minute pubescence and punctation of head and pronotum not or hardly visible. Subsutural margins of elytra appear further behind scutellum. Paramere lobes pointed, penis not curved back towards the base 2

2. Larger, more elongate. Elytra behind shoulders semiparallel, in lateral view sutural line not evenly curved. Penis dilated before pointed apex (Fig. 2 E, F). 1·3-1·6 mm. Tasmania
   2. *Sphaerothorax tasmani* (Blackburn)

   Smaller, elytra both in dorsal and in lateral view evenly arcuate. Penis broad at base with a long and narrow apical process (Fig. 2 A, B). 1·2 mm. New Zealand
   3. *Sphaerothorax suffusus* (Broun)

1. **Sphaerothorax tierensis** (Blackburn, 1902) (Fig. 2 C-D)

Clambus tierensis Blackburn, 1902, Trans.Roy. Soc.S.Austr., 26: 289; Lea, 1912, Proc.Lin. Soc.N.S.Wales, 36: 459.

Clambus latens Lea, 1912, Proc.Lin.Soc.N.S. Wales, 36: 457 (*syn. nov.*).

Clambus pubiventris Lea, 1912, Proc.Lin.Soc. N.S.Wales, 36: 456 (*syn. nov.*).

Sphaerothorax tierensis Endrödy-Younga, 1960, Ann.Nat.Hist.Mus.Hung., 52: 242.

Location of types:

Clambus tierensis Blackburn: Lectotype ♂, Tasmania, British Museum (Natural History), London.

Clambus latens Lea: Lectotype ♂ and three further paratypes, Stonor, Tasmania (probably from tussocks), A. M. Lea, in South Australian Museum, Adelaide.

Clambus pubiventris Lea: Holotype ♂ and two further paratypes from the same locality, Mount Wellington, Tasmania, A. M. Lea, in South Australian Museum, Adelaide.

Elongate ovate, shiny dark brown with lighter transparent lateral lobes of pronotum and front margin of clypeus. Lighter coloured specimens not rare.

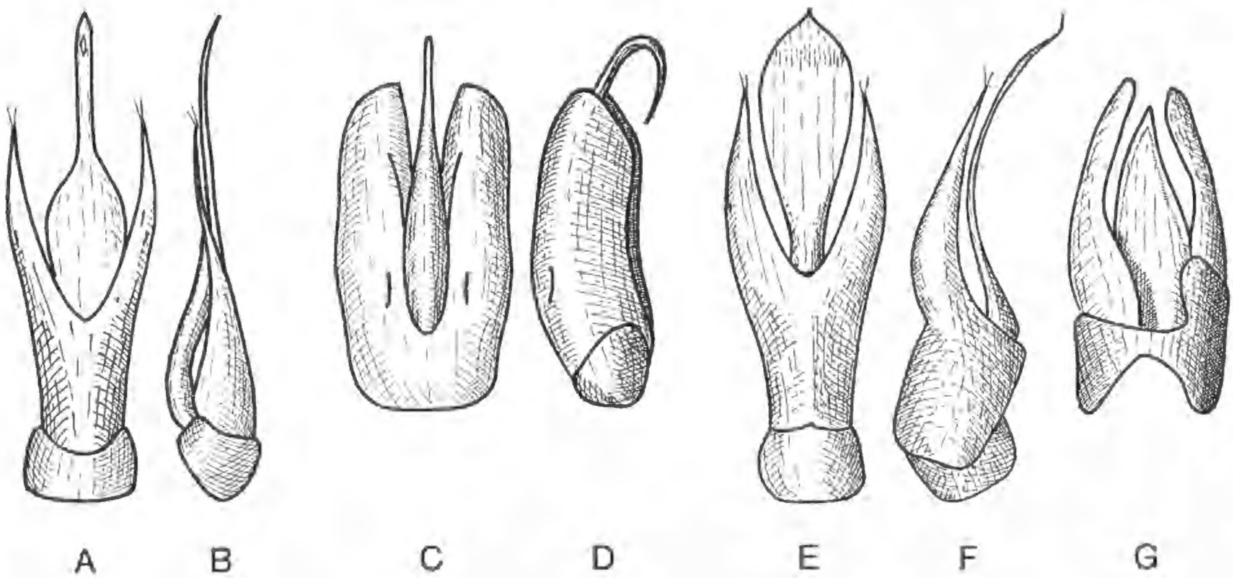

FIG. 2

A *Sphaerothorax suffusus* Broun, aedeagus in ventral view;
B same in lateral view.
C *Sphaerothorax tierensis* Blackb., aedeagus in ventral view;
D same in lateral view.
E *Sphaerothorax tasmani* Blackb., aedeagus in ventral view;
F same in lateral view.
G *Calyptomerus dubius* Marsh., aedeagus in ventral view.

Head broad and short, narrower and shorter than pronotum. Front margin of clypeus between the antennal fossa slightly trilobate, median lobe almost four times broader than one of the lateral ones; median lobe very flatly arcuate, finely emarginate in the middle. Pubescence of disc very short and fine with a few short additional setae. Elytra much longer than their combined breadth (46:38), evenly arcuate, both in dorsal and in lateral view. Subsutural striae of elytra appear close behind scutellum, there fine, slightly diverging from one another, behind the last two-fifths very distinct, parallel. Surface shiny with nearly evenly distributed and similar setae. Hind, horizontal part of metasternum with distinct, large punctures. Punctures in the middle set in two to three rows but more confused laterally. Inclined setae of transverse crest do not reach the hind margin of metasternum. Short and dense pubescence of abdomen collected into a tuft on anal sternite. Male genitalia 0·45 mm long and 0·2 mm broad (Fig. 2 C, D).

Length: 1·4-1·6 mm—*breadth*: 0·8-0·9 mm.

Distribution: Tasmania: Hobart, Stonor, Mount Wellington, New Norfolk.

The type specimens of *Clambus latens* Lea are paler than average *S. tierensis* but are obviously immature, the genitalia of the dissected specimen (lectotype) are feebly sclerotised. No specific difference could be found between the compared lectotypes, therefore *Clambus latens* Lea has to be considered as a junior synonym of *Sphaerothorax tierensis* (Blackburn).

The type specimens of *Clambus pubiventris* Lea are similar to *S. tierensis* (Blackb.). The aedeagus of the first specimen on the label (holotype) is visible without dissection and is identical with that of *S. tierensis*. The colour and setae of the elytra mentioned as specific characters by Lea in the original diagnosis are also characters of *S. tierensis*. The size of the type specimens is within the size range of *S. tierensis* and in the shape no distinct difference could be found. *Clambus pubiventris* Lea has to be considered as a junior synonym of *Sphaerothorax tierensis* (Blackb.). The three type specimens are mounted on the same label, the first from the left, marked as "typ" by Lea should be accepted as holotype. The specimen in the middle had no head and pronotum at the time of the present examination.

2. **Sphaerothorax tasmani** (Blackburn, 1902)
(Fig. 2 E-F)

Clambus tasmani Blackburn, 1902, Trans.Roy. Soc.S.Austr., 26: 288. Lea, 1912, Proc. Lin.Soc.N.S.Wales, 36: 458.

Clambus rufocastaneus Lea, 1912, Proc.Lin.Soc. N.S.Wales, 36: 457 (*syn. nov.*).

Sphaerothorax tasmani Endrödy-Younga, 1959, Opusc.Ent., 24: 89; 1960, Ann.Hist.Nat. Mus.Hung., 52: 243-244.

Location of types:

Clambus tasmani Blackburn: Lectotype ♂, Tasmania, in British Museum (Natural History), London.

Clambus rufocastaneus Lea: Lectotype ♂, Huon River, Tasmania (in tussocks), A. M. Lea, and one further paratype from the same locality, in South Australian Museum, Adelaide.

Elongate ovate, shiny reddish or chestnut brown, lateral lobes of pronotum and lateral margins of elytra (where body does not give a shade) lighter transparent. Setae of elytra numerous, very strong and long.

Head shorter and narrower than pronotum. Front margin of clypeus slightly trilobate, median lobe less than double width of a lateral lobe. Front margin of median lobe only very slightly arcuate, not emarginate in middle. Setae of clypeus longer than in *S. tierensis* but the fine pubescence even less visible. Pronotum convex, margin of lateral lobes finely arcuate, front and hind angles rounded but distinct. Surface very shiny with a pair of setae (on rubbed specimens only the basal punctures visible). Elytra longer than combined breadth (45:36). Sides in dorsal view nearly parallel behind shoulders. Subsutural striae distinct but shorter in front, first visible at the first two-fifths behind scutellum. Setae on disc and lateral margin similar, very long and strong. Horizontal, hind part of metasternum shiny, only punctate laterally close to the transverse crest. Recumbent setae of crest reach or surpass the hind margin of metasternum. Abdomen densely pubescent with a tuft of short hairs on the anal sternite. Male genitalia 0·5 mm long and 0·15 mm broad (Fig. 2 E, F).

Length: 1·4-1·6 mm—*breadth*: 0·8-0·9 mm.

Distribution: Tasmania: Launceston, Mount Wellington, Frankford.

The type specimens of *Clambus rufocastaneus* Lea are identical with specimens of *S. tasmani*, the male genitalia are also similar. The smaller size and lighter colour mentioned by Lea in the original diagnosis are within the variability of *S. tasmani*, and the subsutural striae are also characters of it. *Clambus rufocastaneus* Lea has to be considered as a junior synonym of *S. tasmani* (Blackb.).

3. **Sphaerothorax suffusus** (Broun, 1886) (Fig. 1 C, 2 A-B)

Clambus suffusus Broun, 1886, Man.N.Zeal. Col., 2: 762.

Sphaerothorax maori Endrödy-Younga, 1959, Opusc.Ent., 24: 90; 1960, Ann.Hist.Nat. Mus.Hung., 52: 243.

Sphaerothorax suffusus Endrödy-Younga, 1965, Ann.Hist.Nat.Mus.Hung., 57: 259.

Location of types:

Clambus suffusus Broun: Lectotype ♂, New Zealand, Broun Coll. in British Museum (Natural History), London.

Sphaerothorax maori Endrödy-Younga: Holotype ♂, Wellington Prov., New Zealand, and a paratype, Auckland, New Zealand, in British Museum (Natural History), London. A further paratype with the latter locality in Natural History Museum, Budapest.

Smaller, elongate ovate, shiny reddish brown with lighter sides of pronotum and elytra. Setae of elytra somewhat shorter and less numerous than in *S. tasmani*, but much longer than in *S. tierensis*.

Head much shorter and, also narrower than pronotum. Front margin of clypeus slightly trilobed, median lobe less than double the breadth of a lateral lobe; front margin of lobes more arcuate (Fig. 1 C). Setae of clypeus short, fine pubescence of disc hardly visible. Pronotum convex, margin of lateral lobes evenly arcuate between lateral angles. Surface shiny with a pair of long setae. Elytra only slightly longer than combined breadth (39:36). Sides in dorsal view, and sutural line in lateral view evenly arcuate. Subsutural striae of elytra first appear just before the second third of length. Setae numerous along lateral margins with some additional ones at shoulder and near apex. Ventral side similar to that of *S. tasmani*, but without the accumulation of hairs on anal sternite. Male genitalia 0·48 mm long and 0·1 mm broad (Fig. 2 A, B).

Length: 1·15-1·35 mm—*breadth*: 0·85-0·90 mm.

Distribution: New Zealand: Wellington, Auckland, Rotorua.

Genus **Clambus** Fischer von Waldheim, 1820

Clambus Fischer von Waldheim, 1820, Ent. Russ., 1: 20. Endrödy-Younga, 1960, Acta Zool.Acad.Sci.Hung., 6: 257-303.

Johnson, 1966, Handb.Ident.Brit.Ins., Clambidae, vol. 6, part 6 (a): 1-13 (Roy. Ent. Soc.,London).

Sternuchus Leconte, 1850, *in* Agassiz (ed.), "Lake Superior", p. 222.

In general appearance the genus is very homogeneous and most of the species can only be characterized by minute but usually very constant characters. The male genitalia (penis and the fused parameres) appear to be the best specific characters.

Small, between 0·9 and 1·8 mm, almost spherical to elongate ovate, semiglobular to pear-shaped, *i.e.*, flattened or narrower towards apex of elytra. Surface polished, shiny or sometimes with reticulate microsculpture, if latter, more distinct at apical part of elytra or on ventral surface. Pubescence very characteristic, varying from hardly visible fine hairs to a fairly dense vestiture of long setae. Normally unicoloured brown or black, usually with lighter transparent lateral margin of pronotum and elytra.

Head large and broad, clypeus broadly arcuate between temporal angles. Eyes entirely framed by temporal margin of clypeus (Fig. 1 B), divided into a dorsal and a ventral part. Hind angle of clypeus (temporal angle) situated beside or behind eyes. The pubescence of clypeus is characteristic and can be used for the grouping of species. Pronotum large and convex with distinct lateral margins. Lateral margin broadly and almost evenly arcuate, or straight between front and hind lateral angles: hind angle if distinct more flatly arcuate than front angle. Elytra longer, only exceptionally slightly shorter than combined breadth, uniformly convex or flattened or contracted towards apex. Metasternum, along a deeply bent transverse crest, divided into an almost vertical front and a horizontal hind part (Fig. 1 E). Metasternum very short, only accommodating median coxae. Abdomen 5-segmented. Antennae 10-segmented with two enlarged basal and two club segments. Penis dilated or tubular, parameres fused at base, there with an additional, usually less sclerotised, genital segment.

The genus is widely distributed in all temperate and tropical regions. Only four species are known from the Australian region.

SYSTEMATIC TREATMENT

Key to Species of the Australian Region

1. Head, pronotum and elytra apparently hairless in macroscopic view but minute hairs visible under strong magnification. Punctation on whole disc of elytra very fine. Horizontal, hind part of metasternum reduced to the deeply curved transverse crest at the middle (Fig. 3 A) 2

   Dorsal and ventral surface distinctly pubescent. Punctation of elytra fine at base but very distinct behind the middle. Horizontal, hind part of metasternum also quite long medially, transverse crest less curved (Fig. 1 E) 3

2. Temporal margin of clypeus almost straight in front of temporal angle (Fig. 3 B). Somewhat more elongate ovate, shoulders almost rectangular (Fig. 3 C). Apex of anal sternite simply excised with only one horizontal set of hairs (Fig. 3 D). Club of antennae broader ovate, last funicular segments broader than long. Penis simply curved (Fig. 3 F), apex triangular and shorter (Fig. 3 E), 1·3 mm. Southern Australia
   1. *Clambus myrmecophilus* Lea

   Temporal margin of clypeus slightly more arcuate in front of temporal angle. More broadly ovate, shoulder broadly rounded (Fig. 4 A). Excision of anal sternite double curved, larger area pubescent (Fig. 4 B). Club of antennae with semi-parallel sides, last funicular segments not broader than long. Apex of penis distinctly hooked (Fig. 4 D) and more elongately pointed (Fig. 4 C), 1·3 mm. New Zealand
   2. *Clambus bulla* spec. nov.

3. Pubescence more distinct, longer, hairs on elytra closer to each other than length of a single hair. Temporal margin of clypeus straight to the temporal angle. Penis truncate or flattened at apex (Fig. 5 A), 1·0-1·2 mm. Tasmania, South Australia
   3. *Clambus simsoni* Blackburn

   Pubescence not so distinct, shorter, hairs of elytra more spaced than length of a single hair. Temporal margin of clypeus slightly arcuate in front of temporal angle. Margins of penis evenly curved towards the rounded apex (Fig. 5 C), 0·9-0·95 mm. New Zealand, Southern Australia
   4. *Clambus domesticus* Broun

1. **Clambus myrmecophilus** Lea, 1910
(Fig. 3 A-F)

Clambus myrmecophilus Lea, 1910, Proc.Roy. Soc.Victoria, 23: 190.

Location of types:

Clambus myrmecophilus Lea: Holotype ♀, Portland, V., Inquiline, in South Australian Museum, Adelaide; Neoallotype ♂, South Australia, in author's collection.

Very convex, reddish brown, shiny, apparently glabrous, pubescence extremely fine.

Head large, convex, as large as pronotum between front angles of lateral lobes. Margin of clypeus evenly curved between temporal angles. Labrum very small. Eyes large on dorsal side, somewhat closer to temporal margin than to antennal fossa; on ventral side only few (probably three) ocelli free (Fig. 3 B), a similar reduction of eyes is known also from other regions (c.f. *C. kaszabi* E.-Y. from North Africa). Temporal margin only slightly curved; temporal angles behind eyes (Fig. 3 B). Pronotum convex, lateral lobes with short straight lateral margins, front angles narrower than hind angles. Elytra very convex, only slightly longer than combined breadth (38:35); sides in dorsal view and sutural line in lateral view evenly arcuate. Humeral angle of elytra sharp, almost rectangular (Fig. 3 C). Subsutural striae very faint, only visible near apex. Apical angles sharply rectangular. Ventral surface shiny; pubescence as fine as on the dorsal surface but basal punctures of hairs more distinct. Transverse crest of metasternum very deeply bent in the middle, there touching the hind margin of the plate (Fig. 3 A). Hind coxal plate large, longer than horizontal part of metasternum laterally (Fig. 3 A). Apex of anal sternite simply and angularly excised with only a single line of fine and short yellowish hairs at base (Fig. 3 D). Antennae short, last two segments of funiculus (seventh and eighth segments) broader than long; club ovate. Penis 0·32 mm long and 0·04 mm broad, parallel to apex; apex triangular with tip rounded; in lateral view simply curved. Parameres 0·2 mm long and 0·06 mm broad, deeply and symmetrically excised, excision acute-angular, apices with very fine setae (Fig. 3 E, F). The description of male characters is based on a specimen from South Australia in the author's collection (Neoallotype).

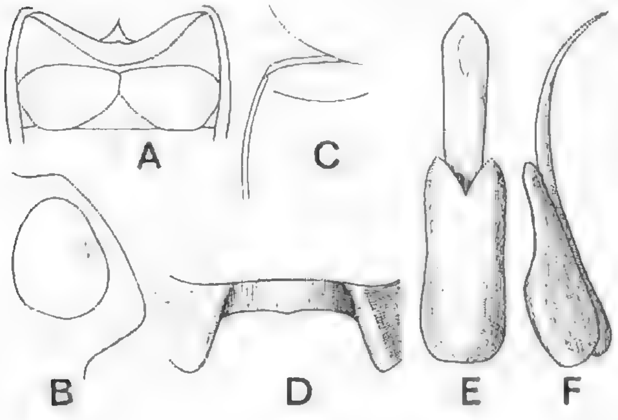

FIG. 3

A *Clambus myrmecophilus* Lea, metasternum and hind coxal plate;
B same, eye with temporal margin and angle in dorsal view with the position of ventral ocelli marked;
C same, humeral angle, semidorsal view;
D same, excision of anal sternite;
E same, aedeagus in ventral view;
F same, aedeagus in lateral view.

Length: 1·3 mm with head bent—*breadth*: 0·88 mm.

Distribution: Victoria, South Australia.

2. **Clambus bulla** Endrödy-Younga, n. sp. (Fig. 4 A-D)

Holotype ♂: New Zealand, Broken Riv., 15.1.1908, Broun coll., 1922-482, in British Museum (Natural History) London.

Very similar to *C. myrmecophilus*. The diagnosis is restricted to characters which are different; others mentioned only under the former species are identical.

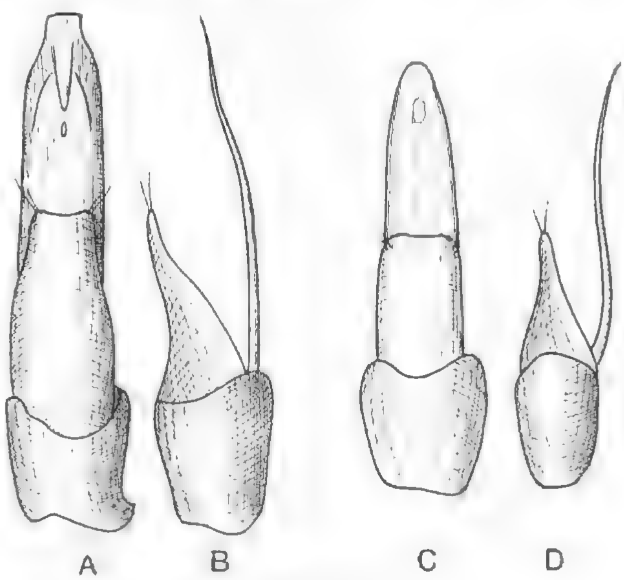

FIG. 4

A *Clambus bulla* spec.nov., humeral angle in semi-lateral view;
B same, excision of anal sternite;
C same, aedeagus in ventral view;
D same, aedeagus in lateral view.

More broadly ovate, temporal margin of clypeus somewhat more strongly bent (compare Fig. 3 B). Humeral angle of elytra rounded (Fig. 4 A). Elytra shorter, as long as combined breadth. Excision of anal sternite double-curved at base, here more densely pubescent (Fig. 4 B). Last two segments of funiculus (seventh and eighth segments of antennae) not broader than long; club of antennae more parallel at sides. Penis 0·4 mm long and 0·05 mm broad, apex more acute with tip rounded. Apex of penis hooked in lateral view. Fused parameres 0·28 mm long and 0·08 mm broad slightly dilated towards apex, apex symmetrically but less deeply excised, excision rectangular (Fig. 4 C, D).

Length: 1·3 mm, with head bent—*breadth*: 1·0 mm.

Distribution: New Zealand.

3. **Clambus simsoni** Blackburn, 1902
(Fig. 5 A-B)

Clambus simsoni Blackburn, 1902, Trans.Roy. Soc.S.Austr., 26: 288. Endrödy-Younga, 1959, Opusc.Ent., 24: 95; 1965, Ann.Hist. Nat.Mus.Hung., 57: 260-261.

Clambus flavipes Lea, 1912, Proc.Lin.Soc.N.S. Wales, 36: 456 (*syn. nov.*).

Location of types:

Clambus simsoni Blackb.; Lectotype ♂, Tasmania, Simson, Broun Coll. B.M. 1910-236, in British Museum (Natural History), London.

Clambus flavipes Lea: Holotype ♂, Gordon River, Tasmania, J. E. Philip, in South Australian Museum, Adelaide.

Light to dark brown with long shiny pubescence. Moderately convex. Front part of dorsal surface shiny, with only indistinct microsculpture and minute basal punctures of hairs, latter becoming very distinct in the hind third of elytra.

Head large, margin of clypeus broadly and evenly arcuate between temporal angles. Temporal margin almost straight between antennal fossa and temporal angle. Temporal angle situated beside eye, i.e., an imaginary line between temporal angles cuts through eyes. Eyes large both on dorsal and ventral side of head, equally close to antennal fossa and to temporal margin in front. Pubescence uniform, shorter than on elytra. Pronotum convex. Hind angle of lateral lobes broadly, front angle more narrowly, arcuate; lateral margin slightly curved. Pubescence as on head. Elytra longer than combined breadth (35:30), sides more strongly arcuate towards apex than behind shoulders. Humeral angle nearly rectangular or slightly obtuseangulate. Sutural line in lateral view more strongly arcuate behind scutellum than towards apex. Sutural striae fine, appearing only before middle of elytra. Pubescence long, more closely set than the length of hairs. Transverse crest of metasternum moderately bent in the middle, here also leaving a comparatively long piece of the horizontal part. Hind, horizontal part of the metasternum, hind coxal plates and abdominal segments evenly pubescent, as on elytra; basal punctures of hairs strongest on hind coxal plates. Legs and antennae reddish yellow. Penis 0·27 mm long and 0·04 mm broad, parallel, with apex contracted. Apex broadly truncate; in lateral view slightly curved to parameres, apical two-thirds straight. Fused parameres 0·15 mm long and 0·05 mm broad, contracted towards apex, apex excised with fine setae at points (Fig. 5 A, B). A specimen from S.E. Queensland has broader penis with less contracted apex.

Length: 1·0-1·2 mm with head bent—*breadth*: 0·75-0·85 mm.

Distribution: Tasmania and Eastern Australia.

The type specimen of *C. flavipes* is light brown and therefore its pubescence less apparent, though identical with that of darker specimens. Subsutural striae present, very fine as is general with this species. Male genitalia identical with that of the lectotype of *C. simsoni*. *Clambus flavipes* Lea has to be considered as a junior synonym of *Clambus simsoni* Blackb.

4. **Clambus domesticus** Broun, 1886
(Fig. 5 C-D)

Clambus domesticus Broun, 1886, Man.N.Zeal. Col., 3: 762. Endrödy-Younga, 1959, Opusc.Ent., 24: 96; 1965, Ann.Mus.Nat. Hist.Hung., 57: 259-260.

Clambus tropicus Blackburn, 1903, Trans.Roy. Soc.S.Austr. 27:97.

Location of types:

Clambus domesticus Broun: Lectotype ♂, New Zealand, Broun coll., B.M. 1922-482. (1350), in British Museum (Natural History), London.

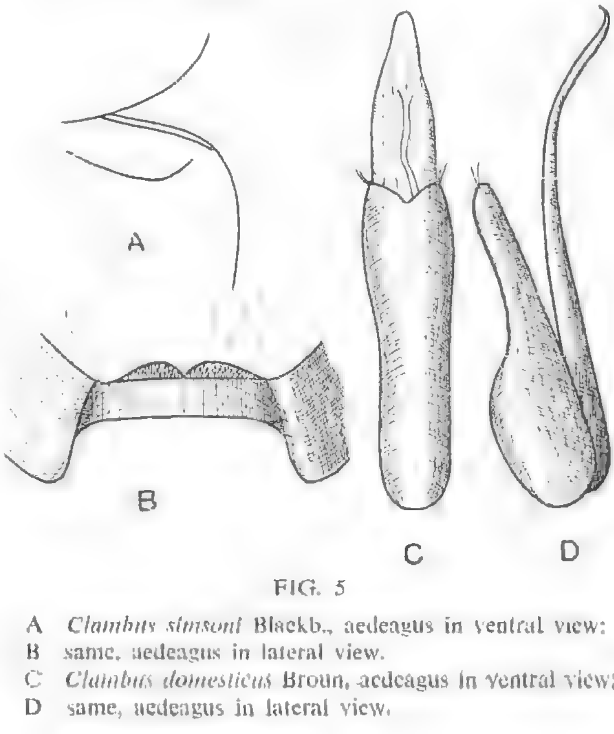

FIG. 5

A *Clambus simsoni* Blackb., aedeagus in ventral view;
B same, aedeagus in lateral view.
C *Clambus domesticus* Broun, aedeagus in ventral view;
D same, aedeagus in lateral view.

Clambus tropicus Blackb.: Lectotype ♀, Australia, Blackburn coll., B.M. 1910-236, in British Museum (Natural History), London.

This species is very similar and is apparently closely related to *C. simsoni*. Therefore the diagnosis hereunder is only extended to those characters which are different; others, mentioned only under *C. simsoni* are identical.

Smaller, pubescence much shorter, dark, less apparent. Colour, punctation and microsculpture similar. Temporal margin of clypeus distinctly arcuate in front of temporal angle, latter less obtuse. Pubescence denser in front of, than between the eyes. Pubescence of elytra similar to that between eyes, hairs wider apart than their length. Pubescence of ventral surface longer than that of dorsal surface, here very similar to *C. simsoni*. Penis 0·22 mm long and 0·04 mm broad, simply curved to the apex, in lateral view more smoothly arcuate. Fused parameres 0·14 mm long and 0·05 mm broad, truncate or slightly emarginate at apex, rounded apical angles with fine setae (Fig. C, D).

Length: 0·9-0·95 mm with head bent—*breadth*: 0·7 mm.

Distribution: New Zealand and Southern Australia.

Taxonomic status of other species described under the family Clambidae

Clambus semiflavus Lea, 1926, Proc.Roy.Soc.S. Austr., 50: 51.

Lectotype ♂: Northern Queensland, Blackburn coll., in South Australian Museum, Adelaide.

The species belongs to the genus *Cybocephalus* Erichson in the family Cybocephalidae. In that genus this species name is already preoccupied by *Cybocephalus semiflavus* Champion, 1925, Ent.Mo.Mag.: 263, from Kumaon, India. Lea's species has therefore to be transferred to the family Cybocephalidae under a *nomen novum*, for which I propose *Cybocephalus leai* nom.nov.

Clambus australiae Lea, 1926, Trans.Ent.Soc. London, 74: 280.

Lectotype ♂: West Australia, King George's Sound, C. Darwin coll., in South Australian Museum, Adelaide.

This species also belongs to *Cybocephalus* Erichson, Cybocephalidae, and becomes *Cybocephalus australiae* (Lea) nov. comb.

Clambus vestitus Broun, 1886, Man.N.Zeal.Col., 2: 762.

Lectotypus ♂: New Zealand, in British Museum (Natural History), London.

The species apparently belongs to the family Anisotomidae. The generic characters of the species required the establishment of a new genus and it was transferred to the family Anisotomidae (Leiodidae) under the name *Australiodes vestitus* (Broun) in Endrödy-Younga, 1960, Ann.Mus.Nat.Hist.Hung., 52: 239-240.

SUMMARY

Since 1886, when the second part of Broun's Manual of the New Zealand Coleoptera was published with the description of the first species of Clambidae in this region, 16 species have been described, all, with one exception, under the genus *Clambus*. The revision of these species was begun by the present author in 1959 when a genus, *Sphaerothorax*, was established for a distinctly different group of the family. Later, after a study of the type specimens of the British and South Australian Museums, a further genus, *Calyptomerus* Redth. is identified and the taxonomic status of all described species clarified. *Clambus bulla* is described as a new species.

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LIST OF SPECIES

Family Clambidae

Calyptomerus Redtenbacher

- *C. dubius* Marsham
  - = *Clambus corylophoides* Lea

Sphaerothorax Endrödy-Younga

- *S. tierensis* (Blackburn)
  - = *Clambus tierensis* Blackburn
  - = *Clambus latens* Lea
  - = *Clambus pubiventris* Lea
- *S. tasmani* (Blackburn)
  - = *Clambus tasmani* Blackburn
  - = *Clambus rufocastaneus* Lea
- *S. suffusus* (Broun)
  - = *Clambus suffusus* Broun
  - = *Sphaerothorax maori* Endrödy-Younga

Clambus Fischer von Waldheim

- *C. myrmecophilus* Lea
- *C. bulla* spec. nov.
- *C. simsoni* Blackburn
  - = *Clambus flavipes* Lea
- *C. domesticus* Broun
  - = *Clambus tropicus* Blackburn

Family Cybocephalidae

Cybocephalus Erichson

- *C. leai* **nom. nov.**
  - = *Clambus semiflavus* Lea
- *C. australiae* (Lea)
  - = *Clambus australiae* Lea

Family Leiodidae

Australiodes Endrödy-Younga

- *A. vestitus* (Broun)
  - = *Clambus vestitus* Broun

RECORDS OF THE
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N. B. Tindale

A REVISION OF THE AUSTRALIAN GENUS STENASPIDIUS WESTWOOD (Coleoptera, Scarabaeidae, Geotrupinae)

By H. F. HOWDEN

SOUTH AUSTRALIAN MUSEUM
North Terrace, Adelaide
South Australia 5000

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BY H. F. HOWDEN

Summary

The Australian genus *Stenaspidius* Westwood is revised, and the species are keyed and illustrated. Five species are recognized: *S. nigricornis* Westwood from southern Western Australia, *S. brittoni* n. sp. from southern Western Australia, *S. matthewsi* n. sp. from west central Western Australia, *S. ruficornis* Boucomont from South Australia, Victoria and New South Wales and *S. albosetosus* n. sp. from the northern portions of Queenlsand, Northern Territory and Western Australia.

A REVISION OF THE AUSTRALIAN GENUS STENASPIDIUS WESTWOOD (COLEOPTERA, SCARABAEIDAE, GEOTRUPINAE)

By H. F. HOWDEN

Biology Department, Carleton University, Ottawa, Canada

ABSTRACT

HOWDEN, H. F. 1974. A revision of the Australian genus *Stenaspidius* Westwood (Coleoptera, Scarabaeidae, Geotrupinae). Rec. S. Aust. Mus., 17 (2): 11-21.

The Australian genus *Stenaspidius* Westwood is revised, and the species are keyed and illustrated. Five species are recognized: *S. nigricornis* Westwood from southern Western Australia, *S. brittoni* n. sp. from southern Western Australia, *S. matthewsi* n. sp. from west central Western Australia, *S. ruficornis* Boucomont from South Australia, Victoria and New South Wales and *S. albosetosus* n. sp. from the northern portions of Queensland, Northern Territory and Western Australia.

INTRODUCTION

On 21st March, 1848, J. O. Westwood read a paper entitled "On the Australian species of the coleopterous genus *Bolboceras*, Kirby" in which he described as new the species *Bolboceras* (*Stenaspidius* [new subgenus]) *nigricornis*. A short version of this paper which validated the names was published in 1848 in The Annals and Magazine of Natural History, Volume 2. An expanded version of the same paper, including figures, was subsequently published in 1852 in The Transactions of the Linnean Society of London, Volume 21. In 1856 Lacordaire gave *Stenaspidius* Westwood generic rank, and subsequent authors have concurred with this. In 1906 a second Australian species, *S. ruficornis*, was described by Boucomont. Paulian (1939) described a third species, *S. wagneri*, from South America which was later correctly synonymized by Martínez (1952) under *Athyreus ruficollis* Bruch (1925). At the same time Martínez transferred *ruficollis* into the genus *Stenaspidius*. Recent studies have shown that *ruficollis* is not congeneric with the Australian species and it has been transferred to a separate genus *Bolbothyreus* (Howden, 1974). *Stenaspidius*, as presently constituted, is an endemic Australian genus containing five species.

A number of people have assisted me with the present study and their generous help is gratefully acknowledged. In the following list of persons and institutions lending material, the abbreviations in parentheses are those used in the text:

E. B. Britton, Australian National Insect Collection, Division of Entomology, CSIRO, Canberra (ANIC).

A. Descarpentries, Muséum National d'Histoire Naturelle, Paris (MNHN).

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The scanning electron microscope pictures used herein were taken by L. E. C. Ling, Carleton University. This work has been supported, in part, by an operating grant from the National Research Council of Canada.

SYSTEMATIC TREATMENT

Stenaspidius Westwood

Westwood, J. O., 1848, p. 144; 1852, p. 17.

Lacordaire, T., 1856, p. 141.

Martínez, A., 1952, p. 326 (Catalogue of references to genus).

Howden, H. F., 1974, p. 1567.

Type-species, *Bolboceras* (*Stenaspidius*) *nigricornis* Westwood, 1848, by monotypy.

15th November, 1974.

Major characters that separate *Stenaspidius* from other genera in the tribe Bolboceratini are as follows: Each mandible moderately to distinctly lobed on outer margin; labrum with irregular transverse carina, at least in median half; clypeus slanting slightly to abruptly upwards to posterior carina, the carina often with median and lateral horns or tubercles; gena rounded or angulate; vertex with at least an indication of median horn; pronotum with complete marginal line, pronotal midline poorly to deeply indented; scutellum approximately twice as long as wide; each elytron with five striae between suture and humeral umbone, intervals broadly convex; fore tibia with five teeth on outer margin; middle and hind tibiae each with one complete subapical transverse carina on outer surface; middle coxae distinctly separated by metasternum. External sexual differences slight; in many males apex of the genital capsule visible between pygidium and last sternite.

The elongate scutellum will separate *Stenaspidius* from all other genera of Australian Geotrupinae except for the genus *Gilletinus* Boucomont. The broadly convex elytral intervals and five narrow striae between the suture and humeral umbone separate *Stenaspidius* from *Gilletinus* which has seven deep, broad, heavily punctate striae (instead of five) and abruptly convex elytral intervals.

The various species of *Stenaspidius* are poorly represented in collections. Adults come occasionally to light. Specimens are best collected by excavating their burrows and, in some cases at least, a number of adults have been found in a single burrow. The meagre data available indicates that the genus occurs (see map) most frequently in sandy soils in areas in which the rainfall exceeds 250 mm per year.

Key to the species of *Stenaspidius*

1. Frons, vertex and pronotum with scattered clumps of coarse punctures; much of vertex and central portion of pronotum impunctate or finely punctate 2

   Frons, vertex, and pronotum relatively evenly, coarsely, heavily punctate (Fig. 5), less so near posterior margin of pronotum; Kalbarri area, W.A.
   Stenaspidius matthewsi n. sp.

2. (1) Metasternum anteriorly elevated into a sharp, abruptly angulate point (e.g. Fig. 22); occurring in southern half of Western Australia 3

   Metasternum rounded or carinate anteriorly but with apex (viewed laterally) rounded, not sharply angulate to vertical face (Figs. 23, 24); occurring in northern or eastern Australia 4

3. (2) Horn on vertex (Fig. 2) distinctly transverse, usually slightly bifid at apex; male genitalia as in Fig. 20
   Stenaspidius nigricornis Westwood

   Horn on vertex (Fig. 3) longitudinal with base extending anteriorly, apex evenly rounded; male genitalia as in Fig. 18
   Stenaspidius brittoni n. sp.

4. (2) Posterior clypeal carina well developed, distinctly narrowed, the three horns obsolete and close together; metasternum distinctly carinate anteriorly; occurring in south-eastern Australia
   Stenaspidius ruficornis Boucomont

   Posterior clypeal carina poorly developed except for distinctly, widely separated horns; metasternum rounded anteriorly; occurring across northern Australia
   Stenaspidius alboseiosus n. sp.

Stenaspidius nigricornis Westwood

(Figs. 1, 2, 19, 20, 22)

Bolboceras (Stenaspidius) nigricornis Westwood, 1848, p. 144; 1852, p. 17.

Stenaspidius nigricornis Westwood, Boucomont, 1932, p. 264.

Males: Length 7·6 to 9·1 mm; greatest width 4·5 to 6·1 mm. Colour usually black, occasionally very dark brown; antennae and tarsi usually very dark brown. Clypeus (Fig. 2) rising at 45° to 55° angle to posterior carina; carina, in large specimens, with three low horns, median horn anterior in position. Face of clypeus on each side with U-shaped carina extending from median to lateral horn, the area encompassed usually as wide as deep or wider. Frons and vertex behind clypeal horns concave anterior to horn on vertex. Gena, frons, and vertex with scattered minutely or moderately sized punctures. Horn on vertex transverse, often pronounced (particularly in large specimens) and slightly bifid at apex (Fig. 2). Pronotum with midline distinctly indented, punctate; on each side on anterior third behind eyes a distinct, punctate indentation delimits an impunctate convexity (Fig. 1); pronotum in anterior lateral two-thirds moderately to heavily, irregularly punctate. Scutellum longitudinally shallowly concave; concave surface dull, often with vague, small punctures. Elytral striae moderately indented, finely punctate; intervals moderately convex, impunctate, smooth to vaguely transversely wrinkled. Metasternum (Fig. 22) narrowed anteriorly to sharply pointed apex, anterior face nearly vertical, slightly indented near apex. Genital capsule (Fig. 19) evenly narrowed to abruptly rounded apex. Genitalia (Fig. 20) with upper lobe of each paramere narrowed, then dorso-ventrally expanding near pointed apex.

Figs. 1-6. *Stenaspidius* spp: 1, Head and pronotum of *S. nigricornis;* 2, Head of *S. nigricornis;* 3, Head of *S. brittoni;* 4, Head of *S. ruficornis;* 5, Head and pronotum of *S. matthewsi;* 6, Lateral view of *S. albosetosus.*

*2

Females: Length 7·8 to 10·5 mm, greatest width 4·8 to 6·9 mm. Variation in females similar to that described for males, horns of small females being poorly developed, those of large females well developed. External sexual differences negligible.

Stenaspidius nigricornis can be distinguished by the following combination of characters: metasternum (Fig. 22) anteriorly narrowed to acutely pointed apex, anterior face nearly vertical, slightly indented by apex; posterior clypeal carina well developed, the three clypeal horns of the carina obtuse, not greatly elevated above the carina, the two lateral horns directly above the mandibular insertions; horn on vertex transverse, usually well developed (Fig. 2) and slightly bifid at apex; male genitalia (Fig. 20) very distinctive.

Type: Holotype, female, Swan River, No. 507 (Hope Museum, Oxford); specimen examined February, 1973.

Material examined: Thirty-one specimens bearing only the following data: 1—Australia; 3—S.W. Australia; 1—Australia Orient., February, 1896, Muller; 1—Nov. Holl. Occid.; 2—Albany, W.A.; 1—Bedfordale, W.A., March, 1951, W. M. O'Donnell; 1—Calgardup, 40—1580; 1—Deepdene, Karridale, W.A., 14th October, 1962, L. M. O'Halloran; 4—King George Sound (nr. Albany), W.A.; 2—Mundaring, W.A., J. Clark; 1—Nedlands, W.A., 27th November, 1939, P. N. Forte; 1—Pearce, Bullsbrook, W.A., 13th January, 1966, O. W. Richards; 1—Salmon Gums, 43—1226; 1—South Perth, W.A., 20th December, 1902, H. M. Giles; 2—Swan River, W.A., J. Clark; 1—Vasse; 2—Warren R. (nr. Pemberton?), W.A., W. D. Dodd; 4—William Bay, W.A., 31st October, 1967, E. Matthews; 1—Yallingup, S.W. Australia, 1st-12th December, 1913, R. F. Turner.

Specimens are in the following collections: ANIC, BM, DAWA, MNHN, NMV, SAM, WAM and Howden.

Stenaspidius brittoni n. sp.

(Figs. 3, 17, 18)

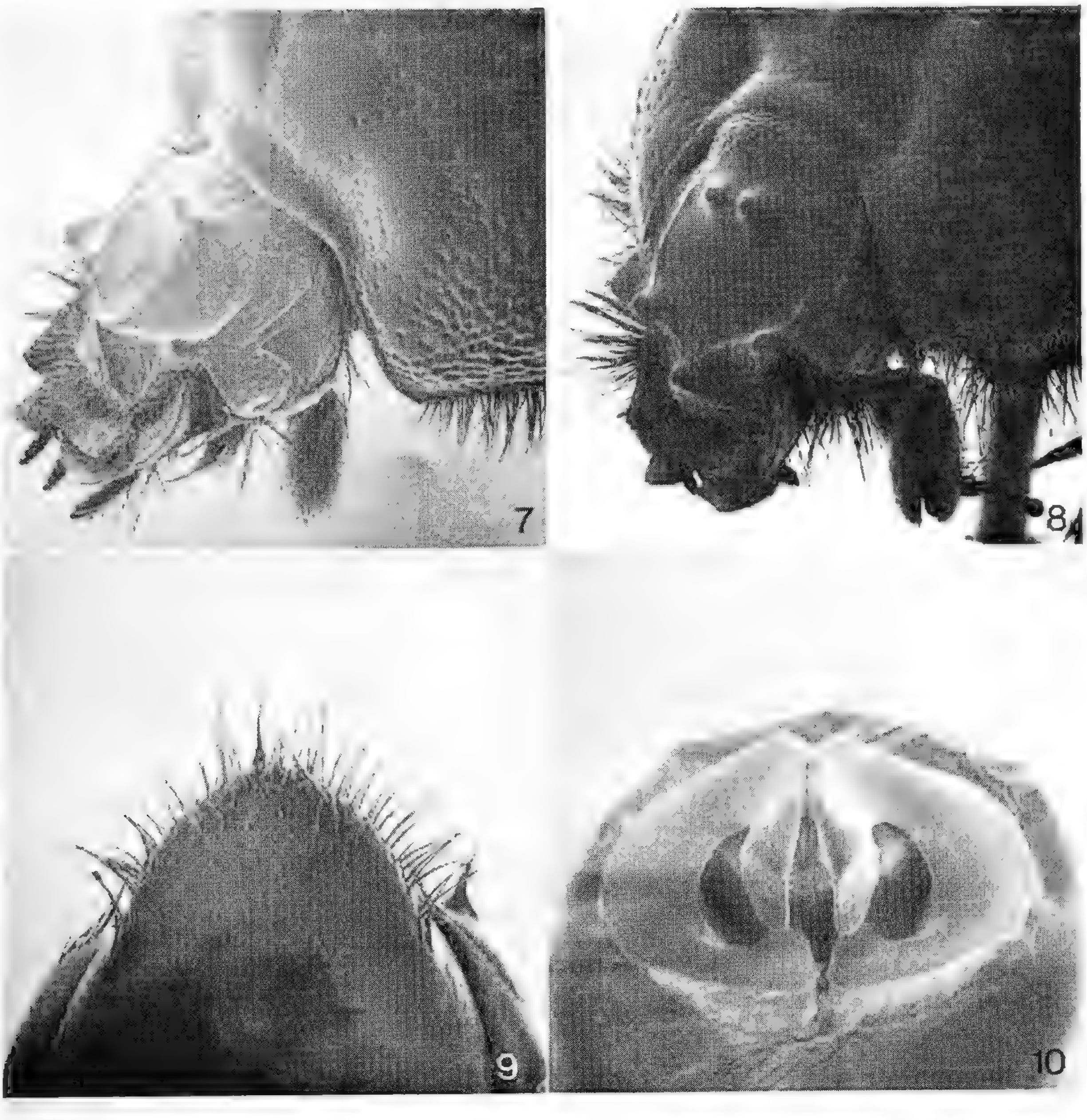
Holotype: Male, length 8·7 mm, greatest width 5·0 mm. Colour dark to very dark brown except dorsum of head and pronotum black. Clypeus (Fig. 3) rising abruptly to three horns at posterior margin; median horn anterior in position, with U-shaped carina on each side extending nearly to anterior margin of clypeus and thence to lateral horns; the U-shaped area approximately as deep as wide. Frons and vertex behind clypeal horns concave except for low, rounded, longitudinal median ridge extending posteriorly to slender horn at base of vertex (Fig. 3). Gena and vertex laterally with scattered coarse punctures, central concave portion of vertex with widely scattered, fine punctures. Pronotum with midline distinctly indented, punctate; on each side on anterior third behind eyes a shallow, punctate indentation delimits an impunctate convexity; pronotum in anterior lateral two-thirds with irregular coarse punctures. Scutellum longitudinally shallowly concave; surface of concavity dull, slightly irregular and with scattered fine punctures. Elytral striae moderately indented, finely punctate; intervals moderately convex, smooth, impunctate. Metasternum narrowing anteriorly to sharply pointed apex, anterior face vertical (metasternum very similar to *nigricornis*, Fig. 22). Genital capsule (Fig. 17) evenly narrowed to acutely rounded apex. Genitalia (Fig. 18) with upper lobe of each paramere evenly arcuate to acutely pointed apex.

Allotype: Female, length 7·1 mm, greatest width 4·4 mm. Similar to male except in following respects: colour brown (specimen teneral), clypeus rising less abruptly, clypeal horns poorly developed; frons and vertex less concave, horn of vertex low, rounded; rounded longitudinal ridge extending anteriorly from base of horn less well defined than in male.

Variation not mentioned in the description is slight. The single female paratype measures 6·6 mm in length and 4·2 mm in greatest width. The clypeal carina and the horn on the vertex are both poorly developed, and distinctly abraded. If the sexual differences in the horns of the head can be shown to be consistent, then *S. brittoni* must be considered to be the most obviously dimorphic species in the genus.

Stenaspidius brittoni is most closely related to *S. nigricornis*, differing from *nigricornis* in the following major characters: horn of vertex not transverse, rounded at apex; a low, rounded, longitudinal carina extending anteriorly from base of horn; genital capsule (Fig. 17) more acutely rounded at apex; genitalia (Fig. 18) with parameres evenly arcuate to acutely pointed apices.

The species is named in honour of Dr. E. B. Britton, who has greatly facilitated my studies on the Australian Geotrupinae.



Figs. 7-12. *Stenaspidius albosetosus*: 7, Head of male from Queensland; 8, Head of male from Western Australia; 9, Male genital capsule, Queensland specimen; 10, Frontal view of male genitalia, Queensland specimen; 11, Lateral view of male genitalia, Queensland specimen; 12, Lateral view of male genitalia, Western Australian specimen.

Type material: Holotype, male, no data (SAM). Allotype, female, Melville, Western Australia, No. 73/798 (WAM). Paratype, 1 female, Bunbury, Western Australia, Whitlock (AM).

Stenaspidius matthewsi n. sp.

(Figs. 5, 15, 16, 21)

Holotype: Male, length 7·2 mm, greatest width 4·5 mm. Colour dorsally very dark brown to black, ventral surfaces dark brown. Clypeus (Fig. 5) gradually sloped upward, at 10° to 15°, to low posterior carina; carina with three poorly developed horns, median one most prominent; U-shaped carina on either side anterior to median horn, irregular in shape. Vertex centrally with slightly bifid, transverse swelling. Entire dorsal surface of head coarsely, irregularly punctate. Pronotum (Fig. 5) with midline shallowly indented, on either side on anterior third of pronotum two or three vague, low convexities present; entire surface of pronotum except for posterior median sixth, coarsely punctate, with fine secondary punctures interspersed. Scutellum longitudinally concave; concave surface dull, granular, with two or three coarse punctures vaguely indicated near base. Elytral striae moderately deep for genus, finely punctate; intervals smooth, evenly convex longitudinally. Metasternum (Fig. 21) distinctly narrowed and carinate anteriorly, apex in lateral view broadly rounded, lobe-shaped. Genital capsule (Fig. 15) broad, tapering abruptly in apical third to rounded tip. Genitalia (Fig. 16) with parameres relatively broad, dorsally angulate before rounded apices.

Allotype: Female, length 7·7 mm, greatest width 4·8 mm. Similar to male in all major external characters except median bifid tumosity of vertex slightly larger, probably a function of the larger size.

Variation in the small series is negligible. Size ranges from 7·0 to 9·1 mm with females averaging larger than males. Width varies from 4·3 to 5·8 mm. The number of coarse punctures in the median, posterior third of the pronotum shows some minor variation. In other respects the characters seem quite stable.

Stenaspidius matthewsi can be readily separated from the other species in the genus by the following combination of characters: posterior clypeal carina low, horns poorly developed; pronotum and head dorsally heavily, closely punctate; pronotal midline shallowly indented; male genitalia as in Fig. 16.

It gives me considerable pleasure to name this species in honour of Dr. E. G. Matthews who has assisted me in many ways. We found the present species in open sandy areas along with several other species of Geotrupinae. One five foot square area when excavated to a depth of about 18 inches yielded eight *Stenaspidius matthewsi* and five *Eucanthus felschei* Boucomont. There was little surface evidence of burrows and no indication of any food, except possibly some rich, black deposits of humus in the soil (humus is used as larval food by some North American Bolboceratini; see Howden, 1955).

Type material: Holotype, male, 50 km E. Kalbarri, W. Australia, 6th August, 1972, E. G. Matthews (SAM). Allotype, female, same data as holotype (SAM). Paratypes, 3 males, 5 females: 3, same data as holotype; 4, 51 km E. Kalbarri, near Murchison River, W.A., 30th July, 1972, 6th August, 1972, H. F. Howden; 1, Highway 1, 59 km north of Murchison River, W.A., 4th August, 1972, H. F. Howden.

Paratypes are in the following collections: ANIC, SAM, Howden.

Stenaspidius ruficornis Boucomont

(Figs. 4, 13, 14, 24)

Bolboceras (*Stenaspidius*) *ruficornis* Boucomont, 1906, p. 452.

Males: Length 6·5 to 8·4 mm, greatest width 4·3 to 5·5 mm. Colour dorsally dark reddish brown, frequently head and pronotum black, antennal club usually reddish. Clypeus (Fig. 4) rising abruptly (90°) to trituberculate posterior carina, the elevated trituberculate portion of carina distinctly narrower than width of clypeus; anterior face with indistinct, irregularly U-shaped carina, the area encompassed deeper than wide. Clypeus, frontal area and gena with irregular, shallow, large puncture; frontal area behind clypeal carina concave, horn of vertex further forward than in *nigricornis*, transverse and slightly bifid at apex. Height of clypeal carina and of horn on vertex proportional to overall size, increasing in development as size increases. Pronotum with midline distinctly indented, on either side of anterior third of pronotum a second indented line, these indentations delimiting four broad, low, circular convexities; a pronounced transverse concavity present on pronotum behind head between anterior margin and circular convexities. Pronotal surface coarsely punctate on lateral thirds and to a lesser degree in indentations; convex areas largely impunctate. Scutellum longitudinally concave, concave surface irregularly, vaguely ridged and granular. Elytral striae moderately deep, finely punctate; intervals moderately convex, either smooth or with vague transverse wrinkles. Metasternum (Fig. 24) carinate, the carina when viewed laterally with apex rounded to nearly vertical anterior face. Genital capsule (Fig. 13) apically moderately broadly rounded in outline. Genitalia (Fig. 14) with dorsal portion of each paramere produced into a slender cylindrical arch.

Females: Length 7·2 to 9·1 mm, greatest width 4·7 to 5·8 mm. Externally not differing noticeably from males, the degree of development of the clypeal carina and of the horn of the vertex being associated with size rather than showing any sexual dimorphism.

The high, narrowed, trituberculate clypeal carina, the forward position of the horn of the vertex in line with the anterior edges of the eyes, and the reddish antennal club are characters that distinguish *ruficornis* from the other *Stenaspidius*. The male genitalia (Fig. 14) are also very distinctive and the range is apparently allopatric from others in the genus.

Types: Boucomont (1906) lists three specimens (cotypes): two from New South Wales, Australia, in the "Deutsches Entomologisches National Museum" (=Deut. Ent. Institute, Berlin?) and one female labelled "Australia, ex Musaeo Van Lansberge", now in the Paris Museum (MNHN). Since the species is easily recognizable and since I have seen only the Paris specimen, a lectotype designation does not seem to be necessary or advisable at present.

Material examined: Twenty-five specimens with the following data: 2—Australia; 2—S. Australia; 1—Adelaide, S. Australia; 1—Lucindale, South Australia; 2—Caulfield, Victoria, 3rd October, 1908, June, 1906; 3—North Melbourne, Vict.; 1—Nova Holland, 50404, ex Mus. Murray; 1—Portland, Vict., January, 1938, C. Oke; 1—Raymond Isl. near Bairnsdale, Vict., 21st October, 1907, W. W.; 1—Seaford, Vict., 4—Wannon, Hamilton, Vict., 10th October, 1947, B. B. Given; 6—Victoria.

Specimens are in the following collections: ANIC, BM, MNHN, NMV, SAM, Howden.

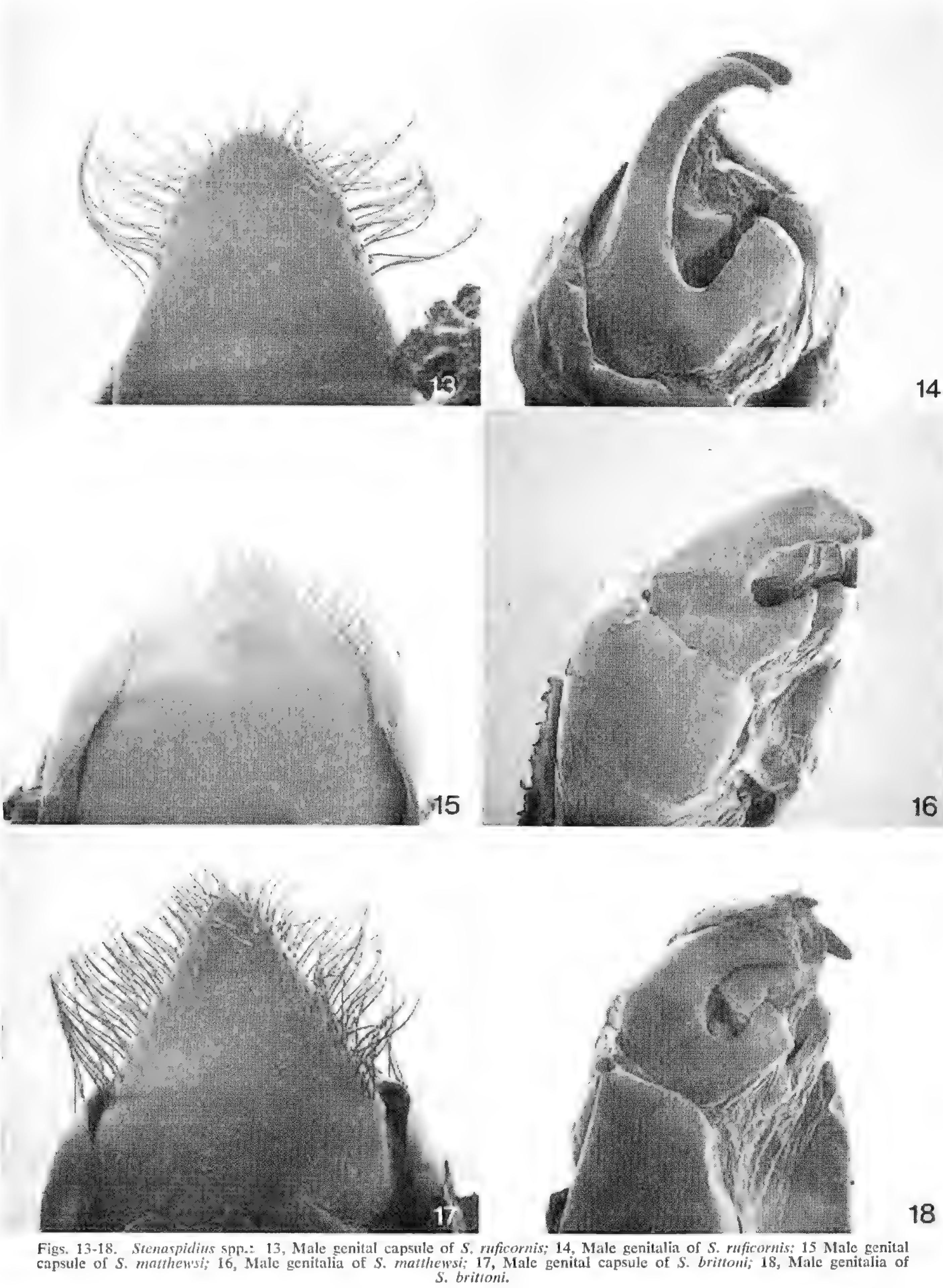
Stenaspidius albosetosus n. sp.

(Figs. 6, 7, 8, 9, 10, 11, 12, 23)

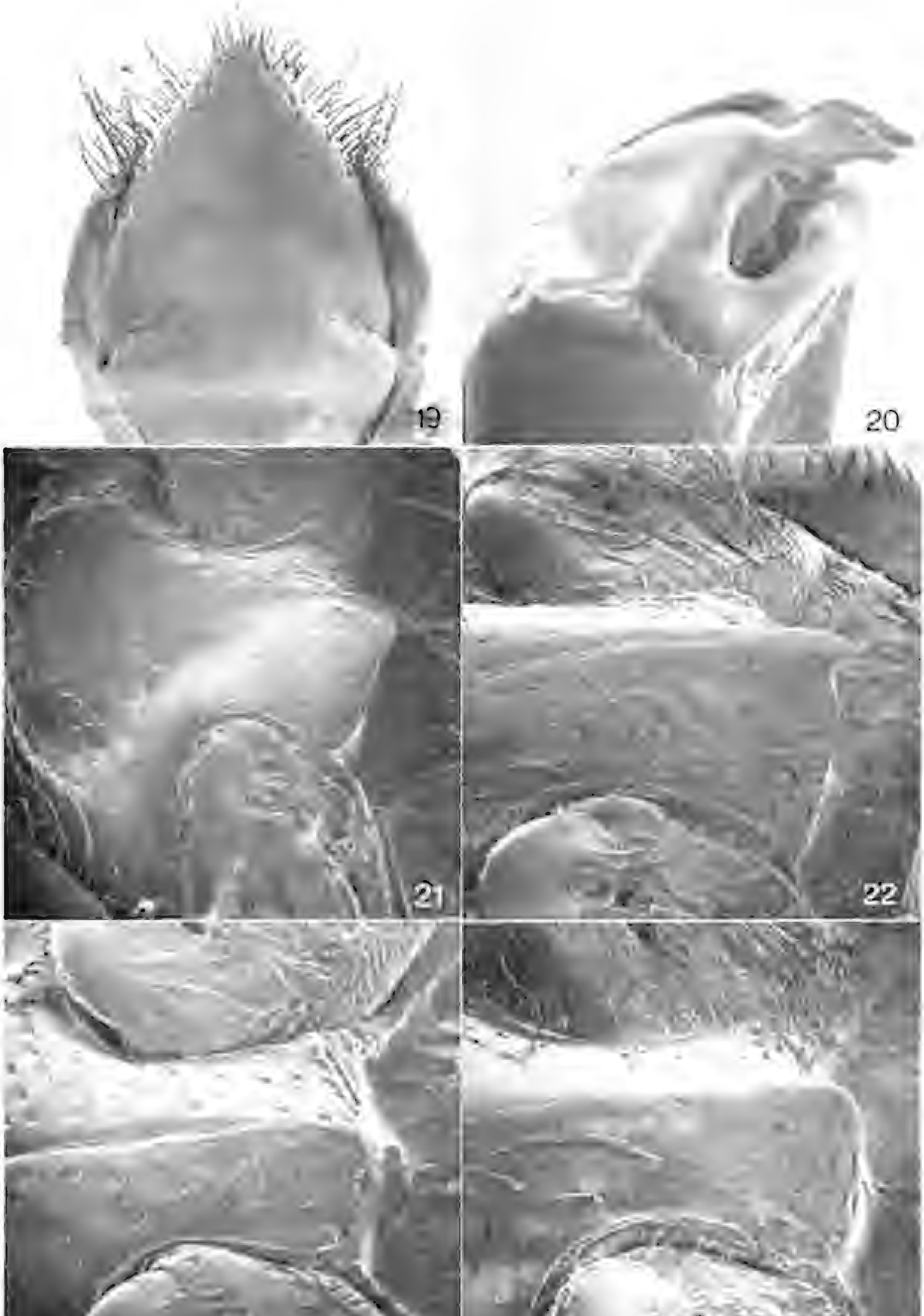
Holotype: Male, length 9·1 mm, greatest width 5·5 mm. Colour very dark brown with head, pronotum and scutellum black; base of the antenna, sides of prothorax (on ventral surface), and base of scutellum densely fringed with conspicuous, white setae; (in other species setae are less numerous and yellow, buff, or tan in colour). Clypeus (Fig. 7) rising abruptly to median anterior horn, gradually sloped upward to low, lateral portions of posterior carina; surface of clypeus divided into nearly equal thirds by U-shaped carina on either side of median tubercle or horn. Vertex posteriorly (Fig. 7) with low, slightly bifid transverse median tubercle; surface of frons and vertex between tubercle and clypeal carina flat or slightly concave and with scattered fine punctures. Pronotum (Fig. 7) with midline slightly to coarsely punctate and shallowly indented, a transverse line of punctures present at anterior third; marginal line behind head thickened, rounded; behind this pronotal surface transversely concave, coarsely punctate; pronotal surface behind eyes shallowly, broadly concave; pronotal surface coarsely punctate laterally (Fig. 6) and in a band near posterior third, elsewhere surface largely smooth and shining. Scutellum slightly concave medially; surface closely, irregularly, coarsely punctate, less so along lateral margins. Elytral striae moderately indented, finely to obsoletely punctate; intervals moderately convex, smooth and shining. Metasternum (Fig. 23) with midline distinctly indented, except anteriorly, not carinate anteriorly; metasternum anteriorly broadly rounded; surface with numerous coarse punctures. Genital capsule (Fig. 9) broad near abruptly rounded apex, dorsal surface near apex flat to shallowly concave. Genitalia (Figs. 10, 11) with each paramere bent, then thickened before acute apex; lower lobe of each paramere slender and sharply hooked near midline.

Allotype: Female, length 9·3 mm, greatest width 5·4 mm. Externally differing only slightly from holotype in the following respects: anterior pronotal concavities smaller and shallower; punctate areas similar but punctures smaller and more numerous; punctures of elytral striae slightly larger and better developed.

Stenaspidius albosetosus ranges widely across northern Australia from Queensland to Western Australia. Variation in the series at hand is of two types, local and geographic. The small series from Cairns, Queensland, varies from 6 to 8 mm in length and from 3·5 to 5·5 mm in greatest width. The smallest specimen of this series has the head and much of the pronotum heavily punctate, the pronotal concavities obsolete, and the elytral striae distinctly deeper and more heavily punctate than in the other specimens. The degree of this "local" type of variation is considerable, being equal to or exceeding the variation noted for the other species in the genus.



Figs. 13-18. *Stenaspidius* spp.: 13, Male genital capsule of *S. ruficornis;* 14, Male genitalia of *S. ruficornis;* 15 Male genital capsule of *S. matthewsi;* 16, Male genitalia of *S. matthewsi;* 17, Male genital capsule of *S. brittoni;* 18, Male genitalia of *S. brittoni.*



Figs. 19-24. *Stenaspidius* spp.: 19, Male genital capsule of *S. nigricornis;* 20, Male genitalia of *S. nigricornis;* 21, Metasternum of *S. matthewsi;* 22, Metasternum of *S. nigricornis;* 23, Metasternum of *S. albosetosus;* 24, Metasternum of *S. ruficornis.*

Geographic variation is also evident and specimens from Queensland are consistently different from those occurring in the Northern Territory or in Western Australia. It could be argued that populations from these different areas should be recognized as taxonomically distinct. However, since the few specimens on hand seem to show concordant clinal variation, I consider the different forms as variants of one species. The major variation occurs in the development of the horns of the head, in the size and depth of the anterior pronotal concavities, in the shape of the apex of the genital capsule, and in the shape of the parameres of the male genitalia.

In specimens from Queensland the clypeal carina is only slightly lower than the three tubercles (or horns). The tubercles are small and generally equally developed. The tubercle (or horn) on the vertex is low and vaguely to moderately bifid. The anterior pronotal concavities vary from obsolete to shallow (Fig. 7) but distinct; distinct convex ridges surrounding the concavities are lacking. The male genital capsule is moderately broad and rounded at the apex. The male genitalia (Figs. 10, 11) have the parameres moderately thickened near the tips and the lower lobes slender and hooked.

In specimens from the Northern Territory and Western Australia the clypeal carina is distinctly lower than the well developed tubercles or horns. The horn on the vertex is usually distinctly bifid (Fig. 8). The anterior pronotal concavities (Fig. 8) are deep, being surrounded laterally and posteriorly by convex ridges. The male genital capsule is flattened near the apex and very broadly rounded. The male genitalia (Fig. 12) have the parameres more distinctly thickened near the tips and the lower lobes wider. These differences seem to be consistent geographically, but with the differences discussed being based upon six specimens, my conclusions are tentative.

Stenaspidius albosetosus is at present the only member of the genus known to occur in the northern third of Australia. The numerous, long, white setae on the basal segments of the antennae and on the underside of the prothoracic margin will identify the species. Also the male genitalia are very distinctive.

Type material: Holotype, male, Yeppoon, Queensland, 20th December, 1969, H. Evans and R. W. Matthews (ANIC). Allotype, female, same data as holotype (ANIC). Paratypes, 18 specimens: 5, Cairns, (N.) Queensland, (1) E. W. Ferguson; 1, Little Mulgrave R., Qld., Hacker; 1, Ravenshoe—Mt. Garnet Road., Archers Creek, N. Qld., Australia, 11th January, 1962, E. B. Britton; 1, Rockhampton, Qld., 23rd March, 1950, I. F. B. Common; 2, Townsville, Qld., (1) N. B. Tindale, (1) 24th December, 1902, F. P. Dodd; 1, N. Queensland; 1, Q. (Victoria) (=museum?) Coll. French; 2, Berrimah Farm, N.T., 27th January, 1956, L. D. Crawford; 1, Daly R., N.T., H. Wesselwan; 2, 80 km E. of Daly Waters on Borroloola Road, N.T., 20th March, 1972, A. Allwood and T. Angeles; 1, Wyndham, W.A., 15th December, 1953, G. Luking, K. R. S., Light Trap.

Paratypes are in the following collections: ANIC, BM, MNHN, NTA, SAM, Howden.

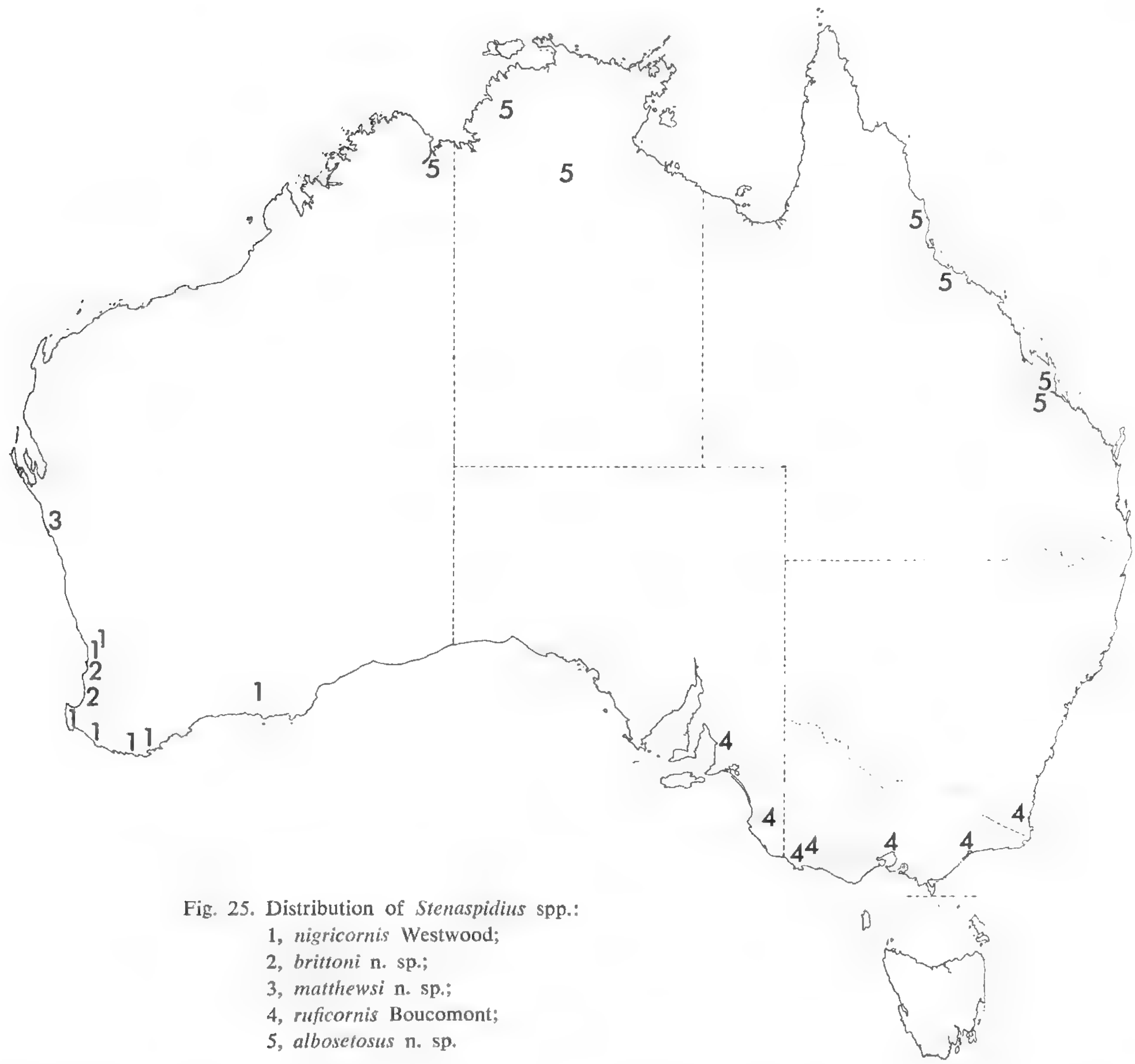


Fig. 25. Distribution of *Stenaspidius* spp.:
1, *nigricornis* Westwood;
2, *brittoni* n. sp.;
3, *matthewsi* n. sp.;
4, *ruficornis* Boucomont;
5, *albosetosus* n. sp.

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RECORDS OF THE
SOUTH AUSTRALIAN
MUSEUM

NOTES ON BRONZE AGE ANTIQUITIES IN THE SOUTH AUSTRALIAN MUSEUM

By J. V. S. MEGAW

SOUTH AUSTRALIAN MUSEUM
North Terrace, Adelaide
South Australia 5000

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Summary

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Three Irish bronzes, an axe and two halberds, are also described and figured. Metallurgical analyses of these are compared with similar objects from the British Isles. They have been tentatively assigned to the Irish Early Bronze Age, ca. 1600-1500 B.C.

NOTES ON BRONZE AGE ANTIQUITIES IN THE SOUTH AUSTRALIAN MUSEUM

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ABSTRACT

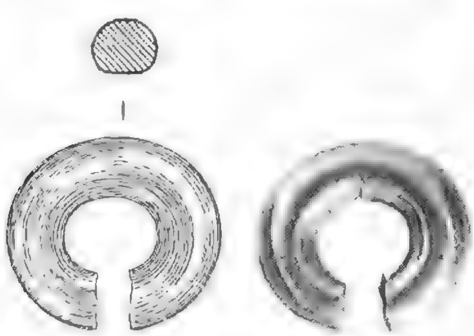
MEGAW, J. V. S. 1974. Notes on Bronze Age antiquities in the South Australian Museum. Rec. S. Aust. Mus. 17 (3): 23-29.

A single penannular bronze ring with a gold sheet is described from the holdings of the South Australian Museum. This piece of 'ring money' has been assigned to the Late Bronze Age.

Three Irish bronzes, an axe and two halberds, are also described and figured. Metallurgical analyses of these are compared with similar objects from the British Isles. They have been tentatively assigned to the Irish Early Bronze Age, ca. 1600-1500 B.C.*

1. AN EXAMPLE OF BRITISH BRONZE AGE "RING MONEY"

As part of a survey of European prehistoric antiquities in Australian collections (Burke and Megaw, 1966; Megaw, 1964, 1965, 1969, 1973), in February, 1970 I was able to study briefly the holdings of the South Australian Museum. Amongst a small group of non-Australian antiquities in the Museum is a penannular ring made of gold sheet over what seems without analysis to be a bronze core (Figs. 1-2).



Figs. 1-2: Bishopstone, Wiltshire. 'Hair ring' of sheet gold over bronze core. Scale 2:1 *Drawing Brenda K. Head; Photo. South Australian Museum.*

Measuring 1·4 cm in maximum diameter, the ring (Reg. No. A50523) was presented to the Museum in 1957 by Mr. Francis P. Dibben whose father, H. J. Dibben, had found it at Bishopstone, Wiltshire some time prior to 1907. An unpublished letter dated December, 1907 from the Rev. E. Goddard notes this 'ring money' as the first found in the country and promises a published description which was forthcoming with a drawing of the Dibben ring as part of a long article on objects of the Bronze Age found in Wiltshire (Goddard, 1911: 112, 156 and Pl. 7:14). Finds of miniature gold rings of this type (so-called 'ring money', once alleged on the grounds of its more or less uniform size and weight to be a primitive form of currency), though commonest in Ireland, occur both in Scotland and Southern Britain. At least one other example—apparently unassociated—is recorded as having been found between Bishopstone and Broad Chalk. This, with a cover of gold and silver bands is preserved as an electrotype in the collections of the Devizes Museum (Goddard, 1911: nos. 293-4, 1923: 251).

The origin and indeed use of such gold-covered penannular rings is still very much a matter of dispute. In a general study of Bronze Age gold ear-rings Hawkes has considered the British 'ring money' as hair rings (Hawkes, 1961: 453-6, 468-9 and Pl.I, 2) on the basis of the custom amongst Egyptian nobility of the New Kingdom for threading similar gold rings through their wigs. Hawkes postulates an original western dissemination of the type as Mycenaean loot passed on by trade. The 'hair ring' suggestion is certainly supported by Childe's citing of the report of the discovery of traces of hair adhering to the rings from the Sculptor's Cave, Covesea mentioned further below (Childe, 1935: 163). As to possible Mediterranean prototypes there are certainly similar forms to 'ring money' amongst Egyptian and Palestinian materials but this is all prior to ca. 1200 B.C. and the earliest possible British find—a penannular ring with tapering ends from an Early Bronze Age Wessex I chieftain's grave, the primary cremation under a ball barrow, Filsford G.8, Normanton Down (Annable and Simpson, 1964: no. 192)—is much more probably a miniature copy of contemporary continental Reinecke Bronze Age A2 "ingot tores".

Eogan (1964: 272ff.) follows Hawkes in suggesting later Mycenaean trade as a source for 'ring money' and ascribes the earliest extant Irish examples to his Middle Bronze Age

* In this paper all dates quoted are 'conventional' *i.e.* uncorrected.

10th January, 1975

"Bishopsland phase"; but there are no associations of 'ring money' in indisputable Middle, let alone Early, Bronze Age contexts in the British Isles. Recent reassessments of the absolute chronology as well as the alleged material for east-west trade in the second millennium B.C. also argue against a possible Mycenaean source (Renfrew, 1969, 1973: 98-103).

In fact in Britain there is no association of 'ring money' of certain date earlier than the eighth century B.C. The material from the Sculptor's Cave, Covesea, Morayshire, Scotland, includes some ten examples of 'ring money'—two without their sheet gold covering—of similar diameter to our Bishopstone example (Benton, 1930-31: 181-2 and Fig. 5). The Covesea find is dated on the basis of imports from the Middle Rhine to ca. 700 B.C. and the "Covesea" phase of Coles' recent review of the later Scottish Bronze Age seems to be one of settlement on the north-eastern coast of the British Isles by groups from the northern German plain. A hoard of similar date to Covesea is that from Balmashanner, Angus which includes a single 'hair ring' (see Coles, 1959-60: 39ff. and 91 for a complete list of Scottish 'ring money'). From Ireland probably the best dated 'ring money' is that from Tooradoo, Co. Limmerick, a hoard of Eogan's "Dowris" phase contemporary with Covesea in Scotland, a phase to which it would seem best to assign Irish hair rings as a whole (Gogan, 1932; Eogan, 1964: 304 and Fig. 15,5). Tending to support this dating is the recent publication of a now lost Irish find which indicates the association of a hair ring with a so-called 'dress fastener' (Herity, 1969: 9 and P1.VIIb), a penannular gold ring with cone-shaped terminals. 'Dress

Fig. 3: (*a*) "Italy", Decorated bronze axe; (*b*) River Suck, Co. Galway. Copper halberd; (*c*) unprovenanced. Copper halberd. Scale as marked. *Photos. South Australian Museum.*

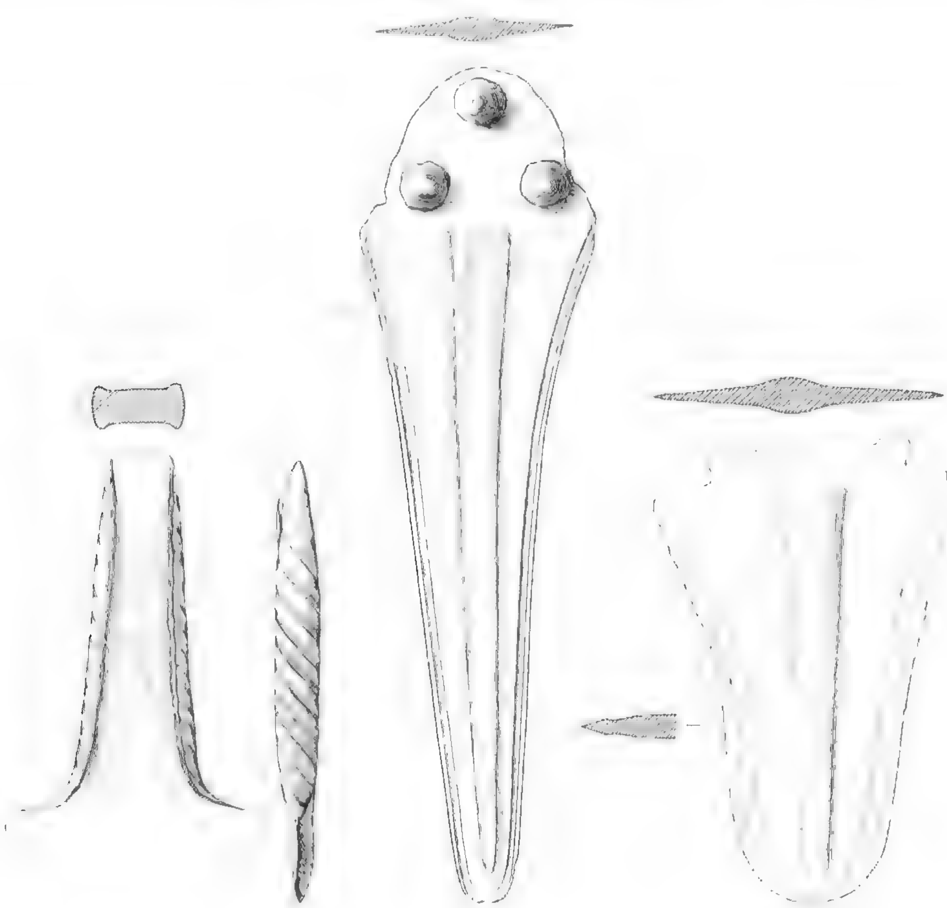
fasteners' of this type have a widespread and even continental distribution (Hawkes and Clarke, 1963, 220ff). The association of an Irish Middle Bronze Age (ca. 1000 B.C.) "Ballintober" sword with a piece of 'ring money' and other fragments of gold alleged to have been found at Strabane, Co. Tyrone cannot now be proved (Eogan, 1965: 8 and 25 no. 12).

In the absence of any closely dated associations of 'ring money' or 'hair rings' in the south of England, it seems best to date such pieces as our Bishopstone ring to the Late Bronze Age when contacts between Ireland and the rest of Britain not to mention the continent were frequent and strong (Eogan, 1964: 310ff., 1965: esp. 107ff.; Burgess, 1969: esp. 17ff).

2. THREE IRISH BRONZES OF THE EARLY BRONZE AGE

Apart from the Bishopstone 'ring money' there are three other prehistoric British pieces in the Museum's collections which, if not unique, are worthy of comment. The first of these, presented by a Captain Davidson to the Museum in 1918 (Reg. No. A11331), is a bronze axe measuring 18 cm in length and with a maximum breadth across the blade of 10·5 cm (Fig. 3a, 4a). The axe, which may have been cast in a one-piece rather than two-piece mould, has a slight or "incipient" stop-ridge just visible halfway down the haft. The flanges on either side of the haft have a cable design produced probably by forging or grinding. On the face of the axe a rough "rain" pattern has been produced by irregular stabs of a scriber or graver (Megaw and Hardy, 1938: 6ff.; Harbison, 1969c: 67-69).

Although the original labelling of the axe as it was received by the Museum seems to have recorded its source as "(Roman) Italy" there can be no doubt that this axe is a product of the Irish Early Bronze Age of about the mid-second millennium B.C. Its decoration and nearly straight sides with hammered rather than cast flanges class it as one of a series of decorated bronze axes first studied by Megaw and Hardy in 1938; the present example is close in size and decoration to their Type II (cf. *op. cit.*, 5ff.). This type corresponds in part to



a b c

Fig. 4: (*a*) "Italy", Decorated bronze axe; (*b*) River Suck, Co. Galway. Copper halberd; (*c*) unprovenanced. Copper halberd. Scale 1:3 *Drawings Brenda K. Head.*

Harbison's Type Derryniggin as defined in his recent corpus of axes of the Early Bronze Age in Ireland (Harbison, 1969c: 55-64, 79, pls. 68-78) and in the Scottish Early Bronze Age is Coles' (1968-69: 15-16 and Fig. 12) Type Bc. Although axes (and other material of Irish origin) were exported to the continent in the Bronze Age, most of these are of the presumed earlier Megaw and Hardy Type I and no bronzes of Irish origin have to the best of my knowledge been found in Italy (Butler, 1963: Chap. II. 241 ff. and Map I). It seems almost certain therefore that the provenance "Italy" for the Adelaide axe is erroneous.

As part of a continuing programme of metallurgical analyses of British and Irish Bronze Age artefacts in Australian collections (Burke and Megaw, 1966; Megaw, 1964, 1969, 1973), arrangements were made to subject the axe and the two other bronzes discussed in this note to non-destructive spectrographic analysis. The analysis was carried out at the Commonwealth Defence Standards Laboratories in Adelaide. The analysis of the Adelaide axe are compared with those of two other Derryniggin axes of similar form in Table 1.

It is clear that these axes have been cast from tin-bronze, the intentional alloying of local copper with bronze being a strikingly early feature of metal technology in Ireland (Butler, 1963: 39-40 and Table I) although the original impetus for tin alloying as well as the basic form of the axes themselves is probably due to continental influence. This influence seems particularly to have been due to contact with the ore-rich area of Saxo-Thuringia in central Germany and in Britain was the result of settlement rather than trade by the so-called "Beaker folk" of the early second millennium (Case, 1965, 1967). The Adelaide Derryniggin axe seems however to lack the arsenic content which was a feature of local Munster copper ores (see also p. 4 below).

Unfortunately there are few finds of axes of the Derryniggin type which are of much use for chronological purposes. Two hoards from the Isle of Wight with axes of Megaw and Hardy Type III indicate that these axes continued comparatively late in the British Early Bronze Age or contemporary with the latter part of the Wessex culture of Southen England (Harbison, 1969a: 68ff., 1969c; 79-80) which on conventional dating should not be before ca. 1500 B.C. Recent recalibration of radiocarbon estimations with absolute dates suggests, however, that this date may be of the order of two to four centuries too young (Renfrew, 1969, 1973).

The two remaining bronzes to be discussed here are again castings and, despite the description of one in the Museum's inventory as a dagger, are both examples of the prehistoric halberd, a metal knife-like blade set at right-angles to its haft. More than 300 halberds of various types are known from Early Bronze Age Europe though of these almost half come from Ireland with a significant number also from Scotland; all but a very small proportion of these Irish and Scottish examples are isolated finds. There have been several typological studies of the halberd in prehistoric Europe prior to Harbison's recent reassessment (Harbison, 1969b) of which the most important is that by the late Professor Sean ÓRíordáin (1937). ÓRíordáin considered the metal halberd as being in the first instance an Irish development spreading thence to the continent and in particular to Central Germany. Subsequently, Coghlan and Case (1957: 103), Butler (1963: 20ff.) and Allen *et al.* (1970: 106-7) have suggested a reversal of this theory. Case (1967: 152ff.) has looked once more to Saxo-Thuringia as an immediate source of the type; this is a region from whence he would also derive the thin-butt axe ancestral to the decorated form we have discussed above. Harbison (1969b: 48ff.), while agreeing to a largely continental source, is less certain as to the precise locality.

Of the two Adelaide halberds, that described as a dagger (Reg. No. A42739; Figs. 3b, 4b) was found eight feet below the surface in an old stream bed of the River Suck in Co. Galway and presented to the Museum in 1951 by Mr. Walter Hawker who had previously lived at Ochrane Castle in Galway. As noted below, this is one of three halberds found in or near the River Suck. The hilt shows considerable evidence of cold working and with a blade 32·5 cm long, this halberd is of Harbison's Type Cotton. This corresponds more or less to ÓRíordáin's Type 5 (with its curved or scythe-like blade) and some of his Type 3. This form of halberd has an asymmetrical blade with three large round-headed rivets set in a triangle and with "blood grooves" running parallel to the cutting edge and a mid-rib whose sides are curved. The "Cotton" class accounts for over half of the known Irish halberds. With straight sides to the mid-rib this becomes

Harbison's Type Carn which corresponds more or less to ÓRíordáin's Type 4 as well as some of his Type 5. It should in fact be noted that it is not always possible to reconcile Harbison's classification with that of ÓRíordáin or vice versa. Thus the examples from the type site of Cotton Moss, Co. Down (see analyses in Table 2) were both classed by ÓRíordáin as being of his Type 4, though by Harbison's criteria at least one of the Cotton halberds (Harbison, 1969b: no. 207) which he compares on the whole with ÓRíordáin's Type 5 would seem certainly to fall rather within his Type Carn. The marked shoulder of the Adelaide halberd is shared by two of Type Carn found with five others of Type Cotton in a peat bog at Hillswood, Co. Galway not far from the River Suck (Harbison, 1969b: Fig. 4a).

As with thin-butt axes, halberds of Irish manufacture seem to have been exported to the Continent, particularly those of ÓRíordáin's Type 4 (Butler, 1963: 20ff.), although it is clear that such exports must have followed the introduction of the halberd form itself—from whatever source.

The second Adelaide halberd Reg. No. A49959, has no find spot recorded (ex Sheffield City Museums; Figs. 3C, 4C). With a squat blade 18·5 cm long, it now lacks part of its hilt and all four of its original rivets. It corresponds to Harbison's Type Clonard or ÓRíordáin's Types 1 and 2. The squared and shouldered hafting-plate is characteristic. Originally considered by ÓRíordáin to be the archetypal form of all Irish halberds, since halberds are now generally considered to have developed from normal elongated metal dagger types, this squat profile is more likely to represent a local development, albeit one which occurred not long after the original introduction of the halberd into Ireland.

Spectrographic analyses were again carried out on these bronzes and Table 2 gives the results and compares them with previously published analyses of halberds of certain and probable Irish provenance whose form is closest to that of the Adelaide examples. Also listed are the two other halberds from the River Suck (listed by ÓRíordáin as Type 5 and Harbison as of his Type Cotton) and two of the three halberds from the type side of Cotton Moss itself.

The analyses indicate that, irrespective of type, these halberds are all made of copper with very little or no tin present and certainly no indication of intentional tin alloying.

The metals consistently show a significantly high content of arsenic, antimony and silver and minor traces of other elements. Similar metals were used for Irish thick-butted axes and for Irish and British Beaker Culture knives (= Group I of Coghlan and Case, 1957: 98-99; Case, 1967: 163-4), and were used in the Early Bronze Age in Scotland (Coles, 1969: 338). Their advantageous content of arsenic is likely to have been deliberately contrived, and Case has advanced the possibility that the Irish metals were alloys, in which the contents of arsenic, antimony and silver reflected the use of a regulus smelted from the Munster *Fahlerze*. This typically Irish Group I metal corresponds more or less with the Early Bronze Age Copper or EII group metal of the Arbeitsgemeinschaft für Metallurgie des Altertums which over the past fifteen years has performed more than 12 000 analyses of prehistoric European metal artefacts. On the basis of some 96 analyses of British halberds more than 70 per cent appear to be of the British EII metal (Junghans *et al.*, 1968: 132-3). In parenthesis it may be noted that analyses of halberds from Britain and particularly Scotland as opposed to Ireland, owing to their very similar spectra, strongly suggest that such halberds are all imports from Ireland or at least cast from imported ore (Britton, 1963: 284 and Table 8; Coles, 1968-69: 35ff. and 97—see here esp. Junghans *et al.*, 1968: nos. 7458, 9287 = Coles' "cluster C" metal).

Regarding chronology, as has already been mentioned finds of halberds in the British Isles in association with other objects are extremely rare; there are in fact only two Irish finds with objects other than halberds, the more important for our purpose being that from a Food-Vessel burial at Frankford, Co. Offaly (also known as the Birr find (Case, 1967: 152ff. and Fig. 8, 5-9; Harbison, 1969b: 23, 52ff. and Fig. 1, c). The Frankford find includes a thin-butted axe and two thick-butted forms and a dagger of a type common in the earlier rather than the later phase of the Wessex culture in the south of England (Harbison, 1969a, 65-66). The halberd, of Harbison's Type Cotton, has been analysed—both the blade and one of the rivets (Coghlan and Case, 1957, nos. 59 and 71)—and is once more of the typical Irish arsenic-antimony-silver copper. Of six associations with halberds from Scotland that from the Moor of Sluie, Morayshire, consisted of two thin-butted axes of Coles' cluster C metal with a halberd of Harbison's rare Type Breaghwy of continental originating cluster D metal (Coles, 1968-69: 40, 73 and 107).

It may be concluded that both our Adelaide halberds belong to what Case has termed the later part of his "impact phase" of the Irish Early Bronze Age, a period when tin-bronze was in fact already in wide use and Ireland's contacts with the Continent no less wide-spread than other parts of the British Isles (as indicated by the export of the earlier decorated thin-butt axes as well as halberds themselves). This stage may be conventionally dated between 1600-1500 B.C.

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TABLE 1

Metallurgical analysis of Bronze Age axe (A11331) held in the South Australian Museum compared with analyses of two other axes

Axe	Metal Content (%)											
	Cu	Sn	Pb	As	Sb	Ag	Ni	Bi	Fe	Au	Co	Zn
A11131	h	11·4	0·17	n d	n d	0·05	0·01	0·01	0·05	—	—	n d
ABC No. 24 (H no. 1853)	h	6·8	<0·02	n d	n d	<0·005	0·0086	<0·004	0·006	—	—	—
ABC No. 25 (H no. 1851)	88·1	11·7	—	—	<0·04	0·006	—	—	—	—	—	—

Key (to Tables 1 and 2):

ABC = Allen, Britton and Coghlan, 1970; CC = Coghlan and Case, 1957; H – Harbison, 1969b,c. Cu – Copper; Sn – Tin; Pb – Lead; As – Arsenic; Sb = Antimony; Ag – Silver; Ni – Nickel; Bi – Bismuth; Fe – Iron; Au = Gold; Co = Cobalt; Zn – Zinc.

n d – none detected; tr = trace (usual range 0·01-0·1 per cent); — = not sought; ~ approximately (± 20 per cent); h = high (>10 <100 per cent); < = less than; > = more than.

TABLE 2

Metallurgical analyses of two Bronze Age halberds (A42739, A49959) held in the South Australian Museum compared with analyses of other halberds of similar age

Halberd	ÓRíordáin Type	Cu	Sn	Pb	As	Sb	Ag	Ni	Bi	Fe	Au	Co	Zn
A42739	5	h	0·01	0·1	~1·0	~0·5	0·3	0·05	0·1	0·02	—	—	n d
CC37 (H no. 198)	5	95·4	n d	0·02	3·99	0·37	0·16	0·01	<0·01	tr	n d	n d	n d
CC19 (H no. 199)	5	98·3	0·01	0·01	1·23	0·24	0·13	0·02	<0·01	tr	n d	n d	<0·01
CC20 (H no. 226)	5	95·8	<0·01	0·01	2·78	0·48	0·14	0·02	<0·01	—	n d	n d	0·01
CC36 (H no. 235)	5 (River Suck)	97·1	n d	0·01	1·97	0·63	0·24	0·01	<0·01	tr	n d	n d	<0·01
CC11 (H no. 236)	4 (River Suck)	96·2	n d	0·05	2·57	0·66	0·43	0·02	0·01	tr	n d	n d	<0·01
CC17 (H no. 205)	4 (Cotton Moss)	96·0	0·01	0·01	3·02	0·52	0·34	0·03	<0·01	tr	n d	n d	n d
CC54 (H no. 207)	4 (Cotton Moss)	96·1	<0·0005	0·04	2·68	0·60	0·20	0·003	0·002	0·001	<0·001	<0·001	<0·01
A49959	2	h	<0·01	0·2	~1·0	~0·5	0·1	0·05	0·02	0·01	—	—	n d
CC26 (H no. 282)	2	97·5	<0·005	0·03	1·35	0·58	0·30	0·01	0·003	0·001	<0·001	<0·001	<0·01
CC12 (H no. 281)	2	98·2	n d	<0·01	0·90	0·52	0·28	0·02	0·01	tr	n d	n d	0·01
CC9 (H no. 286).	2	95·9	0·01	0·02	2·39	1·07	0·55	0·01	0·01	tr	n d	n d	<0·01

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LJUNGHIA OUDEMANS (ACARI: DERMANYSSIDAE); A GENUS PARASITIC ON MYGALOMORPH SPIDERS

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BY ROBERT DOMROW

Summary

A key, illustrations and descriptive notes are given for the four laelapine species now known in *Ljunghia* Oudemans (Dermanyssidae). At least three are parasites of mygalomorph spiders, as follows: *L. selenocosmiae* Oudemans from *Selenocosmia* (Theraphosidae) in Sumatra; *L. hoggi* sp. n. from *Aganippe* (Ctenizidae) in South Australia; *L. pulleini* Womersley from *Selenocosmia* and *Adame* (Dipluridae) in South Australia, and an unidentified diplurid in Queensland; and *L. rainbowi* sp. n. from an unidentified spider in South Australia.

LJUNGHIA OUDEMANS (ACARI: DERMANYSSIDAE), A GENUS PARASITIC ON MYGALOMORPH SPIDERS

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ABSTRACT

DOMROW, R. 1974. *Ljunghia* Oudemans (Acari: Dermanyssidae), a genus parasitic on mygalomorph spiders. *Rec. S. Aust. Mus.* 17 (14): 31-39.

A key, illustrations, and descriptive notes are given for the four laelapine species now known in *Ljunghia* Oudemans (Dermanyssidae). At least three are parasites of mygalomorph spiders, as follows: *L. selenocosmiae* Oudemans from *Selenocosmia* (Theraphosidae) in Sumatra; *L. hoggi* sp. n. from *Aganippe* (Ctenizidae) in South Australia; *L. pulleini* Womersley from *Selenocosmia* and *Aname* (Dipluridae) in South Australia, and an unidentified diplurid in Queensland; and *L. rainbowi* sp. n. from an unidentified spider in South Australia

INTRODUCTION

This paper revises the two known species of the genus *Ljunghia* (family Dermanyssidae *sensu* Evans and Till, 1966) to the extent that the original descriptions need expansion, and details two new species. The following key will quickly show that the setational patterns vary considerably from species to species, but an otherwise uniform *facies* and the ecological data indicate only a single genus is involved (see Hunter and Husband, 1973).

The setae on the dorsal shield are equated with the standard pattern given for *Haemolaelaps* Berlese by Costa (1961, as amended by Lindquist and Evans, 1965). The patterns on the capitulum and legs are compared with those of free-living dermanyssids (Evans and Till, 1965, as amended by Evans, 1969), except for the larvae, whose legs are detailed after Evans (1963). The less reduced species of *Ljunghia* show relatively constant formulae, but the regular presence or absence of one or even two setae in the more reduced species is to be expected.

Genus **LJUNGHIA** Oudemans

Ljunghia Oudemans, 1932, p. 204. Type-species: *Ljunghia selenocosmiae* Oudemans, 1932, by monotypy.

DIAGNOSIS. From Evans and Till's keys (1966) to dermanyssid taxa, *Ljunghia* is clearly a laelapine genus related to the *Hypoaspis* Canestrini complex. The latter also includes many associates of arthropods, but the generally holotrichous condition of the dorsal shield (at least 37 pairs of setae) will distinguish *Hypoaspis*, however unclear its internal relationships may be, from the markedly holotrichous *Ljunghia* (at most 32 pairs of setae).

Frankly, it is difficult to delimit a genus in such a little known subfamily, yet a diagnosis so extended to include the widely varying setal formulae on the dorsal shield and legs may well exclude species as yet undescribed (Costa, 1971). Accordingly, I assign to *Ljunghia* those species with the following characteristics:

Chelicerae chelate-dentate in female; fixed digit reduced (except in *L. selenocosmiae*), but always with at least trace of pilus dentilis. Chelicerae normally formed in male, with spermatophore-carrier slightly exceeding tip of movable digit. Dorsal shield entire, markedly hypotrichous. Metasternal setae absent (except in *L. selenocosmiae*). Only genital setae set on genital shield (except in *L. rainbowi*). Anal shield elongate, with characteristic anteromedial extension. Leg setation holotrichous to markedly hypotrichous. Parasites of spiders, especially mygalomorphs, in the Oriental-Australian Region.

KEY TO SPECIES OF *LJUNGHIA*

(Adults only; male of *L. rainbowi* unknown)

1. (0) Dorsal shield with 32 (21 podonotal and 11 opisthonotal) pairs of setae. Metasternal setae present. Ventral setae numerous. No leg segment has less setae than typical free-living dermanyssids. Cheliceral digits of female subequal .. *selenocosmiae*

   Dorsal shield with 25 pairs of setae at most. Metasternal setae absent. Only eight pairs of ventral setae. At least one leg segment has less setae than typical free-living dermanyssids. Fixed cheliceral digit of female only half as long as movable digit 2

2. (1) Dorsal shield with 25 (17 + 8) pairs of setae. Palpal trochanter-tibia with normal setation (2.5.6.14). Only one leg segment (femur I) with deficient setation .. .. *hoggi*

   Dorsal shield with less than 25 pairs of setae. Palpal trochanter-tibia with reduced setation. At least three leg segments (excluding genu IV) with deficient setation 3

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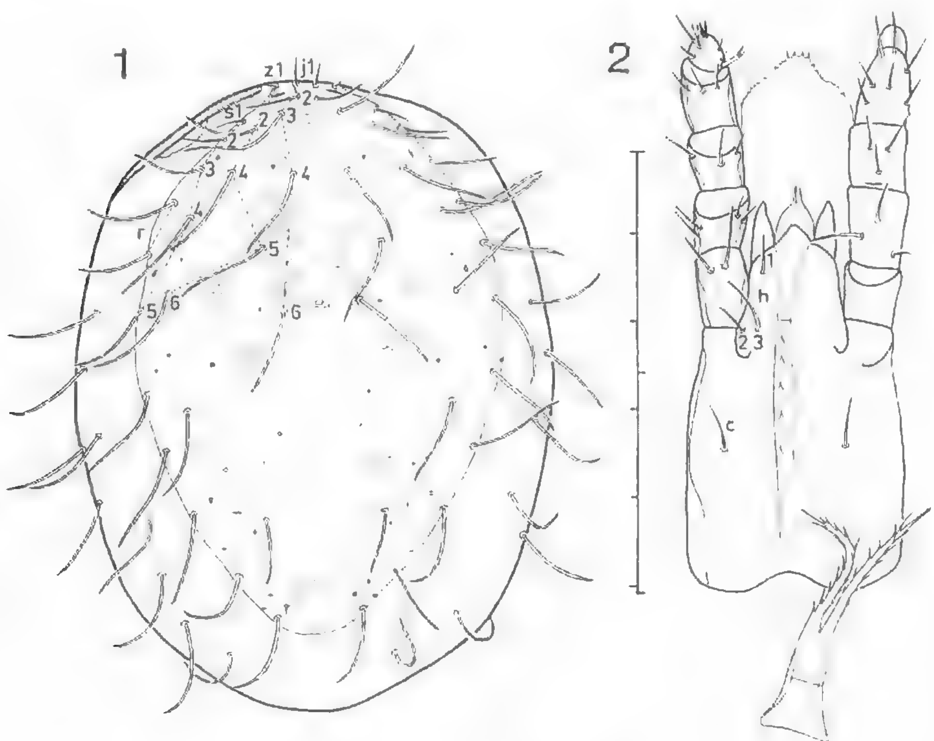
3. (2) Dorsal shield with 18 (15 + 3) pairs of setae. Genital setae on genital shield. Deutosternal denticles single. Palpal trochanter-tibia with 2.5.6.11 setae. Seven leg segments with deficient setation (see text) .. .. *pulleini*

Dorsal shield with 15 (11 + 4) pairs of setae. Genital setae off genital shield. Deutosternal denticles multiple. Palpal trochanter-tibia with 2.5.5.14 setae. Three leg segments with deficient setation (see text) .. .. *rainbowi*



FIGS. 1-2. *LJUNGHIA* OUDEMANS

1. *L. hoggi* sp. n., female, dorsum of idiosoma. 2. *L. pulleini* Womersley, female, venter of capitulum (with inset of epistome and true left palp shown dorsally). (Each division on the scales = 100 μ.)

Ljunghia selenocosmiae Oudemans

Ljunghia selenocosmiae Oudemans, 1932, p. 204.

FEMALE. Capitulum inconveniently, but variously, disposed in available specimens, and many details visible. Setae rather longer than in other species, *c* reaching well beyond sides of basis. Deutosternal groove broad, with multiple denticles (number of rows uncertain). On hypostome, $h3 > h2 > h1$, with $h3$ subequal to *c*. Hypostomatal processes not clear. Epistome triangular, intermediate in length between those of *L. pulleini* and *L. rainbowi;* denticulate. Palpal trochanter-genu with normal setation (2.5.6); tibia and tarsus not clear, but former probably 14; claw bifid. Chelicera as figured by Oudemans; pore undetected.

Dorsal shield 735-755 μm long, 495-525 μm at maximum width; with 32 pairs of setae comprising 21 pairs of podonotals (only *z*3 missing) and 11 pairs of opisthonotals. (The observant will note that Oudemans, well aware of minor individual variation, tacitly shows only 31 setae on the right-hand side of his drawing.)

Tritosternum as in *L. rainbowi.* Deeply eroded, but rectilinear posterior margin of sternal shield confirmed. One ventral seta occasionally usurped by tip of genital shield. Small metapodal shields present. Peritremes reaching forward almost to vertex, but peristigmatic details not clear.

Legs also difficult to examine, but many setae considerably longer than shown by Oudemans. Formulae normal except for tibia I, which shows one additional *v* (2-6/4-2). Tarsus I, including distal sensory plaque, not dissimilar to that of other species. Claws rather larger than in *L. pulleini.*

MALE and DEUTONYMPH. See Oudemans. Dorsal shield 660 μm long, 440 μm at maximum width. Chelicera of male in normal (dorsoventral) aspect in both specimens, but not dissimilar to Oudemans' Fig. 26.

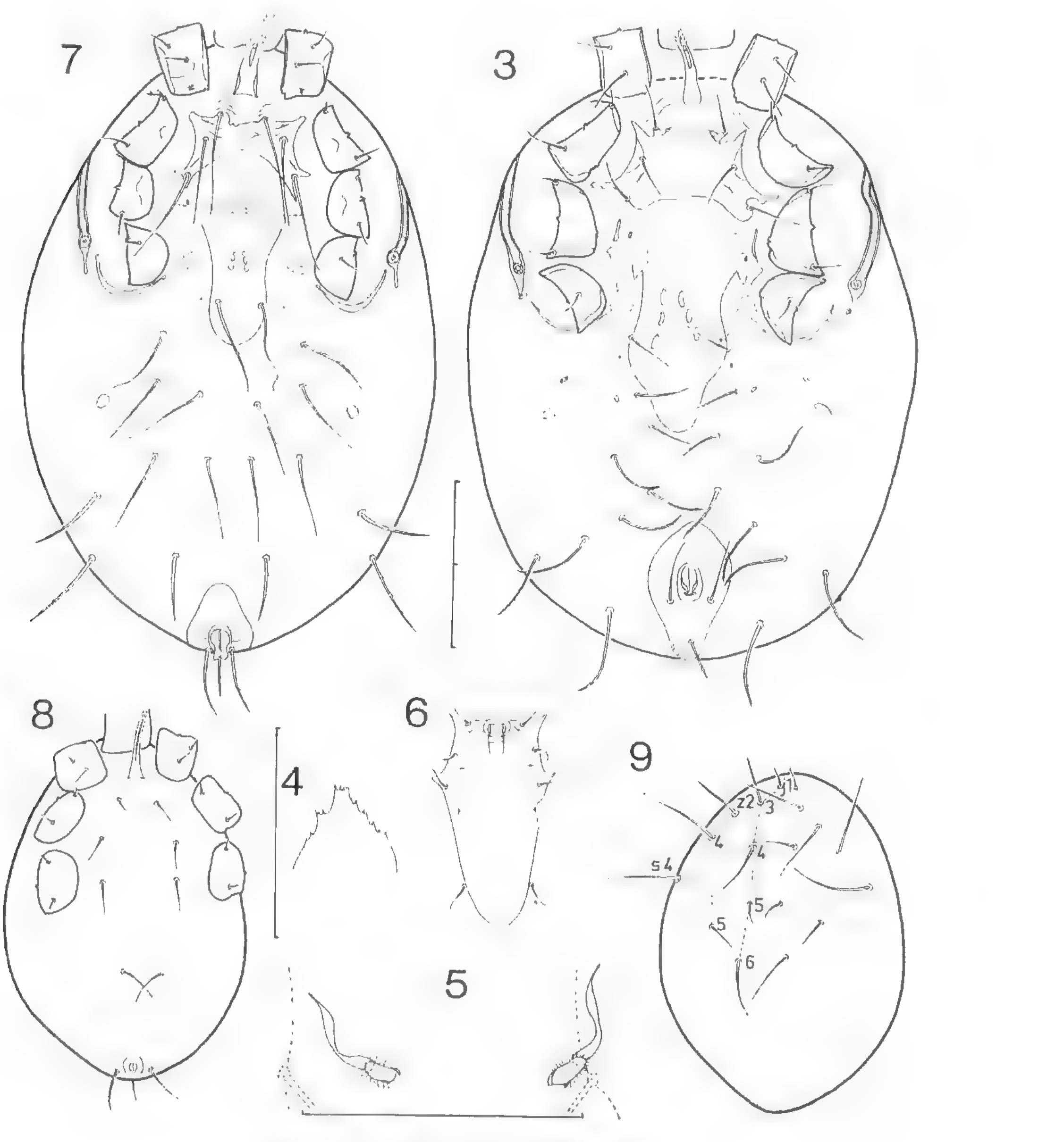
PROTONYMPH and LARVA. Not seen.

LOCALITY. Twelve females, two males, and six deutonymphs from the type series, *Selenocosmia javanensis* (Walckenaer) (Theraphosidae), Deli, Sumatra, 3.1931, col. J. C. van der Meer Mohr, dep. RMNH. I designate one female as lectotype.

Ljunghia hoggi sp. n.

FEMALE. Capitulum with *c* setae only slightly exceeding sides of basis. Deutosternal groove as in *L. rainbowi*, with seven or eight rows of multiple denticles. Hypostome with $h3>h1>h2$; only lattermost shorter than *c*. Hypostomatal processes as in *L. pulleini*. Cornicles as in *L. rainbowi*. Epistome as long as that of *L. selenocosmiae*, but more strongly denticulate. Palpi with normal setation on trochanter-tibia; tarsus not clear; claw bifid. Chelicera as in *L. rainbowi*.

Dorsal shield with outline intermediate between those of *L. selenocosmiae* and *L. pulleini;* 635-690 μm long, 415-440 μm at maximum width. Podonotal half with seventeen pairs of setae: *j*1-4, 6, *z*1, 2, 4-6, *s*1-5, and 2*r*. Opisthonotal half with eight pairs of setae (seven long, one short). Cuticle with about eight pairs of setae, the most anterior pair of which may represent extrascutal *s*6.



FIGS. 3-9. *LJUNGHIA* OUDEMANS

3-6. *L. hoggi* sp. n., female: 3. venter of idiosoma; 4. epistome; 5. spermathecae; male: 6. sternogenital shield. 7-9. *L. pulleini* Womersley, female: 7. venter of idiosoma; larva: 8-9. venter and dorsum of idiosoma.

Sternal shield more conventionally shaped than in other species, but still weak and eroded. With three pairs of subequal setae rather longer than interval between them. Venter otherwise as in *L. rainbowi*, except that genital setae are on genital shield and poststigmatic portion of peritrematal shields is fuller.

Legs with normal setation except for femur I, which is unideficient ventrally (2-5/3-2). Femora lacking outstandingly long setae dorsally. Tarsus I essentially as in *L. pulleini*, but claws rather stronger than in that species.

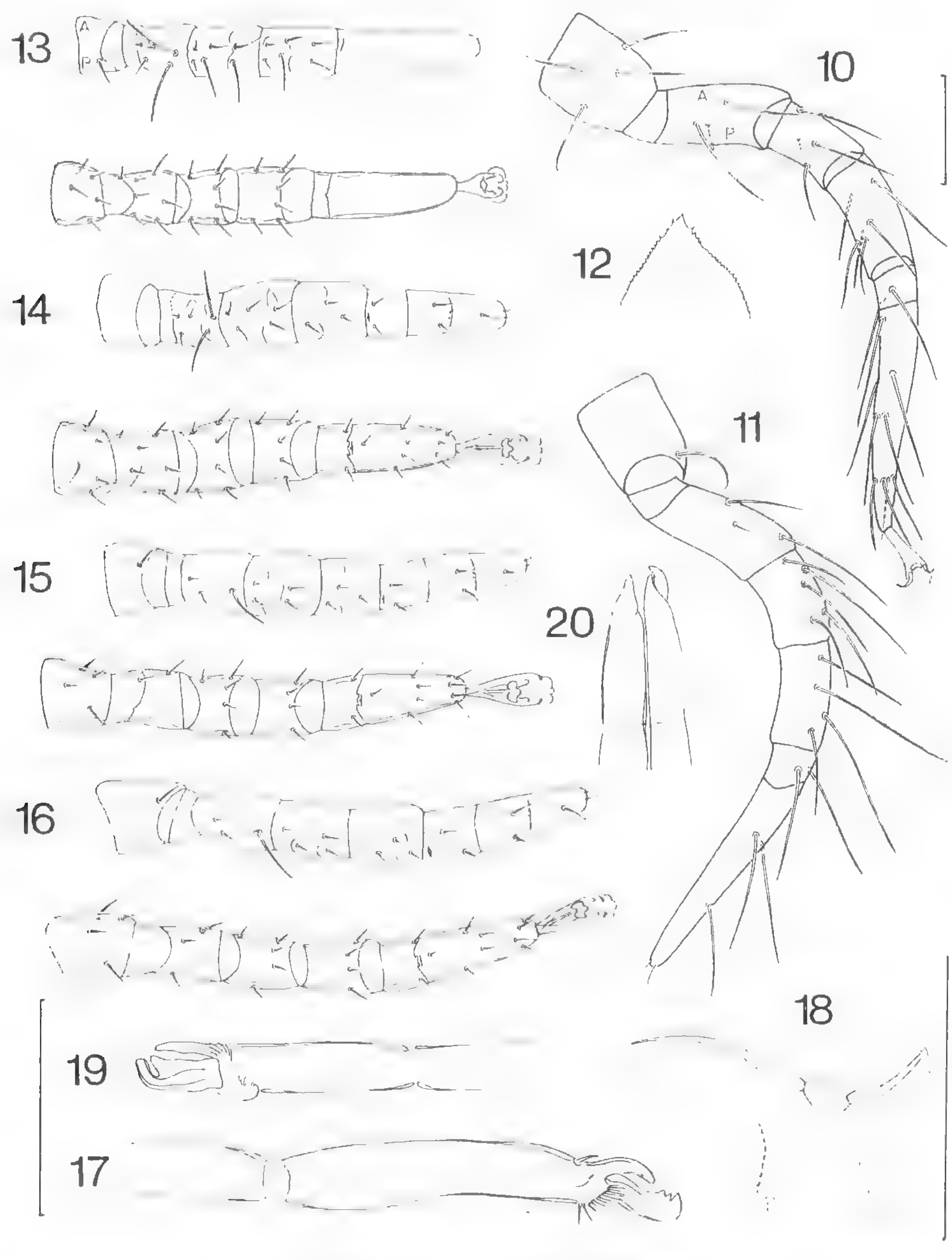
MALE. Capitulum as in female, except for chelicera, which is similar to that of *L. pulleini.*

Dorsum as in female. Dorsal shield 555 μm long, 325 μm at maximum width.

Venter as in female, except for sternogenital shield, which is similar to that of *L. pulleini.*

Legs as in female.

IMMATURES. Unknown.



FIGS. 10-20. *LJUNGHIA* OUDEMANS

10-12. *L. selenocosmiae* Oudemans, female: 10-11. venter and dorsum of leg IV; 12. epistome. 13-20. *L. pulleini* Womersley, female: 13-16. dorsum and venter of legs I-IV; 17. exterior of chelicera; 18. spermathecae; male: 19. ventro-interior of chelicera; larva: 20. venter and dorsum of chelicerae.

LOCALITY. Holotype female, three paratype females, and two morphotype deutonymphs from *Aganippe subtristis* Pickard-Cambridge (Ctenizidae). Seacliff, Adelaide, South Australia, 11.1973, col. R. Coulter, dep. SAM.

Two females and one male from *A. subtristis*. Peterborough, South Australia, 4.3.1967, col. L. Wright, dep. SAM. Not types.

Ljunghia pulleini Womersley

Ljunghia pulleini Womersley, 1956, p. 591.

FEMALE. Capitulum with *c* setae barely reaching sides of basis. Deutosternal groove narrow and difficult to examine posteriorly, but denticles single and at least five in number. Hypostome with three pairs of *h* setae (*h*3 strongest), and moderately sclerotized cornicles in addition to distal processes. Epistome rounded, denticulate, not exceeding distal margin of trochanter. Palpal trochanter-genu with normal setation, but femur occasionally lacking one *d*, or with one (more rarely two, as figured) additional *v* seta; genu occasionally lacking one *d* seta. Tibial setation considerably reduced, comprising eight (seven to nine) *d*, and three (occasionally two) *v*, setae, including dorsodistal rods. Tarsus shown diagrammatically; claw bifid. Chelicera unreduced except for fixed digit, which shows merest indication of pilus dentilis.

Dorsal shield 505-605 μm long 285-340 μm at greatest width. Podonotal half with fifteen pairs of setae: *j*1-6, *z*1-2, 4-6, and *s*1-4 (*z*3 always absent, one *z*1 occasionally absent, and *s*1-2 often represented only by single pair). First six pairs of setae on cuticle constant in number and position, and possibly representing extrascutal *s*5-6 (two long pairs) and *r*2-5 (four short pairs), thereby accounting for full complement of 22 podonotal pairs. Opisthonotal half of shield typically with three pairs of setae (two long and one short), but minor variation common. Thus although terminal pair is always present, one or both of other long pair, or one of short pair, may be lacking. Because of extreme reduction from normal seventeen pairs on opisthonotal half of shield, these setae are not assigned. Of seven or eight additional pairs of setae on cuticle, at least the long pair may be extrascutal.

Metasternal complex absent except for pores (normally free in cuticle, but rarely on extension of sternal shield; Womersley writes "shields" in error for "setae" on p. 593). Genital setae on shield, but attendant pores free in cuticle. Ventral setae in eight pairs, but not easily reconciled with pattern in other two Australian species (2.2.4.6.2). Peritrematal shields extended narrowly behind stigmata, and more broadly on dorsal margin near end of peritreme.

Coxa II with minute process on anterodorsal margin. Setation normal for following leg segments: all coxae and trochanters, femora II and IV, genua II-III, and tarsi II-IV. One seta lacking on femur I (2-5/3-2), femur III (1-3/1-0), genu I (2-6/2-2), tibia I (2-6/2-2), and tibia III (1-3/2-1). Two setae lacking on tibia II (2-3/2-1). Three setae lacking on tibia IV (1-3/2-1). Genu IV with full complement only because additional *v* makes up for absent *d*. Femora with 2,2,1,1 *d* setae distinctly longer than remainder. Tarsus I with sensory plaque distal.

MALE. Setal patterns as in female. Setule and pore on chelicerae not detected.

DEUTONYMPH. Capitulum as in female.

Dorsum as in female, but shield smaller (360-440 μm long, 210-255 μm at maximum width).

Venter as in female except for sternopregenital shield. This bears usual three pairs each of setae and pores along eroded margin; pregenital setae free in cuticle. Development of peritrematal shields minimal.

Legs, including tarsus I, with same setal formulae as female.

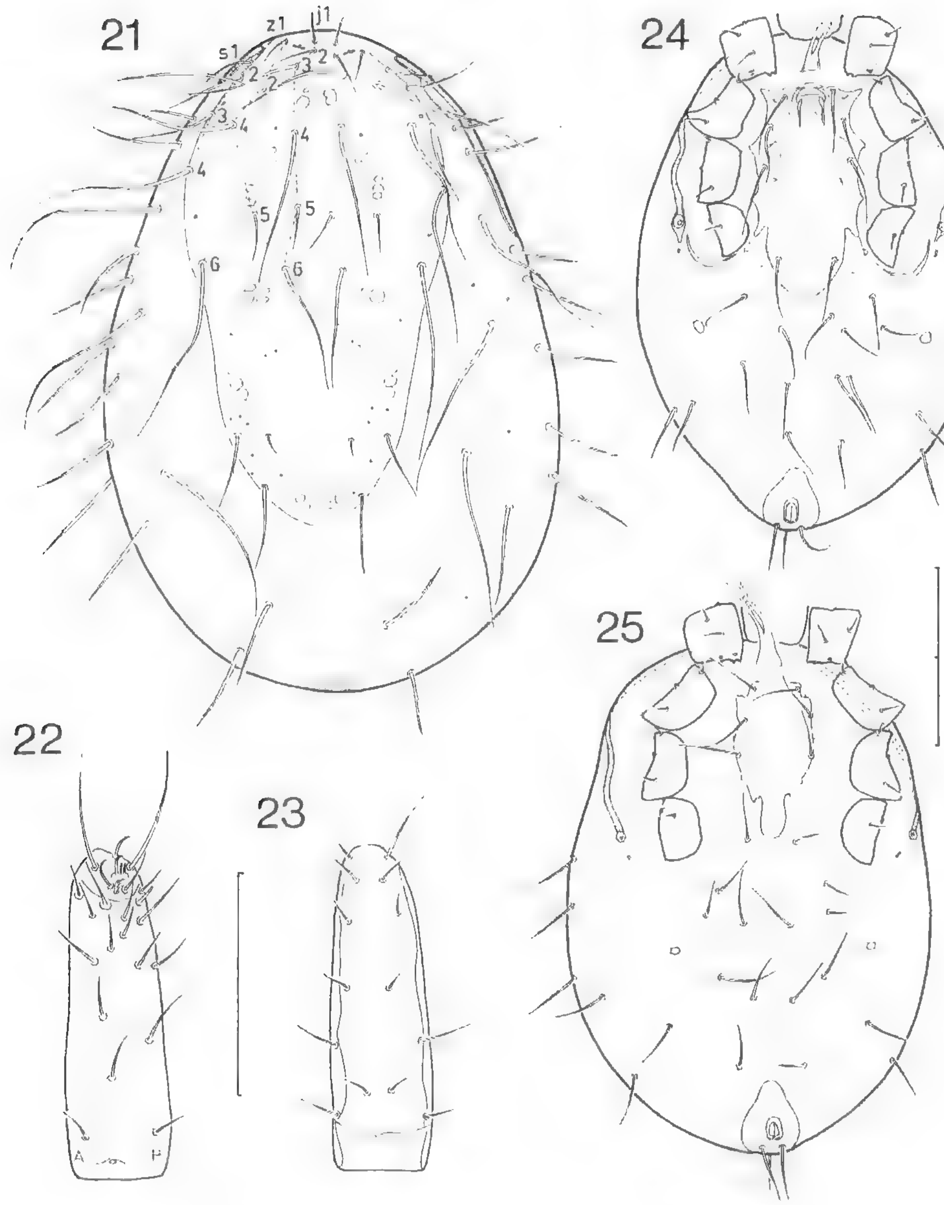
PROTONYMPH. Unknown.

LARVA. Hypostome lacking setal hair *h*3. Palpal setal formula for trochanter-genu normal, but tibia as in adult (i.e., with eleven setae). Chelicera presaging that of adult female.

Idiosoma 425-450 μm long, 310-340 μm at greatest width. Dorsum without shield, but with normal nine pairs of setae: *j*1, 3-6, *z*2, 4-5, and *s*4. These are readily equated with adult pairs of similar position and strength.

Venter without shields, but with three pairs of sternal, one pair of ventral, and three anal setae (postanal shortest as in adult). Stigmatic apparatus absent.

Legs with normal setal patterns, femur II being as in Evans (1963, Fig. 2b). Setae *ad*1 and *pd*1 on tarsi II-III not detected.



FIGS. 21-25. *LJUNGHIA PULLEINI* WOMERSLEY

21-23. Female: 21. dorsum of idiosoma; 22-23. dorsum and venter of tarsus I; 24. male: venter of idiosoma; 25. deutonymph: venter of idiosoma.

LOCALITY. Six females from the type series, *Selenocosmia stirlingi* Hogg (Theraphosidae), Orroroo, near Peterborough, South Australia, 5.1933, col. H. Gray, dep. SAM. Despite Womersley's statement, the present curator, Mr. D. C. Lee, tells me (*in litt.*, 9.8.1973) that no specimen bears a holotype label, and I therefore designate one female as lectotype.

Four females and two males from *Aname* sp. (Dipluridae), Strathalbyn, east of Mount Lofty Range, South Australia, 8.12.1971, col. I. Buring, dep. SAM.

Sixteen females, eighteen males, fourteen deutonymphs, two larvae (plus several specimens still in spirit) from an unidentified spider QM W3856 (Dipluridae), Rifle Range, Chinchilla, Queensland, 10.9.1972, col. R. J. McKay, dep. QM.

REMARKS. The description and figures now given apply to the series from Queensland. The type specimens all show three pairs of setae on the opisthonotal half of the dorsal shield. Generally speaking, their body setae are relatively longer, e.g., *j*5 and especially *z*5 exceed the bases of *j*6 and *z*6. Their leg setal formulae differ only on tibia II (commonly 2-4/2-1, occasionally standard 2-4/2-2) and genu III (commonly 2-4/2-2, occasionally standard 2-4/2-1).

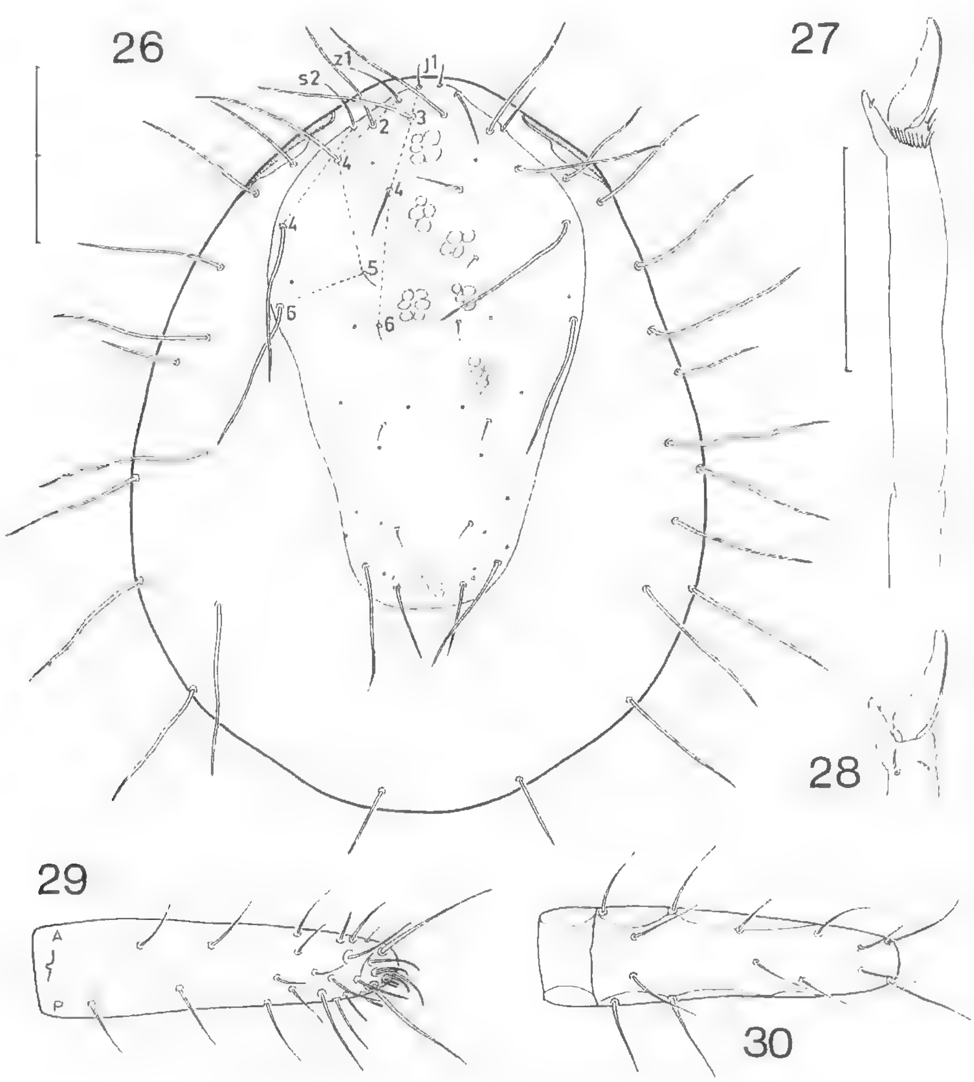
The specimens from *Aname* all lack the subterminal pair of long setae on the dorsal shield. Generally speaking, their body setae are relatively shorter, e.g., *j*6 is hardly longer than *j*5 and *z*5. Their legs are not suitably arranged for detailed examination.

All three series, however, key out together and are clearly conspecific.

Ljunghia rainbowi sp. n.

FEMALE. Capitulum with *c* setae reaching beyond sides of basis. Deutosternal groove more distinct than in *L. pulleini*, with nine rows of multiple denticles. Hypostome with setae *h*1 and 3 subequal to *c*, and longer than *h*2; hypostomatal processes as in *L. pulleini*. Cornicles with incipient cleft distally. Epistome an elongate triangle, weakly denticulate, reaching to mid-femur. Palpi with normal setation on trochanter-tibia, except for unideficient genu (*al*1, *pl*, 3 *d*). Tarsus shown diagrammatically; claw bifid. Chelicera similar to those of *L. pulleini*, but small pilus dentilis present and movable digit almost edentate.

Idiosoma capable of considerable distension because of weakness of shields. Dorsal shield shaped as in *L. pulleini*, 585-615 μm long, 340-365 μm at maximum width. Podonotal half with eleven pairs of setae: *j*1, 3-4, 6, *z*1-2, 4-6, and *s*2, 4. Opisthonotal half with four pairs of setae (two short discals and two long subterminals). Because of strong reduction of setal formulae on dorsal shield, it is idle to assign ten or eleven pairs of setae free on cuticle. Nevertheless, constant position and relative lengths of at least first five pairs suggest they are extrascutal members of *s* and *r* series. More posterior



FIGS. 26-30. *LJUNGHIA RAINBOWI* sp. n.

26-30. Female: 26. dorsum of idiosoma; 27-28. ventrointerior and dorsoexterior of chelicera; 29-30. dorsum and venter of tarsus I.

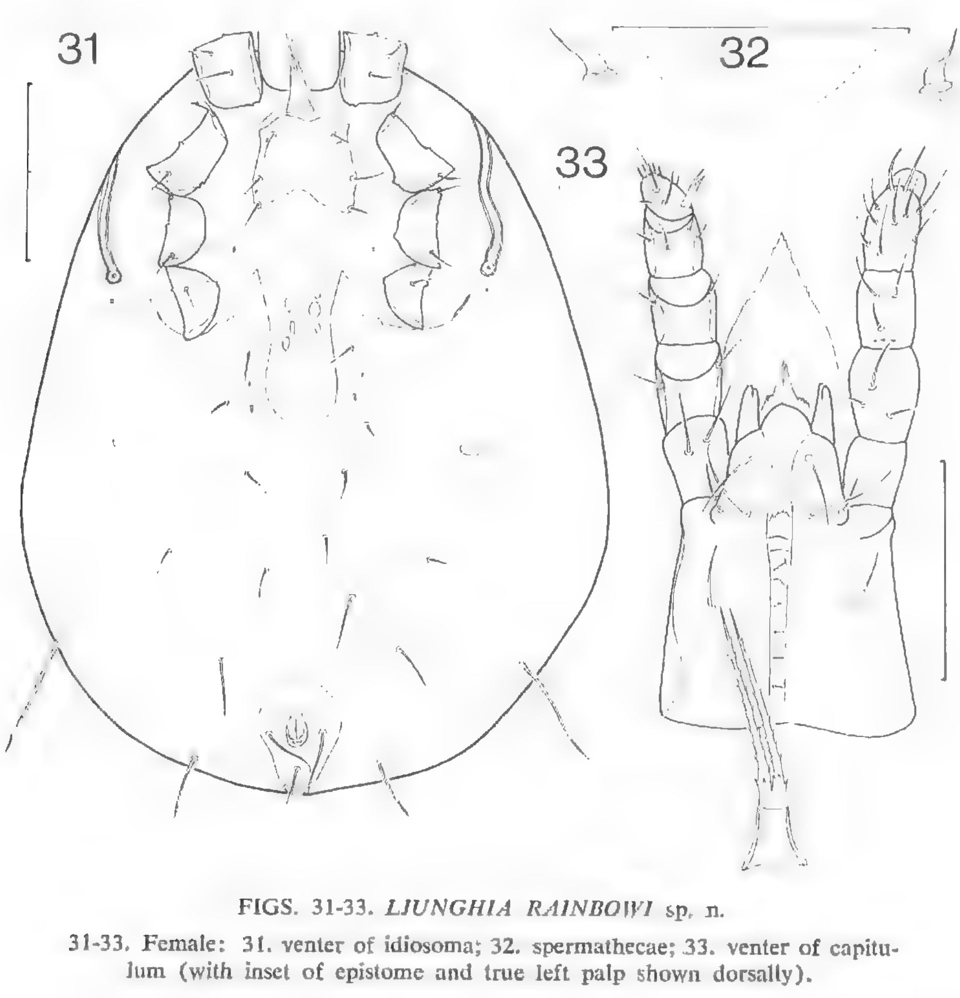
pairs less regular in position, but always long except for terminal pair. Pattern of pores and muscle insertions on shield difficult to discern because of granular inclusions; accordingly, while those shown are correct, more may exist.

Tritosternum with well developed base, but laciniae rather short, slenderly tapering, and weakly ciliated. Sternal shield less conventionally shaped than in other Australian species; pale and unreticulated, with anterolateral margins extremely weak and posterior margin eroded. Sternal setae short and subequal, at most only slightly longer than interval between them; sternal pores present but weak, particularly posterior pair. Metasternal complex represented only by pore. Genital shield reduced and without striae, but with normal muscle insertions and operculum supported by apodemes between coxae IV. Genital setae and pores free in cuticle. Margin of anal shield only slightly extended anteriorly; adanal setae set near centre of anus, rather longer than postanal; cribrum present. Small metapodal shields present. Crescentic exopodal shields IV present but weak. Ventral setae in eight pairs arranged as in *L. hoggi*; of increasing length posteriorly, one posterolateral pair being quite strong. Stigmatic apparatus as in *L. pulleini*, but poststigmatic development minimal.

Legs largely as in *L. pulleini*, with same segments showing normal dermanyssid setation, except for trochanter I (1-0/3-1). Of eight segments modified in *L. pulleini* (Queensland specimens), four retain normal dermanyssid setation (femur III and tibiae II-IV); of remaining four, femur-tibia I are as in *L. pulleini*, while genu IV is normal dorsally, but bears an additional *v* (2-5/2-1). All femora with one *d* distinctly longer than remainder. Tarsus I as in *L. pulleini* except for minute details. Ambulacra as in *L. pulleini*.

MALE AND IMMATURES. Unknown.

LOCALITY. Holotype female and three paratype females from an unidentified spider, Long Gully, South Australia, 11.6.1938, col. H. Womersley, dep. SAM.



FIGS. 31-33. *LJUNGHIA RAINBOWI* sp. n.

31-33. Female: 31. venter of idiosoma; 32. spermathecae; 33. venter of capitulum (with inset of epistome and true left palp shown dorsally).

NOMENCLATURE

Although Womersley (1956) coined his specific name explicitly in honour of R. H. Pulleine, his consistent *pulleini* is in literal accord with Rec. 31A, and is retained as the correct original spelling (Art. 32). Following Womersley's lead, the two new species above are also named after early students of Australian spiders: H. R. Hogg and W. J. Rainbow.

ACKNOWLEDGMENTS

I am grateful to Mr. D. C. Lee, South Australian Museum, Adelaide, for material from Womersley's series and the two new species; to Dr. L. van der Hammen, Rijksmuseum van natuurlijke Historie, Leiden, for slides from the Oudemans collection; to Dr. D. H. Kemp, C.S.I.R.O., Indooroopilly, for specimens from the diplurid with Queensland Museum, Brisbane, labels; and to Miss Leanne Jackson for technical assistance.

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TAXONOMY AND BIOLOGY OF FROGS OF THE *LITORIA CITROPA* COMPLEX (ANURA: HYLIDAE)

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BY MICHAEL J. TYLER AND MARION ANSTIS

Summary

A new species of hylid frog related to *Litoria citropa* is described. The new species inhabits mountainous areas of north-eastern New South Wales and south-eastern Queensland. The tadpoles of both species are described and details of life history are reported. Whereas the adults of *citropa* and the new species are similar, the tadpole mouthparts differ conspicuously.

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ABSTRACT

TYLER, M. J., and ANSTIS, M. 1975. Taxonomy and biology of frogs of the *Litoria citropa* complex (Anura: Hylidae). *Rec. S. Aust. Mus.*, 17 (5): 41-50.

A new species of hylid frog related to *Litoria citropa* is described. The new species inhabits mountainous areas of north-eastern New South Wales and south-eastern Queensland. The tadpoles of both species are described and details of life history are reported. Whereas the adults of *citropa* and the new species are similar, the tadpole mouthparts differ conspicuously.

INTRODUCTION

Litoria citropa is a hylid frog of rather striking appearance and known to occur from north-eastern New South Wales to south-eastern Victoria. The species was known in Victoria from only three specimens (Copland, 1957), until Littlejohn, Loftus-Hills, Martin and Watson (1972) reported on a series collected in East Gippsland. Littlejohn *et al.* provided an analysis of the call, representing the only information on the biology of the species.

Because *L. citropa* is such a distinctive animal and so readily distinguishable from all other Australian species of *Litoria*, we did not envisage that it constituted other than a single species until one of us (M.A.) obtained a series of specimens from Point Lookout in north-eastern New South Wales. These specimens were consistently smaller than those obtained from the central and southern portion of the geographic range, and also differed in the absence of vocal sacs and in having indistinct as opposed to prominent tympana. The subsequent collection of tadpoles introduced an unexpected degree of divergence in what, from adult morphology, we regarded as two closely allied species. Here we define the *L. citropa* complex, describe the new species and report additional biological data.

7th March, 1975

MATERIAL AND METHODS

The specimens reported here are lodged in the following collections: Australian Museum (A.M.); Department of Zoology, University of Melbourne (M.U.Z.D.); South Australian Museum (S.A.M.).

Methods of measurements of adults follow Tyler (1968). The following abbreviations are employed in the text and in tables: S-V (snout to vent length); TL (tibia length); HL (head length); HW (head width); E-N (eye to naris distance); IN (internarial span); E (eye); T (tympanum).

Descriptions of larval morphology follow the format of Duellman (1970) and use the staging tables of Gosner (1960). Measurements were made to the nearest 0·01 mm with either vernier calipers or an eyepiece micrometer. Abbreviations of larval measurements and their definitions follow: ST (total length, being the distance between the tips of the snout and tail); BL (body length, measured from the tip of the snout to the edge of the intestinal mass).

OBSERVATIONS

Definition of the Litoria citropa complex

Members of the *L. citropa* complex occur only in eastern and south-eastern Australia. They are the only Australian frogs possessing a submandibular dermal gland. This gland is located along the lingual margin of the mandible and is clearly demarcated from the surrounding area in having a protuberant form and smooth surface. The supratympanic fold is also a prominent grandular feature.

The snout to vent length of males ranges from 35 mm to 57 mm, and females from 46 mm to 62 mm. The colour of the dorsum varies from brown to green or gold, and there is always a pronounced dark stripe extending along the canthus rostralis and broadening on the sides of the body. The inguinal region and adjacent portions of the abdomen and lower limbs are usually immaculate yellow or reddish-orange.

Litoria citropa (Tschudi)

Type locality: Port Jackson (Sydney), New South Wales.

Material examined: New South Wales—M.U.Z.D. 47/67, 18 km E. of Braidwood; S.A.M. R13304 A-D, 13339 A-F, 13764: Darke's Forest; M.U.Z.D. 176/63: Flat Rock Ck., Royal National Park; M.U.Z.D. 1593/69: 11 km S. of Kiah; M.U.Z.D. 1518-19/69: 8 km S. of Robertson; M.U.Z.D. 1119-20: 10 km W. of Tomerong; M.U.Z.D. 1792-93/64: Upper Allyn; M.U.Z.D. 582/63: Waterfall, Sydney; M.U.Z.D. 1690-91/64: Wombat Ck., Barrington Tops. Victoria—M.U.Z.D. 1594-97/69: Maramingo; M.U.Z.D. 1590-92/69: Tonghi Ck., 8 km W. of Cann River.

Description: Because detailed descriptions of external morphology have been provided by Copland (1957) and Moore (1961), we have only summarised the variation observed in the specimens examined by us, and devoted the greatest attention to those features unreported or inadequately described previously.

The adult males range in size from 44·4 to 56·6 mm S-V, and gravid females from 56·9 to 61·8 mm S-V. The head is bulbous, rounded and broader than long (HL/HW range 0·87-0·96; mean 0·92). The eye to naris distance is consistently greater than the internarial span (E-N/IN range 1·05-1·44; mean 1·3). The superior border of the tympanum passes beneath the glandular supratympanic fold, but the visible portion is very distinct and has a pronounced annulus.

The fingers are long and slender, with moderately large terminal discs, and either a trace of webbing between the third and fourth fingers or no webbing at all (Fig. 1a). Webbing between the toes is incomplete, reaching the subarticular tubercle at the base of the penultimate phalanx of the fifth toe (Fig. 1b). The hind limbs are of short to moderate length (TL/S-V range 0·50-0·57; mean 0·53).

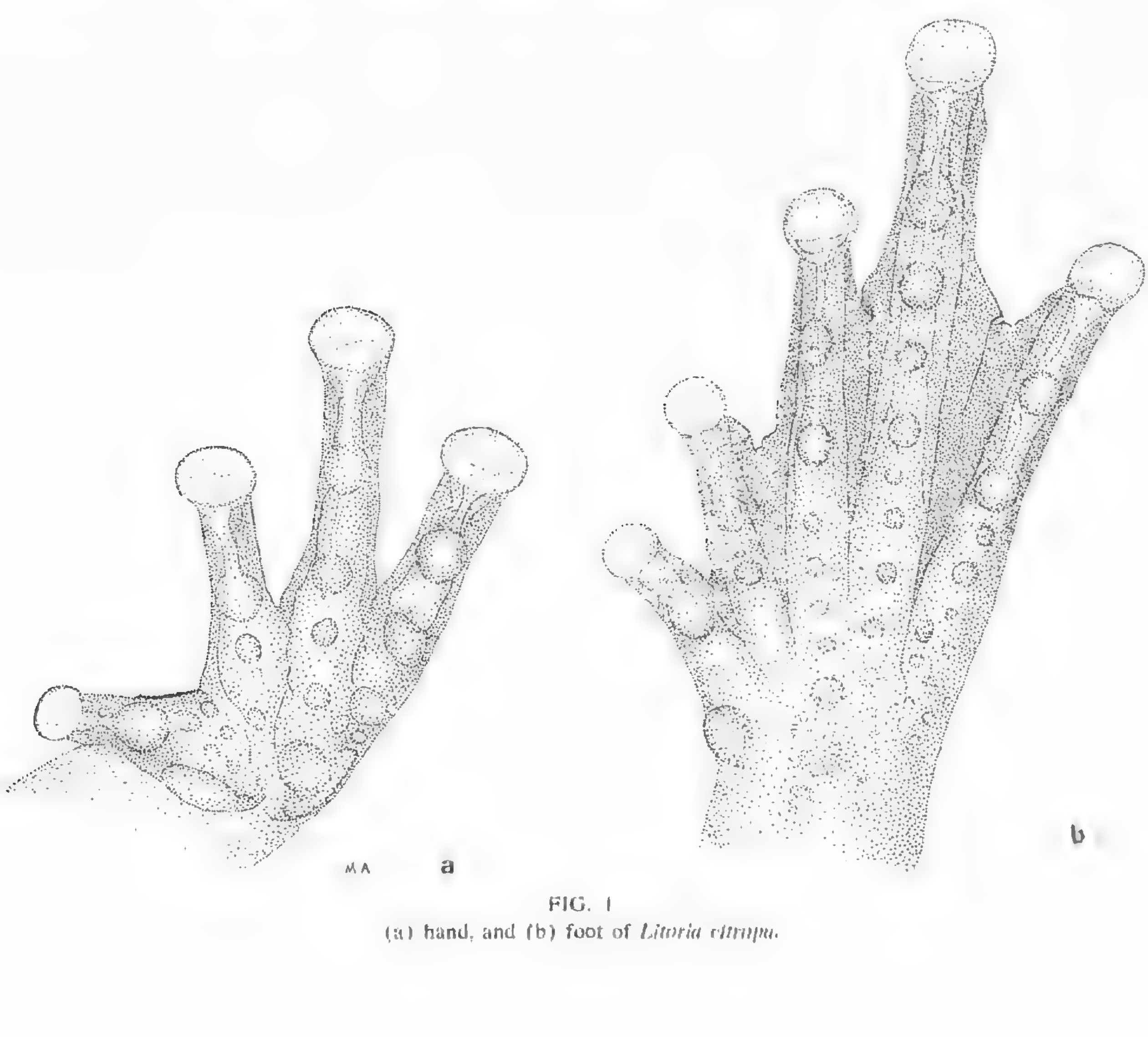

FIG. 1
(a) hand, and (b) foot of *Litoria citropa*.

The vocal sac is a unilobular, submandibular structure confined to the area above the musculus interhyoideus. The size and position of the vocal sac apertures are unique amongst Australian hylid frogs, being very small slits located adjacent to the articulations of the jaws.

The colour in life was described by Kinghorn (1932), and reproduced by Moore (1961). A photograph of a living adult is shown in Figure 2a. Variation of dorsal colours of a live adult includes slate grey with green suffusions, to brown and green or almost pure green. The anterior and posterior surfaces of the hind limbs, the axillary and the inguinal regions are usually deep reddish orange, and the ventral surfaces of the hind limbs are light red.

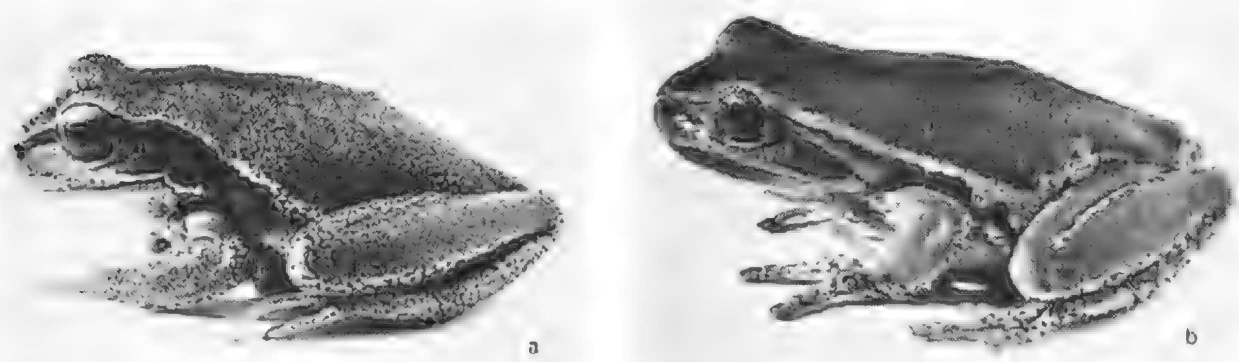

FIG. 2

(a) *Litoria citropa*; (b) *L. glandulosa*.

Some of the specimens examined by us have violet pigmented bones comparable to the condition reported by Tyler (1970) which characterises five other species of frogs occurring in eastern and south-eastern Australia. The pigmentation is most intense in specimens from the extreme south-east of the geographic range: Maramingo, Kiah and Tonghi Creek. Bone pigmentation is very faint or absent in specimens from Tomerong and has not been found in individuals from localities north of Robertson. Absence of violet pigment is in no way associated with the period of time spent in preservative, but is clearly correlated with geography.

Habitat: Specimens were collected over a wide geographic range. The principal field studies, however, took place at Darke's Forest, where adult and/or tadpoles were collected in the following situations: (1) Maddern Creek—a series of broad, deep pools separated by shallow sections of varying flow rates crossing a sandstone base, and sometimes falling into large canyons; (2) The Waratah Creek; and (3) an unnamed creek flowing into the Lodden River.

Plants found along these creeks included species of *Eucalyptus*, *Banksia*, *Acacia*, *Leptospermum*, *Callistemon*, *Hakea*, *Pultenea*, *Persoonia*, *Petrophile*, *Typha*, *Cyperus* and *Ghania*.

Adult Behaviour: Adult males most frequently were collected adjacent to the creeks in Darke's Forest during April, 1971, and September to November, 1972. Dry bulb temperatures recorded on four occasions when frogs were heard calling ranged from 14°C to 19·5°C. During the day frogs were found on sandstone plateaus or outcrops, either beneath or amongst the rocks, and usually fairly close to water. The mating call has been described and analysed by Littlejohn *et al.* (1972). The impression gained was that calling increased on warmer nights following rain when the skies were still overcast.

Breeding is known to occur in September and November and possibly extends until January. Amplexus is axillary.

Life history: Amplexus was observed in a captive pair on the night of 6th-7th November, 1972. The individuals were placed in a plastic container with some water and amplexus was observed at about 20-30 hours. The female uttered a soft release call for some minutes following the onset of amplexus and then remained silent. The specimens were then transferred to a dish containing water, a large, flat sandstone rock and some reeds, and 890 eggs were laid during the night, either singly or in small groups and attached to the surface of the rock or to the floor of the vessel.

The sites of ova deposition in the field were the smooth rocky floors of small pools connected to or separated from the creeks. In all cases the water depth ranged from approximately 10 to 70 mm. The outer capsules of the eggs became covered with fine brown silt within two or three days of deposition.

The eggs have dark brown animal hemispheres, appearing black macroscopically and have creamy white vegetal hemispheres. There are three vitelline membranes.

Measurements of the early stage embryos, capsules and larvae derived from the above mating are listed in Table 1. Initial development was rapid, nerulation was reached early on 9th November, and the tail bud (Stage 17) later on the same day. At this stage a U-shaped groove united two well-formed ventral suckers, above which occurred the stomodeal depression. The body was dark brown and the yolk sac yellowish-brown.

TABLE 1

MEASUREMENTS OF EMBRYOS AND LARVAE OF L. CITROPA AT VARIOUS STAGES

(Means in parenthesis)

EMBRYOS

Stage	Sample	Embryo Diameter (mm)	Capsule Diameter (mm)
2	4	1·68-1·76 (1·73)	5·92-6·48 (6·10)
4-5	5	1·60-1·76 (1·70)	5·44-7·20 (6·18)
5	3	1·70-1·80 (1·75)	5·84-6·48 (6·19)
5-6	3	1·68-1·76 (1·72)	6·08-7·20 (6·45)
8-9	15	1·76-1·84 (1·78)	5·36-6·48 (6·08)
17	15	2·56-3·48 (3·12)	
			Total Length (mm)
19	1		5·68
20	10		5·84-6·56 (6·26)
21-22	9		6·24-7·12 (6·76)
23	3		8·24-8·64 (8·45)
24	3		8·48-9·28 (8·96)
25 (early)	8		8·96-10·16 (9·65)
25 (late)	9		12·48-13·44 (12·92)

LARVAE

Stage	Sample	Body Length (mm)	Total Length (mm)
26	8	5·9-7·8 (6·9)	14·7-20·0 (17·1)
27	11	6·7-9·0 (8·1)	16·2-23·0 (20·3)
28	4	9·4-11·2 (10·3)	23·8-25·6 (24·5)
29	3	10·3-11·2 (10·8)	24·1-28·7 (26·3)
31	6	9·9-11·7 (10·9)	25·8-30·1 (28·3)
32	2	11·0, 11·8	28·7, 29·4
34	1	11·4	29·5
35	3	12·0-12·5 (12·2)	32·9-33·9 (33·2)
36	3	11·3-12·0 (11·7)	30·4-31·6 (30·9)
38	1	12·8	33·4
40	1	13·0	34·1

Hatching commenced after four days at Stage 20, but the peak was reached on the fifth day, and a few larvae hatched on the sixth day at Stages 20 to 21. By Stage 20 there were two pairs of external gills (each with only one or two branches), indistinct optic bulges, and prominent olfactory pits; the stomodeal depression had deepened and the ventral suckers had increased in size.

Maximum gill development occurred at Stage 22 with the anterior pair possessing one or two branches, and the posterior pair two or three. The optic bulges were still not distinctly demarcated and the corneas remained opaque. Stage 23 (material collected in the field on 1st October, 1972) exhibited greatly reduced external gills, clear corneas, well-differentiated olfactory pits (nares), lateral-line sense organs extending along the body to the caudal region, well-developed labia, and an open or partly open anal tube.

Oral ridges on which the labial teeth had developed were characteristic of Stage 25. The horny beak became pigmented and the extreme reduction of the ventral suckers diminished at this stage. Subsequent development mainly involved increase in size and proportions as recorded in Table 1.

In our description of the new species of the *L. citropa* complex we provide a detailed composite description of tadpoles at Stages 29 and 36. Here we report only those features apparent at Stage 35 of *L. citropa* that differ from those of the new species. Thus the anal opening is diagonal from the edge of the ventral fin, and tail depth is greatest just anterior to its mid-region.

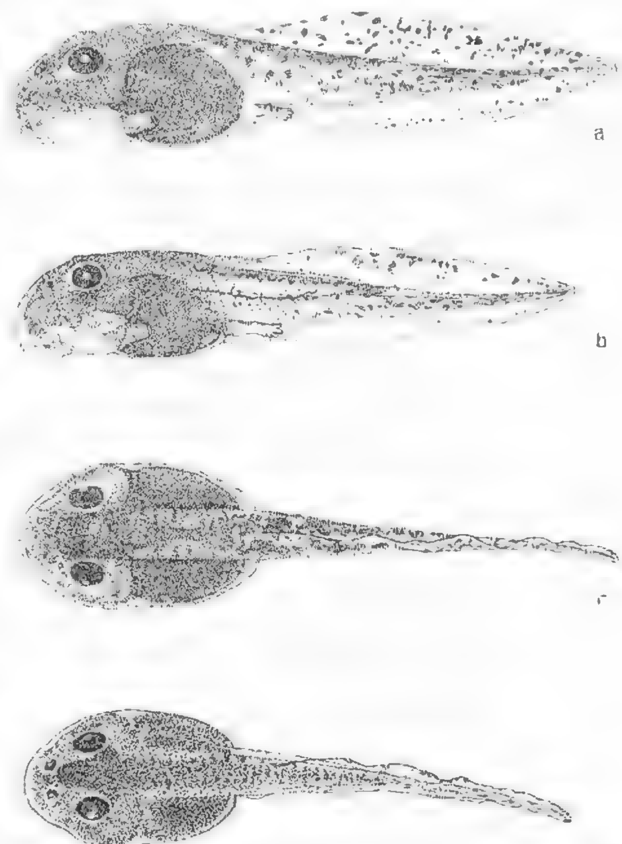

FIG. 3

(a and c) Lateral and dorsal views of larva of *Litoria citropa* at stage 35; (b and d) lateral and dorsal views of *L. glandulosa* at Stage 36.

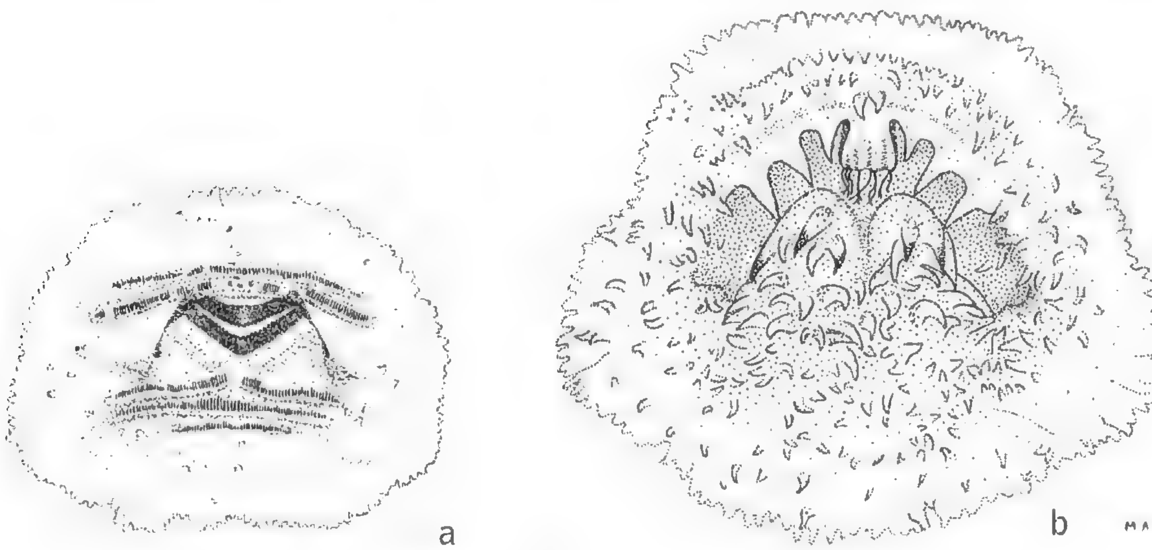

FIG. 4
Mouthparts of (a) *Litoria citropa*; (b) *L. glandulosa*

The mouth is ventral in position (Fig. 3a), and the labia are bordered by a single row of small papillae (Fig. 4a); only a few small papillae occur inside the labial border. There are two rows of upper labial teeth and three rows of lower labial teeth, of which the second upper is the longest, and the third lower the shortest. There is a medial gap in the second upper row and in the first lower row. Odd teeth were missing in the majority of the specimens examined. The beaks are pigmented, relatively shallow, and of almost equal depth with moderately-sized serrations.

In preserved specimens the dorsal surface of the body and the upper labium are dark brown with small areas of darker pigment. The orbital and narial regions are paler. The caudal musculature is cream and densely blotched with brown dorsally. The fins are transparent, but marked with scattered clusters of melanophores. The lateral line organs are unpigmented. In life the dorsal and lateral body surfaces have a uniform golden sheen, noticeably incomplete in its distribution at earlier stages (e.g., Stages 25-26).

Metamorphosis of tadpoles reared from the spawn laid on 6th November, 1972, was completed in January, February and March, 1973, indicating a larval life of from two to four months. Snout to vent lengths of eight newly metamorphosed specimens ranged from 11·9 mm to 14·3 mm (mean 13·1 mm).

Distribution: *Litoria citropa* extends from Aberfeldy in south-eastern Victoria to the Barrington Tops in New South Wales (Fig. 5).

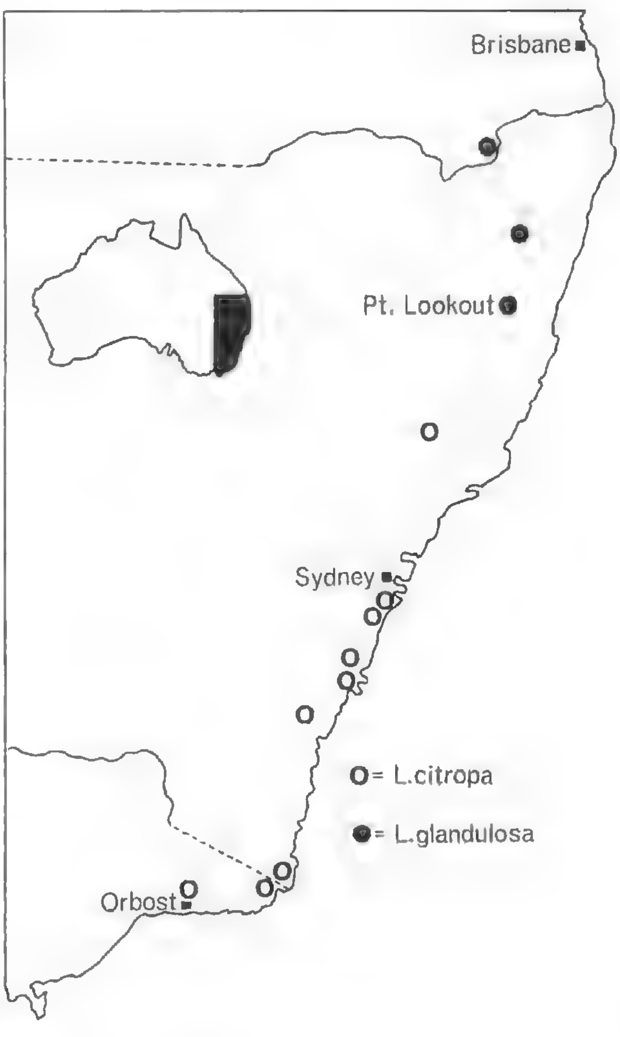

FIG. 5
Geographic distribution of the *Litoria citropa* complex. The close proximity of several adjacent localities is such that each individual locality cannot be shown on a figure of this scale.

Litoria glandulosa n. sp.

Holotype: S.A.M. R13504. A gravid female collected at Barwick Creek, Point Lookout, near Ebor, New South Wales, by M. Anstis on 24th January, 1973.

Definition: A moderately-sized species (adult females 45·8-50·4 mm S-V; adult males 34·5-40·3 mm S-V). Adults are characterised by an indistinct tympanum, and by the presence of a submandibular gland. The tadpole is unique amongst previously described Australian species in lacking tooth rows, and in possessing elongate tubercles and filaments within the buccal cavity (Fig. 4b).

Description of Holotype: The head is deep, bulbous and broader than long (HL/HW 0·91), its length is equivant to approximately one third of the total length (HL/S-V 0·34). The snout is not prominent; bluntly rounded when viewed from above and evenly rounded (but not projecting) in profile. The nostrils are orientated dorsolaterally; their distance from the end of the snout is slightly more than one-half the diameter of the eye. The distance between the eye and the naris is greater than the internarial span (E-N/IN 1·16). The canthus rostralis is clearly demarcated and straight, and the loreal region sloping but not concave. The eye is rather small and not prominent; its diameter equals the E-N distance. The tympanum is small and very poorly defined, there being no distinct tympanic annulus; the tympanum is separated from the eye by a distance about one-third of the eye diameter. The vomerine teeth are on two confluent elevations whose anterior borders are level with the posterior margins of the choanae. The tongue is broadly oval with a very weakly indented posterior border.

The fingers are long and slender with slight lateral fringes and prominent subarticular tubercles (Fig. 6a). There is only a trace of basal webbing between the fingers. The terminal discs are rounded and prominent.

The hind limbs are short and muscular (TL/S-V 0·52). Toes in decreasing order of length 4>5>3>2>1. Webbing between the toes reaches mid-way up the penultimate phalanx of the fifth digit, to a position slightly below the penultimate phalanx of the fourth digit. The terminal discs are prominent. There is a small oval inner and a very slightly developed rounded outer metatarsal tubercle (see Fig. 6b).

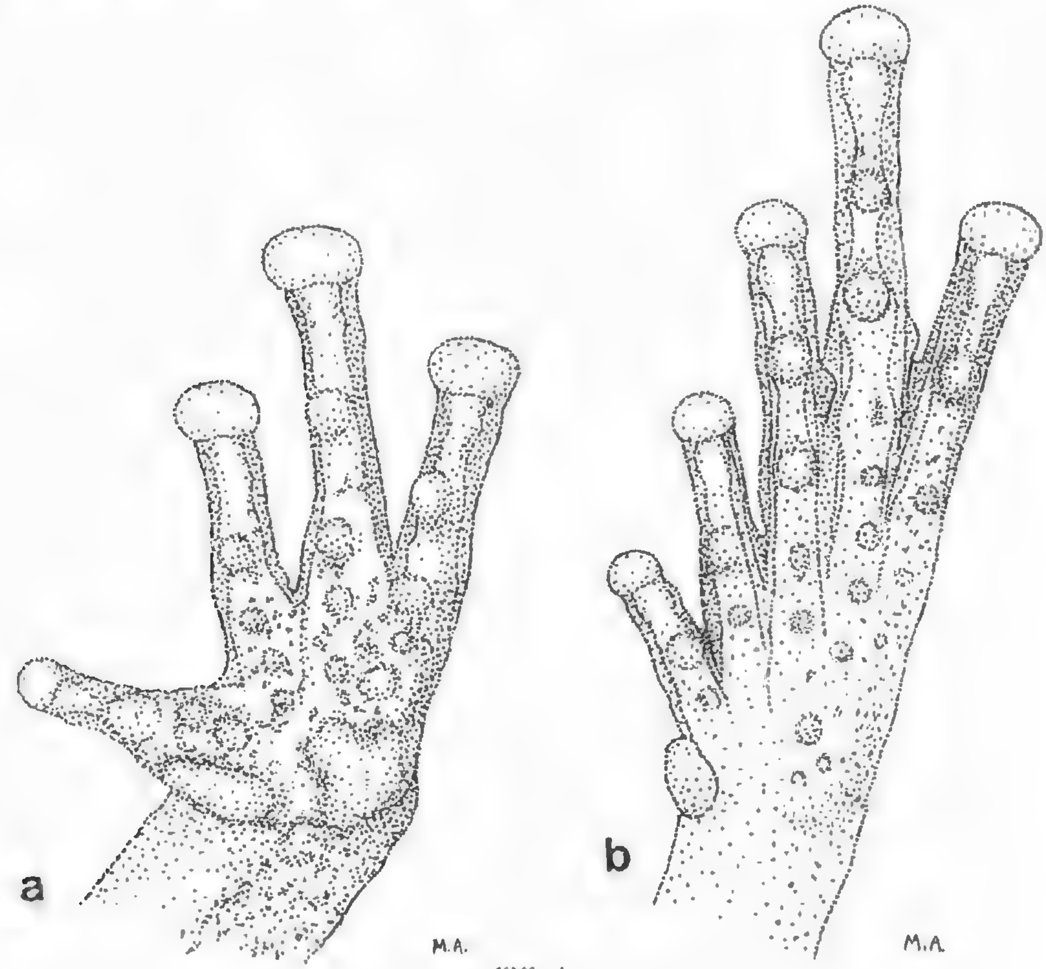

FIG. 6
(a) hand, and (b) foot of *Litoria glandulosa*.

The skin of the dorsal surface of the head and body is rather coarsely granulate. There is a very prominent supratympanic fold which obscures the upper portion of the tympanic region extending from the posterior corner of the eye to a position above the insertion of the forelimb. There is a slender supralabial gland and a narrow tarsal ridge.

There is a broad and prominent submandibular gland covered by smooth skin; the remainder of the ventral surface of the throat, pectoral region, abdomen and limbs is coarsely granulate.

The dorsal surface of the head, body and limbs is dark blue in life. The supratympanic fold is darker, and superior to it is an extremely irregular pale brown line merging into isolated creamish patches on the flanks. The supralabial gland is white and is preceded by a similarly coloured line extending to beneath the eye. A disrupted white line extends along the anterior portion of the labial margin.

The ventral surfaces are dull creamish in colour and densely stippled with black, particularly on the submandibular gland and breast. The posterior surfaces of the thighs are predominantly dull brown, sparsely spotted with cream. These cream spots are densest in the subcloacal area.

Dimensions: Snout to vent length 45·8 mm; tibia length 23·7 mm; head length 15·5 mm; head width 17·1 mm; eye to naris distance 4·3 mm; internarial span 3·7 mm; eye diameter 4·6 mm; tympanum diameter approximately 2·3 mm; diameter of terminal disc of third finger 2·3 mm.

Variation: There are 38 paratypes: S.A.M. R13505-10, collected at Barwick and Bullock Creeks, Ebor on 24th January, 1973; S.A.M R13060 (11 juveniles); S.A.M. R13303, collected at Barwick Creek in January, 1973; S.A.M. R13626-39, A.M. R39498, collected at Point Lookout in May, 1973, all above specimens taken by M.A.; M.U.Z.D. 1991/68, 1992/68, 1997/68, 1999/68, collected at Point Lookout by M. J. Littlejohn, J. J. Loftus-Hills and G. F. Watson; M.U.Z.D. 1885/68 collected at 65 km E. of Glen Innes by Littlejohn, Loftus-Hills and Watson.

The adult male paratypes have snout to vent lengths ranging from 34·5 mm to 40·3 mm. All lack vocal sacs. The short limbs, relatively high E-N/IN ratio and broad head of the holotype are consistently demonstrated by the following ranges and means of proportions of these specimens: TL/S-V = 0·48-0·53, mean 0·50; E-N/IN 1·00-1·23, mean 1·14; HL/HW 0·87-1·00, mean 0·91.

Coloration varies only in the intensity of the blue dorsum and in the extent of the irregular lateral stripes and light markings on them. The posterior surfaces of the thighs are consistently darkly patterned. Snout to vent lengths of recently metamorphosed specimens ranged from 11·5 to 14·5 mm (mean 13·0 mm).

Coloration in life: Observations on an adult (S.A.M. R13678) indicated differences associated with activity. When active the dorsal surface of the head, body and limbs was brilliant green. The lateral stripe was dark brown on the side of the head, becoming paler in the supratympanic region and merging with a series of golden patches in the inguinal region. This lateral stripe was bounded superiorly by a gold line broadening on the body. The superior labial margin bore a cream stripe extending posteriorly to above the insertion of the forearm. The section of the head anterior and posterior to the eye and between these labial and lateral stripes was pale green. The iris was uniformly golden. There were rows of gold and brown flecks on the borders of the limbs. The hands and feet were mottled with gold and green. The ventral surfaces were a creamish white; the submandibular gland had a faint yellow hue. The axilla, and inguinal areas and the anterior and posterior surfaces of the hind limbs were a translucent deep yellow.

When the frog was at rest the dorsum was usually very dark brownish-green, the lateral stripe and associated patches a rusty brown and the labial stripe grey. The iris was golden above the pupil, brown below it. The ventral surfaces were generally dusky brown.

In other specimens dorsal coloration ranged from olive with uniform dark green mottling (or mottling confined to the limbs), green with large, discrete gold patches (J. de Bavay, pers. comm.) to gold or brown so that the lateral stripe was scarcely discernible. Those found in green vegetation were inevitably bright green, whether collected by day or night. The colour of individuals found beneath rocks or logs varied from dark brown to almost any shade of green. In captivity most frogs were dark whilst at rest during the day and bright green whilst active at night.

Habitat: The specimens collected or observed by M.A. were taken adjacent to creeks and rivers in cool, montane forest within 10 km of Point Lookout, and at altitudes of 1 350-1 450 metres. These water courses are:—

(*a*) Barwick River, consisting of moderately deep pools (containing submerged plants), separated by shallow flowing sections and waterfalls. The floor of the river is predominantly basalt.

(*b*) Little Styx River, which is similar to Barwick River, but appreciably broader.

(*c*) Bullock Creek, which differs from Barwick River only in its generally smaller dimensions and predominantly granite base.

(*d*) Spring Creek, the smallest of all four watercourses, with a sandy floor over a basalt base.

Amongst the vegetation on the banks were species of *Juncus*, *Epacris*, *Leptospermum*, *Ranunculus*, *Pterostylis* and various ferns. Areas of sphagnum were present. The dominant species of tree was *Eucalyptus pauciflora*, which was replaced by *Nothafagus moorei* at higher altitudes.

Adult behaviour: During the periods of observation the species was found amongst vegetation adjacent to the watercourses, beneath rotten logs, under bark on trees or amongst rocks and low vegetation (particularly *Juncus*).

In May, 1973, 14 adult males, one female and one juvenile were found together under a rotting log approximately three metres long and one metre across. We conclude from their sluggish behaviour that they had aggregated to hibernate communally. To our knowledge this represents the first report of a possible communal hibernaculum for frogs in Australia.

Data on breeding behaviour are lacking. However, we have evidence to indicate an exceptionally long breeding season. For example, the sighting of amplexal pairs on the Barwick River in mid-December, 1971 (J. Barker, pers. comm.), indicates larval development during the summer months when water temperatures reach their annual maxima. The dates of collection of the stages of larvae reported below are consistent with ova being deposited in November-December.

In apparent conflict is the finding of a gravid adult female in May in the hibernaculum. The entire body cavity was filled with large pigmented eggs up to 2·1 mm in diameter and, perhaps more significantly, the oviducts were greatly enlarged and extensively convoluted. The specimen was found in breeding condition at a time when ground temperatures were so cold as to make it lethargic. We therefore believe that at least this female would have been in breeding condition at the conclusion of hibernation in the following spring.

Newly metamorphosed specimens of *L. glandulosa* were collected in December, supporting our belief that some individuals do breed in the spring.

The mating call has not been recorded on tape. It consists of a series of several, moderately low-pitched notes initially increasing in volume and rate, and finally slowing. M.A. likens it to: "orak-orak-orak . . . .".

Life History: The spawn and early stages of development are unknown. Tadpoles in Stages 25 to 43 were observed in the Barwick River on 20th December, 1972, in a shallow, slowly moving section just beneath a deep pool. Most larvae appeared to be feeding over the red silt covering stones on the stream bed. When disturbed they swam under rocks. Stages 29 to 36 were collected on 25th January, 1973, from a physically similar section of Spring Creek but in an area where the floor was covered with pale sand, against which tadpoles were well camouflaged. Some were amongst the roots of water plants, but others lay in exposed areas, occasionally moving to the shallower sections of the pool.

Measurements and ratios of proportions on the above series are summarised in Table 2. The following description of larval morphology is a composite one based on specimens at Stages 25-43.

TABLE 2

MEASUREMENTS OF LARVAE OF L. GLANDULOSA AT VARIOUS STAGES AT BARWICK RIVER COMPARED WITH SPRING CREEK WHICH ARE SHOWN IN PARENTHESIS

Stage	Body Length (mm)	Total Length (mm)	Sample Size
25	4·8	14·3	1
26	5·3	13·5	1
29	10·2 (8·5)	26·2 (20·6)	1 (1)
30	9·9, 10·1	23·6, 23·8	2
31	10·4	24·8	1
33	9·4 (9·6)	23·2 (25·0)	1 (1)
34	(10·2-11·0)	(25·3-29·0)	(3)
35	11·0 (9·9-10·9)	26·2 (26·1-30·0)	1 (7)
36	10·9-11·2 (11·0, 11·6)	26·2-17·4 (30·2, 30·5)	3 (2)
37	11·4	29·0	1
38	10·7, 11·7	29·1, 31·0	2
39	11·0-11·7 (11·2)	29·7-32·4 (30·5)	4 (1)
40	11·0	29·5	1

The snout is evenly rounded in lateral and dorsal profiles (Fig. 3b, d). The nares are closer to the tip of the snout than to the eyes, dorsal in position and directed anterolaterally. The eyes are in a dorsolateral position. The body is broadest at a position corresponding to the level of the eyes and is broader than deep. The spiracle is sinistral, ventrolateral in position and is slightly further from the tip of the snout than from the anus. The anus is dextral, opening adjacent to the edge of the ventral fin.

The tail is a moderately thick structure deepest at about the anterior one-third, narrowing posteriorly and is terminally rounded. The lateral lines are pigmented and the lateral line organs are numerous and narrowly spaced.

The oral disc is ventral in position and is in the form of a funnel marginally surrounded by a row of small papillae (Fig. 4b). The area within this funnel is occupied by numerous finely-pointed papillae projecting ventrally and occupying the greater part of the lumen. From the most superficial to the deepest, the lengths of the papillae increase so that all terminate in the form of spikes near the level of the disc margin.

On the inner edge of the lower labium, adjacent to the mid-line, is a variable number (2-6) of large, black papillae. There are no tooth rows and the horny beak is small, unpigmented and located far posteriorly. There is a flat white structure projecting from the centre of the upper beak forward and then inclined ventrally, and terminally divided into from four to seven tooth-like structures, each of which bears from one to four fine, hair-like black filaments. Some of the filaments are branched. In many specimens all filaments have broken off leaving a white basal core. On each side of this projecting structure is a row of three large, pointed papillae.

In life the dorsal surface of the tadpole is brown with an irridescent golden sheen. Small, scattered, dark brown spots are most conspicuous in later stage tadpoles. The areas around the eyes and nares are least pigmented. The fins are transparent, but for dark brown flecks, densest on the superior margin. The caudal musculature appears cream in transparency. In preservative the golden irridescence of the body is lost and the specimens appear darker.

At metamorphic climax body lengths range from 12·0 mm to 12·8 mm. In life frogs at this stage are brown with a gold sheen. The lateral stripe, so conspicuous in adults, extends posteriorly only to the insertion of the arm. The dorsum bears numerous flattened tubercles which become progressively less conspicuous in older specimens.

Distribution: *Litoria glandulosa* probably replaces *L. citropa* on the Great Dividing Range of northern New South Wales (Fig. 5). G. Ingram (pers. comm.) reports collecting specimens in eastern Queensland just north of the New South Wales border which were probably *L. glandulosa*. Three specimens were taken adjacent to the Girraween National Park, south of Stanthorpe. The description of the habitat (a small creek descending from extensive rock formation) is similar to those at which *L. glandulosa* has been collected by M.A.

COMPARISON WITH OTHER SPECIES

Distinguishing characters for adult *L. glandulosa* and *L. citropa* are compared in Table 3.

TABLE 3

SUMMARY OF MAJOR DISTINGUISHING FEATURES OF L. GLANDULOSA AND L. CITROPA

Character	L. glandulosa	L. citropa
S-V (males) mm	34·5-40·3	46·9-56·6
S-V (females) mm	45·8-50·4	56·5-56·9
Tympanum	hidden	distinct
Vocal sac	absent	present
Bones	unpigmented	unpigmented or violet
Larval labial teeth	absent	present
Larval oral disc papillae	elongate	short
Larval horny beak	small, white	large, black

Adults of *Litoria glandulosa* can be easily distinguished from all other species of *Litoria* except *L. citropa* by its possession of a very large submandibular dermal gland and prominent supratympanic fold. Only *L. caerulea* has comparable (and in fact more extensive) supratympanic fold, but it is a much larger and far more robust animal and lacks the dark lateral band and gold lateral line of *L. glandulosa*, and has broadly webbed fingers.

DISCUSSION

Absence of labial teeth in hylid tadpoles has previously been reported only for the Neotropical Region (Martin and Watson, 1971), where, in the genera *Amphignathodon*, *Cryptobatrachus*, *Gastrotheca* and *Hemiphractus* larvae are carried on the backs of parent females for at least part of their development. Species of *Hyla* lacking labial teeth usually have enlarged horny beaks. The absence of both labial teeth and of a pigmented horny beak in *L. glandulosa* appears unique.

Until now the newly described species *L. glandulosa* has been included within *L. citropa* and, although morphological comparison of the adults of the populations indicates two distinct species, it appears that they are closely related to one another. Our finding that the larval mouthparts of *L. citropa* (*sensu stricto*) are of a pattern common to many Australian *Litoria*, whereas those of *L. glandulosa* are so different therefore poses problems of interpretation.

There are far from adequate data for assessing the ancestry and phylogenetic relationships of Australian hylids. In view of the extent of morphological divergence currently encompassed within *Litoria*, it can be predicted with some confidence that *Litoria* will be ultimately shown to constitute several distinct genera.

If *L. citropa* had not been known and we were here describing *L. glandulosa*, there would be adequate data from our knowledge of adult and larval morphology to place it in a new genus. The purpose of such a step being to demonstrate that *L. glandulosa* is so different from all species recognised previously, the erection of a separate genus would be a useful and logical step demonstrating the extent of divergence from *Litoria* as currently constituted.

In the absence of any information on larvae, subsequent discovery of *citropa* adults would not have posed a problem. The general morphology and particularly the possession of the submandibular dermal gland would have justified its association with *glandulosa* in the new genus. Subsequent discovery and identification of the tadpole of *citropa* with its generalised mouth-parts would raise the sort of questions that we now actually face.

There seems no reason to doubt that the direction of larval evolutionary change is from the generalised hylid pattern of *citropa* to the bizarre lotic adaptation of *glandulosa*. Nevertheless, the extent of the adaptation involves major morphological changes: loss of all labial teeth rows, and pigmentation of the horny beak, and the development of oral disc tubercles with keratinised tips. Whether or not the central black filaments suspended anterior to the pharynx involve particle filtration, or have a sensory function, is immaterial to the assumption that their evolution constituted an extremely major evolutionary shift.

We do not dispute Watson and Martin's (1971) contention that hylid larval features are of value in assisting studies of phylogenetic relationships. However, our observations demonstrate that divergence in adult and larval morphology is not necessarily complementary.

ACKNOWLEDGMENTS

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A REVISION OF THE PENTATOMIDAE (HEMIPTERA—HETEROPTERA) OF THE RHYNCHOCORIS GROUP FROM AUSTRALIA AND ADJACENT AREAS

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Summary

The history of the recognition and a definition is given of the *Rhynchocoris* group of pentatomid genera. A first section of five genera, two of them new, are described, or revised and redescribed. Thirty-eight species of these genera from the Australian, New Guinea and neighbouring Pacific islands, 22 of them new, are described, or redescribed, and figured. Two other species formerly thought to occur in this area are shown to occur only outside of it, each is briefly redescribed but not figured.

A REVISION OF THE PENTATOMIDAE (HEMIPTERA—HETEROPTERA) OF THE RHYNCHOCORIS GROUP FROM AUSTRALIA AND ADJACENT AREAS

PART I. THE GENERA FROM *OCIRRHOE* THROUGH *CUSPICONA* TO *PETALASPIS* WITH DESCRIPTIONS OF NEW SPECIES AND SELECTION OF LECTOTYPES

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ABSTRACT

GROSS, G. F. 1975. A revision of the Pentatomidae (Hemiptera-Heteroptera) of the Rhynchocoris group from Australia and adjacent areas. Part I. The genera from *Ocirrhoe* through *Cuspicona* to *Petalaspis* with descriptions of new species and selection of lectotypes. *Rec. S. Aust. Mus.* 17 (6): 51-167.

The history of the recognition and a definition is given of the *Rhynchocoris* group of pentatomid genera. A first section of five genera, two of them new, are described, or revised and redescribed. Thirty-eight species of these genera from the Australian, New Guinea and neighbouring Pacific islands, 22 of them new, are described, or redescribed, and figured. Two other species formerly thought to occur in this area are shown to occur only outside of it, each is briefly redescribed but not figured.

INTRODUCTION

The group relationships of the Pentatomidae are in such an unsatisfactory condition that recognition of formal super-generic categories seems undersirable.

In Gross (1975, and in press) where this problem is considered in greater detail it is proposed that the term "group" be applied to clusters of allied genera, each such group being named after the oldest or most typical genus included therein.

The *Rhynchocoris* group of genera of Pentatomidae was first recognised by Stål in 1870 (p. 636) under the name "division Rhynchocorina" in these words: "Genera *Rhynchocoris, Hoffmanseggiella, Morna, Pugione, Pegala, Vitellus, Cuspicona, Ocirrhoe* et *Periboea* divisionem (*Rhynchocorina*) formant, quae mesosterno alte carinato, carina anterius inter vel ante pedes anticos in laminam producta, metasterno elevato, postice emarginato, basi ventris spina, in emarginatura metasterni quiescente, armata, marginibus scutelli apice vel apicem versus nec elevatis, sæpissime etiam tibiis teretibus, sulco destitutis, marginique postico thoracis lævi est insignis[1])".

The group as such was referred to again by Atkinson in 1888 (p. 147) and then by Distant in 1902 (p. 221) as the Rhynchocoraria. Distant's concept of the group was somewhat wider than Stål's or Atkinson's as some of the genera he included (*Sabaeus, Amblycara*) lacked strongly raised, laminate keels on the meso- and metasterna.

My concept of the *Rhynchocoris* group of genera is substantially the same as Stål's and Atkinson's but includes some additional genera (e.g. *Petalaspis, Biprorulus* etc.) described after both ceased to be active in the field and some new genera described in this first part or to be described in the second part.

The group in the Australian region make up one of the biggest and easily characterised subgroupings of Pentatomidae along with the *Halys* group which, in certain features such as the development in some genera of spinously produced juga and the development in a number of genera of spinously produced (or acute) lateral angles to the pronotum, they resemble. However these similarities appear to have arisen convergently for the two groups do not appear to be closely related on other features of the external morphology or of the rigid or sclerotised portions of the male and female genitalia.

Members of the *Rhynchocoris* group as understood here have the following attributes:—medium to large size; juga reaching to apex of anteclypeus, slightly beyond, or produced spinously anteriorad; anterolateral angles or pronotum entire, not serrate; lateral angles of pronotum obtuse or convex, or with posterior part of anterolateral margins forming an acute angle or produced into a spinous process; on mesosternum a raised laminate keel which projects forward over prosternum; on metasternum a similar keel with apex adpressed to the base of the mesosternal keel, or the area of contact difficult to see, its base expanded and excavated or notched; on abdomen arising from second and part of third ventrite an elevated area

22nd December, 1975

directed as a spinous process anteriorly whose apex fits into the notch on the metasternal keel; orifices of metathoracic scent glands followed dorsally by a long, usually curved, vertically directed streak or keel; colour in life usually some shade of green fading to yellowish, yellowish-brown, or brownish when preserved as pinned specimens, other colours frequently present are black, brown, luteous and a bright carmine red, these latter colours not usually fading after capture; outline of posterior margin of pygophore not usually complicated by marked projections or processes; claspers strongly F-shaped, the upper ramus longer than median bulge, frequently inclined upwards a little to appear oblique, median bulge usually blunt or convex and dorsally forming a flattened or convex pilose platform (Figs. 6 C, 8 E, 15 E, 25 A, 25 C-D, 25 F etc.); aedeagus with phallosoma honey-coloured and semi-transparent (in most of the species of other groups of Pentatomidae the phallosoma is more heavily sclerotised and blackish, dark brown or brown in colour, in several sets of dissections one specimen, presumably teneral, had a honey-coloured phallosoma whereas others of that same species had the darker phallosoma, in species of the *Rhynchocoris* group the phallosoma was always honey-coloured), conjunctiva membranous and either single lobed and projecting somewhat anteriorly, or bifid, sometimes right from base, in other cases only towards apex, laterally on conjunctiva on each side a flattish ear- or tongue-like process, here called the "lappet" processes, which are usually a little darker than the rest of the conjunctiva, medial penial plates parallel and directed ventrally, frequently in the form of an inverted Y with very blunt arms as viewed laterally, in other cases hatchet-shaped, vesica and gonopore located in front of the medial penial lobes and directed downwards at about 45° (Figs. 15 C, 25 B, 25 E, 40 A, 46 A, 50 A-C etc.); female external genitalia generally unremarkable; spermathecae only of *Ocirrhoe lutescens* Distant (Fig. 1 A) and of *Cuspicona simplex* Walker (Fig. 1 B) examined, these of usual pentatomid form with a median hollow sclerotised rod through which the sperm-carrying duct runs, processes (diverticula) of the apical spermathecal bulb much longer than those seen in most other pentatomid genera investigated, a single sclerite at entrance of spermathecal duct into genital chamber.

The relationships of this group of genera to other groups within the Pentatomidae are not clear. On external features the group would appear to be related to genera which have a forwardly directed spine arising from the basal abdominal ventrites e.g. *Piezodorus*, *Catacanthus*, *Aspideurus*, *Menida* etc. or those with a conical tubercle or a convex swelling on the basal abdominal segments e.g. *Glaucias*, *Amblybelus*, *Plautia*, *Alciphron* etc. Some of the latter group are also green though this green does not fade in collections. The structure of the aedeagus and claspers in these various genera does not indicate any particularly close relationship between any of them and genera of the *Rhynchocoris* group though there is general relationship amongst many of them.

A relationship between the *Rhynchocoris* group and the Tessaratomidae equally cannot be discounted as some of the latter group have forwardly directed processes developed from the basal visible segments of the abdomen or

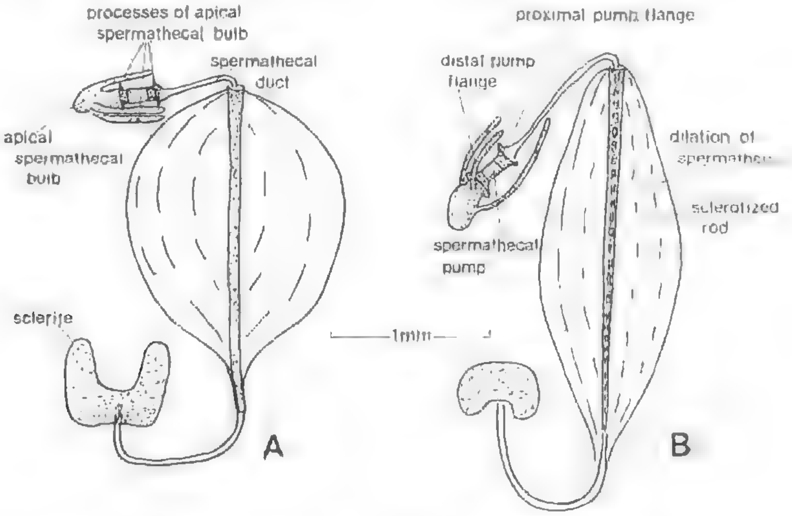

Fig. 1. Spermathecae A. *Ocirrhoe lutescens* Distant. *Cuspicona simplex* Walker.

mesosternal and metasternal keels but again the structure of the aedeagi and claspers do not support any close relationship.

In the descriptions which follow the cited measurements in the tabled dimensions are in eyepiece divisions where 1 division=0·052 mm. If these measurements are converted to millimetres using the above relationship more significant figures appear in the millimetre figure than are justified and the subsequent biometric analysis is frequently inaccurate. Therefore to convert approximately to millimetres divide the number of eyepiece divisions by 20. The head length is measured from the apex of the anteclypeus (or if the juga surpasses the anteclypeus from an imaginary line joining the apices of the juga) to the visible base of the head on the middle of the anterior margin of the pronotum. This measurement is more variable than for some of the other measurements because of differences caused by varying degrees of exsertion of the head. The head width is measured from the outer margin of one eye to the outer margin of the other. For both head measurements the animal was placed so that the head was horizontal. The measurements of the antennal segments need no explanation save that the first segment is in the vicinity of 8-10 eyepiece divisions and hence is being measured with too coarse a scale and shows a high variability because of this. For the remaining measurements the dorsal surfaces of the abdomen, scutellum and hind portion of the pronotum were placed horizontally, hence the two longitudinal measurements are foreshortened in comparison to those which would occur if measurements were made following the longitudinal curve of the body. The pronotal width is taken from one humeral outer margin to the other, if the lateral angles are spinously produced then the measurement is from the tip of one spine across to the tip of the other. The pronotal length is measured from the anterior margin to the posterior margin along the midline. The total length is measured from the apex of the anteclypeus or if the juga surpass it then from their apices to the apex of the membrane along the midline. The total length is also cited converted to millimetres but without assuming any more significant figures than prudent.

The nomenclature of the male and female genitalia follows Gross 1972, p. 131 *et seq.* and much of it is indicated on at least one illustration of each sex on those figures which show their structure.

The abbreviations of the institutions in which type material and material examined is lodged are as follows:

AM	The Australian Museum, Sydney.
AMNH	The American Museum of Natural History, New York.
ANIC	The Australian National Insect Collection, C.S.I.R.O., Canberra.
ASHLOCK	Peter Ashlock Collection, presently in the University of Kansas, Lawrence.
BISHOP	The Bernice P. Bishop Museum, Honolulu.
BM	The British Museum (Natural History), London.
BRUSSELS	Institut Royal de Sciences Naturelles, Brussels.
CAS	The California Academy of Sciences, San Francisco.
HELSINKI	Universitetets Zoologiske Museum, Helsingfors.
HOPE	The Hope Collection, University Museum, Oxford.
KU	University of Kansas, Lawrence.
LEIDEN	The Rijksmuseum van Natuurlijke Historie, Leiden.
NM	The National Museum of Victoria, Melbourne.
QM	The Queensland Museum, Brisbane.
SAM	The South Australian Museum, Adelaide.
SLATER	J. A. Slater Collection, presently in the University of Connecticut, Storrs.
STOCKHOLM	The Naturhistoriska Riksmuseum, Stockholm.
UQ	Department of Entomology, University of Queensland, Brisbane.
USNM	The Smithsonian Institution, The United States National Museum, Washington.
WAM	The Western Australian Museum, Perth.

In the second part of this paper several new genera will be established for some species now placed in *Cuspicona*, such species as do not appear in this first part have not been missed through an oversight but are to be treated as members of new or different genera in the second part.

In drawing up a key for inclusion in this first part it was necessary to avoid all mention of the new genera to be erected in the second part lest their primary descriptions became based on a key or be mentioned without a type. Hence it was necessary to construct an abbreviated key which will serve to distinguish the genera considered in this part from each other, and in a general way from genera to be considered in the later paper. I apologise for this, but I see no other satisfactory solution. A full key to all the genera of the *Rhynchocoris* group from this region will appear in the second part.

Key to part of *Rhynchocoris* group of genera found in the Australian, New Guinea and Pacific Regions

1. (1) Juga produced in front on the anteclypeus or at least level with it
genera not covered in this first part
Juga not produced in front of anteclypeus but obliquely or roundedly sloping back from it
2

2. (1) Apex of scutellum acute with apically a rather quadrate membranous plate around and beneath apex and into which apex is produced, this plate reaching behind true apex of scutellum 3
Apex of scutellum acute or more rounded but without an affixed membranous plate like process 4

3. (2) Lateral angles pronotum produced into a prominent outwardly directed reddish or blackish tipped spine
Vitellus Stål (*not covered in this part*)
Lateral angles of pronotum acute, not produced into laterally directed spines
Petalaspis Bergroth

4. (2) Anterior margin of pronotum not mostly levigate but punctate regularly in two or more series and rest of pronotum mostly finely punctate 5
Pronotum with anterior margin smooth or never more than two rows of large punctations (except *Pegala virens*) and scattered large punctations on disc
genera not covered in this first part

5. (4) Tibiae flattened or sulcate almost their whole length. Scutellum with a very distinct black impression in each basal angle; some black punctations on dorsal surface, including head . . . . . *Ocirrhoe* Stål (part)
Tibiae not sulcate, flattened only apically or not at all. Impressions in the basal angles of the scutellum concolorous, black or absent
6

6. (5) Proportionately long and slender, head relatively long, thoracic angles unarmed
Diaphyta Bergroth
(=*Paraboea* Jensen-Haarup)
(*not covered in this first part*)
Body ovate or obovate, head medium sized, lateral angles of pronotum sometimes produced into spines, sometimes not . . . 7

7. (6) Apical angles of seventh abdominal segment strongly produced or conspicuously angulate 8
Apical angles of seventh abdominal segment not strongly produced 9

8. (7) Lateral angles of pronotum rounded
Parocirrhoe gen. nov.
Lateral angles of pronotum acute or produced into a long spine
genera not covered in this first part

9. (7) Anterolateral margins of pronotum angulately concavely incised at about half their length
Everardia gen. nov.
Anterolateral margins of pronotum straight or gently convex in front of lateral angles
10

10. (9) Mesosternal keel close to prosternum and reaching about base of head 11
Mesosternal keel not so adpressed to prosternum and reaching forward under base of head
Avicenna Distant (part)
(*not covered in this first part*)

11. (10) Tibiae flattened towards apices; foveae in basal angles of scutellum present and black or concolorous; lateral margins of pronotum narrowly reflexed or rarely broadly explanate, this reflexion or explanation continued onto truncate lateral angles for a short distance, antennae relatively robust
Ocirrhoe Stål (part)
Not as above; lateral angles frequently acute or produced into a spinous process. If (*privata* Walker) tibiae flattened towards apices, foveae in basal angles of scutellum present and concolorous and lateral margins of pronotum narrowly reflexed then this reflexion continued around the lateral angles and the antennae slender
Cuspicona Dallas

Ocirrhoe Stål, 1867

Ocirrhoe Stål, 1867, p. 521, 1870, p. 637: 1876, pp. 62 & 102. Lethierry & Severin, 1893, p. 180.

Rhynchocoris Westwood 1837 (in part) p. 29.

Cuspicona Dallas, 1851 (in part) p. 296; Stål, 1867 (in part) p. 521; Lethierry & Severin, 1893 (in part) p. 180. Kirkaldy, 1909 (in part) p. XXXI.

Type species: *Cuspicona inconspicua* Stål, 1867, *non* Dallas, 1851 = *Rhynchocoris australis* Westwood, 1837 OD.

Description:

General appearance: Species greenish or brownish-green in life, in museum collections brown or yellowish brown. Strongly punctate above. Small to moderate sized, rather oval. Anterolateral margins of pronotum reflexed or explanate, nearly straight and diverging posteriorly with lateral angles obtusely rounded or truncate, the reflexion of the anterolateral margin continued partly onto the lateral angle. Head and anterior portion of pronotum inclined at an angle of 30° to rest of body. Tibiae only gently flattened near apices or strongly flattened, even slightly sulcate, on their outer surfaces.

Head: Appearing elongate or not, in most species rather quadrate, wider across eyes than long. Disc flattened anteriorly and rather raised posteriorly; lateral margins usually straight and diverging posteriorly but sometimes concave and in *australis* (Westwood) also reflexed. Apex rounded, rarely rather acuminate, apices of juga and anteclypeus at about same level. Eyes rather triangular and touching anterior margin of pronotum, ocelli not very conspicuous and placed nearer to inner margin of eyes than to centre line of head, on level of, or behind level of, hind margins of eyes. Antennifers short, antennae five-segmented, first segment thicker than second and third, fourth and fifth generally thicker than second and third, antennae not very long.

Pronotum: At least twice as wide across lateral angles as long, anterior margin truncate or concave behind eyes, then excavate behind collum, anterior angles in the form of a small vertical keel or a spine, frequently reflexed. Anterolateral margins straight, slightly convex or slightly concave, diverging posteriorly, marginate, these margins rather reflexed or explanate and continuing onto region of lateral angles. Lateral angles obtusely rounded or truncate. Posterolateral margins concave, sometimes angulately so. Posterior angles obtuse or formed into a small spine (*australis*), posterior margin only slightly concave. Disc behind lateral angles in same plane as hind body, before level of lateral angles inclined downwards at about 30°.

Scutellum: Triangular, anteriorly gently raised or not, lateral margins somewhat concave medially, apex broadly rounded. Frena extending about half to two-thirds of length from base to apex.

Hemelytra: Coriaceous parts normally thickened. Corium with exterior margin concave basally or not, then broadly concave to acute or shortly rounded apex. Posterior margin straight, inner angle broadly rounded. Clavus narrow and strongly triangular. Membrane infuscated and hyaline with veins substantially parallel apically.

Abdomen: Gently convex above, excavate apically in males and faintly so in females.

Laterotergites: Three to seven armed with a short acute spine on lateral posterior angle (except in *dallasi*).

Underside: Head obtusely triangular in lateral view. Bucculae lobulately produced anteriorly then sinuate or straight, reaching to about middle of eyes, deeply sulcate between bucculae. Rostrum robust and four segmented, first segment robust and generally reaching to at least base of bucculae, second segment frequently arched. Meso- and metasternum with a robust keel projecting over part of whole of prosternum, latter broadly sulcate under this keel. Legs normal but tarsi always flattened near apices and sometimes strongly flattened and even sulcate their whole length. Abdominal venter faintly V- or U-shaped in cross section as viewed from behind, third segment medially raised into a short triangular tubercle directed anteriorly, its apex fitting into a notch in the metasternal keel. Seventh ventrite in males shallowly excavated posteriorly and deeply excised in females. Pygophore with lateral portions of posterior ventral margin roundedly or angulately produced or not with margin medially truncate or with a U- or V-shaped excavation. Aedeagus with phallosoma lightly sclerotized, conjunctiva produced forward as a more or less single process with or without sclerotized rods, ventrally a pair of ventrally directed parallel, usually bilobed, medial penial plates. Clasper strongly F-shaped. Female genitalia flat, in some species gonocoxae raised along their interior margins.

General remarks: Species placed in this genus have rather a uniform appearance, they can be confused with *Parocirrhoe* but in that genus the posterior angles of the seventh laterotergites are strongly and angulately produced.

The shape of the posterior ventral margin of the male pygophore differs from species to species but is constant in each species and is a good character to help distinguish species. The F-shaped claspers are probably also distinctive for each species but as only those of several species have been dissected out so far this has not been confirmed. The aedeagus of the male also differs quite considerably from species to species of the few investigated. In those species investigated the "lappet" processes of the *Rhynchocoris* group were present and two of the three species investigated had bilobed medial penial plates.

The female genitalia are not very distinctive but the shape of the hind margin of the gonocoxae and whether the gonocoxae are raised along the midline where they meet are good characters to distinguish closely related species.

The genus breaks up into three distinctive groups of species as does *Cuspicona*. The first group of species are suboval with tibiae strongly flattened their whole length; the anterior or posterior tibiae may even be rather sulcate. The second group has the tibiae only flattened distally but are still suboval. One species of this second group, *prasinata* Stål, is very similar to *Cuspicona privata* Walker in appearance and may bridge the gap between the two genera. Under the description of *C. privata* it will be noted that there the tibiae are more flattened than in the other species of *Cuspicona*. *Prasinata* and its allies seem best placed in *Ocirrhoe* on the feature of the reflexed lateral margin of the pronotum continuing onto the region of the lateral angle and the strongly transverse posterior margins of the hind gonocoxae; these are characteristics of some other species of the second group of *Ocirrhoe* species but not of the *thoracica* group of *Cuspicona* where *privata* is best located. The third group contains only the single species *virescens* Westwood which is rather more elongate in appearance than other *Ocirrhoe* species, has a longer head in relation to its width across the eyes than other species of *Ocirrhoe* and has the posterior margins of the first gonocoxae of the female arcuately convex across their whole width, a feature not seen in any other *Ocirrhoe* species. In this group too the tibiae are only flattened distally. Despite the elongate head there does not seem to be close relationship between *Ocirrhoe virescens* and the long headed *Cuspiconas* of the *intacta* group. The dorsal punctation is relatively sparse in *virescens* whereas it is very strongly developed in the *intacta* group of *Cuspicona*.

The three groups of *Ocirrhoe* may later prove to be of subgeneric or even generic rank but such action should await a thorough examination of the aedeagus and claspers of the males of most, if not all, species.

Stål's genus *Ocirrhoe* is supposed to be based on *Cuspicona inconspicua* Dallas, 1851 as it is the only species mentioned under the key couplet No. 156 (157) (1867, p. 521) which forms the description of *Ocirrhoe*. However in the couplet he mentions "Angulis posticis thoracis dente acuto armatis; . . .; tibiis superne sulcatis; . . ." which are character states only of *Ocirrhoe australis* (Westwood, 1837) in the genus as I understand it. In 1870 (p. 51) Stål gives a second description, again only in the form of a key couplet—No. 2 (3) which repeats most of the features of the 1867 couplet, including the two character states mentioned above, but does not list any included species.

Finally in 1876 in the key couplet 188 (189) (p. 67) which forms his third and last diagnosis of the genus he mentions again the sulcate tibiae, adds that the foveae in the basal angles of the scutellum are black and that the dorsal surface of the body has some black punctations, and notes that the posterior angles of the pronotum may be obtuse or produced into a tooth. This definition could now only refer to *australis* (Westwood) and to two new species, *wilsoni* mihi and *westwoodi* mihi, of those I include in this genus. Clearly at this stage Stål recognises at least two of these three species, both in my first *australis* group, as belonging to the genus. On p. 102 of the same publication he lists two species under the genus heading, *O. unimaculata* (Westwood) and *O. australis* (Westwood); he does not give either a generic description of *Ocirrhoe* in this citation or specific descriptions of the two included species; he does not mention *inconspicua* as an included species and he does not mention any specimens examined of the two species he does include. *O. unimaculata* was also obviously misidentified for true *unimaculata* has to be excluded as it does not have sulcate tibiae, black punctations on the body or black foveae in the basal angles of the scutellum. There are six specimens in Stockholm which could have been concerned with Stål's conception of the genus. Five of them stood above the label *unimaculata* (Westwood), one of them is labelled on the pin "Ocirrhoe inconspicua Dall 1 ex unimaculatae Hope Westw. aff", all five are actually *australis* (Westwood). The sixth specimen stood above the label *australis* (Westwood) but it is an example of my new species *westwoodi*. Therefore it is clear that Stål used one of the series of *australis*, probably the one with the label on the pin (though Dr. Per Inge Persson informs the handwriting is not that of Stål), which he had first misidentified as *inconspicua* and then as *unimaculata*, in the construction of the first diagnosis of *Ocirrhoe*. He expanded the diagnosis upon recognising the second species which he took to be *australis* but which is again not that species but *westwoodi mihi*.

Therefore I have altered the previously cited fixation of *Cuspicona inconspicua* Dallas as the type of this genus to *Cuspicona inconspicua* Stål, 1867 *non* Dallas, 1851 (=*Rhynchocoris australis* Westwood, 1837). Original designation. Application will be made to the International Commission to have this type fixation validated.

Key to *Ocirrhoe* species

1. (1) Head coarsely punctate with black; a black point in each basal angle of scutellum;

tibiae strongly flattened or even vaguely sulcate almost their whole length 2

Head not punctate with black; with or without a black point in each basal angle of scutellum; first two pairs of legs with tibiae only flattened apically, hind tibiae flattened their whole length or not 4

2. (1) Dark brown; head densely punctate with black and appearing much darker than pronotum; third segment of antennae apically infuscated; posterolateral angles of pronotum acutely triangular produced *australis* (Westwood)

Yellowish or greenish brown; head more sparsely and more regularly punctate, usually not appearing darker than pronotum; first three segments of antennae completely pale or if third apically infuscated punctation even on head, pronotum and scutellum; posterolateral angles of pronotum obtuse or rounded 3

3. (2) Anterolateral margins of pronotum rather laminately expanded and vaguely reflexed; a black spot at bases of pro-, meso- and metepisterna; fourth and fifth antennal segments frequently strongly infuscated except at their bases; pronotum coarsely punctate with black (male) or narrowly black punctate just interiorly of anterolateral margins; hind margin of male pygophore gently concave medially and gently convex laterally . . . *wilsoni* sp. nov.

Anterolateral margins of pronotum obtusely marginate, the actual margin raised; no black spots at bases of episterna; all antennal segments pale or at most only lightly infuscated; pronotal punctations usually sparse and brown but if black punctations present then only anteriorly behind collum; hind margin of male pygophore strongly transversely truncate with a small medial concavity .. .. *westwoodi* sp. nov.

4. (1) Last two segments of antennae strongly infuscated (except at their bases and apices) 5

Last two segments of antennae not infuscated, or only fifth infuscated (except at base and apex) 6

5. (4) Scutellum with a conspicuous black or brown spot in each basal angle; hind margin of male pygophore medially strongly concavely excavate and laterally broadly convexly rounded, this hind margin frequently reddish; hind margins of female gonocoxae faintly sinuated, transverse, gonocoxae not raised along their inner (longitudinal contiguous) margins .. *dallasi* sp. nov. (part)

Scutellum without a conspicuous black or brown spot in each basal angle; hind margin of male pygophore medially strongly V-shaped excavated and laterally produced posteriorly into a strong somewhat angulate lobe on each side; hind margins of female gonocoxae strongly transversely truncate except medially where they turn anteriorly, gonocoxae strongly raised medially along their inner (longitudinal contiguous) margins *lutescens* Distant

6. (4) Fifth segment of antennae broadly infuscated with black or dark brown, only extreme base and apex of this segment pale; hind margin of male pygophore laterally lobulately produced and medially with a small tooth on the margin of either side of the midline .. .. *coronata* sp. nov.

Fifth segment of antennae not infuscated; hind margin of pygophore without a small tooth on either side of midline 7

7. (6) Scutellum with a conspicuous black or brown spot in each basal angle 8

Scutellum without a conspicuous black spot in each basal angle 10

8. (7) Under 7·5 mm long; hind third of pronotum transversely reddish or pinkish; with a triangular patch of brown punctations on either side of scutellum just in front of pale apical area .. .. *cavenda* sp. nov.

Over 7·5 mm long; hind third of pronotum concolorous; scutellum uniformly punctate with brown except at pale apex 9

9. (8) Antennae robust, four terminal segments reddish, third segment as long as or longer than second; base of head not black *inconspicua* (Dallas)

Antennae robust or not, four terminal segments reddish or pale; third segment shorter than second; extreme base of head black *dallasi* sp. nov. (part)

10. (7) Pronotum without a pale transverse band posteriorly; pygophore of male with hind margin laterally produced posteriorly as a rather hooked lobulate process on each side; hind margin of female gonocoxae strongly transverse .. .. *prasinata* (Stål)

Pronotum with a pinkish or yellowish transverse band or bar posteriorly, in faded specimens still visible as a paler area; male pygophore not as above; hind margins of gonocoxae transverse or not 11

11. (10) Scutellum laterally yellowish or pale, this yellowish or pale running into apical pale area; if lateral areas of scutellum concolorous then apex of scutellum also not conspicuously lightened. Hind margin of male pygophore rather triangularly produced on either side, medially rather V-shaped incised; hind margins of female gonocoxae strongly roundedly or angulately convex .. .. *virescens* (Westwood)

Scutellum laterally concolorous, apical area generally pale. Hind margin of male pygophore almost truncate, so also hind margins of gonocoxae .. *unimaculata* (Westwood)

Australis Group

This group contains three species collectively occurring in the moister regions of South Australia east of Saint Vincent Gulf, Victoria, Tasmania, New South Wales and southern Queensland. The group characteristics are:— rather obovate (pronotum width: total length about 9 : 16); rostrum not reaching much past hind coxae; all tibiae clearly flattened for most of their length on their exterior surfaces, usually also one or more pairs distinctly sulcate for most of their length on the flattened area; hind margins of female gonocoxae transverse or produced into a rounded lobe interiorly; head and usually also pronotum marked with black punctations; apical segments of antennae usually infuscated; foveae in basal angles of scutellum black.

Ocirrhoe australis (Westwood, 1837)
Figs. 2, 4 A-B

Rhynchocoris australis Westwood, 1837, p. 30.

Ocirrhoe australis Stål, 1876, p. 102. Lethierry & Severin, 1893, p. 180.

Cuspicona australis Walker, 1867, p. 387.

Rhaphigaster viridipes Walker, 1867, p. 370. *New synonymy.*

Cuspicona inconspicua Stål, 1867 (*non* Dallas, 1851), p. 521. Misidentification.

Cuspicona uninotata Walker 1868, p. 571, *New synonymy.*

Description:

General appearance: Museum specimens yellowish-brown or reddish-brown with coarse black and brown punctations and brown and black infuscated areas. Apex of scutellum and most of underside bright yellow. Eyes and ocelli purplish. Foveae in basal angles of scutellum black. Three apical antennal segments infuscated in part.

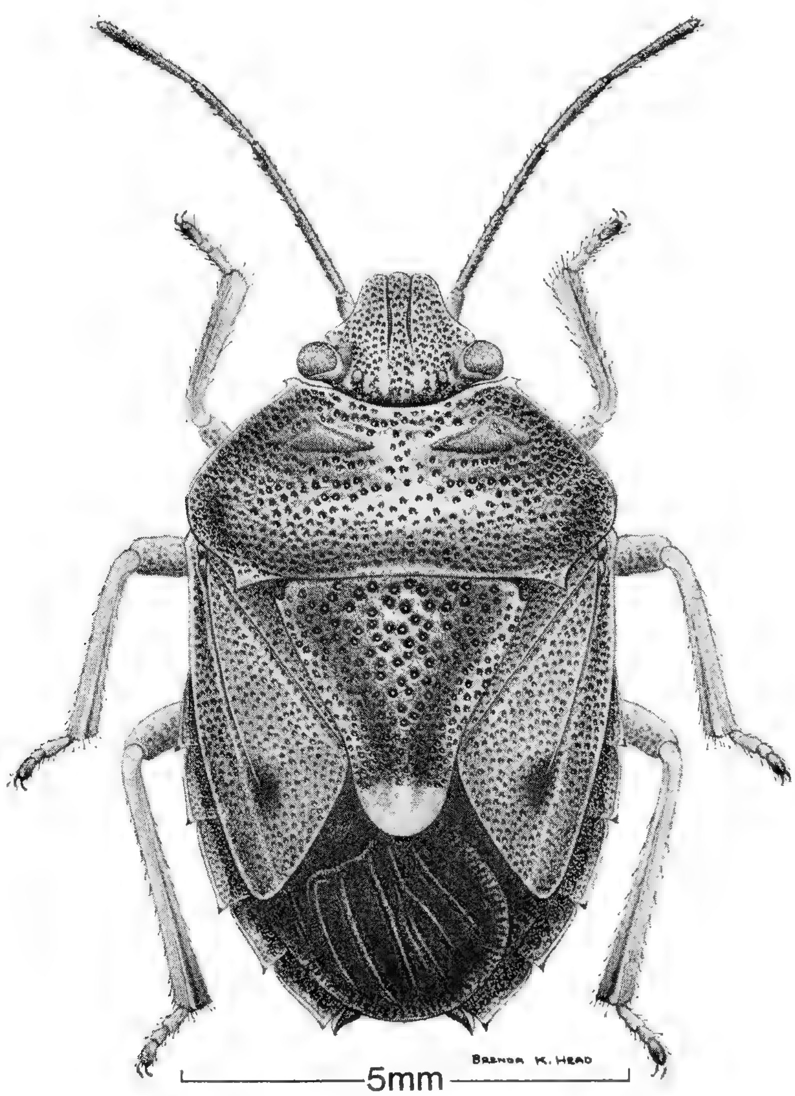

Fig. 2. Dorsal aspect of *Ocirrhoe australis* (Westwood).

Head: Appearing rather broad and apically rather broadly rounded. Concolorous with dense coarse black punctations and base of collum also black. Eyes and ocelli purplish. Anteriorly flattened with lateral margins of juga shallowly reflexed, posteriorly only a very little raised. Anteclypeus hardly surpassing apices of juga, lateral margins distinctly concave.

Pronotum: Concolorous with coarse brown punctations, latter exteriorly sometimes black, not reaching lateral margins. A black or brown spot just interiorly of each lateral angle. Calli glabrous, sometimes with a transverse black bar. Anterior margin oblique behind eyes and trapeziformly excavate behind collum, anterolateral angles represented by a small recurved tooth. Anterolateral margins slightly convex, thickened laterally and narrowly reflexed. Lateral angles behind reflexed margin truncate, posterolateral margins at first convex then concave, posterolateral angles produced as a small, acute, triangular lobe. Posterior margin slightly concave.

Scutellum: Concolorous only laterally, basally medially and preapically suffused with chocolate brown; apex broadly bright yellow and impunctate. Rest of disc with coarse brown or black punctations. A black fovea in each basal angle inward of which on each side is a callous pale point. Raised somewhat in anterior half and flattened in posterior half. Sometimes a trace of a broad longitudinal callous line present in posterior half. Lateral margins gently convex in basal half then straight, short and gently converging to broadly rounded apex. Frena reaching about 7/13 of length.

Hemelytra: Coriaceous parts concolorous or somewhat browner than ground colour; basal half of exterior margin of corium and a callous patch near apex of medial fracture yellowish, behind the latter a black patch; elsewhere coarsely punctate with brown. Exterior margin of corium elongately concave basally then almost straight to subacute apical angle, reaching about middle of abdominal segment VI, laterotergites broadly exposed. Posterior margin of corium straight, inner angle very broadly rounded. Clavus comparatively short and elongately triangular. Membrane and veins brownish hyaline.

Abdomen: Together with dorsum of pygophore black.

Laterotergites: Exteriorly yellowish or reddish interiorly black or reddish, densely punctate, posterior exterior angles produced into moderately strong minutely black tipped spines.

Underside: Bright yellow, punctate on propleuron, except along lateral margin, on mesopleuron in front of evaporative areas, on metapleuron behind evaporative areas and laterally on abdomen, punctations sometimes concolorous, sometimes brown and occasionally black. Antennal segments I and II, the basal 2/3 of III; the base of IV and the base and apex of V yellow, the apical 1/3 of II the apical 3/4 of IV and a medial band on V dark brown or blackish. Rostrum ventrally and its apex black. A black spot at base of pro-, meso- and metepipleura, sometimes abdominal segments IV–VII with a medial black spot basally. Legs completely yellowish.

Bucculae low and strongly sinuated, reaching about middle of an eye, anteriorly produced into a rounded lobe. Rostral segment I robust, reaching to base of bucculae, II compressed and arched, surpassing fore coxae, III to base of mid coxae and IV just onto abdomen. Ratio of antennal segments (♂) 10 : 19 : 15 : 23 : 27. Metasternal-mesosternal keels about the same height their whole length, not reaching apex of prosternum, anteriorly rounded, hardly deflected to left in pentral view. Legs normal without long pilosity, only the normal short pilosity on tibiae and tarsi; fore tibiae strongly flattened their whole length or even sulcate, middle and hind tibiae sulcate. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 4 A, hind margin of pygophore transverse and vaguely sinuated, broadly reflexed. Apex of female abdomen Fig. 4 B, hind margin of first gonocoxae exteriorly transverse and interiorly produced posteriorly as a lobulate process, inner margins very shortly raised; posterior margins of VIIIth laterotergites angulately produced.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	8	40	1·0	2·5	39-42
Head width	8	44	1·3	3·0	42-46
Antennal segment I	13	10	0·8	7·4	9-12
Antennal segment II	10	21	1·4	6·9	19-23
Antennal segment III	9	15	0·9	5·9	14-16
Antennal segment IV	5	23	0·7	3·1	22-24
Antennal segment V	3	27	—	—	26-28
Pronotum width	7	97	5·4	5·6	90-107
Pronotum length	8	40	2·6	6·5	36-42
Total length	8	180	12·4	6·9	164-200

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	17	39	3·5	9·0	32-42
Head width	17	46	2·6	5·8	40-48
Antennal segment I	30	10	0·9	8·9	9-11
Antennal segment II	28	19	1·3	7·0	17-22
Antennal segment III	27	15	1·2	7·9	12-16
Antennal segment IV	23	21	2·2	10·3	16-25
Antennal segment V	18	26	2·3	8·9	20-29
Pronotum width	17	105	9·4	8·9	87-116
Pronotum length	17	43	3·1	7·2	37-47
Total length	16	191	25·9	13·6	155-215

Total length: 8·1-11·2 mm

Remarks: *Ocirrhoe australis* is the darkest coloured of all the species in this genus and is easily recognised in mixed series on this feature alone. It is one of only three species that have black punctations on the head and has the unique feature of the posterolateral angles of the pronotum being produced into acute triangular processes. *Ocirrhoe australis* has a quite restricted distribution, occurring only in Queensland from just north of Brisbane, in eastern New South Wales, and northern Victoria to Trawool. One specimen in Stockholm is supposed to have come from Fiji, if so it is the first record of an *Ocirrhoe* species occurring outside of Australia if we accept that *Cuspicona privata* Walker is not an *Occirhoe*.

The description of *Rhaphigaster viridipes* Walker and *Cuspicona uninotata* Walker are such that they can only apply to *Ocirrhoe australis*.

Location of types:

Type ♂ of *Rhynchocoris australis* Westwood, "New Holland," in HOPE, types of *Rhaphigaster viridipes* Walker, "Queensland", and *Cuspicona uninotata* Walker, "Australia", cited as originally in NM but not now to be found there (A. Neboiss *in litt.*).

Specimens examined: The type of *australis* Westwood and Queensland 1 ♂, Mt. Beerwah via Glasshouse Mountains, 550 m (1 800ft.), 5.XII.1965, T. Weir UQ; 1 ♂, Brisbane, 12.IX.1911, H. Hacker; 1 ♀, Caloundra, 28.X.1913, H. Hacker; 1 ♂, Tambourine Mountain, H. Hacker QM; 1 ♀, Gumdale near Brisbane, 30.VI.1968, at fluorescent light, J. K. Guyomar ANIC; 1 ♂ Brisbane, 12.IX.1911, H. Hacker SAM; 1 ♀, Brisbane, 12.IX.1911, H. Hacker; 1 ♀, Tambourine Mountains, 11-18.IV. 1935, R. E. Turner BM; 1 ♂, 1 ♀, Brisbane, 12.IX.1911, H. Hacker KU. New South Wales 1 ♂, 3 ♀, Mt. Tomah, 28-29.II.1932, in rotting grass-tree, J. Armstrong; 1 ♂, Comboyne, 10.XI. 1932, K. M. McKeown AM; 3 km (2 miles) S.S.W. of Nambucca Heads, 18.X.1956, P. B. Carne ANIC; 1 ♀, French's Forest near, Sydney, 21.X.1948, E. B. Britton; 2 ♀, National Park, 31.X.1948, E. B. Britton BM; 1 ♂, Gosford, 1904, W. W. Froggatt KU; 2 ♀, Sydney, Nov. 1902, *ex* Helms collection; 1 ♀, National Park, Dec. 1905, *ex* Helms collection BISHOP. Australian Capital Territory. 1 ♀, Jervis Bay, 18.IX.1951, T. G. Campbell ANIC. Victoria 2 ♀, Trawool, 17.XII.1919, *ex* J. E. Dixon collection NM. Unlocalised Australian 2 ♂, 1 ♀, Australia, Winnerz (the female is the specimen bearing the additional label mentioned on p. 56 and is believed to be the specimen, or *one* of the specimens, on which the genus *Ocirrhoe* was diagnosed); 1 ♀, Austral. bor., Thorey STOCKHOLM. Fiji 1 ♀, Ins. Fidschi, Dämel STOCKHOLM.

Ocirrhoe wilsoni sp. nov.

Figs. 3, 4 C-D

Description:

General appearance: Museum specimens yellowish with coarse black and brown punctations, some brownish markings on scutellum. Apex of scutellum and most of underside bright yellow. Eyes and ocelli purplish. Foveae in basal angles of scutellum black. Two apical antennal segments black except at base.

Head: Appearing rather broad and apically rounded. Concolorous with dense coarse black punctations and base of collum also black. Eyes and ocelli purplish. Anteriorly flattened with lateral margins of juga broadly reflexed, posteriorly only a very little raised. Anteclypeus just surpassing apices of juga, lateral margins distinctly concave.

Pronotum: Concolorous; punctations on males and females differently coloured; in males blackish brown on all parts of pronotum and conspicuous, in females brown or concolorous on disc but laterally just inside anterolateral margins punctations intense black. Hind portion of pronotum behind level of lateral angles frequently faintly darker than rest of disc. Calli glabrous. Anterior margin oblique behind eyes and semicircularly excavate behind collum, anterolateral angles represented by a small recurved tooth. Anterolateral margins nearly straight and laminate, broadly reflexed. Lateral angles behind reflexed margin very short, posterolateral margins sinuate turning smoothly into faintly concave posterior margin, posterolateral angles therefore not produced.

Scutellum: Concolorous with blackish-brown punctations, on basal margin a brown spot on either side of middle and preapically a brown triangular patch on either side, not meeting in middle. Apex yellow and impunctate, this yellow produced a little forward medially between the subapical brown patches, in front of this a trace of a raised longitudinal line extending forward to base. A conspicuous black fovea in each basal angle. Raised somewhat in anterior half and flattened in apical half. Lateral margins gently convex in basal half then straight and converging to broadly rounded apex. Frena reaching about 7/12 of length.

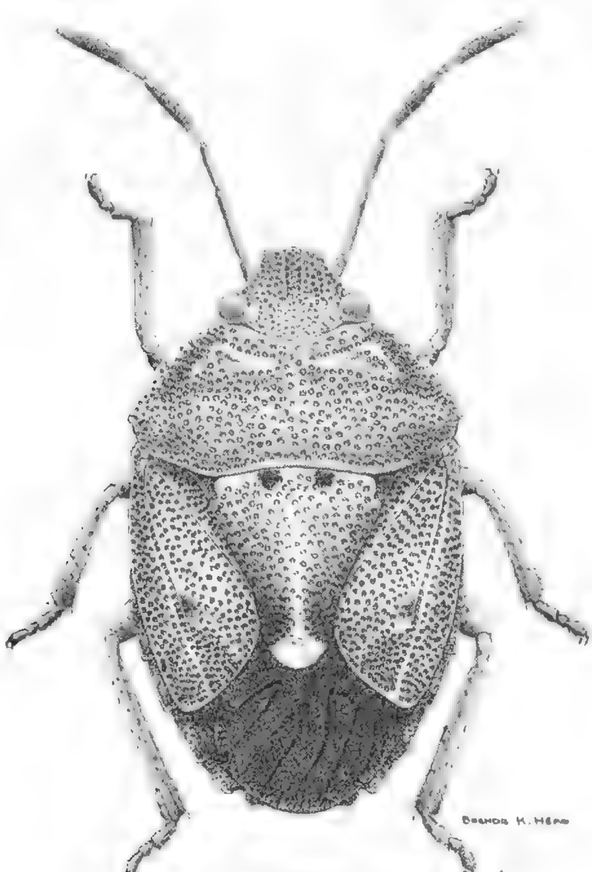

Fig. 3. Dorsal aspect of *Ocirrhoe wilsoni* sp. nov.

Hemelytra: Coriaceous parts concolorous with fine blackish-brown punctations, a callous patch near apex of medial fracture and a small brown patch on interior angle of corium. Exterior margin of corium faintly concave and depressed basally then broadly curved to subacute apical angle, reaching just beyond base of abdominal segment VI, laterotergites broadly exposed. Posterior margin of corium straight, inner angle very broadly rounded. Clavus elongately trianguler. Membrane and veins faintly brownish hyaline.

Abdomen: Probably concolorous.

Laterotergites: Concolorous with black patches of punctations exteriorly in front of and behind each incisure Posterior exterior angles almost rectangular.

Underside: Bright yellowish with brown and black punctations on propleuron, anteriorly on mesopleuron, posteriorly on metapleuron, on femora and tibiae and laterally on abdomen in males, in females these punctations except on femora usually concolorous. Antennal segments I-III concolorous, IV and V black except basally and in V sometimes apically also. Rostrum ventrally and its apex black. A black spot at bases of all episterna, and in males medially at the bases of abdominal ventrites IV-VII, spiracles also black.

Bucculae low and sinuated, reaching to about middle of eye, anteriorly produced into a subtriangular lobe. Rostral segment I robust and reaching to about base of bucculae, II compressed and arched, surpassing fore coxae, III reaching to about middle of mid coxae and IV just onto base of abdomen. Ratio of antennal segments (♂) 8 : 18 : 11 : 19 : 22. Metasternal-mesosternal keels about same height their whole length, not reaching apex of prosternum, anteriorly rounded, hardly deflected to left in ventral view. Legs normal without long pilosity, only the normal short pilosity on tibiae and tarsi and a few short hairs on femora. Tibiae strongly flattened almost their whole length hind tibiae rather sulcate. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 4 C, hind margin of pygophore shallowly excavate. Apex of female abdomen Fig. 4 D, hind margin of first gonocoxae slightly convex and interiorly produced as a short lobulate process, inner margins shortly raised; posterior margins of VIIIth laterotergites subangulately produced.

Dimensions—

MALES (2 only)

Parameter	Mean	Observed Range
Head length	31	31-2
Head width	37	36-38
Antennal segment I	8	8-9
Antennal segment II	18	17-19
Antennal segment III	11	11-12
Antennal segment IV	19	19
Antennal segment V	22	22-23
Pronotum width	78	77-79
Pronotum length	34	34
Total length	137	135-140

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	5	35	0·8	2·4	34-36
Head width	5	39	0·9	2·3	38-40
Antennal segment I	10	8	0·5	5·9	7-9
Antennal segment II	10	17	0·8	4·8	16-18
Antennal segment III	10	11	0·4	3·9	10-11
Antennal segment IV	9	17	1·1	6·2	16-19
Antennal segment V	9	21	1·3	6·3	19-23
Pronotum width	5	87	1·7	1·9	86-90
Pronotum length	5	37	1·3	3·5	36-39
Total length	5	155	6·1	3·9	149-161

Total length: 7·0-8·4 mm

Remarks: *Ocirrhoe wilsoni* is apparently closely related to *australis* as they have in common a black punctate head, dark prepical markings on the scutellum and a lobulate projection inwardly on the hind margins of the first gonocoxae. It lacks the triangular projection of the posterolateral angles of the pronotum of *australis* and is generally paler.

The species is found only in the wetter parts of south eastern Australia, occurring in the four states New South Wales, Victoria, Tasmania and South Australia.

Location of types:

Holotype ♂, allotype ♀, 1 paratype ♂, Grampians, Victoria, Oct. 1928, F. E. Wilson; 1 paratype ♀, Cockatoo, Victoria, G. F. Hill in NM; 1 paratype ♀, Jervis Bay, Australian Capital Territory, 18.IX.1951, T. G. Campbell; 1 paratype ♀, Rupert Point, 5 km (7 miles) north of Pieman River, Tasmania, 30.XII.1953, T. G. Campbell in ANIC; 1 paratype ♀ (Reg. No. 120,726), Tapanappa near Cape Jervis, South Australia, 5-9.XII.1949, G. F. Gross & N. B. Tindale in SAM.

Specimens examined: The types only.

Ocirrhoe westwoodi sp. nov.

Figs. 4 E-F, 5, 6 A-C.

Ocirrhoe unimaculata Stål, 1876 (*non* Westwood, 1837), p. 102, misidentification

Description:

General appearance: Grass green in life with brown and black punctations and brown infuscated areas. Underside paler, apex of scutellum luteous or yellow. Eyes and ocelli purplish. Foveae in basal angles of scutellum black. Antennae yellowish brown, two apical segments infuscated in part. Museum specimens with green colour changed to yellowish, other colours as noted.

Head: Appearing not very broad and narrowing apically, actual apex rounded. Concolorous

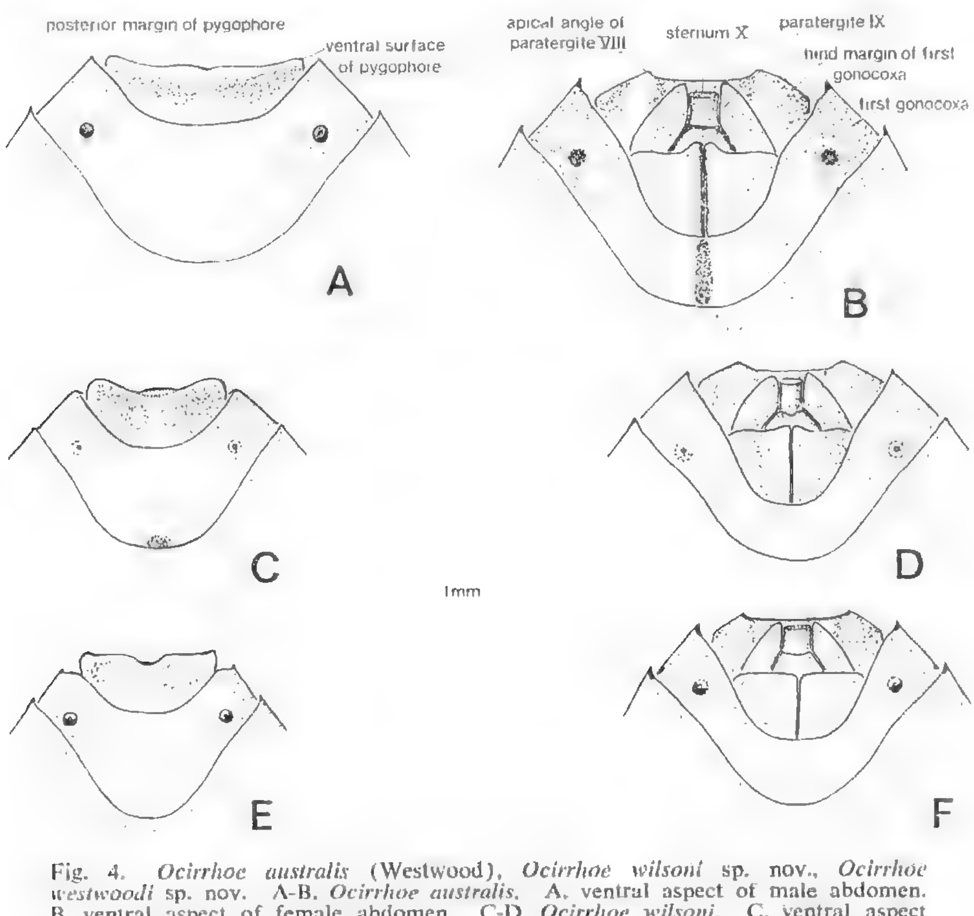

Fig. 4. *Ocirrhoe australis* (Westwood), *Ocirrhoe wilsoni* sp. nov., *Ocirrhoe westwoodi* sp. nov. A-B. *Ocirrhoe australis*. A. ventral aspect of male abdomen. B. ventral aspect of female abdomen. C-D. *Ocirrhoe wilsoni*. C. ventral aspect of male abdomen. D. ventral aspect of female abdomen. E-F. *Ocirrhoe westwoodi*. E. ventral aspect of male abdomen. F. ventral aspect of female abdomen.

with discrete black and some brown punctations, base of collum black. Anteriorly flattened with lateral margins of juga shallowly reflexed, posteriorly only a very little raised. Anteclypeus hardly surpassing apices of juga, lateral margins distinctly concave.

Pronotum: Concolorous with coarse and scattered black, brown and concolorous punctations, posterior 3/7 infuscated with brown and punctations in this region darker. Calli glabrous. Anterior margin oblique behind eyes and concavely excavate behind collum, anterolateral

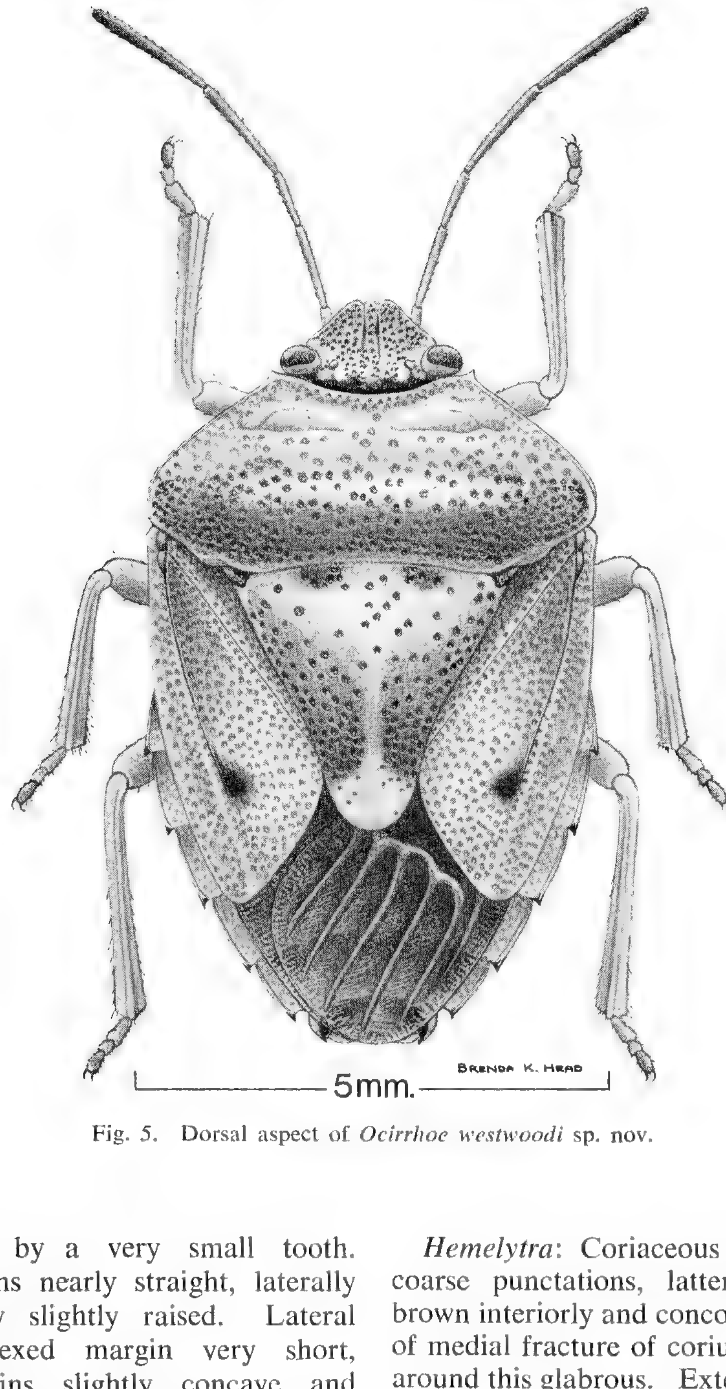

Fig. 5. Dorsal aspect of *Ocirrhoe westwoodi* sp. nov.

angles represented by a very small tooth. Anterolateral margins nearly straight, laterally thickened and very slightly raised. Lateral angles behind reflexed margin very short, posterolateral margins slightly concave and rounding onto slightly concave posterior margin.

Scutellum: Concolorous with a few coarse brown punctations except apically and pre-apically, pre-apically on either side a small triangular brown patch, apex luteous or yellow and nearly impunctate, this yellow or luteous extending forward between the brown patches and then faintly visible as a median paler line extending to base. A black fovea in each basal angle. Raised somewhat in anterior half and flattened in basal half and then straight and gently converging to broadly rounded apex. Frena reaching about 2/3 of length.

Hemelytra: Coriaceous parts concolorous with coarse punctations, latter brown or blackish brown interiorly and concolorous exteriorly; apex of medial fracture of corium with a brown spot, around this glabrous. Exterior margin of corium concave and depressed basally then almost straight to nearly rectangular apical angle, reaching to just past base of abdominal segment VI, laterotergites narrowly exposed. Posterior margin of corium faintly convex, inner angle very broadly rounded. Clavus comparatively long and elongately triangular. Membrane and veins hyaline.

Abdomen: Exteriorly concolorous, behind scutellum with large quadrate black patches, parts of dorsal surface of pygophore black.

Laterotergites: Concolorous with concolorous punctations, posterior exterior angles produced into strong black tipped spines.

Underside: Paler than above, in museum specimens bright yellow, punctate on bucculae, near base of head below, on propleuron except along lateral margin, on mesopleuron in front of evaporative areas, on metapleuron behind evaporative areas and laterally on abdomen, punctations concolorous. Antennal segments yellowish brown, apical pair somewhat darker, the former except at base, the latter except at base and apex. Rostrum ventrally and its apex black. A minute black spot on mesopleuron anteriorly midway between mesepisternum and exterior margin; spiracles and posterior angles of the ventrites black. Legs mostly yellowish.

Bucculae low and strongly sinuated, reaching about middle of an eye, anteriorly produced into a triangular lobe. Rostral segment I robust, reaching base of bucculae, II compressed and reaching about middle of fore coxae, III to about middle of mid coxae and IV to just past middle of hind coxae. Ratio of antennal segments (♂) 9 : 16 : 12 : 20 : 23. Metasternal-mesosternal keels about the same height for most of their length, apically obliquely descending and then shortly rounded, not reaching apex of prosternum, not deflected to left apically in ventral view. Legs normal without long pilosity, only the normal short pilosity on tibiae and tarsi, fore

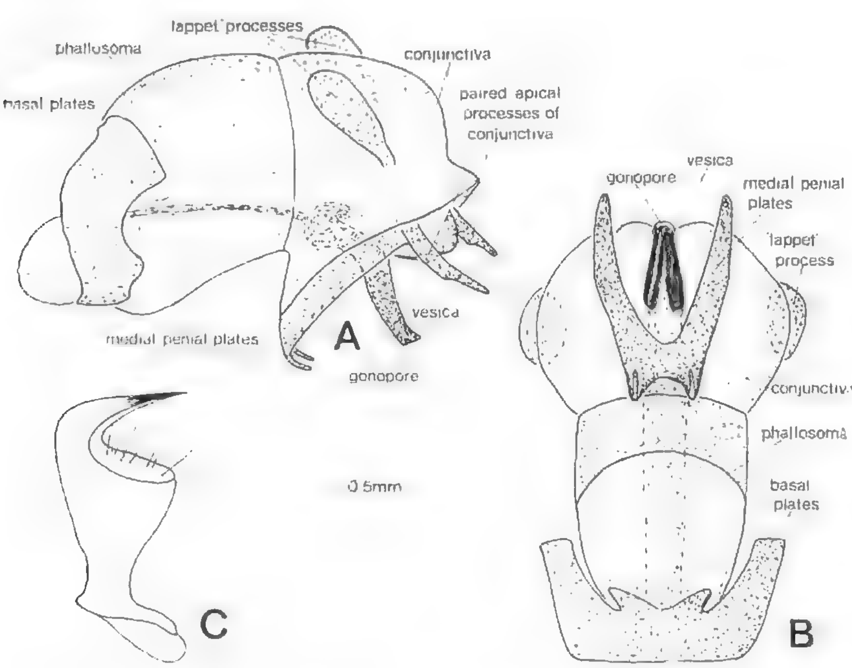

Fig. 6. *Ocirrhoe westwoodi* sp. nov.—aedeagus and clasper. A. left hand side aspect of aedeagus. B. ventral aspect of aedeagus. C. clasper.

tibiae flattened and rather sulcate apically, mid and hind tibiae faintly sulcate almost their whole length. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 4 E, hind margin of pygophore sinuated, shortly semicircularly excavate medially. Clasper Fig. 6 C, strongly F-shaped, the upper ramus sclerotized towards its tip. Aedeagus Figs. 6 A-B, with phallosoma short and honey-coloured, "lappet" processes rather elongate and directed upwards and slightly backwards, conjunctiva curved downwards, apically produced into two tubular processes, medial penial plates apparently different in shape to most other members of the *Rhynchocoris* group, vesica prominent and emerging from between the medial penial plates. Apex of female abdomen Fig. 4 F, hind margins of first gonocoxae virtually transverse, interior margins not raised, apical angles of VIIIth paratergites angulately produced.

Dimensions–

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	15	29	1·5	4·9	27-32
Head width	15	34	1·5	4·4	31-36
Antennal segment I	29	9	0·8	9·2	6-10
Antennal segment II	29	16	1·2	7·5	12-19
Antennal segment III	29	12	0·7	6·3	11-13
Antennal segment IV	20	20	1·6	8·4	16-23
Antennal segment V	15	23	1·8	7·7	21-26
Pronotum width	15	80	3·8	4·7	76-88
Pronotum length	15	31	1·7	5·5	29-34
Total length	15	142	7·0	5·0	130-151

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	19	31	1·6	5·1	28-34
Head width	19	36	1·2	3·3	34-38
Antennal segment I	35	9	0·8	9·1	6-9
Antennal segment II	35	15	1·0	6·1	14-17
Antennal segment III	34	12	0·9	8·1	10-14
Antennal segment IV	27	18	1·0	5·8	16-20
Antennal segment V	25	22	0·9	4·2	20-24
Pronotum width	19	87	4·8	5·5	76-95
Pronotum length	19	34	2·2	6·5	28-39
Total length	19	153	8·7	5·7	130-174

Total length, 6·8-9·1 mm

Remarks: *Ocirrhoe westwoodi* is apparently closely related to *wilsoni*, sharing the black spotted head and similar markings on the pronotum and scutellum. It differs from *wilsoni* in the paler terminal segments of the antennae, in the angulately produced lateral posterior angles of the laterotergites, the hind margin of the pygophore being excavate only medially and the transverse hind margins of the female gonocoxae. The latter feature shows resemblance to the species of the *unimaculata* group. *O. westwoodi* occurs only in the wetter parts of Victoria, New South Wales and Tasmania.

Location of types:

Holotype ♂, Wamberai, Gosford District, N.S.W., 1-3.X.1932, A. Musgrave; 4 paratype ♂, 3 paratype ♀ (Reg. Nos. K63379-80), Marysville, Victoria, 30-31.XII.1930, A. Musgrave; 1 paratype ♂, Fern Tree Gully, Victoria, 27.IX.1919, donated F. P. Spry; 1 paratype ♀, Millgrove, Victoria, Jan. 1927, F. E. Wilson; 1 paratype ♂ (Reg. No. K57813), Eagle Hawk Neck, Tasman Peninsula, Tasmania, 22.I.1928, A. Musgrave; 1 paratype ♂, Kurrajong, New South Wales, Oct. 1933, Dr. K. K. Spence AM; allotype ♀, 1 paratype ♀, Gunyah, Victoria, 12.I.1962, on *Senecio jacobaea* L. (Ragwort), G. Bornemissza; 2 paratype ♀, Fern Tree Gully, Victoria, Oct. 1930, J. Evans; 1 paratype ♀, Kangaroo Valley, New South Wales, 17.IX. 1951, T. G. Campbell ANIC; 1 paratype ♂, Koongalala Point, Lamington National Park, South Queensland, 29.X.1955, T. E. Woodward; 1 paratype ♂, Lamington National Park, 28 Jan.-3 Feb. 1963, G. Montieth; 2 paratype ♀, Mt. William, Grampians Range, 1150 m (1 800ft), Victoria, 2.I.1966, I. B. Cantrell, I. T. Weir UQ; 1 paratype ♂, 1 paratype ♀, Healesville, Victoria, 15.XII.1958, F. E. Wilson NM; 1 paratype ♀, Ringwood (Reg. No. I20,729), 9.XI. 1952, F. E. Wilson; 1 paratype ♂, (Reg. No. I20,727), 1 paratype ♀, (Reg. No. I20,733), Pt. Campbell, Victoria, Nov. 1959, G. F. Gross; 1 paratype ♂ (Reg. No. I20,728), between Peterborough and Port Campbell, Victoria, 17.XI.1959, G. F. Gross; 1 paratype ♀ (Reg. No. I20,730), Selby, Dandenong Ranges, Victoria, 20.XI.1959, by sweeping vegetation, G. F. Gross; 1 paratype ♂, 1 paratype ♀ (Reg. Nos. I20,731-2), Belgrave National Park, Victoria, 20.XI.1959, by sweeping vegetation, G. F. Gross SAM; 1 paratype ♂, National Park, New South Wales, 31.X.1948, E. B. Britton BM; 1 paratype ♂, 1 paratype ♀, Gosford, New South Wales, 16.X.1903, W. W. Froggatt KU; 1 ♀, Mt. Wellington, Tasmania, 2-300 m., 23.XII.1960, in *Nothofagus* forest, J. L. Gressitt BISHOP. 1 paratype ♂, New South Wales, Dümel STOCKHOLM.

Specimens examined: the types only.

Unimaculata Group

This group contains a series of seven species collectively occuring over most of Australia with the exception of the northern part of the Northern Territory and the northern half of Western Australia. The group characteristics are:—rather obovate (pronotum width: total length about 5:9); rostrum not reaching much past hind coxae; tibiae flattened only apically though hind tibiae may be more extensively flattened than those of the two anterior pairs of legs; hind margins of female gonocoxae transverse, transversely sinuate or slightly arched; head not marked with black punctations; four apical antennal segments infuscated or not; and fovae in basal angles of scutellum infuscated or concolorous.

This group appears to be intermediate between members of the *australis* and *virescens* groups as some members have some or all of the four apical segment infuscated and/or have black foveae in the basal angles of the scutellum like the members of the *australis* group whereas others have pale antennae and/or concolorous foveae in the basal angles of the scutellum like the *virescens* group. One member (*unimaculata* (Westwood)) has a pale transverse bar on the pronotum and large red maculae laterally on ventrites III-IV of the abdomen like *virescens* (Westwood). Members of this group differ from those of the *australis* group in having the tibiae flattened only apically and not having black punctations on the head. From the *virescens* group they differ in their more oval shape. *Ocirrhoe prasinata* (Stål), a member of this *unimaculata* group closely resembles *Cuspicona privata* Walker and is presumably closely related to it and hence to the *simplex* group of *Cuspicona*.

Ocirrhoe lutescens Distant, 1900

Figs. 1 A, 7, 8 A-E, 9.

Ocirrhoe lutescens Distant, 1900a, p. 422.

Rhaphigaster virescens Dallas (*non* Westwood) 1851, p. 284.

Description:

General appearance: Green in life; apex of scutellum yellow, sometimes apical margin narrowly red. Extreme base of head black. Eyes and ocelli purplish. Foveae in basal angles of scutellum concolorous. Apical pair of antennal segments infuscated except at bases and apices. In museum specimens green fading to bright yellow, other colours as noted.

Head: Appearing strongly triangular and apically narrowly rounded; concolorous but narrowly black at extreme base; anteriorly flattened and posteriorly only a very little raised. Anteclypeus not surpassing apices of juga, lateral margins distinctly concave. Disc rugulosely punctate.

Pronotum: Concolorous with rather coarse punctations, calli glabrous. Anterior margin oblique and slightly raised behind eyes and trapeziformly excavate behind collum, anterolateral angles represented by a small recurved tooth. Anterolateral margins nearly straight, thickened laterally and broadly reflexed. Lateral angles behind reflexed margin truncate, posterolateral margins somewhat concave, posterior margin almost straight.

Scutellum: Concolorous with rather coarse punctations; on anterior half transversly rugulose; apex bright yellow and impunctate, sometimes margined with red apically. A concolorous fovea in each basal angle. Anteriorly a little raised and in posterior half flat. A trace of a longitudinal glabrous line present. Lateral margins gently convex in basal half then straight or gently rounded and converging to rather acute apex. Frena reaching about 4/7 of length.

Hemelytra: Coriaceous parts concolorous with regular moderately dense punctations, a large elongate callous area inward of the apical third of the medial fracture. Exterior margins of coria elongately concave basally then almost straight to shortly rounded apical angle, reaching base of abdominal segment VII, laterotergites broadly exposed. Posterior margin of corium nearly straight, inner angle very broadly rounded. Clavus comparatively short and elongate triangular. Membrane and veins pale brownish hyaline.

Abdomen: Medially piceous, laterally concolorous.

Laterotergites: Concolorous, densely punctate, posterior exterior angles produced into an acute black-tipped spine.

Underside: Concolorous, coarsely punctate, except on exterior margins of head and pronotum, evaporative areas and the appendages. Antennal segment I concolorous, segments II-III reddish brown, IV-V piceous except at extreme bases and apices. Rostrum ventrally and its apex black. Tibiae apically and tarsi brown or reddish brown, rest of tibiae and rostrum more yellowish than rest of underside.

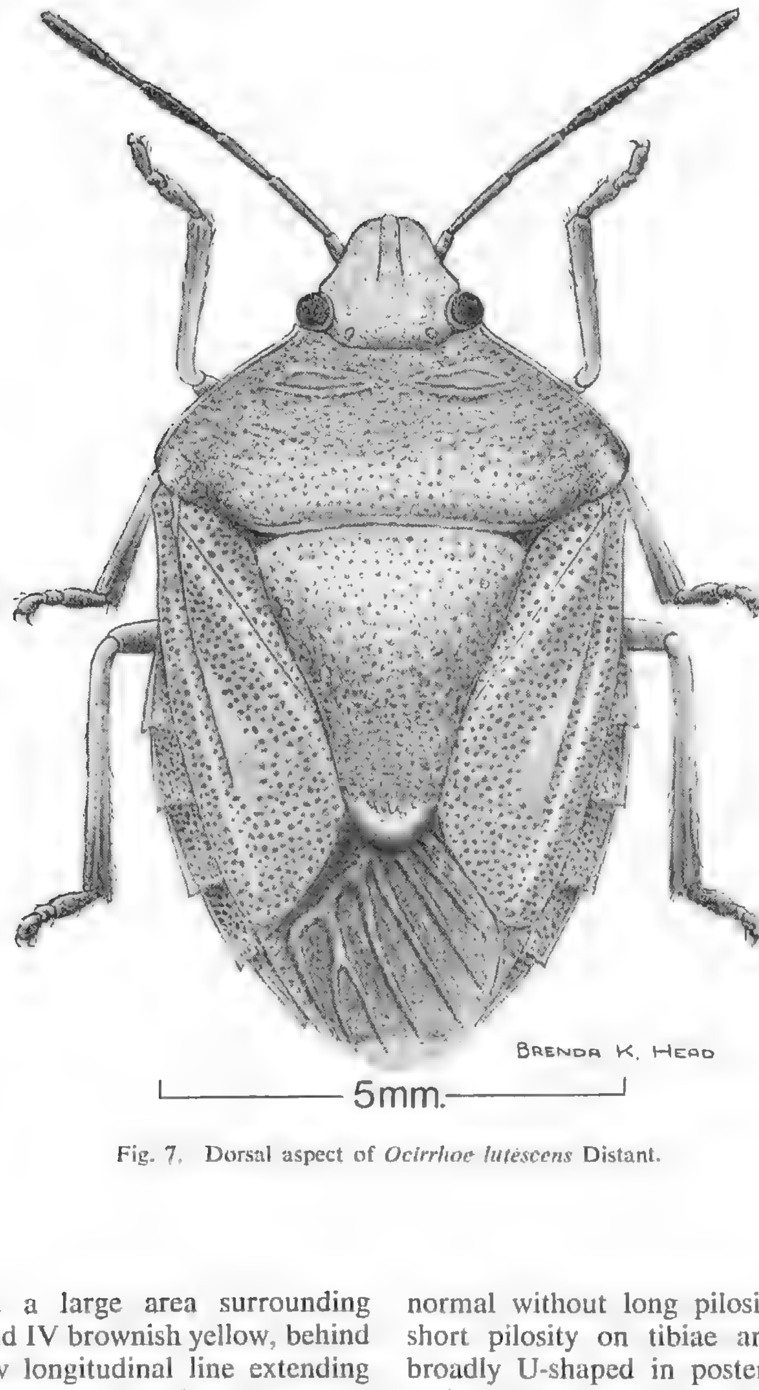

Fig. 7. Dorsal aspect of *Ocirrhoe lutescens* Distant.

Ventral spine and a large area surrounding it on ventrites III and IV brownish yellow, behind this a broad yellow longitudinal line extending back medially to the apex of ventrite VII. Pygophore of male with hind margin frequently reddish.

Bucculae low and sinuated, reaching about middle of an eye, anteriorly produced into a prominent lobe. Rostral segment I robust, reaching nearly to base of bucculae; II compressed and arched, reaching to about middle of fore coxae; III to about middle of hind coxae and IV to about middle of hind coxae. Ratio of antennal segments (♂) 9 : 18 : 14 : 21 : 26. Metasternal-mesosternal keels about the same height their whole length, anteriorly rounded, not deflected to left anteriorly in ventral view. Legs normal without long pilosity, only the normal short pilosity on tibiae and tarsi. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 8 A, hind margin of pygophore medially strongly triangulately excavate, the margins of this incision rather sinuate, exterior margin somewhat convex giving the pygophore the appearance of a lateral subtriangular lobe on either side. Clasper Fig. 8 E, shaped as an inclined F, the central lobe not strongly produced. Phallosoma Figs. 8 C-D, of medium length and honey-coloured, "lappet" processes well developed, the conjunctiva apparently was not completely inflated but made up of a dorsal lobe on either side of which along its base is a strongly sclerotized rod, these rods converging basally. Medial penial plates not heavily sclerotized and perhaps not fully everted

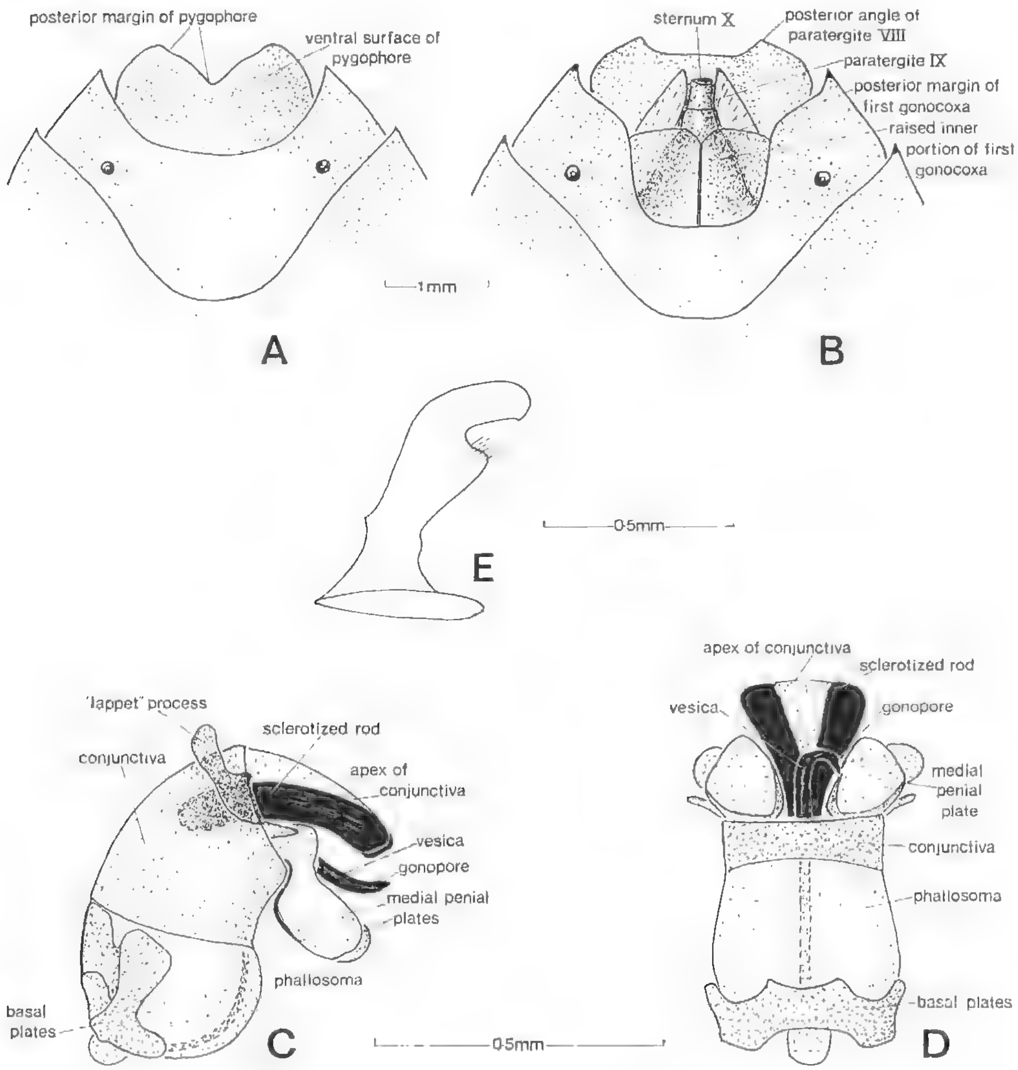

Fig. 8. *Ocirrhoe lutescens* Distant—external genitalia, aedeagus and claspers. A. ventral aspect of male abdomen. B. ventral aspect of female abdomen. C. left-hand side aspect of aedeagus. D. ventral aspect of aedeagus. E. clasper.

in the dissections but sinuated. Apex of female abdomen Fig. 8 B, hind margins of first gonocoxae transverse laterally and directed obliquely forward interiorly, inner half of each gonocoxa strongly reflexed so that the inner margins of the two gonocoxae are strongly elevated. Posterior margins of VIIIth laterotergites strongly and angulately produced. Spermatheca Fig. 1A.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	25	38	1·3	3·3	35-40
Head width	25	41	1·4	3·5	38-44
Antennal segment I	49	9	0·8	8·6	7-11
Antennal segment II	49	18	1·7	9·3	13-21
Antennal segment III	50	14	1·6	11·1	11-18
Antennal segment IV	41	21	1·0	4·7	20-24
Antennal segment V	37	26	1·2	4·8	24-29
Pronotum width	25	105	5·5	5·3	96-112
Pronotum length	25	43	2·8	6·5	38-47
Total length	25	192	11·6	6·1	168-212

Dimensions—

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	25	38	1·2	3·1	36-41
Head width	25	41	1·4	3·4	38-44
Antennal segment I	47	10	0·8	8·6	8-11
Antennal segment II	48	18	1·1	5·9	16-20
Antennal segment III	48	14	1·4	10·0	11-17
Antennal segment IV	47	21	1·2	6·1	18-24
Antennal segment V	41	25	1·4	5·5	22-28
Pronotum width	25	106	5·0	4·8	91-112
Pronotum length	25	44	3·0	6·8	38-50
Total length	25	192	11·5	6·0	174-216

Total length: 8·7-11·3 mm

Remarks: *Ocirrhoe lutescens* is easy to recognise in collections as it has most of segments IV and V of the antennal blackish but the foveae in the basal angles pale. It has no black spots on the head. Two other species in this group without black spots on the head, *dallasi* (sometimes) and *coronata*, may have one or both terminal antennal segments darkened. *Ocirrhoe dallasi* has the foveae in the basal angles of the scutellum infuscated. *Ocirrhoe coronata* has the basal foveae in the scutellum concolorous but has only the terminal antennal segment darkened.

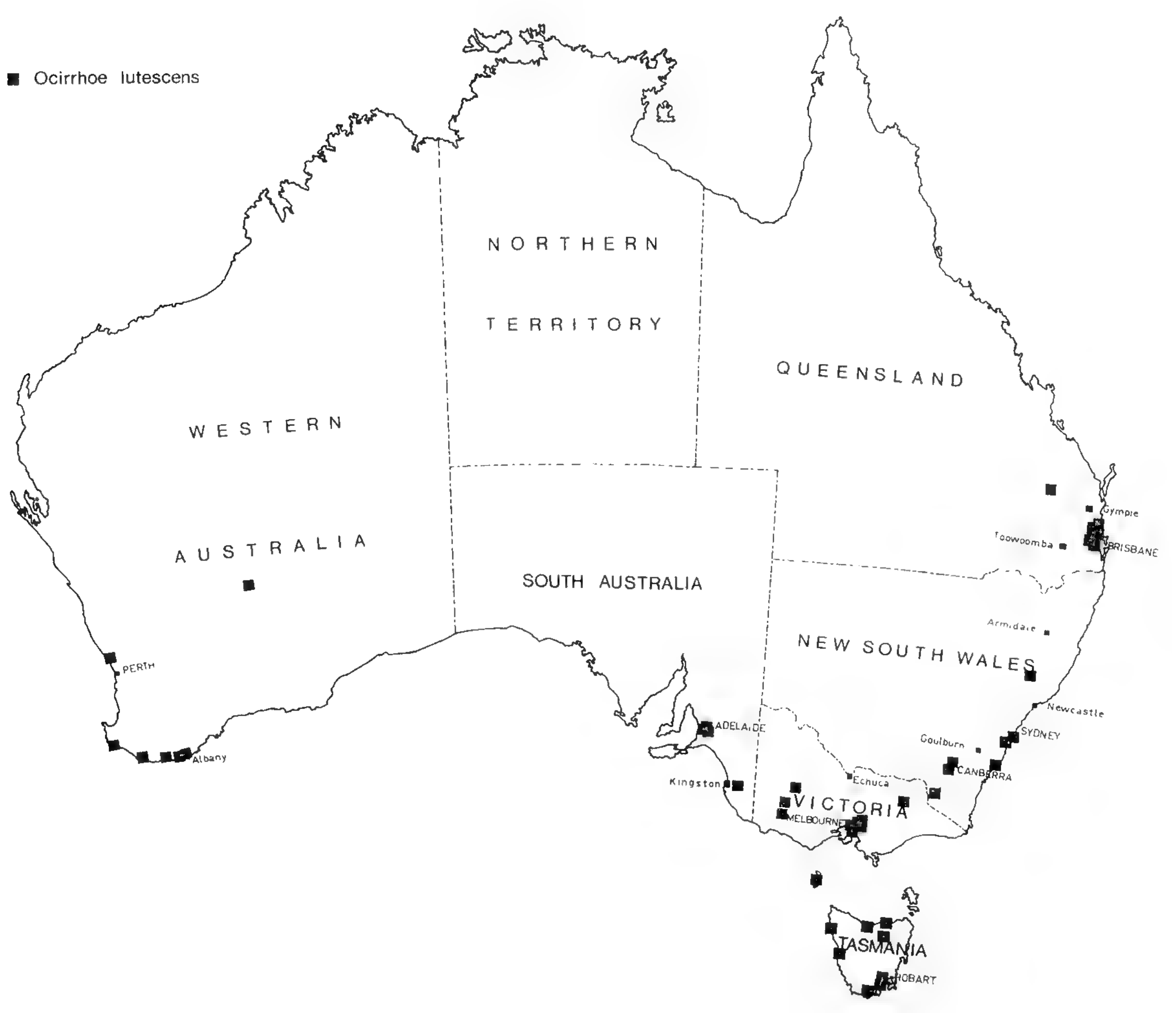

Fig. 9. Distribution of *Ocirrhoe lutescens* Distant.

From both of these species *lutescens* may be distinguished from the strong angulate emargination in the hind margin of the pygophore and the strongly raised inner portion, especially the inner margins, of the female first gonocoxae.

Ocirrhoe lutescens: is distributed in the wetter regions of Australia south of the 25°S line of latitude. The only host plant record is *Leptospermum myrsinoides* Schlecht from Blackwood, South Australia.

Location of type:

Type ♀ of *lutescens* Distant, "King George's Sound, Australia", in BM.

Specimens examined: The type and 68 ♂ and 79 ♀ specimens from 45 localities. Detailed locations for these specimens are not given but are plotted on Fig. 9. The specimens examined came from the following collections (numbers in each collection in parentheses) UQ(24), QM (1), AM(9), ANIC(24), AM(9), NM(21), SAM(28), WAM(1), BM(4), AMNH(8), CAS (12), BISHOP(6).

Ocirrhoe dallasi sp. nov.

Figs. 10, 12 A-B

Cuspicona roei Dallas (*non* Westwood) 1851, p. 297, Distant, 1900 b, p. 815.

Description:

General appearance: Olive green in life with concolorous punctations; first antennal segment yellowish, remaining segments ferruginous, terminal pair frequently infuscated. Eyes and ocelli purplish, very base of head black. Apex of scutellum yellowish or reddish. Museum specimens with green fading to yellow, other colours as noted. Second antennal segment clearly longer than third.

Head: Appearing rather broad and apically broadly rounded; concolorous, black at very base, eyes and ocelli purplish; anteriorly, flattened, posteriorly slightly raised. Anteclypeus hardly surpassing apices of juga, lateral margins of latter gently concave. Disc coarsely and rugulosely punctate.

Pronotum: Concolorous with discrete dense punctations, in green specimens the lateral margins yellowish, calli narrow and slightly rugulose. Anterior margin shortly oblique behind eyes and trapeziformly excavate behind collum, anterolateral angles represented by a small vertical carina. Anterolateral margins nearly straight, thickened and reflexed. Lateral angles behind explanate margin truncate, posterolateral margins slightly concave, posterior margin almost straight.

Scutellum: Concolorous with discrete fairly fine punctations, apex yellow, reddish-yellow or reddish and impunctate. Fovea in each basal angle infuscated. Raised slightly in anterior half and flat posteriorly. No trace of median longitudinal line. Lateral margins nearly straight but converging in basal half then fairly convex to broadly rounded apex. Frena reaching a little past half length.

Hemelytra: Coriaceous parts concolorous with regular moderately coarse punctations, in green specimens basal portion of exterior margin of corium yellowish. Medial fracture glabrous towards apex. Exterior margin of corium concave and reflexed basally then nearly straight to shortly rounded apical angle, reaching middle of abdominal segment VI, laterotergites broadly exposed. Posterior margin of corium straight, inner angle very broadly rounded. Clavus elongate triangular. Membrane and veins pale brownish hyaline.

