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A SYNOPSIS OF THE FROGS OF THE GENUS *HYLA* OF NORTH-WESTERN AUSTRALIA, WITH THE DESCRIPTION OF A NEW SPECIES

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Summary

In comparison with studies undertaken in other parts of Australia, the hylid frog fauna of the north-west has received little attention. The most recent checklists of the species of *Hyla* are those compiled by Moore (1961), recognizing six species in northern Western Australia and nine in the Northern Territory.The majority of species listed are widely distributed in Australia, but the recorded presence of *Hyla aurea* and *H. adelaidensis* in the Northern Territory evoked comment from Moore because the disjunct distribution conflicted with existing knowledge.

In a recent study Tyler (1968a) investigated the taxonomic status of the members of the *H. lesueuri* complex occurring in north-western Australia and described a new species apparently confined to the area. The possible existence of an endemic element within the hylid frog fauna has been reinforced by the subsequent collection of a further undescribed species.

This study has endeavoured to establish the number of species of *Hyla* occurring in the north-west and to compare their distribution patterns.

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INTRODUCTION

In comparison with studies undertaken in other parts of Australia, the hylid frog fauna of the north-west has received little attention. The most recent checklists of the species of *Hyla* are those compiled by Moore (1961), recognizing six species in northern Western Australia and nine in the Northern Territory. The majority of the species listed are widely distributed in Australia, but the recorded presence of *Hyla aurea* and *H. adelaidensis* in the Northern Territory evoked comment from Moore because the disjunct distribution conflicted with existing knowledge.

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This study has endeavoured to establish the number of species of *Hyla* occurring in the north-west and to compare their distribution patterns.

MATERIALS AND METHODS

The specimens reported are lodged in museum collections which are abbreviated in the text as follows:—British Museum (Natural History): B.M.; Museum of Comparative Zoology: M.C.Z.; National Museum of Victoria: N.M.V.; South Australian Museum: S.A.M.; United States National Museum: U.S.N.M.; Western Australian Museum: W.A.M. Letters preceding registration numbers are departmental catalogue references.

Methods of measurement and descriptive techniques conform to those used by Tyler (1968b). The following abbreviations appear in the text:—E-N/IN (ratio of the eye to naris distance to the internarial span); HL/HW (head length to head width ratio); HL/S-V (head length to snout to vent length ratio); TL/S-V (tibia length to snout to vent length ratio).

Issued 5 December, 1969

Hyla meiriana new species

Hyla adelaidensis, Mitchell (1955) p. 405, (1964) p. 339.

HOLOTYPE: S.A.M. R. 9082. An adult female collected at a rock pool 98 miles north of Mainoru, Northern Territory, by A. Fleming, R. Edwards and H. Bowshall on August 19, 1967.

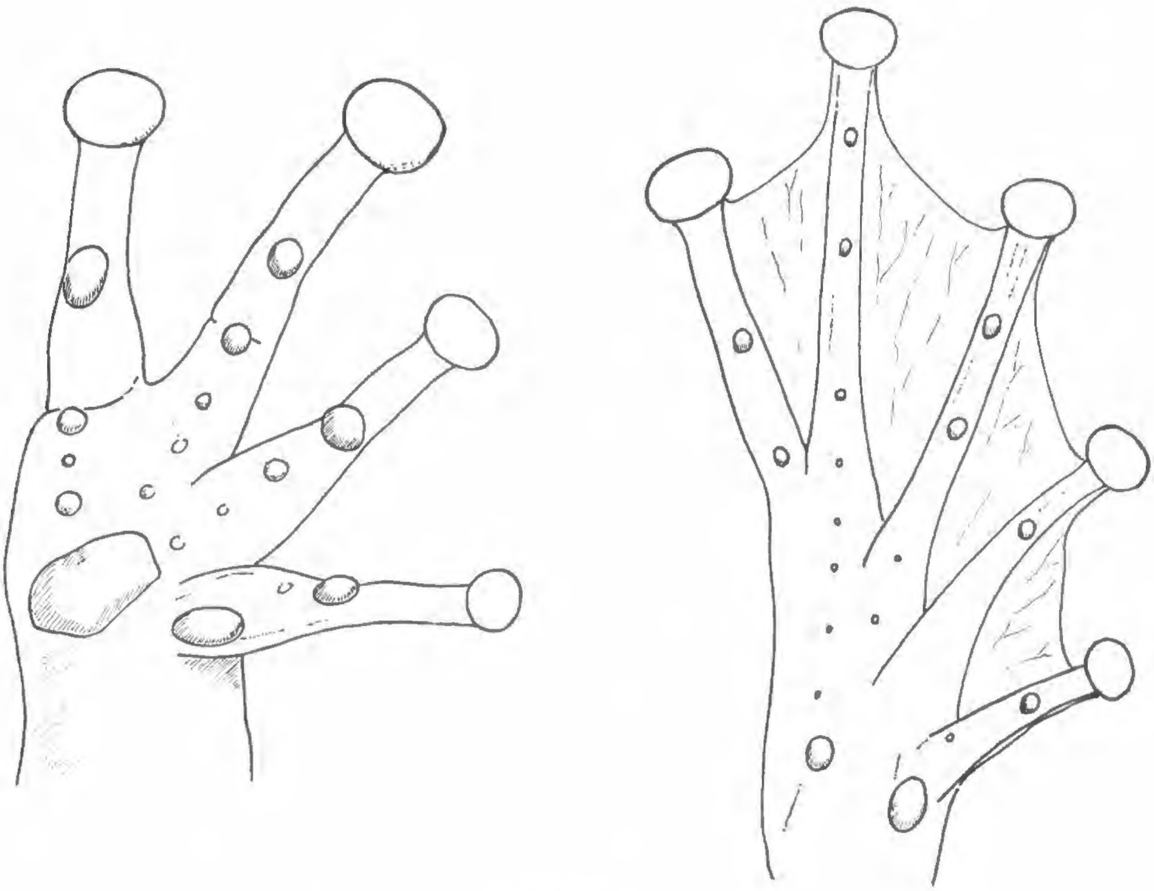

FIG. 1.
Hand and foot of *Hyla meiriana* sp. nov.

DEFINITION: An extremely small species with a maximum snout to vent length of 22.5 mm, characterised by an extremely high E-N/IN ratio (1.286-1.600), short and unwebbed fingers with prominent, transversely oval discs, and extensively webbed toes (the webbing reaching the base of the discs of all toes except the fourth).

DESCRIPTION OF HOLOTYPE: The head is longer than broad (HL/HW 1.097); its length equivalent to considerably more than one-third of the snout to vent length (HL/S-V 0.383). The snout is not prominent; it is rounded when viewed from above and rounded and projecting slightly in profile. The nares are high and oblique, their distance from the end of the snout less than that from the eye. The distance between the eye and the naris is considerably greater than the internarial span (E-N/IN 1.600). The canthus rostralis is poorly defined and slightly curved. The loreal region is concave. The eye is not prominent, its diameter slightly greater than the eye to naris distance. The tympanum is prominent, its diameter equivalent to two-thirds of the eye diameter and separated from the eye by a distance equivalent to approximately one-third of its own diameter. The vomerine teeth are in two raised and slightly oblique series. A line on a level with the posterior margins of the choanae would bisect them. The tongue is roughly circular and lacks a posterior indentation.

The fingers are rather short and are equipped with extremely narrow lateral fringes; in decreasing order of length 3> 4> 2> 1. There is no inter-digital webbing. The terminal discs are prominent and transversely oval in shape (Fig. 1).

The hindlimbs are long and slender with a TL/S-V ratio of 0.539. Toes in decreasing order of length 4> 5> 3> 2> 1. The interdigital webbing reaches the base of the terminal discs of all toes except the fourth where it extends as far as the subarticular tubercle at the base of the penultimate phalanx, and is united to the disc by a narrow lateral fringe (Fig. 1).

There are numerous broad, flattened, very poorly developed tubercles over the entire dorsal surface of the head and body. Each tubercle is composed of numerous small granules, particularly conspicuous in the sacral region. There is a very weak supratympanic fold obscuring the superior margin of the tympanic annulus. There is a prominent oval inner and a small but prominent rounded outer metatarsal tubercle. The throat, chest and lower surfaces of the limbs are smooth and the abdomen is granular.

DIMENSIONS: Snout to vent length 20.6 mm; tibia length 11.1 mm; head length 7.9 mm; head width 7.2 mm; eye to naris distance 2.4 mm; internarial span 1.5 mm; eye diameter 2.5 mm; tympanum diameter 1.6 mm.

In preservative the dorsal surface is dark brown with indistinct black markings surrounding the individual tubercles. When the skin is moist the granular areas within the tubercles possess a distinct metallic irridescence. The canthus rostralis bears a short blackish stripe, and heavy stippling on the mandibular margins produces a pattern of light and dark patches. The anterior and posterior surfaces of the thighs and the posterior surface of the tibia are strikingly variegated with black on a cream background. The throat and chest are uniformly stippled with black on a pale cream background and there is irregular stippling on the ventral surface of the thighs.

VARIATION: There are 32 paratypes collected at the type locality with the holotype:—S.A.M. R. 9014-34, 9074-81, 9083-85.

FIG. 2.
H. meiriana sp. nov.

Adult male paratypes have snout to vent lengths ranging from 16.2 mm to 18.2 mm, whilst the range for females is 17.6-20.7 mm. None of the females are gravid. In their proportions they exhibit only slight variation. The E-N/IN ratio is consistently high with a range of 1.286-1.563 and the mean 1.407. The head is longer than broad in all specimens with an HL/HW range of 1.057-1.222 and the mean 1.132. The TL/S-V range is 0.541-0.640 and the mean 0.584.

The colouration and pattern of markings of the paratypes closely resembles those of the holotype. Divergences worthy of note are the presence of a dark transocular bar in some specimens, and the fact that variegations on the lateral surfaces of the thighs frequently extend on to the dorsal surface.

An additional 34 specimens also represent this species: S.A.M. R. 3235, 9734; U.S.N.M. 12870-25, Oenpelli Creek, 5 miles S.S.E. of Oenpelli, N.T. S.A.M. R. 9097-9100, Kununurra, W.A. N.M.V. D. 10773-74, 10811-16, 10818-26, Jaspers Gorge, N.T. W.A.M. R. 13758, 13758 G-J, Kalumburu, W.A.

The four specimens from Kununurra have E-N/IN and HL/HW ranges within those of the paratypes, but the hind legs are shorter (the TL/S-V range being 0.476-0.556 with a mean of 0.515). One of these specimens (S.A.M. R. 9100) is the largest representative of the species being a gravid female with a snout to vent length of 22.5 mm. Another member of this series is depicted in Fig. 2.

The specimens from Jaspers Gorge differ from the type series in having more extensive webbing of the feet (reaching mid-way up the penultimate phalanx of the fourth toe), and in their colouration. The dorsum in this series is a much darker brown, with the dorsal surface of the thigh similar to the colour of the head and back (the light markings on the posterior face do not extend upon it). The ventral surfaces are much more heavily and extensively marked; the throat is usually a uniform dark brown and only infrequently stippled with brown, and the ventral surface of the thighs is suffused with brown in most specimens.

COMPARISON WITH OTHER SPECIES

Of the Australian species with completely unwebbed fingers the only one whose adults are within the size range of *H. meiriana* is *H. microbelos* of Queensland. A single specimen has been available for comparison (M.C.Z. 70013), an adult male collected at Cooktown which is approximately 100 miles north of the type locality (Cairns).

Hyla meiriana may be distinguished by the presence of vomerine teeth and outer metatarsal tubercles (absent in *H. microbelos*) and by its more extensively webbed toes. In preservative *H. meiriana* has a dark brown dorsal ground colouration and striking post-femoral markings, whereas *H. microbelos* is a very pale grey and lacks these markings.

Of the Papuan species *H. dorsalis* attains a similar adult size but may also be distinguished by having less extensive webbing between the toes, as revealed by comparison of Fig. 1 with the illustration of *H. dorsalis* provided by Tyler (1968b, Fig. 25). The shape of the snout differs in being evenly rounded and not particularly prominent, whereas in *H. dorsalis* it is pointed and projecting. None of the 62 specimens of *H. meiriana* examined bear the median, longitudinal, pale brown band visible on the dorsum of *H. dorsalis*.

HABITAT

The type locality is an aboriginal ceremonial wind-dreaming site 98 miles north-east of Mainoru in an area where the annual rainfall is approximately 50-60 inches. The pool is located on a sandstone plateau on which there are occasional outcrops of exposed quartzite. The vegetation surrounding the pool consists predominantly of sparse eucalypts and clumps of coarse grasses near the water, with occasional *Pandanus* and paper bark trees on the periphery. The bed of the pool is completely free of silt and the water is described as crystal clear and extremely soft.

Messrs. J. Coventry and C. Tanner, who obtained the series at Jasper's Gorge, noted that there the species was living in red silt in rock pools.

FIELD NOTES

The type series was collected at night at the edge of the water. The collectors noted that whereas other species occurring at the same site (*Hyla latopalmata* and *H. wotjulumensis*) jumped into the water when disturbed, the *H. meiriana* moved away from the water on to the dry slopes where they sought refuge amongst the vegetation.

DISTRIBUTION

Hyla meiriana is currently known from five localities in the Northern Territory and Western Australia. The nature of the terrain is such that this species probably occurs in numerous disjunct populations completely isolated from one another.

NORTHERN TERRITORY RECORDS OF *HYLA AUREA* AND *H. ADELAIDENSIS*

Moore (1961) reported the presence in the British Museum collection of seven specimens of *H. aurea raniformis* from Port Essington that had previously been examined by Gunther (1858), Boulenger (1882) and Parker (1938). Moore (1961, p. 319) stated, "I would not believe the locality to be correct, were it not for the fact that Copland (1957) has seen specimens from Darwin, and Loveridge (1949) had specimens from Knuckey's Lagoon, which is 9 miles from Darwin".

The Darwin specimens which Copland (1957, p. 58) includes in his list of the *H. aurea raniformis* which he examined are N.M.V. D5529-30. The former bears a tag labelled "*Phractops* sp.," but lacks an identification in the museum register. The latter is labelled, "*Hyla* sp. young," and is registered as, "*Hyla* sp.". For reasons which are not apparent both were despatched to Copland in 1956 as examples of *Hyla aurea*. D5529 is a representative of *Limnodynastes ornatus*, and D5530 a *Crinia* sp. As there are no other frogs in the N.M.V. collection from the vicinity of Darwin labelled *aurea*, the inclusion of these registration numbers in Copland's list can be attributed to a clerical error, and this particular record discounted.

Loveridge (1949) provided a brief description of the specimens from Knuckey's Lagoon (M.C.Z. 25994-5) commenting that they were too shrivelled to merit measuring. Examination has shown them to be examples of *Cyclorana dahli*.

The presence of *Hyla aurea* in the Northern Territory therefore rests solely on the British Museum series (B.M. 1936. 12.13.135-141). This is not the only species whose presence in the Northern Territory has been queried (Glauert, 1947), and it is pertinent to note that all of the specimens involved were reported to have come from the same locality (Port Essington) and the same source (Dr. Fleming). In view of the identity of the specimens on which the subsequent reports were based it would seem justifiable to now remove *H. aurea* from the Northern Territory checklist.

With the exception of the reports of *aurea* from the Northern Territory considered above, the only additional record for any of the species first cited by Gunther (1858) is probably that of *Hyla adelaidensis* reported by Mitchell (1955, 1964). The specimens involved have been examined and are considered to represent the new species *Hyla meiriana*.

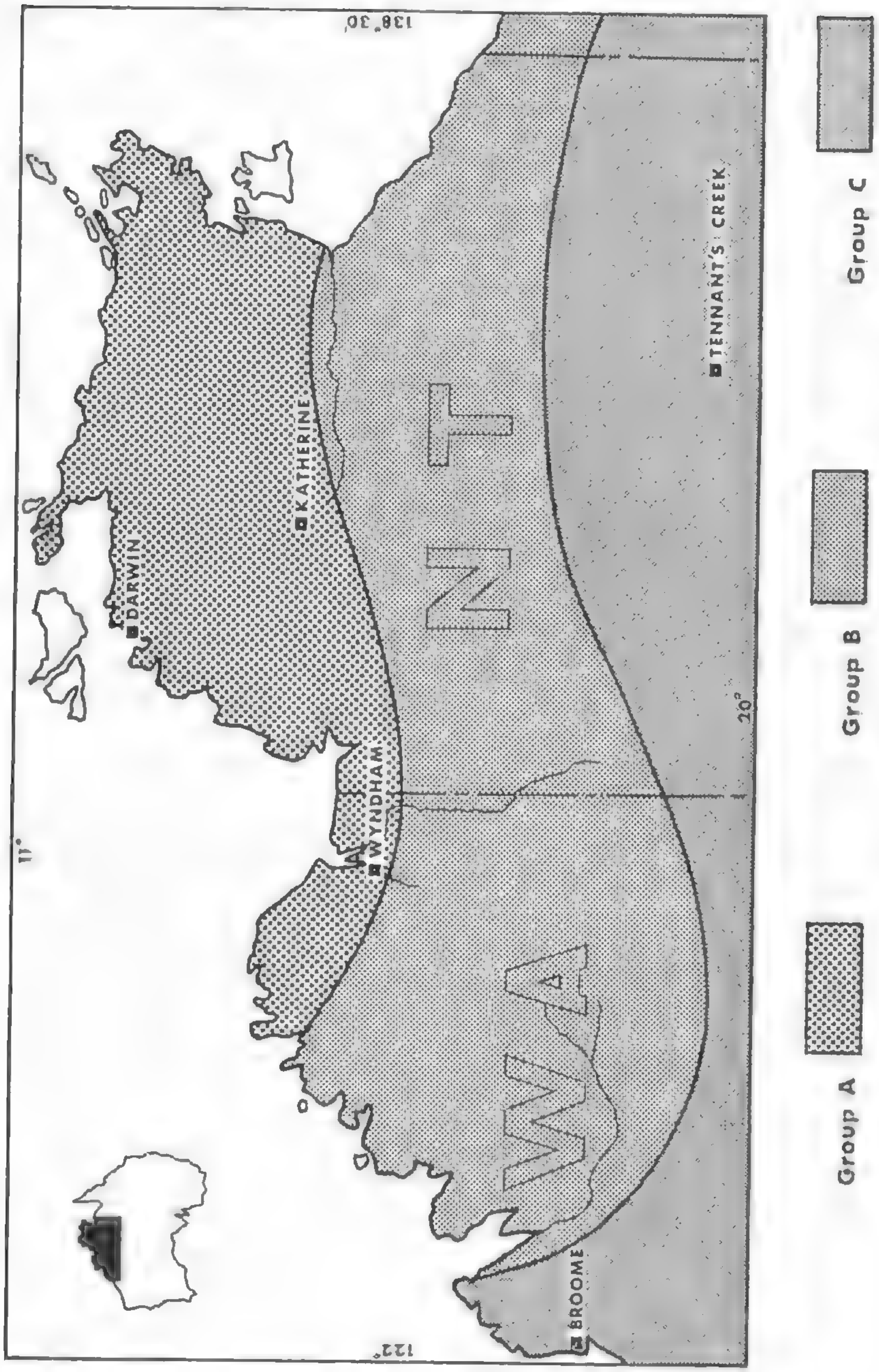

FIG. 3.
Distribution patterns of north-western *Hyla*.

REVISED HYLID CHECKLIST

(All species occur in northern Western Australia and the Northern Territory)

Hyla bicolor (Gray).
Hyla caerulea (White).
Hyla coplandi Tyler.
Hyla latopalmata (Gunther).
Hyla meiriana new species.
Hyla nasuta (Gray).
Hyla peroni (Tschudi).
Hyla rubella Gray.
Hyla wotjulumensis Copland

PATTERNS OF DISTRIBUTION

The hylid frogs occurring in north-western Australia can be divided into three groups according to their respective patterns of distribution. The groups and their member species are as follows:

GROUP A: Species which are confined to areas with an annual rainfall exceeding 30 inches (*H. bicolor, H. meiriana, H. nasuta*).

GROUP B: Species which extend from the coast to approximately the level of the twenty-inch isohyett (*H. coplandi, H. latopalmata, H. peroni, H. wotjulumensis*).

GROUP C: Species which are widely distributed throughout the entire area and extend into the arid parts of Central Australia with an annual rainfall of less than ten inches (*H. caerulea, H. rubella*).

The first two groups form quite distinctive units but the third consists of a pair of species which are so widely distributed and so morphologically variable that each may ultimately merit sub-division.

The paucity of specimens from north-western Australia permits only the broadest generalisations concerning distribution. At localities such as Wotjulum, north of Kings Sound in Western Australia where several fairly extensive collections have been made, eight of the nine species listed above have been found, and the general pattern appears to be one of a gradual reduction in the number of species away from the high rainfall coastal localities. Thus all species occur in the area to which GROUP A are confined, and members of GROUP C share the area occupied by GROUP B (Fig. 3). The rather ubiquitous distribution of the species in GROUP C affects the interpretation of these patterns. It is therefore relevant to briefly summarize the problems involved.

The status of the Central Australian population of *Hyla caerulea* has been the subject of controversy. Spencer (1896) considered it a distinct species which he described as *H. gilleni*. Copland (1957) relegated it as a sub-species of *caerulea*, and Moore (1961) failed to find grounds for even the recognition of sub-species. The most recent contributor (Mertens, 1964) has resurrected *caerulea gilleni*.

A comparable situation exists in the case of Leptodactylid with a similar distribution pattern (*Limnodynastes ornatus*). Parker (1940) described *L. spenceri* from Central Australia, distinguishing it from the coastal *ornatus* by its more extensive toe webbing. Moore (1961) suppressed *spenceri*, but subsequent contributors (with the exception of Warburg, 1967) have not adopted this proposal.

Another species which has a similar distribution is *H. rubella*. Specimens from low rainfall areas tend to be larger, have broader heads and more highly developed lateral digital fringes than those from peripheral high-rainfall areas. However, there has not been any proposal that they should merit taxonomic recognition at the specific or sub-specific level.

Examination of north-western specimens of *caerulea* and *rubella* indicate that if distinct central and peripheral populations are recognized, the southern boundary of the latter is similar to that of the species in GROUP B, but for the purpose of the present discussion no subspecies are recognized.

The hylid fauna of the north-western Australia has hitherto (by implication if not by specific statement) been regarded as simply an extension of the fauna of the north-east, with a gradual westward reduction in the number of species. Utilizing the basic zoogeographical patterns of distribution of frogs adopted by Moore (1961), the north-western *Hyla* would be divided into the Centralian species (corresponding to GROUP C), and those confined to the "north-east crescent" (all remaining species). Of those in the latter category, only *latopalmata* and *peroni* exhibit a continuous range across the north of the continent, and then southwards along the eastern seaboard. *Hyla bicolor* and *nasuta* range over the same area, but (as suggested by Moore, 1961) they are probably separated into two disjunct populations, having yet to be reported from the southern margin of the Gulf of Carpentaria. This area may not be a barrier to *wotjulumensis*, and it is possible that this species occurs in north-western Queensland.

There is now an indication that the north-west possesses a distinctive endemic element in its hylid frog fauna. Intensive collecting is needed to establish the geographical distribution of the endemic species more precisely, but at present potential support for the recognition of north-western Australia as a separate unit within the Torresian zone is indicated.

SUMMARY

Hyla meiriana new species is described and reported from five localities in the Northern Territory and Western Australia. Recent records of *H. adelaidensis* and *H. aurea* in the Northern Territory are demonstrated to be based on misidentified specimens. A checklist of north-western *Hyla* is presented and distribution patterns of the component species are discussed.

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For the loan of the specimens cited in this paper I am indebted to Miss J. M. Dixon (National Museum of Victoria), Dr. J. A. Peters (United States National Museum), Dr. G. Storr (Western Australian Museum), and Dr. E. E. Williams (Museum of Comparative Zoology). I am further indebted to Miss Dixon for abstracting data from her departmental registration catalogue.

Mr. W. Harrington generously undertook the preparation of Fig. 3 and I am also indebted to Mr. R. Ruehle for Fig. 2.

I would like to express my thanks to Mr. K. Cole and Messrs. R. Edwards, H. Bowshall and A. Fleming for their collections obtained at Kununurra and Arnhem Land respectively, and for detailed information on the type locality of the new species.

Finally my thanks are due to the Director and Board of the South Australian Museum for the provision of laboratory and secretarial facilities, and to Mr. F. J. Mitchell for advice and constructive criticism of the manuscript.

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AN ANNOTATED CATALOGUE OF THE OTITIDAE (sens. lat.) (DIPTERA) RECORDED FROM AUSTRALIA, INDONESIA AND THE PACIFIC ISLANDS

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Summary

The aim of this catalogue is to provide a list of all the described species of Otitidae recorded from the area detailed below, together with all published taxonomic references to them. The catalogue inclues all species described up to the end of 1964, and every reference mentioned has been read by the author.

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1. INTRODUCTION

The aim of this catalogue is to provide a list of all the described species of Otitidae recorded from the area detailed below, together with all published taxonomic references to them. The catalogue includes all species described up to the end of 1964, and every reference mentioned has been read by the author.

Although it is well over 100 years since the first species were described from the area, confusion of genera, species, and their respective distributions still exists. The vast taxonomic literature on the family is scattered both in time, and in a wide range of publications, and is in a variety of European languages; few collections of otitid material in institutions have received modern taxonomic study; and some types of genera and species were described, at the time, in a few lines sufficient for their validation, but wholly inadequate for recognition purposes. Where such genera and species occur in this catalogue, a note at the end of each points out the difficulties encountered and directs attention to the most fruitful lines to be followed in order to clear up doubts. As would be expected with small insects, practically every large collection of the family contains undescribed species.

The selected area corresponds with no accepted geographic region. It was chosen primarily because of the author's interest in the sub-family Platystominae which appears to have evolved in the area, and to which, most of its members are naturally confined. The area is extensive: on the west and east, it is bounded by the 90°E and 135°W meridians, respectively; its north and south limits are latitudes 30°N and 60°S. No part of mainland Asia is included; where such is referred to, it is because the distribution of certain species extends from adjacent land masses to the mainland. The land masses of the area are thus Australia and New Zealand, Indonesia, the Australian mandated territories of Papua and New Guinea, the Philippine Islands, and the numerous scattered islands of the western Pacific Ocean.

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6 March 1970

2. SOURCES

This catalogue is based on the work of Hendel who, in several fascicles of *Genera Insectorum* (notably No. 157, Hendel, 1914a) and in his *Die Arten der Platystominen* (Hendel, 1914b), reviewed all the species of which he was aware up to that time. To these, I have added species overlooked by him, corrected names where these have later been shown to be in error, and have added species described since then chiefly by American and European workers to whom material was submitted for identification either by private persons or scientific expeditions. The results of several European scientific surveys have also been incorporated.

Comparison of Hendel's two texts referred to above shows that he intended publication of *Die Arten der Platystominen* to precede that of fascicle 157 of *Genera Insectorum*, since, in the former he described his new genera and species, and referred to them in the latter as already published. As it so happened, however, fascicle 157 of *Genera Insectorum* was published on 15th April, 1914 while *Die Arten der Platystominen* was not published until 15th June of the same year. This resulted in all of Hendel's new names in *Genera Insectorum* being *nomina nuda* which were not validated until the later publication of *Die Arten der Platystominen* (*Abh. zool-bot Ges. Wien* 8). The possibility of prior publication by others therefore exists. While this possibility is a remote one, it still should be borne in mind by anyone working on the family.

Hendel's work laid the foundation on which later taxonomists have built. His ability to find morphological characters for delimiting genera, and to make clear the relation of one genus to another, were gifts of a high order. He did, however, have occasional lapses, as, for example, in re-allocating some of the earlier workers' species to the genera he accepted. He seems, not infrequently, to have seen neither the types, nor specimens known to be conspecific with them, and the original descriptions, which he often quotes *verbatim*, were his only guide. These descriptions, written before modern concepts of generic and specific limits had been elaborated, were, all too frequently, insufficient for identification purposes. Such blemishes may possibly be attributed to the disturbed conditions prevailing in Europe at the time he was preparing his works for publication. While these doubtful species are here included as Hendel placed them, they should preferably be treated as "genus unknown", until their placement is either confirmed, or they can be placed in their correct genera by future workers.

To avoid repetition, citation of Hendel's two major works, in the body of the text, indicates that references to a genus or species published before 1914 will be found therein. *Die Arten der Platystominen* is abbreviated to Hendel 1914a and fascicle 157 of *Genera Insectorum* to Hendel 1914b.

The number following each corresponds with the pagination. This has enabled me to reduce references to works published just before 1914, too late to be included by him, and to those which have been published since.

Students of the Otitidae of Australia and New Guinea will find the series of papers by J. R. Malloch in *Proc. Linn. Soc. N.S.W.* essential. In addition to the genera and species from this area listed by Hendel, Malloch includes a considerable number of genera and species described by himself and others after 1914.

3. NOMENCLATURE

At the present time the nomenclature of the Otitidae is receiving new study. Hendel treated the group as a single family consisting of several subfamilies; the modern trend, as exemplified by Steyskal in the U.S.A., is to raise some, at least, of these to family status. To what extent this lead will be followed, the future alone can decide. In these circumstances, the author has retained the Hendelian system; in practice, this will cause no difficulties for workers in the group.

The sub-family, Platystominae (family Platystomatidae of Steyskal), with 423 described species, is the dominant one in the area, to which nearly all of these species are endemic. In addition, 19 species of other sub-families (Otitinae, 1; Ulidiinae, 18), have been recorded.

Of these 19 species, six are known to be introductions, and some degree of doubt attaches to the remainder. The position is further confused by misidentifications through which species not occurring in the area have been recorded as so doing. The probability is high that some records may still be based on misidentifications.

In this catalogue, the arrangement and numbering of genera are those used by Hendel in fascicles 157 (1914, Platystominae) and 106 (1910, Ulidiinae) of *Genera Insectorum*. Missing numbers represent genera none of whose species have been recorded from the area. This applies, for example, in the Platystominae, to the first eight genera: the list thus begins with Hendel's genus No. 9.

A letter following a number indicates that the genus has been erected since Hendel's work was published, or is one of which he was unaware when he wrote. An asterisk preceding a specific name indicates an "Australian" species, that is, one recorded from Australia, or New Guinea and its adjacent islands.

Within genera, species are arranged in alphabetical order.

Family: OTITIDAE

Type genus: *Otites* Latreille, 1804 *Nouv. Dict. Hist. nat.* 24: 196.

I. Sub-family: PLATYSTOMINAE

Type genus: *Platystoma* Meigen, 1803 *Mag. Insektenkunde* (*Illiger*) 2: 277.

NOTE: Both Curran (1934) and Malloch (1939) claimed that *Platystoma* was not available for use in the Diptera since it "is pre-occupied in Mollusca." Neither gave any reasons for making this assertion, nor referred to any authority. In Neave (*Nomenclator Zoologicus* 3: 802-803), *Platystoma* Meigan, 1803 pre-dates, by many years, the earliest of the six later applications of *Platystoma* to other animal groups. Steyskal in all his publications uses *Platystoma* without any query as to the correctness of such usage, and the name was accepted by workers who preceded Curran (*e.g.*, Williston, 1888 and later editions; Hendel A, B). In these circumstances, Curran's statement appears to be incorrect; Malloch apparently followed him without checking the correctness of the statement since he used the exact wording of Curran.

GENERA

9. Genus: **POECILOTRAPHERA** Hendel, 1914

Hendel, 1914a *Gen. Ins.* 157: 33.

Type species: *Urophora taeniata* Macquart, 1843.

1. **P. taeniata** (Macq. 1843)

Urophora taeniata Macq., 1843 *Dipt. exot.* **2**: 222 Pl. 30, Fig. 6. Bezzi, 1913 *Mem. Indian Mus.* **3**: 80 (No. 259).

Poecilotraphera taeniata (Macq. 1843), Hendel, 1914b :21; 1914a :33. Enderlein, 1924 *Mitt. Zool. Mus. Berlin* **11**: 100.

Distribution: Borneo, Java, China.

The only other described species is *P. comperei* (Coq. 1904) from India.

11. Genus: **XIRIA** Walker, 1857

Xiria Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 36.

Type species: *Xiria antica* Walk., 1857.

Hendel, 1914b :24; 1914a :35.

1. **X. antica** Walker, 1857

Xiria antica Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 36 Pl. 2, Fig. 2. Bezzi, 1913 *Mem. Indian Mus.* **3**: 67 (No. 20). Hendel, 1914b :24; 1914a :37.

Distribution: Sumatra.

2. **X. clarissa** Frey, 1930

Xiria clarissa Frey, 1930 *Notul. ent. Helsingf.* **10**: 62 Pl. 1, Fig. 7.

Distribution: Philippines.

3. **X. lavinia** van der Wulp, 1898

Xiria lavinia v. d. Wulp, 1898 *Tijd. Ent.* **51**: 210 Pl. 10, Figs. 8, 9. Enderlein, 1912 *Zool. Jahrb.* **33**: 361. Hendel, 1914b :25; 1914a :37.

Distribution: Java, Sumatra.

4. **X. limbata** de Meijere, 1924

Xiria limbata de Meijere, 1924 *Tijd. Ent.* **67** (Suppl.): 40.

Distribution: Sumatra.

5. **X. obliqua** Osten-Sacken, 1881

Xiria obliqua Osten-Sacken, 1881 *Ann. Stor. nat. Mus. Genova* **16**: 463. Hendel, 1914b :25; 1914a :37.

Distribution: Sumatra.

*6. **X. papuana** Hennig, 1940

Xiria papuana Hennig, 1940 *Arb. morph. Taxon. Ent. Berl.* **71**: 316.

Distribution: New Guinea.

*7. **X. strigata** Hennig, 1940

Xiria strigata Hennig, 1940 *Arb. morph. Taxon. Ent. Berl.* **71**: 317.

Distribution: New Guinea.

8. **X. violacea** (Wied., 1830)

Trypeta violacea Wied., 1830 *Ausser. Zweifl. Ins.* **2**: 476. Bezzi, 1913 *Mem. Indian Mus.* **3**: 81 (No. 281).

Xiria violacea (Wied., 1830) Hendel, 1914b :26; 1914a :37.

Distribution: Java, Sumatra.

12. Genus: **LASIOXIRIA** Hendel, 1914 (Monotypic)

Hendel, 1914a *Gen. Ins.* **157**: 37.

Type species: *L. hirsuta* Hend. 1914.

Hendel, 1914b :28.

*1. **L. hirsuta** Hendel, 1914

Lasioxiria hirsuta Hendel, 1914b :28; 1914a :37. Malloch, 1939 Proc. *Linn. Soc. N.S.W.* **64**: 101.

Distribution: New Guinea.

Malloch, 1939 suggested that *Lasioxiria* might be a synonym of *Dasyortalis* Hendel, 1913.

13. Genus: **CONICIPITHEA** Hendel, 1914 (Monotypic)

Hendel, 1914a :40.

Type species: *Dacus addens* Walker, 1860.

1. **C. addens** (Walker, 1860)

Dacus addens Walker, 1860 *J. Proc. Linn. Soc. Lond.* **4**: 149. Bezzi, 1913 *Mem. Indian Mus.* **3**: 66 (No. 5).

Conicipithea addens (Walk., 1860) Hendel, 1914b :29. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 103. Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 163.

Distribution: Amboina (Moluccas), Macassar (Celebes).

14. Genus: **PHILOCOMPUS** Osten-Sacken, 1881

Osten-Sacken, 1881 *Ann. Soc. ent. France* (6th Ser.) **1**: 134.

Type species: *Philocompus cupidus* Osten-Sacken, 1881. Hendel, 1914b :30; 1914a :42. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 104.

1. **P. aeneus** de Meijere, 1906

Philocompus aeneus de Meijere, 1906 *Ann. Mus. nat. Hung.* **4**: 187 Pl. 2, Fig. 16. Hendel, 1914b :30; 1914a :42.

Distribution: Bali, Java.

2. **P. cupidus** Osten-Sacken, 1882

Philocompus cupidus Osten-Sacken, 1882 *Berl. ent. Zeit.* **26**: 217. Hendel, 1914b :30; 1914a :42. Frey, 1930 *Notul. ent. Helsingf.* **10**: 46.

Distribution: Philippines.

3. **P. divergens** (Walk., 1860)

Dacus divergens Walker, 1860 *J. Proc. Linn. Soc. Lond.* **4**: 149. Bezzi, 1913 *Mem. Indian Mus.* **3**: 70 (No. 84).

Philocompus divergens (Walk., 1860) Hendel, 1914b :42; 1914a :42. Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 170.

Distribution: Macassar (Celebes).

15. Genus: **ANTINEURA** Osten-Sacken, 1881

Osten-Sacken, 1881 *Ann. Soc. ent. France* (6th Ser.) **1**: 134.

Type species: *Antineura stolata* Osten-Sacken, 1882. Hendel, 1914b :32; 1914a :400. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 104.

*1. **A. biroi** de Meijere, 1906

Antineura biroi de Meijere, 1906 *Ann. Mus. nat. Hung.* **4**: 188 Pl. 2, Fig. 17. Hendel, 1914b :33; 1914a :41. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 104.

Distribution: New Guinea.

*2. **A. devia** (Walk., 1861)

Dacus devius Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 250. Bezzi, 1913 *Mem. Indian Mus.* **3**: 70 (No. 78).

Antineura devia (Walk., 1861) Hendel, 1914b :36; 1914a :41. Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 169.

Distribution: New Guinea.

3. **A. grandis** (Dol., 1858)

Herina grandis Doleschall, 1858 *Nat. Tijd. Ned. Ind.* **17**: 126.

Antineura grandis (Dol., 1858) Hendel, 1914b :35; 1914a :42. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 104.

Distribution: Moluccas.

*4. **A. kerteszi** de Meij., 1906

Antineura kerteszi de Meijere, 1906 *Ann. Mus. nat. Hung.* **4**: 189 Pl. 2, Fig. 18. Hendel, 1914b :34; 1914a :42. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 110. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 104 Pl. 4, Fig. 4.

Distribution: New Guinea.

5. **A. pubiseta** (Walk., 1861)

Dacus pubiseta Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 294. Bezzi, 1913 *Mem. Indian Mus.* **3**: 78 (No. 214).

Antineura pubiseta (Walk., 1861) Hendel, 1914b :36; 1914a :42. Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 181.

Distribution: Moluccas.

6. **A. sericata** Osten-Sacken, 1882

Antineura sericata Osten-Sacken, 1882 *Berl. ent. Zeit.* **26**: 216. Hendel, 1914b :33; 1914a :42. Bezzi, 1917 *Philippine J. Sc.* (D) **12**: 133.

Distribution: Philippines.

7. **A. stolata** Osten-Sacken, 1882

Antineura stolata Osten-Sacken, 1882 *Berl. ent. Zeit.* **26**: 215. Hendel, 1914b :32; 1914a :42. Frey, 1930 *Notul. ent. Helsingf.* **10**: 49.

Distribution: Philippines.

8. **A. strigifer** (Walk., 1862)

Dacus strigifer Walker, 1862 *J. Proc. Linn. Soc. Lond.* **6**: 13. Bezzi, 1913 *Mem. Indian Mus.* **3**: 80 (No. 252).

Antineura strigifer (Walk. 1862) Hendel, 1914b :37; 1914a :42. Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 183.

Distribution: Moluccas.

I have rejected Hendel's sub-division of this genus into the two sub-genera, *Antineura* (*sens. str.*) and *Adantineura*. At least two species were described from single specimens and neither species has since been recorded; the genus is not well known, and still awaits revision.

15A. Genus: **PSEUDOCLEITAMIA** Malloch, 1939 (Monotypic)

Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 104.

Type species: *Pseudocleitamia setigera* Malloch, 1939.

*1. **P. setigera** Malloch, 1939

Pseudocleitamia setigera Malloch, 1939 *ibid.*

Distribution: New Guinea.

16. Genus: **XENASPIS** Osten-Sacken, 1881

Osten-Sacken, 1881 *Ann. Soc. ent. France* (6th Ser.) **1**: 134.

Type species: *Xenaspis polistes* Osten-Sacken, 1882.

1. **X. extranea** Bezzi, 1917

Xenaspis extranea Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 134. Frey, 1930 *Notul. ent. Helsingf.* **10**: 49.

Distribution: Philippines.

2. **X. homichlodes** Hend., 1914

Xenaspis homichlodes Hendel, 1914b :41; 1914a :44.

Distribution: Borneo.

3. **X. pictipennis** (Walker, 1849)

Oxycephala (?) *pictipennis* Walker, 1849 *List. Dipt. Brit. Mus.* **4**: 1162.

Xenaspis vespoides de Meijere, 1904 *Bijd. Dierk.* **17**: 107, Figs. 19, 20. *Polistomima gigantea* Enderlein, 1912 *Zool. Jahrb.* **33**: 353, Fig. C. Hendel, 1914b :39; 1914a :44.

Distribution: India, Indonesia.

4. **X. polistes** Osten-Sacken, 1882

Xenaspis polistes Osten-Sacken, 1882 *Berl. ent. Zeit.* **26**: 220. Hendel, 1914b :38; 1914a :44. Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 134. Frey, 1930 *Notul. ent. Helsingf.* **10**: 49.

Distribution: Philippines.

5. **X. stigma** (Enderlein, 1912)

Polistomima stigma Enderlein, 1912 *Zool. Jahrb. Syst.* **33**: 352 Fig. B.

Xenaspis stigma (End., 1912) Hendel, 1914b :42; 1914a :44.

Distribution: Sumatra.

6. **X. walkeri** (End., 1912)

Polistomima walkeri Enderlein, 1912 *Zool. Jahrb. Syst.* **33**: 350 Fig. A.

Xenaspis walkeri (End., 1912) Hendel, 1914b :42; 1914a :45.

Distribution: Sumatra.

This is a widely-dispersed genus: of its fifteen described species, six have been recorded from India as far north as the Himalaya, one from Burma, three from the Indonesian islands, two from the Philippines, two from Taiwan, and one occurs both in India and Indonesia. It is likely that new species will yet be found in New Guinea.

16A. Genus: **XENASPOIDES** Frey, 1930

Frey, 1930 *Notul. ent. Helsingf.* **10**: 49.

Type species: *Xenaspoides ichneumonea* Frey, 1930

1. **X. cyanea** Frey, 1930

Xenaspoides cyanea Frey, 1930 *Notul. ent. Helsingf.* **10**: 50 Pl. 1, Fig. 2.

Distribution: Philippines.

2. **X. ichneumonea** Frey, 1930

Xenaspoides ichneumonea Frey, 1930 *Notul. ent. Helsingf.* **10**: 50 Pl. 1, Fig. 1.

Distribution: Philippines.

17. Genus: **LAMPROPHTHALMA** Portschinsky, 1892

Portschinsky, 1892 *Horae Soc. ent. Rossicae* **26**: 225.

Type species: *L. metallica* Ports., 1892.

1. **L. cavenda** Bezzi, 1917

Lamprophthalma cavenda Bezzi, 1917 (? publication) Frey, 1930 *Notul. ent. Helsingf.* **10**: 46.

Distribution: Philippines.

I have been unable to find Bezzi's original description. My only reference to the species is the specific name, author and date given in a list by Frey (*loc. cit.*).

2. **L. doleschalli** (End., 1912)

Senopterina doleschalli Enderlein, 1912 *Zool. Jahrb. Syst.* **33**: 357.

Lamprophthalma doleschalli (End., 1912) Hendel, 1914b :49; 1914a :45.

Distribution: Sumatra.

3. **L. meijereana** (End., 1912)

Senopterina meijereana Enderlein, 1912 *Zool. Jahrb. Syst.* **33**: 356.

Lamprophthalma meijereana (End., 1912) Hendel, 1914b :49; 1914a :45.

Distribution: Sumatra.

4. **L. sepedonoides** (Walk., 1864)

Dacus sepedonoides Walker, 1864 *J. Proc. Linn. Soc. Lond.* **7**: 228.

Lamprophthalma sepedonoides (Walk., 1864) Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 181.

Distribution: Moluccas.

5. **L. tuberculifrons** de Meijere, 1933

Lamprophthalma tuberculifrons de Meijere, 1933 *Tijd. Ent.* **76**: 111.

Distribution: Java.

17A. Genus: **APACTONEURA** Malloch, 1930 (Monotypic)

Malloch, 1930 *Ins. Samoa* **6** (5): 223.

Type species: *Apactoneura flavicornis* Malloch, 1930.

1. **A. flavicornis** Malloch, 1930

Apactoneura flavicornis Malloch, 1930 *Ins. Samoa* **6** (5): 223 Fig. 3.

Distribution: Samoa.

18. Genus: **PLAGIOSTENOPTERINA** Hendel, 1914

Hendel, 1914a *Gen. Ins.* **157**: 46. Malloch, 1931 *Proc. U.S. nat. Mus.* **78**: 12.

Type species: *Dacus aeneus* Wiedemann, 1819.

*1. **P. aenea** (Wied., 1819)

Dacus aeneus Wiedemann, 1819 *Zool. Mag.* **3**: 29; 1830 *Ausz. zweifl.* **2**: 512.

Plagiostenopterina aenea (Wied., 1819) Hendel, 1914b :54; 1914a :48. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 107. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 353; 1939 *ibid* **64**: 114.

Distribution: Java; Krakatau; Sumatra; Borneo; Philippines; New Guinea; Queensland (Aust.); Bismarck Archipelago; Ceylon; India; Taiwan.

A wide-spread common species. See *Meringomeria* Enderlein, 1924 (Genus No. 18a).

2. **P. armata** Malloch, 1931

Plagiostenopterina armata Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 20.

Distribution: Philippines.

*3. **P. basalis** (Walk., 1849)

Dacus basalis Walker, 1849 *List Dipt. Brit. Mus.* **4**: 1072. Bezzi, 1913 *Mem. Indian Mus.* **3**: (No. 29).

Plagiostenopterina basalis (Walker, 1849) Hendel, 1914b :64; 1914a :49. Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 164.

Distribution: Northern Territory (Australia).

4. **P. calcarata** (Macq., 1843)

Herina calcarata Macquart, 1843 *Dipt. exot.* **2**: 207 Pl. 28, Fig. 3.

Plagiostenopterina calcarata (Macq., 1843) Hendel, 1914b :63; 1914a :49. Bezzi, 1913 *Philippine J. Sci.* (D) **8**: 321. Malloch, 1931 *Proc. U.S. nat. Must.* **78** (15): 20.

Distribution: Indonesia; Philippines.

5. **P. diptera** Malloch, 1931

Plagiostenopterina diptera Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 18.

Distribution: Philippines.

6. **P. discolor** Malloch, 1931

Plagiostenopterina discolor Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 21.

Distribution: Philippines.

7. **P. dubiosa** Malloch, 1931

Plagiostenopterina dubiosa Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 15.

Distribution: Philippines; Ceylon; Singapore.

8. **P. egregia** de Meijere, 1924

Plagiostenopterina egregia de Meijere, 1924 *Tijd. Ent.* **67** (Suppl.): 41.

Distribution: Sumatra.

*9. **P. enderleini** Hendel, 1914

Plagiostenopterina enderleini Hendel, 1914b :56; 1914a :49. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 108. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 114 Pl. 4, Fig. 14.

Distribution: New Guinea; Sumatra; Ceylon.

10. **P. farinosa** Hendel, 1914

Plagiostenopterina farinosa Hendel, 1914b :68; 1914a :49.

Distribution: Moluccas.

11. **P. hebes** Hendel, 1914

Plagiostenopterina hebes Hendel, 1914b :70; 1914a :49.

Distribution: Singapore.

12. **P. imitans** (Walk., 1860)

Dacus imitans Walker, 1860 *J. Proc. Linn. Soc. Lond.* **4**: 150. Bezzi, 1913 *Mem. Indian Mus.* **3**: 73 (No. 132).

Plagiostenopterina imitans (Walk., 1860) Hendel, 1914a :49. Hardy, 1959 *Bull. Brit. Mus (nat. Hist.) Ent.* **8** (15): 175.

Distribution: Celebes.

13. **P. inapta** (Walk., 1860)

Dacus inaptus Walker, 1860 *J. Proc. Linn. Soc. Lond.* **4**: 151. Bezzi, 1913 *Mem. Indian Mus.* **3**: 73 (No. 135).

Plagiostenopterina inapta (Walk., 1860) Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 175.

Distribution: Celebes.

14. **P. inermis** Malloch, 1931

Plagiostenopterina inermis Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 21.

Distribution: Philippines.

*15. **P. lativentris** (Walk., 1859)

Dacus lativentris Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 115. Bezzi, 1913 *Mem. Indian Mus.* **3**: 74 (No. 144).

Plagiostenopterina orbitalis Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 114 Pl. 4, Fig. 15. *Plagiostenopterina lativentris* (Walk., 1859) Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 177.

Distribution: New Guinea.

16. **P. longivitta** (Walk., 1859)

Dacus longivitta Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 115. Bezzi, 1913 *Mem. Indian Mus.* **3**: 74 (No. 158).

Plagiostenopterina longivitta (Walk., 1859) Hendel, 1914a :49. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 108. Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 178.

Distribution: Aru Islands; India.

17. **P. marginata** (v. d. Wulp, 1880)

Senopterina marginata v. d. Wulp, 1880 *Tijd. Ent.* **23**: 179 Pl. 10, Fig. 13.

Plagiostenopterina marginata (v. d. Wulp, 1880) Hendel, 1914b :66; 1914a :49.

Distribution: Java; China.

See *Meringomeria* Enderlein, 1924 (Genus No. 18a).

18. **P. medionotata** de Meijere, 1924

Plagiostenopterina medionotata, 1924 *Tijd. Ent.* **67** (Suppl.): 40.

Distribution: Sumatra.

19. **P. neurostigma** Bezzi, 1928

Plagiostenopterina neurostigma Bezzi, 1928 *Diptera . . . Fiji Islands* :89.

Distribution: Fiji.

20. **P. nigricostata** (Doleschall, 1858)

Herina nigricostata Doleschall, 1858 *Nat. Tijd. Ned. Ind.* **17**: 126.

Plagiostenopterina nigricostata (Dol., 1858) Hendel, 1914b :70; 1914a :49.

Distribution: Moluccas.

21. **P. pallidipes** Frey, 1930

Plagiostenopterina pallidipes Frey, 1930 *Notul. ent. Helsingf.* **10**: 51.

Distribution: Philippines.

*22. **P. parva** Mall., 1931

Plagiostenopterina parva Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 15; 1939 *Proc. Linn. Soc. N.S.W.* **64**: 114.

Distribution: New Guinea.

23. **P. plagiata** (Bezzi, 1917)

Elassogaster plagiata Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 135. Frey, 1930 *Notul. ent. Helsingf.* **10**: 46.

Plagiostenopterina plagiata (Bezzi, 1917) Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 19.

Distribution: Philippines.

24. **P. planidorsum** (Walker, 1860)

Charax planidorsum Walker, 1860 *Trans. ent. Soc. Lond.* **5**: 325. Hendel, 1914b :53 (footnote).

Plagiostenopterina planidorsum (Walker, 1860) Frey, 1930 *Notul. ent. Helsingf.* **10**: 51.

Distribution: Philippines; Burma.

25. **P. rutila** Hendel, 1914

Plagiostenopterina rutila Hendel, 1914b :61; 1914a :49.

Distribution: Lombok.

26. **P. samoaensis** Malloch, 1930

Plagiostenopterina samoaensis Malloch, 1930 *Ins. Samoa* **6** (5): 230; 1931 *Proc. U.S. nat. Mus.* **78** (15): 15.

Distribution: Samoa.

27. **P. trivittata** (Walk., 1849)

Dacus trivittatus Walker, 1849 *List Dipt. Brit. Mus.* **4**: 1072. Bezzi, 1913 *Mem. Indian Mus.* **3**: 80 (No. 266).

Plagiostenopterina trivittata (Walk., 1849) Hendel, 1914b :65; 1914a :49. Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 183.

Distribution: Singapore; Malacca; Hongkong; Philippines.

See *Meringomeria* Enderlein, 1924 (Genus No. 18A).

28. **P. trivittigera** Malloch, 1931

Plagiostenopterina trivittigera Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 17.

Distribution: Singapore.

18A. Genus: ?**MERINGOMERIA** Enderlein, 1924

Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 108.

Type species: *Dacus trivittatus* Walker, 1849 *List Dipt. Brit. Mus.* **4**: 1072.

The status of this genus is doubtful. It was erected by Enderlein in 1924 for four species. Three of these he transferred from *Plagiostenopterina,* namely *P. trivittata* (Walker, 1849); *P. marginata* (v. d. Wulp, 1880); and *P. aenea* Hendel (sic), 1914. The latter species is unknown to me; it is possibly a *lapsus calami* for *P. aenea* (Wied., 1819). The fourth species was *Meringomeria interrupta* Enderlein, 1924, which he described from Sikkim in India—Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 109. This genus is inserted here to draw attention to the need for a thorough investigation of the four species. It is probable that all four will eventually be placed in *Plagiostenopterina.*

18B. Genus: ?**PERONOTROCHUS** Enderlein, 1924

This genus was erected by Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 109 for the single species *Plagiostenopterina calcarata* (Macq., 1843). The status of the genus is in doubt.

Frey, 1930 (*Notul. ent. Helsingf.* **10**: 52) accepted the genus as valid and described the following species:

1. **P. inermis** Frey, 1930

Peronotrochus inermis Frey, 1930 *Notul. ent. Helsingf.* **10**: 52.

Distribution: Philippines.

18C. Genus: **IMUGANA** Enderlein, 1937

Enderlein, 1937 *S.B. Ges. naturf. Fr. Berl.* (year 1936): 435.

Type species: *Imugana pompiliformis* Enderlein, 1937.

1. **I. metallica** Enderlein, 1937

Imugana metallica Enderlein, 1937 *S.B. Ges. naturf. Fr. Berl.* (year 1936): 436.

Distribution: Philippines.

2. **I. pompiliformis** Enderlein, 1937

Imugana pompiliformis Enderlein, 1937 *S.B. Ges. naturf. Fr. Berl.* (year 1936): 435.

Distribution; Philippines.

19. Genus: **ELASSOGASTER** Bigot, 1859

Bigot, 1859 *Ann. Soc. ent. Fr.* (Ser. 3) **8**: 546.

Type species: *Elassogaster metallicus* Bigot, 1859.

*1. **E. albopilosus** de Meijere, 1915

Elassogaster albopilosus de Meijere, 1915 *Tijd. Ent.* **58**: 133.

Distribution: New Guinea.

*2. **E. didymoides** Hendel, 1914

Elassogaster didymoides Hendel, 1914b :76; 1914a :52. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 117.

Distribution: New Guinea.

*3. **E. didymus** (Osten-Sacken, 1881)

Senopterina didyma Osten-Sacken, 1881 *Ann. Mus. Stor. nat. Genova* **16**: 465.

Elassogaster didymus (Osten-Sacken, 1881) Hendel, 1914b :75; 1914a :51. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 116.

Distribution: New Guinea.

*4. **E. evitta** Malloch, 1939

Elassogaster evitta Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 116 Pl. 4, Fig. 16.

Distribution: New Britain.

5. **E. flavipes** (Schiner, 1868)

Senopterina flavipes Schiner, 1868 *Novara Dipt.* :288.

Elassogaster flavipes (Schiner, 1868) Hendel, 1914b :78; 1914a :52.

Distribution: Singapore.

6. **E. hyalipennis** Malloch, 1931

Elassogaster hyalipennis Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 23.

Distribution: Philippines.

*7. **E. lineatus** de Meijere, 1915

Elassogaster lineatus de Meijere, 1915 *Tijd. Ent.* **58**: 132.

Distribution: New Guinea.

*8. **E. marginalis** Malloch, 1940

Elassogaster marginalis Malloch, 1940 *Ann. Mag. nat. Hist* **6**: 68.

Distribution: Solomon Islands.

*9. **E. nigripes** Malloch, 1940

Elassogaster nigripes Malloch, 1940 *Ann. Mag. nat. Hist.* **6**: 70.

Distribution: Solomon Islands.

10. **E. potens** Frey, 1930

Elassogaster potens Frey, 1930 *Notul. ent. Helsingf.* **10**: 52.

Distribution: Philippines.

*11. **E. sepsoides** (Walker, 1861)

Dacus sepsoides Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 163. Bezzi, 1913 *Mem. Indian Mus.* **3**: 79 (No. 236).

Elassogaster sepsoides (Walker, 1861) Hendel, 1914b :82; 1914a :52. Bezzi, 1913 *Philippine J. Sci.* (D) **8**: 321. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 351 Fig. 4. Frey, 1930 *Notul. ent. Helsingf.* **10**: 52. Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 22; 1939 *Proc. Linn. Soc. N.S.W.* **64**: 115. Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 181.

Distribution: New Guinea; Taiwan; Amboina; Ceylon; Queensland (Australia).

12. **E. signatipes** (Walker, 1861)

Dacus signatipes Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 163.

Elassogaster signatipes (Walker, 1861) Hendel, 1914a :52. Bezzi, 1913 *Mem. Indian Mus.* **3**: 79 (No. 239). Hardy, 1959 *Bull. Brit. Mus (nat. Hist.) Ent.* **8** (5): 181.

Distribution: Amboina.

13. **E. simplex** Frey, 1930

Elassogaster simplex Frey, 1930 *Notul. ent. Helsingf.* **10**: 53.

Distribution: Philippines.

*14. **E. sordidus** (Walker, 1861)

Dacus sordidus Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 251. Bezzi, 1913 *Mem. Indian Mus.* **3**: 79 (No. 244).

Dacus varialis Walker, 1865 Bezzi, 1913 *ibid.* 3: 79 (No. 275). *Elassogaster sordidus* (Walker, 1861) Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 182.

Distribution: New Guinea.

Dacus varialis Walker, 1865 is a synonym of *Dacus sordidus* Walker, 1861. Hendel, 1914a *Gen. Ins.* **157**: 52 refers to it as *Elassogaster varialis* (Walker, 1865). Hardy, 1959 showed the synonymy.

*15. **E. terrae-reginae** Malloch, 1928

Elassogaster terrae-reginae Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 352; 1931 *Proc. U.S. nat. Mus.* **78** (15): 22; 1939 *Proc. Linn. Soc. N.S.W.* **64**: 116.

Distribution: Queensland; New South Wales (Australia).

19A. Genus: **PICROMETOPUS** Frey, 1930 (Monotypic)

Frey, 1930 *Notul. ent. Helsingf.* **10**: 53.

Type species: *Picrometopus bicolor* Frey, 1930.

1. **P. bicolor** Frey, 1930

Picrometopus bicolor Frey, 1930 (*loc. cit.*).

Distribution: Philippines.

20. Genus: **MICROEPICAUSTA** Hendel, 1914 (Monotypic)

Hendel, 1914a *Gen. Ins.* **157**: 52.

Type species: *Microepicausta gracilis* Hendel, 1914.

*1. **M. gracilis** Hendel, 1914

Microepicausta gracilis Hendel, 1914b :85; 1914a :52.

Distribution: New South Wales (Australia).

21. Genus: **SCELOSTENOPTERINA** Hendel, 1914 (Monotypic)

Hendel, 1914a *Gen. Ins.* **157**: 54.

Type species: *Scelostenopterina femorata* Hendel, 1914.

1. **S. femorata** Hendel, 1914

Scelostenopterina femorata Hendel, 1914b :86; 1914a :55. Bezzi. 1917 *Philippine J. Sci.* (D) **12**: 136. Frey, 1930 *Notul. ent. Helsingf.* **10**: 51. Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 24.

Distribution: Sula Islands (Indonesia); Philippines.

21A. Genus: **MINDANAIA** Malloch, 1931 (Monotypic)

Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 25.

Type species: *Mindanaia latifasciata* Malloch, 1931.

1. **M. latifasciata** Malloch, 1931

Mindanaia latifasciata Malloch, 1931 *ibid* **78** (15): 25.

Distribution: Philippines.

22. Genus: **ICTERACANTHA** Hendel, 1912

Hendel, 1912 *Supp. Ent. Berlin* **1**: 14.

Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 112.

Type species: *Trypeta chalybeiventris* Wiedemann, 1830.

1. **I. chalybeiventris** (Wied., 1830)

Trypeta chalybeiventris Wiedemann, 1830 *Auss. zweifl. Ins.* **2**: 479.

Dacus bicolor Walk., 1849 *List Dipt. Brit. Mus.* **4**: 1071.

Dacus bicolor Walk., 1849 Bezzi, 1913 *Mem. Indian Mus.* **3**: 68 (No. 52).

Trypeta chalybeiventris Wied. 1830 Bezzi, 1913 *ibid* **3**: 69 (No. 52).

Icteracantha chalybeiventris (Wied., 1830) Hendel, 1914b :87; 1914a :55. Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 165.

Distribution: Type locality unknown.

2. **I. cyaneiventris** (v. d. Wulp, 1881)

Herina cyaneiventris v. d. Wulp, 1881 *Dipt. Sumatra Exp. Leiden*: 51 Pl. 3, Fig. 6.

Scelacanthina cyaneiventris (v. d. Wulp, 1881) Enderlein, 1912 *Zool. Jahrb.* **33**: 349.

Icteracantha cyaneiventris (v. d. Wulp, 1881) Hendel, 1914b :88; 1914a :55.

Distribution: Sumatra.

23. Genus: **DUOMYIA** Walker, 1849

Walker, 1849 *List Dipt. Brit. Mus.* **4**: 800. Hendel, 1914a, *Gen. Ins.* **157**: 56. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 350; **54**: 506.

Type species: *Duomyia obscura* Walker, 1849.

*1. **D. annulipes** Hendel, 1914

Duomyia annulipes Hendel, 1914b :98; 1914a :57.

Distribution: Western Australia.

*2. **D. azurea** Hendel, 1914

Duomyia azurea Hendel, 1914b :97; 1914a :57.

Distribution: Western Australia.

*3. **D. decora** (Macq., 1846)

Senopterina decora Macquart, 1846 *Dipt. exot. Supp.* **1**: 208 Pl. 18, Fig. 10.

Ortalis punctifrons Macquart, 1847 *ibid Supp.* **3**: 61 Pl. 7, Fig. 4.

Duomyia decora (Macq., 1846) Hendel, 1914b :95; 1914a :57. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 112. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 510.

Distribution: New South Wales (Australia).

4. **D. fidschiensis** Enderlein, 1924

Duomyia fidschiensis Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 112. Bezzi, 1928 *Dipt. Fiji*: 91.

Distribution: Fiji.

5. **D. grandis** (Schiner), 1868

Senopterina grandis Schiner, 1868 *Novara Dipt.*: 289.

Duomyia grandis (Schiner), 1868 Hendel, 1914b :95; 1914a :57.

Distribution: Chile (*sic.*).

*6. **D. irregularis** Malloch, 1929

Duomyia irregularis Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 509 Fig. 16.

Distribution: Northern Australia.

*7. **D. laeta** (Walk., 1849)

Lamprogaster laeta Walker, 1849 *List Dipt. Brit. Mus.* **4**: 805.

Duomyia laeta (Walk., 1849) Hendel, 1914b :96; 1914a :58.

Distribution: Australia (*sic.*).

See *Lamprogaster laeta* (Guerin, 1830).

*8. **D. maculipennis** Hendel, 1914

Duomyia maculipennis Hendel, 1914b :93; 1914a :58. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 511 Fig. 2C.

Distribution: Queensland; New South Wales (Australia).

*9. **D. mithrax** Hendel, 1914

Duomyia mithrax Hendel, 1914b :92; 1914a :58.

Distribution: Queensland (Australia).

*10. **D. nigricosta** Malloch, 1929

Duomyia nigricosta Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 511.

Distribution: Queensland (Australia).

*11. **D. nigripes** (Macq., 1850)

Senopterina nigripes Macquart, 1850 *Dipt. exot. Supp.* **4**: 283 Pl. 26, Fig. 6.

Urophora nigripes (Macquart, 1851) *Mem. Soc. Sci. Lille*: 260 Pl. 26, Fig. 13.

Urophora nigripes (Macquart, 1851) Bezzi, 1913 *Mem. Indian Mus.* **3**: 76 (No. 184).

Duomyia nigripes (Macq., 1851) Hendel, 1914a :102.

Distribution: Tasmania (?).

*12. **D. obscura** Walker, 1849

Duomyia obscura Walker, 1849 *List Dipt. Brit. Mus.* **4**: 800.

Senopterina gigas Macquart, 1850 *Dipt. exot. Supp.* **4**: 282 Pl. 26, Fig. 4. *Duomyia obscura* Walk., 1849 Hendel, 1914b :90; 1914a :58. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 351; 1929 *ibid* 54: 510.

Distribution: Queensland; New South Wales (Australia).

*13. **D. punctifrons** Malloch, 1929

Duomyia punctifrons Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 510.

Distribution: New South Wales (Australia).

*14. **D. scutellaris** (Macq., 1850)

Senopterina scutellaris Macquart, 1850 *Dipt. exot. supp.* **4**: 282 Pl. 26, Fig. 5.

Duomyia scutellaris (Macq., 1850) Hendel, 1914b :102.

Distribution: New South Wales (Australia).

*15. **D. sericea** Hendel, 1914

Duomyia sericea Hendel, 1914b :99; 1914a :58.

Distribution: Queensland (Australia).

*16. **D. spinifemorata** Malloch, 1929

Duomyia spinifemorata Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 508 Figs. 1a, 1b.

Distribution: Northern Territory (Australia).

*17. **D. thalassina** Walker, 1849

Duomyia thalassina Walker, 1849 *List Dipt. Brit. Mus.* **4**: 801. Hendel, 1914b :92; 1914a :58. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 112. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 511.

Distribution: Queensland (Australia).

*18. **D. tomentosa** Hendel, 1914

Duomyia tomentosa Hendel, 1914b :100; 1914a :58. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 507 Fig. 2b.

Distribution: Queensland (Australia).

NOTE: Evidence favours the opinion that this genus is confined to the Australian mainland. No species have been recorded from New Guinea or New Zealand, and there is no authentic record of any from Tasmania. The four species, *D. grandis* Schiner 1868, *D. fidschiensis* Enderlein 1924, *D. nigripes* (Macq. 1850) and *D. scutellaris* (Macq. 1850), which have been recorded from other places, are all suspect in varying degrees.

The status of *D. grandis* is extremely doubtful. It was described by Schiner from *Novara* material labelled "Chile". It is the only *Duomyia* ever to have been recorded from South America, and the species has never been recorded since. Hendel (A) queried the type locality; Malloch (1928) suggested that the species did not belong to *Duomyia*. Malloch's suggestion appears to be much the more probable. Were *D. grandis* an Australian species wrongly labelled as having been collected in Chile, it is not unreasonable to expect that it would since have been recorded from Australia, which it has not. If, on the contrary, it is a member of a South American genus superficially resembling *Duomyia* then all difficulties disappear.

D. fidschiensis may be an introduction from Australia into Fiji, and the name is possibly a synonym; alternatively, the species may not belong to *Duomyia*. Some of Enderlein's work is marred by superficiality and lack of a critical approach, and decisions arrived at by him have often been shown to be wrong by later workers. A detailed examination of the type of *D. fidschiensis,* and a careful comparison with all known species of *Duomyia,* will have to be undertaken before finality can be arrived at.

D. nigripes and *D. scutellaris* were collected by the Verreaux brothers, between 1842 and 1846, for the Musée d'Histoire Naturelle de Paris. They formed part of the 140 species of Diptera described by Macquart in the fourth supplement of his *Diptères Exotiques*. The type locality of all the material was given as "Tasmania". It is significant that these are the only species of *Duomyia* ever to be recorded from Tasmania. Hardy (1929, *Proc. Linn. Soc. N.S.W.* **54**: 61-64), assembled evidence which strongly suggests that all 140 species were collected in a coastal area round Sydney, New South Wales. The types are no longer in existence. Hendel (B) merely quotes Macquart's descriptions *verbatim* with the comment "Die Arten *D. nigripes* Macquart und *scutellaris* Macquart konnten nicht in die Tabelle aufgenommen werden." Malloch (1928, 1929) mentions neither in his revisions of the genus.

There can be little doubt that species yet await description, particularly in Western Australia.

25. Genus: **PSEUDEPICAUSTA** Hendel, 1914

Hendel, 1914a *Gen. Ins.* 157: 62; 1914b :112. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 115. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 118.

Type species: *Herina chalybea* Doleschall, 1858.

*1. **P. angulata** Hendel, 1914

Pseudepicausta angulata Hendel, 1914b :118. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 115. Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 26; 1939 *Proc. Linn. Soc. N.S.W.* **64**: 119.

Distribution: New Guinea; Celebes.

*2. **P. apicalis** Malloch, 1939

Pseudepicausta apicalis Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 119 Pl. 4, Fig. 17.

Distribution: New Guinea.

3. **P. bataviensis** (Schiner, 1868)

Senopterina bataviensis Schiner, 1868 *Novara Dipt.* :288.

Pseudepicausta bataviensis (Schiner, 1868) Hendel, 1914b :115; 1914a :64. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 115. Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 26.

Distribution: Java.

*4. **P. chalybea** (Doleschall, 1858)

Herina chalybea Doleschall, 1858 *Nat. Tijd. Ned. Ind.* **17**: 125.

Dacus obtrudens Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 116. Bezzi, 1913 *Mem. Indian Mus.* **3**: 76 (No. 191).

Pseudepicausta chalybea (Dol., 1858) Hendel, 1913 *Gen. Platy.* Figs. 119, 120; 1914b :113; 1914a :64 Pl. 6, Figs. 119, 120. Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 136. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 115. Frey, 1930 *Notul. ent. Helsingf.* **10**: 54. Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 26; 1939 *Proc. Linn. Soc. N.S.W.* **64**: 118. Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 179.

Distribution: Amboina; Ternate; Deslac and Nusa Islands; Sunda Islands; New Guinea.

5. **P. contrahens** (Walker, 1860)

Dacus contrahens Walker, 1860 *J. Proc. Linn. Soc. Lond.* **4**: 151. Bezzi, 1913 *Mem. Indian Mus.* **3**: 69 (No. 62).

Pseudepicausta contrahens (Walk., 1860) Hendel, 1914a :64. Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 168.

Distribution: Macassar.

*6. **P. detrudens** (Walker, 1865)

Dacus detrudens Walker, 1865 *J. Proc. Linn. Soc. Lond.* **8**: 135. Bezzi, 1913 *Mem. Indian Mus.* **3**: 70 (No. 77).

Pseudepicausta detrudens (Walk., 1865) Hendel, 1914a :64; 1914b :113. Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 169.

Distribution: Indonesia; Salawatty Is. (New Guinea).

Both Hendel and Hardy found differences between the assumed type and Walker's description. There is some uncertainty as to whether Walker's specimen labelled "? type" was the specimen on which he based his description.

7. **P. exigens** (Walker, 1860)

Dacus exigens Walker, 1860 *J. Proc. Linn. Soc. Lond.* **4**: 151. Bezzi, 1913 *Mem. Indian Mus.* **3**: 71 (No. 95).

Pseudepicausta exigens (Walk., 1860) Hendel, 1914a :64. Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 171.

Distribution: Macassar.

8. **P. experta** (Walker, 1862)

Dacus expertus Walker, 1862 *J. Proc. Linn. Soc. Lond.* **6**: 12. Bezzi, 1913 *Mem. Indian Mus.* **3**: 71 (No. 97).

Pseudepicausta experta (Walk., 1862) Hendel, 1914a :64. Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 171.

Distribution: Halmahera Is. (Moluccas).

9. **P. geniculata** (v. d. Wulp, 1898)

Senopterina geniculata v. d. Wulp, 1898 *Tijd. Ent.* **41**: 206. de Meijere, 1911 *Tijd. Ent.* **54**: 369.

Pseudepicausta geniculata (v. d. Wulp, 1898) Hendel, 1914a :64; 1914b :114.

Distribution: Java.

10. **P. limpidipennis** (Doleschall, 1858)

Herina limpidipennis Doleschall, 1858 *Nat. Tijd. Ned. Ind.* **17**: 126.

Pseudepicausta limpidipennis (Dol., 1858) Hendel, 1914a :64; 1914b :117.

Distribution: Amboina.

*11. **P. mutilloides** (Walker, 1859)

Dacus mutilloides Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 115. Bezzi, 1913 *Mem. Indian Mus.* **3**: 76 (No. 176).

Pseudepicausta mutilloides (Walk., 1859) Hendel, 1914a :64; 1914b :116. Frey, 1930 *Notul. ent. Helsingf.* **10**: 54. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 119 ("multilloides") (*sic.*). Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 178.

Distribution: New Guinea.

*12. **P. pompiloides** (Walker, 1859)

Dacus pompiloides Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 116. Bezzi, 1913 *Mem. Indian Mus.* **3**: 77 (No. 210).

Pseudepicausta lagarosia Hendel, 1914a :64; 1914b :118. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 118.

Pseudepicausta pompiloides (Walk., 1859) Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 180.

Distribution: New Guinea.

P. pompiloides was the species described by Hendel as new under the name of *P. lagarosia*. Hardy showed the synonymy.

13. **P. quadrisetosa** (de Meijere, 1911)

Senopterina quadrisetosa de Meijere, 1911 *Tijd. Ent.* **54**: 368.

Pseudepicausta quadrisetosa (de Meij., 1911) Hendel, 1914a :64; 1914b :115.

Distribution: Java.

*14. **P. solocifemur** Enderlein, 1924

Pseudepicausta solocifemur Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 115.

Distribution: New South Wales (Australia).

*15. **P. wallacei** Hendel, 1914

Pseudepicausta wallacei Hendel, 1914b :117; 1914a :64. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 119.

Distribution: New Guinea.

26. Genus: **SCOTINOSOMA** Loew, 1873

Loew, 1873 *Mon. N. Amer. Dipt.* **3**: 45.

Type species: *S. bistrigata* Hendel, 1914.

In 1873, Loew summarized the characters of his new genus, *Scotinosoma* but named no species nor designated a type species. *S. bistrigata* hence became the type species by subsequent designation by Hendel in 1914.

Hendel, 1914a :65; 1914b :120. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 117.

*1. **S. attenuata** (Malloch, 1931)

Pseudepicausta attenuata Malloch, 1931 *Proc. U.S. nat. Mus.* **78**: 27.

Scotinosoma attenuata (Malloch, 1931) Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 117.

Distribution: Queensland (Australia).

Malloch first placed this species and No. 3 in *Pseudepicausta* but later transferred them to *Scotinosoma*.

*2. **S. bistrigata** Hendel, 1914

Scotinosoma bistrigata Hendel, 1914b :120; 1914a :65. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 117.

Distribution: Queensland (Australia).

*3. **S. completa** (Malloch, 1931)

Pseudepicausta completa Malloch, 1931 *Proc. U.S. nat. Mus.* **78**: 27.

Scotinosoma completa (Malloch, 1931) Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 117.

Distribution: Queensland (Australia).

*4. **S. erasa** Malloch, 1939

Scotinosoma erasa Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 117.

Distribution: Queensland (Australia).

5. **S. typicum** Bezzi, 1917

Scotinosoma typicum Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 136. Frey, 1930 *Notul. ent. Helsingf.* **10**: 46.

Distribution: Philippines.

26A. Genus: **GUAMOMYIA** Malloch, 1942 (Monotypic)

Type species: *Guamomyia fascipennis* Malloch, 1942.

Malloch, 1942 *Insects of Guam B. P. Bishop Mus. Bull.* **172**: 206, Fig. 3.

1. **G. fascipennis** Malloch, 1942 *ibid*

Distribution: Guam.

27. Genus: **RHYTIDORTALIS** Hendel, 1914

Hendel, 1914b :121; 1914a :66. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 106.

Type species: *Rhytidortalis cribrata* Hendel, 1914.

*1. **R. rugifrons** (Thomson, 1868)

Senopterina rugifrons Thomson, 1868 *Dipt. Eugen. Resa*: 577.

Rhytidortalis rugifrons (Thomson, 1868) Hendel, 1914b :122; 1914a :68. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 106.

Distribution: Australia (*sic.*).

Two species only have so far been recorded. The type species is from Taiwan.

27A. Genus: **CLEITAMOIDES** Malloch, 1939

Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 106.

Type species: *Cleitamoides kerteszi* (Hendel, 1914).

*1. **C. kerteszi** (Hendel, 1914)

Cleitamia kerteszi Hendel, 1914b :130. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 117.

Cleitamoides kerteszi (Hendel, 1914) Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 107.

Distribution: New Guinea.

*2. **C. latifascia** (Walker, 1859)

Dacus latifascia Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 114. Bezzi, 1913 *Mem. Indian Mus.* **3**: 74 (No. 146).

Cleitamia latifascia (Walk., 1859) Edwards, 1915 *Trans. Zool. Soc. Lond.* **20**: 415.

Cleitamoides latifascia (Walk., 1859) Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 107. Hardy, 1959 *Bull. Brit. Mus (nat. Hist.) Ent.* **8** (5): 177.

Distribution: New Guinea.

*3. **C. liturata** (Walker, 1861)

Dacus lituratus Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 251.

Cleitamia liturata (Walk., 1861) Osten-Sacken, 1881 *Ann. Mus. Stor. nat. Genova* **16**: 468. de Meijere, 1913 *Nov. Guin.* **9**: 375. Hendel, 1914a :73; 1914b :129.

Cleitamoides liturata (Walk., 1861) Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 107. Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 178.

Distribution: New Guinea.

30. Genus: **CLEITAMIA** Macquart, 1835

Macquart, 1835 *Suites à Buffon* **2**: 440. Hendel, 1914a *Gen. Ins.* 157: 71. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 107.

Type species: *Ortalis astrolabei* Boisduval, 1833.

*1. **C. amabilis** Osten-Sacken, 1881

Cleitamia amabilis Osten-Sacken, 1881 *Ann. Mus. Stor. nat. Genova* **16**: 468. Hendel, 1914b :127; 1914a :72. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 109.

Distribution: New Guinea.

*2. **C. astrolabei** (Boisduval, 1833)

Ortalis astrolabei Boisduval, 1833 *Voy. Astrolabe* :688 Pl. 12, Fig. 17.

Cleitamia astrolabei (Boisd., 1833) Macquart, 1833 *Suites à Buffon* :440 Pl. 19, Fig. 4. de Meijere, 1913 *Nov. Guin.* **9**: 375. Hendel, 1914a :72; 1914b :125. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 109 Pl. 4, Fig. 8.

Distribution: New Guinea.

*3. **C. biarcuata** (Walker, 1865)

Poticara biarcuata Walker, 1865 *J. Proc. Linn. Soc. Lond.* **8**: 133.

Cleitamia biarcuata (Walk., 1865) Hendel, 1914b :133; 1914a :73. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 110.

Distribution: New Guinea.

*4. **C. catharinae** de Meijere, 1913

Cleitamia catharinae de Meijere, 1913 *Bijdr. Dierk.* **19**: 63; 1915 *Tijd. Ent.* **58**: 129. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 107 (footnote).

Distribution: New Guinea.

In his 1915 paper, de Meijere synonymized his species with *Poticara* (—*Cleitamia*) *tricurvata* Walker, 1864. Malloch (1939) pointed out that there were considerable differences in the descriptions of the two species. In view of these, he accepted both *catharinae* and *tricurvata* as distinct until both types had been compared. So far as I know this has not yet been done, but the two descriptions differ sufficiently for *catharinae* to be regarded as a valid species until the contrary is shown.

*5. **C. cheesmanae** Malloch, 1939

Cleitamia cheesmanae Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 110 Pl. 4, Fig. 10.

Distribution: West Irian (formerly Dutch New Guinea).

*6. **C. cyclops** Malloch, 1939

Cleitamia cyclops Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 110 Pl. 4, Fig. 9.

Distribution: West Irian (formerly Dutch New Guinea).

*7. **C. delandi** Malloch, 1939

Cleitamia delandi Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 111 Pl. 4, Fig. 12.

Distribution: New Guinea.

*8. **C. excepta** Malloch, 1939

Cleitamia excepta Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 111 Pl. 4, Fig. 11.

Distribution: West Irian (formerly Dutch New Guinea).

*9. **C. gestroi** Kertesz, 1899

Cleitamia gestroi Kertesz, 1899 *Ann. Mus. Stor. nat. Genova* **19**: 566 Pl. 7, Fig. 8. Hendel, 1914a :73; 1914b :133. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 109.

Distribution: New Guinea.

*10. **C. insignis** de Meijere, 1915

Cleitamia insignis de Meijere, 1915 *Tijd. Ent.* **58**: 128 Pl. 1, Fig. 14. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 110.

Distribution: New Guinea.

*11. **C. orthocephala** Hendel, 1914

Cleitamia orthocephala Hendel, 1914b :126; 1914a :73. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 109.

Distribution: New Guinea.

*12. **C. ostensackeni** Kertész, 1898

Cleitamia ostensackeni Kertész, 1898 *Term. Füz.* **21**: 494; 1899 *Ann. Mus. Stor. nat. Genova* **19**: 563 Pl. 7, Fig. 5. Hendel, 1914b :131; 1914a :73. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 109.

Distribution: New Guinea.

*13. **C. rivellioides** Osten-Sacken, 1881

Cleitamia rivellioides Osten-Sacken, 1881 *Ann. Mus. Stor. nat. Genova* **16**: 469. Kertész, 1899 *Ibid* **19**: 564 Pl. 7. Fig. 6. Hendel, 1914b :130; 1914a :73. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 110.

Distribution: New Guinea.

*14. **C. roderi** Kertész, 1899

Cleitamia roderi Kertész, 1899 *Ann. Mus. Stor. nat. Genova* **19**: 565 Pl. 7, Fig. 7. Hendel, 1914a :73; 1914b :132. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 110.

Distribution: New Guinea.

*15. **C. similis** Kertész, 1899

Cleitamia similis Kertész, 1899 *Ann. Mus. Stor. nat. Genova* **19**: 652 Pl. 7, Fig. 4. Hendel, 1914a :73; 1914b :128. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 109.

Distribution: New Guinea.

*16. **C. tricurvata** (Walker, 1864)

(See *C. catharinae* de Meijere, 1913).

Poticara tricurvata Walker, 1864 *J. Proc. Linn. Soc. Lond.* **7**: 227.

Cleitamia tricurvata (Walk., 1864) Hendel, 1914a :73; 1914b :33. de Meijere, 1915 *Tijd. Ent.* **58**: 129. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 116. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 109.

Distribution: New Guinea.

*17. **C. trigonalis** de Meijere, 1913

Cleitamia trigonalis de Meijere, 1913 *Nov. Guin.* **9**: 375; 1915 *Tijd. Ent.* **58**: 129. Hendel, 1914a :73; 1914b :130. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 112.

Distribution: New Guinea.

30A. Genus: **XENOGNATHUS** Malloch, 1930

Malloch, 1930 *Ins. Samoa* **6** (5): 225.

Type species: *Xenognathus bryani* Malloch, 1930.

1. **X. bryani** Malloch, 1930

Xenognanthus bryani Malloch, 1930 *Ins. Samoa* **6** (5): 226 Figs. 4, 5.

Distribution: Samoa.

2. **X. inermis** Malloch, 1930

Xenognanthus inermis Malloch, 1930 *Ins. Samoa* **6** (5): 228 Fig. 6.

Distribution: Samoa.

31. Genus: **LAGLAISIA** Bigot, 1880

Bigot, 1880 *Ann. Soc. ent. France* (5th Ser.) **10**: 92.

Type species: *L. caloptera* Bigot, 1880.

*1. **L. biroi** Hendel, 1914

Laglaisia biroi Hendel, 1914b :136; 1914a :75. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 112.

Distribution: New Guinea.

*2. **L. caloptera** Bigot, 1880

Laglaisia caloptera Bigot, 1880 *Ann. Soc. ent. France* (5th Ser.), **10**: 92. Hendel, 1914a :75; 1914b :134. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 112.

Distribution: New Guinea.

*3. **L. fascipennis** de Meijere, 1915

Laglaisia fascipennis de Meijere, 1915 *Tijd. Ent.* **58**: 134 Pl. 1, Fig. 15. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 112.

Distribution: New Guinea.

*4. **L. kochi** de Meijere, 1907

Laglaisia kochi de Meijere, 1907 *Tijd. Ent.* **50**: 120 Pl. 4, Fig. 1; 1913 *Nov. Guin.* **9**: 374. Hendel, 1914a :75; 1914b :135. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 112.

Distribution: New Guinea.

*5. **L. stylops** Enderlein, 1924

Laglaisia stylops Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 116. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 113.

Distribution: New Guinea.

*6. **L. telescopica** Enderlein, 1924

Laglaisia telescopica Enderlein, 1924 *Mitt. Zool. Mus. Berlin* **11**: 116. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 113.

Distribution: New Guinea.

32. Genus: **LORIOMYIA** Kertész, 1899 (Monotypic)

Kertész, 1899 *Ann. Mus. Stor. nat. Genova* **39**: 567.

Type species: *L. guttipennis* Kertész, 1899.

*1. **L. guttipennis** Kertész, 1899

Loriomyia guttipennis Kertész, 1899 *Ann. Mus. Stor. nat. Genova* **39**: 567. Hendel, 1914a :75; 1914b :137. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 113.

Distribution: New Guinea.

35. Genus: **LOXONEUROIDES** Hendel, 1914 (Monotypic)

Hendel, 1914b :141.

Type species: *L. varipennis* Hendel, 1914.

*1. **L. varipennis** Hendel, 1914

Loxoneuroides varipennis Hendel, 1914b :141; 1914a :80.

Distribution: Australia (*sic.*).

38. Genus: **POGONORTALIS** de Meijere, 1911

de Meijere, 1911 *Tijd. Ent.* **54**: 370.

Type species: *Trypeta doclea* Walker, 1849.

*1. **P. commoni** Paramonov, 1957

Pogonortalis commoni Paramonov, 1957 *Ann. Mag. nat. Hist.* (Ser. 12) **10**: 780.

Distribution: Western Australia.

This species was described from a single specimen (♂) caught at Albany, Western Australia. No other specimens have been recorded.

*2. **P. doclea** (Walker, 1849)

Trypeta doclea Walker, 1849 *List Dipt. Brit. Mus.* **4**: 1035.

(Syn.) *P. barbata, P. barbifera* Hendel, 1914a :84; 1914b :144.

Pogonortalis barbifera Hendel, 1914 Bezzi, 1913 *Mem. Indian Mus.* **3**: 71 (No. 87). Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 612.

Pogonortalis doclea (Walk. 1849) Malloch, 1930 *ibid* **55**: 429; 1939 *ibid* **55**: 429; 1939 *ibid* **64**: 120. Paramonov, 1957 *Ann. Mag. nat. Hist.* (Ser. 12) **10**: 779. Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 213.

Distribution: All Australian States except Tasmania.

3. **P. fulvofemoralis** Malloch, 1942

Pogonortalis fulvofemoralis Malloch, 1942 *Bernice P. Bishop Mus. Bull.* **172**: 205.

Distribution: Guam.

*4. **P. howei** Paramonov, 1957

Pogonortalis howei Paramonov, 1957 *Ann. Mag. nat. Hist.* (Ser. 12) **10**: 780.

Distribution: Lord Howe Island (Australia).

*5. **P. similis** Hendel, 1914

Pogonortalis similis Hendel, 1914b :143; 1914a :85. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 120.

Distribution: New Guinea.

*6. **P. uncinata** de Meijere, 1911

Pogonortalis uncinata de Meijere, 1911 *Tijd. Ent.* **54**: 370. Hendel, 1914a :85; 1914b :145. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 119 (included in key but no further details).

Plagiostenopterina aberrans (Frey, 1930) Hennig, 1941 *Arb. morph. taxon. Ent. Berl.* **7**: 315.

Distribution: Java.

39. Genus: **RIVELLIA** Robineau-Desvoidy, 1830

Robineau-Desvoidy, 1830 *Essai Myodaires* :729.

Type species: *Musca syngenesiae* Fabricius, 1781 (The type species is of European origin).

Curran, 1934 *N. Amer. Dipt.* :281. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 120.

1. **R. abana** Curran, 1929

Rivellia abana Curran, 1929 *Amer. Mus. Nov.* No. **339**: 11.

Distribution: New Caledonia.

2. **R. aequifera** (Walker, 1862)

Ortalis aequiferus Walker, 1862 *J. Proc. Linn. Soc. Lond.* **6**: 15.

Rivellia aequifera (Walk., 1862) Hendel, 1914a :89; 1914b :182.

Hendel regarded this species as doubtful.

Distribution: Moluccas.

*3. **R. affinis** Hendel, 1914

Rivellia affinis Hendel, 1914b :161; 1914a :87. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 121.

Distribution: New Guinea.

*4. **R. basilaris** (Wiedemann, 1830)

Trypeta basilaris Wiedeman, 1830 *Auss. zweifl. Ins.* **2**: 510.

Rivellia basilaris (Wied., 1830) Bezzi, 1913 *Mem. Indian Mus.* **3**: 68 (No. 32); 1913 *Philippine J. Sci.* (D) **8**: 321. Hendel, 1914a :87; 1914b :155. Bezzi, 1928 *Dipt. Fiji* :91. Frey, 1930 *Notul. ent.*

Helsingf. **10**: 54. Malloch, 1930 *Ins. Samoa* **6** (5): 221. Curran, 1936 *Proc. Calif. Acad. Sci.* (4th Ser.) **22** (1): 23.

Distribution: Sumatra; Java; Singapore; Taiwan; Japan; Fiji; Solomon Islands.

5. **R. concisivitta** (Walker, 1862)

Ortalis concisivitta Walker, 1862 *J. Proc. Linn. Soc. Lond.* **6**: 16.

Rivellia concisivitta (Walk., 1862) Hendel, 1914a :88; 1914b :182.

Distribution: Moluccas.

Hendel regarded this species as doubtful.

*6. **R. connata** (Thomson, 1868)

Herina connata Thomson, 1868 *Dipt. Eug. Resa* :575.

Rivellia connata (Thomson, 1868) Hendel, 1914a :88; 1914b :152. Bezzi, 1928 *Dipt. . . . Fiji* :91. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 351; 1930 *ibid* **55**: 491 Fig. 1; 1930 *Ins. Samoa* **6** (5): 221; 1939 *Proc. Linn. Soc. N.S.W.* **64**: 120.

Distribution: Australia; Samoa; Fiji; a common, widely-spread species in all parts of Australia.

*7. **R. connexa** Hendel, 1914

Rivellia connexa Hendel, 1914b :163; 1914a :88. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 121.

Distribution: New Guinea.

8. **R. decatomoides** (Walker, 1862)

Ortalis decatomoides Walker, 1862 *J. Proc. Linn. Soc. Lond.* **6**: 16.

Rivellia decatomoides (Walk., 1862) Hendel, 1914b :182. Hendel, (1914a, 1914b) regarded this species as doubtful.

Distribution: Moluccas.

*9. **R. dimidiata** de Meijere, 1908

Rivellia dimidiata de Meijere, 1908 *Tijd. Ent.* **51**: 122 Pl. 4, Fig. 2. Hendel, 1914a :88; 1914b :164. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 121 Pl. 4, Fig. 19.

Distribution: New Guinea.

*10. **R. distobasalis** Hardy, 1959

Trypeta basalis Walker, 1859 (*nec. Trypeta basalis* Walker, 1852) *J. Proc. Linn. Soc. Lond.* **3**: 120. Bezzi, 1913 *Mem. Indian Mus.* **3**: 67 (No. 30).

Rivellia distobasalis Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 211.

Distribution: Aru Islands (New Guinea).

*11. **R. ferruginea** Hendel, 1914

Rivellia ferruginea Hendel, 1914b :159; 1914a :88. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 121.

Distribution: New Guinea.

*12. **R. fulvescens** Malloch, 1940

Rivellia fulvescens Malloch, 1940 *Proc. R. ent. Soc. Lond.* (B) **9**: 72.

Distribution: Solomon Islands.

*13. **R. fusca** (Thomson, 1868)

Herina fusca Thomson, 1868 *Dipt. Eug. Resa* :575.

Rivellia fusca (Thomson, 1868) Osten-Sacken, 1882 *Berl. ent. Zeit.* **26**: 211. Bezzi, 1913 *Philippine J. Sci.* (D) **8**: 321. Hendel, 1914a :89; 1914b :156. Frey, 1930 *Notul. ent. Helsingf.* **10**: 55. Curran, 1936 *Proc. Calif. Acad. Sci.* (4th Series) **22**: 23. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 121.

Distribution: Java; Philippines; New Guinea; Solomon Islands; Taiwan.

14. **R. hendeliana** Bezzi, 1917

Rivellia hendeliana Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 138. Frey, 1930 *Notul. ent. Helsingf.* **10**: 55.

Distribution: Philippines.

15. **R. imitans** Malloch, 1930

Rivellia imitans Malloch, 1930 *Ins. Samoa* **6** (5): 220.

Distribution: Samoa.

*16. **R. isolata** Malloch, 1930

Rivellia isolata Malloch, 1930 *Proc. Linn. Soc. N.S.W.* **55**: 492 Fig. 2.

Distribution: New South Wales (Australia).

17. **R. lavata** Hendel, 1914

Rivellia lavata Hendel, 1914b :165; 1914a :89. Malloch, 1930 *Ins. Samoa* **6** (5): 221.

Distribution: Samoa.

18. **R. marina** Malloch, 1940

Rivellia marina Malloch, 1940 *Proc. R. ent. Soc. Lond.* (B) **9**: 19.

Distribution: Admiralty Islands.

19. **R. obliqua** (Walker, 1861)

Ortalis obliqua Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 297.

Rivellia obliqua (Walk., 1861) Hendel, 1914b :172; 1914a :89.

Distribution: Moluccas.

Hendel was doubtful of this species.

20. **R. pipartita** Hendel, 1933

Rivellia pipartita Hendel, 1933 *Dtsch. ent. Z.* (year 1933) :42.

Distribution: Java.

*21. **R. polita** Hendel, 1932

Rivellia polita Hendel, 1932 *Mem. Mus. Hist. nat. Belg.* **4**: 30.

Distribution: New Guinea.

*22. **R. radiata** Hendel, 1914

Rivellia radiata Hendel, 1914b :161; 1914a :90. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 121.

Distribution: New Guinea.

*23. **R. rufibasis** Malloch, 1939

Rivellia rufibasis Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 121 Pl. 4, Fig. 18.

Distribution: New Guinea.

24. **R. sauteri** Hendel, 1914

Rivellia sauteri Hendel, 1914b :158; 1914a :90. Frey, 1930 *Notul. ent. Helsingf.* **10**: 55.

Distribution: Taiwan; Philippines.

*25. **R. similis** Hendel, 1914

Rivellia similis Hendel, 1914b :157; 1914a :90.

Distribution: New Britain.

26. **R. sumbawana** Hennig, 1941

Rivellia sumbawana Hennig, 1941 *Arb. morph. taxon. Ent. Berl.* **8**: 23.

Distribution: Sumbawa Island.

27. **R. vacillans** (Walker, 1860)

Ortalis vacillans Walker, 1860 *J. Proc. Linn. Soc. Lond.* 4: 157.

Rivellia vacillans (Walk., 1860) Hendel, 1914a :90; 1914b :182.

Distribution: Celebes.

Hendel was doubtful of this species.

*28. **R. virgo** Hendel, 1914

Rivellia virgo Hendel, 1914b :167; 1914a :90. Malloch, 1930 *Proc. Linn. Soc. N.S.W.* **55**: 492 Fig. 3.

Distribution: New South Wales (Australia).

*29. **R. viridis** Hendel, 1914

Rivellia viridis Hendel, 1914b :152; 1914a :90.

Distribution: New South Wales (Australia).

Hendel suggested that this species was possibly synonymous with *Ortalis mentissa* Walker, 1849 *List Dipt. Brit. Mus.* **4**: 991.

39A. Genus: **ZEALANDORTALIS** Malloch, 1930

Malloch, 1930 *Rec. Canterbury (N.Z.) Mus.* **3**: 243. Harrison, 1959 *N.Z. Dept. Sci. ind. Res. Bull.* **128**: 176.

1. **Z. interrupta** Malloch, 1930

Zealandortalis interrupta Malloch, 1930 *Rec. Canterbury (N.Z.) Mus.* **3**: 243. Harrison, 1959 *N.Z. Dept. Sci. ind. Res. Bull.* **128**: 176 Fig. 209.

Distribution: New Zealand.

2. **Z. philpotti** Harrison, 1959

Zealandortalis philpotti Harrison. 1959 *N.Z. Dept. Sci. ind. Res. Bull.* **128**: 178 Fig. 210.

Distribution: New Zealand.

These are the only species of Otitidae recorded from New Zealand.

42. Genus: **EUXESTOMOEA** de Meijere, 1913

de Meijere, 1913 *Nov. Guin.* **9**: 377. Hendel, 1914a :91; 1914b :187. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 105.

Type species: *Ortalis promptus* Walker, 1859.

*1. **E. bipunctata** Hendel, 1914

Euxestomoea bipunctata Hendel, 1914b :188; 1914a :93. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 106 Pl. 4, Fig. 6.

Distribution: New Guinea.

*2. **E. discifera** de Meijere, 1913

Euxestomoea discifera de Meijere, 1913 *Nov. Guin.* **9**: 377. Hendel, 1914a :93; 1914b :189. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 106.

Distribution: New Guinea.

*3. **E. prompta** (Walker, 1859)

Ortalis promptus Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 118.

Euxestomoea prompta (Walk., 1859) de Meijere, 1913 *Nov. Guin.* **9**: 377; 1915 *Tijd. Ent.* **58**: 135. Hendel, 1914a :93; 1914b :187. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 106.

Distribution: New Guinea.

Although the section on *Euxestomoea* in de Meijere, 1913 *Nova Guinea* was the work of Hendel, and de Meijere used the wording "*Euxestomoea* Hendel, *Euxestomoea* remained a M.S. name until de Meijere validated it by his publication of it in *Nova Guinea*. As Neave (*Nomenclator Zoologicus* **2**: 383) points out, the correct citation is therefore *Euxestomoea* de Meijere, 1913.

44. Genus: **LOXONEVRA** Macquart, 1835

Macquart, 1835 *Suites Buffon* **2**: 446 Pl. 19, Fig. 10.

Loxoneura Hendel, 1914a :96; 1914b :190.

Type species: *Dictya decora* Fabricius, 1805.

Because the letters v and u in Macquart's *Suites à Buffon* are somewhat alike in print, authors have mistakenly adopted the spelling *Loxoneura*. Inspection of Macquart's work shows beyond all doubt that he named the genus *Loxonevra*. *Loxonevra* Macquart, 1835 is the only spelling recognized by Neave (*Nomenclator Zoologicus* **2**: 1003).

1. **L. decora** (Fab., 1805)

Dictya decora Fabricius, 1805 *Syst. Antl.* :327.

Loxonevra decora (Fab., 1805) Macquart, 1835 *Suites Buffon* **2**: 446 Pl. 19, Fig. 10. Bezzi, 1913 *Mem. Indian Mus.* **3**: 81 (No. 280). Hendel, 1914a :98; 1914b :191. Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 138. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 118. Frey, 1930 *Notul. ent. Helsingf.* **10**: 55.

Distribution: Java; Sumatra; Nepal (India); Philippines.

2. **L. fascipennis** Hendel, 1914

Loxonevra fascipennis Hendel, 1914b :195; 1914a :98.

Distribution: Borneo.

3. **L. perilampoides** Walker, 1858

Loxonevra perilampoides Walker, 1858 *Trans. ent. Soc. Lond.* (new ser.) **4**: 226. Hendel, 1914a :98; 1914b :198.

Distribution: Sumatra; Sikkim (India).

46. Genus: **ACHIOSOMA** Hendel, 1914

Hendel, 1914b :200; 1914a :100. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 130.

Type species: *Achias dacoides* Walker, 1865.

*1. **A. aspiciens** (Walker, 1864)

Dacus aspiciens Walker, 1864 *J. Proc. Linn. Soc. Lond.* **7**: 229.

Achiosoma aspiciens (Walk., 1864) Hendel, 1914a :101; 1914b :201. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 130.

Distribution: New Guinea.

*2. **A. costalis** Malloch, 1939

Achiosoma costalis Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 130.

Distribution: New Guinea.

*3. **A. dacoides** (Walker, 1865)

Achias dacoides Walker, 1865 *J. Proc. Linn. Soc. Lond.* **8**: 133.

Achiosoma dacoides (Walker, 1865) Hendel, 1914a :101; 1914b :200. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 130.

Distribution: New Guinea.

*4. **A. nigrifacies** Malloch, 1939

Achiosoma nigrifacies Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 131 Pl. 5, Fig. 26.

Distribution: New Guinea.

47. Genus: **ACHIAS** Fabricius, 1805

Fabricius, 1805 *Syst. Antl.* :247. Hendel, 1914a :101; 1914b :201. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 351; 1939 *ibid* **64**: 132.

Type species: *Achias oculatus* Fabricius, 1805.

*1. **A. albertisi** Osten-Sacken, 1881

Achias albertisi Osten-Sacken, 1881 *Ann. Mus. Stor. nat. Genova* **16**: 473. Hendel, 1914a :103; 1914b :210. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 137.

Distribution: New Guinea.

*2. **A. amplividens** Walker, 1859

Achias amplividens Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 122. Hendel, 1914a :103; 1914b :272. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 135.

Distribution: Aru Island (New Guinea).

*3. **A. apictipennis** Hennig, 1940

Achias apictipennis Hennig, 1940 *Arb. morph. taxon. Ent. Berl.* **7**: 316.

Distribution: Queensland (Australia).

*4. **A. australis** Malloch, 1939

Achias australis Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 137 Pl. 5, Fig. 28.

Distribution: Queensland (Australia).

*5. **A. brachyophthalmus** Walker, 1865

Achias brachyophthalmus Walker, 1865 *J. Proc. Linn. Soc. Lond.* **8**: 119. Hendel, 1914a :103; 1914b :218. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 135 Pl. 5, Fig. 27.

Distribution: New Guinea.

*6. **A. diversifrons** de Meijere, 1913

Achias diversifrons de Meijere, 1913 *Nov. Guin.* **9**: 371. Hendel, 1914a :103; 1914b :214. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 136.

Distribution: New Guinea.

*7. **A. fulviceps** de Meijere, 1913

Achias fulviceps de Meijere, 1913 *Nov. Guin.* **9**: 373. Hendel, 1914a :103; 1914b :205. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 134.

Distribution: New Guinea.

*8. **A. furcatus** Hendel, 1914

Achias furcatus Hendel, 1914b :216; 1914a :103. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 136.

Distribution: New Guinea.

*9. **A. gjellerupi** de Meijere, 1915

Achias gjellerupi de Meijere, 1915 *Tijd. Ent.* **58**: 130.

Distribution: New Guinea.

*10. **A. kurandana** Hennig, 1940

Achias kurandana Hennig, 1940 *Arb. morph. taxon. Ent. Berl.* **7**: 315.

Distribution: Queensland (Australia).

*11. **A. latividens** Walker, 1859

Achias latividens Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 121. Hendel, 1914a :103; 1914b :208. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 126. Malloch, 1939 *Proc. Linn. Soc. Lond.* **64**: 137.

Distribution: New Guinea.

*12. **A. longividens** Walker, 1859

Achias longividens Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 121. Hendel, 1914a :103; 1914b :210. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 137.

Distribution: Aru Island (New Guinea).

*13. **A. macrocephalus** Hendel, 1914

Achias macrocephalus Hendel, 1914b :215; 1914a :104. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 137 (as *microcephalus* (*sic.*)).

Distribution: New Guinea.

14. **A. oculatus** Fabricius, 1805

Achias oculatus Fabricius, 1805 *Syst. Antl.* :247. Hendel, 1914a :104; 1914b :203.

Distribution: Java (*sic.*).

This and *A. australis* Malloch are the only species not recorded from New Guinea. All the other described species are endemic to New Guinea. But see *15. *A. platychirus* Hendel (below).

*15. **A. platychirus** Hendel, 1914

Achias platychirus Hendel, 1914b :204; 1914a :104. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 134.

Distribution: New Guinea.

Hendel (1914b :202 (footnote)) suggested that his *A. platychirus* might be a synonym of *A. oculatus* Fab., 1805. Should this be demonstrated, *A. oculatus* would be a New Guinea as well as a Java species.

*16. **A. punctulatus** de Meijere, 1913

Achias punctulatus de Meijere, 1913 *Nov. Guin.* **9**: 372. Hendel, 1914a :104; 1914b :215. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 137.

Distribution: New Guinea.

*17. **A. rothschildi** Austen, 1910

Achias rothschildi Austen, 1910 *Novit. Zool.* **17**: 459 Pl. 15, Figs. 5-9. Hendel, 1914a :104; 1914b :206. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 137.

Distribution: New Guinea.

*18. **A. strigatus** de Meijere, 1913

Achias strigatus de Meijere, 1913 *Nov. Guin.* **9**: 372. Hendel, 1914a :104; 1914b :205. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 134.

Distribution: New Guinea.

*19. **A. subnudus** Malloch, 1939

Achias subnudus Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 134.

Distribution: New Guinea.

*20. **A. thoracalis** Hendel, 1914

Achias thoracalis Hendel, 1914b :213; 1914a :104. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 136.

Distribution: New Guinea.

*21. **A. venustulus** Walker, 1865

Achias venustulus Walker, 1865 *J. Proc. Linn. Soc. Lond.* **8**: 119. Hendel, 1914a :104; 1914b :219. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 134.

Distribution: New Guinea.

48. Genus: **LAMPROGASTER** Macquart, 1843

Macquart, 1843a *Mem. Soc. R. Sci. Lille* (1842) :368; 1843b *Dipt. exot.* **2**: 211. Hendel, 1914a :104; 1914b :220. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 348; 1929 *ibid* **54**: 513; 1930 *ibid* **55**: 432; 1939 *ibid* **64**: 138.

Type species: *Lamprogaster flavipennis* Macquart, 1843.

1. **L. amitina** Frey, 1930

Lamprogaster amitina Frey, 1930 *Notul. ent. Helsingf.* **10**: 55.

Distribution: Philippines.

2. **L. angusta** Enderlein, 1924

Lamprogaster angusta Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 128.

Distribution: Moluccas.

*3. **L. apicalis** (Walker, 1849)

Chromatomyia apicalis Walker, 1849 *List. Dipt. Brit. Mus.* **4**: 804.

Lamprogaster apicalis (Walk., 1849) Hendel, 1914a :107; 1914b :227.

Helocnemia apicalis (Walk., 1849) Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 128. *Lamprogaster apicalis* (Walk., 1849) Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 138.

Distribution: Western Australia.

*4. **L. austeni** Sharp, 1900

Lamprogaster austeni Sharp, 1900 *Willey Results* **4**: 391 Pl. 35, Figs. 11-11c.

L. xanthoptera Hendel, 1914a :107; 1914b :220; (footnote) *ibid* :225. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 127. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 349; 1929 *ibid* **54**: 515.

L. austeni Sharp, 1900, 1939 *ibid* **64**: 143.

Distribution: Bismarck Archipelago.

*5. **L. basalis** Walker, 1861

Lamprogaster basalis Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 248. Hendel, 1914a :107; 1914b :229. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 127. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 144.

Distribution: New Guinea.

*6. **L. bicolor** Macquart, 1847

Lamprogaster bicolor Macquart, 1847 *Dipt. exot. Supp.* **2**: 89. Hendel, 1914a :107; 1914b :237. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 127. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 349.

Distribution: New South Wales (Australia).

7. **L. celebensis** Enderlein, 1924

Lamprogaster celebensis Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 127.

Distribution: Celebes.

*8. **L. costalis** Walker, 1861

Lamprogaster costalis Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 247. Hendel, 1914a :108; 1914b :231. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 141.

Distribution: New Guinea.

*9. **L. decolor** Malloch, 1939

Lamprogaster decolor Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 144 Pl. 5, Fig. 30.

Distribution: New Guinea.

*10. **L. elongata** v. d. Wulp, 1885

Lamprogaster elongata v. d. Wulp, 1885 *Tijd. Ent.* **28**: 228. Hendel 1914a :108; 1914b :223. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 126. *Non* Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 515 (*L. pseudelongata* Malloch, 1930) see *note*. 1930 *ibid* **55**: 432 Fig. 1, 1939 *ibid* **64**: 144.

Distribution: New Guinea and surrounding islands.

In the 1929 reference above, Malloch misidentified as *L. elongata* a species sent to him from Queensland. He corrected this mistake in his 1930 reference where he described the Queensland species under the name of *L. pseudelongata*. It is to this species, therefore, that the 1929 reference actually applies.

*11. **L. flavipennis** Macquart, 1843

Lamprogaster flavipennis Macquart, 1843 *Dipt. exot.* **2**: 211 Pl. 28, Fig. 7. Hendel, 1914a :108; 1914b :234. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 127. Bezzi, 1928 *Dipt. . . . Fiji* :91. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 349.

Distribution: Victoria and New South Wales (Australia); Fiji.

Bezzi's identification of *L. flavipennis* from Fiji requires confirmation.

12. **L. fulvescens** Malloch, 1931

Lamprogaster fulvescens Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 11.

Distribution: Philippines.

*13. **L. fulvipes** Malloch, 1939

Lamprogaster fulvipes Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 145 Pl. 5, Fig. 31.

Distribution: New Guinea.

*14. **L. fuscibasis** Malloch, 1930

Lamprogaster fuscibasis Malloch, 1930 *Proc. Linn. Soc. N.S.W.* **55**: 433.

Distribution: Queensland (Australia).

*15. **L. grossa** Malloch, 1939

Lamprogaster grossa Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 142.

Distribution: New Guinea.

*16. **L. hilaris** (Walker, 1849)

Chromatomyia hilaris Walker, 1849 *List Dipt. Brit. Mus.* **4**: 804.

Lamprogaster hilaris (Walk., 1849) Hendel, 1914a :108; 1914b :244.

Distribution: ? Australia (*sic.*).

This is a very doubtful species. It is represented by the remains of Walker's type, and has apparently not been collected since. Hendel (1914b) quotes Walker's description *verbatim* without further comment; Malloch does not refer to the species at all. Even the type locality is uncertain.

*17. **L. indistincta** Malloch, 1928

Lamprogaster indistincta Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 349.

Distribution: Northern Australia.

*18. **L. instabilis** (Walker, 1861)

Dacus instabilis Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 250. Bezzi, 1913 *Mem. Indian Mus.* **3**: 74 (No. 140).

L. gracilis Hendel, 1914b :225. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 141. *L. instabilis* (Walk., 1861) Hardy, 1959 *Bull. Brit. Mus.* (*nat. Hist.*) *Ent.* **8** (5): 177.

Distribution: New Guinea.

*19. **L. jucunda** (Walker, 1849)

Chromatomyia jucunda Walker, 1849 *List Dipt. Brit. Mus.* **4**: 802.

Lamprogaster jucunda (Walk., 1849) Hendel, 1914a :108; 1914b :238. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 127.

Distribution: New South Wales (Australia).

Although not referred to by Malloch, Enderlein had specimens sent to him from Sydney, N.S.W.

*20. **L. laeta** (Guérin, 1830)

Platystoma laeta Guérin, 1830 *Voy. Coquille* :299.

Lamprogaster laeta (Guérin, 1830) Hendel, 1914a :108; 1914b :244. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 516.

Distribution: New South Wales (Australia); Queensland (Australia).

This species is not *Chromatomyia laeta* Walker, 1849 (*List Dipt. Brit. Mus.* **4**: 805), a confusion for which Hendel was responsible. In his 1914b publication, although he had seen neither the type nor specimens con-specific with it, he transferred Walker's species to *Lamprogaster* but stated that *he believed it to be Duomyia* sp.! In the same publication, he also transferred *Platystoma laeta* Guerin, 1830 to *Lamprogaster*. By so doing, he produced *L. laeta* (Guérin, 1830) and *L. laeta* (Walker, 1849).

In 1929, Malloch (*Proc. Linn. Soc. N.S.W.* **54**: 516) established the validity of *L. laeta* (Guérin, 1830). He received specimens of it from

Queensland (Australia). In his paper, he provided a modern description and commented that this was "the first known record since the original description".

Walker's species has no definite status until critical examination of the type enables it to be correctly placed generically.

*21. **L. lepida** Walker, 1857

Lamprogaster lepida Walker, 1857 *Trans. ent. Soc. Lond.* (new series) **4**: 226. Hendel, 1914a :108; 1914b :235. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 349; 1929 *ibid* **54**: 516.

Distribution: Queensland (Australia); Celebes.

*22. **L. macrocephala** Hendel, 1914

Lamprogaster macrocephala Hendel, 1914b :230; 1914a :108. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 145.

Distribution: New Guinea.

*23. **L. maculipennis** Macquart, 1847

Lamprogaster maculipennis Macquart, 1847 *Dipt. exot. Supp.* **2**: 89 Pl. 6, Fig. 5. Hendel, 1914a :108; 1914b :231. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 143.

Distribution: Eastern Australia.

24. **L. obliqua** Frey, 1930

Lamprogaster obliqua Frey, 1930 *Notul. ent. Helsingf.* **10**: 56.

Distribution: Philippines.

*25. **L. patula** Walker, 1861

Lamprogaster patula Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 247. Hendel, 1914a :107; 1914b :222. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 128 (as *Ceratopelta patula* (Walk., 1861). Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 140.

Distribution: New Guinea.

26. **L. placida** (Walker, 1849)

Chromatomyia placida Walker, 1849 *List Dipt. Brit. Mus.* **4**: 802.

Lamprogaster placida (Walker, 1849) Hendel, 1914b :243; 1914a :109. Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 139. Frey, 1930 *Notul. ent. Helsingf.* **10**: 46. Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 11.

Distribution: Philippines.

*27. **L. poecila** Hendel, 1914

Lamprogaster poecila Hendel, 1914b :239; 1914a :109.

Distribution: Northern Australia.

*28. **L. pseudelongata** Malloch, 1930

Lamprogaster pseudelongata Malloch, 1930 *Proc. Linn. Soc. N.S.W.* **55**: 432 Fig. 2; 1929 *ibid* **54**: 515.

Distribution: Queensland (Australia).