Abdomen: At about the level of the middle of scutellum a broad transverse black bar, under apex of scutellum and behind it large quadrate black spots, sometimes divided. Dorsum of pygophore reddish. Rest concolorous.

Laterotergites: Concolorous, finely though densely punctate, posterior exterior angles almost rectangular, marked with black.

Underside: Paler than above, coarsely punctate except on sides of head, exterior margin of prothorax, evaporative areas, ventrally along abdomen and appendages. First antennal segment yellowish, remainder reddish, fourth and fifth frequently infuscated, the former not at base and the latter neither at base or apex. Rostrum ventrally and its apex black. Tibiae apically and tarsi reddish-brown. Lateral margins of prothorax, epipleuron and abdomen paler, pygophore edged with reddish. Thoracic keels and a broad median stripe on abdomen paler. Spiracles and posterior angles of abdominal ventrites black.

Bucculae low and strongly sinuated, reaching to about middle of eyes, medially depressed, anteriorly forming a rounded lobe. Rostral segment I robust, not reaching base of bucculae, II compressed and reaching base of fore coxae, III to base of middle coxae and IV to base of abdomen. Antennae not unduly robust, ratio

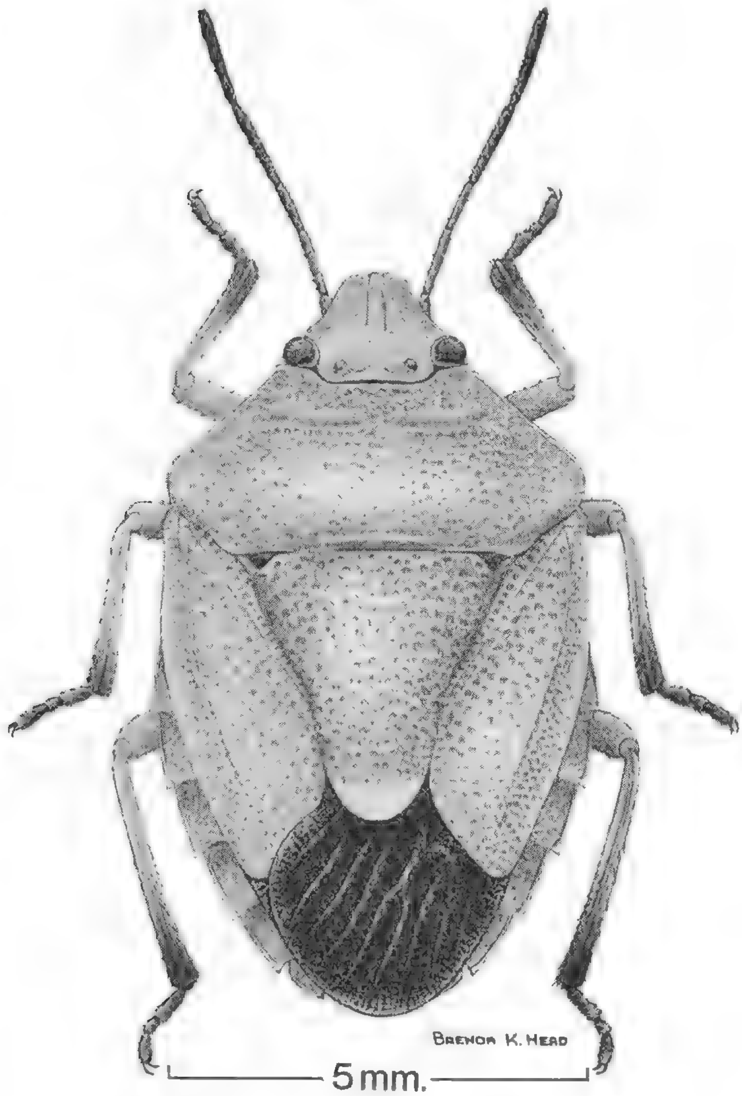

Fig. 10. Dorsal aspect of *Ocirrhoe dallasi* sp. nov.

of segments (♂) 9:17:12:21:24. Metasternal-mesosternal keels of even height to fore coxae, then slightly inclined downwards to apex which is obliquely directed posteriorly dorsally, surpassing apex of prosternum, keels not deflected to left in ventral view. Legs normal without long pilosity, only the usual short pilosity on tibiae and tarsi. Tibiae flattened, at least apically. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 12 A, hind margin of pygophore concave medially and convex laterally. Apex of female abdomen Fig. 12 B, hind margins of first gonocoxae transverse, inner margins only faintly elevated; posterior margins of VIIIth laterotergites produced only into a blunt angle.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	21	36	1·6	4·3	33-39
Head width	21	39	1·8	4·4	37-44
Antennal segment I	38	9	0·5	5·5	8-10
Antennal segment II	38	17	1·2	7·3	15-19
Antennal segment III	38	12	1·4	11·4	10-17
Antennal segment IV	32	21	0·9	4·4	19-23
Antennal segment V	20	24	1·1	4·8	22-26
Pronotum width	21	93	7·9	8·5	83-116
Pronotum length	21	38	3·4	8·7	33-47
Total length	21	174	14·6	8·4	155-213

Dimensions

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	15	38	1·7	4·4	36-42
Head width	15	40	1·9	4·7	38-44
Antennal segment I	26	10	0·6	6·8	9-11
Antennal segment II	28	17	1·2	6·8	15-19
Antennal segment III	28	13	1·6	12·7	11-17
Antennal segment IV	25	21	1·1	5·1	19-22
Antennal segment V	18	24	1·4	5·7	22-26
Pronotum width	15	97	4·7	4·9	91-107
Pronotum length	15	41	3·7	9·0	37-49
Total length	15	182	11·8	6·5	169-205

Total length: 8·1-11·1 mm

Remarks: *Ocirrhoe dallasi* resembles *O. lutescens* in the black base of the head and the tendency of the two terminal segments of the antennae to become infuscated. It differs in having black or fuscous foveae in the basal angles of the scutellum, in the broader apex of the latter, in the apical margin of the male pygophore being convexly excavate not angulately excavate and the inner margins of the first gonocoxae of the female not being strongly elevated.

Ocirrhoe dallasi occurs in southern Queensland, New South Wales, Victoria, South Australia (including Kangaroo Island) and there is one specimen from the Northern Territory, the only example of an *Ocirrhoe* from that state. This species may occur in Western Australia also, a female specimen from Ravensthorpe fits the description in most details whereas another female from Muchea in certain respects is closer to *inconspicua* though it has the short third antennal segment of *dallasi*. The species has been recorded from several species of native plants belonging to the genera *Hakea* and *Grevillea* (Proteaceae), *Exocarpos* (Santalaceae) and *Leptospermum* (Myrtaceae).

Location of types:

Holotype ♂, 1 paratype ♂, Canberra, Australian Capital Territory, Oct. 1929, J. W. Evans; allotype ♀, Black Mountain, Canberra, Australian Capital Territory, 1.XI.1960, on *Exocarpos cupressiformis* Labill, T. G. Campbell; 2 paratype ♂, Black Mountain, Australian Capital Territory, 30.XI.1929, A. Tonnoir; 1 ♂, Black Mountain, Australian Capital Territory, 12.I.1961, I.F.B. Common; 1 paratype ♂, 1 paratype ♀, Black Mountain, Canberra, Australian Capital Territory, 11.X. & 22.XI.1965, *ex Hakea sericea* Schrad, J. M. Walker, AcHa 103; 2 paratype ♂, 1 paratype ♀, Black Mountain, Canberra, Australian Capital Territory, 23.II.1966, *ex Hakea sericea* Schrad, S. Neser, AcHa 103; 4 paratype ♂, Black Mountain, Canberra, Australian Capital Territory, 1.III.1967, on *Grevillea lanigera* A. Cunn. *ex* R.Br. T. G. Campbell; 1 paratype ♀, 16 km (10 miles) east of Bathurst, New South Wales, 850 m (2 800ft.), 20.X.1964, I.F.B. Common and M. F. Upton; 1 paratype ♀, Telegraph Station, National Park, Alice Springs, Northern Territory, 8.V.1967, A. M. Hayes ANIC; 1 paratype ♀, Mt. Norman area via Wallangara, Queensland, 7.8.X.1972, G. B. & S. R. Monteith UQ; 2 paratype ♀, Blackrock District, Victoria, J. E. Dixon; 1 paratype ♀, Kiata, Victoria, Oct. 1928, F. E. Wilson NM; 2 paratype ♀ (Reg. Nos. I20,734-5), Seaford, Victoria, W. F. Hill; 2 paratype ♂ (Reg. Nos. I20,736-7), Mt. Rosea (Grampians), Victoria, Nov. 1950, N. B. Tindale; 1 paratype ♂ (Reg. No. I20,738), Kiata, Victoria, 22.XI.1952, F. E. Wilson; 1 paratype ♀ (Reg. No. I20,739), Mouth Glenelg River, Victoria, 28.VIII.1965, F. J. Mitchell; 1 paratype ♂ (Reg. No. I20,740), Black Mountain, Canberra, Australian Capital Territory, 26.XI.1959, by sweeping vegetation, G. F. Gross; 1 paratype ♀ (Reg. No. I20,741), Adelaide, South Australia, H. M. Hale; 1 paratype ♂ (Reg. No. I20,742), Adelaide, South Australia, taken with sweepnet, N. B. Tindale; 1 paratype ♂ (Reg. No. I20,743), Pt. Lincoln, South Australia, A. M. Lea; 1 paratype ♀ (Reg. No. I20,744), near Coonalpyn, South Australia, Sept. 1967, beating *Leptospermum coriaceum* (FvM) Cheel, A. N. McFarland; 1 paratype ♂ (I20,746), Kangaroo Island, South Australia, Oct. 1924; 2 paratype ♀ (I20,747-8), 4 km (2·5 miles) south of Mt. Taylor, Kangaroo Island, South Australia, 31.XII.1965, beating heath shrubs, D. Seton and A. N. McFarland; 1 paratype ♂ (Reg. No. I20,749), South Australia, Rev. A. P. Burgess SAM.

Specimens examined: The types and two questionable specimens from Western Australia 1 ♀, 24 km (15 miles) east of Ravensthorpe, 110 m, 23.IX.1962, E. S. Ross and D. Q. Cavagnaro CAS; 1 ♀, Muchea, 4.IV.1967, F. H. Uther Baker SAM.

Ocirrhoe inconspicua (Dallas, 1851)
Figs. 11, 12 C-D

Cuspicona inconspicua Dallas, 1851 p. 297. Lethierry and Severin, 1893 p. 180.

Ocirrhoe inconspicua Stål, 1967 p. 521. Distant, 1900a p. 422.

Description:

General appearance: Green in life; apex of scutellum yellow; anterolateral margins of pronotum and basal exterior margin of corium and exterior margins of abdomen yellow or reddish yellow; first segment of antennae concolorous, rest ferruginous, apices of tibiae and tarsi reddish. Eyes and ocelli purplish. Foveae in basal angles of scutellum black. In museum specimens the green colour fading to dull yellow or pale red, other colours as noted. Third antennal segment nearly as long as, about the same length as, or longer than second.

Head: Appearing strongly triangular and apically narrowly rounded; concolorous; anteriorly slightly convex, posteriorly more convex and slightly raised. Anteclypeus slightly surpassing apices of juga, lateral margins distinctly concave. Disc transversely rugulose and punctate.

Pronotum: Concolorous with coarse dense punctations, calli glabrous. Anterior margin oblique and slightly raised behind eyes and trapeziformly excavate behind collum, anterolateral angles represented by a small vertical carina. Anterolateral margins nearly straight, very narrowly explanate, this explanate portion

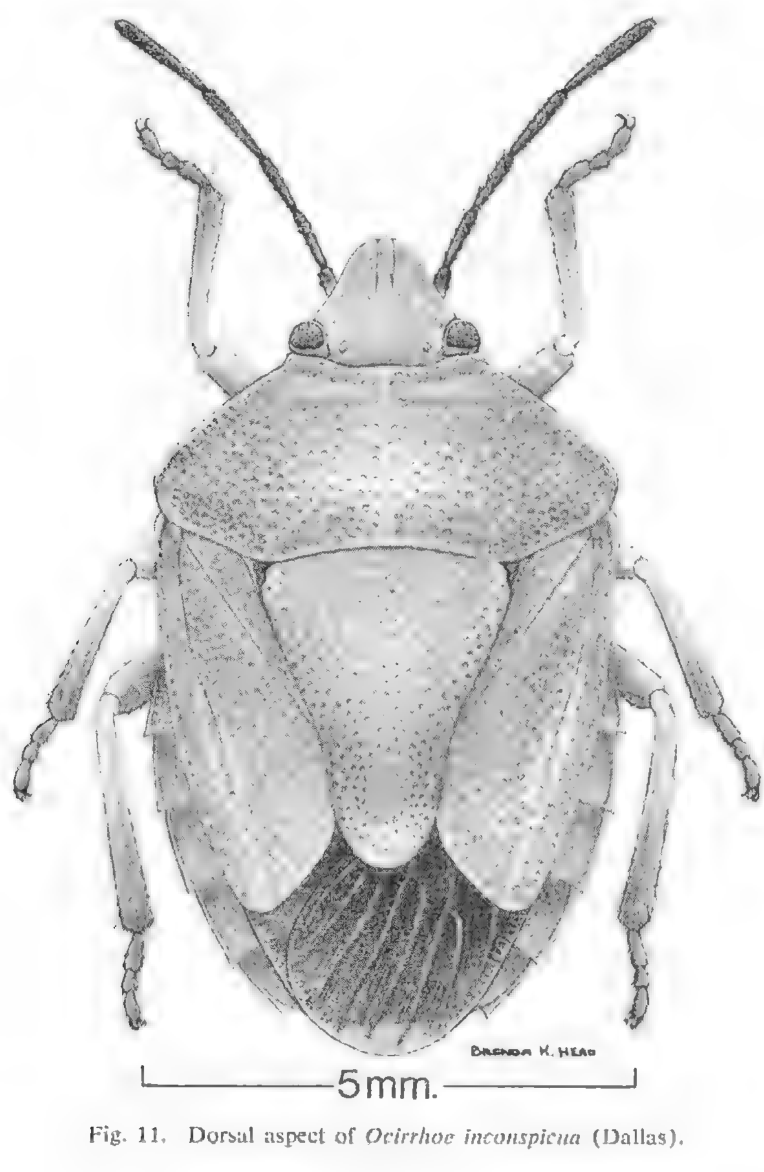

Fig. 11. Dorsal aspect of *Ocirrhoe inconspicua* (Dallas).

yellow or reddish yellow. Lateral angles behind explanate margin truncate, posterolateral and posterior margin slightly concave.

Scutellum: Concolorous with coarse dense punctations, apex yellow and almost impunctate. Fovea in each basal angle black. Raised in anterior half and flat posteriorly. A trace of a faint median longitudinal impunctate line present. Lateral margins gently convex in basal half then straight or gently rounded to broadly rounded apex. Frena reaching about half length.

Hemelytra: Coriaceous parts concolorous with regular coarse dense punctations, medial fracture glabrous towards apex. Exterior margins of coria slightly concave and thickened basally then faintly convex to shortly rounded apical angle, reaching middle of abdominal segment VI, laterotergites broadly exposed. Posterior margin of corium straight, inner angle very broadly rounded. Clavus elongate triangular. Membrane and veins pale brownish hyaline.

Abdomen: Medially a broad black longitudinal bar or series of black maculae behind apex of scutellum, laterally concolorous. Dorsal surface of pygophore reddish.

Laterotergites: Concolorous, densely punctate, posterior exterior angles produced into an acute black-tipped spine.

Underside: Concolorous, coarsely punctate except on sides of head exterior to bucculae, exterior margin of prothorax, evaporative areas, ventrally along abdomen and appendages. Antennal segment I concolorous or yellowish, remaining segments pale red or reddish brown. Rostrum ventrally and its apex black. Tibiae apically and tarsi reddish brown. Lateral margins of prothorax, epipleuron, abdomen and apical margin of pygophore reddish or yellowish. Thoracic keels and a broad longitudinal medial stripe on abdomen yellowish.

Bucculae reaching to about middle of the eyes and rather elevated, medially lower, anteriorly forming a rounded lobe. Rostral segment I robust, reaching nearly to base of bucculae, II compressed and arched, just surpassing fore coxae, III reaching onto hind coxae and IV onto the base of ventrite IV. Antennae comparatively robust, ratio of segements (♂) 9 : 13 : 14 : 18 : 23. Metasternal-mesosternal keels of even height to just behind fore coxae, then gently and obliquely inclined downwards to rounded apex, almost reaching apex of prosternum, not deflected to left in ventral view. Legs normal without long pilosity, only the usual short pilosity on tibiae and tarsi, tibiae flattened, at least apically. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 12 C, hind margin of pygophore gently concave and laterally not convex. Apex of female abdomen Fig. 12 D, hind margins of first gonocoxae rather convex, inner margins a little elevated; posterior margins of VIIIth laterotergites produced into only a blunt not very obvious angle.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	21	36	1·9	5·4	32-39
Head width	21	37	1·2	3·1	33-38
Antennal segment I	38	9	0·6	7·5	7-10
Antennal segment II	37	13	0·9	6·9	11-15
Antennal segment III	37	14	1·0	7·5	12-15
Antennal segment IV	27	18	1·1	5·9	16-20
Antennal segment V	20	23	1·4	6·2	19-24
Pronotum width	21	90	5·1	5·7	79-98
Pronotum length	21	37	1·9	5·0	35-42
Total length	21	164	10·3	6·3	155-195

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	15	38	2·0	5·3	35-41
Head width	15	38	1·4	3·6	36-40
Antennal segment I	28	9	0·5	5·4	8-10
Antennal segment II	29	14	0·9	6·5	12-15
Antennal segment III	29	14	1·1	7·8	12-16
Antennal segment IV	24	19	1·0	5·0	17-21
Antennal segment V	21	23	1·3	5·7	21-26
Pronotum width	15	94	3·4	3·7	89-99
Pronotum length	15	40	1·3	3·3	38-41
Total length	15	174	7·2	4·1	160-185

Total length: 8·1-10·2 mm

Remarks: This species is easily distinguished from all other species of *Ocirrhoe* by the second antennal segment being about the same length as, or longer than, the second. In the non-infuscated antennal segments and the shape of the pygophore it is close to *unimaculata* Westwood, however the black spot in the basal angles of the scutellum and the shape of the pygophore indicates it is also related to *dallasi*. It is distinguished from *dallasi* by its more acuminate head which is not black at base, by the third antennal segment being about the same length as the second or even longer, and by the shallowly concave hind margin of the pygophore.

Ocirrhoe inconspicua has only been recorded from Western Australia with the exception of one male specimen from the mountains of north-eastern Victoria. Host records include a *Melaleuca* species and *Chamelaucium unicinatum*, both members of the Myrtaceae.

Location of type:

Type ♀ of *inconspicua* Dallas, "New Holland", in BM.

Specimens examined: Western Australia: the type and; 1 ♂, Bushmead, 17.XII.1966, on *Melaleuca*, E. M. Exley UQ; 3 ♂, 3 ♀, 1?, Bunbury, 3.I.1957, A. Snell; 1 ♀, Capel District (29 km south of Bunbury), 7.I.1957, A. Snell AM; 1 ♂, Yardie Creek, April 1958, Snell; 1 ♂, 1 ♀, Capel, 7.I.1957, Snell; 1 ♂, Collie, 13.I.1957, Snell NM; 1 ♂, Northhampton, 16.IX.1958, F. H. Uther-Baker; 1 ♀, 1 ♂, Kelmscott, 16 Oct. & 7 Nov. 1958, the first in *Banksia* and scrub, J. Baldwin; 1 ♂, Yanchep, 16.X.1964, F. H. Uther-Baker; 1 ♂, Kings Park, 2.X.1965, H. Mincham; 1 ♀, Jandakot, 24.X.1965, F. H. Uther-Baker SAM; 1 ♂, 1 ♀, Mundaring Weir, 20.II.1963, 1 ♂, same locality, 10.XII.1964, J. Dell; 1 ♂, Wembley Downs, 1.XI.1969, on wax (*Chamelaucium uncinatum* Schau) only, E. A.

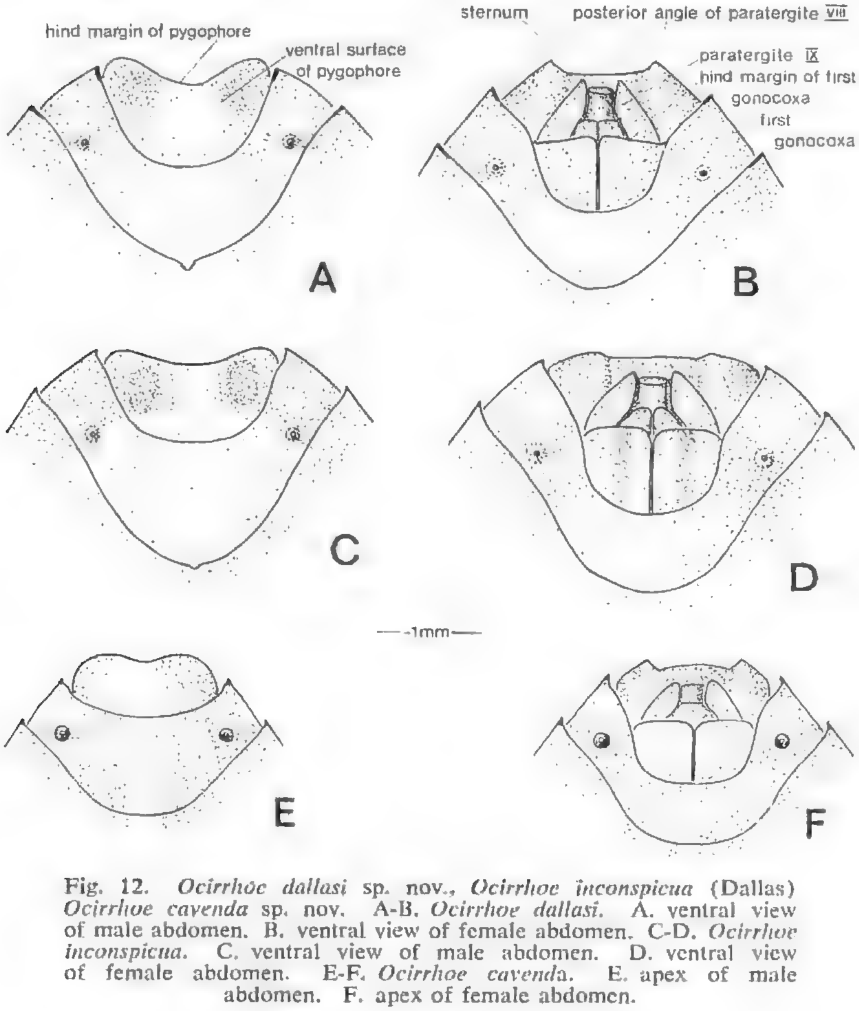

Fig. 12. *Ocirrhoe dallasi* sp. nov., *Ocirrhoe inconspicua* (Dallas) *Ocirrhoe cavenda* sp. nov. A-B. *Ocirrhoe dallasi*. A. ventral view of male abdomen. B. ventral view of female abdomen. C-D. *Ocirrhoe inconspicua*. C. ventral view of male abdomen. D. ventral view of female abdomen. E-F. *Ocirrhoe cavenda*. E. apex of male abdomen. F. apex of female abdomen.

Jefferys & M. Archer WAM; 1 ♀, Swan River, L. J. Newman; 1 ♀, Merredin, L. J. Newman; 1 ♂, 3 ♀, Yanchep, 51 km (32 miles) north of Perth, 13-23.XI.1935, 2 ♂, 1 ♀, same locality, 20-31.XII.1935, R. E. Turner BM; 2 ♂, 1 ♀, Tortoise Reserve, 39 km (24 miles) north of Perth, 16.XII.1971, J. A. Slater; 1 ♂, 1 ♀, Wildlife Reserve, 34 km (21 miles) north of Perth, 16-18.XII.1971, J. A. Slater SLATER; 1 ♂, Margaret River, 2 Nov.; Harvard Australian Expedition, P. J. Darlington AMNH; 1 ♀, Darlington, 150 m (450ft.), 5.IX.1962, E. S. Ross and D. Q. Cavagnaro CAS. Victoria: 1 ♂, Hotham Heights, Victoria, 1 800 m (5 900ft.), on snow, 1.II.1957, A Neboiss NM.

Ocirrhoe cavenda sp. nov.

Figs. 12 E-F, 13, 16

Description:

General appearance: Green in life with pronotum between and behind level of lateral angles pinkish, latter reaching lateral angles and posterolateral and posterior margins. Scutellum apically very broadly pinkish or luteous, in front of this luteous with a diffuse band of black punctations denser laterally, foveae in basal angles black. Antennae and tarsi yellowish brown. Museum specimens with the green faded to yellow.

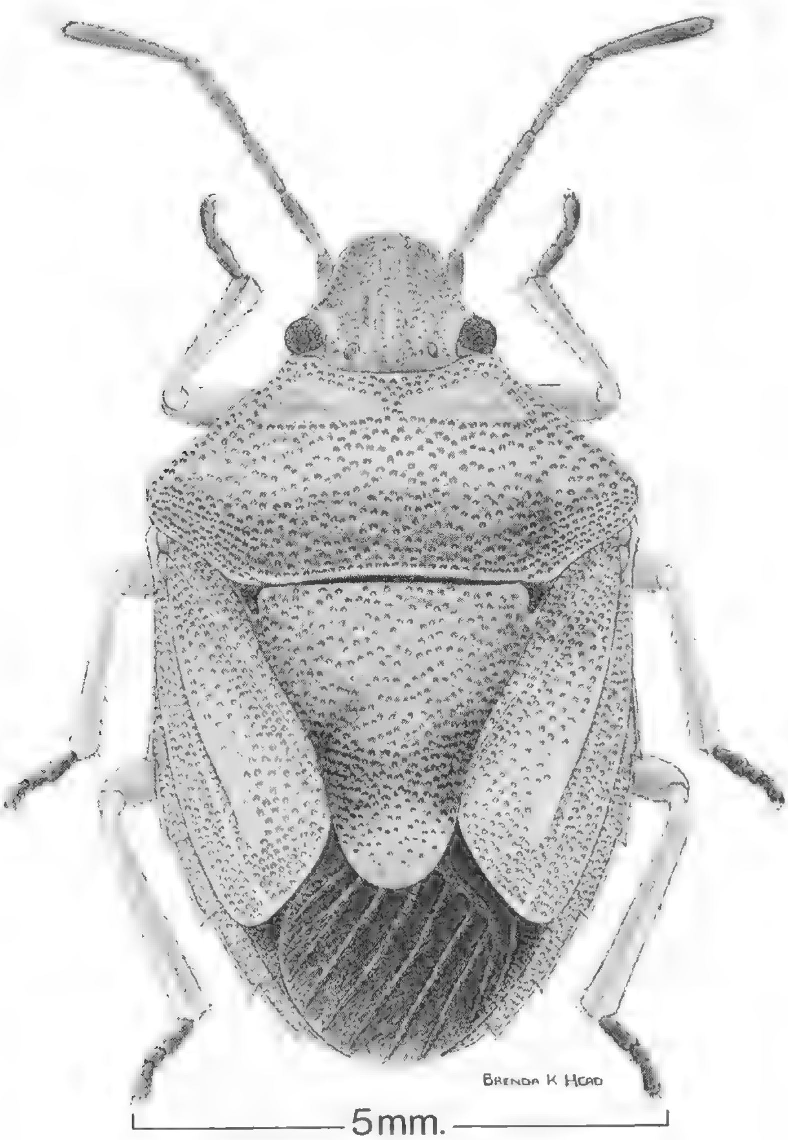

Fig. 13. Dorsal aspect of *Ocirrhoe cavenda* sp. nov.

Head: Appearing fairly broad and apically rather truncate, concolorous, anteriorly flattened and posteriorly only very little raised; anteclypeus, hardly surpassing apices of juga, lateral margins clearly concave. Disc rugulosely punctate. Eyes and ocelli purplish red.

Pronotum: Anteriorly concolorous, from a line drawn between the lateral angles posteriorly pinkish and coarsely punctate, some punctations in the pinkish area infuscated, calli glabrous and frequently a submarginal callous line paralleling the anterolateral margins. Anterior margin oblique behind eyes and trapeziformly excavate behind collum, anterolateral angles represented by a small fine tooth or ridge. Anterolateral margins nearly straight. Lateral angles behind the reflexed margin truncate, posterolateral and posterior angles only slightly concave.

Scutellum: Concolorous with apex very broadly luteous or pinkish, before the pale apex a broad band of black punctations, constricted and less dense medially. A black fovea in each basal angle. Raised a little anteriorly and flat in posterior half. A trace of a faint median longitudinal line present. Lateral margins gently concave in basel half and then almost parallel to rather broadly rounded apex. Frena reaching to about half length.

Hemelytra: Coriaceous parts concolorous with coarse, but not dense, punctations; a glabrous streak just interior of posterior half of medial fracture. Exterior margins of coria distinctly concave basally then almost straight to shortly rounded apical angle, reaching about middle of abdominal segment VI; laterotergites broadly exposed. Posterior margin of corium straight, inner angle broadly rounded. Clavus elongate, triangular. Membrane and veins faintly brownish hyaline.

Abdomen: Concolorous, behind apex of scutellum infuscated.

Laterotergites: Concolorous, densely punctate, posterior exterior angles produced into a short black spine.

Underside: Concolorous; bucculae, propleuron, mesopleuron except exteriorly, metapleuron posteriorly and abdomen coarsely punctate. Antennal segments II-V pale reddish or yellowish-brown. Rostrum ventrally and the apical half of its terminal segment black. Tibiae towards apices and tarsi brown. On abdomen three pale longitudinal stripes, one medial and the other two midlateral. Spiracular eminences dark brown or black below the orifices.

Bucculae low and sinuated, reaching about middle of an eye, anteriorly produced into a blunt triangular process. Rostral segment I robust, reaching nearly to base of bucculae, II compressed and arched and reaching to about middle of fore coxae, III to middle of mid coxae and IV to base of hind coxae. Ratio of antennal segments (♂) 8 : 13 : 11 : 17 : 21. Metasternal-mesosternal keels highest between fore coxae, then obliquely truncate, then broadly rounded at apex, reaching nearly to apex of prosternum, directed to left apically in ventral view. Legs normal without pilosity, only the usual spines present, tibiae only flattened apically. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 12 E, hind margin of pygophore subangulately excavated, lateral lobes not strongly prominent. Apex of female abdomen Fig. 12 F, hind margins of first gonocoxae transverse, turning anteriorly towards the midline, interior margins not raised, apical angles of VIIIth paratergites angulately produced.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	5	34	1·6	4·9	31-35
Head width	5	36	1·4	3·9	34-38
Antennal segment I	9	8	0·7	9·2	7-9
Antennal segment II	9	13	1·1	8·4	11-15
Antennal segment III	9	11	0·9	8·3	9-12
Antennal segment IV	9	17	1·2	7·2	15-19
Antennal segment V	9	21	1·8	8·6	17-22
Pronotum width	5	82	6·5	7·9	73-87
Pronotum length	5	36	2·5	6·9	32-38
Total length	5	149	9·9	6·7	133-160

Dimensions—

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	4	35	—	—	33-36
Head width	4	37	—		35-39
Antennal segment I	6	8	—		8-9
Antennal segment II	5	14	—	—	13-14
Antennal segment III	5	11	—	—	10-13
Antennal segment IV	5	18	—	—	17-19
Antennal segment V	4	22	—	—	21-23
Pronotum width	4	84	—	—	76-91
Pronotum length	4	36	—	—	33-40
Total length	4	154	·		147-158

Total length: 6·9-8·3 mm

Remarks: This species occurs in a narrow belt in New South Wales and Victoria from near the Queensland border to about Bendigo in Victoria. It is very similar to *unimaculata* and easily confused with the latter but differs in the black foveae in the basal angles of the scutellum, the transverse band of black punctations before the pale apex of the latter, the more angulately incised posterior margin of the hind margin of the pygophore, the comparatively longer third antennal segment and its rather smaller size. Only ten specimens are known.

Location of types:

Holotype ♂ (Reg. No. 120,725), Mullaley, New South Wales, Jan. 1959, F. E. Wilson SAM; allotype ♀, Bendigo District, Victoria, 6.X.1928, *ex* J. E. Dixon collection donated Jan. 1940 NM; 3 paratypes ♂, Nollo Mountain 32 km (20 miles) north east of Rylston, New South Wales, 12.XI.1950, T. G. Campbell; 1 paratype ♀, 14 km (9 miles) north east of Putty, New South Wales, 28.X.1956, P. B. Carne ANIC; 1 paratype ♂, "Calumet", 42 km (26 miles) north east of Binnaway, New South Wales, Nov. 1931, A. Musgrave AM; 1 paratype ♂, 2 paratypes ♀, Lennox Bridge, New South Wales, 28.IX.1958, M. I. Nikitin BM 1959-57.

Specimens examined: The types only. The distribution of the known specimens has been added to the map on Fig. 16 so that its distribution may be compared with that of *unimaculata*.

Ocirrhoe unimaculata (Westward, 1837)

Figs. 14. 15 A-E. 16

Rhynchocoris unimaculata Westwood, 1837, p. 29.

Ocirrhoe unimaculata Lethierry & Severin, 1893, p. 180. Distant, 1900a, p. 422.

Rhynchocoris roei Westwood, 1837, p. 30. Lethierry & Severin, 1893, p. 181.

Ocirrhoe roei Distant, 1900b, p. 815, pl. 52, fig. 12. *new synonym*.

Cuspicona fasciata Dallas, 1851, p. 297, pl. 10, fig. 3.

Description:

General appearance: Green in life with an elongate oval pinkish or yellow transverse bar between, but not reaching, lateral angles and posterolateral margins of pronotum. Scutellum apically yellow. Foveae in basal angles concolorous; antennae and tarsi yellowish brown. Museum specimens with the green faded to yellowish, pink or light red. Other colours as noted. Eyes and ocelli purplish.

Head: Appearing fairly broad and apically rather truncate, concolorous, anteriorly flattened and posteriorly very little raised; anteclypeus hardly surpassing apices of juga, lateral margins clearly concave. Disc rugulosely punctate. Eyes and ocelli greyish to purplish red.

Pronotum: Concolorous with rather coarse sparse punctations, latter rather infuscated in the area of the pale patch, calli glabrous. Between lateral angles a very elongate transverse pale pink or yellow bar not reaching lateral angles or posterior margin. In some examples an irregular yellow callous line just inside anterolateral margins. Anterior margin oblique behind eyes and trapeziformly excavate behind collum, anterolateral angles represented by a very small tooth. Anterolateral margins nearly straight. Lateral angles behind the reflexed margin concave, posterolateral and posterior margins only slightly concave.

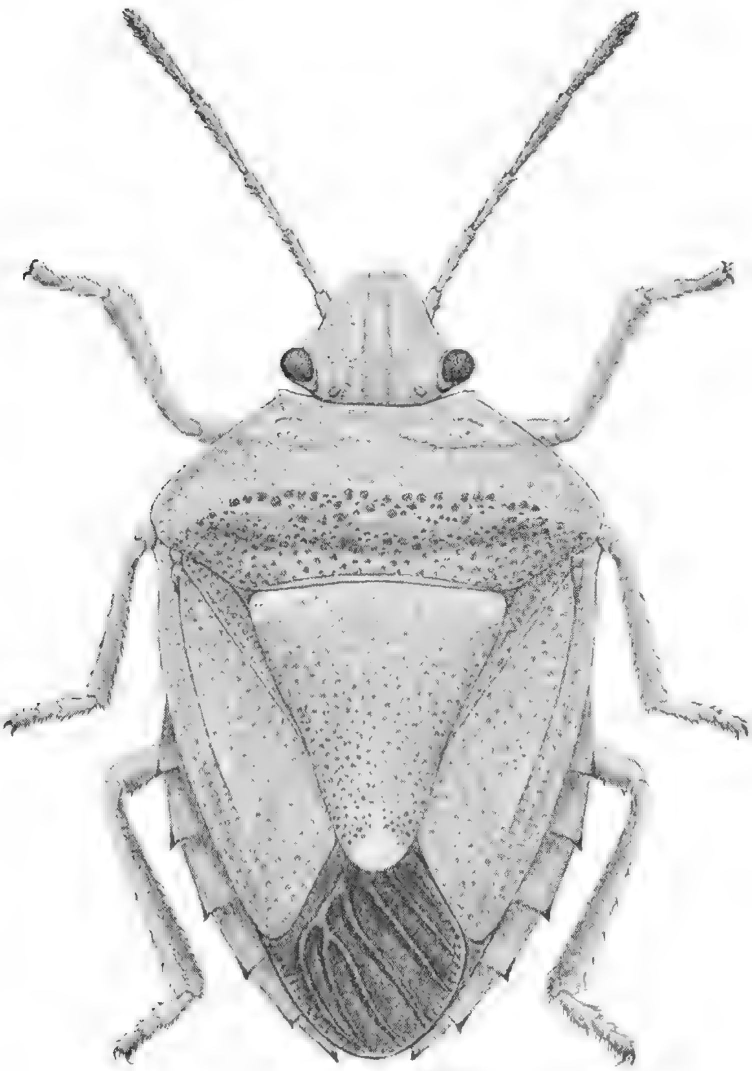

Fig. 14. Dorsal aspect of *Ocirrhoe unimaculata* (Westwood).

Scutellum: Concolorous with evenly distributed fairly dense vaguely fuscous punctations, apex broadly yellow and impunctate. A concolorous foveae in each basal angle. Raised a little anteriorly and flat in posterior half. A faint raised medial longitudinal line present. Lateral margins gently convex in basal half and then converging gently to rounded apex. Frena reaching about 4/7 of length.

Hemelytra: Coriaceous parts concolorous with regular, moderately dense punctations. Exterior margins of coria faintly concave basally then broadly convex to shortly rounded apical angle, reaching about middle of abdominal segment VI, laterotergites broadly exposed. Posterior margin of corium straight, inner angle broadly rounded. Clavus very elongate triangular. Membrane and veins hyaline, frequently rather brownish.

Abdomen: Concolorous, infuscated on either side of apical portion of scutellum.

Laterotergites Concolorous, densely punctate, posterior exterior angles produced into a short, minutely black tipped spine.

Underside: Concolorous, punctate on propleuron, base of mesopleura, hind portion of metapleuron and abdomen, coarser laterally on the latter. Antennal segments II-V pale or yellowish brown. Rostrum ventrally and its apex black. Tarsi brown. In green examples the sternites and three longitudinal lines on the abdomen, one medial and the others midlaterally on each side, yellow. Spiracles with their orifices black. Apical margin of pygophore or in females apical margins of VIIIth paratergites frequently narrowly black. Many examples with two large subquadrate pink markings on either side of the midline, a pair each on segments III and IV.

Bucculae low and sinuated, reaching about middle of an eye, anteriorly produced into a blunt lobulate process. Rostral segment I robust, reaching nearly to base of bucculae; II compressed and arched, reaching about middle of fore coxae, III to middle of hind coxae and IV just onto base of abdomen. Ratio of antennal segments (♂) 8:16:12:20:23. Metasternal-mesosternal keels highest between fore coxae then obliquely truncate, reaching nearly apex of prosternum, directed to left in ventral view. Legs normal without long pilosity, only a few spines present, tibiae only flattened apically. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 15 A, hind margin of pygophore only slightly concave and laterally not produced into prominent lobes. Clasper Fig. 15 E, strongly F-shaped, the upper ramus compressed and darkly sclerotized towards its tip. Phallosoma Figs. 15 C-D, short and honey-coloured, "lappet" processes rather elongate, conjunctiva reflexed downward, medial penial plates elongate in the axis of the aedeagus, notched ventrally in lateral view, in ventral view broad and diverging. Apex of female abdomen Fig. 15 B, hind margins of first gonocoxae transverse and nearly truncate, interior margins not raised; apical angles of VIIIth paratergites angulately produced.

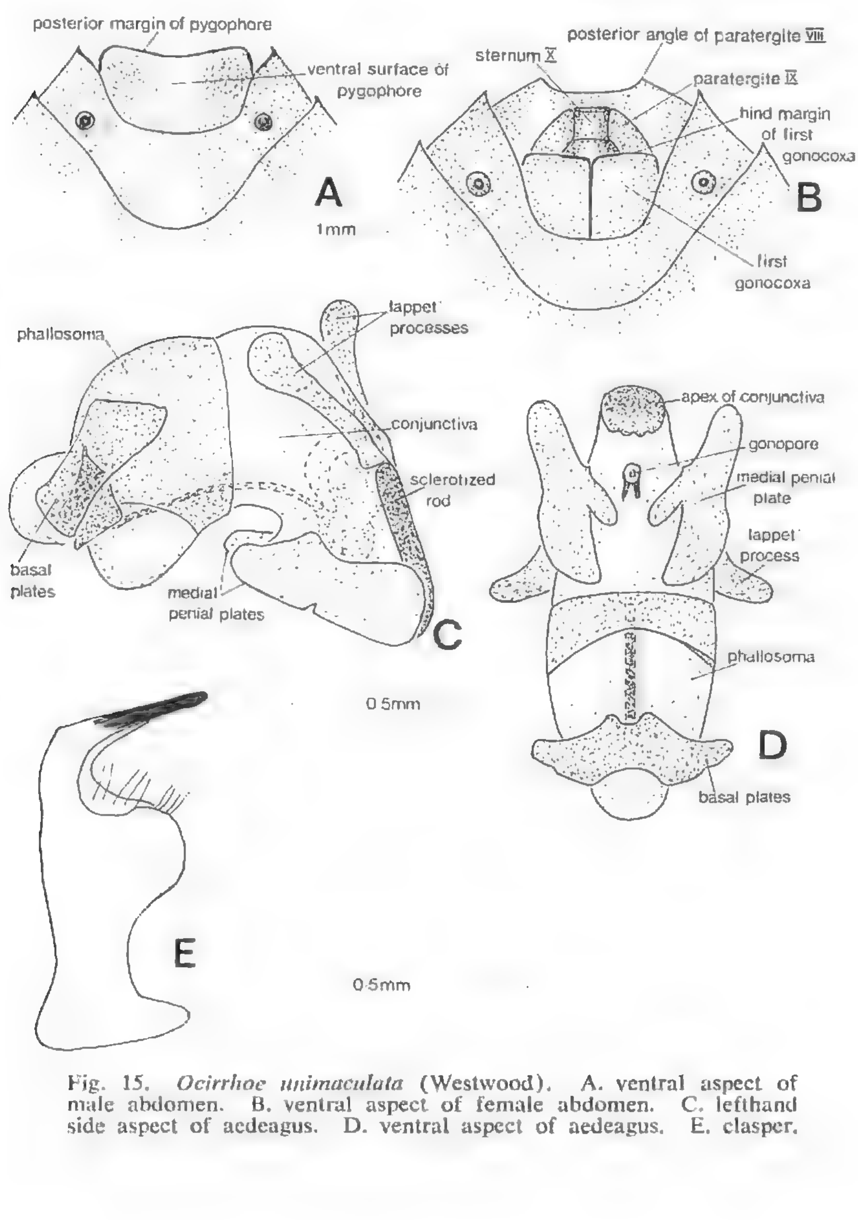

Fig. 15. *Ocirrhoe unimaculata* (Westwood). A. ventral aspect of male abdomen. B. ventral aspect of female abdomen. C. lefthand side aspect of aedeagus. D. ventral aspect of aedeagus. E. clasper.

Dimensions—

MALES FROM SOUTHERN AUSTRALIA

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	20	35	1·9	5·4	31-38
Head width	20	38	1·5	4·1	35-40
Antennal segment I	37	8	0·8	9·2	7-9
Antennal segment II	38	16	1·0	6·5	14-18
Antennal segment III	38	12	1·3	11·2	10-15
Antennal segment IV	33	20	1·1	5·5	17-22
Antennal segment V	25	23	1·3	5·6	21-25
Pronotum width	20	92	4·5	4·9	85-98
Pronotum length	20	38	2·6	6·7	33-43
Total length	20	160	8·0	5·0	148-172

FEMALES FROM SOUTHERN AUSTRALIA

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	20	37	1·8	4·8	34-40
Head width	20	39	1·5	3·8	36-42
Antennal segment I	36	9	0·8	8·7	7-11
Antennal segment II	38	17	1·3	8·0	14-19
Antennal segment III	37	12	1·3	11·2	10-14
Antennal segment IV	32	19	1·0	5·3	17-22
Antennal segment V	28	23	1·4	6·0	20-25
Pronotum width	20	96	5·1	5·4	85-109
Pronotum length	20	40	4·4	11·1	26-47
Total length	20	174	9·4	5·4	155-200

MALES FROM QUEENSLAND AND NEW SOUTH WALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	19	34	1·4	4·2	31-37
Head width	19	36	1·0	2·8	35-38
Antennal segment I	32	7	0·9	12·3	6-9
Antennal segment II	34	16	1·2	7·7	13-18
Antennal segment III	34	11	1·1	10·2	9-14
Antennal segment IV	30	20	1·4	7·3	17-23
Antennal segment V	24	23	1·4	6·2	20-25
Pronotum width	19	84	4·5	5·3	77-91
Pronotum length	19	35	2·0	5·7	32-38
Total length	19	154	10·6	6·9	137-175

FEMALES FROM QUEENSLAND AND NEW SOUTH WALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	19	36	1·2	3·4	35-39
Head width	19	38	1·5	4·0	36-42
Antennal segment I	35	8	0·8	9·9	7-9
Antennal segment II	36	17	1·2	7·4	15-20
Antennal segment III	39	11	0·9	7·8	10-14
Antennal segment IV	36	19	1·3	6·9	16-22
Antennal segment V	28	23	1·3	5·8	21-25
Pronotum width	19	92	3·9	4·2	88-99
Pronotum length	19	39	2·2	5·8	36-42
Total length	19	172	10·4	6·1	148-190

Total length (both populations): 7·1-10·4 mm

Remarks: The type of *unimaculata* Westwood is in poor condition but as it is a male and the pygophore is intact the identity of the species is not in doubt. The types of both *roei* Westwood and *fasciata* Dallas are females in better condition and belong also to this same species. The type of *roei* is the largest example yet seen in the genus.

The species is fairly easily recognised by the pale, usually pinkish elongate-oval, transverse patch near the hind margin of the pronotum. Two other species have a similar pale patch on the pronotum, notably *cavenda* and *virescens*. From *cavenda unimaculata* differs in having pale foveae in the basal angles of the scutellum, in lacking a preapical transverse band of black punctations before the apex of the scutellum and in the hind margin of the pygophore being only faintly concave. From *virescens unimaculata* differs by lacking pale lateral margins to the scutellum, by having the hind margin of the pygophore only faintly excavate (triangularly excavate in *virescens*) and in having the hind margins of the female first gonocoxae transverse (convex in *virescens*).

Ocirrhoe unimaculata is widely distributed near and on the coast of Australia south of about 26°S latitude. It has been taken on the following species of plants—*Correa* sp. (Muston, Kangaroo Island), *Myoporum insulare* R. Br. (Coorong, South Australia), *Geijeria linearifolia* (D.C.) J. M. Black (Mannum, South Australia), *Platylobium* sp. (Mt. Lofty, South Australia), *Beyeria leschenaulti* (D.C.) Baill and *Melaleuca pubscens* Schau (Hallett Cove, South Australia) and in a formation dominated by *Leucopogon parviflora* (Andr.) Lindl. and *Acacia sophorae* (Labill) R.Br. (near Robe, South Australia). Specimens have been captured in all months of the year.

Populations from the southern states of Australia and from New South Wales south of the latitude of about Sydney are somewhat larger than populations from northern New South Wales and southern Queensland. The measurements of the two populations have been analysed separately in the descriptive section.

Location of types:

Type ♀ of *unimaculata* Westwood, "New Holland", and type ♀ of *roei* westwood, "SR" (= Swan River) in HOPE; type ♀ of *fasciata* Dallas, "New Holland", in BM.

Specimens examined: The types and 144 specimens from 58 localities from the following collections (numbers examined in parentheses):—QU(24), QM(4), AM(11), ANIC(19), NM(10), SAM(34), WAM(2), STOCKHOLM(4), BRUSSELS(1), BM(11), J. A. SLATER(1), AMNH(10), CAS(1), BISHOP(12). As this is a common species individual Australian and Tasmanian records have not been listed in detail but are plotted on Fig. 16.

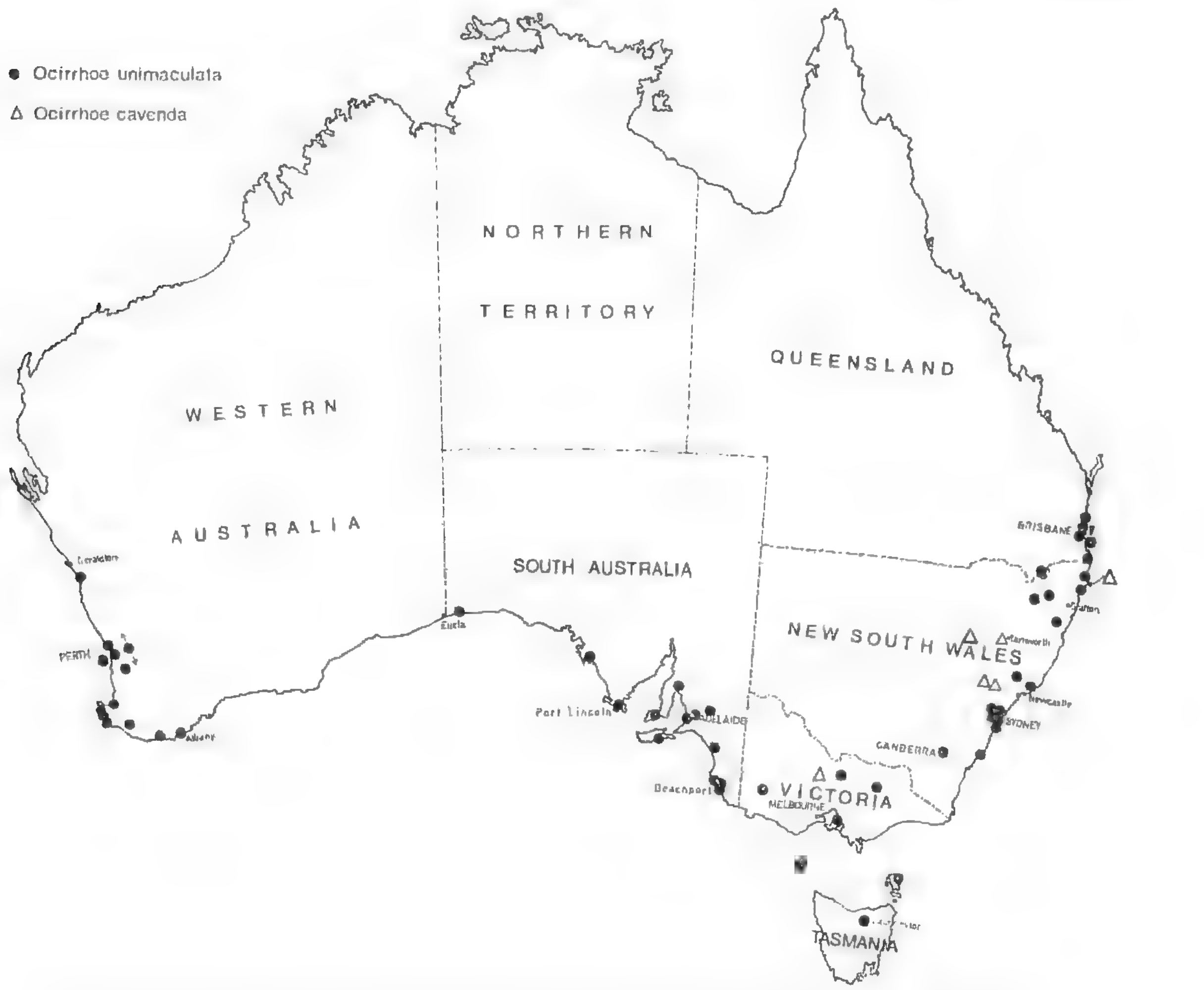

Fig. 16. Distribution of *Ocirrhoe cavenda* sp. nov. and *Ocirrhoe unimaculata* (Westwood).

Ocirrhoe prasinata (Stål, 1859) nov. comb

Figs. 17, 19 A-B.

Cuspicona prasinata Stål, 1859, p. 231; 1876, p. 103, Lethierry and Severin, 1893, p. 180.

Description:

General appearance: Museum specimens greenish-yellow or yellow, in fresher specimens apex of third and fourth and most of fifth antennal segments reddish. Eyes and ocelli greyish. Foveae in basal angles of scutellum concolorous or greyish.

Head: Appearing moderately elongate, concolorous, triangular, anteriorly flattened and posteriorly a little raised; anteclypeus slightly surpassing apices of juga, lateral margins clearly concave. Disc rugulosely punctate. Eyes and ocelli greyish or reddish-grey.

Pronotum: Concolorous with fine dense concolorous or slightly infuscated punctations, calli glabrous. A faint trace of a medial longitudinal line. Anterior margin oblique behind eyes and trapeziformly excavate behind collum, anterolateral angles prominent as a small tooth. Anterolateral margins straight or slightly convex. Lateral angles behind the reflexed margin shortly truncate, posterolateral and posterior margins only slightly concave, posterior margin slightly concave.

Scutellum: Concolorous with fine dense concolorous or slightly infuscated punctations, an almost concolorous fovea in each basal angle. Raised very little anteriorly and flat posteriorly. Lateral margins gently convex in basal 4/7 and then converging gently to broadly rounded apex. Frena reaching about 4/7 of length.

Hemelytra: Coriaceous parts concolorous with fine dense concolorous or slightly infuscated punctations. Exterior margins of coria faintly concave basally and then faintly convex to nearly rectangular apical angle, reaching about middle of abdominal segment VI, laterotergites broadly exposed. Posterior margin of corium straight, inner angle broadly rounded. Clavus very elongate triangular. Membrane and veins hyaline.

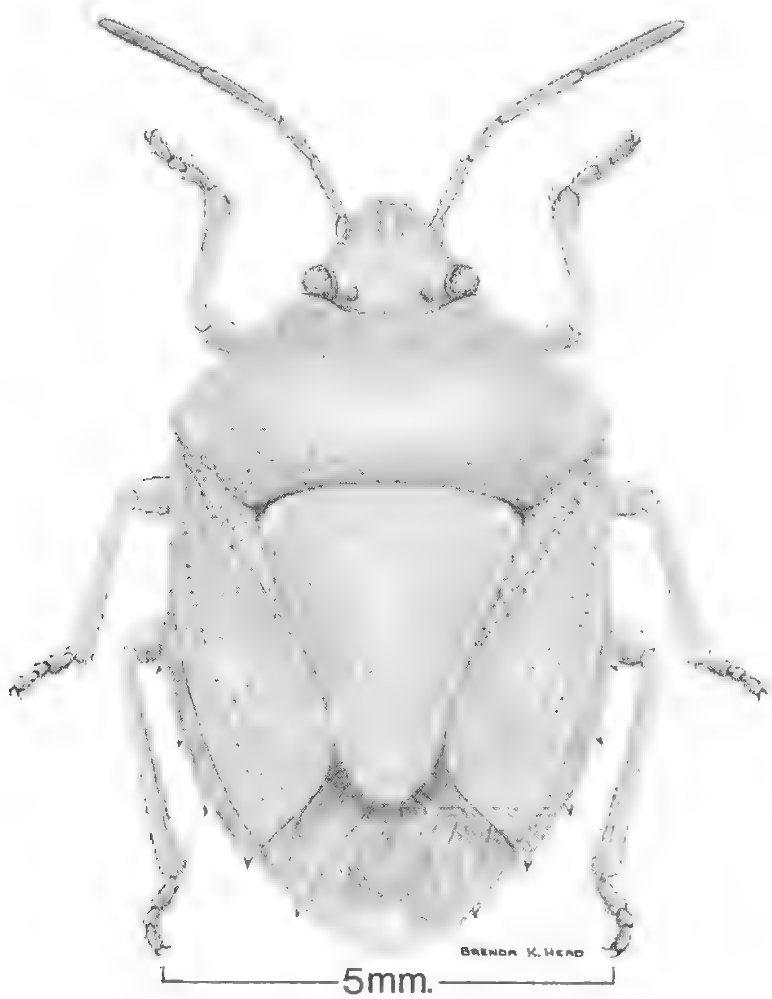

Fig. 17. Dorsal aspect of *Ocirrhoe prasinata* (Stål).

Abdomen: Concolorous, some dorsal portions of pygophore pinkish.

Laterotergites: Concolorous, coarsely punctate exteriorly, posterior exterior angles produced into a short, minutely black tipped spine.

Underside: Concolorous, coarsely punctate except on head, margin of propleuron, evaporative areas and legs. Apex of third and fourth and most of fifth antennal segments reddish or orange. Rostrum ventrally and its extreme apex black. Spiracles concolorous or faintly infuscated.

Bucculae high and moderately sinuated, reaching about middle of an eye, anteriorly produced into a rather triangular lobulate process. Rostrol segment I robust, reaching nearly to base of bucculae, II compressed and arched and reaching middle of fore coxae, III to middle of hind coxae and IV to about middle of ventrite III. Ratio of antennal segments (♂) 9: 15: 12: 21: 25. Metasternal-mesosternal keels depressed a little anteriorly, nearly reaching apex of prosternum, anteriorly rounded and directed to left in ventral view. Legs normal with sparse pilosity, tibiae only flattened apically. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 19 A, hind margin of pygophore laterally produced into a reflexed lobe on either side, between these deeply excavate this excavation with a smaller excavation on midline. Apex of female abdomen Fig. 19 B, hind margins of first gonocoxae transverse and nearly truncate, interior margins not raised.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	8	35	2·1	6·0	30-37
Head width	9	37	0·9	2·4	36-39
Antennal segment I	15	9	0·5	5·1	9-10
Antennal segment II	17	15	1·0	6·7	13-16
Antennal segment III	17	12	1·3	10·7	11-15
Antennal segment IV	14	21	1·4	7·0	19-24
Antennal segment V	9	25	2·3	9·0	23-29
Pronotum width	9	92	1·9	2·0	90-95
Pronotum length	9	38	1·3	3·3	37-40
Total length	9	171	4·9	2·9	165-180

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	13	35	0·9	2·5	33-36
Head width	13	38	1·1	3·0	37-40
Antennal segment I	16	9	0·9	10·1	8-10
Antennal segment II	19	15	1·3	9·0	11-17
Antennal segment III	19	12	1·3	10·7	11-15
Antennal segment IV	13	20	1·8	9·2	17-24
Antennal segment V	13	23	2·4	10·3	21-29
Pronotum width	13	93	5·0	5·4	85-103
Pronotum length	13	39	2·3	6·0	35-43
Total length	13	169	8·8	5·2	155-181

Total length: 8·1-9·4 mm

Remarks: This species is very easily confused with *Cuspicona privata* Walker on a macroscopic examination. It appears to be a true *Ocirrhoe* on the following features:—the antennae are more robust than in *Cuspicona* species, the anterolateral margins of the pronotum are reflexed and this reflexed area continues for a short distance onto the lateral angle and the hind margins of the first gonocoxae of the female are transverse and also truncated, a feature which occurs commonly in *Ocirrhoe* but only in *Cuspicona* in the long-headed *intacta* group which *O. prasinata* does not resemble. *O. prasinata* has much less flattened tibiae than some of its congeners whereas *C. privata* has more flattened tibiae than other species of *Cuspicona*. It is in the area of these two species (*O. prasinata* and *C. privata*) that the two genera become rather close to each other and it is likely the point where the two genera diverged, whether one arose out of the other or both diverged from a common ancestor must remain unanswered.

Within *Ocirrhoe* itself *prasinata* appears to be related most closely to *coronata* by virtue of the rather similar posterior margin of the pygophore of the male, the two strong lobes, one either side of the midline, in *coronata* are reduced to only slightly prominent lobes in *prasinata*.

C. prasinata occurs near the eastern and southern coasts of the Australian mainland from southern Queensland to about the Mt. Lofty Ranges and Kangaroo Island in South Australia.

The high coefficients of variation noted for the lengths of the antennal segments seem to be due to a progressive shortening of their length as one progresses from Queensland to South Australian examples and does not appear to indicate a specific difference.

Location of types:

Typus ♂, allotypus ♀, paratype ♂, paratype "Sidney, Kinb." (for "Sydney, Kinberg"), STOCKHOLM.

Specimens examined: The types and Queensland 1 ♂, 1 ♀, Tibrogargan Creek, 4.IX.1953, on *Leptospermum*, T. E. Woodward UQ; 1 ♀, Springbrook, 12.X.1959, A. N. Burns; 1 ♂, Burleigh, 16.IX.1960, A. N. Burns NM. A.C.T. 3 ♂, 3 ♀, (2 ♀ Lake Windemere), Jervis Bay, 18-19.IX.1951, T. G. Campbell ANIC. Victoria 1 ♀, Mallacoota, 23.XI.1965, A. Neboiss. 1 ♀, locality and date illegible, donated by F. P. Spry 5.X.1922 NM. South Australia 1 ♀, Teatree Gully, 16.XI.1954, R. V. Southcott; 2 ♀, E.S.1. 833, Belair, 10.X.1952, G. F. Gross; 1 ♀, E.S.1. 594, Belair, 11.I.1953, G. F. Gross; 1 ♂, Belair National Park, 20.X.1965, by sweeping, B. K. Hubbard and A. N. McFarland; 1 ♀, Kangaroo Island, A. M. Lea; 1 ♂, Kangaroo Island, Oct. 1924; 1 ♀, 16 km (10 miles) west of Vivonne Bay, 12.X.1966, by beating, A. N. McFarland and M. Pate SAM; 2 ♀ without further locality AMNH. Unlocalised 1 ♀ AM.

Ocirrhoe coronata sp. nov.

Figs. 18, 19 C-D.

Description:

General appearance: Museum specimens yellow; second, third and fourth antennal segments reddish, fifth black medially and narrowly reddish at base and apex. Eyes and ocelli reddish-grey. Fovea in basal angles of scutellum concolorous.

Head: Appearing moderately elongate, concolorous, triangular, anteriorly flattened and posteriorly a little raised, apex of anteclypeus in same curve as apices of juga; lateral margins clearly concave. Disc coarsely and rugulosely punctate. Eyes and ocelli reddish or reddish-grey.

Pronotum: Concolorous with rather coarse vaguely infuscated punctations, calli glabrous. Lateral margins tending orange. No trace of a median longitudinal line. Anterior margin oblique behind eyes and semicircularly excavate behind collum, anterolateral angles prominent as a fine tooth. Anterolateral margins straight. Lateral angles behind the termination of the reflexed anterolateral margins shortly truncate, posterolateral and posterior margins only slightly concave.

Scutellum: Concolorous with coarse dense slightly infuscated punctations and concolorous fovea in each basal angle. Raised very little anteriorly and flat posteriorly. Lateral margins gently convex in basal half and then broadly rounded and converging to sublanceolate apex. Frena reaching about half length.

Hemelytra: Coriaceous parts concolorous with fine not very dense slightly infuscated punctations. Exterior margins of coria faintly concave basally then obtuse angled and then straight and converging to shortly rounded apical angle, reaching about middle of segment VI, laterotergites very broadly exposed. Posterior margin of corium rather rounded, inner angle broadly rounded. Clavus very elongate triangular. Membrane and veins fumose hyaline (holotype) or hyaline (allotype and paratype).

Abdomen: Reddish interiorly and on dorsum of pygophore.

Laterotergites: Concolorous, coarsely punctate exteriorly, hind and inner margins of seventh reddish. Posterior exterior angles produced into a short spine which is minutely black tipped.

Underside: Concolorous, coarsely punctate only on propleura, towards base of mesopleura, hind portion of metapleura, laterally on abdomen and very sparsely on ventral surface of pygophore. First antennal segment concolorous, second, third, fourth and base and apex of fifth reddish, rest of fifth black. Rostrum ventrally and its extreme apex black. Spiracles concolorous.

Bucculae high and moderately sinuated, reaching to about anterior margin of an eye, anteriorly produced into a subtriangular lobulate process. Rostral segment I robust, reaching nearly to base of bucculae, II compressed and slightly arched and reaching about middle of fore coxae, III to anterior part of mid coxae, and IV to posterior part of hind coxae. Metasternal-mesosternal keel rather raised anteriorly and

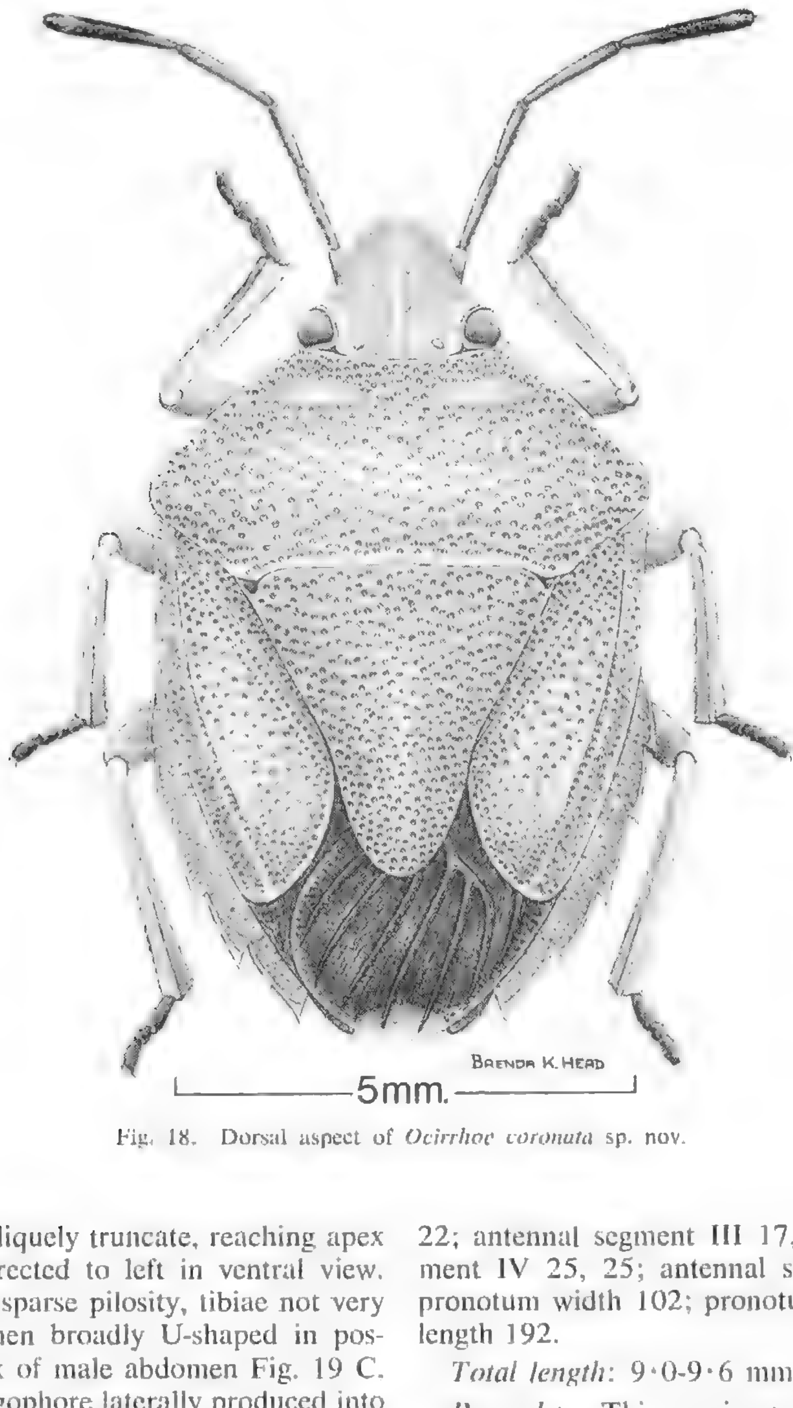

Fig. 18. Dorsal aspect of *Ocirrhoe coronata* sp. nov.

forward of this obliquely truncate, reaching apex of prosternum, directed to left in ventral view. Legs normal with sparse pilosity, tibiae not very flattened. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 19 C. hind margin of pygophore laterally produced into a reflexed lobe on either side, between these excavate, this excavation with a broad tooth on either side of the midline, between the latter notched. Female Fig. 19 C, posterior margins of first gonocoxae transverse, medially slightly concave; posterior angles of eighth laterotergites sharply angulated. Dimensions (holotype): Head length 40; head width 42; antennal segment I 10, 10; antennal segment II 20, 19; antennal segment III 15, 15; antennal segment IV 26, 25; antennal segment V 29, 28; pronotum width 102; pronotum length 44; total length 185; (allotype) head length 42; head width 42; antennal segment I 9, 9; antennal segment II 21, 22; antennal segment III 17, 17; antennal segment IV 25, 25; antennal segment V 28, —; pronotum width 102; pronotum length 44; total length 192.

Total length: 9·0-9·6 mm.

Remarks: This species appears to have only one close relative in the genus, namely *prasinata* (Stål) which it resembles in the shape of the posterior margin of the pygophore. The three known specimens come from two fairly widely separated localities.

Location of types:

Holotype ♂ (Reg. No. T7215), Iron Range, Cape York Peninsula, Queensland, 26.V.-2.VI. 1971, B.K. Cantrell QM; allotype ♀, Mt. Tozer, Iron Range, North Queensland, 20.IV.-1.V.1973, G. Monteith UQ; paratype ♂, Finke River, Central Australia, Dr. H. Basedow SAM.

Specimens examined: The types only.

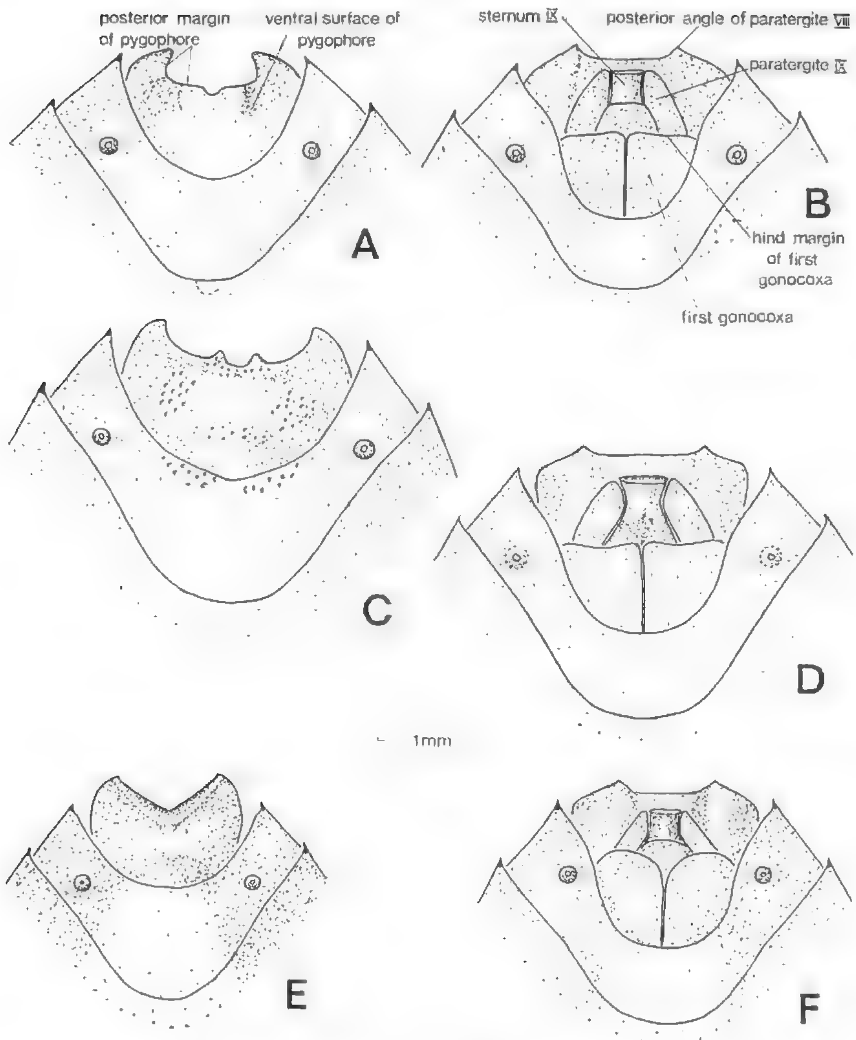

Fig. 19. *Ocirrhoe prasinata* (Stål), *Ocirrhoe coronata* sp. nov. *Ocirrhoe virescens* (Westwood). A-B. *Ocirrhoe prasinata*. A. ventral view of male abdomen. B. ventral view of female abdomen. C-D. *Ocirrhoe coronata*. C. ventral view of male abdomen. D. ventral view of female abdomen. E-F. *Ocirrhoe virescens*. E. ventral view of male abdomen. F. ventral view of female abdomen.

Virescens Group

This group contains only the one species, *Ocirrhoe virescens* (Westwood), which is restricted to Queensland. The group characteristics are:—more elongate than other species of *Ocirrhoe* (pronotum width: total length almost 1:2); rostrum long reaching onto, or almost onto ventrite V; tibiae flattened only apically; and in *virescens* the hind margins of the first gonocoxae of the female arcuately convex; head not marked with black punctations; antennae not apically infuscated and foveae in basal angles of scutellum concolorous.

There is a close resemblance to *O. unimaculata* in the pale transverse bar on the hind portion of the pronotum and the large red maculae on either side on ventrites III and IV. Like *unimaculata* and other species in the *unimaculata* group the tibiae are only slightly flattened.

Ocirrhoe virescens (Westwood, 1837)

Figs. 19 E-F, 20

Rhaphigaster virescens Westwood, 1837, p. 31.

Ocirrhoe? virescens Distant, 1900b, p. 815, pl. 53 fig. 7.

Description:

General appearance: In life green with a broad transverse bar on the hind portion of scutellum, lateral margin and apex of scutellum bright yellow or orange-yellow. In older museum specimens yellow or yellowish-brown with the transverse bar on the scutellum and the scutellar margins and apex paler or more orange. First segment of antennae concolorous, rest brown or reddish-brown. Eyes and ocelli reddish-grey or black. Foveae in basal angles of scutellum concolorous.

Head: Appearing strongly elongate triangular but actually about as wide across eyes as long. Concolorous, anteriorly flattened and posteriorly raised, apex of anteclypeus in same curve as apices of juga; lateral margins only slightly concave. Disc coarsely but not unduly densely punctate, some transverse rugulosities. Eyes and ocelli reddish-grey to black.

Pronotum: Concolorous with rather coarse evenly spaced punctations, latter tending fuscous posteriorly. Calli concolorous but glabrous. Between lateral angles and reaching almost to hind margins an elongate trapeziform transverse yellow or orange-yellow bar not reaching lateral angles or posterolateral margins. Anterior margin oblique behind eyes and trapeziformly excavate behind collum, anterolateral angles represented by a small toothed spine. Anterolateral margins straight. Lateral angles behind termination of reflexed anterolateral margins shortly truncate, posterolateral and posterior margins only slightly concave.

Scutellum: Concolorous medianly in basal half but along lateral margins and tip broadly yellow or orange-yellow; with coarse fairly evenly spaced concolorous or fuscous punctations. Foveae in basal angles concolorous. Raised anteriorly and flat posteriorly. Rather elongate, lateral margins only slightly convex in basal $\frac{4}{7}$ and then changing direction and faintly convex to sublanceolate apex which is slightly reflexed either side of midline. Frena reaching about $\frac{4}{7}$ length.

Hemelytra: Coriaceous parts concolorous but inner angle of corium infuscated with black. Punctations evenly distributed except just inside of apical portion of medial fracture where there is a narrow glabrous area. Exterior margins of coria faintly concave basally and then broadly convex to very shortly rounded apical angle, reaching about middle of segment VI, laterotergites narrowly exposed. Posterior margin of corium nearly straight, inner angle broadly rounded. Clavus very elongate triangular. Membrane and veins hyaline.

Abdomen: Concolorous exteriorly and broadly reddish behind scutellum, dorsum of pygophore also reddish.

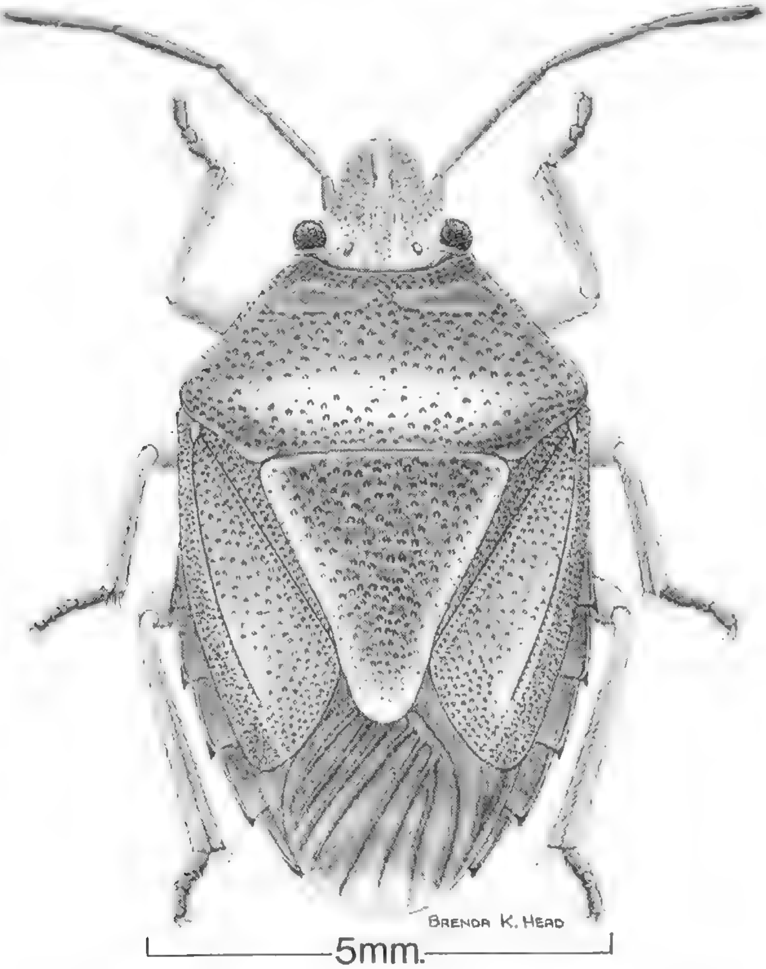

Fig. 20. Dorsal aspect of *Ocirrhoe virescens* (Westwood).

Laterotergites: Concolorous and coarsely and densely punctate. Posterior exterior angles produced into a short black-tipped spine.

Underside: Concolorous, coarsely punctate only on propleura, ventrally on mesopleura and posteriorly on metapleura. First antennal segment concolorous, remaining segments brownish tending reddish-brown towards apex. Rostrum ventrally and tip black. Abdomen medially with pyogophore broadly pale, a quadrate reddish patch just laterally of midline on either side on segments III and IV, not in contact with either fore or hind margins of these segments. Tarsi brown. Spiracles concolorous.

Bucculae low and moderately sinuated, reaching to about middle of eye, anteriorly produced into a subtriangularly lobulate process. Rostral segment I robust, reaching to base of bucculae, II compressed, arched and reaching onto mesosternum, III to past hind coxae and IV onto ventrite V. Ratio of antennal segments (♂) 9: 19 : 14 : 23 : 25. Metasternal-mesosternal keels highest just behind fore coxae, forward of this obliquely and truncately directed downwards then anteriorly shortly rounded, not reaching apex of prosternum, directed to left in ventral view. Legs normal without pilosity, only the normal bristles, tibiae only slightly flattened apically. Abdomen broadly U- or V-shaped in posterior view. Apex of male abdomen Fig. 19 E, hind margin of pygophore laterally produced into a prominent lobe on each side whose external margin is convex, between the lobes a strong V-shaped incision, on the ventral surface slightly in front of this a V-shaped ridge. Apex of female abdomen Fig. 19 F, hind margins of first gonocoxae strongly arcuately convex, inner margins slightly raised, angles of VIIIth paratergites distinctly acute.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	10	35	1·1	3·0	34-37
Head width	10	37	0·7	1·8	36-38
Antennal segment I	19	9	0·8	10·0	7-10
Antennal segment II	18	19	1·2	6·1	16-21
Antennal segment III	18	14	0·9	6·7	12-15
Antennal segment IV	14	23	1·3	5·9	20-25
Antennal segment V	13	25	1·3	5·2	23-27
Pronotum width	10	86	3·2	3·7	81-90
Pronotum length	10	36	1·2	3·3	33-37
Total length	10	164	4·9	3·0	155-170

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	16	38	2·4	6·5	35-43
Head width	16	39	2·3	5·9	33-43
Antennal segment I	27	9	0·7	7·2	8-10
Antennal segment II	26	21	1·7	8·2	18-25
Antennal segment III	26	15	2·5	16·5	12-21
Antennal segment IV	23	25	2·0	8·2	23-29
Antennal segment V	19	26	1·7	6·3	23-29
Pronotum width	16	96	5·0	5·2	88-106
Pronotum length	16	40	2·7	6·7	36-46
Total length	16	187	12·6	6·7	169-220

Total length: 8·1-11·5 mm

Remarks: This species appears not to have any close relatives in *Ocirrhoe*. It is more elongate than the other species in the genus and the convex arcuate outline of the female gonocoxae and the long rostrum are unique in the genus. In other features such as the relatively sparse punctation and the reflexed anterolateral margin of the pronotum which continues partly onto the lateral angle it is similar to most other species of *Ocirrhoe*. The tibiae are only flattened apically but this is a characteristic also of the *unimaculata* group.

Ocirrhoe virescens is only known from eastern Queensland, specimens from Cape York Peninsula are larger and have proportionately longer antennae than those from southern Queensland.

Location of type:

Type (sex unknown as abdomen missing) of *virescens* Westwood, "New Holland", HOPE.

Specimens examined: The type and Queensland 1 ♀, Brisbane, 28.X.1913, H. Hacker; 1 ♀, Brisbane, 15.II.1916, H. Hacker; 1 ♂, Brisbane, 1.XII.1929, A. A. Girault QM; 1 ♀, Brisbane, 16.IV.1956, H. J. Lavery; 3 ♂, 1 ♀, Caloundra, 21.III.1972, G. B. Monteith; 2 ♂, Currumundi Lakes, Caloundra, 30.IX.1972, G. B. & S. R. Monteith; 1 ♂, Dunwich, 12.IV.1952, J. Davis; 1 ♂, Dunwich, 11.IV.1965, K. L. Lehmann; 1 ♂, 3 ♀, Dunwich, Stradbroke Island, 21-22.III. 1970, G. B. Monteith; 1 ♀, Stradbroke Island, 4.III.1971, G. B. Monteith; 1 ♀, Cleveland, 25.VIII.1965, P. Saffigna; 1 ♀, Tibrogargan Creek, 10.IX.1957, F. A. Perkins; 1 ♀, Iron Range, Cape York Peninsula, 11-17.V.1968, G. Monteith; 1 ♀, F. W. Lake, 16 km (10 miles) north of Rocky River via Coen, 17.XII.1964, G. Monteith; 4 ♀, Telegraph Line Crossing, Jardine River, Cape York, 15-17.VI.1969, G. Monteith UQ; 3 ♀ ♀, Stradbroke Island, 27.IX. 1906 & 3.X.1908, *ex* W. W. Froggatt collection ANIC; 1 ♀, Cairns, 23.I-1.II.1964, J. Sedlacek BISHOP.

Cuspicona Dallas, 1851

Cuspicona Dallas, 1851, p. 296. Stål, 1867, p. 521; 1876, p. 102. Lethierry & Severin, 1893, p. 180. Kirkaldy, 1909, p. xxxI.

Type species: *Rhynchocoris thoracica* Westwood, selected by Kirkaldy, 1909.

Description:

General appearance: Species usually greenish in life, rarely yellow brown or orange; in museum collections usually brown, orange or yellow. Strongly punctate above. Small to moderate sized, rather oval; anterolateral margins of pronotum nearly straight and diverging posteriorly with lateral angles acute, obtuse, or rounded; or anterolateral margins of pronotum nearly straight and diverging posteriorly with lateral angles produced into a blunt tooth; or anterolateral margins of pronotum straight anteriorly but posteriorly angling out to form in combination with the lateral angles a prominent laterally directed spine. Head and anterior part of pronotum inclined at an angle of about 30-45° to rest of body.

Head: Appearing elongate or not, in some species rather quadrate, in others strongly triangular but on measurement wider across eyes than long. Disc flattened or rather convex; lateral margins nearly straight though diverging posteriorly, or rather sinuate; apex rounded or rather acuminate, apices of juga and anteclypeus at about same level. Eyes rather triangular and touching anterior margin of pronotum, ocelli conspicuous and placed nearer to inner margin of eyes than to centre line of head but on level of, or behind level of, hind margins of eyes. Antennifers short, antennae five segmented, first segment thicker than second and third, fourth and fifth same thickness as second and third or thicker, antennae not very long.

Pronotum: At least twice as wide across lateral angles as long, anterior margin truncate or concave behind eyes, then excavate behind collum, anterolateral angles not prominent or produced only into a minute spine or ridge. Anterolateral margins straight or very slightly concave in most species and diverging posteriorly but in some species about two thirds of the way back directed directly outwards to form with the fused lateral angles a prominent outwardly (and sometimes upwardly directed) spine; in species with straight or nearly straight anterolateral margins lateral angles spinous, acute, obtuse or truncate. Posterolateral margins usually concave, sometimes almost straight. Posterior angles obtuse, acute, or lobulately produced, posterior margin concave or nearly straight. Disc behind lateral angles in same plane as hind body, before level of lateral angles inclined downwards at about 30-45°.

Scutellum: Triangular, anteriorly not or only slightly raised, lateral margins somewhat concave medially, apex broadly rounded or acutely rounded. Frena extending about half to two thirds of length from base to apex.

Hemelytra: Coriaceous parts normally thickened. Corium with lateral margin concave basally or not, then broadly concave to acute or truncate apex, posterior margin straight or convex. Clavus narrow and strongly triangular. Membrane usually hyaline with veins substantially parallel apically.

Abdomen: Gently convex above, excavate apically in males and faintly so in females.

Laterotergites: Three to seven armed with a short acute spine on posterior exterior angle or this angle unarmed.

Underside: Head obtusely triangular in lateral view. Bucculae mostly lobulately produced anteriorly and then sinuate or straight, reaching to about middle of eyes; deeply sulcate between bucculae. Rostrum four segmented, first segment robust and generally reaching to at least base of bucculae, second segment frequently arched; rostrum reaching base of abdomen, sometimes as far as apex of fourth ventrite. Meso- and metasterna with a robust keel projecting over whole prosternum or only over posterior portion of prosternum, latter broadly sulcate under or behind this keel. Legs normal, tibiae only flattened apically. Abdominal venter faintly V- or U-shaped in cross section as viewed from behind, third segment medially raised into a short triangular tubercle directed anteriorly, its apex fitting into a notch in the metasternal keel. Seventh ventrite in males shallowly excavated posteriorly and deeply excised in females. Pygophore with lateral portion of posterior margin produced or not, with posterior ventral margin deeply excised or not, with or without a small process. Aedeagus with phallosoma lightly sclerotized, conjunctiva produced forward usually into a pair of anterior processes, ventrally a pair of ventrally directed parallel bi-lobed median penial plates. Clasper strongly F-shaped, in one case Y-shaped. Female external genitalia flat or slightly convex.

General Remarks: Species placed in this genus have quite a varied appearance, some are strongly spined laterally on the pronotum, others have the pronotal lateral angles acute, obtuse or even truncate. Members of the genus can be confused with *Parocirrhoe* and *Avicenna* species but in these latter genera the posterior angles of the seventh laterotergites are strongly and angulately produced.

The shape of the posterior margin of the male pygophore varies considerably but is constant in each species and is a good character state to help distinguish species. The claspers are mostly rather F-shaped and in general related species have a similar shape. The aedeagus of the male also varies quite considerably but the "lappet" processes and the rather inverted Y-shaped ventrally directed medial penial plates of the "*Rhynchocoris*" group are present and typical in all species examined except *C. ooldeae* sp. nov. where the "lappet" processes are tubular and the medial penial plates lack the ventral concavity along their margin.

The female genitalia are not very distinctive except at the level of species group where the members of each group tend to show similar features in regards to the hind margin of the first gonocoxae.

I have divided the genus into three recognisable groups of species with one transitional group to handle two species apparently not very closely related to each other and which do not fit into any of the other three more characterisable groups. It is not unlikely that each of the groups ought each to represent a separate subgenus of *Cuspicona* or even separate genera. It is premature, I consider, at this stage to do this until more aedeagi have been examined which requires a lot more material to be collected so that sufficient males can be spared for dissection. If the groups are later recognised as genera then the *thoracica* group will be *Cuspicona sensu stricto* and the other groupings new genera.

A short outline of the features of each group is given in the text before the treatment of the series of species which I have placed in each.

Some species formerly in *Cuspicona* have been, or will be, shifted to other genera and these changes in generic placement will be listed at the end of the second (and last) paper proposed on this revision of members of the "*Rhynchocoris*" Group from Australia and nearby island areas.

Key to *Cuspicona* species

1. (0) Lateral angles of pronotum produced, either as a longish spine like process or acutely produced into an incipient spine like process; if the latter and doubtful then the scutellum unicolorous 2

Lateral angles of the pronotum obtuse or very shortly rounded, not produced into an obvious spine or conspicuously acute 19

2. (1) Lateral angles of the pronotum produced into a substantial and outwardly directed spine 3

Lateral angles of the pronotum acute or produced only into an incipient spine .. 17

3. (2) Yellowish or greenish (in life) above; the only other markings may be pink or red tips to the spinous lateral angles of the pronotum, this pink may be produced anteriorly a little along the anterolateral margin of the pronotum and the anterior part of the exterior margin of the corium, some specimens also have a few black punctations near the lateral angles of the pronotum 4

Variously coloured above but nearly always with the scutellum variously marked or the tips of the spinous lateral angles of the pronotum blackish; frequently black punctations on hind portion of pronotum 8

4. (3) A short line made up of several rows of black punctations on the anterolateral margins of the pronotum in front of the produced lateral angles (visible in part ventrally also) and more black punctations on the epipleura .. .. .. *exnigrospersa* sp. nov.

Black punctations absent from dorsal surface 5

5. (4) Produced lateral angles of pronotum apically distinctly reddish 6
Produced lateral angles of the pronotum concolorous, if reddish or pinkish then very pale and only at extreme apices . .. 7

6. (5) Produced lateral angles of pronotum produced more than their width at base (as determined at the point where the outer margin of the corium terminates anteriorly)
rufispina Stål (Phillipines) and allies
Produced lateral angles of the pronotum not produced more than their width (as measured above) but shorter
forticornis Breddin

7. (5) Smaller, lateral spines a little more acute; pygophore of male with hind margin reflexed as a vertical septum; hind margin of first gonocoxae of female strongly and rather trapezoidally produced posteriorly in its inner half .. .. .. *neocaledoniae* sp. nov.
A little larger, spines not quite so acute; pygophore of male with posterior ventral margin not produced as a vertical septum but obliquely produced only medially and near outer edges with two black lobes; hind margin of first gonocoxae produced posteriorly but lobulately so
proxima Walker[1]

8. (3) Pronotum anteriorly with two short longitudinal lines of coarse punctations, one on either side of the midline and beginning at the anterior margin .. .. *equisignata* sp. nov.
Pronotum anteriorly without two short longitudinal lines of coarse punctations . .. 9

9. (8) On pronotum between the strongly black punctate and produced lateral angles a conspicuous or dense transverse band of black punctations, seven or eight punctations wide 10
Disc of pronotum not traversed posteriorly by a conspicuous wide band of dense black punctations though there may be some scattered black punctations, or a patch of black punctations, or a faint band, in this region 14

10. (9) Males with the head coarsely black punctate, sometimes almost wholly or with only a conspicuous patch of black punctations at the base of the head above; black punctations on the scutellum restricted to the apical third and arranged as a triangular patch on either side of the midline . 11
Head with only fine black punctations or no black punctations; black punctations on apical half of scutellum concentrated laterally or more evenly spread over apical region 12

11. (10) Black punctations on head restricted to about basal third in both sexes and absent from lateral margins; black punctations on scutellum reaching very near to apex; pygophore of male with posterior margin smoothly convex exteriorly grading into smoothly concave medially
apothoracica sp. nov.
Black punctations covering most of dorsal surface of head in males, restricted usually to basal third in females but lateral margins black punctate; black punctations on scutellum ceasing well before apex; pygophore of male with posterior margin laterally rather truncate or even slightly concave, medially broadly concave but separated from lateral portions by a sharp angle
thoracica (Westwood)

12. (10) Black transverse punctate band on pronotum rather broad and diffuse; lateral spines on pronotum short in relationship to their basal width (15:15); underside of abdomen not laterally broadly green and medially luteous in life .. .. *phi* sp. nov. (in part)
Black transverse punctate band on pronotum narrower and intense; lateral spines on pronotum longer than their basal width or not; underside of abdomen broadly green laterally and ventrally luteous in life 13

13. (12) Lateral spines on pronotum short in relation to their basal width (20:15) and about same length as posterolateral margins of pronotum; black transverse band on pronotum rather thin and medially sending a longitudinal branch several punctations wide towards apex; black punctations in apical third of scutellum fairly evenly distributed .. .. *angustizona* sp. nov.
Lateral spines on pronotum longer in relation to their basal width (25-30:15) and longer than posterolateral margins; posterior transverse band of black punctations not sending forward a medial branch; black punctations in apical third of scutellum tending to be concentrated in a V
longispina sp. nov.

14. (9) Posterior angles of laterotergites III-VII black; lateral spines of pronotum not long in relation to their basal width; a medial broad longitudinal pale callus in anterior portion of pronotum; underside of pronotal spines punctate only apically; apical sixth of scutellum impunctate; abdomen apparently unicolorous below
procallosa sp. nov.
Posterior angles of laterotergites III-VI not black, VII black tipped; if a medial longitudinal callus present anteriorly on pronotum then lateral spines strongly punctate beneath their whole length and punctations extending on to propleuron; apical sixth of scutellum punctate or not 15

15. (14) Abdomen laterally broadly green in life; ventrally broadly luteous 16
Abdomen apparently unicolourous below, or with small red maculations
phi sp. nov (in part)

[1] *Campla* Walker from Waigiu and adjacent areas is not included in this key but would run out with *C. proxima* from which it is distinguished by its very much longer rostrum and sparser pronotal punctation.

16. (15) Lateral spines of pronotum long in relation to their basal width (32:17), and equal to length of posterolateral margins (17:17); scutellum with dark punctations in apical sixth .. .. *cygniterrae* sp. nov.

Lateral spines of pronotum shorter in relation to their basal length (20-25:15-17) and longer than posterolateral margins (20-25:20); scutellum mainly glabrous in apical sixth .. .. *strenuella* Walker

17. (2) Suture on either side of anteclypeus blackish in posterior half and base of head somewhat clouded with dark punctations, sometimes basal region of pronotum also; lateral angles and some of anterolateral margin of pronotum pinkish .. *obesula* sp. nov.

Not marked as above 18

18. (17) Hind margin of pronotum strongly concave; anterolateral margins of pronotum black just before lateral angles; disc of head rather raised and head appearing comparatively long .. .. .. *cooperi* sp. nov.

Hind margin of pronotum truncate or only feebly concave; anterolateral margins of pronotum not black; head flat dorsally and not appearing unduly long *simplex* Walker

19. (1) Largish, hind portion of pronotum with a prominent transverse fairly broad pink or red stripe between the lateral angles; outer margins of corium pink or red *carneola* Van Duzee

Smaller, pronotum not marked as above, if a reddish or pinkish transverse stripe present then thin and very sinuous, or very pale and diffuse 20

20. (19) Head strongly triangular and apices of juga acute, sloping back obliquely, though slightly concavely, to eyes 23

Head not so strongly triangular and apices of juga oblique or rounded but distinct from lateral margins 21

21. (20) Lateral angles of pronotum rectangularly or obliquely acute, not broadly rounded; tibiae not sulcate or strongly flattened 22

Lateral angles of pronotum rounded; fore and middle tibiae flattened towards apices *privata* Walker

22. (21) Apex of abdomen beneath infuscated, at least in males; second and third antennal segments subequal, fifth about 6 per cent longer than fourth . *norfolcensis* sp. nov.

Apex of abdomen beneath not infuscated, at least in females; second antennal segment about 25 per cent longer than third and fifth about 20 per cent longer than fourth *cheesmanae* sp. nov.

23. (20) Dorsal surface maculated with black; ground colour in museum specimens yellowish or orange; hind margin of male pygophore medially smoothly concavely excavate, laterally broadly convex .. *intacta* Walker

Dorsal surface not maculated with black; hind margin of male genitalia trapeziformly excavate medially or with a prominent tooth on either side of the middle .. 24

24. (23) Pygophore with apical margin deeply excavate medially, this excavation bordered on each side by a conspicuous tooth; exterior to this convexly rounded; first gonocoxae of female with hind margins sinuated; third antennal segment very short in relation to second (11:20) *eremophilae* sp. nov.

Pygophore with apical margin medially trapeziformly excavate; depressed in front of excavate margin; laterally to this concave; hind margins of female gonocoxae transversely truncate; third antennal segment longer in relation to second (16:21) *ooldeae* sp. nov.

Intacta Group

The *intacta* group of species comprises four species occurring mainly in the semiarid and arid regions of Australia. They do not penetrate in the wetter south western, south eastern or north eastern portions of the continent or into Tasmania. The four species have a similar facies, the head appears very long in relation to its width but is actually a little shorter than its width across the eyes. The lateral margins of the head and the juga laterally are indistinguishable and run forward from the eyes distinctly converging, although the actual profile of this margin may be a little convex. Only one species (*intacta* Walker) has black spots (although frequently absent) but these are widely dispersed and scattered fairly evenly over the whole coriaceous parts of the dorsal surface. The lateral angle of the pronotum is truncate or feebly rounded except on *cooperi* sp. nov. where it is acute.

The first gonocoxae of the female have the posterior margin rather sinuate or transversely truncate (*ooldeae* sp. nov.).

Host plant records for the group include species of *Eremophila* and *Melaleuca*.

Cuspicona intacta Walker, 1868

Figs. 21, 23 A-B, 25 A.

Cuspicona intacta Walker, 1868, p. 571; Kirkaldy 1909, p. 239 (as *incertae sedis*).

Description:

General appearance: Museum specimens brownish yellow or orange, often with widely separated small black maculae on the dorsal surface. First two antennal segments and base of third yellow, apical portion of third, and fourth and fifth reddish brown. Eyes and ocelli blackish.

Head: Appearing strongly elongate, but actually as wide or a little wider across eyes than long; triangular, medially rather raised, particularly towards base, lateral margins almost straight. Coarsely and rugulosely punctate.

Pronotum: Concolorous, frequently with small scattered black spots, densely punctate and appearing rather rugulose, calli glabrous. No trace of a medial longitudinal line. Anterior margin obliquely truncate behind eyes and rather trapeziformly excavate behind collum, anterolateral angles not prominent. Anterolateral margins narrowly obtuse, nearly straight and diverging posteriorly. Lateral angles shortly and obliquely truncate, posterolateral margins angulately concave, posterior margin broadly concave.

Scutellum: Concolorous, frequently with small scattered black points, strongly punctate, rather convex basally and flat apically. Lateral margins gently convex in basal 4/7 then straight and converging gently to narrowly rounded apex. Frena reaching to 4/7 of length.

Hemelytra: Coriaceous parts concolorous, often with scattered small black spots, densely punctate. Exterior margins of coria faintly concave basally and then faintly convex to shortly rounded apical angle, reaching about middle of abdominal segment VI, this and most anterior segments narrowly exposed. Posterior margin of corium straight, inner angle very broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: Concolorous, sometimes coarsely punctate with brown.

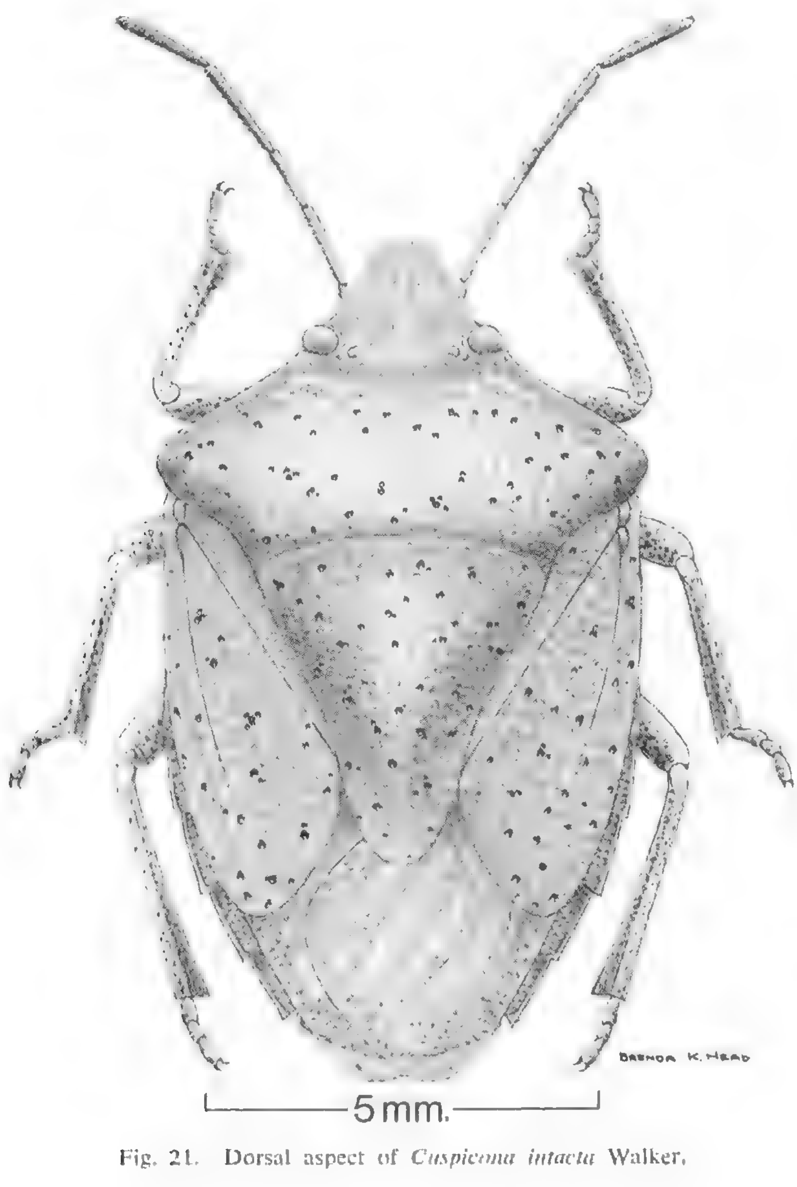

Fig. 21. Dorsal aspect of *Cuspicona intacta* Walker.

Laterotergites: Concolorous, sometimes coarsely punctate with brown; posterior exterior angles produced into a spine which may be minutely black tipped.

Underside: Concolorous but paler along mid-line, coarsely punctate nearly all over, including the evaporative areas, these punctations and also spots on the legs sometimes brown. Rostrum ventrally and extreme apex black.

Bucculae low and sinuated, reaching about middle of an eye, anteriorly produced into an elongate lobular process. Rostral segment I robust, reaching to base of bucculae, II compressed and arched and reaching onto mesosternum, III to about hind coxae and IV onto abdominal ventrite IV. Ratio of antennal segments (♂) 11 : 21 : 15 : 25 : 27. All pleura coarsely punctate, punctations sparser on evaporative areas. Metasternal-mesosternal keels a little higher medially than anteriorly, reaching over prosternum but not to its apex, anteriorly rounded and directed to the left in ventral view. Legs normal with sparse pilosity, femora and tibiae sometimes maculated with brown. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 23 A, hind margin of pygophore medially semicircularly excavate with a slight impression laterally where margin is mainly convex. Clasper Fig 25 A, strongly F-shaped the upper ramus ascending rather steeply. Apex of female abdomen Fig. 23 B, hind margins of first gonocoxae rather angulately sinuated.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	8	43	2·4	5·6	39-45
Head width	8	43	1·8	4·2	40-45
Antennal segment I	16	11	0·7	6·8	9-12
Antennal segment II	16	21	0·7	3·1	20-22
Antennal segment III	16	15	1·2	8·0	13-17
Antennal segment IV	15	25	0·7	2·8	24-26
Antennal segment V	13	27	1·6	6·0	25-30
Pronotum width	8	101	3·0	3·0	96-105
Pronotum length	8	39	4·4	11·4	31-42
Total length	8	187	9·2	4·9	175-200

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	13	46	2·1	4·6	43-50
Head width	13	47	1·9	4·0	44-50
Antennal segment I	24	11	0·7	6·2	10-12
Antennal segment II	22	23	1·8	7·8	21-26
Antennal segment III	22	15	1·2	7·9	14-18
Antennal segment IV	19	26	1·6	6·4	23-28
Antennal segment V	10	27	1·5	5·5	25-29
Pronotum width	13	114	8·6	7·5	99-129
Pronotum length	13	43	5·1	11·9	34-50
Total length	13	210	11·9	5·7	195-230

Total length: 9·1-12·0 mm

Remarks: There is little doubt that this is the species described as *Cuspicona intacta* by Walker. The sternal keels are mentioned by Walker so *intacta* is a member of the *Rhynchocoris* group. It is also from his description clearly not a member of a genus with longly produced lateral angles which eliminates *Biprorulus, Vitellus, Avicenna* and a number of others nor of a genus with the posterior angles of the seventh laterotergites strongly produced which eliminates still more, or of those genera which are shiny with only sparse and coarse punctations above. This leaves only *Ocirrhoe*, part of *Cuspicona* and *Everardia* to which it could belong. The pronotal shape is wrong for *Everardia* and no species of *Ocirrhoe* has a "long" head. Four species of *Cuspicona* do have the head appearing conspicuously long in relation to its width and all four have acute or subacute lateral angles on the pronotum and the third antennal segment shorter than the second, three addition character states mentioned by Walker. Of these four this is the only species which may have black spots on the dorsum. Walker mentions them as only occurring along the hind margin of the pronotum whereas these examples which are spotted which

I have seen tend to have them scattered over the whole pronotum, scutellum and corium, though frequently more concentrated in the posterior regions of the pronotum.

Cuspicona intacta has a wide distribution in the drier regions extending from Arnhem Land in the north to near Adelaide in the south and from Cunnamulla in Queensland and Nyngan in New South Wales in to the east to the area of Carnarvon in the west of Western Australia. The only recorded food plant is *Eremophila freelingii* FvM.

Location of type:

Supposed to be in the NM but apparently lost. The sex was not stated and the locality simply given as "Australia."

Specimens examined: Queensland 1 ♀, Cunnamulla, 12.XII.1938, N. Geary AM. New South Wales 1 ♂, Nyngan District, 1-9.II.1960, T. E. Woodward UQ. South Australia 1 ♀, Tea Tree Gully, 27.XII.1967, C. van Dijk; 1 ♀, Derna Pass, 19 km. south of Copley, 25.X.1969, on *Eremophila freelingii* FvM, A. N. McFarland; 4 ♂, 2 ♀, Arkaroola Homestead, 28.X.1969, on *Eremophila freelingii* FvM, A. N. McFarland; 2 ♂, 4 ♀, same data but 1.I.1969; 1 ♀, Mt. Davies, Oct.-Nov. 1956, at light, S. B. Warne SAM. Western Australia 1 ♂, Reid, 17.X.1968, Britton, Upton and Balderson; 1 ♀, 107 miles (170 km) SSE of Carnarvon, 21.IV.1968, I.F.B. Common and M. S. Upton ANIC. Northern Territory 1 ♂, Arnhem Land (interior), Dr. H. Basedow SAM; 1 ♀, 17 km. (11 miles) north of Alice Springs, 825 m., 28.X.1962, collected at ultraviolet (black) light 15 watt, E. S. Ross and D. Q. Cavagnaro CAS.

Cuspicona ooldeae sp. nov.

Figs. 22, 23 C-D, 25 B-C

Description:

General appearance: Museum specimens pale yellow, frequently with a reddish tinge; strongly punctate above; antennae yellow or sometimes pale reddish; eyes greyish purple or concolorous, ocelli red.

Head: Appearing strongly elongate but actually a little wider across eyes than long; triangular, medially rather raised, particularly towards base. Lateral margins somewhat concave in front of eyes. Coarsely and rugulosely punctate except at very base. Eyes greyish to concolorous, ocelli red.

Pronotum: Concolorous, densely punctate and appearing rather rugulose, punctations sometimes faintly reddish; calli paler and glabrous. Medially a faint trace of a longitudinally raised line. Anterior margin obliquely concave behind eyes and rather trapeziformly concave behind collum, anterolateral angles prominent as a small tooth. Anterolateral margins marginate, nearly straight and diverging posteriorly. Lateral angles narrowly marked with pink or orange, obliquely truncate, posterolateral margins angulately concave, posterior margin broadly concave.

Scutellum: Concolorous, strongly punctate, rather convex basally and flat apically. Lateral margins gently convex in basal 5/8 then straight and converging to narrowly rounded apex. Frena reaching about 5/8 length.

Hemelytra: Coriaceous parts concolorous and densely punctate. Exterior margins of coria faintly concave basally and then faintly convex

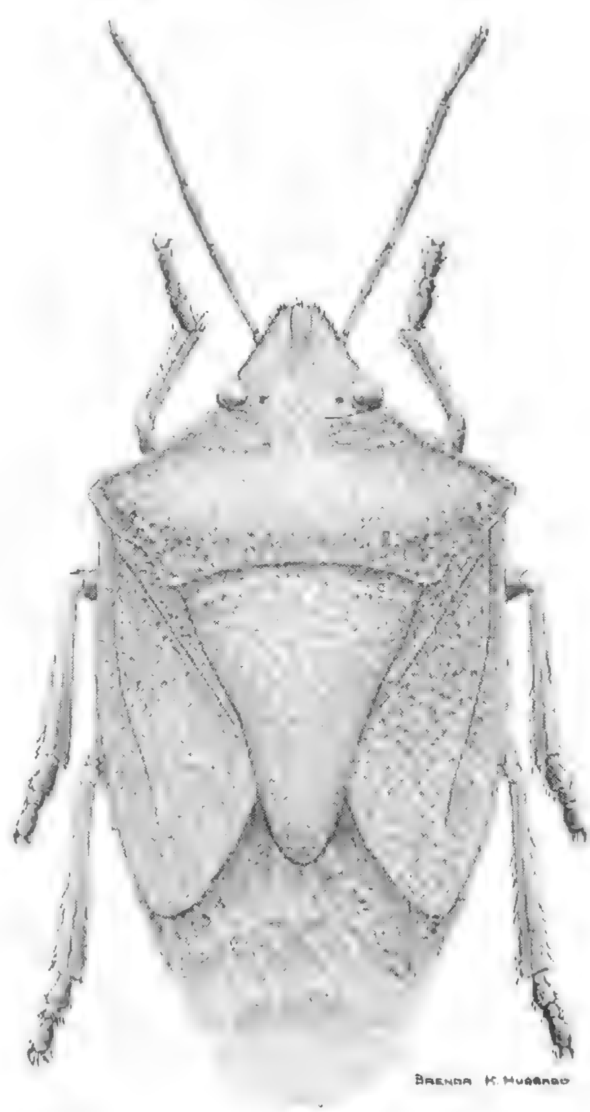

Fig. 22. Dorsal aspect of *Cuspicona ooldeae* sp. nov.

to broadly rounded apical angle, reaching about middle of abdominal segment V, this and most anterior segments narrowly exposed. Posterior margin of corium straight, inner angle very broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: Concolorous.

Laterotergites: Concolorous, sparsely punctate, posterior exterior angles produced into a spine which on the medial segments may be minutely black tipped.

Underside: Concolorous; antennal segments II-V usually reddish yellow, underside of lateral angle of pronotum narrowly orange or reddish; punctations on underside frequently faintly reddish, sides of abdomen sometimes spattered with reddish points or fine punctations. Underside and extreme apex of rostrum black.

Bucculae low and strongly sinuated, reaching about middle of eye, anteriorly produced into a low triangular process. Rostral segment I robust, reaching to base of bucculae, II compressed and arched and reaching beyond fore coxae, III to just behind mid coxae and IV to about middle of 3rd abdominal segment. Ratio of antennal segments ♂ 10 : 21 : 16 : 21 : 21. Propleura coarsely punctate all over, mesopleura mostly glabrous with only a few scattered punctations, metapleura mainly glabrous anteriorly with but a few punctations, more strongly punctate along hind margin. Metasternal-mesosternal keels a little higher medially than anteriorly, reaching over prosternum but not to its apex, anteriorly shortly truncate and directed a little to left in ventral view. Legs normal but conspicuously finely spinose, tibiae flattened apically. Abdomen broadly U-shaped in posterior view. Apex of male abdomen Fig. 23 C, hind margin of pygophore rather trapeziformly excavate, laterally to this broadly rounded. Clasper Fig. 25 C, strongly F-shaped, the upper ramus not ascending so steeply as in *intacta* or *eremophilae*. Aedeagus Fig. 25 B, phallosoma short and honey-coloured, lappet processes in form of two tubules, medial penial plates rather hatchet shaped. Apex of female abdomen Fig. 23 D, hind margins of first gonocoxae transversely straight in contrast to the more sinuated hind margin of allied species.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	7	38	1·7	4·5	36-40
Head width	7	40	1·6	4·1	38-43
Antennal segment I	10	10	0·7	7·3	8-10
Antennal segment II	9	21	1·4	6·8	19-23
Antennal segment III	9	16	0·5	3·4	15-16
Antennal segment IV	8	21	1·0	4·9	20-23
Antennal segment V	3	21	—	—	20-21
Pronotum width	7	94	4·2	4·4	90-102
Pronotum length	7	32	2·9	9·1	30-36
Total length	7	181	4·8	2·6	175-190

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	14	40	2·0	4·9	37-43
Head width	14	41	1·2	3·0	39-43
Antennal segment I	20	9	0·4	4·5	9-10
Antennal segment II	18	22	1·3	5·8	20-25
Antennal segment III	18	15	1·1	7·2	13-18
Antennal segment IV	16	20	0·6	3·0	20-22
Antennal segment V	13	20	0·6	3·0	20-22
Pronotum width	14	100	3·5	3·5	95-106
Pronotum length	14	34	4·7	13·7	27-43
Total length	13	189	8·4	4·5	178-200

Total length: 9·1-10·4 mm.

Remarks: *Cuspicona ooldeae* differs from *C. intacta* by not having black spots on the dorsum, by the faintly trapeziform incision of the hind margin of the pygophore, by the transverse depression on the disc of the pygophore below and by the transverse straight hind margin of the female first gonocoxae. The species is found in the arid centre of the continent ranging from the Flinders Ranges westwards to well into Western Australia and northward to near Alice Springs.

Location of types:

Holotypes ♂ (Reg. No. I20,719), Farina, South Australia, at light in creek bed, 27.X.1970, G. F. Gross & E. Matthews; allotype ♀ (Reg. No. I20, 720), Mambray Creek (crossing on) Port Augusta Road, South Australia, under (bark of) *Eucalyptus camaldulensis* Dehnh, 13.XI.1970, G. F. Gross and E. Matthews SAM; PARATYPES: South Australia 1 ♀ (Reg. No. I20,721, hill near Victory Well, Everard Park Station, 8.XI.1970, T. F. Houston; 1 ♂, Madigan Gulf, Lake Eyre, South Australia, at light, 5.XI.1955, E. T. Giles; 6 ♂, 9 ♀ (Reg. Nos. 20,723-38), Ooldea, South Australia, A. M. Lea SAM; 1 ♀, Emily Gap, 9 km (6 miles) E. of Alice Springs, Northern Territory, 17.II.1966, Britton, Upton & McInnes ANIC; 1 paratype ♂, 18 km (11 miles) north of Alice Springs, Northern Territory, 625 m, 28.X.1962, collected by 15w ultraviolet (black) light, E. S. Ross & D. Q. Cavagnaro CAS; 1 ♀, Meekatharra, Western Australia 3.IX.1971, F. H. Uther Baker WAM.

Specimens examined: The types only.

Cuspicona eremophilae sp. nov.

Fig. 23 E-F, 24, 25 D

Description:

General appearance: In life bluish-green mottled with white or luteous, in museum specimens yellow or brownish yellow; terminal half of antennae light brown, eyes purplish red or brown. Densely and finely punctate.

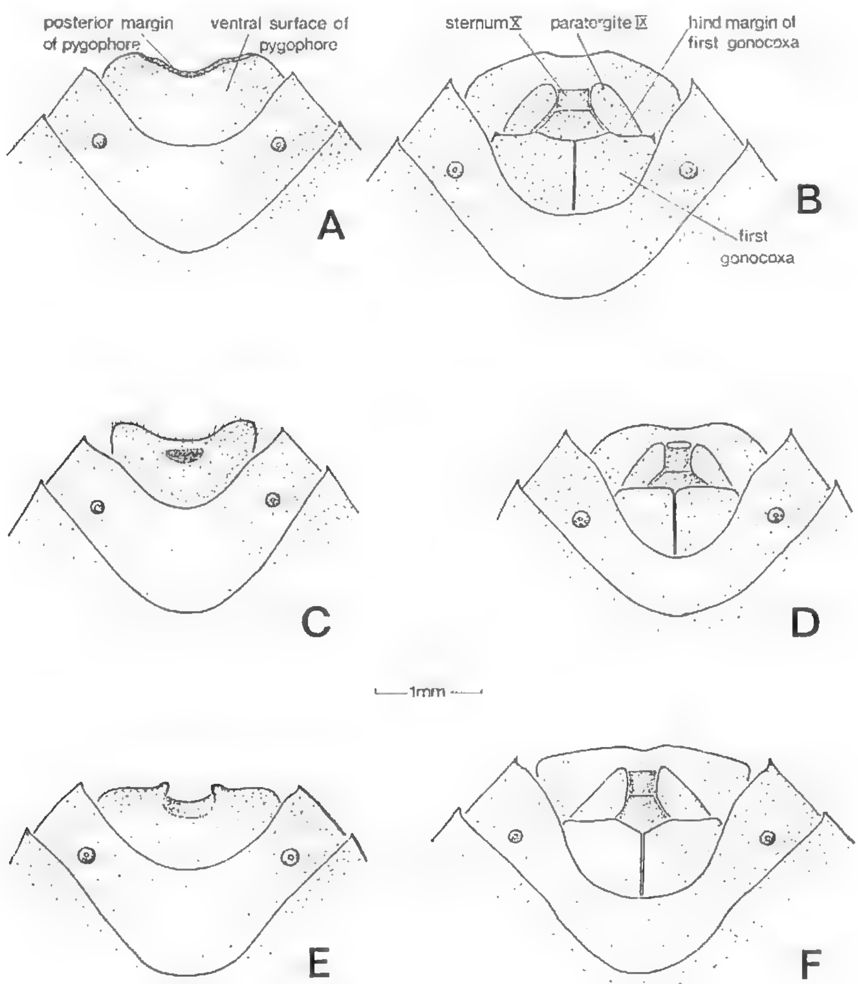

Fig. 23. *Cuspicona intacta* Walker, *Cuspicona ooldea* sp. nov. *Cuspicona eremophilae* sp. nov. A-B. *Cuspicona intacta*. A ventral aspect of male abdomen. B. ventral view of female abdomen. C-D. *Cuspicona ooldea* sp. nov. C. ventral aspect of male abdomen. D. ventral aspect of female abdomen. E-F. *Cuspicona eremophilae*. E. ventral aspect of male abdomen. F. ventral aspect of female abdomen.

Head: Appearing elongate but actually wider than long; strongly triangular, medially rather raised, particularly towards base. Densely punctate, appearing rather rugulose, concolorous. Eyes and ocelli purplish-red or brown.

Pronotum: Concolorous, densely punctate and appearing rather rugulose, calli paler and glabrous. Medially a trace of a longitudinal raised line. Anterior margin concavely oblique behind eyes and broadly concave behind collum, anterolateral angles prominent as a small ridge. Anterolateral margins marginate, nearly straight and diverging posteriorly. Lateral angles rather truncate, posterolateral margins conspicuously concave, posterior margin broadly concave.

Scutellum: Concolorous, strongly punctate and rather flat. Lateral margins faintly convex in basal 4/7 then straight and converging slightly to narrowly rounded apex. Frena reaching to about 4/7 length.

Hemelytra: Coriaceous parts concolorous and densely punctate. Exterior margins of coria faintly concave basally then rather sinuately convex and converging to expose abdominal segments III-VII. Apical angle of corium narrowly rounded, posterior margin straight exteriorly, inner angle very broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: Concolorous.

Laterotergites: Concolorous, coarsely punctate. Posterior exterior angles nearly rectangular.

Underside: Concolorous; apex of third antennal segment, fourth antennal segment (except at base) and fifth light brown. Stylets and extreme apex of rostrum black.

Bucculae low and strongly sinuated, reaching base of head, anteriorly not produced into a

Fig. 24. Dorsal aspect of *Cuspicona eremophilae* sp. nov.

lobulate process. Head laterally coarsely punctate. Rostral segment I robust, reaching almost to base of head, segment II more compressed and arched, surpassing fore coxae, III surpassing mid coxae and IV reaches onto visible base of abdomen. Ratio of antennal segments ♂, 9:21:11:20:22. All pleura coarsely punctate except on evaporative area. Metasternal-mesosternal keels higher medially then narrowly rounded, deflected to left in ventral view. Legs normal but conspicuously pilose, tibiae slightly flattened apically. Abdomen broadly V-shaped in posterior view. Apex of male abdomen Fig. 23 E, hind margin of pygophore semicircularly concavely excised medially, laterally on either side of incision a strong triangular "tooth" and exteriorly to this arcuately rounded. Clasper Fig. 25 D, vaguely F-shaped, with the upper ramus ascending at an oblique angle. Apex of female abdomen Fig. 23 F, hind margins of first gonocoxae gently angulately convex.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	8	36	1·4	3·9	34-38
Head width	8	41	1·6	3·9	39-43
Antennal segment I	16	9	0·6	7·2	8-10
Antennal segment II	16	21	1·0	4·7	19-23
Antennal segment III	16	11	0·8	7·5	10-13
Antennal segment IV	12	20	1·4	7·4	17-21
Antennal segment V	9	21	1·3	6·2	20-23
Pronotum width	8	93	4·6	5·0	87-100
Pronotum length	8	30	3·5	11·6	24-35
Total length	8	160	6·6	4·1	155-175

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	11	39	1·5	3·9	36-41
Head width	11	44	1·0	2·4	42-45
Antennal segment I	21	9	0·6	6·5	8-10
Antennal segment II	21	22	1·3	5·9	19-24
Antennal segment III	21	11	0·9	8·4	10-13
Antennal segment IV	20	19	1·0	5·1	17-20
Antennal segment V	17	20	0·6	3·0	19-21
Pronotum width	11	101	2·5	2·5	96-104
Pronotum length	11	34	1·8	5·3	31-37
Total length	11	180	6·3	3·5	173-190

Total length: 8·1-9·9 mm

Remarks: *C. eremophilae* is rather similar to *C. ooldeae* but differs in the much shorter third antennal segment and in lacking the pink marking on or just before the lateral angles.

C. eremophilae is a true eremian species occurring in the north of South Australia, southern half of the Northern Territory and western Queensland, but with a single specimen collected on the outskirts of Adelaide.

A single female specimen in the British Museum (Nat. Hist.) from Alexandra in the Northern Territory, and well outside the range of distribution for *eremophilae* as indicated by other specimens, has the same rather angulate hind margin of the first gonocoxae as has *eremophilae* but has the third antennal segment longer than the second. It likely represents a fifth species of the *intacta* group but is being passed over in this present revision due to its poor condition.

Location of types:

South Australia Holotype ♂ (Reg. No. I20,700), allotype ♀ (Reg. No. I20,701), 4 paratype ♂ (Reg. No. I20,702-5), 5 paratype ♀ (Reg. No. I20,706-10), Arkaroola homestead, 1.XI.1969, on *Eremophila freelingii* FvM, A. N. McFarland; 1 paratype ♂ (Reg. No. I20,711), 2 paratype ♀ ♀ (Reg. Nos. I20,712-3), same data and collector but on 28.X.1969; 1 paratype ♀ (Reg. No. I20,717), Aroona Dam south of Copley, 3.XI.1969, at ultraviolet light, A. N. McFarland; 1 paratype ♂ (Reg. No. I20,714), near Victory Well, Everard Park Station, 30.X.1970, by beating trees and shrubs, G. F. Gross & E. G. Matthews; 1 paratype ♂ (Reg. No. I20,715), Mt. Eyre west of Hookina, 10.V.1956, at light, G. F. Gross; 1 paratype ♀ (Reg. No. I20,716), Coopers Creek, 1916 Museum Expedition to Central Australia; 1 paratype ♀ (Reg.

No. I20,790), Athelstone, 15.XI.1973, at light, M. L. Szent-Ivany SAM; Queensland 1 paratype ♀, Cunnamulla, Queensland, 8-19.X.194?, A. J. Turner QM; 1 paratype ♀, Thargomindah, Apr. 1941, N. Geary AM; Northern Territory 1 paratype ♀, 150 km south of Alice Springs, Sept. 1972, Dimits NM; 1 paratype ♀, Standley Chasm, 40 km (26 miles) west of Alice Springs, 9.II.1966, Britton, Upton & McInnes ANIC. 1 paratype ♂, Ooratipra, 275 m., 31.X.1962, E. S. Ross & D. Q. Cavagnaro; 1 paratype ♂, 18 km (11 miles) northeast of Yamba near Alice Springs, 625 m, 29.X.1962, E. S. Ross & D. Q. Cavagnaro; 1 paratype ♀, 18 km (11 miles) northeast of Alice Springs, 28.X.1962, collected by 15w (ultravoilet) light, E. S. Ross & D. Q. Cavagnaro CAS.

Specimens examined: The types and South Australia 1? (abdomen missing), Lake Callabonna, A. Zietz; 1 ♀, Ooldea, A. M. Lea SAM.

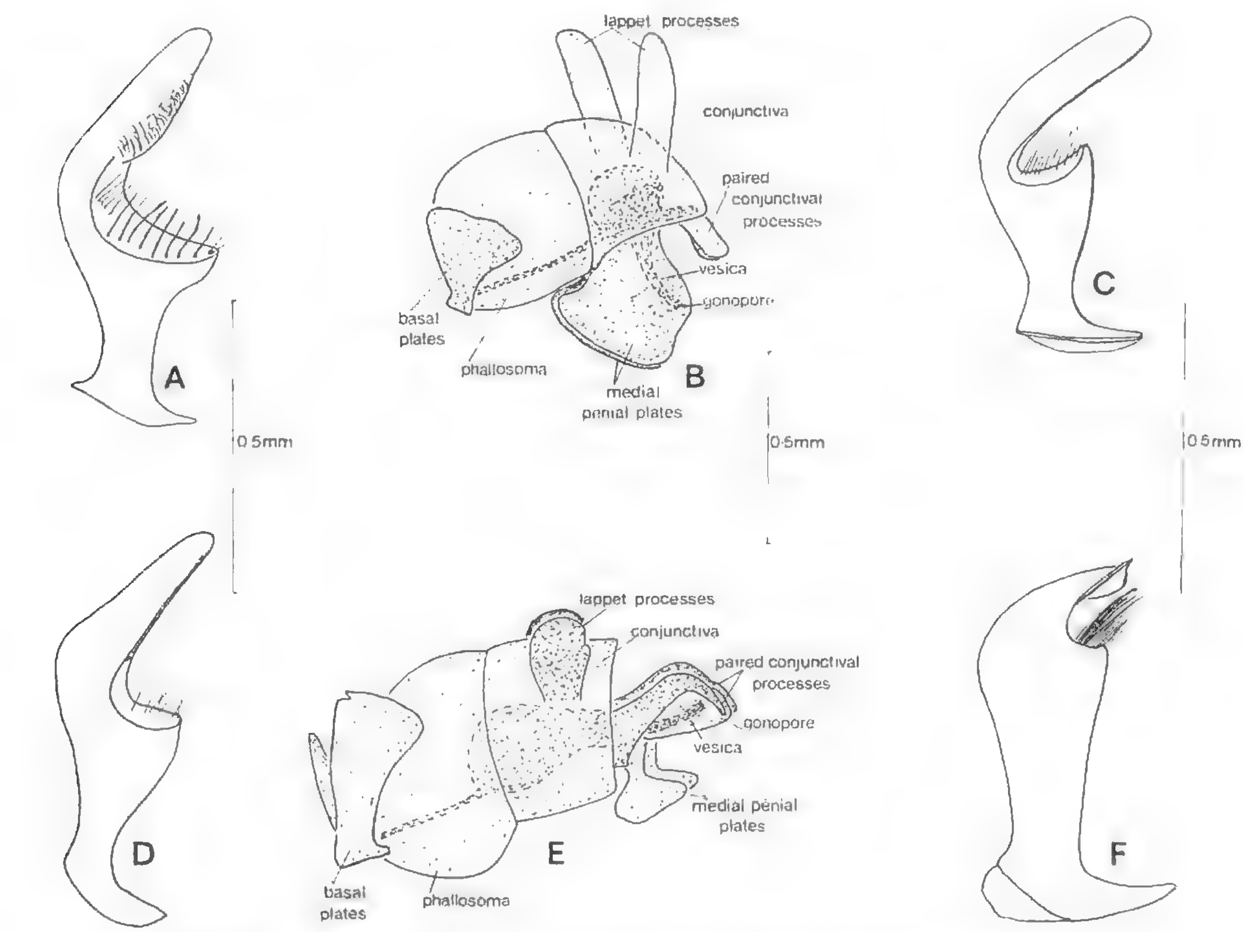

Fig. 25. *Cuspicona intacta* Walker, *Cuspicona ooldeae* sp. nov., *Cuspicona eremophilae* sp. nov., *Cuspicona carneola* Van Duzee. A. *Cuspicona intacta*—clasper. B-C. *Cuspicona ooldeae*. B. lefthand side aspect of aedeagus. C. Clasper. D. *Cuspicona eremophilae*—clasper. E-F. *Cuspicona carneola*. E. lefthand side aspect of aedeagus. F. clasper.

Cuspicona cooperi sp. nov.

Figs. 26, 28 A-B

Description:

General appearance: Ground colour yellow or brownish yellow in museum specimens with terminal half of antennae brown and anterolateral margins of pronotum just in front of lateral angles narrowly black. Eyes purplish. Sparsely and finely punctate.

Head: Appearing elongate but actually a little wider than long; strongly triangular, medially rather raised particularly towards base. Finely punctulate, concolorous. Eyes and ocelli purplish or purplish red.

Pronotum: Concolorous and densely and rather finely punctate, punctations discrete, calli paler and glabrous. Medially a faint raised longitudinal line. Anterior margin concavely oblique behind eyes and broadly concave behind collum, anterolateral angles slightly prominent. Anterolateral margin thin but obtuse, shallowly concave and diverging to region of anterolateral angles, black just before latter. Lateral angles rectangularly acute. Posterolateral margins conspicuously concave, posterior margin broadly concave.

Scutellum: Concolourous and rather flat with fine discrete punctations. Lateral margins faintly convex in basal ⅓ then straight and converging to narrowly rounded apex. Frena reaching to about ⅓ length.

Hemelytra: Coriaceous parts concolorous and densely punctate. Exterior margins of coria faintly concave basally then slightly convex and gradually converging so that 4-7th segments of abdomen are only narrowly visible. Apical angle of corium nearly rectangular, posterior margin straight, inner angle very broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: Concolorous.

Laterotergites: Concolorous except apices of posterior exterior angles which are black; sparsely punctulate.

Underside: Concolorous; apical half of third and fourth and fifth antennal segments brownish, stylets of, and apex of, rostrum black.

Bucculae low and strongly sinuated, reaching to about middle of eye, anteriorly formed into a rounded lobe which is not particularly obstrusive. Rostral segment I robust, reaching to just behind base of antennifer and not quite to base of bucculae, segment II more compressed and arched, reaching just behind fore coxae, III to base of mid coxae and IV to base of hind coxae. Ratio of antennal segments ♂ 9:18:15:23:27. All pleura rather sparsely punctate but evaporative areas impunctate. Metasternal-mesosternal keels higher anteriorly than posteriorly, reaching over prosternum almost to its apex, anteriorly broadly rounded, deflected to left in ventral view. Femora normal, tibiae slightly flattened apically. Abdomen strongly V-shaped in posterior view. Apex of male abdomen Fig. 28 A, hind margin of pygophore rather angulately incised medially with a small convex margin at base of "notch", laterally on either side of medial incision a small tooth and exteriorly to this strongly rounded. Apex of female abdomen Fig. 28 B, hind margins of first gonocoxae transverse and slightly concave along their central portions, turning anteriorad both interiorly and exteriorly.

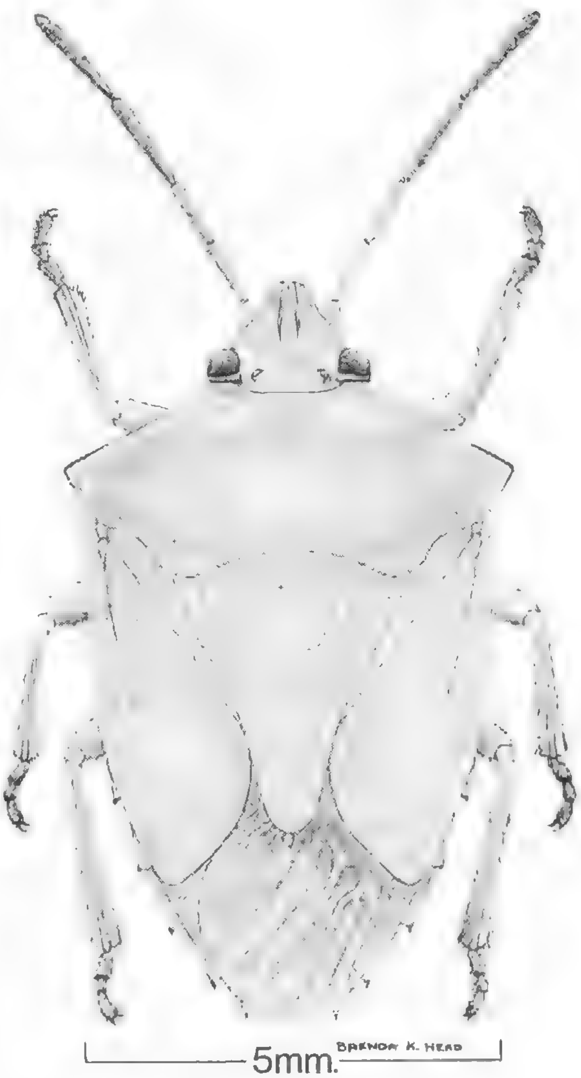

Fig. 26. Dorsal aspect of *Cuspicona cooperi* sp. nov.

Dimensions

MALES

Parameter	Holotype	Stockholm Paratype	RM Paratype
Head length	40	39	37
Head width	41	41	42
Antennal segment I	10, 9	9, —	9, 9
Antennal segment II	18, 17	19, —	18, 17
Antennal segment III	16, 16	15, —	15, 15
Antennal segment IV	25, 25	23, —	22, 23
Antennal segment V	27, —	—, —	28,
Pronotum width	105	110	109
Pronotum length	39	40	40
Total length	175	189	194

Dimensions—

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	8	41	2·5	6·0	37-45
Head width	8	45	2·4	5·4	40-47
Antennal segment I	14	10	0·3	3·0	9-10
Antennal segment II	14	19	1·3	6·7	17-21
Antennal segment III	14	15	0·8	5·5	14-16
Antennal segment IV	9	22	1·2	5·5	21-24
Antennal segment V	3	25	—	—	24-26
Pronotum width	8	119	8·1	6·9	102-127
Pronotum length	8	44	4·1	9·3	38-50
Total length	8	207	14·6	7·1	180-225

Total length: 9·1-11·7 mm.

Remarks: *C. cooperi* is closely related to *C. eremophilae* in the shape of the male pygophore, it is however distinguished from that species by its longer third antennal segment, much sparser punctation and in not developing the mottled rugulose appearance of *eremophilae*. From *eremophilae* and other species in the *intacta* group it is distinguished by the rather rectangular lateral angles of the pronotum and the short black marginal line on the anterolateral margins just before the lateral angles.

The present known distribution of the species is over an elongate elliptical area stretching from Rockhampton in Queensland to the southern Flinders Ranges in South Australia. The species is named after the late H. M. Cooper who gave so much of his time in a voluntary capacity to the South Australian Museum and who collected the holotype specimen.

Location of types:

Holotype ♂ (Reg. No. 120,698), Mt. Remarkable, South Australia, 600-700 m (1800-2200ft.), 12.V.1968, H. M. Cooper SAM; allotype ♀, 1 paratype ♂, 3 paratype ♀, Rockhampton, Queensland STOCKHOLM; 1 paratype ♂ (Reg. No. 120,699), 18 km north of Broken Hill, New South Wales, by sweeping, 8.III.1963, K. Dansie SAM; 2 paratype ♀, unlocalised, Distant collection 1911-383 BM; 1 paratype ♂, 1 paratype ♀, Peak-Downs, Queensland; 1 paratype ♀ Rockhampton, Queensland RM.

Specimens examined: The types only.

UNGROUPED

The next two species of *Cuspicona* appear not to have any close relatives in the genus nor are they apparently closely related to each other. They lack the strongly triangular heads of the *intacta* group but have not developed the strongly produced spinose lateral angles of the pronotum of the *thoracica* and *simplex* groups. Their position in the sequence of groups appears to be somewhere in between the *intacta* and *thoracica* groups.

Cuspicona carneola Van Duzee, 1905

Figs. 25 E-F, 27, 28 C-D

Cuspicona carneola Van Duzee, 1905: 207; pl. 8 fig. 9.

Description:

General appearance: Ground colour yellow or brownish-yellow in museum specimens; lateral angles of pronotum and a broad band across scutellum, apex of scutellum, lateral margins of corium (broadly) and laterotergites (at least exteriorly) bright carmine red, occasionally only pinkish. Lateral angles of pronotum angulately truncate.

Head: Appearing large, broad and flat, transversely rugulose, concolorous. Frequently a pinkish suffusion along lateral margins in front of eyes. Eyes and ocelli reddish-brown. Lateral margins very gently angulately concave.

Pronotum: In anterior half and along posterior margin concolorous; across disc from, and including, lateral angle to lateral angle a broad carmine red (or in some specimens pink) stripe. Punctations on disc reddish or blackish, calli glabrous. Anterior margin oblique behind eyes and broadly concave behind collum, anterolateral angles somewhat prominent. Anterolateral margins thickened, straight and obliquely diverging to region of lateral angles. Latter obliquely truncate. Posterolateral margins strongly and angulately incised, a convex lobe formed between each and shallowly concave posterior margin.

Scutellum: Concolorous with apex broadly carmine red, disc covered with coarse reddish or brown punctations and flattish. At base of each lateral margin a deep concolorous fovea visible if pronotum has moved a little forward. Lateral margins broadly convex in basal 5/9, then straight and slightly converging to very broadly rounded apex. Frena reaching to about 5/9 length.

Hemelytra: Coriaceous parts concolorous interiorly but outer margin of corium broadly carmine red or pink, coarsely and concolorously punctate. Exterior margins of coria straight basally then gradually converging so that laterotergites are exposed in the more distal region. Apical angle of corium fairly acute, posterior margin straight, inner angle very broadly rounded. Clavus elongate triangular. Membrane fumose hyaline with veins browner, near inner base of membrane a large piceous spot.

Abdomen: Mostly concolorous but black areas around margins of scutellum and along posterior margin of genitalia, sometimes also along posterior margin of segment VII. Behind apex of scutellum frequently carmine red, the extent of this red variable.

Laterotergites: Concolorous interiorly and carmine red or pink exteriorly. Posterior exterior angles produced into a small black tipped spine, sometimes whole exterior margin narrowly black.

Underside: Yellowish. Apical half of third antennal segment and antennal segments III-IV, tibiae and tarsomeres sometimes darker, brown or reddish. Underside of rostrum and very apex, and sometimes lateral margin of abdomen and posterior margin of female genitalia, very narrowly black. Margins of head basally, lateral margins of pronotum, exterior margin of epipleuron, lateral margin of abdomen (latter sometimes only submarginally, extreme margin then black) most of pygophore and female genitalia behind first gonocoxae usually carmine red or pinkish, sometimes however concolorous.

Bucculae low and sinuate, reaching to about middle of eye, produced into a blunt triangular lobe anteriorly. Rostral segment I robust, reaching to base of bucculae, II fairly thick and arched, reaching to just behind fore coxae, III to mid coxae, IV to about middle of abdominal ventrite III. Ratio of antennal segments (♂) I-V 11:19:21:27:29. Propleura red or brown punctate except on proepisternum and proepimeron, exteriorly to these two latter a raised though sparsely punctate area. Mesopleuron punctate anteroventrally and posteriorly, metapleuron posteriorly and sometimes anteriorly also. Metasternal-mesosternal keels higher anteriorly then posteriorly, reaching over prosternum to its

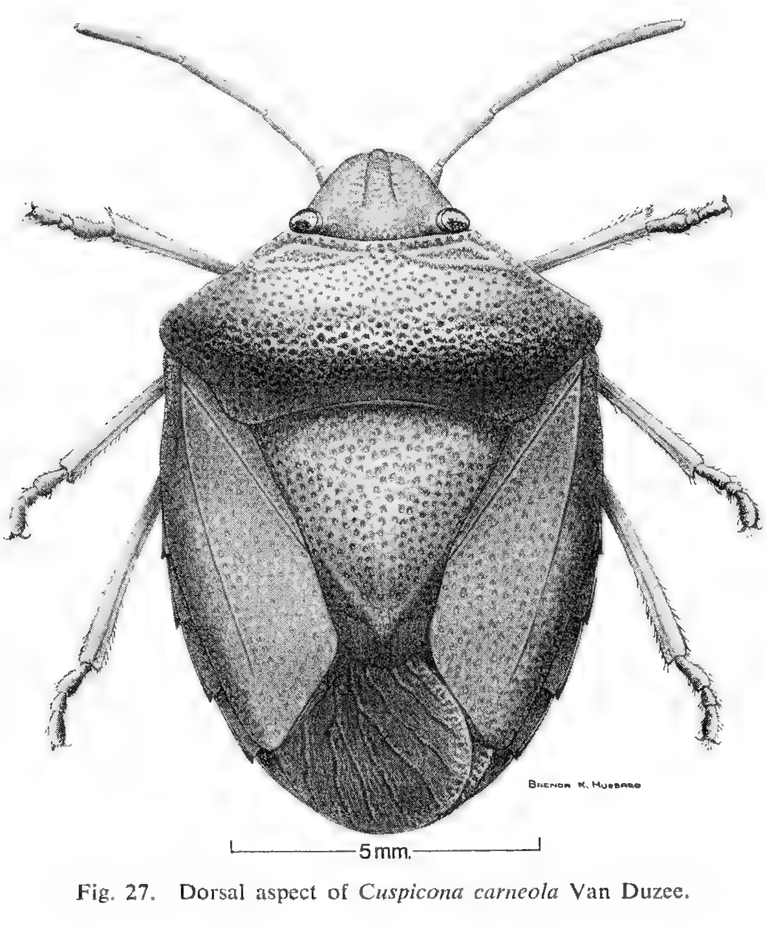

Fig. 27. Dorsal aspect of *Cuspicona carneola* Van Duzee.

apex, anteriorly very broadly rounded, deflected to left in ventral view. Femora normal, tibiae fairly flattened apically. Abdomen rounded in posterior view and only becoming broadly V-shaped anteriad. Apex of male abdomen Fig. 28 C, hind margin of pygophore strongly excavated medially and lateral lobes on either side of this excavation with the inner margins sinuate, apically a little produced. Clasper Fig. 25 F, slightly F-shaped. Aedeagus of male Fig. 25 E, with phallosoma rather short, conjunctiva basally shortly tubular with rather large dorsally directed "lappet" processes, more distally two conjunctival processes which are dorsally sclerotized. Medial penial plates shaped rather as an inverted T, directed downwards, gonophore opening between the conjunctival processes. Apex of female abdomen Fig. 28 D, hind margins of first gonocoxae faintly oblique and nearly straight.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	10	45	2·4	5·3	40-49
Head width	10	52	2·4	4·7	48-55
Antennal segment I	15	11	0·9	8·4	10-13
Antennal segment II	14	19	1·4	7·6	17-22
Antennal segment III	13	21	0·9	4·0	20-23
Antennal segment IV	11	27	1·3	4·8	25-29
Antennal segment V	8	29	1·1	3·7	28-31
Pronotum width	10	119	5·8	4·8	110-125
Pronotum length	10	39	3·8	9·7	33-45
Total length	10	186	14·6	7·8	160-205

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	21	48	4·2	8·8	39-52
Head width	21	54	3·3	6·2	46-58
Antennal segment I	29	11	0·7	6·1	9-12
Antennal segment II	33	18	1·9	10·6	15-23
Antennal segment III	28	20	2·3	11·7	15-26
Antennal segment IV	23	23	2·6	10·9	17-26
Antennal segment V	19	26	2·6	9·9	20-29
Pronotum width	21	128	10·8	8·4	106-147
Pronotum length	21	40	5·8	14·5	30-54
Total length	21	191	15·8	8·2	161-220

Total length: 8·3-11·5 mm

Remarks: This species is one of the largest in the genus and easily recognised by the broad carmine bar across the hind portion of the pronotum and the strongly truncated lateral angles of the pronotum. It appears to have no other close relatives in the genus.

A feature of note is the rather high coefficient of variation in the series of females which could indicate that there may be two closely related species mixed in together in this sample. I was unable to make any real distinctions on the examples of this series but the point should be borne in mind and when a much larger series of males becomes available when the augmented male series should be examined for differences in the shape of the pygophore.

Location of type:

Holotype ♀ of *carneola* Van Duzee, "New South Wales," AMNH.

Specimens examined: The holotype and Northern Territory 1 ♀, Oooratippra, 275 m, 31.X.1962, E. S. Ross & D. Q. Cavagnaro CA; Queensland 1 ♀, 32 km north of Emerald, 10.1.1972, B. Cantrell UQ; New South Wales 1 ♀, South Ite Sand Hills (100 km south of Broken Hill), 10.XII.1966, J. B. Williams UQ; 1 ♀, Bogan River, Jan. 1932, J. Armstrong AM; 1 ♂, no precise locality, presented by Perth Museum BM 1953-629; Victoria 1 ♀, Lake Hattah, J.G.O. donated F. P. Spry 16.V.1922; 1 ♀ 4 ♀ ♀, Lake Hattah, J. E. Dixon, donated Jan. 1940; 1 ♂, Hattah, Mar. 1914, Dixon, donated F. P. Spry 5.X.1922; 1 ♂, Ouyen, donated F. P. Spry 5.X.1922; 1 ♀, Mallee, *ex* J. E. Dixon coll. donated Jan. 1940; 2 ♂, 1 ♀, Mallee, Oct. 1904, donated F. P. Spry 8.X.1922; 1 ♀, Quantong, June 1929, A. D. Selby NM; South Australia 1 ♀, no further data AM; 1 ♂, Minnipa, H. A. Johnson;

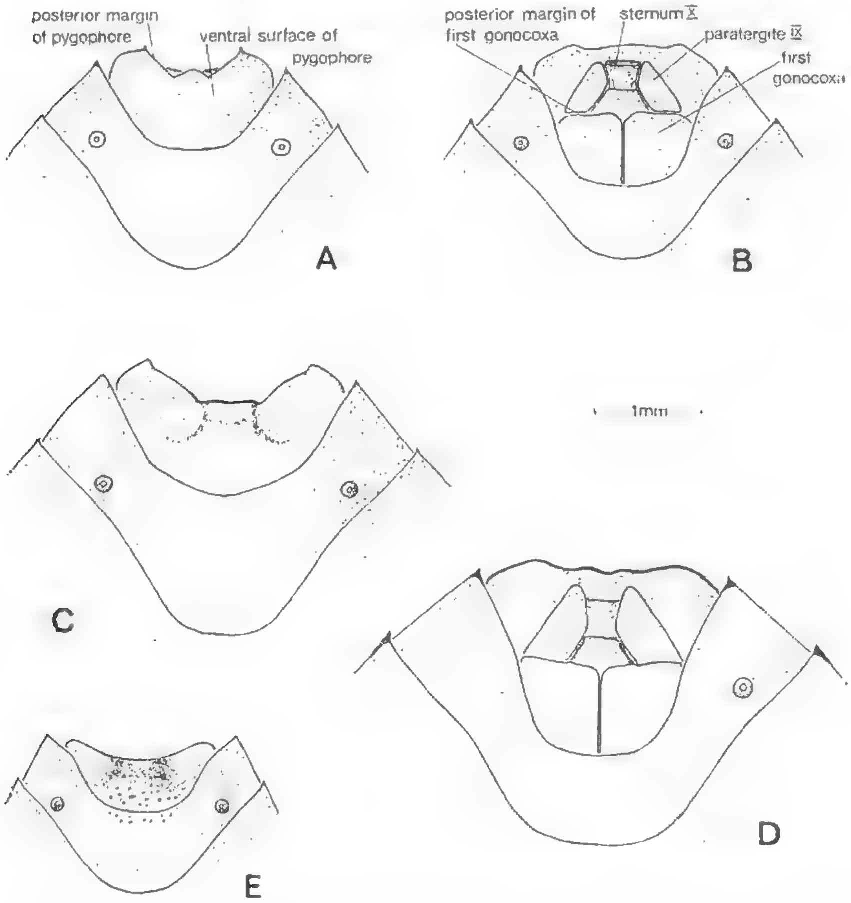

Fig. 28. *Cuspicona cooperi* sp. nov., *Cuspicona carneola* Van Duzee, *Cuspicona phi* sp. nov. A-B. *Cuspicona cooperi*. A. ventral aspect of male abdomen. B. ventral aspect of female abdomen. C-D. *Cuspicona carneola*. C. ventral aspect of male abdomen. D. ventral aspect of female abdomen. E. *Cuspicona phi*—ventral aspect of male abdomen.

1 ♀, St. Francis Island; 1 ♀, Ardrossan, 25.VII. 1879, Tepper; 1 ♀, Adelaide, 12.VII.1947, F. J. Mitchell; 1 ♂, 1 ♀, Karoonda; 1 ♀, Mallee, 22.X.1879, SAM; 1 ♂, 1 ♀, no precise locality, H. Edwards AMNH; Western Australia 1 ♀, Katanning, 12.X.1941, K. R. Norris ANIC; 1 ♂, 1 ♀, Swan River, L. J. Newman, presented by Comm. Inst. Ent. BM 1948-548.

Cuspicona obesula sp. nov.

Figs. 29, 30 A-B, 32 E-F

Description:

General appearance: Ground colour bright green in life fading to brownish-yellow in museum specimens. Anterolateral margins of pronotum (including produced lateral angles) carmine-red, apex of scutellum reddish-orange. Head brownish-yellow, just interior of anterolateral margins of pronotum in anterior 2/3 a yellowish stripe, a median longitudinal yellowish stripe on scutellum in apical half but terminating before apex. Lateral angles of pronotum produced rectangularly.

Head: Yellowish-brown and rather convex above, groove between anteclypeus and rest of head infuscated in posterior half, a patch of fine black punctations medially at base, just inward of eyes glabrous. Lateral margins with fine black punctations or very narrowly infuscated. Ocelli and eyes purplish-grey. Lateral margins gently angulately concave.

Pronotum: Concolorous, lateral margins narrowly at apex and more broadly at produced lateral angles margined with carmine-red in anterior 2/3, this red bordered interiorly by a yellow bar. In faded examples sometimes a transverse band of fine black punctations between lateral angles. Anterior margin obliquely truncate behind eyes and rather trapeziformly excavate behind collum, anterolateral angles produced as a small ridge. Anterolateral margins thickened and irregular, nearly straight but diverging in anterior halves, posterior halves with lateral angles produced as rectangular subspinous angles directed outwards only, about 40 per cent length of posterolateral margin, basal diameter also about 40 per cent of latter, Posterolateral margin gently concave, posterior margin gently concave medially, produced into posteriorly directed lobes at junction with posterolateral margins.

Scutellum: Concolorous with apex broadly reddish-orange, latter preceded by a medial longitudinal yellow streak which becomes obsolete near middle. Black punctations absent or only faintly indicated laterally to latter. No fovea at bases of lateral margins, latter faintly concave in basal half then changing direction and nearly straight but converging to broadly rounded apex. Frena reaching to about half length.

Hemelytra: Coriaceous parts concolorous with coarse punctations. Outer margin of corium concave in basal quarter then broadly convex to shortly rounded apical angle. Posterior margin straight, inner angle broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: Concolorous above.

Laterotergites: Concolorous, posterior exterior angles almost rectangular.

Underside: Concolorous; head yellowish-brown except at base; first three segments of antennae mainly yellowish-brown, apex of third and whole of fourth and fifth segments reddish-brown; rostrum yellowish-brown, ventrally and apex blackish; all thoracic sterna and keels and a broad median longitudinal bar on abdomen reaching to apex of VIIth segment whitish luteous; lateral margins of prothorax carmine-red; apices of the tibiae and tarsomeres reddish-brown.

Bucculae low and sinuate, reaching to middle of eye, produced into a thickened convex lobe anteriorly. Rostral segment I robust, just surpassing base of bucculae, II slightly arched and compressed and surpassing fore coxae, III surpassing mid coxae and IV to about apex of abdominal ventrite III. Ratio of antennal seg-

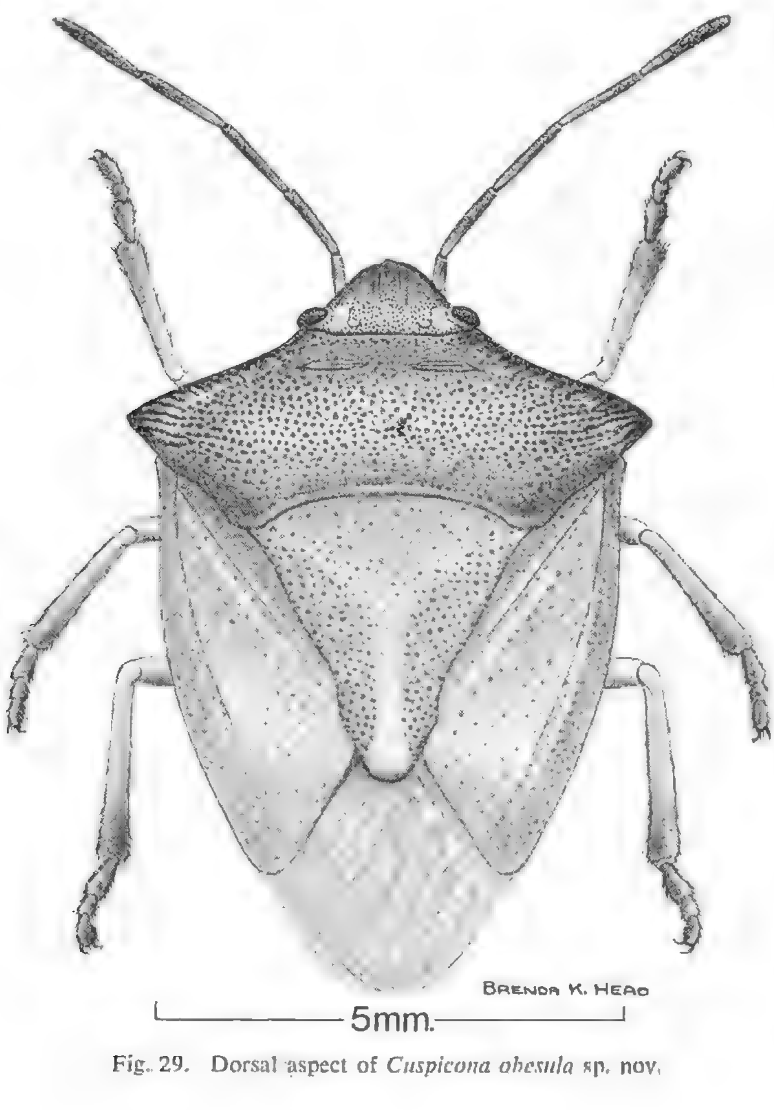

Fig. 29. Dorsal aspect of *Cuspicona obesula* sp. nov.

ments I-V 9:19:20:21:23. Propleuron with a strong raised ridge behind anterior margin mostly coarsely punctate but more finely and sparsely punctate exteriorly in anterior half, mesopleuron punctate in a triangular patch lying anteroventrally, metapleuron punctate below and behind evaporative area. Metasternal-mesosternal keels a little higher anteriorly than posteriorly, reaching over prosternum almost to its apex, anteriorly very broadly rounded, deflected to left in ventral view. Femora normal, tibiae a little flattened apically. Abdomen rounded in posterior view but segments VII-III progressively more V-shaped. Apex of male abdomen Fig. 32 E, hind margin of pygophore reddish, medially rectangularly excavate, laterally sinuated. Clasper Fig. 30 B, strongly F-shaped. Aedeagus of male Fig. 30 A, conjunctiva produced into two tubular apical processes which cross over each other, "lappet" processes elongate, medial penial plates elongate with a posterior concavity, lower lobe with a small spine on its dorsal surface. Apex of female abdomen Fig. 32 F, hind margins of first gonocoxae distinctly oblique and straight.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	14	33	1·2	3·5	31-35
Head width	14	38	1·1	2·8	36-40
Antennal segment I	19	9	0·6	6·5	9-11
Antennal segment II	19	19	0·9	4·7	16-20
Antennal segment III	19	20	1·3	6·4	18-21
Antennal segment IV	16	21	1·0	4·8	20-23
Antennal segment V	13	23	1·2	5·2	21-24
Pronotum width	14	101	3·0	2·9	96-106
Pronotum length	14	35	2·9	8·1	31-41
Total length	14	150	7·3	4·9	138-165

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	25	36	1·3	3·7	33-38
Head width	25	41	1·2	2·9	37-42
Antennal segment I	45	10	0·6	6·6	8-11
Antennal segment II	46	19	1·0	5·1	16-20
Antennal segment III	44	19	1·0	5·3	17-21
Antennal segment IV	36	20	0·9	4·4	18-21
Antennal segment V	27	22	1·1	5·3	20-23
Pronotum width	25	110	4·5	4·0	98-118
Pronotum length	25	38	3·5	9·2	31-43
Total length	25	165	10·3	6·2	146-183

Total length: 7·2-9·5 mm.

Remarks: *C. obesula* shows some affinity with the *thoracica* group of species in that in some examples a transverse band of dark punctations crosses the pronotum between the lateral angles. However the lack of black areas on the lateral angles, the only modest production of these angles and the strong medial excavation of the hind margin of the pygophore indicate that the relationship is not close. The strong red lateral coloration is similar to that of *carneola* but the more narrow head and more produced lateral angles of the pronotum indicates that *obesula* is not very closely related to *carneola*.

C. obesula occurs in the southern wetter part of South Australia from the Mount Lofty Ranges east to the Victorian border and in the adjacent western districts of Victoria. The only host plants recorded both belong to the genus *Leptospermum* (Myrtaceae).

Location of types:

Holotype ♀ (Reg. No. I20,683), 1 paratype ♂, (Reg. No. I20,684), 3 paratype ♀ (Reg. No. I20,685-7), 6 km east of Lucindale, South Australia, on *Leptospermum myrsinoides* Schlecht 26.XII.1968, A. N. McFarland; Paratypes: 1 ♀, (Reg. No. I20,688), Naracoorte Cave Reserve, South Australia, by sweeping *Leptospermum myrsinoides* Schlecht in *Eucalyptus obliqua* L'Herit dominated dry sclerophyll forest, 25.X.1958, G. F. Gross; 1 ♀, (Reg. No. I20,689), nr. Coonalpyn, South Australia, by beating *Leptospermum coriaceum* (FvM)Cheel, Sept. 1967, A. N. McFarland; 1 ♀, (Reg. No. I20,690), Meningie, South Australia, in mallee scrub, 1.XI.70, V. H. Mincham; 1 ♀, (Reg. No. I20,691), Blewitts Springs, South Australia, 20.X.1972, C. van Dijk; 2 ♀ (Reg. No. I20,692-3), Mt. Lofty Ranges, South Australia, N. B.

Tindale; 1 ♂ (Reg. No. I.20,699), Williamstown. South Australia, on *Leptospermum*, 20.X.1888, J. O. Tepper; 1 ♀ (Reg. No. I20,695), Largs North, South Australia, Nov. 1969, R. Cook; 1 ♂, 1 ♀, (Reg. Nos. I20,718, I20,696), Pt. Lincoln, South Australia, A. M. Lea; 1 ♀ (Reg. No. I20,697), Marble Range in Pt. Lincoln District, South Australia, 15.X.1957, N. B. Tindale SAM; allotype ♂, 1 paratype ♂, Little Desert, Victoria, 23.X.1952, A. Burns; Paratypes (continued): 1 ♀, Little Desert, Victoria, 17-25.X.1952, E. Matheson; 2 ♂, 2 ♀, Lake Hattah, Victoria, J. E. Dixon; 1 ♂, Kiata, Victoria, Oct. 1929, F. E. Wilson; 1 ♀, Kiata, Victoria, Oct. 1928, F. E. Wilson; 1 ♀, Grampians, Victoria, Nov. 1922; 1 ♀, Grampians, Victoria, 29.X. 1946, A. Burns NM; 1 ♀, 8 km south of Lah Arum, Grampians, Victoria, 5.II.1956, I. F. B. Common; 1 ♀, Little Desert 8 km south of Kiata, Victoria, 12.II.1956, I. F. B. Common ANIC: 1 ♂, 1 ♀, Murray Bridge, South Australia, A. M. Lea, AM; 1 ♂, 1 ♀, Lake Hattah, Victoria, J. E. Dixon; 1 ♂, Mt. Lofty Ranges, South Australia, N. B. Tindale BM; 1 ♂, 2 ♀ ♀, Aldgate, Mt. Lofty Ranges, South Australia, 29.XI.1931, Darlington on Harvard Expedition AMNH; 3 ♂, Bordertown, South Australia, 22.X.1963, J. Sedlacek BISHOP.

Specimens examined: The type series only.

Thoracica Group

The *thoracica* group of species includes species which appear to be restricted to the wetter parts along the east and south coasts of the Australian continent, including the south-west corner of Western Australia. Members of the group are absent from the wetter forests of north Western Australia and the Northern Territory. The species in this group are probably all grass green in life with the tips of pronotal spines black or black punctate. Black punctations are always present laterally near the apex of the scutellum and frequently on the hind lobe of the pronotum as well. Luteous markings are common and sometimes some areas are pinkish. The lateral angles of the pronotum are always produced into a conical spine. The hind margin of the corium is almost straight.

The first gonocoxae of the female have the posterior margin transversely or obliquely truncate or sinuate, if part of this margin is produced more posteriorly than any other part then it is the exterior half.

Host plant records for the group include species of *Aster* (introduced), *Hakea*, *Melaleuca*, *Leptospermum* and *Callitris* representing the families Compositae, Proteaceae, Myrtaceae and Cupressaceae.

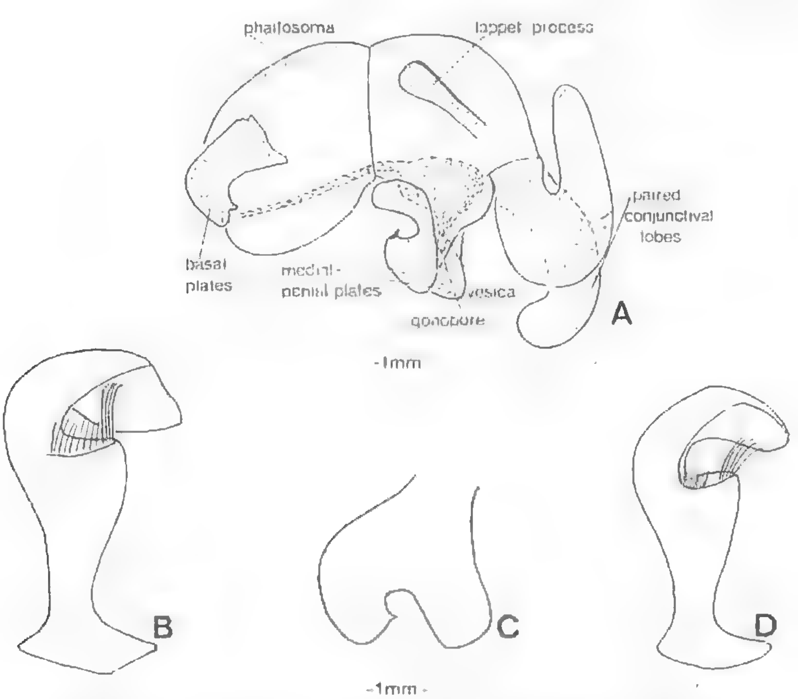

Fig. 30. *Cuspicona obesula* sp. nov., *Cuspicona thoracica* (Westwood). A-B. *Cuspicona obesula*. A. lefthand side aspect of aedeagus. B. clasper. C-D. *Cuspicona thoracica*. C. lefthand side aspect of visible portion of a medial penial plate of aedeagus. D. clasper.

Cuspicona procallosa sp. nov.

Figs. 31, 32 C-D

Description:

General appearance: Ground colour in museum specimens yellow or brownish-yellow with a few black punctations along lateral margins of head, dorsally on pronotal spines in apical half, and on scutellum on either side of midline (but not reaching base or apex). Lateral angles of pronotum produced into conical spines.

Head: Concolorous and rather convex above, some black punctations along lateral margins. Eyes and ocelli purplish or grey. Lateral margins gently angulately concave.

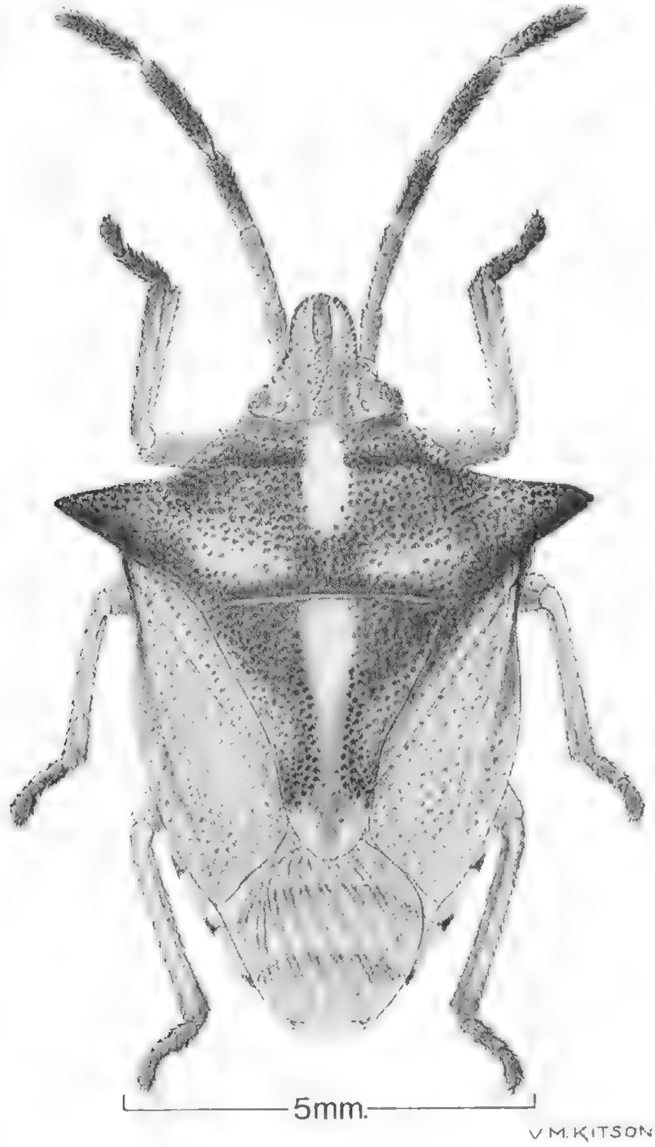

Fig. 31. Dorsal aspect of *Cuspicona procallosa* sp. nov.

Pronotum: Concolorous, but dorsal surface of exterior portion of spinous angles of pronotum with black punctations in apical half and black along apical half of anterior margins of these spines and at extreme apex; sometimes a few scattered dark punctations medially just in front of hind margin of pronotal disc. In anterior half of pronotum in the middle a broad longitudinal pale yellow or luteous glabrous fascia or bar, sometimes a glabrous patch of the same colour on each side just in front of posterior angles (as in example figured). Anterior margin obliquely truncate behind eyes and only shallowly concave behind collum, anterolateral angles hardly produced. Anterolateral margins obtuse and nearly straight in anterior halves, posterior halves, with lateral angles, each produced into a conical spinous process directed outwards and only a little upwards, about as long as posterolateral margin, its basal diameter about 75 per cent length of latter. Posterlateral margin concave, posterior margin broadly concave.

Scutellum: Concolorous with apex (broadly) and midline luteous and nearly glabrous, midline area widening anteriad. Laterally to midline and beginning about a third of the way back and reaching to about three quarters of the way back an area of black punctation on each side, basally this patch narrow and paralleling the pale streak, apically broadened and reaching lateral margins, one or two black punctations medially on glabrous area where the lateral patches finish. No fovea at bases of lateral margins, latter broadly concave in basal half then changing direction and nearly straight but faintly converging to broadly rounded apex. Frena reaching to about half length.

Hemelytra: Coriaceous parts concolorous with coarse concolorous punctation. Outer margin of corium concave in basal quarter then broadly convex to shortly rounded apical angle. Posterior margin straight, inner angle broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: Concolorous above but with upper surface of pygophore somewhat darkened. Sometimes some black patches, one under tip of scutellum and the other before pygophore.

Laterotergites: Concolorous but posterior exterior angles of III-VII black, latter almost rectangular.

Underside: Concolorous except extreme apex of prothoracic spine, posterior angles of abdominal ventrites III-VII, rostrum ventrally and apical third of its last segment, black. Apical third of antennal segment III, antennal segments IV and V, and sometimes tarsi and extreme apices of tibiae, light brown.

Bucculae punctate, not reaching base of head but to middle of eye, sinuate, produced into a convex lobe anteriorly. Rostral segment I robust, surpassing base of bucculae and reaching onto apex of prosternum, II arched and compressed and reaching mid coxae, III to about middle of hind coxae, IV to about base of abdominal ventrite IV. Ratio of antennal segments I-V 11:20:19:23:21. Most of propleuron (except two glabrous patches medially), mesepisternum, metepisternum and hind portion of metapleuron punctate. Metasternal-mesosternal keel higher anteriorly than posteriorly, reaching over prosternum almost to its apex, anteriorly broadly rounded, deflected to left in ventral view. Femora normal, tibiae a little flattened apically. Midline of abdomen narrowly luteous, rounded in posterior view but segments VII-III progressively more V-shaped. Spiracles a little raised. Apex of male abdomen Fig. 32 C, apical margin of pygophore shallowly concave, rather reflexed. Apex of female abdomen Fig. 32 D, hind margin of first gonocoxae oblique and slightly concave.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	9	36	2·6	7·2	32-41
Head width	11	36	3·5	9·7	26-39
Antennal segment I	17	11	0·8	7·2	9-12
Antennal segment II	17	20	1·2	6·3	17-22
Antennal segment III	16	19	1·3	6·8	16-20
Antennal segment IV	8	24	1·7	7·0	22-26
Antennal segment V	6	22	1·0	4·9	20-23
Pronotum width	11	120	6·2	5·2	110-133
Pronotum length	11	32	4·0	12·3	26-40
Total length	11	158	9·7	6·1	150-180

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	6	39	1·3	3·4	37-41
Head width	7	38	1·5	3·9	36-40
Antennal segment I	10	11	1·0	9·2	9-12
Antennal segment II	10	19	1·1	5·8	17-20
Antennal segment III	10	18	1·7	9·3	16-21
Antennal segment IV	8	22	1·9	8·9	19-25
Antennal segment V	6	20	0·8	4·2	19-21
Pronotum width	7	133	29·5	22·1	113-199
Pronotum length	7	34	5·5	15·7	25-42
Total length	7	166	9·8	5·9	148-180

Total length: 7·7-9·4 mm.

Remarks: *C. procallosa* is fairly easy to recognise by the longitudinal pale callous bar in the anterior half of the pronotum and by the black posterior exterior angles of the laterotergites and abdominal ventrites. The species is restricted to the southwestern portion of Western Australia.

Location of types:

(All cited localities are in Western Australia.) Holotype ♂, Fremantle, 3.II.1934, K. R. Norris; allotype ♀, same locality and collector but 2.II.1934; 1 paratype ♀, 1 km. WNW Foul Bay, Augusta (34° 19S 115′ 10E), 3.XI.1969, E. B. Britton; 1 paratype ♂, Deep Dene, Karridale, 16.XII.1962, L. M. O'Halloran ANIC; 1 paratype ♀, Geraldton, W. D. Dodd SAM; 1 paratype ♀, Geraldton and Mullewa, Lea; 1 paratype ♂, Geraldton; 2 paratype ♂, Swan River, L. J. Newman; 1 paratype ♂, Swan River; 1 paratype ♀, Flinders Bay, 11.IV.1936, A. L. Raymond (BM 1936-429); 3 paratype ♂, 2 paratype ♀, Yanchep, 50 km north of Perth, 29 Jan-8th Feb. 1936, R. E. Turner (BM 1936-28) BM; 1 paratype ♂, Cape Naturaliste, 5 m, 27.IX.1962, E. S. Ross and D. Q. Cavagnaro CA, 1 paratype ♂, Mt. William, 250 m, 6.XI.1963, J. Sedlacek BISHOP.

Specimens examined: The types only.

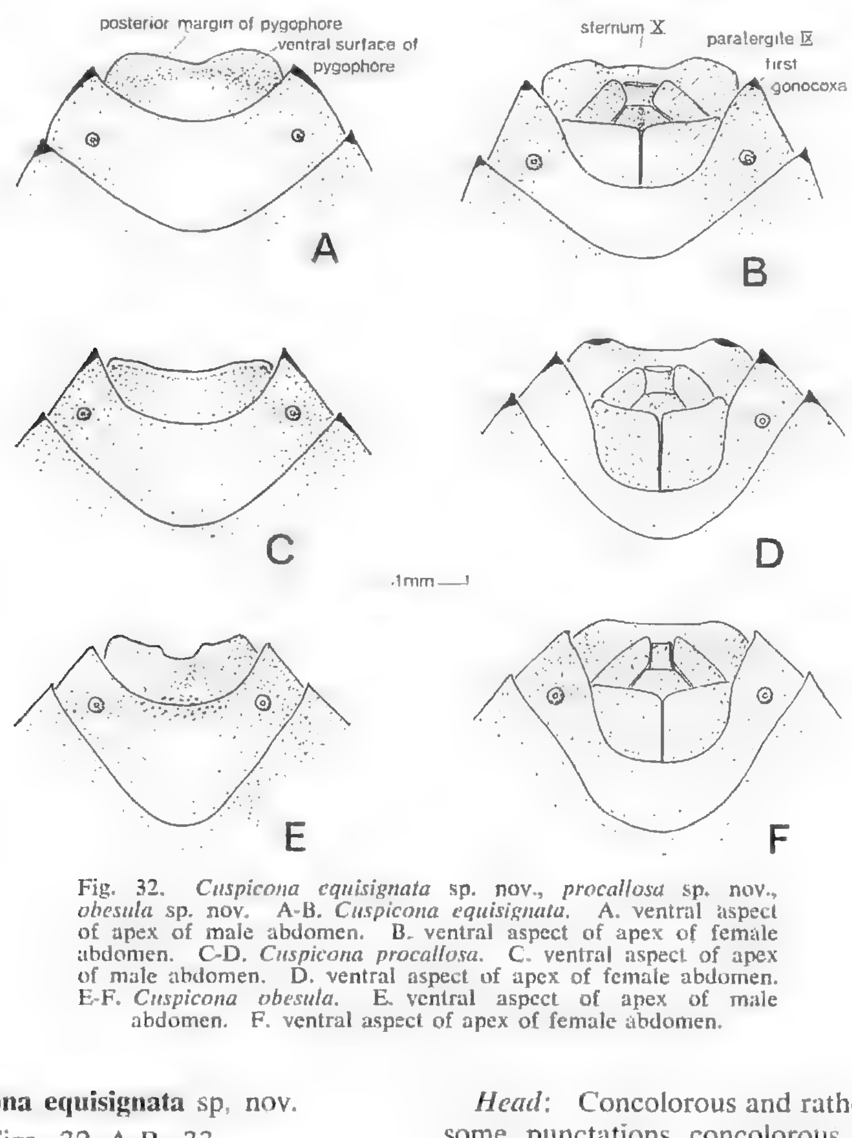

Fig. 32. *Cuspicona equisignata* sp. nov., *procallosa* sp. nov., *obesula* sp. nov. A-B. *Cuspicona equisignata*. A. ventral aspect of apex of male abdomen. B. ventral aspect of apex of female abdomen. C-D. *Cuspicona procallosa*. C. ventral aspect of apex of male abdomen. D. ventral aspect of apex of female abdomen. E-F. *Cuspicona obesula*. E. ventral aspect of apex of male abdomen. F. ventral aspect of apex of female abdomen.

Cuspicona equisignata sp. nov.

Figs. 32 A-B, 33

Description:

General appearance: Ground colour in museum specimens yellow with black punctations on head (sparse), pronotum and scutellum. Lateral angles of pronotum produced into conical spines.

Head: Concolorous and rather convex above, some punctations concolorous but on disc of juga towards apex and near base a few black punctations. Eyes and ocelli purplish or grey. Lateral margins concave.

Pronotum: Mostly concolorous but anteriorly in either side of midline adjoined to anterior margin and reaching about a third of the distance back a pair of longitudinal lines of black punctations, between these lines and extending back almost to hind margin on Cape York examples a pink longitudinal median linear marking. Dorsal surface of spines black punctate, especially towards apices, across posterior portion of pronotum between spines a diffuse line of sparse black punctations. Anterior margin oblique behind eyes and rather rectangularly excavate behind collum, anterolateral angles produced as a small ridge. Anterolateral margins obtuse and nearly straight in anterior halves, posterior halves with lateral angles each produced into a conical slightly recurved spinous process directed outwards and only a little upwards, not as long as posterolateral margin, its basal diameter about 75 per cent length of posterolateral margin. Posterolateral margin slightly sinuate, posterior margin broadly concave.

Scutellum: Concolorous with apex (broadly) and midline luteous and nearly glabrous, midline area wider anteriorly than posteriorly where it runs into glabrous apical area. Laterally to these glabrous areas punctations all black, or some black and some concolorous, just behind where luteous midline joins apical area a few scattered punctations near the midline in the luteous area. No fovea at base of lateral margins, latter broadly convex in basal half then changing direction and broadly convex to broadly rounded apex. Frena reaching reaching to about half length.

Hemelytra: Coriaceous parts concolorous with coarse punctation, some or many of these punctations fuscous, inner angle of corium narrowly black. Exterior margin of corium concave in basal quarter then broadly convex

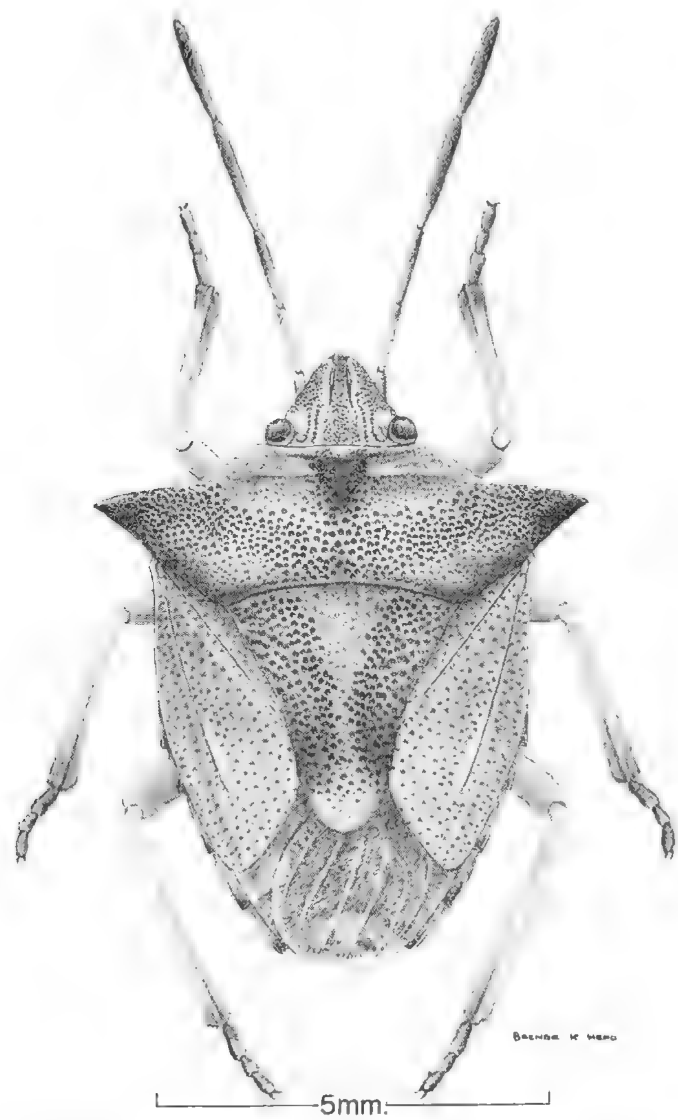

Fig. 33. Dorsal aspect of *Cuspicona equisignata* sp. nov.

to nearly acute apical angle, posterior margin nearly straight, inner angle broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: Concolorous or with a fuscous area around apex of scutellum or (holotype) with a broad longitudinal black band behind scutellum reaching apex. Dorsum of pygophore with a lateral black patch on either side, dorsum of female genitalia with a fuscous patch on either side of midline.

Laterotergites: Concolorous, posterior exterior angles of III-VII black, almost rectangular, hind margin of VII strongly black in holotype.

Underside: Concolorous except extreme tip of prothoracic spine and posterior angles of abdominal ventrites III-VII, rostrum ventrally and apical third of its last segment, black. Apical half of antennal segment III, antennal segments IV and V, tarsi and extreme apices of tibiae brown. Bucculae not reaching base of head but to middle of eye, elevated, sinuate, produced into a convex lobe anteriorly. Rostral segment I robust, surpassing base of bucculae and reaching nearly to fore coxae, II arched and reaching mid coxae, III to about middle of hind coxae or beyond, IV onto IVth abdominal ventrite. Ratio of antennal segments 10:21:21:25:24. Episterna, proepimera, propleuron, and hind portion of metapleuron, and abdomen (except along midline) punctate. Metasternal-mesosternal keel higher anteriorly than posteriorly, reaching over prosternum but not to apex, anteriorly broadly rounded, deflected to left in ventral view. Femora normal, tibiae a little flattened apically. Abdomen with midline luteous, rounded in posterior view but segments VII-III progressively more V-shaped. Spiracles raised. Apex of male abdomen Fig. 32 A, apical margin of pygophore somewhat triangularly excavate, reflexed. Apex of female abdomen Fig. 32 B, hind margins of first gonocoxae half truncate and only faintly oblique.

Dimensions -

Parameter	Holotype ♂	Allotype ♀	Paratype ♂	Paratype ♀
Head length	36	35	41	37
Head width	37	39	39	39
Antennal segment I	10, 10	11, 11	11, 11	10, 10
Antennal segment II	21, 21	21, 21	23, 23	21, 21
Antennal segment III	19, 19	20, 20	24, 23	20, 21
Antennal segment IV	29, 29	24, 25	30, 22	24, 24
Antennal segment V	26, 26	23, 23	24, —	24, —
Pronotum width	110	121	121	115
Pronotum length	28	36	34	30
Total length	148	170	158	140

Total length: 7·7-9·0 mm.

Remarks: Only the four specimens listed above are known, the distribution appears to be unusually wide for such an uncommon species and it may be noted here that some other localities on Captain S. A. White labels have proved to be in error, these Cape York Peninsula records may also be. The species is similar to *procallosa* having the same black posterior angles to the laterotergites and abdominal ventrites and a callous median patch anteriorly on the pronotum. It differs from that species in having a small black line on either side of the anterior callosity of the pronotum and the V-shaped posterior margin of the pygophore and the more black punctate hind portion of the pronotum. It is also somewhat similar to *phi* but differs in not having the underside of the pronotal spines strongly punctate right to their bases.

Location of types:

Holotype ♂ (Reg. No. I20,672), allotype ♀ (Reg. No. I20,673), 1 paratype ♀ (Reg. No. I20,674), Cape York Peninsula, Queensland, Captain S. A. White; 1 paratype ♂ (Reg. No. 20,675), Mt. Wedge, South Australia, 16.X. 1954, N. B. Tindale SAM.

Specimens examined: The types only.

Cuspicona phi sp. nov.

Figs. 28 E, 34, 36 F

Description: Ground colour in museum specimens brownish-yellow with black punctations on hind portion of pronotum and scutellum, on underside of frontal spines and hind or ventral portions of thoracic pleura, black markings on dorsum of abdomen above. Lateral angles of pronotum produced into conical spines.

Head: Concolorous and rather convex above; punctation rather sparse and concolorous or light brown, arranged in rows. Eyes and ocelli purplish red. Lateral margins strongly concave.

Pronotum: In anterior portion mostly concolorous with brown punctations but calli a darker brown, between calli and extending to anterior margin a rather callous luteous marking. On dorsal surface of produced lateral spines and in disc between them a broad rather diffuse band of black punctations, apices of lateral spines black. Anterior margin oblique behind eyes and broadly excavate behind collum, anterolateral angles produced into a small ridge. Lateral margins obtuse and slightly convex in their anterior halves, posterior halves with lateral angles produced into a conical slightly recurved spinous process directed outwards and only a little upwards, not as long as posterolateral margins, its basal diameter about 75 per cent length of posterolateral margin. Posterolateral margin obtusangulately excavate, posterior margin broadly concave.

Scutellum: Concolorous and finely punctate with apical third luteous and glabrous, this luteous produced forward along midline. In apical fifth some black punctations medially, just anterior to these on either side (leaving midline there broadly impunctate) a triangular to quadrate patch of black punctations. A concolorous fovea visible at base of lateral margins in one of the paratypes, lateral margins broadly convex in basal half, then changing direction and broadly convex to broadly rounded apex. Frena reaching to about half length.

Hemelytra: Coriaceous parts concolorous but inner angle or corium margined with fuscous. Exterior margin of corium concave in basal quarter then broadly rounded to almost rectangular apical angle, posterior margin nearly straight, inner angle broadly rounded. Clavus elongate

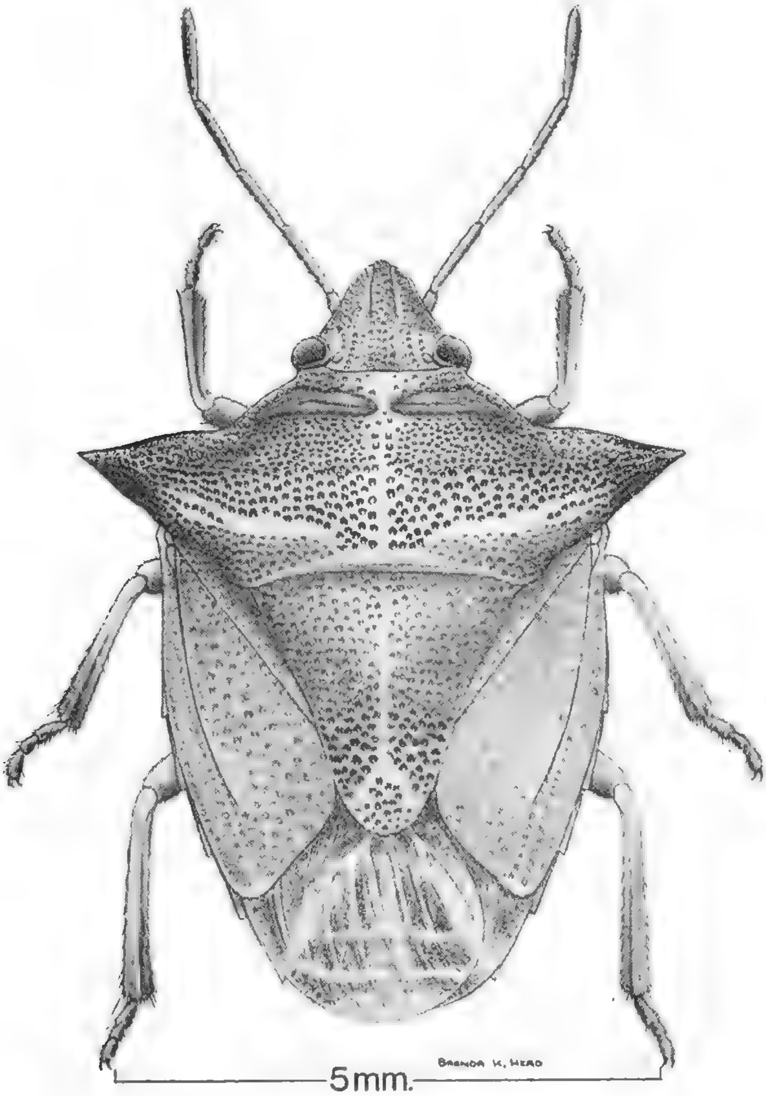

Fig. 34. Dorsal aspect of *Cuspicona phi* sp. nov.

triangular. Membrane and veins largely hyaline but at inner anterior angle a small longitudinal fuscous bar joining the fuscous on inner angle of corium.

Abdomen: Concolorous; large single or paired black patches on segments VI and VII medially, dorsum of female genitalia with large, black patches, one on each side.

Laterotergites: Concolorous but fuscous along posterior margin of VII, lateral angles almost rectangular.

Underside: Concolorous but in holotype with a reddish tinge and reddish punctations, reddish especially more intense on evaporative area, on femora and broadly along lateral margins of abdominal ventrite VII. Bucculae, whole underside of spinous angles of pronotum and extending somewhat onto propleuron, and female genitalia with reddish fuscous punctations. Rostrum ventrally and most of apical segment black. Prominent luteous areas ventrally and along hind margin of propleuron turning anteriorly under punctate area on lateral spines, ventrally on mesopleuron and ventrally and posteriorly on metapleuron. Mesosternal-metasternal keel semihyaline.

Bucculae not reaching base of head and not to past middle of eye, sinuate, produced into a convex lobe anteriorly. Rostral segment I robust, surpassing base of bucculae and reaching about base of head, II arched and reaching mid coxae, III to about middle of hind coxae and IV past middle of third abdominal ventrite. Ratio of antennal segments 9:16:12:18:16. Episterna, proepimeron and hind portions of pro- and metapleura punctate. Metasternal-mesosternal keel higher anteriorly than posteriorly, reaching over prosternum to about its apex, anteriorly broadly rounded, deflected to the left in ventral view. Femora normal, tibiae a little flattened exteriorly in apical quarter. Abdomen fairly densely punctate, rounded in posterior view but segments VI-III progressively more V-shaped. Apex of male abdomen Fig. 28 E, apical margin of pygophore gently concave medially and broadly convexly rounded laterally. Apex of female abdomen Fig. 36 F, hind margins of first gonocoxae somewhat oblique and narrowly sinuated.

Dimensions—

Parameter	Holotype ♂	Allotype ♀	Paratype ♀ (Peak-Downs)	Paratype ♀ (Peak-Downs)	Paratype ♀ (Sydney)
Head length	39	36	33	33	32
Head width	38	36	33	33	33
Antennal segment I	9, 9	9, 9	8, 9	8, 9	9, 8
Antennal segment II	19, 19	16, 17	15, —	16, 15	15, 16
Antennal segment III	13, 13	12, 13	12, —	12, 14	11, 12
Antennal segment IV	20, 21	18, 19	—	17, —	17, —
Antennal segment V	19, 19	17, 17	—	15, —	—
Pronotum width	116	115	103	115	103
Pronotum length	40	33	33	30	33
Total length	155	150	140	145	150

Total length: 7·3-7·8 mm.

Remarks: This species is apparently closely related to *procallosa* and *equisignata* but differs from them in not having prominently black posterior angles to laterotergites anterior to the VIIIth pair and by having dense black punctations on the underside of the pronotal spines. Only the nine specimens listed below are known.

Location of types:

Holotype ♂ (Reg. No. T7216), Mt. Tozer area, Iron Range, North Queensland, 29.IV-1.V.1973, G. B. Monteith QM; allotype ♀, West Normanby River, 64 km (40 miles) west of Cooktown, north Queensland, 12.XI.1965, G. Monteith UQ; 2 paratype ♀, Peak-Downs, Queensland; 1 ♀ paratype, Sydney (spelt "Sidney"), New South Wales STOCKHOLM; 2 paratype ♀, New South Wales, Distant coll. 1911-383 BM; 1 paratype ♂, Australia; 1 paratype ♀, New Holland, Deyrolle; 1 paratype ♀, Peak-Downs RM.

Specimens examined: The types only.

Cuspicona angustizona sp. nov.

Figs. 35, 36 E

Description:

General appearance: Ground colour in museum specimens greenish yellow with black punctations on head (sparse), on upper surface of pronotal spines and in a narrow but dense band across disc of pronotum between lateral spines and beneath on underside of pronotal spines. Lateral angles of pronotum produced into conical spines.

Head: Concolorous, not very convex above; punctation moderately dense but fine, black and brown, basally arranged in rows. Eyes and ocelli dull purple. Lateral margins concave.

Pronotum: Concolorous with punctation mostly concolorous or reddish but on dorsal surface of lateral spine, in a narrow but dense band across disc between lateral spines and in a thin longitudinal, medial line only one or two punctations wide given off from transverse band to anterior margin (interrupted a little before anterior margin) with punctations black. Anterior margin oblique behind eyes and broadly excavate behind collum, anterolateral angles hardly produced. Lateral margins obtuse and only slightly convex in anterior two thirds, posterior thirds with lateral angles each produced into a conical slightly recurved spinous process directed outwards and a little upwards, not as long as posterolateral margins, basal diameter about 60 per cent length of posterolateral margin. Posterolateral margin obtusangulately excavate, posterior margin broadly concave.

Scutellum: Concolorous and finely punctate anteriorly, in posterior third paler with scattered coarse black punctations, no less dense medially than laterally; this punctate area produced anteriorly from the main mass of punctations for a short distance along midline. A small concolorous fovea at base of each lateral margin, lateral margins almost straight in anterior half, then changing direction and almost straight to broadly rounded apex. Frena reaching about half length.

Hemelytra: Coriaceous parts fuscous but inner angle of corium and apical angle of claws margined with fuscous. Exterior margin of corium concave in basal quarter then broadly rounded to almost rectangular apical angle, posterior margin nearly straight, inner angle broadly rounded. Clavus elongate triangular. Membrane and veins largely hyaline but at inner

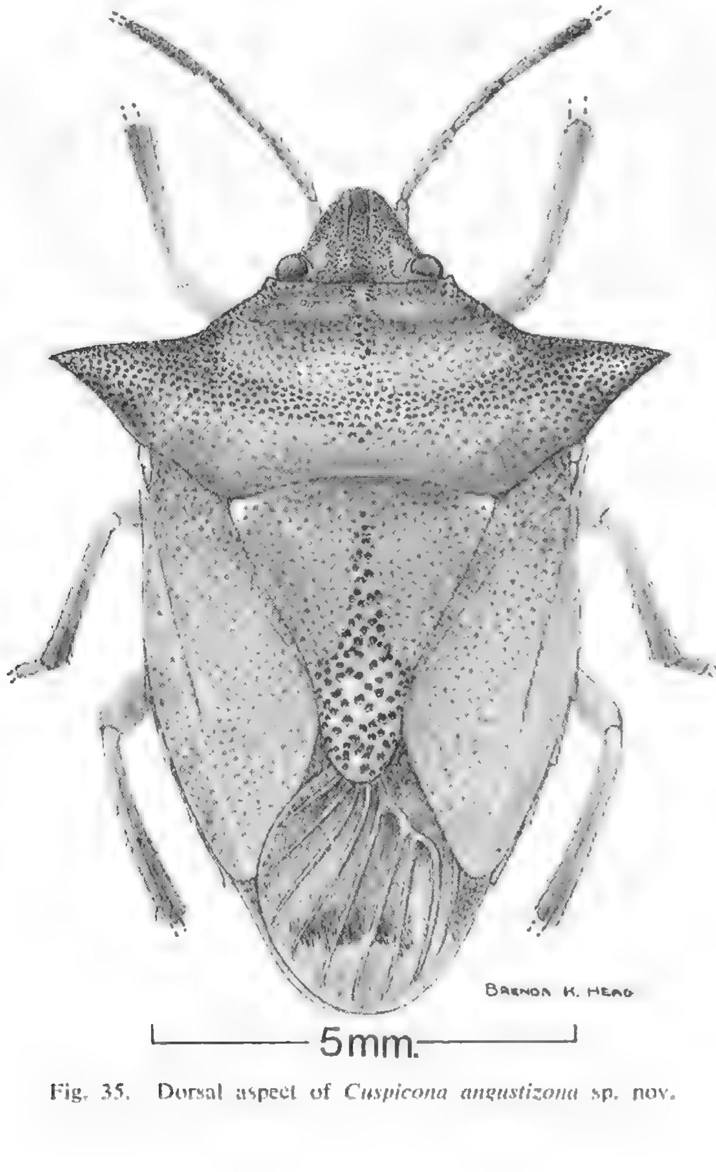

Fig. 35. Dorsal aspect of *Cuspicona angustizona* sp. nov.

anterior angle a small fuscous area adjoins the fuscous on corium and clavus.

Abdomen: Apparently concolorous or perhaps rather reddish medially, dorsum of female genitalia with some black patches.

Laterotergites: Concolorous but apical angle of VII darkened, lateral angles produced into a small spine.

Underside: Concolorous but bucculae, underside of pronotal spine and first gonocoxae of female with black punctations. Abdomen ventrally broadly luteous, a medial spot on propleura and posterior margins of paratergites VIII black. Metasternal-mesosternal keel hyaline.

Bucculae not reaching base of head and not to past middle of eye, sinuate, produced into a blunt triangular lobe anteriorly. Rostral segment I robust, just surpassing base of bucculae, II arched and probably reaching about mid coxae, IV and III missing on both specimens. Ratio of first four antennal segments (fifth missing in both specimens) 10:20:18:22. Episterna, proepimeron, hind portion of propleuron and metapleuron punctate. Legs apparently normal, tibiae flattened towards apices, most tarsi missing on the two specimens examined. Metasternal-mesosternal keel higher and thinner anteriorly than posteriorly, reaching over prosternum nearly to its apex, anteriorly broadly rounded, deflected a little to the left in ventral view. Abdomen finely punctate, rounded in posterior view but segments VI-III progressively more V-shaped. Apex of female abdomen Fig. 36 E, hind margins of first gonocoxae oblique and narrowly sinuated. Males unknown.

Dimensions—

Parameter	Holotype ♀	Paratype ♀
Head length	38	36
Head width	41	39
Antennal segment I	10, 10	10, —
Antennal segment II	20, 20	—
Antennal segment III	18, 18	—
Antennal segment IV	22, —	—
Antennal segment V	Absent on both examples	
Pronotum width	130	125
Pronotum length	31	35
Total length	180	175

Total length: 9·1-9·4 mm

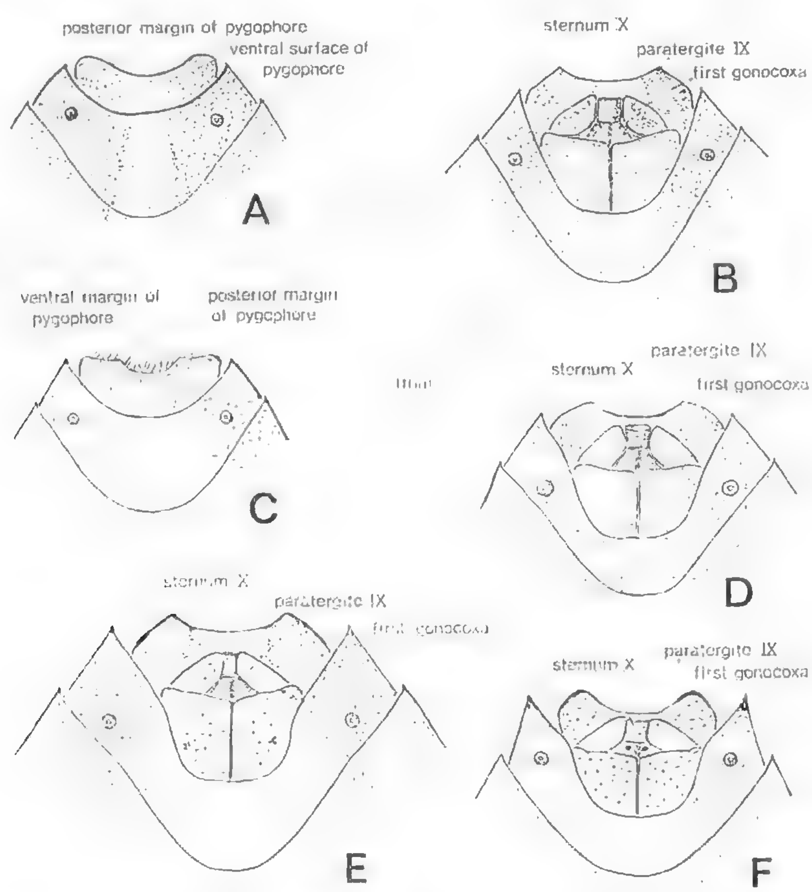

Fig. 36. *Cuspicona apothoracica* sp. nov., *Cuspicona thoracica* (Westwood), *Cuspicona angustizona* sp. nov., *Cuspicona phi.* sp. nov. A-B. *Cuspicona apothoracica*. A. ventral aspect of male abdomen. B. ventral aspect of female abdomen. C-D. *Cuspicona thoracica*. C. ventral aspect of male abdomen. D. ventral aspect of female abdomen. E. *Cuspicona angustizona* —ventral aspect of apex of female abdomen. F. *Cuspicona phi*—ventral aspect of apex of female abdomen.

Remarks: This species is closely related to *phi*, having the apical area of the scutellum fairly evenly covered with black punctations and having a median prolongation forward of the transverse dark band on the pronotum. It differs by its larger size, prolongation forward of the black punctations medially on the scutellum and the strongly bicoloured abdomen beneath. Both examples are unfortunately incomplete.

Location of types:

Holotype ♀ (Reg. No. T7217), Brisbane, Queensland, R. Kumar QM; paratype ♀, Eidsvold, Queensland, ANIC.

Specimens examined: The types only.

Cuspicona thoracica (Westwood, 1837)

Figs. 30 C-D, 36 C-D, 37, 38 A

Rhynchocoris thoracica Westwood, 1837, p. 30.

Cuspicona thoracica Dallas, 1851, p. 386. Mayr, 1866, p. 67. Stål, 1876, p. 103. Van Duzee, 1905, p. 208.

Cuspicona xanthochlora Walker, 1867, p. 389.

Description:

General appearance: Ground colour green in life with dorsum of head, a broad transverse band on pronotum between, and extending onto, produced lateral angles, antennae, underside of head, rostrum, apices of femora and tarsi brown. Basally or wholly on head, across pronotum as a transverse band, and laterally near apex of scutellum black punctate.

Head: Brown and flattened above; in males strongly punctate with black above on almost entire disc; females usually less extensively black punctate than males but basally a median quadrate area made up of three short parallel longitudinal bands of black punctations always present and lateral margins with black punctations. Eyes and ocelli purplish red.

Pronotum: Green in life, yellowish or pale yellowish brown in museum specimens; dorsal surface of lateral angles and a broad transverse band between them brown with numerous black punctations, this band of punctations about seven punctations wide medially, anteriorly and posteriorly to this band finely and concolorously punctate except on glabrous calli. Anterior margin oblique behind eyes and concave behind collum, anterolateral angles produced into a very small tooth. Anterolateral margins obtuse, straight and diverging in anterior half; posteriorly half, with lateral angles, produced into a conical slightly recurved spinous process directed outwards and only a little upwards, about as long as posterolateral margin, its basal diameter about 75 per cent or less length of posterolateral margins. Posterolateral margins obtusangulately excavate, posterior margin broadly concave.

Scutellum: Green in life with anterior median portion rather yellowish-green, pale yellowish-brown in museum specimens. Apical half with a broad median luteous or reddish longitudinal stripe reaching apex, laterally to this a triangular or semi-circular patch of black punctations not beginning as far forward as base of luteous stripe nor reaching near to apex. Latter broadly impunctate. No fovea at base of lateral margins, latter broadly convex in basal half, then very broadly and slightly convex to rounded apex. Frena reaching nearly to half length.

Hemelytra: Green in life, pale yellowish brown in museum specimens, coarsely and concolorously punctate. Exterior margin of corium concave in basal quarter then broadly rounded to very shortly rounded apical angle, posterior margin nearly straight, inner angle broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: Green in life, yellow in museum specimens; without black markings, except at posterior margins of pygophore.

Laterotergites: Green in life, narrowly black just laterally of midline on dorsum of female genitalia.

Underside: In life, pale green, in museum specimens yellowish brown. Underside of head yellowish; antennae, most of rostrum, apical half of pronotal spines, apices of tibiae, tarsi and pygophore ventrally brown. Rostrum ventrally and most of apical segment black. Mesosternal-metasternal keel, a broad median band on abdomen and all female external genitalia except paratergites VIII luteous. Underside of pronotal spines frequently reddish.

Bucculae not reaching base of head and not to past middle of eye, strongly sinuate, produced into a triangular lobe anteriorly. Rostral segment I robust, surpassing base of bucculae

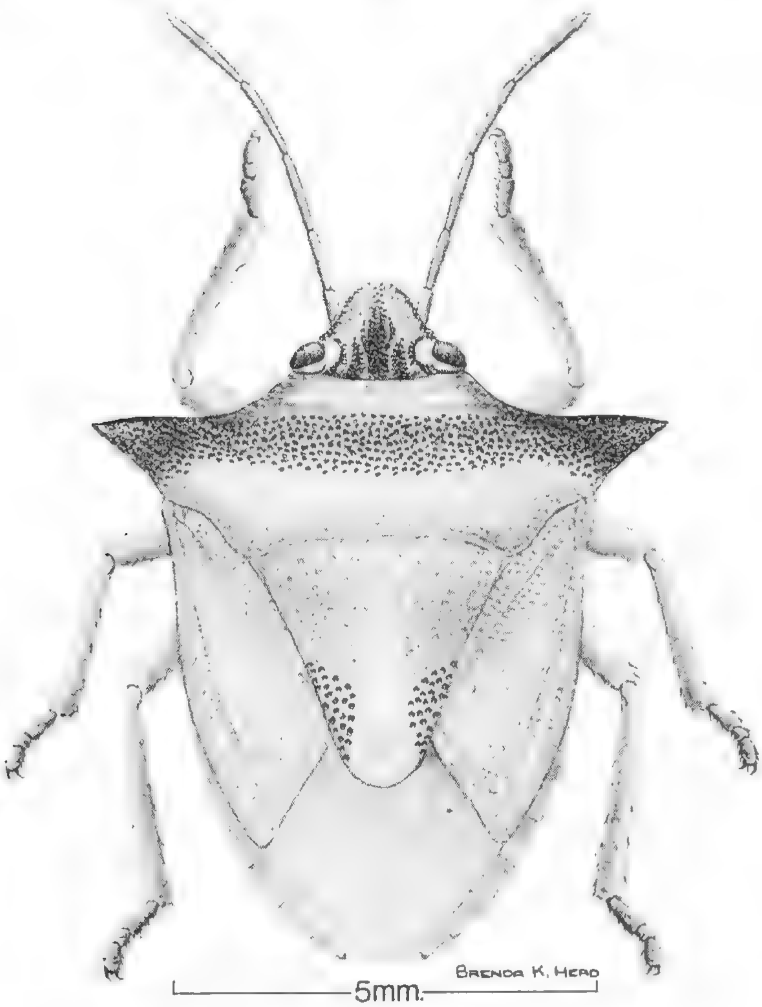

Fig. 37. Dorsal aspect of *Cuspicona thoracica* (Westwood).

but not reaching base of head, II slightly arched and reaching mid coxae, III to hind coxae and IV to middle of abdominal ventrite III. Ratio of antennal segments 9:16:19:20:21. Episterna, proepimeron, hind portion of propleuron and metapleuron lightly and concolorously punctate. Metasternal-mesosternal keel reaching over apex of prosternum, higher anteriorly than posteriorly, its anterior margin only slightly convex, deflected to the left in ventral view. Femora normal, tibiae rather flattened exteriorly in apical quarter. Abdomen sparsely, finely and concolorously punctate laterally and on external genitalia, medially impunctate, rounded in posterior view but ventrites V-III progressively more V-shaped. Apex of male abdomen Fig. 36 C, apical margin of pygophore rather truncate laterally, concavely excavate medially. Clasper Fig. 30 D, rather curved F-shaped. Medial penial plates of aedeagus Fig. 30 C, strongly Y-shaped, their ventral surfaces sinuate, gonopore opening between them. Apex of female abdomen Fig. 36 D, hind margins of first gonocoxae sinuated and vaguely oblique.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	30	29	1·6	5·4	27-34
Head width	31	34	1·2	3·6	32-37
Antennal segment I	46	9	0·6	7·0	7-10
Antennal segment II	48	16	1·3	7·8	14-18
Antennal segment III	48	20	1·1	5·8	18-22
Antennal segment IV	42	21	1·2	6·0	19-24
Antennal segment V	40	22	1·3	6·0	20-27
Pronotum width	31	104	3·4	3·2	99-112
Pronotum length	31	31	2·7	8·7	28-34
Total length	31	133	9·7	7·3	117-151

Dimensions—

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	36	32	2·3	7·0	28-39
Head width	36	37	1·7	4·7	31-40
Antennal segment	63	9	0·6	6·8	8-11
Antennal segment II	63	16	1·6	9·5	10-19
Antennal segment III	63	19	1·2	6·2	17-22
Antennal segment IV	56	20	1·5	7·3	18-25
Antennal segment V	50	21	1·2	5·7	19-25
Pronotum width	36	114	8·3	7·3	104-155
Pronotum length	36	33	2·6	7·9	29-39
Total length	36	145	9·2	6·3	130-165

Total length: 6·9-7·6 mm

Remarks: When work was part way on specimens labelled *thoracica* in most collections it was noticed that the series were made up of two very similar species which can be distinguished by the outline of the male pygophore, by the degree of black in the head in males, by whether the margins of the head are black spotted or not in females and the degree of posterior extension of the black punctations on the scutellum. As I was unaware of this when I examined the types of *thoracica* and *xanthochlora* in England in 1969 it was necessary to call upon the good offices of Mr. I. Lansbury in the Hope Department at Oxford and Dr W. R. Dolling at the British Museum to recheck these types for me. They prove to be conspecific and to apply to this taxon. The second species is described hereunder and the differences between the two treated in the *Remarks* section there. *Cuspicona thoracica* occurs only near the coast in central and south-eastern Victoria, New South Wales and south-eastern Queensland.

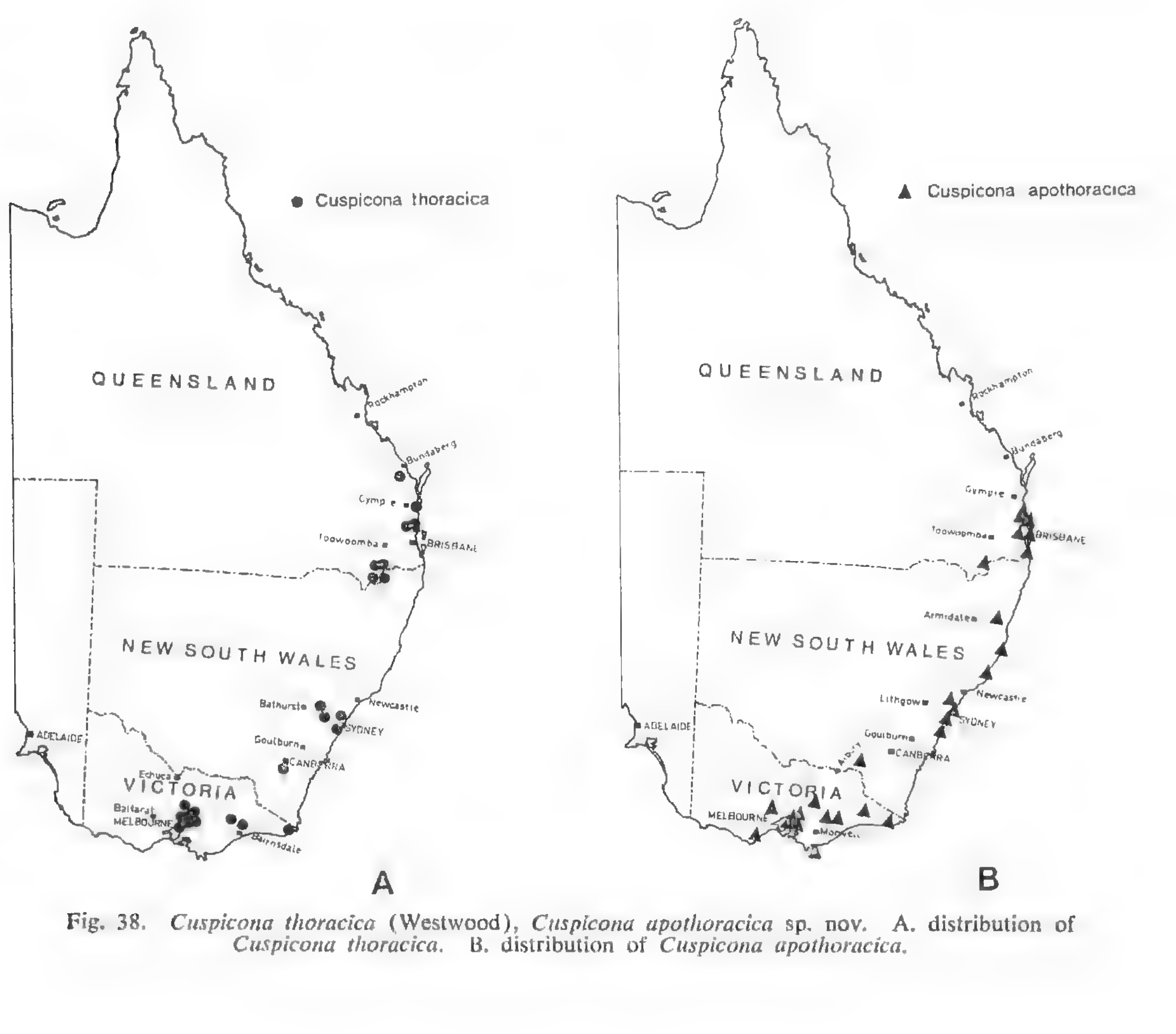

Fig. 38. *Cuspicona thoracica* (Westwood), *Cuspicona apothoracica* sp. nov. A. distribution of *Cuspicona thoracica*. B. distribution of *Cuspicona apothoracica*.

Location of types:

Holotype ♀ of *thoracica* Westwood, "New Holland", in Hope, holotype ♀ of *xanthochlora* Walker, "Australia", in BM.

Specimens Examined: About 140 examples were examined, their detailed distributions are not given but the distribution plotted on Fig. 38 A.

Cuspicona apothoracica sp. nov.

Figs. 36 A-B, 38 B, 39, 40 A-C

Description:

General appearance: Very similar to *thoracica*. Grass green in life with dorsum of head, a broad transverse band on pronotum between and extending onto, produced lateral angles,

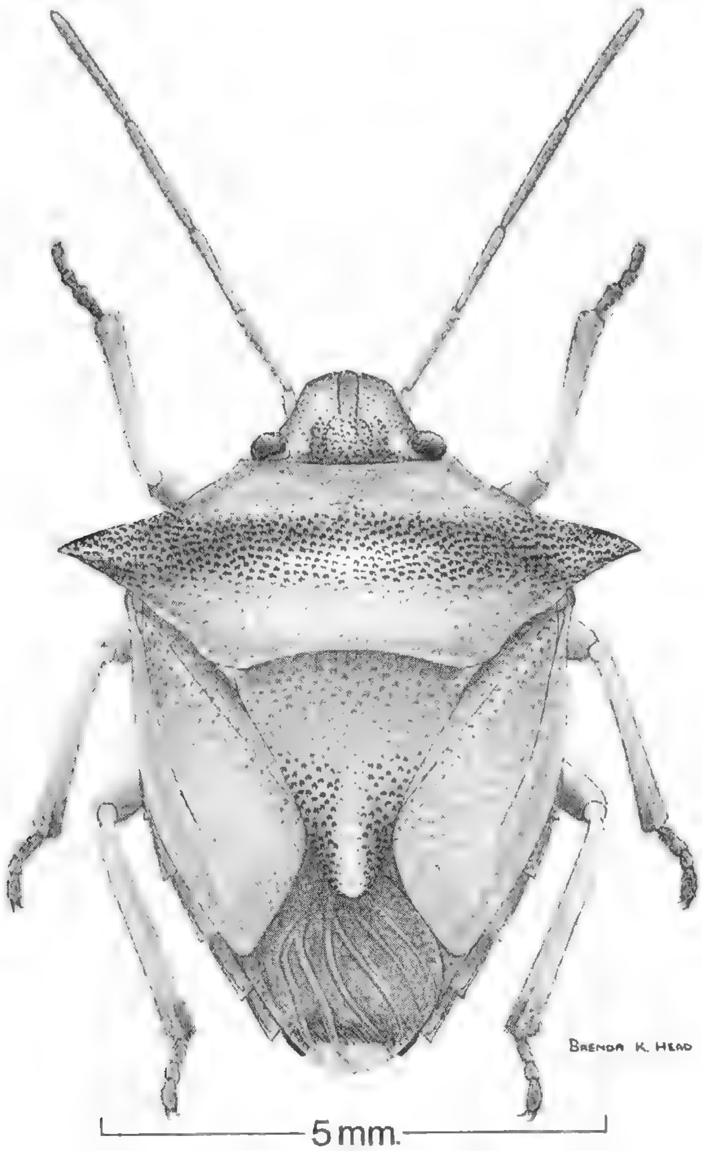

Fig. 39. Dorsal aspect of *Cuspicona apothoracica* sp. nov.

antennae, underside of head, rostrum, apices of tibiae, and tarsi brown. Basally on head, across transverse band on pronotum and laterally near apex of scutellum black punctate.

Head: Brown and slightly convex above; in both sexes black punctations restricted to three basal black longitudinal bars, if punctations present in front of anterior margins of eyes then sparse and not reaching apex. Lateral margins and most of apical portion with concolorous punctations. Eyes and ocelli purplish red.

Pronotum: Green in life, yellowish or pale yellow brown in museum specimens; dorsal surface of lateral angles and a broad transverse band between them brown with numerous black punctations, this band of punctations about seven punctations wide medially, anteriorly and posteriorly to this band finely and concolorously punctate except on glabrous calli. Anterior margin oblique behind eyes and deeply concave behind collum, anterolateral angles produced into a small tooth. Anterolateral margins obtuse, straight and diverging in anterior half; posterior half, with lateral angles, produced into a conical slightly recurved process directed outwards and only a little upwards, about 75 per cent length of posterolateral margin, its basal diameter about 50 per cent length of posterolateral margins. Posterolateral margins obtusangulately angulate and sinuate, posterior margin broadly convex.

Scutellum: Green in life with a broad orange-luteous median fascia in apical 2/5, in museum specimens the green areas change to yellow or yellowish brown. Laterally to apical pale streak an elongate triangular patch of black punctations on each side beginning at about base of pale streak and continued almost to apex, there tending to continue on to the apically rounded portion as a narrow band one or two punctations wide. No fovea at base of lateral margins, latter broadly convex in basal half, then broadly and slightly convex to rounded apex. Frena reaching past half length.

Hemelytra: Green in life, yellow in museum specimens, coarsely and concolorously punctate. Exterior margin of corium concave in basal quarter then broadly rounded to very shortly rounded apical angle, posterior margin nearly straight, inner angle broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: Green in life, yellow in museum specimens, upper margins of male pygophore with some black markings.

Laterotergites: Concolorous, posterior exterior angles with a small reflexed spine.

Underside: Concolorous but in life head rather yellowish, abdomen medially towards base, thoracic sterna and their keels lightened in colour. Antennae, most of rostrum, apical half of pronotal spines, apices of tibiae, tarsi and pygophore brown. Rostrum ventrally and most of apical segment and pronotal spines apically black.

Bucculae not reaching base and not even to middle of eye, strongly sinuate, produced into an acute triangular lobe anteriorly. Rostral segment I robust, just surpassing apex of bucculae, II slightly arched and reaching mid coxae. III to hind coxae, IV to base of abdominal segment III. Ratio of antennal segments I-V 9 : 16 : 19 : 23 : 24. Episterna and epimera nearly glabrous, propleuron sparsely punctate anteriorly and posteriorly and with some black punctuations on underside of pronotal spine, metapleuron punctate posteriorly. Metasternal-mesosternal keel reaching over apex of prosternum to apex of latter, higher anteriorly than posteriorly, its interior margin only slightly convex, deflected to the left in ventral view. Femora normal, tibiae rather flattened exteriorly in apical quarter. Abdomen fairly densely punctate laterally and more sparsely on female external genitalia, medially impunctate, rounded in posterior view but ventrites V-III progressively more V-shaped. Apex of male abdomen Fig. 36 A, apical margin of pygophore convexly rounded laterally and broadly concave medially. Clasper Fig. 40 C, rather F-shaped. Aedeagus Figs. 40 A-B, phallosoma only lightly sclerotized, conjunctiva produced apically into two tubular lobes which cross over each other in dorsal view, "lappet" processes elongate and directed downwards in their basal portion. Medial penial plates strongly inverted Y-shaped, their ventral surfaces sinuate, gonopore opening between them. Apex of female abdomen Fig. 36 B, hind margins of first gonocoxae faintly concave and rather oblique.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	25	34	1·4	3·9	32-38
Head width	25	36	1·3	3·5	34-39
Antennal segment I	34	9	0·4	4·3	8-10
Antennal segment II	32	16	1·0	6·3	14-17
Antennal segment III	32	19	1·1	5·6	15-21
Antennal segment IV	26	23	1·3	5·7	21-26
Antennal segment V	21	24	1·4	6·0	20-26
Pronotum width	25	104	5·4	5·2	99-125
Pronotum length	25	28	3·4	11·9	23-36
Total length	25	130	8·9	6·9	116-140

Dimensions—

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	32	37	1·5	4·0	34-39
Head width	32	38	1·1	2·8	37-41
Antennal segment I	37	9	0·2	2·6	8-10
Antennal segment II	40	15	1·2	8·1	13-18
Antennal segment III	40	18	1·4	7·7	16-21
Antennal segment IV	35	22	1·3	5·9	20-24
Antennal segment V	23	23	0·9	3·9	21-24
Pronotum width	32	113	5·0	4·4	106-128
Pronotum length	32	29	2·8	9·6	24-36
Total length	32	139	7·1	5·1	123-15[illegible]

Total length: 6·0-8·1 mm

Remarks: *Cuspicona apothoracica* is very similar in appearance to *C. thoracica* and very easily confused with the latter. The salient differences are:—

thoracica

Head in males extensively marked with black punctations over most of dorsal surface and to lateral margins.

Head in females with dorsal black punctations basally and also submarginally. Scutellum in both sexes with a short triangular patch of black punctations on either side which do not reach near to apex.

Ratio of antennal segments I-V 9:16:19: 20:21.

Posterior outline of male pygophore from below with a truncate or slightly concave lobe on either side separated by a concave area medially, the lateral and medial regions separated by an angle (Fig. 36 C).

apothoracica

Head in males usually only black punctate in region between eyes. If black punctations present in anterior portion of disc then sparse and marginal areas concolorously punctate.

Head in females with dorsal black punctations restricted to basal area, marginal areas concolorously punctate. Scutellum in both sexes with an elongate triangular patch of black punctations on either side which extend almost to apex of scutellum.

Ratio of antennal segments I-V 9:16:19: 23:24.

Posterior outline of male pygophore from below with a convex lobe on either side running smoothly into a concave area medially (Fig. 36 A).

Apothoracica (Fig. 38 B) has almost the same distribution as *thoracica*, occurring only near the coast in central and eastern Victoria, eastern New South Wales and south eastern Queensland.

Location of types:

Holotype ♂, Acacia Ridge, Brisbane, Queensland, 17.IX.1964, A. Neboiss; paratypes:—♂, Burleigh, Queensland, 28.IX.1960, A. N. Burns; ♀, same locality and collector, 18.IX.1960; ♀, North Queensland, from C. French Jun., 19.XI. 1911; ♂, Buchan, Victoria, Oct. 1907, N. V. Leach; 2♂, Thurra River, Cape Everard, Victoria, 29.X.1970, A. Neboiss; ♀, 17 km S.E. of Merrijig on 8 Mile Creek off Howqua River, Victoria, 1.XII.1971, A. Neboiss; ♀, Montrose, Victoria, 25.XI.1945, P.B.; ♀, Beaconsfield, Victoria, 8.XII.1933, G. F. Hill; 2♀, Ringwood, Victoria NM; allotype ♀ (Reg. No. I20,678), Glenmaggie Weir, Victoria, 14. IV.1957, F. E. Wilson; paratypes:— ♀ (Reg. No. I20,679), by sweeping, 1·6 km west of Apollo Bay, Victoria, 19.I.1962, G. F. Gross; ♀ (Reg. No. I20,680), Seaford, Victoria, W. F. Hill; 2♀, (Reg. Nos. I20,681-2), Bribie Island in Moreton Bay, Queensland, Lea and Hacker SAM; ♂, Brisbane, Queensland, 6.X.1914, H. Hacker; 3 ♂, 1♀, Birkdale, Brisbane, Queensland, 7.IX.1926, H. Hacker; ♀, Stanthorpe, Queensland, 26.X.1930, E. Sutton QM; ♂, Glen Aplin, Queensland, 4.VII.1964, P. Kerridge; ♀, Nth. Stradbroke Island, Queensland, 20.IV.1968, T. Weir; ♂, Caloundra, Queensland, 21.III.1972, G. B. Monteith; ♂, on *Leptospermum*, Tibrogargan Creek, Queensland, 4.IX.1953, T. E. Woodward UQ; ♂, Pt. Macquarie, New South Wales, 25 Aug.-14 Sept. 1941, H. W. Simmonds; ♂, La Perouse, Sydney, New South Wales, G. H. Hardy; ♂, Sylvania, New South Wales, Oct. 1934, Dr. K. K. Spence AM; 1 ♂, 3 paratype ♀, Mannus near Tumbarumba, New South Wales, 1.XII.1930, T. G. Campbell; ♀, 18 km south of Forster, New South Wales, 17.X.1956, P. B. Carne; ♀, Blundells, Australian Capital Territory, T. G. Campbell; ♂, 6 km north of Briagolong, Victoria, 13.XII.1949, T. G. Campbell, ♀, shaken from *Hakea sericea* Schrad, Mount Oberon, Wilson's Promontory, Victoria, 5.IX.1967, S. Neser; ♀, shaken from *Hakea sericea* Schrad in flower. Story Creek, Cann River, Victoria, 9.IX.1967, S. Neser ANIC; ♂, Brisbane, Queensland, 4.IX.1914, H. Hacker, Brit. Mus. 1923-313; ♀, North Narrabeen, New South Wales, 27.X.1957, M. I. Nikitin; ♀, cliff over Pacific Ocean, North Narrabeen, New South Wales, 13.II.1960, B.M. 1960-619; ♀, Bulli Pass, New South Wales, 20.XI.1948, E. B. Britton; ♀, by net sweeping on river banks, Loddun River near Bulli, New South Wales, 1.X.1959, N. Nikitin BM 1960-203; ♀, Dorrigo, New South Wales, W. Heron, BM 1935-46; ♀, Sydney, New South Wales, Distant Coll. 1911-383; ♀, New South Wales, presented by Perth Museum B.M. 1953-629; ♀, unlocalised BM; ♀, New South Wales AMNH; 7 ♂, 5 ♀, Brisbane, 1910, Sept. 1915 and 15.IX.1915, *ex* Bridwell Coll.; 2 ♂, Stradbroke Island, Moreton Bay, Queensland, 20.IX.1915, J. C. Bridwell; 1 ♂, 1 ♀, Botany Bay, New South Wales, H. Petersen, *ex* C. F.

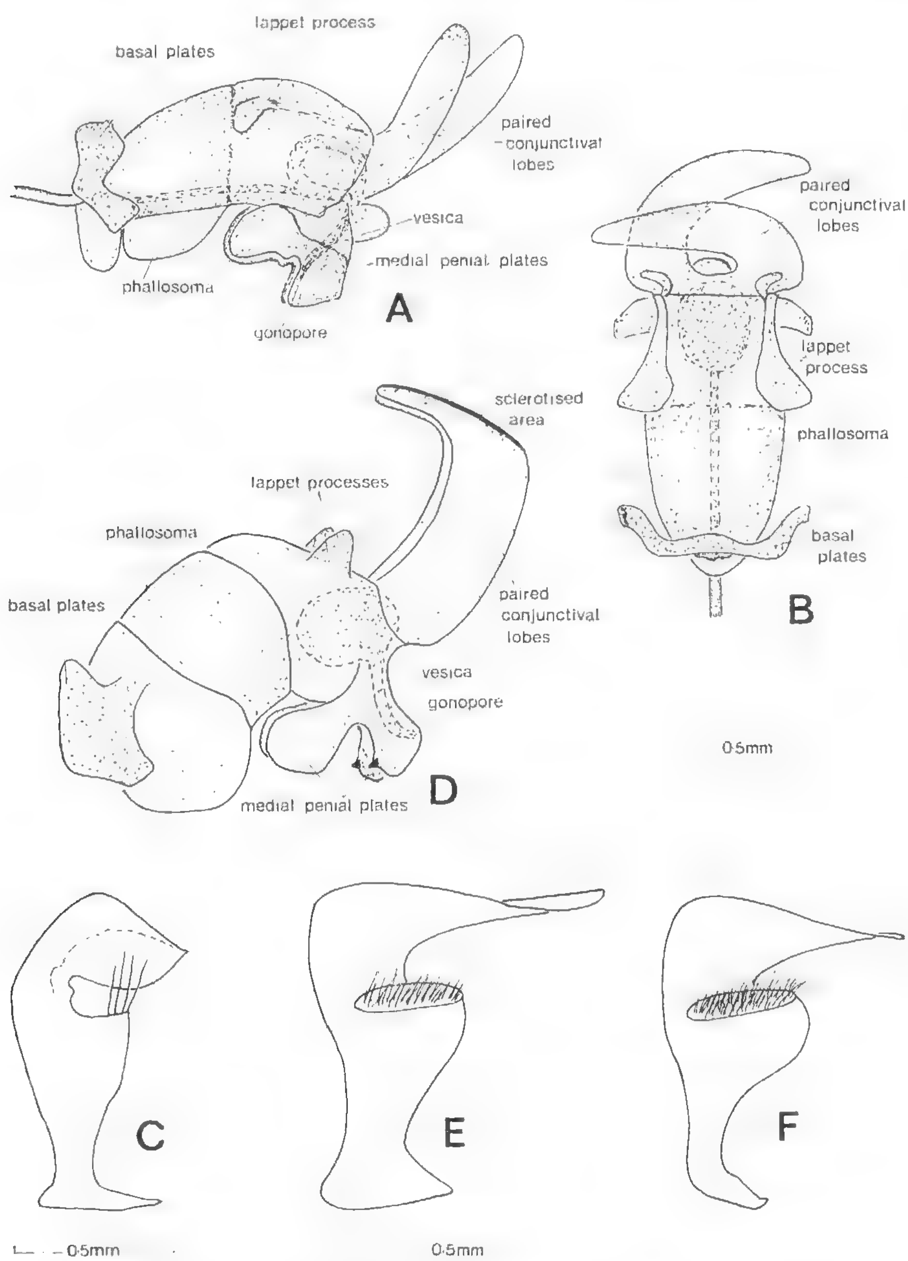

Fig. 40. *Cuspicona apothoracica* sp. nov., *Cuspicona strenuella* Walker. A-C. *Cuspicona apothoracica*. A. lefthand aspect of aedeagus. B. dorsal aspect of aedeagus. C. clasper. D-F. *Cuspicona strenuella*. D. lefthand aspect of aedeagus. E. clasper of usual individual. F. clasper of rather unusual Queensland example.

Baker Coll. 1927; ♂, National Park, New South Wales, 15.II.1957, W. W. Wirth; ♂, Bacchus Marsh, Victoria, *ex* G. W. Kirkaldy Coll, 1919 USNM; ♀, Stradbroke Island, Queensland, 2.X.1911, H. Hacker; ♀, Brisbane, Queensland, 10.VIII.1913, H. Hacker KU; 2 ♀, Sydney, New South Wales, Oct. 1903, *ex* Helms Coll. 1 ♂, 2 ♀♀, National Park, New South Wales, Dec. 1905, *ex* Helms Coll. BISHOP.

Specimens examined: The type series only.

Cuspicona strenuella Walker, 1867

Figs. 40 D-F, 41, 43 E-F

Cuspicona strenuella Walker, 1868, p. 572.
Cuspicona beutenmülleri Van Duzee, 1905, p. 208, pl. 8, Fig. 10. *New synonym.*

Description:

General appearance: Ground colour rather greenish brown in life with anterior half of scutellum, corium, clavus, a patch on propleuron,

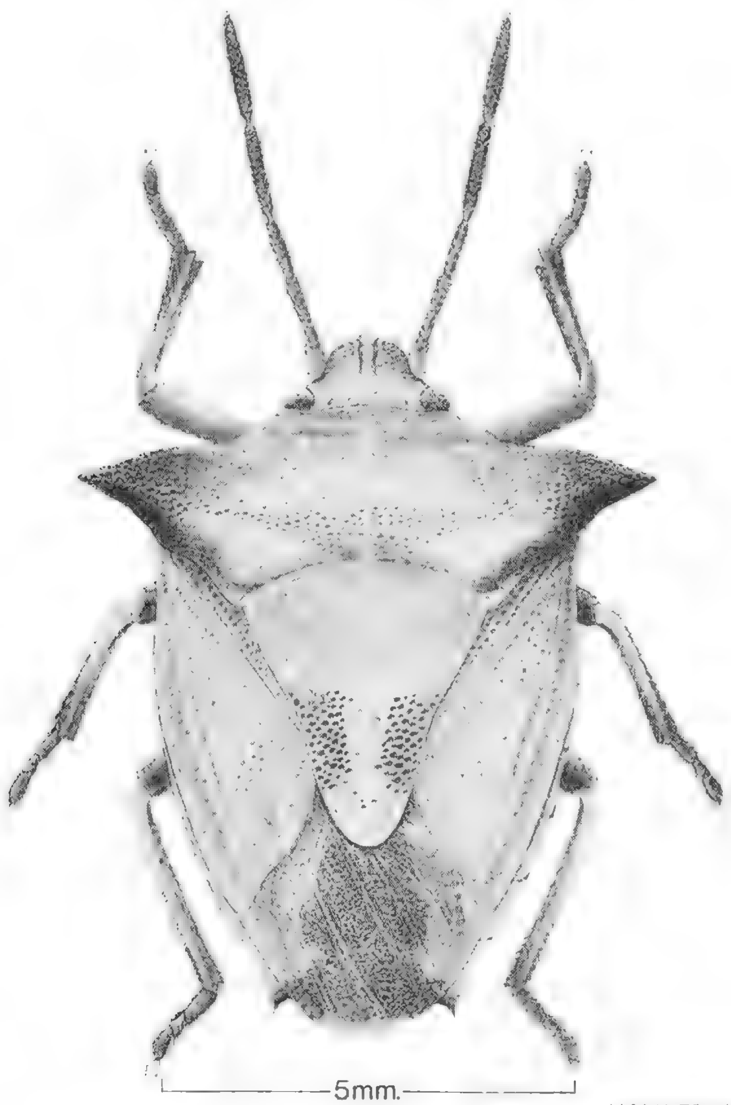

Fig. 41. Dorsal aspect of *Cuspicona strenuella* Walker.

tibiae medially, embolium and abdomen (laterally) green. Lateral angles of pronotum produced into conical spines, latter black punctate and infuscated towards apices; black punctations in two patches laterally near middle of scutellum; femora maculated with brown.

Head: Greenish brown, evenly punctate; eyes and ocelli reddish or purplish. Lateral margins frequently with black punctations.

Pronotum: Greenish brown, anterolateral margins frequently with black punctations. Spinous lateral angles infuscated towards apices, dark punctate in their basal posterior portions, occasionally these punctations extending transversely across pronotal disc as a narrow band two or three punctations wide, more frequently a quadrate patch of black punctations medially near posterior margin. On each side from base of each lateral spine an oblique luteous fascia reaching posterior margin near middle. Anterior margin oblique behind eyes and sinuously excavate behind collum. Lateral margins straight or slightly convex and diverging posteriorly in anterior half; posterior half, with lateral angles, produced into a conical, slightly recurved spinous process directed outwards and upwards, about as long as posterolateral margin, its basal diameter rather less than length of posterolateral margin. Posterolateral margins slightly angulately concave, posterior margin broadly concave.

Scutellum: In life anterior half green and posterior half luteous, medianly luteous produced forward a little into the green. On either side of scutellum a quadrate patch of dark punctations, their centre just behind midlength of lateral margins, some sparse dark punctations in apical portion. No fovea at base of lateral margins, latter broadly convex in basal third, then very broadly and slightly convex to broadly rounded apex. Frena reaching about half length.

Hemelytra: Coriaceous parts green in life, rather sparsely and coarsely punctate. Exterior margin of corium concave in basal quarter then broadly rounded to shortly rounded apical angle, posterior margin nearly straight, inner angle broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: Reddish green above with a medial broad black stripe extending back from well before apex of scutellum, genital segment black and reddish green above.

Laterotergites: Green in life, posterior margin of VIIth narrowly black. Posterior exterior angles of all segments nearly rectangular with only a fine short spine.

Underside: Luteous; a callous green patch on propleuron just behind eye and narrower than latter, extending back only a little more than half length of segment, most of basal 2/3 of tibiae (except extreme bases), a triangular patch in posterior portion of metapleuron and a broad lateral band on abdomen with its inner edge irregular also green, in males also a dark patch, perhaps green in life, more ventrally on either side and extending over ventrites III-V, separated from the lateral patch by a narrow luteous bar. Antennal segments II-V darker, II-III strongly maculated with brown as are femora and tibia of last two pairs of legs. Fore femora and tibiae less densely maculated. A bar on the dorsal surface of antennifer and another along base of bucculae frequently black as are ventral surface and most of last segment of rostrum and a series of lateral spots, one each at outer ends of sutures between episterna and epimera and one each on abdominal segments IV-VII, just behind each suture. Sometimes more ventral spots on the fourth and fifth ventrites. Mesosternal keel hyaline, metasternal keel sometimes darker.

Bucculae not quite reaching base of head, strongly sinuate, produced into an obtuse lobe anteriorly. Rostral segment I robust, surpassing bucculae and reaching to anterior portion of prosternum; segment II compressed and curved, reaching to mid coxae; segment III reaching hind coxae and IV onto III rd abdominal ventrite. Ratio of antennal segments 10:17:17:24:25. Proepisterna and proepimera and posterior outer portion or propleuron lightly punctate with reddish black, mesepisterna and metepisterna lightly punctate with fuscous as is extreme hind margin of metapleuron. Mesosternal keel projecting over prosternum to a little past its apex, higher and thinner anteriorly, deflected to left anteriorly in ventral view. Femora normal, tibiae rather flattened exteriorly in their apical third. Abdomen inpunctate except on external genitalia but rather finely rugulose, rounded in posterior view but ventrites VI-III progressively more carinate. Apex of male abdomen Fig. 43 E, apical margin of pygophore sinuate and medianly rather rectangularly excavate, slightly reflexed. Clasper Fig. 40 E-F, strongly F-shaped. Aedeagus Fig. 40 D, phallosoma only lightly sclerotized; conjunctiva produced apically into two paralleled tubular lobes directed rather upwards and apically constricted, their posterior margins in the constricted region sclerotized: "lappet" processes small, medial penial plates shaped like an inverted Y, a small tooth on posterior margins of interior branches. Gonopore located between them. Apex of female abdomen Fig. 43 F, hind margins of first gonocoxae transverse but "stepped", the inner halves lying more anteriorly than the outer sections.

Dimensions

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	14	38	2·0	5·4	35-42
Head width	14	39	0·8	2·1	38-40
Antennal segment I	20	10	0·7	6·8	8-10
Antennal segment II	21	17	1·5	8·8	15-20
Antennal segment III	21	17	1·1	6·2	15-19
Antennal segment IV	12	25	1·1	4·2	23-27
Antennal segment V	9	26	1·5	5·7	24-28
Pronotum width	14	129	7·6	5·9	120-140
Pronotum length	14	32	2·6	8·1	26-35
Total length	13	159	9·5	6·0	140-177

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	25	41	2·8	6·8	33-44
Head width	25	41	1·6	3·9	37-44
Antennal segment I	38	10	0·7	7·3	8-11
Antennal segment II	38	18	1·5	8·2	15-20
Antennal segment III	38	16	1·6	10·2	13-20
Antennal segment IV	26	24	1·7	7·2	20-28
Antennal segment V	22	24	1·6	6·7	21-28
Pronotum width	25	138	8·8	6·4	121-152
Pronotum length	25	37	3·9	10·7	31-43
Total length	25	175	12·5	7·2	155-210

Total length: 7·3-10·9 mm

Remarks: One male Queensland specimen to hand of this species is rather smaller than the other material, the pronotum anteriorly has a longitudinal pale callus and the shape of the clasper appears to be rather different to that seen in the other specimens dissected. This Queensland form may represent a distinct subspecies but one specimen is not adequate to determine that this is so. Consequently it is not so considered here. the dimensions of this male is: head length 36; head width 36; antennal segment I 8; antennal segment II 18; antennal segment III 13; antennal segment IV 25; antennal segment V 27; pronotum width 115; pronotum length 30; total length 139 (7·2 mm.).

The types of both *strenuella* Walker and *beutenmülleri* Van Duzee have been examined, and, although females, clearly represent this one species.

Location of types:

Type ♀ of *strenuella*, Walker, without locality BM; type ♀ of *beutenmülleri* Van Duzee, "Victoria", AMNH.

Specimens Examined: Queensland ♂, Mt. Norman area via Wallangarra, 7-8.X.1972, G. B. & S. R. Monteith UQ; 3♂, unlocalised, from C. French Jun. 15.XI.1911 NM; New South Wales 1♀, Ebor. 3.XII.1915 QM; 1♀, Jindabyne, 1 000 m, Mar. 1889, Helms; 1♀, Mannus near Tumbarumba, 1.XII.1950, T. G. Campbell; 1♂, Dorrigo, Feb. 1929, W. Heron, K 59373, AM; 2♂, Abercrombie River, 80 km north of Goulburn, 27.XI.1967, Britton and Misko ANIC; 3♀, Dorrigo SAM; 2♀, The Dorrigo, 1 000 m, W. Heron; 1♀, near Sydney, Wheeler AMNH; 1♀, 3 km west of Kioloa, 90 m, 17.XII.1962, E. S. Ross & D. O. Cavagnaro CA; 1♂ National Park, 29.IX.1902, Helms Collection, Bishop; Australian Capital Territory 4♂, 1♀, Blundells, 30.III.1930, T. G. Campbell; 1♀, Blundells, 30.VIII.1933, T. G. Campbell ANIC; Victoria 1♂, Emerald, Sept. 1930, J. Evans ANIC; 3♀, Ringwood; 1♀, Trafalgar, 9.VI.1930, F. E. Wilson; 1♀, Murrindini, 24.III.1971. A. Neboiss; 1♂, Wallan, 25.XII.1956, F. Hallgarten, NM; 1♂, Croydon, 24.XII.1948, N. B. Tindale; 1♀, Port Campbell, Nov. 1959, G. F. Gross SAM; 1♀, Launching Place, 17.I.1905, Bueno via Van Duzee Collection CA; Tasmania 1♀, Dulverton, Mar. 1972 ANIC; South Australia 1♀, Mylor, J. Formby, K56187 AM; 1♀, Glen Stuart, 9.XII.1893, Tepper; 1♂, Magill, 13.X. 1883, on *Aster* sp, Tepper; 1♀, no locality or date, Rev. A. P. Burgess SAM; 1♂, 1♀, no other data AMNH; Unlocalised 1♂; 1♀, *ex* C. French Jun. 15.XI.1911 NM; 1♀, Austral bor., Thorey; 1♀, Australia, Boutard; 1♀, Nov. Holl., Ekeberg, Stockholm.

Cuspicona longispina sp. nov.
Figs. 42, 43 C-D.

Description:

General appearance: Ground colour green in life with head and antennae, most of pronotum, apical half of scutellum, dorsum of abdomen, brownish, yellowish or cream coloured as also on underside of head, rostrum, most of prothorax, half of mesothorax, ventral regions of metathorax and abdomen, bases of femora and apices of tibiae. Head and anterior part of pronotum strongly deflexed. Lateral angles of pronotum produced into long spines, on dorsal surface of spines and across disc of pronotum between spines a band of black punctates five or more punctations wide.

Head: Brownish yellow, extreme lateral margins with some blackish punctations, eyes and ocelli purplish red. Disc evenly and finely punctate, rather raised medially, more so towards base than apex.

Pronotum: Brownish with apices of lateral spines black and a broad row of punctations on spines basal to black tips and then running transversely across pronotum black, this row more than five punctations wide in centre of disc. In fresh specimens a green trapezium shaped patch anteriorly not reaching anterior or lateral margins, calli glabrous, located in the green area. Anterior margin oblique behind eyes and rather rectangularly excavate behind collum. Anterolateral margins straight, obtuse, and diverging posteriorly in anterior half; posterior half, with lateral angles, produced into a long, conical acute tipped spinous process which is directed outwards and somewhat upwards, these spines about 50 per cent longer than posterolateral

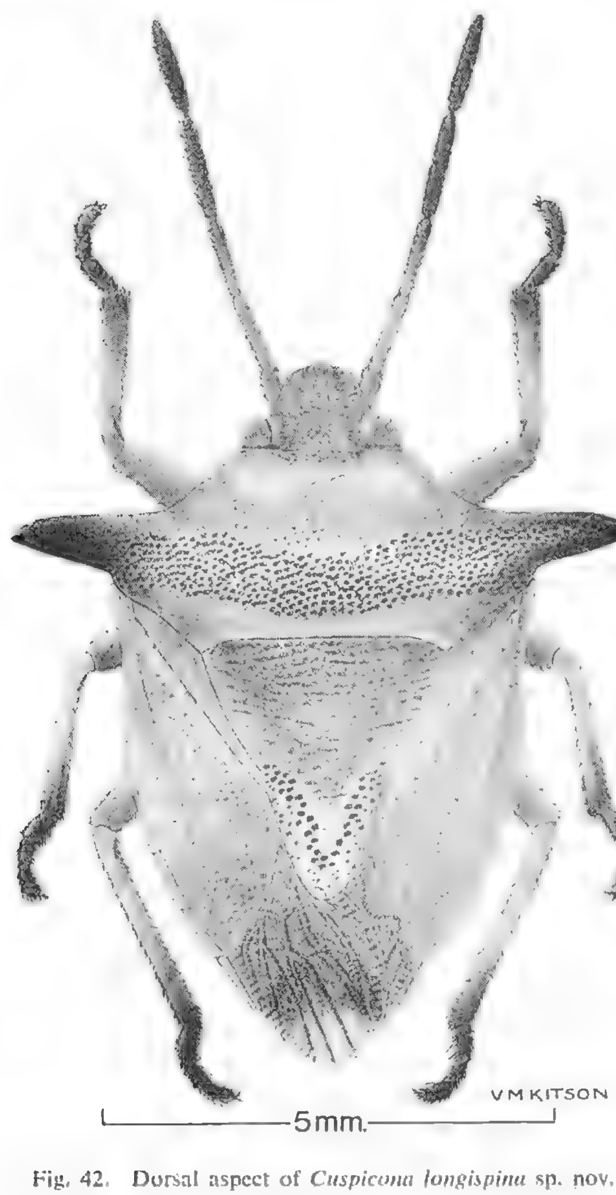

Fig. 42. Dorsal aspect of *Cuspicona longispina* sp. nov.

margins, their basal diameters about 25 per cent less than length of posterolateral margins. Posterolateral margins obtusangulately concave, posterior margins broadly concave.

Scutellum: In fresh specimens a basal green triangular patch more or less in the shape of scutellum itself but not reaching lateral margins nor further than three quarters of the length, laterally to this bright yellow, in posterior third to one quarter of scutellum cream coloured with coarse black punctations tending to be concentrated near midline. No fovea at base of lateral margins, latter broadly convex in basal half then almost straight to broadly lanceolate apex. Disc only slightly raised basally. Frena reaching about half length.

Hemelytra: Coriaceous parts green in life, fading to brown in museum specimens, coarsely punctate. Slightly narrower than abdomen in apical two thirds; exterior margin of corium concave in basal quarter then broadly convex to nearly acute apical angle, posterior margin of corium nearly straight, inner angle broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: Not clearly seen in any of the specimens but apparently brownish yellow with some paired black marks behind apex of scutellum.

Laterotergites: Green in life, posterior exterior angles of segments nearly rectangular.

Underside: Head, first, second and most of third antennal segments and most of rostrum brownish yellow; apex of third antennal and fourth and fifth antennal segments brown; rostrum ventrally and most of its apical segment black, a reddish patch ventrally near base of second segment. Prothorax rather cream coloured with black spots course on underside of lateral spines and less dense on propleuron. Above proepisternum and proepimeron a glabrous concolorous patch and exterior to this a rhomboidal callous green patch reaching to anterior margin, almost to exterior margin but widely separated from posterior margin. Mesothorax mostly cream coloured with posteriorly a narrow nearly quadrate green patch reaching exterior margin. Metathorax broadly cream coloured ventrally, laterally green, the inner margin of this green in line with inner margin of green mesothoracic patch. Metasternal-mesosternal keel semihyaline. Coxae and bases of femora cream coloured, rest of femora and bases of tibiae green, apical 2/5 of tibiae yellow, tarsi and claws brown. Abdomen with whole external genitalia broadly pale cream coloured medially, laterally green.

Bucculae reaching base of head, convexly curved, produced into a rather triangular lobe anteriorly. Rostral segment I robust, reaching base of head, segment II arched and reaching mid coxae, segment III to base of abdomen and IV to base of abdominal ventrite V. Ratio of antennal segments 9:17:16:22:22. Propleuron sparsely punctate except on green area, mesopleuron sparsely punctate on mesepisternum, metapleuron sparsely punctate on metepisternum. Metasternal-mesosternal keel projecting over prosternum to a little past its apex, higher and thinner anteriorly, deflected a little to left anteriorly in ventral view. Femora normal, tibiae slightly flattened apically on exterior surface. Abdomen impunctate, rather rounded in posterior view but ventrites VI-III progressively more carinate ventrally. Apex of male abdomen Fig. 43 C, pygophore with posterior margin shallowly concave in middle, laterally slightly sinuate, rather broadly and slightly reflexed. Apex of female abdomen Fig. 43 D, posterior margins of first gonocoxae sinuate, paratergites XI almost triangular.

Dimensions

	Holotype ♂	Paratype Males (Average of 6)	Paratype Females (Average of 6)
Head length	37	36	39
Head width	37	37	37
Antennal segment I	8	9	9
Antennal segment II	17	18	17
Antennal segment III	16	16	15
Antennal segment IV	21	22	22
Antennal segment V	23	23	21
Pronotum width	135	130	138
Pronotum length	32	30	35
Total length	145	139	145

Total length: 6·0-7·8 mm

Remarks: This species is rather similar to *thoracica* but differs in the much longer lateral spines on the pronotum, in the laterally green and ventrally luteous abdomen, the different shape of the male pygophore and the lack of black punctations on the disc of the head. It appears to replace *thoracica* and *apothoracica* in South Australia and Western Victoria.

Location of types:

Holotype ♂, 1 paratype ♂, North Beach, Wallaroo, South Australia, by beating flowering ti-tree (*Melaleuca* sp.), 12.II.1964, G. F. Gross SAM 120,633-4; allotype ♀, 1 paratype ♀, 6 km east of Two Wells, South Australia, beaten from

Melaleuca lanceolata Otto, 7.VII.1971, A. N. McFarland SAM I20,665-6; 1 paratype ♂, 1 paratype ♀, 6 km east of Two Wells, South Australia on *Callitris preissii* Miq., 6.IV.1968, A. N. McFarland SAM I20,667-8; 1 paratype ♂, approx. 5 km east of Two Wells, South Australia, on *Melaleuca*, 27.VIII.1966, A. N. McFarland SAM I20,669; 1 paratype ♂, Yarcowie, 26.IV. 1894, H. Mayer SAM I20,670; 1 paratype ♂, Summit of Hummocks Mount, in dense underscrub and trees, 30.V.1968, H. M. Cooper SAM I20,671; 1 paratype ♂, 1 paratype ♀, Murray River South Australia, H. S. Cope AM; 1 paratype ♀, Purnong on Murray River South Australia; 1 paratype ♀, Mallee, Northwest Victoria, donated 5.X.1922 F. P. Spry NM.

Specimens examined: The types only.

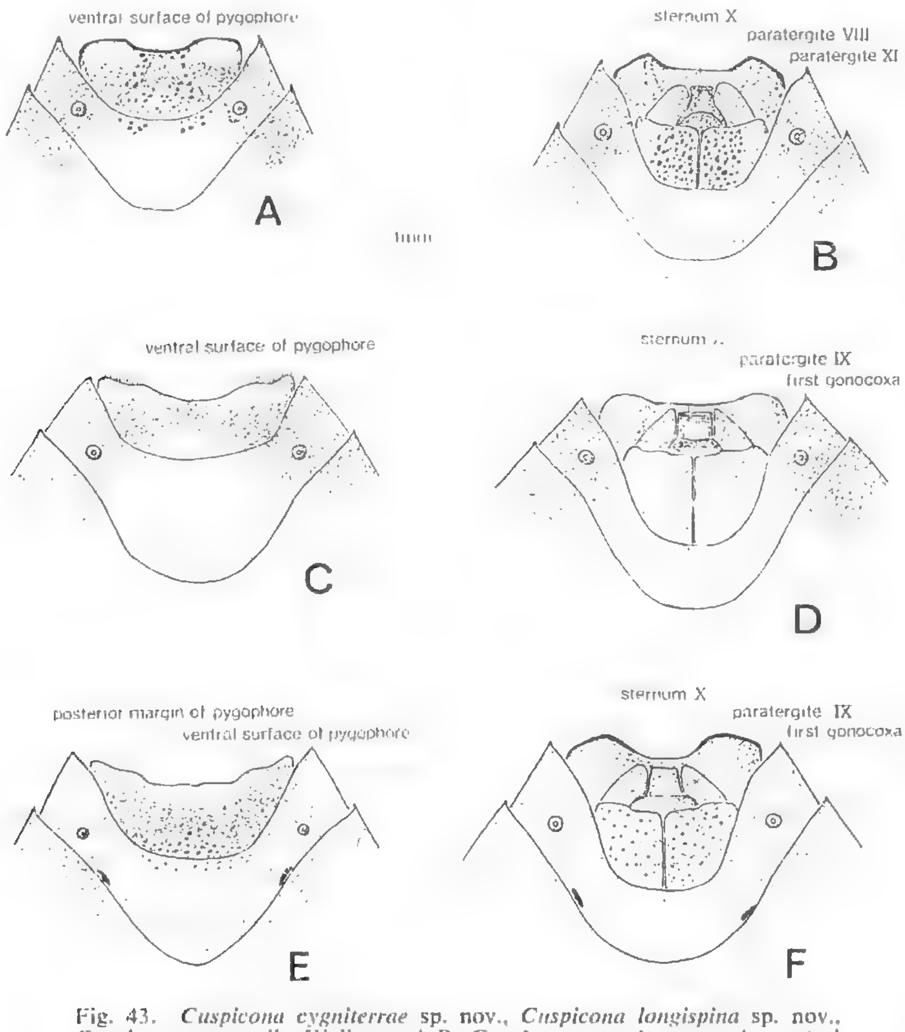

Fig. 43. *Cuspicona cygniterrae* sp. nov., *Cuspicona longispina* sp. nov., *Cuspicona strenuella* Walker. A-B. *Cuspicona cygniterrae*. A. ventral aspect of male abdomen. B. ventral aspect of female abdomen. C-D. *Cuspicona longispina*. C. ventral aspect of male abdomen. D. ventral aspect of female abdomen. E-F. *Cuspicona strenuella*. E. ventral aspect of male abdomen. F. ventral aspect of female abdomen.

Cuspicona cygniterrae sp. nov.

Figs. 43 A-B, 44.

Description:

General appearance: Ground colour brown in life with anterior half of scutellum, corium, clavus, laterotergites, legs (except apices of tibiae and tarsi), a patch on propleuron, and outer margin of abdomen (broadly) bright green. Rest of underside creamy coloured. Lateral angles of pronotum produced into long spines.

Head: Yellowish or greenish brown, evenly punctate; eyes and ocelli reddish or purplish. Relatively long in relation to its width.

Pronotum: Brown, apices of lateral angles black or reddish black, punctations reddish black, a broad longitudinal raised area in anterior half and calli glabrous, yellowish. Anterior margin oblique behind eyes and rather rectangularly excavate behind collum. Lateral margins straight and diverging posteriorly in anterior half, posterior half with lateral angles produced into a long, conical, acute-tipped spinous process up to about 75 per cent longer than posterolateral margin, its basal diameter about the same as length of posterolateral margin. Posterolateral margin only faintly concave, posterior margin broadly concave.

Scutellum: In life anteriorly greenish and posteriorly brown, normal length, raised basally and nearly flat in apical two thirds. No, or only a minute fovea at base of lateral margins, latter broadly convex in basal third, then very broadly and slightly convex to broadly rounded apex. Punctations rather sparse and concolorous in anterior portion and in midline in medial third, laterally a dense patch of reddish black punctations near middle, in apical quarter punctations sparse but reddish black. Frena reaching about half length.

Hemelytra: Coriaceous parts green in life, yellowish brown in museum specimens, rather sparsely and coarsely punctate, depressed and silvery glabrous just exterior to medial fracture. Narrower than abdomen in apical three quarters; exterior margin of corium concave in basal quarter then broadly rounded to shortly rounded apical angle, posterior margin of corium nearly straight, inner angle broadly rounded. Clavus elongate triangular. Membrane and veins hyaline.

Abdomen: In museum specimens anteriorly and laterally yellowish; medially (behind apex of scutellum) a black spot, then reddish to apex with some black patches margining the reddish.

Laterotergites: Yellowish or green, posterior margin of VIIth narrowly reddish black. Posterior lateral angles of all segments rather blunt.

Underside: Head, antennae and rostrum yellowish brown, latter darker ventrally and with terminal segment black in apical half. Thorax

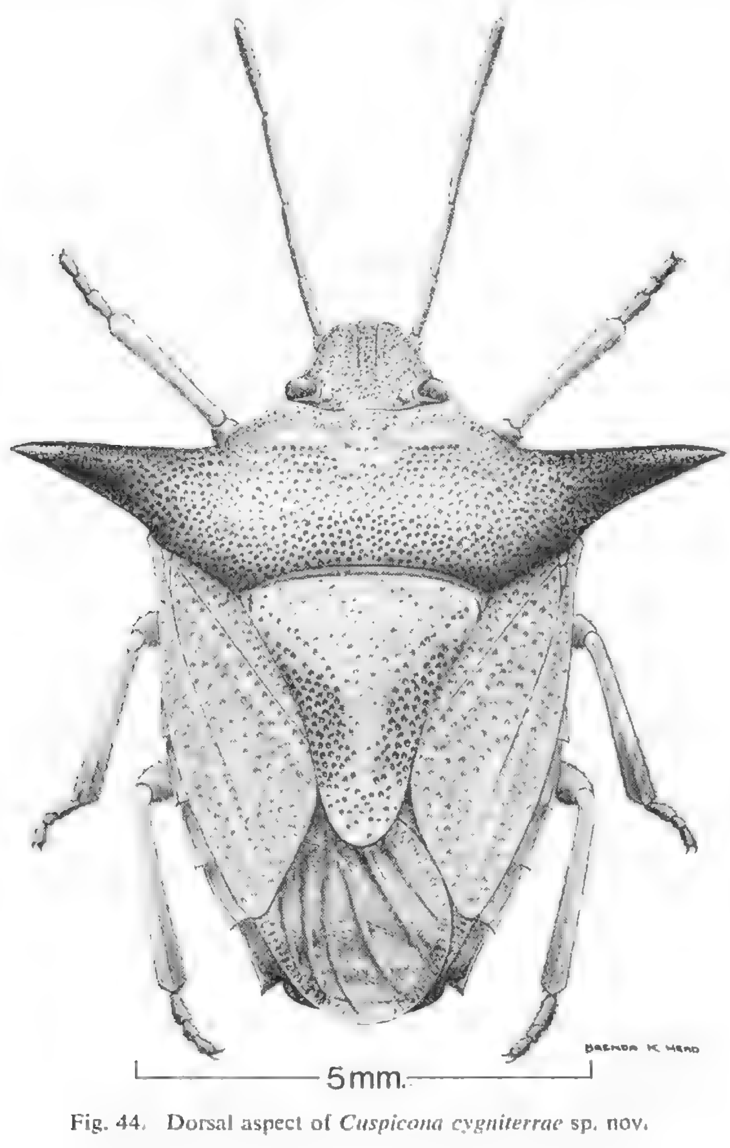

Fig. 44. Dorsal aspect of *Cuspicona cygniterrae* sp. nov.

and abdomen yellow but green areas as follows: femora and basal 2/3 of tibiae, a rather quadrate glabrous patch on propleuron behind eye but not reaching posterior margin of propleuron, a triangular region along outer portion of hind margin of metapleuron which extends forward on this segment as lateral margin is approached, a broad lateral band on abdomen with its interior edge sinuated. Tarsal claws black, apical half of lateral spine red, infuscated towards apex, metasternal-mesosternal keel hyaline. Pale portion of abdominal venter with faint pink maculations. In males medially on ventrite VII near its apex some black spots and apical margin and red markings. Female with reddish black spots on first gonocoxae and pale reddish marks on rest of external genitalia, hind margins of paratergite VIII lateral to median incision narrowly black.

Bucculae not reaching base of head, sinuate, produced into an obtuse lobe anteriorly. Rostral segment I robust, surpassing bucculae and reaching base of head, segment II reaching about middle of mid coxae, segment III to base of abdomen and IV to base of IVth abdominal ventrite. Ratio of antennal segments 9 : 15 : 13 : 21:21. Propleuron sparsely punctate on mesepisternum and mesepimeron along posterior margin, on underside of lateral spine strongly punctate, mesopleuron punctate only on mesepisternum, metapleuron punctate on episternum, epimeron and along posterior margin. Metasternal-mesosternal keel projecting over prosternum to a little past its apex, higher and thinner anteriorly, deflected to the left anteriorly in ventral view. Femora normal, tibiae rather flattened exteriorly in their apical third. Abdomen impunctate save where previously indicated, rather rounded in posterior view but ventrites V-III progressively more carinate medianly. Apex of male abdomen Fig. 43 A, pygophore with posterior margin medianly rather rectangularly excavate, posterior margin rather broadly and slightly reflexed. Apex of female abdomen Fig. 43 B, posterior margins of first gonocoxae rather concave.

Dimensions—

Parameter	Males (average of 2)	Females (average of 5)
Head length	32	37
Head width	34	36
Antennal segment I	9	9
Antennal segment II	16	15
Antennal segment III	11	14
Antennal segment IV	21	21
Antennal segment V	21	21
Pronotum width	128	137
Pronotum length	25	27
Total length	126	147

Total length: 6·6-7·6 mm

Remarks: *C. cygniterrae* resembles rather closely *C. longispina* in general appearance and in the possession of very long produced lateral angles of the pronotum. It is however distinguished from that species by not having a conspicuous transverse dark band of punctations running across the pronotum between the lateral angles, by having a conspicous patch of dark punctations on either side of the scutellum near its middle and by the more rectangularly excised hind margin of the pygophore.

C. cygniterrae, like *C. longispina*, also resembles *C. strenuella* but has longer lateral spines on the pronotum and differently shaped external genitalia. *C. cygniterrae* appears to occur only in Western Australia whereas *C. longispina* is found in South Australia and Western Victoria and *C. strenuella* ranges from South Australia to Queensland. The Thomas River specimen of *cygniterrae* has shorter lateral spines on the pronotum than the other examples.

Location of Types:

Holotype ♀, Kalamunda, Western Australia, 3.IV.1963, J. Dell WAM; 1 paratype ♀, Thomas River 100 km east of Esperance at 33° 51′ S 121° 53′ E, Western Australia, 20.XI.1969, E. B. Britton ANIC; allotype ♂, 1 paratype ♀, Mt. William, Western Australia, 250 m, 6.XI. 1963, J. Sedlacek Bishop; 1 paratype ♂, 1 paratype ♀, Swan River, L. J. Newman BM; 1 paratype ♂, 1 paratype ♀, Serpentine Dam near Jarrahdale, Western Australia 9.XII.1971, on *Agonis linearifolia* (DC) Schau, J. A. Slater in J. A. Slater Collection, Storrs, Connecticut, U.S.A.

Specimens Examined: The types only.

Simplex Group

The *simplex* Group of species includes a group of species ranging from the Philippines through Indonesia and New Guinea to Australia, New Zealand, Norfolk Island, New Caledonia and the New Hebrides. The species in this group are nearly completely grass-green in life with perhaps pinkish or reddish lateral angles of the pronotum and sometimes several of the other lateral margins as well. In museum collections most specimens fade to a characteristic light yellow colour with the pink areas persistent in colour. The lateral angles of the pronotum may be rounded (*privata*), obliquely truncate (*norfolcensis*), acute (*simplex*) or produced as a rather conical spine (*forticornis*). The hind margin of the corium is convex.

In all of the species the first gonocoxae of the female do not have a transverse or slightly concave posterior margin but instead this margin is produced posteriorly in its inner half, sometimes gently, sometimes almost rhomboidally.

There is a small but varied list of host plants from which members of this group have been captured but only plants of the family Solanaceae have been recorded more than once and in their case for four of the eight species of this group which occur in the area covered by this paper.