Malloch, 1929 referred this species to *L. elongata* v. d. Wulp, 1885. He corrected the mistake in his 1930 reference where he described *L. pseudelongata* as *sp. nov.* His 1929 reference is hence to *L. pseudelongata.*

29. **L. pumicata** v. d. Wulp, 1885

Lamprogaster pumicata v. d. Wulp, 1885 *Tijd. Ent.* **28**: 230 Pl. 7, Fig. 12. Hendel, 1914a :109; 1914b :238. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 516; 1939 *ibid* **64**: 143.

Distribution: New Caledonia.

*30. **L. quadrilinea** Walker, 1859

Lamprogaster quadrilinea Walker, 1859. Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 111. de Meijere, 1913 *Nov. Guin.* **9**: 370. 1915 *Tijd. Ent.* **58**: 132. Hendel, 1914a :109; 1914b :242. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 142.

Distribution: New Guinea.

*31. **L. rufipes** Hendel, 1914

Lamprogaster rufipes Hendel, 1914b :233; 1914a :109. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 143.

Distribution: New Guinea.

*32. **L. severa** Hendel, 1914

Lamprogaster severa Hendel, 1914b :240; 1914a :109. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 143.

Distribution: New Guinea.

*33. **L. stenoparia** Hendel, 1914

Lamprogaster stenoparia Hendel, 1914b :227; 1914a :109. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 350; 1929 *ibid* **54**: 515; 1939 *ibid* **64**: 144.

Distribution: Queensland (Australia).

34. **L. superna** Walker, 1862

Lamprogaster superna Walker, 1862 *J. Proc. Linn. Soc. Lond.* **6**: 12. Hendel, 1914a :109; 1914b :240.

Distribution: Moluccas.

35. **L. taeniata** v. d. Wulp, 1885

Lamprogaster taeniata v. d. Wulp, 1885 *Tijd. Ent.* **28**: 229 Pl. 7, Figs. 10 and 11. Hendel, 1914a :109; 1914b :241. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 145.

Distribution: Moluccas.

*36. **L. trisignata** v. d. Wulp, 1885

Lamprogaster trisignata v. d. Wulp, 1885 *Tijd. Ent.* **28**: 231 Pl. 7, Fig. 13. de Meijere, 1913 *Nov. Guin.* **9**: 370. Hendel, 1914a 109; 1914b :232. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 143.

Distribution: New Guinea.

*37. **L. unimacula** Hendel, 1914

Lamprogaster unimacula Hendel, 1914b :239.

Distribution: Queensland (Australia).

*38. **L. vella** (Walker, 1849)

Chromatomyia vella Walker, 1849 *List Dipt. Brit. Mus.* **4**: 803.

Lamprogaster vella (Walker, 1849) Hendel, 1914a :109; 1914b :233.

Distribution: Queensland (Australia).

*39. **L. viola** Malloch, 1929

Lamprogaster viola Malloch, 1929. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 515.

Distribution: Queensland (Australia).

*40. **L. violacea** (Macquart, 1843)

Cryphocera violacea Macquart, 1843 *Dipt. exot.* **2**: 212 Pl. 29, Fig. 4.

Lamprogaster violacea (Macq., 1843) Hendel, 1914a :109; 1914b :244.

Distribution: New Guinea.

*41. **L. zelotypa** Hendel, 1914

Lamprogaster zelotypa Hendel, 1914b :226; 1914a :110. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 350; 1929 *ibid* **54**: 515; 1939 *ibid* **64**: 141.

Distribution: Queensland (Australia); New Guinea.

Lamprogaster is essentially a *New Guinea-Australian* genus. Inspection of otitid collections in Australian museums shows that many species await description.

49. Genus: **MONTROUZIERA** Bigot, 1860 (Monotypic)

Bigot, 1860 *Ann. Soc. ent. France* (3rd series) **8**: 224.

Type species: *M. lifua* Bigot, 1860.

1. **M. lifua** Bigot, 1860

Montrouziera lifua Bigot, 1860 *Ann. Soc. ent. France* (3rd series) **8**: 224. Hendel, 1914a :110; 1914b :245.

Distribution: New Caledonia.

49A. Genus: **RHEGMATOSAGA** Frey, 1930 (Monotypic)

Frey, 1930 *Notul. ent. Helsingf.* **10**: 63.

Type species: *Rhegmatosaga latiuscula* (Walker, 1857).

1. **R. latiuscula** (Walker, 1857)

Noeeta latiuscula Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 133.

Syn.: *Rhegmatosaga insignis* Frey, 1930 *Notul. ent. Helsingf.* **10**: 63 Pl. 1, Fig. 8; 1932 *Ann. Mag. nat. Hist.* **10**: 256.

Rhegmatosaga latiuscula (Walker, 1857) Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **10**: 256.

Distribution: Philippines.

Frey designated his *insignis* as the type species of his *gen. nov.*, *Rhegmatosaga*. Since *insignis* is a synonym of *Noeeta latiuscula* Walker, *latiuscula* is the type species of *Rhegmatosaga*.

49B. Genus: **TYLOPTERNA** Bezzi, 1917

Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 131.

Type species: *Tylopterna monstruosum* Bezzi, 1917.

1. **T. monstruosum** Bezzi, 1917

Tylopterna monstruosum Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 133. Frey, 1930 *Notul. ent. Helsingf.* **10**: 64.

Distribution: Philippines.

51. Genus: **LENOPHILA** Guérin-Ménéville, 1843

Guérin-Ménéville, 1843 *Rev. Zool.* **6**: 200.

Celetor Loew, 1873 *Mon. N. Amer. Dipt.* **3**: 41. Hendel, 1914a :113; 1914b :246. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 505.

Lenophila Guerin, 1843 Bezzi, 1913 *Mem. Indian Mus.* **3**: 70.

Type species: *Ortalis dentipes* Macquart, 1843.

*1. **L. caerulea** (Macquart, 1846) (*conj. nov.*)

Tephritis caerulea Macquart, 1846 *Dipt. exot. Supp.* **1**: 212 Pl. 18, Fig. 15.

Trypeta cluana Walker, 1849 *List Dipt. Brit. Mus.* **4**: 1019.

Lamprogaster caerulea (Macq., 1846) Schiner, 1868 *Dipt. Novara Reis.* :285.

Celetor caerulea (Macq., 1846) Loew, 1873 *Mon. N. Amer. Dipt.* **3**: 41. Hendel, 1914a :115; 1914b :247. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 506. Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 211.

Distribution: Most Australian States.

This species has the peculiar habit of resting on the long, sharp-edged, siliceous leaves of "grass-trees" (*Xanthorrhoea* spp.) with the outspread wings pressed flat against the leaf surface. This habit, aided by the markings on the wings, gives the insects the appearance of spiders. When the plant is approached, the insects make no attempt to fly; they merely close their wings rapidly, and drop down in the spiny centre of the plant where they are more than adequately protected. This behaviour has been noted by several entomologists, but the association between insect and plant is unknown.

*2. **L. dentipes** (Macquart, 1843)

Ortalis dentipes Macquart, 1843 *Dipt. exot.* **2**: 210 Pl, 28. Fig. 5.

Ceratitis? dentipes (Macq., 1843) Guérin, 1843 *Rev. zool.* **6**: 200.

Lenophila dentipes (Macq., 1843) Guérin, 1843 *ibid* **6**: 200.

Tephritis strigipennis Macquart, 1850 *Dipt. exot. Supp.* **4**: 290 Pl. 27, Fig. 2.

Lamprogaster dentipes (Macq., 1843) Schiner, 1868 *Dipt. Novara Reis.* 285.

Celetor dentipes (Macq., 1843) Loew. 1873 *Mon. N. Amer. Dipt.* **3**: 41.

Lenophila dentipes (Macq., 1843) Bezzi, 1913 *Mem. Indian Mus.* **3**: 70 (No. 75).

Celetor dentipes (Macq., 1843) Hendel, 1914a :115; 1914b :246. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 120. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 506.

Distribution: New South Wales (Australia).

This genus has long been wrongly known as *Celetor*. When Loew erected *Celetor*, he designated *Celetor caerulea* (Macq., 1846) as the type species, being unaware that Guérin (1843) had already proposed *Lenophila*, and by giving a full re-description of *Lenophila dentipes* (Macq., 1843) had made it the type species of the genus. Bezzi (1913) was aware of Guérin's work but in his paper in *Mem. Indian Mus.* he merely cited the correct name without comment, so that the incorrect *Celetor* has hitherto been used by almost all earlier workers in the Otitidae. The above facts necessitate the transfer of both species to *Lenophila* with *Ortalis dentipes* Macq., 1843 as the type species of the genus.

52. Genus: **SCHOLASTES** Loew, 1873

Loew, 1873 *Mon. N. Amer. Dipt.* **3**: 38. Hendel, 1914a :117; 1914b :248. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 127.

Type species: *Platystoma cinctum* Guérin, 1830.

*1. **S. aitapensis** Malloch, 1939

Scholastes aitapensis Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 128, Pl. 5, Fig. 24; 1940 *Ann. Mag. nat. Hist.* **6**: 20; 1942 *Bernice P. Bishop Mus. Bull.* **172**: 207; 1946 *ibid* **189**: 199.

Distribution: New Guinea; Guam; Solomon Islands; Shortland Island; Admiralty Islands.

*2. **S. bimaculatus** Hendel, 1914

Scholastes bimaculatus Hendel, 1914b :252; 1914a :117. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 121. Bezzi, 1928 *Dipt. . . . Fiji* :92. Malloch, 1930 *Ins. Samoa* **6** (5): 223; 1939 *Proc. Linn. Soc. N.S.W.* **64**: 129.

S. solomonensis Curran, 1936. Malloch, 1940 *Ann. Mag. nat. Hist.* **6**: 73.

Distribution: New Britain; Fiji; Samoa; Hawaii.

3. **S. carolinensis** Enderlein, 1924

Scholastes carolinensis Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 121.

Distribution: Caroline Islands.

*4. **S. cinctus** (Guérin, 1830)

Platystoma cinctum Guérin, 1830 *Voy. Coquille Zool.* :299 Pl. 21, Fig. 9.

Scholastes cinctus (Guérin, 1830) Hendel, 1914b :249; 1914a :117. Bezzi, 1913 *Mem. Indian Mus.* **3**: 71, 72 (Nos. 99 and 102); 1917 *Philippine J. Sci.* (D) **12**: 139; 1928 *Dipt. . . . Fiji* :91. de Meijere, 1915 *Tijd. Ent.* **58**: 132. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 120. Malloch, 1930 *Ins. Samoa* **6** (5): 22; 1939 *Proc. Linn. Soc. N.S.W.* **64**: 128 Pl. 5, Fig. 23.

S. whitneyi Curran, 1936. Malloch, 1940 *Ann. Mag. nat. Hist.* **6**: 73.

Distribution: New South Wales (Australia); New Guinea; New Britain; Java; Philippines; Fiji.

5. **S. frauenfeldi** (Schiner, 1868)

Dacus frauenfeldi Schiner, 1868 *Dipt. Novara Reis.* :285. Bezzi, 1913 *Mem. Indian Mus.* **3**: 72 (No. 114).

Scholastes frauenfeldi (Schiner, 1868) Hendel, 1914a :117: 1914b :251. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 121.

Distribution: Java; Caroline Islands.

6. **S. furcatifascia** Enderlein, 1924

Scholastes furcatifascia Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 121.

Distribution: Borneo.

7. **S. hirtiventris** Malloch, 1942

Scholastes hirtiventris Malloch, 1942 *Bernice P. Bishop Mus. Bull.* **172**: 208. Swezey, 1946 *ibid* **189**: 199.

Distribution: Guam.

8. **S. lonchifera** Hendel, 1914

Scholastes lonchifera Hendel, 1914b :253; 1914a :117. Bezzi, 1928 *Dipt. . . . Fiji* :92. Malloch, 1932 *Bernice P. Bishop Mus. Bull.* **98**: 205; 1939 *Proc. Linn. Soc. N.S.W.* **64**: 129.

Distribution: Cook Islands; Society Islands; Fiji.

*9. **S. palmyra** Curran, 1936

Scholastes palmyra Curran, 1936 *Proc. Calif. Acad. Sci.* (4th Ser.) **22** (1): 24 Pl. 1, Fig. 5.

Distribution: Solomon Islands.

10. **S. sexvittatus** (Walker, 1861)

Lamprogaster sexvittata Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 261.

Scholastes distigma Hendel, 1914b :252. Frey, 1930 *Notul. ent. Helsingf.* **10**: 56 (as *S. distigma*, Hendel).

Scholastes sexvittatus (Walker, 1861) Malloch, 1940 *Ann. Mag. nat. Hist.* **6**: 74.

Distribution: Java; Admiralty Islands.

*11. **S. taylori** Malloch, 1939

Scholastes taylori Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 129 Pl. 5, Fig. 25.

Distribution: New Guinea.

12. **S. trifasciatus** Enderlein, 1924

Scholastes trifasciatus Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 122.

Distribution: Mariana Islands.

58. Genus: **PSEUDORICHARDIA** Hendel, 1911

Hendel, 1911 :21 (footnote); 1914b :267; 1914a :123.

Although Hendel gave no complete description of *Pseudorichardia* until 1914b :267 his footnote in *Gens. Ins.* (**113**: 21) complies with the minimum requirements of Article 25 (*a*) of the Rules.

Type species: *Richardia flavitarsis* Macquart, 1850.

1. **P. aristalis** Bezzi, 1928

Pseudorichardia aristalis Bezzi, 1928 *Dipt. . . . Fiji* :93. Fig. 27. Steyskal, 1952 *Occas. Pap. Bernice P. Bishop Mus.* **21**: 64.

Distribution: Fiji.

2. **P. bezziana** Steyskal, 1952

Pseudorichardia bezziana Steyskal, 1952 *Occas. Pap. Bernice P. Bishop Mus.* **21**: 64.

Distribution: New Hebrides.

3. **P. flavitarsis** (Macquart, 1850)

Richardia flavitarsis Macquart, 1850 *Dipt. exot. Supp.* **5**: 121 Pl. 7, Fig. 3.

Pseudorichardia flavitarsis (Macquart, 1850). Hendel, 1911 *Gens. Ins.* **113**: 21 (footnote); 1914a *ibid* **157**: 124; 1914b :267. Bezzi, 1928 *Dipt. . . . Fiji* :92 Fig. 26. Malloch, 1929 *Ann. Mag. nat. Hist.* (ser. 10) **4**: 100; 1930 *Ins. Samoa* **6** (5): 222; 1932 *Bernice P. Bishop Mus. Bull.*: 206. Steyskal, 1952 *Occas. Pap. Bernice P. Bishop Mus.* **21** (5): 66.

Distribution: Malay Archipelago; Samoa; Tahiti; Marquesa Islands; Society Islands.

4. **P. interrupta** (Bezzi, 1928)

Pseudorichardia flavitarsis (Macq., 1850) var. *interrupta* Bezzi, 1928. *Dipt. . . . Fiji.* :92 Fig. 26.

Pseudorichardia interrupta (Bezzi, 1928) Steyskal, 1952 *Occas. Pap. Bernice P. Bishop Mus.* **21**: 66.

Distribution: Fiji.

59. Genus: **BREA** Walker, 1859

Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 117. Hendel, 1914a :125; 1914b :260. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 123.

Type species: *Brea contraria* Walker, 1859.

*1. **B. angustilimbata** de Meijere, 1915

Brea angustilimbata de Meijere, 1915 *Tijd. Ent.* **58**: 129.

Distribution: New Guinea.

*2. **B. basalis** Enderlein, 1924

Brea basalis Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 129. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 125.

Distribution: New Guinea.

*3. **B. contraria** Walker, 1859

Brea contraria Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 117. Hendel, 1914a :126; 1914b :269. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 124 Pl. 4, Fig. 21.

Distribution: Aru Islands (New Guinea).

*4. **B. discalis** Walker, 1859

Brea discalis Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 117. Hendel, 1914a :126; 1914b :272. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 124.

Distribution: Aru Islands (New Guinea).

*5. **B. discifera** Hendel, 1914

Brea discifera Hendel, 1914b :270; 1914a :126. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 124.

Distribution: New Guinea.

*6. **B. flavipes** de Meijere, 1913

Brea flavipes de Meijere, 1913 *Nov. Guin.* **9**: 371; 1915 *Tijd. Ent.* **58**: 130. Hendel, 1914a :126; 1914b :272. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 124.

Distribution: New Guinea.

*7. **B. magnifica** Hendel, 1914

Brea magnifica Hendel, 1914b :271; 1914a :127. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 125 Pl. 5, Fig. 22.

Distribution: New Guinea.

*8. **B. nouhuysi** de Meijere, 1913

Brea nouhuysi de Meijere, 1913 *Nov. Guin.* **9**: 370 Pl. 10, Fig. 42; 1915 *Tijd. Ent.* **58**: 130. Hendel, 1914a :127; 1914b :270.

Distribution: New Guinea.

*9. **B. ralumensis** Enderlein, 1924

Brea ralumensis Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 129. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 125.

Distribution: New Britain.

61. Genus: **CHAETORIVELLIA** de Meijere, 1913 (Monotypic)

de Meijere, 1913 *Nov. Guin.* **9**: 376. Hendel, 1914a :128; 1914b :276. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 127.

Type species: *Ortalis trifasciata* Doleschall, 1859.

*1. **C. trifasciata** (Doleschall, 1859)

Ortalis trifasciata Doleschall, 1859 *Nat. Tijd. Ned. Ind.* **17**: 121.

Chaetorivellia trifasciata (Doleschall, 1859) de Meijere, 1913 *Nov. Guin.* **9**: 376; 1915 *Tijd. Ent.* **58**: 132. Hendel, 1914a :129; 1914b :276. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 127.

Distribution: New Guinea.

62. Genus: **DASYORTALIS** Hendel, 1914

Hendel, 1914b :277; 1914a :129. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 506; 1939 *ibid* **64**: 102.

Type species: *Ortalis complens,* Walker, 1859.

*1. **D. angustifrons** Hendel, 1914

Dasyortalis angustifrons Hendel, 1914b :279; 1914a :131. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 103.

Distribution: New Guinea.

*2. **D. barbata** Hendel, 1914

Dasyortalis barbata Hendel, 1914b :279; 1914a :131. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 103.

Distribution: New Guinea.

*3. **D. complens** (Walker, 1859)

Ortalis complens Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 118.

Dasyortalis complens (Walker, 1859) (*Nom. nud.*) de Meijere, *Nov. Guin.* **9**: 378. Hendel, 1914b :277; 1914a :131. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 506; 1939 *ibid* **64**: 102 Pl. 4, Figs. 1, 2.

Distribution: New Guinea; Solomon Islands; Moluccas.

Curran, 1936 (*Proc. Cal. Acad. Sci.* **22**: 54) and Malloch, 1939 (*Proc. Linn. Soc. N.S.W.* **64**: 103) have described two doubtful varieties of this species—var. *fasciata* Curran, and var. *separata* Malloch. Both require further study before their status can be determined.

*4. **D. goniceps** Hendel, 1914

Dasyortalis goniceps Hendel, 1914b :281; 1914a :131. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 103.

Distribution: New Guinea.

5. **D. ? leucomera** (Walker, 1863)

Ortalis leucomera Walker, 1863 *J. Proc. Linn. Soc. Lond.* **7**: 219.

Dasyortalis leucomera (Walker, 1863) Hendel, 1914a :131; 1914b :277 (footnote).

Distribution: Moluccas.

Examination of the type will be necessary to determine the genus to which this species belongs.

6. **D. signifacies** (Walker, 1861)

Trypeta signifacies Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 165. Bezzi, 1913 *Mem. Indian Mus.* **3**: 79 (No. 240).

Dasyortalis signifacies (Walker, 1861) Hardy, 1959 *Bull. Brit. Mus. (nat. Hist.) Ent.* **8** (5): 223.

Distribution: Moluccas.

7. **D. ? tarsalis** (Walker, 1861)

Ortalis tarsalis Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 296.

Dasyortalis tarsalis (Walker, 1861) Hendel, 1914a :131; 1914b :277 (footnote).

Distribution: Moluccas.

Examination of the type will be necessary to determine the genus to which this species belongs.

65. Genus: **TROPIDOGASTRELLA** Hendel, 1914

Hendel, 1914b :285; 1914a :134.

Type species: *Tropidogastrella tropida* Hendel, 1914.

1. **T. cristiventris** (Gerstäcker, 1860)

Gorgopsis cristiventris Gerstäcker, 1860 *Stett. ent. Zeit.* **21**: 135.

Tropidogastrella cristiventris (Gerstäcker, 1860) Hendel, 1914b :287; 1914a :136. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 130. Bezzi, 1913 *Philippine J. Sci.* (D) **8**: 321. Frey, 1930 *Notul. ent. Helsingf.* **10**: 56.

Distribution: Moluccas.

2. **T. decora** (de Meijere, 1911)

Zygaenula decora de Meijere, 1911 *Tijd. Ent.* **54**: 371.

Tropidogastrella decora (de Meijere, 1911) Hendel, 1914a :136; 1914b :289. Frey, 1930 *Notul. ent. Helsingf.* **10**: 56.

Distribution: Java.

The type species was recorded from Taiwan.

66. Genus: **ASYNTONA** Osten-Sacken, 1881

Osten-Sacken, 1881 *Ann. Soc. ent. France* (series 6) **1**: 135. Hendel, 1914a :136; 1914b :290. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 121.

Type species: *Lamprogaster tetyroides* Walker, 1859.

*1. **A. flaviceps** Hendel, 1914

Asyntona flaviceps Hendel, 1914b :291; 1914a :138. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 122.

Distribution: New Guinea.

*2. **A. tetyroides** (Walker, 1859)

Lamprogaster tetyroides Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 112.

Asyntona tetyroides (Walker, 1859) Hendel, 1914b :290; 1914a :138. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 130. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 122 Pl. 4, Fig. 20.

Distribution: New Guinea.

67. Genus: **ZYGAENULA** Doleschall, 1858

Doleschall, 1858 *Nat. Tijd. Ned. Ind.* **17**: 117. Hendel, 1914a :138; 1914b :292. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 123.

Type species: *Zygaenula paradoxa* Doleschall, 1858.

See note at end of *Mesoctenia*, No. 67A.

*1. **Z. coalescens** Hendel, 1914

Zygaenula coalescens Hendel, 1914b :293.

Mesoctenia coalescens (Hendel, 1914) Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 123.

Distribution: New Britain.

*2. **Z. hylaris** Hendel, 1914

Zygaenula hylaris Hendel, 1914b *Abh. zool. -bot. Ges. Wien* **8**: 294.

Mesoctenia hylaris (Hendel), 1914 Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 123.

Distribution: New Guinea.

3. **Z. paradoxa** Doleschall, 1858

Zygaenula paradoxa Doleschall, 1858 *Nat. Tijd. Ned. Ind.* **17**: 118. Hendel, 1914a :139; 1914b :292. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 130. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 123.

Distribution: Moluccas.

67A. Genus: ? **MESOCTENIA** Enderlein, 1924 (Monotypic)

Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 130. Mallcch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 123.

Type species: *Mesoctenia ralumensis* Enderlein, 1924.

*1. **M. ralumensis** Enderlein, 1924

Mesoctenia ralumensis Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 131. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 123. (A possible synonym of *Zygaenula coalescens*.)

Distribution: New Guinea.

NOTE: Although *Zygaenula* and *Mesoctenia* are shown in this catalogue as being distinct genera, the status of neither can at present be defined, nor species allotted to either with certainty. All that can be done is to detail the events that have led to the confusion, leaving clarification of the situation to the future.

Doleschall (1858 *Nat. Tijd. Ned. Ind.* **17**: 117) erected *Zygaenula* for the reception of his species, *paradoxa*. By monotypy *Z. paradoxa* is the type species of the genus, *Zygaenula*.

Hendel (1914a) revised the genus. He began by synonomizing *Gorgopsis bucephala* Gerstäcker, 1860 (misprinted in A as *G. hucephala*), with *Z. paradoxa*, quoting *verbatim*, Gerstäcker's description of *G. bucephala* as that of *paradoxa* (Hendel 1914a: 292). To *Zygaenula*, he transferred

Lamprogaster celyphoides Walker, 1859. He also suggested that "Vielleicht gehört hieher auch *Ortalis dispila* Thomson, 1868" (*ibid*: 292 footnote), though he omitted this species from his key to, and discussion on, the genus. He described two species *Z. coalescens* and *Z. hilaris*. Thus, as he saw it, *Zygaenula* comprised the species, *paradoxa* (type species of the genus), *celyphoides*, *coalescens* and *hilaris*, with *O. dispila* in abeyance. Hendel must have considered that the species he added to *Zygaenula* had the generic characters of *paradoxa*.

In 1924, Enderlein (*Mitt. zool. Mus. Berlin* **11**: 130) erected the monotypic genus, *Mesoctenia* for his new species, *ralumensis* (*ibid* :131) which he designated as the type species of *Mesoctenia*. He distinguished his genus from *Zygaenula* (of which he claimed to have three males and one female of *paradoxa* from Amboina) "durch die Anwesenheit einer Längsreihe kurzer kräftiger dornartiger Borsten auf der Unterseite (aufsen) der etwas verdickten Mittelschenkel".

In 1939, Malloch (*Proc. Linn. Soc. N.S.W.* **64**: 123) discussed both genera. From Enderlein's description, he synonomyzed *M. ralumensis* with *Z. coalescens*. But he accepted *Mesoctenia* as a valid genus with *Z. coalescens* (= *M. ralumensis*) as its type species. To *Mesoctenia* he transferred *Z. celyphoides* and *Z. hilaris*. He left *paradoxa* in *Zygaenula* as "it is unknown to me", and he ignored *O. dispila*.

As revised by him, *Zygaenula* regained its monotypic status with *Z. paradoxa* as its type species, while his enlarged *Mesoctenia* contained *coalescens* (type of the genus), *celyphoides*, and *hilaris*. Since he admitted knowing nothing of *Z. paradoxa*, it is difficult to understand how Malloch could distinguish between *Zygaenula* and *Mesoctenia*. His reliance on Enderlein appears to be his only reason. His ignoring of *O. dispila* would seem to indicate that he regarded it as too doubtful for placement in a genus.

Because of the impossibility of making correct decisions based on the above facts alone, the author has been forced to adopt a makeshift arrangement: *Zygaenula*, as revised by Hendel, is, for the time being, accepted; *Mesoctenia* is of doubtful validity.

68. Genus: **NAUPODA** Osten-Sacken, 1881

Osten-Sacken, 1881 *Ann. Soc. ent. France* (Ser. 6) **1**: 135. Hendel, 1914a :140; 1914b :295. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 513; 1939 *ibid* **64**: 122.

Type species: *Naupoda platessa* Osten-Sacken 1882.

*1. **N. insularis** Paramonov, 1957

Naupoda insularis Paramonov, 1957 *Ann. Mag. nat. Hist.* (Ser. 12) **10**: 781.
Distribution: Lord Howe Island (Australia).

2. **N. platessa** Osten-Sacken, 1882

Naupoda platessa Osten-Sacken, 1882 *Berl. ent. Zeit.* **26**: 223 Fig. 6. Bezzi, 1913 *Philippine J. Sci.* (D) **8**: 321. Hendel, 1914a :141; 1914b :296. Frey, 1930 *Notul. ent. Helsingf.* **10**: 57.

Distribution: Philippines.

*3. **N. regina** Hendel, 1914

Naupoda regina Hendel, 1914b :298; 1914a :141. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 513. 1939 *ibid* **64**: 122.

Distribution: New Guinea; Queensland (Australia).

4. **N. simmondsi** Bezzi, 1928

Naupoda simmondsi Bezzi, 1928 *Dipt. . . . Fiji* :95.

Distribution: Fiji.

5. **N. strigifera** de Meijere, 1919

Naupoda strigifera de Meijere, 1919 *Bijdr. Dierk.* **21**: 33 Pl. 2, Fig. 13. Bezzi, 1928 *Dipt. . . . Fiji* :95.

Distribution: Sumatra.

6. **N. unifasciata** Bezzi, 1917

Naupoda unifasciata Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 141. Frey, 1930 *Notul. ent. Helsingf.* **10**: 57.

Distribution: Philippines.

*7. **N. ventralis** Curran, 1936

Naupoda ventralis Curran, 1936 *Proc. Calif. Acad. Sci.* (Ser. 4) **22**: 26.

Distribution: Solomon Islands.

8. **N. ypsilon** v. d. Wulp, 1898

Naupoda ypsilon v. d. Wulp, 1898 *Tijd. Ent.* **41**: 206 Pl. 10, Fig. 2. Hendel, 1914a :141; 1914b :297.

Distribution: Java.

9. **N. ypsilonoides** de Meijere, 1924

Naupoda ypsilonoides de Meijere, 1924 *Tijd. Ent.* **67** (supp.) :42.

Distribution: Java.

69. Genus: **PTEROGENIA** Bigot, 1859

Bigot, 1859 *Rev. Mag. Zool.* (Ser. 2) **11**: 315 Pl. 11, Figs. 2a-2c. Hendel, 1914a :141; 1914b :304. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 513; 1939 *ibid* **64**: 125.

Type species: *Pterogenia singularis* Bigot, 1859.

1. **P. basilutea** (Walker, 1857)

Lamprogaster basilutea Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 131.
Pterogenia basilutea (Walker, 1857) Hendel, 1914a :145; 1914b :329.

Distribution: Borneo.

2. **P. bifasciata** Enderlein, 1924

Pterogenia bifasciata Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 133.

Distribution: Sumatra.

3. **P. boettcheri** Frey, 1930

Pterogenia boettcheri Frey, 1930 *Notul. ent. Helsingf.* **10**: 58.

Distribution: Philippines.

*4. **P. brevis** (Walker, 1865)

Platystoma breve Walker, 1865 *J. Proc. Linn. Soc. Lond.* **8**: 120.
Pterogenia brevis (Walker, 1865) Hendel, 1914a :145; 1914b :325.

Distribution: New Guinea.

5. **P. centralis** Bezzi, 1917

Pterogenia centralis Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 148. Frey, 1930 *Notul. ent. Helsingf.* **10**: 60.

Distribution: Philippines.

6. **P. dayak** Bigot, 1859

Pterogenia dayak Bigot, 1859 *Rev. Mag. Zool.* (Ser. 2) **11**: 316 Pl. 16, Fig. 2. Hendel, 1914a :145; 1914b :314.

Distribution: Borneo.

7. **P. divisa** (Walker, 1857)

Lamprogaster divisa Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 131.
Pterogenia divisa (Walker, 1857) Hendel, 1914a :146; 1914b :324.

Distribution: Borneo.

8. **P. flavicornis** Frey, 1930

Pterogenia flavicornis Frey, 1930 *Notul. ent. Helsingf.* **10**: 59.

Distribution: Philippines.

*9. **P. fuliginosa** Hendel, 1914

Pterogenia fuliginosa Hendel, 1914b :309; 1914a :146. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 126.

Distribution: New Guinea.

10. **P. glabra** (Walker, 1857)

Lamprogaster glabra Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 30.

Pterogenia glabra (Walker, 1857) Hendel, 1914a :146; 1914b :324.

Distribution: Singapore.

11. **P. glabrella** Hendel, 1914

Lamprogaster glabra Walker, 1857 pp. *J. Proc. Linn. Soc. Lond.* **1**: 131.

Pterogenia glabrella Hendel, 1914b :310; 1914a :146.

Distribution: Sarawak.

12. **P. glabrina** Hendel, 1914

Lamprogaster glabra Walker, 1857 pp. *J. Proc. Linn. Soc. Lond.* **1**: 131.

Pterogenia glabrina Hendel, 1914b :318; 1914a :146.

Distribution: Sarawak.

Walker, 1857, under the name of *P. glabra* included three closely-related species—*P. glabra, P. glabrella* and *P. glabrina*. Hendel, 1914b distinguished the three species, naming the two which were distinct from *glabra*.

13. **P. guttata** (Walker, 1857) (No. 1)

Lamprogaster guttata Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 31.

Pterogenia guttata (Walker, 1857) Hendel 1914b :325; 1914a :146.

Distribution: Singapore.

13a. **P. guttata** (Walker, 1857) (No. 2)

Lamprogaster guttata Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 132.

Pterogenia guttata (Walker, 1857) Hendel, 1914b :326; 1914a :146.

Distribution: Borneo.

In 1857, Walker (*loc. cit.*) applied the name *Lamprogaster guttata* to two of his *sp. nov.* Whether these are one and the same species, or whether they are distinct, can be determined only after the types have been examined. It will then be possible to place them generically. I know of no evidence to justify Hendel's transference of them to *Pterogenia*, but this is accepted here for convenience.

14. **P. hamifera** Frey, 1930

Pterogenia hamifera Frey, 1930 *Notul. ent. Helsingf.* **10**: 58 Pl. 1, Fig. 3.

Distribution: Philippines.

*15. **P. latericia** Hendel, 1914

Pterogenia latericia Hendel, 1914b :312; 1914a :146. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 126.

Distribution: Queensland; New South Wales (Australia).

16. **P. laticeps** Bezzi, 1917

Pterogenia laticeps Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 145; 1928 *Dipt. Fiji* :97. Frey, 1930 *Notul. ent. Helsingf.* **10**: 59.

Distribution: Philippines.

17. **P. luteipennis** Bezzi, 1917

Pterogenia luteipennis Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 147. Frey, 1930 *Notul. ent. Helsingf.* **10**: 59.

Distribution: Philippines.

18. **P. niveitarsis** (Bigot, 1859)

Agastrodes niveitarsis Bigot, 1859 *Rev. Mag. Zool.* **11**: 312.

Pterogenia niveitarsis (Bigot, 1859) Hendel, 1914b :307; 1914a :146.

Distribution: Ceylon; Borneo.

*19. **P. nubecula** Hendel, 1914

Pterogenia nubecula Hendel, 1914b :34; 1914a :146. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 126.

Distribution: Queensland; New South Wales (Australia).

*20. **P. nudiseta** Bezzi, 1928

Pterogenia nudiseta Bezzi, 1928 *Dipt. Fiji.* :97.

Distribution: Lord Howe Island (Australia).

21. **P. parva** Bezzi, 1917

Pterogenia parva Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 144. Frey, 1930 *Notul. ent. Helsingf.* **10**: 59.

Distribution: Philippines.

*22. **P. pectoralis** Hendel, 1914

Pterogenia pectoralis Hendel, 1914b :316; 1914a :146. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 126.

Distribution: New Guinea.

23. **P. punctata** (Walker, 1857)

Lamprogaster punctata Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 132.

Pterogenia punctata (Walker, 1857) Hendel, 1914b :324; 1914a :146.

Distribution: Borneo.

24. **P. ruficrus** Hendel, 1914

Pterogenia ruficrus Hendel, 1914b :321; 1914a :146.

Distribution: Java.

*25. **P. scutellaris** (Walker, 1859)

Lamprogaster scutellaris Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 112.

Pterogenia scutellaris (Walker, 1859) Hendel, 1914b :327; 1914a :146.

Distribution: New Guinea.

*26. **P. similis** Malloch, 1939

Pterogenia similis Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 126.

Distribution: Queensland (Australia).

27. **P. singularis** Bigot, 1859

Pterogenia singularis Bigot, 1859 *Rev. Mag. Zool.* (ser. 2) **11**: 315 Pl. 11, Figs. 2a-c. Hendel, 1914a :146; 1914b :305.

Distribution: Amboina, Celebes.

28. **P. subcruciata** Frey, 1930

Pterogenia subcruciata Frey, 1930 *Notul. ent. Helsingf.* **10**: 60 Pl. 1, Fig. 4.

Distribution: Philippines.

29. **P. tristis** Bezzi, 1917

Pterogenia tristis Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 143. Frey, 1930 *Notul. ent. Helsingf.* **10**: 59.

Distribution: Philippines.

30. **P. truncatula** (Walker, 1857)

Lamprogaster truncatula Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 31.

Pterogenia truncatula (Walker, 1857) Hendel, 1914b :325; 1914a :146.

Distribution: Singapore.

31. **P. valida** Bezzi, 1917

Pterogenia valida Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 142. Frey, 1930 *Notul. ent. Helsingf.* **10**: 58.

Distribution: Philippines.

32. **P. variipennis** Walker, 1861

Pterogenia variipennis Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 292. Hendel, 1914a :146; 1914b :326.

Distribution: Moluccas.

33. **P. vittata** (Walker, 1857)

Lamprogaster vittata Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 31.

Pterogenia vittata (Walker, 1857) Hendel, 1914b :328; 1914a :146.

Distribution: Sumatra; Singapore.

34. **P. vittifinis** Walker, 1861

Pterogenia vittifinis Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 292. Hendel, 1914a :146; 1914b :327.

Distribution: Moluccas.

35. **P. zonata** (Walker, 1857)

Lamprogaster zonata Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 30.

Pterogenia zonata (Walker, 1857) Hendel, 1914a :146; 1914b :328.

Distribution: Singapore.

69A. Genus: **NEOHEMIGASTER** Malloch, 1939

Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 126.

Type species: *Hemigaster albovittatus* Rondani, 1875.

1. **N. albovittata** (Rondani, 1875)

Hemigaster albovittatus Rondani, 1875 *Ann. Mus. Stor. nat. Genova* **7**: 431.

Pterogenia albovittata (Rondani, 1875) Hendel, 1914b :322.

Neohemigaster albovittata (Rondani, 1875) Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 127.

Distribution: Borneo.

69B. Genus: **CHAETOSTICHIA** Enderlein, 1924

Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 133.

Type species: *Chaetostichia aduncivena* Enderlein, 1924.

1. **C. aduncivena** Enderlein, 1924

Chaetostichia aduncivena Enderlein, 1924 (*ibid*) **11**: 134.

Distribution: Java.

70. Genus: **EUPROSOPIA** Macquart, 1847

Macquart, 1847 *Dipt. exot. supp.* **2**: 89. Hendel, 1914a :147; 1914b :329. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 136. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 343; 1928 *ibid* **53**: 612; 1929 *ibid* **54**: 512; 1939 *ibid* **64**: 145; 1931 *Proc. U.S. nat. Mus.* **78** (15): 1.

Type species: *Euprosopia tenuicornis* Macquart, 1847.

1. **E. albifacies** (Doleschall, 1858)

Pachycephala albifacies Doleschall, 1858 *Nat. Tijd. Ned. Ind.* **17**: 117.

Euprosopia albifacies (Doleschall, 1858) Hendel, 1914a :149; 1914b :360. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 136.

Distribution: Amboina.

*2. **E. albolineata** de Meijere, 1913

Euprosopia albolineata de Meijere, 1913 *Nov. Guin.* **9**: 367 Pl. 10, Fig. 39. Hendel, 1914a :149; 1914b :345.

Distribution: New Guinea.

*3. **E. alticeps** Malloch, 1940

Euprosopia alticeps Malloch, 1940 *Ann. Mag. nat. Hist.* **6**: 81.

Distribution: Solomon Islands.

4. **E. atomaria** (Walker, 1861)

Platystoma atomaria Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 293.

Euprosopia atomaria (Walker, 1861) Hendel, 1914a :149.

Distribution: Moluccas.

*5. **E. aureovitta** Malloch, 1939

Euprosopia aureovitta Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 151 Pl. 5, Fig. 42.

Distribution: New Guinea.

*6. **E. australis** (Walker, 1849)

Platystoma australe Walker, 1849 *List Dipt. Brit. Mus.* **4**: 1061.

Euprosopia australis (Walker, 1849) Hendel, 1914a :149; 1914b :363.

Distribution: Australia (*sic.*).

7. **E. basalis** (Walker, 1860)

Platystoma basale Walker, 1860 *J. Proc. Linn. Soc. Lond.* **4**: 148.

Euprosopia basalis (Walker, 1860) Hendel, 1914a :149; 1914b :361.

Distribution: Celebes.

*8. **E. biarmata** Malloch, 1929

Euprosopia biarmata Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 512; 1930 *ibid* **55**: 431.

Distribution: Queensland (Australia).

*9. **E. bilineata** de Meijere, 1906

Euprosopia bilineata de Meijere, 1906 *Nov. Guin.* 5 *zool. Dipt.* :92 Pl. 1, Fig. 14. Hendel, 1914a :149; 1914b :349. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 149 Pl. 5, Fig. 35.

Distribution: New Guinea.

10. **E. brevicornis** Hendel, 1914

Euprosopia brevicornis Hendel, 1914b :335; 1914a :149.

Distribution: Borneo.

11. **E. calypterata** Enderlein, 1912

Euprosopia calypterata Enderlein, 1912 *Zool. Jahrb.* **33**: 359 Fig. D. Hendel, 1914a :149; 1914b :350.

Distribution: Sumatra.

12. **E. chalybea** Frey, 1930

Euprosopia chalybea Frey, 1930 *Notul. ent. Helsingf.* **10**: 60 Pl. 1, Fig. 6.

Distribution: Philippines.

*13. **E. conjuncta** Hendel, 1914

Euprosopia conjuncta Hendel, 1914b :339; 1914a :149. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 345; 1929 *ibid* **54**: 512; 1930 *ibid* **55**: 429.

Distribution: Queensland; Northern Territory (Australia).

*14. **E. connexa** Malloch, 1940

Euprosopia connexa Malloch, 1940 *Ann. Mag. nat. Hist.* **6**: 79.

Distribution: Solomon Islands.

15. **E. curta** (Osten-Sacken, 1882)

Notopsila curta Osten-Sacken, 1882 *Berl. ent. Z.* **26**: 210.

Euprosopia curta (Osten-Sacken, 1882) Hendel, 1914a :149; 1914b :332. Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 149. Frey, 1930 *Notul. ent. Helsingf.* **10**: 62.

Distribution: Philippines; Taiwan.

*16. **E. depressifrons** Malloch, 1940

Euprosopia depressifrons Malloch, 1940 *Ann. Mag. nat. Hist.* **6**: 86.
Distribution: Solomon Islands.

17. **E. dorsata** Hendel, 1914

Euprosopia dorsata Hendel, 1914b :340; 1914a :149. Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 9.
Distribution: Ceylon, Philippines.

*18. **E. dubitalis** Malloch, 1939

Euprosopia dubitalis Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 149 Pl. 5, Fig. 33.
Distribution: New Guinea.

19. **E. frontalis** (Walker, 1861)

Platystoma frontale Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 268.

Euprosopia frontalis (Walker, 1861) Hendel, 1914a :149; 1914b :362.
Distribution: Celebes.

*20. **E. fusifacies** (Walker, 1859)

Platystoma fusifacies Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 113.

Euprosopia fusifacies (Walker, 1859) Osten-Sacken, 1881 *Ann. Mus. Stor. nat. Genova* **16**: 473. Hendel, 1914a :149; 1914b :347. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 151 Pl. 5, Fig. 41.

Euprosopia squamifera de Meijere, 1913 *Nov. Guin.* **9**: 368 Pl. 10, Fig. 40.
Distribution: New Guinea.

21. **E. gigas** Bezzi, 1917

Euprosopia gigas Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 151. Frey, 1930 *Notul. ent. Helsingf.* **10**: 62.
Distribution: Philippines.

*22. **E. impingens** (Walker, 1865)

Platystoma impingens Walker, 1865 *J. Proc. Linn. Soc. Lond.* **8**: 134.

Euprosopia impingens (Walker, 1865) Hendel, 1914b :345; 1914a :149. Edwards, 1915 *Trans. zool. Soc. Lond.* **20**: 416. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 151 Pl. 5, Fig. 40.

Lepidocompsia impingens (Walker, 1865) *Enderlein*, 1924 *Mitt. zool. Mus. Berlin* **11**: 137.
Distribution: New Guinea.

The status of Enderlein's monotypic genus, *Lepidocompsia*, cannot at present be determined.

*23. **E. innocua** Malloch, 1939

Euprosopia innocua Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 152 Pl. 5, Fig. 43.

Distribution: New Guinea.

Malloch (*ibid*) suggests that this species is possibly *Tetrachaetina burgersiana* Enderlein, 1924 *q.v.*

*24. **E. insulicola** Malloch, 1940

Euprosopia insulicola Malloch, 1940 *Ann. Mag. nat. Hist.* **6**; 84.

Distribution: Solomon Islands.

*25. **E. lepida** Curran, 1936

Euprosopia lepida Curran, 1936 *Proc. Calif. Acad. Sci.* (4th Ser.) **22** (1): 25 Pl. 1, Fig. 2.

Distribution: Guadalcanal Islands (Solomon Islands).

26. **E. lepidophora** Bezzi, 1917

Euprosopia lepidophora Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 153. Frey, 1930 *Notul. ent. Helsingf.* **10**: 47.

Distribution: Philippines.

27. **E. longicornis** Bezzi, 1917

Euprosopia longicornis Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 154. Frey, 1930 *Notul. ent. Helsingf.* **10**: 62. Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 9.

Distribution: Philippines.

*28. **E. macrotegularia** Malloch, 1928

Euprosopia macrotegularia Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 345 Fig. 1; 1929 *ibid* **54**: 512; 1930 *ibid* **55**: 430.

Distribution: Queensland (Australia).

*29. **E. maculipennis** (Guérin), 1831

Platystoma maculipennis Guérin, 1831 *Voy. Coquille* Liv. 24, Pl. 21, Fig. 8, p. 299.

Euprosopia maculipennis (Guérin, 1831) Hendel, 1914b :358; 1914a :149. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 136. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 346; 1928 *ibid* **53**: 612; 1930 *ibid* **55**: 430.

Distribution: Queensland (Australia).

For details of publication date of *E. maculipennis* see Musgrave, 1932 *Bibliography of Australian Entomology* 1775-1930 p. 133.

30. **E. metallica** Malloch, 1931

Euprosopia metallica Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 6.

Distribution: Philippines.

*31. **E. miliaria**? Hendel, 1914

Platystoma pectorale Walker, 1862 *J. Proc. Linn. Soc. Lond.* **6**: 13.

Euprosopia miliaria Hendel, 1914b :353; 1914a :149. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 346; 1929 *ibid* **54**: 512; 1939 *ibid* **64**: 148.

Distribution: New Guinea; Queensland (Australia).

Some doubt attaches to the specific name. Walker (1862) described this species as *Platystoma pectorale*. Although Hendel (b) was aware of this, when he transferred the species to *Euprosopia*, he substituted the specific name *miliaria* for *pectorale*, but gave no reasons for doing so. Neither Malloch (1928) could, nor Steyskal (in correspondence) can, give any explanation for his action.

Since attempted restoration of *pectorale* would only further cloud the issue, *miliaria* is here temporarily retained.

32. **E. millepuncta** Bezzi, 1917

Euprosopia millepuncta Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 152. Frey, 1930 *Notul. ent. Helsingf.* **10**: 62. Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 10.

Distribution: Philippines.

*33. **E. minor** Malloch, 1940

Euprosopia minor Malloch, 1940 *Ann. Mag. nat. Hist.* **6**: 82.

Distribution: Solomon Islands.

*34. **E. minuta** Malloch, 1939

Euprosopia minuta Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 148 Pl. 5, Fig. 32.

Distribution: New Guinea.

35. **E. mohnikei** (Doleschall, 1858)

Pachycephala mohnikei Doleschall, 1858 *Nat. Tijd. Ned. Ind.* **17**: 116.

Notopsila mohnikei (Dol. 1858) Osten-Sacken, 1882 *Berl. ent. Z.* **26**: 209.

Oncoscelia mohnikei (Dol. 1858) Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 136.

Euprosopia mohnikei (Dol. 1858) Hendel, 1914a :150; 1914b :359.

Distribution: Amboina.

See note under *Notopsila*.

*36. **E. multivitta** (Walker, 1859)

Platystoma multivitta Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 113.

Euprosopia multivitta (Walker, 1859) Hendel, 1914b :362; 1914a :150.

Distribution: New Guinea.

37. **E. nobilis** Frey, 1930

Euprosopia nobilis Frey, 1930 *Notul. ent. Helsingf.* **10**: 61 Pl. 1, Fig. 5.

Distribution: Philippines.

*38. **E. penicillata** Hendel, 1914

Euprosopia penicillata Hendel, 1914b :343; 1914a :150. Edwards, 1915 *Trans. zool. Soc. Lond.* **20**: 416. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* 64: 151.

Distribution: New Guinea.

*39. **E. potens** (Walker, 1862)

Platystoma potens Walker, 1862 *J. Proc. Linn. Soc. Lond.* **6**: 12.

Euprosopia potens (Walker, 1862) Osten-Sacken, 1881 *Ann. Mus. Stor. nat. Genova* **16**: 472. de Meijere, 1913 *Nov. Guin.* **9**: 369. Hendel, 1914a :150; 1914b :341. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 150 Pl. 5, Fig. 37.

Distribution: New Guinea; Moluccas.

40. **E. producta** (Walker, 1861)

Platystoma productum Walker, 1861 *J. Proc. Linn. Soc. Lond.* **5**: 293.

Euprosopia producta (Walker, 1861) Hendel, 1914a :150; 1914b :361.

Distribution: Moluccas.

*41. **E. protensa** (Walker, 1864)

Platystoma protensa Walker, 1864 *J. Proc. Linn. Soc. Lond.* **7**: 228.

Euprosopia protensa (Walker, 1864) Hendel, 1914a :150; 1914b :344. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 136. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 150 Pl. 5, Fig. 36.

Distribution: New Guinea.

*42. **E. punctifacies** Malloch, 1928

Euprosopia punctifacies Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 346 Fig. 2; 1929 *ibid* **54**: 512; 1930 *ibid* **55**: 430.

Distribution: Queensland (Australia).

*43. **E. rufiventris** Hendel, 1914

Euprosopia rufiventris Hendel, 1914b :334; 1914a :150. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 148.

Distribution: New Guinea.

*44. **E. scatophaga** Malloch, 1930

Euprosopia scatophaga Malloch, 1930 *Proc. Linn. Soc. N.S.W.* **55**: 431; 1931 *Proc. U.S. nat. Mus.* **78** (15): 7.

Distribution: Queensland (Australia).

45. **E. semiarmata** Malloch, 1931

Euprosopia semiarmata Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 3.

Distribution: Philippines.

*46. **E. separata** Hendel, 1914

Euprosopia separata Hendel, 1914b :338; 1914a :150. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 344. 1929 *ibid* **54**: 512.

Distribution: Queensland (Australia).

*47. **E. setinervis** Malloch, 1939

Euprosopia setinervis Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 149 Pl. 5, Fig. 34.

Distribution: New Guinea.

48. **E. sexpunctata** (Osten-Sacken, 1882)

Notopsila sexpunctata Osten-Sacken, 1882 *Berl. ent. Z.* **26**: 210.

Euprosopia sexpunctata (Osten-Sacken, 1882) Hendel, 1914b :359; 1914a :150. Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 149. Frey, 1930 *Notul. ent. Helsingf.* **10**: 61. Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 8.

Distribution: Moluccas; Philippines.

49. **E. tarsalis** (Walker, 1864)

Platystoma tarsale Walker, 1864 *J. Proc. Linn. Soc. Lond.* **7**: 237.

Euprosopia tarsalis (Walker, 1864) Hendel, 1914b :360; 1914a :150.

Distribution: Moluccas.

*50. **E. tegularia** Malloch, 1928

Euprosopia tegularia Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 346, Fig. 3.

Distribution: Solomon Islands.

*51. **E. tenuicornis** Macquart, 1847

Euprosopia tenuicornis Macquart, 1847 *Dipt. exot. supp.* **2**: 90 Pl. 6, Fig. 4. Hendel, 1914a :150; 1914b :336. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 136. Malloch, 1928 *Proc. Linn. Soc. N.S.W.* **53**: 612; 1930 *ibid* **55**: 430; 1931 *Proc. U.S. nat. Mus.* **78** (15): 7.

Distribution: Queensland; New South Wales (Australia).

*52. **E. tigrina** Osten-Sacken, 1881

Euprosopia tigrina Osten-Sacken, 1881 *Ann. Mus. Stor. nat. Genova* **16**: 473. Hendel, 1914a :150; 1914b :331. Malloch, 1929 *Proc. Linn. Soc. N.S.W.* **54**: 513; 1939 *ibid* **64**: 147.

Distribution: New Guinea.

53. **E. trivittata** Bezzi, 1917

Euprosopia trivittata Bezzi, 1917 *Philippine J. Sci.* (D) **12**: 150. Frey, 1930 *Notul. ent. Helsingf.* **10**: 61. Malloch, 1931 *Proc. U.S. nat. Mus.* **78** (15): 10.

Distribution: Philippines.

54. **E. ? truncata** (Enderlein, 1924) (*conj. nov.*)

Oncoscelia truncata Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 137.

Distribution: Celebes.

See note at end of ? *Notopsia*.

*55. **E. ventralis** (Walker, 1859)

Lamprogaster ventralis Walker, 1859 *J. Proc. Linn. Soc. Lond.* **3**: 131.

Euprosopia ventralis (Walker, 1859) Hendel, 1914b :343; 1914a :150. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 150 Pl. 5, Figs. 38, 39.

Distribution: New Guinea.

70A. Genus: ? **NOTOPSILA** Osten-Sacken, 1882

Osten-Sacken, 1882 *Berl. ent. Z.* **26**: 209.

The validity or otherwise of this genus has yet to be determined. It was erected by Osten-Sacken (*loc. cit.*) as a *nom. nov.* for *Pachycephala* Doleschall, 1858 (*Nat. Tijd. Ned. Ind.* **17**: 116—*Pachycephala mohnikei*) which was pre-occupied in Aves by *Pachycephala* Vigors, 1825.

Having overlooked Osten-Sacken's change, Enderlein in 1924 (*Mitt. zool. Mus. Berlin* **11**: 136) erected his genus *Oncoscelia* to replace *Pachycephala* Doleschall, designating *P. mohnikei* Dol., 1828 as the type species. At the same time, he transferred the Ceylonese species, *Euprosopia* *nigropunctata* Hendel, 1914 (*Abh. zool.-bot. Ges. Wien* **8**: 356) to *Oncoscelia* and described as *sp. nov. O. truncata* from the Celebes (*ibid* **11**: 137).

As *N. nigropunctata* does not occur in the area covered by this catalogue, no further consideration of it is necessary. Hendel's placement of *mohnikei* is accepted, and a new combination, *Euprosopia truncata* is proposed for *Oncoscelia truncata* Enderlein, until the matter has been cleared up.

70B. Genus: ? **TETRACHAETINA** Enderlein, 1924 (Monotypic)

Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 138.

Type species: *T. burgersiana* Enderlein, 1924.

*1. **T. burgersiana** Enderlein, 1924

Tetrachaetina burgersiana Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 138.

Distribution: New Guinea.

This genus is doubtful. Malloch, 1939 (*Proc. Linn. Soc. N.S.W.* **64**: 153) claimed that it "is not tenable"; he also suggested that his own *Euprosopia innocua* (Malloch, 1939 *ibid*) might be a synonym of *T. burgersiana*. *Tetrachaetina* will probably later be rejected as a synonym of *Euprosopia*.

76. Genus: **EUTHYPLATYSTOMA** Hendel, 1914

Hendel, 1914b :398.

Type species: *Platystoma rigidum* Walker, 1857.

1. **E. plumatum** Hendel, 1914

Euthyplatystoma plumatum Hendel, 1914b :399; 1914a :160.

Distribution: Singapore.

2. **E. rigidum** (Walker, 1857)

Platystoma rigidum Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 32.

Euthyplatystoma rigidum (Walker, 1857) Hendel, 1914b :398; 1914a :160 Pl. 15, Fig. 284. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 153.

Distribution: India; Singapore; Celebes.

3. **E. superbum** (v. d. Wulp, 1881)

Platystoma superbum v. d. Wulp, 1881 *Dipt. Sumatra Exped.* :50 Pl. 3, Fig. 5.

Euthyplatystoma superbum (v. d. Wulp, 1881) Hendel, 1914b :401; 1914a :160.

Distribution: Sumatra.

77. Genus: **VALONIA** Walker, 1857 (Monotypic)

Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 34.

Type species: *Valonia complicata* Walker, 1857.

1. **V. complicata** Walker, 1857

Valonia complicata Walker, 1857 *J. Proc. Linn. Soc. Lond.* **1**: 34 Pl. 1, Fig. 6. Hendel, 1914a :161; 1914b :402. Enderlein, 1924 *Mitt. zool. Mus. Berlin* **11**: 150.

Distribution: Singapore.

II. Sub-family: OTITINAE

Type genus: *Otites* Latreille, 1804 *Nouv. Dict. Hist. nat.* **24**: 196.

1. Genus: **CERATOXYS** Rondani, 1861

Rondani, 1861 *Dipt. Ital. Prodr.* **4**: 10. Curran, 1934 *Fam. Gen. N. Amer. Dipt.* :281.

Ceratoxys was proposed by Rondani to replace *Meckelia* R.-D., 1830 (*Mém. Prés. Acad. Sci. Paris* **2**: 714) which was pre-occupied by *Meckelia* Leucart, 1828 (Vermes). *Anacampta* Loew, 1868 (*Z. Naturw. Berlin* **32**: 7) is a synonym.

1. **C. latiuscula** (Loew, 1873)

Anacampta latiuscula Loew, 1873 *Smithson. misc. Coll.* **11** (3): 130.

Distribution: North America (introduced into Hawaii).

III. Sub-family: ULIDIINAE

Type genus: *Ulidia* Meigen, 1826 *Syst. Beschr. Eur. zweifl. Ins.* **5**: 385.

3. Genus: **PHYSIPHORA,** Fallén, 1810

Fallén, 1810 *Sp. Ent. nov. Dipt. Dispon. Methodus* :11.

Syn.: *Chrysomyza* Fallén, 1817 *Dipt. Suec. Scenopinii* :3.

Type species: *Musca demandata* Fabricius, 1798.

Until recently this genus has been wrongly known as *Chrysomyza* Fallén, 1817. After erecting *Physiphora* in 1810, Fallén thought that it was pre-occupied (which it was not), and suggested *Chrysomyza* in 1817 as a substitute. Since *Physiphora* is valid, *Chrysomyza* is to be rejected as a synonym.

*1. **P. aenea** (Fabricius, 1794)

Musca aenea Fab., 1794 *Ent. Syst.* **4**: 335.

Chrysomyza aenea (Fab., 1794) Hendel, 1910 *Gen. Ins.* **106**: 21 (for all references up to 1909).

Chrysomyza sp. Grimshaw, 1902 *Fauna Hawaiiensis* **3** (2): 85 (probably *C. aenea*).

Chrysomyza aenea (Fab., 1794) Bezzi, 1913 *Philippine J. Sci.* (D) **8**: 321. Knab, 1916 *Brooklyn ent. Soc. Bull.* **11**: 43 Fig. 1. Hardy, 1920 *Proc. Linn. Soc. N.S.W.* **45**: 472 (? Identification). Malloch, 1930 *Ins. Samoa* **6** (5): 215. Curran, 1934 *N. Amer. Dipt.* :277 Figs. 27, 46. Hennig, 1941 *Ent. Beihefte* **8**: 117. Malloch, 1942 *B.P. Bishop Mus. Bull.* **172**: 205.

Physiphora aenea (Fab., 1794) Steyskal, 1952 *Occ. Pap. B.P. Bishop Mus.* **20** (15): 285.

Distribution: India; Java; Sumatra; Borneo; New Guinea; New South Wales; Queensland; Northern Territory (Australia); New Caledonia; New Hebrides; Solomon Islands; Philippines; Taiwan; Samoa; Marshall Islands; Marianas Islands; Guam; Hawaii.

All records of this species need careful checking since it is easily confused with *P. demandata* (Fab., 1798).

*2. **P. aperta** Steyskal, 1952

Physiphora aperta Steyskal, 1952 *Occ. Pap. B.P. Bishop Mus.* **20** (15): 285 Figs. 1a, b.

Distribution: Solomon Islands.

*3. **P. demandata** (Fab., 1798)

Musca demandata Fabricius, 1798 *Ent. Syst.* (*Suppl.*) :564.

Chrysomyza demandata (Fab., 1798) Hendel, 1910 *Gen. Ins.* **106**: 21. Knab, 1916 *Brooklyn ent. Soc. Bull.* **11**: 41 Fig. 2.

Physiphora demandata (Fab., 1798) Steyskal, 1952 *Occ. Pap. B.P. Bishop Mus.* **20** (15): 284.

Distribution: Cosmopolitan: Europe; Africa; North America; Australia.

The one Australian record for this species consists of specimens caught and identified by me in various parts of South Australia. I have also reared adults from larvae infesting wet, badly-made ensilage. Despite wide collecting over more than forty years, I have not seen, in South Australia, a single specimen of *aenea*. These facts suggest to me the possibility that some at least of the specimens recorded from Australia as *aenea* may well be mis-identifications. The two species may be readily distinguished by the wing venation. Knab, 1916 (*Brooklyn ent. Soc. Bull.* **11**: 43 Figs. 1, 2) gives good illustrations of the wings of both.

4. Genus: **EUXESTA** Loew, 1867

Loew, 1867 *Berl. ent. Zeit.* **11**: 297 Pl. 2, Figs. 7-20. Hendel 1910 *Gen. Ins.* **106**: 22 (see for all references prior to 1909). Malloch, 1930 *Ins. Samoa* **6** (5): 215; 1932 *B.P. Bishop Mus. Bull.* **98**: 208. Curran, 1934 *N. Amer. Dipt.* :277 Figs. 64; 85.

Type species: *Urophora quadrivittata* Macquart, 1835.

1. **E. hyalipennis** Malloch, 1932

Euxesta hyalipennis Malloch, 1932 *B.P. Bishop Mus. Bull.* **98**: 209. Steyskal, 1952 *Occ. Pap. B.P. Bishop Mus.* **20** (15): 280.

Distribution: Marquesas Islands.

2. **E. lafooni** Steyskal, 1952

Euxesta lafooni Steyskal, 1952 *Occ. Pap. B.P. Bishop Mus.* **20** (15): 280.

Distribution: New Hebrides.

3. **E. pruinosa** Malloch, 1932

Euxesta pruinosa Malloch, 1932 *B.P. Bishop Mus. Bull.* **98**: 210. Steyskal, 1952 *Occ. Pap. B.P. Bishop Mus.* **20** (15): 282.

Distribution: Marquesas Islands.

4. **E. quadrivittata** (Macquart, 1835)

Urophora quadrivittata Macquart, 1835 *Hist. nat. Dipt.* **2**: 456.

Euxesta quadrivittata (Macquart, 1835) Knab, 1916 *Brooklyn ent. Soc. Bull.* **11**: 44. Steyskal, 1952 *Occ. Pap. B.P. Bishop Mus.* **20** (15): 282.

E. exilis Knab, 1916 (*loc. cit.*).

Distribution: Florida; Cuba; Jamaica (introduced into Hawaii and Philippines).

5. **E. semifasciata** Malloch, 1930

Euxesta semifasciata Malloch, 1930 *Ins. Samoa* **6** (5): 216 Fig. 1.

Distribution: Ellice Islands.

The possibility that one or more of the species, *hyalipennis, lafooni, pruinosa,* and *semifasciata* may be introductions from Central America or the Caribbean area should not be overlooked.

7. Genus: **PSEUDEUXESTA** Hendel, 1910

Hendel, 1910 *Gen. Ins.* **106**: 30.

Type species: *Pseudeuxesta prima* (Osten-Sacken, 1881).

*1. **P. prima** (Osten-Sacken, 1881)

Pseudeuxesta prima Osten-Sacken, 1881 *Ann. Mus. Stor. nat. Genova* **16**: 470.

Euxesta semifasciata Malloch, 1930 *Ins. Samoa* **6** (5): 216.

Pseudeuxesta prima (Osten-Sacken, 1881) Hendel, 1910 *Gen. Ins.* **106**: 32; 1931 *Verh. zool.-bot. Ges. Wien* **81**: 4. Malloch, 1939 *Proc. Linn. Soc. N.S.W.* **64**: 98. Steyskal, 1952 *Occ. Pap. B.P. Bishop Mus.* **20** (15): 286.

Distribution: Celebes; Seychelles; Ceram; New Guinea; Solomon Islands; Palau Islands; Truk Islands; Marshall Islands; Marianas Islands; Hawaii.

17. Genus: **ACROSTICTA** Loew, 1867

Loew, 1867 *Berl. ent. Z.* **11**: 293 Pl. 2, Fig. 5; 1873 *Smithson. misc. Coll.* **11** (3): 151. Hendel, 1910 *Gen. Ins.* **106**: 50.

Type species: *Acrosticta scrobiculata* Loew, 1867.

1. **A. apicalis** (Williston, 1896)

Euxesta apicalis Williston, 1896 *Trans. ent. Soc. Lond.* **12**: 375 Pl. 12, Fig. 128.

Acrosticta pallipes Grimshaw, 1901 *Fauna Hawaiiensis* **3** (1): 44; 1902 *ibid* **3** (2): 85. Hendel, 1910 *Gen. Ins.* **106**: 52. Bezzi, 1928 *Dipt. Fiji* :89. *Acrosticta apicalis* (Williston, 1896) Malloch, 1930 *Ins. Samoa* **6** (5): 217; 1932 *B.P. Bishop Mus. Bull.* **98**: 206. Bryan, 1934 *Proc. Haw. ent. Soc.* **8** (3): 430. Steyskal, 1952 *Occ. Pap. B.P. Bishop Mus.* **20** (15): 279.

See Steyskal, 1952 for complete bibliography.

Distribution: West Indies; (introduced into Hawaii).

21. Genus: **NOTOGRAMMA** Loew, 1867

Loew, 1867 *Berl. ent. Z.* **11**: 289; 1873 *Smithson. misc. Coll.* **3**: 148. Hendel, 1910 *Gen. Ins.* **106**: 58.

Type species: *Notogramma cimiforme* Loew, 1867.

1. **N. cimiforme** Loew, 1867

Notogramma cimiformis Loew, 1867 *Berl. ent. Z.* **11**: 289. Loew, 1867 described *N. cimiformis*; in 1873 (*Smithson. Misc. Coll.* **11** (3): (148) he mistakenly synonymized it with *N. stigma* (Fab., 1798). Since then, both species have been confused. Steyskal, 1963 (*Proc. ent. Soc. Wash.* **65**: 196) has distinguished the two species and emended *cimiformis* to *cimiforme* in conformity with the gender of *Notogramma*. *N. stigma* has never been correctly recorded from any Pacific Island; all such records should be referred to *N. cimiforme*. (See Steyskal, *loc. cit.* for complete bibliography.)

Distribution: West Indies; Central and South America. (Introduced into the following places: Hawaii; Marianas Islands; Guam; Palau Islands and Wake Island.)

APPENDIX

GENERA OF ULIDIINAE ERECTED AFTER 1910

Hendel's work on the sub-family, Ulidiinae, appeared in 1910 (*Gen. Ins.* fascicle 106). Since that year, three new genera were erected by Malloch who, however, did not refer them to Hendel's arrangement of genera. In these circumstances, I am unable to do so, and therefore present them in this appendix.

1. Genus: **HETERODOXA** Malloch, 1932

Malloch, 1932 *B.P. Bishop Mus. Bull.* **98**: 211.

Type species: *Heterodoxa uapouae* Malloch, 1932.

1. **H. fatuhivae** Malloch, 1932

Heterodoxa fatuhivae Malloch, 1932 *ibid* **98**: 214 Fig. 49d.

Distribution: Marquesas Islands.

2. **H. hivaoae** Malloch, 1932

Heterodoxa hivaoae Malloch, 1932 *ibid* **98**: 213 Fig. 49b.

Distribution: Marquesas Islands.

3. **H. uahukae** Malloch, 1932

Heterodoxa uahukae Malloch, 1932 *ibid* **98**: 214 Fig. 49c.

Distribution: Marquesas Islands,

4. **H. uapouae** Malloch, 1932

Heterodoxa uapouae Malloch, 1932 *ibid* **98**: 212 Fig. 49a.

Distribution: Marquesas Islands.

2. Genus: **NEOEUXESTA** Malloch, 1930

Malloch, 1930 *Ins. Samoa* **6** (5): 218.

Type species: *Neoeuxesta fumicosta* Malloch, 1930.

1. **N. fumicosta** Malloch, 1930

Neoeuxesta fumicosta Malloch, 1930 *ibid* **6** (5): 218. Steyskal, 1952 *Occ. Pap. B.P. Bishop Mus.* **20**: 283.

Distribution: Samoa.

2. **N. guamana** Steyskal, 1952

Neoeuxesta guamana Steyskal, 1952 *ibid* **20**: 283 Fig. 1d.

Distribution: Guam.

3. Genus: **PERISSONEURA** Malloch, 1932

Malloch, 1932 *B.P. Bishop Mus. Bull.* **98**: 207.

Type species: *Perissoneura diversipennis* Malloch, 1932.

1. **P. diversipennis** Malloch, 1932

Perissoneura diversipennis Malloch, 1932 *ibid* **98**: 207 Fig. 28. Steyskal, 1952 *Occ. Pap. B.P. Bishop Mus.* **20**: 284.

Distribution: Marquesas Islands.

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RECORDS OF THE
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THE RHODACARIDAE (ACARI : MESOSTIGMATA); CLASSIFICATION, EXTERNAL MORPHOLOGY AND DISTRIBUTION OF GENERA

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INTRODUCTION

The Rhodacaridae is a group of mainly free-living, predatory mites occurring in ground habitats and, although the family as a whole is cosmopolitan, the majority of its genera and species have only been found in the Southern Hemisphere.

A number of concepts of the family have been put forward during the last 15 years. The most similar to that delineated by the diagnosis given here would either be that of the "*Rhodacarus*-group" genera proposed by Evans (1963), being distinguished from another group of genera (including *Asca*, *Digamasellus* and *Halolaelaps*) within the Rhodacaridae *sensu* Ryke, 1962b by their leg chaetotaxy, or a combination of the two families Rhodacaridae and Cyrtolaelapidae as recognized by Johnston (1968).

Oudemans (1902a) established the Rhodacarinae with one, monospecific genus, *Rhodacarus*, while Halbert (1915) was the first to regard the taxon as a family. Only a few genera were added to the family before 1955, but since then the number of genera referred to the family, as defined below, has risen rapidly, initially by transferring established genera from other families and more recently by establishing new genera within the family.

In the present study, as in the past, the taxonomic characters used to classify categories within the Rhodacaridae are mostly external morphological structures of the adults. The external morphology of the immature stages has been used in gamasine classification, but for rhodacarids there is not usually enough of this kind of data for it to be useful.

Soon after I started to study the Australian members of the Rhodacaridae it became clear that this could not be done satisfactorily without a more general, prior survey of the family, because the original descriptions of the type-species of many nominal rhodacarid genera and subgenera are meagre by present standards and only in some cases have they since been improved. As a consequence, it is often difficult to decide how to apply many of the available genus-group names; the placement of new or even long since established species within a genus is often uncertain, or the validity of a new genus recognized to contain such a species is often dubious. In an attempt to overcome this difficulty, the type-species of nearly all nominal genera or subgenera have been examined. As a result it is possible to make a conservative decision as to which genus-group names can be regarded as valid and to base the diagnosis of the taxa to which they are applicable on the characters of the type-species.

Having based the definitions of rhodacarid genera and subgenera on their types, I considered it desirable to extend these definitions without embarking upon a project that would too long delay my study of the Australian rhodacarid fauna. Therefore, although care has been taken to try and ensure that most nominal species are placed within the correct genus and that any consequent adjustments to the generic diagnosis are made, this survey is not sufficiently extensive to ensure the validity of all such species. The conservative approach of trying to refer all nominal species to previously established genera has usually been possible, sometimes by recognizing species-complexes within a genus and sometimes by considering species as *incertae sedis*, but some new genera have been established. Also, from amongst the many unnamed species seen only a few are established as new species; usually, either so that their descriptions will illustrate the range of characters within a genus, or in order to rename rhodacarid mites that have been misidentified in the literature. But, in order to extend the general usefulness of this work, I have referred several of these unnamed species to genera so that their locality data can be used to give a more complete indication of the geographical occurrence of the supraspecific taxa.

As a result 45 genera are recognized as valid within the Rhodacaridae and are placed in a framework of suprageneric taxa in order to facilitate the further study of the family. The genera are grouped in six subfamilies and the genera of one subfamily, the Ologamasinae, are further grouped in two tribes. Although the delimitation of the subfamilies should not be considered final and some genera are only provisionally referred to them, I have confidence in the viability of the basic concepts of these groupings and would regard them as an indication of the phylogeny of rhodacarid mites. In contrast, even if the tribal names used within the Ologamasinae continue in use in the future, the present concepts of these two taxa are used here largely for convenience, particularly as they reflect a previous, widely held, concept for which a reliable alternative has not yet been found.

MATERIAL AND METHODS

Some mites have been mounted in lactic acid, before being drawn with the aid of a camera lucida, while others were mounted in a gum chloral medium and may have been more squashed when drawn.

The material described or examined is deposited as listed after the locality data of the species, using the following abbreviations. BBM: Bernice P. Bishop Museum, Honolulu, Hawaii. BM(NH): British Museum (Natural History). London, England. LAEHE: Laboratoire d'Acarologie, Ecole Practique des Hautes Etudes, Paris, France. NRS: Naturhistoriska Riksmuseum, Stockholm, Sweden. PUSA: Potchefstroom University, South Africa. SAM: South Australian Museum. SEAF: Stazione di Entomologia Agraria, Florence, Italy. ZMH: Zoologisches Museum, Hamburg, Germany.

Generally, the terminology follows that used by Evans and Till (1965), but using a change in nomenclature for tarsal chaetotaxy (Evans, in press) which regards this segment as carrying four instead of three whorls of setae (see Fig. 1 for abbreviations used). The names for parts of the female spermathecal system are Anglicized terms derived from those used by Michael (1892). Under the heading "Diagnosis" the following terms are used for categories of adult mites having an idiosomal length within the particular ranges given; "minute" for less than 400μ, "small" for 400μ to 600μ, "average sized" for 601μ to 800μ, "large" for 801μ to 1,200μ and "gigantic" for more than 1,200μ. Under the heading "Sclerotization" the word "shield" is omitted, as is "seta" under "Chaetotaxy". A map (Fig. 427) of Zoogeographical regions of the world is given as a key to abbreviations used for the distribution of the members of each genus.

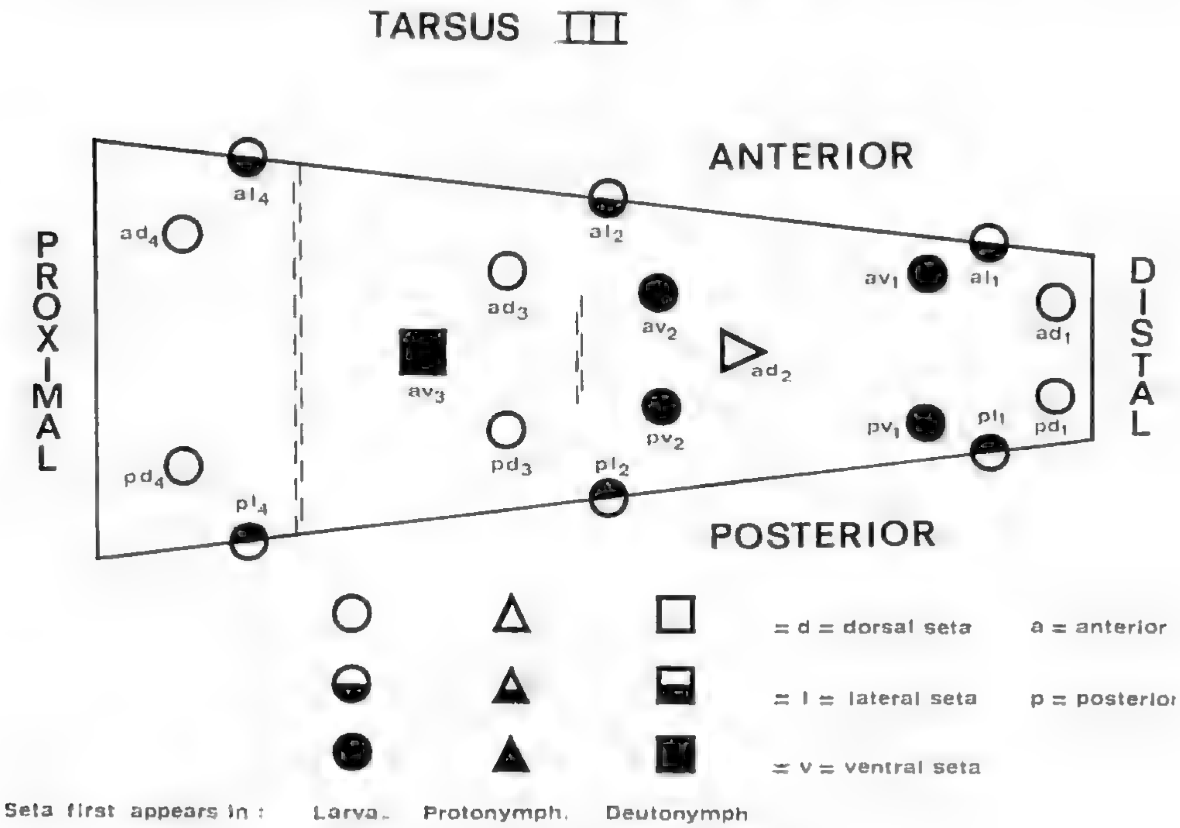


Fig. 1. Setal nomenclature for tarsus III.

Previously (Lee, 1966), I used the term "species-group" for a supra-specific category within a genus, but in the text below the alternative term "species-complex" is used in order to avoid confusion with the use of "species-group" for a species and infraspecific category in the Internation Code of Zoological Nomenclature, 1961. Particular complexes of species, named after characteristic species, as for example in *falciger*-complex, follow this system.

HISTORY OF CLASSIFICATION

Oudemans (1902a) exaggerated the importance of some characters of *Rhodacarus roseus* when he established the species in a new subfamily—the Rhodacarinae—within the Parasitidae, a family then equivalent to the present Mesostigmata. As a result in 1923 he incorrectly allied the Rhodacaridae (still containing only one genus) by placing it in the Sejina and not the Gamasina, and also maintained an inadequately narrow concept of the family when he (Oudemans, 1939a) transferred *Rhodacarellus* to the Gamasolaelaptidae leaving only *Rhodacarus* and *Rhodacaropsis* as rhodacarid genera.

Berlese (1913b) used a systematic framework in which the arrangement of the genera, considered here as belonging to the Rhodacaridae, fits the concept of the family used here much better than that of Oudemans. Berlese referred nearly all the then nominal rhodacarid genera (exceptions being *Heydeniella,* then considered a junior synonym of *Gamasiphis,* and *Stylochirus*) to either his tribe Cyrtolaelaptini or to the tribe Gamasini. Although neither of these family-group names are regarded as available here, Cyrtolaelaptini can be regarded as equivalent to the Veigaiidae, while Gamasini can be regarded as equivalent to the Parasitidae. *Gamasellus, Heterogamasus, Protolaelaps* (junior objective synonym of *Cyrtolaelaps*), *Rhodacarus* and *Sessiluncus* were grouped with what are now considered to be veigaiid genera and *Euryparasitus, Gamasiphis, Hydrogamasus, Laelogamasus* and *Ologamasus* were grouped with what are now considered to be parasitid genera.

Vitzthum (1941) maintained nearly as narrow a concept of the family as that of Oudemans, but included *Rhodacarellus,* and was followed in this by Baker and Wharton (1952). In the latter publication, genera that are here grouped in the Rhodacaridae were referred to five other families (Ascaidae, Gamasolaelaptidae, Macrochelidae, Neoparasitidae and Pseudoparasitidae).

The concept of the Rhodacaridae was broadened by Evans (1955 and 1957) in his classification of the British Mesostigmata, when he included in the family those members of the Gamasina with a three-pronged apotele (without an associated hyaline flap) and a divided dorsal shield. By including *Sessiluncus* (entire dorsal shield) and *Digamasellus* (two-pronged apotele) in the Rhodacaridae, Ryke (1958) implied a further extension of the limits of the family. When he later redefined the family (Ryke, 1962b), he recognized 37 genera or subgenera within it, of which 11 are not regarded here as belonging to the Rhodacaridae. His broad definition appears to only exclude, with certainty, those members of the Gamasina without a divided dorsal shield in the deutonymph and a ventro-anal shield in the female. In the latter publication, Ryke recognized two subfamilies within the Rhodacaridae; the Rhodacarinae with a divided dorsal shield in the adult and the Ologamasinae with an entire dorsal shield in the adult. A grouping of genera within the Rhodacaridae similar to that for the Rhodacaridae *sensu* Evans, 1957, was used by Karg (1961), while Athias-Henriot (1961b) apparently used a grouping similar to that for the Rhodacarinae *sensu* Ryke, 1962b.

During the last decade, two main schools of thought have developed on the classification of the Mesostigmata, originating either from the work of Hirschmann (1957 and 1959) or that of Evans (1963). Hirschmann (1957 and 1959) based his "Gangsystematic" studies on morphological characters which are preferred if they are similarly expressed at all stages of their ontogenetic development, but which must be distinctive throughout this development so that any postembryonic instar of a species can be correctly placed in a supraspecific category. The characters Hirschmann used are the nature of the dorsal sclerotization, the chaetotaxy of the idiosoma, and the structure of the appendages and ventral surface of the gnathosoma. Evans (1963) introduced a new diagnostic character, the leg chaetotaxy, which is not similarly expressed during ontogenetic development and is usually only distinctive for a taxon in the later-stages of development (*i.e.*, in the deutonymph and adult). Although Evans rightly emphasized that the leg chaetotaxy must not be used in isolation from other characters, it has proved of considerable importance because of its usefulness. Since I follow Evan's usage of morphology, I will only consider the further history of the classification of the Rhodacaridae as it has been affected by acarologists using leg chaetotaxy as an important taxonomic character. After which I will indicate the approximately equivalent groupings of genera by other acarologists.

Evans (1963), after pointing out that his analysis of the leg chaetotaxy of free-living Gamasina supported familial concepts based on other morphological criteria, noted that the Rhodacaridae (*sensu* Ryke, 1962b) was an exception in containing two groups of genera, one of which he called the "*Rhodacarus*-group", which could be accommodated in the Rhodacaridae, while the other group of genera, containing *Asca, Digamasellus* and *Halolaelaps*, did not appear to be confamilial with the first group. This gave rise to the concept of a "Rhodacaridae *sens. lat.*" equivalent to the

Rhodacaridae *sensu* Ryke, 1962b, and a "Rhodacaridae *sens. str.*" equivalent to the "*Rhodacarus*-group" genera of Evans (1963).

The above concept of "Rhodacaridae *sens. lat.*" with uncertain limits was retained longer than necessary. When genera not belonging to the "*Rhodacarus*-group" had been transferred either to the Ascidae or Digamasellidae (Lindquist and Evans, 1965) or to the Halolaelapidae (Karg, 1965), the Rhodacaridae could be defined on the basis of other morphological criteria as well as the leg chaetotaxy. The unnecessay reference to the "*Rhodacarus*-group" genera as if they were a category within an undefinable Rhodacaridae *sens. lat.* can be seen in my own work (Lee 1966 and 1967).

I (Lee, 1966) did not accept the division of genera into two subfamilies within the Rhodacaridae as established by Ryke (1962b). Instead, as a temporary measure recognized as unsatisfactory at the time, I used two unnamed groups of genera, the members of which were distinguished by the structure of the dorsal setae.

Johnston (1968) transferred all those genera containing species with seta *pl4* present on tarsus IV from the Rhodacaridae to a new family, the Cyrtolaelapidae. The resulting narrow concept of the Rhodacaridae is equivalent to that for the Rhodacarinae as defined below.

Within Hirschmann's (1962) classification, the reference of genera to higher taxa indicates that his concept of the Gamasellini within the Eugamasinae closely approximates to that used here for the Rhodacaridae. The other tribe in his Eugamasinae, the Eugamasini, contains genera that were referred to the Parasitidae and Veigaiidae by Vitzthum (1941), a reference accepted by most acarologists since then. On the other hand Karg (1965) places most rhodacarid genera, genera that Johnston (1968) has grouped in the Cyrtolaelapidae, in the Gamasellinae, a subfamily within the Eugamasidae, while *Rhodacarus*, *Rhodacarellus*, *Dendrolaelaps* (syn. *Digamasellus*), and *Protogamasellus* are grouped in the Rhodacaridae. The other subfamilies in Karg's Eugamasidae are the Parasitinae and Veigaiinae. Bregetova (1967), on the basis of the ontogenesis of the dorsal sclerotization, groups in the Rhodacaridae approximately those genera that were grouped by Ryke (1962b) in the Rhodacarinae and, presumably, genera from Ryke's Ologamasinae would be referred to the Parasitidae.

MORPHOLOGY

A comparative study of all the morphological characters used in the classification given below has not been made. But a study has been made of the following four sets of characters that are important in the diagnoses of suprageneric rhodacarid taxa. The ventral sclerotization of the adult idiosoma which is used in diagnosing subfamilies, as is the deutonymph and adult leg chaetotaxy. The dorsal sclerotization of the adult idiosoma and the form of the dorsal setae which are used in diagnosing the two tribes in the Ologamasinae because of precedence and convenience, and the location of the external aperture of the spermathecal system which may in the future be more important in the diagnoses of these two tribes.

1. VENTRAL SCLEROTIZATION

In the past, the ventral sclerotization has been used to distinguish genera, for example the fusion of the ventro-anal shield with the opisthonotal shield has been considered diagnostic for *Gamasiphis* and *Ologamasus*, but I use it here for diagnosing suprageneric taxa. The following two characters of the ventral sclerotization are considered of value: the fusion of the ventro-anal shield with other shields and the fusion of the posterior end of the peritrematal shield with other shields. Two monogeneric subfamilies, Laelaptonyssinae and Tangaroellinae, are not considered in this section, because, although their ventral sclerotization is somewhat atypical, alternative characters are more useful in distinguishing them from other rhodacarid subfamilies.

The four major groups of genera which I treat as subfamilies are largely characterized by the fusion or lack of fusion of the ventro-anal shield to other shields and, ignoring the exceptions, they can be distinguished as follows: Rhodacarinae, female ventro-anal shield discrete, male ventro-anal shield fused to opisthonotal shield but not to peritrematal shield; Gamasiphinae, female and male ventro-anal shield fused to opisthonotal shield but not to peritrematal shield; Ologamasinae, female ventro-anal shield discrete, male ventro-anal shield fused to opisthonotal and peritrematal shield; Sessiluncinae, female and male ventro-anal shield not fused to opisthonotal or peritrematal shield.

These differences are illustrated in Figure 2, and the importance of knowing both sexes of a species in the use of this character for diagnosis should be noted. However, even if only one sex of a species is known, members of the Rhodacarinae can be distinguished from other rhodacarid species by the chaetotaxy of tarsus IV and females of the Ologamasinae can be distinguished from females of the Sessiluncinae by the fusion of the peritrematal shield to other shields. As a result, diagnoses of the subfamilies would be relatively easy if there were no exceptions to the characteristic fusion of the ventro-anal shield to other shields, but this is not so.

Within the subfamilies Rhodacarinae, Gamasiphinae and Sessiluncinae, the extent of the fusion of the ventro-anal shield to the opisthonotal and peritrematal shields shows only a few, simple exceptions to the above characteristic forms, thus: some males of the Rhodacarinae have a discrete ventro-anal shield; some species of *Gamasiphoides* within the Gamasiphinae have females and males with a discrete ventro-anal shield; all species of

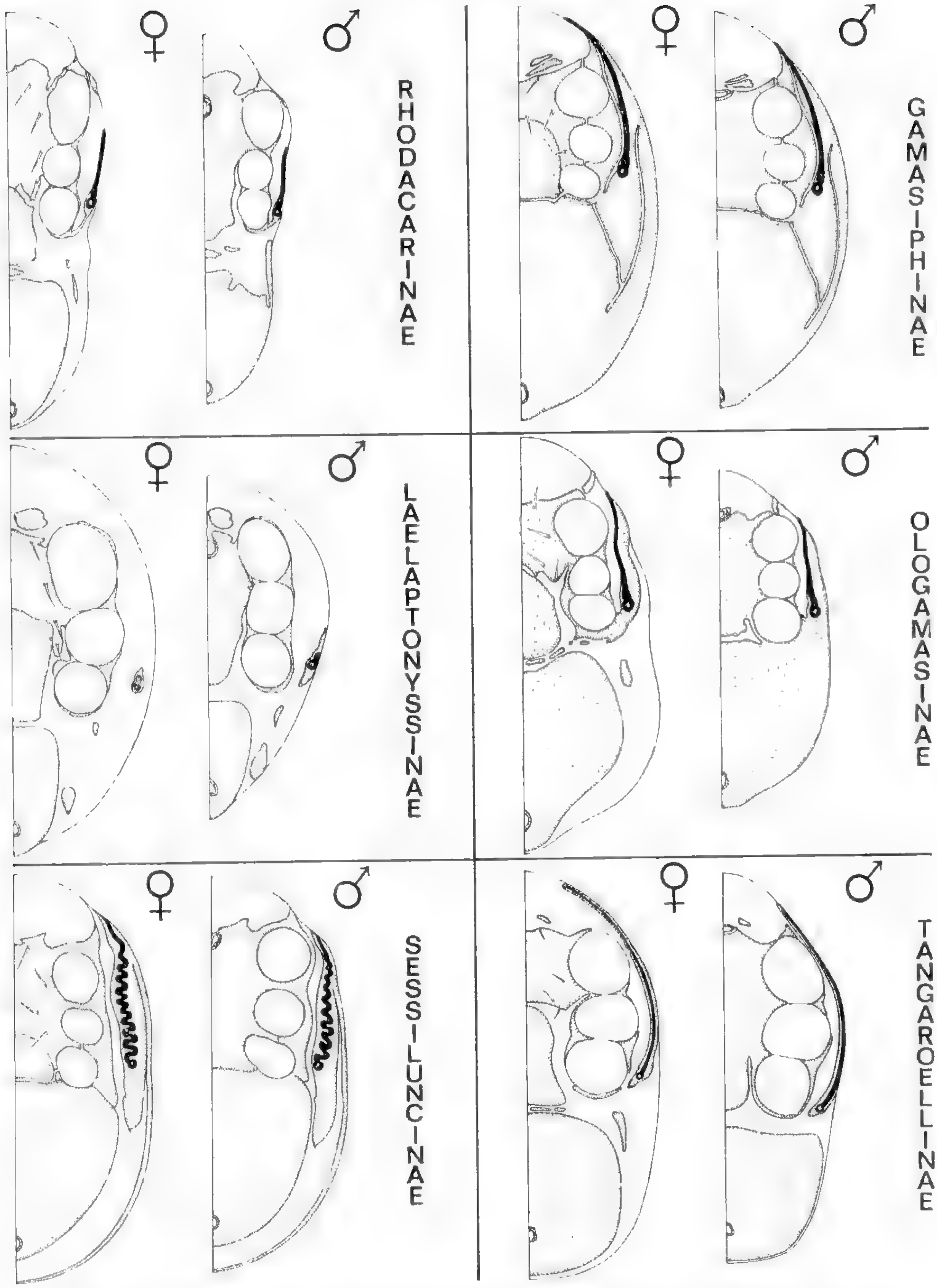


Fig. 2. Ventral sclerotization of the adults of the type-species of the type-genera of rhodacarid subfamilies, excepting Laelaptonyssinae for which *Laelaptonyssus chinensis* is illustrated and Ologamasinae for which the type of *Cyrtolaelaps* is illustrated.

Stylochirus within the Sessiluncinae have females and males with the ventro-anal shield fused to the notal shield. On the other hand, within the Ologamasinae there are many exceptions to the characteristic fusion of the ventro-anal shield with other shields, and in some lightly sclerotized (*e.g.*, *Acugamasus cursor*) or heavily sclerotized (*e.g.*, *Hiniphis hinnus*) species this character is not sexually dimorphic.

Two general statements without exceptions, to which I attach considerable importance, can be made about the fusion of the ventro-anal shield to other shields. Only members of the Rhodacarinae and Ologamasinae ever have sexual dimorphism of the fusion of the ventro-anal shield to the opisthonotal shield, and only members of the Ologamasinae ever have the ventro-anal shield fused to the peritrematal shield and when this is the case it usually only occurs on the male.

Members of the Sessiluncinae can usually be further diagnosed by the peritrematal shield not being fused to exopodal shield IV, but species of *Gamasellopsis*, *Onchogamasus communis* and *Queenslandolaelaps vitzthumi* are exceptions. It is possible that the fusion in these latter cases is different in origin from the apparently similar fusion in most members of the other three large subfamilies. A visible difference in such a fusion on members of the Sessiluncinae is that there is no fissure between the peritrematal and exopodal shields posterior to the stigma. This is true also for a few members of the other subfamilies (some *Gamasiphis* species and *Hiniphis hinnus*), but these particular rhodacarid mites are usually heavily sclerotized and I consider them to have relatively recent ancestors in which the above fissures occurred behind the stigma.

2. LEG CHAETOTAXY

The first analysis of the leg chaetotaxy of the free-living Gamasina, as well as a system of setal nomenclature for individual leg segments, was introduced by Evans (1963) who considered the setae as being in patterns based on the numbers distributed amongst six zones on the surface of a leg segment. According to which zone they are in, the setae are named either antero-lateral, antero-dorsal, postero-dorsal, antero-ventral, postero-ventral or postero-lateral as indicated in the accompanying diagram (Fig. 1). For most leg segments, the setal pattern or chaetotaxy varies in the deutonymphs and adults of the Gamasina. Evans (1963) showed that this variation provides a valuable taxonomic criterion for the classification of these mites and he listed the types of chaetotaxy that he had observed on each leg segment excepting tarsus I, which, because of its large number of setae, has not yet been described for any gamasine mites. Although Evans refers to "types of chaetotaxy" and Costa (1968) uses the term "chaetotactic variants", here I refer to "kinds of chaetotaxy".

I have confirmed that for the majority of species the leg chaetotaxy is the same as that described by Evans (1963) for the "*Rhodacarus*-group" genera. This kind of leg chaetotaxy has been illustrated in a previous paper (Lee, 1966, Fig. 1) for *Gamasellus discutatus* and is termed here the "commonest kind of rhodacarid leg chaetotaxy" or as being "as *Gamasellus*" or "as *Gamasellus discutatus*".

While Evans (1963) mainly demonstrated that the chaetotaxy of legs I and II are valuable in the diagnosis of gamasine families, later publications show that leg chaetotaxy, especially of legs III and IV, is a valuable diagnostic character for genera; for example in the Ascidae (Lindquist and Evans, 1965) and Dermanyssidae (Evans and Till, 1965). Leg chaetotaxy has also proved useful in the diagnosis of rhodacarid taxa. There are a fair number of rhodacarid species with a different kind of leg chaetotaxy to the commonest one, and amongst them I have observed 18 kinds of leg chaetotaxy, if a kind of leg chaetotaxy is recognized by differences as small as the presence or absence of one seta from amongst all the leg setae.

To give a general indication of the variability of rhodacarid leg chaetotaxy, I have made a visual presentation of the data (Fig. 3) that provides a simple measure of the variability of particular setae in different subfamilies and tribes. Labels are attached to all the setae (Fig. 3) that sometimes do not occur (present or absent) as in the commonest kind of leg chaetotaxy.

The symbols used on the diagram (Fig. 3) have the following meanings. A "+ve" indicates that the seta is sometimes present, but is absent in the commonest leg chaetotaxy, and "—ve" indicates that the seta is sometimes absent but is present in the commonest leg chaetotaxy. The letters indicate the subfamilies or tribes in which the particular seta's occurrence differs from that in the commonest leg chaetotaxy. The figures associated with these letters indicate the number of kinds of leg chaetotaxy, found in these taxa, which include an uncommon occurrence of the particular seta, and this gives a measure of the seta's variability. The actual kinds of total leg chaetotaxy are given under the different subfamily headings later in this paper.

An example of the use of Figure 3 is given as follows. If a rhodacarid species is examined and found to lack seta *pv* on genu III, Figure 3 is referred to and this seta is seen to be labelled " 4G:3S:1G,S". This means that the seta is present on most nominal rhodacarid species but absent in at least some members of both the Gamasiphinae and Sessiluncinae and it is quite often absent since it is missing in 8 of the 18 kinds of leg chaetotaxy differing from the commonest rhodacarid kind. Also, since 4 of these kinds of chaetotaxy occur on some members of the Gamasiphinae, 3 on some members of the Sessiluncinae and 1 on some members of both the Gamasiphinae and Sessiluncinae, the seta tends to equally variable in both subfamilies.

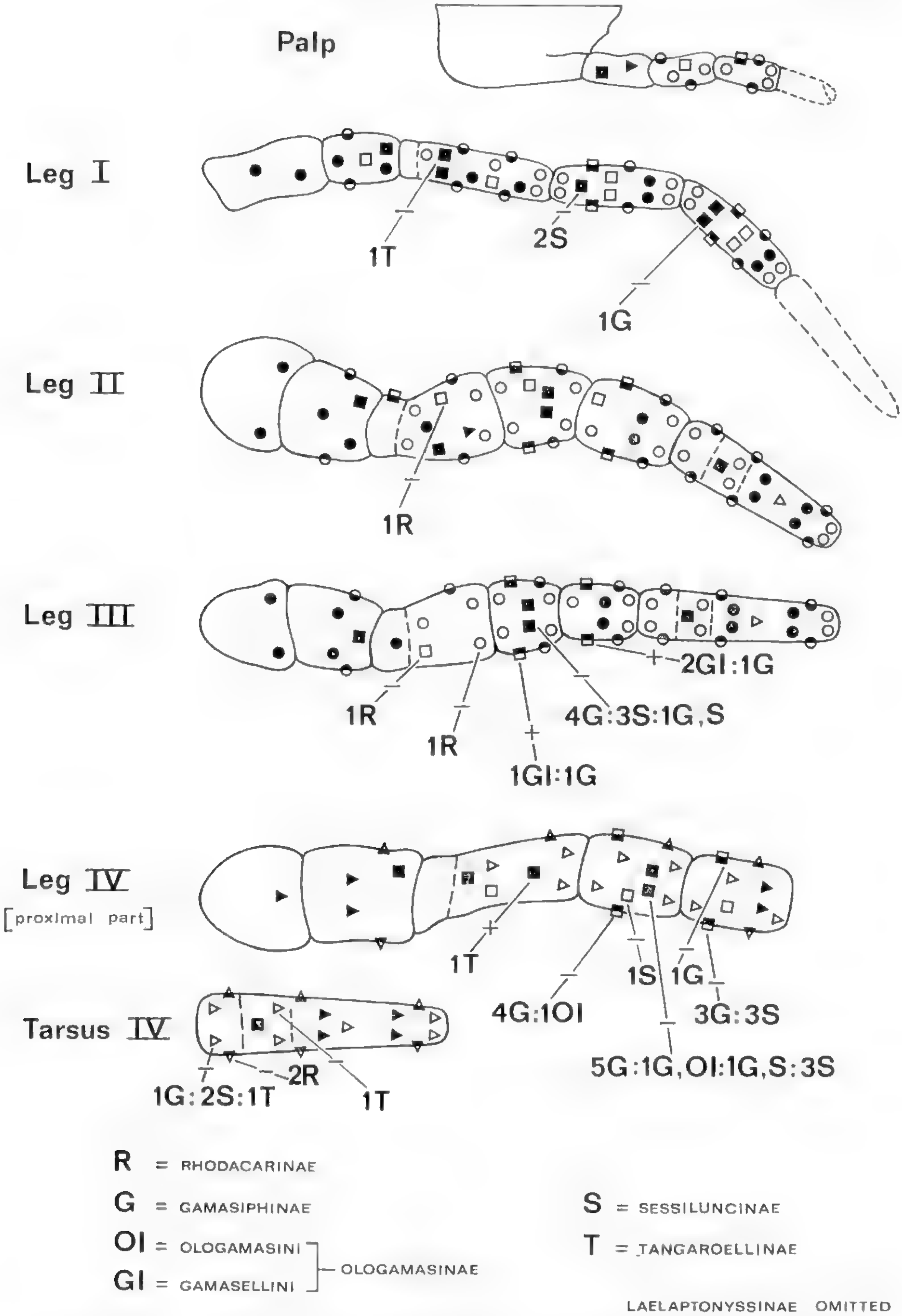


Fig. 3. Setation of adult rhodacarid appendages. Unlabelled setae and labelled setae accompanied by a "— ve" sign indicate chaetotaxy of *Gamasellus discutatus*. Labelled setae accompanied by a "+ve" sign occur in certain rhodacarid taxa but not in *G. discutatus*. The labels to setae are explained in the text (p. 11). The symbols used for setal position and first appearance are as in Fig. 1.

Costa (1968) compared the number of kinds of chaetotaxy for different leg segments on free-living Gamasina (using the data of Evans, 1963) and on a gamasine parasite (*Hemipteroseius adleri*) which has intraspecific variation of leg chaetotaxy, and showed that in both cases there is a similar gradient of variability depending on the location of the leg segments. The setal patterns are more stable on the segments of legs I and II than on legs III and IV, and on the proximal leg segments and tarsi than on the genua and tibiae. The numbers of different kinds of chaetotaxy for particular adult rhodacarid leg segments usually support Costa's observation if the aberrant leg chaetotaxy of *Laelaptonyssus* is ignored, and there also appears to be a gradient around the surface of the leg segments. For example, although there are 34 antero-lateral, 69 dorsal, 30 postero-lateral and 62 ventral setae on the adult *Gamasellus* legs (excluding tarsus I) of one side, the variability of setae from these zones, as measured by the addition of the number of kinds of leg chaetotaxy in which a particular seta does not occur as on *Gamasellus*, is 1 for the antero-lateral, 9 for the dorsal, 17 for the postero-lateral and 23 for the ventral setae.

The point, emphasized by Lindquist and Evans (1965), that leg chaetotaxy is not a taxonomic panacea, but is another set of characters which, when regarded alone, may have exceptions among related species, is well illustrated in the Rhodacaridae. For example, the setal pattern on tarsus IV has been regarded as stable amongst free-living Gamasina, but variations in the occurrence of setae on the tarsi IV of rhodacarids can be used in the diagnosis of the Rhodacarinae (45 nominal species), Tangaroellinae (1 nominal species), *Gamasellopsis* (4 nominal species), *Gamasiphoides propinqua* and *Laelaptonyssus mitis*.

3. DORSAL SCLEROTIZATION AND CHAETOMORPHY

Amongst members of the Rhodacaridae, the attributes of three characters are often associated as follows: 'some complex dorsal setae—divided dorsal shield—dull sclerotization', or 'all simple dorsal setae—entire dorsal shield—shiny sclerotization'. Two groups of mites, distinguished by this association of attributes, were placed in either *Gamasellus* or *Hydrogamasus* by earlier acarologists, or the subgenera *Gamasellus* or *Hydrogamasellus* by Hirschmann (1966). From amongst these three characters, the presence or absence of a division of the dorsal shield was used by Ryke (1962b) in dividing the family into the Rhodacarinae and Ologamasinae, and latter the dorsal chaetomorphy was used by Lee (1966) in a temporary division of the family into two unnamed groups of genera.

A comparison between species of *Euepicrius* and characteristic species of *Gamasellus* and *Gamasiphis* indicates that, if the classification given below is followed, the above associations of attributes should be regarded as relatively superficial within this family. Despite this, I recognize the two groups of genera within the Ologamasinae, referred to as the tribes Ologamasini and Gamasellini, by such attributes. The character given the most importance here is the dorsal sclerotization as used by Ryke (1962b) in his division of the whole family: most adults of the Ologamasini have an entire dorsal shield, while on adults of the Gamasellini the dorsal shield is usually divided. Species in the Ologamasinae which do not have the dorsal sclerotization characteristic of their tribe, are members of genera (*Geogamasus, Heydeniella, Hydrogamasellus* and *Gamasellus discutatus*-complex) in which this character varies between species or sexes of the same species and occasionally males of two of these genera (*Geogamasus* and *Hydrogamasellus*) have a partially divided dorsal shield, a rare attribute in this family. Of these genera with varying adult dorsal sclerotization, *Geogamasus, Heydeniella* and *Hydrogamasellus* have simple dorsal setae and are placed in the Ologamasini, while the *Gamasellus discutatus*-complex species have some pilose dorsal setae and are placed in the Gamasellini. The concepts used here for the two Ologamasinae tribes are mainly to provide a convenient division of this large subfamily that follows some precedence. But it is interesting that the resulting grouping of genera is similar to one based on the location of the external spermathecal aperture (see below). Therefore, although the present tribal taxa are tentative, a similar, stable grouping may be made later which is an indication of the phylogeny of the included mites.

4. SPERMATHECAL SYSTEM

In the Gamasina, male gametes are transferred to the female in a spermatophore, and Michael (1892) considered it likely that these gametes reached the spermatheca and ova through the vagina in some species, and through special tubes, the "*tubuli annulati*" (here termed "spermathecal ringed tubes") with an external aperture distinct from that of the vagina, in other species. Michael's evidence included the presence of a possible spermathecal sacculus and ringed tubes in the female only, the connection of these structures with the ovaries, the similarity of their contents to the contents of the spermatophore and observations of mites copulating.

Although evidence supporting Michael's (1892) work on gamasine reproduction is meagre, Camin's (1953) description of vaginal insemination for *Ophionyssus natricis* and Dosse's (1958 and 1959) description of direct spermathecal insemination for *Typhlodromus zwolferi*, as well as some more recent work by others, establish that the two kinds of insemination suggested by Michael do occur in different members of the Gamasina. Costa (1966) implies that the members of a particular family would all have the same kind of insemination, but this may not be true for this family or for the included

Ologamasinae. Spermathecal ringed tubes are present in many species grouped in these taxa, but Michael (1892) presents evidence that the insemination of a member of the Ologamasinae, *Euryparasitus emarginatus*, is through the vagina and I have been unable to find spermathecal ringed tubes in *Aceugamasus* females despite my examination of many carefully cleared specimens.

By describing the spermathecal ringed tube and sacculus in a large number of gamasine mites, Athias-Henriot (in press) demonstrates the variety of their form and location of access aperture, especially amongst rhodacarids. One, two or, in a single instance, three locations of the spermathecal ringed tube aperture are described on the females of unnamed species that Athias-Henriot considers as belonging to the same rhodacarid genus. From my own work there usually appears, for any particular rhodacarid genus, to be only one locality for the external aperture of the spermathecal ringed tube. Therefore, I suggest that Athias-Henriot (in press) allots some Southern Hemisphere rhodacarids to the wrong genera. If the assumption that there is one locality for the external aperture of the spermathecal ringed tube in most rhodacarid genera is substantiated in the future, then the considerable variety of this character will make it an important taxonomic criterion.

Because of the possibility of confusing a structure (*e.g.*, ducts of coxal and femoral glands, described by Fain, 1966, or even the genital apodeme and muscles, described by Treat, 1965) with the spermathecal ringed tube it is necessary to have some indication of the reliability of such an identification. When there is a connection between the tube in question and a central sacculus, I regard it as certain that this tube is a spermathecal ringed tube. On this basis a spermathecal ringed tube opens near the posterior paraxial edge of acetabulum IV just ventral to the genital apodeme in the following genera: *Gamasiphis*, *Caliphis*, *Euepicrius*, *Gamaselliphus*, *Gamasiphoides*, *Laelaptiella*, *Parasitiphus*, *Gamasellus falciger*-complex, *Periseius* (*Psammonsella*), *Antennolaelaps* and *Queenslandolaelaps*. Observations (to be published later) of copulation in *Euepicrius filamentosus* and *Gamasellus tragardhi* endorse this, and similar observations for *Heydeniella dentata* endorse the identification of a tube opening near the dorsal distal margin of trochanter III as a spermathecal ringed tube. In other cases I am, for a number of reasons, fairly sure that I have correctly identified the spermathecal ringed tube and in the text below the "probable" location of its external aperture is referred to. This is true for the following genera with the ringed tube probably opening near the posterior paraxial edge of acetabulum IV: *Rhodacarellus*, *Hydrogamasus*, *Gamasellus discutatus*-complex, *Periseius* (*Periseius*), *Pilellus* and *Paragamasellevans*. This is also true for some species of *Afrogamasellus* where the opening is probably on the metapodal shield and for the following genera in which the ringed

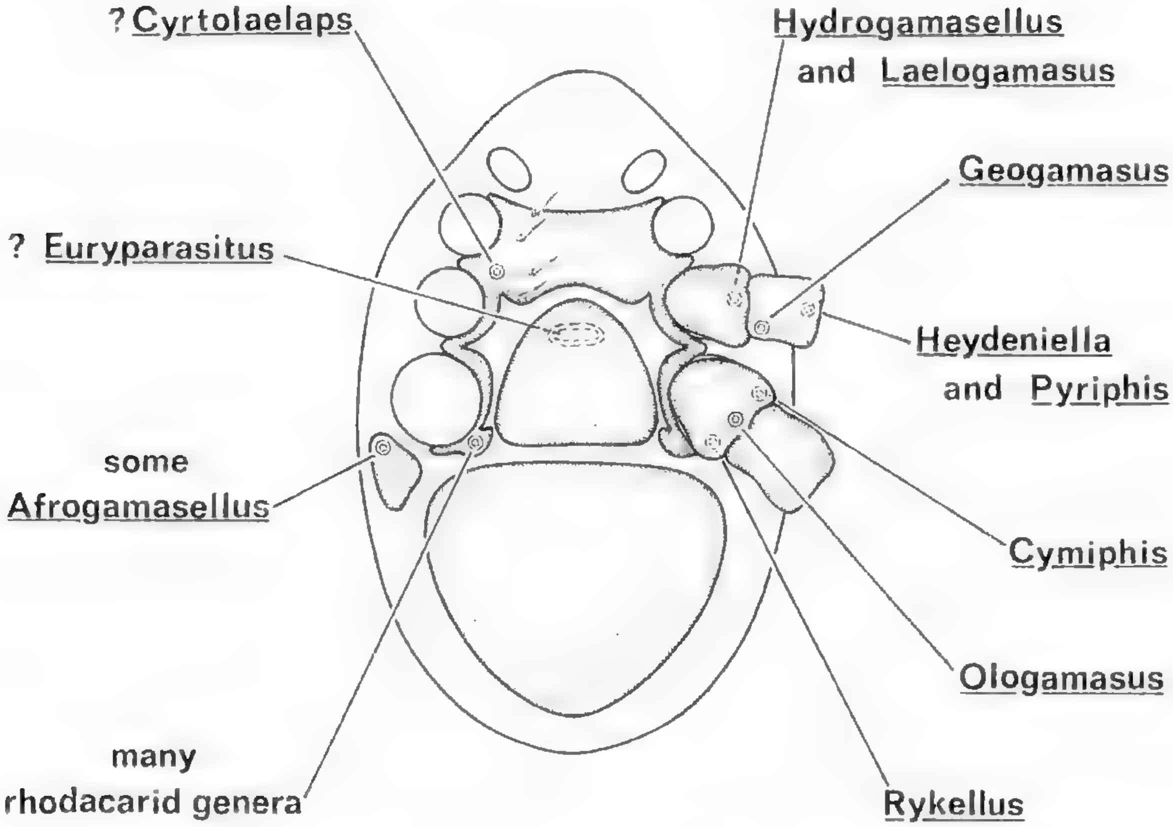


Fig. 4. Probable location of access to spermatheca on rhodarid females.

tube probably opens on the proximal segments of legs III and IV: *Ologamasus, Cymiphis, Geogamasus, Hydrogamasellus, Rykellus, Pyriphis* and *Laelogamasus*. On female *Cyrtolaelaps* and *Euryparasitus* there is a tube opening on the sternal shield between seta *st*3 and acetabulum III, other than the sternal pores which also occur on the male. But, because of Michael's (1892) observation that the spermatophore is applied to the vagina of *Euryparasitus emarginatus* (as *Gamasus terriblis*) and spermatozoa are found in a domed recess in the vagina, I regard the identification of the above sternal tubes of *Cyrtolaelaps* and *Euryparasitus* as spermathecal ringed tubes as dubious. Also, on one of the three known females of *Neogamasellevans berlesei* (described under species *incertae sedis*), a tube apparently opening near the genital apodeme has been blown partly out of the idiosoma by the clearing process and may be a spermathecal ringed tube. Therefore, there are 23 rhodacarid genera, subgenera or species-complexes of which I have not seen members or in which I have been unable to locate a possible spermathecal ringed tube. Amongst these latter genera, Athias-Henriot (in press) has located a possible spermathecal ringed tube opening on femur III of a *Rhodacarus* species and on coxa III and coxa IV of two *Sessiluncus* species.

On the assumption that only one location for the aperture of the spermathecal ringed tube usually occurs in a particular genus, I summarize my observations in Figure 4. All genera with the spermathecal ringed tube probably opening on the proximal segments of legs III and IV are listed on the right hand side of the diagram and, excepting *Laelogamasus*, they all belong to the Ologamasini. Therefore, it is possible that the diagnosis of the Ologamasini may later be based on the location of the aperture of the spermathecal ringed tube.

CLASSIFICATION

Family RHODACARIDAE Oudemans

Rhodacarinae Oudemans, 1902a, p. 48.

Rhodacaridae Oudemans, Halbert, 1915, p. 81.

Cyrtolaelaptini Berlese, 1913b, p. 11.

(This name is considered to be based on a misidentified type-genus and therefore is not available by the terms of the International Code of Zoological Nomenclature (1961). The evidence put forward for misidentification is that later (p. 86), in the paper where this family-group name was first published, *Cyrtolaelaps* is redefined with "species typica *Gamasus nemorensis* K", indicating that Berlese had overlooked the type-designation by monotypy (Berlese, 1887b) of *Gamasus mucronatus* G. and R. Canestrini for *Cyrtolaelaps* and the type-designation by Oudemans (1905) of *Gamasus nemorensis* Koch for *Veigaia*.)

Cyrtolaelaptinae Berlese, 1920, p. 166.

Rhodacaridae Oudemans, *sensu* Evans (in part), 1957, p. 221.

Rhodacaridae Oudemans, *sensu* Ryke (in part), 1962b, p. 155.

Gamasellini Hirschmann, 1962, p. 39.

Rhodacarus-group Evans, 1963, p. 302.

Rhodacaridae Oudemans, *sensu* Karg (in part), 1965, p. 295.

Rhodacaridae Oudemans, *sensu* Bregetova (in part), 1967, p. 472.

Type-genus: *Rhodacarus* Oudemans, 1902a.

DIAGNOSIS. Sclerotization very variable, but always separate podonotal and opisthonotal shields on deutonymph and a posteriorly truncated female genital shield separated from a conspicuous ventro-anal shield. Female metasternal seta, *st*4, usually on a sterno-metasternal shield. Leg chaetotaxy usually as for the "*Rhodacarus*-group" genera referred to by Evans (1963). Apotele usually three-pronged, never with associated hyaline flap, and if two-pronged then there are four ventral setae on tibia I. Male with distally free spermadactyl, presternal genital orifice and seta *av* on femur II larger than that of female and usually considerably modified to a conspicuous spur.

MORPHOLOGY.

SCLEROTIZATION. There are always separate podonotal and opisthonotal shields on the deutonymph, and on the adults they may or may not be fused together. On the male of *Geogamasus delamarei* and an unnamed *Hydrogamasellus* male there are lateral incisions partially separating the podonotal and opisthonotal shields. The ventro-anal shield and the posterior half of the peritrematal shield may or may not be fused to other shields (see "Morphology", p. 8). The female genital shield is rounded anteriorly or has a pointed hyaline flap, and is truncated posteriorly. There are no associated parasternal shields, but there is usually a central vaginal shield, and sometimes small intergenito-ventral shields posteriorly. There is always a continuous male sternito-genital shield. The extent of the fusion between the pre-endopodal, jugular, sternal, metasternal, endopodal and expodal shields varies. In some subfamilies there is conspicuous sexual dimorphism of the sclerotization.

CHAETOTAXY. Idiosoma: There are usually 20, 21 and 22 pairs of setae on the podonotum. But there may be 23 pairs (*Rhodacarus* and *Rhodacaropsis*) or there may be hypertrichy of the podonotal setae as in some members of the Gamasiphinae or Gamasellini. The two monogeneric subfamilies have an unusually low number of podonotal setae; Laelaptonyssinae having 13, 19 or 20 pairs and Tangaroellinae having 16 pairs. The setation of the opisthonotum is very variable. There are usually four pairs of setae on a sterno-metasternal shield and one pair on the genital shield, but setae *st*1 and *st*4 may be on separate shields, and seta *st*4 may be on striated cuticle or it may be absent as in *Evanssellus medusa* and *Laelaptonyssus mitis*. Setae *Jv*2, *Jv*3, *Zv*2, a pair of paranals and an unpaired postanal are always on the ventro-anal shield. There are no euanal setae on the adult anal valves.

Legs: The commonest chaetotactic pattern is that found on the legs of *Gamasellus* species where the complement of setae on each leg segment is: coxae I to IV, 2-2-2-1: trochantera I to IV, 6-5-5-5: femora I to IV, 13-11-6-6: genua I to IV, 13-11-9-10; tibiae I to IV, 14-10-8-10: tarsi II to IV, 18-18-18. Eighteen variants from this pattern are known, usually with fewer setae. Only two genera have less than the maximum complement of 14 setae on tibia I: *Hydrogamasus* has 13 setae (2-6/3-2) and *Laelaptonyssus* has 9 setae (1-4/3-1) or 11 setae (2-4/3-2).

OTHER CHARACTERS. Apotele three-pronged, except for the two-pronged apotele of *Tangaroellus porosus*, and without an associated hyaline flap. Conspicuous salivary styli lie ventro-laterally to chelicerae. Movable digit on male chelicera carries a distally free spermadactyl, although the two are fused into what appears to be a single process in some species of *Afrogamasellus*. Chaetomorphy of most setae varies through a wide range of shapes, and there are thin walled sensory setae at the distal tip of tarsus I, strong, grooming setae on the antero-lateral margin of the palp genu and enlarged, spur-like setae on the male leg II. The spermathecal system in the female is either closely associated with the vagina or there are a pair of ringed tubes opening on the idiosoma or proximal leg segments, level or nearly level with genital shield, and leading to a single, central sacculus. The male genital orifice is presternal and level with the anterior edge of acetabulum II, although it may be enclosed by the fused sternal and pre-endopodal shields.

DISTRIBUTION. The family as a whole is cosmopolitan, having been found in every major zoogeographical region, although none of the individual genera have this wide distribution and their geographical range varies considerably. Taxa within the family are more numerous and morphologically diverse in the extra-holarctic regions. For example, 5 genera are known only from the holarctic region, while there are 31 genera from only the extra-holarctic regions, with 9 found in both holarctic and extra-holarctic regions.

This distribution of the Rhodacaridae has resulted in it being considered as replacing the Parasitidae, which is more numerous in the Northern Hemisphere, as free-living predators in the ground habitats of the Southern Hemisphere (Athias-Henriot, 1968 and Balogh, 1963a) or the extra-palaearctic regions (Sheals, 1962). Members of the Rhodacaridae are very much rarer than those of the Parasitidae in Palaearctic regions but are probably as common in Nearctic regions, commoner in Tropical regions and very much commoner in Southern Temperate regions. But, the enormous diversity in form of rhodacarid mites in Southern Temperate regions suggests that they replace more than the morphologically conservative Parasitidae.

The rhodacarid fauna of the Northern Temperate regions is similar throughout, except that *Hydrogamasus* and *Sessiluncus* appear to be confined to the Palaearctic region. The Tropical regions show some of the differences that are found between the rhodacarid faunas of the major Southern Temperate regions, but because two well represented rhodacarid genera, *Rhodacarus* and *Gamasiphis*, have a pantropical distribution and may be the only rhodacarid genera present in some localities, the rhodacarid faunas of these regions are fairly similar throughout. In the Southern Temperate regions there are considerable differences in the rhodacarid faunas of the Neotropical, Ethiopian and Australian regions indicating that they have been evolving in isolation from each other for some time. On the other hand, in the Subantarctic and Antarctic regions, there appears to have been a relatively recent circumpolar distribution because of the similarity between the rhodacarid faunas.

A table summarizing the size and distribution of supraspecific taxa, as well as a map of the zoogeographical regions used, is given at the end of this paper (p. 204 and Fig. 427).

REMARKS. The concept of the Rhodacaridae used here is based on the *Rhodacarus*-group of Evans (1963). The approximately equivalent taxa in other systematic frameworks would be Hirschmann's (1962) Gamasellini, Johnston's (1968) Rhodacaridae and Cyrtolaelapidae, Karg's (1965) Rhodacaridae (in part, excluding the Digamasellidae) and Gamasellinae, and Ryke's (1962b) Rhodacaridae (in part, excluding some Ascidae, the Digamasellidae and Halolaelapidae). Bregetova (1967) places *Rhodacarus, Asca, Digamasellus, Halolaelaps* and *Cyrtolaelaps* in the Rhodacaridae, and appears to exclude by definition all species with a holonotal shield in the adult.

The Rhodacaridae is probably closely allied to both the Parasitidae and Veigaiidae, with the same type of leg chaetotaxy, and the Digamasellidae and Halolaelapidae, with a reduced leg chaetotaxy. Although the Rhodacaridae is almost certainly not similarly allied to the Ascidae, some species, which would be atypical of either of these families, are placed in one of them with little certainty. Finally, on superficial examination, some members of the Pachylaelapidae, Parholaspidae and Zerconidae (females only) may be thought to be rhodacarids.

Within the family, as recognized here, there are six major subgroups, which I recognize formally as subfamilies. The names Rhodacarinae Oudemans, 1902a, Laelaptonyssinae Womersley, 1956a and Ologamasinae Ryke, 1962b are already available for three or these groups and below I propose the names Gamasiphinae, Sessiluncinae and Tangaroellinae for the other three groups. Adults of these groups can be distinguished by using the following key.

KEY TO SUBFAMILIES OF RHODACARIDAE

1. Femur I with less than 13 setae, having only 2 or 3 ventral setae	2
Femur I with 13 setae, having 4 ventral setae	3
2. Apotele 2-pronged. Leg chaetotaxy as for *Gamasellus*, except femur I with 12 setae (one ventral seta less), femur IV with 7 setae (one ventral seta more) and tarsus IV with 16 setae (two dorsal setae less) . .	Tangaroellinae

Apotele 3-pronged. Chaetotaxy of many leg segments differs from *Gamasellus*, for example tibia I has only 9 or 11 setae . . Laelaptonyssinae

3. Tarsus IV with 17 setae, seta *pl*4 absent. An exception, with 18 setae because seta *pl*4 is present on tarsus IV, is one *Afrogamasellus* sp. which has seta *st*1 on an area of sternal shield with punctate sclerotization Rhodacarinae

Tarsus IV with 18 setae or, if 17 setae, seta *pd*4 absent. Seta *st*1 on an evenly sclerotized area of sternal shield 4

4. Peritrematal shield not fused to exopodal IV shield or, if fused, then completely merged with exopodal shields behind stigma. Ventro-anal shield rarely fused to notal shield and when it is (as in *Stylochirus*), seta *al* on palp femur is in central third. Peritreme extends in front of anterior edge of acetabulum III (except in some species of *Stylochirus*) and setae on male tarsus II are never enlarged into tubercles . . . . Sessiluncinae

Peritrematal shield generally fused to exopodal IV shield, but usually it is also partly separated from the exopodal shields behind the stigma by a fissure running backwards from between the anterior parts of the peritrematal and exopodal shields. On palp femur, seta *al* is in proximal third (except in some species of *Litogamasus*). If peritrematal shield is completely merged with exopodal shields behind stigma (as in some species of *Gamasiphis and Hiniphis*), ventro-anal shield is fused to notal shield. Or, if peritrematal shield not fused at all to exopodal shields then ventro-anal shield is either fused to notal shield (as in some species of *Caliphis, Hydrogamasus* and *Geogamasus* males), or the mite is minute, with a short peritreme not extending in front of anterior edge of acetabulum III (as in *Neogamasellevans* and *Notogamasellus*), or it is the male of a littoral mite with an enlarged leg IV and seta *av*2 on tarsus II enlarged into tubercle (as in *Litogamasus* and *Parasitiphis*) 5

5. Discrete genital shield covering genital orifice which is posterior to sternal shield. Female 6

Sternito-genital shield with genital orifice close to its anterior margin. Male 7

6. Ventro-anal shield fused to notal shield except on some females of *Gamasiphoides*. On sterno-metasternal shield a line joining setae *st*2, *st*3 and *st*4 would enclose an angle of less than 95°, except in *Hydrogamasus* which has 13 setae (2-6/3-2) on tibia I. Some females of *Gamasiphis* and *Caliphis* (*e.g.*, *G. concilator* and *C. calvus*) have seta *st*3 so far forward that it could be mistaken for seta *st*2, so that they may be confused with Ologamasinae females on which the ventro-anal shield is fused to the notal shield (compare Fig. 64 and 233). But, the absence of a split in exopodal III shield and having the combination of less than two lateral prongs on palp genu seta *al*1, a peritrematal shield not fused to the ventro-anal shield and the sternal shield continuous with endopodal IV shield distinguishes *Gamasiphis* and *Caliphis* females from such Ologamasinae females . . . . . . Gamasiphinae

Generally ventro-anal shield not fused to notal shield, but there are various exceptions. On sterno-metasternal shield a line joining setae *st*2, *st*3 and *st*4 is usually nearly straight, and never encloses an angle of less than 95°, except on some females of the *Gamasellus discutatus*-complex, which can be distinguished by having complex notal setae and a ventro-anal shield that is not fused to notal shield. Chaetotaxy of leg I always as for *Gamasellus*, with 14 setae (2-6/4-2) on tibia . . . . Ologamasinae

7. Ventro-anal shield fused to notal shield except on some males of *Gamasiphoides*, but not to peritrematal shield. *Gamasiphoides* males with ventro-anal shield not fused to notal shield have simple idiosomal setae, no lateral prongs on palp genu seta *al*1, 2 pairs of pre-endopodal shields and a holonotal shield. Idiosomal sclerotization always similar to that of female .. .. Gamasiphinae

Ventro-anal shield either not fused to notal shield or, if fused, also fused to peritrematal shield. Exceptions with a ventro-anal shield fused to notal shield and not to peritrematal shield are found in the *Gamasellus discutatus*-complex and *pyriformis*-complex which can be distinguished by having both the podonotal seta *j*4, *z*5, and *r*3 obviously pilose amongst simple or lanceolate setae and 2 or 3 pairs of pre-endopodal shields. Also some males of *Parasitiphis* are similar exceptions but can be distinguished by having seta *av*2 on tarsus II modified into a tubercle. If ventro-anal shield not fused to notal shield or peritrematal shield then, either some idiosomal setae are complex, or palp genu seta *al*1 has more than 2 lateral prongs, or there is a single pair of pre-endopodal shields or there are separate podonotal and opisthonotal shields. Idiosomal sclerotization often differing considerably from that of female .. .. Ologamasinae

Subfamily RHODACARINAE Oudemans

Rhodacarinae Oudemans, 1902a, p. 48. Type-genus: *Rhodacarus* Oudemans, 1902a.

DIAGNOSIS: Minute or small mites which are generally lightly sclerotized, except for *Afrogamasellus*, a genus restricted to the Ethiopian region, which contains a number of average sized, heavily sclerotized species. The sclerotization is often conspicuously sexually dimorphic. Only very rarely are opisthosomal shields fused to those of the podosoma. Seta *pl*4 is absent on tarsus IV, except on one unnamed species.

MORPHOLOGY.

SCLEROTIZATION. The shields on the podosoma are not usually fused to those on the opisthosoma, but on *Afrogamasellus luberoensis* the podonotal is fused to the opisthonotal (although a distinct groove marks the line of fusion), and in an unnamed species described by Loots (thesis, 1967) the female (the male is unknown) metapodal is completely merged with the peritrematal. In most species, except the heavily sclerotized *Afrogamasellus* species, parts of the shields have punctate sclerotization. Rarely are there free pre-endopodals as in *Rhodacaropsis*, although the jugular may be discrete from the sternal. The male sclerotization is usually more extensive than that of the female (except in some species of *Afrogamasellus* and *Rhodacaropsis* where it is similar in both sexes) with the ventro-anal fused posteriorly to the opisthonotal, the metapodal sometimes enlarged or in lightly sclerotized species fused to the opisthonotal by punctate sclerotization and, in some *Afrogamasellus* species, the peritrematal is enlarged. Unlike the Ologamasinae, the other subfamily with many species having sexually dimorphic sclerotization, the male ventro-anal is never fused to the peritrematal.

CHAETOTAXY. Idiosoma: There are 22 or 23 pairs of podonotal setae, except on one species of *Afrogamasellus* where there are 18 pairs. If there are 23 pairs they are regarded as being in rows with 6*j*, 6*z*, 6*s*, 5*r*, unlike Lindquist and Evans (1965, p. 14) who would regard the podonotal setae of *Rhodacarus* as being in rows with 6*j*, 6*z*, 5*s*, 6*r*, naming the four pairs of setae on the anterior edge of the podonotal shield *j*1, *z*1, *s*1, *r*1. Here, row *j* is considered to be compressed forward in *Rhodacarus* (compare Figs. 5, 14 and 20) so that *j*1, *j*2, *z*1, *s*1 are on the anterior edge of the podonotal shield, and therefore, as in other Gamasina, *r*1 does not exist. 6*j*, 5 or 6*z*, 3, 5 or 6*s*, 4 or 5*r*: 5*J*, 5*Z*, 5*S*, 2, 4 or 5*R*: 5*st*: 3*Jv*, 3*Zv*, 0 or 1*Sv*.

Legs: Unique amongst rhodacarids, and Gamasina, is the absence of *pl*4 on tarsus IV, except for one unnamed species of *Afrogamasellus* described by Loots (thesis, 1967) where it is present on the adult but absent on the deutonymph. The only other variant from the *Gamasellus* leg chaetotaxy is the absence of some dorsal setae on femur II and III on at least one species of *Rhodacaropsis*.

OTHER CHARACTERS. On palp femur, seta *al* is on central third, as in *Laelaptonyssus* and a number of Sessiluncinae genera, in contrast to nearly all members of the Ologamasinae, Gamasiphinae and *Tangaroellus* where it is on the proximal third. Dorsal setae are usually simple and setose but in some *Afrogamasellus* species they are spatulate and/or pilose. The spermadactyl is unusual in either being recurved (*Rhodacarus*, *Rhodacarellus* and

Rhodacaropsis) or being merged with a reduced movable digit (*Afrogamasellus*). A recurved spermadactyl does occur on members of other subfamilies (*Pyriphis* and *Sessiluncus*). Pulvilli II-IV with paired lateral, short lanceolate lobes and paired central circular lobes.

DISTRIBUTION. *Rhodacarus* (and probably *Rhodacarellus* and *Rhodacaropsis* when more collecting is done) is cosmopolitan except that it has not yet been collected from the polar regions or the southern Neotropical regions; is commonest in the deeper soil layers and the littoral zone and is constant in form as well as being small and lightly sclerotized. *Afrogamasellus* is confined to the Ethiopian region, is more often collected from plant litter or upper soil layers and is variable in form, as well as sometimes being larger and heavily sclerotized.

REMARKS. Although the concept of this subfamily is similar to that of the Rhodacaridae up until 1955, the important diagnostic characters used here are largely those which will be used by Loots (in press), as are the characters used to distinguish the genera it contains. The addition of a new genus, *Afrogamasellus* Loots and Ryke (1968), is important in clarifying which characters of the previous nominal members of the Rhodacarinae are absent when a species is not specialized for living in the high humidity and small spaces between soil particles; for example, small size, light sclerotization and products of an articulated narrow idiosoma that allows the separate movements of the opisthosoma needed to circumambulate narrow soil pore spaces. But, although the larger species of *Afrogamasellus* are heavily sclerotized and probably hemiedaphic, the opisthosomal shields are rarely fused to those of the podosoma, and when they are there is a line of demarcation suggesting that the fusion is secondary. This indicates that the ancestors of these *Afrogamasellus* species may have been euedaphic like *Rhodacarus* and had an articulated idiosoma.

The removal of *Rhodacaroides* from the Rhodacarinae to the Gamasellini depends partly on the characters of unnamed species that I consider to be congeneric with the type species (which I have not seen). But on Willmann's (1959) original description there can be little doubt that this genus is not closely allied to *Rhodacarus*.

I recognize 4 genera within this subfamily, *Rhodacarus*, *Afrogamasellus*, *Rhodacarellus* and *Rhodacaropsis*. Adults of these genera can be distinguished by using the following key.

KEY TO GENERA OF RHODACARINAE

1. Four pairs (*j*1, *j*2, *z*1 and *s*1) of setae on anterior edge of podonotal shield. Third hypostomal seta approximately halfway between *hyp*2 and *hyp*4

(capitular) setae. On ventral surface of podonotal shield, 3 light-refractile structures between setae *j*5 and *j*6 2

Two or 3 pairs (always *j*1 and *z*1, sometimes *j*2) of setae on anterior edge of podonotal shield. Third hypostomal seta approximately level with *hyp*2. On ventral surface of podonotal shield, 4 or more light-refractile structures between setae *j*5 and *j*6 3

2. No pretarsus I. No pre-endopodal shields of normal sclerotization, although anterior edge of sternal shield may be separated from the rest by punctate sclerotization and there may be separate shields of punctate sclerotization . . . . . . *Rhodacarus*

Pretarsus I present, consisting of a pair of strong, sessile claws. Normally sclerotized pre-endopodal shields separated from sternum by striated cuticle . . . . *Rhodacaropsis*

3. Arthrodial process at base of movable cheliceral digit is a simple coronet. Spermadactyl separates from normal movable cheliceral digit at level of single tooth and is recurved, enclosing an angle of less than 100° . . . . *Rhodacarellus*

Arthrodial process at base of movable cheliceral digit is produced into a conspicuous brush. Spermadactyl curves in the same way as movable cheliceral digit, which is reduced and may be entirely merged with it . . . . *Afrogamasellus*

Genus RHODACARUS Oudemans

Rhodacarus Oudemans, 1902a, p. 50. Type-species: *Rhodacarus roseus* Oudemans, 1902a, by monotypy.

DIAGNOSIS. Minute or small mites, with lightly sclerotized, slim, centrally articulated idiosoma and a relatively large, well sclerotized gnathosoma. Third hypostomal seta approximately halfway between second and fourth hypostomal setae. Podonotal shield has 4 pairs of setae on anterior margin and 3 light-refractile structures. Pre-endopodal shields absent. Spermadactyl recurved. Pretarsus I absent.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal (may be fragmented into three or four smaller shields) and opisthonotal. On ventral surface of podonotal, 3 light-refractile structures between setae *j*5 and *j*6 (usually on rhodacarids there are 4 such structures, if present, but *Rhodacaropsis* also has 3). Discrete ventro-anal (bearing ariculae posterior to anus) widely separated from genital and exopodal IV. Discrete metapodal which may be fragmented and have punctate sclerotization. Intergenito-ventral shield present. Peritrematal reduced and may or may not be narrowly fused to podonotal and exopodal IV. If present, exopodals only between or at posterior edge acetabula. Sterno-metasternal fused to endopodal II and part of III. Pre-endopodals absent, although anterior edge of sternal may be normally sclerotized and separated from similarly sclerotized areas by punctate sclerotization. Areas of punctate sclerotization on edges of many shields, seta *st*1 usually on such an area.

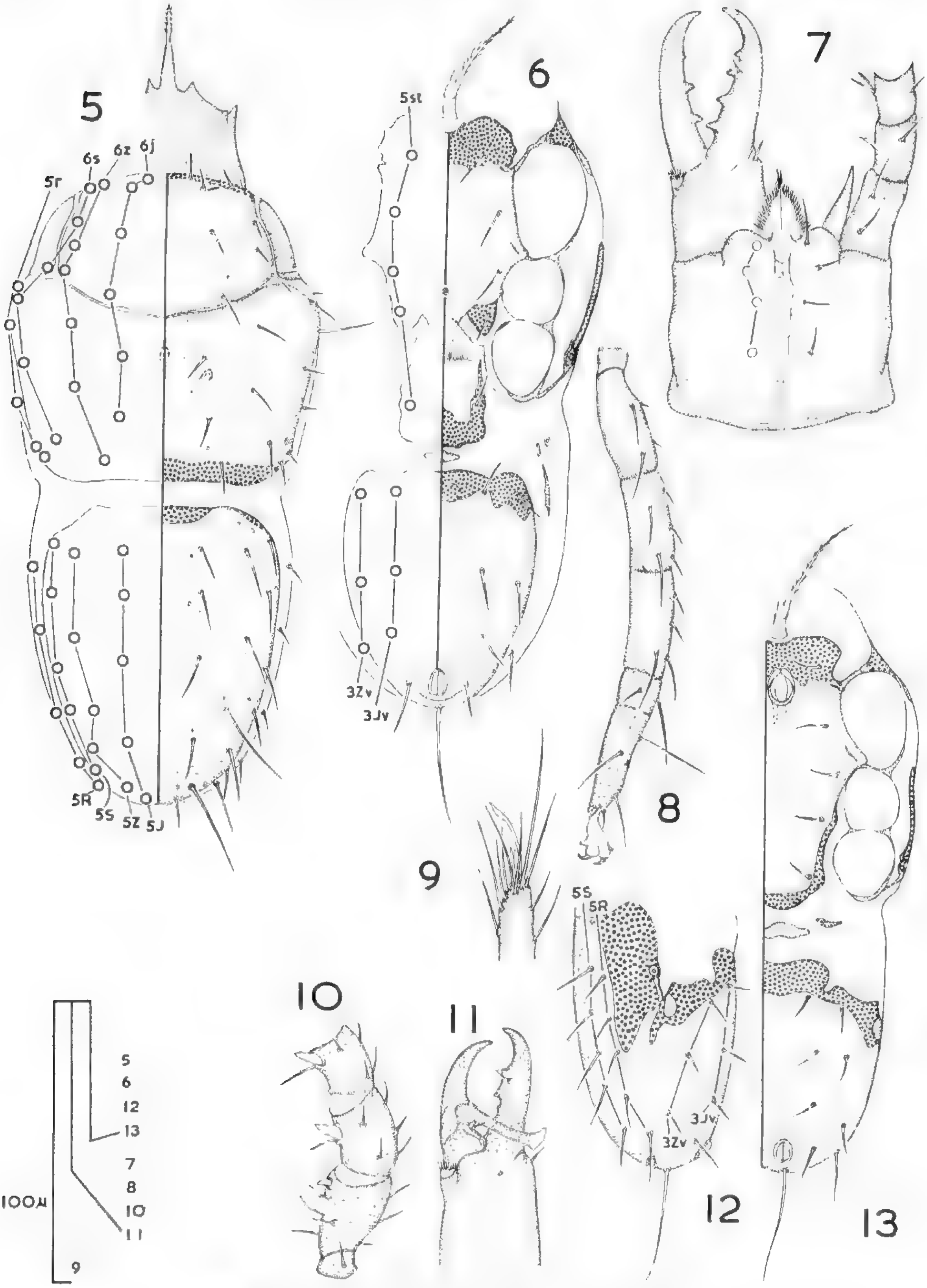
Male: Ventro-anal fused to opisthonotal, but widely separated from sternito-genital, exopodal IV and peritrematal. Metapodal may be broadly fused to opisthonotal by punctate sclerotization.

CHAETOTAXY. Idiosoma: *6j*, *6z*, *6s*, *5r*: *5J*, *5Z*, *5S*, *5R*: *5st*: *3Jv*, *3Zv*.

Legs: As *Gamasellus*, except tarsus IV lacks *pl*4.

OTHER CHARACTERS. Female: Size of gnathosoma relative to idiosoma is unusually large and chelicerae are long and heavily sclerotized. Deutosternal denticles in 7 horizontal rows with a longitudinal and a horizontal deutosternal ridge anterior to denticles. Tectum anterior margin basically trispinate, but the large central spine, and more rarely the lateral spines, may carry spinules distally. Hypostomal setae almost in a longitudinal line (unique to this rhodacarid genus and *Rhodacaropsis*). Movable cheliceral digit with 3 teeth. On palp genu, setae *al*1 and *al*2 almost level and very slightly spatulate. On palp femur, seta *al* in central third. Sclerotization is pale, and may be pinkish with a red gnathosoma. Idiosoma is constricted between podosoma and opisthosoma. Dorsal setae simple, setose. Pretarsus I absent. Spermathecal ringed tube not located in this study, but Athias-Henriot (in press) states that it opens on femur III. Pretarsus I absent. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest.

Male: Movable cheliceral digit with one tooth and fused at base to recurved, spatulate spermadactyl. On leg II, femur setae *av* and *pv*1, genu seta *av*, tibia seta *av*, enlarged into spurs.



Figs. 5-13. *Rhodacarus roseus* Oudemans.

5-9, female: 5, soma, dorsum; 6, idiosoma, venter; 7, gnathosoma, venter; 8, leg IV (part), dorsal setae only; 9, tarsus I, distal tip. 10-13, male: 10, leg II (part), antero-latus; 11, chelicera; 12, opisthosoma, latus; 13, idiosoma, venter.

DISTRIBUTION. Nn, Na: NTa, NTb: Ew, Ee, Es: Pe, Pm: Oi, Om: Am, Aa. Besides the locality records published with the original descriptions of nominal species or forms there are records of *Rhodacarus* species from North America (Emberson, thesis, 1968; Fox, 1967, Haq, 1965; Rodriguez and Ibarra, 1967), Africa (Loots, in press), Israel (Costa, 1966a) and numerous records from the european Palaearctic region. I regard as dubious the record of a *Rhodacarus* sp. from the Crozet Islands (Sk) by Richters (1907) and it should be noted that *Rhodacarus costai* from Argentina has been removed from this genus. The specimens from Neotropical regions (from Jamaica, Trinidad and British Guiana) and the Oriental and malayan Australian regions (from Nepal, Malaya and Solomon Islands) are before me and to be dep. BM(NH). It will be interesting if *Rhodacarus* continues to be absent from collections taken from southern Neotropical regions.

Found amongst plant litter and soil (particularly deeper layers below 3 inches) and in littoral zone

REMARKS. The concept of *Rhodacarus* was broader when Ryke (1962b) included *Rhodacarellus, Rhodacaropsis* and *Rhodacaroides* as subgenera. It is possible that *Rhodacaropsis* should be synonymized with *Rhodacarus.* Previously species have usually been correctly placed in this genus, but I consider *Rhodacarus costai* a species *incertae sedis* and not a member of the Rhodacarinae, while the transfer of *Rhodacarellus minimus* to this genus by Hirschmann, 1962, is incorrect. The following 17 nominal species are, therefore, included in this genus: *R. roseus* Oudemans, 1902a; *R. ananasi* Ryke, 1962a; *R. angustiformis* Willmann, 1951; *R. calcarulatus* Berlese, 1920 (syn. *R. pallidus* in Sheals, 1958); *R. clavulatus* Athias-Henriot, 1961b; *R. coronatus* Berlese, 1920; *R. cuneatus* Athias-Henriot, 1961b; *R. denticulatus* Berlese, 1920; *R. laureti* Athias-Henriot, 1961b; *R. mandibularis* Berlese, 1920 (syn. *R. roseus* in Sheals, 1958); *R. marksae* Domrow, 1957; *R. pallidus* Hull, 1918; *R. reconditus* Athias-Henriot, 1961b; *R. rhodacaropsis* Ryke, 1962a, *R. stenzkei* Willmann, 1957; *R. sublapideus* Ryke, 1962a; *R. tribaculatus* Athias-Henriot, 1961b. Two new species are described by Loots (in press). Also there are *simplex* forms of *R. roseus* (in Sheals, 1958), *R. coronatus* (in Athias-Henriot, 1961b) and *R. pallidus* (in Sheals, 1958, referred to as *calcarulatus* form) in which the podonotal shield is not split into anterior and posterior sections by a V-shaped fissure.

Rhodacarus roseus Oudemans

Rhodacarus roseus Oudemans, 1902a, p. 50.

FEMALE. Fig. 5-9. Idiosomal length, 450μ. The punctate sclerotization is usually an area where thicker sclerotization is limited to spots on a thin shield, but at the anterior of the ventro-anal shield there are areas where the thicker sclerotization has spots of thin sclerotization in it. The anterior end of the peritreme is joined to the small humeral section of the podonotal shield by a thin strip of thickened sclerotization.

MALE. Fig. 10-13. Idiosomal length, 410μ. In Fig. 11, tooth on movable cheliceral digit is mainly obscured by spermadactyl.

LOCALITY. Three females (N196879-N196881) and 4 males (N196882-N196885) drawn or examined: Australia; LF58, grass and leaf litter under *Eucalyptus camaldulensis*, Heywood Park, Adelaide, South Australia, 6.6.1965, col. R. V. Southcott, dep. SAM.

REMARKS. *R. roseus* is the best name for the above specimens, although there are slight differences between them and the previous descriptions of this species, particularly in the extent of the punctate sclerotization.

Genus AFROGAMASELLUS Loots and Ryke

Afrogamasellus Loots and Ryke, 1968, p. 2. Type-species: *Cyrtolaelaps* (*Gamasellus*) *franzi*, Loots and Ryke, 1966, by original designation.

DIAGNOSIS. Minute to average sized mites, with light to heavy sclerotization. Idiosoma is often ellipsoidal without central articulation. Second and third hypostomal setae nearly level, both being a similar distance from hypostomal seta 4. Podonotal shield has 2 or 3 pairs of setae on anterior margin and 4 light-refractile structures. Pre-endopodal shields absent. Spermadactyl not recurved but broadly merged with reduced movable digit of chelicera. Pretarsus I present.

MORPHOLOGY.

SCLEROTIZATION. Female: Usually separate podonotal and opisthonotal, but may be holonotal with groove across shield where split is normally. On ventral surface of podonotal, 4 light-refractile structures between setae *j*5 and *j*6. Discrete ventro-anal (sometimes bearing aciculae posterior to anus) sometimes fused to metapodal and anterior margin may or may not lie close to genital and exopodal IV. Usually discrete metapodal. Intergenito-ventral shield absent. Peritrematal usually fused to exopodal IV, and rarely to metapodal as well, but may be reduced and not fused to any shields posteriorly. Split in exopodals II, III and IV. Sterno-metasternal fused to endopodals II and III, and rarely to endopodal IV as well. May be separate jugular, or punctate anterior area of sternum which may or may not carry seta *st*1. Pre-endopodals absent, although anterior edge of sterno-metasternal may be normally sclerotized and separated from similarly sclerotized areas by punctate sclerotization.

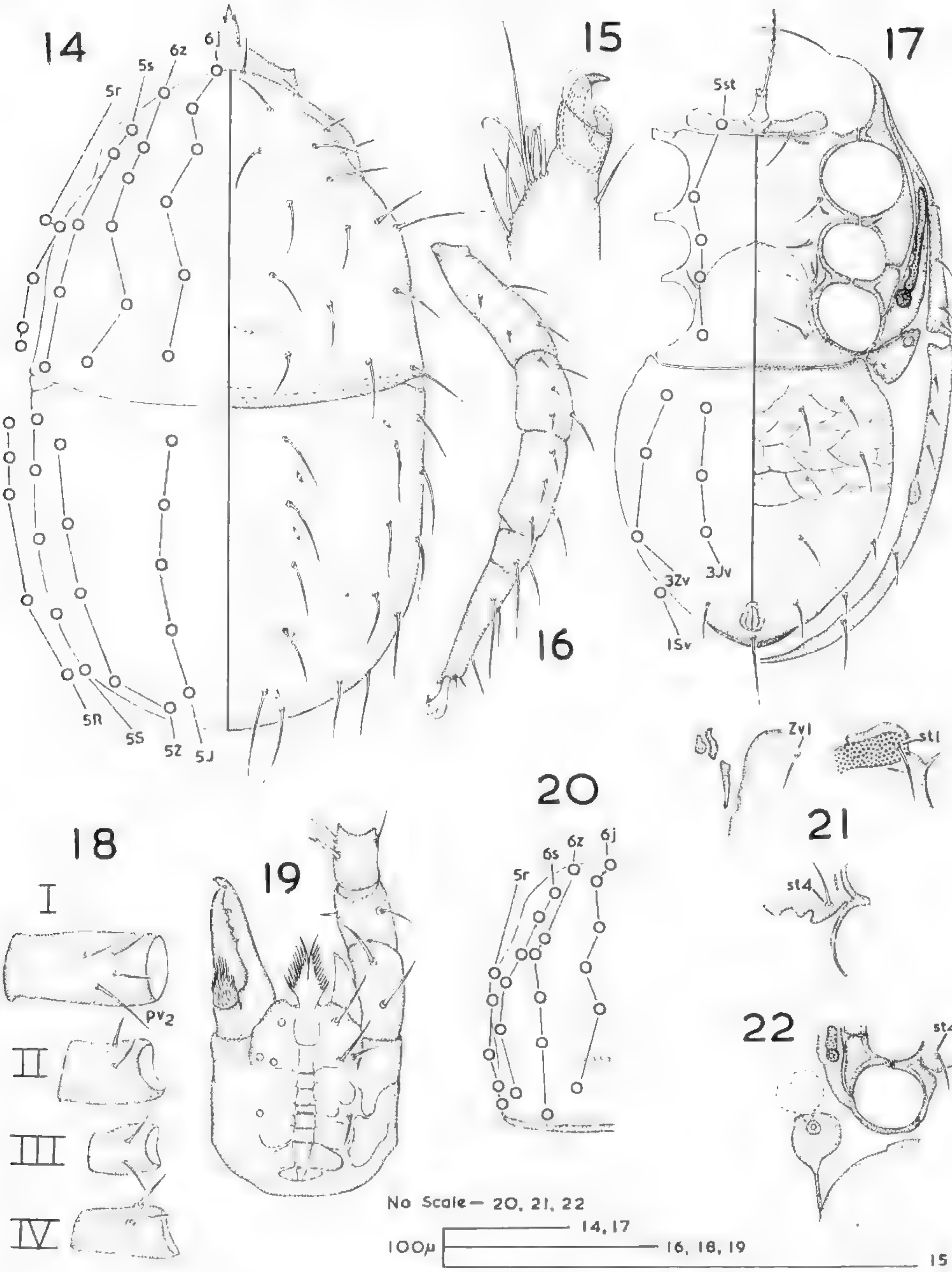
Male: May be similar to female, or metapodal is enlarged, or metapodal and peritrematal are enlarged with the peritrematal and ventro-anal fused to the notals and in one species the metapodal is joined to the opisthonotal by punctate sclerotization. Usually an entire sternito-genital, but section carrying seta *st*5 may be separated from rest and fused to endopodal IV. Although ventro-anal shield is always separate from sternito-genital it is usually close to it.

CHAETOTAXY. Idiosoma: 6*j*, 5 or 6*z*, 3, 5 or 6*s*, 4 or 5*r*: 5*J*, 5*Z*, 5*S*, 4 or 5*R*: 5*st*: 3*Jv*, 3*Zv*, 1*Sv*.

Legs: As *Gamasellus*, except tarsus IV lacks *pl*4 (other than in one unnamed species where it is present on the adult but missing on the deutonymph).

OTHER CHARACTERS. Female: Relative size of gnathosoma compared to idiosoma is average. Deutosternal denticles in 7 horizontal rows with a horizontal deutosternal ridge anterior to denticles. Tectum anterior margin may be basically unispinate or trispinate, and usually also has spinules and sometimes the central spine broadens out at its tip. Third hypostomal seta nearly level with seta *hyp*2, both being a similar distance from seta *hyp*4. Movable cheliceral digit with 3 teeth. Cheliceral arthrodial process at base of movable digit is extended into short brush, usually about half the length of the movable digit, while in most other genera it is a simple coronet. On palp genu, seta *al*1 and seta *al*2 may both be spine-like or spatulate or seta *al*1 may be spatulate and seta *al*2 slightly pilose. On palp femur, seta *al* in central third. Sclerotization usually shiny. Dorsal setae usually tapering and simple, may be slightly pilose, or pilose and spatulate. On the basis of my examination of female *A. tetrastigma* and *A. mitigatus*, I consider it probable that the pore at the anterior end of the metapodal shield (see Figs. 17 and 22) is the opening of the spermathecal ringed tube. This pore is referred to as the "quasi-stigma" by Loots (1969). The strongest evidence supporting my homology is the description of the female and male of an unnamed species by Loots (thesis, 1967): the female has a long, internal chitinized tube attached to the pore, which is absent on the male and the male spermadactyl is unusually long and narrow. If this homology is correct, then the pore drawn on the male metapodal shield of *A. tetrastigma* by Loots (1969) would be homologous to the pore near the posterior, paraxial margin of the female metapodal shield (see Fig. 17). Further evidence is required before the location of the aperture of the spermathecal ringed tube is considered to be probably on the female metapodal shield of *Afrogamasellus* species other than those belonging to the *tetrastigma*-complex or the unnamed species mentioned above. Pretarsus I may be pedunculate with smaller claws than other pretarsi or broadly fused to tarsus. Leg I often thicker than other legs. Femur II may have ventral process. Amongst dorsal setae on tarsus IV, setae *pd*3 and *pd*4 are the longest being subequal in length.

Male: Movable cheliceral digit reduced and merged into spermadactyl, sometimes to the extent that only the grooved spermadactyl appears present, but often there is a conspicuous dorsal tooth which could be homologous



Figs. 14-22. *Afrogamasellus* Loots and Ryke.

14-19, *A. tetrastigma* (Berlese), female: 14, soma, dorsum; 15, pretarsus I and tarsus I (part); 16, leg IV (part), dorsal setae only; 17, idiosoma, venter; 18, tibia I, II, III and IV, ventral setae only; 19, gnathosoma, venter. 20, nominate species of *camaxiloensis*-complex Loots (1969), podonotal chaetotaxy. 21, *A. succinctus* (Berlese), parts of idiosoma, venter. 22, *A. mitigatus* (Berlese), acetabulum IV and surroundings.

with the female teeth or could represent the tip of the movable digit. On tarsus I, in one species, one of the distal, hollow setae is ovoid, being swollen compared with the equivalent female seta. On leg II, seta *av* on femur and genu enlarged into spurs. May be other spurs on these segments and on tibia II, but their homologies are not known.

DISTRIBUTION. Ew, Ee, Es. Besides the locality records published with the original descriptions of nominal species, there are other records of unnamed species described by Loots (thesis, 1967). Members of this genus have not been collected south of 30°S.

Found in plant litter and soil.

REMARKS. Before 1968 the species now included in *Afrogamasellus* were placed in *Gamasellus* (as subgenus of *Cyrtolaelaps*). Loots (1969) states that this is a heterogenous taxon and divides it into the following 4 species-complexes, which contain 18 nominal species and 7 unnamed species (Loots, in press).

1. *quadrisigillatus-succinctus*-complex (includes the type-species of the genus).

The following 9 nominal species, plus a subspecies distinguished from a nominate subspecies, are included in this species-complex: *A. quadrisigillatus* (Berlese, 1916a); *A. succinctus* (Berlese, 1916a); *A. franzi* (Ryke and Loots, 1966); *A. kilimanjaroensis* (Ryke and Loots, 1966); *A. kivuensis* (Ryke and Loots, 1966); *A. leleupi* (Ryke and Loots, 1966); *A. lunguensis* (Ryke and Loots, 1966); *A. maskamensis* (Ryke and Loots, 1966); *A. uviraensis* (Ryke and Loots, 1966); *A. uviraensis congoensis* (Ryke and Loots, 1966).

Jugular shield may be present, or seta *st*1 may be on the sternal shield or on punctate sclerotization. If punctate sclerotization is present in region of seta *st*1, it either bears this setae when it may or may not separate a normally sclerotized anterior edge of the sternal shield from the rest (Fig. 21), or it separates off a jugular shield. FEMALE. Metapodal shield smaller than anus, sometimes with one or two small elongate shields between it and the ventro-anal shield. Striated cuticle between ventro-anal shield and podal shields never more than moderately extensive so that anterior edge of ventro-anal shield is never much further (more than 10μ) from sternal seta *st*4 than the distance between both setae *st*4. MALE. Ventro-anal shield fused to notal shield posteriorly, and the metapodal shield is much larger than the anus, with a triangular outline wedged between the lateral margins of the ventro-anal and notal shields. Sternito-genital shield undivided and broadly fused to endopodal IV shield.

2. *camaxiloensis*-complex.

I have only seen the descriptions of 7 unnamed species belonging to this species-complex by Loots (thesis, 1967), although, since a diagnosis is given for this species-complex by Loots (1969), names for these species must now be formally recognized and the descriptions by Loots (in press) published.

Jugular shield absent, but always an area of punctate sclerotization in this region, which may or may not bear seta *st1*, and which never separates a normally sclerotized anterior edge of the sternal shield from the rest. FEMALE. Metapodal shield smaller than anus, and with a small elongate shield between it and ventro-anal shield. Extensive area of striated cuticle between ventro-anal shield and podal shields; the anterior margin of ventro-anal shield is much further from sternal seta *st4* than the distance between both seta *st4*. Posterior margin of genital shield usually bordered by punctate sclerotization. MALE. Ventro-anal shield fused to notal shield posteriorly. Metapodal shield larger than anus with a triangular outline wedged between the lateral margins of the ventro-anal and notal shields. Sternito-genital shield around seta *st5* is separate from the rest of the shield and fused to endopodal IV shield, while the rest of the sternito-genital shield is separated by punctate sclerotization or striated cuticle from endopodal IV shield.

3. *luberoensis*-complex.

The following single nominal species, plus a subspecies distinguished from the nominate subspecies, is included in this species-complex: *A. luberoensis* Loots, 1968; *A. luberoensis kalibuensis* Loots, 1968.

This is the only species in the Rhodacarinae on which adult podosomal and opisthosomal shields are fused together; the podonotal and opisthonotal shields are fused to form a holonotal shield and the metapodal is fused to the peritrematal shield, and only on the female to the ventro-anal shield as well. Otherwise this species is similar to members of the *tetrastigma*-complex, except that in the nominate subspecies the metapodal is smaller than the anus. The male ventro-anal shield is not fused to the notal shield.

4. *tetrastigma*-complex.

The following 8 nominal species are included in this species-complex: *A. tetrastigma* (Berlese, 1916a); *A. celisi* Loots, 1969; *A. evansi* Loots, 1969; *A. kahusiensis* Loots, 1969; *A. mitigatus* (Berlese, 1923); *A. muhiensis* Loots, 1969; *A. rugegensis* Loots, 1969; *A. nyinabitabaensis* Loots, 1969.

Jugular shield present and discrete. FEMALE. Metapodal shield larger than anus, usually discrete, but narrowly fused to ventro-anal shield on *A. mitigatus*. Usually striated cuticle inconspicuous between ventro-anal shield and podal shields and never more extensive than on the females of the *quadrisigillatus-succinctus*-complex. MALE. Ventro-anal shield may or may not be fused to notal shield posteriorly; if it is not fused then the metapodal shield is smaller than the anus, but if it is fused then the metapodal shield is much larger than the anus with a triangular outline wedged between the lateral margins of the ventro-anal and notal shields. Sternito-genital shield undivided and broadly fused to endopodal IV shield.

Two further species-complexes, each including a single unnamed species, were recognized by Loots (thesis, 1967). One of these unnamed species has a conspicuous spermatheceal ringed tube as mentioned above.

Afrogamasellus mitigatus (Berlese)

Gamasellus mitigatus Berlese, 1923, p. 250.

FEMALE. Fig. 22. Idiosomal length, unknown. The sketch (Fig. 22) shows that the metapodal shield bears a pore leading to an internal sac and not an external process as in the drawing (Fig. 125) in Ryke, 1962c. This internal sac is probably part of the spermatheceal ringed tube.

MALE. Not known.

LOCALITY. The 'tipico' female (221/11), sketched and examined. East Africa: col. Alluaud and Jeannell, dep. SEAF.

Afrogamasellus succinctus (Berlese)

Gamasellus succinctus Berlese, 1916a, p. 160.

FEMALE. Fig. 21. Idiosomal length, unknown. The 3 sketches (Fig. 21) given, show that this species is more like *Afrogamasellus franzi* than the drawing (Fig. 3) of it (named *C.* (*Gamasellus*) *succinctus*) given by Loots and Ryke (1966) indicates. The pore on the metapodal shield may be homologous to the pore near the posterior, paraxial margin of the metapodal shield of *A. tetrastigma* (see Fig. 17), or it may homologous with the pore considered to be the aperture of the spermatheceal ringed tube.

MALE. Not known.

LOCALITY. A 'tipico' female (175/35), and a 'cotipico' female (197/46), sketched or examined: East Africa: col. Alluaud and Jeannell, dep. SEAF.

Afrogamasellus tetrastigma (Berlese)

Gamasellus tetrastigma Berlese, 1916a, p. 161.

FEMALE. Fig. 14-19. Idiosomal length, 520μ. The pore at the anterior end of the metapodal shield, here considered to be the aperture of the spermatheceal ringed tube, is drawn by Loots (1969) on similar females referred to this species. On the male the pore that is drawn by Loots (1969) on the metapodal shield is probably homologous to the pore near the posterior, paraxial margin of the female metapodal shield. Pretarsus I has claws subequal in size to those of other pretarsi, and in a sclerotized sheath that is broadly fused to the tarsus. Leg I is relatively large as drawing (Fig. 18) of tibiae shows.

MALE. Specimens referred to this species described by Loots (1969).

LOCALITY. Two 'tipico' females (175/38) and a 'cotipico' female (197/45) drawn or examined: East Africa: col. Alluaud and Jeannell. dep. SEAF.

Genus RHODACARELLUS Willmann

Rhodacarellus Willmann, 1935, p. 429. Type-species: *Rhodacarellus subterraneus* Willmann, 1935, by original designation.

DIAGNOSIS. Minute or small mites, with lightly sclerotized, centrally articulated idiosoma and a relatively average sized gnathosoma. Second and third hypostomal setae nearly level, both being a similar distance from hypostomal seta 4. Podonotal shield has 2 or 3 pairs of setae on anterior margin and 4 light-refractile structures. Pre-endopodal shields absent. Spermadactyl recurved. Pretarsus I present.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal (may be fragmented into four smaller shields) and opisthonotal. On ventral surface of podonotal, 4 light-refractile structures between setae *j*5 and *j*6. Discrete ventro-anal (bearing aciculae posterior to anus) widely separated from genital and exopodal IV. Discrete metapodal. Intergenito-ventral shield or shields present. Peritrematal reduced but may or may not be narrowly fused to podonotal and exopodal IV. If present, exopodals only between or at posterior edge of acetabula. Sterno-metasternal fused to endopodals II and III. Pre-endopodals absent, seta *st*1 on punctate sclerotization at anterior end of sternal.

Male: Ventro-anal fused to opisthonotal, and metapodal enlarged and fused to anterior end of this line of fusion. Ventro-anal widely separated from sternito-genital and peritrematal.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r: 5J, 5Z, 5S, 5R: 5st: 3Jv, 3Zv*, 0 or *1Sv*.

Legs: As *Gamasellus*, except tarsus IV lacks *pl*4.

OTHER CHARACTERS. Female: Relative size of gnathosoma compared to idiosoma is average or smaller. Deutosternal denticles in 7 horizontal rows, with a horizontal deutosternal ridge anterior to denticles. Tectum anterior margin basically trispinate or quinquispinate, with the longer spines nearer the centre, and spinules on or lateral to spines. Third hypostomal seta nearly level with seta *hyp*2, both being a similar distance from seta *hyp4*. Movable cheliceral digit with 3 teeth. On palp genu, setae *al*1 and *al*2 almost level and slightly spine-like. On palp femur, seta *al* in central third. Idiosoma is constricted between podosoma and opisthosoma. Sclerotization is pale. Dorsal setae simple, setose. Usually setae *Jv*1 and *Zv*1 on striated cuticle anterior to ventro-anal shield but either both of them (*e.g., R. corniculatus*), or just seta *Zv*1 (*e.g., R. kreuzi*) may be on shield. Spermathecal ringed tube probably opens near posterior paraxial edge of acetabulum IV. Pretarsus I pedunculate or broadly attached to tarsus, and smaller than other pretarsi. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest.

Male: Movable cheliceral digit with one tooth and fused at base to recurved, pointed spermadactyl. On leg II, femur seta *av*, genu seta *av*, tibia seta *av*, and distal setae on tarsus enlarged into spurs.

DISTRIBUTION. Nn; Pe, Pm; Aa. The distribution of this genus may be considerably more extensive than the records indicate. There are a number of Palaearctic records besides those published with the original descriptions of nominal species, but the record from Israel (Costa, 1966a) is outside this established range. The records from North America are from Fox (1967) and Emberson (thesis, 1968) and a female (N1968280) from South Australia is dep. SAM.

Found amongst plant litter and soil (particularly deeper layers below 3 inches).

REMARKS. The appearance of *Rhodacarellus* species is similar to the lightly sclerotized species of *Afrogamasellus*, but the cheliceral arthrodial process and spermadactyl are like those of *Rhodacarus* and *Rhodacaropsis*. The following 9 nominal species are included in this genus: *R. arcanus* (Athias-Henriot, 1961b); *R. corniculatus* Willmann, 1935; *R. epigynialis* Sheals, 1956; *R. francescae* Athias-Henriot, 1961b; *R. kreuzi* Karg, 1965; *R. minimus* Karg, 1961; *R. silesiacus* Willmann, 1936; *R. subterraneus* Willmann, 1935; *R. vervacti* (Athias-Henriot, 1961b). There is one subspecies: *R. epigynialis perspicuus* Halasková, 1959.

Genus RHODACAROPSIS Willmann

Rhodacaropsis Willmann, 1935, p. 426. Type-species: *Rhodacaropsis inexpectatus* Willman, 1935, by original designation.

DIAGNOSIS. Minute or small mites, with lightly sclerotized, slim, centrally articulated idiosoma and a relatively large gnathosoma. Third hypostomal seta approximately half-way between second and fourth hypostomal setae. Podonotal shield has 4 pairs of setae on anterior margin and 3 light-refractile structures. Pre-endopodal shields present. Spermadactyl recurved. Pretarsus I present.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal (may be fragmented into smaller shields) and opisthonotal. On ventral surface of podonotal, 3 light-refractile structures between setae *j5* and *j6*. Discrete ventro-anal (bearing aciculae posterior to anus) widely separated from genital and exopodal IV. Discrete metapodal. Intergenito-ventral shields absent. Peritreme reduced and peritrematal absent. If present, exopodals only between or at posterior edge of acetabula. Sterno-metasternal fused to endopodals II and III. Two pairs of pre-endopodals, but posterior pair may be connected to sternal by punctate sclerotization, although seta *st1* is never on such an area.

Male: Ventro-anal discrete. Sternito-genital is divided, a single discrete posterior section carrying both setae *st5*.

CHAETOTAXY. Idiosoma: *6j*, *6z*, *6s*, *5r*: *5J*, *5Z*, *5S*, *4R*: *5st*: *3Jv*, *3Zv*, *1Sv*.

Legs: As *Gamasellus*, except tarsus IV lacks *pl4* and femur II lacks one dorsal seta (2, 4/3, 1) and femur III lacks 2 dorsal setae (1, 2/1, 0) on an unnamed species for which the leg chaetotaxy was examined by Loots (in press).

OTHER CHARACTERS. Female: Relative size of gnathosoma to idiosoma is unusually large and the chelicerae are long and heavily sclerotized. Nature of deutosternal denticles or ridges unknown. Tectum anterior margin basically unispinate, but may be spinules at tip or base of spine and if the latter are large enough, the tectum is similar to that of *Rhodacarus* species. Hypostomal setae almost in a longitudinal line, seta *hyp3* being approximately half-way between seta *hyp2* and *hyp4*. Movable cheliceral digit with 3 teeth. Shape of setae on palp femur and genu unknown. Sclerotization pale. Idiosoma constricted between podosoma and opisthosoma. Dorsal setae simple, setose. Position of spermathecal ringed tube not known. Pretarsus I reduced except for large claws that are attached almost directly on to tarsus.

Male: Movable cheliceral digit with one tooth and fused at base to recurved, spatulate spermadactyl. On leg II, femur seta *av* enlarged into a spur and genu seta *av* may be spine-like.

DISTRIBUTION. Na: Es: Pe. The single palaearctic record was published with the original description of the type-species. The record from North America is of the type-species and is from Haq (1965), and that from South Africa is of an unnamed species (Loots, in press).

Found in the littoral zone in sandy rather rocky areas.

REMARKS. *Rhodacaropsis* is closely allied to *Rhodacarus*. The following single nominal species is included in this genus: *R. inexpectatus* Willmann, 1935. A new species is described by Loots (in press).

The 5 *Rhodacaropsis* species listed by Athias-Henriot (1961b) belong elsewhere; 3 species were transferred to *Protogamasellus* by Lindquist and Evans (1965) and the 2 species listed above under *Rhodacarellus* are referred to that genus by Loots (in press).

Subfamily GAMASIPHINAE **subf.n.**

Type-genus: *Gamasiphis* Berlese, 1904a.

DIAGNOSIS. Minute to large mites, usually with extensive, well sclerotized shields and often the idiosoma is strongly convex dorsally. Holonotal shield or separate podonotal and opisthonotal shields. Ventro-anal shield fused to the notal shield except on some *Gamasiphoides* species. Peritrematal shield usually fused to exopodal IV shield and never fused to ventro-anal shield. Sclerotization not conspicuously sexually dimorphic. On the female sterno-metasternal shield a line joining setae *st2*, *st3* and *st4* would enclose an angle of less than 95° except in *Hydrogamasus*.

MORPHOLOGY.

Sclerotization. The extent of the fusion between shields is fairly constant amongst species of this subfamily, and except for the fusion of the genital with other shields it is the same amongst females and males of the same species. In five genera there is always a holonotal, but in *Euepicrius* and *Gamaselliphis* there is a separate podonotal and opisthonotal. The ventro-anal is fused to the notal, except on some *Gamasiphoides* species, and is either fused to exopodal IV or lies very close to it. Intergenito-ventral shields are only present on *Hydrogamasus* species. The peritrematal is fused to the notal anteriorly and, although posteriorly it is never fused to the ventro-anal, it is usually fused to exopodal IV, except on *Caliphis, Laelaptiella* and *Hydrogamasus*. In many species there is a triangular posterior extension of the apparent peritrematal, posterior to its fusion with exopodal IV, which may be homologous with the metapodal and is referred to here as the metapodal. The exopodals tend to be fused together; the exopodals completely encasing the peraxial margin of acetabulum III, except on *Gamaselliphis* and *Gamasiphoides* species. The sterno-metasternal is fused to endopodal IV on *Gamasiphis, Caliphis* and *Euepicrius* species, and one *Gamasiphoides* species. The pre-endopodal may be fused to the sterno-metasternal or it may be one or two pairs of discrete shields.

Chaetotaxy. The number of setae on the notum is variable, although there are never less than 21 pairs on the podonotum. *Caliphis* and *Euepicrius* species may be hypertrichous on the notum, and *Gamasiphis* species are sometimes hypotrichous on the opisthonotum. The leg chaetotaxy is as *Gamasellus* in *Caliphis, Gamaselliphis* and *Laelaptiella*, but amongst the other four genera there are eight kinds of chaetotaxy differing from this pattern. On *Gamasiphis*, *Euepicrius* and *Gamasiphoides* species there is always at least one ventral less on genu IV (2, 5/1, 1) than in *Gamasellus*.

OTHER CHARACTERS. Tectum anterior margin always more complex than unispinate. Setae *al*1 and *al*2 on palp genu usually simple, although may be spine-like or spatulate, and in *Caliphis*, *Gamaselliphis* and *Caliphis* seta *al*1 may have one or two small lateral prongs. On palp femur, seta *al* always in proximal third unlike Rhodacarinae, Tangaroellinae and some Sessiluncinae species. Setae are usually simple and sclerotization shiny on species with a holonotal shield, while in *Euepicrius* and *Gamaselliphis* species the sclerotization is dull, being covered by a thick exudate, and always some dorsal setae are complex. On female sterno-metasternal shield a line joining seta *st*2, *st*3 and *st*4 would enclose an angle of less than 95°, except in *Hydrogamasus* species, while in some *Gamasiphis* (*e.g.*, *G. concilator*) and *Caliphis* (*e.g.*, *C. calvus*) species seta *st*3 is positioned so far forward that it can be mistaken for seta *st*2 and these sternal setae appear to be in a straight line. Spermatheceal ringed tube opens near posterior paraxial edge of acetabulum IV and its junction with a single central sacculus is often quite clear. If pretarsus I present it is often pedunculate and similar in size to other pretarsi. Pulvilli II-IV with paired lateral, short lanceolate lobes and paired central, circular lobes except in *Hydrogamasus* (see Fig. 96).

DISTRIBUTION. None of the genera are restricted to the Northern Hemisphere, while five of the genera are only found in the Southern Hemisphere. Excluding the discontinuous distribution of *Hydrogamasus*, containing species which are found in the littoral zone, only *Gamasiphis* and *Gamasiphoides* have a wide distribution and they have been collected from all three of the Southern Hemisphere temperate regions (Neotropical, Ethiopian and Australian).

REMARKS. I have confidence in my grouping of *Gamasiphis*, *Caliphis*, *Euepicrius*, *Gamasiphoides* and *Laelaptiella* as closely allied genera, although a superficial examination can lead to some species of *Gamasiphoides* with a discrete ventro-anal shield being confused with some species of Ologamasini. *Gamaselliphis* species have characters that are unusually similar to those of *Gamasellus* species and, since the *Gamasellus discutatus*-complex contains females on which the sternal setae are located as in Gamasiphinae females, the placing of this genus as closely allied to *Gamasiphis* is tentative. *Hydrogamasus* is not closely allied to the above genera, and is placed in the Gamasiphinae in preference to any other subfamily.

I recognize 7 genera within this subfamily; *Gamasiphis*, *Caliphis*, *Euepicrius*, *Gamaselliphis*, *Gamasiphoides*, *Hydrogamasus* and *Laelaptiella*. Members of these genera can be distinguished by using the following key.

KEY TO GENERA OF GAMASIPHINAE

1. Tibia I with 3 ventral setae (2, 6/3, 2). On female sterno-metasternal shield a line joining setae *st*2, *st*3 and *st*4 would be nearly straight and sterno-metasternal shield not fused to endopodal IV shield. Male seta *st*5 on ventro-anal and not sternito-genital shield . . . . *Hydrogamasus*

   Tibia I with 4 ventral setae (2, 6/4, 2). On female sterno-metasternal shield a line joining setae *st*2, *st*3 and *st*4 would enclose an angle of less than 95°, and if seta *st*3 positioned so far forward that it can be mistaken for seta *st*2, then sterno-metasternal shield is fused to endopodal IV shield. Male seta *st*5 is on sternito-genital shield 2

2. Separate podonotal and opisthonotal shields. Always some complex dorsal setae; notal shields dull 3

   Holonotal shield. Usually dorsal setae simple and notal shield shiny 4

3. Pretarsus I absent. Pre-endopodal shield fused to sterno-metasternal shield. Behind stigma, there are 3 conspicuous pits opening along peritrematal ridge. Genu IV with 1 ventral seta (2, 5/1, 1) . . . . *Euepicrius*

   Pretarsus I present. Pre-endopodal shields in single, discrete pair. Behind stigma, only one conspicuous pit opening beside peritrematal ridge near stigma. Genu IV with 2 ventral setae (2, 5/2, 1). . . . . *Gamaselliphis*

4. Pre-endopodal shields in 2 pairs (anterior one may be fragmented). Either peritrematal shield separate from exopodal IV shield or exopodal III shield is split 5

   Pre-endopodal shields in single pair, or if 2 pairs, peritrematal shield fused to exopodal IV shield and exopodal III shield is not split 6

5. Palp genu three-times longer than broad. Peritrematal shield separate from exopodal IV shield and exopodal III shield not split. Genu IV with 2 ventral seta (2, 5/2, 1) . . . . *Laelaptiella*

Palp genu less than two-times longer than broad. Peritrematal shield fused to exopodal IV shield and exopodal III shield split. Genu IV with 1 ventral seta (2, 5/1, 1) . . . . *Gamasiphoides*

6. Peritrematal shield either separate from fused metapodal and exopodal IV shields or narrows behind stigma before its fusion with enlarged triangular metapodal which is usually fused to exopodal IV shield. Exopodal II shield undivided. Genu IV with 2 ventral setae (2, 5/2, 1) . . . . *Caliphis*

Peritrematal shield broadens behind stigma to fuse with the fused metapodal and exopodal IV shields. Exopodal II shield split. Genu IV with 1 ventral seta (2, 5/1, 1 or 2, 5/1, 0) . . . . . . *Gamasiphis*

Genus GAMASIPHIS Berlese

Gamasiphis Berlese, 1904a, p. 261. Type-species: *Gamasus pulchellus* Berlese, 1887a, by original designation.

Micriphis Berlese, 1914, p. 140, **syn.n.** Type-species: *Gamasiphis gamasellus* Berlese, 1913a, by monotypy.

Heteroiphis Trägårdh, 1952, p. 55. Type-species: *Gamasiphis* (*Heteroiphis*) *arcuatus* Trägårdh, 1952, by original designation.

Neogamasiphis Trägårdh, 1952, p. 57, **syn.n.** Type-species: *Neogamasiphis hamifer* Trägårdh, 1952, by original designation.

DIAGNOSIS. Minute to large mites, always with extensive, well sclerotized shields and often the idiosoma strongly convex dorsally. Ventro-anal shield fused to a holonotal shield. Peritrematal shield fused to exopodal IV shield. Exopodal III shield never split. Sterno-metasternal shield fused to endopodal IV shield. Female movable cheliceral digit has 4 teeth. Pretarsus I usually subequal in size to other pretarsi, but may be smaller. Genu IV with one ventral seta.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal fused to ventro-anal, which bears aciculae posterior to anus. Peritrematal fused to exopodal IV and to a triangular metapodal posteriorly. Always split in exopodal II, sometimes split in exopodal IV, but never split in exopodal III. Sterno-metasternal fused to endopodals II, III and IV. One or 2 pairs of pre-endopodals.

Male: Sternito-genital, otherwise as female.

CHAETOTAXY. Idiosoma: *6j*, *6z*, 4-5*s*, 5*r*: 3-5*J*, 3-5*Z*, 3-5*S*, 3-5*R*, 0-2*UR*: 5*st*: 3*Jv*, 3*Zv*, 1*Sv*.

Legs: Following segments may (genu IV always differs) differ from *Gamasellus*: genu III (2, 4/1 or 2 as for *Gamasellus*, 1); genu IV (2, 5/1, 0 or 1 as for *Gamasellus*); tibia IV (1 or 2 as for *Gamasellus*, 4/2, 1 or 2 as for *Gamasellus*). The species with only one antero-lateral seta on tibia IV (1, 4/2, 1) is unnamed and from the Nearctic region (Emberson, thesis, 1968).

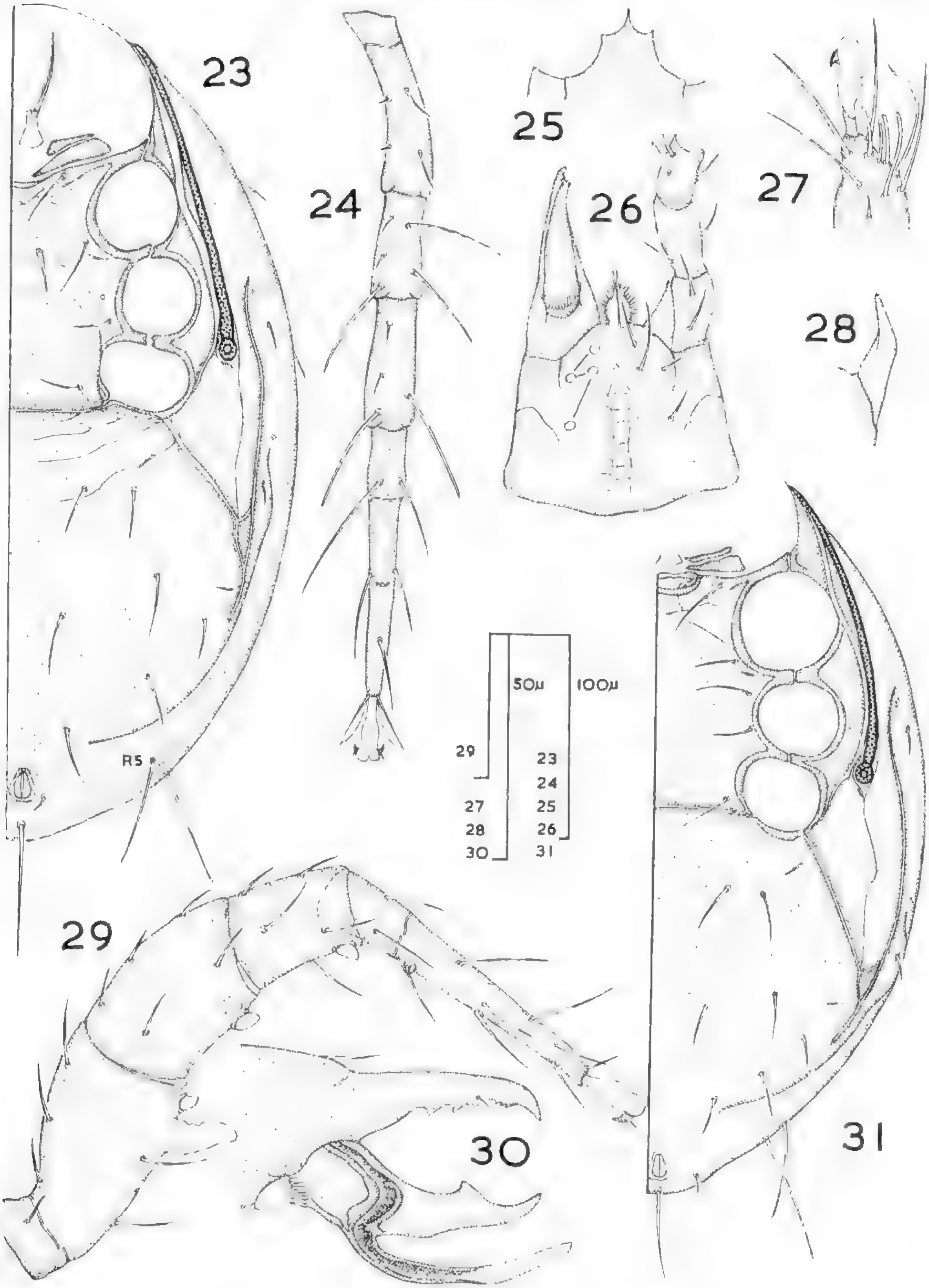
OTHER CHARACTERS. Female: Deutosternal denticles in 7 or fewer horizontal rows. Tectum anterior margin basically trispinate, but it may be complicated by spinules and central spine may also be spatulate. Movable cheliceral digit with 4 teeth. On palp genu, setae *al*1 and *al*2 spine-like. Dorsal setae simple or rarely with hyaline flaps making them spatulate or lanceolate. Shields shiny and often reticulated. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV, passing back to single central sacculus. Pretarsus I usually similar in size to other pretarsi, but may be conspicuously smaller. Amongst dorsal setae on tarsus IV, setae *ad*2, *pd*3 or *pd*4 may be the longest.

Male: Corniculi attenuated and long compared with female. Movable cheliceral digit with one tooth, fused at base to spatulate spermadactyl that is subequal in length, or up four times as long. On leg II, femur seta *av* and sometimes seta *pv*1, genu seta *av* and sometimes seta *pv*, tibia seta *av*, enlarged into spur or stout spine. On tarsus II, seta *av*3 may be on small tubercle.

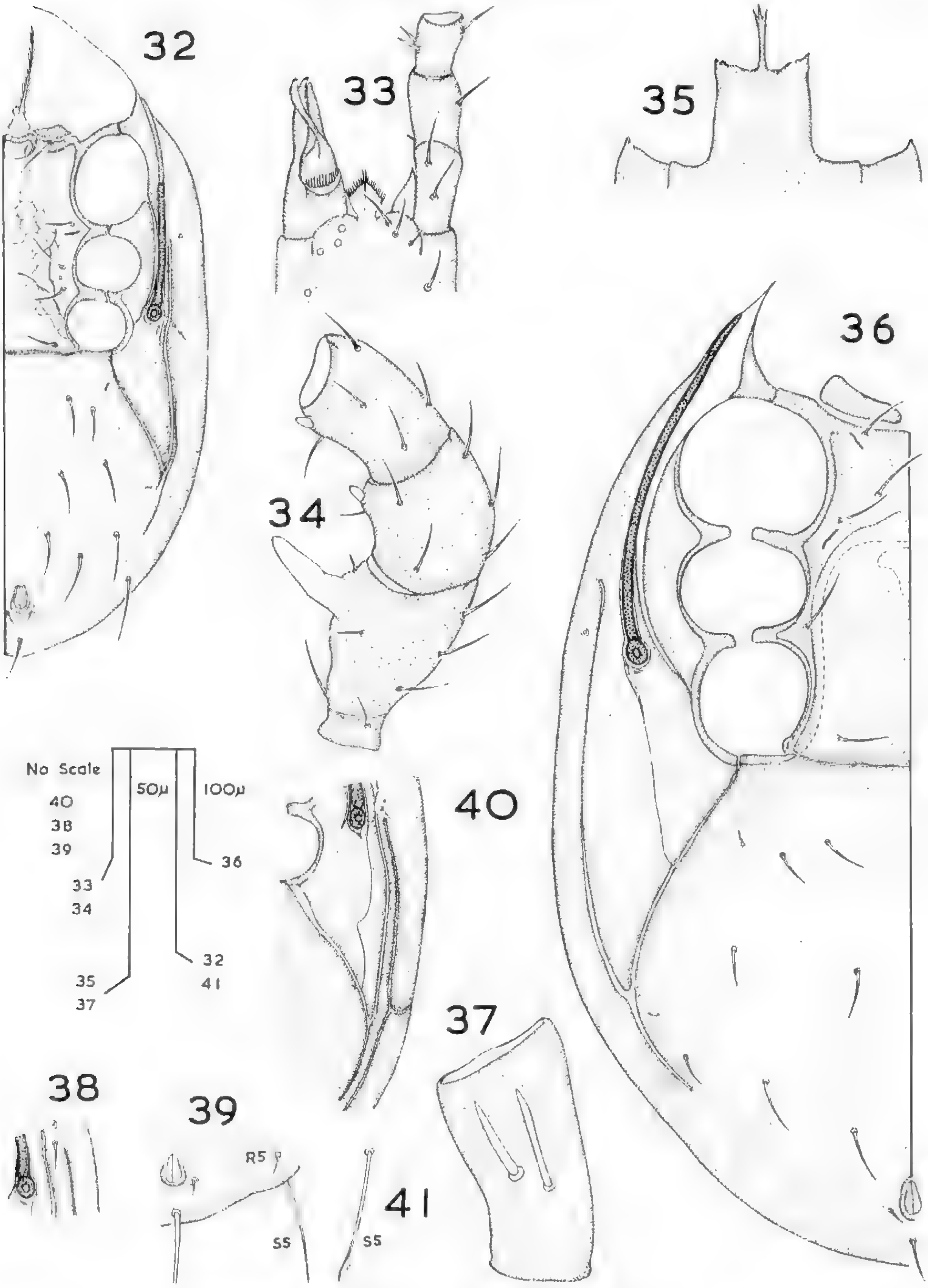
DISTRIBUTION. Nc, Na: NTa, NTb, NTc: Ew, Es, Em: Pm, Pc: Oi, Os, Om: Am, Aa, Ap, An. Besides the locality records published with the original descriptions of nominal species there are records of *Gamasiphis* species from North America (Emberson, thesis, 1968; Pearse, 1946; Rodriguez and Ibarra, 1967), South Africa (Loots, thesis, 1967), Pyrenees in France (Trägårdh, 1912), Israel (Costa, 1966a), India (Bhattacharyya, 1968) and Hawaii (Butler and Usinger, 1963). Specimens from many other regions, Jamaica (NTa), Trinidad (NTb), British Guiana (NTb), Argentina (NTc), Annobon Island (Ew), Seychelle Islands (Em), Nepal (Os), Malaya (Om), Borneo (Om) and Solomon Islands (Am), are before me and to be dep. BM(NH), while yet others dep. SEAF are listed under *G. pulchellus*. The genus is distributed right round the tropics, is less common in temperate regions, and has not been found north of 50°N, or south of 50°S.

Found amongst moss, plant litter and upper soil layers. A single female was found on a rat in Puerto Rico (Fox, 1949).

REMARKS. *Gamasiphis* has sometimes been incorrectly associated with *Ologamasus* as mentioned below under that genus. Three subgenera, *Periphis*, *Epiphis* and *Megaliphis*, which were established within *Gamasiphis*, I here transfer to *Stylochirus*, a genus in the Sessiluncinae. The synonymy

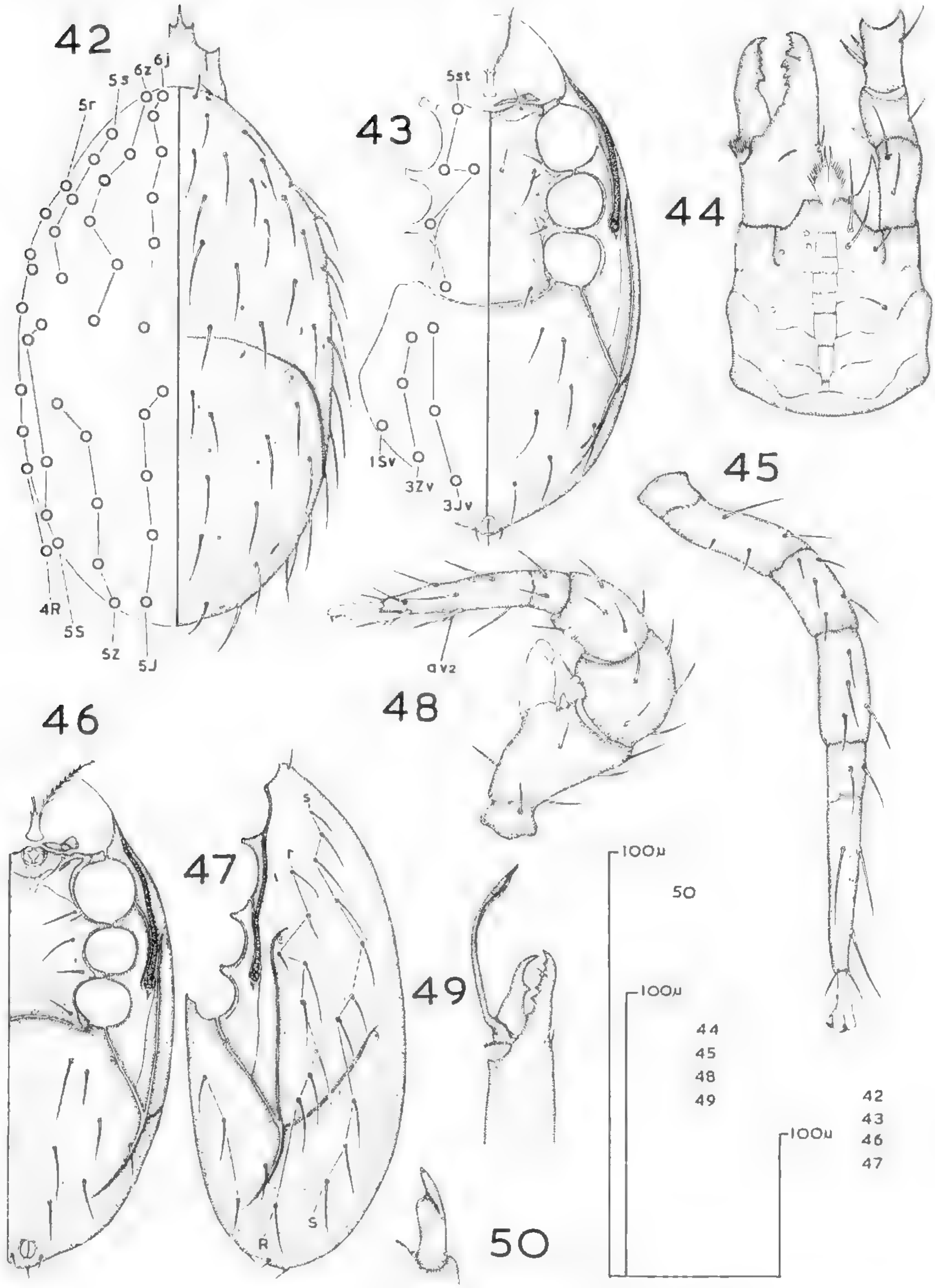


Figs. 23-31. *Gamasiphis pulchellus* (Berlese).
23-27, female: 23, idiosoma, venter; 24, leg IV (part), dorsum; 25, tectum; 26, gnathosoma, venter; 27, pretarsus I and tarsus I (part). 28-31, male: 28, corniculus; 29, leg II (part), antero-latus; 30, chelicera; 31, idiosoma, venter.



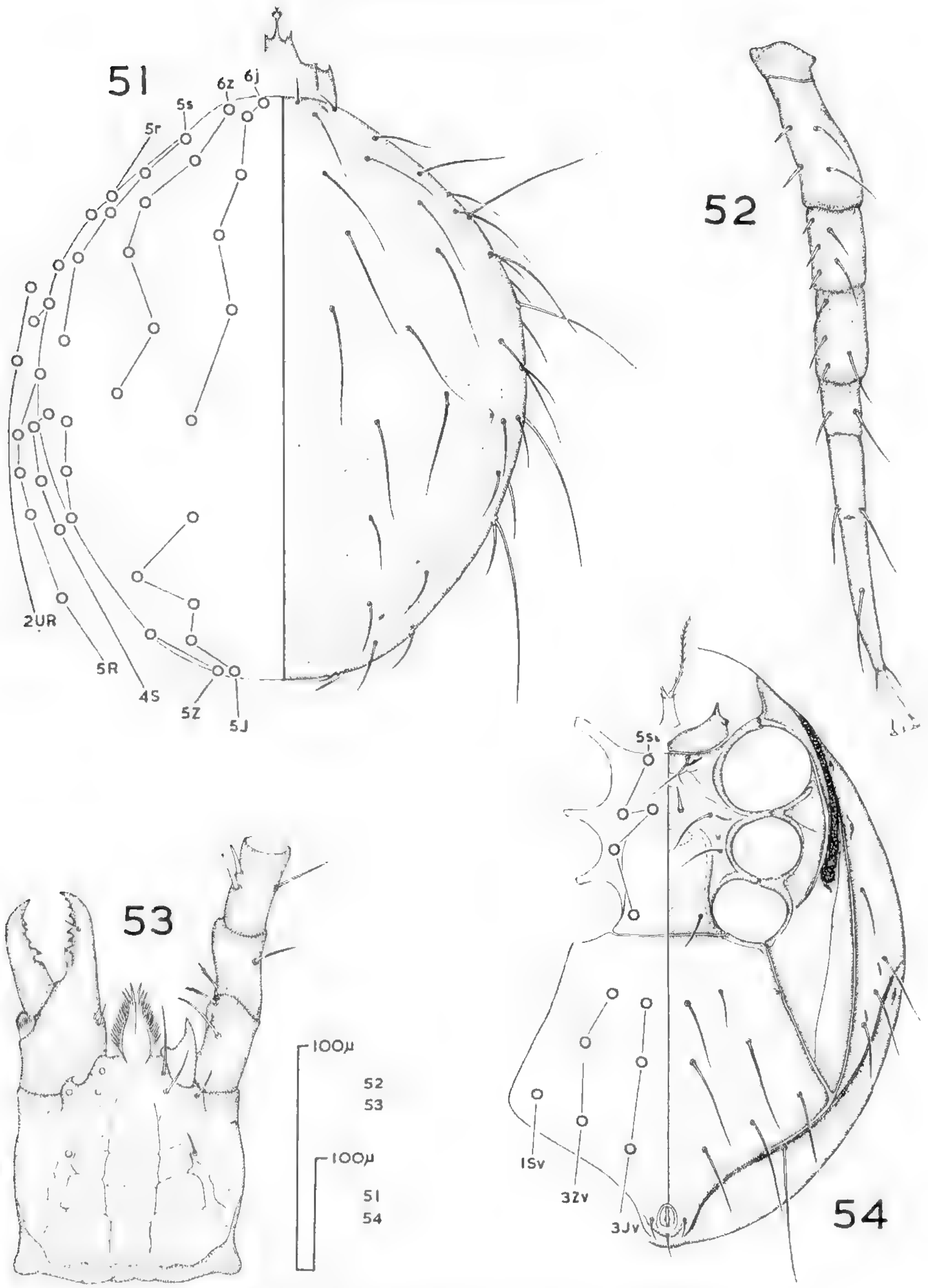
Figs. 32-39. *Gamasiphis* Berlese.

32-34, *G. gamasellus* Berlese, male: 32, idiosoma, venter; 33, gnathosoma, venter: 34, leg II (part), antero-latus. 35-37, *G. concilator* Berlese, female: 35, tectum: 36, idiosoma, venter; 37, setae *al*1 and *al*2 on palp genu. 38 and 39, *G. pilosellus* Berlese, female: 38, stigma and surroundings; 39, anus and surroundings. 40 and 41, *G.* "pulchellus" from Java: 40, stigma and surroundings; 41, seta *S*5.

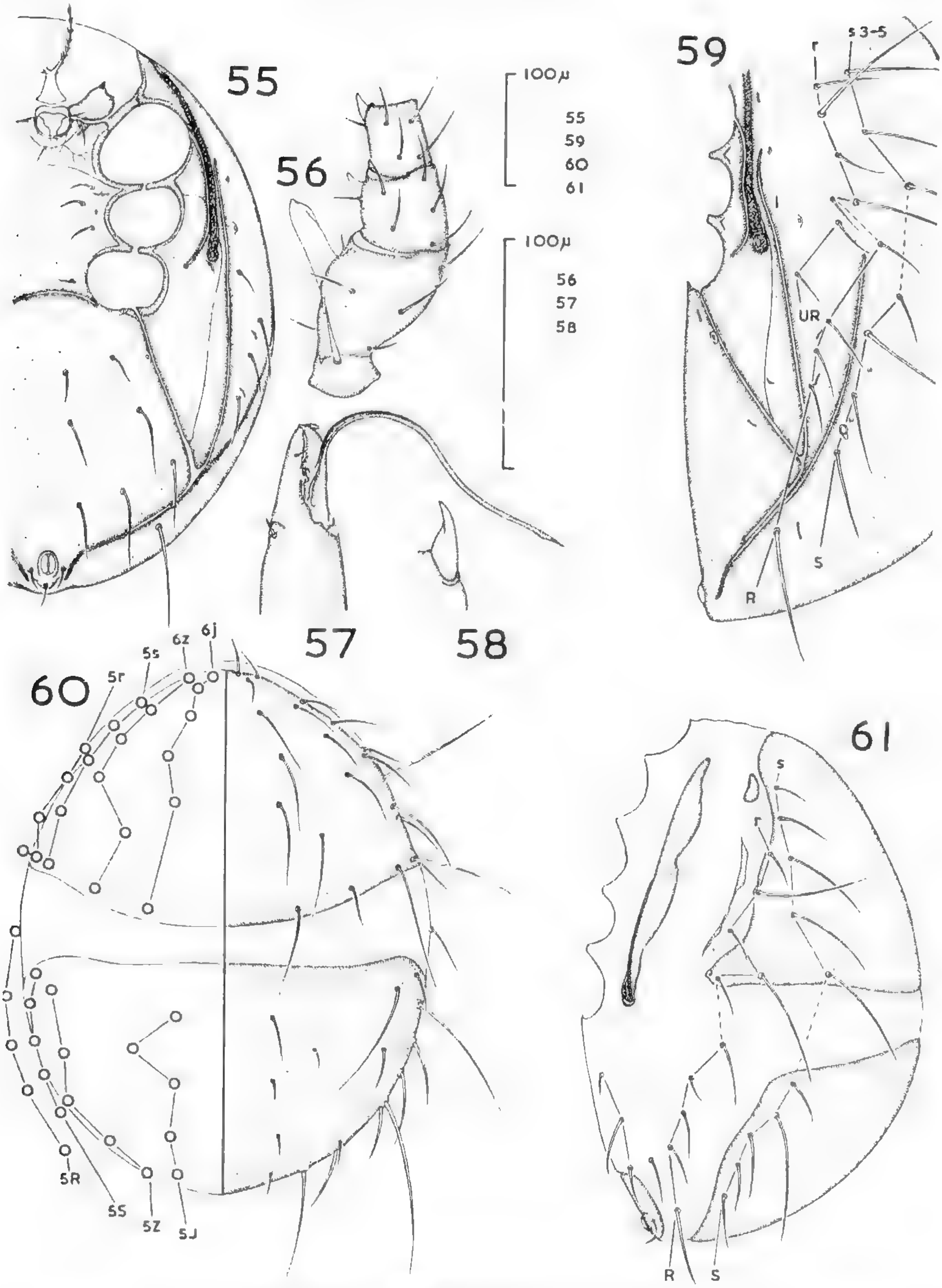


Figs. 42-50. *Gamasiphis australicus* Womersley.

42-45, female: 42, soma, dorsum; 43, idiosoma, venter; 44, gnathosoma, venter; 45, leg IV (part), dorsum. 46-50, male: 46, idiosoma, venter; 47, idiosoma, latus; 48, leg II (part); 49, chelicera; 50, corniculus.



Figs. 51-54. *Gamasiphis fornicatus* sp.n., female.
51, soma, dorsum; 52, leg IV (part), dorsum; 53, gnathosoma, venter; 54, idiosoma, venter.



Figs. 55-61. *Gamasiphis fornicatus* sp.n..

55-58, male: 55, idiosoma, venter; 56, leg II (part), antero-latus; 57, chelicera; 58, corniculus. 59, female, idiosoma, latus. 60 and 61, deutonymph: 60, idiosoma, dorsum; 61, idiosoma, latus.

of *Heteroiphis* with *Gamasiphis* was established by Ryke (1962b), and agreed with here, since *G. arcuatus* is very like *G. setosus*, although considerably larger. The synonymy of *Micriphis* and *Neogamasiphis* with *Gamasiphis* is new, and made because the characters claimed by Berlese (1914) and Trägardh (1952) as distinguishing the type-species of these genera from the type-species of *Gamasiphis* are in fact similar and no other suitable distinguishing characters have been found. Womersley (1956a) treated *Neogamasiphis* as a subgenus of *Gamasiphis* and placed species in *G.* (*Neogamasiphis*) that are here either retained in *Gamasiphis* or transferred to a new genus, *Caliphis*. The following 16 nominal species are, therefore, included in this genus: *G. pulchellus* (Berlese, 1887a); *G. arcuatus* Trägårdh, 1952; *G. australicus* Womersley, 1956a; *G. bengalensis* Bhattacharyya, 1966; *G. conciliator* Berlese, 1916a; *G. elegantellus* Berlese, 1910a; *G. elongatellus* Berlese, 1910b; *G. femoralis* (Banks, 1916); *G. fornicatus* **sp.n.**, *G. gamasellus* Berlese, 1913a; *G. hamifer* (Trägårdh, 1952); *G. illotus* Fox, 1949, *G. pilosellus* Berlese, 1913a; *G. productellus* Berlese, 1923; *G. setosus* Womersley, 1956a; *G. uncifer* Trägårdh, 1931. Two unnamed species are described by Loots (thesis, 1967). Two unnamed species are listed by Emberson (thesis, 1968) and the unusual leg setation of one of these species is described.

Gamasiphis pulchellus (Berlese)

Gamasus pulchellus Berlese, 1887a, XXXIX, 4.

FEMALE. Fig. 23-27. Idiosomal length, 410μ. Dorsal idiosoma not clear enough to be drawn. Most dorsal setae seen, but not drawn, appear to be similar to seta *Zv*3, except the humeral setae which are more like seta *R*5. Lateral suture (using Trägårdh's (1952) term in describing *Heteroiphis arcuatus*, although this line is not a break in the shield, but a thickened ridge beside a line of weak sclerotization, similar to a strong reticulation line) follows fissure at edge of holonotal shield. Chaetotaxy differs from *Gamasellus* on the following leg segments: genu III (2, 4/1, 1); genu IV (2, 5/1, 0); tibia IV (2, 4/2, 1). On some specimens, setae *ad*1 and *pd*1 on tarsi II-IV appear to have hyaline flap.

MALE. Fig. 28-31. Idiosomal length, 360μ.

LOCALITY. Female (29/39) and male (29/38), that appear to be conspecific with the type specimens, were drawn: Italy; leaves, Castions di Strada, dep. SEAF.

Female, 2 males and a deutonymph on one slide (8/10, 'tipico') which, because some of their characters were obscured, were only examined: Italy; humus, Botanic Gardens, Padova, dep. SEAF.

Gamasiphis specimens labelled *G. pulchellus* from North America (103/17), South America (103/18, 103/19 and 151/34) and South Africa

(103/20, 103/21, 136/24, 136/35); specimens labelled 'speciosellus' (64/7, 140/18, 147/14, 221/12) from Japan; and *G. elongatellus* (130/6, 136/20, 136/23, 148/21) from Java and *G. productellus* (221/14) from China, dep. SEAF, examined and all considered here to be similar to *G. pulchellus*. A careful study of these specimens is needed before making a decision as to which of them belong to *G. pulchellus* and which, if any, should belong to different species.

Gamasiphis australicus Womersley

Gamasiphis (*Heteroiphis*) *australicus* Womersley, 1956a, p. 521.

FEMALE. Fig. 42-45. Idiosomal length, 360μ. The lateral suture is longer than as described by Womersley (1956a), since it continues posteriorly beside the ventro-holonotal fissure, and, after the latter stops just behind seta *Sv*1, it continues on to behind seta *Zv*3. In the drawing of the dorsum (Fig. 42) the lateral suture is shown merging with the only reticulation line drawn from amongst many such lines; this is not a fissure separating the holonotal shield into two parts. Chaetotaxy differs from *Gamasellus* on the following leg segments: genu III (2, 4/1, 1); genu IV (2, 5/1, 0).

MALE. Fig. 46-50. Idiosomal length, 350μ.

LOCALITY. Three females (N196886-N196888) and 2 males (N196889-N196890) drawn or examined: Australia; LF58, grass and leaf litter under *Eucalyptus camaldulensis*, Heywood Park, South Australia, 6.6.1965, col. R. V. Southcott, dep. SAM.

The holotype female (N196891) examined: Australia; moss, Mylor, South Australia, 27.6.1948, col. G. F. Gross, dep. SAM.

REMARKS. *Gamasiphis australicus*: Domrow, 1957 is more like the female *G. setosus* (male is a dermanyssid) than this species, the lateral sutures being similarly placed, although Womersley (1956a) does not record their presence. Therefore, I regard the *Gamasiphis* specimens described by Domrow (1957) as being *G. setosus* in preference to any other nominal species.

Gamasiphis concilator Berlese

Gamasiphis (*Periphis*) *concilator* Berlese, 1916a, p. 159.

FEMALE. Fig. 35-37. Idiosomal length, 910μ. In this species seta *st*3 is so far forward that it is anterior to seta *st*2 and may be mistaken for it.

MALE. Not known.

LOCALITY. The 'tipico' female (175/42) drawn: New Caledonia; 500 m., on Mt. Panié, col. Sarrasin and Roux, dep. SEAF.

REMARKS. This species is a typical *Gamasiphis* and clearly not congeneric with the type-species of *Periphis* which is here transferred to *Stylochirus* in the Sessiluncinae.

Gamasiphis fornicatus sp.n.

FEMALE. Fig. 51-54 and 59. Idiosomal length, 500μ. Genital shield has a group of 4 oval depressions on it and the ventro-anal shield is reticulated. There is a large pore-like structure, with a raised flange on its posterior rim, which may be a modified seta *S4* (Fig. 59). The drawings of the lateral surface of the idiosoma (Fig. 59 and the deutonymph in Fig. 61) are of squashed specimens and what is drawn ventral to setal rows *r* and *S* would not be visible normally since the venter is flat. Chaetotaxy differs from *Gamasellus* on genu IV (2, 5/1, 1).

MALE. Fig. 55-58. Idiosomal length, 490μ.

DEUTONYMPH. Fig. 60 and 61. Idiosomal length, 450μ. The idiosomal setation has been drawn in attempt to make the labelling of the lateral notal setae more accurate. It supports the above suggestion about the modification of seta *S4*, but the labelling of setal rows, *r*, *R* and *UR* is still uncertain.

LOCALITY. The holotype female (N196892), allotype male (N196893) and morphotype deutonymph (N196894) drawn, and 6 paratype females (N196895-N1968100), 3 paratype males (N1968101-N1968103) and one paratype deutonymph (N1968104) examined: Australia; LF 142, moss amongst bracken and gum trees in gully, Mt. Remarkable, South Australia, 9.8.1966, col. H. M. Cooper, dep. SAM.

REMARKS. This unusually globular species with its long dorsal setae and long spermadactyl is easily distinguishable from other nominal species.

Gamasiphis gamasellus Berlese

Gamasiphis gamasellus Berlese, 1913a, p. 80.

FEMALE. Not known.

MALE. Fig. 32-34. Idiosomal length, 310μ. Leg chaetotaxy as *G. pulchellus*. Dorsal setae on leg IV with similar lengths relative to each other as the equivalent setae on *G. australicus* (Fig. 45), except that seta *ad2* on genu IV is as long as the genu.

LOCALITY. The 'tipico' male (144/11) drawn: Java; humus, Samarang, dep. SEAF.

REMARKS. This species is the type, by monotypy, of *Micriphis* (initially a subgenus of *Ologamasus*, then *Ologamasellus*), but is clearly congeneric with *G. pulchellus*.

Gamasiphis pilosellus Berlese

Gamasiphis pilosellus Berlese, 1913a, p. 81.

FEMALE. Fig. 38 and 39. Idiosomal length, 590μ. As on *Gamasiphis elegantellus* Berlese, 1910a, the peritrematal shield is not separated from the exopodal shields posterior to stigma, in contrast to

Berlese's drawing (1913a, Fig. 27) of the latter. Other similarities between these species are also closer than suggested by Berlese's drawings. The lateral suture nearly reaches to the anterior end of the peritrematal-holonotal fissure (Fig. 38) and seta *R*5 is nearly as short as the paranal setae (Fig. 39). An unnamed species (labelled *G. pulchellus*, male (37/34), from Java, dep. SEAF) has a lateral suture which extends anteriorly almost as far as in this species and also a dorsal branch (Fig. 40) similar to the anterior end of the lateral suture on *G. australicus*. This unnamed species also has a short seta *R*5 and those dorsal setae which are relatively long (*e.g.*, seta *S*5, Fig. 41) have a hyaline flap at the tip. Leg chaetotaxy as *G. pulchellus*.

MALE. Not figured. Idiosomal length, 490μ. Corniculi, spermadactyl and leg II (even seta *av*3 of tarsus on small tubercle) are similar to those of *G. pulchellus*.

LOCALITY. The 'tipico' female (136/17), and 'tipico' male (136/14) drawn or examined (other four specimens in collection are difficult to observe): Java; humus, Samarang, dep. SEAF.

Genus CALIPHIS **gen.n.**

Type-species: *Caliphis calvus* **sp.n.**

DIAGNOSIS. Small to large mites, always with extensive, well sclerotized shields and idiosoma which is strongly convex dorsally. Ventroanal shield fused to a holonotal shield. Peritrematal shield either separate from fused metapodal and exopodal IV shields or narrows behind stigma before its fusion with an enlarged triangular metapodal, which may or may not be fused to exopodal IV shield. Exopodal III shield never split. Sternometasternal shield fused to endopodal IV shield. Female movable cheliceral digit has 3 teeth. Pretarsus I subequal in size to other pretarsi. Genu IV with 2 ventral setae.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal fused to ventro-anal, which bears aciculae posterior to anus. Peritrematal usually fused to combined exopodal IV and metapodal, but peritrematal may be separate (*C. hickmani* and *C. queenslandicus*) or exopodal IV may be separate (*C. tamborinensis*). Exopodals II, III and IV fused into continuous strip. Sterno-metasternal has a short axis, but laterally a narrow strip extends a long way backwards fusing with endopodals II, III and IV. Single pair of pre-endopodals.

Male: Sternito-genital, otherwise as female.

CHAETOTAXY. Idiosoma: 6*j*, 6*z*, 5*s*, 5*r* or, as for the new species described here, podonotum is hypertrichous: opisthonotum apparently always hypertrichous although there may be as few as 48 setae: 5*st*: 3*Jv*, 3*Zv*, 2*Sv*.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 7 horizontal rows. Tectum anterior margin basically trispinate but there may be spinules between the spines. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 with single lateral prong. both setae *al*1 and *al*2 slightly lanceolate or spatulate. Dorsal setae tapering and simple. Shields shiny and covered with reticulations. On sternal shield. seta *st*3 may be placed anterior to *st*2. Spermatheceal ringed tube opens near posterior paraxial edge of acetabulum IV. passing back to single central sacculus. Pretarsus I subequal in size to other pretarsi. Amongst dorsal setae on tarsus IV. seta *pd*3 is the longest.

Male: Corniculi proportionately slightly longer than in female. Movable cheliceral digit with single tooth and fused along proximal half with sinuous spermadactyl which is subequal in length or up to twice as long. On leg II, femur setae *av* and *pv*1. genu seta *av* and tibia seta *av* enlarged into a spur or spine.

DISTRIBUTION. Aa, An; Sa. All published records are with the original descriptions of nominal species. Specimens have been collected from Lord Howe Island, dep. SAM. Found in plant litter and moss.

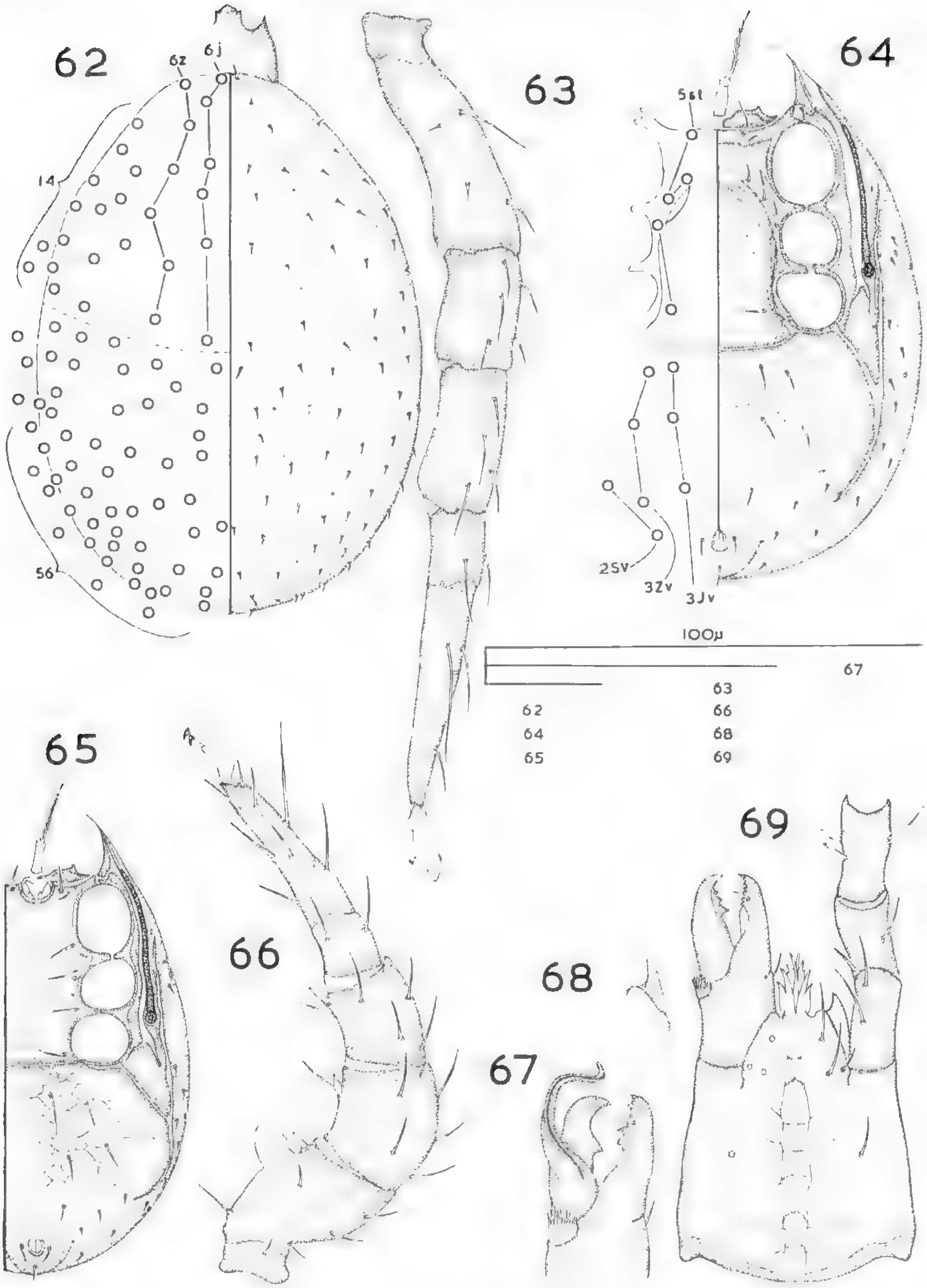
REMARKS. *Caliphis* is similar to *Gamasiphis*, but can be distinguished from it as indicated in the key to Gamasiphinae. The following 6 nominal species are included in this genus: *Caliphis calvus* **sp.n.**; *Caliphis hickmani* (Womersley) **comb.n.** for *Gamasiphis* (*Neogamasiphis*) *hickmani* Womersley, 1956a; *Caliphis novaezelandiae* (Womersley) **comb.n.** for *Gamasiphis* (*Neogamasiphis*) *novae-zelandiae* Womersley, 1956a; *Caliphis queenslandicus* (Womersley) **comb.n.** for *Gamasiphis* (*Neogamasiphis*) *queenslandicus* Womersley, 1956a; *Caliphis schusteri* (Hirschmann) **comb.n.** for *Gamasellus* (*Hydrogamasellus*) *schusteri* Hirschmann. 1966; *Caliphis tamborinensis* (Womersley) **comb.n.** for *Gamasiphis* (*Neogamasiphis*) *hickmani* var. *tamborinensis* Womersley, 1956a.

Caliphis calvus sp.n.

FEMALE. Fig. 62-64, 69. Idiosomal length, 430μ. Idiosoma covered in reticulations as figured for male (Fig. 65). The spermatheceal ringed tube and anterior edge of sacculus can be clearly seen and are shown by dotted lines in drawing of venter (Fig. 64).

MALE. Fig. 65-68. Idiosomal length, 410μ.

LOCALITY. The holotype female (N1968231), allotype male (N1968232), 19 paratype females (N1968233 and N1968235-N1968252) and 3 paratype males (N1968234, N1968253, N1968254) drawn or examined: Australia; LF 191, moss, Lena Valley Track, 800ft. Mt. Wellington, near Hobart. Tasmania. 14.12.1966. col. L. W. Miller, dep. SAM.



Figs. 62-69. *Caliphis calvus* sp.n..
62-64 and 69, female; 62, soma, dorsum; 63, leg IV (part), dorsal setae only; 64, idiosoma, venter; 69, gnathosoma, venter. 65-68, male: 65, idiosoma, venter; 66, leg II (part), antero-latus; 67, chelicera; 68, corniculus.

REMARKS. The large number (more than 150) of uniformly short dorsal setae distinguishes this species from other nominal species, and it also differs from *C. hickmani, C. queenslandicus* and *C. tamborinensis* in having a peritrematal shield fused to a combined exopodal IV and metapodal shield.

Genus EUEPICRIUS Womersley

Euepicrius Womersley, 1942, p. 170. Type-species: *Euepicrius filamentosus* Womersley, 1942, by original designation.

DIAGNOSIS. Small to average sized mites, always with extensive, well sclerotized shields and idiosoma which is strongly convex dorsally. Ventro-anal shield fused to the opisthonotal shield which is separated from the podonotal shield. Peritrematal shield is fused to all the exopodal shields, which are themselves fused into a strip of undivided shield. Sterno-metasternal shield fused to both endopodal shield IV and the pre-endopodal shields. Leg I long and slender with long setae distally on tarsus. Female movable cheliceral digit has 3 teeth. Pretarsus I is absent. Genu IV with one ventral seta.

MORPHOLOGY.

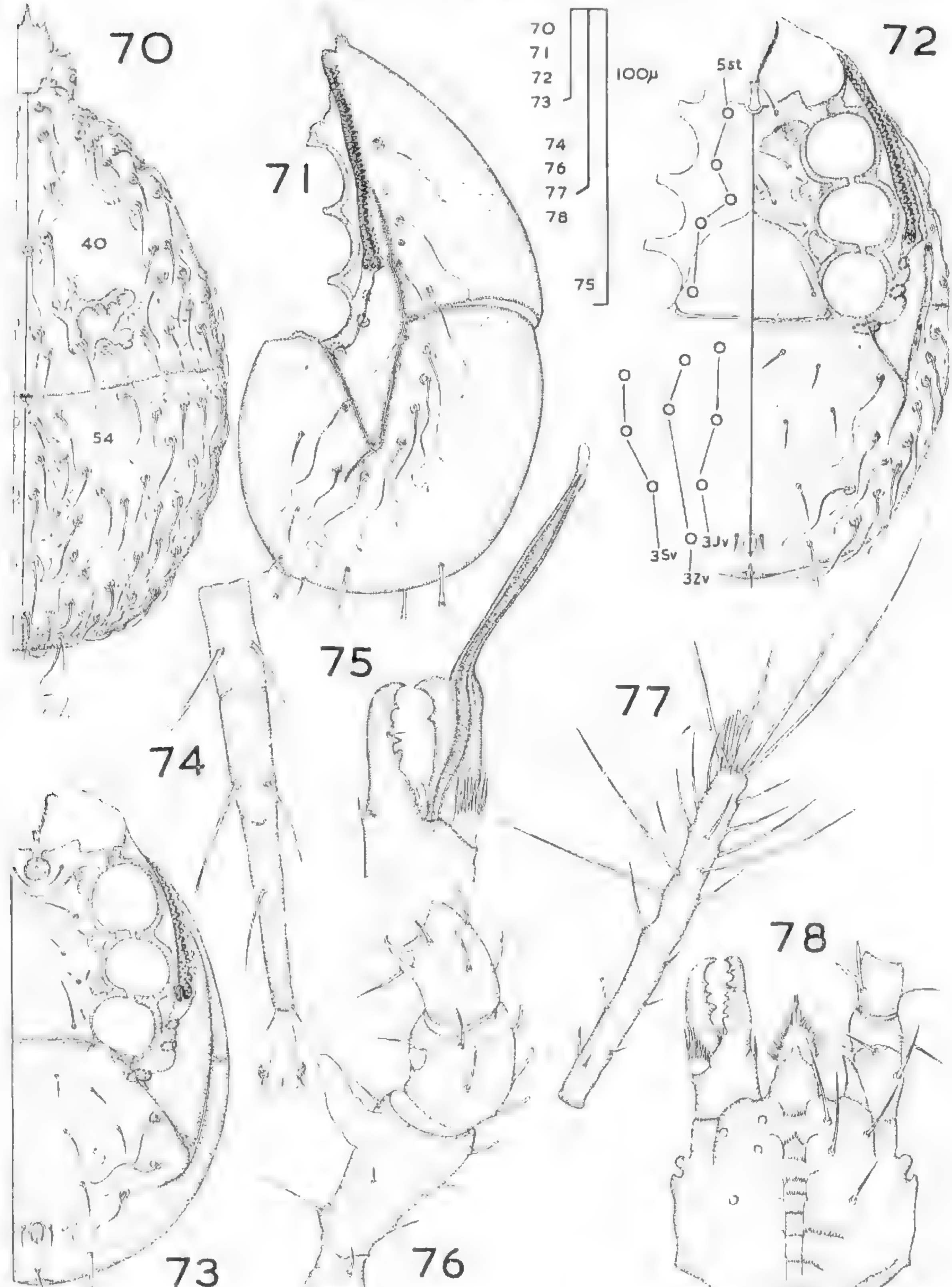
SCLEROTIZATION. Female: Separate podonotal and opisthonotal, the latter is fused to ventro-anal which bears aciculae posterior to anus. Peritrematal appears to be fused to the complete strip of undivided exopodals and to a triangular metapodal posteriorly. Sterno-metasternal fused to endopodals II, III and IV as well as to pre-endopodals.

Male: Sternito-genital, otherwise as female.

CHAETOTAXY. Idiosoma: Hypertrichous on notum: 5*st*: 3*Jv*, 3*Zv*, 3*Sv*.

Legs: As *Gamasellus* except that there is only one ventral on genu IV (2, 5/1, 1).

OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin basically trispinate with spinules between lateral spines. Movable cheliceral digit with 3 teeth. On palp genu, setae *al*1 and *al*2 spine-like or slightly lanceolate. Gnathosoma has distinct lateral notch and tubercle. Dorsal setae may be simple and tapering, but usually, either sinuous and slightly spatulate or straight and pilose with clearly spatulate tip. Shields ridged, pitted and dull, being covered by a thick exudate. Peritreme with lateral pockets and corrugated ridge outside it, which runs to posterior edge of peritrematal shield and borders 3 conspicuous pores behind stigma. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV, passing back to a single central sacculus. Leg I long and slender, tibia may be up to 16-times longer than its breadth. Tip



Figs. 70-78. *Euepicrius lootsi* sp.n..
70-72, 74, 77 and 78, female: 70, soma, dorsum; 71, idiosoma, latus; 72, idiosoma, venter; 74, tarsus IV, dorsum; 77, tarsus I; 78, gnathosoma, venter. 73, 75 and 76, male: 73, idiosoma, venter; 75, chelicera; 76, leg II (part), antero-latus.

of tarsus I with long setae but no pretarsus. Amongst dorsal setae on tarsus IV, the slightly spatulate seta *pd*3 is the longest.

Male: Movable cheliceral digit with one tooth, fused along its entire length to spatulate spermadactyl which is longer, and may be up to 4-times the length of the digit. On leg II, femur seta *av*, genu seta *av*, tibia seta *av* enlarged into spurs.

DISTRIBUTION. Aa, An: Sa. Besides the locality records published with the original descriptions of nominal species there are specimens before me from Auckland and Campbell Islands (Sa) to be dep. BBM, and Lord Howe Island and New Caledonia, dep. SAM.

Found in moss and plant litter.

REMARKS. *Euepicrius* was originally placed in the Macrochelidae. I (Lee, 1966) transferred it to the Rhodacaridae, but was uncertain as to which genera it was related. I now consider it to be quite a close ally to *Gamasiphis* despite the differences in superficial appearance. Members of *Euepicrius* have a very characteristic appearance, so there is no doubt that the new species described here is congeneric with the type-species. The following 3 nominal species are included in this genus: *E. filamentosus* Womersley, 1942; *E. lootsi* **sp.n.**; *E. queenslandicus* Womersley, 1956b.

Euepicrius lootsi sp.n.

FEMALE. Fig. 70-72, 74, 77, 78. Idiosomal length, 610μ. This species has an unusually large number of idiosomal setae, the number on the podonotum and opisthonotum in Fig. 70 indicates the number of setae in one half of these regions, excluding those on the centre line. Only part of three long setae on distal end of tarsus I are drawn (Fig. 77).

MALE. Fig. 73, 75, 76. Idiosomal length, 550μ.

LOCALITY. The holotype female (N1968138), allotype male (N1968139) and 4 paratype females (N1968140-143) and 3 males (N1968144-N1968146) drawn or examined: Australia: LF127, moss and grass beside Wannon River, near Yarram Gap, Grampians, Victoria, 14.5.1966, col. D. C. Lee, dep. SAM.

REMARKS. This species can be distinguished from the other two nominal species by the shortness of the two terminal pairs of spatulate setae on the opisthosoma, which are less than three-times the length of the anal valves, and the relatively short spermadactyl, the free part of which is less than two-times the length of the movable digit and is straight, having no bends as in the other nominal species.

Genus GAMASELLIPHIS Ryke

Gamaselliphis Ryke, 1961a, p. 99. Type-species: *Cyrtolaelaps* (*Gamaselliphis*) *potchefstroomensis*, Ryke, 1961a, by original designation.