Further work on the male aedeagus pattern in *Cuspicona* may reveal that this group of species should perhaps be placed into a new genus of their own. However the dissections which could be done on members of the group do not reveal any apparent major differences from earlier mentioned species of *Cuspicona* and so far as I have been able to see nothing of the order of differences which distinguish *Ocirrhoe* species from species of *Cuspicona*.

Cuspicona privata Walker, 1867

Figs. 45, 46 A-D, 48 A-B.

Pentatoma viride Montrouzier, 1855, p. 98 (preoccupied by *Pentatoma viridis* Palisot de Beauville, 1811).

Cuspicona viridis Montrouzier and Signoret, 1861, p. 65. Stål, 1866, p. 156; 1876, p. 102. Lethierry and Severin, 1893, p. 181. Distant, 1920, p. 146.

Cuspicona privata Walker, 1867, p. 382. *New synonym but oldest available name.*

Cuspicona laminata Stål, 1876, p. 102. Lethierry and Severin, 1893, p. 180. Kirkaldy, 1905. p.357. *New synonym.*

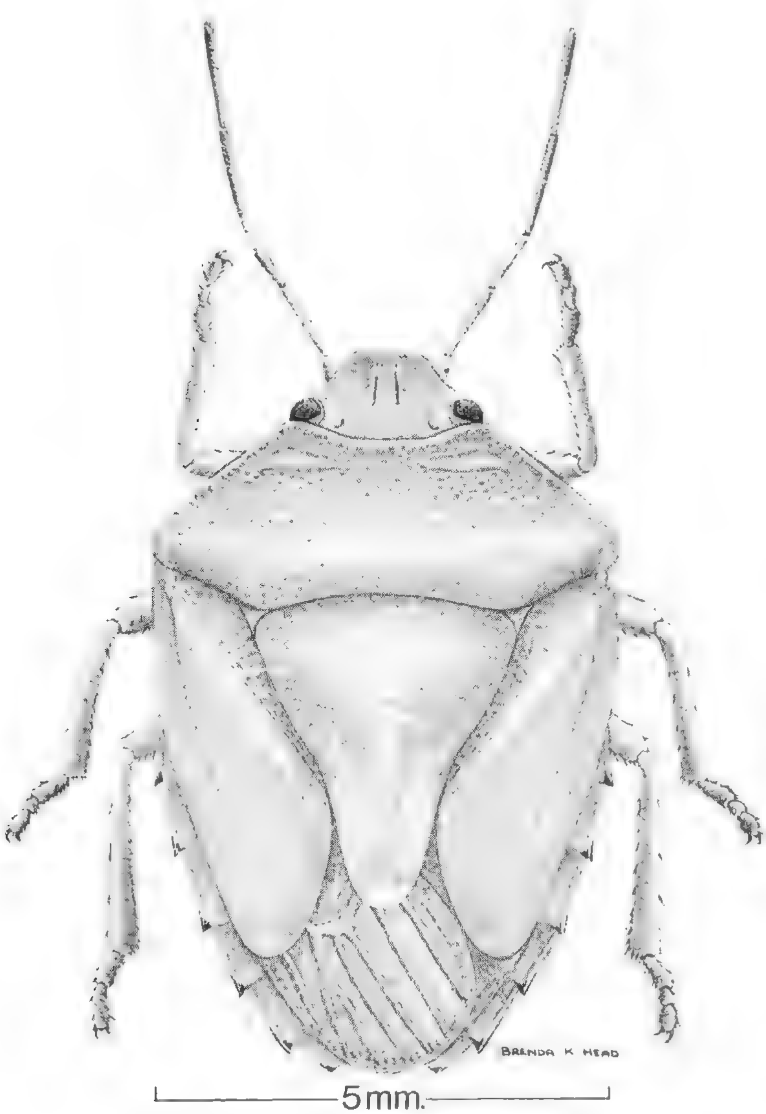

Fig. 45. Dorsal aspect of *Cuspicona privata* Walker.

Ocirrhoe privata Distant, 1900a, p. 422.

Cuspicona zeloma Kirkaldy, 1909, p. 143 (new name for *viride* Montrouzier).

Description:

General appearance: Ground colour bright green in life but museum specimens frequently yellowish. Punctation fairly fine and even over dorsal surface, on dorsum of head denser and appearing rugulose. Lateral angles of pronotum broadly rounded.

Head: Concolorous, densely punctate. Eyes and ocelli concolorous or blackish.

Pronotum: Concolorous though lateral angles sometimes slightly infuscated; latter broadly rounded. Anterior margin concavely excavate behind collum changing rather gradually to obliquely excavate behind eyes. Anterolateral margins nearly straight. Posterolateral margin concavely elongate, posterior margin only slightly concave. Punctations fine though not very dense, calli impunctate.

Scutellum: Concolorous; rather long; faintly raised basally and nearly flat in apical two thirds. Lateral margins with at base a concolorous fovea, slightly convex in basal half, then straight and gently converging then converging more strongly to apex. A trace of a medial impunctate line on disc.

Hemelytra: Coriaceous parts concolorous, finely but not so densely punctate, narrowly glabrous just interior to medial fracture. Narrower than abdomen in apical three quarters; exterior margin of corium faintly concave basally then broadly convex to apex; apical angle strongly convex, posterior margin convex. Clavus reaching to about middle of scutellum, elongate triangular. Membrane hyaline with veins same colour.

Abdomen: Concolorous; impunctate.

Laterotergites: Concolorous; sometimes impunctate sometimes with sparse punctations; apical angles with a small black tipped spine, those on seventh segment hardly longer than rest.

Underside: Mainly concolorous or tending somewhat lighter than upperside with antennae and apical segment of rostrum (except black apex) brown. Tarsal claws black in apical halves. Bucculae low and sinuate, reaching about base of head, anteriorly produced into a small angulate lobe. Rostral segment I robust, reaching to base of bucculae, II nearly straight and just surpassing fore coxae, III reaching nearly to second coxae, IV to about middle of hind coxae. Ratio of antennal segments I-V 8:17:14: 23:26. Propleuron coarsely punctate except

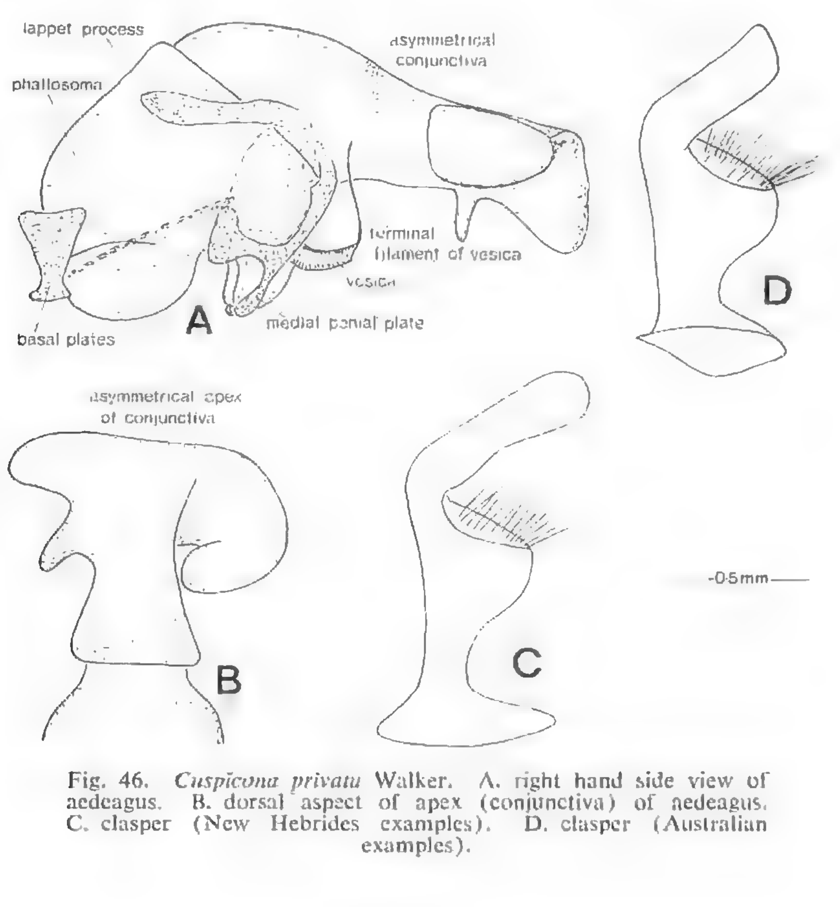

Fig. 46. *Cuspicona privata* Walker. A. right hand side view of aedeagus. B. dorsal aspect of apex (conjunctiva) of aedeagus. C. clasper (New Hebrides examples). D. clasper (Australian examples).

broadly along lateral margin and on proepisternum and proepimeron. Mesopleuron punctate only laterally in an anterior triangular area reaching from, and including, mesepisternum and with apex not reaching to exterior margin. Metasternum coarsely punctate only posteriorly. Metasternal-mesosternal keel reaching over prosternum but not to apex of latter, prosternum deeply sulcate under the keel, keel more elevated anteriorly than posteriorly. Femora normal, all tibiae rather flattened exteriorly in their apical quarter, first two pairs more obviously so than posterior pair; tarsi normal.

Abdomen only gently V-shaped in posterior view, coarsely punctate laterally, glabrous along midline and lateral margins. Apex of male abdomen Fig. 48 A, apical margin of pygophore rather angulately concave, above posterior margin a low forwardly inclined septum. Clasper Fig. 46 C-D, rather F-shaped, the upper ramus much longer in New Hebrides specimens (Fig. 46 C) than in Australian specimens (Fig. 46 D). Aedeagus Fig. 46 A-B, with basal plates rather slender though large, phallosoma only slightly sclerotized. Conjunctiva produced anteriorly into an asymmetrical lobe (shown clearly in dorsal view Fig. 46 B), produced dextrally into two short lobes and sinistrally into a larger reflexed lobe; "lappet" processes rather long and slender; a robust vesica with a terminal filament opens in front of the medial penial plates which lie laterally on a ventral membranous swelling. Apex of female abdomen Fig. 48 B, hind margin of first gonocoxae oblique and slightly concave, so that there is only a short obtuse interior lobe.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	27	32	1·6	5·1	30-34
Head width	28	37	1·2	3·7	34-41
Antennal segment I	41	8	0·7	8·2	7-10
Antennal segment II	49	17	1·6	9·7	14-21
Antennal segment III	49	14	1·9	13·8	11-20
Antennal segment IV	33	23	1·8	7·8	20-27
Antennal segment V	23	26	1·7	6·7	23-29
Pronotum width	28	96	6·7	7·0	85-119
Pronotum length	28	34	2·2	6·6	28-39
Total length	28	159	12·0	7·6	138-176

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	32	32	1·8	5·4	28-35
Head width	32	38	1·6	4·2	35-41
Antennal segment I	54	8	0·8	9·2	6-9
Antennal segment II	57	17	1·5	9·0	13-20
Antennal segment III	56	14	1·8	13·4	11-22
Antennal segment IV	50	23	2·4	10·8	18-29
Antennal segment V	38	26	2·1	7·9	20-30
Pronotum width	32	99	5·4	5·5	83-110
Pronotum length	32	35	2·6	7·5	27-41
Total length	32	166	12·4	7·5	148-190

Total length: 7·2-9·9 mm

Remarks: This is one of the most widely distributed species of the genus in this area, ranging from the New Hebrides through the Loyalty Islands and New Caledonia to Australia and in Australia from Queensland to Victoria. The only records on plants are from ferns and blackberries.

The aedeagus is singular in the genus in that the conjunctiva apically is produced laterally but asymmetrically with two lobes, one the right hand side (as seen from the rear and looking forward) bifid and one larger entire reflexed lobe on the left hand side.

As the claspers of New Hebrides examples have the upper ramus much longer than in Australian examples a case could be made for a subspecific difference here. However, as we do not yet know the shape of the claspers in Loyalty Island or New Caledonian examples it would be premature to create subspecies at this time.

Location of types:

Type of *Pentatoma viride* Montrouzier, "Woodlark I.", not located; holotype ♀ of *Cuspicona privata* Walker, "Aneityum, New Hebrides", in BM; holotype of *Cuspicona laminata* Stål, "New Caledonia", in Stockholm.

Specimens examined: New Hebrides the type of *privata* Walker and 1 ♀, Aneityum, Nov. 1930, L. E. Cheesman, BM 1931-127; 1 ♀, Red Crest, 365 m., 4·8 km N.E. of Anelcauhat, Aneityum, May-June 1955, L. E. Cheesman, BM 1955-217; 1 ♀, Tanna, Oct. 1930, L. E. Cheesman BM 1931-30; 2 ♂, Erromanga, Aug. 1930, L. E. Cheesman, BM 1930-496; 1 ♂, north east Malekula, July 1929, L. E. Cheesman, BM 1929-514; 1 ♀, by beating ferns in vicinity of Anelcauhat, Aneityum, 22.VII.1971, G. F. Gross on Royal Society Percy Sladen Expedition SAM. Loyalty Islands 1 ♂, La Roche, Maré, 30.XI. 1911, Distant coll. 1911-383 BM. Queensland 1 ♀, Pimpama, 17.III.1962, I. J. McKenzie, 1 ♂ Mt. Glorious, 25.IV.1930, D.D.A.; 1 ♂ Lamington National Park, 28.V.1959, F. A. Perkins; 1 ♂, Bald Mountain area, via Emu Vale, 900-1 200 m (3 000-4 000ft.), 26-30.I.1973, G. Monteith; UQ; 1 ♂, 2 ♀, Mt. Tambourine, 19 & 22.XII.1925, A. Musgrave & G. P. Whitley AM K 54695; 1 ♂, Fairy Bower, Rockhampton, 15.I.1962, I.F.B. Common; 1 ♀, Eidsvold ANIC; 1 ♀, Cairns, A. M. Lea; 1 ♂, Kuranda, F. P. Dodd; 1 ♀, Lake Barrine, Atherton Tableland, 700 m., 12.IV.1932, P. Darlington on Harvard Expedition; 1 ♀, Lankelly Creek, McIlwraith Range, Cape York Peninsula, 7.VI.1932, P. Darlington on Harvard Expedition; 1 ♀, Bundaberg, A. M. Lea; 1 ♀, National Park, McPherson Range, (910-1 220 m), 12.III.1932, P. Darlington on Harvard Expedition; 1 ♂, 3 ♀ ♀, Mt. Tambourine, A. M. Lea SAM; 1 ♂, Bundaberg BM 1942-95; 1 ♂, 2 ♀, Tambourine Mountains, 1-9 & 18-25.V.1935, R. E. Turner BM 1935-240; 1 ♀, National Park, McPherson Range, (910-1 220 m), 10.III.1932, P. Darlington on Harvard Expedition; 1 ♀, Lankelly Creek, McIlwraith Range, Cape York Peninsula, 7.VI.1932, P. Darlington on Harvard Expedition AMNH; 1 ♂, Tambourine Mountain, 28.X.1912, H. Hacker, KU; 1 ♂, Mt. Glorious, in rain forest, 13-16.II.1961, L. & M. Gressitt; 1 ♂, 1 ♀, Lamington National Park, 900-1 000 m., 16-18.II. 1964, J. Sedlacek; 1 ♂, 1 ♀, Babinda, from scrub, 1920, J. F. Illingworth BISHOP. New South Wales 1 ♂, Dorrigo National Park via Dorrigo, 21.I.1966, T. Weir UQ; 1 ♀, Tooloom, Jan. 1926, H. Hacker QM; 1 ♂, Dorrigo, W. Heron; 2 ♂, Ulong East, Dorrigo, W. Heron, K 43657; 1 ♂, 1 ♀, Comboyne, 10.XI.1932, K. C. McKeown, K 66123-4; 1 ♂, Wollongong, Dobbins Bush, on blackberry, 12.II.1949 and 1 ♀, Wollongong, on blackberry inflorescence, 13.III. 1949, both C. E. Chadwick; 1 ♀, Sydney, Oct. 1931, Dr. K. K. Spence AM; 1 ♀, Bawley Points of Ulladulla, 2.II.1961, D. F. Waterhouse; 1 ♀, 8 km (5 miles) south of Bega, 28.XII.1964, K. R. Norris ANIC; 1?, Upper Williams Road, Oct. 1926, Lea & Wilson; 1 ♂, Baw Baw near Armitage, Mar. 1914 NM; 1 ♂, 1 ♀, Dorrigo; 1 ♂, Sydney, Lea SAM; 1 ♂, Fairfield, 27.II.1960, F. L. Edwards BM 1960-370; 1 ♀, The Dorrigo, 1 000 m, W. Heron BM; 1 ♂, 1 ♀ Killara, 16.III. 1945, N.E. Kent BM 1950-317; 1 ♀, unlocalised, RM; Australian Capital Territory 1 ♀, Black Mountain, 4.III.1964, H. Davies; 2 ♀, O'Connor, 13.XII.1967, I.F.B. Common ANIC; Victoria 2 ♀, Langwarrin, 8.XII.1923; 1 ♂, Jarrah Valley, Jan. 1961, K. Healey; 1 ♂, Walhalla, Apr. 1930, F. E. Wilson; 1 ♂, Burwood, 16.IX. 1959, K. Matchett; 1 ♂, 1 ♀, Ferntree Gully, Jan. 1916, donated F. P. Spry; 1 ♂, Melbourne, May 1929, F. D. Selby; 2 ♂, 12 km. south east of Merrijig, Howqua River, 30.XI.1971, A. Neboiss; 1 ♀, Millgrove, 9.II.1929, F. E. Wilson NM; 1 ♂, Launching Place, 10.I.1905, *ex* E. P. Van Duzee Collection CA.

Cuspicona norfolcensis sp. nov.

Figs. 47, 48 C

Description:

General appearance: Yellowish, but probably bright green in life. Punctation not even over dorsal surface, on head denser and appearing rugulose. Lateral angles of pronotum obliquely truncate.

Head: Concolorous, densely punctate. Eyes purple, ocelli red.

Pronotum: Concolorous. Anterior margin rather angulately excavate behind collum and oblique behind eyes. Anterolateral margins nearly straight, lateral angles obliquely truncate; posterolateral margin concavely excavate; posterior margin slightly concave. Punctations fine and fairly dense, calli impunctate.

Scutellum: Concolorous, rather long; faintly raised basally and nearly flat in apical two thirds. Lateral margin with at base a concolorous fovea, slightly convex in basal half, then straight then converging to relatively narrow rounded to lanceolate apex. Punctate as for pronotum.

Hemelytra: Coriaceous parts concolorous, punctations coarser and less dense than on pronotum and scutellum, narrowly glabrous just interior to medial fracture. Only slightly narrower than abdomen in apical half; exterior margin of corium fairly concave basally then broadly convex to apex; apical angle convex and posterior margin convex. Clavus reaching about middle of scutellum, elongate triangular. Membrane and its veins hyaline.

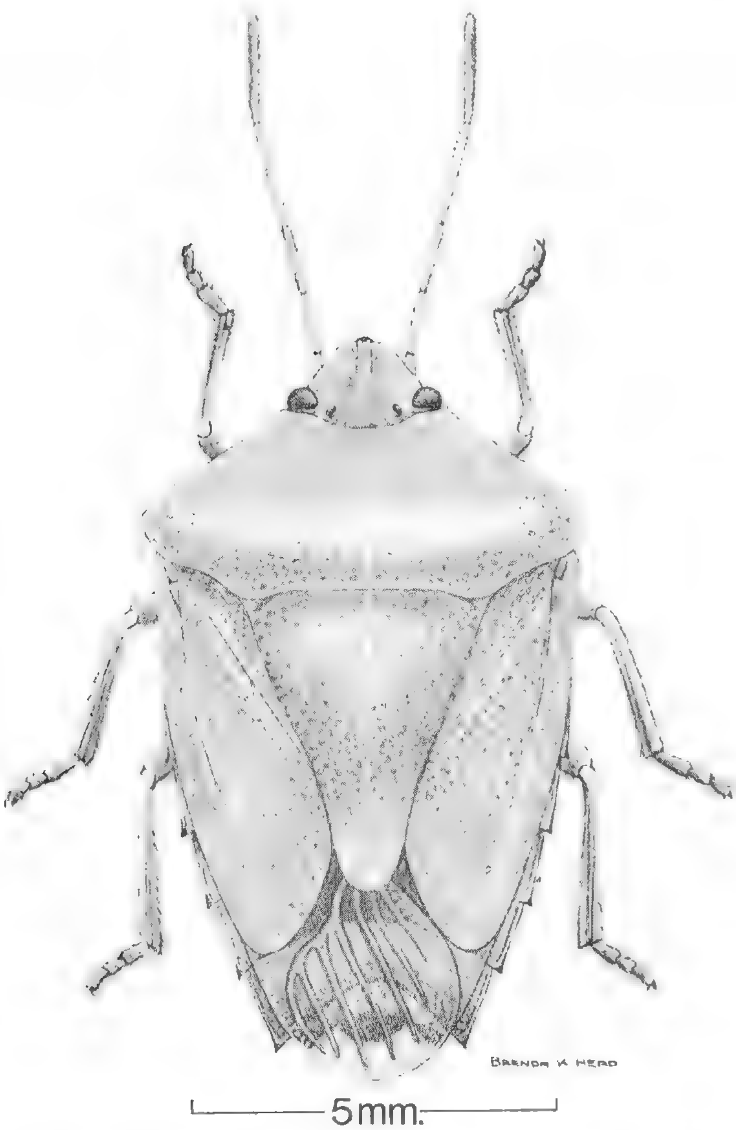

Fig. 47. Dorsal aspect of *Cuspicona norfolcensis* sp. nov.

Abdomen: Not visible on single example.

Laterotergites: Interiorly concolorous but exteriorly narrowly infuscated on laterotergites VI and VII; apical angles with a small black-tipped spine, the spines on VI and VII larger than rest.

Underside: Concolorous but apices of rostrum, tarsal claws, abdomen and pygophore (wholly) infuscated. Bucculae low and sinuate, reaching base of head, anteriorly produced into an angulate lobe. Rostral segment I robust, reaching to base of bucculae, II nearly straight and just surpassing fore coxae, III reaching between mid and hind coxae, IV to about middle of third abdominal segment. Ratio of antennal segments I-V 11:20:20:28:30. Propleuron coarsely punctate except broadly laterally and on proepisternum and proepimeron. Mesopleuron apparently impunctate, metapleuron also impunctate. Metasternal-mesosternal keel reaching over prosternum to apex of latter, rather strongly elevated anteriorly and lower posteriorly. Legs normal, tibiae not flattened.

Abdomen strongly V-shaped in posterior view, a few scattered punctations laterally. Apex of male abdomen Fig. 48 C, seventh segment apically in the middle and its posterior spines and pygophore infuscated. Apical margin of pygophore sinuate.

Dimensions: Head length 30, head width 42, antennal segment I 11, antennal segment II 20, antennal segment III 20, antennal segment IV 28, antennal segment V 30, pronotum length 41, pronotum width 119, total length 200.

Total length: 10·4 mm.

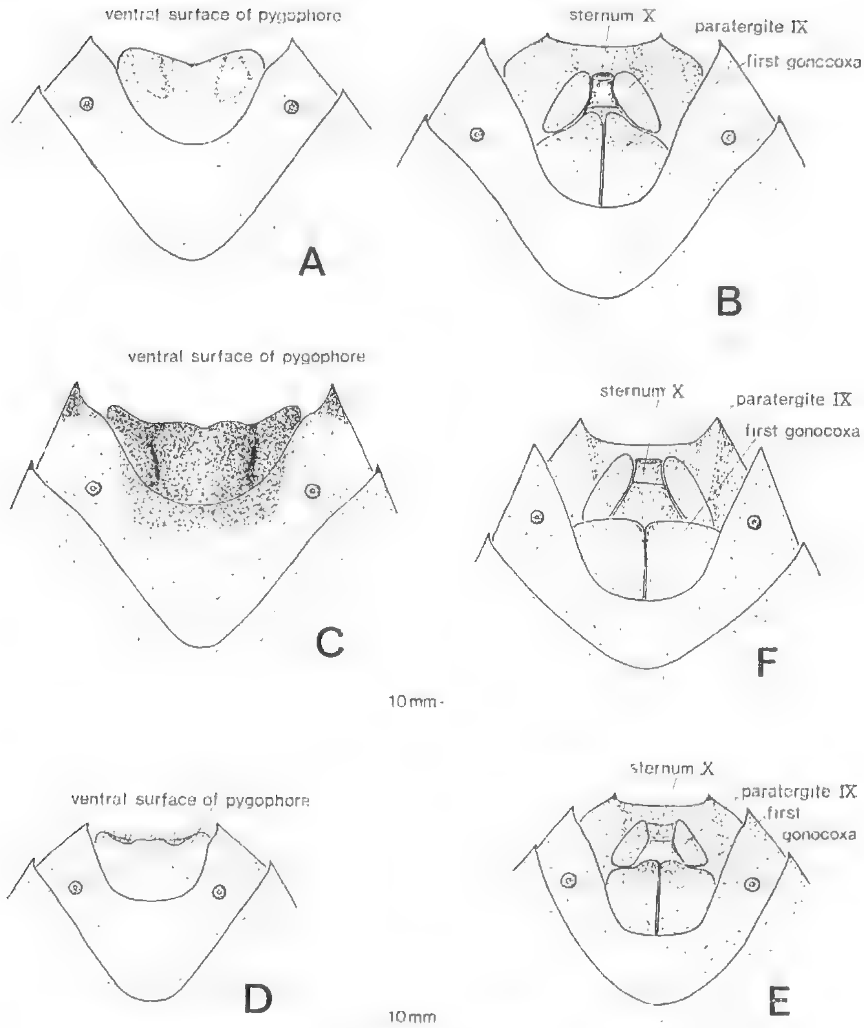

Fig. 48. *Cuspicona privata* Walker, *Cuspicona norfolcensis* sp. nov., *Cuspicona simplex* Walker, *Parocirrhoe woodwardi* gen. sp. nov. A-B. *Cuspicona privata*. A. ventral aspect of apex of male abdomen. B. ventral aspect of female abdomen. C. *Cuspicona norfolcensis*—ventral aspect of male abdomen. D-E. *Cuspicona simplex*. D. ventral aspect of male abdomen. E. ventral aspect of female abdomen. F. *Parocirrhoe woodwardi*—ventral aspect of female abdomen.

Remarks: This species is fairly similar to *privata, simplex* and *proxima* in general appearance but may be distinguished, at least in males, by the darkened abdominal apex beneath.

Location of type:

Holotype ♂, Norfolk Island, A. M. Lea, SAM I 20, 662.

Specimens examined: The holotype only.

Cuspicona simplex Walker, 1867

Figs. 1 B, 48 D-E, 49, 50 A-D, 51

Cuspicona simplex Walker, 1867, p. 388. Froggatt, 1901, p. 5, fig. 8; 1907, p. 329, pl. 31. Sloan, 1941, p. 277-294. *Anon.*, 1942 p. 498. Spiller & Turbott, 1944, p. 79. Woodward, 1953, p. 314, 320; 1954, p. 215, 217. Eyles, 1960, p. 1004. Ramsay 1963, p. 5.

Cuspicona virescens Tryon, (*non* Westwood & Dallas), 1889, p. 189.

Description:

General appearance: Ground colour bright green in life but museum specimens frequently yellowish. Punctation fairly fine and even over dorsal surface, on dorsum of head denser and appearing rugulose. Lateral angles of pronotum acute.

Head: Concolorous, densely punctate. Eyes and ocelli concolorous or blackish purple.

Pronotum: Concolorous though lateral angles partly blackish or pinkish at extreme apex. Apical angles produced as a short rectangular spine about one-third length of posterolateral margins. Anterior margin trapeziformly excavate behind collum and obliquely truncate behind eyes.

Anterolateral margin straight or only very faintly concave, obtuse. Posterolateral margin strongly and rather rectangularly concave, posterior margin only faintly concave. Punctation fine and dense, calli impunctate.

Scutellum: Concolorous; flat in apical two thirds, faintly raised in basal third. Lateral margins with at base a concolorous fovea, slightly convex in basal half, then straight but converging to near apex, latter broadly rounded. A trace of a medial impunctate line on disc.

Hemelytra: Coriaceous parts concolorous; finely and fairly densely punctate except just inward of medial fracture in its apical half, then glabrous. Exterior margin of corium slightly concave basally then broadly convex to apex; apical angle strongly convex; posterior margin convex. Clavus short but elongate triangular. Membrane hyaline with veins same colour.

Abdomen: Concolorous; impunctate.

Laterotergites: Concolorous; some coarse punctations exteriorly; apical angles with a small black tipped spine, those on seventh segment not longer than rest.

Underside: Concolorous except: antennae brown; underside of rostrum and apex of terminal segment, apical halves of tarsal claws, and apical spines on sides of abdominal ventrites black. Bucculae low and sinuate, reaching almost to base of head, anteriorly lobulately produced. Rostral segment I robust, reaching almost to base of bucculae, II arched and reaching nearly to middle of mesosternum, III reaching to between mid and hind coxae, IV reaching about apex of abdominal ventrite III. Ratio of antennal segments I-V approximately 8 : 19 : 18 : 26 : 29. Propleuron coarsely punctate except broadly along lateral margin and on proepisternum and proepimeron. Mesosternum coarsely punctate but with several callous patches, an especially large one ventrally. Metasternum coarsely

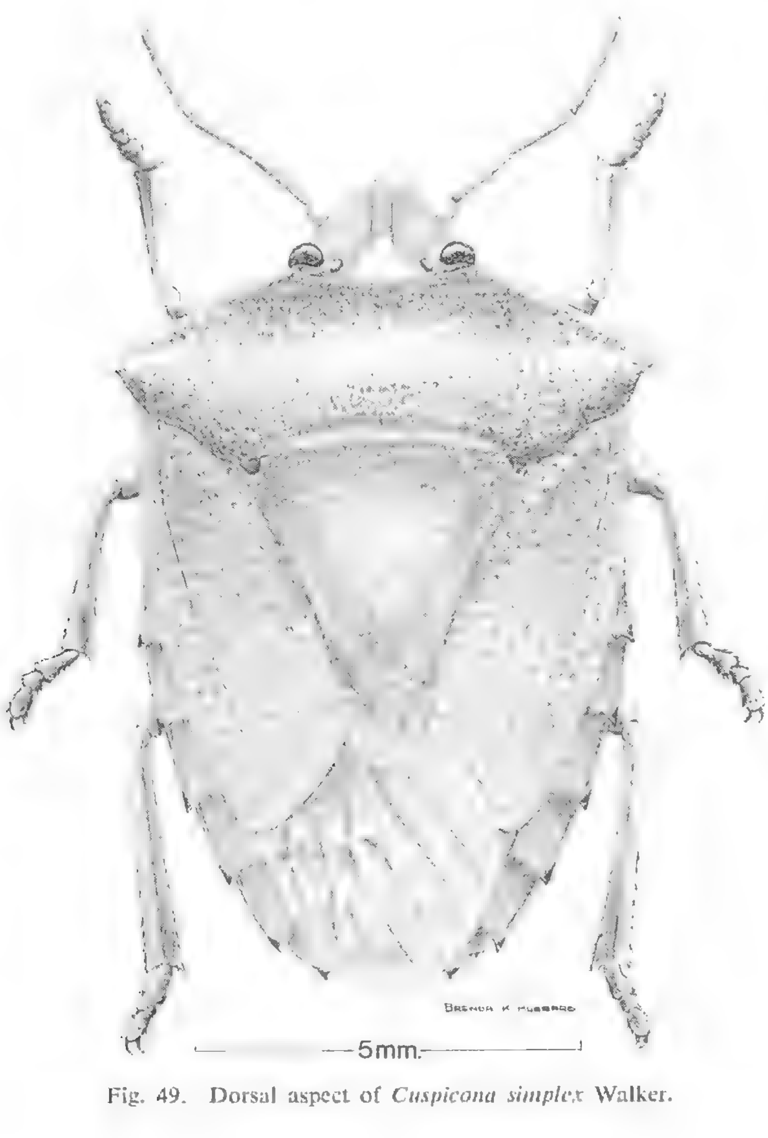

Fig. 49. Dorsal aspect of *Cuspicona simplex* Walker.

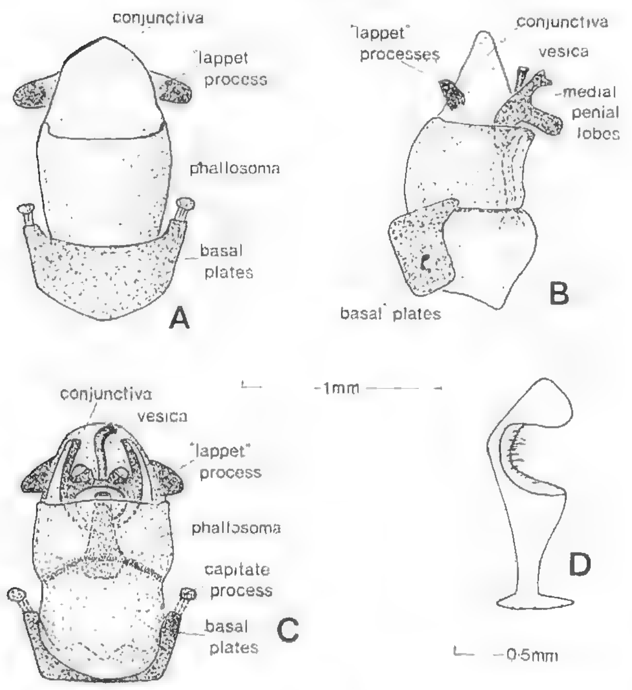

Fig. 50. *Cuspicona simplex* Walker. A. dorsal aspect of aedeagus. B. righthand side view of aedeagus. C. ventral aspect of aedeagus. D. clasper.

punctate except on evaporative area. Mesosternal keel reaching over prosternum but not to apex of latter, prosternum deeply sulcate under the keel, the keel more elevated in anterior half than posterior half. Legs normal, tibiae cylindrical.

Abdomen strongly V-shaped in posterior view, medially rather broadly raised along midline and glabrous, glabrous also along lateral margins between, these and midline coarsely punctate. Apex of male abdomen Fig. 48 D, apical margin of pygophore rather sinuate, medially the posterior margin ventrally more depressed than the remainder, above posterior margin a low septum. Clasper Fig. 50 D, strongly F-shaped. Aedeagus Fig. 50 A-C with basal plates rather large, phallosoma only very lightly sclerotized. Conjunctiva rather rounded in dorsal and ventral view, triangular in lateral view, not divided into appendages except for a pair of more strongly sclerotized "lappet processes" dorso-laterally; medial penial plates ventrally directed and in the shape of an inverted Y when viewed from the side, their dorsal arms apparently connected (Fig. 50 C); there is a short vesica opening just in front of the medial penial plates. Apex of female abdomen Fig. 48 E, hind margin of first gonocoxae produced only into a short lobe which is not rectangular.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	49	34	1·8	5·4	29-38
Head width	50	40	1·5	3·8	36-43
Antennal segment I	76	9	1·0	10·8	6-11
Antennal segment II	85	19	1·2	6·0	17-22
Antennal segment III	86	18	1·6	8·9	14-21
Antennal segment IV	78	26	1·6	6·3	21-29
Antennal segment V	60	30	1·4	4·9	25-31
Pronotum width	49	117	6·5	5·5	105-135
Pronotum length	50	38	3·5	9·1	32-47
Total length	50	182	9·3	5·1	160-203

Dimensions—

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	49	34	2·1	6·1	30-40
Head width	50	41	1·6	4·0	37-45
Antennal segment I	79	9	0·7	8·3	7-10
Antennal segment II	86	20	1·2	6·0	16-25
Antennal segment III	83	18	1·7	9·1	15-22
Antennal segment IV	69	26	1·7	6·4	22-30
Antennal segment V	59	29	1·6	5·3	23-32
Pronotum width	50	125	8·7	6·9	105-139
Pronotum length	50	41	3·6	8·7	34-48
Total length	50	196	12·2	6·3	170-225

Total length: 8·3-11·7 mm

Remarks: This species is particularly common near the coast in eastern Australia though there are scattered records from Victoria, Tasmania, South Australia and Western Australia (Fig. 51). It occurs in New Zealand (Spiller and Turbott, 1944; Woodward 1953 and 1954; Eyles, 1960; Ramsay, 1963) and the Three Kings Islands (Woodward, 1954) where it is believed to be introduced from Australia, and occurs also on Lord Howe Island (material in ANIC).

In common with several other species in this section of the genus it is associated frequently with solanaceous plants, particularly the genus *Solanum*. In Australia it has been reported from *Solanum nigrum* L. and potatoes (Tryon 1889, Froggatt 1901) and from tomatoes (Sloan, 1941). Other records noted from the specimens examined are potatoes (Gordon N.S.W.), *Solanum hispidum* Pers. (Mitcham S.A.), wild tobacco (Mt. Tambourine, Queensland), flower

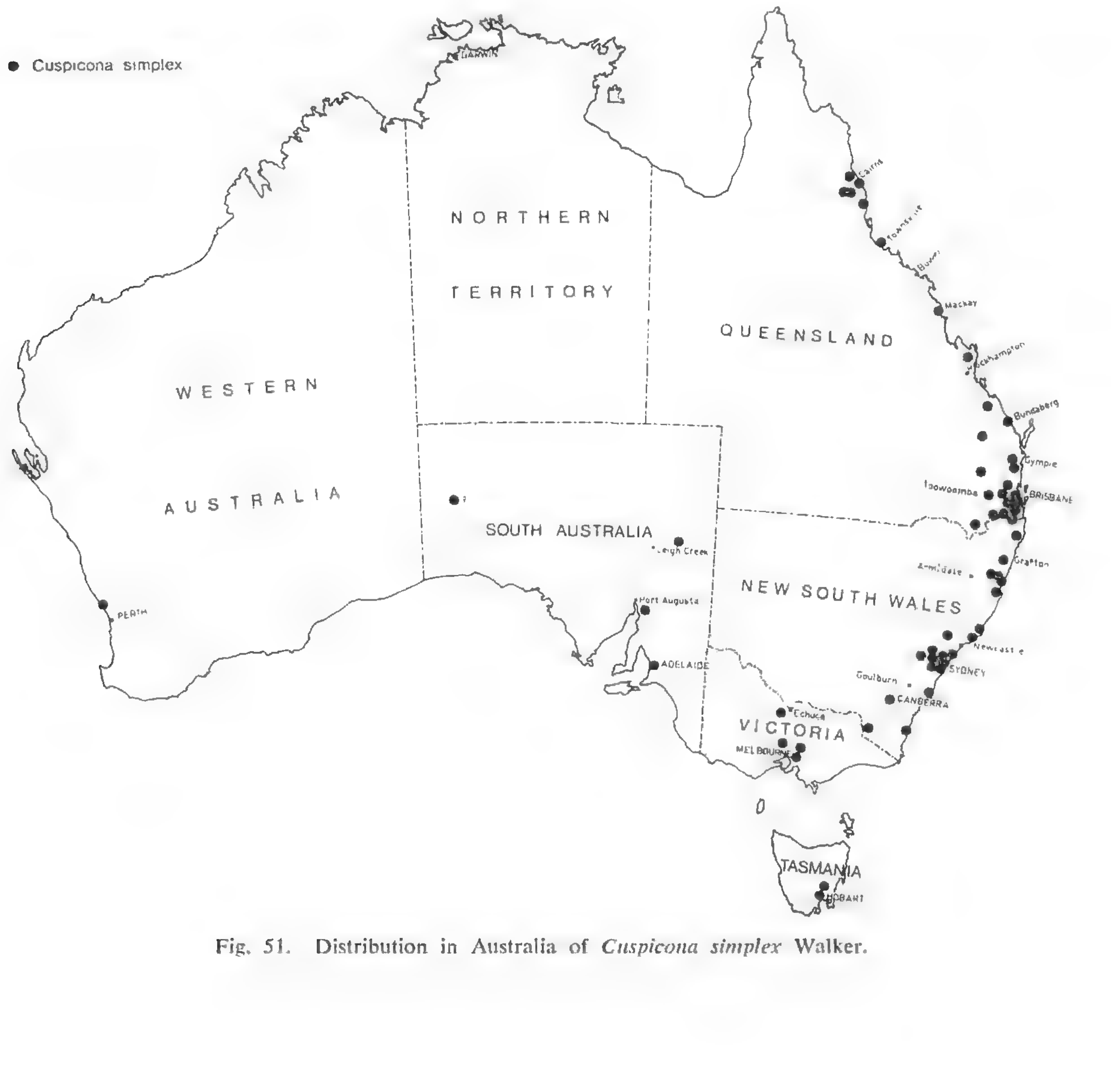

Fig. 51. Distribution in Australia of *Cuspicona simplex* Walker.

garden near rain forest (Eagle Mts., Queensland) and in a sweepnet (Menai, N.S.W.). On Lord Howe Island it was taken from *Solanum mauritianum* Scop. and in New Zealand has been recorded from tomatoes, *Solanum auritulatum* Ait. and *Solanum sodomaeum* L. (Spiller and Turbott, 1944), and also on Mangels (Eyles, 1960). On the Three Kings Islands it was captured on *Solanum nigrum* L. and *Solanum aviculare* Forst.

Location of types:

Holotype ♂ of *simplex* Walker, "South Australia, presented R. Bakewell", in BM.

Specimens examined: New Zealand 2♀, Auckland, 30.IX.1939, O. Spiller ANIC. Lord Howe Island 1♂, 29.XI.1955, S. J. Paramanov and Z. Liepa; 3♂, 2♀, 5.X.1959, T. G. Campbell; 1♀, 1?, 15.X.1964, on *Solanum mauritianum* Scop., R. G. Lukins ANIC. Australia and Tasmania, the type and the numbers in parentheses from the following collections: QM (15), UQ (31), AM (32), ANIC (41), NM (10), SAM (42), BM (25), Stockholm (2), AMNH (6), KU (3), Ashock (1), CA (1) and Bishop (16). As this is a quite common species individual Australian and Tasmanian records have not been listed in detail but are plotted on Fig. 51.

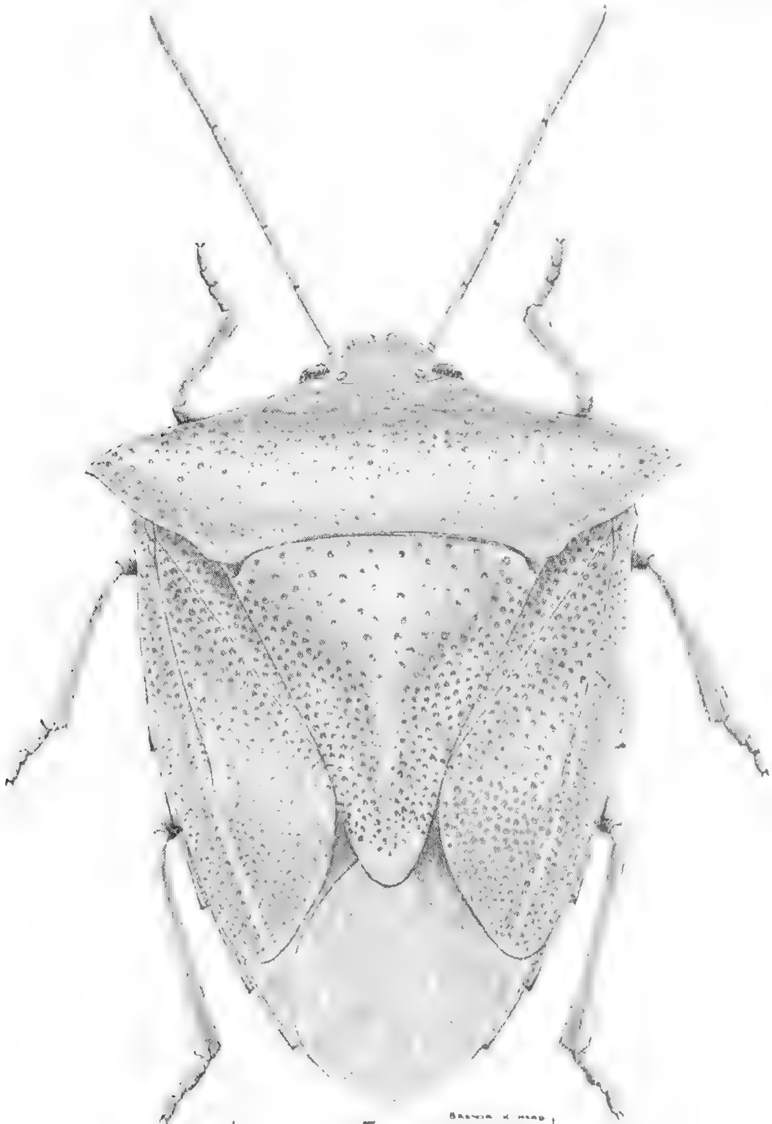

Fig. 52. Dorsal aspect of *Cuspicona proxima* Walker.

Cuspicona proxima Walker, 1867

Figs. 52, 53 A-C

Cuspicona proxima Walker, 1867, p. 382. Black, 1968, p. 563.

Description:

General appearance: Ground colour green in life but yellowish in museum specimens with produced lateral angles of pronotum occasionally fairly pinkish at extreme apices. Punctation relatively coarse and even over dorsal surface, on dorsum of head denser and appearing rugulose.

Head: Concolorous, densely punctate; about as wide as long. Eyes and ocelli purplish or concolorous.

Pronotum: Concolorous though tip of lateral angles faintly pink, reddish or yellowish. Latter produced as a very short, conical, reflexed, thick, blunt spine about 3/5 length of posterolateral margins; its apical portion, calli and anterolateral margins impunctate. Anterior margin trapeziformly excavate behind collum and obliquely truncate behind eyes. Anterolateral margin before produced lateral angle faintly concave, obtuse. Posterolateral margin concave, posterior margin shallowly concave.

Scutellum: Concolorous, flat in apical half but faintly raised in basal half, in apical half a faint trace of a medial longitudinal line; lateral margins basally feebly convex, at apices of frena broadly angulate then straight but gradually converging to near apex, latter broadly angulate. Frena reaching about half length of lateral margins.

Hemelytra: Coriaceous parts concolorous. Exterior margin of corium broadly concave in basal quarter and broadly convex in apical three-quarters; apical angle strongly convex, posterior margin convex. Clavus short but elongate triangular. Membrane hyaline with veins same colour.

Abdomen: Concolorous; finely punctate.

Laterotergites: Concolorous; some coarse punctations exteriorly; apical lateral angles with a small black tipped spine, those on seventh segment not longer than rest.

Underside: Concolorous except for reddish, sometimes blackish, apex of lateral spine on thorax and some small black spots on embolium. Bucculae low and sinuate, reaching almost to base of head, anteriorly lobulately produced. Rostral segment I robust, reaching base of bucculae; II arched and reaching about middle of mesosternum; III reaching between mid and hind coxae; IV reaching almost to apex of third abdominal ventrite, apically black. Antennae rather browner than rest of body, first segment not reaching apex of head, ratio of segments 10:21:22:34:38.

Propleuron coarsely punctate behind level of coxae except on obtuse margin and underside of lateral angle, metapleuron sparsely punctate in extreme posterior region. Mesosternal keel reaching over prosternum to apex of latter, more elevated in anterior half. Legs normal, tibiae cylindrical.

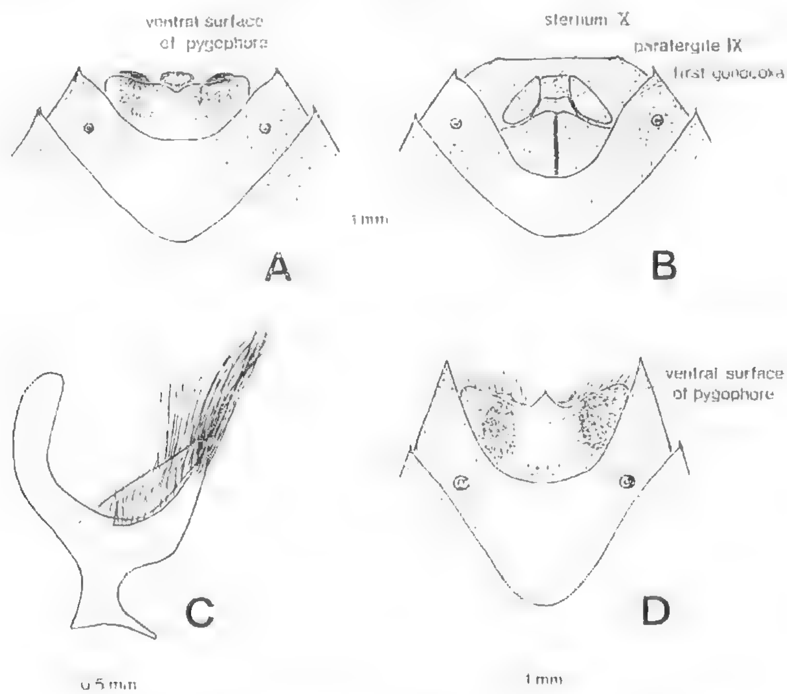

Fig. 53. *Cuspicona proxima* Walker, *Parocirrhoe* woodwardi gen. et sp. nov. A-C. *Cuspicona proxima*. A. ventral aspect of male abdomen. B. ventral aspect of female abdomen. C. clasper. D. *Parocirrhoe woodwardi*—ventral aspect of male abdomen.

Abdomen strongly V-shaped in posterior view, medially rather raised along ventral midline, impunctate. Apex of male abdomen Fig 53 A, apical margin of pygophore conspicuously notched medially with two very shallow black lobes laterally about midway between notch and lateral margin, medially behind notch above a narrow obliquely directed septum, on the inner lateral wall on each side a small black tipped tooth. Clasper of male, Fig. 53 C, rather Y-shaped with one lobe strongly pilose. Apex of female abdomen, Fig. 53 B, hind margin of first gonocoxae sinuately oblique and not produced medially into a rather angular lobe.

Dimensions

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	15	39	2·1	5·3	35-43
Head width	15	45	1·5	3·4	42-47
Antennal segment I	26	10	0·4	3·9	9-11
Antennal segment II	27	21	1·3	6·3	18-24
Antennal segment III	27	23	2·0	8·9	19-25
Antennal segment IV	24	34	2·1	6·2	30-38
Antennal segment V	17	37	2·7	7·4	31-40
Pronotum width	15	143	6·3	4·4	130-153
Pronotum length	15	40	5·1	12·7	34-52
Total length	15	201	13·1	6·5	170-210

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Heed length	19	39	2·4	6·2	35-43
Head width	19	45	1·7	3·8	42-50
Antennal segment I	26	10	0·3	2·8	9-11
Antennal segment II	31	21	0·9	4·5	20-23
Antennal segment III	31	21	1·6	7·6	19-25
Antennal segment IV	25	33	2·0	6·1	28-36
Antennal segment V	14	39	1·1	2·8	37-40
Pronotum width	19	146	12·3	8·4	129-173
Pronotum length	19	39	5·2	13·5	32-50
Total length	19	200	13·2	6·1	170-230

Total length: 8·8-12·0 mm

Remarks: On exterior appearance this species would appear to be closest to *simplex*, though the lateral angles of the pronotum are more acutely produced. However, the clasper is significantly differently shaped in having a rather Y-shaped appearance with the lower lobe being strongly developed.

Examples of this species from New Guinea may have been misidentified as *ampla* Walker (originally described from Waigiu) and at other times as *laminata* Stål as, for example, in the Annual Report of the Papua and New Guinea Department of Agriculture, Stock and Fisheries for the financial year 1965-66 where the following reference occurs on page 118. "Heavy populations of the pentatomid *Cuspicona* sp? *laminata* occurred on tobacco at Popondetta." This record, and the records below, of the species being found frequently on members of the genus *Solanum* are significant as specimens of three other species in the group, *simplex*, *neocaledoniae* and *forticornis*, have also been recorded from *Solanum* species (see pp. 143-4, 150 and 153).

Cuspicona proxima was described from the Ké Islands. A specimen of each sex, the female bearing a green "Type" disc, are in the British Museum from this locality. The marking of the type seems to be an arbitrary curatorial decision according to Dr. W. R. Dolling (pers. com.). As this species is most likely to be confused with *C. ampla* (which is represented in the British Museum by the original female type and one specimen added subsequently to Walker's description) I have chosen the female from the Ké Islands as the lectotype of *C. proxima*, and the male as a paralectotype. This species has now been recorded from the Aru Islands and from New Britain and the Duke of York Islands in the Bismark Archipelago (Black, 1968). The species can now be recorded from Papua-New Guinea (from several species and genera of plants) and possibly also from Celebes.

Location of types:

Lectotype ♀ paralectotype ♂, "Ké Islands presented W. W. Saunders", in BM.

Specimens examined: Papua-New Guinea ♂, Port Moresby, Papua, 28.II.1962, K. R. Norris (ANIC); 2♂♂, 3♀♀, Komba, New Guinea, Reverend L. Wagner (SAM); 8♂♂, 6♀♀ Pati, Popondetta, Northern District of Papua, 10-17.I. 1966, feeding on tobacco, S. Ido & B. Kearo (these specimens were taken during infestation mentioned in 1965-66 Department of Agriculture, Stock and Fisheries report cited above); ♂♀, Wau, New Guinea, 30.X.1956, on *Solanum verbascifolium* L. = *erianthum* D. Don, J. H. Ardley; sex?, no precise locality or date, New Guinea, J. L. Froggatt; ♀, Upper Sirimumu in Central District, Papua, 8.V.1966, T. Fenner; 1♂, 4♀♀, Papuan Highland on *Solonum mammosum* L., Stock and Rubber Experimental Station, Bisianumu, Central District, Papua, 1 (1 600 feet), on *Hevea brasiliensis* Muell. Arg. seedlings, 15.VI.1962, T. V. van Harren; ♂♀, Redshield Farm (32 miles) from Pt. Moresby, Central District, Papua, on *Crotalaria anagyroides* H.B.C., 15.X.1965, E. Kanjiri (Department of Agriculture, Stock and Fisheries, Pt. Moresby). New Britain, 2♀♀, Rabaul, from seedheads of *Solanum* sp., 22.V.1941, J. L. Froggatt; ♂♀, Mosa Plantation, West New Britain, 25.IV.1968, D. F. O'Sullivan, (Department of Agriculture, Stock and Fisheries, Pt. Moresby).

Two specimens collected by Forsten at Tondano in the Celebes in the RM collections over the label *ampla* Walker appear to be very close to, if not, *proxima* Walker. A note to this effect has been added by the author to the labels under each example.

Cuspicona ampla Walker, 1867

Cuspicona ampla Walker, 1867, p. 381. Distant, 1888, p. 480.

Remarks: The type of this species has been examined for me by Dr. W. R. Dolling of the British Museum and the species appears to be distinct from *proxima*. The species is definitely a *Cuspicona* and differs from the type of *proxima* in that the pronotal dorsal punctation is much sparser than that of *proxima* and that the rostrum reaches to the base of abdominal ventrite VII. A second specimen from New Guinea bearing the label "New Guinea Coll. Sayer" is clearly the specimen recorded by Distant and has the rostrum reaching the apex of the seventh abdominal ventrite.

As I have not seen this species in any of the material and have examined from the eastern half of New Guinea a detailed description is omitted. The species appears to be very close to *proxima* and also to some of the species in the Indonesian area.

Location of type:

Holotype ♀, "Wagiou, presented W. W. Saunders" in BM.

Cuspicona neocaledoniae sp. nov.

Figs. 54, 55 A-D

Description:

General appearance: Ground colour probably green in life but yellowish-brown in museum specimens with produced lateral angles of pronotum occasionally faintly pinkish at apices. Punctation relatively coarse and even over dorsal surface save on dorsum of head, there denser and appearing rugulose.

Head: Concolorous, densely punctate; wider than long. Eyes and ocelli purplish or concolorous.

Pronotum: Concolorous though rarely tip of lateral angles faintly pink. Latter produced as a short, conical, slightly reflexed, blunt spine, about three-quarters length of posterolateral margins, its apical portion and calli impunctate. Anterior margin strongly and rather obtuse angledly excavate behind collum, obliquely truncate behind eyes. Anterolateral margin before produced lateral angle faintly concave, obtuse. Posterolateral margin concave, posterior margin shallowly concave.

Scutelum: Concolorous; rather flat but with a distinct low, narrow, longitudinal median raised line running from base to apex; laterally margins basally feebly concave, frena reaching about four-sevenths their length, at apices of frena broadly angulate, then straight and converging gradually to subacuminate apex.

Hemelytra: Coriaceous parts concolorous. Exterior margin of corium slightly concave in basal quarter, rather angulately convex in distal three-quarters; apical angle strongly convex; posterior margin convex. Clavus short and triangular. Membrane hyaline with veins same colour.

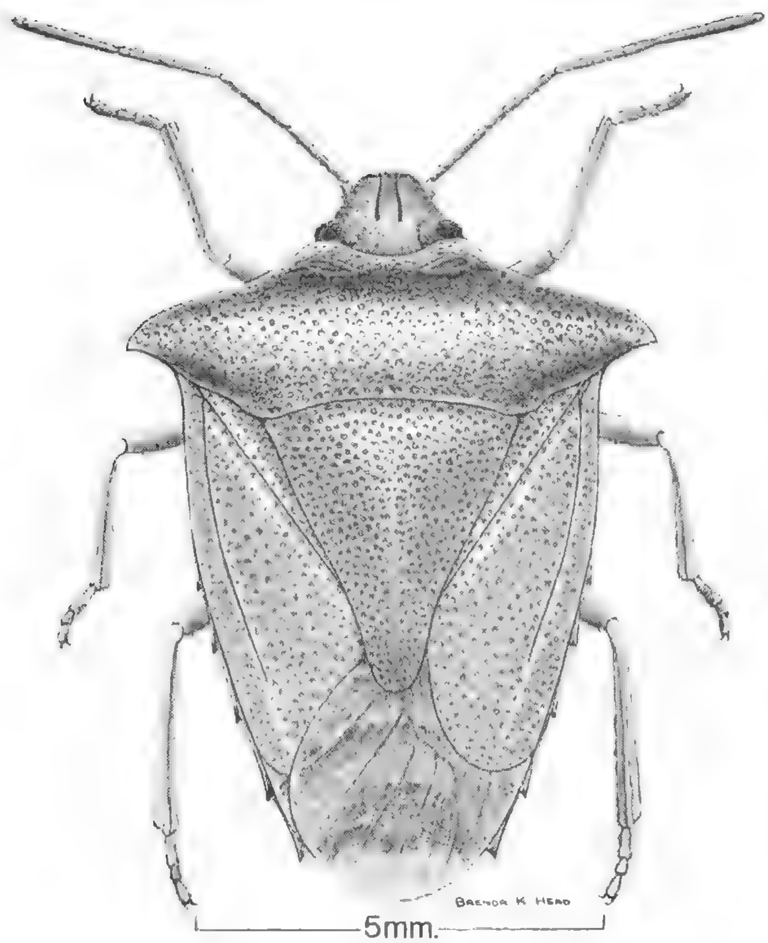

Fig. 54. Dorsal aspect of *Cuspicona neocaledoniae* sp. nov.

Abdomen: Concolorous laterally, darker medially.

Laterotergites: Concolorous; apical lateral angles with a small acute spine, those of seventh segment larger.

Underside: Concolorous. Bucculae low and sinuate, reaching almost to base of head, anteriorly more raised and rectangularly lobulate. First rostral segment robust, reaching to base of bucculae, second faintly arched and reaching about middle of mesoternum, third reaching between mid and hind coxae, fourth reaching almost to apex of third abdominal ventrite, apically tipped with black. Antennae concolorous, first segment not reaching apex of head, shortest, second a little longer than third, fourth about 25% longer than second, fifth a little longer than fourth.

Propleuron coarsely punctate except for obtuse lateral margins and underside of produced lateral angle, metapleuron punctate only in extreme posterior portion. Mesosternal keel reaching over prosternum to apex of latter, somewhat more elevated in anterior half. Legs normal, tibiae cylindrical.

Abdomen strongly V-shaped in posterior view, medially rather raised along ventral midline, finely punctate or rugulose laterally. Apex of male abdomen Fig. 55 A, apical margin of pygophore turned vertically upwards as a sort of septum but along ventral surface of the septum medially notched, ventral surface of pygophore swollen laterally and also basally in the middle. Clasper F-shaped, Fig. 55 D. Aedeagus of male Fig. 55 C, with phallosoma lightly sclerotized, conjunctiva dorsally near base with a pair of small "lappet" processes, towards apex dorsally produced upwards as a large medial lobe, apico-ventrally produced into a pair of tubular processes. Medial penial plates faintly in the form of a thick inverted Y, vesica placed a little in front of them. Apex of female abdomen Fig. 55 B.

Dimensions—

MALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	11	35	1·0	3·0	33-37
Head width	12	39	1·1	2·8	37-40
Antennal segment I	19	9	0·7	7·2	8-10
Antennal segment II	20	19	0·9	4·7	18-21
Antennal segment III	20	18	1·7	9·0	15-20
Antennal segment IV	17	25	0·9	3·4	25-28
Antennal segment V	8	28	1·4	5·0	26-30
Pronotum width	12	126	6·8	5·4	120-140
Pronotum length	12	34	2·0	6·0	30-37
Total length	12	172	7·3	4·3	161-180

FEMALES

Parameter	Number of Measurements	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	6	37	2·0	5·4	33-38
Head width	8	40	1·4	3·4	38-42
Antennal segment I	15	10	0·5	5·3	9-10
Antennal segment II	16	20	0·8	4·2	19-21
Antennal segment III	16	17	1·7	9·8	15-20
Antennal segment IV	12	26	1·2	4·5	24-28
Antennal segment V	5	28	1·6	5·8	27-30
Pronotum width	9	134	8·7	6·5	122-150
Pronotum length	8	35	2·8	8·2	32-41
Total length	8	185	9·4	5·1	170-200

Total length: 8·4-10·4 mm

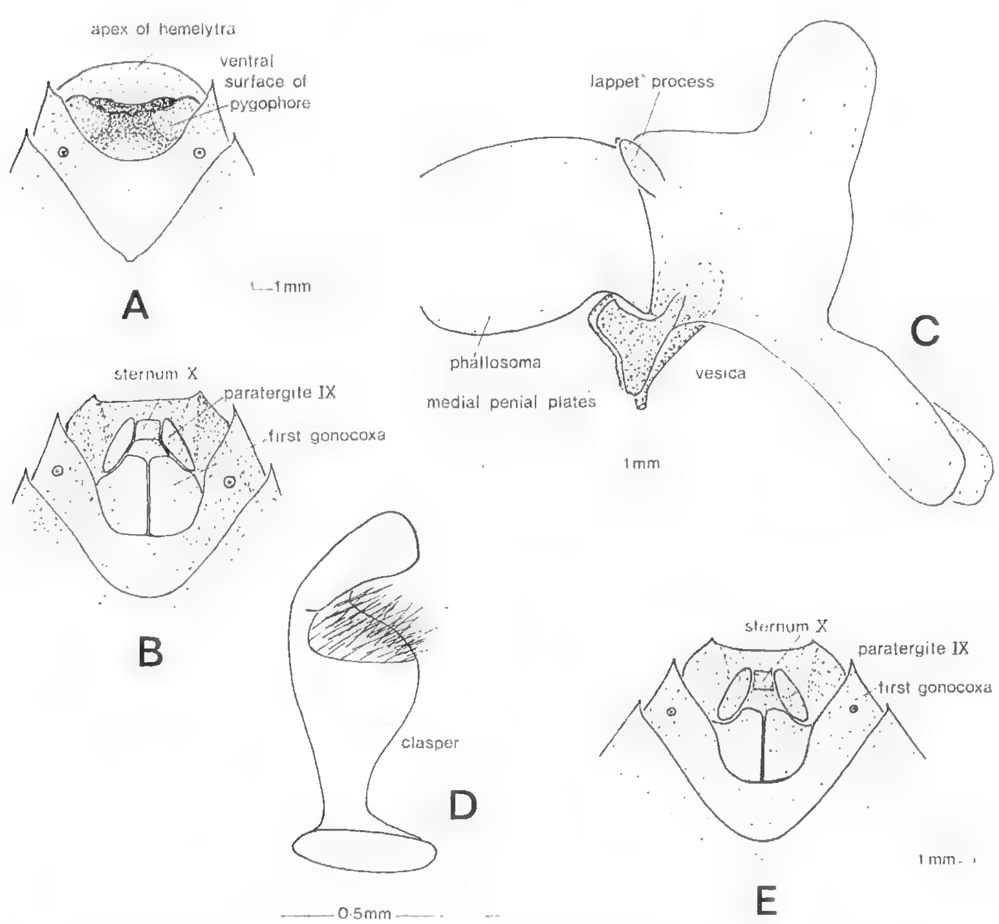

Fig. 55. *Cuspicona neocaledoniae* sp. nov., *Cuspicona cheesmanae* sp. nov. A-D. *Cuspicona neocaledoniae.* A. ventral aspect of apex of male abdomen. B. ventral aspect of apex of female abdomen. C. aedeagus from lefthand side. D. clasper. E. *Cuspicona cheemanae*—ventral aspect of apex of female abdomen.

Remarks: Within the *simplex* group of species and commencing with *neocaledoniae* I have placed together a series of species in which the posterior margins of the first gonocoxae of the female are rather rectangularly produced in their inner half and the hind margin of the male pygophore has a small notch. Species in this final section of *Cuspicona* occur in the Philippines and Indonesia, possibly in South East Asia, Australia, New Caledonia and the New Hebrides.

Location of types:

Holotype ♂, allotype ♀, Forêt de Thi, New Caledonia, 8.II.1957 (Paris); 6♂♂ 4♀♀ 1? paratypes, same data as type; ♂ paratype, Noumea, New Caledonia, Sept, 1955, J. Rageau (Orstom—Noumea); 2♂♂ paratypes, Mt. Chapeau Gendarme, New Caledonia, in rain-forest 7 & 8.VI.1944, J. C. Harrud (Bishop); ♂ 2♀♀ paratypes (Reg. No. 62-7601), mountains west of Houailou, New Caledonia, on *Solanum torvum* Sw. 5.II.1962, N. H. L. Krauss (USNM); ♂ paratype, Grotte de Ninrin-Reu near Poya, New Caledonia, at light 25.XII.1965, G. F. Gross on Biospelaeological Expedition to New Caledonia; ♀ paratype, Noumea, New Caledonia, A. M. Lea (SAM).

Specimens Examined: The types only.

Cuspicona cheesmanae sp. nov.

Figs. 55 E, 56

Description:

General appearance: Ground colour green in life, yellow in museum specimens. Lateral angles of pronotum rectangular, hardly or not produced; whole upperside except membrane moderately coarsely punctate. Rather elongate and kite-shaped.

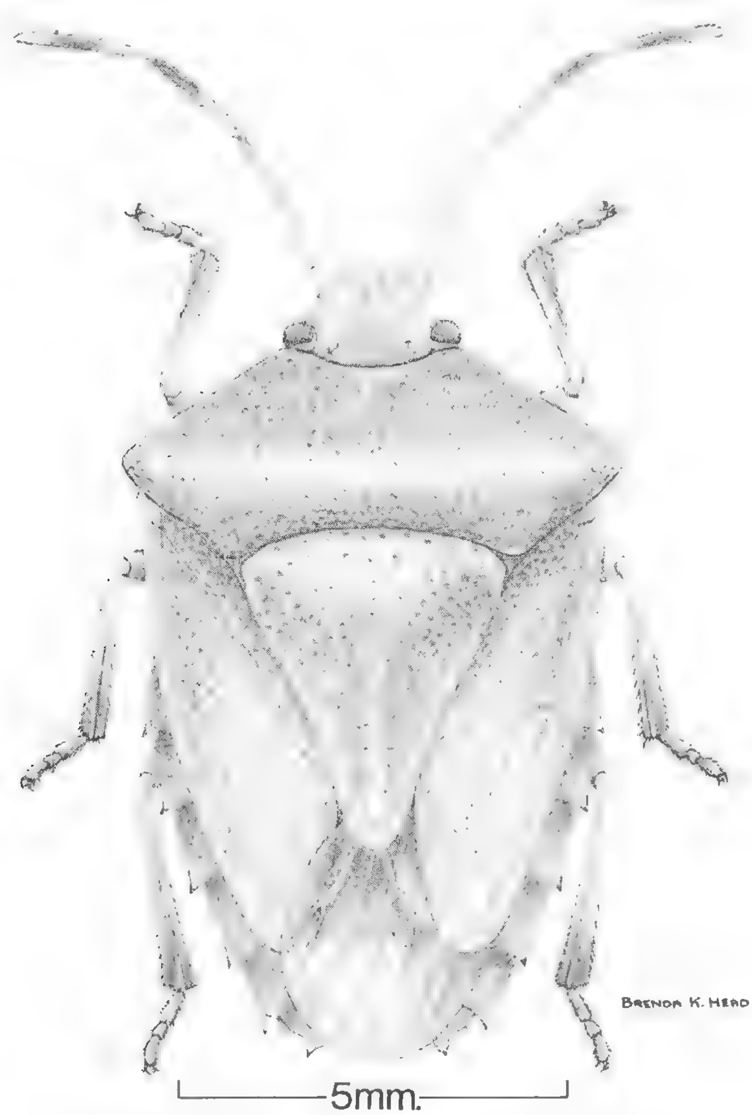

Fig. 56. Dorsal aspect of *Cuspicona cheesmanae* sp. nov.

Head: Concolorous, eyes and ocelli purplish. Wider than long. Densely punctate so as to appear rather rugulose.

Pronotum: Concolorous. Anterior margins strongly excavate behind collum, obliquely truncate behind eyes. Anterolateral margins almost straight, margins obtuse, lateral angles not produced beyond line of lateral margins and rectangular. Posterolateral margins shallowly bisinuate, posterior margin shallowly concave.

Scutellum: Concolorous; rather flat but with a distinct low, narrow, percurrent, median line; lateral margins in basal half faintly convex thence straight and converging only gradually to subacuminate apex.

Hemelytra: Coriaceous parts concolorous. Exterior margin of corium slightly concave in basal quarter, faintly convex in distal three-quarters; apical angle of corium strongly convex, posterior margin gently convex. Clavus short and narrow. Membrane with veins hyaline.

Abdomen: Concolorous.

Laterotergites: Concolorous; posterior exterior angles with a small but acute spine, minutely black tipped or not.

Underside: Concolorous. Bucculae low and sinuate, reaching almost to base, anteriorly more raised and rectangularly lobulate. First rostral segment robust, reaching to base of bucculae, second nearly straight and surpassing fore coxae, third just surpassing mid coxae and fourth comparatively short and reaching visible base of abdomen. Antennae concolorous but two distal segments faintly infuscated, fourth terminally and fifth medially; first segment not surpassing apex of head, second longer than third, fourth longer than second and fifth longest of all. Propleuron punctate all over except obtuse lateral margins, metapleuron punctate in only extreme posterior portion. Mesosternal keel reaching over prosternum to apex of latter, semicircularly raised in its anterior half. Legs normal, tibiae cylindrical. Abdomen strongly V-shaped. Male terminalia unknown, apex of female abdomen Fig. 55 E.

Dimensions—

Parameter	Holotype	Paratypes
Head length	34	32-37
Head width	40	38-42
Antennal segment I	10	8-10
Antennal segment II	19	19-21
Antennal segment III	10	15-19
Antennal segment IV	26	22
Antennal segment V	31	26
Pronotum width	115	107-117
Pronotum length	41	42-45
Total length	193	180-201

Total length: 9·4-10·5 mm

Remarks: This species is very similar in appearance to *privata* Walker which also occurs in the New Hebrides, but is more elongate and the lateral angles of the pronotum are more prominent and rectangulate whereas in *privata* they are broadly rounded. In *cheesmanae* the inner halves of the posterior margins of the female gonocoxae are rectangularly produced, in *privata* this projection has its outer margin more inclined and the whole structure is more roundly produced. In *privata* the fore and middle tibiae are rather flattened apically above but not in *cheesmanae*. *Cheesmanae* is probably most closely related to *neocaledoniae*.

Location of Types:

Holotype ♀ (Reg. No. 20-660), Nokovula, Espiritu Santo, New Hebrides, 1 100 m, by sweeping low herbage, 14.IX.1971, G. F. Gross on Royal Society—Percy Sladen Trust Expedition to the New Hebrides (SAM); 2 ♀ paratypes, Malekula, New Hebrides, Dec. 1929 and Jan. 1939, L. E. Cheesman, BM 1930-38 and BM 1930-178 (BM).

Specimens examined: The types only.

Cuspicona forticornis Breddin, 1900

Figs. 57, 58 A-C

Cuspicona forticornis Breddin, 1900, p. 28 Fig. 2. Froggatt, 1902, p. 320 pl. 2, Fig. 17; 1907, pl. 32 Fig. 2.

Cuspicona rufispina Van Duzee 1905 (*non* Stål, 1870), p. 209.

Description:

General appearance: Ground colour probably green in life but yellow in museum specimens with produced lateral angles of pronotum red or pink. Punctation relatively coarse and even over dorsal surface save on dorsum of head, there denser and appearing rugulose.

Head: Concolorous, densely punctate as described above. Wider than long. Eyes purplish, ocelli pink or concolorous.

Pronotum: Concolorous except for produced lateral angles which are usually red or pink. Latter strongly produced into a short, blunt, slightly upwardly and outward directed spine or horn, latter about two-thirds length of posterolateral margins, its apical portion impunctate. Calli impunctate. Anterior margin strongly and rather trapeziformly excavate behind collum, obliquely truncate behind eyes. Anterolateral margins obtuse and straight but diverging posteriorly in anterior half, then obtusely angled

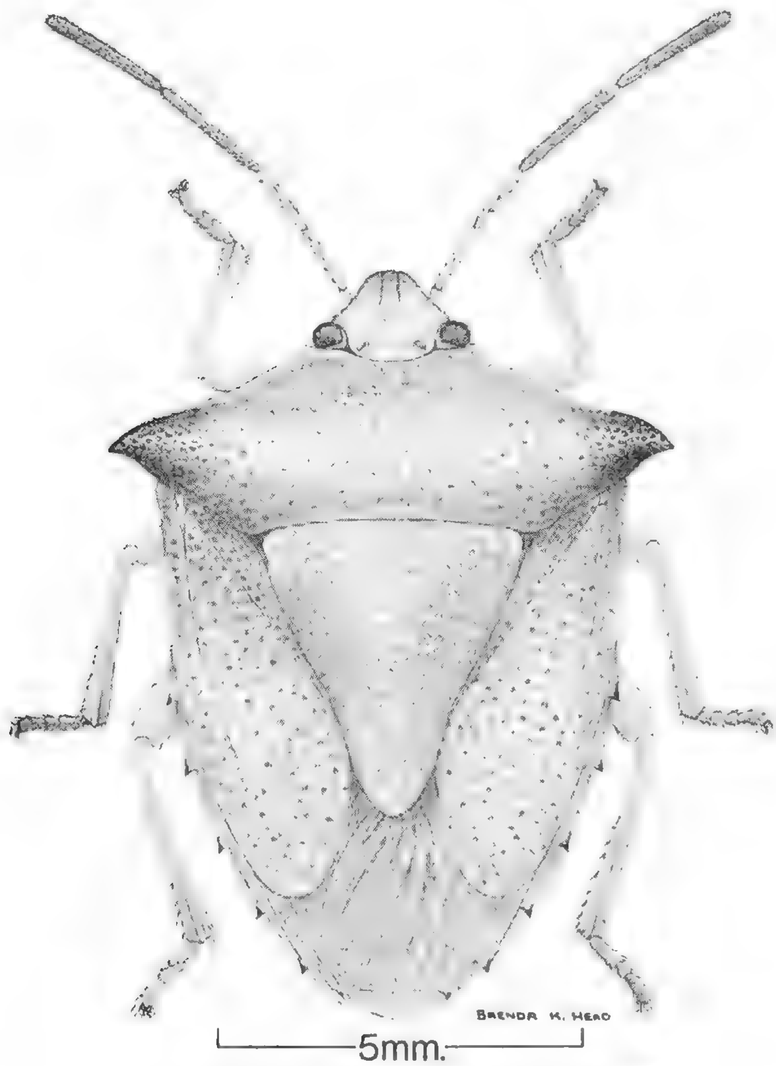

Fig. 57. Dorsal aspect of *Cuspicona forticornis* Breddin.

to form anterior margin of lateral spines. Posterolateral and posterior margins shallowly concave.

Scutellum: Concolorous; rather flat; lateral margins in basal half feebly convex, frena reaching about ⅗ their length, at apices of frena concavely angulate, then straight and converging gradually to convex but narrowish apex.

Hemelytra: Coriaceous parts concolorous. Exterior margin of corium slightly concave in basal quarter, faintly convex in distal three-quarters; posterior margin of corium strongly convex. Clavus relatively short and narrow. Membrane hyaline with veins same colour.

Abdomen: Apparently concolorous, at least laterally.

Laterotergites: Concolorous; apical lateral angles minutely black spined; finely punctate in exterior half.

Underside: Head concolorous, occasionally lateral margins pink. Bucculae low and sinuate, reaching almost to base, anteriorly more raised and lobulate. First rostral segment robust, reaching to base of bucculae, second arched and surpassing fore coxae, third surpassing second coxae, fourth reaching nearly to base of fourth abdominal ventrite. Antennae concolorous or pale brown, second and third segments subequal, fourth and fifth much longer and subequal. Thorax concolorous except underside of produced lateral angles of prothorax red. Propleuron conspicuously punctate in posterior half and metapleuron in extreme posterior portion. Metasternal-mesosternal keel reaching over prosternum to apex, higher anteriorly than posteriorly. Legs normal, tibiae cylindrical; concolorous. Epipleuron faintly marked with brown spots.

Abdomen V-shaped in posterior view; concolorous but occasionally lateral margins pink.

Apex of male abdomen Fig. 58 A. Clasper, Fig. 58 C, F-shaped, medially rather robust with an obliquely directed upper ramus. Apex of female abdomen Fig. 58 B.

Dimensions—

Parameter	Mean of Males (7)	Mean of Females (7)
Head length	37	39
Head width	45	46
Antennal segment I	10	10
Antennal segment II	20	22
Antennal segment III	20	22
Antennal segment IV	32	32
Antennal segment V	33	33
Pronotum width	157	163
Pronotum length	42	43
Total length	214	222

Total length: 9·9-12·5 mm

Remarks: This species occurs in a fairly narrow belt in far eastern Australia ranging from New South Wales to Northern Queensland.

Location of Type:

Holotype ♂ of *forticornis* Breddin, "New South Wales" (not located).

Specimens examined:

Queensland ♂ ♀, Upper Mulgrave River, 20.IV.1970, G. B. Monteith; ♀, Gap Creek, 8 km (5 miles) north of Bloomfield River, 30 m (100ft.) 8-9.V.1970, G. B. Monteith UQ; 2 ♂ ♂, North Tambourine, on low bushes in grassland, 7.III.1955 M. B. Wilson QM; ♂, Caboolture River, Caboolture, on *Solanum*, 6.II.1959, T. G. Campbell ANIC; ♂, Rockhampton SAM; ♀, Mt. Glorious, Mar. 1963, J. E. Dunwoody BISHOP. New South Wales ♂, 3 km (2 miles) south of Port Macquarie, on *Solanum maritianum* Scop., 7.XI.1958, T. G. Campbell; ♀, Coffs Harbour, 20.X.1958, T. G. Campbell ANIC; ♀, Tweed River SAM; ♂ ♀, no precise locality but bearing labels (1) "347 N.S.Wales" (2) "Pres. by Perth Museum. BM 1953-629"; ♀, no precise locality but bearing label "347 N.S. Wales" AMNH (this is the specimen misidentified by Van Duzee as *rufispina* Stål).

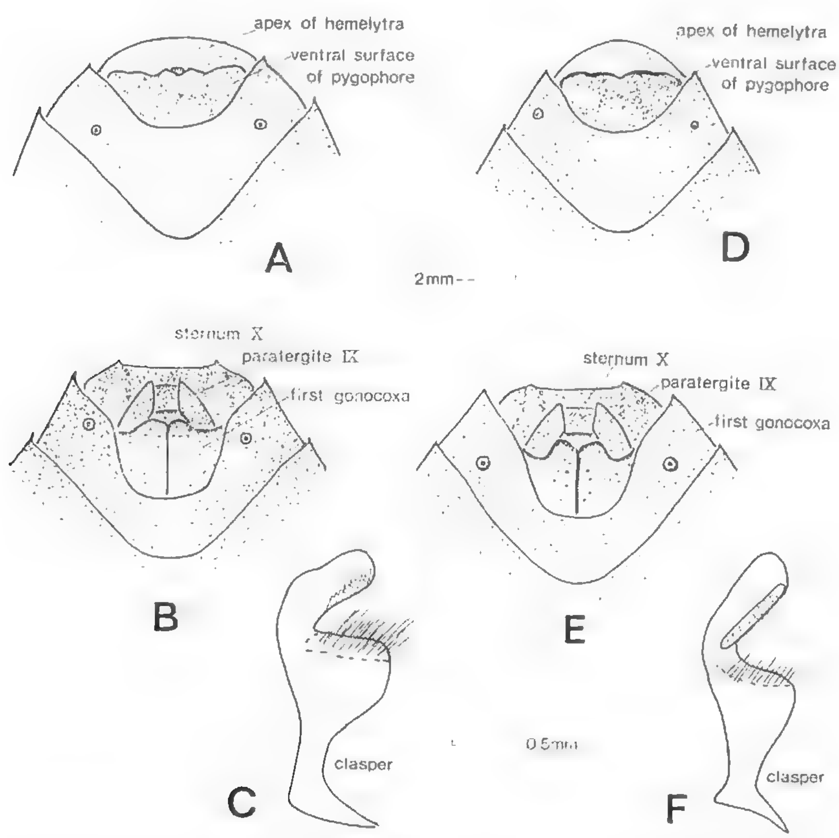

Fig. 58. *Cuspicona forticornis* Breddin, *Cuspicona exnigrospersa* sp. nov. A-C. *Cuspicona forticornis*. A. ventral aspect of apex of male abdomen. B. ventral aspect of apex of female abdomen. C. clasper. D-F. *Cuspicona exnigrospera*. D. ventral aspect of apex of male abdomen. E. ventral aspect of apex of female abdomen. F. clasper.

Cuspicona exnigrospersa sp. nov.
Figs. 58 D-F, 59

Description:

General appearance: Ground colour probably green in life but yellow in museum specimens with produced lateral angles of pronotum and extreme lateral margins of head and abdomen red, and with black spots and black marks laterally on sides of pronotum and abdomen. Punctation relatively coarse and even over dorsal surface save on dorsum of head, there denser and appearing rugulose.

Head: Concolorous with extreme lateral margin frequently red or pink; wider than long. Eyes purplish, ocelli pink or concolorous. Densely punctate so as to appear rather rugulose. Much wider than long; first antennal segment not surpassing apex.

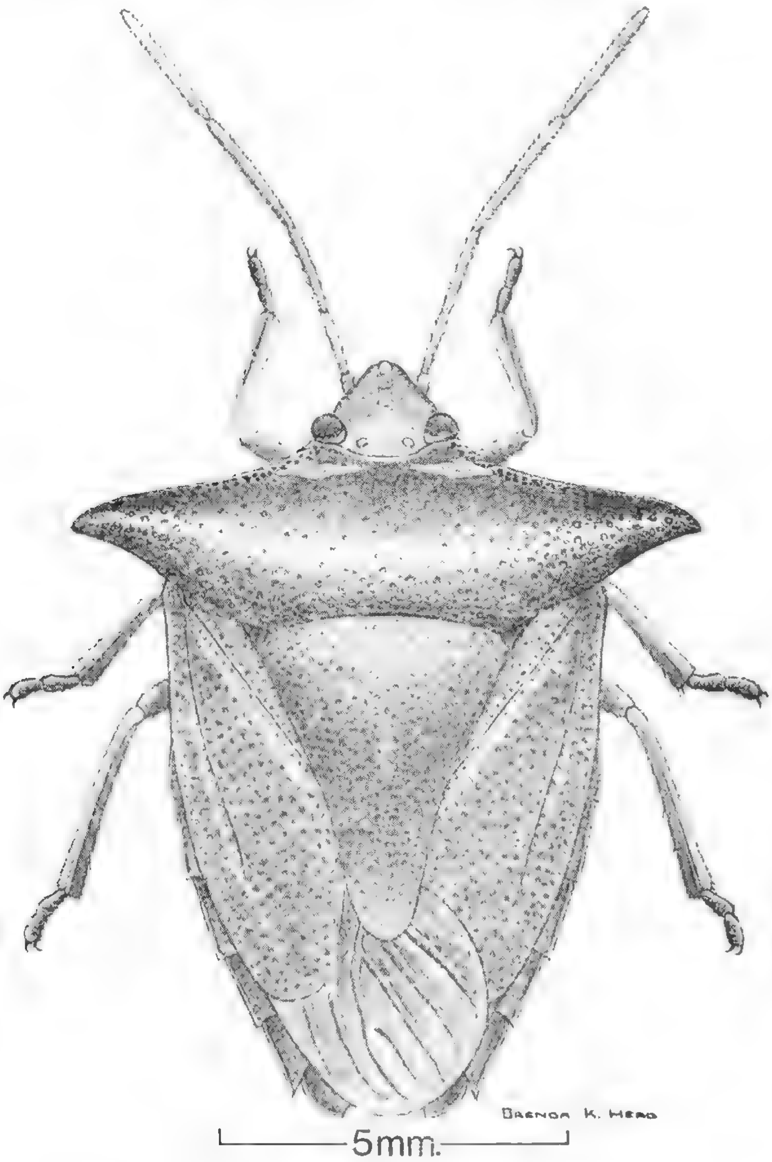

Fig. 59. Dorsal aspect of *Cuspicona exnigrospersa* sp. nov.

Pronotum: Concolorous except along anterolateral margins (maculated with black) and produced lateral angles (red or pink). Latter strongly produced into a blunt upwardly and outward directed, strong, apically slightly recurved spinous processes, these as long or longer than posterolateral margins. Apical portions of these spines impunctate. Calli impunctate. Anterior margin strongly and rather obtuse angledly excavate behind collum, obliquely truncate behind eyes. Anterolateral margins in front of spinous lateral angles rather concave and obtuse. Posterolateral margins nearly straight, posterior margins shallowly concave.

Scutellum: Concolorous; rather flat, lateral margins basally feebly convex, frena reaching about ⅔ the length, at apices of frena rather angulate, thence straight and converging only gradually to convex but narrowish apex.

Hemelytra: Coriaceous parts concolorous, in some specimens basal half of exterior margin of corium pinkish or pinkish with black spots. Exterior margin of corium slightly concave in basal quarter, faintly convex in distal three-quarters; posterior margin of corium strongly convex. Clavus relatively short and narrow. Membrane hyaline with veins same colour.

Abdomen: Apparently concolorous, at least laterally.

Laterotergites: Apical lateral angles acute or minutely spined; lateral margins broadly pink, in some specimens this pink bordered exteriorly and very narrowly with black; inner halves concolorous.

Underside: Head concolorous, occasionally lateral margins pink or red. Bucculae low and sinuate, reaching almost to base, anteriorly more raised and rectangulately lobulate. First rostral segment robust, reaching to base of bucculae, second curved and surpassing first coxae, third just surpassing second coxae and fourth reaching about middle of third abdominal segment, latter apically black. Antennae concolorous or pale brown, second and third segments subequal in length, fourth longer and fifth longest. Thorax concolorous except for exterior margins of prothorax which are black spotted and hind margin of produced lateral angles may have a thin black line, produced lateral angles themselves red or pink beneath. Propleuron conspicuously punctate in posterior half and metapleuron in extreme posterior portion. Metasternal-mesosternal keel reaching over prosternum almost to apex, higher anteriorly than posteriorly. Legs normal, tibiae cylindrical; concolorous except apices of tibiae and tarsi tending reddish brown. Epipleuron maculated with black.

Abdomen V-shaped in posterior view; concolorous but lateral margins frequently reddish or pinkish, sometimes exteriorly to this narrowly black. Apex of male abdomen Fig. 58 D, posterior margin of pygophore black. Clasper Fig. 58 F, strongly F-shaped and upper ramus more vertically directed than in *forticornis* and with an opaque bar visible in its ventral area. Apex of female abdomen Fig. 58 E.

Dimensions-

Parameter	Holotype	Allotype	Mean of all Males (8)	Mean of all Females (3)
Head length	34	35	33	34
Head width	42	44	41	43
Antennal segment I	10	11	10	11
Antennal segment II	19	22	20	23
Antennal segment III	22	25	21	23
Antennal segment IV	33	38	32	38
Antennal segment V	36	—	35	—
Pronotum width	180	185	163	177
Pronotum length	42	45	39	40
Total length	205	225	196	207

Total length: 10·7-11·7 mm

Remarks: This species is clearly closely related to *forticornis* but differs from it in the longer spine formed by the production of the anterolateral margins of the pronotum and the lateral black spots on the pronotum and epipleuron. The male and female external genitalia look very similar but in the male of *exnigrospersa* the medial "notch" on the posterior margin does not have the two little produced lobes, one on either side of it, which occur in *forticornis*. The posterior margin is also usually black in *exnigrospersa* but not in *forticornis*. In the female *exnigrospersa* the posterior margins of the first gonocoxae are more deeply excised than in *forticornis*. The clasper of *exnigrospersa* is narrower than that of *forticornis* and the upper ramus is more vertically directed.

This species seems to occur only in a limited area near the eastern portion of the Queensland-New South Wales border.

Location of types:

Holotype ♂ (Reg. No. K51604), 2 ♂♂ paratypes (Reg. Nos. both K51267), Mt. Tambourine, Queensland, Oct. 1924, A. Musgrave & C. Geissman AM; allotype ♀, National Park, Queensland, Dec. 1910, H. Hacker (with additional label Brit. Mus. 1926-241) BM; ♂♂ paratypes (Reg. Nos. I20,658-9), Mt. Tambourine, Queensland, A. M. Lea SAM; ♂ ♀ paratypes, Tambourine Mountain, H. Hacker; ♂ paratype, Tambourine, 21.II.1927, H. Hacker QM; ♀ paratype Lamington National Park, Queensland, 17-21.II.1964, G. Monteith &

H. A. Rose UQ; ♀ paratype, New South Wales STOCKHOLM; ♂ paratype, Tambourine, Queensland, 500-550 m, 15.II.1964, J. Sedlacek BISHOP.

Specimens examined: The types only.

Cuspicona rufispina Stål, 1870

Cuspicona rufispina Stål, 1870 p. 636; 1876, p. 103.

Remarks:

This Philippine species was erroneously reported from Australia by Van Duzee (1905, p. 209) but a re-examination of the specimen Van Duzee saw reveals that it is in fact an example of *C. fortincornis* Breddin.

Cuspicona rufispina is very similar in appearance to *C. exnigrospersa* but differs from it in lacking the black speckling along the anterolateral margin of the pronotum and on the epipleuron, and the black marks along the margins of the abdomen (as seen from below or in side view). In addition in *rufispina* the head is only about 5-10% shorter than its width across the eyes and the third antennal segment is about 15% shorter than the second. In *exnigrospersa* the head is 15% or more shorter than its width across the eyes and the second and third antennal segments are about the same length.

The male pygophore from beneath and the female external genitalia from below resemble more closely those of *C. forticornis* but *rufispina* differs from this species in the much longer lateral spines of the pronotum, in its relatively longer head, and in the third antennal segment being shorter than the second; in *forticornis* as in *exnigrospersa* the head in shorter than wide and the second and third antennal segments are about the same length.

Cuspicona rufispina is clearly closely allied to *forticornis, exnigrospersa, neocaledoniae* and to a lesser extent to *proxima* Walker. In the consignment of *Cuspicona* species lent to me by the British Museum (Natural History) were three further specimens belonging to two species, probably both undescribed, one from Mindanao in the Philippines and the other from Tondano in the Celebes, which, though the lateral spines of the pronotum are concolorous, are clearly also members of this same group of species.

Comparative measurements (in eyepiece divisions) on all of these specimens are:

	Holotype ♂ of *rufispina*	Allotype ♀ of *rufispina*	No. 1 ♂ Mindanao	No. 2 ♂ Mindanao	♂ Tondano
Head length	40	40	32	43	39
Head width	42	44	44	46	43
Antennal segment I	10	10	11	10	9
Antennal segment II	24	24	24	25	21
Antennal segment III	20	21	30	27	24
Antennal segment IV	—	33	40	—	31
Antennal segment V	—	36	41	—	—
Pronotum width	165	180	170	182	165
Pronotum length	40	40	40	40	38
Total length	205	208	230	240	200

Very likely *Cuspicona curtispina* Stål 1861 from Java belongs to this same complex and requires further investigation. It is probable that the major differences between these species, as in the case of *simplex, proxima, neocaledoniae, cheesmanae, forticornis* and *exnigrospersa*, would lie in the length and colour of the lateral spines of the pronotum and in the structure of the claspers of the males.

Location of Types:

Holotype ♂ and allotype ♀, Ins. Philipp. Stockholm.

Everardia gen. nov.

Type species: *Everardia picta* sp. nov.

Description:

General appearance: Type species bright green and red in life, smallish, rather oval, anterolateral margins of pronotum at first straight and diverging posteriorad, then at about midway angled more strongly exteriorly though still straight, lateral angles subacute or rounded. Head and anterior part of pronotum inclined at an angle of about 45° to rest of body.

Head: Not appearing elongate, wider across eyes than long, lateral margins strongly concave in front of eyes, juga then rounding broadly to apex, apex of head wide, juga not surpassing apex of anteclypeus, latter rather broad. Eyes rather triangular and touching anterior margin of pronotum, ocelli conspicuous and placed about midway between inner margin of eyes and centre of head, but somewhat behind level of kind margin of eyes. Antennifers short, antennae five segmented, segments I, IV and V, thicker than II and III; antennae not very long.

Pronotum: About twice as wide as long, anterior margin strongly but obliquely truncate behind eyes, then deeply excavate behind collum, anterolateral angles only very minutely prominent. Anterolateral margins straight or slightly concave in anterior half and diverging gradually posteriorad, at about mid length abruptly angling exteriorly to diverge much more strongly to obtuse or subacute lateral angles. Posterolateral margins rather rectangularly excavate, angulately turning to become the truncate posterior margin. Disc behind lateral angles in same plane as hind body, before level of lateral angles inclined downwards at about 45°.

Scutellum: Elongately triangular, anteriorly rather raised, lateral margins anteriorly rather convex, medially rather concave, apex broadly rounded. Frena extending half length from base to apex.

Hemelytra: Coriaceous parts normally thickened. Corium with lateral margins basally thickened then concave, behind this straight to almost subacute apex, posterior margin strongly convex. Clavus strongly triangular. Membrane with veins substantially parallel except at base.

Abdomen: Rather flat above and slightly excavate in males and truncate apically in females.

Laterotergites: Three to seven armed with a short acute spine on posterior exterior angles.

Underside: Head obtusely triangular in lateral view. Bucculae faintly lobulately produced anteriorly and then vaguely sinuate, reaching to above middle of eyes, between bucculae deeply sulcate. Rostrum four segmented, first segment reaching base of bucculae, second just past fore coxae, third just to second coxae and fourth to

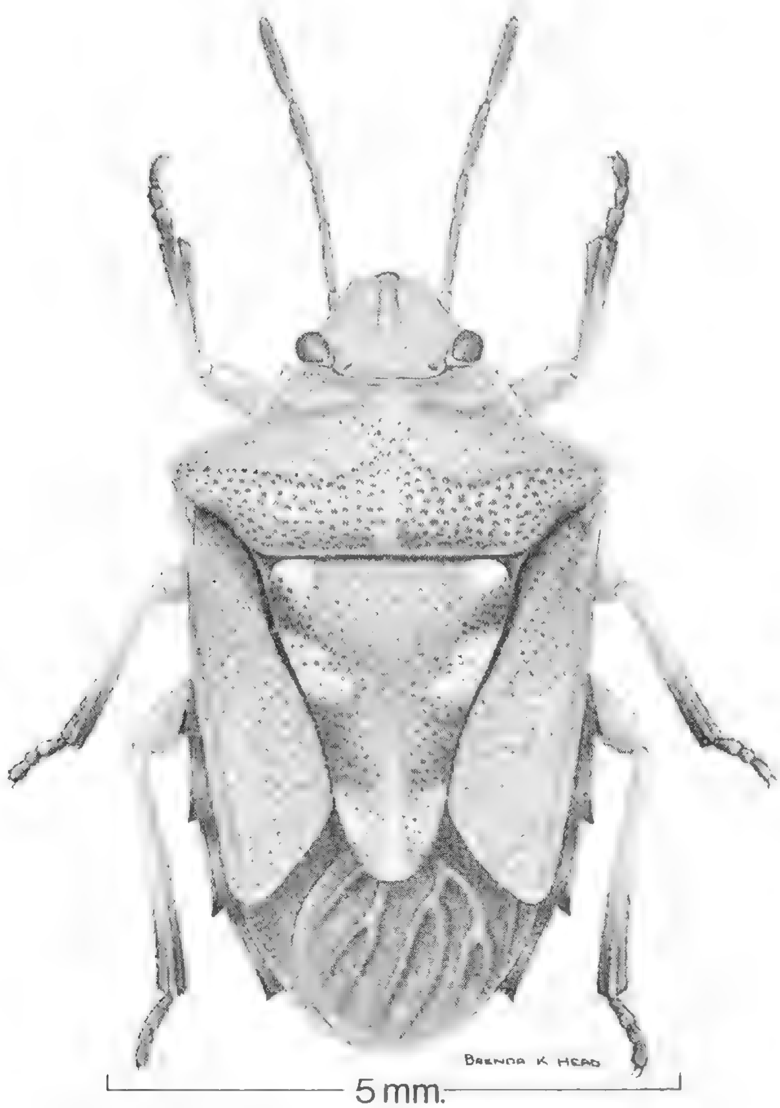

Fig. 60. Dorsal aspect of *Everardia picta* gen. et sp. nov.

about hind coxae. Meso- and metasterna with a robust keel projecting over posterior portion of prosternum, latter broadly sulcate under the keel. Abdominal venter more or less semicircular in cross section in posterior view, third segment medially raised into a short triangular tubercle directed anteriorly, its apex fitting into a notch in the metasternal keel. Seventh ventrite in males excised posteriorly and in females much more deeply incised. Pygophore with lateral angles produced and rounded and medially on posterior ventral margin a small process. Aedeagus with phallosoma lightly sclerotized, a prominent pair of anterior conjunctival processes and with ventrally placed and directed, parallel, rather bilobed medial penial plates. Clasper rather F-shaped. Female external genitalia flattened medially.

General Remarks: Only the type species known of this genus. At first appearance the species looks rather like a *Cuspicona* but the strongly uncised lateral angles of the pronotum indicates that it is a separate genus. The structure of the aedeagus indicates a close relationship to *Cuspicona* and *Petalaspis*.

Everardia picta sp. nov.

Figs. 60, 61 A-E

Description:

General appearance: Ground colour green in life, yellow in museum specimens, with red, yellow, luteous and black markings; hind part of scutellum coarsely punctate, scutellum and coriaceous parts of hemelytra more finely punctate.

Head: Concolorous; juga transversely wrinkled; base rugose punctate or impunctate and slightly swollen; eyes and ocelli reddish purple.

Pronotum: Concolorous in anterior half except along midline (luteous); about halfway back a transverse fine sinuate red line projecting

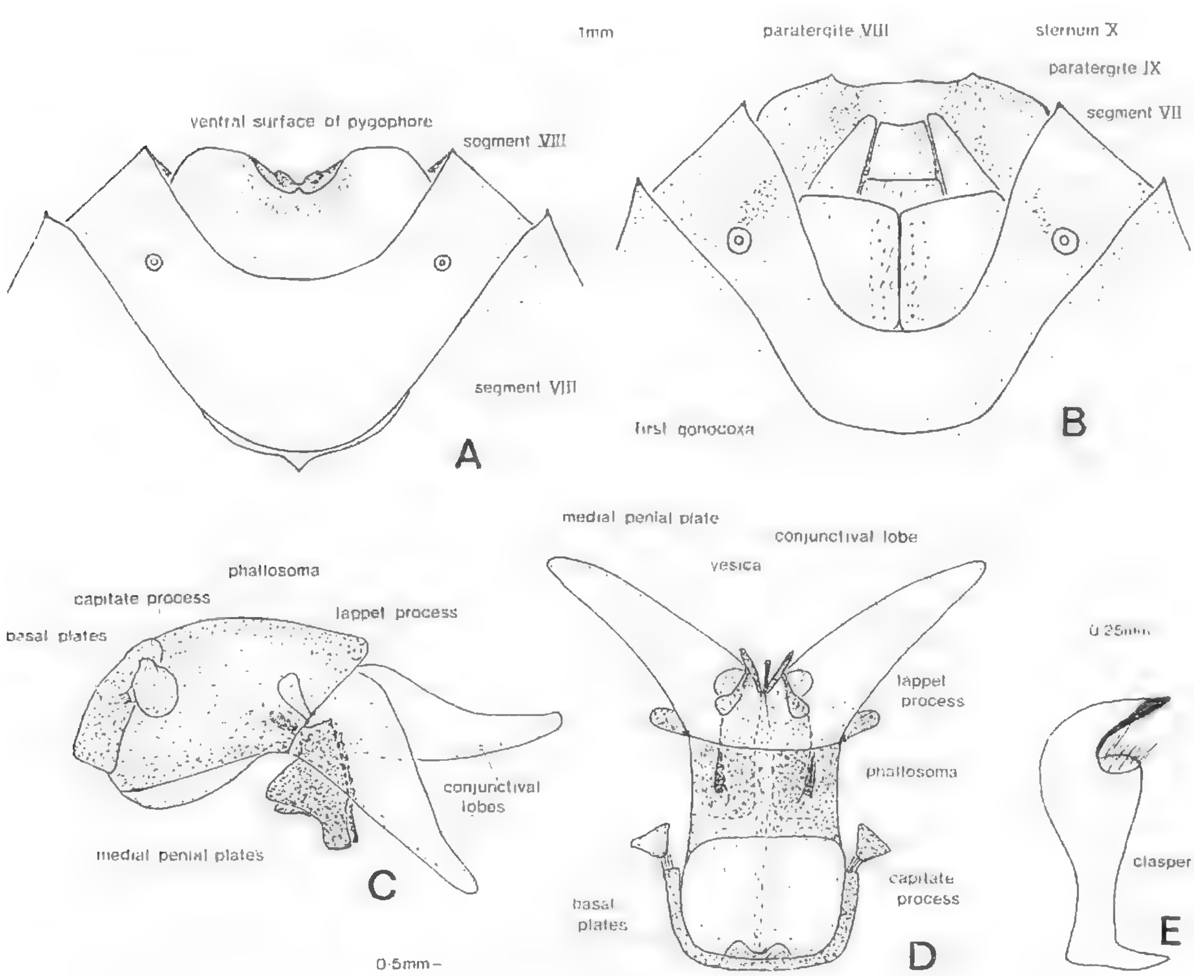

Fig. 61. *Everardia picta* gen. et sp. nov. A. ventral aspect of apex of male abdomen. B. ventral aspect of apex of female abdomen. C. lefthand side view of aedeagus. D. ventral view of aedeagus. E. clasper.

forward medially, behind this line luteous with red punctations, anteriorly punctations concolorous. Midline almost glabrous, anterior margin reflexed, immediately behind it a single transverse line of course punctations, calli impunctate, behind calli coarsely punctate.

Scutellum: Medially in basal half concolorous lateral margins (broadly) and apical third luteous, a red fascia on each side just outward a luteous callous point in each basal angle, another at medial concavity of pronotum on each side and obscuring the luteous margin in this region, and a smaller one on each side just before apex. In apical third of scutellum and along lateral margins some red punctations, punctations on basal two-thirds medially concolorous; frena black.

Hemelytra: Coriaceous parts concolorous with concolorous punctations, inner margin of clavus (at very base quite broadly, rest narrowly) black, inner sixth of hind margin of corium also black. Membrane hyaline.

Abdomen: Concolorous with black quadrate spots or paired more rounded spots medially on some of the distal segments, genital segment concolorous.

Laterotergites: Concolorous with a red spot or bar along anterior and posterior margins and posterior portion of exterior margins, spines tipped with black.

Underside: Head concolorous; bucculae low and sinuate, apically a little rectangularly produced, reaching only to about anterior margin of eyes, head rather swollen behind bucculae. Fourth rostral segment black.

Thorax concolorous but with a red spot at common base of episterna and epimera. Legs normal, tibiae cylindrical or vaguely flattened.

Abdomen concolorous but with a small red spot laterally in the anterior angle, and lateral margin in posterior quarter red, of each segment. Apex of male abdomen Fig. 61 A. Clasper Fig. 61 E, F-shaped.

Aedeagus Fig. 61 C-D, with phallosoma very lightly sclerotized and honey coloured, probably the conjunctiva was not completely inflated in the dissections but the "lappet" processes are strongly developed, there are two rather tubular conjunctival lobes and the medial penial plates are large, parallel and ventrally placed and directed, their ventral surfaces strongly concave. Apex of female abdomen Fig. 61 B.

MALES (from 11 specimens)

Dimensions—

Parameter	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	26	1·6	6·0	23-28
Head width	35	1·4	4·0	33-38
Antennal segment I	6	0·5	8·3	5-7
Antennal segment II	14	0·8	5·3	13-15
Antennal segment III	9	1·1	11·6	8-11
Antennal segment IV	14	1·0	7·3	13-16
Antennal segment V	16	0·5	3·3	15-16
Pronotum width	77	3·4	4·4	71-81
Pronotum length	32	2·0	6·3	29-36
Total length	141	8·2	5·8	125-150

FEMALES (from 17 specimens)

Parameter	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	28	2·2	7·8	25-31
Head width	36	1·1	3·2	34-38
Antennal segment I	7	1·5	22·4	5-10
Antennal segment II	13	1·1	8·2	11-15
Antennal segment III	9	0·8	9·0	7-10
Antennal segment IV	14	1·1	8·3	11-15
Antennal segment V	15	1·1	7·3	13-18
Pronotum width	81	3·5	4·3	75-88
Pronotum length	34	2·6	7·6	30-39
Total length	148	8·7	5·8	135-165

Total length: 6·5-8·6 mm

Remarks: All but two specimens have been collected in arid regions. The "tea-tree" mentioned by Brumby on the labels of the specimens he collected may be a species of *Melaleuca* for this genus occurs in the Everard Ranges area, but equally he could have applied it to a species of *Thryptomene* as the latter, apart from its small size, resembles *Melaleuca*.

Location of Types:

Holotype ♂, allotype ♀, 8 ♂ ♂ 10 ♀ ♀, paratypes (Reg. Nos. 120,634-53), Everard Ranges, South Australia to Warburton Ranges, Western Australia, A. Brumby (paratypes on flowering tea-tree); 1 ♂, 1 ♀ paratypes (Reg. Nos. 120,654-5), Victoria Desert 6 km (= 4 miles) south west of Maynard's Bore, Everard Park Station, South Australia, 6.IX. 1970, G. F. Gross (by beating *Thryptomene maisonneuvi* FvM.—a small myrtaceous plant); ♂ paratype (Reg. No. 120,656), Adelaide Hills, South Australia, Jan. 1968 and ♀ paratype (Reg. No. 120,657), same general locality, 20.1.69, C. van Dyk SAM; 3 ♀ ♀ paratypes, Murchison River, Western Australia, 21. XI.1963, J. Sedlacek (BISHOP); ♀ paratype, 48 km (= 30 miles) east of Southern Cross, 350 m, Western Australia, 16.IX.1962, E. S. Ross & D. Q. Cavagnaro CA.

Specimens examined: The types only.

Parocirrhoe gen. nov.

Type species: *Parocirrhoe woodwardi* sp. nov.

Description:

General appearance: Very similar to *Ocirrhoe* but posterior angles of seventh laterotergites strongly produced and pygophore different. Species probably bright green in life; small, elongate oval, lateral angles of pronotum rounded; head and anterior portion inclined at an angle of about 30°.

Head: Appearing rather broad, wider across eyes than long, basally rather raised, apically flattened. Anteclypeus only a very little produced past apices of juga and convex apically, juga apically broadly rounded and laterally broadly concave above antennifers. Eyes triangular and touching anterior margin of pronotum, ocelli conspicuous and placed just inward of inner posterior angles of eyes. Antennifers short, antennae five segmented, first segment shorter and thicker than others.

Pronotum: More than twice as wide as long, anterior margin only shallowly concave behind collum, anterolateral angles only very slightly prominent. Anterolateral margins nearly straight almost to base and strongly diverging posteriorly, anterolateral angles rounded. Posterolateral margins rather angulately concave, posterior margin shallowly concave. Disc behind level of lateral angles in the same plane as hind body, in front of level of lateral angles inclined downwards at about 30°.

Scutellum: Triangular, flattish; frena extending for nearly half length from base to apex; in basal third only slightly raised.

Hemelytra: Coriaceous parts rather transparent. Corium with outer apical angles rounded and lateral margins very slightly convex, posterior margin also faintly convex. Clavus narrow but triangular. Membrane with veins substantially parallel apically.

Abdomen: Apparently flattish above, deeply excised apically in males.

Laterotergites: III to VI armed with a small acute spine on each posterior exterior angle, VII with apical angle rather strongly produced posteriorly, triangular with acute apex.

Underside: Head rather triangular in lateral view. Bucculae rather lobulately produced anteriorly then convex, reaching to about midway along eyes, between bucculae deeply sulcate. Rostrum four segmented, segment I not reaching base of bucculae, II a little past fore coxae, III about midway between second and third coxae, IV to base of third abdominal ventrite. Meso- and metasterna with a robust raised keel projecting forward over prosternum, low to about midway betwee mid and hind coxae then becoming elevated to reach its highest elevation just before fore coxae, prothorax shallowly and obliquly keeled on either side of this keel. Abdominal venter beneath with sides flattened and oblique, medially rounded, third segment medially raised into a short triangular tubercle directed anteriorly, its apex fitting into a notch in the mesosternal keel. Seventh abdominal segment deeply incised. Pygophore ventrally with lateral angles slightly produced medianly into a posteriorly directed triangular process. Hind margins of first gonocoxae of females transverse.

General Remarks: At first sight this genus resembles *Ocirrhoe* very closely and could easily be confused with it. However it differs in that the apical angles of the seventh laterotergites are much more strongly produced and the hind tibiae are not flattened (although the first and second are flattened just before their apices). The median triangular spine on the hind margin of the pygophore indicates that the genus has a closer relationship with such genera as *Petalapis*, *Vitellus* and *Avicenna* rather than to *Ocirrhoe*. Only the type species is known.

Parocirrhoe woodwardi sp. nov.

Figs. 48 F, 53 D, 62

Description:

General appearance: Probably green in life but the type yellowish, smallish.

Head: Concolorous, eyes and ocelli purplish. Juga dorsally punctate, anteclypeus with only several sparse punctations. Head behind base of anteclypeus transversly rugulose, immediately adjacent to eyes glabrous.

Pronotum: Concolorous, densely punctate but ocelli and anterolateral margins impunctate.

Scutellum: Concolorous, densely punctate. In apical half medially a broad flattened (but punctate) mark becoming a short raised impunctate keel apically.

Hemelytra: Coriaceous parts concolorous, densely punctate; membrane hyaline.

Abdomen: Concolorous.

Laterotergites: Concolorous, posterior lateral spines black tipped.

Underside: Concolorous except eyes purplish and a lateral black irregular macula near exterior margin of metapleuron and about equidistant from base and apex. Apical halves of tarsal claws black. Head slightly rugulose and depressed in front of antennifers. Propleuron conspicuously punctate only posteriorly, mesopleuron with only mesepisternum punctate, metapleuron punctate posteriorly and on metepisternum. Abdomen rather rugulose. Apex of male abdomen Fig. 53 D, the ventral margin

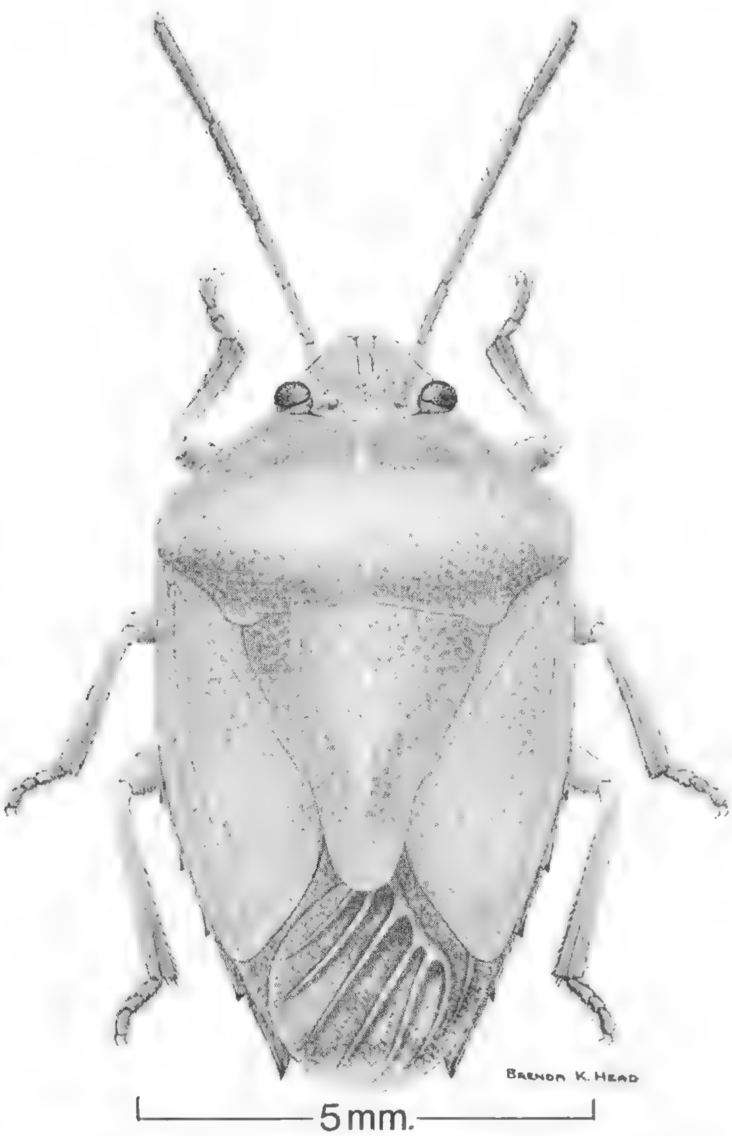

Fig. 62. Dorsal aspect of *Parocirrhoe woodwardi* gen. et. sp. nov.

of pygophore sinuate on either side of median process, ventral surface with a depressed pit on each side near spine margin and about midway between median process and lateral margin. Apex of female abdomen Fig. 48 F, posterior margins of first gonocoxae nearly transverse, apical spines of paratergite VIII strongly produced.

Dimensions—

	Holotype ♂	Allotype	Paratype
Head length	30	33	33
Head width	38	41	39
Antennal segment I	7	8	8
Antennal segment II	13	12	12
Antennal segment III	15	16	16
Antennal segment IV	20	22	21
Antennal segment V	25	27	25
Pronotum width	91	97	91
Pronotum length	37	31	40
Total length	165	170	181

Total length: 8·7-9·0 mm

Location of types:

Holotype ♂ (Reg. No. T7218), South Queensland, Koongalala Point, Lamington National Park, 29.X.1955. T. E. Woodward QM, allotype ♀, Dorrigo, New South Wales, W. Heron SAM 120,661; Paratype ♀, Sydney, Sept. 1902, *ex* Helms Collection BISHOP.

Specimens examined: The types and unlocalised 1 ♂, BM.

Petalaspis Bergroth, 1916

Petalaspis Bergroth, 1916, p. 29.

Type species: Petalaspis tescorum Bergroth, 1916 (monotypy).

Description:

General appearance: Pale yellowish (museum specimens); medium sized, elongate oval lateral angles of pronotum acute. Head and anterior portion of pronotum inclined at an angle of about 45°.

Head: Rather elongate but still wider across eyes than long, tapering anteriorad, basally slightly convex, apically flattened. Anteclypeus a little produced beyond apices of juga and rounded apically; juga apically rounded, laterally slightly concave above antennifers. Eyes rather triangular and touching anterior margin of pronotum, ocelli conspicuous and placed just inward of inner posterior angles of eyes. Antennifers short, antennae five segmented, first segment shortest and thicker than others.

Pronotum: About twice as wide as long. Anterior margin rather concave, anterolateral angles only very slightly prominent. Anterolateral margins straight almost to base and strongly diverging posteriorly, then turning inward shortly at 90° forming rectangular lateral angles. Posterolateral margins strongly concave and rounding broadly to become the strongly concave posterior margin. Disc behind level of lateral angles in same plane as hind body, before level of lateral angles inclined downwards at about 45°.

Scutellum: Strongly triangular, flattish, frena extending for four fifths of length from base to true apex. Apex beneath with a square pale sclerotized plate, latter in plane of body and beginning at apices of frena and extending about an equal distance past true apex of scutellum.

Hemelytra: Coriaceous parts pale and rather transparent. Corium with outer apical angles almost truncate and lateral margins very slightly convex, posterior margin straight exteriorly but broadly rounded interiorly. Clavus strongly triangular. Membrane hyaline, veins substantially parallel apically.

Abdomen: Flattish above, rather deeply excised apically in males.

Laterotergites: Three to six armed on posterior exterior angles with a short acute spine, seven with apical angle rather strongly triangularly produced posteriorly with apex acute.

Underside: Head rather triangular in lateral view. Bucculae rather lobulately produced anteriorly then rather sinuate, reaching base of eyes, between bucculae rather deeply sulcate. Rostrum four segmented, first segment reaching base of bucculae, second to about midway between fore and hind coxae, third to about midway between second and third coxae, fourth to base of fourth abdominal ventrite. Meso- and metasterna with a robust raised keel projecting forward over prothorax, there directed somewhat to left (as viewed from below) so that rostrum passes to right of its apex. Prosternum rather sulcate under this keel. Abdominal venter beneath with sides flattened and oblique, medially broadly raised, third segment medially raised into a short triangular tubercle directed anteriorly, its apex fitting into a notch on base of metasternal keel. Seventh ventrite deeply excised posteriorly in males and females. Pygophore ventrally with lateral angles produced a little and truncate, medially with a posteriorly directed process. Clasper rather

F-shaped and similar to that of *Cuspicona* spp. Aedeagus with phallosoma lightly sclerotized, three pairs of conjunctival processes the ventral pair apparently medial penial plates. Female external genitalia rather flattened medially.

General remarks: Only the type species is known in this genus, in general appearance species is very similar to some species of *Cuspicona* which do not have produced lateral angles to the pronotum. However the square plate like structure under the apex of the scutellum distinguishes this genus from *Cuspicona* and indicates a relationship closer to *Vitellus*.

Petalaspis tescorum Bergroth, 1916

Figs. 63, 64 A-D

Petalaspis tescorum Bergroth, 1916, p. 29-30.

Description:

General appearance: Moderate sized, elongate obovate. General colour straw coloured but with lateral angles of the pronotum sometimes narrowly reddish, also the posterior apices of the seventh laterotergites and the genital segments. Dorsally finely and concolorously punctate.

Head: Juga rather finely transversely wrinkled; base finely punctate; eyes and ocelli reddish purple. First antennal segment not surpassing apex.

Pronotum: Finely punctate, punctations generally concolorous but sometimes a little darker than ground colour. Calli impunctate. Sometimes a faint reddish suffusion posteriorly.

Scutellum: Finely punctate, punctations generally (but not always) concolorous. Medially in basal half a raised nearly glabrous line.

Hemelytra: Corium and clavus finely concolorously punctate. A small black spot at apex of clavus; membrane including its veins hyaline.

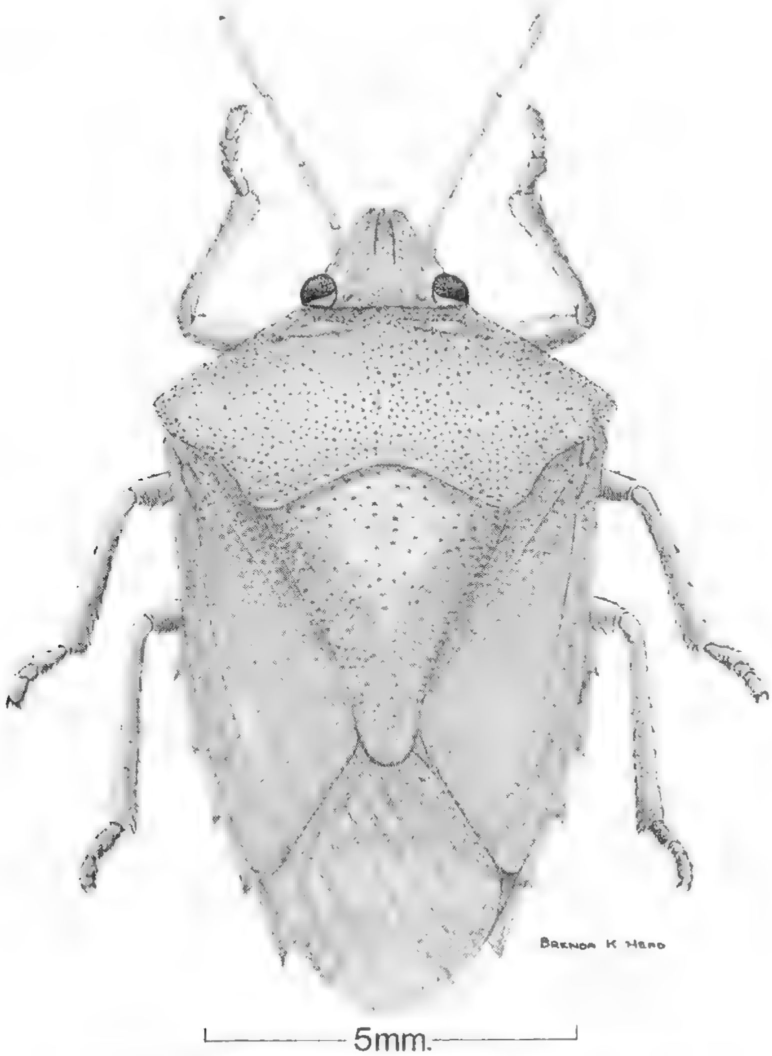

Fig. 63. Dorsal aspect *Petalaspis tescorum* Bergroth.

Laterotergites: Posterior angles of III to VI with small backwardly directed black tipped spines, posterior angle of VII produced into a much larger flattened posteriorly directed spine; this spine, posterior margin of laterotergite VII and posterior margin of last abdominal segment reddish.

Underside: Bucculae low and sinuate, not reaching base of head, rounded anteriorly. Head laterally rather swollen below antennifers. First segment of rostrum reaching to about level of base of antennifers, second segment curved and reaching just behind fore coxae, third segment to just behind middle coxae, fourth segment to base of fourth abdominal ventrite. Rostrum yellow with pale reddish infusion, tip of apical segment black.

Raised keel of mesosternum thickish, protruding over prosternum and close to it (latter narrowly and shallowly sulcate anteriorly), almost reaching base of head, apically shortly truncate. Raised keel of metasternum darker, thicker, much shorter, posteriorly excavate to receive apex of ventral spine. Legs normal, tibiae cylindrical.

Third ventrite of abdomen medially raised in a thick forwardly directed spine, all visible ventrites rather V-shaped as viewed from rear of animal. Spinous projections of seventh laterotergites and apical portions of visible genitalia, frequently reddish, sometimes also ventral midline and base of abdomen. Apex of male abdomen Fig. 64 A. Clasper Fig. 64 D, rather F-shaped. Aedeagus Fig. 64 C, with phallosoma very lightly sclerotized and honey-coloured, as the inflations were not completely successful the whole conjunctiva was not seen but the "lappet" processes are strongly developed, there are two rather tubular conjunctival lobes and the medial penial plates are large and ventrally placed, each has a lateral laminate process. Apex of female Fig. 64 B.

MALES (from 12 specimens)

Dimensions—

Parameter	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	39	4·2	10·7	34-47
Head width	44	1·7	3·8	42-48
Antennal segment I	11	1·5	13·6	9-15
Antennal segment II	22	2·0	11·0	20-26
Antennal segment III	20	1·5	7·5	18-23
Antennal segment IV	24	1·7	7·0	22-29
Antennal segment V	27	1·1	4·0	25-28
Pronotum width	107	5·1	4·7	95-112
Pronotum length	47	2·7	5·7	43-50
Total length	206	8·9	4·3	195-225

FEMALES (from 7 specimens)

Parameter	Mean	Standard Deviation	Coefficient of Variation	Observed Range
Head length	41	3·8	9·2	35-46
Head width	47	2·1	4·4	44-50
Antennal segment I	11	2·6	23·6	9-17
Antennal segment II	23	1·7	7·3	21-25
Antennal segment III	19	1·2	6·3	17-21
Antennal segment IV	24	(five measurements only)		23-25
Antennal segment V	26	(three measurements only)		25-27
Pronotum width	121	8·7	7·1	107-131
Pronotum length	53	3·7	6·9	48-59
Total length	233	21·2	9·0	210-275

Total length: 10·3-14·5 mm

Remarks: A not very common species but widely distributed, ranging from near Geraldton in Western Australia to Yeppoon in Queensland. Most specimens examined were from arid regions.

In Helsinki an unmarked male specimen was located which agrees in locality and all essential details of Bergroth's original description of this species. The specimen has been marked as the lectotype.

Location of Type:

Lectotype ♂, "Stevenson River, N.T." in Helsinki.

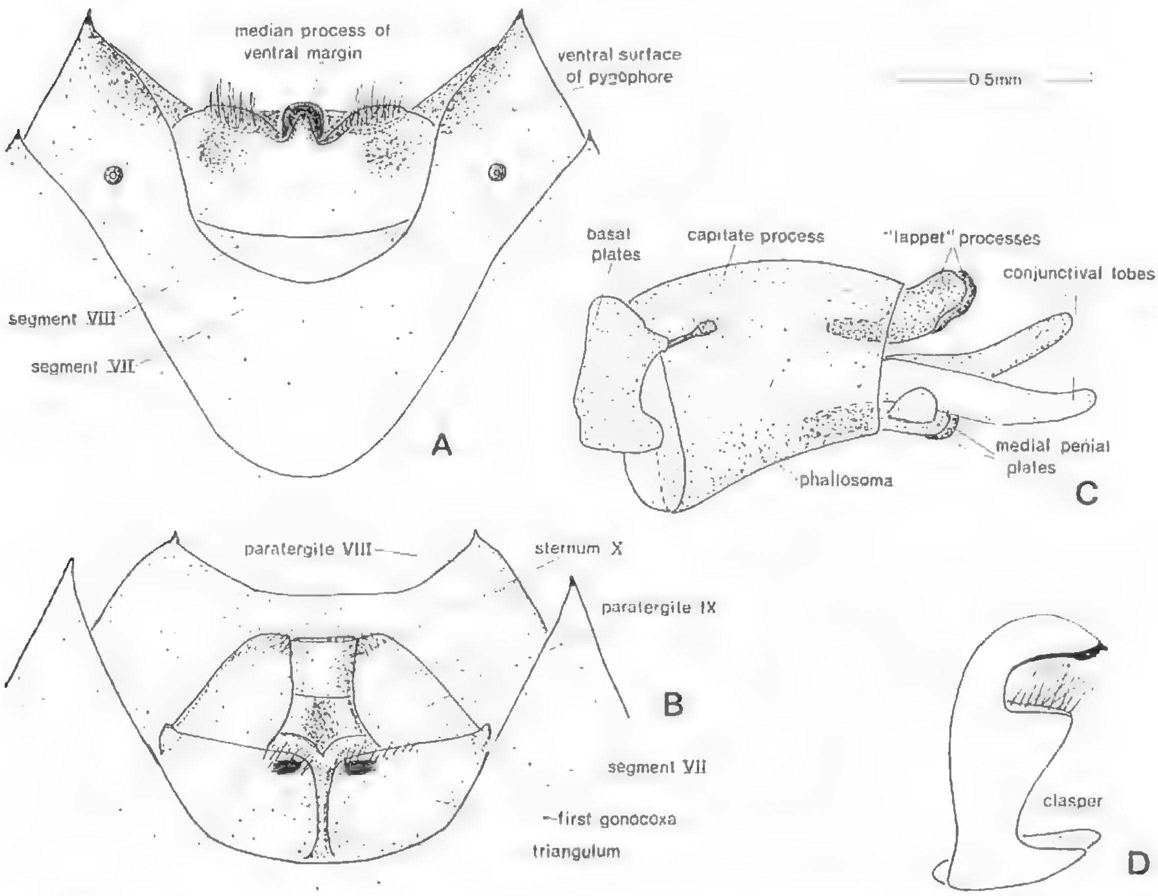

Fig. 64. *Petalaspis tescorum* Bergroth. A, ventral aspect of apex of male abdomen. B, ventral aspect of apex of female abdomen. C, lefthand side view of aedeagus. D, clasper.

Specimens examined: The lectotype and one other unlocalised specimen ♀, Australia, Blackburn SAM. Western Australia 3 ♂ ♂, 1 ♀, Dongarra, 26.XI-3.XII.1935, R. E. Turner; ♂, Dongarra, 4-10.X.1935, R. E. Turner BM; 2 ♀ ♀, 24 km (= 15 miles) west of Louisa Downs, 250 m, 18.X.1962, at Ultraviolet (black) light, E. S. Ross & D. Q. Cavagnaro CAS. South Australia; 4 ♂, 2 ♀, Parachilna Gorge 11 km east of Parachilna, 20.V.1975, by beating foliage of *Eucalyptus camaldulensis* Dehn., G. F. Gross; ♂, Lake Eyre, May 1951, G. F. Gross; ♀, Cooper Crossing, 21.II.1956, G. F. Gross SAM. Victoria 1 ♀, Lake Hattah, J. E. Dixon NM. New South Wales ♂, Bourke, 25.V.1905, *ex* Kirkaldy Coll. USNM. Queensland ♀, Bowen, A. Simpson BM; 2 ♂ ♂, Mt. Isa, 3.XI.1967. on *Eucalyptus* sp., E. M. Exley; 2 ♂ ♂, 2 ♀ ♀, Lake Moondarra 19 km (= 12 mi) from Mt. Isa, 3.XI.1967, on *Eucalyptus* sp. E. M. Exley UQ; 1 ♀, Rockhampton, Sept. 1943, Helfer, *ex* J. R. De la Torre Bueno Collection KU; 2 ♂ ♂, 1 ♀, Yeppoon, 25.XI.1967, J. M. Sedlacek Bishop.

SUMMARY

The history of the recognition that the genera of Pentatomidae related to *Rhynchocoris* Westwood form a distinctive grouping within the family is discussed and the distinctive features of the grouping given. The external morphology and the structure of the male and female external genitalia and the spermatheca of the female are considered in this context. A partial key to the genera in Australia and adjacent regions of the group is given which distinguishes the genera treated in this first part but avoids mentioning new genera to be erected in a subsequent paper on the second half of the group.

This paper considers five genera, three of them known viz. *Ocirrhoe* Stål, *Cuspicona* Dallas and *Petalaspis* Bergroth and two new genera, *Everardia* and *Parocirrhoe*. A description of each genus is given, and where there is more than one included species, a key to the species.

Ocirrhoe is considered to contain 11 species of which five (*wilsoni, westwoodi, dallasi, cavenda* and *coronata*) are new. *Cuspicona prasinata* Stål is transferred to the genus and the three names which follow are shown to be previously unrecognised junior synonyms of earlier names: *Rhaphigaster viridipes* Walker (of *australis* (Westwood)), *Cuspicona uninotata* Walker (of *australis* (Westwood)), and *Rhynchocoris roei* Westwood (of *unimaculata* (Westwood)). The citations which follow are shown not to apply to the species to which they allegedly pertained: *Cuspicona roei* Dallas *non* Westwood (now to *dallasi* sp. nov.), and *Ocirrhoe unimaculata* Stål *non* Westwood (now to *westwoodi* sp. nov.)

Cuspicona is considered to contain 24 species in this region, of which 15 (*ooldeae, eremophilae, cooperi, obesula, procallosa, equisignata, phi, angustizona, apothoracica, longispina, cygniterrae, norfolcensis, neocaledoniae, cheesmani* and *exnigrospersa*) are new. *Cuspicona privata* Walker is returned to the genus and is the first valid name for the taxon previously known as *Pentatoma viride* Montrouzier, then *Cuspicona viridis* auctt. then *Cuspicona zeloma* Kirkaldy. The two names which follow are shown to be previously unrecognised junior synonyms of earlier names: *Cuspicona beutenmulleri* Van Duzee (of *strenuella* Walker) and *Cuspicona laminata* Stål (of *privata* Walker). The citations which follow are shown not to apply to the species to which they allegedly pertained: *Cuspicona virescens* Tryon *non* Westwood (now to *simplex* Walker) and *Cuspicona rufispina* Van Duzee *non* Stål (now to *forticornis* Breddin).

Everardia is based on a single new species (*picta*) and *Paroecirhoe* is also based on a single new species (*woodwardi*). A lectotype has been selected for *tescorum* Bergroth, the type and only included species in the genus *Petalaspis*.

Descriptions and figures of all new species and redescriptions and figures of previously recognised species from the area are given. Short comparative descriptions are given of *Cuspicona ampla* Walker and *Cuspicona rufispina* Stål which are shown to occur only outside of the area under consideration.

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RECORDS OF THE SOUTH AUSTRALIAN MUSEUM

VERTEBRATE TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM

SOUTH AUSTRALIAN MUSEUM
North Terrace, Adelaide
South Australia 5000

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VERTEBRATE TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM

I. Fishes by C. J. M. Glover

Summary

The type-specimens of six genera and 71 species or subspecies of recent fishes in the South Australian Museum are catalogued. Most are from Australia, a number from Antarctica.

VERTEBRATE TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM

I. FISHES

by

C. J. M. GLOVER

South Australian Museum, Adelaide 5000

ABSTRACT

GLOVER, C. J. M., 1976. Vertebrate type-specimens in the South Australian Museum. I. Fishes. *Rec. S. Aust. Mus.* 17 (7): 169-175.

The type-specimens of six genera and 71 species or subspecies of recent fishes in the South Australian Museum are catalogued. Most are from Australia, a number from Antarctica.

INTRODUCTION

The following is a list of all recent fish types, representing six genera and 71 species or subspecies, registered in the South Australian Museum to date, together with descriptive references, collecting data and currently accepted names.

Most of these specimens have recently been relocated and data from their labels, type descriptions and the collection register cross checked. Some specimens, as indicated, have still to be located, but efforts to find them are continuing.

CLASS CYCLOSTOMATA

ORDER PETROMYZONIFORMES

Family Eptatretidae

Eptatretus longipinnis Strahan, 1975.

Aust. Zool. 18 (3): 137-148, fig. 1.

Holotype: F4042, in spirit, from south-eastern Indian Ocean off Robe, South Australia, collected by R. B. Hawes, 2.ix.1971.

CLASS ELASMOBRANCHII

ORDER HETERODONTIFORMES

Family Triakidae

Fur ventralis Whitley, 1943.

Rec S. Aust. Mus. 7: 397

=*Furgaleus ventralis* (Whitley, 1943)

Paratypes: F2069, cast of specimen taken from St. Vincent Gulf, South Australia, collector unknown, 30.x.1943. F2070, mounted skin of above specimen; neither the cast or the skin can be located.

ORDER RHINOBATIFORMES

Family Rhinobatidae

Trygonorhina melaleuca Scott, 1954.

Rec. S. Aust. Mus. **11** (2): 106, fig. 1.

Holotype: F2769, male in formalin, taken off Kingscote, Kangaroo Island, South Australia, collected by E. Sundberg, 26.iii.1953; a cast of this specimen (numbered F2769) is also in the South Australian Museum.

ORDER MYLIOBATIFORMES

Family Urolophidae

Urolophus gigas Scott, 1954.

Rec. S. Aust. Mus. **11** (2): 105, pl. XXII.

Holotype; F2744, female in formalin, taken at Port Noarlunga, South Australia, collected by T. D. Scott and F. J. Mitchell, 31.i.1952; a cast (F4127) of this specimen is also in the South Australian Museum.

CLASS TELEOSTOMI

ORDER CLUPIEFORMES

Family Dorosomidae

Chatoessus horni Zietz, 1896.

Rept. Horn Sci. Exped. C. Austr., **2** (Zool): 180, pl. XVI, fig. 6.

=*Fluvialosa horni* (Zietz, 1896)

Holotype: F1063, in spirit, from "Central Australia", collected by Horn Expedition party, 1894.

ORDER SALMONIFORMES

Family Idiacanthidae

Idiacanthus aurora Waite, 1916.

Austr. Ant. Exped., (C) **3** (1) (Fish): 53-55, pl. V, fig. 1, text fig. 11.

Holotype: F380, in spirit, from 25 miles (40 km) northward of Macquarie Island, collected by the Australasian Antarctic Expedition party, 1912.

Family Paralepididae

Notosudis hamiltoni Waite, 1916.

Austr. Ant. Exped., (C) **3** (1) (Fish): 56-58, pl. V, fig. 2, text fig. 12.

Holotype: F382, in spirit, from Macquarie Island, Antarctica, collected by H. Hamilton, sometime during the period 1911-1913.

ORDER SILURIFORMES

Family Plotosidae

Plotosus argenteus Zietz, 1896.

Rept. Horn. Sci. Exped. C. Austr. **2** (Zool): 410, pl. XVI, fig. 7.

=*Tandanus* (*Neosilurus*) *argenteus* (Zietz, 1896).

Holotype: F1090, in spirit, from the Barcoo River (=Cooper Creek), near Innamincka, South Australia, collected by the Horn Expedition party, 1894.

Ostophycephalus duriceps Ogilby, 1899.

Proc. Linn. Soc. N.S. Wales **24**: 156.

=*Cnidoglanis macrocephalus* (Cuvier & Valenciennes, 1840).

Holotype: F1093, in spirit from Semaphore, St. Vincent Gulf, South Australia, presented by A. Zietz, 1898.

ORDER GOBIESOCIFORMES

Family Gobiesocidae

Aspasmogaster patella Scott, 1954.

Rec. S. Aust. Mus. **11** (2): 111, fig. 3.

=*Aspasmogaster tasmaniensis* (Guenther, 1861).

Holotype: F2788, in spirit, from Kingston Park (near Adelaide), South Australia, collected by University of Adelaide biology students, 26.ix.1953.

Paratypes: F2789, three specimens, in spirit, locality and collection data as for the holotype.

ORDER LOPHIIFORMES

Family Antennariidae

Echinophryne crassispina McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 67, pl. VI, fig. 2.

Holotype: F609, in spirit, from Spencer Gulf South Australia, collector and date of collection unknown.

Histiophryne scortea McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 74, pl. VII, fig. 2.

Holotype: F618, in spirit, from Stansbury, St. Vincent Gulf, South Australia, collector and date of collection unknown.

Paratypes: F617 and F619, two specimens in spirit, locality and collecting data as for the holotype.

ORDER ATHERINIFORMES

Family Melanotaeniidae

Nematocentris winneckii Zietz, 1896.

Rept. Horn. Sci. Exped. C. Austr. **2** (Zool): 179, pl. XVI, fig. 3.

=*Melanotaenia nigrans* (Richardson, 1843).

Syntype: F1075, in spirit, from Finke River. "Central Australia", collected by Horn Expedition party, 1894.

Nematocentris tatei Zietz, 1896.

Rept. Horn. Sci. Exped. C. Austr. **2** (Zool): 178, pl. XVI, fig. 2.

Syntypes: F1166, three specimens in spirit, from Idracowra, "Central Australia", collected by Horn Expedition party, 1894.

Family Atherinidae

Tropidostethus rhothophilus Ogilby, 1895.

Proc. Linn. Soc. N.S. Wales **2** (10): 323.

Paratype: F1164, from Maroubra Bay, New South Wales, collected by T. Whitelegge, March, 1893.

Craterocephalus dalhousiensis Ivantsoff & Glover, 1974.

Aust. Zool. **18** (2): 88-98, fig. 1.

Holotype: F3453, male in spirit, from Main Spring at Dalhousie Springs, collected by C. J. M. Glover, 3.viii.1968.

Allotype: F3453, female in spirit, locality and collection data as for the holotype.

Paratypes: F3453, 11 males and nine females, stored apart from the primary types, locality and collection data as for the primaries.

NOTE—Some other paratype specimens were deposited with the following institutions: Australian Museum (Sydney), American Museum of Natural History (New York), British Museum of Natural History (London), Museum National d'Histoire Naturelle (Paris), Zoologisch Museum (Amsterdam).

ORDER BERYCIFORMES

Family Berycidae

Hoplostethus mediterraneus Cuvier & Valenciennes, var. *latus* McCulloch, 1914.

Biol. Res. Endeavour **2**: 97, fig. 5.

Syntype: F213, in spirit, from Great Australian Bight, collected by *F.I.S. Endeavour*, March, 1912 or 4.iv.1913 (?).

ORDER GASTEROSTEIFORMES

Family Syngnathidae

Syngnathus vercoi Waite & Hale, 1921.

Rec. S. Aust. Mus. **1** (4): 298, fig. 41.

Holotype: F690, male in spirit, from Spencer Gulf, South Australia, collected by Sir Joseph Verco, 7.xii.1920.

Paratypes: F691, 18 specimens in spirit, locality and collection data as for the holotype.

Leptonotus costatus Waite & Hale, 1921.

Rec. S. Aust. Mus. **1** (4): 301, fig. 43.

Holotype: F693, female in spirit, from Spencer Gulf, South Australia, collected by Sir Joseph Verco, 7.xii.1920.

Paratype: F694, in spirit, locality and collection data as for the holotype.

Histiogamphelus maculatus maculatus Hale, 1939.

S.A. Naturalist **19** (4): 2-3, fig.

Holotype: F2039, female in spirit, from Aldinga, St. Vincent Gulf, South Australia, collected by J. D. McDonald, 9.xii.1936.

Histiogamphelus maculatus robensis Whitley, 1948.

Rec. Aust. Mus. **22**: 76.

Holotype: F2611, in spirit, from coastal waters near Robe, South Australia, collected by B. Hendon, 13.ii.1946.

Histiogamphelus gallinaceus Hale, 1941.

S.A. Naturalist, **21** (2): 10, fig.

Holotype: F2227, male in spirit, from silt grounds at Outer Harbor, South Australia, collected by A. E. McWaters, 20.viii.1941.

Histiogamphelus rostratus Waite & Hale, 1921.

Rec. S. Aust. Mus. **1** (4): 303, fig. 44.

=*Hypselognathus rostratus* (Waite & Hale, 1921).

Holotype: F696, in spirit, from Spencer Gulf, collected by Sir Joseph Verco, 7.xii.1920.

Paratype: A juvenile specimen which, having very badly deteriorated, was subsequently destroyed; locality and collection data as for the holotype.

Ichthyocampus cristatus McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 40, fig. 26.

Holotype: F569, a dried specimen, in good condition, from Spencer Gulf, collector and date of collection unknown.

Lissocampas caudalis Waite & Hale, 1921.

Rec. S. Aust. Mus. **1** (4): 306, fig. 46.

Holotype: F701, in spirit, from near Kangaroo Island, South Australia, collected by a Mr. Rumball, 2.x.1901.

Paratype: F702, locality and collection data as for the holotype.

Corythoichthys flindersi Scott, 1957.

Trans. R. Soc. S. Aust. **80**: 182, fig. 2.

=*Syngnathus flindersi* (Scott, 1957).

Holotype: F2922, two specimens in spirit, from Pelican Lagoon, Kangaroo Island, South Australia, collected by H. M. Cooper, 20.ix.1956.

Acentronura australe Waite & Hale, 1921.

Rec. S. Aust. Mus. **1** (4): 317, fig. 53.

Holotype: F719, female in spirit, from St. Vincent Gulf, South Australia, collector and date of collection unknown.

Paratype: F720, male in spirit, locality and collection data as for the holotype.

Siokunichthys herrei Herald, 1953.

Bull. U.S. Nat. Museum **202** (1): 254-256 fig. 38.

Paratype: F3841, in spirit, from Fiji, Suva, collected by the Crocker Expedition party, 20.iv.1933.

NOTE—Formerly in the collection of the Californian Academy of Natural Sciences (C.A.S. Catalog No. 5910) until presented to the South Australian Museum; one of seven specimens, all paratypes, of the same collection.

ORDER SCORPAENIFORMES

Family Scorpaenidae

Neosebastes pantica McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 64, pl. IV, fig. 1.

Holotype: F601, in spirit, from Spencer Gulf, South Australia, collector and date of collection unknown.

ORDER PERCIFORMES

Family Cyclopteridae

Paraliparis wildi Waite, 1916.

Austr. Ant. Exped. (C) 3 (1) (Fish): 43-44, pl. IV, fig. 1, text fig. 9.

Holotype: F378, in spirit, from off the Shackleton Ice-shelf, Antarctica, collected by the Australasian Antarctic Expedition party, 29.i.1914.

Family Brotulidae

Dermatopsis multiradiatus McCulloch & Waite, 1918.

Rec. S. Aust. Mus. 1 (1): 63, pl. V, fig. 4.

Holotype: F480, in spirit, from Kangaroo Island, South Australia, collected by E. R. Waite, 1917.

Paratype: F480, in spirit, with the holotype, locality and collection data as above.

Family Centropomidae

Ambassis telkara Whitley, 1955.

Rec. S. Aust. Mus. **5** (3): 349, fig. 2.

Holotype: F1793, in spirit, from Bathurst Head, Queensland, collected by H. M. Hale and N. B. Tindale, January, 1927.

NOTE—Although the type description specifies no holotype, the South Australian Museum fish register indicates specimen F1793 as being the holotype.

Twenty-seven specimens registered F1794, with locality and collection data as for the above specimen, probably constitute paratypes. The type description merely states that six specimens (presumably of this collection) were retained for the Australian Museum, Sydney (Reg. No. IA 6046).

Family Pseudochromidae

Dampieria ignita Scott, 1959.

Trans. R. Soc. S. Aust. **82**: 75-76, fig. 1.

Holotype: F2997, in spirit, from Sharks Bay, Western Australia, collected by a member of the Underwater Spearfishermen's Association of Western Australia, May, 1954; this specimen cannot be located.

Family Plesiopidae

Trachinops norlungae Glover, 1974.

The Marine and Freshwater Fishes of South Australia (Second Edition) Govt. Printer, South Aust.: 225; fig.

Holotype: F3721 in spirit, from Port Noarlunga reef, St. Vincent Gulf, South Australia, collected by S. Doyle, January, 1973.

Paratypes: F3676, eight specimens, in spirit, locality and collection data as for the holotype.

Family Theraponidae

Therapon welchi McCulloch & Waite, 1917.

Trans. Roy. Soc. S. Aust. **41**: 472, fig. 1.

=*Hephaestus welchi* (McCulloch & Waite, 1917).

Holotype: F606, in spirit, from Cooper Creek, near Innamincka, South Australia, collected by E. R. Waite, 3.x.1916.

Therapon barcoo McCulloch & Waite, 1917.

Trans. R. Soc. S. Aust. **41**: 474, fig. 2.

=*Scortum barcoo* (McCulloch & Waite, 1917).

Holotype: F607, in spirit, from Cooper Creek, "Central Australia", collected by E. R. Waite, date of collection unknown.

Family Apogonidae

Archamia leai Waite, 1916.

Trans. R. Soc. S. Aust. **40**: 455-456, pl. XLV.

Syntypes: F308, four specimens in spirit, from Norfolk Island, off New South Wales coast, collected by A. M. Lea, 18.ii.1916.

Family Carangidae

Caranx humerosus McCulloch, 1915.

Biol. Res. Endeavour **3**: 137, pl. XXV.

=*Carangoides humerosus* (McCulloch, 1915).

Paratypes: F191, two specimens in spirit, from 11-14 miles N. 59°W, off Pine Peak, Queensland, collected by *F.I.S. Endeavour*, 1.viii.1910.

NOTE—The holotype and other paratypes of this species are housed in the Australian Museum, Sydney (Reg. No. E1436 & c.).

Family Lutjanidae

Nemipterus samsonensis Scott, 1959.

Trans. R. Soc. S. Aust. **82**: 77-78, fig. 2.

Holotype: F2966, in spirit, from Point Samson, Western Australia, collected by a member of the Underwater Spearfishermen's Association of Western Australia, November, 1954.

Family Pomadasyidae

Plectorhynchus ordinalis Scott, 1959.

Trans. R. Soc. S. Aust. **82**: 79-80, fig. 3.

Holotype: F3006, in spirit, from Sharks Bay, Western Australia, collected by a member of the Underwater Spearfishermen's Association of Western Australia, May, 1954.

Family Chironemidae

Threpterius chalceus Scott, 1954.

Rec. S. Aust. Mus. **11** (2): 108-109, fig. 2.

Holotype: F2739, a female in spirit, from the west coast of Kangaroo Island, South Australia, collected by P. M. Thomas, 10.ix.1951.

Family Labridae

Cheilinus aurantiacus Castelnau, 1875.

Proc. Zool. Acclim. Soc. Vic. **1**: 245.

= *Pseudolabrus aurantiacus* (Castelnau, 1875).

Paratypes: F1349, an indeterminate number of specimens from St. Vincent Gulf, South Australia, collected by F. G. Waterhouse, date of collection unknown; the three specimens found registered F1349 are labelled being either "types or co-types".

NOTE—McCulloch (1929-30) states that the Type is in the Paris Museum.

Eupetrichthys gloveri Scott, 1974.

The Marine and Freshwater Fishes of South Australia (Second Edition) Govt. Printer, South Australia.: 303-304.

Holotype: F3164, in spirit, from Thistle Island, South Australia, collected from *F.R.V. Weerutta*, September or October, 1960.

Paratypes: F3164, three specimens in spirit, locality and collecting data as for the holotype.

Stethojulis rubromacula Scott, 1959.

Trans. R. Soc. S. Aust. **82**: 87-88, fig. 7.

Holotype: F2993, in spirit, from Sharks Bay, Western Australia, collected by a member of the Underwater Spearfishermen's Association of Western Australia, May, 1954.

Thalassoma septemfasciata Scott, 1959.

Trans. R. Soc. S. Aust. **82**: 84-85, fig. 4.

Holotype: F2984, the larger (total length 214 mm) of two specimens in spirit, from Sharks Bay, Western Australia, collected by a member of the Underwater Spearfishermen's Association of Western Australia, May, 1954.

Anampses lennardi Scott, 1959.

Trans. R. Soc. S. Aust. **82**: 86-87, fig. 6.

Holotype: F3024, the larger (a male, total length 203 mm) of two specimens in spirit, from Point Samson, Western Australia, collected by a member of the Underwater Spearfishermen's Association of Western Australia, December, 1957; this specimen cannot be located.

Choerodon rubidis Scott, 1959.

Trans. R. Soc. S. Aust. **82**: 89-90, fig. 7.

Holotype: F2985, in spirit, from Sharks Bay, Western Australia, collected by a member of the Underwater Spearfishermen's Association of Western Australia, May, 1954.

Family Uranoscopidae

Kathetostoma nigrofasciatum Waite & McCulloch, 1915.

Trans. R. Soc. S. Aust. **39**: 469, pl. XIII, figs. 1-2.

Holotype: F170, the largest (total length 195 mm) of three specimens in spirit, from the Great Australian Bight, collected during the *S.T. Simplon* experimental trawling cruise, 1914.

Paratypes: F170, two specimens in spirit, locality and collecting data as for the holotype.

Family Nototheniidae

Notothenia coriiceps Richardson var. *macquariensis* Waite, 1916.

Austr. Ant. Exped. (C) **3** (1) (Fish): 64-66, pl. V, fig. 3, text fig. 15.

Syntype: F385, in spirit, from Macquarie Island, Antarctica, collected by H. Hamilton of the Australasian Antarctic Expedition party, sometime during the period 1911-1913.

Family Bathydraconidae

Bathydraco nudiceps Waite, 1916.

Austr. Ant. Exped. (C) **3** (1) (Fish): 27-29, pl. I, fig. 3, text fig. 4.

Holotype: F369, in spirit, from off the Shackleton Ice-shelf, collected by the Australasian Antarctic Expedition party, 28.i.1914.

Aconichthys harrissoni Waite, 1916.

Austr. Ant. Exped. (C) **3** (1) (Fish): 30-32, pl. II, fig. 1, text fig. 5.

Genotype and Holotype: F371, one specimen in spirit, from off the Shackleton Ice-shelf, collected by the Australasian Antarctic Expedition party, 29.i.1914.

Cygnodraco mawsoni Waite, 1916.

Austr. Ant. Exped. (C) **3** (1) (Fish): 32-34, pl. III, fig. 1, text fig. 6.

Genotype and Holotype: F372, one specimen in spirit, from off Drygalski Island, Antarctica, collected by the Australasian Antarctic Expedition party, sometime during the period 1911-1914.

Family Channicthyidae

Dacodraco hunteri Waite, 1916.

Austr. Ant. Exped. (C) **3** (1) (Fish): 35-37, pl. II, fig. 2, text fig. 7.

Genotype and Holotype: F374, one specimen in spirit, from off the Shackleton Ice-shelf, Antarctica, collected by the Australasian Antarctic Expedition party, 31.i.1914.

Family Peronedysidae

Eucentronotus zietzi Ogilby, 1898.

Proc. Linn. Soc. N.S. Wales **23** (3): 294.

=*Peronedys anguillaris* Steindachner, 1884.

Syntype: F1491, in spirit, from St. Vincent Gulf, South Australia, collector and date of collection unknown.

Family Ophiclinidae

Ophiclinus aethiops McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 57, fig. 29.

Holotype: F481, in spirit, from Kangaroo Island, South Australia, collected by E. R. Waite, 1917.

Ophiclinus varius McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1); 57, fig. 30.

=*Ophiclinus gracilis* Waite, 1906.

Holotype: F503, in spirit, from Kangaroo Island, South Australia, collected by E. R. Waite, 1917.

Paratypes: F503, three specimens in spirit, with the holotype, locality and collection data as above; only one of these specimens has been located to date.

Ophiclinus pardalis McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 58, pl. 4, fig. 2.

=*Ophiclinops pardalis* (McCulloch & Waite, 1918).

Holotype: F600, in spirit, from Streaky Bay, South Australia, collector and date of collection unknown.

Family Tripterygiidae

Helcogramma decurrens McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 52, pl. 3, fig. 2.

Holotype: F598, from St. Vincent Gulf, South Australia, collector and date of collection unknown.

Brachynectes fasciatus Scott, 1957.

Trans. R. Soc. S. Aust. **80**: 180, fig. 1.

=*Veronectes fasciatus* (Scott, 1957).

Genotype and Holotype: F2921, in spirit, from Pelican Lagoon, Kangaroo Island, South Australia, collected by H. M. Cooper, 20.ix.1956.

Family Clinidae

Heteroclinus adelaide Castelnau, 1872.

Proc. Zool. Acclim. Soc. Vict. **1**: 247.

Holotype: F1492, from St. Vincent Gulf, South Australia, collected by F. G. Waterhouse, date of collection unknown.

Trianectes bucephalus McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 53, pl. 3, fig. 3.

Holotype: F599, in spirit, from Spencer Gulf, South Australia, collected by Sir Joseph Verco, date of collection unknown.

Family Nomeidae

Cridorsa moonta Whitley, 1938.

Rec. S. Aust. Mus. **6** (2): 159-161, pl. XVI.

Genotype and Holotype: F2023, from Moonta Bay, Spencer Gulf, South Australia, collected by H. Kemp, 4.viii.1938; having later very badly deteriorated it was subsequently destroyed.

Family Gobiidae

Eleotris larapintae Zietz, 1896.

Rept. Horn. Sci. Exped. C. Austr. **2** (Zool.): 179, pl. XVI, fig. 4.

Mogurnda mogurnda (Richardson, 1844).

Syntypes: F513, three specimens, from Red Bank Creek, "Central Australia"; F514, two specimens, from the Finke River, "Central Australia"; all collected by the Horn Expedition party, 1894.

Gobius eremius Zietz, 1896.

Rept. Horn. Sci. Exped. C. Austr. **2** (Zool.): 180, pl. XVI, fig. 5.

=*Chlamydogobius eremius* (Zietz, 1896).

Syntypes: F525, six specimens in spirit, from Coward Springs railway bore, Far North South Australia, collected by the Horn Expedition party, 4.v.1894.

Mugilogobius galwayi McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 50, pl. III, fig. 1.

=*Lizagobius galwayi* (McCulloch & Waite, 1918).

Holotype: F583, in spirit, from Patawalonga Creek (near Adelaide), South Australia, collector and date of collection unknown.

Oxyurichthys cornutus McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 80, pl. VIII, fig. 2.

Holotype: F592, in spirit, from Cairns, Queensland, collected by J. A. Anderson, date of collection unknown.

Drombus halei Whitley, 1935.

Rec. S. Aust. Mus. **5** (3): 353-354, fig. 5.

Holotype: F1801, in spirit, from Flinders Island, North Queensland, collector and date of collection unknown.

Boleophthalmus caeruleomaculatus McCulloch & Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 79, pl. VIII, fig. 1.

Holotype: F590, in spirit, from the Adelaide River, Australian Northern Territory, collector and date of collection unknown; this specimen cannot be located.

Paratypes: F591, three specimens in spirit, locality and collection data as for the holotype; these specimens cannot be located.

ORDER TETROADONTIFORMES

Family Balistidae

Weerutta ovalis Scott, 1962.

The Marine and Freshwater Fishes of South Australia, Govt. Printer, Adelaide: 310, fig.

Genotype and Holotype: F3057, a single specimen in spirit, from off Dangerous Reef, South Australia, collected by *F.R.V. Weerutta*, February, 1961.

Family Ostraciontidae

Anoplocapros gibbosus McCulloch & Waite, 1915.

Trans. R. Soc. S. Aust. **39**: 480, pl. 18.

=*Anoplocapros lenticularis* (Richardson, 1841).

Paratypes: F248, two specimens in spirit, from South Australian coastal waters, collector and date of collection unknown.

Aracana spilogaster Richardson var. *angusta* McCulloch & Waite, 1915.

Trans. R. Soc. S. Aust. **39**: 488, pl. XXIII.

Holotype: F166, in spirit, from Bass Strait, east of Flinders Island, collector and date of collection unknown.

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VERTEBRATE TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM

II. AMPHIBIANS

by

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ABSTRACT

TYLER, M. J. 1976. Vertebrate type-specimens in the South Australian Museum. II. Amphibians. *Rec. S. Aust. Mus.* **17** (8): 177-180.

Type-specimens of amphibians in the South Australian Museum represent 34 species and subspecies, and include holotypes and syntypes of 21 species. With the sole exception of a ranid from the Philippines, they are all from Australia, New Guinea and adjacent islands.

INTRODUCTION

Dowling, Gilboa and Zweifel (1970) included 53 titles in a world-wide survey of published lists of type-specimens of reptiles and amphibians. Of the lists of types held in particular institutions, the only Australian museums represented at that time were the Macleay Museum (Goldman, Hill and Stanbury, 1969) and the Western Australian Museum (Anonymous, 1962, *et seq.*: six titles vide Dowling *et al.*, 1970). Subsequently Coventry (1970) and Covacevich (1971) published lists of the types in the National Museum of Victoria and the Queensland Museum respectively.

In Australia the largest number of amphibian types is lodged at the Australian Museum; a list of these is being prepared (H. G. Cogger, pers. comm.). However the South Australian Museum type collection is relatively substantial, containing types of 34 species and subspecies representing the following families: Hylidae (20 species), Ranidae (five), Leptodactylidae (five) and Microhylidae (three). Holotypes or syntypes of 21 species and subspecies are included.

Twenty-four of these species involved are from New Guinea, eight from Australia and one from the Philippines.

AMPHIBIA, ANURA

Hyla albolabris Wandolleck, 1911, *Abh. K. zool. Anthrop.-ethn. Mus. Dresden* **13** (6): 12.

=*Litoria albolabris* (Wandolleck), vide Tyler, 1971: 352

Syntype: S.A.M. R4947, Aitape, New Guinea (coll. O. Schlaginhaufen)

Hyla bulmeri Tyler, 1968a, *Zool. Verh.* (96): 56.

=*Litoria bulmeri* (Tyler), vide Tyler, 1971: 352

Holotype: S.A.M. R5625, Glkm, Upper Aunjung Valley, Schrader Mountains, New Guinea (coll. R. N. H. Bulmer).

Paratypes: S.A.M. R5624, R8107 (same as holotype).

Hyla contrastens Tyler, 1968a, *Zool. Verh.* (96): 72.

=*Litoria contrastens* (Tyler), vide Tyler, 1971: 352

Holotype: S.A.M. R5845, Barabuna, near Kundiawa, New Guinea (coll. F. Parker).

Paratype: S.A.M. R6450 (same data as holotype).

Hyla coplandi Tyler, 1968b, *Rec. S. Aust. Mus.* **15** (4): 716

=*Litoria coplandi* (Tyler), vide Tyler, 1971: 352

Paratype: S.A.M. R9103, Wave Hill, Northern Territory, Australia. (coll. K. G. Buller).

Hyla dorsivena Tyler, 1968a, *Zool. Verh.* (96): 83

=*Litoria dorsivena* (Tyler), vide Tyler, 1971: 352

Holotype: S.A.M. R7901, Telefomin, New Guinea (coll. B. Craig).

Paratypes: S.A.M. R7902-7910 (same data as holotype). R7911 transferred to Museum of Natural History, University of Kansas. Now K.U. 153143.

Hyla leucova Tyler, 1968a, *Zool. Verh.* (96): 119

=*Litoria leucova* (Tyler), vide Tyler, 1971: 353

Holotype: S.A.M. R6461, Busilmin, New Guinea (coll. B. Craig).

Hyla meiriana Tyler, 1969, *Rec. S. Aust. Mus.* **16** (1): 2

=*Litoria meiriana* (Tyler), vide Tyler, 1971: 353

Holotype: S.A.M. R9082, 157 km north of Mainoru, Northern Territory, Australia (coll. A. Fleming, R. Edwards and H. Bowshall).

Paratypes: S.A.M. R9014-32, 9034, 9074-81, 9083-85 (same data as holotype). (R.9033 transferred to Museum of Natural History, University of Kansas. Now K.U. 153144).

Hyla micromembrana Tyler, 1963, *Trans. R. Soc. S. Aust.* **86**: 121

=*Litoria micromembrana* (Tyler), vide Tyler, 1971: 353

Holotype: S.A.M. R4150, Mt. Podamp, near Nondugl, New Guinea (coll. M. J. Tyler).

Hyla mintima Tyler, 1963, *Trans. R. Soc. S. Aust.* **86**: 123

=*Litoria angiana* (Boulenger), vide Tyler, 1971: 354

Holotype: S.A.M. R4151, Mintima, near Kerowaghi, New Guinea (coll. M. J. Tyler).

Hyla modica Tyler, 1968a, *Zool. Verh.* (96): 135

=*Litoria modica* (Tyler), vide Tyler, 1971: 354

Paratype: S.A.M. R8108, Oruge, New Guinea (coll. F. Parker).

Hyla multiplica Tyler, 1964, *Amer. Mus. Novit.* (2187): 2

=*Litoria multiplica* (Tyler), vide Tyler, 1971 354

Paratype: S.A.M. R4946, Kassam, Kratke Mountains, New Guinea (coll. H. M. Van Deusen).

Hyla prora Menzies, 1969, *Trans. R. Soc. S. Aust.* **93**: 165

=*Litoria prora* (Menzies), vide Tyler, 1971: 354

Paratypes: S.A.M. R10410-11, Efogi, Owen Stanley Mountains, New Guinea (coll. J. I. Menzies).

Hyla spinifera Tyler, 1968a, *Zool. Verh.* (96): 167

=*Litoria spinifera* (Tyler), vide Tyler, 1971: 354

Paratypes: S.A.M. R6928-31, Oruge, New Guinea (coll. F. Parker).

Hyla wisselensis Tyler, 1968a, *Zool. Verh.* (96): 180

=*Litoria wisselensis* (Tyler), vide Tyler, 1971: 355

Paratypes: S.A.M. R5539-43, Enarotali, Lake Paniai, Wissel Lakes, New Guinea (coll. M. Boeseman and L. D. Holthius).

Litoria brevipalmata Tyler, Martin and Watson, 1972, *Proc. Linn. Soc. N.S.W.* 97 (1): 82

Holotype: S.A.M. R11236, Ourimbah Creek, 8 km north-west of Gosford, New South Wales, Australia (coll. F. Parker).

Litoria glandulosa Tyler and Anstis, 1975, *Rec. S. Aust. Mus.* **17** (5): 41

Holotype: S.A.M. R13504, Barwick Creek, Point Lookout, near Ebor, New South Wales, Australia (coll. M. Anstis).

Paratypes: S.A.M. R13505-10, Barwick and Bullock Creeks, Ebor; R13060 (11 juveniles), R13303, Barwick Creek; R13626-39, Point Lookout. (coll. M. Anstis).

Litoria quadrilineata Tyler and Parker, 1974, *Trans. R. Soc. S. Aust.* **98** (2): 71

Holotype: S.A.M. R13489, Jalan Trikora Road), Merauke, Irian Jaya (coll. F. Parker).

Paratypes: S.A.M. R13490-93, collected with holotype by F. Parker.

Litoria timida Tyler and Parker, 1972, *Trans. R. Soc. S. Aust.* 96 (3): 157.

Holotype: S.A.M. R11658, Menemsorae, Western District, New Gunea (coll. F. Parker).

Paratypes: S.A.M. R11659-61 (same data as holotype.

Nyctimystes montana Parker, 1936, *Ann. Mag. Nat. Hist.* **17**: 80

=*Nyctimystes cheesmani* (*nomen nudum*) Tyler, 1965: 268

Paratype: S.A.M. R9424, Mondo, New Guinea (coll. L. E. Cheesman).

Nyctimystes zweifeli Tyler, 1967, *Trans. R. Soc. S. Aust.* **91**: 191.

Holotype: S.A.M. R5426, Telefomin, New Guinea (coll. B. Craig).

Paratypes: S.A.M. R8812-8813, 8815-8819 (same data as holotype). (R8814 transferred to Museum of Natural History, University of Kansas. Now K.U. 15345).

Leptodactylidae

Crinia affinis halmaturina Condon, 1941, *Rec. S. Aust. Mus.* 7: 114

=*Ranidella signifera* Girard, vide More, 1961: 234 & Blake, 1973.

Holotype: S.A.M. R2165, Flinders Chase, Kangaroo Island, South Australia. (coll. Tate Society). Specimen missing. Notes: This specimen could not be found when a specific search for it was undertaken in 1960.

Crinia riparia Littlejohn and Martin, 1965, *Copeia*, 1965 (3): 319

=*Ranidella riparia* (Littlejohn and Martin), vide Blake 1973.

Paratypes: S.A.M. R9101-02, Alligator Gorge, Flinders Ranges, South Australia (coll. M. J. Littlejohn, A. A. Martin and P. Rawlinson).

Glauertia russelli Loveridge, 1933, *Occ. Pap. Boston Soc. Nat. Hist.* 8: 89.

Paratype: S.A.M. R9723, Creek flowing into Gascoyne River, near Landor Station, Western Australia (coll. L. Glauert).

Kyarranus kundagungan Ingram and Corben, 1975, *Mem. Qld. Mus.* **17** (2): 335.

Paratypes: S.A.M. R13921-22, Mistake Mountains, Queensland (Coll. C. J. Corben and A. K. Smyth).

Limnodynastes dumerili variegatus Martin, 1972, *Aust. J. Zool.* **20**: 181.

Paratypes: S.A.M. R13174-75, 6 km north of Cape Otway, Victoria, Australia. (coll. A. A. Martin).

Ranidella remota Tyler and Parker, 1974, *Trans. R. Soc. S. Aust.* 98 (2): 74

Holotype: S.A.M. R13524, Morehead, Papua New Guinea (coll. F. Parker).

Paratypes: S.A.M. R13527-28, Gubam; R13525-26, R13681-82, Morehead (coll. F. Parker).

Microhylidae

Barygenys cheesmanae Parker, 1936, *Ann. Mag. nat. Hist.*, **17**: 74.

Paratype: S.A.M. R9423, Mount Tafa, New Guinea (coll. L. E. Cheesman).

Cophixalus exiguus Zweifel and Parker, 1969, *Amer. Mus. Novit.* (2390): 2.

Holotype: S.A.M. R10311, Mount Hartley, Queensland, Australia (coll. F. Parker).

Paratypes: S.A.M. R9796, 10035-40 (same data as holotype). (R9723 transferred to Museum of Natural History, University of Kansas. Now K.U. 153146).

Sphenophryne dentata Tyler and Menzies, 1971, *Trans. R. Soc. S. Aust.* **95** (2): 79.

Holotype: S.A.M. R12063, Alotau, Milne Bay, New Guinea (coll. J. I. Menzies).

Paratypes: S.A.M. R11819-28 (same data as holotype).

Ranidae

Cornufer ingeri Brown and Alcala, 1963, *Copeia* 1963 (4): 672.

=*Platymantis ingeri* (Brown and Alcala), vide Zweifel, 1967: 120.

Paratypes: S.A.M. R8808, Cantaub area, Bohol Island, Philippines; S.A.M. R13606, Dusita area, Bohol Id., Philippines (both coll. A. Alcala).

Platymantis akarithymus Brown and Tyler, 1968, *Proc. biol. Soc. Wash.* **81**: 76.

Holotype: S.A.M. R7073, Pomogu, 11 km north-west of Kandrian, New Britain (coll. M. J. Tyler).

Paratypes: S.A.M. R6982 (same data as holotype) S.A.M. R7066, R7082, near Malassait, approx. 85 km west of Rabaul, New Britain (coll. M. J. Tyler).

Platymantis mimicus Brown and Tyler, 1968, *Proc. biol. Soc. Wash.* **81**: 74.

Holotype: S.A.M. R6868, Numundo Plantation, Willaumez Peninsula, New Britain (coll. M. J. Tyler).

Paratypes: S.A.M. R7064, R7069, Pomugu 11 km north-west of Kandrian; S.A.M. R6864, Gazelle Peninsula, New Britain. (All coll. M. J. Tyler).

Platymantis rhipiphalcus Brown and Tyler, 1968. *Proc. Biol. Soc. Wash.* **81**: 77.

Holotype: S.A.M. R7071, near Pomogu, approx 11 km north-west of Kandrian, New Britain (coll. M. J. Tyler).

Paratype: S.A.M. R7078, San Remo Plantation, Willaumez Peninsula, New Britain (coll. M. J. Tyler).

Platymantis papuensis schmidti Brown and Tyler. 1968, *Proc. biol. Soc. Wash.* **81**: 85.

Holotype: S.A.M. R7618, Talasea, Willaumez Peninsula, New Britain (coll. M. J. Tyler).

Paratypes: S.A.M. R6762-68, 6772-93, 6795, 6801, 6803-07, 6809-13, 6815-16, 6858-60, 6862, 6869, 6912-13, 6915, 6922-28, 7061, 7070, 7080, 7085, 7088-89, 7093, 7095, 7097, 7101-04, 7106, 7109, 7115, Willaumez Peninsula; 7615, 7617-23, 7625-37, 7639-47, 7649-74, 7677-78, Baining Ranges, Gazelle Peninsula; 7043, 7045, 7099, 7132, 7134-37, 7139, 7147-48, 7151, Kerevat, Gazelle Peninsula (all coll. M. J. Tyler). (R7616, 7638, 7648 transferred to Museum of Natural History, University of Kansas. Now K.U. 153147-49).

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VERTEBRATE TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM

III. REPTILES

by

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ASTRACT

HOUSTON, T. F. 1976. Vertebrate type-specimens in the South Australian Museum. III. Reptiles. *Rec. S. Aust. Mus.* 17 (9): 181-187.

The South Australian Museum holds primary type-specimens of 58 species of living reptiles (all but one species are Australian). Thirty-one species are represented by holotypes, syntypes or lectotypes. Full collection data are provided for all specimens.

INTRODUCTION

The following list is based primarily on the taxonomic literature so that it should include all reptile type-specimens (i.e. holo-, syn-, lecto-, allo-, para- and paralecto-types) purported to be in the South Australian Museum. An examination of the type-specimen collection, however, has brought to light other types received by donation or exchange whose presence has not previously been published.

The specimens are listed under their original names which are arranged alphabetically within each family. The currently accepted names of the taxa are noted where these differ from the original ones. Collection data are taken from the Museum registers.

The names of several institutions are abbreviated as follows:—

MCZ—Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A.

SAM—South Australian Museum, Adelaide, S.A.

USNM—United States National Museum, Smithsonian Institution, Washington, U.S.A.

WAM—Western Australian Museum, Perth, W.A.

SQUAMATA: LACERTILIA

Agamidae

Amphibolurus caudicinctus macropus Storr, 1967a.

J. R. Soc. West. Aust. **50** (2): 53.

Holotype: R3229 (=USNM 128750), ♂, 4·5 mi. (7·2 km) SSE of Oenpelli Mission, Northern Territory, 30.ix.1948, R. R. Miller, Australian-American Arnhem Land Expedition.

Amphibolurus barbatus minimus Loveridge, 1933.

Proc. New Engl. zool. Club **13**: 69.

Paratypes: R3170 (2 specimens, =MCZ 32978), West Wallaby Island, Western Australia, 10.x.1921, G. M. Allen & W. E. Schevill.

Amphibolurus gibba Houston, 1974b.

Trans. R. Soc. S. Aust. **98** (4): 209-212, figs. 1-4.

Holotype: R13954A, ♀, 5·5 km NNW of Alberrie Creek Railway Siding, South Australia, 29·35S x 137·31E, 14.i.1974, ex burrow under cracked mud crust of gibber plain, R. Forsyth and T. Houston.

Paratypes: (All from South Australia) R2525, Finniss Springs, 17.i.1947, A. J. Pearce; R3542, 12 mi. (19 km) SE of Mt. Hamilton Station on Margaret River, 19.v.1953, R. Tedford; R3805, Lake Lettie Waterhole, 23.iii.1956, G. F. Gross; R7605-6, R8310, 2mi. (3·2 km) S of Marree, February, 1966, F. J. Mitchell; R9499, Marree, June, 1966, F. J. Mitchell; R11165, 23 mi. (37 km) S of Coward Springs on road to Stuart Creek HS, 26.x.1969, Zool. Dept., Univ. of Adelaide, "gibber, crumbly clay soil, ran into burrow"; R12494A-B, 20 mi. (32 km) N of Oodnadatta, 1971, J. Bredl; R13891, Finniss Springs, 6.ii.1964, F. J. Mitchell; R13894A-B, data as for R2525; R13953, 34 km N of Coober Pedy, 6.x.1973, E. Story; R13954B-K, data as for holotype.

Amphibolurus rufescens Stirling and Zietz, 1893.

Trans. R. Soc. S. Aust. **16**: 164, pl. 6, figs. 2 and 2a.

Lectotype: R1423, ♂, Mt. Sir Thomas, Birksgate Range, South Australia, Elder Expedition (1891-92). Selected by F. R. Zietz, 1915, p. 768.

Paralectotypes: R1424-5, data as for lectotype.

NOTES—In describing this species, Stirling & Zietz did not designate types but simply noted they had three specimens and gave the dimensions of two of them. However, F. R. Zietz, 1915, noted that the largest specimen was the "type" and gave its dimensions; these accord with those of "specimen A" in the original description.

Amphibolurus scutulatus Stirling and Zietz, 1893.

Trans. R. Soc. S. Aust. **16**: 165-167, pl. 7, figs. 1 and 2.

Syntypes: R1459 (9 specimens), R3024 (2 specimens), R4814 (12 specimens), between Fraser Range and Queen Victoria Springs, Western Australia, Elder Exploring Expedition (1891-2).

NOTES—Stirling & Zietz noted they had several specimens of each sex without giving any registration numbers. Therefore, all specimens collected by the Elder Expedition at the type locality are regarded as syntypes.

Amphibolurus vadnappa Houston, 1974a.

Trans. R. Soc. S. Aust. **98** (2): 55-57, figs. 1, 2, 12-16.

Holotype: R3416B, ♂, Aroona Waters (138·21E x 30·35S), Flinders Ranges, South Australia, 3.v.1953, P. F. Lawson.

Allotype: R3314C, Mt. Aroona, South Australia, 29.xi.1951, F. J. Mitchell.

Paratypes: (All from South Australia), R2819, 6 mi. (9·7 km) NE of Commodore, 4.x.1947, Adelaide Bush Walkers; R3001, Beltana, 14.ix.1949, H. Mincham; R3314A, B & D, see allotype; R3416A & C, same data as holotype; R3423, 20 mi. (32 km) E of Angepena, 8.v.1953, P. F. Lawson; R3492, Yudnamutana Gorge, Flinders Ranges, 2.ix.1952, K. Peake-Jones; R3950, Illawartina (error for Illinawortina) Pound, Gammon Range, 25.ix.1956, F. J. Mitchell; R4321, Parachilna Gorge, 6.xi.1961, J. Findley; R4821, Aroona Waters, H. Mincham; R8114, Mt. Fitton, Moolawatana Station, 12.v.1966, H. Ehmann; R10402-4, Narrina Station, Flinders Ranges, April 1969, H. Mincham; R10638, Wilpena Pound, 25.viii.1969, H. Mincham; R10918-23, Arkaroola HS, 24.x.1969, SAM expedition; R10934-5, near Boulder Bore, 27.x.1969, SAM expedition; R10946, Echo Camp (Arkaroola Station), 27.x.1969, SAM expedition; R10965-7, East Painter Gorge, 1.xi.1969, SAM expedition; R11361, Copper Creek, Arkaroola Station, May 1969, C. P. Brown; R11373, Arkaroola Station, January 1970; R12432, Terrapinna Springs (139·40E x 29·55S), 17.ix.1970, Ehmann and Houston; R12749, Oraparinna National Park, September 1971, Nature Conservation Society; R12837, Walkawonda (error for Waukawoodna) Gap, 60 mi. (97 km) N of Blinman, 1971, R. Maddern; R13053, see R12749; R13135, see R3492.

Diporiphora lalliae Storr, 1974a.

Rec. West. Aust. Mus. 3 (2): 138-139, fig. 4.

Paratypes: R3536, Moola Bulla Station, northern Western Australia, 7-30.ix.1953, N. B. Tindale; R4824A-C, Tennant Creek, Northern Territory, 20.iv.1906, J. F. Field; R5047, Palm Valley, Northern Territory, September 1959, P. F. Lawson; R5352, Giles, Rawlinson Ranges, Western Australia, November 1963, P. F. Aitken and N. B. Tindale; R13539A-B, 16 km NW of Tennant Creek, Northern Territory, 26.i.1969, in light scrub and spinifex.

Diporiphora magna Storr, 1974a.

Rec. West. Aust. Mus. 3 (2): 137-138, fig. 4.

Paratype: R8167, Delamere Station, Northern Territory, August 1966, P. Aitken.

Diporiphora bilineata margaretae Storr, 1974a.

Rec. West. Aust. Mus. 3 (2): 143-144, fig. 5.

Paratypes: R2848, R13483A-Z, Umba Kumba, South side of Little Lagoon, Groote Eylandt, Northern Territory, 1-16.vi.1948, R. R. Miller, Australian-American Arnhem Land Expedition.

Tympanocryptis cephalus gigas Mitchell, 1948.

Rec. S. Aust. Mus. 9 (1): 65-67, figs. 1 and 4.

Holotype: R2434, ♂, between Ashburton and Gascoyne Rivers, Western Australia, 1893, P. St. Barbe, Ayliffe. This specimen cannot be found.

Paratypes: R2434 (two specimens), data as for holotype.

Tympanocryptis intima Mitchell, 1948.

Rec. S. Aust. Mus. 9 (1): 60-62, figs. 1 and 2.

Holotype: R2331, ♀, Oodnadatta, South Australia, Prof. J. B. Cleland, on gibber plain.

Tympanocryptis maculosa Mitchell, 1948.

Rec. S. Aust. Mus. 9 (1): 78-80, figs. 1 and 9.

Amphibolurus maculosus (Mitchell), vide Mitchell, 1965a, p. 190.

Holotype: R2220a, ♂, Lake Eyre North, South Australia, August 1929, C. T. Madigan.

Allotype and Paratypes: R2220 (19 specimens), data as for holotype. Only 13 of these specimens have been located.

Tympanocryptis lineata pinguicolla Mitchell, 1948.

Rec. S. Aust. Mus. **9** (1): 70-72, figs. 1 and 6.

Holotype: R2468a, ♂, Victoria.

Paratypes: R2468 (two specimens), data as for holotype.

Tympanocryptis uniformis Mitchell, 1948.

Rec. S. Aust. Mus. **9** (1): 76-78, figs. 1 and 8.

Holotype: R705, Darwin, Northern Territory, June 1911, O. Wesselmann.

Gekkonidae

Diplodactylus elderi Stirling and Zietz, 1893.

Trans. R. Soc. S. Aust. **16**: 161, pl. 6, figs. 1 and 1a.

Holotype: R2027, Barrow Range, Western Australia, 23.viii.1891, Elder Exploring Expedition.

Diplodactylus galeatus Kluge, 1963.

Rec. S. Aust. Mus. **14** (3): 545-548, pl. 34a.

Holotype: R973, ♂, Stuart Range, South Australia, 15.x.1919, Henry Greenfield.

Paratype?: R1563, Hermannsburg, Northern Territory, 24.i.1930, H. Heinrich.

NOTES—Kluge regarded specimen R1563 as conspecific with the holotype and noted its differences. Paratypes were not designated in his paper.

Diplodactylus mitchelli Kluge, 1963

Rec. S. Aust. Mus. **14** (3): 548-550, pl. 34b.

Paratypes?: R4280 (formerly R4142), Coolawanyah HS, Western Australia, 17.vii.1958, F. J. Mitchell, under stones; R4281 (formerly R4143), Tambrey Creek near Tambrey HS, Western Australia, 28.vii.1958, F. J. Mitchell, under stones near waterhole.

NOTES—Kluge regarded these specimens as conspecific with the holotype and noted their differences. Paratypes were not designated in his paper.

Diplodactylus savagei Kluge, 1963.

Rec. S. Aust. Mus. **14** (3): 550-553, pl. 35, a and b.

Paratypes?: R3464 (two specimens), Pilgangoora Well, Western Australia, 16-25.v.1953, N. B. Tindale (one missing); R4282 (formerly R4144), Coolawanyah HS, Western Australia, 17.vii.1958, F. J. Mitchell, under iron.

NOTES—Kluge regarded these specimens as conspecific with the holotype and noted their differences. Paratypes were not designated in his paper.

Gehyra fenestra Mitchell, 1965b.

Senckenberg. biol. **46** (4): 307-310, fig. 9.

Paratypes: R4596, summit of Mt. Herbert-Big Pool, Western Australia, 25.vii.1958, F. J. Mitchell; R4597, Tambrey Station, Western Australia, 30.vii.1958, A. Douglas, in crack in roof of cave; R4601-2, Tambrey Station, Western Australia, 3-4.viii.1958, F. J. Mitchell; R4600, top of Mt. Herbert, Western Australia, 4.viii.1958, F. J. Mitchell.

NOTES—Specimens R4596, 4600 and 4602 are alizarin-stained skeletons.

Gehyra pilbara Mitchell, 1965b.

Senckenberg. biol. **46** (4): 303-306, figs. 7 and 8.

Paratypes: R4433-69 (R4437 and R4454 sent by exchange to USNM), Tambrey HS and Nuntana waterhole, Tambrey Creek, Western Australia, 28.vii.-3.viii.1958, F. J. Mitchell, ex termite mounds.

NOTES—The following specimens are alizarin-stained skeletons: R4435, 4441, 4446a-b, 4462 and 4599.

Nephrurus stellatus Storr, 1968a.

West. Aust. Nat. **10** (8): 180-182, fig. 1.

Paratype: R8392, Hambidge Reserve, Eyre Peninsula, South Australia, 9.x.1966, M. Smyth.

Pygopodidae

Aprasia inaurita Kluge, 1974.

Misc. Publs. Mus. Zool. Univ. Mich. **147**: 51-53, figs. 21 and 32.

Paratypes: (All from South Australia) R379, Mitchell via Yeelanna, 31.vii.1914, W. A. Dorwood; R1673, Lock 3, Murray River, 28.viii.1931, J. Allen; R2752, near Renmark, 9.v.1948, T. L. Wadrop; R2808, Salisbury, 16.ix.1948, H. Harris; R3089A, Streaky Bay, 8.viii.1950, E. J. Greenfield; R3885, Port Lincoln, W. C. Johnston; R4302, Tumby Bay, 28.ix.1962, J. F. Darling; R8410, Lameroo, November, 1966, J. Troubridge; R8994, "A" Island, Venus (Bay), 20.ix.1967, Macrow and Sorrell; R9210, Blesing Reserve, 3.x.1967, R. Henzell, under limestone; R9215, data as for R9210 but collected 7.x.1967; R11655, Cultana Army Base, Whyalla, 1.ix.1970, L. Payne; R12617, 5 mi. (8 km) NW of Wharminda, Eyre Peninsula, E. Jericho.

Aprasia pseudopulchella Kluge, 1967.

Misc. Publs. Mus. Zool. Univ. Mich. **147**: 56-57, figs. 24 and 27.

Holotype: R6360, a few miles N of Burra, South Australia, 19.viii.1965, J. Bishop.

Paratypes: (All from South Australia) R406A-D, Clare, December 1914, L. G. Thorpe; R2110A-D, Mylor, 10.viii.1936, F. C. Carson; R6357-9, R6361, data as for holotype; R10778-9, Mambray Creek Reserve, 17.ix.1969, T. Grearson, under stones on top of range; R12510, Yudnamutana, North Flinders Ranges, 10.ix.1970, Rostrevor College.

Delma australis Kluge, 1974.

Misc. Publs. Mus. Zool. Univ. Mich. **147**: 77-80, figs. 4, 6, 41-43 and 120.

Paratypes: (All from South Australia) R380, Mitchell via Yeelana, 31.viii.1914, W. A. Dorwood; R3852, 15 mi. (24 km) N of Poochera, 15.vi.1956, F. J. Mitchell; R4301, Port Germein Gorge, August 1961, J. A. Fisher; R5375, Gawler Ranges, March, 1963, F. J. Mitchell; R9189, R9213, Blesing Reserve, Eyre Peninsula, 10/3/.x.1967, R. Henzell; R9224, 4 mi. (6·4 km) S of Baird Bay, 12.x.1967, R. Henzell; R10374, data as for R3852; R10376, data as for R5375; R12454-5, Corunna Hills near Iron Knob, 18.iv.1971, ex *Triodia* bushes, H. Mincham and T. Houston; R12481, R12669, Miccollo Hill (136·36E x 32·32S), Siam Station, 19-20.iv.1971, ex *Triodia* bush, H. Mincham and T. Houston; R12751, data as for R12454.

Delma borea Kluge, 1974.

Misc. Publs. Mus. Zool. Univ. Mich. **147**: 81-82, figs. 44-47 and 124.

Paratype: R8409, Katherine, Northern Territory, 25.xi.1966, J. Turner.

Delma elegans Kluge, 1974.

Misc. Publs. Mus. Zool. Univ. Mich. **147**: 82-86, figs. 43, 48-50 and 124.

Paratype: R4475, Tambrey HS, Western Australia, 28.vii.1958, F. J. Mitchell.

Delma inornata Kluge, 1974.

Misc. Publs. Mus. Zool. Univ. Mich. **147**: 101-105, figs. 58, 62-64.

Paratypes: R11095, 20 mi. (32 km) N of Walla Walla, New South Wales, 25.xi.1969, D. J. Rees; R12745, Tooperang, South Australia, 26.vii.1971, G. S. Wynniatt, found under stone.

Delma nasuta Kluge, 1974.

Misc. Publs. Mus. Zool. Univ. Mich. **147**: 109-113, figs. 70-73 and 124.

Paratype: R4513, Millstream HS, Western Australia, 18.vii.1958, F. J. Mitchell.

Delma pax Kluge, 1974.

Misc. Publs. Mus. Zool. Univ. Mich. **147**: 113-117, figs. 69, 74-77.

Paratypes: (All from Western Australia) R3445A, Pilgangoora Well, 16-25.v.1953, N. B. Tindale; R3452, Yandeyarra Station, 20-24.vi.1953, N. B. Tindale; R4514, Tambrey HS, 28.vii.1958, F. J. Mitchell.

Scincidae

Carlia amax Storr, 1974b.

Rec. West. Aust. Mus. 3 (2): 160-162.

Paratypes: R13531A-B, R13536, Kangaroo Springs, Bing Bong Station near Borroloola, Northern Territory, 8.iii.1969.

Carlia gracilis Storr, 1974b.

Rec. West. Aust. Mus. 3 (2): 158-159.

Paratype: R5367D (now R14723), Northern Territory.

Carlia rufilatus Storr, 1974b.

Rec. West. Aust. Mus. 3 (2): 157.

Paratypes: R5367A-C and E, Northern Territory.

Ctenotus alacer Storr, 1969.

J. R. Soc. West. Aust. **52** (4): 104-105.

Paratype: R5588, MacDonnell Ranges, Northern Territory, November, 1963, M. Warburg.

Ctenotus uber orientalis Storr, 1971a.

Rec. S. Aust. Mus. **16** (6): 8-9.

Paratypes: R23-4, Turners Well, River Murray, South Australia, 24.i.1911, G. Wright; R1507, Pinnaroo, South Australia, don. Mr. Broadbent; R2789, R9466-9, between South Gap and Pernatty HS, South Australia, 18.viii.-6.ix.1948, F. J. Mitchell and G. F. Gross; R3618, Lake Palankarinna, South Australia, June 1954, P. F. Lawson; R5738, Panaramitee Station, South Australia, R. Edwards; R9735, Dalhousie HS, South Australia, 3.viii.1968, F. J. Mitchell; R10017, R10027, R10030, Mern Merna, South Australia, November 1947 and January 1948, D. R. Hall; R10044, Milparinka, New South Wales, 10.x.1968, A. Kowanko; R10055, MacDonnell Ranges, Northern Territory, 17.iii.1913, Capt. S. A. White; R10122, Blue Range Creek, South Australia, October 1968, M. Smyth.

Ctenotus regius Storr.

Rec. S. Aust. Mus. **16** (6): 7-8.

Paratypes: (All from South Australia) R759, Killalpaninna, September-October 1916, SAM Expedition; R2657, R10028-9, R10031-3, Mern Merna, January 1948,

D. R. Hall; R2788, R10024-6, between South Gap and Pernatty HS, 18.viii.-6.ix.1948, F. J. Mitchell and G. F. Gross; R3177, R10013-4, Yudna Swamp, Moralana Station, 12.ii.1951, D. R. Hall; R10342, Goyders Lagoon, 12.ix.1968, J. Hilditch, in rat burrow.

Dasia smaragdina perviridis Barbour, 1921.

Proc. New Engl. zool. Club 7: 106.

Paratypes: R3166 (two specimens, =MCZ 15050-1), Graciosa Bay, Santa Cruz, Solomon Is., 5.xi.1916, N. M. Mann.

Egernia kintorei Stirling and Zietz, 1893.

Trans. R. Soc. S. Aust. 16: 171.

Lectotype: R2925, Victoria Desert S of Barrow Range, Western Australia, R. Helms, Elder Exploring Expedition (1891-2). Selected by Mitchell (1950, p. 284).

Paralectotypes: R2915-6 (=*E. inornata* Rosen), Fraser Range and between Fraser Range and Victoria Springs, Western Australia, 28.x.1891, R. Helms, Elder Exploring Expedition.

Egernia whitii multiscutata Mitchell and Behrndt, 1949.

Rec. S. Aust. Mus. 9 (2): 176.

=*E. m. multiscutata* (M. & B.), vide Storr, 1968b, p. 57.

Holotype: R2636, ♂, Greenly Island, South Australia, 6-17.xii.1947, F. J. Mitchell.

Allotype and Paratypes: R2636 (7 specimens) and R8579-81 (3 specimens formerly under R2636), data as for holotype.

Notes—Two of the paratypes under R2636 have not been found.

Egernia margaretae personata Storr, 1968b.

J. R. Soc. West. Aust. 51 (2): 53.

Holotype: R3748, Wilpena Gorge, South Australia, 26.ix.1955, F. J. Mitchell.

Paratypes: (All from South Australia) R2573, 8 mi. (13 km) SE of Warcowie School, 22.iv.1947, D. R. Hall; R2645, Mern Merna, 11.ix.1947, D. R. Hall; R3934, S branch of Balcanoona Creek, Gammon Ranges, September 1956, F. J. Mitchell; R8503, Wilpena Gorge, 26.x.1955, F. J. Mitchell; R8717-8 (formerly R3301), Wilpena Gorge, 27-28.xi.1951, F. J. Mitchell; R8724-6, North Tusk, Gammon Ranges.

Egernia whitei tenebrosa Condon, 1941.

Rec. S. Aust. Mus. 7 (1): 111.

Holotype: R2161, Flinders Chase, Kangaroo Island, South Australia, presented by the Tate Society, University of Adelaide.

Egernia slateri virgata Storr, 1968b.

J. R. Soc. West. Aust. 51 (2): 60.

Holotype: R602, Oodnadatta to Everard Ranges, South Australia, Capt. S. A. White.

Leiolopisma greeni Rawlinson, 1975.

Mem. natn. Mus. Vict. 36: 8-10, fig. 2; pl. 1, fig. 2; pl. 2, fig. 3b.

Paratype: R11136, Barn Bluff, western Tasmania, 16.i.1963, F. J. Mitchell.

Leiolopisma triacantha Mitchell, 1953.

Rec. S. Aust. Mus. 11 (1): 88-89, fig. 4.

=*Carlia triacantha* (Mitchell), vide Storr, 1974b, p. 159.

Holotype: R2697, ♂, Adelaide River, 61 mi. (98 km) S of Darwin, Northern Territory, 2.vi.1943, R. V. Southcott.

Paratypes: R2700, R2702 (the latter destroyed), data as for holotype.

Lerista picturata baynesi Storr, 1971b.

J. R. Soc. West. Aust. 54 (3): 66-67.

Paratype: R9498 (= WAM R24617), Eucla, Western Australia, 7.ix.1968, G. M. Storr & A. M. Douglas.

Lygosoma melanops Stirling & Zietz, 1893.

Trans. R. Soc. S. Aust. 16: 173-174, pl. 7, figs. 3 and 3a.

=*Tiliqua b. branchiale* (Günther), vide Mitchell, 1950, p. 303.

Syntypes: Two specimens, between the Everard and Barrow Ranges, South Australia—Western Australia, Elder Exploring Expedition (1891-2).

Notes—No registration numbers were quoted in the original description. Mitchell, 1950, p. 304, lists R2732 (two specimens) as the types but the SAM register indicates only one specimen under that number and this could not be located. Another specimen, R8139, is listed in the register as a paratype and may be the juvenile described by Stirling and Zietz.

Lygosoma (Sphenomorphus) taeniata Mitchell, 1949.

Rec. S. Aust. Mus. 9 (2): 180.

=*Ctenotus brooksi taeniatus* (Mitchell), vide Storr, 1971a, p. 14.

Holotype: R2803, Tobys Swamp, Andamooka Ranges, South Australia, 18.viii.-6.ix.1948, F. J. Mitchell & G. F. Gross, in burrow in sandhill with two geckos—*Diplodactylus damaeus*.

Rhodona stylis Mitchell, 1955.

Rec. S. Aust. Mus. **11** (4): 400-402, figs. 6 and 7.

=*Lerista stylis* (Mitchell), vide Greer, 1967, p. 19.

Holotype: R3094, Yirrkala Mission, Northern Territory, 22-27.vii.1948, R. R. Miller, Australian-American Arnhem Land Expedition.

Paratypes: R2855 (2 specimens), Umba Kumba, Groote Eylandt, Northern Territory, 1-16.vi.1948, Australian-American Arnhem Land Expedition; R2856 (5 specimens), same data as for holotype.

Tiliqua scincoides intermedia Mitchell, 1955.

Rec. S. Aust. Mus. **11** (4): 393-394.

Holotype: R3095, ♂, Yirrkala Mission, Northern Territory, 22-27.vii.1948, R. R. Miller, Australian-American Arnhem Land Expedition.

Paratype: R3225 (= USNM 128388), near Umba Kumba, Groote Eylandt, Northern Territory, Australian-American Arnhem Land Expedition (April-November 1948).

Varanidae

Varanus (Odatria) glebopalma Mitchell, 1955.

Rec. S. Aust. Mus. **11** (4): 389-390, fig. 3, pl. 37.

Holotype: R3222 (=USNM 128385), ♂, S end of Lake Hubert, Northern Territory, Australian-American Arnhem Land Expedition (April-November 1948).

Varanus (Varanus) mitchelli Mertens, 1958.

Senckenberg. biol. **39**: 256-259, pls. 27 and 31.

Holotype: R3230 (= USNM 128755), 5 mi, (8 km) W of Oenpelli Mission, Northern Territory, Australian-American Arnhem Land Expedition (April-November 1948).

SQUAMATA: OPHIDIA

Elapidae

Demansia acutirostris Mitchell, 1951.

Rec. S. Aust. Mus. **9** (4): 547-549, fig. 1.

=*Pseudonaja acutirostris* (Mitchell), vide Worrell, 1963, p. 143.

Holotype: R3133, Island in Lake Eyre North, South Australia, 28.26S x 137.24E, 27.x.1950, E. D. & M. Brooks and E. Price.

Denisonia nigrostriata brevicauda Mitchell, 1951.

Rec. S. Aust. Mus. **9** (4): 550-551.

=*Parasuta brevicauda* (Mitchell), vide Worrell, 1963, p. 135.

Holotype: R3137, Fowlers Bay, South Australia.

Paratypes: (All from South Australia) R1230, Waikerie, L. G. Thorpe; R2273, Parrakie; R3136 (21 specimens), Sedan, Murray Scrub, October, 1885?, Mr. Rothe; R3138, Murray Bridge, J. G. Neumann; R3139, Beetaloo Waterworks, Dr. Stirling; R3140, Murray Bridge; R3141, Mt. Wedge via Elliston, 29.vii.1907, J. L. Harwood.

Denisonia brunnea Mitchell, 1951.

Rec. S. Aust. Mus. **9** (4): 551-552, figs. 2a and 2b.

Holotype: R3151, Mt. Wedge via Elliston, South Australia, 29.vii.1907, J. L. Harwood.

NOTES—This specimen appears to be a juvenile of *Pseudechis australis*. Only the last five subcaudals are paired, the remainder being single.

Vermicella fasciata Stirling & Zietz, 1893.

Trans. R. Soc. S. Aust. **16**: 175-176, pl. 7, figs. 4 and 4a.

=*Rhynchoelaps fasciolata fasciata* (S. & Z.), vide McDowell, 1969, p. 489.

Holotype: R2935, near the Barrow Ranges, Western Australia, 1891, R. Helms, Elder Exploring Expedition.

NOTES—No registration number was quoted in the original account but the specimen labelled as the holotype in the SAM agrees with the description and figures.

Vermicella bertholdi littoralis Storr, 1967b.

J. R. Soc. West. Aust. **50** (3): 84.

=*Rhynchoelaps bertholdi littoralis* (Storr), vide McDowell, 1969, p. 489.

Paratype: R2271 (published in error as R2771), Murchison Goldfield, Annean, Western Australia, H.Y.L. Brown.

Typhlopidae

Typhlops endoterus Waite, 1918.

Rec. S. Aust. Mus. **1** (1): 32-33, chart 5, fig. 24.

Typhlina endotera (Waite), vide McDowell, 1974, p. 6.

Holotype: R88, Hermannsburg, Northern Territory, 22.i.1912, don. F. Scarfe.

Paratypes?: R87, R89, data as for holotype.

NOTES—Waite recorded three specimens but only the registration number of the "Type" was noted. It seems obvious that R87 and R89 are the other two.

Typhlops pinguis Waite, 1897.

Trans. R. Soc. S. Aust. **21**: 25, pl. 3.

=*Typhlina pinguis* (Waite), vide McDowell, 1974, p. 6.

Holotype: R803, South Australia.

NOTE—Registered in 1918 as "Type".

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VERTEBRATE TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM

IV. BIRDS

by

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ABSTRACT

CONDON, H. T., 1976. Vertebrate type-specimens in the South Australian Museum. IV. Birds. *Rec. S. Aust. Mus.* **17** (10): 189-195.

Holotypes, paratypes and syntypes in the South Australian Museum of 27 forms involving six non-passerine and 21 passerine subspecies of living Australian birds are listed with explanatory notes.

Some of the names applied to the specimens listed have been placed in synonymy; their correct (or valid) names and geographical ranges are given.

INTRODUCTION

In the following account the type specimens are listed in systematic sequence under Orders, Families, Subfamilies, Species and Subspecies; vernacular names are given also. The nomenclature is that of the Official Checklists of the Royal Australasian Ornithologists Union.

Following the original published reference to each name, the type-category, registration (B) number, sex, type-locality, date of collection and collector's name are given together with any other data, such as measurements, colours of soft parts, and remarks on the original label.

Reference is also made to known paratypes, syntypes and lectotypes.

The last paragraph under each heading provides the currently accepted (or valid) scientific name with author, date of publication, vernacular name and Checklist numbers in brackets: the first number in brackets refers to the Second Edition of the R.A.O.U. Official Checklist (1926) and the second to Part I of the Third Official Checklist (1974).

ORDER ACCIPITRIFORMES

Family Accipitridae, Subfamily Accipitrinae: Goshawks, Sparrowhawks

Astur clarus robustus F. R. Zietz, 1914.

S. Aust. Orn. **1** (1): 13.

Holotype: B1334, ♀, Melville Island, Northern Territory, 2.viii.1913, W. D. Dodd. Grey phase, subadult. Original label marked "ZT" in red.

=*Accipiter novaehollandiae novaehollandiae* (Gmelin, 1788), Grey (White) Goshawk (220) (137). Australia and Tasmania.

ORDER COLUMBIFORMES

Family Columbidae, Subfamily Turturinae: Bronzewing and Emerald Pigeons

Chalcophaps chrysochlora melvillensis F. R. Zietz, 1914.

S. Aust. Orn. **1** (1): 12.

Holotype: B1365, ♂, Melville Island, Northern Territory, 15.viii.1913, W. D. Dodd. Original label marked "ZT" in red.

=*Chalcophaps indica melvillensis* F. R. Zietz, 1914. Green-winged Pigeon (33) (286). Melville Island, Northern Territory.

ORDER PSITTACIFORMES

Family Polytelidae: Longtailed Parrots

Aprosmictus erythropterus melvillensis F. R. Zietz, 1914.

S. Aust. Orn. **1** (1): 14.

Holotype: B1336, ♂, Melville Island, Northern Territory 4.viii.1913, W. D. Dodd. Original label marked "ZT" in red.

=*Aprosmictus erythropterus coccineopterus* (see note) (Gould, 1865) Redwinged Parrot (280) (318b). Coastal Northern Territory and Melville Island.

NOTE—For details of Gould's type of *coccineopterus* see de Schauensee 1957, page 167.

Family Platycercidae, Subfamily Platycercinae: Rosellas and allies

Platycercus elegans fleurieuensis Ashby, 1917.

Emu 17: 43.

Holotype: B2323, ♂, Second Valley, Fleurieu Peninsula, South Australia, 7.iv.1917, Edwin Ashby.

Paratype: B5333, ♀, Second Valley, Fleurieu Peninsula, South Australia, 7.iv.1917, E. Ashby.

For coloured plate of Holotype and Paratype see *Emu* 17 (3), plate 17.

=*Platycercus elegans fleurieuensis* Ashby, Crimson ("Adelaide") Rosella (283) (329), Fleurieu Peninsula, South Australia.

Psephotus haematonotus caeruleus Condon, 1941.

Rec. S. Aust. Mus. 7: 141; coloured plate.

Holotype: B2237, ♂, Innamincka Station, South Australia, 30.ix.1916, South Australian Museum Expedition.

=*Psephotus haematonotus caeruleus* Condon, Redrumped Parrot (295), (336b). North-eastern Interior, South Australia and adjacent parts of south-western Queensland and north-western New South Wales.

ORDER CUCULIFORMES

Family Cuculidae, Subfamily Cuculinae: Parasitic Cuckoos

Chrysococcyx minutillus melvillensis F. R. Zietz, 1914.

S. Aust. Orn. **1** (1): 14.

Holotype: B1288, ♂, Melville Island, Northern Territory, 26.viii.1913, W. D. Dodd. Original label marked "ZT" in red.

=*Chrysococcyx malayanus minutillus* Gould, 1859, Little Bronzecuckoo (345), (357). Northern Australia.

ORDER PASSERIFORMES

Family Timaliidae, Subfamily Cinclosomatinae: Quailthrushes and allies

Cinclosoma castanotum clarum Morgan, 1926.

S. Aust. Orn. **8**: 138-9; *Emu* 16, 1926; coloured plate I.

Holotype: B7705, ♂, Wipipippee, *ca.* 5mi. (= *ca.* 8km) E of southern end of Lake Gairdner, South Australia, 17.viii.1902, A. M. Morgan.

=*Cinclosoma castanotum clarum* Morgan 1926, Chestnut Quailthrush (437). North-western South Australia (and adjacent parts of Northern Territory and Western Australia) south to Ooldea and vicinity of Lake Gairdner.

Cinclosoma castanotum morgani Condon, 1951.

S. Aust. Orn. **20**: 42.

Holotype: B5673, ♂, 18 mi. (= c. 29km) NW of Kimba, Eyre Peninsula, South Australia, 19.ix.1925, A. M. Morgan.

=*Cinclosoma castanotum morgani* Condon 1951, Chestnut Quailthrush (437). Eyre Peninsula and Flinders Ranges, South Australia.

Family Acanthizidae, Subfamily Acanthizinae: Thornbills

Acanthiza pusilla cambrensis A. G. Campbell, 1922.

Emu **22**: 64.

Holotype: B19415, ♂, Cape Jervis, South Australia, 6.iv.1917, E. Ashby. Original label marked (in red) "TYPE *A.p. cambrian* (*sic*) A.G.C. 2/6/22". Ashby collection No. 13.

Paratype: B19413, ? sex, Lucindale, South Australia, —.vii.1916, ? collector. Ashby collection No. 9. NOTE—This specimen is referred to by Campbell (*Emu* 22: 64).

=*Acanthiza pusilla macularia* Quoy & Gaimard 1830, Brown Thornbill (475). Coastal districts of Victoria and eastern South Australia.

Geobasileus chrysorrhoa westernensis A. G. Campbell, 1922.

Emu **22**: 65.

Holotype: B19353, ♂, "Watheroo Obs.", near Moora, Western Australia, 5.xi.1920, E. Ashby. Original label marked (in red) "TYPE *G.c. westernensis* A. G. Campbell 2/6/22". Ashby collection No. 82.

Paratype: B19355, ♂, breeding, "Watheroo Obs." near Moora, Western Australia, 5.xi.1920, E. Ashby. Ashby collection No. 81. NOTE—specimen referred to by Campbell (*Emu* 22: 65).

=*Acanthiza chrysorrhoa alexanderi* Mathews, 1921, Yellowtailed Thornbill (486). Mid Western Australia.

Acanthiza tenuirostris A. H. Zietz, 1900.

Trans. R. Soc. S. Aust. **24**: 112.

Syntypes (2): B7267, B7268, ? sex, Leigh's Creek scrub, South Australia,—.viii.1895, R. M. Hawker. On original labels of both specimens, in handwriting of A. Zietz, is noted "*Acanthiza tenuirostris* A. Zietz (Type specimen) Aug. 1895. Leigh Creek, Hawker Esq".

=*Acanthiza iredalei morgani* Mathews, 1911, Samphire Thornbill (482-3). Interior of South Australia.

Family Acanthizidae, Subfamily Sericornithinae: Scrub-, Ground-, and Fieldwrens.

Sericornis maculatus condoni Mathews, 1942.

J. R. Soc. West. Aust. **27**: 78.

Holotype: B9431, ♀, Hopetoun, Western Australia, 12.vii.1906, J. T. Tunney (collection No. 8565). Pencil notes on label by G. M. Mathews "in Esperance Bay. Wing 55 cul. 10 tar. 21 tail 45. Type of *Sericornis m. condoni* Mathews". Notes by J. T. Tunney "Shot in dense scrub. Mostly seen in pairs".

=*Sericornis frontalis condoni* Mathews, 1942, Whitebrowed Scrubwren (488-492). South-west Australia.

Sericornis maculatus houtmanensis F. R. Zietz, 1921.

S. Aust. Orn. **6** (2): 44-5.

Syntypes (3): B547, B548, B549, ♂ ♀ ♂, Abrolhos Islands, Western Australia, 14.x.1912, W. D. Dodd. NOTE—Same data for each skin; but only B547 and B548 (♀) are marked "Type" in handwriting of F. R. Zietz.

=*Sericornis frontalis balstoni* Grant, 1909, Whitebrowed Scrubwren (491).

Calamanthus fuliginosus parsonsi Condon, 1951.

S. Aust. Orn. **20**: 50.

Holotype: B11850, ♂, 23 mi. (= c. 37km) E of Meningie, South Australia, 3.x.1929, Dr. A. M. Morgan. Other details are "pharynx light flesh colour; palate dark flesh colour; iris creamy white; legs dark flesh colour, feet darker; bill: maxilla dark horn, mandible light horn at base, brownish tip. Total length 13·5 cm; wing span 15·7 cm".

Paratypes (2): B11849, ♂—other details as above; "total length 12 cm; wing span 16·6 cm; stomach contents—insect remains". B23068, ♂, 17 mi. (=c. 27 km) E of Meningie, South Australia, 2.x.1929, F. E. Parsons. "Iris buff, darker on inner margin; bill: upper horn colour, lower whitish; legs and feet light horn. Total length 4·75 in. [= 12·07 cm]; wing span 7·75 in. [= 19·7 cm]". B11839, ♂, Coombe, South Australia, 10.ix.1929, W. J. Harvey. Other details "iris dark grey; feet dirty pink; bill dark brown: pharynx yellow".

=*Calamanthus fuliginosus parsonsi* Condon, 1951, Striated Fieldwren (500-503). Drier areas, South-east of South Australia.

Calamanthus fuliginosus suttoni Condon, 1951.

S. Aust. Orn. **20**: 51.

Holotype: B5669, ♂, Wertigo, SW of Whyalla, Eyre Peninsula, South Australia, 8.ix.1925, Dr. A. M. Morgan. Details from original label "iris cream; feet light brown; bill: upper dark brown, lower light brown; inside mouth dark horn. Total length 12 cm; wing span 17·25 cm; weight 16 mg. Stomach contents—insect remains".

=*Calamanthus fuliginosus suttoni* Condon, 1951, Striated Fieldwren (500-503). Northern Eyre Peninsula.

Family Maluridae, Subfamily Stipiturinae: Emu-wrens

Stipiturus malachurus halmaturinus Parsons, 1920.

S. Aust. Orn. **5**: 15.

Holotype: B22762, ♂, Stokes Bay, Kangaroo Island, South Australia, 14.x.1919, F. E. Parsons. Other details from original label "iris brown; legs and feet brown; bill brown-almost black; length from tip of bill to base of tail 2·75 in. [= 7 cm] . . . . . to tip to tail 7·5 in. [= 19 cm]".

Paratypes (4): B2984-2986, B4350-4352—a series of six specimens, all collected by F. E. Parsons at Stokes Bay, Kangaroo Island in October, 1919. For details, see Parsons (1920) pages 16 and 17.

=*Stipiturus malachurus halmaturinus* Parsons, 1920, Southern Emu-wren (526). Confined to Kangaroo Island.

Family Rhipiduridae: Fantails

Rhipidura mayi Ashby, 1911.

Emu **11**: 41.

Syntype: B176, ? sex (desiccated specimen, from formalin), Anson Bay, Northern Territory, 1911, C. E. May. Received in exchange from Ashby on 15th February, 1912. Ashby (*loc. cit.*) stated that he had received two formalin specimens from May; the second syntype was presented by Ashby to the Academy of Natural Sciences, Philadelphia, in 1917 (de Schauensee, 1957: 213).

=*Rhipidura rufifrons dryas* Gould, 1843, Rufous Fantail (362) Northern Australia.

Family Muscicapidae: Old World Flycatchers

Petroica cucullata melvillensis F. R. Zietz, 1914.

S. Aust. Orn. **1** (1): 15.

Holotype: B1285, ♂, Melville Island, Northern Territory, 21.viii.1913, W. D. Dodd. Specimen label shows "ZT" in red.

=*Petroica cucullata picata* Gould, 1865, Hooded Robin (385) Northern Australia.

Family Pachycephalidae: Whistlers, Songshrikes and allies

Pachycephala gutturalis longirostris F. R. Zietz, 1914.

S. Aust. Orn. **1** (1): 15.

Holotype: B1283, ♂, Melville Island, Northern Territory, 29.vii.1913, W. D. Dodd.

=*Pachycephala pectoralis violetae* Mathews, 1912, Golden Whistler (298-399). From Daly River, Northern Territory east to Normanton, Queensland; Melville Island.

Pachycephala rufiventris minor F. R. Zietz, 1914.

S. Aust. Orn. **1** (1): 15.

Holotype: B1001, ♂, Melville Island, Northern Territory, 10.vii.1913, W. D. Dodd. Marked "ZT" in red on label.

Paratypes (2): B1002 (labelled "CTZ" in red) same details as above; B1003 (labelled "ZT" in red) as above except date (23.vii.1913).

=*Pachycephala rufiventris falcata* Gould, 1842, Rufous Whistler (401). Melville Island, Groote Eylandt and adjacent Northern Territory mainland.

Colluricincla parvula melvillensis F. R. Zietz, 1914.

S. Aust. Orn. **1** (1): 16.

Syntypes (7): B1008-1011; B1271-1273. A series of seven specimens from Melville Island, Northern Territory, collected between 10.vii.1913 and 6.viii.1913 by W. D. Dodd are labelled "Z" in red and probably formed the basis for Zietz's description in *The South Australian Ornithologist*. There are five males and two females; all are indistinguishable from specimens from the adjacent mainland.

=*Colluricincla parvula parvula* (see note) Gould, 1845, Little Shrike-thrush (412). Northern Australia.

NOTE—For details of type see de Schauensee 1957, p. 216.

Colluricincla brunnea melvillensis F. R. Zietz, 1914.

S. Aust. Orn. **1** (1): 16.

Syntypes (3): B1007 (♂), B1269 (♂), B1270 (♀) all from Melville Island, Northern Territory, collected on 10.vii.1913 and 27.viii.1913 (B1269) by W. D. Dodd. None of the specimens is marked "ZT" (in red) which was used by F. R. Zietz to indicate type specimens, but they are marked "Z" in red. There is no indication in the original description as to the number of specimens Zietz had, or whether he selected a holotype.

=*Colluricincla brunnea* Gould, 1841, Brown Shrike-thrush (409). Northern Australia.

Colluricincla harmonica anda Condon, 1951.

S. Aust. Orn. **20**: 41.

Holotype: B12897, ♂ breeding, Clifton Hills, South Australia, 31.vii.1930, Dr. A. M. Morgan.

=*Colluricincla harmonica anda* Condon, 1951, Grey Shrike-thrush (408-410). North-east South Australia from Innamincka north to Clifton Hills and adjacent parts of New South Wales and south-western Queensland east to Charleville.

Family Falcunculidae: Shrike-tits, Bellbirds, Whipbirds and allies.

Psophodes nigrogularis pondalowiensis Condon, 1966.

S. Aust. Orn. **24** (5): 89.

Holotype: B27133, ♂ adult, coastal sand dunes, near Pondalowie Bay, Yorke Peninsula, South Australia, 30.x.1965, H. T. Condon.

=*Psophodes nigrogularis pondalowiensis* Condon, 1966, Western Whipbird (421). Southern Yorke Peninsula, South Australia.

Family Climacteridae: Australian Treecreepers

Climacteris waitei S. A. White, 1917.

Emu **16**: 168-9.

Holotype: B2303, ♂, Innamincka, South Australia, 2.x.1916, S. A. White. "Iris brown".

Paratype: B2304, ♀, Innamincka, South Australia, 2.x.1916, S. A. White. "Iris reddish brown; feet and bill blackish brown".

=*Climacteris picumnus* Temminck, 1824, Brown Treecreeper (555). South-eastern Australia, coastal and inland, from central Queensland to Yorke Peninsula, South Australia.

Family Zosteropidae: Silvereyes.

Zosterops westernensis flindersensis Ashby, 1925.

Emu **25**: 117.

Holotype: B4506, ♂, Flinders Island, near Elliston, South Australia, 6.i.1924, Prof. F. Wood-Jones. "Iris dark brown; feet greenish grey; bill grey with black tip". NOTE—Correction of page reference needed in R.A.O.U. Checklist (1926) from "177" to "117" as given above.

=*Zosterops lateralis halmaturina* A. G. Campbell, 1906, Eastern Silvereye (576). Southern districts of South Australia.

Family Meliphagidae: Honeyeaters.

Melithreptus magnirostris North, 1905.

Rec. Aust. Mus. **6** (1): 20, plate 5.

Holotype: B8610, ♂, Eastern Cove, Kangaroo Island, South Australia, 3.x.1901, F. R. Zietz. Other details from original label "*Melithreptus magnirostris* (Type). A.J.N." (in red ink); note in handwriting of F. R. Zietz "these birds were shot out of a flock. Coll. by F. R. Zietz".

Paratype: B8616, ♀, Kangaroo Island, South Australia, -.xii.1905, F. R. Zietz. A note on label apparently copied from original label (now lost) says "cotype of *zietzi*" which suggests North seems to have had difficulty in choosing a name. It is recalled that in a letter to Robert Zietz, North stated that he wished to make "*magnirostris*" a subspecies of *M. brevirostris*, but the absurdity of the combination (*brevirostris* and *magnirostris*) was pointed out by the Director of the Australian Museum, Robert Etheridge, who prevailed upon him to treat the Kangaroo Island bird as a full species, *Melithreptus magnirostris*.

=*Melithreptus brevirostris magnirostris* North, 1905, Brownheaded Honeyeater (583). Kangaroo Island.

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— NOTES —

— NOTES —

VERTEBRATE TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM

V. MAMMALS

by

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ABSTRACT

AITKEN, P. F., 1976. Vertebrate type-specimens in the South Australian Museum. V. Mammals. *Rec. S. Aust. Mus.* **17** (11): 197-203.

Type-specimens of 19 species or subspecies are housed in the mammal collection at the South Australian Museum. They comprise either holotypes, lectotypes, syntypes or paratypes of 11 marsupials, seven rodents and one chiropteran. All are from Australia except the chiropteran which is Papuan.

INTRODUCTION

Although the acquisition of mammals for display began some years earlier, registration of mammal specimens at the South Australian Museum did not commence until July, 1890, when such specimens were first entered in the Taxidermist's Register. This register was superseded by the current Mammal Register in January, 1911. Since 1890 five species and 10 subspecies of Australian mammals, plus one species of Papuan mammal, have been described from specimens in the Museum's mammal collection, and type-specimens of three more Australian mammals have been acquired from other institutions.

Some type-specimens in the mammal collection were described by authors who identified them individually in original descriptions, documented their dispositions and labelled them as types. These have been easy to catalogue. Others, on the other hand, were described by authors who did not identify them individually in original descriptions, gave few clues to their dispositions and did not label them as types. Cataloguing such specimens has been extremely difficult and has devolved on deduction and assumption rather than factual knowledge. Most types in the collection described by Wood Jones and many paratypes described by Finlayson are in the latter category. In many cases Wood Jones' types are quite impossible to identify from his original descriptions, and in the absence of personally attached labels, if indeed these were ever present, can never be selected with certainty. The South Australian Museum may well have unsuspected Wood Jones types, in addition to those catalogued, of the following species: *Myrmecobius rufus* Wood Jones 1923, *Dromicia britta* Wood Jones 1925 and *Arctocephalus doriferus* Wood Jones 1925.

MARSUPIALIA

Dasyuridae

Planigale gilesi Aitken, 1972. (Fig. 1)

Rec. S. Aust. Mus. **16** (10): 1, pls. 1, 2, 3a-d.

Holotype: M8406, male skin and skull plus torso in spirit, No. 3 Bore, pastoral property of Anna Creek, South Australia, collected P. Aitken, A. Kowanko, J. Forrest and J. Howard, 29.vi.1969.

Paratypes: M8407, male skin and skull, collected P. Aitken, A. Robinson and M. Stanley, 25.vii.1969; M8408 and M8409, male skins and skulls, collected P. Aitken, J. Forrest and J. Glover, 26.xi.1969; M8410, male in spirit, collected P. Aitken, A. Robinson and M. Stanley, 27.vii.1969; M8411, female in spirit with skull extracted, collected A. Kowanko and J. Glover, 25.vii.1970, locality data of all as for Holotype.

NOTES—Five additional paratypes are at the Australian Museum: M7033, female in spirit with skull extracted, collected I. Kirkby, 27.ii.1945 and M7393, collected v.1948, both from Bellata, New South Wales, Australia; M7819, male in spirit with skull extracted and M7820, female in spirit with skull extracted, both from Brewarrina, New South Wales, Australia, collected K. Turnbull, 1954; M9190, male in spirit, Lake Cawndilla, Kinchega National Park, New South Wales, Australia, collected M. Gray, 20.v.1969.

Phascogale (Antechinus) swainsoni maritima Finlayson, 1958.

Trans. R. Soc. S. Aust. **81**: 148, pls. 1a-h, 2a-b.

—*Antechinus minimus maritimus* (Finlayson) vide Wakefield and Warneke, 1963.

Holotype: M4985, male in spirit with skull extracted, Port MacDonnell, South Australia, collected G. H. Tilley, VI. 1938.

NOTES—Ten paratypes were indicated, but not identified individually, by Finlayson. All are in his private collection.

Myrmecobius fasciatus rufus Finlayson, 1933.

Trans. R. Soc. S. Aust. **57**: 203.

—*Myrmecobius fasciatus rufus* (Wood Jones) vide Tate, 1951.

Syntypes: M3061, female skin and skull, south of the Musgrave and north of the Everard Ranges, South Australia, collected A. Brumby, date of collection unknown; M3759, female in spirit Oolarinna, north of the Everard Ranges, South Australia, collected R. T. Maurice, date of collection unknown.

NOTES—Wood Jones (1923) published the first description of *Myrmecobius rufus* based on at least two syntypes, the skulls of which are at the odontological museum of the Royal College of Surgeons, London. His description was of a preliminary nature in which the name *Myrmecobius rufus* was treated as a synonym of *M. fasciatus* (Waterhouse), pending further description in a "scientific journal". Finlayson (1933) apparently considered that Wood Jones had not made the name *Myrmecobius rufus* available in nomenclature and published a fresh description under the name *Myrmecobius fasciatus rufus*, based on two new syntypes selected from a series of 17 examples. However, Wood Jones' original name undoubtedly is available under the provisions of Article 11 (d) of the Rules of Zoological Nomenclature and therefore has priority.

Peramelidae

Thalacomys nigripes Wood Jones, 1923. (Fig. 2)

Rec. S. Aust. Mus. **2** (3): 347, figs. 358-60.

=*Macrotis lagotis nigripes* (Wood Jones) vide Troughton, 1932 (1).

Paratype: M3922, male in spirit, Ooldea Soak, South Australia (by inference), donated Daisy M. Bates, date of collection unknown.

Fig. 1. *Planigale gilesi* Aitken, 1972. Paratype male—M 8410. (Photo—Roman Ruehle.)

Fig. 2. *Thalacomys nigripes* Wood Jones, 1923. General characters of adult male. (Drawing—F. Wood Jones.)

NOTES—Wood Jones based his description on a holotype and four paratypes, none of which was identified individually. He stated that one of this series was a male spirit-preserved specimen in the South Australian Museum, from Ooldea Soak, captured by Aboriginals and donated by Mrs. Daisey M. Bates. It is reasonable to assume that the paratype listed above was that specimen, because it fits the sub-specific description of Wood Jones and, although its locality is not entered in the mammal register, it is the only spirit specimen of *M. lagotis* in the South Australian Museum, known to have been donated by Daisy Bates. The skin of the holotype male is at the British Museum (Natural History), registered number 1925.10.8.1 and its skull is at the odontological museum of the Royal College of Surgeons, London, registered number A.378.31. The whereabouts of the remaining three paratypes is unknown.

Thalacomys minor miselius Finlayson, 1932.

Trans. R. Soc. S. Aust. **56**: 168.

=*Macrotis minor miselius* (Finlayson) vide Iredale and Troughton, 1934.

Holotype: M3465, male skin and skull, Cooncherie, South Australia, collected L. Reese and H. H. Finlayson, xii.1931.

NOTES—A series of 11 paratypes was indicated by Finlayson, but none was identified individually. They are all presumably in his private collection.

Macrotis lagotis grandis Troughton, 1932.

Aust. Zool. **7** (3): 229.

Holotype: M5225, male stuffed skin without skull, Nalpa, South Australia, collector and collection date unknown.

Paratype: M1625, skull (sex unknown), Nalpa, South Australia, collected Dr. E. Stirling, vi.1891.

NOTES—Troughton designated three paratype skulls from Nalpa . . . . "as listed by Wood-Jones (1923-5 : 156)". The South Australian Museum has four skulls of *M. lagotis* from Nalpa, but only one of these has dimensions which correspond to those of a skull listed by Wood Jones. The whereabouts of the other two paratype skulls is unknown.

Phalangeridae

Trichosurus vulpecula raui Finlayson, 1963.

Trans. R. Soc. S. Aust. **87**: 18.

Holotype: M2518, male skin and skull, scrubs of Rocky River, Flinders Chase, Kangaroo Island, South Australia, collected H. H. Finlayson and F. J. Rau, viii.1928.

Paratypes: M2509, M2524, M2530, M2541 to M2543, M2545 and M2546, female skins and skulls; M2516, M2517, M2519, M2531, M2532, M2540, M2544 and M2548, male skins and skulls; M2526, M2547 and M2561, female skulls; M2559 and M2560, male skulls, locality and collection data of all as for Holotype.

NOTES—According to the mammal register of the South Australian Museum, two additional paratypes with the same locality and collection data as the holotype were sent to the Australian Museum—M2515, male skin and skull and M2525, female skin and skull (original South Australian Museum registration numbers). Six other paratypes were indicated, but not identified individually by Finlayson; they are presumably in his private collection.

Macropodidae

Bettongia penicillata anhydra Finlayson, 1957.

Ann. Mag. nat. Hist. Ser. 12 **10** (115): 552.

=*Bettongia lesueur* (Quoy and Gaimard) vide Wakefield, 1967.

Holotype: M3582, skull (sex unknown), McEwin Hills, Northern Territory, Australia, collected M. Terry, 20.i.1933.

NOTE—The holotype was the only original specimen.

Bettongia penicillata francisca Finlayson, 1957.

Ann. Mag. nat. Hist. Ser. 12 **10** (115): 552.

Holotype: M5484, part skull (sex unknown), Saint Francis Island, Nuyt's Archipelago, Australia, collector and collection date unknown.

NOTES—According to the mammal register of the South Australian Museum, M5484 has no locality or collection data, but was found untagged in an old collection and registered in 1945. How Finlayson knew that it had been discovered on Saint Francis Island has never been explained. The holotype was the only original specimen.

Lagorchestes asomatus Finlayson, 1943.

Trans. R. Soc. S. Aust. **67**: 319, pls. 33 A-D and 34 E-H.

Holotype: M3710, skull (sex unknown), between Mount Farewell and Lake Mackay, Northern Territory, Australia, collected M. Terry, i.1933.

NOTE—The holotype was the only original specimen.

Thylogale flindersi Wood Jones, 1924.

Trans. R. Soc. S. Aust. **48**: 12.

=*Macropus eugenii flindersi* (Wood Jones).

Paratypes: M1749 and M1751, skulls (sex unknown), Flinders Island, South Sustralia, collectors and collection dates unknown; M1750, skull (sex unknown), Flinders Island, South Australia, ex Adelaide Zoological Gardens, 30.ix.1892; M2025, female skin and skull, Flinders Island, South Australia, collected F. Wood Jones, i.1924.

NOTES—Wood Jones based his description on a series of nine specimens, one of which he designated as the holotype. Only three of the paratypes (M1749 to M1751 above) were individually identified by number, but the female (M2025) was almost certainly another paratype, since she was presented to the South Australian Museum by Wood Jones and, from her collection data, must have been the female mentioned in his description as having been snared on Flinders Island in 1924. The whereabouts of the remaining four paratypes is unknown, but the skin of the holotype male is at the British Museum (Natural History), registered number 1925.10.8.11 and its skull is at the odontological museum of the Royal College of Surgeons, London, registered number A.347.91.

RODENTIA

Muridae

Conilurus pedunculatus Waite, 1896.

Rept. Horn. Sci. Exped. Centr. Aust. **2** (*Zool.*): 395, figs. 1a-f.

=*Zyzomys pedunculatus* (Waite) vide Ride, 1970.

Syntypes: M2412 and M2437, male skulls, labelled "Horn Expedition, spec. F" and "spec. B" respectively.

NOTES—The whereabouts of the skins for the above skulls is unknown, as is the exact location of the remaining five syntypes designated by Waite (A, C, D, E, and G). The erection of a lectotype is thus considered inappropriate at present. According to Dixon (1970) the Australian Museum, Sydney, probably has specimens A and G, numbered M1064 and M1065, and the National Museum, Victoria, has another supposed syntype numbered C7806 and labelled "F". As pointed out by Dixon, the latter specimen could not be specimen F because it is a male in spirit and F was a male with the skull removed. Other specimens of *Z. pedunculatus*, some of which were possibly in Waite's syntypic series, are in the Australian Museum: M1158, skin with skull *in situ*, Central Australia, ex. Horn 1896 and M1298, skin with skull *in situ*, Alice Springs, Australia, ex. Spencer, 1898; and in the South Australian Museum: M4384, female in spirit and M4385 to M4387, males in spirit, Alice Springs, collected Horn Expedition, also M4379, female in spirit, labelled "Conilurus hirsuitus, Alice Springs, don. Prof. B. Spencer, Dir. Mus. Melbourne, 1.10.1900".

Ascopharynx fuscus Wood Jones, 1925.

Rec. S. Aust. Mus. **3**: 3.

=*Notomys fuscus* (Wood Jones) vide Aitken, 1968.

Lectotype: M6258, male in spirit with skull extracted, Ooldea, South Australia, collected A. G. Bolam, date of collection unknown.

NOTES—Wood Jones based his description on four, or possibly five, syntypes selected from "numerous specimens" of *N. fuscus* that he stated he had received from A. G. Bolam collected "about Ooldea". None of these syntypes was identified individually and all were apparently in Wood Jones' private collection. In 1959, Finlayson discovered what he considered was one of the syntypes in the museum of the Department of Zoology, University of Adelaide registered number—524. He transferred this specimen to the South Australian Museum and erected it as lectotype (Finlayson 1960). However, although Finlayson's lectotype is almost certainly one of the "numerous specimens" Wood Jones received from A. G. Bolam, and although its body dimensions are reasonably close to those of one of the two male syntypes for which Wood Jones supplied body dimensions, there appears to be no real proof that Finlayson's lectotype was, in fact, a syntype. It bears no label signifying it as such, nor is it listed as a type in the museum register of the Department of Zoology, which for No. 524 reads—"Ascopharynx fuscus, Ooldea, F. Wood Jones (A. G. Bolam)". According to Mr. J. A. Mahoney of the Department of Geology and Geophysics, Sydney University (pers. comm.), there are more specimens of *N. fuscus* from Wood Jones' collection in London, where nearly all of Wood Jones' private type material is housed. Further evaluation of the validity of Finlayson's Lectotype might be possible after a critical examination of these specimens.

Another specimen of *N. fuscus*, which may have been a Wood Jones syntype, is M5966 in the South Australian Museum. This is a male in spirit with a damaged tail, whose body dimensions correspond very closely to those of the second male syntype for which Wood Jones supplied body dimensions, and which he described as having an imperfect tail. This specimen was also donated by the Department of Zoology, University of Adelaide, to the South Australian Museum, where it is still stored in a Department of Zoology spirit jar, presumably the one in which it was transferred. With the specimen in the jar is its original Department of Zoology label, on which is written—"Rodentia, Muridae, Ascopharynx fuscus, museum No. 524", the same number as that of Finlayson's lectotype. According to the mammal register of the South Australian Museum, M5966 was transferred from the Department of Zoology in 1953, whereas Finlayson's lectotype was not transferred until 1959. It is probable that number 524 of the Department of Zoology museum originally referred to both specimens, because no other entries for *Ascopharynx* (*Notomys*) *fuscus* appear in the museum register of the Department of Zoology.

Notomys fuscus eyreius Finlayson, 1960.

Trans. R. Soc. S. Aust. **83**: 81.

=*Notomys fuscus* (Wood Jones) vide Aitken, 1968.

Holotype: M4595, female skin and skull, Mulka (New Well) east side of Lake Eyre, South Australia, collected G. Aiston, iv.1934.

Paratypes: M3354, male in spirit and M3355, male skin and skull, Mulka, South Australia, collected G. Aiston, vi.1932. M4579 and M4581, male skins and skulls; M4580, skin and skull (sex unknown); M4601, skull (sex unknown); M4582 to M4594, males in spirit; M4602 to M4604, immature males in spirit; M4597 to M4599 and M4600, females in spirit, Mulka (New Well), South Australia, collected G. Aiston, iv.1934. M6098 and M6099, male skins and part skulls; M6148, male in spirit and M6100 female skin and part skull, lagoon ruins, Goyders Lagoon, South Australia, collected R. Tedford and P. Lawson 28.vii.1957. M6113 and M6125, female skins and part skulls, Cordillo Downs homestead, South Australia, collected R. Tedford and P. Lawson 7.vii.1957. M6114, female part skull; M6115 and M6117 female skins and part skulls and M6129, male skin and part skull, Etadunna, South Australia, collected R. Tedford and P. Lawson 28.vi.1957. M6116 and M6126, male skins and part skulls; M6124, female skin and part skull and M6145, male in spirit, Mudderacootera Hills, Innamincka, South Australia, collected R. Tedford and P. Lawson 18.viii.1957. M6119 and M6120, male skins and part skulls and M6127, female skin and part skull, Motor Car Dam, Innamincka, South Australia, collected R. Tedford and P. Lawson 18.viii.1957. M6122, male skin and part skull and M6123, female skin and part skull, Howica Dam, Innamincka, South Australia, collected R. Tedford and P. Lawson, 18.viii.1957. M6152 and M6153, males in spirit; M6151 male skin in spirit and part skull; M6153 female skin in spirit and part skull, Tilparee Waterhole, Strzelecki Creek, South Australia, collected R. Tedford and P. Lawson 22.viii.1957.

NOTES—According to the mammal register of the South Australian Museum, two additional paratypes were donated to the Museum of the Northern Territory Administration, Animal Industries Branch at Alice Springs: M6121, male skin and skull and M6188, female in spirit, Innamincka, South Australia, collected R. Tedford and P. Lawson, 18.viii.1957.

In his description Finlayson indicated a series of 52 specimens, 27 of which he stated were from Mulka and 25 from other localities in the Lake Eyre Basin, "most of the latter having been collected and carefully prepared in the field by Mr. Paul Lawson . . . and Mr. R. Tedford". Only the holotype was identified individually by number.

It is reasonable to assume that the 26 paratypes from Mulka were those listed above, because, apart from the holotype, they are the only specimens of *N. fuscus* from Mulka in the South Australian Museum. It is probable that the remaining 25 paratypes were those additionally listed above, because they are the only other specimens of *N. fuscus* from the Lake Eyre Basin in the South Australian Museum that would have been available to Finlayson at the time. It is just possible, however, that the latter specimens might not all be paratypes, because all were collected by Lawson and Tedford, not "most" as stated by Finlayson.

Notomys alexis everardensis Finlayson, 1940.

Trans. R. Soc. S. Aust. **64**: 133.

Lectotype: M3673, female skin and skull, Chundrinna, north of the Everard Range, South Australia, collected H. H. Finlayson, ii.1933.

Allolectotype: M3685, male skin and part skull, Walthajalkanna, north of the Everard Range, South Australia, collected H. H. Finlayson, ii.1933.

Paralectotypes: M3669 and M3671, male skins and skulls, Chundrinna; M3672, female skin and skull, Chundrinna; M3684, female skin and skull, Walthajalkanna; M3686 male skin and skull, Walthajalkanna; M3670, male in spirit, Chundrinna; M3674, M3675 and M3688, females in spirit, Chundrinna; M3676 to M3679, M3681, M3682 and M3687, females in spirit, Walthajalkanna; M3680 and M3683, males in spirit, Walthajalkanna, all collected H. H. Finlayson, ii.1933.

NOTES—Finlayson indicated a series of 40 specimens in his description. Two of these he selected as opposite-sexed cotypes. I have designated the female as lectotype because she has a complete skull. None of the other specimens in the series was identified individually, but it is probable that 18 of them are those paralectotypes listed above, because they are entered together with the lectotype and allolectotype in Finlayson's handwriting in the mammal register of the South Australian Museum. The type locality described by Finlayson encompassed both Chundrinna and Walthajalkanna, but he did not state form which locality each of his type-specimens was collected. His entries in the mammal register clarify this matter. The twenty additional paralectotypes are presumably in Finlayson's private collection.

Pseudomys (Gyomys) apodemoides Finlayson, 1932.

Trans. R. Soc. S. Aust. **56**: 170.

= *Pseudomys albocinereus* (Gould) vide Ride, 1970.

Holotype: M3466, female in spirit, Coombe, South Australia, collected W. J. Harvey, viii.1932.

Paratypes: M3467, male skull and skeleton. M3468 to M3471, skulls and skeletons (sex unknown), locality and collection data of all as for Holotype.

NOTES—In his description Finlayson indicated a series of 14 specimens, one of which he designated as the holotype. None of the others was identified individually, but it is probable that five of the remaining 13 specimens in the series were those paratypes listed above, because they are registered in Finlayson's handwriting, consecutively with the holotype, in the mammal register of the South Australian Museum. Originally these 5 specimens were preserved in spirit, but in 1964 their bodies were found to be decomposed so they were reprepared as skulls and skeletons. The other eight paratypes are presumably in Finlayson's private collection.

Mus hermannsburgensis Waite, 1896.

Rept. Horn Sci. Exped. Centr. Aust. **2** (zool): 405, figs. 5a-f.

= *Pseudomys (Leggadina) hermannsburgensis* (Waite) vide Troughton, 1932 (2).

Paralectotypes: M2417 and M2417B, female skulls, labelled "Horn Expedition, spec. B" and "spec. C" respectively.

NOTES—Waite based his description on five syntypes (A, B, C, D, and E), one of which was erected lectotype by Troughton (1932) and is at the Australian Museum, Sydney, registered number M1070A. This is a mounted specimen of indeterminable sex, but according to Troughton was probably specimen D. Dixon (1970) claimed that the National Museum of Victoria held three of the four paralectotypes: C7807, male in spirit, which must be specimen A because this was the only male syntype; C7808, female in spirit, which is probably specimen E, because this was the only specimen, other than D, in which the skull was not removed; and C4879, female skin without skull. The latter is almost certainly the skin from one of the two South Australian Museum paralectotype skulls. The whereabouts of the other missing female skin is unknown, it may be the mounted skin of *L. hermannsburgensis* at the Australian Museum mentioned by Troughton as being registered with the lectotype.

Rattus greyi pelori Finlayson, 1960.

Trans. R. Soc. S. Aust. **83**: 140.

Rattus fuscipes greyii (Gray) vide Taylor and Horner, 1973.

Holotype: M6268, male skin and skull, north slope, main mass of Greenly Island, Australia, collected H. H. Finlayson, xi.1947.

NOTES—Finlayson indicated a series of 13 specimens in his description, but, except for the holotype, none was identified individually. In addition to the holotype, the South Australian Museum has 12 *R. f. greyii* from the main mass of Greenly Island, collected by a South Australian Museum expedition in December 1947. It is possible that these are the paratypes. Their numbers are M5738 to M5749 inclusive, all are skins and skulls.

CHIROPTERA

Vespertilionidae

Lamingtona lophorhina McKean and Calaby, 1968.

Mammalia, **32** (3): 373, figs. 1-2.

Holotype: M6404, female skin and skull, Mount Lamington, Papua, purchased from C. T. McNamara, xii.1929.

Paratypes: M6402 and M6403, male skins and skulls, and M6401, male in spirit, locality and purchase data of all as for Holotype.

NOTES—Two additional paratypes, CM2090 and CM2091, female skins and skulls with the same locality and purchase data as the holotype, are at the Division of Wildlife Research, C.S.I.R.O., Canberra.

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I am deeply indebted to Mr. J. A. Mahoney of the Department of Geology and Geophysics, Sydney University, for information on the whereabouts of the holotype specimens of *Thalacomys nigripes* Wood Jones, *Thylogale flindersi* Wood Jones and the syntype specimens of *Myrmecobius rufus* Wood Jones.

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— NOTES —

VERTEBRATE TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM

VI. FOSSILS

by

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ABSTRACT

PLEDGE, N. S. 1976. Vertebrate type-specimens in the South Australian Museum. VI. Fossils. *Rec. S. Aust. Mus.* **17** (12): 205-219.

The South Australian Museum holds primary type-specimens of 34 species of fossil vertebrates, all from Australia, and mostly marsupials. Of these types, three are in the collection of the University of Adelaide, Geology Department (AUGD), now held in the South Australian Museum.

Besides primary types, there are plastotypes (casts) of type-specimens of 28 species, held mainly in the British Museum (Natural History), and two plesiotypes.

INTRODUCTION

The South Australian Museum owns (or holds) primary type-specimens (mainly holotypic material) of 34 species of fossil vertebrates, which form the first part of the following list. Much paratypic material of more recently described species is held by the Museum of Palaeontology, University of California at Berkeley, and is also listed briefly.

One of the problems that faces the vertebrate palaeontologist, as distinct from most invertebrate palaeontologists and taxonomic zoologists, is that in many cases only a small portion of an animal is preserved and used as the basis of a new species. This is particularly so for mammals and birds, where even a single tooth or broken bone is sufficient to indicate and diagnose a new form. Subsequently, if more complete material is found, the unknown parts of the animal may be described and occasionally, two species based on different elements may even be shown to be synonyms or, more rarely, a "species" based on several isolated elements may turn out to be a composite of two or more distinct taxa.

Consequently, in compiling this list, I have included such specimens which have expanded our knowledge of their species, defining them as "plesiotypes", i.e. specimens used in later, more complete descriptions of the species. Only two species are so treated here, in the second section of the list.

An advantage of a fossil bone is that to all intents and purposes its form may be reproduced faithfully in plaster, plastic or other media. These replicas of type-specimens—plastotypes—may enjoy a wider circulation than their originals, both for research and display purposes. Accordingly, they also are listed here. Twenty-seven species, mainly marsupials, are so designated.

Within each of these categories of type-specimens—primary types, plesiotypes and plastotypes—the species are listed alphabetically in their taxonomically arranged families, under the author's original name. Original and currently-used names are cross-indexed wherever necessary.

Besides the original reference, the data include type locality, geological formation and age, and collector in so far as these facts are known.

The names of several institutions are abbreviated as follows:—

- AM—Australian Museum, Sydney.
- AMNH—American Museum of Natural History, New York.
- AUGD—Adelaide University Geology Department.
- BM(NH)—British Museum (Natural History), London.
- CPC—Commonwealth Palaeontological Collection, Bureau of Mineral Resources, Canberra.
- SAM—South Australian Museum, Adelaide.
- UCMP—University of California, Museum of Palaeontology, Berkeley.
- UCR—University of California, Riverside (Department of Geological Sciences).
- WAM—Western Australian Museum, Perth.

PART 1. PRIMARY TYPES

CLASS CHONDRICHTHYES

ORDER SELACHII

Family Carchariidae

Carcharias maslinensis Pledge, 1967.

Trans. R. Soc. S. Aust., **91**: 146-147, pl. 2.

Holotype: AUGD. F17260, an anterior tooth.

Locality: E. & W.S. Bore No. 5, Naracoorte, South Australia, 426ft. (129·8 m).

Formation: Knight Group.

Age: Middle to Upper Eocene.

REMARKS—It seems probable that this species can be referred to *Scapanorhynchus* (Pers. observ.).

Family Odontaspididae

Odontaspis maslinensis Pledge, 1967 see **Carcharias maslinensis** Pledge.

REMARKS—Opinion 723 (*Bull. Zool. Nomencl.* **22** (1): 32, April, 1965) repealed opinion 47, ruling that *Carcharias* should be repressed and the generic name *Odontaspis* Agassiz be restored.

CLASS OSTEICHTHYES

ORDER PALAEONISCIFORMES

Family Indet.

Leighiscus hillsi Wade, 1953.

Trans. R. Soc. S. Aust., **76**: 80-81.

Holotype: AUGD. F15094. ("Tate Collection, P2070" *in litt.*) part and counterpart, compression of caudal region.

Locality: Leigh Creek, South Australia.

Formation: Sand lens in Leigh Creek Coal Measures.

Age: Late Triassic.

REMARKS—This is the only Triassic vertebrate so far found in South Australia. Unfortunately, too little of the fossil was found to enable it to be placed taxonomically.

CLASS REPTILIA

ORDER SQUAMATA

Family Varanidae

Varanus warburtonensis Zietz, 1899.

Trans. R. Soc. S. Aust., **23**: 209-210.

Holotype: SAM. P.11529, an unguinal phalanx.

Locality: Float on gravel bars, Warburton River near Lake Eyre, South Australia.

Formation: Unknown, probably Katipiri Sands.

Age: Pleistocene.

Collector: H. Y. L. Brown.

REMARKS—As this specimen was associated with *Diprotodon*, which is not known from the early Pleistocene Kanunka Fauna, it probably belongs to the later Malkuni Fauna. The species has long been overlooked. Hecht (1975: 245) suggests it is a junior synonym of *Megalania prisca* Owen.

CLASS AVES

ORDER CASUARIIFORMES

Family Dromornithidae

Genyornis newtoni Stirling & Zietz, 1896.

Trans. R. Soc. S. Aust., **20**: 182-209, pls. III, IV, V. *Mem. R. Soc. S. Aust.*, 1900, **1** (2): 50-80, also 1905 *idem* 1 (3): 81-110; and 1913 *idem* **1** (4): 111-126.

Lectoholotype: SAM. P.17001, a left femur (selected by P. Vickers Rich).

	Plate (fig.)	Element
Syntypes— SAM P.10788	XXXVII	mandibles and associated rt. maxilla
10835	XXII	sternum
10838	XXXVI (1)	skull
13866	XX (4)	rt. tibiotarsus
13867	XXI (4, 5)	rt. fibula
13871	XXIV (4-6)	rt. humerus
13872	XXIV (1-3)	coracoscapula
13873	XXIV (8)	l. ulna
13874	XXIV (7)	l. radius
13875	XXX (9)	carpometacarpus
13876	XXX (11)	rib
13877	XXX (10)	rib
13927	XX (1-3), XXI (1-3)	rt. tibiotarsus
17024	XXII (1-4)	rt. tarsometatarsus
17041	XXXIX (1)	synsacrum
17044	XXII (1-6)	rt. pes.
17048	XXXIX (3)	synsacrum
17049	XXXVIII (1), XXXIX (2)	synsacrum
17073	XXX (13)	rib
17074	XXX (14)	rib
17075	XXX (15)	rib

Locality: Lake Callabonna, South Australia. Zone 6. Sheet SH 54-6 Callabonna 1:250 000. Grid reference for exact site unknown.

Formation: "Unctuous blue Clays".

Age: Pleistocene.

Collector: A. H. C. Zietz, 1893.

REMARKS—This species is associated with rich deposits of bones of *Diprotodon optatum*, macropodids, *Phascolonus gigas*, and *Dromaius*. The only reliable C-14 age determinations, on wood and plant material, indicate an age greater than 40 000. The species was established on the bones of at least three individuals, but their original associations have been lost.

Family Dromaiidae

Dromiceius ocypus Miller, 1963.

Rec. S. Aust. Mus., **14** (3): 414-418.

Holotype: SAM. P.13444, right tarsometatarsus.

Locality: Lake Palankarinna. UCMP Loc. No. V5769 (Lawson Quarry).

Formation: Mampuwordu Sands.

Age: Late Pliocene—Palankarinna Fauna.

Collector: SAM-UCMP Expedition 1957.

REMARKS—*Dromiceius* is now considered to be a misprint, and the I.C.Z.N. recommendation is that *Dromaius* be used instead. (*See* Serventy, Condon and Mayr, 1965.)

ORDER SPHENISCIFORMES

Family Spheniscidae

Pachydyptes simpsoni Jenkins, 1974.

Palaeontology, **17** (2): 294-304, pls. 37-39, text fig. 2a.

Holotype: SAM. P.14157 *a-g*: (*a*) most of left coracoid, (*b*) head of right humerus, (*c*) broken head of left humerus, (*d*) damaged right radius, (*e*) incomplete left carpometacarpus, (*f*) left proximal phalanx of 2nd digit, (*g*) damaged vertebra.

Locality: Blanche Point, extreme tip, opposite Gull Rock, Maslin Bay, South Australia.

Formation: Blanche Point Marl, 3·6 m below top of Banded Marl Member.

Age: Early Upper Eocene. (Aldingan.)

Collected: B. Robinson & H. Eames, May, 1968.

REMARKS—This is one of the earliest, well-dated penguins known. Other material known includes two paratypes (humerus and radius fragments) and a referred specimen believed to be a fragment of rib.

Pachydyptes simpsoni Jenkins, 1974.

Palaeontology, **17** (2): 294-304, pls. 37-39, text fig. 2a.

Paratype: SAM. P.14158 (*a*) proximal two thirds of right humerus, (*b*) proximal end of right radius.

Locality: Blanche Point, Maslin Bay, South Australia.

Formation: Blanche Point Marl, lower part of Transitional Marl Member.

Age: Early Upper Eocene (Aldingan).

Collected: L. W. Parkin, October, 1932.

REMARKS—A referred specimen, believed to be a segment of the proximal part of a rib, P.17913, was collected as "float" in 1971, and appears to have been derived from the Transitional Marl.

ORDER CICONIIFORMES

Family Phoenicopteridae

Phoenicopterus novaehollandiae Miller, 1963.

The Condor, **65** (4): 289-292.

Holotype: SAM. P.13648, right tarsometatarsus with proximal end missing.

Locality: Lake Pitikanta, west side, about 550 m from south end. UCMP loc. V6150.

Formation: Etadunna Formation.

Age: Early to Middle Miocene-Ngapakaldi Fauna.

Collector: SAM-UCMP Expedition, 1961.

Phoeniconaias gracilis Miller, 1963.

The Condor, **65** (4): 294-296.

Holotype: SAM. P.13650, left tarsometatarsus, distal end.

Locality: Lake Kanunka, northwest corner. UCMP loc. V5772.

Formation: Katipiri Sands.

Age: Early Pleistocene-Kanunka Fauna.

Collector: SAM-UCMP Expedition, 1957.

Phoeniconotius eyrensis Miller, 1963.

The Condor, **65** (4): 292-294.

Holotype: SAM. P.13649, left tarsometatarsus, distal end, and two basal phalanges.

Locality: West side of Lake Palankarinna, float from Etadunna Formation. UCMP Loc. 5763 (between UCMP Locs. V5762 and 5375).

Formation: Etadunna Formation.

Age: Early to Middle Miocene-Ngapakaldi Fauna.

Collector: SAM-UCMP Expedition, 1957.

ORDER PELECANIFORMES

Family Pelecanidae

Pelecanus tirarensis Miller, 1966.

Mem. Qld. Mus., **14** (5): 182-185.

Holotype: SAM. P.13857, right tarsometatarsus, distal half.

Locality: Lake Palankarinna, north-west shore. UCMP Loc. V5762 (Turtle Quarry).

Formation: Etadunna Formation.

Age: Early to Middle Miocene-Ngapakaldi Fauna.

Collector: SAM-UCMP Expedition, 1957.

Pelecanus validipes de Vis, 1894.

(*in* Etheridge) *South Aust. Ann. Rept. of Govt. Geologist*, **1894**: 21, pl. II (5, 6).

Holotype: SAM. P.18412, a right tarsometatarsus, distal end.

Locality: Warburton River near Lake Eyre, South Australia; float.

Formation: Unknown, probably Katipiri Sands or equivalent.

Age: Pleistocene.

Collector: H. Y. L. Brown.

REMARKS—This specimen was given to the South Australian Museum in 1899, but in common with other material at the time, was not registered. During subsequent shifts of the collections it was mislaid and its whereabouts was unknown until September, 1974, when it was relocated.

Family Phalacrocoracidae

Phalacrocorax gregorii de Vis, 1905.

Ann. Qld. Mus., No. 6: 18-22, pls. V (6A, B).

Syntype: SAM. P.18413, a premaxilla, entire from tip to nasofrontal suture.

Locality: "Cutupirra", (equivalent to Katipiri Waterhole), lower Cooper Creek, South Australia.

Formation: Unknown, probably Katipiri Sands.

Age: Pleistocene.

Collector: H. Y. L. Brown.

REMARKS—This specimen was rediscovered in September, 1974, along with *Pelecanus validipes* de Vis. Included with the premaxilla, and listed also on the printed label (for they were apparently once on exhibition), are two tarsometatarsi. P.18414, an almost complete left, lacking the inner trochlea, and badly corroded, is otherwise almost identical to the right tarso-metatarsus figured in Plate VII (2). The other, P.18415, also a left, lacks only the proximal end. These specimens apparently were not seen by de Vis as they do not fit the description of his unfigured material.

ORDER GALLIFORMES

Family Megapodidae

Progura naracoortensis van Tets, 1974.

Trans. R. Soc. S. Aust., **98** (4): 214-215.

Holotype: SAM. P.17856, an almost complete right tarsometatarsus.

Paratypes: SAM. P.17152, a right tibiotarsus; P.17153, a left humerus; P.17154, distal end of a left humerus; P.17157, proximal end of right femur; P.17876, distal part of right tibiotarsus; P.17877 right ulna; P.17878, left humerus; P.17879, distal part of left ulna; P.18181, a cervical vertebra; P.18182, distal part of left ulna; P.18183, proximal and distal parts of a right humerus; P.18184, left radius; P.18185, proximal part of a right tarsometatarsus; P.18186, distal part of a right femur; P.18187, anterior fragment of synsacrum; P.16700, a right coracoid.

Locality: A small cave disclosed in Henschke's Quarry, Naracoorte, South Australia.

Formation: Cave earth.

Age: Late Pleistocene, around 30 000-35 000 yrs. B.P.

Collectors: F. W. Aslin, N. S. Pledge, *et al.*, 1970-1974.

REMARKS—The paratype P.16700 was collected from the Fossil Chamber of Victoria Cave, by R. T. Wells *et al.*, and is one of only two specimens so far recorded outside the type locality. The other, a referred specimen (fragment of tarsometatarsus QM F2769), was collected from the Darling Downs.

CLASS MAMMALIA

ORDER MONOTREMATA

Family Ornithorhynchidae

Obdurodon insignis Woodburne & Tedford, 1975.

Amer. Mus. Novitates, No. 2588: 3-10.

Holotype: SAM. P.18087, a right upper last molar.

Locality: Lake Palankarinna, north-west side. UCR Loc. RV/7247. (SAM. North Quarry). Zone 5, sheet SH 54-1: Kopperamanna 1: 250 000, grid reference 656431.

Formation: Etadunna Formation in white to pale grey quartz sandstone at local base of Number 6 of Stirton, Tedford & Miller (1961), about 10 ft. stratigraphically below the calcareous mudstone of Number 8.

Age: Early to Middle Miocene-Ngapakaldi Fauna.

Collectors: M. O. Woodburne. UCR-SAM Expedition, 1972.

REMARKS—A cast of the paratype AMNH 97228, which was collected by Tedford at Lake Namba in the Frome Embayment, is also held under the SAM registration P.18942.

ORDER ?MONOTREMATA

Family Ektopodontidae

Ektopodon serratus Stirton, Tedford & Woodburne, 1967. (Fig. 1)

Rec. S. Aust. Mus., **15** (3): 438-445.

Holotype: SAM. P.13847, a left upper molar.

Paratypes: UCMP. 67173, 67174, 67176, at Berkeley.

Locality: Lake Ngapakaldi, east shore. UCMP Loc. V6213.

Formation: Wipajiri Formation.

Age: Late Miocene-Kutjamarpu Fauna.

Collector: SAM-UCMP Expedition, 1962.

REMARKS—The authors presented arguments for including this taxon in the Monotremata, but material collected more recently by Woodburne and Clemens (in prep.) shows this is not the case (Woodburne and Tedford, 1975:1).

ORDER MARSUPIALIA

Family Peramelidae

Ischnodon australis Stirton, 1955. (Fig. 2)

Rec. S. Aust. Mus., **11** (3): 249-252.

Holotype: SAM. P.13645 (originally U.C. No. 44380), anterior half of right mandible.

Locality: Lake Palankarinna. UCMP Loc. V5367 (Woodward Locality).

Formation: Mampuwordu Sands.

Age: Late Pliocene-Palankarinna Fauna.

Collector: R. H. Tedford, 30th July, 1953.

REMARKS—Found in weathered surface zone, and consequently badly shattered.

Family Thylacoleonidae

Wakaleo oldfieldi Clemens & Plane, 1974.

Jour. Paleontol., **48** (4): 654-656.

Holotype: SAM. P.17925, a left mandible with incisor P_3 and M_1, and alveoli for M_2, M_3 and a single-rooted tooth between incisor and P_3.

Locality: Lake Ngapakaldi, UCMP loc. V6213 (Leaf locality).

Formation: Wipajiri Formation.

Age: Late Miocene-Kutjamarpu Fauna.

Collector: W. A. Clemens, UCMP-SAM Expedition, 1971.

REMARKS—Two referred specimens are held in the collections of the Museum of Paleontology, University of California, Berkeley. They are UCMP 102678: an anterior fragment of a right P_3; and UCMP 102677: a right M_2.

Family Phascolarctidae

Litokoala kutjamarpensis Stirton, Tedford & Woodburne, 1967. (Fig. 3)

Rec. S. Aust. Mus., **15** (3): 446-451.

Holotype: SAM. P.13845, right upper first molar in early stages of wear.

Locality: Lake Ngapakaldi, east shore. UCMP Loc. V6213.

Formation: Wipajiri Formation.

Age: Late Miocene-Kutjamarpu Fauna.

Collector: SAM-UCMP Expedition, 1962.

Perikoala palankarinnica Stirton, 1957.

Rec. S. Aust. Mus., **13** (1): 71-81.

Holotype: SAM. P.10893, part of left mandible with talonid of P_3, M_1 and M_2 nearly complete.

Paratype: UCMP 45343.

Locality: Lake Palankarinna, west side. UCMP Loc. V5375.

Formation: Etadunna Formation.

Age: Early to Middle Miocene-Ngapakaldi Fauna.

Collector: SAM-UCMP Expedition, 1954.

REMARKS—This was originally believed derived from the Pliocene Mampuwordu Sands Palankarinna Fauna, but the correction was noted in Stirton *et al.* (1961) following clarification of the stratigraphy.

Family Vomabatidae

Rhizophascolonus crowcrofti, Stirton, Tedford & Woodburne, 1967. (Fig. 4)

Rec. S. Aust. Mus., **15** (3): 454-456.

Holotype: SAM. P.13846, left upper third premolar, moderately worn.

Locality: Lake Ngapakaldi, east shore. UCMP Loc. V6213. (Fig. 4)

Formation: Wipajiri Formation.

Age: Late Miocene-Kutjamarpu Fauna.

Collector: SAM-UCMP Expedition, 1962.

REMARKS—This is the earliest known wombat, retaining a labial and two lingual roots on the P^3. The teeth of modern wombats are open-rooted, and grow continuously throughout life.

Family Diprotodontidae

Meniscolophus mawsoni Stirton, 1955. (Fig. 5)

Rec. S. Aust. Mus., **11** (3): 258-264.

Holotype: SAM. P.13647, (originally UC No. 44397) mandibles with complete, little-worn dentition, found in close proximity to UCMP 44397: left maxillary fragment with M^2 and M^3 in same stage of wear.

Locality: Lake Palankarinna. UCMP Loc. V5367 (Woodard Locality).

Formation: Mampuwordu Sands.

Age: Late Pliocene-Palankarinna Fauna.

Collector: SAM-UCMP Expedition, 1953.

Neohelos tirarensis Stirton, 1967.

Bur. Min. Resour., Bull. **85**: 48-51.

Holotype: SAM. P.13848, posterior part of left upper third premolar.

Paratypes: (at UCMP, Berkeley). UCMP 69976, 69977, 69978, 69979.

Locality: Lake Ngapakaldi, east shore. UCMP Loc. V6213. (Leaf Locality.)

Formation: Wipajiri Formation.

Age: Late Miocene-Kutjamurpu Fauna.

Collector: SAM-UCMP Expedition, 1962.

REMARKS—This species is known only from isolated teeth.

Ngapakaldia bonythoni Stirton, 1967.

Bur. Min. Resour. Bull., **85**: 26-30.

Holotype: SAM. P.13863, a badly weathered specimen: most of cranium and left mandible, incomplete appendicular skeleton, some caudal vertebrae.

Locality: Lake Ngapakaldi, eastern shore. UCMP Loc. V5879.

Formation: Etadunna Formation, weathered surface zone—same stratigraphic unit as Ngapakaldi Quarry.

Age: Early to Middle Miocene-Ngapakaldi Fauna.

Collector: SAM-UCMP Expedition, 1958.

REMARKS—One questionably referred specimen UCMP 57263 from Lake Pitikanta.

Ngapakaldia tedfordi Stirton, 1967.

Bur. Min. Resour. Bull., **85**: 4-26.

Holotype: SAM. P.13851, near-complete cranium; left radius, ulna, manus, pes, caudal vertebrae and haemal arches, all more or less complete; various right appendicular elements.

Paratypes: (at UCMP, Berkeley). UCMP 57256, 69817, 69814, 60985, 69815, 60977, 60979, 69812, 57286, 57257.

Locality: Lake Ngapakaldi, east shore. UCMP Loc. V6213. Ngapakaldi Quarry.

Formation: Etadunna Formation.

Age: Early to Middle Miocene-Ngapakaldi Fauna.

Collector: SAM-UCMP Expedition, 1958, 1961, 1962.

REMARKS—In two localities (V5774 and V5858), this taxon occurs abundantly from 1 m to 5 m apart, but none is a complete skeleton.

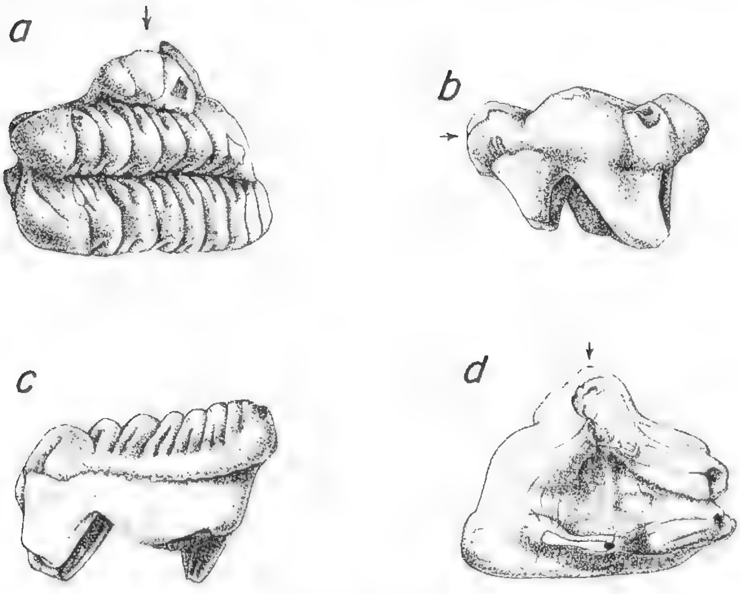

Fig. 1

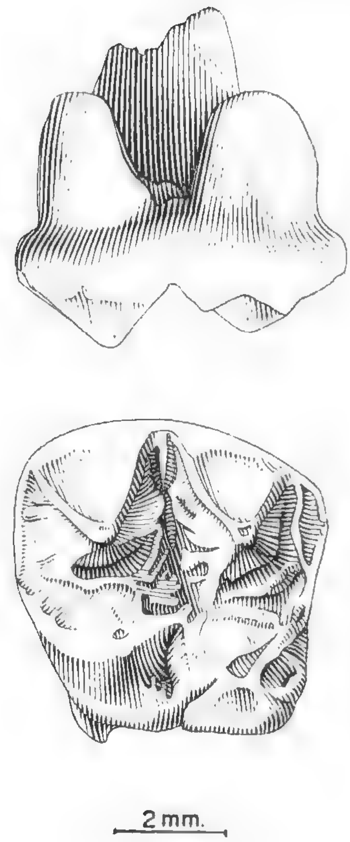

Fig. 3

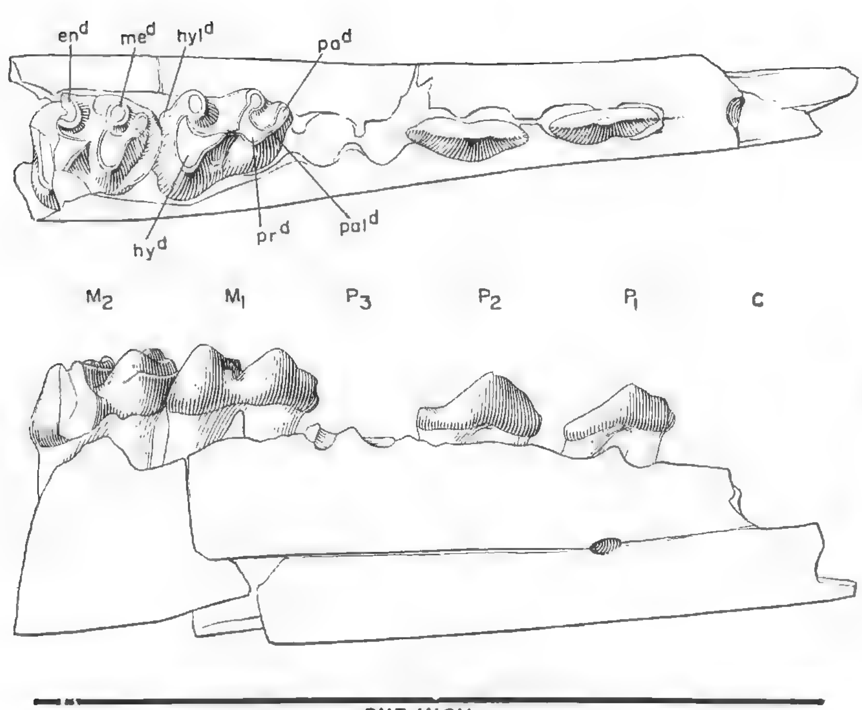

Fig. 2

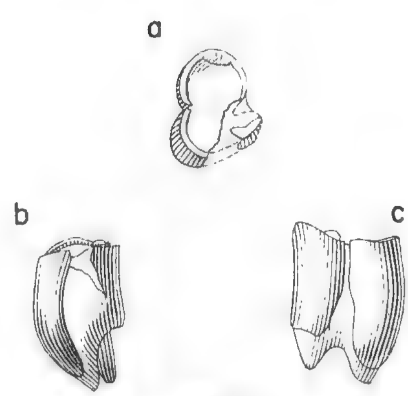

Fig. 4

Fig. 1. *Ektopodon serratus* Stirton, Tedford & Woodburne, 1967. Holotype (P.13847), a left upper molar, in four views. X4. Fig. 2. *Ischnodon australis* Stirton, 1955. Holotype (P.13645), a right mandible, in occlusal and labial views. X4. Fig. 3. *Litokoala kutjamarpensis* Stirton, Tedford & Woodburne, 1967. Fig. 4. *Rhizophascolonus crowcrofti* Stirton, Tedford & Woodburne, 1967. Holotype (P.13846), a left upper premolar in three views. X1.