DIAGNOSIS. Minute to average sized mites, always with extensive, well sclerotized shields and idiosoma which is fairly convex dorsally. Ventro-anal shield fused to opisthonotal shield which is separated from the podonotal shield. Peritrematal shield fused to exopodal IV shield. Exopodal III shield split. Sterno-metasternal shield not fused to endopodal IV shield. Female movable cheliceral digit has 3 teeth. Pretarsus I smaller than other pretarsi. Genu IV with 2 ventral setae.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal, the latter is fused to ventro-anal, which bears aciculae posterior to anus. Peritrematal fused to exopodal IV and to a triangular metapodal posteriorly. Always a split in exopodals II, III and IV. Sterno-metasternal fused to endopodals II and III. One pair of pre-endopodals.

Male: Sternito-genital, otherwise as female.

CHAETOTAXY. Idiosoma: *6j*, *6z*, *5s*, *5r*: *5J*, *5Z*, *5S*, *5R*, 0-2*UR*: *5st*: *3Jv*, *3Zv*, *2Sv*.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 7 horizontal rows. Tectum anterior margin is trispinate. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 spatulate with 2 small lateral prongs and seta *al*2 is lanceolate. Dorsal setae on idiosoma and legs rarely simple, usually at least lanceolate, may be pilose as well, or spatulate and pilose. Shields dull being covered by thick exudate. Single pore, which is conspicuous in one specimen (N1968275), opens beside peritrematal ridge, level with stigma, and may homologous with one of the three similarly placed pores on *Euepicrius* species. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV, passing back to single central sacculus. Pretarsus I smaller than other pretarsi especially in one species (*G. grahamstowni*) which has an unusually long leg I, with long distal setae. Amongst dorsal setae on tarsus IV, seta *pd*3, which is setose or lanceolate, is the longest.

Male: Movable cheliceral digit with one tooth and fused at base to sinuous spermadactyl, which is slightly longer or up to four times as long as digit. On leg II, femur seta *av*, genu seta *av*, tibia seta *av* enlarged into spurs. Genu and tibia II setae *pv* may be stubby spines.

DISTRIBUTION. Ew, Ee, Es. All the published records are with the original descriptions of nominal species from South Africa. Records from Congo, Kenya, Rwanda and Tanzania are from Loots (thesis, 1967).

The males of *Gamaselliphis* recorded from Nobska Beach, Massachusetts, U.S.A. (Na) by Haq (1965) are *Parasitus* species according to Emberson (thesis, 1968).

Found in plant litter.

REMARKS. *Gamaselliphis* was established as a subgenus of *Cyrtolaelaps* by Ryke (1961a). Because of the extensive sclerotization without fusion of the broad peritrematal to the ventro-anal shield on *Gamaselliphis* males, as well as other characters, I am now treating this taxon as a genus and consider it most like *Euepicrius.* Species in this genus have a lot of characters similar to those of some *Gamasellus discutatus*-complex species whose females have the sternal setae located as in Gamasiphinae females. Therefore, the alliances I have indicated for this genus depend on the importance I have given to the lack of sexual dimorphism of the ventral sclerotization. I have examined three non-type females of this genus dep. SAM.; one *G. potchefstroomensis* (N1968275) and two similar to *G. montanellus* (N1968276 and N1968277) from South Africa. The following 5 nominal species are included in this genus: *G. potchefstroomensis* Ryke, 1961a; *G. cathkini* Ryke, 1961a; *G. grahamstowni* Ryke, 1961a; *G. lawrencei* Ryke, 1961a; *G. montanellus* Ryke, 1961a. Also, I have examined the specimen with the manuscript name "Laelogamasus inguinalis", slide 222/16, East Africa, dep. SEAF, and confirm Ryke's (1962c, p. 51) placing of it in this genus but have not established whether or not it belongs to a nominal species.

Genus GAMASIPHOIDES Womersley

Gamasiphoides Womersley, 1956a, p. 528. Type-species: *Gamasiphis (Gamasiphoides) propinqua* Womersley, 1956a, by original designation.

DIAGNOSIS. Small to average sized mites, often with extensive, well sclerotized shields. The ventro-anal shield may or may not be fused to a holonotal shield. The peritrematal shield fused to exopodal IV shield. The exopodal III shield is split. The sterno-metasternal shield rarely fused to endopodal IV shield. Female movable cheliceral digit has 3 teeth Pretarsus I usually subequal in size to other pretarsi, but may be smaller. Genu IV with one ventral seta.

MORPHOLOGY.

Sclerotization. Female: Holonotal, which may or may not be fused to ventro-anal that bears aciculae posterior to the anus. Peritrematal fused to exopodal IV and only sometimes is there a posterior triangular metapodal extension of this merged shield. There is often a discrete, subcircular shield posterior to acetabulum IV which Womersley (1956a) terms the metapodal. Exopodal II, III and IV split. Sterno-metasternal fused to endopodals II and III, and rarely to IV. Two pairs of pre-endopodals, anterior pair may be fragmented.

Male: Sternito-genital. Subcircular shield posterior to acetabulum IV is merged in ventro-anal. Otherwise similar to female of same species.

CHAETOTAXY. Idiosoma: Variable, usually setae on striated cuticle between holonotal and ventral shields, and between levels of setae *st4* and *Zv2*, and these are included in peripheral dorsal rows, although they might be better regarded as a separate row. *6j*, 5 or *6z*, *5s*, 5 or *6r*: 4 or *5J*, 4 or *5Z*, 4 or *5S*, 4, 5 or *8R*: *5st*: *3Jv*, *3Zv*, *1Sv*.

Legs: Most Australian species differ from *Gamasellus* only by having one less ventral on genu IV (2, 5/1, 1). But, *G. propinqua* also has no *pd4* on tarsus IV, and an unnamed *Gamasiphoides* female from Tasmania (dep. SAM, N1968280) differs on genu III (2, 4/1, 2) and tibia III (2, 3/2, 2) in having an extra postero-lateral. African and South American species differ from *Gamasellus* in having one less ventral on genu III (2, 4/1, 1) and genu IV (2, 5/1, 1). The species from the Subantarctic regions may have a ventral seta less on genu IV or on genu III and IV.

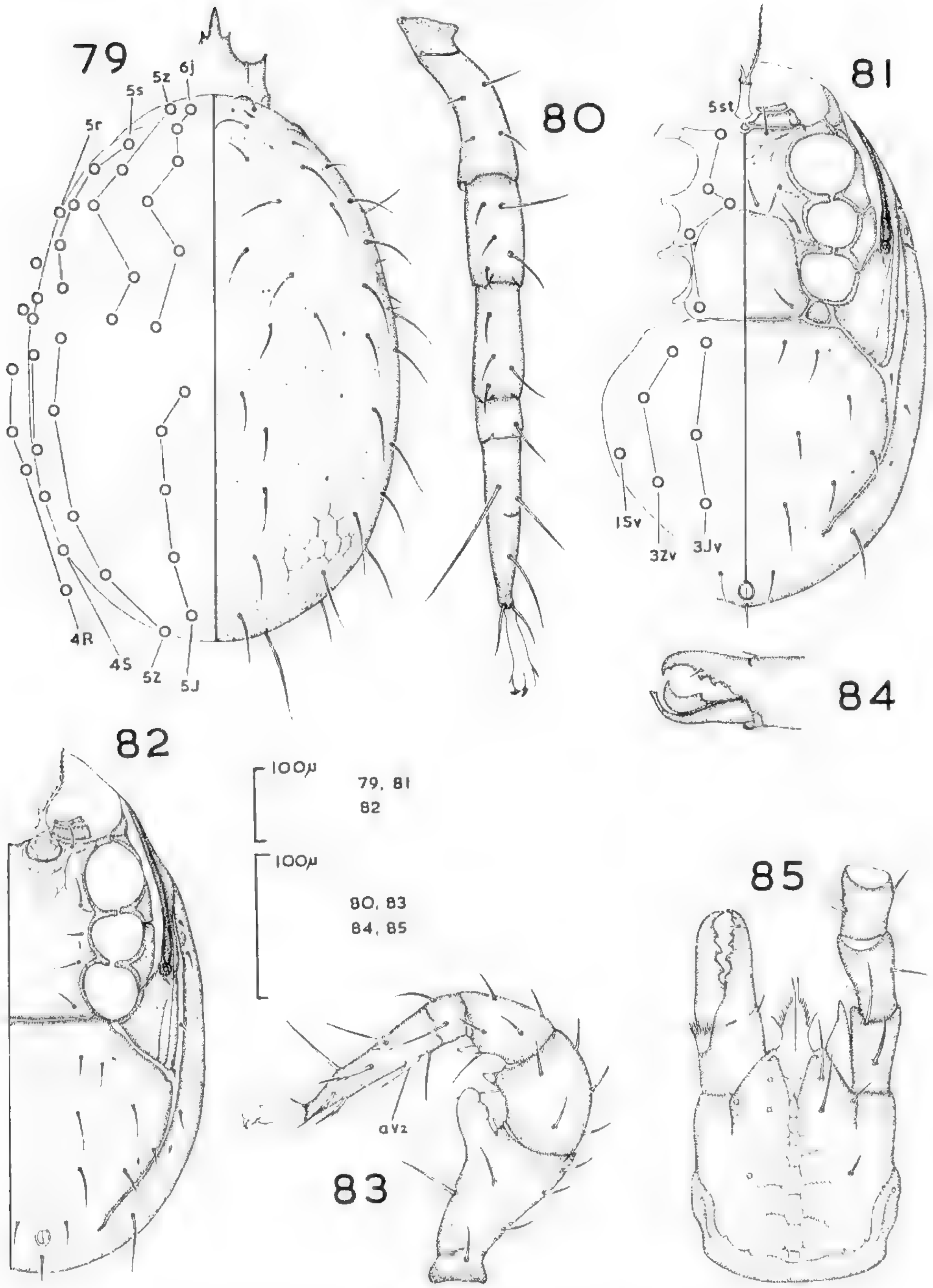
OTHER CHARACTERS. Female: Deutosternal denticles in 8, 9 or 10 rows. Tectum anterior margin is trispinate. Movable cheliceral digit with 3 teeth. On palp genu, setae *al1* and *al2* spatulate. Dorsal setae simple and tapering. Shields shiny and often reticulated. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV, passing back to single central sacculus. Pretarsus I usually similar in size to other pretarsi, but may be conspicuously smaller. Amongst dorsal setae on tarsus IV, seta *pd3* is the longest.

Male: Palp femur has small tubercle in one species (Fig. 91). Movable cheliceral digit with one tooth, and fused along proximal half to slightly longer, spermadactyl. On leg II femur seta *av* and sometimes seta *pv1*, genu seta *av*, tibia seta *av* and tarsus seta *av2* enlarged to spines or spurs.

DISTRIBUTION. NTe: Es: Aa: Sm. Sa. Besides the locality records published with the original descriptions of nominal species, two unnamed species from South Africa were described by Loots (thesis, 1967), and specimens have been collected from Tierra del Fuego, dep. BM(NH) and from Lord Howe Island and New Caledonia, dep. SAM.

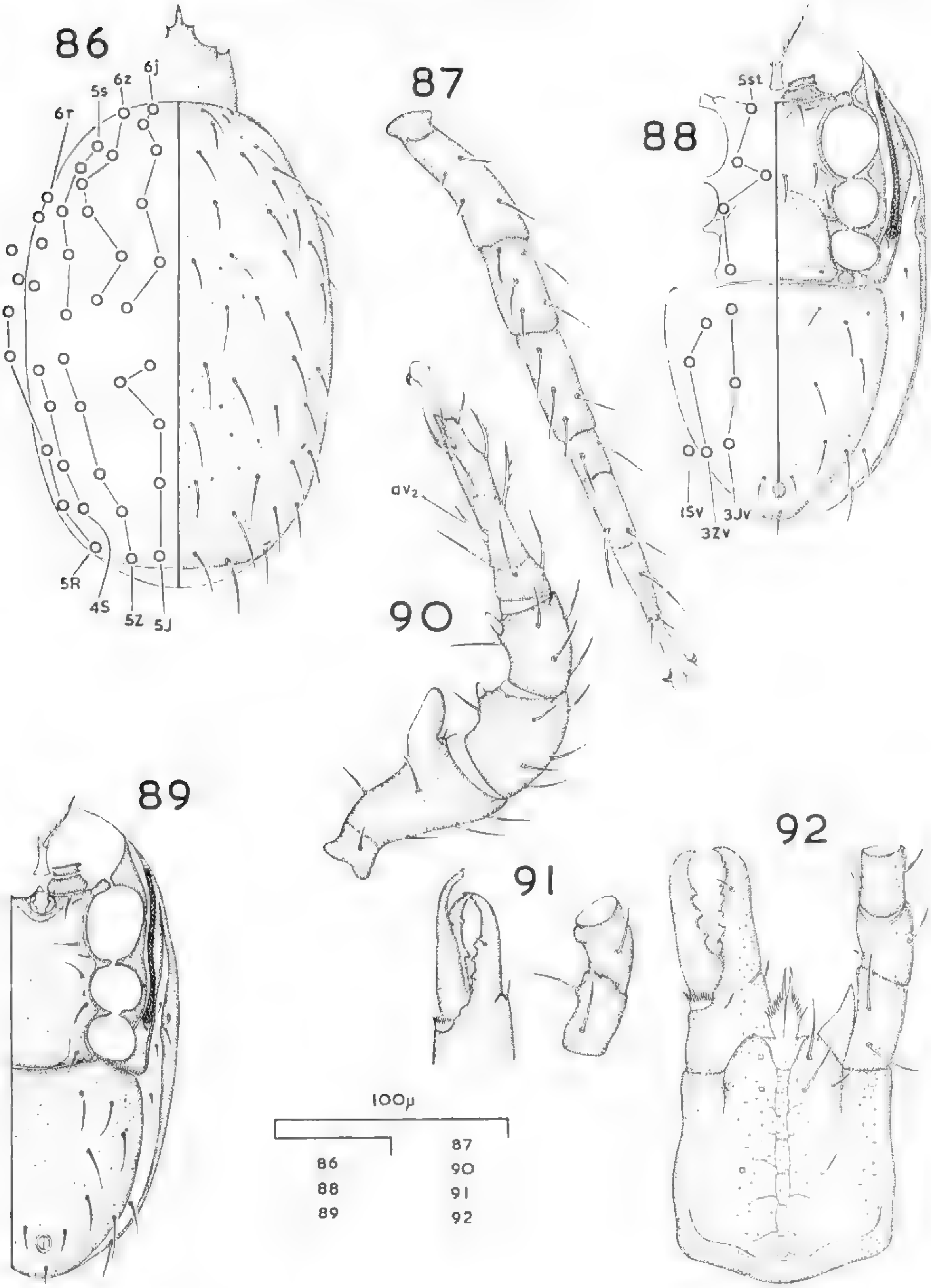
Found in moss and plant litter.

REMARKS. *Gamasiphoides* was originally a subgenus within *Gamasiphis* but it was given the rank of genus by Ryke (1962b). An unnamed species from Victoria, Australia, dep. SAM (female, N1968282; male, N1968283), has more extensive shields and is similar to *Gamasiphis* species in having a female metasternal shield that is fused to endopodal IV



Figs. 79-85. *Gamasiphoides propinqua* Womersley.

79-81 and 85, female: 79, soma, dorsum; 80, leg IV (part), dorsum; 81, idiosoma, venter; 85, gnathosoma, venter. 82-84, male: 82, idiosoma, venter; 83, leg II (part); 84, chelicera.



Figs. 86-92. *Gamasiphoides aitkeni* sp.n..
86-88 and 92, female: 86, soma, dorsum; 87, leg IV (part), dorsum; 88, idiosoma, venter; 92, gnathosoma, venter. 89-91, male: 89, idiosoma, venter; 90, leg II (part); 91, chelicera, plus palp trochanter and femur, venter.

shield, but because of the split exopodal IV shield, the three teeth on the movable digit of the female chelicera and the short, non-spatulate spermadactyl, it is placed in this genus. Another unnamed species from Tasmania, Australia, dep. SAM (female, N1968281) is mentioned above because of its unusual leg chaetotaxy. *Gamasiphoides* species with a reduced sclerotization may be mistaken for members of the Ologamasini when superficially examined. The following 4 nominal species are included in this genus: *G. propinqua* Womersley, 1956a; *G. aitkeni* **sp.n.**; *G. gamasiphioides* (Sheals) **comb.n.** for *Hydrogamasus gamasiphioides* Sheals, 1962; *G. macquariensis* (Hirschmann, 1966) **comb.n.** for *Gamasellus* (*Hydrogamasellus*) *macquariensis* Hirschmann, 1966. Two unnamed species are described by Loots (thesis, 1967).

Gamasiphoides propinqua Womersley

Gamasiphis (*Gamasiphoides*) *propinqua* Womersley, 1956a, p. 528.

FEMALE. Fig. 79-81, 85. Idiosomal length, 780μ. On dorsum, seta *j*1 is so small that it is difficult to discern. On tarsus IV, seta *pd*4 is absent (Fig. 80), and leg chaeotaxy also differs from *Gamasellus* on genu IV (2, 5/1, 1)

MALE. Fig. 82-84. Idiosomal length, 760μ.

LOCALITY. Female (N1968151) and male (N1968152) drawn: Australia; LF16, rotting wood and lichen, near Mt. Lofty summit, South Australia, 20.11.1964, col. G. F. Gross, dep. SAM. The paratype female (N1968153) and paratype male (N1968154) examined: Australia; moss, National Park, Belair, South Australia, 9.1938, col. H. Womersley, dep. SAM.

Gamasiphoides aitkeni **sp.n.**

FEMALE. Fig. 86-88, 92. Idiosomal length, 420μ. Leg chaetotaxy differs from *Gamasellus* on genu IV (2, 5/1, 1).

MALE. Fig. 89-91. Idiosomal length, 400μ. Small process on antero-ventral edge of palp femur (Fig. 91). Ventro-anal shield not fused to notal shield although this is not clear in Fig. 89.

LOCALITY. The holotype female (N1968155), allotype male (N1968156), paratype female (N1968157) and paratype male (N1968158) drawn or examined: Australia; LF36, moss and litter, under shrubs at top of 100ft. cliff near Glenelg River, near Nelson, Victoria, 28.1.1965, col. P. F. Aitken and N. B. Tindale, dep. SAM.

REMARKS. The only other nominal species in this genus on which the ventro-anal shield is separate from the holonotal shield is *G. macquariensis*, and specimens to be dep. BBM and apparently belonging to that species have only one ventral seta on genu III, while on this species there are two ventral setae on genu III. Also *G. macquariensis* is a much bigger species, the female idiosomal length being about 760μ.

Genus HYDROGAMASUS Berlese

Hydrogamasus Berlese, 1892b, LXVIII, 5. Type-species: *Gamasus littoralis* G. & R. Canestrini, 1881, designated by Vitzthum, 1941, p. 756 as the junior synonym of *Gamasus salinus* Laboulbène, 1851, a synonymy which is revoked below.

DIAGNOSIS. Small to large mites with shields not so extensive and dorsal idiosomal surface not so convex as most members of this subfamily. Ventro-anal shield fused to holonotal shield. Peritrematal shield usually fused to exopodal IV shield. Exopodal III shield continuous, but has a longitudinal split. Sterno-metasternal shield not fused to endopodal IV shield. Female movable cheliceral digit has 3 teeth. Pretarsus I smaller than other pretarsi. Setation of tibia I (2, 6/3, 2) differs from *Gamasellus* in having only three ventral setae.

MORPHOLOGY.

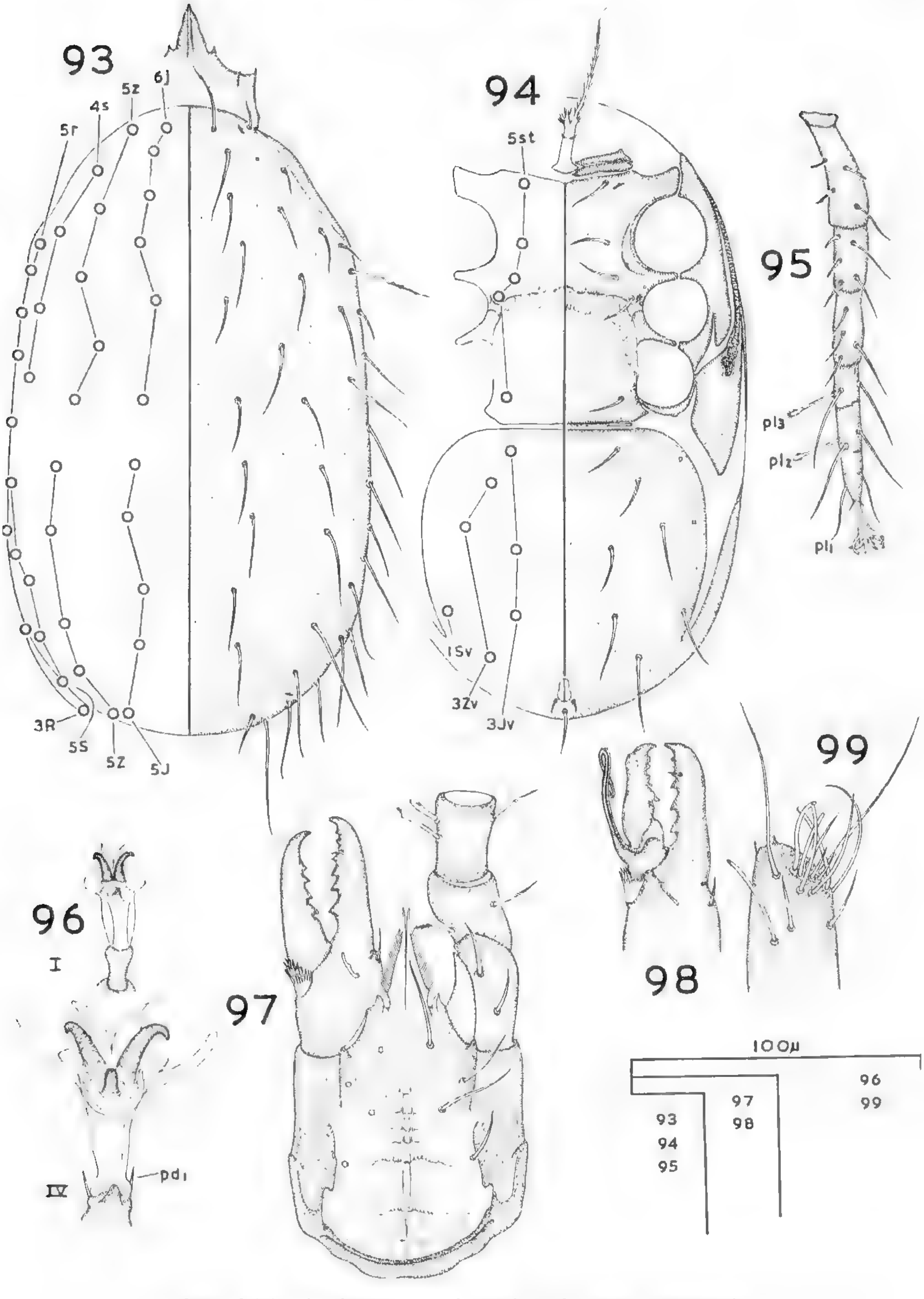
SCLEROTIZATION. Female: Holonotal, fused to ventro-anal posterior to seta *Sv*1. Peritrematal usually fused to exopodal IV in varying degrees (Hirschmann, 1966, draws *H. littoralis*, using the revoked synonymy *H. salinus*, without such a fusion) and to a triangular metapodal posteriorly. Exopodals II and III not split, but in Palaearctic species the broad shield is incised parallel to part of the edge of acetabulum III. Exopodal IV is split. Intergenito-ventral is present. Sterno-metasternal fused to endopodal II and part of III. Two pairs of pre-endopodals.

Male: Sternito-genital fused to endopodals II, III and IV or only to endopodal II and part of III. Since seta *st*5 is on ventro-anal, part of sternito-genital might be regarded as being represented in this shield. Otherwise similar to female.

CHAETOTAXY. Idiosoma: 6*j*, 5*z*, 4*s*, 5*r*: 5*J*, 5*Z*, 5*S*, 1-3*R*; 5*st*; 3*Jv*, 3*Zv*, 1*Sv*.

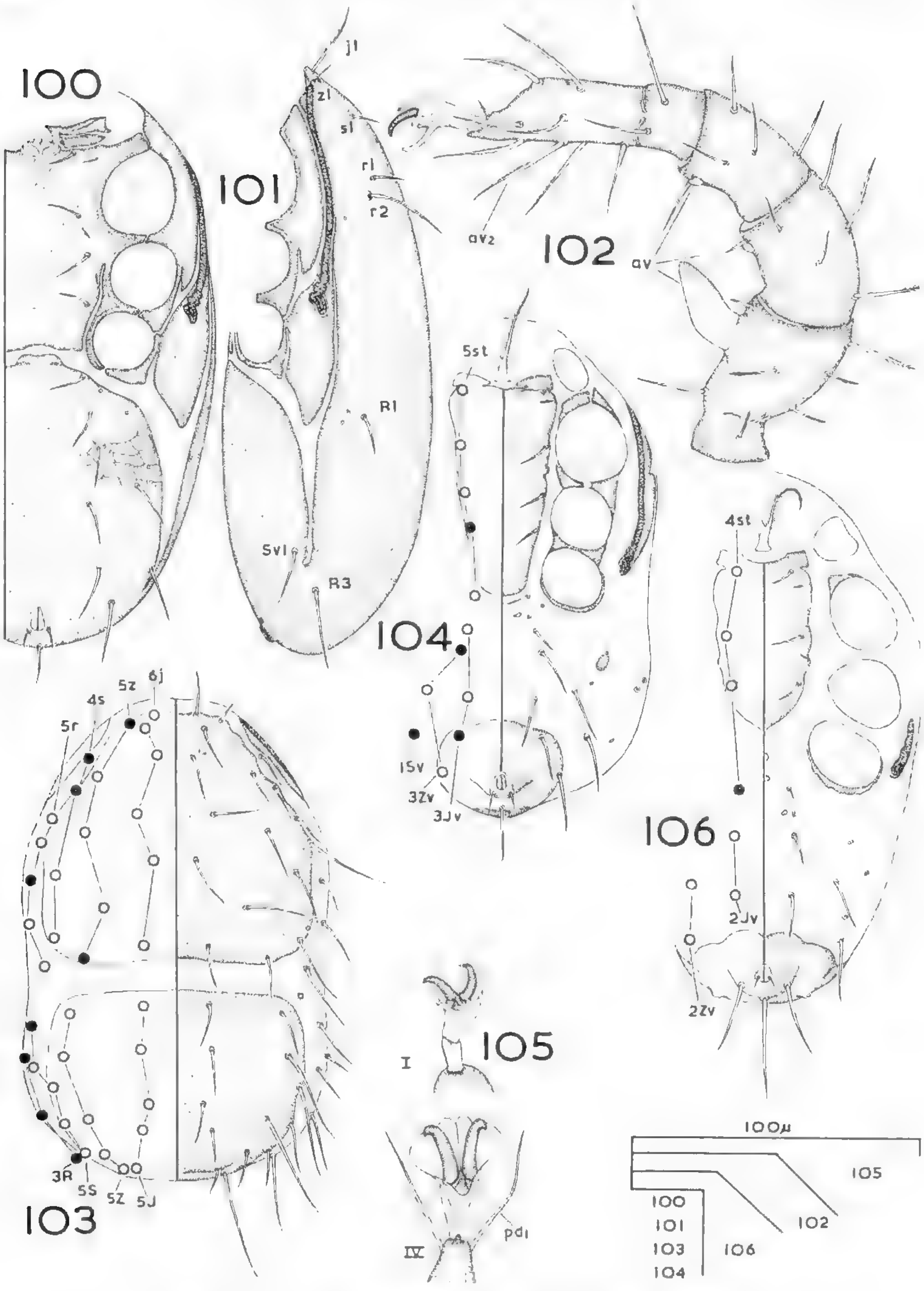
Legs: Following segments differ from *Gamasellus* in having a postero-lateral or ventral seta missing: tibia I (2, 6/3, 2); genu IV (2, 5/2, 0); tibia IV (2, 4/2, 1).

OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin trispinate, with stout central spine and 2 small lateral spines. Movable, cheliceral digit with 4 conspicuous teeth and sometimes with series of small teeth distal to these. On palp genu, seta *al*1 slightly lanceolate with one lateral prong and seta *al*2 slightly spatulate.



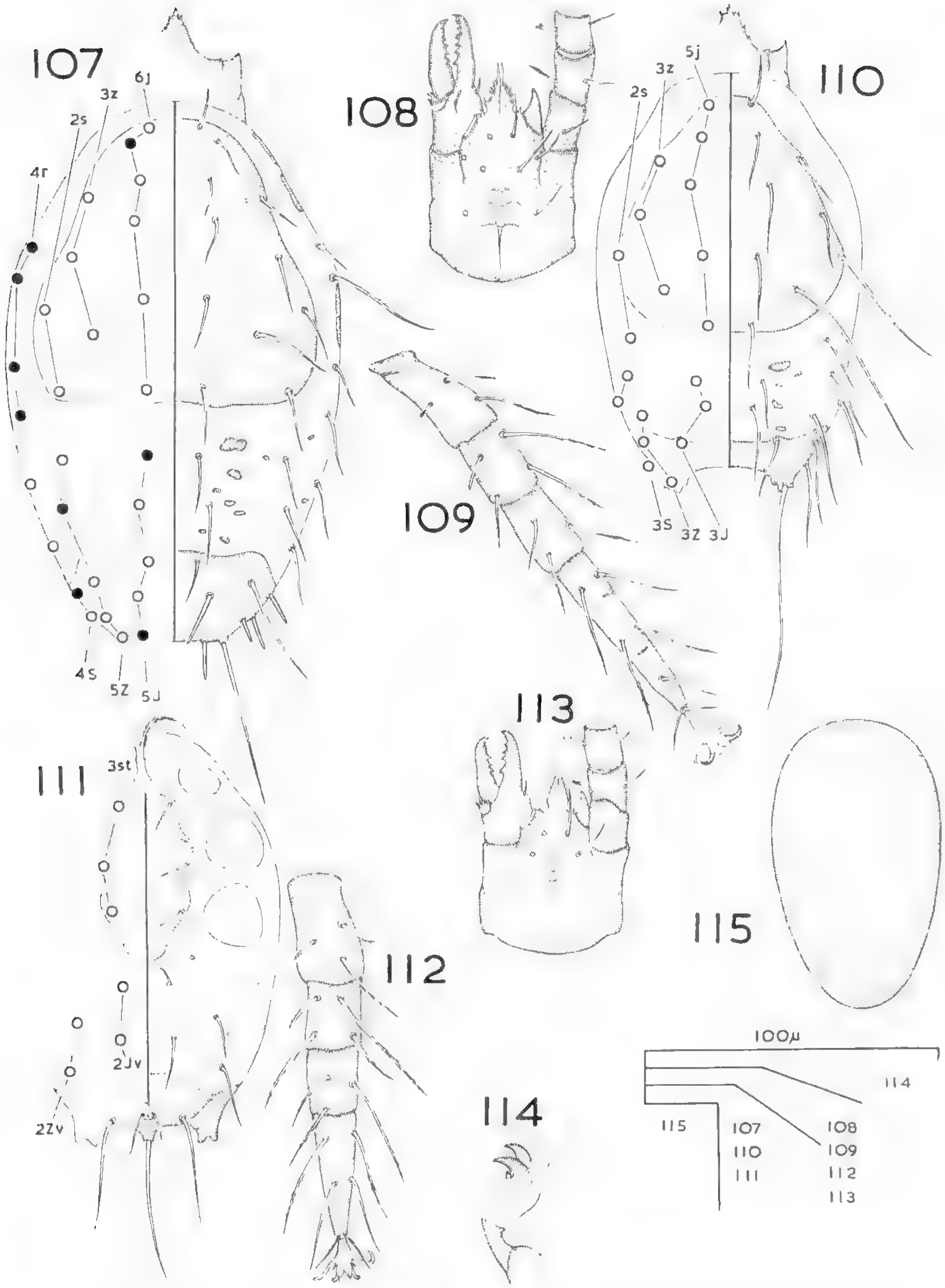
Figs. 93-99. *Hydrogamasus littoralis* (G. & R. Canestrini).

93-97 and 99, female: 93, soma, dorsum; 94, idiosoma, venter; 95, leg IV (part), dorsum; 96, pretarsi I and IV; 97, gnathosoma, venter. 99, distal tip of tarsus I. 98, male, chelicera.



Figs. 100-106. *Hydrogamasus littoralis* (G. & R. Canestrini).

100-102, male: 100, idiosoma, venter; 101, idiosoma, latus; 102, leg II (part). 103-105, deutonymph: 103, idiosoma, dorsum; 104, idiosoma, venter; 105, pretarsi I and IV. 106, protonymph, idiosoma, venter.



Figs. 107-115. *Hydrogamasus littoralis* (G. & R. Canestrini).
107-109, protonymph: 107, soma, dorsum; 108, gnathosoma, venter; 109, leg IV (part), dorsum. 110-114, larva: 110, soma, dorsum; 111, idiosoma, venter; 112, leg III (part), dorsum; 113, gnathosoma, venter; 114, pretarsus I. 115, egg.

Dorsal setae long and tapering, may be slightly pilose. Shields with reticulations (mainly on ventro-anal shield, but also around edges of other shields). Spermathecal ringed tube probably opens near posterior paraxial edge of acetabulum IV. Pretarsus I pedunculate and smaller than other pretarsi. Lobes of pulvillus II-IV attenuated and long with extra, skirt-like lobe around base of claws. On tarsus IV all four dorsal setae in whorls 3 and 4 are subequal in length.

Male: Tectum may differ slightly from female. Movable cheliceral digit with series of more than 3 teeth, and fused at base to slender spermadactyl, which loops over back on itself level with digit tip. Seta *st5* on ventro-anal shield. On leg II, femur seta *av*, genu seta *av*, and tibia seta *av* enlarged into spurs. In Hirschmann's (1966) drawings, *H. vitzthumi* appears to have ventral process on tarsus II.

DISTRIBUTION. Pe, Pm: An: Sa. Besides the locality records published here and with the original descriptions of nominal species there are records of *Hydrogamasus* species from the North Atlantic coastline of Europe, the furthest north being from Anglesey, North Wales (Glynne-Williams and Hobart, 1952). Also, specimens have been found as far east in the Mediterranean as Israel (Costa, 1966a).

Usually found in rock crevices of the upper littoral zone, but may be found elsewhere on the marine shore.

REMARKS. *Hydrogamasus* has in the past included many rhodacarids which have a holonotal shield that is not fused to the ventro-anal shield of the female, but they have been transferred to *Gamasiphoides, Geogamasus, Heydeniella* and *Hydrogamasellus* by Hirschmann (1966) or myself (see below). Hirschmann (1966) restricted the genus and divided it into 2 subgenera. One subgenus, *Austrohydrogamasus*, is here newly regarded as synonymous with *Parasitiphis*, and the genus is considered restricted to his other subgenus. The resulting genus is easy to diagnose, and I consider its closest relationship is with the *Gamasiphinae*, although it is atypical within the subfamily. The following 4 nominal species are included in the genus: *H. littoralis* (G. & R. Canestrini, 1881); *H. giardi* (Trouessart, 1888); *H. kensleri* Luxton, 1967; *H. vitzthumi* Hirschmann, 1966.

Hydrogamasus littoralis (G. & R. Canestrini)

Gamasus littoralis G. and R. Canestrini, 1881, p. 1078.

FEMALE. Fig. 93-97 and 99. Idiosomal length, 860μ.

MALE. Fig. 98 and 100-102. Idiosomal length, 780μ.

DEUTONYMPH. Fig. 103-105. Idiosomal length, 660μ.

PROTONYMPH. Fig. 106-109. Idiosomal length 630μ.

LARVA. Fig. 110-114. Idiosomal length, 450μ.

EGG. Fig. 115. Longest axis length, 390μ.

LOCALITY. Female (N196859), male (N196860), deutonymph (N196861), protonymph (N196862), larva (N196863), and unlaid egg (N196864) drawn: Channel Islands (English Channel): rocks below high tide, Belerouts Bay, Jersey, 18.7.1950, col. E.B., dep. SAM.

The 'tipico' female (34/25) and 'tipico' male (34/26) examined: Italy; the Lido, Venice, dep. SEAF.

REMARKS. In figured chaetotaxy patterns, filled in circles represent setae considered to have been added at the previous moult. Characters of the immature stages have not been used in the classification given here. The extensive drawings of these stages are given only to increase this type of data, which is too limited from this family for satisfactory comparative studies. Similar drawings are made in this paper of the immature stages of *Heydeniella dentata* and *Gamasellus tragardhi*.

The adult *H. littoralis* specimens in the Berlese collection agree with the figures here, but disagree with Hirschmann's (1966) drawings which show a peritrematal shield completely free of the exopodal shields.

Gamasus littoralis is usually regarded as a junior synonym of *Gamasus salinus* Laboulbène after Oudemans (1902). Not many characters of *G. salinus* can be gleaned from Laboulbène's (1851) description, but the *al* setae on the palp femur and genu are drawn (enlarged copy, Fig. 317) and commented on in the text. The position and shape of seta *al* on the palp femur in this description is not similar to that of any rhodacarid, but it is similar to seta *al* on the palp femur (Fig. 316) of *Hydrogamasus silvestri* Berlese, 1904b which Berlese, in the catalogue of his collection, has placed under *Pergamasus hamatus* (K). I have, therefore, revoked Oudemans' (1902, p. 286) synonymy of *G. salinus* with *G. littoralis* and made a new combination, *Pergamasus salinus* (Laboulbène, 1851), and regarded the original description as being of the deutonymph and *G. maritimus* Laboulbène, 1851 as being the adult female.

Hydrogamasus kensleri Luxton

Hydrogamasus kensleri Luxton, 1967, p. 76.

LOCALITY. Three females (N196865-N196867), two males (N196868 and N196869), two protonymphs (N196870 and N196871) and a larva (N196872) examined: Macquarie Island; rotting kelp, between tide marks, Lusitania Bay, 4.12.1931, col. B.A.N.Z.A.R. Expedition, no. 1668, station 82, dep. SAM.

REMARKS. Adults, protonymphs and a larva considered as belonging to this species, which was originally described from New Zealand, have been collected as above. The larva appears to be conspecific with the larva which was described as *Hydrogamasus (Austrohydrogamasus) watsoni* Hirschmann, 1966 (syn. *Parasitiphis jeanneli* (André)).

Genus LAELAPTIELLA Womersley

Laelaptiella Womersley, 1956a, p. 512. Type-species: *Laelaptiella anomala* Womersley, 1956a, by original designation.

DIAGNOSIS. Minute to small mites with shields not so extensive and dorsal idiosomal surface not so convex as most members of this subfamily. Ventro-anal shield fused to holonotal shield. Peritrematal shield not fused to exopodal IV shield. Exopodal III shield not split. Sterno-metasternal shield not fused to endopodal IV shield. Female movable cheliceral digit has 3 teeth. Pretarsus I subequal in size to other pretarsi. Genu IV with two ventral setae.

MORPHOLOGY

Sclerotization. Female: Holonotal fused to ventro-anal posterior to seta *Zv*3, anterior to which holonotal is widely separated from the ventro-anal. Discrete subcircular shield posterior to acetabulum IV. Peritrematal reduced, narrowly boardering peritreme and not fused to exopodal IV. Metapodal may be represented as part of small triangular posterior extension of exopodal IV. Exopodals without any splits. Sterno-metasternal fused to endopodals II and part of III. Two pairs of pre-endopodals.

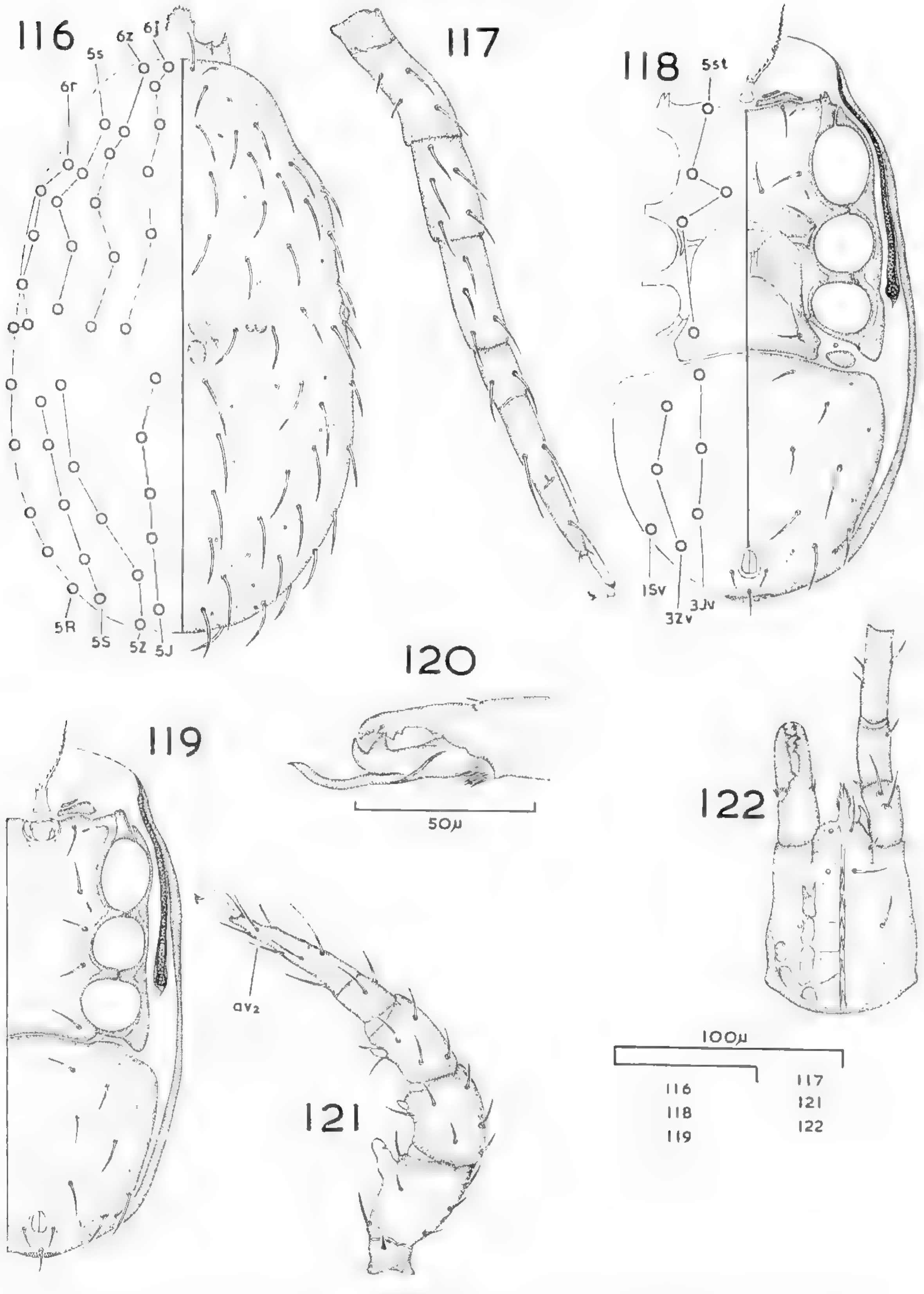
Male: Sternito-genital. Subcircular shield posterior to acetabulum IV is merged into ventro-anal. Otherwise as female.

Chaetotaxy. Idiosoma: *6j, 6z, 5s, 6r: 5J, 5Z, 5S, 5R; 5st: 3Jv, 3Zv, 1Sv.*

Legs: As *Gamasellus.*

Other Characters. Female: Deutosternal denticles in 7 horizontal rows of what are either single, large denticles or ridges without denticles that are acutely bent in the middle. Tectum anterior margin has a central process, with spinules along its broad, convex distal edge which is as wide as its base. Movable digit with 3 teeth. Palp attenuated and long. On palp genu, setae *al*1 and *al*2 spine-like. Dorsal setae simple, slightly lanceolate. Holonotal shield dimpled but not reticulated, while venter is reticulated, and all shields are shiny. Spermatheceal ringed tube opens near posterior paraxial edge of acetabulum IV, passing back to single, central sacculus. Pretarsus I similar in size to other pretarsi. Amongst dorsal setae on tarsus IV, seta *pd*3 is only just the longest.

Male: Movable cheliceral digit with one tooth, fused at base to longer spermadactyl. On leg II, femur seta *av*, genu seta *av*, tibia seta *av* enlarged into spurs.



Figs. 116-122. *Laelaptiella anomala* Womersley.

116-118, 122, female: 116, soma, dorsum; 117, leg IV (part), dorsum; 118, idiosoma, venter; 122, gnathosoma, venter. 119-121, male: 119, idiosoma, venter; 120, chelicera; 121, leg II (part).

DISTRIBUTION. Aa. All published records are with the original descriptions of nominal species. Specimens have been collected from Lord Howe Island and New Caledonia, dep. SAM.

Found in moss and plant litter.

REMARKS. Originally *Laelaptiella* had genus rank and was placed in the Ascidae. Domrow (1957b) transferred it to *Gamasiphis* as a subgenus, while Ryke (1962b) treated it as having genus rank when he included *Gamasiphis* and *Laelaptiella* in the Ologamasinae. The following 2 nominal species are included in the genus: *L. anomala* Womersley, 1956a; *L. mackerrasae* Domrow, 1957.

Laelaptiella anomala Womersley

Laelaptiella anomala Womersley, 1956a, p. 512.

FEMALE. Fig. 116-118, 122. Idiosomal length, 420μ.

MALE. Fig. 119-121. Idiosomal length, 370μ.

LOCALITY. Three females (N1968147-N1968149) and one male (N1968150) drawn or examined: Australia; LF30, litter under epacridaceous shrub amongst 'Bottle Brush' bushes and *Eucalyptus*, 8 miles north of Apsley, Victoria, 17.12.1964, col. D. C. Lee, dep. SAM.

The holotype (N1968278) and paratype (N1968279) females examined: Australia; Adelaide, South Australia, 6.1935, col. H. Womersley, dep. SAM.

Subfamily LAELAPTONYSSINAE Womersley

Laelaptonyssidae Womersley, 1956a, p. 543. Type-genus: *Laelaptonyssus* Womersley, 1956a.

REMARKS. Since this subfamily contains only two species grouped in a single genus, and the main function of this paper is to give diagnoses for genera, the characters of the known material are listed under the genus heading.

Genus LAELAPTONYSSUS Womersley

Laelaptonyssus Womersley, 1956a, p. 543. Type-species: *Laelaptonyssus mitis* Womersley, 1956a, by original designation.

Puchihlungia Samsinák, 1964, p. 39, **syn.n.** Type-species: *Puchihlungia chinensis* Samsinák, 1964, by original designation.

DIAGNOSIS. Average sized mites. Separate podonotal and opisthonotal shields. Reduced ventral shields; ventro-anal shield being narrow with a pair of small discrete shields posterior to metapodal shields and peritrematal shield reduced and discrete. The setation of the notum and legs reduced.

All setae are simple, tapered. Cheliceral digits attenuated and spermadactyl strongly recurved. Location of spermathecal ringed tube, if present, is unknown. Pretarsus I pedunculate and larger than other pretarsi.

MORPHOLOGY.

SCLEROTIZATION. Female; Separate podonotal and opisthonotal. Discrete, narrow ventro-anal, from which two small lateral shields have split off at level of seta *Jv*3. Discrete metapodal. Inconspicuous peritrematal around the peritreme and stigma which are subequal in size. Exopodals do not completely encase peraxial edges of acetabula. Sterno-metasternal either fused to endopodal II and part of III or discrete. Single pair of pre-endopodals, or they may be absent. *L. chinensis* illustrated in Fig. 2.

Male: Sternito-genital and more extensive peritrematal, otherwise as female.

CHAETOTAXY. Unusually variable and the homologies are uncertain. On the legs the variations from the chaetotaxy of *Gamasellus* do not follow the gradients indicated in the section on Leg Chaetotaxy (p. 13). For the leg chaetotaxy only numbers of setae on a segment are given below.

Idiosoma. *L. mitis*: 6*j*, 7 or 8*z*, 6*s*, 0*r*: 4 or 4 plus an unpaired *J*, 5*Z*, 4*S*, 0*R*: 4*st*: 3*Jv*, 3*Zv*, 0*Sv*.

L. chinensis: 5*j*, 5*z*, 3*s*, 0*r*: 5*J*, 5*Z*, 5*S*, 0*R*: 5*st*: 3*Jv*, 3*Zv*, 2*Sv*.

Legs. *L. mitis*: palp, 1*t*, 3*f*, 5*g*: leg I, 2*c*, 5*t*, 11*f*, 12 or 13*g*, 9*ti*: leg II, 2*c*, 6 or 7*t*, 10*f*, 10*g*, 7*ti*, 17*ta*: leg III, 2*c*, 5*t*, 8*f*, 9*g*, 6*ti*, 17*ta*: leg IV, 1*c*, 5*t*, 7*f*, 10*g*, 7*ti*, 17*ta* (seta *av*3 absent).

L. chinensis; palp, 2*t*, 5*f*, 6*g*: leg I, 2*c*, 5*t*, 11*f*, 11*g*, 11*ti*: leg II, 2*c*, 6*t*, 10*f*, 9*g*, 9*ti*, 18*ta*: leg III, 2*c*, 5*t*, 7*f*, 8*g*, 8*ti*, 18*ta*: leg IV, 1*c*, 5*t*, 6*f*, 7*g*, 8*ti*, 18*ta*.

OTHER CHARACTERS. Female: Tectum anterior margin with a long, narrow, central spine. Cheliceral digits unusually attenuated and movable digit with only 2 fine teeth or edentate. On palp genu, setae *al*1 and *al*2 are simple, tapered. On palp femur, seta *al* in proximal third or absent. Dorsal setae simple, tapered. No noticeable spermathecal ringed tube. Pretarsus I pedunculate and larger than other pretarsi. Pulvilli I-IV appear to have a single, large, bell-like lobe and claws are inconspicuous. Dorsal setae on tarsus IV subequal in length and setose.

Male: Movable cheliceral digit with one tooth or edentate and fused at base to strongly recurved spermadactyl that is similar length or more than three times as long. On leg II, femur seta *av* enlarged into a spur.

DISTRIBUTION. Os: Aa. Only records from Western Australia and Kanton Province, China.

Found associated with insects; *L. mitis* in a fly culture and *L. chinensis* on termites or in their nest.

REMARKS. When Womersley (1956a) established Laelaptonyssidae, containing only *Laelaptonyssus mitis*, he referred to it as being a "laelaptid". Samsinák (1964) described *L. chinensis* as the only species in *Puchihlungia*, which was regarded as belonging to the Rhodacaridae. Despite the reduced setation and, in one species, the reduced sternal sclerotization (cf. Halolaelapidae), I have retained Samsinák's (1964) concept of this genus being a rhodacarid on the basis of the apotele, idiosomal sclerotization and arming of the male leg II. But, *Laelaptonyssus* is considered unusual enough to be placed in a separate subfamily. The following 2 nominal species are included in the genus: *L. mitis* Womersley, 1956a; *L. chinensis* (Samsinák, 1964) **comb.n.** Allotype female (N1968284), three paratype females (N1968285-N1968287), holotype male (N1968288) and three paratype males (N1968289-N1968291) of *L. mitis* have been examined: Australia, from fly culture, Zoology Department, University of Western Australia, 10.1950, col. E. P. Hodgkin, dep. SAM. Paratype female, paratype male (N1968269) and paratype protonymph (N1968270) have been examined: China; off *Coptotermes formosanus* Shiraki, near Koa-ho, Kanton Province, 1963, col. K. Samsinák, dep. male and protonymph SAM, female in the collection of K. Samsinák.

Subfamily OLOGAMASINAE Ryke

Ologamasinae Ryke, 1962b (1st August), p. 159.

Gamasellinae Hirschmann, 1962 (August, assumed 31st by terms of the International Code of Zoological Nomenclature, 1961), p. 39.

Cyrtolaelapidae Berlese, *sensu* Johnston (in part), 1968, p. 19.

Type-genus: *Ologamasus* Berlese, 1888.

DIAGNOSIS. Minute to gigantic mites, with shields that range from being limited in extent and lightly sclerotized, to being extensive and heavily sclerotized. Holonotal shield or separate (or very rarely partially separated) podonotal and opisthonotal shields, in some cases both attributes of this character occur in members of the same genus or sexes of the same species. Ventro-anal shield may or may not be fused to the notal shield and this also varies within a genus or species. Peritrematal shield usually fused to the exopodal IV shield and often to the ventro-anal shield, although in most cases the latter fusion only occurs on males. Sclerotization often conspicuously sexually dimorphic. On the female sterno-metasternal shield a line joining setae *st*2, *st*3 and *st*4 would never enclose an angle of less than 95° except in some *Gamasellus discutatus*-complex species.

MORPHOLOGY.

SCLEROTIZATION. The size of shields and extent of the fusion between them varies considerably between species and often between the females and males of the same species. This sexual dimorphism usually appears as a more extensive sclerotization of the male venter, but in *Gamasellus discutatus*, some *Geogamasus* species and an unnamed *Heydeniella* species the female has a holonotal, while the male has a narrow fissure between the podonotal and opisthonotal, and on the male of *Geogamasus delamarei* and an unnamed *Hydrogamasellus* species there are lateral incisions partly separating the podonotal and opisthonotal, while in some males of the *Acugamasus punctatus*-complex a humeral section of the podonotal is partly separated from the rest and fused to the peritrematal. Conspicuous, wide spread sexual dimorphism of this type only occurs in species of this subfamily and the Rhodacarinae, and an aspect of it most commonly found in this subfamily, but not in other rhodacarids, is the fusion of the ventro-anal to the peritrematal of the male. Also the females of some species of Ologamasinae differ from all the females in the other subfamilies within the Rhodacaridae by having the ventro-anal fused to the peritrematal (*Cymiphis*, *Hiniphis*, *Periseius*, and some *Gamasellus falciger*-complex and *discutatus*-complex species). The following other sclerotization characters are fairly constant within the subfamily. Although the male ventro-anal is often fused to the notal, in the female this is not so except for the following groups: *Ologamasus*, *Cymiphis*, some *Heydeniella crozetensis*-complex and *Hydrogamasellus* species, and *Hiniphis* and *Pyriphis* species. Small intergenito-ventrals occur on some members of a number of genera. The peritrematal is fused to the notal anteriorly and exopodal IV posteriorly except for some species with unusually short peritremes (*Notogamasellus* and *Neogamasellevans* species) and for the males of most species of *Geogamasus*, *Parasitiphis* and *Litogamasus*. Exopodal III always split. The female metasternal is not fused to endopodal IV except for the following groups: *Cymiphis*, *Hiniphis*, and some *Heydeniella crozetensis*-complex species.

CHAETOTAXY. The number of setae on the idiosoma is very variable especially on the opisthosoma, which may also be hypertrichous or hypotrichous. The podosoma usually has between 20 and 22 pairs of setae dorsally and 5 pairs of setae ventrally, the few exceptions being for some species of Gamasellini. The leg chaetotaxy is fairly constant, but compared with *Gamasellus*, some species of Gamasellini may have an extra one or two setae on leg III and some Ologamasini may have one seta less on leg IV.

OTHER CHARACTERS. Tectum anterior margin can have many different shapes and may be sexually dimorphic. On palp genu, seta *al*1 is often pectinate or spatulate with a single lateral prong and seta *al*2 is often spatulate, as for the antero-lateral setae on the palp genu of some species of Sessiluncinae. On palp femur, seta *al* is generally on proximal third in contrast to Rhodacarinae, Tangaroellinae and some Sessiluncinae species, but on an unnamed *Litogamasus* species it is on central third. On the ventral surface of the podonotal shield of some species there are 4 light-refractile structures between seta *j*5 and *j*6. These structures also occur in the Rhodacarinae and may be strengthened areas of sclerotization to which muscles are attached. The female sternal seta *st*2, *st*3 and *st*4 are usually nearly in a straight line, and the smallest angle that would be contained by such a line is 95° except in some species of the *Gamasellus discutatus*-complex. The method of introduction of sperm into the female may vary considerably in this subfamily. According to Michael (1886 and 1892) the sperm is introduced directly into the vagina of *Euryparasitus emarginatus* and because of the similarity of the spermadactyls the same could be true for *Cyrtolaelaps*. On the other hand many species of Ologamasinae have structures looking like spermatheceal ringed tubes which usually open near the posterior paraxial edge of acetabulum IV, but on a number of other species (usually members of the Ologamasini) they open on the proximal segments of leg III and leg IV. Since these tubes cannot always be seen to be attached to a sacculus, data is needed to support their spermatheceal function and this is not yet available in many cases.

As commented on in the general section on Morphology (p. 13), within the Rhodacaridae there is often an association of three sets of attributes as follows: 'some complex dorsal setae—divided dorsal shield—dull sclerotization', or 'all simple dorsal setae—entire dorsal shield—shiny sclerotization'. This is particularly obvious in the Ologamasinae and although some species do not have an association of the attributes as given, these characters are the basis for distinguishing two tribes in this subfamily. The dullness appears to be caused by a covering of adhesive exudate with attached detritus and fungal hyphae in older specimens. In species where the exudate is thick, simple or lanceolate setae run parallel to the body surface, imbedded in the exudate, while pilose setae stick out through the exudate at right angles to the body surface. On species with a shiny sclerotization, the dorsal seta are rarely complex and detritus and fungal hyphae are not found attached to the mite.

Besides the conspicuous sexual dimorphism in sclerotization many other structures vary between the sexes in this subfamily, most of which are probably concerned with assisting the male keep its grip on the female during sperm transference. The male gnathosoma may have attenuated corniculi which are often on a protuberance of the hypostome, also there may be a ventral process on the palp (*Hydrogamasellus* and *Acugamasus natalensis*-complex) and the tectum may be different (*Ologamasus* and *Geogamasus* species). The anterior edge of the male podonotal shield may extend forward over the gnathosoma (some *Heydeniella* and *Euryparasitus* species). The enlargement of setae on leg II is usually more extensive than in other subfamilies and tarsus II may have ventral setae (*Parasitiphis, Cyrtolaelaps, Euryparasitus and Litogamasus* species) or dorsal setae (*Cymiphis, Geogamasus* and *Hydrogamasellus* species) enlarged into tubercles. Two littoral genera (*Parasitiphis* and *Litogamasus*) have the male legs III and IV enlarged and carrying setous or non-setous processes. Often the cuticular processes on the distal margins of the proximal segments of female legs III and IV are enlarged, but sometimes there are more conspicuous processes on the female legs (*Cymphis* and some *Heydeniella* and *Gamasellus discutatus*-complex species).

DISTRIBUTION. The subfamily is cosmopolitan, with 17 genera found only in the Southern Hemisphere. Three genera (*Cyrtolaelaps, Allogamasellus* and *Euryparasitus*) are only found in the Northern Hemisphere. The *Gamasellus falciger*-complex is the only group of closely related species found in moss, plant litter and soil that has a large number of species in both the Northern and Southern Hemispheres. *Periseius* and probably *Rhodacaroides* occur in both of these hemispheres. *Heydeniella goei* from the British Isles is the only species belonging to the Ologamasini that is not restricted to the Southern Hemisphere. Species are usually found in moss, plant-litter and soil, but some genera (*Cyrtolaelaps* and *Euryparasitus*) are usually found in animal nests or roosting places of bats while other genera (*Parasitiphis, Litogamasus* and *Periseius*) are usually found in the littoral zone and *Rhodacaroides* is either littoral or probably commoner in deeper soil layers.

REMARKS. Among the rhodacarids some members of the Ologamasinae are the most similar to the Parasitidae and Veigaiidae and therefore I would regard them as more like the ancestoral rhodacarids. Also, on the basis of the presence or absence of conspicuous sexual dimorphism, I would regard this subfamily as more closely allied to the Rhodacarinae than to the Gamasiphinae and Sessiluncinae. Therefore, I disagree with Johnston's (1968) transfer of members of this subfamily to another family, Cyrtolaelapidae, with the members of the Gamasiphinae and Sessiluninae, leaving only what are here regarded as members of the Rhodacarinae in the Rhodacaridae. This subfamily has the most species and genera, and its genera are the most difficult to delineate. The division of the subfamily into two tribes as presented here is probably no indication of its phylogeny but it is convenient and the use of the adult dorsal sclerotization to distinguish the groups resulting from such a division has precedent.

I recognize 2 tribes within this subfamily; Ologamasini and Gamasellini. Adults of these tribes, and the genera grouped in them, can be distinguished by the following key. The 3 species *incertae sedis* commented on at the end of this paper belong to the Ologamasinae and key out to their correct tribe, but not necessarily to the genus which they have been placed in for convenience.

KEY TO TRIBES AND GENERA OF OLOGAMASINAE

1. Usually holonotal shield. If separate or partially separate podonotal and opisthonotal shields (some *Geogamasus, Heydeniella* and *Hydrogamasellus* species), then single pair of pre-endopodal shields (as for all other members of this tribe except for *Neogamasellevans berlesei*), all dorsal setae superficially simple (may carry inconspicuous lateral prongs, but never have conspicuously pilose podonotal setae *j*4, *z*5 and *r*3 amongst simple setose or lanceolate setae which is also the case for all other members of this tribe except for *Pyriphis* species), pretarsus I pedunculate and seta *al*1 on palp genu has more than 5 lateral prongs . . . . Ologamasini, 2

   Usually separate podonotal and opisthonotal shields. If holonotal shield (some *Gamasellus discutatus*-complex species) then 2 or 3 pairs of pre-endopodal shields and podonotal setae *j*4, *z*5 and *r*3 are conspicuously pilose amongst simple setose or lanceolate setae. No species in this tribe has all the following characters: single pair of pre-endopodal shields; all dorsal setae superficially simple; pretarsus I pedunculate and seta *al*1 on palp genu with more than 5 lateral prongs Gamasellini, 10

2. Seta *al*1 on palp genu is spine-like or spatulate and never has more than 2 lateral prongs 3

   Seta *al*1 on palp genu always has more than 2 lateral prongs 6

3. Pretarsus I not pedunculate. Peritrematal shield reduced; on female narrows behind stigma before fusing with exopodal IV shield, on male terminates behind stigma without fusing to other shields . . . . *Parasitiphis*

   Pretarsus I pedunculate. Peritrematal shield substantial; on female broadens behind stigma before fusing with exopodal IV shield, on male extends back behind stigma to fuse with both exopodal IV and ventro-anal shields 4

4. Dorsal setae all simple. Female ventro-anal shield separate from notal shield and male ventro-anal shield fused to sternito-genital shield. Spermadactyl straight, running parallel to movable cheliceral digit . . . . *Rykellus*

   Some dorsal setae conspicuously pilose. Female ventro-anal shield fused to notal shield and if male ventro-anal shield fused to sternito-genital shield then spermadactyl recurved from point of attachment to movable cheliceral digit so that it nearly points in the opposite direction 5

5. Female sterno-metasternal shield fused to endopodal IV shield. Male sternito-genital shield not fused to ventro-anal shield. Spermadactyl approximately parallel to movable cheliceral digit . . *Cymiphis*

   Female sterno-metasternal shield not fused to endopodal IV shield. Male sternito-genital shield fused to ventro-anal shield. Spermadactyl recurved from point of attachment to movable cheliceral digit so that it nearly points in the opposite direction . . . . *Pyriphis*

6. Single pair of female pre-endopodal shields have paraxial margins subequal in length to distance between sternal setae *st*1 and *st*2, and ventro-anal shield not fused to notal shield. Peritreme short, not reaching forward to level of anterior margin of acetabulum III. Peritrematal shield not conspicuously fused to exopodal shields. Spermadactyl nearly straight . . . . *Neogamasellevans*

   If female pre-endopodal shield with paraxial margin subequal in length to distance between sternal setae *st*1 and *st*2, then ventro-anal shield fused to notal shield. Peritreme reaches forward beyond anterior margin of acetabulum III. If peritrematal shield not conspicuously fused to exopodal shields (some *Geogamasus* males), then spermadactyl able to coil up around 3 hinges 7

7. Podonotal setae in 22 pairs. Spermathecal ringed tube opens on coxa III or proximally on trochanter III. On male tarsus II, seta *ad*3 modified to tubercle 8

Podonotal setae in 20 or 21 pairs. Spermathecal ringed tube opens on coxa IV or distally on trochanter III. On male tarsus II, seta *ad*3 is setose 9

8. Spermathecal ringed tube opening proximally on posterior surface of trochanter III, often coiling in coxae III. Spermadactyl able to coil up around 3 hinges . . . . *Geogamasus*

Spermathecal ringed tube opening distally on dorsal surface of coxa III. Spermadactyl unable to coil up around 3 hinges . . . . *Hydrogamasellus*

9. Spermathecal ringed tube opening distally on dorsal surface of female trochanter III. If female ventro-anal shield fused to holonotal shield then sterno-metasternal shield fused to endopodal IV shield. Central spine on anterior edge of tectum comes to a single point. There are 20 pairs of podonotal setae. On male tarsus II, seta *av*2 may be modified to a spine . . . . *Heydeniella*

Spermathecal ringed tube opening distally on ventral surface of female coxa IV. Female sterno-metasternal shield not fused to endopodal IV shield although ventro-anal shield is fused to holonotal shield. Central spine on anterior edge of tectum is bifurcate at tip. There are 21 pairs of podonotal setae. On male tarsus II, seta *av*2 is setose . . . . *Ologamasus*

10. Podonotal shield conspicuously larger than opisthonotal shield and bearing 56-65 setae. Unpaired pre-anal seta about as close to anus as paranal setae . . . . *Notogamasellus*

Podonotal shield subequal in size to opisthonotal shield, or fused to it, and bearing up to 48 setae although usually 22 pairs of setae or less. No unpaired pre-anal seta near anus. 11

11. Well developed leg I, bearing stout spines (enlarged ventral and antero-lateral setae) on genu and tibia 12

Setae on genu and tibia of leg I not enlarged to stout spines 13

12. Anterior spine on genu I is seta *al*1. Pretarsus I absent. Single postero-lateral seta on genu III (2, 4/2, 1) and tibia III (2, 3/2, 1). Vertical setae (*j*1) on prominent protruberances . . . . *Evanssellus*

Anterior spine on genu I is seta *av*2. Pretarsus I present, although small compared with other pretarsi it has 2 claws. Two postero-lateral setae on genu III (2, 4/2, 2) and tibia III (2, 3/2, 2). Vertical setae (*j*1) not on prominent protruberances . . . . *Heterogamasus*

13. Ventro-anal shield separate from opisthonotal shield, but fused to peritrematal shield in both sexes. In female, metasternal shield fused to endopodal IV shield, although it may be separate from sternal, and in male, sternito-genital shield fused to ventro-anal shield . . . . *Periseius*

Rarely is ventro-anal shield both fused to peritrematal shield and separate from opisthonotal shield, and then only in females with metasternal shield separate from endopodal IV shield and in males with ventro-anal shield separate from sternito-genital shield 14

14. Pretarsus I present but not pedunculate. All dorsal setae with tapering tip. Female sclerotization reduced ventrally: sterno-metasternal shield never fused to more than endopodal II shield and the anterior half of endopodal III shield; discrete metapodal shields; peritrematal shield usually narrows behind stigma or at least is not so broad that it has a truncated posterior margin. Male chelicerae atypical: either fixed digit with dorsal groove (Fig. 362), or movable digit fused along its entire length to longer, stout spermadactyl (Fig. 331 and 343) 15

Pretarsus I, if present, usually pedunculate, if not, (*Gamasellus pyriformis*-complex) then some dorsal setae with spatulate tip, and female sclerotization not reduced ventrally as above. The male chelicerae not atypical as above 17

15. One or more pairs of pre-endopodal shields, if only one pair then female metasternal seta (*st*4) is on small discrete shield. Male fixed cheliceral

digit has dorsal groove, and spermadactyl is slim and fused to the movable digit at its base only . . . . *Litogamasus*

If pre-endopodal shields present, then one pair only and metasternal seta (*st*4) is on sterno-metasternal shield. Male fixed cheliceral digit without dorsal groove, and spermadactyl is stout and fused to the movable digit along the digit's entire length 16

16. Clearly defined pre-endopodal shields absent. Paranal seta anterior to centre of anus. Female setae *Jv*1 and *Zv*1, or just seta *Jv*1, are anterior to ventro-anal shield. Male tibia and tarsus II with articulated connection . . . . *Cyrtolaelaps*

Clearly defined pre-endopodal shields present. Paranal setae posterior to centre of anus. Setae *Jv*1 and *Zv*1 are on ventro-anal shield. Male tibia and tarsus II are rigidly fused together . . . *Euryparasitus*

17. Female ventro-anal shield fused to dorsal shield, and sterno-metasternal shield fused to endopodal IV shield. Male ventro-anal shield fused to sternito-genital shield. Two pairs of pre-endopodal shields. Peritrematal shield completely merged with the exopodal shields behind stigma . . . . *Hiniphis*

Female ventro-anal shield never fused to dorsal shield, and sterno-metasternal shield never fused to endopodal IV shield. If male ventro-anal shield fused to sternito-genital shield then there is a single pair of pre-endopodal shields and a fissure separates peritrematal from part of exopodal IV shield behind stigma 18

18. All dorsal setae simple, setose or spine-like, except that setae *j*1 and *z*1 may be slightly pilose . . . 19

At least some dorsal setae conspicuously pilose, and often lanceolate dorsal setae present 20

19. Dorsal setae, short, spine-like, with setae *j*1 and *z*1 the longest and slightly pilose. Three pairs of pre-endopodal shields . . . . *Allogamasellus*

Dorsal setae, fine and setose. One or two pairs of pre-endopodal shields . . . . *Rhodacaroides*

20. One pair of pre-endopodal shields 21
   Two or three pairs of pre-endopodal shields 22
21. On opisthonotal shield there are 60 or more setae, not all of which are paired, and there is at least one accessory seta between the *J* rows of setae. Male sternito-genital shield fused to ventro-anal shield . . . . *Pilellus*
   On opisthonotal shield there are 58 or fewer setae in pairs, and no accessory setae between the *J* rows of setae. Male sternito-genital shield not fused to ventro-anal shield . . . . *Acugamasus*
22. All dorsal setae on idiosoma and genu and tibia of legs II, III and IV are densely pilose along their entire length . . . . *Laelogamasus*
   Only some dorsal setae on idiosoma are densely pilose, and usually for only part of their length, while the dorsal setae on the genu and tibia of leg II, III and IV are not pilose . . . . *Gamasellus*

Tribe OLOGAMASINI Berlese

Ologamasinae Ryke, 1962b, p. 159. Type-genus: *Ologamasus* Berlese, 1888.

DIAGNOSIS. Minute to large mites. The following characters usually occur on adults of this tribe (exceptions are given in parenthesis). Holonotal shield (some *Geogamasus, Heydeniella* and *Hydrogamasellus* species). One pair of pre-endopodal shields (*Neogamasellevans berlesei*). Simple dorsal setae or, if complex, then single conspicuously complex setae are not surrounded by simple setae (*Pyriphis* species). Spermathecal ringed tube opens on proximal segments of legs III and IV (*Parasitiphis* and possibly *Neogamasellevans* species).

MORPHOLOGY.

SCLEROTIZATION. Usually holonotal, but may be separate or partially separate podonotal and opisthonotal as on some *Geogamasus, Heydeniella,* and *Hydrogamasellus* adults. Rarely more than one pair of pre-endopodals but may be 2 pairs as on *Neogamasellevans berlesei.*

CHAETOTAXY. Setation of the legs is as that of *Gamasellus,* except for many *Heydeniella* species and some *Hydrogamasellus* species which have only one ventral seta on genu IV (2, 5/1,1).

OTHER CHARACTERS. Usually, all dorsal setae are simple and setose, but they may be slightly pilose, while in some *Ologamasus* and all *Cymiphis* and *Pyriphis* species a number of dorsal setae are conspicuously pilose and may be spatulate. The tendency in the former two genera is for lateral and posterior dorsal setae to be larger and more pilose, and podonotal setae *z*3, *z*4 and *r*3 are never pilose amongst simple setae as in *Pyriphis* species. Female sternal setae are usually nearly in a straight line but never as on most Gamasiphinae species. Spermathecal ringed tubes may open near the posterior paraxial edge of female acetabulum IV (*Parasitiphis* and possibly *Neogamasellevans* species) but usually opening is probably on the proximal segments of legs III or IV.

DISTRIBUTION. Only one species, *Heydeniella goei*, belonging to this tribe has been found in the Northern Hemisphere. Many species have been found in the Southern Hemisphere. It is common in the Australian region, while its species constitute the bulk of rhodacarid material collected from the Neotropical region.

REMARKS. The Ologamasini is intended mainly for species with adults that have a single holonotal shield and usually simple dorsal setae. There is a precedent for this concept although it probably gives little indication of the phylogenetic relationship of the species. It may later prove more useful to limit this tribe to species in which the spermathecal ringed tube opens on the proximal segments of female legs III or IV. At the moment it is not easy to distinguish the females of three genera, *Ologamasus*, *Heydeniella* and *Hydrogamasellus*, because their diagnoses are based on the location of the external opening of the spermathecal ringed tube, a character which can be difficult to observe. But if both females and males of a species belonging to these genera are known, the placing of the species in the correct genus is much easier.

I recognize 9 genera within this tribe; *Ologamasus*, *Cymiphis*, *Geogamasus*, *Heydeniella*, *Hydrogamasellus*, *Neogamasellevans*, *Parasitiphis*, *Pyriphis*, and *Rykellus*. Also, two species, *incertae sedis* (*Neogamasellevans berlesei* and *Hydrogamasellus ubatubaensis*), commented on at the end of this paper, are placed in this tribe. Members of these genera can be distinguished by using the above key (p. 78).

Genus OLOGAMASUS Berlese

Ologamasus Berlese, 1888, p. 194 (not Berlese, 1906, p. 242 and *lapsus*, *Hologamasus* Berlese, 1892d, *inter page* 61 *et* 62 (bound between page 60 and 61). Type-species: *Gamasus aberrans* Berlese, 1888, by monotypy.

Ologamasellus Berlese, 1914, p. 139. Type-species: *Gamasus aberrans* Berlese, 1888, by original designation.

DIAGNOSIS. Small to average sized mites, always with extensive, well sclerotized shields. Always holonotal shield fused to ventro-anal shield, although the extent of this fusion may be limited. Male ventro-anal shield always fused to the exopodal IV shield and peritrematal shield. Sterno-metasternal shield is not fused to endopodal IV shield. Dorsal setae may be simple, pilose, spatulate or pilose and spatulate. Spermatheceal ringed tube opens distally on ventral surface of coxa IV. Pretarsus I pedunculate and smaller than other pretarsi. On male tarsus II, setae all setose.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal fused to ventro-anal, although fusion may be limited to area bearing aciculae posterior to anus. No discrete metapodal. Peritrematal fused to exopodal IV and may extend posterior to this as triangular shield which may be homologous with the metapodal. Split in exopodals II, III and IV. Sterno-metasternal fused to endopodal II and part of III. Single pair of pre-endopodals.

Male: Fusion of ventro-anal to holonotal similar to female or slightly more extensive. Peritrematal and exopodal IV fused to ventro-anal. Sternito-genital not fused to ventro-anal.

CHAETOTAXY. Idiosoma: *6j*, *6z*, *4s*, *5r*: *5J*, *5Z*, *5S*, *5R*: *5st*: *3Jv*, *3Zv*, 0 or *1Sv*.

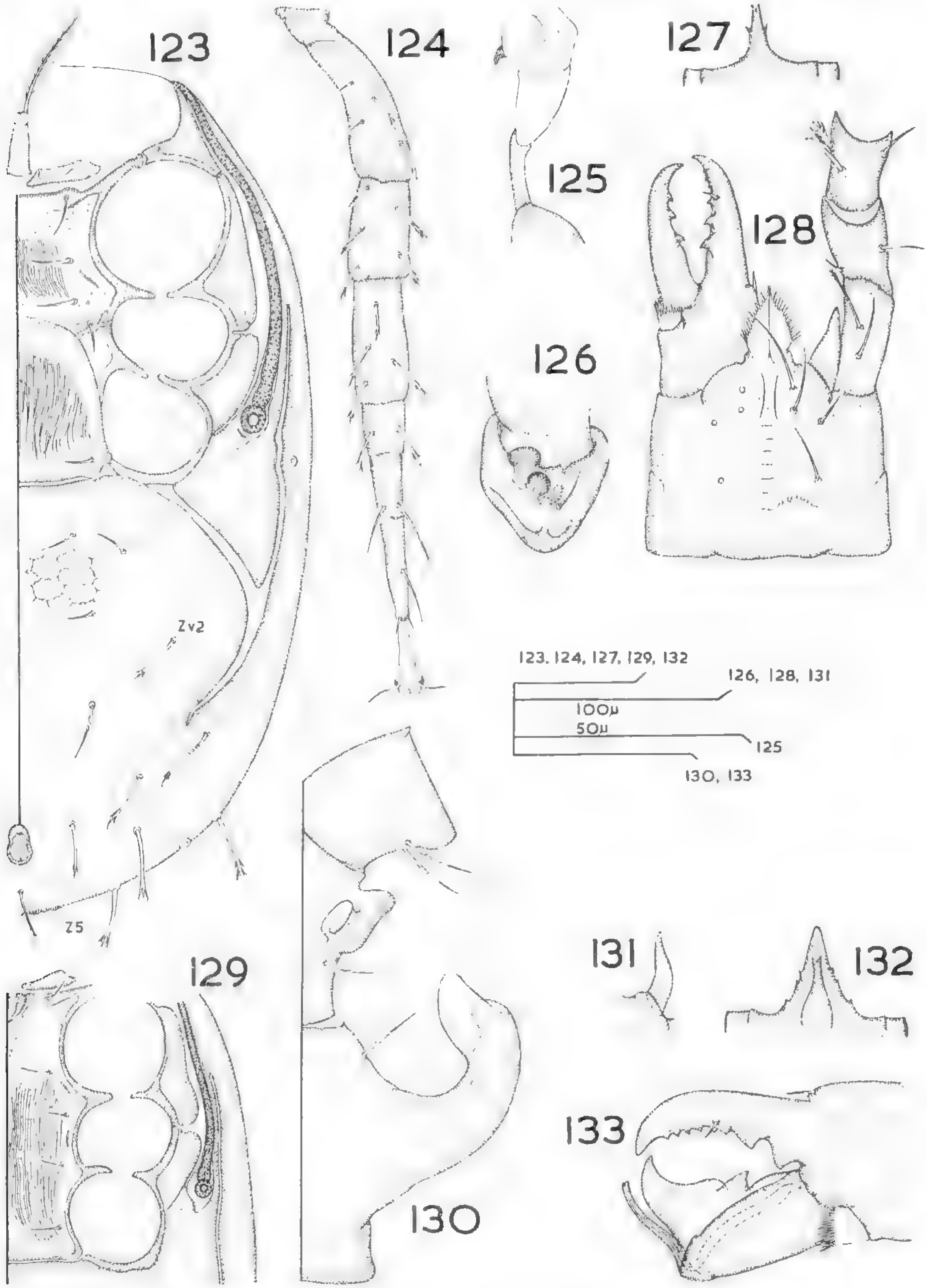
Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 8 or 9 horizontal rows. Tectum anterior margin basically unispinate, but spine is bifurcate at tip and has a spinule on each side. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 pectinate with 5 lateral prongs and seta *al*2 spatulate. Dorsal setae may be simple or spatulate or spatulate and pilose at tip. Shields apparently shiny. Usually genital and sometimes sternal shield with longitudinal striae. On coxa IV, just distal to ventral seta, there is the aperture of what is probably the spermatheceal ringed tube. Pretarsal sheath I on slim peduncle of similar length. Pulvilli II-IV with lateral lobes that are attenuated and long. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest, being either setose or spatulate.

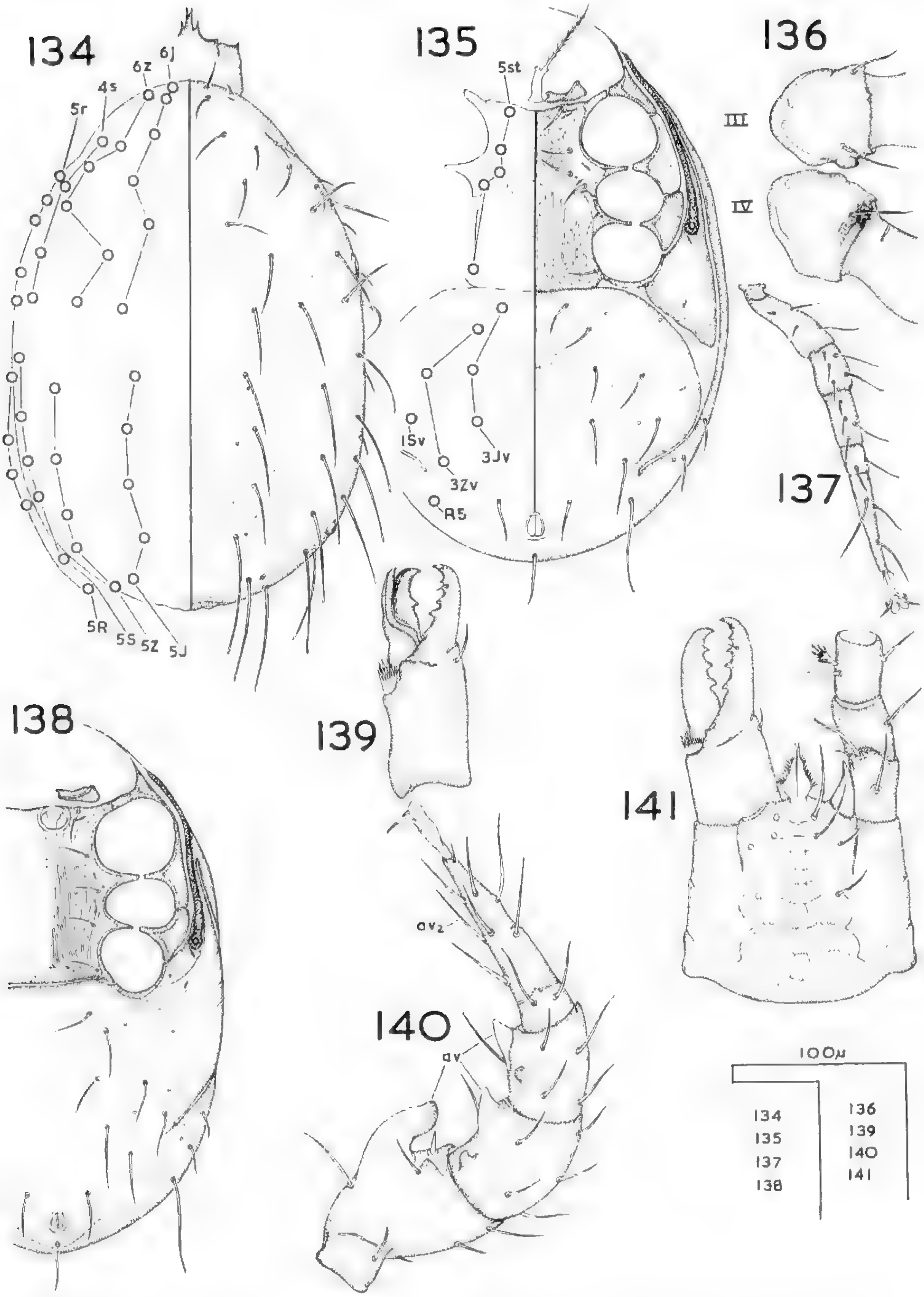
Male: Corniculi proportionately longer than on female. Tectum may be more complex than on female. Movable cheliceral digit with one tooth, and it may have a ventro-lateral groove opposite a spermadactyl that is subequal in length to digit. Sternito-genital shield with longitudinal striae. On leg II, femur seta *av* and sometimes seta *pv*1, genu seta *av* and sometimes tibia seta *av* enlarged into spur or spine. May be non-setous processes on these segments.

DISTRIBUTION. NTb, NTc. All records are from a region between the Mato Grosso in Brazil and La Plata in Argentina, occurring in a range similar to that covered by the locality records published with the original descriptions of nominal species in this genus.

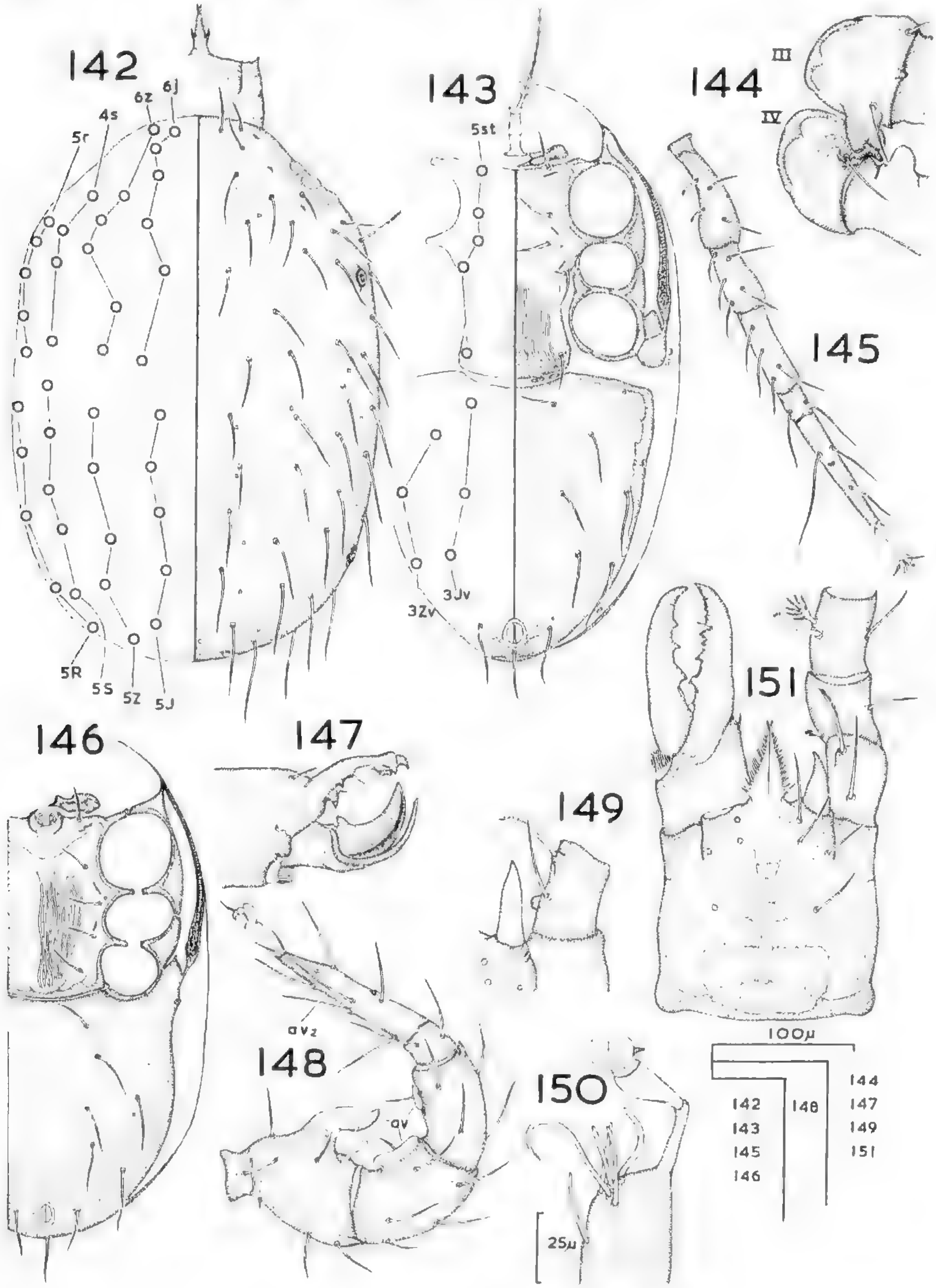
Found amongst plant litter on soil, or under stones or the bark of trees.



Figs. 123-133. *Ologamasus aberrans* (Berlese).
123-128, female: 123, idiosoma, venter; 124, leg IV (part), dorsum; 125, pretarsus I; 126, coxae IV, plus trochanter IV (part); 127, tectum; 128, gnathosoma, venter. 129-133, male: 129, podosoma, venter; 130, leg II (part), postero-latus; 131, corniculus; 132, tectum; 133, chelicera.



Figs. 134-141. *Ologamasus simplicior* (Berlese).
134-137 and 141, female: 134, soma, dorsum; 135, idiosoma, venter; 136, coxae III and IV plus trochanters (parts); 137, leg IV (part), dorsum; 141, gnathosoma, venter. 138-140, male: 138, idiosoma, venter; 139, chelicera; 140, leg II (part).



Figs. 142-151. *Ologamasus striolatus* (Berlese).

142-145 and 151, female: 142, soma, dorsum; 143, idiosoma, venter; 144, coxae III and IV plus trochanters (parts); 145, leg IV (part), dorsum; 151, gnathosoma, venter. 146-150, male: 146, idiosoma, venter; 147, chelicera; 148, leg II (part); 149, corniculus and palp trochanter; 150, pretarsus I plus tarsus I (part).

REMARKS. Because of the fusion of the female ventro-anal shield to the notal shield, *Ologamasus* has been confused with a very different genus, *Gamasiphis*, as indicated by a reference to the '*Ologamasus-Gamasiphis* group' in Ryke (1961b). Lee (1966) redefined this genus, placing in it species with a single holonotal shield in the female, complex dorsal setae and in some cases without fusion between the ventro-anal shield and the notal shield. This definition is revoked here, and the genus is used to contain species with females having what is probably a spermathecal ringed tube opening ventrally on coxa IV. So far the females of all the nominal species have the ventro-anal shield fused to the notal shield, but the extent of this fusion varies considerably and may be very limited. The form of the dorsal setae is also very variable and they may be mostly simple with only a few setae being inconspicuously pilose. Since some species of *Hydrogamasellus* are similar to species in *Ologamasus* and other *Hydrogamasellus* species are similar to *Heydeniella* species, alloting a species to one of these three genera can be difficult, especially when only the female is known and the probable spermathecal ringed tube is indistinct. The following 3 nominal species are included in this genus: *O. aberrans* (Berlese, 1888); *O. simplicior* (Berlese, 1914); *O. striolatus* (Berlese, 1916a).

Ologamasus aberrans (Berlese)

Gamasus aberrans Berlese, 1888, p. 194.

FEMALE. Fig. 123-128. Idiosomal length, 730μ. Dorsal setae difficult to examine, but podonotal setae mostly shaped as seta *Zv*2, or simpler, while opisthonotal setae as seta *Z*5. Proximal segments of leg IV drawn (Fig. 124) belong to the right side while the tarsus belongs to the left side.

MALE. Fig. 129-133. Idiosomal length, 700μ. On leg II, only seta *av* on femur and genu are enlarged into spurs. The posterior process of femur seta *av* is quite thick although lightly sclerotized. All setae on tarsus II are setose.

LOCALITY. The 'tipico' female (9/16), and 'tipico' male (9/1), drawn, also 'cotipico' female (215/28), and 2 'tipico' males (9/16), examined: Brazil; under the bark of trees, Mato Grosso, col. A. Balzan, dep. SEAF.

Ologamasus simplicior (Berlese)

Ologamasellus simplicior Berlese, 1914, p. 140.

FEMALE. Fig. 134-137 and 141. Idiosomal length, 620μ. Pretarsus I with peduncle that is proportionately shorter and broader than that of *O. aberrans*.

MALE. Fig. 138-140. Idiosomal length, 580μ. Tectum similar to that of female.

LOCALITY. Female (N1968255) and male (N1968256) drawn, and female and 3 males examined: Argentina; in dark place among humus, fallen leaves and rotten wood, 9 de Julio Park, Tucumán City, 1953, col. P. Wygodzynsky dep. SAM (N1968255 and N1968256) and BM(NH) (other 4 specimens).

The 'tipico' female (165/45) and 'tipico' male (165/45) examined: Argentina; La Plata, col. Bruck, dep. SEAF.

Ologamasus striolatus (Berlese)

Ologamasellus striolatus Berlese, 1916a, p. 163.

FEMALE. Fig. 142-145 and 151. Idiosomal length, 750μ. Three raised, oval areas on podonotal shield anterior to seta *r*2, appear to have many fine pores. Berlese's specimens have peritrematal shield more completely fused to exopodal shield IV and processes on coxae III and IV are not so big.

MALE. Fig. 146-150. Idiosomal length, 720μ. Tectum similar to that of female. On Berlese's specimens, seta *pv*1 on femur II shorter and fatter.

LOCALITY. Female (N1968257) and male drawn, and 2 females examined: Argentina; rotten vegetable matter (chiefly corn stalks, grass and twigs), vacant lot, Tucumán City, 1.1953, col. P. Wygodzynsky, dep. SAM (N1968257) and BM(NH) (other 3 specimens).

The 'tipico' female (170/16), 'tipico' male (170/16), and female (170/49), and three males (170/49, 170/17 and 215/27) examined: Argentina; under stones, La Plata, col. Bruck, dep. SEAF.

Genus CYMIPHIS **gen.n.**

Type-species: *Ologamasus cymosus* Lee, 1966.

DIAGNOSIS. Minute to large mites, always with extensive, well sclerotized shields. Holonotal shield always extensively fused to ventro-anal shield. Male and sometimes female peritrematal shield fused to ventro-anal shield. Sterno-metasternal shield is fused to endopodal IV shield. Dorsal setae may be simple, pilose or pilose and slightly spatulate. Spermathecal ringed tube probably opens distally on antero-lateral surface of coxa IV. Pretarsus I pedunculate and smaller than other pretarsi. Conical, non-setous spur on ventral surface of female femur II and sometimes on femur III and, or IV. On male tarsus II, seta *ad*3 modified to a short spine or tubercle.

MORPHOLOGY.

Sclerotization. Female: Holonotal fused to ventro-anal. Peritrematal fused to exopodal IV and it extends to point posterior to this as triangular shield which may be homologous with the metapodal. Peritrematal may also be fused to ventro-anal. Split in exopodals II, III and IV. Sternometasternal fused to endopodals II, III and IV. Single pair of pre-endopodals.

Male: Peritrematal fused to ventro-anal. Sternito-genital not fused to ventro-anal.

Chaetotaxy. Idiosoma: *6j, 6z, 5s, 4r:* 4 or *5J, 5Z, 4S,* 4, 6 or *7R: 5st: 3Jv, 3Zv, 1Sv.*

Legs: As *Gamasellus.*

Other Characters. Female: Deutosternal denticles in 7 horizontal rows. Tectum anterior margin is basically trispinate but may have lateral spinules, which may be large enough to make margin quinquispinate. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 with single lateral prong and both setae *al*1 and *al*2 slightly spatulate. Some dorsal setae may be simple, but pilose or pilose and spatulate setae always present. Shields dull and usually covered with reticulations. Spermathecal ringed tube is often not easy to locate, but in some species a tube clearly opens distally on the antero-lateral surface of coxa IV. Pretarsus I pedunculate and smaller than other pretarsi. Conical, non-setous spur on femur II and sometimes on femur III and, or IV. Pulvilli II-IV with lateral lobes that are attenuated and long. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest, and at least slightly lanceolate or pilose.

Male: Corniculi may be proportionately longer than in female. Movable cheliceral digit with 1 tooth or 3 teeth as in female, and fused at base to stout, slightly longer spermadactyl. On leg II, femur setae *av* and *pv*, genu seta *av* and sometimes tibia seta *av* enlarged into spurs, while on tarsus, seta *ad*3 modified to a short spine or tubercle.

DISTRIBUTION. An: Sa. All published records are with the original descriptions of nominal species.

Found in moss and plant litter.

REMARKS. Six out of the seven *Cymiphis* species were originally described as belonging to the '*cymosus*-group' in *Ologamasus* by Lee (1966). *Cymiphis* is similar to *Ologamasus*, but there are a number of morphological differences, besides the absence of lateral prongs on seta *al*1 on the palp genu used in the key to Ologamasinae genera, which are found only on these species from New Zealand and near by islands. The following 7 nominal species are included in this genus: *C. cymosus* (Lee, 1966) **comb.n.**; *C. dumosus* (Lee, 1966) **comb.n.**; *C. leptosceles* (Lee, 1966) **comb.n.**;

C. mansoni (Lee, 1966) **comb.n.**; *C. nucilis* (Lee, 1966) **comb.n.**; *C. validus* (Lee, 1966) **comb.n.**; *C. watsoni* (Hirschmann, 1966) **comb.n.** for *Gamasiphis watsoni* Hirschmann, 1966.

Genus GEOGAMASUS **gen.n.**

Type-species: *Geogamasus skoshi* **sp.n.**

DIAGNOSIS. Minute or small mites, only the male having extensive shields. May be holonotal shield or separate or partially separate podonotal and opisthonotal shields. Female ventro-anal shield never fused to notal shield and peritrematal shield only fused to notal shield by a narrow anterior strip. Male ventro-anal shield and peritrematal shield broadly fused to notal shield. Sterno-metasternal shield is not fused to endopodal IV shield. Dorsal setae simple or larger setae may be inconspicuously pilose. Spermathecal ringed tube opens at proximal end of trochanter III. Spermadactyl able to coil up around three hinges. Pretarsus I pedunculate and smaller than other pretarsi. On male tarsus II, seta *ad*3 modified to a tubercle.

MORPHOLOGY.

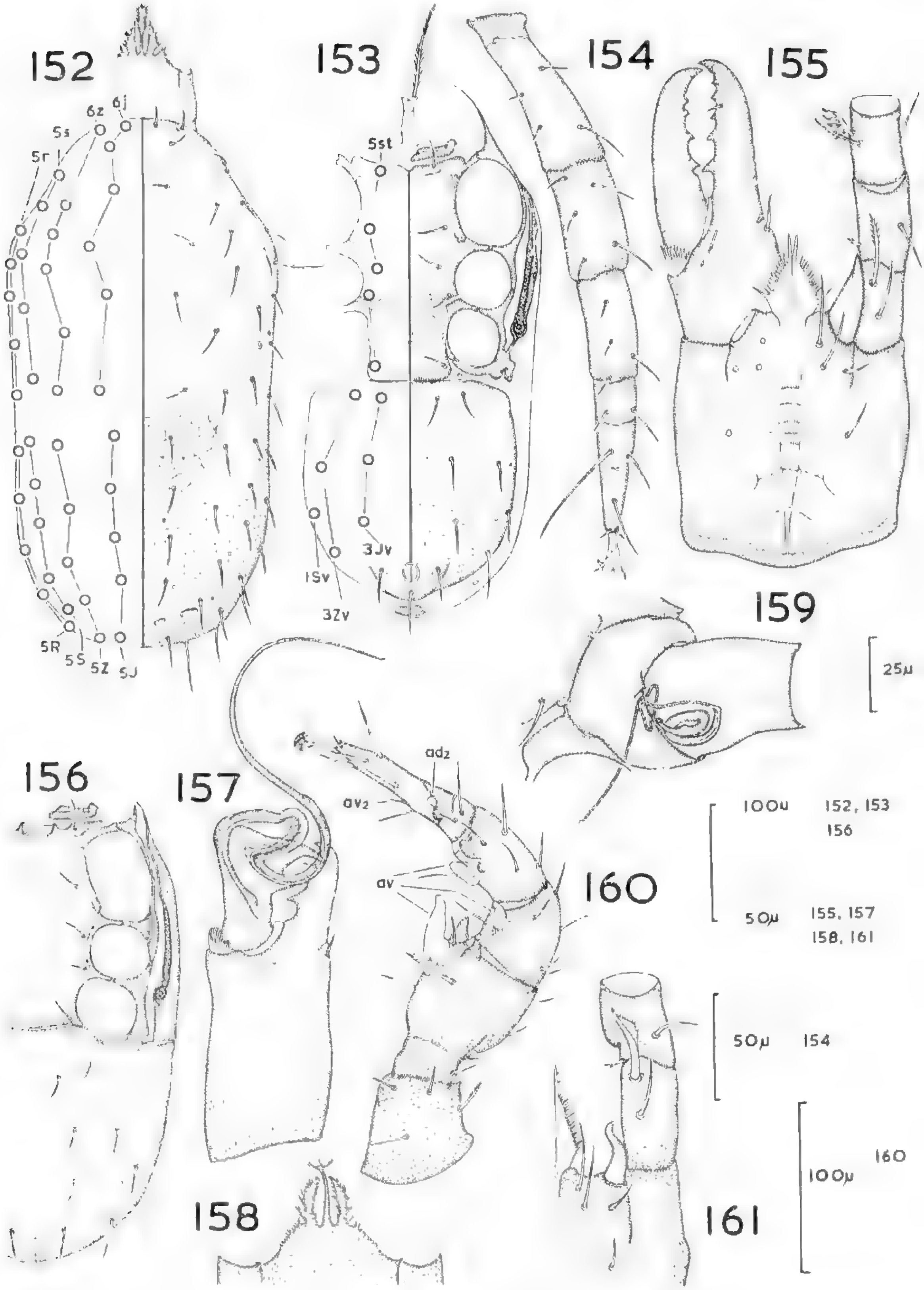
SCLEROTIZATION. Female: Holonotal or separate podonotal and opisthonotal. Discrete ventro-anal. Small, discrete shield only bearing aciculae. Small shield with pore, which is either discrete or fused to exopodal IV, may be regarded as metapodal. Peritrematal reduced and narrowly fused to exopodal IV. Split in exopodal III and there may be split in exopodal IV. Sterno-metasternal fused to endopodal II and part of III. Single pair of pre-endopodals.

Male: Notal may be as female, or, if holonotal on female, male may have separate or partially separate podonotal and opisthonotal. Ventro-anal fused to opisthonotal, exopodal IV, sometimes to peritrematal, but not sternito-genital. Peritrematal fused to notal along its entire length.

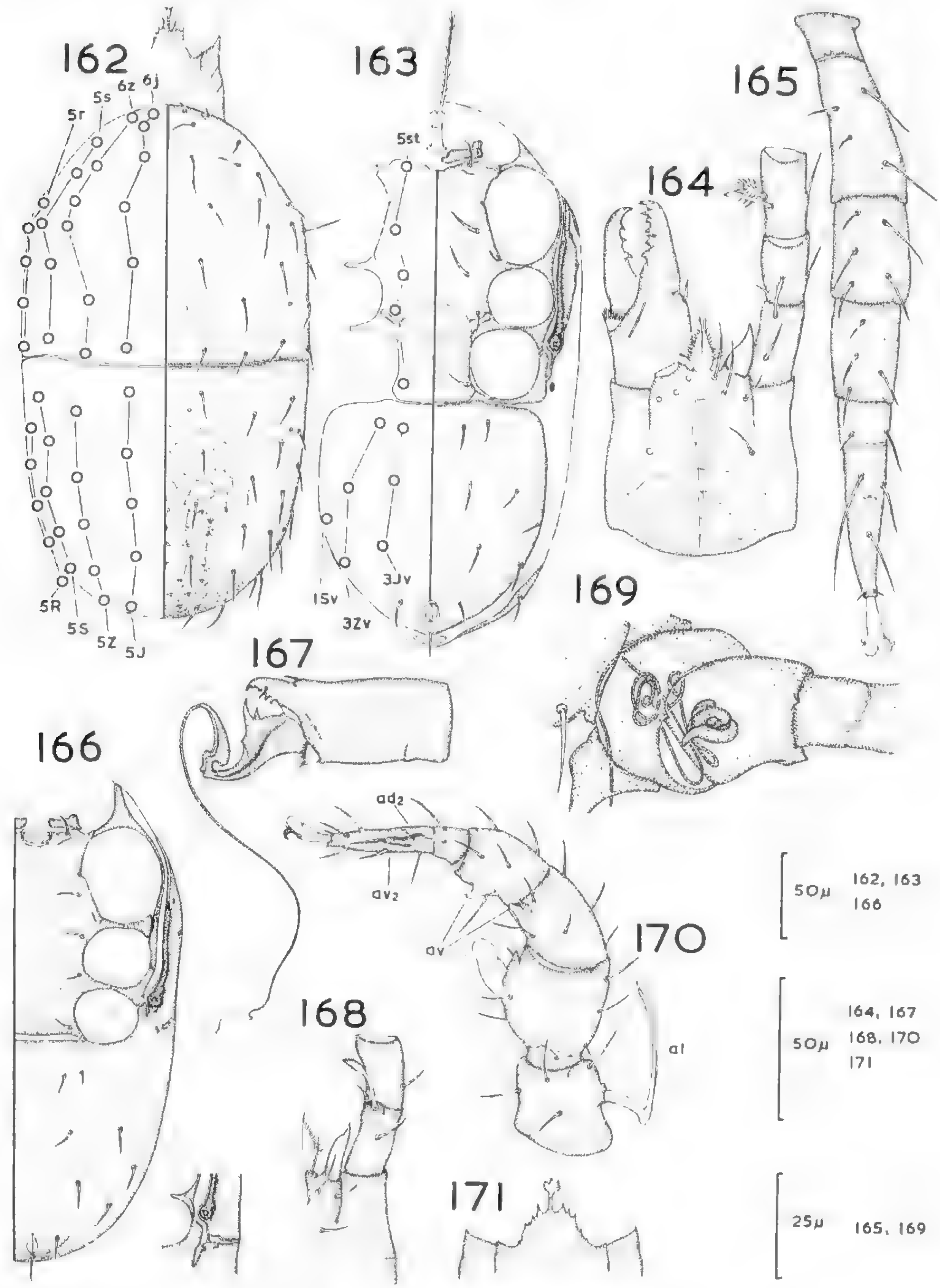
CHAETOTAXY. Idiosoma: *6j*, *6z*, 4 or *5s*, 4 or *5r*: *5J*, *5Z*, *5S*, *5R*: *5st*: *3Jv*, *3Zv*, *1Sv*.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin basically trispinate with central spine broader distally, and spinules may make the margin complex. Movable digit with 3 or 4 teeth. On palp genu, seta *al*1 with 5 to 10 lateral prongs, and seta *al*2 spatulate. Dorsal setae tapering, simple or slightly pilose. Shields shiny or pale. Spermathecal ringed tube probably opens proximally on postero-lateral surface of trochanter III and usually coils around within coxa III. Pretarsus I pedunculate and smaller than other pretarsi. Pulvilli



Figs. 152-161. *Geogamasus skoshi* sp.n..
152-155 and 159, female: 152, soma, dorsum; 153, idiosoma, venter; 154, leg IV (part), dorsum; 155, gnathosoma, venter; 159, spermathecal ringed tube in coxa and trochanter III. 156-158, 160 and 161, male: 156, idiosoma, venter; 157, chelicera; 158, tectum; 160, leg II (part); 161, gnathosoma and palp (part), venter.



Figs. 162-171. *Geogamasus howardi* sp.n..
162-165 and 169, female: 162, soma, dorsum; 163, idiosoma, venter; 164, gnathosoma, venter; 165, leg IV (part), dorsum. 169, spermathecal ringed tube in coxa and trochanter III. 166-168, 170 and 171, male: 166, idiosoma, venter; 167, chelicera; 168, gnathosoma and palp (part), venter; 170, leg II (part); 171, tectum.

II-IV with lateral lobes lanceolate and slightly longer than central circular lobes, or short and inconspicuous. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest and setose.

Male: Corniculi attenuated and long compared with female. Tectum differs from female. Movable cheliceral digit with single tooth or no teeth and broadly fused to long sinuous spermadactyl, which can coil up around 3 hinges. Palp setae may be modified compared with female. On leg II, femur seta *av*, genu seta *av*, tibia seta *av* and tarsus seta *ad*3 enlarged to spurs or tubercles, there are also non-setous processes, and other setae may be modified.

DISTRIBUTION. NTe: Aa. All published records are with the original descriptions of nominal species.

Found in moss and plant litter.

REMARKS. Of the first two *Geogamasus* species described, the one with a single adult holonotal shield was placed in *Hydrogamasus* and the one with separate podonotal and opisthonotal shields was placed in *Gamasellus*. Both species were placed in *Gamasellus* (*Hydrogamasellus*) by Hirschmann (1966) who defined the subgenus *Hydrogamasellus* as having females and males with one dorsal shield. Athias-Henriot (in press) refers to species of *Queenslandolaelaps* from South America which probably belong to this genus. The location of the opening of the spermathecal ringed tube and the form of the spermadactyl in this genus are unique among rhodacarids. If these characters are disregarded there are many similarities between this genus and *Neogamasellevans*. The following 4 nominal species are included in this genus: *G. skoshi* **sp.n.**; *G. coxalis* (Sheals, 1962) **comb.n.**; *G. delamarei* (Sheals, 1962) **comb.n.**; *G. howardi* **sp.n.**.

Geogamasus skoshi sp.n.

FEMALE. Fig. 152-155, 159. Idiosomal length, 450μ.

MALE. Fig. 156-158, 160, 161. Idiosomal length, 410μ. The notal shield is similar to the female excepting that the podonotal and opisthonotal shield are separate, the lateral extremity of the fissure being shown on the drawing of the venter (Fig. 156). Seta *ad*3 (Fig. 160) is labelled "*ad*2".

LOCALITY. The holotype female, allotype male, paratype female (N1968215) and paratype male (N1968216) drawn or examined: South America; University grounds, Tucumán, Argentina, 11.1957, col. P. Wygodzynsky, dep. holotype and allotype in BM(NH) paratypes in SAM.

REMARKS. The female of this species can be distinguished from *G. coxalis* and *G. howardi* by its entire dorsal shield, and from *G. delamarei* by its sterno-metasternal shield which is more extensive posteriorly, lying close to endopodal IV shield. The male is very similar in the distribution of shields to both of the other two nominal males (paratype male of *G. delamarei*, 1961.6.20.18, dep BM(NH), has been examined and it has the podonotal shield and opisthonotal shield partially separated by lateral incisions and the peritrematal shield is separate from the exopodal shields except posterior to stigma). The male can be distinguished from that of *G. delamarei* by the podonotal and opisthonotal shields being completely separated by a fissure, and also by having a tooth on the movable cheliceral digit and lacking the process on the spermadactyl and movable digit which is present on *G. delamarei*. The male can be distinguished from that of *G. howardi* by seta *al* on femur II not being enlarged, bent and spatulate.

Geogamasus howardi sp.n.

FEMALE. Fig. 162-165, 169. Idiosomal length, 300μ.

MALE. Fig. 166, 168, 170, 171. Idiosomal length, 270μ. The inset drawing of the region around the stigma in Fig. 166, shows part of a less sclerotized specimen. Seta *ad*3 (Fig. 170) is labelled "*ad*2".

LOCALITY. The holotype female (N1968217), allotype male (N1968218), 3 paratype females (N1968219, N1968220 and another) and 2 paratype males (N1968221 and another) drawn or examined: Australia; plant litter and soil, *Pinus radiata* forest, Mt. Burr, South Australia, 30.5.1966, col. G. W. Howard, dep. SAM (N1968217-N1968221) and BM(NH) (other 2 specimens).

REMARKS. The female of this species can be distinguished from *G. skoshi* and *G. delamarei* by its having separate podonotal and opisthonotal shields and from *G. coxalis* by the complex coiling of its spermathecal ringed tube. The male is easily recognized by seta *al* on femur II being enlarged, bent and spatulate.

Genus HEYDENIELLA Richters

Heydeniella Richters, 1907, p. 281. Type-species: *Heydeniella crozetensis* Richters, 1907, by monotypy.

DIAGNOSIS. Small to large mites, with a considerable range in the extent and sclerotization of shields. Holonotal shield except for the male of an unnamed species belonging to the *crozetensis*-complex, which has a separate podonotal and opisthonotal shield. Usually ventro-anal shield of female not fused to the notal shield, while on male it is fused to notal shield, but such a fusion may not occur in either sex or it may occur in both sexes. If female ventro-anal shield fused to the notal shield, then the sterno-metasternal shield also fused to the endopodal IV shield. Male ventro-anal shield always fused to the exopodal IV shield and peritrematal shield. Dorsal setae always simple. Spermathecal ringed tube opens distally on dorsal surface of trochanter III. Pretarsus I pedunculate and conspicuously smaller than other pretarsi. On male tarsus II, seta *av*2 may or may not be spine-like.

REMARKS. *Heydeniella* was established to contain one species. *H. crozetensis*, and was regarded as synonymous with *Gamasiphis* by Trägardh (1907) when he described the male of a new species as *Gamasiphis loricatus*. In fact, neither of these species belong to *Gamasiphis*, and they probably both belong to *Heydeniella*. Unfortunately, the type-species of this genus has been lost, but the description of it (Richters, 1907) is complete enough for it to be likely that a neotype can be designated when further collections have been made on the Crozet Islands. It is certain that the type-species belongs to the Ologamasini and it is likely that it is closely allied to a group of species with less extensive shields on the female, the *dentata*-complex, that are common in Australia and New Zealand. All females of the *dentata*-complex have a spermathecal ringed tube that opens distally on trochanter III. Species have been examined from the antipodean Sub-antarctic Islands that appear to have a spermathecal ringed tube opening distally on trochanter III, are similar to the *dentata*-complex species, and in some cases have extensive shields on the female similar to those described for *H. crozetensis*. I have, therefore, assumed that the spermathecal ringed tube opens distally on the female trochanter III of *H. crozetensis*, and I am using *Heydeniella* to contain only species with this character though it also occurs in *Pyriphis* species.

I recognize 2 species-complexes within this genus, *crozetensis*-complex and *dentata*-complex, which can be distinguished by the following key. The morphology and distribution of what are assumed to be members of this genus are given under the species-complex headings.