Fig. 5

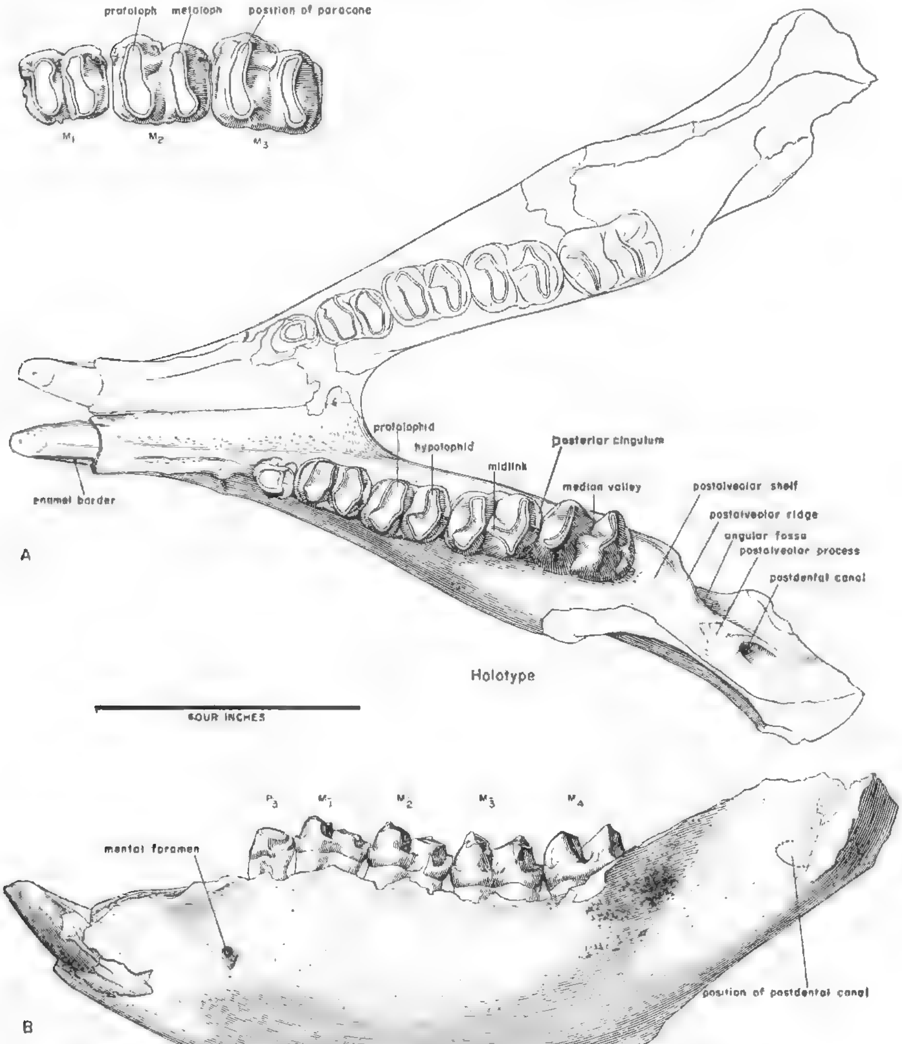

Fig. 6

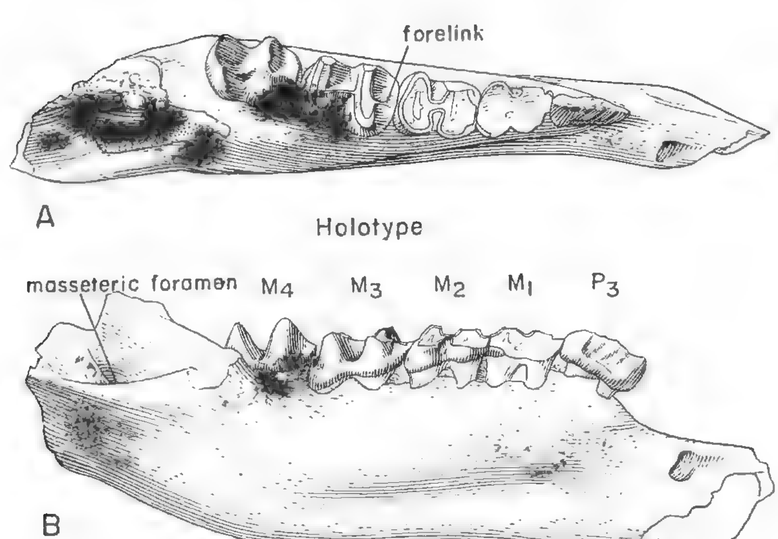

Fig. 5. *Meniscolophus mawsoni* Stirton, 1955. Holotype (P.13647), mandibles, in occlusal (A) and labial (B) views. X½. Fig. 6. *Prionotemnus palankarinnicus* Stirton, 1955. Holotype (P.13646), a right mandible, in occlusal (A) and labial (B) views. X1.

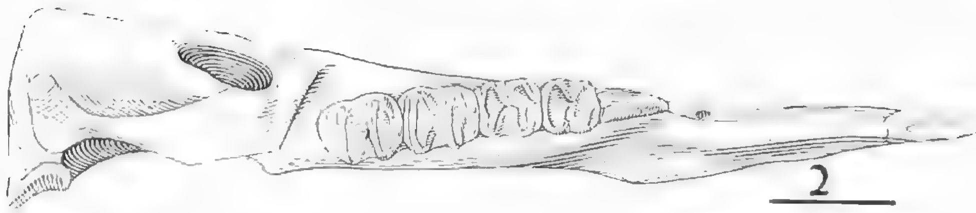

Fig. 7. *Troposodon kenti* Campbell, 1973. Holotype (P.14507), a left mandible, in occlusal views. X$\frac{3}{4}$ (scale in cm).

Nototherium victoriae Owen, 1872.

Phil. Trans., 162: 61, pl. VII.

Holotype: SAM. P.4986, left mandible with incisor and premolar missing and M_1 damaged.

Locality: Near Lake Victoria, New South Wales.

Formation: "freshwater deposits" (Owen). "45-60 feet below ground surface in a well" (Mahoney & Ride).

Age: Pleistocene (?).

Collector: Mr. Felgate (*non* Tilgate), 1869.

REMARKS—Marshall (1973) believes that the state of preservation indicates derivation from the Pliocene Moorna Formation of the Lake Victoria area. A small sample was removed from the symphyseal stub of the right mandible for fluorine analysis to check this hypothesis, but the results are inconclusive (see Gill, 1973: 60, and Sinnott, 1973: 175). Stirton has noted that the species should probably be included in *Zygomaturus*. Two contemporary reports of the discovery are in newspapers: Pastoral Times, December 18, 1869, p. 2; The South Australian Advertiser, January 1, 1870, p. 3. A cast M3637, is held in the BM (NH).

Pitikantia dailyi Stirton, 1967.

Bur. Min. Resour. Bull., **85**: 30-34.

Holotype: SAM. P.13862, right upper incisors I^1-I^3, left I^1 & I^3, left P^3; part of right mandible with incisor, P_3, M_1, M_2, left P_3, tarsals, metatarsals and phalanges.

Locality: Lake Pitikanta, west side. UCMP Loc. V5774 (Discovery Basin).

Formation: Etadunna Formation.

Age: Early to Middle Miocene-Ngapakaldi Fauna.

Collector: B. Daily, SAM-UCMP Expedition, 1957.

Zygomaturus keanei Stirton, 1967.

Bur. Min. Resour. Bull., **85**: 136-144.

Holotype: SAM. P.13844, fused mandibles with all cheek teeth and base of left incisor; upper incisors; left maxilla with P^3 to M^4; rP^3, rM^2, rM^4.

Paratypes: (at UCMP) UCMP 66326, 70120, 70121, 44622, 45409.

Locality: Lake Palankarinna, north-west shore. UCMP Loc. V6265. (Keane Quarry.)

Formation: Mampuwordu Sands.

Age: Late Pliocene-Palankarinna Fauna.

Collector: SAM-UCMP Expedition, 1962.

Zygomaturus victoriae (Owen, 1872), see **Nototherium victoriae** Owen.

Family Macropodidae

Macropus birdselli Tedford, 1967.

Univ. Calif. Publ. Geol. Sci., **64**: 114-127.

Holotype: SAM. P.13857, associated left and right mandibles, with right lower incisor and M_4, and left M_{1-4}.

Paratypes: SAM. A27920, A27936—fragmentary left and right mandibles (and other material at UCMP, Berkeley).

Locality: Lake Menindee, north side. UCMP Loc. V5371, approx. 19 km north-west of Menindee, N.S.W. (Site 1).

Formation: Un-named lunette sand, Unit B of Tindale.

Age: Late Pleistocene.

Collector: R. H. Tedford, 1953.

REMARKS—C-14 age determinations have been made on charcoal samples taken from Unit B but are equivocal in interpretation: LJ-204 giving 26 300 ± 1 500 years B.P.; Gak 335 giving 18 800 ± 800 years B.P. and NZ66 (on shell) giving 6 570 ± 100 years B.P.

Potorous morgani Finlayson, 1928.

Trans. Roy. Soc. S. Aust., **62** (1): 132-140, pls. V-VII.

Syntypes: SAM. P.168, skull and partial skeleton. SAM. P.3413, skull.

Locality: Kelly Hill Caves, Kangaroo Island.

Formation: Cave earth.

Age: Recent.

Collector: Miss Edith May (P168). February 1926. Dr. A. M. Morgan (P3413), 1927 (?).

REMARKS—Ride (1970: 224) has synonymised this species with *P. platyops*, an extant species in Western Australia. See also Butler and Merrilees (1971) for further discussion. The species may still live on Kangaroo Island.

Prionotemnus palankarinnicus Stirton, 1955. (Fig. 6)

Rec. S. Aust. Mus., **11** (3): 252-258.

Holotype: SAM. P.13646 (originally UC No. 44381), right mandible with P_3-M_4 in place.

Paratypes: (at UCMP, Berkeley). UC Nos. 44382 to 44396:—maxillae, mandibles, and right metatarsal IV and phalanges.

Locality: Lake Palankarinna. UCMP Loc. V5367. (Woodard Locality).

Formation: Mampuwordu Sands.

Age: Late Pliocene-Palankarinna Fauna.

Collector: SAM-UCMP Expedition, 1953.

REMARKS—This is one of the more common mammalian taxa in the fauna. Bartholomai (1975) considers *Prionotemnus* to be a subgenus of *Macropus*.

Sthenurus (Sthenurus) tindalei Tedford, 1966.

Univ. Calif. Publ. Geol. Sci., **57**: 26-33.

Holotype: SAM. P.13820 (*non* P.138201), a fragmentary skull with complete cheek dentition and damaged incisors.

Locality: Lake Menindee, New South Wales, northern side, about 19 km from Menindee township. UCMP Loc. V5371.

Formation: Unnamed lunette sand, Unit B of Tindale.

Age: Late Pleistocene, approximately 26 000 ± 1 500 years B.P. (LJ-204).

Collector: R. H. Tedford, 1953.

REMARKS—Other age determinations from this deposit give conflicting results; see *Macropus birdselli* Tedford.

Troposodon kenti Campbell, 1973. (Fig. 7)

Rec. S. Aust. Mus., **16** (3): 3-11.

Holotype: SAM. P.14507, a left mandible.

Locality: Lake Pitikanta.

Formation: Katipiri Sands.

Age: Early Pleistocene-Kanunka Fauna.

Collector: UCMP-SAM Expedition, 1961.

Family Squalodontidae

Metasqualodon hardwoodi (Sanger, 1881). see **Zeuglodon hardwoodii** Sanger.

Squalodon gambierense Glaessner, 1955.

Rec. S. Aust. Mus., **11** (4): 362-367, text fig. 5a-c.

Holotype: AUGD. F15107, a perfect molariform tooth, probably from the right mandible.

Locality: Pritchard Brothers' Quarry, 12 km west-north-west of Mount Gambier, South Australia.

Formation: Gambier Limestone.

Age: Probably Late Oligocene.

Collector: P. Pritchard, 1952.

REMARKS—When this species was described, the whereabouts of *Metasqualodon hardwoodi* (Sanger), although relocated, had not been disclosed. Both preservation and form of the two species are quite different.

Zeuglodon harwoodii Sanger, 1881.

Proc. Linnean Soc. N.S.Wales, **5** (3): 298-300.

Holotype: SAM. P.8446, a molariform tooth. Undescribed material of same specimen comprises a near complete anterior molar, half of another molar, and two premolars.

Locality: "near Wellington, South Australia".

Formation: "a bed of yellow calcareous clay" containing invertebrate fossils. Probably Ettrick Formation.

Age: Tertiary, probably Oligocene.

Collector: James C. Harwood, 1881.

REMARKS—The specimens were mislaid soon after description, but Hall (1911) working from the original description, established a new genus, *Metasqualodon*, for them. The material was relocated in 1948 and is currently being redescribed. Regrettably, accurate data on the locality are wanting, as the enclosed label stated only: "Wellington, 100f", suggesting a depth of 100 feet (30·4 m) in a bore. An allegedly associated shark tooth (*Notidanus*) bears a label indicating derivation from the cliffs at Wellington. However, the dark grey preservation of both argues against the reported lithology, and for the barely exposed Oligocene Ettrick Formation.

PART 2, PLESIOTYPES

CLASS MAMMALIA

ORDER MARSUPIALIA

Family Diprotodontidae

Diprotodon optatum Owen, 1838.

In Mitchell: *Three Expeditions to the interior of eastern Australia.* II: 362.

Stirling & Zietz, 1899: *Mem. R. Soc. S. Aust.*, I (1): 1-40, pl. 1-18.

Plesiotypes: SAM. P.5120 (right manus), P.5121 (right pes).

Locality: Lake Callabonna, north-eastern South Australia.

Formation: "unctuous blue clay".

Age: Pleistocene.

REMARKS—Previous to the discoveries at Lake Callabonna, only a few isolated elements of the pes were known, and reconstructions of the animal (e.g. Owen, 1877: pl. 35) always hid the feet.

Family Vombatidae

Phascolomys gigas Owen, 1859.

Encyclopaedia Britannica, 8th ed., vol. XVII: 175.

Owen, 1872: *Phil. Trans.*, **162**: 257.

Stirling, 1913: *Mem. R. Soc. S. Aust.*, I (4): 127-178, pl. 40-58.

Plesiotypes—	Plate (fig.)	Element
SAM P.5000	XLIV, XLV (1-3)	palate
5001	XLII	mandibles
5002	XLIII	mandibles
5003 (N)	XL, XLI	mandibles
5004	—	natural matrix mould joining P.5000 to 5001
5005	XLVII (4, 5)	l. clavicle
5006	—	rt. clavicle
5007	LVII (6)	epipubic
5008 (N)	XLVI (4, 5)	atlas frag.
5009 (N)	XLVI (6)	atlas frag.
5010	XLVI (11)	vert. centrum
5011	XLVI (1-3)	atlas
5012	XLVI (8, 9)	axis
5013	XLVII (2)	rib
5014	XLVII (3)	rib
5015	XLVII (1)	rib
5016	—	rib
5017	XLV (4-5)	incisor
5018 (N)	XLV (6, 7)	incisor
5019 (N)	XLV (8)	molar
5020	XLVII (7, 8)	presternum
5021	LIII	l. femur
5022	LVI	l. tibia
5023	XLVIII	scapula
5024	—	tibia
5025	LIV (4); LV	rt. femur frag.
5026	unfig.	rt. humerus
5027	XLIX (1-4), L (1, 2)	rt. humerus
5028 (N)	LIV (1-3)	l. femur
5029	LVII (1-4)	rt. fibula
5030	LI (1-4)	rt. ulna
5031	L (3-5)	rt. radius
5032	LIV (5)	rt. femur frag.
5033	LII (12, 13)	rt. phalanx V
5037	LVIII (7)	rt. MT V
5038	LII (10)	rt. MC V
5039	LII (1-2)	l. pisiform
5040	LII (11)	rt. prox. phalanx V
5041	LII (5, 6)	rt. cuneiform
5042 (N)	LVIII (3, 4)	rt. astragalus
5043	LII (3, 4)	l. unciform
5044	LVIII (1, 2)	rt. astragalus

Locality: Lake Callabonna, north-eastern South Australia. (Those indicated (N) are from Normanville, south of Adelaide.)

Formation: "unctuous blue clay".

Age: Pleistocene.

Remarks—The discovery at Lake Callabonna of articulated remains of this species proved that the upper incisors known as *Sceparnodon ramsayi* Owen belonged to *Phascolonus gigas* as Lydekker (1887: 157) had suggested. The specimen also provided the first definite *P. gigas* skeletal remains for description. See also Ride (1967; 419-425).

Phascolonus gigas (Owen, 1859). See **Phascolomys gigas** Owen.

PART 3, *PLASTOTYPES*

CLASS REPTILIA

ORDER CHELONIA

Family Meiolaniidae

Meiolania oweni Smith Woodward, 1888.

Ann. Mag. Nat. Hist., ser. 6, **1**: 89.

Plastotypes: SAM. P.18002; P.18003 (Skull and jaws; caudal armour).

Originals: BM(NH) R391, R392 respectively.

Locality: King's Creek, Condamine River, Darling Downs, Queensland.

Formation: Alluvium.

Age: Pleistocene.

Remarks—These specimens had previously been regarded by Owen (1881a, b) as *Megalania prisca*. See Lydekker (1889: 167). P.18002 is actually a cast of the restored, modelled skull, the imperfect original of which is figured by Owen (1881: Pl. 37 (1), 38 (1-3)) and Lydekker.

ORDER SAURISCHIA (?)

Family Megalosauridae (?)

Megalosauropus broomensis Colbert & Merrilees, 1967.

Journ. R. Soc. W. Aust., **50** (1): 22-25.

Plastotype of footprint G5-6. SAM. P.14532.

Original: WAM No. 66.2.51.

Locality: Wavecut platform below high tide level; Broome, Western Australia.

Formation: Broome Sandstone.

Age: Early Cretaceous.

Collector: (casting) Messrs. J. & E. Tapper.

CLASS AVES

ORDER CASUARIIFORMES

Family Dromornithidae

Dromornis australis Owen, 1874c.

Trans. Zool. Soc., **8**: 383, pl. 62, 63.

Plastotype: SAM. P.17107.

Original: AM F.10950, a femur.

Locality: 55 m depth in a well, Peak Downs, Queensland.

Formation: "drift pebbles and boulders".

Age: Pleistocene.

Remarks—See discussion of this species in Stirling and Zeitz (1900: 43 ff.) and Rich (unpubl. Ph.D. dissertation, 1973: 127).

Dromornis australis Owen, 1874c.

Owen, 1879: *Trans. Zool. Soc.*, **10**: 186, pl. 33.

Plastotype: SAM. P.17108.

Original: BM(NH) 48160, a fragmentary synsacrum—a plesiotype.

Locality: 61 m depth in the Canadian Gold Lead, near Mudgee, Gulgong mining district, New South Wales.

Formation: Deep lead alluvium.

Age: ? Pliocene.

Remarks—Rich (ibid, p. 128) believes this specimen is too fragmentary to identify beyond the family level.

Dromornis australis Owen, 1874c.

Owen, 1879: *Trans. Zool. Soc.*, **10**: 186.

Stirling & Zietz, 1900: *ibid*: 43.

Plastotype: SAM. P.17106.

Original: BM(NH) 44011, distal end of a tibiotarsus, a plesiotype.

Locality: A cave, "Mount Gambier range", Mount Gambier, South Australia.

Formation: ? Cave earth.

Age: Pleistocene.

REMARKS—Stirling and Zietz believed this specimen to be of their new species *Genyornis newtoni*.

ORDER DINORNITHIFORMES

Family Emeidae

Dinornis queenslandiae de Vis, 1884.

Proc. R. Soc. Qld., **1**: 32.

Plastotype: SAM. P.17105.

Original: Queensland Museum; proximal end of a femur.

Locality: Allegedly "King's Creek, Darling Downs, Queensland".

Age: Pleistocene.

REMARKS—Stirling and Zietz (1900: 44) note arguments against this taxon, and Rich (1973, unpubl. dissertation) notes Scarlett's (1969) objection regarding the preservation of the specimen which is quite distinct from other King's Creek fossils. Scarlett equated it with the New Zealand moa *Pachyornis elephantopus*.

CLASS MAMMALIA

ORDER MONOTREMATA

Family Ornithorhynchidae

Obdurodon insignis Woodburne & Tedford, 1975.

Amer. Mus. Novitates, No. 2588: 3-10.

Plastotype: SAM. P.18942.

Original: AM(NH) 97228, paratype, a right upper molar.

Locality: West side of Lake Namba, Frome Embayment, South Australia, Grid zone 6, refce. 320135, Curnamona 1:250 000 sheet SH54-14.

Formation: Float specimen, from un-named unit of thin-bedded black claystone, sand lenses, green claystone and white dolomitic claystone.

Age: Miocene, Ngapakaldi fauna equivalent.

ORDER MARSUPIALIA

Family Wynyardiidae

Wynyardia bassiana Spencer, 1900.

Proc. Zool. Soc. Lond., **1900**: 776-795.

Plastotype: SAM. P.4979, 4980.

Original: Tasmanian Museum, Z237, an imperfect skull and partial skeleton, no teeth.

Locality: Fossil Bluff, near Wynyard, north-western Tasmania.

Formation: Fossil Bluff Sandstone.

Age: Longfordian—basal Miocene.

REMARKS—This fossil was found in marine sediments, and its age was for long in doubt, as some authors believed it to be intrusive. Gill (1957) demonstrated its contemporaneity with the associated fauna, but believed it to be Oligocene. Ludbrook (1967) points out the uncertainty of its age.

P.4979 is a cast of the specimen as originally found. P.4980 comprises casts of the excavated skull, jaws and limb bones, and the cleared spine.

Family Macropodidae

Leptosiagon gracilis Owen, 1874.

Phil. Trans., **164**: 785, pl. 76 (11-15).

Plastotype: SAM. P.18124.

Original: BM(NH) 40005, fragment of a right mandible with M_2, M_3.

Locality: Queensland.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—Lydekker (1887: 231) included this specimen in *Macropus ferragus* Owen, but Simpson (1930: 72) leaves it separate as *Macropus gracilis* (Owen). Bartholomai (1975) returns it to *Macropus* (*Osphranter*) *ferragus*.

Macropus altus (Owen, 1874). See **Phascolagus altus** Owen.

Macropus ferragus Owen, 1874.

Phil. Trans., **164**: 784, pl. 81 (4), 82 (3, 4).

Plastotype: SAM. P.18126.

Original: BM(NH) 32903, fragment of right mandible.

Locality: Condamine River, Queensland.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—Owen (1877: 449) used this specimen as type for *Pachysiagon ferragus* but Lydekker (1887: 231) returned it to Macropus. Bartholomai (1975) places it in the subgenus *Osphranter*.

Macropus goliah Owen, 1846.

In Waterhouse (1846) *Natural History of Mammalia*, **1**: 59.

Plastotype: SAM. P.18125.

Original: BM(NH) M1896, right maxilla with M^{2-4}.

Locality: Darling Downs, Queensland.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—Species renamed *Procoptodon goliah* by Owen (1873: 387).

Macropus gracilis (Owen, 1874). See **Leptosiagon gracilis** Owen.

Macropus titan Owen, 1838.

In Mitchell (1838) *Three Expeditions into the interior of eastern Australia*, **1**: 359, pl. 29 (3).

Plastotype: SAM. P.18127.

Original: BM(NH) M10777, anterior fragments of right mandible.

Locality: Cave, Wellington Valley, New South Wales.

Formation: Cave earth.

Age: Pleistocene.

Pachysiagon otuel Owen, 1874.

Phil. Trans., **164**: 784, pl. 76 (1-10).

Plastotype: SAM. P.18123.

Original: BM(NH) 46310, fragment of right mandible with M_{2-4}.

Locality: King's Creek, Clifton, Queensland.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—Figured in Owen (1877: pl. LXXXIX (7-10)) as *Procoptodon pusio*. See Lydekker (1887: 237). Species is now known as *Procoptodon otuel*.

Phascolagus altus Owen, 1874.

Phil. Trans., **164**: 261, pl. 22 (1, 2).

Plastotype: SAM. P.13125.

Original: BM(NH) M10779, an imperfect palate lacking rP^3, and with both M^4's unerupted.

Locality: Wellington Caves, New South Wales.

Formation: Cave earth.

Age: Pleistocene.

REMARKS—This specimen was originally a syntype of *Macropus titan* Owen (1838). The species was replaced in *Macropus altus* by Lydekker (1887: 223), and Bartholamai (1975) puts it in the subgenus *Osphranter*.

Procoptodon goliah Owen, 1846. See **Macropus goliah** Owen.

Procoptodon otuel Owen, 1874. See **Pachysiagon otuel** Owen.

Procoptodon pusio Owen, 1874.

Phil. Trans., **164**: 788, pl. 77 (2-6).

Plastotype: SAM. P.18130.

Original: BM(NH) 39996, imperfect palate (left and right maxillae) with P_3-M_3.

Locality: Queensland.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—Lydekker (1887: 235) transferred this specimen to *Procoptodon rapha*.

Procoptodon rapha Owen, 1874.

Phil. Trans., **164**: 788, pl. 77 (8-12).

Plastotype: SAM. P.18129.

Original: BM(NH) 32885.

Locality: "alluvial drift".

Age: Pleistocene.

Protemnodon anak Owen, 1874.

Phil. Trans., **164**: 275, pl. 25 (1-2).

Plastotype: SAM. P.13124.

Original: BM(NH) M1895, a left mandible with P_3-M_4.

Locality: Darling Downs, Queensland.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—See Bartholomai (1973: 318).

Protemnodon antaeus Owen, 1877.

Extinct Mammals of Australia: 448, pl. 110 (1-3).

Plastotype: SAM. P.13123.

Original: BM(NH) M2258, a partial left mandible with P_3-M_4.

Locality: Queensland.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—This species was transferred to *Macropus raechus* by Lydekker (1887: 212), and is now included in *Protemnodon roechus* Owen. (Bartholomai, 1973: 340).

Protemnodon brehus Owen, 1874. See **Sthenurus brehus** Owen.

Protemnodon mimas Owen, 1874.

Phil. Trans., **164**: 278, pl. 26 (1-3).

Plastotype: SAM. P.13121.

Original: BM(NH) 43351, a left mandible with all cheek teeth.

Locality: Gowrie, Queensland.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—Included in *Macropus brehus* by Lydekker (1887: 207), then *Protemnodon brehus* by Stirton (1963: 141). See Bartholomai (1973: 330).

Protemnodon og. Owen, 1874.

Phil. Trans., **164**: 277, pl. 25 (5-6).

Plastotype: SAM. P.13122.

Original: BM(NH) 35963, an imperfect left mandible with all cheek teeth.

Locality: Gowrie, Queensland.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—Lydekker (1887: 217) included this species in *M. anak*, now *Protemnodon anak*; see Bartholomai (1973: 318).

Protemnodon roechus Owen, 1874.

Phil. Trans., **164**: 281, pl. 27 (10-13).

Plastotype: SAM. P.18128.

Original: BM(NH) 35968, anterior part of left mandible with P_3-M_3.

Locality: Gowrie, Queensland.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—Lydekker (1887) and others, transferred this to *Macropus*, but this has since been reversed. See Stirton (1963), Bartholomai (1973).

Sthenurus brehus Owen, 1874.

Phil. Trans., **164**: 272, pl. 27 (5-6).

Plastotype: SAM. P.13126.

Original: BM(NH) 43303a, an imperfect palate with M^1-M^4 of both sides.

Locality: Wellington Valley, New South Wales.

Formation: Cave earth.

Age: Pleistocene.

REMARKS—The species was transferred to *Macropus* by Lydekker (1887: 209), and to *Protemnodon brehus* (Owen) by Stirton (1963: 141).

Sthenurus minor Owen, 1877.

Proc. Zool. Soc., **1877**: 353, pl. 37, 38 (1-3).

Plastotype: SAM. P.13120.

Original: BM(NH) 48409, an imperfect palate.

Locality: County Phillip, New South Wales.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—This species was transferred to *Macropus* by Lydekker (1887: 218) although the name was already occupied by *Macropus minor* Shaw, 1800. Bartholomai (1967: 22) used this specimen as type for *Troposodon minor* (Owen).

Sthenurus occidentalis Glauert, 1910.

Rec. W. Aust. Mus., **1**: 31-36, pl. 5 (6-7).

Plastotype: SAM. P.13662.

Original: WAM 60.10.2, left and right mandibles.

Locality: Mammoth Cave, near Margaret River, south-western Western Australia.

Formation: Cave earth.

Age: Pleistocene, 37 000 yrs. B.P.

REMARKS—See also Tedford (1966: 33-39).

Troposodon minor (Owen, 1877). See **Sthenurus minor** Owen.

Family Diprotodontidae

Euryzygoma dunense (de Vis, 1888). See **Nototherium mitchelli** Owen.

Kolopsis torus Woodburne, 1967.

Bur. Miner. Resour. Bull., **87**: 139-148.

Plastotype: SAM. P.18116, skull.

Original: CPC 6747.

Locality: UCMP V6345 (Paine Quarry). 6·5 km south-west of Alcoota Homestead, southern Northern Territory.

Formation: Waite Formation.

Age: Late Miocene-Alcoota Fauna.

Nototherium mitchelli Owen, 1845.

Rept. Brit. Ass. Adv. Sci., York, **1844**: 232. *Cat. Foss. Mamm. & Aves Mus. R. Coll. Surg.*: 316.

Plastoplesiotype: SAM. P.18122.

Original: BM(NH) 43523, a left mandible with M_2-M_4,—a plesiotype. Figured by Owen, 1872, *Phil. Trans.*, **164**: pl. 11.

Locality: Queensland.

Formation: "alluvial drift".

Age: Pleistocene?

REMARKS—Woods (1968: 115) referred this specimen to *Euryzygoma dunense* (de Vis).

Palorchestes painei Woodburne, 1967.

Bur. Miner. Resour. Bull., **87**: 107-124.

Plastotype: SAM. P.18118, skull.

Original: CPC 6752.

Locality: UCMP V6345 (Paine Quarry). 6·5 km south-west of Alcoota Homestead, southern Northern Territory.

Formation: Waite Formation.

Age: Late Miocene-Alcoota Fauna.

Plaisiodon centralis Woodburne, 1967.

Bur. Miner. Resour. Bull., **87**: 149-159.

Plastotype: SAM. P.18119, skull.

Original: CPC 6748.

Locality: UCMP V6345 (Paine Quarry). 6·5 km south-west of Alcoota Homestead, southern Northern Territory.

Formation: Waite Formation.

Age: Late Miocene-Alcoota Fauna.

Pyramios alcootense Woodburne, 1967.

Bur. Miner. Resour. Bull., **87**: 125-138.

Plastotype: SAM. P.18117, skull.

Original: CPC 6749.

Locality: UCMP V6345 (Paine Quarry). 6·5 km south-west of Alcoota Homestead, southern Northern Territory.

Formation: Waite Formation.

Age: Late Miocene-Alcoota Fauna.

Zygomaturus trilobus Owen, 1859 (*non* Macleay, 1857).

Quart. J. Geol. Soc. Lond., **15**: 168.

Plastotype: SAM. P.18121.

Original: AM. F4635, an almost-perfect cranium.

Locality: King's Creek, a tributary to the Condamine River, eastern Darling Downs, Queensland.

Formation: "alluvial drift".

Age: Pleistocene.

REMARKS—For a comprehensive resume of the vicissitudes of this taxon, see Stirton (1967: 133-134).

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RECORDS OF THE
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THE DERMAPTERA OF THE NEW HEBRIDES

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THE DERMAPTERA OF THE NEW HEBRIDES

BY A. BRINDLE

Summary

The present paper is mainly based on two collections of Dermaptera from the New Hebrides, the first lodged in the South Australian Percy Sladen Trust Expedition to these islands, and consisting of 118 specimens resulting from the 1971 Royal Society of London – Museum, in which the South Australian Museum participated.
The second belongs to the B. P. Bishop Museum, Honolulu, and consists of 189 specimens collected over a number of years. A few additional specimens of Dermaptera from these islands belonging to the British Museum (Natural History) have also been examined, some being those recorded in Hincks (1952). All previous records of Dermaptera from the New Hebrides known to the present author are included, and two previous records are rejected – that of *Titanolabis colossea* (Dohrn) in Dohrn (1864), and that of *Labia canaca* (Burr) in Burr (1908).
Keys are given to all families, subfamilies, genera and species and a total of 16 species are now recorded, of which three are new and are described. The composition of the Dermaptera fauna of the islands is discussed and comparisons made between this fauna and those of other groups of islands in the area of the Western Pacific and the Papuan Region.

THE DERMAPTERA OF THE NEW HEBRIDES

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ABSTRACT

BRINDLE, A. 1976. The Dermaptera of the New Hebrides. *Rec. S. Aust. Mus.*, 17 (13): 221-238.

The present paper is mainly based on two collections of Dermaptera from the New Hebrides, the first lodged in the South Australian Percy Sladen Trust Expedition to these islands ing from the 1971 Royal Society of London— Museum, and consisting of 118 specimens result- in which the South Australian Museum participated. The second belongs to the B.P. Bishop Museum, Honolulu, and consists of 189 specimens collected over a number of years. A few additional specimens of Dermaptera from these islands belonging to the British Museum (Natural History) have also been examined, some being those recorded in Hincks (1952). All previous records of Dermaptera from the New Hebrides known to the present author are included, and two previous records are rejected—that of *Titanolabis colossea* (Dohrn) in Dohrn (1864), and that of *Labia canaca* Burr in Burr (1908). Keys are given to all families, subfamilies, genera and species and a total of 16 species are now recorded, of which three are new and are described. The composition of the Dermaptera fauna of the islands is discussed and comparisons made between this fauna and those of other groups of islands in the area of the Western Pacific and the Papuan Region.

INTRODUCTION

The first survey of known records of Dermaptera from the New Hebrides is that of Hincks (1938) in which three species were listed, one of which, *Titanolabis colossea* (Dohrn) was thought to be doubtful. Four additional species were recorded in Hincks (1947) and another species in Rehn (1948). Hincks (1952) examined a series of 77 specimens of Dermaptera collected in the New Hebrides by Miss L. E. Cheesman, and added six species to the fauna. Of the fourteen species thus recorded, however, the record of *Titanolabis colossea* is rejected; Dohrn (1864) listed the localities of *colossea* as Australia, New Caledonia, New Hebrides, and Fiji, but the location of any specimen is doubtful. There are large species of *Anisolabis* in New Caledonia which could be mistaken for *colossea*, but they are not conspecific, nor congeneric with it. No large species of this family have since been recorded from the New Hebrides nor from Fiji, but the location of any specimen is doubtful. to Australia, where, if correctly recognised, it attains a considerable size, and is almost the largest of existing earwigs. The names *Prolabia arachidis* (Yersin) and *Marava wallacei* (Dohrn), listed in Hincks (1952) are now known to refer to forms of the same species (Hincks 1954). One species was only named to genus (*Labia* sp., Hincks, 1952), and the reference to *Nesogaster aculeatus* (Bormans) in Hincks (1947) is referable to *N. apicalis* Hincks (Hincks, 1952). The specimen recorded as *Labia canaca* Burr, by Burr (1908) and Hincks (1938) has been examined and is a female of one of the species described as new in the present paper.

Recently, an expedition organised jointly by the Royal Society of London and the Percy Sladen Trust, which included entomologists from the South Australian Museum and the CSIRO Division of Soils in Adelaide, undertook a survey of the New Hebrides; the 118 specimens of Dermaptera resulting from the survey have been examined by the present author. In addition 189 specimens of Dermaptera from these islands belonging to the B.P. Bishop Museum, Honolulu, have been studied. These specimens are recorded in the present paper, which includes all previous records known to the author. The paper thus attempts to provide a complete survey of the known Dermaptera of the New Hebrides, and keys are given to all families, subfamilies, genera, and species represented. Notes on the composition of the fauna and comparison of this with those or other groups of islands in the Western Pacific and in the Papuan Region are included. A total of 16 species are now known from the New Hebrides, of which three are described as new.

My sincere thanks are due to Mr. G. F. Gross, of the South Australian Museum, Adelaide, and to Dr. J. Linsley Gressitt, of the B.P. Bishop Museum, Honolulu, for the opportunity to examine the respective collections of Dermaptera under their care. I am also indebted to Dr. D. R. Ragge and Mrs. J. Marshall for freely granted facilities in examining specimens of Dermaptera in the British Museum (Natural History), London.

1st December, 1976.

The Dermaptera fauna of the New Hebrides (Table 1) is small, of 16 recorded species, but it is obviously related to the fauna of other island groups in the Western Pacific and the Papuan area. The Solomon Islands are the nearest to the north-west, and the south-eastern islands of Micronesia to the north-east. The Fiji islands lie to the east of the New Hebrides and the actual nearest island group to the New Hebrides is that of New Caledonia, with its associated Loyalty Islands. The Dermaptera of all these islands, except for Fiji, have recently been studied and the relationships of the Dermaptera fauna are now better understood.

The Solomon Islands, as a group, are much larger in area than those of the New Hebrides; they are relatively close to New Guinea, have a much richer fauna, and mark the eastern limit of a number of Papuan genera. The islands of Micronesia are smaller, widely scattered and have 24 species, whilst New Caledonia and the Loyalty Islands have 18 species.

All the genera recorded from the New Hebrides occur in the Solomon Islands and all, except for *Sphingolabis*, occur in Micronesia, but three genera are absent from New Caledonia. This indicates that the Dermaptera fauna of the New Hebrides has extended from New Guinea into the Solomon Islands and further south to the New Hebrides. The New Hebrides have five endemic species, (about 31 per cent of species) which account for 18 per cent of the number of specimens examined. The endemic species thus form less of the population of Dermaptera than the number of species would suggest, and this feature is true of the Solomon Islands, and more particularly of Micronesia. In contrast the endemic species of New Caledonia are dominant. The influence of cosmopolitan species, however (excluding *Chelisoches morio* (F.)), is much less in the New Hebrides (18 per cent of species but only 6 per cent of specimens) than in either the Solomon Islands or Micronesia, indicating that the New Hebrides are somewhat off the general distribution range of the cosmopolitan species. The term "cosmopolitan" species has been generally used in the Dermaptera for species with a very wide world distribution, which to some extent may be due to accidental introduction, but recent work is clarifying these distributions and the status of some cosmopolitan species may have to be modified. *Chelisoches morio* (F.) although classed as a cosmopolitan species, is now known to be mainly a dominant Pacific and Papuan species; it extends westwards to India and Ceylon, where it is not common, and is probably adventive in Madagascar, and certainly adventive in Africa and elsewhere. It is well represented in the New Hebrides, as in Micronesia, but less well represented in the Solomon Islands, and much less well represented in New Caledonia.

There are four Australasian species recorded from the New Hebrides, so the influence of the Australasian fauna is clear, and these species account for nearly one quarter of the total specimens examined. There are also three Pacific species (excluding *C. morio*), i.e. one Oriental-Pacific; one Australasian-Pacific; and one entirely western Pacific species, and these account for about one fifth of the total number of specimens. The position of the New Hebrides in the western Pacific, but close to the Australasian Region,

TABLE 1
DISTRIBUTION OF DERMAPTERA IN THE NEW HEBRIDES

	Vanua Lava	Espiritu Santo	Maewo	Aoba	Pentecost	Malekula	Epi	Efate	Erromanga	Tanna	Aneityum	World distribution
Carcinophoridae—												
Carcinophorinae—												
1. *Euborellia annulipes* (Lucas)									X			Cos.
2. *Anisolabis verhoeffi* Zacher		X	X	X		X		X	X		X	Aus.
Brachylabiinae—												
3. *Brachylabis cordata* sp.n.		X										End.
Labiidae—												
Nesogastrinae—												
4. *Nesogaster apicalis* Hincks	X	X				X						Aus.
5. *N. bakeri* Hincks		X	X	X	X	X		X			X	End.
Sparattinae—												
6. *Auchenomus insularis* sp.n.		X										End.
Labiinae—												
7. *Chaetolabia stoneri* (Caudell)									X			Pac.
8. *C. dentata* sp.n.				X					X		X	End.
9. *Labia curvicauda* (Motschulsky)		X		X		X			X			Cos.
10. *L. bituberculata* Brindle		X							X			Aus.
11. *Sphingolabis hawaiiensis* (Bormans)	X	X	X	X		X	X		X	X		O-P
Spongiphorinae—												
12. *Marava arachidis* (Yersin)		X				X			X			Cos.
13. *M. feae* (Bormans)		X										Aus.
Chelisochidae—												
14. *Chelisoches morio* (Fabricius)	X	X	X	X		X		X	X	X	X	Cos.
15. *C. cheesmanae* Hincks	X											End.
16. *Hamaxas nigrorufus* (Burr)		X						X	X			A-P

Aus. = Australian Cos. = Cosmopolitan A-P = Australasian-Pacific O-P = Oriental-Pacific Pac. = Pacific End. = Endemic could be expected to produce a balance between the Australasian and Pacific fauna, and this is the type of Dermaptera fauna found in the New Hebrides.

Key to families and subfamilies

1. Elytra and wings completely absent; male genitalia with two distal lobes, one directed backwards and one directed forwards at rest (Fig 2) (Carcinophoridae) 2
   At least elytra present, wings often visible; male genitalia with a single median distal lobe (Fig. 26) 3
2. First antennal segment shorter than the distance between the antennal bases; body depressed, not fusiform; branches of forceps of both sexes trigonal at bases, with a short dorsal ridge on each; male forceps asymmetrical (Fig. 1) . . . . Carcinophorinae
   First antennal segment longer than the distance between the antennal bases; body less depressed, fusiform; branches of forceps of both sexes cylindrical, not trigonal at bases, and symmetrical (Fig. 5) Brachylabiinae
3. Second tarsal segment prolonged beneath third (distal) segment as a narrow lobe; male genitalia with two dark paired sclerites associated with the virga (Fig. 26) Chelisochidae
   Second tarsal segment simple; male genitalia without two dark paired sclerites but often with a complex arrangement of denticulations and sclerites associated with the virga (Labiidae) 4
4. Head flat; body strongly depressed; first antennal segment as long as distance between the antennal bases or almost so; pronotum narrowed anteriorly, forming a distinct neck (Fig. 28) . . . . Sparattinae
   Head normally convex; body less depressed; first antennal segment shorter than the distance between the antennal bases; pronotum without such a distinct neck 5
5. Each elytron with a distinct lateral longitudinal ridge (Fig. 6) . . . . Nesogastrinae
   Elytra without such ridges 6
6. Third antennal segment shorter than fifth; elytra usually punctured and pubescent . . . . Labiinae
   Third antennal segment longer than fifth or almost so; elytra glabrous and impunctate . . . . Spongiphorinae

CARCINOPHORIDAE

A large family, poorly represented in the Pacific and in the Australasian Region, the species being typically dark coloured apterous earwigs with short forceps, those of the male often being asymmetrical. A minority of species have rudimentary elytra and sometimes both elytra and wings are fully developed. Two subfamilies are now recorded from the New Hebrides.

CARCINOPHORINAE

The largest subfamily, the species having rather short basal antennal segments, a depressed body, relatively short legs, and often a shining and more or less glabrous cuticle. The puncturation of the abdominal tergites may be stronger in the males than in the females, and a frequent feature of the males is the presence of well defined lateral longitudinal ridges on the posterior abdominal tergites, one ridge occurring on each side of a tergite; a dorso-median longitudinal ridge may also be present on the last (tenth) tergite. The penultimate sternite may have the apex excised in males but not in the females. The determination of the species is based on the male genitalia, and there are few suitable external characters.

Key to genera and species

1. Parameres of male genitalia about as broad as long; each distal lobe of genitalia without a visible virga and with denticulated pads. Male penultimate sternite not excised at apex . . . . *Euborellia annulipes* (Lucas)
   Parameres of male genitalia long and slender, much longer than broad; each distal lobe of genitalia with a visible virga, but without denticulated pads (Fig. 2). Male penultimate sternite excised at apex (Fig. 4) *Anisolabis verhoeffi* Zacher

Euborellia annulipes (Lucas)

Forficesila annulipes Lucas, 1847, *Ann. Soc. ent. France* (2) **5:** 84 (Paris, introduced).

Anisolabis annulipes (Lucas): Burr, 1911, *Genera Insectorum* **122:** 29.

Euborellia annulipes (Lucas); Burr, 1915, *J. R. Micr. Soc.* **1915:** 545.

Anisolabis annulipes (Lucas): Rehn, 1948, *Trans. Am. ent. Soc.* **74:** 160 (Erromanga).

A rather small blackish, shining species, legs yellow with femora usually banded with blackish; antennae brown or dark brown, one or more distal segments white. Head transverse, eyes small, pronotum more or less as broad as long, wider posteriorly; elytra and wings completely absent. Penultimate sternite of male with apex rounded. Forceps short, trigonal at base, those of male rather asymmetrical, those of female symmetrical.

Length of body 8-11 mm, *forceps* 1-1·5 mm.

World distribution: Cosmopolitan; occurs in all faunal Regions, often as an adventive.

Remarks: The above record of Rehn (1948) appears to be the only one from the New Hebrides, and may possibly be due to confusion with *Anisolabis verhoeffi*, which is superficially similar to *E. annulipes*.

Location of type:

Holotype ♀ in Paris museum.

Anisolabis verhoeffi Zacher

Figs. 1-4

Anisolabis verhoeffi Zacher, 1911, *Zool. Jb.* **30:** 374 (Bismarck Archipelago).

Anisolabis verhoeffi Zacher: Hincks, 1947, *Entomologist's mon. mag.* **83:** 65 (Espiritu Santo).

Anisolabis verhoeffi Zacher: Hincks, 1952, *Ann. Mag. nat. Hist.* (12) **5:** 200 (Espiritu Santo; Malekula).

Dark brown to blackish, antennae dark brown, sometimes with one or more distal segments pale yellow or whitish; legs yellowish, femora usually darkened for basal half. Head, and thoracic nota impunctate, glabrous; abdominal tergites sparsely and finely punctured and pubescent.

Male (Fig. 1): Head transverse, tumid, eyes small. Pronotum strongly transverse, more or less rectangular; elytra and wings completely absent; abdomen broad, depressed, tergites 6-9 with lateral ridges, those on sixth tergite extending for distal half only, those on ninth tergite also short, but those on seventh and eighth tergites almost complete; last tergite with a dorsomedian ridge towards each side, the ridge curved medially posteriorly, and posterior part of tergite depressed; penultimate sternite with apex concave, the lobes pointed (Fig. 4). Branches of forceps trigonal at base, cylindrical distally, those of male often asymmetrical (Fig. 1) or almost symmetrical, those of female symmetrical and straighter. Genitalia of male with two basal penes, parameres long with a median darker membraneous flap, virga narrow and long (Fig. 2); slight variations in the exact shape of the parameres occur in genital mounts due to slight distortion (Fig. 3).

Length of body 7-9 mm, *forceps* 1·25-1·75 mm.

World distribution: Bismarck Archipelago and New Hebrides.

Remarks: Specimens of *A. verhoeffi* from the original area (Bismarck Archipelago) in the British Museum (Natural History) have recently been examined, and appear to be conspecific with the present specimens from the New Hebrides. The species is variable in general appearance and colour, but all the males examined have the same type of excision in the penultimate sternite whilst the male genitalia are identical. *A. verhoeffi* is closely similar to *A. horvathi* Burr from New Guinea, *A. bifida* Brindle from the Solomon Islands, and *A. minutissima* Brindle from the Western Caroline islands. The latter two species have a less excised male penultimate sternite, although in *verhoeffi* the pointed lobes tend to curl dorsally and may seem blunt at first sight. The males of *A. horvathi* and *A. bifida* have lateral longitudinal ridges on abdominal tergites 7-9, whilst both *A. minutissima* and *A. verhoeffi* have similar ridges on abdominal tergites 6-9, the ridges on both tergites 6 and 9 being short. *A. minutissima* is smaller in body length (6 mm) than *verhoeffi* (7-9 mm) and the puncturation and pubescence of the tergites of the latter species are much more sparse than in the former. The male genitalia of these four species are similar in structure and differ only in minor details.

Location of type:

♂ in Berlin museum.

Material examined:

ESPIRITU SANTO: From litter, flat terrace, E bank Apuna River Campsite No. 2, 10 km SSW of Malau village, Big Bay area, 27.VIII.1971, 1 ♂, 2 larvae, J. C. Buckerfield; terrace of Apuna River, 15° 13′ S, 166° 50′ E, lowland rainforest, Coll. No. NH 49, 13.IX.1971, 1 ♀, 1 larva, K. E. Lee (SAM).

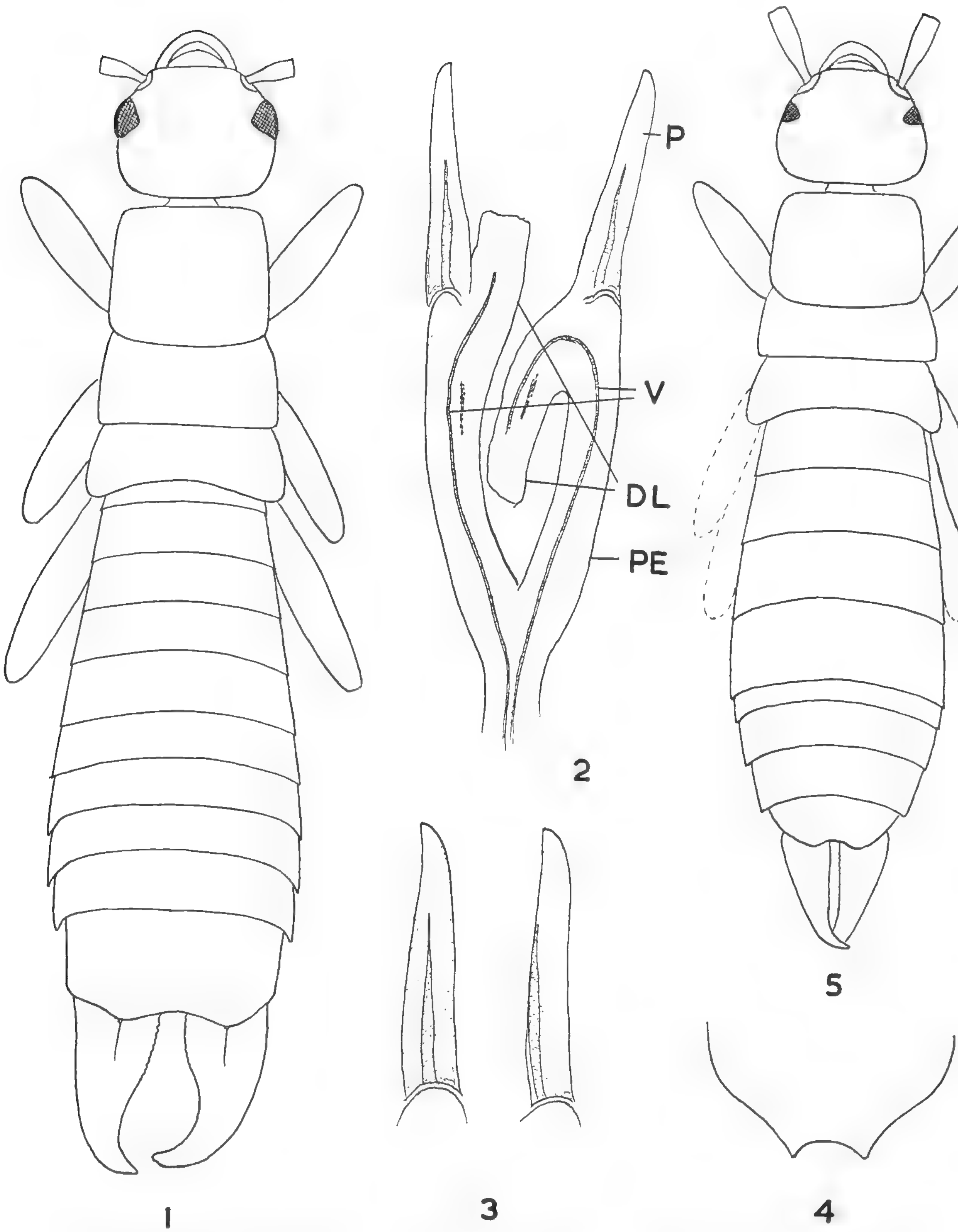
MAEWO: Above Nasaua, 180 + m, 4.IX.1958, 1 ♂, B. Malkin (BISHOP).

AOBA: Dunduy, 6/8.IX.1958, 2 ♂, B. Malkin (BISHOP).

MALEKULA: SW Malekula, 16° 28′ S, 167° 27′ E, mesophyll rainforest, Coll. No. NH 68, 11.X.1971, 1 ♀, 3 larvae, K. E. Lee; SW Bay, 16° 29′ S, 167° 26′ E, disturbed forest grazed by cattle, Coll. No. NH 63, 2 ♀, 1 larva, K. E. Lee; SW Malekula, 16° 28′ S, 167° 27′ E, Meso-noto vine forest, NH 67, 11.X.1971, 1 ♀, 2 larvae, K. E. Lee; SW Malekula, 16° 29′ S, 167° 27′ E, cocoa plantations with some coconuts, Coll. No. NH 69, 13.X.1971, 1 ♂, 1 larva, K. E. Lee, (SAM).

EFATE: From litter, terrace surface in ridge, 400 m, down ridge from Narabut Camp site, 2.VII.1971, 1 larva, J. C. Buckerfield; SE Efate, 17° 45′ S, 168° 24′ E, coastal forest on recently raised beach, NH 19, 13.VII.1971, 1 larva, K. E. Lee. (SAM).

ERROMANGA: From *Pandanus* epiphytes, 2 km NNE of Nuankau River bridge on secondary milling road, 10 km WSW of Ipotak, 4.VIII.1971, 1 ♀, K. E. Lee; S. Erromanga, 18° 53′ S, 169° 12′ E, *Agathis-Calophyllum*



Figs. 1-4, *Anisolabis verhoeffi* Zacher—1, male—2, male genitalia—3, male parameres—4, male penultimate sternite. Fig. 5, *Brachylabis cordata,* sp.n., female. (DL=distal lobe; P=paramere; PE=penis; V=virga).

high canopy rainforest, Coll. No. NH 33, Coll. No. NH 34, 4♂, 2♀, 4 larvae, K. E. Lee; S. Erromanga, 18° 54′ S, 169° 11′ E, *Agathis* forest, Coll. No. NH 35, 7.VIII.1971, 2 larvae, K. E. Lee (SAM).

ANEITYUM: SW Aneityum, 20° 15′ S, 169° 46′ E, fire-induced grassland, *Imperata* dominant, Coll. No. NH 27, 23.VII.1971, 1 very small larva, K. E. Lee (SAM).

The last recorded specimen has not been definitely named as this species but is thought to belong here, and the two larvae in the last record for Erromanga may not belong to this species although they appear to be Carcinophorine. One of these larvae has been removed and dried and appears to differ from the rest in the degree of puncturation and sculpture of the cuticle. These specimens are provisionally assigned to this species.

BRACHYLABIINAE

This subfamily is characterised by the long first antennal segment, the fusiform abdomen and by the relatively long legs; the cuticle may be shining, often punctured, sometimes very strongly so, or may be rugose and dull, often strongly pubescent; the forceps of both sexes are often similar, almost always cylindrical, and relatively slender.

No representative of this subfamily has previously been recorded from the New Hebrides, but a single female specimen is in the present material and is placed in the genus *Brachylabis* Dohrn.

Brachylabis cordata sp.n.

Fig. 5

Black, posterior parts of tergites of abdomen with a reddish tint; lateral margins of pronotum yellow; antennae blackish, segment 10 (last in type) somewhat paler; legs yellowish-brown, femora vaguely darkened; forceps dark red. Cuticle rugose, rather shining, with rather sparse, relatively long but fine yellow hairs, more conspicuous laterally on abdomen.

Female (Fig. 5): Head transverse, almost cordiform in shape; eyes small. Antennae 10-segmented in type, first segment long, second transverse, third segment four times as long as broad, evenly widened distally, fourth segment one and half times as long as broad, fifth segment one and three-quarters as long as broad, sixth twice as long as broad; distal segments shorter and relatively wider than basal segments. Pronotum strongly transverse, slightly widened posteriorly, margins more or less straight; an impressed smooth line occurs medially on anterior half, with short similar lines on each side. Mesonotum broad, with a broad lateral fold at base but without lateral longitudinal ridges. Only two first legs and right median leg present in type.

Abdomen fusiform, scarcely depressed, last tergite small; each branch of forceps very short, cylindrical, wider at base, apex slender and curved.

Length of body 7 mm, *forceps* 1 mm.

Remarks: The description of a species on a single female is usually not desirable in the Dermaptera, where the taxonomy is so largely based on the male genitalia. In the Brachylabiinae, however, the sexes are almost always similar, although the male forceps may be more strongly curved than those of the female, so that the male can be recognised from the description of a female. The external taxonomic characters are usually good in this subfamily, unlike those in the Carcinophorinae, where isolated females cannot be identified with any certainty. The structure of the male genitalia is still necessary to place the species without doubt in a genus, but at present the present author has been placing all new species in the genus *Brachylabis*, pending a revision of the World species of the subfamily.

B. cordata, however, is so closely similar in external characters to *Brachylabis greensladei* Brindle from the Solomon Islands and Micronesia, and to *Brachylabis yaloma* Ramamurthi from New Britain, that it seems possible that all are congeneric. There are sufficient external differences to separate these three species, so it has been thought desirable to name the species and describe it as new. These three species may be separated as follows:—

1. Pronotum longer than broad; body length 8·5 mm. New Britain . . . . *yaloma* Ramamurthi
   Pronotum transverse 2
2. Pronotum less strongly transverse, ratio of length to width 11:9. Antennae dark brown with two or more distal segments white, ratio of segments 4, 5, 6 = 1:1·25:1·5. Smaller species, body length 5-6·5 mm . . . *greensladei* Brindle
   Pronotum more strongly transverse, ratio of length to width 12·5:9. Antennae blackish, almost unicolorous, ratio of segments 4, 5, 6 = 1·5:1·75:2. Larger species, body length 7 mm . . . . . . *cordata* sp.n.

Location of type:

Holotype ♀, ESPIRITU SANTO: Nokovula, Mt. Tabwemasana track, 1 325 m, 15° 22′ S, 166° 44′ E. Coll. No. NH 47, ex. litter, 4.IX.1971, K. E. Lee (SAM).

Material examined: The type only.

LABIIDAE

A large family, mainly of small species, and characterised by the simple second tarsal segment and by the male genitalia having a single distal lobe and virga. Represented in all faunal Regions. Four subfamilies are represented in the New Hebrides, with ten species, four being endemic, and of these three are described as new species.

NESOGASTRINAE

This subfamily includes the single Indo-Australian genus *Nesogaster* Verhoeff, which is distinctive since it is the only Indo-Australian genus in which the elytra have lateral longitudinal ridges and in which the cuticle is brightly shining and more or less glabrous. The only other Old World genera of the Labiidae in which lateral longitudinal ridges are present on the elytra are *Physogaster* Ramamurthi and *Parapericomus* Ramamurthi (Physogastrinae) but in these genera the body and forceps have long stiff hairs.

Key to Species

1. Larger, body length 6-8 mm; more uniformly coloured species; male pygidium blunt at tip or with a short narrower tip (Fig. 6); branches of female forceps relatively shorter and broader, dorso-median ridge (DR) at base forming two tubercles (Fig. 7) ... *bakeri* Hincks

   Smaller, body length 4-6 mm; usually more contrastingly coloured species; male pygidium with a short wide base, distal part slender, narrowed distally (Fig. 11); branches of female forceps relatively longer and narrower, dorso-median ridge (DR) at base entire (Fig. 12) . . . . *apicalis* Hincks

Nesogaster apicalis Hincks

Fig. 12

Nesogaster apicalis Hincks, 1951, *Ann. Mag. nat. Hist.* (12) **4:** 568 (Malekula, Espiritu Santo, Banks Is., Papua).

Nesogaster apicalis Hincks: Hincks, 1952, *Ann. Mag. nat. Hist.* (12) **5:** 201.

Nesogaster apicalis Hincks: Brindle, 1971, *Entomologist's mon. mag.* **107:** 120.

Nesogaster aculeatus (Bormans): Hincks, 1947, *Entomologist's mon. mag.* **83:** 66 (♂, ♀, Espiritu Santo).

Brown to dark reddish-brown, head reddish, antennae and legs yellow; last abdominal segment often reddish-brown or reddish-yellow, forceps reddish-yellow, sometimes partially darkened medially. Cuticle brightly shining, impunctate or almost so.

Head transverse, eyes small, antennal segments strongly moniliform; pronotum transverse, more or less rectangular; elytra short, wings absent or concealed. Each branch of male forceps long, rather broad, inner margin flattened at base and with small denticulations, and with a double-toothed projection beyond midpoint, distal part of branch cylindrical and curved; pygidium wide at base, thence sharply narrowed and long (Fig. 11). Each branch of female forceps shorter and broader, inner margin with a dorso-median longitudinal ridge at base (Fig. 12, DR), distal part of branch with a ventral serrated flange, apex slender and curved (Fig. 12).

Length of body 4-6 mm, *forceps* 2·5 mm (males), 1·75 mm (females).

World distribution: New Guinea; New Britain; Solomon Islands; and New Hebrides.

Remarks: The description and length given above refer to the present specimens which are rather small and more brightly coloured. Specimens from other areas may be less contrastingly coloured and larger.

Location of types:

Holotype ♂ and paratypes in British Museum, paratypes in Manchester Museum.

Material examined: BANKS IS.: Vanua Lava, Sola, 5/11.VIII.1958, 1 ♂, 2 larvae, B. Malkin (BISHOP). ESPIRITU SANTO: Luganville, 23/28.VII.1958, 2 ♂, 5 ♀, 19 larvae, B. Malkin; Narango, 90m, June, 1960, 1 ♀, W. W. Brandt (BISHOP).

Nesogaster bakeri Hincks

Figs. 6, 7

Nesogaster bakeri Hincks, 1947, *Entomologist's mon. mag.* **83:** 66 (Espiritu Santo).

Nesogaster bakeri Hincks; Hincks, 1951, *Ann. Mag. Nat. Hist.* (12) **4:** 572.

Nesogaster bakeri Hincks; Hincks, 1952, *Ann. Mag. nat. Hist.* (12) **5:** 200 (Malekula, Espiritu Santo, Aneityum).

Dark reddish-brown, head reddish to reddish-brown, legs yellowish-brown, femora vaguely darkened; forceps and pygidium yellowish-brown or with a reddish tint. Cuticle brightly shining, abdominal tergites 4-9 of male or 4-7 of female punctured, middle tergites more strongly punctured than others, last tergite irregularly punctured.

Similar in structure to *apicalis,* but larger, more robust, and more uniformly coloured. Each branch of male forceps long and broad, with an inner tooth, basal part of branch with a flattened inner surface on which are small denticulations or crenulations; pygidium large, long, somewhat variable in shape but usually broad for most of length and narrower only near apex (Fig. 6). Each branch of female forceps short and broad, excavated at base and with a dorso-median inner ridge forming two tuberculate-like projections (DR), distal part of branch with a ventral inner serrated flange, apex slender and incurved (Fig. 7).

Length of body 6-8 mm, *forceps* 3-5 mm (males), 2-2·5 mm (females).

World distribution: New Hebrides, endemic.

Location of type:

Holotype ♂ in Hope Department of Entomology, Oxford, England.

Material examined:

ESPIRITU SANTO: From logs and epiphytes on crest of main ridge leading SE from Nokovula to summit of Mt. Tabwemasana, 25 km SSW Malau village, Big Bay area, 4.IX.1971, 1 ♂, K. E. Lee; Nokovula, 1 132 m, 15.IX.1971, 2 ♀, G. F. Gross; Nokovula, village, camp 4, 23 km SSW Malau village, Big Bay, 5.IX.1971, 1 ♀, J. C. Buckerfield; Nokovula village, camp 4, 1 128 m, 10.IX.1971, 1? (abdomen missing), G. F. Gross (SAM). Namatasopa, 300 m, 28.VIII.1957, 1 ♀, 2 larvae, J. L. Gressitt; above Namatasopa, 400 m, 30.VIII.1957, 3 ♀, 2 larvae, J. L. Gressitt; below Namatasopa, 250 m, 1.IX.1957, 1 larva, J. L. Gressitt (BISHOP).

MAEVO: Above Nasua, 180+ m, 4.IX.1958, 4 ♂, 10 ♀, 1 larva, B. Malkin (BISHOP).

AOBA: Dundy, 6/9.IX.1958, 4 ♀, B. Malkin (BISHOP).

PENTECOST: 200-500 m, 27.II.1964, 1 ♀, R. Straatman (BISHOP).

MALEKULA: From rotten logs, gentle slope on broad ridge, 8 km NNW of summit of Mt. Yang'abalé, 45 km E of Tisvel village, 1.X.1971, 1 ♂, K. E. Lee (SAM); Amok, 17.IX.1958, 1 ♂, 1 ♀, B. Malkin (BISHOP).

EFATE: Terrace surface on ridge, camp site, Narabut, 1.VII.1971, 2 ♂, J. C. Buckerfield; from rotten logs, 500 m. NE Narabut camp site, 7.VII.1971, 1 larva, K. E. Lee; from rotten logs, terrace surface on ridge, 400 m. down ridge from Narabut camp site, 2.VII.1971, 2 larvae, J. C. Buckerfield (SAM); limestone plateau, N of Maat, 100 m, 20.VIII.1957, 8 ♂, 1 ♀, 2 larvae, J. L Gressitt (BISHOP).

SPARATTINAE

Mainly Neotropical in distribution, and only represented in the Old World by a single genus, *Auchenomus* Karsch, which is distinctive by the strongly flattened head and body. The single species represented in the present material is new.

Auchenomus insularis sp.n.

Figs. 27, 28

Reddish-yellow to pale reddish-brown, elytra and wings somewhat darker; antennae pale yellow; legs dark yellow. Cuticle slightly shining, punctured and pubescent, hairs mainly short and yellow, more conspicuous laterally; abdominal tergites with longer hairs and with longer marginal setae.

Male (Fig. 28): Head broad, flat posterior margin concave; eyes small. First antennal segment about as long as distance between the antennal bases, second segment transverse, third segment three times as long as broad, fourth two and half times as broad as long, fifth longer than third, basal segments more or less cylindrical; distal segments shorter, twelfth (last in holotype) shorter than fourth, and more moniliform than basal segments. Pronotum as broad as long, narrowed posteriorly, lateral margins straight, posterior margin convex. Elytra and wings fully developed; legs relatively short, femora broad.

Abdomen mainly parallel-sided, narrowed towards base, flat; last tergite transverse, produced and raised above the base of each branch of the forceps, median part depressed. Each branch of forceps broad at base, with a dorso-median rounded tubercle, and with a ventro-median tooth beyond, last quarter of branch sharply curved medially (Fig. 28).

Female: Similar to male, branches of forceps shorter and broader, with a narrow ventral inner flange, evenly narrowed to distal third where each branch is more strongly narrowed forming a curved apex (Fig. 27).

Length of body 7-8 mm, *forceps* 2·5 mm (male), 2 mm (females).

Remarks: This species is distinctive by the shape of the forceps of both sexes. Those of the male are sharply curved distally, and in this resemble those of some of the Neotropical species of *Sparatta*, whilst those of the female are unusual in having the inner margin of each branch almost smooth, not dentated as in most species of the genus which occur in the Pacific and Australasian Region.

Location of types:

Holotype ♂, ESPIRITU SANTO: SW above Namatasopa, 400 m, 30.VIII.1957, L. G. Gressitt. Paratypes, same data, 4♀, (including allotype) (BISHOP, except 1♀ paratype in British Museum (Natural History) and in Manchester).

Material examined: The types and two further specimens, without posterior abdominal segments, same data.

LABIINAE

Three genera of this subfamily are now recorded from the New Hebrides, with a total of five species, one of which is new.

Key to genera and species

1. Branches of forceps of both sexes not strongly setulose, those of the males without a ventral inner flange, and those of the females narrowed from base to apex, with inner margin at most weakly dentated or crenulated 2
   Branches of forceps of both sexes strongly setulose, those of the males with or without a ventral inner flange, and those of the females not narrowed from base to apex, and inner margin with at least a ventral inner flange, the margins of which are strongly dentated or crenulated 3
2. Pronotum almost as wide as head and transverse; a broad, shorter, less depressed species with more slender branches of the forceps
   Labia bituberculata Brindle
   Pronotum small, narrower than head, and quadrate or almost so; a more narrower, elongated, and strongly depressed species with broad short branches of the forceps . . . . . . *Labia curvicauda* (Motschulsky)
3. Larger species, body length 10 mm or more; antennal segments more or less cylindrical; elytra glabrous and impunctate . . . *Sphingolabis hawaiiensis* (Bormans)
   Smaller species, body length 8 mm or less; antennal segments moniliform; elytra punctured and pubescent 4
4. Smaller species, body length 6 mm or less; each branch of male forceps with one very large tooth on inner margin, pygidium large (Fig. 15); each branch of female forceps less strongly dentated, ventral inner margin differing strongly in dentation from dorsal inner margin (Fig. 16) *Chaetolabia stoneri* (Caudell)
   Larger species, body length 7-8 mm; each branch of male forceps with two relatively large and one very small teeth on inner margin, pygidium small (Fig. 13); each branch of female forceps more strongly dentated, ventral inner margin more similar in dentation to dorsal margin (Fig. 14) *Chaetolabia dentata* sp.n.

Chaetolabia stoneri (Caudell) comb. nov.

Figs. 8, 15, 16

Labia stoneri Caudell, 1927, *Univ. Iowa Studies* **12** (3): 5 (Fiji).

Yellowish to reddish-brown, elytra and wings somewhat darker; antennae brown; legs yellowish-brown; forceps and pygidium reddish-yellow. Cuticle of head impunctate and glabrous, that of pronotum impunctate but with sparse short yellow hairs of elytra and wings punctured and pubescent; abdominal tergites pubescent and with long marginal setae.

A small and slender species (Fig. 8); elytra and wings fully developed, or with elytra shorter and only tips of wings protruding. Each branch of male forceps curved, with a large ventral inner tooth, pygidium almost pentagonal ventrally with a concave posterior margin, dorsal part of pygidium rounded (Fig. 15); each branch of female forceps straight, ventral inner margin dentated basally, dorsal inner margin scarcely dentated basally but dentated prominently from near midpoint, pygidium broad, ventral surface concave posteriorly, dorsal surface rounded; a small tubercle occurs medially near the posterior margin of the last tergite (Fig. 16).

Length of body 4·5-6 mm, *forceps* 1·25-1·5 mm.

World distribution: Fiji and New Hebrides.

Remarks: The original description and figure of the male forceps are excellent and the structure of the forceps and pygidium is characteristic.

Location of types:

Holotype ♂, allotype ♀, 1 paratype, 1 paratype ♀ in the United States National Museum.

Material examined: ERROMANGA: Ex light trap, Nuankau river, 5/7.VIII.1971, 1♂, 1♀, (fully winged), G. Robinson; under bark of log, 500 m SW of Nuankau river bridge, 10 km WSW of Ipotak, 7.VIII.1971, 1♀, (short elytra and wings), J. C. Buckerfield (SAM).

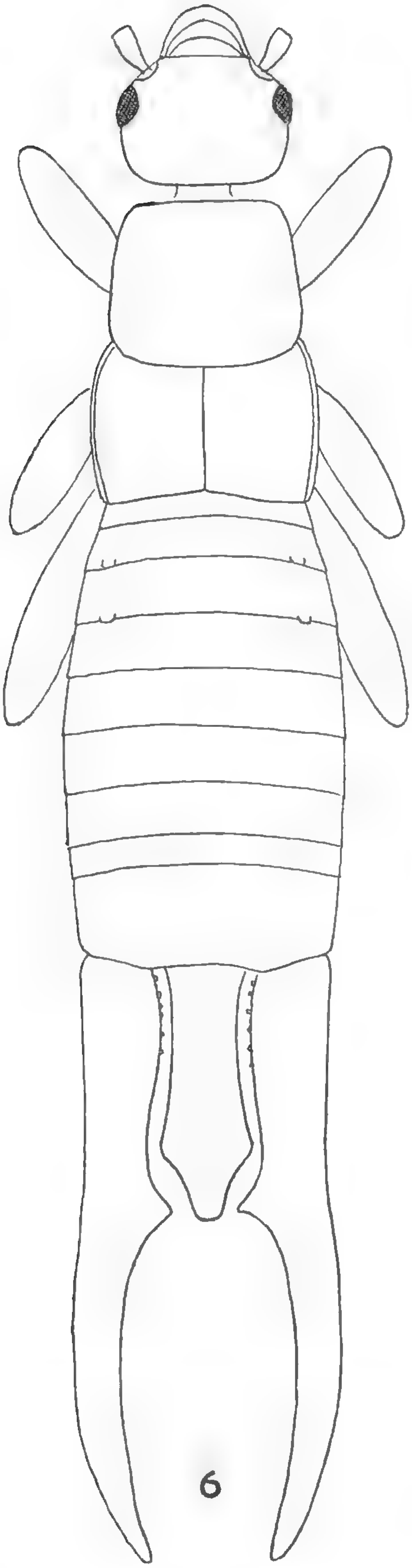
Chaetolabia dentata sp.n.

Figs. 13, 14

Labia canaca Burr, 1908 (not Burr, 1903), *Bull. Mus. natn. Hist. nat. Paris* **1908**: 32 (New Hebrides).

Reddish-brown; antennae yellowish to brown; legs yellow; forceps yellowish-brown. Cuticle of head and pronotum smooth, impunctate and glabrous, elytra and wings punctured and pubescent, hairs sparse and short, yellowish; abdominal tergites punctured and pubescent, more strongly on tergites 6-7; marginal setae present on most tergites; forceps with shorter hairs and long setae. Cuticle rather shining.

Male: Head tumid, cordiform, transverse, eyes small. First antennal segment rather shorter than the distance between the antennal bases, second segment transverse, third two and half times as long as broad, fourth equal to third in



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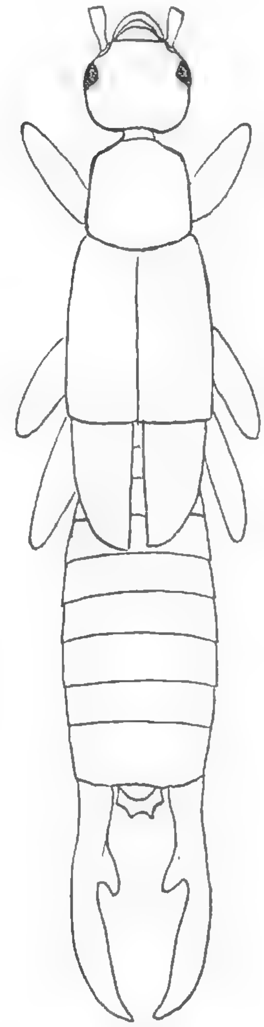

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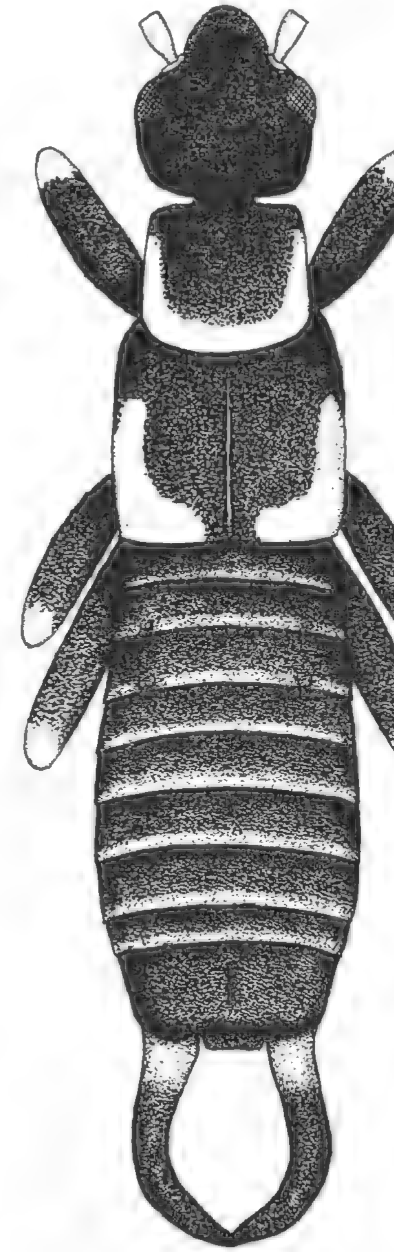

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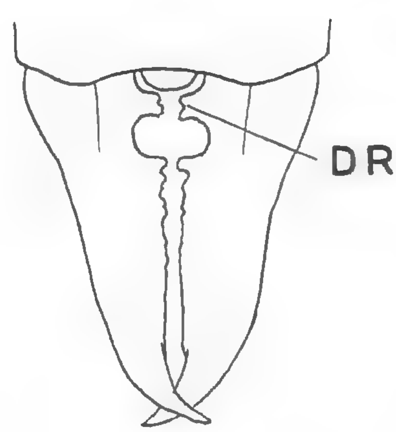

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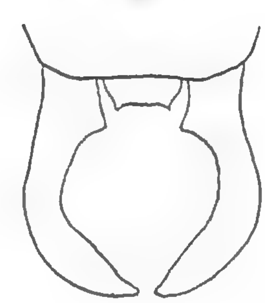

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Figs. 6-7, *Nesogaster bakeri* Hincks—6, male—7, female forceps.
Fig. 8, *Chaetolabia stoneri* (Caudell). Figs. 9-10, *Marava feae* (Bormans)—9, male, New Hebrides—10, male forceps, Australia. (DR=dorsal ridge).

length, fifth three times as long as broad; distal segments as long as fifth, each segment narrowed to base, all segments pubescent. Pronotum slightly longer than broad, strongly widened posteriorly, lateral margins straight, posterior margin convex. Elytra and wings fully developed or short.

Abdomen relatively long, somewhat depressed, lateral tubercles on third and fourth tergites very small. Each branch of forceps weakly curved with one tuberculate median tooth on inner margin near base and a second small median tooth towards apex; a very small ventral tooth occurs distal to basal tooth; pygidium small, narrowed posteriorly (Fig. 13).

Female: Similar to male, but last tergite with a median tubercle near posterior margin; each branch of forceps straight except at apex, broad, apex curved, ventral and dorsal inner margins with similar dentation, consisting of one larger tooth about one third from apex, followed by three smaller teeth beyond midpoint (ventral margin with only two), a distal tooth occurs only on the ventral margin; pygidium short and broad (Fig. 14).

Length of body 7-8 mm, *forceps* 2·75 mm (male), 1·5 mm (females).

Remarks: In addition the female specimen from the New Hebrides, without exact locality, recorded by Burr (1908) as *Labia canaca* Burr, is in the British Museum (Natural History) and proves to be a female of the present species, and is hereby designated as a paratype. The locality label reads "N. Hebrides francais" whilst a second label reads "*Labia canaca* Burr ♀". *Labia canaca* is restricted to New Caledonia.

The specimen from Aneityum is the only specimen in which the elytra and wings are fully developed; it has been named by the shape of the pronotum and other details of the anterior part of the insect which are adequate for the known New Hebrides fauna, but it is possible that there is another species in the New Hebrides, and without the forceps it is not possible to be entirely certain about its identity. The pronotum is rather more transverse in this specimen than in the others.

There are three known species of *Chaetolabia* from other areas in the Western Pacific, but none are yet known from the Australasian Region. These three species, together with the two now recorded from the New Hebrides may be separated as follows:—

1. Each branch of the male forceps with a very large inner tooth (Fig. 15); each branch of the female forceps with the inner dorsal edge scarcely dentated at base and merging with the ventral inner edge beyond midpoint (Fig. 16) . . . . . *stoneri* (Caudell)
   Branches of male forceps with small inner teeth or a tooth; dorsal inner edge of female forceps dentated from base 2
2. Pronotum parallel-sided; male pygidium narrowed to apex; female pygidium broad, short, narrowed distally, apex concave. Micronesia (Palau) . *spicata* Brindle
   Pronotum widened posteriorly 3
3. Male pygidium short, partly hidden by basal inner teeth of forceps (Fig. 13); inner margin of each branch of female forceps irregularly dentated, with teeth of varying sizes (Fig. 14) . . . . . *dentata* sp.n.
   Male pygidium large, or long, not hidden by inner teeth; inner margin of each branch of female forceps regularly dentated with small teeth of almost equal size 4
4. Male pygidium large, as long as broad, narrower at base but widened distally with margin curved, and apex deeply concave; last tergite of female with a small median dorso-posterior projection. Micronesia (Ponape; Kusaie) . . . . *esakii* (Menozzi)
   Male pygidium long, narrow, almost parallel-sided, apex concave; last tergite of female with a larger median dorso-posterior projection. Micronesia (Ponape; Truk) *appendicina* (Menozzi)

Labia canaca Burr from New Caledonia has a male pygidium similar to that of *esakii*, but the pygidium of *canaca* is not narrowed at base and is more deeply excised posteriorly; the female of *canaca* has the inner margin of each branch of the forceps irregularly dentated as in *dentata*, but the pygidium is not short and broad but longer than broad and ending in two irregular posterior projections, the projections separated by a median concavity.

Location of types:

Holotype ♂, AOBA: Dunduy, 6/8.IX.1958, B. Malkin; allotype ♀, same data; both in the Bishop Museum.

ERROMANGA: 1 ♀ paratype, Nuankau river camp, 7.VIII.1971, G. F. Gross in the South Australian Museum.

Material examined:

The types and ANEITYUM: Red Crest, 1 200ft., 3 m NE of Anelcauhat, III.1955, 1? (end of abdomen missing), L. E. Cheesman (BRIT. MUS.).

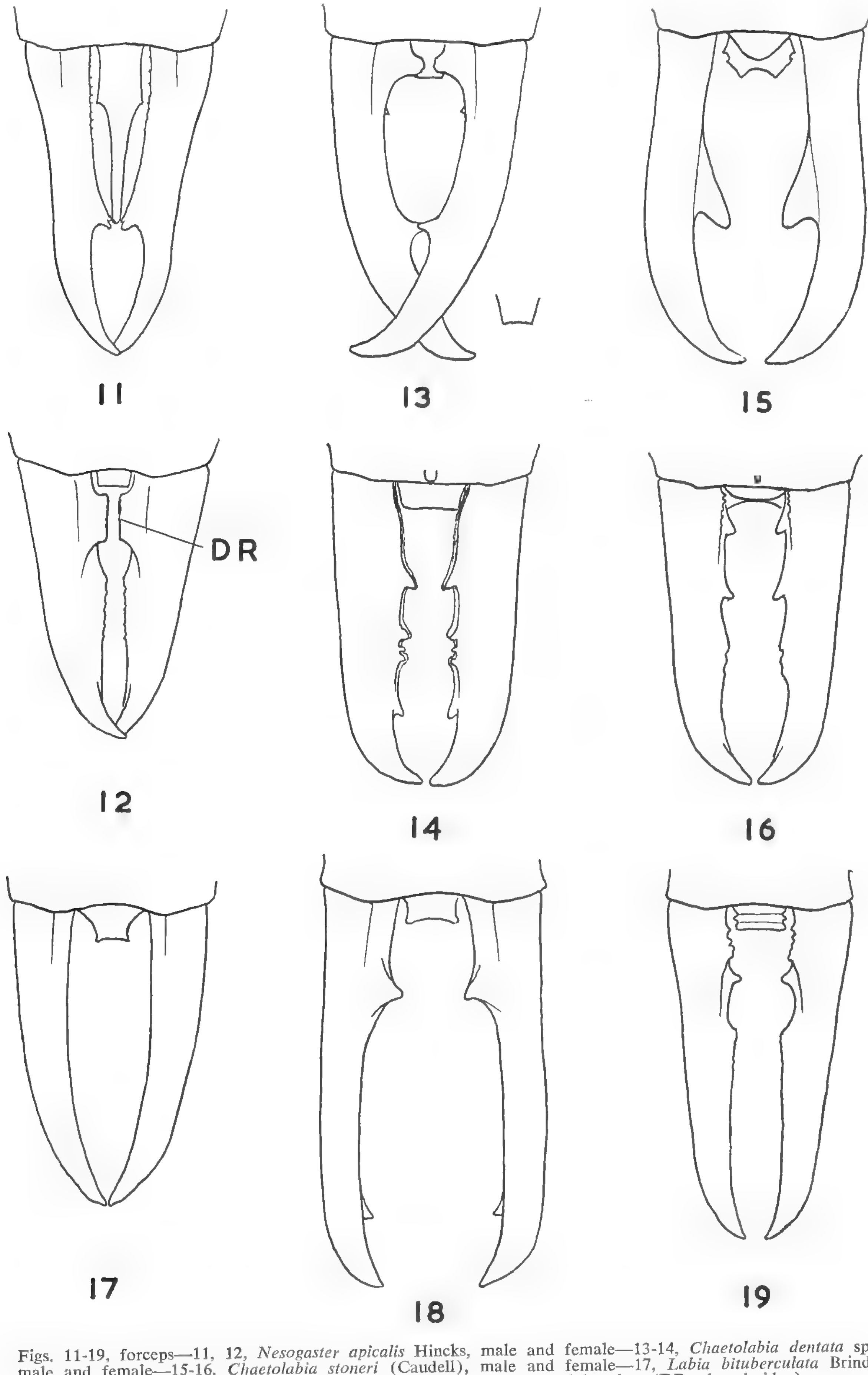
Labia curvicauda (Motschulsky)

Figs. 22, 23

Forficesila curvicauda Motschulsky, 1863. *Bull. Soc. nat. Moscou* **36:** 2 (Ceylon).

Labia curvicauda (Motschulsky); Hincks, 1952. *Ann. Mag. nat. Hist.* (12) **5:** 201 (Espiritu Santo; Malekula; Erromanga).

Blackish, abdomen reddish, legs yellow with femora partially darkened, antennae yellow or brown pronotum sometimes yellow.



Figs. 11-19, forceps—11, 12, *Nesogaster apicalis* Hincks, male and female—13-14, *Chaetolabia dentata* sp.n. male and female—15-16, *Chaetolabia stoneri* (Caudell), male and female—17, *Labia bituberculata* Brindle, male—18-19, *Sphingolabis hawaiiensis* (Bormans), male and female. (DR=dorsal ridge).

A small depressed species usually recognisable by the relatively small pronotum, which is parallel-sided, and the short broad branches of the forceps. Elytra and wings fully developed, legs short. Each branch of male forceps curved, with a basal wider part, pygidium broad (Fig. 22). Each branch of female forceps broad, more or less straight, and narrowed distally (Fig 23).

Length of body 4-5 mm, *forceps* 0·75-1·25 mm.

World distribution: Cosmopolitan, in all faunal Regions, but mainly adventive in temperate countries.

Location of types:

Believed lost.

Material examined:

ESPIRITU SANTO: Luganville, 20.VII.1958, 1 ♀, B. Malkin (BISHOP).

AOBA: Dunduy, 6/8.IX.1958, 1 ♂, B. Malkin (BISHOP).

Labia bituberculata Brindle

Fig. 17

Labia bituberculata Brindle, 1970, *Pacific Insects* **12** (3): 675 (Solomon Islands).

Reddish-brown to blackish; cuticle punctured and pubescent. A short broad species, very similar to *Labia pilicornis* (Motschulsky) in the dark form, but distinguished by the structure of the male pygidium, which is smaller than that of *pilicornis*, the latter having a larger triangular pygidium. Elytra and wings normally developed. Each branch of male forceps simple, evenly and weakly curved (Fig 17); each branch of female forceps similar to those of *curvicauda* (Fig. 23), but much more slender.

Length of body 4·5 mm, *forceps* 1-1·25 mm.

World distribution: Solomon Islands (San Cristobal) and New Hebrides.

Location of types:

Holotype ♂, allotype ♀ in the British Museum.

Material examined:

ESPIRITU SANTO: At light, Apuna river camp 2, 146 m, 30.VIII.1971, 1 ♀, G. F. Gross (SAM).

ERROMANGA: 18° 53′ S, 169° 12′ E, *Agathis-Calophyllum* high canopy rainforest, NH 33, 3.VIII.1971, 1 ♂, K. E. Lee (SAM).

The above specimens are blackish and much darker than the original material.

Sphingolabis hawaiiensis (Bormans)

Figs. 18, 19

Forficula hawaiiensis Bormans, 1882, *Ann. Mus. civ. Stor. nat. Giacoma Doria* **18**: 341 (Hawaii).

Sphingolabis hawaiiensis (Bormans); Hincks, 1947, *Entomologist's mon. mag.* **83**: 67 (Banks Is.; Espiritu Santo; Elephant Is. ?).

Very dark reddish or purplish brown, base of wings yellow. Cuticle of head and pronotum more or less impunctate and glabrous, elytra and wings pubescent, hairs sparse and rather long, yellow; abdominal tergites punctured and pubescent, hairs short and yellow, but with long yellow setae in addition; forceps with long golden setae (Figs. 18, 19).

Length of body 10-13 mm, *forceps* 5-6 mm (males) 3·5-4 mm (females).

World distribution: Lesser Sunda Islands eastwards to Hawaii, but somewhat sporadic, not in Micronesia; New Guinea and Solomon Islands.

Location of types:

♂, ♀, in Genoa Museum.

Material examined:

BANKS ISLAND: Vanua Lava, Sola, 5/11.VIII.1958, 1 ♂, B. Malkin (BISHOP).

ESPIRITU SANTO: Apuna river, camp 2, 146 m, 30.VIII.1971-2.IX.1971, 2 ♀, G. F. Gross (SAM); Namatasopa, 300 m, 29.VIII.1957, 1 ♂, 2 ♀, J. L. Gressitt; Namatasopa, 400 m, 31.VIII.1957, light trap, 1 ♀, J. L. Gressitt; Luganville, 23/28.VII.1958, 1 ♀, 1 larva, B. Malkin (BISHOP).

MAEWO: Above Nasua, 180+ m, 4.IX.1958, 4 ♀, 3 larvae, B. Malkin (BISHOP).

AOBA: Dunduy, 6/8.IX.1958, 1 larva, B. Malkin (BISHOP).

MALEKULA: From rotten log, gentle slope on broad ridge, 1 km NNW of summit of Mt. Yang'abalé, 45 km E of Tisvel village, 1.X.1971, 1 ♂, 7 larvae, K. E. Lee; Notophyll vine forest, 16° 17′ S, 167° 26′ E, NH 58, 1.X.1971, 3 larvae, K. E. Lee (SAM); Amok, 17.IX.1958, 1 ♂, 1 ♀, B. Malkin (BISHOP).

EPI: Ringdove Bay, 21.VII.1900, 1 ♂, 1 ♀, J. J. Walker (BRIT. MUS.).

ERROMANGA: Vicinity of Ipotak, 3.VIII.1971, 1 ♀, G. F. Gross; Nuankau river camp, 7.VIII.1971, 1 ♀, G. F. Gross (SAM).

TANNA: No locality, VIII.1900, 1 ♂, 1 ♀, J. J. Walker (BRIT. MUS.).

SPONGIPHORINAE

Two species of this subfamily are now recorded from the New Hebrides, both in the genus *Marava* Burr.

Key to species

1. General colouration reddish-brown, or with head, pronotum, and elytra blackish; wings, when present broadly yellow at bases; forceps of male with branches evenly arcuate, bases not broadened, each branch with one or two inner teeth (Fig. 21); forceps of female with a small inner tooth near base of each branch (Fig. 20) *Marava arachidis* (Yersin)

General colouration blackish, wings usually present and whitish, blackish on external margins; pronotum broadly white laterally and posteriorly; abdomen often reddish medially or posteriorly and forceps usually pale at bases; forceps of male strongly curved, usually with a wider part at base of each branch (Fig. 10), sometimes without (Fig. 9); forceps of female without a small inner tooth at base *Marava feae* (Bormans)

Marava arachidis (Yersin)

Figs. 20, 21

Forficula arachidis Yersin, 1860, *Ann. Soc. ent. France* **8** (3): 509 (Marseilles, France, introduced).

Prolabia arachidis (Yersin); Hincks, 1952, *Ann. Mag. nat. Hist.* (12) **5:** 201 (Erromanga).

Marava wallacei (Dohrn); Hincks, 1952, *Ann. Mag. nat. Hist.* (12) **5:** 202 (Malekula).

Marava arachidis (Yersin); Hincks, 1954, *Proc. R. ent. Soc. Lond.* (B) **23:** 162.

Variable in colour and in development of elytra and wings, together with size of eyes. Two forms are concerned in the records from the New Hebrides.

(1) Elytra and wings normally developed; blackish to dark reddish-brown, elytra usually paler, wings partially yellow, legs mainly dark, tarsi yellow (Fig. 21). Eyes usually large.

(2) Elytra short, wings absent or concealed; reddish to yellowish-brown, legs yellow, abdomen reddish often darkened laterally (Fig. 20). Eyes smaller.

Each branch of male forceps weakly curved, with two inner teeth (Fig. 21) or with one tooth absent; pygidium basically pentagonal (Fig. 21), but somewhat variable. Each branch of female forceps shorter, branches more or less contiguous (Fig. 20).

Length of body 5-9 mm, *forceps* 1·5-2·75 mm (males), 0·75-1·25 mm (females).

World distribution: Cosmopolitan, in all faunal Regions, often as an adventive; form 1 is more typical of the Oriental and Australasian Regions, whilst form 2 appears to dominate in the Neotropical and Ethiopian Regions and in the Pacific.

Location of types:

♂, ♀ in the Paris Museum.

Material examined:

ESPIRITU SANTO: Malau village, Big Bay area, 22.VIII.1971, 1 ♀ (form 2), G. F. Gross (SAM).

MALEKULA: Ounua, III/IV.1929, 1 ♂ (form 1), L. E. Cheesman (BRIT. MUS.) (specimen recorded in Hincks, 1952).

Marava feae (Dubrony)

Figs. 9, 10

Labia feae Dubrony, 1879, *Annali Mus. civ. Stor. nat. Giacoma Doria* **14:** 368 (New Guinea and Key Islands).

Marava feae (Dubrony); Hincks, 1952, *Ann. Mag. nat. Hist.* (12) **5:** 201 (Espiritu Santo).

Black, rather dull, pronotum broadly whitish laterally and posteriorly, elytra usually unicolorous but sometimes whitish laterally and along posterior margins; wings, when present, largely whitish; posterior abdominal tergites often more or less reddish, forceps black, base and sometimes apex reddish or yellowish (Fig. 9). Elytra and wings usually fully developed but the elytra are short and the wings absent or concealed in the present specimens. Each branch of male forceps strongly curved, usually with a wider base (Fig. 10) but present specimens have simple forceps (Fig. 9); pygidium broad, usually with two posterior teeth; forceps of female with simple, straight branches, more or less contiguous.

Length of body 5-6 mm, *forceps* 1-1·25 mm.

World distribution: New Guinea eastwards to Caroline Islands and south to Australia, but present known distribution is sporadic.

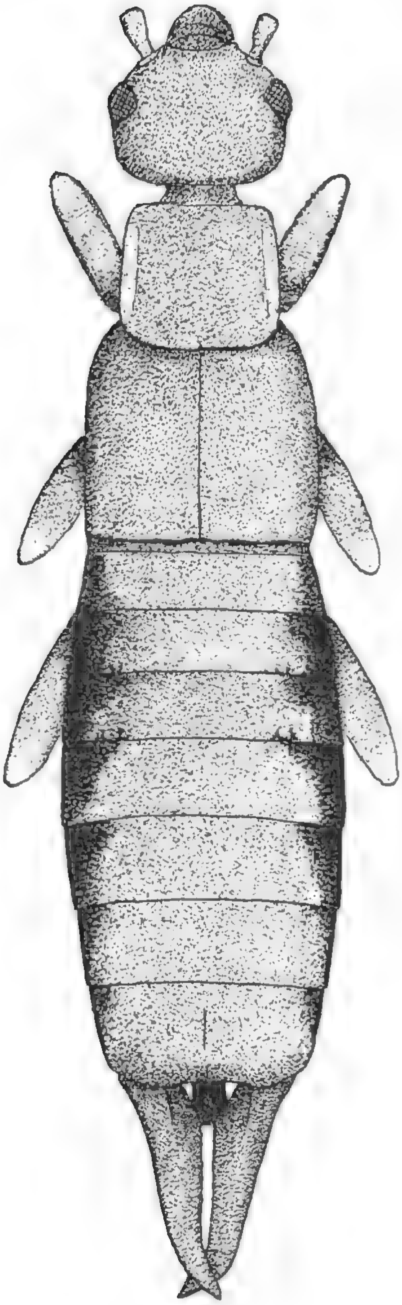
Location of types:

♂, ♀ in the Genoa Museum.

Material examined:

ESPIRITU SANTO: no exact locality, VIII-IX.1929, 1 ♂; VIII.1921, 1 ♀, L. E. Cheesman (BRIT. MUS.).

The above specimens are recorded in Hincks (1952) and are unusual in having no visible wings, in having the elytra broadly whitish posteriorly and laterally, and by the simple male forceps.



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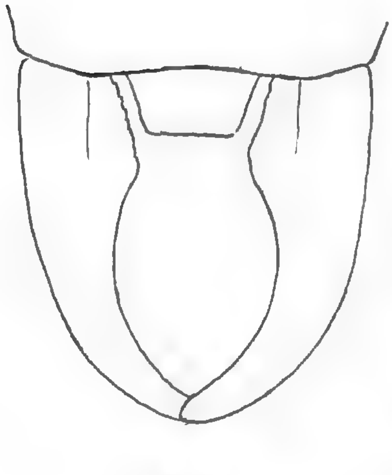

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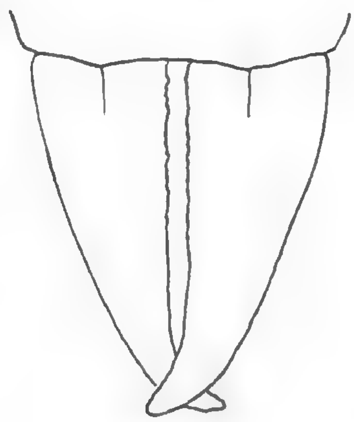

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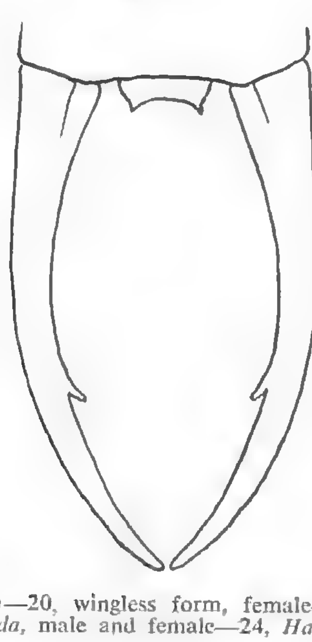

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Figs. 20-21, *Marava arachidis* (Yersin)—20, wingless form, female—21, winged form, male. Figs. 22-24, forceps—22-23, *Labia curvicauda*, male and female—24, *Hamaxas nigrorufus* (Burr), male.

CHELISOCHIDAE

Mainly Oriental and Australasian in distribution. Two species are recorded from the New Hebrides, both in the genus *Chelisoches* Scudder.

Key to species

1. Pronotum parallel-sided, longer than broad; black; head, pronotum, and elytra metallic bluish-green, shoulders, sutures, and wings violet *Chelisoches cheesmanae* Hincks
   Pronotum as broad as long or nearly so, more or less widened posteriorly; black generally, but sometimes elytra and wings metallic bluish or green or sometimes the whole insect is almost uniformly reddish-brown *Chelisoches morio* (Fabricius)

Chelisoches morio (Fabricius)

Forficula morio Fabricius, 1775, *Syst. Ent.*: 270 (Tahiti).

Chelisoches morio (Fabricius): Hincks, 1938, *J. Fed. Malay States Mus.* **18:** 313 (New Hebrides).

Chelisoches morio (Fabricius); Hincks, 1947, *Entomologist's mon. mag.* **83:** 67 (Espiritu Santo).

Chelisoches morio (Fabricius); Rehn, 1948, *Trans. Am. ent. Soc.* **74:** 162 (Efate; Erromanga; Tanna; Aneityum; Aniwa ?; Fortuna = Futuna).

Chelisoches morio (Fabricius); Hincks, 1952, *Ann. Mag. nat. Hist.* (12) **5:** 202 (Malekula; Espiritu Santo; Efate; Mai).

Black, rather shining, antennae black, one or more distal segments white; tarsi yellowish-brown. Sometimes with a bluish or greenish metallic sheen or sometimes almost uniformly reddish-brown. Similar in structure to *cheesmanae* (Fig. 25), but with the pronotum relatively shorter and usually widened posteriorly. Male forceps variable in length and structure, one form similar to those of *cheesmanae*, or with the basal inner dentation extending down to and including the distal teeth or tooth. Forceps of female simple, but variable in length.

Length of body 14-18 mm, *forceps* 4-7 mm.

World distribution: Nearctic, Palaearctic, and Ethopian Regions as adventive; Oriental Region more commonly, and most common in Pacific and Papuan Regions.

Location of types:

♂, ♀ in the British and Kiel Museums.

Material examined:

BANKS ISLANDS: Vanua Lava, Sola, 5/11.VIII.1958, 2♂, 1♀, 2 larvae, B. Malkin (BISHOP).

ESPIRITU SANTO: Malau village, Big Bay area, 23.VIII.1971, 1♂, G. F. Gross; Malau village, 23.VIII.1971, at light, 1 larva, G. F. Gross; Apuna river, camp 2, 146 m, 26/28.VIII.1971, 2 larvae, G. Robinson; Apuna river, camp 2, in leaf bases of *Pandanus*, 28/29.VIII.1971, 2♂, 1♀, K. E. Lee and J. C. Buckerfield; Apuna river, camp 2, 10 km SSW of Malau village, Big Bay area, from litter and leaf bases of *Pandanus*, flat terrace on E bank, 27/29.VIII.1971, 1♂, 1♀, 2 larvae, K. E. Lee and J. C. Buckerfield; Apuna river, camp 2, 4.IX.1971, 2♀, G. F. Gross; Apuna river, camp 3, at light, 8.IX.1971, 1♀, 1 larva, G. F. Gross (SAM); Luganville, 23/28.VII.1958, 5♀, 1 larva, B. Malkin; Narango, 90 m, VI.1960, 3♂, 2♀, 1 larva, W. W. Brandt; SW, above Namatasopa, 400 m, 30.VIII.1957, 1♂, 1♀, J. L. Gressitt; Segond Channel, IX.1942, 1♀, R. L. Dautt; no exact locality, VIII.1950, 1♀, N. L. H. Krauss; no exact locality, 13.I.1921, 1♂, F. P. Drowne (BISHOP).

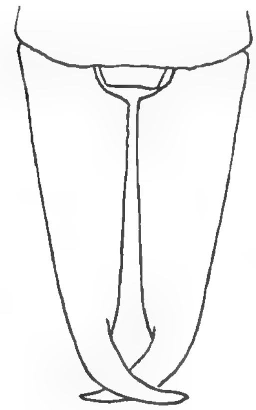
MAEWO: Above Nasaua, 150— 180+ m, 4.IX.1958, 1♂, 6♀, 2 larvae, B. Malkin (BISHOP).

AOBA: Dunduy, 6/8.IX.1958, 1♂, 3♀, 1 larva, B. Malkin (BISHOP).

MALEKULA: Leaf bases of *Pandanus* in gully, 3 km ENE of Tisvel village, 1.X.1971, 2♂, 1♀, 1 larva, K. E. Lee and J. C. Buckerfield; from logs, Hurrnamburr, low-lying swamp, 500 m, E of head of Marine Lagoon, 4 km SSE of Wintua, SW Bay, 9.X.1971, 1♂, K. E. Lee (SAM); Amak, 1 000ft., 15/18.IX.1958, sweeping, 1♂, B. Malkin; Tenmark, 14.IX.1958, 1 larva, B. Malkin (BISHOP).

EFATE: La Cascade, W of Vila, 13.VII.1971, 1♀, 1 larva, G. F. Gross; in secondary forest, de Gaillande estate, Tagabe, 15.VII.1971, 1 larva, G. F. Gross (SAM); Efate, 12.VI.1900, 1♂, J. J. Walker (BRIT. MUS.); NW, Maat (Mat Ambryn Vill.) 3 m, 5.VIII.1957, 1♂, 2♀, 3 larvae, J. L. Gressitt; NW, Limestone plateau, N of Maat, 100 m, 19/20.VIII.1957, 5♂, 10♀, 3 larvae, J. L. Gressitt; Vila, 0-50 m, II.1970, 1♂, 1 larva, N. L. H. Krauss (BISHOP).

ERROMANGA: Nuankau river camp, 7/8.VIII.1971, 2♂, 1♀, G. F. Gross; from *Pandanus* beside secondary milling road, 500 m SW of Nuankau river bridge, 10 km WSW of Ipotak, 8.VIII.1971, 1 larva, J. C. Buckerfield (SAM); 11 km W of Ipotak, 100-200 m, II.1970, 1♀, N. L. H. Krauss (BISHOP).



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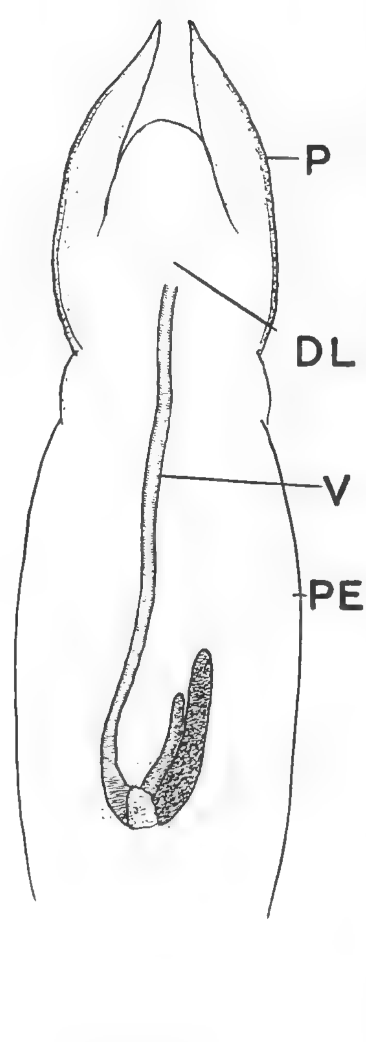

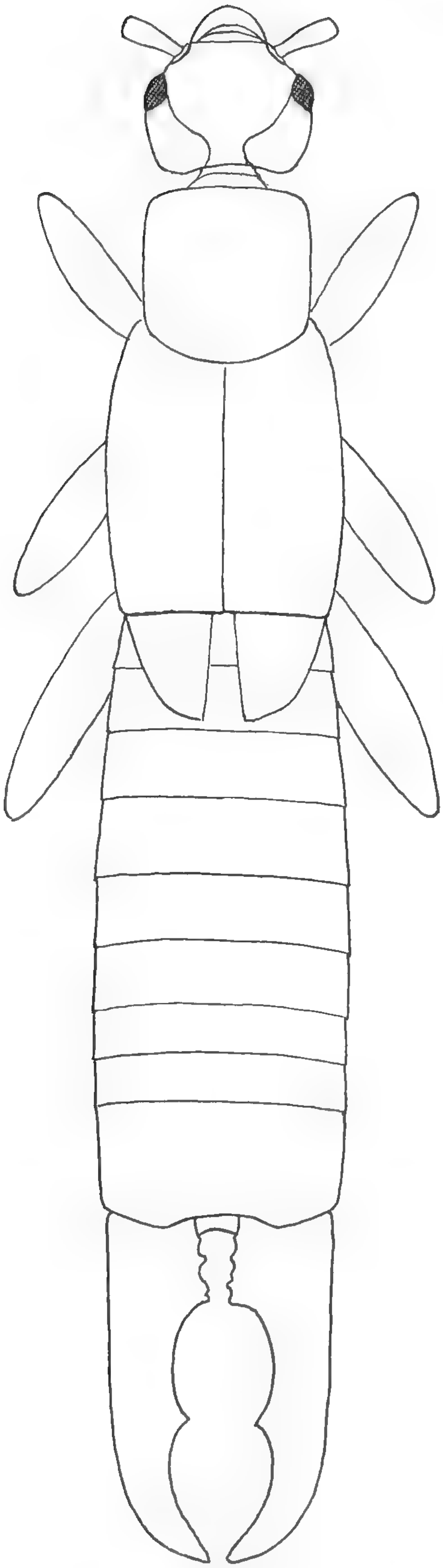

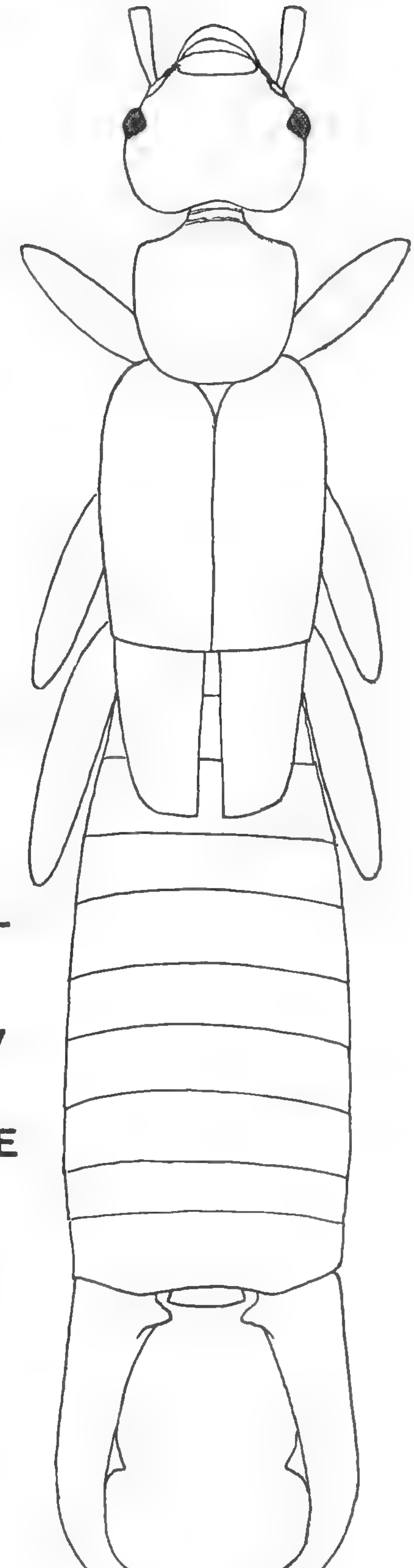

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Figs. 25-26, *Chelisoches cheesmanae* Hincks—25, male—26, male genitalia.
Figs. 27-28, *Anchenomus insularis* sp.n.—27, female forceps—28, male. (DL=distal lobe; P=paramere; PE=penis; V=virga).

TANNA: Isokoai (Enpinan), 28.VII.1971, at light, 1 ♂, 1 ♀, G. F. Gross and G. Robinson (SAM); Tanna Is., 1904, 1 ♂, J. J. Walker (BRIT. MUS.).

ANEITYUM: Vicinity of Anelcauhat, 20/21.VII.1971, 1 ♂, 1 larva, G. F. Gross (SAM); Red Crest, 1 200ft., 3 m NE of Anelcauhat, III.1955, 2 ♂, 3 ♀, 2 (abdomen missing), L. E. Cheesman; rain forest, 500-1 000ft., XI.1954, 1 ♂, L. E. Cheesman (BRIT. MUS.).

Chelisoches cheesmanae Hincks

Figs. 25, 26

Chelisoches cheesmanae Hincks, 1952, *Ann. Mag. nat. Hist.* (12) **5:** 703 (Banks Is., Vanua Lava).

Similar in structure to *morio*, but rather more robust (Fig. 25); separable mainly by the colouration, and by the shape of the pronotum, of which the latter character is the more satisfactory. The forceps are robust but are similar to some forms of *morio* in shape. The genitalia of *cheesmanae* (Fig. 26) are similar to those of *morio* but the parameres are more slender and the two sclerites associated with the base of the virga are unequal in size whilst those of *morio* examined are usually subequal in size. The differences, however, are small.

Length of body 13 mm, *forceps* 5 mm.

World distribution: New Hebrides, endemic.

Remarks: No other specimen has been recorded and the type remains unique.

Location of type:

Holotype ♂ in the British Museum.

Hamaxas nigrorufus (Burr)

Fig. 24

Spongiphora nigrorufa Burr, 1902, *Term. Fuzet.* **25:** 480 (New Guinea).

Hamaxas papuanus Burr, 1909, *Nova Guinea* **9:** 23.

Spongovostox nigrorufus (Burr); Burr, 1911, *Genera Insectorum* **122:** 52.

Hamaxas nigrorufus (Burr); Burr, 1916, *J. R. Micr. Soc.* **1916:** 10.

Blackish in colour, legs dark red to blackish, sometimes yellow; abdomen and forceps dark red or with abdomen darkened. A rather depressed species. Elytra and wings punctured and pubescent, always fully developed. Each branch of male forceps arcuate, with one inner tooth, pygidium short with posterior margin concave and postero-lateral angles produced (Fig. 24). Branches of female forceps shorter, wider near base, narrowed distally and more or less straight and contiguous, pygidium angular.

Length of body 7-9 mm, *forceps* 3-4·5 mm (males), 1·5-2·5 mm (females).

World distribution: From Celebes eastwards to New Guinea and Solomon Islands, and extending across the Pacific to Hawaii.

Location of type:

♂, ♀ in the Hungarian National Museum.

Material examined:

ESPIRITU SANTO: Apuna river camp, 1.IX.1971, 1 ♀, G. F. Gross (SAM); Narango, 90 m, VI.1960, 1 ♂, W. W. Brandt (BISHOP).

EFATE: NW Limestone plateau, N of Maat, 100 m, 19.VIII.1957, 1 ♀, J. L. Gressitt (BISHOP).

ERROMANGA: Kauri camp (on Nuankau River) 3.VIII.1971, 2 ♀, G. F. Gross (SAM).

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RECORDS OF THE
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THE GENUS *MICROTETRAMERES* TRAVASSOS (NEMATODA, SPIRURIDA) IN AUSTRALIAN BIRDS

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Summary

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ABSTRACT

MAWSON, PATRICIA M. The genus *Microtetrameres* Travassos (Nematoda, Spirurida) in Australian birds. *Rec. S.A. Mus.* 71 (14): 239-259.

Australian *Microtetrameres* species were taken only from birds of the orders Accipitriformes, Cuculiformes, Strigiformes, Caprimulgiformes and Passeriformes. Considerable host specificity was noted. Fifteen new species are proposed, named after the host group or genus: *M. meliphagidae, M. philemon, M. mirafrae, M. gymnorhinae, M. streperae, M. cractici, M. coracinae, M. sphecotheres, M. eopsaltriae, M. aegotheles, M. paraccipiter, M. cerci, M. raptoris, M. ninoctis* and *M. tytonis. M helix* Cram (syn. *M. corax* Schell) was identified from Australian corvids, and *M. oriolus* Petrov and Tschertkova from an Australian oriole. The shape and size of the hilt of the left spicule are regarded as of taxonomic value. A key is given based on male characters and a partial key based on female characters.

INTRODUCTION

No species of the genus *Microtetrameres* has ever been recorded from Australian birds. This is surprising, since in dissections made in this Department the incidence of species of this genus has been relatively high in some bird groups (Table 1). In honeyeaters, *Microtetrameres* spp. are the most common nematode parasites. In water birds (waders, gulls, grebes, cormorants, petrels) the same niche in the body is occupied by species of *Tetrameres*. Species of *Microtetrameres* have, however, been recorded from water birds in other countries—*M. canadensis* Mawson, 1956 (♂ only), *M. egretes* Rasheed, 1960, *M. pelecani* Skrjabin, 1949 (♂ only), and *M. spiralis* Seurat, 1915. In our dissections both *Microtetrameres* and *Tetrameres* have been taken from an owl and from falcons—in two cases both parasite genera were represented in the same host animal. *Microtetrameres* is a relatively homogenous genus in which the species have many characters in common. Ellis (1970) considers the female specimens as the type of a species; because of the dissimilarity in the appearance of the sexes, he allows the allocation of a male to a species only when this has been proved by breeding from the eggs of the female. In the present work, it is considered that the form of males belonging to the genus *Microtetrameres* is characteristic of the genus, and that in general the occurrence of male and female specimens in the same host specimen is evidence of conspecificity. The characters considered to be of the greatest taxonomic use are discussed below in the section "Characters of specific importance".

The division of the genus into two subgenera, as proposed by Rasheed (1960), has not been followed, because of the sporadic occurrence of a poorly developed gubernaculum in some specimens of some species in the Australian material.

Most of the *Microtetrameres* spp. recognised show a marked degree of host specificity among cuculiform and passeriform birds, and less among birds of prey. Almost all the species found in Australian birds are regarded as new. Exceptions are *M. helix* Cram from crows, and *M. oriolus* Petrov and Tschertkova from an oriole. *M. mirafrae* n.sp. from a lark and a flycatcher is very close to *M. jakutensis* Kontrimevichus from related birds in U.S.S.R., and *M. paraccipiter* n.sp. from an Australian *Accipiter* sp. is very close to *M. accipiter* Schell from an American *Accipiter* sp. It is noteworthy that *Corvus, Mirafra, Oriolus,* and *Accipiter* are regarded as relatively recent arrivals in Australia (late Pliocene or Pleistocene).

METHODS

Adult female *Microtetrameres* were taken from the proventricular glands of the host. Infected glands are readily recognisable by their dark colour, and pressure on the adjoining proventricular wall causes the worm to pop out of the gland. The female lies in the gland with the tail end nearest the opening and often protruding through it (Fig. 61). Males and very young females are usually in the mucus on the surface of the proventriculus, but in two or three cases a male has apparently come out of a gland with a female. The greatest numbers of females present in one individual host were 40 in *Tyto alba* and 30 in *Corvus mellori*. This compares poorly with 250 females from a Golden Eagle and 102 from a Great Horned Owl recorded by Schell (1953, p. 227).

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The worms were fixed in 70% alcohol. The measurements of all species described are given in Tables 2-7. In all cases the length of the whole oesophagus and of the muscular part of the oesophagus has been taken from the anterior end of the body to the posterior end of the organ in question. Measurements of the spicules have been taken along their whole length.

In giving the locality of specimens the State is abbreviated as follows: SA, South Australia; NT, Northern Territory; Qld, Queensland; NSW, New South Wales; ACT, Australian Capital Territory; Tas, Tasmania; Vic, Victoria.

Types of new species will be deposited in the South Australian Museum, and other material in the Helminthological Collection of the Zoology Department, University of Adelaide.

GENERAL DESCRIPTION OF THE AUSTRALIAN SPECIES

The head (Plate 1; Figs. 1, 2, 3 and 4) bears two lateral lips each with three swellings—a lateral one bearing the amphid, and a dorsal and a ventral with the submedian cephalic papillae. The mouth opening is more or less hexagonal. The inner circle of papillae around the mouth, described by Ali (1970), were not seen.

The buccal capsule is well-developed. In the male it is laterally compressed, in the female barrel- or urn-shaped. In both sexes the anterior part is connected by a relatively thin cuticular sleeve to a chitinised basal ring lying just above the anterior end of the oesophagus.

The oesophagus consists of an anterior narrower muscular and a longer glandular section. The nerve ring surrounds the anterior section at about $\frac{2}{3}$ to $\frac{3}{4}$ its length; the excretory pore is shortly behind this and the small cervical papillae at or behind the level of the excretory pore. The cervical papillae are seldom distinguishable in the gravid female, as the cuticle becomes inflated and folded in this region. In the female there is sometimes an apparent intestinal diverticulum, as the oesophagus joins the intestine obliquely; in one case (*M. raptoris*) two distinct diverticula are formed at this junction.

Female: The shape of the coil of the female varies to some extent among individuals, but the general form is more or less constant in one species. There are three types of coil, the spiral, the reversed spiral, and the irregular (Figs. 61, 72, 51). There is some evidence that the form is influenced by the shape of the gland which in some birds (e.g. honeyeaters) is shallow, in other (e.g. falcons and hawks), deep and narrow. It seems impossible that the form of the coil can change, or be assumed as the worm emerges from the gland, as suggested by Ellis (1969, p. 716). In fact, if the whole infested gland be dissected out and cleared, the contained worm, in its typical coil, can be seen inside (Fig. 61).

It appears that whether fertilised or not, the female enters the gland at an early stage (its body somewhat twisted and only slightly swollen). Young female worms have been found to thicken and coil before any eggs are visible (Fig. 72), so the swelling is not caused by pressure of eggs. Eggs are produced in great numbers even in unfertilised females. The shape of the female with infertile eggs is similar to that of the female with fertile eggs although on closer inspection it is seen that the unembryonated eggs are thin-shelled, often mis-shapen, and smaller than fertile eggs of the same species. Both fertile and infertile eggs may be present in one female.

The posterior end of the female is often surrounded by a prepuce formed by overgrowth of the prevulvar cuticle; this is not seen in young females.

Male: The tip of the tail ends in a small ball point. In all the Australian specimens there are two pairs of pre-anal papillae shortly in front of the cloaca, two pairs of post-anal papillae on the first half of the tail and a pair of phasmids laterally at $\frac{1}{2}$-$\frac{3}{4}$ of the tail length from the anus. In most specimens the papillae are not exactly symmetrical; in a very few, one papilla is missing or one extra is present. The odd one is always aligned longitudinally with the others, and is never medial. The position of the papillae with relation to the tail length varies within the limits noted above; this variation is, however, as great among individuals from one host as among all the specimens examined from any host. The phasmids are usually small and often hard to see. It is presumed that they are present in all specimens.

The left, and longer spicule has a relatively short cylindrical hilt proximally and ends in a small terminal ala. The tip of the spicule within the ala is usually cleft or otherwise imperfectly chitinised. The shorter right spicule is simple and acicular or rounded at the tip. There is some thickening of the dorsal wall of the cloaca in some specimens, but this appears to be a variable feature, apparent in one or two specimens of a number of species. In one species (*M. raptoris*) it is well-developed in all the males (16), and in another it is present but only lightly chitinised in the three males available.

CHARACTERS OF SPECIFIC IMPORTANCE

Females: The form of the coil is not a specific character, as even among females from the same bird there are variations, some a simple coil, some reversed once or twice.

The length of the oesophagus and of its component parts, the position of the nerve ring, the cervical papillae (seen only in young specimens) and the excretory pore are very similar in all specimens examined. The presence or absence of an intestinal diverticulum at the point of junction with the oesophagus is cited by some authors as a specific character; however, in the gravid female its absence can only be ascertained by dissection.

Ellis (1969) considered that the size and shape of the buccal capsule and of the eggs, and the presence or absence of cuticular ridges and flanges, is sufficient to differentiate the females of the various species of *Microtetrameres*, and he gave (p. 718) a key to species from the western hemisphere based on these characters in the female. In the Australian specimens, only a single worm was seen with cuticular flanges, and this was among and in other respects similar to, unflanged females taken from the same specimen of *Corvus bennetti*. Most of the measurements of female worms are subject to error because of cuticular inflation to which the specimens are subject and because of the many curves of the intact worm. In the present work the measurements of the female considered to be most reliable are those cited by Ellis, i.e. those of the largest fertile egg and of the buccal capsule. However, these characters are not sufficiently varied throughout the genus to form the sole basis for the identification of the species. The difficulties of identification of species from females only is apparent in the key given below in which only female characters are used. As some species are represented only by females, this key is given here, although the species are by no means fully segregated.

Males: In the male as in the female the position of the nerve ring, cervical papillae and excretory pore in relation to each other and to the end of the muscular oesophagus is similar in all specimens examined. The same situation is found with the positions of pre- and post-cloacal papillae. Judging from figures given by authors, there is a marked similarity between the arrangement of the caudal papillae in all *Microtetrameres* species, except where a larger number of papillae have been described. From some descriptions it seems likely that a third pair of post-anal papillae are in fact the phasmids.

Schell (1953) suggested that the position of the constriction in the male reproductive tube between the testis and the vas deferens, might be a constant character within a species. This feature, however, is not clear in all of the Australian specimens and has not been used by other workers. Schell also used as a specific character the presence or absence of a "ball point" on the tip of the tail. Such a point is present on all the Australian males.

Another character used by Schell as a distinguishing feature, is the shape of the tip of the left spicule. However, this character must be used with discretion as the tip may appear bifurcate in one view and rounded in another. The tip in almost all the Australian specimens is more or less cleft, or is imperfectly chitinised.

In the present study, the characters of the spicules have been considered most useful in diagnosis. The length of the longer spicule in relation to the body length, the ratio of the lengths of the two spicules and the shape and proportions of the hilt (proximal end) of the left spicule, appear to be of value in separating species. The spicule ratio has been used by many authors. In the present study both the spicule ratio and the shape and size of the hilt of the left spicule were found to be similar in specimens from the same host bird, and this similarity extends to those from the same host species and often to those from related species, from the same and different localities. At the same time, the spicule ratio and the shape and size of the hilt differ, often markedly, from those of specimens from hosts belonging to a different group even from the same locality. The shape of the hilt (tapering, or slightly bulbous, etc.) as well as the actual length:width ratio has been considered. To obtain this ratio, referred to in Tables 1-7 as the Hilt Factor, the width is measured across the base of the cylindrical part of the spicule in lateral view, just anterior to the longitudinal groove, in the position indicated in Fig. 6 by line *ab*; the length is the distance from this level to the proximal end of the spicule. The chief limitation to the use of the hilt of the left spicule as a specific character is that in a few specimens it is damaged or folded over so that the shape, or at least the measurements, are not clear. As the hilt has seldom been noted by other workers, it cannot be used to compare the Australian specimens with many of the species already described. However, through the kindness of the Beltsville Parasitological Laboratory (U.S. Department of Agriculture), and of Dr. Schell (University of Idaho), male specimens of *M. helix* Cram, *M. aquila* Schell, *M. bubo* Schell, *M. accipiter* Schell and *M. corax* Schell, have been examined, and some comparisons have been made. In particular it was noted (1) that the hilt has a different shape in each of Schell's species (Figs. 5, 55, 56 and 57) and (2) that the shape is similar in *M. helix* (Cram's specimens), *M. corax* (Schell's specimen) and specimens from Australian corvids.

The characters which have emerged as most indicative of the species among male worms are the body length, the spicule lengths, the length and breadth of the hilt of the left, or longer, spicule, and the length of the buccal capsule.

TABLE 1

Incidence of *Microtetrameres* spp. and *Tetrameres* spp. in "land" birds dissected. Numbers refer to specimens, not species.

Bird Group	Number Dissected	Number with Nematodes	Number with *Microtetrameres* sp.	Number with *Tetrameres* spp.	Number with Other spp.
Passeriformes—					
Alaudidae	2	1	1	—	1
Motacillidae	11	1	1	—	—
Campephagidae	16	11	5	—	8
Muscicapidae	50	11	6	—	10
Pachycephalidae	37	16	7	—	4
Falcunculidae	7	7	1	—	6
Meliphagidae	199	45	38	—	18
Oriolidae	6	2	2	—	—
Grallinidae	34	11	2	—	10
Cracticidae	100	51	27	—	40
Corvidae	77	69	24	—	61
Other families	385	42	—	—	42
Caprimulgiformes	21	11	1	—	11
Coraciiformes	28	14	—	1	13
Strigeiformes	25	17	8	2	12
Accipitriformes	59	38	19	2	29
Cuculiformes	21	5	4	—	2
Columbiformes	43	1	—	—	1
Psittaciformes	157	4	1	—	3
Gruiformes	56	17	—	7	12
Galliformes	7	2	—	—	2

LIST OF AUSTRALIAN SPECIES ARRANGED UNDER THEIR HOSTS

The following is a list of hosts from which *Microtetrameres* spp. have been taken. The numbers after each species indicates the number of host specimens in which *Microtetrameres* were found/the number of specimens examined. *Microtetrameres* is shown as *M.* throughout.

Passeriformes

Alaudidae

Mirafra javanica Horsfield, *M. mirafrae* n.sp.; 1/2, NT.

Campephagidae

Coracina novaehollandiae (Gmelin). *M. coracinae* n.sp.; 1/2 SA, 0/1 Tas, 0/2 NT.

Coracina hypoleuca Gould. *M. coracinae* n.sp.; 1/1 NT.

Lalage sueuri tricolor (Swainson) *M.* sp.; 2/3 SA.

Muscicapidae

Microeca leucophaea (Latham). *M. mirafrae* n.sp.; 2/9 SA; 1/2 NT.

Eopsaltria australis (Shaw). *M. eopsaltriae* n.sp.; 2/2 SA.

Falcunculidae

Oreoica gutturalis (Vig. & Horsf.) *M.* sp.; 1/1 SA; 1/5 NT.

Ptiloris sp. *M.* sp.; 1/1.

Meliphagidae

Meliphaga virescens (Vieillot) *M. meliphagidae* n.sp.; 4/15 SA; O/5 NT.

Meliphaga leucotis (Latham) *M. meliphagidae* n.sp.; 2/10 SA.

Manorina melanocephala (Latham) *M. meliphagidae n.*sp.; 2/7 SA; 1/1 ACT.

Manorina flavigula Gould. *M. meliphagidae* n.sp.; 1/5 SA; 0/1 NT.

Entomyzon cyanotis (Latham). *M. philemon* n.sp.; 2/4 NT.

Philemon citreogularis (Gould). *M. philemon* n.sp.; 3/3 NT.

Philemon argenticeps (Gould). *M. philemon* n.sp.; 3/11 NT.

Anthochoera chrysoptera (Latham). *M. meliphagidae* n.sp.; 3/11 SA.

Anthochoera carunculata (Shaw) *M. meliphagidae* n.sp.; 5/10 SA.

Acanthocephala rufogularis Gould. *M. meliphagidae* n.sp.; 10/18 SA; 0/5 NT.

ORIOLIDAE

Oriolus sagittatus (Latham) *M. oriolus oriolus* Petrov & Tschertchova. 1/3 NT.

Sphecotheres flaviventris Gould. *M. sphecotheres* n.sp.; 1/2 NT.

GRALLINIDAE

Corcorax melanorhamphus (Vieillot) *M. helix* Cram 2/9 SA.

CRACTICIDAE

Strepera versicolor (Latham) *M. streperae* n.sp.; 1/7 SA; 0/1 NT.

Cracticus torquatus (Latham). *M. cractici* n.sp.; 1/5 SA.

Gymnorhina tibicen tibicen (Latham) *M. gymnorhinae* n.sp.; 0/4 SA; 0/2 NT, 8/16 ACT.

Gymnorhina tibicen leuconota Gould. *M. gymnorhinae* n.sp.; 9/58 SA.

CORVIDAE

Corvus mellori Mathews. *M. helix* Cam. 8/9 SA; 11/48 Tas.

Corvus bennetti North. *M. helix* Cram 3/3 NT.

Corvus orru Bonaparte. *M. helix* Cram. 0.2 SA; 4/7 NT.

Corvus coronoides Vig. & Horsf. *M. helix* Cram. 4/5 SA.

CAPRIMULGIFORMES

Aegotheles cristata Shaw. *M. aegotheles* n.sp.; 0/2 SA; 0/1 Tas; 1/3 NT.

CUCULIFORMES

Cuculus pallidus (Latham) *M. coracinae* n.sp.; 1/4 NT; 0/1 Tas.

Cacomantis variolosus Vig. & Horsf. *M. cacomantis* n.sp.; 1/1 NT.

Cacomantis pyrrhophanus Vieillot. *M.* sp.; 1/9 SA; 1/1 Tas.

ACCIPITRIFORMES

Accipiter fasciatus Vig. & Horsf. *M. paraccipiter* n.sp.; 3/5 SA; 1/1 Tas; 3/3 NT.

Accipiter cirrhocephalus Vieillot. *M.* sp.; 2/2 SA; 1/1 Tas; 0/2 NT.

Circus assimilis Jard. & Selby. *M. circi* n.sp.

Falco berigora Vig. & Horsf. *M. raptoris* n.sp.; 2/4 SA; 0/1 Tas; 3/7 NT.

F. longipennis Swainson *M. raptoris* n.sp.; 0/2 Tas; 1/3 NT.

F. cenchroides Vig. & Horsf. *M. raptoris* n.sp; 1/5 SA; 0/1 NT.

F. peregrinus Tunstall. *M. raptoris* n.sp.; 2/4 SA.

STRIGIFORMES

Ninox novaeseelandiae (Gmelin) *M. raptoris* n.sp.; *M. ninoctis* n.sp.; 4/12 SA; 0/1 Tas; 3/4 NT.

Tyto alba (Scopoli) *M. tytonis* n.sp.; 0/6 SA; 1/1 NT.

Keys to *Microtetrameres* spp.

Two keys are offered. The first has been compiled from male characters. The second key, based only on the females, is necessarily restricted, but is included as the information conveyed may help other workers.

In some cases the ratios used were not given by the authors but have been calculated from data provided. Abbreviations have been used to assist in the lay-out of the keys, as follows: HF, hilt factor; L, left; pap, papillae; R, right; spic, spicule; sp. rat, spicule ratio. All measurements are in μm.

1. Key to male *Microtetrameres* spp.

1.		Gubernaculum absent or weakly developed . .	2
		Gubernaculum present	42
2.	(1)	Median preanal pap. present	3
		Median preanal pap. absent	4
3.	(2)	Sp. rat. 6·2; median preanal pap. on lip of cloaca . . . . *M. calabocencis* Diaz-Ungria	
		Sp. ratio 15·8; median preanal pap. anterior to cloacal lip . . . . *M. inermis* (Linstow)	
4.	(2)	Fewer than two preanal papillae	5
		Two or more pre pairs of preanal papillae	6
5.	(4)	No preanal papillae . . *M. xiphidiopici* Barus	
		One pair of preanal papillae . . . . *M. cruzi* (Travassos)	
6.	(4)	Three pairs of preanal papillae	7
		Two pairs of preanal papillae	9
7.	(6)	Sp. rat. 32 . . . . *M. papillocephala* Oshmarin	
		Sp. rat. 25-26	8
8.	(7)	R. spic. 85-88 . . . . *M. erythrorhynchi* Ali	
		R. spic. 150 . . . . . . *M. canadensis* Mawson	
9.	(6)	L. spic. longer than body	10
		L. spic. not longer than body	11
10.	(9)	Sp. rat. 16-22 . . . . *M. spiculata* Boyd	
		Sp. rat. 37 . . . . *M. helix asiaticus* Oshmarin	
11.	(9)	Four pairs of post-cloacal pap. *M. oshmarini* Sobolev	
		Not more than three pairs of post-cloacal pap.	12

12. (11) Adanal pap. present 13
Adanal pap. absent 14
13. (12) One pair of adanal pap. *M. pusilla* Travassos
Two pairs of adanal pap. *M. travassosi* Rasheed
14. (12) R. spic longer than tail 15
R. spic. shorter than tail 22
15. (14) L. spic. less than 1200 16
L. spic. more than 1300 17
16. (15) Vestibule length 25 *M. cloacitectus* Oshmarin
Vestibule length 19 .. .. .. *M. singhi* Sultana
17. (15) Sp. rat. over 18 .. .. *M. centuri* Barus
Spicule ratio not more than 17 18
18. (17) Sp. rat. less than 9 19
Sp. rat. between 10-17 20
19. (18) Junction of vas deferens and testis 500-600 from cloaca .. .. *M. bubo* Schell
Junction of vas deferens and cloaca 800-900 from cloaca .. .. *M. aquila* Schell
20. (18) Vestibule about 10 long . *M. copsaltriae* n.sp.
Vestibule at least 13 long 21
21. (20) Hilt of L. spic. very long; HF 6·8-1 *M. cacomantis* n.sp.
Hilt of L. spic. shorter; HF 2·5-3·3 *M. cerci* n.sp.
22. (14) L. spic. 3200 long or more 23
L. spic. not longer than 3100 25
23. (22) Spicule ratio not more than 30; parasitic in crows .. .. *M. helix helix* Cram
Spicule ratio more than 34 24
24. (23) Spicule ratio 36; parasitic in hornbills *M. contorta* (Wiedman)
Spicule ratio 40-45; parasitic in hornbills *M. bucerotidae* Ortlepp
25 (22) Vestibule 30 long .. .. *M. spiralis* (Seurat)
Vestibule not longer than 25 26
26. (25) Sp. rat. 11 or less 27
Sp. rat. 12 or more 31
27. (26) L. spic. not more than half body length 28
L. spic. more than half body length .. 29
28. (27) Hilt of L. spic. long, slender; HF 4·7-5·6 *M. sphecotheres* n.sp.
Hilt of L. spic. shorter; HF 1·6-1·9 *M. tytonis* n.sp.
29. (27) R. spic. 120 long *M. oriolus orientalis* Oshmarin
R. spic. 80-100 long 30
30. (29) From *Tachyphonus* sp., Brazil *M. minima* (Travassos)
From *Cracticus* sp., Australia *M. cracticus* n.sp.
31. (26) L. spic. not longer than 1050; egg longer than 75 32
L. spic. not shorter than 1060; egg shorter than 60 33
32. (31) R. spic. 66; vestibule 19 long *M. longiovatus* Barus
R. spic. 100; vestibule 14 long *M. asymmetrica* Oshmarin
33. (31) Vestibule 21 or more long 34
Vestibule not longer than 20 35
34. (33) L. spic. over 2500 long; 1/1·1 of body length .. .. *M. o. oriolus* Oshmarin
L. spic. less than 2500 long; 1/1·7-1·8 of body length .. .. .. *M. accipiter* Schell
35. (33) Tail more than 1·5 times length of R. spic 36
Tail not more than 1·5 times length of R. spic 37
36. (35) L. spic. 2032-2270; vestibule 16 long *M. oriolus rasheedae* Skrjabin et al.
L. spic. 1250; vestibule 11 long *M. aegotheles* n.sp.
37. (35) Vestibule 18-20 long .. *M. paraccipiter* n.sp.
Vestibule not more than 16·5 long 38
38. (37) L. spic. over 2200 long .. *M. philemon* n.sp.
L. spic. not longer than 2200 39
39. (38) Sp. rat. 21 .. .. *M. streperae* n.sp.
Sp. rat. not more than 20 40
40. (39) R. spic. almost equal to tail length .. 41
R. spic. distinctly less than tail length .. 42
41. (40) Vestibule elongate in shape .. .. *M. saguei*
Vestibule almost as wide as long *M. meliphagidae* n.sp.
42. (40) Vestibule not more than 11 long 43
Vestibule not less than 12 long 44
43. (42) HF 6·1-7·9 .. .. *M. coracinae* n.sp.
HF 3-4 .. .. *M. mirafrae* n.sp.
44. (42) From small passerines in Russia *M. jakutensis* Kontrimavichus
From Australian birds 45
45. (44) HF 2·2-3·3; hilt more or less cylindrical *M. raptoris* n.sp.
HF 3·3-4·4; hilt tapering towards extremity *M. gymnorhinae* n.sp.
46. (1) Spic. rat. under 11 47
Sp. rat. over 13 49
47. (46) Length of oesophagus less than ⅛ that of body *M. tubocloacis* Oshmarin
Length of oesophagus ⅐-⅛ that of body 48
48. (47) L. spic. 1125; R. spic. 220-260 *M. rasheedae* Sultana
L. spic. 1950-2120; R. spic. 142 *M. cephalatus* Sultana
49. (46) L. spic. over 2200 long 50
L. spic. not longer than 2000 52
50. (49) R. spic. less than half tail length; vestibule 23 *M. egretes* Rasheed
R. spic. more than half tail length; vestibule 17 or less 51
51. (50) R. spic. 100-110 .. .. .. *M. ninoctis* n.sp.
R. spic. 190-230 .. ..*M. malabari* Ali
52. (49) Gubernaculum 20-21 long {*M. creplini* (Vavilova), *M. raptoris* n.sp.}
Gubernaculum 28 long 53
53. (52) R. spic. 50-80; tail 100-120 *M. osmaniae* Rasheed
R. spic. 80-90; tail 140-180 *M. mirzae* Rasheed

2. Key to female *Microtetrameres* spp.

M. contorta Wiedman is not included, as the length of the vestibule is not known; the eggs are 40-45 x 20-25 μm.

1. Eggs very long, 70 at least 2
Eggs very short, under 40 3
Egg length between 40-60 4

2. Eggs 80-82 x 36-39; from *Lanius* sp. — *M. asymmetrica* Ashmarin
   Eggs 70-73 x 20-23; from *Glaucidium* sp. — *M. longiovata* Barus
3. Eggs 39 x 26; vestibule 39 long — *M. erythrorhynchi* Ali
   Egg 36 x 21; vestibule 24 long — *M. travassosi* Rasheed
   Egg 36 x 20; vestibule 20 long — *M. inermis* (Linstow)
   Egg 35 x 15; vestibule 24 long — *M. egretes* Rasheed
4. Vestibule not more than 12 long 5
   Vestibule more than 12 long 6
5. Vestibule 12 long; egg 45 x 24; from *Tachyphonus* sp. .. .. *M. minima* (Travassos)
   Vestibule 9 long; eggs 42-49 x 28; from *Turdus* sp. .. .. *M. pusilla* Travassos
   Vestibule 12 long; eggs 45 x 25-26; from *Aegotheles* sp. .. .. *M. aegotheles* n.sp.
6. Vestibule not longer than 20 7
   Vestibule longer than 20 13
7. Body with two longitudinal flanges — *M. accipiter* Schell
   Body without flanges 8
8. Breadth of egg not more than 28 9
   Breadth of egg more than 28 12
9. Vestibule twice or more, as long as wide .. 10
   Vestibule less than twice as long as wide .. 11
10. Egg length 40 .. .. .. *M. canadensis* Mawson
    Egg length 45-49 .. .. *M. oshmarini* Sobolev
    Egg length 50-60 .. .. .. *M. cruzii* Travassos
11. Vestibule 17-19; egg 44-46 x 23-26 — *M. paraccipiter* n.sp.
    Vestibule 17-19; egg 43-50 x 26-28 — *M. raptoris* n.sp
    Vestibule 19; egg 46 x 26 .. .. *M. ninoctis* n.sp.
    Vestibule 15-17; egg 42-44 x 24-27 — *M. tytonis* n.sp.
    Vestibule 17-19; egg 45 x 25-26 — *M. cacomantis* n.sp.
    Vestibule 18-20; egg 44-48 x 24-26 — *M. osmaniae* Rasheed
12. From Passeriformes:
    Vestibule 15; egg 46-49 x 29-31 . *M. saguei* Barus
    Vestibule 17; egg 49-53 x 32 — *M. jakutensis* Kontrimavichus
    Vestibule 16; egg 44 x 31 .. *M. eopsaltriae* n.sp.
    Vestibule 13; egg 44 x 29 .. *M. coracinae* n.sp.
    Vestibule 13-16; egg 45-50 x 31-35 — *M. meliphagidae* n.sp.
    Vestibule 16-19; egg 47-50 x 31-33 — *M. philemon* n.sp.
    Vestibule 14-17; egg 51-55 x 33-34 — *M. streperae* n.sp.
    Vestibule 17-20; egg 49-51 x 31-33 — *M gymnorhinae* n.sp.
    From Piciformes:
    Vestibule 19; egg 49-53 x 33-38 — *M. centuri* Barus
    From Coraciiformes:
    Vestibule 18; egg 42-45 x 30-32 — *M. bucirotidae* Ortlepp
13. From birds of prey 14
    From other groups of birds 17
14. Vestibule not longer than 23 15
    Vestibule over 25 16
15. Eggs 44-48 x 24-16 .. .. .. *M. osmaniae* Rasheed
    Egg 44 x 28 .. .. *M. bubo* Schell
16. Egg 48 x 28 .. .. *M. mirzai* Rasheed
    Egg 44-50 x 23-26 .. .. *M. aquila* Schell
17. Egg at least 32 wide 18
    Egg at most 31 wide 19
18. Length of vestibule less than twice its width — *M. xiphidiopici* Barus
    Length of vestibule at least twice its width — *M. helix* Cram
19. Vestibule 30 long .. .. *M. spiralis* (Seurat)
    Vestibule less than 25 long 20
20. Egg length 48-50 .. .. .. *M. spiculata* Boyd
    Egg length less than 47 21
21. Vestibule length 21; egg (34)-43 x (17)-30 — *M. oriolus oriolus* Oshmarin
    Vestibule length 23; egg 40-46 x 25-29 — *M. oriolus rasheedae* Skrjabin *et al*

Microtetrameres helix Cram

Plate 1; Figs. 1-9; Table 2

Microtetrameres helix Cram 1926, p. 355.

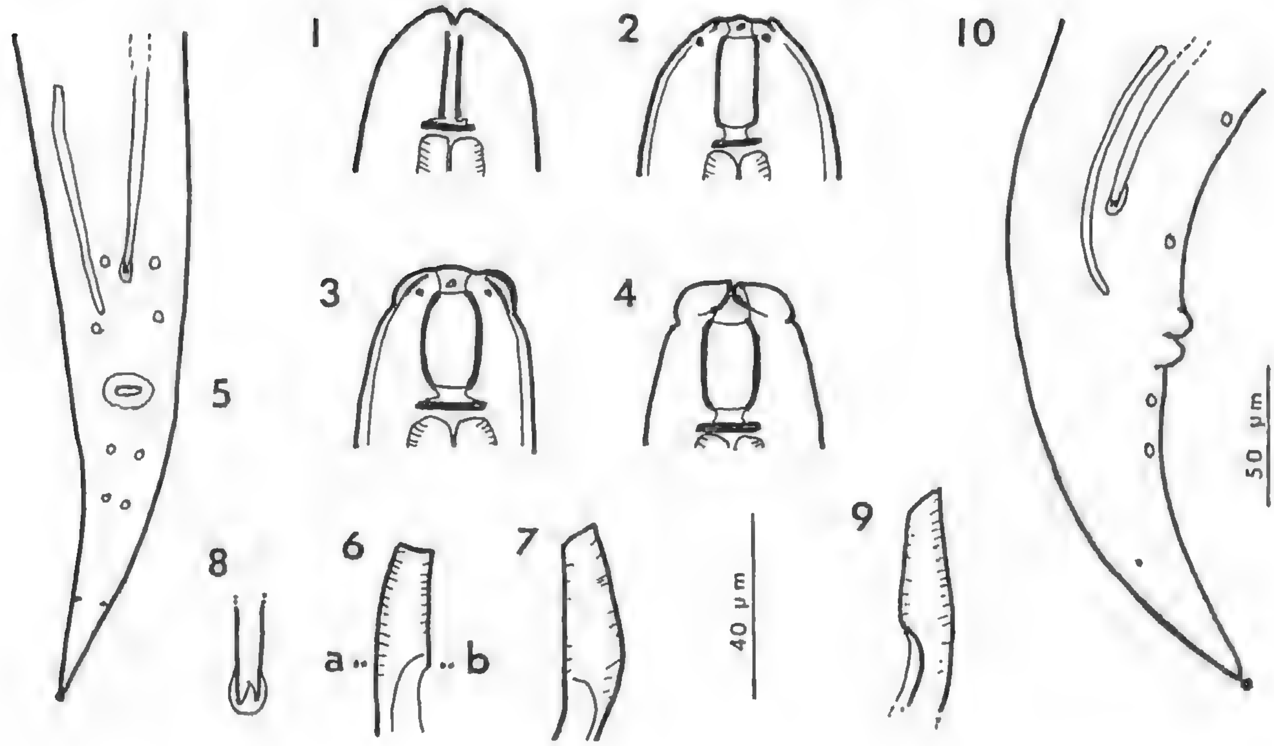
Microtetrameres corax Schell, 1953, p. 234.

Hosts and localities: *Corvus mellori*, Launceston, Tas; Balgowan, Ardrossan, Williamstown, Adelaide, SA; *C. bennetti* (♀s only) Ayers Rock, Erldunda, NT; *C. coronoides*, Adelaide, Heatherleigh, Lock, Oodnadatta, SA; *C. orru* (♀s only) Ayers Rock, Alice Springs, Death Adder Creek, NT; *Corcorax melanorhamphus*, Mt. Crawford, Mantung, SA; Inverleigh, Vic.

The numerous Australian specimens have been compared with *M. corax* (one male specimen lent by Dr. Schell) and with *M. helix* (male specimens from Dr. Lichtenfels) and it has been concluded that all belong to the same species.

Schell differentiates *M. corax* from *M. helix* in the male by the length of the body and of the left spicule, the bifid tip of the left spicule in *M. helix*, the absence of a ball point on the tip of the tail in *M. helix*, and by the distance of the vulva from the tip of the tail.

Examination of the single loaned male specimen of *M. corax* shows that the tip of the left spicule is slightly incised, resembling that of the Australian specimens (Fig. 7). The four male specimens of *M. helix* (Cram's material) are mounted and are in a poor condition, because of air bubbles on the slides. The tips of the tails are not very clear, but in one there is definite



Figs. 1-8, *M. helix*. 1 and 2, head of male, median and lateral views respectively; 3 and 4, head of female, median and lateral views respectively; 5, posterior end of male; 6 and 7, hilt of left spicule in Australian and U.S.A. (*M. corax* Schell) specimens respectively; 8, tip of left spicule. Figs. 9-10, *M. oriolus*. 9, posterior end of male; 10, hilt of left spicule. Figs. 1, 2, 3, 4, 6, 7, 8 and 9 to same scale; Figs. 5 and 10 to same scale.

indication of the presence of a ball point; the hilt of the left spicule is similar to those of the Australian specimens and to that of *M. corax*.

The measurements of all three sets of specimens are very close, except those of the eggs which in Cram's and Schell's descriptions are smaller than those of the Australian specimens. As it is easy to measure infertile eggs in *Microtetrameres* spp. this difference is not considered significant. Bethel (1973) recorded *M. corax* Schell from *Pica pica hudsoni* in Colorado and studied its life cycle. His young adult males agree in general appearance and in measurements with those of *M. helix*. Sultana (1962, 336) described *M. helix* from a hornbill, *Tockus birostris*, from India. The measurements of her specimens fall within, or close to, those of the Australian ones, except for those of the eggs which are smaller. Morgan and Waller (1941, 16) recorded *M. helix* from *Corvus brachyrhynchos brachyrhynchos* from eastern U.S.A. This work has not been seen by the present author.

Oshmarin (1956, 303) described *M. helix asiaticus* from four corvid species from Turkestan. This is a large worm known only from the male. Only one set of measurements is given. It differs from Cram's specimens chiefly in the greater length of the left spicule which is longer than the body.

Other records of *M. helix* and of *M. corax* are by Ellis (1972, p. 31 *et seq*). It appears that the species has a wide distribution, and that it is apparently restricted to corvids and hornbills, apart from the two records from an Australian chough, not now regarded as a corvid. It is possible that closer examination of the specimens from hornbills may show some differences not indicated in published measurements and drawings. *M. malabari* Ali, 1970, from a hornbill, is very similar to Sultana's specimens of *M. helix* in many points, but differs in the presence of a gubernaculum.

Microtetrameres oriolus Petrov and Tschertkova
Figs. 9-10; Table 4

Microtetrameres oriolus Petrov and Tschertkova, 1950, 78. From *Oriolus oriolus*.

Host and locality: *Oriolus sagittatus*, Katherine Gorge, NT.

Only a single male worm was collected. It agrees with the description and measurements of *M. oriolus*. In *M. oriolus rasheedae* Skrj. (syn. *M. orioles* Rasheed, 1960, 60) the spicules are shorter. The subspecies *M. oriolus orientalis* Oshmarin, 1956, is a much smaller worm. The hilt of the left spicules of these species cannot at present be compared.

TABLE 2

Males of *Microtetrameres helix* from Australian birds and from U.S.A.

Unless otherwise indicated, measurements are in μm.

Host species	*Corvus mellori*				*C. coronoides*		*C.* spp.	*C. americanus*	*C. corax*		*Corcorax* spp.
Locality	Tasmania		South Australia		South Australia		All Aust. Species	U.S.A.	U.S.A.		South Australia
Number of specimens	19		16		5						
	Range	Mean	Range	Mean	Range	Mean	Mean	(Ram)	Schell	PMM	PMM
Male:											
Length (mm)	3·7–5·8	5·0	4·1–5·3	4·7	4·0–5·4	4·4	4·4	4·9	3·7–4·7	3·6	3·8–4·3
Oesophagus—											
Total	860–1 200	1 076	900–1 200	1 070	900–1 200	1 022	1 058	826	885–1 051	—	950–1 250
Musc.	260–350	309	230–330	298	225–300	265	28·9	274	244–266	—	270–350
Buccal capsule											
Length	19–23	21	19–23	16·7	24–26	21	20	21†	21–25†	20	16–20
Ant. end—											
Nerve ring	175–260	187	140–190	179	150–190	163	174	191	151–187	—	160–185
Cerv. pap	212–280	225	180–235	210	190–235	208	210	—	194–237	—	200–230
Excr. pore	175–280	214	150–245	202	180–225	198	201	—	154–194	—	200–215
Spicule—Left	2 800–4 200	3 625	3 600–4 450	3 922	3 650–4 510	4 042	3 950	3 600	3 200–3 800	2 650	3 000–3 950
Right	120–162	140	130–160	144	125–145	133	141	135	120–140	—	110–140
Ratio	20·7–32·3	27·6	23·1–30·7	27·5	25·2–34·7	30·5	28·2	26·6	26·6–27·1*	22·1	27·3–29·0
Left spicule—											
Hilt L	23–32	26	20–27	24	21–30	27	25	—	—	17	26–30
Hilt factor	1·7–2·8	2·3	1·7–2·7	2·2	2·0–2·7	2·3	2·2	—	—	1·9	2·0–2·5
Body L/left spicule L	1·1–1·5	1·3	1·0–1·3	1·2	1·1–1·2	1·1	1·2	1·3	1·1–1·2*	1·4	1·1–1·3
Tail	135–200	172	140–180	152	160–180	172	1 164·5	183	160–207	—	165–170
Female:							From *Corvus orru*				
Oesophagus—											
Total	1 760–1 900	—	1 640–1 900	—	1 800–2 000	—	1 400	—	1 625–1 709	—	—
Musc.	340–360	—	340–380	—	360–420	—	250	225–250	241–284	—	—
Vestibule—											
Length	20–25	—	22–26	—	23–26	—	22–23	22·5	24–25†	—	—
Ext. diameter	11·0–12·1	—	11·0–12·1	—	8·8–12·1	—	11·0	—	—	—	—
Ant. end, Nerve ring	190–200	—	185–250	—	190–210	—	180	—	126–129	—	—
Tail	200–220	—	190–220	—	190–310	—	180	141	129–187	—	—
Post. end vulva	340–350	—	300–330	—	320–450	—	290	216	237–240	—	—
Egg—Length	50–52	—	50–55	—	50–55	—	57–53	42	47	—	—
Breadth	33	—	33	—	33	—	33	33	32	—	—

*As these proportions are taken from the largest and smallest measurements given by Schell they may be inexact.

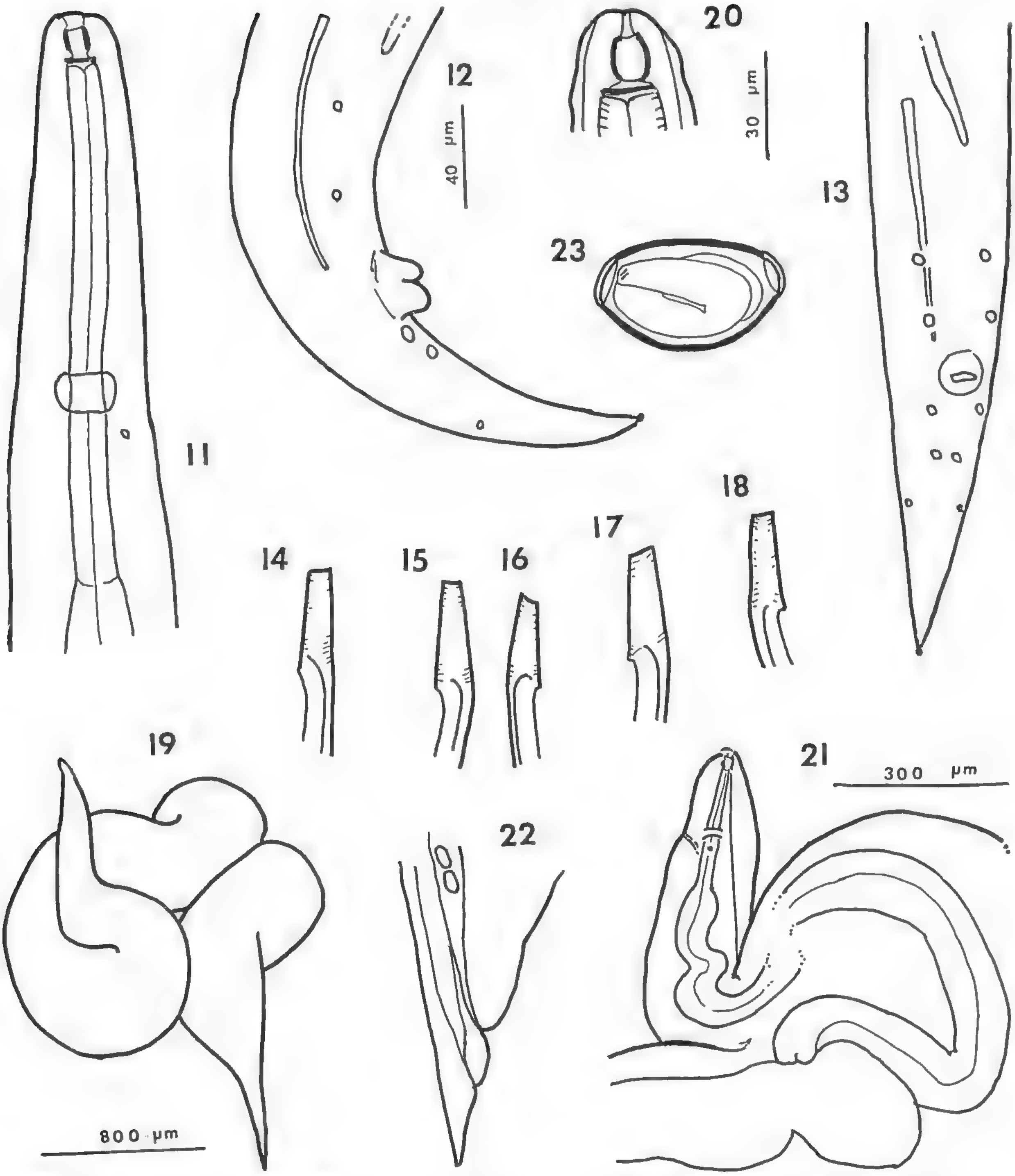
†Measured by the authors.

TABLE 3

Measurements of *Microtetrameres meliphagidae* and *M. philemon*.

Unless otherwise noted measurements are in μm.

	Microtetrameres meliphagidae								*M. philemon*	
Host species	*Acanthogenys* sp.		*Manorina* spp.		*Meliphaga* spp.		*Anthochoera* spp.		*Philemon* spp.	
Number of specimens	13		10		16		17		18	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Male:										
Length (mm)	2·0–3·3	2·7	1·9–2·2	2·1	1·9–2·7	2·2	1·8–2·8	2·3	2·8–4·3	3·4
Oesophagus—Total	550–680	6·4	450–600	552	490–650	562	500–730	587	600–850	736
Musc.	190–245	218	190 (1x)	—	170–240	193	180–240	202	205–250	230
Vestibule length	11–14	13	12–13	13	12–14	13	11–14	12	13–17	15
Ant. end—Nerve ring	130–170	152	135 (1x)	—	120–150	132	120–150	133	120–165	144
Cerv. pap.	160–210	194	170 (1x)	—	150–200	170	145–204	173	150–225	181
Excr. pore	155–205	182	—	—	125–180	152	130–177	152	140–205	166
Left Spicule—Left	1 450–2 200	1 910	1 550–1 770	1 642	1 400–1 850	1 644	1 500–2 050	1 737	2 200–3 000	2 571
Right	90–130	114	90–110	98	85–110	96	80–120	103	95–125	109
Ratio	14·1–20·7	16·9	14·3–18·3	16·8	14·7–19·6	17·4	15·9–19·8	16·7	20–28	23·4
Body L/left spicule	1·2–1·6	1·4	1·2–1·3	1·2	1·2–1·4	1·3	1·1–1·5	1·3	1·2–1·4	1·3
Left spicule—Hilt L	17–26	24	18–27	23	17–30	22	17–30	22	19–26	23
Hilt factor	2·0–3·2	2·5	2·2–3·3	2·8	2·2–3·3	2·6	2·3–3·2	2·6	1·9–2·5	2·3
Tail	110–140	112	100–130	115	100–140	115	95–130	112	120–150	131
Female:										
Oesophagus—Total	1 600	—	850–1 200	—	1 200	—	980–1 400	—	900–1 450	—
Musc.	260	—	220–320	—	270–280	—	200–300	—	280–300	—
Vestibule—Length	13–15	—	14–16	—	16	—	14–16	—	16–19	—
Ext. Breadth	10–12	—	10–11	—	10–11	—	10–11	—	10–12	—
Ant. end Nerve ring	140	—	150–175	—	160–170	—	130–160	—	140–160	—
Tail	80–120	—	120–140	—	150	—	120	—	130	—
Post. end vulva	130–220	—	220–270	—	240	—	230	—	230	—
Egg—Length	49–50	—	48–50	—	50	—	50	—	46–50	—
Breadth	31–35	—	31–33	—	30	—	31–33	—	31–33	—



Figs. 11-23, *M. meliphagidae;* unless otherwise stated, all from type host. 11, anterior end of male; 12 and 13, lateral and ventral views of posterior end of male; 14, 15, 16, 17, and 18, hilt of left spicule; 14, from type host; 15 and 16, from *Anthochoera* sp.; 17, from *Myzantha* sp.; 18, from *Meliphaga* sp.; 19, entire female; 20, bead of female; 21 anterior end of female; 22, posterior end of female; 23, egg. Figs. 11, 12 and 13 to same scale; Figs. 14, 15, 16, 17, 18, 20 and 23 to same scale; Figs. 21 and 22 to same scale.

Microtetrameres meliphagidae n.sp.

Figs. 11-23; Table 4

Hosts and localities: *Acanthogenys rufogularis*, Pt. Augusta, Flinders Ranges, Blanchetown, Meningie, SA; *Meliphaga virescens*, Blanchetown, Eyre Peninsula and the Flinders Ranges, SA; *M. leucotis*, Eyre Peninsula, SA; *M. melanocephala*, Canberra, ACT, Naracoorte, SA; *M. flavigula*, Flinders Ranges, SA; *Anthochoera chrysoptera*, Naracoorte, and Mt. Barker, SA; *A. carunculata*, Adelaide, Eyre Peninsula and Yorke Peninsula, SA.

The male of this species is of medium size, with a short buccal capsule almost as wide as long. The left spicule is rounded, with a small cleft at the tip. The right spicule is simple, rounded at the tip. There is no gubernaculum.

The body of the female is twisted into a reversed spiral, sometimes twice reversed. The buccal capsule is barrel-shaped. There is a short intestinal caecum. This species is closest to *M. philemon* n.sp., in which the left spicule is longer and the spicule ratio greater; to *M. saguei* *Barus* (1966) from *Myadestes* sp. (Turdidae) from Cuba, and to *M. gymnorhinae* n.sp. in both of which however the buccal capsule is elongate, of size, as the spicule ratio is quite different. The hilt of the left spicule is similar to that of *M. meliphagidae*, and the ratio between the lengths of the left spicule and the body, the egg size, and the shape of the female body (though not its size) are similar in the two species. The size of the body and spicules are somewhat similar to those of *M. oriolus oriolus* but the buccal capsule and eggs are smaller.

Microtetrameres philemon n.sp.

Figs. 26-28; Table 4

Hosts and localities: Philemon argenticeps, Coomalie Creek and Berrimah, NT; *P. citreogularis*, (♀s), Coomalie Creek, NT; *Entymyzon cyanotis*, (immature ♀s), Edith R. and Yam Creek, NT.

All the specimens of *Microtetrameres* taken from honeyeaters in the Northern Territory are distinctly larger than those from South Australia. The specimens from *Entomyzon*, though immature, are larger and have a larger buccal capsule than those of a similar stage from *Acanthogenys rufogularis* from South Australia, and are similar to some from *Philemon* sp. The distinction between the two groups is not only

Microtetrameres mirafrae n.sp.

Figs. 26-28; Table 4

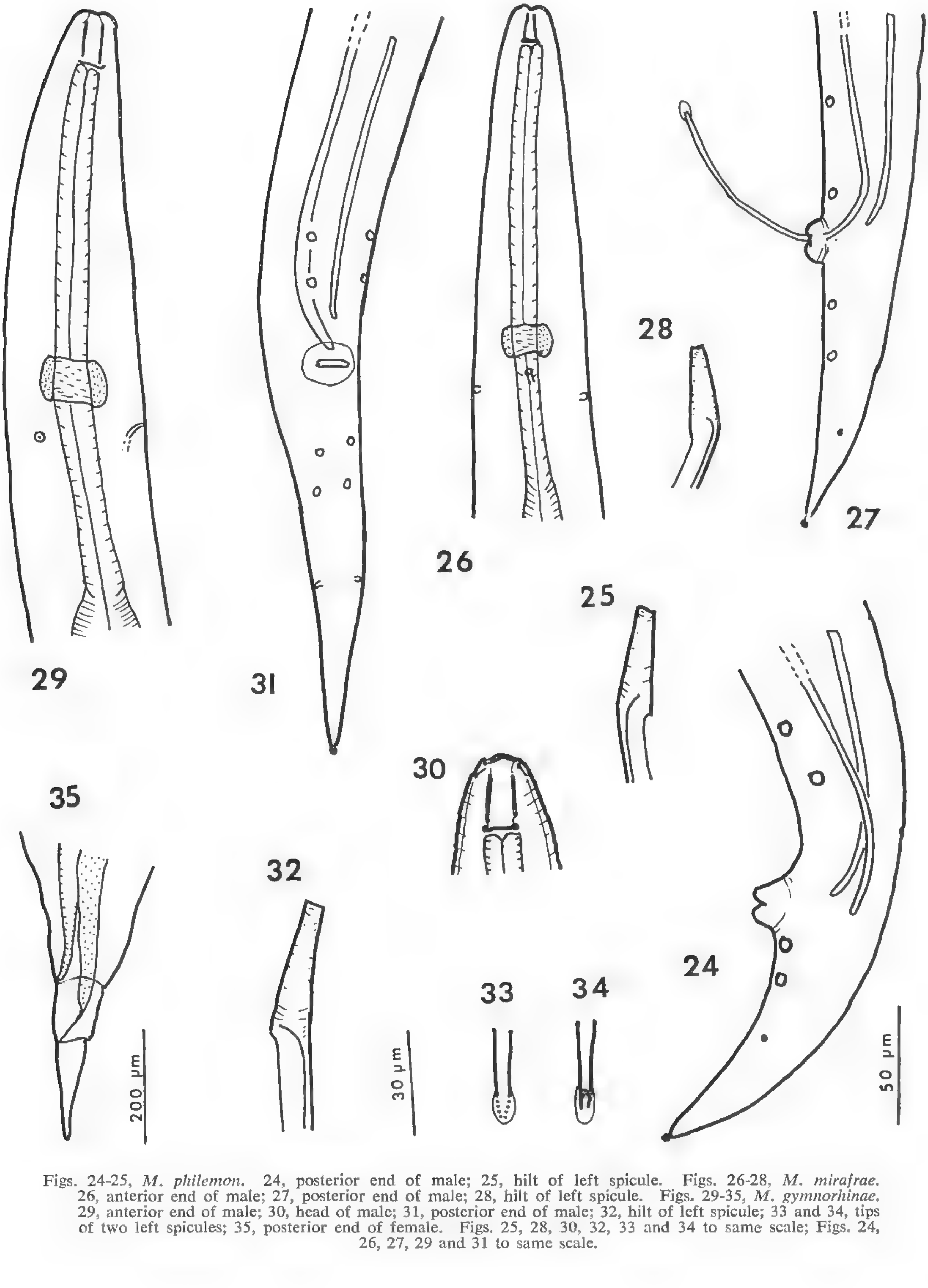
Host and locality: Mirafra javanica, ? loc., NT (6 ♂s, 1 imm. ♀); *Microeca leucophaea*, Newcastle Waters, NT (1 ♂); Blanchetown, SA (1 ♀), Waikerie, SA (3 young ♀s).

These are small worms, in some ways resembling *M. meliphagidae* but the buccal capsule is more elongate and the left spicule shorter with a more slender hilt. The only females in the collections are immature. The male specimen from *Microeca* is very similar in shape and proportions to those from *Mirafra*. The females from *Microeca* from SA are placed in this species because they are from the same host species.

TABLE 4

Measurements of *Microtetrameres mirafrae*, *M. gymnorhinae*, *M. streperae* and *M. cractici*
Unless otherwise indicated, measurements are in μm.

Species	*M. mirafrae*		*M. gymnorhinae*			*M. streperae*	*M. cractici*
Host species	*Mirafra javanica*	*Microeca leucophaea*	*Gymnorhina t. tibicen*	*G. tibicen leuconota*	Mean of all from *Gymnorhina* sp.	*Strepera versicolor*	*Cracticus torquatus*
Number of specimens	6	1	6	16		1	3
Male:							
Length (mm)	1·8–2·0	1·4	2·3–2·9	2·2–3·2	2·6	3·1	1·3–1·7
Oesophagus—Total	480–560	470	750–1 080	620–800	751	900	530–580
Musc.	170–210	190	230–290	215–300	245	260	195–210
Buccal capsule length	12–13	12	14–19	14–17	16	14	13–16
Ant. end—Nerve ring	125–140	100	130–190	130–165	151	150	135–150
Cerv. pap.	145–170	120	155–230	155–190	168	—	150–170
Excr. pore	148–160	120	150–180	145–200	171	—	150–165
Spicule—Left	1 100–1 200	1 060	1 500–1 830	1 400–1 960	1 685	2 100	860–1 000
Right	80–92	80	90–124	100–120	113	100	80–100
Ratio	13·1–15·0	13·3	15·2–17·0	14·2–18·2	14·2	21·0	8·6–11·2
Left spicule—Length	1·3–1·7	1·3	1·3–1·7	1·4–1·8	1·6	1·5	1·5–1·7
Hilt	19–27	14	32–36	26–38	34	45	26–32
Factor	3·0–4·0	3·0	3·3–4·2	3·3–4·4	3·7	5·0	4·1–4·6
Tail	115–130	120	130–180	130–160	—	150	110
Female:							
Oesophagus—Total	—	650	1 300–1 320	1 150	—	1 600–1 800	—
Musc.	—	190	280–310	250	—	330–400	—
Buccal capsule—Length	—	19	17–20	17–20	—	14–17	—
Breadth	—	8·0	11–12	11	—	12–13	—
Tail	—	90	120–130	190	—	190–200	—
Post. end vulva	—	140	280–290	300	—	340–350	—
Egg—Length	—	—	49·5–50·6	49·5	—	50·6–55·0	—
Breadth	—	—	30·8–33·0	30·8–33·0	—	33–34·1	—



Figs. 24-25, *M. philemon.* 24, posterior end of male; 25, hilt of left spicule. Figs. 26-28, *M. mirafrae.* 26, anterior end of male; 27, posterior end of male; 28, hilt of left spicule. Figs. 29-35, *M. gymnorhinae.* 29, anterior end of male; 30, head of male; 31, posterior end of male; 32, hilt of left spicule; 33 and 34, tips of two left spicules; 35, posterior end of female. Figs. 25, 28, 30, 32, 33 and 34 to same scale; Figs. 24, 26, 27, 29 and 31 to same scale.

In the spicule ratio and the ratio of the lengths of the left spicule and the body, this species is very close to *M. jakutensis* Kontrimavichus, 1958, from species of *Alauda, Motacilla, Anthus* and *Prunella*, but as it is impossible to compare the hilt of the left spicule and as females are not present in the Australian species, it is considered wiser to regard the Australian species as distinct, pending further information.

Microtetrameres gymnorhinae n.sp.

Figs. 29-35; Table 4

Hosts and localities: *Gymnorhina tibicen tibicen*, Canberra, ACT; *G. tibicen leuconota*, Clarendon, Victor Harbor, One Tree Hill, Ashbourne, Blackwood, Naracoorte, SA.

Microtetrameres specimens from *Gymnorhina* spp. are about the same overall size as those from honeyeaters. They are differentiated in the male mainly by the characters of the left spicule, which is rather shorter and has a more elongate hilt and in both sexes by the more elongate buccal capsule.

In many specimens the tip of the left spicule, which as in all the Australian species is enclosed in a small ala, is incompletely chitinised so that it appears bifid or broken.

The female body forms a complex coil, often twice reversed and sometimes with the tail end passing between the coils. The whole coil is about the same size as that of *M. meliphagidae*.

Microtetrameres streperae n.sp.

Figs. 36-40; Table 4

Host and locality: *Strepera versicolor*, Waikerie, SA (1 ♂, 4 ♀s).

The tip of the left spicule is bifid, within the terminal ala. The female body forms an irregular coil reversed two or three times. No intestinal diverticulum was seen. The egg is larger than that of most other Australian species.

In most measurements it resembles *M. paraccipiter* but the buccal capsule is shorter and the shape of the hilt of the left spicule is different. It differs from *M. gymnorhinae* (from a host species closely related to *Strepera*) chiefly in the spicule ratio and the shape of the hilt of the left spicule.

Microtetrameres cractici n.sp.

Figs. 41-42; Table 5

Host and locality: *Cracticus torquatus*, Eyre Peninsula, SA (3 ♂s).

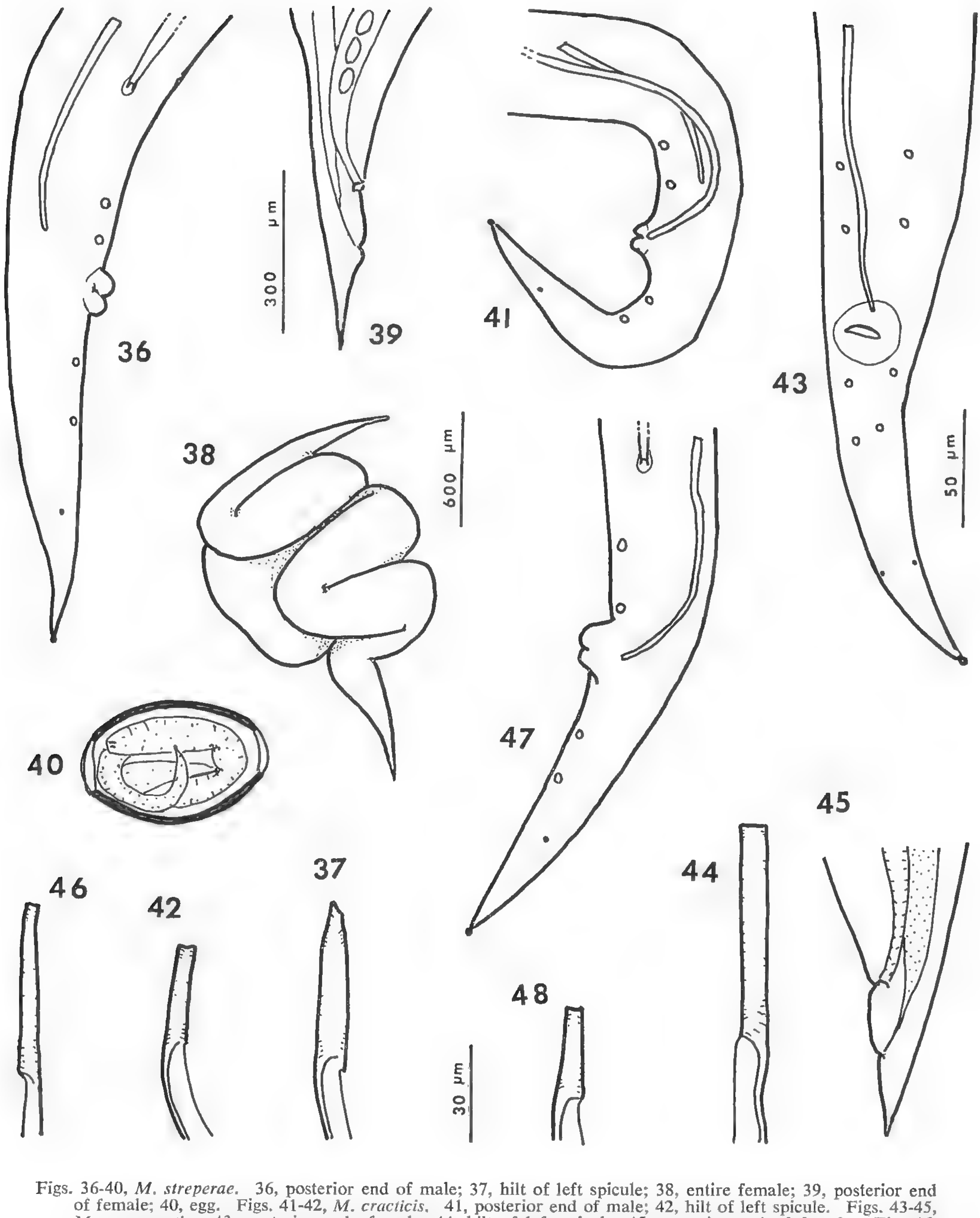
The tip of the left spicule is entire and rounded, lying within the terminal ala.

The species is close to *M. asymmetrica* Oshmarin, 1956, from *Lanis* sp., USSR, and to *M. minima* (Travassos, 1914) from *Tachyphonus* sp., Brazil. These three species are very similar in such measurements as are available. The male of *M. minima* is briefly described and poorly figured. *M. asymetrica* differs from *M. cractici* in having the tail longer in comparison with the length of the right spicule and in the shape of the hilt of the left spicule.

TABLE 5

Measurements of *Microtetrameres oriolus*, *M. cacomantis*, *M. aegotheles*, *M. coracinae*, *M. sphecotheres*, and *M. eopsaltriae*. Unless otherwise indicated, all measurements are in µm.

	M. oriolus	*M. cacomantis*	*M. aegotheles*	*M. coracinae*			*M. sphecotheres*	*M. eopsaltriae*
Host species	*Oriolus sagittatus*	*Cacomantis variolosus*	*Aegotheles cristata*	*Coracina hypoleuca*	*C. novae-hollandiae*	*Cuculus pallidus*	*Sphecotheres flaviventris*	*Eopsaltria australis*
Number of specimens	1	7	1	1	1	1	2	1
Male:								
Length (mm)	3·4	3·1–4·3	2·0	2·1	1·7	2·6	2·0–2·3	2·6
Oesophagus—Total	710	600–900	—	—	480	—	700 (1x)	690
Musc.	300	270 (2x)	310	—	—	—	190–200	220
Buccal capsule	16	16–22	13	13	11	13	16–17	11
Ant. end—Nerve ring	180	140–200	200	—	—	—	130–132	140
Cerv. pap.	—	160 (1x)	240	—	—	—	132–135	170
Excr. pore	180	155 (1x)	—	—	—	—	142 (1x)	170
Spicule—Left	3 000	1 900–2 250	1 250	1 400	1 200	1 350	1 000–1 100	1 420
Right	110	130–150	75	100	90	115	95–115	130
Ratio	27·3	14·2–16·1	16·6	14·0	13·3	11·7	9–11	10·1
Left Spicule—Length	1·1	1·6–1·9	1·6	1·5	1·4	1·9	2·0–2·3	1·8
Hilt L.	26	55–78	27	37	47	50	36–40	27
Hilt factor	2·5	6·0–8·1	3·5	7·9	6·3	6·1	4·7–5·6	3·7
Tail	155	120–145	130	130	100	—	130–150	120
Female:								
Oesophagus—Total	—	1 150	850–1 000	(1x)	—	—	—	—
Musc.	—	330	310	—	—	—	—	295
Buccal capsule—Length	—	19–20	13	14	—	—	—	17
Breadth	—	11	9	11	—	—	—	10
Tail	—	160	190	—	—	—	—	160
Post. end Vulva	—	300	320–330	—	—	—	—	220
Egg—Length	—	44	45	44	—	—	—	44
Breadth	—	28	25–26	29	—	—	—	31



Figs. 36-40, *M. streperae*. 36, posterior end of male; 37, hilt of left spicule; 38, entire female; 39, posterior end of female; 40, egg. Figs. 41-42, *M. cracticis*. 41, posterior end of male; 42, hilt of left spicule. Figs. 43-45, *M. cacomantis*. 43, posterior end of male; 44, hilt of left spicule; 45, posterior end of female. Fig. 46, *M. coracina*, hilt of left spicule. Figs. 47-48, *M. sphecotheres*. 47, posterior end of male; 48, hilt of left spicule. Figs. 36, 41, 43 and 47 to same scale; Figs. 37, 40, 42, 44, 46 and 48 to same scale; Figs. 39 and 45 to same scale.

Microtetrameres cacomantis n.sp.

Figs. 43-45; Table 5

Host and locality: *Cacomantis variolosus*, Tobermory, NT (7 ♂s, 2 ♀s).

The males are distinguished by a combination and a low spicule ratio. The body of the female forms a more or less spherical knot from which of a short left spicule with a long slender hilt, head and tail protrude; one is a simple and one a reversed spiral.

The species is perhaps nearest to *M. centuri* Barus, 1966, from a Cuban piciforme bird, and *M. cerci* n.sp. from an Australian harrier. It is distinguished from both of these by the spicule ratio and actual spicule lengths, and from *M. cerci* by the shape of the hilt of the left spicule.

Microtetrameres coracinae n.sp.

Fig. 46; Table 5

Hosts and localities: *Coracina novaehollandiae* (1 ♂, 3 juv. ♀s) from Culburra, SA; *C. hypoleuca* (1 ♂, 1 broken ♀) Katherine, NT; *Cuculus pallidus* (1 ♂), Casuarina Beach, NT.

Although the three male specimens come from very different localities they are very similar in general morphology and in measurements. They resemble *M. cacomantis* but are distinguished by the shorter spicules, and the fact that the right spicule is shorter than the tail. The specimens are not in good condition, but the chitinous parts are unimpaired. The shape of the hilt of the left spicule (Fig. 46) distinguishes this from all other Australian species.

Microtetrameres sphecotheres n.sp.

Figs. 47-48; Table 5

Host and locality: *Sphecotheres flaviventris*, Katherine Gorge, NT (3 ♂s).

The tip of the left spicule is indented and alate. The species is nearest to *M. tytonis* (described below) and *M. oriolus oriolus*. It is distinguished from the former by the length of the buccal capsule, from the latter by the length of the left spicule in relation to the body length, and from both by the shape of the hilt of the left spicule.

Microtetrameres aegotheles n.sp.

Figs. 49-52; Table 5

Host and locality: *Aegotheles cristata*, Markaranka, NT (1 ♂, 2 ♀s).

In the male the hilt of the left spicule is distinctly narrower than the shaft, a circumstance not seen in any other Australian specimen. The female forms a reversed spiral. There is a bulge, probably a diverticulum, at the anterior end of the intestine. The species is similar in many features to *M. saguei* Barus, differing in the shorter left spicule and in the ratio of tail length to that of the right spicule.

Microtetrameres eopsaltriae n.sp.

Figs. 53-54; Table 5

Host and locality: *Eopsaltria australis*, Heatherleigh, SA (1 ♂, 1 ♀).

The tip of the left spicule is not fully chitinised. The right spicule is longer than the tail.

The female body forms a spiral reversed about its mid-length.

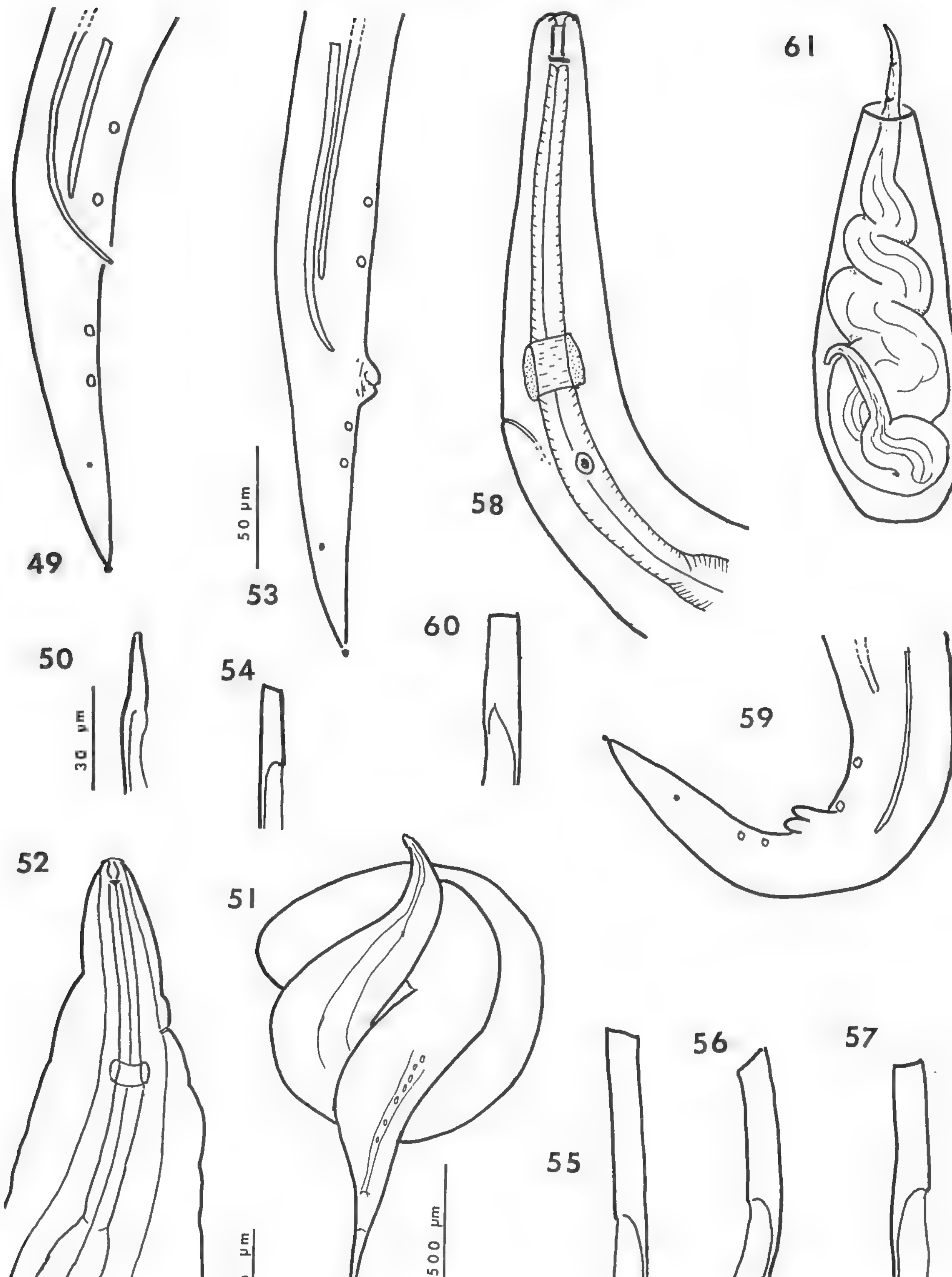
The measurements of this species are closest to those of *M. cerci* n.sp.; the buccal capsule however, is much shorter.

Microtetrameres paraccipiter n.sp.

Figs 58-61; Tables 6 and 7

Hosts and localities: *Accipiter fasciatus* from Darwin (♀). (Type host and locality), Kunoth Wells (♂), and Petermann Range (♀) NT; Happy Valley (♀) and Mallala (♀) SA; Longford, Tas (♀); Brisbane, Qld (♀).

The male and female specimens listed above are placed together here only because they occur in the same host species, but in no case were both males and females in the same host specimen. The female body forms an elongate simple spiral (Fig. 61); the morphology and the measurements of the eggs and buccal capsule are similar in all the females present. No intestinal caecum was observed. The male worms are very similar to those of *M. accipiter* Schell in measurements and appearance, and the species are separated on characters of the females, which in *M. paraccipiter* lack the longitudinal flange on the body, and the intestinal caecum described for *M. accipiter*. It seems more likely that the male worms from *A. fasciatus* in Australia belong to the same species as the female worms from the same host species than that they belong to *M. accipiter* Schell from an American host.



Figs. 49-52, *M. aegotheles*. 49, posterior end of male; 50 hilt of left spicule; 51, entire female; 52, anterior end of female. Figs. 53-54, *M. eopsaltriae*. 53, posterior end of male; 54, hilt of left spicule. Fig. 55, *M. bubo*, hilt of left spicule. Fig. 56, *M. aquila*, hilt of left spicule. Fig. 57, *M. accipiter*, hilt of left spicule. Figs. 58-61, *M. paraccipiter*. 58, anterior end of male; 59, posterior end of male; 60, hilt of left spicule; 61, entire female in proventricular gland of host. Figs. 49, 53 and 58 to same scale; Figs. 50, 54, 55, 56 and 57 to same scale; Figs. 51 and 61 to same scale.

TABLE 6

Measurements of male specimens of *Microtetrameres paraccipiter*, *M. cerci*, *M. raptoris*, *M. ninoctis*, *M. tytonis* and *M.* sp. from *Tyto alba*. Unless otherwise indicated, measurements are in μm.

Species	*M. paraccipiter*	*M. cerci*	*M. raptoris*			*M. ninoctis*		*M. tytonis*	*M.* sp.
Host Species	*Accipiter fasciatus*	*Circus assimilis*	*Falco peregrinus*	*F. berigora*	*Ninox* sp.	*Ninox* sp.		*Tyto alba*	*Tyto alba*
Locality	Kuneth Wells, Northern Territory	Petermann Ra., Northern Territory	South Australia	Northern Territory and South Australia	Northern Territory	Northern Territory	South Australia	Northern Territory	Northern Territory
Number of specimens	2	10	6	7	3	1	2	4	1
Lenth	3·4, 3·7	2·1–3·3	3·3–3·8	2·2–2·6	2·1–3·0	3·4	2·6, 3·2	2·9–3·3	3·9
Oesophagus—Total	900, 950	530–800	1 200–1 400	600–750	810–1 200	1 250	?, 1 130	850–950	850
Ant.	250, 260	—	230–290	165	—	300	?, 310	240–250	250
Buccal capsule	16, 20	21–25	19–20	16–20	19–20	20	17, 21	20–22	26
Ant. end—Nerve ring	140, 150	—	130–160	105	—	170	?, 160	140	180
Cerv. pap.	190, 200	—	180–210	110	—	200	?, 210	170–185	220
Excr. pore	180, 180	—	155–180	110	—	205	?, 185	150–170	—
Spicule—Left	2 000, 2 400	1 400–1 920	1 750–2 000	1 250–1 490	1 510–1 630	2 250	2 490, 2 500	1 200–1 250	1 900
Right	110, 120	115–150	100–150	80–105	90–130	100	100, 110	115–135	160
Ratio	18·2, 20·0	10·4–16·0	13–20	13·5–17·0	12·5–16·8	22·5	22·7, 24·9	9·3–10·4	11·9
L/left spicule—Length	1·7, 1·5	1·5–1·8	1·7–2·1	1·5–1·9	1·4–1·8	1·5	1·1, 1·3	2·4–2·8	2·1
Hilt L	27, 31	20–32	29–36	18–27	20–24	20	18, 13	15–21	43
Hilt factor	3·0, 3·3	2·5–3·3	3·0–4·0	2·5–2·9	2·5–3·3	1·8	1·4, 2·5	1·6–1·9	4·2
Tail	120, 140	110–130	100–150	130–170	150–190	160	160, 160	150–155	170

TABLE 7

Measurements of females of *Microtetrameres paraccipiter*, *M. raptoris*, *M. ninoctis*, *M. tytonis*, and *M.* sp. from *A. cirrhocephalus*. All measurements are in μm.

Species	*M. paraccipiter*			*M.* sp.		*M. raptoris*			*M. ninoctis*	*M. tytonis*
Host Species	*Accipiter fasciatus*			*A. cirrhocephalus*		*Falco peregrinus*	*F. berigora*	*F. longipennis*	*Ninox novaeseelandiae*	*Tyto alba*
Locality	Northern Territory	South Australia	Tasmania	Tasmania	South Australia	South Australia	South Australia	Northern Territory	Northern Territory	Northern Territory
Oesophagus—Total	1 400	2 000	1 800	1 300	1 300	1 100–2 140	1 300–1 400	1 050–1 400	1 500	1 300–1 400
Ant.	260	240	270	230	200	210–290	200–240	230–270	250	140
Ant. end nerve ring	130	140	120	100	100	140–170	110–120	—	—	260–290
Buccal capsule—Length	15	19	17	15	13	17–20	19	17–20	21	15–17
Breadth	10	11	10	10	10	10–12	10	10–11	11	9–10
Tail	250	—	200	160	140	150–190	100–210	150–170	—	200–280
Post. end vulva	400	—	300	310	280	250–330	230–320	250–290	—	340–380
Egg—Length	44–45	44–46	—	46–49	44	50	—	43	46	42–44
Breadth	23–24	24–26	—	23–24	24	28	—	26–27	26	24–27

Microtetrameres cerci n.sp.

Figs 62-65; Tables 6 and 7

Host and locality: *Circus assimilis*, Petermann Ranges, NT (12 ♂s, no ♀s).

Some of these specimens, all collected from a single host were found actually in the wall of the proventriculus between the glands. The buccal capsule is relatively long, the cloacal lips are outstanding. The tip of the left spicule is not divided, but there is an annular groove shortly before the tip (Fig. 65). In some specimens there is a definite chitinisation of the dorsal wall of the gubernaculum, but this is not present in all. The lips of the cloaca are more prominent in this than in any other Australian species.

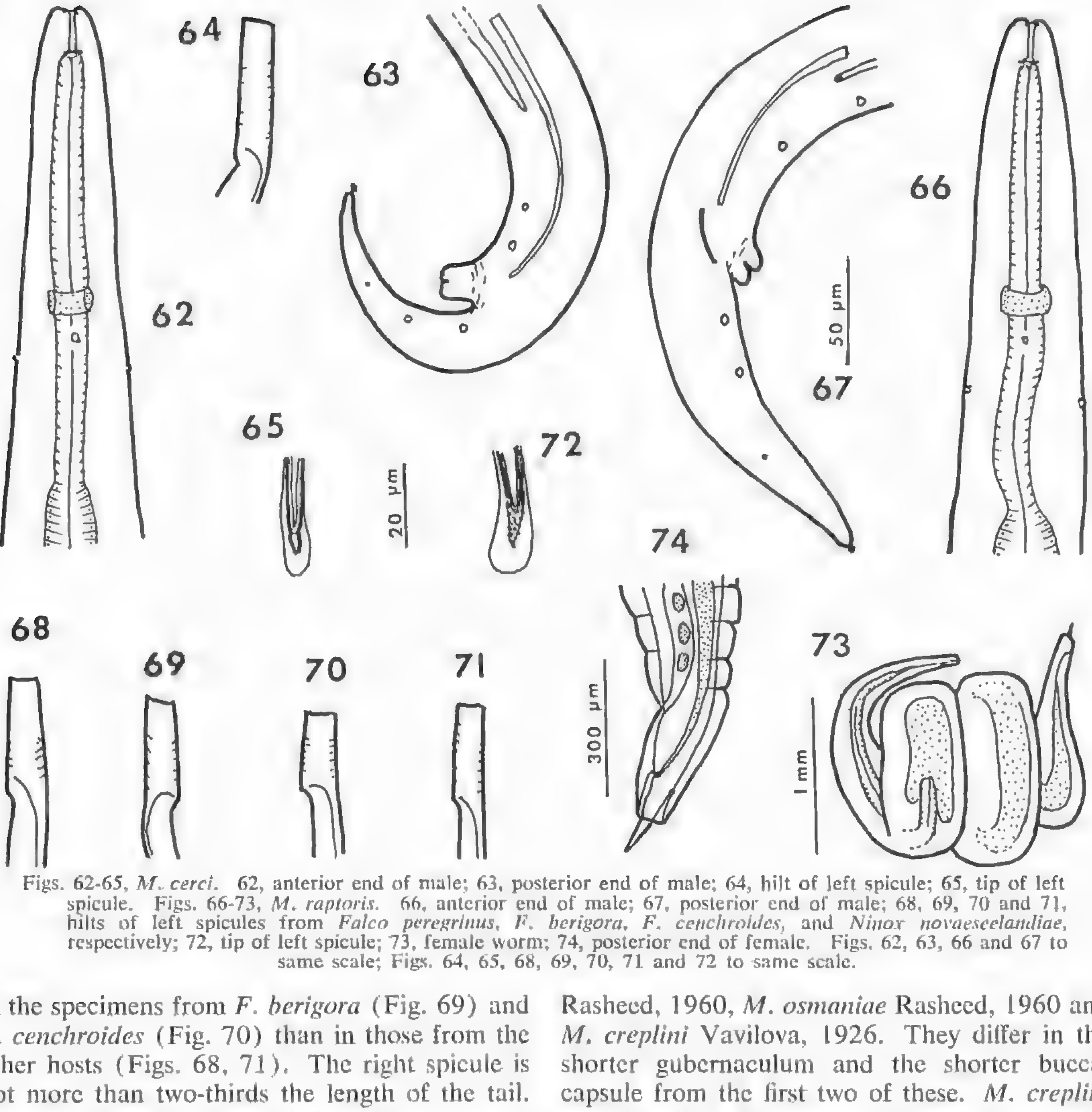
The species is distinguished from *M. aquila* and *M. bubo* by the greater spicule ratio; in measurements and proportions it is perhaps closest to *M. centuri* Barus and *M. cacomantis* n.sp., but is distinguished from the former by the very prominent cloacal lips from the latter by the shape of the hilt of the left spicule, and from both by the rather different, though overlapping, range of measurements. Among Australian species, the measurements are closest to those of *M. gymnorhinae*, but the species are distinguished by the length of the tail compared to that of the right spicule.

Microtetrameres raptoris n.sp.

Figs. 66-74; Tables 6 and 7

Hosts and localities: *Falco peregrinus*, Pt. Augusta, SA (5 ♂s, 14 ♀s) (type host and locality), Mallala, SA (1 ♂, 1 ♀); *F. berigora*, Blanchetown, SA, Robe, SA (♀s), Petermann Ranges, NT; *F. cenchroides*, Meningie, SA (2 ♂s, 1 ♀); *F. longipennis*, Humpty Doo, NT (♀s); *Ninox novaeseelandiae*, Petermann Ranges, NT (4 ♂s, juv. ♀).

The buccal capsule is elongate. The tip of the left spicule is bifid (within the terminal ala) and the hilt is stoutly built, tapering very slightly. It is slightly shorter, but similar in general shape,



Figs. 62-65, *M. cerci*. 62, anterior end of male; 63, posterior end of male; 64, hilt of left spicule; 65, tip of left spicule. Figs. 66-73, *M. raptoris*. 66, anterior end of male; 67, posterior end of male; 68, 69, 70 and 71, hilts of left spicules from *Falco peregrinus*, *F. berigora*, *F. cenchroides*, and *Ninox novaeseelandiae*, respectively; 72, tip of left spicule; 73, female worm; 74, posterior end of female. Figs. 62, 63, 66 and 67 to same scale; Figs. 64, 65, 68, 69, 70, 71 and 72 to same scale.

in the specimens from *F. berigora* (Fig. 69) and *F. cenchroides* (Fig. 70) than in those from the other hosts (Figs. 68, 71). The right spicule is not more than two-thirds the length of the tail. In all specimens there is a distinct gubernaculum, most heavily chitinised in the type specimens.

The body of the female forms a spiral, usually simple, in a few cases reversed. The intestine forms two short caeca at its junction with the oesophagus. There were no females with fertilised eggs in any specimen from *F. berigora*.

Two male and one female specimens from *Falco cenchroides* were broken, so measurements are not given. Their general appearance, the hilts of the left spicules and the egg size agreed with those of the other specimens from *Falco* spp. The females from *F. longipennis* and those from *F. berigora* from Robe agree with those from the Blanchetown, but the identification is not certain.

Of the species in which a distinct gubernaculum has been described, the males of these Australian specimens fall closest to *M. mirzae* Rasheed, 1960, *M. osmaniae* Rasheed, 1960 and *M. creplini* Vavilova, 1926. They differ in the shorter gubernaculum and the shorter buccal capsule from the first two of these. *M. creplini* was described from *Accipiter niseus* from the U.S.S.R., from male specimens only; as the females cannot be compared it is safer to describe the Australian specimens as a separate species.

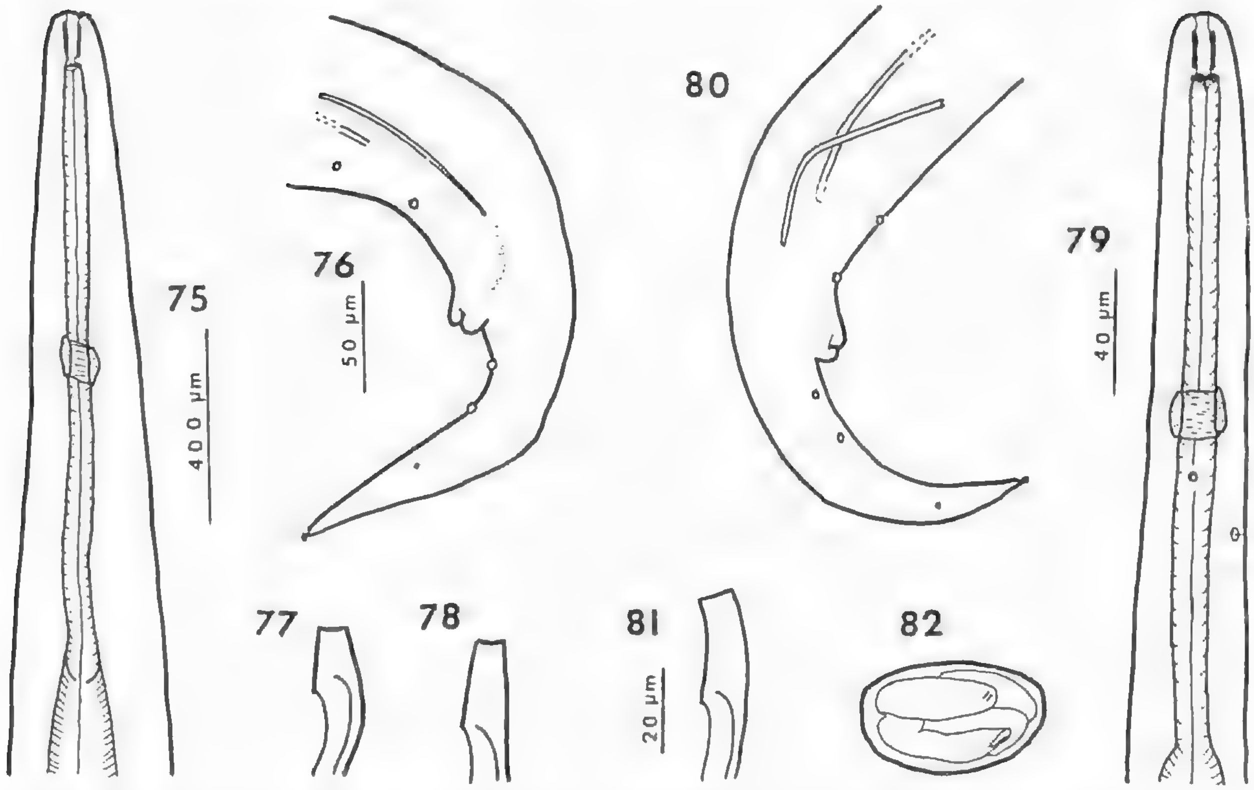
Microtetrameres ninoctis n.sp

Figs. 75-78, Tables 6 and 7

Host and localities: *Ninox novaeseelandiae*, Berrimah, NT (1 ♂, 4 ♀s); Adelaide, SA (2 ♂s, 2 ♀s).

The three male worms are similar in measurements, but in those from South Australia the hilt of the left spicule is rather longer.

The tips of the left spicules are different in the three specimens—one bifid, one rounded and one truncated. A very slight chitinisation, 30µm long, of the dorsal wall of the cloaca, which



Figs. 75-78, *M. ninoctis*. 75, anterior end of male; 76, posterior end of male; 77 and 78, hilts of left spicules from specimens from Berrimah and Adelaide, respectively. Figs. 79-82, *M. tytonis*. 79, anterior end of male; 80, posterior end of male; 81, hilt of left spicule; 82, egg. Figs. 75 and 79 to same scale; Figs. 76 and 80 to same scale; Figs. 77, 78, 81 and 81 to same scale.

could be called a small thin gubernaculum, is present in two specimens, one of them from Berrimah.

The female specimens are broken and the form of the spiral is uncertain. Only one contained fertile eggs.

These specimens differ from *M. raptoris* recorded from the same host species chiefly in the very much longer left spicule and the different spicule ratio. Among specimens in which a gubernaculum is present, the length of the left spicule brings it closest to *M. egretes* Rasheed, 1960 (from an egret) but the gubernaculum of the male, the buccal capsule of both sexes, and the length of the eggs, are all shorter than those of *M. egretes*.

Microtetrameres tytonis n.sp.

Figs. 77-80, Tables 6 and 7

Host and locality: *Tyto alba*, Banka Banka, NT (4♂s, 5♀s).

Of the six male *Microtetrameres* found in the only host specimen, four (the type material for *M. tytonis*) were similar, the fifth was without any spicules, and the sixth was very different, in relative length of the left spicule, in the longer hilt of the left spicule, and in the length of the buccal capsule. The measurements of this sixth specimen are given separately in Table 6 as it may belong to another species, or may be another aberrant form.

The left spicule in the four similar males is short, considerably less than half the body length; as in some other species the tip is not well chitinised, looking like a collection of refractile pieces in the terminal ala.

The body of the female forms a long spiral, reversed in the most posterior coil. The eggs, which contain a spiny-headed larva (Fig. 80), are more strongly curved on one side than the other, and the operculum, presumably present, is not distinct.

The species is closest to *M. sphecotheres* in which the hilt of the left spicule is longer, and to *M. raptoris*—in which the left spicule ranges from just less than ½ to ⅔ the body length—but in which the spicule ratio is very different.

Microtetrameres spp.

Female worms only were taken from the following hosts:—

Accipiter cirrhocephalus, from Koonamore, SA, and Flinders Island, Tas. The measurements of five females from SA and 1 from Flinders Island showed a small difference in the size of the buccal capsule and in the shape of the eggs, from those of *M. paraccipiter*. Because of this and because no male is present, the specimens from *A. cirrhocephalus* have not been allotted to a species. In other respects the specimens from the two host species are similar.

Lalage sueuri tricolor, Mt Barker, SA (2 ♀s); Sandy Creek, SA (2 ♀s). All without embryonated eggs. The buccal capsule is 14 x 10 μm.

Oreoica gutturalis, Waikerie, SA (1 ♀), Petermann Ranges, NT, (1 juvenile ♀). The buccal capsule of the specimen from Waikerie is 12 x 10 μm, the eggs 44 x 22 μm.

Ptiloris sp., two females, without fertile eggs. Buccal capsule 10 x 11 μm.

Anthus australis, Reynella, SA, one female only, without fertile eggs.

Cacomantis pyrrhophanus, Gravelly Beach, Tas (1 ♀) with infertile eggs and Hamley Bridge, SA (3 immature ♀s). The adult female is coiled in a reversed spiral. The barrel-shaped buccal capsule is 16·5 μm long, 11μm wide. The specimen is very similar to the female of *M. cacomantis* n.sp., but is impossible to identify positively on the material available.

ACKNOWLEDGEMENTS

Many of the bird carcases from which *Microtetrameres* spp. were obtained were given by the South Australian Museum, or by the Northern Territory Administration (Animal Industry and Agriculture Branch). Others were given by various friends, the late Dr. M. Smyth, Mrs. J. Paton, Dr. R. Swaby and Dr. I. Beveridge. Hosts from Tasmania were sent by Dr. B. Munday of the Mt. Pleasant Laboratories of the Tasmanian Department of Agriculture, and by Mr. B. Green of the Victoria Museum, Launceston.

Paratype material was lent by Dr. S. C. Schell of the University of Idaho, and the types of *M. helix* by Dr. Lichtenfels of the U.S. Department of Agriculture Research Service, Beltsville.

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I am more than grateful for all this help.

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LIST OF SPECIES

FAMILY TETRAMERIDAE

Microtetrameres Travassos

- *M. helix* Cram. syn. *M. corax* Schell
- *M. oriolus* Petrov and Tschertkova
- *M. meliphagidae* n.sp.
- *M. philemon* n.sp.
- *M. mirafrae* n.sp.
- *M. gymnorhinae* n.sp.
- *M. streperae* n.sp.
- *M. cacomantis* n.sp.
- *M. coracinae* n.sp.
- *M. sphecotheres* n.sp.
- *M. aegotheles* n.sp.
- *M. eopsaltriae* n.sp.
- *M. paraccipiter* n.sp.
- *M. cerci* n.sp.
- *M. raptoris* n.sp.
- *M. ninoctis* n.sp.
- *M. tytonis* n.sp.
- *M. accipiter* Schell
- *M. bubo* Schell
- *M. aquila* Schell

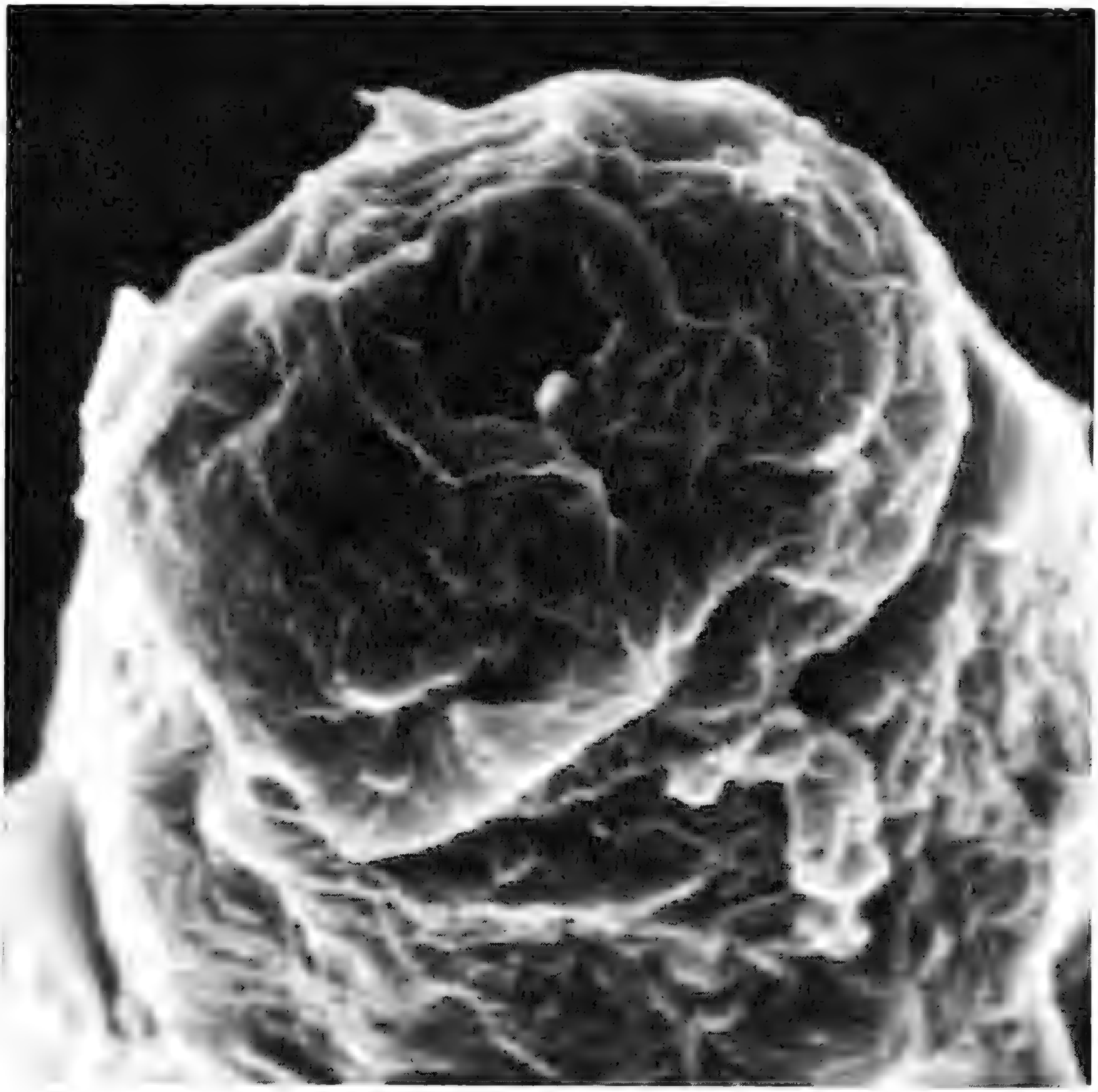

Plate 1. Head of *Microtetrameres helix*, female, S.E. micrograph. X 8000. The lateral lobes of the lips became wrinkled and shrunken in drying the specimen, but the median lobes, with the amphids, are clear.

RECORDS OF THE
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TAXONOMIC STUDIES OF SOME AUSTRALIAN LEPTODACTYLID FROGS OF THE GENUS *CYCLORANA* STEINDACHNER

By

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Summary

The Australian leptodactylid frogs Cyclorana brevipes and C. cultripes are here redefined on the basis of adult morphology and mating calls. Frogs variously reported to be these species from Western Australia, the Northern Territory, Queensland and New South Wales are shown to represent different species. Five new species are described here.

TAXONOMIC STUDIES OF SOME AUSTRALIAN LEPTODACTYLID FROGS OF THE GENUS *CYCLORANA* STEINDACHNER

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MICHAEL J. TYLER* AND ANGUS A. MARTIN†

ABSTRACT

TYLER, M. J., and MARTIN, A. A. 1976. Taxonomic studies of some Australian leptodactylid frogs of the genus *Cyclorana* Steindachner. *Rec. S. Aust. Mus.* 17 (15): 261-276.

The Australian leptodactylid frogs *Cyclorana brevipes* and *C. cultripes* are here redefined on the basis of adult morphology and mating calls. Frogs variously reported to be these species from Western Australia, the Northern Territory, Queensland and New South Wales are shown to represent different species. Five new species are described here.

INTRODUCTION

The leptodactylid frogs of the genus *Cyclorana* Steindachner occur throughout Australia with the exception of the extreme south-eastern and south-western portions of the continent. As defined by Parker (1940) the genus comprises seven species and, although its content has been changed substantially by subsequent workers, the total of species has been maintained. The additions are *C. slevini* Loveridge (1950) from southeast Queensland, and the type species *C. novaehollandiae* Steindachner which was resurrected from the synonymy of *C. australis* (Gray) by Tyler & Martin (1975). The species recognised by Parker but subsequently removed from the genus are *C. inermis* and *C. alboguttatus*, which were shown by Straughan (1969) and Tyler (1974) respectively to be hylid frogs of the genus *Litoria*. Cogger (1975), on seemingly arbitrary grounds, retains *alboguttatus* in *Cyclorana*. However, we continue to regard it as a hylid frog of the genus *Litoria*, a disposition which has now received additional support from chromosomal studies (Morescalchi & Ingram, 1974).

It has been suggested that the genus *Cyclorana* has hylid affinities, and also that Australian hylids and leptodactylids are derived from a common ancestor (Tyler 1970). There are considerable data in support of the first hypothesis: affinities in musculature were demonstrated by Tyler (1972), similarities of proportions of the adrenal catecholamines by Robinson & Tyler (1972) and similarities in larval structure and biology by Watson & Martin (1973). In addition, N. G. Stephenson (pers. comm.) has found that there are numerous chromosomal similarities between *C. platycephalus* and species of *Litoria*.

In the course of studies of the poorly documented species *C. brevipes* and *C. cultripes* we had difficulty in confirming the identification of preserved specimens in various museum collections. Eventually it became clear that several undescribed species are included under these names. Our purpose here is to define the existing species and describe new ones and thus take a further step towards evaluating the genus.

MATERIAL AND METHODS

Specimens reported here are deposited in university and museum collections abbreviated as follows:—

- A.M. = Australian Museum, Sydney
- B.M. = British Museum (Natural History) London
- J.C.U. = Department of Biology, James Cook University of North Queensland, Townsville
- M.C.Z. = Museum of Comparative Zoology, Harvard University, Boston, U.S.A.
- M.U.D.Z. = Department of Zoology, University of Melbourne
- N.M.V. = National Museum of Victoria, Melbourne
- N.P.W.S. = National Parks and Wildlife Service, Yeerongpilly, Brisbane
- N.T.M. = Northern Territory Museum, Alice Springs
- Q.M. = Queensland Museum, Brisbane
- S.A.M. = South Australian Museum, Adelaide
- W.A.M. = Western Australian Museum, Perth

Methods of measurement and of recording and analysis of mating calls follow our previous treatment of members of this genus (Tyler & Martin 1975).

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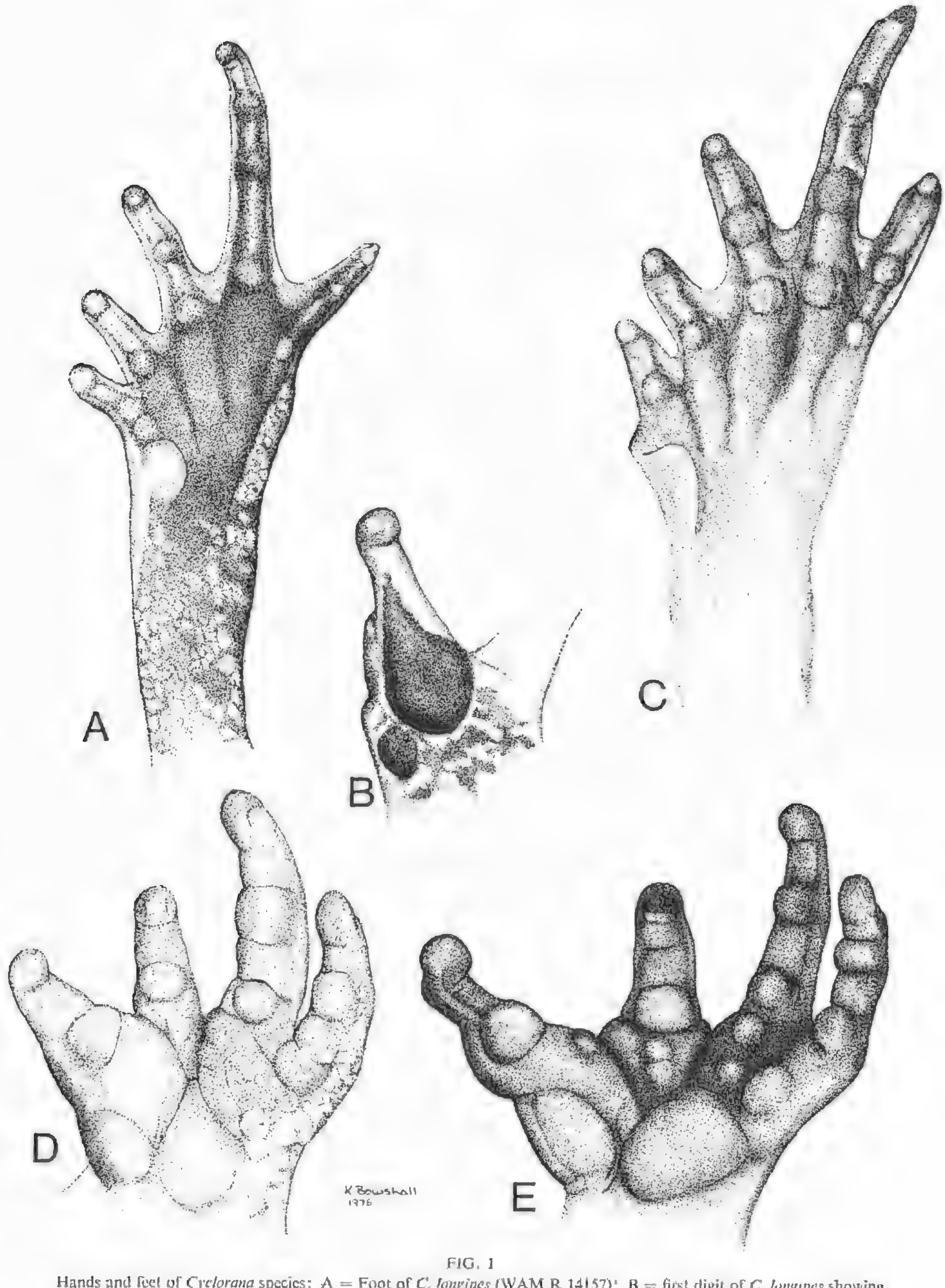

FIG. 1

Hands and feet of *Cyclorana* species: A = Foot of *C. longipes* (WAM R 14157); B = first digit of *C. longipes* showing nuptial pads (WAM R 14157); C = foot of *C. cultripes* (NMV D 12703); D = hand of *C. longipes* (WAM R 14157); E = hand of *C. cultripes* (NMV D 12703).

SYSTEMATICS

Cyclorana Steindachner, 1867

The leptodactylid frogs of the subfamily Cycloraninae are distinguished morphologically from those of the Myobatrachinae by possession of a broad tongue, and omohyoideus muscle, pedunculate alary processes on the hyoid, and confluent occipital condyles.

Cyclorana is distinguished from all other cycloranine genera by possession of a differentiated intermandibularis muscle, forming an apical element. It is further distinguished from *Notaden* by possession of teeth on the maxilla and premaxilla, and from *Heleioporus*, *Mixophyes* and *Neobatrachus* by having the first finger opposed to the remainder (Fig. 1).

Lynch (1971) has provided a detailed generic diagnosis of *Cyclorana*, and we defer any major redefinition pending completion of our studies of all members of this genus. However, insofar as the species discussed here are concerned, the following data diverge from Lynch (1971), who studied other species:—

> Squamosal:—The zygomatic process of the squamosal is in extensive juxtaposition with the maxilla (not a feature confined to *australis*).
>
> Palatine:—Each palatine bears pronounced pre- and post-choanal alae.
>
> Tympanum:—The tympanum is normally visible, but is completely covered with skin in *C. cryptotis*.

Within the genus *Cyclorana* several species groups are recognisable. *C. australis* and *C. novaehollandiae* comprise one group. They are large, robust frogs (S-V range for adults 61·4-120 mm) in which there is exostosis of the maxillary, premaxillary, frontoparietal and squamosal bones (Tyler & Martin 1975). *Cyclorana platycephalus* is similarly a large frog but lacks exostosed skull bones. It has extensive webbing between the toes, and possesses a shovel-shaped inner metatarsal tubercle. *Cyclorana dahli* is a large frog adapted to aquatic conditions. It has fully webbed toes but lacks such a tubercle, and lacks an exostosed skull.

The remaining species are smaller in size, possess two separate nuptial pads on the first finger (Fig. 1), and have little or no webbing between the fingers. These species form the subject of the present paper.

All the species on which we have call data share an essentially similar mating call structure. Following the interpretation of Watkins (1967) of signals of the kind represented, the basic call structure can be described as a pulse-modulated pure frequency. Interspecific variations occur in frequency, pulse rate and duration of the signal.

To assist in treatment of the undescribed forms the currently recognised species *C. brevipes* (Peters) and *C. cultripes* Parker are first redefined.

Cyclorana brevipes (Peters)

Chiroleptes brevipes Peters, 1871, Mber. Akad., Berlin 1871: 648

Chiroleptes brevipalmatus Gunther, 1876, J. Mus. Godeffroy, 12: 47

Phractops brevipes: Nieden, 1923: 523

Cyclorana brevipes: Parker, 1940: 21

Holotype: A presumably subadult specimen (S-V 31 mm) collected at Bowen ("Port Bowen"), Queensland, by Godeffroy. Specimen now missing (G. Peters *in litt.*).

Definition: A small or moderate-sized species (S-V of males 36-45 mm), clearly distinguished from congeners by its smooth skin and striking dorsal pattern of sharply demarcated areas of dark pigment on a very pale greyish or brownish background (Fig. 2).

Description: The head is broadly rounded when viewed from above and ranges from being distinctly broader than long to almost as broad as long (HL/HW 0·84-0·98). The snout is rounded when viewed from above and in profile. The eye is conspicuous, its diameter almost one and one-half times the eye to naris distance. The canthus rostralis is straight and inconspicuous. The nostrils are inclined laterally and separated from one another by a distance which is almost invariably greater than the internarial span (E-N/IN 0·97-1·19). The tympanum is entirely visible except for the upper portion of its annulus which is occasionally hidden beneath the supratympanic fold.

The tongue has a diameter of about one-half of the gape of the mouth, and is almost entirely free behind. The choanae are small and widely spaced, and the vomerine teeth are on obliquely converging elevations whose posterior margins reach or extend behind the posterior margins of the choanae.

The fingers are short, unwebbed and without lateral fringes. The foot has a prominent inner metatarsal tubercle. The toes are webbed only at the base, the webbing on the fifth toe not reaching the subarticular tubercle at the base of the penultimate phalanx. The hind limbs are very short (TL/S-V 0·36-0·45).

The skin of the dorsal surface is entirely smooth. The ventral surface is smooth anteriorly and finely granular on the abdomen.

In preservative the dorsal surface is pale grey marked with sharply defined vermiculations of black or dark slate. There is a narrow white vertebral stripe extending posteriorly at least as far as the sacral region. Dark markings are commonly absent from the posterior margin of the head, creating a pale, transverse, broad post-ocular bar. There is a dark stripe from the tip of the snout to the eye. The posterior surfaces of the thighs are an immaculate dull brown. The ventral surface is usually white or a dull cream colour, with the submandibular margin of adult males varying from pale grey to black.

Material examined: *Queensland*—QM J 18773-74 Ban Ban; JCU A15 (4 specimens), SAM R 3966 (2) Bowen; QM J 18776 14 km E. of Biggenden; AM R 16928 Gin Gin; QM J

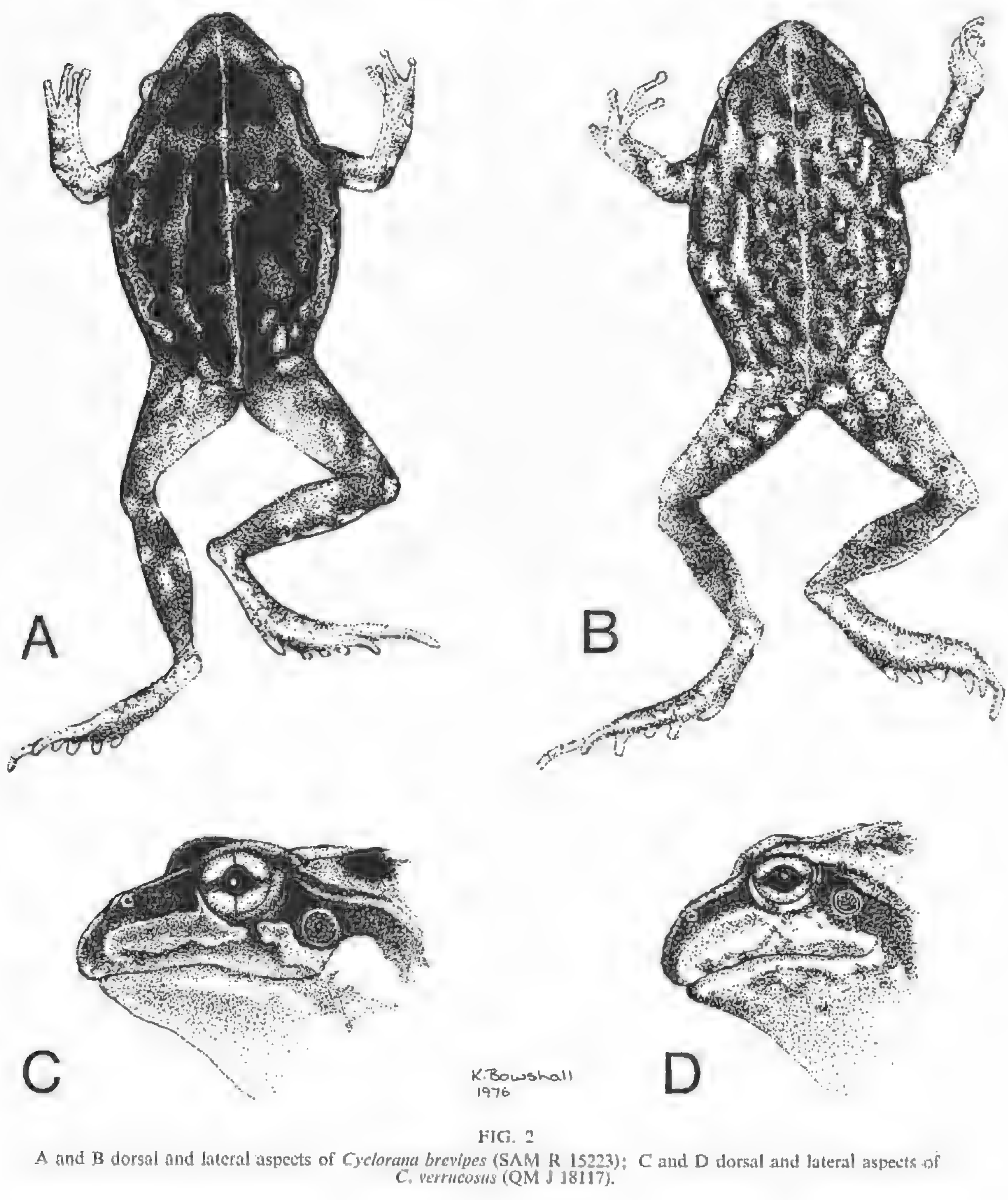

FIG. 2
A and B dorsal and lateral aspects of *Cyclorana brevipes* (SAM R 15223); C and D dorsal and lateral aspects of *C. verrucosus* (QM J 18117).

18775 Helidon; MUDZ 109/70, 110/70 6 km E. of Gracemere; SAM R 15223 Mourangee Station, Edungalba; QM J 18771, 18772, 18777, 18779, 18118, Murphy's Lagoon near Townsville; SAM R 15488 Bundaberg (alizarin); *New South Wales*—QM J 18778 Warrumbungle Natnl. Pk.

Comparison with other species: This species can be distinguished from all congeners except *C. longipes* and *C. maculosus* by the existence of very sharply demarcated areas of black or intense brown pigment on the dorsum. Detailed comparisons of these species with *C. brevipes* appear in the accounts of those species. Some other species possess dark markings but in none is there a sharp delimitation from the background colouration.

The existence of the dark markings is sufficient to distinguish the species from *C. cultripes* which (in preservative) is most commonly a dull, dowdy grey frog lacking any dark pattern. In addition *C. cultripes* tends to have shorter legs, the TL/S-V ratio for *C. brevipes* being 0·36-0·45 (mean 0·41) and for *C. cultripes* 0·33-0·40 (mean 0·37).

Call: Calls of *C. brevipes* were recorded 6 km E. of Gracemere, Qld., on 19-20.i.1970. The frogs were calling from positions near the margins of a permanent pond in lightly-forested country; wet bulb air temperatures at the calling sites ranged from 23·8°C to 25·8°C. Calls of five individuals were recorded, and mean values (with ranges in parentheses) are: call duration 1090 msec (957-1460); dominant frequency 1930 Hz (1470-2210); pulse repetition rate 169 pulses/sec (163-175) (Fig. 3).

Discussion: Chiroleptes brevipes Peters was based on a single, unsexed specimen with a "total length" (probably slightly more than snout to vent length) of 31 mm. No illustrations of the species were provided and, in the absence of the holotype and any previous critical studies, it is virtually obligatory for us to investigate its identity.

Boulenger (1882) referred *Chiroleptes brevipalmatus* Gunther to the synonymy of *brevipes*. In the light of the fraction of the Australian species known at that time, such an action also merits investigation. Insofar as the latter step is concerned our material conforms to, and varies from, the elaborate pattern depicted by Boulenger to an extent that eliminates any doubts based solely on external morphology.

Other than in size the only real areas of difference between our material and Peters' description of *brevipes* involve colouration. In particular none of our specimens tallies with the description of the surface of the thighs and of the ventral surface. Peters (1871) writes: "Die Hinterseite der Oberschenkel schwarz. Die ganz Unterseite einfarbig rostbraun". In other species examined by us there is not a difference of this magnitude between immature and adult material, leading us to attribute the darker colour of the holotype

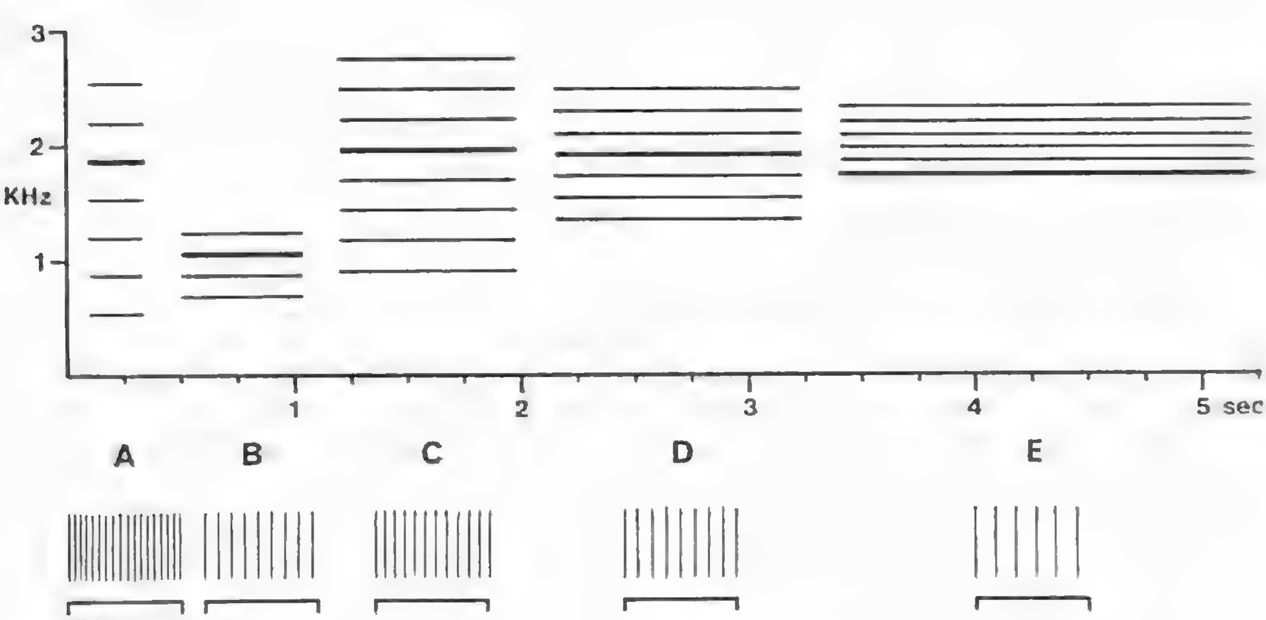

FIG. 3

Diagrams showing male mating call structure of: A, *C. cultripes*; B, *C. cryptotis*; C, *C. maini*; D, *C. brevipes*; E, *C. maculosus*. In each case the upper trace is a representation of an audiospectrogram and the lower trace a diagram of the pulse repetition rate, showing the number of pulses in a 50 msec segment of the call. Details of recording localities are contained in the text.

venter to an artefact of preservation, rather than to an ontogenetic trend.

Distribution: In addition to the localities cited above, this species has been taken at Port Denison, Peak Downs and Gayndah (types of *C. brevipalmatus*) and from Coomooboolaroo Station, Qld. (Slevin 1955). As indicated in Fig. 4 the species occurs in coastal Queensland south of latitude 19°, and east of the Great Dividing Range.

A series of four frogs (NMV D0737-40), taken at Lower Archer River on the Cape York Peninsula by J. Thompson in 1933, has been excluded from this species but is not assigned to any other at this stage. Their narrowly spaced nostrils (E-N/IN 1·22-1·25) are conspicuously different from the habitus of all 21 measured specimens throughout the considerable geographic range of *C. brevipes*. It is conceivable that these frogs represent *longipes* despite the vast gap in distribution between the Lower Archer River and north-eastern Western Australia.

Cyclorana cultripes Parker

Mitrolysis alboguttatus (non Gunther): Loveridge (1935): 13 (part).

Cyclorana cultripes Parker, 1940: 22 (part).

Holotype: BM 1908. 2.25.33, an adult male, collected at Alexandra, Northern Territory, by W. Stalker.

Definition: A moderate-sized species (males 43-52 mm, females 44-55 mm) with short hind limbs; dorsally marked with a broad, pale, transverse,

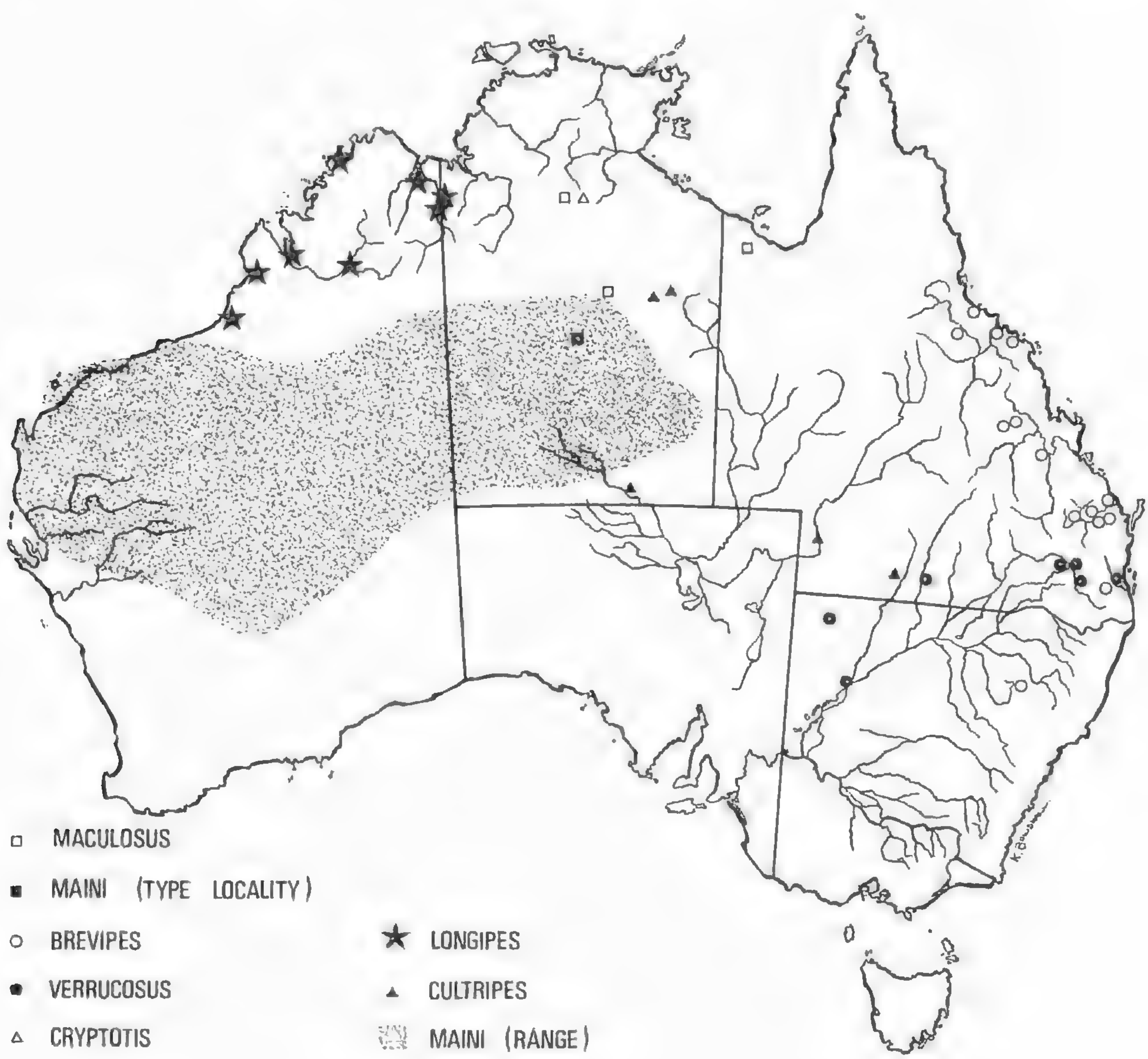

FIG. 4
Distribution of seven species of *Cyclorana*. The stippled area represents the geographic range of *C. maini*.

postocular bar and a narrow, pale vertebral stripe on an otherwise featureless dorsum (Fig. 5).

Description: The head is triangular and distinctly broader than long (HL/HW 0·88-0·97). The snout is rounded when viewed from above and in profile. The eye is inconspicuous but its diameter is greater than the eye to naris distance. The canthus rostralis is straight and inconspicuous. The nostrils are inclined laterally and are separated from one another by a distance which is greater than or less than the eye to naris distance (E-N/IN 0·89-1·31). The tympanum is entirely visible except for a portion of the superior margin of its annulus which is hidden beneath the supratympanic fold.

The tongue is broad and is almost entirely free behind. The choanae are small and widely spaced, and the vomerine teeth are on oblique converging elevations whose posterior margins just reach or extend posterior to the posterior margins of the choanae.

The fingers are short, unwebbed and lack lateral fringes. The foot has a prominent inner metatarsal tubercle (Fig. 1). The toes are only slightly webbed, the webbing on the fifth toe not reaching the subarticular tubercle at the base of the penultimate phalanx. The hind limbs are very short (TL/S-V 0·33-0·40).

The skin of the dorsal surface is smooth except for occasional tubercles on each side of the midline in a few specimens. Ventrally the skin is weakly granular in the posterior portion of the abdomen and smooth elsewhere.

In preservative the dorsum is a dull and uniform greyish or brownish colour. A pale postocular bar varies from being conspicuous to just detectable, whilst a very fine, white or creamish vertebral stripe can be seen quite clearly. The ventral surface is usually cream with the throat of males a dark grey. NMV D 12703 is entirely grey ventrally, but this may be an artefact of preservation.

Material examined: Northern Territory—BM 1908. 2.25.33 (Holotype), BM 1947. 2.18.46-47 (Paratypes), MCZ 11647, Alexandra; NMV D 5732 Charlotte Waters; NMV D 12703 "Central Australia" Spencer Collection; SAM R 14724-25 Alroy Downs; SAM R 14726 Barrow Creek. *Western Australia*—WAM R 27251 17 km N. of Argyle turn off on Duncan Highway. *Queensland*—NPWS 12610, 12622 Durham Downs; NPWS 12628-29, 12632-36 Dynevor Downs.

Comparison with other species: Cyclorana cultripes is set apart from most congeners by its rather drab appearance. The dull greyish or brownish dorsum is relieved only by the pale postocular bar and the mid-vertebral stripe. Of the six other species reported here only *C. cryptotis* shares the absence of particularly conspicuous patches or mottling of the dorsal surface. The externally visible tympanum distinguishes *C. cultripes* from *C. cryptotis* which has the tympanum covered with skin and so not visible externally. *Cyclorana cultripes* lacks the dark lateral head stripe of *C. maini*.

Call: Calls of two specimens of *C. cultripes* were recorded at Alroy Downs, N.T., on 12.xii.1971. This locality is approximately 70 km W.S.W. of the type locality. The frogs were calling from the margins of a flooded roadside ditch; the wet bulb air temperature was 23·8°C. Means and ranges of call values are: duration 221 msec (220-223); dominant frequency 1879 Hz (1857-1900); pulse repetition rate 373 pulses/sec (370-375) (Fig. 3).

Distribution: As presently defined *C. cultripes* is known from five localities, all in or adjacent to the Northern Territory. The presence of the species as far south as Charlotte Waters indicates that it probably occurs in South Australia. However the specimen involved is part of the Spencer Collection. Thus the precision of the locality is questionable.

Discussion: Parker (1940) was the first to observe that a wide diversity of animals were being identified as *brevipes*. Accordingly he referred four of the specimens available to him to the new species *cultripes* which he erected to accommodate specimens from "Western New South Wales, Northern Territory and northern West Australia, probably northern South Australia also". Parker was certainly correct in recognising the existence of an additional species, but he included in his type series a female from Wilcannia on the Darling River, N.S.W. This individual we refer to the new species, *verrucosus*. Similarly Parker's deductions about the identity of specimens from other parts of Australia and not examined by him are attributable to other species described in the present paper.

Cyclorana verrucosus new species

Phractops brevipalmatus (non Gunther), Fry 1915: 70.

Phractops brevipes (non Peters), Loveridge, 1935: 12.

Cyclorana cultripes Parker, 1940: 22 (part).

Holotype: QM J 18105, a gravid female collected 18 km W. of Dalby, Queensland by I. R. Straughan on 8.ii.1964.

Definition: A moderate-sized species (males 35-45 mm; females 39-48 mm S-V) with a dull and diffusely marked dorsal colouration and a slightly to extremely warty dorsal skin surface.

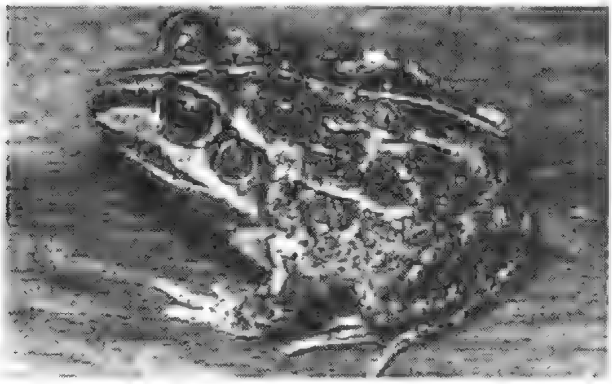

FIG. 5
Cyclorana verrucosus. Photo: A. Easton

Description of Holotype: The head is high, broadly triangular and distinctly broader than long (HL/HW 0·91). The snout is rounded when viewed from above and in profile. The eye is large and prominent, and its diameter is equivalent to one and one-third times the distance between the eye and the naris. The canthus rostralis is poorly defined and very slightly curved. The nostrils are inclined dorso-laterally and are separated from one another by a distance very slightly less than the internarial span (E-N/IN 1·03). The tympanum is visible except for a small superior portion of the annulus which passes beneath the supratympanic fold.

The tongue is very broad and is almost entirely free behind. The choanae are small and broadly spaced and the vomerine teeth are on oblique, converging elevations whose posterior margins are anterior to the posterior borders of the choanae.

The fingers are slender and unwebbed and lack lateral fringes. The foot has a prominent inner metatarsal tubercle and the toes are webbed only at the base. The webbing on the fifth toes does not reach the subarticular tubercle at the base of the penultimate phalanx. The hind limbs are short (TL/S-V 0·45).

The skin of the dorsal surface bears numerous, raised, circular, oval and elongated tubercles. There is a rather prominent supratympanic fold. The skin is finely granular on the lower thighs and abdomen and smooth on the pectoral and submandibular region.

The dorsal surface is a very pale olive colour with small darker patches conforming to the tubercles and intermediate zones of dark grey. There is a narrow dark stripe from the tip of the snout to the eye, broadening as a dark postocular patch covering the tympanum and bordered superiorly and posteriorly by the supratympanic fold. There is an extremely narrow white vertebral stipe (Fig. 5). The posterior surfaces of the thighs are dark brown mottled with paler areas (Fig. 2). The ventral surface is dull cream with indistinct and sparse faint brown mottling on the submandibular area.

Dimensions: S-V 43·8 mm; TL 19·5 mm; HL 17·3 mm; HW 19·1 mm; E-N 3·6 mm; IN 3·5 mm; E 5·7 mm; T 3·5 mm.

Paratypes: There are 15 adult paratypes: *Queensland*—QM J 12274, Brookstead via Pittsworth, recd. I. R. Straughan 17.ii.64; QM J 18108, 18116 21 km E. of Dalby, coll. A. K. Lee and I. R. Straughan, 16.xi.63; QM J 18111 18 km W. of Dalby, coll. I. R. Straughan, 8.ii.64; QM J 18104, 18107 Waratah Stn. via Cunnamulla, coll. A. K. Lee; QM J 18109, 18112, 18114-15, 18117, Warrawee near Petrie, coll. I. R. Straughan, 7.xii.62-10.ii.64; *New South Wales*—BM 1947.2.18.48 (formerly 1911.3.28.1, and AM R 5149), Wilcannia, Darling River (Paratype of *C. cultripes*), MCZ 3585-86 (same locality), all coll. W. Stalker; SAM R 14081 Sturt Ntl. Pk. near Tibooburra, coll. R. Galt.

The male paratypes range in size from 37·3 to 45 mm and the females from 37·2 to 49·2 mm. Variations in body and limb proportions are presented in Table 1. The paratypes are fairly homogeneous and share a conspicuously roughened dorsal surface with diffuse markings. The dorsum varies from greyish to an obscure very dark brown; the posterior surfaces of the thighs are commonly a different shade of brown to the dorsum, and are usually irregularly flecked with pale grey. The vertebral stripe is a constant feature. The throats of the male paratypes are deeply suffused with uniform slate.

An additional four specimens probably represent *verrucosus*, but have been excluded from the paratype series, because of doubt about their conspecificity. Three are recently metamorphosed

TABLE 1

SIZES AND PROPORTIONS OF SOME *CYCLORANA* SPECIES

Species	n	S-V ♂♂	S-V ♀♀	TL/S-V	E-N/IN	HL/HW
brevipes	21	36·4-45·8	33·0-38·3	0·36-0·45	0·97-1·19	0·84-0·98
cryptotis	1	40·8	—	0·42	1·13	0·81
cultripes	18	42·7-52·2	44·0-55·1	0·33-0·40	0·89-1·31	0·88-0·97
longipes	10	37·5-45·9	43·8-47·8	0·36-0·45	1·12-1·36	0·90-0·95
maculosus	6	47·4-49·5	48·8-50·6	0·31-0·38	0·95-1·14	0·90-0·95
maini	50	35·4-46·4	38·7-47·2	0·33-0·41	0·97-1·23	0·88-0·98
verrucosus	16	34·7-45·0	39·2-47·8	0·35-0·45	0·94-1·25	0·89-0·96

Measurements are in millimetres.

juveniles (QM J 18106, 18110, 18113) ranging from 18·4 to 22·4 mm S-V. There is also a transforming tadpole (QM J 18119). The series was taken at Waratah Station with two of the *verrucosus* paratypes.

Comparison with other species: For many years field workers in eastern Queensland have recognised the existence of two species. The first is *C. brevipes*, and the second has been erroneously referred to as *C. cultripes*. With clarification of the morphology of *C. cultripes*, the Queensland population can be distinguished quite readily by its tendency to exhibit verrucosities on the skin (*C. cultripes* is usually quite smooth), the extensive irregular mottling of the dorsum (see Fig. 2), and by a tendency for *verrucosus* to have longer hind limbs (Table 1).

Although *C. brevipes* and *C. verrucosus* both have extensive dorsal pigmentation, the dark markings of *C. brevipes* are sharply defined peripherally, whereas *C. verrucosus* is diffusely marked. Individuals of both species may be rough skinned, but the verrucosities in *C. verrucosus* are rendered conspicuous by being surrounded by areas of paler pigmentation. In *C. brevipes* there is no such highlighting and they are indistinct. In lateral view (Fig. 2) *C. verrucosus* has a higher head than *C. brevipes*. As in members of the *C. australis* group (Tyler & Martin 1975), we have been unable to express these differences in a quantitative fashion.

Distribution: *Cyclorana verrucosus* extends from south-eastern Queensland to north-western New South Wales. It is sympatric with *C. brevipes* over a limited portion of its range (Fig. 4).

Cyclorana maculosus new species

Holotype: SAM R 14719, an adult male collected at Daly Waters, Northern Territory by B. Low and D. F. Gartside on 13.xii.1971.

Definition: A moderate-sized species (males 47-49 mm, females 49-51 mm S-V) with short hind limbs and a pattern of markings in which there are strong contrasts of small dark patches on a lighter background (Fig. 6).

Description of Holotype: The head is rather flattened, triangular and distinctly broader than long (HL/HW 0·93). The snout is rounded when viewed from above and in profile. The eye is not prominent but its diameter is considerably greater than the eye to naris distance. The canthus rostralis is straight and distinguishable by the shelf-like structure of the maxilla. The nostrils are inclined superiorly and are separated from one another by a distance which is less than the eye to naris distance (E-N/IN 1·13). The tympanum is entirely visible but for a portion of the superior margin of its annulus which is hidden beneath the supratympanic fold.

The tongue is broad and is almost entirely free behind. The choanae are widely spaced and the vomerine teeth are on oblique, converging elevations whose posterior margins are anterior to the posterior borders of the choanae.

The fingers are slender and unwebbed. The foot has a prominent inner metatarsal tubercle. The toes are slightly less than one-half webbed; the webbing on the fifth toe not reaching the subarticular tubercle at the base of the penultimate phalanx. The hind limbs are very short (TL/S-V 0·34).

Macroscopically the skin of the dorsal surface is quite smooth; under low-power magnification it can be seen to be covered by numerous, flattened tubercles. Ventrally the skin is weakly granular over the posterior half of the abdomen, and smooth anteriorly.

The dorsal surface is a uniform very pale grey on which there are a few clearly demarcated black markings. There is a stripe from the tip of the snout through each nostril to the eye. Behind the eye this stripe envelops the tympanum and continues to the insertion of the forearm, bordered superiorly by the supratympanic fold. There are a pair of small ellipsoid markings on the scapula and elongate markings on the flanks and in the groin. There is a narrow white vertebral stripe and a pale postocular bar. The posterior surface of the thighs is a uniform dull grey. The ventral surface of the body is cream with a dark slate submandibular region.

This adult male specimen has a submandibular vocal sac with short, paired openings near the mandibular articulation, and two distinctly separated, brown nuptial pads on each first digit.

Dimensions: S-V 47·4 mm; TL 16·2 mm; HL 16·9 mm; HW 18·1 mm; E-N 3·6 mm; IN 3·2 mm; E 5·4 mm; T 3·6 mm.

Variation: There are five paratypes—SAM R 14717-18, collected at the type locality with the holotype; SAM R 7612, Doomadgee Mission, Qld., G. Douglas, February, 1966; NTM 3178, Stuart Highway at Tennant Creek, D. Lindner, 30.i.66; SAM R 14736, Tennant Creek, J. F. Field, April, 1907.

The paratypes comprise two adult males (S-V 48·8-49·5 mm) and three adult females (48·8-50·6 mm). In all specimens the limbs are short (TL/S-V 0·31-0·38). Topotypic material varies only in the extent and distribution of dark markings and differs from the holotype in the presence of a broad, pale postocular bar and a pale border on each side of the mid-vertebral stripe.

The lighter markings are most pronounced in the Doomadgee Mission specimen, whereas the paratypes from Tennant Creek vary from having minimal dark markings to extensive areas of dark pigment.

Comparison with other species: Cyclorana maculosus is a rather large species in comparison with the others described here. In fact each of the three adult males is larger than all males of all other species included. However it is its striking dorsal colouration that sets *maculosus* apart from congeners. Namely the isolated, jet black, patches contrasting with a pale background. The species with which there is partial sympatry (*C. cultripes* and *C. maini*) lack black patches, although the latter shares with *maculosus* a conspicuous dark stripe on the side of the head.

Call: The call of the holotype was recorded at Daly Waters, N.T., on 13.xii.1971. The site was

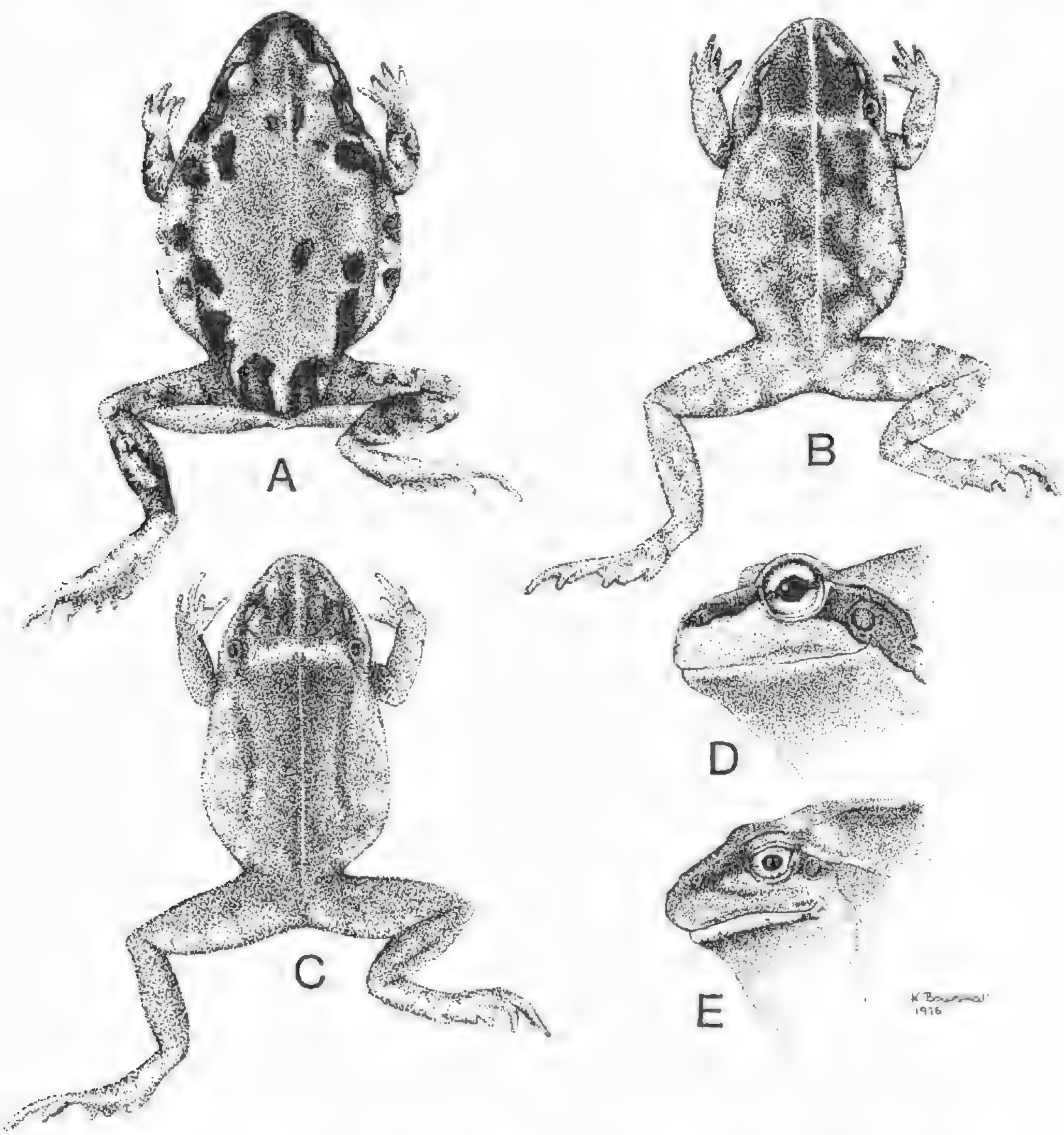

FIG. 6
Dorsal and lateral views of *Cyclorana* species. A = *C. maculosus* (SAM R 14717); B and C = *C. cultripes* (NMV D 12703, SAM R 14725); D = *C. maculosus* (SAM R 14717); E = *C. cultripes* (SAM R 14725).

a small roadside ditch; wet bulb air temperature was 24·1°C. Call values are: duration 1810 msec; dominant frequency 1767 Hz; pulse repetition rate 108 pulses/sec. (Fig. 3).

Distribution: The species is currently known from two localities on the Stuart Highway, N.T., and one in Queensland (Fig. 4).

Cyclorana cryptotis new species

Holotype: SAM R 14716, an adult male collected at Daly Waters, Northern Territory by B. Low and D. F. Gartside on 13.xii.1971.

Definition: A small species (male adult at 41 mm) which is also characterised by having the tympanum covered with skin (and hence invisible externally), and by its obscure greyish colouration (Fig. 7).

Description of Holotype: The head is rather flattened, broadly triangular and distinctly broader than long (HL/HW approximately 0·87). The snout is rounded when viewed from above and rather truncated in profile. The eye is not prominent but its diameter is greater than the eye to naris distance. The canthus rostralis is almost straight and very poorly defined. The nostrils are inclined superiorly and are separated from one another by a distance slightly less than the eye to naris distance. The tympanum is completely hidden beneath the skin.

The tongue is roughly circular, not large and almost entirely free behind. The choanae are widely spaced and the vomerine teeth are on elevations projecting slightly behind the posterior margin of the choanae.

The fingers are slender and unwebbed. The foot has a prominent inner metatarsal tubercle. The toes are approximately one-half webbed, the webbing on the fifth toe reaching the subarticular tubercle at the base of the penultimate phalanx. Hind limbs are of moderate size (TL/S-V 0·42).

The skin of the dorsal surface is covered with numerous and densely aggregated, flattened tubercles. Ventrally the skin is granular except in the pectoral region where it is almost smooth.

The dorsal surface is pale grey suffused with irregular darker markings. There is a narrow, disrupted, white vertebral stripe and broader, dark stripes between the nostril and eye and from the eye to the insertion of the forearm. The ventral surface of the body is cream with a greyish submandibular region. The plantar surface is lightly stippled with very dark brown. This adult male specimen has a submandibular vocal sac with short, paired openings near the mandibular articulation, and two distinctly separated, unpigmented nuptial pads on each first digit.

Dimensions: S-V 40·8 mm; TL 17·0 mm; HL 13·8 mm; HW 17·1 mm; E-N 3·4 mm; IN 3·0 mm; E 5·0 mm; T 2·2 mm.

Comparison with other species: *Cyclorana cryptotis* has few obvious affinities with other species. The lack of any dark markings on the dorsum is shared by *C. cultripes* and some individuals of *C. maini*. However *C. cryptotis* has the tympanum completely covered with skin, whereas it is visible externally in *C. maini* and all other members of the genus. A further feature unique to *C. cryptotis* is the rather compressed head producing the exceptionally low HL/HW ratio of 0·81 (0·84-0·99 are the limits of the ranges for all other species).

Call: The call of the holotype was recorded at Daly Waters, N.T., on 13.xii.1971. The frog was calling from the margin of a flooded ditch; wet bulb air temperature was 24·1°C. Call values are: duration 530 msec; dominant frequency 1060 Hz; pulse repetition rate 158 pulses/sec (Fig. 3).

Distribution: *Cyclorana cryptotis* is known solely from the type locality of Daly Waters, N.T., (Fig. 4).

Cyclorana longipes new species

Chiroleptes brevipalmatus (non Gunther), Fletcher, 1899: 678.

Phractops brevipalmatus (non Gunther), Fry, 1915: 200.

Holotype: WAM R 43258, an adult female collected at Mitchell Plateau (140° 52′ S: 125° 50′ W), Kimberley Division, Western Australia by L. A. Smith and R. E. Johnstone on 5.ii.1973.

Definition: A moderate-sized species (males 37·5-45·9 mm; females 35·8-47·8 mm) with a skin texture which varies from smooth to very coarsely granular, and a colouration of dark patches on a lighter background (Fig. 7). The nostrils are narrowly spaced (E-N/IN 1·12-1·36).

Description of Holotype: The head is high, triangular and almost as broad as long (HL/HW 0·91). The snout is triangular when viewed from above and evenly rounded in profile. The eye is small, its diameter equivalent to one and one-quarter times the distance between the eye and the naris. The canthus rostralis is distinct and very slightly curved. The nostrils are inclined dorsolaterally and are separated from one another by a distance which is less than the eye to naris distance

(E-N/IN 1·25). The tympanum is almost entirely visible except for the upper portion of the tympanic annulus which passes beneath the supratympanic fold.

The tongue is very broad and almost entirely free behind. The choanae are small and broadly spaced and the vomerine teeth are on prominent, oblique, converging elevations whose posterior margins are posterior to the choanae.

The fingers are moderately long, slender, unwebbed and without lateral fringes (Fig. 1). The foot has a small but prominent inner metatarsal tubercle. The webbing between the toes is comparatively well developed, and on the medial surface of the fifth toe reaches the posterior edge of the subarticular tubercle at the base of the penultimate phalanx. The hind limbs are very short (TL/S-V 0·38).

Anteriorly the skin of the dorsal surface is very coarsely granular. There are distinct plicae between the upper eyelids and in the form of a continuous dorsolateral glandular fold extending to the flanks. Posteriorly the skin becomes progressively less conspicuously granular, the individual granules being smaller and less prominent. The ventral skin is finely granular from the posterior surface of the thighs to the post-axillary pectoral skin fold. Anterior to that fold the skin is smooth. There is a small postmandibular gland.

The dorsal surface is a dull brown colour which is to a great extent covered by large, elongate, irregular patches of darker brown. The arrangement is disrupted on a level with the tympanum. There is a dark and clearly defined stripe from the tip of the snout through the nostril and eye to the tympanum. There is also a pale vertebral stripe which is quite broad above the sacral region and tapers to a very narrow line at the snout and cloaca. The posterior surfaces of the thighs are spotted with pale grey on a dark brown back-

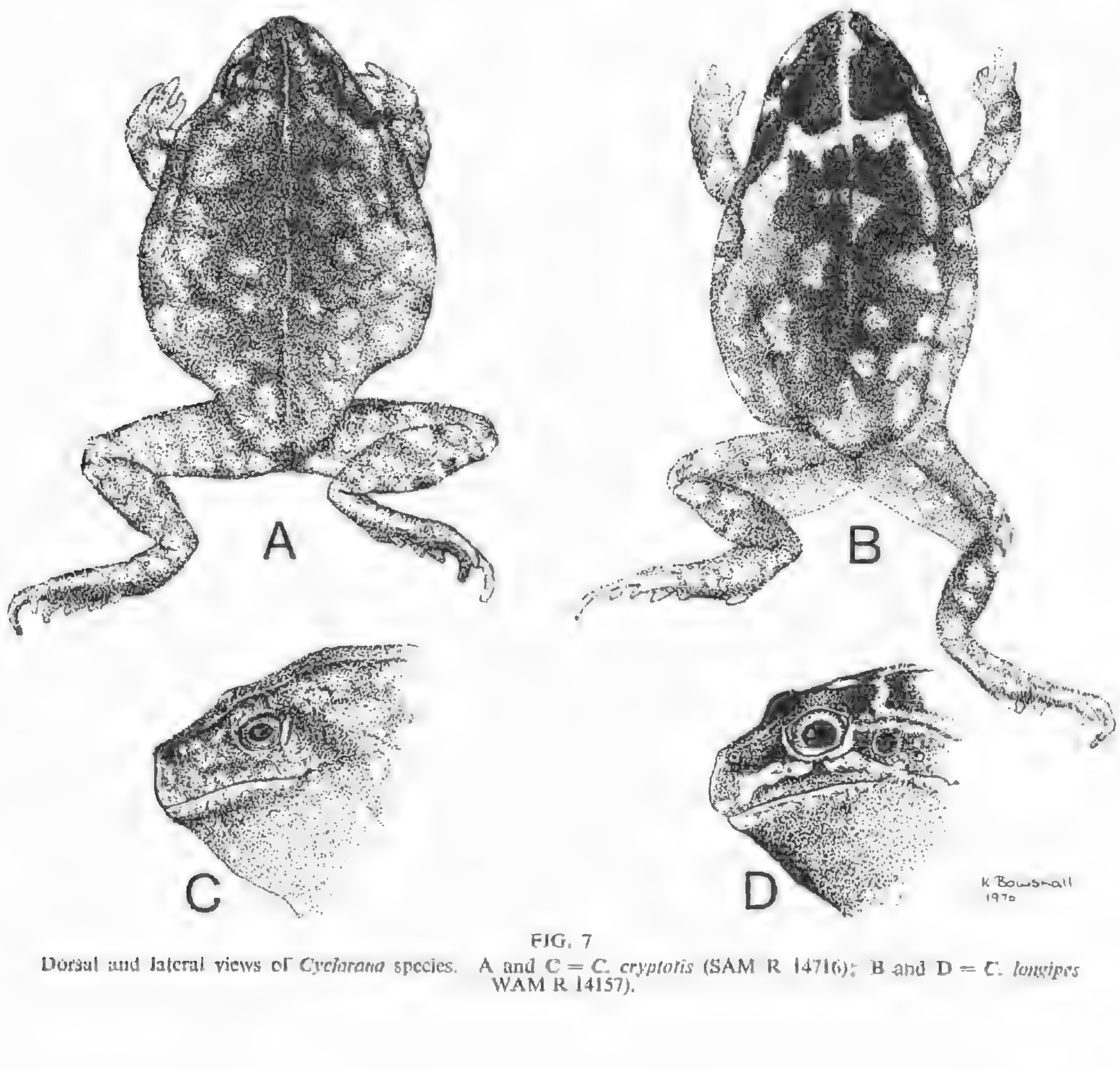

FIG. 7
Dorsal and lateral views of *Cyclorana* species. A and C = *C. cryptotis* (SAM R 14716); B and D = *C. longipes* WAM R 14157).

ground, and there is similar spotting in the groin. The ventral surface of the body and limbs is a dull cream.

Dimensions: S-V 47·8 mm; TL 18 mm; HL 16·3 mm; HW 18 mm; E-N 4 mm; IN 3·2 mm; E 5 mm; T 3·1 mm.

Variation: There are 43 paratypes, comprising nine adults and 34 juveniles, all from localities in Western Australia: WAM R 14157, Broome, K. Male. 14.ii.1962; WAM R 43199-43200, L. A. Smith & R. E. Johnstone 5.ii.73, R 43268-75, Smith & Johnstone 21.ii.73, R 43294-95, R 43346 Smith & Johnstone 22.ii.73, all from Mitchell Plateau; WAM R 32349-51, Wyndham, T. Nelson 19.iv.68; WAM R 44735-59 Lake Argyle, Smith & Johnstone, 5.i.72; WAM R 42388, Mt. Phire, W. H. Butler 29.ix.63.

None of the female adult paratypes is as large as the holotype female, their size being 35·8-43·8 mm. Males have an S-V length range of 37·5-45·9 mm, and there is a female 40·3 mm long. The subadult material ranges in S-V length from 21·8 to 33·2 mm.

Variations in adult dimensions are shown in Table 1; the consistently high E-N/IN ratio (1·12-1·36) is notable.

Colouration of adults and juveniles is rather variable. In the figured specimen from Broome the darker markings are particularly extensive, because the longitudinally arranged markings have partly coalesced. In many juveniles and adults from the Mitchell Plateau the longitudinal orientation is detectable, but the markings are broken up into separate segments. The featureless post-orbital area, the presence of a mid-vertebral stripe and the spotted pattern of light markings on the posterior surface of the thighs are the only features common to all individuals.

Males have a submandibular, unilobular vocal sac and the submandibular area of the largest male (WAM R 14157) is almost black.

Comparison with other species: All individuals of *C. longipes* exhibit a dorsal pattern in which there are black markings on a contrasting light background. The only other species sharing such a feature are *C. maculosus* and *C. brevipes*. *Cyclorana maculosus* tends to be a shorter-limbed frog (TL/S-V 0·31-0·38 as opposed to 0·36-0·45 in *C. longipes*). Similarly *C. maculosus* has a lower E-N/IN ratio range of 0·95-1·14, compared with 1·12-1·36. Other data in Table 1 indicate that *C. longipes* may be a slightly smaller species. However, existing samples of adults of each species are inadequate to confirm the apparent trend.

Distribution: Fletcher (1898) reported *Cyclorana brevipes* (as *Chiroleptes brevipalmatus*) from two localities in northern Western Australia (Kings Sound and the junction of Margaret Creek with the Fitzroy River). Parker (1940) attributes the records to *C. cultripes*. However the situation of these localities within the range of *longipes*, and the striking similarity of *longipes* to *brevipes*, cause us to favour the new identification. Thus *C. longipes* is now known to occupy the coastal zone of northern W.A. and to penetrate inland via the Fitzroy River. At its southern boundary the arid Eighty Mile Desert effectively isolates the species from *C. maini*. However there is no such geographic barrier to dispersal in the west, and *longipes* may extend into the Northern Territory and be sympatric with at least one other species reported here.

Cyclorana maini new species

Chiroleptes brevipalmatus (non Gunther), Spencer (1896): 165.

Cyclorana sp., Warburg (1967): 27, (1972): 91.

Cyclorana cultripes (non Parker), Cogger (1975) pl. 214.

Holotype: SAM R 15191. An adult male collected at Barrow Creek, Northern Territory by D. F. Gartside and B. Low on 11.xii.1971.

Definition: A moderate-sized species (males 35·4-46·4 mm; females 38·7-47·2 mm) characterised by a dark lateral head stripe and irregular darker patches on a pale dorsum in most specimens (Fig. 8).

Description of Holotype: The head is high, distinctly broader than long, evenly rounded when viewed from above and projecting slightly downwards in profile (HL/HW 0·93). The eye is large and prominent, and its diameter is equivalent to one and one-half times the diameter of the distance between the eye and the naris. The canthus rostralis is straight and quite prominent. The nostrils are inclined dorsolaterally and are separated from one another by a distance very slightly greater than the internarial span (E-N/IN 1·03). The tympanum is visible and is not overlapped by the supratympanic fold.

The tongue is very broad and slightly free behind. The choanae are obliquely inclined and are separated in the midline, and the vomerine teeth are on converging, oblique elevations whose posterior margins are posterior to the choanae.

The fingers are slender, unwebbed and without lateral fringes, and have prominent subarticular tubercles. The foot has a prominent inner metatarsal tubercle and the toes are long and webbed only at the base. The webbing on the fifth toe extends slightly above the base of the penultimate phalanx. The hind limbs are very short (TL/S-V 0·36).

The skin of the dorsal surface is very slightly pitted and raised tubercles on other areas are totally lacking. The supratympanic fold is weak and the skin of the ventral surface is almost entirely smooth. The posterior surfaces of the thighs are weakly granular.

The dorsal surface is a dull brown on which areas of darker pigment are densely scattered. A fine white vertebral stripe is present, and a dark stripe extends between the nostril and the eye, and then divides at the axillary region and is covered posteriorly by isolated patches of dark pigment on the flanks.

The submandibular region is an intense dark grey, and the remainder of the ventral surface is dull creamish.

This male specimen has paired nuptial pads on the first finger and a submandibular vocal sac.

Dimensions: S-V 46 mm; TL 16·8 mm; HL 16·3 mm; HW 17·6 mm; E-N 3·6 mm; IN 3·5 mm; E 5·2 mm; T 3·3 mm.

Variation: There are 95 paratypes—*Northern Territory*—NTM 2309-11, 2316, Arid Zone Research Institute 5 km S of Alice Springs

FIG. 8
Dorsal and lateral views of *Cyclorana maini* (NTM 2311).

21.x.64; SAM 15192 10 km S of Alice Springs 3.xi.63; SAM 6311, 14715 27 km S of Alice Springs; NTM 3177 Mt. Doreen Stn., D. Lindner 23.i.66; SAM R 13038 A-D, Toko Range, S. Parker 20.i.72; *Western Australia*—SAM R 1711 Well No. 26, Canning Stock Route Expedition; WAM R 1440 Laverton, P. C. Warren, 1925 (accessed); WAM R 1510-11 Booylgoo Stn., E. L. Michel, 1925 (accessed); WAM R 10216 Mundabullangana, D. Lukis, 1951 (accessed); WAM R 10634 Roeburne, T. Stove, 1952 (accessed); WAM R 20546 Nannine, P. J. Fuller, 2.iii.63; WAM R 28486-508, SAM R 5979, R 15341-46 Mt. Edgar, A. R. Main & G. M. Storr, February, 1961; WAM R 28517, R 28536 Jiggalong, 6.xii.1959, presumably E. Lindgren; WAM R 28634-35, R 28638-48, R 39193-94 Mundabullangana, G. M. Storr, February, 1961; WAM R 28795 New Yamarna, 29.i.1967, WAM expedition; 28806-07 44 km SE of Leonora, WAM expedition; WAM R 28984-85, R 28987 8 km S of Mundabullangana, R. M. Sadlier, 26.v.1960; WAM R 29127-28 Roeburne, Christchurch Grammar School, 22.v.67; WAM R 31444 presumably near Exmouth, D. G. Bathgate 1965-68; WAM R 32373-80, R 32382 Koordarrie, N.T., Allen, 1967; WAM R 33188, Woodstock, E. H. M. Ealey 18.i.56; WAM R 33212, R 34791, R 34793 Woodstock, E. H. M. Ealey, February, 1957; WAM R 34206-07 Wittenoom, E. P. Hodgkin, 2.iii.1954; WAM R 34208 S of Wanning, E. H. M. Ealey, June, 1954; WAM R 36092 40 km N of Carnarvon, R. Humphries *et al.*, 4.ii.1970; WAM R 36094-96 near Winning, R. Humphries *et al.*, 4.ii.1970; WAM R 36105-06 Barrabiddy Creek, R. Humphries *et al.*, 5.ii.1970; WAM R 36695 Mandidjarra R. H., NE of Carnegie, P. J. Fuller, 11.v.1970; WAM R 37248 Angel Is., Dampier Archipel., W. K. Youngson & P. Prince, 18.vi.1970; WAM R 39147 Talawana, J. B. Wade, 3.ii.1971; WAM R 40355 Durba Hills, W. H. Butler, early August, 1971; WAM R 45665-67, Bamboo Creek, A. M. & M. J. Douglas, 22.i.1974.

Because of the wide geographic area occupied by *C. maini* (Fig. 4), and because of limited data, particularly biological information, we are unable to give a definitive account of variation in this species. We can demonstrate that none of the individuals within this area represent *C. cultripes*, the species to which they have been referred in the literature; but we cannot assert that they all represent *C. maini*.

We have therefore omitted from our list of *C. maini* paratypes a number of individuals from Western Australia and the Northern Territory. Many are immature and others are so poorly fixed or preserved that positive identification is not possible. Others again are satisfactorily preserved but possess sufficient morphological divergence from our concept of *C. maini* to warrant their exclusion. Individuals from the Peterman Ranges and adjacent localities in southeastern N.T. and Western Australia fall into this latter category. We are not able to make specific identification of this material, but suspect that they represent an additional species remaining undescribed. Ranges of measurements of *C. maini* appear in Table 1.

Colour in life: Specimens from Jay Creek 20 km W of Alice Springs have an extremely variable colouration. Individuals can change from green to brown in a matter of a few hours. Invariably the pattern consists of dark and commonly longitudinally orientated markings on a paler background. In all specimens a dark canthorostral stripe continues behind the eye to the flanks.

Comparison with other species: Cyclorana maini as defined here is readily distinguishable from congeners. Possession of a tympanum distinguishes it from *C. cryptotis*, and the limbs of the latter species may be slightly longer (TL/S-V 0·33-0·41 in 50 *maini*; 0·42 in the single *cryptotis*). The nature of the dorsal pattern of markings in *C. brevipes*, *C. longipes* and *C. maculosus* (clearly demarcated islands of dark pigment on a pale background), distinguishes each from *maini* which has obscure longitudinal streaks. The allopatric *C. verrucosus* has a dorsal skin with raised folds or large tubercles highlighted by being surrounded by dark pigment. *Cyclorana cultripes* tends to be a larger frog lacking the dark lateral head stripe and distinguished, as are most other species, by differences in mating call parameters (Fig. 3).

Distribution: Extending from the Hammersley Ranges in Western Australia in a continuous broad arc throughout central and southern Northern Territory to the western border of Queensland (Fig. 4).

Habitat: Main & Storr (1966) state that this species occurs "in small temporary watercourses with sandy or gravelly beds", and occasionally in larger wooded creeks and at windmills. It is found in areas that form swamps in wet weather but are dry at other times, and specimens have been dug from depths of 25 to 35 cm (Main 1965). It is clear from our examination of several sites at which this species has been taken that it can occur in flat, open, arid country subject to seasonal flooding.

Call: Calls attributed to this species (reported as *C. cultripes*) are as follows. Main & Calaby (1957) describe the call in the Pilbara region as resembling a sheep bleating. Main (1965) considered it a "high pitched even maa-a-a-a-a". Main & Storr (1966) state that it is "loud, moderately high-pitched and rasping. Close up and in chorus, when the vibrato is clearly audible, the call sounds like an ambulance siren. At a distance it is more like the bleating of a sheep". Calls of two specimens were recorded at Barrow Creek, N.T., on 11.xii.1971. The frogs were calling at the edge of a pool in a sandy river bed; wet bulb air temperature was 22·6°C. Call values (mean and range) are: duration 814 msec (775-852); dominant frequency 1922 Hz (1867-1977); pulse repetition rate 244 pulses/sec (232-255) (Fig. 3).

Biology: Main & Calaby (1957) state that eggs are approximately 1·2 mm in diameter. Main (1965) reports the tadpoles to be comparable to those of *C. platycephalus* and that in their later stages they are pink with an opalescent sheen.

Details of the diet of 12 adult frogs are provided by Main & Calaby (1957) and of a further three by Calaby (1960). Termites and ants predominated in the diet of those individuals, but a small centipede was included.

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Dr. Gunther Peters provided information on the fate of the type of *C. brevipes*, whilst the Queensland Museum generously made available the photograph of *C. verrucosus* taken by Mr. A. Easton. Finally we wish to express our deep gratitude to Miss K. B. Bowshall for the superbly executed line drawings of each of the species.

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RECORDS OF THE
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A NEW SPECIES OF *THYLACOLEO* (MARSUPIALIA: THYLACOLEONIDAE) WITH NOTES ON THE OCCURRENCES AND DISTRIBUTION OF THYLACOLEONIDAE IN SOUTH AUSTRALIA

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Summary

A new species, *Thylacoleo hilli*, is described from the Town Cave of Curramulka, South Australia, based on an upper carnassial P3, which is about half the size of that of *T. carnifex* but otherwise almost identical. It is markedly larger than the Miocene species of *Wakaleo* Clemens & Plane, and because there is no indication of such a diminutive Pleistocene species, it is suggested that *T. hilli* is of Late Tertiary, possibly Miocene-Pliocene age.
A summary of the sites of thylacoleonid discoveries in South Australia is also presented.

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ABSTRACT

PLEDGE, NEVILLE S. 1975. A new species of *Thylacoleo* (Marsupialia: Thylacoleonidae), with notes on the occurrences and distribution of Thylacoleonidae in South Australia. *Rec. S. Aust. Mus.* 17 (16): 261-267.

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A new species, *Thylacoleo hilli*, is described from the Town Cave of Curramulka, South Australia, based on an upper carnassial P^3, which is about half the size of that of *T. carnifex* but otherwise almost identical. It is markedly larger than the Miocene species of *Wakaleo* Clemens & Plane, and because there is no indication of such a diminutive Pleistocene species, it is suggested that *T. hilli* is of Late Tertiary, possibly Miocene-Pliocene age.

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INTRODUCTION

In 1956, the late Alan Hill collected an unusual tooth from the far recesses of the Town Cave (Y2) at Curramulka, on Yorke Peninsula, South Australia.

The Curramulka Town Cave had a natural 30 m shaft entrance which was enlarged so that the cave could be used as the town's water supply. The easier passages were explored early, bones being noted in passing. Germein (1960) published a popular account of his 1936 visit to the cave. In 1959, Messrs. B. Daily, G. Gross and P. Aitken of the South Australian Museum visited the cave, following reports from the Cave Exploration Group of South Australia (CEGSA) which examined it in 1956. Daily excavated lime- and sand-encrusted bone, including a partial skeleton of *Thylacoleo carnifex* (P12784) and a crushed skull of *Protemnodon* (P13027).

The cave is developed in the Early Cambrian Kulpara Limestone along a system of vertical joints that probably were originally open to the surface, such as those that can now be seen in the nearby council quarry. The fissures filled with sediment and debris, which became partly lithified as a tough, red bone-breccia. Subsequent ground water movement apparently re-excavated the fissures from the bottom, leaving high narrow passages roofed with breccia. Remains of Pleistocene marsupials have been found in this breccia and in the soft red silt that partially clogs some parts of the cave. It is from the latter that Daily's specimens were collected, in the section called the "Bedroom Chamber". Although it has not yet been properly prepared or identified, a cursory inspection of the fossil fauna suggests that it is of Late Pleistocene age. Hill's specimen, however, does not fit this hypothesis and suggests that at least some parts of the cave may date from Tertiary times. This is discussed below.

The tooth is interpreted to be the upper left carnassial (P^3) of *Thylacoleo*, but is so much smaller than that tooth in other members of the genus that it warrants the erection of a new species.

DESCRIPTION

Systematic Palaeontology:

Marsupialia
Phalangeroidea
Thylacoleonidae
Thylacoleo Owen
Thylacoleo hilli sp. nov.

Diagnosis: *Thylacoleo* with P^3 about half as long as in *T. carnifex*.

Holotype: upper left P^3, registered no. P18621 in the South Australian Museum.

Type locality: Town Cave (Y2), Curramulka, Yorke Peninsula.

Etymology: I have pleasure in naming this species for its finder, the late Alan Hill, a founding member of CEGSA in 1956, and a dynamic speleologist until his untimely death in 1972.

Description:

The only known specimen, P18621, an upper left P^3, measures 24·4 mm long which is less than half the length of the equivalent tooth of *Thylacoleo carnifex*. It has a long trenchant ridge, with the highest point over the anterior root (broken away). The height is 12·2 mm on the outer face. From here the crista descends abruptly on the anterior face to a point below the general base level of the crown, though not so obviously as in *T. carnifex*. Posteriorly from the anterior cusp, the crest descends gently (at about 20° below the horizontal, the base of the enamel being taken as horizontal) for a little more than halfway before abruptly levelling out to form the posterior "cusp" over the posterior root, then descends again at the same rate. In profile it is similar to P^3 of *T. carnifex*, although with less development of the anterior "cusp",

1st June, 1977

There are more obvious differences in occlusal view. In *Thylacoleo hilli*, P^3 is relatively broad and shows a rather tuberous outline in contrast to the more slender form of *T. carnifex*. However, the crest has the same sigmoid form, starting slightly mesiad at the anterior end and curving, convex outwards, to the anterior "cusp". Thence it is almost straight until the midway break-in-slope, where it bends slightly but sharply outwards to the posterior "cusp", after which it curves gently outwards to reach the posterior extremity. The sigmoid curve is thus rather more angular than in *T. carnifex*.

As in *Thylacoleo carnifex*, the anterior cusp is buttressed with a noticeable internal ridge and a somewhat more rounded external ridge, but in contrast to *T. carnifex*, this is not the widest part of the tooth. That point occurs

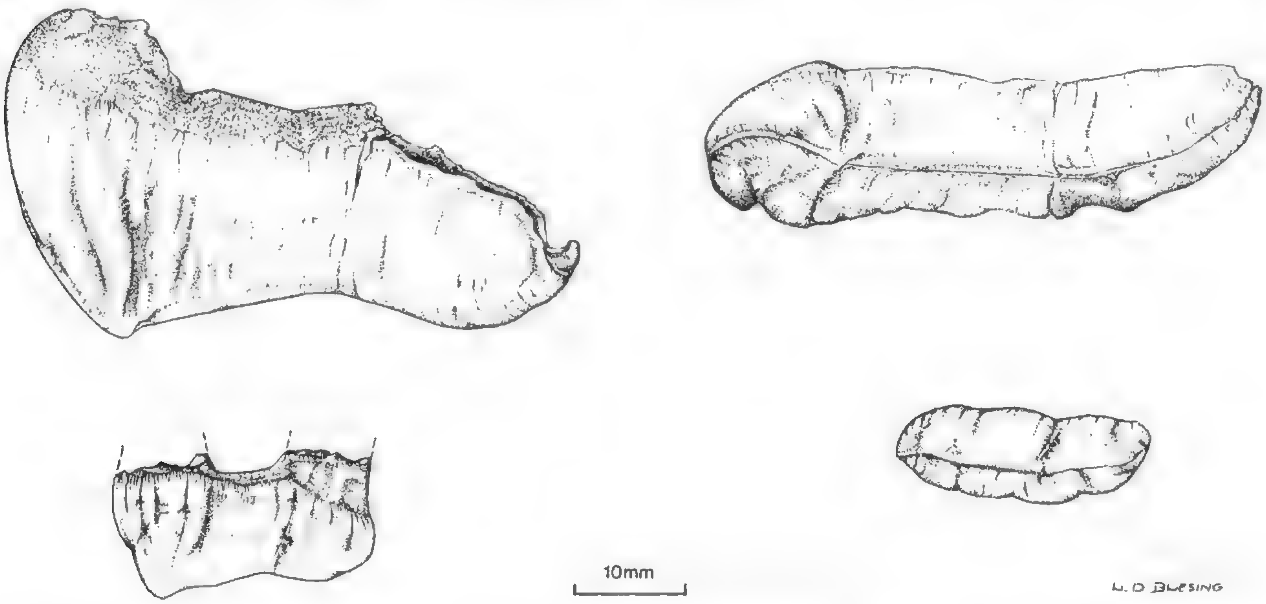

Fig. 1. Comparison of upper premolars of *Thylacoleo carnifex* P17654 (upper drawings) and *T. hilli* P18621, holotype, (lower drawings), in labial (left) and occlusal (right) views.

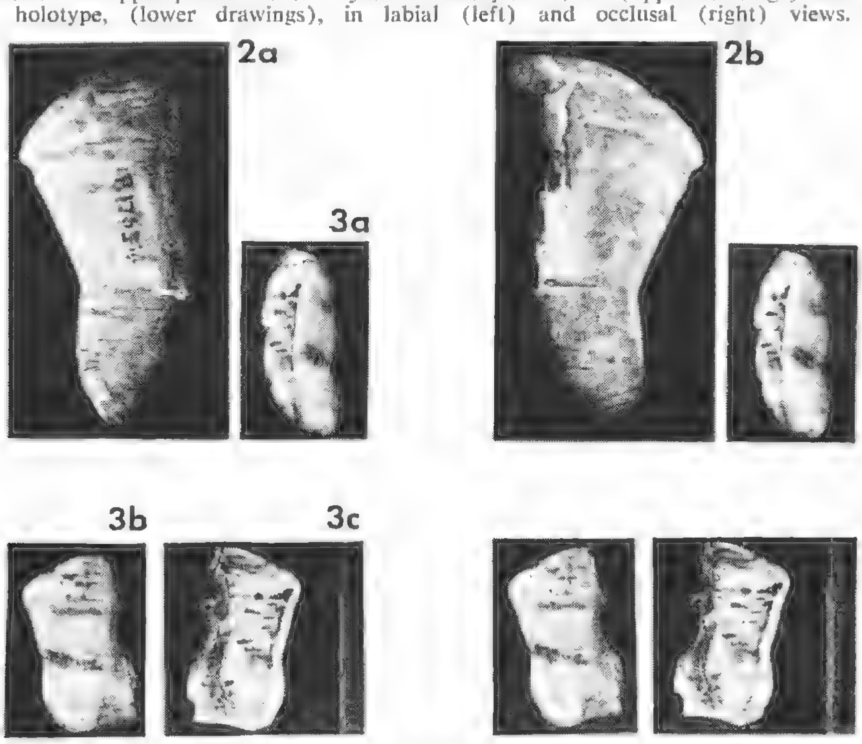

Fig. 2. *Thylacoleo carnifex* left P^3 (SAM P17654) a: labial view; b: lingual view. Natural size.

Fig. 3. *Thylacoleo hilli* n. sp. left P^3 (SAM P18621) Stereopairs; a: occlusal view; b: labial view; c: lingual view. Natural size.

slightly posterior to the cusp and just before the midpoint of the tooth. Again as in *T. carnifex*, the outer face is convex while the inner face is slightly hollow to maintain a constant sharp edge as tooth-wear progresses. This is particularly noticeable in the central region of the ridge, where tooth-wear has bevelled the inner face of the crest in a one-millimetre band. The hollow part of the face is apparently unworn, and is gently rugose in a vertical direction.

The anterior root appears to have been by far the stronger, although both are missing from the specimen. It has a deeply crescentic cross section at the base of the crown. There is no cingulum and the enamel thins and ends in a rather irregular line, as in *T. carnifex*.

Discussion: Apart from *Thylacoleo*, the only other form to which the Hill tooth could be compared is the lower premolar (P_3) of *Protemnodon* spp. (see Bartholomai 1974), but the differences in size and form (*Protemnodon* is too small, too flat-bladed and too narrow, and lacks the anterior descension of the crown enamel) are too obvious for this to seriously considered.

The possibility has been considered that the Town Cave tooth is an abnormal development. Various abnormalities of marsupial teeth have been discussed by Archer (1975) but the only type of interest here is the ephemeral tooth: that which may be present in embryo, but normally is resorbed or shed in young juveniles. There does not seem to be any certain way of distinguishing an isolated, unusually small tooth as a deciduous or ephemeral tooth. In the present instance, however, it is likely that this possibility can be discounted, for several reasons: (1) the tooth is well calcified and had well-developed roots (by contrast, some specimens of unworn *T. carnifex* premolars have very thin walled, fragile roots), (2) the enamel is thick and solid, (3) the tooth was functional, having a small but well-defined wear facet.

The Thylacoleonidae have a relatively long history, which unfortunately is poorly represented for most of its length. A single undescribed toothless palate from the Miocene Etadunna Formation (Ngapakaldi local fauna) (Stirton, Tedford and Woodburne 1968) in the Lake Eyre Basin, seems to be the first possible representative (Clemens and Plane 1974:659). This is followed by the two species of *Wakaleo* (Clemens and Plane 1974) from later Miocene deposits; then by the rather poorly known *Thylacoleo crassidentatus* (Bartholomai 1962) from the Pliocene Chinchilla Formation of the Western Darling Downs in Queensland. There is also an unidentified specimen from the Lower Pliocene Allingham Formation of north Queensland (Archer & Wade 1976:390), in which P^3 is relatively shorter than in *T. crassidentatus*, but larger than that estimated for *T. hilli* (M. Archer, pers. comm., 11.ii.75). The Allingham species has been compared with a specimen from Balladonia, W.A., mentioned by Merrilees (1968:14). The best known species, *Thylacoleo carnifex* (Owen 1859), is widespread in Australian Pleistocene cave deposits and in some other open situations (see Gill 1954).

Thylacoleo was an unusual animal in many ways, one of which was the apparent lack of deciduous cheek-teeth. Most notably, the large sectorial premolars apparently had no functional precursors, and persisted from the pouch stage to senility (Finch 1971). In two specimens in the South Australian Museum (P13721, P13829), these full-sized carnassials are almost fully erupted in jaws that are only 22-23 mm deep at the posterior end of the P_3 alveolus, and 85-90 mm long from the incisor alveolus to the angular process. Mandibles of mature *T. carnifex* reach a depth, at the P_3 alveolar margin, of up to 53 mm. The premolars are, therefore, apparently functional even in pouch young, although the two specimens mentioned above show no signs of wear. It is thus unlikely that the Curramulka tooth, *T. hilli*, which is slightly worn and has well-developed roots, is deciduous.

It is impossible, however, to present conclusive evidence one way or the other as to whether the tooth in question is permanent or deciduous. On the one hand, there is a slight indication that it could be deciduous by comparison with its postulated closest relatives. Woods (1956:138) has indicated its phalangeroid affinities, and certainly the jaw of *Wakaleo oldfieldi* bears some similarities in form with, say *Burramys*, which Broom (1898) concluded was close to the ancestral condition of the Thylacoleonidae. Many groups of phalangeroids have diminutive deciduous premolars (e.g. SAM M5539, a juvenile *Trichosurus vulpecula* with dP3, M1-3, and P3 unerupted below dP3.). At the same time, a koala M4625 has only the premolar and M1 fully erupted, and these premolars are identical in size and form with those in adult, even senile, individuals which suggests that the deciduous premolar, if it existed, was of very short duration. A deciduous cheek tooth in a koala embryo was noted by an early German embryologist (M. Archer, pers. comm., Nov. 1976).

On the other hand, there is good circumstantial evidence against the Hill tooth being deciduous, in that for all the scores of specimens

TABLE 1

Lengths of premolars of Thylacoleonidae (calculated parameters are based on the ratio for *T. carnifex* $P^3:P_3$ = 1·295)

Species	Carnassial Length			
	P^3		P_3	
	Range	Mean	Range	Mean
Thylacoleo carnifex—				
Darling Downs (Woods, 1956)	35·3-40·7	38·6 (N = 4)	49·8-53·8	51·7 (N = 3)
Wellington Caves (Australian Museum coll.)	35·7-46·0	39·8 (N = 48)	47·0-54·1	50·7 (N = 23)
Naracoorte Caves (S. Aust. Mus. coll.)	37·1-41·6	39·6 (N = 24)	49·2-54·5	52·2 (N = 14)
Total sample	35·3-46·0	39·6 (N = 76)	47·0-54·5	51·3 (N = 40)
T. crassidentatus—(Bartholomai, 1962)	35·6-41·4	37·5 (N = 4)		calc. 48·6
T. hilli n. sp.		calc. 18·8		24·4
Wakaleo vanderleuri (range of estimates)		13·5-15·3 (N = 1)		calc. 17·5-19·8
W. oldfieldi		12·4		calc. 16·1

of *Thylacoleo carnifex*, at all stages of development, there is no other tooth of similar size known. Also, the roots were not being resorbed. Accordingly, the easiest explanation is that it is a valid diminutive species.

Thylacoleo hilli gives the impression of being more akin to *Thylacoleo carnifex*. While there is an obvious similarity shown between the mandibles of *Wakaleo* and *Thylacoleo carnifex*, the P_3 of the former is of different proportions, being relatively shorter, while the molars are relatively larger and better developed (Clemens and Plane 1974). In contrast, the P^3 of *Thylacoleo hilli* is proportionally and morphologically closely similar to *T. carnifex* (see Fig. 1). It is not yet possible to compare directly the premolars of *Wakaleo* and *T. hilli*, but estimates of the size of the unknown premolars can be made, assuming that a regular size relationship between the upper and lower premolars of *T. carnifex* persists throughout the family. A large sample of premolars of *T. carnifex* in the Australian Museum, mostly from the Wellington Caves, and a somewhat smaller collection from the Naracoorte Caves, held by the South Australian Museum, have been measured, and using also the data in Woods (1956), the mean lengths of the upper and lowers calculated. The assumption was then made that the ratio of these two measurements ($P^3:P_3$) has been more or less constant at about 1.3. Using this constant, the lengths of P_3 of *Thylacoleo hilli* and P^3 of *Wakaleo* spp. have been calculated (see Table 1). It is seen that the premolar of *T. hilli* is closer in size to *Wakaleo* than to *T. carnifex*. However, as discussed above, its form is nearer to the latter. It is therefore more probably an ancestor of *T. carnifex*, and closer in time to *Wakaleo* than *T. carnifex*, but unlikely to be a descendant of *Wakaleo*. Clemens and Plane (1974) consider *Wakaleo* probably was not directly ancestral to *Thylacoleo carnifex*, and that thylacoleonid phylogeny was a plexus of lineages rather than a single line. *Thylacoleo hilli* would then represent a short twig near the axis of this plexus.

Age: The age of *T. hilli* is unknown, though presumably late Tertiary. It is unlikely to be Pleistocene, as there is no indication of it in any of the rich Pleistocene faunas known from Australia. It is not the same as the Balladonia *Thylacoleo* (Merrilees 1968; Archer & Wade 1976) which is regarded as Pleistocene. Nor is it likely to be a dwarfed Pleistocene species, produced by insular isolation in the same way as the pigmy elephants of some Mediterranean islands (e.g. Kurtén 1968:135), for although Curramulka is in the middle of the low and elongate Yorke Peninsula, there is no evidence that this has been an island at any time during the Cainozoic, and certainly not during the Pleistocene. Furthermore *T. carnifex* has been found in contiguous areas, such as Port Pirie and the Flinders Ranges, as well as in the Curramulka Town Cave itself and elsewhere on Yorke Peninsula. By comparison with the phylogenetic pattern of the Diprotodontidae (Stirton *et. al*, 1967) with its Pleistocene gigantism, and its absence from the late Pliocene Chinchilla and Mampuwordu sands, I suggest that *T. hilli* lived in late Miocene or early Pliocene times. However, this cannot be confirmed until more material and other associated species of the same age are found. Attempts to find the actual site within the cave, to collect more material, have so far been unsuccessful.

THYLACOLEONIDAE IN SOUTH AUSTRALIA

The discoveries of thylacoleonid fossils in South Australia are summarised in Table 2, and their distribution is shown in Fig. 4.

Remains of *Thylacoleo carnifex* were first reported from South Australia by Waterhouse (1879) in his annual report to the South Australian Institute. These were found, with *Diprotodon* "*Phascolomys*" (*Phascolonus gigas*) and *Macropus* by Mr. R. M. Robertson in a spring bog deposit in Salt Creek near Normanville. This deposit continued to yield bones until Zietz (1907) apparently worked it out with the discovery of more *Thylacoleo*. Zietz (1889) had previously reported *Thylacoleo* with *Diprotodon* from dam excavations at "Yam Creek, Bundaree". Gill (1954), unable to locate this place on a map, considered it a misspelling of Bungaree, but study of Museum reports shows that the site was at Bundey, about 40 km west of Morgan.

In the early 1900's, a fragment of *Thylacoleo carnifex* was found with other bones on the gravel bars of the Warburton River, near (old) Kalamurina. The source of these bones is probably the eroding channel deposits known as the Katipiri Sands (Stirton, Tedford & Miller 1961). This formation has yielded a single tooth at Lake Kanunka (idem) south of the Warburton River. Other open sites yielding *Thylacoleo* have been found in recent years: near Port Pirie, and at Lake Fowler, Yorke Peninsula.

At the turn of the century, *Thylacoleo* was found in cave deposits when William Reddan, Curator of the Naracoorte Caves, started excavating there, particularly in Alexandra Cave.

Zietz later undertook excavations in "Specimen Cave" and found considerable quantities of material. In recent years, better specimens have been collected from several other caves in the Naracoorte area: Haystall Cave (Pledge *et al.* unpubl.), Henschke's Quarry cave (Pledge in prep.), and particularly Victoria Cave (Smith 1971:185).

TABLE 2

Summary of distribution and discoveries of Thylacoleonidae in South Australia.

Locality	Type of Deposit	Collector	Year	Reference
Thylacoleo carnifex—				
Salt Creek, Normanville	Spring swamp	R. M. Robertson	1878	Waterhouse (1879)
Salt Creek, Normanville	Spring swamp	A. H. R. Zietz	1907	Zietz (1907)
Bundey, west of Morgan	Fluviatile (loam)	?	1889	Zietz (1890)
Kalamurina, Warburton R.	Fluviatile (channel?)	E. A. King	1905	S.A. Museum Report (1905-1906)
Alexandra Cave (U3), Naracoorte	Cave earth	Wm. Reddan	1900, 1907, 1912	
Specimen Cave (U35), Naracoorte	Cave earth	F. R. Zietz	1916	
Moorak, Mount Gambier	?(Well)	Campbell	1913	
Derrington Street, Mount Gambier	Cave	D. W. P. Corbett	1963	
James Quarry (U29), Naracoorte	Cave	N. B. Tindale and P. F. Lawson	1956	Daily (1961)
James Quarry (U29), Naracoorte	Cave	B. Daily, P. Aitken	1959	Daily (1961)
Cathedral Cave (U12/13), Naracoorte	Cave earth	B. Daily	1959	Daily (1961)
Town Cave (Y2), Curramulka	Cave earth	R. Sexton	1958	Daily (1961)
Town Cave (Y2), Curramulka	Cave earth	B. Daily	1959	Daily (1961)
Haystall Cave (U23), Naracoorte	Cave earth	N. Pledge *et al.*	1964	
Quarry, Curramulka	Fissure bone breccia	G. Pretty and N. Pledge	1967	
Fox Cave (U22), Naracoorte	Cave earth	F. W. Aslin	1968	
Mairs Cave (F3), Buckalowie Creek	Cave travertine	B. Daily *et al.*	1968	
Henschke's Quarry cave, Naracoorte (U91/97)	Cave earth	N. Pledge and F. Aslin	1969	
Victoria Cave (U1), Naracoorte	Cave earth	R. T. Wells *et al.*	1969	Smith (1971)
Port Pirie	Fluviatile (channel)	R. Elding	1973	
Lake Fowler, Yorke Peninsula	Gypsum lunette	J. McNamara	1975	
Thylacoleo hilli—				
Town Cave (Y2), Curramulka	Cave earth	A. Hill	1956	This paper
Wakaleo oldfieldi—				
Leaf locality, UCMP V6213, Lake Ngapakaldi	Wipajiri Formation, fluviatile (channel)	W. A. Clemens *et al.*	1971	Clemens and Plane (1974)

(Symbols such as U3, Y2, etc. are the official code numbers of caves as listed in the caves register of the Cave Exploration Group of South Australia, Inc.)

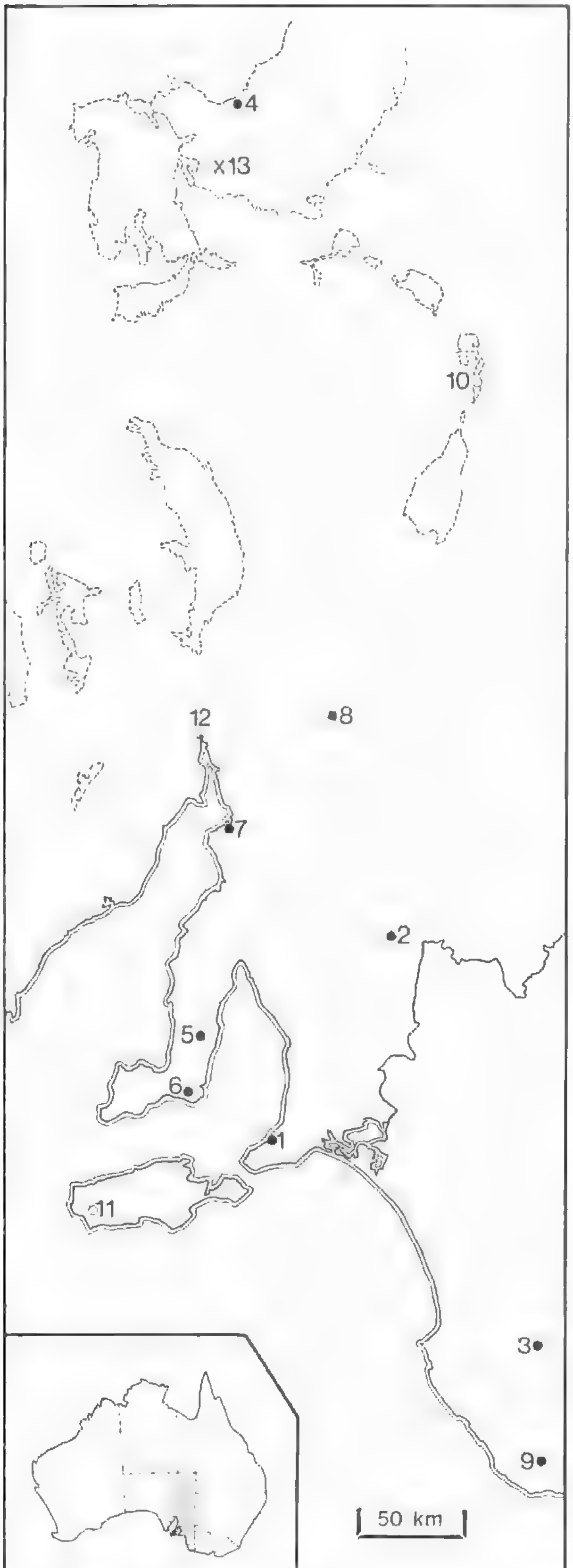

Fig. 4. Occurrences of Thylacoleonidae specimens in South Australia. ●: *Thylacoleo carnifex* ○: no record for the site, ×: *Wakaleo oldfieldi*. 1. Normanville, 2. Bundey, 3. Naracoorte, 4. Kalamurina (Warburton River), 5. Curramulka, 6. Lake Fowler, 7. Port Pirie, 8. Buckalowie Caves, 9. Mt. Gambier, 10. Lake Callabonna, 11. Rocky River, 12. Port Augusta, 13. Lake Ngapakaldi.

Partial skeletons were recovered from Cathedral Cave and from the two small caves in James Quarry, Naracoorte (Daily, 1960). The quarry and Town Cave at Curramulka on Yorke Peninsula, and Mairs Cave on Buckalowie Creek in the Flinders Ranges have also yielded some good material of *Thylacoleo carnifex*. *Wakaleo oldfieldi* was found in the Miocene Wipajiri Formation channel deposits at Lake Ngapakaldi (Clemens & Plane 1974).

Possibly more interesting than the occurrences outlined above are those richly fossiliferous areas where *Thylacoleo carnifex* has not been found. The species is apparently rare in the channel deposits intersected by the Warburton River and Cooper Creek. It is absent from the rich (though as yet poorly investigated) swamp deposits at Rocky River, Kangaroo Island, (Tindale, Fenner & Hall 1935) and has not been found in any of the cave deposits nearby. Most notably, there has been no sign of it (or any other carnivore) in the vast *Diprotodon* "graveyard" of Lake Callabonna. At the Salt Creek (Normanville) site, broken bones bearing distinct tooth or cut marks were recovered: these have been ascribed to *Thylacoleo* by A. Zietz (unpubl. note, 1907). No such indications have been reported from the Callabona fossils. No explanation has been offered for these apparent gaps in the range of *Thylacoleo carnifex*, and none will be attempted here, save that the reason may have some bearing on the animals way of life, which is still speculative.

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RECORDS OF THE
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METASQUALODON HARWOODI (SANGER, 1881)—A REDESCRIPTION

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BY NEVILLE S. PLEDGE AND KARLHEINZ ROTHAUSEN

Summary

The long-lost holotype and several undescribed paratype teeth of the squalodontid whale *Metasqualodon harwoodi* have been rediscovered, and form the basis for a more detailed description. Comparison is made with the teeth of other squalodontids from Australia and New Zealand, and based on Rothausen's revision of European Squalodontidae, an attempt is made to classify *Metasqalodon* more precisely. The teeth represent a valid genus.

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By NEVILLE S. PLEDGE* AND KARLHEINZ ROTHAUSEN†

ABSTRACT

PLEDGE, N. S. & ROTHAUSEN, K., 1977: *Metasqualodon harwoodi* (Sanger, 1881)—a redescription. *Rec. S. Aust. Mus.* 17 (17): 285-297.

The long-lost holotype and several undescribed paratype teeth of the squalodontid whale *Metasqualodon harwoodi* have been rediscovered, and form the basis for a more detailed description. Comparison is made with the teeth of other squalodontids from Australia and New Zealand, and based on Rothausen's revision of European Squalodontidae, an attempt is made to classify *Metasqualodon* more precisely. The teeth represent a valid genus.

General tendencies in the evolution of squalodontid teeth make it more likely that *Metasqualodon* is nearer to the evolutionary stage of longirostral Lower Miocene species of *Squalodon* in the Northern Hemisphere than to that of presently known brevirostral genera of the Southern Hemisphere. Nevertheless, curvature of the crown and roots, and the denticles on the anterior-most buccal tooth indicate that the teeth probably belong to a brevirostral form. This would mean that there was a tendency in the evolution of the teeth of brevirostral squalodontids similar to that shown in the longirostral forms of Europe.

In any case, this gives a supplementary indication to the disputed age of the find since, on the grounds of preservation, it has been determined as coming from the uppermost part of the Ettrick Formation, and is therefore very late Oligocene.

INTRODUCTION

In 1880, Sanger (1881) reported to the Linnean Society of New South Wales the discovery of a tooth and some fragments of a second at Wellington, South Australia. These he regarded as belonging to a new zeuglodont whale species "*Zeuglodon harwoodii*". He figured and described a "molar" tooth, consisting of a near-complete serrated crown and the upper, confluent part of the roots.

Later, Hall (1911), in discussing the systematic positions of *Squalodon* and "*Zeuglodon*" from Australia, compared "*Z.*" *harwoodi* and *Squalodon wilkinsoni* McCoy (1867), and put both into new genera: viz. *Metasqualodon harwoodi* (Sanger) and *Parasqualodon wilkinsoni* (McCoy). His treatment of *M. harwoodi* was necessarily only cursory and based on Sanger's rather inadequate paper, because the whereabouts of the type material was unknown.

In 1948, Charles Fenner, then Honorary Curator of Fossils at the South Australian Museum, discovered a box of teeth recorded as P8446 in the Palaeontological Register, and stored as a holotype. The box contained six teeth or fragments thereof, glued to a card labelling them as molars and canines. Two of the "molars" were also labelled as types. In addition, a slip bearing the legend (in script):

Zeuglodon teeth		
(Notodanus tooth)		separated
		100[r]
Wellington		
	J. C. Harwood	
Sydnam		Norwood

and a cutting of the text figures from Sanger's paper were enclosed. Fenner realised that this box contained Sanger's type material and more besides. The pencilled addition "separated" referred to the "*Notidanus*" tooth, which was not present in the box. This tooth was later discovered (1972) elsewhere in the collection, and bears the additional information on its card:

"Fossil shark tooth, Notidanus sp?
River Murray Cliffs near Wellington, S. Austral.
pres. by Mr. J. C. Harwood, December 1881."

The tooth is additionally labelled "*Notidanus primigenius*".

However, the whereabouts of *Zeuglodon harwoodi* was not disclosed for some time, for it was not seen by Flynn (1948) when he minutely described the nearly complete skull and mandibles of *Prosqualodon davidi* Flynn; nor was it seen by Glaessner (1955) when he established *Squalodon gambierensis*, although he later rediscovered it.

Rothausen (1968: pp. 85-86) established a terminology and some indices to standardise the description of squalodontid whales. Appendix

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8th August, 1977

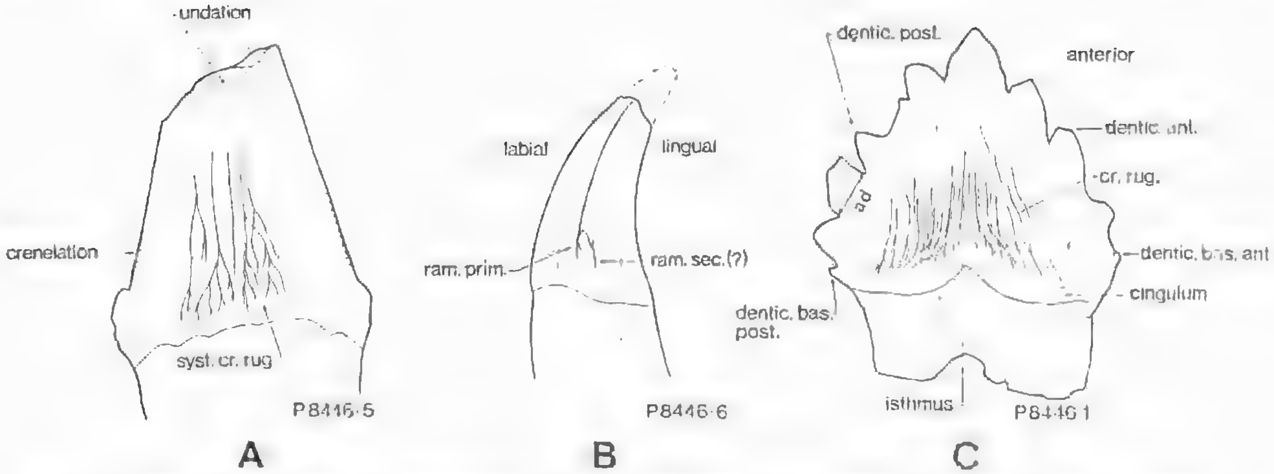

Fig 1. Feature terminology in Squalodontoid teeth. Diagrams not to scale. A. Internal face of P8446.6, diagramatically showing crenelation, syst. cr. rug. and undation. B. Anterior view of P8446.5, showing basal region of anterior carina with ram. prim. and possible ram. sec. C. Lingual view of P8446.1, showing anterior and posterior denticles, and dentic. bas. ant. and post., syst. cr. rug., and cingulum.

1 gives a summary of this terminology, with additional terms used herein. A number of them are commonly applied in the text as Latin abbreviations. See Fig. 1.

HISTORY OF STUDIES ON AUSTRALIAN AND NEW ZEALAND SQUALODONTIDS

Flynn (1948; p. 185) gave a precise and concise account of discoveries of and papers on Australasian archaeocetes and primitive odontocetes, therefore only the time from 1948 till now shall be considered except for a few references not mentioned by him.

1939. Pritchard describes a partial skull and jaws of a new whale *Mammalodon pritchardi*. The preserved teeth are extremely worn, to the extent that comparison with other squalodontoid teeth is not possible.

1942. Camp and Kellogg (in Camp 1942: p. 367) agree with Thomson (1905: p. 491) in contrast to Benham (1935a: p. 238) (who thought it a reptile as accepted by Neave 1940 (*b*): p. 395 in wrong spelling "*Tangarosaurus*"), that *Tangaroasaurus kakanuiensis* Benham, 1935 represents the rostrum of a squalodontid; accepted also by Romer (1945: p. 624; 1966: p. 392) and Dechaseaux (1961: p. 860) both in wrong spelling (*Tangarasaurus*), and by Rothausen in his revision (1965: pp. 656-658), who could verify it in detail.

1948. Flynn published a full description of the near complete skull of *Prosqualodon davidi* Flynn, 1923 discovered by him at Wynyard, Tasmania, in September 1919 (*vide* Mahoney and Ride 1975: pp. 161-162). He first mentioned it in 1920 and described and named it in 1923. An addendum by Carter (in Flynn 1948: pp. 192-193) gives a microscopic comparison of the enamel structure of *P. davidi*, "*Zeuglodon*" *osiris*, several carnivores, a creodont, and an ungulate (*Sus*). The two whales show a closer affinity to the ungulate than to any carnivore. Flynn here discusses also—with other odontocetes—the position of *Metasqualodon harwoodi*.

1948. Sanger's type material is rediscovered in Adelaide, but its importance is not fully realised, and its whereabouts are not made known immediately.

1955. Glaessner describes a buccal tooth, probably a lower right, found in Oligocene bryozoal limestone at Mt. Gambier. It is of a form not previously recorded from Australasia, and is given the name *Squalodon gambierense*. (Fig. 3M,N).

1961. Rothausen discusses the position of "*Microcetus*" *hectori* Benham 1935 (*b*) and he is sure that it at least belongs in another genus than the genotype *M. ambiguus* (v. Meyer, 1840).

1964. Dickson describes *Prosqualodon marplesi* Dickson 1964 from Upper Oligocene beds in New Zealand.

1965. Rothausen in a revision of European squalodontids also discusses the non-European forms in some detail. This part of his manuscript is not yet published, even in abstract form.

1970. Rothausen discusses general aspects of some Squalodontoidea from Australia and New Zealand in connection with the question of the Oligocene-Miocene boundary.

1972. Climo and Baker present an updated summary of studies on New Zealand squalodonts and describe a new genus and species *Austrosqualodon trirhizodonta* based on a pair of edentulous mandibles collected in 1970 in Duntroonian (Middle Oligocene) siltstone near Nelson, New Zealand. The genus is considered by these authors to be allied to *Squalodon* Grateloup, but differs in having a small median third root on the molariform teeth.

1972. Glaessner redescribes a cetacean tooth from New Zealand, previously described by Davis (1888) as *Squalodon serratus*. It is from the same stratigraphic horizon as *Kekenodon onomata* Hector 1881 and shows some similarities with, but is considerably smaller than, that species. Glaessner also to some extent clarifies the rather uncertain situation concerning isolated teeth of squalodontoids in the Australian-New Zealand area.

1973. Keyes describes, but does not name, two buccal teeth of a "protosqualodontid" from the Lower Oligocene of Oamaru, New Zealand. He also revises the records of all known fossil Cetacea from New Zealand.

1975. Mahoney and Ride, indexing the genera and species of Australasian fossil mammals, list fifteen species of fossil cetaceans, and *inter alia* note that the type of *Metasqualodon harwoodi* had disappeared and that the cranium and much of the skeleton of the type of *Prosqualodon davidi* Flynn had been lost in 1961 during renovations of the Zoology Department, University of Tasmania.

1976. Whitmore and Sanders review the Oligocene Cetacea, but do not mention *Metasqualodon*, apparently believing it to be a Miocene species.

In this present paper, a summary of the stratigraphic occurrences of the squalodonts of Australia and New Zealand, in the light of current knowledge and interpretation, is given in Table 1. This has been done in more detail for New Zealand species by Keyes (1973).

TABLE 1
STRATIGRAPHIC DISTRIBUTION OF AUSTRALASIAN SQUALODONTOIDEA

Species	Locality	Formation	Age	Age Reference
Tangaroasaurus kakanuiensis Benham, 1935a	Kakanui, Otago, N.Z.	Blue clay	Otaian-Altonian (Early to Middle Miocene) or Waitakian (Late Oligocene)	Keyes (1973) Climo and Baker (1972)
Prosqualodon davidi Flynn, 1923 ..	Fossil Bluff, Wynyard, Tas.	Fossil Bluff Sandstone	Early Longfordian (very early Miocene)	Ludbrook (1973)
Metasqualodon harwoodi Sanger 1881	Near Wellington, River Murray, S.A.	Ettrick Formation..	Janjukian (Late Oligocene)	This paper
Parasqualodon? wilkinsoni McCoy 1867	Castle Cove, Loc. AW3, Aire Coast, Vic.	Calder River Limestone	Janjukian (Late Oligocene to earliest Miocene)	Carter (1958) Ludbrook (1973)
Squalodon? andrewi Benham 1942	Clarendon Limestone Quarry, Otago, N.Z.		Waitakian (Late Oligocene)	
"Prosqualdodon" hamiltoni Benham 1937	Caversham Quarry, Dunedin, N.Z.	Caversham Sandstone	Waitakian (Late Oligocene)	–
Prosqualodon marplesi Dickson 1964	Near Trig. Z, Waitaki Valley, Otago, N.Z.	Waitoura Marl Member of Otekaike Limestone	(Late Oligocene)	-
"Microcetus" hectori Benham 1935b	Maerewhenua River, Waitaki Valley, Otago, N.Z.	Maerewhenua Glauconitic Limestone Member of Otekaike Limestone	Waitakian (Late Oligocene)	—
Austrosqualodon trirhizondonta Climo and Baker 1972	S.E. of Fossil Point, N.W. Nelson, N.Z.	Glauconitic Sandstone	Duntroonian (Middle Oligocene)	Keyes (1973)
Squalodon? gambierensis Glaessner 1955	Pritchard's Quarry Mount Gambier, S.A.	Gambier Limestone	Early "Janjukian" (Early Middle Oligocene)	Jenkins (1974) p.292
Squalodon? serratus Davis 1888 ..	Karetu River, North Canterbury, N.Z.	Weka Pass Stone	Whaingaroan-Duntroonian (Early Middle Oligocene)	Glaessner (1972)
Unnamed squalodontoid	Gay's Limestone Quarry, Weston, Oamaru, N.Z.	McDonald Limestone	Whaingaroan (Early Oligocene)	Keyes (1973)

TAXONOMY

Squalodontoidea Simpson, 1945
Squalodontidae Brandt, 1873
Squalodontinae Rothausen, 1968

Metasqualodon Hall, 1911

Metasqualodon harwoodi (Sanger 1881)

Zeuglodon Harwoodii Sanger 1881: 298-300, Fig. A, B.

Zeuglodon Harwoodi Sanger Stromer 1908: 147.

Metasqualodon harwoodi (Sanger) Hall 1911: 257, 262, 263, pl. 36, Fig. 7A, B (not Fig. 6).

Microzeuglodon ? Harwoodi (Sanger) Abel 1913: 220.

Zeuglodon harwoodi Sanger Abel 1913: 209.

S. harwoodi Sanger Winge 1919: 129.

Metasqualodon harwoodi (Sanger) Kellogg 1923: 20, 40.

Zeuglodon harwoodi Pritchard 1939: 153, 155.

Metasqualodon Hall 1911 Neave 1940: 133.

Metasqualodon harwoodi Flynn 1948: 186.

Metasqualodon harwoodi Glaessner 1955: 336.

Metasqualodon Hall 1911 Rothausen 1958: 372.

Metasqualodon (="*Zeuglodon*") *harwoodi* Thenius 1959: 273.

Metasqualodon harwoodi (Sanger 1881) Rothausen 1965: 659.

Metasqualodon harwoodi Rothausen 1970: Fig. 1.

Metasqualodon Hall 1911 Dubrovo 1971: 89.

Metasqualodon harwoodi Sanger Climo and Baker 1972: 61.

Metasqualodon harwoodi (Sanger) Glaessner 1972: 185.

Metasqualodon Keyes 1973: 384.

Metasqualodon harwoodi Mahoney and Ride 1975: 158.

Zeuglodon harwoodi Sanger *idem*: 164.

Holotype: A buccal tooth lacking only the distal parts of the roots, some points of the crown and part of the enamel at the labial face (Fig. 3A-B; Sanger 1881: p. 298, Fig. A-B). South Australian Museum, Adelaide P8446.1.

Paratypes: Five teeth or fragments of teeth (Fig. 3C-J). South Australian Museum, Adelaide P8446.2-6.

Type Locality: The teeth were found near Wellington, on the River Murray in South Australia (Fig. 2). ". . . in a bed of yellow calcareous clay, containing specimens of *Echinus, Spatangus, Clypeaster, Pecten, Turritella, Corbis* and *Spondylus*." (Sanger 1881: p. 298). These accompanying fossils have been lost, so their modern identities are unknown.

Age: Late Oligocene (see discussion below).

Diagnosis: Typical squalodontoid teeth with the following characteristics:

Posterior buccal teeth with many dentic. ant. and dentic. post. including dentic. bas. ant. and post. on antero-posterior carina. Labial face shows only few weak cr. rug., the lingual face stronger. Characteristic number of cr. rug. about 14-15, ID with 18.6 is small. Low values for ant.-post. diameter of crown base, middle value for apical-angle, and not a very high degree of symmetry. Root with two fangs, confluent at top by thin isthmus extending for up to 10 mm (estimated) but often less in more posterior buccal teeth.

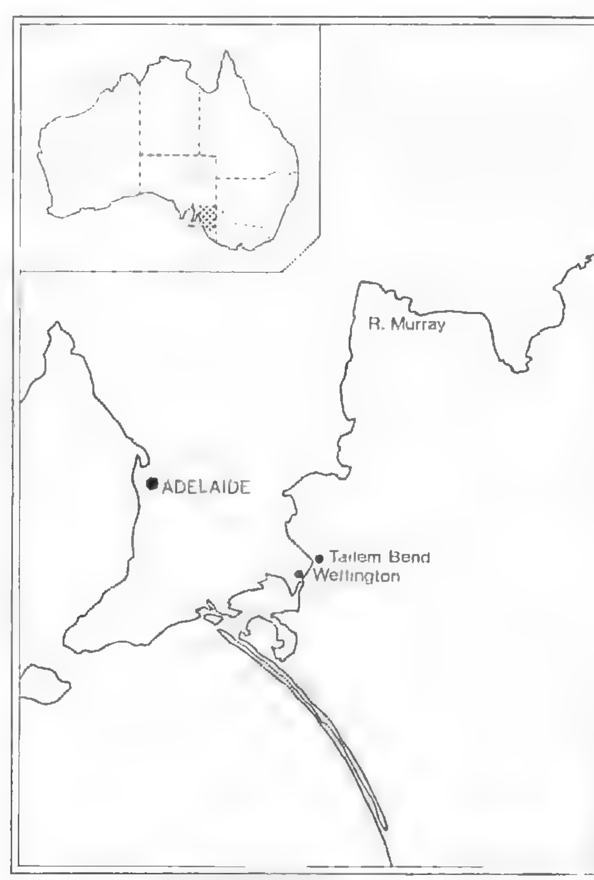

Fig. 2. Locality map.

Cheek teeth of more anterior position are similar but with fewer denticles and longer isthmus.

The anterior-most cheek teeth show one or two denticles.

Redescription of Holotype: The Holotype (P8446.1; Fig. 3 A, B) is a well preserved buccal tooth which lacks most of the roots, the points of several denticles, and part of the enamel from the labial face. The crown is laterally compressed, triangular in facial aspect, with a distinct antero-posterior carina which is occupied with a number of well-defined, acutely-pointed denticles: three dentic. ant. and one dentic. bas. ant. as well as five dentic. post. and one dentic. bas. post. The dentic. bas. on each side is very small, and others are about the same size, somewhat smaller than the apical point. All denticles bear an antero-posterior carina.

The greatest length of this buccal tooth is above the base of the crown, at the level of the apices of the dentic. bas. Greatest width is in that part of the crown above the anterior root. The base of the enamel is visible only on the lingual face, and is straight except for a median V-shaped embayment. Both faces show a wide "sulcus" in this position, which corresponds to the junction between the two roots.

The labial face bears faint, near-vertical cr. rug. which appear to converge near the apex, some also diverging to enter the denticles. The enamel of the lingual face is more strongly decorated: above a smooth basal zone (the cingulum) up to 4 mm wide, irregular stronger cristae rugae converge near the apex, some also diverging to enter the denticles. The cristae are most pronounced at their lower ends where they have developed small tubercular prominences bordering the cingulum, above which they are papillated, especially those of the posterior part of the crown. The cr. rug. die out without reaching the apex.

In anterior profile, the crown is more convex on the labial face, but this only concerns the anterior part of the crown. The apical part is slightly incurved. The enamel is thickened at the base to form a smooth cingulum.

The two roots are broken off about 6-7 mm below the crown. The anterior root is circular in section, the other is laterally compressed. The fracture shows the radial structure of the dentine, and shows that the pulp cavities of the two roots join within the thin isthmus which connects the proximal portion of the roots. Irregular, deep, vertical striations are seen on the parts of the roots nearest to the base of the crown, particularly on the labial face.

Most characters and indices (Table 2) are in good accordance with B^{9-10} dext. of European Squalodontinae, but with very small absolute dimensions.

TABLE 2

DIMENSIONS OF HYPODIGM TEETH OF *METASQUALODON HARWOODI*

	Holotype	Paratypes				
	P8446.1 post.B sup. ?	P8446.2 post.B fragm.	P8446.3 post.B inf. ? fragm.	P8446.4 mid.B sup. ?	P8446.5 mid.B sup. ?	P8446.5 ant.B sup. ?
(1) Max. ant.-post. diameter of crown ...	22·8	?	?	~17·5	11·9	8·6
(2) Ant.-post. diameter at base of crown (*a*)	20·4	?	?	~17·5	11·2	8·5
(3) Apical-angle	55°	?	?	>47°	33°	~31°
(4) Lat. diameter at base of crown (ant. in two-rooted teeth); (*b*)	8·8	?	?	>7·8	7·6	7·1
(5) Lat. diameter at base of post. part of crown in two-rooted teeth	7·2	?	?	>7·6	—	—
(6) Number of dentic. ant.	4	4	?	1	1	1
(7) Number of dentic. post.	6	?	?	2	1	0
(8) Ant.-post. diameter of largest dentic. post. (*ad*)	3·8	?	?	5·7	~3·4	—
(9) Index dentic. (in %)	18·6	?	?	—	—	—
(10 Characteristic number of cr. rug......	14/15	?	?	—	—	—
(11) Vertical width of cingulum in the preserved parts	~4	>2	~4	~3	~1·1	~1·7
(12) Index bas. (in %)	43·1	?	?	44·6	67·8	83·5
(13) Number of roots	2	2	2	2	1	1
(14) Extent of isthmus	>9	~8·5	>6·4	>10	—	—
(15) Max. lat. diameter of ant. root or single root	7·8	~8	?	~8·5	8·2	7·8
(16) Max. lat. diameter of post root	6·6	?	?	~7·5	—	—

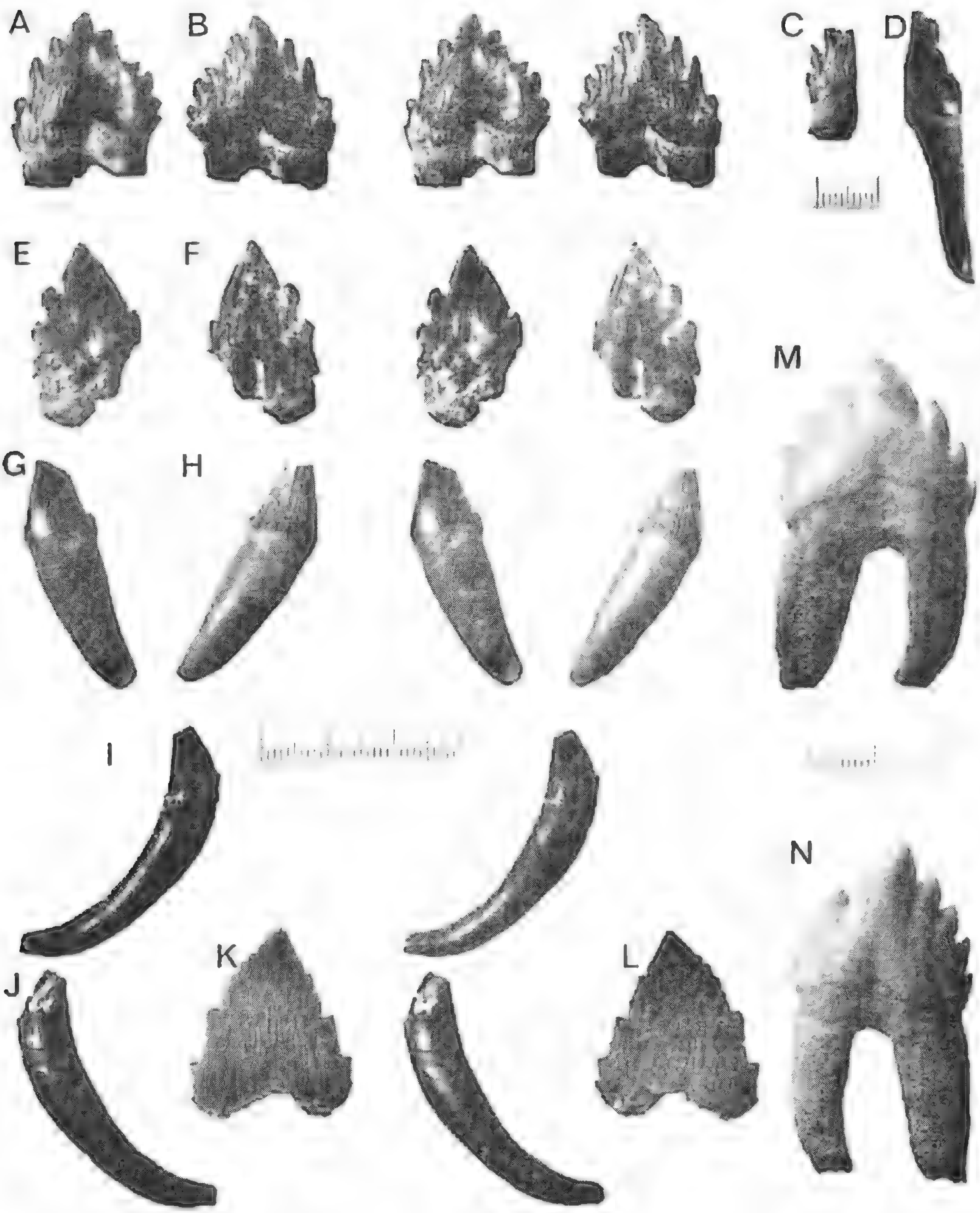

Fig. 3. A-J, the hypodigm teeth of *Metasqualodon harwoodi* (Sanger 1881). A. P8446.1, labial face; B. ditto, lingual; C. P8446.2, lingual; D. P8446.3, lingual; E. P8446.4, labial; F. ditto, lingual; G. P8446.5, labial; H. ditto, lingual; I. P8446.6, labial; J. ditto, lingual; K. *Prosqualodon davidi* Flynn, AUGD T857, labial; L. ditto, lingual; M. *Squalodon ? gambierensis* Glaessner, AUGD F15107, labial; N. ditto, lingual face.
All approximately natural size. A, B, E-J stereophotos and to the same scale.

Description of Paratypes: Sanger (1881: p. 298) mentioned a fragment of a second tooth in his original description. One fragment in the assemblage is labelled "type", and consists of the anterior internal quarter of a cheek tooth, lacking the apex and most of the root (P8446.2; Fig. 3 C).

Its features are similar to those of the holotype, but it displays some better. Three dentic. ant. are present or indicated, and also a very small dentic. bas. ant. All are sharply pointed, and separated by deep grooves. The cr. rug. are very strongly developed, producing sharp-crested ridges converging towards the apex. A smooth 2 mm high cingulum borders the root.

Only a few millimetres of root are present, but it has a roughly circular section, and is deep enough to indicate that the isthmus joining the roots did not extend very deeply—only 7·5 mm below the medial base of the crown enamel.

It is not possible to say more than that its position is middle or posterior buccal.

Another buccal tooth originally labelled as "canine tooth", is represented by the posterior internal quarter of the crown, and most of the posterior root (P8446.3; Fig. 3 D). It is not part of the tooth represented by the foregoing fragment. The preservation of the crown is poor; only the apex and the topmost dentic. post., or, more likely, only the two topmost dentic. post., are present with their lingual parts, and both lack apices through wear or damage; the cr. rug. are relatively course, but appear worn. The cingulum is 3-4 mm high.

The strongly incurved root is nearly complete, lacking only a short proximal portion and the labial part nearest to the crown, so exposing the pulp cavity. The isthmus is short, about 6-7 mm. In lateral view the root is straight.

This latter characteristic is typical for lower buccals in European squalodontids and thus we probably have a fragment of a B inf. dext. of middle or posterior position.

A more anterior cheek tooth is represented by a near-complete crown with a small portion of its root (P8446.4; Fig. 3 E, F). The crown is laterally compressed, is high-triangular in side view, and slightly incurved in profile. The antero-posterior carina bears one dentic. ant., near the base of the crown, and two widely spaced dentic. post. Small basal denticles may have been present, but are not preserved. The labial face is mainly smooth, having a few short, poorly developed cr. rug. near the base posterior to the median sulcus. The enamel of the lingual face is preserved only in the anterior half, and shows strong irregular cr. rug.

The root is preserved, poorly, only on the lingual side. The two roots are seen to be confluent, but the extent of the isthmus cannot be determined. The pulp cavity is obscured by matrix.

In most quantitative characteristics (Table 2) and in the general appearance, it is similar to a left B^6 in European squalodontids, but with smaller absolute dimensions.

Two teeth, originally labelled as canines, we deem to be anterior-most buccal teeth.

The larger is a specimen lacking the crown apex and the distal portion of the single root (P8446.5; Fig. 3 G, H). The crown is a laterally compressed cone, incurved, with a pronounced antero-posterior carina. A small dentic. bas., with apex missing, is present at each end of the carina, and minute denticulations can just be perceived along the lingual side, a phenomenon in all anterior teeth of squalodontids for which one of the authors proposed the term "crenelation" (Fig. 1 A; Rothausen 1965: p. 26, Abb. 1). The labial face is convex, and smooth except for a few short, poorly developed cr. rug. near the middle and in the posterior half. The lingual face is concave in profile and is strongly decorated with cr. rug. converging in the direction of the apex. The systems of cr. rug. die out in a narrow smooth cingulum in which the enamel is not thickened. The root is somewhat tumid just below the crown, and is laterally compressed there. More distally it narrows and becomes circular in section.

Most of its characteristics and indices, except its smaller absolute dimensions, are similar to those of a B^4 dext. of European squalodontids. But there are some differences in habitus. For example, in European forms no tooth anterior to $B\frac{5}{5}$ has any dentic. ant. or bas. ant.

An upper buccal tooth is especially indicated here by a character that seems common to all anterior teeth of squalodontids—the carina divides into a main branch (ramus primus = ram. prim.) and another, weaker one (ramus secundus = ram. sec.) at its basal anterior part, and as far as it was possible to check this character, the ram. sec. branches off to the lingual side in upper teeth and to the labial side in lower teeth. (Fig. 1 B; Rothausen 1965,

Abb. 21-28, 53-56). Here it branches off to the lingual side.

The sixth specimen is more complete and smaller, and from the opposite jaw or mandible (P8446.6; Fig. 3 I, J). Its identity is uncertain, as it shows the great length and curvature of root associated with canines and third incisors of squalodontids, and yet bears a distinct dentic. ant. near (4·7 mm) the anterior end of the carina. Although there are, in other squalodontids, similar teeth which belong to the most anterior of the buccal series, nevertheless even these do not show such a denticle.

The crown is a compressed cone bearing a well developed antero-posterior carina. There is no discernable dentic. post. The labial face shows very weak cr. rug. and only at the posterior part is there other poorly developed sculpture: the crown shows weak undation here.

The lingual face is slightly concave in profile, and bears strong cr. rug. These are fully visible only at the posterior part because only a small portion of enamel remains on that face, but the striations have left distinct traces on the underlying dentine. The cr. rug. arise from a smooth cingulum 1·5 mm wide.

The root is slightly compressed at the base of the crown and is a little tumid below this; this also is a character more or less developed in anterior teeth of squalodontids, but often also (less pronounced) in posterior teeth, for which the term "Basiswulst" (Rothausen 1965: p. 27) or "basal swelling" has been proposed. It may be that the teeth were implanted that far in the connective tissue. The root then narrows and becomes almost cylindrical. About 5·7 mm above the end there is a "sharp" bend, and the lingual side veers labial. There is a slight but distinct constriction 3 mm from the end. On the anterior side, a shallow groove extends from the open end of the root to the constriction.

The position of this tooth is very uncertain. Because enamel is broken away at the lingual side of the crown there is only a possible vestige of a ram. sec. (Fig. 1B) at the denticle. If this were the case it would be an upper right tooth. There is some similarity with B^{1-2} in European squalodontids, but in far smaller dimensions. The development of a dentic. ant. on a tooth anterior to B⅗ is however of generic significance.

DISCUSSION

Hall (1911), making some invalid assumptions based on Sanger's rather inadequate description and figure, concluded that the faces of the lost teeth were smooth, and that a tooth from Mt. Gambier (Hall 1911: pl. 36, Fig. 6), possessing a nearly complete root with fangs confluent for most of their length, was of the same species. This latter tooth, however, has the faces strongly ornamented with papillated cr. rug. Hall had disregarded this feature erroneously as being nontaxonomic, and based his two genera on the characters of the incomplete roots (1911: p. 262), which are of far less or even of no importance in this regard.

Kellogg (1923: p. 20) suggested the Mt. Gambier specimen was in reality closer to *Parasqualodon ? wilkinsoni* (McCoy 1867); this was tentatively endorsed by Flynn (1948: p. 186), but it certainly differs in habitus and some very significant points: (*a*) the apical angle is far smaller (40·5°) than in a buccal tooth (P8446.4) of similar position (>47°) of *M. harwoodi*. (*b*) the characteristic number of cr. rug. should be taken at a B^7 (see Appendix 1), but one may be sure that, according to Hall's figure where the cr. rug. are much coarser, the characteristic number of this tooth is far smaller than in *M. harwoodi* (14-15 in the holotype).

These differences clearly distinguish the Mt. Gambier tooth of Hall (1911: pl. 36, Fig. 6) from *M. harwoodi*, and we are sure that this tooth should be consequently included in *Prosqualodon davidi* Flynn because almost the same differences are found between the teeth of *P. davidi* and *M. harwoodi*.

The holotype of *Parasqualodon ? wilkinsoni* (McCoy 1867) itself (Hall 1911: pl. 36, Fig. 5) is similar in shape to the penultimate lower buccal of *P. davidi*. But we hesitate to include *P. ? wilkinsoni* (only the holotype remains in this genus and species) in *P. davidi* without comparing the material itself, since even Flynn accepted this taxon, and indeed there are some differences. We are in doubt whether the form, separation and kind of connection of roots are of any special taxonomic meaning. The occasional appearance of a third, lingual vestigial root (Flynn 1948: p. 183) in *P. davidi* is also of no taxonomic value, because this feature appears in most species of *Squalodon* Grateloup, 1840 with irregular variability in the cheek teeth behind the B^5. (Note, however, Climo and Baker (1972). The real third root they describe in lower cheek teeth of *Austrosqualodon* does seem to be of taxonomic value at least at the generic level.) But there are some other differences in the crown: in *P. davidi* only the anterior carina is convex in lateral view, while in the holotype of *P. ? wilkinsoni* it looks as if the posterior one also is convex. All comparable buccal teeth of the Tasmanian form bear three dentic. ant. while the tooth of *P. ? wilkinsoni* only bears two but with some spacing, as in *P. davidi* and in the species of *Squalodon.* The cr. rug., as far as it is possible to interpret from the figure of Hall (1911: pl. 36, Fig. 5), are finer and their characteristic number is larger than in *P. davidi.*

All these differences however, compared with the differences between teeth within other squalodontoid genera, seem not to be of generic significance, and it is more likely that this Mt. Gambier tooth represents only another species of *Prosqualodon* Lydekker 1893. Because the material is poor, and because there was no opportunity to compare the material itself, we cannot decide this question here finally, but the existence of the genus *Parasqualodon* Hall 1911 is questionable. An isolated tooth (AUGD T857) figured by Hall (1911: pl. 36, Fig. 4) as *P. wilkinsoni* was regarded by Flynn (1948) to be *Prosqualodon davidi.*

Thenius (1959: pp. 272-273) even united the Tasmanian species with the Australian one, including both under "*Parasqualodon wilkinsoni*". But even if he were right—which seems possible—the IRZN would require this species to be named "*Prosqualodon wilkinsoni* (McCoy 1867)".

Like *S. gambierensis* Glaessner, 1955 (the genus is not entirely certain) *M. harwoodi* has dentic. ant. and post. well-defined, large, sharp-pointed, and smooth-faced. In contrast, the denticles of *P. davidi* are short, obtusely pointed, thick, less well-defined, and bear on their own carinae a varying number of small nod. sec. But this last character occurs in most of the European longirostral Squalodontidae and seems not to be of special taxonomic significance.

In superficial ornamentation, *Metasqualodon* stands between the relatively smooth-faced *S. gambierensis*, and the rough-faced teeth of *Parasqualodon* ? and *Prosqualodon davidi* which are both—somewhat differently—covered with papillated cr. rug. (see Fig. 3 K-N).

What is the taxonomic significance of the ornamentation of teeth with syst. cr. rug.?

The cr. rug. are only of a very limited importance in this regard, but it seems that beside a specific character, they show some general tendencies. For example, Middle Oligocene European Squalodontoidea have characteristic numbers of cr. rug. of about 7, as is also the case for the Upper Oligocene *Microcetus ambiguus* (Meyer 1840). Other Upper Oligocene European forms which are to be placed within Squalodontidae have characteristically 8-10 cr. rug., while most species of Miocene *Squalodon* show 10 and more. *Prosqualodon davidi* and *P. australis* Lydekker 1893 show characteristic numbers of about 7, which seems to be a primitive character, like other features of the teeth of this genus (small apical angle, good symmetry of crowns, three dentic. post. only, ID about 27-28 per cent). The same is the case with early Oligocene squalodontoid buccal teeth described from Oamaru, New Zealand by Keyes (1973). There is a characteristic number of 6-7 with relatively weak cr. rug. (beside this: good symmetry of crowns, three dentic. ant. and post., ID about 25 per cent and only a big apical angle as a specialised character similar to the manner in *Xenorophus sloani* Kellogg 1923).

It should be noted that Keyes apparently did not realise that Rothausen's systematic concept is one of stages and not of clades. Therefore it is highly likely that the early paths of evolution of Squalodontidae and other odontocetes are embedded in the more primitive agorophiid stage, so far known only from such specialised forms as those from the Oligocene upper part of the Jackson Group of South Carolina (Cooke and MacNeil 1952: p. 27). This part, the Cooper Marl, from which the cetacean fossils have been collected, has now been extended into the Upper Oligocene (Whitmore and Sanders 1976: p. 308), on the basis of new studies of the invertebrate fauna. Numerous odontocete skulls have been found there over the past five or six years. Complete skulls of *Xenorophus sloani* Kellogg 1923 have verified conclusions by Rothausen (1965: p. 652) based on the holotype fragment, that it belongs not to the Agorophiidae but must be classed as "incertae sedis" at this time. (pers. comm. to K. R., from Albert E. Sanders, Charleston, June 1976; Whitmore and Sanders 1976: p. 310).

The teeth described by Keyes can only be placed in the superfamily Squalodontoidea with our present knowledge, and thus Keyes in his comparisons (1973: p. 384, 385) is correct only in his opinion that the teeth cannot be placed in *Prosqualodon, Parasqualodon, Microcetus* (contrary to Keyes, buccals are furnished with dentic. ant.: Rothausen 1961) or *Metasqualodon.*

Concerning the intensity of development of cr. rug. in squalodontoids, there is a difference between Oligocene Squalodontidae and other Oligocene Squalodontoidea. There are very pronounced cr. rug. in the older Squalodontidae with a tendency to become weaker to varying degrees in Miocene forms. But there are only weak cr. rug. in many other Oligocene Squalodontoids—most Middle Oligocene and small forms—as far as we know them at present from material or useful figures. These latter seem to offer more similarity, for instance, with *Neosqualodon* Dal Piaz 1904.

In all these characters *M. harwoodi* resembles very much the Aquitanian species of *Squalodon*, as well as in the high number of 6 dentic. post. (including dentic. bas.), the loss of symmetry in lateral view, and the small ID.

Six dentic. post. is the highest number found in Squalodontidae, known in *Squalodon* only very rarely in $B^{9,10}$ (*S. bellunensis* Dal Piaz 1916; variability left/right: 6/5, Rothausen 1965: p. 316). Three dentic. post. for B in middle and posterior positions are characteristic for a relatively ancestral stage in the evolution of squalodontoids. In one lineage of species of *Squalodon*, 1-2 (3) dentic. post. were added later (*catulli*—group: Rothausen 1968: p. 91) in connection with longitudinal stretching of the crown, resulting in a larger apical angle, bending of basal parts of post. cr. rug. in a posterior direction, loss of symmetry in lateral view, straight instead of convex posterior carina, and smaller ID. (In European Oligocene Squalodontidae, ID is 23-27 per cent; in the Miocene the ID of the more conservative *bariensis* group of *Squalodon* is 20-23 per cent, while in the *catulli* group: less than 20 per cent is normally indicated.)

Glaessner (1972) redescribed *Squalodon* ? *serratus* Davis 1888. After a new preparation of the single buccal tooth that represents the holotype, he was able to show that Hall (1911) and Flynn (1948: p. 186) were wrong when they thought this form possibly belonged to *M. harwoodi*, or that both were *P. wilkinsoni*. Rothausen (1965: p. 660), expressing some doubt, had seen in the figure of Davis (1888: Fig. 9) at least some similarity with *M. harwoodi*. Glaessner clearly showed it had a form of its own, but doubted whether it belonged to the genus *Squalodon*. We are sure now that this taxon should be placed in a group with *Prosqualodon*—*Parasqualodon* ?—*Squalodon*? *andrewi* Benham 1942 and has nothing to do with *Kekenodon onomata* Hector 1881 which Kellogg (1923: p. 27) had already placed outside the Squalodontoidea.

All these facts mentioned above make it seem very likely that *M. harwoodi* belongs to another group with *Squalodon*—*Phoberodon* Cabrera 1926—*Squalodon*? *gambierensis*.

The fact that most teeth of *M. harwoodi* agree more with the teeth of longirostral squalodontids than those of brevirostral forms, as far as we know them, need not mean that it represents a longirostral taxon. It may be that these are teeth of a brevirostral species in which the dental evolution has reached a level similar to some Aquitanian *Squalodon* species in the northern hemisphere, but as yet unrepresented by complete skulls. The above-mentioned view has support in some aspects of the anterior buccal teeth of *M. harwoodi*, such as denticles on the most anterior B or curvature of crowns and roots of these anterior teeth.

It should be mentioned that while the teeth of both good species of *Prosqualodon*, *P. davidi* and *P. australis*, show primitive characters, in skull morphology they differ in similar manner as *Eosqualodon* Rothausen 1968 and *Squalodon* Grateloup 1840 (Rothausen 1965: pp. 552, 560); the taxonomic consequences should not be decided here.

One should mention in this connection, as did Rothausen (1965: p. 763), that as in the Equidae, where modern equine characters are combined in different ways with ancestral ones (Tobien 1960: p. 581), so there are here such character pairs in different combinations in Squalodontidae (here considering the buccal teeth only): symmetry/asymmetry; original number of denticles/increased number; relatively big denticles/relatively small ones; coarse cr. rug./weak cr. rug.; vestige of third root/no vestige, etc. There must be similar split lines of evolution, but our knowledge of the Squalodontoidea is far inferior to that of the Equidae. Thus it is still nearly impossible to fix the position and taxonomic state of isolated squalodontoid teeth if the species is not also known by complete or near complete dentitions and skulls. Rothausen in his revision therefore prefers to name such finds in open nomenclature which, however, is not possible if there is already a valid name, such as *Metasqualodon harwoodi* (Sanger 1881).

As mentioned by Keyes (1973: p. 381), the numerous different very early squalodontoids in the southern hemisphere (see below; also new discoveries in New Zealand, pers. comm. R. E. Fordyce, Christchurch, 1975, 1976) have so far been studied much less than those in the north. A revision of this material, as is now being done for a part by Fordyce, may help us to recognise clades as a base for a vertical classification system of the early Odontoceti. This will be the more significant, as brevirostral squalodonts are so far known only from the southern hemisphere, and it is very likely that most modern odontocetes are derived from this group.

STRATIGRAPHY

Sanger (1881: pp. 298-299) reported the following macro-fossils as coming from the same beds as the teeth: (p. 298) "*Echinus, Spatangus, Clypeaster, Pecten, Turritella, Corbis,* and *Spondylus*" and (p. 299) "*Lamna elegans, Notidanus primigenius, Carcharodon angustidens, Nautilus (Aturia) zic-zac, Pecten Poulsoni, Crassatella alta,* and *Clypeaster (Mortonia) Rogersi*". The latter group he interpreted as typically Eocene in age, according to the state of knowledge at that time. His passing description of the source being "in a bed of yellow calcareous clay" fits many of these fossils which may be equated with Miocene species from the Mannum Formation, a sequence of yellow sandy limestones and marls. However, it is at variance with the state of preservation of the teeth, and with their accompanying label. The teeth of *Metasqualodon* are black. The rare shark teeth from the Mannum Formation are ferruginised pinkish- or orange-brown. If the label is interpreted correctly, the teeth came from a depth of 100 feet (about 33 m), presumably in a bore or well. It must be admitted that the only direct evidence for this is the note "100f" on the label. However, considering the rarity of fossil whale material, the fact that the teeth seem to form part of a sequence, mainly from one jaw, and the absence of any bone, the discovery of *Metasqualodon harwoodi* during the sinking of a bore (rather than a well) seems rather likely. The boring method would explain the damaged teeth and loss of such a large part of the specimen. Such discoveries are by no means unknown—several teeth and fragments of a marsupial were recently found at a depth of some 30 m in a bore in New South Wales (Pledge, in prep.). If the *Metasqualodon* teeth were found in outcrop, their preservation would indicate that a more-or-less complete jaw or skull should have been discovered, and it was not. The possibility of such a jaw having disintegrated before discovery does exist, but the teeth show no sign of erosion.

A search through available records of the period has failed to produce any information on such a bore. Two old wells of c. 1880 vintage are known (Hundred of Brinkley, Sections 78 and K[1]) but both are abandoned and full of sand, and nothing is known of their depths or stratigraphy. Another bore in the area (Knight's Bore, Section 217, Hundred of Brinkley, completed 1899) was accurately logged. In this bore, the interval around 100ft. was well within the Oligocene Ettrick Formation (O'Driscoll 1960: p. 230).

The shark tooth (SAM P10867) mentioned on the original label was relocated by one of us (N.S.P.) recently. It seems referable to *Hexanchus agassizi* (Cappetta 1976) although larger. It has a similar preservation to the *Metasqualodon* teeth—dark grey to black—which is typical of bone and teeth from glauconitic or other reducing sediments. The label with the tooth gives the additional information: "R. Murray Cliffs near Wellington".

The beds Sanger (1881) describes would seem to be part of the Mannum Formation (see Ludbrook 1961). This forms a large part of the cliffs at Tailem Bend, only 14 km upstream from Wellington, but it disappears from outcrop only a few kilometres downstream, having been stripped off and replaced by the Pliocene Norwest Bend Formation, a yellow calcareous sand unit with abundant bivalves (notably *Ostrea*, with *Spondylus* and various pectinids). Some of Sanger's assemblages could conceivably have been derived from this younger formation. It is in this same area, just south of Tailem Bend, that the Ettrick Formation makes one of its few surface appearances, as a hard, pale greenish-grey, finely glauconitic marl (Ludbrook 1961: p. 38), occurring as a bench at present pool level of the river. This pool level is largely artificial, following the installation of barrages at the mouth of the river, in the 1930's, to control depth and salinity. It is therefore probable that the extent of outcrop of the Ettrick Formation was far greater *circa* 1880. Being glauconitic, and therefore of a somewhat reducing origin, the Ettrick Formation would yield teeth of a decidedly dark grey-black colouration.

Interestingly, a tooth of the Oligocene shark *Carcharodon angustidens*, collected at Tailem

Bend in 1936, has the same dark preservation as the *Metasqualodon* and *Hexanchus* teeth, and other shark teeth from reducing sediments, and adds support for the provenance of *Metasqualodon* being the Ettrick Formation.

The conclusion is that, whatever the source of the invertebrates allegedly associated with them, the teeth of *Metasqualodon* were obtained from the Ettrick Formation, either in a bore or well or from outcrop. The top of this unit is believed to be equivalent to the end of the Oligocene (Ludbrook 1973: Table 1). Hence the age of *Metasqualodon harwoodi* (Sanger 1881) is Late Oligocene, possibly even Latest Oligocene, since it probably came from near the top of the formation. The younger age is also indicated on the basis of the form of the teeth in relation to the general tendencies and similarities seen in Lower Miocene species of *Squalodon* in Europe.

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APPENDIX I

STANDARDISED TERMINOLOGY FOR SQUALODONTOID TEETH

Buccal tooth—(B). Rothausen (1965: p. 718; 1968: pp. 86, 100) stated that there was no way of determining the premolar—molar division and homology in most squalodontoids and proposed this more neutral term, similar to the sense of Dal Piaz (1916: p. 17) and Kellogg (1928: p. 53). The term is equivalent to the informal "cheektooth" (*bucca*: Lat. cheek) also used herein. Buccal teeth are numbered consecutively from the front, i.e. $B^1/_1$, $B^2/_2$, $B^3/_3$ . . . $B^n/_n$.

Denticulus anterior; d. posterior—Dentic. ant.; dentic post. (*denticulus*: Lat. little tooth, denticle) small conical extensions on the anterior and posterior cutting edges (carinae) of the flattened buccal crowns.

Denticulus basis—Dentic. bas. Basal denticle—a small cusp at the base of the crown on the anterior or posterior edges. They have special significance in some cases and therefore are mentioned separately.

Nodulus primus—Nod. prim. Small tubercular extensions of the main carina, c.f. *nod. sec.* Both are to be strictly separated from "denticles".

Nodulus secundus—Nod. sec. Small tubercle-like extensions on the carinae of denticles.

Cingulum A smooth encircling zone of thickened enamel at the base of the crown.

Crista rugosa—Cr. rug. (*crista*: Lat. ridge) Enamel ridges, mostly irregular, that may be more or less covered with enamel papillae.

Systema cristarum rugosarum—Syst. cr. rug. Viewing the apical end of a cr. rug. as the stem or trunk, one sees it divide into branches towards the base of the crown. These branches may anastomose with others from the same trunk, but not with those from another "stem". They belong to closed systems. These syst. cr. rug. die out at the cingulum (Fig. 1). This observation seems to be true for all squalodontid teeth.

Undation (*unda*: Lat. wave). Common, weak, relatively broad, longitudinal, wave-form surface relief on the crown face following the curvature of the crown of anterior teeth. (Fig. 1; Rothausen 1965: p. 26, Abb. 4).

Crenelation Minute serration on the carinae of anterior teeth of squalodontids (Fig. 1; Rothausen 1965: p. 26, Abb. 4).

Ramus primus—Ram. prim. The main branch of the carina when it divides. (Fig. 1).

Ramus secondus—Ram. sec. A weaker, secondary branch at the basal end of the anterior carina in anterior teeth of squalodontids. (Fig. 1).

Apical angle The angle enclosed by lines from the apex to the anterior and posterior end points of the base of the crown; gives an index of the antero-posterior diameter (*a*) to the height of the crown.

Index denticulorum—(ID). Expresses the relationship between the basal diameter of the largest dentic. post. (ad), measured in the direction of the carina, and the antero-posterior diameter of the crown (*a*).

$$\text{i.e. ID} = \frac{100\,\text{ad}}{\text{a}} \text{ per cent}$$

For best comparison of species, the ID should be calculated only for B^7 to B^9 (Rothausen 1965: p. 32).

Index basalis—(β). Expresses the flattening of the crown. $\beta = \frac{100\text{b}}{\text{a}}$ where b is the transverse diameter of the crown (above the anterior root in two-rooted teeth).

Cristae density—Cr. density. The characteristic number of cr. rug. The number of cr. rug. counted in 5 mm just posterior of the middle of the labial face about 5 mm above the base of the crown, preferably of a B^7.

RECORDS OF THE
SOUTH AUSTRALIAN
MUSEUM

PROTURA (INSECTA) OF THE NEW HEBRIDES

By S. L. TUXEN

SOUTH AUSTRALIAN MUSEUM
North Terrace, Adelaide
South Australia 5000

VOLUME 17
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PROTURA (INSECTA) OF THE NEW HEBRIDES

BY *S. L. TUXEN*

Summary

Protura collected in the New Hebrides in 1971 are described. Nine species were found, four of which are described as new, viz. *Eosentomon penelopae* and *insularum*, *Isoentomon pumilioides* and *Berberentulus tannae*. The species composition compares well with the known fauna or the Bismarck Archipelago and the Solomon Islands.

PROTURA (INSECTA) OF THE NEW HEBRIDES

By S. L. TUXEN*

ABSTRACT

TUXEN, S. L. 1977. Protura (Insecta) of the New Hebrides. *Rec. S. Aust. Mus.*, 17 (18): 299-307.

Protura collected in the New Hebrides in 1971 are described. Nine species were found, four of which are described as new, viz. *Eosentomon penelopae* and *insularum*, *Isoentomon pumilioides* and *Berberentulus tannae*. The species composition compares well with the known fauna of the Bismarck Archipelago and the Solomon Islands.

INTRODUCTION

Following the publication of our paper on the Solomon Island Protura (Tuxen & Imadaté 1975a), Ms Penelope Greenslade of the South Australian Museum, Adelaide, separated out the Protura from the Berlese samples collected in the New Hebrides by the Royal Society—Percy Sladen Expedition to these islands in 1971 which are lodged in the South Australian Museum and forwarded them to me for identification. Although only a small collection of 52 specimens, the material contains some highly interesting representatives of no less than nine species which are the subject of this paper.

I am grateful to Ms Greenslade for giving me the opportunity to study this material.

SYSTEMATIC TREATMENT

I. Key to the Known Protura of the New Hebrides

1. Spiracles present; all three pairs of abdominal legs two-segmented (Eosentomoidea) 2
   Spiracles absent; only the first pair of abdominal legs two-segmented (Acerentomoidea) 8

2. Sensilla e in foretarsus missing, sensilla g spiniform .... *Isoentomon pumilioides* n. sp.
   Sensillae e and g in foretarsus spatulate (*Eosentomon*) 3

3. b′1 absent in foretarsus; abdominal sterna I-VII with central posterior seta; tergal seta p 2 displaced anteriorly on abd. II-VI .... *Eosentomon noonadanae* Tx. & Imad.
   b′1 present; abdominal sterna I-VII with an even number of setae; tergal p 2 not displaced 4

4. t 1 in foretarsus close to α 3; f 1 and b short; stern. VIII with two anterior setae . . *Eosentomon insularum* n.sp.
   t 1 midway between α 3 and α 3′; f 1 and b long; stern. VIII without anterior setae.................. 5

5. Seta p 1′ on abd. terg. VI short and on line with p 1 and 2, close to p 2; terg. X-XI with eight setae *Eosentomon oceaniae* Tx. & Imad.
   Seta p 1′ on abd. terg. VI long, placed in row with p 2′ on hind margin 6

6. Terg. X-XI with eight setae; p 1′ on terg. VII on line with p 2′ .... *Eosentomon penelopae* n.sp
   Terg. X with less than eight setae; p 1′ on terg. VII on line with p 1 and 2 and close to p 2 7

7. Terg. X with four setae, no. 1 and 4 .... *Eosentomon sakura* Imad. & Yos.
   Terg. X with two setae (No. 4) or none .... *Eosentomon wygodzinskyi* Bon.

8. Sensilla a′ in foretarsus broadly vase-shaped, short, only reaching δ 3; sensilla f midway between e and g; terg. VII with six anterior setae; stern. XI with six setae .... *Berberentulis capensis* (Wom.)
   Sensilla a′ longer, sword-shaped, reaching δ 4; sensilla f close to e; terg. VII with two anterior setae; stern. XI with four setae .... *Berberentulus tannae* n.sp.

* Zoological Museum, Copenhagen, Denmark.

II. Synopsis of the Species

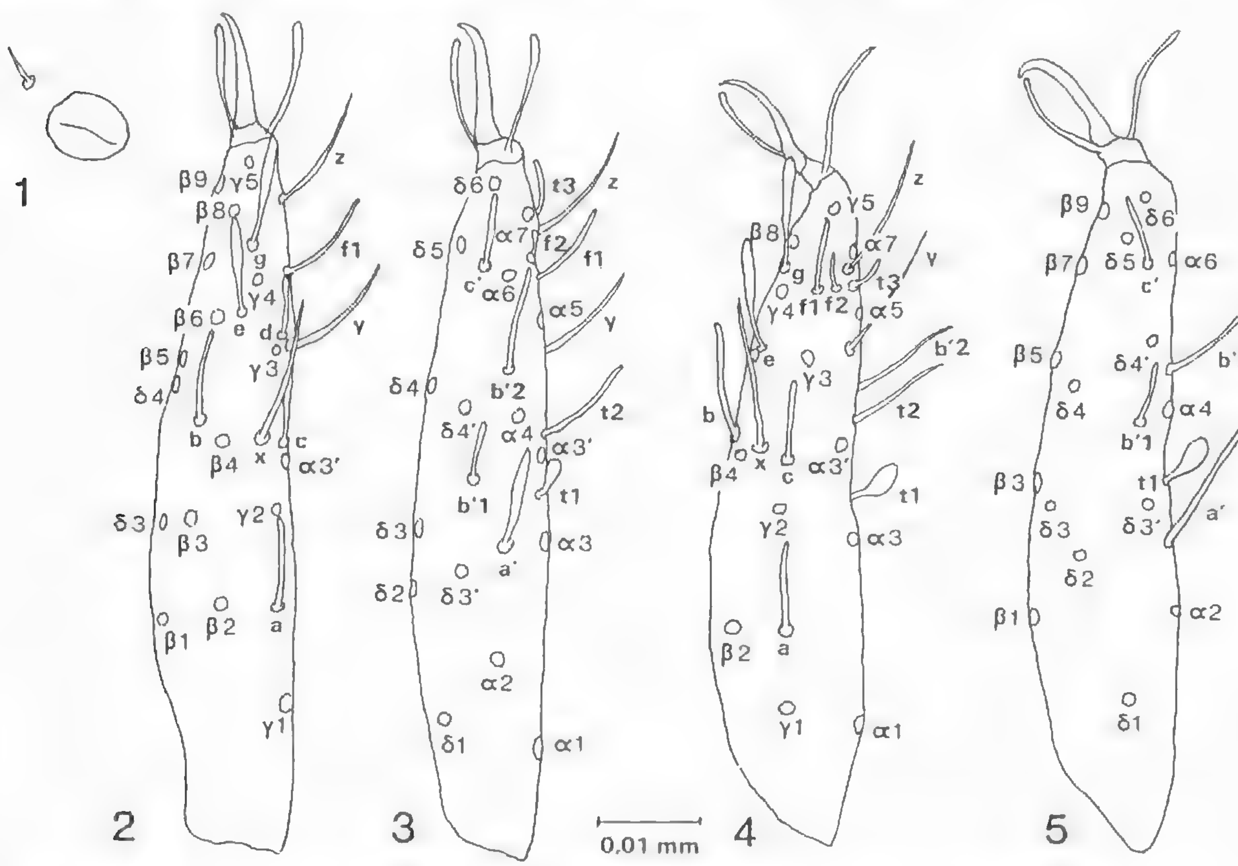
1. **Eosentomon oceaniae** Tuxen & Imadaté 1975a: p.350

Three specimens are present of this species which is easily recognisable among the *Eosentomon* species of the *swani* group by the position of seta p 1′ on terg. VI.

Occurrence on the New Hebrides: Efate Island, Point Narabau, 100 m from high water mark on old beach surface, 17° 45′ S, 168° 24′E. Simple mesophyll notophyll vine forest, in soil of 0-8 cm depth. Coll. no. NH 19. K. E. Lee leg. July 13, 1971. One ♂, one maturus junior.

Aneityum Island, near top of steep slope above E side of Anelcauhat Bay, 20° 15′S, 169° 46′E. Disturbed coastal forest with *Acacia spirorbis*, in soil of 4-6 cm depth. Coll. no. NH 26. K. E. Lee leg. July 23, 1971. One ♀.

Further distribution: Bismarck Archipelago and Solomon Islands, widely distributed (Tuxen & Imadaté 1975a: p.352). Australia: North Queensland (Tuxen 1967: p.6 and Tuxen & Imadaté 1975b: p.195).



Figs. 1-3: *Eosentomon penelopae* n.sp. 1: Pseudoculus. 2: Foretarsus in ventral-exterior view. 3: Foretarsus in dorsal-interior view. Figs. 4-5: *Eosentomon wygodzinskyi* Bon. from the New Hebrides. Foretarsus in exterior and interior views.

2. **Eosentomon penelopae** n.sp.

Figs. 1-3

This species is related to *E. solomonense* Tx. & Imad. 1975 from the Solomon Islands, but it is smaller, pseudoculus is smaller, p 4′ is missing on terg. II-III and terg. VII has four setae instead of two.

Length of body 750 μm, of foretarsus without claw 75 μm.

Mouthparts normal, clypeal apodeme not visible (specimen seen in directly lateral view). Pseudoculus oval, small, PR = 12·5 (Fig. 1). Labral setae present.

Foretarsus (Figs. 2-3). All setae inclusive of b′1 present, position and size as in *solomonense*. f and g spatulate, t 1 midway between α 3 and 3′, BS = 1.1. Tarsus small, TR = 6.0. Empodium shorter than claw, EU = 0·9.

Empodium of middle and hind leg short.

Chaetotaxy: On thorax p 1′ on segment III long, behind the line p 1-2; the abdominal chaetotaxy set out in Table 1— p 4′ absent on terg. II-III.—a 3 present on terg. IV; a 4 and 5 present on terg. V-VII.—p 1′ short, on line with p 2′, on terg. VII.—p 1″-2 not anteriorly displaced on terg. VIII.—no.1 and 2 on terg. XI extremely small.

Female squama genitalis unknown.

Holotype and only known specimen: ♂ from Erromanga Island, New Hebrides, 8 km SW of

TABLE 1

Abdominal chaetotaxy of *Eosentomon penelopae* n.sp. Numbers above a line refer to the number of setae in the anterior row, numbers below the same line refer to the number of setae in the posterior row.

segment	I	II-III	IV	V-VI	VII	VIII	IX-X	XI	Telson
tergum	4	10	10	4	4	6	8	8	9
	8 (1)	14	16	16	16	9			
sternum	4	6	6	6	6	7	4	8	12
	4	4	10	10	10				

(1) The presence or absence of the very small p 5 is very difficult to determine in most species.

Ipotak, 18° 54′S, 169° 13′E. In soil of remnant grove of *Podocarpus imbricatus*, 0-4 cm depth. Coll. no. NH 36. K. E. Lee leg. Aug. 9, 1971. In the South Australian Museum, Adelaide.

Named in honour of Ms Penelope Greenslade.

3. Eosentomon wygodzinskyi Bonet 1950: 122

Figs. 4-8

Syn. *E. solare* Tuxen & Imadaté 1975a: p. 356.

This species was described by Bonet in 1950 from two females from Itaguaí, Brazil, and redescribed by Tuxen (1964: 137). In 1975 Imadaté and Tuxen described the new species *solare* from a fairly large series from the Bismarck Archipelago and Solomon Islands. We mentioned that "the difference, such as the relative length of the filum processus of the female squama genitalis and of the foretarsal sensilla c′, may be significant, although these two forms closely resemble each other". In 1976, after a renewed examination of the type of *wygodzinskyi* now in the Zoological Museum, Copenhagen, I concluded that "perhaps we did the wrong thing in describing *solare*" and the new material from the New Hebrides has convinced me of the synonymy.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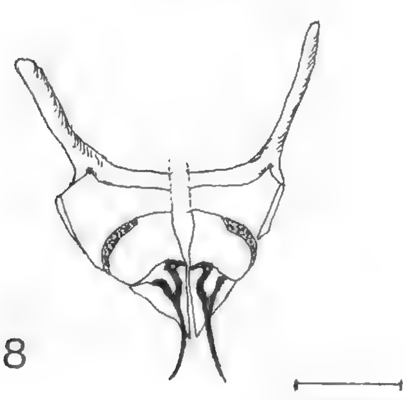

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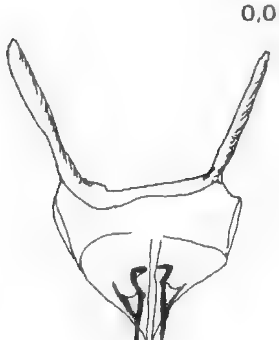
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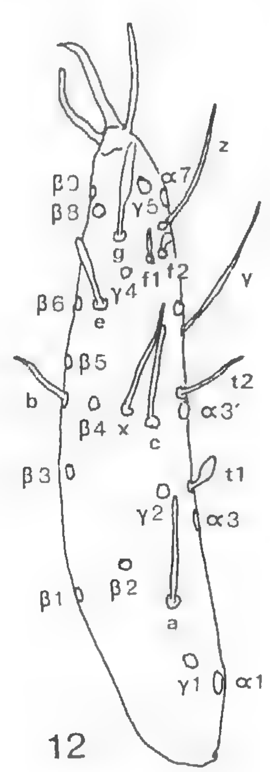

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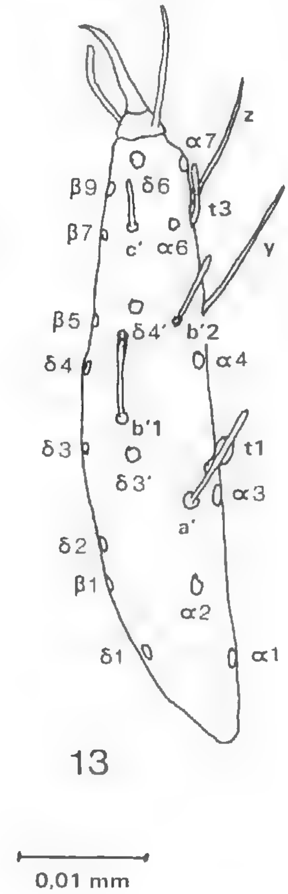

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Figs. 6-8: *Eosentomon wygodzinskyi* Bon. from the New Hebrides. 6: Clypeal apodeme. 7: Pseudoculus. 8: Female squama genitalis in ventral view. Figs. 9-13: *Eosentomon insularum* n.sp. 9: Clypeal apodeme. 10: Pseudoculus. 11: Female squama genitalis in ventral view. 12-13: Foretarsus in exterior and interior views.

Whereas the material of "*solare*" from the Bismarck and Solomon Islands showed no variation, the present material varies in chaetotaxy and so I give a short description with drawings of a typical specimen from Aneityum, New Hebrides.

Labral setae present, clypeal apodeme with broad "clubs", pseudoculus oval, PR = 13 (Fig. 4).

Foretarsus without claw 77 μm, BS = 1·2, TR = 5·0. Length and position of sensillae as in "*solare*" (Fig. 5-6).

Female squama genitalis, Fig. 7.

The usual abdominal chaetotaxy is tabulated in Table 2—terg. V with anterior setae a 4, 5.—terg. VI-VII only a 5.—terg. X with setae no. 4 or none at all.—terg. XI with setae no. 3 and 4 and one or two medial microchaetae.—seta p 1′ on line with p 1-2 and close to p 2 on terg. VII.—p 1″-2 not displaced on terg. VIII.

TABLE 2

Usual abdominal chaetotaxy of *Eosentomon wygodzinskyi* Bonet. Numbers above a line refer to the number of setae in the anterior row, numbers below the same line refer to the number of setae in the posterior row.

segment	I	II-III	IV	V	VI	VII	VIII	IX	X	XI	Telson
tergum	4/8	10/16	10/16	4/16	2/16	2/16	6/9	8	0	4	9
sternum	4/4	6/4	6/10	6/10	6/10	6/10	7	4	4	8	12

However, this is not exactly identical to the chaetotaxy of the type specimens of either *wygodzinskyi* or *solare*. The chaetotaxy of important abdominal segments in all known specimens of the species is set out in Table 3.

TABLE 3

Comparison of abdominal chaetotaxy for selected segments of all known examples of *Eosentomon wygodzinskyi* Bonet and *Eosentomon solare* Tuxen & Imadaté.

terg.	IV	V	VI	VII	X	XI
wygodzinskyi from Brazil	10	4	4	2	2	4
"*solare*" from Bismarck Archipelago and Solomon Islands	10	4	4	2	2	4
6 *wygodzinskyi* from Aneityum, New Hebrides	10	4	2	2	0	4 (8) var.a.
2 *wygodzinskyi* from Erromanga, New Hebrides	10	4	2	2	0	6 (8) var.a.
1 *wygodzinskyi* from Erromanga, New Hebrides	10	4	4	2	2	4 f.princ.
2 *wygodzinskyi* from Malekula, New Hebrides	4	4	4	2	2	4 var. b.

In one specimen from Aneityum seta no. 4 was present on one side of terg. X. The medial microchaetae on terg. XI may all be present, or there may be only two of them or none at all. They are so small that they are very hard to see.

I deduce from this survey that the principal form is found in Brazil and all over the Bismarck Archipelago and Solomon Islands in all 27 adult specimens, as well as in one specimen on Erromanga. The var. a with reduction of anterior setae on terg. VI and X is found on Aneityum and Erromanga (eight specimens). The var. b with reduction of anterior setae on terg. IV is found on Malekula (two specimens).

Occurrence on the New Hebrides: Malekula Island, Toro, terrace-like surface on mountain side ca. 2 km NNW of summit of Mount Yang'abalé. 16° 16′S, 167° 26′E. Complex mesophyll vine forest, in soil of 0-4 cm depth. Coll. no. NH 57-58. K. E. Lee leg. Oct. 1, 1971. One ♀, one mat. jun., one larva II.

Erromanga Island, 1-2 km NNE of Nuangkau River bridge, 10-11 km WSW of Ipotak. 18° 53′S, 169° 12′E, resp. 18° 54′S, 169° 11′E. Mixed mesophyll evergreen vine forest, in soil of 0-4 cm depth. Coll. no. NH 34-35. K. E. Lee leg. Aug. 3-7, 1971. Two ♂, one ♀, one mat. jun. and one larva I.

Aneityum Island 4 km NE by N of Anelcauhat 20° 11′S, 169° 47′E. Mixed rainforest, in soil of 0-4 cm depth. Coll. no. NH 22. K. E. Lee leg. July 20, 1971. One ♀.—Near top of steep slope above E side of Analcauhat Bay 20° 15′S, 169° 46′E. Coastal forest with *Acacia spirorbis*, in soil of 0-6 cm depth. Coll. no. NH 26. K. E. Lee leg. July 23, 1971. One ♂, one ♀, one mat. jun.

Further distribution: Bismarck Archipelago and Solomon Islands (Tuxen & Imadaté, 1975a) and Brazil (Tuxen, 1976).

4. Eosentomon sakura Imadaté & Yosii 1959: 7

This species is described in detail by Imadaté, 1974 and is easily recognised by the chaetotaxy of terg. X where only setae no. 1 and no. 4 are present.

Occurrence in the New Hebrides: Malekula Island, 500 m E of SE corner of Lambubu Bay, 16° 12'S, 167° 23'E. Complex mesophyll vine forest, in soil of 0-4 cm depth. Coll. no. NH 61. K. E. Lee leg. Oct. 4, 1971. One ♂, one ♀, one mat. jun.—Lamdorr, 3 km NNE of Wintua village, SW Bay, 16° 28'S, 167° 27'E. Mixed mesophyll vine forest, in soil of 0-4 cm depth. Coll. no. NH 67. K. E. Lee leg. Oct. 11, 1971. One ♂.

Further distribution: In Japan this species is the commonest *Eosentomon* and has been found at almost all collecting sites, rarest on Hokkaido. Further afield it occurs in Formosa (Taiwan) (Imadaté 1964), Bismarck Archipelago and Solomon Islands (Tuxen & Imadaté 1975).

5. Eosentomon insularum n. sp.

Figs. 9-13

This species is distinguishable from other New Hebrides Protura in the position of sensilla t 1 in foretarsus (near α 3) and in the presence of two anterior setae on stern. VIII. It seems to be most closely related to *E. asahi* Imad. from Japan, but differs in many respects, is much smaller, has a different position of t 1 on foretarsus as well as differences in chaetotaxy.

Length of body 560 μm, of foretarsus without claw 58 μm.

Mouthparts and clypeal apodeme of common shape (Fig. 8), labial setae present. Pseudoculus small, with three small "lines" (Fig. 9), PR = 12-13.

Foretarsus (Figs. 10-11) with all sensillae present incl. b'1. t 1 near α 3, BS = 0·85. e and g spatulate, f 1 small, seta-like, f 2 knob-like. a' weakly broadened basally, b'1 nearer to δ 3' than to δ 4', c' short. Tarsus small, TR = 7·0.

Empodium of middle and hind leg short, one-fifth the claw.

Chaetotaxy: On thorax p 1' on segment III long, behind the line p 1-2; abdominal chaetotaxy set out in Table 4—a 3 missing on terg. V-VI and a 1 and 3 on terg. VII—terg. XI with setae no. 3 and 4, but in one case with all setae 1-4,—p 1' long on all terga I-VI, short and on line with p 2' on terg. VII,—p 1''-2 not displaced on terg. VIII.

TABLE 4

Abdominal chaetotaxy of *Eosentomon insularum* n.sp. Numbers above a line refer to the number of setae in the anterior row; numbers below the same line refer to the number of setae in the posterior row.

segment	I	II-III	IV	V-VI	VII	VIII	IX-X	XI	Telson
tergum	4/8	10/16	10/16	8/16	6/16	6/9	8	4	9
sternum	4/4	6/4	6/10	6/10	6/10	2/7	4	8	12

Female squama genitalis (Fig. 12) of the *swani* or *kumei* type.

Holotype: ♂ from Erromanga Island, New Hebrides, 1 km WSW of Nuangkau River bridge, 11 km WSW of Ipotak, 18° 54'S, 169° 11'E. Large grove of *Agathis*, in soil of 0-4 cm depth. Coll. no. NH 35. K. E. Lee leg. Aug. 7, 1971. In the South Australian Museum, Adelaide.

Occurrence in the New Hebrides: Erromanga Island (see above). Tanna Island, 8 km E of Lenakel near summit of main W-E road, 19° 30'S, 169° 20'E. Primary tropical rain forest, in soil of 0-4 cm depth. Coll. no. NH 30. K. E. Lee leg. July 27, 1971. One ♂, one larva II, one larva I. Aneityum Island, near top of steep slope above East side of Anelcauhat Bay, 20° 15'S, 169° 46'E. Coastal forest with fire induced *Imperata*, in soil of 0-8 cm depth. Coll. no. NH 27. K. E. Lee leg. July 23, 1971. Two ♀.

6. Eosentomon noonadanae Tuxen & Imadaté 1975: p. 367

This species is in many respects different from all other *Eosentomon* species, most evident is the presence of a central posterior seta on abdominal sterna I-VII, see Tuxen & Imadaté 1975a. The specimen from the New Hebrides agrees in all details with the holotype.

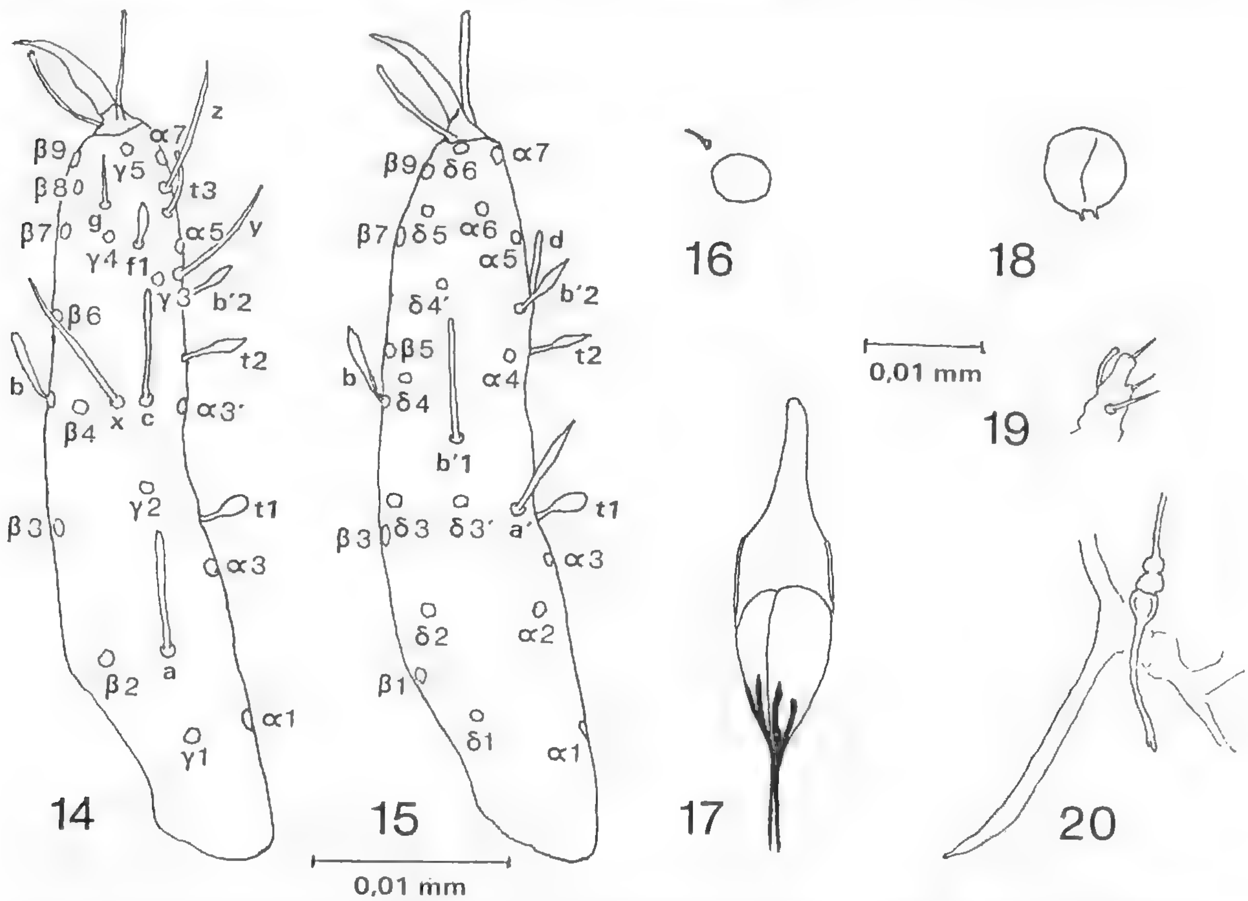
Occurrence on the New Hebrides: Malekula Island, Werimia, 2 km NE of Wintua village, SW Bay, 16° 28'S, 167° 27'E. Mixed mesophyll vine forest, in soil of 0-4 cm depth. K. E. Lee leg. Oct. 11, 1971. One maturus junior.

Further distribution: Valoka, New Britain, Bismarck Archipelago: the holotype and only previously known specimen.

Isoentomon pumiliodes n. sp.

Figs. 14-17

The genus *Isoentomon* was erected by Tuxen in 1975 on species of "*Eosentomon*" with spini-or setiform sensillae e and g. It contained nine species, two of which differed from the others in missing sensilla e. To this group belongs the new species.



Figs. 14-17: *Isoentomon pumiliodes* n.sp. 14-15: Foretarsus in exterior and interior views. 16: Pseudoculus. 17: Female squama genitalis in oblique lateral view. Figs. 18-20: *Berberentulus tannae* n.sp. 18: Pseudoculus. 19: Labial palp in side view. 20: Canal of maxillary gland.

Length of body 530 μm, of foretarsus without claw 50 μm.

Mouthparts of the common shape, but the specimen is seen directly from the side. Pseudoculus small, circular, without "distinctions" (Fig. 13), PR = 14. Labral setae absent.

Foretarsus (Figs. 14-15). t 1 closest to α 3, t 2 lanceolate as are also b'2 and f 1, t 3 fairly long. b broad, e missing, g short seta-like. a' sword-shaped, placed anterior to t 1 (!), b' 1 present, c' absent (?). BS = 0·9, EU = 0·9, TR = 6·0.

Empodium of middle and hind leg short, one-fifth the claw.

Chaetotaxy: On thorax p 1' on segment III fairly long, behind the line p 1-2, abdominal chaetotaxy set out in Table 5—a 3 missing on

TABLE 5

Abdominal chaetotaxy of *Isoentomon pumilioides* n.sp. Numbers above a line refer to the number of setae in the anterior row, numbers below the same line refer to the number of setae in the posterior row.

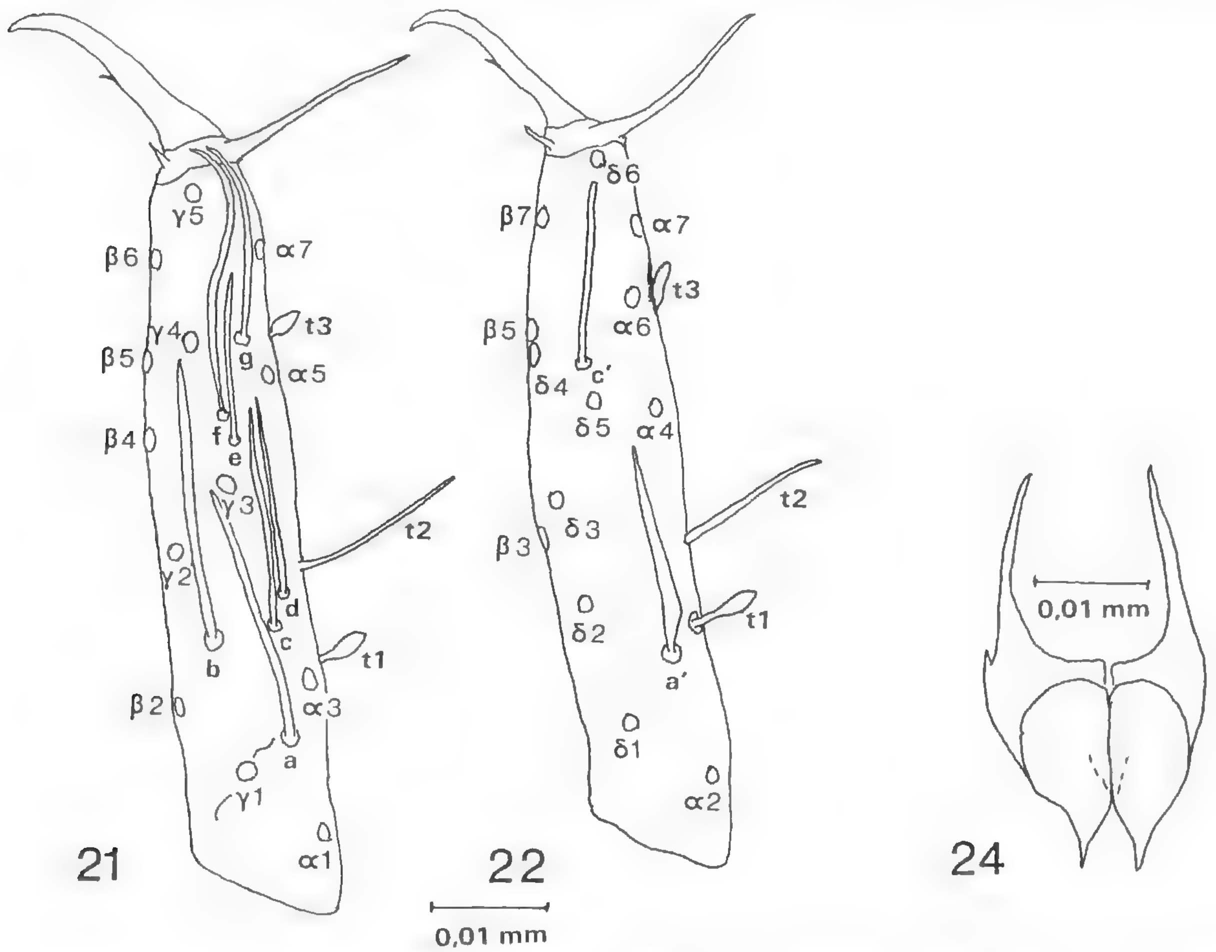
segment	I	II-III	IV-VI	VII	VIII	IX-X	XI	Telson
tergum	4	8	8	6	6	8	4	9
	8	12	14	14	9			
sternum	?	6	6	6	7	4	8	12
		4	10	10				

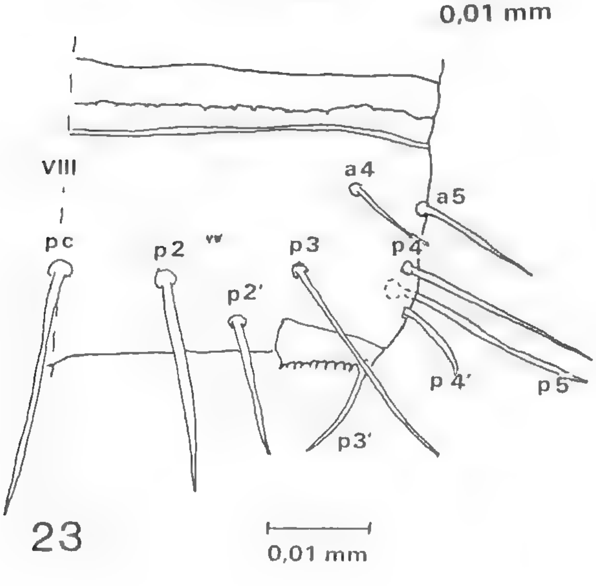
terg. II-VI, on terg. VII also a 1.—p 4′ missing on terg. II-VII, on terg. II-III also p 5.—On terg. VII p 1′ is as long as on the other tergites (a feature I do not remember having noticed on any other eosentomid)—On terg. VIII p 1″-2 are displaced anteriorly.

Female squama genitalis (Fig. 16) seen in lateral view, but resembles that of *pumilio* Bon.

Holotype and only known specimen: ♀. New Hebrides, Tanna Island, on hillside above Bethel village, 4 km S of Lenakel, 19° 33′S, 169° 13′E. Disturbed coastal forest, in soil of 0-4 cm depth. Coll. no. NH 31. K. E. Lee leg. July 28, 1971. In the South Australian Museum, Adelaide.

Three species of *Isoentomon* without sensilla e are now know, in only one specimen each: the present one from the New Hebrides, *I. pumilio* (Bon. 1950) from Mexico and *I. pluviale* Tx. 1975 from Brazil (Amazonia). They agree in many details, but the chaetotaxy of the present one is closest to that of *pumilio*—hence the name.





Figs. 21-24: *Berberentulus tannae* n.sp. 21-22: Foretarsus in exterior and interior views (from different specimens). 23: Right half of abdominal tergite VIII. 24: Female squama genitalis in ventral view.

8. Berberentulus tannae n. sp.

Figs. 18-24

This species is closely related to B. *rennellensis* Tx. & Imad. 1975, in fact it only differs in abdominal chaetotaxy. On terg. VI the anterior seta a 1 is present in *tannae*, absent in *rennellensis*. This may seem a minor difference, perhaps on subspecies level only, but as long as the importance of differences in chaetotaxy is not clearly understood it should be accorded specific rank. The difference in chaetotaxy is constant in both species. *B. buchi* Tx. & Imad. which is different in chaetotaxy from both differs also in the sensilla e in foretarsus being much smaller than c.

Length of body 670 μm, of foretarsus without claw 70 μm.

No rostrum. Labial palp with three setae and a sausage-like sensilla (Fig. 17). Pseudoculus circular (Fig. 18), PR = 13. Canal of maxillary gland of normal shape except for some small dilatations (not excrescences) distal to calyx, proximal part fairly short, end dilatation bipartite (Fig. 19).

Foretarsus (Fig. 20) with sensillae of shape and length as in *rennellensis*. b-c-d may be on line or d placed a little distal to c. c and d close to each other. Sensillae a, b and f extremely long. b′ missing, a′ long and sword-like reaching almost to α 4. BS = 0·5. Claw with a small flap which is said to be missing in *rennellensis* but this flap may be visible or not and is no good as distinguishing character. TR = 4·0. EU = 0·14.

Abdominal appendages II-III with two setae, the apical one less than half the subapical.

Striate band reduced, no striae. Comb on terg VIII oblique, with 10-11 small teeth (Fig. 22).

Female squama genitalis (Fig. 23) with pointed acrostylus.

Abdominal chaetotaxy set out in Table 6—on terg. II-VI a 1, 2, 5 are present, on terg. VII only a 5.

TABLE 6

Abdominal chaetotaxy of *Berberentulus tannae* n.sp. Numbers above a line refer to the number of setae in the anterior row, numbers below the same line refer to the number of setae in the posterior row.

segment	I	II-III	IV-VI	VII	VIII	IX	X	XI	Telson
tergum	6/12	6/16	6/16	2/16	4/15	14	12	6	9
sternum	3/2	3/5	3/8	3/8	4	4	4	4	6

Holotype: ♂ from the New Hebrides, Tanna Island, on hillside above Bethel village, ca. 4 km S of Lenakel, 19° 33′S, 169° 13′E. Coastal forest, in soil of 0-4 cm depth. Coll. no. NH 31. K. E. Lee leg. July 27, 1976. In the South Australian Museum, Adelaide.

Further material: seven ♀, four ♂, three mat. jun., one larva II (?) from the same locality and date.

The specific name is derived from the name of the island.

9. Berberentulus capensis (Womersley 1931)

Berberentulus capensis Wom., Tuxen 1964: p. 311.

This species is easily distinguished from *tannae* in the shape and size of sensilla a′ in foretarsus which is short, only reaching δ 3, and broadly vase-shaped; furthermore sensilla f is placed midway between e and g and e is only a little more than half the length of c. In chaetotaxy the following characters are important: terg. VI with eight anterior setae (1, 2, 4, 5), VII with six (1, 2, 5) and stern XI with six setae (1, 1′, 2).

Occurrence on the New Hebrides: Tanna Island, on hillside above Bethel village, ca. 4 km S of Lenakel 19° 33′S, 169° 13′E. Coastal forest, in soil of 0-4 cm depth. Coll. no. NH 31. K. E. Lee leg. July 27, 1971. Two ♀, one larva II.

Aneityum Island, near top of steep slope above E side of Anelcauhat Bay 20° 15′S, 169° 46′E. Coastal forest with *Acacia spirorbis*, in soil of 4-6 cm depth. Coll. no. NH 26. K. E. Lee leg. July 23, 1971. One ♀.

Further distribution: South Africa, South-west Europe (Tuxen 1964); Australia (Tuxen 1967).

Berberentulus capensis (Wom.), *travassosi* (Silv.) from Brazil, and *nelsoni* Tx. from Brazil (both São Paulo) form a group of their own, related to B. *rennellenis* Tx. & Imad., *buchi* Tx. & Imad. and the above new species *tannae*, all three from Melanesia. See the key in Tuxen (1977).

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BRACHINA METEORITE— A CHASSIGNITE FROM SOUTH AUSTRALIA

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Summary

A small, achondritic stony meteorite, the second recorded chassignite, was found near Brachina, South Australia (31 ^{o} 18' S, 138^{o} 23' E) on 26th May, 1974. It was in two pieces with a combined weight of 202.85g. The form of the frontal surface and the types and distribution of the fusion crusts are indicative of oriented flight. The meteorite, which consists of unshocked subhedral grains of olivine (Fa33) with minor amounts of diopside and plagioclase and accessory chromite, troilite and pentlandite, is compared with the mineralogically and chemically analogous Chassigny meteorite. It is, however, unshocked in contrast to the original Chassigny which was severely shocked.

BRACHINA METEORITE—A CHASSIGNITE FROM SOUTH AUSTRALIA

by

J. E. JOHNSON*, JUNE M. SCRYMGOUR*, EUGENE JAROSEWICH† AND BRIAN MASON†

ABSTRACT

JOHNSON, J. E., SCRYMGOUR, J. M., JAROSEWICH, E. and MASON, B., 1977. Brachina meteorite—A Chassignite from South Australia. *Rec. S. Aust. Mus.* 17 (19): 309-319.

A small, achondritic stony meteorite, the second recorded chassignite, was found near Brachina, South Australia (31° 18′ S, 138° 23′ E) on 26th May, 1974. It was in two pieces with a combined weight of 202·85 g. The form of the frontal surface and the types and distribution of the fusion crusts are indicative of oriented flight. The meteorite, which consists of unshocked subhedral grains of olivine (Fa_{33}) with minor amounts of diopside and plagioclase and accessory chromite, troilite and pentlandite, is compared with the mineralogically and chemically analogous Chassigny meteorite. It is, however, unshocked in contrast to the original Chassigny which was severely shocked.

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INTRODUCTION

The discovery of the Brachina meteorite was made at about 7.30 a.m. on Wednesday, 26th May, 1974 by Mr. Brian Eves, Senior Inspector for the South Australian National Parks and Wildlife Service, who noticed a shining black object lying on a small pedestal of soil with the frontal surface facing west-south-west. There had been rain during the night and Mr. Eves was attracted first by the wet shining surface of the fusion crust and thought he had found a large australite. A smaller piece lying close by was also recovered.

On his return to Adelaide Mr. Eves brought the specimen to the South Australian Museum where it was recognised by one of us (JEJ) as a chassignite.

The meteorite was found at approximately 31° 18′ S, 138° 23′ E on the floodplain of Brachina Creek on the eastern side of the Flinders Ranges (Fig. 1).

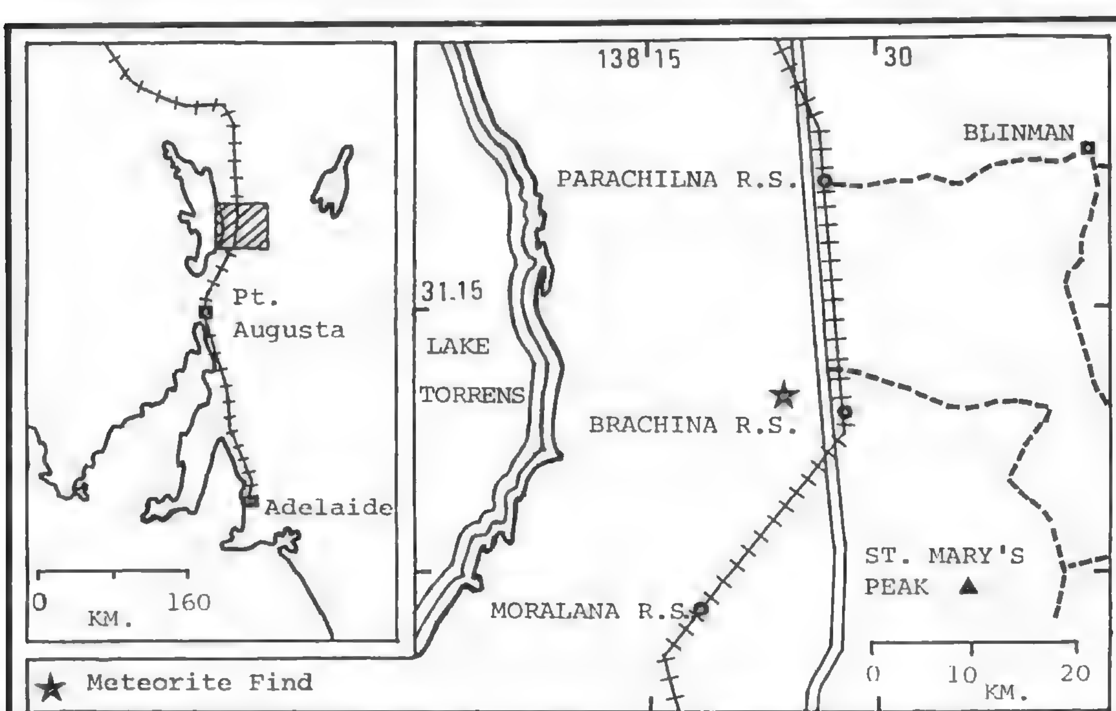


FIG. 1. Locality map.

DESCRIPTION

Weight and External Form

The main mass weighed 195·30 g and the small detached fragment 7·55 g, the total recovery being 202·85 g. Both pieces retained a distinct black fusion crust. The core of granular, greyish-brown, achondritic stony material could be seen where the crust was broken.

The main mass has a complete smooth fusion crust on the asymmetrically-domed frontal surface. The edges of this surface form an irregular five-sided polygon with rounded corners and one broken edge. Slightly off-centre from the apex is a very small depression from which radiate numerous striae and one shorter, broader groove (see Fig. 4). The maximum length is 62·4 mm and the minimum width about 10 mm less. Thickness from the apex of the domed anterior surface to the crest of the posterior central ridge is 41·3 mm.

The posterior surface is covered by a finely vesicular to scoriaceous fusion crust (see Fig. 6). When the detached fragment was replaced it was seen to form part of a longitudinal ridge coincident with the maximum lateral dimension which is flanked by subparallel "facets", two on each side, the two outermost and narrowest being aligned with polygon edges "a" and "c". These bear the most highly scoriaceous crusts and are separated from the rather smoother inner facets by a distinct line of raised glassy material. The smooth fused crust of the frontal surface encroaches slightly on to these facets, and where this occurs the onlapping frontal crust is distinctly grooved at right angles to the edge of the outer facet (see Figs. 7, 8 and 9). The smooth (frontal), grooved (lateral) and scoriaceous (rear) crust types have the distribution relative to the domed frontal surface of a meteorite which was oriented in flight.

It is suggested that the faceting may be the result of the longitudinal ridge acting like a "fin" during atmospheric flight causing the stone to oscillate laterally just after entry but later acting as a stabiliser in generating the domed frontal surface.

Chemical composition, mineralogy, petrology

The chemical analysis of the Brachina meteorite is given in Table 1, along with the calculated CIPW norm, and an analysis of the Chassigny meteorite for comparison. As can be seen, the analyses of the two meteorites are closely comparable; the principal differences are the higher Al_2O_3 and Na_2O in Brachina, a reflection of the higher plagioclase content in this meteorite, and the presence of sulfide in Brachina (a little sulfide is present in Chassigny, but was not determined in the analysis).

TABLE 1

CHEMICAL ANALYSIS AND CIPW NORM OF THE BRACHINA METEORITE

With analysis of Chassigny (McCarthy *et al.* 1974) for comparison.

	Brachina	Chassigny
SiO_2	38·04	37·00
TiO_2	0·12	0·067
Al_2O_3	2·12	0·36
Cr_2O_3	0·58	0·83
FeO	23·69	27·44
MnO	0·34	0·533
MgO	27·27	32·83
CaO	2·10	1·99
Na_2O	0·63	0·15
K_2O	0·08	0·033
P_2O_5	0·27	0·041
H_2O+	nd*	—
H_2O-	0·26	—
C	0·07	—
FeS	3·59	—
NiS	0·56	—
CoS	0·05	—
	99·77	101·27
Total Fe	20·70	21·34
m**	67·0	67·6
S.G.	3·51	3·57

Brachina norm (weight per cent)	
Olivine	77·0
Diopside	4·8
Hypersthene	2·9
Albite	5·3
Anorthite	2·7
Orthoclase	0·4
Chromite	0·9
Apatite	0·6
Ilmenite	0·2
(Fe, Ni, Co) S	4·2

* nd = not determined

** m = 100 Mg/(Mg + Mn + Fe) atomic

Olivine (Fa_{33}) is the dominant mineral in Brachina; it also contains minor amounts of diopside ($Wo_{40}En_{46}Fs_{14}$) and plagioclase (An_{22}), and accessory chromite, troilite, and pentlandite. The 0·27% P_2O_5 indicates the presence of phosphate minerals (apatite and/or merrillite), but these were not identified in microscopic and microprobe examination. The mineralogical composition corresponds very well with the CIPW norm (Table 2). Hypersthene is absent or present only in traces in the meteorite; normative hypersthene is present in solid solution in the diopside, which has a CaO content (18·7%) considerably lower than the theoretical content (25·9%) used in calculating normative diopside.

Trace elements in Brachina, in parts per million, determined by spark source mass spectrometry, (figures for Chassigny (Mason *et al.* 1976) in parentheses) are: Rb 2·0 (0·4), Sr 15·00 (7·2), Y 2·4 (0·64), Zr 2·7 (1·5), Nb 0·28 (0·32), Cs 0·20, Ba 12·00 (7·1),

TABLE 2

MINERAL COMPOSITIONS (MICROPROBE ANALYSES) IN THE BRACHINA METEORITE

And a comparison of the calculated bulk composition with the analytical results in Table 1.

Mineral	Olivine	Plagioclase	Diopside	Chromite	Calculated composition	Analysis data
Weight %	77	8	8	0·8		
SiO_2	37·4	63·3	54·7	—	38·3	38·04
Al_2O_3	—	23·1	0·92	8·5	1·99	2·12
FeO	28·6	0·30	8·6	28·8	22·9	23·65
MnO	0·29	—	0·16	0·32	0·25	0·34
MgO	33·5	—	15·7	5·8	27·1	27·27
CaO	0·25	4·71	18·7	—	2·07	2·10
Na_2O		8·92	—	—	0·71	0·63
K_2O	—	0·26	—	—	0·02	0·08
TiO_2	—	0·05	0·34	2·94	0·05	0·12
Cr_2O_3	0·08	—	0·94	53·2	0·57	0·58

La 0·95 (0·39), Ce 1·6 (1·12), Pr 0·19 (0·13), Nd 0·86 (0·54), Sm 0·27 (0·11), Eu 0·11 (0·038), Gd 0·27 (0·11), Tb 0·05 (0·02), Dy 0·32 (0·12), Ho 0·07 (0·03), Er 0·19 (0·09), Yb 0·18 (0·10), Pb 0·60 (1·0), Th 0·13 (0·057). As can be seen, for most trace elements the content in Brachina is approximately twice that in Chassigny. A comparison of the rare earth (REE) abundance is presented in Fig. 2. The distribution patterns are quite similar, showing a rapid decline in relative abundances for the light REE (La-Sm) followed by a slight positive Eu anomaly and practically uniform relative abundances for the heavy REE (Gd-Yb). This distribution pattern may be unique to Brachina and Chassigny; the only comparable pattern among meteorites is that for Nakhla, an achondrite consisting of approximately 75% clinopyroxene ($Ca_{39}Mg_{38}Fe_{23}$), 15% olivine (Fa_{80}), minor plagioclase (An_{33}), and accessory magnetite and sulfides. The REE distribution pattern for Nakhla, however, shows a uniform decline in relative abundances from La to Yb, and no Eu anomaly. Nakhla is classified as a calcium-rich achondrite and Chassigny and Brachina are calcium-poor achondrites, but a genetic relationship may exist between them.

The texture of the Brachina meteorite can be described as subhedral-granular (Figs. 10 and 15). Individual grains of the silicate minerals range from 0·05-0·7 mm in greatest dimension, the average being about 0·2 mm. This is in marked contrast to Chassigny (Fig. 14), which is much coarser-grained, the range for the silicate minerals being 0·3-1·8 mm and the average 0·7 mm; Chassigny is also a shocked meteorite (evidenced by the extreme fracturing of the silicate grains), in contrast to the unshocked nature of Brachina. In Brachina chromite and the sulfide minerals (troilite and pentlandite) are interstitial to the silicate minerals. A small amount of limonite produced by terrestial weathering permeates the meteorite below the fusion crust.

The texture of Brachina suggests the slow crystallisation under static conditions of a body of magma of essentially the same composition. This composition in the MgO-FeO-SiO_2 system would be completely molten at about 1 600°C (Bowen and Schairer, 1935); the presence of minor components such as CaO, Al_2O_3, and Na_2O would lower this temperature somewhat. The first phase to crystallise would be olivine, followed at about 1 400°C by clino- and/or orthopyroxene, and plagioclase at about 1 200°C; an immiscible sulfide melt would be present in small amount, and would crystallise interstitially to the silicates at considerably lower temperatures (1 000°C or less).

Brachina is a somewhat friable meteorite—individual silicate grains were detached from a smaller piece by gentle rubbing, although this fragment was removed from the main mass only with considerable difficulty. The friability is due to the non-interlocking nature of many of the grains, and the presence of microscopic voids. The porosity is clearly seen in scanning electron micrographs (Figs. 12 and 13), as is the subhedral to euhedral nature of many of the grains; these features suggest the presence during crystallisation of a vapour phase.

The Brachina meteorite has a well-preserved fusion crust, a fortunate feature since without it the identification as a meteorite might have been difficult, in view of its mineralogical and textural similarity to a terrestrial peridotite. This is clearly seen in Fig. 10 and magnified in Fig. 11 Three distinct zones can be recognised. An outer

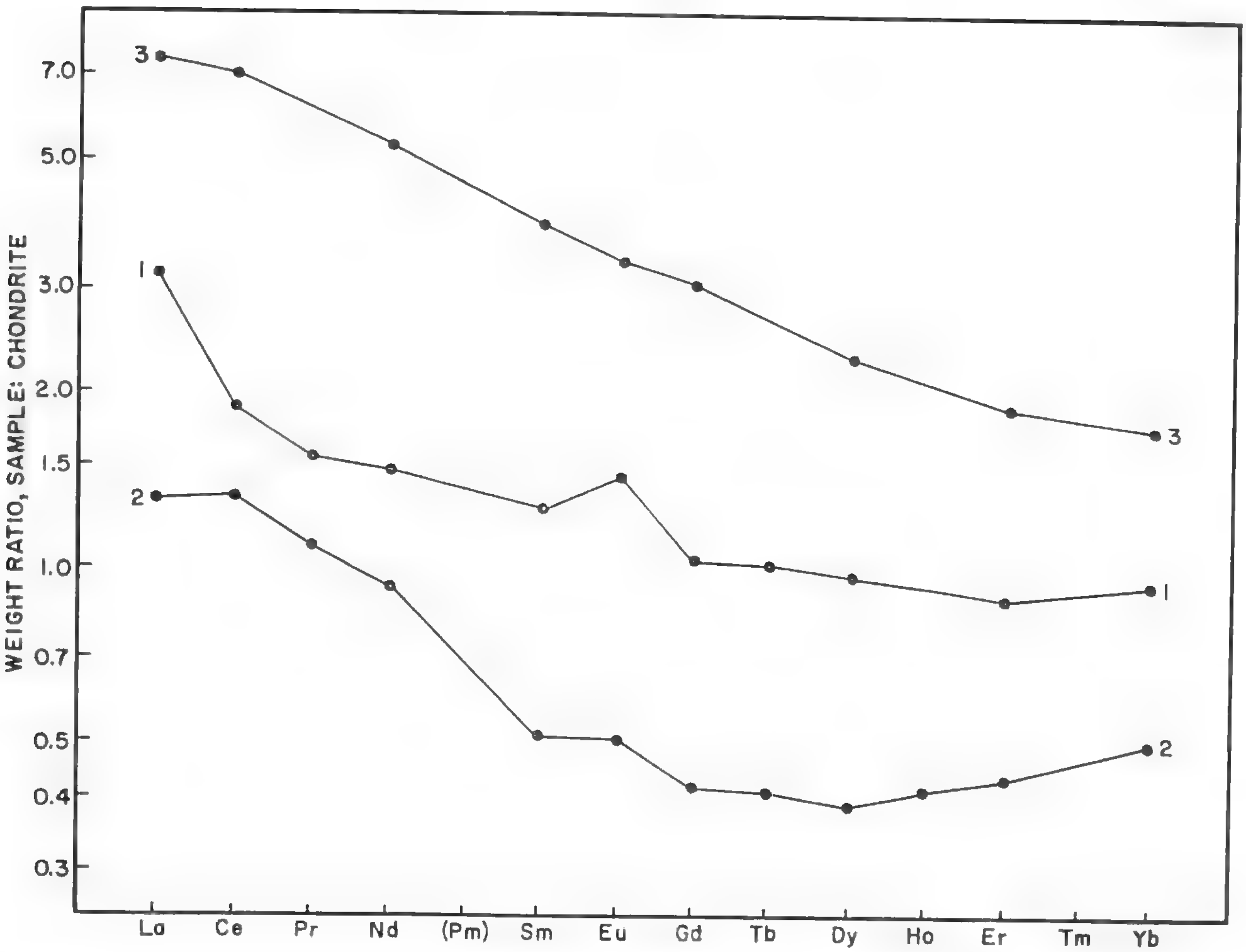


FIG. 2. Rare earth distribution, normalised to chondritic abundances, for (1) Brachina, (2) Chassigny (Mason *et al.*, 1976), and (3) Nakhla (Nakamura and Masuda, 1973).

zone (up to 0·5 mm thick) consists of highly vesicular dark glass with small skeletal olivine crystals; in places this zone has been partly or wholly removed, probably by terrestrial abrasion. A median zone (averaging 0·4 mm thick) consists largely of skeletal olivine with interstitial glass and olivine. This skeletal olivine is notably more magnesian (Fo_{84}) than the olivine (Fo_{67}) of the main mass of the meteorite; the formation of the fusion crust results in the precipitation of some of the iron in the meteoritic olivine as Fe_3O_4. A very thin (~0·03 mm) inner zone records the beginning vitrification of the silicate minerals, with the appearance of a dusting of magnetite (?) grains. Immediately below the fusion crust the silicate grain boundaries have a thin sulfide coating, evidently developed from the fusion of sulfide grains, the least refractory of the meteorite phases.

DISCUSSION

Although classified as achondrites, Chassigny and Brachina are chemically comparable to the chondrites, specifically the L and LL chondrites, as has been pointed out by Dr. R. A. Schmitt (pers. comm.—see below). Using the criteria developed by Van Schmus and Wood (1967), we see the following analogies:

	L	LL	Brachina
Total Fe/SiO_2	0·55 ± 0·05	0·49 ± 0·03	0·54
Olivine composition (% Fa)	24	29	33
SiO_2/MgO	1·59	1·58	1·39

Unlike the chondrites, Brachina contains no free nickel-iron metal, and its SiO_2/MgO ratio is lower than most chondrites. However, some carbonaceous chondrites have SiO_2/MgO ratios similar to that of Brachina, e.g. Allende (1·39). The relatively high Fa content of the olivine in Brachina is similar to that in the LL and C3 chondrites. The classification of Brachina and Chassigny as achondrites is determined essentially by their granular non-chondritic textures; it should be remarked that chondritic structure is practically absent in the L chondrite Shaw, and texturally it resembles Brachina closely (Fredriksson and Mason, 1967). However, the distinctive rare-earth distribution pattern in Brachina and Chassigny does indicate that if those meteorites are related to the chondrites, some chemical fractionation has taken place.

Dr. R. A. Schmitt of Oregon State University (pers. comm.) has supplied the following additional information based on his analysis of a small sample of Brachina meteorite.

> "Bulk and trace elements were determined in an aliquant of a powdered sample obtained from Brian Mason. The sample was analysed via instrumental neutron activation analysis by Drs. A. V. Murali and M.-S. Ma. The results are listed below.

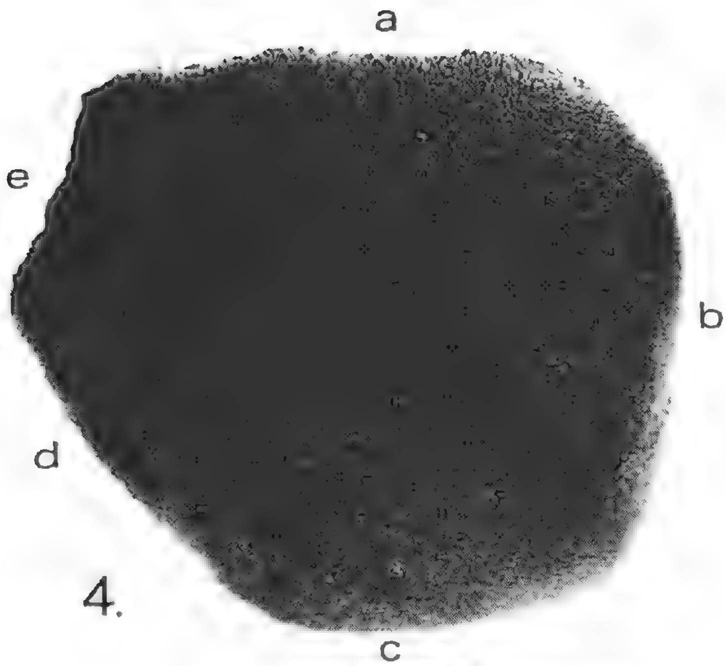
	Per cent	
Al_2O_3	2·05	
FeO	26·5	(all Fe calculated as FeO)
MgO	26·6	
CaO	2·2	
Na_2O	0·74	
MnO	0·33	
Cr_2O_3	0·63	
Sc	8·2	ppm
V	77	ppm
Co	265 (equivalent to 0·041% CoS)	ppm
Ni	4180 (equivalent to 0·64% NiS)	ppm
La	0·38 ± 0·04	ppm
Sm	0·20	ppm
Eu	0·05 ± 0·02	ppm
Yb	0·24 ± 0·06	ppm
Lu	0·07 ± 0·02	ppm
Ir	111	ppb
Au	15 ± 2	ppb

3a

3b

FIG. 3a. Looking east towards the Flinders Ranges from the site of the find. The specimen was found in the small open space at the ranger's feet.

FIG. 3b. Closer view of the site. The meteorite was lying on a small pedestal of soil within the ring of stones by the ranger's right foot.



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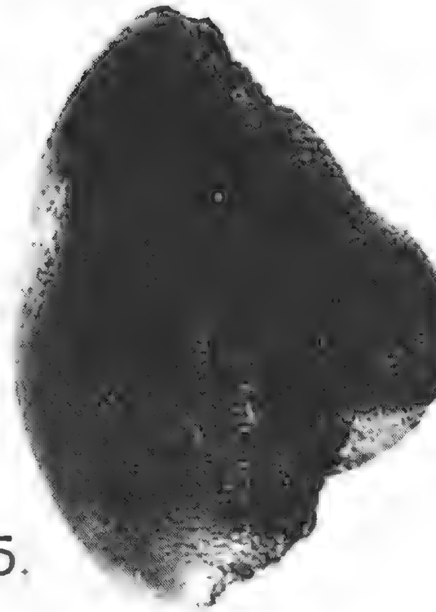

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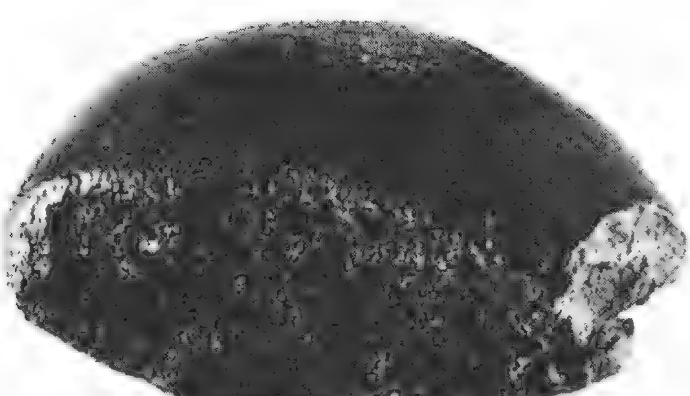

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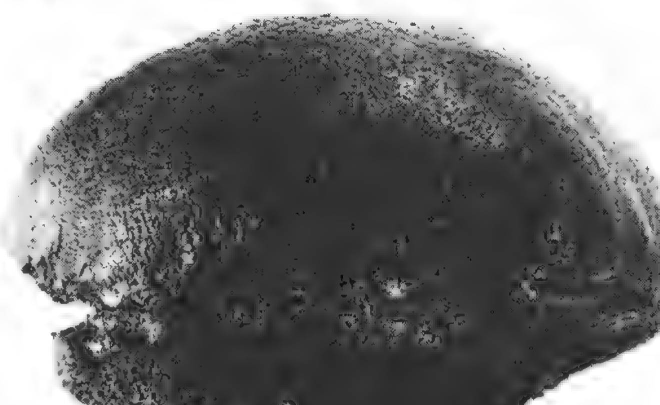

9.

From our analysis, we must conclude that essentially all abundances fall within the range for L- or LL-chondrites. The deficiency of free nickel-iron metal as reported by B. Mason accounts for the lower Co, Ni, Ir and Au abundances in Brachina. Perhaps the significant differences between REE patterns observed by B. Mason and us may be attributed to sampling problems. This would suggest that some trapped interstitial liquid may be responsible for these observations. Such a hypothesis would be consistent with current studies by our group on ten small (50 mg) chips of Chassigny."

ACKNOWLEDGEMENTS

We thank Mr. J. Nelen for the microprobe analyses of the minerals, Mr. W. Brown for the scanning electron microphotographs and Dr. S. R. Taylor and Ms. P. Muir for assistance with the spark source mass spectrometric analyses for trace elements. Thanks are also due to Dr. R. A. Schmitt for permission to reproduce in full the results of a chemical analysis by Drs. A. V. Murali and M.-S. Ma.

Mr. R. Ruehle of the S.A. Museum took the photographs and Ms. F. Gommers drew the locality map.

The South Australian Museum gratefully acknowledges the generosity of Mr. Brian Eves in donating the Brachina meteorite to the State Collections.

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FIG. 4. Brachina meteorite. Scale in centimetres. Oriented anterior surface with striae. Edge "e" is a broken surface.

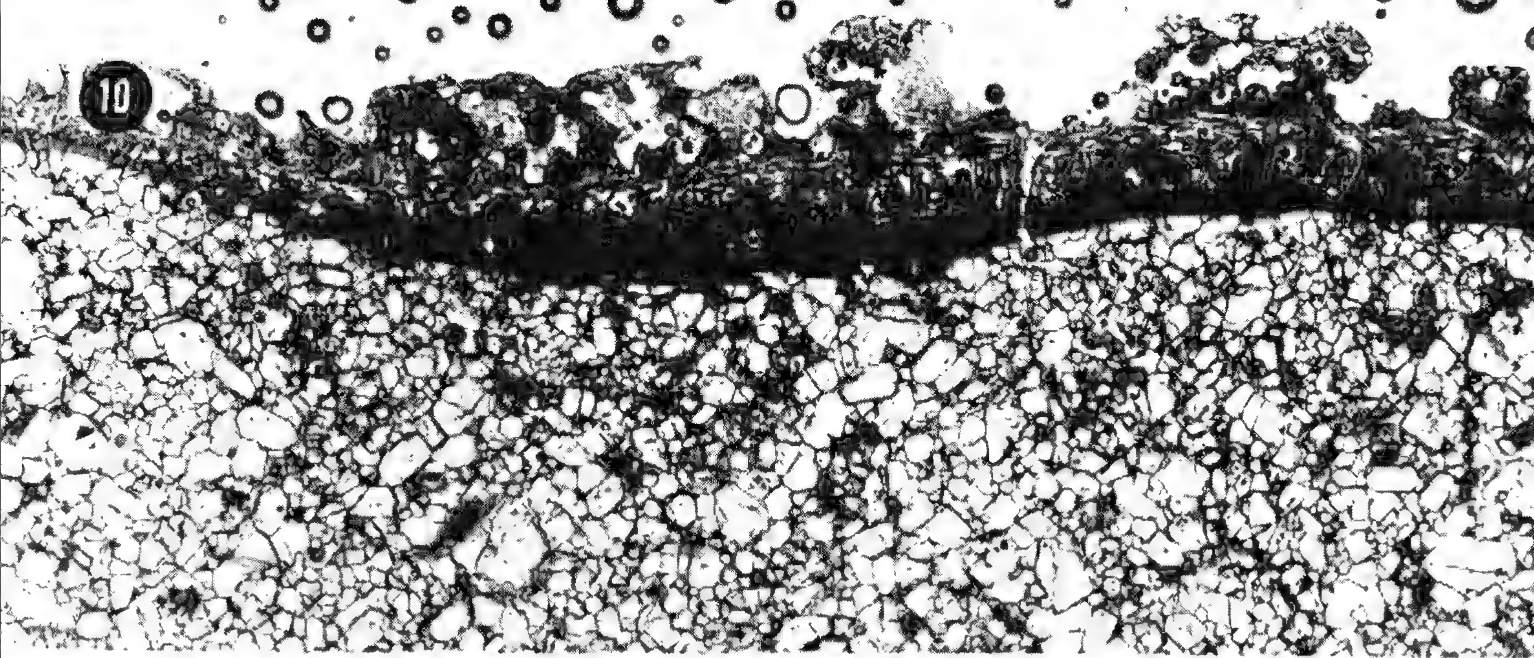
FIG. 5. Side elevation of edge "b" showing almost triangular outline with continuous fusion crust to the base of the ridge.

FIG. 6. Plaster cast. Posterior surface with detached piece restored to its original position, showing flattened longitudinal ridge, subparallel "facets" and scoriaceous fusion crust.

FIG. 7. Plaster cast. Side elevation of edge "c", showing grooved smooth crust of the frontal surface encroaching on to a scoriaceous "facet".

FIG. 8. Side elevation of edge "a".

FIG. 9. As for Fig. 7 but tilted down slightly towards viewer.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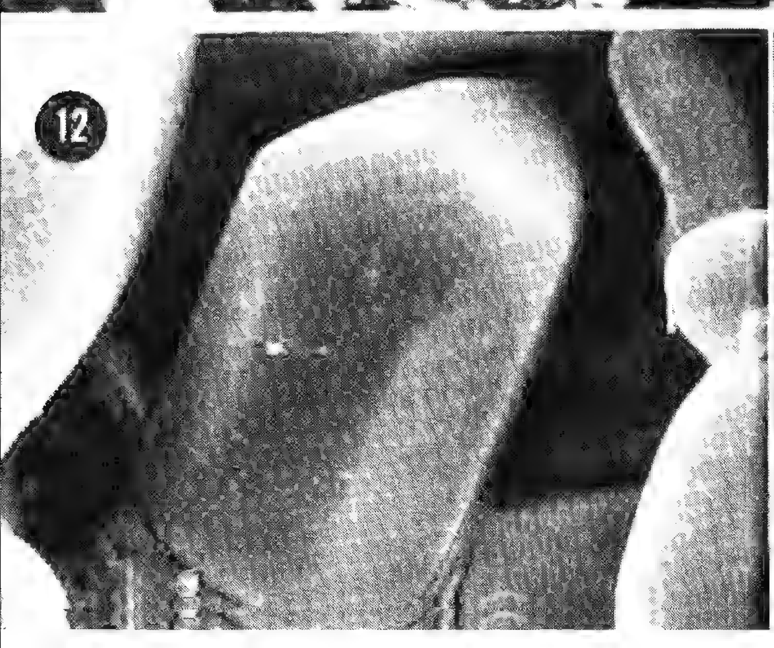
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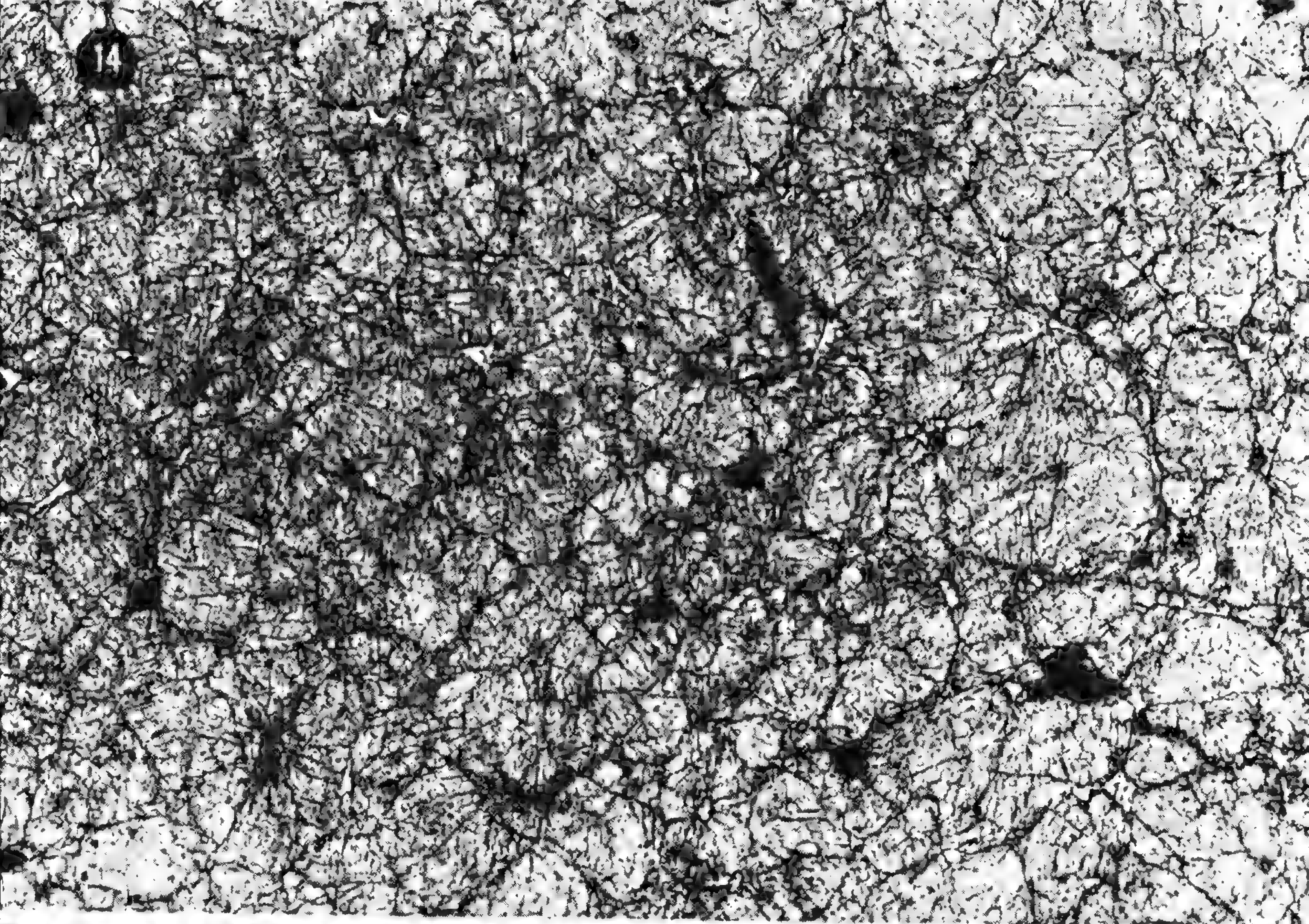
FIG. 10. Photomicrograph (transmitted light) of portion of a thin section of the Brachina meteorite illustrating the subhedral granular texture. Fusion crust is present at one edge (x23).

FIG. 11. Photomicrograph (transmitted light) of the fusion crust of Brachina meteorite. Total thickness of fusion crust is approximately 1 mm.

FIG. 12. Scanning electron micrograph of euhedral olivine crystal in a void (x675).

FIG. 13. Scanning electron micrograph of octahedral chromite crystal in a void (x400).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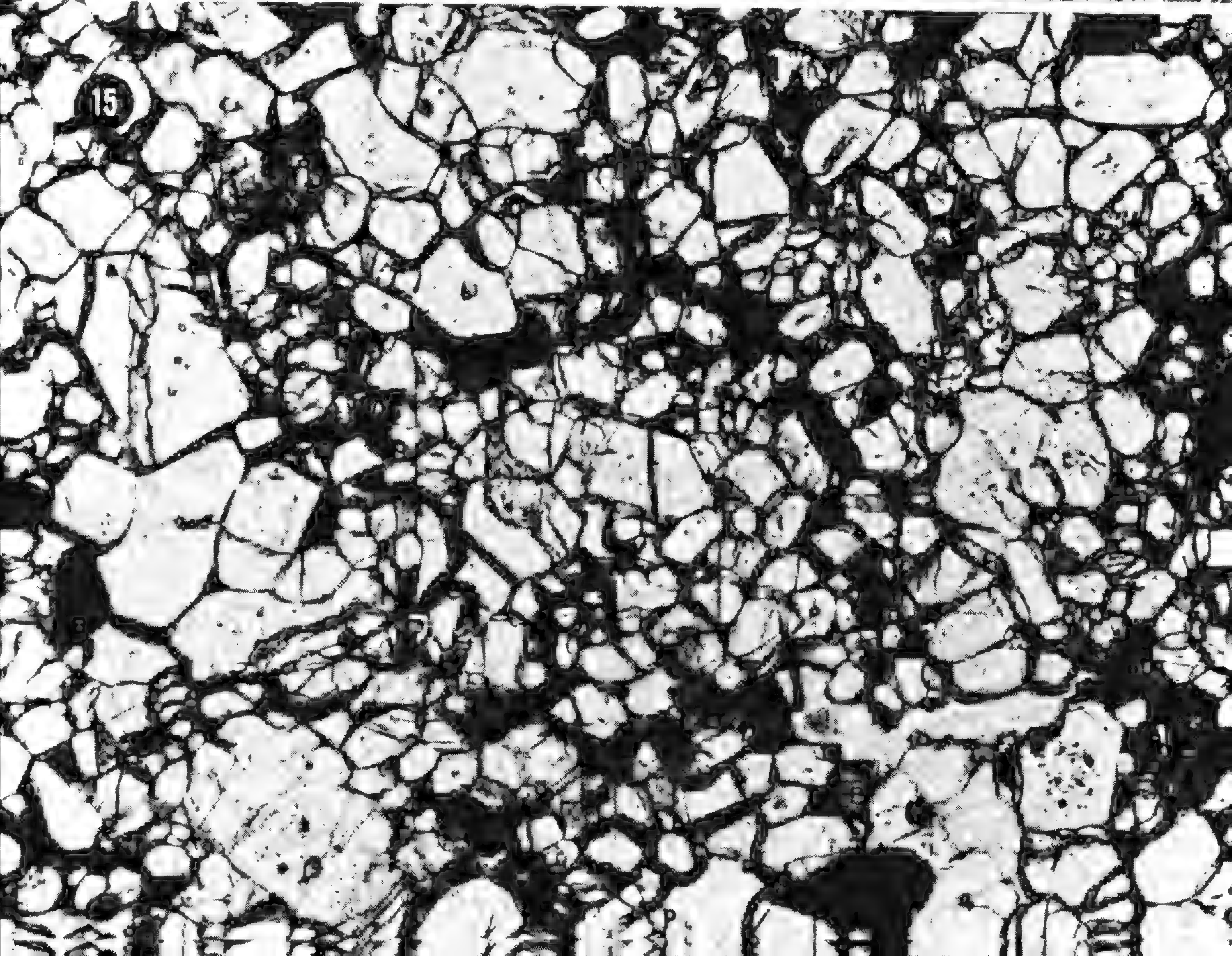
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FIG. 14. Photomicrograph (transmitted light) of a thin section of the Chassigny meteorite (x27). Most of the grains are olivine and show extreme fracturing due to shock.

FIG. 15. Photomicrograph (transmitted light) of a thin section of the Brachina meteorite at a higher magnification (x83). Most of the white grains are olivine, with minor pyroxene. Plagioclase is present as larger interstitial grains.

RECORDS OF THE
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AUSTRALITES OF MASS GREATER THAN 100 GRAMS FROM SOUTH AUSTRALIA AND ADJOINING STATES

By W. H. CLEVERLY and JUNE M. SCRYMGOUR

SOUTH AUSTRALIAN MUSEUM
North Terrace, Adelaide
South Australia 5000

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Summary

The 17 australites of mass exceeding 100g known from eastern Australia are round, oval and dumbbell-shaped cores. They were found within a belt extending from Charlotte Waters, N.T. to western Victoria, and divergent south-ward from a more populous belt of unusually massive australites in Western Australia. There is a suggestion of radiation of australite distribution pattern from central Australia.

AUSTRALITES OF MASS GREATER THAN 100 GRAMS FROM SOUTH AUSTRALIA AND ADJOINING STATES

by

W. H. CLEVERLY* and JUNE M. SCRYMGOUR†

CLEVERLY, W. H. and SCRYMGOUR, J. M. 1977. Australites of mass greater than 100 grams from South Australia and adjoining States. *Rec. S. Aust. Mus.* 17 (20): 321-330.

ABSTRACT

The 17 australites of mass exceeding 100 g known from eastern Australia are round, oval and dumbbell-shaped cores. They were found within a belt extending from Charlotte Waters, N.T. to western Victoria, and divergent southward from a more populous belt of unusually massive australites in Western Australia. There is a suggestion of radiation of australite distribution pattern from central Australia.

INTRODUCTION

Only one australite in about 2 000 has mass 100 grams or more. The purposes of this paper are to describe several such rare specimens from eastern Australia and to collate information on others known from the region. The methods and manner of presentation of Cleverly (1974) are followed.

The sites of find and some physical details of the specimens are presented in Figure 3 and Table 1. The numbers allotted to the specimens in that table are also used in the descriptive section below and on the illustrations. Figures in parentheses in the table are estimated restored dimensions or mass and each immediately precedes the observed figure. Specimens for which adequate descriptions are already available were not re-examined. Information on two further specimens which have been reliably reported, but which could not be located, has also been included in Table 1.

DESCRIPTIONS

1. S.A.M. T1159. Salient details with illustrations of the posterior surface of flight and a side elevation have been given by Fenner (1955; p. 90 and Pl. VII Figs. 3 and 4).

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Though the surface of the specimen is considerably etched, the form is generally well preserved. The posterior surface in particular is deeply etched. Minor sculpture includes a system of grooves of V-shaped section forming a complex maze over the posterior pole but trending generally parallel to the long axis of the specimen and radiating towards the ends. Away from the central complex, short grooves occur singly or in "sheaves" with the peculiar form of those described and illustrated by Baker (1973). Each "sheaf" contains two or three parallel grooves and shallower extensions of the individual grooves form divided ends. A further swirling system of grooves together with more lightly etched schlieren crosses the first system near one end of the specimen. There are three small areas of close pitting with almost scoriaceous appearance.

The rim is regular and generally sharp. The equatorial zone (13-15 mm wide) shows two only, much modified "flake scars", a few grooves of U-shaped cross section oriented normal to the rim and some etched schlieren. Circular and lunate etch grooves are abundant on the anterior surface with a few lightly etched schlieren.

Enlarged longitudinal and transverse profiles of the posterior surface were prepared in two ways—by projection with a lantern and using a travelling vernier microscope (readable to 0·01 mm horizontal and vertical). It was suspected that projection by lantern or photography might lead to some distortion of the profile of such an unusually large specimen. It is therefore of interest, considering the tedium of the microscopic method, that arcs of circles fitted very closely to both of the prepared transverse profiles and gave insignificantly different estimates of 2·96 mm and 2·95 mm respectively for the radius of curvature. If the shape of the primary body was a response to rotation of a mass of melt about the Y axis (Fig. 1), then departure from circular transverse section to a shape approximating an ellipse should be most evident in the principal transverse section, the effect declining outward towards the ends of the mass. No such effect was detectable, despite the large

TABLE 1

SHAPES, SITES OF FIND, AND PHYSICAL DETAILS OF AUSTRALITE CORES OF MASS GREATER THAN 100 GRAMS

No.	Shape Type	Site of Find	Longitude (East)	Latitude (South)	Mass (g)	Dimensions (mm)	S.G.	Source of Information
1	Narrow oval	Karoonda, S.A.	139° 55′	35° 06′	207·88	84·4 x 47·0 x 37·7	2·408	
2	Broad oval (fragment)	c.25 km N.N.W. of Balaklava, S.A.	138° 20′	33° 58′	(210 ± 10) 141·00	(c.82) 64·4 x (c.59) 57·0 x 30·1	2·384	
3	Narrow oval	Connangorack Swamp, Victoria	142° 05′	36° 58′	173·621	78·9 x 47·6 x 34	2·417	Baker (1972)
4	Round	Western Victoria or Teetulpa, S.A.			(c.168) 153·96	52·7 x (51·3) 51 x 44·5	2·399	Cleverly (1974)
5	Round	c.40 km S.S.W. of Charlotte Waters	134° 50′	26° 10′	149·31	54·2 x 51·8 x 41·1	2·448	
6	Boat	c.5 km E. of Port Campbell, Victoria	143° 02′	38° 37′	141·575	86·2 x 41·3 x 30·5	2·414	Baker (1969)
7	Broad oval	Gymbowen, Victoria	141° 36′	36° 45′	135·09	55·0 x 51·4 x 36·3	2·417	Baker (1969)
8	Round	Penwortham, c.33 km N.E. of Balaklava	138° 38′	33° 55′	131·95	49·5 to 46·8 x 42·0	2·375	
9	Broad oval	c.10 km S.S.W. of Abminga Siding	134° 48′	26° 13′	121·24	54·4 x 49·5 x 35·7	2·447	
10	Broad oval (fragment)	c.13 km E. of William Creek Railway Siding, S.A.	136° 29′	28° 55′	(c.120 ± 5) 100·71	(c.66) 55·3 x 51·7 x 28·2	2·390	
11	Round	Koralta Station, N.S.W.	142° 18′	31° 37′	117·99	46·6 to 44·6 x 44·4	2·401	
12	Round	Lower Norton, Victoria	142° 04′	36° 47′	115·92	52 x 33	2·463	Baker (1969)
13	Dumbbell	Laing, Victoria	c.142° 50′	c. 38° 25′	115·752	74·9 x 36 x 29·7	2·467	Baker (1969)
14	Broad oval	Between Karoonda and Lowaldie, S.A.	c.139° 57′	c. 35° 04′	113	52·1 x 51·5 x 36·5		Fenner (1955)
15	Round	Lake Wallace, Victoria	141° 18′	37° 02′	111·25	49·6 x 36·5	2·447	Baker (1969)
16	Boat	Central Australia			110·10	75·2 x 37·0 x 28·4	2·399	
17	Round	Charlotte Waters, N.T.	134° 56′	25° 56′	103			D. H. McColl

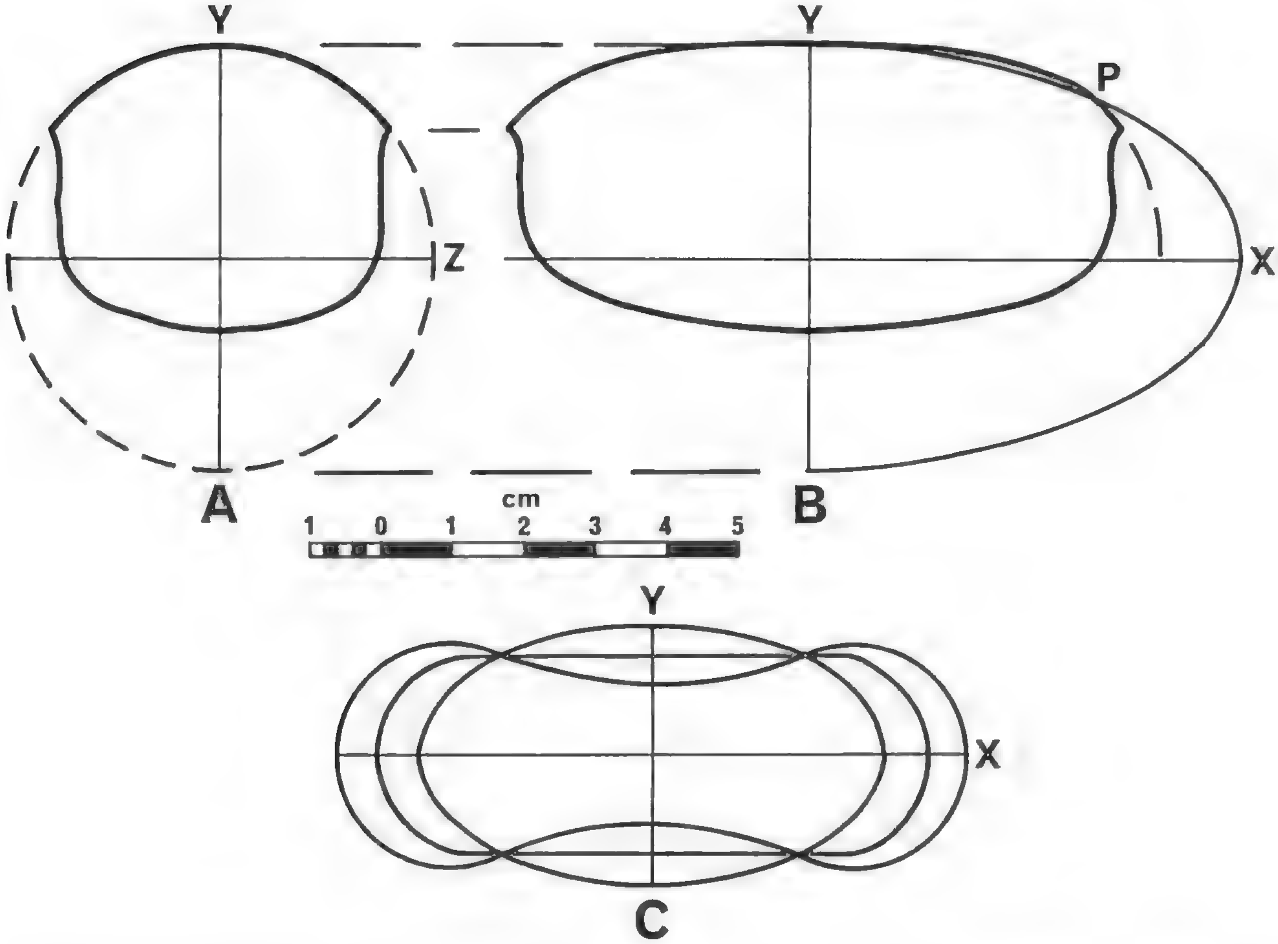


FIG. 1. A. Principal transverse section of australite S.A.M. T1192 with broken line indicating restored circular section of primary body. Direction of flight towards bottom of page. B. Principal longitudinal section of same australite showing attempt to fit an ellipse having semi-minor axis equal to radius of principal transverse section and semi-major axis calculated by using co-ordinates of point P. More realistic partial reconstruction of profile indicated by broken line. C. Principal longitudinal sections of three idealised types of primary bodies formed in response to increasingly faster rates of rotation about the Y axis:— prolate spheroid (elliptical section), body with cylindrical mid-section (boat primary body), dumbbell. Axes X, Y and Z are along the length, thickness and width respectively of the primary australite bodies and are parallel to the analogous dimensions of the australite specimen. Scale applies to A and B only.

size of the core, the circular arcs fitting the profile within the thickness of construction lines (Fig. 1A).

Unsuccessful attempts were made to fit an ellipse to the longitudinal profile using the transverse radius of curvature as the semi-minor axis of the ellipse (Fig. 1B). The failure arises from the considerable flattening of the central portion of the profile and strong curvature of the ends. Deep etching is inadequate to account for the lack of fit. The specimen appears to have been derived from a parent mass intermediate between a prolate spheroid and a dumbbell shape of more rapid rotation, when the sides were approaching parallelism and the shape approximated very roughly towards a cylinder with rounded ends (Fig. 1C). Such a form would be the ideal parent body for parallel-sided, boat-shaped australites.

*2

An approximate assessment of the parent body was made using a major axis positioned by the principal transverse radius of curvature, sketching the ends of the profile to completion on that axis, and summing the volumes of a number of short cylinders. On that basis, the parent body of dimensions c.9·5 x 6 x 6 cm, volume c.195 cm^3 and mass c.470 g, lost rather more than one-third of its thickness and rather more than half its mass in forming the remnant core.

2. Fig. 2. S.A.M. T1391. Found by Mr. Robert Williams about 1969 in Hundred of Everard, Section 383 adjacent to Section 361 (c.25 km north-north-west of Balaklava, S.A.). The specimen is about two-thirds of a broad oval core which has broken through a large bubble cavity. The cavity was open to the posterior surface. Lightly etched schlieren, small pits and the dull lustre of the fracture surface indicate its

considerable age. The mass and length prior to fracturing (Table 1) are based on the assumption that the specimen was initially symmetrical. The estimate of mass was made by immersing the complete end of the specimen in liquid to the adjudged mid-line and noting the loss of weight. The mass was then calculated by using the proportion of twice the loss of weight of the complete end/loss of weight of the whole specimen.

A depressed area on the posterior surface contains a roughly radial system of short grooves which are V-shaped in cross section. A non-spherical bubble cavity c.1 cm in diameter opens to the posterior and fracture surfaces. It appears to have adjoined a smaller bubble cavity but the present shape is at least partially the result of weathering. The rim is sharp and regular. The equatorial zone, 15 mm wide, is bounded anteriorly by a distinct shoulder. The anterior surface has abundant circular and lunate etched features and shows some bruising, apparently recent and artificial. A small area on the equatorial zone has also been artificially abraded. Short gutters, which are U-shaped in section, are developed on the periphery of the anterior surface and extend on to the equatorial zone. The depression on the posterior surface (Fig. 2-2A) affects the transverse and longitudinal profiles to the extent that no reliable estimate of the primary body is possible. The low specific gravity is accountable to high silica content as the refractive index is also low ($n_{Na} = 1{\cdot}496$).

3. Fully described and figured by Baker (1972).

4. Briefly noted and figured by Fenner (1955: Pl. VII Figs. 5 and 6). Described by Cleverly (1974), who favoured western Victoria rather than Teetulpa, S.A., as the likely place of find because of the limited distribution of large australites then known. A much wider distribution is reported in this paper and the low specific gravity of the specimen (2·399) is more nearly allied to the values for five specimens from central and southern South Australia (2·375-2·408, weighted mean 2·393) than to the higher values for the six Victorian specimens (2·414-2·467, weighted mean 2·435). Teetulpa, located in southern South Australia and within the belt of occurrence of large australites, is therefore at least equally likely to be the site of find.

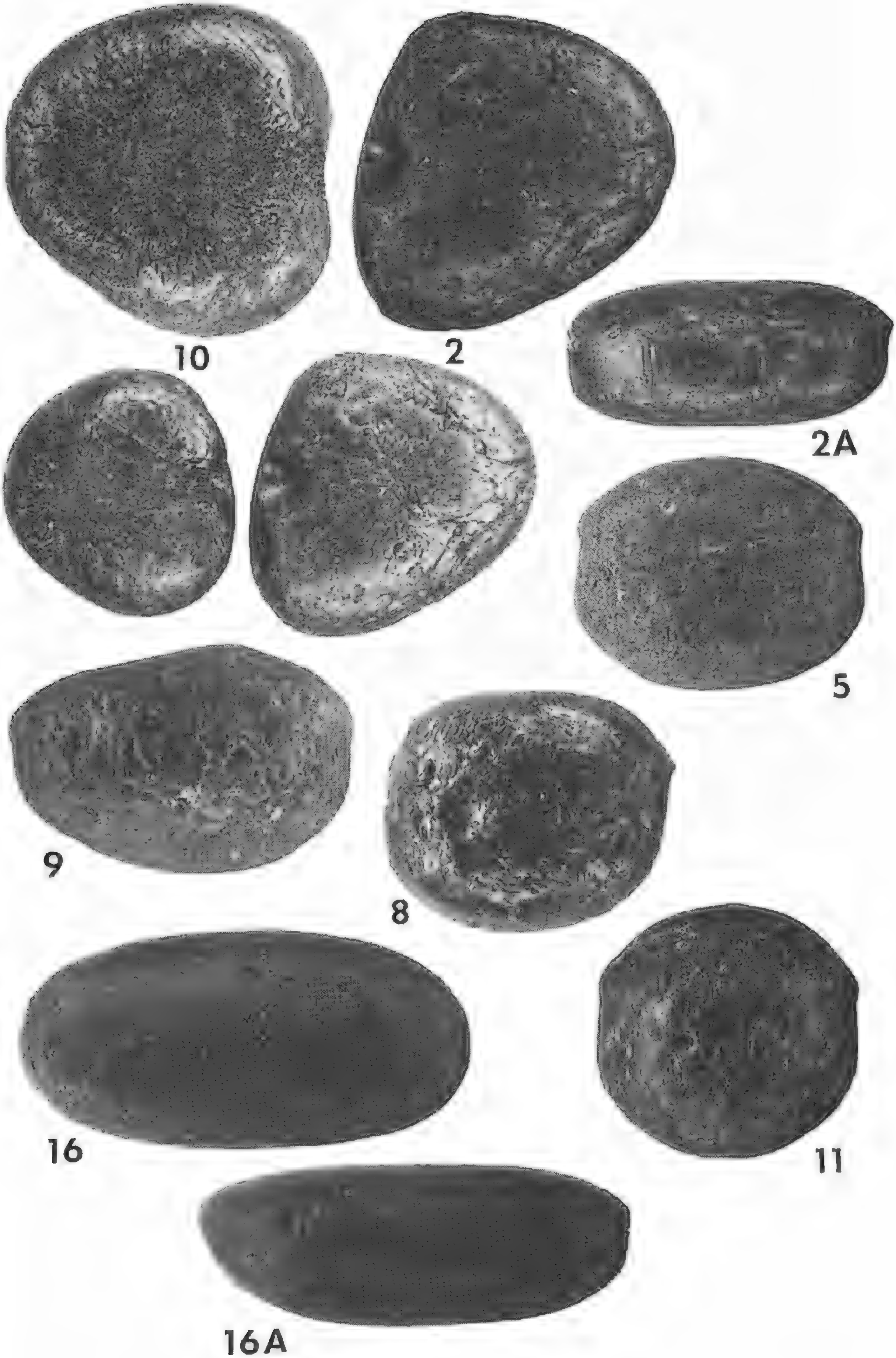
5. Fig. 2. No. 194 in private collection Mr. G. Latz. Mr. D. H. McColl (*pers. comm.*) states that the specimen was found by an Aboriginal in 1969 at a point located approximately 134°50' E., 26°10' S. The co-ordinates indicate a site in South Australia about 40 km south-south-west of the abandoned Charlotte Waters Station.

The form is affected by old flake losses, the only minor sculpture being rounded and lunate features attributed to the etching of natural percussion scars. The equatorial zone, about 15 mm wide, is defined between the rim and a distinct shoulder. The core has its greatest diameter at the shoulder, i.e. bulges anterior to the rim. The only reasonably complete profile of the posterior surface through the posterior pole gives an estimate of 6·6 cm for the diameter of the primary body, which, on the assumption that it had the same density as the remnant core, had volume c.150 cm^3 and mass c.370 grams. Losses from the primary body during atmospheric flight (including the stress shell) were approximately 40 per cent of volume and 38 per cent of thickness. These figures include small percentages accountable to terrestrial losses which have been minimised by allowing for the flakes.

6. and 7. Fully described and figured by Baker (1969).

8. Fig. 2. Private collection of Mr. L. French. The history of recovery is obscure. According to Mr. A. E. Bannear, who arranged the loan, the specimen is thought to have been found at Penwortham during excavation of a dam, either during the 1870's or early 1900's. Attempts were made to break the specimen and it was then discarded for many years. The resulting artificial damage comprises only some bruising

FIG. 2. Australites from eastern Australia numbered as in text and Table 1. Scales differ slightly and may be judged by the dimension given for each specimen. In elevational views direction of flight is towards bottom of page. 10 (left) and 2 (right). Posterior surfaces. Width (top to bottom of photograph) is 51·7 mm for 10 and 57 mm for 2. Lower photographs are both on the same scale with proximal ends raised to emphasise bubble cavities. 2A, Elevational view looking normal to the lower right hand edge of Fig. 2. Note slightly sway-backed posterior (upper) profile through etched depression. 5. Side elevation, width 53 mm. 8. Side elevation, width 48 mm. 9. Side elevation, width 54·4 mm. 11. Side elevation, width 45·5 mm. 16. Posterior surface, length 75·2 mm. 16A. Side elevation. Profile at left affected by natural loss of material.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16A

and the loss of minor flakes. Additionally, a small area on the posterior surface has been artificially abraded. These losses represent only a few tenths of a gram of glass.

An old, natural flake loss from the posterior surface contributes to the marked asymmetry of the core and most of the rim has been lost by natural flaking. Two shallow depressions on the posterior surface each c.7 mm diameter, are centres of development of a few short (1-2 mm), roughly radially disposed, gash-like grooves; the depressions were probably bubble craters, now considerably modified by weathering. A system of short (1-4 mm) grooves of U-shaped section is orientated approximately parallel to the flight path on the narrow flake scars where rim has been lost. A few scars of detachment of the stress shell ("flake scars"), now greatly modified by weathering, are still detectable on the equatorial zone, which averages 15 mm wide. The anterior surface is relatively smooth except for some short grooves of U-shaped section and some etched circular and lunate "scars".

The specific gravity is low but not abnormally so (cf. the Mortlake, Victoria specimen of Chapman 1971: p. 6318) and might be indicative of high silica content rather than bubble cavities.

9. Fig. 2. S.A.M. T1392. Found about 10 km south-south-west of Abminga Siding by R. J. Hyde of Hamilton Station, Pedirka, via Port Augusta, prior to 1974. The specimen is asymmetrical as the result of old flake losses from the posterior surface and variable thickness of the stress shell. The profile is distinctly "peaked" in end elevation. The core is badly weathered but traces of the rim and an equatorial zone 8-10 mm wide with "flake scars" are still recognisable. Minor sculpture comprises a few weathering pits and etched lunate and circular scars.

10. Fig. 2. Private collection of Mr. G. Hume. The specimen is the major part of a broad oval core which has broken through a large bubble cavity and been much modified by weathering. Estimates of the original length and mass were made as for No. 2 above. A depression on the posterior surface contains a highly developed, roughly radial system of short, gash-like grooves. The rim is worn smooth and the equatorial zone is poorly defined, the elevational profile passing with almost imperceptible change of angle to the anterior surface which has a high polish ("carry" polish?).

There is a general similarity in shape and posterior sculpture to No. 2 specimen and further similarity in the low specific gravity and refractive index indicative of high silica content. The somewhat complementary positions of the bubble cavities (Fig. 2, 10-2) might also suggest that the two specimens are parts of one original core. It is therefore emphasised that each specimen can be seen to be more than half of its original by continuity of rim. The elevational profiles are also quite different. The No. 2 specimen is shallow posterior to the level of the rim and has a well-defined shoulder anterior to it. The superficial resemblances are therefore fortuitous but the other similarites could be due to similar chemical compositions. Two australites with closely comparable physical properties found in this same geographical belt have been analysed by Chapman (1971: p. 6318 "Match 9").

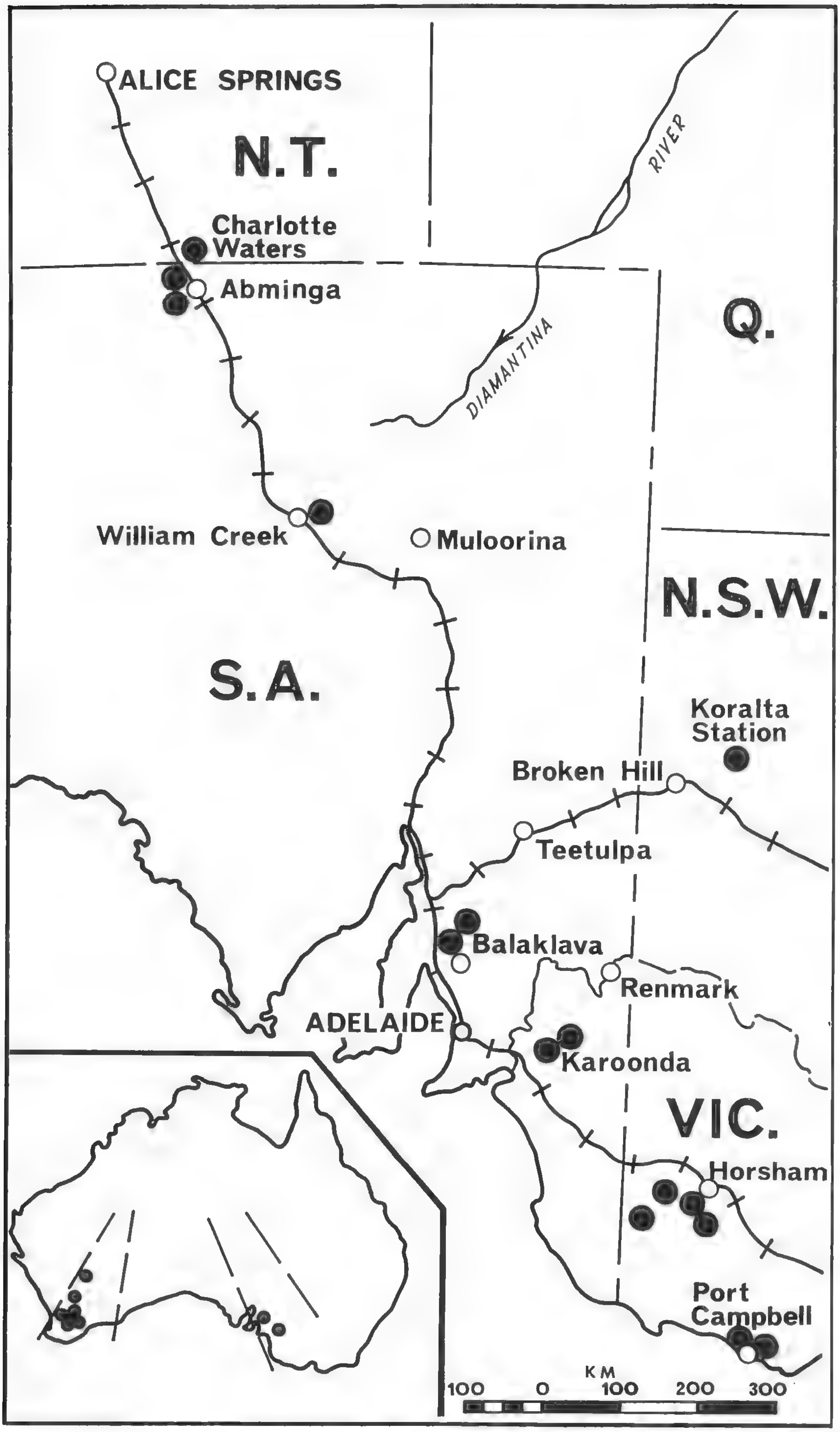
11. Fig. 3. Bureau of Mineral Resources collection R18277. Found on Koralta pastoral station, the homestead of which is located 87 km east-north-east of Broken Hill, N.S.W.

The ratio of thickness to average diameter (0·97) makes this the most nearly spherical of any large australite core known. The diameter is greatest at the shoulder anterior to the rim. The rim is ill-defined and is affected by very old flake losses. The flake scars have the same etched lunate and circular "scars" which are the dominant sculpture elsewhere on the core. Surviving profiles of the posterior surface enable an estimate of c.6·2 cm for the diameter of the parental sphere, which therefore had volume c.72 cm^3 and mass c.173 g on the assumption that it had the same density as the remnant core. Losses from the parental sphere, including terrestrial losses minimised as for specimen No. 5, were approximately 30 per cent of volume and 14 per cent of thickness.

12. See Baker (1969).

13. Fully described and figured by Baker (1969).

FIG. 3. Parts of South Australia and adjoining States showing sites of find of australites of mass exceeding 100 grams. Insert: Australia, showing approximate limits of western and eastern belts in which australties of mass exceeding 100 grams have been found. Only the sites of those weighing more than 200 grams are indicated.


ALICE SPRINGS
N.T.
RIVER
Charlotte Waters
Abminga
Q.
DIAMANTINA
William Creek
Muloorina
N.S.W.
S.A.
Koralta Station
Broken Hill
Teetulpa
Balaklava
Renmark
ADELAIDE
Karoonda
VIC.
Horsham
Port Campbell
KM
100 0 100 200 300

14. This specimen was examined by Fenner (1955; p. 90 Pl. VII Figs. 7 and 8) whilst on loan to the South Australian Museum (T1162), where the site of find was recorded simply as "Karoonda". Present ownership is unknown.

15. See Baker (1969).

16. Fig. 2. Geological and Mining Museum, Sydney 18408. Acquired in 1916 from Mr. W. T. Brown and attributed very vaguely to central Australia (not the political subdivision Central Australia, 1926-31). It is stated on a display label that the specimen was used by Aboriginals as a medicine stone. The source of that information is unknown but there is some support for it in the artificial abrasion of the specimen, apparently accomplished by rubbing it back and forth parallel to the length so that slight ridges remain between adjoining facets. This abrasion has removed the minor sculpture except from around one end of the equatorial zone and the tips of the posterior surface, where the surviving natural surface shows considerable weathering. Abrasion of the posterior surface precludes assessment of the primary shape.

17. This specimen was noted by Mr. D. H. McColl while in the possession of Mr. G. Hume. Its present whereabouts are unknown.

DISCUSSION

The 52 known australites having mass greater than 100 g were found in two belts or sectors which are divergent southward (inset to Fig. 3). Specimens were more numerous towards the southern ends of the belts, with the most massive specimens (exceeding 200 g) on the western sides and towards, but not at, the southern ends. The number of known specimens is so small that these observations must be treated with due caution.

The numerical distribution by States with references to description of the specimens is as follows:

Eastern belt—

Northern Territory . .	1	This paper.
"Central Australia" .	1	This paper.
South Australia	7	Fenner (1955) and this paper.
New South Wales . .	1	This paper.
Victoria	6	Baker (1969, 1972).
Western Victoria or Teetulpa, S.A. . . .	1	Cleverly (1974) and this paper.
Total	17	

Western belt—

Western Australia . .	35	Cleverly (1974).

The Western Australian figure includes three undescribed specimens which have only recently come to scientific notice. They are a round core of mass 197·2 g from 10·5 km south-east of Babakin, a round core of 132·7 g from Lake Grace, and a narrow oval core of 110·1 g from the Warburton Range area.

The shape types of the cores are shown in Table 2, columns 2-4. Differences in the proportions of the shape types within each belt are not significant in these small samples.

The definitions of the narrow oval and boat shapes used here are those of Fenner (1940), with the result that specimens Nos. 1 and 3 (described by previous authors as boats) are reclassified as narrow ovals. There could be justification for the alternative definition however, which recognises parellelism of the sides as a criterion for identification of boat shapes rather than the length/width ratio used here. It is possible that increasingly higher rates of rotation of parent bodies of melt led to a series of primary

TABLE 2

SHAPE TYPES OF LARGE AUSTRALITE CORES

Shape Type	Eastern Belt	Western Belt	Percentage of Total	Percentage of Total (including Teardrops exceeding 50 g)	Estimated Percentages of Parent Bodies and their shapes	
Round	7	18	48·1	44·6	46·3	Spheres and oblate spheroids
Broad Oval	5	12	32·7	30·4	31·5	Prolate spheroids
Narrow Oval	2	3	9·6	9·0	13·0	Prolate spheroids and Boat Primary Bodies
Boat	2	—	3·8	3·6		
Dumbbell	1	2	5·8	5·3	5·5	Dumbbell Primary Bodies
Teardrop	—	—	—	7·1	3·7	Double Apioid Bodies

shapes ranging from ellipsoids through forms having a cylindrical mid-section (parental to boats?) to dumbbell shapes (Mueller, 1971). The total figures for narrow oval and boat shapes in Table 2 are independent of the definition used.

Teardrop cores are unknown amongst australites of mass exceeding 100 grams. Their parental bodies are generally believed to have been apioids produced when masses of melt rotated so rapidly that they progressed beyond the dumbbell stage to separate as two bodies. Specimens simulating teardrop form could also develop when narrow-waisted dumbbells were slimmed by ablation stripping, loss of stress shell, or terrestrial processes to the stage of separation. Aerial bomb forms probably had a similar parentage but for some reason (such as length/diameter ratio) they adopted a different orientation during atmospheric transit (Chapman, *et al.* 1962: p. 19). In the sense that any teardrop or aerial bomb form was derived from only half the parent mass, any specimen of mass greater than 50 g could be ranked with the other large australites discussed here. At least four such specimens are known—from Wongawol Station, W.A. (E. S. Simpson Collection 22), Earaheedy Station, W.A. (W.A. School of Mines 10944), Renmark, S.A. (S.A.M. T92) and Diamantina (S.A.M. T91). Two of the localities are within the western belt and the other two are in or near the eastern belt depending upon the meaning given to "Diamantina". If these specimens are admitted to the class of the most massive australites, recalculation gives the figures of column 5, Table 2.

The parental bodies of most of the round forms for which an assessment was possible were either spheres or spheroids which differed little from spheres. Some of the broad oval cores were also derived from such spheroids. Amongst the parental bodies of very large australites, spheres and spheroids were therefore about as abundant as all other shapes combined. The number of very rapidly rotating parent masses which separated into apioids was only half the number of teardrop type specimens. Recalculation thus gives the figures of column 6, Table 2. Despite the small total number involved, the figures of that column illustrate the generally acceptable concept that australites were derived from masses of melt of which the most abundant were non-rotating or only slowly rotating, while decreasing numbers of masses had the more rapid rates of rotation which culminated in their separation into two individual bodies.

With the exception of specimens Nos. 1 and 2 (a fragment), both of which were found in southern South Australia, the degree of preservation of the eastern Australian specimens examined is generally poorer than for those from south-west Western Australia, and these are in turn more weathered than western Victorian specimens. The degree of preservation thus correlates in a general way with the humidity of the area concerned.

The eastern specimens have a much greater range of specific gravity than those from Western Australia, suggesting that they belong to more than one chemical type (cf. Chapman 1971: Fig. 2).

The distribution of localities in the eastern belt suggests the possibility of mass grading, as has already been noted for the western belt (Cleverly 1974). However, the number of specimens is so small that the boundaries of the belts can be but vaguely defined and even their reality may be questioned and related to accidents of collection. There is, however, some supporting evidence for the reality of the belts if specimens of somewhat lower mass are also considered. Of 115 known specimens of mass exceeding 62 g, all except five were found within one or other of the two belts. The exceptions include two specimens attributed very vaguely to the Nullarbor Plain (one of which might be from Whyalla, S.A.), one from Eucla reported by Fenner (1934: p. 78) on hearsay evidence, one said to have been found in the Ernabella Mission area by an Aboriginal, and one specimen from Pindera, N.S.W. which has the annotation "transported by Aborigines". There are therefore various degrees of vagueness or doubt concerning all five of the supposed exceptions.

Apropos the southerly divergence of the belts or sectors, it is noted that sectors of australite chemical types radiating from central Australia may be visualised on the map of Chapman (1971: Fig. 2). The need for further work on distribution pattern is clearly evident from these observations.

ACKNOWLEDGMENTS

We thank particularly Mr. D. H. McColl of Canberra who provided information on specimens in private collections which would otherwise have remained unknown to us. Mr. McColl also kindly arranged the loan of some specimens. Dr. Brian Mason (Smithsonian Institution), Mr.

R. G. Hirst (Geological and Mining Museum, Sydney), Mr. G. Latz (Henley Beach, S.A.), Mr. G. Hume (Nobby Beach, Queensland), Mr. A. E. Bannear (Saddleworth, S.A.) and Mr. L. French (Auburn, S.A.) also kindly lent specimens for examination and/or supplied information.

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RECORDS OF THE
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THREE LARGE AUSTRALITES FROM SOUTH AND WESTERN AUSTRALIA

By JUNE M. SCRYMGOUR

SOUTH AUSTRALIAN MUSEUM
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VOLUME 17
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23rd February, 1978

THREE LARGE AUSTRALITES FROM SOUTH AND WESTERN AUSTRALIA

BY JUNE M. SCRYMGOUR

Summary

Three large australite cores weighing 225.07g (W.A.), 220.13g (S.A.) and 120.30g (S.A.) respectively are figured and described. The specimen from Shackleton, Western Australia is the largest recorded 'teardrop' shape. The new material fits well with the known distribution pattern for large australites.

THREE LARGE AUSTRALITES FROM SOUTH AND WESTERN AUSTRALIA

by

JUNE M. SCRYMGOUR*

ABSTRACT

SCRYMGOUR, J. M. 1977. Three large australites from South and Western Australia. *Rec. S. Aust. Mus.* 17 (21): 331-335.

Three large australite cores weighing 225·07 g (W.A.), 220·13 g (S.A.) and 120·30 g (S.A.) respectively are figured and described. The specimen from Shackleton, Western Australia is the largest recorded "teardrop" shape. The new material fits well with the known distribution pattern for large australites.

INTRODUCTION

Australites weighing more than 100 g are rare and of the 52 recorded only 7 weighed more than 200 g (Cleverly 1974; Cleverly and Scrymgour 1977). Two further specimens of more than 200 g weight have come to our attention since the previous paper was written—one from near Lameroo in the South East of South Australia (220 g) and one from near Shackleton in Western Australia (225 g). A third specimen, a narrow oval weighing 120 g from near Maitland on Yorke Peninsula, has been donated to the South Australian Museum collection by the finder, Mr. Mark Hasting.

In common with other large australites these specimens are all cores, the end result of ablation losses during oriented hypervelocity flight through the earth's atmosphere and subsequent spalling of the aerothermal stress shell. Some further losses of flakes and the development of minor surface sculpture have occurred as a result of weathering and erosion on the earth's surface after landing.

DESCRIPTIONS

Table 1 summarises locality and physical data of the three specimens described below.

1. *Teardrop core from Shackleton, Western Australia* (Figs. 1a, b)

The specimen is in the private collection of Mr. A. McConnell and was reputedly found during seeding in May, 1975 on a farm near Shackleton, Western Australia. This is by far the largest and heaviest teardrop-shaped australite known. It is more than two and a half times as heavy as the teardrop core (SAM T91: weight 83·5 g) from Diamantina illustrated by Fenner (1934: Pl. IX, Fig. 6). Shackleton is only about 65 km north-west of the locality near Notting where the heaviest of all known australites (weight 437·53 g) was ploughed up in 1969 (Cleverly 1974).

There is no well defined equatorial zone and a rim is present only around the narrow end. An abundance of "U"-grooves on one major surface and their absence on the opposing surface, however, indicates the flight orientation. U-grooves are characteristic of anterior surfaces etched by prolonged exposure to terrestrial weathering after the loss of the stress shell. (Chapman 1964; p. 849).

The narrow end is rounded rather than pointed and in this feature resembles the well-preserved specimen from Renmark, South Australia (SAM

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TABLE 1

SHAPES, SITES OF FIND AND PHYSICAL DETAILS OF THREE LARGE AUSTRALITE CORES

Specimen No.	Shape Type	Site of Find	Latitude and Longitude	Dimensions mm	Weight g	Specific Gravity	Collection
1	Teardrop	Near Shackleton, W.A.	31° 56′S 117° 50′E	66·0 x 56·95 x 50·1	225·07	2·42	Private Collection A. McConnell
2	Broad oval	Near Lameroo, S.A.	35° 30′S 140° 45′E	61·2 x 57·8 x 50·15	220·13	2·42	On indefinite loan to S.A. Museum
3	Narrow oval	Near Maitland, S.A.	34° 25′S 137° 43′E	76·8 x 38·75 (c.40) x 30·35	120·30 (c.123·50)	2·40	SAM Reg. No. T1429

Dimensions and weights in parentheses are estimated after allowing for flake losses.

23rd February, 1978

T92) figured in side elevation by Fenner (1934: Pl. IX, Fig. 5). This feature is presumably also a result of stress shell spallation from a large australite and is in contrast to the pointed ends of small teardrops which have not lost a stress shell.

The anterior surface shows pitting and the abundant development of U-grooves generally transverse to the length of the core, but with typical orientation at right angles to the rim around the narrow end of the specimen. A thin flake has been removed by artificial fracturing.

The posterior surface displays a variety of minor sculptural features including an area of close, deep pitting where scoriaceous glass has been exposed through removal of the surface by weathering processes. There are numerous pits, not usually more than 2 mm in diameter, a few ill-defined flow swirls indicated by etched schlieren and a single short and rather shallow U-groove.

Loss of a flake from one side of the posterior surface has resulted in a rather asymmetrical profile as seen in end elevation. The flake loss was an old one (and presumably therefore due to natural causes) as the scar is almost as deeply and abundantly etched as other parts of the surface.

2. *Broad oval core from near Lameroo, South Australia* (Figs. 2a, b, c, d)

The specimen was found by Mr. A. E. Vigar early in 1975 approximately 24 km south-east of Lameroo, on the southern edge of a large clay "flat". It was lying half-exposed on the crown of a freshly cut track in the top 20 cm of soil and appeared to have been exhumed by the grader. The area, where a clay soil horizon is overlain by sand dunes (mapped as Molineaux Sands)* was cleared of vegetation in 1968.

The specimen is badly weathered and the rim ill-defined except on one side where old flake losses have emphasised the profile (Fig. 2b, 2c and 2d). The flake scars show small pits and occasional U-grooves, some randomly oriented, others showing the more typical orientation at right angles to the rim.

The posterior surface is characterised by numerous circular and lunate depressions up to 5 mm in diameter, some with a raised central area (described as a "navel" by Chapman 1964: p. 853). These features occasionally overlap. A narrow area of close pitting is elongated parallel to the etched schlieren and in some instances this has developed into a U-groove. A small ovoid flow swirl (approx. 12 x 8 mm) has been revealed by light etching on an old flake scar. A few small isolated pits are also present.

The commonest features of the anterior surface are circular and lunate depressions similar to those on the posterior surface. Some U-grooves extend across the flake scar on this surface.

3. *Narrow oval core from near Maitland, South Australia* (Figs. 3a, b)

This specimen was found about four years ago in the south-west corner of Section 248, Hundred of Maitland, County Ferguson, by Mr. Mark Hasting. Though parallel-sided, it has been classed as a narrow oval rather than a boat in conformity with the shape definitions of Fenner (1940: p. 312) which have been used consistently in recent publications on large australites (Cleverly 1974; Cleverly and Scrymgour 1977).

The rim is well-defined along one edge and at both extremities. Flake losses have removed the rim on the other long edge. Flaking is evidently of some age as the surface of the scars show shallow etching of flow structures and a few small pits. There are a few shallow U-grooves at right angles to the periphery. The equatorial zone is well-defined (10-11 mm wide) between the rim and the shoulder and carries badly eroded flake scars.

On the posterior surface the most notable single feature is an etched flow swirl occupying almost the whole of that surface, running around the periphery of the rim and transitional in places into U-grooves. Numerous small pits are also occasionally transitional into short U-grooves.

The anterior surface is featureless except for minor etched schlieren and small pits.

DISCUSSION

Australites weighing more than 100 g have been found to occur in two wide bands trending south-west and south-east, with the heaviest specimens (over 200 g) towards the southern extremities and western margins of the two zones (Chalmers *et al.* 1976; Cleverly and Scrymgour 1977). The localities of these three new specimens fit well into this pattern (see Figure 1).

There are now 36 known specimens weighing 100 g or more from the western belt (including seven of more than 200 g) and 19 from the

* Pinnaroo 1:250 000 Sheet, S.A. Department of Mines, Preliminary Edition.

eastern belt (including two of more than 200 g). The specific gravities of the two larger specimens are typical for their localities. The narrow oval from near Maitland is lower than average but not anomalously so. The variation may be due to internal bubble cavities.

ACKNOWLEDGEMENTS

The South Australian Museum gratefully acknowledges the donation by Mr. Mark Hasting of the narrow oval from Maitland, Yorke Peninsula.

Thanks are also due to Mr. A. McConnell and Mr. A. E. Vigar for the loan of specimens from Shackleton and Lameroo respectively. Mr. Roger Giesecke of the Chemical Engineering Department, University of Adelaide, kindly allowed us to use the Department's Mettler Balance for specific gravity measurements.

Ms. Faye Gommers drew the map and Mr. R. Ruehle took the photographs.

Special thanks are due to Mr. W. H. Cleverly for the estimated original weight of the Maitland specimen and for helpful advice during the preparation of the manuscript.

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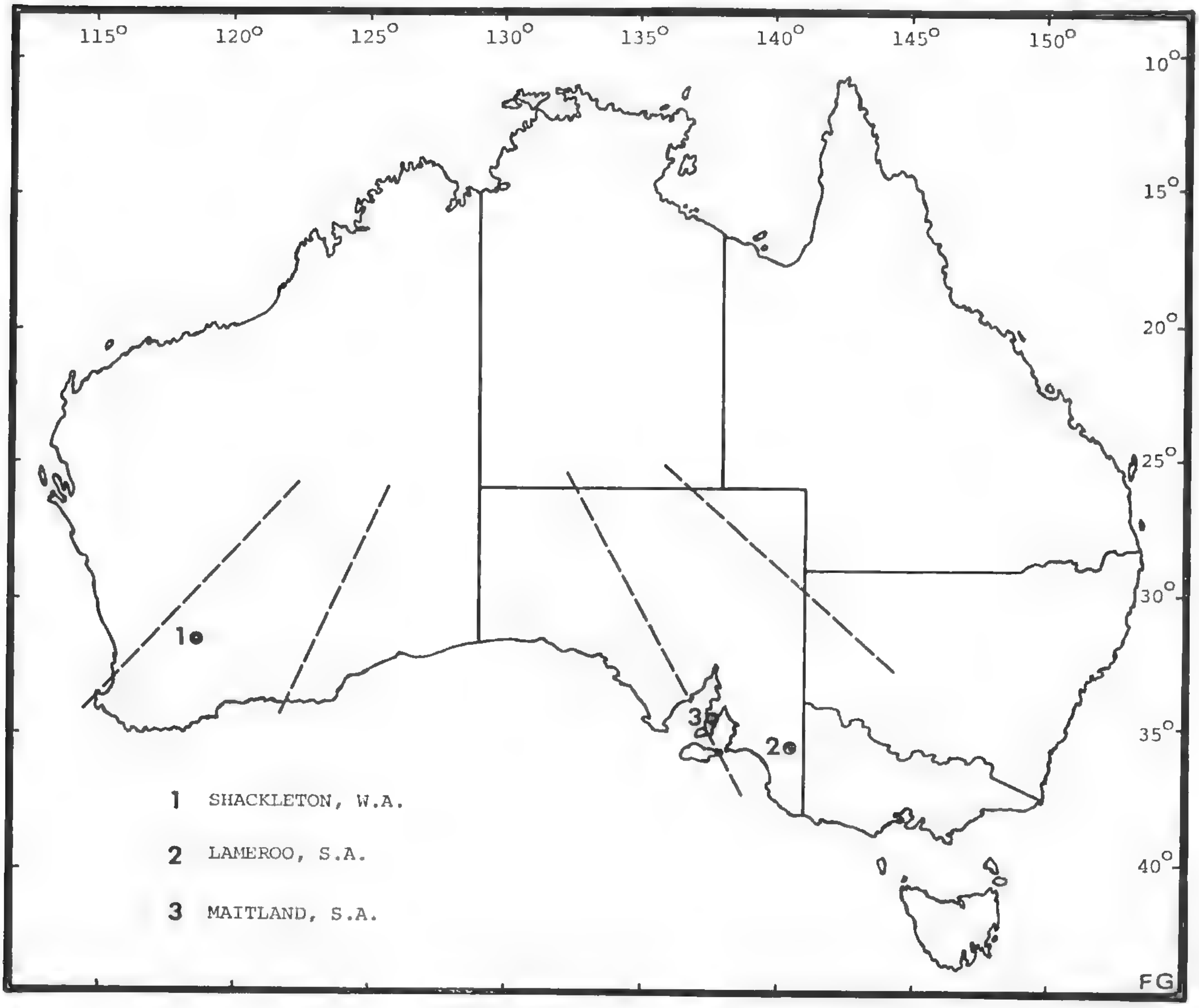
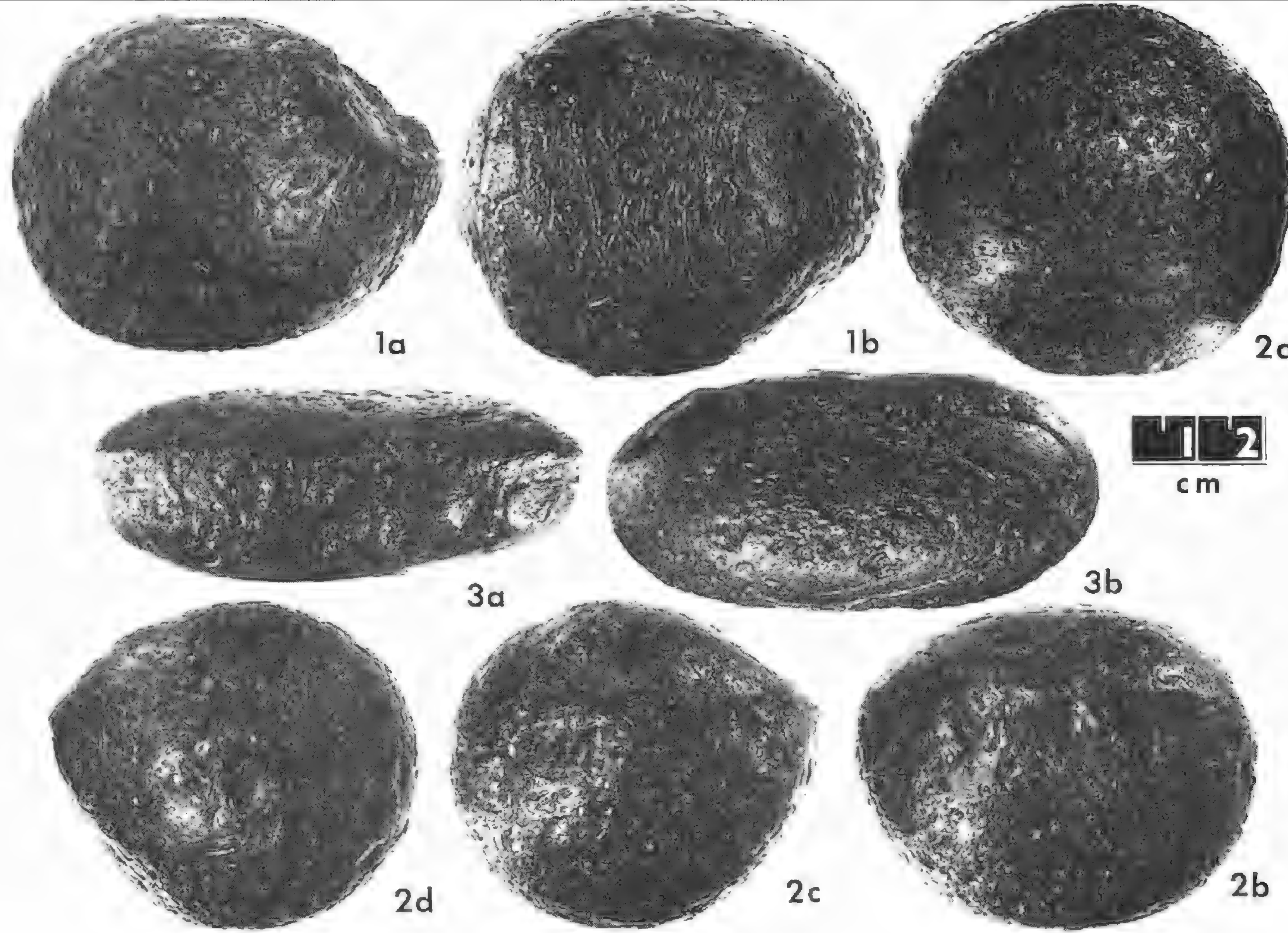


FIG. 1. Locality map.

FIG. 2. (1a) *Large teardrop core from near Shackleton, W.A.* Side elevation showing remnant of rim at narrow end (right of photo). (1b) Anterior surface showing U-grooves and rounded shape of narrow end. Artificial flake loss has occurred at upper left. (2a) *Broad oval core from near Lameroo, S.A.* Posterior surface of flight showing numerous circular and lunate depressions. A small etched flow swirl can be seen at the lower left centre of the photograph. (2b) Side elevation showing remnant of rim with U-grooves developed on old flake scars. The flow swirl described in 2a is visible at the top left centre of the photograph. (2c) and (2d) End elevations—left and right sides of 2b. (3a) *Narrow oval core from near Maitland, S.A.* Side elevation showing well-defined rim and equatorial zone with badly eroded flake scars. (3b) Posterior surface showing pits and large etched flow swirl.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VARIATION IN THE CRANIAL OSTEOLOGY OF THE AUSTRALO-PAPUAN HYLID FROG *LITORIA INFRAFRENATA*

By MARGARET DAVIES

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VARIATION IN THE CRANIAL OSTEOLOGY OF THE AUSTRALO-PAPUAN HYLID FROG *LITORIA INFRAFRENATA*

BY MARGARET DAVIES

Summary

The cranial osteology of specimens of *Litoria infrafrenata* from Tully (Queensland) and Aitape (New Guinea) and of *Litoria infrafrenata militaria* from Keravat (New Britain) were examined. The species were chosen because of their wide geographic range and known isolation for a considerable period of time, with a view to establishing the validity of skull character states as good species indicators. The only noteworthy variation found was in the extent and degree of ossification; the extent of development of the sphenethmoid in relation to the nasals; the relationship of th otic ramus of the squamosal to the crista parotica; the extent of development of the zygomatic ramus of the squamosal; and the shape and nature of the dentigerous processes of the prevomers. Examination of these characters only distinguishes those populations recognised already as sub-species. In view of the extent of isolation of Australia and New Guinea it is concluded that the character states examined are valid species indicators.

VARIATION IN THE CRANIAL OSTEOLOGY OF THE AUSTRALO-PAPUAN HYLID FROG *LITORIA INFRAFRENATA*

by

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ABSTRACT

DAVIES, M. 1977. Variation in the cranial osteology of the Australo-Papuan hylid frog *Litoria infrafrenata*. *Rec. S. Aust. Mus.* 17 (22): 337-345.

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The cranial osteology of specimens of *Litoria infrafrenata infrafrenata* from Tully (Queensland) and Aitape (New Guinea) and of *Litoria infrafrenata militaria* from Keravat (New Britain) were examined. The species were chosen because of their wide geographic range and known isolation for a considerable period of time, with a view to establishing the validity of skull character states as good species indicators. The only noteworthy variation found was in the extent and degree of ossification; the extent of development of the sphenethmoid in relation to the nasals; the relationship of the otic ramus of the squamosal to the crista parotica; the extent of development of the zygomatic ramus of the squamosal; and the shape and nature of the dentigerous processes of the prevomers. Examination of these characters only distinguishes those populations recognised already as subspecies. In view of the extent of isolation of Australia and New Guinea it is concluded that the character states examined are valid species indicators.

INTRODUCTION

Studies are currently in progress in this laboratory on the hylid frogs of the genus *Litoria* of Australia and New Guinea to establish species groups in *Litoria*. Three major lines of investigation—myology, karyology and osteology—form the basis of the study.

Little has been published to date on the cranial osteology of the Australian hylids. W. K. Parker (1881) described the skulls of *Litoria caerulea*, *L. phyllochroa*[1], *L. ewingi* and *L. bicolor*, Keferstein (1868) described the skull of *L. aurea* and *L. freycineti* whilst Gillies and Perbody (1917) described the skull of *L. caerulea* with some references to that of *L. aurea*. Briggs (1940) described *L. aurea* whilst Lynch (1971) examined *L. alboguttata* (as *Cyclorana alboguttatus*).

[1] The identification of this animal is suspect as the locality is given as Cape York Peninsula; the species is not known to occur as far north.

1—28th February, 1978

The paucity of data available regarding osteology of the Australian hylids indicates a need to establish the limits of variation within a species of those characters commonly in usage in the definition of species groups (Duellman 1970). It is also necessary to determine the validity of such character states with reference to the Australo-Papuan fauna.

For these reasons, a frog species was chosen with a known wide geographic range having evidence of isolation of populations for varying periods of time. *Litoria infrafrenata* is the largest tree frog in the world (maximum length 135 mm) so that ease of preparation of material adds to its suitability for study. Its distribution ranges throughout New Guinea and includes the north-eastern portion of the Cape York Peninsula in Australia. Two subspecies are recognised: *infrafrenata infrafrenata* found in Cape York and throughout New Guinea, and *infrafrenata militaria* restricted to New Britain (Tyler 1968). The subspecies are delineated by presence or absence of a projecting pollex. The karyotype of *L. infrafrenata* appears to differ in basic chromosome number from all other Australo-Papuan hylids so far examined (Menzies and Tippett 1976). This species, then is of particular interest in the general evolution of Australo-Papuan hylid fauna and an analysis of skull and skeletal characters is relevant to this overall study.

MATERIAL AND METHODS

L. infrafrenata militaria from Keravat, New Britain. South Australian Museum (SAM) R7030, R7031, R7032, R7037, R7153, R7155.

L. infrafrenata infrafrenata from Aitape, New Guinea. SAM R4156, R4157, R4159, R4160, R4161, R4162.

L. infrafrenata infrafrenata from Tully, N. Queensland.

Six specimens obtained live from banana inspection depot of S.A. Department of Agriculture 1975-1976. SAM R15854, R15855, R15856A, R15856B, R15857.

Animals were sexed and morphological measurements were made before preparation of the skulls. Dry preparations of the skulls were made with the exception of one entire skeleton from Tully which was prepared as an alizarin.

The following measurements were made of the skulls using dial calipers: skull length (the absolute length of the skull), skull width, skull depth, the depth of pars dentalis of premaxillary, height of alary processes of premaxillary, length of anterior ramus of squamosal, length of posterior ramus of squamosal, distance from tip of anterior ramus of squamosal to post orbital process of pars facialis of maxillary (Table 1).

TABLE 1 MEASUREMENTS OF SKULLS OF *LITORIA INFRAFRENATA INFRAFRENATA* FROM TULLY, QLD. (AUSTRALIA) AND AITAPE (NEW GUINEA), AND *LITORIA INFRAFRENATA MILITARIA* FROM KERAVAT, NEW BRITAIN.

Locality		Depth of skull as a percentage of length	Breadth of skull as a percentage of length	Per cent distance to maxillary spanned by zygomatic arm of squamosal	Height of alary processes in relation to pars dentalis
Tully, Qld. (2♀♀, 3♂♂)	Mean	42	107·4	53·8	2·98
	Standard deviation	1·58	8·23	7·82	0·4
	Range	41-44	100-114	41-61	2·35-3·82
Aitape, New Guinea (1♀, 5♂♂)	Mean	41·67	107	51·33	2·74
	Standard deviation	2·34	10·78	6·53	0·25
	Range	39-45	91-122	39-57	2·31-3·04
Keravat, New Britain (3♀♀, 3♂♂)	Mean	46·33	117·8	74	2·61
	Standard deviation	3·2	5·2	2·28	0·18
	Range	42-50	114-125	72-78	2·47-2·84

Outline drawings of selected skulls were made using a Wild M5 stereoscopic microscope with a Wild camera lucida attached.

OBSERVATIONS

Generalised description of the skull of L. infrafrenata infrafrenata.

The specimen used for this description was a female: SAM R15857 of S-V 91·1 mm from Tully, Qld., Australia (Fig. 1).

The skull is generally broader than long with a snout in both profile and dorsal view that is rounded. The dorsal surfaces of the skull are smooth and unornamented and the skin overlying the head is freely movable. There is no evidence of prenasal, internasal or dermal sphenethmoid bones. Similarly there are no labial flanges nor occipital crests present. The anterior supraorbital margins of the frontoparietals are expanded in the form of a flange. Posterolaterally, the frontoparietals do not overlap the crista parotica. The anterior arm of the squamosal extends approximately half the distance to the maxillary. The posterior arm of the squamosal is slightly shorter than the anterior arm, expanded medially and overlaps and broadly articulates with the distal portion of the crista parotica.

The pterygoid is only moderately robust. The medial ramus is well developed and makes a bony articulation with the otic capsule. The anterior ramus has an extensive articulation with the maxillary at approximately mid-orbit, whilst the posterior ramus is poorly ossified and articulates with the ventral arm of the squamosal. The prootics and exoccipitals are fused and the columella is bony. The quadratojugal is well developed; it articulates anteriorly with the maxilla and posteriorly with the ventral arm of the squamosal. The parasphenoid lacks odontoid structures and extends anteriorly to the level of the widest portion of the supraorbital frontoparietal flange.

The premaxillaries are narrow and separated medially by connective tissue. The alary processes are widely separated medially and are posteriorly inclined at slightly less than an 80° angle. The processes are perpendicular to the pars dentalis and approximately four times as long as the depth of the pars dentalis. The premaxillaries articulate laterally with the pars palatina and pars dentalis of the maxillary; small palatine processes are present posteromedially on the premaxillaries.

The prevomers do not converge medially, the anterior borders lying posterior to the premaxillary dentigerous processes. Posterolaterally the prevomers bear wings forming the anterior, medial and posterior margins of the choanae. The dentigerous processes are small and moderately separated; they lie perpendicular to the midline and bear 9-11 teeth.

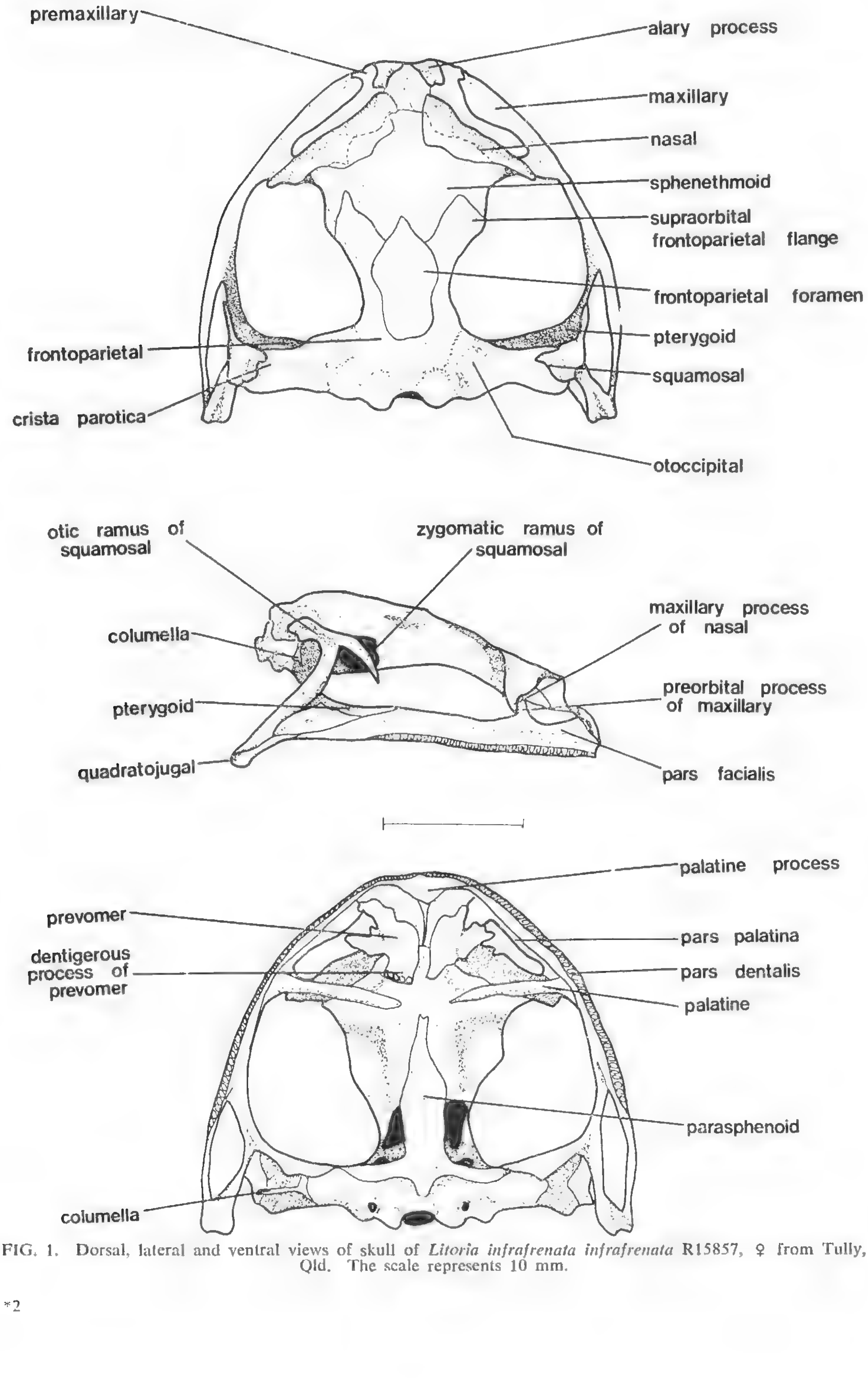

FIG. 1. Dorsal, lateral and ventral views of skull of *Litoria infrafrenata infrafrenata* R15857, ♀ from Tully, Qld. The scale represents 10 mm.

The palatines are narrow, slender bones forming the posterior margins of the choanae, with the distal ends slightly expanded and lying adjacent to the maxillaries; the posterior ends lie on the anterior ventrolateral corners of the sphenethmoid. The palatines bear very small posteroventral shelves.

The nasals are narrow and poorly ossified; the anterior tips are extended to meet the internasal septum at the level of the tips of the alary processes of the premaxillaries. The nasals are barely separated from one another medially and overlap the sphenethmoid in places. The maxillary process of the nasal is sharp and slender and articulates with the posterior process of the pars facialis; it does not extend to the level of the maxillary.

The maxillary bears a well developed pars facialis anterior to the orbit with all the surfaces free; the pars palatina is minute, extending the length of the maxillary ventromedially to the pars dentalis; the maxillary articulates with the slender quadratojugal firmly at the level of the prootic foramen.

The sphenethmoid is well ossified with the nasals extending anteriorly beyond its anterior terminus.

The frontoparietal fontanelle is moderately sized and extends approximately half the length of the orbit. The frontoparietals are moderately developed, the anterior margin is almost indistinguishable anteriorly in the area of overlap of the frontoparietal and sphenethmoid, both bones forming there a slightly upturned supraorbital flange terminating at the posterior margin of the orbit. The frontoparietals have smooth distal margins which do not extend posterolaterally over the crista parotica.

Variation

The descriptive format of variation of individual bones employed here follows that of Trueb (1973).

Frontoparietals: The frontoparietals are paired elements which may or may not be separated from the prootic and exoccipitals by connective tissue. (The presence of connective tissue is the usual condition in the hylids.) Variation can occur in the extent to which the frontoparietals fuse with each other and with the surrounding elements (exoccipital, prootic, sphenethmoid and nasals). Further variation occurs in the extent to which these bones are ossified. Ossification of the frontoparietals is generally an indication of the overall ossification of the skull.

In *L. infrafrenata infrafrenata* and *L. infrafrenata militaria* the presence of a supraorbital frontoparietal flange is consistent in all specimens examined. In the Tully and Aitape populations the frontoparietal foramen is generally broad and ovoid, whilst in the Keravat population (*L. infrafrenata militaria*) the foramen is partially covered by bone in two specimens.

In all but one (R15857) of the Tully specimens the frontoparietal gives the appearance of being a very thin bone, whilst in the Aitape population the bone appears to be thicker, and in the Keravat population the frontoparietals can be described as well ossified.

The general shape of the bones and their fusion with the surrounding elements is consistent between the three populations.

Nasals: The paired nasals can vary greatly in size and shape. They can fuse to form a single element and the extent of ossification is very labile. They are equally variable in the existence and extent to which they articulate with other skull elements.

The three populations show of all characters examined the greatest qualitative interpopulation variation in the relationship of the nasals to the sphenethmoid, and in the ossification of the nasals (Fig. 2).

In the Tully population, the nasals are very thin bones (in fact opaque in appearance) that articulate along their posterior edge with the anterior edge of the sphenethmoid. In all but one of the specimens examined (R15857) the sphenethmoid does not extend anteriorly between the nasals and the anterior extension is slight.

In the Aitape population, the nasals are again very thin bones, two specimens showing slight signs of some additional bone deposition along the anterior edge. The posterior margins of the nasals articulate with the sphenethmoid which extends slightly forward between the two nasal bones in these specimens.

In the Keravat population, the sphenethmoid extends between the nasals to the level of the anterior margins of these bones. The bones again are opaque but consistently show some signs of deposition of bone along the anterior margins to a greater extent than shown by Aitape specimens.

The maxillary processes of the nasals articulate with the preorbital process of the maxillary in all three groups.

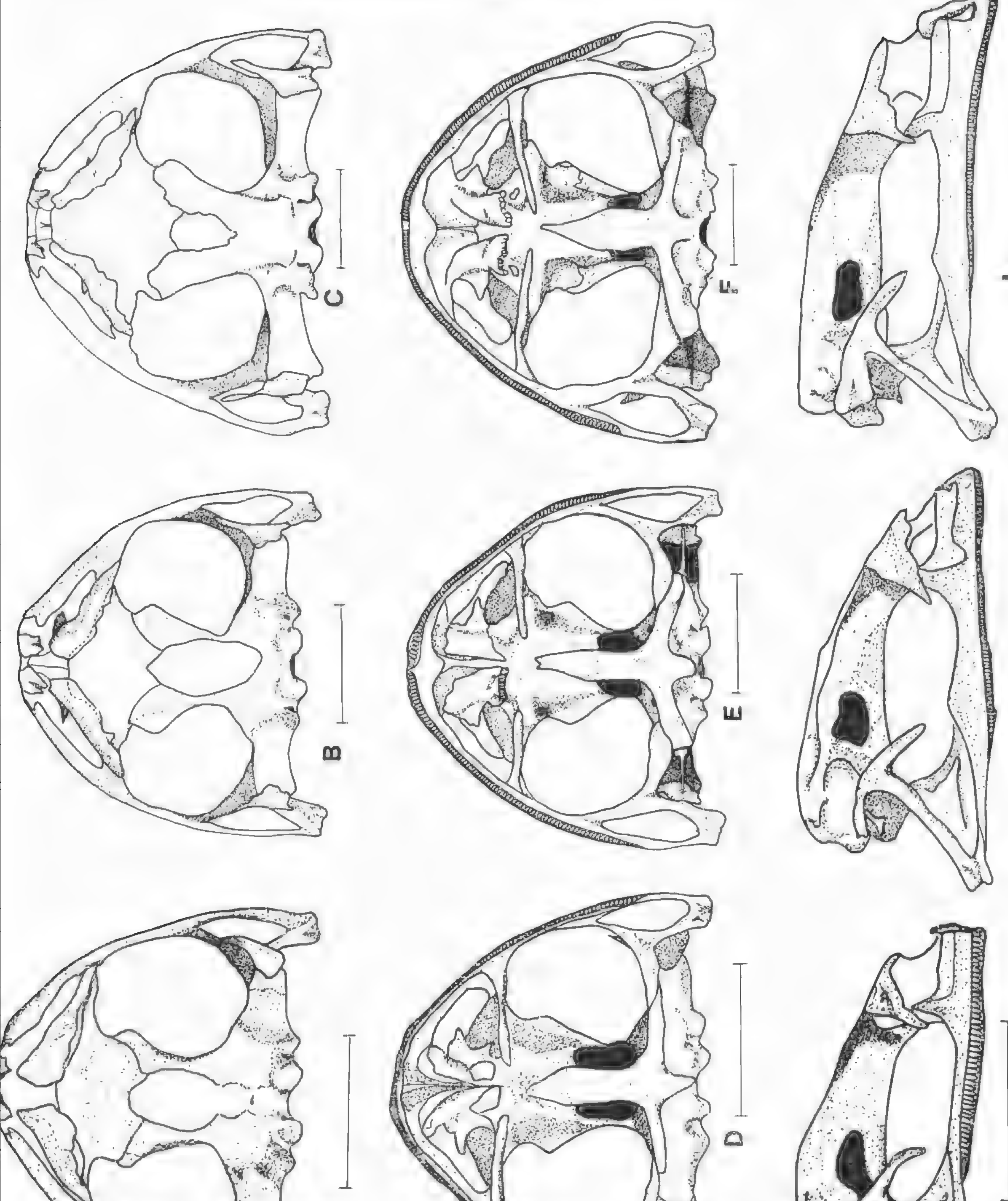

FIG. 2. Dorsal, ventral and lateral views of skulls of *Litoria infrafrenata*. A, D, G, *L. i. infrafrenata*, R15854, ♂ from Tully, Qld. B, E, H, *L. i. infrafrenata* R4157, ♂ from Aitape, New Guinea, and C, F, I, *L. i. militaria*, R7030, ♂ from Keravat, New Britain. The scale represents 10 mm. To aid comparison, diagrams have been reproduced to the same size.

Premaxillaries: The premaxillaries are paired dermal elements which may or may not bear teeth on the pars dentalis. The premaxillaries may be narrow or broad and the pars palatina may be extended into a broad shelf or be greatly reduced. In addition the pars palatina may be expanded at its lateral extremity or be very narrow medially. In fact according to Trueb (1973) the nature of the palatine processes is a useful specific character. These processes may or may not articulate with each other. Variation occurs, too, in the structure and orientation of the alary processes. These may be exceedingly short (less than or equal to the height of the pars dentalis) or very long (to five times the height of the pars dentalis).

The alary processes in some species are known to slope anteriorly, usually at about 80° with the horizontal plane of the skull. At the extremes, the processes may be displaced anteriorly at angles of 10° to 20°. Most alary processes, however, are nearly vertical, or inclined posteriorly at angles no greater than 135°. The alary processes generally consist of a bony shaft that is convex anteriorly (or ventrally) and concave posteriorly (or dorsally). An exception is *Plectrohyla* in which the alary processes are bifurcate.

There is little to no variation in the premaxillaries between the three populations of *L. infrafrenata*. All specimens have teeth on the pars dentalis. The premaxillaries are narrow and the pars palatina is extended into a broad shelf. The alary processes do not articulate with each other and are moderately long (2·3 to 3·0 times the length of pars dentalis). They are inclined posteriorly at an angle of 80° to the horizontal plane of the skull. The shape of the processes is in no way outstanding.

Maxillaries: The pars dentalis of the maxillaries may or may not bear teeth. The maxillaries bear a lingual ledge termed the pars palatina. They are further expanded dorsolaterally into a facial flange, the pars facialis, which usually has a preorbital process and, less often, a postorbital process. At the most, the pars facialis articulates at five separate points with the remainder of the skull. These are (1) the pars dentalis and pars palatina at the lateral edge of the premaxillary; (2) the preorbital process at the maxillary process of the nasal; (3) the pars dentalis and pars palatina sometimes articulate at the anterolateral edge of the anterior pterygoid ramus; (4) the postorbital process articulates with the zygomatic process of the squamosal; and (5) the posterior end of the maxillary articulates with the quadratojugal.

Variation can occur also in articulation with the squamosal, quadratojugal and nasal and in the development of the preorbital and postorbital processes of the pars facialis.

There is little to no variation in the maxillaries between the three populations of *L. infrafrenata*. A postorbital process is not present in this species, but the pars facialis articulates at the other four points. There is no variation in articulation with the maxillary process of the nasal.

Quadratojugals: These bones are highly variable in occurrence and are frequently lost or reduced, particularly in smaller frogs or in those in which ossification is reduced. Reduction is always in an anteroposterior sequence, the first sign of reduction being the loss of articulation with the maxillary.

The quadratojugals articulate with the maxillary in all specimens of the three populations of *L. infrafrenata* examined.

Parasphenoid: Variation in this bone is slight and concerns the length of the cultriform process, the presence and orientation of the alae and the presence of odontoid structures ventrally.

Any variation in these features in the groups under discussion is so slight as to be unnoticeable. Odontoid structures are not present (see Fig. 2).

Prevomers: Trueb (1973) considers the prevomers to be amongst the most variable bones in the skull. The anterior ends of these bones usually lie in connective tissue and the lateral wings form the bony anterior, medial and posteromedial margins of the internal nares. The dentigerous processes generally lie at a level slightly anterior to the palatines. Minor variation is found in the overall size of the bones and in the orientation of the dentigerous ridges (these latter characters are useful diagnostically at genus and species levels and may be transverse, oblique, curved or angled). Teeth are sometimes absent and odontoids are occasionally present in the absence of true teeth. The prevomers have been known to fuse with palatine elements and variation also occurs in the subdivision into discrete anterior and posterior elements.

Variation between the three populations lies in the orientation of the dentigerous processes of the prevomers. The overall size and shape of the bones appears to scarcely differ between the groups and the relationship between the prevomers and the palatines is consistent within the species. In the Tully population, the dentigerous processes, when present, are transverse, as are those of the Aitape population. However, the dentigerous processes of the Keravat population are curved.

Palatines: These bones usually lie adjacent to the maxillaries and articulate with the sphenethmoid medially. They are always edentate and may have a ventral transverse ridge which may be smooth or serrate. The palatines are frequently reduced in length or lost, reduction being in a medial to lateral direction.

Variation in the palatines is not discernable in the specimens examined.

Pterygoids: This triradiate bone shows variation in the nature of the articulation of the anterior and medial rami, usually at the midlevel of the orbit. If the medial ramus is absent, or lacks a cranial articulation, or if the skull is poorly ossified, the anterior ramus usually has an extensive articulation with the maxillary.

The medial ramus may be present or absent and if present, may or may not be articulated directly with the neurocranium. The medial ramus may be reduced so that there is no bony articulation with the otic capsule, but in this case there is usually some indirect association by means of pseudobasal or basal processes.

Variation in this bone between the groups studied here is minimal. All three rami are present and a bony articulation occurs between the medial ramus and the otic capsule.

Squamosals: The greatest variation in this bone is in the nature and presence of the anterior (zygomatic) and posterior (otic) rami. The posterior arm can have one of three relationships with the medially adjacent crista parotica:

(1) bears medially expanded otic plate that broadly articulates with the dorsal portion of the crista parotica;

(2) the medial expansion of the otic ramus articulates with the posterolaterally expanded frontoparietal forming a complete or partial arch over the crista parotica; or

(3) the otic ramus is small and poorly developed and lies laterally adjacent to the crista parotica, but does not overlap it.

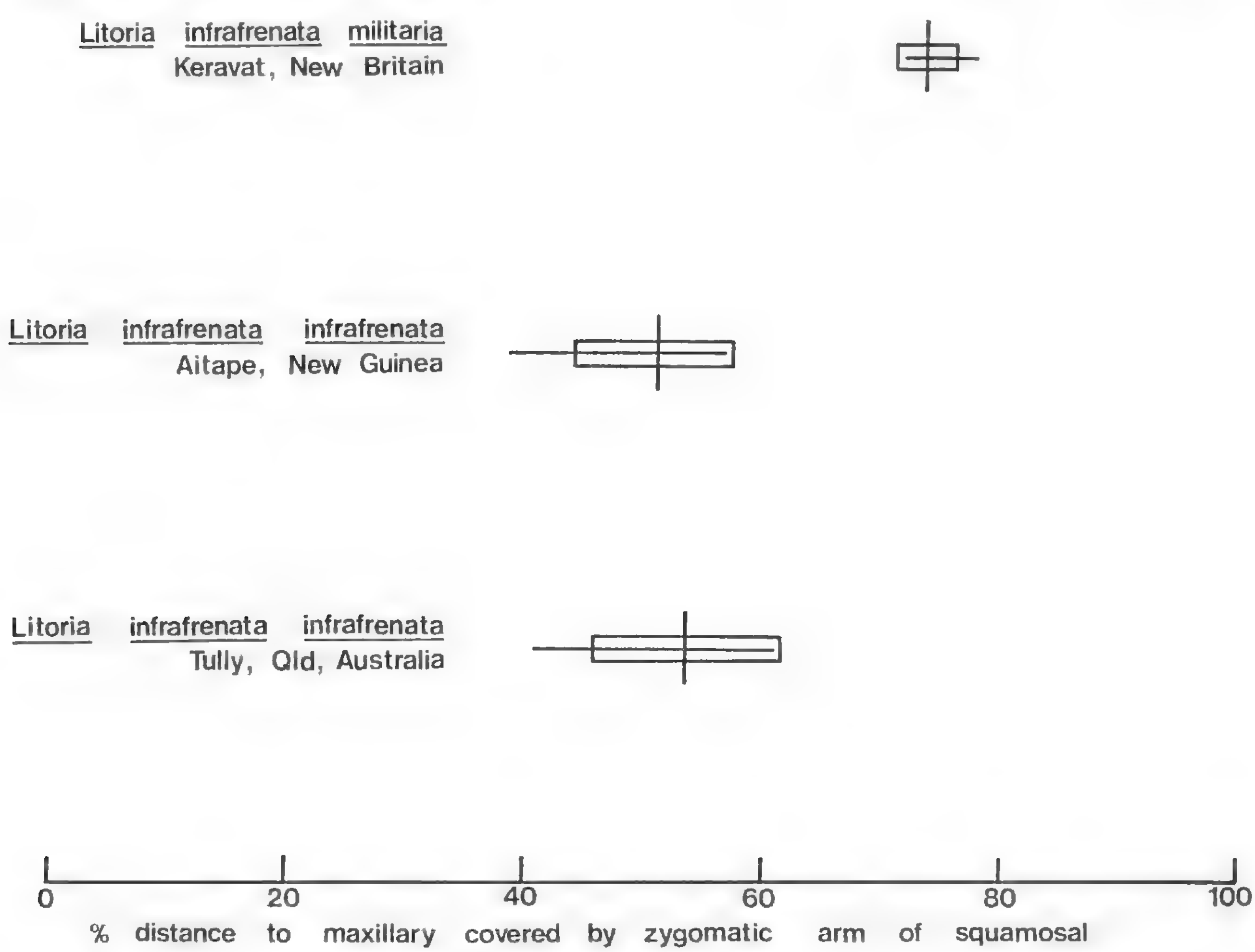

Fig. 3 Percentage distance to maxillary covered by zygomatic ramus of squamosal in three populations of *Litoria infrafrenata*. The mean is expressed by the vertical line. The rectangle represents standard deviation, and the horizontal line indicates the range.

Within the Tully population, the otic ramus varies from broad to slight overlap of the crista parotica. However, in the Aitape population, the variation is from slight overlap to no overlap at all, and in the Keravat skulls, this is again the case, with the majority of skulls showing no overlap of the otic ramus and the crista parotica.

A further variation between populations occurs in the nature of this bone and this is in the relationship of the length of the zygomatic ramus to the total distance to the maxilla. The Tully and Aitape populations would appear to have similar relationships; the anterior arm stretching from 40% to 61% of the distance to the maxilla. The anterior rami of the squamosals of the Keravat population, however, extend much further toward the maxillary; the arms covering from 72% to 78% of the distance to be spanned (Figs. 2, 3).

Sphenethmoid: Variation in this bone is generally a question of ossification. The anterior terminus of the bone extends to the posterior level of the nasals and posteriorly to the anterior margin of the frontoparietal fontanelle. Additional ossification can occur anteriorly in the form of an internasal septum and posteriorly around the optic foramen which is probably a feature of more heavily ossified skulls.

Variation in the shape of the sphenethmoid within the three groups under discussion has been considered in relation to the nasals. Again, in this bone there is a progression in the degree of bone deposition through the groups. The sphenethmoids of the Tully skulls are relatively thin, those of Aitape less so whilst the Keravat skulls have more extensive bone deposition.

Otoccipital: The prootic and the exoccipital are indistinguishably fused in modern anurans. The same kind of variation occurs in ossification as in the sphenethmoid and there can also be a reduction in the number of nerve foramina.

Little or no variation in these features is observed in the three populations.

DISCUSSION

From the above data it is evident that in the samples studied the most noteworthy variations in the skull are:

(*a*) the extent and degree of ossification,

(*b*) the extent of development of the sphenethmoid in relation to the nasals,

(*c*) the relationship of the otic ramus of the squamosal to the crista parotica,

(*d*) the extent of development of the zygomatic ramus of the squamosal (Fig. 3), and

(*e*) the shape and nature of the dentigerous processes of the prevomers.

There does not appear to be any sexual dimorphism apart from absolute size (Table 1).

Despite its size, the skull of *L. infrafrenata* is a relatively delicate structure in contrast to the dermal coossification and exostosis found in many large South American hylids (Trueb 1970; Duellman 1970).

It could be postulated, then, that the only reasonably definitive characters distinguishing the samples are the relative length of the zygomatic ramus of the squamosal and the shape of the dentigerous processes of the prevomers. These features distinguish only the populations recognised elsewhere as subspecies (Tyler 1968).

Isolation of Australia and New Guinea occurred for the last time 6 000 years BP (Jennings 1972), so separating the frogs of the Cape York Peninsula from the population of southern New Guinea. In contrast, the isolation of the population in New Britain from New Guinea cannot be attributed to recent eustatic changes and may be a much older event.

Although New Britain and New Guinea are separated by the very narrow Vitiaz Strait, the sea floor there is 3 000 m deep. In fact the rather depauperate nature of the frog fauna of New Britain is consistent with an interpretation of the absence of a land connection with New Guinea at any time (Zweifel 1960; Tyler 1968; Brown and Tyler 1968). Therefore, the arrival of *L. infrafrenata* in New Britain is almost certainly the result of overwater dispersal. This does not imply that the greater morphological divergences between New Britain and New Guinea populations is necessarily indicative of extensive isolation. However, it is quite clear that the duration of isolation of New Britain and New Guinea is indeed much greater than that between Australia and New Guinea.

Trueb (1968) described clinal variation in the skulls of *Hyla lancasteri*. Variation between extreme populations made recognition of the one species extremely difficult. However, variation in the intermediate ranges was interpreted as suggesting uninterrupted gene flow between adjacent populations.

Variation between the three populations examined here can be described as minimal, particularly in the light of Trueb's findings. It would seem, therefore, that the character states under consideration vary little between geographically isolated populations and can be considered as valid species indicators.

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RECORDS OF THE SOUTH AUSTRALIAN MUSEUM

A REVIEW OF THE FROND-LIKE FOSSILS OF THE EDIACARA ASSEMBLAGE

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Summary

Restudy of the frond-like fossils which occur as part of the Late Precambrian, Ediacara assemblage of the Flinders Ranges confirms previous reconstructions which show the majority of these forms to be basically foliate, leaf-like structures. In some, the axial zone or rhachis terminated in a disc-like anchoring device.

The genus *Arborea* Glaessner and Wade, 1966, is considered a synonym of *Charniodoscus* Ford, 1958, and a new species of this genus is described. The genus *Glaessnerina* Germs, 1973, is briefly reviewed and earlier opinion that *Charniodoscus* and *Glaessnerina* are probably related to the extant Pennatulacea is confirmed. *Phyllozoon hanseni* gen. Et sp. nov. is a new taxon resembling *Pteridinium* Gurich, 1930.

A REVIEW OF THE FROND-LIKE FOSSILS OF THE EDIACARA ASSEMBLAGE

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RICHARD J. F. JENKINS* and JAMES G. GEHLING†

ABSTRACT

JENKINS, R. J. F.* and GEHLING, J. G.†, 1977. A review of the frond-like fossils of the Ediacara assemblage. *Rec. S. Aust. Mus.* **17** (23): 347-359.

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Restudy of the frond-like fossils which occur as part of the Late Precambrian, Ediacara assemblage of the Flinders Ranges confirms previous reconstructions which show the majority of these forms to be basically foliate, leaf-like structures. In some, the axial zone or rhachis terminated in a disc-like anchoring device.

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INTRODUCTION

The large and distinctive frond-like fossils which occur as frequent components of the Ediacara assemblage of the Flinders Ranges were first described by Glaessner (1959a). However an earlier indirect indication of these fossils was given by Sprigg (1949: p. 73), who identified some of them as algae. Glaessner (1959a) referred specimens to *Rangea* and *Pteridinium* Gürich, 1930, genera described from the Late Precambrian, Nama Group of Namibia (South West Africa) and to *Charnia* Ford, 1958, from rocks of comparable age at Charnwood Forest, Leicestershire, England. He considered these genera to be related to the living Pennatulacea. Formal descriptions of the same material were given by Glaessner (1959b) and numerous citations concerning them have appeared in his later works. Glaessner and Wade (1966) presented an updated formal taxonomic study in which they referred the then single known specimen of the *Charnia*-like form to *Rangea*, and erected the genus *Arborea* to accommodate some of the materials previously identified as belonging to *Rangea*. The taxa which they recognised are as follows:—

Rangea longa Glaessner and Wade, 1966

Rangea grandis Glaessner and Wade, 1966 (single *Charnia*-like specimen)

Pteridinium cf. *simplex* Gürich, 1930

Arborea arborea (Glaessner 1959).

Germs (1973) considered *R. longa* and *R. grandis* distinct from *Rangea* Gürich and erected a new genus to contain them, *Glaessnerina* (type species *R. grandis*). Glaessner's (1959a, b) placement of the above listed Australian taxa as relatives of the modern octocoral Order Pennatulacea has generally been maintained in later studies (e.g. Glaessner and Wade 1966; Glaessner 1971b), although one current suggestion is that they may belong to a phylum intermediate between plants and animals, the "Petalonamae" (Pflug 1972b, c, 1973, 1974a, b). Glaessner and Walter (1975) consider that they can best be classified provisionally as Coelenterata of uncertain systematic position.

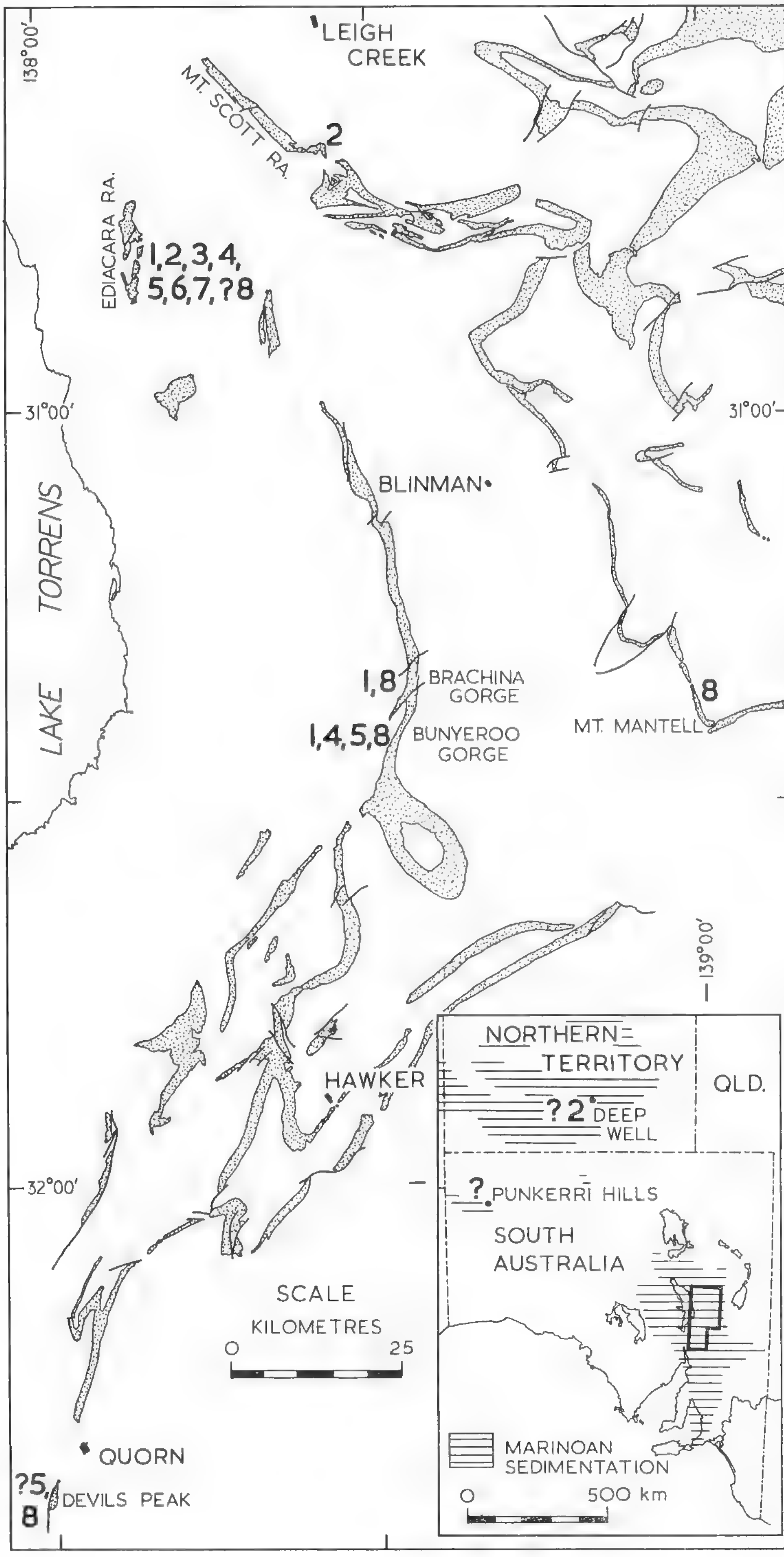
Wade (1970) reported the discovery of the Ediacara assemblage at widely spaced localities in the western Flinders Ranges and its known distribution has now been extended over much of the Ranges (m.s. in preparation). Significant, new, well preserved specimens of frond-like fossils have been found at several of these localities (Fig. 1), mainly by J.G.G. working in conjunction with Messrs. C. H. Ford and D. A. Westlake. This new material sheds additional light on the structure and probable affinities of the previously described forms and indicates a greater diversity of taxa.