KEY TO SPECIES-COMPLEXES OF *HEYDENIELLA*

1. On palp genu, if seta *al*2 broadens distally it is spatulate, broadening out to suboval shape, and seta *al*1 often has less than 12 lateral prongs . . . . *crozetensis*-complex

   On palp genu, seta *al*2 cuneate, broadening out in distal half to inverted subtriangular shape, and seta *al*1 always has at least 12 lateral prongs . . . . *dentata*-complex

CROZETENSIS-complex

DIAGNOSIS. As for genus. On palp genu, seta *al*2 lanceolate or spatulate. Spermadactyl always fused to movable cheliceral digit throughout section level with proximal tooth.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal which may or may not be fused to ventro-anal. If ventro-anal is fused to holonotal then it is usually also fused to peritrematal. Aciculae may be on ventro-anal or on small discrete shield. There is sometimes a small shield lateral to anterior margin of ventro-anal which may be regarded as a metapodal. Exopodals II, III and IV split. Sterno-metasternal fused to endopodal II and part of III or, in species with ventro-anal fused to holonotal, it is fused to endopodal II, III and IV. Single pair of pre-endopodals.

Male: Rarely there is a separate podonotal and opisthonotal. Ventro-anal may or may not be fused to notal, and sternito-genital, but it is always fused to peritrematal and exopodal IV.

CHAETOTAXY. Idiosoma: *6j*, *6z*, *4s*, *4r*: *5J*, *5Z*, *5S*, *5R*: *5st*: *3Jv*, *3Zv*, *1Sv*.

Legs: As *Gamasellus* or rarely with one less ventral on genu IV (2, 5/1, 1).

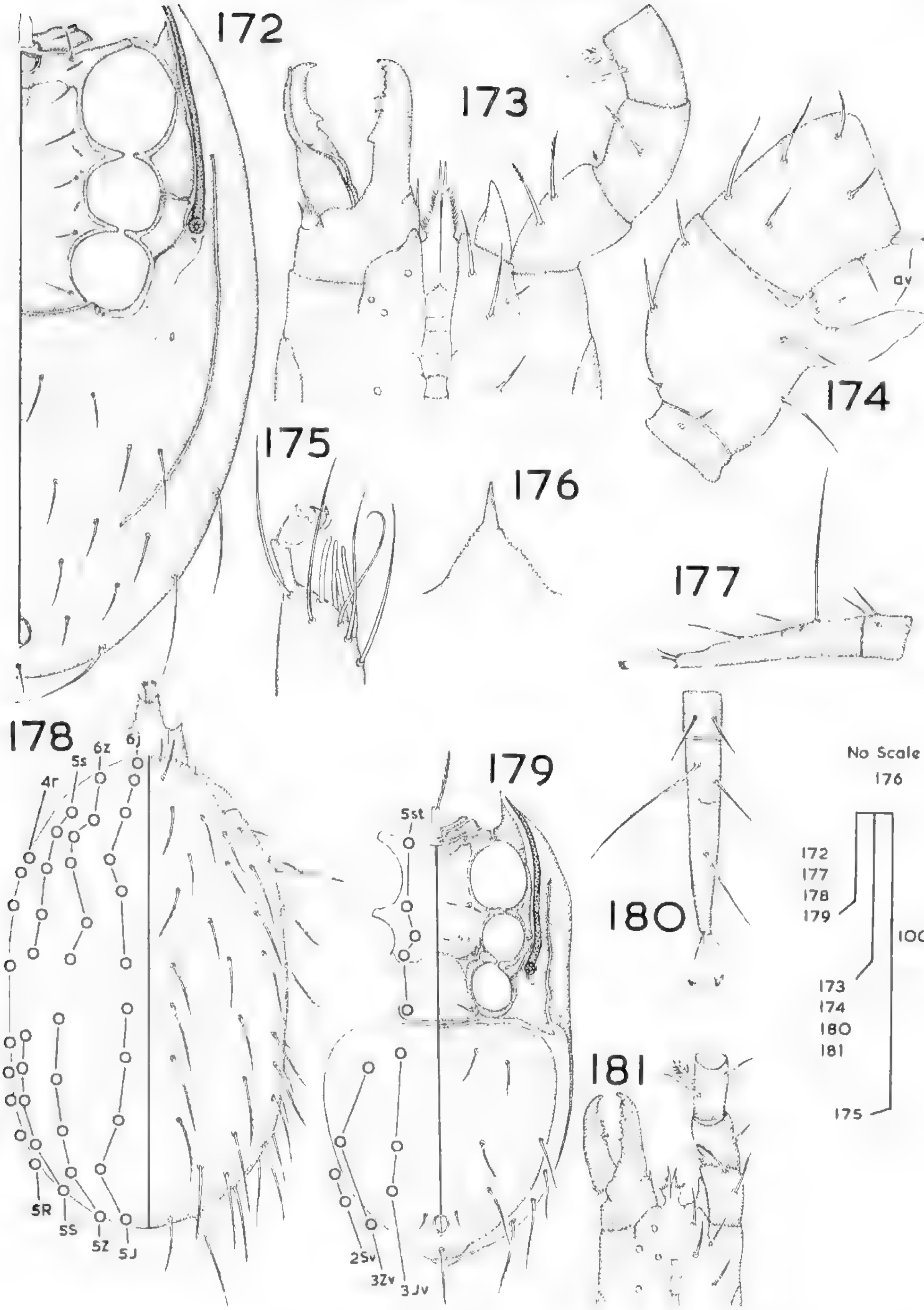
OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin either basically unispinate with lateral spinules or trispinate. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 pectinate with 3 to 12 lateral prongs and seta *al*2 is usually spatulate but may be lanceolate. Dorsal seta simple, tapering. Shields shiny. Spermathecal ringed tube is considered to open distally on dorsal surface of trochanter III. Pretarsus I pedunculate and smaller than other pretarsi. Pulvilli II-IV with lateral lobes that are usually attenuated and longer than central circular lobes. Amongst dorsal setae on tarsus IV, setae *pd*3 is setose and at least twice as long as any other seta.

Male: Corniculus slightly attenuated compared with female. Movable cheliceral digit with 1 tooth, or rarely 2 teeth, and fused to similarly shaped spermadactyl that is subequal in length or slightly longer or shorter. The spermadactyl is fused to the movable digit along most of its length in some species, and always as far as section level with proximal tooth. On leg II, femur seta *av* is always enlarged into a conspicuous spur, but femur seta *pv*1, genu seta *av* and tibia seta *av* may be enlarged into a spine or spur. Seta *av*2 on tarsus II is not conspicuously spine-like.

DISTRIBUTION. Sm, Sk, Sa. Besides the locality records published with the original descriptions of the two nominal species I have examined unnamed species from Auckland and Campbell Islands to be dep. BBM.

Found amongst lichens, moss or plant litter, or under stones.

REMARKS. The *crozetensis*-complex contains species that may have much more extensive shields on the female than on the females of the *dentata*-complex, while other species may be difficult to distinguish from



Figs. 172-181.
172-177, *Heydeniella loricata* (Trägårdh), male: 172, idiosoma, venter; 173, gnathosoma, venter; 174, femur and genu II; 175, pretarsus I and tarsus I (part); 176, tectum; 177, tarsus IV, antero-latus. 178-181, *Neogamasellevans berlesei* (Womersley), female: 178, soma, dorsum; 179, idiosoma, venter; 180, tarsus IV, dorsum; 181, gnathosoma, venter.

members of the *dentata*-complex. The unnamed species from Auckland and Campbell Islands, which I have examined and regard here as being members of the *crozetensis*-complex, are a morphologically diverse group of species. When the latter species, the type-species and possibly other unknown species have been described or redescribed, it may be found that it is not expedient to split this genus into the two species-complexes delineated here. The reason for the division given here is to separate the well known nominal species, which represent a successfully, large group of species in the Australian region, from the poorly known species from the Subantarctic region, which I may have incorrectly allied to *H. crozetensis* because I know so few of the latter's characters. The following 2 nominal species are included in this species-complex: *H. crozentensis* Richters, 1907; *H. loricata* (Trägårdh) **comb.n.** for *Gamasiphis loricatus* Trägårdh, 1907. Six unnamed species from Auckland and Campbell Islands are described by Hunter and Lee (manuscript), dep. BBM.

Heydeniella crozetensis Richters

Heydeniella crozetensis Richters, 1907, p. 281.

FEMALE. Fig. none. Approximate length, 1,120μ. Tectum anterior margin basically unispinate with lateral spinules. Movable cheliceral digit with 3 teeth. Holonotal shield fused to ventro-anal shield. Peritrematal shield fused to exopodal shield and although it extends posterior to this fusion it does not fuse with ventro-anal as in two unnamed species with fused holonotal and ventro-anal shields from Auckland and Campbell Islands. Split in exopodals II, III and IV. Sterno-metasternal shield fused to exopodal shields II, III and IV. Single pair of pre-endopodal shields. Idiosomal setae short.

MALE. Fig. none. Approximate length, 1,120μ. Movable cheliceral digit with 1 tooth and fused at base to similarly shaped but slimmer and shorter spermadactyl. Ventro-anal shield broadly fused to all surrounding shields except perhaps the sternito-genital shield. On leg II, femur seta *av* is enlarged into a spur which is not wide at the distal end as on the *Hydrogamasellus* males, and some setae on the genu and tibia are spine-like.

LOCALITY. Possession Island, one of the Crozet Islands in the kerguelenian Subantarctic region, col. German Antarctic Expedition, 1901-1903.

REMARKS. The types of this species, and other mites collected by the same Expedition, were probably destroyed with the rest of Richter's collection, by the British Army occupying Germany just after the Second World War (Sellnick, personal communication, 24.4.1966). The above description is based only on Richter's original description, which is accompanied by a photograph of the female venter.

Heydeniella loricata Trägårdh, **comb.n.**

Gamasiphis loricatus Trägårdh, 1907, p. 10.

FEMALE. Not known.

MALE. Fig. 172-177. Idiosomal length, 810μ. The sclerotization is similar to that of *H. crozetensis* except that the sternito-genital shield is certainly not fused to the ventro-anal shield. The chaetotaxy of the holonotum has not been reconstructed from the fragments of this part of the idiosoma. All idiosomal setae are simple and the range of their lengths does not extend beyond that of those drawn (Fig. 172). Except for the centre of the podonotal shield most shields bear reticulations. Setae on tibia and tarsus II are simple, unmodified.

LOCALITY. The holotype male drawn: Falkland Islands; under stone, east of Port Stanely, 25.2.1902, col. Swedish South Polar Expedition of 1901-1903, dep. NRS.

DENTATA-complex

DIAGNOSIS. As for genus, except there is always a holonotal shield, and the female ventro-anal shield always discrete and sterno-metasternal shield never fused to endopodal IV shield. On palp genu, seta *al*2 cuneate. Spermadactyl never fused to movable cheliceral digit throughout section level with proximal tooth.

MORPHOLOGY.

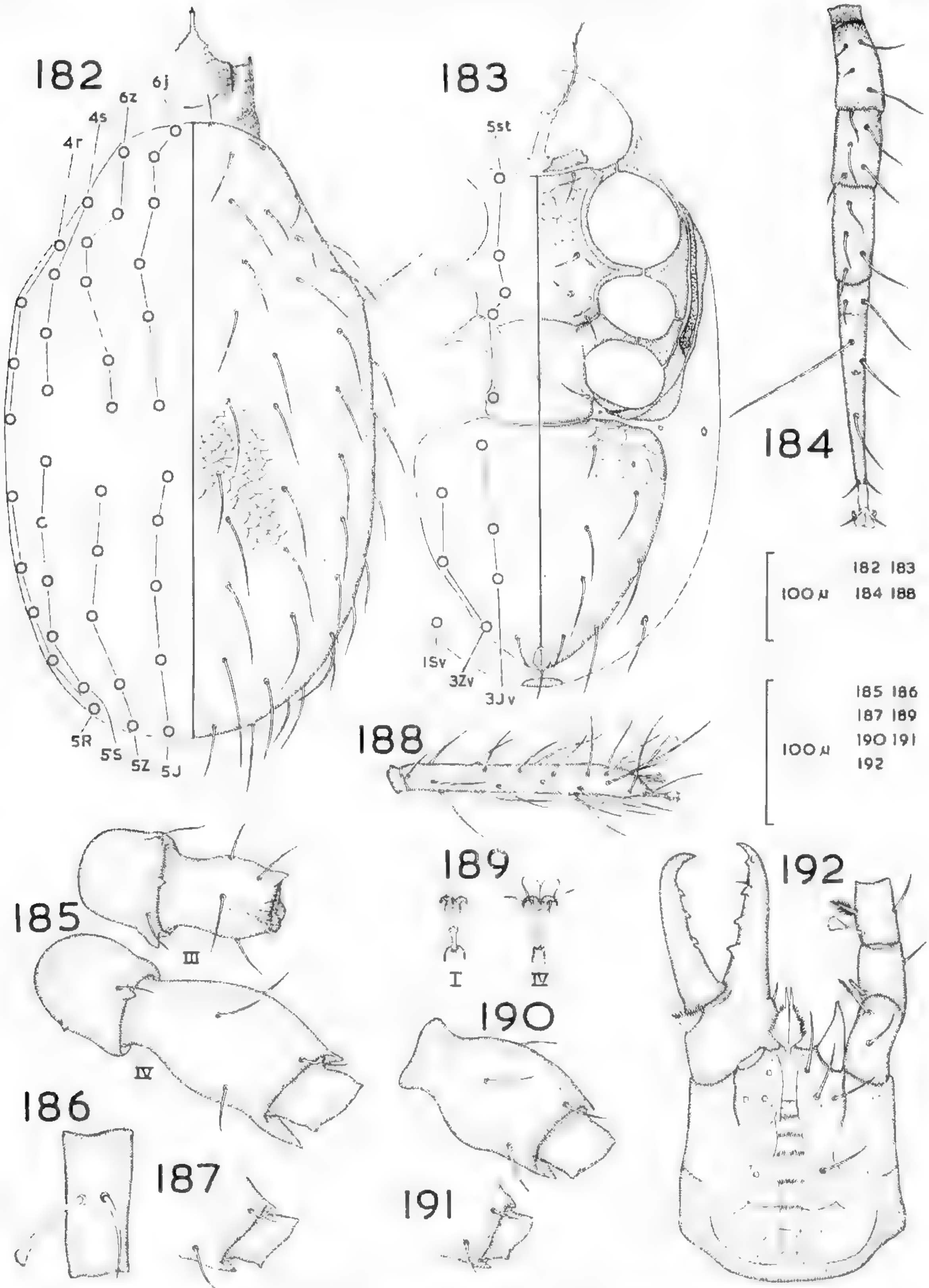
SCLEROTIZATION. Female: Holonotal. Ventro-anal discrete. Aciculae on small discrete shield. Metapodal may be discrete or included in ventro-anal. Peritrematal fused to exopodal IV. Exopodals II, III and IV split. Sterno-metasternal fused to endopodal II and much of III. Single pair of pre-endopodals.

Male: Ventro-anal usually fused to holonotal, always fused to peritrematal and exopodal IV, and separate from sternito-genital.

CHAETOTAXY. Idiosoma: *6j, 6z, 4s, 4r*: *5J, 5Z, 5S, 5R*: *5st*: *3Jv, 3Zv, 1Sv*.

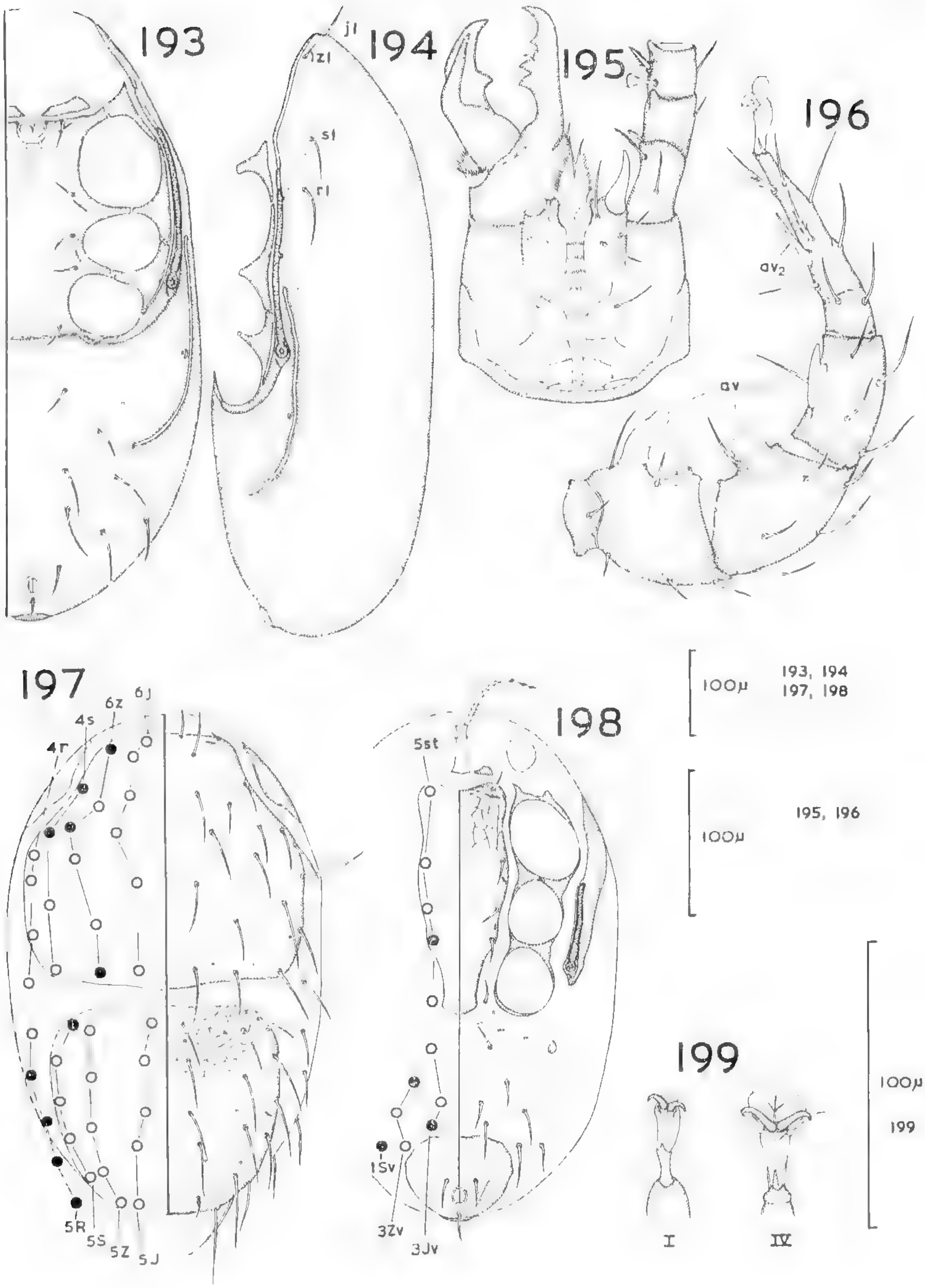
Legs: Only on the single species from the Northern Hemisphere is it as *Gamasellus*, usually there is one less ventral on genu IV (2, 5/1, 1).

OTHER CHARACTERS. Female: Deutosternal denticles in 6, 7 or 8 horizontal rows. Tectum anterior margin unispinate with prominent, narrow central spine, and spinules on or near spine. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 pectinate with at least 12 lateral prongs and seta *al*2 broadly cuneate in distal half. Dorsal setae simple, tapering. Shields shiny, usually reticulated, but may be smooth centrally on sternum and podonotum. Spermathecal ringed tube opens distally on



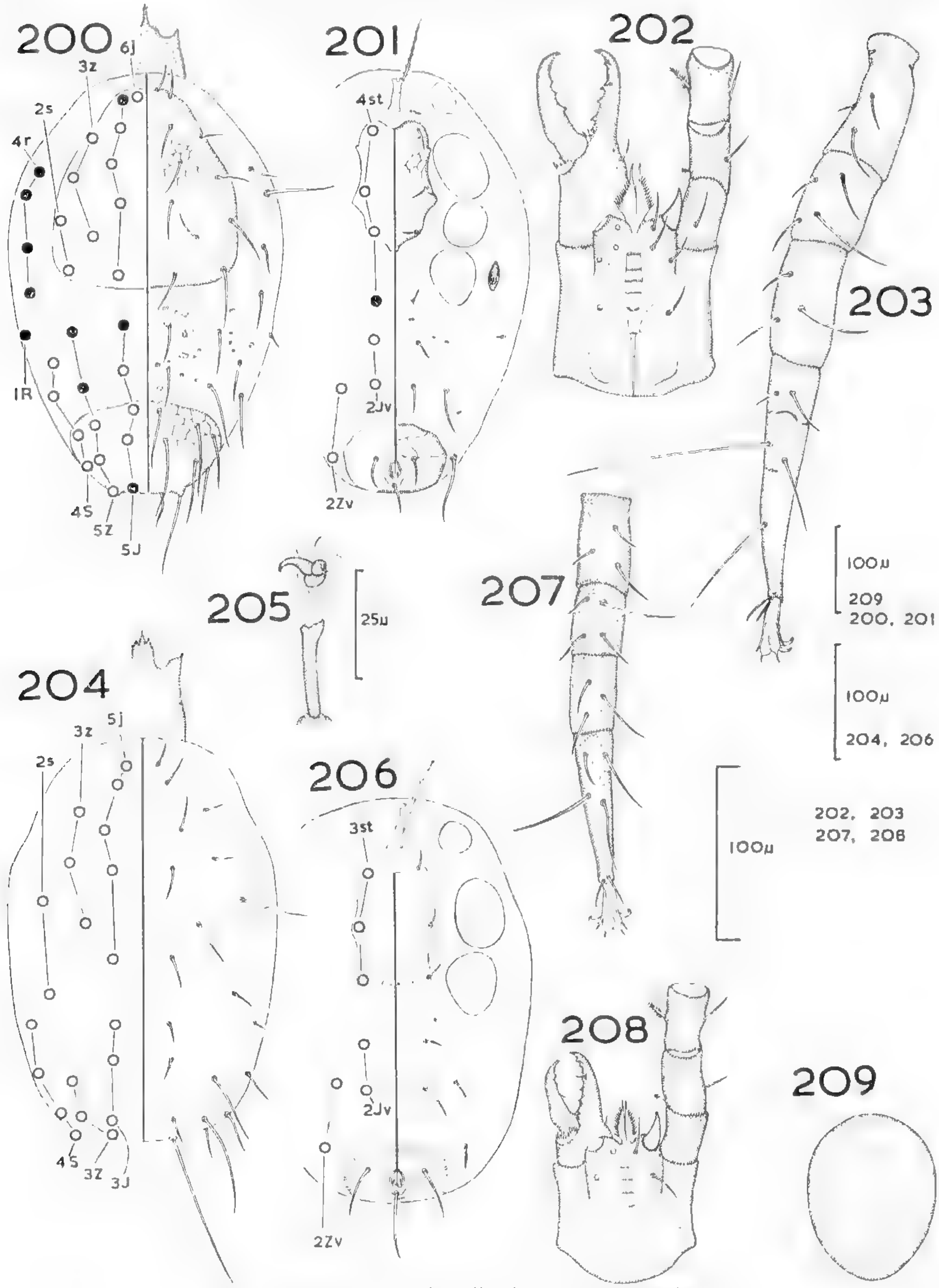
Figs. 182-192. *Heydeniella dentata* (Womersley).

182-186, 188-190 and 192, female: 182, soma, dorsum; 183, idiosoma, venter; 184, leg IV (part), dorsum; 185, coxa and trochanter III and IV; 186, ventral setae on tibia IV; 188, tarsus I; 189, pretarsus I and IV; 190, trochanter IV of specimens from Wilmington; 192, gnathosoma, venter. 187 and 191, male: 187, trochanter-femur IV joint; 191, trochanter-femur IV joint of specimens from Wilmington.



Figs. 193-199. *Heydeniella dentata* (Womersley).

193-196, male: 193, idiosoma, venter; 194, idiosoma, latus; 195, gnathosoma, venter; 196, leg II (part). 197-199, deutonymph: 197, idiosoma, dorsum; 198, idiosoma, venter; 199, pretarsus I and IV.



Figs. 200-209. *Heydeniella dentata* (Womersley).
200-203, protonymph: 200, soma, dorsum; 201, idiosoma, venter; 202, gnathosoma, venter; 203, leg IV (part), dorsum. 204-208, larva: 204, soma, dorsum; 205, pretarsus I; 206, idiosoma, venter; 207, leg III (part), dorsum; 208, gnathosoma, venter. 209, egg.

dorsal surface of trochanter III. Pretarsus I pedunculate and smaller than other pretarsi Pulvilli II-IV with lateral lobes always attenuated and longer than central circular lobes. Proximal segments on legs III and IV often have non-setous processes. Amongst dorsal setae on tarsus IV, seta *pd*3 is setose and at least twice as long as any other seta.

Male: Corniculus slightly attenuated compared with female, and on a raised base. Movable digit usually with 1 tooth, but it has 2 teeth on a single species from the Northern Hemisphere, and fused at base to spermadactyl of similar length, but may be slightly longer or shorter. Spermadactyl is never fused with movable digit as far as section level with proximal tooth. On leg II, femur seta *av* and *pv*1, genu seta *av*, tibia seta *av* and tarsus seta *av*2 enlarged into spurs or spines, may also be non-setous spurs on femur, genu and tibia.

DISTRIBUTION. Pe: Aa, An. All records are published with the original descriptions of the nominal species. Many unnamed species have been seen from Australia, Lord Howe Island, New Caledonia and New Zealand, dep. SAM.

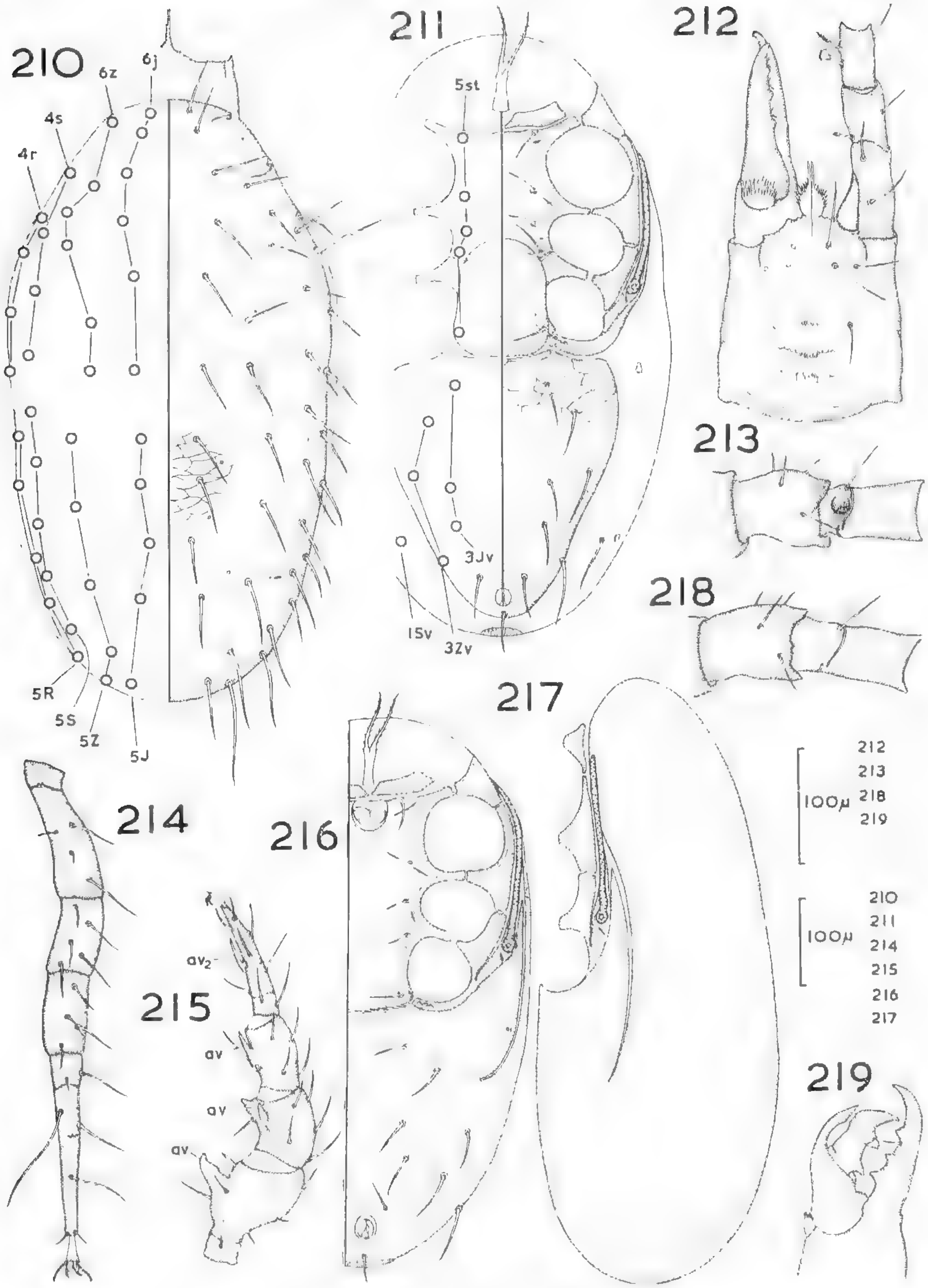
Found in moss, plant litter and soil. The single species from the Northern Hemisphere was found amongst mould in a chalk mine.

REMARKS. The first four *dentata*-complex species described were placed in *Hydrogamasus*, then Hirschmann (1966) realized that these species are not congeneric with the type of that genus and placed them in a new subgenus, *Gamasellus* (*Hydrogamasellus*), for which the type was *G.* (*H.*) *antarcticus*. The species of the *dentata*-complex differ from *H. antarcticus* in having the spermathecal ringed tube opening distally on trochanter III and the dorsal seta *ad*3 on the male tarsus II not being enlarged. Since only a few characters of *H. crozetensis* (type-species of *Heydeniella*) are known, the placing of the *dentata*-complex in *Heydeniella* is tentative and results from the study of unnamed species from Auckland and Campbell Islands which are here considered as belonging to the *crozetensis*-complex. The following 6 nominal species are included in this species-complex: *H. dentata* (Womersley, 1942) **comb.n.**; *H. australica* (Womersley, 1942) **comb.n.**; *H. goei* **sp.n.**; *H. markmitchelli* **sp.n.**; *H. relata* (Womersley, 1942) **comb.n.**; *H. relicta* (Womersley, 1942) **comb.n.**. The species *H. relicta* has a variety *major* Womersley, 1942.

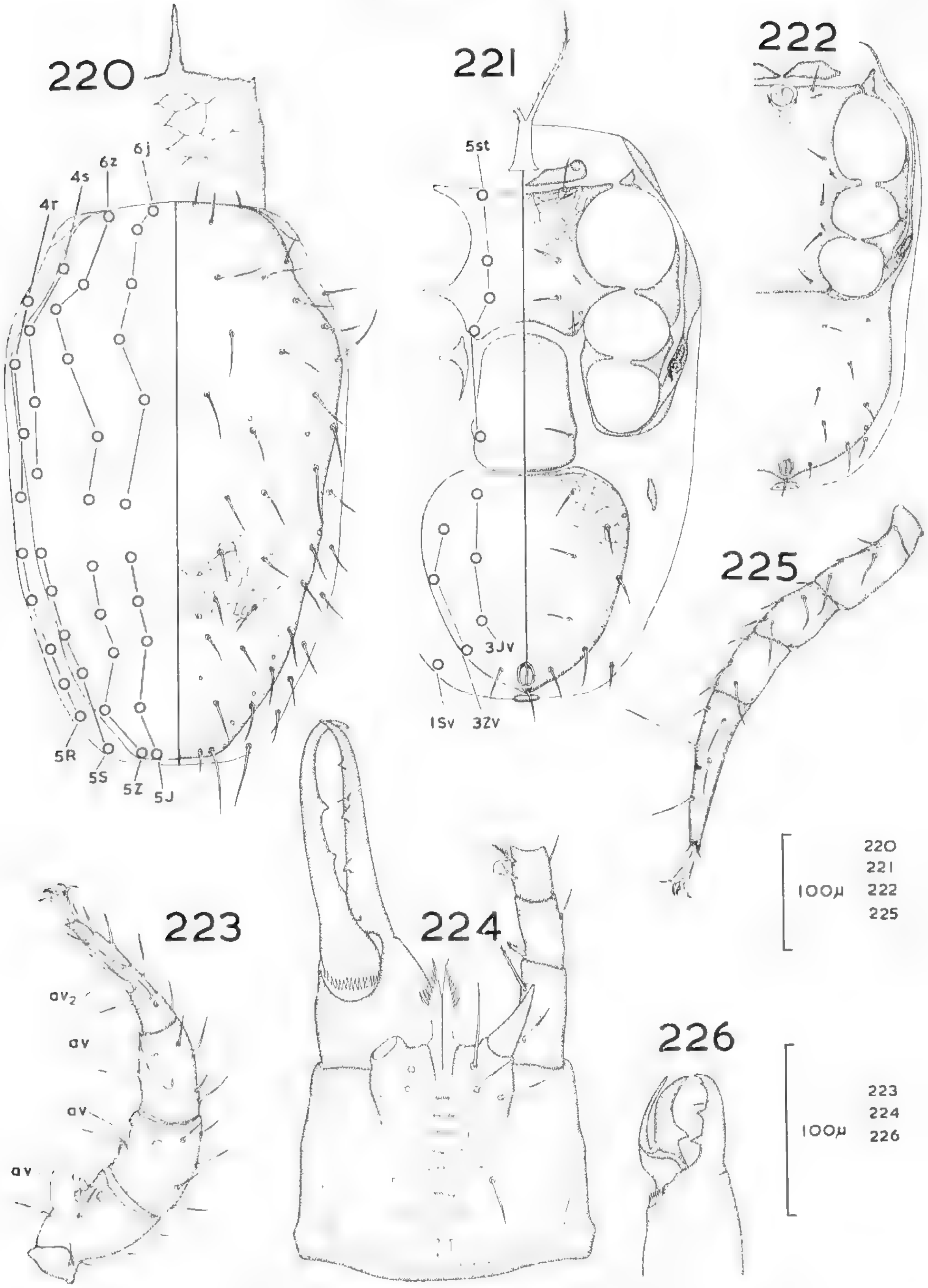
Heydeniella dentata (Womersley) **comb.n.**

Hydrogamasus dentatus Womersley, 1942, p. 149.

FEMALE. Fig. 182-186, 188-190 and 192. Idiosomal length, 700μ. The leg chaetotaxy differs from *Gamasellus* in having only one ventral seta on genu IV (2, 5/1, 1). Specimens from the Flinders Ranges and the



Figs. 210-219. *Heydeniella goei* sp.n..
210-214, female: 210, soma, dorsum; 211, idiosoma, venter; 212, gnathosoma, venter; 213, trochanter and femur III; 214, leg IV (part), dorsum. 215-219, male; 215, leg II (part); 216, idiosoma, venter; 217, idiosoma, latus; 218, trochanter and femur III; 219, chelicera.



Figs. 220-226. *Heydeniella markmitchelli* sp.n..
220, 221, 224 and 225, female: 220, soma, dorsum; 221, idiosoma, venter; 224, gnathosoma, venter; 225, leg IV (part), dorsal setae only. 222, 223 and 226, male: 222, idiosoma, venter; 223, leg II (part): 226, chelicera.

Hummock Ranges (localities which are 80-180 miles north-west of the type locality) have a shorter 'tooth' on trochanter IV (Fig. 190).

MALE. Fig. 187, 191 and 193-196. Idiosomal length, 690μ. There is a conspicuous rugose tubercle on the distal edge of the ventral surface of the palp femur and genu which do not show clearly in the drawing (Fig. 195).

DEUTONYMPH. Fig. 197-199. Idiosomal length, 580μ.

PROTONYMPH. Fig. 200-203. Idiosomal length, 480μ.

LARVA. Fig. 204-208. Idiosomal length, 360μ.

EGG. Fig. 209. Longest axis length, 200μ.

LOCALITY. Two females (N1968108 and N1968109), males (N1968110 and N1968111), deutonymph (N1968112), 2 protonymphs (N1968113 and N1968114), larva (N1968115) and egg (N1968116) drawn: Australia; LF134, moss and litter, near tree-fern at edge of pond, Waterfall Gully, Mt. Lofty Ranges, near Adelaide, South Australia, 30.5.1966, col. D. C. Lee, dep SAM (immature stages not collected direct, but bred from females in this sample).

The holotype female (N1968117), allotype male (N1968118), deutonymph (N1968119) and protonymph (N1968120) examined: Australia: moss, Long Gully, Mt. Lofty Ranges, near Adelaide, South Australia 8.1938, col. H. Womersley, dep. SAM.

Female (N1968121) and male (N1968122) examined and base of leg IV drawn: Australia; LF133, moss off rocks, Stony Creek, Flinders Ranges, nr. Wilmington, South Australia, 25.5.1966, col. H. M. Cooper, dep. SAM.

REMARKS. In figured chaetotaxy patterns, filled in circles represent setae considered to have been added at the previous moult. Characters of the immature stages have not been used in the classification given here. The extensive drawings of these stages are given only to increase this type of data which is too limited from this family for satisfactory comparative studies. Similar drawings are made in this paper of the immature stages of *Hydrogamasus littoralis* and *Gamasellus tragardhi*.

Heydeniella goei **sp.n.**

FEMALE. Fig. 210-214. Idiosomal length, 690μ. The spermathecal ringed tube opens in a similar position to that of *Heydeniella dentata* (Fig. 185). Leg chaetotaxy differs from all other *dentata*-complex species that I have seen, in being as *Gamasellus*, having 2 ventral setae on genu IV (2, 5/2, 1).

MALE. Fig. 215-219. Idiosomal length, 620μ. Unusual for *Heydeniella* in having 2 teeth on movable, cheliceral digit, the anterior one being associated with a lateral process on the digit. The posterior process on genu II is non-setous.

LOCALITY. The holotype female and allotype male drawn: England; under mats of fur-like mould, on decaying wooden pit props, in chalk-mine, Chislehurst Caves, Kent, 20.2.1955, col. P. N. Lawrence, dep. BM(NH).

REMARKS. This species can be distinguished from other nominal species in the *dentata*-complex by the chaetotaxy of genu IV, the proximal protruberance on the female femur III and the two teeth on the male movable cheliceral digit.

Heydeniella markmitchelli sp.n.

FEMALE. Fig. 220, 221, 224 and 225. Idiosomal length, 500μ. The spermathecal tube opens in a similar position to that of *Heydeniella dentata* (Fig. 185). The leg chaetotaxy differs from *Gamasellus* in having only one ventral seta on genu IV (2, 5/1, 1).

MALE. Fig. 222, 223 and 226. Idiosomal length, 400μ.

LOCALITY. The holotype female (N1968123) and 2 paratype females (N1968124 and N1968125) drawn and examined: Australia; moss, 2,000ft. Flinders Ranges, near Wilmington, South Australia, 25.9.1958, col. H. M. Cooper, dep. SAM.

The allotype male (N1968127) and 2 paratype males (N1968128 and N1968129) drawn and examined: Australia: moss, 1,064ft. Hummock Ranges, near Bute, South Australia, 9.9.1958, col. H. M. Cooper, dep. SAM.

A paratype female (N1968126) and paratype male (N1968130) examined: Australia; LF133, moss off rocks, Stony Creek, 1,200ft. Flinders Ranges, near Wilmington, South Australia, 25.5.1966, col. H. M. Cooper, dep. SAM.

A female (N1968131) examined; New Zealand; off *Uloma tenebrionoides* (tenebrionid beetle), Kaitoke, North Island, 3.7.1960, col. D.C.M. Manson, dep. SAM.

REMARKS. The gnathosoma of this species is relatively large while the sclerotization is reduced. This species can be distinguished from other nominal species in the *dentata*-complex by setal row *R* being on the striated cuticle instead of the holonotal shield and by the male ventro-anal, which is separate from the holonotal shield. Since making the drawings, I have seen the female and male specimens from Stony Creek that indicate that at the locality where the holotype female was collected members of this species are larger than at the locality where the allotype male was collected.

Genus HYDROGAMASELLUS Hirschmann

Hydrogamasellus Hirschmann, 1966, p. 7. Type-species: *Hydrogamasus antarcticus* Trägårdh, 1907, by original designation.

DIAGNOSIS. Small to large mites, with a considerable range in the extent and sclerotization of shields. Usually holonotal shield, but may be separate or partially separate podonotal and opisthonotal shields. Usually ventro-anal shield of the female not fused to the notal shield, while on male it is fused to the notal shield, but such a fusion may not occur in either sex or it may occur in both sexes. If female ventro-anal shield is fused to the notal shield then, as on other females in this genus, sterno-metasternal shield not fused to endopodal IV shield. Male ventro-anal shield always fused to exopodal IV shield and peritrematal shield. Dorsal setae always simple. Spermathecal ringed tube opens at distal end of coxa III. Pretarsus I pedunculate and conspicuously smaller than other pretarsi. On male tarsus II, seta *ad*3 modified, not setose.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal or rarely a separate podonotal and opisthonotal. Ventro-anal may or may not bear aciculae, include metapodal or be fused to notal. Aciculae may be on small discrete shield. Peritrematal fused to exopodal IV, and may extend well behind this point. Exopodals II, III and IV split. Sterno-metasternal fused to endopodal II and part of III. Single pair of pre-endopodals.

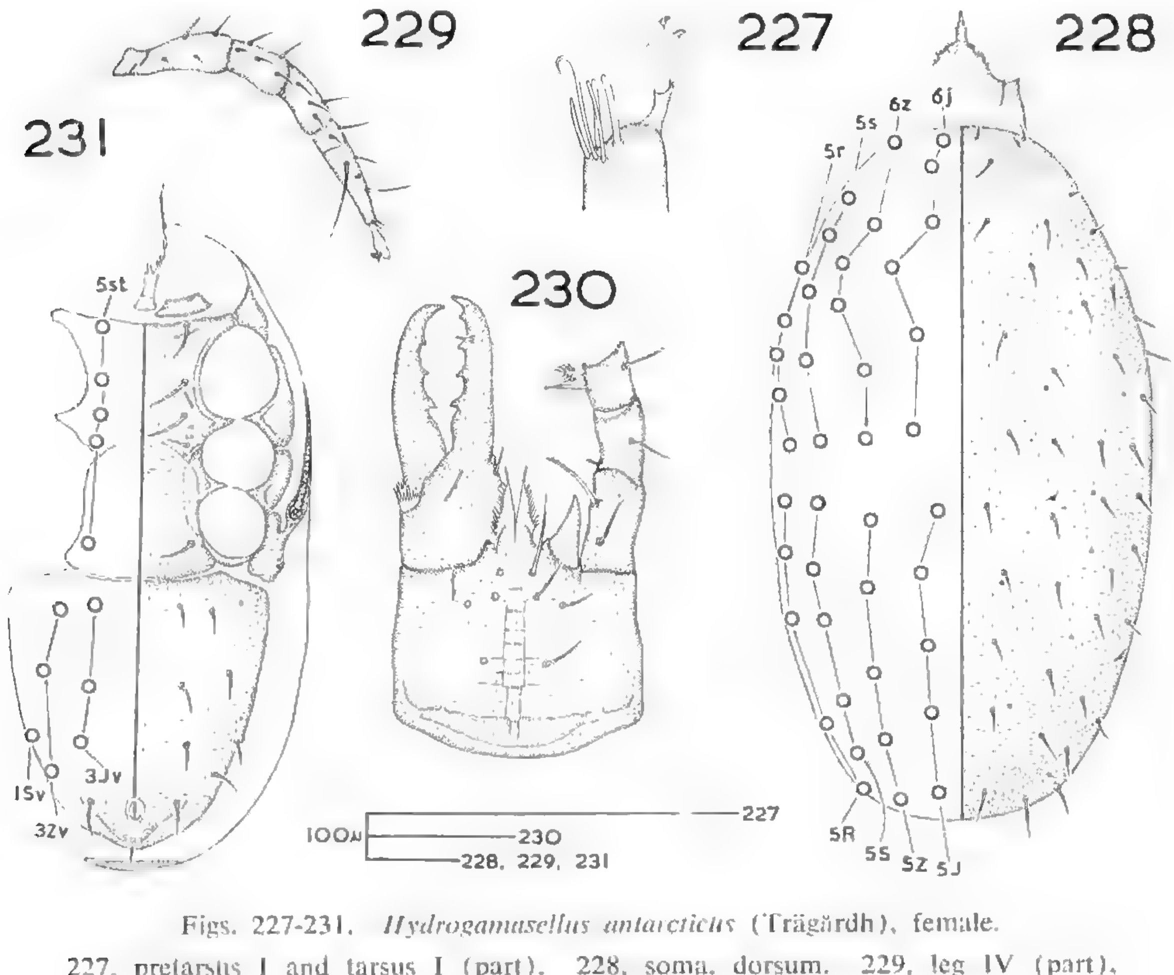
Male: Notal as above, except that on the male of an unnamed species the podonotal and opisthonotal are partially separated. Ventro-anal usually fused to notal, always fused to peritrematal and exopodal IV, and separate from sternito-genital.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r: 5J, 5Z, 5S, 5R: 5st: 3Jv, 3Zv, 2Sv.*

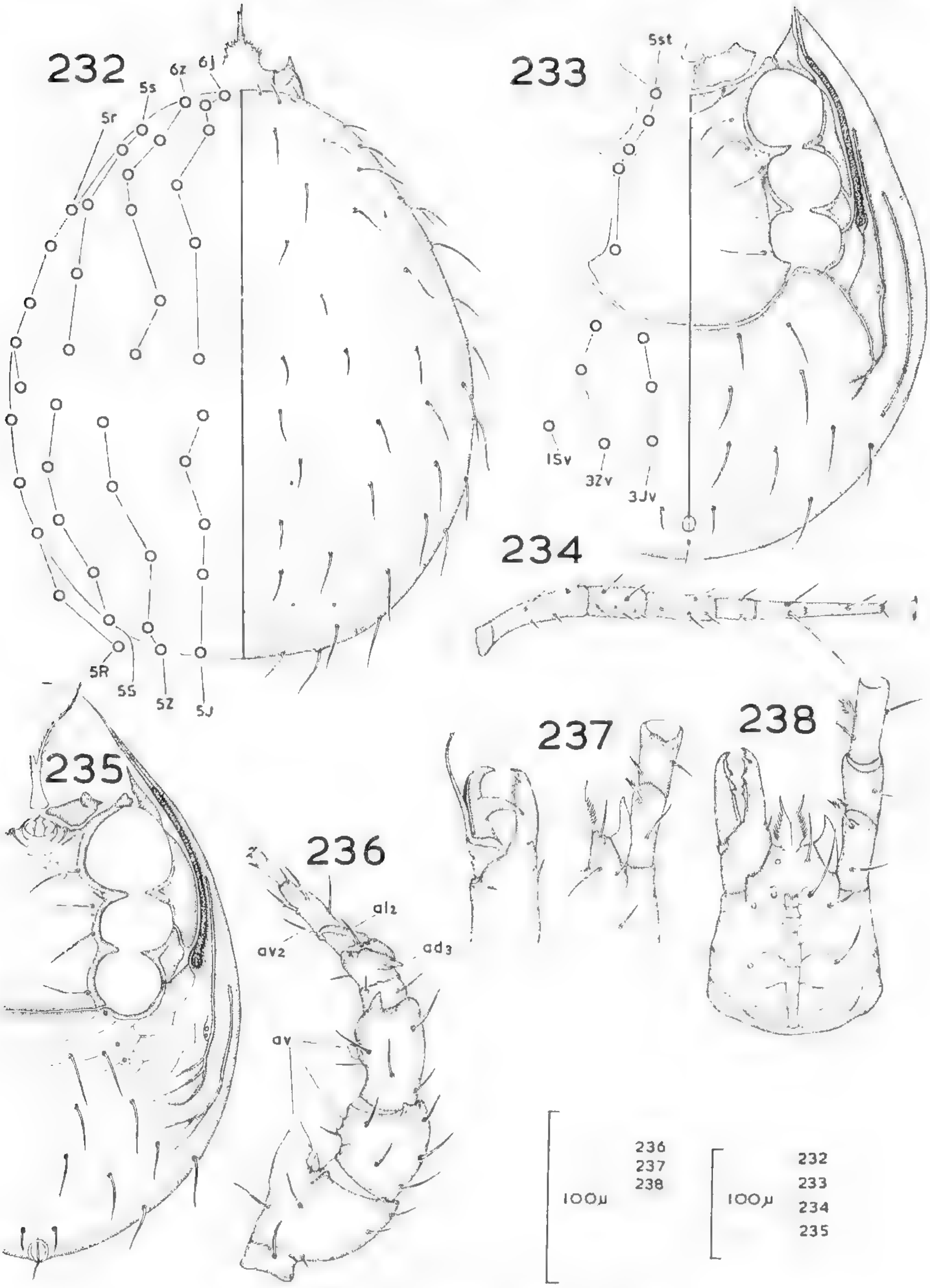
Legs: Usually as *Gamasellus,* but there is one less ventral on genu IV (2, 5/1, 1) in an unnamed species.

OTHER CHARACTERS. Female: Deutosternal denticles in 8 or 9 horizontal rows. Tectum anterior margin basically unispinate, with broad base to spine which bears small spinules or rarely (as in *H. richtersi*) quinquispinate with complex, broad tip to central spine. Movable, cheliceral digit with 3 teeth. On palp genu, seta *al*1 pectinate with 5 or 6 lateral prongs, and seta *al*2 spatulate. Dorsal setae usually simple, slightly spatulate or tapered, may be slightly pilose. Shields shiny and usually reticulate, while sternal shield may have longitudinal striae. Spermathecal ringed tube probably opens distally on dorsal surface of coxa III. Pretarsus I pedunculate and smaller than other pretarsi. Pulvilli II-IV with attenuated lateral lobes which may be shorter or much longer than central circular lobes. Amongst dorsal setae on tarsus IV, seta *pd*3 is setose and at least twice as long as any other seta.

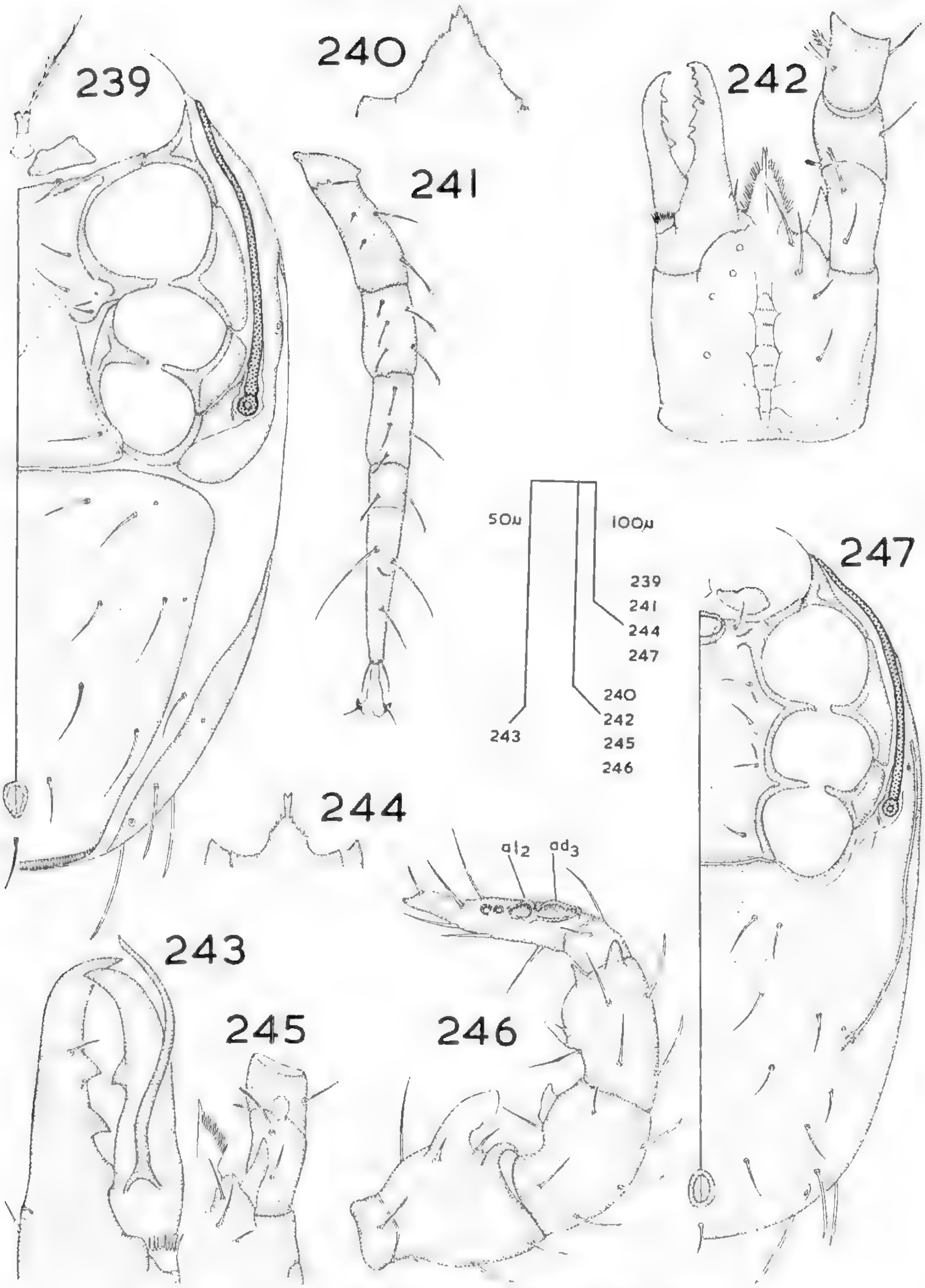
Male: Corniculus attenuated and on raised process which may have paraxial tubercle carrying seta *hyp*1. Movable cheliceral digit with one tooth, attached at base to slim spermadactyl which may be subequal in length or up five times as long. Tectum anterior margin may differ from female and be trispinate. Often process on ventral surface of palp trochanter or femur. On leg II, femur seta *av* and usually seta *pv*1, genu seta *av*, tibia seta *av* enlarged into spur or spine, while tarsus seta *ad*3 and sometimes seta *al*2 enlarged into a hollow spine or spur, or a rimmed pit. Non-setous processes also occur on tibia and tarsus II.



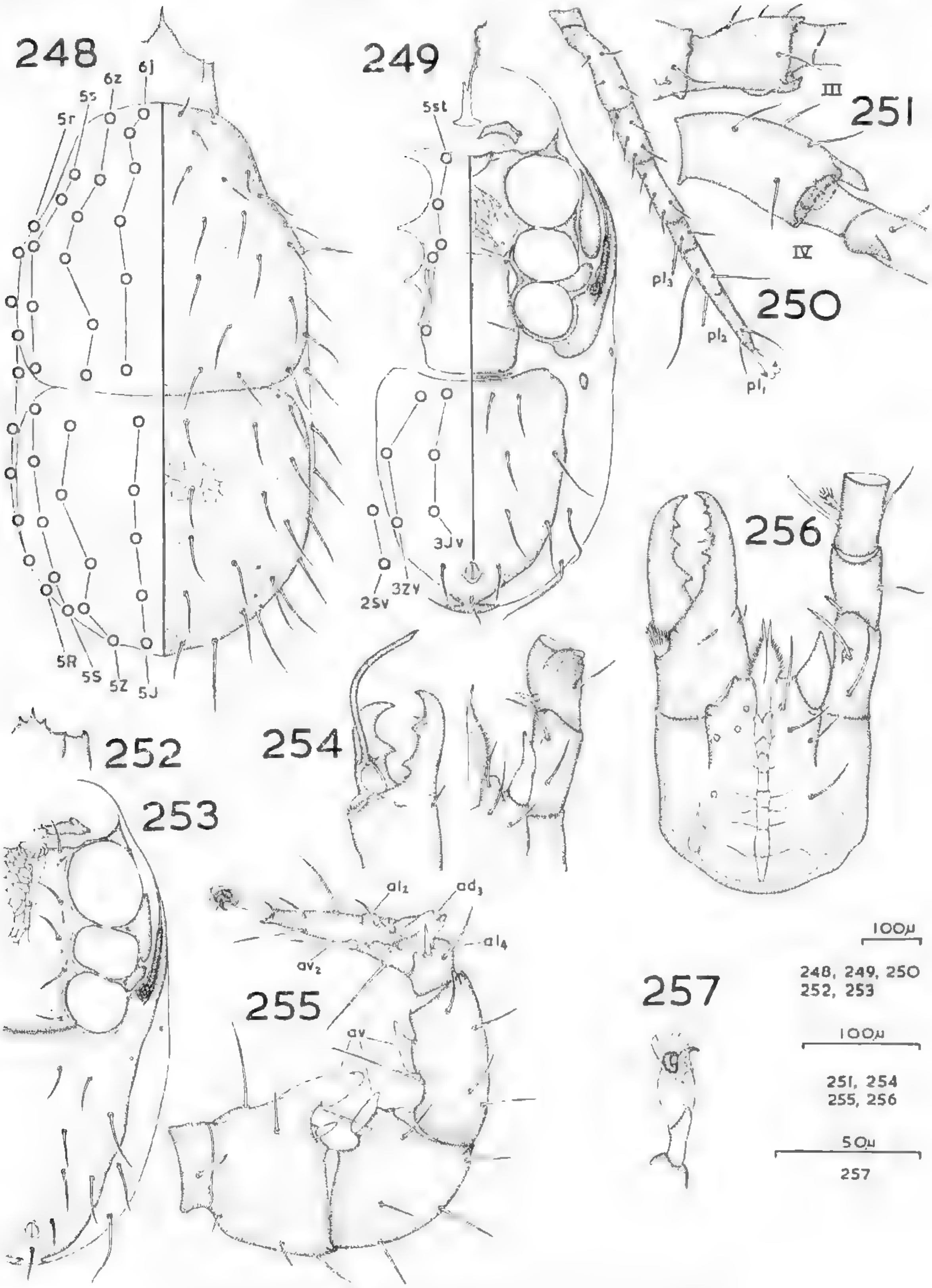
Figs. 227-231. *Hydrogamasellus antarcticus* (Trägårdh), female.
227, pretarsus I and tarsus I (part). 228, soma, dorsum. 229, leg IV (part), dorsum. 230, gnathosoma, venter. 231, idiosoma, venter.



Figs. 232-238. *Hydrogamasellus cavei* (Sheals).
232-234 and 238, female: 232, soma, dorsum; 233, idiosoma, venter; 234, leg IV (part), dorsum; 238, gnathosoma, venter. 235-237, male: 235, idiosoma, venter; 236, leg II (part); 237, chelicera, and gnathosoma and palp (part), venter.



Figs. 239-247. *Hydrogamasellus coleoptratus* (Berlese).
239-242, female: 239, idiosoma, venter; 240, tectum; 241, leg IV (part), dorsum; 242, gnathosoma, venter. 243-247, male: 243, chelicera; 244, tectum; 245, gnathosoma and palp (part), venter; 246, leg II (part); 247, idiosoma, venter.



Figs. 248-257. *Hydrogamasellus racovitzai* (Trouessart).

248-251, 256 and 257, female: 248, soma, dorsum; 249, idiosoma, venter; 250, leg IV (part), dorsum; 251, trochanter III and IV, and other segments (parts); 256, gnathosoma, venter; 257, pretarsus I. 252-255, male; 252, tectum; 253, idiosoma, venter; 254, chelicera, and gnathosoma and palp (part), venter; 255, leg II (part).

DISTRIBUTION. NTc: Sm, Sk, Sa: ACs. Besides the records published with the original descriptions of the nominal species, *H. racovitzai* is recorded from many other localities in the scotian Antarctic region. *H. antarcticus* is recorded from Macquarie Island (Hirschmann, 1966) and unnamed males have been collected in Tierra del Fuego, dep BM(NH).

Found in moss, lichens, algae, plant litter and soil, and under stones.

REMARKS. *Gamasellus* (*Hydrogamasellus*) was originally diagnosed (Hirschmann, 1966) as being *Gamasellus*-like, but having an entire dorsal shield and simple dorsal setae. As diagnosed here, with generic status, *Hydrogamasellus* has members with a considerable range in the extent and degree of fusion of their idiosomal shields, including an entire or divided dorsal shield, and with all simple or some slightly spatulate or pilose dorsal setae but the location of the spermathecal ringed tube aperture and the male gnathosoma and leg II characters are similar. Therefore, an unusually high number of species have been removed from (see "Changes in Nomenclature"), or transferred to this genus. Because *Hydrogamasellus* is similar to *Heydeniella* (type-species: *H crozetensis*) both *crozetensis* species transferred to *Hydrogamasellus* have been given new names. The following 8 nominal species are included in this genus: *H. antarcticus* (Trägårdh, 1907); *H. cavei* (Sheals) **comb.n.** for *Ologamasus cavei* Sheals, 1962; *H. coleoptratus* (Berlese) **comb.n.** for *Ologamasus coleoptratus* (Berlese, 1888); *H. gaussi* **nom.n.** for *Neoparasitus crozetensis* Richters, 1907; *H. racovitzai* (Trouessart, 1903) **comb.n.** for *Gamasellus racovitzai* (Trouessart, 1903); *H. richtersi* **nom.n.** for *Gamasellus crozetensis* Richters, 1907; *H. striatus* (Sheals, 1962); *H. topali* (Balogh, 1963b). Two unnamed species (from Argentina; Province of Neuquen or Tucumán, 3 or 4. 1959, col. C. Delamare Deboutteville, dep. BM(NH)) which belong to this genus are listed so that their characters, not found on nominal species of this genus, can be listed. One unnamed species (single female) has only one ventral seta on genu IV, while the other (single male) has the podonotal and opisthonotal shields partially separated by lateral incisions. *Hydrogamasellus ubatubaensis*, *incertae sedis*, has been left in this genus for convenience.

Hydrogamasellus antarcticus (Trägårdh)

Hydrogamasus antarcticus Trägårdh, 1907, p. 12.

FEMALE. Fig. 227-231. Idiosomal length, 750μ. On right side, seta *Sv*1 is off ventro-anal shield.

MALE. Fig. none. No males seen from Naturhistoriska Ricksmuseum, Stockholm, but a full description is given in Hirschmann (1966) of conspecific specimens.

LOCALITY. The holotype female with two legs missing drawn: Antarctica; wet moss, Paulet Island, between South Shetland Islands and Palmer Peninsula, 15.1.1902, col. Swedish South Polar Expedition of 1901-1903, dep. NRS.

Hydrogamasellus cavei (Sheals) **comb.n.**

FEMALE. Fig. 232-234, 238. Idiosomal length, 510μ. Dorsal surface strongly convex. Lateral longitudinal split in holonotal shield. On tarsus IV, setae *pl*2 and *pl*4 are simple and not spine-like and pilose as in *H. racovitzai.*

MALE. Fig. 235-237. Idiosomal length, 510μ. Slight thickening on ventral, distal edge of palp femur which may be equivalent to process in *H. racovitzai.* On tarsus II, seta *ad*3 appears to be a hollow spine.

LOCALITY. A paratype female (1961.6.20.22) and three males examined or drawn: Argentina; litter under *Nothophagus dombeyi,* Nahuel Huapi Reserve, Puerto Blest, 7.3.1959, col. C. Delamare Deboutteville, dep. BM(NH).

Hydrogamasellus coleoptratus (Berlese) **comb.n.**

Hypoaspis coleoptratus Berlese, 1888, p. 199.

FEMALE. Fig. 239-242. Idiosomal length, 700μ. Dorsal setae difficult to examine, but opisthonotal setae mostly slightly lanceolate and as long as the peripheral setae that are drawn, while podonotal setae (except seta *r*2 which is similar to the peripheral opisthonotal setae) are shorter and tapering like seta *Zv*1.

MALE. Fig. 243-247. Idiosomal length, 620μ. Small process on palp trochanter. Tarsus II has a row of steeply rimmed pits on its dorsal surface, the larger 2 pits are considered homologous with setae *al*2 and *ad*3.

LOCALITY. The 'tipico' female (34/32), 'tipico' male (34/32) and female and male (202/15) examined or drawn: Argentina; under the bark of trees, Buenos Aires, dep. SEAF.

Hydrogamasellus racovitzai (Trouessart) **comb.n.**

Gamasus racovitzai Trouessart, 1903, p. 8.

Zercon tuberculatus Trägårdh, 1907, p. 17.

FEMALE. Fig. 248-251, 256 and 257. Idiosomal length, 960μ. Pre-endopodal shields appear to be connected to sternal shield by a lightly sclerotized and reticulated shield. Seta *pl*4 (Fig. 250) is labelled "*pl*3".

MALE. Fig. 252-255. Idiosomal length, 870μ. Large process on palp femur. Distinct process on hypostome bearing seta *hyp*1. On tarsus II, seta *ad*3 appears to be a hollow cone, with thick vertical ridge in posterior wall.

LOCALITY. Three females (N1968132-1968134) and three males (N1968135-1968137) examined or drawn: South Orkneys; under stones on shore, station 1089, Michelsen Island, 3.1.1933, col. Discovery Investigations (British) of 1931-1933, dep. SAM.

REMARKS. The above locality is close to Laurie Island where *Gamasellus racovitzai neorcadensis* Trouessart, 1912, was collected. Probably this should not be a subspecies, the structure of seta *av* on the male femur II (the character used to distinguish the subspecies) would appear as the nominate subspecies if viewed laterally, and as the other subspecies if viewed ventrally.

Genus NEOGAMASELLEVANS Loots and Ryke

Neogamasellevans Loots and Ryke, 1967a, p. 13. Type-species: *Neogamasellevans preendopodalis* Loots and Ryke, 1967a, by original designation.

DIAGNOSIS. Minute mites, only the male having extensive shields. Holonotal shield. Discrete ventro-anal shield on the female, but it is fused to the holonotal, peritrematal and exopodal IV shields on the male. Female peritrematal shield joined only by a slight thickening of striated cuticle to exopodal IV shield. Male peritrematal shield separated from exopodal IV shield and notal shield at level of acetabulum IV, although all 3 shields are fused to ventro-anal shield. Female sterno-metasternal shield not fused to endopodal IV shield. Dorsal setae simple and tapered. Spermathecal ringed tube opening not known. Spermadactyl short and straight. Pretarsus I pedunculate and smaller than other pretarsi. On male tarsus II, all setae are setose.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal. Discrete ventro-anal. Posterior to ventro-anal there is a small discrete shield only bearing aciculae. Backward extension of exopodal IV, may have included metapodal. Peritrematal reduced, joined by a slight thickening of striated cuticle to exopodal IV. Exopodals II, III and IV split. Sterno-metasternal fused to endopodals II and III. Single pair of large pre-endopodal shields, paraxial margins being equal in length to distance between setae *st*1 and *st*2.

Male: Ventro-anal is fused to exopodal IV, peritrematal and holonotal. Peritrematal is not fused to exopodal IV, nor to holonotal between levels of setae *st*4 and *Zv*1. Sternito-genital shield separate from ventro-anal and from anterior section of endopodal II.

CHAETOTAXY. Idiosoma: 6*j*, 6*z*, 5*s*, 5*r*: 5*J*, 5*Z*, 5*S*, 5*R*: 5*st*: 3*Jv*, 3*Zv*, 1*Sv*.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in at least 6 horizontal rows. Tectum anterior margin basically trispinate with lateral spinules and central spine broader distally with spinules making the margin complex. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 pectinate with 5 lateral prongs, and seta *al*2 slightly lanceolate. Dorsal setae, simple tapering. Shields slightly shiny and reticulated. Peritreme short, not extending anterior to mid-acetabulum III. Spermathecal ringed tube opening not known. Pretarsus I pedunculate and smaller than other pretarsi. Pulvilli II-IV with attenuated lateral lobes that are slightly longer than central circular lobes. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest and setose.

Male: Tectum anterior margin with the central spine shorter but broader and more complex than on female, while the two lateral spines are reduced to spinules. Movable cheliceral digit with one tooth, fused at base to shorter similarly shaped spermadactyl. Dorsal setae on palp femur are enlarged to spines. On leg II, femur, genu and tibia seta *av* enlarged into spurs, also seta *pv*1 on femur is a spine and there are non-setous processes on the tibia.

DISTRIBUTION. NTc. The only published record is with the original description of the single, nominal species.

Found in plant litter on soil.

REMARKS. *Neogamasellevans* is not here regarded as closely allied to *Gamasellevans* as might be assumed from its name. Hirschmann (1968) considers *N. preendopodalis* similar to *Gamasellus* (*Hydrogamasellus*) *delamarei* (transferred above to *Geogamasus*) and therefore makes *Neogamasellevans* a junior synonym of *Hydrogamasellus*. I would agree it is similar to *Geogamasus*, but regard the probable differences in location of the aperture of the female spermathecal ringed tube and in the structure of the male spermadactyl sufficient to refer the species to different genera, and to suggest that these genera may not in fact be closely allied. Some of the characters given for the genus were obtained by examination of 2 paratype females and 3 paratype males (1967.9.7.39-43), dep. BM(NH), of the single nominal species, *N. preendopodalis* Loots and Ryke, 1967a, included in this genus. *Queenslandolaelaps berlesei, incertae sedis*, has been transferred to this genus because it should be in the Ologamasini, although it is improbable that it belongs to this genus.

Genus PARASITIPHIS Womersley

Parasitiphis Womersley, 1956a, p. 535. Type-species: *Parasitiphis littoralis* Womersley, 1956a, by original designation.

Austrohydrogamasus Hirschmann, 1966, p. 10, **syn.n.**. Type-species: *Hydrogamasus* (*Austrohydrogamasus*) *watsoni* Hirschmann, 1966, by original designation.

DIAGNOSIS. Average sized to large mites. Holonotal shield. Discrete ventro-anal shield in both sexes, except on some males where metapodal shields and/or holonotal shield may be fused to the ventro-anal shield. Peritrematal shield fused to exopodal IV shield on female but not on male. Female sterno-metasternal shield not fused to endopodal IV shield. Dorsal setae simple and tapering. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV. Movable cheliceral digit of male always with more than one tooth and parallel spermadactyl that is subequal in length. Pretarsus I not pedunculate and at least as large as the other pretarsi. On male tarsus II, seta *av*2 modified into a spur or tubercle.

MORPHOLOGY.

Sclerotization. Female: Holonotal. Discrete metapodal and ventro-anal bearing aciculae posterior to anus. Peritrematal narrowly fused to exopodal IV. Exopodals do not completely encase peraxial edge of acetabulum II nor usually of acetabulum III. Sterno-metasternal fused to endopodal II and part of III. Single pair of pre-endopodals.

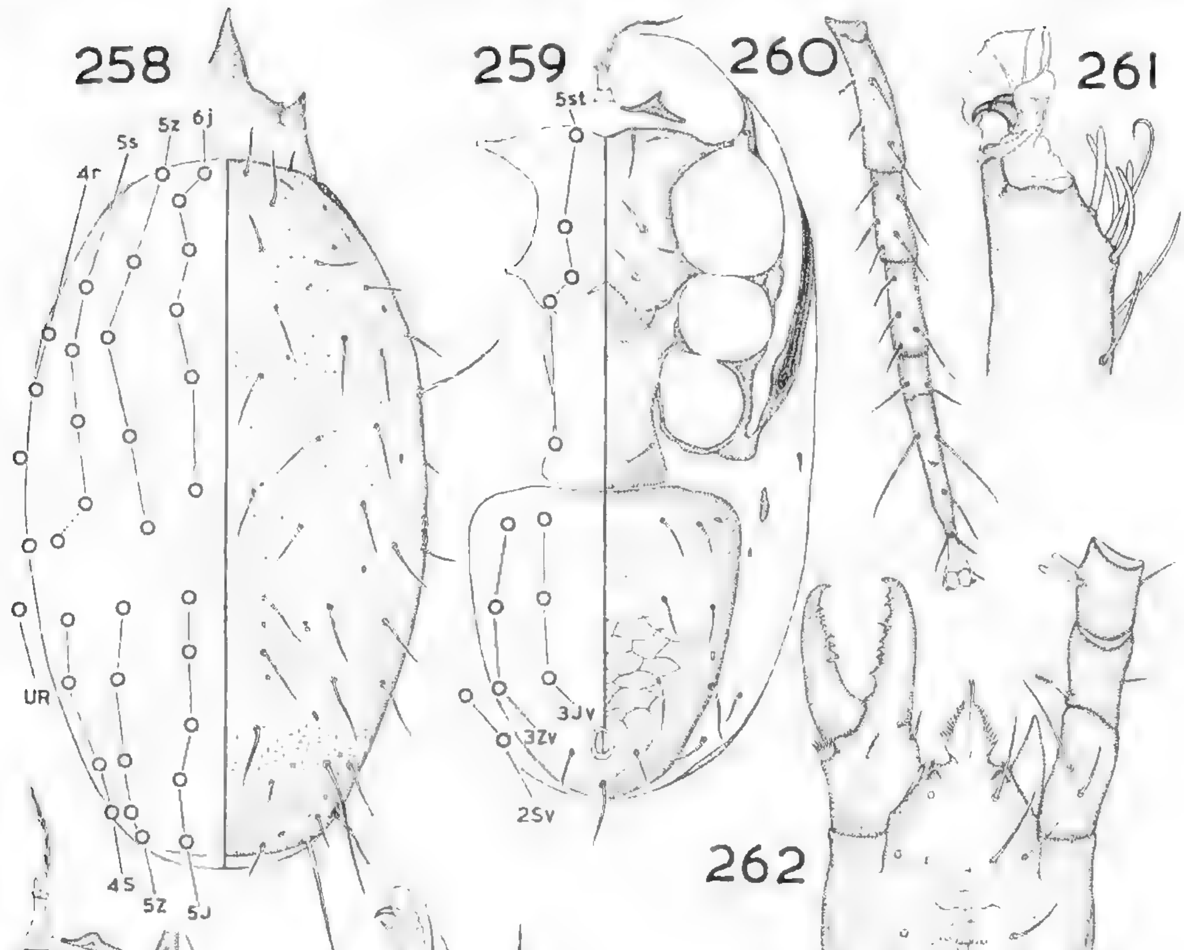
Male: Discrete sternito-genital shield, which tends to be unusually narrow posteriorly. Ventro-anal posterior to seta *Zv*3 may or may not be fused to holonotal. Metapodals may or may not be fused to the ventro-anal. Peritrematal not fused to exopodal IV.

Chaetotaxy. Idiosoma: *6j*, *5z*, *5s*, *4r*: *5J*, *5Z*, 4 or 5*S*, 0 or 3*R*, 1*UR*: 5*st*: 3*Jv*, 3*Zv*, 2*Sv*.

Legs: As *Gamasellus* or differs in being without a postero-lateral on genu IV (2, 5/2, 0).

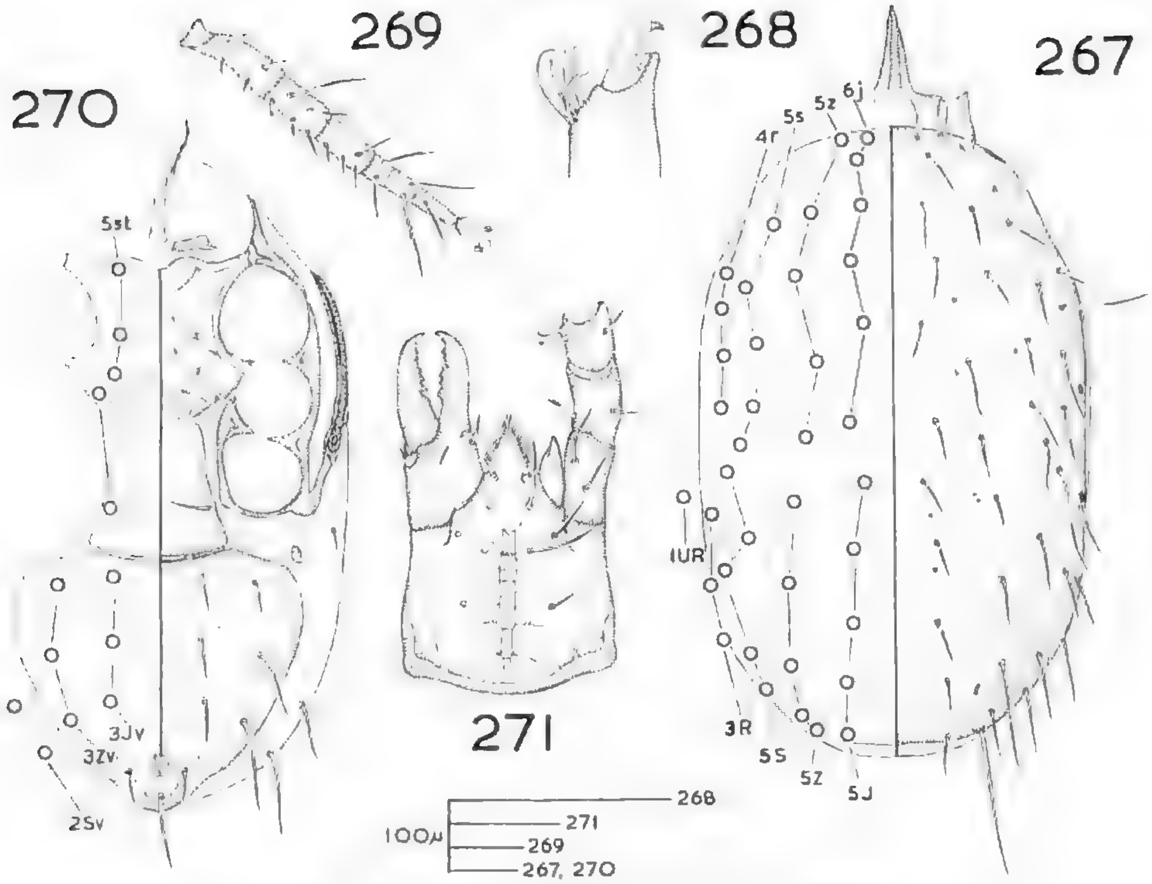
Other Characters. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin unispinate; the spine being large and having central ridge. Movable cheliceral digit with 4-7 teeth. On palp genu, seta *al*1 and seta *al*2 spatulate. Dorsal setae simple, tapered. Shields shiny and reticulated. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV. Pretarsi sheath I not pedunculate, only being long enough to contain the retracted claw-complex, which is large, being subequal in size to other claw-complexes. Pulvilli II-IV with lateral lobes attenuated and subequal in length to central circular lobes. Amongst dorsal setae on tarsus IV, seta *pd*3 is either just the longest or both setae *pd*3 and *ad*3 are the longest, and the former may be slightly pilose.

Male: Movable cheliceral digit with 2-5 teeth and fused at base to spermadactyl of similar length. On leg II femur seta *av*, genu seta *av*, tibia seta *av* and tarsus seta *av*2 enlarged into spurs. Bases of leg III and IV may have conspicuous non-setous processes.



Figs. 258-266. *Parasitiphis littoralis* Womersley.

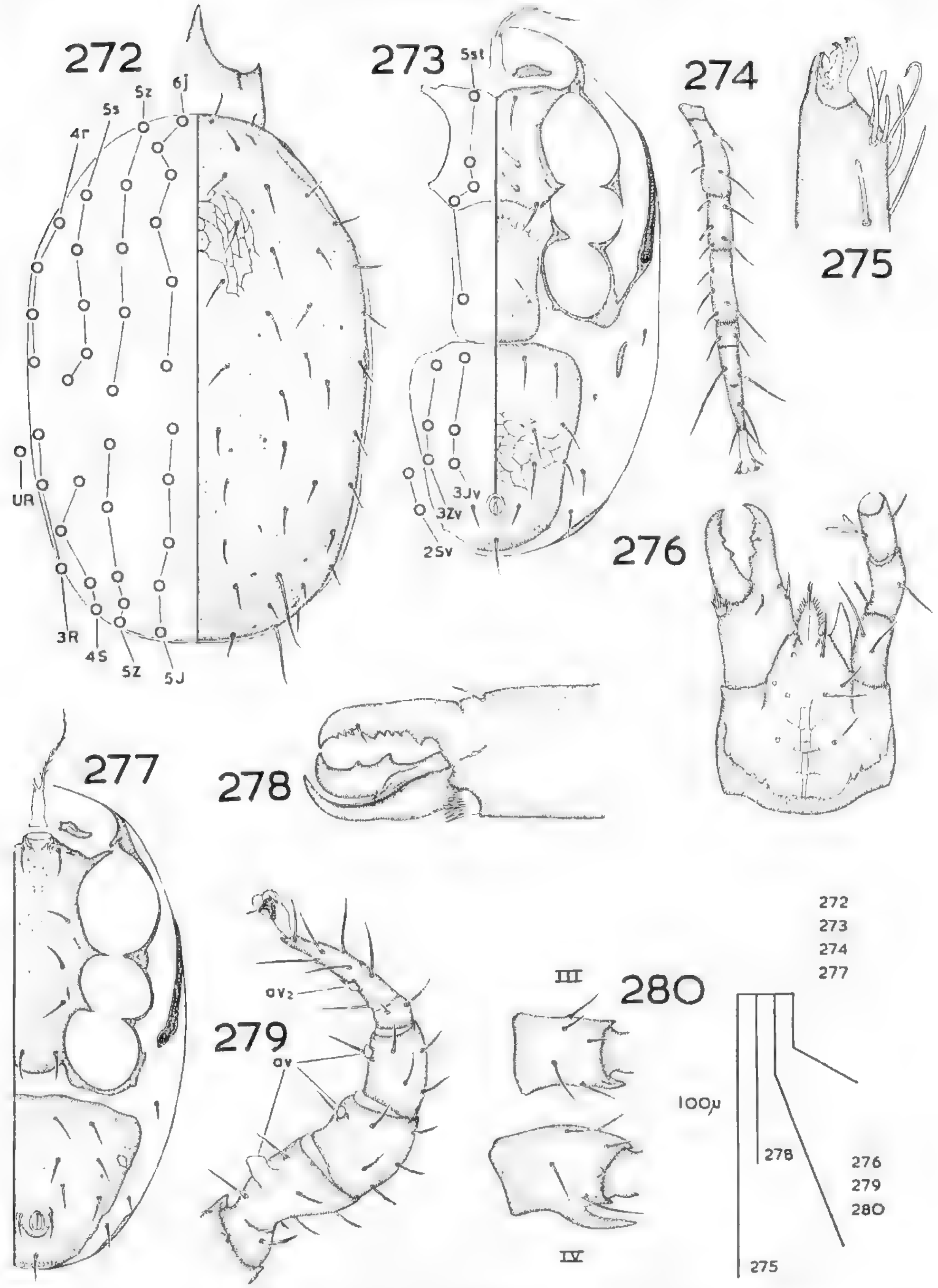
258-262, female: 258, soma, dorsum; 259, idiosoma, venter; 260, leg IV (part), dorsum; 261, pretarsus I and part of tarsus; 262, gnathosoma, venter. 263-266, male: 263, idiosoma, venter; 264, chelicera; 265, leg II (part); 266, trochanter and femur III, and trochanter IV.



Figs. 267-271. *Parasitiphis aurora* sp.n., female.
267, soma, dorsum. 268, pretarsus I and tarsus I (part). 269, leg IV (part), dorsum. 270, idiosoma, venter. 271, gnathosoma, venter.

DISTRIBUTION. Aa, An: Sm, Sk, Sa: ACs. Besides the locality records published with the original or the below descriptions of the nominal species, Hunter (manuscript) records *P. jeanneli* (as *H.* (*A.*) *watsoni*) from South Georgia. Found in or near the littoral zone.

REMARKS. Previously *Parasitiphis* contained one species, but I now include species or misidentified specimens from *Hydrogamasus, Gamasellus* and *Laelaps. Laelaps brunneus* Kramer is referred here on the basis of the few characters given in the original description, because the only two specimens (females), collected from the sea shore, Tierra del Feugo, by Michaelsen, dep. AMH, cannot be found (Rack, personal communication, 21.4.1967). The only genus that can be considered a close ally is *Litogamasus*, a new genus in the Gamasellini, which occurs in similar habitats. Hirschmann (1966) described *Parasitiphis jeanneli* adults and nymphs as *Hydrogamasus* (*Austrohydrogamasus*) *watsoni*; a new species that was the type of the subgenus. *Parasitiphis* is quite unlike *Hydrogamasus*, but the larva described as *H.* (*A.*) *watsoni* was that of *Hydrogamasus kensleri*. The following 4 nominal species are included in this genus: *P. littoralis* Womersley, 1956a; *P. aurora* **sp.n.**; *P. brunneus* (Kramer) **comb.n.** for *Laelaps brunneus* Kramer, 1898; *P. jeanneli* (André) **comb.n.** for *Gamasellus jeanneli* André, 1947.



Figs. 272-280. *Parasitiphis jeanneli* (André).

272-276, female: 272, soma, dorsum; 273, idiosoma, venter; 274, leg IV (part), dorsum; 275, pretarsus I and tarsus I (part); 276, gnathosoma, venter. 277-280, male: 277, idiosoma, venter; 278, chelicera; 279, leg II (part); 280, trochanter III and IV.

Parasitiphis littoralis Womersley

Parasitiphis littoralis Womersley, 1956a, p. 536.

FEMALE. Fig. 258-262. Idiosomal length, 770μ. Claw complex I (Fig. 261) is shown partly extended, when retracted it appears to be similar to that of the other nominal species (*e.g.*, Fig. 268). Leg chaetotaxy as *Gamasellus*.

MALE. Fig. 263-266. Idiosomal length, 740μ. Idiosomal length of allotype male, 760μ.

LOCALITY. The holotype female (N1968160) drawn, 4 paratype females (N1968162-N1968165) and allotype male (N1968161) examined: Australia; littoral zone, mouth of American River, Kangaroo Island, South Australia, 1.1946, col. H. Womersley, dep. SAM.

Two males (N1968166 and N1968167) drawn or examined: Australia: on seaweed covered rocks, littoral zone, Myponga Cove, South Australia, 30.10.1966, col. D. C. Lee, dep. SAM.

Parasitiphis aurora sp.n.

Hydrogamasus antarcticus: Womersley, 1937 (not Trägårdh, 1907), p. 17, **syn.n.**

FEMALE. Fig. 267-271. Idiosomal length, 860μ. Leg chaetotaxy as *Gamasellus* except for genu IV (2, 5/2, 0). Female from Gough Island has 4 setae, and not just 3, in row *R*.

MALE. Not known when drawing made, but since seen from Auckland and Campbell Islands, to be dep. BBM. Will be described later. The male of this species is unusual in having the ventro-anal shield posterior to seta *Zv*3 fused to the holonotal shield.

DEUTONYMPH. On the basis of the lengths of the notal setae, form of the dorsal setae on leg IV and the chaetotaxy of genu IV, the deutonymph drawn with the description of *H. antarcticus*: Womersley, 1937, belongs to this species, but the other deutonymph (N1968184), in the same collection, belongs to *P. jeanneli*.

LOCALITY. The holotype female (N1968182) drawn and morphotype deutonymph (N1968183) examined: Macquarie Island; between tide-marks, 28.11.1913, col. T. H. Johnston (on Australasian Antarctic Expedition, 1911-1914), dep. SAM.

Female examined: Tristan da Cunha Group; with *Pertorgunia* sp., Archway Point, Gough Island, col. M. W. Hollgate (Gough Island Scientific Survey, 1955-56), dep. BM(NH).

REMARKS. This species can be distinguished from the other two nominal species by the lack of a postero-lateral seta on genu IV (2, 5/2, 0), and by the two antero-dorsal setae on femur IV being spine-like. The male also differs in having the ventro-anal shield fused to the notal shield and in lacking conspicuous non-setous processes on the proximal segments of legs III and IV.

Parasitiphis jeanneli (André) **comb.n.**

Gamasellus jeanneli André, 1947, p. 70.

Hydrogamasus (*Austrohydrogamasus*) *watsoni* Hirschmann, 1966, p. 7 **syn.n.**

FEMALE. Fig. 272-276. Idiosomal length, 920μ. Leg chaetotaxy as *Gamasellus*.

MALE. Fig. 277-280. Idiosomal length, 890μ. Dorsal setae *Z*3 and *Z*5 longer than on female. Ventro-anal shield in Heard Island males have an unsclerotized patch, lateral to seta *Zv*2 (see Fig. 277), which may be more extensive than on specimen drawn, nearly separating off antero-lateral corner as a metapodal shield. In Macquarie Island specimens the metapodal shield is separated completely from the ventro-anal shield.

LOCALITY. Two females (N1968168 and N1968169) and 2 males (N1968170 and N1968171) drawn or examined: Heard Island, on vegetation, Rogers Head, 31.1.1952, col. K. Brown (on Australian National Antarctic Research Expedition, 1947-1955), dep. SAM.

Four females (N1968172-N1968175) examined: Kerguelen Islands; under stones, between tidemarks, 16.11.1929, col. British-Australian-New Zealand Antarctic Research Expedition, 1929-31, dep. SAM.

Two females (paratypes of *Hydrogamasus* (*Austrohydrogamasus*) *watsoni*, N1968176 and N1968177) examined: Macquarie Island; *Pucinellia*, Isthmus or Mid Royal Penguin rookery, North Head, 1961, col. K. Watson, dep. SAM.

Two females (N1968178 and N1968179) and two males (N1968180 and N1968181) examined: Macquarie Island; Isthmus, 12.1949, col. T.M. (on Australian National Antarctic Research Expedition, 1947-1955), dep. SAM.

One deutonymph (N1968184), previously named *Hydrogamasus antarcticus*: Womersley, 1937, examined: Macquarie Island; between tidemarks, 28.11.1913, col. T. H. Johnston (on Australasian Antarctic Expdition, 1911-1914), dep. SAM.

REMARKS. Although there are differences in size and slight morphological differences between specimens collected in different parts of the Subantarctic region, I consider that all the specimens with their collection data given above are members of this one species.

Genus PYRIPHIS **gen.n.**

Type-species: *Ologamasus pyrenoides* Lee, 1966.

DIAGNOSIS. Average sized mites. Holonotal shield. Ventro-anal shield broadly fused to notal and exopodal IV shield on female and notal, peritrematal, exopodal IV and sternito-genital shield on male. Single pair of pre-endopodal shields. At least two pairs of setae (*z*5 and *r*3) on podonotum are conspicuously pilose and surrounded by mainly simple or lanceolate setae. Spermathecal ringed tube opens distally on dorsal surface of trochanter III. Spermadactyl strongly recurved. Pretarsus I pedunculate and smaller than other pretarsi. On male tarsus II all setae are setose.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal, broadly fused to ventro-anal which bears aciculae posterior to anus. Ventro-anal and peritrematal fused to exopodal IV. Split in exopodals II, III and IV. Sterno-metasternal fused to endopodal II only. Single pair of pre-endopodals.

Male: As female but peritrematal and sternito-genital also fused to ventro-anal.

CHAETOTAXY. Idiosoma: 6*j*, 6*z*, 5*s*, 5*r*: 5*J*, 4*Z*, 5*S*, 8*R*, 6*UR*: 5*st*: 3*Jv*, 3*Zv*, 2*Sv*.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 7 horizontal rows. Movable cheliceral digit with 3 conspicuous teeth and a series of smaller teeth. On palp genu, seta *al*1 with single lateral prong while both setae *al*1 and *al*2 are slightly spatulate. There are three pairs of podonotal shield protruberances (bearing setae *j*1, *z*5 and *r*3). Some dorsal setae may be simple, tapering, but some are lanceolate, or pilose and spatulate. Shields are dull. Spermathecal ringed tube probably opens distally on dorsal surface of trochanter III. Pretarsus I reduced and pedunculate. Lateral lobes of pulvilli I-IV attenuated and longer than central oval lobes. Amongst dorsal setae on tarsus IV, setae *ad*1 and *pd*1 are the longest.

Male: Movable cheliceral digit with one tooth, fused at base to strongly recurved spermadactyl. On leg II, femur setae *av* and *pv*, genu setae *av* and *pv*, tibia seta *av* enlarged into spurs or spines.

DISTRIBUTION. Aa. Besides the locality published with the original description of the type-species, members of this genus have been found in other forests on the coastal ranges of Victoria, southern New South Wales and Tasmania, dep. SAM.

Found in leaf litter.

REMARKS. *Pyriphis* is established for one species originally described (Lee, 1966) as the only species in the *Ologamasus pyrenoides*-group. At least two unnamed species have been seen since, dep. SAM, with the same extensive sclerotization and unusual, strongly recurved spermadactyl. As in some *Gamasellus discutatus*-complex species, members of this genus are unusual in having both a holonotal shield and conspicuously pilose dorsal setae amongst simple setae. Besides the holonotal shield, the single pair of pre-endopodal shields and, more important, the location of the spermathecal ringed tube aperture on the proximal leg segments support the placing of *Pyriphis* in the Ologamasini. The following single nominal species is included in this genus: *P. pyrenoides* (Lee, 1966) **comb.n.**

Genus RYKELLUS **gen.n.**

Type-species: *Cyrtolaelaps (Gamasellus) darglensis* Ryke, 1962c.

DIAGNOSIS. Large mites. Although there is a clear line on the dorsal shield dividing it into podonotal and opisthonotal regions, it is more like a strong reticulation marking than a fissure, and I would consider that a holonotal shield was present. Ventro-anal shield of the female discrete, while on male it completely merges with all the surrounding shields. Single pair of pre-endopodal shields. Dorsal setae all simple. Spermathecal ringed tube opens distally on postero-lateral surface of coxa IV. Pretarsus I pedunculate and smaller than other pretarsi. On male tarsus II all setae are setose.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal, with groove between podonotal and opisthonotal regions. Discrete ventro-anal bearing aciculae posterior to anus. No discrete metapodal. Peritrematal fused to exopodal IV. Exopodals II and IV split. Sterno-metasternal fused to endopodal II. Single pair of pre-endopodals.

Male: Ventro-anal is fused to all the surrounding shields.

CHAETOTAXY. Idiosoma: *6j, 6z, 4s, 4r; 5J, 5Z, 5S, 5R; 5st; 3Jv, 3Zv, 2Sv.*

Legs: As *Gamasellus.*

OTHER CHARACTERS. Female: Deutosternal denticles in 7 horizontal rows. Tectum anterior margin has single central spine with multispinulate proximal sides. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 is spine-like or spatulate and seta *al*2 is spatulate. Dorsal setae simple, tapering. Shields shiny and reticulated. Spermathecal ringed tube probably opens distally on postero-lateral surface of coxa IV. Pretarsus I pedunculate and smaller than other pretarsi. Pulvilli II-IV with attenuated lateral lobes that are longer than central circular lobes. Non-setous spur may be present on postero-lateral surface of trochanter IV. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest and setose.

Male: Corniculi on raised hypostomal process. Movable cheliceral digit with 1 tooth and fused at base to slim, similarly directed spermadactyl that is subequal in length. On leg II, femur seta *av*, genu seta *av* and tibia seta *av* enlarged into spur, while femur seta *pv*1 is spine-like and there may be small non-setous processes on leg II segments.

DISTRIBUTION. Es. All records are published with the original descriptions of the nominal species.

Found in plant litter.

REMARKS. Both *Rykellus* species were originally placed in *Cyrtolaelaps* (*Gamasellus*). Hirschmann (1966) transferred them to *Gamasellus* (*Hydrogamasellus*). Because of the holonotal shield, simple dorsal setae with only 20 podonotal pairs, spermathecal ringed tube aperture on proximal leg segments and single pair of pre-endopodal shields, they clearly belong to the Ologamasini in my classification. Because of the simple dorsal setae and seta *al*1 on palp genu, the unique location of the spermathecal ringed tube aperture and the fusion of the male ventro-anal shield to the sternito-genital shield, I have established a new genus for them. I have examined two paratype females of *R. nkandhlaensis*, dep. PUSA. The following 2 nominal species are included in this genus: *R. darglensis* (Ryke, 1962c) **comb.n.**; *R. nkandhlaensis* (Ryke, 1962c) **comb.n.**.

Tribe GAMASELLINI Hirschmann

Cyrtolaelaptini Berlese, 1913b, p. 11.

(As indicated with the synonyms of the family name, this family-group name is not considered available.)

Gamasellini Hirschmann, 1962, p. 39.

Cyrtolaelapidae Berlese, sensu Johnston (in part), 1968, p. 19.

Type-genus: *Gamasellus* Berlese, 1892d

DIAGNOSIS. Minute to gigantic mites. The following characters usually occur on adults of this tribe (exceptions are given in parenthesis).

Separate podonotal and opisthonotal shields (some *Gamasellus discutatus*-complex species). One or more pairs of pre-endopodal shields. Form of dorsal setae very variable, and if only some setae are pilose on podonotum then usually they include seta *j*4, *z*5 and *r*3 surrounded by simple or lanceolate setae. Spermathecal ringed tube, if recognized, opens on idiosoma (*Laelogamasus* species).

MORPHOLOGY.

SCLEROTIZATION. Usually podonotal and opisthonotal are separate but they are fused together on most *Gamasellus discutatus*-complex adults. Often there is more than one pair of pre-endopodals as in *Allogamasellus*, *Gamasellus*, *Laelogamasus*, *Hiniphis*, *Periseius* and *Rhodacaroides* species.

CHAETOTAXY. Setation of the legs is as that of *Gamasellus* except for some *Cyrtolaelaps* species which have an extra postero-lateral seta on tibia III, while other *Cyrtolaelaps* species and *Heterogamasus* and *Notogamasellus* (*Notogamasellus*) species have an extra postero-lateral seta on genu III (2, 4/2, 2) and tibia III (2, 3/2, 2).

OTHER CHARACTERS. Often some dorsal setae are conspicuously pilose, lanceolate or spatulate. Species which have only setose dorsal setae (that may sometimes be slightly pilose) occur in the following groups: *Allogamasellus*, *Euryparasitus*, *Hiniphis*, *Litogamasus*, *Periseius* (*Psammonsella*) and *Rhodacaroides*. When only some podonotal setae are pilose and, or spatulate, they are often setae *j*1, *j*4, *z*5, and *r*3, as in *Cyrtolaelaps* and *Gamasellus* species. Some females of the *Gamasellus discutatus*-complex have the sternal setae positioned as in the Gamasiphinae, but usually they are in a pair of nearly straight rows. If spermathecal ringed tubes are recognized they usually open on the idiosoma, but in *Laelogamasus* species they open on coxa III.

DISTRIBUTION. Species of Gamasellini and the Rhodacarinae make up most of the rhodacarid fauna of the Northern Hemisphere, but about two-thirds of those belonging to this tribe were collected in the Southern Hemisphere.

REMARKS. The Gamasellini is intended mainly for the many species with adults that have two subequal dorsal shields and often some complex dorsal setae. There is a precedent for this concept, although it probably gives little indication of the phylogenetic relationships of the species.

I recognize the following 14 genera within this tribe: *Gamasellus*, *Acugamasus*, *Allogamasellus*, *Cyrtolaelaps*, *Euryparasitus*, *Evanssellus* *Heterogamasus*, *Hiniphis*, *Laelogamasus*, *Litogamasus*, *Notogamasellus*, *Periseius*, *Pilellus and Rhodacaroides*. Members of these genera can be distinguished by using the above key (p. 78).

Genus GAMASELLUS Berlese

Gamasellus Berlese, 1892d, p. 60. Type-species: *Gamasus falciger* G. & R. Canestrini, 1881, designated by Berlese, 1906, p. 101.

DIAGNOSIS. Small to large mites, with a considerable range in the extent and sclerotization of shields. Usually separate podonotal and opisthonotal shields, but most females and some males of the *discutatus*-complex species have a holonotal shield. Ventro-anal shield on the female rarely (as in the anal region of *pyiformis*-complex species) fused to notal shield, while on male it may be fused to the notal shield. Two or three pairs of pre-endopodal shields. Some dorsal setae always complex. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV. Pretarsus I either pedunculate and conspicuously smaller than other pretarsi, or not pedunculate and claws subequal in size to claws of other pretarsi.

REMARKS. There is a distinctive group of nominal species, similar to the type-species of *Gamasellus* to which I refer to as the *falciger*-complex. A very similar *pyriformis*-complex is recognized from East Africa and a *discutatus*-complex is recognized from Australia. Most members of the latter complex are conspicuously different from the *falciger*-complex because of their idiosomal sclerotization while one species is quite similar to the *falciger*-complex.

The 3 species-complexes that I recognize within this genus can be distinguished by the following key. The morphology and distribution of members of this genus are given under the species-complex headings.

KEY TO SPECIES-COMPLEXES OF *GAMASELLUS*

1. Less than 23 pairs of opisthonotal setae, and fewer than 6 pairs of setae on striated cuticle between ventro-anal and opisthonotal shield other than the setae in row *R*. Male ventro-anal shield rarely fused to opisthonotal shield, or, if it is, also fused to peritrematal shield . . *falciger*-complex

   With either 25 or more pairs of opisthonotal setae, or, if 23 or 24 pairs, there are more than 6 pairs of setae on striated cuticle between ventro-anal and opisthonotal shield while setae in row *R* are on opisthonotal shield. Male ventro-anal shield usually fused to opisthonotal shield but not peritrematal shield 2

2. Seta *al*1, on palp genu, is pectinate with at least 5 lateral prongs. Pretarsus I not pedunculate, sheath being only long enough to contain retracted claw-complex. Female ventro-anal shield not fused to exopodal IV shield, but fused in its anal region to opisthonotal shield *pyriformis*-complex

   Seta *al*1, on palp genu, is spatulate with a single lateral prong. Pretarsus I is pedunculate. Female ventro-anal shield is fused to exopodal IV shield, but not to opisthonotal shield . . . *discutatus*-complex

FALCIGER-complex

DIAGNOSIS. Small to average sized species. Separate podonotal and opisthonotal shield. Ventro-anal shield never fused to notal shield, exopodal IV shield or peritrematal shield of female, and rarely fused to notal shield and peritrematal shield on male, but quite often fused to male exopodal IV shield. If male ventro-anal shield fused to notal shield it is also fused to peritrematal shield. Less than 23 pairs of opisthonotal setae. Spermadactyl subequal in length to movable cheliceral digit of male, or slightly longer. On palp genu, seta *al*1 spine-like with 2 to 6 lateral prongs. Pretarsus I pedunculate.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Ventro-anal usually discrete, but may bear aciculae posterior to anus. May be small discrete shield only bearing aciculae. No discrete metapodal. Peritrematal fused to exopodal IV. Split in exopodals II, III and IV. Sterno-metasternal fused to endopodal II and part of III. Three pairs of pre-endopodals.

Male: Ventro-anal either discrete but extending closer to exopodal IV than on female, or more rarely it is fused to exopodal IV, and on *G. falciger* and *G. nepotulus* it is fused to sternito-genital, exopodal IV, peritrematal and notal.

CHAETOTAXY. Idiosoma: 6*j*, 6*z*, 5*s*, 5*r*: 5*J*, 5*Z*, 5*S*, 5*R*, 0-2*UR*: 5*st*: 3*Jv*, 3*Zv*, 0-2*Sv*.

Legs: As *Gamasellus discutatus* (see Fig. 3).

OTHER CHARACTERS. Female: Deutosternal denticles in 7 or 8 horizontal rows with 1 or 2 horizontal deutosternal ridges anterior to denticles. Tectum anterior margin is basically trispinate but usually with a number of spinules around the two smaller lateral spines, which may be large enough to make the margin quinquispinate. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 spine-like with 2 to 6 lateral prongs, and seta *al*2 slightly spatulate. Some dorsal setae on nominal species are always pilose and often spatulate as well, and usually many are lanceolate, only a few being setose. Shields usually dull being covered in an adhesive exudate. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV. Pretarsus I pedunculate, and smaller than other pretarsi. Lateral lobes of pulvilli II-IV much shorter than central, circular lobes. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest and is spatulate.

Male: If there is a ventral protruberance on palp, there is also one on female palp. Movable cheliceral digit with one tooth, and fused at base to similarly shaped spermadactyl, that is subequal in length or slightly longer. On leg II, femur seta *av*, and sometimes seta *pv*1, genu seta *av*, and sometimes tibia seta *av* and tarsus seta *av*2 enlarged into spurs or spines. Sometimes non-setous spurs on leg II (see Fig. 318).

DISTRIBUTION. Nn, Nc, Nr, Na: Es: Pe, Pm, Ps, Pc: Os: Aa, An. The locality records with the original descriptions of nominal species are from the following major regions.

Nearctic region: *G. leggetti* Ryke, 1962c; *G. vibrissatus* Emberson, 1967; *G. bellavistae* Emberson, 1967.

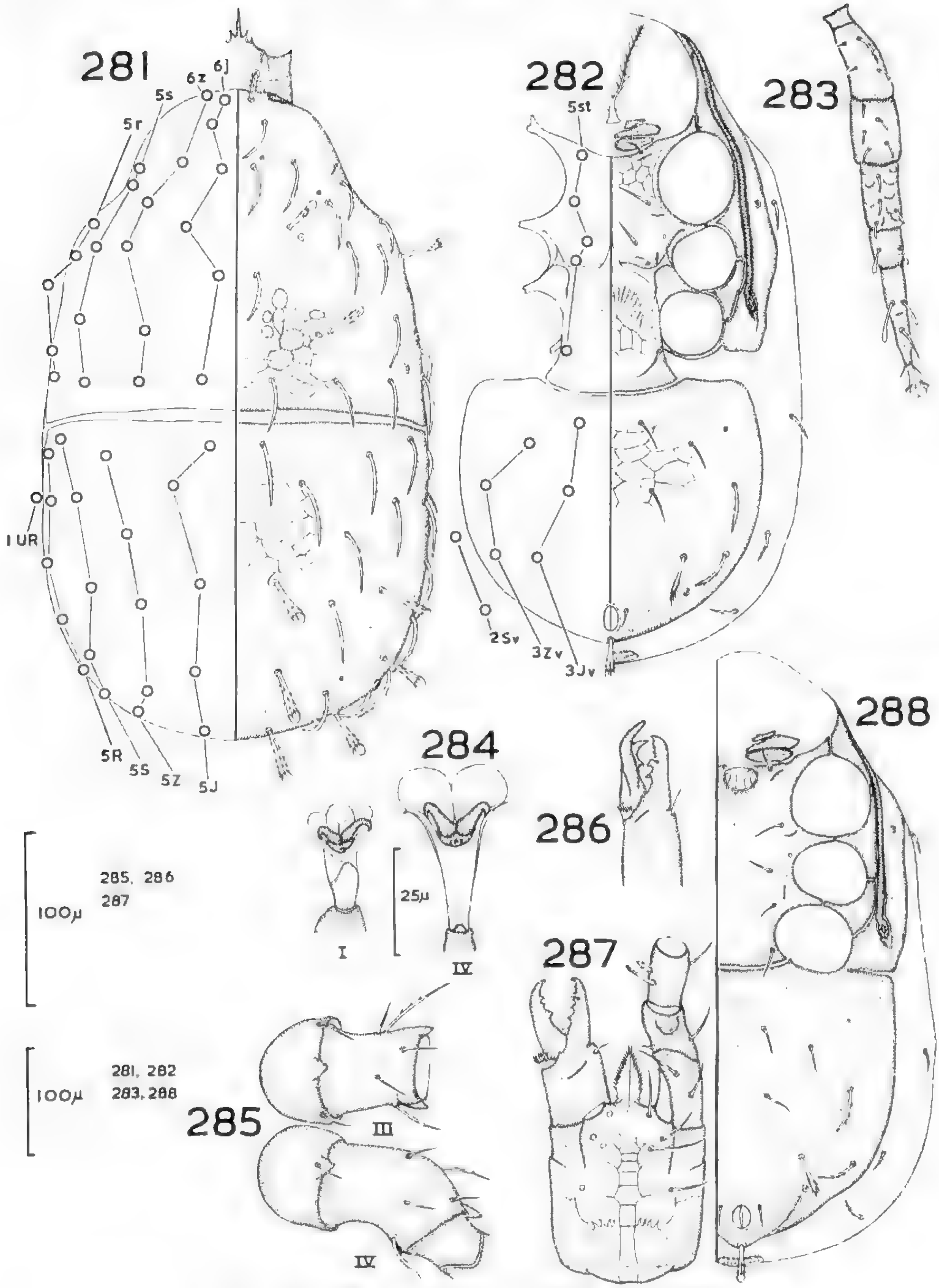
Ethiopian region: *G. deepdalensis* Ryke, 1962c; *G. shongwiensis* Ryke, 1962c.

Palaearctic region: *Gamasellus borealis* (Koch, 1879) **comb.n.**; *G. falciger* (G. & R. Canestrini, 1881); *G. humosus* Ishikawa, 1969; *G. nepotulus* Berlese, 1908; *G. montanus* (Willmann, 1936); *G. sertatus* (Willmann, 1941) (*G. falciger*, syn. Ryke, 1962c); *G. alpinus* Schweizer, 1949; *G. nivalis* Schweizer, 1949; *G. silvestris* Halasková, 1958 (*G. montanus*, syn. Hirschmann, 1962); *G. spiricornis* (G. & R. Canestrini, 1882).

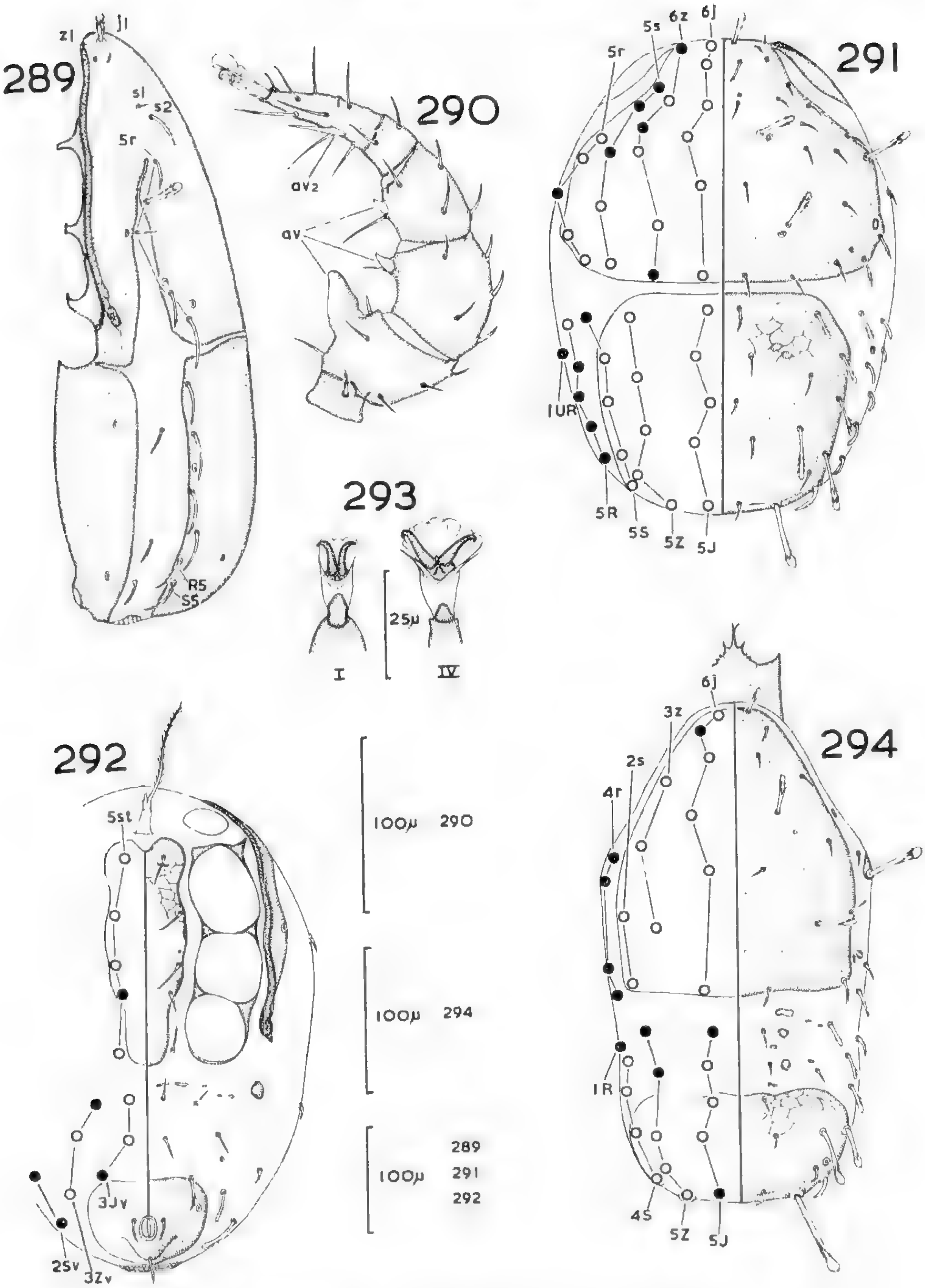
Australian region: *G. concinnus* (Womersley, 1942); *G. tragardhi* (Womersley, 1942); *G. cooperi* (Womersley, 1961).

My new combination for *Gamasus borealis* from the siberian Palaearctic region is only based on the original, brief description. Ten unnamed species from all four zoogeographical regions of North America are described by Emberson (thesis, 1968). The specimens from the Oriental region were from Nepal and are to be dep. BM(NH). Specimens from New Zealand and New Caledonia are dep. SAM.

Found amongst moss, plant litter and upper soil layers. A single female of *G. spiricornis* was found on a carabid beetle, Belgium (Cooreman, 1943).