Current interest has been focused on Late Precambrian, frond-like fossils by works such as those of Pflug (1970a, b, 1971a, b, 1972a, b, c, 1973, 1974a, b), and the present study has been prepared to update information on the Australian examples.

Ediacara assemblage

Termier and Termier (1960) erected the "Ediacaran" stage which they defined as being characterised by the fossils from Ediacara and the other similar "Eocambrian" fossils then

18th May, 1978


LEIGH CREEK
MT. SCOTT RA.
2
EDIACARA RA.
1,2,3,4,
5,6,7,?8
138°00'
31°00'
31°00'
BLINMAN
TORRENS
LAKE
1,8
BRACHINA GORGE
1,4,5,8
BUNYEROO GORGE
8
MT. MANTELL
139°00'
HAWKER
32°00'
SCALE
KILOMETRES
0
25
QUORN
?5,
8
DEVILS PEAK
NORTHERN TERRITORY
QLD.
?2
DEEP WELL
?
PUNKERRI HILLS
SOUTH AUSTRALIA
MARINOAN SEDIMENTATION
0
500 km

known from England and southern Africa. In a later work the same authors (Termier and Termier 1967: p. 141) discuss "la faune d'Ediacara", and subsequently they refer to the different world occurrences of the comparable fossils as "la faune ediacarienne" or "des faunes ediacariennes" (Termier and Termier 1968; p. 74 and p. 76).

The English usage "Ediacara fauna" was adopted by Wade (1970) in reference to the fossils from the Ediacara Range and elsewhere in the Flinders Ranges. Here it is considered that the term "fauna" is more applicable to the original living population of animals and that the term "assemblage" is preferable to denote the incomplete collection of fossils which, because of preservational factors, undoubtedly represents but a part of the original fauna. For example, in all of the known Australian occurrences the sand grains in the beds containing the fossils are too coarse to preserve imprints of small organisms (cf. Glaessner 1972).

Repositories

The repositories of the material studied are the South Australian Museum (registered numbers prefixed P. in text) and the Palaeontology Collection of the University of Adelaide (numbers prefixed T. or F.).

DISCUSSION

The repositories of the material studied are the fossils in the Ediacara assemblage are preserved as markings standing in either positive or negative relief on bedding plane surfaces of flaggy sandstone or quartzite. Mostly the fossils occur on the undersides of such beds. Wade (1968) detailed the several alternative ways in which they were probably preserved and indicated general principles applicable for their interpretation.

Study of the available materials referred to *Arborea* confirms that the reconstruction given by Glaessner and Wade (1966: pp. 618-620, fig. 2) is correct in its major details. They consider that the organism was basically a foliate, leaf-shaped structure normally preserved lying on one of its (two) broad sides in the plane of the bedding. This foliate structure or frond was elongate and symmetrical in form, and comprised a relatively narrow median zone or rhachis from which lateral, primary branches extended on either side at an angle of between 45° to 90° relative to the rhachis. This interpretation is proved correct by a unique specimen (P. 19687) in which the frond is overfolded near the middle of its length so that features of both sides are preserved.

It is also evident that the primary branches were linked by a foliate base which formed one side of the frond (the more or less smooth or "dorsal" side). The branches were fleshy or inflated, and on the side opposite the foliate base (the "ventral") each supported a free standing, flap-like polyp-leaf. Each polyp-leaf shows a series of close-spaced grooves which evidently correspond to spicular supportive devices lying in the position of the joins or sutures between the polyp anthosteles. In some species the margins of the frond seem to have extended into a membraneous structure or marginal-zone which was either featureless or with faint indications of extensions of the axial traces of the branches.

Frequently, the rhachis shows impressions of more or less straight spicules which were longitudinally arranged within it (Glaessner 1959a, b, 1971b; Glaessner and Wade 1966). The new materials available indicate that the rhachis continued at the base of the frond as a stalk which terminated in a disc-like structure. Such a stalk, passing into the base of a frond at one end and attached to a "bulbous expansion" at the other, is partially figured in plate 103 figure 1 of Glaessner and Wade (1966) and is discussed in the explanation of this figure on their page 624. The disc-like structure usually consists of a central circular boss and an outer flange which may or may not show evidence of a radial musculature.

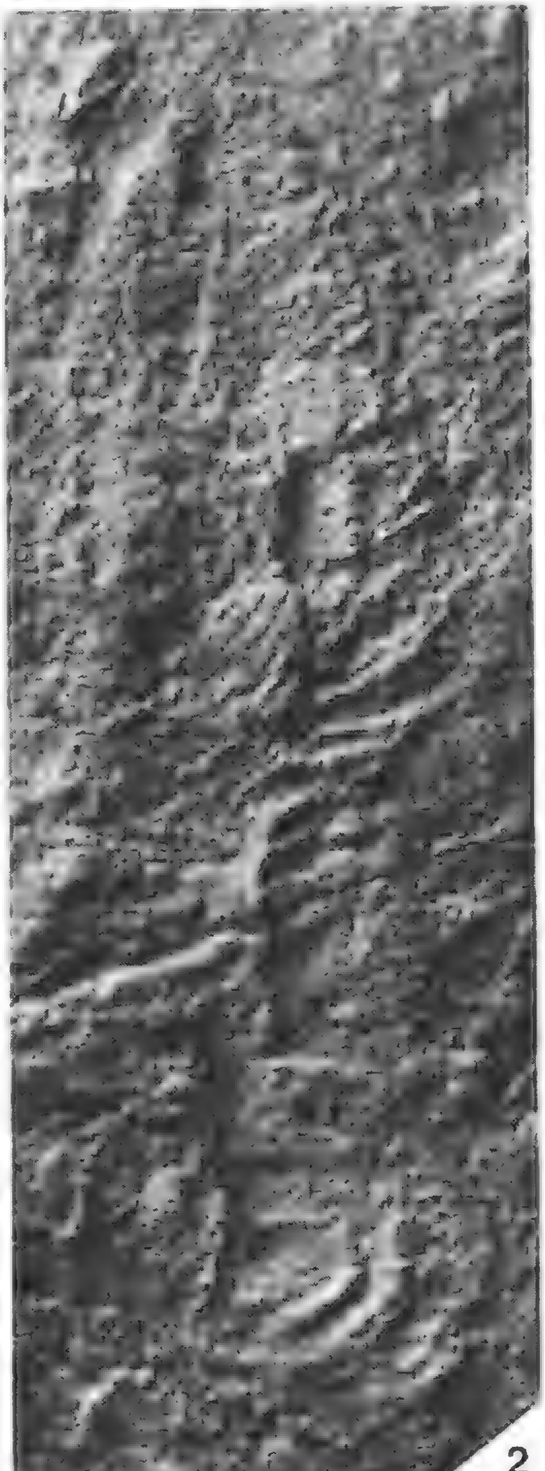
Specimens of *Arborea* have been preserved with a circular collapse structure indicating the position of the buried disc in the substrate and the frond bent over and laid flat from its position in life. Thus the disc was evidently an anchoring device.

Ford (1958) described frond-like and disc-like organisms from the Late Precambrian of Charnwood Forest, England. He erected the taxon *Charnia masoni* to include most of the frond-like organisms. The disc-like structures were included in his new taxon *Charniodiscus concentricus*. Ford (1963) referred additional material to *C. concentricus*.

The holotype of *Charniodiscus concentricus* (illustrated in Ford 1958: pl. 13, fig. 2 and

Fig. 1. Locality maps of finds of Ediacaran frond-like fossils in Australia. The larger map shows the greater part of the Flinders Ranges with outcrop of the Pound Quartzite indicated by areas of stipple; numbers signify the taxa identified from each locality. 1: *Charniodiscus arboreus* (Glaessner 1959). 2: *Charniodiscus longus* (Glaessner and Wade 1966). 3: *Charniodiscus oppositus* sp. nov. 4, undescribed new species of *Charniodiscus* with crinkled resistive structures within the branches. 5: *Glaessnerina grandis* (Glaessner and Wade, 1966). 6. undescribed new species of *Glaessnerina*. 7: *Pteridinium* cf. *simplex* Gürich, 1930. 8: *Phyllozoon hanseni* gen. et. sp. nov.

Ford 1963: pl. 1, fig. a) is a disc-like structure associated with a stalked frond which appears to be attached to the centre of the disc (Figs. 2 and 4). Similar Australian materials (e.g. Fig. 3) provide confirmatory evidence that the disc and attached frond represent a single organism. Ford (1963) included this frond in *Charnia masoni*, although he previously remarked that it differed in structure from the holotype of that species (Ford 1958: pp. 213-214). The frond is of comparable dimensions to the holotype of *Charnia masoni*, but differs markedly in that it shows a wide, tapering median rhachis and has upwards of 45 branches on each side of the



2

3

Fig. 2. Photograph of a cast of the holotype of *Charniodiscus concentricus* Ford, 1958, the original being from the Late Precambrian of Charnwood Forest, Leicestershire, England; x .8.

Fig. 3. Photograph of a cast of a specimen of *Charniodiscus arboreus* (Glaessner 1959), P. 19690, occurring at Bunyeroo Gorge, western Flinders Ranges, x .45. The zone of imperfect preservation between the disc and the base of the frond is considered to have resulted from arching of the stalk.

rhachis rather than about 20; in one area the branches show a faint cross-structure, but strong secondary divisions are lacking. The reverse side of the frond, fortuitously revealed by a small overfolded portion (Figs. 2 and 4), shows the branches to be smooth dorsally, though still delimited by weak grooves. Thus this frond cannot represent the reverse aspect of *Charnia masoni* and almost certainly represents a separate genus and species, surely referable to the available name taxon *Charniodiscus concentricus*.

The Australian Ediacara materials included in *Arborea* are extraordinarily similar to *Charniodiscus concentricus*. Their rhachis extends into a stalk attached to a quite similar disc-like structure. The number of branches is similar, upwards of 30, and there is every indication that the form of the branches and the shape of the grooves between them is comparable. The overfolded portion of the frond of the holotype of *C. concentricus* suggests that the branches were linked laterally by a foliate base. *Charniodiscus* seems to differ from *Arborea* only in that some of its branches show a pronounced curvature rather than being nearly straight. This feature may well be exaggerated by distortion.

Considering the boardly similar age of *Arborea* and *Charniodiscus* (Late Precambrian; see Glaessner 1971a) and their morphological similarity, there seems little justification in maintaining them as distinct genera and accordingly they are here considered congeneric, *Arborea* becoming a synonym of *Charniodiscus*. *Charniodiscus concentricus* can be distinguished from the local forms of the genus at the specific level.

The forms which have been included in *Arborea arborea* (Glaessner) are herein split into two separate species. *Charniodiscus arboreus* is characterised by relatively narrow branches which occur in alternate positions on each side of the rhachis; the ventral track of the rhachis is narrow and zig-zag towards the end of the frond (Fig. 3). The new taxon, described herein as *Charniodiscus oppositus* sp. nov., and illustrated in Figures 5 and 6, has broad branches situated in opposite positions on either side of the rhachis, the ventral track of which is relatively broad for its whole length.

A third and very rare form, which is new and still to be described, is tentatively included in *Charniodiscus*. It is characterised by crinkled, resistive structures within the branches. Some of these structures are bent or deformed, indicating an original flexibility.

As has already been mentioned, most of the frond-like fossils of the Ediacara assemblage are preserved on lower surfaces of flaggy sandstone beds. The holotype of *Rangea longa* and the majority of the other specimens referred to this taxon by Glaessner and Wade (1966) are unusual in that they are preserved on the *upper* surfaces of quartzite slabs. Twenty or more fronds (not including the holotype, P13777) occur lying in close juxtaposition on a number of similar quartzite slabs (P12721a-j) which were evidently broken from a single bed. These fronds are all orientated in the same way, stretched out lengthwise by a current which eddied around them and scoured the sediment (Wade 1968). On the same or similar bedding surfaces (P 12716, P12721b and c, P12736) are several more or less circular depressions which are evidently craters of collapse over anchoring devices resembling those described for *Charniodiscus*. An impression of part of a thick stem extends from one of these collapse craters (P12716)). The organisms preserved were apparently bent over from the position in which they were anchored in life and laid flat by the current. They were gregarious, living in near proximity to one another, with individuals at all stages of growth represented.

The fronds of *R. longa* are generally preserved as external moulds, with sand underpacking spaces between the polyp-leaves and branches. No unequivocal interpretation of the structure of the frond is possible, partly because no single specimen shows a whole individual, and also because of overlapping and distortion. Nevertheless it is considered that the reconstruction of *R. longa* given by Glaessner and Wade (1966) is probably incorrect in showing polyp-leaves on both sides of the frond. The specimens interpreted as showing this (Glaessner 1959b: pl. 45 Fig. 1) include a cast (left side of figure just indicated) in which the rhachis is preserved by composite moulding. In the holotype, particularly, the structure of the frond appears to be essentially similar to that of *Charniodiscus*, with inflated, laterally linked branches each bearing a polyp-leaf. The polyp-leaves seem to narrow and terminate at the edge of the frond. It is considered that the other available specimens lend weight to those findings and accordingly *Rangea longa* is tentatively referred to *Charniodiscus*.

The frond of *R. longa* shows no evidence of a marginal membranous structure. One specimen (P12721c) seems to show the more lateral anthosteles on the polyp-leaves fanning outwards and forming a curved array at the edge of the frond, much as occurs in many modern pennatulaceans. Wade (pers. comm.) has indicated that text-figure 1c of Glaessner and Wade (1966)

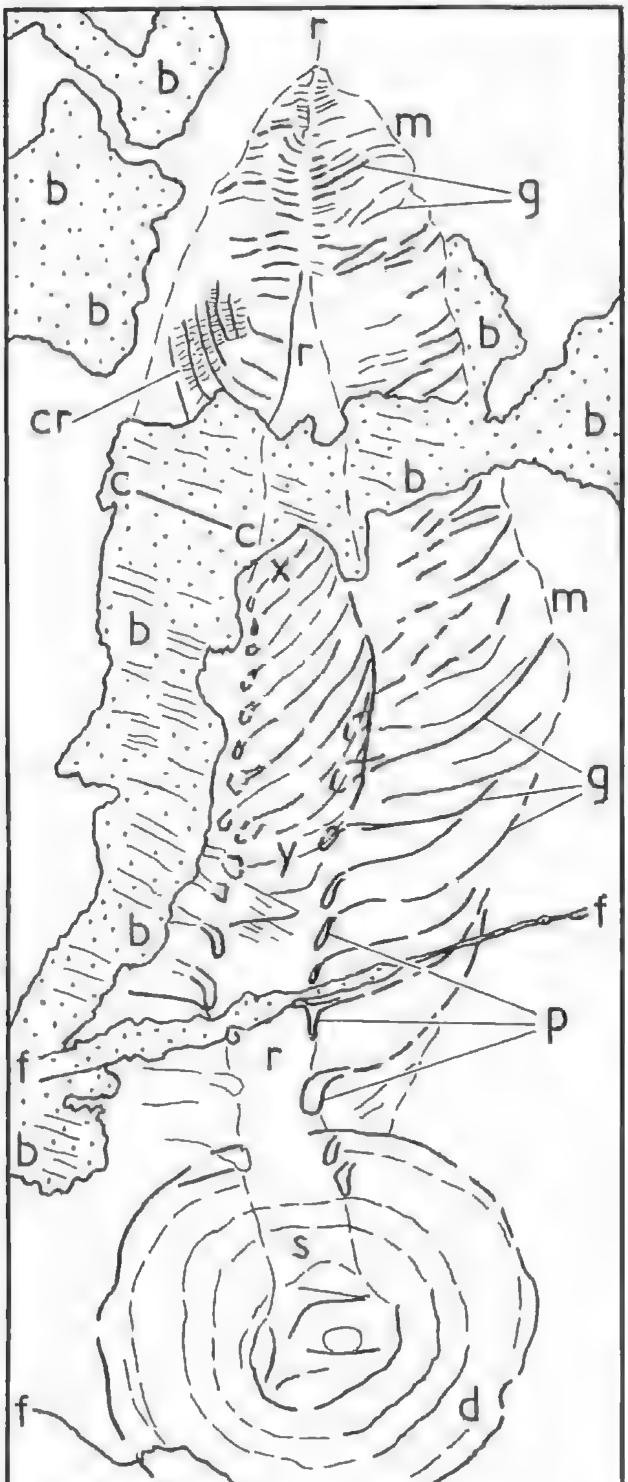


Fig. 4. Interpretive outline drawing made from the cast of the holotype of *Charniodiscus concentricus* Ford, 1958, illustrated in figure 2, x 08 f, fractures in original rock surface; b, projecting irregularities in sediment; d, disc of organism and, s, stalk attached to it; r, rhachis of frond; m, outline of frond; g, primary grooves between branches of frond and p, pockets formed by these grooves adjacent to the rhachis; cr, faint cross-structure on branches; x-y, overfolded portion of frond.

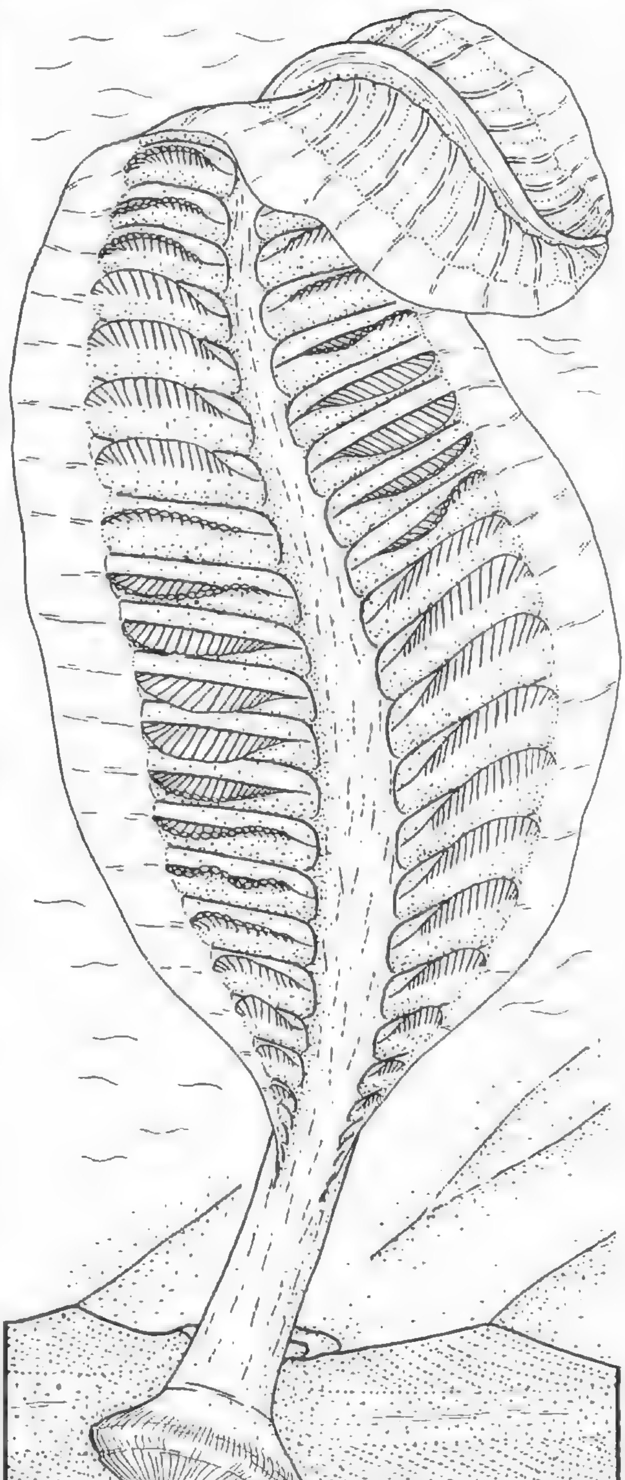


Fig. 5. A reconstruction of *Charniodiscus oppositus* sp. nov., about x .8 of average sized specimens. The organism is shown in its inferred life position, anchored in ripple-bedded sands. It is drawn as though it were partly transparent, the spicules shown in the stalk and rhachis were evidently imbedded in the sub-dermal integument.

is based on similar evidence, but we consider that the polyp-leaves only overlapped or enveloped one another to a minimal degree.

The genus *Glaessnerina* Germs, 1973, is considered herein to include its type species *Rangea grandis* Glaessner and Wade and one other new species yet to be described. *Glaessnerina grandis* is now represented by four specimens, three of which show the polyp-bearing ventral side of the frond, and the other the dorsal side, which is characterised by a broad rhachis (P. 19688). The branches of its frond were evidently attached to the ventral side of the rhachis. The polyp anthosteles on one branch reached to or overlapped those of the next serial branch on the opposite side to completely hide the rhachis and give the effect of a zig-zag medial commissure. This overlap of the polyps is probably a function of compression during preservation, as in life the polyps must have projected away from the frond at an angle so that there was no interference between them during feeding.

Little new information can be added concerning the form which Glaessner (1963) and Glaessner and Wade (1966) identify as *Pteridinium* cf. *simplex* (Gürich 1930). The majority of specimens are unusual in that they are preserved as moulds and counterpart moulds in massive sandstone (Wade 1968, 1971). These fossils provide no indication as to how the organism may have been oriented relative to bedding, much less its possible orientation in life. Pflug (1970a, b, 1971a, b, 1972a, 1973) has now given an extensive documentation of the material of *Pteridinium* from the Nama Group of Namibia. Their preservation is evidently the same as for the Australian examples. The African specimens often show three half leaf-shaped elements ("petaloids" of Pflug 1970a) extending from an axial line. One of the Australian specimens (plate 101, figure 1 of Glaessner and Wade 1966) also shows three petaloids extending from the axis, two of the petaloids lying in close juxtaposition and separated by a thin lamina (about 1 mm thick) of quartzite, and the third more or less symmetrically opposite, on the other side of the axial line.

A new taxon, *Phyllozoon hanseni* gen. et sp. nov. is erected for a leaf-shaped fossil, numerous individuals of which are typically preserved together on lower surfaces of quartzite beds. The frond of this organism shows numerous distinct grooves extending away from a zig-zag median suture, and appears to have had a membranous or foliate base. The lateral grooves extend from the axis of the frond at 65° to 85° and gradually become more widely spaced in the direction of the end of the frond towards which they are inclined. It is evident that the median axis of the frond and the lateral grooves actually represent a flexible, resistive framework or skeleton. The edges of the frond are usually indistinct.

Specimens of frond-like fossils have been reported from the northern part of the Officer Basin in the possibly Late Precambrian Punkerri Beds of the Punkerri Hills, northwestern South Australia (Major 1974 and references therein). Restudy suggests that one of the supposed remains is of inorganic origin, a pseudofossil of striking realism simulated by a set of repeated parallel micro-faults. Imprints on another block of sandstone resemble parts of the frond of *Charniodiscus*, but are so fragmentary that they should be considered essentially indeterminate.

The above discussion, together with more detailed studies too lengthy to be included in this work, provide the basis for the systematic listing below.

SYSTEMATICS

Genus *Charniodiscus* Ford, 1958

Type species:

Charniodiscus concentricus Ford, 1958: 213, pl. 31 fig. 2, by monotypy.

Charniodiscus Ford, 1958: 213; 1963: 57.

Rangea Gürich, 1930. Glaessner, 1959a: 1472-1473; 1959b: 383. Glaessner and Wade, 1966 (partim): 614-616.

Charnia Ford, 1958. Glaessner, 1962: 483 (partim, with reference to pl. 1 fig. 5).

Arborea Glaessner and Wade, 1966 (partim): 618-619.

Revised diagnosis: Frond large, leaf-like, fusiform or tapering; dorsal track of rhachis wide, ventral track narrower, either straight or tapering narrowly and zig-zag, base of rhachis forming a stalk attached to centre of a disc-shaped structure showing a central circular boss and an outer flange which may have a radial ornament; branches about 30 to more than 50 in number (on either side of frond) situated either in alternate or opposite positions along rhachis and diverging from it at 45° to 90°; individual branches evidently swollen or inflated during life, composed largely of unresistant material, but generally with a stiffened or resistant structure positioned medially; each branch linked to immediate neighbours by a foliate base, and with grooves between, these grooves curved and particularly deep near rhachis; mature branches each bearing a flap or flange-like polyp-leaf which shows secondary grooves delimiting fused polyp anthosteles; edges of frond either with or without a membranous marginal one.

Referred taxa: The Australian forms which are apparently referable to this genus are all evidently of Late Precambrian age and are as follows:

Rangea arborea Glaessner, 1969, about 30 specimens from the Pound Quartzite and occurring variously at Ediacara Range, Brachina Gorge and Bunyeroo Gorge, in the Flinders Ranges. The holotype is specimen P. 12891, and two paratypes are P. 12892 and P. 12895; other referable specimens are P. 13787, P. 13801b, P. 14212, P. 19689, and F. 16718; all from Ediacara Range. A cast of a specimen occurring at Bunyeroo Gorge, P. 19690, is shown in Figure 3.

Rangea longa Glaessner and Wade, 1966, approximately 30 specimens from the Pound Quartzite, occurring mainly at Ediacara Range, but with one specimen from Mount Scott Range (coll. Dr. B. Daily), Flinders Ranges. The holotype is specimen P. 13777, with the paratypes including P. 12716, P. 12721 a-i, P. 12736 and P. 12743; all from Ediacara Range. Also referable to *Charniodiscus* is a specimen of a small part of a frond collected in a loose block on the lower part of the Arumbera Formation, east of Deep Well Homestead, S.S.E. of Alice Springs, central Australia, and identified by Glaessner (1969) as *Rangea* cf. *longa*. Restudy of the specimen suggests that it is too incomplete for specific identification.

Two new species from the Pound Quartzite of the Flinders Ranges; one represented by more than 40 specimens and described below; the second very rare and yet to be described (see p. 351 above).

Charniodiscus oppositus sp. nov.
Figs. 5 and 6

Rangea sp. Glaessner, 1959a (partim): 1472-3.

Rangea arborea Glaessner, 1959b (partim): 383, pl. 43 figs. 2 and 4, pl. 44 figs. 1 and 3. Glaessner, 1961 (partim): fig. p. 75; 1962 (partim): 483-485, pl. 1 fig. 10.

Arborea arborea (Glaessner 1959). Glaessner and Wade, 1966 (partim): 619.

Derivation of name: From the Latin *oppositus*, in reference to the approximate opposite positioning of the branches on either side of the rhachis.

Diagnosis: Species reaching large size with frond up to 30 cm wide and well in excess of 73 cm long; frond broad, 2·5-4 times as long as wide in more complete specimens (excluding marginal zone); ventral track of rhachis wide, only slightly narrower than the dorsal; branches about 30 in number (on each side of frond), located in nearly opposite positions on either side of rhachis and diverging away from it at about 65° to 85°; branches relatively broad, 3-3·5 times as long as wide on more central parts of frond.

Material: This is one of the more numerous frond-like fossils in the Ediacara assemblage with upwards of 40 specimens being referable to it with greater or lesser degrees of confidence. The holotype is F. 17337 and the nominated paratypes are T. 94-2015, T. 94-2016, P. 12888, P. 12896, P. 14213, P. 19684, P. 19685 and P. 19687; all from Ediacara Range. Also referable is a specimen occurring at Bunyeroo Gorge and represented by a cast, P. 19686.

The majority of specimens are preserved as casts (sometimes with composite moulding) on the bottom surfaces of sandstone flags. The holotype is uniquely preserved as a smooth external mould within a sandstone bed (Fig. 6).

Remarks: *C. oppositus* closely resembles *C. concentricus*, but differs in that its branches do not show a pronounced trend to decrease in width towards the tip of the frond and are possibly less numerous. The well marked radial ornament on the outer flange of its attachment disc may also be distinctive.

C. oppositus differs from *C. arboreus* in the more regular width of its branches and in their opposite rather than alternate positioning on either side of the rhachis. The attachment disc has a smaller central boss relative to *C. arboreus*. *C. longus* has a much more elongate frond with very numerous branches.

Zoological affinities: Glaessner (1959a, b, 1961, 1962, 1963, 1969, 1971a, b and Glaessner and Wade (1966) considered that the frond-like fossils of the kind just described are allied to living members of the order Pennatulacea. The few difficulties which the above authors raised against this interpretation are now largely obviated by information from the new materials for *Charniodiscus* to hand and studies of modern live pennatulids (e.g. Brafield 1969, and observations made by J.G.G. on living animals on the sea floor and in aquaria). Some major charac-

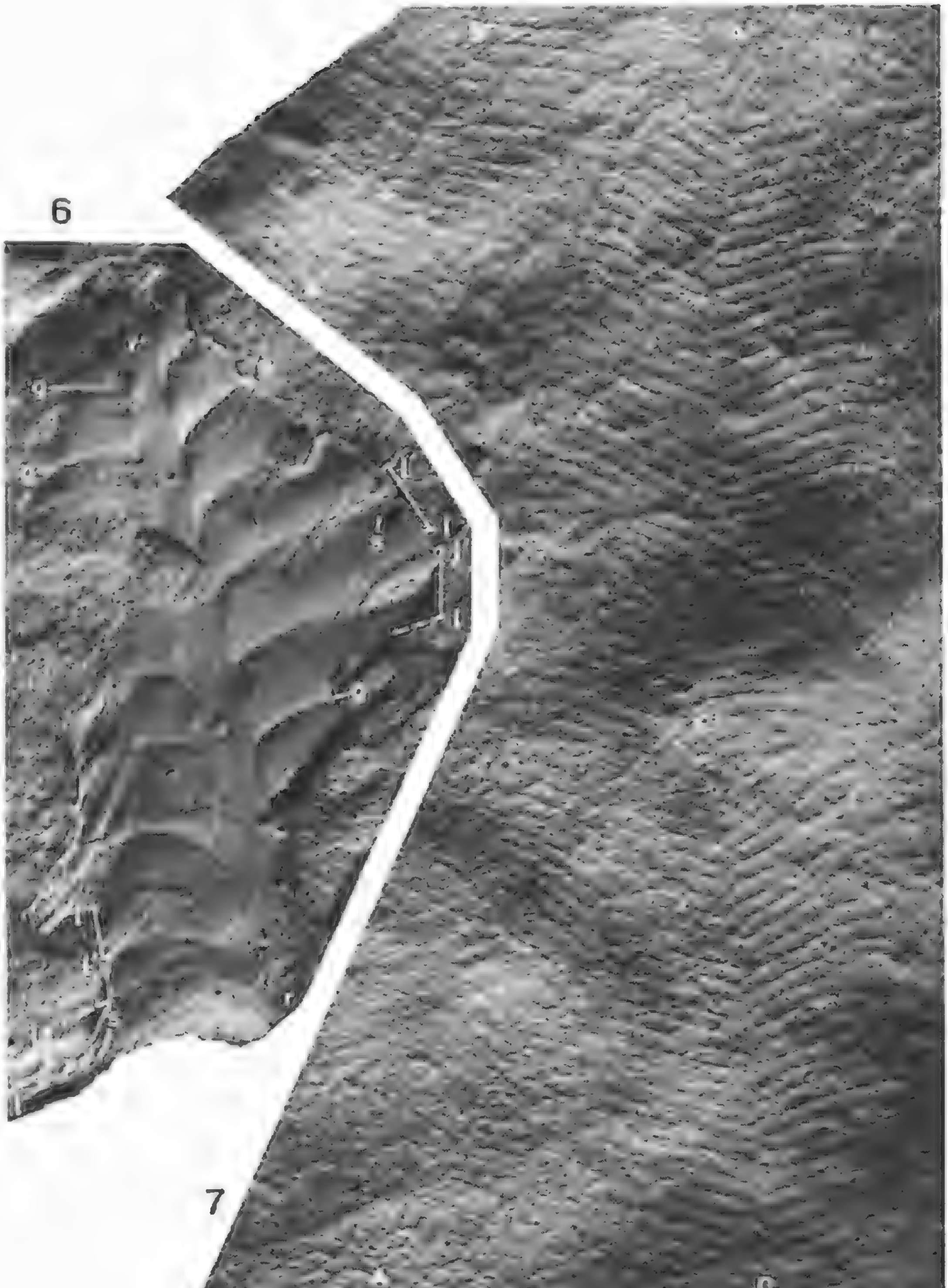


Fig. 6. Holotype of *Charniodiscus oppositus* sp. nov., F.17337, from Ediacara Range, x .7. The specimen is an external mould of a central part of the polyp-bearing (ventral) side of the frond. r-, r′, rhachis; g, grooves between the primary branches; 1-1′, flap-like polyp-leaves extending distally on the right side of the frond and folded proximally on the left side; s, spicular supportive devices in the polyp-leaves.

Fig. 7. *Phyllozoon hanseni* gen. et sp. nov. Holotype, specimen A-A′, P.19508A, and incomplete remains of two paratype specimens, B-B′ and C-C′, from the Devils Peak, southern Flinders Ranges, x 1. Composite moulding has occurred where the end of specimen C-C′ overlaps the holotype, A-A′.

teristics shared by *Charniodiscus* and present-day pennatulaceans are as follows:—

a. Both have an anchoring structure characterised by strong longitudinal or radial musculate. In the living genus *Pteroeides* Herklots, 1858, the anchoring device is essentially a muscular sack which can be dilated with water. A sphincter muscle lies at the junction of this sack and the stalk. A basal expansion or protrusion of the sack (Brafield 1969: pl. 1, fig. a) seems analagous to the central boss in the attachment disc of the fossil forms.

b. A stalk and median rhachis is present in each. In modern pennatulaceans the rhachis functions as a hydrostatic organ of support, becoming greatly swollen and stiffened by water drawn into large internal canals; in symmetrical forms additional support is provided by a calcified rod or axis in the lower part of the rhachis and stalk. *Charniodiscus* lacked this rod or axis; its rhachis, though up 3-4 cm wide in large specimens, readily collapsed flat during preservation, suggesting that it was also filled largely with fluid during life.

c. Spicular elements present in the stalk and rhachis of *Charniodiscus* resemble those commonly occurring in the modern animals.

d. In both, lateral branches extending from the rhachis bear foliate structures (polyp-leaves) showing secondary divisions (polyp anthosteles). The branches of modern forms can be inflated with water and some specimens of *Charniodiscus* also show evidence that the branches were dilated.

e. The large spicules evident in the polyp-leaves of *Charniodiscus* seem analogous with those in species of *Pennatula* Linné, 1758, and *Ptereoides*.

f. Modern pennatulids, even those with an axis, have considerable powers of distension and contraction. A live specimen of *Ptereoides* has been observed to extend its length by about 100 per cent from the contracted to the expanded state. Specimens of *Charniodiscus* showing evidence of appreciable stretching by currents suggest that it also may have been capable of significant distension.

Charniodiscus was seemingly close to the living branched family Pennatulidae in its gross morphology, but differed in lacking a calcified axis and in having its branches fused or linked laterally rather than free. The extant Renillidae have a continuous foliate frond and no axis, but lack recognisable branches. Considering the diversity of form shown by modern pennatulaceans and their very long separation in time from the Ediacara assemblage, it is hardly surprising that *Charniodiscus* shows several unique characteristics.

Genus *Glaessnerina* Germs, 1973

Type species: *Rangea grandis* Glaessner and Wade, 1966: 616, pl. 100 fig. 5, by original designation.

Glaessnerina Germs, 1973: 5.

Revised diagnosis: Frond large, tapering, with broad tapering dorsal rhachis; primary branches situated in alternate positions on rhachis and diverging from it at approximately 40-65°, with their lateral terminations sharply delimited; each primary branch bearing a row of large, similar, blunt secondary branches (polyp anthosteles) projecting obliquely towards axis of frond at about 30-50° to it; secondary branches of type species widest near rhachis and becoming progressively narrower away from it; basal parts of primary branches and secondary branches overlapping in ventral midline to form a zig-zag commissure.

Remarks: In a number of his earlier works on the Ediacara assemblage Glaessner (1959a, 1959b, 1961, 1962) referred the type species of this taxon, *Rangea grandis*, to the genus *Charnia*. Germs (1973) again drew attention to the similarity between *Glaessnerina grandis* and *Charnia* and suggested that further study of them might "make it advisable to place them in the same genus". However, several marked differences do occur between them and for this reason their separation is maintained here.

In *Glaessnerina* part of each primary branch is continuous or undivided, and it is this undivided portion which bears the secondary branches. In *Charnia*, the secondary divisions extend continuously across the primary branches, and as well, have their long axis more nearly transverse to the axis of the whole frond. The secondary divisions of the branches of Glaessnerina are widest near the axis of the frond and become progressively narrower towards the ends of the primary branches. The secondary structures of *Charnia* are narrow near the frond axis, become wider near the middle of the length of each primary branch, and then narrow again towards the edge of the frond. A further distinctive character in

Charnia is that the secondary structures are themselves regularly subdivided by tertiary grooves.

In its morphology *Glaessnerina* shows a resemblance to *Charniodiscus* on the one hand, and a suggestive similarity to members of the extant Pennatulidae on the other. It is almost certainly related to *Charniodiscus* and thus can also probably be considered as allied to the pennatulaceans.

Genus *Pteridinium* Gürich, 1930

Type species: *Pteridinium simplex* Gürich, 1930: 637, by original designation.

Interpretations given to this genus by Pflug (1970a, b, 1971a, b, 1972a, 1973 pose problems outside the scope of the present work, and it seems inappropriate to attempt to provide a generic diagnosis.

Referred taxa: The single Australian form is represented by rare materials from Ediacara which Glaessner (1963) and Glaessner and Wade (1966) identify as *Pteridinium* cf. *simplex*. Aside from the brief remarks above on pp 353 no new information can be given.

Genus *Phyllozoon* gen. nov.

Type species: *Phyllozoon hanseni* sp. nov.

Derivation of name: *Phyllo*, from the Greek noun *phyllon*, leaf; *zoon*, Greek for animal.

Diagnosis: As for type species.

Phyllozoon hanseni sp. nov.
Fig. 7

Derivation of name: The species is named after Mr. Anthony Kym Hansen, who made the initial discovery of this taxon whilst studying geology at Adelaide University, and has since lost his life during seismic exploration in Western Australia, 1976.

Diagnosis: Frond leaf-like, resembling *Pteridinium simplex* in its incised zig-zag median line and almost evenly spaced, repetitive lateral grooves, but differing in that the organism was evidently of more or less planar or two dimensional form, not with three ribbed wings extending from the axis; incised axis and lateral grooves evidently representing a resistive skeleton which lay within foliate base of frond; lateral grooves extending from axis at about 70°, with their ends curved outwards; spacing of lateral grooves tending to become less at (?)proximal end of frond.

Material: Fifteen or so individuals are available for study. The holotype, P. 19508A, a nearly complete frond, and eight or nine other fragmentary individuals, all occurring on a single bedding plane, were discovered by Mr. A. K. Hansen at Devils Peak, southern Flinders Ranges. Three individuals occurred at Mt. Mantell Range, central Flinders Ranges. Numerous individuals have been observed on rock slabs in the Heysen Range, western Flinders Ranges, particularly near Bunyeroo Gorge; a specimen occurs in a collection from Brachina Gorge. Several fragmentary remains showing resemblances to this taxon are present in collections from Ediacara.

Dimensions: The frond of the holotype (specimen A, A′ in Fig. 7) is about 18 cm long and 5·5 cm wide towards the middle of its length, with about 75 lateral grooves (on each side of frond) spaced at about 2 mm (end of frond opposite to direction in which lateral grooves are inclined) to fractionally under 3 mm (average). A spacing of about 3 mm is common in other specimens. Individuals may reach in excess of 23 cm long with upwards of 100 lateral grooves.

Remarks: *Phyllozoon hanseni* apparently differs from the Namibian material of *Pteridinium simplex* in that it is a two dimensional frond, showing no evidence of an additional ribbed wing extending from the axis. Where separate, individual fronds overlap, composite moulding results, and if an additional wing did exist it seems likely that it would be evidenced by this process. Another difference between the new form and *P. simplex* is that the lateral grooves show a characteristic inclination relative to the axis (about 70°) in the former, but are nearly transverse or variably inclined in the latter. *Phyllozoon* does not show a series of small distinct lobes adjacent to the axis, a character often present in *Pteridinium* (where they have been termed "commissurae" by Pflug, 1970a).

P. hanseni differs from the material from Ediacara identified as *Pteridinium* cf. *simplex* in that the ends of its lateral grooves curve in the opposite direction and do not converge together towards the margin of the frond, and "commissurae" are lacking.

P. hanseni shows a resemblance to another of the forms occurring in the Nama Group, *Nasepia altae* Germs, 1973. The latter is described as consisting of ribbed, leaf-like bodies (petaloids) which have a "skeletal structure". However, a number of petaloids are evidently bundled together in *Nasepia* and the individual petaloids seem to be broad rather than elongate in shape.

A striking, but probably superficial similarity of form exists between *P. hanseni* and species of *Plumalina* Hall, 1858, frond-like remains occurring in the Middle Devonian to latest Devonian or earliest Mississipian of New York and the Middle Devonian of Eifel, Germany. In the detailed recent review of *Plumalina* presented by Sass and Rock (1975) it is described as being a plume or feather-like form, in which the separate lateral branches (or "pinnae") and perhaps the rhachis were apparently tubular prior to burial. *P. hanseni* differs from *Plumalina* principally in having a foliate base to the frond rather than separate pinnae, and in its axial line consisting essentially of a single groove, not a distinct narrow band forming a clearly marked rhachis.

In their discussion of the likely affinities of *Plumalina*, Sass and Rock reject the possibility that it is a plant and compare it to members of the Gorgonacea and hydrozoans belonging to the feather-like Plumulariidae. In the last paragraph of their work they favour an affinity with the hydrozoa, a view with which we concur.

In the Plumulariidae and near relatives (members of the Order Hydroida) the colony consists of an axial stolon or hydrocaulus from which branch individual lateral stolons bearing small or microscopic polyps or hydranths (Hyman 1940). The stolons have a chitinous covering or periderm; the polyps are partially enclosed by goblet-shaped expansions of the periderm, the hydrotheca. The colony grows by the progressive budding and branching of new single stolons from the distal end of the hydrocaulus. This mode of development would seem to preclude the evolution of a common membrane inter-connecting the individual branches of the frond. Thus it seems unlikely that *Phylozoon* is allied to the Plumulariidae and there is a dearth of evidence to link it with other hydrozoans.

In the short recent review which Glaessner and Walter (1975) present on the now diverse array of frond- and sack-like fossils variously known from a number of Late Precambrian localities in the world, they consider that these remains all show a "general similarity" and imply that this reflects an underlying taxonomic unity. This viewpoint may, however, prove to be simplistic.

As has been argued above, the genera *Charniodiscus* and *Glaessnerina* and probably *Charnia* are evidently allies of the modern Pennatulacea. On the other hand, the unnamed Late Precambrian forms from Newfoundland which Glaessner (in Glaessner and Walter 1975) considered as possibly being allied to hydrozoans, show a pattern of branching consistent with this hypothesis. A comparable form of branching is present in *Rangea* (see Pflug 1070b; Germs 1973). A quite different phylum may be represented by the apparently sack-like form *Arumbera banksi* Glaessner and Walter, 1975, which is a relatively common fossil in the latest Precambrian of central Australia. Its walls are characterised by a skeleton of elongate, subparallel, resistive fibrils, and the form shows a suggestive resemblance to primitive, thin-walled, vase-shaped sponges, such as the Early Palaeozoic Leptomitidae.

The possible systematic position of genera such as *Pteridinium* and *Nasepia* and the remaining forms grouped in the "Petalonamae" is clouded, either because of imperfect preservation, or inconsistencies in presently available descriptions. There is apparently little recorded field information which might throw light on either their life habits or life orientation. The resemblance which *Phyllozoon* shows to *Pteridinium*, together with its enigmatic state of preservation, dictate its present placement within this essentially unclassified group.

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Emeritus Professor M. F. Glaessner, University of Adelaide, is sincerely thanked for constructive criticism of the manuscript and lively discussion; he also made comparisons with overseas materials and assisted with literature. Mr. Colin H. Ford, Esso Petroleum, Malaysia and Mr. Dennis A. Westlake, discovered important new materials and provided invaluable assistance in the field. Dr. B. Daily, University of Adelaide, is also acknowledged for making available a significant new specimen. This work was partly supported by an Australian Research Grant.

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RECORDS OF THE SOUTH AUSTRALIAN MUSEUM

SOME OBSERVATIONS ON THE EYREAN GRASSWREN *AMYTORNIS GOYDERI* (GOULD, 1875)

By S. A. PARKER, I. A. MAY and W. HEAD

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Summary

Following the recent rediscovery of *Amytornis goyderi* in the eastern Simpson Desert (I. A. May 1977b), the present authors spent several days in the area studying the species. Reported here are the results of the latter expedition, including notes on plumage, habitat, status, voice, food, and the first description of the eggs. Also discussed are the relationships of *A. goyderi* within the genus, and previous European acquaintance with this little-known grasswren.

SOME OBSERVATIONS ON THE EYREAN GRASSWREN **AMYTORNIS GOYDERI** (GOULD, 1875)

by

S. A. PARKER*, I. A. MAY† and W. HEAD*

ABSTRACT

PARKER, S. A., MAY, I. A. and HEAD, W., 1978. Some observations on the Eyrean Grasswren *Amytornis goyderi* (Gould, 1875). *Rec. S. Aust. Mus.* 17 (24) 361-371.

Following the recent rediscovery of *Amytornis goyderi* in the eastern Simpson Desert (I. A. May 1977b), the present authors spent several days in the area studying the species. Reported here are the results of the latter expedition, including notes on plumage, habitat, status, voice, food, and the first description of the eggs. Also discussed are the relationships of *A. goyderi* within the genus, and previous European acquaintance with this little-known grasswren.

INTRODUCTION

The Eyrean Grasswren, *Amytornis goyderi* (Gould, 1875), was first collected by F. W. Andrews on the Lewis Expedition to the Lake Eyre district (Fig. 1) in 1874-1875. Of the six skins received by the South Australian Museum from Andrews (Waterhouse 1875) only three can now be traced: two are in the British Museum (Natural History) (Warren and Harrison 1971: 211) and one is in the Australian Museum, Sydney (Hindwood 1945). Of these, only BMNH 1881.5.1.516 has an (apparently) original label bearing details of locality: "Macumba Lat 27° 41′ 23″" (Mathews 1922-23: 207, confirmed by I. C. J. Galbraith *in litt.* 20th January, 1977). Although it is widely assumed that the other five specimens were also taken at this spot (e.g. Sutton 1927; Morgan *et al.* 1961) there is no evidence for this; they could have been secured elsewhere on the expedition's route, which ran through a great deal of country to the north and east of Lake Eyre (Lewis 1876).

In the next 50 years, the species was reported twice more in South Australia and once in the Northern Territory, but these reports were based on misidentified specimens of the Thick-billed Grasswren *A. textilis* (Parker 1972). In addition, Whitlock (1923: 273) on 5th November, 1923 observed two grasswrens that he identified as *A. goyderi* some 40 miles from Oodnadatta on the Macumba Run. On the basis of habitat, however—saltbush and low dead scrub on a low hill—the species involved was almost certainly *A. textilis.*

In 1922 Brooke Nicholls (1924) observed in canegrass on sandhills at Cowarie grasswrens that he identified as *A. textilis;* considering the habitat in this instance, however, it is far more likely that these were *A. goyderi* (Parker 1972).

In September, 1961, a party of Victorian ornithologists reported *A. goyderi* at Christmas Waterhole, at about 27° 35′ 54″ S on the Macumba River, nine miles upstream from the type locality (Morgan *et al. op. cit.*). They saw two adults, and found a nest containing two young in a tussock of Sandhill Canegrass, *Zygochloa paradoxa.* They published some notes on the habitat, nesting and behaviour of the birds observed. A puzzling aspect of their account—how one of the birds passed through their mist net four times—will be discussed below.

In September, 1972, Ian May was driving over a large sandhill 65 km due east of Poeppel's Corner when he flushed several grasswrens from tussocks of *Zygochloa paradoxa.* Suspecting these to be *A. goyderi,* but unable at the time to investigate owing to mechanical troubles, he returned to the area in August, 1976 (May, 1977b). On his second visit, and assisted by his wife, he found *A. goyderi* common in *Zygochloa* on sandhills from 32 km to 75 km east of Poeppel's Corner, and also recorded it in the adjoining area of Queensland. He collected two specimens (listed in Table 1), one at 26° 00′ S, 138° 46′ E (now SAM B30520) and one at 25° 52′ S, 138° 39′ E in Queensland (now in the Queensland Museum, No. 0.16606).

On 10th September, 1976, May set off once more for the area, this time with Shane Parker and Mr and Mrs Winston Head. The results of our expedition are presented below.

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† National Parks and Wildlife Service, Adelaide, South Australia 5000.

1—30*th May,* 1978

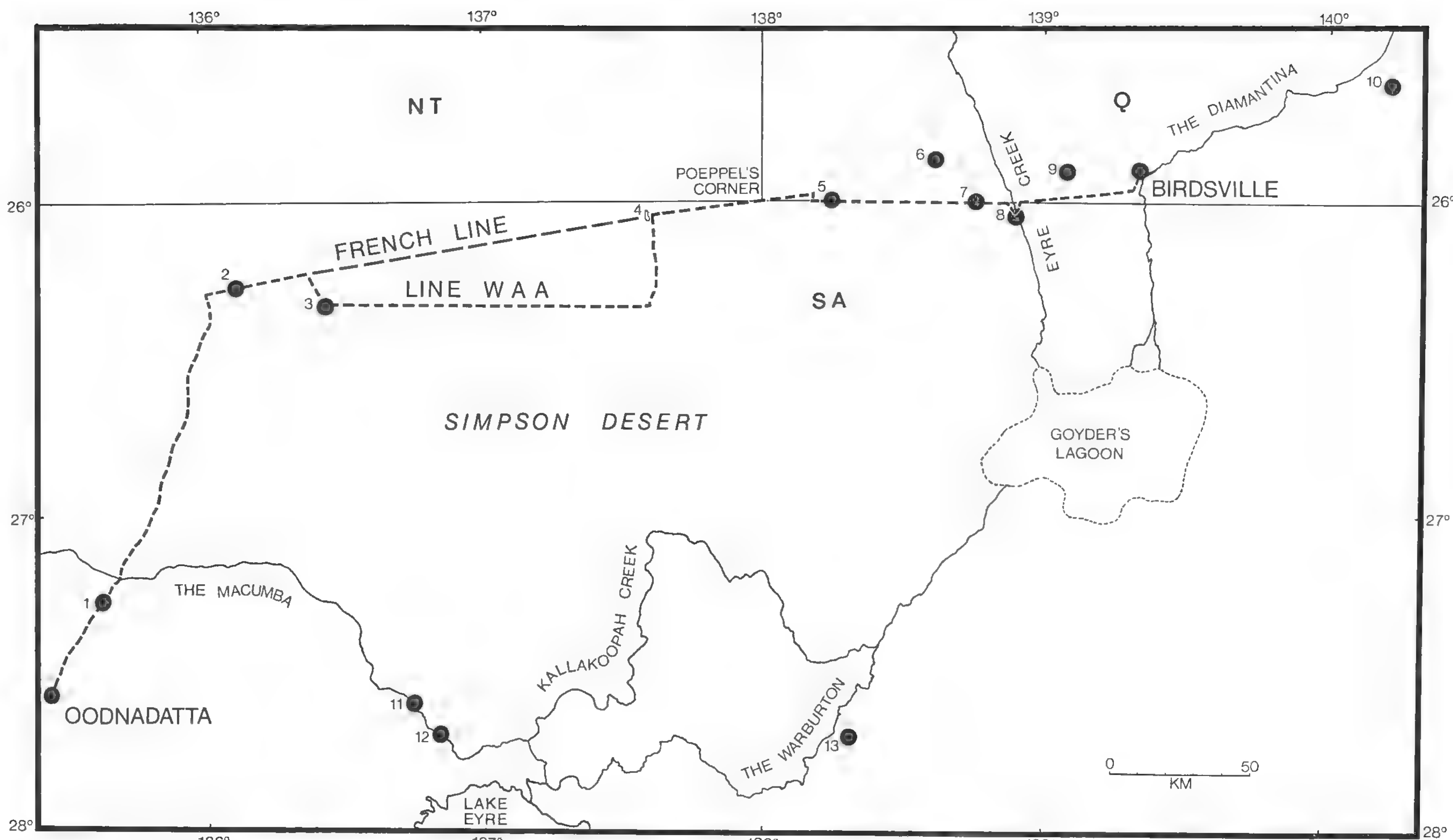

Figure 1. Map showing route taken between Oodnadatta and Birdsville in September, 1976 (----) and localities mentioned in text: 1. Macumba HS. 2. Purni Bore. 3. Makari airstrip. 4. Lake Surprise. 5. 25 km east of Poeppel's Corner. 6. 25° 52′ S, 138° 39′ E. 7. 75 km east of Poeppel's Corner. 8. Terrachi WH. 9. 28·8 km west of Birdsville. 10. Durrie sandhills. 11. Christmas WH. 12. The Macumba at 27° 41′ 23″ S (type-locality of *A. goyderi*). 13. Cowarie.

TABLE 1

Measurements of specimens of *A. goyderi*. [1] Measured by D. Goodwin, [2] by H. J. de S. Disney. [3] Listed as male by Warren and Harrison (1971: 211). (Numbers of observations in parenthesis).

Age/Sex	Winglength	Tail	Tarsus	Culmen (from Skull)	Bill-depth at nostril
Ad. and subad. ♂♂ (SAM)	56-64 (8)	76-79.2 (6), 89 (1)	23-24 (8)	12-13.5 (7), 15.8 (1)	6.2-8 (7)
Ad. and subad. ♀♀ (SAM)	55-57 (4)	74-78 (3)	21.3-24 (4)	13-13.8 (3)	6-7 (4)
Immatures (SAM)	53-58 (5)	60-71 (4)	21-24 (5)	11.2-13 (5)	5-6.1 (5)
SAM B30299 (ad. ♂ phase)	55	72.5	22	13.8	6.8
SAM B30297 (ad. ♀ phase)	57	72.5	23.5	damaged	6.1
SAM B30520 (ad. ♂ phase)	58.5	82.6	25	14	6.9
QM O.16606 (ad. ♂ phase)	59	damaged	24.3	13	6.8
BMNH 1881.5.1.516[1], [3] (ad. ♀ phase)	55.5	70	23	12	6.5
BMNH 1881.5.1.517[1] (ad. ♂ phase)	60.5	72	24	13	7
AM O.18596[2] (ad. ♂ phase)	58	77	21.1	13.4	6.5

SEPTEMBER, 1976: A BRIEF LOG

12th September—From camp at 26° 57′ S, 135° 50′ E on Allapalilla Creek 50 km north of Macumba Station we travelled north to French Line, which we struck at 26° 18′ S, 136° 01′ E. From here we drove 37·5 km on a bearing of 78° true north, entering the Simpson Desert. At 26° 13′ S, 136° 24′ E we changed direction to 150° t.n. to reach Makari airstrip at about 13 km further on. After refuelling, we followed Seismic Line WAA on a bearing of 90° t.n. from Makari, camping at 100 km along this line.

13th September—Continued for a further 16 km, where the line ended abruptly at 26° 20′ S, 137° 36′ E on the western edge of a small un-named saltlake. From here we drove due north to regain French Line at Lake Surprise (a dry saltlake), then continued along French Line on a bearing of 84° t.n., reaching Poeppel's Corner after dark at about 2000 hours.

14th September—From Poeppel's Corner we continued along French Line until it ended 19 km further on. We then drove 1·5 km south to the Queensland/South Australian border, then followed the border eastwards. At 26° 00′ S, 138° 15′ E (25 km east of Poeppel's Corner) we saw the first Eyrean Grasswrens of the trip. We continued along the border to 138° 30′ E (50 km east of Poeppel's Corner) where we camped, sighting more grasswrens nearby just before dusk.

15th September—Searching from first light, we found *A. goyderi* common on the nearby sandhills and collected eight birds (B30295-30302) and a nest (B30327). We then resumed our journey eastwards along the border, camping at 26° 00′ S, 138° 40′ E (66 km east of Poeppel's Corner).

16th September—Drove a few kilometres south-west from camp and collected three more specimens of *A. goyderi* (B30303, 30312-3). Late in the afternoon we found three nests, one with two young (not collected) and one with two eggs, the first eggs known of this species.

17th September—After sending a radio-telegram to colleagues in Adelaide with news of the discovery of the eggs of *A. goyderi*, we continued due east, encountering the species in abundance on all sandhills examined. At 26° 00′ S, 138° 45′ E (75 km east of Poeppel's Corner) we came to the last sandhill before the Coolibah flats on the western side of Eyre Creek; although sandhills occurred regularly from here to Eyre Creek itself, this was the last on which we found grasswrens, collecting a further eight specimens there (B30304-30311).

We crossed Eyre Creek 4 km south of the border at the southern end of Terrachi Waterhole, then resumed our journey along the border to camp at 26° 00′ S, 139° 00′ E. Once across Eyre Creek we ceased to look for grasswrens.

18th September—Drove on to Birdsville. From here May and Parker visited an isolated group of *Zygochloa*-clad sandhills on Durrie Station, 93 km east-north-east, from where grasswrens had been reported to May by the station owner. In a two-hour search of these sandhills we found only partly-obliterated tracks that could have been of *A. goyderi*. We then rejoined Head, who had proceeded down the Birdsville Track and was camped at Pandiburra Bore, on Goyder's Lagoon.

SPECIMENS COLLECTED OF *AMYTORNIS GOYDERI*, SEPTEMBER, 1976

Adult and subadult males: six study skins (B30296, 30298, 30302, 30304, 30307, 30311), one mount (B30300), one spirit specimen (B30303).

Adult male phase: one study skin (B30299).

Adult and subadult females: three study skins (B30295, 30301, 30305), one mount (B30306).

Adult female phase: one spirit specimen (B30297).

Immatures: three study skins (B30308-30310), two spirit specimens (B30312, 30313).

Nests: three (B30327-30329).

Eggs: one clutch of two eggs (B30330).

In addition, the contents of 15 stomachs from the above specimens were preserved and analysed (see Table 2 below); a further three stomachs in spirit specimens have not been opened, and stomach contents of one specimen were not retained. The two mounted specimens were prepared in the field by Winston Head and are at present on exhibition in the South Australian Museum.

The term *subadult* refers here to specimens in adult plumage but with the skull not fully pneumatised and the palate usually yellow instead of the adults' light grey. Possibly these individuals are the young of an autumn breeding season about six months previously. The term *immature* refers here to individuals that appeared to have recently fledged. The terms *male* and *female* are here used to denote only those specimens that have been sexed by examination of the gonads; *male phase* and *female phase* refer to specimens whose gonads could not be found, and which were sexed by plumage characters only.

TABLE 2

Stomach contents of *A. goyderi*

	Number of stomachs in which found (out of fifteen)
Plant remains, chiefly seeds	15
(Seeds of *Zygochloa paradoxa*)	12
(Seeds of *Aristida browniana*)	5
Arachnida: spiders	3
Orthoptera	4
Hemiptera	13
(Pentatomidae: *Cephaloplatus*)	4
(Lygaeidae: *Oxycarenus*)	4*
Neuroptera larvae (ant-lions)—(Myrmeleontidae, Ascalaphidae)	5
Coleoptera: adults	4
larvae	1
Lepidoptera: adults	2
larvae	1
Hymenoptera: ants	11
small wasps	3
Feather fragments	4

* One stomach contained 25-30 heads.

GROSS EXTERNAL MORPHOLOGY

Plumage—(Numbers refer to the colours in Smithe 1975). Adult and subadult males—Ground-colour of crown, hindneck, sides of neck, back and rump cinnamon-brown (between 27 and 37), each feather with a whitish, dark-brown-bordered, shaft-streak, this streaking obsolescent to obsolete on the rump. Feathers of face degenerate, dull white, their borders grading from brownish on the upper cheek to black on the lower cheek; an indistinct black malar bar or moustache formed by the juxtaposition of the black-bordered feathers of the lower cheek and the adjacent line of throat-feathers, the latter being white with a black border on their dorsad edge. Tail and wing-feathers fuscous (near 21), primaries edged light brownish-grey (close to 45) grading to light cinnamon (between 38 and 39) on inner secondaries; upper wing-coverts and inner secondaries with pale shaft-streaks; tail edged cinnamon (39). Underside dully creamy-white, tinged light cinnamon (near 39) on flanks and crissum. Adult and subadult females similar to males but with chestnut patch (near 38) on either side of belly, this patch partly overlying the light cinnamon suffusion on the flanks. Immatures (males) as adult males but plumage much duller, ground colour of dorsum dull brown (between 25 and 34), lacking rufous tones of adults, and streaking indistinct.

The plumage of the adults and subadults is worn, markedly so on the wings and tail. The immatures are in fledgeling plumage, with adult feathers growing through on the throat of one, B30309.

Colours of unfeathered parts (taken five minutes to two hours after death by Parker).

Iris—Immatures: olive. Adults and subadults: mainly olive-brown, olive in one adult male and female and one subadult female.

Legs and feet—Immatures: legs pale violet-grey, toes and claws medium grey. Adults and subadults: legs medium grey usually with violet tinge, toes and claws darker, soles ashen.

Bill—Immatures: upper mandible light grey, lower mandible paler, gape-flange dull yellow. Adults and subadults: u.m. light or pale grey, sometimes paler distally and usually with tip light brown; all or mid or mid-and-distal part of culmen darker grey, brownish grey or blackish; l.m. light or pale grey, usually with tip light brown.

Mouth—Immatures: palate lemon, grading to orange-yellow in pharynx. Subadults: palate light yellow or orange-yellow, grading to purplish-pink

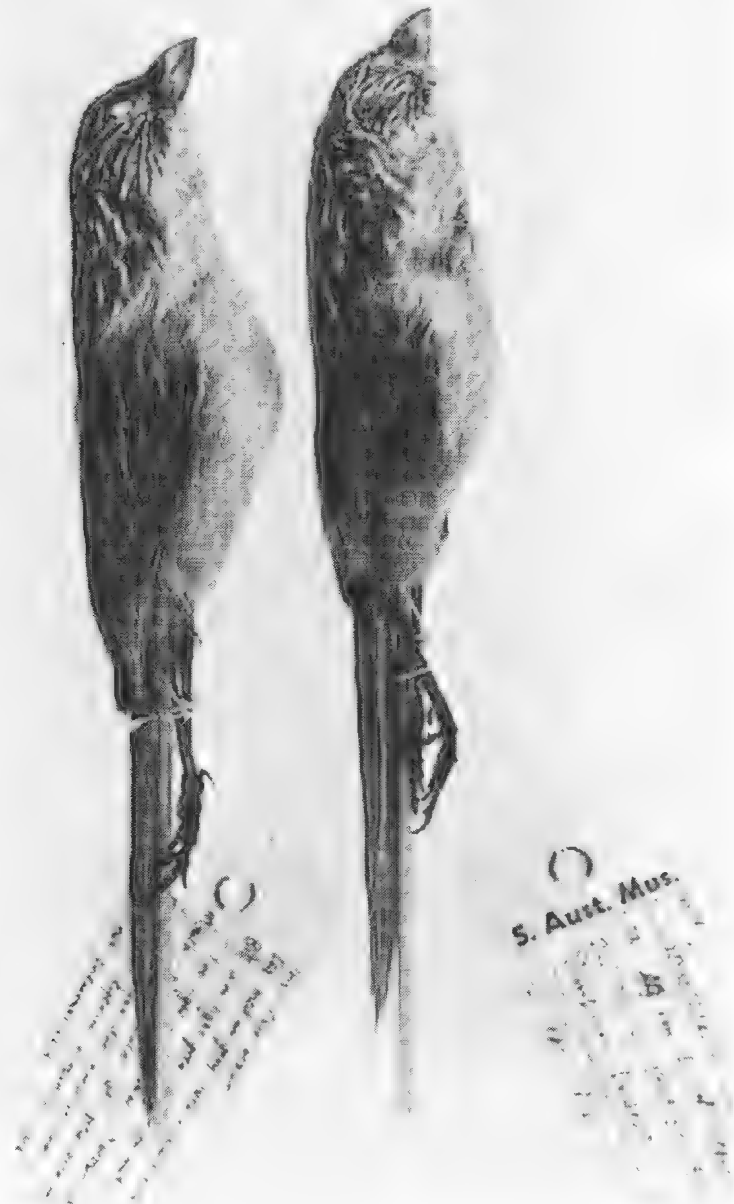

Fig. 2. *Amytornis goyderi* (right side view). Left, adult male; right, adult female.

in pharynx. Adults: palate light grey, grading to purplish-pink in pharynx.

Eyerim—Immatures: brownish grey. Adults and subadults: various intensities of olive-grey, grey-brown, brownish grey or brownish black.

Measurements (see Table 1).

Morgan *et al.* (*op.cit.*) wrote of *A. goyderi* "In body size, the birds appeared about the same size as the Blue-and-White Wren [*Malurus leucopterus*], perhaps a little longer, but more slender in appearance. The fact that it passed so readily through the mist net [four times] would suggest a more slender build than in most wrens. However, its habit of scurrying from one cane-grass clump to another with wings half spread out at the sides and the tail partly fanned makes the bird appear larger than its true size". Our observations and specimens do not bear out these remarks at all. In body size and general proportions (except for its longer tail), *A. goyderi* is about the same size as the Thick-billed Grasswren *A. textilis* and at least twice the bulk of Malurus *leucopterus* (weight of 11 *Malurus leucopterus* 6·5-9·2 gms, weight of four *A. goyderi* 17·5-18·5 gms). Only one bird in the Simpson Desert could be considered "more slender in appearance" than *Malurus leucopterus*, and that is the Rufous-crowned Emu-wren *Stipiturus ruficeps* (weight of one adult male 5·5 gms). We were also puzzled by how so substantial a

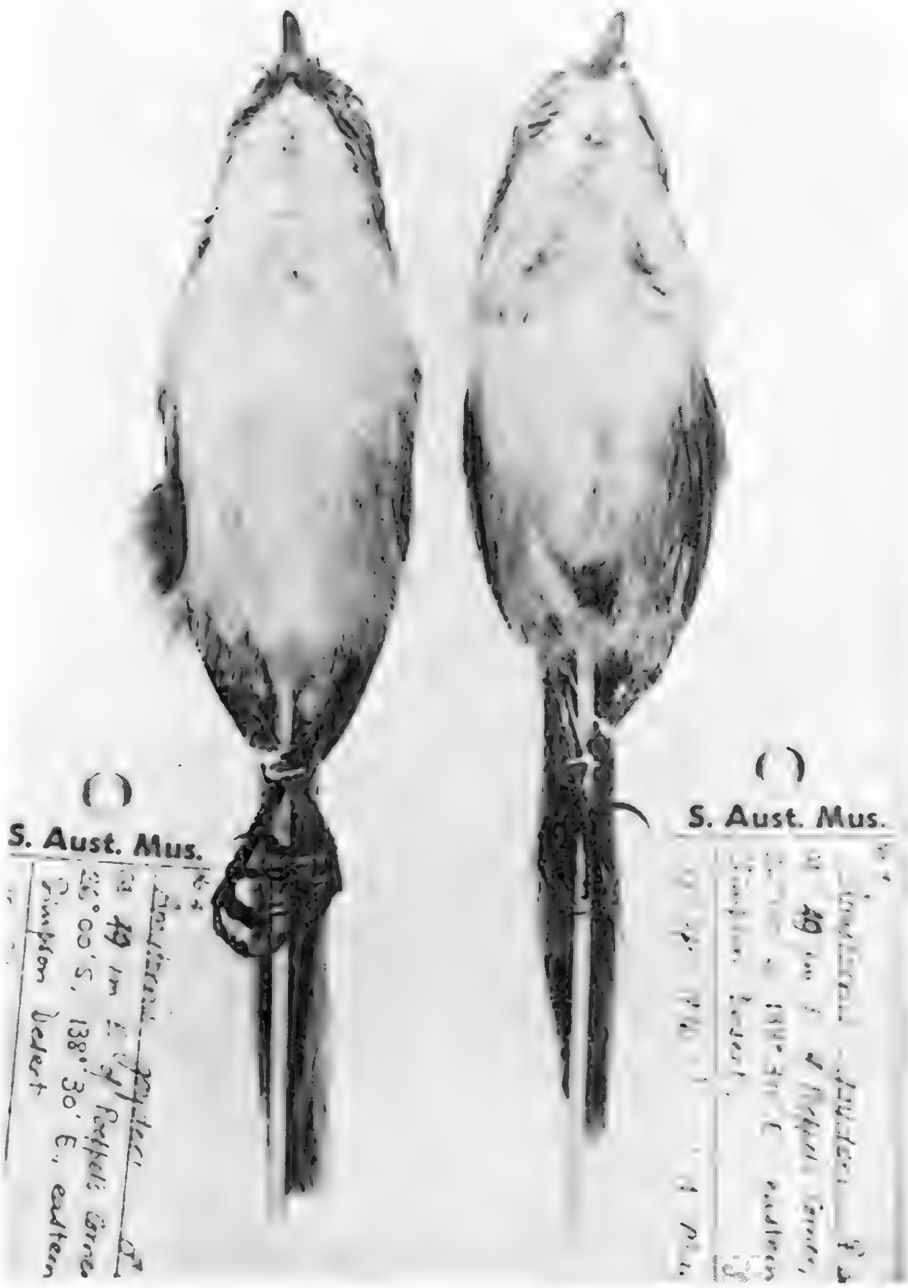

Fig. 3. *Amytornis goyderi* (ventral view). Left, adult male; right, adult female.

bird as *A. goyderi* could have passed with ease through what Morgan *et al.* described as a fine mesh nylon mistnet. However, Mr J. L. McKean (pers. comm.) informs us that the mistnet was lent to the party by him, and that its mesh was 1·5 inches (3·8 cm) across the stretched diagonal, as opposed to 1·25 inches (3·2 cm), the finest standard net now used.

Sexual dimorphism

There appears to be no sexual dimorphism in coloration of the unfeathered parts. In size, males are on average a little larger than females and have deeper bills. The main difference, and one that occurs also in *A. striatus, A. dorotheae, A. textilis* and *A. purnelli,* is the chestnut patch on either side of the belly in the female, absent in the male.

HABITS

Habitat

We encountered *Amytornis goyderi* mainly in and among tussocks of Sandhill Canegrass, *Zygochloa paradoxa,* growing on the crests and sides of large sandhills. It was sometimes also seen in and around clumps of the legume *Swainsona rigida*, which grew in varying abundance among the tussocks of *Zygochloa* on many sandhills. These two plants are of similar size and habit, and superficially resemble each other, particularly in their sere state (which most clumps were in). Throughout the area, the low grass *Aristida browniana* grew abundantly on many of the sandhills, mainly on the mid and lower slopes. Of the larger plants growing on the dunes frequented by *A. goyderi*, the wattles *Acacia dictyophleba* and *Ac. murrayana*, were the most prevalent, occurring mainly on the lower slopes. The grasswrens seemed most numerous among tussocks of *Zygochloa* growing on bare drifting sand at and near the crests of the dunes, though they were frequently found lower down. At no time were they found away from the dunes; of two birds pursued to the bottom of a dune, one doubled back to the top, whereas the other moved about erratically at the edge of the flat.

The vegetation of the swales was not examined closely by us. Most swales carried scattered Gidgea, *Acacia cambagei*, and a corkwood, *Hakea eyreana* (syn. *H. divaricata*, *H. intermedia*). *Triodia basedowii* grew commonly on the flats and the lower slopes of the dunes east to a little beyond Poeppel's Corner, where it petered out.

Locomotion

As with other species of grasswrens, *A. goyderi* is reluctant to show itself. Most birds encountered kept to the cover of the clumps of *Zygochloa paradoxa*, and less often *Swainsona rigida*, growing on the otherwise bare, windswept sand of the crests and upper slopes of large sandhills. They were very difficult to flush; when they did flush, they half flew, half bounded from one tussock to the next with great rapidity. Depending on the degree to which they used their wings during these dashes, they touched the ground with their feet at intervals of 20-240 cm. This method of locomotion left tracks of paired footprints, with one print of each pair invariably a little ahead of the other. These tracks are so distinctive that we used them to ascertain the presence of the species on a dune before seeing the birds themselves. On a few occasions, individuals that had been flushed flew *over* low extensive clumps of *Zygochloa* for more than 10 metres before regaining cover. The species was almost entirely terrestrial, though one bird was seen perching more than a metre off the ground in a small bushy *Grevillea nematophylla* on the lower slope of a dune.

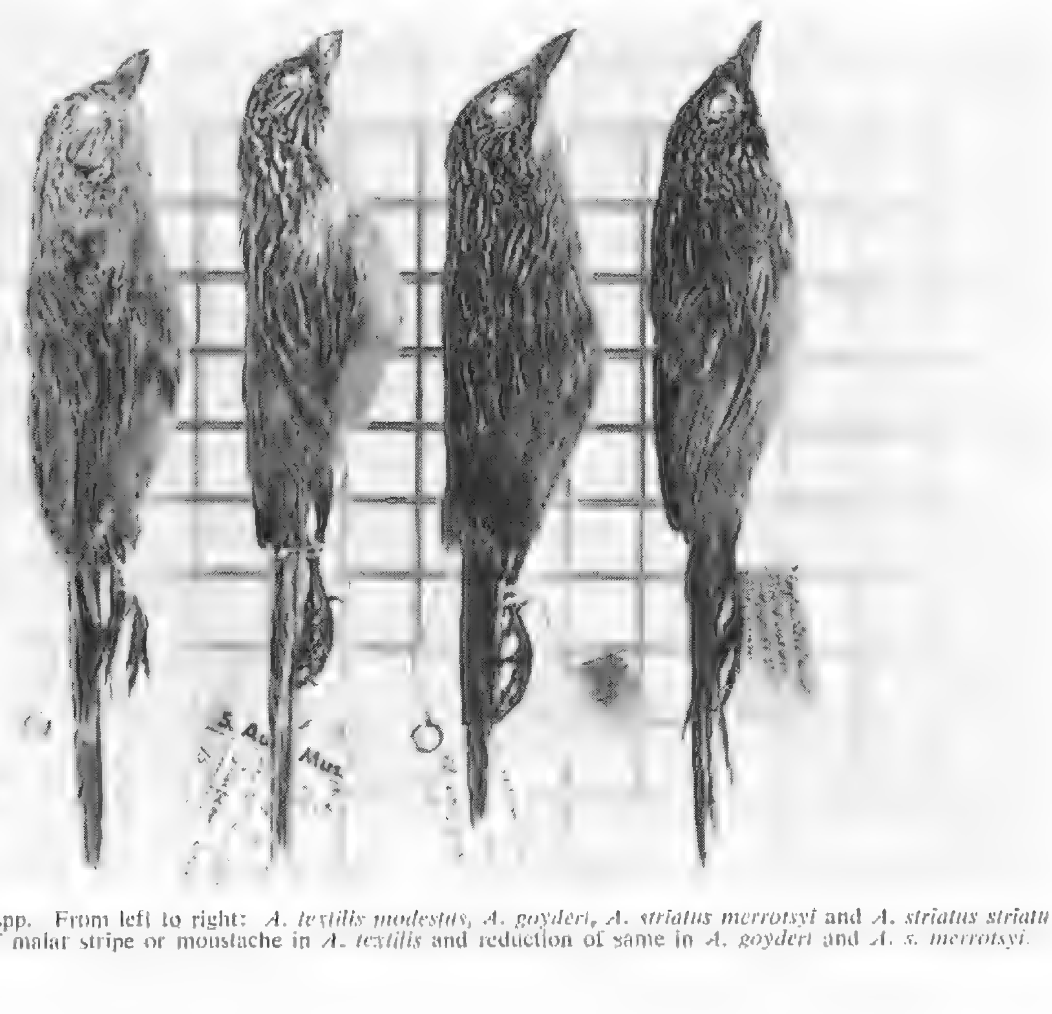

Fig. 4. *Amytornis* spp. From left to right: *A. textilis modestus*, *A. goyderi*, *A. striatus merrotsyi* and *A. striatus striatus*. Note absence of malar stripe or moustache in *A. textilis* and reduction of same in *A. goyderi* and *A. s. merrotsyi*.

Fig. 5. Nest of *Amytornis goyderi* (SAM B30329) from which eggs were taken.

Voice

Song and calls of the adults were difficult to distinguish from each other, usually being uttered jumbled together in loud excited bursts. Among the elements recorded were a high sharp *seep seep* (also a fledgeling alarm call), an upward-inflected buzzing *zzrrt zzrrt*, beautiful silvery cadences, pips, trills and long bursts of piercing staccato. Sometimes a song-phrase would end with a running-together of several notes into a high jangling flourish as in the song of the Dusky Grasswren *A. purnelli*. The almost inaudible whistling call *swi-it swi-it* reported by Morgan *et al.* was not heard by us.

Food

See Table 2.

Nests

B30328, 65 km east of Poeppel's Corner, 16th September, 1976. Found by W. Head in tussock of *Zygochloa paradoxa* on crest of sandhill. Two immatures had just left the nest. Nest a deep truncated cup, the plane of the rim being 45° and the entrance facing eastwards towards the lee-ward side of the dune. Front rim of nest 60 cm from ground. Nest fairly loosely woven, wedged into (not woven around) a cluster of stout stems in the tussock, composed of fine dry greyish strips and stems of grass with many of the fibre-bundles frayed apart, the stems at least too slender to be of *Zygochloa paradoxa* and probably of *Aristida browniana;* a very few long strands of *Zygochloa* rootlets woven in near base of nest. Inner cup of finer pieces of grass than outer, with vegetable down and a few spiders' cocoons woven in. Measurements (mm): entrance (internal) 50 across, 59 from back to front, width of rim *ca* 17, front rim to base 140, hind rim to base 180.

B30329 (Fig. 5), 65 km east of Poeppel's Corner, 16th September, 1976. Found by I. A. May in tussock of *Z. paradoxa* on flat crest of sandhill. Contained two eggs two-thirds incubated (B30330); incubating bird flushed (not collected). Nest a truncated sphere (i.e. with definite hood, unlike truncated cup of B30328), plane of truncation 45°, entrance facing eastwards towards leeward side of dune. Front rim of nest *ca* 50 cm from ground. Nest fairly compact, wedged admist cluster of stems in tussock; of same dry greyish grass as previous (?*Aristida browniana*), with a few rootlets of *Zygochloa* but no cocoons and apparently no vegetable down in lining. Measurements (mm): entrance (internal) 46 across, 46 from back to front, width of rim 20, front rim to base 108, hind rim to base 156.

B30327 (on display). 49 km east of Poeppel's Corner, 15th September, 1976. Found by S. A. Parker, 130 cm from ground in centre of dense head-high tussock of *Zygochloa*; not visible from outside; birds (not collected) heard moving inside tussock. Nest (probably read for eggs) a deep truncated cup, like B30328, of leaf-strips and stems of ?*Aristida browniana*, with a few strands of *Zygochloa* rootlets in outer cup. Entrance facing eastwards towards leeward side of dune.

A fourth nest was found by W. Head in the same area as B30328 and B30329, again in a tussock of *Zygochloa* and with the entrance facing the leeward side of the dune. This nest contained two naked young; neither the young nor the nest was collected.

Eggs

The eggs of *A. goyderi* have not hitherto been described. The clutch of two (B30330) from nest B30329, found by I. A. May, appears to be the first of this species ever to have been collected.

The eggs (Fig. 6) are typical in markings and colouration of those of the *striatus* group*. One is a regular oval, the other almost biconical but with one end slightly more pointed than the other. The oval egg measures 21·40 x 16·10 mm. Its ground colour is a fairly glossy off-white, peppered (save at the more pointed end) with barely visible specks of pale lavender grey. Larger spots and blotches of dull reddish-browns, light purplish-greys and light olive are concentrated in a belt round the broad end, occurring sparingly elsewhere. The second egg measures 21·50 x 15·55 mm. It is similar to the first in ground colour and distribution of peppering. Close to the pole of the broad end is a belt of coalescent blotches of light brownish-grey, light purplish-grey and light olive. Below this belt is a second more dispersed belt of darker spots and blotches of dull reddish-browns, with specks of the same scattered sparingly over the rest of the shell.

* eggs of *A. striatus* examined in S.A.M.; eggs of *A. dorotheae* and *A. woodwardi* examined in National Museum of Victoria and C.S.I.R.O. Division of Wildlife Research (Canberra) respectively.

RELATIONSHIPS OF *A. GOYDERI*

Keast (1958) wrote: "*Amytornis* falls into two species groups, the *striatus* group, which has a rich and somewhat complicated colour pattern, and the *textilis* group, with a simple colour pattern. Behavioural differences between typical species in the two groups include a "sweet, rippling song" in *A. striatus* and the absence of a song in *A. textilis*". In his *striatus* group Keast placed *A. striatus*, *A. dorotheae*, *A. woodwardi* and, tentatively, *A. housei*. In his *textilis* group he placed *A. textilis* (in which he included *A. purnelli*), *A. modestus* (= *A. textilis modestus*) and *A. goyderi*, remarking of the last "*A. goyderi* . . . represents the end-point of a trend (cf. bill length) visible in *modestus* and obviously had a common ancestor with that species."

The relationships within *Amytornis* will be discussed elsewhere (Parker in prep.). Suffice it to say here that we regard *A. goyderi* as a member of the *striatus* group. At first glance it seems to lack the black malar stripe prominent in *A. striatus* (except *A. s. merrotsyi*). A closer examination shows that, as in *A. s. merrotsyi*, the stripe is present but partly obliterated by white streaks (see Figures 2 and 4 and notes under Plumage, above). In its unmarked underparts *A. goyderi* is similar to *A. s. whitei*. The eggs of *A. goyderi* are like those of *A. striatus*, *A. woodwardi* and *A. dorotheae*, and differ from those of *A. textilis* and *A. purnelli* (Fig. 6). The heavy bill of *A. goyderi* is indeed closer in size to that of *A. textilis* than to the bill of any member of the *striatus group*, but this character is a plastic one (compare the bills of the species-pair *A. textilis* and *A. purnelli*). That *A. goyderi* has a musical song has been noted above. Contrary to Keast (*op. cit.*) *A. textilis* and *A. purnelli* also have a song (Parker *in* Frith 1976).

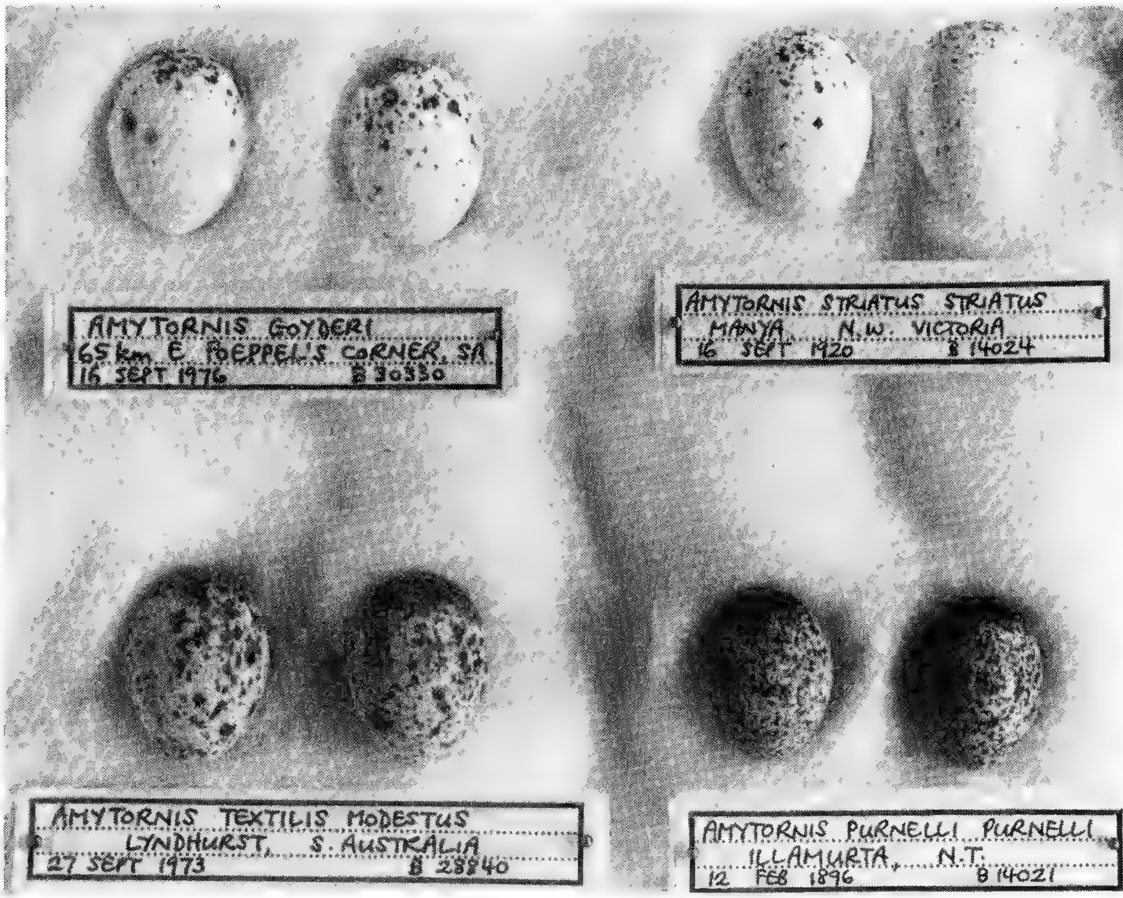

Fig. 6. Eggs of *Amytornis* spp.: *A. goyderi*, *A. striatus*, *A. textilis*, *A. purnelli* (in South Australian Museum).

ACKNOWLEDGEMENTS

We are indebted to Dr J. K. Ling (Director, South Australian Museum) and Messrs R. G. Lyons and A. R. Gobby (Director, and Superintendent, Field Operations, respectively, National Parks and Wildlife Service, South Australia) for quick decisions that allowed us to mount our expedition within seven days of May's return with the first two specimens. For information on the original specimens we thank Mr I. C. J. Galbraith and Mr D. Goodwin (British Museum (Natural History)) and Mr H. J. de S. Disney (Australian Museum). We also thank Dr E. G. Matthews and Mr G. F. Gross for examining the stomach contents, Mr P. K. Latz (Arid Zone Research Institute, Alice Springs) for identifying the plants, Mr R. Ruehle for taking the photographs, Miss D. Rankin for typing the manuscript, Miss J. Thurmer for preparing the map, and Mr J. L. McKean (C.S.I.R.O., Canberra) for allowing us to use his observations.

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ADDENDUM

In April 1977, Dr T. Houston, Curator of Herpetology, South Australian Museum (pers. comm.) saw *A. goyderi* on *Zygochloa*-clad sandhills 6 km west-south-west of Purni Bore at the western end of French Track (see Fig. 1). His report was confirmed by I. A. May and R. Lovell during a further west-east crossing of the Simpson Desert in July and August 1977. In September 1977 May and Parker, accompanied by D. Close and P. Greenslade, visited the Simpson Desert once more, crossing from west to east and dropping south from the centre to Kallakoopah Creek. These subsequent trips revealed that *A. goyderi* was not confined to the eastern part of the Desert, but was actually common throughout the southern half, from the western edge a few km west of Purni Bore to a few km west of Birdsville[1], and south to the Kallakoopah. Assuming the northern half of the Desert to be similar to the southern half, *A. goyderi* may well occupy the whole Desert, some 143 000 sq. km.

The observations in 1977 confirmed that *A. goyderi* occurred mainly in *Zygochloa paradoxa* on sandhills. On one occasion, however, at 8 km east-north-east of Purni Bore, we encountered a party on a flat between two sandhills, in *Triodia basedowii, Acacia ligulata* and the chenopod *Rhagodia spinescens*.

Also of interest here is the occurrence in the Simpson Desert of the Rufous-crowned Emu-wren *Stipiturus ruficeps*. It was first recorded in the Desert by May in August 1976 (May 1977a), and on the trip in September 1977, we found it to be common throughout the southern half, in the same habitat as and usually in association with *A. goyderi*. The emu-wrens, however, were even more secretive than the grasswrens, keeping mainly to the interior of dense tussocks of *Zygochloa* (though a nest was found in a tussock of *Triodia basedowii*), and betraying their presence only by their almost inaudible call, a faint high cadence preceded by a markedly lower note and often ending with a highly compressed zitting burst of song.

[1] Also noted 28·8 km west of Birdsville in November 1976 by J. L. McKean (pers. comm.).

RECORDS OF THE SOUTH AUSTRALIAN MUSEUM

ECHINODERM TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM

By W. ZEIDLER

SOUTH AUSTRALIAN MUSEUM
North Terrace, Adelaide
South Australia 5000

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Summary

The collection of echinoderms in the South Australian Museum contains type material of 64 species including 47 holotypes, the remainder being secondary types. Species are listed alphabetically according to the original name of the genus or species.

ECHINODERM TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM

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W. ZEIDLER*

ABSTRACT

ZEIDLER, W., 1978. Echinoderm type-specimens in the South Australian Museum. *Rec. S. Aust. Mus.* 17 (25): 373-380.

The collection of echinoderms in the South Australian Museum contains type material of 64 species including 47 holotypes, the remainder being secondary types. Species are listed alphabetically according to the original name of the genus or species.

INTRODUCTION

During the years 1890-1912, Sir Joseph Cooke Verco spent much of his time and money dredging for marine life in Southern Australian waters (Verco 1935). Although Verco was mainly interested in molluscs the echinoderm material collected by him was considerable and formed the basis of the collection now held by the South Australian Museum. The holothurians collected by Verco were examined by Joshua and Creed (1915) who described four new species from South Australian waters. H. L. Clark (1928) examined the remainder of Verco's collection of echinoderms and this study resulted in the bulk of the type material held by this museum.

Since Verco's collecting efforts there have only been two other additions of note to the type collection of echinoderms. In 1938 H. L. Clark donated paratypes of nine of the many new species that he described from his extensive collecting expedition to Australia (Clark 1938). More recent additions have come from the extensive BANZARE collections and this museum holds the Echinoidea (Mortensen 1950) and Ophiuroidea (Madsen 1967) types and some of the secondary types of the Crinoidea (John 1939) and Asteroidea (A. M. Clark 1962).

The 64 species are arranged alphabetically according to the original name of the genus or species. Where a name change has occurred the most recent name is given together with the relevant reference.

The following abbreviations are used in the text. BANZARE = British, Australia and New Zealand Antarctic Research Expedition, 1929-1931. BM = British Museum. MCZ = Museum of Comparative Zoology, Harvard University, U.S.A. S.A. = South Australia. SAM = South Australian Museum. Vic. = Victoria. NMV = National Museum of Victoria. W.A. = Western Australia. WAM = Western Australian Museum.

* South Australian Museum, Adelaide, South Australia 5000

7th June, 1978

CLASS CRINOIDEA

Genus **Euantedon** A. H. Clark, 1912

Euantedon paucicirra H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 369-370, fig. 109.

Holotype: K37 (was E399), dried specimen, from St. Vincent Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Genus **Nanometra** A. H. Clark, 1907

Nanometra johnstoni John, 1939.

BANZARE Rep. Ser. B. **4** (6): 193-196.

Paratypes: K1563, two specimens in spirit, from BANZARE station 113 (42° 40′ S, 148° 27′ 30″ E), off Tasmania, depth 122 m, collected 23.iii.1931. (Holotype and other paratypes in BM.)

Note:—These specimens are incorrectly labelled as co-types as a type specimen was clearly selected.

Genus **Teliocrinus** Döderlein, 1912

Teliocrinus monarthrus H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 365-366, fig. 108.

=*Teliocrinus springeri* (A. H. Clarke, 1909); after H. L. Clark, 1946: 20.

Holotype: K1382 (was E391), spirit specimen with no collection or locality data.

CLASS ASTEROIDEA

Genus **Allostichaster** Verrill, 1914

Allostichaster regularis H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 400-401, fig. 115.

Holotype: K169 (was E437), dried specimen, from St. Vincent Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Paratypes: K1383, eleven dried specimens, from St. Vincent and Spencer Gulfs, S.A., collected by J. C. Verco, date of collection unknown.

Genus Asterina Nardo, 1834

Asterina alba H. L. Clark, 1938.

Mem. Mus. comp. Zool. Harv. **55**: 150-152.

Paratypes: K718, two dry specimens, from Neds Beach, Lord Howe Island, collected April, 1932. (Holotype in MCZ).

Asterina crassispina H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 390-391, fig. 112.

Holotype: K101 (was E425), dried specimen, from Northern Australia. No other collection data available.

Asterina lutea H. L. Clark, 1938.

Mem. Mus. comp. Zool. Harv. **55**: 153-155, pl. 12, fig. 2.

Paratype: K716, dried specimen, from under surface of rock near low water mark, Entrance Point, Broome, W.A., collected August-September, 1929. (Holotype in MCZ).

Genus Astropecten Gray, 1840

Astropecten syntomus H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 372-373, fig. 110.

=*Astropecten pectinatus* Sladen, 1883; after Shepherd, 1968: 733.

Holotype: K45 (was E409), dried specimen with no collection or locality data but presumably from S.A.

Genus Cycethra Bell, 1902

Cycethra verrucosa *mawsoni* A. M. Clark, 1962.

BANZARE Rep. Ser. B. **9** (1): 25-27.

Paratypes: K1530, five specimens in spirit, from BANZARE station 30 (66° 48′ S, 71° 24′ E), off MacRobertson Land, depth 540 m, collected 27.xii.1929. K1531, four specimens in spirit, from BANZARE station 39 (66° 10′ S, 49° 41′ E) off Enderby Land, depth 300 m, collected 17.i.1930. K1532, one specimen in spirit, from BANZARE station 41 (65° 48′ S, 53° 16′ E), off Enderby Land, depth 193 m, collected 24.i.1930. K1533, one specimen in spirit, from BANZARE station 42 (65° 50′ S, 54° 23′ E), off Enderby Land, depth 220 m, collected 26.i.1930 (Holotype and other paratypes in BM).

Genus Echinaster Müller and Troschel, 1840

Echinaster glomeratus var. *extremus* H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 396, fig. 114.

Holotype: K156 (was E432), dried specimen with no collection or locality data but presumably from S.A.

Note:—The original label with the specimen, which is in Clark's handwriting, gives the varietal name as *extremis*, but it was eventually published as *extremus*, which is the correct Latin form of this superlative adjectival form.

Echinaster varicolor H. L. Clark, 1938.

Mem. Mus. comp. Zool. Harv. **55**: 184-186, pl. 11, fig. 1.

Paratype: K729, dried specimen, from sandy bottom, S.W. of Broome, W.A., in 5-8 fms., collected June, 1932 (Holotype in MCZ).

Genus Goniodiscaster H. L. Clark, 1909

Goniodiscaster acanthodes H. L. Clark, 1938.

Mem. Mus. comp. Zool. Harv. **55**: 84-87, pl. 5, fig. 2.

Paratype: K726, dried specimen, from firm sandy bottom, S.W. of Broome, W.A., in 7-8 fms., collected June, 1932. (Holotype in MCZ).

Genus Kenrickaster A. M. Clark, 1962

Kenrickaster pedicellaris A. M. Clark, 1962.

BANZARE Rep. Ser. B. **9** (1): 81-82.

Paratypes: K1536, seven specimens in spirit, from BANZARE station 39 (66° 10′ S, 49° 41′ E), off Enderby Land, depth 300 m, collected 17.i.1930. K1537, two specimens in spirit, from BANZARE station 107 (66° 45′ S, 62° 03′ E), off MacRobertson Land, depth 219 m, collected 16.ii.1931. (Holotype and other paratypes in BM).

Genus Lysasterias Fisher, 1908

Lysasterias digitata A. M. Clark, 1962.

BANZARE Rep. Ser. B. **9** (1): 91-92.

Paratypes: K1534, four specimens in spirit, from BANZARE station 40 (66° 12′ S, 49° 37′ E), off Enderby Land, depth 300 m, collected 17.i.1930. K1535, seven specimens in spirit, from BANZARE station 105 (67° 46′ S, 67° 03′ E), near Murray Monolith, MacRobertson Land, depth 163 m, collected 13.ii.1931. (Holotype and other paratypes in BM).

Genus Nectria Gray, 1840

Nectria multispina H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 375-378, fig. 111.

Holotype: K50 (was E413), dried specimen with no collection or locality data but presumably from St. Vincent or Spencer Gulf, S.A.

Paratypes: K52, two dried specimens with no locality data but presumably from St. Vincent or Spencer Gulf, S.A., collected by J. C. Verco, February, 1891.

Nectria saoria Shepherd, 1967.

Rec. S. Aust. Mus. **15** (3): 475-478, fig. 2.

Holotype: K670, dried specimen, from Wright Island, Encounter Bay, S.A., on granite, on exposed side, living on encrusting sponge and ascidians, depth 30-40ft., collected by S. A. Shepherd, 8.vi.1963.

Paratypes: K627, three dried specimens, from West Island, Encounter Bay, S.A., depth 30ft., collected by S. A. Shepherd, 23.viii.1964. K628, four dried specimens from submerged limestone reef between Wright Island and The Bluff, Encounter Bay, S.A., depth 30ft., collected by S. A. Shepherd, 8.vi.1963. K656, one dried specimen with same collection data as K628. K658, one dried specimen, from limestone reef between Thistle and Hopkins Island, Spencer Gulf, S.A., depth 30ft., collected by S. A. Shepherd, January, 1964.

Nectria wilsoni Shepherd and Hodgkin, 1965.

J. Roy. Soc. W.A. **48** (4): 119-121, fig. 1g.

Paratype: K613, dried specimen, from Hall Bank near Fremantle, W.A., on dead coral, collected by B. R. Wilson, 1.ii.1963. (Holotype and other paratypes in WAM).

Genus Nepanthia Gray, 1840

Nepanthia grandis H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 393-395, fig. 113.

=*Paranepanthia grandis* (H. L. Clark, 1928), after H. L. Clark, 1938: 159.

Holotype: K152 (was E430), dried specimen, from S.A. coast, collected by J. C. Verco, date of collection unknown.

Paratypes: K151, one dried specimen, from Spencer Gulf, S.A., collected by J. C. Verco, date of collection unknown. K153, three dried specimens, including a six and a four rayed individual, from Spencer Gulf, S.A., collected by J. C. Verco, date of collection unknown. K557, one dried juvenile with no collection or locality data but presumably from S.A.

Nepanthia variabilis H. L. Clark, 1938.

Mem. Mus. comp. Zool. Harv. **55**: 176-179, pl. 10, fig. 4.

Paratype: K725, dried specimen, from Broome, W.A., collected August, 1929. (Holotype in MCZ).

Genus Paranepanthia Fisher, 1917

Paranepanthea rosea H. L. Clark, 1938.

Mem. Mus. comp. Zool. Harv. **55**: 161-162.

Paratypes: K713, two dried specimens, from the cove on the N.E. corner of Rottnest Island, W.A., collected 19.x.1929. (Holotype in MCZ).

Genus Psalidaster Sladen, 1885

Psalidaster mordax *rigidus* A. M. Clark, 1962.

BANZARE Rep. Ser. B. **9** (1): 79-80.

Paratype: K1529, spirit specimen, from BANZARE station 105 (64° 46′ S, 67° 03′ E), near Murray Monolith, MacRobertson Land, depth 163 m, collected 13.ii.1931. (Holotype in BM).

Genus Smilasterias Sladen, 1889

Smilasterias irregularis H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 402-403, fig. 116.

Holotype: K171 (was E438), dried specimen, from St. Vincent or Spencer Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Genus Uniophora Gray, 1840

Uniophora gymnonota H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 405-7, fig. 118.

Holotype: K179 (was E440), dried specimen, dredged between Backstairs Passage and The Pages, S.A., depth about 25 fms., collected Field Naturalists Excursion, April, 1888.

Paratypes: K178, dried, non-typical specimen, with no collection or locality data. K180, dried specimen with no collection or locality data. K1384, dried specimen, from St Vincent or Spencer Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Note:—Shepherd (1967a) considers this species as conspecific with *U. nuda* (Perrier, 1875) but Shepherd's revision of the genus still remains to be generally accepted.

Uniophora multispina H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 407-409, fig. 119.

Holotype: K184 (was E441), dried specimen, from Henley Beach, S.A., collected by C. B Adcock, November, 1890.

Paratypes: K185, two dried specimens with same locality and collection data as holotype.

Note:—Shepherd (1967a) considers this species as conspecific with *U. granifera* (Lamarck, 1816).

Uniophora obesa H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 409-411, fig. 120.

Holotype: K190 (was E442), dried specimen, from Rocky Point, Eastern Cove, North Coast, Kangaroo Island, S.A., collected 2.x.1901. (Paratype in MCZ).

Note:—As for *U. multispina.*

Uniophora uniserialis H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 413-416, fig. 122.

Holotype: K193 (was E444), dried specimen, from St. Vincent Gulf, S.A. No other collection data available.

Paratype: K1385, dried juvenile specimen, from St. Vincent or Spencer Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Note:—As for *U. multispina.*

CLASS OPHIUROIDEA

Genus Amphiura Forbes, 1843

Amphiura phrixa H. L. Clark, 1938.

Mem. Mus. comp. Zool. Harv. **55**: 232-233.

Paratypes: K745, two dried specimens, from Roebuck Bay, Broome, W.A., depth 5-8 fms., collected June, 1932. (Holotype in MCZ).

Amphiura trisacantha H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 425-426, fig. 125.

Holotype: K212 (was E455), dried specimen consisting of disc and only one broken arm still attached, no collection or locality data but presumed to be from either Spencer or St. Vincent Gulf, S.A.

Genus Anophiura H. L. Clark, 1939

Anophiura banzarei Madsen, 1967

BANZARE Rep. Ser. B. **9** (3): 135-136, fig. 4.

Holotype: K1231, dried specimen, from BANZARE station 29 (66° 28′ S, 72° 41′ E), off Princess Elizabeth Land, depth 1 266 m, collected 25.xii.1929.

Genus Asteronyx Mueller & Troschel, 1842

Asteronyx banzarei Madsen, 1967.

BANZARE Rep. Ser. B. **9** (3): 140-141, pl. 1, figs. 1-2; text fig. 6.

Holotype: K1318, dried specimen, from BANZARE station 76 (35° 18′ S, 118° 15′ E), East of Albany, W.A., depth 62 m., collected 21.iii.1930.

Paratypes: K1319, six spirit specimens with same locality and collection data as holotype. (Incorrectly labelled co-types).

Other specimens: K1320, two dried, slightly damaged specimens with same locality and collection data as holotype.

Note:—According to A. N. Baker, National Museum, Wellington, N.Z. (pers. comm.), this species is conspecific with *Ophiuropsis adhaerens* (Studer), 1884.

Genus Astroconus Döderlein, 1911

Astroconus pulcher H. L. Clark, 1939.

Rec. S. Aust. Mus. **6** (3): 207-208, pl. 18.

Holotype: K561, dried specimen, from Cape Dutton, S.A. (in crayfish pot), depth 20 fms., collected by K. Mattson, date of collection unknown.

Genus Ophiacantha Mueller & Troschel, 1842

Ophiacantha brachygnatha H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 420-422, fig.123.

Holotype: K208 (was E453), dried specimen from Spencer or St. Vincent Gulf, S.A., collected by J. C. Verco, date of collection unknown. (Paratype in MCZ).

Genus Ophiactis Lütken, 1856

Ophiactis fuscolineata H. L. Clark, 1938.

Mem. Mus. comp. Zool. Harv. **55**: 266-267.

Paratypes: K744, two dried specimens, from Broome, W.A., depth 5-8 fms., collected June, 1932. (Holotype in MCZ).

Ophiactis tricolor H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 427-429, fig. 126.

Holotype: K213 (was E458), dried specimen with only four arms, no collection or locality data but presumably from S.A.

Paratype: K214, dried specimen with only three arms, no collection or locality data but presumably from S.A. (Other paratypes in MCZ).

Genus Ophiocoma Agassiz, 1836

Ophiocoma canaliculata var. *pulchra* H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 439-440, fig. 131.

=*Ophiocoma pulchra* (H. L. Clark, 1928); after H. L. Clark, 1938: 333.

Holotype: K241 (was E470), dried specimen with no collection or locality data.

Paratypes: K1387, three specimens in spirit, from St. Vincent Gulf, S.A., collected by J. C. Verco, date of collection unknown. (Other paratypes in MCZ).

Ophiocoma occidentalis H. L. Clark, 1938.

Mem. Mus. comp. Zool. Harv. **55**: 334-337.

Paratype: K699, dried specimen, from Point Peron, W.A., collected October, 1929. (Holotype in MCZ).

Genus Ophiocomina Koehler, 1920

Ophiocomina australis H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 422-425, fig. 124.

Holotype: K211 (was E454), spirit specimen with no collection or locality data but presumably from S.A.

Paratypes: K209, five spirit specimens, from between Trowbridge Lighthouse and Backstairs Passage, S.A., collected by J. C. Verco, date of collection unknown. K210, three spirit specimens, from Port Vincent, S.A., collected by J. C. Verco, date of collection unknown. K1386, three spirit specimens, from near Trowbridge Island, S.A., collected by J. C. Verco, date of collection unknown. (Other paratypes in MCZ).

Genus Ophiocrossota H. L. Clark, 1928

Ophiocrossota heteracantha H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 451-453, fig. 136.

=*Ophiocrossota multispina* (Ljungman, 1867); after H. L. Clark, 1946: 267.

Holotype: K258 (was E484), dried specimen, from Spencer or St. Vincent Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Paratypes: K1387, thirty-eight spirit specimens with same locality and collection data as holotype. (Other paratypes in MCZ).

Genus Ophiocten Lütken, 1855

Ophiocten banzarei Madsen, 1967.

BANZARE Rep, Ser. B. **9** (3): 139, pl. I, figs. 3-4; text fig. 5.

Holotype: K1302, dried specimen, from BANZARE station 39 (66° 10′ S, 49° 41′ E), off Enderby Land, depth 300 m., collected 17.i.1930.

Other specimens: K1301, two dried specimens with same locality and collection data as holotype. K1303, seven dried specimens, from BANZARE station 41 (65° 48′ S, 53° 16′ E), off Enderby Land, depth 193 m., collected 25.i.1930. K1304, three small specimens in spirit, from BANZARE station 42 (65° 50′ S, 54° 23′ E), off Enderby Land, depth 220 m., collected 26.i.1930.

Note:—No paratypes designated.

Genus Ophiomusium Lyman, 1869

Ophiomusium anisacanthum H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 446-447, fig. 133.

Holotype: K254 (was E480), dried specimen consisting of disc and broken arms, from St. Vincent or Spencer Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Paratypes: K1388, two dried specimens with same locality and collection data as holotype. (Other paratypes in MCZ).

Ophiomusium aporum H. L. Clark, 1928.

Rec. S. Aus. Mus. **3** (4): 447-449, fig. 134.

Holotype: K255 (was E481), dried specimen, from St. Vincent or Spencer Gulf, S.A., collected by J. C. Verco, date of collection unknown. (Paratype in MCZ).

Ophiomusium simplex var. *australe* H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 449, fig. 135.

Holotype: K256 (was E482), dried specimen, from St. Vincent or Spencer Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Genus Ophiothrix Mueller & Troschel, 1840

Ophiothrix albostriata H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 429-430, fig. 127.

=*Ophiothrix* (*Placophiothrix*) *albostriata* H. L. Clark, 1928; after A. M. Clark, 1967: 648.

Holotype: K215 (was E459), dried specimen, from Great Australian Bight, presumably collected by J. C. Verco, date of collection unknown.

Ophiothrix hymenacantha H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 431-432, fig. 128.

=*Ophiothrix* (*Keystonea*) *hymenacantha* H. L. Clark, 1928; after A. M. Clark, 1967: 648.

Holotype: K217 (was E462), dried specimen, from Great Australian Bight, presumably collected by J. C. Verco, date of collection unknown.

Ophiothrix lineocaerulea H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 432-433, fig. 129.

=*Ophiothrix* (*Placophiothrix*) *lineocaerulea* H. L. Clark, 1928; after A. M. Clark, 1967: 648.

Holotype: K218 (was E463), dried specimen, from St. Vincent or Spencer Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Note:—The cited locality of the holotype is probably incorrect as no other specimens of this species have been found in Southern Australia and yet it is a common species in the Broome region, W.A.

Genus Ophiurodon Matsumoto, 1915

Ophiurodon opacum H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 440-442, fig. 132.

Holotype: K243 (was E471), dried specimen with broken arms, from St. Vincent or Spencer Gulf, S.A., collected by J. C. Verco, date of collection unknown. (Paratype in MCZ).

Genus Ophiurolepis Matsumoto, 1915, emend. Koehler, 1922

Ophiurolepis banzarei Madsen, 1967.

BANZARE Rep. Ser. B. **9** (3): 134, pl. 1, figs. 7-8; text fig. 3.

Holotype: K1207, spirit specimen, from BANZARE station 41 (65° 48′ S, 53° 16′ E), off Enderby Land, depth 193 m., collected 24-25.i.1930.

Other specimens: K1206, four spirit specimens, from BANZARE station 39 (66° 10′ S, 49° 41′ E), off Enderby Land, depth 300 m., collected 17.i.1930. K1208, 44 spirit specimens with same locality and collection data as holotype. K1209, one dried specimen with same locality and collection data as holotype. K1210, nine spirit specimens, from BANZARE station 42 (65° 50′ S, 54° 23′ E), off Enderby Land, depth 220 m., collected 26.i.1930. K1211, two dried specimens, from BANZARE station 107 (66° 45′ S, 62° 03′ E), off MacRobertson Land, depth 219 m., collected 16.ii.1931. K1212, twelve spirit specimens with same locality and collection data as K1211.

Note:—No paratypes designated.

CLASS ECHINOIDEA

Genus Ammotrophus H. L. Clark, 1928

Ammotrophus cyclius H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 471-474, fig. 140.

Holotype: K401 (was E644), dried specimen, from Spencer or St. Vincent Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Paratypes: K397, twenty-eight dried specimens, dredged at Encounter Bay, S.A., collector and date of collection unknown. K398, eleven dried specimens, from Encounter Bay, S.A., collected by H. Pulleine, date of collection unknown. K399, one dried specimen with no collection or locality data. K504, two dried specimens with no collection or locality data. K1391, twenty dried specimens, from Spencer or St. Vincent Gulf, S.A., collected by J. C. Verco, date of collection unknown. (Other paratypes in MCZ).

Ammotrophus platyterus H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 474-475, fig. 141.

Holotype: K477 (was E645), dried specimen, dredged in deep water in St. Vincent Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Genus Amphipneustes Koehler, 1900

Amphipneustes bifidus Mortensen, 1950.

BANZARE Rep. Ser. B. **4** (10): 304-305 pl. 7, figs. 1-3; pl. 9, figs. 7-9.

Holotype: K857, dried specimen, from BANZARE station 107 (66° 45′ S, 62° 03′ E), off MacRobertson Land, depth 219 m., collected 16.ii.1931.

Paratypes: K855, one juvenile specimen in spirit, from BANZARE station 41 (65° 48′ S, 53° 16′ E), off Enderby Land, depth 193 m., collected 24.i.1930. K856, two specimens in spirit, (one broken), from BANZARE station 42 (65° 50′ S, 54° 23′ E), off Enderby Land, depth 220 m., collected 26.i.1930. K859, one spirit specimen with same locality and collection data as holotype.

Other specimens:—K858, seven juvenile specimens in spirit with same locality and collection data as holotype.

Genus Ctenocidaris Mortensen, 1910

Ctenocidaris polyplax Mortensen, 1950.

BANZARE Rep. Ser. B. **4** (10): 296-297, pl. 8, figs. 1, 2, 8; pl. 9, fig. 4.

Holotype: K815, dried specimen, from BANZARE station 41 (65° 48′ S, 53° 16′ E), off Enderby Land, depth 200 m., collected 24.i.1930.

Genus Eucidaris Pomel, 1883

Eucidaris australiae Mortensen, 1950.

BANZARE Rep. Ser. B. **4** (10): 291-293, pl. 8, figs. 5-7; pl. 9, figs. 3, 5, 6; text figs. 1-4.

Holotype: K801, dried specimen, from BANZARE station 76 (35° 18′ S, 118° 15′ E), East of Albany, W.A., depth 69 m., collected 21.iii.1930.

Genus **Fibularia** Lamarck, 1816

Fibularia plateia H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 477-478, fig. 142.

Holotype: K448 (was E650), dried bare test, from Wallaroo Bay, S.A., depth 15 fms., collected by J. C. Verco, date of collection unknown.

Note:—Most of the specimens mentioned by Clark (1928) are present in the Museum's collections but none have been designated paratypes. There are however, 37 paratypes from Backstairs Passage, S.A., in the MCZ.

Genus **Genocidaris** Agassiz, 1869

Genocidaris incerta H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 457-458, fig. 137.

Holotype: K293 (was E623), dried, bare test, broken in half, from off Cape Jaffa, S.A., dredged in 300 fms., collected by J. C. Verco, date of collection unknown.

Paratype: K294, dried, bare test with no locality or collection data. (Other paratypes in MCZ.

Note:—Most of the other specimens mentioned by Clark (1928) are present in the Museum's collections but none have been designated paratypes.

Genus **Microcyphus** Agassiz, 1841

Microcyphus pulchellus H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 462-463, fig. 139.

Holotype: K340 (was E628), dried bare test, from Spencer Gulf, S.A., presumably collected by J. C. Verco, date of collection unknown.

Genus **Notocidaris** Mortensen, 1909

Notocidaris remigera Mortensen, 1950.

BANZARE Rep. Ser. B, **4** (10): 298-299, pl. 5, figs. 1-2; pl. 8, figs. 3-4.

Holotype: K826, spirit specimen, from BANZARE station 107 (66° 45′ S, 62° 03′ E), off MacRobertson Land, depth 219 m., collected 16.ii. 1931.

Paratypes: K824, one dried, bare test and a few spines with same locality and collection data as holotype. K825, one dried, bare test and a few spines with same locality and collection data as holotype.

Other material: K821, five isolated dried spines, from BANZARE station 39 (66° 10′ S, 49° 41′ E), off Enderby Land, depth 300 m., collected 17.i.1930. K822, two isolated dried spines, from BANZARE station 40 (66° 12′ S, 49° 37′ E), off Enderby Land, depth 300 m. collected 17.i.1930. K823, one very young dried specimen with same locality and collection data as holotype.

Genus **Phyllacanthus** Brandt, 1835

Phyllacanthus irregularis var. *kimberi* Cotton & Godfrey, 1942.

Rec. S. Aust. Mus. **7** (2): 216-217, pl. 12.

Holotype: K576, dried specimen, from Port Willunga, S.A. collected by W. R. Steadman, date of collection unknown.

Note:—Although a number of other specimens were available no paratypes were designated.

Genus **Temnopleurus** Agassiz, 1841

Temnopleurus australis H. L. Clark, 1928.

Rec. S. Aust. Mus. **3** (4): 458-461, fig. 138.

=*Temnopleurus (Toreumatica) michaelseni* (Döderlein, 1914); after Mortensen 1943: 105.

Holotype: K298 (was E464), dried specimen, from Port Lincoln, S.A., collector and date of collection unknown.

Paratypes: K299, one dried specimen with no locality or collection data. K314, five dried specimens with same locality and collection data as holotype. K315, one dried specimen with no locality or collection data (figured). K1390, six small dried specimens, from between Trowbridge lighthouse and Backstairs Passage, S.A., collected by J. C. Verco, date of collection unknown. (Other paratypes in MCZ).

Note:—Most of the other specimens mentioned by Clark (1928) are present in the Museum's collections but none have been designated paratypes.

CLASS HOLOTHURIOIDEA

Genus **Cucumaria** Blainville, 1830

Cucumaria striata Joshua & Creed, 1915.

Trans. R. Soc. S. Aust. 39: 18, pl. 3, figs. 2a-d.

Holotype: K1371, spirit specimen, from Great Australian Bight, W.A., collected by J. W. Howard, August 1888.

Genus **Phyllophorus** Grube, 1840

Phyllophorus ventripes Joshua & Creed, 1915.

Trans. R. Soc. S. Aust. **39**: 19, pl. 2, fig. 1; pl. 3, fig. 5.

=*Lipotrapeza ventripes* (Joshua & Creed, 1915), after H. L. Clark, 1938: 495.

Holotype: K1374, dried specimen, from S.A. coast, collected by J. C. Verco, date of collection unknown.

Other specimens: K1375, four spirit specimens collected with holotype and with note "in MSS".

Genus Thyone Oken, 1815

Thyone nigra Joshua & Creed, 1915.

Trans, R. Soc. S. Aust. **39**: 20, pl. 3, figs. 3a-e, 4.

Holotype: K1376, spirit specimen and one slide of spicules, collected between 33°-37° S and 132°-140° E, S.A., by J. C. Verco, date of collection unknown.

Thyone vercoi Joshua & Creed, 1915.

Trans, R. Soc. S. Aust. **39**: 19, pl. 2, figs. 2-4; pl. 3, figs. 1a-g; pl. 4.

=*Straurothyone vercoi* (Joshua & Creed, 1915); after H. L. Clark, 1946: 397.

Holotype: K517, one slide of spicules from pharynx, one slide of T.S. pharynx, one slide of skin, one slide of tentacle tissue, dried remains of specimen, collected between 33°-37° S and 132°-140° E, S.A., by J. C. Verco, date of collection unknown.

Genus Trochodota Ludwig, 1891

Trochodota roebucki Joshua, 1914.

Proc. Roy. Soc. Vic. **27**: 9, pl. 1, figs. 4a-c.

Paratypes: K1712, two dry specimens from Torquay Vic., collected by E. C. Joshua, October 1913.

Note:—Obtained on exchange from NMV, 1919. (Old NMV Reg. 60647-8).

Trochodota shepherdi Rowe, 1976.

Trans. R. Soc. S. Aust. **100** (4): 203-206, figs. 1-4.

Paratypes: K1366, two spirit specimens, from Proper Bay, Port Lincoln, among algae growing on *Pinna dolabrata* (=*P. bicolor*), depth 10 m., collected by S. A. Shepherd, 23.viii. 1975.

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RECORDS OF THE SOUTH AUSTRALIAN MUSEUM

MOLLUSC TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM

I. CEPHALOPODA and SCAPHOPODA

By W. ZEIDLER and M. K. MACPHAIL

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Summary

Type-specimens of nine species of Cephalopoda and seventeen species of Scaphopoda in the South Australian Museum are catalogued. All are recent species and except for one scaphopod species from New Zealand, all are from Australian waters.

MOLLUSC TYPE-SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM
1. CEPHALOPODA and SCAPHOPODA

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W. ZEIDLER* and M. K. MACPHAIL*

ABSTRACT

ZEIDLER, W., and MACPHAIL, M. K., 1978. Mollusc type-specimens in the South Australian Museum. 1. Cephalopoda and Scaphopoda. *Rec. S. Aust. Mus.* 17 (26): 381-385.

Type-specimens of nine species of Cephalopoda and seventeen species of Scaphopoda in the South Australian Museum are catalogued. All are recent species and except for one scaphopod species from New Zealand, all are from Australian waters.

INTRODUCTION

This is the first of an intended series of papers listing the mollusc types held by the South Australian Museum.

The species are arranged alphabetically according to the original name of the genus or species. Full synonymies are not given, but where a name change has occurred, the most recent acceptable name is given together with the relevant reference.

CLASS CEPHALOPODA

Cephalopod types in the South Australian Museum comprise "cuttles" (family Sepiidae) and one octopus. The Sepiidae are known only from the gladius and even now, *Sepia braggi* Verco, 1907 is the only species for which a whole animal is available, collected in 1969.

Nearly all the types were described by Bernard C. Cotton, the second curator of Molluscs at the South Australian Museum. Cephalopods were Cotton's first interest and the subject of his first paper (Verco & Cotton 1928). The bulk of the types came from Western Australia and are described in Cotton (1929). Little research has been done on the group in South Australia since.

In their revision of the Sepiidae, Adam & Rees (1966) discuss the synonomy of a number of species for which the South Australian Museum holds the types. However since the requisite type or number of specimens was then not always available, the taxonomic status of several South Australian species could not be resolved. It is probable that the sub-genera *Decorisepia* and *Solitosepia* (given full generic status by Iredale 1926) are no longer valid, but until further material, particularly of the whole animal, is available, additional comment cannot be made.

In all cases, the *Holotype* was clearly selected but *Paratypes* were rarely designated, even when other good material was available.

Family Sepiidae

Genus Crumenasepia Iredale, 1926

Crumenasepia ursulae Cotton, 1929.

J. Proc. R. Soc. W. Aust., **15**: 90-91, pl. 15, figs. 3, 4.

=*Sepia pharaonis* Ehrenberg, 1831; after Adam & Rees, 1966: 22.

Holotype: D10013, gladius with detached spine, from Cottesloe Beach, W.A. collector and date of collection unknown.

Paratypes: D10011, gladius with detached spine, from Cottesloe, W.A., collected by Mrs. U. Glauert, date of collection unknown. D16016 (ex. D10013), two gladiuses, one juvenile, the other with missing spine, both with same locality and collection data as holotype. (Paratype D10012 sent to Western Australian Museum.)

Note:—Paratypes incorrectly labelled co-types as a type specimen was clearly selected.

Genus Decorisepia Iredale, 1926

Decorisepia cottesloensis Cotton, 1929.

J. Proc. R. Soc. W. Aust., **15**: 90, pl. 16, figs. 1, 2.

=*Sepia (Decorisepia) cottesloensis* (Cotton, 1929); after Cotton and Godfrey, 1940: 438.

Holotype: D13681, gladius from Cottesloe, W.A., collector and date of collection unknown.

*South Australian Museum, Adelaide 5000

12th June, 1978

Decorisepia jaenschi Cotton, 1931.

S. Aust. Nat., **12** (3): 41, figs. 5, 6.

—*Sepia jaenschi* (Cotton, 1931); after Adam & Rees, 1966: 55.

Holotype: D10163, gladius broken in half (clean break), from Robe, S.A., collected by B. C. Cotton, date of collection unknown.

Genus Sepia Linnéus, 1758

Sepia braggi Verco, 1907.

Trans. Roy. Soc. S. Aust., **31**: 213, pl. 27, figs. 6a-d.

Holotype: D14130 (ex D311), gladius from Glenelg, S.A., collected by Mr. Bragg, 1907.

Paratypes: D15998 (ex. D311), three gladiuses, one broken, one very worn around the edges, from Torquay, Vic., collected by C. J. Gabriel, date of collection unknown. D16017 (ex D311 and D14130), gladius figured with holotype, with spine missing, from St. Vincent Gulf, S.A., collected by A. Zietz, date of collection unknown.

Note:—Cotton and Godfrey (1940) list the holotype as being held in the Manchester Museum, U.K., but a recent search there failed to locate any records of it. The specimen cited as the holotype here conforms exactly to that described by Verco and the label with it in Verco's handwriting refers to it as the "figured type". This must therefore be the authentic type.

Genus Solitosepia Iredale, 1926

Solitosepia glauerti Cotton, 1929.

J. Proc. R. Soc. W. Aust., **15**: 87, pl. 14, figs. 3, 4.

=*Sepia* (*Solitosepia*) *glauerti* (Cotton, 1929); after Cotton and Godfrey, 1940: 421.

Holotype: D13628, gladius from Rottnest Is., W.A., collector and date of collection unknown.

Solitosepia hendryae Cotton, 1929.

J. Proc. R. Soc. W. Aust., **15**: 87-88, pl. 15, figs. 1, 2.

=*Sepia* (*Solitosepia*) *hendryae* (Cotton, 1929); after Cotton and Godfrey, 1940: 421.

Holotype: D13625, gladius from Rottnest Is., W.A., collector and date of collection unknown.

Solitosepia occidua Cotton, 1929.

J. Proc. R. Soc. W. Aust., **15**: 88, pl. 14, figs. 1, 2.

=*Sepia* (*Solitosepia*) *occidua* (Cotton, 1929); after Cotton and Godfrey, 1940: 420.

Holotype: D13627, gladius from Rottnest Is., W.A., collector and date of collection unknown.

Genus Tenuisepia Cotton, 1932

Tenuisepia mira Cotton, 1932.

Rec. S. Aust. Mus., **4** (4): 546-547, figs. 7-9.

—*Sepia mira* (Cotton, 1932); after Adam & Rees, 1966: 87.

Holotype: D10507, gladius broken in half (clean break), from North-West Islet, Capricorn Group, Qld., collected by W. J. Kimber, date of collection unknown.

Family Octopodidae

Genus Octopus Lamarck, 1798

Octopus flindersi Cotton, 1932.

Rec. S. Aust. Mus., **4** (4): 543-544, fig. 6.

Holotype: D10169, large female (in spirit) from Largs Bay, S.A., collected by L. Davidson, K. Heywood and H. Cobb, date of collection unknown.

CLASS SCAPHOPODA

Most of the scaphopod types in the South Australian Museum were collected around the turn of the century by Sir Joseph C. Verco (Verco 1935), subsequently Honorary Curator of Molluscs at this museum from 1914 to 1933. Only two species, one described by Suter (1907) and the other described by Tate and May (1900) were not collected by Verco but types were acquired by him for the museum collection. Verco (1911a, 1911b) described 7 of the 17 types in the museum's collections. Cotton and Ludbrook (1938) described the remaining Dentaliidae (five species) and Cotton and Godfrey (1940) described the remaining Siphonodentalidae (three species).

The taxonomy of the recent scaphopod molluscs of South Australia have not been revised since Cotton and Godfrey (1940) but the supraspecific classification of the Scaphopoda has received considerable attention (Ludbrook 1960, Emerson 1962 and Palmer 1974). In this paper the classification proposed by Palmer (1974) is adopted. Thus most of the subgenera referred to by Cotton and Godfrey (1940) are now regarded as full genera.

In most cases the holotype was clearly selected but, as with the Cephalopoda, paratypes were rarely designated, even when other good material was available.

Family Dentaliidae

Genus Dentalium Linnéus, 1758

Dentalium francisense Verco, 1911.

Trans. R. Soc. S. Aust., **35**: 207-208, pl. 26, figs. 1, 1a.

=*Paradentalium francisense* (Verco, 1911); after Palmer, 1974: 119.

Holotype: D13724, dry shell dredged in 15-20 fms., Petrel Bay, St. Francis Is., S.A., collected by J. C. Verco, date of collection unknown.

Paratype: D16004 (ex D13724), juvenile dry shell with same locality and collection data as holotype.

Dentalium hemileuron Verco, 1911.

Trans. R. Soc. S. Aust., **35**: 208, pl. 26, fig. 2.

=*Paradentalium hemileuron* (Verco, 1911); after Palmer, 1974: 119.

Holotype: D13727, dry shell dredged in 300 fms., off Cape Jaffa, S.A., collected by J. C. Verco, date of collection unknown.

Dentalium hyperhemileuron Verco, 1911.

Trans. R. Soc. S. Aust., **35**: 217-218, pl. 26, figs. 3, 3a.

=*Episiphon hyperhemileuron* (Verco, 1911) (Laevidentallidae); after Palmer, 1974: 120.

Holotype: D13726, dry shell dredged in 12-14 fms., King George Sound, W.A., collected by J. C. Verco, December, 1910 or January, 1911.

Paratypes: D16000, four dry shells with same locality and collection data as holotype.

Note:—Paratypes incorrectly labelled co-types as a type specimen was clearly selected.

Dentalium octopleuron Verco, 1911.

Trans. R. Soc. S. Aust., **35**: 206.

=*Paradentalium octopleuron* (Verco, 1911); after Palmer, 1974: 119.

Holotype: D13725, dry shell dredged in 15-22 fms., St. Vincent Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Subgenus Episiphon Pilsbry and Sharp, 1897

Dentalium (Episiphon) arenarium Suter, 1907.

Proc. Mal. Soc. Lond., **7** (4): 214-215, pl. 18, fig. 11.

=*Dentalium suteri* Emerson, 1954: after Emerson, 1954: 185.

Paratype: D16001, dry shell dredged in 18 fms., Port Pegasus, Stewart Is., New Zealand, collected by Captain J. Bollons, date of collection unknown.

Note:—Specimen incorrectly labelled co-type as a type specimen was clearly selected.

The specific name *arenarium* was preoccupied when Suter first described this species. Emerson (1954) therefore erected the new name *suteri* to replace the homonym.

Dentalium (Episiphon) bordaensis Cotton and Ludbrook, 1938.

Trans. R. Soc. S. Aust., **62** (2): 220-221, pl. 12, fig. 3.

=*Episiphon bordaensis* (Cotton and Ludbrook, 1938) (Laevidentallidae); after Palmer, 1974: 120.

Holotype: D13340, dry shell dredged in 60 fms., off Cape Borda, Kangaroo Island, S.A., collected by J. C. Verco, date of collection unknown.

Subgenus Eudentalium Cotton and Godfrey, 1933

Dentalium (Eudentalium) beachportensis Cotton and Ludbrook, 1938.

Trans. R. Soc. S. Aust., **62** (2): 220, pl. 12, fig. 2.

=*Entalina beachportensis* (Cotton and Ludbrook, 1938) (Siphonodentallidae): after Ludbrook, 1954: 110.

Holotype: D13339, broken and eroded dry shell dredged in 110 fms., off Beachport, S.A., collected by J. C. Verco, date of collection unknown.

Subgenus Fissidentalium Fischer, 1885

Dentalium (Fissidentalium) jaffaensis Cotton and Ludbrook, 1938.

Trans. R. Soc. S. Aust., **62** (2): 221, pl. 12, fig. 5.

=*Fissidentalium jaffaensis* (Cotton and Ludbrook, 1938); after Palmer, 1974: 119.

Holotype: D13337, dry shell dredged in 90 fms., off Cape Jaffa, S.A., collected by J. C. Verco, date of collection unknown.

Dentalium (Fissidentalium) verconis Cotton and Ludbrook, 1938.

Trans. R. Soc. Aust., **62** (2): 221-222, pl. 12, fig. 1.

=*Fissidentalium verconis* (Cotton and Ludbrook, 1938); after Palmer, 1974: 119.

Holotype: D13341, dry shell dredged in 200 fms., off Beachport, S.A., collected by J. C. Verco, date of collection unknown.

Subgenus Paradentalium Cotton and Godfrey, 1933

Dentalium (Paradentalium) flindersi Cotton and Ludbrook, 1938.

Trans. R. Soc. S. Aust., **62** (2): 210, pl. 12, fig. 4.

=*Paradentalium flindersi* (Cotton and Ludbrook, 1938); after Palmer, 1974: 119.

Holotype: D13338, dry shell dredged in 22 fms., St. Vincent Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Family Siphonodentaliidae

Genus Cadulus Philippi, 1844

Cadulus angustior Verco, 1911.

Trans. R. Soc. S. Aust., **35**: 211-212, pl. 26, figs. 5, 5a, 5b.

=*Gadila angustior* (Verco, 1911) (Cadulidae); after Palmer, 1974: 121.

Holotype: D13728, dry shell dredged in 26 fms., 18 miles South-East of Newland Head, outside Backstairs Passage, S.A., collected by J. C. Verco, date of collection unknown.

Cadulus occiduus Verco, 1911.

Trans. R. Soc. S. Aust., **35**: 218, pl. 26, fig. 7.

=*Gadila occiduus* (Verco, 1911) (Cadulidae) after Palmer, 1974: 121.

Holotype: D13759, dry shell dredged in 15 fms., Geographe Bay, off Bunbury, W.A., collected by J. C. Verco, December, 1910 or January, 1911.

Subgenus Gadila Gray, 1847

Cadulus (Gadila) bordaensis Cotton and Godfrey, 1940.

The Molluscs of South Australia, Part II, Scaphopoda, Cephalopoda, Aplacophora and Crepipoda: 340, fig. 362.

=*Gadila bordaensis* (Cotton and Godfrey, 1940) (Cadulidae); after Palmer, 1974: 121.

Holotype: D13761, dry shell dredged in 55 fms., off Cape Borda, Kangaroo Island, S.A., collected, by J. C. Verco, date of collection unknown.

Cadulus (Gadila) ludbrookae Cotton and Godfrey, 1940.

The Molluscs of South Australia, Part II. Scaphopoda, Cephalopoda, Aplacophora and Crepipoda: 340, fig. 362.

=*Gadila ludbrookae* (Cotton and Godfrey, 1940) (Cadulidae); after Palmer, 1974: 121.

Holotype: D13760, dry shell dredged in 62 fms., North-West of Cape Borda, Kangaroo Island, S.A., collected by J. C. Verco, date of collection unknown.

Cadulus (Gadila) spretus Tate and May, 1900.

Trans. R. Soc. S. Aust., **24** (2): 102.

=*Gadila spretus* (Tate and May, 1900) (Cadulidae); after Palmer, 1974: 121.

Syntypes: D15848 (May No. 1048), twenty-two dry shells dredged in 24 fms., Port Esperance, Tasmania, collected by W. L. May, date of collection unknown. D16002 (ex. D303), five dry shells with no locality or collection data.

Note:—Specimens originally labelled co-types.

Cadulus (Gadila) vincentianus Cotton and Godfrey, 1940.

The Molluscs of South Australia, Part II. Scaphopoda, Cephalopoda, Aplacophora and Crepipoda: 338-339, fig. 360.

=*Gadila vincentianus* (Cotton and Godfrey, 1940) (Cadulidae); after Palmer, 1974: 121.

Holotype: D13730, dry shell from Holdfast Bay, St. Vincent Gulf, S.A., collected by J. C. Verco, date of collection unknown.

Subgenus Polyschides Pilsbry and Sharp, 1898

Cadulus (Polyschides) gibbosus Verco, 1911.

Trans. R. Soc. S. Aust., 35: 213, pl. 26, fig. 6.

=*Polyschides gibbosus* (Verco, 1911) (Cadulidae); after Palmer, 1974: 121.

Holotype: D13729, dry shell dredged in 300 fms., off Cape Jaffa, S.A., collected by J. C. Verco, date of collection unknown.

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RECORDS OF THE
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TREPONEMATOSES (YAWS AND TREPONARID) IN EXHUMED AUSTRALIAN ABORIGINAL BONES

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Summary

Active early treponemal bone lesions heal within a few months to leave little if any change. The active late ones may last for a year or more, and when healed leave changes that last for ever; they are thus more likely to be found in bone populations in which a treponemal infection is present.
Diagnostic criteria are described and illustrated from exhumed Australian Aboriginal bones. The total of such specimens in Australian museums is not great, perhaps a few scattered among thousands of normal specimens.

TREPONEMATOSES (YAWS AND TREPONARID) IN EXHUMED AUSTRALIAN ABORIGINAL BONES

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ABSTRACT

HACKETT, C. J., 1978. Treponematoses (yaws and treponarid) in exhumed Australian Aboriginal bones. *Rec. S. Aust. Mus.* 17 (27): 387-405.

Active early treponemal bone lesions heal within a few months to leave little if any change. The active late ones may last for a year or more, and when healed leave changes that last for ever; they are thus more likely to be found in bone populations in which a treponemal infection is present.

Diagnostic criteria are described and illustrated from exhumed Australian Aboriginal bones. The total of such specimens in Australian museums is not great, perhaps a few scattered among thousands of normal specimens.

INTRODUCTION

Diagnostic criteria of treponemal changes in dry bones have recently been proposed (Hackett 1976) and frequent reference was made to similar changes in Australian Aboriginal bones in Australian museums. Unfortunately few good illustrations of these have been published (Hackett 1936b; McKay 1938). It would, therefore, seem useful to publish some illustrations of characteristic treponemal changes in these bones.

Extensive collections of Australian Aboriginal bones are in the South Australian Museum, Adelaide; the Anatomy Department of the Australian Museum, Sydney, and the Australian Institute of Anatomy, Canberra. The specimens in the Department of Anatomy in Melbourne and in Canberra are complementary in that they were excavated by the late Murray Black from the same site in the north west of Victoria and across the River Murray into New South Wales in 1944-1949.

THE TREPONEMATOSES

These are a group of communicable diseases caused by spiral organisms (treponemes) that cannot be distinguished from each other by any visual means. To avoid the long-standing controversy about their identity or difference they will be assumed to be four different diseases. This decision is based upon the work of Ouchinnikov and Delekorskij (1970) and Turner and Hollander (1957).

Before European settlement only two treponematoses, yaws and treponarid (previously called "endemic syphilis") were in Australia. These diseases are transmitted by non-venereal contact, probably by the fingers, in childhood; they are characterised by changes in the skin and bones (Hackett 1957). Yaws has an initial lesion mostly on the lower part of the leg through which the infection enters the body; in treponarid this is not usually recognised. The early infectious skin lesions of yaws are numerous, while those of treponarid are often scanty; both are transient.

Yaws occurs in the humid warm equatorial belt, and treponarid in the arid warm areas north and south of it. Treponarid is usually found in hunter/gatherer and pastoral nomad people (Rost 1942; Murray *et al.* 1956; Hudson 1958). This zonal distribution is curious. It is possible that treponarid developed from yaws when the then more extensive humid equatorial belt contracted and left the arid zones to the north and south much as they are today. This could have happened about 9 000 years ago at the end of the last Ice Age (Hackett 1967). In West Africa a natural infection of baboons by a treponeme resembling that of yaws has been found in the northern arid zone as well as the adjacent humid zone (Fribourg-Blanc 1972) in which treponarid and yaws respectively occur.

Abundant serological evidence of these two infections has been found in the Northern Territory of Australia (Garner *et al.* 1972).

A third treponemal infection was brought to Australia by Europeans. This was the venereally transmitted disease of adults, syphilis. Early Australian explorers, ill-equipped to diagnose that disease, and shrinking from mentioning its forbidden name, often referred to it as the "loathesome" disease. What they saw, however, was yaws or treponarid and not syphilis (Hackett 1936a).

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Syphilis has initial genital lesions, skin and bone changes, and also causes grave damage to the heart, arteries and brain. Yaws and treponarid in childhood protect against syphilis in adult life. Syphilis was not in Australia before Europeans arrived, and is probably still absent in tribal groups in Central Australia. It can, thus, be accepted that any treponemal changes in Aboriginal bones are due to yaws, if they come from the north, or to treponarid, if they come from the centre or south.

The fourth treponemal disease, pinta, also starts in childhood but it affects the skin only, and is found only in Central and the northern part of South America. It too protects against syphilis so Columbus could not have taken syphilis to America, nor have brought it back to Europe when he returned with his 43 crewmen and 10 Indians in two ships in 1492!

The diagnostic criteria referred to apply equally to yaws, treponarid and syphilis.

DIAGNOSTIC CRITERIA

If the diagnosis of the changes in exhumed bones from the past is to contribute to knowledge, they must be based upon acceptable criteria. Such diagnoses cannot be a matter of weighing up points that are present against others that are absent before coming to a "majority verdict". Some of the changes thus diagnosed might occur in other conditions. So it is not a matter of knowing all and every bone change that can occur in a disease, but of recognising the changes that *can occur in that disease only* (Hackett 1976).

DISEASE IN A PAST POPULATION

The question arises of how many specimens in a bone population should have diagnostic criteria of a particular disease before that disease can said to have been present in that community (Hackett 1976).

When this question was raised with Professor F. J. Fenner, F.R.S., of Canberra, he replied in a letter (February 1973), "The whole exercise of diagnosis, with all the support of modern laboratory services, is an exercise in probability. Palaeopathology is just that much more difficult because there is only one kind of end-result—bone damage—upon which to base judgment. For this reason a single bone lesion on a continent would be suspect and one would have to suspend judgement; whereas a number consistent with known pathology would enable a much better guess to be made".

There is some information about this which is worth briefly considering. In England, and probably elsewhere in Europe, in the first decade of this century before any really effective treatment was available for the treatment of syphilis, it is estimated (McElligott 1960) from serological studies that at least 10 per cent of the adult population was infected with syphilis. A study of about 2 000 untreated early syphilis patients in Oslo between 1891 and 1920 (Gjestland 1955) indicated that about one per cent might be expected to develop bone lesions. Thus about one in a thousand of the previously mentioned adult population might have had bone lesions of syphilis at some time in their lives.

In 1937-1939 in Lira, Uganda, in a population with yaws whose disease pattern had probably been little influenced by modern treatment, a study was made of yaws bone lesions (Hackett 1951). At the local clinic between August 1937 and January 1938, when an estimated 1 350 (Hackett, 1947) new yaws patients attended for treatment, 340 new yaws patients with bone lesions were seen at a study centre about 100 metres from the clinic. Although some of these patients were referred from the clinic to the centre, others came direct; treatment was free to attract patients. The 2·5 per cent of patients with bone lesions that these figures give may have little meaning. Steinbock (1976) estimates from published figures that yaws bone lesions might be found in roughly 1-5 per cent of skeletons from yaws endemic areas.

In 1939 among 100 consecutive Lango males in the Lira jail, after trial by their chiefs for petty offences, 81 were found to have serological evidence of yaws (Hackett 1947). None had any obvious yaws lesions at the time. High prevalences would be expected in such populations in the last century before the effective treatment of yaws and the improvement of the standard of living of this century.

Perhaps about one per cent of Aboriginal skulls in Australian museums may have changes due to treponemal infection, i.e. changes of the *caries sicca* sequence. More precise information on this should be sought, especially in the collections of the Anatomy Department of the Melbourne University and of the Australian Institute of Anatomy, Canberra, which are of the same provenance and do not appear to have been selected against specimens with pathological changes.

Treponemal Changes in Exhumed Bones

It is interesting that all the changes in bones in European medical museums that can be regarded as diagnostic criteria of syphilis (Hackett 1976) are found in Australian Aboriginal bones and in bones from many Pacific Islands. At the same time a very frequent disease in Europeans in Australia and elsewhere until a few decades ago, haematogenous pyogenic osteomyelitis, is absent in Australian Aboriginal museum specimens. It was not seen in living Aboriginals until recently, but it is said now to occur in Aboriginal children in Central Australia (Dr. H. G. Heller, 1977, a personal letter) presumably because bacteria that cause such bone damage have been carried into the Centre.

Sandison (1973 a, b), after a more thorough study of pathological changes in Australian Aboriginal bones, came to similar conclusions about the presence of treponemal changes in them.

Treponemal bone changes may occur in the early stage, during the first five years after infection, and in the late stage, usually after a symptom-free further period of several years. The early lesions in children are transient and not destructive, while the late ones are destructive, and thus leave the bone changed for life. In both stages relapses of active changes are characteristic.

An occasional deformity in Aboriginal bones in Australia and elsewhere, at one time thought to be due to yaws, is boomerang leg (Hackett 1936b). Subsequent studies of yaws bone lesions in Uganda provided no evidence for this (Hackett 1951).

Dr. H. G. Hillier, Alice Springs, recently (1977) called my attention to the similarity of the bowed tibiae and fibulae described and illustrated by Weismann-Netter and Stuhl (1954) as "Toxopachyostéose diaphysaire tibio-péronière" and boomerang leg. The more likely causes for this deformity could be excluded, and it was regarded as at least familial. Other bones were occasionally also changed, i.e., shortened. The bowing in the illustrations involved the middle of the shaft, and the bones were of normal length. In boomerang leg the curvature uniformly involves the whole bone, which is lengthened, and other long bones may be bowed (Hackett 1936b; Hackett 1957, in fig. 20 the length of the legs is exaggerated). More study is needed.

Skulls contain two broad sequences of late treponemal changes, a discrete and a contiguous. The latter may be regarded as the fusion of a number of the former; their inter-relationships are as follows:—

Clustered pits

Confluent clustered pits

Discrete	Contiguous
Focal superficial cavitation	Serpiginous cavitation
Circumvallate cavitation	Nodular cavitation
Radial scars	Caries sicca

The development of the changes in these two sequences are indicated in Figures 1 and 2.

In the *long bones,* in which it is admittedly more difficult to establish diagnostic criteria, a sequence of nodes and expansions with superficial cavitation can be recognised. A similarity with caries sicca in the skull may be seen.

The Illustrations

These cover most of the diagnostic criteria of treponemal infections in skulls and other bones. Injury may perhaps influence the frequent involvement of parts of bones that are not very far below the skin.

For the purpose of this paper the specimens illustrated may be regarded as pre-European, that is from burials 150-200 years ago depending upon the locality from which they came. As late as the early 1930's there were tribal groups in the western part of Central Australia who had had negligible contact with Europeans. They were unclothed, stone-tooled hunter-gatherer nomads much as they probably had been, in many ways including their health and diseases, for tens of thousands of years. In this lies their considerable interest for the health of early man.

CONCLUSION

The active early treponemal bone lesions heal within a few months to leave little if any change. The active late ones may persist for a year or more, and when healed leave changes that last forever; they are thus more likely to be found in bone populations in which a treponemal infection is present.

In any population in which a bone damaging treponemal infection (yaws, treponarid or syphilis) is present caries sicca will be found in skulls, and nodes/expansions with superficial cavitations in other bones.

Exhumed Australian Aboriginal bones with pathological changes are valuable in the study of disease in man in the past. Probably most of such bones that may ever been found are now in museums; hence the need for their conservation.

The total of such specimens in Australian museums is not great, perhaps a few hundred scattered among thousands of normal specimens. Would it not be practical for these specimens to

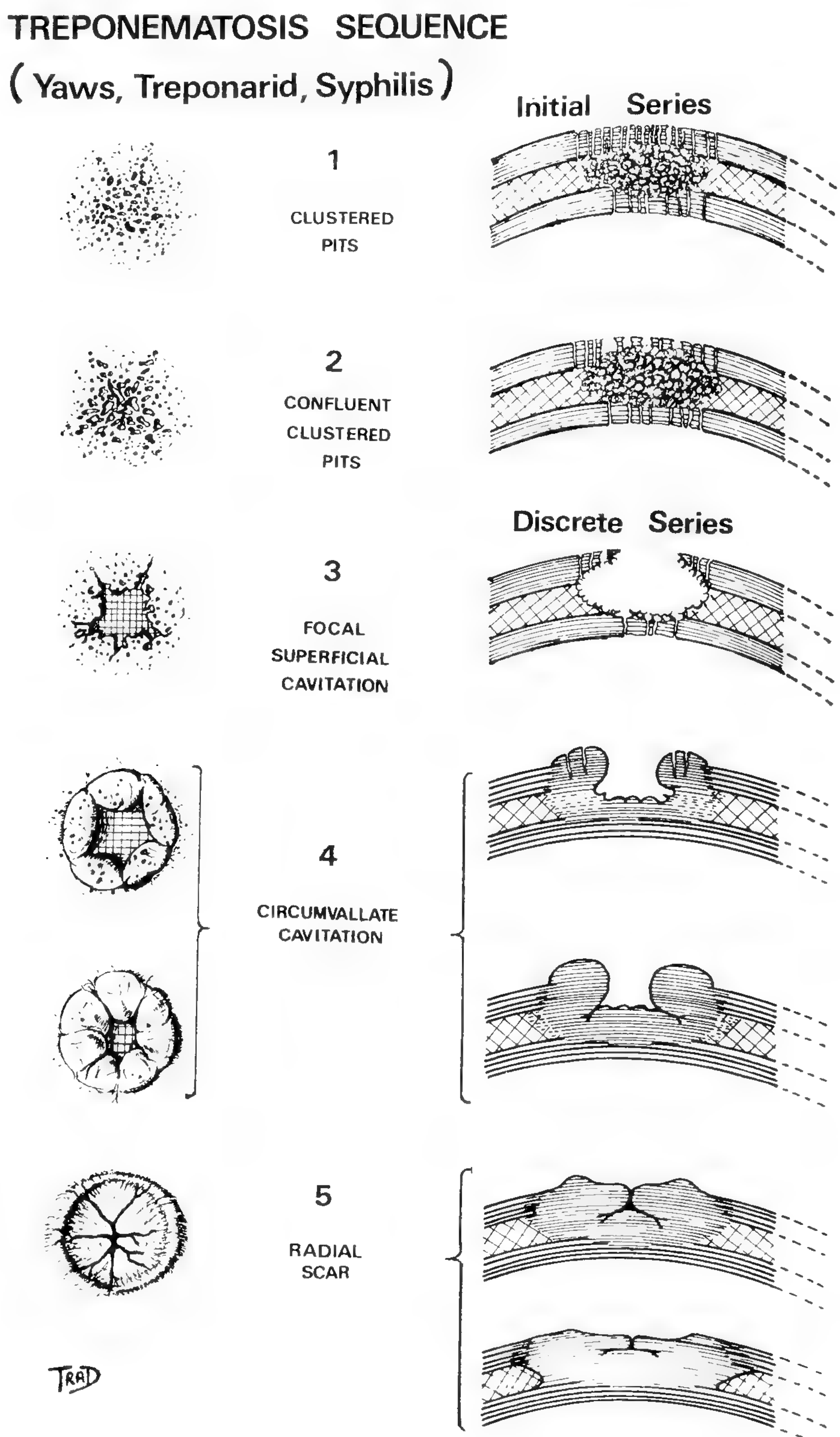

FIG. 1. Treponematosis sequence; caries sicca, initial and discrete series.

be taken out of the general collection and held in a safe place in each museum, or at least to be separately indexed for ready retrieval? If some suitable central institution, such as a Museum of Man, be established, a full series of "type" specimens should be assembled there, supported by a list of all pathological Aboriginal bones in museums and other collections throughout Australia at least.

ACKNOWLEDGEMENTS

I am grateful to Springer-Verlag of Heidelberg for permission to reproduce Figures 1 and 2 in this paper from Hackett (1976). I am also indebted to Professor L. J. Ray for permission to use photographs of two of the specimens in his collection for Figures 6 and 9.

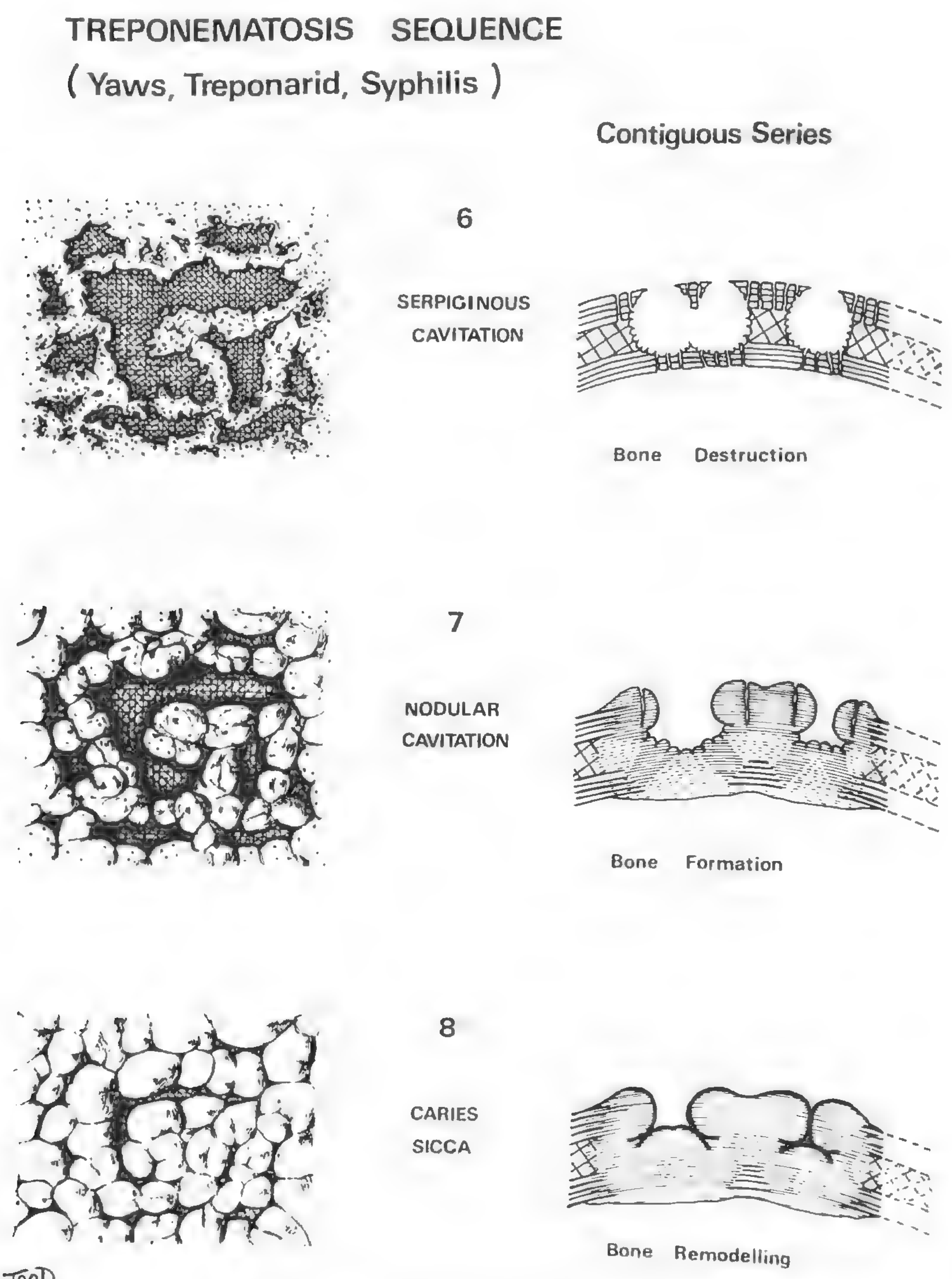

FIG. 2. Treponematosis sequence; caries sicca, contiguous series.

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APPENDIX

Of caries sicca, Virchow (1896, p. 7) wrote:—

"The only reliable and pathognomic lesion of syphilis is the scar which remains after superficial gummatous osteitis. This is not ordinary caries. The smallest scars . . . always show the same characteristics. I want to emphasize that I know of no other disease causing such changes. It is easy to recognise such foci, however small they may be, but it may be difficult to say how they differ from other defects. Most frequently a peculiar jagged, radiate, often star-shaped depression attracts attention. It is deepest in the centre and its borders are relatively smooth, round and not eroded. The diagnosis can be reached only by considering the appearance as a whole. One must note how the changes are grouped round the centre, radiate and join up again, but give the impression of a uniform pattern. This is what is decisive. It is unimportant whether the defect is deep or wide and flat. Its shape can never by caused by true [pyogenic] caries, lupus or leprosy." [Translation.]

FIG. 3. Clustered pits. In each cluster confluence has started. Sutures are not crossed.

FIG. 4. Confluent clustered pits. In two areas the confluence is peripheral. A triangular depression on the left frontal is the scar of previous active disease. Its slightly raised margin, depressed base, and groups of thin radiating lines suggest that it is made up of several radial scars. These active changes are a relapse. The cut on the right frontal shows the slightly thickened outer table.

School of Public Health and Tropical Medicine, University of Sydney. I am indebted to Dr. P. M. Moodie and to the Illustrations Department of the University of Sydney for the photographs from which this figure and Figs. 10A, B were prepared.

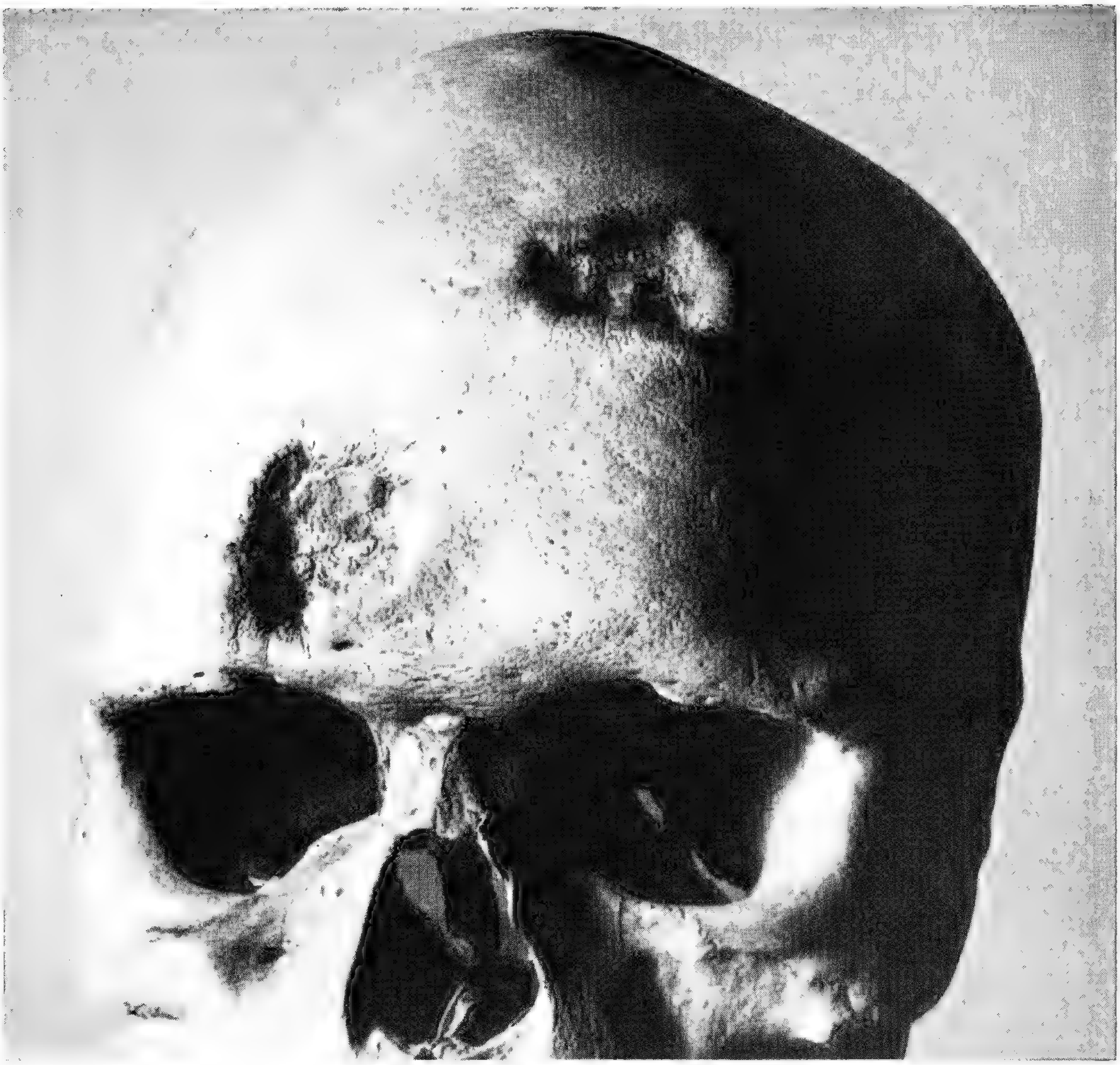

FIG. 5. Focal superficial cavitation. These are usually smaller, but the raised rim and its striated inner surface are characteristic. With further healing the base will flatten and a few thin wavy radiating lines will appear. The changes in this specimen are made up by the confluence of 3-4 smaller ones (see Stewart and Spoehr 1952, Fig. 3). In more extensive confluence the floor may be thin and perforated.

Anatomy Department, University of Melbourne (49 Box 442)

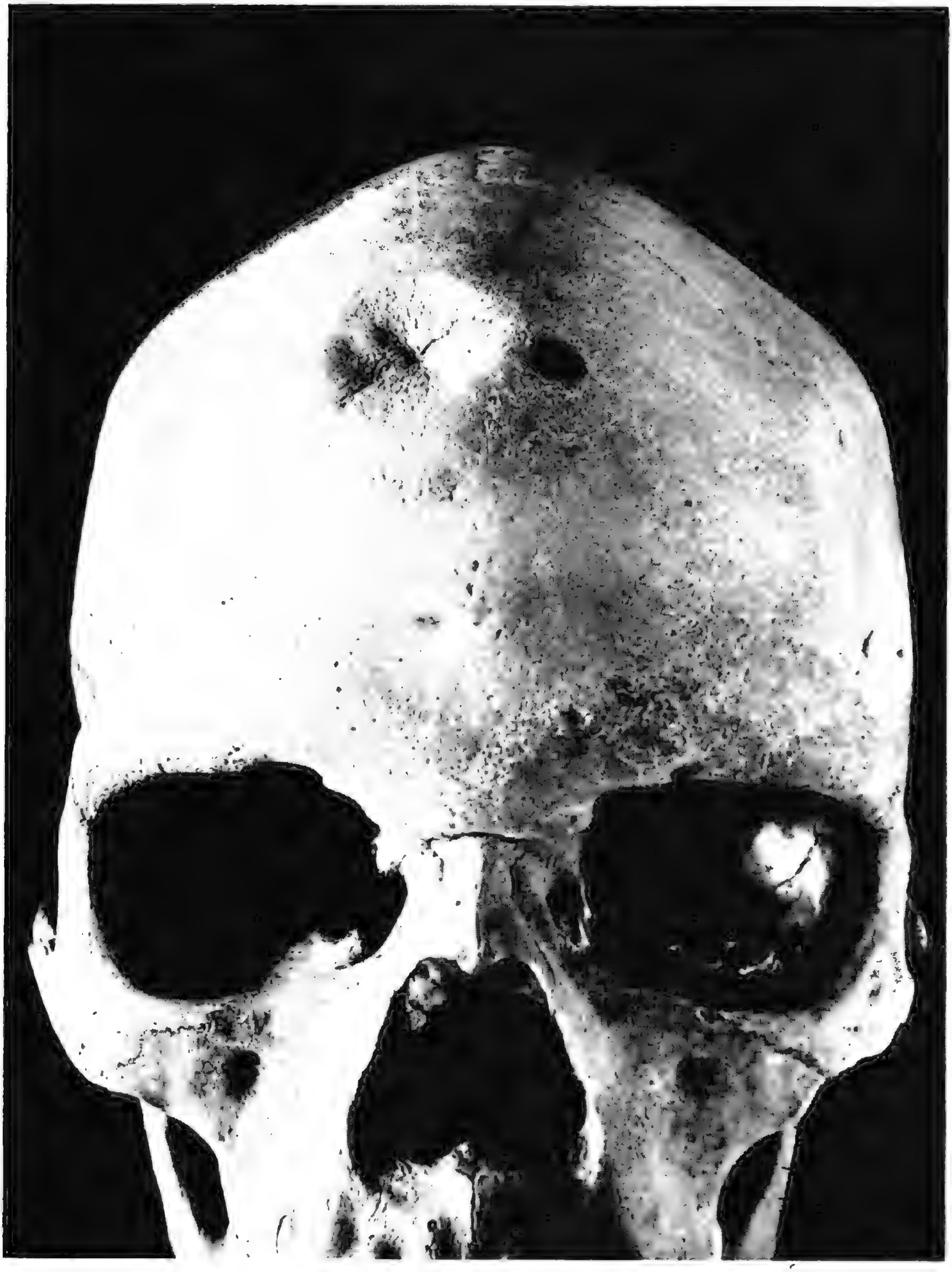

FIG. 6. Radial scars. This is a further stage of healing; later the rim may flatten to the level of the surrounding bone. Thin radiating scars mark its base.

Australian Institute of Anatomy, Canberra (SF 39:57 see No. 9)

FIG. 7. Serpiginous cavitation. Some pitting is seen round the border of the change, especially above the supraorbital ridges where there are also some periosteal bone deposits. This change does not cross the sutures. Other similar changes may be found on the same skull.

South Australian Museum (A11521).

FIG. 8. Contiguous sequence of caries sicca. In the centre are nodules of caries sicca interrupted in a few places by the preceding nodular cavitation. Surrounding this is serpiginous cavitation separated in a few places from the surrounding unchanged bone by pitting. The soundness is, thus, demonstrated of the sequence of caries sicca, arising from nodular cavitation and, with the earliest change, serpiginous clustered pits at the periphery.

South Australian Museum (A25592)

FIG. 9. Caries sicca. This is the healed stage of the contiguous series. The regularity of the nodules at the left posterior quarter of the area is characteristic. The changes started after the frontal suture had fused. The nodules may be large, small, or flat; all are seen in this specimen. It is the regular pattern of nodules and the intervening star-like scars that are important for its recognition (Virchow, 1896; see Appendix). The change stops at the coronal suture. Some radial scars are on the left frontal and parietal bones. The ragged holes in the thinned left parietal result from termite activity during burial.

Anatomy Department, University of Melbourne (SF44:88)

FIG. 10. Naso-palatine destruction. Only a small bar remains of the anterior mandible, and the central part of the palate is missing. The nasal cavity is empty, and its walls are smooth. That this gross damage has healed excludes malignant tumours. This is the gangosa of yaws and treponarid (see Hackett 1951: Fig. 129). The unworn teeth are notable.

School of Public Health and Tropical Medicine, University of Sydney.

FIG. 11. Node with superficial cavitation. The section shows the formation of the node by periosteal deposition of bone and the focal destruction of the cortex.
Australian Institute of Anatomy, Canberra (SF 20:37)

FIG. 12. Expansion and superficial cavitation. Active stage in a young person. Similar small cavities were in a clavicle, scapula and ilium (see Fig. 43; Hackett 1936b).
School of Public Health and Tropical Medicine, University of Sydney.

FIG. 13. Nodes with superficial cavitation. Single as well as multiple cavities. Similar changes are found in ribs, metacarpals and metatarsals.

FIG. 14. Expansions with superficial cavitation. Changes are extensive with much bony thickening, and encroachment upon the lower third of the medulla.
Australian Institute of Anatomy, Canberra (SF 19:27)

FIG. 15. Expansion with superficial cavitation. Healing is occurring; the openings are becoming smoother. Wellcome Museum of Medical Science, London.

FIG. 16. Superficial cavitation in clavicles. Little bony thickening is present. Australian Institute of Anatomy, Canberra (SF19:6 & 9)

FIG. 17. Superficial cavitation in a scapula. There is little deposition. McKay (1938, Fig. 17) illustrates similar changes and labels them osteitis. Similar changes can occur in the ilia. Australian Institute of Anatomy, Canberra (SF 19:19)

RECORDS OF THE SOUTH AUSTRALIAN MUSEUM

A NEW SPECIES OF VIVIPAROUS ASTERINID ASTEROID FROM EYRE PENINSULA, SOUTH AUSTRALIA

By MICHAEL J. KEOUGH and ALAN J. DARTNALL

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Summary

A new species of asterinid sea star, *Patiriella parvivipara*, is described. It is a viviparous, intra-ovarian brooder similar to *Patiriella vivipara* Dartnall, but it reaches maturity at a much smaller size. The new species occupies an extremely restricted, intertidal habitat under granite rocks and has only been recorded from five localities on the west coast of Eyre Peninsula, South Australia.

A NEW SPECIES OF VIVIPAROUS ASTERINID ASTEROID FROM EYRE PENINSULA, SOUTH AUSTRALIA

by

MICHAEL J. KEOUGH* and ALAN J. DARTNALL†

KEOUGH, M. J. and DARNALL, A. J., 1977. A new species of viviparous asterinid asteroid from Eyre Peninsula, South Australia. *Rec. S. Aust. Mus.* **17** (28): 407-416.

ABSTRACT

A new species of asterinid sea star, *Patiriella parvivipara*, is described. It is a viviparous, intra-ovarian brooder similar to *Patiriella vivipara* Dartnall, but it reaches maturity at a much smaller size. The new species occupies an extremely restricted, intertidal habitat under granite rocks and has only been recorded from five localities on the west coast of Eyre Peninsula, South Australia.

INTRODUCTION

The asterinid sea stars are prominent members of the Australian littoral, particularly in south-eastern Australia, where large aggregations of species *Patiriella* are found. This genus was examined by Dartnall (1971) and includes the viviparous species *Patiriella vivipara* Dartnall, 1969, which was the first sea star reported to be an intra-ovarian brooder. A second viviparous species is of obvious interest.

SYSTEMATIC ACCOUNT

ASTEROIDEA

Family ASTERINIDAE Gray, 1840.

Genus *Patiriella* Verrill, 1913.

Patiriella parvivipara new species. Figs. 1-4.

Description of Holotype

A small asterinid sea star with five rays. $R = 3 \cdot 75$ mm, $r = 3 \cdot 62$ mm, $R : r = 1 \cdot 1 : 1$. Body comparatively thin and depressed. At this size it is difficult to give an accurate measurement of body height (vh) because the spinulation causes a relatively greater margin of error than in larger species. The best available value of $vh = 1 \cdot 48$ mm (averaged from dial caliper and micrometer readings).

Plates of the abactinal surface closely imbricated and few secondary plates present. Abactinal plates very flat and not greatly thickened at their free margins. Four rows of papulae on each side of the radial midline of which only the two inner rows reach the end of the ray. Spines of carinal plates in groups of 4-7; spines of abactinal, interradial area grouped 3-5 to a plate. Abactinal spines range from 0·15-0·11 mm in length and are about 0·1 mm broad at the base. Single madreporite is about 0·4 mm in diameter. Superomarginal plates not distinct from abactinal plates. Proximal inferomarginals each carrying four or five spines, the distal only two.

Distal actinal intermediate plates imbricated and broadly trilobed or convex at their exposed edge, with each plate carrying a single spine, occasionally two, about 0·2 mm long. "Floating", rounded, aspinous, actinal plates present behind mouth plates. The holotype has eight adambulacral plates, the first four bearing two furrow spines of which the distal spine of the pair is the longest (c. 0·4 mm). Distal to adambulacral four the remaining plates carry single farrow spines. Subambulacral spines arranged one to a plate and about the same size as the furrow spines, i.e. larger than the actinal spines.

Most of the oral plates carry five spines, two carry six and two, four. The first spine is the largest (0·9 mm long x 0·25 mm wide at the base), the second is about 0·7 mm long and the remaining three (about 0·4 mm long x 0·1 mm wide at the base) are grouped separately from the first two. The additional spine on two of the oral plates is inserted between the second spine and the final triad and is intermediate in size (c. 0·5 mm long). Suboral spines are absent on all oral plates but one where a short spine is present.

Colour in life

Colour is consistently reddish yellow, Munsell colour 7·5 YR 7/8, varying to 7/6 and 8/6.

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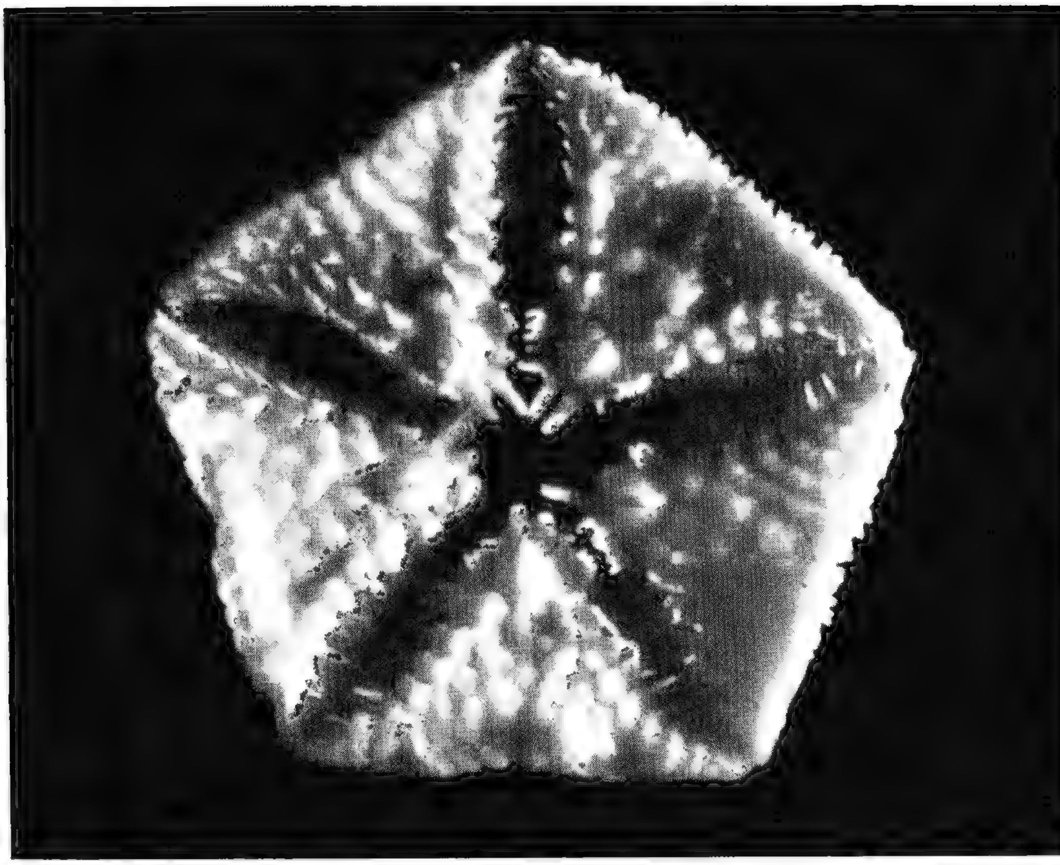
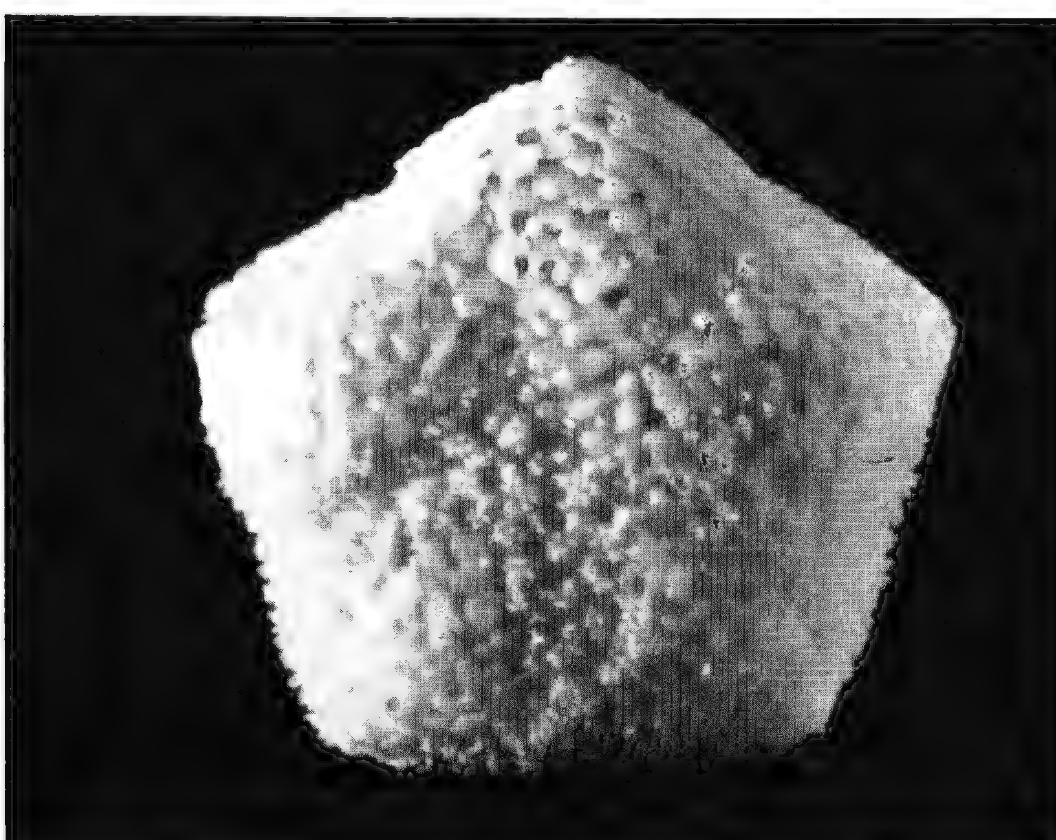


Figure 1. *P. parvivipara.* Holotype SAM K781 (*a*) Actinal surface

mm

Figure 2. *P. parvivipara.* Holotype SAM K781 (*b*) Abactinal surface



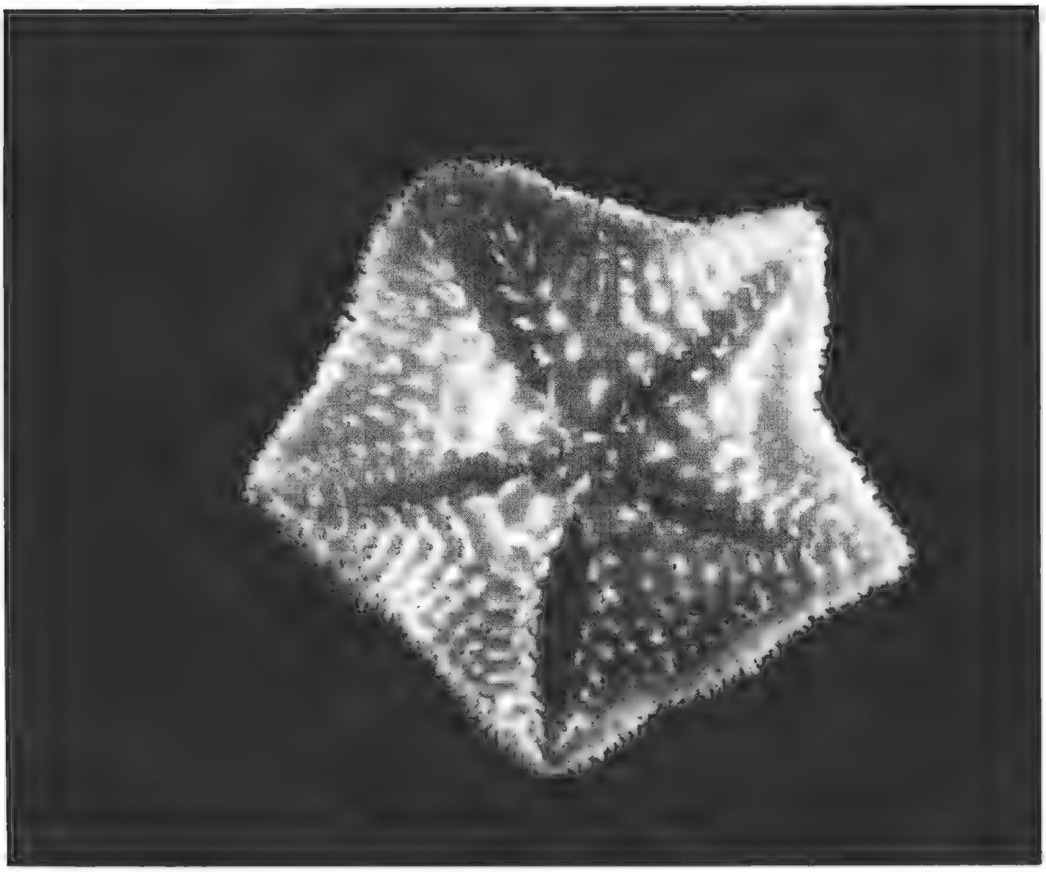
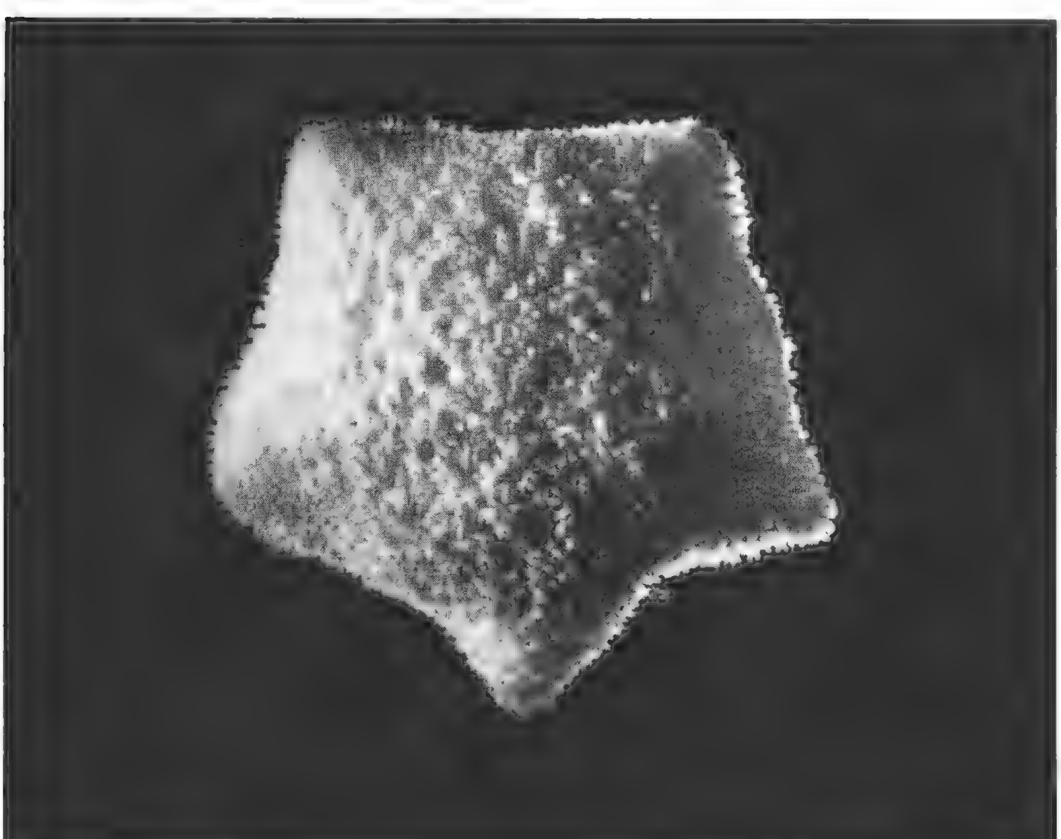


Figure 3. *P. parvivipara*. Paratype SAM K1720 (*a*) Actinal surface

mm

Figure 4. *P. parvivipara*. Paratype SAM K1720 (*b*) Abactinal surface



Holotype and type locality

One spirit-preserved specimen, SAM K781: Smooth Pool, south of Point Westall, South Australia; Grid Reference: 928203, Department of National Development 1:250 000 series, Map S153-2, Edition 1, Series R502. Collected by W. Zeidler, 28.ii.1975.

Paratypes and other material examined

Abbreviations used: SAM—South Australian Museum; AM—Australian Museum; TM—Tasmanian Museum; NMV—National Museum of Victoria; WAM—Western Australian Museum.

Paratypes

SAM K782 (1 specimen). Smooth Pool, south of Point Westall. Coll. by W. Zeidler, 1.iii.1975.

SAM K1719 (10). Smooth Pool, south of Point Westall. Under rocks intertidally. M.Keough, 19.ix.1975.

SAM K1720 (1). Smooth Pool, near Point Westall. Under granite rocks intertidally. P. Searle, 19.ix.1975. Dried specimen.

WAM 540/77 (1). Smooth Pool, near Point Westall. H. A. Searle, 19.ix.1975.

AM J10916 (1). Smooth Pool, near Point Westall. P. Searle, 19.ix.1975.

TM H1002 (1). Smooth Pool, near Point Westall. H. A. Searle, 19.ix.1975.

NMV H303 (1). Smooth Pool, south of Point Westall. Under rock. Intertidal. H. A. Searle, 19.ix.1975.

Other material

SAM K783 (1). Whittlebee Point, S.A. W. Zeidler, 1.iii.1975.

SAM K784 (1). Whittlebee Point, S.A. W. Zeidler, 1.iii.1975.

SAM K785 (1). Point Brown, S.A. W. Zeidler, 9.viii.1974.

SAM K1713 (c.70). Smooth Pool, near Point Westall. Under granite rocks intertidally. M. Keough, 19.ix.1975.

SAM K1714 (10). Cape Labatt. Under granite rocks intertidally. M. Keough, 15.i.1976.

SAM K1715 (1). D'Anville Bay, southern Eyre Peninsula. J. McNamara, 11.ii.1977.

SAM K1716 (1). Adult with emerging young. Smooth Pool, S.A. H. A. Searle, 19.ix.1975.

SAM K1717 (20). Smooth Pool, near Point Westall. Under granite rocks intertidally. M. Keough, 27.ii.1977.

Note:—Other material is held at all above institutions.

Distribution and habitat

The known distribution of *Patiriella parvivipara* extends from Whittlebee Point near Ceduna, south as far as D'Anville Bay and the species is known from five localities (see Fig. 6). Despite searching, no specimens were found on Yorke Peninsula or on the eastern coasts of Eyre Peninsula. The Western Australian Museum contains no specimens of the species although detailed collecting has only been done along the south-western coast of Western Australia (Mrs. L. M. Marsh, pers. comm.).

Along Eyre Peninsula the species did not occur at a series of other localities searched (see Fig. 6) and at D'Anville Bay considerable searching was necessary to collect the single specimen (J. McNamara, pers. comm.). At Cape Labatt, the population density is moderate, one to five animals per square metre of rock surface examined. At Point Westall, however, densities may reach 2 000 individuals per square metre of rock underside. Even here the animal is extremely localised, only one rock pool of many containing the species. A similar phenomenon was observed at Cape Labatt.

The habitat of the species is also very restricted. *P. parvivipara* occurs in mid- to lower-intertidal rock pools of characteristic appearance. The pools are depressions in an igneous base rock, granite (Smooth Pool, Cape Labatt, Point Brown and Whittlebee Point) or basalt (D'Anville Bay) outcropping along a Pleistocene coastline (Parkin, 1969). Small rocks litter the bottom of the pools and *P. parvivipara* occurs under these rocks (see Fig. 5). At Cape Labatt, some limestone rocks are also present but the species has not been found under these rocks.

The rocks were almost bare of epibiota at Smooth Pool and D'Anville Bay and carried small amounts at Whittlebee Point and Point Brown. At Cape Labatt the rocks were encrusted with calcareous algae, sponges and colonial ascidians as well as mobile species including *Patiriella gunnii* (Gray), *Paranepanthia grandis* (H. L. Clark), *Allostichaster polyplax* (Muller and Troschel), several species of molluscs, the prawn *Leander* sp. and the ophiuroids *Clarkcoma canaliculata* (Lutken), *Ophionereis schayeri* (Muller and Troschel) and

Figure 5. Smooth Pool Type Locality. Photo courtesy of Bruce Chester.

Ophiactis resiliens Lyman. *P. parvivipara* occurred at the side of rocks partially sheltered by calcareous algae.

The rock pools occurred in sheltered parts of exposed rocky shores and the localities on Eyre Peninsula at which *P. parvivipara* did not occur were of different geology, with the exception of Cape Carnot which was a granite area. Granite areas of Yorke Peninsula were searched unsuccessfully by Mr. W. Zeidler of the South Australian Museum. The habitat is very specialised, a phenomenon shown by many small, cryptic Asterinidae. The eastern limit of distribution is probably fairly precise, although further collecting may extend the range westwards.

Biological observations

Patiriella parvivipara is able to survive high temperatures, as at Smooth Pool the temperature in the pool may exceed 30°C during summer and tidal flushing has little effect on the temperature. Thus the species is able to tolerate temperatures much higher than many asteroids (see Ursin, 1960; Smith, 1940), although it must be noted that the congeneric species *Patiriella exigua* has been recorded from waters of summer temperatures of 30-35 C in South Australia (Shepherd, 1968).

Thermal stress may not be a problem to individuals during summer, but "reproductive stress" may be important. Specimens kept in laboratory aquaria for two months at 15°C changed very little. When kept at 20-23°C, however, reproduction was induced and over seven days all animals of R > 2 mm produced young. Animals which were kept at 12°C and subjected to a rise of similar magnitude (5·5°C) produced no young. These specimens were collected during February, 1977, and examination of specimens collected at the same time showed juveniles to be present. In the first trial, 25 animals were used, and in the second, 10. The results suggest that it is the temperature of 20-23°C, rather than merely a rise in temperature, which stimulates emergence of juveniles.

Juveniles emerged through the abactinal surface of the adult and, in aquaria, their emergence was always fatal to the adults. Most adults contain more than one juvenile and few carried none (see Table 1). Emergent juveniles were as much as 25 per cent of adult diameter. The position of emergence corresponds closely to that of *Patiriella vivipara* (Dartnall, 1969a). Most adults carry many juveniles indicating considerable reproductive potential in the population. At Smooth Pool, the population is sheltered from both wave stress, and competitors and predators while the Cape Labatt and Point Brown populations are more exposed to wave action and to predators and competitors. At Cape Labatt *Patiriella gunnii* and *Paranepanthia grandis* are available as predators upon *Patiriella parvivipara* and prawns are not unknown as sea star predators (Bruce, 1971).

TABLE 1

Distribution of number of young in adult *P. parvivipara* from Smooth Pool at different times of the year. Figures show the frequency of animals carrying given numbers of juveniles.

Month	0	1	2	3	4	5	6	7	8	9	10	>10	Adults Examined
February	13	1	1	2	2	1	0	0	0	0	0	0	20
May	3	2	3	1	2	3	3	2	1	0	0	0	20
July	—	—	—	—	1	—	3	—	—	—	—	—	4
September	1	5	4	7	4	4	1	1	1	2	1	1	32

Data from September, 1975 and 1977 were homogeneous, and so were pooled.

The reproduction is extremely efficient, since each adult produces a few young, which are relatively large and thus have a greater probability of survival. It is therefore possible that, because of this and the lack of predators and physical stresses, the Smooth Pool population is approaching maximum density in contrast to the other sites. The role of temperature in reproduction suggests that breeding occurs in December-February as water temperatures rise about 20°C. This behaviour contrasts with that of *P. vivipara,* which breeds throughout the year in colder Tasmanian waters (Dartnall, 1969a), although there may be a December-February breeding peak in that species as Hoggins (1976) believes that breeding is restricted to that period and tank experiments suggest a similar conclusion (G. Prestedge, pers. comm.).

The mode of reproduction does limit widespread dispersal, as evidenced by the distribution of this species (Fig. 6). The method of fertilization is as yet unknown, although Dr. F-S. Chia (pers. comm.) is currently investigating this.

It is possible that cross fertilization occurs, as in *P. vivipara* (F-S. Chia, pers. comm.) and if this is also true for *P. parvivipara* the reproduction would only restrict dispersal, without creating problems of inbreeding.

Some idea of the dynamics of the population of *P. parvivipara* at Smooth Pool may be inferred from measurements of size (i.e. greater radius R) and reproductive capacity of samples at different times. In September, 1975, before the summer rise in water temperature, mean R of animals was $3 \cdot 31 \pm 0 \cdot 6$ mm, while during February 1976, near the end of the probable reproductive season when warm water temperatures were nearing their end, mean size of the population had fallen, $R = 1 \cdot 85 \pm 0 \cdot 6$ mm. In the following May mean size was intermediate, $R = 2 \cdot 6 \pm 0 \cdot 631$ mm. (These specimens are no longer held as they were dissected for juveniles, destroying the specimens). In February, 1977, mean size was again small, $R = 1 \cdot 95 \pm 0 \cdot 62$ mm and by July, mostly large animals were present, mean R being $2 \cdot 93 \pm 0 \cdot 52$ mm.

The data in Table 1 show that in February, most animals are immature and do not contain juveniles. In May and July many animals, whilst not fully grown, had reached maturity and contained juveniles, and by September, almost all animals were mature and contained juveniles.

The most reasonable explanation for these observations is that the animals are short-lived, juveniles are produced in early summer, grow rapidly and reach maturity between February and June. The animals continue to grow until fully grown the following summer when juveniles emerge. The larger animals present in February are slow-developing animals of the previous year. Since reproduction appears fatal, all adults of a given year die during the summer to be replaced by juveniles, i.e. the data are consistent with almost complete annual turnover of the population. Collection of monthly samples from Smooth Pool is continuing in an attempt to confirm this hypothesis, and more detailed ecological data will be presented at a later date.

Extent of morphological variation

The number of arms is extremely uniform. Of about 300 specimens examined, only one had four arms and one, six. This is less variable than in *P. exigua* where six- and four-rayed specimens are not uncommon (5·5 per cent with other than five rays in 252 Tasmanian specimens (Dartnall, 1969b), but is similar to observed variation in *P. vivipara* where of a sample of 2 016 specimens only two had six arms (Dartnall, loc. cit.).

Maximum R for the species is 4·7 mm, and sexual maturity is reached at about R = 2 mm. This compares with *P. vivipara,* which reaches

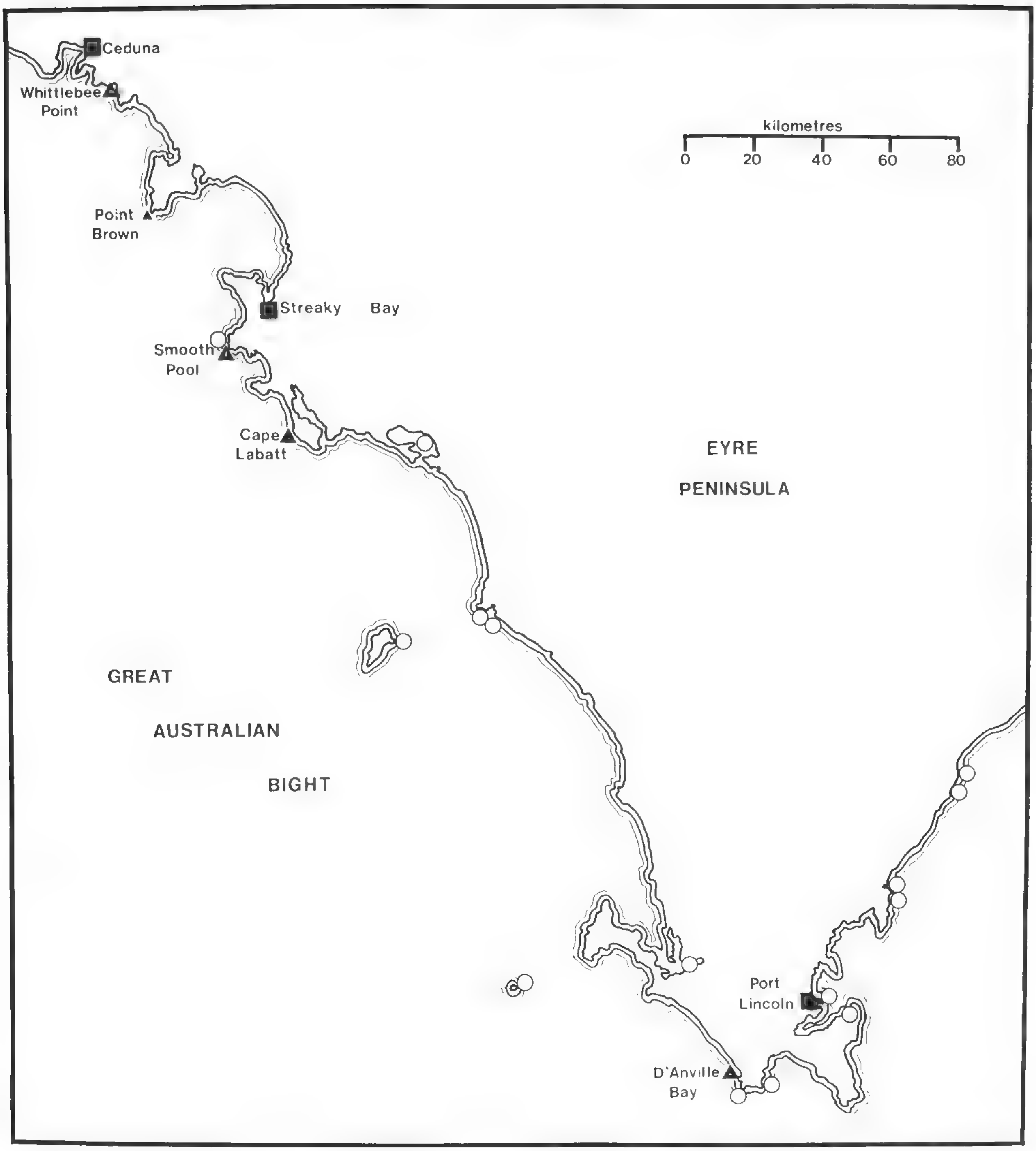


Figure 6. Distribution of *Patiriella parvivipara*. Closed triangles show localities where the species occurs; open circles localities searched unsuccessfully for the species.

TABLE 2

Comparative spine counts of "*exigua*" group.

	parvivipara	*exigua*[1]	*pseudoexigua*[11]	*vivipara*[111]
Arms	5 (4r; 6r)	5 (4r; 6c)	5 (4r; 6r)	5 (4r; 6r)
R; r range	1.1-1.4	1.08-1.67	1.3	1.1-1.6
Oral spines	4-5 (3r; 6r)	5-6 (4r)	5 not known	6 (5c; 7r)
Suboral spines	0 (1r)	1 (0r)	1 not known	1 (0r)
Actinal * interradial spines/plate	1 (0c; 2c)	1 (0c; 2c)	1 (0c; 2c)	1 (0c; 2c)
Furrow spines*	2 (3r; 1c)	2 (3r; 1r)	3 (2c; 1c)	3 (2c)
Subambulacral spines	1 (2r; 0r)	1 (0r)	1 (2r; 0r)	1 (2c; 0r)
Inferomarginal spines	3 (4, 5, 6c, 7r)	3 (4, 5)	7-9	4-5
Abactinal spines	4-10	4-20	4-20	3-14

Figures show the most common number of spines per plate and parenthesised figures indicate alternative counts. "c" indicates a common occurrence; "r" a rare occurrence.

* The number often varies on a particular animal and one animal may carry 0, 1 and 2 spines on actinal plates and 3, 2 and 1 furrow spines.

[1] Dartnall (1971) and Keough (unpublished observations)

[11] Dartnall (1971)

[111] Dartnall (1969) and Keough (measurements on TM822 and TM927)

maximum size of R > 15 mm, and maturity at 5-6 mm (Dartnall, 1969b; Hoggins, pers. comm.). The larger specimens of *P. parvivipara* (i.e. R > 2 mm) invariably contain juveniles.

Four or five oral spines are usually present in *P. parvivipara* though six occur occasionally. Individuals sometimes had oral plates carrying three, four and five spines on one animal. The usual lack of suboral spines, and smaller size at maturity distinguishes the species from *P. vivipara* in nearly all cases, but a comparison of species within the "*exigua*" group, *P. exigua, P pseudoexigua, P. vivipara and P. parvivipara* shows that there is considerable morphological overlap between the species (see Table 2) and that no morphological character or combination of characters suffices to distinguish species in all cases, especially for specimens of R less than 2 mm.

Preserved specimens are often exceedingly difficult to identify and existing keys are, at best, a general guide. There is a great need to investigate new characters, ecological, reproductive and possibly biochemical in an effort to provide reliable characters. It is fortunate that, at least within the "*exigua*" group, modes of reproduction serve to distinguish specimens of R > 1·5 mm.

In the field only two species are likely to occur in any area and these pairs are readily distinguishable. The combinations are *P. parvivipara* and *P. exigua* in South Australia, *P. vivipara* and *P. exigua* in Tasmania and *P. exigua* and *P. pseudoexigua* in southern Queensland. The presence or absence[1] of gonoducts and their orientation, together with colour, are adequate to identify the species.

DISCUSSION

The distribution of the "exigua" crop

The distribution of *P. exigua, P. pseudoexigua* and *P. vivipara* was described by Dartnall (1971) and it is interesting to note that *P. parvivipara* is continguous with *P. exigua*. The distribution pattern is shown in Figure 7.

The geographical separation of *P. vivipara* from *P. parvivipara*, together with the precosity of *parvivipara* strongly supports their separation as distinct species. They are also distinct from *P. exigua* and *P. pseudoexigua* so that along the Australian coastline four similar species exist but reproductive isolating mechanisms have evolved which ensure the integrity of the species concerned. The idea proposed by Dartnall (1971) that the "*exigua*" group forms a triple sequence may be re-examined. The original idea (Dartnall, 1970) of sibling pairs may be valid and if

[1] Gonoducts are present in *P. vivipara* (F-S. Chia, pers. comm.), but they are difficult to observe, in contrast to *P. exigua* and *P. pseudoexigua*.

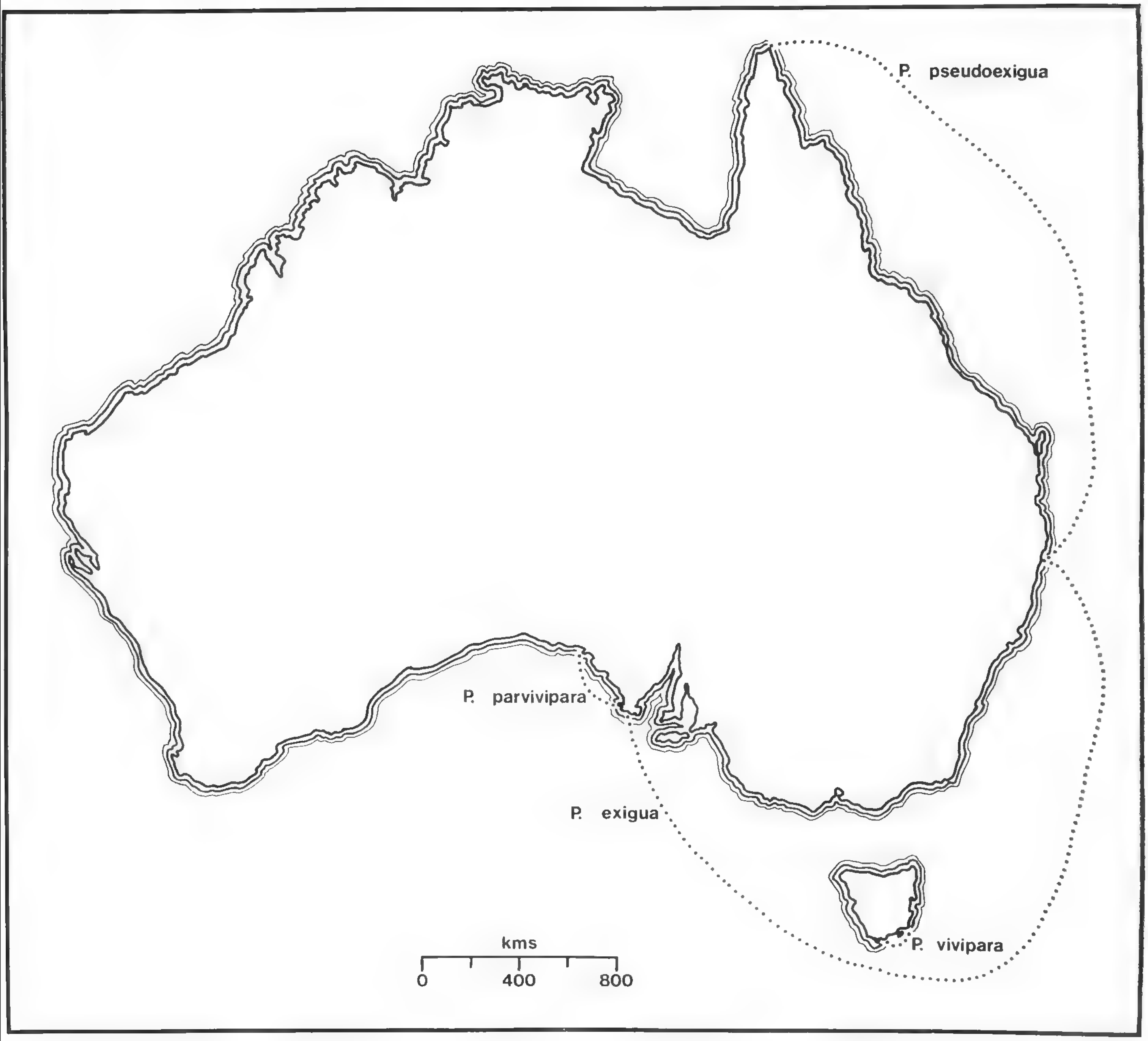


Figure 7. Distribution of *Patiriella* species of the "*exigua*" group within Australia. Note that the broken lines link only the extremities of the range for each species, and do not indicate presence in water other than the intertidal areas on the Australian coastline

this is so two sibling pairs are now known to exist. There is little intellectual difficulty in deriving both *Patiriella vivipara* and *P. parvivipara* from *P. exigua* which lays its eggs in gelatinous packets on littoral rocks and which exhibits an abbreviated larval development. There is also little difficulty if one considers brooding a method of maintaining a consistent recruitment to a restricted, specialised habitat, although it may restrict the dispersal of the species where free swimming larvae are absent.

The reason for the speciation is uncertain, although brood protection is most characteristically a property of cold water species (Mileikovsky, 1971) and it could be argued that cold conditions in the past were involved in the speciation observed. Dartnall (1974), following Gill (1970), has invoked a Pleistocene closing of Bass Strait to explain other marine distributions in the area. Whether this phenomenon, combined with waters of glacial origin in south-eastern Tasmania, and cold subantarctic water washing the shores of the Great Australian Bight, were appropriate triggers for the successful speciation of both *P. vivipara* and *P. parvivipara* must, hopefully, be a source of fruitful argument.

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The co-operation of H. A. Searle, P. Searle, M. Dutschke and B. Chester in collecting and despatching specimens to one of us (M.J.K.), and the assistance of J. McNamara, D. Keough and A. Chugg in the field was greatly appreciated. We are also indebted to Mr. W. Zeidler, who readily made available the collections of the South Australian Museum, Mr. P. G. Kempster, who photographed the specimens, and Miss R. Altmann, for drawing up the figures.

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RECORDS OF THE
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THE GENUS *BATHYCOELIA* A & S IN NEW GUINEA AND *PRYTANICORIS* GEN. NOV. FROM THE NEW GUINEA AREA AND THE NEW HEBRIDES

(Heteroptera-Pentatomidae-Pentatominea)

By GORDON F. GROSS

SOUTH AUSTRALIAN MUSEUM
North Terrace, Adelaide
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Summary

The genus Bathycoelia is recorded for the first time from New Guinea where it is represented by *chlorospila* Walker, originally described from the Aru Islands. *Chlorospila* is redescribed and figured and its male genitalia illustrated, the latter confirming that *Bathycoelia* is a member of the Pentatoma group. *Prytanicoris* gen. nov. is described and its four included species, *ambivivens* sp. nov. from New Guinea and the New Hebrides, *dimorpha* sp. nov. from New Guinea, *novaebritaniae* from the Bismark Archipelago and *solomonensis* from the Solomons, are described and figured; the genitalia of *ambivivens* indicate it belongs to a new grouping of pentatomine genera near the *Antestia* group.

THE GENUS *BATHYCOELIA* A & S IN NEW GUINEA AND *PRYTANICORIS* GEN.NOV FROM THE NEW GUINEA AREA AND THE NEW HEBRIDES (HETEROPTERA-PENTATOMIDAE-PENTATOMINAE)

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ABSTRACT

GROSS, G. F. 1978: The Genus *Bathycoelia* A & S in New Guinea and *Prytanicoris* gen.nov. from the New Guinea area and the New Hebrides. *Rec. S. Aust. Mus.* 17 (29): 417-428.

The genus *Bathycoelia* is recorded for the first time from New Guinea where it is represented by *chlorospila* Walker, originally described from the Aru Islands. *Chlorospila* is redescribed and figured and its male genitalia illustrated, the latter confirming that *Bathycoelia* is a member of the Pentatoma group. *Prytanicoris* gen.nov. is described and its four included species, *ambivivens* sp.nov. from New Guinea and the New Hebrides, *dimorpha* sp.nov. from New Guinea, *novaebritaniae* from the Bismark Archipelago and *solomonensis* from the Solomons, are described and figured; the genitalia of *ambivivens* indicate it belongs to a new grouping of pentatomine genera near the *Antestia* group.

INTRODUCTION

During a visit to the B. P. Bishop Museum in 1969 a series of large New Guinea Pentatomidae was selected out as probably belonging to a new genus of what was then known as the subfamily Halyinae but subsequently characterised (Gross, 1976, pp. 448-451) as a group of genera, the *Halys* group, of the subfamily Pentatominae as redefined in the preceding year (Gross, 1975, pp. 98-101, 104-109). Additional material of similar appearance was obtained in the New Hebrides during the 1971 Royal Society—Percy Sladen Expedition to these islands.

Closer examination proved that there were two genera in the series. The more greenish one proved to be *Bathycoelia* Amyot and Serville which was represented only in the New Guinea material by *chlorospila* Walker, previously known only from the type specimen from the Aru Islands. *Bathycoelia* was believed to belong to the *Pentatoma* group and dissection of its male genitalia has confirmed this. The second genus is new and likewise is not a member of the *Halys* group. On the basis of the elongated rima of the scent gland and the form of its male genitalia it belongs to a hitherto unrecognised grouping of Pentatominae close to the *Antestia* group.

ACKNOWLEDGMENTS AND ABBREVIATIONS OF INSTITUTIONS

Most of the material for this study was made available by the Bernice P. Bishop in Honolulu, abbreviated in the text to BISHOP, and by the British Museum of Natural History, abbreviated to BMNH. I am particularly indebted to the late Miss S. Nakata of Honolulu and Dr. W. R. Dolling of the British Museum in assisting in the selection and transmission of the material. Some of the specimens examined are in the South Australian Museum which is abbreviated to SAM. Funds for my visit overseas in 1969 were made available by the Sir Mark Mitchell Research Foundation and the C.S.I.R.O. Science and Industry Endowment Fund. The work in the New Hebrides was financed by the Royal Society of London and the Percy Sladen Trust.

The halftone illustrations of the dorsal aspect of the species were prepared by Mrs. Linda Blesing and for her meticulous work my thanks are recorded here.

SYSTEMATICS

Pentatoma Group

Bathycoelia Amyot & Serville, 1843

Bathycoelia Amyot & Serville, 1843, p. 110; type: *Pentatoma buonopoziensis* Palisot de Beauvais, 1805 (monobasic). Stal, 1865, p. 189; 1876, p. 101. Kirkaldy, 1909, p. 139. Bergroth, 1913, p. 230. Distant, 1914, p. 376.

Bathycelia (*sic*) Herrich-Schaeffer, 1853, pp. 290, 326.

Gastraulax Herrich-Schaeffer, 1844, p. 61; type: *Gastraulax torquatus* Herrich-Schaeffer, 1844 (first mentioned species). Herrich-Schaeffer, 1853, p. 326; synonymy with

Bathycelia (*sic*). Bergroth, 1906, p. 9. Kirkaldy, 1909, pp. xxxi and 139. Bergroth, 1913, p. 230; synonymy with *Bathycoelia*.

Jurtina Stål, 1867, p. 518; type: *Pentatoma longirostris* Moutrouzier & Signoret, 1861 (monobasic). Stål, 1876, p. 101. Distant, 1902, p. 223. Bergroth, 1906; p. 9; synonymy with *Gastraulax*. Bergroth, 1913, p. 230; synonymy with *Bathycoelia*.

Large greenish, greyish-green or ochraceous-green Pentatominae with head rather triangular, ocelli widely separated, second segment of antennae shorter than third, labium reaching onto abdomen and considerably surpassing hind coxae, sometimes reaching almost to apex of abdomen; anterolateral margins of pronotum nearly straight and lateral angles acute or slightly produced; scutellum with a black, purple or green metallic spot in each anterior angle; rima of scent gland produced as a long keel to near upper margin of metapleuron; tibiae sulcate or not; venter slightly raised basally and strongly sulcate to receive the labium medially.

Remarks: The genus ranges from Africa through the Comoro Islands, Madagascar, Réunion, India, Malaysia, the Phillippines, Indonesia, Aru Islands, New Caledonia and the Loyalty Islands to the New Hebrides and Fiji and is here recorded from New Guinea for the first time.

Bathycoelia was placed by Stal (1876) and Distant (1902) with such genera as *Alciphron*, *Glaucias* (as *Zangis*) and *Nezara* which I (Gross, 1976, pp. 448-451) have shown to be closely related to each other as a grouping of genera provisionally called the *Pentatoma* group. The form of the aedeagus and claspers of the species redescribed below from the Aru Islands and New Guinea indicates that *Bathycoelia* does belong to this group, the claspers having some similarity to those of *Plautia* and the aedeagus to *Glaucias* and *Alciphron* (Gross, 1976, figs. 201 A-F, 202 A-B). The long rima of the scent gland opening and a greenish color are additional features, along with its general appearance, confirming its placement in the *Pentatoma* group.

Specimens from New Guinea, despite a somewhat more speckled appearance, appear on measurement to be conspecific with *Bathycoelia chlorospila* Walker, 1867, from the Aru Islands. As it is a unique specimen the genitalia of the type of *chlorospila* have not been examined to confirm this.

Bathycoelia chlorospila belongs to that section of the genus in which the tibiae are sulcate whereas the species from more eastern Pacific Islands, notably *B. longirostris* (Montrouzier & Signoret, 1861) from New Caledonia and *B. simmondsi* Izzard, 1932, from Fiji and the New Hebrides, have rounded tibiae

Bathycoelia chlorospila Walker, 1867

Figs. 1, 2 A-C

Bathycoelia chlorospila Walker, 1867, p. 350. Bergroth, 1913, p. 230.

Gastraulax chlorospilus Kirkaldy, 1909, p. 140.

Holotype yellowish-testaceous but probably green in life. New Guinea specimens greyish-green with a finely speckled appearance. On dorsum numerous brown (type) or brownish-black punctations with some punctations, patches of punctations and markings iridescent greenish-black.

Head with anteclypeus, ocular peduncle and a patch inside and behind each eye glabrous; behind anteclypeus transversely strigose and except for two central longitudinal lines of punctations, impuncate. This glabrous area bordered on either side by a longitudinal line of punctations and another longitudinal line extends forward from ocelli. Juga obliquely strigose and punctate in their inner halves. At each inner basal angle of juga a black spot and lateral margins of juga narrowly black. Ocular peduncles flattened behind and touching anterior margins of pronotum. Antennae slender, length of segments (holotype) 1·14, 1·67, 3·38 mm, fourth and fifth missing but in one New Guinea male with the full number of segments 0·93, 1·72, 2·96, 3·64, 3·22 mm and in a New Guinea female 0·73, 1·88, 3·43, 3·90, 3·70; first segment pale brown, sometimes darkened basally and apically, second and third black, fourth pale brown in basal, third to half and dark apically, fifth pale brown with a broad blackish annulation after the middle.

Pronotum with anterior margin obliquely truncate behind eyes and trapeziformly excavate behind collum, anterior angles formed into a small blunt spine, anterolateral margins almost straight and moderately acute, lateral angles shortly produced and almost rectangular, posterolateral margins vaguely sinuated, posterior margin almost straight; disc with some transverse very low ridges in a somewhat vermiculate pattern, calli glabrous, inwardly of each anterior angle a triangular patch of iridescent greenish-black or purplish punctations, these two patches sometimes connected by a narrow line of similar punctations just behind anterior margin.

Scutellum with a prominent greenish-black or purplish, transversely strigose, circular macula in

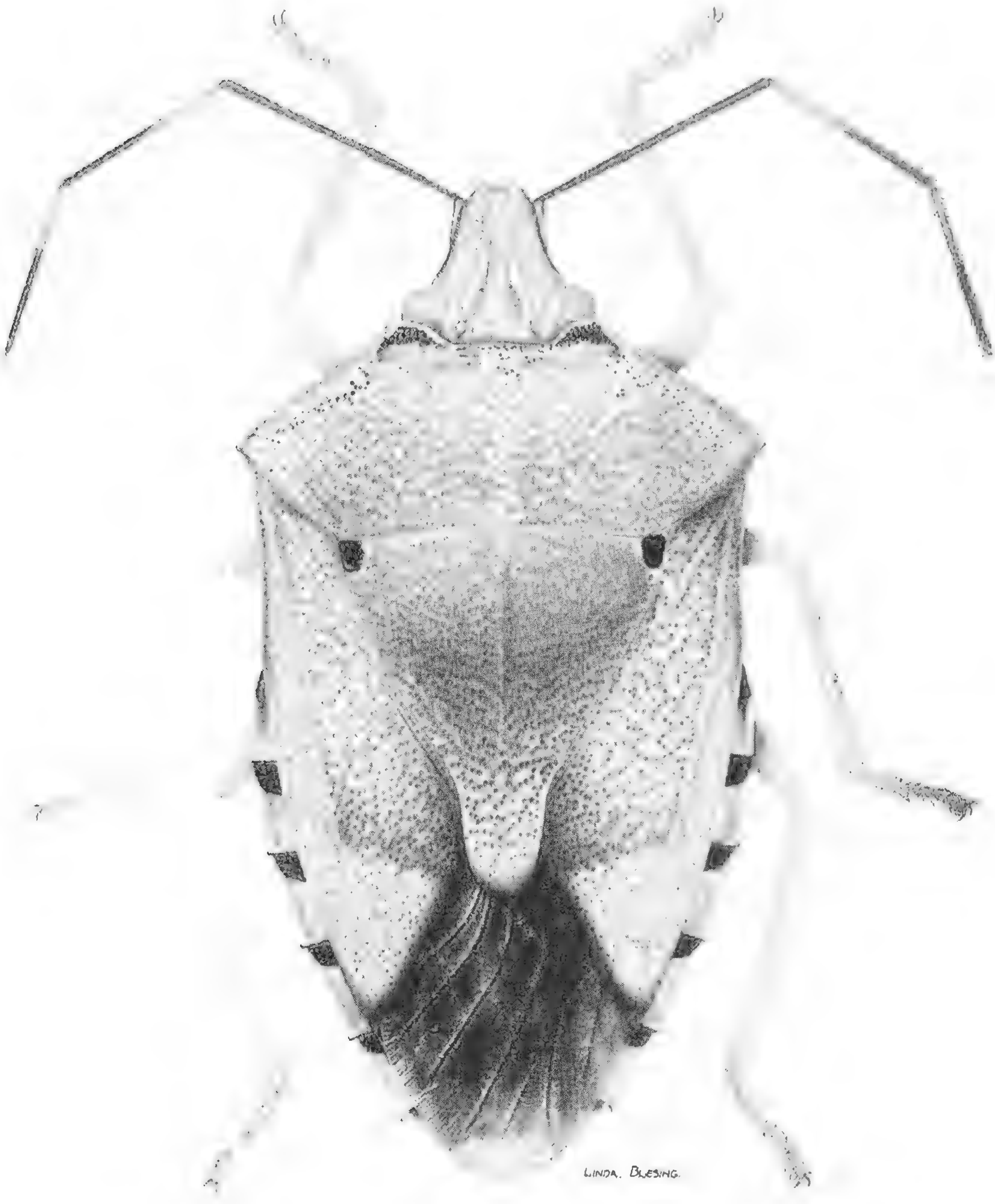

FIG. 1. Dorsal aspect of *Bathycoelia chlorospila* Walker.

each basal angle; apex broadly rounded; disc only slightly raised anteriorly and punctations tending to be arranged in short lines to form a vermiculate pattern.

Hemelytra narrower than abdomen for most of their length, membrane just surpassing apex of abdomen; punctations on coriaceous portions tending to form groups or short lines to give a vermiculate appearance; membrane smoky hyaline with prominent, mostly parallel, veins.

Laterotergites with posterior angles acute and black tipped, anteriorly on each laterotergite a large purplish or greenish-black macula.

Dorsum of abdomen not seen.

Head beneath impunctate and yellowish, a short iridescent greenish-black or black line beginning at anterior margins of eyes and passing forward over antennifers but not nearly reaching apex; labrum well developed; labium reaching onto sixth abdominal ventrite, stylets and extreme apex blackish.

Thorax beneath yellowish, propleura and sometimes hind part of metapleura with fine brownish punctations; mesosternum with a low raised keel; anteriorly of each fore coxa an elongate black spot, exteriorly on propleuron a curved black streak starting on anterior margin and extending at least half length of segment, anteriorly on mesopleuron a small black spot exteriorly and partly concealed under hind margin of propleuron, on metapleuron a curved black streak exteriorly margining the evaporative area; evaporation area with a vermiculate pattern, peritreme long and raised. Legs yellowish and not unduly long, tibiae sulcate exteriorly.

Abdomen with segments III-VI broadly sulcate medially; exterior anterior angles of each segment black, behind each spiracle a small black spot and midlaterally an oblique dark spot on anterior margin of segments IV-VII; male genitalia concealed by ventrite VII, hind margin of pygophore forming a smooth concave curve but interiorly of this a complex, sinuous upright septum, a membranous eighth segment is present in front of the pygophore. Claspers, fig. 2C, large and T-shaped with a small lateral lobe on the main shaft. Aedeagus, fig. 2A-B, with phallosoma moderately sclerotized, three conjunctival lobes present, one dorsal and two lateral, the latter sclerotized at their apices; medial penial plates lying on either side of a short sclerotized vesica and rather curved. Female first gonocoxae somewhat convex and with hind margins faintly curved, paratergites IX rather triangular with rounded apices.

Length (holotype) 19·2 mm, (range) 18·7-21·6 mm.

Maximum width (holotype) 10·4 mm, (range) 10·4-11·9 mm.

Remarks: The original description of Walker is too brief to adequately characterise this species.

Location of type: Holotype ♂, ARU ISLANDS, Saunders. 65-13, in BMNH.

Specimens Examined: The type and NEW GUINEA-PAPUA Daradae Plantation, 80 km north to Port Moresby, 500 m, 4 & 6.ix.1959, T. C. Maa; NORTH-EASTERN paratype ♂ 2 ♀, Wau, Morobe District, 1 200 m, 20.iii.1964, 16.vii.1961 2-10.xi.1961, the two females at light, J. & J. H. Sedlacek. IRIAN JAYA ♀, W. Sentani, Cyclops Mountains, Hollandia area, 150-250 m, 25.vi.1959, T. C. Maa; ♀, Bodem, 11 km S.E. of Oerberfaren, 7-17.vii.1959, in MV light trap, T. C. Maa; ♀, Waris S. of Hollandia, 450-500 m, 1-7.viii.1959, T. C. Maa; all specimens except the type in BISHOP.

Prytanicoris Group

The new genus *Prytanicoris* is very similar in appearance to New Guinea members of the *Halys* group (c.f. species of *Acanthidiellum* Kirkaldy, 1904 = *Bromocoris* Horváth, 1915 and *Cocto-teris* Stål, 1858), especially in its large size, rather rectangular head, produced lateral angles of the pronotum and slender antennae. However, the long rima of the scent gland is suggestive of a position somewhat nearer the *Antestia*, *Pentatoma* and *Rhynchocoris* groups though the form of the animal excludes it from any of those three. Dissection of the aedeagus confirms a placing close to the *Antestia* group. *Prytanicoris* may in fact lie somewhere along the line of development from the *Halys* group to *Antestia* and the two other groups (*Pentatoma* and *Rhynchocoris*) with a long rima. If so the *Antestia* group should be derived more directly from the *Halys* group, than from nearer the *Asopus* group as previously suggested (Gross 1975) in discussing the origins of the various groups of Australian genera of Pentatominae.

Although the *Prytanicoris* group is known at the moment only from the New Guinea, Bismark, Solomons and New Hebrides areas, its presence in this region adjacent to Australia further suggests that nearly all the groups of genera of Pentatominae in the Australasian region, except the *Podops* and *Strachia* groups, can be easily visualised as deriving from the *Asopus-Poecilotoma-Halys* groups axis.

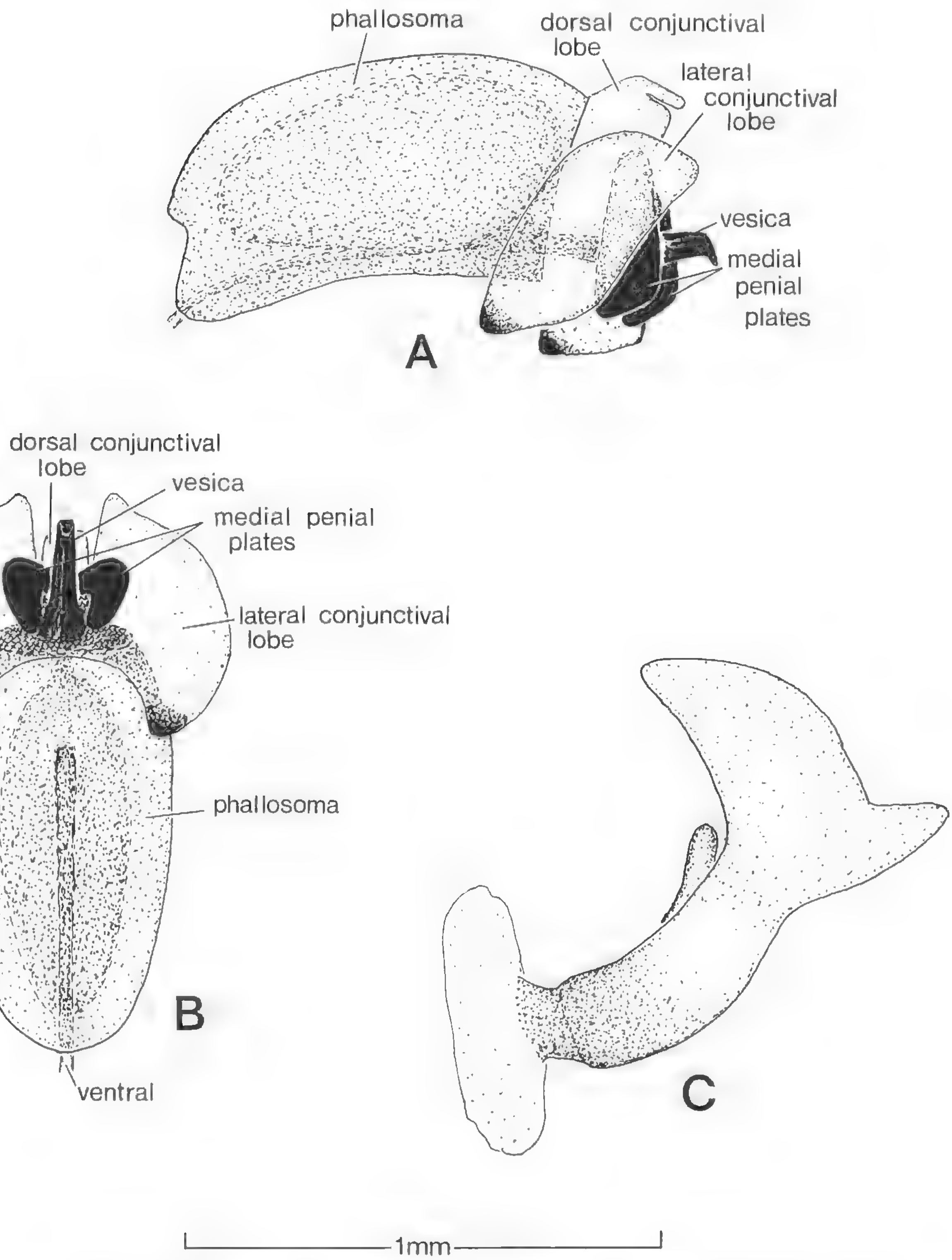

FIG. 2. A-C. *Bathycoelia chlorospila* (Walker). A. aedeagus-sinistral aspect. B. ditto-ventral aspect. C. Clasper.

The features of the *Prytanicoris* group must for the time being be those of its only included genus.

Prytanicoris gen.nov.

Large or medium sized, speckled brown or blackish Pentatominae with head elongate and for most of its length parallel sided but anteriorly broadly rounded, apices of juga not quite reaching apex of anteclypeus, ocelli widely separated and just behind a line between hind margin of eyes, second segment of antennae shorter than third, labium reaching onto third segment of abdomen; anterior margins of pronotum trapeziformly excavate behind collum and obliquely truncate behind eyes, slightly separated from latter, anterior angles produced as a blunt tooth, anterolateral margins of pronotum nearly straight and lateral angles produced as a conical recurved spine or rectangularly produced, posterolateral margins somewhat sinuate, posterior margin straight; scutellum only slightly raised anteriorly on disc, apex rounded, a black fovea in each basal angle; bucculae long and low but not reaching base of head; mesosternum with a very low keel; tibiae sulcate on their outer surfaces; second abdominal ventrite constricted and depressed, abdomen medially not sulcate. Claspers (Fig. 4 C-E) foliaceous with a small hook like process dorsally or posteriorly; aedeagus (Fig. 4 A-B) with phallosoma lightly sclerotized, medial penial plates ventral and strap like; two small, lateral, membranous conjunctival lobes and a pair of parallel dorsal lobes which are membranous dorsally and sclerotized ventrally, vesica free apically and emerging between the lateral conjunctival lobes.

Type: *Prytanicoris ambivivens* sp.nov.

Prytanicoris is known from four species which may be separated as follows:—

Key to species of *Prytanicoris* gen.nov.

1\. Large species, usually over 17 mm in length and sometimes over 21 mm and 10·4 mm-12·3 mm in width; lateral angles of pronotum produced into a sharp slightly recurved spine . . . . *ambivivens* n.sp.

Smaller species, if exceeding 17 mm in length not exceeding 19 mm and less than 10·4 mm in width; lateral angles of pronotum produced into a very short conical process or obtuse 2

2\. (1) Lateral angles of pronotum produced into a conical process; dorsal appearance brown and abdomen without a black sublateral stripe 3

Lateral angles of pronotum obtuse and abdomen with dark iridescent, broad, sublateral stripe . *solomonensis* n.sp.

3\. (2) Males under 16 mm in length and under 9 mm in width; from New Guinea . . . . *dimorpha* n.sp.

Males over 17 mm in length and 9 mm in width; from the Bismark Archipelago . . *novaebritanniae* n.sp.

Prytanicoris ambivivens sp.nov.

Figs. 3, 4 A-C

Ground colour yellowish-orange with numerous brown punctations and small brown patches joining and surrounding punctations making the dorsum appear brown and finely speckled.

Punctations on juga sparse interiorly, exteriorly dense and concentrated into a broad sublateral line, latter frequently iridescent green or blackish-green. Between eyes and almost to base of collum six parallel lines of brown punctations, the outer pair of each side joining and terminating behind ocelli where they are frequently greenish, these sending a small side branch to hind margins of eyes. Anteclypeus anteriorly and laterally dark, in its basal half a medial orange glabrous streak which is continued to base of head. Length of antennal segments (holotype)—I 1·04, II 1·77, III 3·07, IV 4·00, V 3·04; (allotype)—I 0·99, II 1·92, III 2·91, IV 4·16, V 3·70 mm; first to third segments yellowish but black exteriorly, second and third maculated with brown and third infuscated at extreme apex, fourth and fifth brown with base orange-yellow.

Pronotum with anterior angle produced into a small, blunt, reflexed tooth, behind this on lateral margin a few crenulations, rest of anterolateral margin nearly straight and terminating in a reflexed spinose process just before true lateral angles; lateral angles shortly rounded, posterolateral and posterior margins nearly straight. On disc of pronotum a small tumescence just interiorly of each lateral angle; punctations on most of disc discrete and arranged in short randomly directed lines, around each punctation a small brown annulus, these coalesce to form lines here and there, anteriorly and laterally of each callus a dense patch of iridescent greenish or greenish-black punctations.

Scutellum marked as for hind portions of pronotum.

Hemelytra narrower anteriorly than hinder parts of thorax but considerably narrower than abdomen for most of their length. Clavus and corium marked as for disc of scutellum and hind portion of pronotum. Membrane fumose-hyaline with brown and apically parallel veins. Laterotergites yellowish, anteriorly on each an oblique broad bar and posteriorly a rhomboidal patch which are iridescent greenish or blackish and punctate, hind angles of each laterotergite produced into a small, backwardly directed, infuscated tooth.

Dorsum of abdomen not completely seen but apparently mostly yellowish-orange.

Except for a few fine punctations along base of bucculae head beneath yellow and impunctate, from anterior margin of eye and running forward to in front of antennifer a curved iridescent greenish or blackish line, in front of this and separated from it and apex of head an elongate brown streak on underside of juga. Labrum and labium yellowish but ventrally narrowly black, apical segment of latter also black. Thoracic pleura yellow and finely brown punctate, so also on epipleura and epimera and posteriorly on propleuron and metapleuron. At apex of first and second coxal clefts a small black spot, propleuron with an elongate spot of dark iridescent punctations midway betwen apex of coxal cleft and outer margin which does not reach

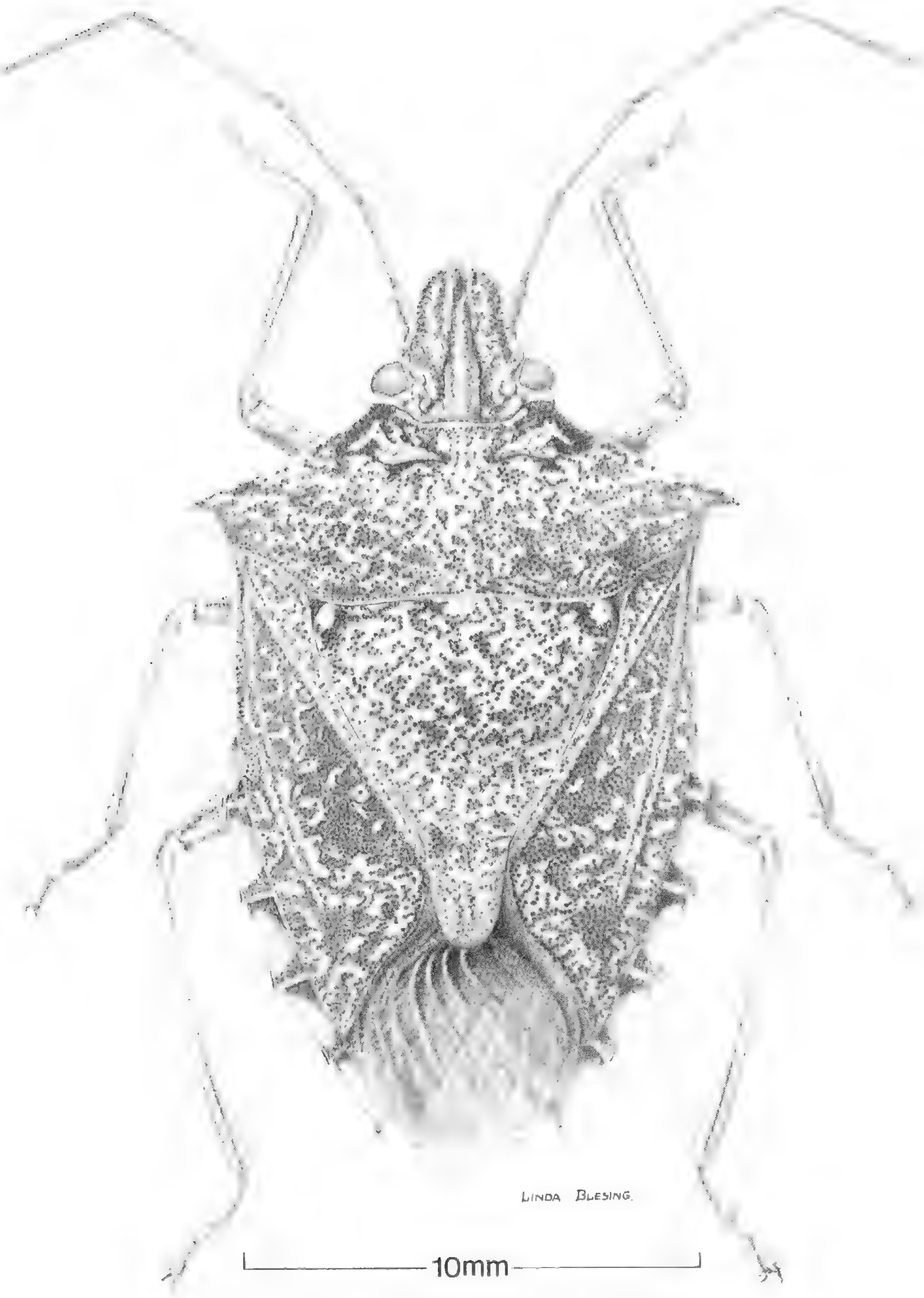

FIG. 3. Dorsal aspect of *Prytanicoris ambivivens* gen. & sp.nov.

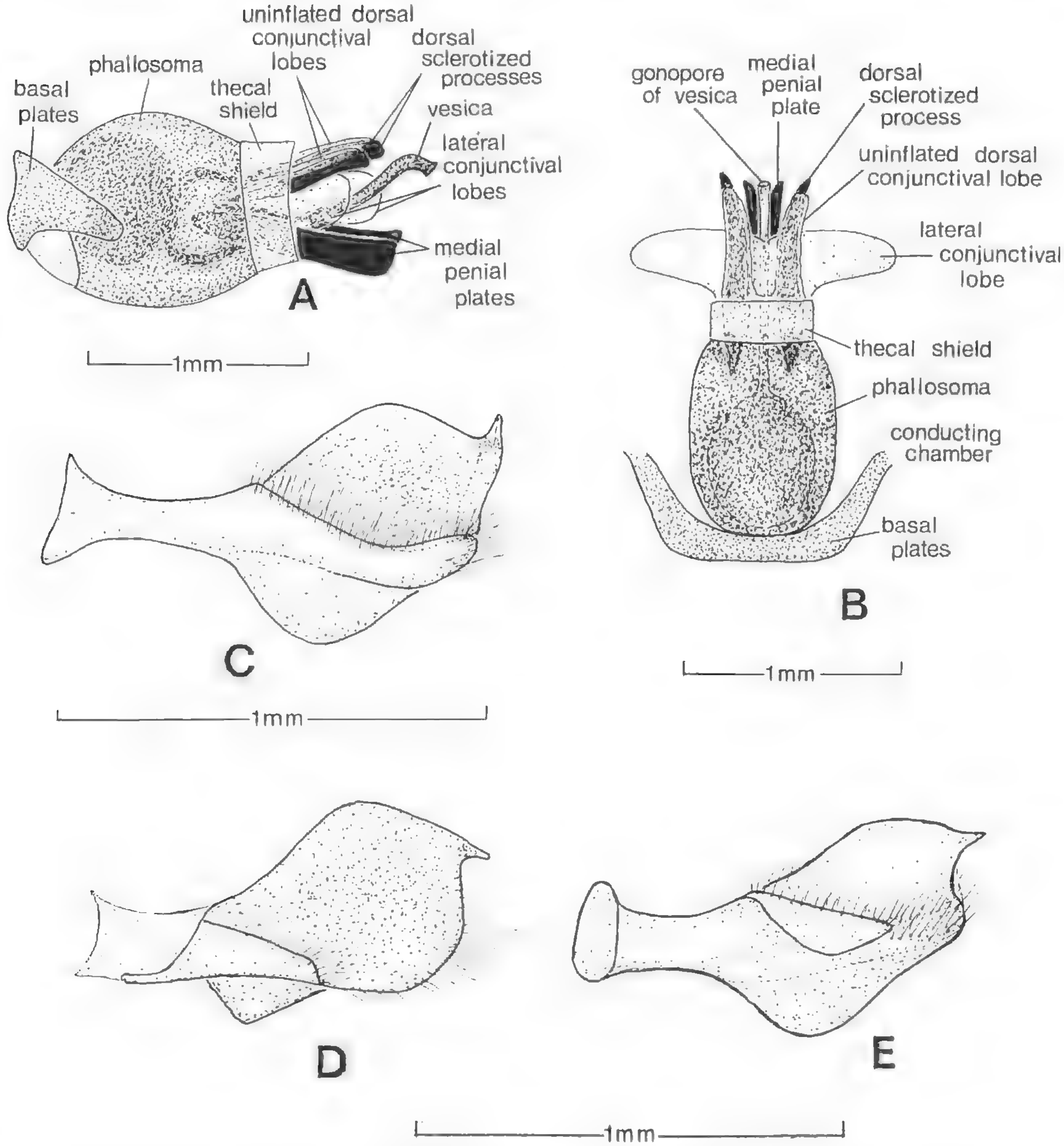

FIG. 4. A,C, *Prytanicoris ambivirens* gen. & sp.nov. A. aedeagus-sinistral aspect. B. ditto-dorsal aspect. C, clasper. D. *Prytanicoris dimorpha* sp.nov.—clasper. E. *Prytanicoris novaebrittaniae*—clasper.

anterior margin but joins a short transverse similarly coloured line in a sulcus just behind anterior margin; on meso- and metapleura a small spot centrally in line with the anterior spot and the abdominal spiracles. Legs normal and yellowish, fore femora maculated with brown in their apical three quarters, middle and hind femora only maculated apically, sulci of tibiae margined with black, apices of claws black.

Abdomen yellowish beneath, spiracles black. Hind margin of pygophore deeply excavated with lateral lobes rounded when viewed from below but with a more inner oblique short black ridge when viewed from behind, projecting into the excavated a pilose bilobed structure. Clasper (Fig. 4C) with a short thick basal portion which is expanded on both sides distally into membranous extensions, the upper one hooked dorsally. Aedeagus (Fig. 4A-B) with phallosoma mediumly sclerotized and provided with a short membranous thecal shield. First gonocoxae of female with posterior margins somewhat concave, top of ninth paratergites slightly reflexed.

Length: (holotype) 19·2, (allotype) 21·7, (range paratypes) 17·2-20·9 mm.

Width: (holotype) 11·2, (allotype) 12·7, (range paratypes) 10·4-12·3 mm.

Types: All from Wau, Morobe District, Northeast New Guinea and unless otherwise stated at 1 200 m altitude, in M.V. light trap and collected J. Sedlacek—HOLOTYPE ♂, 11-12 Apr. 1964, J. & M. Sedlacek; ALLOTYPE ♀, 1 250 m, 9 Jan. 1963; PARATYPES 2 ♀, 200 m, 25 Mar. 1956, Gressitt & Willies, 2 ♀, 1-20 Nov. 1961; ♀, 9 Apr. 1964; ♀, on Coviak Ridge, 763 m, 7 Dec. 1963, H. C.; ♂, 5-13 Mar. 1964; ♂ & ♀, 14-24 Mar. 1964; ♀, Mount Missim, 1 150 m (not at light); ♂ & 5 ♀, 3-7 Apr. 1964; ♀, 11-12 Apr. 1964, J. & M. Sedlacek; ♀, 15 Apr.-15 May 1964, M. Sedlacek; ♂, Hospital Creek, Feb. 1965, J. & M. Sedlacek; ♂, Hospital Creek, 17 Feb. 1965, in Malaise trap; 1 ♂ & 2 ♀, Hospital Creek, 7 Mar. 1965, J. & M. Sedlacek. All in BISHOP.

Other specimens examined: NORTHEAST NEW GUINEA Fermin (3 BISHOP), Mt. Missim (1 BISHOP), Mokai in Torricelli Mts. (3 BISHOP), Pindiu in Huon Peninsula (1 BISHOP). PAPUA Agenehambo near Popondetta (2 SAM), Kiunga on Fly River (9 BISHOP). IRAN JAYA Humboldt Bay District (4 BMNH), Tor River mouth—4 km E. of Hollandia (Kota Raya) (3 BISHOP), Waris—S. of Hollandia (5 BISHOP), Ifar-Cyclops Mts. (1 BISHOP), Mt. Sabron—Cyclops Mts. (7 BMNH), Bewani Mts. (1 BMNH), Urupuru—Wissel Lakes (1 BISHOP), Sabil Valley—Star Mts. (1 BISHOP). WAIGEU Camp Nok (8 BMNH). WOODLARK (MURUA) Kalumadau Hill (2 BISHOP). NEW HEBRIDES Vila—Efate (2 SAM).

Remarks: The Woodlark specimens are darker than those from the other localities and the New Hebrides specimens have the green iridescent areas on the pronotum strongly developed along the antero lateral margins and the lateral angles are more shortly spined. The New Hebrides and Woodlark specimens may represent two further new species but unfortunately both specimens of each form are female so the shapes of the male claspers remain unknown, the colour patterns and measurements are, however, consistent with *umbivivens*.

Prytanicoris dimorpha sp.nov.

Fig. 4D, 5A

Ground colour yellowish-orange with numerous brown punctations and areas of dense blackish-green iridescent punctations making the animal appear brown macroscopically. Females markedly larger than males.

Punctations on juga sparse interiorly, exteriorly dense and darker and concentrated into a sublateral line. Interiorly of each eye a glabrous patch and head laterally behind eyes glabrous, interiorly of each glabrous patch two lines of concentrated punctations running forward from ocelli, the outer one frequently turning outward apically to join line on juga, behind ocelli fused to base of head and sending an oblique branch to interior of eye. Length of male antennal segments in millimetres—holotype first, paratype in brackets—I 1·0 (1·0), II 1·7 (1·6), III 2·8 (2·6), IV 3·8 (3·6), V missing; length of female antennal segments—allotype first, paratype in brackets—I 1·1 (1·0), II 1·7 (1·6), III 2·9 (2·9), IV missing (3·6), V missing. First and third antennal segments yellowish with brown maculations, first dark exteriorly, third darkened apically; second sometimes brown, sometimes yellow maculated with brown; third brown but paler basally.

Pronotum with anterior angles produced into a small, blunt, reflexed tooth, behind this anterolateral margins vaguely crenulate anteriorly and straight posteriorly, terminating in a blunt short conical process just before true anterolateral angles. Lateral angles obtusely rounded, posterolateral margins vaguely sinuate and posterior margin nearly straight. On disc of pronotum a small low tumescence just interior of each lateral angle, punctations mostly discrete but aligned in a rather vermiculate pattern, around each callus and sublaterally an interrupted line of dense iridescent darker punctations.

Scutellum and coriaceous portions of hemelytra marked as for hind portion of pronotum. Sometimes a reddish diffusion posteriorly on latter. Membrane fumose hyaline with brown veins.

Dorsum of abdomen not seen but laterotergites yellowish with a dark rugulose patch anteriorly and posteriorly on each.

Head beneath yellowish and finely, sparsely and almost concolorously punctate. Running forward from each eye to over and before each antennifer a black streak, another dark streak in front of this but more exteriorly under each jugum. Labrum and labium yellowish but latter ventrally and apically black. Thoracic pleura finely and sparsely dark punctate, anteriorly or propleuron a T-shaped mark of dense iridescent punctations with the head of the T near the anterior margin, on mesopleuron a small triangular patch of similar punctations on disc and on metapleura a not so well developed oblique bar exteriorly of evaporative area, a short iridescent-dark line exteriorly in anterior half. Legs normal and yellowish, femora speckled with brown except at base, tibiate more finely speckled and sometimes darkened apically, claws black in apical halves.

Abdomen yellowish, spiracles black. Hind margin of pygophore deeply and triangularly excavated, lateral lobes truncate apically, their transverse axes at the truncation directed obliquely inwards. In the anterior notch of the excavation semicircularly excised behind this a black macula and directed obliquely posteriorly from the notch and macula a groove. Clasper Fig. 4D similar to that of *ambivivens* but there is no thickened portion dividing the membranous apical portion into two, the ventral extension of the membranous expansion is triangular in shape and the upper portion is hooked apically, not dorsally.

Length: (holotype) 15·6, (allotype) 17·7, (male and female paratypes) 15·6 and 18·7 mm.

Width: (holotype) 8·5, (allot type) 10·3, (male and female paratypes) 8·8 and 10·1 mm.

Types: Holotype ♂, IRIAN JAYA, Waris S. of Kota Raya (= Hollandia), 450-500 m, 24-31 Aug. 1959, T. C. Maa; allotype and paratype ♀♀, PAPUA, Owen Stanley Range, Goilala—Loloipa, 1-15 Feb. 1958, W. W. Brandt; paratype ♂, same data as allotype except date 21-31 Dec. 1957. All in BISHOP.

Prytanicoris novaebrittaniae sp.nov.

Fig. 4E, 5B

Very similarly marked to *P. dimorpha* but males significantly larger (length 17·1 to 15·6 mm). As the unique type is male it is not known whether there is a marked size difference between the sexes. The following characters differ. The four basal antennal segments are yellow with only a faint suggestion of darker maculations, there is a dark subapical annulus on the third (fifth missing). Lengths antennal segments (holotype)—I 0·9, II 1·6, III 2·6, IV 3·7, V ?. On the disc of head behind base of anteclypeus there are six, not four distinct longitudinal rows of punctations. The coriaceous parts of hemelytra are reddish-orange all over with the punctations, except on clavus, very little darker. Head beneath almost glabrous with a line of fine punctations along bucculae. Lateral lobes of pygophore with a small tooth at the ventral end of the truncate lateral lobes. Clasper Fig. 4E very similar to *dimorpha* with the upper membranous extension hooked apically but with a medial thickened longitudinal portion so that there are upper and lower laminate sections.

Length: 17·1 mm.

Width: 9·9 mm.

Type: Holotype ♂, NEW BRITAIN, Keravat, 30 m, 4 Apr. 1956, in light trap, J. L. Gressitt, in BISHOP.

Prytanicoris solomonensis nov.sp.

Fig. 5C

Much darker in appearance than the preceding species (except the Woodlark specimens of *ambivivens*) and with lateral angles of pronotum bluntly rectangular. Ground colour yellow with numerous shining piceous punctations.

Punctations on juga absent along extreme margin and sparse interiorly, on disc of juga forming a dense piceous bar. Between eyes six lines of punctations, the inner four parallel, the outer two curved in front of ocelli and oblique behind ocelli, these joined by a cross branch to outer of straight lines. Length of antennal segments—I 1·1, II 1·9, III 2·9, IV & V missing. First antennal segment pale basally and brown apically, exteriorly this brown more extensive than interiorly; second and third segments yellowish-brown with faint brown maculations, third infuscated apically.

Pronotum with anterior margin obliquely thickened behind eyes and anterior angles produced into a small, blunt tooth; behind this anterolateral margins entire and straight, terminating as a right angle just before true lateral angles. Latter obtusely rounded, posterolateral margins faintly concave and posterior margin straight. On disc of pronotum a small tumescence just interior of each lateral angle, punctations piceous and mostly surrounded by a brown ring, many of the punctations arranged in vaguely transverse rows with the brown rings coalescing to form brown lines, calli piceous.

Scutellum and coriaceous portions of hemelytra marked like disc of pronotum but punctations in apex of former small, sparse and not ringed with a brown annulus, and on hemelytra the dark lines more irregularly disposed. Membrane fumose hyaline with concolorous veins.

Dorsum of abdomen not seen, laterotergites blackish with a large orange spot on lateral margin of each (not reaching incisures), strongly punctate, punctations in black areas black and in orange areas orange.

Head beneath yellow, smooth except for a few punctations along base of bucculae and immediately in front of antennifers. Behind eye

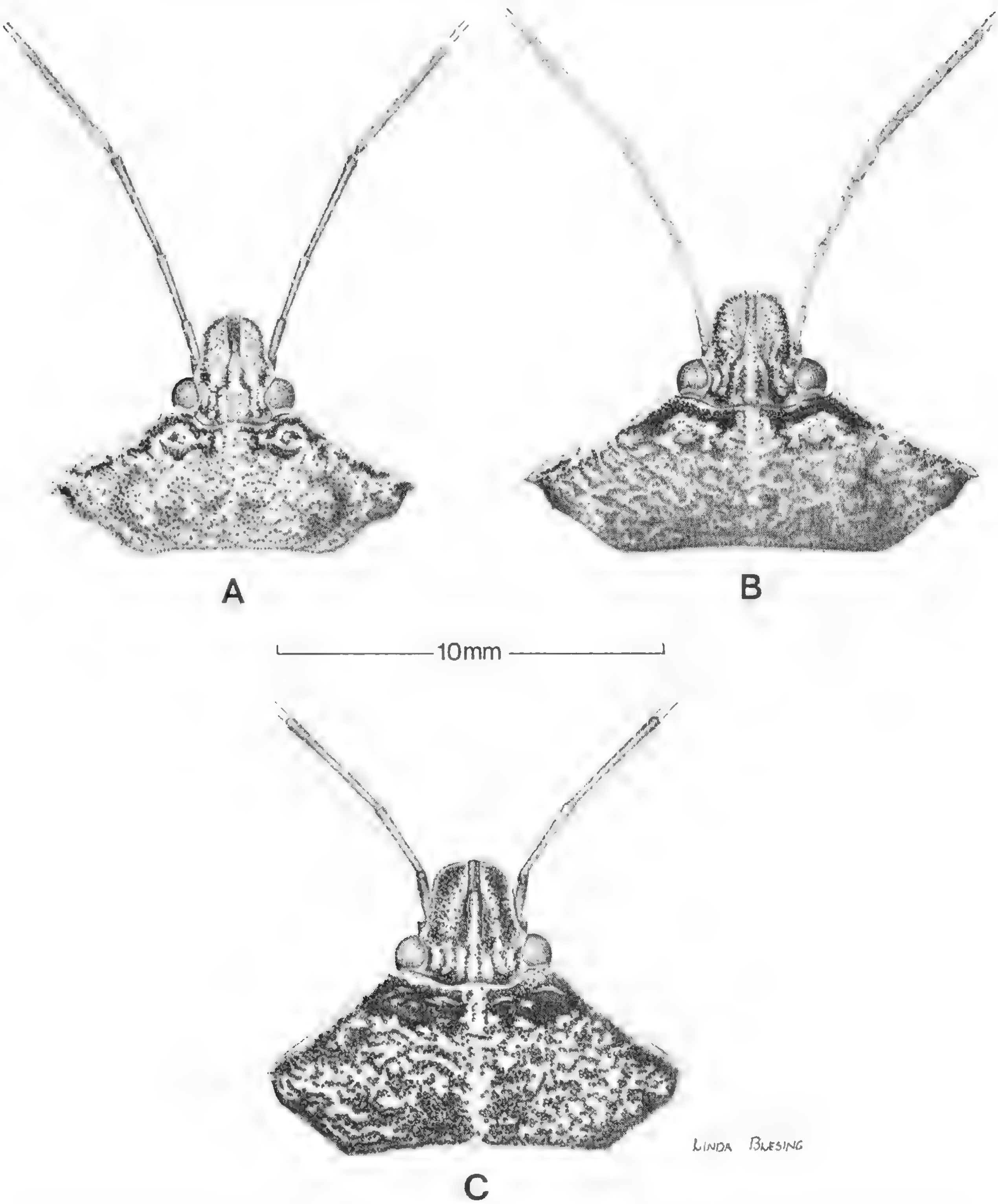

FIG. 5. A. Dorsal aspect of anterior portion of *Prytanicoris dimorpha* sp.nov. B. Dorsal aspect of anterior portion *Prytanicoris novaebrittaniae* sp.nov. C. Dorsal aspect of anterior portion of *Prytanicoris solomonensis* sp.nov.

narrowly brown, in front of eye a brown bar passing forward over antennifer and tapering to end about half way to apex of head, on underside of juga a brown bar and in front of antennifer a diffuse brown patch. Labrum and labium yellowish but both ventrally black, stylets and apical segment of labium also black. Thoracic pleura yellowish and sparsely punctate except posteriorly on propleuron where punctations are coarser. On disc of propleuron a large, greenish, iridescent, vaguely rectangular marking; on mesopleuron a brown to piceous patch at apex of coxal cleft and another on disc nearer anterior margin than posterior; metapleuron darkened on evaporative area and behind and exteriorly of latter. Legs yellowish brown, femora faintly speckled with brown, tibiae darkened on either side of sulcus, tarsi darkened dorsally and laterally, claws dark in apical halves.

Abdomen yellowish, spiracles and a brown longitudinal band passing just below them brown, a short brown bar posteriorly in centre of segment VII. First gonocoxae mostly piceous along with interior halves of eighth paratergites.

Width: 9.9 mm.

Type: Holotype ♀, SOLOMON ISLAND, Bougainville (S.), Mosigata, 25 m, 3 May 1956, E. J. Ford Jr., in BISHOP.

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RECORDS OF THE SOUTH AUSTRALIAN MUSEUM

THE TRIBE HYALOPEPLINI OF THE WORLD (HEMIPTERA: MIRIDAE)

By JOSÉ C. M. CARVALHO

THE AUSTRALIAN FAUNA
In collaboration with GORDON F. GROSS

SOUTH AUSTRALIAN MUSEUM
North Terrace, Adelaide
South Australia 5000

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Summary

The present paper comprises a monographic revision of the tribe Hyalopeplini (Hemiptera: Miridae, Mirinae) with descriptions of new genera and new species.

THE TRIBE HYALOPEPLINI OF THE WORLD (HEMIPTERA:MIRIDAE)

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(With 292 text-figures)

ABSTRACT

CARVALHO, José C. M. The Tribe Hyalopeplini of the World (Hemiptera:Miridae). The Australian Fauna in collaboration with Gordon F. Gross. *Rec. S. Aust. Mus.* **17**(30): 429-531.

The present paper comprises a monographic revision of the tribe Hyalopeplini (Hemiptera:Miridae, Mirinae) with descriptions of new genera and new species. The taxa included and described are, in order: *AUSTROHYALOMA* Carvalho & Gross n.gen.—*A. collessi* Carvalho & Gross n.sp., North Queensland; *CHRYSORRHANIS* Kirkaldy—*C. daphne* Kirkaldy, Pulo Laut, Sumatra, Larat, Borneo; *C. hyalinus* (Usinger) *n.comb.*, Saipan; *C. lineatus* Carvalho n.sp., West Irian, Larat, Hainan; *CORIZIDOLON* Reuter—*C. australiense* Carvalho & Gross n.sp., Australia; *C. dexlineatum* Dellatre, Ivory Coast; *C. notaticolle* Reuter, Mauritius; *GUIANERIUS* Distant—*G. typicus* Distant, Borneo, Philippine Is.; *GUISARDINUS* n.gen.—*G. neoguineanus* Carvalho n.sp., New Guinea; *G. solomonicus* Carvalho n.sp., Solomon Is.; which is compared with *Argenis incisuratus* (Walker), a convergent member of the Mirini from Sri Lanka; *GUISARDUS* Distant—*G. bogorensis* Carvalho n.sp., Java; *G. chinensis* Carvalho n.sp., South China; *G. cristovalensis* Carvalho n.sp., Solomon Is.; *G. fasciatus* Carvalho n.sp., Solomon Is.; *G. pellucidus* Distant, Java Malacca, Tenasserin, Burma, Vietnam, Laos; *G. strigicollis* Poppius, Mentawei, New Guinea; *HYALOPEPLINUS* n.gen.—*H. antennalis* (Distant) *n.comb.*, New Caledonia, Loyalty Is.; *H. cairnsensis* Carvalho & Gross n.sp., Queensland; *H. cristovalensis* Carvalho n.sp., Solomon Is.; *H. fijiensis* Carvalho & Gross n.sp., Fiji; *H. malayensis* Carvalho n.sp., Laos, Sumatra, Sri-Lanka, Malay Peninsula; *H. papuensis* Carvalho n.sp., Papua-New Guinea; *H. philippinensis* Carvalho n.sp., Philippine Is.; *H. samoanus* (Knight) n.comb., Samoa; *H. solomonensis* Carvalho n.sp., Solomon Is.; *HYALOPEPLOIDES* Poppius, *H. alienus* Carvalho & Gross n.sp, Queensland; *H. australiensis* Carvalho & Gross n.sp., Queensland; *H. borneensis* Carvalho n.sp., Borneo; *H. cyanescens* Poppius, New Guinea; *H. fasciatus* Carvalho n.sp., Java; *H. maculatus* Carvalho n.sp., New Guinea; *H. neoguineanus* Carvalho n.sp., New Guinea; *H. ochraceus* Carvalho n.sp., New Guinea; *H. queenslandensis* Carvalho & Gross n.sp., Queensland; *H. rubrinoides* Carvalho n.sp., New Britain; Bismark Archipelago; *H. rubriniscus* Carvalho n.sp., New Ireland; *H. similaris* Carvalho n.sp., Solomon Is.; *H. trinotatus* Carvalho n.sp., New Ireland: *HYALOPEPLUS* Stål and *ADHYALOPEPLUS* n.subgen.—*HYALOPEPLUS (HYALOPEPLUS) aneityumensis* Carvalho n.sp., Aneityum I.; *H.(H.) clavatus* Distant, Bangladesh; *H.(H.) grandis* Carvalho n.sp., Philippine Is.; *H.(H.) guamensis* Usinger, Guam I.; *H.(H.) hebridensis* Carvalho n.sp., New Hebrides; *H.(H.) kandanensis* Carvalho n.sp., New Ireland, Solomon I.; *H.(H.) malayensis* Carvalho n.sp., Malaya; *H.(H.) marquesanus* Carvalho n.sp., Marquesas Is.; *H.(H.) nigrifrons* (Hsiao) *n.comb.*, Philippines, Indonesia, New Guinea; *H.(H.) nigroscutellatus* Carvalho n.sp., New Guinea, Philippine Is.; *H.(H.) rama* (Kirby), Sri Lanka, Sumatra, Philippines, Borneo, Java,

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10th September, 1979

Malaya; *H.(H.) rubroclavatus* Carvalho n.sp., Queensland, West Irian; *H.(H.) rubrojugatus* Carvalho n.sp., New Guinea; *H.(H.) smaragdinus* Roepke, Java. Borneo; *H.(H.) spinosus* Distant, Vietnam, Assam; *H.(H.) tongaensis* Carvalho n.sp., Tonga I., Fiji; *H.(H.) tutuilaensis* Carvalho n.sp., American Samoa; *H.(H.) vitripennis* (Stål), Java, Sumatra, Borneo, Sarawak, Philippine Is., Malaya, Palau Is., Solomon Is., Moluccas, Mariana Is., New Hebrides, Babelthaup Is., New Britain, Papua New Guinea, Bismark Archipelago, Queensland, Singapore, Indo-China, Sumatra, Vietnam, Laos; *H. HYALOPEPLUS (ADHYALOPEPLUS)* n.subgen.—*H. (A.) cuneatus* Carvalho n.sp., New Guinea; *H. (A.) loriae* Poppius, New Guinea, Queensland, New South Wales; *H.(A.) madagascariensis* Carvalho n.sp., Madagascar; *H.(A.) pellucidus* (Stål), Hawaiian Is., Marquesas Is.; *H.(A.) samoanus* Knight, Samoa; *H.(A.) similis* Poppius, New Guinea, Malaya, India, Australia, Timor, Solomon Is., Philippines Is., New Britain, Borneo, Africa; *HYALOPLICTUS* n.gen.—*H. minor* n.sp., Solomon Is.; *H. solomonicus* Carvalho n.sp., Solomon Is.; *ISABEL* Kirkaldy—*I. ravana* (Kirby), Sri Lanka, Sumatra, Philippines, Burma, Formosa, South China, New Guinea; *KOSMIOMIRIS* Kirkaldy—*K. rubroornatus* Kirkaldy, Borneo, Malaya, Philippines, Thailand; *MACROLONIUS* Stål—*M. schenklingi* Poppius, Formosa; *M. sobrinus* (Stål), Borneo, Sumatra, Malaya, Singapore; *M. superbus* Distant, Burma; *ONOMAUS* Distant—*O. elegans* Poppius, Burma; *O. lautus* (Uhler), Japan; *O. pompeus* Distant, Burma; *RAMBEA* Poppius—*R. annulicornis* Hsiao, Philippine Is.; *R. gracilipes* Poppius, Sumatra; *R. malasica* Carvalho n.sp., Malaya.

A list of genera and lists of species are included, together with keys to genera, subgenera and species. Each species is illustrated in full dorsal view and where possible also their external morphology and male genitalia. A neotype is designated for *Capsus vitripennis* Stål. The genera *Macrolonidea* Hsiao and *Euhyalopeplus* Hsiao are relegated to the synonymy of *Chrysorrhanis* Kirkaldy and *Guisardus* Distant respectively. The following species names have been relegated to synonyms:—*Macrolonidea cyanescens* Hsiao (of *Chrysorrhanis daphne* Kirkaldy); *Guianerius palliditarsis* Poppius (of *G. typicus* Distant); *Hyalopeplus smaragdinus rubrinus* Roepke (of *H. rama* (Kirby)); *H. amboinae* Carvalho (of *H. vitripennis* (Stål)); *H. uncariae* Roepke (of *H. vitripennis* (Stål)); *H. bakeri* Poppius and *H. horvathi* Poppius (of *H. similis* Poppius); *H. krishna* Ballard (of *H. similis* Poppius); *Isabel beccarii* Poppius and *I. horvathi* Poppius (of *Isabel ravana* Distant); *Kosmiomiris modigliani* Poppius and *K. scutellaris* Poppius (of *K. rubroornatus* Kirkaldy).

The Australian and some of the Pacific Islands components of the tribe Hyalopeplini were written up in collaboration with Gordon F. Gross, Department of Entomology, The South Australian Museum, Adelaide. In the summary above and in the text which follows those new taxa on which we worked jointly are indicated by the use of both authors' names after the genus or species name.

CONTENTS

INTRODUCTION

This paper deals with the tribe Hyalopeplini (Hemiptera: Miridae) of the World and is based principally on collections assembled by the Bernice P. Bishop Museum, Honolulu, by the Wau Ecological Station, Papua New Guinea and by the British Museum of Natural History.

Type specimens and unnamed collections were also provided through the courtesy of the Zoological University Museum, Helsinki; Riksmuseum of Natural History, Stockholm; Natural History Museum, Leiden; National Natural History Museum, Budapest; American Museum of Natural History, New York; South Australian Museum, Adelaide; Australian National Insect Collection, Canberra; Department of Entomology, University of Queensland, Brisbane and by other museums or organisations, as mentioned in the text. Holotypes and other type categories are deposited in the various collections named after the descriptions.

The author wishes to acknowledge his grateful thanks to Doctors J. L. Gressitt and Wayne C. Gagné, who provided most of the material for this study and to express his appreciation to his colleagues W. R. Dolling (London); M. Meinander (Helsinki); R. C. Froeschner (Washington); I. Persson (Stockholm); T. Vásárhelyi (Budapest); P. Doesburg Jr. (Leyden); R. T. Schuh (New York); G. F. Gross (Adelaide); D. F. Waterhouse (Canberra) and T. E. Woodward (Brisbane), for the loan of material.

The greater part of work was undertaken at the National Museum, Rio de Janeiro. Most of the illustrations were made there under the author's supervision by Paulo Wallerstein, Luiz Antonio Alves Costa and Paulo Roberto Nascimento.

The Australian and some Pacific Islands material was studied jointly with my colleague Gordon F. Gross and joint authorship of new taxa is indicated in the appropriate places. Mr. Gross also kindly went through the whole manuscript and corrected the English wherever an unidiomatic or awkward expression had crept in. He also illustrated several of the Australian species.

The following abbreviations for collections have been used

AMNH—	The American Museum of Natural History, New York.
ANIC—	The Australian National Insect Collection, Canberra.
BISHOP—	The Bernice P. Bishop Museum, Honolulu.
BMNH—	The British Museum (Natural History), London.
BUDAPEST—	Természettudományi Múzeum, Budapest.
HELSINKI—	Zoological Museum, University of Helsinki.
LEIDEN—	Rijksmuseum van Natuurlijke Historie, Leiden.
QU—	University of Queensland, Brisbane.
SAM—	The South Australian Museum, Adelaide.
STOCKHOLM—	Naturhistoriska Riksmuseum, Stockholm.
USNM—	United States National Museum, Washington.

TRIBE HYALOPEPLINI CARVALHO, 1952

Hyalopeplini Carvalho, 1951, p. 133; Carvalho, 1952, p. 38; Carvalho, 1955, p. 14; Carvalho, 1959, p. 317

This tribe was erected to include a group of genera within the subfamily Mirinae with hemelytra glassy and transparent, without or with incomplete nervures, allowing the membranous wings and abdomen to be distinctly seen from above.

The great majority of species are found in the Pacific region and show several characters in common, such as the pronotum and scutellum totally or partially rugose, rugose-punctate or coarsely punctate only; hemelytra vitreous, if not entirely then at least corium distinctly transparent, but usually the whole upper wing is transparent though the cuneus and embolium or even the clavus may be opaque in some specimens, in this case with some sparse hairs.

Type genus: Hyalopeplus Stål, 1870.

In previous works the genera *Iridopeplus* Bergroth, 1910 from South America and *Moroca* Poppius, 1912 from Papua-New Guinea were included in this tribe. In the present revision, however, these genera are excluded and transferred to the tribe Mirini Hahn, 1831, since they show a complete neuration on the corium and the opaque portions of hemelytra are due to structure and not to colour. *Pleurochilophorus* Reuter, 1905 from Africa was also recently studied by the author and found to have a complete neuration on the hemelytra, a character which excludes it from the tribe.

In this revision 15 genera are recognised as belonging to the tribe. Two formerly recognised genera: *Macrolonidea* Hsiao, 1944 and *Euhyalopeplus* Hsiao, 1944 are considered to be synonyms of earlier described genera and four new genera are described: *Hyaloplictus* n.gen., *Hyalopeplinus* n.gen., *Guisardinus* n.gen. and *Austrohyaloma* n.gen. The genus *Hyalopeplus* Stål, 1870 is subdivided into two subgenera: *Hyalopeplus* Stål and *Adhyalopeplus* n.subgen., based mainly on the structure of the pronotum and shape of the spiculum of the vesica of aedeagus.

List of genera included presently in the tribe:

1. *Austrohyaloma* Carvalho and Gross n.gen.
2. *Chrysorrhanis* Kirkaldy, 1902
3. *Corizidolon* Reuter, 1907
4. *Guianerius* Distant, 1903
5. *Guisardinus* n.gen.
6. *Guidardus* Distant, 1904
7. *Hyalopeplinus* Carvalho and Gross n.gen.
8. *Hyalopeploides* Poppius, 1912
9. *Hyalopeplus* Stål, 1870
10. *Hyaloplictus* n.gen.
11. *Isabel* Distant, 1902
12. *Kosmiomiris* Kirkaldy, 1902
13. *Macrolonius* Stål, 1870
14. *Onomaus* Distant, 1904
15. *Rambea* Poppius, 1912

Key to the genera of *Hyalopeplini* Carvalho

1. Corium with radial nervule present only apically; segment I of antenna almost twice as long as width of head; membrane with two characteristic bent fasciae apically ..... *Isabel* Distant
   Corium without nervures or median nervure complete, segment I of antenna not almost twice as long as width of head, or if so then membrane without the two fasciae mentioned above 2

2. Pronotum distinct, deep and coarsely punctate, without traces of transverse rugosities (fig. 256) 3
   Pronotum smooth, distinctly rugose transversely or with punctures intermixed with rugosities or only very finely punctulate (figs. 158, 210, 276) 7

3. Collar smooth or with several faint oblique striations 4
   Collar punctate, rugose-punctate. Rugose or transversely striate, usually wide, with medial length approximately equal to half the width of eye 5

4. Rostrum reaching the 7th or 8th abdominal segment; eyes occupying the whole sides of head; lorum strongly prominent ..... *Kosmiomiris* Kirkaldy
   Rostrum reaching the middle coxae; eyes not occupying the whole side of head; lorum normal ..... *Austrohyaloma* Carvalho and Gross, n.gen.

5. Scutellum smooth or only sparsely punctate; segment I of antenna longer than width of head ..... *Chrysorrhanius* Kirkaldy
   Scutellum distinctly, densely and coarsely punctuate 6

6. Humeral angles globose; head rounded posteriorly, eyes prominent; segment I of antenna incrassate subbasally; small species ..... *Guisardinus* n.gen.
   Humeral angles not globose; head not rounded posteriorly, eyes not prominent; segment I of antenna narrowed towards base; large species ..... *Macrolonius* Stål

7. Pronotum beset with numerous short dark bristles; first antennal segment narrowed at apical third (incrassate subbasally and at extreme apex) ..... *Corizidolon* Reuter
   Pronotum without short black bristles; first antennal segment not noticeably narrowed at apical third 8

8. Pronotum noticeably narrowed anteriorly, collar very wide, its mesal length greater than thickness of segment I of antenna which is bent outwards; cuneus more than twice as long as wide at base ..... *Hyaloplictus* n.gen.
   Pronotum not noticeably narrowed anteriorly or if so collar not very wide, its mesal length equal to, or less than, thickness of segment I of antenna; cuneus shorter 9

9. Pronotum and scutellum smooth (including collar) or only very finely punctulate; segment I of antenna longer than width of head (fig. 276) 10
   Pronotum and scutellum distinctly rugose, at least on median portion, with black longitudinal fasciae or spots, or when this is not the case, segment I of antenna about as long as or shorter than width of head (fig. 41, 75) 12

10. Eyes contiguous with collar; pronotum not constricted in front, strongly convex, calli obsolete; segment II of antenna slightly incrassate towards apex (fig. 23) ..... *Guianerius* Distant
    Eyes placed at middle of head; pronotum noticeably constricted anteriorly; calli prominent; segment II of antennae linear (fig. 289) 11

11. Cuneus long, more than twice as long as wide at base; body erectly pilose, mostly on scutellum; pubescence of hind tibiae shorter than width of segment; species pale yellow and brown or castaneous ..... *Onomaus* Distant
    Cuneus short, less than twice as long as wide at base; body long and erectly pilose on pronotum and scutellum; pubescence of hind tibiae erect, as long as or longer than width of segment (fig. 288) ..... *Rambea* Poppius

12. Head wide, rounded posteriorly, about three times wider than long, segment I of antenna incrassate subbasally; disc of pronotum coarsely rugose, humeral angles globose (fig. 41) ..... *Guisardus* Distant
    Head only about twice as long as wide, not rounded posteriorly; segment I of antenna narrower basally; if disc of pronotum rugose then humeral angles not globose 13

13. Rugosities of pronotum present only on the black fasciae or spot of disc and scutellum; segment I of antenna very short, about as long as half the width of vertex; cuneus transparent, ochraceous, pale yellow or hyaline ..... *Hyalopeplinus* n.gen.
    Rugosities of pronotum present on the whole surface of disc intermixed with punctures not, or present only on two anterior thirds of disc; segment I of antenna about as long as width of head or if shorter, always longer half the width of vertex; cuneus usually opaque 14

14. Rugosities of pronotum occupying only the anterior two thirds, portion before hind margin finely punctate (fig. 98, 112, 113); disc noticeably constricted anteriorly, calli prominent, humeral angles rounded ..... *Hyalopeploides* Poppius
    Rugosities of pronotum occupying the whole surface, including portion before hind margin, anterior margin of disc not noticeably constricted, calli not prominent; humeral angles usually spinously produced outwards (fig. 75, 181) ..... *Hyalopeplus* Stål

Austrohyaloma Carvalho and Gross, n.gen.

Type-species: Austrohyaloma collessi Carvalho and Gross, n.sp.

Body elongate and glabrous above. Head distinctly wider than long and virtually without a collum, in front of eyes inclined vertically, clypeus not visible from above; frons obliquely striate, projecting between antennal peduncles and broadly rounded; vertex not carinate posteriorly and with a faint longitudinal sulcus on disc between eyes. Eyes widely separated dorsally, semistylate; laterally elliptical but not reaching base of head. In lateral view clypeus not very prominent and feebly arched; gena and gula separated by a strong oblique fossa almost reaching antennal peduncle. Bucculae short but prominent and semicircular. Antennae cylindrical and long and slender, first segment as long as head and noticeably incrassated at base, second segment pilose and about twice as long as first. Rostrum reaching to middle coxae, first segment incrassated and surpassing base of head.

Pronotum with a strong collar which is not punctate but has several faint, oblique striolations, calli prominent and glabrous and behind calli strongly and reticulately punctate; lateral margins obtusely convex in region of calli, behind this nearly straight, lateral angles broadly rounded, posterior margin almost straight. Disc elevated posteriorly and sloping to region of calli and collar. Mesoscutum exposed, striolate laterally but glabrous medially. Scutellum slightly swollen and smooth, lateral margins crenulate.

Hemelytra nearly vitreous except for exocorium, clavus and cuneus which are more opaque. Underside of body with propleura punctate, mesosternum vaguely convex and medially divided, mesopleura with oblique striations and orifice of scent gland without a peritreme. All coxae relatively long, anterior pair nearly contiguous, rest of legs normal. Abdomen tapering, reaching about half length of cuneus.

Remarks: This genus is characterised by the portion of pronotum behind calli and scutellum being densely and reticulately punctate but punctations on pronotum absent from collar and calli.

Austrohyaloma appears to be most closely related to *Guisardinus* n.gen. from which it differs in having the pronotal collar almost smooth, though there are in fact three oblique striations on each side to be seen under good lighting, in having the hind margin of the pronotum not bisinuate, the scutellum not punctate and the median vein reaching the hind margin of corium. It also approaches *Kosmiomiris* Kirkaldy, 1902 which has also a smooth collar by the much shorter rostrum, by the eyes not occupying the whole side of head, and being much smaller in size.

Austrohyaloma collessi Carvalho and Gross, n.sp.

(Figs. 1-2)

Characterised by its colour and dimensions.

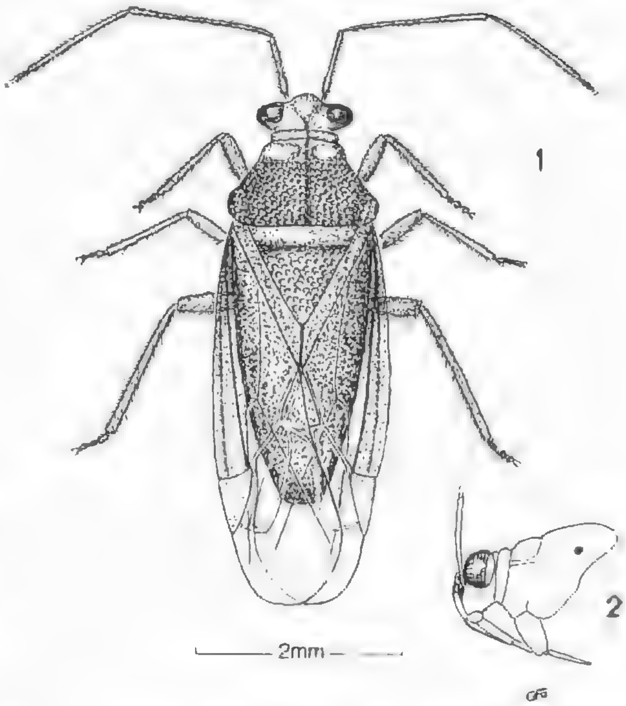
Female: Length 5·3 mm, width 1·6 mm. *Head:* Length 0·8 mm, width 1·0 mm, vertex 0·42 mm. *Antenna:* Segment I, length 0·8 mm, II, 1·6 mm; III, 1·1 mm; IV, missing. *Pronotum:* Length 1·2 mm, width at base 1·6 mm. *Cuneus:* Length 0·86 mm, width at base 0·36 mm.

General coloration light brownish yellow with a faint greenish tinge; antennae and eyes brown; disc of pronotum with a thin median longitudinal brown line and on margin of lateral angles and on posterior lateral margin of collar a blackish-brown spot. Beneath rostrum brown, rest concolorous.

Glabrous above, appendages with a fine very short and recumbent pilosity, on tibiae and tarsi mixed with long, fine erect hairs. First antennal segment swollen near base.

Underside of body sparsely and shortly pilose.

Male: Unknown.



Figs. 1-2—*Austrohyaloma collessi* Carlvalho & Gross, n.sp.: fig. 1-Female, holotype; Idem, fig. 2-Lateral view of head and pronotum.

Holotype: female, NORTH QUEENSLAND: 16 km (10 mi) S of Daintree, 25.iv.1967, D. H. Colless (ANIC).

Chrysorrhanis Kirkaldy, 1902

Chrysorrhanis Kirkaldy, 1902, p. 226; Poppius, 1912, p. 439; Carvalho, 1959, p. 318.

Macrolonidea Hsiao, 1944, p. 372, (new synonymy); Carvalho, 1955, p. 106; Carvalho, 1959, p. 322.

Type-species: Chrysorrhanis daphne Kirkaldy, 1902.

Body elongate; pronotum, including collar, strongly and deeply punctate, hemelytra hyaline, pubescence very short. Head wider than long, vertex short and longitudinally sulcate, immarginate, about as wide as one eye when seen from above; eyes slightly removed from anterior margin of pronotum; rostrum reaching base of intermediate coxae. Antenna linear, longer than body, segment I about as long as pronotum, segment II about twice as long as I.

Pronotum coarsely and deeply punctuate, posterior lobe strongly convex, lateral margins rounded, collar wide, punctate, calli small; mesoscutum concealed; scutellum smooth, prominent, crenulate along lateral margins, apex acute.

Hemelytra hyaline, embolium slightly sinuate at middle, clavocorial and embolio-corial sutures with punctures, cuneus slightly longer than wide at base, membrane bicellulate. Propleura punctate, ostiolar peritreme large, femora thickened before apex, tibiae minutely and sparingly spinulose, parempodia convergent at apex.

Differs from *Macrolonius* Stål, 1870 by the smooth scutellum and by the much smaller size.

Key to the species of the genus *Chrysorrhanis*:

1. Apical portion of hind femora enlarged, black; size larger, about 5 mm long . . . . *daphne* Kirkaldy
   Apical portion of hind femora not enlarged, pale yellow; size smaller 2
2. Corium with a transverse dark fascia level with apex of clavus . . . . *lineatus* n.sp.
   Corium unicolorous, pale yellow to ochraceous *hyalinus* Usinger

Chrysorrhanis daphne Kirkaldy, 1902

Chrysorrhanis daphne Kirkaldy, 1902a, p. 226; Poppius, 1912a, p. 440; Carvalho, 1959, p. 318.

Macrolonidea cyanescens Hsiao, 1944, p. 372, fig.; Carvalho, 1959, p. 322 (new synonymy).

(Figs. 3-7)

Characterised by the punctation of the body and by its colour.

Male: Length 5·2-5·9 mm, width 1·6 mm. *Head:* Length 0·4 mm, width 0·8-0·9 mm, vertex 0·28-0·30 mm. *Antenna:* segment I, length 1·0-1·2 mm; II, 2·2-2·6 mm; III, 1·7 mm; IV, 0·7 mm. *Pronotum:* Length 1·2 mm, width at base 1·4 mm. *Cuneus:* Length 0·56 mm, width at base 0·40 mm.

General coloration flavous with dark brown markings; segments II-IV of antenna dark brown, pronotum with collar laterally, calli, humeral angles and two elongate spots or a single spot in the middle of disc posteriorly, base and apex of scutellum, dark brown. Hemelytra hyaline, extreme margin of embolium, apex of corium and cuneus, veins of membrane, dark brown. Metapleura, apex of abdomen, apex of anterior tibia, apical fourth of posterior femora and third tarsal segments fuscous to black.

Morphological characters as indicated for genus.

Genitalia: Penis (fig. 4) with membranous lobes and no sclerotised spiculi. Left paramere (fig. 5) falciform, pointed, with dorsal setae. Right paramere (fig. 6-7) elongate, tapering to apex, with numerous dorsal setae.

Female: Length 5·6-6·4 mm, width 1·5-1·7 mm. *Head:* Length 0·4 mm, width 0·9 mm, vertex 0·72 mm. *Antenna:* Segment I, length 1·0-1·3 mm; II, 2·0-2·7 mm; III, 1·6 mm; IV, 0·7 mm. *Pronotum:* Length 1·3 mm, width at base 1·5 mm. *Cuneus:* Length 0·44 mm, width at base 0·36 mm. Similar to male in coloration and general aspect, slightly more robust.

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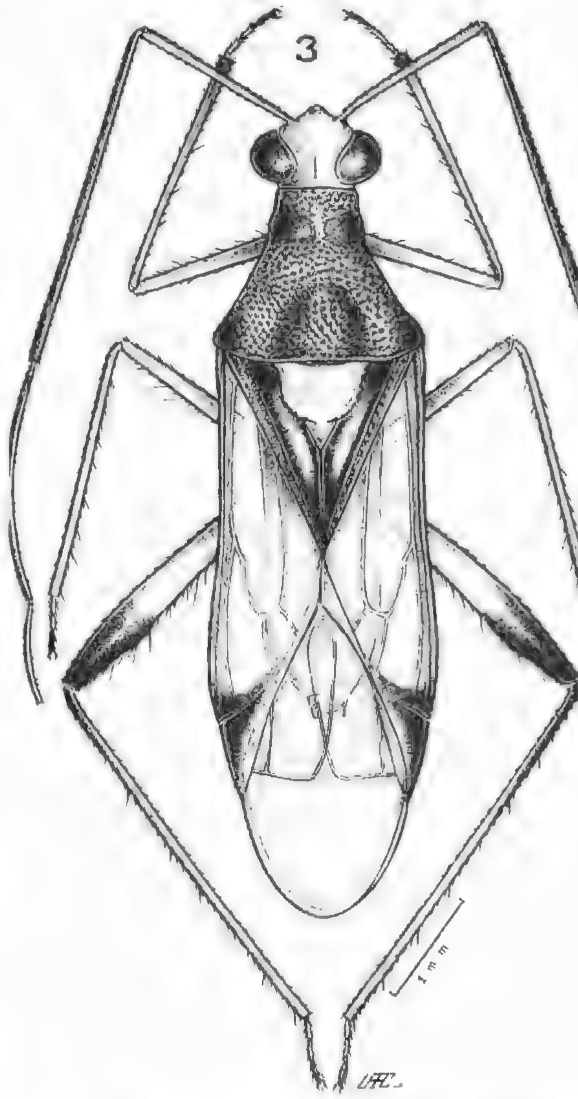


Fig. 3—*Macrolonidea cyanescens* Hsiao, male, holotype (=*Chrysorrhanis daphne* Kirkaldy.)

Geographical distribution: Borneo, Sumatra, Pulo Laut and Larat Islands.

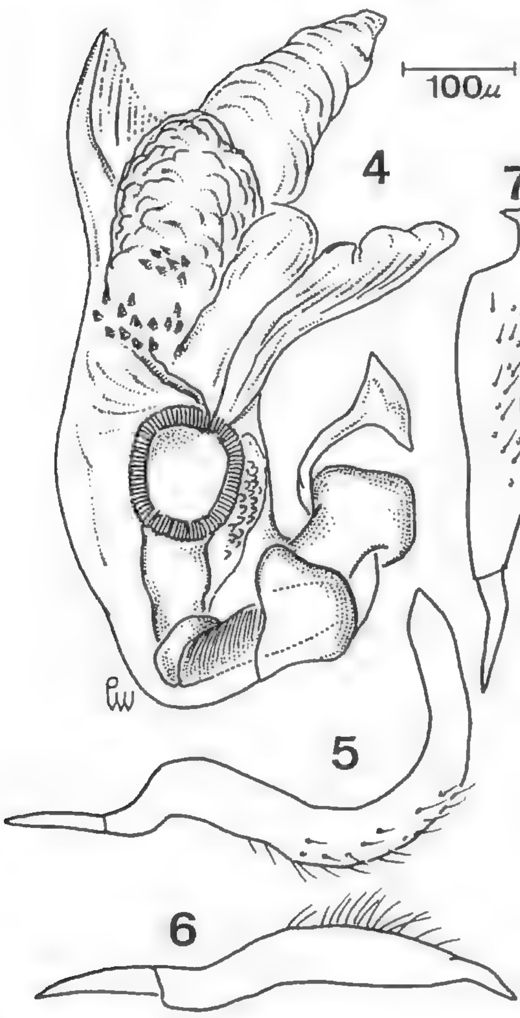
Types and specimens studied: female, holotype *Chrysorrhanis daphne*, INDONESIA: Pulo Laut, J. Gribode, Col. Kirkaldy, ex-col. Montandon (HELSINKI); female, Benkoelen, Mocreng Lima, Sumatra, (Mus. Paris, Col. Noualhier, 198); male, holotype *Macrolonidea cyanescens* Hsiao; one female, Larat (Tenimbar Is.), F. Muir, in the author's collection. EAST MALAYSIA: Sandakan, Baker, 15·759 (USNM).

Remarks: Differs from *Chrysorrhanis hyalinus* (Usinger, 1946) by its larger size, by the colour of pronotum and posterior femora.

Chrysorrhanis hyalinus (USINGER, 1946), *n.comb.*

Macrolonidea hyalinus Usinger, 1946, p. 60, fig.; Carvalho, 1956, p. 97, fig.; Carvalho 1959, p. 322.

(Figs. 8-10)



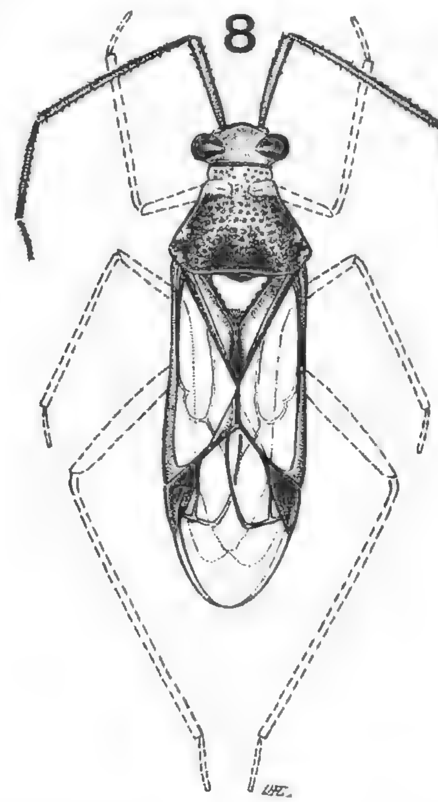
Figs. 4-7—*Chrysorrhanis daphne* Kirkaldy: Fig. 4—Penis; Fig. 5—Left paramere; Fig. 6, 7-Right paramere.

Characterised by the coloration of the pronotum and by the size of the body.

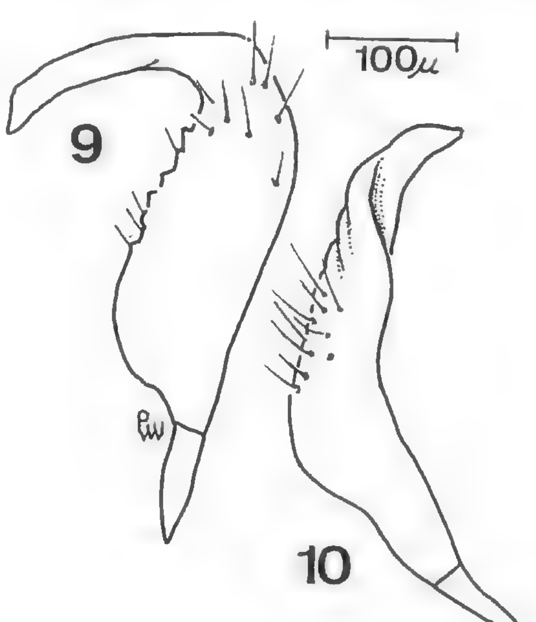
Male: Length 4·2 mm, width 1·2 mm. *Head:* Length 0·3 mm, width 0·8 mm, vertex 0·32 mm. *Antenna:* Segment I, Length 0·8 mm; II, 1·6 mm; III, 0·8 mm; IV, 0·4 mm. *Pronotum:* Length 1·0 mm, width at base 1·2 mm. *Cuneus:* Length 0·44 mm, width at base 0·28 mm.

General coloration ochraceous with fulvous on head anteriorly, eyes brown, apex of second antennal segment and terminal segments (except for narrow white base of third) dark brown; pronotum with humeral angles and a fascia on either side of middle near hind margin brown; scutellum yellow with black base (mesonotum), an ill-defined brown line along middle, and apex brown. Hemelytra clear, hyaline, the inner margin of clavus broadly dark brown to black, the outer punctate margin of clavus brown, corium pale along costal margin and narrowly at apex of clavus, elsewhere along inner margin and apical margin brown, cuneus dark brown at inner base, pale along outer margin, membrane clear. Underside of body mostly pale, brown at middle of abdomen, apex of rostrum and apices of tarsi brown.

Morphological characteristics as mentioned for genus; pronotum much less narrowed anteriorly than in *daphne* Kirkaldy, scutellum not rounded laterally.



Figs. 8-10—*Chrysorrhanis hyalinus* (Usinger): Fig. 8—Female holotype; Fig. 9—Left paramere; Fig. 10-Right paramere



Genitalia: Penis with membranous lobes and no sclerotised spiculi. Left paramere (fig. 9) curved, with enlarged basal portion and dorsal setae. Right paramere (Fig. 10) elongate, slender, with dorsal setae.

Female: Similar to male in coloration and general aspect. Length 4·6 mm, width 1·4 mm; vertex 0·30 mm; segment I of antenna 1·0 mm long.

Geographical distribution: MARIANA IS., Saipan, Tinian, Garapan.

Host plant: Paipay *(Guamia mariannae)*.

Specimens studied: females, Saipan, 1 to 2 miles east of Tanapag, Mar. 1944, Dybas col. beating vegetation.

Differs from *Chrysorrhanis daphne* Kirkaldy by its smaller size and by the hind femora being not enlarged apically and pale yellow. The genitalia of this species were studied from specimens in the type series.

Chrysorrhanis lineatus, n.sp.

(Figs. 11-15)

Characterised by the transverse fascia or line on the corium.

Male: Length 4·6 mm, width 1·4 mm. *Head:* Length 0·2 mm, width 0·8 mm, vertex 0·28 mm. *Antenna:* Segment I, length 1·0 mm; II, 2·2 mm; III, 1·3 mm; IV, 0·7 mm. *Pronotum:* Length 1·0 mm, width at base 1·3 mm. *Cuneus:* Length 0·48 mm, width at base 0·28 mm.

General coloration pale yellow to orchraceous with dark brown areas; eyes, apical portions of segment II of antenna, segments III-IV, and spot on humeral angles dark brown; mesoscutum and apex of scutellum fuscous; hemelytra glassy, transparent, outer and inner margins of embolium, clavus, corium and cuneus dark, a characteristic transverse fascia or line on corium level with apex of clavus; corial commissure, apex of corium and nervures of membrane dark brown, membrane hyaline. Underside of body pale yellow, a wide fascia on propleura, side of mesosternum and pleura dark brown; legs pale yellow, apex of hind femora slightly darker.

Corium finely punctulate.

Genitalia: Penis (fig. 12) with two groups of sclerotised spines and sclerotised structures around secondary gonopore (fig. 13). Left paramere (fig. 14) falciform, tapering to apical end. Right paramere (fig. 15) wider subbasally, also tapering to apex.

Female: Similar to male in colour and general aspect, the underside of body pale yellow.

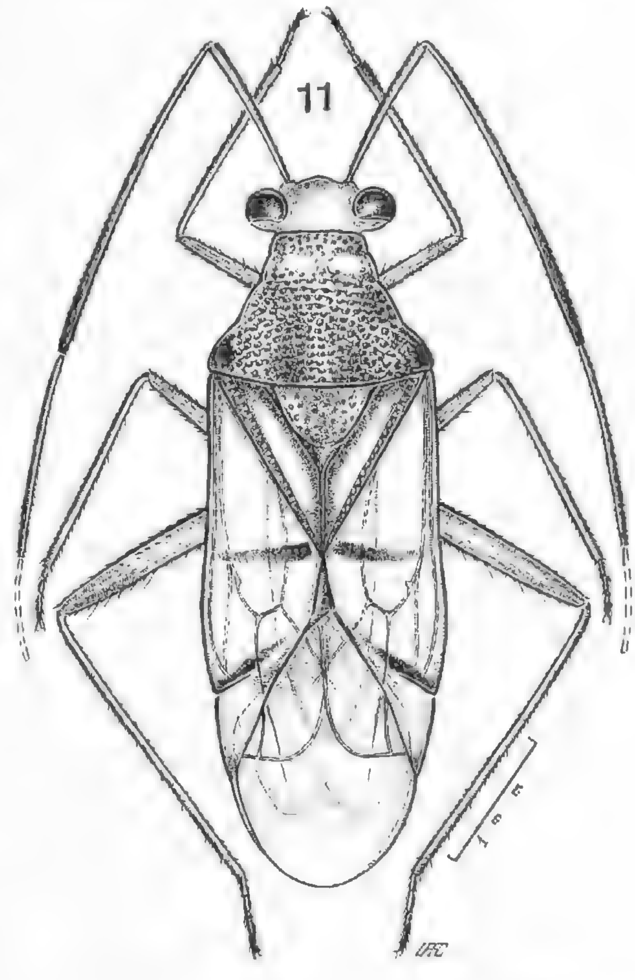
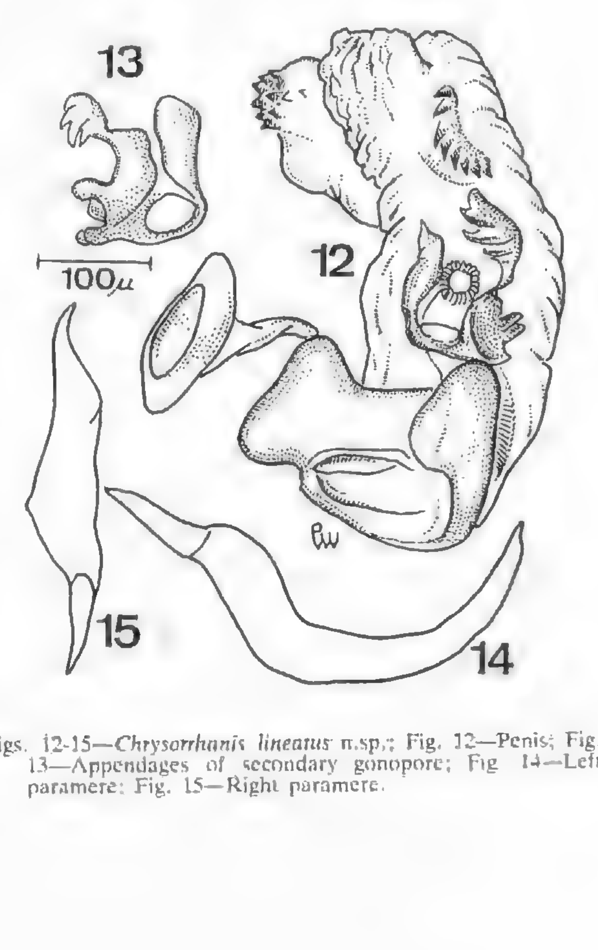


Fig. 11—*Chrysorrhanis lineatus* n.sp.: male, holotype.



Figs. 12-15—*Chrysorrhanis lineatus* n.sp.; Fig. 12—Penis; Fig. 13—Appendages of secondary gonopore; Fig. 14—Left paramere; Fig. 15—Right paramere.

Holotype: Male, INDONESIA: Muffin Bay, Irian Jaya, x.5.44, E. S. Ross, in the Collection of the Academy of Sciences of California, San Francisco; Larat (Tenimbar Is.) xii.47; *Paratypes:* male and female, CHINA: Ta Han, Hainan, vii.6.35, J. L. Gressitt (BM 1964-26).

This species differs from the others in the genus by the transverse dark fascia or line on corium level with apex of scutellum.

Corizidolon Reuter, 1907

Corizidolon Reuter, 1907, p.3; Poppius, 1912b, p.9; Carvalho, 1955, p.106; Carvalho, 1959, p.318.

Type-species: Corizidolon notaticolle Reuter, 1907.

Body elongate, pronotum, embolium and cuneus shortly setose, clavus and corium sparingly pilose. Head wider than long, frons rounded, prominent between antennal bases, vertex immarginate; eyes large, slightly removed from collar; rostrum reaching middle coxae. Antenna cylindrical, segment I narrowed on apical third, distinctly enlarged subbasally, shortly setose, about as long as width of head; segment II about two and two thirds times as long as I; segments III much shorter than II and IV much shorter than III.

Pronotum superficially rugose-punctate, collar and calli smooth, lateral margins slightly narrowed behind calli, hind margin broadly rounded; mesoscutum and scutellum smooth.

Hemelytra semihyaline and transparent, wings distinctly visible from above, embolium and cuneus setose, clavus and embolium sparingly pilose, cuneus longer than wide at base, membrane bicellulate. Legs of medium size, tibiae with minute sclerotised dots and shortly spinulose, parempodia convergent towards apices.

Differs from other genera of the tribe Hyalopeplini by the superficially rugose-punctate pronotum and by the setose hairs covering its surface.

Key to the species of the genus *Corizidolon* Reuter

1. Pronotum with six longitudinal brown vittae; rostrum reaching beyond the hind coxae . . *dexlineatum* Delattre
   Pronotum without six longitudinal brown vittae; rostrum reaching the middle coxae 2
2. Disc with two black round spots behind calli; apex of hind femora and hind tibiae pale yellow . *notaticolle* Reuter
   Disc without two black round spots behind calli but with two short, dark fasciae on disc of pronotum and two maculae laterally on each side; apex of hind femora and tibiae reddish-brown *australiense* Carvalho and Gross, n.sp.

Corizidolon australiense Carvalho & Gross, n.sp.

(Figs. 16-21)

Characterised by the colour of pronotum and by the structure of the first antennal segment.

Male: Length 5·0 mm, width 1·5 mm. *Head:* Length 0·8 mm, width 1·0 mm, vertex 0·30 mm. *Antenna:* Segment I 0·8 mm, II-IV, missing. *Pronotum:* Length 1·0 mm, width at base 1·5 mm. *Cuneus:* Length 0·80 mm, width at base 0·40 mm.

General coloration honey to lemon coloured; first antennal segment, basal two-thirds of second antennal segment, basal third of third antennal segment, apices of hind femora and all of hind tibiae reddish-brown; apical third of second antennal segment, apical two thirds of third antennal segment, all of fourth antennal segment, terminal tarsal segments, a short scattered pilosity on the dorsal surface and a denser short pilosity on the appendages, blackish; corium, clavus and cuneus semihyaline brown; on the pronotum on either side of the midline a longitudinal brown bar and on the lateral margins of the pronotum a pair on each side of brown maculae, the posterior one of each pair at the lateral angles. In the type a pair of short parallel faint brown lines on either side of the midline of the scutellum about mid way back. The abdomen and thorax beneath with a not very dense whitish pilosity.

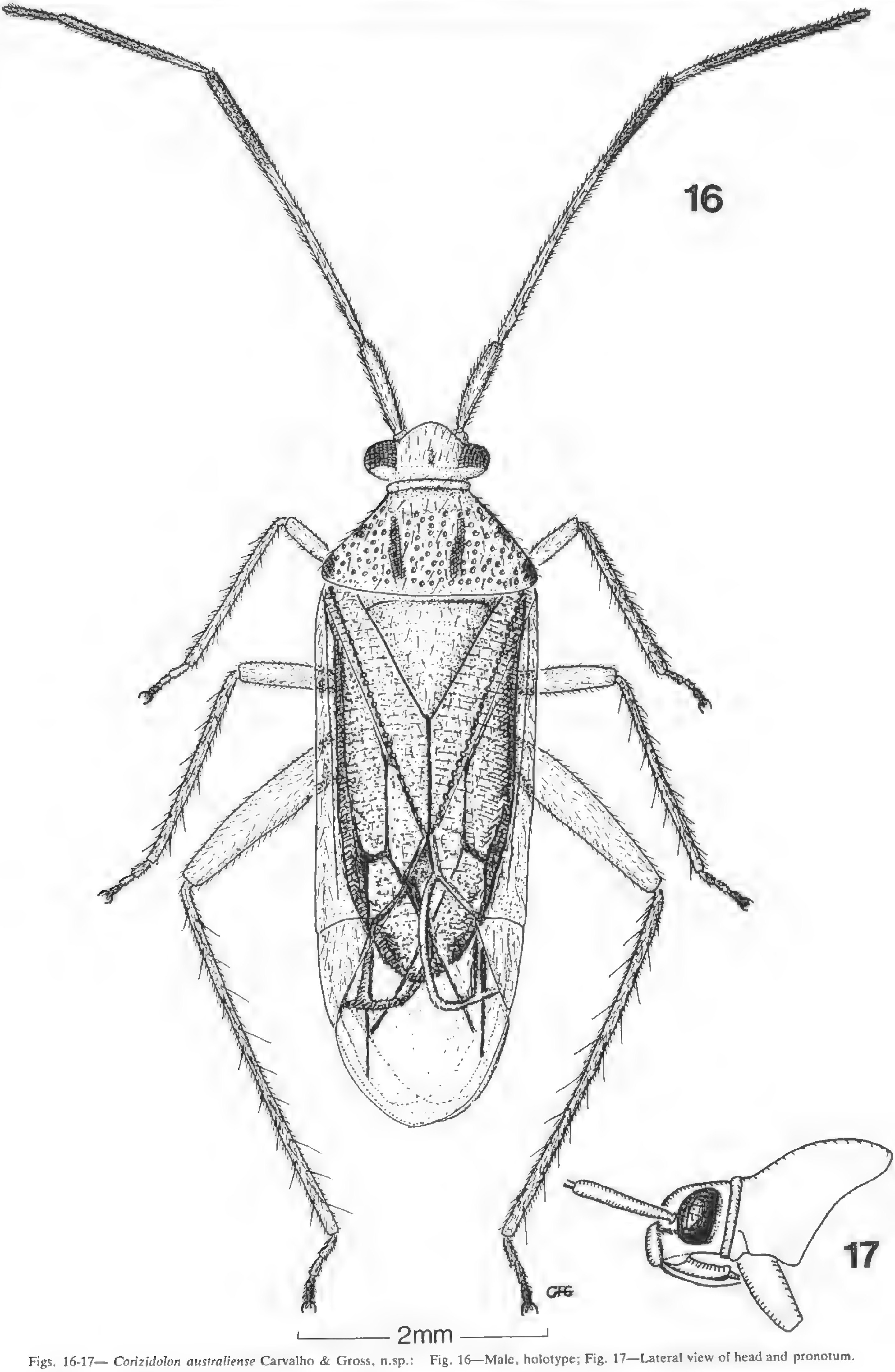
The short pilosity of the dorsal and ventral surfaces and the appendages nearly recumbent. On the tibiae also some longer erect spines, those on the fore tibiae finer and shorter than those on the other tibiae.

Genitalia: Vesica of aedeagus (fig. 18) without spiculum, with two large membranous lobes. Left paremere (fig. 19) falciform, with acute apical extremity and long dorsal setae. Right paramere (figs. 20, 21) small, less sclerotised ventrally, with long dorsal setae, anterior end acute.

Female: Length 6·6 mm, width 1·9 mm. *Head:* Length 1·0 mm, width 1·1 mm, vertex 0·47 mm. *Antenna:* Segment I, length 0·8 mm, II, 2·7 mm; III, 1·3 mm; IV, 0·5 mm. *Pronotum:* Length 1·3 mm, width at base 1·8 mm. *Cuneus:* Length 1·00 mm, width at base 0·60 mm.

General coloration and aspect similar to male. The pale brown bars on the scutellum are absent on several of the female paratypes.

Holotype: female, AUSTRALIA: Queensland: Tamborine Mountain, 15.ii.1968, F. A. Perkins (QM); paratype ♀, Lamington National Park, 19-22.v.1963, B. V. Timms; paratype ♀, Brisbane, 2.iv.1957, I. Martin; paratype ♀ and one damaged male, Bald Mountain Area, 350-1200 m (1500-4000 ft.), via Emu Vale, South East Queensland, 27-31.i.1972, B. K. Cantrell (QU); paratype ♀ (Reg No. I20, 936), Mt. Tambourine, A. N. Lea (SAM); paratype ♀, Bunya Mts. 610 m, 22.i.1938, N. Geary; paratype ♀, Upper Broken River, Eungella,

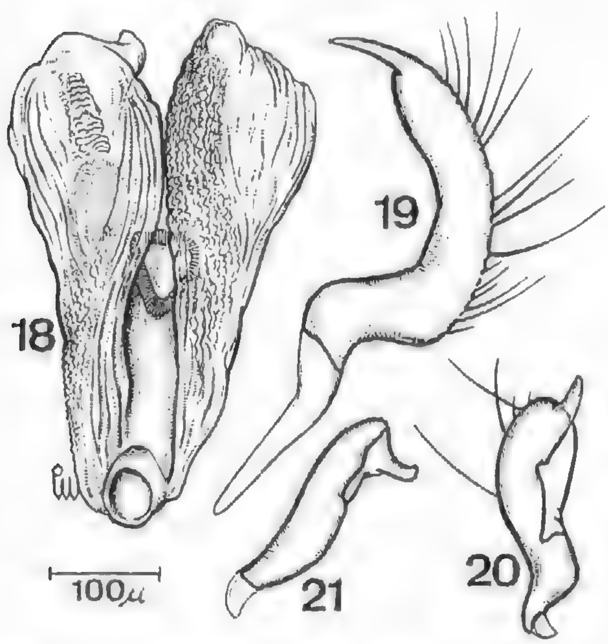


Figs. 16-17— *Corizidolon australiense* Carvalho & Gross, n.sp.: Fig. 16—Male, holotype; Fig. 17—Lateral view of head and pronotum.

12.xii.1961, McAlpine & Loss (AM). New South Wales: allotype ♂, Huon Brook near Mullumbimby, 2.iii.1965, D. K. McAlpine (AM).

The allotype is more reddish brown in appearance than the one other male specimen or the females in the series and has reddish areas anteriorly on the head below the level of the eyes, on the anterior portion of the lateral margin of the pronotum, as two spots (one above the other on the mesopleuron and metapleuron) and as a sublateral longitudinal band on the abdomen. The brown marks on the scutellum are much more strongly marked than in females and much longer.

The species differs from *Corizidolon notaticolle* Reuter, by the colour and markings of the pronotum and by the structure of the first antennal segment.



Figs. 18-21—*Corizidolon australiense* Carvalho & Gross, n.sp.: Fig. 18—Vesica of aedeagus; Fig. 19—Left paramere; Figs. 20, 21—Right paramere.

Corizidolon dexlineatum Delattre, 1949

Corizidolon dexlineatum Delattre, 1949, p. 24; Carvalho, 1959, p. 318.

The author was not able to study the type and cotypes of this species, collected at Bouaké (C.I.), 27.xii.47 and 6.xii.47, attacking cotton (R. Delattre). The original description is as follows: "Conforme à la description du genre, sauf pour l'apex du rostre qui dépasse nettement l'apex des hanches postérieures, et pour les antennes dont les articles ont les longueurs relatives suivantes: I: 2, 5, II: 7, III: 6, IV: 3, 9. Les articles II, III, IV ont sensiblement le même diamètre. Une soie de chaque côté du front près des antennes.

Tête brun jaune, verdâtre à l'état frais, avec deux traits longitudinaux rougeâtres, en forme de parenthèse, sur le vertex. Yeux brun noir, granuleux, saillants. Antenne brun pâle un peu rougeâtre, avec des zones rouge brun au milieu et à l'apex de II et III. Rostre verdâtre, à apex brun noir, luisant, presque lisse, fortement rembruni vers le bord postérieur.

Thorax brun verdâtre, avec six lignes longitudinales brun rouge réparties ainsi: deux lignes médianes assez rapprochées, une ligne de chaque côté du disque, près du bord externe, et une ligne sur le milieu des pleurites. Une tache noire dans l'angle postérieur externe du pronotum. Ecusson ridé transversalement luisant, brun noir, sauf une ligne plus claire au centre, et une tache de chaque côté à la base.

Elytres transparents, à ponctuation nette, régulière, le cuneus lisse, l'aire costale vert clair sur le vivant, translucide à l'état sec, le bord commissural du clavus, surtout la base et l'apex une tache sur le bord interne et postérieur de la corie, le bord antérieur du cuneus jusqu'à la fracture, la nervure de la grande cellule, de la membrane, bruns. Une tache en V sur les bords postérieurs interne et externe du cuneus, brun rouge, de même la nervure postérieure de la petite cellule brun rouge.

Pattes jaune pâle, fémurs tachés de rougeâtre, tibias II et III vert pâle, avec des épines et des microtriches noirs, l'apex des tarses verdâtre.

Abdomen vert pâle avec des taches rouges étendues sur les sternites."

The mention of a punctate hemelytron, rostrum reaching beyond the hind coxae and colour of body seems to exclude the species from the genus *Corizidolon* Reuter. This, however, is merely a conjecture.

Corizidolon notaticolle Reuter, 1907

Corizidolon notaticolle Reuter, 1907, p. 4; Poppius, 1912b, p. 10; Carvalho 1959, p. 318.

(Fig. 22)

Characterised by the colour of the pronotum and by the type of pubescence.

Male: Length 5·0 mm, width 1·8 mm. *Head:* Length 0·4 mm, width 0·6 mm, vertex 0·18 mm. *Antenna:* Segment I, length 0·7 mm, II, 2·1 mm; III, 1·0 mm; IV, broken. *Pronotum:* Length 0·9 mm, width at base 1·5 mm. *Cuneus:* Length 0·78 mm, width at base 0·34 mm.

General coloration ochraceous to pale yellow: apex of segment II of antenna, a small spot externally on segment I, margins of collar, two round spots behind calli on disc, two spots at humeral angles and two spots on mesoscutum externally dark brown to black; disc of pronotum with two obsolete longitudinal vittae, sutures and commissure of hemelytra, nervures of membrane, outer margin of embolium, fuscous; legs pale yellow, femora with small round dark spots, segment III of tarsi fuscous.

Morphological characters as mentioned for genus.

Genitalia: Not dissected for lack of appropriate specimens.

Female: Similar to male in colour and general aspect but slightly more robust. Length 6·2 mm, width 2·0 mm.

Geographical distribution: Mauritius Island.

Specimens studied: Male, La Réunion, Plaine des Cafres, Pilon Manuel, 27.i.1955; male, Department of Agriculture, Mauritius Island, iii.1962, C.I.E., in the author's collection.

This species is well characterised by the four round black spots on pronotum (*notaticolle*).

Guianerius Distant, 1903

Guianerius Distant, 1903, p. 269; Poppius, 1912, p. 436; Carvalho, 1955, p. 107; Carvalho, 1959, p. 318.

Type-species: Guianerius typicus Distant, 1903.

Body elongate, erectly pilose, pronotum very finely rugose-punctate, clavus opaque, densely pilose. Head wider than long, frons vertical, vertex marginate laterally, eyes contiguous with collar, rostrum reaching middle coxae. Antenna with segment I about as long as width of head, segment II twice as long as I, incrassate, segment III-IV short, slender. Pronotum superficially rugose-punctate, calli obsolete, collar smooth, disc convex, lateral margins rounded, hind margin straight at middle, rounded at humeral angles, erectly pubescent; mesoscutum partially covered; scutellum smooth, pilose. Hemelytra glassy, transparent (except on clavus, embolium, cuneus and black areas of corium), finely punctulate, cuneus twice as long as wide at base, clavus noticeably pilose, membrane bicellulate, apex of larger areola rounded. Ostiolar peritreme prominent, legs of medium size, hind tibiae sulcate externally, parempodia divergent towards the apices.

This genus has the general fascies of *Kosmiomiris* Kirkaldy, 1902, but differs by having the pronotum only superficially rugose-punctate and by the much shorter rostrum.

Guianerius typicus Distant, 1903

Guianerius typicus Distant, 1903, p. 269, fig. 14; Poppius, 1912a, p. 437; Carvalho, 1959, p. 318.

Guianerius palliditarsis Poppius, 1915, p. 44; Carvalho, 1959, p. 318 (new synonymy).

(Figs. 23-26)

Characterised by the colour of the body and by the rostrum reaching only the middle coxae.

Male: Length 6·2 mm, width 2·2 mm. *Head:* Length 0·6 mm, width 1·3 mm, vertex 0·56 mm. *Antenna:* Segment I, length 1·2 mm; II, 2·4 mm; III, 0·8 mm; IV, broken. *Pronotum:* Length 1·5 mm, width at base 2·0 mm. *Cuneus:* Length 0·80 mm, width at base 0·40 mm (lectotype of *palliditarsis*).

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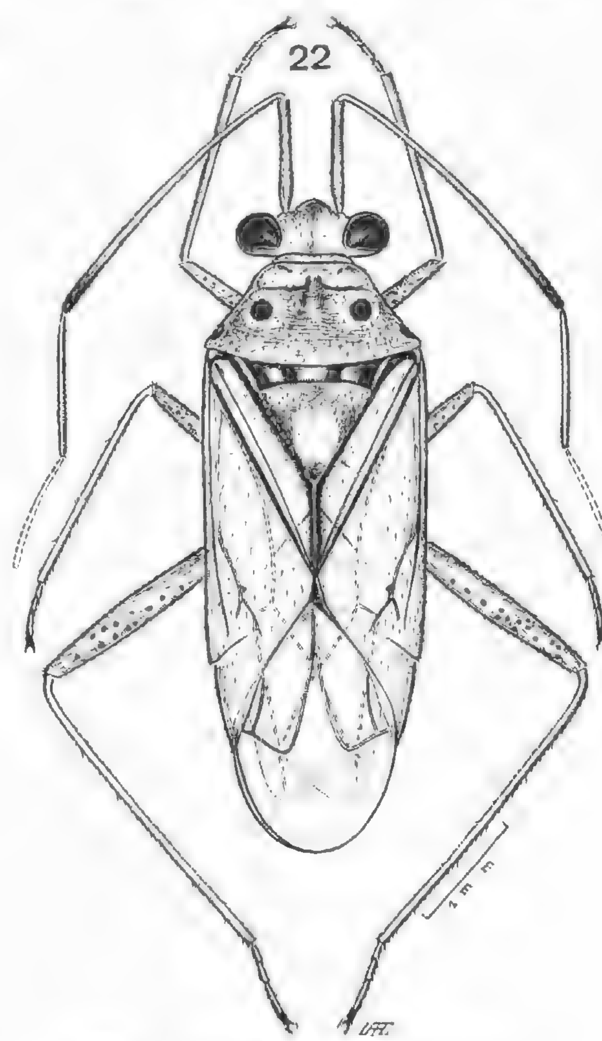


Fig. 22—*Corizidolon notaticolle* Reuter, male.

General coloration black with hyaline to citrine or lutescent areas; head and pronotum black (except hind margin, humeral angles and collar which are citrine to lutescent); antenna brownish to black; scutellum citrine, black basally; clavus black, opaque; corium hyaline, glassy, with a black

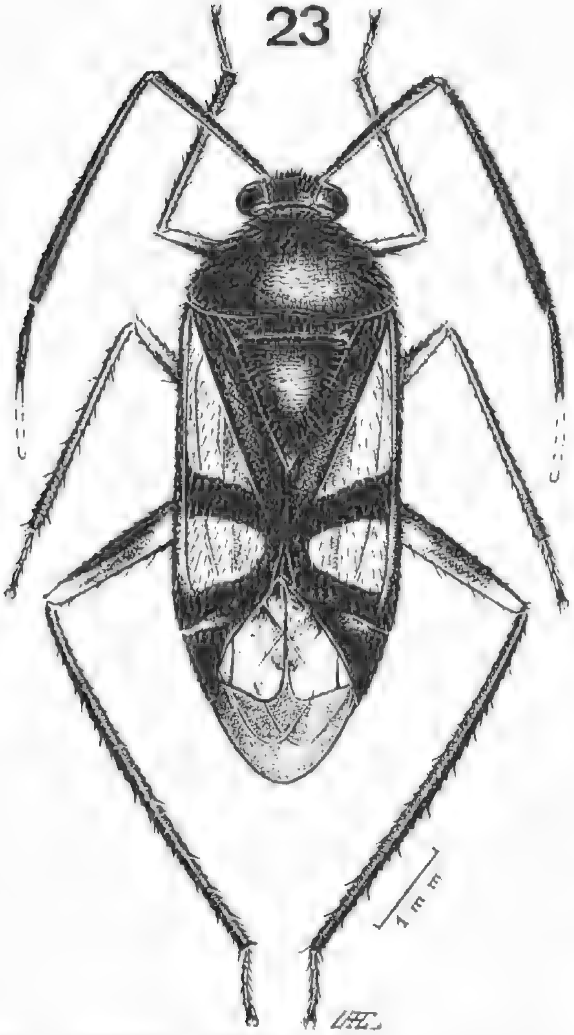


Fig 23—*Guianerius palliditarsis* Poppius, male, holotype (=*Guianerius typicus* Distant).

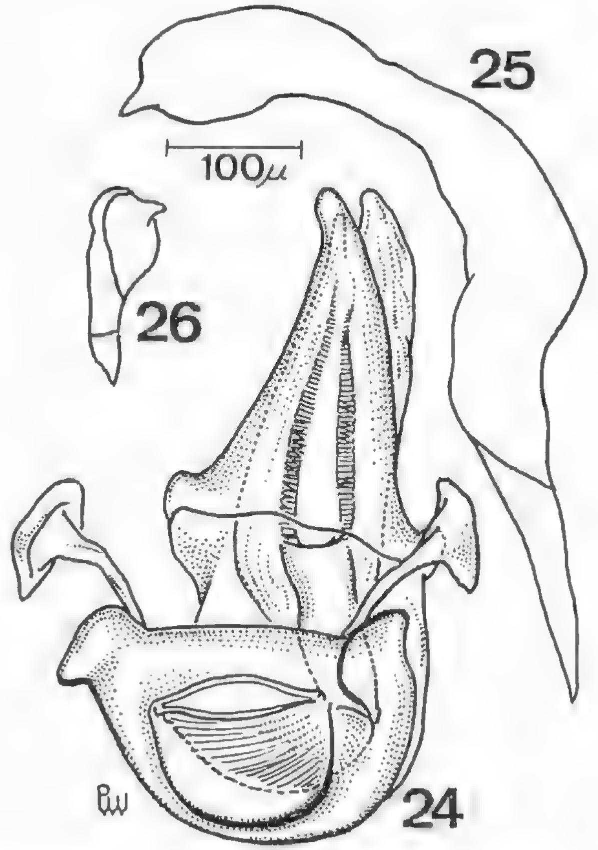
transverse fascia level with apical fifth of clavus, followed by black commissure and another oblique fascia apically, cuneus hyaline internally, tending to reddish externally; membrane fuscous on extra-areolar portion. Underside of body and inferior margin of propleura pale yellow, mesosternum, spot on metapleura, coxae totally or partially and a spot on abdomen from 5th to 9th segments (except lateral portions of tergites VI-IX which are pale) black. Legs pale, hind tibiae and segment III of tarsi brown.

Morphological characters as mentioned for genus.

Genitalia: Penis (fig. 24) with an elongate secondary gonopore, without sclerotised spiculi. Left paramere (fig. 25) large and long, with an apical acute and short point. Right paramere (fig. 26) small, as seen in illustration.

Female: Similar to male in colour and general aspect, slightly more robust. Length 7·0 mm, width 2·0 mm.

Geographical distribution: Malay Peninsula, Borneo, Philippines.



Figs. 24-26—*Guianerius typicus* Distant: Fig. 24—Penis; Fig. 25—Left paramere; Fig. 26—Right paramere.

Specimens studied: Lectotype (new designation), male, PHILIPPINES: Los Banos, Baker (*Guianerius pallidiiarsis* Poppius) (HELSINKI); paralectotype, male, Mt. Makiling, Luzon, Baker, (same Museum); one male and two females, EAST MALAYSIA: Bundu Tukan, 18.ii.1959, T. C. Maa (BISHOP) (compared with type).

The characters mentioned by Poppius for *pallidiiarsis* are within the range of variation of *typicus* Distant.

According Distant (l.c.) "hovering over flowers in jungle; flight and movements very wasp-like."

Comparing specimens of *pallidiiarsis* with the original drawing of Distant the author considers them as synonyms.

Guisardinus, n.gen.

Type-species: Guisardinus neoguineanus n.sp.

Body elongate, sparingly pilose. Head distinctly wider than long, with a short neck, vertex immarginate, slightly depressed, frons prominent, protruding in front of antennal bases, eyes semi-pedunculate, placed at middle of head, clypeus wide, rounded, buccula characteristic, rounded. Antenna cylindrical, segment I approximately as long as width of head, noticeably incrassated towards base, with long and erect hairs, their length about as long as or longer than width of segment; segment II densely pilose, slender and approximately twice as long as first. Rostrum reaching base of middle coxae.

Pronotum deep and coarsely punctate, except at posterior margin of disc where it is finely punctulate, collar wide, distinctly rugose transversally, calli large, smooth, humeral angles prominent, globose, lateral margins rounded, hind margin bisinuate in front of scutellum, rounded at humeral angles, propleura punctate, mesosternum rugose laterally; mesoscutum largely exposed; scutellum flat, coarsely punctate, lateral margins crenulate, beset with fine and erect hairs, apex pointed, smooth.

Hemelytra glassy, transparent, finely punctulate, sparingly pilose, clavo-corial and embolio-corial commissures with a row of punctures, embolium wide, explanate; medial vein reaching to about half length of corium, cuneus about twice as long as wide at base, membrane biareolate. Legs of medium size, beset with long and erect hairs, hind tibiae with sclerotised minute tubercles and hairs about as long as width of segment, parempodia divergent towards apices

Guisardinus is most closely allied to *Austrohyaloma* as noted under the latter. *Guisardinus* also approaches *Guisardus* Distant, 1904 but differs by having the pronotum and scutellum distinctly punctate; it differs also from *Chrysorrhanis* Kirkaldy, 1902 by the punctate scutellum and distinctly rugose collar.

The species *Argenis incisuratus* (Walker, 1873) in the tribe Mirini is strongly convergent with species of *Guisardinus* and can be very easily mistaken for a member of this genus. To help distinguish *Argenis incisuratus* from the species of *Guisardinus* it has been included in the key below and redescribed immediately after *Guisardinus solomonicus*.

Key to the species of the genus *Guisardinus* n.gen.

1. Pronotum with black spots only on globose humeral angles; segment I of antenna incrassate subbasally; hemelytra with a transverse fuscous spot at corial apex ..... *Argenis incisuratus* (Walker)
   Pronotum with four black spots; segment I of antenna mostly cylindrical; hemelytra without a transverse fuscous spot at corial apex 2
2. Base of clavus infuscate; segment I of antenna with long and erect pubescence; lower margin of collar with an anterior narrow black spot ..... *neoguineanus* n.sp.
   Base of clavus pale yellow; segment I of antenna with common medium size hairs; lower margin of collar with a posterior black fascia or spot ..... *solomonicus* n.sp

Guisardinus neoguineanus n.sp.

(Fig. 27)

Characterised by the four dark round spots of pronotum.

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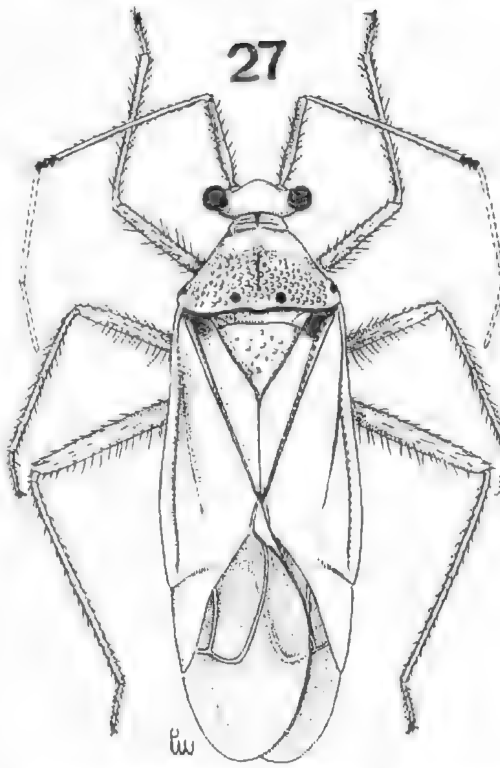

Fig. 27—*Guisardinus neoguineanus* n.sp., female, holotype.

Female: Length 6·2 mm, width 1·9 mm. *Head:* Length 0·3 mm, width 1·1 mm, vertex 0·48 mm. *Antenna:* Segment I, length 0·9 mm; II, 1·8 mm; III-IV, broken. *Pronotum:* Length 1·1 mm, width at base 1·6 mm. *Cuneus:* Length 0·08 mm, width at base 0·48 mm (holotype).

General coloration ochraceous to pale yellow; eyes, apex of second antennal segment, small longitudinal triangular vitta and small lateral spot on collar, a narrow longitudinal line on middle of disc, two roundish spots at posterior portion of disc, two others at humeral angles (one at each side) brown to black; hemelytra glassy, transparent, clavus internaly at base, apex and basal angles of scutellum, apex of clavus, apex of corial commissure and a small spot at apex of corium fuscous. Underside of body and legs pale yellow, segment III of tarsi fuscous.

Morphological characters as mentioned for genus.

Male: Unknown.

Holotype: female, NEW GUINEA; NE, Eliptamin Valley, 1200-1350 m, June 19-30, 1959, W. W. Brandt (BISHOP).

Differs from *Guisardinus solomonicus* n.sp. by the colour of pronotum and mesoscutum.

Guisardinus solomonicus, n.sp.

(Fig. 28)

Characterised by the colour of pronotum and mesoscutum.

Female: Length 5·2 mm, width 1·8 mm. *Head:* Length 0·4 mm, width 1·1 mm, vertex 0·48 mm. *Antenna:* Segment I, length 0·8 mm; II ,1·6 mm; III, 1·0 mm, IV, broken. *Pronotum:* Length 1·1 mm, width at base 1·6 mm. *Cuneus:* Length 0·56 mm, width at base 0·36 mm (holotype).

General coloration ochraceous to pale yellow; eyes, antennae and two spots laterally on collar (one at each side) black; longitudinal line at middle of disc of pronotum (interrupted in middle of calli), spot at humeral angle, two roundish spots at posterior margin of disc and two others, equivalent, on mesoscutum dark brown; claval commissure, external margin of embolium and cuneus, nervures of membrane towards apex fuscous. Underside of body pale yellow, apex of clypeus, apex of buccula, anterior margin of coxal cleft I and obsolete spots on femora externally brown.

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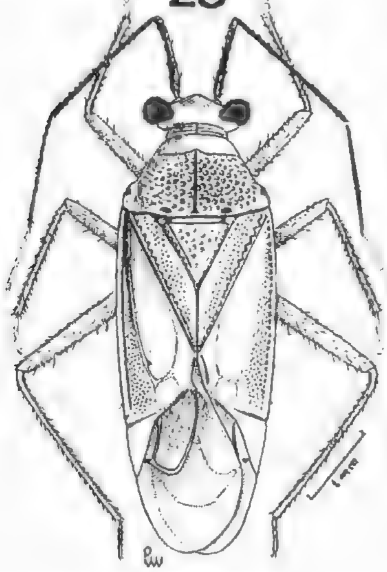

Fig. 28—*Guisardinus solomonicus* n.sp., female, holotype.

Head with flat vertex, external margin of clavus strongly crenulate, pubescence of legs noticeably long.

Male: Unknown.

Holotype: female, SOLOMON ISLANDS: NW, Malaita, Dala, 9.vi.1964, R. Straatman (BISHOP).

This species differs from *Guisardinus neoguineanus* n.sp. by colour of the antenna, pronotum and mesoscutum.

Argenis incisuratus (Walker, 1873)

(Figs. 29-33)

Characterised by the colour of the body and structure of male genitalia.

Male: Length 3·8 mm, width 1·2 mm. *Head:* Length 0·3 mm, width 0·8 mm, vertex 0·24 mm. *Antenna:* Segment I, length 0·5 mm; II, 1·5 mm; III, 1·0 mm; IV, 0·3 mm. *Pronotum:* Length 0·9 mm, width at base 1·2 mm. *Cuneus:* Length 0·40 mm. width at base 0·28 mm.

General coloration brown to fuscous with black areas; head, pronotum (except globose humeral angles which are shining black) and scutellum brown; eyes black, antenna fuscous, segment I pale; hemelytra with clavus fuscous to brown, corium pale (fuscous bordering clavus), with a large fuscous transverse spot apically which reaches outer margin of embolium, the latter and cuneus also pale with extreme margins fuscous, membrane with black nervures. Underside of body brown, legs pale yellow.

Antenna with segment I enlarged subbasally, pubescence very short, pronotum and scutellum punctate, vertex carinate, body with fine, long, erect hairs; clavo-corial and embolio-corial sutures with a row of punctures.

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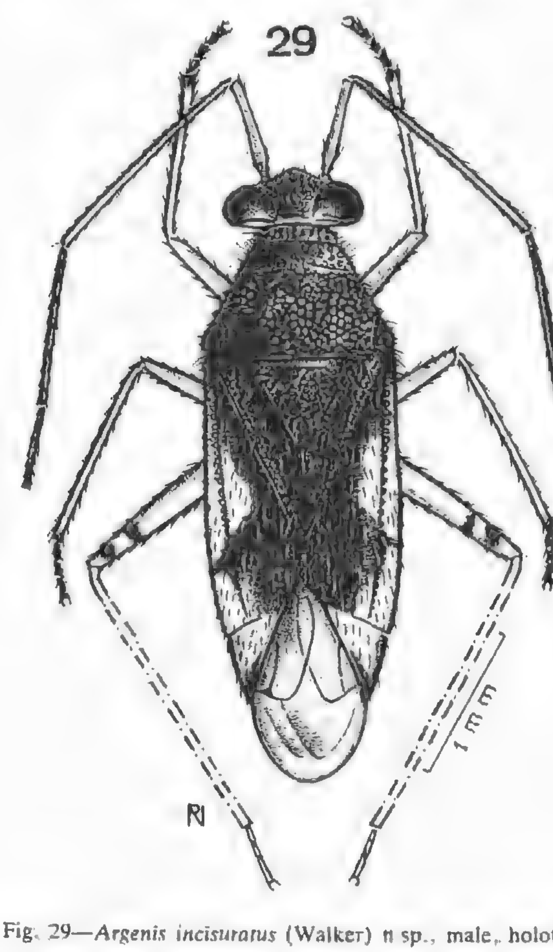


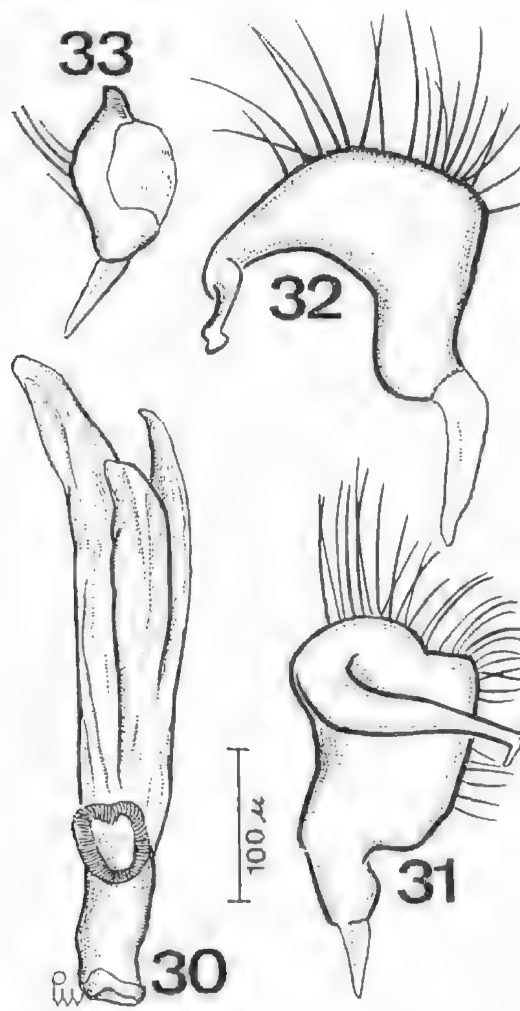
Fig. 29—*Argenis incisuratus* (Walker) n sp., male, holotype.

Genitalia: Penis (fig. 30) with a pointed characteristic spiculum and membranous lobes. Left paramere (fig. 31, 32) enlarged basally, strongly curved, apex pointed and somewhat bifurcate at extremity. Right paramere (fig. 33) small, globose, with pointed apex.

Female: Similar to male in colour and general aspect, slightly more robust.

This species collected by our colleague Karl V. Krombein in Sri-Lanka when it was being carried in flight by a solitary crabronid wasp, *Encopognathus* sp. (Hymenoptera).

It differs from the species of *Guisardinus* by the colour of the body, structure of segment I of antenna and male genitalia.



Figs. 30-33—*Argenis incisuratus* (Walker) n.sp.: Fig. 30—Vesica of aedeagus; Figs. 31-32—Left paramere; Fig. 33—Right paramere.

Guisardus Distant, 1904

Guisardus Distant, 1904, p. 436; Kirkaldy, 1906, p. 134; Reuter, 1910, p. 163; Carvalho, 1952, p. 97; Carvalho, p. 107; Carvalho, 1959, p. 319.

Euhyalopeplus Hsiao, 1944, p. 370; Carvalho, 1959, p. 318 *(n.syn.)*.

Serropeltis Poppius, 1912a, p. 425 (*syn.* by Knight, 1935, p. 211.).

Type-species: Guisardus pellucidus Distant, 1904.

Body elongate, glabrous above; head about three times as wide as long, vertex immarginate, frons prominent between antennal bases, eyes prominent, placed at middle of head, removed from collar; rostrum reaching to intermediate coxae; antenna cylindrical, segment I incrassate at base, about as long as width of head, segment II about twice as long as I, segments III-IV slender.

Pronotum with disc coarsely, regularly and transversely rugose, a little wider than long, posterior margin slightly bisinuate before scutellum, humeral angles rounded, distinctly thickened or globose, calli large, reaching sides of pronotum; mesoscutum covered; scutellum convex, lateral margins crenulate, in some specimens only a few punctures visible on its surface.

Hemelytra glassy, hyaline, except clavus, corium and clavus without nervures, the latter with a row of punctures, cuneus longer than wide at base.

Underside of body showing a punctate propleura, ostiolar peritreme conspicuous, legs long and slender, tibiae spinulose, hind femora with a few erect setae, parempodia divergent towards apices.

This genus has the general facies of *Chrysorrhanis* Kirkaldy, 1902 but differs by the distinctly rugose pronotum and globose humeral angles. Knight (1935) erroneously synonymised this genus with *Nesosylphas* Kirkaldy, 1908, a genus of the tribe Mirini Hahn, from Fiji.

Key to the species of the genus *Guisardus* Distant

1. Scutellum black, pale apically; metapleura with a black rugose fascia medially . . . . *chinensis* n.sp.
   Scutellum pale yellow, sometimes with dark punctures or dark only apically; metapleura pale yellow 2
2. Disc of pronotum with two distinct, dark, round or elongate spots 3
   Disc of pronotum without distinct dark spots, sometimes infuscate medially or with a longitudinal median vitta . 5
3. Posterior margin of pronotum with a round black spot, sometimes with two smaller ones at each side; spots on disc elongate . . . . *fasciatus* n.sp.
   Posterior margin of pronotum without a round black spot, spots on disc rounded 4
4. Scutellum without black punctures; disc without median longitudinal dark vitta . . . . *strigicollis* (Poppius)
   Scutellum with four to five black punctures; disc with a longitudinal vitta and three punctures black; pronotum with a narrow longitudinal median dark vitta *cristovalensis* n.sp.
5. Scutellum with a subapical spot followed by a narrow median longitudinal vitta and three punctures black; pronotum with a narrow longitudinal median dark vitta *bogorensis* n.sp.
   Scutellum infuscate only apically, without median longitudinal vitta; pronotum with a wide longitudinal obsolete dark vitta . . . . *pellucidus* Distant.

Guisardus bogorensis, n.sp.

(Figs. 34-37)

Characterised by the coloration of scutellum and clavus, and by the structure of male genitalia.

Male: Length 6·3 mm, width 1·6 mm. *Head:* Length 0·4 mm, width 1·1 mm, vertex 0·48 mm. *Antenna:* Segment I, length 1·0 mm; II, 1·7 mm; III-IV, broken. *Pronotum:* Length 1·2 mm, width at base 1·6 mm. *Cuneus:* Length 0·72 mm, width at base 0·28 mm.

General coloration ochraceous to pale yellow; eyes and segments II-IV of antenna brown, segment I tending to pale; pronotum with a fine longitudinal median line (obsolete) and spots at humeral angles brownish to black; scutellum with three or four punctures, longitudinal line (obsolete in some specimens) and subapical portion black; clavus (except lateral margin), corial commissure, external margin of embolium, apical margin of corium, outer margin of cuneus and nervures of membrane brown. Underside of body and legs pale yellow, hind tibiae tending to brown, segments III of tarsi fuscous.

Clavus distinctly crenulate laterally, noticeably pilose.

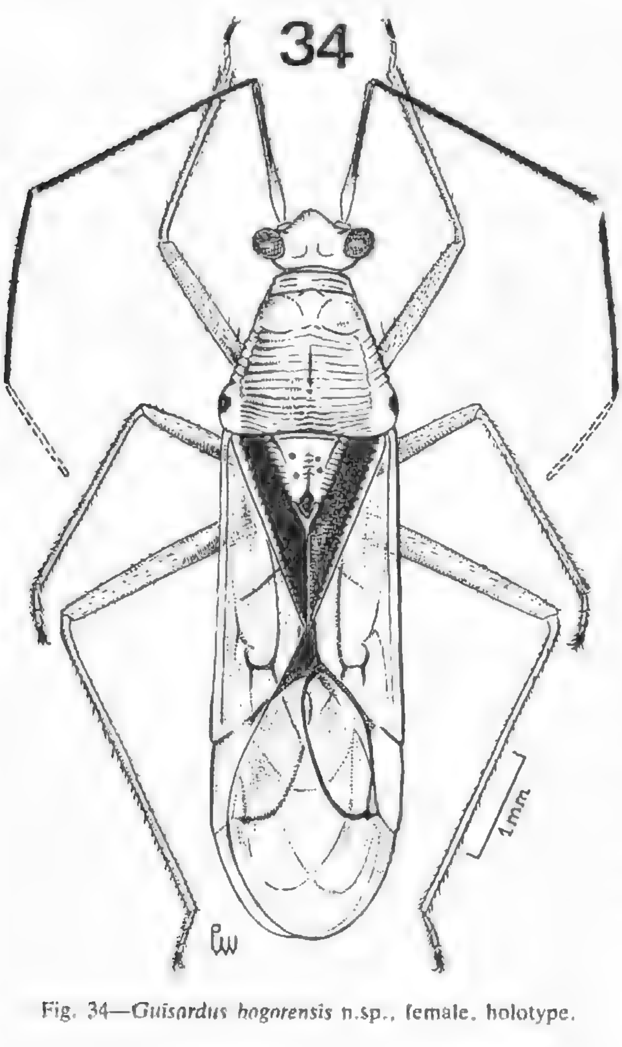


Fig. 34—*Guisardus bogorensis* n.sp., female, holotype.

Genitalia: Penis (fig. 35) with large basal plate and theca, no spiculi present. Left paramere (fig. 36) falciform, noticeably narrowed towards apex. Right paramere (fig. 37) small, pointed apically.

Figs. 35-37—*Guisardus bogorensis* n.sp.: Fig. 35—Penis; Fig. 36—Left paramere; Fig. 37—Right paramere.

Female: Similar to male in colour and general aspect. Vertex 0·56 mm, cuneus at base 0·36 mm.

Holotype: female, INDONESIA, Java, Bogor, ii.1957, O. D. Deputy (USNM). *Allotype:* male, idem. *Paratypes:* 4 females, in the Collection of the above Museum and of the author.

Differs from *pellucidus* Distant by the colour of the scutellum.

Guisardus chinensis, n.sp.

(Fig. 38)

Characterised by the colour of scutellum and by the black rugose vittae of metapleura.

Female: Length 6·4 mm, width 1·6 mm. *Head:* Length 0·6 mm, width 1·1 mm, vertex 0·56 mm. *Antenna:* Segment I, length 0·8 mm; II, 1·7 mm; III, 1·4 mm; IV, 0·7 mm. *Pronotum:* Length 1·4 mm, width at base 1·6 mm. *Cuneus:* Length 0·80 mm, width at base 0·32 mm (holotype).

38

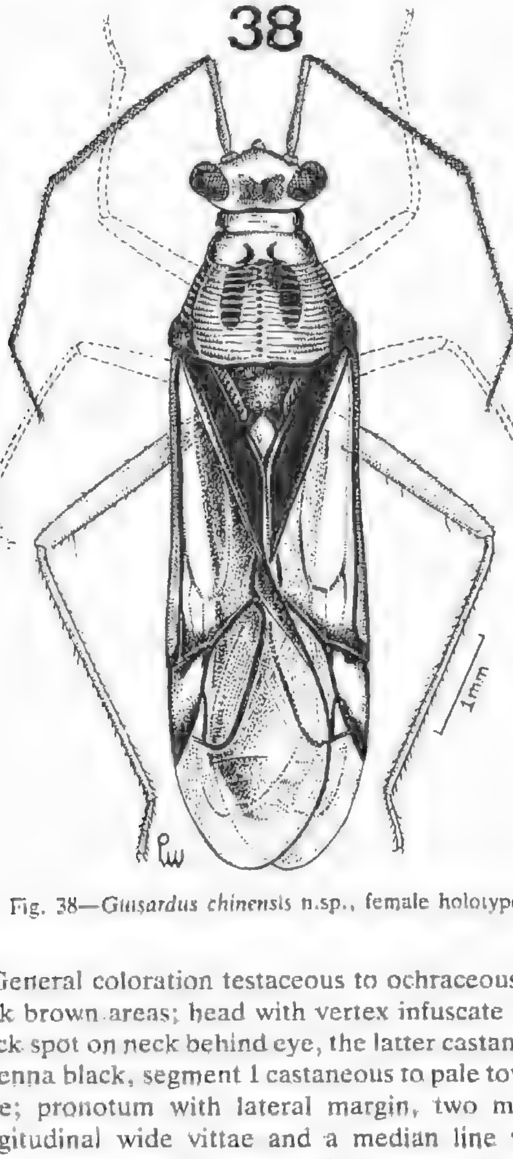


Fig. 38—*Guisardus chinensis* n.sp., female holotype.

General coloration testaceous to ochraceous with dark brown areas; head with vertex infuscate and a black spot on neck behind eye, the latter castaneous; antenna black, segment I castaneous to pale towards base; pronotum with lateral margin, two median longitudinal wide vittae and a median line which narrowly coalesce between calli, and lateral margin of collar dark brown; laterally on pronotum two longitudinal, wide, pale vittae running from collar to hind margin through calli with the two on central portion of disc, one at each side of median line, narrower; scutellum black with apex pale; hemelytra glassy, transparent, without nervures, clavus, corial commissure, apical portion of corium and embolium, apex of cuneus and nervures of membrane black. Underside of body pale yellow, collar inferiorly, propleura (except lower margin), mesosternum, meso- and metapleura rugose, black; abdomen pale yellow, segments VIII-IX black, apex of hind femur and tibiae tending to brown, apices of tarsi fuscous.

Pronotum coarsely transversely rugose, vertex depressed at middle, posterior margin lightly marginate, segment I of antenna incrassate basally.

Male: Unknown.

Holotype: female, SOUTH CHINA: Hianan I., Sam-ah-Kong, Yei, Hsian (District), Jan. 30, 1935, F. K. To, Brit. Mus. 1964-26 (BMNH).

This species differs from others in the genus by the black scutellum and by the black rugose fascia of metapleura.

Guisardus cristovalensis, n.sp.

(Fig. 39)

Characterised by the colour of pronotum.

Female: Length 5·4 mm, width 1·5 mm. *Head:* Length 0·4 mm, width 1·1 mm, vertex 0·48 mm. *Antenna:* Segment I, length 1·0 mm; II, 1·8 mm; III-IV, broken. *Pronotum:* Length 1·1 mm, width at base 1·4 mm. *Cuneus:* Length 0·78 mm, width at base 0·28 mm.

General coloration ochraceous with dark brown to fuscous areas; eyes brown, antenna pale yellow, apex of second joint fuscous; pronotum with suture between collar and calli, a spot between the latter, two spots at lateral sides of disc, humeral angles and a narrow longitudinal facia along its inner margin (coalescing with a black spot of lateral margin at middle of pronotum), middle of mesoscutum, basal angles and apex of scutellum, and clavus dark brown; corium glassy, transparent, outer margin of embolium, apical margin of corium, commissure, cuneal margins and nervures of membrane fuscous. Underside of body pale yellow, a longitudinal vitta on upper margin of propleura, sides of mesosternum and base of abdomen laterally dark; legs pale yellow, hind femora with small fuscous spots.

Male: Unknown.

Holotype: female, SOLOMON ISLANDS: Guadalcanal, Lame nr. Mt. Tatuve, 300 m, 18.v.1960, C. W. O'Brien (BISHOP). *Allotype:* female, San Cristoval, Kira Kira, 15.viii.1960, C. W. O'Brien.

This species differs from *strigicollis* (Poppius) by the presence of black punctures on the scutellum.

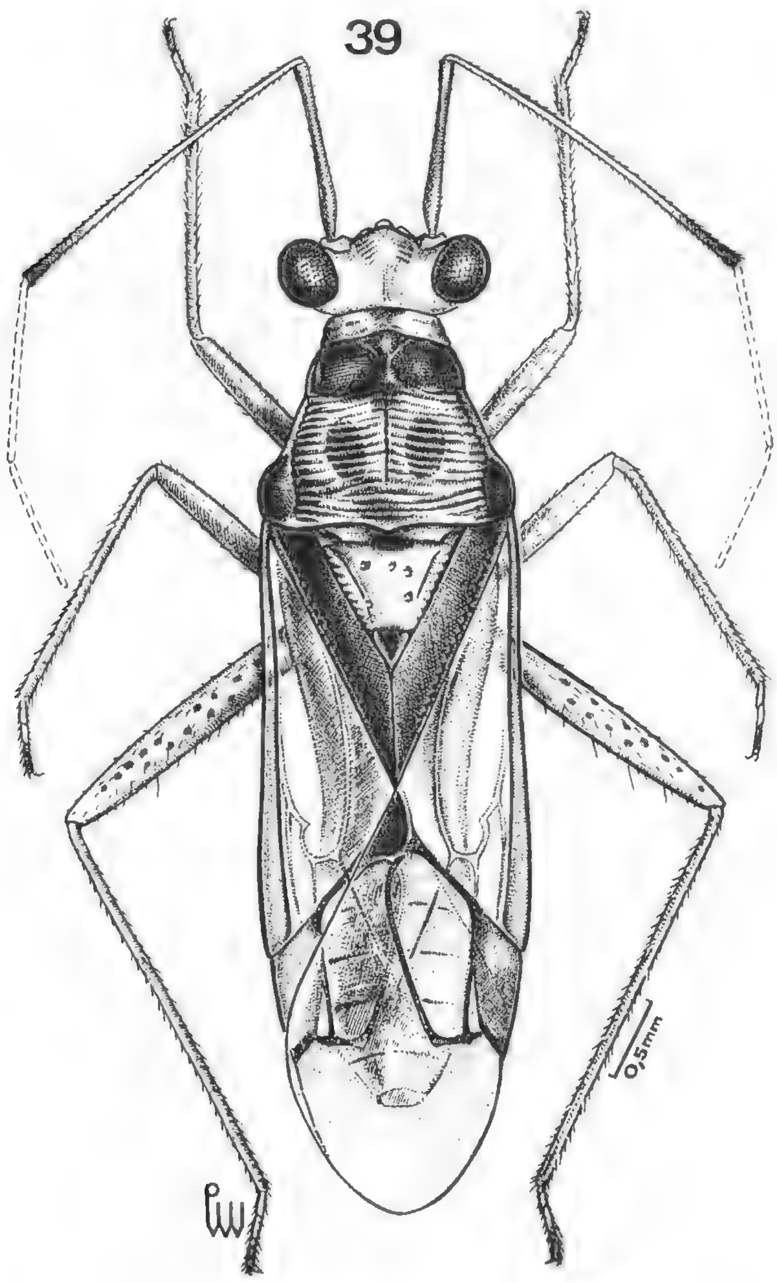


Fig. 39—*Guisardus cristovalensis* n.sp., female, holotype.

Guisardus fasciatus, n.sp.

(Fig. 40)

Characterised by the colour of pronotum and collar.

Male: Length 7·4 mm, width 1·9 mm. *Head:* Length 0·4 mm, width 1·2 mm, vertex 0·56 mm. *Antenna:* Segment I, length 1·4 mm; II, 2·4 mm; III, 2·8 mm; IV, broken. *Pronotum:* length 1·4 mm, width 1·8 mm. *Cuneus:* Length 1·04 mm, width at base 0·36 mm (holotype).

General coloration ochraceous to citrine-lutescent; eyes and antennae brown, except basal portion of segment I; a longitudinal line at middle of disc of pronotum beginning behind calli (obsolete in one specimen), two longitudinal vittae well marked at central portion of disc, lateral margin of pronotum anteriorly and outer margin of collar, a spot at globose portion of humeral angles, a median roundish spot continguous to hind margin of disc and two small ones at either side of the latter dark brown to black; scutellum with two dark points subapically; hemelytra glassy, transparent, clavus (except external margin), outer margin of embolium and cuneus, corial commissure, apical margin of corium and nervures of membrane brownish; membrane hyaline. Underside of body ochraceous, femora with dark points externally, segment II of tarsi fuscous.

Clavus with short pubescence, pronotum strongly transversely rugose, frons with oblique striations.

Male: Unknown.

Holotype: female, SOLOMON ISLANDS: Guadalcanal, Gold Ridge, 800 m, vii.23.1956, J. L. Gressitt (BISHOP). *Paratype:* female, Buca Agric. Station, 6-10.xii.1959, J. L. Gressitt.

Differs from other species in the genus by the colour of pronotum.

40

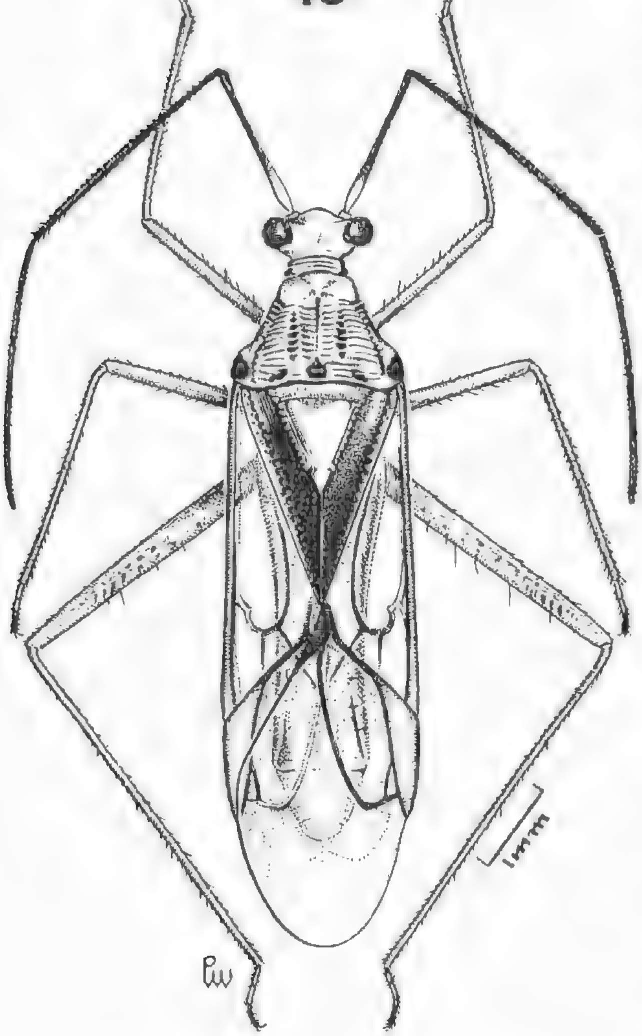


Fig. 40—*Guisardus fasciatus* n.sp., female, holotype.

Guisardus pellucidus Distant, 1904

Guisardus pellucidus Distant, 1904, p. 436, fig. 281; Poppius, 1914, p. 102; Carvalho, 1952, p. 97; Carvalho, 1959, p. 319.

Euhyalopeplus pulchellus Hsiao, 1944, p. 370, fig.; Carvalho, 1959, p. 318. New synonymy.

(Figs. 41-44)

Characterised by the colour of pronotum and structure of male genitalia.

Male: Length 5·6 mm, width 1·6 mm. *Head:* Length 0·4 mm, width 1·1 mm, vertex 0·48 mm. *Antenna:* Segment I, length 1·1 mm; II, 2·3 mm; III, 0·8 mm; IV, broken. *Pronotum:* Length 1·2 mm, width at base 1·4 mm. *Cuneus:* Length 0·72 mm, width at base 0·28 mm.

General coloration pale yellow to citrine with fuscous to brown areas; eyes brown, sides of neck, collar, calli and humeral angles dark fuscous to black; middle of mesoscutum, apex of scutellum, sutures of hemelytra, margins of cuneus and nervures of membrane brown to fuscous; hemelytra and membrane glassy, transparent. Underside of body pale yellow, upper margin of propleura (following margin of pronotum) with a longitudinal vitta above coxal cleft I.

Head strongly vertical, clypeus flat, eyes large, prominent, exserted, removed from pronotum by a distance approximately equal to width of collar, a short neck visible; antenna with segment I thickened basally, as long as width of head; pronotum rugose transversally, calli smooth, hind margin of disc near humeral angles slightly punctate, the latter prominent, nodulose; scutellum sparsely punctate, serrate or crenulate laterally; hemelytra glassy, transparent, corium without nervures, cuneus about three times as long as wide at base; membrane biareolate, apex of large areola rounded; pubescence of legs moderate.

Genitalia: Penis (fig. 42) without sclerotised spiculi. Left paramere (fig. 43) falciform, with a few dorsal setae. Right paramere (fig. 44) small, globose, with a more sclerotised acute apex.

Female: Similar to male in colour and general aspect but slightly more robust.

Geographical distribution: Java, Penang Island, Tenasserin Island, Burma, Laos, Vietnam.

Specimens studied: male, lectotype (new designation), BURMA, Tenass Valley, Myiita, Doherty (*Guisardus pellucidus* Distant), BMNH; female, PENINSULAR MALAYSIA, Penang Island, Straits of Malacca (Baker), holotype, *Euhyalopeplus pulchellus* Hsiao (USNM No. 56716); LAOS: Vientiane Prov. Ban Van Eue, 14.iv.1966, J. L. Gressitt; VIETNAM: Dak Song, 76 km SW of Banme Thuot, 870 m, 19.v.1960, L. W. Quate (BISHOP).

This species differs from others by the colour of pronotum and clavus.

41

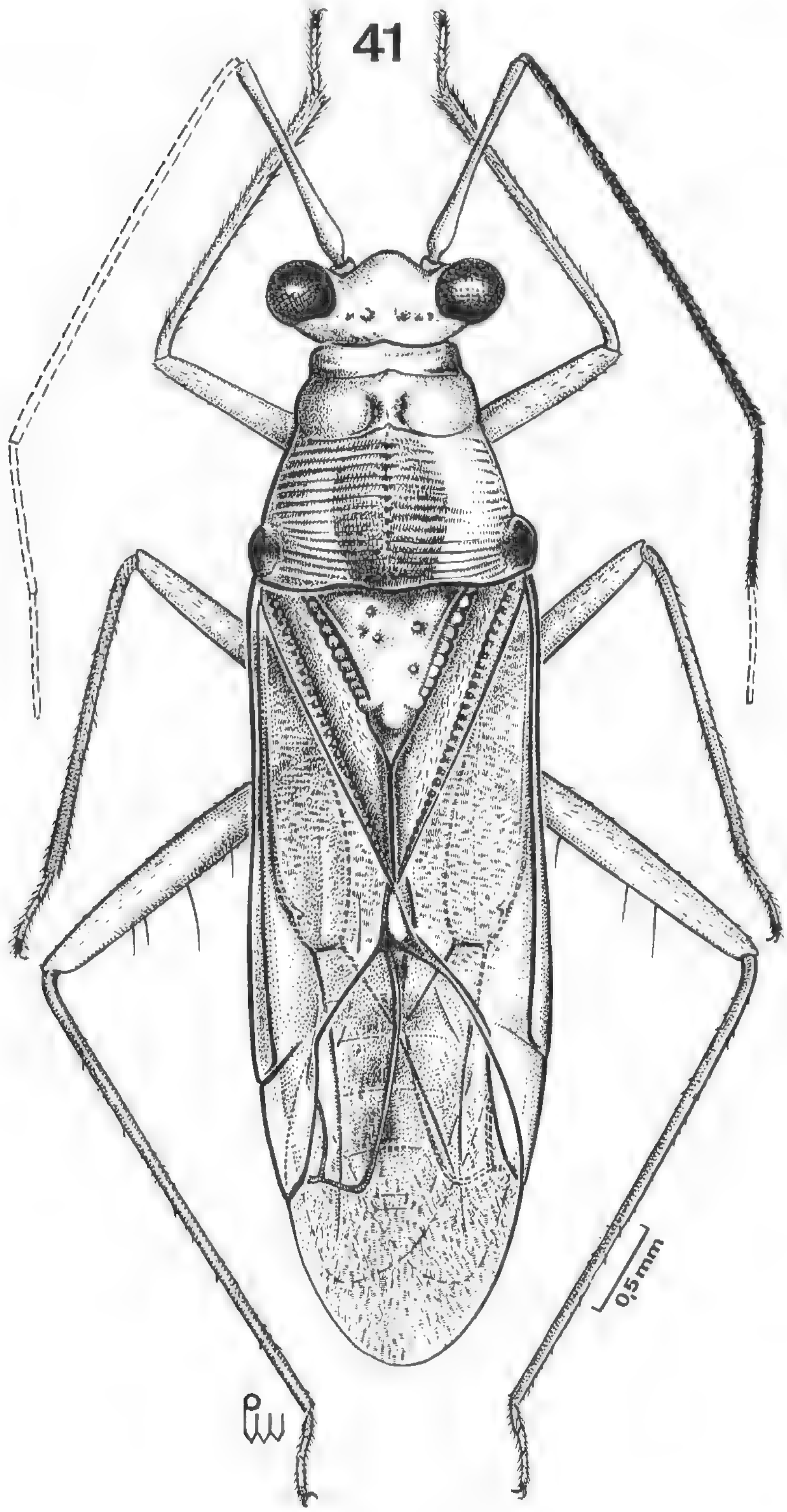
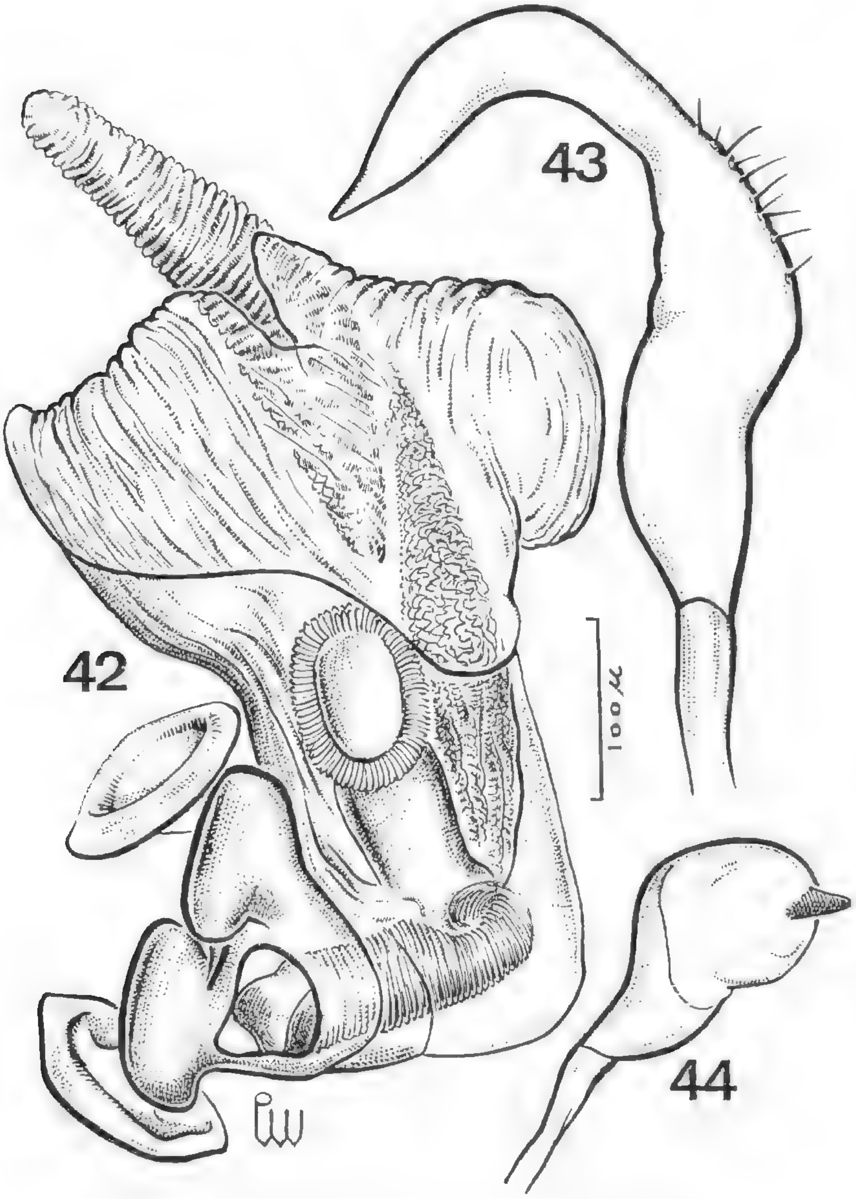


Fig. 41—*Euhyalopeplus pulchellus* Hsiao, female, holotype (=*Guisardus pellucidus* Distant).



Figs. 42-44—*Guisardus pellucidus* Distant: Fig. 42—Penis; Fig. 43—Left paramere; Fig. 44—Right paramere.

Guisardus strigicollis (Poppius, 1912) Carvalho, 1952

Serropeltis strigicollis Poppius, 1912a, p. 425.

Guisardus strigicollis Carvalho, 1952, p. 97; Carvalho, 1959, p. 319.

(Figs. 45-48)

Characterised by the colour of pronotum and scutellum.

Male: Length 6·7 mm, width 1·7 mm. *Head:* Length 0·5 mm, width 1·3 mm, vertex 0·48 mm. *Antenna:* Segment I, length 1·2 mm; II, 2·4 mm; III, 2·2 mm; IV, 0·6 mm. *Pronotum:* Length 1·4 mm, width 1·6 mm. *Cuneus:* Length 0·88 mm, width at base 0·32 mm.

General coloration pale testaceous; head reddish brown anteriorly, vertex brown between eyes, humeral angles black, two fasciae bent outwards, fused anterior and posteriorly on disc, diluted before hind margin (forming a longitudinal vitta from hind margin of calli to anterior margin of collar), lateral margins of scutellum to apical third of clavus, propleura in large extension, mesosternum and metapleura black; inner and outer margins of embolium narrowly, apicaly margin of corium, inner margin of cuneus widely, outer margin of same narrowly, membrane, antennae, a vitta on each side of abdomen and apices of tarsi dark brown; segment I of antenna pale yellow with apex and base darker; femora reddish brown with fuscous dots, paler towards base.

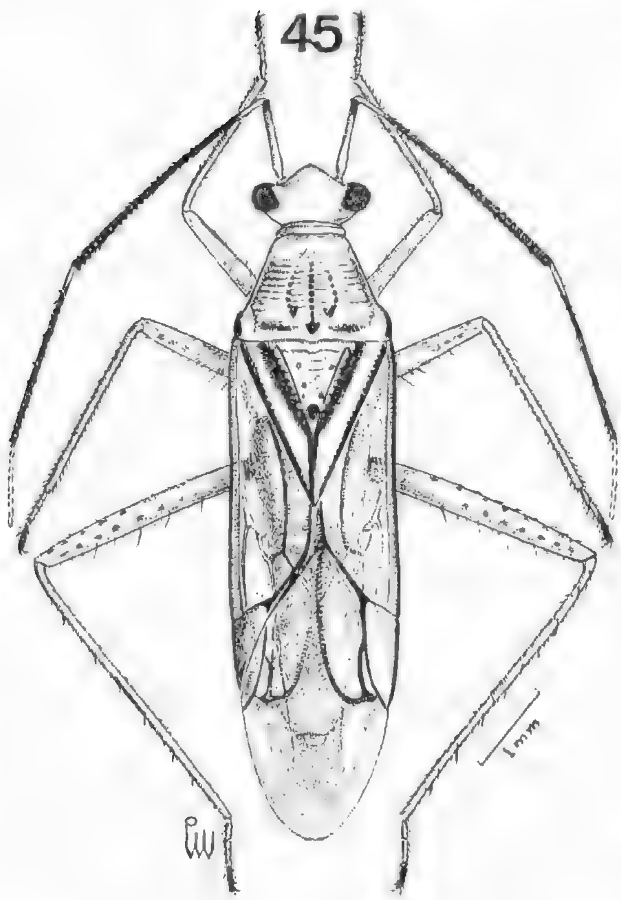


Fig. 45—*Guisardus strigicollis* (Poppius), male.

Genitalia: Penis (fig. 46) with membranous lobes and elongate secondary gonopore. Left paramere (fig. 47) somewhat enlarged sub-basally, pointed apically, Right paramere (fig. 48) short, thick, sclerotised and pointed apically.

Female: Similar to male in colour and general aspect, slightly more robust.

Geographical distribution: Mentawei Islands, New Guinea.

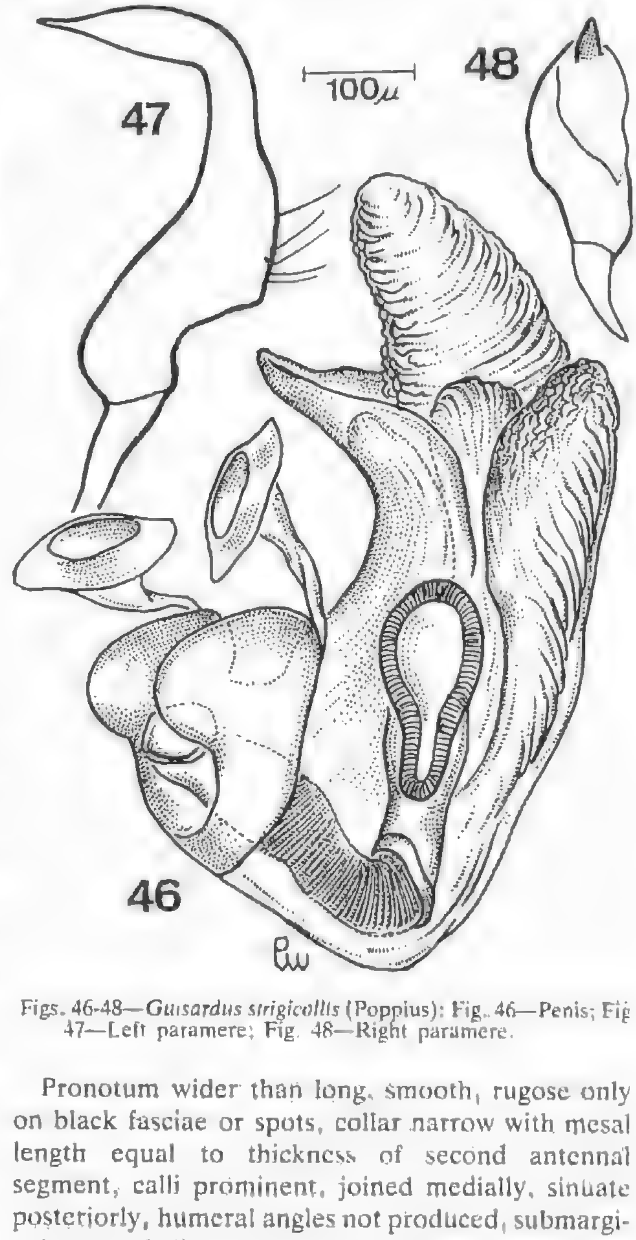
Specimens studied: NEW GUINEA, NE, W. Highlands, Bayer R. 1150 m, x.19.1958, J. L. Gressitt; INDONESIA, Bokondini, 40 km N of Baleim Val. Irian Jaya, ca 1300 m, 5.xii.1961, light trap, S. Quate and L. Quate (BISHOP).

The type of this species is mentioned by Poppius as deposited in the "Giacomo Doria" Natural History Museum, Genova. It could not be studied as this Museum does not loan types.

Hyalopeplinus, n.gen.

Type-species: Callicralides antennalis Distant, 1920.

Body elongate oval, mostly glabrous. Head twice as long as width, eyes prominent, continuous with anterior margin of pronotum, noticeably exserted beyond lateral margins of collar, clypeus vertical, prominent, jugum, lorum and buccula of medium size, rostrum reaching hind margins of posterior coxae; antennae cylindrical, with segment I about as long as half the width of head, segment II about four times as long as I, segment III half as long as II, segment IV about half as long as III, pubescence short and dense.



Figs. 46-48—*Guisardus strigicollis* (Poppius): Fig. 46—Penis; Fig. 47—Left paramere; Fig. 48—Right paramere.

Pronotum wider than long, smooth, rugose only on black fasciae or spots, collar narrow with mesal length equal to thickness of second antennal segment, calli prominent, joined medially, sinuate posteriorly, humeral angles not produced, submarginal area of disc with fine punctures; mesoscutum exposed, scutellum tumid, longitudinal vitta rugose.

Hemelytra glassy, corium and membrane transparent, embolium and cuneus opaque, sparsely pubescent, the latter about twice as long as wide at base, large cell rounded apically. Legs of moderate size, tibiae sparsely spinulose.

This genus is close to *Hyalopeploides* Poppius, 1912 but differs by the restriction of the rugosities of the pronotum to the black fasciae of the spots on the disc; by the very short segment I of antenna, about as long as width of vertex and by the smaller size—from 5·5 to 6·2 mm long. The anterior portion of pronotum does not show such a marked constriction and the body is more compact.

Besides the characters mentioned above the table of measurements below indicates a further sequence of characters to separate the two genera:

(mm)	*Hyalopeplinus*	*Hyalopeploides*
Length of body	5·4-6·2	6·5-9·8
Width of body	1·8-2·0	1·8-3·2
Width of vertex	0·40-0·48	0·50-0·76
Length of antenna I	0·5-0·6	0·8-1·2
Length of cuneus	0·60-0·80	0·80-1·20

These measurements were mainly based on the type specimens. It is possible that in large series there are variations which might exceed these limits.

List of species of the genus *Hyalopeplinus* n.gen.

1. *antennalis* (Distant, 1920)—(as *Callicratides*) New Caledonia and Loyalty Is.
2. *cairnsensis* Carvalho and Gross, n.sp. Australia (Queensland)
3. *cristovalensis* n.sp. Solomon Is. (San Cristoval)
4. *fijiensis* n.sp. Fiji Is.
5. *malayensis* n.sp. Malay Peninsula, Laos, Sumatra, Sri-Lanka, Vietnam
6. *papuensis* n.sp. Papua New Guinea, New Britain
7. *philippinesis* n.sp. Philippines Is.
8. *samoanus* (Knight, 1935)—(as *Guisardus*) Samoan Is., Society Is., New Hebrides
9. *solomonesis* n.sp. Solomon Is.

Key to the species of *Hyalopeplinus* n.gen.

1. Collar to pronotum without longitudinal dark vittae or bars; disc of pronotum with a M-shaped black marking enclosing two roundish spots (fig. 79) ... 2
   Collar of pronotum with one or more longitudinal or cross fasciae or bars; disc with a median longitudinal vitta enlarged basally and two or four black spots (one or two on each side) ... 3
2. Lateral arms of the M-shaped marking of disc narrow, discontinuous; mesopleura and abdomen without black, velvety ocellate spots or bars; collar mostly lutescent to orange ... *cristovalensis* n.sp.
   Lateral arms of the M-shaped marking of disc wide and continuous; mesopleura and abdomen with black, velvety ocellate spots or bars; collar mostly black ... *solomonensis* n.sp.
3. Frons without a small black spot above antennal peduncle ... 4
   Frons with a small black spot above antennal peduncle ... 6
4. Humeral angles with a black spot; propleura pale yellow laterally ... *antennalis* (Distant)
   Humeral angles pale yellow or with a brown spot; propleura with a longitudinal strigose black or brown vitta ... 5
5. Collar with a wide lateral vitta or bar behind eye, upper portion of vitta on propleura closely approximated to the small lateral black spot of disc ... *cairnsensis* Carvalho & Gross, n.sp.
   Collar without a lower lateral vitta or bar behind eye, upper portion of vitta on propleura not approaching the small lateral black spot of disc ... *malayensis* n.sp.
6. Mesosternum and metapleura pale yellow; area of calli pale or mostly so ... *philippinesis* n.sp.
   Mesosternum laterally and metapleura with black spots; area of calli mostly black ... 7
7. Humeral angles pale yellow; lateral portion of abdomen reddish ... *papuensis* n.sp.
   Humeral angles with a black spot; sides of abdominal ventrites black dorsally ... 8
8. Scutellum except for central black line concolorous; pygophore black ... *samoanus* (Knight)
   Scutellum except for central black line reddish; pygophore pale to dark brown ... *fijiensis* n.sp.

Hyalopeplinus antennalis (Distant, 1920), *n.comb.*

Callicratides antennalis Distant, 1920, p. 160.

Hyalopeplus antennalis Carvalho, 1959, p. 319.

(Figs. 49-52, 86)

Characterised by the colour of pronotum and apex of hind femur.

Male: Length 5·4 mm, width 1·8 mm. *Head:* Length 0·6 mm, width 1·2 mm, vertex 0·44 mm. *Antenna:* Segment I, length 0·6 mm; II, 2·8 mm; III, 0·9 mm; IV, broken. *Pronotum:* Length 0·8 mm, width at base 1·7 mm. *Cuneus:* Length 0·72 mm, width at base 0·40 mm (lectotype).

"Ochraceous; eyes black; antennae ochraceous, basal joint pale sanguineous, apex of second joint black, third and fourth joints black, with their bases narrowly ochraceous; pronotum with a short longitudinal black line on basal area, three spots (sometimes wanting) on the anterior collar, and the extreme basal angles black, basal marginal area more or less castaneous; margins and a central longitudinal line to scutellum, inner and outer margins of clavus, and narrow apical margins to corium black; membrane very pale ochraceous, with the venation black; body beneath and legs ochraceous, apices of the femora castaneous; corium more or less pale castaneous, with the lateral marginal areas and the cuneus very pale ochraceous; antennae with the basal joint incrassated, about as long as head, second joint longest, moderately thickened, about four times as long as first; scutellum moderately long, tumid, subdepressed, and longitudinally sulcate; femore moderately incrassated. Long. 5 mm. Hab. New Caledonia, Central District and Upper Houadou R."

Pale yellowish to citrine or ochraceous; segments I and II of antenna pale yellow to castaneous, reddish apically; vertex and inner margins of eyes with obsolete, castaneous, longitudinal vittae; eyes brown; collar with seven longitudinal bars (three median and two lower lateral running backwards on the propleura) fuscous to reddish; pronotum with a short longitudinal black vitta on middle of disc, a median slender line between calli reddish, humeral angles black; mesoscutum with two oblique fasciae and scutellum with a rugose longitudinal black vitta (not reaching apex) and lateral margins (with punctures) also black; hemelytra with claval, clavo-corial and corial sutures black; nervures of membrane fuscous; apex of hind femora reddish.

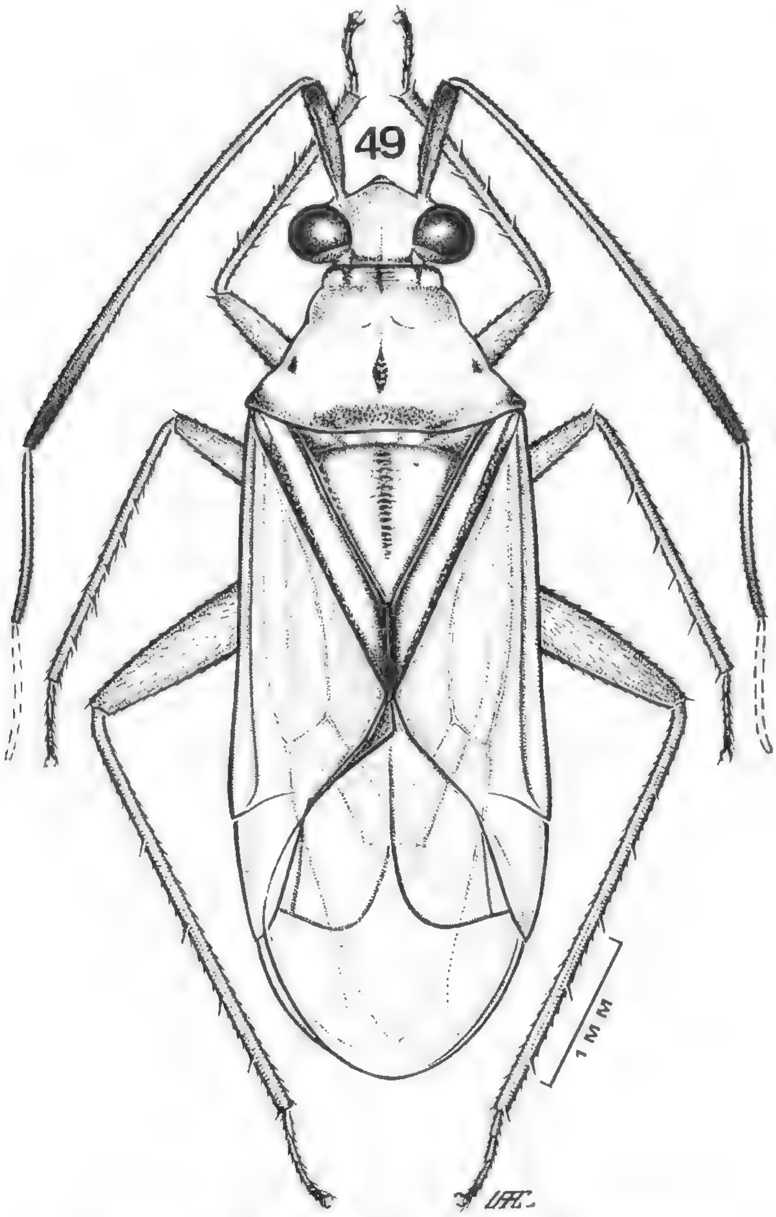


Fig. 49—*Callicratides antennalis* Distant, male, holotype (=*Hyalopeplinus antennalis* (Distant).

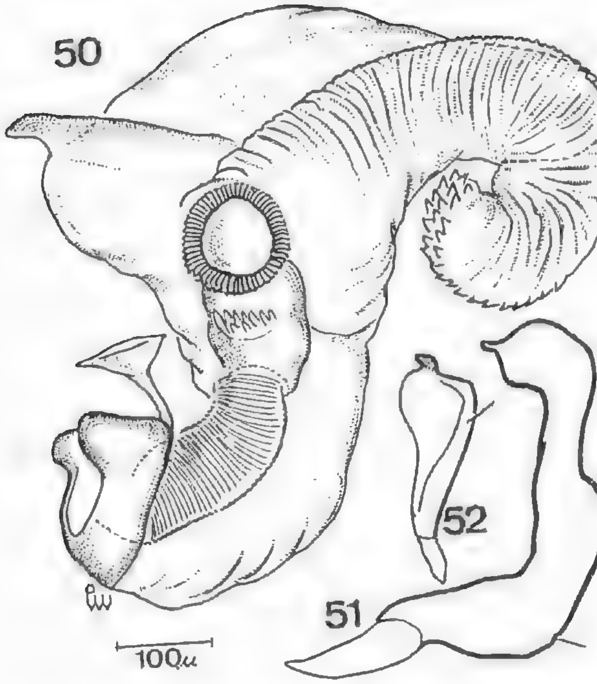
Male genitalia: Penis (fig. 50) with membranous lobes provided with minute sclerotized teeth. Left paramere (fig. 51) falciform, curved irregularly, with acute apex. Right paramere (fig. 52) small, enlarged apically, ending in a small sclerotized point.

Female: Similar to male in colour and general aspect. Length 6·0 mm, width 2·4 mm.

Geographical distribution: New Caledonia.

Specimens studied: male, lectotype (new designation) from Central NEW CALEDONIA, 5.xii.1914, P. D. Montague, 1918-87 (BMNH). *Paralectotype:* male, same data as type and 52 males and females, NEW CALEDONIA: male, Gadji, 23.ix.1962, G. F. Gross (SAM); Yahoué, 12.ii.1962, N. L. Krauss; Plum, 20-60 m, 23-25.iii.1968, T. C. Maa; Pouebo, 2.i.1964, R. Straatman, light trap; St. Louis, 1950, N. L. H. Krauss; La Grouen, 150 m, 20-22.iii.1968, J. L. Gressitt; id. T. C. Maa, 15.iii.1961; Col. d'Amieu, 700-800 m, 31.iii.1968; Nouméa, v.1950, N. L. H. Krauss; Plateau de Dogmy, 1·000 m 9.iv.1969, J. L. Gressitt; Col. des Roussetes, 300-400 m, 29.i.1969; Poindimié, 50 m, i.1969; Thio, 50 m, 7.i.1969; Saramea, 12.ii.1963; Ciu, 9.i.1969, N. L. H. Krauss; St. Louis Valley, 17.iii.1945, H. E. Miliron; LOYALTY ISLANDS: Mare I., La Roche, iii.1959, N. L. H. Krauss (BISHOP).

This species differs from others in the genus by lack of a M-shaped figure on disc; frons without a small black spot over antennal peduncle; propleura pale laterally and collar with three upper vittae.



Figs. 50-52—*Hyalopeplinus antennalis* (Distant): Fig. 50—Penis; Fig. 51—Left paramere; Fig. 52—Right paramere.

Hyalopeplinus cairnsensis Carvalho and Gross, n.sp.

(Figs. 53-57, 85)

Characterised by the absence of a black spot above antennal peduncle and by the colour of collar and sternal areas.

Male: Length 6·3 mm, width 1·9 mm. *Head:* Length 0·9 mm, width 1·3 mm, vertex 0·47 mm. *Antenna:* Segment I, length 0·8 mm; II, 2·6 mm; III, 1·6 mm; IV, 1·0 mm. *Pronotum:* Length 1·3 mm, width at base 1·8 mm. *Cuneus:* Length 1·09 mm, width at base 0·47 mm.

General coloration ochraceous or honey coloured with dark areas; apex of a second antennal segment and whole of third and fourth segments and a thin longitudinal line on crown of head brown. On pronotum a central, broad, longitudinal, impressed and transversely striate line extending from anterior margin to about middle of disc of hind lobe; on either side of the expanded portion of the latter but near the lateral margins a depressed striate pit, and a spot on the lateral margins of the collar, black. A spot on each lateral angle and sometimes also a small spot on collar on either side of midline about half way to lateral margin brown. On mesoscutum a spot on either side and on scutellum a broad, tapering, longitudinal, impressed and transversely striate line medially reaching about two thirds of the way back, black. Clavus outlined with black, this black continuing along inner veins of corium for a short distance behind apex of clavus; otherwise hemelytra and wings vitreous, embolium and clavus more opaque. Apex of rostrum black. Laterally on propleuron a blackish or brownish strigose longitudinal impresses bar, wider posteriorly than anteriorly. Mesosternum and sides of abdomen reddish or brownish orange. Legs faintly maculated with brown.

Pilosity restricted to appendages where it is short and dark and to apical portion of underside of abdomen where it is longer, sparser and pale.

Genitalia: Vesica (fig. 54) with membranous lobes and an indication of a weakly sclerotized spiculum (fig. 55). Left paramere (fig. 56) irregularly and broadly curved, apically acute. Right paramere (fig. 57) expanded before apex and with an apical tubercle.

Female: Length 6·3 mm, width 2·1 mm. *Head:* Length 0·8 mm, width 1·5 mm, vertex 0·55. *Antenna:* Segment I, length 0·8 mm, II, 2·7 mm; III, 1·5 mm; IV, 1·1 mm. *Pronotum:* Length 1·4 mm, width at base, 2·1 mm. *Cuneus:* Length 1·04 mm, width at base 0·49 mm.

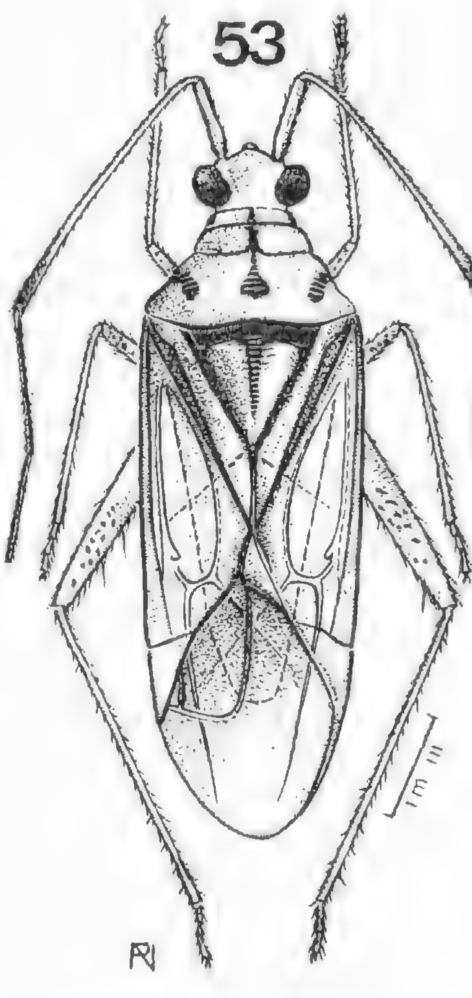
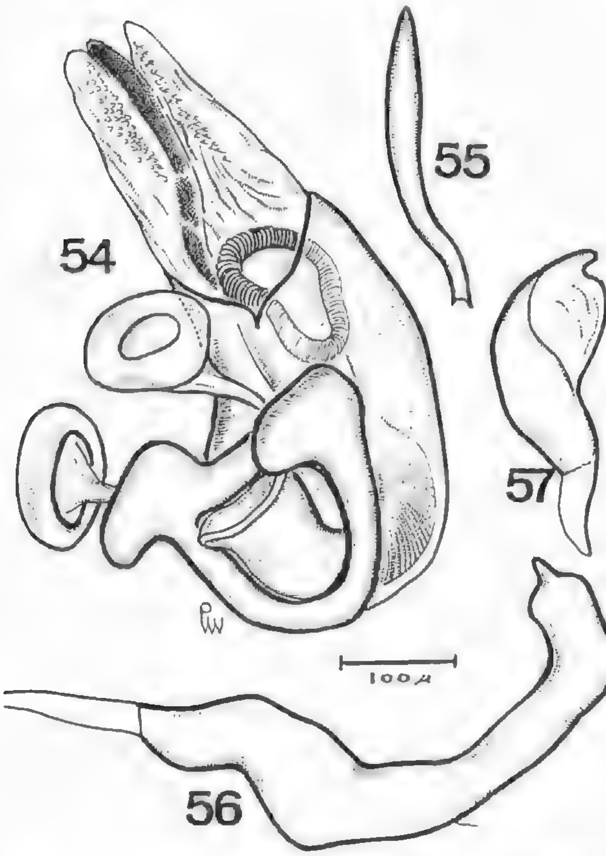


Fig. 53—*Hyalopeplinus cairnsensis* Carvalho & Gross, n.sp.; male, paratype.



Figs. 54-57—*Hyalopeplinus cairnsensis* Carvalho & Gross, n.sp.: Fig. 54—Penis; Fig. 55—Spiculum of vesica; Fig. 56—Left paramere; Fig. 57—Right paramere.

Colour and structure as for male. In some specimens the median line on the head is quite faint, in others the two brown spots on either side of the midline of the pronotal collar are absent. The width of the orange coloration on the sides of the abdomen varies considerably.

Holotype: male, AUSTRALIA, North Queensland: (Reg. no. I20,966), paratype ♂ and 4 paratype ♀ (Reg. nos. I20,967-71), Cairns District, F. P. Dodd; paratype ♀ (Reg. no. I20,977), Cairns District, A. M. Lea (SAM); allotype ♀, 4 paratype ♂, 3 paratype ♀, Iron Range, Cape York Peninsula, 27.iv-4v.1975, G. B. Monteith; paratype ♂, same locality, 13-14.xi.1965, G. Monteith; 3 paratype ♂, same locality, 16-23.xi.1965, G. Monteith; paratype ♂, paratype ♀, Lockerbie Scrub, Cape York, 19-22.iv.1973, G. B. Monteith; paratype ♂, Churchill Creek, Mt. Lewis Road, *via* Julatten, 27.xi.1965, G. Monteith (QU); 4 paratype ♂, 2 paratype ♀, Dunk Island, Aug. 1927, H. Hacker; 1 paratype ♂, 1 paratype ♀, to light, Little Cedar Creek, Mt. Spec, 1.ii.1965, E. Dahms (QM); paratype ♀, Finch Hatton Gorge, 29.i.1975, B. K. Cantrell, Dept. Prim. Industries, Brisbane; paratype ♂, Iron Range, 11.iv.1964, I. F. B. Common & M. S. Upton (ANIC); Lockerbie, N. Cape York, Jan. 1958, Darlington col. (BNMH); N. Queensland, Redlynch, 14.ii.1938, Papuan-Australian Archbold Exp., BM. 1947-448.

This species differs from *Hyalopeplinus malayensis* n.sp. by having the collar without a lower lateral vitta or bar behind eye and by the vitta of propleura fused to a small lateral black spot on disc.

Hyalopeplinus cristovalensis, n.sp.

(Figs. 58-61, 89)

Characterised by the colour of pronotum and by the structure of male genitalia.

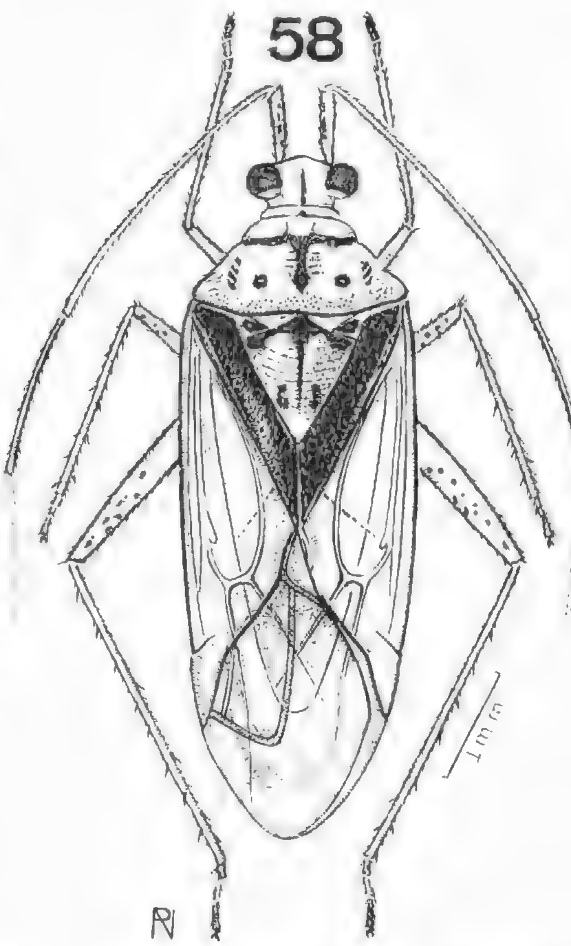


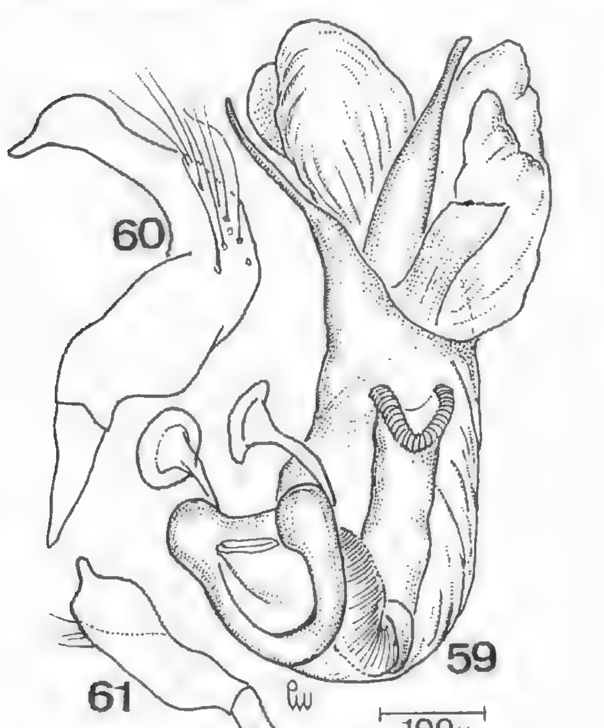
Fig. 58—*Hyalopeplinus cristovalensis* n.sp., male, holotype.

Male: Length 5·4 mm, width 1·8 mm. *Head:* Length 0·4 mm, width 1·2 mm, vertex 0·4 mm. *Antenna:* Segment I, length 0.6 mm; II, 2.8 mm; III, 1.2 mm; IV, broken. *Pronotum:* Length 1·0 mm, width at base 1·6 mm. *Cuneus:* Length 0·76 mm, width at base 0·36 mm (holotype).

General coloration ochraceous to lutescent with black areas; eyes, a longitudinal line on vertex and two spots on frons above antennal peduncles brown to black; antenna brownish, segment I pale to lutescent with spots or fascia on lower external portion; pronotum with posterior margin of collar, posterior margins of calli (coalescent with a longitudinal median vitta which extends to middle of disc), two lateral vittae and two rounded spots (one at each side) on the disc and an irregular spot on propleura coalescing with a small rounded spot on lateral margin of disc brown to black; mesoscutum with three spots (median and two lateral) black; scutellum with a median longitudinal strigose vitta narrowed towards apex (not reaching extremity), two spots on basal angles and four small spots, sometimes coalescent (two at each side) black; hemelytra glassy, corium and embolium transparent, clavus black, opaque, beset with silvery pubescence, external margin of corium and ebolium, corial commisure and corial apex, margin and apex of cuneus, nervures of mebrane fuscous, the latter hyaline with two small longitudinal spots on the apical portion. Underside of body pale yellow to ochraceous, posterior margin of mesosternum, a spot on metapleura and a lateral, longitudinal fascia on abdomen pale yellow; femora with distinct black spots.

Lateral margins of pronotum, clavus, embolium and cuneus noticeably pilose, ventral surface of abdomen and pygophore with long hairs.

Genitalia: Penis (fig. 59) with a median sclerotized spiculum and membraneous lobe. Left paramere (fig. 60) curved, somewhat enlarged preapically, apex pointed. Right paramere (fig. 61) small, also pointed apically.



Figs. 59-61—*Hyalopeplinus cristovalensis* n.sp.: Fig. 59—Penis; Fig. 60—Left paramere; Fig. 61—Right paramere.

Female: Similar to male in colour and general aspect. Length 6·0 mm, width 2·0 mm, vertex 0·44 mm (allotype).

Holotype: male, SOLOMON ISLANDS: San Cristoval, Kira Kira, 26.vii.1960, light trap, C. W. O'Brien (BISHOP). *Allotype:* female, Bweinaniawarikiapu, 12.viii.1960, light trap, C. W. O'Brien. *Paratypes:* 6 females and 7 males, same data as types (BISHOP), and author's collection.

This species is close to *Hyalopeplinus solomonensis* n.sp. but differs by the colour of pronotum and by the lack of velvety spots on the sides of abdomen.

Hyalopeplinus fijiensis Carvalho & Gross, n.sp.

(Figs. 62, 87)

Characterised by the reddish scutellum and by the black suffusion on calli covering most of calli.

Male: Length 5·7 mm, width 2·0 mm. *Head:* Length 1·0 mm, width 1·1 mm, vertex 0·48 mm. *Antenna:* Segment I, length 0·7 mm; II, 2·6 mm; III, 1·0 mm; IV, 0·5 mm. *Pronotum:* Length 1·1 mm, width at base 1·8 mm. *Cuneus:* Length 0·8 mm, width at base 0·51 mm.

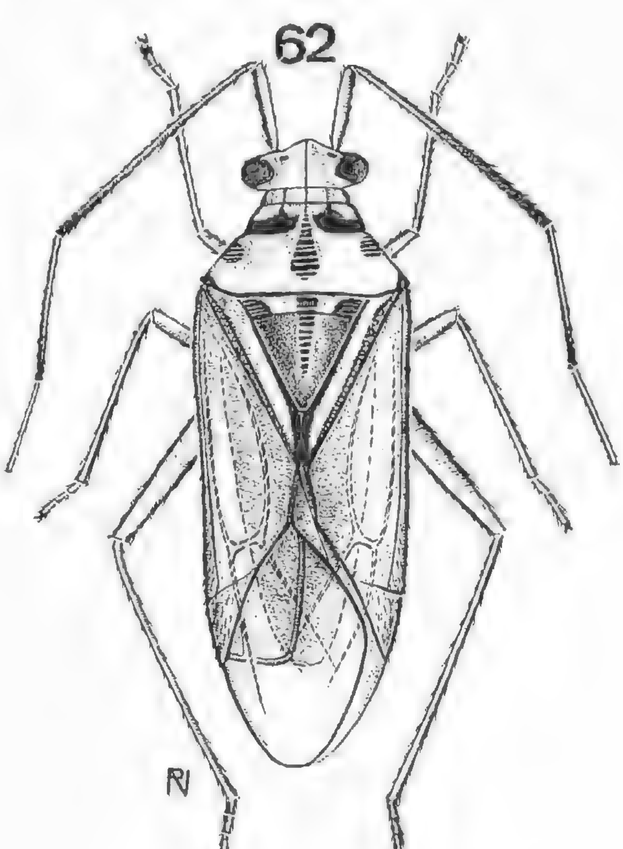


Fig. 62—*Hyalopeplinus fijiensis* n.sp., male, holotype.

General coloration ochraceous with a faint tinge of green shining through hind lobe of scutellum and corium, embolium, clavus and cuneus. On head clypeus from above reddish, on crown dorsally a thin longitudinal line brown and anteriorly a vivid black spot above each antennifer; apex of second and third antennal segments faintly infuscated, from the small portion left of one of the fourth segments that segment too may be wholly infuscated.

On pronotum five black bars on collar, central and extreme lateral ones wider and longer than the ones behind the inner margins of the eyes. Calli strongly marked with black except on their interior and exterior anterior margins. Between calli and anteriorly continuous with central line on collum and there extending back to just before level of lateral angles black, impressed and transversally striate line which is expanded basally, on either side of expanded portion of latter but near the lateral margins a depressed striate pit and a spot on the lateral angles also black. Mesoscutum blackish except for a short, oblique, reddish-orange bar on each side about midway between centre and lateral margin; on scutellum a central, longitudinal, depressed, transversely striate, black line, in anterior portion rest of disc dark reddish. Clavus outlined with black, more broadly so along inner and posterior margins, this black continuing on to corium for a short distance behind apex of clavus. Hemelytra and wings vitreous, embolium and cuneus more opaque.

Anteclypeus anteriorly and laterally also reddish, apex of rostrum black. Laterally on propleura in addition to the lateral black spot on collar and at the lateral angles of the pronotum a large K-shaped bluish-black area which is strigose in parts. Anterior scute of mesopleural region bluish-black, posterior brownish yellow. Peritreme of scent gland brownish yellow, metapleuron above this bluish-black. Sides of abdominal ventrites black dorsally except for last and genital segments. Anterior portion of hind femora strongly maculated with brown.

Pilosity restricted to appendages where it is short and pale except for some longer thin spinous hairs on hind femora.

Genitalia: Penis with membranous lobes and a sclerotised spiculum. Left paramere falciform, pointed apically. Right paramere smaller, also with an acute distal extremity.

Female: Similar to male in coloration and general aspect. Length 6·1 mm, width 2·2 mm, vertex 0·50 mm.

Holotype: male, FIJI: Nadarivatu, Viti Levu, 8.ii.1968, N. McFarland (SAM, registered number I21,076).

Paratypes: males and females, Viti Levu, ii.1951. N. L. H. Kraus (BISHOP).

This species is close to *Hyalopeplinus samoanus* (Knight) but differs by the colour of scutellum and lateral portion of pronotum (figs. 83, 87).

Hyalopeplinus malayensis, n.sp.

(Figs. 63-66, 91)

Characterised by the colour of frons, collar and lateral area of propleura.

Female: Length 6·2 mm, width 2·0 mm *Head:* Length 0·5 mm, width 1·2 mm, vertex 0·52 mm. *Antenna:* Segment I, length 0·6 mm; II, 2·4 mm; III, 1·0 mm; IV, 0·8 mm. *Pronotum:* Length 1·0 mm, width at base 1·8 mm. *Cuneus:* Length 0·68 mm, width at base 0·40 mm (holotype).

63

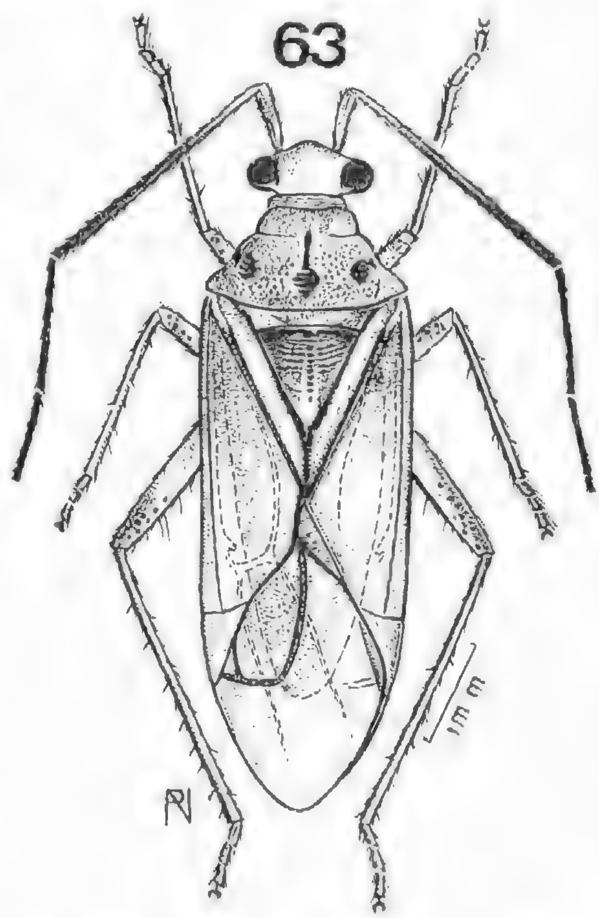


Fig. 63—*Hyalopeplinus malayensis* n.sp., male, holotype.

General coloration ochraceous with black to fuscous areas; eyes, median longitudinal vitta (dilated as a spot posteriorly) and two lateral spots on disc of pronotum, basal angles and a median longitudinal strigose vitta on scutellum (not reaching apex), lateral margins of clavus, claval commissure, apical margin and commissure of corium, margins of cuneus and nervures of membrane fuscous to black;

antenna fuscous, segment I ochraceous, corium and membrane glassy, transparent, embolium and cuneus opaque. Underside of body ochraceous, propleura above with a longitudinal vitta (enlarged posteriorly) black; between this vitta and the lateral rounded spot of pronotum there is also a small black spot; apex of rostrum fuscous; legs ochraceous, hind femora with a series of fuscous spots on external margin.

On the specimens from Malaya the apex of scutellum and a small area at each side of median longitudinal strigose vitta are paler yellow; on the Sumatran and Sri Lanka specimens the longitudinal median vitta of pronotum is continuous (on allotype this vitta extends also over vertex; and the collar, besides the median bar or vitta, also possessing two others on each side, one exteriorly and one laterally).

Male: Similar to female in general aspect but with collar showing two extra vittae on lower lateral margin. Length 5·4 mm, width 1·8 mm, vertex 0·52 mm.

Genitalia: Penis (fig. 64) with a small sclerotised spiculum and membranous lobes. Left paramere (fig. 65) falciform, pointed apically. Right paramere (fig. 66) small, enlarged apically, with a minute sclerotised apex.

Holotype: female, LAOS: Sedone Prov., Pakson, 18.v.1965, P. D. Ashlock, light trap (BISHOP). *Allotype:* male, INDONESIA: Dolok Merangir, Sumatra, July-Aug., 1971, Deihl (AMNH). *Paratypes:* female, SRI LANKA: Peradeniya, viii.1911 (BMNH); female, INDONESIA: Sumatra, Dolok Merangir, Sept. 27-30, 1970, Diehl (AMNH); female, same data as holotype; VIETNAM: Saigon, viii.1903, Donnateur Comm. Foukeut; Sanari, 1934.

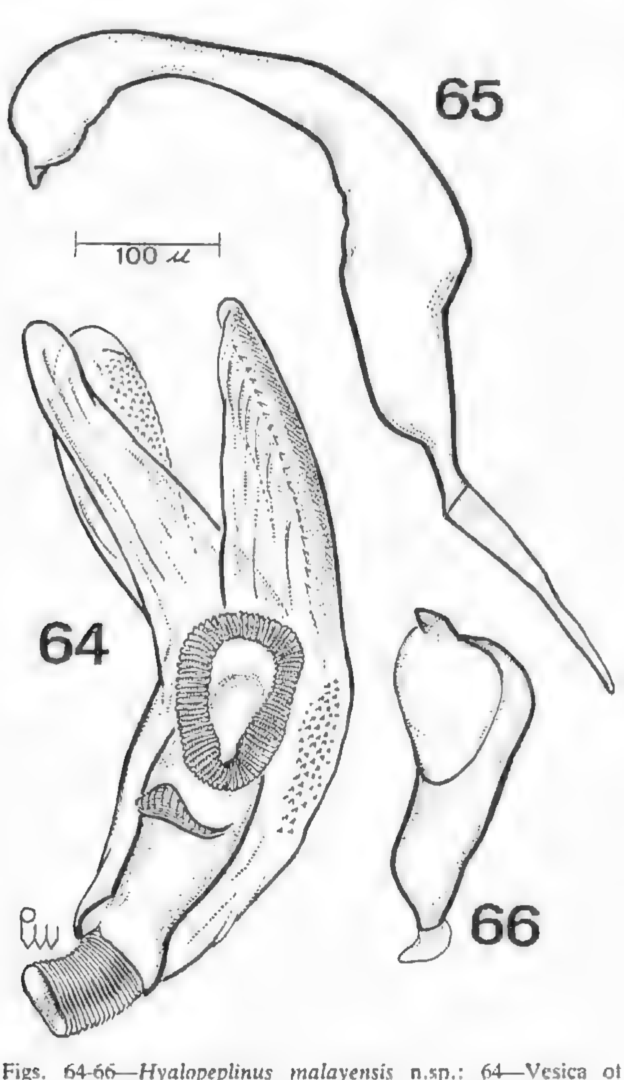
This species resembles *Hyalopeplinus cairnsensis* n.sp. but vittae of the propleura do not come as close to the lateral spots on the dorsum of the pronotum.

Hyalopeplinus papuensis, n.sp.

(Figs. 67-70, 84)

Characterised by the colour of frons, sides of sternum and abdomen.

Male: Length 4·8 mm, width 1·8 mm. *Head:* Length 0·4 mm, width 1·2 mm, vertex 0·44 mm. *Antenna:* Segment I, length 0·7 mm; II, 2·4 mm; III, 1·8 mm; IV, 0·7 mm. *Pronotum:* Length 0·9 mm width at base 1·5 mm. *Cuneus:* Length 0·60 mm, width at base 0·32 mm (holotype).



Figs. 64-66—*Hyalopeplinus malayensis* n.sp.: 64—Vesica of aedeagus; Fig. 65—Left paramere; Fig. 66—Right paramere.

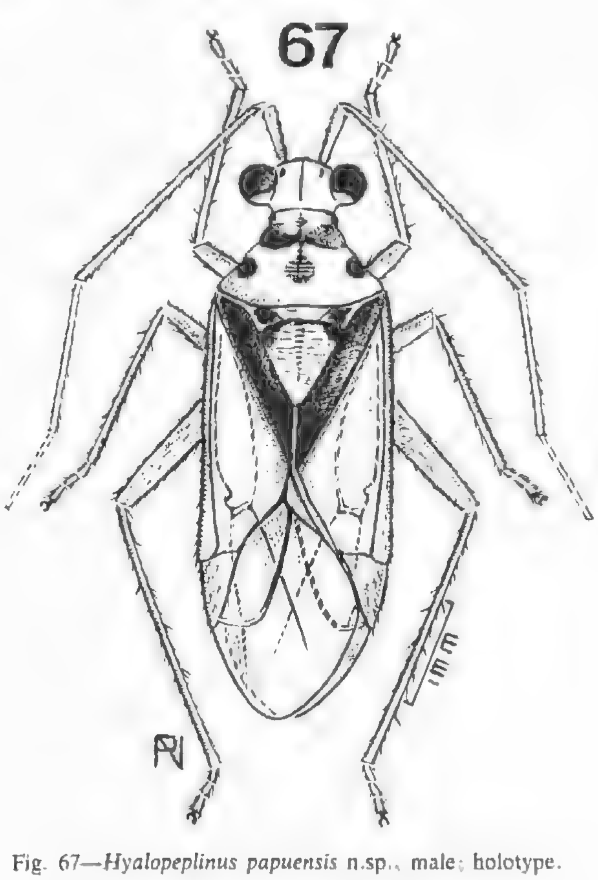


Fig. 67—*Hyalopeplinus papuensis* n.sp., male; holotype.

General coloration ochraceous with fuscous to black areas; eyes, area of calli, five roundish spots on disc of pronotum, one median followed anteriorly by a longitudinal median vitta reaching collar and vertex, and four lateral spots, the larger ones seen from above and the smaller ones seen only from side (united or not with larger spots); two lateral spots on mesoscutum, longitudinal strigose vitta of scutellum (not reaching apex) and clavus fuscous to black; embolial and cuneal margins, apical margin of corium and nervures of membrane fuscous; corium and membrane glassy, transparent, embolium and cuneus opaque; sternal area ochraceous, propleura (except margin of anterior coxal cleft), mesosternum laterally, meso and metapleura black. In some specimens the posterior portion of propleuron below the dark fascia ochraceous; abdomen reddish laterally. The collar of this species shows three bars or vittae above (the median one extending whole length of the collar but the two lateral ones not reaching anterior margin) and two lower ones laterally behind eyes well marked and about as wide as width of segment I of antenna, black. Legs ochraceous, tibiae slightly darker.

Genitalia: Penis (fig. 68) with a small sclerotized spiculum and membranous lobes. Left paramere (fig. 69) falciform, pointed apically. Right paramere (fig 70) small, globose apically, ending in a blunt point.

Female: Similar to male in colour and general aspect. Length 6·5 mm, width 2·1 mm, vertex 0·48 mm.

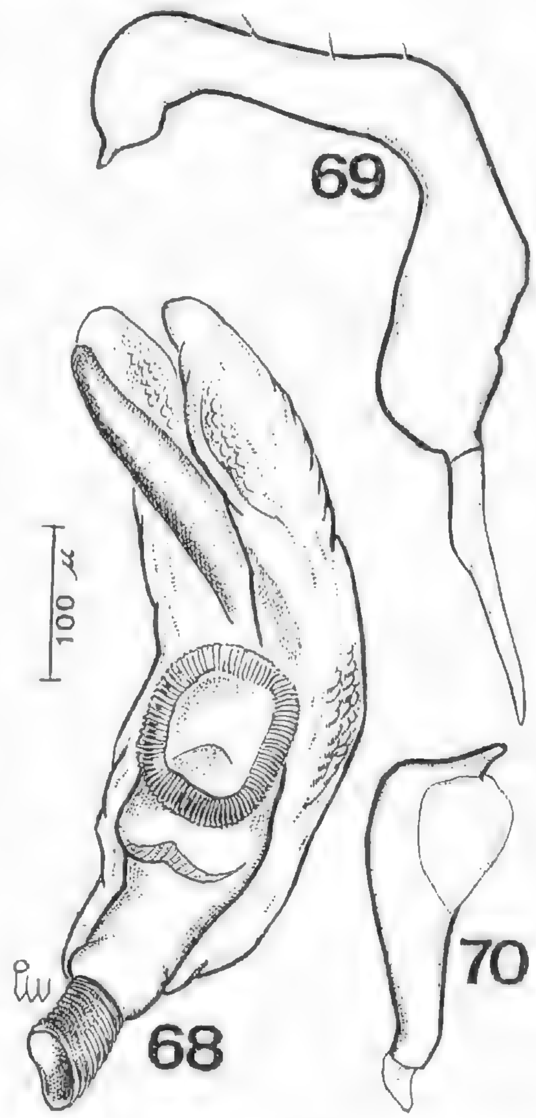
Holotype: male, PAPUA-NEW GUINEA: Abaleti, Rossel Isl., 0·50 m, no12, 28.ix.1956, Fifth Archbold Exp. to New Guinea, L. J. Brass (AMNH). *Allotype:* female, Biniguni, Gulariu River, 150 m, no3, July-Aug. 14.1953, Geoffrey M. Tate, Fourth Archbold Exp. *Paratypes:* two males, same data as holotype; female, Mt. Riu, Sudest Isl. 250-350 m, no10, 9.i.1956, Fifth Archbold Exp. to New Guinea, L. J. Brass, male, New Guinea, S. E. Ruka 9 m, 12.viii.1964, H. Clissold, light traps. INDONESIA: Irian Jaya, Waris S of Hollandia, 450-500 m, 1-7.viii.1959, T. C. Maa; male, NEW BRITAIN: Linga Linga, W of Willeumes, P. En. Im. xiv.1956, J. L. Gressitt.

Differs from *Hyalopeplinus samoanus* (Knight) by the pale humeral angles and by the reddish lateral fascia of abdomen.

Hyalopeplinus philippinensis, n.sp.

(Figs. 71-74, 88)

Characterised by the colour of frons, collar and lateral area of sternum.



Figs. 68-70—*Hyalopeplinus papuensis* n.sp.: Fig. 68—Vesica of aedeagus; Fig. 69—Left paramere; Fig. 70—Right paramere.

Male: Length 5·8 mm, width 1·8 mm. *Head:* Length 0·4 mm, width 1·2 mm, vertex 0·44 mm. *Antenna:* Segment I, length 0·7 mm; II, 2·7 mm, III, 1·4 mm; IV, 0·9 mm. *Pronotum:* Length 1·1 mm, width at base 1·6 mm. *Cuneus:* Length 0·72 mm, width at base 0·40 mm.

General coloration ochraceous with fuscous to black areas; eyes, three spots on pronotum—one median followed anteriorly by a longitudinal vitta reaching collar, two lateral ones visible from above; median and lateral spots on mesoscutum, a median longitudinal strigose vitta on scutellum (not reaching apex) black; margins of clavus, commissure and apical margin of corium, margins of embolium, margins of cuneus and nervures of membrane fuscous; corium and membrane glassy, transparent; antenna ochraceous, segments III and IV fuscous. Underside of body ochraceous, a lateral fascia on propleura coalescing or not with lateral spot of disc black; legs pale; collar with three median bars or vittae and two lower lateral ones (their width approximately equal to width or segment I of antenna) black; femora with fuscous spots externally, abdomen with a lateral orange fascia.

Genitalia: Penis (fig. 72) with a sclerotized spiculum and membranous lobes provided with minute teeth apically. Left paramere (fig. 73) falciform, pointed. Right paramere (fig. 74) globose, small.

Female: Similar to male in colour and general aspect. Length 6·0 mm, width 2·0 mm, vertex 0·46 mm.

71

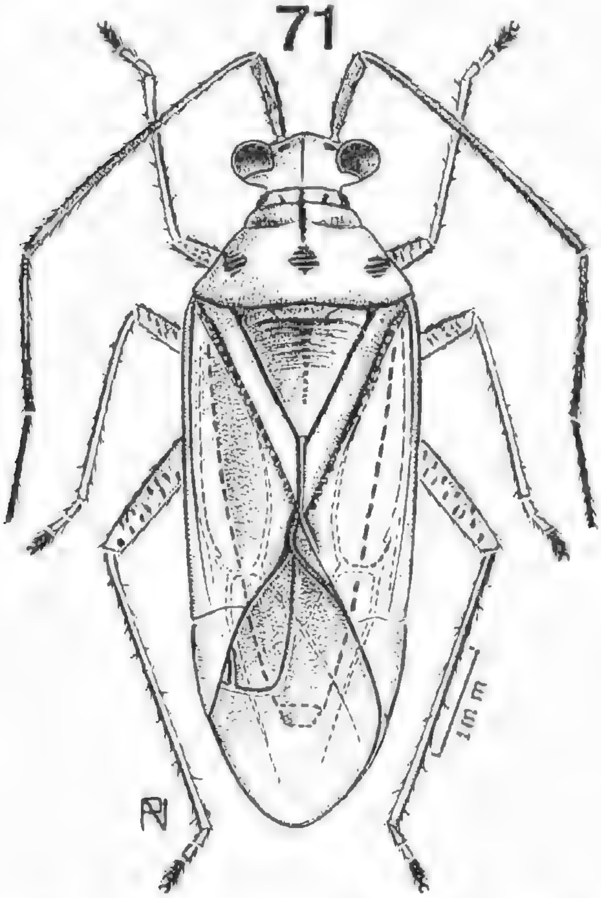


Fig. 71—*Hyalopeplinus philippinensis* n.sp., male holotype.

Holotype: male, PHILIPPINES: Negros I., Camp Lookout, Dumaguete, 14.v.1961, T. Schneiria, A. Reyes (AMNH). *Paratypes:* seven males and females Luzon, Prov. Ifugao, Mt. Mayoyao, 1 000-1 500 m, 7.vii.1966, H. Torrevillas, light trap (BISHOP), and in the author's collection.

This species approaches *Hyalopeplinus papuensis* n.sp. but differs by the pale colour of sternal area and by the ochraceous area of calli.

Figs. 72-74—*Hyalopeplinus philippinensis* n.sp.: Fig. 72—Penis; Fig. 73—Left paramere; Fig. 74—Right paramere.

Hyalopeplinus samoanus (Knight, 1935), n. comb.

Guisardus samoanus Knight, 1935, p. 211, fig.; Carvalho, 1959, p. 319.

(Figs. 75-78, 83)

Characterised by the colour of pronotum and by the structure of male genitalia.

Male: Length 5·9 mm, width 2·0 mm. *Head:* Length 0·5 mm, width 1·3 mm, vertex 0·48 mm. *Antenna:* Segment I, length 0·6 mm; II, 2·5 mm; III, 1·4 mm; IV, 0·5 mm. *Pronotum:* Length 1·0 mm, width at base 1·7 mm. *Cuneus:* Length 0·80 mm, width at base 0·40 mm.

General coloration ochraceous to pale yellow with fuscous to black areas; eyes, antenna (segments II-IV darker), narrow longitudinal line on vertex fuscous to brown, two spots above antennal peduncle on frons black, clypeus castaneous; pronotum with a wide vitta laterally, a small median longitudinal triangular vitta and two small (sometimes obsolete) spots or vittae at each side of median vitta of collar; hind margin of calli, a longitudinal median vitta following median vitta of collar, enlarged and globose posteriorly at middle of disc, two sublateral spots, usually curved anteriorly, continuing or not with equivalent spot on lateral margin of pronotum, a spot at humeral angles, a longitudinal vitta on propleura coalescing with another at lateral margin fuscous to black; spots at middle and basal angles of mesoscutum, a longitudinal vitta on scutellum narrowed towards apex (but not reaching it) and basal angles black; clavus internal and externally, claval, corial and cuneal margins and nervures of membrane fuscous. Underside of body pale yellow, mesoscutum laterally, metapleura and spot on second abdominal segment fuscous, lateral longitudinal vitta on abdomen black; legs pale yellow, hind femora tending to castaneous apically with fuscous spots on outer surface.

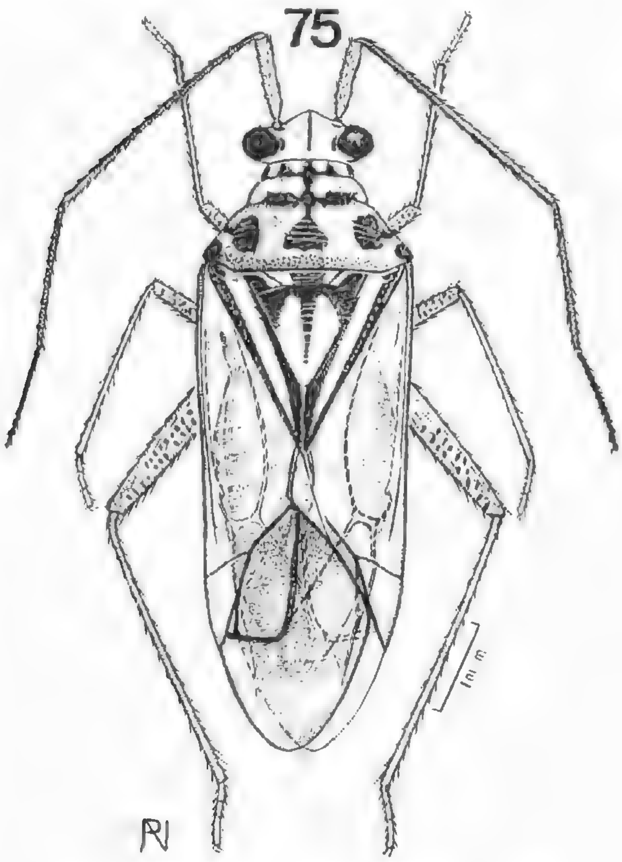


Fig. 75—*Hyalopeplinus samoanus* (Knight), female.

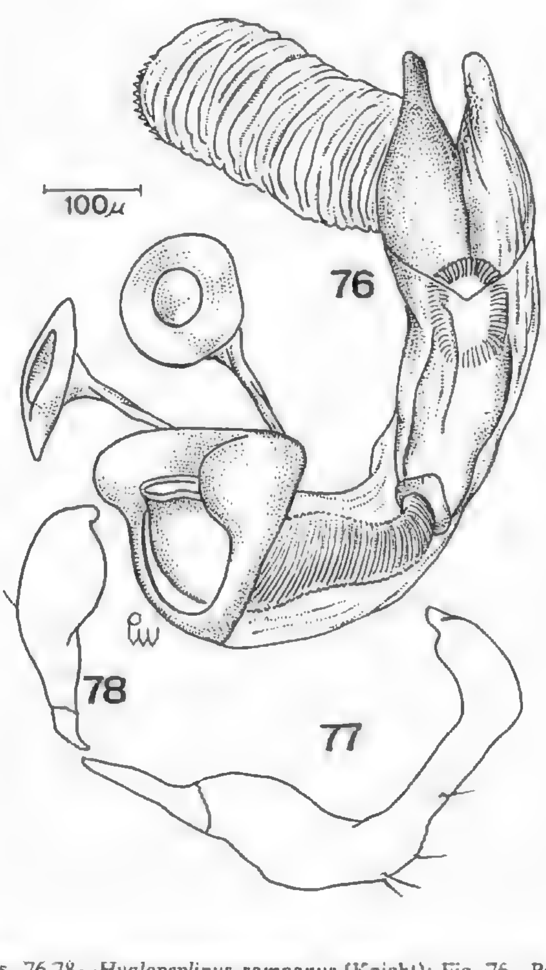
Genitalia: Penis (fig. 76) with a sclerotised spiculum and membranous lobes. Left paramere (fig. 77) falciform, thicker at basal and subapical portions, pointed apically. Right paramere (fig. 78) small, thickest at middle, with a blunt point at apex.

Female: Similar to male in colour and general aspect. Length 6·2 mm, width 2·2 mm, vertex 0·52 mm.

Geographical distribution: Samoa, New Hebrides, Raratonga Is., American Samoa, Society Islands, Tabuai Is.

Specimens studied: several males and females, SAMOA: Afiamalu, Upolu, 10.vi.1940, 2 200 ft, at light, Swezey and Zimmerman; id. 25.vi.1940; id. 30.vi.1940; id. 5.vii.1940; id. ii.1955, N. L. Krauss; Pago-Matafao trail, 13.vii.1940, Tutuila I. 2 141 ft, beating shrubbery; Tapafao, Upolu, 21.v.1940, 1 000 ft, at light, Swezey & Zimmerman; Afiamalu, Upolu, iii.1962, R. W. Taylor (BISHOP and AMNH). AMERICAN SAMOA: Tutuila, Tapuna, 5.viii.1964, N. R. Spencer; Tatuputimu Farm, 11.xi.1963; Fagatogo, 19.vii.1963 (BISHOP); NEW HEBRIDES: Espiritu Santo I. (SW), Namatosopa, 300 m. 29.viii.1957; Narango, 90 m, vi.1960 (BISHOP); Aneityum, Red Crest, 1 200 ft, 3 m NE of Anelgauhat, v.1955; Erromanga, vii.1930, L. E. Cheesman, (BMNH); Aneityum, *Agathis* Camp, 19-21.vii.1971, G. Robinson (SAM). RARATONGA ISLAND: 2.ii.1937 (BISHOP). SOCIETY ISLANDS: Moorea, Baie de Cook, iii.1959, N. L. Krauss (BISHOP).

This species differs from others in the genus by the humeral angles and abdomen being black laterally.



Figs 76-78—*Hyalopeplinus samoanus* (Knight): Fig. 76—Penis; Fig. 77—Left paramere; Fig. 78—Right paramere.

Hyalopeplinus solomonensis, n.sp.

(Figs. 79-82, 90)

Characterised by the colour of pronotum and lateral margins of sternum.

Male: Length 5·6 mm, width 2·0 mm. *Head:* Length 0·3 mm, width 1·2 mm, vertex 0·44 mm. *Antenna:* Segment I, length 0·6 mm; II, 3·1 mm; III, 1·4 mm; IV, broken. *Pronotum:* Length 1·0 mm, width at base 1·8 mm. *Cuneus:* Length 0·60 mm, width at base 0·32 mm (holotype).

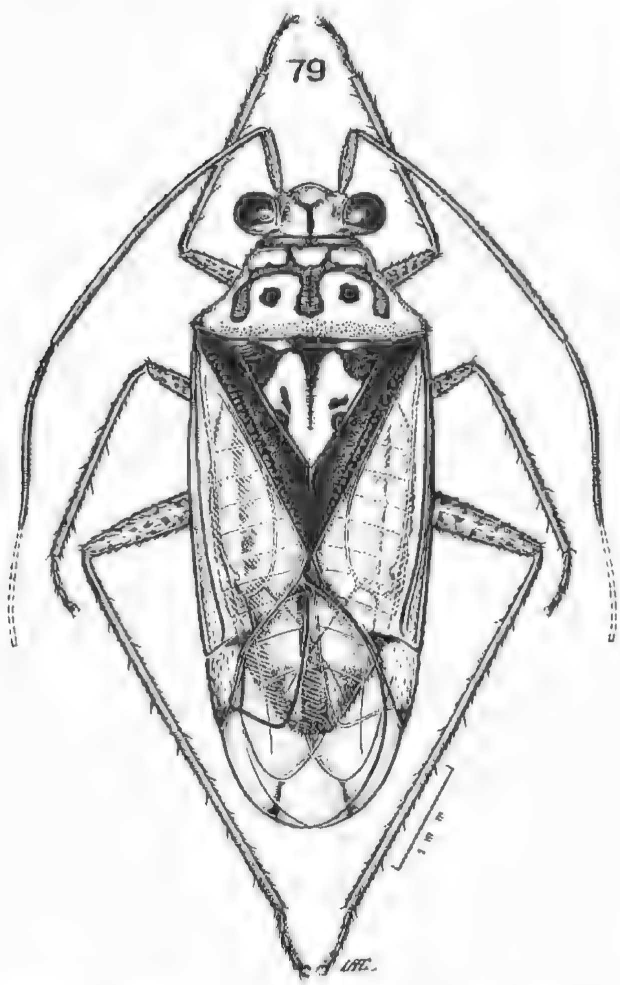
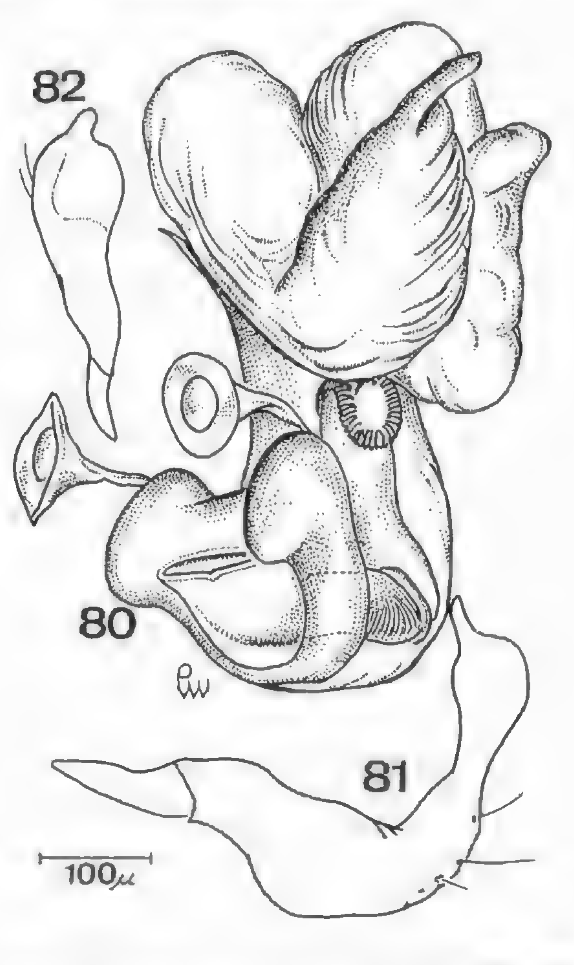


Fig. 79—*Hyalopeplinus solomonensis* n.sp., male, holotype.

General coloration ochraceous to citrine with dark silvery pruinose and brown areas; head with a longitudinal vitta on vertex, branched anteriorly, two spots above base of antennal peduncles, four spots on clypeus (base, sides and apex), vitta on lorum and vitta on lower margin of gena and spot on neck behind eye fuscous to black; eyes castaneous; antenna with segment I and II pale yellow (segment I with a dark longitudinal vitta interiorly), segments III-IV black; pronotum with collar, a characteristic M-shaped pruinose spot on disc (running along hind margin of calli with two projections forwards), the lateral and median longitudinal branches running backwards and becoming enlarged apically (not reaching hind margin of disc) black, extreme portion of humeral angles fuscous; mesoscutum at middle and external fossae black; scutellum with a longitudinal narrow strigose vitta (not reaching apex) and two vittae curving inwards and arising from the two black spots dark with silvery pruinosity; hemelytra glassy, transparent, clavus opaque, black, covered by silvery pruinosity, inner and outer margins of embolium and corium, commissure, inner and apical portion of cuneus, nervures of membrane fuscous to brown; membrane hyaline with two narrow longitudinal vitae at apical portion. Underside of body pale yellow, xyphus of prosternum, a characteristic spot on propleura with a round velvety black spot at middle, mesosternum (except a small pale spot) and a wide longitudinal vitta laterally on abdomen with elongate velvety spots on the upper portion of each segment fuscous to black; legs pale yellow, femora with small fuscous spots.

Pronotum strigose on black vittae or spots, scutellum also strigose at middle, clavus opaque, pilose, eyes large and prominent.



Figs. 80-82—*Hyalopeplinus solomonensis* n.sp.; Fig. 80—penis; Fig. 81—Left paramere; Fig. 82—Right paramere.

Genitalia: Penis (fig. 80) with a sclerotised spiculum and membranous lobes. Left paramere (fig. 81) falciform, pointed apically. Right paramere (fig. 82) small, globose.

Female: Similar to male in colour and general aspect. Length 6·0 mm, width 2·2 mm, vertex 0·48 mm (allotype).

Holotype: male, SOLOMON ISLANDS: Florida Group, Gairava, M'boli passage, Big Nggnela, 13.ix.1960, C. W. O'Brien (BISHOP). *Allotype:* female, same data as holotype. *Paratypes:* Eight males and fourteen females, same data as holotype and New Georgia Grp., Gizo I, 100 m, 17.vii.64, J. Sedlacek, malaise trap; Florida Grp., Vunula, Small Nggela, 19.ix.60, light trap, C. W. O'Brien; Santa Ysabel, Tamatahi, 450 m, 2.vii.1960, light trap, C. W. O'Brien; N. W. Malaita, Dala, 2.vii.1964, R. Straatman, light trap; id. Kwalo, 600-750 m, 29.ix.1957, light trap, J. L. Gressitt; Guadalcanal, Jan. 1921, J. A. Kuschel; id. Roroni, 35 km of Honiara, 10 m, 13.v.1964, R. Straatman; id. Lame nr. Mt. Tatuva, 300 m, 18.v.1960, light trap, C. W. O'Brien; Paripao, 21.v.1960, light trap; Bougainville, Kulugai Village, 150 m, xi.1960, W. W. Brandt; id. Buin, Kangu, 1-50 m, 3.v.1956, J. L. Gressitt.

This species approaches *Hyalopeplinus cristovalensis* n.sp. but differs by the colour of pronotum and velvety spots of abdomen.

Hyalopeploides Poppius, 1912

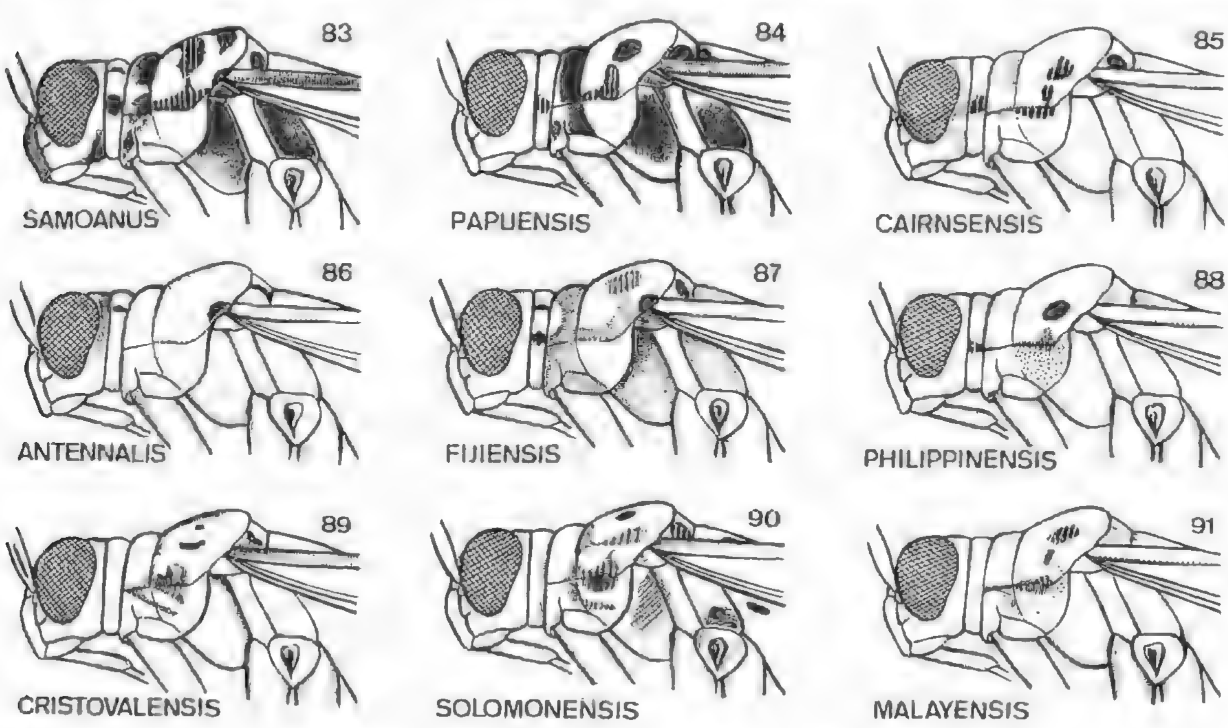
Hyalopeploides Poppius, 1912a, p. 419; Carvalho, 1959, p. 319.

Type-species: Hyalopeploides cyanescens Poppius, 1912.

Body elongate, mostly glabrous, shining. Head slightly wider than long, eyes almost contiguous with collar, frons with oblique striations (obsolete or absent in some species), clypeus prominent, compressed, rostrum reaching the middle coxae. Antenna with segment I thicker than others, about as long as width of head, segment I about three times as long as I, segments III-IV slender, pubescence short.

Pronotum with anterior portion noticeably constricted (so as to appear three lobed), collar wide, calli prominent, reaching lateral margins and well separated from collar and disc, hind margin slightly sinuate at middle; surface of pronotum faintly transversely rugose, the rugosities more marked on the dark vittae or spots, submarginal portion finely punctate; mesoscutum partially exposed, scutellum longitudinally impressed (with a shallow wide sulcus) and rugose transversely.

Hemelytra glassy, transparent, embolium and cuneus opaque, pubescent (in some species clavus also with hairs), clavo-corial and corio embolial sutures with a row of punctures, cuneus about twice or more as long as wide at base, membrane vitreous.



Figs. 83-91—Lateral view of head and pronotum showing colour markings on species of genus *Hyalopeplinus* n.gen.: Fig 83—*samoanus*; Fig. 84—*papuensis*; Fig. 85—*cairnsensis*; Fig 86—*antennalis*; Fig. 87—*fijiensis*; Fig. 88—*philippinensis*; Fig. 89—*cristovalensis*; Fig. 90—*solomonensis*; Fig. 91—*malayensis*.

Legs fairly long, hind tibiae with hairs, spines and minute sclerotised tubercles, parempodia divergent towards apices.

This genus is very close to *Hyalopeplus* Stål, 1870 but differs by the rugosities of pronotum occupying only the anterior two thirds and more evident on the black vittae or spots; by the submarginal portion of disc posteriorly finely punctate and without rugosities; by the disc noticeably constricted anteriorly as if being divided into three portions and by the rounded humeral angles.

List of species of the genus *Hyalopeploides* Poppius

1. *alienus* Carvalho & Gross, n.sp. ... Australia
2. *australiensis* Carvalho & Gross, n.sp. Australia
3. *borneensis* n.sp. ... Borneo
4. *cyanescens* Poppius, 1912 Papua-New Guinea
5. *fasciatus* n.sp. ... Java
6. *maculatus* n.sp. ... Papua-New Guinea
7. *neoguineanus* n.sp. ... Papua-New Guinea
8. *ochraceus* n.sp. ... Papua-New Guinea
9. *queenslandensis* Carvalho & Gross, n.sp. Australia
10. *rubriniscus* n.sp. ... New Ireland
11. *rubrinoides* n.sp. ... New Britain Bismark Is.
12. *similaris* n.sp. ... Solomon Is.
13. *trinotatus* n.sp. ... New Ireland

Key to the species of the genus *Hyalopeploides* poppius

1. Body except cuneus ochraceous; disc of pronotum with obsolete longitudinal orange vittae ... *ochraceus* n.sp.
   Body with black or dark brown vittae or spots ... 2
2. Head unicolorous; pronotum with three rugose vitta-like black spots ... 3
   Head with two spots on vertex or a longitudinal median dark vitta or the latter plus two vittae along inner margin of eyes ... 5
3. Collar without longitudinal dark vittae or bars; pronotum with a median and two lateral brown fossae or spots *alienus* Carvalho & Gross, n. sp.
   Collar with longitudinal dark vittae or bars ... 4
4. Collar with only two lower lateral spots, one at each side; calli unicolorous ... *trinotatus* n. sp.
   Collar with two median triangular black fasciae or bars; calli with two dark spots laterally, one at each side *queenslandensis* Carvalho & Gross, n. sp.
5. Cuneus black to dark brown; collar with four longitudinal median vittae, the lower ones larger and darker; vertex with two black spots at inner margin of eyes; calli mostly black or with black spots ... *cyanescens* Poppius
   Cuneus reddish or sulphurescent; collar with five to seven longitudinal vittae or bars ... 6
6. Disc of pronotum with a longitudinal median vitta reaching collar anteriorly and two round central spots, or with such vitta and spots plus two lateral vittae, one at each side, black; collar with three longitudinal vittae ... 7
   Disc of pronotum with three longitudinal vittae, usually covered by silvery pruinosity; collar with five to seven longitudinal bars or vittae ... 8
7. Disc of pronotum with a median longitudinal vitta and two spots black; scutellum with two longitudinal black vittae *maculatus* n. sp.
   Disc of pronotum with three longitudinal vittae and two spots black; scutellum with a single basal median longitudinal vitta ... *borneensis* n. sp.
8. Scutellum with two longitudinal dark brown to black vittae; sometimes fused into one ... 9
   Scutellum unicolorous or nearly so, without longitudinal black vittae ... 11
9. Collar with three longitudinal black vittae or bars, the lower ones characteristic, large and quadrate; head with a single median vitta ... *similaris* n. sp.
   Collar with five to seven longitudinal black vittae; head with three longitudinal vittae ... 10
10. Collar with five longitudinal vittae, the two lower ones, one at each side, large, black, quadrate ... *fasciatus* n. sp.
    Collar with seven longitudinal vittae, the two lower ones distinct, not fused into one ... *neoguineanus* n. sp.
11. Head unicolorous, without longitudinal reddish vittae; disc of pronotum with two longitudinal brown vittae between the median and the lateral *australiensis* Carvalho & Gross, n. sp.
    Head with three longitudinal reddish vittae; disc without three longitudinal brown vittae ... 12
12. Collar with seven longitudinal vittae, the lower ones reddish; sides of abdomen with one red vitta above *rubriniscus* n. sp.
    Collar with five longitudinal vittae, the two lower ones characteristic, fused anteriorly; sides of abdomen with two red longitudinal lateral vittae ... *rubrinoides* n. sp.

Hyalopeploides alienus Carvalho & Gross, n. sp.

(Figs. 92, 128)

Characterised by the colour of pronotum and collar.

Female: Length 7·5 mm, width 2·0 mm. *Head:* Length 1·0 mm, width 1·3 mm, vertex 0·54 mm. *Antenna:* Segment I, length 1·0 mm; II, 2·8 mm; III, 1·7 mm; IV, 0·8 mm. *Pronotum:* Length 1·5 mm, width at base 2·0 mm. *Cuneus:* Length 1·22 mm, width at base 0·49 mm (holotype).

General coloration brownish yellow; on head eyes blackish and apex of second and third and fourth antennal segments infuscated; pronotum with central depressed fossa pale brown and laterally to this on each side on lateral margins an oval brown spot; clavus vaguely darker then rest of hyaline portion of wings and hemelytra, embolium and cuneus pale yellowish brown; rest of hemelytra and wings hyaline. Dorsum of abdomen yellowish brown medianly, becoming more reddish brown laterally. Laterally and beneath concolorous with dorsal surface and apex of rostrum infuscated, apices of femora and towards lateral margins of abdomen faintly reddish.

Pilosity restricted to apical portion of embolium, cuneus, appendages and underside of abdomen, the pilosity dark on all but the underside of the abdomen where it is whitish. On tibiae some longer and paler spine like hairs interspersed with the shorter dark pilosity.

On pronotum medially a longitudinal, rather narrow, depressed transversely strigose groove extending from level of hind margin of calli to about $^2/_3$ of hind lobe. Disc of hind lobe faintly transversely strigose. Scutellum depressed anteriorly in the middle behind which is a longitudinal, depressed, transversely strigose groove running almost to apex.

Male: Unknown.

Holotype: female, AUSTRALIA: North Queensland, Cairns District, F. P. Dodd; 1 damaged female, Kuranda, F. P. Dodd (SAM Reg. no. I20,980).

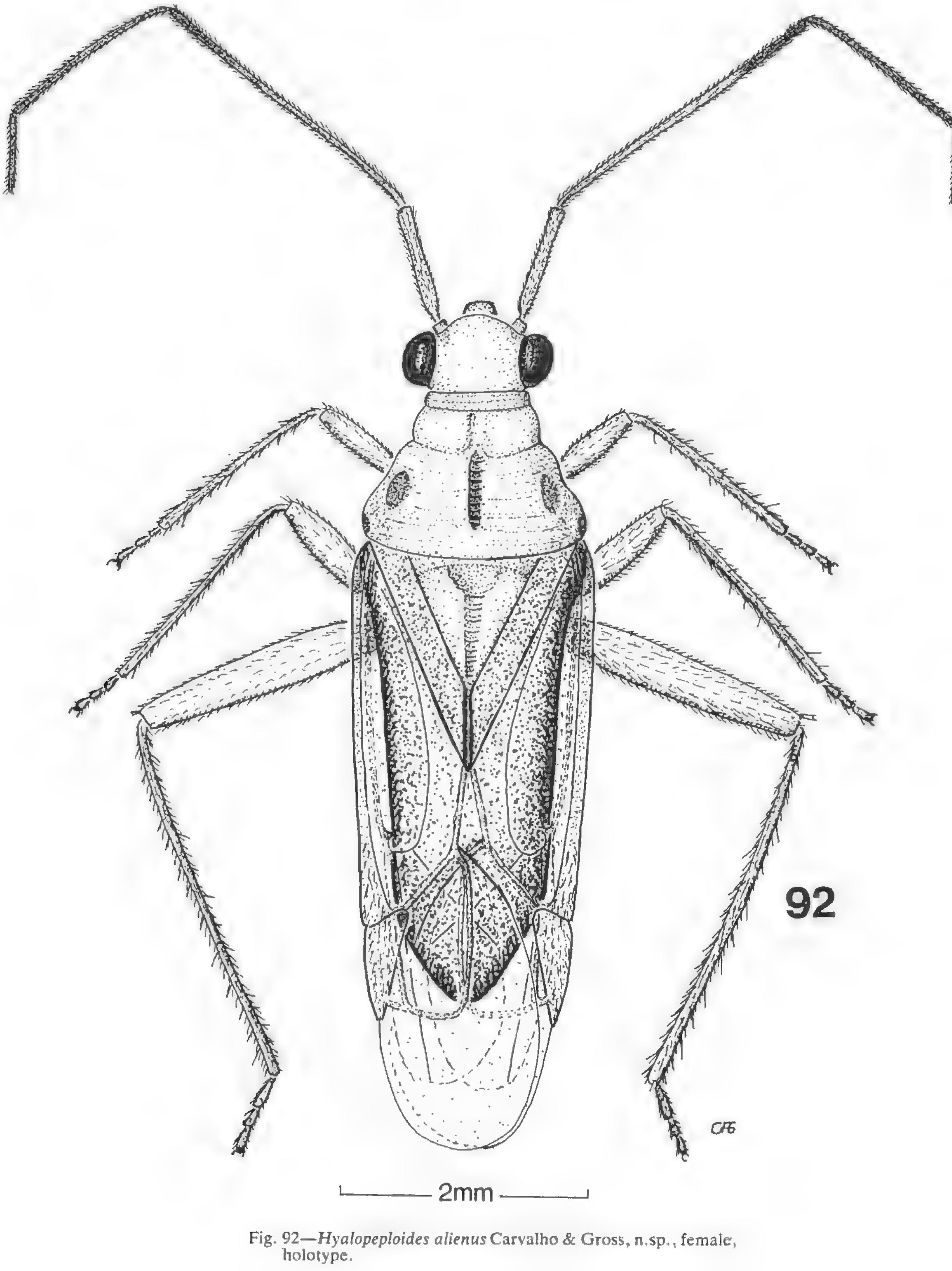


Fig. 92—*Hyalopeploides alienus* Carvalho & Gross, n.sp., female, holotype.

Differs from *Hyalopeploides australiensis* n.sp. by having the body considerably longer in relation to its width and also by having the transversely strigose groove on the pronotum narrow and brownish in colour.

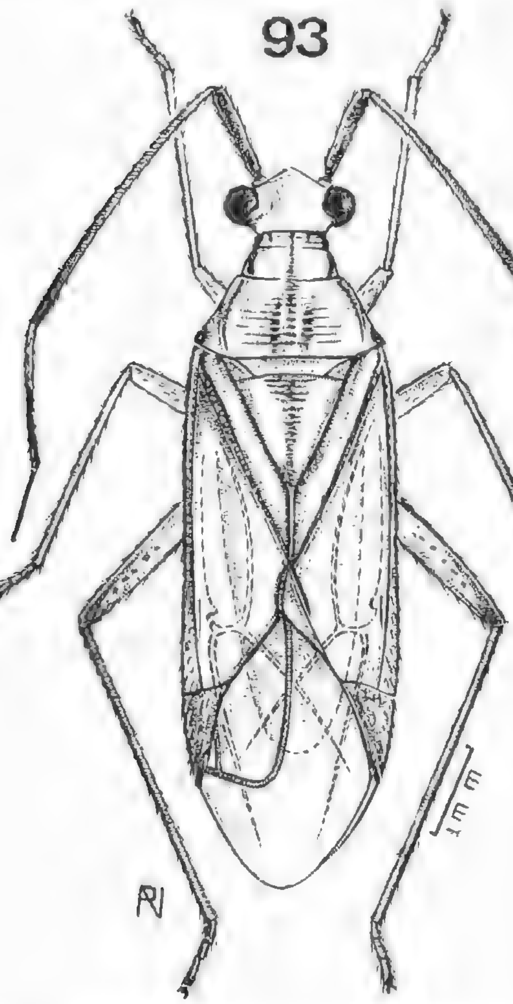


Fig. 93—*Hyalopeploides australiensis* Carvalho & Gross, n.sp., female, holotype.

Hyalopeploides australiensis
Carvalho & Gross, n. sp.

(Fig. 93, 129)

Characterised by the colour of head and pronotum.

Female: Length 6·8 mm, width 2·2 mm. *Head:* Length 0·5 mm, width 1·1 mm, vertex 0·52 mm. *Antenna:* Segment I, length, 1·0 mm; II, 2·9 mm; III, 1·5 mm; IV, 0·7 mm. *Pronotum:* Length 1·2 mm, width at base 1·9 mm. *Cuneus:* Length 0·76 mm, width at base 0·44 mm (holotype).

General coloration ochraceous with reddish and black areas; eyes castaneous, antenna reddish, apical portion of segment II, segment III (except base) and segment IV dark brown; collar with three vittae or bars above and two lateral (one of the latter on each side wider and about as wide as segment I of antenna) dark brown; area of calli and disc with three strigose longitudinal vittae (with a silvery pruinosity on well preserved specimens), disc also with three longitudinal vittae plus two others wider and shorter at posterior portion brown, humeral angles black exteriorly; mesoscutum and scutellum with a longitudinal orange vitta reaching apex of scutellum; hemelytra glassy, transparent margins of clavus, commissure and apical margin of corium, nervures of membrane, inner and outer margin of embolium brown; cuneus and embolium opaque, the first reddish and the second ochraceous; membrane transparent. Underside of body pale yellow, propleura with a longitudinal, strigose brown vitta, legs pale yellow, hind femora reddish apically with two rows of small fuscous spots, hind tibiae and tarsi reddish, claws black.

Male: unknown.

Holotype: female, AUSTRALIA; Queensland; F. P. Dodd, 1907-54, Kuranda, Qld. F. P. Dodd, April 1904 (BMNH). *Paratypes:* female, same data as holotype, June, 1904; female, N. Queensland, Redlynch, 14.viii.1938, Papuan-Australian Exp. B.M. 1947-48; female, Redlynch, Qld. xii.1938, B.M. 1949-61, R. F. Sternitsky, Papuan-Australian Exp., B.M. 1949-61. Female, Kuranda, F. Dodd, (SAM Reg. no. I20,981).

This species approaches *Hyalopeplinus rubrinus* n. sp. and *Hyalopeplinus rubrinoides* n. sp. but differs by the colour of head and pronotum.

Hyalopeploides borneensis, n. sp.

(Figs. 94-97, 132)

Characterised by the colour of head and pronotum.

Male: Length 6·5 mm, width 2·0 mm. *Head:* Length 0·5 mm, width 1·1 mm, vertex 0·48 mm. *Antenna:* Segment I, length 0·6 mm; II, 2·8 mm; III and IV, mutilated. *Pronotum:* Length 1·3 mm, width at base 1·7 mm. *Cuneus:* Length 0·60 mm, width at base 0·28 mm (holotype).

General coloration ochraceous with brown and reddish areas; eyes brown, antenna, dark brown, segment I reddish; pronotum and vertex with a continuous longitudinal, median vitta which is strigose and widened posteriorly on disc, two strigose lateral spots, humeral angles, two lower lateral vittae on collar, the lowest one reaching over calli dark brown to black; mesoscutum with two lateral black spots; scutellum with two black basal spots joining a longitudinal brown vitta widened basally, apical portion of scutellum lighter; hemelytra glassy, transparent, margins of clavus, commissure and apical margin of corium, nervures of

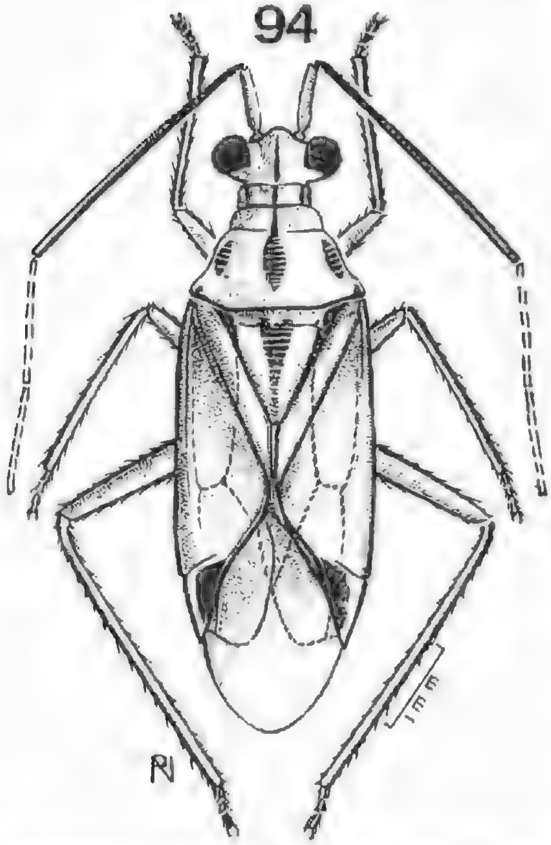


Fig. 94—*Hyalopeploides borneensis* n.sp., male, holotype.

membrane, inner and outer margins of embolium and of cuneus castaneous, median area of latter orange to red; membrane transparent. Underside of body ochraceous, propleura with a lateral posterior strigose vitta fuscous, femora with small fuscous spots, the hind pair tending to orange apically, hind tibiae orange to reddish.

Genitalia: Penis (fig. 95) with membranous lobes provided with minute teeth at extremities. Left paramere (fig. 96) curved, enlarged subapically. Right paramere (fig. 97) smaller, simple.

Female: Similar to male in colour and general aspect. Length 6·5 mm, width 2·0 mm, vertex 0·48 mm. *Cuneus:* Length 0·72 mm, width at base 0·40 mm.

Holotype: Male, EAST MALAYSIA: Mt. Kinabalu, Manei Parei, 5 000 ft, 5.ii.1929, Exp. F.M.S., B.M. 1955-354, H. M. Pendlebury (BMNH). *Allotype:* female, Forest Camp 19 km, N of Kalabakan, 12.x.1962, Y. Hirashima, light trap (BISHOP). *Paratype:* male, same data as holotype.

Approaches *Hyalopeplinus maculatus* n. sp. but differs by the colour of pronotum.

Hyalopeploides cyanescens Poppius, 1912

Hyalopeploides cyanescens Poppius, 1912a, p. 419; Carvalho, 1959, p. 319.

(Figs. 98, 133)

Characterised by the colour of head, pronotum and cuneus.

Female: Length 6·5 mm, width 1·8 mm. *Head:* Length 1·0 mm, width 1·3 mm, vertex 0·60 mm. *Antenna:* Segment I, length 1·0 mm; II, 2·9 mm; III-IV, broken. *Pronotum:* Length 1·5 mm, width at base 2.0 mm. *Cuneus:* Length 1·12 mm, width at base 0·44 mm (lectotype).

General coloration ochraceous with dark areas; inner margin of eye and post-ocular area of head black, antenna pale yellow, apex of segment II and segments III and IV black; pronotum with collar showing four longitudinal vittae (the lower lateral ones larger and darker), spots on calli or the whole area, two lateral spots on disc and a narrow longitudinal vitta (not reaching the hind margin or obsolete in some specimens), propleura (except lower margin), lateral margin of mesosternum fuscous to black; hemelytra ochraceous, transparent, cuneus and embolium partially ochraceous. Underside of body and legs pale yellow to lutescent, hind tibiae tending to castaneous, abdomen with reddish tinge.

Pronotum rugose anteriorly, noticeably constricted behind calli which are prominent, scutellum rugose at middle, clavus, embolium and cuneus pubescent.

Male: unknown.

Specimens studied: female, lectotype (new designation), NEW GUINEA: Astrolabe Bai, Erima (HELSINKI); female, INDONESIA: Bodem, 100m, 11km SE of Oerberfaren, Irian Jaya, 10.vii.1959, light trap (BISHOP).

This species is close to *Hyalopeplus ochraceous* n. sp. but differs by the colour of pronotum.

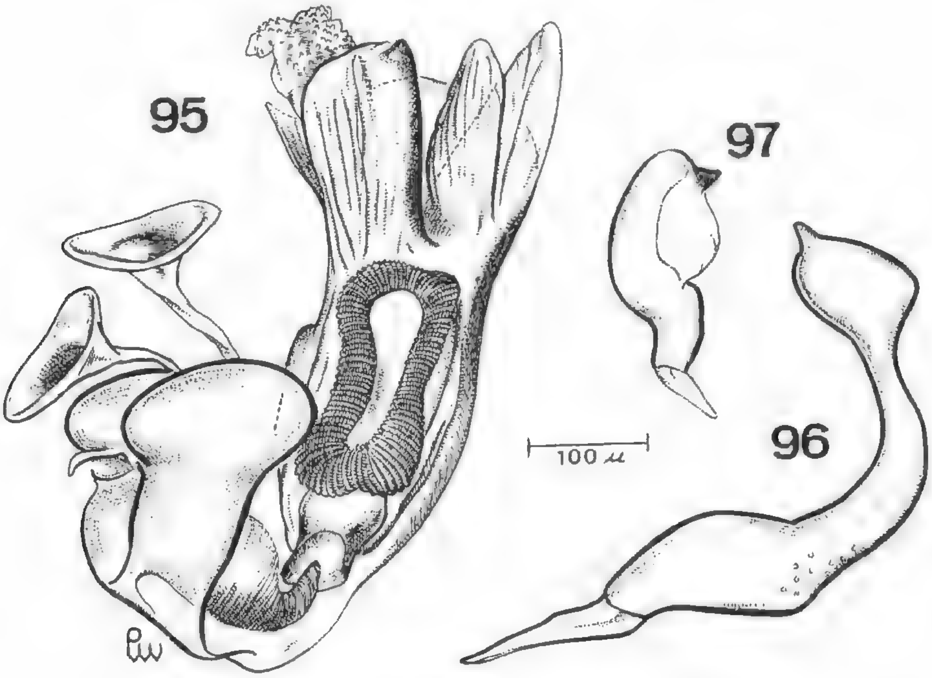
Hyalopepoides fasciatus, n. sp.

(Fig. 125)

Characterised by the longitudinal pruinose vitta of pronotum and by the two wide longitudinal vittae of scutellum.

Female: Length 8·4 mm, width 2·8 mm. *Head:* length 0·8 mm, width 1·4 mm, vertex 0·64 mm. *Antenna:* Segment I, length 1·0 mm; II, 3·2 mm; III, 1·4 mm; IV 0·8 mm. *Pronotum:* Length 1·6 mm, width at base 2·4 mm. *Cuneus:* 1·12 mm, width at base 0·56 mm (holotype).

General coloration flavescent to citrine with dark brown to reddish areas; head, pronotum and scutellum citrine; a longitudinal vitta on middle of head, two lateral ones along inner margins of eyes (obsolete in some specimens) joining middle line of clypeus fuscous to brown; five vittae or bars on



Figs. 95-97—*Hyalopeploides borneensis* n.sp.: Fig. 95—Penis; Fig. 96—Left paramere; Fig. 97—Right paramere.

collar (the lower lateral ones forming a black rectangular spot behind eye), three longitudinal wide pruinose vittae on pronotum; one median and two lateral (these slightly inside the corresponding pair on calli) black, two obsolete longitudinal vittae running between the pruinose vittae castaneous; mesoscutum and scutellum with lateral margins basally and two longitudinal vittae (not reaching apex) castaneous; hemelytra glassy, transparent, sutures black, cuneus reddish with outer margin pale; membrane glassy, slightly fuscous, nervures dark. Eyes castaneous, antenna reddish, apex of segment II black, segments III-IV black (with pale bases). Underside of body flavescent, a line along side of head, a vitta along upper margin of propleura and another above coxal cleft I castaneous to reddish; legs flavescent, apices of tibiae I and II reddish, femora suffused with red, hind pair apically and hind tibiae totally red, apices of tarsi fuscous.

Pronotum distinctly rugose, scutellum prominent, cuneus noticeably long.

Male: unknown.

Holotype: female, INDONESIA: Bibidjilan, West Java, M. E. Welsh, 8.v.38, in the collection of the author.

This species differs from allied forms by having three longitudinal wide pruinose fasciae on pronotum, two longitudinal fasciae on scutellum and a quadrate black spot present on lower lateral margin of collar.

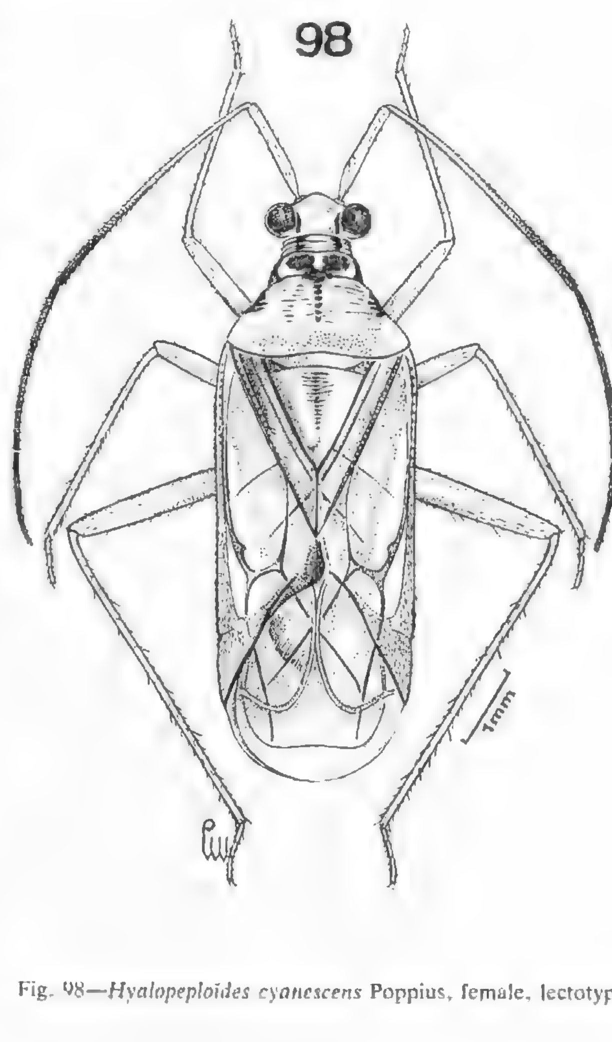


Fig. 98—*Hyalopeploides cyanescens* Poppius, female, lectotype.

Hyalopeploides maculatus, n. sp.

(Figs. 99-102, 123)

Characterised by the colour of pronotum, hemelytra and hind legs.

Female: Length 9·8 mm, width 3·2 mm. *Head:* Length 0·7 mm, width 1·6 mm, vertex 0·76 mm. *Antenna:* Segment I, length 1·2 mm; II, 4·2 mm; III-IV, broken. *Pronotum:* Length 1·6 mm, width at base 2·8 mm. *Cuneus:* Length 1·20 mm, width at base 0·64 mm (holotype).

99

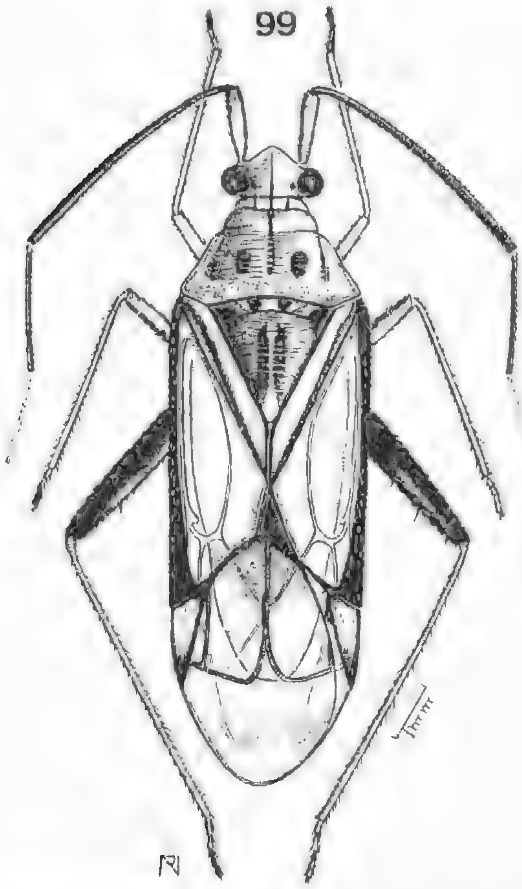


Fig. 99—*Hyalopeploides maculatus* n.sp.: female, paratype.

General coloration ochraceous to lutescent with brown and reddish areas; a longitudinal vitta on head, eyes, antennae (except segment I) black; pronotal collar with three well marked longitudinal vittae (in some specimens only median vitta present), a longitudinal median vitta on disc not reaching posterior margin, two round spots at central portion, two longitudinal vittae near humeral angles, and a small spot at each angle brown to black; mesoscutum with four dark spots; scutellum with two median longitudinal vittae united or joined brown, apical portion pale; hemelytra glassy, transparent, clavus and corium with inner and outer margins and commissure brown, embolium opaque dark, cuneus opaque, pale at central portion, reddish at apex and margins (in some specimens the median portion is also reddish); membrane fuscous, nervures brown. Underside of body ochraceous, posterior margin of ostiolar peritreme, keel of metapleura, and apical end of abdomen dark; legs ochraceous, hind femora black, hind tibiae brown, segment II of tarsi fuscous.

Male: Similar to female in colour and general aspect. Length 8·6 mm, width 2·7 mm, vertex 0·72 mm.

Genitalia: Penis (fig. 100) with membranous lobes showing areas of sclerotised teeth. Left paramere (fig. 101) enlarged apically with a terminal short point. Right paramere (fig. 102) small with a szlerotised apical branched tubercle.

Holotype: female, INDONESIA: Swart Val., Karubaka, Irian Jaya, 1 400-1 600 m, 9.xi.1958, J. L. Gressitt (BISHOP). *Allotype:* male, same data as holotype. *Paratypes:* three females, idem, in the above collection and of the author.

This species approaches *Hyalopeplinus similaris* n. sp. but differs by the presence of two rounded spots on the disc of the pronotum.

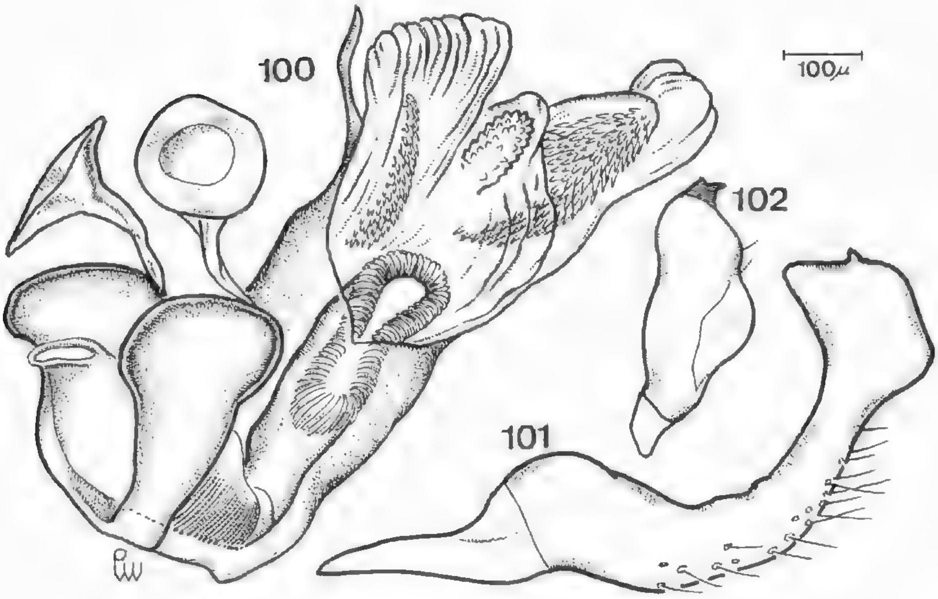
Hyalopeploides neoguineanus, n. sp.

(Figs. 103-107, 126)

Characterised by the colour of the body and by the structure of male genitalia.

Male: Length 7·6 mm, width 2·6 mm. *Head:* Length 0·6 mm, width 1·2 mm, vertex 0·52 mm. *Antenna:* Segment I, length 1·2 mm; II, 3·0 mm; III, 1·1 mm; IV, 0·6 mm. *Pronotum:* Length 1·5 mm, width at base 2·2 mm. *Cuneus:* Length 0·84 mm, width at base 0·52 mm (holotype).

General coloration ochraceous to citrine with brown and reddish areas; head with a median longitudinal and two lateral vittae (obsolete in some specimens), lateral vitta on gena brown, clypeus, jugum and lorum, posterior margin of eyes on neck, and segment I of antenna reddish, segments III-IV brown to black (segment II tending to reddish at base); pronotum seen from above with collar, calli and disc marked by five longitudinal vittae; one median and two lateral brown with silvery pruinosity; two sublateral and reddish (absent or obsolete in some specimens, especially on females); lateral margins, lower lateral vittae of collar (the upper ones brown to dark), longitudinal vitta on sternal area and lateral portion of abdomen reddish; mesoscutum with two median vittae (not reaching apex) and basal angles black, hemelytra glassy, transparent, inner and outer margins of clavus, corium and embolium (at basal portion), apical



Figs. 100-102—*Hyalopeploides maculatus* n.sp.: Fig. 100—Penis; Fig. 101—Left paramere; Fig. 102—Right paramere.

margin of corium and nervures of membrane brown, apical portion (in the male the whole extension) of embolium, corial commissure and cuneus reddish, membrane ochraceous, transparent. Underside of body ochraceous, segment I of rostrum, ostiolar peritreme, upper margins of abdominal segments, terebra and area continguous reddish, segment IX brown, femora reddish, tibiae brown, the hind pair reddish, tarsi fuscous.

Genitalia: Penis (fig. 105) with membranous lobes provided with sclerotized teeth. Left paramere (fig. 106) curved, ended by a slender point. Right paramere (fig. 107) simple, with a sclerotized apical point.

Female: Similar to male in colour and general aspect. In some specimens the pronotum do not show the longitudinal vittae between the central and the two lateral ones. Length 8·3 mm, width 3·0 mm, vertex 0·52 mm. *Cuneus:* Length 1·00 mm, width at base 0·60 mm (allotype).

Holotype: Male, INDONESIA: Irian Jaya, Wisselmeren, 1 700 m, Wagaete, Tigi L., 17. Aug. 1955, J. L. Gressitt (BISHOP). *Allotype:* female, NEW GUINEA: NE Elliptami Valley, 1 200-1 350 m, August 1-15, 1959, W. W. Brandt. *Paratypes:* 9 females, Ahl.V. Nodungl, 1 750 m, 8.viii.1955, J. L. Gressitt; NE Torricelli Mts. Sugoitei Vill., 900 m, W. W. Brandt, 1-5.ii.1959; Swart Vall., Karubaka, 10.xi.1958; NE Feramin, 1 450 m, 26.viii.63, R. Straatman; Wisselmeren, Moanemani, Kamo, 1 500 m, J. Sedlacek; Duroto, E of Enarotadi, 1 800 m, in the collection above and of the author.

Very close to *Hyalopeplus rubrinus* n. sp. but differs by the presence of longitudinal dark vittae on scutellum. It is also near *Hyalopeplus fasciatus* n. sp. from which it can be separated by the presence of the seven vittae on collar.

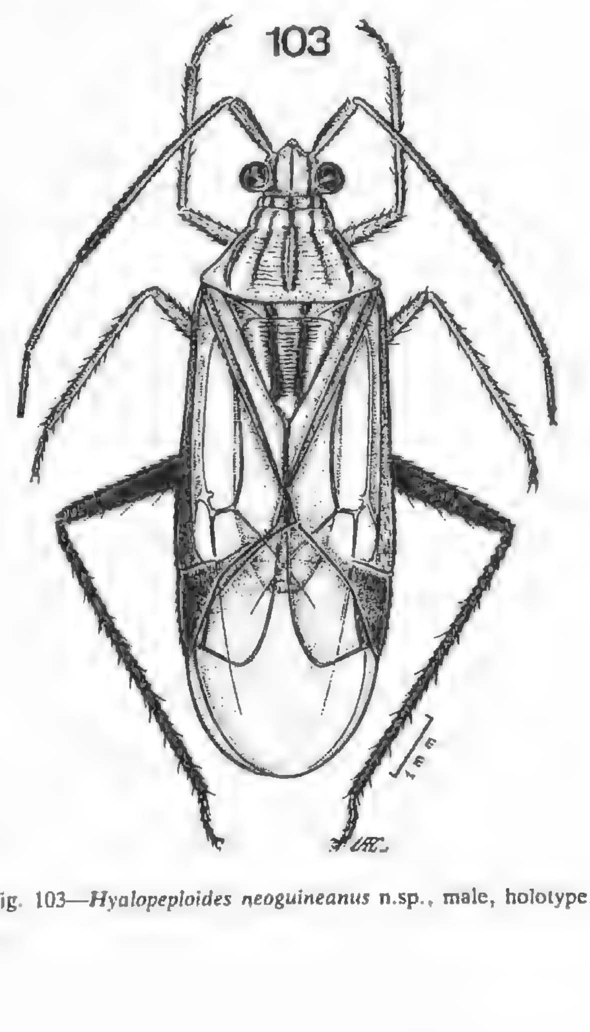


Fig. 103—*Hyalopeploides neoguineanus* n.sp., male, holotype.

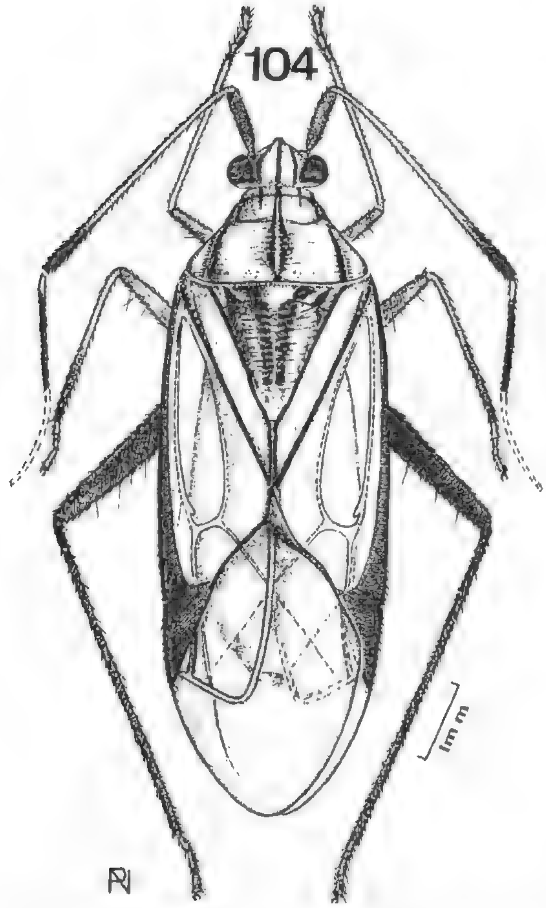


Fig. 104—*Hyalopeploides neoguineanus* n.sp., female, allotype.

Hyalopeploides ochraceus, n. sp.

(Figs. 108-111, 122)

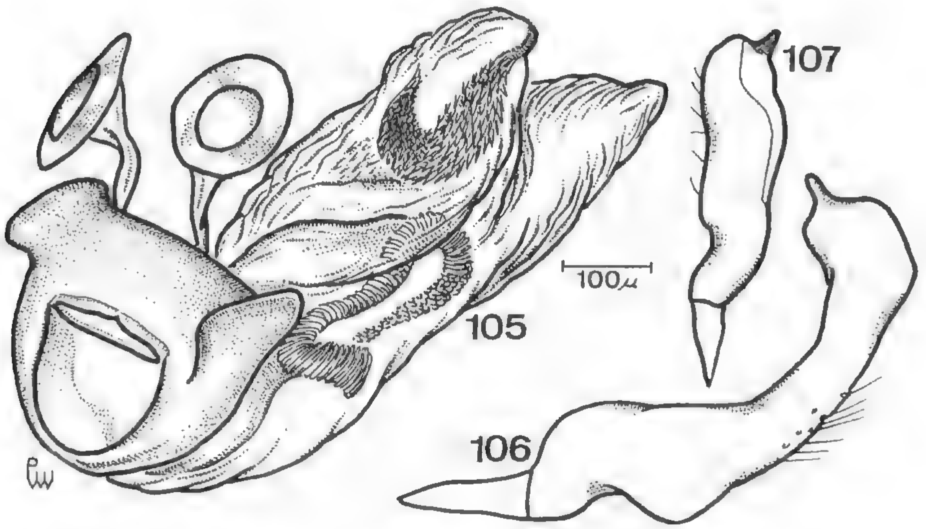
Characterised by the colour and structure of male genitalia.

Male: Length 7·6 mm, width 2·2 mm. *Head:* Length 0·5 mm, width 1·2 mm, vertex 0·64 mm. *Antenna:* Segment I, length 1·0 mm; II, 2·9 mm; III-IV, broken. *Pronotum:* Length 1·6 mm, width at base 2·2 mm. *Cuneus:* Length 0·80 mm, width at base 0·40 mm (holotype).

General coloration ochraceous tending to lutescent; pronotum and scutellum tending to citrine; in some specimens there is an indication of five longitudinal, orange vittae on disc of pronotum and also an indication of a longitudinal vitta on vertex, base on clypeus, lateral area of head and lateral portion of abdomen; eyes brown; cuneus tending to reddish internally; posterior femora with small reddish spots internally at apical portion.

Pronotum and scutellum noticeably rugose transversally, the disc constricted behind calli.

Genitalia: Penis (fig. 108) with a sclerotized spiculum (fig. 111) and membranous lobes with sclerotised teeth apically; secondary gonopore with groups of sclerotised teeth nearby. Left paramere (fig. 109) curved, pointed apically. Right paramere (fig. 110) globose, with an apical point.

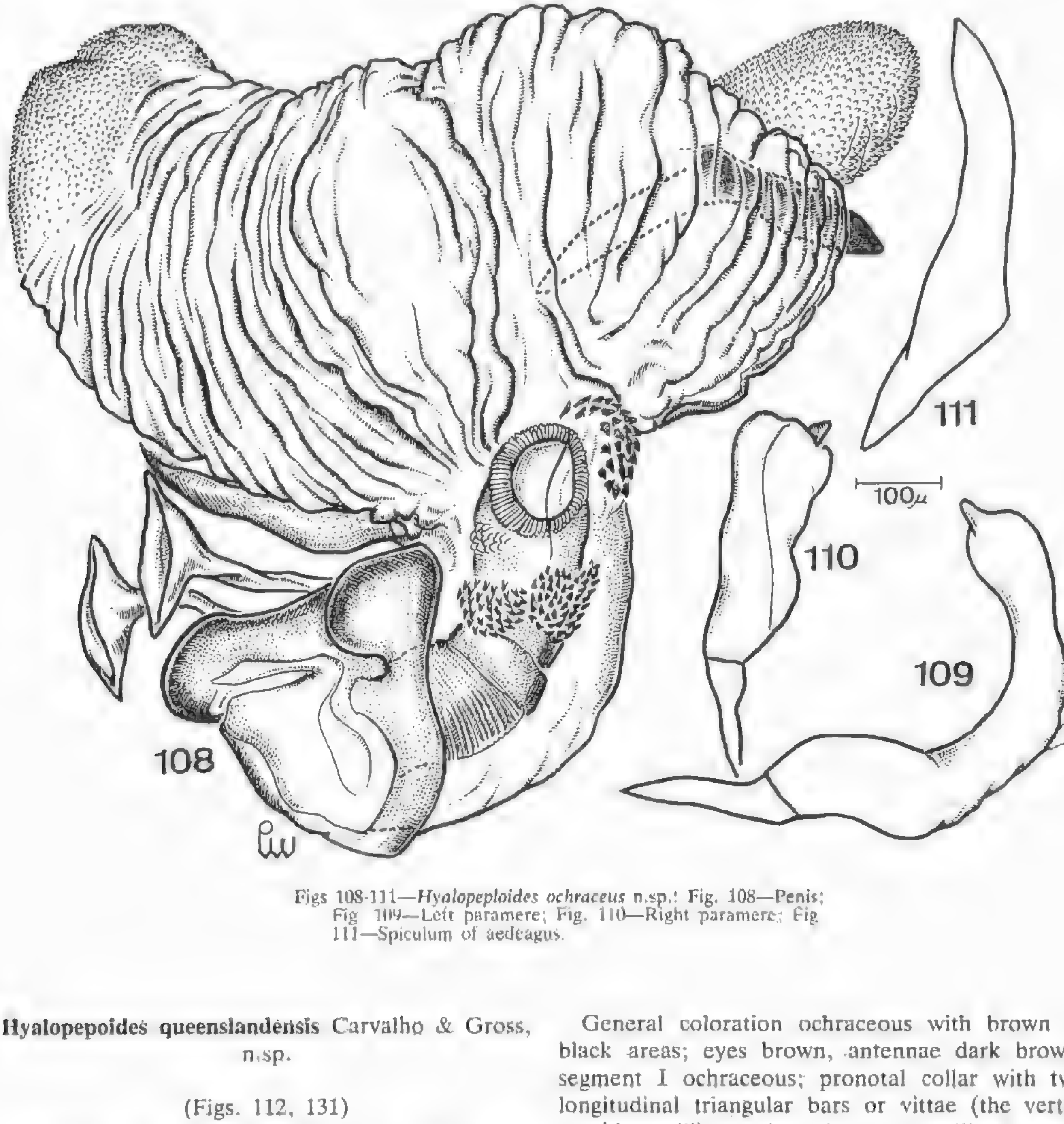


Figs. 105-107—*Hyalopeploides neoguineanus* n.sp.: Fig. 105—Penis; Fig. 106—Left paramere; Fig. 107—Right paramere.

Female: Similar to male in colour and general aspect. Length 7·6 mm, width 2·.4 mm, vertex 0·68 mm. *Cuneus:* Length 0·84 mm, width at base 0·56 mm (allotype).

Holotype: Male, NEW GUINEA: Elliptami Valley, 1 200-1 350 m, August, 1-15, 1959, W. W. Brandt (BISHOP). *Allotype:* female, INDONESIA: Swart Val., Karubaka, Irian Jaya, 10.xi.1958, light trap, J. L. Gressitt. *Paratypes:* two males and three females, same data as holotype, in the above collection and of the author.

Differs from all others species included in the genus by the almost uniform ochraceous colour of the body.



Figs 108-111—*Hyalopeploides ochraceus* n.sp.: Fig. 108—Penis; Fig. 109—Left paramere; Fig. 110—Right paramere; Fig 111—Spiculum of aedeagus.

Hyalopepoides queenslandensis Carvalho & Gross, n.sp.

(Figs. 112, 131)

Characterised by the colour of head and pronotum.

Female: Length 8·4 mm, width 1·9 mm. *Head:* Length 0·5 mm, width 1·3 mm, vertex 0·50 mm. *Antenna:* Segment I, length 0·9 mm; II, 2·8 mm; III, 1·8 mm; IV, broken. *Pronotum:* Length 1·3 mm, width at base 1·9 mm. *Cuneus:* Length 0·88 mm, width at base 0·36 mm (holotype).

General coloration ochraceous with brown to black areas; eyes brown, antennae dark brown, segment I ochraceous; pronotal collar with two longitudinal triangular bars or vittae (the vertex touching calli), two lateral spots on calli, two small ones near the confluence of the latter posteriorly brown; a median longitudinal strigose vitta on disc, widened posteriorly and two lateral spots (also strigose) black; a small brown spot at each side near the two lateral spots but situated inferiorly and the humeral angles brown; mesoscutum and scutellum ochraceous, the latter darker near apex; hemelytra glassy, transparent, margins of clavus, commissure and apical margin of corium, nervures of membrane brown; embolium and cuneus opaque, orange to reddish membrane transparent. Underside of body ochraceous, a small spot above anterior portion of coxal cleft I and longitudinal strigose vitta on posterior portion of propleura brown; legs pale yellow, femora with reddish tinge apically.

Male: Unknown.

Holotype: female, AUSTRALIA: Kuranda, Qld., June 1904, F. P. Dodd, Queensland, F. P. Dodd, B. M. 1907-54 (BMNH).

This species approaches *Hyalopeplinis rubriniscus* n.sp. *Hyalopeplinus rubrinoides* n.sp. but differs by the colour of head and pronotum.

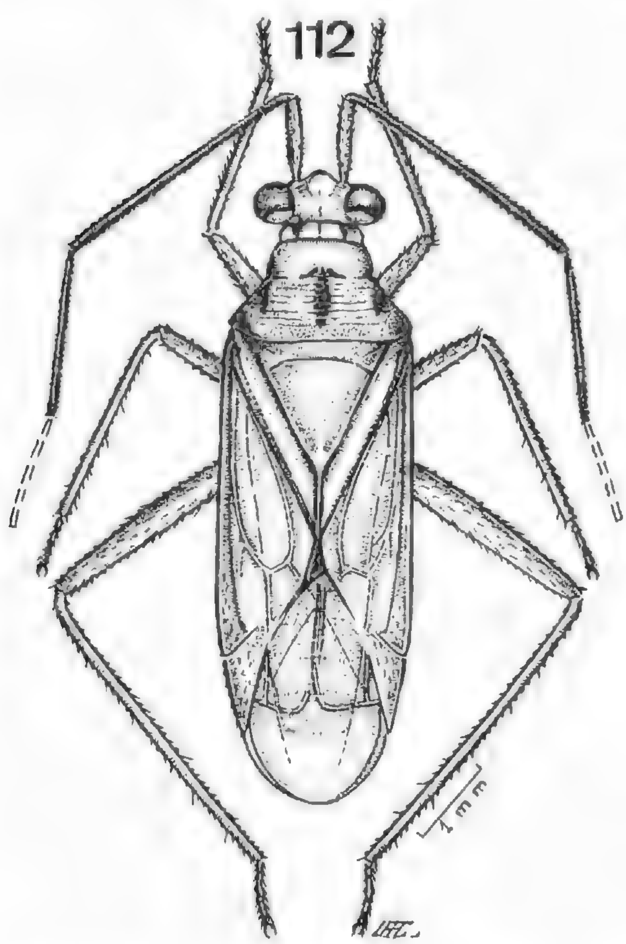


Fig. 112—*Hyalopeploides queenslandensis* Carvalho & Gross, n.sp., female, holotype.

Hyalopeploides rubrinoides, n.sp.

(Fig. 127)

Characterised by the colour of collar.

Female: Length 8·4 mm, width 2·7 mm. *Head:* Length 0·8 mm, width 1·4 mm, vertex 0·64 mm. *Antenna:* Segment I, length 0·8 mm; II, 3·0 mm; III, 1·3 mm; IV, 0·8 mm. *Pronotum:* Length 1·6 mm, width 2·4 mm. *Cuneus:* Length 1·00 mm, width at base 0·52 mm (holotype).

General coloration ochraceous with brown and reddish areas; head with a median longitudinal vitta and two lateral ones along inner margins of eyes which coalesce on clypeus, a lateral vitta on gena and lorum, as well as on jugum, reddish; eyes and antenna brown to black, segment I reddish; pronotum with three longitudinal brown to reddish vittae covered by silvery pruinosity, having also between them two submedian orange vittae (obsolete in some specimens); collar with a longitudinal brown median vitta, two reddish sublateral vittae (following those of head and pronotum) and two lower lateral ones black, fused anteriorly and characteristic for the species; mesoscutum and scutellum ochraceous; unicolorous; hemelytra glassy, transparent, sutures and commissures and nervures of membrane fuscous; embolium and cuneus reddish; membrane pale at intrareolar portion and ochraceous at extra-areolar portion, underside of body ochraceous, lateral margin of pronotum and a longitudinal vitta on side of sternal portion following longitudinal vitta of head and continuing through lateral portion of abdomen reddish; legs pale yellow, femora towards apices and hind tibiae reddish.

Embolium and cuneus distinctly pilose, scutellum coarsely rugose transversely.

Male: Unknown.

Holotype: female, NEW BRITAIN: Giseluve, Nakanai Mts. 1 050 m, 26 July 1956, E. J. Ford Jr. (BISHOP). *Paratype:* female, Yalom, 1 000 m, 16 May 1962, Noona Dan Expedition, 1961-1962, in the Collection of the Universitets Zoologiske Museet, Copenhagen.

Very close to *Hyalopeplinus rubriniscus* n.sp. but differs by the shape of the lower lateral spot of collar.

Hyalopeploides rubriniscus, n.sp.

(Figs. 113-116, 134)

Characterised by the colour of collar and scutellum.

Female: Length 8·0 mm, width 2·8 mm. *Head:* Length 0·8 mm, width 1·3 mm, vertex 0·56 mm. *Antenna:* Segment I, length 0·8 mm; II, 3·2 mm; III, 1·2 mm; IV, 0·8 mm. *Pronotum:* Length 1·5 mm, width at base 2·2 mm. *Cuneus:* Length 1·00 mm, width at base 0·48 mm (holotype).

General coloration ochraceous with reddish and brown areas; head with a median longitudinal vitta and two lateral ones along inner margins of eyes, a longitudinal vitta on gena and lorum, jugum and base of clypeus reddish; eyes and antennae brown, segment I reddish; pronotum with three longitudinal brown vittae covered by silvery pruinosity, collar with seven longitudinal vittae as follows: one brownish at middle; two submedian brown to reddish; two more distinct, laterally black; two on lower lateral margin reddish. In some specimens, especially on females, the two lateral vittae of head are followed posteriorly by a corresponding sublateral vitta on collar, calli and disc, between the darker vittae. Mesoscutum and scutellum ochraceous, unicolorous (in some specimens with an indication of a median orange longitudinal vitta); hemelytra glassy, transparent, inner and outer margins of corium and nervures of membrane fuscous to brown, embolium and cuneus reddish, membrane hyaline. Underside of body pale yellow, lateral margins of pronotum, lateral vitta on upper margin of propleura (covered with silvery pruinosity), longitudinal vitta on lower margin of propleura following the equivalent one on lorum and extending along side of sternum and upper margin of abdomen reddish; legs pale yellow, apical portion of femora with reddish tinge, hind tibiae reddish, apices of rostrum and tarsi fuscous.

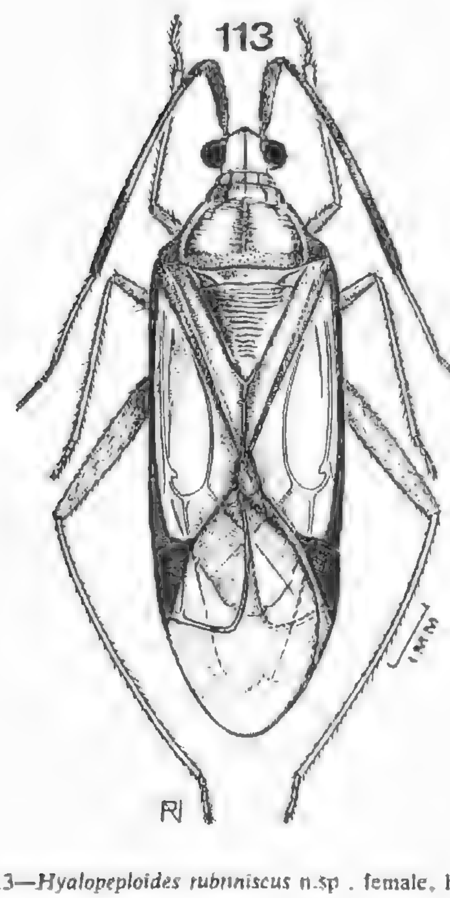


Fig. 113—*Hyalopeploides rubriniscus* n.sp., female, holotype.

Embolium and cuneus opaque, pilose, pronotum strongly rugose transversely.

Genitalia: Penis (Fig. 114) with membanous lobes provided with sclerotized spines apically. Left paramere (Fig. 115) curved, enlarged apically, with a pointed apex. Right paramere (Fig. 116) simple, also pointed apically.

Female: Similar to male in colour and general aspect, slightly more robust. Pronotal vittae more marked and five in number: three dark to brown and two sublateral reddish.

Holotype: male, NEW IRELAND: Schleinitz Mts. Lelet Plateau, Oct. 1959, W. W. Brandt (BISHOP). *Allotype:* female, same data as holotype. *Paratypes:* two females, Elemkamin, 16 April 1962, Noona Dan Expedition, 1961-1962, in the collection of the Universitets Zoologiske Museet, Copenhagen.

Very close to *Hyalopeplinus neoguineanus* n.sp. but differs by the colour of scutellum. It is also close to *Hyalopeplinus rubrinoides* n.sp. but differs by the colour of collar.

Hyalopeploides similaris, n. sp.

(Figs. 117-120, 124)

Characterised by the colour of head and collar.

Male: Length 7·4 mm, width 2·5 mm. *Head:* Length 0·6 mm, width 1·4 mm, vertex 0·64 mm. *Antenna:* Segment I, length 0·9 mm; II, 3·3 mm; III-IV, broken. *Pronotum:* Length 1·4 mm, width at base 2·3 mm. *Cuneus:* Length 0·80 mm, width at base 0·52 mm (holotype).

General coloration ochraceous to lutescent with black and reddish areas; head with a longitudinal vitta (more marked on vertex) dark, clypeus, a narrow longitudinal vitta on gena and segment I of antenna reddish; eyes and antennal segments II-IV brown to black; pronotum with three longitudinal vittae (covered by silvery pruinosity) dark: the median one reaching middle of collar where it is narrower but not reaching hind margin of disc, the two lateral beginning at posterior margin of calli (also not reaching hind margin of disc); collar with a lower lateral quadrate and characteristic black spot; mesoscutum and scutellum with two submedian vittae (those on scutellum not reaching apex) and two rounded spots at lateral margins of mesoscutum black; hemelytra glassy, transparent, inner and outer margins of clavus, corium, embolium and nervures of membrane brown to black; embolium and cuneus reddish, opaque; membrane hyaline. Underside of body ochraceous, a lateral vitta on abdomen reddish (in some specimens the margin of mesosternum and metapleura dark), legs ochraceous, apices of femora and posterior tibiae brown.

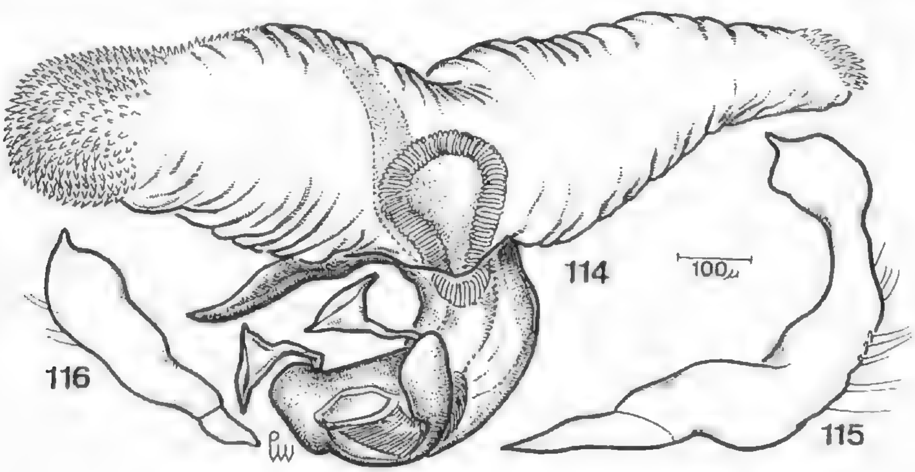
Embolium and cuneus distinctly pilose, opaque.

Genitalia: Penis (fig. 118) with membranous lobes provided with sclerotized spines apically. Left paramere (fig. 119) enlarged apically, with a small pointed tubercle at apex. Right paramere (fig. 120) small, with a short apical somewhat branched tubercle.

Female: unknown.

Holotype: male, SOLOMON ISLANDS: Kolombangara, Gollifer's Camp, 700 m, 23.i.1964, P. Shanahan (BISHOP). *Paratype:* male, same data as holotype.

This species approches *Hyalopeplinus maculatus* n.sp. but differs by the absence of rounded spots on the disc of pronotum and by the characteristic black lower lateral spot or bar on the collar.



Figs. 114-116—*Hyalopeploides rubriniscus* n.sp.: Fig. 114—Penis; Fig. 115—Left paramere; Fig. 116—Right paramere.

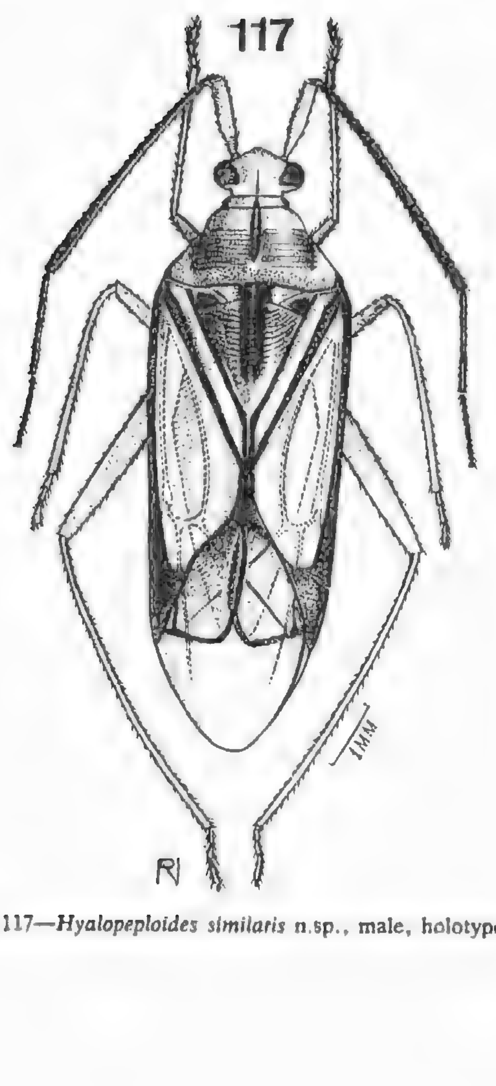


Fig. 117—*Hyalopeploides similaris* n.sp., male, holotype.

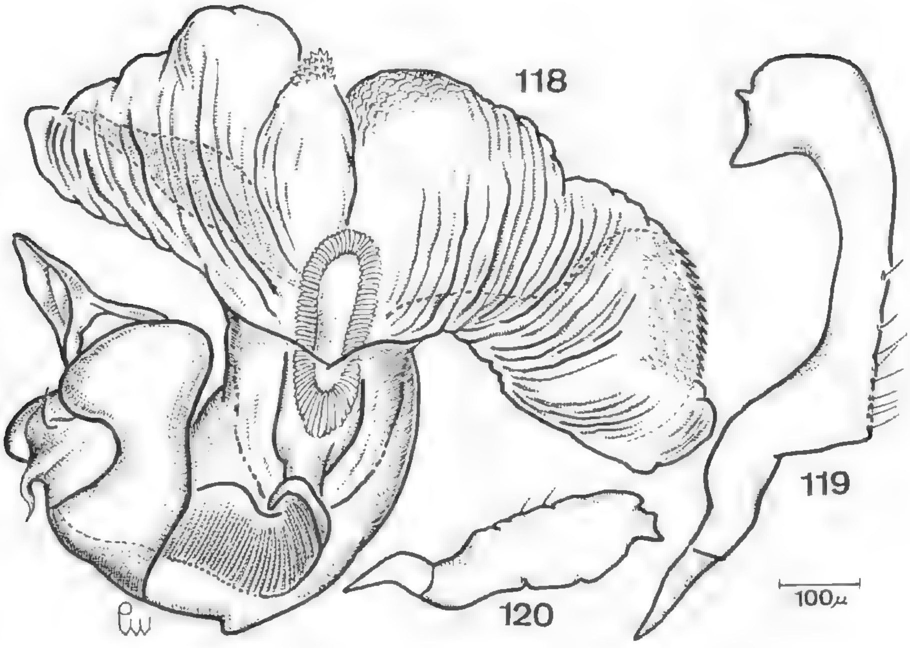
Hyalopeploides trinotatus, n.sp.

(Figs. 121, 130)

Characterised by the colour of pronotum.

Female: Length 8·1 mm, width 2·3 mm. *Head:* Length 0·6 mm, width 1·3 mm, vertex 0·50 mm. *Antenna:* Segment I, length 1·0 mm; II, 3·2 mm; III-IV, broken. *Pronotum:* Length 1·4 mm, width at base 2·1 mm. *Cuneus:* Length 0·90 mm, width at base 0·44 mm (holotype).

General coloration ochraceous tending to lutescent or orange; eyes and segments II-IV of antenna fuscous to brown; pronotum with three characteristic black strigose vittae or spots on disc: one median and two lateral; extreme humeral angles dark; scutellum with lateral margins black at base, inner and outer margins of clavus, corium (widened towards apical portion) and embolium, commissure and nervures of membrane fuscous to black; cuneus internally red, black at apex, membrane hyaline, fuscous. Underside of body (except black apex of clypeus, epipharynx and valvulae) unicolorous lutescent to reddish; legs pale yellow to lutescent, femora with small fuscous spots on inner apical portion, tibiae light brown, tarsi fuscous apically.



Figs. 118-120—*Hyalopeploides similaris* n.sp.: Fig. 118—Penis, Fig. 119—Left paramere; Fig. 120—Right paramere.

Pronotum rugose at middle of disc, scutellum rugose longitudinally at central portion, clavus, embolium and cuneus pilose.

Male: Unknown.

Holotype: female, NEW IRELAND: Schleinitz Mts. Lelet Plateau, ix.1959, W. W. Brandt (BISHOP).

This species differs from others in the genus by the colour of the pronotum.

Hyalopeplus Stål, 1870

Hyalopeplus Stål, 1870, p. 670: Atkinson, 1890, p. 106: Distant, 1904b, p. 447: Reuter, 1905b, p. 1: Kirkaldy, 1906, p. 142: Reuter, 1910, p. 158: Poppius, 1912b, p. 2: Carvalho, 1952, p. 97: Carvalho, 1955, p. 107: Carvalho, 1959, p. 319.

Callicratides Distant, 1904b, p. 415: Reuter, 1905b, p. 1.

Type-species: Capsus vitripennis Stål, 1855

Body elongate, glabrous or with a few sparse hairs (more visible on cuneus and embolium). Head wider than long, vertex smooth, not marginated, frons rounded anteriorly, clypeus prominent, lorum shelf-like, visible from above, buccula small, rostrum reaching apex of middle or base of hind coxae, segment I reaching middle of xyphus of prosternum; eyes slightly removed from collar (this distance being approximately equal to thickness of segment II

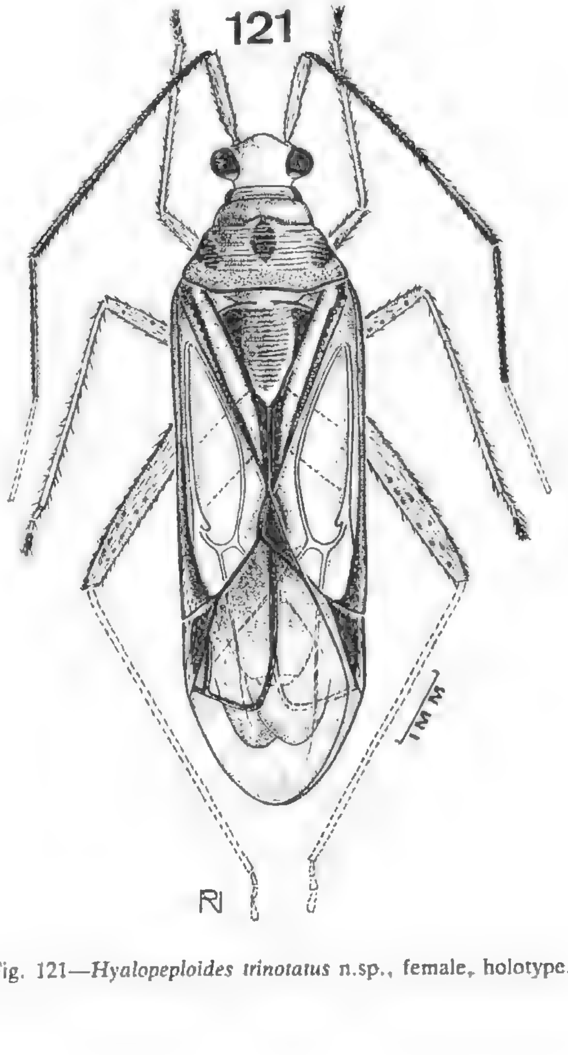
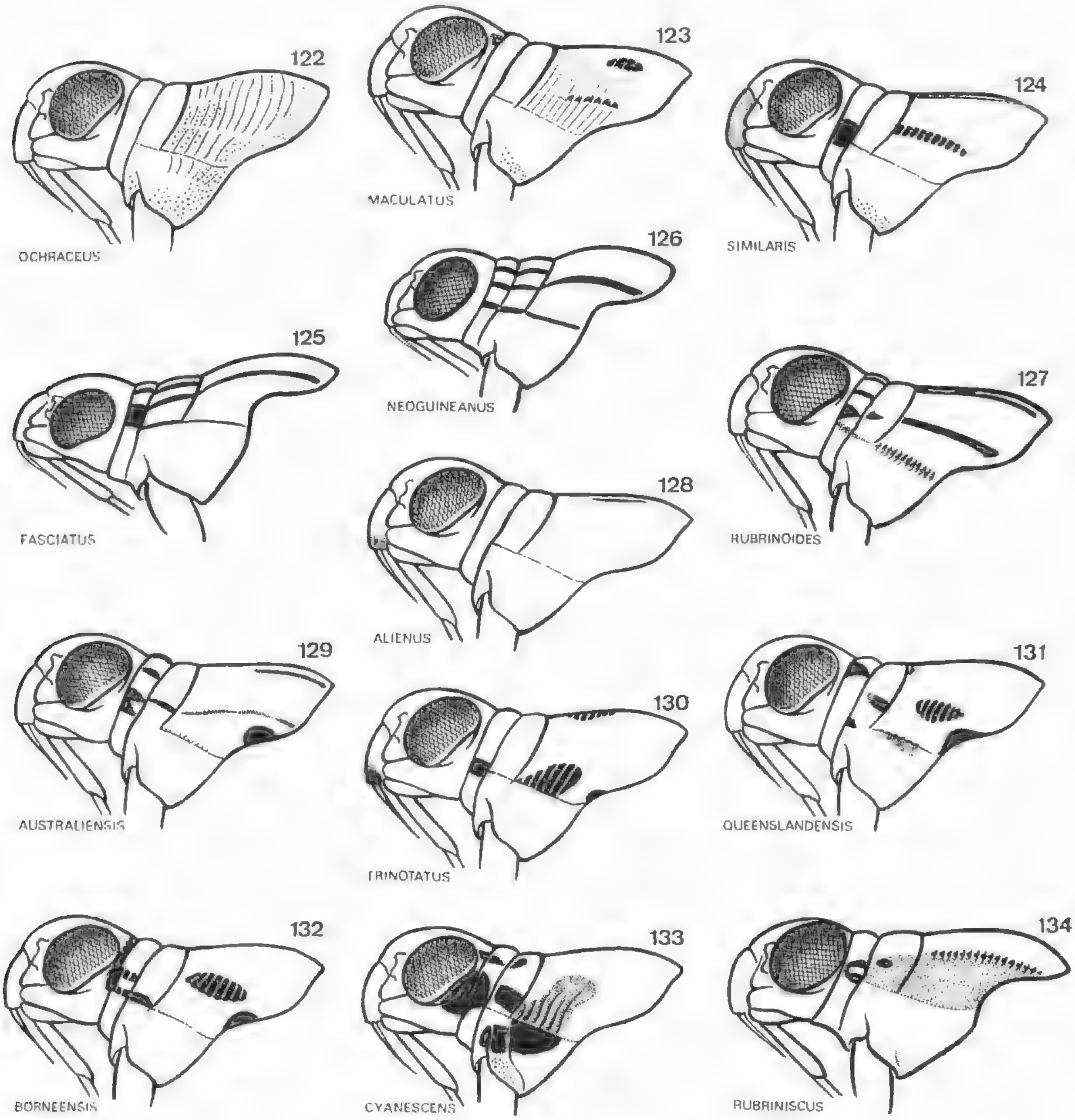


Fig. 121—*Hyalopeploides trinotatus* n.sp., female, holotype.

of antenna); antenna with segment I about two or three times as thick as II, the latter about five times as long as I, segments III and IV slightly longer than I, all segments with short pubescence.

Pronotum noticeably rugose transversally (typical subgenus)—on collar, rugose, rugose punctate or punctate-rugose on disc, this structure covering the whole disc behind calli and also whole propleura, calli slightly punctate or corrugate, posterior margin of disc slightly immarginated in the middle, humeral angles prominent (somewhat acutely pointed in some species); mesoscutum partially covered, scutellum prominent, with a longitudinal median transversely rugose fascia and punctures inferiorly on lateral margin.

Hemelytra glassy (transparent), without nervures, the lower wings and abdomen clearly visible from above, clavo-corial and embolio-corial sutures with a row of punctures; membrane vitreous, transparent, the larger cell rounded apically. Legs with tibiae covered by minute sclerotized teeth, hairs and spines.



Figs. 122-134—Lateral view of head and pronotum of species of *Hyalopeploides* n.gen., showing colour markings: Fig. 122—*ochraceus*; Fig. 123—*maculatus*; Fig. 124—similaris; Fig. 125— *fasciatus*; Fig. 126—neoguineanus; Fig. 127—*rubrinoides*; Fig. 128—*alienus*; Fig. 129—*australiensis*; Fig. 130—*trinotatus*; Fig. 131—*queenslandensis*; Fig. 132—*borneensis*; Fig. 133—*cyanescens*; Fig. 134—*rubriniscus*.

It differs from others in the tribe by the structure of the pronotum and propleura, corium without nervures, rostrum reaching apex of middle or base of hind coxae, hemelytra glabrous and by the single elongate spiculum of vesica. Its closest allied genus is *Hyalopeploides* Poppius, 1912 which has the disc of pronotum and propleura rugose only in patches and the pronotum is noticeably constricted anteriorly.

The genus may be subdivided into two subgenera on the structure of pronotum and propleura, and also of the spiculum of aedeagus, and these can be recognized as follows:

1. Disc of pronotum and propleura distinctly rugose transversely, if punctures present obscured by rugosities; spiculum of vesica usually elongate ... *Hyalopeplus* Stål, 1870
   Disc of pronotum and propleura distinctly punctate rugose or punctate, the rugosities obscured by punctures; spiculum of vesica usually enlarged subasally ... *Adhyalopeplus* n.subgen.

Type-species of new subgenus: Capsus pellucidus Stål, 1859.

A reddish or reddish-coloured cuneus with the apex of hind femur and hind tibiae partially or totally red are characteristic of many of the species of this subgenus. The first antennal segment in the genus *Hyalopeplus* is usually over 1·0 mm long, while in the new subgenus it is usually less than 1·0 mm long.

List of the species of the genus *Hyalopeplus* Stål

1. **amboinae* Carvalho, 1956 ... Amboina Is., Babelthuap Is.
   = *vitripennis* Stål
2. *aneityumensis* n.sp. ... New Hebrides
3. **bakeri* Poppius, 1915 ... Philippine Is.
   = *similis* Poppius
4. *clavatus* Distant ... Bangladesh, Malaya
5. *cuneatus* n.sp. ... Papua-New Guinea
6. *grandis* n.sp. ... Philippine Is.
7. *guamensis* Usinger, 1946 ... Guam Is.
8. *hebridensis* n.sp. ... New Hebrides
9. **horvathi* Poppius, 1912 ... Saint Thomé Is.
   = *similis* Poppius
10. *kandanensis* n.sp. ... New Ireland Is., Solomon Is.
11. **krishna* Ballard, 1927 ... India
    = *rama* Kirby, 1891—*Capsus*
12. **lineifer* Walker, 1873—*Capsus* ... Australia
    = *vitripennis* Stål
13. *lorlae* Poppius, 1912 ... Australia, Papua New Guinea
14. *madagascariensis* n.sp. ... Madagascar
15. *malayensis* n.sp. ... Malaya
16. *marquesanus* n.sp. ... Marquesas Is.
17. *nigrifrons* Hsiao, 1944—*Euhyalopeplus* ... Philippine Is., Sumatra, Papua New Guinea
18. *nigroscutellatus* n.sp. ... Philippine Is., Papua New Guinea
19. *pellucidus* Stål, 1859—*Capsus* ... Hawaiian Islands
20. *rama* Kirby, 1891—*Capsus* ... Oriental Region, Oceania
21. *rubroclavatus* n.sp. ... Duncan Is., Irian Jaya
22. *rubrojugatus* n.sp. ... Papua-New Guinea
23. *samoanus* Knight, 1935 ... Samoan Is.
24. *similis* Poppius, 1912 ... Ethiopian and Oriental Regions, Oceania
25. *smaragdinus* Roepke, 1919 ... Borneo, Java
26. *spinosus* Distant, 1904 ... Assam, Vietnam
27. *tonguensis* n.sp. ... Tonga Is.
28. *tutuilaensis* n.sp. ... American Samoa
29. *vitripennis* Stål, 1855—*Capsus* ... Oriental Region, Oceania

* Names in synonymy

Key to the species of the subgenus *Hyalopeplus* Stål

1. Hind margin of pronotum with a transverse reddish fascia; clavus totally, or only internal and externally, red ... 2
   Hind margin of pronotum without a transverse reddish fascia; clavus not red ... 3
2. Humeral angles spinously produced outwards, reflexed; collar with seven longitudinal fuscous vittae or bars; scutellum castaneous; clavus totally red ... *rubroclavatus* n.sp.
   Humeral angles rounded, collar reddish; scutellum sulphurescent, reddish apically, with a median longitudinal orange vitta; clavus red, pale longitudinally at middle ... *rubrojugatus* n.sp.
3. Disc of pronotum with two to six round spots, humeral angles and a median longitudinal vitta on disc black ... 4
   Disc of pronotum without round spots, with or without humeral angles or a longitudinal median vitta black ... 7
4. Hind tibiae red; segment I of antenna red to dark castaneous; segment II pale ... *hebridensis* n.sp.
   Hind tibiae pale to ochraceous, segment I of antenna pale or light castaneous; segment II infuscated to black apically ... 5
5. Pronotum with two black spots behind calli; head with a median longitudinal vitta ... *marquesanus* n.sp.
   Pronotum with four to six black spots, situated posteriorly on disc ... 6
6. Segment II of antenna less than 4 mm long; hind margin of disc with only four black spots (including those of humeral angles) ... *tutuilaensis* n.sp.
   Segment II of antenna more than 4 mm long; hind margin of disc with six black spots (including those of humeral angles) ... *tongaensis* n.sp.
7. Scutellum and mesoscutum black; area of calli and a transverse fascia on hind margin of disc fuscous to black; general coloration orange to ochraceous ... *nigroscutellatus* n.sp.
   Scutellum and mesoscutum not black; pronotum and body otherwise coloured ... 8
8. Mesoscutum with black round spots at lateral fossae (one at each side) ... 9
   Mesoscutum without black round spots at lateral fossae ... 10
9. Head with three longitudinal black vittae; collar with five bars or vittae; humeral angles noticeably pointed; embolium and cuneus ochraceous ... *smaragdinus* Roepke
   Head without dark vittae; collar with only two lateral black bars; humeral angles rounded; embolium and cuneus reddish ... *kandanensis* n.sp.
10. Segment I of antenna black or reddish; scutellum with two black spots subapically; transverse black fascia on hind margin of disc reaching the hind border ... 11
    Segment I of antenna pale yellow to ochraceous, sometimes with reddish or fuscous dots; scutellum without two subapical black spots; transversal black fascia of hind margin of disc when present submarginal ... 13
11. Head pale yellow with a narrow longitudinal vitta; segment III of antenna pale on basal half; hind tibiae with short pubescence ... *guamensis* Usinger
    Head with three longitudinal vittae, sometimes united to leave only two pale areas on vertex; segment III of antenna pale only at extreme base; hind tibiae with long pubescence ... 12
12. Frons totally black; collar and area of calli mostly black; scutellum largely black at middle ... *nigrifons* Hsiao
    Frons pale; collar and area of calli pale yellow, varying in colour; scutellum black only at basal angles and subapically ... *rama* (Kirby)

13. Humeral angles of pronotum rounded; segment I of antenna and hind femora with reddish or fuscous dots; pronotum with three to five longitudinal dark or reddish vittae mostly visible on collar 14
    Humeral angles spinously produced outwards, prominent; segment I of antenna and hind femora without reddish or fuscous dots; pronotum without longitudinal vittae or when present, not extending beyond calli 15
14. Cuneus reddish at middle; clypeus without a median longitudinal red vitta; size large, over 12 mm long *malayensis* n.sp.
    Cuneus ochraceous; clypeus with a median longitudinal red vitta; size less than 11 mm long . . . . *vitripennis* (Stål)
15. Head and collar without longitudinal dark vittae or bars; cuneus reddish internally; species about 12 mm long *grandis* n.sp.
    Head and collar with longitudinal dark vittae or bars; cuneus pale yellow; species below 10·5 mm long 16
16. Calli without longitudinal zig-zag shaped vitta; hind submarginal fascia of pronotum narrow . *clavatus* Distant
    Calli with longitudinal zig-zag shaped vittae; hind submarginal fascia of pronotum wide 17
17. Humeral angles strongly produced, pointed and turned backwards; lower lateral vittae of collar much wider than others . . . . *spinosus* Distant
    Humeral angles not strongly produced, pointed and turned backwards; lower lateral vittae of collar equal to width of others . . . . *aneityumensis* n. sp.

Hyalopeplus (H.) aneityumensis, n.sp.

(Fig. 135)

Characterised by the colour of collar and pronotum.

Female: Length 10·4 mm, width 2·8 mm. *Head:* Length 1·2 mm, width 1·6 mm, vertex 0·60 mm. *Antenna:* Segment I, length 1·2 mm; II, 4·2 mm; III, 1·6 mm; IV, broken. *Pronotum:* Length 2·0 mm, width at base 2·8 mm. *Cuneus:* Length 1·24 mm, width at base 0·62 mm (holotype).

General coloration ochraceous with reddish areas; eyes and humeral angles black; three longitudinal vittae on head: one median and two lateral along inner margin of eyes and antennal peduncle, nine longitudinal vittae on collar: five continuing irregularly on disc of pronotum without reaching hind margin, two above on propleura (one at each side) and two along coxal cleft I continuing through inferior margin of propleura red. The two fasciae which are aside the longitudinal median fascia of disc are characteristic (zig-zag-shaped). Hemelytra glassy, transparent, embolium and cuneus opaque, antenna pale, segment I with small reddish dots. Underside of body ochraceous, a longitudinal vitta on lorum, lateral spot on mesosternum, median spot on metapleura and longitudinal vitta on abdomen red; apices of segments II and III of antenna dark brown.

Male: unknown.

Holotype: female, NEW HEBRIDES: Aneityum, xi.1930, L. E. Cheesman, B. M. 1931-127 (BMNH).

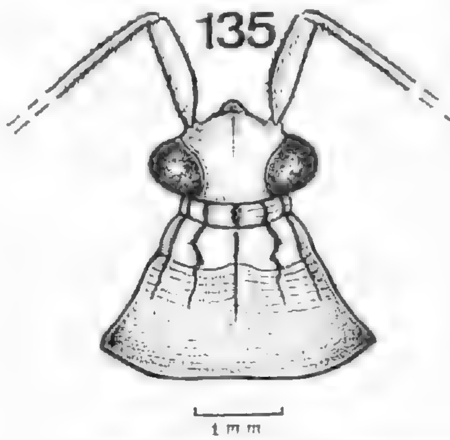


Fig. 135—*Hyalopeplus aneityumensis* n.sp., head and pronotum of female, holotype.

This species is close to *Hyalopeplus spinosus* Distant, 1904 but differs by the much less produced humeral angles and by the slender lower lateral vitta or bar of collar.

Hyalopeplus (H.) clavatus Distant, 1909

Hyalopeplus clavatus Distant, 1909, p. 509; Distant, 1910, p. 250.

(Fig. 136)

Characterised by strongly produced humeral angles.

Female: Length 10·2 mm, width 2·8 mm. *Head:* Length 1·0 mm, width 1·4 mm, vertex 0·64 mm. *Antenna:* Segment I, length 1·2 mm; II-IV, broken. *Pronotum:* Length 1·6 mm, width at base 2·8 mm. *Cuneus:* Length 1·12 mm, width at base 0·56 mm (lectotype).

"Head, pronotum scutellum, and corium bronzy ochraceous; head with three longitudinal black lines, the lateral ones converging anteriorly; antennae with the basal joint bronzy ochraceous, with a more or less distinct piceous line beneath, second joint black, with its base ochraceous (remaining joints mutilated in typical specimens); pronotal collar with the margins and three longitudinal lines black, the central line more prominent, posterior pronotal margin and the posterior angles black; clavus with the inner and outer margins and the suture black; corium with the costal margin area paler and bordered on each side with black; veins piceous; membrane pale olivaceous, subhyaline, the basal area reflecting the darker abdomen beneath, the cellular margins black; body beneath, rostrum, and legs ochraceous; antennae with the basal joint moderately thickened and a little longer than head, second joint slightly thickened and nearly four times as long as first; rostrum reaching the posterior coxae; pronotum with the anterior area subgranulose, the posterior area transversely striate and centrally longitudinally impressed, posterior angles slightly straightly prominent, scutellum with the disc very finely transversely striate. Length 10 mm."

Male: unknown.

Geographical distribution: Bangladesh, Malaysia

Specimens studied: female, lectotype (new designation), *Hyalopeplus clavatus* Distant, BANGLADESH: Lebong, 500 ft. (Lefroy), Bengal (BMNH). *Paralectotype:* female, same data as lectotype; id. PENINSULAR MALAYSIA: Kedah, nr. Jitra catchment area, 4.iv.1928.

Distant compares this species correctly with *Hyalopeplus spinosus* Distant, 1904 which has much more produced humeral angles.

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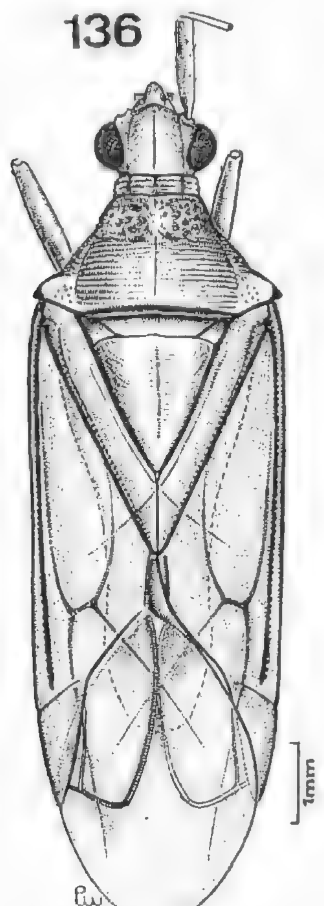

Fig. 136—*Hyalopeplus clavatus* Distant, female, holotype.

Hyalopeplus (H.) grandis, n.sp.
(Fig. 137)

Characterised by the large size and by the colour of the body.

Female: Length 12·3 mm, width 3·6 mm. *Head:* Length 1·0 mm, width 1·8 mm, vertex 0·84 mm. *antenna:* Segment I, length 1·8 mm; II, 6·4 mm; III-IV, broken. *Pronotum:* Length 2·0 mm, width at base 3·6 mm. *Cuneus:* Length 1·4 mm, width at base 0·68 mm (holotype).

General coloration ochraceous with black and reddish areas; head with eyes, joints of segments I and II of antenna, apical portion of segments III-IV black (segment II with more than half of basal portion whitish); pronotum with humeral angles black; hemelytra glassy, transparent, inner and outer margins of clavus, corium and embolium, commissure and apical margin of corium, and nervures of membrane castaneous to fuscous; embolium and cuneus opaque, the latter reddish at internal portion, membrane hyaline. Underside of body pale yellow, lateral portion of abdomen with indication of a longitudinal reddish brown vittae, legs pale yellow (hind pair mutilated).

Male: unknown.

Holotype: female, PHILIPPINES: Mt. Province, Mayayao, Ifugao, 1 200-1 500 m, 9.viii.1966, H. M. Torrevillas (BISHOP). *Paratype:* female, Ifugao Prov. Liwo, 8 km E Mayayao, 1 000-1 300 m, 1.vi.1967, H. M. Torrevillas.

Differs from others in the subgenus by its unicolorous head and collar.

Hyalopeplus (H.) guamensis Usinger, 1946

Hyalopeplus guamensis Usinger, 1946, p. 58, fig. 13; Carvalho, 1959, p. 320, 1959.

(Figs. 138-142)

Characterised by the colour of pronotum and head.

Male: Length 7·5 mm, width 2·1 mm. *Head:* Length 0·7 mm, width 1·3 mm, vertex 0·56 mm. *Antenna:* Segment I, length 0·9 mm; II, 3·8 mm; III, 1·2 mm; IV, 0·8 mm. *Pronotum:* Length 1·2 mm, width at base 2·0 mm. *Cuneus:* Length 0·88 mm, width at base 0·40 mm.

"Colour yellowish ochraceous with two long, interrupted brown stripes laterally and one short median stripe on tylus, a median longitudinal brown stripe on vertex, seven longitudinal stripes on collar. Brown elsewhere as follows: hind margin of pronotum narrowly, eyes, inner margin of commissure of clavus, veins of hind wings of membrane, and apex of rostrum. Cuneus mostly reddish and costal margin of corium and cuneus light brown to ochraceous posteriorly. Antennae reddish with brown at extreme base and apex of second segment, and ochraceous bases and brownish apices of third and fourth segments. Front and middle legs pale with reddish apices of tibiae and reddish tarsi except for brown apices and claws. Hind femora pale with brown spots and red apices, tibiae and tarsi red with brown tarsal apices and claws."

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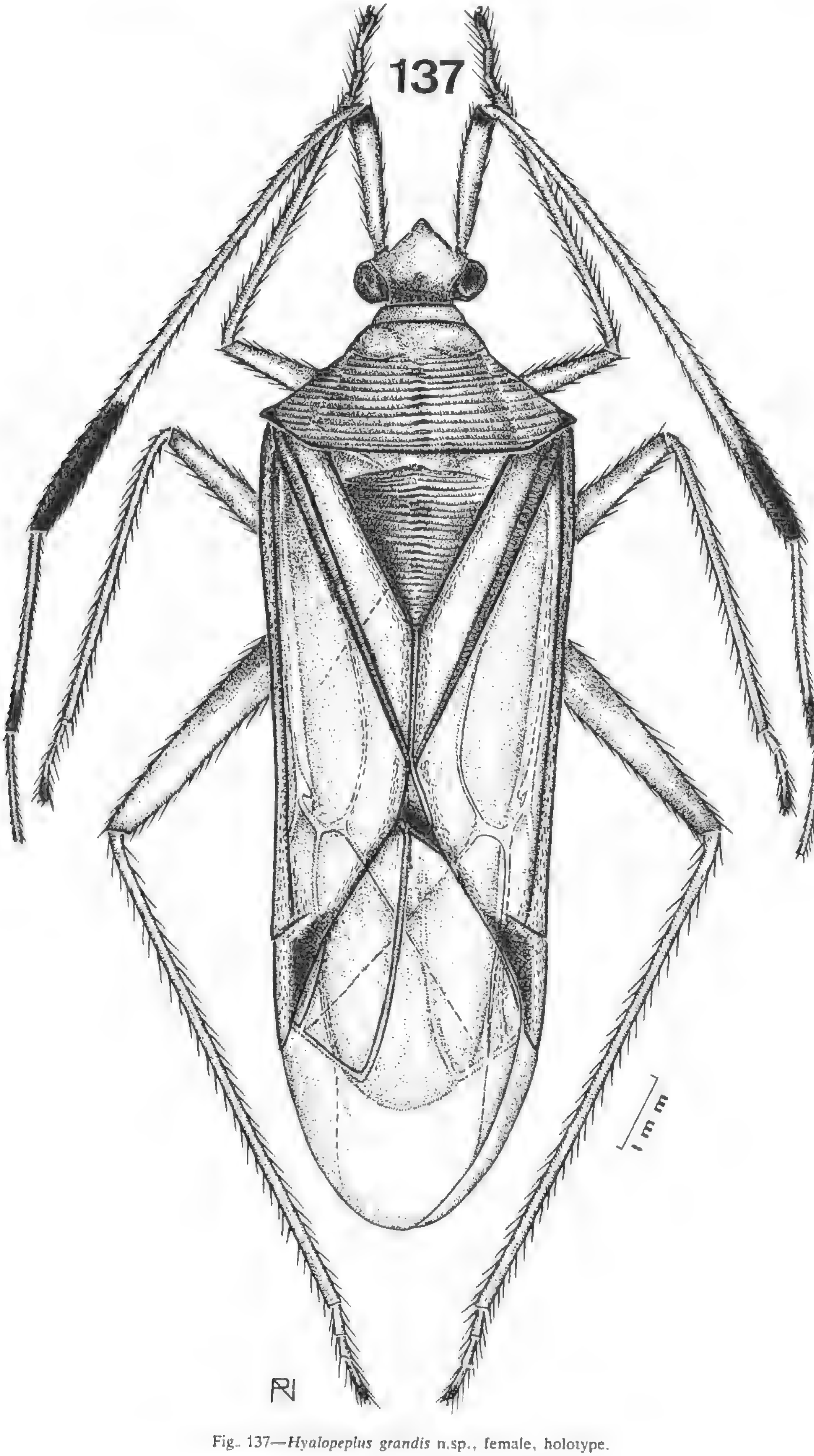


Fig. 137—*Hyalopeplus grandis* n.sp., female, holotype.