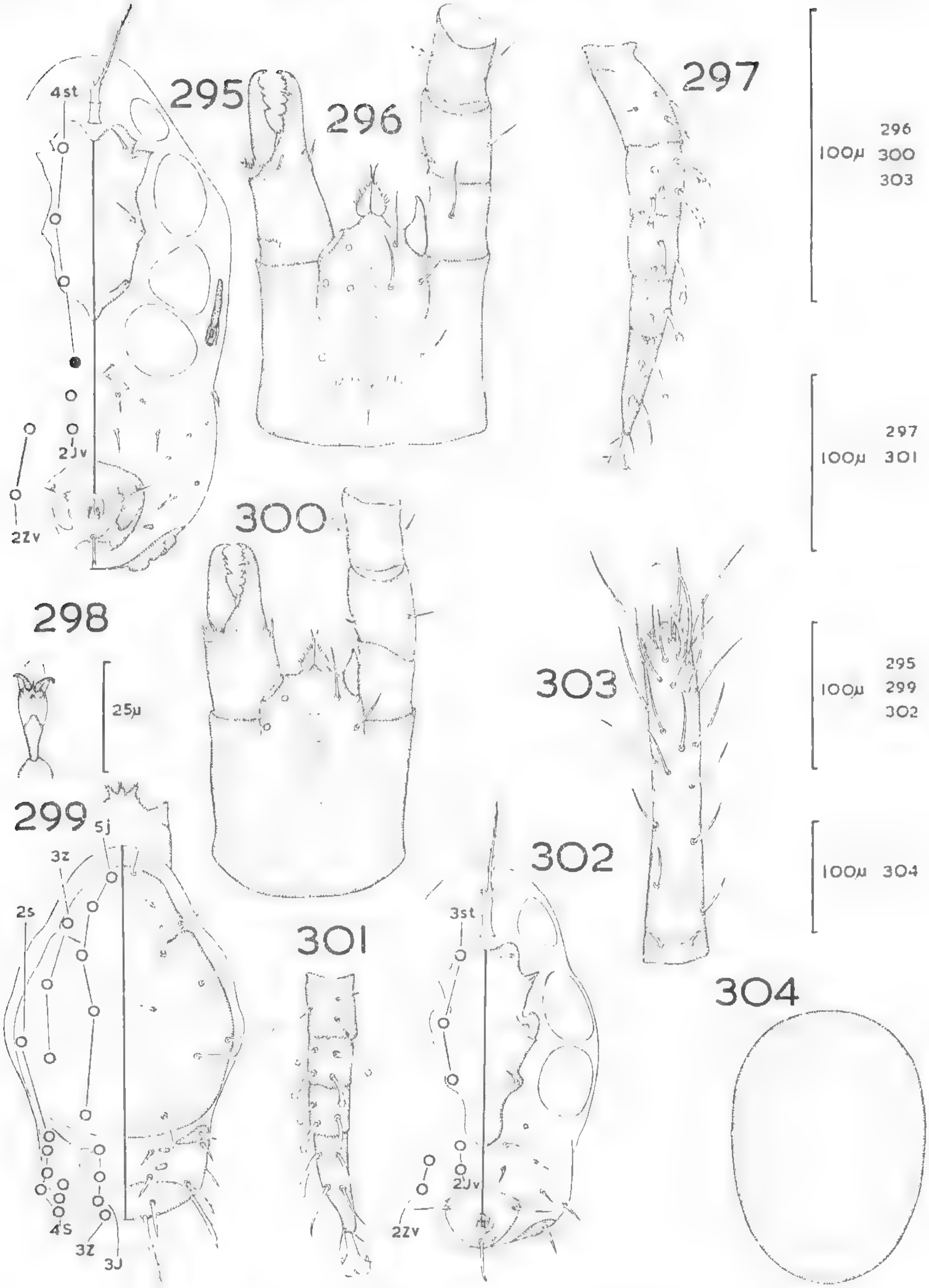


Figs. 281-288. *Gamasellus tragardhi* (Womersley).
281-285 and 287, female: 281, soma, dorsum; 282, idiosoma, venter; 283, leg IV (part), dorsum; 284, pretarsus I and IV; 285, coxae and trochanter III and IV; 287, gnathosoma, venter. 286 and 288, male: 286, chelicera; 288, idiosoma, venter.



Figs. 289-294. *Gamasellus tragardhi* (Womersley).

289 and 290, male: 289, idiosoma, latus; 290, leg II (part). 291-293, deutonymph: 291, idiosoma, dorsum; 292, idiosoma, venter; 293, pretarsus I and IV. 294, protonymph, soma, dorsum.



Figs. 295-304. *Gamasellus tragardhi* (Womersley).

295-297, protonymph: 295, idiosoma, venter; 296, gnathosoma, venter; 297, leg IV (part), dorsum. 298-302, larva: 298, pretarsus I; 299, soma, dorsum; 300, gnathosoma, venter; 301, leg III (part), dorsum; 302, idiosoma, venter. 303, female, tarsus I, dorsum. 304, egg.

REMARKS. Of the *Cyrtolaelaps* (*Gamasellus*) species listed by Ryke (1962) but not listed here in this genus, or in *Acugamasus, Cyrtolaelaps, Parasitiphis* or *Rykellus,* I have seen those described by Berlese and they are not rhodacarids. The same is probably true for the *Gamasellus* species described by Cooreman and Vitzthum, although I have not seen them, and for *G. grabouwensis* Ryke, 1964. The 18 nominal species included in this species-complex are listed in the 'Distribution' section.

Gamasellus tragardhi (Womersley)

Digamasellus tragardhi Womersley, 1942, p. 161.

FEMALE. Fig. 281-285, 287 and 303. Idiosomal length, 610μ.

MALE. Fig. 286 and 288-290. Idiosomal length, 600μ. Note process on genu II is seta *av,* while on *G. falciger* (Fig. 318) and *G. nepotulus* in the Berlese Collection, it is non-setous.

DEUTONYMPH. Fig. 291-293. Idiosomal length, 540μ.

PROTONYMPH. Fig. 294-297. Idiosomal length, 360μ.

LARVA. Fig. 298-302. Idiosomal length, 260μ.

EGG. Fig. 304. Longest axis length, 230μ.

LOCALITY. Female (N196843), male (N196844), deutonymph (N196845), protonymph (N196846), larva (N196847) and egg (N196848) drawn: Australia; LF133, moss off rocks, Stony Creek, nr. Wilmington, South Australia, 25.5.1966, col. H. M. Cooper, dep. SAM (immature stages not collected direct, but bred from females in this sample except the egg which was dissected from a female).

Holotype female (N196849) examined: Australia; moss, Adelaide, South Australia, 6.1935, col. H. Womersley, dep. SAM.

Allotype male (N196850) examined: Australia; moss, Bridgewater, South Australia, 8.1942, col. J. S. Womersley, dep. SAM.

REMARKS. In figured chaetotactic patterns, filled in circles represent setae considered to have been added at the previous moult. Characters of the immature stages have not been used in the classification given here. The extensive drawings of these stages are given only to increase this type of data which is too limited from this family for satisfactory comparative studies. Similar drawings are made in this paper of the immature stages of *Hydrogamasus littoralis* and *Heydeniella dentata.*

DISCUTATUS-complex

DIAGNOSIS. Small to large mites. Both sexes may have either a holonotal shield or separate podonotal and opisthonotal shields, or female may have a holonotal shield and male of the same species have separate podonotal and opisthonotal shields. Ventro-anal of the female fused only to exopodal IV shield and rarely to peritrematal shield as well, while on male it is fused to exopodal IV shield and either to part of the peritrematal shield, or to notal shield. More than 22 pairs of opisthonotal setae. Some females differ from all other Ologamasinae species in that a line joining sternal setae *st*2, *st*3 and *st*4 would enclose an angle of just less than 95°. Spermadactyl sinuous and conspicuously longer than movable cheliceral digit of male. On palp genu, seta *al*1 spatulate with a single lateral prong. Pretarsus I pedunculate.

MORPHOLOGY.

Sclerotization. Female: Usually holonotal but has separate podonotal and opisthonotal in one nominal species (*G. tasmanicus*). Ventro-anal is fused to the exopodal IV along the posterior rim of acetabulum IV and may also be fused to peritrematal. Posterior to ventro-anal there is a small, discrete shield bearing aciculae. No discrete metapodal. Peritrematal fused to exopodal IV. Split in exopodals II, III and IV. Sterno-metasternal fused to endopodal II and III. Two or three pairs of pre-endopodals.

Male: Usually notal is as in the female but in one nominal species (*G. discutatus*) the male has separate podonotal and opisthonotal while the female has a holonotal. Ventro-anal may be fused to notal, in a species (*G. southcotti*) where it is not, its fusion to the podal along the posterior rim of acetabulum IV may extend to part of the peritrematal. Peritrematal usually broader and as a result may carry seta *r*4, which is on striated cuticle in the female.

Chaetotaxy. Idiosoma: 6*j*, 6*z*, 5*s*, 5*r*: 6*J*, 4 or 6*Z*, 4 or 6*S*, 5 or 6*R*, 4, 6 or 9*UR*; 5*st*; 3*Jv*, 3*Zv*, 3*Sv*, 4 or 5*Rv*. In some species setae belonging to row *Rv* are on the notal shield. The 'post-lateral' setae referred to as present on these species by myself (Lee, 1966), are here regarded as belonging to row *Sv* or *Rv*.

Legs: As *Gamasellus discutatus* (see Fig. 3).

Other Characters. Female: Deutosternal denticles in 8 horizontal rows with one horizontal deutosternal ridge anterior to denticles. Tectum anterior margin basically unispinate with lateral spinules, which may be large enough to make the margin quinquispinate. Movable cheliceral digit with 4 teeth. On palp genu, seta *al*1 spatulate with single lateral prong and seta *al*2 slightly spatulate. Most dorsal setae are lanceolate, but always some setae are pilose or pilose and spatulate. Shields dull being covered by an adhesive exudate. Spermatheceal ringed tube probably opens near posterior edge of acetabulum IV. Pretarsus I pedunculate and smaller than other pretarsi. Lateral lobes of pulvilli II-IV attenuated and conspicuously longer than central, circular lobes. Amongst dorsal setae on tarsus IV, seta *ad*2 is the longest and is setose.

Male. Movable cheliceral digit with one tooth and fused at base to slimmer and longer spermadactyl which is sinuous and spatulate at tip. On leg II, femur setae *av* and *pv*1, genu setae *av* and *pv*, tibia seta *av* and tarsus seta *av*2 enlarged to spurs or spines. I (Lee, 1966) incorrectly drew seta *av*2 on tarsi II of males as being setose.

DISTRIBUTION. Aa. All records are from the south eastern states of Australia including Tasmania and are published with the original descriptions of the nominal species.

Found in moss and plant litter.

REMARKS. Five species from the *discutatus*-complex were originally described in the '*discutatus*-group' of *Ologamasus* (Lee, 1966). Characters such as the 2 or 3 pairs of pre-endopodal shields, the pilose setae amongst the simple dorsal setae and the spermatheceal ringed tube aperture on the idiosoma are now regarded as more important than the female holonotal shield, and, therefore, this species-complex has been transferred to *Gamasellus* and *G. tasmanicus*, which has a separate podonotal and opisthonotal shield in both adults and was transferred to *Gamasellus* by Ryke (1962c), has also been included. The following 6 nominal species are, therefore, included in this species-complex: *G. discutatus* (Lee, 1966) **comb.n.**; *G. litoprothrix* (Lee, 1966) **comb.n.**; *G. southcotti* (Lee, 1966) **comb.n.**; *G. tasmanicus* (Womersley, 1956a); *G. tindalei* (Lee, 1966) **comb.n.**; *G. virgosus* (Lee, 1966) **comb.n.**

PYRIFORMIS-complex

DIAGNOSIS. Small to average sized mites. Separate podonotal and opisthonotal shields. Ventro-anal fused to notal shield only in anal region on female but extensively on male. Male ventro-anal shield also fused to exopodal IV shield, but there is a conspicuous fissure between it and the peritrematal shield. More than 22 pairs of opisthonotal setae. Spermadactyl straight and subequal in length to movable cheliceral digit of male. On palp genu, seta *al*1 spine-like with 5 lateral prongs. Pretarsus I not pedunculate, sheath being broadly fused to tarsus and only long enough to contain retracted claw-complex.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Ventro-anal bearing aciculae posterior to anus and in this limited region fused to opisthonotal, but not fused to any other shields. No discrete metapodal. Peritrematal fused to exopodal IV. Split in exopodals II, III and IV. Sterno-metasternal fused to endopodal II and part of III. Three pairs of pre-endopodals.

Male: Ventro-anal is fused to opisthonotal and to exopodal IV around posterior edge of acetabulum IV, but there is a fissure between it and peritrematal.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r: 6J, 5Z, 5S, 5R, 7UR: 5st: 3Jv, 3Zv, 1Sv.*

Legs: As *Gamasellus discutatus* (see Fig. 3).

OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin is basically unispinate, but multispinulate laterally. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 with 5 lateral prongs and seta *al*2 slightly spatulate. Dorsal setae vary in form as for *falciger*-complex. Spermathecal ringed tube opening not known. Pretarsus I not pedunculate, with sheath that is only long enough to contain retracted claw-complex.

Male: Movable cheliceral digit has two small denticles (these may represent the edges of base of broken off single tooth) and is fused at base to similarly shaped spermadactyl which is slimmer but subequal in length. On leg II, femur seta *av*, genu seta *av*, tibia seta *av* and tarsus seta *av*2 are enlarged into spurs or spines.

DISTRIBUTION. Ee. The only published record is from East Africa with the description of the nominate species, while an unnamed species from this region is described by Loots (thesis, 1967).

Found in plant litter and soil.

REMARKS. The members of the *pyriformis*-complex are very similar to the *falciger*-complex, but differ in having a large number of opisthonotal setae, a short, large clawed pretarsus I and a slightly unusual ventral sclerotization on both sexes. There is one nominal species (only the female is known) included in this species-complex, *G. pyriformis* Berlese, 1916a, and Loots (thesis, 1967) describes the female and male of an unnamed species.

Gamasellus pyriformis Berlese

Gamasellus pyriformis Berlese, 1916a, p. 161.

FEMALE. Fig. 312-315. Idiosomal length, 590μ. Pretarsus I broadly fused with tarsus, so that claws appear retractable into tarsus, pulvillus may be present, although not drawn. This specimen contains an egg, with larva (legs and setae visible) inside.

MALE. Not known.

LOCALITY. Single specimen in SEAF collection. Female (175/37) drawn: East Africa; soil and litter, col. Alluaud and Jeannell, dep. SEAF.

Genus ACUGAMASUS **gen.n.**

Type-species: *Digamasellus punctatus* Womersley, 1942.

DIAGNOSIS. Small to average sized mites. Separate podonotal and opisthonotal shields. Ventro-anal shield on female never fused to notal shield, peritrematal shield or exopodal IV shield, but on male may or may not be fused to these shields. Single pair of pre-endopodal shields. Some or most dorsal setae pilose and/or spatulate. Spermathecal ringed tube opening not known. Spermadactyl shorter than movable cheliceral digit of male. Pretarsus I pedunculate.

REMARKS. When Ryke (1962c) redefined *Gamasellus*, as a subgenus of *Cyrtolaelaps*, he included in it a wide variety of species. While some of these species are conspicuously different from *Gamasellus falciger* (*e.g.*, those now referred to *Afrogamasellus* (Rhodacarinae) and *Rykellus* (Ologamasini)), the majority of species not congeneric with the type of *Gamasellus* belong to the same tribe (Gamasellini) and have only a single pre-endopodal shield. I have established this group of species as a new genus; *Acugamasus*.

I recognize two species-complexes within this genus, *punctatus*-complex and *natalensis*-complex, which can be distinguished by the following key. The morphology and distribution of members of this genus are given under the species-complex headings.

KEY TO SPECIES-COMPLEX OF *ACUGAMASUS*

1. Seta of row *R* off opisthonotal shield. Excluding anal setae, at least 6 pairs of setae on ventro-anal shield. No ventral spurs on male palp. Male ventro-anal shield never fused to opisthonotal shield . . . . *punctatus*-complex

   Setae of row *R* on opisthonotal shield. Excluding anal setae, sometimes 6 pairs but often 5 pairs of setae on ventro-anal shield. Ventral spur on proximal palp segments of male or at least 1 ventral setae of palp femur enlarged into spine. Male ventro-anal shield usually fused to opisthonotal shield . . . . *natalensis*-complex

PUNCTATUS-complex

DIAGNOSIS. Ventro-anal shield not fused to notal shield and widely separated from exopodal IV shield on both sexes. Usually most dorsal setae are pilose and sometimes also spatulate. Between 19 and 24 pairs of opisthonotal setae, with at least anterior 2 setae of row *R* on striated cutucle, and 6 pairs of setae on ventro-anal shield (excluding anal setae). Male chelicera and spermadactyl is smooth. Male palp similar to female, being without ventral spurs or spines.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Ventro-anal discrete and bearing aciculae posterior to anus. Discrete metapodal. Peritrematal fused to exopodal IV. Exopodals not completely encasing peraxial edges of acetabula. Sterno-metasternal fused to endopodal II and a small part of III. Single pair of pre-endopodals.

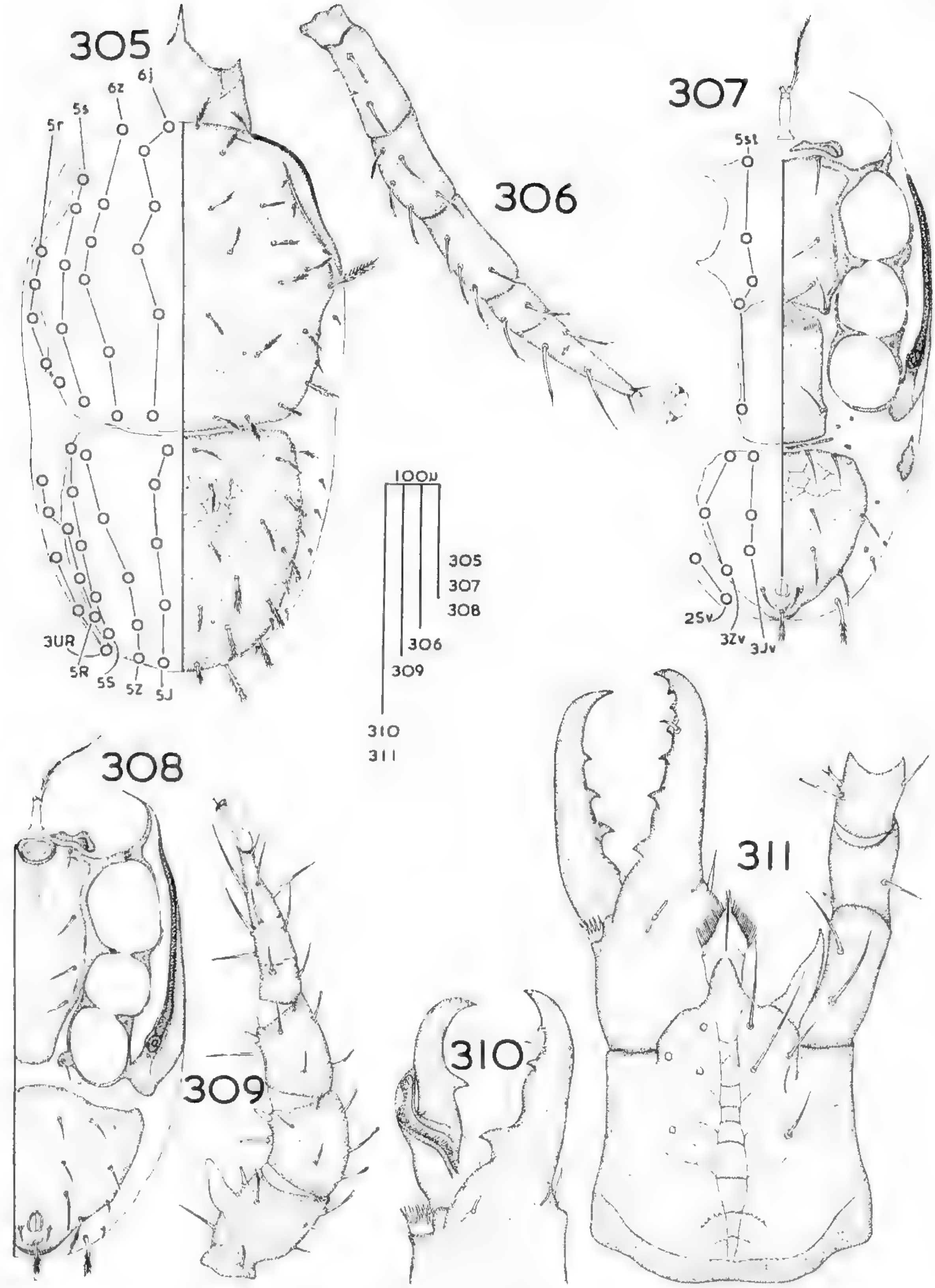
Male: Except on *A. watsoni*, a section of the podonotal carrying at least seta *r*2 and *r*4, is split away posteriorly from the rest of shield and fused to peritrematal. Ventro-anal separate from opisthonotal, but broader than in female (setae *Zv*1 and *Zv*2 being well in from edge) probably including metapodal. Sternito-genital separate from ventro-anal and may be separate from endopodal IV leaving *st*5 either on striated cuticle, or on small discrete shield or on shield fused to endopodal IV.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r: 5J, 5Z, 5S, 5R*, 0-3*UR*: 5*st*: 3*Jv*, 3*Zv*, 2*Sv*.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows with one deutosternal ridge anterior to denticles. Tectum anterior margin having a central spine with a multispinulate lateral margin. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 spatulate, seta *al*2 slightly lanceolate. Three forms of dorsal setae always present, simple, pilose, and pilose and spatulate (size increases through this series), but at the most there are only four pairs of simple setae. Spermathecal ringed tube opening not known. Pretarsus I similar to that of *Gamasellus tragardhi*. Pulvilli II-IV may be as *A. cursor* or with lateral lobes longer than central circular lobes. Amongst dorsal setae on tarsus IV, seta *ad*2 is just the longest and is setose.

Male: Movable cheliceral digit with one tooth, and fused at base to shorter (may be only half length) spermadactyl. On leg II, femur setae *av* and *pv*1, sometimes genu setae *av* and *pv*, and sometimes tibia seta *av*, enlarged into spur or spine. May be non-setous process on genu II.



Figs. 305-311. *Acugamasus cursor* sp.n..
305-307 and 311, female: 305, soma, dorsum; 306, leg IV (part), dorsum; 307, idiosoma, venter; 311, gnathosoma, venter. 308-310, male: 308, idiosoma, venter; 309, leg II, antero-latus; 310, chelicera.

DISTRIBUTION. Aa, Am, An: Sa. The distribution in the australian Australian region is wider than the records published with original descriptions of nominal species would indicate. I have seen specimens from the Australian Capital Territory, Lord Howe Island and New Caledonia, dep. SAM, and from the Solomon Islands, dep. BM(NH). There is one male, closely allied to *A. semipunctatus,* from Wellington, New Zealand, dep. SAM. *A. watsoni* has been collected from Auckland and Campbell Islands, dep. BBM.

Found amongst moss, plant litter and upper soil layers.

REMARKS. The *punctatus*-complex contains the type of *Acugamasus* which is superficially similar to *Gamasellus* because of its two dorsal shields and pilose dorsal setae. Members of the *punctatus*-complex can be distinguished from *Gamasellus* by having only one pair of pre-endopodal shields, a short spermodactyl and a setose seta *av*2 on the male tarsus II. The following 4 nominal species are included in this species-complex: *A. cursor* **sp.n.**; *A. punctatus* (Womersley, 1942) **comb.n.**; *A. semipunctatus* (Womersley, 1942) **comb.n.**; *A. watsoni* (Hirschmann, 1966) **comb.n.**.

Acugamasus cursor **sp.n.**

FEMALE. Fig. 305-307 and 311. Idiosomal length, 510μ. Opisthonotal shield has reticulations but neither notal shield has raised punctations. The cells drawn in Fig. 305, near seta *J*2, belong to a piece of fungal hypha in the exudation layer. On one paratype female (N196855), seta *st*4 is on striated cuticle.

MALE. Fig. 308-310. Idiosomal length, 460μ. The lateral edge of the podonotal shield extends as far forward as seta *s*3, as a fissure separating off part of the podonotal shield bearing setae *r*2, *r*3 and *r*4, and this is fused to peritrematal shield.

LOCALITY. Holotype female (N196851) and allotype male (N196852) drawn, and 3 paratype females (N196853-N196855) and 3 paratype males (N196856-N196858) examined: Australia; LF99, moss on rocks and rotting tree stumps, by Beauchamp Falls, near Beech Forest, Otway Ranges, Victoria, 9.12.1965, col. D. C. Lee, dep. SAM.

REMARKS. Although the number of setae on the opisthonotal shield appears to vary between members of the same nominal species in this species-complex, this species is unusual in having at least 18 pairs of setae, including seta *S*1, on this shield. This species can also be distinguished from the other two nominal species from Australia in not having raised punctations covering most of the podonotal shield.

NATALENSIS-complex

DIAGNOSIS. Ventro-anal shield discrete on female, but rarely so on male where it is usually extensively fused to all the surrounding shields except the sternito-genital. Dorsal setae may be mostly pilose and/or spatulate as on *punctatus*-complex species or only a few dorsal setae may be pilose and/or spatulate as on *Gamasellus falciger*-complex species. Between 21 and 25 pairs of opisthonotal setae, with all setae of row *R* on opisthonotal shield, and usually only 5 pairs of setae on ventro-anal shield (excluding anal setae). Male chelicera and spermadactyl often gnarled. Male palp always has a ventral spur or spine on femur or trochanter that are not present on female.

MORPHOLOGY.

SCLEROTIZATION. Female; Separate podonotal and opisthonotal. Discrete ventro-anal. May be small discrete shield only bearing aciculae. May be discrete metapodal. Peritrematal fused to endopodal IV. Sterno-metasternal fused to endopodal II and part of III. Single pair of pre-endopodals.

Male: Ventro-anal may be discrete, but usually fused to all surrounding shields except the sternito-genital. In the latter case the peritrematal is broader and extensively fused to podonotal.

CHAETOTAXY. Idiosoma: Podosoma has 6*j*, 6*z*, 5*s*, 5*r*: 5*st*. The setation of the opisthosoma is uncertain, but in most species it probably conforms to 5*J*, 5*Z*, 5*S*, 5*R*, 2-4*UR*: 3*Jv*, 3*Zv*, 1*Sv*.

Legs: Unknown.

OTHER CHARACTERS. Female: Tectum anterior margin is trispinate or quinquispinate, or basically trispinate with spinules on and around the spines. Movable cheliceral digit with 3 teeth. The dorsal setae may be either nearly all pilose or all spatulate, or pilose and spatulate, or there may be pilose setae amongst simple setae. In species with a number of row *UR* setae, there are only 5 pairs of setae on the ventro-anal shield, excluding anal setae, seta *Zv*3 being on the striated cuticle.

Male: Tectum anterior margin is usually more elaborate than in female. Ventral spur or spine on proximal segments of palp that is not present in the female. Movable cheliceral digit with 1 tooth and fused at base to similarly shaped, but slightly shorter spermadactyl. Both chelicera and spermadactyl may be gnarled. On femur II, seta *av* enlarged into a spur, usually other spurs also present on leg II.

DISTRIBUTION. Es. All records are from Cape Province and Natal, South Africa and are published with the original descriptions of the nominal species.

Found in plant litter and soil.

REMARKS. I have not seen any members of the *natalensis*-complex so that fewer characters are mentioned. Because its members have only a single pair of pre-endopodal shields, I have transferred this species-complex from *Gamasellus* to *Acugamasus*, but I am uncertain of its relationship to the *punctatus*-complex in latter genus. The following 8 nominal species are included in this species-complex: *A. drakensbergensis* (Ryke, 1962c) **comb.n.**; *A. grahami* (Ryke, 1962c) **comb.n.**; *A. hluhluwensis* (Ryke, 1962c) **comb.n.**; *A. knysnaensis* (Ryke, 1962c) **comb.n.**; *A. macrosetosus* (Ryke, 1962c) **comb.n.**; *A. natalensis* (Ryke, 1962c) **comb.n.**; *A. neotasmanicus* (Ryke, 1962c) **comb.n.**; *A. paranatalensis* (Ryke, 1962c) **comb.n.**. An unnamed species was described by Loots (thesis, 1967).

Genus ALLOGAMASELLUS Athias-Henriot

Allogamasellus Athias-Henriot, 1961b, p. 473. Type-species: *Allogamasellus aquafortensis* Athias-Henriot, 1961b, by original designation.

DIAGNOSIS. Minute mites only known from females. Separate podonotal and opisthonotal shields. Discrete ventro-anal and metapodal shields. Three pairs of pre-endopodal shields. Dorsal setae short and spine-like, except setae *j*1 and *z*1 which are longer and slightly pilose. Spermathecal ringed tube opening not known. Pretarsus I pedunculate.

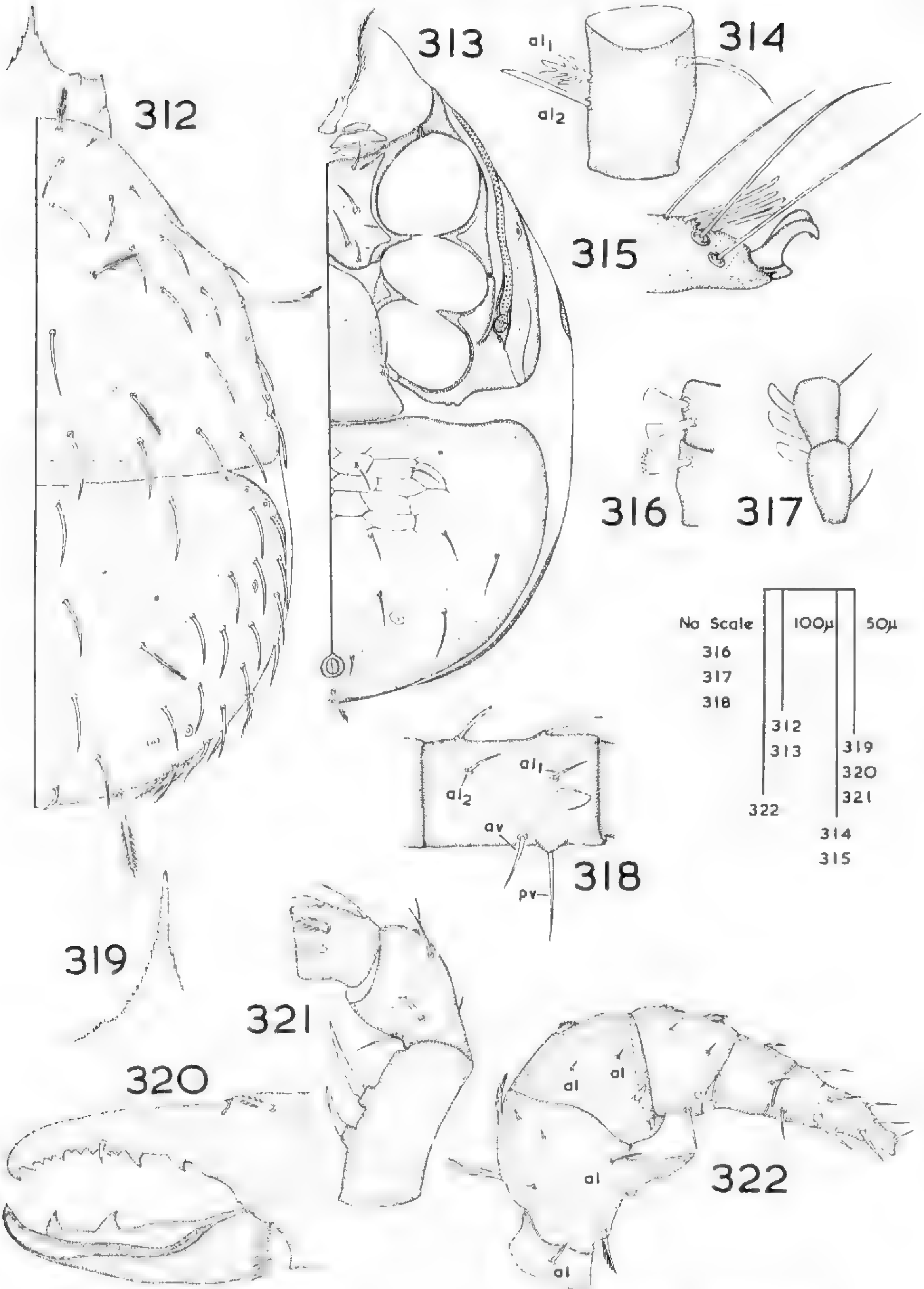
MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal Aciculae not observed. Discrete ventro-anal and metapodal. Peritrematal fused to exopodal IV. Exopodals not completely encasing peraxial edges of acetabula. Metasternal fused, although it may be narrowly, to sternal. Sternal fused to endopodal II and III. Three pairs of pre-endopodals.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r: 5J, 5Z, 5S, 5R*, 2 or 4*UR*: 5*st*: *3Jv, 3Zv, 1Sv*.

Legs: As *Gamasellus.*

OTHER CHARACTERS. Female: Deutosternal denticles in 7 horizontal rows plus a single, anterior, horizontal deutosternal ridge. Movable cheliceral digit with 3 or 4 teeth. On palp genu, seta *al*1 and *al*2 slightly spatulate. Small pore-like structure posterior to capitular seta *hyp*4 on hypostome. Most dorsal setae, short, spine-like, but setae *j*1 and *z*1, longer and slightly pilose. Large pore between setae *s*5 and *r*5 on podonotal shield. Peritreme short, less than twice the diameter of the spiracle. Spermathecal ringed tube opening not known. Pretarsus I pedunculate and smaller than other pretarsi.



Figs. 312-322. *Gamasellus* Berlese, *Laelogamasus* Berlese and parasitid (ex-*Hydrogamasus*) species.

312-315, *G. pyriformis* Berlese, female: 312, soma, dorsum; 313, idiosoma, venter; 314, palp genu; 315, pretarsus I and tarsus I (part). 316 and 317, ex *Hydrogamasus*, *al* setae on palp femur and genu: 316, *H. silvestri* Berlese; 317, *H. salinus* (Laboulbène). 318, *G. falciger* (G. & R. Canestrini), male, genu II. 319-322, *L. simplex* (Berlese), male: 319, mid-tectum; 320, chelicera; 321, palp trochanter, femur and genu, antero-latus; 322, leg II (part).

DISTRIBUTION. Pm. The only records are with the original descriptions of the nominal species from Algeria.

Found amongst plant roots and litter.

REMARKS. *Allogamasellus* males are unknown. The females are similar to those of the *Gamasellus falciger*-complex but there would have to be new intermediate species for it to be preferable to regard this genus as congeneric with *Gamasellus*. The following 2 nominal species are included in this genus: *A. aquafortensis* Athias-Henriot, 1961b; *A. squalidus* Athias-Henriot 1961b. Two syntype females (C988 and C991) of *A. aquafortensis* and the holotype female (C464) of *A. squalidus*, dep. MNHN, have been examined.

Genus CYRTOLAELAPS Berlese

Cyrtolaelaps Berlese, 1887b, XLIV, 5 (not Berlese, 1892a, LXIV, 3). Type-species: *Gamasus mucronatus* G. & R. Canestrini, 1881, by monotypy.

Protolaelaps Trägardh, 1912. p. 563. Type-species: *Gamasellus ? brevispinosus* Trägårdh, 1910 (syn. *Gamasus mucronatus* G. & R. Canestrini, 1881), by original designation.

DIAGNOSIS. Average sized to large mites. Separate podonotal and opisthonotal shields. Ventro-anal shield discrete on female, while on the male it may or may not be fused to notal, but it is always fused to peritrematal and exopodal IV shields. Clearly defined pre-endopodal shields absent. Usually. at least one pair of conspicuously pilose setae on podonotal shield and on opisthonotal shield. Spermathecal ringed tube may open on sternometasternal shield. Spermadactyl stout and fused to shorter movable cheliceral digit along its entire length. Pretarsus I not pedunculate, sheath being broadly fused to tarsus and only long enough to contain retracted claw complex.

MORPHOLOGY.

Sclerotization. Female: Separate podonotal and opisthonotal. Aciculae may be on separate shield or on ventro-anal. Discrete ventro-anal and metapodal. Peritrematal fused to exopodal IV. Exopodals not completely encasing peraxial edges of acetabula. Metasternal discrete or fused to sternal. Sternal fused to endopodal II and sometimes to part of endopodal III. Pre-endopodals absent, or are small and ill defined as described for *C. paraster* by Costa (1961).

Male: Ventro-anal either entirely fused to opisthonotal, peritrematal and exopodal IV, but separate from sternito-genital, or fused only to peritrematal and exopodal IV as described on *C. aster* by Schweizer (1961).

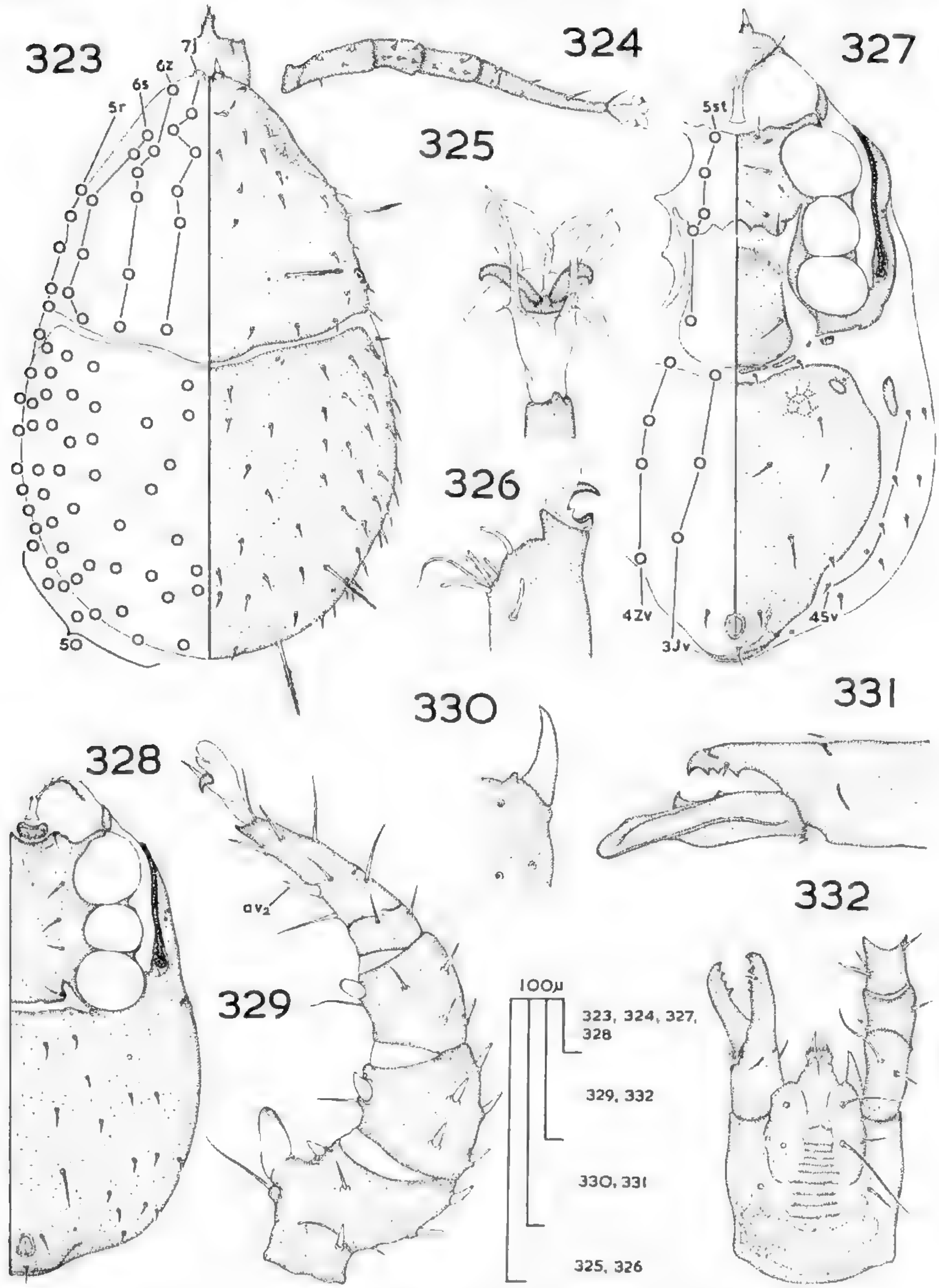
CHAETOTAXY. Idiosoma: *7j*, *6z*, *5-6s*, *5r*: *5J*, *5Z*, *5S*, *5R*, *2UR* or hypertrichous with up to 100 or more setae; *5st*: *3Jv*, *4Zv*, *2-4Sv*.

Legs: As *Gamasellus* with 1 postero-lateral on tibia III and genu III; or 2 postero-laterals on tibia III (2, 3/2, 2) genu III (2, 4/2, 2), or an extra postero-lateral on tibia III only.

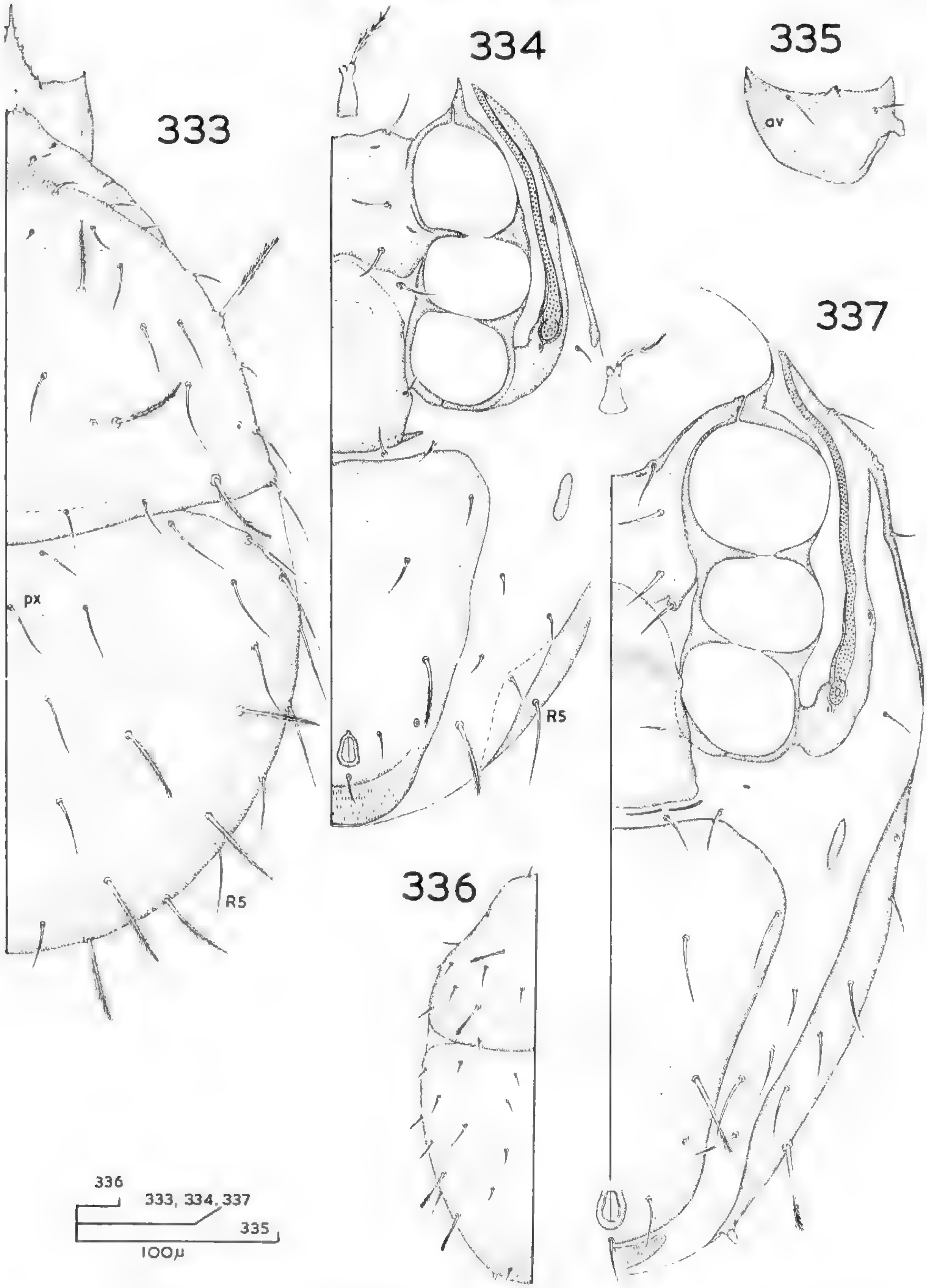
OTHER CHARACTERS. Female: Deutosternal denticles in 10 or 11 horizontal rows. Tectum anterior margin has large central spine with multispinulate sides. Movable cheliceral digit with 3 or 4 teeth. On palp genu, seta *al*1 and *al*2 simple or very slightly spatulate. Vertical seta, *j*1, usually stout spine. Always, some dorsal setae are conspicuously pilose on nominal species, but Emberson (thesis, 1968) records an unnamed species from the californian Nearctic region, which is probably referable to this genus, with simple dorsal seta. Shields are dull. Spermatheceal ringed tube may open between sternal seta *st*3 and acetabulum III. But, considering the similarity of the spermadactyl on males of this genus to the unusually powerful looking spermadactyl of *Euryparasitus emarginatus*, which Michael (1892) claims is used to lift female genital plate so that the spermatophore can be applied directly to the vagina, it may be that vaginal fertilization occurs in this genus also, instead of fertilization through spermatheceal ringed tubes. Pretarsus I not pedunculate, only being long enough to contain retracted claw-complex. Pulvilli II-IV have lateral lobes which are smaller but similar in shape to central lobes, and a pair of streamer-like lobes ventral to claws. Amongst dorsal setae on tarsus IV, seta *ad*2 is the longest and is setose.

Male: Corniculi proportionately longer than in female. Movable cheliceral digit with one tooth and fused to longer, stout spermadactyl along its entire length. On leg II, at least femur setae *av* and *pv*1, genu seta *av*, tibia seta *av* and tarsus seta *av*2 enlarged into spurs or spines.

DISTRIBUTION. Nn, Nc, Nr: Pe, Pm, Ps, Pc. Besides the locality records published with the original descriptions of nominal species there are many published records from the european and mediterranean Palaearctic regions, ranging from Scotland and the Russian Karelian Isthmus in the north, to Spain, Sardinia and Israel in the south. There are also records from the Kemerovo (Tagil'tsev and Men Yan-Tsuy, 1963) and South Primorye regions (Aksenenko, 1963 and Khudyakov, 1963) of Russia, and the western Canadian prairies and California (Emberson, thesis, 1968) in North America showing that this genus has a Holarctic range.



Figs. 323-332. *Cyrtolaelaps mucronatus* (G. & R. Canestrini).
323-327 and 332, female: 323, soma, dorsum; 324, leg IV (part), dorsum; 325, pretarsus IV; 326, pretarsus I plus tarsus I (part); 327, idiosoma, venter; 332, gnathosoma, venter. 328-331, male: 328, idiosoma, venter; 329, leg II (part); 330, corniculus; 331, chelicera.



Figs. 333-337. *Cyrtolaelaps* Berlese.
333-335, *C. aster* (Berlese), female: 333, soma, dorsum; 334, idiosoma, venter; 335, coxa IV. 336 and 337, *C. rectus* (Berlese), female: 336, idiosoma, dorsum; 337, idiosoma, venter.

Usually found in the nests of rodents and moles, but also found on these animals, in the nests of other Insectivora and birds, on ferrets, in caves (sometimes near bat roosts), under stones or fallen leaves, amongst leaf mould, grain spill, rotting potatoes and manure.

REMARKS. *Cyrtolaelaps* is similar to *Euryparasitus*, and if it is shown that both are unusual within the Rhodacaridae in having females that are fertilized either through the vagina or a spermatheceal ringed tube opening on the sterno-metasternal shield, it may be preferable to regard them as synonymous. *Euryparasitus* was included in *Cyrtolaelaps* as a subgenus by Ryke (1962c), but he also similarly included *Gamasellus*, *Digamasellus* and *Gamaselliphis*. The following 6 nominal species are included in this genus: *C. mucronatus* (G. & R. Canestrini, 1881); *C. aster* (Berlese, 1918); *C. minor* Willmann, 1952; *C. paraster* Costa, 1961; *C. rectus* (Berlese, 1920); *C. spurius* (Holzmann, 1969) **comb.n.**. *Gamasellus spalacis* Oudemans, 1912, probably belongs to this genus, but may well be synonymous with *C. mucronatus*. An unnamed species from California is partly described by Emberson (thesis, 1968).

Cyrtolaelaps mucronatus (G. & R. Canestrini).

Gamasus mucronatus G. & R. Canestrini, 1881, p. 1081.

FEMALE. Fig. 323-327 and 332. Idiosomal length, 1,000μ. Chaetotaxy of genu III (2, 4/2, 2) and tibia III (2, 3/2, 2) differs from *Gamasellus* in having two instead of one postero-lateral seta.

MALE. Fig. 328-331. Idiosomal length, 960μ.

LOCALITY. Female (N196841) and male (N196842) drawn: Scotland; mole's nest (4), Roxburgh, East Lothian, 1964, col. R. M. Emberson, dep. SAM. Female idiosoma (34/17, designo in A.M.Sc.it.) examined and considered conspecific with female (N196841) drawn: Italy; manure, Old College, Padova, dep. SEAF.

Cyrtolaelaps aster (Berlese)

Gamasellus (*Protolaelaps*) *aster* Berlese, 1918, p. 137.

FEMALE. Fig. 333-335. Idiosomal length, 700μ. Note following differences to Ryke (1962c) Fig. 9 and 11; seta *z*5 is posterior to *j*6, seta *Jv*3 and *Sv*2 are pilose, peritrematal shield is fused to exopodal IV. The setal characters, as in Ryke (1962c), were used in Costa (1961) to distinguish this species from *C. paraster*, but, although they cannot now be used, being inaccurate, the difference in stoutness of vertical seta (*j*1) holds, and the capitular seta (*hyp*4) is not pilose and a posterior accessory seta (*px*) is present on the opisthonotal shield in this species. Ventral shields are reticulated. Broken line in Fig. 334 indicates extent of opisthonotal shield on right side. There is a small process on coxa IV. Chaetotaxy of genu III (2, 4/2, 1) is as for *Gamasellus* while on tibia III (2, 3/2, 2) there is an extra postero-lateral seta.

MALE. Not figured. Idiosomal length, 680μ. Corniculi proportionately longer than in female. Spermadactyl viewed ventrally seems similar to that of *C. mucronatus,* but shorter. Sclerotization as *C. mucronatus* (and not with ventro-anal shield separate from notal shield as drawn by Schweizer, 1961), but sternito-genital shield extends back closer to ventro-anal shield. Leg II similar to *C. mucronatus* but on genu, seta *pv* is a spur half the size of seta *av*. Process on coxa IV smaller than in female.

LOCALITY. Only two specimens in SEAF collection. Female (190/37) examined: Sardinia; field-mouse's nest, Asuni, col. Krausse, dep. SEAF.

Cyrtolaelaps rectus (Berlese)

Gamasellus (*Protolaelaps*) *rectus* Berlese, 1920, p. 163.

FEMALE. Fig. 336 and 337. Idiosomal length, 850μ. Gnathosoma similar to that of *C. mucronatus* but seta *hyp*3 proportionately shorter. Aciculae, unlike those of other species, are on discrete shield posterior to ventro-anal shield. Vertical seta, *j*1, setose, not a short spine. Chaetotaxy of genu III (2, 4/2, 1) and tibia III (2, 3/2, 1) is as for *Gamasellus.*

MALE. Not known.

LOCALITY. The single 'tipico' female (40/17) drawn: North America; leaf mould, Columbia, Missouri, U.S.A., 1904-1906, col. C. R. Crosby, dep. SEAF. (For justification of this data, see Hammen, 1959, p. 24.)

Genus EURYPARASITUS Oudemans

Euryparasitus Oudemans, 1902a, p. 30. Type-species: *Gamasus terriblis* Michael, 1886 (syn. *Gamasus emarginatus* C. L. Koch, 1839), by monotypy.

Eurylaelaps Oudemans, 1902a, p. 8. *Lapsus* for *Euryparasitus* Oudemans, 1902a.

DIAGNOSIS. Gigantic mites. Separate podonotal and opisthonotal shields. Ventro-anal shield discrete on female, but fused to peritrematal and exopodal IV shield on male. Single pair of clearly defined pre-endopodal shields. Dorsal setae mostly simple, tapered, although some setae near anterior edge of podonotal shield may be slightly pilose. Spermatheca may open direct into vagina. Spermadactyl stout and fused to shorter movable cheliceral digit along its entire length. Pretarsus I not pedunculate, sheath being broadly fused to tarsus and only long enough to contain retracted claw complex.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Discrete metapodal and ventro-anal (bearing aciculae posterior to anus). Peritrematal fused to exopodal IV. Exopodals narrow, inconspicuous. Sterno-metasternal fused to endopodal II. Single pair of pre-endopodals.

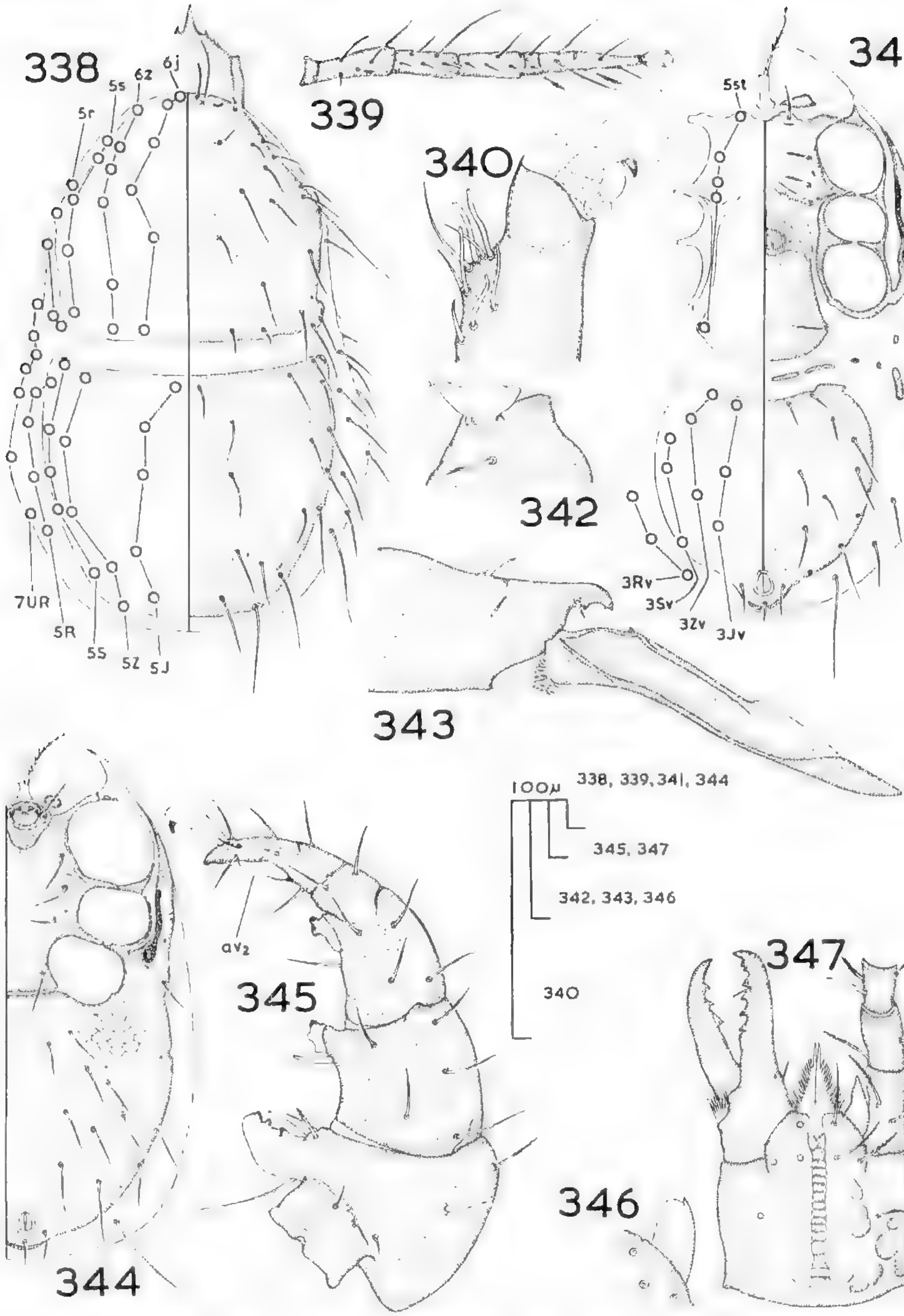
Male: Ventro-anal fused to peritrematal and exopodal IV, but separate from opisthonotal and sternito-genital.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r: 5J, 5Z, 5S, 5R, 7UR: 5st: 3Jv, 3Zv, 3Sv, 3Rv.*

Legs: As *Gamasellus.*

OTHER CHARACTERS. Female: Deutosternal denticles in 16 horizontal rows. Tectum anterior margin basically trispinate, with central spine being the largest and with a number of spinules lateral to the 2 lateral spines. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 slightly pilose and seta *al*2 slightly spatulate. On palp femur, seta *al* in proximal third, unusually long, being sub-equal in length to ventral setae on palp trochanter. Dorsal setae simple (or slightly pilose), tapered. Shields are dull. Peritreme fairly short, not extending anteriorly to mid-acetabulum II. Michael (1892) claims that the spermatophore is applied directly to the vagina, which has a domed recess (spermatheca) in its roof that stores the sperms. But, there is a tube opening between sternal seta *st*3 and acetabulum III, apparently on the female only, as for *Cyrtolaelaps*, and this may be a spermathecal ringed tube. Pretarsus I not pedunculate, only being long enough to contain retracted claw-complex. Pulvilli II-IV with central lobes enlarged and merged into a single pleated flap with a fimbriated distal margin, while lateral lobes are inconspicuous. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest and is setose.

Male: Corniculi with paraxial flap. Movable cheliceral digit without tooth and fused to much longer, stout spermadactyl along its entire length. Anterior edge of podonotal shield is more heavily sclerotized than in female and produced forward (in *E. calcarator* it covers the gnathosoma). On trochanter I, seta *d* large and knob-like. On leg II, femur seta *av*, genu seta *av*, tibia seta *av*, tarsus seta *av*2 enlarged into spurs; while femur seta *pv*1 and genu seta *pv* are spines. Tibia and tarsus II are fused together.



Figs. 338-347. *Euryparasitus emarginatus* (Koch).

338-341 and 347, female: 338, soma, dorsum; 339, leg IV (part), dorsum; 340, pretarsus I and tarsus I (part); 341, idiosoma, venter; 347, gnathosoma, venter. 342-346, male: 342, trochanter I (part), dorsum; 343, chelicera; 344, venter; 345, leg II (part); 346, corniculus.

DISTRIBUTION. Nc, Na: Pe, Pm, Ps, Pc. Besides the locality records published with the original descriptions of the two nominal species there are many published records from the european Palaearctic region, ranging from Scotland and the Russian Karelian Isthmus in the north to Spain and Corsica in the south. There are also records from Kemerovo (Tagil'tsev and Men Yan-Tsuy', 1963) and South Primorye (Aksenenko, 1963 and Khudyakov, 1963) regions of Russia and from British Columbia and Oregon in North America (Emberson, thesis, 1968).

Usually found in nests of rodents, moles and sometimes other Insectivora, but also found on these animals, in caves (sometimes near bat roosts), in moss on soil and in forest soil.

REMARKS. There are a number of similarities between *Euryparasitus* and *Cyrtolaelaps*, some of which probably reflect a close phylogenetic relationship as well as the occupation of a similar ecological niche. As suggested in the remarks on *Cyrtolaelaps*, it may be preferable to transfer members of this genus to *Cyrtolaelaps*. The following two nominal species are included in this genus: *E. emarginatus* (C. L. Koch, 1839); *E. calcarator* (Banks, 1910).

Euryparasitus emarginatus (C. L. Koch)

Gamasus emarginatus C. L. Koch, 1839, 24.17.

Gamasus terriblis Michael, 1886, p. 265.

FEMALE. Fig. 338-341 and 347. Idiosomal length, 1,800μ.

MALE. Fig. 342-346. Idiosomal length, 1,780μ. The anterior edge of the podonotal shield is more heavily sclerotized than in female and produced forward to cover more of the gnathosoma.

LOCALITY. Two females (N196875 and N196876) and two males (N196877 and N196878) drawn or examined: Scotland; mole's nest (4), Roxburgh, East Lothian, 1964, col. R. M. Emberson, dep. SAM.

Subgenus EVANSSELLUS Ryke

Evanssellus Ryke, 1961b, p. 17. Type-species: *Evanssellus foliatus* Ryke, 1961b, by original designation.

DIAGNOSIS. Small to average sized mites. Separate podonotal and opisthonotal shields. Ventro-anal shield discrete on female, while on the male it is fused to the peritrematal shield and exopodal IV shield and sometimes to the sternito-genital shield. Single pair of pre-endopodal shields. Dorsal setae sinuous, lanceolate or spatulate and sometimes pilose, rarely setose. Spermathecal ringed tube opening not known. Pretarsus I absent. Large leg I bearing stout spines (anterior spine on genu I is seta *al*1).

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Discrete ventro-anal. Posterior to ventro-anal there is a small discrete shield only bearing aciculae. Peritrematal fused to exopodal IV. Exopodals slim or absent around middle of peraxial margins of acetabula II and III. Sterno-metasternal fused to endopodal II. Single pair of pre-endopodals.

Male: Ventro-anal not fused to opisthonotal, but fused to peritrematal and exopodal IV, and may or may not be fused to sternito-genital.

CHAETOTAXY. Idiosoma: 6*j*, 6*z*, 5*s*, 5*r*: 5*J*, 5*Z*, 5*S*, 5*R*: 4 or 5*st*: 3*Jv*, 3*Zv*.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin basically unispinate but with lateral spinules. Movable cheliceral digit with 2 teeth. On palp genu, seta *al*1 pilose with over 11 lateral prongs and seta *al*2 spine-like. Dorsal setae are sinuous, lanceolate or spatulate and sometimes pilose as well. Vertical seta, *j*1, on prominent protuberance. Sternal seta, *st*4, may be absent. Shields dull and covered by an adhesive exudate. Spermathecal ringed tube opening not known. Pretarsus I absent. The following setae on leg I developed into large spines: setae *al*1 and *pv* on genu, setae *av*2 and *pv*2 on tibia. Lateral lobes of pulvilli II-IV attenuated and longer than central oval lobes. Amongst dorsal setae on tarsus IV, seta *pd*3 or *ad*2 is the longest and both are lanceolate or spatulate.

Male: Movable cheliceral digit with 1 tooth, and fused at base to slightly longer spermadactyl. On femur II, seta *av* enlarged into a spur which may be quite inconspicuous.

DISTRIBUTION. Aa, An: Sa: NTe. Besides the published records of nominal species which are all from Australia or New Zealand south of 36° South, I have seen specimens from Auckland Island to be dep. BBM, and Athias-Henriot (personal communication, 26.3.1969) informs me that *Evanssellus* specimens were collected on the Isla de Chiloe, Chile, 1961-62, during a study directed by Professor F. di Castri.

Found in moss or plant litter.

REMARKS. I (Lee, 1967) transferred *Evanssellus* to *Heterogamasus* giving it the rank of subgenus. I here revoke this change in rank, once more regarding *Evanssellus* as a genus. The consistent differences between the two groups of species (*Heterogamasus* and *Evanssellus*), the few individual members of which exhibit a fair range of characters in both cases, suggest that these taxa have had a separate evolution considerable enough to be comparable with that of other rhodacarid genera. The following two nominal species are included in this genus: *E. foliatus* Ryke, 1961; *E. medusa* Lee, 1967.

Genus HETEROGAMASUS Trägårdh

Heterogamasus Trägårdh, 1907, p. 2. Type-species: *Heterogamasus claviger* Trägårdh, 1907, by monotypy.

DIAGNOSIS. Small to average sized mites. Separate podonotal and opisthonotal shields. Ventro-anal shield discrete on female, while on male it is fused to peritrematal and exopodal IV shields and sometimes to sternito-genital shield. Single pair of pre-endopodal shields. Dorsal setae spatulate or lanceolate and sometimes pilose, rarely setose. Spermathecal ringed tube opening not known. Pretarsus I pedunculate and small. Large leg I bearing stout spines (anterior spine on genu I is seta *av*2).

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Discrete ventro-anal bearing aciculae posterior to anus. Peritrematal fused to exopodal IV and extends backwards from this point as well as dorsally, to broadly fuse with podonotal. Split in exopodals II, III and IV. Sterno-metasternal fused to endopodal II. Single pair of pre-endopodals.

Male: Ventro-anal not fused to opisthonotal, but fused to peritrematal, exopodal IV and sternito-genital.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r: 5J, 5Z, 5S, 6R*, 0 or *3UR: 5st: 3Jv, 3Zv, 0-2Sv*.

Legs: Differs from *Gamasellus* in having an extra postero-lateral on genu III (2, 4/2, 2) and tibia III (2, 3/2, 2).

OTHER CHARACTERS. Female: Deutosternal denticles in 7 horizontal rows. Tectum anterior margin basically unispinate, but spine is bifurcate at tip and there are a series of lateral spinules. Movable cheliceral digit with 3 or 4 teeth. On palp genu, seta *al*1 slightly pilose over distal half and seta *al*2 simple. Most dorsal setae spatulate or lanceolate and may be pilose. Vertical seta, *j*1, not on prominent protruberance. Shields dull and covered by an adhesive exudate. Spermathecal ringed tube opening not known. Pretarsus I pedunculate and smaller than other pretarsi. The following setae on leg I developed into large spines; setae *av*2 and *pv* on genu, setae *av*2 and *pv*2 on tibia. Lateral lobes of pulvilli II-IV attenuated and longer than central oval lobes. Amongst dorsal setae on tarsus IV, seta *ad*2 is the longest and is setose.

Male: Movable cheliceral digit with 1 tooth, and fused at base to spermadactyl of similar length. On leg II, femur seta *av*, and genu seta *av* enlarged into spurs.

DISTRIBUTION. NTc: Sm. All records are from near the southern end of South America and are published with original descriptions of nominal species.

Found amongst plant litter or under stones.

REMARKS. Previously I (Lee, 1967) redefined *Heterogamasus* and included *Evanssellus* as a subgenus. As remarked on under *Evanssellus*, that taxon is again regarded as a genus. The following three nominal species are included in this genus: *H. claviger* Trägårdh, 1907; *H. calcarellus* Lee, 1967; *H. spinosissimus* (Balogh, 1963b).

Genus HINIPHIS **gen.n.**

Type-species: *Hiniphis hinnus* **sp.n.**

DIAGNOSIS. Minute mites. Separate podonotal and opisthonotal shields. Ventro-anal shield is broadly fused to opisthonotal shield, peritrematal shield and exopodal IV shield on both sexes and to the sternito-genital shield on the male. Two pairs of pre-endopodal shields. All dorsal setae are simple and tapered. Spermathecal ringed tube opening not known. Pretarsus I pedunculate.

MORPHOLOGY.

Sclerotization. Female: Separate podonotal and opisthonotal. Ventro-anal fused to opisthonotal, peritrematal and exopodal IV, and bearing aciculae posterior to anus. Peritrematal fused to exopodal III and IV. Split in exopodals II and III. Sterno-metasternal fused to endopodals II, III and IV. Two pairs of pre-endopodals.

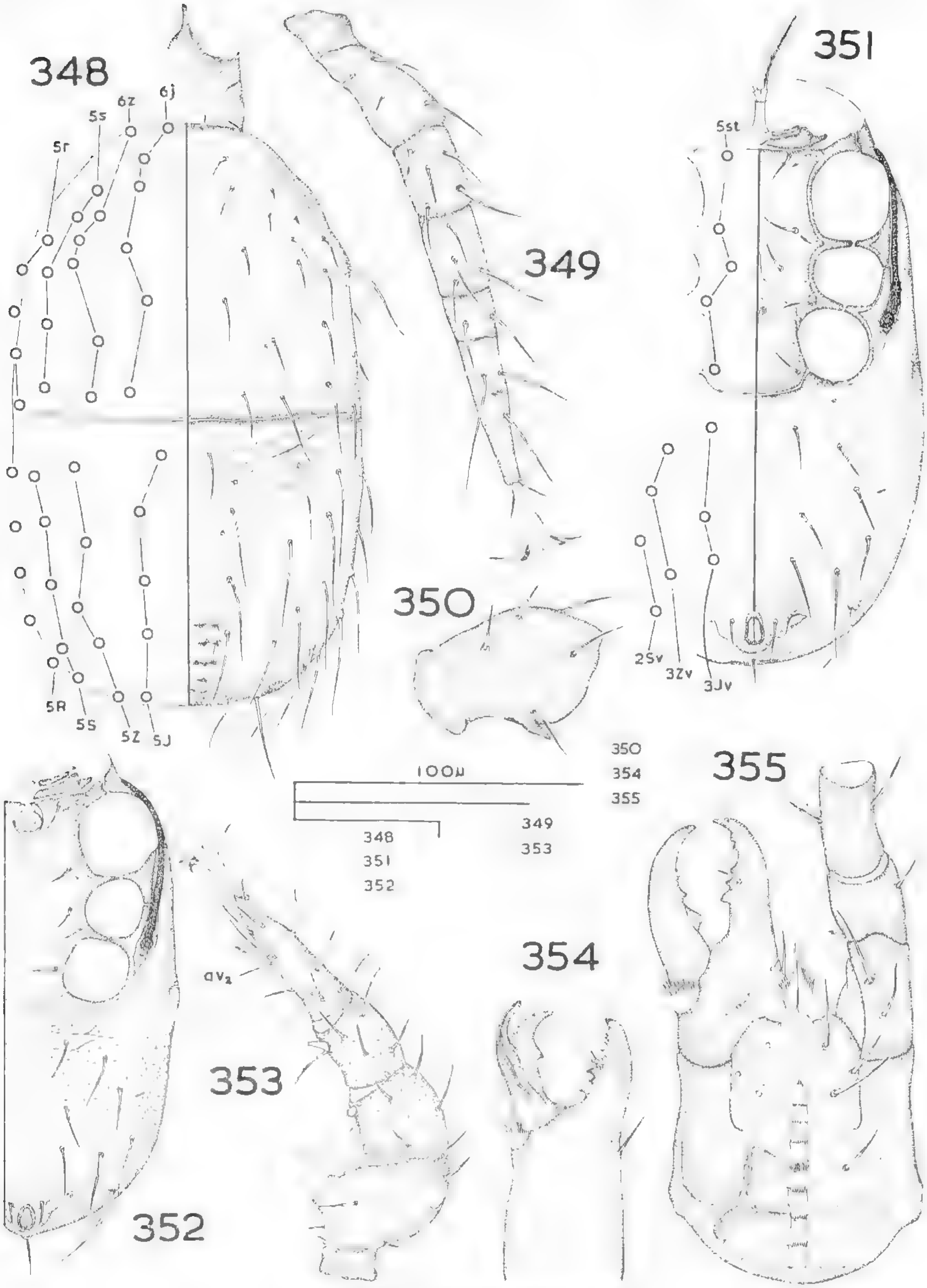
Male: Sternito-genital fused to ventro-anal, otherwise as female.

Chaetotaxy. Idiosoma: *6j, 6z, 5s, 5r: 5J, 5Z, 5S, 5R: 5st: 5Jv, 3Zv, 2Sv.*

Legs: As *Gamasellus.*

Other Characters. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin is unispinate. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 tapering spine and seta *al*2 is slightly spatulate. Dorsal setae are simple and tapered. Shields are slightly shiny. Spermathecal ringed tube opening not known. Pretarsus I pedunculate and smaller than other pretarsi. Lateral lobes of pulvilli II-IV attenuated and longer than central oval lobes. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest and is setose.

Male: Movable cheliceral digit with 1 tooth and fused along proximal half with spermadactyl of similar length. On leg II, femur seta *av*, tibia seta *av* enlarged into spurs, and femur and genu setae *pv* are small spines, while tarsus seta *av*2 is a large spine.



Figs. 348-355. *Hiniphis hinnus* sp.n..
348-351 and 355, female: 348, soma, dorsum; 349, leg IV (part), dorsum; 350, trochanter IV, venter; 351, idiosoma, venter; 355, gnathosoma, venter. 352-354, male: 352, idiosoma, venter; 353, leg II (part); 354, chelicera.

DISTRIBUTION. Aa. Collected from a number of locations in southern Victoria, Australia, besides the locality given below with the description of the type-species.

Found in moss.

REMARKS. Hiniphis is unusual in having a divided dorsal shield but considerable fusion of other shields on the female as well as the male. The following single nominal species is included in this genus: *H. hinnus* **sp.n.**

Hiniphis hinnus sp.n.

FEMALE. Fig. 348-351, 355. Idiosomal length, 390μ. Trochanter IV has a non-setous spur.

MALE. Fig. 352-354. Idiosomal length, 360μ. Trochanter IV has a spur that is about half as long as that figured for the female.

LOCALITY. Holotype female (N1968222), allotype male (N1968223), 4 paratype females (N1968225-N1968228) and 3 paratype males (N1968224, N1968229, N1968230) drawn or examined: Australia; LF104, moss, *Pinus radiata* plantation, near Beech Forest, Otway Ranges, Victoria, 9.12.1965, col. D. C. Lee, dep. SAM.

Genus LAELOGAMASUS Berlese

Laelogamasus Berlese, 1905, p. 167. Type-species: *Gamasus (Laelogamasus) simplex* Berlese, 1905, by original designation.

DIAGNOSIS. Small mites. Separate podonotal and opisthonotal shields. Ventro-anal shield discrete on female, but fused to exopodal IV and peritrematal shield on male. Two or 3 pairs of pre-endopodal shields. Most dorsal setae on idiosoma, and genu and tibia II, III and IV, are densely pilose along their entire length. Spermatheceal ringed tube opens distally on dorsal surface of coxa III. Pretarsus I pedunculate or absent.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Discrete ventro-anal bearing aciculae posterior to anus. No discrete metapodal. Peritrematal fused to exopodal IV. Split in exopodals II, III and IV. Sterno-metasternal fused to entire endopodal II and part of III. Two or three pairs of pre-endopodals.

Male: Ventro-anal is not fused to sternito-genital or notal but it is fused to peritrematal and exopodal IV.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r: 5J, 5Z, 5S, 5R, 5UR: 5st: 3Jv, 3Zv, 3Sv,* 2 or *3Rv*.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin having a central spine with multi-spinulate lateral margin. On palp genu, seta *al*1 pilose with more than 5 lateral prongs and seta *al*2 setose or spine-like. Dorsal idiosomal setae all densely pilose. Shields are dull. Spermathecal ringed tube probably opens distally on dorsal surface of coxa III. Pretarsus I pedunculate and smaller than other pretarsi or absent. Lateral lobes of pulvilli II-IV are attenuated and shorter or subequal in length to central circular lobes.

Male: Movable cheliceral digit with 1 tooth, and fused near base to similarly curved spermadactyl which is subequal in length or slightly longer. On leg II, femur seta *av* enlarged into a spur while most ventral setae on more distal segments are enlarged into spines.

DISTRIBUTION. Om. Published record of single nominal species is from Java, but unnamed specimens have been seen from Borneo, Malaya and Sumatra, dep. BM(NH).

Found amongst plant litter on soil.

REMARKS. Having seen at least 3 conspicuously different species, with the unusually pilose dorsal setae on the legs as well as the idiosoma, with the probable, unusually location of the spermathecal ringed tube for *Gamasellus*-like mites, and from a limited geographical region, I consider that *Laelogamasus* is a distinct genus, possibly relatively unrelated to *Gamasellus*. There is 1 nominal species in this genus, *L. simplex* Berlese, 1905, but at least 2 unnamed species have been collected from the localities listed above, dep. BM(NH).

Laelogamasus simplex (Berlese)

Gamasellus (*Laelogamasus*) *simplex* Berlese, 1905, p. 167.

FEMALE. Redescribed by Berlese, (1906, p. 115).

MALE. Fig. 319-322. Idiosomal length, 440μ. Apparently all that remains of the types is on the slide listed below. Most of this material (that can be seen without remounting) is drawn.

LOCALITY. Some of the 'cotipico' male (33/4), slide has gnathosoma and parts of legs only, drawn: Java; Island of Iaba, Buitenzorg.

Genus LITOGAMASUS **gen.n.**

Type-species: *Cyrtolaelaps setosus* Kramer, 1898.

DIAGNOSIS. Small to gigantic mites. Separate podonotal and opisthonotal shields. Ventro-anal shield discrete on female and male. Peritrematal shield always fused to exopodal IV shield on female but may not be on male. May be single pair of pre-endopodal shields, but more often there are a number of small shields posterior to the main pair of shields. Dorsal setae tapered and may or may not be slightly pilose. Spermatheceal ringed tube opening not known. Male fixed cheliceral digit has conspicuous ridges dorsally, each side of a groove in which the *pilus dentilis* is located. Pretarsus I not pedunculate, sheath being broadly fused to tarsus and only long enough to contain retracted claw complex.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Ventro-anal discrete, may be narrow (bearing less than the 6 pairs of setae in setal rows *Jv* and *Zv*) and may or may not bear aciculae. Posterior to ventro-anal there may be a small discrete shield only bearing aciculae. Discrete metapodal. Peritrematal reduced and narrowly joined to exopodal IV. Exopodals slight and not split around peraxial edge of acetabula III and IV. Sterno-metasternal fused to endopodal II. Usually 2 pairs of pre-endopodals with the posterior or both pairs fragmented, but may be only single pair.

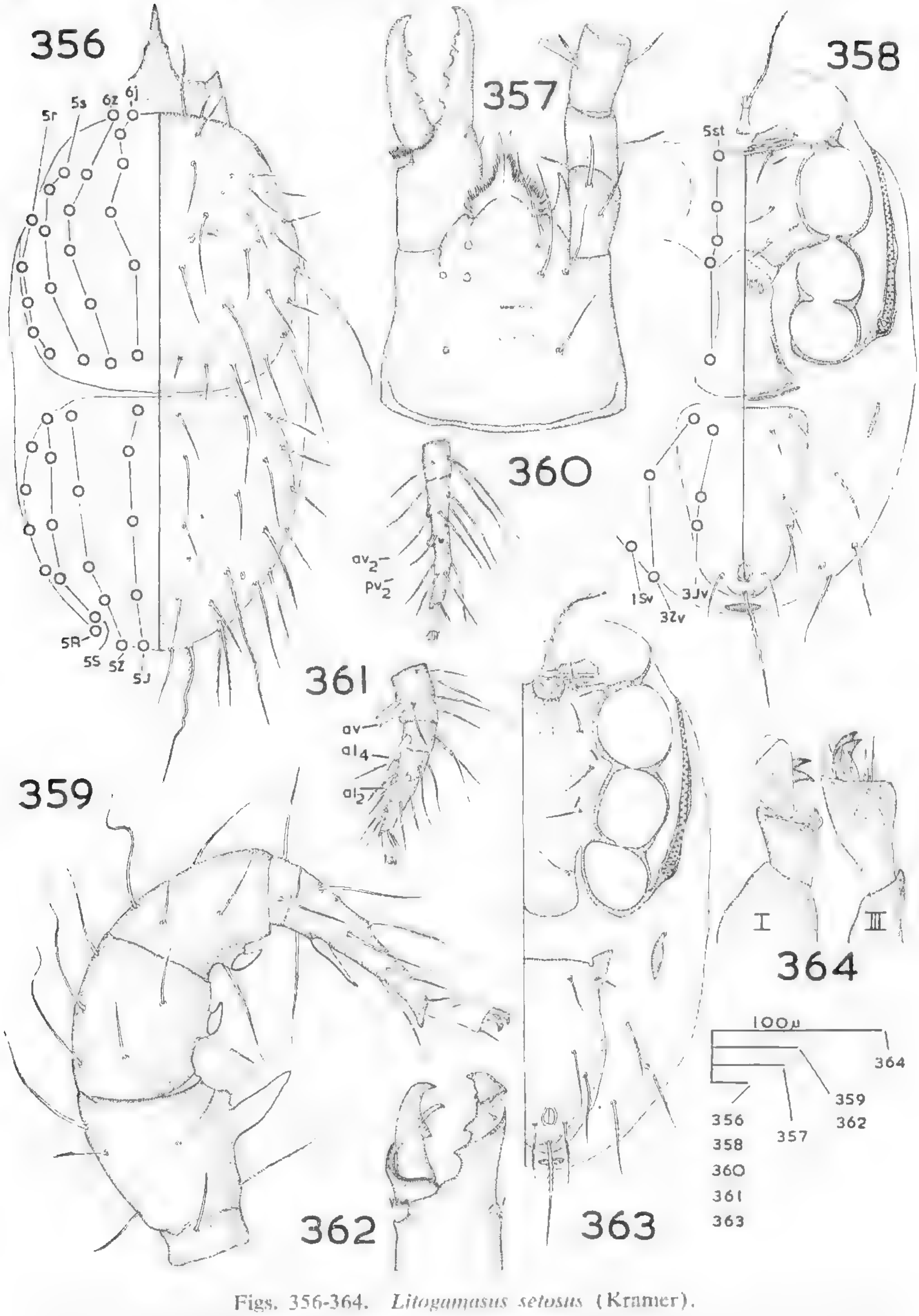
Male: Ventro-anal discrete. Sternito-genital not fused to ventro-anal or endopodal IV. Peritrematal may or may not be fused to exopodal IV.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r: 5J, 5Z,* 4 or *5S,* 3 or *5R: 5st: 3Jv, 3Zv,* 1 or *2Sv.*

Legs: As *Gamasellus.*

OTHER CHARACTERS. Female: Deutosternal denticles in 7 or 8 horizontal rows. Tectum anterior margin basically unispinate, but may have a few lateral spinules. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 tapered and slightly pilose, and seta *al*2 spatulate or spine-like. On palp femur, seta *al* usually in proximal third, but in one unnamed species from South Georgia it is in central third (the only species of Ologamasinae for which this is true). Dorsal setae tapered and sometimes inconspicuously pilose. Shields shiny. Spermatheceal ringed tube opening not known. Pretarsi sheath I not pedunculate only being large enough to contain retracted claw-complex. Pulvilli II-IV have a pair of streamer-like lobes ventral to claws, while dorsally there may be attenuated central and lateral lobes or a single pair of large circular lobes. Amongst dorsal setae on tarsus IV, setae *ad*4 and *pd*4 may be the longest, or they may be short and spine-like and seta *pd*3 the longest.

Male: Movable cheliceral digit with single tooth and fused at base to attenuated spermadactyl or similar length. Fixed cheliceral digit ridged dorsally. On leg II, femur setae *av* and *pv*, genu seta *av*, tibia seta *av*, tarsus seta *av*2 modified into spurs or spines. Other legs may have modified setous or non-setous processes.



Figs. 356-364. *Litogamasus setosus* (Kramer).

356-358 and 364, female: 356, soma, dorsum; 357, gnathosoma, venter; 358, idiosoma, venter; 364, pretarsus I and III. 359-363, male: 359, leg II (part), antero-latus; 360, tarsus III; 361, tibia and tarsus IV; 362, chelicera; 363, idiosoma, venter.

DISTRIBUTION. Sm, Sa: ACs. Besides the published record of the single nominal species from Tierra del Feugo, I have seen an unnamed species and *L. setosus* from Auckland and Campbell Islands to be dep. BBM, and another unnamed species from South Georgia, dep. SAM.

Found in or near to littoral zone.

REMARKS. Excepting the division of the dorsal shield *Litogamasus* has a number of characters in common with *Parasitiphis*, but these may only be an indication that they occupy a similar habitat. The following single nominal species, previously in *Cyrtolaelaps*, is included in this genus: *L. setosus* (Kramer, 1898) **comb.n.**. Two unnamed species have been described, one from South Georgia by Hunter (manuscript), some dep. SAM, and the other from Auckland and Campbell Islands by Hunter and Lee (manuscript) dep. BBM.

Litogamasus setosus (Kramer) **comb.n.**

Cyrtolaelaps setosus Kramer, 1898, p. 22.

FEMALE. Fig. 356-358, 364. Idiosomal length, 1,410μ.

MALE. Fig. 359-363. Idiosomal length, 1,420μ. Tectum is slightly broader and more heavily sclerotized than on female. The processes on tarsus III are non-setous. On leg IV, genu ventral setae are spine-like as are those on the tibia. Leg IV is enlarged to a similar extent to that of leg II.

LOCALITY. Type female (137) and type male (117) drawn: South America; under stone, at mouth of brook above high tide mark or seashore, Uschuaia, Tierra del Fuego, Argentina, 27.10.1892, col. Michaelsen, dep. ZMH.

Genus NOTOGAMASELLUS Loots and Ryke

Notogamasellus Loots and Ryke, 1966b, p. 30. Type-species: *Notogamasellus (Notogamasellus) vandenbergi* Loots and Ryke, 1966b, by original designation.

DIAGNOSIS. Minute mites. Separate podonotal and opisthonotal shields, podonotal shield being conspicuously larger than opisthonotal shield. Ventro-anal shield discrete on the female and male, but on male it is larger extending anteriorly to carrying more setae. Peritrematal shield reduced and may or may not be narrowly connected to exopodal IV shield. Setation of podonotum hypertrichous. Single pair of pre-endopodal shields. The short dorsal setae may all be pilose or most of them are peg-like with a central spherical dilation. Location of spermathecal ringed tube, if present, unknown. Pretarsus I absent.

REMARKS. *Notogamasellus* was originally defined with two subgenera, *Notogamasellus* and *Podonotogamasellus*, which may be distinguished by the following key. The morphology and distribution of the members of this genus are given under the subgeneric headings.

KEY TO SUBGENERA OF *NOTOGAMASELLUS*

1. Two postero-lateral setae on genu III (2, 4/2, 2) and tibia III (2, 3/2, 2). Podonotum with 32 pairs of setae and one unpaired seta	*N.* (*Notogamasellus*)
One postero-lateral seta on genu III (2, 4/2, 1) and tibia III (2, 3/2, 1). Podonotum with 28 pairs of setae . .	*N.* (*Podonotogamasellus*)

Subgenus NOTOGAMASELLUS Loots and Ryke

Notogamasellus Loots and Ryke, 1966b, p. 30. Type-species: *Notogamasellus* (*Notogamasellus*) *vandenbergi* Loots and Ryke, 1966b, by original designation.

DIAGNOSIS. As for genus with the addition of the characters given in the relevant half of the couplet in the key to subgenera of *Notogamasellus*.

MORPHOLOGY.

SCLEROTIZATION. Female: Podonotal and opisthonotal. Discrete ventro-anal bearing aciculae posterior to anus. Peritrematal reduced, narrowly connected to exopodal IV. Exopodals inconspicuous. Sternometasternal fused to endopodal II and part of III. Single pair of pre-endopodals.

Male: Discrete sternito-genital and ventro-anal, but the latter extends further anterior than in the female so that it also carries setae *Jv*1, *Jv*2 and *Zv*1.

CHAETOTAXY. Idiosoma: 1 unpaired, 9*j*, 8*z*, 8*s*, 7*r*: 5*J*, 5*Z*, 5*S*, 5*R*: 5*st*: 1 or 2 unpaired, 3*Jv*, 3*Zv*, 1*Sv*.

Legs: Differs from *Gamasellus* in having an extra postero-lateral on genu III (2, 4/2, 2) and tibia III (2, 3/2, 2).

OTHER CHARACTERS. Female: Deutosternal denticles in 7 horizontal rows. Tectum anterior margin is basically unispinate, the spine being narrow and parallel sided for most of its length, but most of the margin, including the tip of the spine, is multispinulate. Movable cheliceral digit with 3 teeth. Form of setae on palp genu unknown. All dorsal setae are pilose. Shields dull with adhesive exudate so that fragments of the nymphal exoskeleton and other detritus cover the idiosoma of the specimens described. Pretarsus I absent.

Male: Movable cheliceral digit with 1 tooth, and fused at base to attenuated spermadactyl of similar length. On leg II only femur seta *av* is enlarged into spur.

DISTRIBUTION. Es. The single nominal species has only been recorded from the Transvaal, South Africa.

Found in plant litter on forest floor.

REMARKS. The following single nominal species is included in this subgenus: *N.* (*N.*) *vandenbergi* Loots and Ryke, 1966b.

Subgenus PODONOTOGAMASELLUS Loots and Ryke

Podonotogamasellus Loots and Ryke, 1966, p. 471. Type-species: *Notogamasellus* (*Podonotogamasellus*) *magoebaensis* Loots and Ryke, 1966, by original designation.

DIAGNOSIS. As for genus with the addition of the characters given in the relevant half of the couplet in the key to subgenera of *Notogamasellus*. Males of this subgenus are unknown.

MORPHOLOGY.

SCLEROTIZATION. Female: Similar to that of the subgenus *Notogamasellus*, except that peritrematal is not narrowly connected to exopodal IV.

CHAETOTAXY. Idiosoma: 7*j*, 7*z*, 7*s*, 7*r*: 5*J*, 5*Z*, 5*S*, 5*R*: 5*st*: 1 unpaired, 3*Jv*, 3*Zv*, 1*Sv*.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Similar to that of the subgenus *Notogamasellus*, except that the form of setae on palp genu is known and the form of the dorsal setae is different. On palp genu, seta *al*1 is pilose with 6 short lateral prongs and seta *al*2 is simple, setose. The dorsal setae are mostly short and peg-like with a central spherical dilation, and the proximal half of the seta is covered by a membranous flap. The vertical seta *j*1 is lanceolate with a serrate edge and with 1 proximal tooth enlarged so that it is nearly as long as the whole seta.

DISTRIBUTION. Es. Transvaal.

Found in plant litter on forest floor.

REMARKS. The following single nominal species is included in this subgenus: *N.* (*P.*) *magoebaensis* Loots and Ryke, 1966b.

Genus PERISEIUS Womersley

Periseius Womersley, 1961, p. 198. Type-species: *Periseius littorale* Womersley, 1961 (syn. *Cyrtolaelaps hammeni* Womersley, 1961), by original designation.

Psammonsella Haq, 1965, p. 413. Type-species: *Psammonsella nobskae* Haq, 1965, by monotypy.

DIAGNOSIS. Minute to small mites. Separate podonotal and opisthonotal shields. Ventro-anal shield separate from notal shield but fused to peritrematal and exopodal IV shields on both female and male, and also fused to sternito-genital shield on male. Three pairs of pre-endopodal shields. Some dorsal setae may be pilose or all dorsal setae may be simple, tapered. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV. Pretarsus I pedunculate and smaller than other pretarsi.

REMARKS. Hirschmann (1966) redefined *Periseius* and transferred *Psammonsella* to it with subgeneric status. This concept is followed here, and members of the two subgenera can be distinguished by the following key. The morphology and distribution of members of this genus are given under the subgeneric headings.

KEY TO SUBGENERA OF PERISEIUS

1. Dorsal setae *r*3 and *Z*5, and postanal seta, are pilose and spatulate. Female metasternal shield is fused to sternal shield . . . . *P.* (*Periseius*)

   Dorsal setae *r*3 and *Z*5, and postanal seta, are simple and tapered. Female metasternal shield is not fused to sternal shield . . . . . . *P.* (*Psammonsella*)

Subgenus PERISEIUS Womersley

Periseius Womersley, 1961, p. 198. Type-species: *Periseius littorale* Womersley, 1961 (syn. *Cyrtolaëlaps hammeni* Womersley, 1961), by original designation.

DIAGNOSIS. Small mites with some pilose dorsal setae and female metasternal shield fused to sternal shield.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Ventro-anal fused to peritrematal, and both are fused to exopodal IV. Aciculae on ventro-anal, posterior to anus. Exopodals II, III and IV are split. Sterno-metasternal fused to endopodals II, III and IV. Three pairs of pre-endopodals.

Male: Ventro-anal fused to peritrematal, exopodal IV and sternitogenital.

CHAETOTAXY. Idiosoma: *6j*, 5 or *6z*, *5s*, *5r*: *5J*, *5Z*, 5 or *6S*, *6R*: *5st*: *3Jv*, *3Zv*, *1Sv*.

Legs: As *Gamasellus* on type-species but an extra postero-lateral on genu III (2, 4/2, 2) and tibia III (2, 3/2, 2) of an unnamed species from North America.

OTHER CHARACTERS. Female: Deutosternal denticles in 7 horizontal rows. Tectum anterior margin basically uninspinate with spinules on sides. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 spatulate with single prong each side and seta *al*2 slightly spine-like. Some dorsal setae may be simple and tapering, but there are always pilose, and pilose and spatulate setae present. Spermathecal ringed tube probably opens near posterior paraxial margin of acetabulum IV. Pretarsus I pedunculate and smaller than other pretarsi. Lateral lobes of pulvilli II-IV attenuated and longer than central oval lobes. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest and is lanceolate.

Male: Movable cheliceral digit, with 1 tooth, and fused at base to slightly longer, but attenuated spermadactyl. On leg II, seta femur *av*, sometimes seta *pv*1, and genu seta *av* enlarged into spur. Sometimes non-setous processes on leg II.

DISTRIBUTION. Na: NTb: Am. The three known records are from between the latitudes 25 N and 10 S, being from Biak Island off the north coast of New Guinea, Recife on the Brazilian coast and a record (Emberson, thesis, 1968) of an unnamed species from the Florida Keys, only just north of the tropic of Cancer.

Found in or near littoral zone.

REMARKS. This taxon, when originally established as a genus, contained only the type-species, *P. littorale*, apparently only known from the deutonymphs, but *Cyrtolaelaps hammeni* adults described in the same paper are now recognized as conspecific with those deutonymphs and *hammeni* has been chosen as the valid name. The following two nominal species are included in this subgenus: *P.* (*P.*) *hammeni* (Womersley, 1961) **comb.n.**; *P.* (*P.*) *braziliensis* Hirschmann, 1966. An unnamed species is partly described by Emberson (thesis, 1968).

Periseius hammeni (Womersley) **comb.n.**

Cyrtolaelaps hammeni Womersley, 1961, p. 190.
Periseius littorale Womersley, 1961, p. 198, **syn.n.**

SCLEROTIZATION. Womersley's (1961) drawings of the distribution and fusion of the shields on the adults and deutonymphs are inaccurate.

The drawings by Hirschmann (1966) of *P. brasiliensis* are very similar to the actual sclerotization on *P. hammeni*. The main differences are to Hirschmann's drawing (Fig. 22VW, 1966) of the female venter. On the venter of the female of *P. hammeni* there is a narrow fissure of striated cuticle between the genital and the ventro-anal, and there is no indentation on the posterior edge of sterno-metasternal running in behind pore 4, just anterior to seta *st*4. The important differences between *P. hammeni* and Womersley's (1961) drawings are that the ventro-anal is fused to the peritrematal in both sexes, the female metasternal is fused to the sternal and the male sternito-genital is fused to the ventro-anal. Also, the deutonymph has a widely separated podonotal and opisthonotal.

LOCALITY. Paratype female (N1968212), paratype male (N1968213) and paratype deutonymph (N1968214) examined: New Guinea; *Cladophora socialis* and red algae, on stones, intertidal zone, Biak Island, 10.12.1953, col. L. V. D. Hammen, dep. SAM.

REMARKS. A comparison between *C. hammeni* described only from adults, and *P. littorale* (should be changed to *littoralis* because *Seius* is masculine) described only from deutonymphs in the same collection, as well as a comparison between this material and the drawings of the adults and deutonymph of *P. brasiliensis,* leaves no doubt about the synonymy of the first two species names. I have chosen *hammeni* as the valid name for three reasons: it is the name for the adult; the name *littoralis* is valid for the type species of two other rhodacarid genera (*Hydrogamasus* and *Parasitiphis*); the name *hammeni* has precedence of position in the text. Therefore, despite the name *littorale* being the first name used for specimens on which the genus was originally based, I have made it invalid.

Sugenus PSAMMONSELLA Haq

Psammonsella Haq, 1965, p. 413. Type-species: *Psammonsella nobskae* Haq, 1965, by monotypy.

DIAGNOSIS. Minute mites with no pilose dorsal setae and female metasternal shield separate from the sternal shield.

MORPHOLOGY.

SCLEROTIZATION. Similar to that of the subgenus *Periseius,* except that female ventro-anal is more narrowly fused to the peritrematal and the metasternal is entirely separate from the sternal.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r*: *5J, 5Z, 5S, 5R*: *5st*: *3Jv, 3Zv, 1Sv*.

Legs: As *Gamasellus.*

OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin basically unispinate with spinules on sides. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 spatulate with single prong on each side and seta *al*2 slightly lanceolate. Dorsal setae simple, tapered, and podonotal setae *s*1, *s*2 and *r*3 much longer and stouter than other notal setae. Spermatheceal ringed tube opens near posterior paraxial margin of acetabulum IV. Pretarsus I pedunculate and smaller than other pretarsi. Lateral lobes of pulvilli II-IV attenuated and more than twice as long as central oval lobes. Dorsal setae on tarsus IV short except for seta *ad*2 which is long and setose.

Male: Movable cheliceral digit with 1 tooth (may be small second tooth) and fused at base to spermadactyl of similar length. On leg II, femur seta *av*, genu seta *av*, tibia seta *av* enlarged into spurs.

DISTRIBUTION. Na: Pm. All records are from the northern mediterranean coastline or from a similar latitude on the east coast of North America (Massachusetts).

Found in littoral zone.

REMARKS. Hirschmann (1966) transferred *Psammonsella* to *Periseius* with subgeneric status. It may later be preferable not to recognize subgenera within this genus. I have seen paratypes of the two species (*P. nobskae* dep. Mrs. Haq's personal collection, *P. schusteri* dep. SAM, N1968258-N1968268) and Hirschmann's key (1966, p. 5) does not distinguish between them, so they may be conspecific. The following 2 nominal species are included in this subgenus: *P.* (*P.*) *nobskae* Haq, 1965; *P.* (*P.*) *schusteri* Hirschmann, 1966.

Genus PILELLUS **gen.n.**

Type-species: *Cyrtolaelaps* (*Gamasellus*) *rykei* Hunter, 1967.

DIAGNOSIS. Small to average sized mites. Separate podonotal and opisthonotal shields. Ventro-anal shield discrete on female, but fused to sternito-genital, exopodal IV and peritrematal shields on male, and may also be fused to notal shield. One pair of pre-endopodal shields. Most dorsal setae are short and lanceolate, and at least one pair of dorsal setae are pilose. Setation of both podonotum and opisthonotum is hypertrichous. Spermatheceal ringed tube opens near posterior paraxial edge of acetabulum IV. Pretarsus I pedunculate.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Discrete ventro-anal bearing aciculae posterior to anus. No discrete metapodal. Peritrematal fused to exopodal IV. Split in exopodals II, III and IV. Sterno-metasternal fused to endopodal II and part of III. Single pair of pre-endopodals.

Male: Ventro-anal may be either separate from or fused to opisthonotal, but always fused to sternito-genital, exopodal IV and peritrematal.

CHAETOTAXY. Idiosoma: 6*j*, 6*z* plus 16 or 17: over 60 opisthonotal setae, some paired, some single accessory setae: 5*st*: 3*Jv*, 3*Zv*, plus 0 or 9 or more.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 7 horizontal rows. Tectum anterior margin with central spine with uneven, lateral spinules. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 with 1 or 4 lateral prongs and seta *al*2 spine-like or lanceolate. Dorsal setae either lanceolate, pilose or pilose-lanceolate. Shields are dull. Spermathecal ringed tube probably opens near posterior paraxial edge of acetabulum IV. Pretarsus I pedunculate and smaller than other pretarsi. Lateral lobes of pulvilli II-IV are attenuated and longer than central, circular lobes. Amongst dorsal setae on tarsus IV, seta *ad*2 is the longest and is setose.

Male: Movable cheliceral digit with 1 tooth, and fused at base to similarly shaped spermadactyl, that is subequal in length or longer. On femur II, seta *av* is enlarged into a spur, while *pv*1 is spine-like. Setae of other leg II segments are similar to those on female.

DISTRIBUTION. Sa: ACs. The single nominal species is recorded from Candlemas Island and South Sandwich Islands, but an unnamed species is recorded from Auckland and Campbell Islands by Hunter and Lee (manuscript), dep. BBM.

Found in moss mats.

REMARKS. The only nominal species in *Pilellus* was previously in *Gamasellus*. Although it is not congeneric with *G. falciger*, I could have transferred this species to a special species-complex in *Acugamasus*. Instead, a new genus is established for it, distinguishable from *Acugamasus* by the chaetotaxy and form of its dorsal setae. There is one nominal species included in this genus, *P. rykei* (Hunter, 1967) **comb.n.**, and an unnamed species is described by Hunter and Lee (manuscript), dep. BBM.

Genus RHODACAROIDES Willmann

Rhodacararoides Willmann, 1959, p. 97 Type-species: *Rhodacaroides aegyptiacus* Willmann, 1959, by original designation.

DIAGNOSIS. Small mites. Separate podonotal and opisthonotal shields. Ventro-anal shield discrete on both sexes. Two pairs of pre-endopodal shields. Dorsal setae all simple. Location of the spermathecal ringed tube, if present, is unknown. Spermadactyl fused to base of movable cheliceral digit and runs parallel to it as on most Gamasellini males. Pretarsus I pedunculate.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Discrete ventro-anal. Peritrematal fused to exopodal IV by a narrow strip. Exopodals do not completely encase the peraxial edges of the acetabula. Sterno-metasternal fused to endopodals II and III. Two pairs of pre-endopodals.

Male: Sternito-genital shortened posteriorly so that it does not carry seta *st5*.

CHAETOTAXY. Idiosoma: *6j, 6z, 6s, 5r*: *5J, 5Z, 5S, 6R*: *5st*: *3Jv, 3Zv, 1Sv*.

Legs: Not known, but assumed to be as *Gamasellus*.

OTHER CHARACTERS. Female: Nature of deutosternal denticles is unknown. Tectum anterior margin trispinate with large central spine. Movable cheliceral digit with 4 teeth. Although the rows of podonotal setae contain the same numbers as *Rhodacarus*, their positions are more like some *Afrogamasellus*, especially in seta *s1* being well posterior to seta *z1* thereby leaving only 3 pairs of seta on the anterior margin of the podonotal shield. Dorsal setae simple, tapered. Spermathecal ringed tube aperture not known. Pretarsus I reduced, but pedunculate and with pulvillus.

Male: Movable cheliceral digit with 1 tooth and fused at base to similarly shaped, but attenuated and longer, spermadactyl. On leg II, femur seta *av*, genu seta *av* and tibia seta *av* enlarged into spurs.

DISTRIBUTION. Pm. Single record with the original description of the type-species is from the Red Sea coast line, Egypt.

Found in moist soil bordering sea.

REMARKS. Because of a number of characters on the type-species not being known, the diagnosis of *Rhodacaroides* is difficult. Neither Willmann nor Schulz (personal communications, 8.1967) were able to locate the types of *R. aegyptiacus*, but they are now in the possession of Dr. W. Hirschmann who will soon be publishing a redescription of this species. The placing of *Rhodacaroides* in the Ologamasinae rather than the Rhodacarinae (the members of which it was previously allied to) is speculative. The speculation is made partly because of a number of unnamed species (two partly described by Emberson, thesis, 1968, and two collected by myself in South Australia) which are *Rhodacarus*-like, but clearly belong in the Ologamasinae, and do have characters similar to those of *R. aegyptiacus*. The following single nominal genus is included in this genus: *R. aegyptiacus* Willmann, 1959. *Rhodacarus costai*, *incertae sedis*, has been transferred to this genus because it should be in the Ologamasinae, but it is improbable that it belongs in this genus.

Subfamily SESSILUNCINAE **subf.n.**

Type-genus: *Sessiluncus* G. Canestrini, 1898.

DIAGNOSIS. Minute to gigantic mites, usually with moderately well sclerotized and extensive shields. Holonotal shield or more rarely separate podonotal and opisthonotal shields. Ventro-anal shield only fused to notal in one atypical genus; *Stylochirus*. Peritrematal shield often separate from exopodal IV shield but if fused to this shield, then it is completely merged with it from level of stigma back. Sclerotization not conspicuously sexually dimorphic. On the female sterno-metasternal shield a line joining setae *st*2, *st*3 and *st*4 would or would not enclose an angle of less than 95°.

MORPHOLOGY.

Sclerotization. The extent of the fusion between shields is fairly constant amongst species of this subfamily, and except for the fusion of the genital with other shields it is nearly always constant amongst females and males of the same species. In eight genera there is a holonotal, although *Gamasellevans* has a line of demarcation between the podonotum and opisthonotum. *Paragamasellevans* is the only genus with a separate podonotal and opisthonotal, and the opposing edges of these shields are touching. Except in *Stylochirus* the ventro-anal is separate from the notal, but in some undescribed males of *Antennolaelaps*, where the aciculae are on the ventro-anal, it lies so close to the notal in the region posterior to the anus that it appears to be fused to it on superficial examination. Usually the ventro-anal is separate from the exopodals, but in *Gamasellevans*, where the peritrematal is always reduced and free posteriorly, a posterior extension of exopodal IV (which may represent the metapodal) may be broadly or narowly fused to the ventro-anal. The peritrematal is free posteriorly in *Sessiluncus*, *Antennolaelaps*, *Gamasellevans*, *Gamasitus*, the *Onchogamasus pumilio*-complex and *Paragamasellevans*. In *Stylochirus* the peritrematal may be free posteriorly or fused to the notal along its entire length. In *Gamasellopsis*, *Onchogamasus communis* and *Queenslandolaelaps* the peritrematal is fused to at least exopodal IV. The exopodals may form a continuous strip, but in *Gamasellopsis*, *Onchogamasus communis* and *Queenslandolaelaps* there is a split in exopodal II, and in *Gamasellevans*, *Gamasitus*, the *Onchogamasus pumilio*-complex and *Paragamasellevans* there is a split in exopodal II and III. The sterno-metasternal is separate from endopodal IV in most *Gamasellopsis* species, *Paragamasellevans* and *Stylochirus*, but usually it is fused to endopodal IV. There may be a single pair of pre-endopodals or they may be fused to the sterno-metasternal.

CHAETOTAXY. Idiosoma: 6*j*, 6*z*, 5*s*, 4 or 5*r*: 5*J*, 5*Z*, 5*S*, 4 or 5*R*, 0 or 2*UR*: 5*st*: 3*Jv*, 3*Zv*, 1 or 2*Sv*. *Stylochirus* species are exceptional in that they have a hypertrichous opisthosoma.

Legs: As *Gamasellus* except in *Sessiluncus*, *Gamasellopsis* and *Gamasitus* where there may be between 2 and 7 setae less, and there is always only 1 ventral on genu III and IV.

OTHER CHARACTERS. Tectum anterior margin varies from basically unispinate with lateral spinules to trispinate with spinules making structure complex. Fixed cheliceral digit of males of *Sessiluncus*, *Gamasellevans*, *Paragamasellevans* and *Queenslandolaelaps* carries tubercle or process dorsally. Usually on palp genu seta *al*1 is pectinate and seta *al*2 is setose or spatulate, a combination often found in Ologamasinae, especially Ologamasini. On palp femur, seta *al* is on central third in *Sessiluncus*, *Gamasellevans*, *Gamasellopsis*, *Onchogamasus communis* and *Stylochirus* as in the Rhodacarinae and Tangaroellinae, but otherwise it is on the proximal third as in most Rhodacaridae. The female sternal seta *st*2, *st*3 and *st*4 are usually nearly in a straight line as in most Ologamasinae, but in *Antennolaelaps*, *Onchogamasus communis* and *Queenslandolaelaps* a line joining these setae would enclose an angle of less than 95° as in the Gamasiphinae. Usually idiosomal and leg setae are simple, setose, but although they are never spatulate they may be pilose. Some *Antennolaelaps* species are the only rhodacarids with pilose sternal setae. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV in *Antennolaelaps* and *Queenslandolaelaps* and probably so in *Paragamasellevans* species. If pretarsus I present it may be pedunculate or in *Sessiluncus*, *Gamasellevans* and *Paragamasellevans* the pretarsal sheath I is only long enough to contain retracted claw-complex and is often broadly attached at base so that it merges into tarsus.

DISTRIBUTION. Only one genus, *Stylochirus*, has species occurring in the Nearctic region and no members of the subfamily have been collected from the Neotropical region. Except for *Sessiluncus*, the other genera are confined to the Southern Hemisphere and apparently only occur in either the Ethiopian or the Australian region.

REMARKS. I have confidence in my grouping together of all but one of the genera in the *Sessiluncinae*, and that is *Stylochirus*, which is not closely allied to the other genera and is placed in the Sessiluncinae in preference to any other subfamily.

I recognize 9 genera within this subfamily; *Sessiluncus, Antennolaelaps, Gamasellevans, Gamasellopsis, Gamasitus, Onchogamasus, Paragamasellevans, Queenslandolaelaps* and *Stylochirus*. Adults of these genera can be distinguished by the following key.

KEY TO GENERA OF SESSILUNCINAE

1.	Ventro-anal shield fused to posterior end of notal shield	*Stylochirus*
	Ventro-anal shield separate from notal shield . .	2
2.	One ventral seta on genu III (2, 4/1, 1) and genu IV (2, 4 or 5/1, 1)	3
	Two ventral setae on genu III (2, 4/2, 1) and genu IV (2, 5/2, 1)	5
3.	Two ventral setae on genu I (2, 6/2, 2) and peritrematal shield fused to exopodal IV shield	*Gamasellopsis*
	Three ventral setae on genu I (2, 6/3, 2) and peritrematal shield separate from exopodal IV shield	4
4.	Pretarsus I pedunculate. Exopodal III shield split level with centre or acetabulum	*Gamasitus*
	Pretarsus I not pedunculate, having sheath only long enough to contain retracted claw-complex. Exopodal shield III continuous around peraxial edge of acetabulum	*Sessiluncus*
5.	Peritrematal shield never extends backwards posterior to level of mid-acetabulum IV . . .	6
	Peritrematal shield extends backwards to level of posterior margin of acetabulum IV	8
6.	Peritreme with a series of lateral pockets. Line joining female sternal setae *st*2, *st*3, and *st*4 would enclose an angle of less than 95°. Male chelicerae normal with spermadactyl running parallel to digits from point of attachment near base of movable digit	*Antennolaelaps*

Peritreme without a series of lateral pockets. Line joining female sternal setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. Male cheliceral fixed digit with tubercle or process and spermadactyl curving away from movable digit at point of attachment near distal tip 7

7. Separate podonotal and opisthonotal shields. Seta *st*5 on female genital shield is posterior to acetabulum IV. Male seta *st*5 off sternito-genital shield . . . . *Paragamasellevans*

Holonotal shield, but usually with clear demarcation line between podonotal and opisthonotal areas. Seta *st*5 on female genital shield level with posterior edge of acetabulum IV . . . . *Gamasellevans*

8. Single conspicuous pore posterior to stigma on peritrematal shield. Tectum anterior margin basically trispinate, with central spine narrow at base and spreading to broader, fimbriate tip. Male cheliceral fixed digit with dorsal process and spermadactyl curving away from movable digit at point of attachment near distal tip . . . . *Queenslandolaelaps*

Two conspicuous pores posterior to stigma on peritrematal shield. Tectum anterior margin basically unispinate although there may be lateral spinules on spine which is broad at base, narrowing to a pointed tip. Male unknown . . . . *Onchogamasus*

Genus SESSILUNCUS G. Canestrini

Sessiluncus G. Canestrini, 1898, p. 486. Type-species: *Gamasus heterotarsus* G. Canestrini, 1897, by original designation.

DIAGNOSIS. Small to large mites. Holonotal shield. Ventro-anal shield separate from notal shield but apparently fused to exopodal IV shield on both sexes. Peritrematal shield not fused to exopodal shields. Sterno-metasternal shield fused to endopodal IV shield and a line joining sternal setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. Spermadactyl fused to base of male movable cheliceral digit and strongly recurved.

One ventral seta on genua III and IV. Pretarsus I not pedunculate, sheath being broadly fused to tarsus and only long enough to contain retracted claw complex.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal. Ventro-anal separate from notal, bearing aciculae posterior to anus and apparently fused to exopodal IV. No discrete metapodal, may be represented in posterior extension of peritrematal. Peritrematal not fused to exopodals. Exopodals II, III and IV form continuous strip. Sterno-metasternal usually fused to endopodals II, III and IV, but may be separate from endopodal IV (as on an unnamed species from Nepal, dep. BM(NH)), and sometimes fused to the single pair of pre-endopodals.

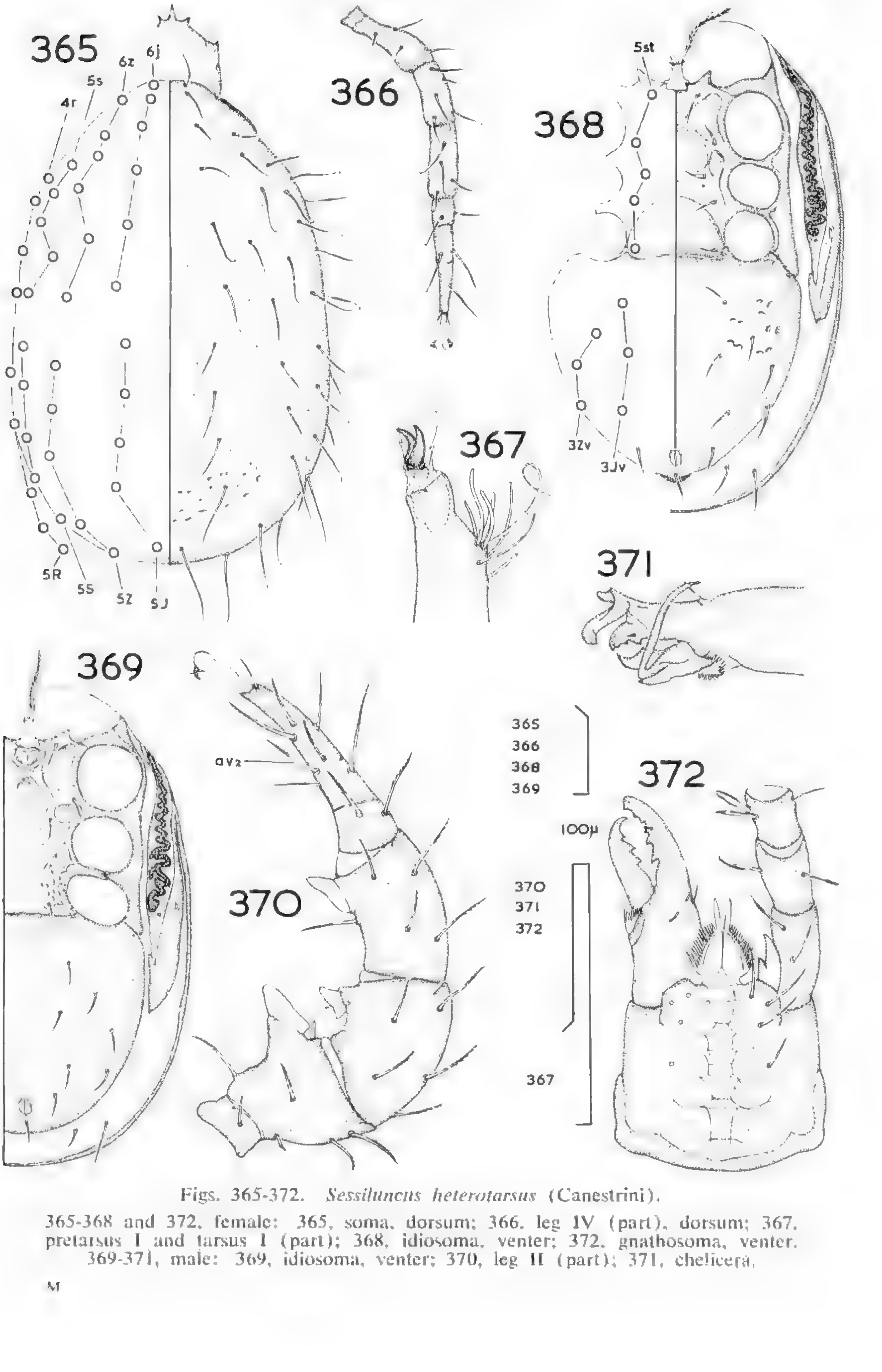
Male: Sternito-genital, otherwise as female, except peritrematal may extend further back.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 4r: 5J, 5Z, 5S, 5R: 5st: 3Jv, 3Zv.*

Legs: Following segments differ from *Gamasellus* in having ventral or sometimes a postero-lateral seta missing: genu III, (2, 4/1, 1); genu IV, (2, 5/1, 1); tibia IV, (2, 4/2, 1 or 2 as for *Gamasellus*).

OTHER CHARACTERS. Female: Deutosternal denticles in 8 or 9 horizontal rows. Corniculus may be simple or it may have a paraxial hyaline flange. Tectum anterior margin is trispinate, the central spine being the largest. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 finely pilose and nearly level with a simple or slightly spatulate seta *al*2. On palp femur, *al* in central third. Dorsal setae, simple or slightly pilose and tapering tip may be coiled. Shields often strongly reticulated or pitted but are shiny Peritreme may be sinuous and also have lateral pockets. On sternum a line joining setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. Spermathecal ringed tube opening not located in this study, but Athias-Henriot (in press) states that it opens on coxa III or coxa IV. Pretarsus I not pedunculate but broadly fused to tarsus and sclerotized, so that the large claws appear retractable into tarsus. Lateral lobes of pulvilli II-IV attenuated and shorter than central circular lobes. Amongst dorsal setae on tarsus IV, seta *ad*2 is the longest. There may be spurs on the femur of leg III and the trochanter and femur of leg IV.

Male: Corniculus with hyaline paraxial flange similar to that of female. Movable, cheliceral digit with 1 or 2 teeth, and fused at base to strongly recurved spermadactyl. Fixed cheliceral digit may have dorsal process. On leg II, setae *av* on femur, genu and tibia enlarged into spurs. Postero-ventral setae on femur and genu may be spines. There may also be spurs on the femur, genu and tibia of leg III and the trochanter and femur of leg IV.



Figs. 365-372. *Sessiluncus heterotarsus* (Canestrini).

365-368 and 372, female: 365, soma, dorsum; 366, leg IV (part), dorsum; 367, pretarsus I and tarsus I (part); 368, idiosoma, venter; 372, gnathosoma, venter. 369-371, male: 369, idiosoma, venter; 370, leg II (part); 371, chelicera.

DISTRIBUTION. Em: Pe, Pm: Oi, Om: Am, Ap. From the records of nominal species the distribution of this genus appears to lie around a line running south eastwards from Karg's (1964) record from Hungary (Pe) to Vitzthum's (1935) record from the Society Islands (Ap). Unnamed species from Nepal, Seychelles, Malaya, Sumatra, Borneo and the Solomon Islands are to be dep. BM(NH), while Bhattacharyya (1965 and manuscript) has recorded *S. oculatus* and four unnamed species of *Sessiluncus* from West Bengal, India.

Found amongst plant litter and upper soil layers. One species from cave in the Balkans (Pm).

REMARKS. *Sessiluncus* is perhaps most like the two other genera, *Gamasellopsis* and *Gamasitus*, that have a reduced leg setation compared to *Gamasellus*, but it is also similar to *Onchogamasus*. The following 4 nominal species are included in this genus: *S. heterotarsus* (Canestrini, 1897); *S. oculatus* Vitzthum, 1935; *S. cavensis* Willmann, 1940; *S. hungaricus* Karg, 1964. Berlese's *S. eremita*, *S. solitarius* and *S. latus* are not rhodacarids. Four unnamed species are described by Bhattacharyya (manuscript).

Sessiluncus heterotarsus (Canestrini)

Gamasus heterotarsus Canestrini, 1897, p. 473.

FEMALE. Fig. 365-368 and 372. Idiosomal length, 620μ. Some of the longer dorsal setae are very slightly pilose, although not figured as such. Leg chaetotaxy differs from *Gamasellus* on the following leg segments: genu III, (2, 4/1, 1); genu IV, (2, 5/1, 1); tibia IV, (2, 4/2, 1).

MALE. Fig. 369-371. Idiosomal length, 620μ.

LOCALITY. Female (1956.1.22.1) and male (1956.1.22.2) drawn: Indonesia; Bogor, 10-12.1.1954, col. A. H. G. Alston, dep. BM(NH). Male (37/28 and 37/29) examined: Java, dep. SEAF.

Sessiluncus hungaricus Karg

Sessiluncus hungaricus Karg, 1964, p. 73.

MALE. Spermadactyl recurved. Leg chaetotaxy differs from *Gamasellus* on the following leg segments: genu III, (2, 4/1, 1); genu IV, (2, 5/1, 1).

LOCALITY. Two males (N196873 and N196874) (M. Costa determined associated females as being this species or very similar) examined: Israel; forest litter (Wadi), Mishmar Haemek, 24.4.1967, col. M. Costa, dep. SAM.

Genus ANTENNOLAELAPS Womersley

Antennolaelaps Womersley, 1956b, p. 112. Type-species: *Antennolaelaps affinis* Womersley, 1956b, by original designation.

Stylogamasus Womersley, 1956b, p. 113, **syn.n.**. Type-species: *Stylogamasus convexa* Womersley, 1956b, by original designation.

DIAGNOSIS. Small or average sized mites. Holonotal shield. Ventro-anal shield separate from notal shield, but closely abuts on exopodal IV shield or on some males fused to this shield. Peritrematal shield limited in extent and not fused to exopodal shields. Sterno-metasternal shield fused to endopodal IV shield and a line joining sternal setae *st*2, *st*3 and *st*4 would enclose an angle of less than 95°. Spermadactyl fused to base of male movable cheliceral digit, and if strongly recurved then only distally near tip. Two ventral setae on genua III and IV. Pretarsus I pedunculate or absent.

MORPHOLOGY.

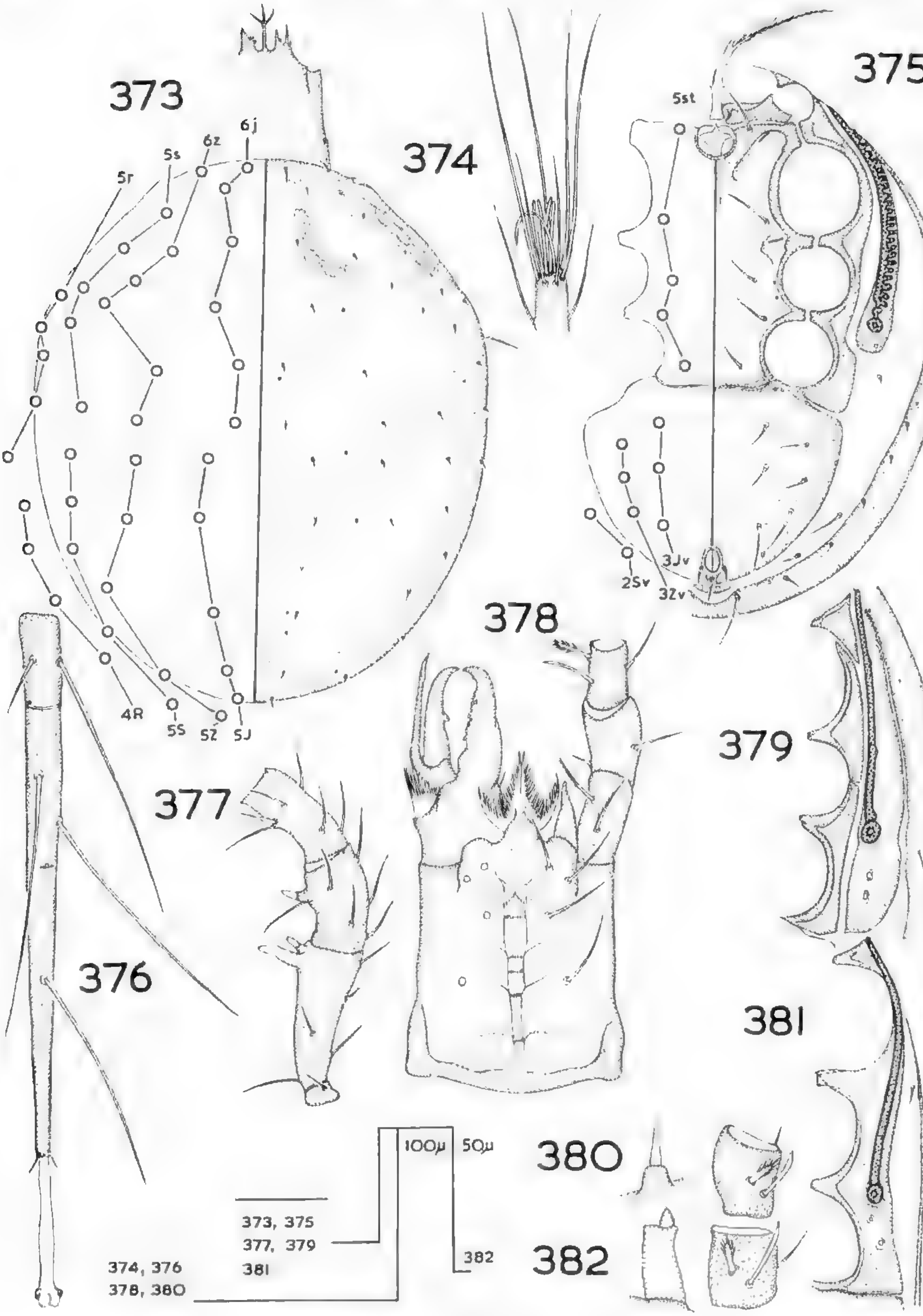
SCLEROTIZATION. Female: Holonotal. Discrete ventro-anal which closely abuts on genital and exopodal IV shield. Small discrete shield bearing only aciculae lies posterior to anus. Peritrematal free posteriorly and limited in extent, not reaching back to level of mid acetabulum IV. All exopodals fused into continuous strip. Sterno-metasternal fused to endopodals II, III and IV and sometimes to pre-endopodals, which are a single pair if separate.

Male: Sternito-genital and exopodal IV may be fused or not fused to ventro-anal. Otherwise as female.

CHAETOTAXY. Idiosoma: *6j*, *6z*, *5s*, *5r*: *5J*, *5Z*, 4-*5S*, 1-*5R*: *5st*: *3Jv*, *3Zv*, 0-*2Sv*.

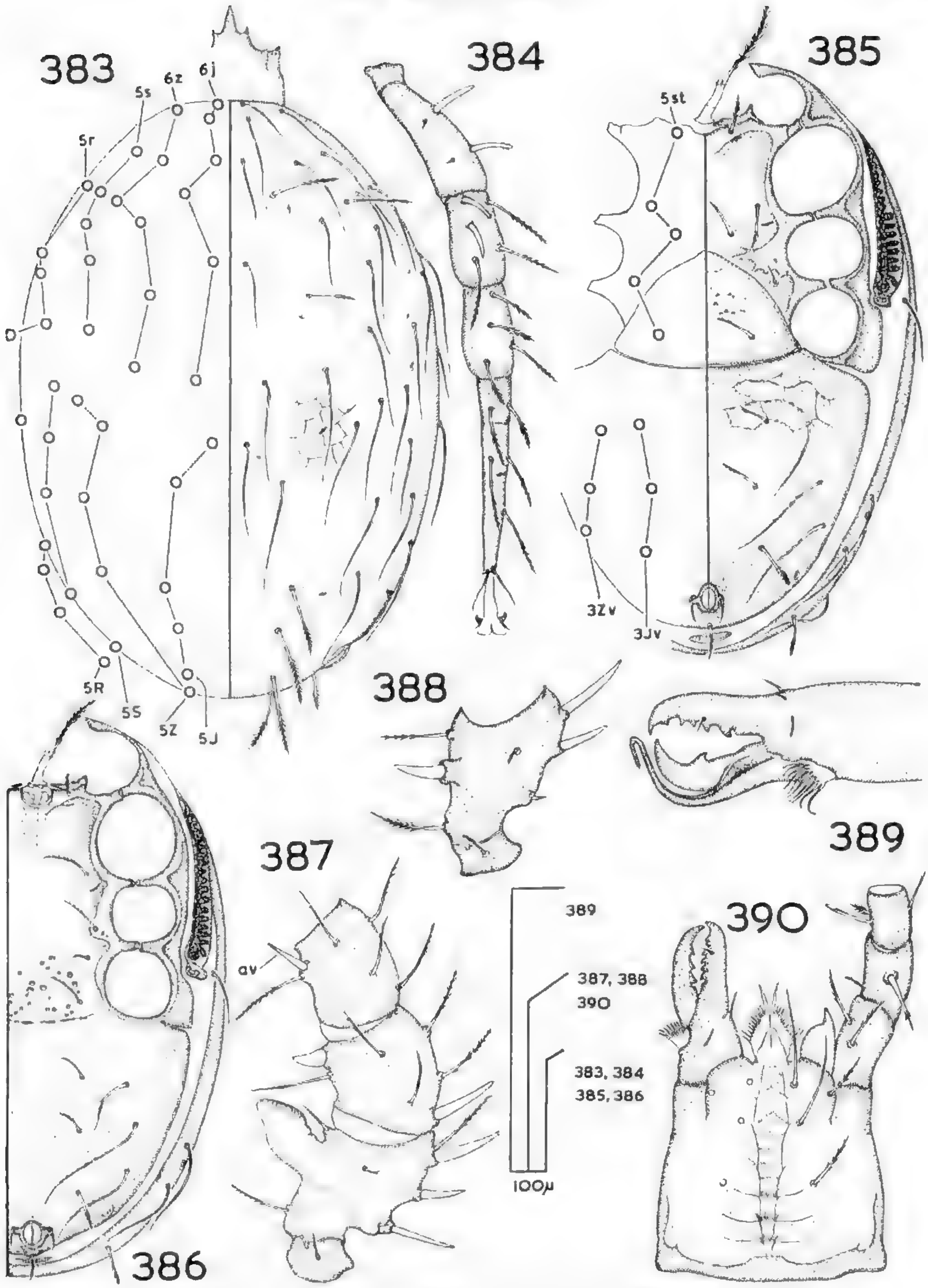
Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 6 to 9 horizontal rows. Corniculus has paraxial flange. Tectum anterior margin is either trispinate or there may be spinules on lateral spines and central spine may be trident-like. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 pectinate with 8 lateral prongs and seta *al*2 spatulate. On palp femur, seta *al* in proximal third. Dorsal setae tapering may be simple or pilose. Shields may be pitted or reticulated and usually there is a strongly raised central ridge and peripheral rim on sternum, also shields may be either shiny or dull, being covered by an adhesive exudate. Peritreme with lateral pockets. On sternum, a line joining setae *st*2, *st*3 and *st*4 would enclose an angle of less than 95°. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV. Pretarsus I pedunculate or absent. Leg setae may have strong spines and *av* on femur II and one species is a spine set on a tubercle. Lateral lobes of pulvilli II-IV attenuated and shorter than central circular lobes. Amongst dorsal setae on tarsus IV, setae *ad*2, *ad*3, *pd*3 and *ad*4 may be subequal in length, or seta *ad*2 or seta *pd*3 may be the longest and these seta may be simple or pilose.

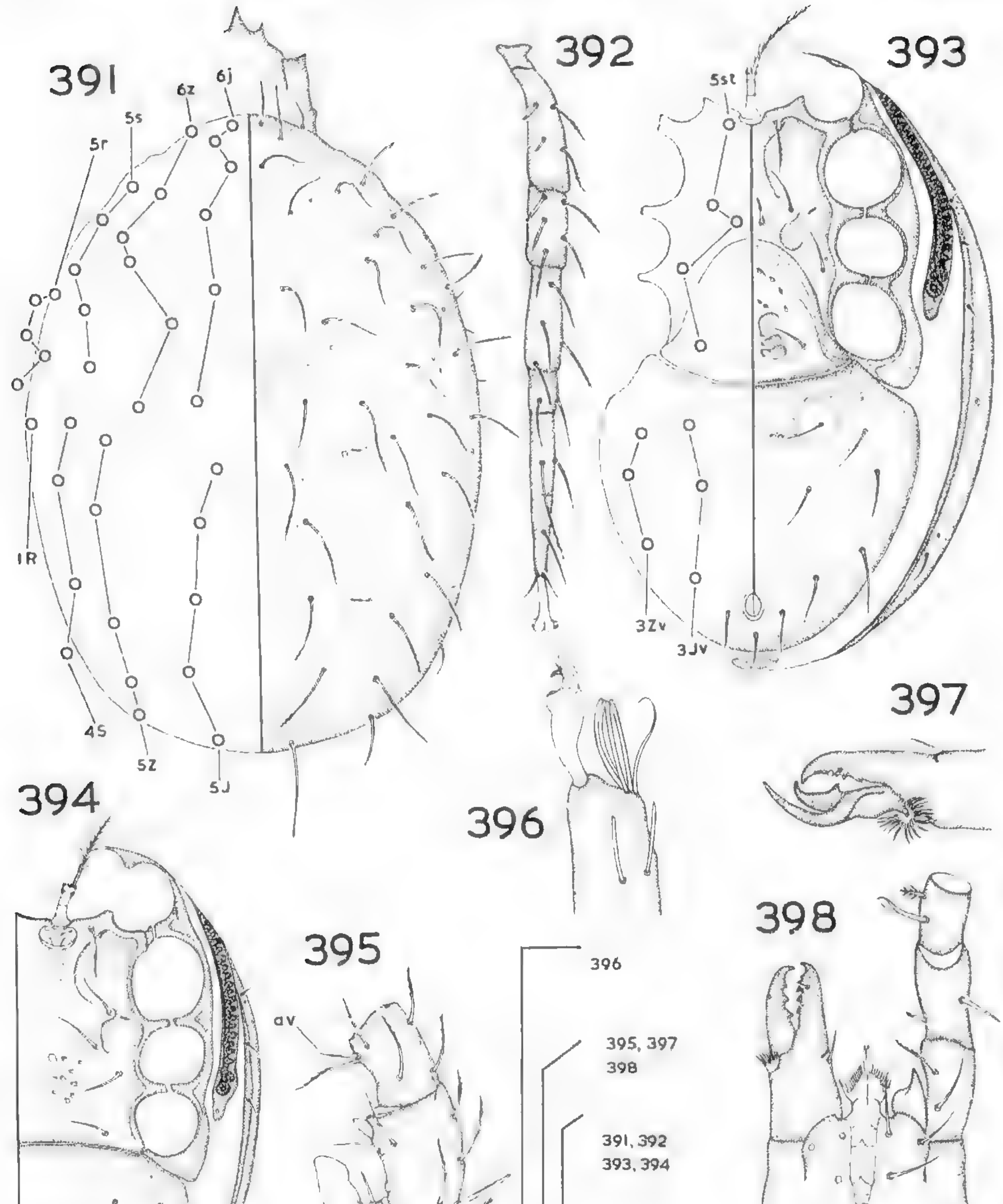


Figs. 373-382.

373-378, *Antennolaelaps affinis* Womersley, male: 373, soma, dorsum; 374, tarsus I, distal tip; 375, idiosoma, venter; 376, tarsus IV, dorsum; 377, leg II (part), anterolatus; 378, gnathosoma, venter. 379 and 380, *Gamasitus obscurus* Womersley, female: 379, stigma and surroundings; 380, seta *pv*1 on femur II and setae *al*1 and *al*2 on palp genu. 381 and 382, *Onchogamasus communis* Womersley, female: 381, stigma and surroundings; 382, corniculus and setae *al*1 and *al*2 on palp genu.



Figs. 383-390. *Antennolaelaps convexus* Womersley.
383-385, 388 and 390, female: 383, soma, dorsum; 384, leg IV (part), dorsum; 385, idiosoma, venter; 388, femur II, antero-latus; 390, gnathosoma, venter. 386, 387 and 389, male: 386, idiosoma, venter; 387, leg II (part); 389, chelicera.



Figs. 391-398. *Antennolaelaps testudo* sp.n..
391-393, 396 and 398, female: 391, soma, dorsum; 392, leg IV (part), dorsum; 393, idiosoma, venter; 396, pretarsus I and tarsus I (part); 398, gnathosoma, venter. 394, 395 and 397, male: 394, idiosoma, venter; 395, leg II (part); 397, chelicera.

Male: Corniculus with paraxial flange or on *A. affinis* (female not known) it is attenuated and without flange. Movable cheliceral digit with 1 tooth, fused at base to longer spermadactyl which may be hook-like at tip. On leg II femur seta *av*, and sometimes *pv*1, and genu seta *av* clearly enlarged into spurs. Tibia seta *av* may be a spine but not so stout as some of the dorsal setae on that segment.

DISTRIBUTION. Aa, An. Besides the records of nominal species there are two females of a possibly unnamed species from near Auckland, New Zealand, and specimens from Lord Howe Island and New Caledonia, to be dep. SAM.

Found in moss and plant litter.

REMARKS. *Antennolaelaps* is a distinctive genus, rather different from its most closely allied genera. Although the type-species is unusual compared to the species that was previously placed in *Stylogamasus* and to the new species, I have preferred to group them all in one genus, because of the similarities in the structure of the peritreme and the ventral sclerotization. The following three nominal species are included in this genus: *A. affinis* Womersley, 1956; *A. convexus* (Womersley) **comb.n.** for *Stylogamasus convexa* Womersley, 1956b; *A. testudo* **sp.n.**.

Antennolaelaps affinis Womersley

Antennolaelaps affinis Womersley, 1956b, p. 112.

FEMALE. Not known.

MALE. Fig. 373-378. Idiosomal length, 470μ.

LOCALITY. Male (N1968193) drawn: Australia; LF172, moss and plant litter, Brookfield, near Brisbane, Queensland, 7.9.1966, col. D. C. Lee, dep. SAM.

The holotype male (N1968194) and paratype male (N1968195) examined: Australia: litter, Brookfield, near Brisbane, Queensland, 31.5-10.6.1949, col. E. H. Derrick, dep. SAM.

Antennolaelaps convexus (Womersley) **comb.n.**

Stylogamasus convexa Womersley, 1956b, p. 113.

FEMALE. Fig. 383-385, 388, 390. Idiosomal length, 550μ. There is a conspicuous adhesive exudate on the idiosoma and legs of this species. Also the legs bear reticulations dorsally.

MALE. Fig. 386, 387, 389. Idiosomal length 540μ.

LOCALITY. One female (N1968196) and two males (N1968197 and N1968198) drawn or examined: Australia; LF171, moss, Brookfield, near Brisbane, Queensland, 7.9.1966, col. D. C. Lee, dep. SAM.

The holotype female (1968199) and allotype male (1968200) examined: Australia; soil litter, Brookfield, near Brisbane, Queensland, 31.5-1.6.1949, col. E. H. Derrick, dep. SAM.

Antennolaelaps testudo sp.n.

Sessiluncus heterotarsus: Domrow, 1957, p. 204, **syn.n.**

FEMALE. Fig. 391-393, 396, 398. Idiosomal length, 550μ.

MALE. Fig. 394, 395, 397. Idiosomal length, 450μ. Movable cheliceral digit not longer than fixed digit, but has been drawn (Fig. 397) pushed forward by clearing process.

LOCALITY. The holotype female (1968201), allotype male (N1968202), 6 paratype females (N1968203-N1968208) and 3 paratype males (N1968209-N1968211) drawn or examined: Australia; LF171, moss, Brookfield, near Brisbane, Queensland, 7.9.1966, col. D. C. Lee, dep. SAM.

REMARKS. Note that the new synonymy above is only based on a comparison of this material with Domrow's (1957) drawings, but I have little doubt that the specimens are conspecific and no doubt that they are congeneric.

Genus GAMASELLEVANS Loots and Ryke

Gamasellevans Loots and Ryke, 1967b, p. 212. Type-species: *Gamasellevans epigynialis* Loots and Ryke, 1967b, by original designation.

DIAGNOSIS. Minute or small mites. Holonotal shield (but there is a complete or broken demarcation line between podonotal and opisthonotal parts). Ventro-anal shield separate from notal shield, and may be either separate from all other shields or narrowly fused to a posterior extension of exopodal IV shield (that may in fact be either homologous with the metapodal shield or the posterior extension of the peritrematal on, for example, *Gamasellopsis*, since it bears a pore) or broadly fused to exopodal IV shield. Peritrematal shield reduced and free posteriorly. Sterno-metasternal shield fused to endopodal IV shield and a line joining sternal setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. Spermadactyl fused to male movable cheliceral digit on distal third, where it points away from the tip of digit as an attenuated, curving process. The arthrodial process on the male cheliceral enlarged and spoon-like, being subequal or longer than movable digit. Two ventral setae on genua III and IV. Pretarsus I not pedunculate, sheath being only long enough to contain retracted claw complex.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal (there is complete or broken line across middle of shield between podonotal and opisthonotal parts, but holonotal does not break along it). Ventro-anal may be either discrete or narrowly fused to a posterior extension of exopodal IV (since this extension bears a pore, it may in fact be homologous with the metapodal or part of the peritrematal) or broadly fused to exopodal IV. Peritrematal reduced and free posteriorly. Exopodals II and III may or may not be split. Sterno-metasternal fused to endopodals II, III and IV. Metasternal region may be partially separated from sternal region by split from posterior margin to near seta *st4*. Single pair of pre-endopodals.

Male: Sternito-genital not fused to ventro-anal. Ventro-anal fused or not fused to exopodal IV as in female.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r: 5J, 5Z, 5S, 6R: 5st: 5Jv, 3Zv, 2Sv.*

Legs: As *Gamasellus.*

OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin usually basically unispinate with lateral spinules but may be trispinate, with spinules on lateral spines. Movable cheliceral digit with 3 teeth. On palp genu, chaetomorphy unknown. On palp femur, seta *al* in central third. Dorsal setae simple and tapering. Peritreme without conspicuous lateral pockets. On sternum, a line joining setae *st2*, *st3* and *st4* would enclose an angle of more than 110°. Anterior hyaline flap on genital shield extends forward, with point reaching anterior to seta *st3* and sometimes nearly reaching seta *st1*. Spermathecal ringed tube opening not known. Pretarsus I not pedunculate, sheath only long enough to contain retracted claw-complex. Often small processes on femur II.

Male: Corniculus attenuated and longer than on female. Movable cheliceral digit with 1 tooth or no teeth, and fused for most of its length with long curving spermadactyl. Dorsal process distally on fixed cheliceral digit. Arthrodial membrane long and spoon-like (this may be homologous with the extra, fimbriated flap in *Queenslandolaelaps vitzthumi*). On femur, genu and tibia of leg II there are spurs which are probably modified antero-ventral setae.

DISTRIBUTION. Es. All nominal species recorded from the Transvaal, South Africa.

Found in pasture soil and evergreen forest litter.

REMARKS. The long anterior hyaline flap on the genital shield and the reduced peritrematal shield in all species, as well as the extensive fusion of the exopodal IV shield to the ventro-anal shield in some species would seem to make *Gamasellevans* quite distinctive, but two of these three attributes do not occur in the closely allied *Paragamasellevans*, while the unusual male chelicera is very similar to that of *Paragamasellevans* and *Queenslandolaelaps*. Therefore *Gamasellevans* may be more closely allied to *Queenslandolaelaps* than the characters of the idiosomal venter would suggest. The following 7 nominal species are included in the genus: *G. epigynialis* Loots and Ryke, 1967b; *G. bispermadactylus* Loots and Ryke, 1967b; *G. evansi* Loots and Ryke, 1967b; *G. magoebaensis* Loots and Ryke, 1967b; *G. reticulatus* Loots and Ryke, 1967b; *G. spermadactylus* Loots and Ryke, 1967b; *G. vandenbergi* Loots and Ryke, 1967b.

Genus GAMASELLOPSIS Loots and Ryke

Gamasellopsis Loots and Ryke, 1966a, p. 551. Type-species: *Gamasellopsis curtipilus* Loots and Ryke, 1966a, by original designation.

DIAGNOSIS. Minute or small mites. Holonotal shield. Ventro-anal shield discrete, being separate from notal shield, although it may closely abut on exopodal IV shield. Peritrematal fused to exopodal IV shield. Sterno-metasternal shield may or may not be fused to endopodal IV shield and a line joining seta *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. The spermadactyl fused to the male movable cheliceral digit for at least two-thirds of its length, and is longer than the digit but similarly shaped. One ventral seta on genua III and IV. Pretarsus I pedunculate.

MORPHOLOGY.

Sclerotization. Female: Holonotal. Discrete ventro-anal bearing aciculae posterior to anus. Peritrematal fused to exopodal IV. No split in exopodal III or IV. Sterno-metasternal either fused to endopodal IV or to single pair of pre-endopodals but not to both.

Male: Sternito-genital not fused to ventro-anal.

Chaetotaxy. Idiosoma: 6*j*, 4 or 5*z*, 5*s*, 4*r*: 5*J*, 5*Z*, 5*S*, 1 or 2*R*: 5*st*; 3*Jv*, 3*Zv*, 1*Sv*.

Legs: There are 6 or 7 setae less than in *Gamasellus*, the following segments being different: genu I (2, 6/2, 2); genu III (2, 4/1, 1); genu IV (2, 4 or 5/1, 1); tibia IV (2, 4/2, 1); tarsus IV (3, 6/5, 3). The seta missing on tarsus IV is *pd*4.

Other Characters. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin quinquispinate. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 pilose with over 10 short, lateral prongs and seta *al*2 simple, tapering. On palp femur, *al* in central third. Dorsal setae simple, tapering. Peritreme without conspicuous lateral pockets.

On sternum, a line joining setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. Tibia I is swollen ventrally and seta *pv*1 may be on a small protuberance. Spermathecal ringed tube opening not known. Pretarsus I pedunculate and smaller than other pretarsi.

Male: Movable digit with 1 tooth, may be considerably shorter than fixed digit, fused along two-thirds of its length to spermadactyl which is at least half as long again. On leg II, femur seta *av* enlarged into spur, may be other protuberances on femur and genu, but their homologies are unknown.

DISTRIBUTION. Es. All nominal species recorded from Transvaal, South Africa.

Found in evergreen forest litter.

REMARKS. Members of *Gamasellopsis* are very similar to the *Sessiluncus* species of the Palaearctic region although there are a number of conspicuous differences such as the spermadactyl shape, the fusion of the peritrematal shield to the exopodal shield IV, the pedunculate pretarsus I and the leg chaetotaxy. There are also similarities to *Gamasitus* and *Onchogamasus*, but the males of those genera are not yet known. The following 4 nominal species are included in this genus: *G. curtipilus* Loots and Ryke, 1966a; *G. longipilus* Loots and Ryke, 1966a; *G. magoebaensis* Loots and Ryke, 1966a; *G. vandenbergi* Loots and Ryke, 1966a.

Genus GAMASITUS Womersley

Gamasitus Womersley, 1956a, p. 531. Type-species: *Gamasitus obscurus* Womersley, 1956a, p. 531.

DIAGNOSIS. Large mite. A single female is the only known member of this genus. Holonotal shield. Ventro-anal shield separate from notal shield, but closely abuts on exopodal IV shield. Peritrematal shield not fused to exopodal IV shield and extends as far posteriorly as that shield. Sterno-metasternal shield fused to endopodal IV shield and pre-endopodal shields, and a line joining sternal setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. One ventral seta on genua III and IV. Pretarsus I pedunculate and subequal in size to other pretarsi.

MORPHOLOGY.

Sclerotization. Female: Holonotal. Discrete ventro-anal. Small discrete shield bearing only aciculae lies posterior to anus. Peritrematal free posteriorly and reaching back to level of posterior edge of acetabulum IV. Exopodals II and III split, while IV is not split. Sterno-metasternal fused to endopodal II, III and IV, and to pre-endopodals.

CHAETOTAXY. Idiosoma: Notum too fragmented to recognize chaetotaxy; 5*st*: 3*Jv*, 2*Zv*.

Legs: Following segments differ from *Gamasellus* in having a ventral seta missing: genu III (2, 4/1, 1); genu IV (2, 5/1, 1).

OTHER CHARACTERS. Female: Movable cheliceral digit with 4 teeth. Tectum anterior margin trispinate, the lateral spines being quite small. On palp genu, seta *al*1 with 7 lateral prongs and seta *al*2 slightly spatulate. On palp femur, seta *al* in proximal third. Dorsal setae simple, tapering. Shields shiny. Peritreme without conspicuous lateral pockets. On sternum, a line joining setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. Spermathecal ringed tube opening not known. Pretarsus I pedunculate and subequal in size to other pretarsi. Femur II with seta *pv*1 spine-like and on process. Lateral lobes of pulvilli II-IV attenuated and longer than central, circular lobes. Amongst dorsal setae on tarsus IV setae *pd*3 and *pd*4 are the longest and subequal in length.

DISTRIBUTION. Aa. The only record is of the single female from Tasmania, Australia.

Found in moss.

REMARKS. Male *Gamasitus* are unknown and only one incomplete and fragmented female is known. As observed by Womersley when he established this genus, it is similar to *Sessiluncus*. The following single nominal species is included in this genus: *G. obscurus* Womersley, 1956a.

Gamasitus obscurus Womersley, 1956a

Gamasitus obscurus Womersley, 1956a, p. 531.

FEMALE. Fig. 379, 380. Idiosomal length, 940μ.

MALE. Not known.

LOCALITY. The holotype female (N1968159) drawn and examined: Australia; moss, Mt. Wellington, Tasmania. 2.12.1934, col. V. V. Hickmann, dep. SAM.

Genus ONCHOGAMASUS Womersley

Onchogamasus Womersley, 1956b, p. 108. Type-species: *Onchogamasus communis* Womersley, 1956b, by original designation.

DIAGNOSIS. Minute or small mites, only known from the females. Holonotal shield. Ventro-anal shield separate from the notal shield, but fused to exopodal IV shield. Peritrematal shield may or may not be fused to exopodal IV shield and a line joining *st*2, *st*3 or *st*4 would or would not enclose an angle of less than 95°. Two ventral setae on genua III and IV. Pretarsus I pedunculate and subequal in size to other pretarsi.

REMARKS. *Onchogamasus* was originally established for a single female specimen, similar to members of *Gamasellopsis* and *Gamasitus*, and also to the Palaearctic members of *Sessiluncus*, but, unlike those three genera, its leg chaetotaxy is as for *Gamasellus*. Unfortunately no males of the two Australian genera (*Gamasitus* and *Onchogamasus*) are known and therefore the relationships within this group of genera are unusually uncertain. When trying to place two species, *pumilio* and *quasicurtipilus*, in a genus, I decided to put them in *Onchogamasus* mainly because of their leg chaetotaxy, but as a separate species-complex because of their characters which are different to those of *Onchogamasus* and similar to those of other genera. Therefore, I recognize the following two species-complexes within this genus, *communis*-complex and *pumilio*-complex, which can be distinguished by the following key. The morphology and distribution of members of this genus are given under the species-complex headings.

KEY TO SPECIES COMPLEX OF *ONCHOGAMASUS*

1. Peritrematal shield is fused to exopodal shields, which are unsplit. Line joining setae *st*2, *st*3 and *st*4 would enclose an angle of less than 95° . . . . *communis*-complex

   Peritrematal shield is not fused to exopodal shields, of which II and III are split. Line joining setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110° . . . . *pumilio*-complex

COMMUNIS-complex

DIAGNOSIS. Limited within generic diagnosis to small mites, with peritrematal shield fused with all exopodal shields into a single shield, and a line joining sternal setae *st*2, *st*3 and *st*4 would enclose an angle of less than 95°.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal. Ventro-anal separate from notal but fused to exopodal IV. Aciculae are on small, discrete shield posterior to anus. Peritrematal fused to all exopodals forming a single shield. Sterno-metasternal fused to endopodal II, III and IV. One pair of pre-endopodals.

CHAETOTAXY. Idiosoma: Notum too fragmented to recognize chaetotaxy: 5*st*: 3*Jv*, 3*Zv*, 1*Sv*.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin is unispinate. Movable cheliceral digit with 3 teeth. On palp genu, seta *al*1 pectinate with 7 lateral prongs and seta *al*2 slightly spatulate. On palp femur, seta *al* in proximal third. Dorsal seta tapering, may be simple or slightly pilose. Shields slightly shiny. Exopodal process between coxae II and III has dorsal flap. Peritreme without lateral pockets. On sternum a line joining seta *st*2, *st*3 and *st*4 would enclose an angle of less than 95°. Spermathecal ringed tube opening not known. Pretarsus I pedunculate and subequal in size to other pretarsi. Lateral lobes of pulvilli II-IV attenuated and longer than central oval lobes. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest and slightly pilose.

DISTRIBUTION. Aa. The only record is of the single female from Queensland, Australia.

Found amongst plant debris and soil.

REMARKS. Males of the *communis*-complex are unknown. Only one squashed and fragmented female is known. This female has similarities to *Sessiluncus*, *Gamasellopsis* and *Gamasitus*. The following single nominal species is included in this species-complex: *O. communis* Womersley, 1956b.

Onchogamasus communis Womersley

Onchogamasus communis Womersley, 1956b, p. 108.

FEMALE. Fig. 381, 382. Idiosomal length, 560μ. Idiosoma covered in reticulations which often consists of wavy lines because of punctations beside them. Tarsus II bears conspicuous spines, one is seta *av*2, while the two at the distal tip are non-setous. Some leg setae are on slight protruberances, seta *ad*2 on genu II is on a conspicuous protruberance.

MALE. Not known.

LOCALITY. The holotype female (N1968185) drawn and examined: Australia: soil and plant debris, Brookfield, near Brisbane, Queensland, 21.5.1949-2.6.1949, col. E. H. Derrick, dep. SAM.

PUMILIO-complex

DIAGNOSIS. Limited within generic diagnosis to minute mites, with peritrematal shield separate from all exopodals, and a line joining sternal setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal. Ventro-anal separate from notal but fused to exopodal IV. Aciculae on small discrete shield posterior to anus. Peritrematal not fused to exopodals or any other shields posteriorly.

Exopodals II and III are split. Sterno-metasternal fused to endopodal II, III and IV. One pair of pre-endopodals which may be fused to sternal.

CHAETOTAXY. Idiosoma; *6j, 6z, 5s, 5r*: *5J, 5Z, 5S, 5R, 2-3UR*: *5st*; *3Jv, 3Zv, 1Sv*.

Legs: As *Gamasellus*.

OTHER CHARACTERS. Female: Deutosternal denticles in 6 horizontal rows. Tectum anterior margin basically unispinate with lateral spinules. Movable cheliceral digit with 2 or 3 teeth. On palp genu, seta *al*1 pectinate with 7 lateral prongs and seta *al*2 slightly spatulate. On palp femur, seta *al* in proximal third. Dorsal setae simple and tapering. Shields pale. Peritreme without lateral pockets and does not extend anterior to mid acetabulum II. On sternum a line joining setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. Spermathecal ringed tube opening not known. Pretarsus I pedunculate and subequal in size to other pretarsi. Tibia I is dilated distally in area of ventral setae. Lateral lobes of pulvilli II-IV attenuated and shorter than central oval lobes. Amongst dorsal setae on tarsus IV, setae *ad*2, *ad*3 and *pd*3 subequal in length.

DISTRIBUTION. Aa. As recorded below the nominal species are from South Australia and Victoria, Australia.

Found in moss and plant litter.

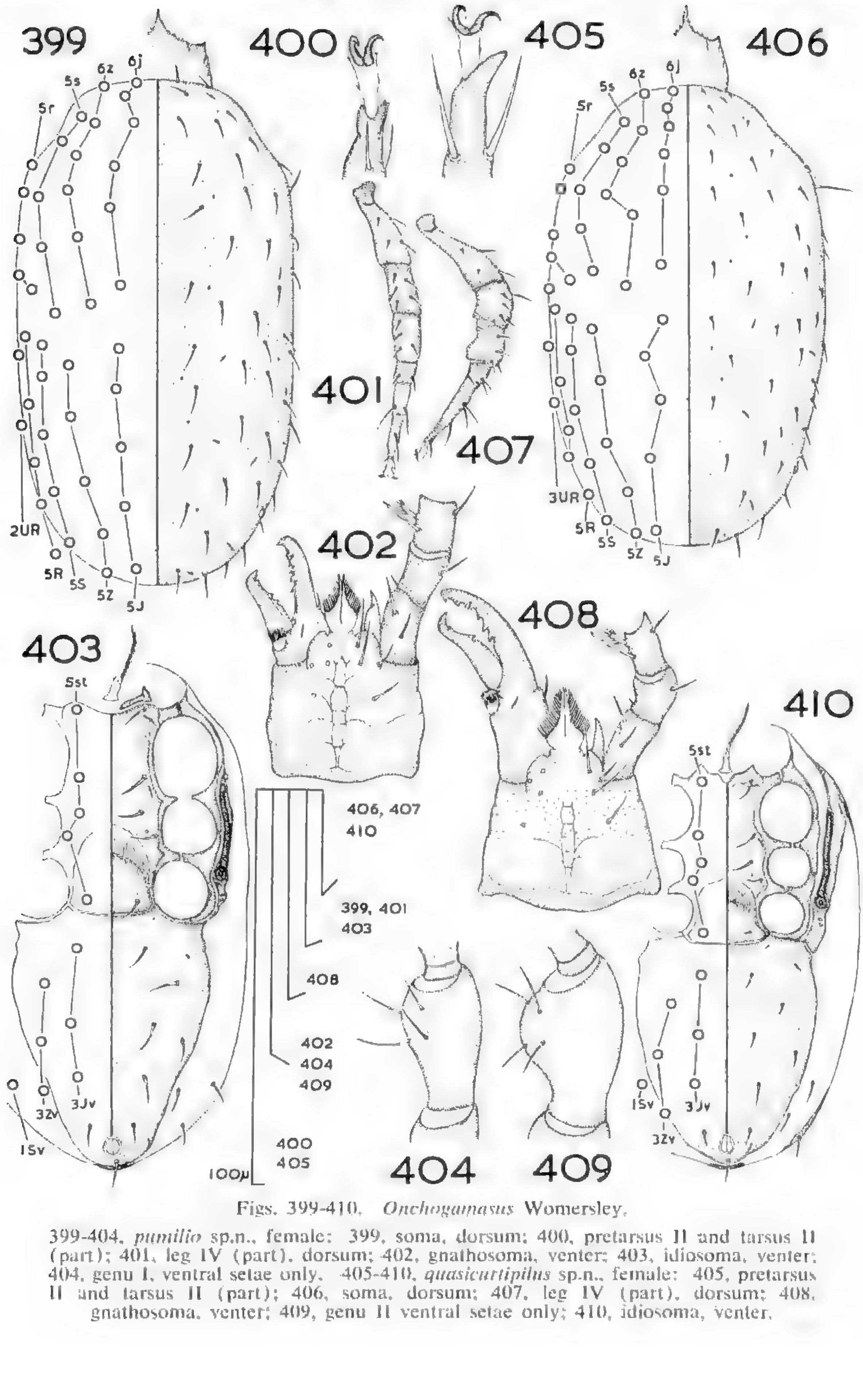
REMARKS. Males of the *pumilio*-complex are unknown. The females are similar to those of the *Onchogamasus communis*-complex, but there are enough differences, including characters which are similar to those of *Gamasitus*, for me to consider it worth while to keep them in a separate complex until more is known about these mites. The following two nominal species are included in this species-complex: *O. pumilio* **sp.n.**; *O. quasicurtipilus* **sp.n.**.

Onchogamasus pumilio sp.n.

FEMALE. Fig. 399-404. Idiosomal length, 320μ. The chelicera (Fig. 402) is drawn from a postero-lateral angle, while viewed laterally it would probably appear similar in shape to the chelicera (Fig. 408) of *O. quasicurtipilus*. Seta *Zv*3 of the right side is on ventro-anal shield.

MALE. Not known.

LOCALITY. The holonotal female (N1968186) drawn: Australia; LF97 moss beneath White Mallee scrub, overlooking Formby Bay, Yorke Peninsula, South Australia, 3.11.1965, col. N. McFarland and N. B. Tindale, dep. SAM.



Figs. 399-410. *Onchogamasus* Womersley.

399-404, *pumilio* sp.n., female: 399, soma, dorsum; 400, pretarsus II and tarsus II (part); 401, leg IV (part), dorsum; 402, gnathosoma, venter; 403, idiosoma, venter; 404, genu I, ventral setae only. 405-410, *quasicurtipilus* sp.n., female: 405, pretarsus II and tarsus II (part); 406, soma, dorsum; 407, leg IV (part), dorsum; 408, gnathosoma, venter; 409, genu II ventral setae only; 410, idiosoma, venter.

Onchogamasus quasicurtipilus sp.n.

FEMALE. Fig. 405-410. Idiosomal length, 430μ. Instead of the three non-setous spurs at distal tip of tarsus II being equally increased in size, as on *O. pumilio*, only the central one is enlarged (Fig. 405).

MALE Not known.

LOCALITY. The holotype female (N1968187) and paratype female (N1968188) drawn and examined: Australia; LF79, moss and litter beneath tree ferns and *Eucalyptus*, Otway Ranges, Victoria, 28.8.1965, col. F. J. Mitchell, dep. SAM.

Genus PARAGAMASELLEVANS Loots and Ryke

Paragamasellevans Loots and Ryke, 1968, p. 3. Type-species: *Paragamasellevans michaeli* Loots and Ryke, 1968, by original designation.

DIAGNOSIS. Minute mites. Separate podonotal and opisthonotal shields. Ventro-anal shield widely separated from all other shields in both sexes, but broader on male where it may include metapodal shields. Peritrematal shields reduced to slim strip between anterior end of peritreme and podonotal shield and therefore not fused to exopodal IV shield. Sterno-metasternal shield not fused to endopodal IV shield and a line joining sternal setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. Spermadactyl fused to male movable cheliceral digit on distal third, where it points away from the tip of digit as an extremely long, attenuated process. The arthrodial process on the male chelicera similar to that on female. Two ventral setae on genua III and IV. Pretarsus I not pedunculate.

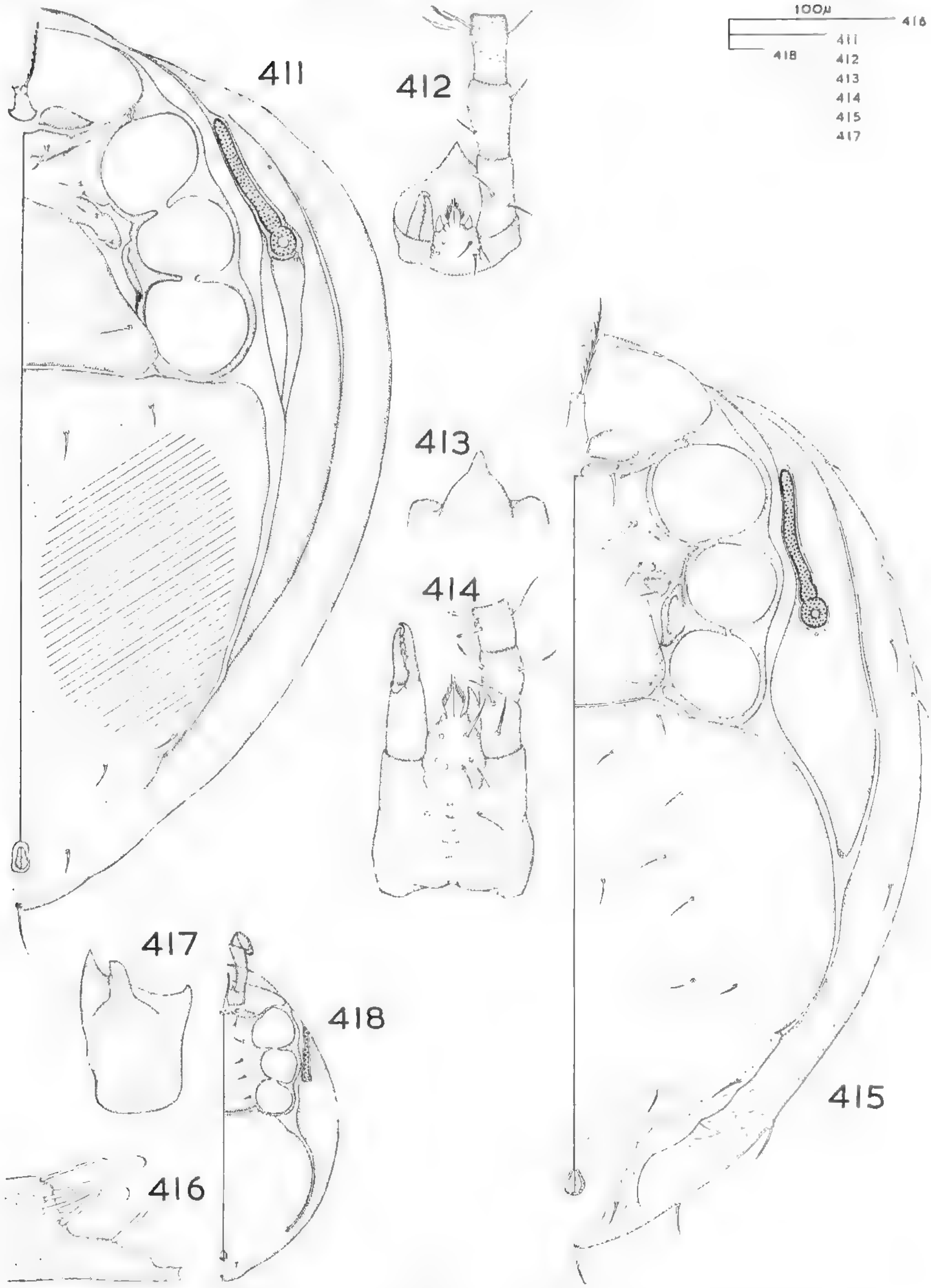
MORPHOLOGY.

SCLEROTIZATION. Female: Podonotal and opisthonotal with facing edges closely apposed. Discrete ventro-anal bearing aciculae posterior to anus. Discrete metapodal. Peritrematal reduced to slim strip between anterior end of peritreme and podonotal. Exopodals do not completely encase peraxial edges of acetabula. Sterno-metasternal fused to endopodal II and part of III. Single pair of pre-endopodals.

Male: Sternito-genital not fused to endopodal IV and not broad enough posteriorly to bear seta *st*5.

CHAETOTAXY. Idiosoma: *6j*, *5z*, *5s*, *5r*: *5J*, *5Z*, *5S*, 3 or *5R*: *5st*: *3Jv*, *3Zv*, *1Sv*.

Legs: As *Gamasellus*.



Figs. 411-418. *Stylochirus* G. and R. Canestrini.
411 and 412, *S. haemisphaericus* (Koch), female: 411, idiosoma, venter; 412, gnathosoma, venter. 413-415, *S. rarior* (Berlese), female: 413, tectum; 414, gnathosoma, venter; 415, idiosoma, venter. 416-418, *S. ampulliger* Berlese, male: 416, tarsus I, distal tip; 417, femur II, venter; 418, idiosoma, venter.

OTHER CHARACTERS. Female: Deutosternal denticles in 7 horizontal rows. Tectum anterior margin is basically unispinate with lateral spinules. Movable cheliceral digit with 3 teeth. Shape and position of antero-lateral setae on palp femur and genu unknown. Dorsal setae tapering, simple or slightly pilose. Peritreme without lateral pockets. On sternum, a line joining setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. What is probably a long, conspicuous spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV. Pretarsus I not pedunculate.

Male: Tectum anterior margin is without lateral spinules as in female. Movable cheliceral digit with 1 tooth, fused to extremely long spermadactyl along its entire length. When at rest, long spermadactyl loops back into pouch lying immediately dorsal to sternum, and reaching back to just posterior to sternal seta *st*4. Corniculi are longer than on female. On leg II, seta *av* on femur, genu and tibia is enlarged into spur.

DISTRIBUTION. Es. All nominal species recorded from Transvaal, South Africa.

Found in forest soil.

REMARKS. *Paragamasellevans* is closely allied to *Gamasellevans*, but with a morphology that is better adapted for life in the lower soil layers. The following two nominal species are included in this genus: *P. michaeli* Loots and Ryke, 1968; *P. vandenbergi* Loots and Ryke, 1968.

Genus QUEENSLANDOLAELAPS Womersley

Queenslandolaelaps Womersley, 1956b, p. 109. Type-species: *Queenslandolaelaps vitzthumi* Womersley, 1956b, by original designation.

DIAGNOSIS. Small or average sized mites. Holonotal shield. Ventro-anal shield separate from notal shield and fused to exopodal IV shield on both sexes. Peritrematal shield fused to exopodal IV shield. Sterno-metasternal shield fused to endopodal IV shield and line joining sternal setae *st*2, *st*3 and *st*4 would enclose an angle of less than 95°. Spermadactyl fused to male movable cheliceral digit on distal third, where it points away from the tip of digit as an attenuated, curving process with lateral hyaline flaps. Hyaline process with fimbriated border between arthrodial process and movable cheliceral digit male. Two ventral setae on genua III and IV. Pretarsus I pedunculate and smaller than other tarsi.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal. Ventro-anal fused only to exopodal IV. Aciculae on small discrete shield posterior to anus. No separate metapodal. Peritrematal fused to exopodal IV. Exopodal II and III not split. Sterno-metasternal fused to endopodal II, III and IV. Single pair of pre-endopodals.

Male: Separate sternito-genital.

CHAETOTAXY. Idiosoma: *6j, 6z, 5s, 5r: 5J, 5Z, 5S, 5R: 5st: 3Jv, 3Zv, 2Sv.*

Legs: As *Gamasellus.*

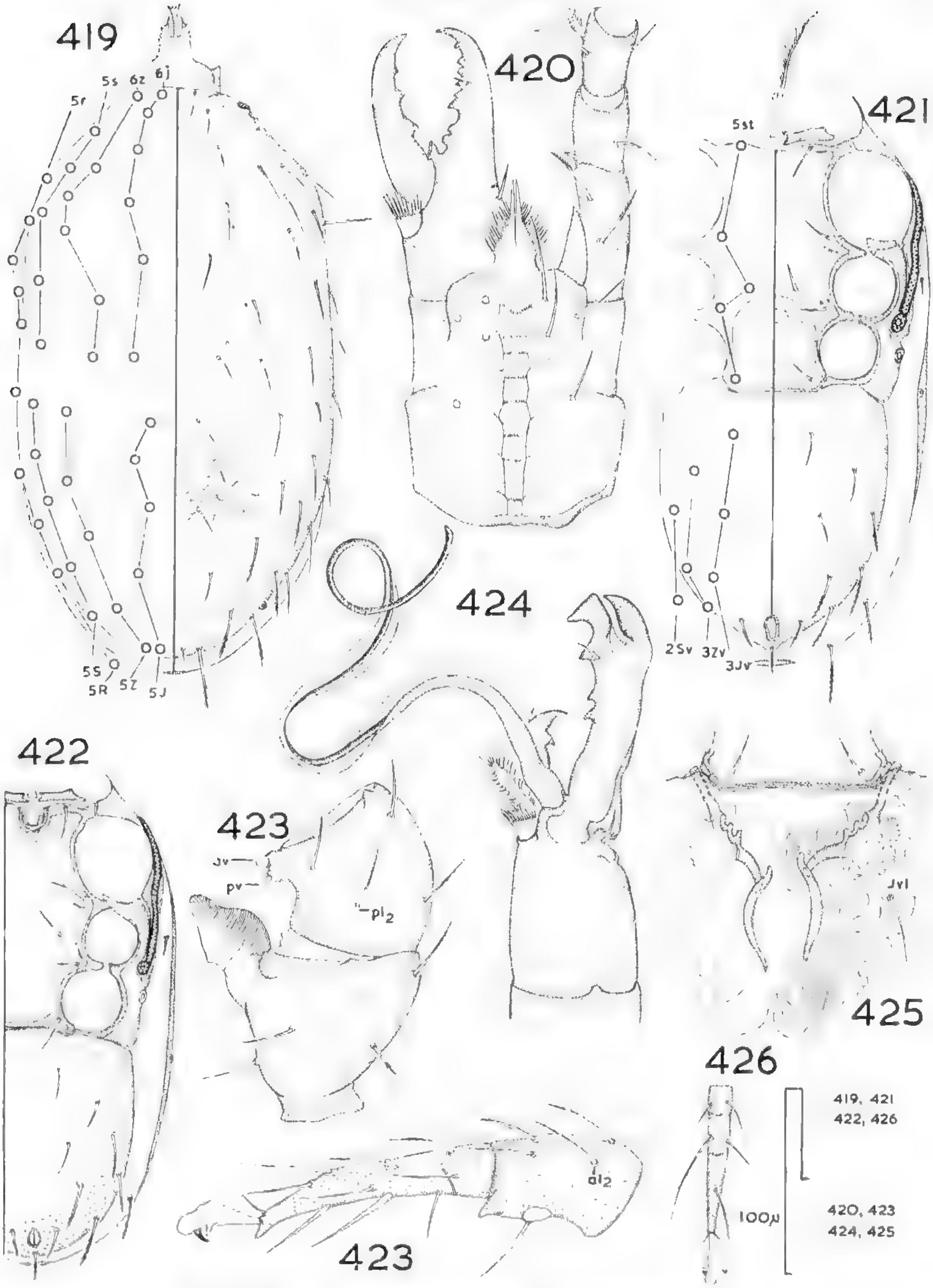
OTHER CHARACTERS. Female: Deutosternal denticles in 8 horizontal rows. Tectum anterior margin trispinate with central process narrow at base, spreading out to broader fimbriated tip. Movable cheliceral digit with three teeth. On palp genu, seta *al*1 pectinate with 7 lateral prongs and seta *al*2 slightly lanceolate. On palp femur, seta *al* in proximal third. Dorsal setae tapering, simple or slightly pilose. Exopodal process between coxae II and III has dorsal flap. Peritreme without lateral pockets. On sternum, a line joining setae *st*2, *st*3 and *st*4 would enclose an angle of less than 95°. Spermathecal ringed tube opens near posterior paraxial edge of acetabulum IV, and its junction with a single central sacculus is clear. Pretarsus I pedunculate and smaller than other pretarsi. Lateral lobes of pulvilli II-IV attenuated and shorter than central circular lobes. Amongst dorsal setae on tarsus IV, set *pd*3 is the longest and setose.

Male: Movable cheliceral digit with 1 tooth, and fused for much of its length with a long, sinuous spermadactyl with lateral flaps. Extra, fimbriated flap between arthrodial process and movable cheliceral digit, and there is a dorsal process distally on fixed cheliceral digit. On leg II, femur setae *av* and *pv*1, genus setae *av* and *pv*, tibia seta *av*, modified into spurs or spines. On tarsus II, seta *av*2 is slightly enlarged into a spine.

DISTRIBUTION. Aa. The only records are from Queensland, Australia.

Found in plant debris and soil.

REMARKS. Although there are differences between the ventral sclerotization of the idiosoma of the single species in *Queenslandolaelaps* and *Gamasellevans*, the similarities between the unusual male chelicera suggest that the two genera may be closely allied. The following single nominal species is included in this genus: *Q. vitzthumi* Womersley, 1956b.



Figs. 419-426. *Queenslandolaelaps vitzthumi* Womersley.

419-421, 425, 426, female: 419, soma, dorsum; 420, gnathosoma, venter; 421, idiosoma, venter; 425, spermatheca; 426, tarsus IV, dorsum. 422-424, male: 422, idiosoma, venter; 423 (two parts), leg II; 424, chelicera.

Queenslandolaelaps vitzthumi Womersley

Queenslandolaelaps vitzthumi Womersley, 1956b, p. 109.

FEMALE. Fig. 419-421, 425, 426. Idiosomal length, 630μ.

MALE. Fig. 422-424. Idiosomal length, 550μ.

LOCALITY. Females (N1968189) and male (N1968190) drawn: Australia; LF200, leaf litter, Brookfield, near Brisbane, Queensland, 10.5.1967, col. J. A. Herridge, dep. SAM.

The holotype female (N1968191) and allotype male (1968192) examined: Australia: soil debris, Brookfield, near Brisbane, Queensland, 31.5-10.6.1949, col. E. H. Derrick, dep. SAM.

Genus STYLOCHIRUS G. and R. Canestrini

Stylochirus G. and R. Canestrini, 1882, p. 56. Type-species: *Stilochirus rovennensis* G. and R. Canestrini, 1882, by monotypy.

Physalloaelaps Berlese, 1908, p. 13, **syn.n.**. Type-species: *Physallolaelaps ampulliger* Berlese, 1908, by original designation.

Periphis Berlese, 1914, p. 142, **syn.n.**. Type-species: *Iphis haemisphaericus* Koch, 1839, by original designation.

Epiphis Berlese, 1916b, p. 302, **syn.n.**. Type-species: *Gamasiphis* (*Epiphis*) *rarior* Berlese, 1916b, by original designation.

Megaliphis Willmann, 1938, p. 161, **syn.n.**. Type-species: *Gamasiphis* (*Megaliphis*) *giganteus* Willmann, 1938, by monotypy.

DIAGNOSIS. Average sized to gigantic mites. Holonotal shield. Ventro-anal shield fused to notal shield on both sexes. Peritrematal extending well posterior to acetabulum IV, and either free posteriorly or fused to notal shield. Sterno-metasternal shield not fused to endopodal IV shield and a line joining sternal setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. Male cheliceral digits reduced and edentate, the movable digit being fused along its entire length to a much longer, tapering spermadactyl. Two ventral setae on genua III and IV. Pretarsus I is pedunculate.

MORPHOLOGY.

SCLEROTIZATION. Female: Holonotal fused to ventro-anal, which is otherwise discrete but closely abuts on exopodal IV shield. Peritrematal only fused to holonotal, sometimes along its entire length. Usually no splits in exopodals but the female of *S. minor* is drawn with exopodals not completely encasing the peraxial edges of the acetabula. Metasternal may be discrete or narrowly joined to sternal which is only fused to endopodal II. Single pair of pre-endopodals.

Male: Discrete sternito-genital.

CHAETOTAXY. Idiosoma: Not known, other than 5*st* and opisthosoma is hypertrichous.

Legs: As *Gamasellus.*

OTHER CHARACTERS. Female: Globular mites, pointed posteriorly, and with a relatively small gnathosoma and attenuated chelicerae, the latter being about as long as the distance from anterior edge of acetabulum II to posterior edge of acetabulum IV. Movable cheliceral digit with 3 or 4 teeth. Tectum anterior margin with triangular shaped central process. On palp genu, seta *al*1 and *al*2 slightly pilose or lanceolate but not simple. On palp femur, seta *al* in central third. Dorsal setae simple and short. Shields extensively reticulated. Peritreme without lateral pockets and short not extending anterior to mid-acetabulum II and may be only as long as stigma width. On sternum a line joining setae *st*2, *st*3 and *st*4 would enclose an angle of more than 110°. Spermathecal ringed tubes not recognized. Pretarsus I is pedunculate and may be reduced compared to other pretarsi.

Male: The single well described male is that of *S. ampulliger* for which the female is not known (unless *S. rovennensis* is conspecific), so it is difficult to compare the sexes. The dilated, bulbous seta at the distal end of tarsus I (Fig. 416) may occur only in the male since this is true for the male of an unnamed *Afrogamasellus* species described by Loots (thesis, 1967). The male cheliceral digits are reduced and edentate, and the movable digit is fused along its entire length to a stout, tapered spermadactyl which may be longer than palps. On leg II, femur seta *av* and tibia seta *av* are enlarged into a spur while all the other setae appear setose, and seta *av* on the genu is certainly setose although slightly stouter and blunter than seta *pv*.

DISTRIBUTION. Na: Pe, Pm. Beside the locality records published with the original descriptions of nominal species, Athias-Henriot (1961a) records *S. ampulliger* from the Appennino Ligure Mountains, Italy and the Pyrenees Mountains, France.

Found in moss and plant litter.

REMARKS. There is little doubt about the close relationship between all the members of this genus except for one. Unfortunately, the exception is the type associated with the oldest available generic name for this taxon, *i.e.*, *S. rovennensis.* Athias-Henriot (1961a) has pointed out the resemblance between the meagre description of *S. rovennensis* and her thorough redescription of *Physallolaelaps ampulliger,* suggesting that they might be the same species, but not formally recognizing their synonymy. It can be argued that Berlese should have noticed this resemblance, but the male *S. rovennensis* that Professor Canestrini sent to him was obscure and fragmented (Berlese, 1892c). I have here formally recognized *S. rovennensis* and *P. ampulliger* as congeneric and therefore *Stylochirus* is the valid name for this taxon. If any division into subgenera was used, then the ex-members of *Megaliphis*, the two largest species with the peritreme no bigger than the stigma, would be the best to group into a separate subgenus. This genus is not closely allied to the other Sessiluncinae genera and is placed here for convenience. The following 6 nominal species are included in this genus: *S. rovennensis* G. and R. Canestrini, 1882; *S. ampulliger* (Berlese) **comb.n.** for *Physallolaelaps ampulliger* Berlese, 1908; *S. giganteus* (Willmann) **comb.n.** for *Megaliphis giganteus* Willmann, 1938; *S. haemisphaericus* (Koch) **comb.n.** for *Periphis haemisphaericus* (Koch, 1839); *S. minor* (Willmann) **comb.n.** for *Megaliphis minor* Willmann, 1953; *S. rarior* (Berlese) **comb.n.** for *Epiphis rarior* Berlese, 1916b.

Stylochirus rovennensis G. and R. Canestrini

Stilochirus rovennensis G. and R. Canestrini, 1882, p. 56.

FEMALE. Not figured. Idiosomal length, 940μ. Cheliceral fixed digit is multidenticulate and the movable digit is tridentate, the posterior tooth being the largest. Tectum anterior margin with single triangular process. Palps close together, the hypostome being constricted and clearly separated from the base of the palps. Corniculi small ("absent"). Idiosoma strongly convex and pointed posteriorly, with smooth surface and short setae ("unprovided with setae"). Holonotal shield. Ventro-anal shield semicircular. Peritreme short. Reddish brown.

MALE. Not figured. Idiosomal length, 800μ. Cheliceral digits reduced and with elongated spermadactyl directed forward past palps. Leg II with medium sized process on femur and a small process on tibia.

LOCALITY. Italy; moss, fields of Tridentini, Non Valley, Mt. Rovenna, Trentino District, Alps.

REMARKS. This description is culled from G. and R. Canestrini's (1882) and Berlese's (1892c) descriptions of this species.

Stylochirus ampulliger Berlese

Physallolaelaps ampulliger Berlese, 1908, p. 13.

FEMALE. Not known.

MALE. Fig. 416-418. Idiosomal length, 890μ. From the single specimen in Berlese Collection it is difficult to observe any finer detail than what is drawn here. Athias-Henriot (1961a) gives a detailed description of conspecific males.

LOCALITY. The 'tipico' male (75/9, two slides, one leg I being mounted separately) drawn: Italy; Vallombrosa, dep. SEAF.

Stylochirus haemisphaericus (Koch) **comb.n.**

Iphis haemisphaericus Koch, 1938, 27.16.

FEMALE. Fig. 411, 412. Idiosomal length, 910μ. Gnathosoma bent ventrally, probably obscuring seta *hyp*4. Part of ventro-anal shield obscured (shown by hatched shading on Fig. 411).

MALE. Not known.

LOCALITY. Two females (148/23 and 151/35, legs, palps and gnathosoma fragments) drawn: Italy; moss in pasture, Cansiglio, dep. SEAF.

Stylochirus rarior (Berlese) **comb.n.**

Gamasiphis (*Epiphis*) *rarior* Berlese, 1916b, p. 303.

FEMALE. Fig. 413-415. Idiosomal length, 950μ. Holonotal and ventro-anal seta may be hypertrichous. Some dorsal setae on legs as spiny as sternal seta *st*2 and slightly pilose at tip.

MALE. Not known.

LOCALITY. The 'tipico' female (175/43) drawn: North America; leaf mould, Columbia, Missouri, U.S.A., 1904-1906, col. C. R. Crosby, dep. SEAF (for justification of this data, see Hammen, 1959, p. 24).

Subfamily TANGAROELLINAE **subf.n.**

Type-genus: *Tangaroellus* Luxton, 1968.

REMARKS. Since this subfamily contains only a single species and the main function of this paper is to give diagnosis for genera, the characters of the species are listed under the genus heading.

Genus TANGAROELLUS Luxton

Tangaroellus Luxton, 1968, p. 497. Type-species: *Tangaroellus porosus* Luxton, 1968, by original designation.

DIAGNOSIS. Small mites. Separate podonotal and opisthonotal shields. Discrete ventro-anal shields on both sexes, although on male there is no discrete pair of metapodal shields so they may be merged into ventro-anal shield. Peritrematal shield not fused to exopodal IV shield. Setation of legs unique within Rhodacaridae in having one ventral seta less than *Gamasellus* on femur I, one ventral seta more on femur IV, and two dorsal setae less on tarsus IV. Only rhodacarid genus with 2-pronged apotele. Location of spermatheecal ringed tube, if present, unknown. Pretarsus I not pedunculate.

MORPHOLOGY.

SCLEROTIZATION. Female: Separate podonotal and opisthonotal. Discrete ventro-anal and metapodal. Peritrematal not fused to any other shields posteriorly. Exopodals do not completely encase peraxial edges of acetabula. Sterno-metasternal fused to endopodal II. Single pair of pre-endopodals.

Male: Sternito-genital. Ventro-anal larger and probably including metapodals. Fusion of peritrematal to podonotal anteriorly is more extensive.

CHAETOTAXY. Idiosoma: *6j, 4z, 3s, 3r: 4J, 4Z, 4S, 0R: 5st: 3Jv, 2Zv, 0Sv.*

Legs: Differs from *Gamasellus* in having one less ventral on femur I (2, 5/3, 2) and one more ventral on femur IV (1, 4/2, 0), and in having two dorsal setae (setae *ad*3 and *pd*4) less on tarsus IV.

OTHER CHARACTERS. Female: Tectum anterior margin unispinate. Movable cheliceral digit with 3 teeth. On palp genu, setae *al*1 and *al*2 are simple, setose. On palp femur, seta *al* in proximal third. Apotele 2-pronged in contrast to all other rhodacarid mites which have a 3-pronged apotele. Most dorsal setae are simple, setose, but some are spatulate. No noticeable spermatheceal ringed tube. Pretarsus I not pedunculate, sheath only being long enough to contain the retracted claw-complex. Pulvilli II-IV have two oval lobes. Amongst dorsal setae on tarsus IV, seta *pd*3 is the longest and is spatulate.

Male: Movable cheliceral digit with 1 tooth and fused at base to longer, tapered spermadactyl. Seta *pl* on palp genu is modified into a spur. On leg II, setae *av* on femur, genu and tibia are spurs and other setae may be robust spines, larger than the same setae on the female.

DISTRIBUTION. An. Only records are from New Zealand. Found in littoral zone, usually in the crevices between barnacle carapaces.

REMARKS. Tangaroellus is unusual in having both a 2-pronged apotele and 4 ventral setae on tibia I. The chaetotaxy of tibia I is given more weight and the genus is retained in the Rhodacaridae. Because of the structure of the apotele, the unusual leg setation, the reduced idiosomal setation and the ventral sclerotization of the idiosoma this genus is considered unusual enough to be placed in a separate subfamily. Luxton (1968) pointed out that there was a good case for establishing a new family group for *Tangaroellus*. The following single nominal species is included in this genus: *T. porosus* Luxton, 1968. Two paratype females (N1968271 and N1968272) and two paratype males (N1968273 and N1968274) examined: New Zealand; among barnacles, littoral zone, Magazine Point, near Nelson, 5.6.1967, col. G. W. Ramsay, dep. SAM.

SPECIES INCERTAE SEDIS

Neogamasellevans berlesei (Womersley) **comb.n.**

Queenslandolaelaps berlesei Womersley, 1956b, p. 111.

FEMALE. Fig. 178-181. Idiosomal length, 520μ. All shields strongly reticulated. Spermathecal ringed tube possibly opens near the posterior paraxial edge of acetabulum IV.

MALE. Not known.

LOCALITY. Two females (N1968105 and N1968106) drawn or examined: Australia; LF171, moss, beside Gold Creek, Brookfield, near Brisbane, Queensland, 7.9.1966, col. D. C. Lee, dep. SAM.

The holotype female (N1968107) examined; Australia; soil litter, Brookfield, near Brisbane, Queensland, 31.5.1949-10.6.1949, col. E. H. Derrick, dep. SAM.

REMARKS. This species belongs to the Ologamasinae and not the Sessiluncinae which contains *Queenslandolaelaps*, the genus it was originally placed in. Beyond this I am uncertain of its relationships, but I have referred it to *Neogamasellevans* as a temporary measure until more data, especially the male morphology, is available.

Rhodacaroides costai (Sheals) **comb.n.**

Rhodacarus costai Sheals, 1962, p. 85.

FEMALE. The following characters not noted in the original description are listed here. Peritrematal shield is connected by a thickened striation on cuticle to exopodal IV shield. Both tarsi IV are missing, so the setation of this segment is unknown, but otherwise the leg chaetotaxy is as for *Gamasellus*. Third hypostomal seta nearly level with seta *hyp*2, both being a similar distance from seta *hyp*4. On palp genu, seta *al*2 has a number of lateral prongs. On palp femur, seta *al* in proximal third. Spermathecal ringed tube opening not located.

MALE. Not known.

LOCALITY. Holotype female (1961-6-20-2) examined: South America; surface soil, Los Arrayanes, Nahuel Huapi Reserve, Andes Mountains, Argentina, 2-5.1959, col. C. Delamare Deboutteville, dep. BM(NH).

REMARKS. This species belongs to the Ologamasinae and not the Rhodacarinae which contains *Rhodacarus*, the genus it was originally placed in. Beyond this I am uncertain of its relationships, but I have referred it to *Rhodacaroides* as a temporary measure until more data is available.

Hydrogamasellus ubatubaensis Hirschmann, 1966

Gamasellus (Hydrogamasellus) ubatubaensis Hirschmann, 1966, p. 25.

REMARKS. This species from the rocky shoreline, Recife, Brazil, cannot be placed in any established genus with confidence and I have been unable to borrow the type material in order to decide whether or not a new genus should be erected for it. Despite the fact that the peritrematal shield is not fused to exopodal IV shield, I would regard this species as belonging to the Ologamasinae and therefore have left it in *Hydrogamasellus* as a temporary measure until it is more fully described.

TAXA SIZES AND DISTRIBUTION

Table 1 summarizes the number of species in the supraspecific taxa and the distribution of those taxa amongst the major zoogeographical regions. In the map (Fig. 427) of the zoogeographical regions the minor regions and the abbreviations used for them are given, but these are only referred to in the text under the genera headings. Kerguelenian is mis-spelt in Fig. 427. It should be remembered that the rhodacarid fauna of South America is probably as morphologically diverse as that of Australia, rather than that of North America as suggested by the table. The unnamed species enumerated include only species that have been described but not formally named.

TABLE 1

Sizes and distribution or rhodacarid supraspecific taxa

Taxa	Number of known species		Major Zoogeographical Regions								
	Nominal	Unnamed	N	P	NT	E	O	A	S	AC	Page
RHODACARIDAE (52 distinct genus-group taxa)	220	49	N (10)	P (14)	NT (10)	E (16)	O (6)	A (27)	S (13)	AC (4)	17
RHODACARINAE	45	12	N	P	NT	E	O	A	—	—	23
Rhodacarus	17	2	*N*	*P*	*NT*	*E*	*O*	*A*	—	—	26
Afrogamasellus	18	9	—	—	—	*E*	—	—	—	—	30
Rhodacarellus	9	—	*N*	*P*	—	—	—	*A*	—	—	36
Rhodacaropsis	1	1	*N*	*P*	—	*E*	—	—	—	—	37
GAMASIPHINAE	40	6	N	P	NT	E	O	A	S	—	39
Gamasiphis	16	4	*N*	*P*	*NT*	*E*	*O*	*A*	—	—	42
Caliphis	6	—	—	—	—	—	—	*A*	*S*	—	52
Euepicrius	3	—	—	—	—	—	—	*A*	*S*	—	55

TABLE 1—*continued*

Sizes and distribution or rhodacarid supraspecific taxa—*continued*

Taxa	Number of known species		Major Zoogeographical Regions								
	Nominal	Unnamed	N	P	NT	E	O	A	S	AC	Page
Gamaselliphis	5	—	—	—	—	*E*	—	—	—	—	57
Gamasiphoides	4	2	—	—	*NT*	*E*	—	*A*	*S*	—	59
Hydrogamasus	4	—	—	*P*	—	—	—	*A*	*S*	—	64
Laelaptiella.............	2	—	—	—	—	—	—	*A*	—	—	70
LAELAPTONYSSINAE.	2	—	—	—	—	—	O	A	—	—	72
Laelaptonyssus	2	—	—	—	—	—	*O*	*A*	—	—	72
OLOGAMASINAE	101	20	N	P	NT	E	O	A	S	AC	74
OLOGAMASINI	38	8	—	P	NT	E	—	A	S	AC	83
Ologamasus	3	—	—	—	*NT*	—	—	—	—	—	84
Cymiphis	7	—	—	—	—	—	—	*A*	*S*	—	90
Geogamasus	4	—	—	—	*NT*	—	—	*A*	—	—	92
Heydeniella—											
crozetensis-complex....	2	6	—	—	—	—	—	—	*S*	—	97
dentatus-complex......	6	—	—	*P*	—	—	—	*A*	—	—	101
Hydrogamasellus	8	2	—	—	*NT*	—	—	—	*S*	*AC*	110
Neogamasellevans	1	—	—	—	*NT*	—	—	—	—	—	117
Parasitiphis	4	—	—	—	—	—	—	*A*	*S*	*AC*	118
Pyriphis	1	—	—	—	—	—	—	*A*	—	—	125
Rykellus	2	—	—	—	—	*E*	—	—	—	—	126
GAMASELLINI	63	19	N	P	NT	E	O	A	S	AC	127
Gamasellus—											
falciger-complex	18	10	*N*	*P*	—	*E*	*O*	*A*	—	—	130
discutatus-complex	6	—	—	—	—	—	—	*A*	—	—	136
pyriformis-complex	1	1	—	—	—	*E*	—	—	—	—	137
Acugamasus—											
punctatus-complex.....	4	—	—	—	—	—	—	*A*	*S*	—	140
natalensis-complex.....	8	1	—	—	—	*E*	—	—	—	—	143
Allogamasellus	2	—	—	*P*	—	—	—	—	—	—	144
Cyrtolaelaps	6	1	*N*	*P*	—	—	—	—	—	—	146
Euryparasitus	2	—	*N*	*P*	—	—	—	—	—	—	151
Evanssellus	2	—	—	—	*NT*	—	—	*A*	*S*	—	154
Heterogamasus..........	3	—	—	—	*NT*	—	—	—	*S*	—	156
Hiniphis	1	—	—	—	—	—	—	*A*	—	—	157
Laelogamasus	1	2	—	—	—	—	*O*	—	—	—	159
Litogamasus	1	2	—	—	—	—	—	—	*S*	*AC*	160
Notogamasellus—											
(*Notogamasellus*)	1	—	—	—	—	*E*	—	—	—	—	164
(*Podonotogamasellus*) ..	1	—	—	—	—	*E*	—	—	—	—	165
Periseius-											
(*Periseius*)	2	1	*N*	—	*NT*	—	—	*A*	—	—	166
(*Psammosella*)	2	—	*N*	*P*	—	—	—	—	—	—	168
Pilellus	1	1	—	—	—	—	—	—	*S*	*AC*	169
Rhodacaroides	1	—	—	*P*	—	—	—	—	—	—	170

TABLE 1—*continued*

Sizes and distribution or rhodacarid supraspecific taxa—*continued*

Taxa	Number of known species		Major Zoogeographical Regions								
	Nominal	Unnamed	N	P	NT	E	O	A	S	AC	Page
SESSILUNCINAE	31	4	N	P	—	E	O	A	—	—	172
Sessiluncus	4	4	—	*P*	—	*E*	*O*	*A*	—	—	175
Antennolaelaps	3	—	—	—	—	—	—	*A*	—	—	178
Gamasellevans	7	—	—	—	—	*E*	—	—	—	—	184
Gamasellopsis	4	—	—	—	—	*E*	—	—	—	—	186
Gamasitus	1	—	—	—	—	—	—	*A*	—	—	187
Onchogamasus—											
communis-complex	1	—	—	—	—	—	—	*A*	—	—	189
pumilio-complex	2	—	—	—	—	—	—	*A*	—	—	190
Paragamasellevans	2	—	—	—	—	*E*	—	—	—	—	193
Queenslandolaelaps	1	—	—	—	—	—	—	*A*	—	—	195
Stylochirus	6	—	*N*	*P*	—	—	—	—	—	—	198
TANGAROELLINAE ..	1	—	—	—	—	—	—	A	—	—	201
Tangaroellus	1	—	—	—	—	—	—	*A*	—	—	201

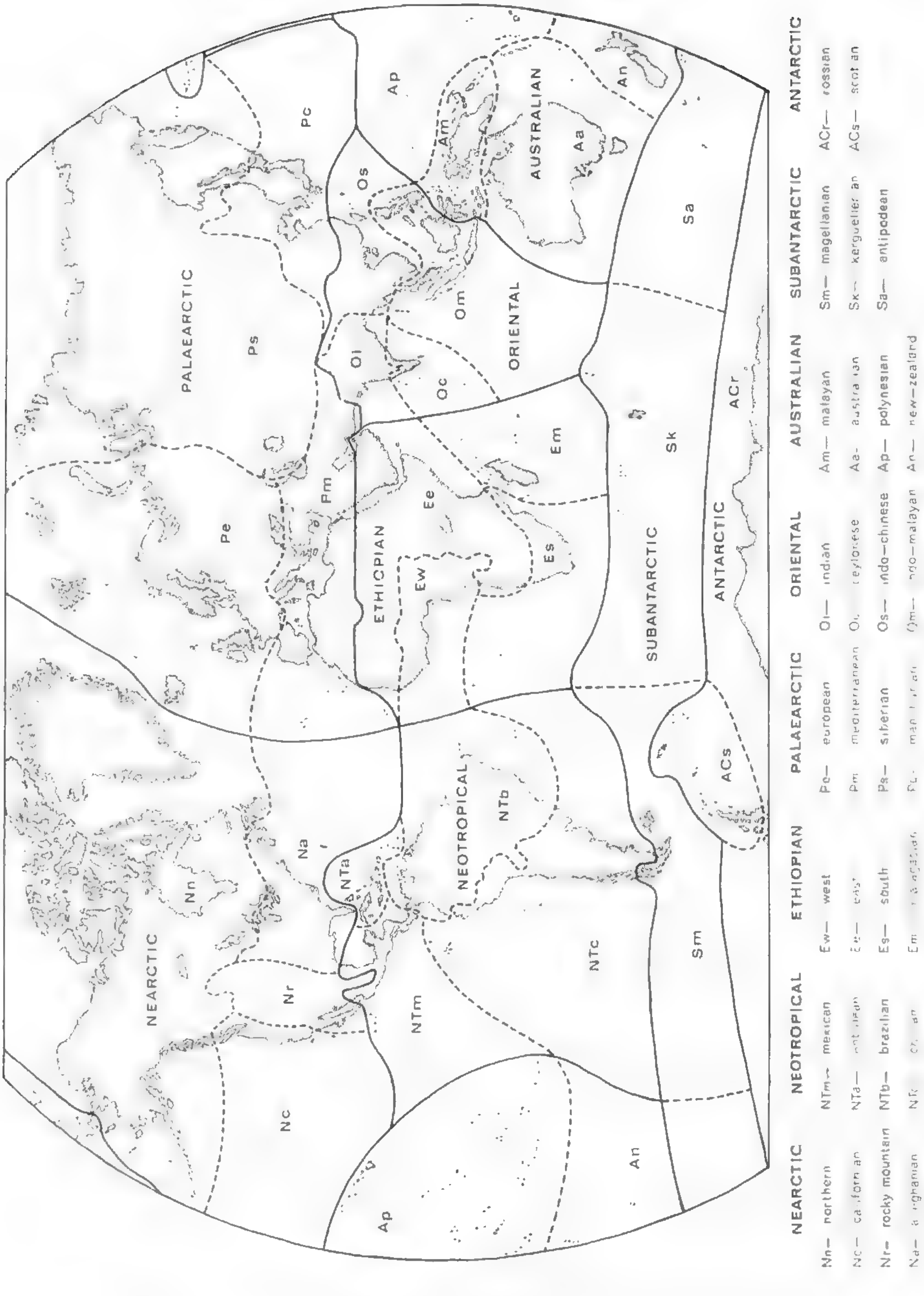


Fig. 427. Zoogeographical Regions (after Vercammen-Grandjean, 1966).

CHANGES IN NOMENCLATURE

The author and date of publication are only given for names that were misidentifications or are preoccupied.

NEW TAXA.

Subfamilies: Gamasiphinae; Sessiluncinae; Tangaroellinae.

Genera: *Acugamasus*; *Caliphis*; *Cymiphis*; *Geogamasus*; *Hiniphis*; *Litogamasus*; *Pilellus*; *Pyriphis*; *Rykellus*.

Species: *Gamasiphoides aitkeni*; *Parasitiphis aurora*; *Caliphis calvus*; *Acugamasus cursor*; *Gamasiphis fornicatus*; *Heydeniella goei*; *Hiniphis hinnus*; *Geogamasus howardi*; *Euepicrius lootsi*; *Heydeniella markmitchelli*; *Onchogamasus pumilio*; *Onchogamasus quasicurtipilus*; *Geogamasus skoshi*; *Antennolaelaps testudo*.

NOMINA NOVA.

Species: *Hydrogamasellus gaussi* for *Neoparasitus crozetensis* Richters 1907; *Hydrogamasellus richtersi* for *Gamasellus crozetensis* Richters, 1907.

NEW RANK.

Subfamily: Laelaptonyssinae.

Tribe: *Ologamasini*.

Genera: *Gamaselliphis*; *Hydrogamasellus*; *Laelogamasus*.

Species: *Caliphis tamborinensis*.

NEW SYNONYMS.

Genera: *Austrohydrogamasus* under *Parasitiphis*; *Epiphis* under *Stylochirus*; *Megaliphis* under *Stylochirus*; *Micriphis* under *Gamasiphis*; *Neogamasiphis* under *Gamasiphis*; *Periphis* under *Stylochirus*; *Physallolaelaps* under *Stylochirus*; *Puchihlungia* under *Laelaptonyssus*; *Stylogamasus* under *Antennolaelaps*.

Species: *Hydrogamasus antarcticus* sensu Womersley, 1937 under *Parasitiphis aurora*; *Gamasiphis australicus* sensu Domrow, 1957 under *Gamasiphis setosus*; *Sessiluncus heterotarsus* sensu Domrow, 1957 under *Antennolaelaps testudo*; *Periseius littorale* under *Periseius hammeni*; *Hydrogamasus* (*Austrohydrogamasus*) *watsoni* under *Parasitiphis jeanneli*.

REVOKED SYNONYMS.

Genus: *Heydeniella* not under *Gamasiphis*; *Laelogamasus* not under *Gamasellus*; *Neogamasellevans* not under *Hydrogamasellus*.

Species: *Hydrogamasus littoralis* not under *Gamasus salinus*.

NEW COMBINATIONS. *ampulliger* (ex *Physallolaelaps*) with *stylochirus*; *australica* (ex *Hydrogamasellus*) with *Heydeniella*; *berlesei* (ex *Queenslandolaelaps*) with *Neogamasellevans* (under species *incertae sedis*); *borealis* (ex *Gamasus*) with *Gamasellus*; *brunneus* (ex *Laelaps*) with *Parasitiphis*; *cavei* (ex *Ologamasus*) with *Hydrogamasellus*; *coleoptratus* (ex *Ologamasus*) with *Hydrogamasellus*; *convexus* (ex *Stylogamasus*) with *Antennolaelaps*; *costai* (ex *Rhodacarus*) with *Rhodacaroides* (under species *incertae sedis*); *coxalis* (ex *Hydrogamasellus*) with *Geogamasus*; *crozetensis* (ex *Gamasellus*) with *Hydrogamasellus*; *crozetensis* (ex *Neoparasitus*) with *Hydrogamasellus*; *cymosus* (ex *Ologamasus*) with *Cymiphis*; *darglensis* (ex *Gamasellus*) with *Rykellus*; *delamarei* (ex *Hydrogamasellus*) with *Geogamasus*; *dentata* (ex *Hydrogamasellus*) with *Heydeniella*; *discutatus* (ex *Ologamasus*) with *Gamasellus*; *drakensbergensis* (ex *Gamasellus*) with *Acugamasus*; *dumosus* (ex *Ologamasus*) with *Cymiphis*; *gamasiphioides* (ex *Hydrogamasellus*) with *Gamasiphoides*; *giganteus* (ex *Megaliphis*) with *Stylochirus*; *grahami* (ex *Gamasellus*) with *Acugamasus*; *haemisphaericus* (ex *Periphis*) with *Stylochirus*; *hammeni* (ex *Cyrtolaelaps*) with *Periseius*; *hickmani* (ex *Neogamasiphis*) with *Caliphis*; *hluhluwensis* (ex *Gamasellus*) with *Acugamasus*; *jeanneli* (ex *Gamasellus*) with *Parasitiphis*; *knysnaensis* (ex *Gamasellus*) with *Acugamasus*; *leptosceles* (ex *Ologamasus*) with *Cymiphis*; *litoprothrix* (ex *Ologamasus*) with *Gamasellus*; *loricata* (ex *Gamasiphis*) with *Heydeniella*; *macquariensis* (ex *Hydrogamasellus*) with *Gamasiphoides*; *macrosetosus* (ex *Gamasellus*) with *Acugamasus*; *mansoni* (ex *Ologamasus*) with *Cymiphis*; *minor* (ex *Megaliphis*) with *Stylochirus*; *natalensis* (ex *Gamasellus*) with *Acugamasus*; *neotasmanicus* (ex *Gamasellus*) with *Acugamasus*; *nkandhlaensis* (ex *Gamasellus*) with *Rykellus*; *novaezelandiae* (ex *Neogamasiphis*) with *Caliphis*; *nucilis* (ex *Ologamasus*) with *Cymiphis*; *paranatalensis* (ex *Gamasellus*) with *Acugamasus*; *punctatus* (ex *Gamasellus*) with *Acugamasus*; *pyrenoides* (ex *Ologamasus*) with *Pyriphis*; *queenslandicus* (ex *Neogamasiphis*) with *Caliphis*; *racovitzai* (ex *Gamasellus*) with *Hydrogamasellus*; *rarior* (ex *Epiphis*) with *Stylochirus*; *relata* (ex *Hydrogamasellus*) with *Heydeniella*; *relicta* (ex *Hydrogamasellus*) with *Heydeniella*; *rykei* (ex *Gamasellus*) with *Pilellus*; *salinus* (ex *Hydrogamasus*) with *Pergamasus* (*Parasitidae*); *schusteri* (ex *Hydrogamasellus*) with *Caliphis*; *semipunctatus* (ex *Gamasellus*) with *Acugamasus*; *setosus* (ex *Cyrtolaelaps*) with *Litogamasus*; *southcotti* (ex *Ologamasus*) with *Gamasellus*; *spurius* (ex *Euryparasitus*) with *Cyrtolaelaps*; *tamborinesis* (ex *Neogamasiphis*) with *Caliphis*; *tindalei* (ex *Ologamasus*) with *Gamasellus*; *validus* (ex *Ologamasus*) with *Cymiphis*; *virgosus* (ex *Ologamasus*) with *Gamasellus*; *watsoni* (ex *Gamasellus*) with *Acugamasus*; *watsoni* (ex *Gamasiphis*) with *Cymiphis*.

INCLUDED AVAILABLE GENUS-GROUP NAMES

The names are in alphabetical order. The reference in parenthesis indicates when the genus was first placed in this family if this was after the name was made available.

EXCLUDED GENERA

The following genera were placed in the Rhodacaridae when made available or in the publication referred to in parenthesis, but have since been regarded as belonging to other families, a transfer followed here. *Panteniphis* is the only genus newly regarded as belonging to another family.

Antennoseius Berlese, 1916 (Ryke, 1962b), to Ascidae.

Asca Heyden, 1826 (Ryke, 1961c), to Ascidae.

Digamasellus Berlese, 1905 (Ryke, 1958), to Digamasellidae.

Gamasellodes Athias-Henriot, 1961b, to Ascidae.

Halolaelaps Berlese and Trouessart, 1889 (Evans, 1955), to Halolaelapidae.

Leitneria Evans, 1957, to Halolaelapidae.

Longoseius Chant, 1961 (Ryke, 1962b), to Digamasellidae.

Pachyseius Berlese, 1910a (Ryke, 1962b), to Pachylaelapidae.

Pantheniphis Willmann, 1949 (Athias-Henriot, 1968) to Ascidae. This genus was not placed in any family when originally described, but has since been allotted to the Rhodacaridae by Athias-Henriot (1968). It contains one species, *P. mirandus*, only the female being described when the name was made available (Willmann, 1949), but the male has since been thoroughly described by Athias-Henriot (1969). I have preferred to exclude this genus from the Rhodacaridae, transferring it to the Ascidae, mainly on the basis of three characters (reduced leg setation with only 12 setae on tibia I, 2-pronged apotele, inconspicuous enlarging of setae on male leg II with only seta *av* on femur slightly enlarged to a short, blunt spine) which all occur on members of the Rhodacaridae, but rarely, and never together.

Protogamasellus Karg, 1962 (Karg, 1965), to Ascidae.

Saintdidieria Oudemans, 1939b (Ryke, 1961), to Halolaelapidae.

Saprolaelaps Leitner, 1946 (Evans, 1957), to Halolaelapidae.

Trachygamasus Berlese, 1904 (Ryke, 1962b), to Parasitidae.

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RECORDS OF THE
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A REVISION OF THE AUSTRALIAN PENTATOMID BUGS OF THE GENUS CEPHALOPLATUS WHITE (Hemiptera—Pentatomidae—Pentatominea)

By GORDON F. GROSS

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Summary

The genus *Cephaloplatus* White 1842 as now understood includes 15 species. The genus is easily recognized because, excepting *C. minor* Distant which is blackish brown, the species are yellowish, yellowish brown or reddish brown moderately sized Pentatomine bugs. They have the juga of the head broad and flattened and extending forward well past the apex of the anteclypeus. The anterolateral margins of the pronotum are explanate and are usually crenulate or dentate. The anterolateral margins exterior to the true anterior angles of the pronotum are usually produced forward as angulate flattened lobes. These processes are indicated in the descriptions as the "regions of the anterior angles". The species are found in the tropical north of Australia and southwards of this into the arid desert areas and the semi arid desert fringes, they rarely occue in the moister regions of the south. The genus is known only from Australia.

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(Hemiptera — Pentatomidae — Pentatominae)

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INTRODUCTION

The genus *Cephaloplatus* White 1842 as now understood includes 15 species. The genus is easily recognized because, excepting *C. minor* Distant which is blackish brown, the species are yellowish, yellowish brown or reddish brown moderately sized Pentatomine bugs. They have the juga of the head broad and flattened and extending forward well past the apex of the anteclypeus. The anterolateral margins of the pronotum are explanate and are usually crenulate or dentate. The anterolateral margins exterior to the true anterior angles of the pronotum are usually produced forward as angulate flattened lobes. These processes are indicated in the descriptions as the "regions of the anterior angles". The species are found in the tropical north of Australia and southwards of this into the arid desert areas and the semi arid desert fringes, they rarely occur in the moister regions of the south. The genus is known only from Australia.

The species are quite difficult to separate if not illustrated. Unfortunately the previous descriptions are all verbal with the consequence that only one or two of the more distinctive species could be named confidently by a worker in this country who did not have recourse to the types.

With the assistance of the Sir Mark Mitchell Trust and the C.S.I.R.O. Science and Industry Fund, I was able recently to visit Europe to help complete the first part of a projected descriptive Handbook of the South Australian Heteroptera and in so doing was able to see the *Cephaloplatus* types lodged there. The type of *Cephaloplatus nubifer* Bergroth was found unmarked as such in Helsinki and has been selected and labelled as a lectotype, the types of *Cephaloplatus granulatus* Bergroth and *Cephaloplatus reticulatus* Bergroth were located on my return amongst material lent for the purpose of this study by the National Museum, Melbourne, similarly not marked as types, these also have been selected and labelled as lectotypes.

I am indebted to the Directors of entomological staffs of the following institutions who permitted me to examine their collections, to make notes on type material and in many cases lent critical and unsorted material to

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the completion of this project. The letters in brackets before each Institution are the abbreviation used to designate the respective Institution in which material is lodged in the "Distribution" section under each species.

(Q.M.)	The Queensland Museum, Brisbane.
(U.Q.)	The collections of the Department of Entomology, the University of Queensland, Brisbane.
(A.M.)	The Australian Museum, Sydney.
(A.N.I.C.)	The Australian National Insect Collection, c/o C.S.I.R.O., Canberra.
(N.M.)	The National Museum, Melbourne.
(S.A.M.)	The South Australian Museum, Adelaide.
(Helsinki)	Universitetets Zoologiska Museum, Helsingfors.
(Stockholm)	Naturhistoriska Riksmuseum, Stockholm.
(Paris)	Muséum d'Histoire Naturelle, Paris.
(B.M.)	The British Museum (Natural History), London.
(A.M.N.H.)	American Museum of Natural History, New York.
(U.S.N.M.)	The Smithsonian Institution, The United States National Museum, Washington.
(Snow)	The Snow Entomological Collection, The University of Kansas, Lawrence.
(C.A.)	The California Academy of Sciences, San Francisco.
(Bishop)	The Bernice P. Bishop Museum, Honolulu.

My especial thanks go to Drs. W. Hackman and M. Meinander (Helsinki), Professor L. Brundin and Dr. P. I. Persson (Stockholm), Dr. Knight, Mrs. J. M. Black, and Mr. L. Mound (B.M.), Dr. J. Rozen (A.M.N.H.), Drs. R. Froeschner and J. Herring (U.S.N.M.), Dr. P. Ashlock (Kansas), Drs. E. Ross and P. Arnaud (C.A.), and Miss S. Nakata (Bishop) for the very special efforts on their part to see that all material relevant to this project in particular was available for me to see and/or borrow at the time I passed through.

SYSTEMATIC TREATMENT

Genus **Cephaloplatus** White 1842

Dryptocephalus?(Cephaloplatus) White, 1842, Trans. ent. Soc. Lond., 3:91.

Cephaloplatus Dallas, 1851, *List of the Specimens of Hemipterous Insects in the Collection of the British Museum* 1:131, 148.

Cephaloplatys Stål, 1867, Ofvers. Kongl. svenska Vetensk Akad Förh., 507. 1876, Kongl. svenska Vetensk Akad Handl., 14(4):55, 71. Lethierry & Severin, 1893, Catalogue génèral des Hémiptères 1:113.

Rather oval moderate sized Pentatominae, reddish brown, yellowish brown, or blackish brown in colour.

Head comparatively large, basally slightly swollen, apically flattened or even concave. Eyes moderately prominent, very close to the anterior margin of the pronotum in the subgenus *Cephaloplatus* and *Dolichoplatus subgen. nov.*, well separated in *Melanoplatus subgen. nov.* Juga laterally expanded, produced well in front of the anteclypeus and their apical and lateral margins sometimes strongly reflexed. Anteriorly their margins may be truncate or rounded, laterally usually sinuate, in some species thrown into a flattened spine or process in front of the eyes. Antennae very slender, first segment not reaching the apices of the juga, antennophore usually with a short blunt hooked process laterally.

Pronotum fairly flattish, the anterior margin strongly concave, the lateral margins explanate and the anterior angles produced angulately and in the subgenera *Cephaloplatus* and *Dolichoplatus* reaching forward to in front of the eyes, in some species of *Cephaloplatus sens. str.* markedly so (*C.* (*C.*) *explanatus* sp. nov.). The lateral angles are acute or angulate, the posterolateral margins are sinuate with a low tumescence just behind the lateral angles, the posterior margin is feebly concave.

Scutellum more or less triangular and a little larger than usual in Pentatominae, only very feebly raised basally and its apex rounded, often broadly so.

Hemelytra always wider than the abdomen in their basal half, in most but not all species narrowing in their apical half to expose some or all of the connexivum. Veins of the membrane straightish, or apically forked, or reticulate. The laterotergites are unarmed anteriorly and posteriorly.

Beneath the bucculae are sinuously elevated and do not reach the base of the head, the rostrum reaches about the hind coxae. The prosternum is only shallowly depressed, the mesosternum is very feebly convex and has the median longitudinal ridge or raised line characteristic of groups of Pentatominae from more or less the *Halys* group onwards in arrangements of genera such as Lethierry and Severin. The metasternum appears to be almost flat. The embolium of the hemelytra is well developed over the thorax but is concealed behind this point. The legs are normal and the abdomen fairly convex.

Type: *Dryptocephalus*? (*Cephaloplatus*) *pertyi* White 1842, monobasic.

Remarks: White did not give a generic diagnosis and the only descriptions in Dallas and Stål form part of their respective Keys to genera. The often used spelling *Cephaloplatys* dates from Stål but is not valid, it is not strictly a *lapsus calami* as Stål knew very well what he was doing—*vide* his 1876 citation of references under "*Cephaloplatys*".

Fifteen species can be recognized as belonging to this genus and they may be separated by the following Key.

Key to subgenera and species of *Cephaloplatus* White.

1. Smaller (7-8 mm.), blackish brown; anterolateral explanate margins of pronotum concave, only minutely crenulated, anterior angle produced into a rather curved triangular outwardly directed flattened process which does not reach in front of the eye . . Subgenus *Melanoplatus* **nov.** (one included species *C.* (*M.*) *minor* Distant)

   Larger or smaller, yellowish brown or reddish brown. Anterolateral margins of pronotum straight, angulately concave (*spurcatus* Walker) or convex, generally strongly crenulated, at least anteriorly, the anterior angles rather lobately or triangularly produced forward, reaching to, or well in front of, the eyes 2

2. Smallish (7-8 mm.), elongate; anterior angles of pronotum produced into a lobate anteriorly directed flattened process which reaches the anterior margins of the eyes, anterolateral margins of the pronotum not explanate or depressed behind these lobes . Subgenus *Dolichoplatus* **nov.** (one included species *C.* (*D.*) *elongatus* Distant)

   Larger (more than 8 mm.), obovate; anterior angles of pronotum produced into an angulate process which reaches or surpasses the anterior margins of the eyes, anterolateral margins explanate and depressed (at least anteriorly) behind these lobes . . . . 3 (Subgenus *Cephaloplatus* White)

3. Juga relatively narrow across at the level of the apex of the anteclypeus, not as wide as width of head across eyes; lateral margins of head produced into an obvious laterally directed flattened tooth or triangular process just in front of the eyes 4

   Either juga relatively wide across at the level of the apex of the anteclypeus, as wide as width of head across eyes and/or lateral margins of head not produced into an obvious flattened tooth like or spinous process in front of eyes [*C.* (*C.*) *pertyi* has expanded juga and something of a produced tooth in front of the eyes] 11

4. Membrane reticulate; generally over 11 mm. in length . . . . *C.* (*C.*) *reticulatus* Bergroth

   Membrane not reticulate; generally under 11 mm. in length 5

5. Margins of head just in front of eyes produced into a broad triangular process which is strongly convex above 6

   Margins of head just in front of eyes produced into a spine or tooth like process 9

6. Anterior angles of pronotum exteriorly produced forward to about anterior margins of eyes 7

   Anterior angles of pronotum exteriorly produced forward well in front of anterior margins of eyes, reaching to anterior margin of produced triangular process on lateral margin of head . . . . *C.* (*C.*) *clementi* Distant

7. Small (8.0-9.5 mm.); greyish; occurring in the gulf of Carpentaria region . . . . *C.* (*C.*) *pellewensis* *sp. nov.*

   Larger (9.75-11.0 mm.); reddish or greyish; occurring in Western and Central Australia 8

8. Greyish; juga at their apices rather widely separated; anterolateral margins of pronotum rather strongly angulately concave just behind the middle . . . . *C.* (*C.*) *australis* Dallas

Reddish; juga at their apices contiguous; anterolateral margins of pronotum only slightly concave near their middle . . . . . . *C.* (*C.*) *nubifer* Bergroth

9. Anterolateral margins of pronotum almost straight, slightly convex anteriorly, if denticulate or serrate then so very minutely that the margin appears to be entire . . . *C.* (*C.*) *bellus sp. nov.*

Anterolateral margins of pronotum angulately concave, the angulation nearer the lateral angle than the anterior; the anterolateral margins strongly denticulate or crenulate . . 10

10. Anterolateral margins of pronotum strongly angulately concave just behind the middle, anteriorly to this angulation with four or more strong denticulations; juga apically only shortly surpassing the apex of the anteclypeus and usually their apices clearly divaricate; occurring in the North of the Northern Territory and Western Australia, and in Cape York Peninsula and the Torres Strait Islands . . . . *C.* (*C.*) *darwini* Distant

Anterolateral margins of pronotum not so strongly and angulately concave behind the middle, anteriorly to this angulation crenulate, the crenulations all of the same size; juga apically more longly surpassing the apex of the anteclypeus and usually their apices not divaricate (although they may not be contiguous); occurring in Queensland south of Cape York Peninsula and in New South Wales . . . . *C.* (*C.*) *spurcatus* Walker

11. Juga markedly expanded and foliaceous, apically widely divaricate; near the apex of the anteclypeus the width of the head across the juga is as wide or wider than the width across the eyes 12

Juga not markedly expanded and foliaceous, apically widely divaricate or not; at the level of the apex of the anteclypeus the width of the head across the juga not equal to or wider than its width across the eyes 13

12. Anterolateral margins of the pronotum and the basal third of the exterior margin of the corium strongly serrate or denticulate . . . . *C.* (*C.*) *pertyi* (White)

Anterolateral margins of the pronotum and the basal third of the exterior margin of the corium nearly entire, only very minutely denticulate or crenulated . . . . *C.* (*C.*) *explanatus sp. nov.*

13. Anterior angles of the pronotum produced well in front of the eyes; a pair or more longitudinal ochraceous or luteous stripes on the scutellum 14

Anterior angles of the pronotum produced about to the front of the eyes, no longitudinal paler stripes on the scutellum . . . . . . *C.* (*C.*) *pallipes* Walker

14. Three longitudinal ochraceous or luteous stripes on scutellum composed of a broad one on each side not reaching apex (and margined with dark) and an obsolete median one; membrane brownish hyaline with piceous veins; no transverse ridge between the lateral angles of the pronotum *C.* (*C.*) *granulatus* Bergroth

More than three longitudinal ochraceous or luteous stripes on scutellum composed of a narrow one on each side not reaching apex (and margined with dark) and two or three median ones divaricating basad; membrane milky hyaline with brown veins; a conspicuous transverse ridge running between the lateral angles of the pronotum *C.* (*C.*) *fasciatus* Distant

Subgenus **Melanoplatus** nov.

This subgenus is being erected for one species, *Cephaloplatus minor* Distant, which shows a number of differences from the species which are placed here in the subgenus *Cephaloplatus sensu stricto*. *Cephaloplatus* *minor* is a piceous colour whereas these species of *Cephaloplatus sensu stricto* are reddish or yellowish in appearance, the lateral margins of the pronotum although produced are shaped quite a lot differently. The lateral margins are very little explanate from the lateral angles forward until a point just in front of the calli where they suddenly are produced as explanate triangular processes which are directed forward and outwards, the processes are strictly processes of the anterolateral margins because the anterior angles are distinely evident lying behind the eyes and interiorly to these structures. In *Melanoplatus* the anterior lobe of the pronotum is also raised and very rugulose whereas in *Cephaloplatus sensu stricto it is* declivous. Otherwise the species seems to belong in the one genus with other *Cephaloplatus* species and does not merit the erection of a new genus purely to accommodate it.

Type: Cephaloplatus minor Distant 1910.

Cephaloplatus (Melanoplatus) minor Distant

Cephaloplatys minor Distant, 1910, Ann. Mag. nat. Hist., (8)6: 474.

Fig. 1

Smallish, suboval, strongly piceous in dorsal view with one or two lighter areas. Densely and finely punctate, the punctations concolorous.

Head with juga somewhat foliaceously developed and produced forward past the apex of the anteclypeus, though not much. Lateral margins of the juga in front of the eyes produced into a blunt triangular process which is strongly concave above. Lateral margins of juga in front of this process at first incised then broadly and semicircularly convex to their shortly rounded anterior angles. Inner margins of juga shortly truncate, divaricate. Lateral margins of the juga somewhat raised so that the head in front of the eyes is somewhat convex. Head between the ocelli somewhat raised, eyes moderately prominent, in most specimens fairly well separated from the anterior margin of the pronotum (this does not appear in the drawing), facets occupying most of the anterior surface. That part of the juga lying in front of the insertions of the antennae tending to be somewhat paler than the rest of the body, sometimes also some pale spots on the anteclypeus. Antennophore with a short reflexed spine exteriorly; antennae moderate sized, five segmented, the segments progressively longer from one through to five, the first not reaching the apices of the juga.

Pronotum with the anterior and posterior lobes slightly raised with a faint depression between the two. Anterior margin concave behind the collum, the anterior angles subacute and located just behind the inner margins of the eyes. Anterolateral margins beginning at the lateral angles, only slightly produced and reflexed concave as they run forward to just in front of the calli where they abruptly turn outwards to form an outwardly and forwardly

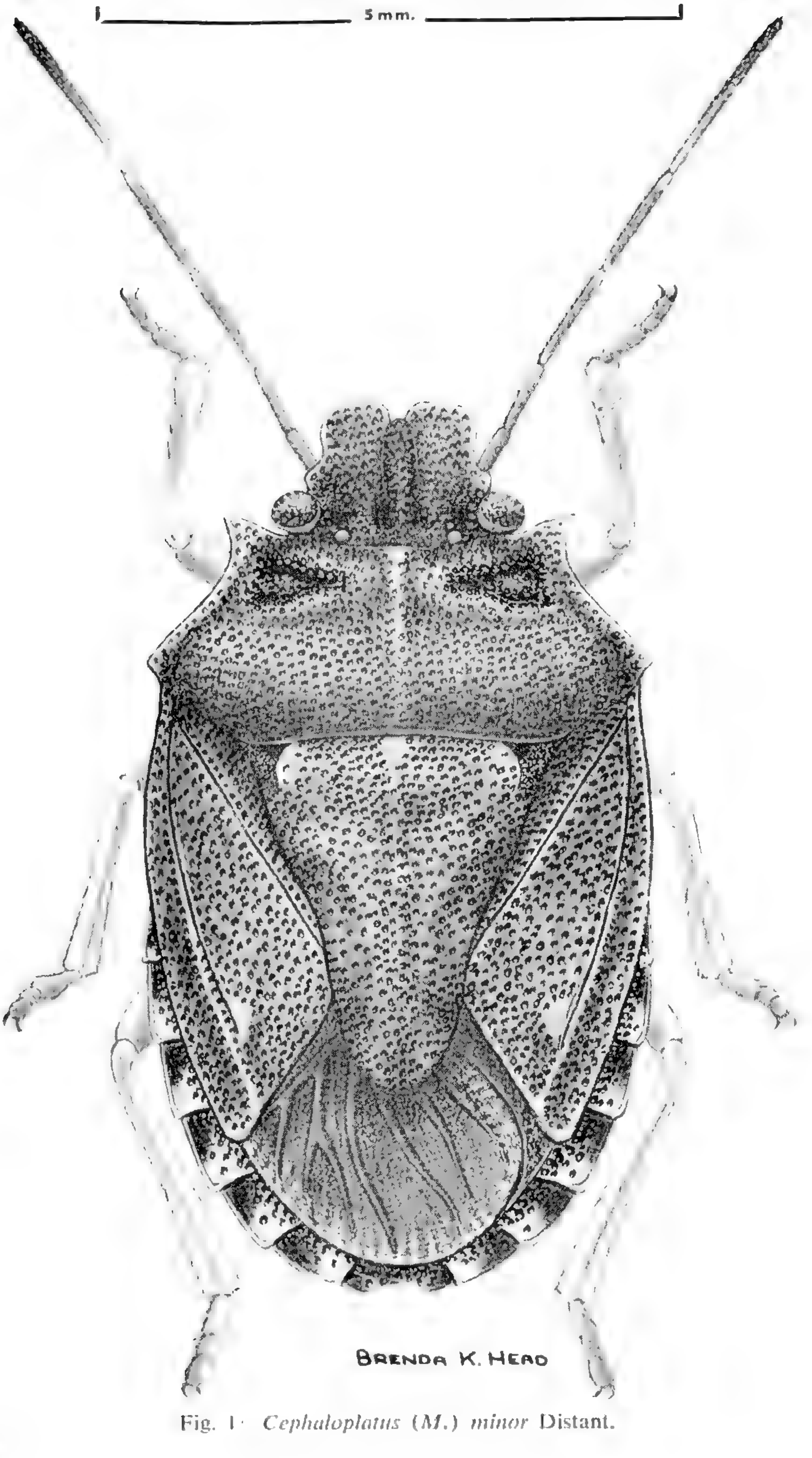

Fig. 1. *Cephaloplatus* (*M.*) *minor* Distant.

directed, somewhat recurved, spinous process which is flat on top, between this process and the anterior angles truncate. Lateral angles subacute, posterolateral margin angulately convex, posterior margin nearly truncate. The raised portion of the anterior lobe of the pronotum and to a certain extent some of the posterior lobe rather rugulose.