Genitalia: Penis (fig. 139) with membranous lobes provided with sclerotized spines apically, a median spiculum (fig. 140) and a group of spines near secondary gonopore. Left paramere (fig. 141) curved, pointed apically. Right paramere (fig. 142) smaller, also pointed apically.

Female: Similar to male in colour and general aspect, slightly more robust.

Host plant: Thespesia populnea.

Specimens studied: Five males and females, compared with type, Ft. Oca, Guam, light trap, iv.1945, G. E. Bohard & J. L. Gressitt; Gana, Guam, 15.v.1945, G. E. Bohart (BISHOP).

Usinger (1946), working with Poppius's key (1912) for the species of this genus, compared *guamensis* with *horvathi* Poppius and correctly pointed out that there were sensible differences in the structure of pronotum. Usinger's species is a good representative of the typical subgenus while *horvathi* Poppius represents the new subgenus *Adhyalopeplus*.

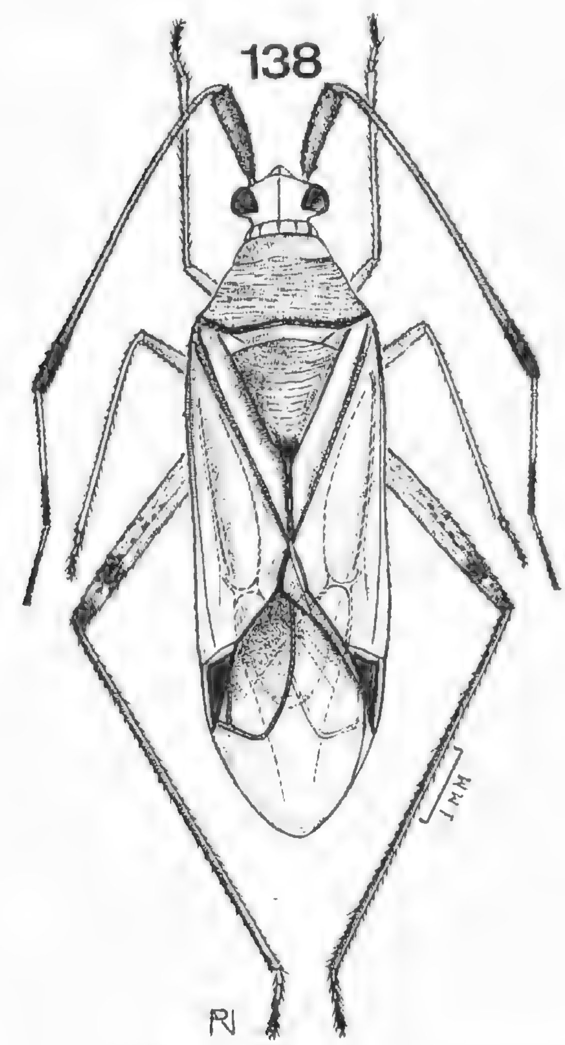
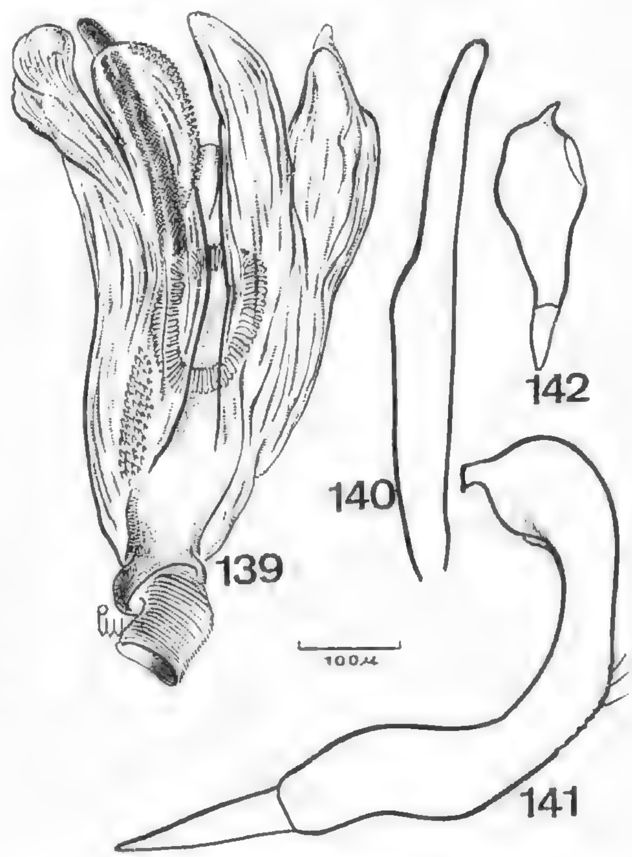


Fig. 138—*Hyalopeplus guamensis* Usinger, female, compared with type.



Figs. 139-142—*Hyalopeplus guamensis* Usinger-Fig. 139—Vesica of aedeagus; Fig. 140—Spiculum of vesica; Fig. 141—Left paramere; Fig. 142—Right paramere

This species is very close to *Hyalopeplus rama* (Kirby) but differs by having the pronotum citrine to ochraceous without indication of longitudinal lines, by the transverse fascia of posterior portion of disc being very slender and by the much less pubescent hind tibiae. The segments III-IV of antenna are pale in their basal halves while in *rama* only the extreme bases are pale.

Hyalopeplus (H.) hebridensis, n.sp.

(Figs. 143-146)

Characterised by the colour of pronotum.

Female: Length 8·8 mm, width 2·6 mm. *Head:* Length 0·7 mm, width 1·5 mm, vertex 0·60 mm. *Antenna:* Segment I, length 1·1 mm; II, 4·6 mm; III, 1·3 mm; IV, 0·8 mm. *Pronotum:* Length 1·6 mm, width at base 2·6 mm. *Cuneus:* Length 1·00 mm, width at base 0·52 mm (holotype).

General coloration ochraceous with dark brown and reddish areas; head with three longitudinal vittae (one central and two along inner margins of eyes), vitta on clypeus and a vitta on jugum; lorum and gena reddish; eyes brown, antenna castaneous to reddish, joints of segments I and II, segments III-IV (except pale basal portion) fuscous to black;

pronotum with collar showing seven longitudinal vittae (the two lower lateral ones narrow and reddish), four rounded spots on disc, humeral angles fuscous to black (in some specimens there is indication of a longitudinal reddish vitta on calli and middle of disc), mesoscutum with a black spot on each lateral fossa, scutellum with an obsolete longitudinal median castaneous line and two black rounded subapical spots; hemelytra glassy, transparent, inner and outer margins of clavus, embolium, corium and cuneus fuscous to brown, the latter reddish internally; membrane hyaline, nervures fuscous. Underside of body pale yellow with a reddish longitudinal vitta present on side of head, coxal cleft, metapleura and side of abdomen; legs pale yellow, hind femora with reddish tinge apically, hing tibiae red, apices of tarsi fuscous. In some specimens the two hind spots on disc become united by a transverse brown fascia.

Pronotum and scutellum transversely rugose, humeral angles pointed, reflexed.

Male: Similar to female in colour and general aspect. Length 8·0 mm, width 2·1 mm, vertex 0·60 mm.

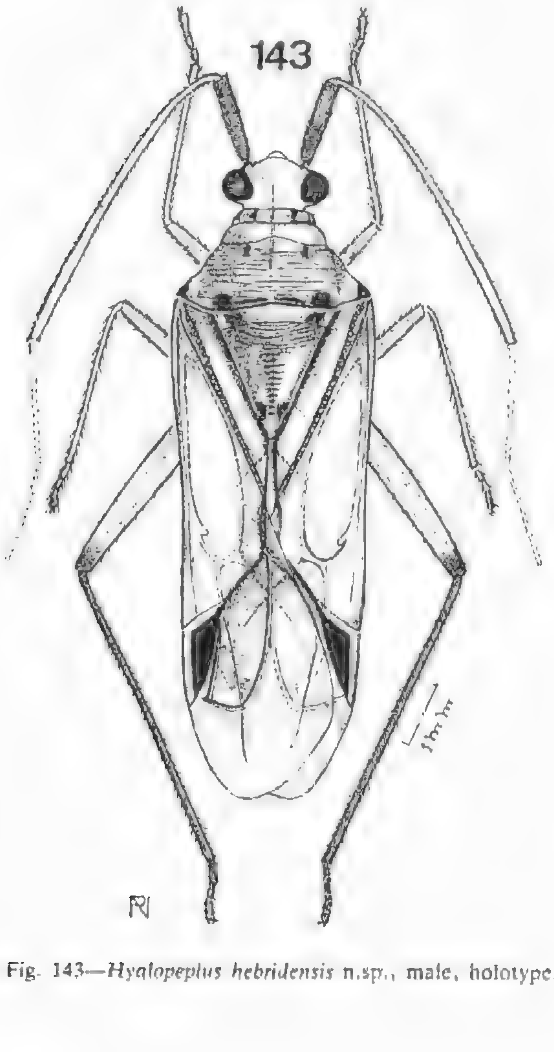


Fig. 143—*Hyalopeplus hebridensis* n.sp., male, holotype.

Genitalia: Penis (fig. 144) with membranous lobes provided with groups of sclerotized teeth. Left paramere (fig. 145) curved, pointed apically. Right paramere (fig. 146) small, globose, pointed at apex.

Holotype: male, NEW HEBRIDES: Aneityum, Red Crest, 1 200 ft, 3 mi NE of Anelgauhat, vi.1955, L.E. Cheesman, B.M. 1931-1927. *Allotype:* idem, Erromanga, vii.1930, L. E. Cheesman, B.M. 1930-496. *Paratypes:* 13 males and females same data as holotype and several specimens: Espiritu Santo, Apuna River, camp 3, 270 m, 9-12 Sept. 1971, G. S. Robinson, at light; Malau Village in Big Bay, 14-15 Sept. 1971, G. S. Robinson; Aneityum, at light, Agathis Camp, 19 July 1971, G. S. Robinson, Royal Society-Percy Sladen Expedition (SAM); Espiritu Santo, Narango, 90 m, 7.1960, W. W. Brandt id. SW Namatasopa, 300 m, 29.viii.1957, light trap, J. L. Gressitt; Malekula Is. Lamap, 8-12.ix.1967 (BISHOP).

This species approaches *Hyalopeplus tongaensis* n. sp. but differs by the colour of the segment II of antenna and hind tibiae.

Hyalopeplus (H.) kandanensis, n.sp.

(Fig. 147)

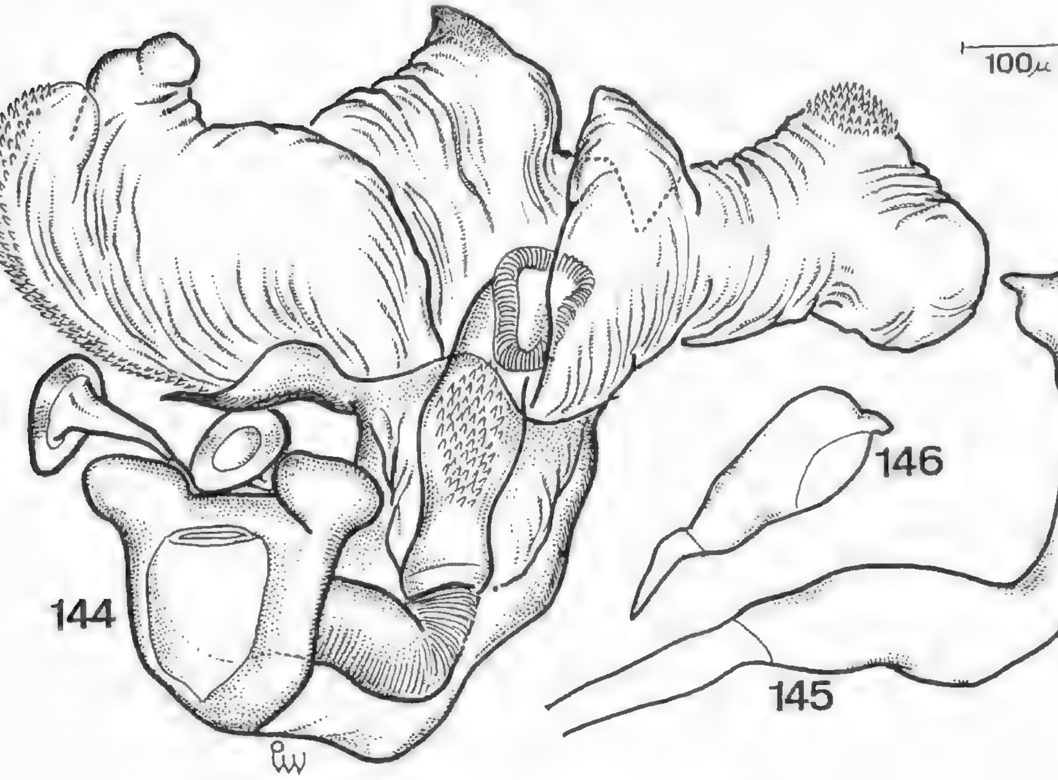
Characterised by the colour of the head, pronotum and cuneus.

Female: Length 10·4 mm, width 3·2 mm. *Head:* Length 1·0 mm, width 1·8 mm, vertex 0·80 mm. *Antenna:* Segment I, length 1·0 mm; II, 3·8 mm, III-IV, broken. *Pronotum:* Length 1·9 mm, width at base 2·8 mm. *Cuneus:* Length 1·20 mm, width at base 0·52 mm (holotype).

General coloration ochraceous with brown and reddish areas; eyes and antenna castaneous, segment I reddish; pronotum with collar showing a quadrate spot on lower lateral margin and a spot between calli anteriorly black, three longitudinal obsolete vittae on disc castaneous, mesoscutum with a black spot on each lateral fossa, scutellum infuscated longitudinally at middle; hemelytra glassy, transparent, innner and outer margins of clavus and corium fuscous, embolium and cuneus opaque, reddish; membrane hyaline, nervures brown. Underside of body pale yellow, ostiolar peritreme, longitudinal vitta and middle portion of abdomen reddish, segment IX brownish; legs pale yellow, femora towards apices and hind tibiae reddish, apices of tarsi fuscous.

Pronotum and scutellum noticeably transversely rugose, humeral angles rounded.

Male: unknown.



Figs. 144-146—*Hyalopeplus hebridensis* n.sp.: Fig. 144—Penis: Fig. 145-Left paramere; Fig. 146—Right paramere.

Holotype: female, NEW IRELAND: Kandan, 24.xii.1959, W. W. Brandt (BISHOP). *Paratype:* SOLOMON ISLANDS: Guadalcanal, Sukakiki R. 22.vi.56, E. S. Brown.

Differs from *Hyolopeplus smaragdinus* Roepke, 1919 by the rounded humeral angles, by the head lacking longitudinal vittae and by the collar having only two dark bars or vittae.

Hyalopeplus (H.) malayensis, n.sp.

(Fig. 148)

Characterised by the colour of pronotum and cuneus.

Female: length 13·0 mm, width 2·8 mm. *Head:* Length 1·1 mm, width 1·3 mm, vertex 0·80 mm, *Antenna:* Segment I, length 1·1 mm; II, 4·8 mm; III, 1·6 mm; IV, broken. *Pronotum:* Length 2·1 mm, width at base 2·8 mm. *Cuneus:* Length 1·20 mm, width at base 0·56 mm (holotype).

General coloration ochraceous to lutescent with reddish areas; eyes brown, antenna ochraceous, segment I with small red dots, segment II towards apex and segments III-IV castaneous; three longitudinal vittae on head (one median and two lateral along inner margins of eyes and antennal peduncles) following through pronotum with two others laterally (five vittae altogether) reddish to orange, a submarginal transverse median fascia

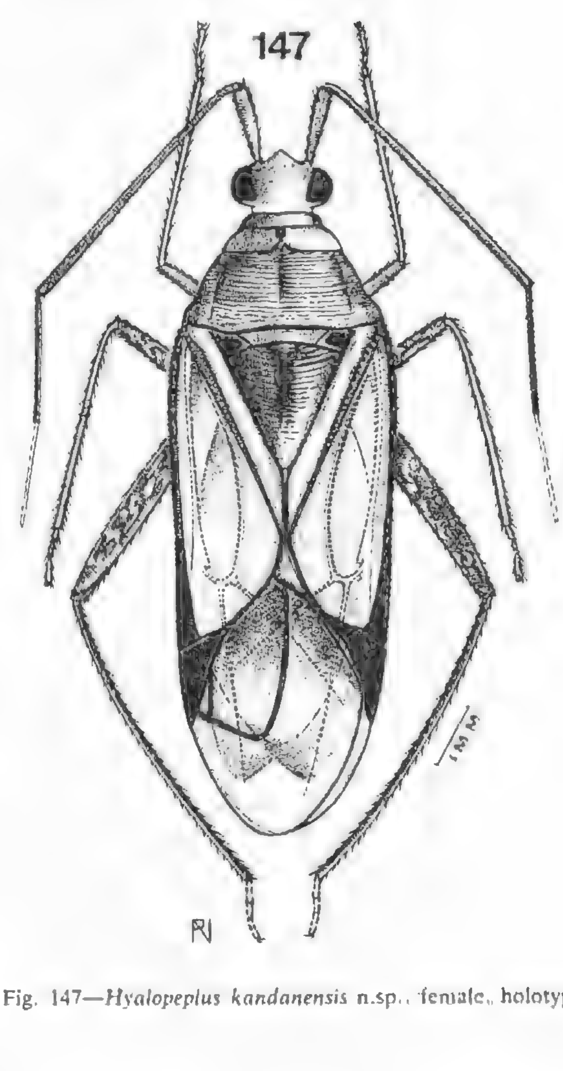


Fig. 147—*Hyalopeplus kandanensis* n.sp., female, holotype

extending somewhat onto mesoscutum and spot on humeral angles dark brown, hind margin of disc with a narrow fascia contiguous with mesoscutum pale; the latter and scutellum ochraceous to lutescent; hemelytra glassy, transparent, inner and outer margins of clavus, corial commissure and nervures of membrane, inner and outer margins of embolium and outer margin of cuneus castaneous, middle portion of latter reddish, membrane transparent.

Underside of body ochraceous, a spot on jugum, longitudinal vittae on lorum following through gena and inferior portion of propleura, two longitudinal vittae on propleura (median and superior), longitudinal vitta on abdomen and several small spots towards apices of femora reddish.

Male: unknown.

Holotype: female, PENINSULAR MALAYSIA: Pahang, Cameron's Highlands, 4 800 ft, 26.vi.1935, H. M. Pendlebury, Ex. Coll. F.M.S. Museum Natural History (BMNH). *Paratypes:* female, Perak, (F.M.S.), Larut Hills, 4 500 ft, 20 Feb. 1932, H. M. Pendlebury, Ex. F.S.M. Museum, B. M. 1955-354. This species approaches *Hyalopeplus vitripennis* (Stål, 1855) but differs by the reddish colour on cuneus, by its larger size and by the absence of a red longitudinal vitta on clypeus.

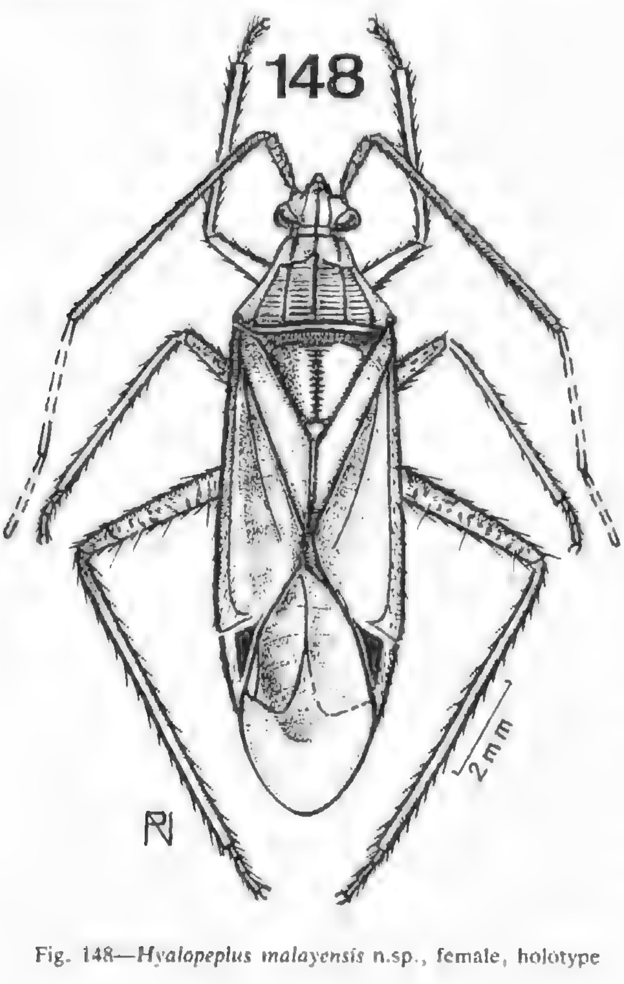


Fig. 148—*Hyalopeplus malayensis* n.sp., female, holotype

Hyalopeplus (H.) marquesanus, n. sp.

(Figs. 149-152)

Characterised by the colour of pronotum.

Male: Length 6·4 mm, width 2·0 mm. *Head* Length 0·9 mm, width 1·2 mm, vertex 0·60 mm. *Antenna:* Segment I, length 0·8 mm; II, 3·2 mm; III, 1·6 mm; IV, 0·8 mm. *Pronotum:* Length 1·2 mm width at base 1·8 mm. *Cuneus:* Length 0·40 mm, width at base 0·20 mm (holotype).

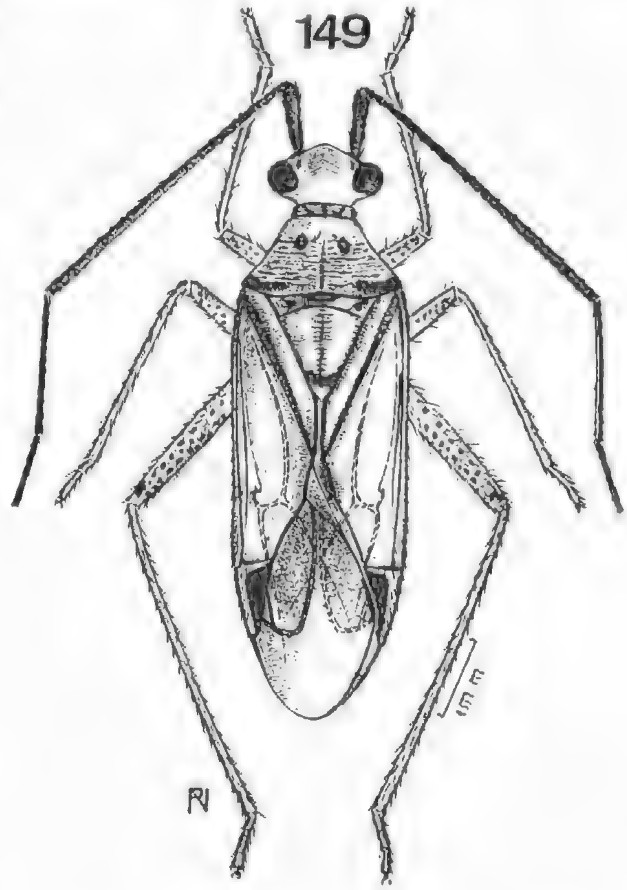


Fig. 149—*Hyalopeplus marquesanus* n sp., male, holotype.

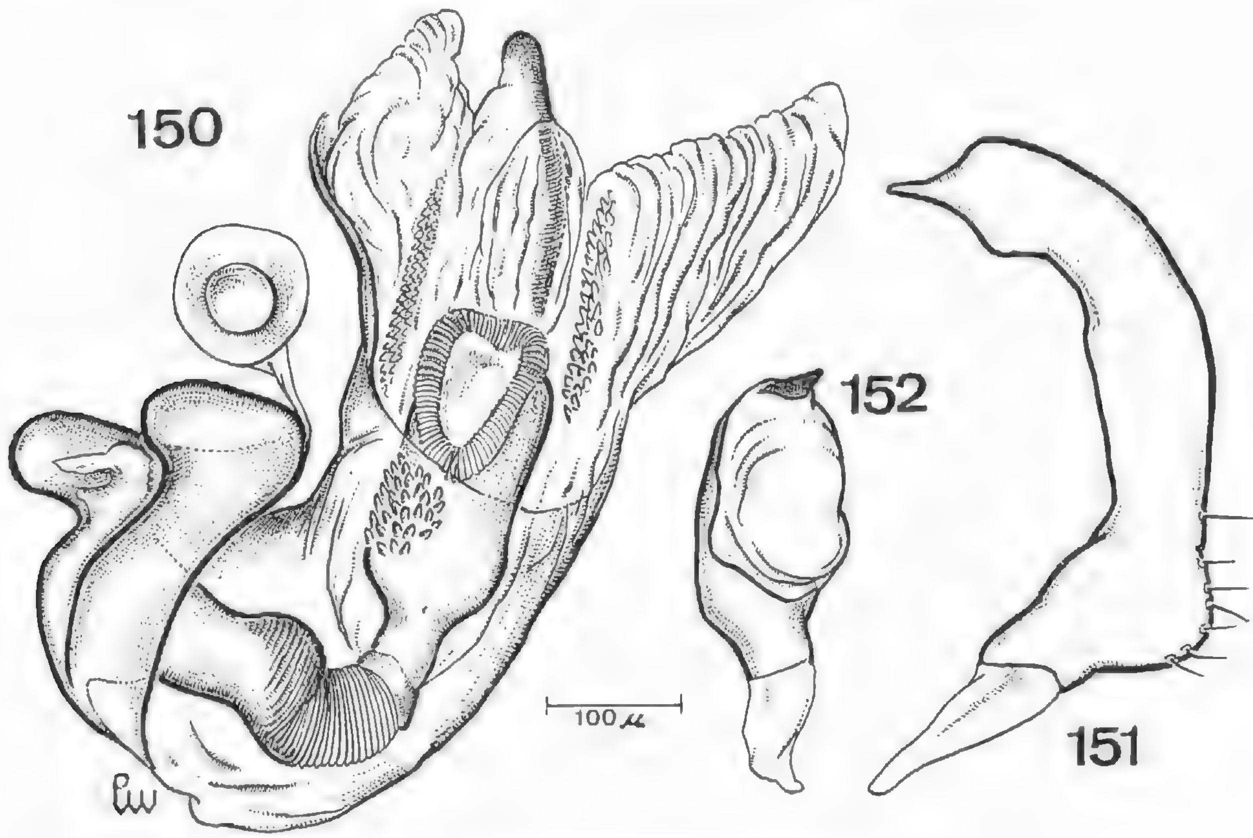
General coloration ochraceous with brown and reddish areas; eyes and antenna brown, segment I pale towards base with small dark dots inferiorly, clypeus with three vertical fasciae at base, a small spot above antennal peduncle, pronotal collar with three longitudinal vittae above and two lower lateral ones wider and divided at middle, brown; disc of pronotum with two characteristic black spots behind calli; a median longitudinal vitta along surface of disc, humeral angles and area contiguous of hind border (in some specimens only humeral angles) brown; mesoscutum with three median and two lateral spots, scutellum with subapical spot and median longitudinal line infuscate to black; hemelytra glassy, transparent, lateral margins of clavus, commissure and apical margin of corium, inner and outer margin of embolium, nervures of membrane, outer margin of cuneus fuscous to brown (in fully coloured specimens cuneal margin red, in teneral specimens cuneus totally ochraceous). Underside of body and legs ochraceous, femora with several brown dots, tibiae with hairs and spines black.

Genitalia: Penis (fig. 150) with membranous lobes with sclerotized teeth spically and a median spiculum. Left paramere (fig. 151) curved, pointed apically. Right paramere (fig. 152) small, also, pointed apically.

Female: Similar to male in colour and general aspect, slightly more robust.

Holotype: female, MARQUESAS ISLANDS: Mohotni, 300 ft, 4.ii.1931, on *Coreopsis* sp. Le Bonnec & H. Tauraa, Pacific Entomological Survey (USNM). *Allotype:* female, Eiao above Vaituha, 1.x.29, 800 ft, biting on *Melochia velutina*, A. M. Adamson, Pacific Entomological Survey. *Paratypes:* Two males and one female, same data as holotype.

The species is similar to *Hyalopeplus tongaensis* n.sp. and *Hyalopeplus tutuilaensis* n.sp. but differs in the structure of the pronotum.



Figs. 150-152—*Hyalopeplus marquesanus* n.sp.; Fig. 150—Penis; Fig. 151—Left paramere; Fig. 152—Right paramere.

Hyalopeplus (H.) nigrifrons (Hsiao, 1944), n.comb.

Hyalopeplus nigrifrons Hsiao, 1944, p. 369; Carvalho, 1959, p. 319.

(Fig. 153)

Characterised by the colour of head and scutellum.

Male: Length 9·7 mm, width 2·4 mm. *Head:* Length 0·8 mm, width 1·7 mm, vertex 0·65 mm. *Antenna:* Segment I, length 1·0 mm; II, 4·4 mm; III, 1·9 mm; IV, 1·3 mm. *Pronotum:* Length 1·4 mm, width at base 2·3 mm. *Cuneus:* Length 1·16 mm, width at base 0·60 mm (holotype).

General coloration ochraceous to pale yellow with black areas; "head black, two transverse spots on vertex, a triangular spot behind each eye, a spot at base of antennae, apical third of clypeus, lorum and whole underside of head ochraceous; antennae black; pronotum with collar (except a large spot on each side), calli, a longitudinal median line tapering anteriorly, and basal margin very broadly, black; scutellum black, lateral margins except apical fourth ochraceous; hemelytra glassy, transparent, corium, clavus, margins of embolium, cuneus and veins of membrane dark, embolium and cuneus opaque, the latter reddish; posterior lobe of ostiolar peritreme, posterior legs, side of ventral segments, apex of abdomen, and all third tarsal segments dark".

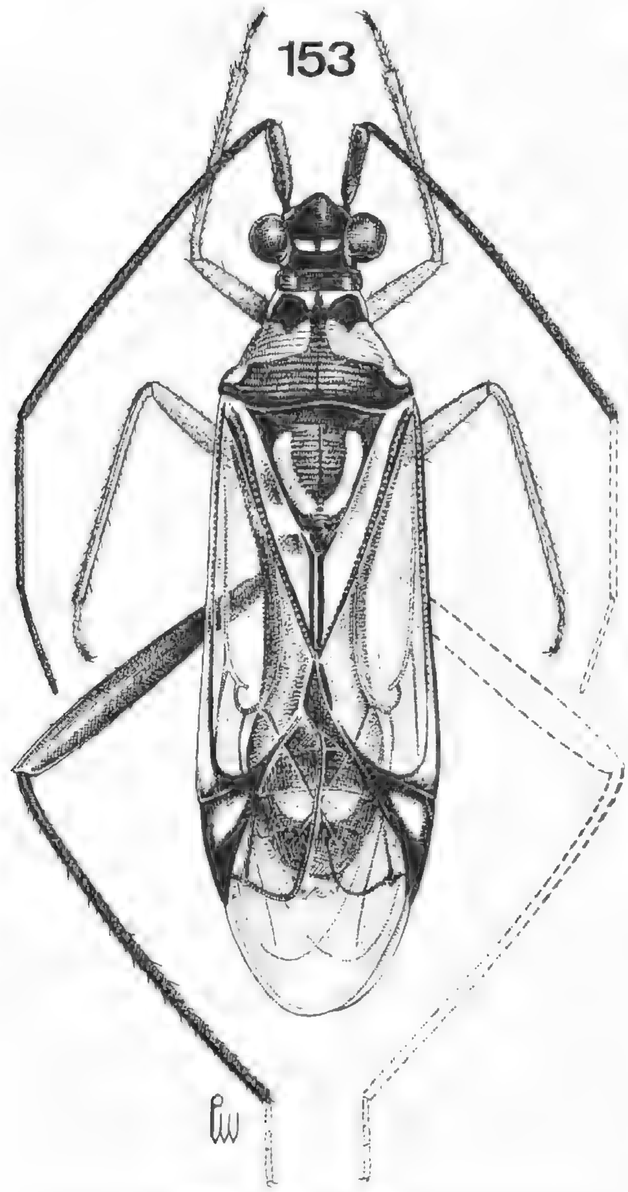


Fig. 153—*Hyalopeplus nigrifrons* Hsiao, male, holotype

Genitalia: Not dissected since holotype was only male studied.

Female: Similar to male in colour and general aspect. Length 10·2 mm, width 2·8 mm, vertex 0·72 mm.

Geographical distribution: Philippine Islands (Luzon, Mindanao, Negros), Indonesia (Sumatra, Irian Jaya).

Specimens studied: male, holotype, PHILIPPINES: Mt. Mackiling, Luzon, Baker col., *Hyalopeploides nigrifrons* Hsiao (USNM) together with seven males and females from: Negros Is., Camp Lookout, Dumaguete, 6.iv.-15.v.1961; Mindanao, Lanao, Gerain Mts, 1 300 m, 16.v.1958, jungle around swamp. INDONESIA: Sumatra, 1 800 m, Dolok Merangir, April-June, 1970, E.W. Diehl, Hollandia, Irian Jaya, L. Sentani, viii-ix, Markos Hart (AMNH and the author's collection).

This species is probably only a dark variety of *Hyalopeplus rama* (Kirby, 1891) with more black colour on head, anterior portion of pronotum and scutellum. The presence of intermediate forms in specimens from the same locality has been found. Only a more careful study however will allow a definite proof on this matter. It can be separated from *rama* by the totally black frons and by the scutellum being extensively black in the middle.

Hyalopeplus (H.) nigroscutellatus, n.sp.

(Figs. 154-158)

Characterised by the colour of pronotum and scutellum.

Female: Length 11·8 mm, width 3·1 mm. *Head:* Length 1·0 mm, width 1·8 mm, vertex 0·80 mm. *Antenna:* Segment I, length 1·6 mm; II, 5·1 mm; III-IV, broken. *Pronotum:* Length 1·8 mm, width at base 3·0 mm. *Cuneus:* Length 1·1 mm, width at base 0·72 mm (holotype).

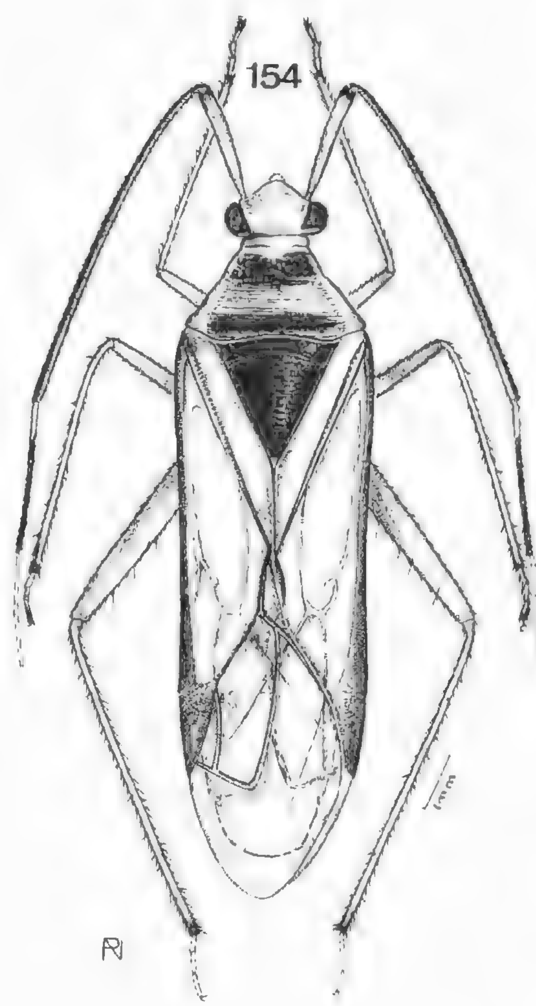


Fig. 154—*Hyalopeplus nigroscutellatus* n.sp., female, holotype

General coloration orange to ochraceous with brown and reddish areas; head and pronotum ochraceous eyes and antenna (except base of segment I) fuscous to black; pronotum with area of calli and a median transverse spot on hind margin of disc fuscous to brown; scutellum and mesoscutum black; hemelytra glassy, transparent, inner and outer margins of clavus and corium fuscous, embolium and cuneus opaque, brown to reddish, membrane hyaline, nervures reddish. Underside of body brick red, mesosternum and ostiolar peritreme, coxae partially fuscous to black; femora reddish, tibiae and tarsi brown to black.

Pronotum and scutellum noticeably transversely rugose, humeral angles prominest, acute reflexed, claval commissure, embolium and cuneus pubescent.

Male: Similar to female in size, coloration and general aspect.

Genitalia: Penis (fig. 155) with membranous lobes provided with sclerotized teeth, vesica with a characteristic spiculum (fig. 156). Left paramere (fig. 157) enlarged subapically, apex acute. Right paramere (fig. 158) less sclerotized ventrally, apex pointed.

Holotype: female, NEW GUINEA: SE Popondetta, 60 m, 3-4.ix.1963, J. L. Gressitt (BISHOP). *Paratypes:* five females. NE Torricelli, Mts. Mobitei, 750 m, 1-15.viii.1959, J. L. Gressitt; Kokada, 400 m, 14-16.xi.1965, J. L. Gressitt; male, PHILIPPINES: Leyte, Abuyong, mi S Tacloda, 14.vii.1961.

This species is readily separated from others in the genus by its black scutellum.

Hyalopeplus (H.) rama (Kirby, 1894) Kirkaldy, 1902

Capsus rama Kirby, 1894, p. 106.

Hyalopeplus rama Kirkaldy, 1902, p. 58, pl A, fig. 8; pl. B, fig. 6; Reuter, 1905b, p. 3; Poppius, 1912a, p. 147; Carvalho, 1953, p. 42; Carvalho, 1959, p. 320.

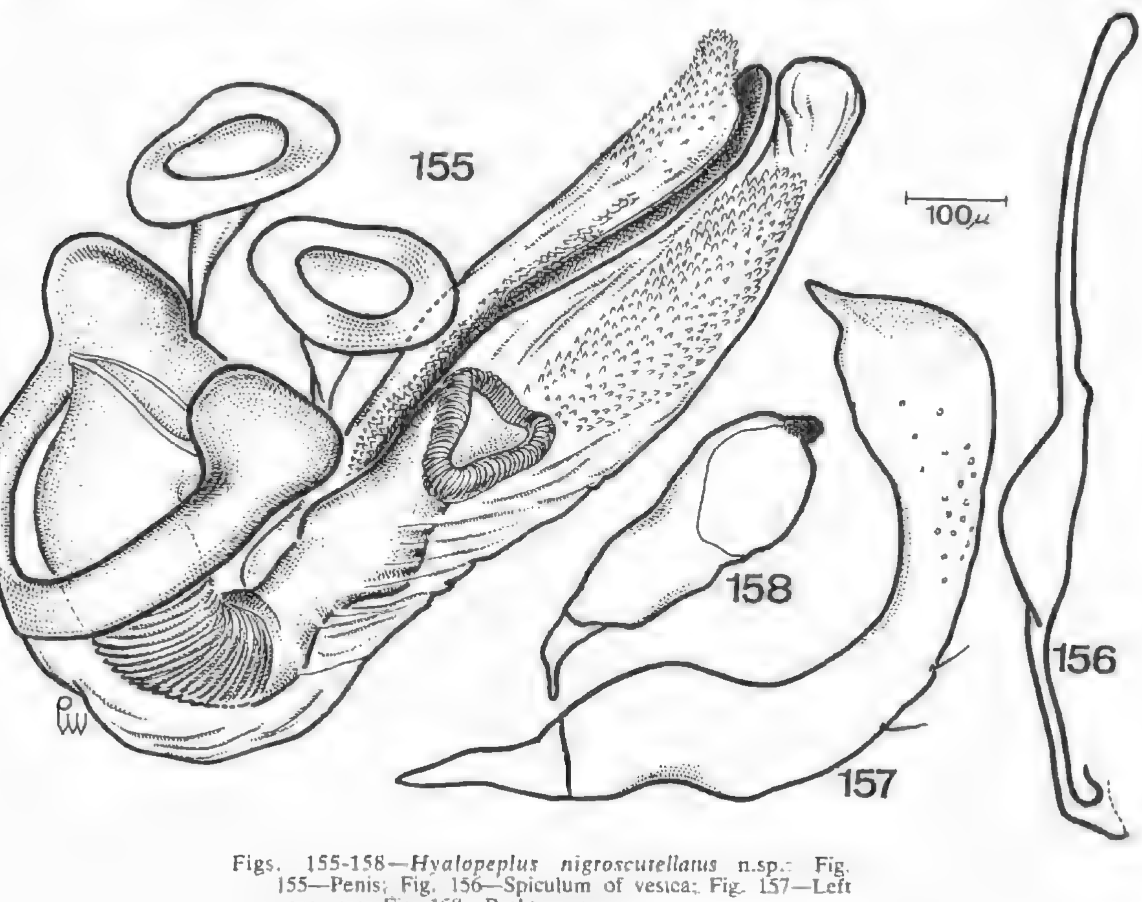
Callicratides rama Distant, 1904b, p. 417, fig. 265; Reuter, 1905a, p. 5, fig. 3; Distant, 1913, p. 174.

Hyalopeplus smaragdinus rubrinus Roepke, 1919, p. 73.

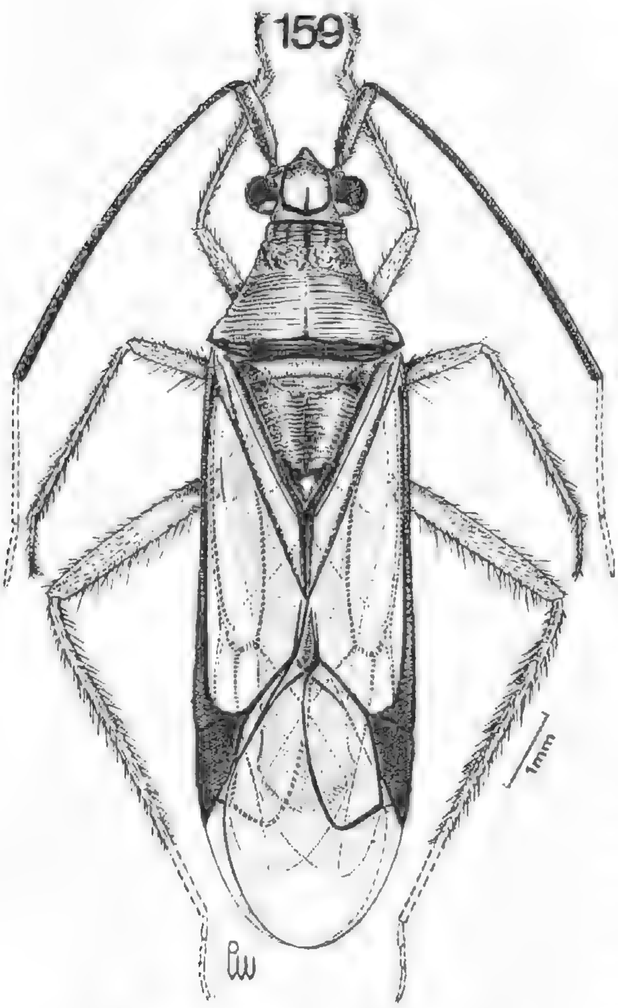
(figs. 159-169)

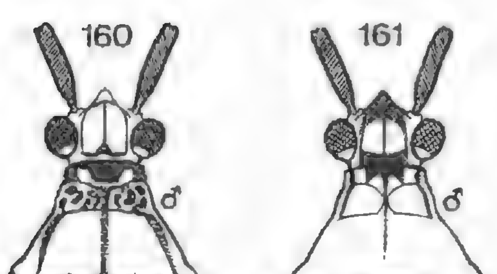
Characterised by the colour of head and pronotum.

Male: Length 9·6 mm, width 2·6 mm. *Head:* length 0·7 mm, width 1·5 mm, vertex 0·60 mm. *Antenna:* Segment I, length 0·8 mm; II, 4·4 mm; III, 1·4 mm; IV, 1·2 mm. *Pronotum:* Length 1·1 mm, width at base 2·6 mm. *Cuneus:* Length 1·10 mm, width at base 0·44 mm (holotype).



Figs. 155-158—*Hyalopeplus nigroscutellatus* n.sp.: Fig. 155—Penis; Fig. 156—Spiculum of vesica; Fig. 157—Left paramere; Fig. 158—Right paramere.





Figs. 159-161—*Hyalopeplus rama* (Kirby), female, lectotype Fig. 159; Fig. 160, 161—Colour variation of head and pronotum.

"Yellow, vertex with a slender black line between the eyes, and meeting behind them; pronotum blackish at the base, and with narrow black central and marginal lines, or with three short black lines at the base, the central line reddish, and the lateral lines reddish, black only at base; pale part of the pronotum transversely striated, the hinder margin black, the lateral angles not produced. Scutellum transversely striated, more or less black towards the base and extremity, and divided by a deep groove. Wings hyaline, the corium with brown nervures; the costal nervure, and the opaque space at the extremity of the corium reddish, the latter yellowish in the center. Antennae reddish brown, darker or lighter, the second joint not distinctly thickened, joints 3 and 4 narrowly yellow at base. Legs yellowish, tarsi black, hind femora dotted with brown, hind tibiae red. Under surface of body yellow, with a narrow red line on each side. Pundaloya. Long. Corp. 8-10 mm. Allied to *Capsus lineifer* "Walker" (Kirby, 1894).

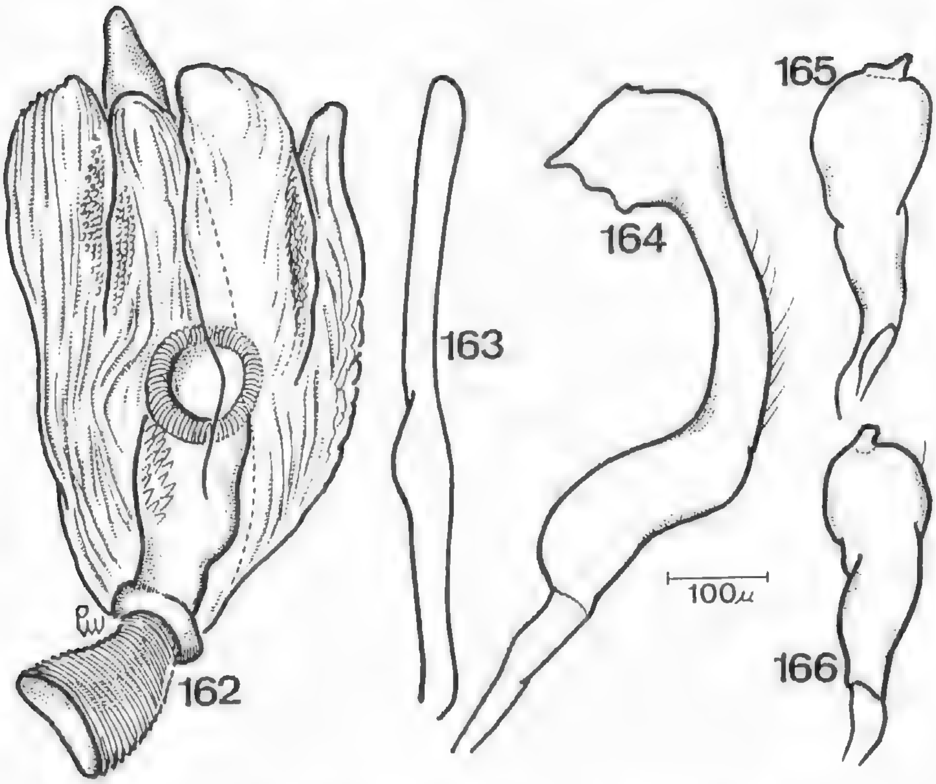
Studies undertaken on the type and fresh specimens from Sri-Lanka (Ceylon) have shown the following characters: general coloration yellow to citrine on head, pronotum and scutellum; glassy and transparent on hemelytra and membrane; antenna brownish to castaneous, segment I tending to reddish; three lines on head: one median (usually interrupted or obsolete) and two lateral along inner margins of eyes, sometimes joined on vertex; seven lines on collar (usually narrowed towards calli) reaching anterior margin of calli, the median one running backwards over disc of pronotum, usually reaching the transverse dark posterior fascia (which covers totally the hind margin of disc and humeral angles) dark to dark brown. The intensity and width of lines and fasciae are variable. Scutellum with extreme basal angles and two spots near apex brown to black, the extreme apex reddish or with reddish tinge; margins of clavus and corium, nervures of membrane and lower wings brown to black; cuneus and embolium reddish (embolium may be brown or pale at base), membrane vitreous. Underside of body yellow to citrine, a longitudinal reddish line laterally on head below eye which may be obsolete at side of sternum and abdomen. Legs pale yellow, hind femora with rows of brownish dots, apex of anterior and median tibiae, apical portion of hind femur (variable) and the hind tibiae totally red; tarsi infuscated towards apex.

Eyes usually removed from anterior margin of pronotum, disc transversely rugose, scutellum strigose sulcate longitundinally and distinctly longer than wide at base, rostrum reaching apex of middle coxae, hind tibiae densely pilose, length of hairs equal to or longer than width of tibia.

Genitalia: Vesica of aedeagus (fig. 162) with membranous lobes provided with sclerotized teeth apically and one spiculum (fig. 163). Left paramere (fig. 164) curved, enlarged apically, with an acute apex. Right paramere (figs. 165, 166) smaller, enlarged apically, also with a terminal pointed lobe.

Geoprahical distribution: Sri-Lanka, Java, Sumatra, Borneo, Malaya, Philippines, Sabah.

Host plants: Thea sinensis and *Melafoe* sp.



Figs. 162-166—*Hyalopeplus rama* (Kirby): Fig. 162—Vesica of aedeagus; Fig. 163—Spiculum of vesica; Fig. 164—Left paramere; Figs. 165, 166—Right paramere.

Specimens studied: SRI-LANKA: female, holotype, Pundaloy, Walker det. (BMNH): 3 males and 3 females, Kan Dist., Kandy 1 800 ft, Peak View Motel, 7-14, Jan. 1970, Davis & Rowe; INDONESIA: male, F.C. Drescher, Java: Preanger. N.O.I. Mt. Moerangrang 1 600 m, ix.1936; female, Blawan-Idjen, H. Luth (USNM); female, Asahan, Sumatra, 1912, Roepke; female, Asahan, S.O.K., on *Melafoe*, iv.'17, Corporal (det. by Leefmans as *H. uncariae* Rpke); two males and six females, Sumatra, W. Roepke; Goenong, Java, Roepke, 1919; Dolok Merangir, Sumatra, E.W. Diehl, April-June, 1970; id. Jan.-Feb. 1972; id. July-Aug. 1971; Central At Jeh, Sumatra, Kotadjane, 400 m, E.W. Diehl; id. 20 m, Kebon Belok, 60 km NW Medan, May 7, 1970; id. Langkat, E. coast, Namoe Dengas Est. col. Jourin; PHILIPPINES: Palawan, Brookes Point Uring, 17 Aug. 1961, Noona Dan Exp, 61-62; Busuanga Is. 4 km San Nicolas, 26.v.1962, H. Holtmann, light trap; id. 21.v.1962; Negros Or. Mt. Talinas, 1 000 m, 29-31.xii.60, at light, H. Holtmann; EAST MALAYSIA Tenompok, 1 460 m Jesselton, 30 mi E, 26-31.i.1959, T.C. Maa; id. 15.ii.1959; Mt. Kinabalu, Mesilau, 14.ii.1964, J. Smart, Royal Soc. Exp. B.M. 1964-250; PENINSULAR MALAYSIA: Pahang, Cameron Highlands, 4 800-5 000 ft, 4-12-1939; Kuala Lumpur, at light, 19.xii.1938, N.C.E. Miller (*Hyalopeplus vitripennis* Stål, N.C. Miller det. 1956).

This species has been confused with *Hyalopeplus vitripennis* (Stål, 1855) but it is readily differentiated by the reddish cuneus and hind tibiae with long hairs, as well as, by the black transversal hind fascia of disc reaching hind border and humeral angles. It has also similarity with the species of the subgenus *Adhyalopeplus* n. subgen. but can be differentiated by the well marked transverse rugosities of pronotum and scutellum obscuring punctures.

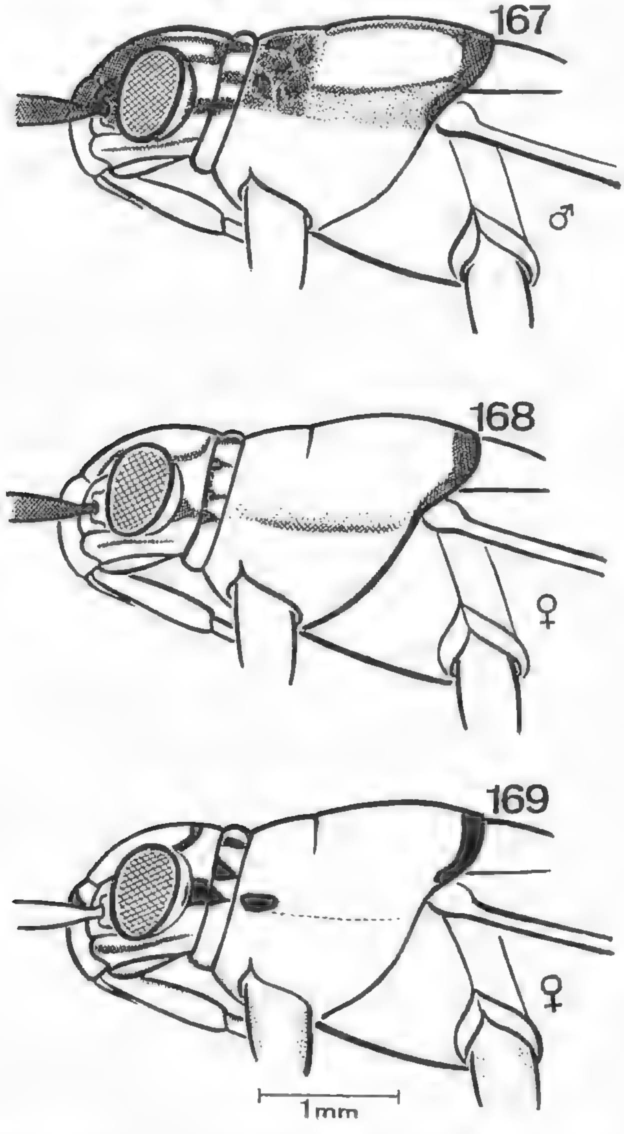
Hyalopeplus (H.) rubroclavatus, n.sp.

(Fig. 170)

Characterised by the large size and by the colour of the clavus.

Female: Length 11·0 mm, width 3·0 mm. *Head:* Length 0·9 mm, width 1·6 mm, vertex 0·76 mm. *Antenna:* Segment I, length 1·2 mm; II, 5·6 mm; III, 1·8 mm; IV, broken. *Pronotum:* Length 1·9 mm, width at base 3·0 mm. *Cuneus:* Length 1·24 mm, width at base 0·64 mm (holotype).

General coloration ochraceous with brown and reddish areas; head above with three longitudinal vittae (one median and two lateral along inner margins of eyes), extreme base and apex of segment I of antenna and eyes fuscous to castaneous; segment II brown, darkened towards apex, segments III-IV black, basal portion of III pale; pronotum with collar showing seven longitudinal bars or vittae fuscous, posterior margin of disc with a transverse red fascia, humeral angles black; mesoscutum and scutellum castaneous, unicolorous; hemelytra glassy, transparent, clavus, commissure and apical margin of corium, embolium and cuneus internally reddish; membrane hyaline, nervures brown to reddish. Underside of body pale yellow to lutescent, legs pale yellow, hind femora apically and tibiae towards base red.



Figs. 167-169—*Hyalopeplus rama* (Kirby): Figs. 167, 168, 169—Colour variation of head and pronotum seen from side.

Pronotum rugose punctate, humeral angles prominent, pointed, reflexed, scutellum rugose punctate, hind margin of pronotum slightly concave at middle, embolium and cuneus pubescent.

Male: Unknown.

Holotype: female, AUSTRALIA: Cairns, North Queensland, F.P. Dodd, ex-tree (BMNH). *Paratypes:* 2 females, INDONESIA: Humboldt Bay Dist. Bewani Mts., Irian Jaya, ix. 1937, W. Stober, B.M. 1938-177; AUSTRALIA: Dunk Island, H. Hacker, Aug. 1927; same data as holotype, in the collection of the author.

Very close to *Hyalopeplus rubrosignatus* n.sp. but differs by the spinously produced humeral angles, by the collar with dark fasciae or bars and by the unicolourous red clavus.

Hyalopeplus (H.) rubrojugatus, n.sp.

(Figs. 171-175)

Characterised by the colour of the jugum, collar and clavus.

Male: length 10·2 mm, width 2·4 mm. *Head:* Length 1·0 mm, width 1·6 mm, vertex 1·04 mm. *Antenna:* Segment I, length 1·4 mm; II 6·2 mm; III, 2·0 mm; IV, broken. *Pronotum:* Length 1·8 mm, width at base 2·4 mm. *Cuneus:* Length 1·00 mm, width at base 0·48 mm (holotype).

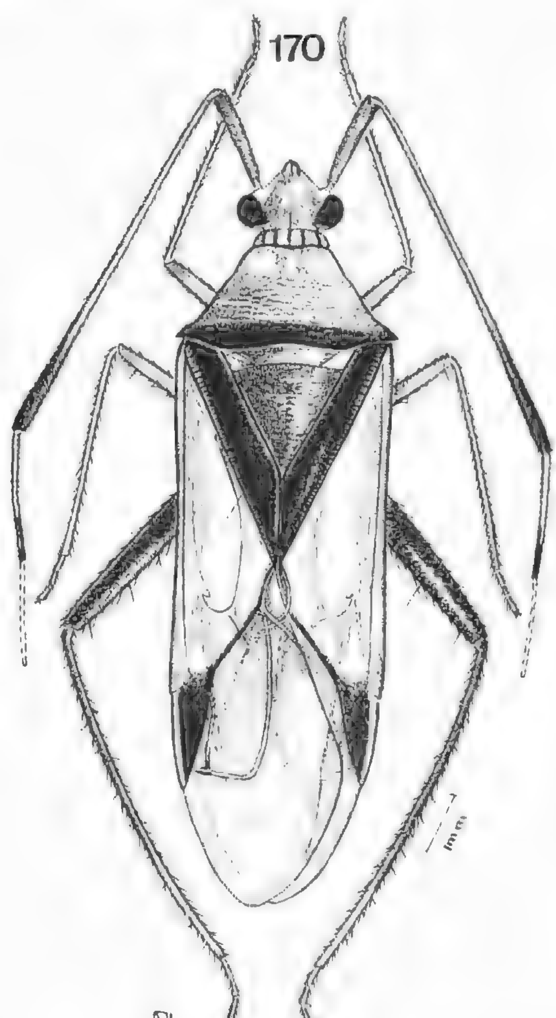


Fig. 170—*Hyalopeplus rubroclavutus* n.sp., female, holotype.

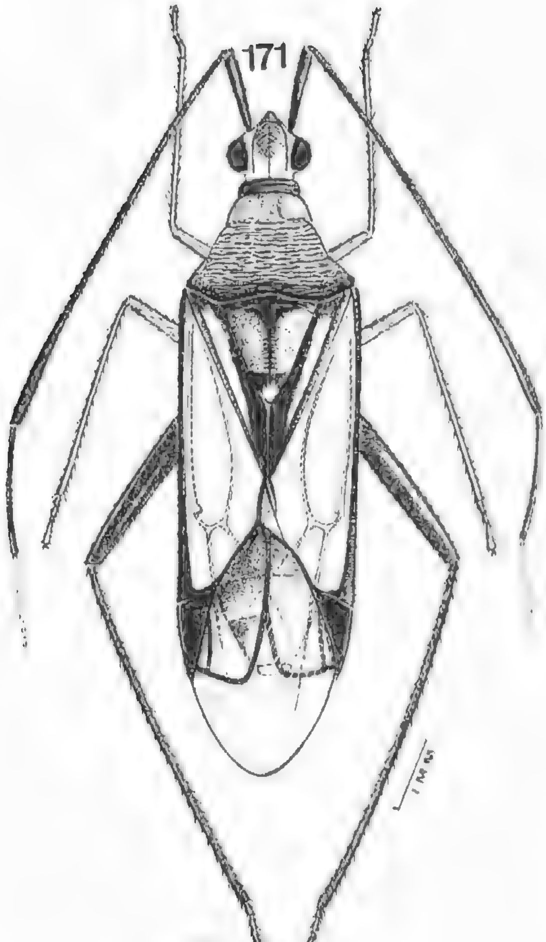
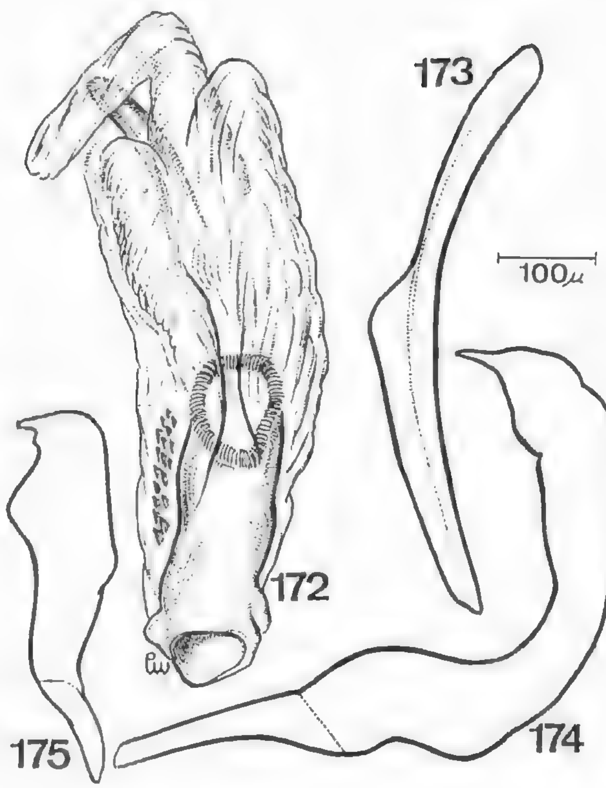


Fig. 171—*Hyalopeplus rubrojugatus* n.sp., male, holotype.



Figs. 172-175—*Hyalopeplus rubrojugatus* n.sp.: Fig. 172—Vesica of aedeagus; Fig. 173—Spiculum of vesica; Fig. 174—Left paramere; Fig. 175—Right paramere.

General coloration ochraceous with brown and reddish areas; head with three longitudinal dark brown vittae, the median running over clypeus, sides of the latter, jugum and vitta on lorum reddish; eyes brown, segment I of antenna red, segment II castaneous, reddish towards apex, infuscate to black apically, segments III-IV black, pale at extreme base; pronotum and scutellum lutescent to citrine; collar, a transverse fascia on hind margin of pronotum and apex of scutellum reddish; hemelytra glassy, transparent, clavus red, pale along middle portion, embolium, commissure and apical margin of corium and cuneus red, membrane hyaline, nervures brown. Underside of body pale yellow, apex of abdomen, hind femora and tibiae red, apex of tarsus fuscous.

Pronotum sinuate at posterior margin, humeral angles rounded, second antennal segment very long.

Genitalia: Vesica of aedeagus (fig. 172) with membranous lobes, a sclerotized spiculum (fig. 173) and a group of spines near secondary gonopore. Left paramere (fig. 174) falciform, tapering to extremity. Right paramere (fig. 175) small, with an apical point.

Female: Similar to male in colour and general aspect, slightly more robust.

Holotype: male, INDONESIA: Genjan, 40 km W of Hollandia, Irian Jaya 100-200 m, 1.x1960, T. C. Maa (BISHOP). *Paratype:* male, same data as holotype.

Close to *Hyalopeplus rubroclavatus* n.sp. but differs by the colour of the jugum, clavus and by the rounded humeral angles.

Hyalopeplus (H.) smaragdinus Roekpe, 1919

Hyalopeplus smaragdinus Roepke, 1919a, p. 173, figs. 1-5; Roepke, 1919b, p. 1, 7 figs.; Corporal, 1920, p. 108; Carvalho, 1959, p. 320.

(Figs. 176-180)

Characterised by the black spots of the mesoscutum, the large size and colour of posterior tibiae.

Male: Length 9·6 mm, width 2·8 mm. *Head:* Length 0·8 mm, width 1·6 mm, vertex 0·76 mm. *Antenna:* Segment I, length 1·4 mm; II, 5·2 mm; III-IV, broken. Pronotum: Length 1·6 mm, width at base 2·6 mm. *Cuneus:* Length 1·2 mm, width at base 0·6 mm *Scutellum:* Length 2·6 mm, width at base 1·6 mm.

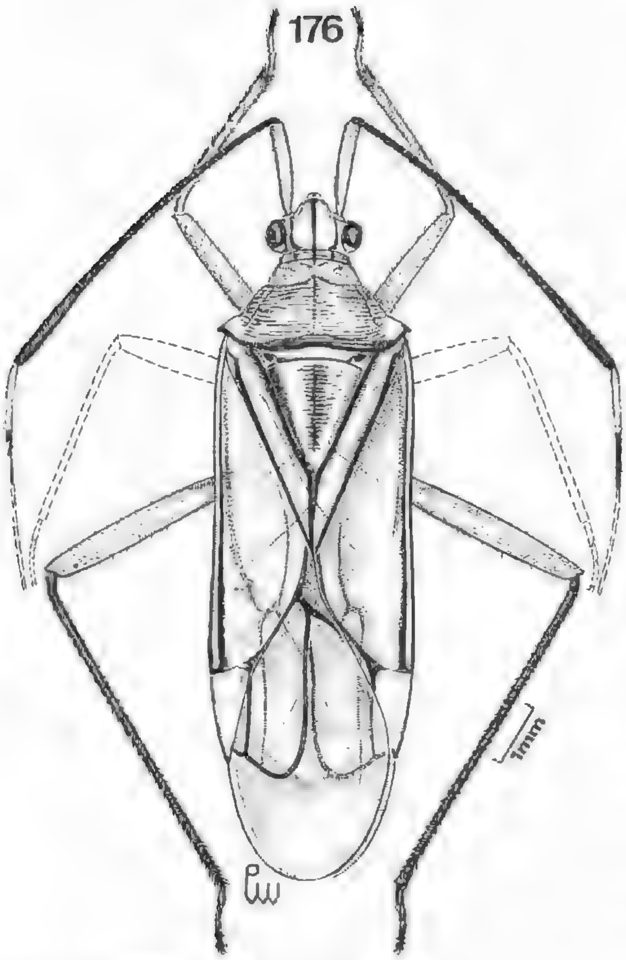


Fig. 176—*Hyalopeplus smaragdinus* Roepke, female, syntype.

According to the original description both males and females are emerald green (bright green) when alive. Antennae dark cineraceous, segment III noticeably pale basally; head above with three longitudinal black lines, convergent anteriorly, the median one stronger; side of head with a longitudinal orange to red vitta which extends to the anal segment without reaching its apex; eyes reddish brown, rostrum light green, valvulae dark brown, apex dark; pronotum anteriorly with three longitudinal black lines, corresponding to those of head and another on lateral margin; hind margin black with humeral angles pointed; scutellum light green margins and central line cineraceous; mesoscutum with two blackish points near lateral corners. Legs greenish cineraceous, apical portions of tibiae and tarsi becoming darkish; abdomen yellow translucent. Hemelytra completely transparent, with black nervures; cuneus yellowish green; membrane unicolours and shining. Antennae with segment I and II slightly thickened, III and IV slender as hairs; head with spherical eyes, strongly prominent, vertex slightly shorter than length of head. Rostrum reaching about the third abdominal segment. Pronotum rugose, with acute humeral angles. Body practically glabrous. "Length of both sexes 9·0-10·0 mm. Tjisampora (Soekaboemi) and Goenoeng Mas (Buitenzorg) about 1 000 m, on tea plantation, Java.

The bugs live on flower buds, especially in old plantations.

The variety described by Roepke as *Hyalopeplus smaragdinus rubrinus* n. form from specimens collected in Goenoeng in tea plants (1918) is undoubtedly a synonym of *Hyalopeplus rama* (Kirby, 1891). All the characters indicated are those of *rama*, especially the reddish embolium and cuneus, as well as the reddish apex of scutellum, apical third of hind femora and also hind tibiae.

The species lives in floral buds of tea. Nymphs reach the adult stage in a period of 9-10 days after six ecdiases. Adults are very delicate and difficult to maintain in captivity.

Genitalia: Penis (fig. 177) with membranous lobes with groups of sclerotised spines and a median spiculum (fig. 178). Left paramere (fig. 179) curved, enlarged apically, with a terminal point. Right paramere (fig. 180) small, globose.

Female: Similar to male in colour and general aspect. Length 10·0 mm, width 2·8 mm, vertex 0·80 mm.

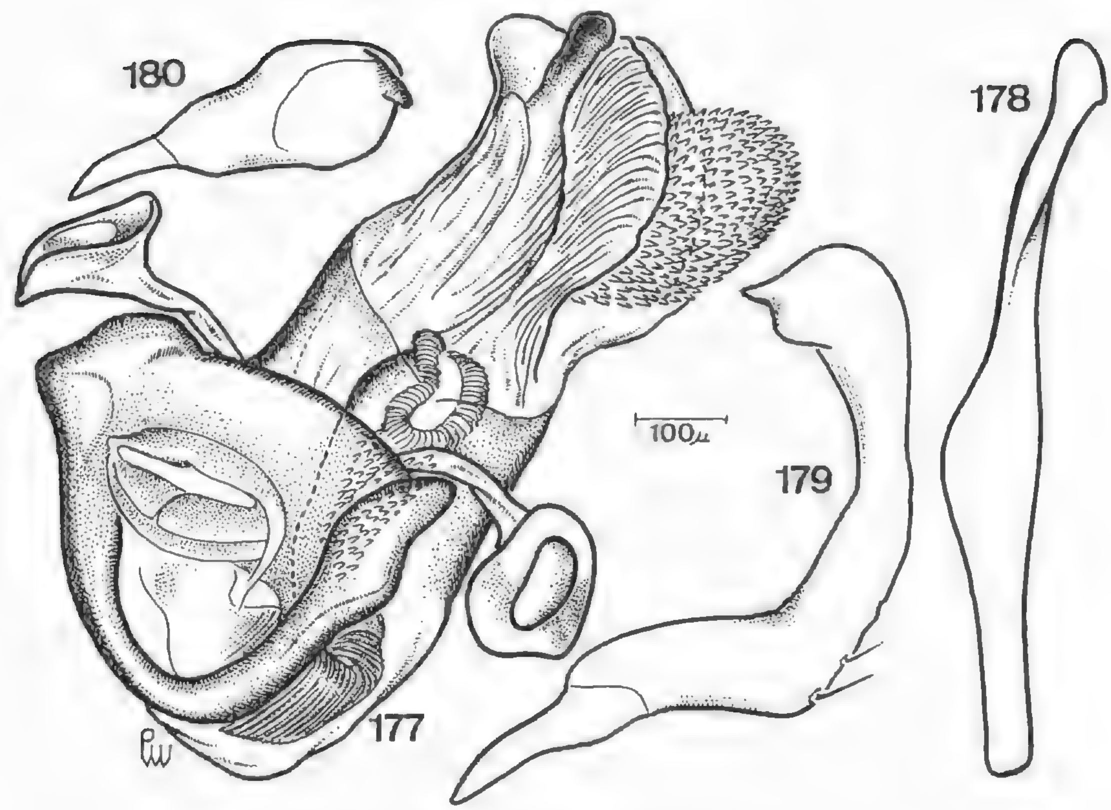
Host plants: Thea sinensis.

Specimens studied: INDONESIA: female, Op thee bloemtnop, Pd. Gedeh, vi.37, Proefst. us Java, *Hyalopeplus smaragdinus* Ropke (handwriting of Leefmans?); two females, L.G.E. Kalshoven Java, Mt. Salals, 600 m, 11.i.1925; male, West Java, Ag. Malang, 4290, M.E. Walsh, 13.xii.37; EAST MALAYSIA: female, Bau District, Bidi, 240 m, 2.ix.1958, T.C. Maa.

Geographical distribution: Java, Borneo.

In his second paper of 1919 Roepke presents more data for this species and states that it is not conspecific with *rama* (Kirby). Corporal (1920) gives data concerning fresh coloration.

The two black spots on mesoscutum are characteristic for the species. Its large size and colour of hind legs helps to separate it from allied species.



Figs. 177-180—*Hyalopeplus smaragdinus* Roepke, female Fig. 177—Penis; Fig. 178—Spiculum of vesica; Fig. 179—Left paramere; Fig. 180—Right paramere.

Hyalopeplus (H.) spinosus Distant, 1904

Hyalpeplus spinosus Distant, 1904b, p. 447; id, Poppius, 1912a, p. 416; Carvalho, 1959, p. 320.

(Fig. 181)

Characterised by the spinously produced humeral angles and by the colour of pronotum.

Female: Length 10·4 mm, width 3·0 mm. *Head:* Length 0·8 mm, width 1·4 mm, vertex 0·72 mm. *Antenna:* Segment I, length 1·2 mm; II, 5·2 mm; III, 1·8 mm; IV, broken. *Pronotum:* Length 1·7 mm, width at base 3·2 mm. *Cuneus:* Length 1·28 mm, width at base 0·56 mm (holotype).

General coloration flavescent to citrine with brownish to reddish areas; head with a median and two lateral longitudinal vittae on vertex which run backwards to pronotum, more visible over collar and calli where the two lines corresponding to those bordering inner margins of eyes are reddish and zig-zag-shaped, the median longitudinal vitta and the submarginal transverse fascia of disc, as well as the humeral angles are castaneous to black; hemelytra with sutures fuscous, embolio-corial margin dark longitudinally, external margin of cuneus and nervures of membrane fuscous. Underside of body flavescent, a line on side of head, a line or vitta on upper margin of propleura and a vitta laterally on abdomen brown to reddish. Antennae castaneous, segment I paler, with small reddish dots, segment II infuscate apically, segment III black apically with basal ¼ pale.

Humeral angles strongly spinously produced out and backwards, pronotum distinctly rugose.

Male: Unknown.

Specimens studied: INDIA: female, lectotype (new designation), Margherita, Upper Assam, Doherty (BMNH); id, VIETNAM: Dalat, 1 500 m, 29.iv.-4.v.1960, L. W. Quate.

Geographical distribution: India, Vietnam.

The lectotype is apparently the only remaining specimen of the original series. The legs are not mentioned in the original description. The species approaches *Hyalopeplus clavatus* Distant, 1909 but differs by the transverse submarginal fascia of hind margin of disc being much more distant from border, by the much more spinously produced humeral angles which are somewhat turned backwards and by the colour and shape of the lateral vittae or lines of pronotum.

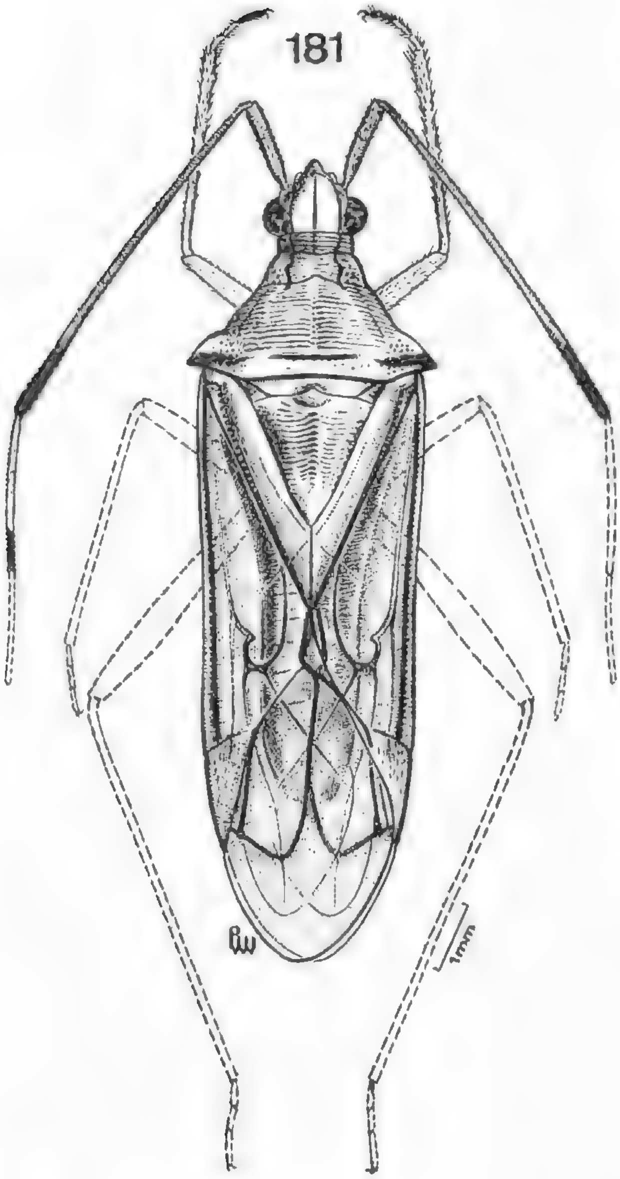


Fig. 181—*Hyalopeplus spinosus* Distant, female, lectotype.

Hyalopeplus (H.) tongaensis, n.sp.

(Figs. 182-186)

Characterised by the colour of pronotum, antenna and hind tibiae.

Male: Length 8·0 mm, width 2·2 mm. *Head:* Length 0·9 mm, width 1·4 mm, vertex 0·50 mm. *Antenna:* Segment I, length 1·0 mm; II, 4·7 mm; III, 1·5 mm; IV, 0·8 mm. *Pronotum:* Length 0·9 mm, width at base 2·0 mm. *Cuneus:* Length 0·90 mm, width at base 0·40 mm (holotype).

General coloration ochraceous with brown and reddish areas; head with three longitudinal vittae (one median and two lateral along inner margins of eyes), vitta on clypeus, jugum, lorum and gena brown to reddish; eyes and antenna castaneous, segment I with small fuscous to reddish dots, segments III-IV black towards apices (segments III-IV pale basally); pronotum with collar showing five longitudinal vittae, the lower lateral one at each side quadrate and large, four rounded spots on disc and humeral angle fuscous to black; In some specimens there is also a median longitudinal vitta and two sublateral ones, between calli and humeral angles with same colour; mesoscutum with a rounded black spot at each lateral fossa, scutellum with an obsolete longitudinal line and two black subapical round spots; hemelytra glassy, transparent, inner and outer margins of clavus, corium, embolium and cuneus fuscous to brown, the latter reddish internally, membrane hyaline, nervures brown to fuscous. Underside of body pale yellow with a reddish vitta on coxal cleft I, a black spot on mesosternum laterally and a reddish vitta on metapleura and sides of abdomen; legs pale yellow, hind femora reddish to fuscous apically with fuscous dots or bars, hind tibiae reddish, segment III of tarsi fuscous.

Pronotum and scutellum transversely rugose, humeral angles acute, prominent, reflexed.

Genitalia: Penis (fig. 183) with membranous lobes provided with sclerotised teeth apically and a spiclulum (fig. 184). Left paramere (fig. 185) curved, pointed apically. Right paramere (fig. 186) small, also with pointed apex.

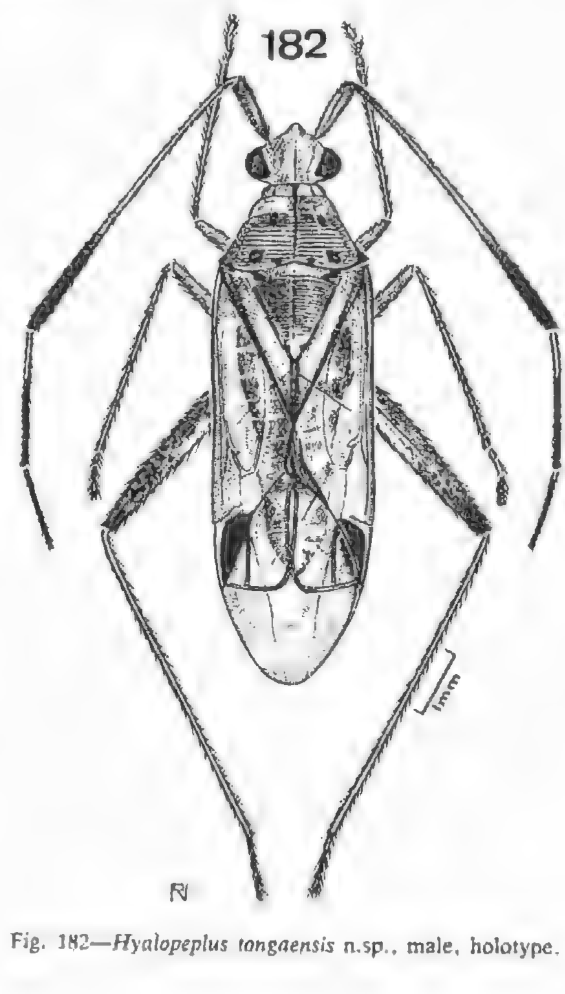
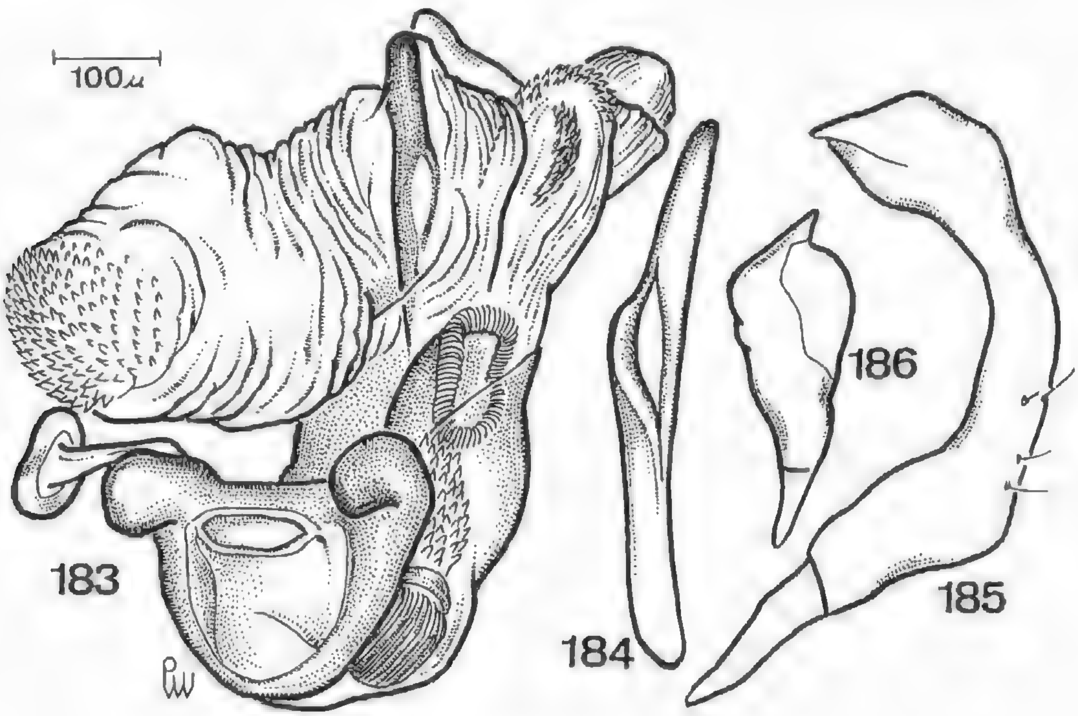


Fig. 182—*Hyalopeplus tongaensis* n.sp., male, holotype.

Female: Similar to male in colour and general aspect. Length 8·3 mm width 2·5 mm; vertex 0·60 mm.

Holotype: male, TONGA ISLANDS: Eua, Pangai, 90-120 m, iii.1969, N.L.H. Krauss (BISHOP). *Allotype:* female, same data as holotype *Paratypes:* two males and two females, Tongatapu, Haatapu, 0-50 m, 11.ii.1969, N.L.H. Krauss; Eua, Parker's Hill area, 200-300 m, iii.1969, N.L.H. Krauss; 3 males and 7 females, FIJI ISLANDS: Nandarivatu, Viti Levu, 3.vii.1938, E. C. Zimmerman; id. Taviuni, xii.1921, H. W. Simmonds; id Suva, 29.vii.1923 and 2.v.1923, C. L. Edwards (BMNH).

Very close to *Hyalopeplus tutuilaensis* n. sp. but differs by the colour of second antennal segment and also by the number of spots on the disc of pronotum.



Figs. 183-186—*Hyalopeplus tongaensis* n.sp.: Fig. 183—Penis; Fig. 184—Spiculum of vesica; Fig. 185—Left paramere; Fig. 186—Right paramere.

Hyalopeplus (H.) tutuilaensis, n.sp.

(Figs. 187-190)

Characterised by the colour of antenna and pronotum

Male: Length 6·7 mm, width 2·0 mm. Head: Length 0·6 mm, width 1·3 mm, vertex 0·56 mm. *Antenna:* Segment I, length 0·9 mm; II, 3·9 mm; III-IV, broken. *Pronotum:* Length 1·1 mm, width at base 1·8 mm. *Cuneus:* Length 0·76 mm, width at base 0·44 mm (holotype).

General coloration ochraceous with dark brown and reddish areas; head with three longitudinal vittae (one median and two lateral along inner margins of eyes), obsolete in some specimens, vitta on clypeus, jugum and gena, reddish to brown , eyes brown, antenna pale yellow, apex of segment II, segments III-IV (except pale base) fuscous to black, pronotum with collar showing five longitudinal vittae (three median and two lower lateral larger, quadrate), disc with median longitudinal vitta and four rounded spots (humeral angles included) fuscous to black. In some specimens the lateral vitta on head follows backwards through collar and calli and there is also a narrow sublateral vitta between calli and humeral angles. Mesoscutum with a black spot on each lateral fossa, scutellum with a fine longitudinal castaneous, line and two subapical round spots; hemelytra glassy, transparent, ochraceous, inner and outer margins of clavus, embolium, corium and cuneous fuscous to black, the latter reddish internally, membrane hyaline, nervures brown. Underside of body pale yellow, a longitudinal reddish vitta laterally beginning on lorum and running backwards, broken at certain points at side of abdomen, a characteristic black, round spot on mesosternum laterally, legs pale yellow, hind femora with dilute fuscous spots or bars, segments III of tarsi fuscous.

Pronotum and scutellum with rugosities, humeral angles acute.

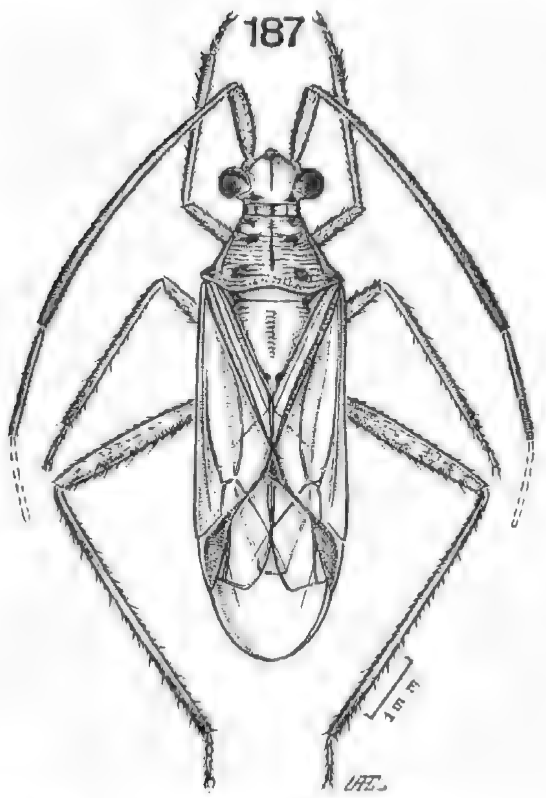


Fig. 187—*Hyalopeplus tutuilaensis* n.sp., male, holotype.

Genitalia: Penis (fig. 188) with membranous lobes provided with sclerotized teeth apically and a sclerotized spiculum. Left paramere (fig. 189) curved, pointed apically. Right paramere (fig. 190) smaller, also pointed apically.

Female: Similar to male in colour and general aspect. Length 8·6 mm, width 2·6 mm, vertex 0·60 mm.

Holotype: male, AMERICAN SAMOA: Tutuila, Taputima, 12.xi. 1963, N. R. Spencer (BISHOP). *Allotype:* female, same data as holotype. *Paratypes:* four males and six females, same as data above and 16.ix.1963, 4.iii.1964; Apia Upolu, 2.ii.51, J.S. Armstrong, B.M. 1963-291 (BMNH).

This species approaches *Hyalopeplus tongaensis* n.sp. but differs by the colour of second antennal segment and number of black spots on pronotum.

Hyalopeplus (H.) vitripennis (Stal, 1855) Stal, 1870

Capsus vitripennis Stål, 1855, p. 186; Stal, 1859, p. 255; Walker, 1873, p. 118.

Hyalopeplus vitripennis Stål, 1870, p. 671; 1870; Atkinson, 1890, p. 106; Distant, 1904a, p. 108; Distant, 1904b, p. 447, fig. 288; Reuter, 1905b, p. 2; Poppius, 1912a, p. 417; Poppius, 1914, p. 101; Carvalho, 1952, p. 97; Carlvalho, 1959, p. 320.

Capsus lineifer Walker, 1873, p. 122; Atkinson, 1890, p. 109; Kirkaldy, 1902c, p. 253.

Hyalopeplus uncariae Roepke, 1916, p. 182, fig. 3; Carvalho, 1959, p. 320 (*n.syn.*).

Hyalopeplus amboinae Carvalho, 1956, p. 74, figs. 1956 (*n.syn.*).

(Figs. 191-210)

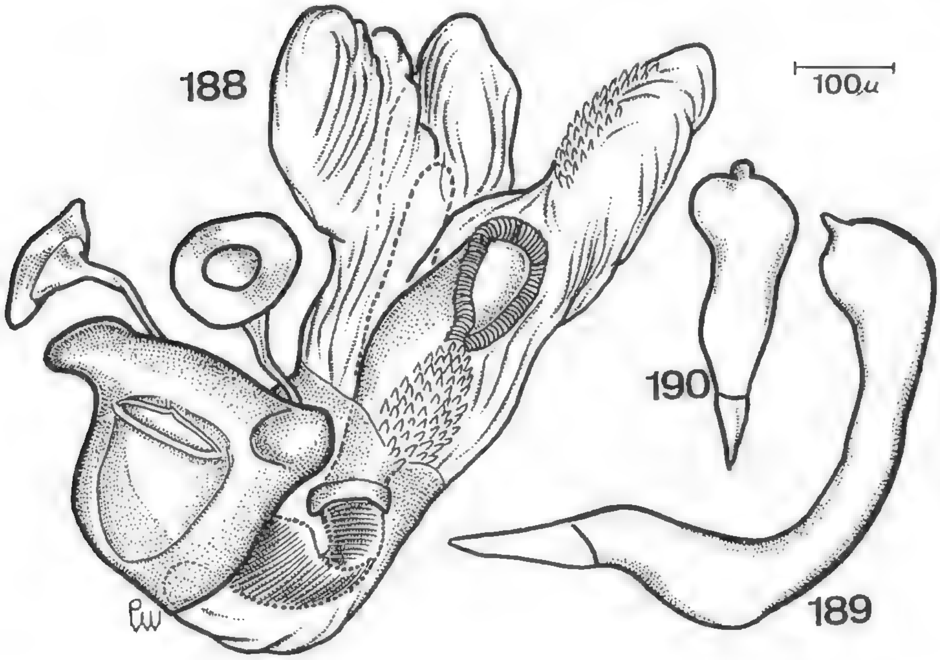
Characterised by the colour of pronotum and cuneus.

Male: Length 7·6-8·0 mm, width 2·4 mm. *Head:* Length 0·8 mm, width 1·2 mm, vertex 0·68 mm. *Antenna:* Segment I, length 0·8-0·9 mm; II, 3·9-4·4 mm; III, 1·2-1·3 mm; IV, 1·0-1·3 mm. *Pronotum:* Length 1·6 mm, width at base 2·3 mm. *Cuneus:* Length 0·86 mm, width at base 0·48 mm.

"Virescenti-flavus; antennis, art. 1 excepto. fuscis; capite thoraceque longitudinaliter rufo-vel ferrugineo-lineatis, hoc etiam linea transversa intramarginali basali nigrofusca; scutelli linea media maculisque 2 apicis brunnescentibus; hemelytris flavo-hyalinis, obscurioribus; femoribus posticis fuscopunctatis; abdominis utrimque linea longitudinalis sanguinea. Lond. 8, Lat. 2·5 mm. Java" (Stål, 1855).

"Luteous; head with three, and pronotum with five longitudinal lines either red or black; scutellum with a central line similarly variable in colour; basal margin of pronotum black; antennae luteous, sometimes (excluding basal joint) fuscous; hemelytra pale ochraceous hyaline, the venation piceous; apex of scutellum more or less castaneous. Length 9 to 10 mm. Assam (Margherita), Ceylon, Tenasserin (Myita), Mallacca, Java, Philippines, North Queensland." (Distant, 1904). The figure 288 given for the species is correct.

"Testaceous, fusiform, very finely punctured. Head and pronotum with three black parallel lines the lateral pair abbreviated on the prothorax hindward. Head triangular. Eyes piceous, prominent. Rostrum extending somewhat beyond hind coxae. Antennae piceous, slender, as long as the body; first joint stout, as long as head; second more than thrice as long as the first and less than thrice as long as the third; fourth shorter than the third. Prothorax with two exterior black and red lines on each side, in addition to those before mentioned; transverse furrow extremely slight. Legs rather long and slender. Wings cinereous, veins piceous. Length of body 4 lines. Malacca." (Walker, 1873). The description is rather poor and the pronotum of the holotype is distinctly rugose.



Figs. 188-190—*Hyalopeplus tutuilaensis* n.sp.: Fig. 188—Penis; Fig. 189—Left paramere; Fig. 190—Right paramere.

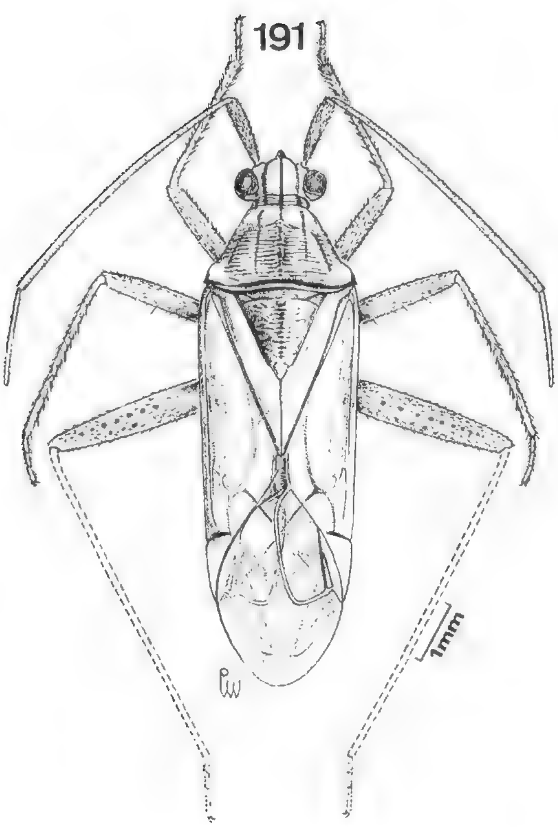


Fig. 191—*Capsus vitripennis* Stål, neotype.

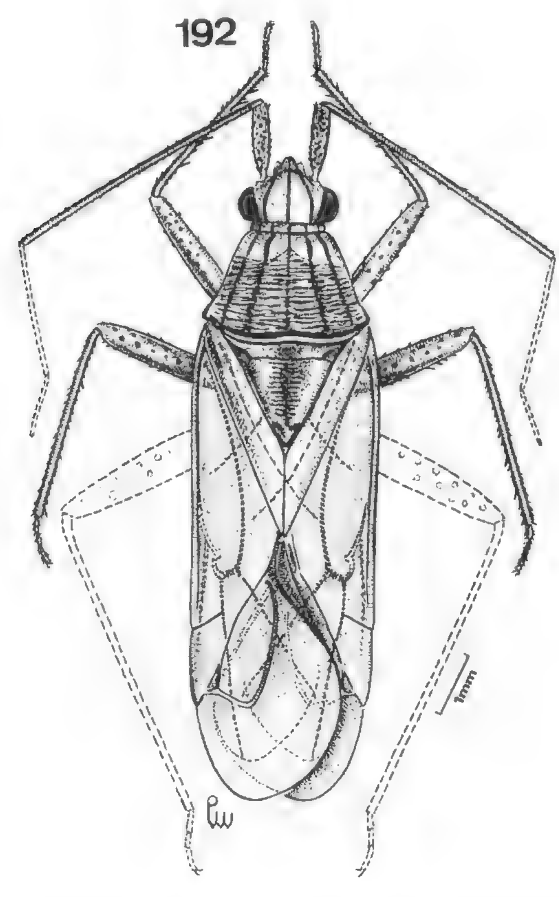


Fig. 192—*Capsus lineifer* Walker, female, lectotype.

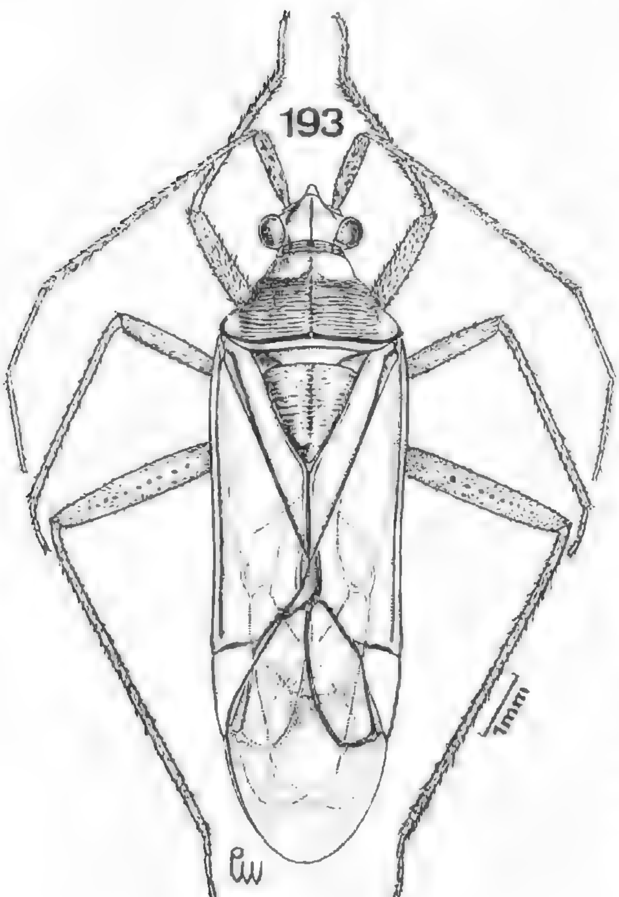


Fig. 193—*Hyalopeplus uncariae* Roepke, female, lectotype.

"Colour citrine to lutescent with glassy, transparent hemelytra; seven longitudinal vittae on pronotum and propleura, the three median ones following those on head, median line and two spots at apex scutellum dark brown to reddish; veins of membrane and extreme apex of cuneus darker; gena with a longitudinal dark stripe, apex of rostrum and veins of membranous wings black; femora with rows of dark or reddish spots, tibiae and antennae with reddish tinge or minute reddish areas." (Carvalho, 1956).

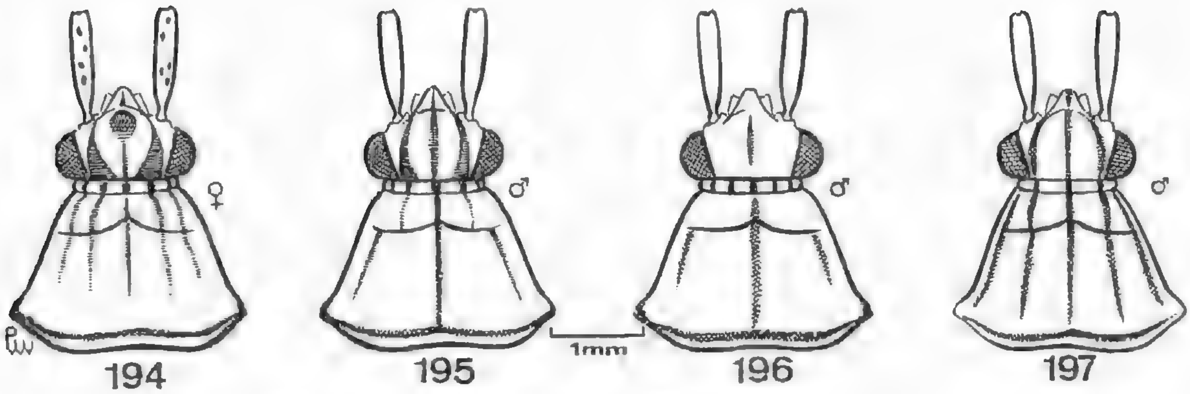
Genitalia: Penis (figs. 203, 207) with vesica of aedeagus provided with membranous lobes with sclerotised teeth apically or in groups and a sclerotised spiculum (figs. 204, 208). Left paramere (figs. 205, 209) curved, pointed apically. Right paramere (figs. 206, 210) smaller, also pointed apically.

Female: Similar to male in colour and general aspect, more robust. Length 8·6-9·4 mm, width 2·4-2·6 mm, vertex 0·72-0·76 mm. *Cuneus:* Length 0·90-1·12 mm, width at base 0·50-0·56 mm.

Host plants: Thea sinensis, Uncaria gambir.

Geographical distribution: Australia, Indonesia (Amboina, Java, Sumatra), Malaysia (Malacca, Peninsular Malaysia, East Malaysia), Philippines Babelthuap, Papua-New Guinea, Palau Islands, Mariana Islands, Solomon Islands, New Hebrides Islands, New Britain, Bismarck Archipelago, Singapore, Sri-Lanka, Vietnam, Laos.

Specimens studied: 2 females, Ins. Philipp., Semper and Malacca, Kinb. (STOCKHOLM). The Philippine specimens bears Stals handwriting: '*Hyalopeplus vitripennis*'; 10 paratypes of *Hyalopeplus amboinae* Carvalho, Amboina Island and Babelthuap Islands (BISHOP): INDONESIA: several males and females: Ambon, 70 m, 29.iii.1963, A.M.R. Wegner; Ambon, Waai, 150 m, 10.i.1964, A.M.R. Wegner; Bogor, Tegalega, Java, 21.xi.1960, P. Maric; Sumatra, Tandjong Morawa, 16.xi.1951, J.V.d. Vecht; lectotype (new designation) of *Hyalopeplus uncariae* Roepke, Asaham, Sumatra, 1912 (Leyden Museum); Pandang, W. Sumatra, xi.1924, C.B.K.; J.B. Corporal, 1920-95, Prse. Imp. Bur. Ent.; 180 m Dolok Merangir, Sumatra, April-June, 1970. E.W. Diehl; Kebon Balok, 20 m, 60 km NW Medan, Sumatra, 7.v.1970; Dairi, 1600 m, NW end of Lake Toba, Sumatra; Eramboe, 80 km ex. Marauke, Irian Jaya, 29.i.1960, T.C. Maa; PENINSULAR MALAYSIA: female, holotype, *Capsus lineifer* Walker, Malacca (BMNH): Selangor Subang Forest Reserve, 90-120 m, 12-14.iii.1958, T.C. Maa, Selangor, Ulugombak, 300 m, 18.v.1958, T.C. Maa; Kuala Lumpur, viii.1958, N.L.H. Krauss (on *Melastoma malabathricum*); West Coast, Langkawi, Is.v.1928, West Coast, Perhentian, vii.1926, ex. F.M.S. Museum, B.M. 1955-354; Penang, King Geo. Nat. Park, 15.xii.1958; EAST MALAYSIA: Tawau Residency, Kalabakan R., 48 km (30 mi) W, 18.ix.1958, T.C. Maa; W. Coast Residency, Ranau, 13 km (8 mi) Paring Hot Springs, 500 m, x.1958, L.W. Quate & T.C. Maa; id. 28.ix.-7.x.1958; 22-25.i.1959; Bundu Tukan, 18.ii.1959; 6.x.1959, T.C. Maa; Sandakan Residency, Gomaton Caves, 32 km (20 mi) s. Sandakan, 22-26.ix.1958, T.C. Maa; Penampang SE of Jesselton, 17.x.1958, T. C. Maa; Singkor, 19.i.1959, T.C. Maa; Tenompok, 1 460 m, 48 km (30 mi) E Jesselton, 17-21.x.1958, T.C. Maa; Sensuron, 9-11.i.1959, T.C. Maa; Pontianak, F. Muir, T.C. Maa; Manorg, F. Muir; Ranau, 22-25.ii.1959, T. C. Maa, Ranau, 13 km (8 mi) N Paring Hot Springs, 500 m, 9-18.x.1958, L.W. Quate; Keningau, 12-17.i.1959, T.C. Maa; SE, Forest Camp, 19 km N of Kalabakan, 60 m, 21.xi.1962; Kuching, Santubong, 797-1500 m, 18-30.vi.1958, T.C. Maa; Merirai V. Kapit Dist. 1-6.viii.1958, T.C. Maa, *PHILIPPINES:* Minanao, Zamboanga de Norte, 11 km-9 km E of Sindagan, 20.vii.1958, H. E. Mildanao; Bukidon, 1250 m, Mt. Katangland, 4-9.xii.1959, L. W. Quate;



Figs. 194-197—*Hyalopeplus vitripennis* (Stål): Colour variation of antenna, head and pronotum seen from above.

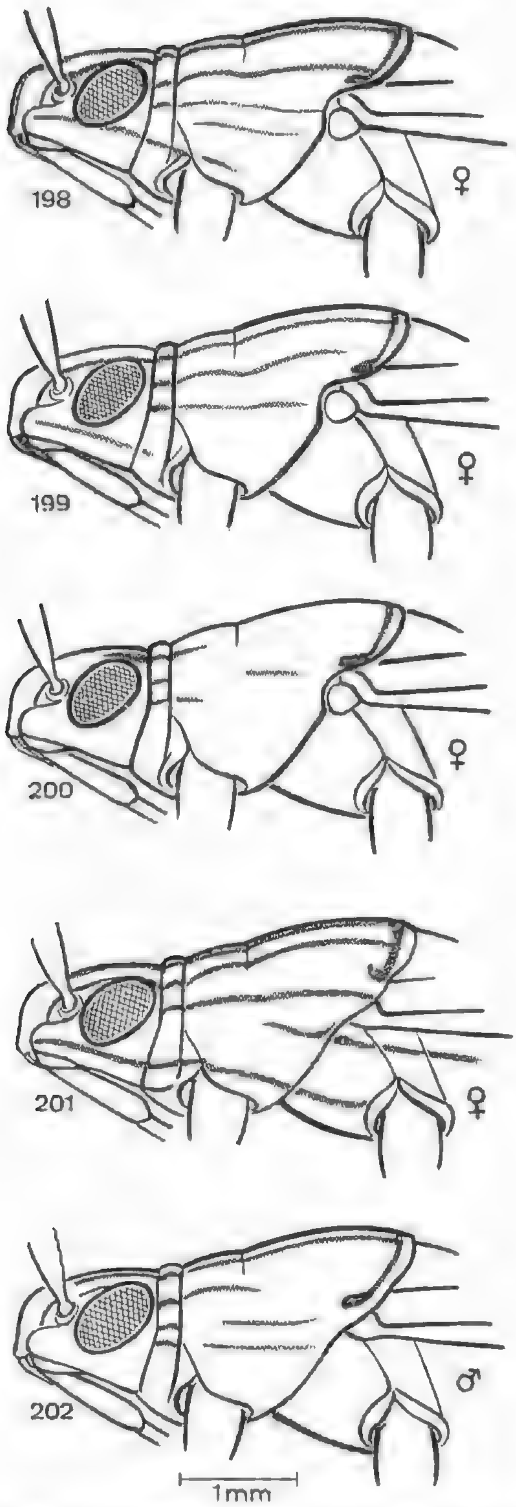
Negros Or. Sibulan, 30.ix.1959, L.W. Quate; Negros Or. Mt. Province Mayoyao, Ifugao, 1250-1500 m, 11.ix.1966, H. Torrevillas; Busuanga Is. 4 km N San Nicholas, 25-27.1962, H. Holtmann; Misamiris Or. Mt. Empagatao, 25.iv.1961, H. Torrevillas; Luzon Camarineu, Sur, Mt. Isarog, Pili, 800-900 m, 4.v.1965, H.M. Torrevillas; Luzon, Mt. Prov. Ifugao, Mayoyao, 1000-1500 m, 8-9.ii.1966, H.M. Torrevillas; Palawan Mantalingajan, Pinigisan, 600 m, 9.ix.1961, Noona Dan exp. 61-62; id. Brookes Point Uring, 23.viii.1961; Bur. Agr. Col.B, Aroe; Mt. Banahao, Baker; Cuernos, Baker; Surigao, Mindanao, Baker; Mt. Makiling, Luzon, Baker; PALAU ISLANDS: Koror Is. NE, 26.iv.1957, C. W. Sabroski; MARIANA ISLANDS: Guam, ii.1958, N.L.H. Krauss; SOLOMON ISLANDS: Bougainville, Kukugai Village, 1500 m, xii.1960, N.W. Brandt; Guadalcanal, Gold Ridge, 21.iii.1955, E.S. Brown, Pres. com. Inst. ent. B.m. 1958-79. NEW HEBRIDES ISLANDS: Espiritu Santo Island, SW, Namatasopa, 300 m, 29.viii.1957, J. L. Gressitt; BABELTHAUP ISLAND: Iwang, Palau, 8 m, 19.xii.1952, J.L. Gressitt; NEW BRITAIN: Gisiluve, Nakanai Mts. 1050 m, 26.vii.1956, E. J. Ford Jr.; PAPUA-NEW GUINEA: Bisianuma St. 40 km NW Port Morseby, 29.iv.1960, Port O'Brien; BISMARK ARCHIPELAGO: Rossum, 6 km, SE of Lorengau, 180 m, 23.xii.1959; AUSTRALIA: North Queensland: Dunk Island, Aug. 1927, H. Hacker; Davis Creek, 26.iii.73, R. W. Broadleg; Iron Range, 1-9.vi.1971, S. R. Monteith; SINGAPORE: Col. Baker; H. N. Riley, 1904-2, id. 95-76; Gardens, xi.1922; Nee Sung Forest Reserve, 20 m, 7.xii.1958; VIETNAM: Haut Mekong, Nam Tiene, 14.iv.1918, R. V. Salvaza, 1918-1; Dalat, 6 km S, 1400-1500 m, 9.vii.1960, S. Quate, N.R. Spencer, R. Leech; LAOS: Sedone Prov. Paksong, 18.v.1965. The specimens mentioned are in the BMNH, BISHOP, USNM, QU and SAM.

The holotype of this species, described by Stål from Jave, has been lost (*fide* Doctor Inge Persson, curator of Insects, Naturhistoriska Riksmuseet, Stockholm, in a letter dated December, 1975).

The two other specimens deposited at Stockholm were however handled by Stål and used for the description of the genus *Hyalopeplus*. These two females from the Philippines (Semper) and from Malacca (Kinberg) are typical *vitripennis*, the first specimen bearing the manuscript label '*Hyalopeplus vitripennis* Stål' (Stål's own handwriting). On these specimens the lines or vittae of the pronotum are fairly well marked, but those on the propleura and sides of abdomen and head are only vaguely indicated. The segment I of antenna is spotted with small reddish dots.

These specimens when compared with a series of twelve others taken in Bogor, Java, Indonesia, Tjilebut, 13.xi.1960, H. Hamann (BISHOP), have proved to belong to the same species. In these series the longitudinal stripes of head and pronotum, propleurs and abdomen show a fairly wide range of variation, as can be seen in the figures.

According to article 75 of the International code of Zoological Nomenclature (1964) I am designating a male specimen from Bogor, Jave, Tjilebut, as a *neotype* of *Capsus vitripennis* Stål, 1855. Besides agreeing with the characters mentioned in the original description, they agree also with the specimens handled from the Philippines and Malacca. The locality, comparison with specimens handled by Stål and lodgement in the same Institution, in my view, renders it as a valid designation of the neotype.



Figs. 198-202—*Hyalopeplus vitripennis* (Stål): Colour variation of head and pronotum seen from side.

In the series from Bogor from which the neotype has been chosen the general coloration is ochraceous to pale yellow or citrine on head, pronotum and scutellum, the hemelytra and membrane vitreous and transparent (in this species there is a tendency for the hemelytra to become opaque or leathery). The head above shows three longitudinal lines or vittae (one median and two lateral along inner margins of eyes); collar with seven distinct vittae or lines; one median and six lateral, plus one above the coxal cleft I and indication of another (sometimes obsolete) in front of coxal cleft, inferiorly; pronotum on fully coloured specimens also with seven longitudinal lines or vittae (greatly variable): five seen from above (one median and four lateral) and two slightly below lateral margin of propleura, which may have also two other lateral lines (one median and one inferiorly) following the lateral line of head and continuing to lateral portion of sternum and abdomen; scutellum with median line and two preapical spots (sometimes including the whole apex) reddish to dark brown or black. The intensity and colour of the lines varies considerably. Hind margin of pronotum with a transverse submarginal characteristic dark fascia not reaching hind border (as in *rama* Kirby), humeral angles black. Hemelytra and membrane vitreous, transparent, margins of clavus, corium, embolium, cuneus and nervures of membrane brown to black; legs pale yellow, hind femora with a few brownish or reddish dots on apical third; segment I of antenna in full coloured specimens with reddish dots.

Pronotum and longitudinal sulcus of scutellum transversally rugose, the latter and the cuneus about as long as wide at base, rostrum reaching the apex of hind coxae, hind tibiae with spines, short hairs and minute sclerotized tubercles.

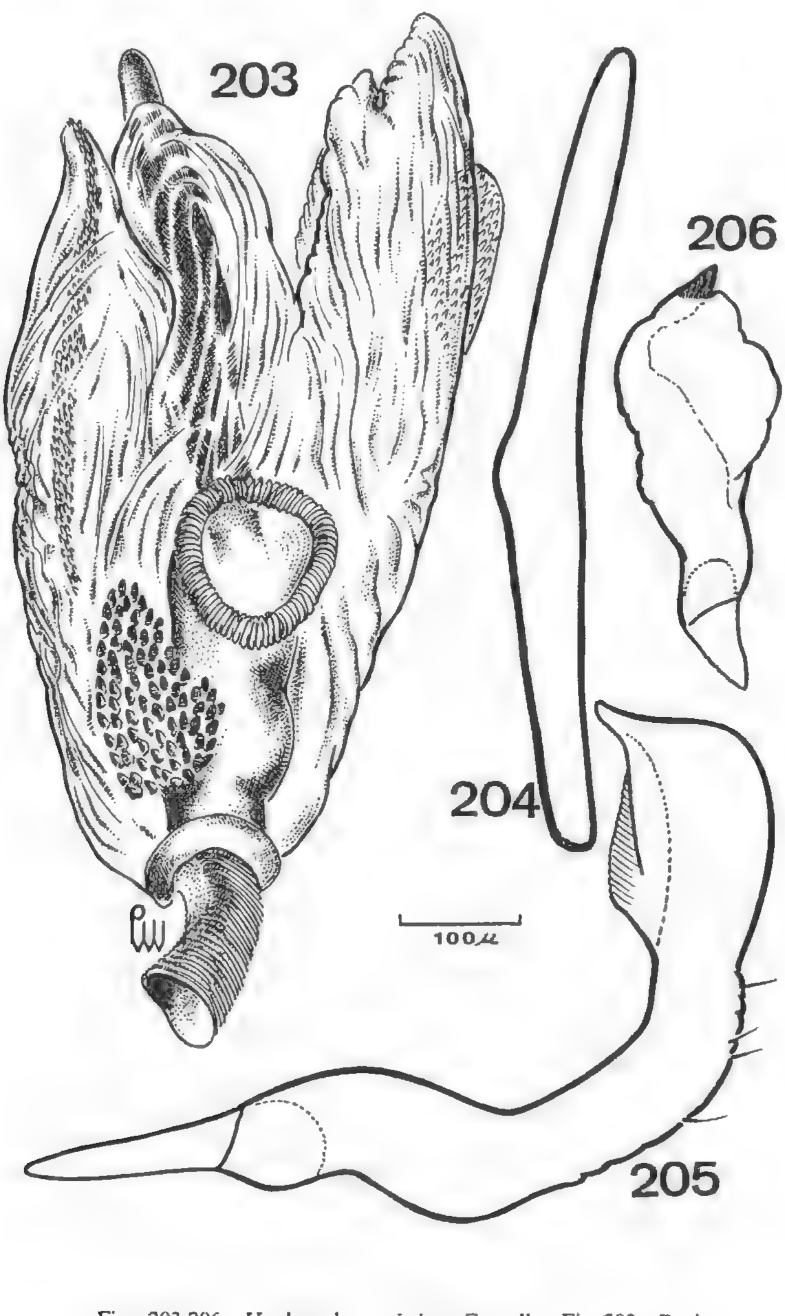
Though he indicates a series of 20 specimens examined when describing *Hyalopeplus uncariae*, Roepke (1916) apparently had before him a mixed series of *vitripennis* Stål and *rama* Kirby. Following his description and illustration, and based also on his label data: "Asaham, Sumatra, 1912, W. Roepke" I have chosen a female specimen as *lectotype* (hemelytra leathery and transverse dark fascia of posterior portion of disc of pronotum not reaching the hind border). This specimen has the scutellum about as long as wide at base, cuneus only twice as long as wide and legs with the apex of hind femora and hind tibiae pale, not noticeably pilose. This species is identical with *vitripennis* Stål and must be treated as its synonym.

Other specimens examined in the series from Asaham, are as follows: 1 female, Asaham, Sumatra, 1912, W. Roepke; 1 female, Asaham (S.O.K. (alimatan), on *Melafoe*, iv. '17, leg Corporal, *Hyalopeplus uncariae* Rpke, det. Leefmans; 2 males and 6 females, Sumatra, W. Roepke, belong to *Hyalopeplus rama* (Kirby, 1891). In all of them, the scutellum is noticeably longer than wide at base, the second antennal segment of males are longer (about 4·0-4·6 mm long), the cuneus is reddish and distinctly longer than wide at base, the apex of hind femora and the hind tibiae are reddish hairs of tibia long. The transverse posterior dark fascia of disc reaching the hind border will separate it at once from *vitripennis*. The mention of "absence of colored fasciae on head and pronotum" is due to the fact that the specimens were kept in alcohol. Also the mention of a leathery hemelytra is a character that occurs occasionally in specimens of *vitripennis*.

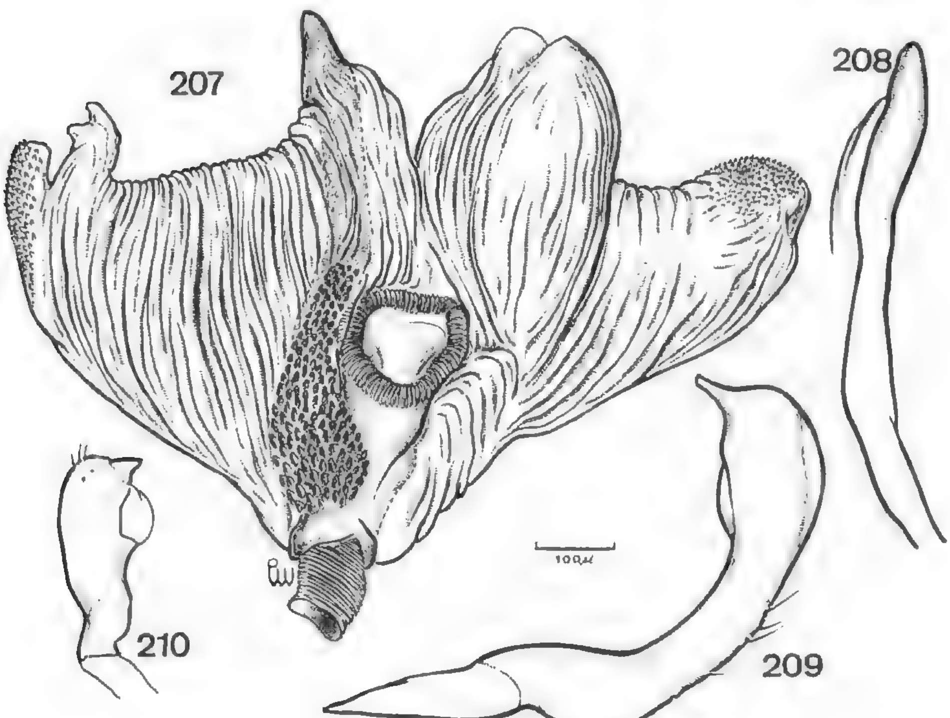
Hyalopeplus amboinae Carvalho, 1956 is also a synonym of *vitripennis* Stål. At the time of its description the author was not aware of the colour variation of *vitripennis* and the differences indicated in the structure of male genitalia were found to be also within the range of variation of the species.

Finally *capsus lineifer* Walker, 1873 was correctly synonymized with *vitripennis* by Distant, 1904. It represents the extremely intensely coloured specimens, usually females. In the series studied from Bogor I have found all colour variations which are here represented in figures.

This species approaches *Hyalopeplus malayensis* n.sp. but is readily differentiated by the colour of cuneus and size.



Figs. 203-206—*Hyalopeplus amboinae* Carvalho: Fig. 203—Penis; Fig. 204—Spiculum of vesica; Fig. 205—Left paramere; Fig. 206—Right paramere.



Figs. 207-210—*Hyalopeplus vitripennis* (Stål): Fig. 207—Penis; Fig. 208—Spiclum of vesica; Fig. 209—Left paramere; Fig. 210—Right paramere.

Key to the species of the subgenus *Adhyalopeplus* nov.

1. Pronotum distinctly setose; hind femur apically and hind tibiae basally pale to brownish . . . . *pellicidus* (Stål)
   Pronotum glabrous or very sparsely and shortly setose; hind tibia otherwise coloured 2
2. Collar without longitudinal vittae or bars, infuscate to castaneous anteriorly; pronotum with a single longitudinal wide vitta . . . . *samoanus* Knight
   Collar with longitudinal vittae or bars 3
3. Inner base of cuneus and extreme apex of corium with a common black spot; scutellum very large and prominent, lutescent; cuneus opaque, sulphurescent to reddish *cuneatus* n.sp.
   Inner base of cuneus and extreme apex of corium without a common black spot; scutellum of normal size 4
4. Disc of pronotum with a single longitudinal line or vitta, sometimes present only anteriorly or posteriorly; collar with a whitish pruinose vitta or bar laterally *similis* Poppius
   Disc of pronotum with five longitudinal lines or vittae, sometimes the two median obsolete; collar without a whitish pruinose bar laterally 5
5. Longitudinal vittae or lines on disc wide; pronotum and scutellum coarsely punctate; cuneus totally reddish *madagascariensis* n.sp.
   Longitudinal vittae or lines on disc narrowed towards head; pronotum and scutellum moderately punctate; cuneus reddish on base and outer margin . . . . *loriae* Poppius

Hyalopeplus (Adhyalopeplus) cuneatus, n.sp.

(Figs. 211-215)

Characterised by the large and prominent scutellum and by the colour of base of cuneus and apex of corium.

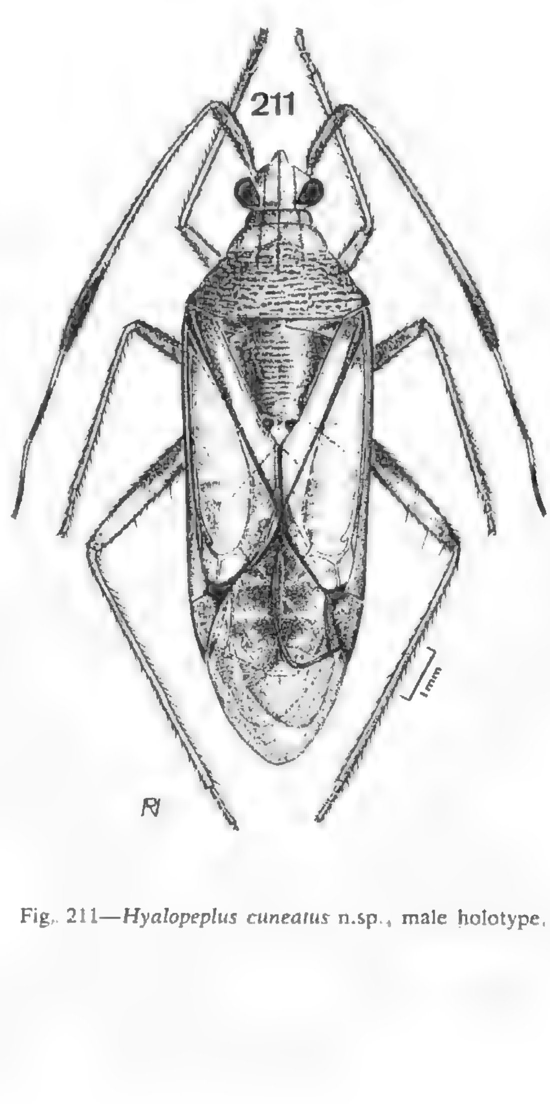


Fig. 211—*Hyalopeplus cuneatus* n.sp., male holotype.

Male: Length 8·9 mm, width 2·7 mm. *Head:* Length 1·0 mm, width 1·5 mm, vertex 0·68 mm. *Antenna:* Segment I, length 1·0 mm; II, 4·5 mm; III, 1·5 mm; IV, 1·3 mm. *Pronotum:* Length 1·4 mm, width at base 2·6 mm. *Cuneus:* Length 1·0 mm, width at base 0·72 mm (holotype).

General coloration ochraceous with castaneous and reddish areas; head with a longitudinal median vitta reaching clypeus, eyes, apical portion of segment I of antenna (main body of segment is pale yellow), segment II (except black apex) brown, segments III-IV (except pale base) black. The head in some specimens show also two lateral vittae along inner margins of eyes and a longitudinal vitta on gena reddish. Pronotum with collar showing seven longitudinal narrow vittae (in some specimens the three median ones reach the area of calli) brown, humeral angles black; scutellum lutescent with two subapical black spots (one at each side); hemelytra glassy, transparent, extreme base of clavus, commissure and apical area of corium, coalescent with base of cuneus, fuscous to castaneous; embolium and cuneus opaque, the latter sulphurescent, pale yellow or reddish in some specimens; membrane hyaline. Underside of body pale yellow, hind femora reddish towards apex, segments III of tarsi black.

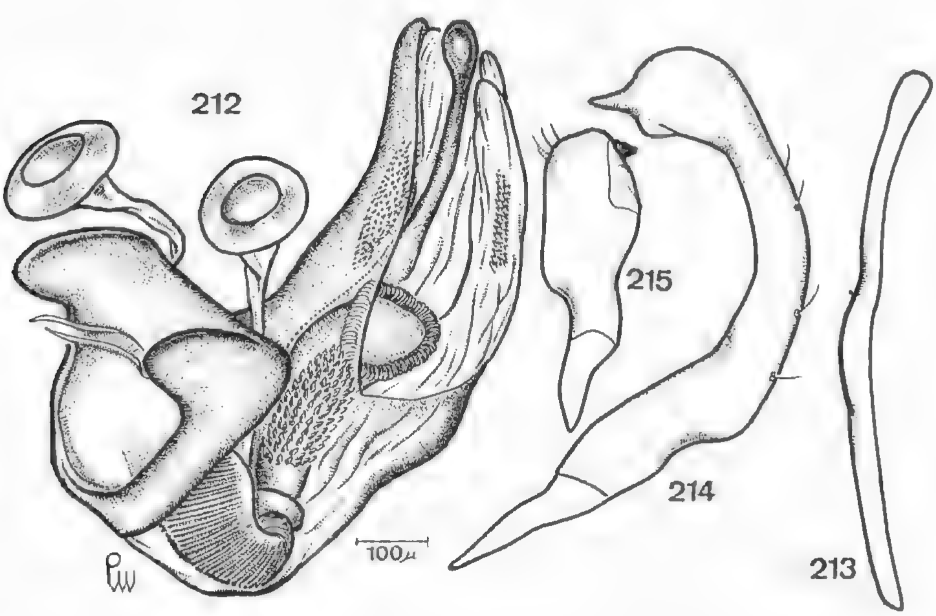
Pronotum distinctly punctate-rugose, scutellum very prominent, punctate-rugose, the punctures more visible, humeral angles acute, frons striate.

Genitalia: Penis (fig. 212) with membranous lobes provided with groups of sclerotized spines, a median spiculum (fig. 213) and a group of spines near secondary gonopore. Left paramere (fig. 214) curved, enlarged apically, ending in an acute point. Right paramere (fig. 215) smaller, also ending in a point.

Female: Similar to male in colour and general aspect. Length 10·4 mm, width 3·1 mm, vertex 0·80 mm.

Holotype: male, INDONESIA: Waris, S of Hollandia, Irian Jaya, 450-500 m, 8-15.viii.1959 (BISHOP). *Allotype:* female, NEW GUINEA: NE Wau, 1200 m, 11.xii.1965, J. Sedlacek. *Paratypes:* three males and three females, same data as holotype and Gazelle Pen., Gaulin, 140 m, 21-27.x.1962, J. Sedlacek, malaise trap; Wareo, Finsch Haven, Rev. L. Wagner, in the collection above and of the author.

Differs from others in the subgenus by the peculiar spot common to base of cuneus and apex of corium, as well as by the large and prominent scutellum.



Figs. 212-215—*Hyalopeplus cuneatus* n.sp.: Fig. 212—Penis; Fig. 213—Spiculum of vesica; Fig. 214—Left paramere; Fig. 215—Right paramere.

Hyalopeplus (Adhyalopeplus) loriae Poppius, 1912

Hyalopeplus loriae Poppius, 1912a, p. 415; Carvalho, 1959, p. 320.

(Figs. 216-220)

Characterised by the colour of pronotum and cuneus.

Male: length 7·8 mm, width 2·2 mm. *Head:* Length 0·7 mm, width 1·4 mm, vertex 0·56 mm. *Antenna:* Segment I, length 0·6 mm; II, 3·6 mm; III-IV, broken. *Pronotum:* Length 1·3 mm, width at base 2·1 mm. *Cuneus:* Length 0·84 mm, width at base 0·50 mm.

General coloration ochraceous with brown and reddish areas; head with three longitudinal lines (one median and two lateral along inner margin of eyes); collar with seven longitudinal bars or vittae, disc with a median and two longitudinal lateral vittae becoming wider towards the hind portion and humeral angles brown to black, hind margin of disc with a transverse narrow dark fascia; base, lateral margins and apex of scutellum dark brown; hemelytra glassy, transparent, margins of clavus narrowly, apical portion of corium, cuneus internal and externally, nervure of membrane dark brown to reddish. Underside of body pale yellow, legs pale, apex of front tibiae, apex of hind femora and hind tibiae reddish; basal half of hind femora pale. Antenna brownish yellow, segments II and II towards apices and segment IV almost totally black, segment I reddish yellow with reddish dots.

Rostrum reaching the middle coxae, disc of pronotum punctate-rugose.

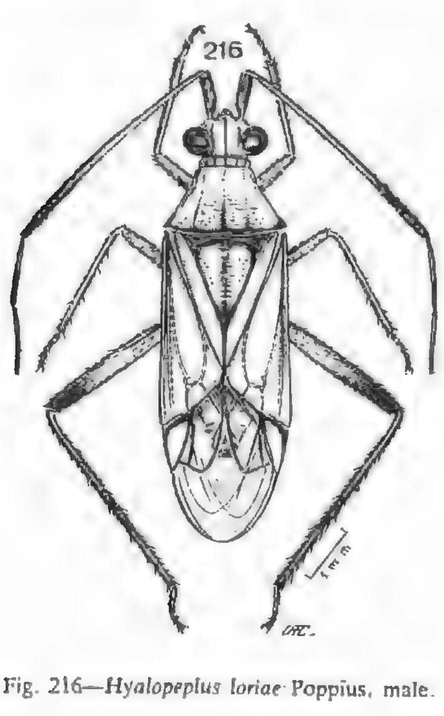


Fig. 216—*Hyalopeplus loriae* Poppius, male.

Genitalia: Vesica of aedeagus (fig. 217) with membranous lobes with groups of sclerotized spines apically and a median spiculum (fig. 218). Left paramere (fig. 219) curved, pointed apically. Right paramere (fig. 220) globose, also with a sclerotized point.

Female: Similar to male in colour and general aspect, slightly more robust.

Specimens studied: males and females, NEW GUINEA: Wau, Morobe District, 1 200 m, 1-4.viii.1962 (BISHOP). AUSTRALIA: N.S. Wales, 19 mi W of Woodenbong, nr. Kilarney, 8.xii.1948; Queensland, Townsville, 14.v.'03, F. P Dodd, (BMNH). There are a number of specimens of this species in Australian collections from Queensland, the Northern Territory and the north of Western Australia. In coastal Queensland it extends as far south as Brisbane but elsewhere in Australia it is restricted to the far northern areas.

The holotype of this species is mentioned as being deposited in the Museum of Natural History "Giacomo Doria", Genova. It is close to *Hyalopeplus (N.) madagascariensis* n.sp. but differs by the colour of pronotum and cuneus.

Hyalopeplus (Adhyalopeplus) madagascariensis, n.sp.

(Figs. 221-225)

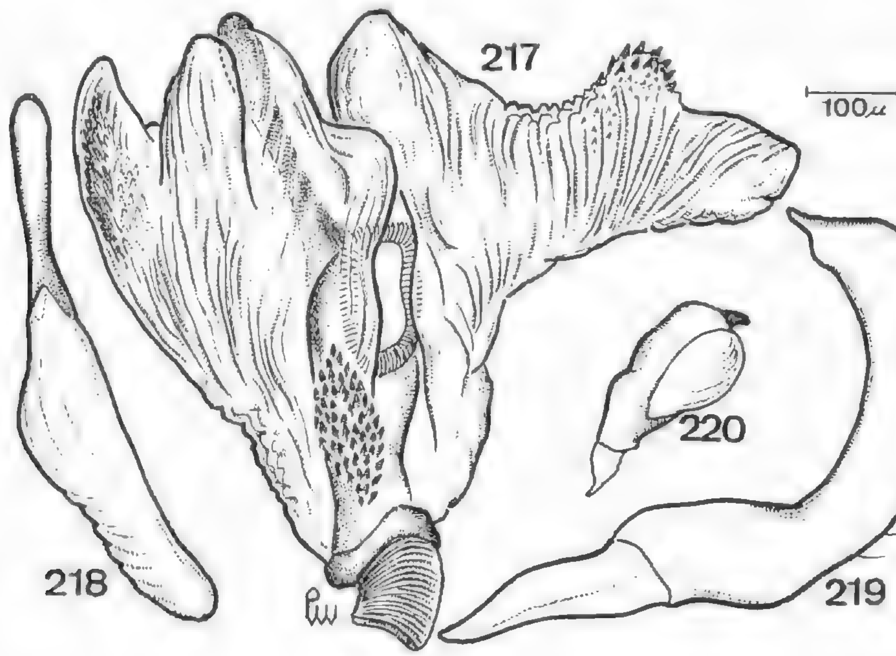
Characterised by the wide longitudinal vittae of pronotum and colour of cuneus.

Male: Length 8·0 mm, width 2·1 mm. *Head:* Length 0·8 mm, width 1·2 mm, vertex 0·48 mm. *Antenna:* Segment I, length 0·7 mm; II, 4·0 mm; III-IV, broken. *Pronotum:* Length 1·4 mm, width at base 2·1 mm. *Cuneus:* Length 0·92 mm, width at base 0·48 mm (holotype).

General coloration flavescent to citrine with dark brown and reddish areas; head, pronotum and scutellum citrine; a longitudinal vitta on middle of head, including clypeus (which has also two lateral spots basally), two lateral ones bordering inner margins of eyes castaneous to fuscous; five longitudinal vittae on pronotum: one median, two lateral (the three wide and continuous from collar to hind margin of disc) and two submedian (much more slender, almost obsolete, reddish-orange), a transverse marginal fascia posteriorly on disc and humeral angles dark brown to black; scutellum with median line, basal angles and apex dark brown, hemelytra glassy, transparent, sutures and external margins of embolium and cuneus black, the latter reddish with a pale fascia along inner margin, membrane glassy, slightly fuscous, nervures dark. Antenna castaneous to reddish, segment I dark brown, segment II fuscous at apex, segment III black, pale basally, segment IV black; eyes castaneous. Underside of body flavescent, a vitta along side of head, a spot on collar behind eye and a vitta on upper margin of propleura, as well as an identical one on lateral area of abdomen reddish to fuscous or black; legs pale yellow, hind femora reddish apically with brown spots, hind tibiae reddish, apices of tarsi fuscous.

Pronotum distinctly punctate-rugose on black fasciae, scutellum punctate, cuneus fairly short, tibiae moderately pubescent.

Genitalia: Penis (fig. 222) with membranous lobes, a median spiculum (fig. 223) and a group of spines near secondary gonopore. Left paramere (fig. 224) curved, enlarged apically, apex pointed. Right paramere (fig. 225) small, globose, pointed.



Figs. 217-220—*Hyalopeplus loriae* Poppius: Fig. 217—Vesica of aedeagus; Fig. 218—Spiculum of vesica; Fig. 219—Left paramere; Fig. 220—Right paramere.

Female: Unknown.

Holotype: male, MADAGASCAR: Morafenoche, Fôret Majesy, 5·52, R. Paulian, in the Collection of the author. *Paratype:* male, same data as holotype.

This species differs from *loriae* Poppius by the colour of pronotum and cuneus.

Hyalopeplus (Adhyalopeplus) pellucidus (Stål, 1859) Stål, 1870

Capsus pellucidus Stål, 1859, p. 255; Walker, 1873, p. 127.

Hyalopeplus pellucidus Stål, 1870, p. 671; Atkinson, 1890, p. 106; Kirkaldy, 1902c, p. 143; Reuter, 1905b, p. 2; Kirkaldy, 1907, p. 159; Poppius, 1912a, p. 417; Cheesman, 1927, p. 157; Zimmerman, 1948, p. 218, fig. 97; Carvalho, 1959, p. 320.

(Figs. 226-230)

Characterised by the pubescence of pronotum and scutellum.

Male: Length 7·6 mm, width 2·3 mm. *Head:* Length 0·8 mm, width 1·4 mm, vertex 0·48 mm. *Antenna:* Segment I, length 0·9 mm; II, 3·8 mm; III-IV, broken. *Pronotum:* Length 1·3 mm, width at base 2·0 mm. *Cuneus:* Length 0·92 mm, width at base 0·28 mm (holotype).

General coloration flavescent testaceous with castaneous and reddish areas; head, pronotum and scutellum flavescent testaceous; three longitudinal lines on head (on central and two lateral along inner margin of eyes), three longitudinal ones on pronotum (the lateral pair reaching only over calli, sometimes indicated or absent), the median one reaching the hind border of disc (obsolete or absent in some specimens), a transverse submarginal posterior fascia and humeral angles fuscous to castaneous or black; mesoscutum at middle, scutellum basally and two subapical spots fuscous to black; eyes castaneous, antennae fuscous to brown, segment I paler with small reddish dots, segments III and IV black with extreme base pale; hemelytra glassy, transparent, sutures of clavus and corium, outer margin of embolium and cuneus fuscous to castaneous (cuneus frequently reddish), in some specimens darker externally; membrane glassy, nervures fuscous. Underside of body ochraceous to lutescent, a longitudinal fascia on side of head (sometimes obsolete or absent) and anteriorly on propleura castaneous; legs pale yellow to testaceous, femora with numerous fuscous dots, tibiae flavescent to testaceous.

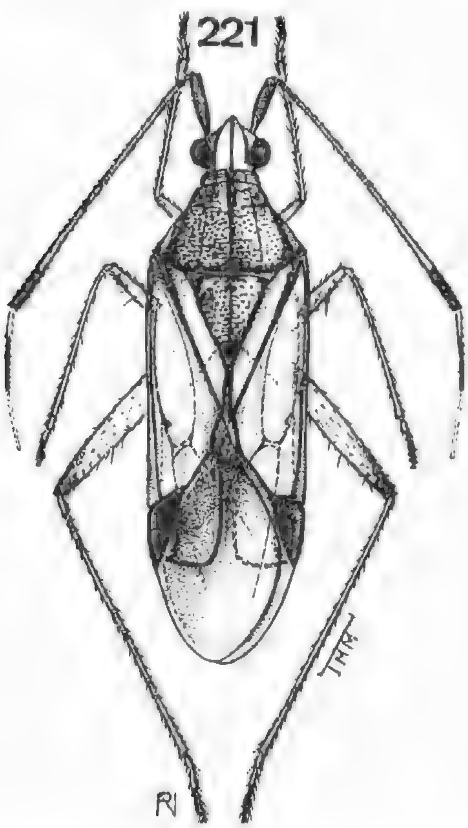


Fig. 221—*Hyalopeplus madagascariensis* n.sp., male, holotype.

Pronotum and scutellum noticeably setose, cuneus and hind tibiae densely pubescent.

Genitalia: Penis (fig. 227) with membranous lobes with sclerotized teeth apically, a median spiculum (fig. 228) and a group of spines near secondary gonopore. Left paramere (fig. 229) curved, pointed apically. Right paramere (fig. 230) small, also pointed apically.

Female: Similar to male in colour and general aspect, slightly more robust.

Host plants: Acacia koa, Coprosma, Dodonaea, Hibiscus, Guava, Metrosideros, Pipturus, Sida, Strausia.

Specimens studied: male, holotype, Oahu, *Capsus pellucidus* Stål (STOCKHOLM); HAWAIIAN ISLANDS: Haleakala, Maui, NW Slope, 4.iii.1947, 3 500 ft; Ollaa, 2 500 ft, Washmead; Hilo, 16.iv; Oahu, vi.1958, light trap, J. Rodgers; Puu Palikea, iv.1960, E. J. Ford Jr.; Posmohotrail Koolau Mt.; Maiawa, 15.i.1942 on *Bougainvillea;* Kilauea, Washmead; Manoa, on pear Buds, 1936; MacDonald Hotel; Pearl City, Oahu, 22.ii.1923, E. H Bryan; Castle Trail, Ohau, 27.ix.1958, E. H. Bryan: Waimea, Hawaii, 18.vi.1922, Old Parker Place, Illingworth; Upper Hamakua, Ditch Trail, 10.i.1929, O. H. Swezey; Honolulu, Ohau, xii.1925, S. C. Ball: Manoa, Ohau, 2.v.1925, S. C. Ball; Kam School, 5.viii.1922, Bryan Ex. *Hibiscus;* Koko Head, F. F. Illingworth; Hana, Maui, 7.v.1920, E H. Bryan; Kiaulea, Hawaii, 10.ix.1929, Kipuka Puaplu, O. H. Swezey; Waimea, Hawaii, 15.vi.1922, Old Parker Place, Illingworth; Kainalu, Molkai, O. H. Swezey; Hawaii, Olaa, 29 mi. in house, viii.1938, A. Stiehiro; Haelaau, Maui, 19.xii.1928, O. H. Swezey; Molokai, Waikalu, 29.iv.1955, Joyce; Kamiloloa, Molokai, 19.xii.1925, O. H. Swezey; Wailae Beach, Oahu, Illingworth; Mr. Kaala, 6.vii. Oahu, O. H. Swezey; Maui, 9.iii (BISHOP).

According to Kirkaldy this species is predacious. All indications however are that it is phytophagous, as are most other species in the genus. Zimmerman (1948) states that it is intoduced in Hawaii. Miss Cheesman (1927) records the species from Hiva-oa in the Marquesas Islands.

It differs from others in the subgenus by the distinctly setose pronotum and scutellum and by the unicolorous hind tibia which is flavescent to testaceous but without traces of reddish. Its closest ally is *Hyalopeplus samoanus* Knight which has the collar without bars or lines, the disc of pronotum differently coloured and hind legs with the apex of femur and base of tibia reddish.

Hyalopeplus (Adhyalopeplus) samoanus Knight, 1935

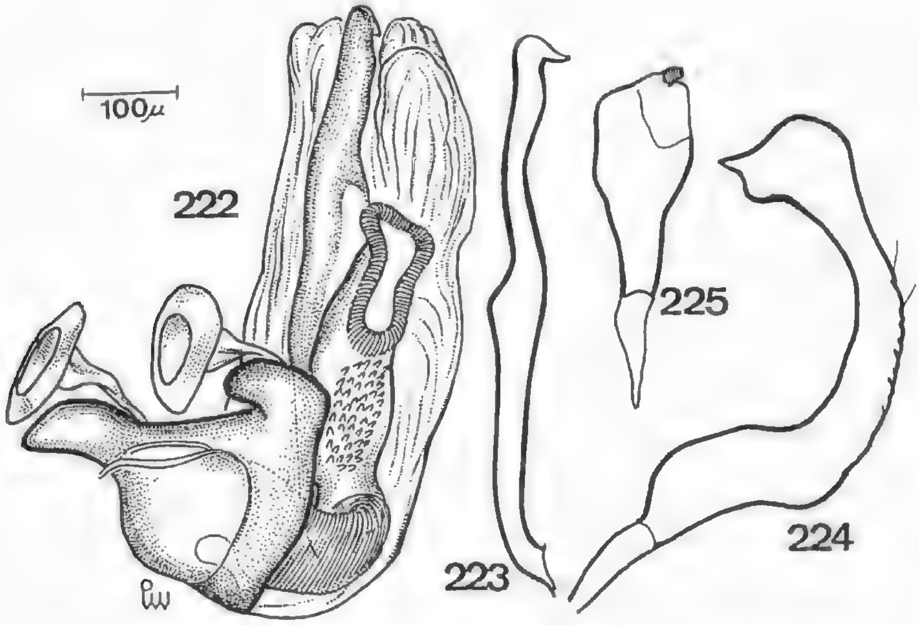
Hyalopeplus samoanus Knight, 1935, p. 213, fig. 5; Carvalho, 1959, p. 320.

(Figs. 231-235)

Characterised by the colour of pronotum and hind legs.

Male: Length 8·7 mm, width 2·4 mm. *Head:* Length 0·8 mm, width 1·5 mm, vertex 0·61 mm. *Antenna:* Segment I, length 1·3 mm; II, 5·2 mm; III, 1·9 mm; IV, 1·3 mm. *Pronotum:* Length 1·6 mm, width at base 2·2 mm. *Cuneus:* Length 0·8 mm, width at base 0·44 mm.

General coloration flavescent to testaceous or citrine with castaneous and reddish areas; head, pronotum and scutellum ochraceous to citrine, vertex in some specimens with indication of three longitudinal fuscous lines (obsolete in others); collar castaneous anteriorly or totally castaneous; pronotum with a transverse submarginal castaneous to black fascia which reaches the humeral angles, a longitudinal wide castaneous to black vitta on disc (in some specimens reaching calli, in others present only posteriorly), some darker specimens with hind margins of calli also dark, leaving only central area of disc flavescent testaceous; mesoscutum dark at middle or totally; scutellum with basal angles and two subapical spots castaneous to black (in extreme coloured specimens the base and apex of scutellum black); eyes castaneous, antenna yellow testaceous, segment I paler with minute reddish dots, segments III and IV black, pale basally; hemelytra glassy, transparent, claval, corial and embolial sutures castaneous to black, cuneus reddish with outer margin pale, membrane transparent, nervures fuscous. Underside of body ochraceous, side of head and propleura with indication of a longitudinal vitta (in fully coloured specimens), legs pale testaceous, femora with fuscous spots, apex of hind femora, apices of tibiae and base of hind tibiae reddish. Pronotum punctate-rugose, cuneus noticeably long, hind tibiae densely pubescent.



Figs. 222-225—*Hyalopeplus madagascariensis* n.sp.: Fig. 222—Penis; Fig. 223—Spiculum of vesica; Fig 224—Left paramere; Fig. 225—Right paramere.

Genitalia: Penis (fig. 232) with vesica of aedeagus showing membranous lobes provided with sclerotized teeth apically, a median spiculum (fig. 233) and a group of spines near the secondary gonopore. Left paramere (fig. 234) curved, enlarged apically, with an apical point. Right paramere (fig. 235) small, also pointed apically.

Female: Similar to male in colour and general aspect, but more robust.

Geographical distribution: Samoan Islands.

Specimens studied: two paratypes, SAMOA: Upolu, Vailima and Apia Is. *Hyalopeplus samoanus* Knight (BISHOP); Upolu, Savago, 0-100 m, 14.x.1969, N. L. H. Krauss; Manua, Tau E of Tau Village (Luma), 50-200 m, 16.iii.1965, sweeping, Samuelson; Tutuila Is. 2.ii.1957, W. R. Kellen; Pago-Pago, 9.ix.1923, Swezey & Wilder; Afinalu, Upolu, 6.ii.1940, 2 200 ft, at light, Swezey & Zimmerman; Vailima, Upolu Is. Buxton & Hopkins; Afiamalu, Upolu, iii.1962, R. W. Taylor, light trap.

The species differs from allied forms by the colour of the collar (longitudinal bars or vittae absent), by the single longitudinal vitta on disc of pronotum and by the noticeably long cuneus.

Hyalopeplus (Adhyalopeplus) similis Poppius, 1912

Hyalopeplus similis Poppius, 1912b, p. 8; Poppius, 1912a, p. 41; Carvalho, 1959, p. 320.

Hyalopeplus horvathi Poppius, 1912a, Poppius, 1912b, p. 9, Carvalho, 1959, p. 320. (*n.syn.*).

Hyalopeplus bakeri Poppius, 1915, p. 3; Carvalho, 1959, p. 320 (*n.syn.*).

Hyalopeplus krishna Ballard, 1927, p. 64, pl. 17, fig. 7; Carvalho, 1959, p. 320 (*n. syn.*).

(Figs. 236-247)

Characterised by the colour of collar and pronotum and by the structure of the male genitalia.

Male: Length 7·0-8·4 mm, width 2·0-2·4 mm. *Head:* Length 0·6-0·8 mm, width 1·2-1·3 mm, vertex

0·48-0·58 mm. *Antenna:* Segment I, length 0·8-0·9 mm; II, 4·0-4·4 mm; III-IV, broken. *Pronotum:* Length 1·4-2·0 mm, width at base 2·4-2·8 mm. *Cuneus:* Length 0·80-1·0 mm, width at base 0·40-0·44 mm.

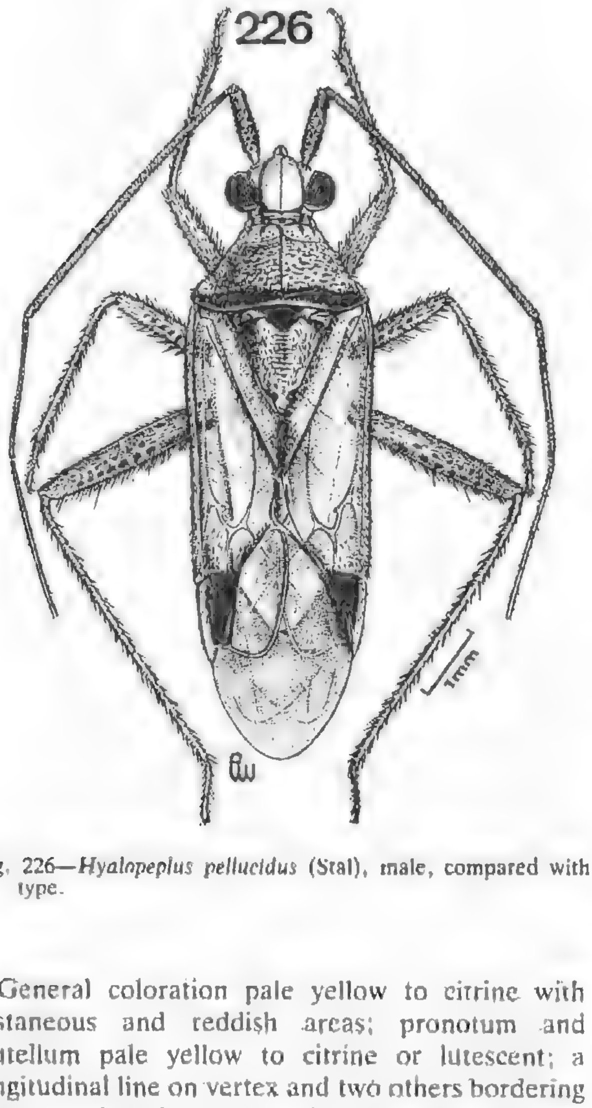


Fig. 226—*Hyalopeplus pellucidus* (Stal), male, compared with type.

General coloration pale yellow to citrine with castaneous and reddish areas; pronotum and scutellum pale yellow to citrine or lutescent; a longitudinal line on vertex and two others bordering inner margins of eyes, a median longitudinal line to pronotum and scutellum (obsolete or absent in some specimens) castaneous; collar castaneous to pale yellow with two characteristic whitish pruinose bars (one at each side) in well preserved specimens, the central portion with three bars, usually forming a somewhat triangular area darker in colour, its apex lying between front area of calli. The whitish pruinose bars and the dark triangular area are visible on fully coloured specimens. Pronotum with a transverse fascia posteriorly reaching the hind border of disc and humeral angles castaneous to black; mesoscutum at middle and scutellum basally and apically (sometimes the subapical spot is divided into two small ones not reaching apex) castaneous; antenna brown, apex of segment II and segments III-IV fuscous, basal portions of segments pale; hemelytra glassy, transparent, claval, corial and embolial sutures fuscous to black, cuneus reddish (pale at external margin), membrane glassy, slightly fuscous, nervures castaneous. Underside of body ochraceous, a reddish castaneous vitta on lateral portion of head and another on upper margin of propleura reddish to castaneous, abdomen with a reddish lateral vitta (obsolete in some specimens); legs pale yellow, tibiae I and II reddish apically, hind femora and hind tibiae totally reddish.

Pronotum noticeably punctate-rugose, scutellum prominent, sulcate at middle, cuneus fairly long, hind tibiae with long pubescence.

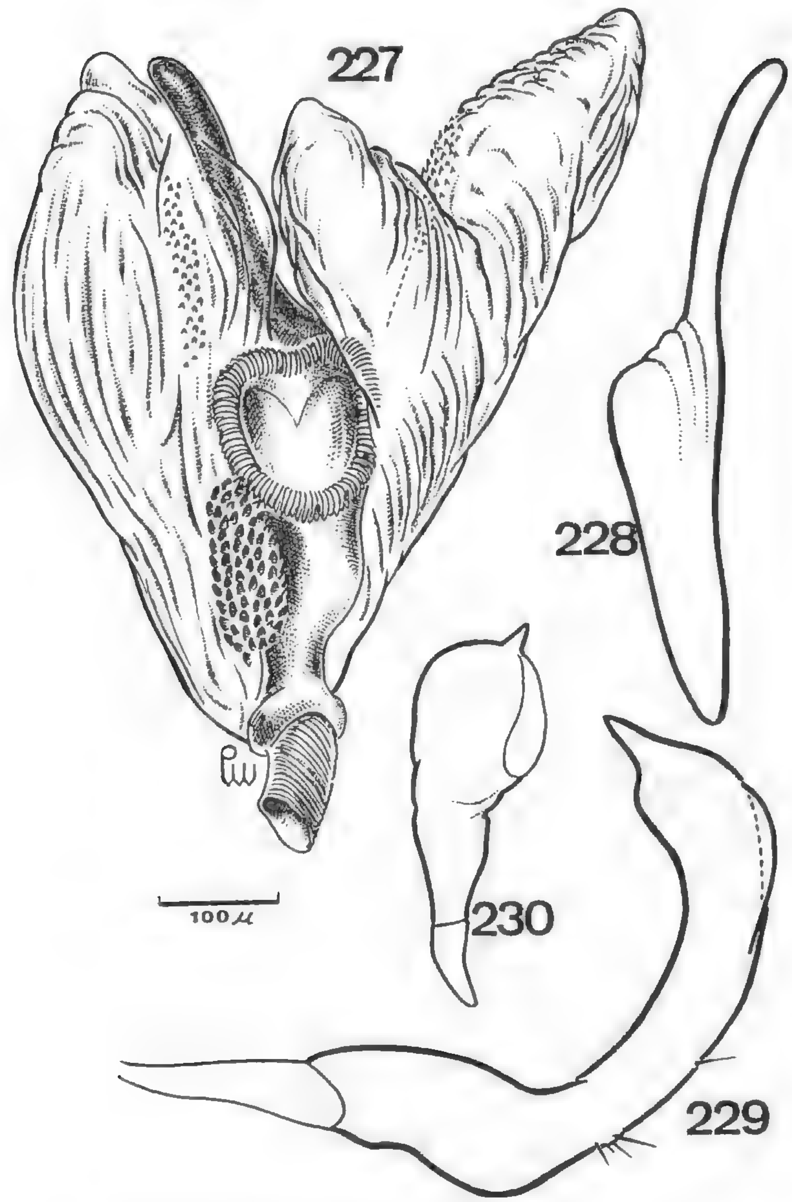
Genitalia: Penis (fig. 237, 243) with membranous lobes provided with sclerotized apical teeth, a median spiculum (fig. 238, 244) and a group of spines near secondary gonopore. Left paramere (fig. 239, 245) curved, enlarged and pointed apically. Right paramere (fig. 240, 246) small, enlarged apically, with a terminal point.

Female: Similar to male in colour and general aspect, more robust.

Geographical distribution: AFRICA: Ivory Coast, Saint Thorme Island. ASIA: India, Malay Peninsula. OCEANIA: Philippine Islands, Solomon Islands, New Britain, Borneo, Papua New Guinea, West Irian, Australia, Timor.

Specimens studied: male, lectotype (new designation), *Hyalopeplus horvathi* Poppius, Ins. St. Thome, Mocquerys (HELSINKI); female, lectotype (new designation), *Hyalopeplus similis Poppius*, Langenburg, iv.1898, Fulleborn (HELSINKI). *Hyalopeplus bakeri* Poppius, Los Banos, Philippines, Baker (HELSINKI); lectotype, *Hyalopeplus krishna* Ballard, Chapra. Mackenzie. Pres. by E. Ballard (BMNH); female, paralectotype, same data as lectotype.

Several males and females; PHILIPPINE ISLANDS: Luzon, Mt. Prov. Ifugao, Mayoyao, 1 000-1 500 m, 8.vii.1966, M. Torrevillas; Mindanao, Agusan, Los Arcos, 19-23.xi.1959, C. M. Yashimoto; Negros Is., Camp Lookout, Dumaguete, 6.iv.1961, T. Schneiria, A. Reyes; Leyte, Aboyog, 35 mi S Tacloban, 7-14.vii.1961; Balabao Dalawam Bay, 5.x.1961, Noona Dan Exp. 61-62; Acupan Benquet, Luzon 15.vii., C. S. Banks; Busuanga Is., 4 km N San Nicolas, 21.v.1962, M. Thompson; Mindanao, Lanao, Grain Mts. 1380 m, 16.vi.1958, Ifugao Prov.; Liwo, 8 km E Mayoyao, 1 000-1 300 m; Busuanga, 4 km N San Nicolas 26.v.1962, H. Holtman; Mt. Province Mayoyao, Ifugao, 1 200-1 500 m, 10.viii.1966, H. M. Torrevillas; Mindanao, Lanao Butig Mts. 24 km, Ne Butig, 1080 m, H. F. Milliron; SOLOMON ISLANDS: Guadalcanal, i.1921, J. A. Kuschel; New Georgia Gr. Gize Is. 30 Km, 11-18.vii.1964, J. M. Sedlacek;



Figs. 227-230—*Hyalopeplus pellucidus* (Stal): Fig. 227—Vesica of aedeagus; Fig. 228—Spiculum of vesica; Fig. 229—Left paramere; Fig. 230—Right paramere.

San Cristoval, Bwelnaniawarikiapu, 12.vii.1960, C. W. O'Brien; Santa Isabel, Tatamb, 24.vi.1960, C. W. O'Brien; Malaita, Auki, 20 m, 3-5.vi.1964, N. V.; Kolombangara, Gollifer's Camp, 700 m, 23.i.1964, P. Shanagan; Guadalcanal, Lame nr. Mt. Tatuve, 300 m, 17.v.1960, C. W. O'Brien. NEW BRITAIN: Gazelle Pen., Gaulim, 140 m, 21-27.x.1962, J. Sedlacek. BORNEO: Sarawak, Gunong Matang, 120 m, 16.xi.1958, M.V., J. L. Gressitt & Maa. PAPUA NEW GUINEA: Eliptamin Valley, W. W. Brandt; NE Tsenga, 1 200 m, Upper Jimmi V., 15.viii.1955, J. L. Gressitt; Torricelli Mts., Mokai Vill. 750 m, 16-31.xii.1958, W. W. Brandt; Wau, 1 200 m, 16.viii.1964, J. Sedlacek. INDONESIA: Waris, S of Hollandia, Irian Jaya, 4 500-5 000 m, 8-15.viii.1959, T. C. Maa; Waigeu, Camp Nok. 2 500 ft. iv.1938, L. E. Cheesman, B.M. 1938-593; Kupang, Timor, 6-21.vi.1929, I. M. McKerras; MALAYSIA: Perak, Larut Hills, at light, 4 500 ft, ii.1915, H. M. Pendlebury; Bettotan, NT, Sandakan, 24.viii.1927; CENTRAL INDIA: Mandhya Pradesh, Satpura Hills, ix.1970, Pachmari 3 500 ft. AUSTRALIA: North Queensland, Redlynch, 10.xii.1938, Papuan-Australian Exp. B.M. 1947-448; id. 14.xii.1938; id. 21-30. vii.1938; Redlynch, Queensland, xii. 1938, B.M. 1949-61; Peach River, Shepards Battery Site, Cape York Pen., 800 ft, 13.viii.1948, Archbold Exp. North Queensland; 3♂ 2♀ Iron Range, Cape York Peninsula, 27.iv.-4.v.1973, G.B. Monteith; 1♀, same locality and collector but 5-10.v.1968; 1♀, same locality and collector but 11-17.v.1968; 1♀, Lockerbie Scrub, Cape York, 19-22.iv.1973, G.B. Monteith; 1♀, Mt. Carbine, 5.i.1964, G. Monteith;

2♀, Upper Mulgrave River, 30.iv.1970, G. B. Monteith; 2♀♀, same locality and collector but 1-3.xii.1965; 1♀ Bowen, 8.ii.1975, B. K. Cantrell; 2♀, 5 km (3 mi.) W of Mossman, 13.iii.1964, I. F. B. Common & M. S. Upton; 1♂ 1♀, Iron range, 10.iv.1964, I. F. B. Common & M. S. Upton.

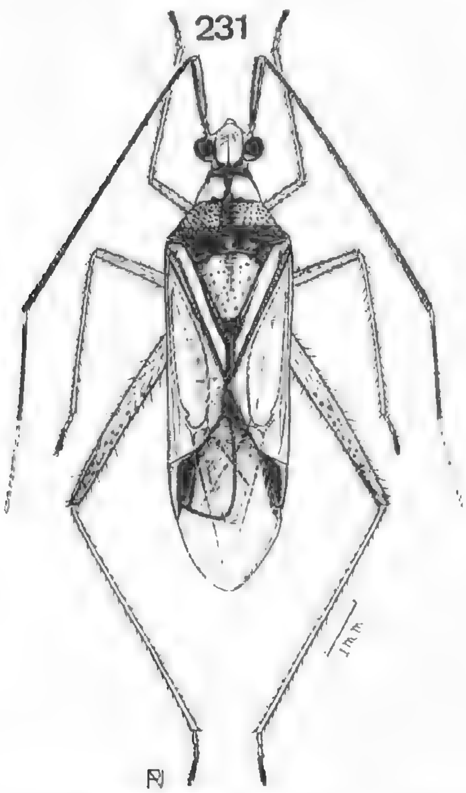


Fig. 231—*Hyalopeplus samoanus* Knight; male, compared with type

Specimens recorded are in AMNH, BMNH, BISHOP, USNM, ANIC, QU and Department of Primary Industries Brisbane.

Differs from other species in the genus by the colour of collar and pronotum, by the noticeably long cuneus and by the hind tibiae densely pubescent.

Hyalopeplus similis Poppius was described based on two females from Lake Nyassa. In the present study we have examined specimens from Lamto, Toumodi, Ivory Coast; Bambari (on cotton) and Tafo. *Hyalopeplus horvathi* is mentioned by Poppius as deposited in the Museum of Natural History, Budapest. At least one of the two males was retained in Helsinki and is being designated as lectotype.

In the present work *horvathi* and *bakeri* are considered as synonyms of *similis*. Besides having a very close similarity in coloration and general aspect, especially bars of head and collar, the male genitalia are similar. Since the species is widely spread over the Oriental Region and Oceania is quite probable that it has been introduced in the Ethiopian Region.

Hyaloplictus, n. gen.

Type-species: Hyaloplictus solomonicus n. sp.

Body elongate, glabrous above. Head with a short neck, vertex immarginate, frons prominent, striate, clypeus flat, visible from above, eyes prominent, slightly removed from collar, jugum and lorum flat, buccula small, rounded, rostrum reaching hind coxae; antennae cylindrical, shortly pubescent, segment I slightly shorter than width of head, bent outwards, segment II about four times as long as I.

Pronotum smooth (in one specimen strigose on medial black spot of disc), noticeably constricted and narrowed anteriorly, collar very large, mesal length about equal to half the width of eyes, lateral margins sinuate in front of humeral angles (which are rounded), hind margin sinuate at middle and near humeral angles; mesoscutum exposed, scutellum long, slightly convex.

Hemelytra glassy, transparent, corium without nervures; scutellum laterally, a line following claval suture internally and embolio-corial commissure with a row of punctures; cuneus about three times as long as wide at base, membrane biareolate, large areola rounded apically. Legs long, tibiae densely and shortly pilose.

This genus differs from others in the tribe by the very wide collar, by the disc of pronotum strongly narrowed and constricted anteriorly and by the segment I of antenna bent outwards.

Key to the species of the genus *Hyaloplictus* n. gen.

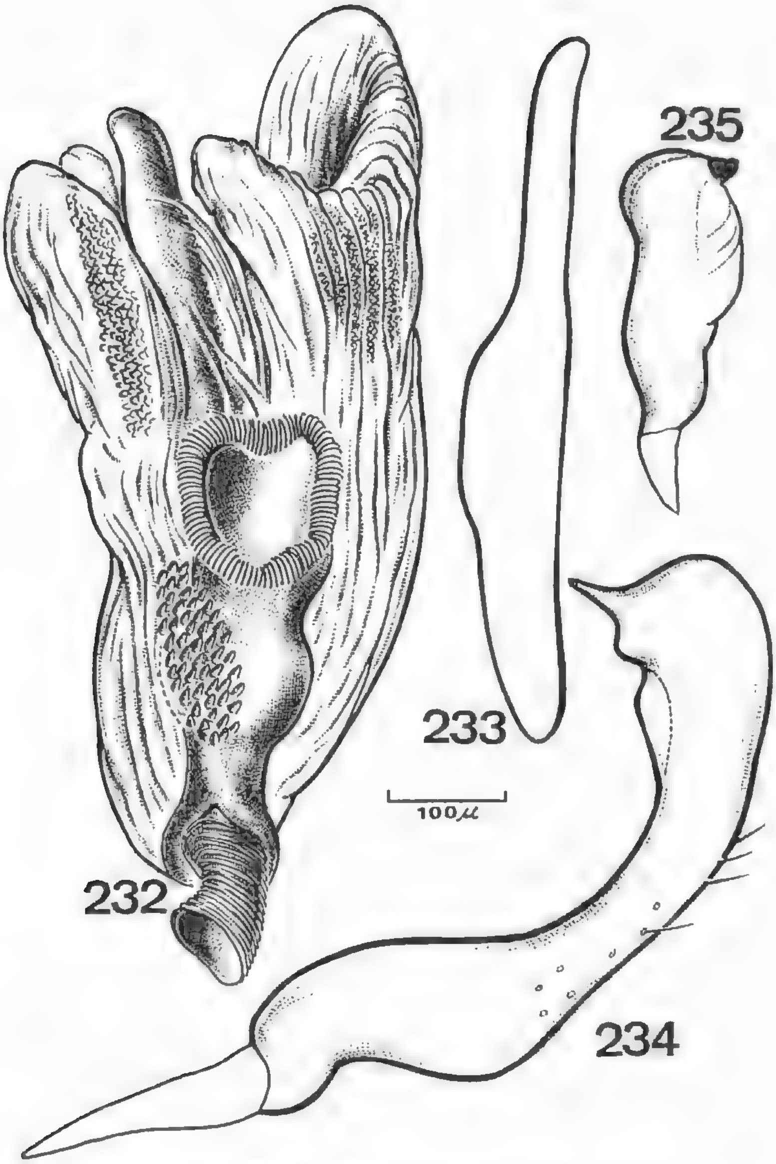
1. Collar black; cuneus red; size large, over 10 mm long . . . *solomonicus* n. sp.
   Collar pale with black vittae; cuneus pale; size medium, less than 9 mm long . . . *minor* n. sp.

Hyaloplictus minor, n.sp.

(Fig. 248)

Characterised by the colour and size.

Female: Length 8·7 mm, width 2·2 mm. *Head:* Length 1·0 mm, width 1·4 mm, vertex 0·60 mm. *Antenna:* Segment I, length 1·0 mm; II, 3·9 mm; III, 1·9 mm; IV, broken. *Pronotum:* Length 1·5 mm, width at base 2·0 mm. *Cuneus:* Length 1·00 mm, width at base 0·36 mm (holotype).



Figs. 232-235—*Hyalopeplus samoanus* Knight: Fig. 232—Vesica of aedeagus; Fig. 233—Spiculum of vesica; Fig. 234—Left paramere; Fig. 235—Right paramere.

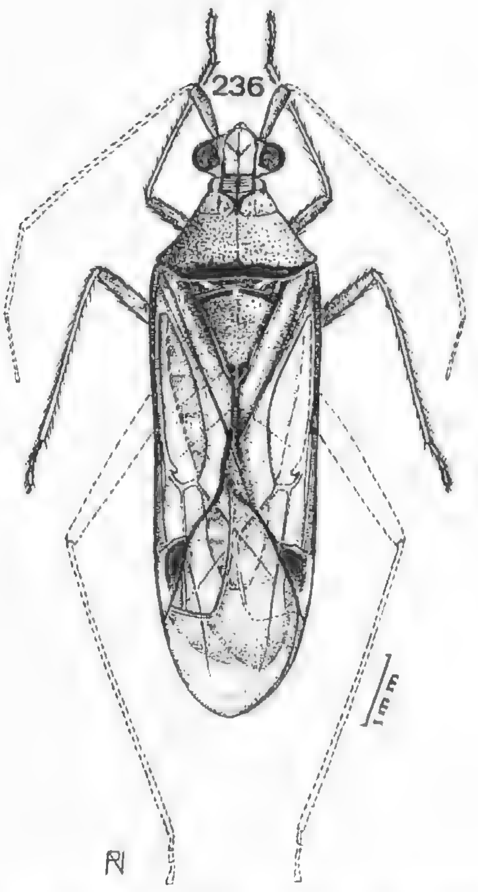


Fig. 236—*Hyalopeplus bakeri* Poppius, male, holotype.

General coloration ochraceous with black areas; eyes and antenna light castaneous, apex of segment II, segment III and IV infuscate; collar with narrow median longitudinal line and two lower lateral vittae, two round spots at lateral margins of pronotum and two small spots at middle of disc, spots on mesosternum fuscous to black; hemelytra glassy, ochraceous, inner and outer margins of clavus, corium, cuneous and embolium (narrowly) fuscous; membrane hyaline, nervures brown. Underside of body and legs pale yellow, lateral margin of abdomen with a longitudinal reddish vitta. Pronotum and scutellum smooth.

Male: Unknown.

Holotype; female, SOLOMON ISLANDS: San Cristoval, Maniate, 6.viii.1960, C. W. O'Brien (BISHOP).

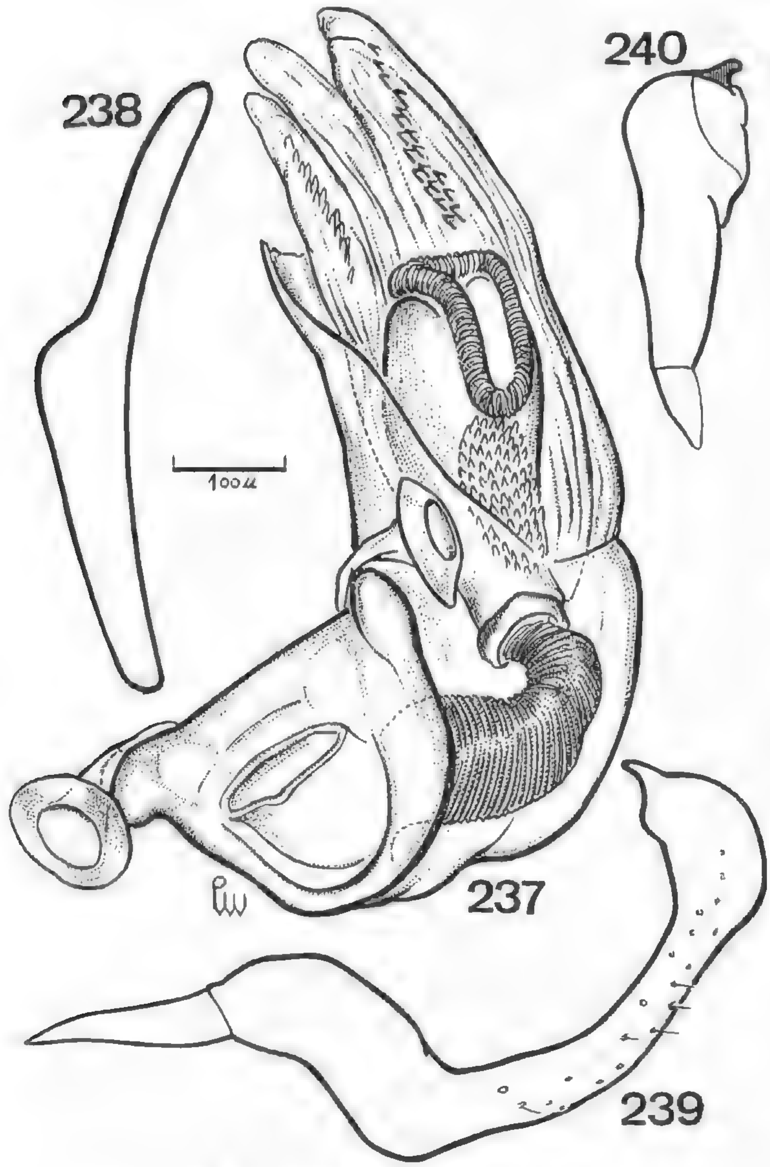
Differs from *Hyaloplictus solomonicus* n.sp. by the colour of cuneus, collar and by the smaller size.

Hyaloplictus solomonicus, n.sp.

(Figs. 249-252)

Characterised by the large size and by the colour of the collar and cuneus.

Male: Length 10·6 mm, width 3·2 mm. *Head:* Length 1·0 mm, width 1·6 mm, vertex 0·60 mm. *Antenna:* Segment I, length 1·2 mm; II, 5·0 mm; III, 1·4 mm; IV, 1·2 mm. *Pronotum:* Length 1·7 mm, width at base 2·4 mm. *Cuneus:* Length 1·40 mm, width at base 0·60 mm (holotype).



Figs. 237-240—*Hyalopeplus bakeri* Poppius: Fig. 237—Penis; Fig. 238—Spiculum of vesica; Fig. 239—Left paramere; Fig. 240—Right paramere.

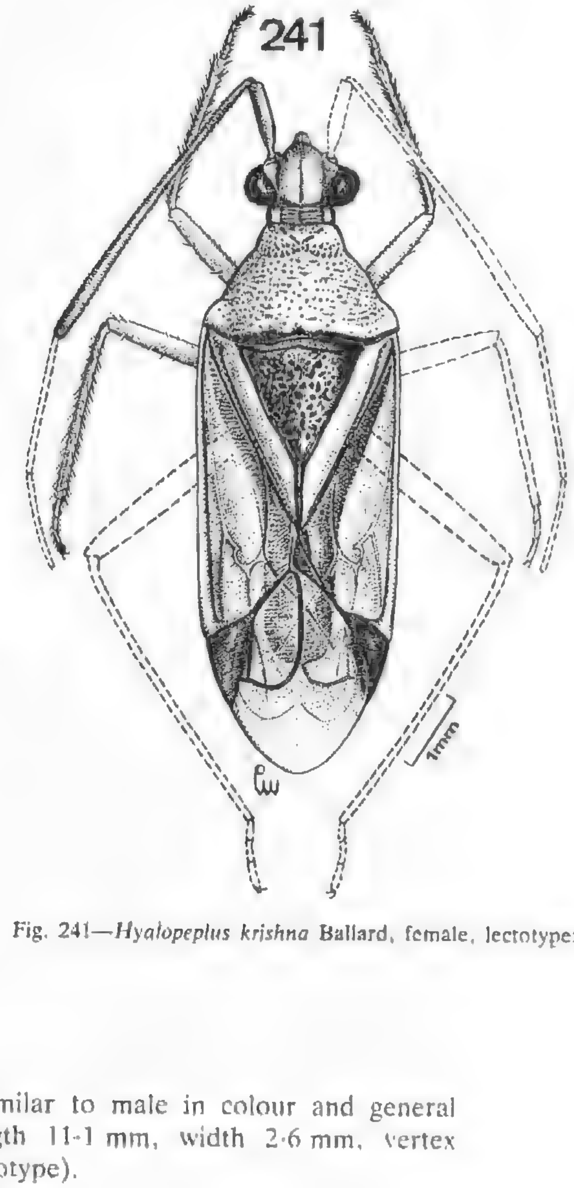


Fig. 241—*Hyalopeplus krishna* Ballard, female, lectotype.

General coloration ochraceous to castaneous with red and black areas; eyes and antennae castaneous, segment I paler, pronotum with collar, two large round spots laterally and a small strigose median longitudinal spot black; hemelytra glassy, transparent, clavus, embolium, cuneus, commissure and apical margin of corium, nervures of membrane red; membrane hyaline. Underside of body and legs pale yellow with reddish tinge.

Pronotum rugose on black median spot.

Genitalia: Penis (fig. 250) with a sclerotized spiculum and membranous lobes. Left paramere (fig. 251) curved, somewhat enlarged preapically, with pointed apex. Right paramere (fig. 252) small, ended by a sclerotized point.

Female: Similar to male in colour and general aspect. Length 11·1 mm, width 2·6 mm, vertex 0·60 mm (allotype).

Holotype: male, SOLOMON ISLANDS: Bougainville, Kukugau Vill., 150 m, xii.1960, W. W. Brandt (BISHOP). *Paratype:* female, Santa Isabel, Molao, 30.vi.1960, C. W. O'Brien.

Differs from *Hyaloplictus minor* n.sp. by the larger size, by the red cuneus and black collar.

Isabel Kirkaldy, 1902

Isabel Kirkaldy, 1902, p. 58, Poppius, 1912a, p. 417; Carvalho, 1955, p. 107; Carvalho, 1959, p. 321.

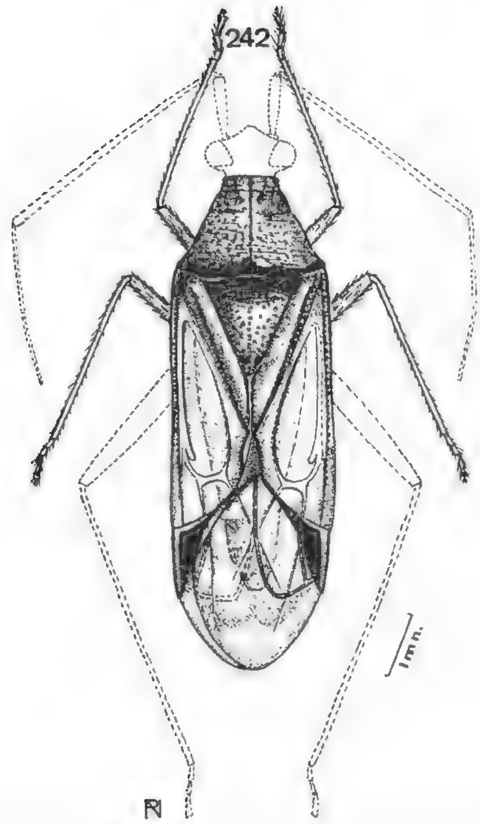


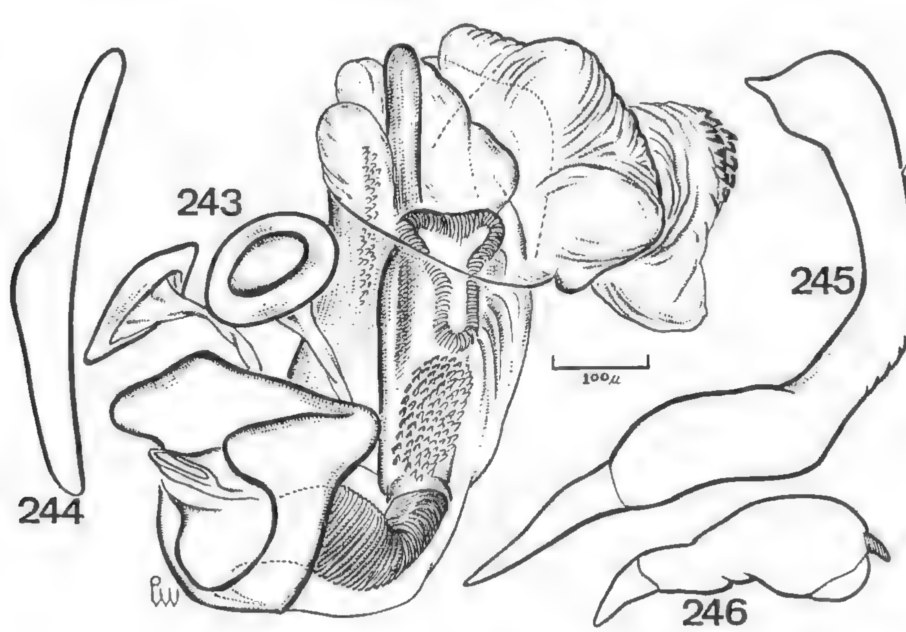
Fig. 242—*Hyalopeplus horvathi* Poppius, male , lectotype.

Isabellina Distant, 1904b, p. 415 (syn. by Reuter, 1910, p. 166).

Type-species: Isabel ravana (Kirby, 1891).

Body elongate, glabrous above. Head triangular, subhorizontal, vertex sulcate longitudinally, immarginate, clypeus and lorum visible from above, eyes well removed from anterior margin of pronotum, this distance being approximately equal to thickness of first antennal segment; rostrum reaching apex of posterior coxae; antennae moderately long, slender, segment I distinctly longer than width of head, segment II twice as long as I, slightly incrassate apically, segments III and IV slender, shortly pubescent.

Pronotum considerably narrowed anteriorly, collar with mesal length equal to thickness of first antennal segment, calli flat, separate at middle, reaching sides of pronotum, which are rounded, disc convex, rugose-punctate, with a central longitudinal and two lateral impressed strigose vittae, humeral angles subspinously produced and reflexed, hind margin broadly rounded; mesoscutum exposed, scutellum tumid, noticeably rugose (rugosities of basal angles extending also to fossae of mesoscutum).



Figs. 243-246—*Hyalopeplus horvathi* Poppius: Fig. 243—Penis; Fig. 244—Spiculum of vesica; Fig. 245—Left paramere; Fig. 246—Right paramere.

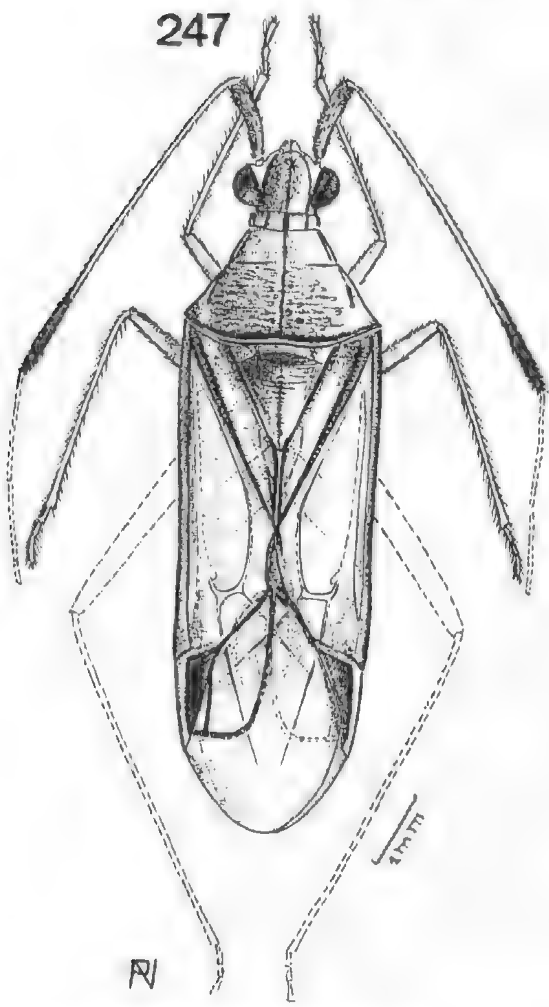


Fig. 247—*Hyalopeplus similis* Poppius, female, lectotype.

Hemelytra glassy, transparent, corium with costal nervure present only apically, clavo-corial and embolio-corial sutures with a row of punctures, cuneus longer than wide at base, membrane with large areola distinctly and acutely angulose apically. Legs of moderate length, hind femur incrassate, with numerous characteristic small black spines inferiorly, tibiae shortly spinose, parempodia divergent apically.

This genus is characterised by the apical nervure of corium, by the small black spines of hind femora and by the spinously produced and reflexed humeral angles of pronotum.

Isabel ravana (Kirby, 1891) Kirkaldy, 1902

Capsus ravana Kirby, 1891, p. 106, pl. 4, fig. 10;
Isabel ravana Kirkaldy, 1902, p. 58, pl. A, fig. 9, pl. B, fig. 6; Reuter 1910, p. 97; Carvalho, 1959, p. 321.

Isabellina ravana Distant, 1904b, p. 417.

Isabel beccarii Poppius, 1912a, p. 417 (*n.syn.*).

Isabel horvathi Poppius, 1915a, p. 10 (*n.syn.*).

(Figs. 253-256)

Characterised by the silvery vittae on pronotum and scutellum and by the longitudinal, extrareolar, bent vittae of membrane.

Male: Length 7·8 mm, width 2·0 mm. *Head:* Length 0·8 mm, width 1·0 mm, vertex 0·48 mm. *Antenna:* Segment I, length 1·6 mm; II, 3·3 mm; III-IV, broken. *Pronotum:* Length 1·2 mm, width at base 2·1 mm. *Cuneus:* Length 0·96 mm, width at base 0·40 mm (lectotype—*Isabel beccarii* Poppius).

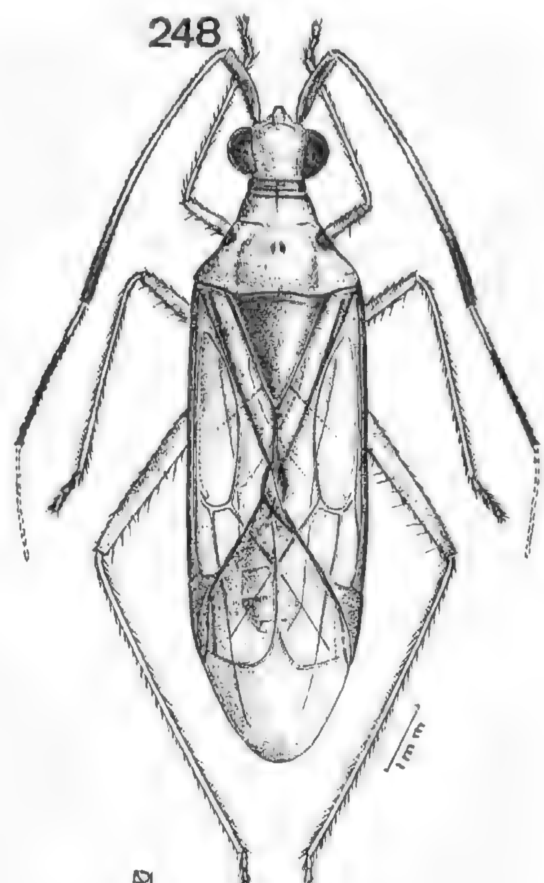


Fig. 248—*Hyaloplictus minor* n.sp., female, holotype.

General coloration pale testaceous to ochraceous, more or less mottled and speckled with castaneous to reddish; head with longitudinal vittae (the two median ones wider) and striations on frons reddish, clypeus, lorum, gula and portion behind eyes with brown vittae or spots, eyes and antennae brown, segment I speckled with black, apex of segment II castaneous to dark, segments III-IV castaneous, pale basally; pronotum with five longitudinal, and a transverse sub-basal, vittae whitish, covered by silvery pruinosity and darkened at each side, humeral angles black, hind margin narrowly pale; mesoscutum and scutellum reddish to brown with three longitudinal pale to whitish vittae (one central, two lateral): hemelytra ochraceous, transparent or semi-transparent, commissures, cuneus and nervures of membrane reddish, embolium in some specimens with four dark spots (basal, apical and two sub-median), the cuneus totally red or castaneous or with this colour only marginally; membrane hyaline with two characteristic apical bent longitudinal vittae brown to black. Legs pale yellow, speckled with brown, abdomen with a wide lateral brown band and small reddish dots ventrally, femora and tibiae pale with numerous brownish dots or bars, extreme apex reddish, the hind femur mostly brown with numerous black short spines ventrally, hind tibiae with a sub-basal wide brown band.

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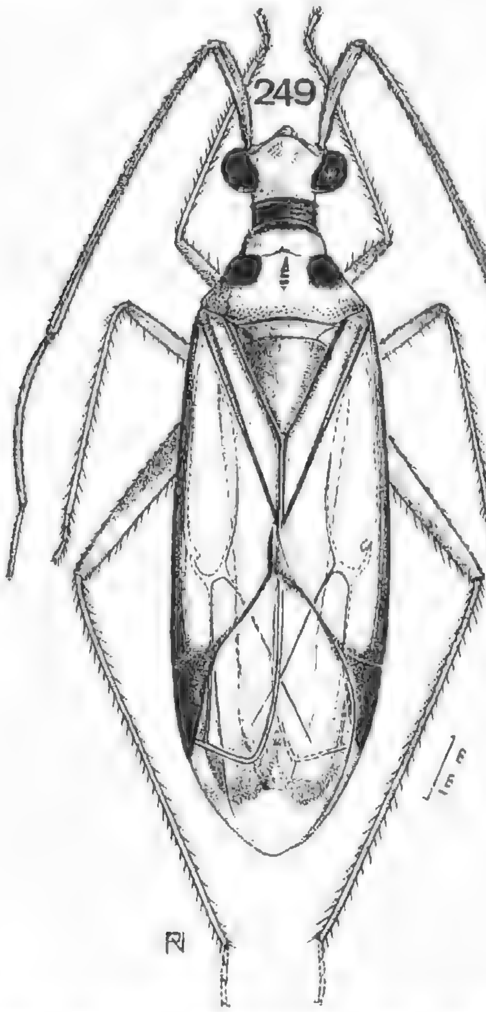


Fig. 249—*Hyaloplictus solomonicus* n.sp., male, holotype.

Genitalia: Penis (fig. 254) with membranous lobes and fields of sclerotized teeth. Left paramere (fig. 255) strongly curved, apex blunt. Right paramere (fig. 256) small, with a typical apical curved point.

Female: similar to male in colour and general aspect, slightly more robust.

Geographical distribution: Burma, China, Formosa, Sri Lanka, Sumatra, New Guinea, Philippines.

Specimens studied: lectotype (new designation), male, SUMATRA: Mt. Singaland, vii.1978, O. Beccari (*Isabel beccarii* Poppius) (HELSINKI); PHILIPPINES: Albay Prov., Mt. Mayon, 16 km NW of Lagaspi, 900-1 500 m, 4.v.1962, H. M. Torrevillas; IRIAN JAYA: Wamena, 1 700 m, 10-25.ii.1960, T. C. Maa; BURMA: Nam Tamai Valley, 23.vii.1938, R. Kaulback, alt. 3 000 ft (BMNH); SOUTH CHINA: Kwantung, Su-Ling-Paei, Yaoshan District, Sept 30, 1934, F. K. To (BMNH).

The specific characters pointed out by Poppius for *Isabel beccarii* and *Isabel horvathi* are within the range of variation of the species and appears even in single individuals. The two species must be treated as synonyms of *ravana* (Kirby).

Kosmiomiris Kirkaldy, 1902

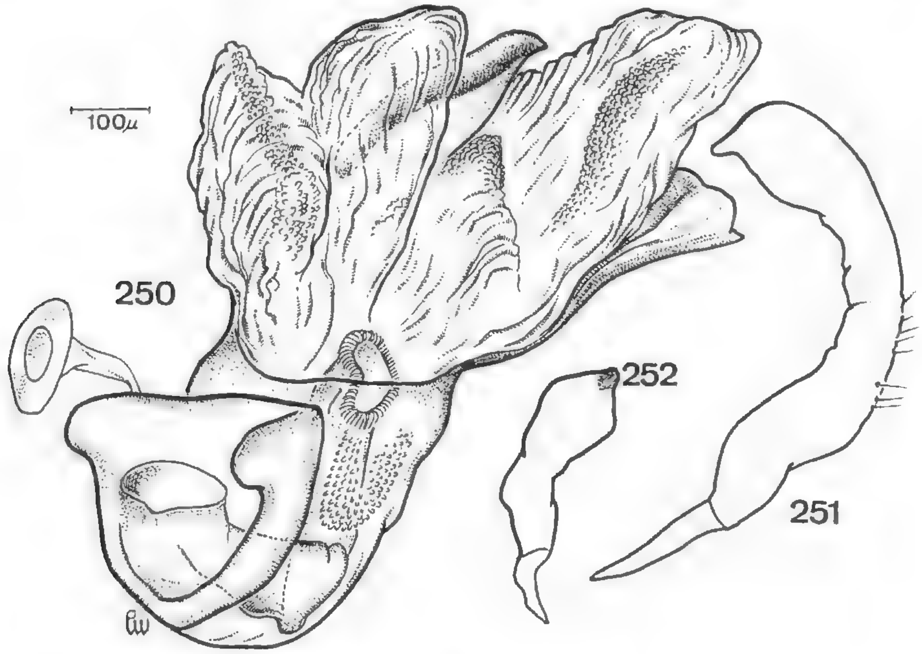
Kosmiomiris Kirkaldy, 1902, p. 253; Poppius, 1912a, p. 433; Carvalho, 1955, p.106; Carvelho, 1959, p. 321.

Type-species: Kosmiomiris rubroornatus Kirkaldy, 1902=*Capsus lucidus Walker, 1873.*

Body elongate oval, beset with fine and erect pubsence. Head small, transverse, short, vertical in front of the eyes, vertex superficially sulcate longitudinally, immarginate, eyes removed from collar by a space about equal to thickness of first antennal segment, straight posteriorly, angulose at inner hind margin, occupying two thirds of head when seen from side, clypeus flat, jugum and lorum long, narrow, buccula small, rostrum very long, reaching to 6th abdominal segment; antenna inserted level with upper portion of eye, cylindrical, segment II slightly incrassate, shortly pubescent, about twice as long as I, which is about as long as width of head.

Pronotum convex, deep and coarsely punctate, lateral margins rounded, calli small and flat, collar narrow and smooth, hind margin of disc straight at middle, oblique near humeral angles; mesosternum covered, scutellum strongly tumid, smooth or with sparse punctures (in some geographical populations the scutellum is punctured).

Hemelytra without nervures, glassy transparent (except on reddish or black areas), clavo-corial and embolio-corial sutures with a row of punctures, cuneus distinctly longer than wide at base, large areola rounded apically. Legs of moderate length, tibiae dense and shortly pilose, the spines of hind pair about as long as thickness of segment.



Figs. 250-252—*Hyaloplictus solomonicus* n.sp.: Fig. 250—Penis; Fig. 251—Left paramere; Fig. 252—Right paramere.

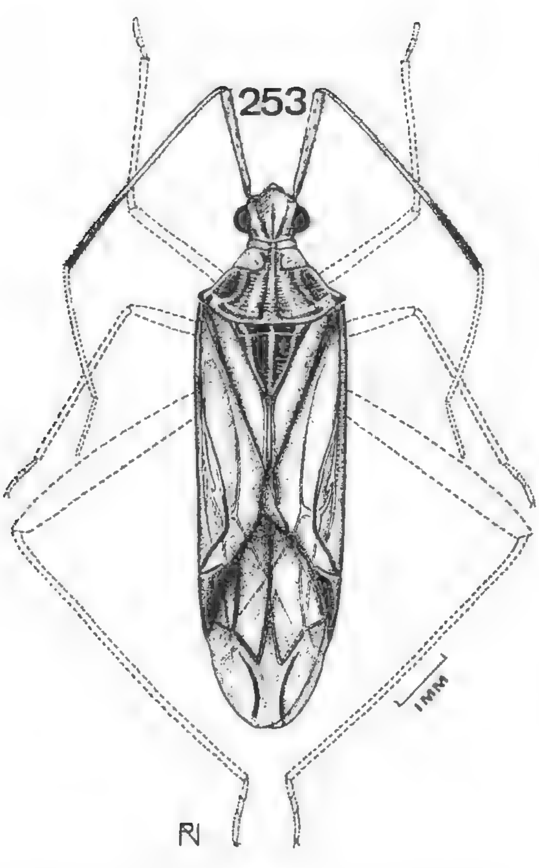


Fig. 253—*Isabel beccarii* Poppius, male, holotype.

The genus is characterised by the coarsely punctate pronotum, by the very long rostrum and by the smooth collar. It differs from *Guianerius* Distant by the length of the rostrum, by the structure of pronotum and by the insertion of antenna on frons.

Kosmiomiris rubroornatus Kirkaldy, 1902

Capsus lucidus Walker, 1873, p. 124 (n. preoc. by *Capsus lucidus* Kirschbaum, 1855).

Kosmiomiris rubroornatus Kirkaldy, p. 253, pl. f, fig. 4; pl. 6, fig. 6; Poppius, 1912a, p. 434; Carvalho, 1959, p. 322.

Kosmiomiris lucidus Distant, 1904a. p. 106.

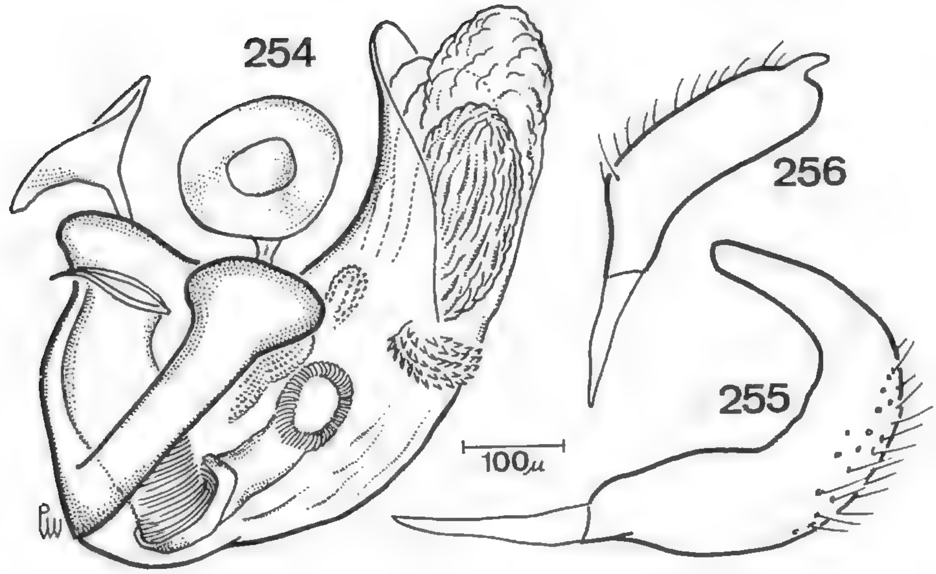
Kosmiomiris modigliani Poppius, 1912a, p. 433 (N.SYN.).

Kosmiomiris scutellaris Poppius, 1912a, p. 433, (*n.syn.*).

(Figs. 257-264)

Characterised by the colour of the body and by the stucture of male genitalia.

Male: Length 4·6-6·4 mm, width 1·8-2·1 mm. *Head:* Length 0·4-0·7 mm, width 0·5-1·3 mm, vertex 0·44-0·48 mm. *Antenna:* Segment I, length 0·8 1·1 mm; II, 1·6-2·3 mm; III 1·0 mm; IV, 0·7 mm. *Pronotum:* Length 0·7-0·8 mm, width at base 0·30-0·40 mm.



Figs. 254-256—*Isabel ravana* Distant: Fig. 254—Penis; Fig. 255—Left paramere; Fig. 256—Right paramere.

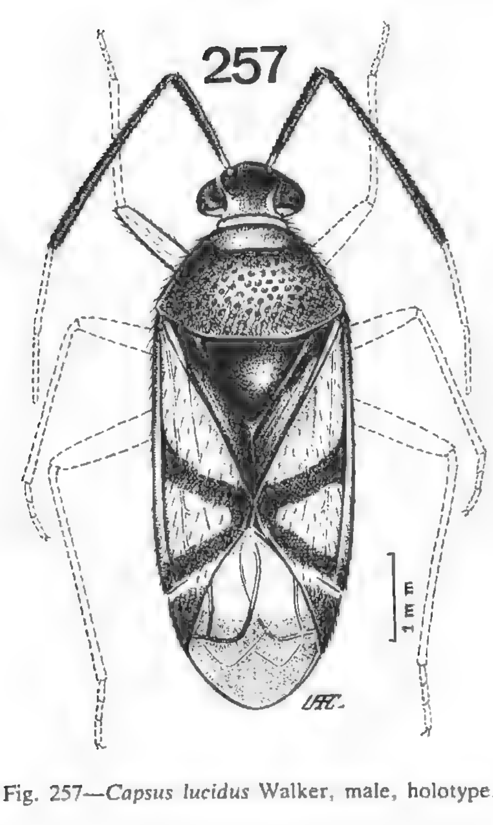
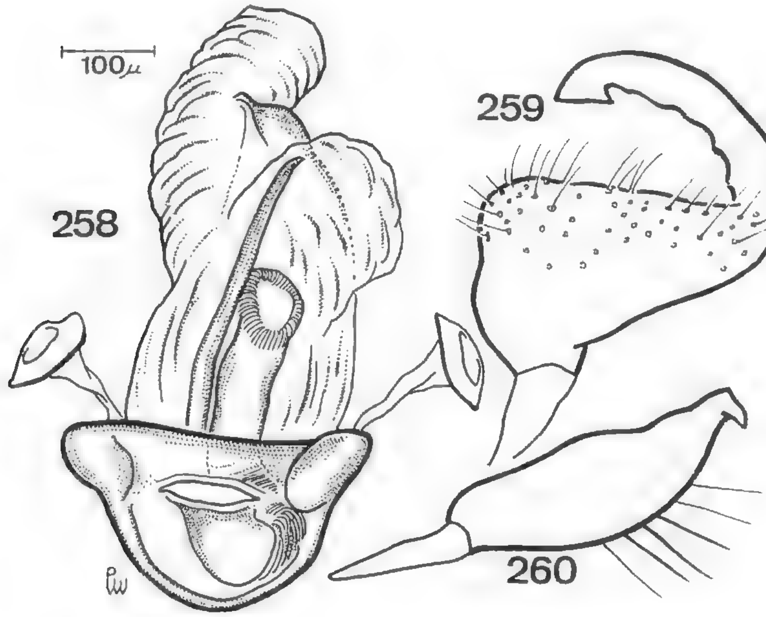


Fig. 257—*Capsus lucidus* Walker, male, holotype.

General coloration ochraceous with brown, black and reddish areas; apex of abdomen, basal half of posterior tibiae and antennae black (in some specimens the basal third or the extreme base of segment III whitish, this variation occurs in specimens taken at the same locality, by the same collector, and on same day); pronotum, scutellum, cuneus (more or less), clavus at base, nervures and apical portion of membrane dull brownish black; clavus in a more or less extensive arc (except basal portion), a characteristic V-shape spot (with apex on corial commissure) red; corium (except reddish areas), a cross bar at base of scutellum and base of membrane pale, transparent (in some specimens the whole membrane is black). Underside of body (except black apex of abdomen) pale, femora reddish, tibiae I and II pale brown, tibiae III black, pale apically, tarsi pale.

Genitalia: Penis (figs. 258, 262) with a characteristic sclerotized cylindrical spiculum and membranous lobes. Left paramere (figs. 259, 263) enlarged basally, strongly curved at middle. Right paramere (figs. 260, 264) widest at middle, with a curved apical point.



Figs. 258-260—*Kosmiomiris rubroornatus* Kirkaldy: Fig. 258—Penis; Fig. 259—Left paramere; Fig. 260—Right paramere.

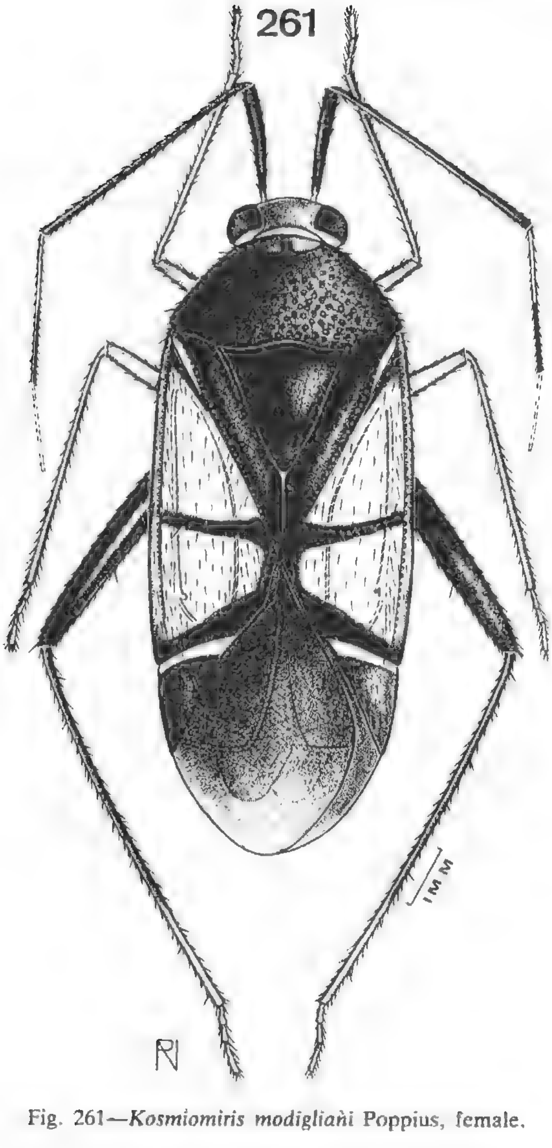
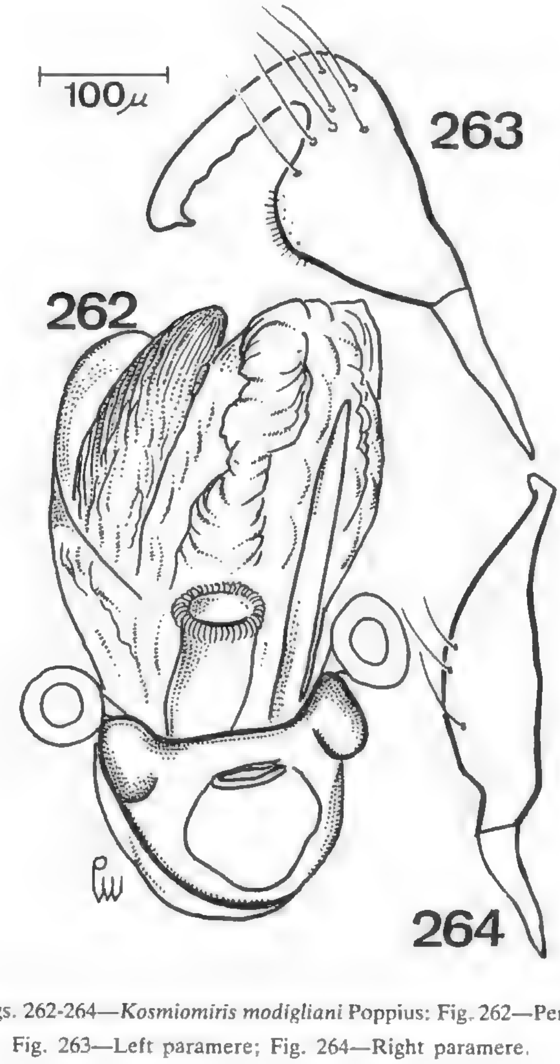


Fig. 261—*Kosmiomiris modigliani* Poppius, female.



Figs. 262-264—*Kosmiomiris modigliani* Poppius: Fig. 262—Penis; Fig. 263—Left paramere; Fig. 264—Right paramere.

Female: Similar to male in colour and general aspect but noticeable more robust. Length 7·3-5·0 mm, width 2·5-2·0 mm, vertex 0·48-0·50 mm.

Geographical distribution: Borneo, Malay Peninsula, Philippines, Thailand, Sarawak, Sumatra, Malacca.

Specimens studied: male, holotype, 294, PENINSULAR MALAYSIA: *Capsus lucidus* Walker, Saunders, 65.13; sar., type (printed on green-bordered disc) (BMNH); female lectotype (new designation), Museum Paris, Perak coll. Noualhier, 1898 *(Kosmiomiris scutellaris* Poppius) (HELSINKI); Selangor, Bukit Kutu, 3 300 ft, ix.1932, H. M. Pendelbury; Kuala Lumpur, xii.1939; INDONESIA: paralectotype, male, Soekaranda, Sumatra, Januar. 1894, Dohrn (HELSINKI); EAST MALAYSIA: SE Forest camp, 19 km N of Kalabakan, 60 m, 24.x.1962; Gomatong caves, 22-26.xi.1958, T. C. Maa; Sandakan Bay (NW) Sepilok For. Res., 1-10 m, 28.x.1957, J. L. Gressitt; id. Sapagaya Lumber Camp; Samawang; Sadong, Kampong Tapuh, 300-400 m, 10.vii.1958; PHILIPPINES: Palawan Mantalingajan, Pinigisan, 600 m, 22.ix.1961, Noona Dan Exp. 61-62; PENINSULAR THAILAND: Nakon Sri Tam trat, Khao Huang, 2 500 ft. iii.1922, H. M. Pendelbury, in the Collections of BISHOP, BMNH and AMNH.

This species seems to vary in colour and also in size. The amount of red and black color on the clavus varies in individuals taken at the same place, by the same collector and on the same date. Females tend to have the red coloration more extensive. The same applies to the size, especially in populations from different geographical areas. Poppius based his species description mostly on the size and the colour of membrane. In the series of specimens from Borneo and Sumatra the membrane may be totally black, pale basally or pale only apically.

Due to this colour and also size variation and also the regular and uniform pattern of the genitalia the Poppius species are here considered as synonyms of *rubroornatus* Kirkaldy.

The types of *scutellaris* Poppius and *rubroornatus* were studied. *Kosmiomiris modigliani* Poppius is said to be in Genova (Giacomo Doria Museum of Natural History) but the type could not be seen because that Museum does not loan types for study.

Macrolonius Stål, 1870

Macrolonius Stål, p. 670; Poppius, 1912a, p. 432; Carvalho, 1955, p. 106; Carvalho, 1959, p. 322.

Type-species: Macrolonius sobrinus (Stål, 1855).

Body elongate, glabrous, sides parallel. Head vertical, vertex wide, immarginate, eyes contiguous with collar, clypeus, jugum and lorum flat, buccula prominent, rounded, convex gula, rostrum reaching hind coxae; antenna inserted at level of middle portion of eyes, cylindrical, segment I longer than width of head, shortly pubescent.

Pronotum punctate, including collar, calli small, median portion slightly carinate, collar narrow, its mesal length slightly greater than thickness of first antennal segment, lateral margins rounded, hind margin straight, oblique near humeral angles, memsoscutum covered, scutellum flat, punctate, apical portion prominent, rounded.

Hemelytra glassy, transparent, without nervures, clavus opaque, clavo-corial and embolio-corial sutures with a row of punctures, cuneus very long, about four times as long as wide at base, large areola rounded apically. Legs long, cylindrical, shortly pubescent, tibiae shortly spinulose.

The genus differs from other Hyalopeplini with coarsely punctate pronotum and scutellum by its large size, very long cuneus, large areola of membrane reaching well below apex of cuneus and by the punctate collar.

Key to the species of the genus *Macrolonius* Stål

1. Head seen from above unicolorous; pronotum with a median dark-brown spot on disc, not reaching lateral margins; collar pale . . . . . . *sobrinus* (Stål)
   Head seen from above with dark spots or vitta; pronotum with a median black spot reaching lateral margins; collar black 2
2. Head with a median black longitudinal vitta; lateral margins of pronotum with a single pale spot behind calli . . . *superbus* (Distant)
   Head black with a semilunar pale spot above; lateral margins of pronotum with two pale spots (one behind calli and one at humeral angle) . . . . . . *schenklingi* (Poppius)

Macrolonius schenklingi (Poppius, 1915) Carvalho, 1959

Malalasta schenklingi Poppius, 1915a, p. 21; *Macrolonius schenklingi* Carvalho, 1959, p. 322.

(Fig. 265)

Characterised by the colour of head and pronotum.

Female: Length 10·2 mm, width 2·1 mm. *Head:* Length 0·6 mm, width 1·4 mm, vertex 0·56 mm. *Antenna:* Segment I, length 1·8 mm; II, 2·8 mm; III and IV, broken. *Pronotum:* Length 1·6 mm, width at base 2·5 mm. *Cuneus:* Length 1·68 mm, width at base 0·40 mm (lectotype).

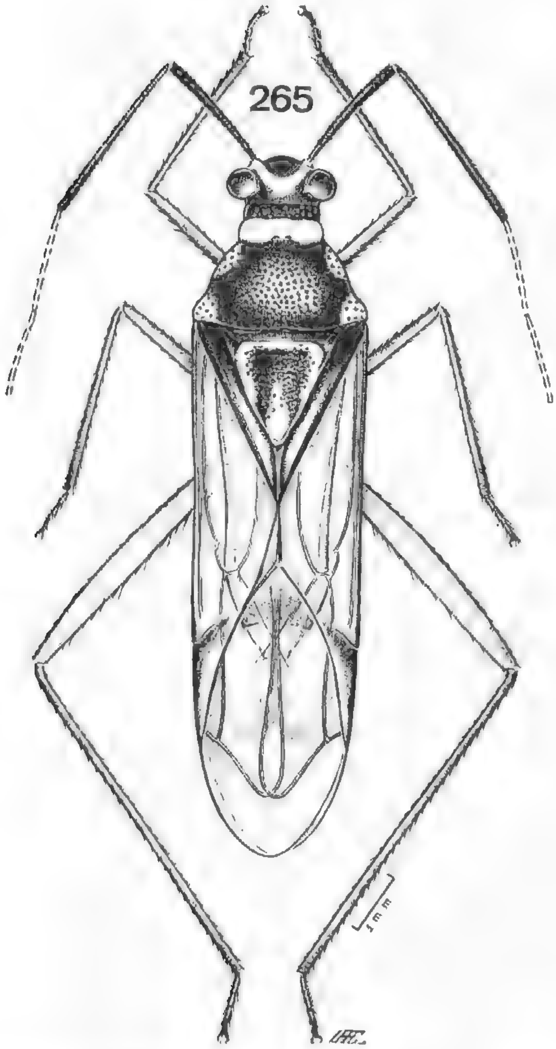


Fig. 265—*Malalasta schenklingi* Poppius, female, lectotype.

General coloration ochraceous to pale yellow with dark brown to black areas; head black with a semilunate pale spot on vertex and frons, eyes and antennae black; pronotum black with calli and two spots on lateral margins (one behind calli and one on humeral angle) pale to lutescent; scutellum citrine with two longitudinal vittae fused basally; hemelytra glassy, transparent, clavus and cuneus opaque, brown to black, the first in the middle and the second at inner portion pale to lutescent, membrane hyaline. Underside of body and legs pale yellow, hind tibiae tending to brown, tarsi fuscous.

Pronotum slightly sinuate laterally, mesoscutuum partially exposed, nervures of embranes very long, the large areolae rounded apically, superposing each other, cuneus very long.

Male: Unknown.

Geographical distribution: Formosa.

Specimens studied: female, lectotype (new designation), FORMOSA: Fuhosho, 7.ix., H. Sauter (HELSINKI).

This species differs from the two others in the genus by the colour of head, lateral margins of pronotum and by the length of cuneus.

Macrolonius sobrinus (Stål, 1855) Stål 1870

Capsus sobrinus Stål, 1835, p. 186.

Macrolonius sobrinus Stål, 1870, p. 670 Poppius, 1912a, p. 433; Carvalho. 1959, p. 323.

Capsus discoidalis Walker, 1873, p. 122 (n.syn.)

Malacopeplus discoidalis Carvalho, 1959, p. 322.

(Fig. 266-270)

Characterised by the colour of head and pronotum.

Female: Length 9·6 mm, width 2·4 mm. *Head:* Length 0·4 mm, width 1·4 mm, vertex 0·72 mm. *Antenna:* Segment I, Length 1·8 mm; II, 3·0 mm; III, 1·6 mm; IV, broken, *Pronotum:* Length 1·9 mm, width at base 2·4 mm. *Cuneus:* Length 1·16 mm, width at base 0·48 mm (lectotype of *discoidalis* Walker).

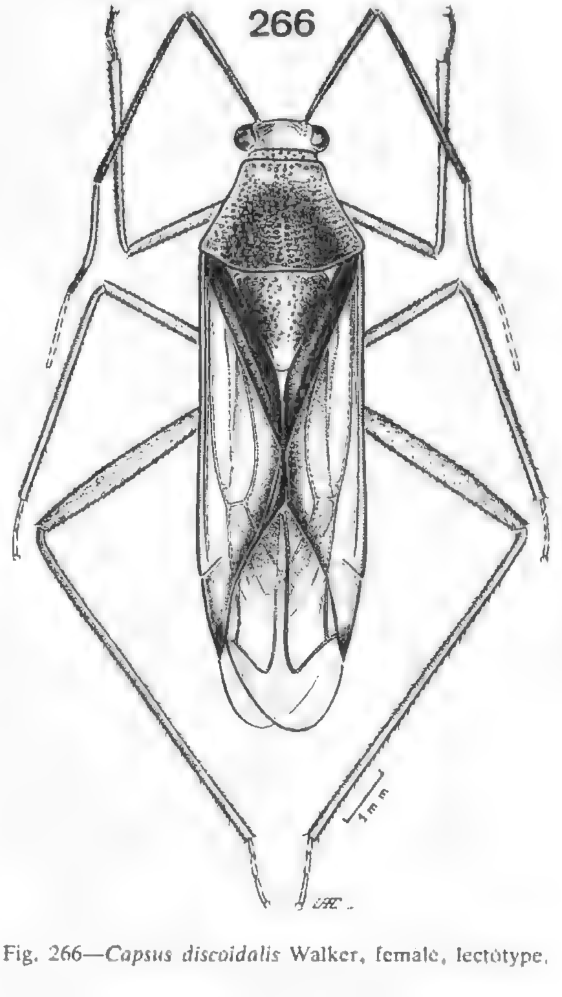
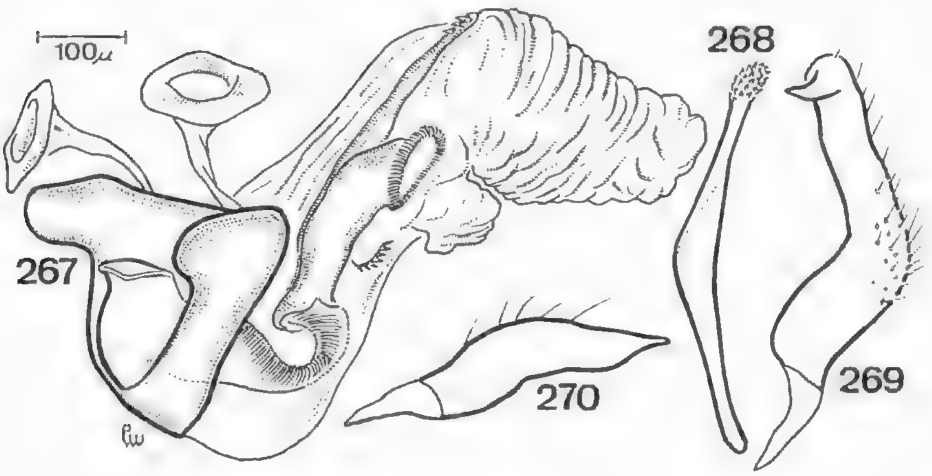


Fig. 266—*Capsus discoidalis* Walker, female, lectotype.



Figs. 267-270—*Macrolonius sobrinus* (Stal): Fig. 267—Penis; Fig. 268—Spiculum of vesica; Fig. 269—Left paramere; Fig. 270—Right paramere.

General coloration ochraceous to lutescent with brown to citrine areas; head, pronotum and scutellum lutescent to citrine, eyes and antennae (except base of segment III which is pale) castaneous, segment II darker towards apex; a central spot on disc of pronotum reaching posterior margin, clavus, two lateral spots on scutellum, corial commissure and inner apical margin of corium, outer margin of embolium and outer margin of cuneus, nervures of membrane fuscous to brown; cuneus and embolium lutescent, fuscous apically; clavus and cuneus opaque. Underside of body and legs pale yellow, hind tibiae brown, pale apically, tarsi fuscous.

Male: Similar to female in colour and general aspect, less robust.

Genitalia: Penis (fig. 267) with membranous lobes, fields of sclerotized teeth and a characteristic spiculum (fig. 268). Left paramere (fig.269) curved, pointed apically. Right paramere (fig. 270) small, tapering to apex.

Geographical distribution: Borneo, Java, Malacca, Singapore, Sumatra, Sarawak, Malay Peninsula.

Specimens studied: female, lectotype (new designation), SINGAPORE, Saunders, 65-13, type (printed on green-bordered disc), 286, *Capsus discoidalis*; id. paralectotype (abdomen, wings and hemelytra missing), Mal. CA. Saunders, 65-13 (BMNH); INDONESIA: Somgei, Lalah, Indragiri, Sumatra, W. Burchard, 26.viii.1901; EAST MALAYSIA: W. Coast Residence, Ranau, 500 m, 22-25.i.1959, T. C. Maa; id. 28.ix.1958; id. 30.iv.-5.x.1958; L. W. Quate; Ranai, 8 m N Paung Host Springs, 500 m, 8-11.x.1958, T. C. Maa (BISHOP) Sandakan, Baker, (USNM); PENINSULAR MALAYSIA: Pehang, F.M.S. Jerantut, March, 1927; Kuala Lumpar, March 27, 1932; SINGAPORE: Selitar, Aug. 1911 (BMNH).

Differs from *Macrolonius schenklingi* Poppius and *Macrolonius superbus* (Distant) by the colour of the head and pronotum.

Macrolonius superbus (Distant, 1904) Carvalho, 1952

Malalasta superba Distant, 1904b, p. 446, fig. 287.

Macrolonius superbus Carvalho, 1959, p. 323.

(Fig. 271)

Characterised by the colour of head and pronotum.

Male: Length 8·2 mm, width 1·7 mm. *Head:* Length 0·5 mm, width 1·2 mm, vertex 0·56 mm. *Antenna:* Segment I, length 2·0 mm; II, 3·4 mm; III-IV, broken. *Pronotum:* Length 1·5 mm, width at base 2·0 mm. *Cuneus:* Length 1·28 mm, width at base 0·32 mm (lectotype).

General coloration pale ochraceous to stramineous with black areas; head (except pale spots along inner margin of eyes), pronotum (except area of calli and pale marginal spot behind calli) black; scutellum ochraceous to pale with two longitudinal black spots (one at each side); hemelytra glassy, transparent, clavus and cuneus opaque, black to fuscous; membrane hyaline, nervures fuscous. Underside of body pale yellow, abdomen with a black transverse spot on each side, anterior margin of penultimate segment and some apical spots black; apices of posterior femora, extreme bases, apices and a central annulation to posterior tibiae, the antennae (except base of first and third joints basally) brown to fuscous.

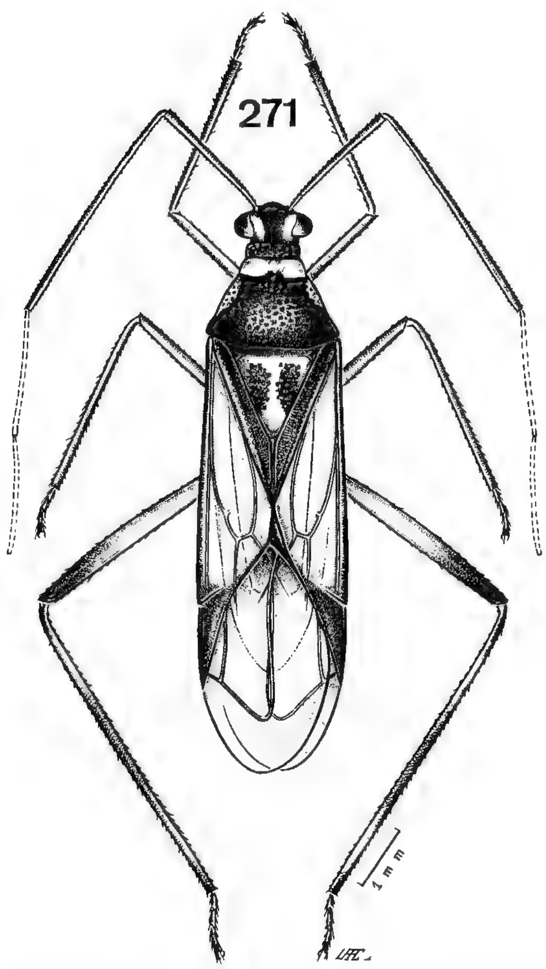


Fig. 271—*Malalasta superba* Distant, male, lectotype.

Pronotum not sinuated laterally, nervures of membrane superposing each other along median line.

Genitalia: Not dissected as the author had access only to the lectotype.

Female: Similar to male in colour and general aspect.

Geographical distribution: Burma.

Specimens studied: male lectotype (new designation), Tenass Valley, Myiita (Doherty), distant Col. 1913-383, type (printed in red bordered disc, *Malalasta superba* Distant (author's handwriting) (BMNH).

This species differs from *Macrolonius schenklingi* (Poppius) by the colour of head and lateral margins of pronotum.

Onomaus Distant, 1904

Onomaus Distant, 1904b, p. 416; Poppius, 1912a, p. 438; Carvalho, 1955, p. 107; Carvalho, 1959, p. 323.

Type-species: Onomaus pompeus Distant, 1904.

Body sub-elongate, smooth, with long and erect hairs on scutellum. Head slightly sulcate on vertex, hind border immarginate, eyes well separated from collar, placed near middle of head; antenna with segment I twice as long as width of head, cylindrical, segment II twice as long as I, shortly pubescent; rostrum reaching the posterior coxae.

Pronotum sub-triangular, constricted behind calli and narrowed anteriorly, collar also narrow, its mesal length about equal to thickness of first antennal segment, disc tumid, inclined forwards, posterior margin curved at lateral angles which are sub-prominent; scutellum tumid with long, erect pubescence, mesoscutum slightly exposed.

Hemelytra with lateral margin slightly sinuate, transparent, without nervures, cuneus about two and half times as long as wide at base, apex of large areola angulate, Legs long and slender, tibiae moderately spinulose.

Differs from *Rambea* Poppius, 1912 which has also a long first antennal segment and erect pubescence by the larger size and by the shorter pubescence on tibiae, as well as by the long cuneus.

Key to the species of the genus *Onomaus* Distant

1. Eyes situated at middle of head, space between eye and collar approximately equal to diameter of eye; species of medium size, less than 7 mm long . . . *elegans* Poppius.
   Eyes not situated at middle of head or if so then space between eye and collar less than diameter of eye; species over 7 mm long 2
2. Scutellum with a median longitudinal black vitta; species of large size (10 mm long) . . . . *pompeus* Distant
   Scutellum with three spots (one at apex and two lateral); species of medium size (8 mm long) . . . . . . *lautus* (Uhler)

Onomaus elegans Poppius, 1915

Onomaus elegans Poppius, 1915b, p. 6; Carvalho, 1959, p. 323.

(Fig. 272)

Characterised by the colour of pronotum and position of eyes on head.

Male: Length 6·2 mm, width 1·4 mm. *Head:* Length 0·4 mm, width 0·8 mm, vertex 0·36 mm. *Antenna:* Segment I, length 1·4 mm; II, 2·9 mm; III, 2·0 mm; IV, 1·8 mm. *Pronotum:* Length 1·0 mm, width at base 1·3 mm. *Cuneus:* Length 0·96 mm, width at base 0·40 mm.

General coloration pale yellow to stramineous with dark brown areas; head pale with extreme posterior margin of vertex, spots behind eyes and extreme apex of clypeus black; eyes brown, clypeus towards base, frons anteriorly, jugum, lorum with reddish tinge; antenna black, extreme base of segment I pale; posterior margin of collar, carina of lateral margin of pronotum anteriorly, two longitudinal median vittae, enlarged as a spot behind calli and at posterior margin of disc (divided by a longitudinal pale yellow narrow vitta), spots (one at each side) near humeral angles dark brown, area of calli, sub-median posterior area of disc and posterior margin of pronotum narrowly pale yellow; mesoscutum dark brown, scutellum pale yellow with a narrow longitudinal median vitta and apex black; hemelytra pale yellow, glassy, transparent, a basal spot, clavo-scutellar margin, sub-basal vitta on corium, apical spot on clavus, a characteristic sub-rectangular fascia or spot on corium, with anterior and posterior angles reaching outwards forming a semi-circle, inner and apical margin of cuneus brown; membrane transparent, pale with apical end dark. Underside of body pale yellow, propleura, a spot on meso and metapleura dark brown; abdomen pale yellow with basal portion, lateral spots and apex reddish; coxae and legs pale yellow, hind femora with two red rings (sub-median and apical).

Eyes situated at middle of head, distant from collar by a space approximately equal to diameter of eye.

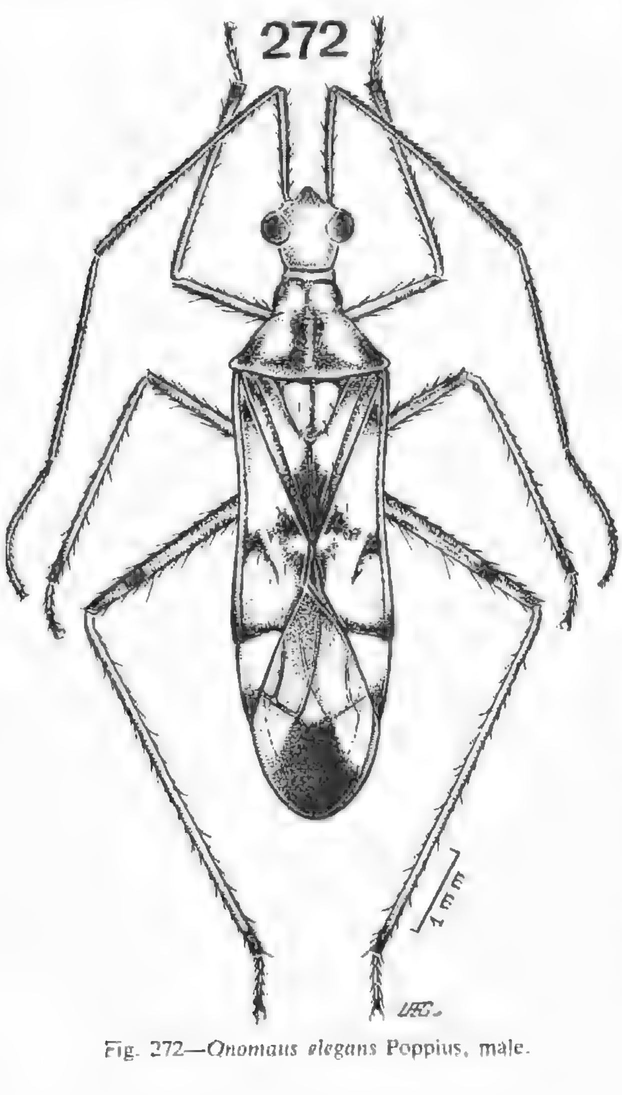


Fig. 272—*Onomaus elegans* Poppius, male.

Genitalia: Penis with membranous lobes provided with apical sclerotized teeth. Left paramere falciform, narrowing to extremity. Right paramere smaller, tapering to apex.

Female: Similar to male in colour and general aspect. Length 6·4 mm, width 1·4 mm, vertex 0·36 mm.

Specimens studied: two males and three females, UPPER BURMA: alt. 3 000 ft., Lat. N 27° 42′ Long. E 97° 54′, Nam Tamai Valley, 26.viii.1938, R. Kaueback, BM 1938-741 (BMNH and author's collection).

This species differs from *Onomaus pompeus* Distant, 1904 by its smaller size and by the colour of pronotum.

Onomaus lautus (Uhler, 1896) Poppius, 1912

Dicyphus lautus Uhler, 1896, p. 267.

Onomaus lautus Poppius, 1912a, p. 439; Carvalho, 1959, p. 323.

Dicyphus lautus Esaki et auct., 1952, p. 261, fig. 686.

(Figs. 273-276)

Characterised by the colour of scutellum and membrane.

Male: Length 8·0 mm, width 2·4 mm. *Head:* Length 0·6 mm, width 1·0 mm, vertex 0·44 mm. *Antenna:* Segment I, length 1·2 mm, II, 2·8 mm; III, 1·8 mm; IV, mutilated. *Pronotum:* Length 1·2 mm, width at base 1·8 mm. *Cuneus:* Length 1·20 mm, width at base 0·60 mm.

General coloration pale yellow with brown and reddish areas; head brown to black with a pale transverse spot on vertex; antenna castaneous, apical portion of segment II black, basal half of segment III pale; pronotum brown to dark brown, collar and a large spot on middle of disc pale yellow, the latter with a black, rugose spot at its middle; mesoscutum fuscous, scutellum pale yellow with basal angles and apex brown to black; hemelytra pale yellow with basal angles and apex brown to black; hemelytra pale yellow, glassy, transparent, clavus (except middle portion and apex), a quadrate spot on corium extending outwards to embolium (at middle of corium), extreme apex of corium and apex of embolium brown to castaneous or reddish; membrane with basal half of areolar area dark, the extrareolar portion fuscous with two pale spots at each side. Underside of body pale yellow, propleura black with lower area pale, a spot on metapleura fuscous; abdomen with segment II (first visible) and a longitudinal lateral vitta on segments III-VIII castaneous to reddish; femora reddish (except base and a narrow median ring), tibiae pale, base and apex reddish.

Genitalia: Penis (fig. 274) with membranous lobes provided with sclerotized apical teeth. Left paramere (fig. 275) falciform. Right paramere (fig. 276) with pointed apex.

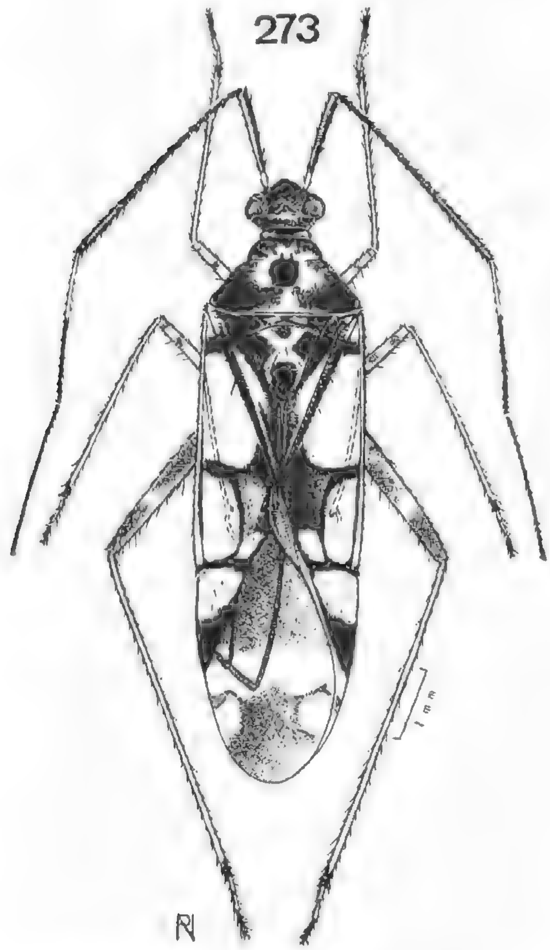


Fig. 273—*Onomaus lautus* (Uhler), female.

Female: Similar to male in colour and general aspect, slightly more robust.

Geographical distribution: Japan.

Specimens studied: two females and one male, JAPAN: Mitsukuri, Takao, vii.14.1930, J. L. Gressitt, in the collection of the author.

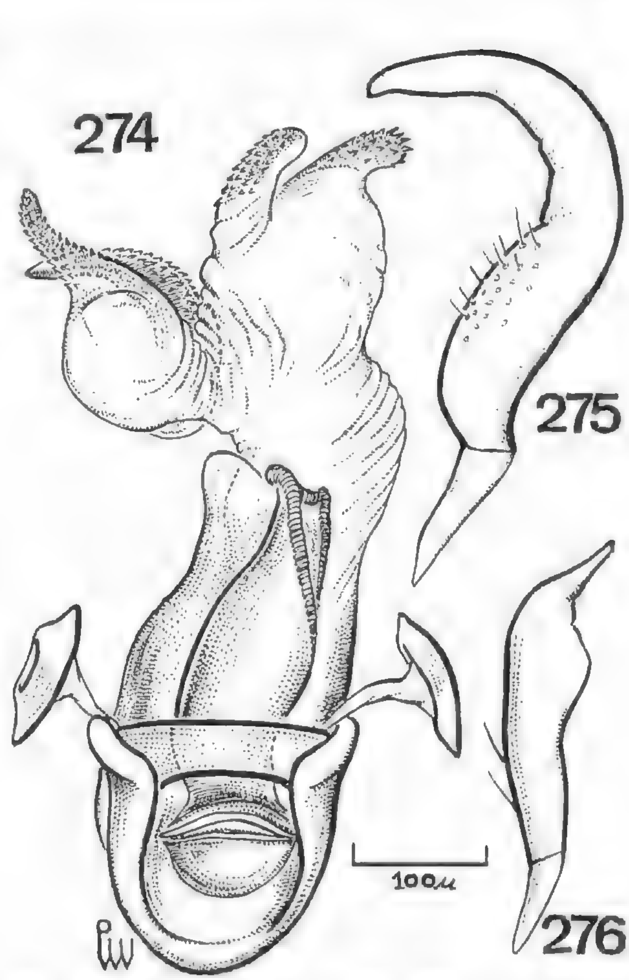
Differs from the two other species in the genus by the colour of the scutellum and membrane.

Onomaus pompeus Distant, 1904

Onomaus pompeus Distant, 1904b, p. 416; Carvalho, 1959, p. 323.

(Figs. 277-280)

Characterised by the large size and colour of pronotum and antenna.



Figs. 274-276—*Onomaus lautus* (Uhler): Fig. 274—Penis; Fig. 275—Left paramere; Fig. 276—Right paramere.

Female: Length 10·2 mm, width 2·6 mm. *Head:* Length 0·7 mm, width 1·2 mm, vertex 0·60 mm. *Antenna:* Segment I, length 2·3 mm; II, 4·0 mm; III, 3·4 mm; IV, 3·6 mm. *Pronotum:* Length 1·6 mm, width at base 2·6 mm. *Cuneus:* Length 1·52 width at base 0·64 mm (lectotype).

General coloration ochraceous to citrine or pale yellow with dark brown and reddish areas; head black with a semilunate wide pale vitta on vertex, antenna uniformily castaneous to dark brown, pronotum dark brown with collar, calli and a central spot on disc anteriorly pale, the latter with a rugose black spot at middle, bordering calli; mesoscutum fuscous, scutellum pale yellow with a median longitudinal vitta which enlarges and also covers the apex, fuscous; hemelytra ochraceous, glassy, transparent, clavus (central area castaneous), a transverse triangular fascia on corium extending outwards to embolium, extreme apex of corium, outer margin of embolium, apex of cuneous, nervures and extrareolar portion of membrane (except pale spot contiguous to apex of cuneous) fuscous to brown. Underside of body with external portion black, spots on coxal cleft 1, basilar plate and ostiolar peritreme pale; abdomen and femor reddish (except base and a

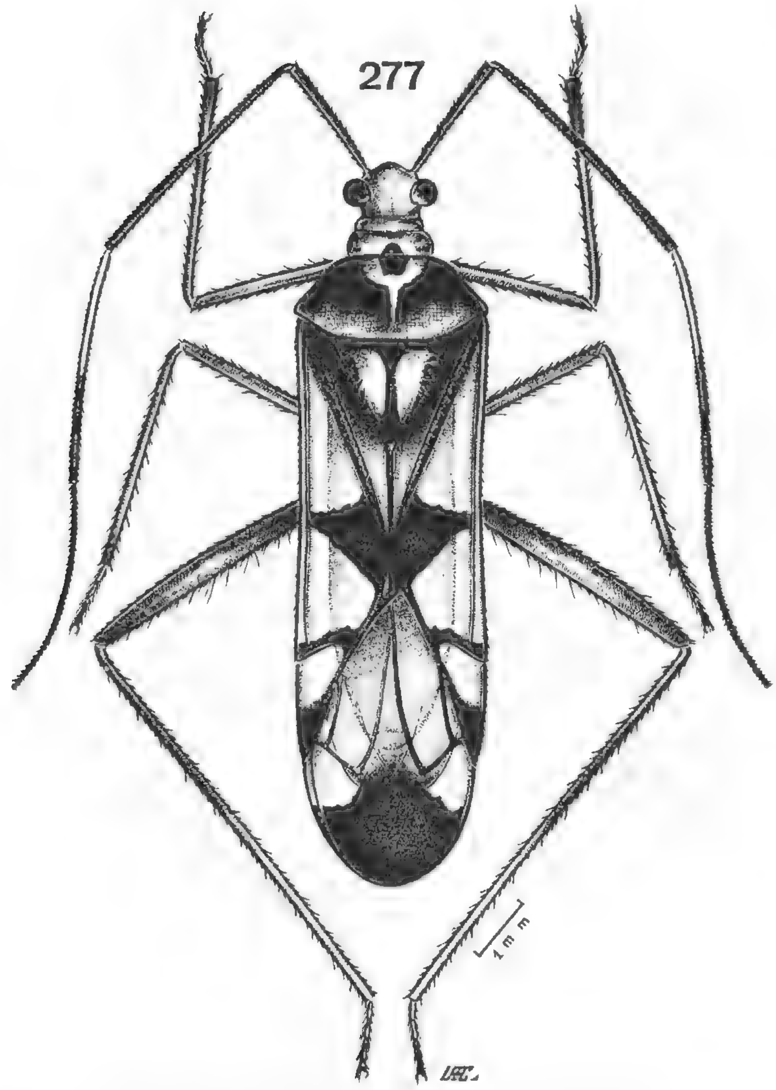


Fig. 277—*Onomaus pompeus* Distant, female, lectotype.

narrow ring at middle), tibiae I and II pale, infuscate apically, tibiae III fuscous on basal half, pale on apical half, segments III of tarsi fuscous.

Male: Similar to female in colour and general aspect, a little less robust.

Genitalia: Penis (fig. 278) with membranous lobes provided with sclerotized teeth apically. Left paramere (fig. 279) falciform. Right paramere (fig. 280) slender apically.

Geographical distribution: Burma.

Specimens studied: female, lectotype (new designation), BURMA, *Onomaus pompeus* distant (BMNH); five males and females, *BURMA:* Nam Tamai Valley, 29viii.1938, alt. 3 000 ft., R. Kaulback, B. M. 1938-741; Mishmi Hills, Lohit River, 30.iii.1935, M. Steele.

Differs from others in the genus by its large size and by the colour of pronotum and segment III of antenna.

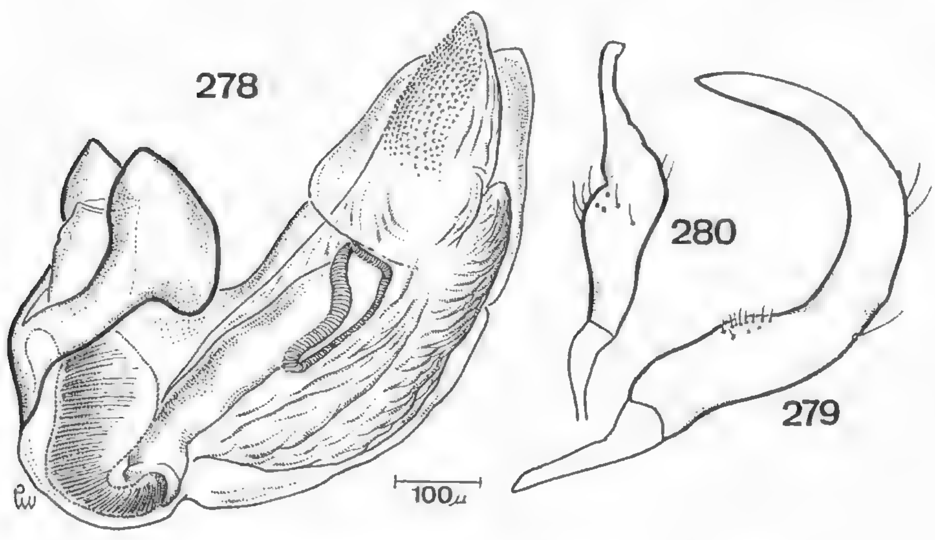
Rambea Poppius, 1912

Rambea Poppius, 1912a, p. 440; Carvalho, 1955, p. 107; Carvalho, 1959, p. 324.

Type-species: Rambea gracilipes Poppius, 1912.

Body elongate, clothed with long, erect pubescence. Head inclined, vertex sulcate longitudinally, slightly convex, gula long: eyes far removed from collar, seen from above small and rounded, placed at middle of head, seen from side obliquely ovate, post-ocular portion of head gradually but strongly narrowed; rostrum surpassing apex of posterior coxae; antenna linear, slender, segment II approximately twice as long as first.

Pronotum with disc strongly convex, posterior margin broadly rounded, lateral margins strongly sinuate behind calli, collar with mesal length nearly equal to thickness of first antennal segment, calli confluent, reaching side of pronotum, posterior margin broadly impressed, strongly punctate along



Figs. 278-280—*Onomaus pompeus* Distant: Fig. 278—Penis; Fig. 279—Left paramere; Fig. 280—Right paramere.

the impression together with collar forming an interior lobe about half as long as the posterior lobe; lateral margins and three longitudinal bands of posterior lobe silvery; scutellum triangular, strongly convex before apex, depressed and deeply medially bipunctate.

Hemlytra finely punctulate, semi-transparent, clavus and corium without nervures, claval suture strongly punctate, membrane bicellulate, transparent, inner margin of large areola rounded.

Legs long and slender, tibiae finely spinulose, parempodia divergent towards apices.

This genus differs from others in the tribe by the longitudinal silvery bands of the pronotum and by the long and erect pubescence of body and hind tibiae.

Key to the species of the genus *Rambea* Poppius

1. Second antennal segment with a broad ring beyond basal fourth; pronotum with three pale longitudinal bands on anterior portion of disc . . . . *annulicornis* Hsiao
   Second antennal segment unicolorous; pronotum with a single longitudinal vitta 2
2. Disc of pronotum greenish; globose area of humeral angles pale green . . . . *gracilipes* Poppius
   Disc of pronotum with a large dark brown spot; globose area of humeral angles with a black spot . . . . . *malasica* n.sp.

Rambea annulicornis Hsiao, 1944

Rambea annulicornis Hsiao, 1944, p. 373, Carvalho, 1959, p. 324.

(Figs. 281-284)

Characterised by the length and colour of second antennal segment.

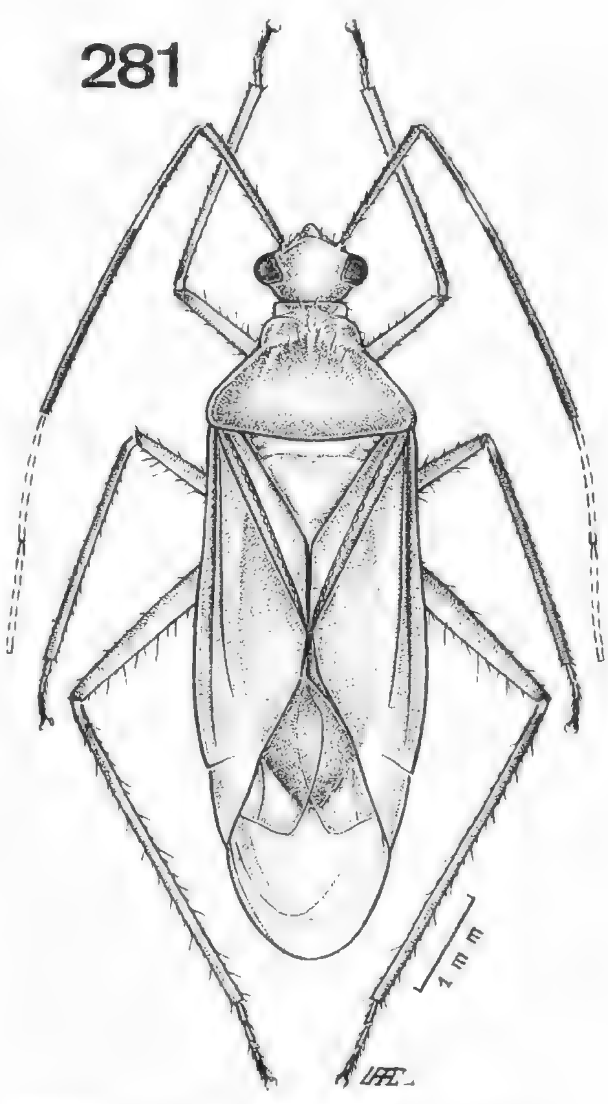
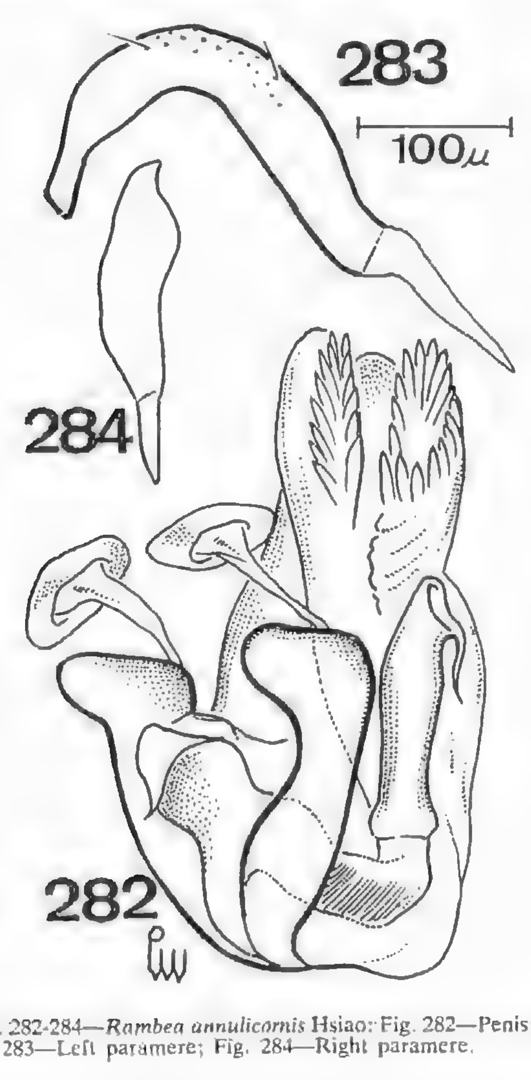


Fig. 281—*Rambea annulicornis* Hsiao, female, holotype.

Male: Length 6·3 mm, width 1·8 mm. *Head:* Length 0·6 mm, width 1·0 mm, vertex 0·50 mm. *Antenna:* segment I, length 1·3 mm; II, 2·8 mm; III, 2·1 mm; IV, 1·2 mm. *Pronotum:* Length 1·2 mm, width at base 1·8 mm. *Cuneus:* Length 0·60 mm, width at base 0·40 mm.

General coloration light greenish to stramineous; lorum and lateral margin of post-ocular part of head fuscous, antenna dark brown, segment I stramineous, a broad ring beyond basal fourth of second segment, basal fourth of third and basal fifth of fourth whitish; pronotum with lateral margins and three longitudinal silverybands on posterior lobe, seen from side, with a fuscous longitudinal line along the anterior half of lateral margin; hemelytra semi-transparent, emboliar margins narrowly fuscous, membrane transparent. Underside of body pale yellow, legs pale, base of tibiae white, extreme apex of femora, a narrow sub-basal ring of tibiae and third tarsal segments fuscous.

Morphological characters as mentioned for genus, pubescence long and erect, especially on pronotum, scutellum and base of hemelytra.



Figs. 282-284—*Rambea annulicornis* Hsiao: Fig. 282—Penis; Fig. 283—Left paramere; Fig. 284—Right paramere.

Genitalia: Penis (fig. 282) with membranous lobes provided with apical papillae. Left paramere (fig. 283) falciform. Right paramere (fig. 284) small, pointed apically.

Male: Similar to male in colour and general aspect.

Geographical distribution: Philippines.

Specimens studied: holotype, female, PHILIPPINES: Mt. Maquiling, Luzon, Philipines Islands (baker), *Rambea annulicornis* Hsiao (U.S.N.M. no. 56718). *Allotype and Paratypes:* Same data as types.

Differs from *Rambea gracilipes* Poppius, 1912 by the presence of a pale ring on the second antennal segment.

Rambea gracilipes Poppius, 1912

Rambea gracilipes Poppius, 1912a, p. 440; Carvalho, 1959, p. 324.

(Figs. 285-288)

Characterised by the colour of second antennal segment.

Male: Length 4·6 mm, width 1·6 mm. *Head:* Length 0·5 mm, width 0·9 mm, vertex 0·40 mm. *Antenna:* Segment I, length 1·4 mm; II, 2·4 mm; III-IV, broken. *Pronotum:* Length 1·0 mm, width at base 1·4 mm. *Cuneus:* Length 0·70 mm, width at base 0·28 mm (lectotype).

General coloration light greenish to pale yellow; head, collar, a longitudinal vitta at middle of disc, lateral margins, humeral angles, scutellum and underside of body whitish; base (on each side) and apex of clypeus, neck behind eye, lower margins of calli, a spot on humeral angles and an equivalent one laterally, as well as a spot on each side of base of abdomen fuscous to black; hind margins of calli, spots on each side of longitudinal pale vitta of disc, base and apex of cutellum, commissure and apex of clavus, inner and outer margins of embolium, outer margin of cuneus and nervures of membrane fuscous to brown, legs pale yellow.

Morphological characters as mentioned for genus.

Genitalia: Penis (fig. 286) with membranous lobes ended by papillae. Left paramere (fig. 287) falciform. Right paramere (fig. 288) small, simple.

Female: Similar to male in colour and general aspect. Length 6·0 mm, width 1·7 mm, vertex 0·40 mm.

Geographical distribution: Sumatra.

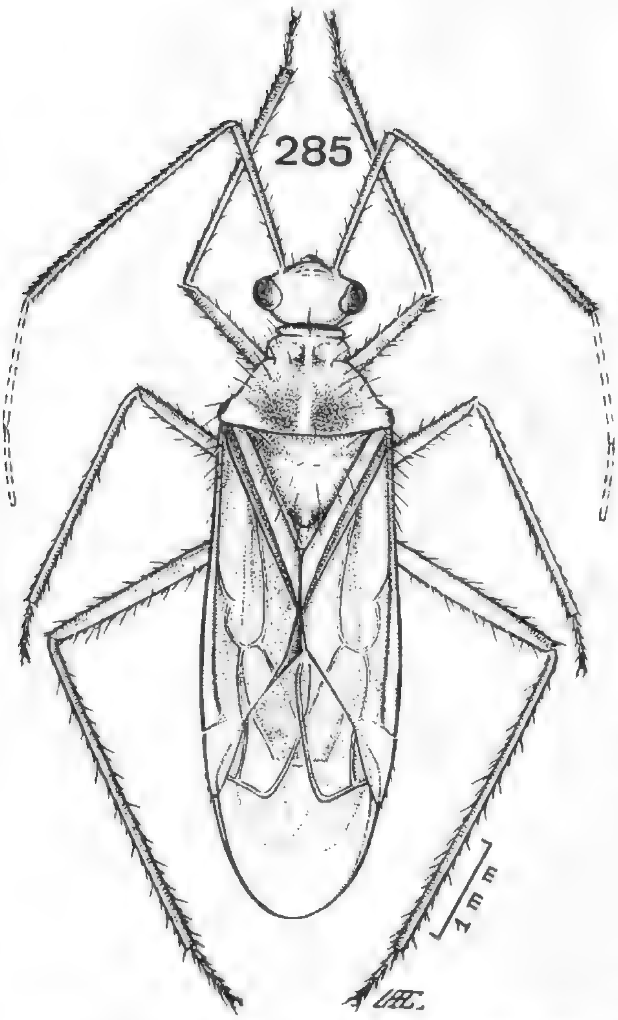


Fig. 285—*Rambea gracilipes* Poppius, male, lectotype.

Specimens studied: male, lectotype (new designation); INDONESIA: Si-Rambee, Sumatra, xii.1890, iii.1891, E. Modigliani (*Rambea gracilipes* Poppius) (HELSINKI); paralectotype, same data as male.

This species differs from *Rambea annulicornis* Hsiao, 1944 by the unicolorous second antennal segment and by the single longitudinal vitta on pronotum.

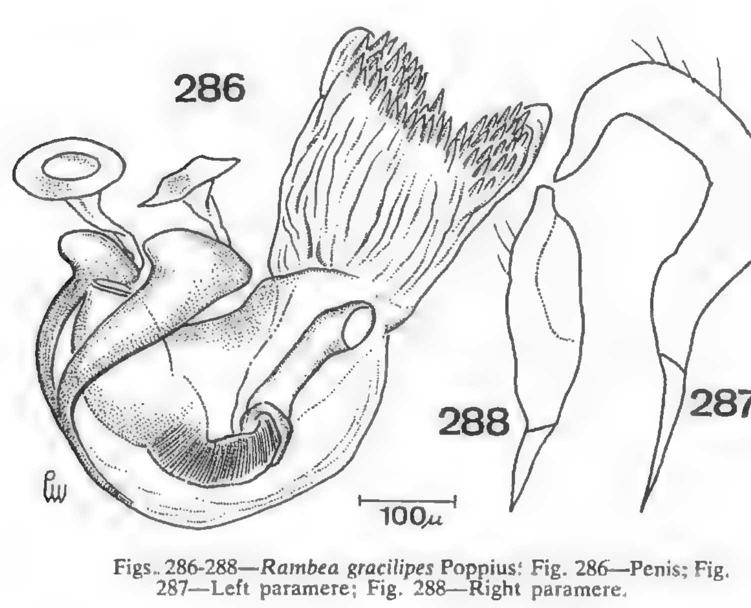
Rambea malasica n.sp.

(Figs. 289-292)

Characterised by the colour of pronotum and sterral area.

Male: Length 5·3 mm, width 1·4 mm. *Head:* Length 0·5 mm, width 1·0 mm, vertex 0·44 mm. *Antenna:* Segment I, length 1·5 mm; II, 2·6 mm; III, 1·9 mm; IV, ? mm. *Pronotum:* Length 1·2 mm, width at base 1·5 mm. *Cuneus:* Length 0·52 mm, width at base 0·28 mm (holotype).

General coloration pale greenish to pale yellow with brown and black areas; head pale, eyes brown, vitta on neck behind eye, jugum, lorum and gena fuscous; antenna fuscous, segment I and base of II pale; pronotum with area on lower lateral margins of calli and humeral angles black, collar with a median and two lateral fuscous bars anteriorly, a transverse fascia behind calli and a large V-shaped mark on disc, brown to dark brown, within the arms of the V-shaped mark and also humeral angles pale, the surface of disc around brown area with silvery pruinose colour; mesoscutum brown, scutellum pale



Figs. 286-288—*Rambea gracilipes* Poppius: Fig. 286—Penis; Fig. 287—Left paramere; Fig. 288—Right paramere.

with a fuscous preapical spot; hemelytra ochraceous, transparent, apex of corium, an obsolete transverse fascia on corium level with apical one fifth of clavus, corial commissure fuscous, nervures of membrane dark, the latter transparent. Underside of body pale yellow, a black spot above coxal cleft I and another on ostiolar orifice, legs pale yellow tending to fuscous on apices of femora.

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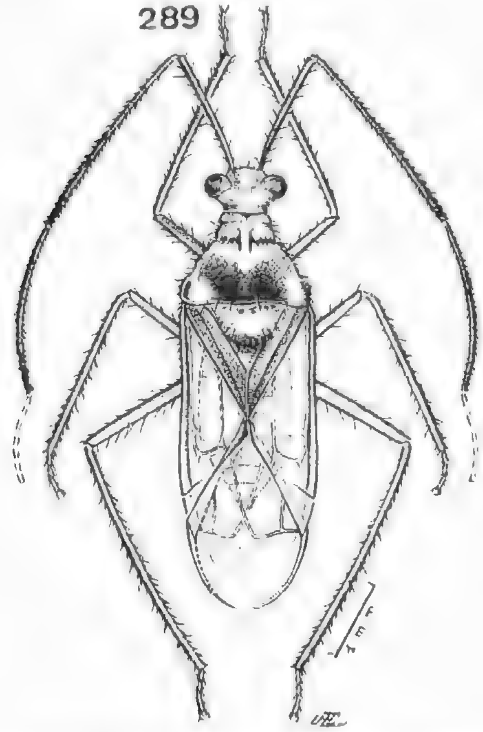
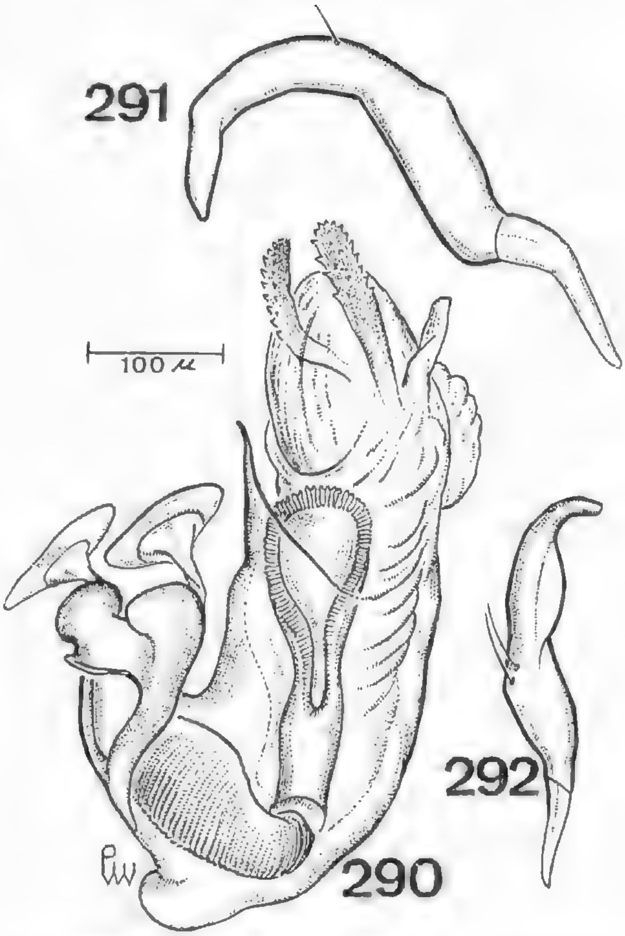


Fig. 289—*Rambea malasica* n.sp., male, holotype.



Figs. 290-292—*Rambea malasica* n.sp.: Fig. 290—Penis; Fig 291—Left paramere; Fig. 292—Right paramere.

Genitalia: Penis (fig. 290) with vesica provided with two spiculi with minute sclerotized teeth. Left paramere (fig. 291) falciform, as seen in figure. Right paramere (fig. 292) slender, with acute apex.

Female: Unknown.

Holotype: male, PENINSULAR MALAYSIA: Pahang, Gua'Ghe Yatim to Terrenggan, 17,xii,1951, L. W. Quate (BMNH).

Differs from *Rambea gracilipes* Poppius by the colour of the pronotum.

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