The scutellum shaped very much as other members of the genus, the concave angulation of the lateral margins a little nearer the middle than in some of the others, tip broadly rounded. In each basal angle a somewhat elongate concolorous fascia, interiorly to this margined by a callous or smooth raised granule, a light point at the base of the scutellum medially and in some specimens a short streak on the ventral margins on either side just before the apex. Base of the scutellum rather triangularly raised, apical half flatter, somewhat rugulose.

Hemelytra wider than the body only in the anterior quarter, the exterior margin of the corium forming a smooth gently convex curve, entire, not irregular. This curve leaves about half of the laterotergites exposed. Hind margin of the corium somewhat convexly produced exteriorly, then more or less truncate becoming broadly convex interiorly. Membrane with slightly darker veins, several of the veins forked, one or two closed cells basally. Laterotergites yellowish or yellowish brown with a transverse bar immediately behind each incisure which is piceous and which runs into a narrow longitudinal piceous area along the inner edge of the connexivum.

Beneath concolorous with above, if anything somewhat darker. The following yellowish areas are present: the anterior underside of the head (and the bucculae) save for a longitudinal piceous stripe immediately in front of the insertion of the antennae; the base of the head; the rostrum; all legs; the extreme exterior of the abdominal ventrites making the edge of the abdomen appear as if it has a yellowish stripe; the male terminalia. On the thorax the epimera and episterna and most of the pleura are somewhat lightened.

Length: 7.5-8.5 mm.

Distribution: Queensland Holotype ♂ and 1 other, Peake Downs (B.M.); 1 ♂, 2 ♀♀, Peake Downs (Stockholm); 1 ♂, Flinders Island, Jan. 1927, coll. Hale & Tindale; 3 ♂♂, 2 ♀♀, Gladstone, coll. Lea (S.A.M.); 2♂♂, 3♀♀, Clermont, coll. Dr. K. K. Spence; 2♀♀, no precise locality, 25 August 1929, coll. Dr. K. K. Spence (A.M.); 3♀♀, Gin Gin, 13 October 1901, coll. W. W. Froggatt (A.N.I.C.); 1♀, Mutchilba, Feb. 1933, coll. A. D. Selby (N.M.); 1♂ 1♀, Mount Carbine, 20 July, 1932, coll. Darlington on Harvard Expd. (A.M.N.H.). *Northern Territory* 1 (abdomen missing), Horn Islet in Sir Edward Pellew Group, 15-21 November 1968, coll. B. Cantrell (U.Q.). *Western Australia* 1♂, Derby, coll. W. D. Dodd (S.A.M.).

Remarks: The species is very easy to recognize in the genus *Cephaloplatus sensu lato*. Its conspicuous piceous colouration, its relatively small size and the fact that the anterolateral margins of the pronotum are formed into an outwardly directed triangular process which does not reach forward much behind the hind margin of the eye distinguishes it from all members of the subgenus *Cephaloplatus sensu stricto*.

Subgenus **Dolichoplatus** nov.

This subgenus is being erected to accommodate the one species *Cephaloplatus elongatus* Distant, which shows certain differences to those species placed here in the subgenus *Cephaloplatus sensu stricto*. Species placed in the last mentioned subgenus are all rather oval whereas *C. elongatus* is a lot more elongate; the anterolateral margin of the pronotum in *C. elongatus* is not expanded and laminate, only the anterolateral margin just exterior to the anterior angle is produced as a roundish lobe projecting to in front of the eyes whereas in species of *Cephaloplatus sensu stricto* the anterolateral margins of the pronotum are expanded and more or less laminate at least in their anterior half and the produced portions outside of the anterior angles are always acute at their anterior apices. The pronotum of *C. elongatus* has about 12-20 large granules on the disc, in other *Cephaloplatus* species these are either very much smaller and very much more numerous or absent.

Type: *Cephaloplatus elongatus* Distant 1899.

Cephaloplatus (Dolichoplatus) elongatus Distant

Cephaloplatvs elongatus Distant, 1899, Ann. Mag. nat. Hist., 7(4):433.

Fig. 2

Smallish, elongate ovate, rather pale brownish in macroscopic dorsal view. The ground colour in fact is light brownish yellow in front of about the middle of the pronotum and yellowish behind this point but this is obscured somewhat by a moderately dense and fairly regular brown punctation.

Head with juga moderately foliaceously developed, produced to about the level of the apex of the anteclypeus. Lateral margins of the head in front of the eyes produced into a blunt triangular process which is only faintly concave above and then only anteriorly. Lateral margins of juga in front of this forming a segment of a convex curve to their comparatively broadly rounded apices, the latter fairly widely separated and the inner margins of the juga tending to be a little obliquely rounded in front of the point where they touch the anteclypeus. The anteclypeus is rather declivous from a point just in front of the produced triangular lobes of the margin of

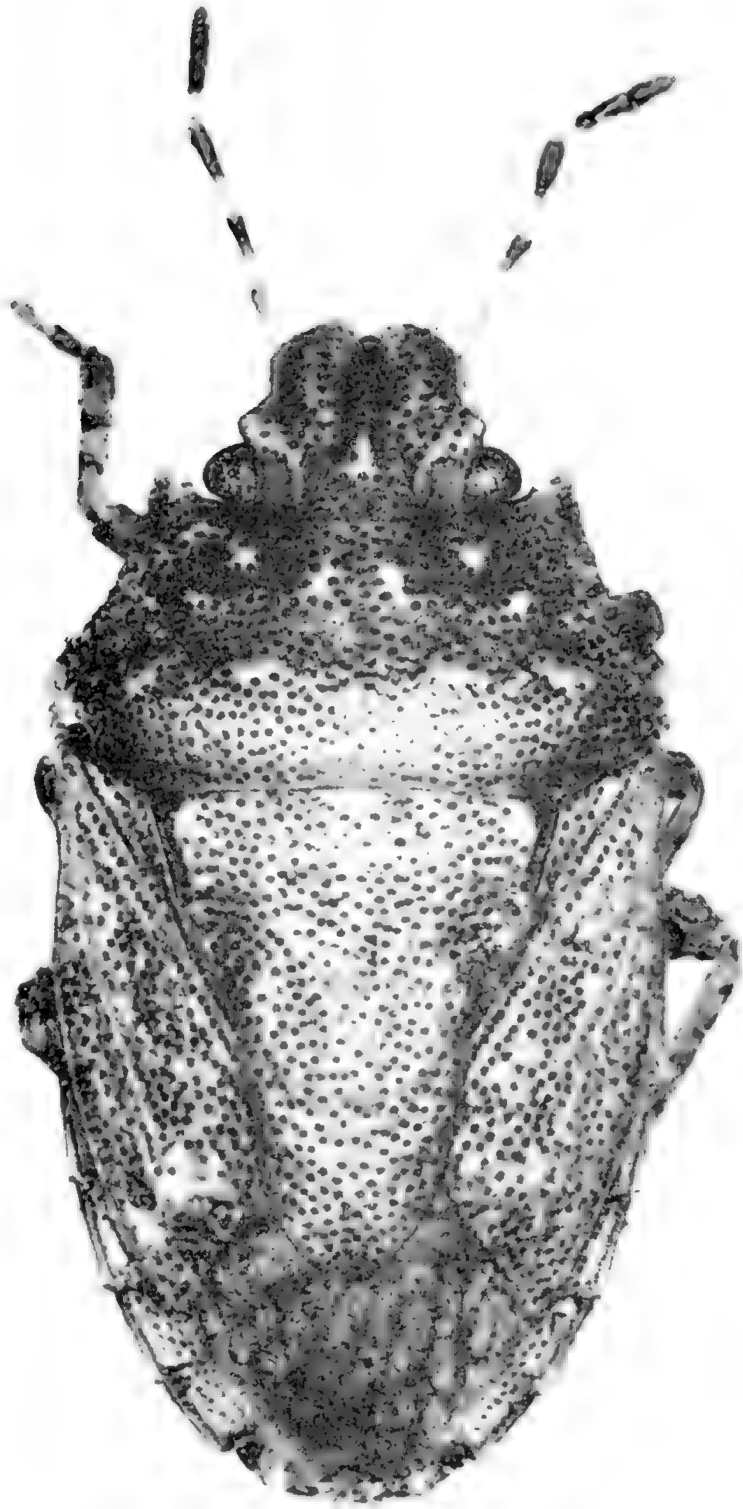

Fig. 2: *Cephaloplatus* (*D.*) *elongatus* Distant.
[Photograph by courtesy of the Trustees of the British Museum (Natural History).

the head forwards, the inner part of each jugum tends to be depressed commesurately on either side so that the head is anteriorly depressed in the middle, apex of anteclypeus well below the apices of the juga. Head between the ocelli feebly raised, eyes moderately prominent and very close to the anterior margin of the pronotum, facets occupying all but the flattened posterior surface. Antennophore with a short reflexed spine exteriorly, antennae five segmented and rather shorter than in most other species of the genus, second third and fourth segments nearly subequal and each one longer than the first, fifth the longest, first not reaching apex of jugum. Third and fourth brown in apical one half, fifth brown except in basal fifth.

Pronotum with the posterior lobe raised and sloping declivously anteriorly to the anterior margin. Anterior margin concave behind the eyes and collum, anterior angles and part of the anterolateral margin of the pronotum produced into an apical rounded anteriorly produced lobe which extends forward to nearly the level of the anterior margin of the eyes. Anterolateral margins behind this structure hardly or not explanate or laminate somewhat concavely excavate and somewhat irregular though not denticulate or crenulate, produced a little in front of the lateral angles. Lateral angle comparatively broadly rounded, posterolateral margin somewhat concave; posterior margin almost straight. Disc of pronotum with between 12 and 20 callous raised areas or very large granulations.

Scutellum comparatively longer than in other members of the genus, the concave angulation of the lateral margins very nearly at the mid point of the length of the scutellum. Apex tending to be acuminately rounded, the disc from somewhat in front of the apex to the base progressively though not very raised, depressed on either side just in front of the angulation of the lateral margin and again in each basal angle where there is a brownish impression bordered on its inner side by a luteous callous area, traces of other such areas on the scutellum.

Hemelytra wider than the body only in their anterior quarter, the exterior margin of the corium anteriorly rather concave then forming a smooth convex curve to its apex, the margin a little irregular anteriorly. Hind margin of corium almost straight or only very slightly concave, its inner angle broadly rounded. Membrane whitish with only slightly darker veins, the latter (at least distally) apparently mainly parallel. Laterotergites concolorous except for a submarginal fine brown stripe, their posterior angles somewhat bluntly projecting.

As the unique specimen is carded not a great deal is visible of the underside. The punctation and colouration seems much the same as that above. A short brown stripe in front of each antennifer, the usual somewhat curved brown stripe on the propleuron on the muscle scar, on the mesopleuron, metapleuron, and the sides of abdominal segments III-VI the punctations tending to be concentrated to form a denser and darker sublateral line, a brown spot anteriorly and laterally on each abdominal sternite. Femora and tibiae coarsely maculated with brown.

Length: 7 mm.

Distribution: *North Western Australia Holotype* ♀ S. Heywood I., 90-126 (B.M.).

Remarks: The holotype is the only specimen of this species to hand; it came from a very poorly collected area and it is not practicable to predict its possible range.

Subgenus **Cephaloplatus** White

To include species which are are elongate oval or ovate but which have the anterior angles and the anterior part of the anterolateral margins of the pronotum extending forward as angulate processes to at least the level of the anterior margins of the eyes. The anterolateral margins of the pronotum are also rather explanate, particularly anteriorly.

Type: *Dryptocephalus*? (*Cephaloplatus*) *pertyi* White 1842, monobasic.

Cephaloplatus (C.) pallipes Walker

Cephaloplatus pallipes Walker, 1868, Cat. Hem. Het Brit. Mus., 3:541.

Cephaloplatys pallipes Distant, 1910, Ann. Mag. nat. Hist., (8)6:472.

Fig. 3.

Rather smaller than average for the genus, strongly greyish in macroscopic appearance although the ground colour is actually luteous or light yellowish with numerous brown or blackish brown punctations. The hinder parts of the pronotum, scutellum, and the coriaceous parts of the hemelytra densely covered with small luteous or light yellowish granules.

On the head the juga are expanded somewhat though not as foliaceous as in some of the succeeding species, extending somewhat in front of the apex of the anteclypeus. Anterior margins of juga oblique, shortly rounded to join the parallel lateral margins which immediately in front of each eye are convex, inner margins divaricate, short. Disc of head rather rugulose and coarsely punctate, head slightly raised behind. Eyes moderately prominent and the facets occupying nearly all of the optic process save the oblique and flattened hind margin. Antennae moderately slender, first segment the shortest, third segment the second shortest, second and fourth segments subequal, fifth segment slightly longer, first segment not reaching the apices of the juga.

Pronotum rather strongly raised posteriorly, flatter and more declivous anteriorly, the anterolateral margins explanately produced progressively from posteriorly to anteriorly. Region of the anterior angles shortly triangular but

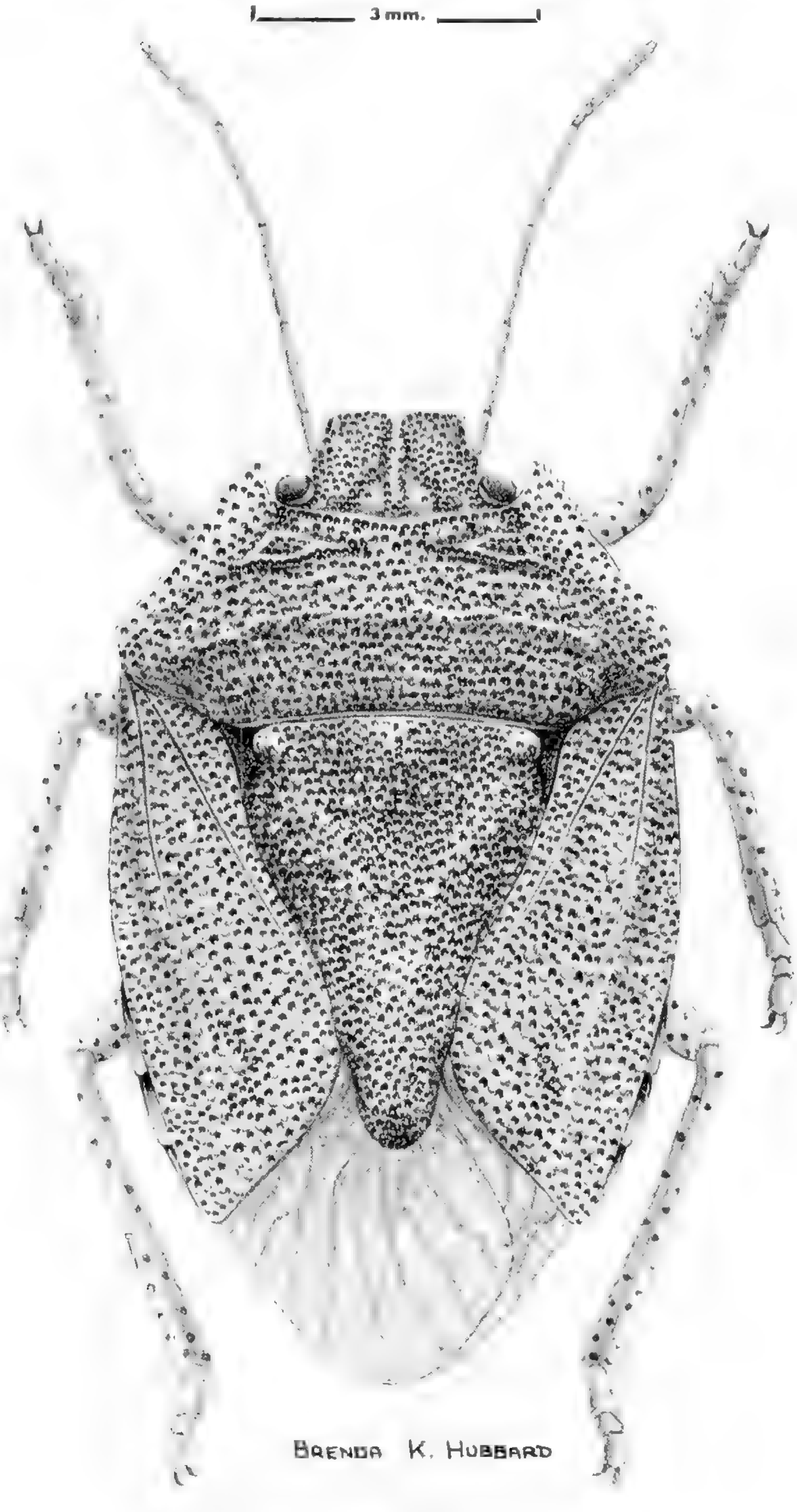

Fig. 3: *Cephaloplatus (C.) pallipes* Walker.

only extending to about the level of the anterior margin of the eyes. Anterior margin convex behind the collum, shortly truncate behind each eye, then slightly diverging to the apices of the produced angles. Anterolateral margins almost straight or perhaps very slightly concave, irregular and tending somewhat crenulate in their anterior third. Lateral angles irregularly truncate, posterolateral margins nearly straight, posterior margin very slightly concave. Hinder portion of the disc of the pronotum densely covered with small luteous granules, these granules between the lateral angles tending to be more concentrated and to form a more or less continuous sinuate line.

Scutellum substantially triangular, with the usual slight concavity somewhat behind the middle. Basal half rather raised, apical half rather flat, tip broadly rounded. In each basal angle a somewhat elongate black fovea inward of which lies a rather prominent luteous large granule or small tumescence. Apex of scutellum sometimes with a darkened medial longitudinal line. Scutellum densely covered with small luteous granules.

Hemelytra wider than the body in their basal quarter, this portion of the corial margin slightly irregular. Behind this point the lateral margins of the corium smoother and gradually converging posteriorly leaving some of the connexivum exposed, the degree of convergence is not so marked as in any of the preceding species. Hind margin of corium somewhat sinuate. Corium and parts of the clavus covered with small luteous granules. Membrane milky hyaline, veins the same colour, several of them forked. Laterotergites with their posterior angles not prominent, incisures between the laterotergites infuscated as is the inner half of each laterotergite.

Beneath mainly concolorous with the dorsal surface, punctations larger and darker on the head and prothorax, finer and much denser on the abdomen. Head just inward of the lateral margin infuscated, all the thoracic sterna brown. Femora with some spattered brown granules, sometimes the tibiae also. Male genitalia with the posterior ridge convexly curved rather as in Fig. 6B, its lateral angles strongly prominent and directed posteriorly.

Length: 9.5-10.75 mm.

Distribution: *Unlocalized*. *Holotype* ♂ (B.M.). *Western Australia*. 1 ♂, Junction of Fitzroy and Margaret Rivers, 1896, coll. Calvert Expedition (S.A.M.). *Northern Territory*. 1 ♀, Horn Islet in Sir Edward Pellew Group, 15-21 November 1968, coll. B. Cantrell (U.Q.); a series, Alexandra (B.M.); 2 ♀♀, Newcastle Waters, 2 June 1929, coll. T. G. Campbell (A.M.); 3 ♂♂, 2 ♀♀, Newcastle Waters, 2-5 June 1929, coll. T. G. Campbell; 2 ♂♂, Brunette Downs, 20 March 1968, coll. L. Hall; 1 ♀, 1 ?, 2 miles South of Barrow Creek, 13 February 1966, coll. Britton, Upton & McInnes; 1 ♀, 22 miles South of Alice Springs, at light on railway, 15 February 1966, coll. E. Britton (A.N.I.C.); large series, 28 miles South of

Renner Springs, at ultraviolet light, coll. N. McFarland; 1 ♂, unlocalized, coll. S.A. White (S.A.M.). *South Australia.* 1 ♂, 4 ♀♀, Oodnadatta; 1 ♀, North East Corner of state, coll. F. Parsons (S.A.M.). *Queensland.* 1 ♂, 2 ♀♀, Winton—Longreach, 15-24 August 1963, coll. T. E. Woodward; 1 ♂, Mt. Isa, 23 January 1968, coll. B. Cantrell; 1 ♂, 2 ♀♀, 1 ?, Cloncurry, 15 April 1947, coll. H. Bell (U.Q.); 1 ♂, 1 ♀, Cairo Station, 15-31 January 1951, coll. C. McC. (N.M.); 9 ♂♂, 6 ♀♀, at light, Normanton, 3-4 May 1963, coll. P. Aitken & N. B. Tindale; 1 ♀, at light Mornington Island Mission, 12 May 1963, coll. P. Aitken & N. B. Tindale (S.A.M.).

Remarks: This is the first of the species of the Subgenus *Cephaloplatus sensu stricto* to be treated and the first of a section within the subgenus which does not have a prominent and acute spine on the lateral margins of the juga in front of the eyes. This species can be recognized quite easily from the other members of its section in that the anteriorly produced angulate portions of the pronotum do not protrude in front, or only very little in front of the anterior margin of the eyes. Its greyish colouration is similar to that of *C.* (*C.*) *granulatus* Bergroth but it lacks the strong luteous fasciae on the scutellum and is also rather smaller. All of the localities cited are in moderately arid to very arid regions.

Cephaloplatus (C.) fasciatus Distant

Cephaloplatys fasciatus Distant, 1881, Trans. ent. Soc. Lond., 212.

Fig. 4, 6A

Average size for the genus and rather elongate, ground colour luteous with brown and some patches of blackish punctations, the latter along the anterior half of the lateral margin of the scutellum, and a number of small luteous granulations on the hind margin of the pronotum, the scutellum and the coriaceous parts of the hemelytra.

Head with juga as flattened or foliaceous structures which however, are not unusually extensive in relation to the area of the rest of the head, at their widest they do not extend much past the inner margin of the eyes nor anteriorly much in front of the apex of the anteclypeus. Anterior margins of the juga at first oblique then rounding broadly onto the virtually straight lateral margins, latter incised just in front of anterior margin of the eyes, somewhat reflexed. Inner margins short, sometimes touching, sometimes not Eyes moderately prominent and the facets occupying nearly all of the optic process save the oblique and flattened hind margin. Antennae slender and five segmented, fourth and fifth segments the longest and subequal in length, brownish or yellowish, apices of the fourth and fifth segments sometimes infuscated.

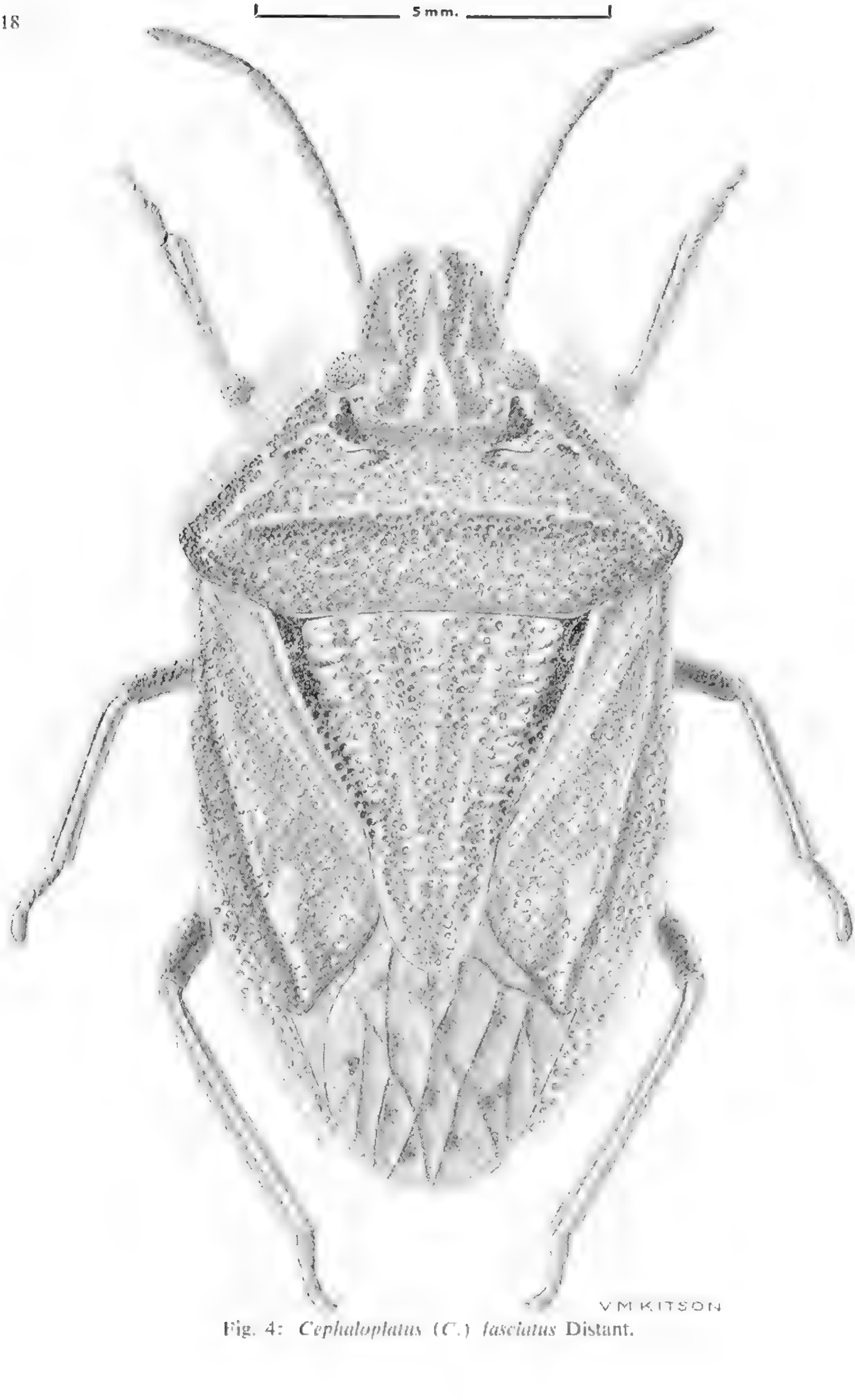

Fig. 4: *Cephaloplatus (C.) fasciatus* Distant.

Pronotum somewhat raised posteriorly, flatter and more declivous anteriorly, between the lateral angles a continuous line of raised contiguous granules. Anterolateral margins progressively more explanate from posteriorly to anteriorly, the region of the anterior angles forming a curved triangular process which extends somewhat in front of the eyes. Anterior margin of the pronotum concavely excavate behind collum, shortly truncate behind the eyes, margins then virtually parallel anteriorly to the apices of the anterior processes. Anterolateral margins somewhat crenulate, at first convex anteriorly then becoming slightly and angulately concave at about half their length back. Lateral angles irregular, posterolateral margins almost straight, posterior margins straight.

Scutellum substantially triangular with the lateral margins gently angulately concave, the tip more or less rounded. Basally somewhat raised, flattened in the posterior half. Disc with five rather diffuse luteous stripes, outer pair reaching only to the angle of the lateral margins, the median one reaching to only about the same level, thereafter obsolete, the exterior pair margined on their outside by a dense streak of black punctations, this streak becoming more obsolete as it approaches the angle of the lateral margins.

Hemelytra wider than the body in their basal quarter, this portion of the corial margin slightly irregular. Behind this point the lateral margins of the corium smoother and gradually converging posteriorly leaving progressively more of the connexivum exposed, hind margin of corium sinuate, convex interiorly. Membrane subhyaline with veins and spots between the veins only slightly darker, several of the veins forked. Laterotergites with their posterior angles somewhat prominent.

Beneath mainly concolorous with the dorsal surface, covered with dense dark punctations, these punctations finer on expanded lateral margins of the pronotum and on the abdomen. Head beneath with a short black streak beginning on the upper insertion of the antennae and proceeding forward for a short distance on either side. Prothorax on either side with a black or piceous longitudinal bar extending from the anterior margin three quarters of the way to the posterior margin, at the base of the epimeron and episternum sometimes a patch of darker punctations. The dark line continued though much more narrowly onto the lateral areas of the mesothorax and metathorax and then becoming wider and extending to about the middle of the sixth ventrite. A small black patch at the extreme base of the head and all thoracic sterna black or piceous, two semicircular piceous areas on the third abdominal segment immediately behind each metacoxa, a small median spot near the base of both the fifth and sixth abdominal segments and a median longitudinal brown stripe running from the base of the seventh to three quarters of the distance posteriorad piceous.

Length: 10.0-12.3 mm.

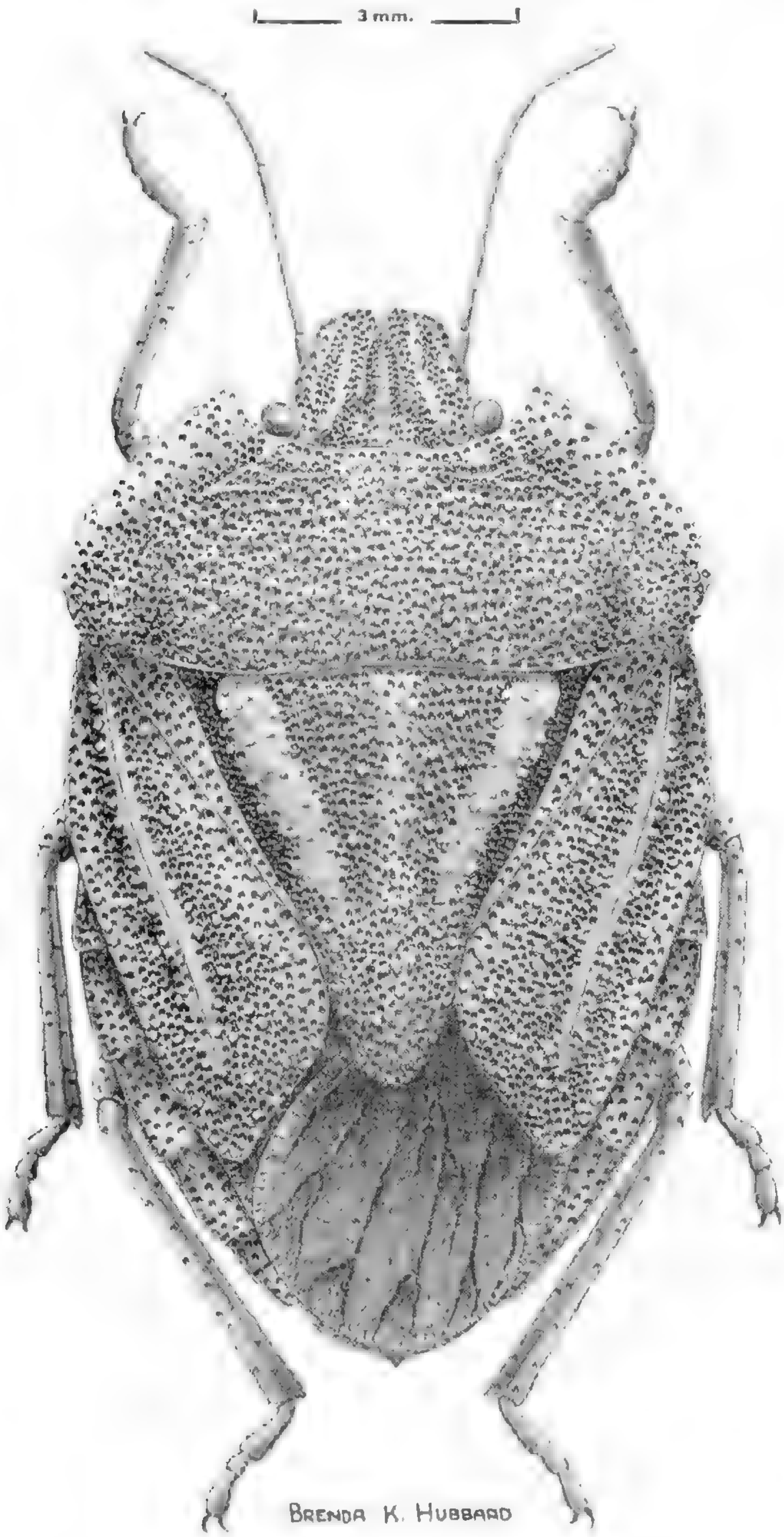

Fig. 5: *Cephaloplatus (C.) granulatus* Bergroth

Distribution: *Queensland*. *Holotype* ♀, Rockhampton (B.M.); 4, "Austral. bor.", coll. Daniel and Rockhampton (Stockholm); 1 ♂, 5 ♀ ♀, Cairns (1918), at light (1920), coll. J. F. Illingworth (Bishop); 1 ♂, 1 ♀, Kuranda, coll. F. P. Dodd; 2 ♀ ♀, Bowen, coll. A. Simpson; 1 ♂, 2 ♀ ♀, at light, Normanton, 4 May 1963, coll. P. Aitken & N. B. Tindale; 1 ♂, 3 ♀ ♀, Mornington Island (Birri), 8 & 12 May 1960, coll. P. Aitken & N. B. Tindale; 1 ♂, 2 ♀ ♀, at light, Mornington Island, May 1963, coll. P. Aitken & N. B. Tindale (S.A.M.); 1 ♂, Coen, 14-28 May, 1951, coll. C. Oke; 1 ♂, unlocalized, donated F. P. Spry, 5 October 1922 (N.M.). *Northern Territory*. Series Adelaide River and Stapleton (B.M.); 1 ♀, Darwin, coll. W. K. Hunt; 1 ♀, Batchelor, coll. G. F. Hill; 1 ♀, Daly River, coll. H. Wesselman; 1 ♀, unlocalized, 1875, coll. Tepper (S.A.M.); 1 ♀, Pt. Denison (A.M.); 3 ♂ ♂, 4 ♀ ♀, Sixty Mile, on rice (*Oryza sativa* L.), 23 March 1956, coll. L. D. Crawford (A.N.I.C.). *Western Australia*. 1 ♂, Leopold Downs, coll. W. R. Richardson; 1 ♀, Junction of the Fitzroy and Margaret Rivers, 1896, coll. Calvert Expedition (S.A.M.). *New South Wales*. 1 ♀, No. 393 (A.M.N.H.).

Remarks: This species is more elongate and browner than *C. granulatus* Bergroth, the lateral margins of the pronotum are vaguely excavate, and there are five pale luteous bars on the pronotum.

Cephaloplatus (C.) granulatus Bergroth

Cephaloplatys granulatus Bergroth, 1895, Proc. R. Soc. Vict., 7:288.

Cephaloplatus granulatus Fay, 1966, Pap. Dep. Ent. Univ. Qd., 2(4):76, figs.

Fig. 5, 6B.

Average sized for the genus, ground colour luteous with brown and blackish punctations, the latter finer and denser on the hind lobe of the pronotum, and a number of small luteous granulations on the hind portion of the pronotum and on the scutellum and coriaceous parts of the hemelytra.

Head with juga as flattened or foliaceous structures which however, are not unusually extensive in relation to the area of the rest of the head, at their widest they do not extend much past the inner margin of the eye nor anteriorly much in front of the apex of the anteclypeus. Anterior margins of the juga at first slightly oblique then rounding broadly onto the lateral margins, latter at first straight then gently convex in front of the eyes, somewhat reflexed. Inner margins short, sometimes touching, sometimes not. Eyes moderately prominent and the facets occupying nearly all of the optic process save the oblique and flattened hind margin. Antennae slender and five segmented, second, fourth and fifth segments subequal in length, first not reaching the apex of the jugum, light brownish in colour.

Pronotum rather strongly raised posteriorly, flatter and rather declivous anteriorly, the anterolateral margins explanately produced, at least on the anterior half, and the region of the anterior angles produced forward as a rather triangular process which does not reach much in front of the eyes. From the apices of the anterior angles the anterior margin of the pronotum is convexly excavate, though shortly truncate just behind each eye. Anterolateral margins distinctly crenulate, the lateral angles obtuse. Posterolateral margins rather convexly angulate, the hind margin almost straight.

Scutellum substantially triangular with the lateral margins gently angulately concave, the tip more or less rounded. Basally somewhat elevated and on each side an oblique broad luteous, impunctate (but granulate) streak running from the base to about the angle of the lateral margins. Punctations bordering this streak much darker and denser than elsewhere, particularly basally.

Hemelytra wider than the body in their basal quarter, this portion of the corial margin slightly irregular. Behind this point the lateral margins of the corium smoother and gradually converging posteriorly leaving more of the connexivum exposed, hind margin of corium more or less straight. Membrane milky with brownish veins, a number of the latter forked, and brown maculae between the veins. Laterotergites with their posterior angles only slightly produced.

Beneath mainly concolorous with the dorsal surface, the punctations larger and darker on the head and prothorax. Thoracic sterna and last segment of rostrum piceous or dark brown as is also the base of the third abdominal segment. Fourth and fifth also may be darker along the incisures. Male genitalia from below Fig. 6B.

Length: 10.5-13.5 mm.

Distribution: Queensland, Lectotype ♂ (Reg. No. T4117), unlocalized, numbered 63, donated C. French Jun. 15 November 1911; 1 ♂, Mulgowie Well, 8 September 1953, coll. Smith; 1 ♀, Rymple, 16 November 1955 (N.M.). *South Australia.* 2 ♀ ♀, Lake Calabonna, coll. A. Zietz (A.M. & S.A.M.); 1 ♀ Innaminka, at light, 18 October 1962, coll. J. Findley; 1 ♂ Trouda Bore (Murnpeowie Station), at light, 24 August 1967, coll. G. F. Gross; 1 ♂, 5 ♀ ♀, Cooper Crossing, at light, 12 November 1955, coll. E. T. Giles; 2 ♂ ♂, 3 ♀ ♀, Coopers Crossing, at light, 21 February 1956, coll. G. F. Gross; 1 ♂, 2 ♀ ♀, Clayton Crossing, at light, 13 November 1955, coll. E. T. Giles; 2 ♂ ♂, 1 ♀, Marree, coll. L. Reese; 1 ♂, 1 ♀, Muloorina Station, 18-19 February 1956, coll. G. F. Gross; 1 ♂, 6 ♀ ♀, Lake Eyre, 22 April 1955, coll. G. F. Gross; large series, Madigan Gulf area of Lake Eyre, at light, 3-6 November 1955, coll. E. T. Giles; 1 ♂, 1 ♀, found dead on salt surface of Lake Eyre (Madigan Gulf), 8 November 1966, coll. G. F. Gross; 1 ?, attracted to light.

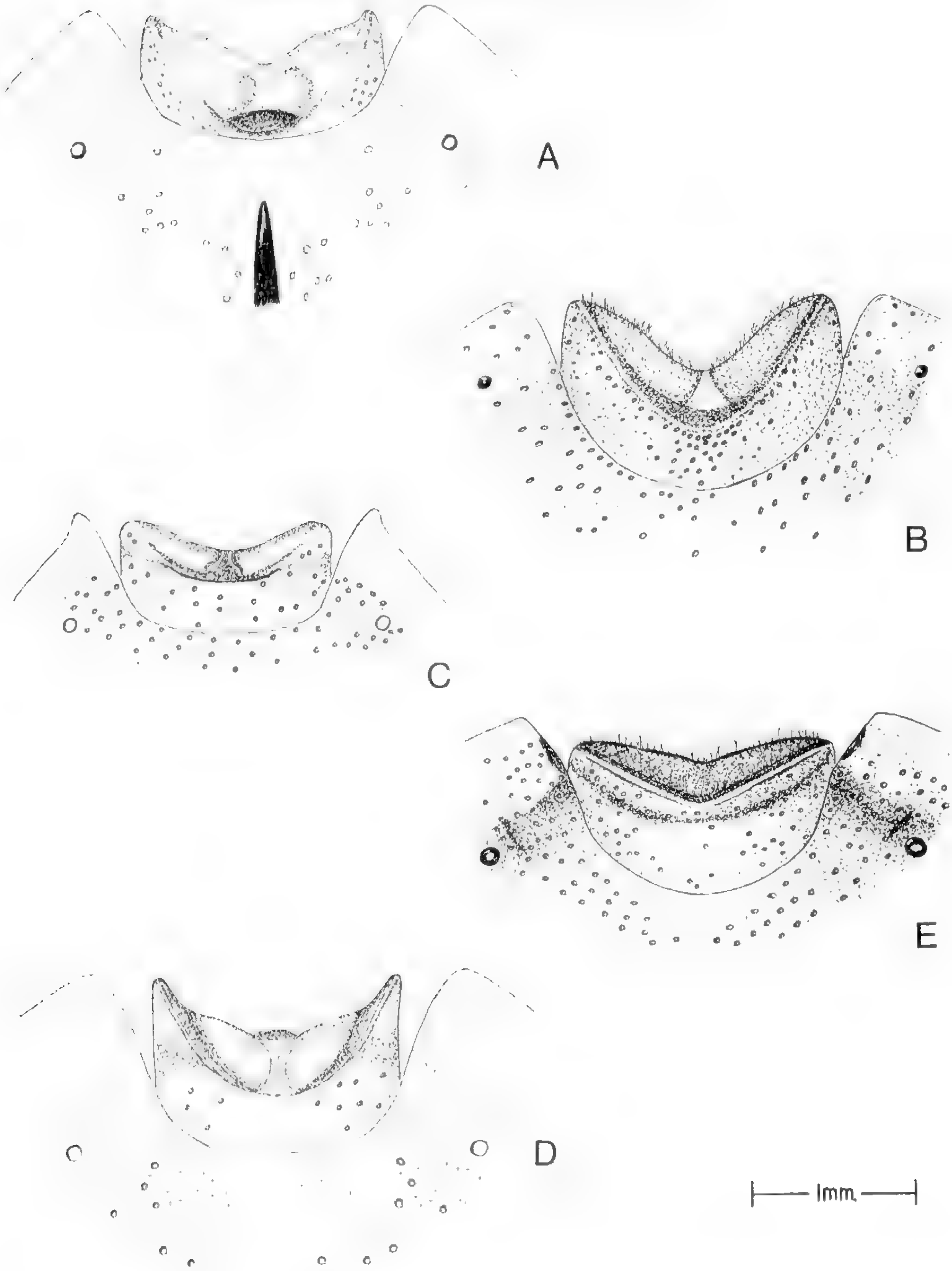

Fig. 6: Ventral (and slightly posterior) aspect of the male pygophore of A, *Cephaloplatus* (*C.*) *fasciatus* Distant; B. *Cephaloplatus* (*C.*) *granulatus* Bergroth; (*C.*) *Cephaloplatus darwini* Distant; D. *Cephaloplatus* (*C.*) *explanatus* sp. nov.; E. *Cephaloplaths* (*C.*) *reticulatus* Bergroth.

Prescott Point, Lake Eyre, 30 September 1967, coll. G. F. Gross; 1 ♀, Prescott Point on Madigan Gulf Lake Eyre, at light, 22 February 1968, coll. G. F. Gross; 4 ♂♂, 1 ♀, Wirraminna, 27 October 1953, coll. N. B. Tindale (S.A.M.); 3 ♂♂, 2 ♀♀, Coopers Creek, 12 August 1958, coll. R. A. Stirton; 2 ♂♂, 3 ♀♀, Lake Palankarinna, 28 July 1953, coll. R. A. Stirton; 1 ♂, Neales River at Agebuckina, 10 May 1953, coll. R. A. Stirton & R. H. Tedford (C.A.). *New South Wales*. 1 ♂, Broken Hill, 22 November 1943, coll. C. E. Chadwick (A.M.).

Remarks: An examination of the material in the National Museum, Melbourne where much of the C. French Jun. collection is to be found or the collections of the Zoological Institute in Helsinki where a large part of Bergrowth's own collection is lodged failed to reveal any of the material described by Bergroth in this genus marked as types. Drs. Hackman and Meinander were able to inform me that on the basis of their experience with the Mascarene material of the Bergroth collection that the latter had frequently returned the material he described to whoever had sent it to him, unlabelled but possibly accompanied by some sort of list. No specimen in Helsinki could be located to fit Bergroth's description of this species or having French as a collector on it (although—*vide infra*—some other material considered to be types of other Bergroth species was found). However, a single male specimen in the National Museum of Victoria fits Bergroth's description (even to having only the first antennal segment remaining) and has a Queensland-French indication on the label. I have every reason to believe that this specimen is in fact the type of "*Cephaloplatys granulatus*" Bergroth described from Queensland from a collection sent to Bergroth by French. Accordingly this specimen is here selected as the lectotype male of "*Cephaloplatys granulatus*" Bergroth.

Although described from Queensland the species appears to be rather rare there and also in New South Wales. Its main centre of occurrence appears to be in the region of the Lake Eyre drainage basin in South Australia. Many of the specimens to hand were collected at lights.

Cephaloplatus (C.) clementi Distant

Cephaloplatys clementi Distant, 1910, Ann. Mag. nat. Hist., (8)6:473.

Fig. 7

Average sized for the genus, rather reddish in macroscopic appearance, the ground colour reddish yellow with numerous brown punctations and rather sparse small concolorous granules on the hinder part of the pronotum, scutellum, and the coriaceous parts of the hemelytra.

Head with juga strongly and foliaceously developed, extending well in front of the anteclypeus, at their widest, however, not wider than the width of the head across the eyes. Lateral margins of the juga just in front

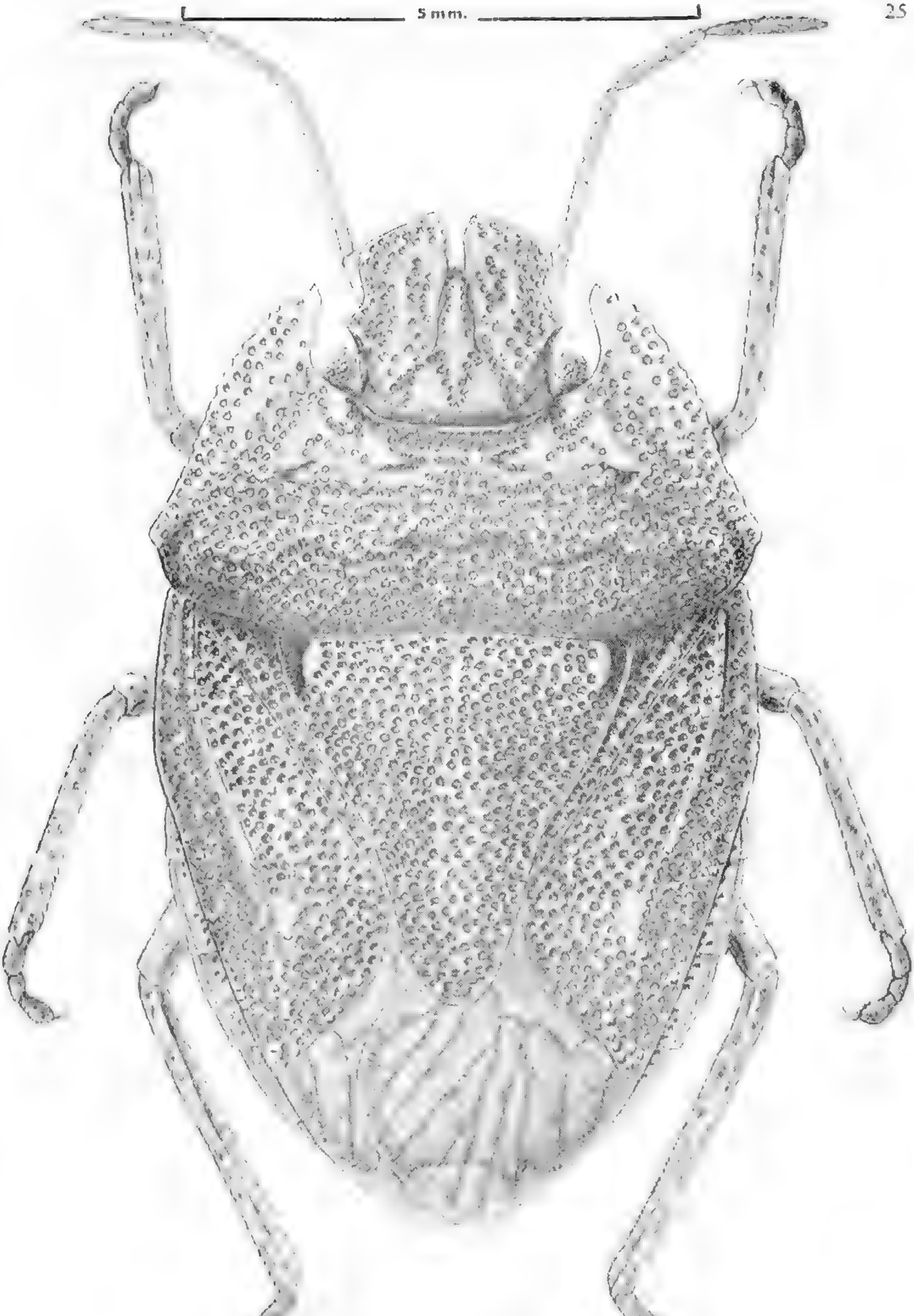

Fig. 7: *Cephaloplatus (C.) clementi* Distant.

of the eyes produced into a blunt convex process which is distinctly concave above, lateral margins in front of the convexity almost semicircular, forming a broad sweep to the shortly rounded interior angles of the apices of the juga, interior margins of juga more or less straight, separated or not. Disc of the juga somewhat concave, particularly anteriorly. Base of head between the ocelli somewhat elevated. Eyes moderately prominent, facets occupying most of the anterior portion. Antennae slender and five segmented, though none of the specimens to hand has the fifth segment. First segment not reaching apices of the juga, third and fourth segments subequal, second somewhat shorter than either, brownish or reddish brown.

Pronotum only slightly raised posteriorly, declivous anteriorly, anterolateral margins progressively more explanate from posteriorly to anteriorly, regions of the anterior angles projecting forward as somewhat recurved processes extending well in front of the eyes and to in front of the convex process on the lateral margins of the juga. Anterior margin truncate behind the collum, oblique behind each eye then somewhat convergent to the apices of the anterior processes. Anterolateral margins slightly convergent anteriorly, thence nearly straight to the lateral angles but with a slight more or less angular concavity behind the midline of the pronotum, finely denticulate or crenulate. Lateral angles irregular or irregularly rounded, posterolateral margins somewhat sinuate, posterior margin truncate.

Scutellum very similar in shape to most other *Cephaloplatus* with the slight angulate concavity just behind the middle and the tip broadly rounded. Basally slightly raised, apically more flattened, in each basal angle a somewhat elongate black fovea inward of which lies a concolorous callous area or point.

Hemelytra in their basal quarter wider than the abdomen, this margin of the corium slightly sinuate, not denticulate or crenulate. Behind this point hemelytra gradually narrowing and leaving more or less half of the connexivum exposed. Outer and inner parts of the hind margin of the corium convex, the outer angle of the corium somewhat produced. Membrane opaque with only slightly darker light brown veins and odd scattered brown maculae in the cells between the veins, some of the veins forked and some closed cells at the base of the membrane. Laterotergites concolorous, not infuscated, their posterior angles not produced.

Beneath rather darker than the dorsal surface, the area around the opening of the scent glands brown with concolorous punctations, punctations on the rest of the thorax and on the underside of the head coarse and piceous, on the abdomen finer, denser, piceous. On the head there is a short piceous bar in the front of the antennifers and a piceous patch at the base of the head behind the bucculae. On the pronotum all thoracic sterna are piceous and there is a semicircular piceous bar in line with the eyes on the propleuron and a shorter one on the metapleuron behind the evaporative area. On the abdomen there are piceous or infuscated areas as follows; a pair of semi-circular patches at the base of the abdomen behind each metacoxa, a rather diffuse lateral line on either side extending from the base of the abdomen to nearly the apex of the fifth abdominal segment, and a broken line ventrally made up of basal bars on the fifth, sixth and seventh abdominal segments. Rostrum and legs yellowish, the latter with scattered brown raised maculae on the femora and tibiae. Male pygophore from below similar to fig. 6B.

Length: 10.25-11.5 mm.

Distribution: *Western Australia*. *Holotype* ♀, Nicol Bay District, coll. Dr. Clement; 1 ♀, Onslow, donated C. French Jun. 15 November 1911 (B.M.); 3 ♂♂, 7 ♀♀, Onslow, some donated C. French Jun. 15 November 1911, others F. P. Spry, 5 October 1922, (N.M.); 1 ♀, Onslow; 1 ♂, Onslow, donated F. P. Spry, 5 October 1922 (A.M.); 1 ♀, Wittenoom Gorge, 475 m, 9 October 1962, coll. E. S. Ross & D. Q. Cavagnaro; 1 ♂, Milly Milly, 600 m, 6 October 1962, coll. E. S. Ross & D. Q. Cavagnaro (C.A.).

Remarks: This species appears restricted to Western Australia, in fact possibly only the Central West of Western Australia. It is a ruddy brown species with a remarkably even colour pattern on the dorsal surface. It is the first of a series of species (or taxa) in the subgenus *Cephaloplatus* which have the lateral margins of the head produced into a small but conspicuous triangular process just in front of the eyes.

Cephaloplatus (C.) australis Dallas

Cephaloplatus australis Dallas, 1851, List of specs. Hem. Ins. Coll. Brit. Mus. 1:138.

Fig. 8

Average size for the genus, appearing rather greyish and variegated in macroscopic view. Ground colour yellowish, punctations brown, in some parts of the pronotum and scutellum rather blackish. Some fine luteous granules present on the dorsum particularly in the hind portion of the pronotum between the lateral angles. Three fuscous maculae across the base of the head and one shaped rather like a U on its side around the inner margin of each callus on the pronotum.

Head with juga foliaceously expanded and rather acutely produced in front of the anteclypeus like the next taxon (*nubifer* Bergroth). Lateral margins of juga immediately in front of the eyes produced into an angulate process which is vaguely concave dorsally and directed somewhat upwards, this process not so strongly developed as to constitute a spine but is rather

Fig. 8: *Cephaloplatus* (*C.*) *australis* Dallas.
(Photograph by courtesy of the Trustees of the British Museum (Natural History).

an equilateral triangle. Lateral margins of juga in front of this point broadly curved to their relatively acute apices. this part of juga not extending much in width beyond the inner margin of the eyes. Juga apically shortly and roundedly acute, inner margins parallel and *relatively widely separated*. (contiguous in *nubifer*). Disc of head slightly raised between the ocelli, behind each ocellus and medially, on the hind margin a black patch, punctations in the basal half of the anteclypeus strongly blackish, behind them a glabrous patch. Antennae in type represented by only the first three segments, apparently slender, first segment somewhat orange and not reaching the apex of the jugum, second longer than the third, yellowish in its basal 2/3 then with a preapical brown ring, third segment blackish brown except basally.

Pronotum rather more raised posteriorly than *nubifer* and anteriorly to this declivous and with a shallow transverse depression just behind the collum. Anterolateral margins progressively more explanate from posteriorly to anteriorly and rather depressed. The regions of the anterior angles are produced forward as angular processes which reach about the anterior margins of the eyes. Anterior margin *strongly rectangular* behind the collum and behind the eyes shortly truncate (*not obliquely* so as in *nubifer*) and then diverging to the apical processes. Anterolateral margins almost straight, or only very slightly concave anteriorly, a little behind the middle turning out rather angulately (this concave angulation much more conspicuous than in *nubifer*) to the shortly and triangulately produced paler lateral angles. The true lateral angle lies behind this process and is rounded. The anterolateral angles in front of the concave angulation are conspicuously (though the serrations are rather small) serrate. (In *nubifer* they are virtually entire). Posterolateral margin sinuate, posterior margin entire. On the disc of the pronotum anteriorly the inner margins of the calli outlined in black, on the posterior lobe a sinuous whitish line made up of more than usually dense granules running between the lateral angles, behind this line a similar line made up of black punctations, a dense patch of black punctations also in the anterolateral margins at the angulation.

Scutellum very much as in other species of *Cephaloplatus* with the usual slight concavity of the lateral margins just behind the middle. Anteriorly somewhat raised (in *nubifer* a lot more strongly raised). In each basal angle of the scutellum the usual black fovea margined on its inner side by a glabrous point.

The hemelytra wider than the body in their basal quarter, this portion of the corial margin nearly entire. Behind the basal quarter the lateral margins of the coria rather strongly converging to leave most of the connexivum exposed, apical margin of the corium almost straight, rounded broadly at each end (in *nubifer* rather concave medially). Membrane milky white or opaque with light brown veins and light brown maculae between the veins. Laterotergites mainly concolorous but with a black spot interiorly just in front of each incisure and a large triangular one exteriorly just behind each incisure.

Beneath concolorous with above, punctation coarse and evenly distributed, areas more infuscated or blackish are, a patch on the head beneath behind the bucculae, the thoracic sterna, a short shining bar anteriorly and exteriorly on the propleuron and the mesopleuron and metapleuron obscurely, a small patch on the lateral margin of each abdominal segment just behind each incisure and a medial streak in the basal half of the ninth abdominal segment; the femora and tibiae are coarsely maculated with black, the latter only exteriorly.

Length: 11 mm. (approx.).

Distribution: Western Australia. Holotype ♀ (B.M.)

Remarks: The type does not now bear any indication of provenance but Dallas in his original description indicated the North West Coast of the continent.

The status of this taxon and the three which follow (*nubifer* Bergroth, *pellewensis* sp. nov. and *bellus* sp. nov.) is still rather uncertain. *Nubifer* could be an arid region subspecies of *australis*; it is about the same size though rather reddish but has many of the same dark markings. The anterolateral margins of the pronotum are not so incised but this probably a rather variable character and could be subspecific. *Pellewensis* on description fits *australis* rather well although it is conspicuously smaller but could be the subspecies found in the Gulf of Carpentaria region. *Bellus* looks very like *pellewensis* and is about the same size and could be a subspecies of *australis* from Central Australia closest to *pellewensis*, although it is conspicuously reddish it has the same colour patterns as *pellewensis*, however the lateral margins of the pronotum are hardly serrate (in *pellewensis* they are conspicuously so), and in *bellus* the triangular lobe in front of the eye has become a distinct spine like process. The relative lengths of the antennal segments and their almost identical colouration in the four taxa would tend to support the same hypothesis as does the structure of the male pygophore from both dorsal and ventral aspects (the *australis* type unfortunately is a female). The female external genitalia also appear not to differ on shape or colour pattern.

However, the above cannot be the correct explanation for *nubifer* and *bellus* coexist in the Alice Springs region of Central Australia.

Alternatively a case could be made out that *australis* Dallas and *nubifer* Bergroth are the Northern and more Southern subspecies of one single species in the 9.75-11.0 mm. range and that *pellewensis* sp. nov. and *bellus* sp. nov. are subspecies, Northern and Southern respectively of a more Eastern species in the 8.0-9.5 mm. size range.

For the moment the only really satisfactory method appears to be to regard these taxa as distinct species until more material, especially from the Northern coastal regions of the continent, is available.

Cephaloplatus (C.) nubifer Bergroth

Cephaloplatus nubifer Bergroth, 1916, Proc. R. Soc. Vict., 29:25.

Fig. 9

Average size for the genus, appearing rather reddish and variegated in macroscopic view. Ground colour reddish yellow or yellow, punctations brown, tending to be rather finer and sparser on the head and pronotum than in some of the other species. Some fine concolorous granulations present on the dorsum particularly in the extreme hind portion of the pronotum, the hind part of the scutellum and the hind quarter of the coriaceous parts of the hemelytra.

Head with juga expanded somewhat foliaceously, but rather more acutely produced in front of the apex of the anteclypeus than in other species of this genus. Lateral margins of juga immediately in front of the eyes produced into an angulate process which is concave dorsally, this process is not so strongly developed as to constitute a spine, it is more in the shape of an equilateral triangle. Lateral margins of juga in front of this point broadly curved to their relatively acute apices, this part of juga not extending much beyond the inner margins of the eyes. Anterior angles of jugae more acute than other species, inner margins convex contiguous anteriorly but leaving a small gap immediately in front of the anteclypeus in the three specimens available. Head slightly raised basally between the ocelli. Eyes prominent, facets occupying only the anterior facing surfaces, hind surface flattened and oblique. Antennae relatively long and slender, five segmented, first segment not reaching the apices of the juga, second, third and fourth segments subequal, fifth segment somewhat longer. Antennae brownish or reddish brown in colour, the apical halves of the third, fourth and fifth segments infuscated.

Pronotum only very slightly raised posteriorly, anteriorly to this somewhat declivous but with a slight transverse convexity between the anterior margin and the hinder portion. Anterolateral margins progressively more explanate from posteriorly to anteriorly. The region of the anterior angles shortly produced as angular processes but reaching only to about the anterior margins of the eyes. Anterior margin shallowly concave behind the collum, obliquely truncate behind each eye and diverging to the apices of the anterior processes. Anterolateral margins somewhat curved anteriorly thence more or less straight with perhaps a *slight* concavity between this point and the lateral angles, almost entire, with only very fine irregularities.

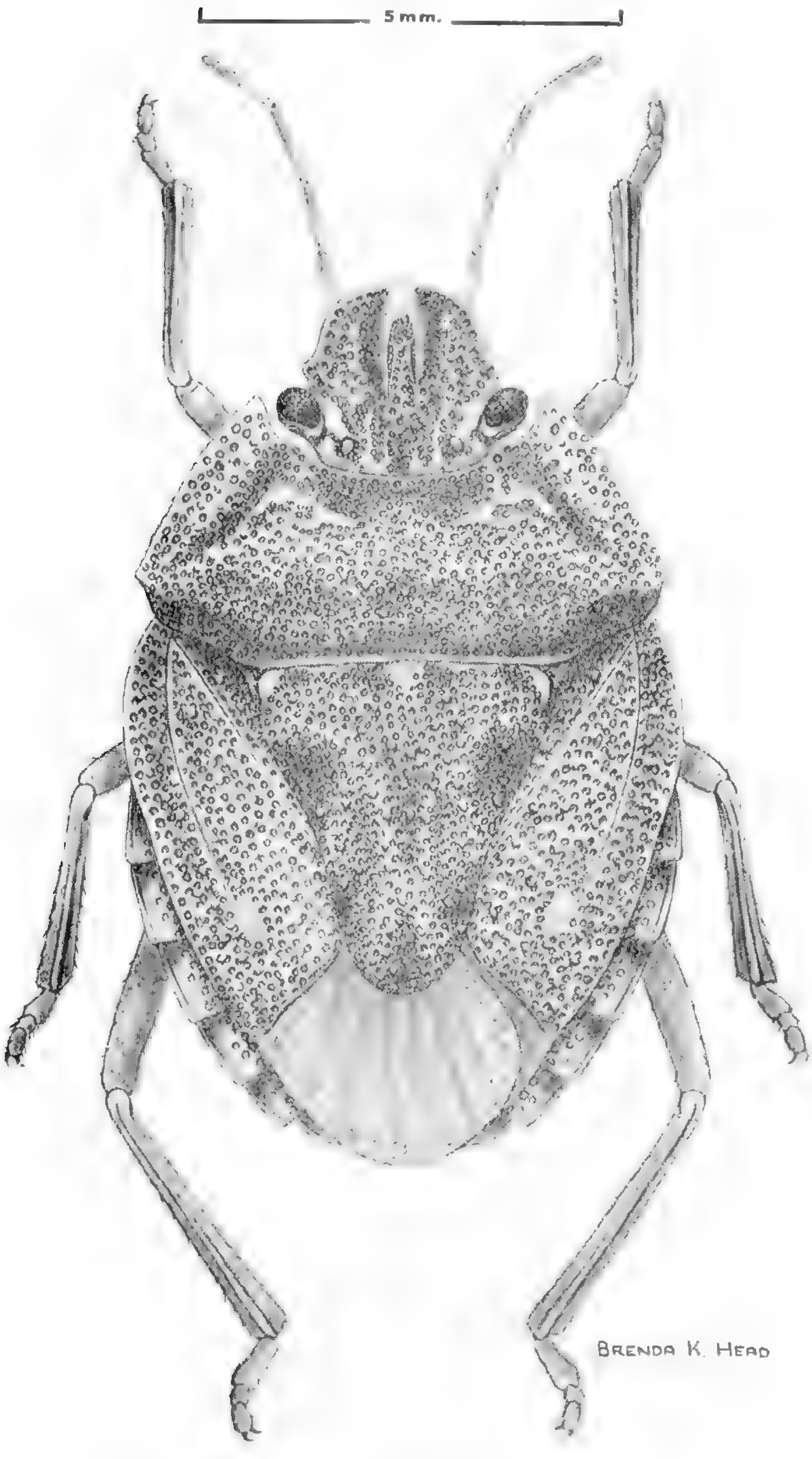

Fig. 9: *Cephaloplatus* (*C.*) *nubifer* Bergroth.

Lateral angles obliquely truncate, posterolateral margin sinuate, posterior margin truncate. On the disc of the anterior lobe of the pronotum the calli relatively conspicuous, on the hind lobe a trace of a sinuous line running between the lateral angles made up of rather more than usually densely concentrated granules.

Scutellum very much as in other species of *Cephaloplatus* with the usual slight concavity of the lateral margins just behind the middle. Anteriorly somewhat raised, this anterior portion continuing as a slightly raised area to the tip thus giving the impression of a flask shaped raised area on the scutellum. In each basal angle of the scutellum the usual rather elongate black fovea margined on its inner side by a concolorous glabrous area or point.

The hemelytra wider than the body in their basal quarter, this portion of the corial margin nearly entire. Behind this point the lateral margin of the corium rather more strongly converging posteriorly than in some other species and leaving most of the connexivum exposed, apical margin of corium slightly concave exteriorly, broadly rounded interiorly, the outer angle of the corium very slightly prominent. Membrane milky white or opaque with almost concolorous veins and some light brown maculae in the cells between the veins, veins apparently not forked apically. Laterotergites concolorous but with an infuscation on each just behind the incisure.

Underside concolorous with above, punctations comparatively sparse and coarse. On the underside of the head a piceous short bar just in front of the insertion of the antennae and a piceous spot on either side of the base of the head just behind the bucculae, in some specimens the bucculae infuscated, in others not. Thoracic sterna piceous, a piceous somewhat irregular line present near the exterior of the propleuron and thinner and shorter lines present in much the same position on the metapleuron and mesopleuron. Abdomen at base with a small semicircular piceous area behind each metacoxa, incisures somewhat darkened and a distinct fuscous spot exteriorly immediately behind where each reaches the lateral margin. On the venter of the abdomen faint traces of an interrupted series of fuscous spots or short small bars. Male genitalia from below similar to Fig. 6B.

Length: 9.75-10.0 mm.

Distribution: *Northern Territory*. *Lectotype* ♂, Mcdonnell Ranges; 1 ♀, Alice Springs (Helsinki); 1 ♀, Alice Springs, 31 August 1936, coll. H. O. Fletcher & W. Barnes; 1 ♂, 1 ♀, 14 miles North of Tyon Station, August 1936, coll. H. O. Fletcher & W. Barnes (A.M.); 1 ♀, Hermannsburg, 1908, coll. H. J. Hillier (B.M.). *Western Australia*. 1, Hermite Is., coll. H.M.S. Campania, accessed 1952 (B.M.); 1 ♂, Fitzroy Crossing, 4 September 1953, coll. N. B. Tindale; 1 ♀, Derby, coll. W. D. Dodd. (S.A.M.). *Unlocalized*. 1 ♀ (N.M.).

Remarks: Bergroth in his original description of *nubifer* mentions two localities "Mcdonnell Ranges" and "Alice Springs" the material being collected on the Horn Expedition into Central Australia. In Helsinki I was able to find a section of Horn Expedition material which Bergroth had worked over but no types were marked. Amongst it were a male from Mcdonnell Ranges and one other from Alice Springs of a species of *Cephaloplatus* which fit the description of *nubifer*. The Mcdonnell Range male fits the description very well and there can be no doubt that this is the type, this specimen is accordingly selected here as the lectotype of *Cephaloplatus nubifer* Bergroth.

Cephaloplatus nubifer appears to be a fairly rare species probably ditributed over a fairly narrow belt of arid country stretching from about Alice Springs to approximately the same latitude on the Western Australian coast and off shore islands.

The possibility that *nubifer* is a subspecies of *australis* Dallas is discussed in the remarks section under the latter.

Cephaloplatus (C.) pellewensis sp. nov.

Fig. 10

A little smaller than the average size for the genus, usually appearing greyish and variegated in macroscopic view. The ground coloration is actually rather whitish with coarse brownish black punctations, many of them forming clusters. The hind part of the pronotum, scutellum and the coriaceous parts of the hemelytra with sparse concolorous small granules

Head with juga strongly and foliaceously developed, produced well in front of the apex of the anteclypeus. Anterior margins of juga oblique, then rounded smoothly into the lateral margins of the head which are produced into a prominent slightly curved triangular process in front of each eye, inner margins straight or curved, contiguous or not. Eyes moderately prominent, facets occupying all but the posterior flattened surfaces. Antennae moderately slender, first segment not reaching apex of head, third somewhat shorter than second; second, fourth and fifth subequal, yellowish, on the second segment a subapical darkened ring, apical two thirds of third, fourth, and fifth segments darkened.

Pronotum somewhat raised posteriorly, more depressed anterolaterally, the anterolateral margins progressively more explanate from the lateral angles forward, the region of the anterior angles produced forward as a triangular process to about the level of the convex spine in front of the eyes. Anterior margin of pronotum truncate behind the collum and again behind each eye then diverging forward to the apex of each anterior process. Anterolateral margins at first rather convex then concave, distinctly finely serrate. Lateral

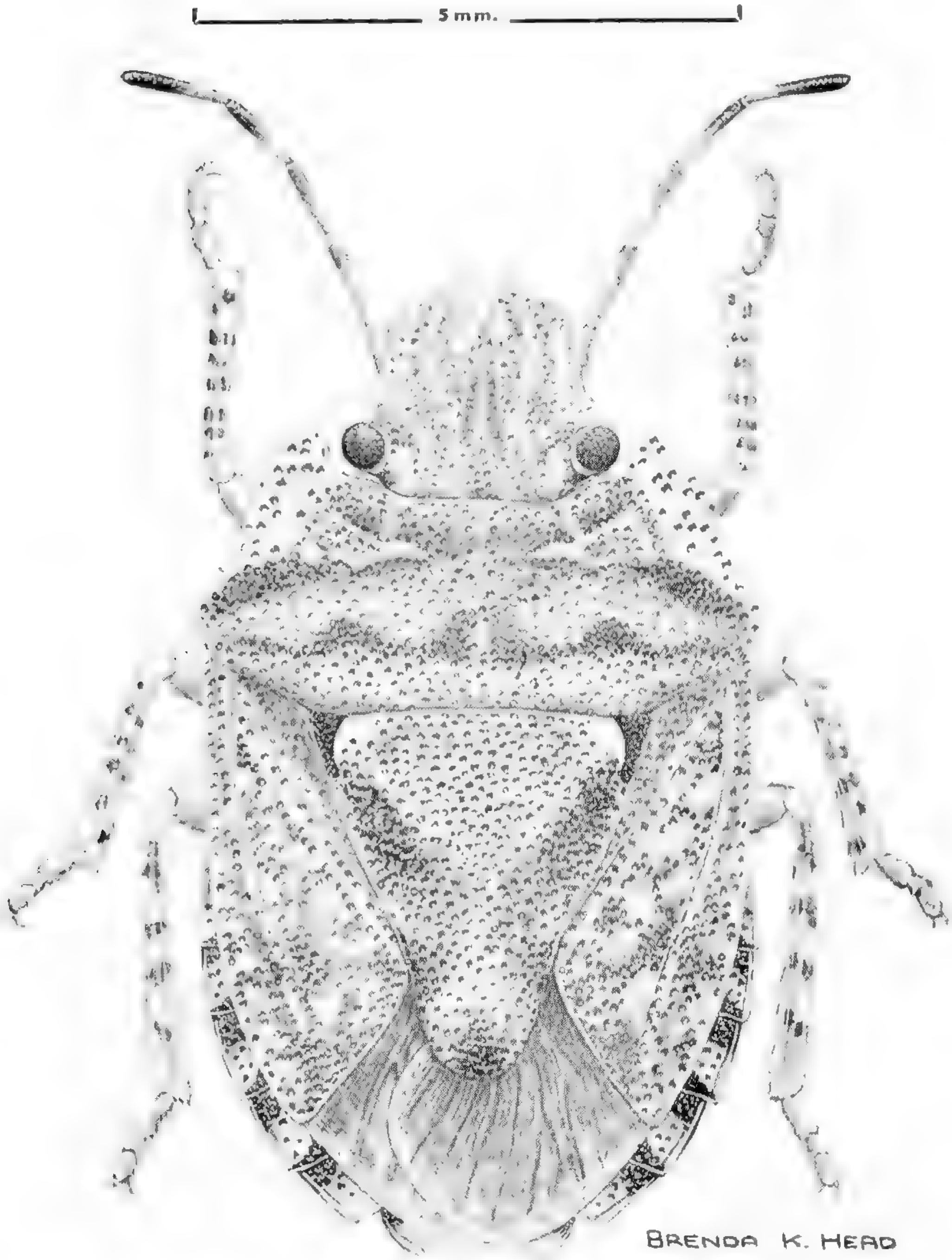

Fig. 10: *Cephaloplatus* (*C.*) *pellewensis* sp. nov.

angles distinctly prominent as small triangular flattened lobes, posterolateral margin strongly sinuate, posterior margin truncate. The hind quarter of the pronotum with moderately sparse small concolorous granules. Just in front of these a sinuous thinnish line of more than usually concentrated blackish punctations and in front of this a broad sinuous transverse bar, in front of this again rather darker with odd patches of denser punctations, especially at the inner edges of the calli, punctations on the expanded anterolateral margins quite sparse.

Scutellum substantially triangular with the usual angulate concavity somewhat behind the middle. Basal half somewhat raised, apex depressed. Disc only moderately densely covered with small granules, in each apical angle an elongate black fovea margined interiorly by a small glabrous patch, another glabrous patch medially on the base, a paler less punctate broad longitudinal streak medially, lateral areas with symmetrically placed darkish areas of more densely concentrated punctations. Tip rounded.

Hemelytra wider than the body in their basal quarter, behind this point converging rather strongly to leave the more posterior laterotergites completely exposed, whole corial exterior margin rather irregular. Hind margin of corium straight exteriorly, broadly curved at its inner angle. On the disc of the corium patches of impunctate areas and areas of dense punctation. Membrane whitish hyaline with light brownish veins and a number of brown maculae in the cells between the veins (which do not appear to be forked). Laterotergites with a brown patch at each posterior inner angle and each anterior outer angle.

Beneath mainly concolorous with the dorsal surface, punctations on the metapleura rather finer. Strongly infuscated areas are present to a greater or lesser degree, in the darkest specimens they occur as follows, a narrow line on the side of the head immediately in front of the insertion of the antennae, a large spot at the base of the buccalae, all thoracic sternites, lateral bars on the thoracic pleura, on the third abdominal sternite immediately behind each metacoxa, most of the abdominal incisures, medially at the base of at least the sixth and seventh sternites, exteriorly at the anterior angle of each sternite and on the apices of the first valvifers of the female genitalia. Male pygophore from below similar to fig. 6B. Legs with coarse brownish maculations.

Length: 8.5-9.5 mm.

Distribution: *Northern Territory*. *Holotype* ♂ (T6908) Horn Islet, Pellew Group, 16-23 May 1968, coll. B. Cantrell (Q.M.), *allotype* ♀, *paratype* ♂, *paratype* ♀, Horn Islet, Sir Edward Pellew Group, 25-31 January 1968, coll. B. Cantrell; 1 ♂ doubtful, Horn Islet, Sir Edward Pellew Group, 22-28 February 1968, coll. B. Cantrell; 1 ♂ doubtful, Horn Islet, Sir Edward Pellew Group, 15-21 February 1968, coll. B. Cantrell (U.Q.).

Remarks: The possibility of a subspecific relationship existing between *pellewensis* and either *australis* Dallas or *bellus* sp. nov. is discussed in the remarks section under *australis* (p. 30). The last two males mentioned under the distribution preceding above are only provisionally referred to this species for the moment. They are very similar to each other but show a rather different facies to the type series of *pellewensis*. They are both in the same size range as *pellewensis*, have the triangular lobe in front of the eyes, the same structure and coloration of the antennae and the male and female genitalia appear to be identical and the same general colour pattern. However, they are both very much smoother, the anterolateral margins of the pronotum are virtually straight and they lack all but a few of the dense patches of black punctations above They may represent an extreme of the variation to be found in *pellewensis* or alternatively yet another species in the complex from *australis* through to *bellus*. It is worth noting in the latter context that three other species of *Cephaloplatus* also occur on Horn Islet, namely *C* (*M.*) *minor* Distant *C.* (*C.*) *pallipes* Walker and *C.* (*C.*) *pertyi* (White).

Cephaloplatus (C.) bellus sp. nov.

Fig. 11

A little smaller than the average size for the genus, often appearing rather reddish and variegated in macroscopic view The variegation in some parts is luteous or even almost whitish, in other parts reddish, in other parts pinkish or even ferrugineous. Punctations in the main brownish but small patches on the head, pronotum and scutellum blackish. The hind parts of the pronotum, scutellum and the coriaceous parts of the hemelytra with numerous concolorous small granules.

Head with juga strongly and foliaceously developed, produced well in front of the apex of the anteclypeus. Anterior margins of the juga oblique, turning shortly into the sinuous lateral margins which are produced into a prominent slightly curved elongate triangular or spinous process in front of each eye, inner margins of the juga curved, sometimes contiguous, sometimes not. Eyes moderately prominent, facets occupying only the anterior half. Antennae moderately slender, first segment not reaching the apex of the head, third segment relatively short, second, fourth, and fifth segments subequal, on the second segment a subapical darkened ring, apical two thirds of third segment infuscated, apical half of fourth infuscated, apical two thirds of fifth infuscated.

Pronotum somewhat raised posteriorly, more depressed anterolaterally, the anterolateral margins progressively more explanate from the lateral angles forward, the region of the anterior angles produced as a triangular process forward to about the level of the apex of the spine in front of the eyes.

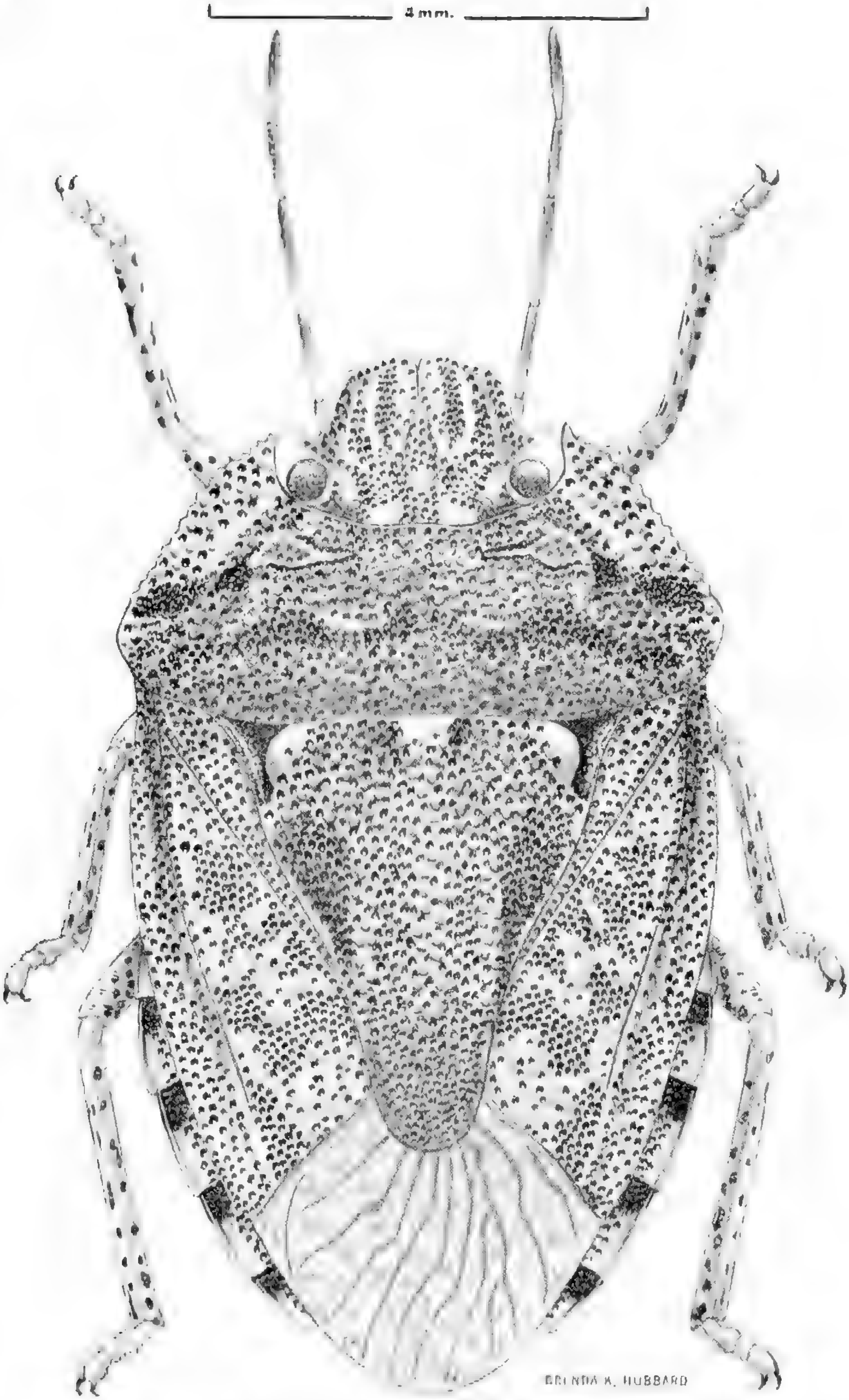

Fig. 11 *Cephaloplatus* (*C.*) *bellus* sp. nov.

Anterior margin of pronotum concave behind the collum, truncate behind each eye, then parallel forward to the apex of each anterior process. Anterolateral margins almost straight or very slightly convex, irregular but definitely not crenulate or serrate. Lateral angles shortly truncate, posterolateral margin somewhat sinuate, posterior margin truncate. Hind area of the pronotum fairly densely covered with small concolorous granules. The areas of darker punctations tending to vary in position from specimen to specimen but always symmetrically placed on either side of the midline.

Scutellum substantially triangular with the usual angulate concavity well behind the middle. Basal half somewhat raised, apical half somewhat depressed. Disc fairly densely covered with small granules, in each apical angle a somewhat elongate black fovea margined interiorly by a small glabrous area. Patches of dark punctations on the scutellum likewise differently placed in different specimens but tending to be symmetrical about the middle. Tip broadly rounded.

Hemelytra wider than the body in their basal quarter, this portion of the corial margin smooth. Behind this point the lateral margins of the corium smoother and gradually converging posteriorly leaving more of the connexivum exposed, hind margin of corium more or less straight exteriorly, broadly curved at its inner angle. On the disc of the corium and clavus various patches of concolorous impunctate areas. Membrane milky white with light brownish veins and a number of brown maculae in the cells between the veins, some of the veins forked. Laterotergites with a brown patch at each anterior angle, this brown patch sometimes extending inwards further towards the inner margin of the connexivum.

Beneath mainly concolorous with the dorsal surface, the punctations tending to be finer only on the metapleura. Strongly infuscated areas are present to a greater or lesser degree; in the darkest specimens they occur as follows: on the sides of the head immediately in front of the insertions of the antennae, a spot on either side of the basal ends of the bucculae, all thoracic sternites, lateral bars on the thoracic pleura, and the incisures of all abdominal sternites. In other specimens there are only the thoracic sternites, a diffuse lateral line on either side of the abdomen and a broken line of infuscations along the midline of the venter. Legs with brownish granulations or maculations. Male pygophore somewhat like fig. 6A.

Length: 9.5-10.0 mm

Distribution: *Northern Territory*. *Holotype* ♂ (Reg. No. 120,549) 2 *paratype* ♀♀, 1 *paratype* ? sex (as abdomen is missing) (Reg. Nos. 120,550-2), Haast Bluff Station, 2,000 feet 69 Fahrenheit at Mercury Vapor Light, 4 September 1957, coll. N. B. Tindale; 1 *paratype* ♂, 3 *paratype* ♀♀ (Reg. Nos. 120,553-6) Haast Bluff Station, 2,000 feet, 62° Fahrenheit at Mercury Vapor Light, 5 September 1957, coll. N. B. Tindale; 2 *paratype*

♀♀ (Reg. Nos. 120,557-8), near Ayers Rock, 20 August 1960, coll. R. Garnett; *paratype* ♀ (Reg. No. 120,562), Yuendemu, February 1968; 1 *paratype* ♂, 2 *paratype* ♀♀ (Reg. Nos. 120,569-71), Yuendemu, February 1968, coll. C. Watts; *paratype* ♂ (Reg. No. 120,563), Devil's Marbles 7 miles North of Wauchope, 22 April 1966, coll. N. McFarland (S.A.M.); *allotype* ♀ 2 *paratype* ♂♂ (1 at light) 4 *paratype* ♀♀ (2 at light), Stanley Chasm, 31 miles West of Alice Springs, 9 February 1966, coll. Britton, Upton & McInnes; 1 *paratype* ♀, 48 miles WSW of Alice Springs, 10 February 1966, coll. Britton, Upton & McInnes; 2 *paratype* ♂♂, near Reedy Rockhole, Amadeus Basin at 24 20′S 131 35′E, 6 June & 8 September 1962, coll. R. Ranford; 1 *paratype* ♀, Amadeus Basin, 15-16 September 1962, coll. R. Ranford (A.N.I.C.); 1 *paratype* ♀, Mt. Gillen near Alice Springs, 1,500 feet, 31 August 1936, coll. H. O. Fletcher & W. Barnes (A.M.); 1 *paratype* ♂, 11 miles North of Alice Springs 625 m, at 15 watt ultra violet (black) light, 28 October 1962, coll. E. S. Ross & D. Q. Cavagnaro; 1 *paratype* ♀, Devil's Marbles, 350 m, 27 October 1962, coll. E. S. Ross & D. Q. Cavagnaro (C.A.). *Western Australia.* 2 *paratype* ♀♀ (Reg. Nos. 120,560-1), Pilgangoora Well, Pilbara District, 6 & 7 June 1953, coll. N. B. Tindale; 1 *paratype* ♀ (Reg. No. 120,559), Coolgardie (S.A.M.). *Queensland.* 1 *paratype* ♂, Split Rock 30 miles East of Camooweal, September 1936, coll. H. O. Fletcher & W. Barnes (A.M.). *South Australia.* 1 *paratype* ♂ and 1 *paratype* ♀, (Reg. Nos. 120,564-5), found dead on salt of Lake Eyre North (Madigan Gulf), 27 October and 4 November 1963, coll. G. F. Gross (S.A.M.).

Remarks: The possible relationship of this species with the series beginning with *C.* (*C.*) *australis* is discussed on page 30. Its centre of distribution is clearly in the southern part of the Northern Territory extending out East and West into Queensland and Western Australia and South into South Australia.

It is the first of a series of species in which the lateral margin of the head is produced into a distinct spine like process just in front of each eye.

Cephaloplatus (C.) spurcatus Walker

Cephaloplatus spurcatus Walker, 1867 Cat. spec. Het.-Hem. Coll. Brit. Mus., 1:191.

Cephaloplatys spurcatus Van Duzee, 1905, Bull. Amer. Mus. nat. Hist., 21:201.

Fig. 12

Average size of the genus, in macroscopic view tending to appear grey, light or dark. Ground colour light yellowish or luteous with numerous coarse brown punctations which are not evenly disposed over the dorsum of the animal. Pronotum, scutellum and coriaceous parts of the hemelytra covered with sparse luteous granules.

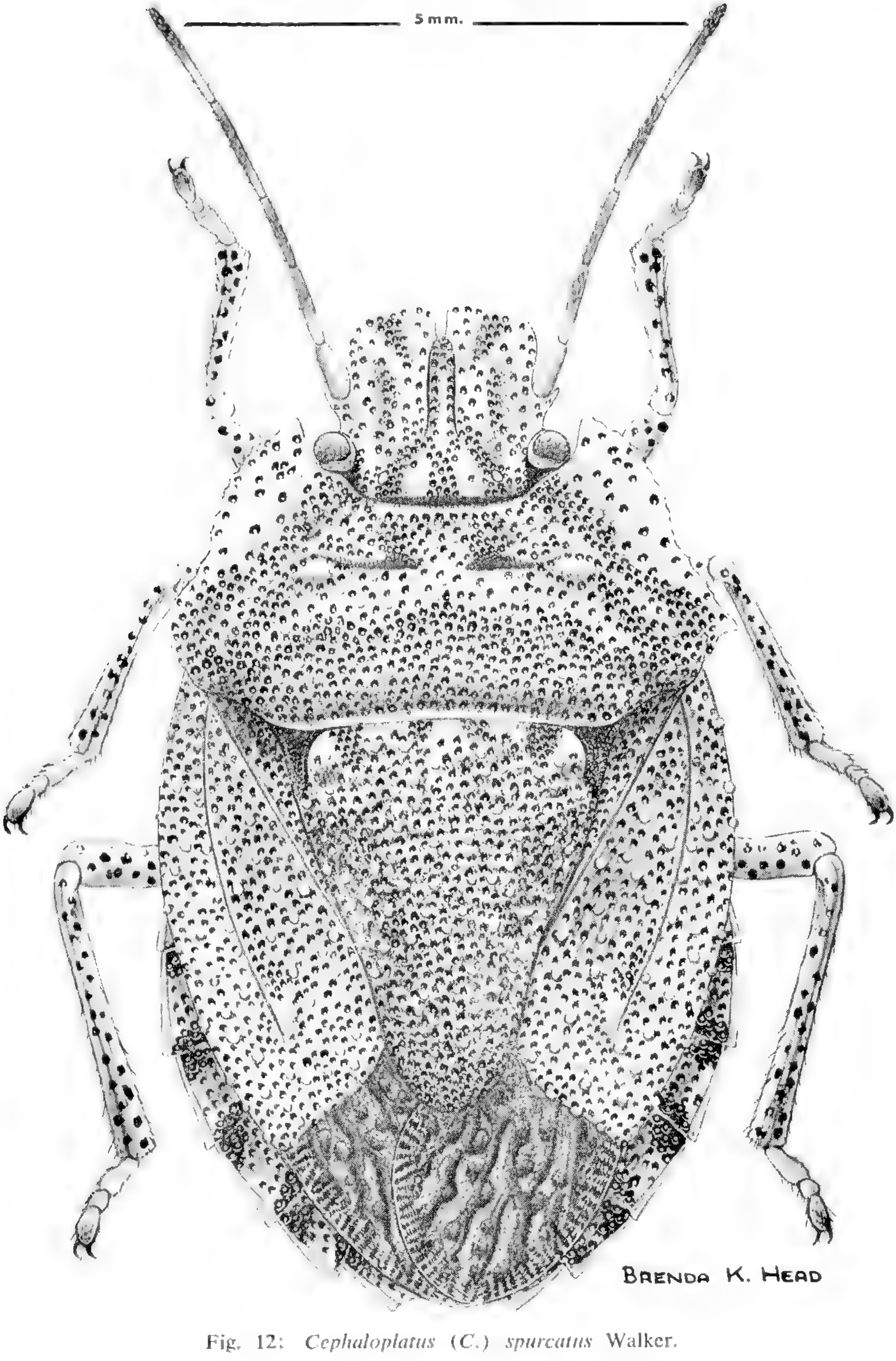

Fig. 12: *Cephaloplatus* (*C.*) *spurcatus* Walker.

Head with juga rather foliaceously developed and produced forward in front of the apex of the anteclypeus, their apices broadly rounded, running back to a prominent flattened spine between the base of the antennifer and the eye which projects forwards and outwards to about the level of the outer margin of the eye. Just in front of this spine the lateral margins of the juga strongly incised, their inner margins in front of the apex of the anteclypeus rather convex, contiguous or not. Lateral and anterior margins of juga somewhat raised so that the anterior portion of the head is somewhat concave. Eyes moderately prominent, facets occupying only the anterior half to two thirds. Antennae moderately slender, first segment not reaching the apices of the juga, second and third segments subequal, fourth about 30% longer than them and fifth about 25% longer than fourth. Distal antennal segments brownish with segments basally yellowish, the first segment yellowish and sometimes also the second.

Pronotum only somewhat raised posteriorly, depressed anterolaterally, the anterolateral margins progressively more explanate from the lateral angles forward, the region of the anterior angles produced anteriorly as a triangular process to about the level of the apex of the spine in front of the eyes. Anterior margin of pronotum truncate behind collum, rather oblique behind each eye, rounded, straight or oblique to the apex of each anterior process. Anterolateral margins feebly to strongly angulately concave a little behind the middle, clearly crenulate or serrate in front of the angle of the concavity, the crenulations or serrations all the same length, lateral angles subacute (strictly speaking the acute projection lies a little in front of the true lateral angles which are obtusangulately rounded), posterolateral margin almost straight behind the true lateral angles, posterior margin straight to rather concave. Luteous granules on the pronotum rather sparse and mainly confined to the posterior half. Punctations quite sparse on the expanded anterolateral margins, on the disc sometimes more concentrated in a sinuous line extending between the lateral angles.

Scutellum substantially triangular with the usual angulate concavity behind the middle. Basal half raised only medially, apical angle very broadly rounded. Disc with scattered small luteous granules, punctations not evenly disposed, in each apical angle a black fovea margined interiorly by a small glabrous point.

Hemelytra wider than the body in their basal third, this part of the corial margin clearly crenulate. Behind this point the lateral margins of the corium smoother and gradually converging posteriorly leaving about half or more of the connexivum exposed, hind margin of corium exteriorly rather concave, rounded at its inner angle. On the disc of the coriaceous portion of the hemelytra small scattered luteous granules and the punctations not evenly disposed. Membrane a very pale brown with light brown veins and some faint brown maculae in the cells between the veins, some of the veins forked and near the base of the membrane some closed cells. Laterotergites concolorous and punctate only interiorly, black in each anterior angle and along their hind margins, their hind angles a little protuberant.

Beneath much darker than the dorsal surface, the punctation much denser, the juga, the explanate anterolateral margins of the pronotum, the episterna and epimera, the embolium and the sides of the abdomen pale with relatively few punctations. A large brownish black spot on the head beneath at the base of the bucculae, in some specimens a line on the side of the head in front of the antennifers, the thoracic sterna, a smooth somewhat curved longitudinal line exteriorly on the propleuron, another on the metapleuron, a spot near the lateral angles, a large area at the base of the abdomen at each side behind each metacoxa, a longitudinal broad line on either side of the abdomen on segments II-V and a medial spot at the base of segments III-VII all blackish or piceous. The anterior half of the lateral margin of each abdominal segment and a spot near the edge of each incisure immediately in front of the former blackish. Femora and tibiae with coarse brown or piceous maculae, sparsely distributed. Male pygophore with apical angles prominent, otherwise similar in appearance to fig 6C.

Length: 8.5-11.0 mm.

Distribution: North Australia. Holotype ♂, 1 ♂ etc. (B.M.); 2 ♀ ♀, coll. Dämel (Stockholm). *Queensland.* 1 ♀, Brisbane, 2 December 1961, coll. A. J. Hiley; 1 ♀, Brisbane, 10 March 1962, coll. D. Schoorl; 1 ♀, Toowoomba, 3 February 1963, coll. J. C. Cardale; 1 ♂, 2 ♀ ♀, Carnarvon, 29 May 1959, coll. T. E. Woodward; 1 ♀, Sunnybank, 6 February 1966, coll. F. R. Wylie; 1 ♀, Mt. Elliot via Townsville, 24 May 1968, coll. G. Monteith; 1 ♀, Mt. Etna, 29 April 1967, coll. J. Bluhdorn; 1 ♀, Mt. Isa, 23 January 1968, coll. B. Cantrell; 1 ♀, Highvale, 28 May 1958, coll. T. E. Woodward (U.Q.); 1 ♂, 3 ♀ ♀, Clermont, April and December 1928, coll. Dr. K. K. Spence; 2 ♂ ♂, 1 ♀, Almaden, March 1928 & 1929, coll. W. D. Campbell; 1 ♀, Gayndah, coll. Masters (A.M.); 1 ♂, Brisbane, 15 March 1908, coll. W. W. Froggatt; 1 ♀, 50 miles SW Ayr, 9 October 1950, coll. E. F. Riek (A.N.I.C.); 1 ♀, Toowong, 3 May 1908, (N.M.); 1 ♂, 1 ♀, Bowen, coll. A. Simpson; 1 ♀, Normanton, coll. R. Kemp; 1 ♀, Maryborough, coll. E. W. Fischer (S.A.M.); 1 ♀, Brisbane, 23 November 1915, coll. H. Hacker; 1 ♀, Brisbane, 11 July 1926; 1 ♂, Brisbane, 6 May 1937, coll. R. F. Langdon (B.M.); 1 ♀, Rockhampton (Stockholm); 2 ♂ ♂, 2 ♀ ♀, Townsville, January 1945, B. Malkin (U.S.N.M.); 1 ♂, 32 Km South of Ayr, 6 November 1964, coll J. Sedlacek; 1 ♂, 88 Km East Charters Towers, 18 January, 1969, coll. J. Sedlacek (Bishop). *Northern Territory.* 5 ♂ ♂, 10 ♀ ♀, Borroloola, November 1911, coll. G. F. Hill on Barclay Expedition (N.M.); 1 ♂, 1 ♀, Borroloola, 28 February

1968, coll. B. Cantrell (U.Q.). *New South Wales*, 1 ♀, (B.M.); 1 ♀, from E. P. Van Duzee collection (C.A.). *Unlocalized*, 2 ♀♀, 1 ? (A.M.).

Remarks: This species is very close to the one following (*darwini*). The salient features distinguishing the two and a possible subspecies relationship between them is discussed under the remarks section of the latter. *C.* (*C.*) *spurcatus* occurs over most of Eastern Queensland except the Cape York areas, part of the Gulf of Carpentaria region of both Queensland and the Northern Territory, and some part of New South Wales, possibly the North East Coast of that state. Its distribution therefore, lies in the centre then East and South of the *darwini* distribution with areas of probable contact with the range of the latter across the base of Cape York Peninsula, near the Queensland-Northern Territory border, and in the region of the southern section of the shores of the Gulf of Carpentaria.

Cephaloplatus (C.) darwini Distant.

Cephaloplatus spurcatus (*non* Walker 1867) Carpenter, 1891, Sci. Proc. R. Dublin Soc. 7:139.

Cephaloplatus darwini Distant 1910, Ann. Mag. nat. Hist., (8)6:473.

Fig. 13, 6C.

Rather variable in size but large specimens average sized for the genus, in macroscopic view tending to appear rather greyish. Ground colour light yellowish or luteous with numerous moderately coarse brown punctations which are not evenly disposed over the dorsum of the animal. Pronotum, scutellum and coriaceous parts of the hemalytra covered with sparse luteous granulations.

Head with juga rather foliaceously developed and produced forward in front of the apex of the anteclypeus, their apices oblique, then broadly rounded just in front of the antennifer then running back to a prominent spine between the base of the antennifer and the eye which projects outwards and forwards to about the level of the outer margin of the eye. In front of this spine lateral margins of the juga strongly incised, their inner margins in front of the apex of the anteclypeus rather straight, usually well separated from each other and in many cases divaricate, the apex of the anteclypeus therefore free. Lateral and anterior margins of juga somewhat raised so that the anterior portion of the head is rather concave. Eyes moderately prominent, facets occupying only the anterior half. Antennae moderately slender, first segment not reaching the apices of the juga, the second and fourth segments subequal, the fifth segment longer than either, the third segment shorter than either. In some specimens the antennae in the main reddish, in others brownish or brownish with the apical halves of the third, fourth and fifth segments infuscated.

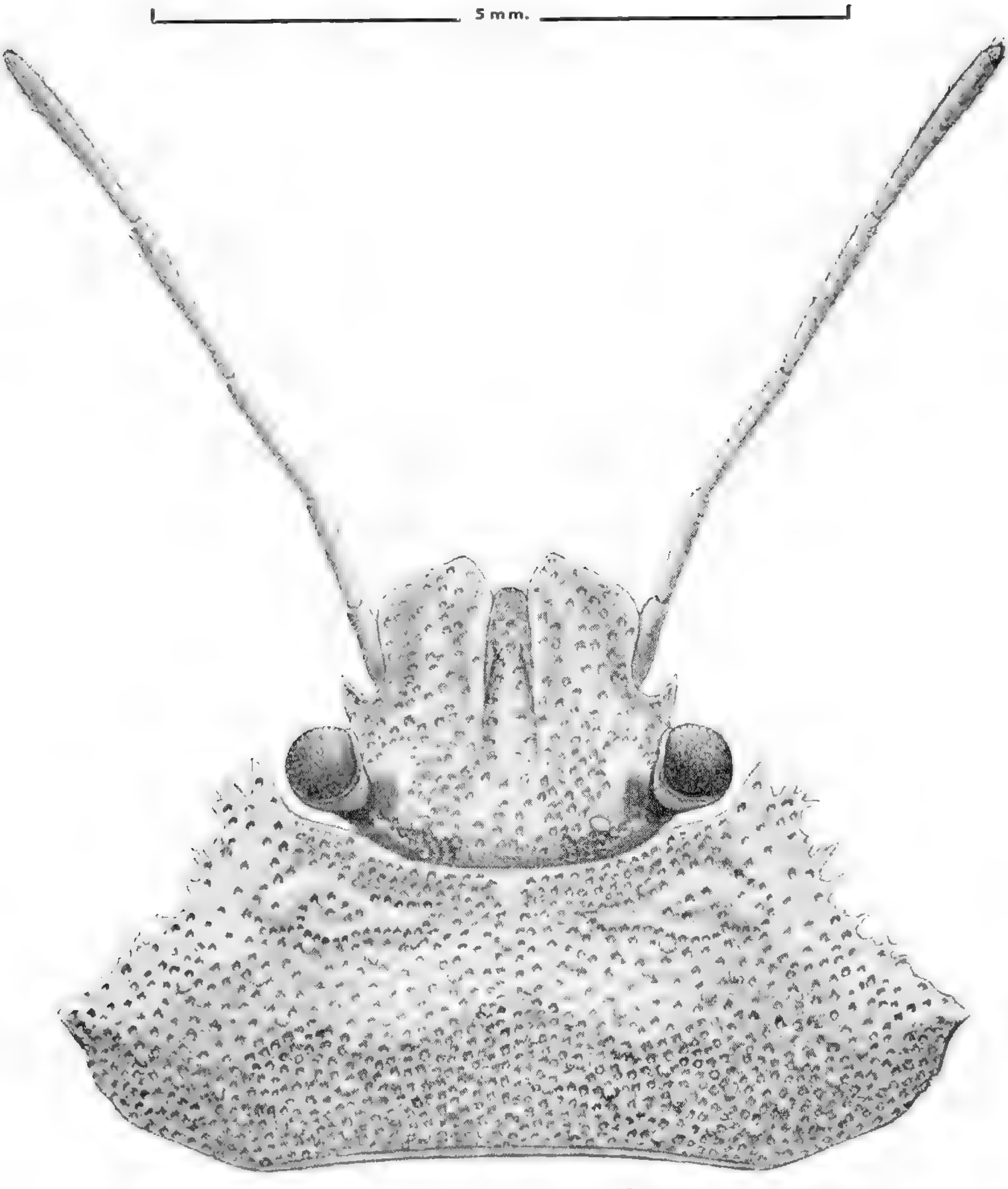

Fig. 13: Head and pronotum of *Cephaloplatus* (*C.*) *darwini* Distant.

Pronotum only somewhat raised posteriorly, depressed anterolaterally, the anterolateral margins progressively more explanate from the lateral angles forward, the region of the anterior angles produced as a triangular process forward to about the level of the apex of the spine in front of the eyes. Anterior margin of pronotum truncate behind the collum, truncate behind each eye, then diverging somewhat forward to the apex of each anterior process. Anterolateral margins strongly angulately concave a little behind the middle, with four to seven very marked denticulations in front of the angle of this concavity, in front of the lateral angles subacutely produced, true lateral angles rounded, posterolateral margin at first rather convex then obliquely concave, posterior margin truncate. Luteous granules on the pronotum very sparse and mainly confined to the posterior half. Between the lateral angle is a vestige of a sinuous transverse line made up of rather more than usually densely concentrated luteous granules.

Scutellum substantially triangular with the usual concavity somewhat behind the middle. Basal half somewhat raised, apical half somewhat depressed, apical angle rounded and narrower than that of *C. (C.) spurcatus*. Disc with scattered small luteous granules, in each apical angle a somewhat elongate black fovea margined interiorly by a small glabrous area or point, another glabrous point medially on the base.

Hemelytra wider than the body in their basal quarter, this portion of the corial margin finely denticulate. Behind this point the lateral margins of the corium smoother and gradually converging posteriorly leaving about half of the connexivum exposed, hind margin of corium exteriorly more or less straight, broadly curved at its inner angle. On the disc of the coriaceous parts of the hemelytra small scattered luteous granules and the punctations not disposed evenly. Membrane opaque with light brownish veins and a number of light brown maculae in the cells between the veins, some of the veins forked and near the base of the membrane some closed cells. Laterotergites concolorous, generally only lightly infuscated at the incisures, their hind angles slightly protruding, lightly punctate and that only in their inner portion.

Beneath tending to be darker and more reddish than the dorsal surface, the punctations on the underside of the head and on the thorax coarse and dense. Piceous are: a longitudinal streak in front of each antennifer, a large spot at the base of the bucculae, the thoracic sterna (with the exception of the yellowish keel on the mesosternum), sundry darker patches above the epimeron and episternum, two large semi-circular areas at the base of the abdomen behind each metacoxa, an interrupted line on the abdomen made up of triangular median bars on the fourth, fifth, sixth and seventh ventrites, a broad to very broad lateral band on either side extending from the base of the abdomen to the apex of the fifth ventral segment. All femora and tibiae with coarse brown or piceous raised coarse maculae, fairly sparse in distribution, these spots not present on the Murray Island specimen. Male pygopore with apical angles prominent (Fig. 6C).

Length: 8.0-11.0 mm

Distribution: *Northern Territory*. *Holotype* ♀, Port Darwin, coll. Walker; 1 ♂, Darwin 7 April 1913, coll. G. F. Hill (B.M.); 1 ?, Darwin, January, 1939, coll. M. Kamper; 1 ♂, 1 ♀, 1 ?, Burnside, 23 March 1929, coll. T. G. Campbell (A.M.); 1 ♀, same data; 1 ♀, Brocks Creek, March 1933, coll. T. Campbell (A.N.I.C.); 1 ♂, 1 ♀, Darwin, coll. G. F. Hill; 2 ♀♀, 30 miles East of Darwin, coll. G. F. Hill; 1 ♂, Croker Island Mission, 28 March-5 April 1961; 1 ♂, Oenpelli, December 1918, coll. D. P. Cahill (N.M.); 1 ♂, 1 ♀, Darwin, 12 March 1913, coll. G. F. Hill; 1 ♂, 4 ♀♀, Darwin, coll. G. F. Hill; 1 ♀, Darwin; 1 ♂, Darwin March 1956, coll. D. Groves; 1 ♂, 3 ♀♀, Darwin by sweeping in cleared monsoon forest, 7 January 1961, coll. G. F. Gross; 1 ♀, Melu Island near Darwin, coll. G. F. Hill; 2 ♂♂, 6 ♀♀, 30 miles East of Darwin, coll. G. F. Hill; 1 ♀, Batchelor, coll. G. F. Hill; 1 ♂, Roper River, coll. N. B. Tindale (S.A.M.); 2 ♂♂, 2 ♀♀, Darwin, 11 February 1945, coll. B. Malkin; 3 ♂♂, 3 ♀♀, Darwin, 25 March 1945, coll. B. Malkin; 1 ♀, Batchelor, coll. G. F. Hill (U.S.N.M.): 1 ♀, 2 ♀♀, 3-7 December 1963, 2 ♂♂, 1 ?, 1-8 January 1964, Darwin, at m.v. light trap, coll. J. Sedlacek; 2 ♂♂, 1 ♀, Darwin, coll. J. Sedlacek; 2 ♀♀, Berry Springs, 50 Km South-East of Darwin, 12 March 1966, coll. J. L. & M. Gressitt (Bishop). *South Australia*. 1 ♂, donated C. French Jun., 15 November 1911 (N.M.). (The Northern Territory was formerly part of South Australia politically and it is reasonably certain that this specimen would have come from what is now a Northern Territory locality.) *Western Australia*. 1 ♀, Wyndham, 15 December 1930-8 January 1931; 2 ♂♂, Chumooli near Wyndham, 18 January 1930-12 February 1931, coll. H. J. Willings (A.N.I.C.); 1 ♀, Junction of Fitzroy and Margaret Rivers, 1896, coll. Calvert Expedition; 1 ♂, Derby (S.A.M.). *Queensland*. 2 ♀♀, Lockerbie, Cape York Pen., 10-15 June, 1969, coll. G. B. Monteith. 1 ♀, Homestead, Silver Plains via Coen, 11 December, 1964, coll. G. Monteith; 1 ♀, Bamaga, Cape York Peninsula, May 1968, coll. R. Trundle (U.Q.); 2 ♂♂, 1 ♀, Bamaga, Cape York Peninsula, 5 April 1964, coll. I. F. B. Common & M. S. Upton (A.N.I.C.); 2 ♂♂, Stewart River, January-February 1927, coll. Hale & Tindale (S.A.M.); 1 ♂, Weipa, 15 June 1969, coll. C. McCubbin (N.M.); 1 ♀, Rocky Scrub, McIlwraith Range, Cape York Pen., 28 June 1932, coll. Darlington on Harvard Expd. (A.M.N.H.). *Torres Strait Islands*. 1 ♂, Murray Island (A.M.); 3 ♀♀, Murray Island, coll. A. M. Lea (S.A.M.); 1 neanide, Thursday Island, 5 June 1969, coll. A. Neboiss; 1 ♀, Prince of Wales Island, 29 May 1969, coll. A. Neboiss (N.M.); 1 ♀, Prince of Wales Island, 27 January 1939, coll. R. G. Wind (C.A.).

Remarks: This species is to be found in North Western Australia, north of approximately the latitude of the Fitzroy River, in the Darwin and Arnhem Land regions of the Northern Territory, in the Northern part of the Cape Yorke Peninsula and Torres Straight Islands areas of North Queensland.

The Northern Territory and Queensland populations appear to be separated by an extension of *C.* (*C.*) *spurcatus* which runs up through Mt. Isa to the south coast of the Gulf of Carpentaria. *C.* (*C.*) *spurcatus* and *C.* (*C.*) *darwini* are very close to each other in general appearance, distinctions are (1) in *spurcatus* the anterolateral margins of the pronotum are fairly finely crenulate with many small teeth, in *darwini* this margin is coarsely serrate with about 4-7 much larger teeth, the latter of unequal length and some are doubled. (2) the second segment of the antennae is very nearly the same length as the third (15:15) in *spurcatus* whereas in *darwini* the second is usually about 30% longer than the third (20:15) although some variation does exist. (3) the dark bands on the sides of the abdomen in *spurcatus* tend to be narrow but very broad in *darwini*. The male pygophore is apparently virtually the same in both species.

It could be argued that *darwini* is a subspecies of *spurcatus*. Evidence to the contrary is that *darwini* is made up of two populations west and east divided by an extension of *spurcatus* (which is hardly to be expected of subspecies) and that transitional forms are very rare, only the Derby and one or two (not all) of the Murray Island specimens of *darwini* approach *spurcatus*, these being from localities quite remote from any areas of possible *spurcatus-darwini* contact or overlap whereas if they were subspecies these forms would be expected along the zones of contact, *i.e.*, the region of the Gulf of Carpentaria. As far as can be determined from the material at hand the two species are allopatric. It could also be argued that *darwini* is an impressed variation of *spurcatus* to be found in hotter and/or more humid areas. It can hardly be the more humid factor as many of the localities for *spurcatus* are from quite wet areas of Eastern Queensland. On the evidence presented here the series of *spurcatus* referred to by Carpenter from the Torres Strait region are more likely to be *darwini*, unfortunately I did not see this series when in Europe.

Cephaloplatus (C.) pertyi (White)

Dryptocephalus? (*Cephaloplatus*) *pertyi* White, 1842, Trans. ent. Soc. Lond., 3:90.

Cephaloplatus pertyi Dallas, 1851, List spec. Hem. Ins. coll. Brit. Mus., 1:148.

Cephaloplatys pertyi Distant, 1899, Ann. Mag. nat. Hist., (7)4:433.

Fig. 14

Average sized for the genus, light yellowish or luteous with light brown punctations, sometimes with a reddish tinge. Dorsal surface with scattered granulations.

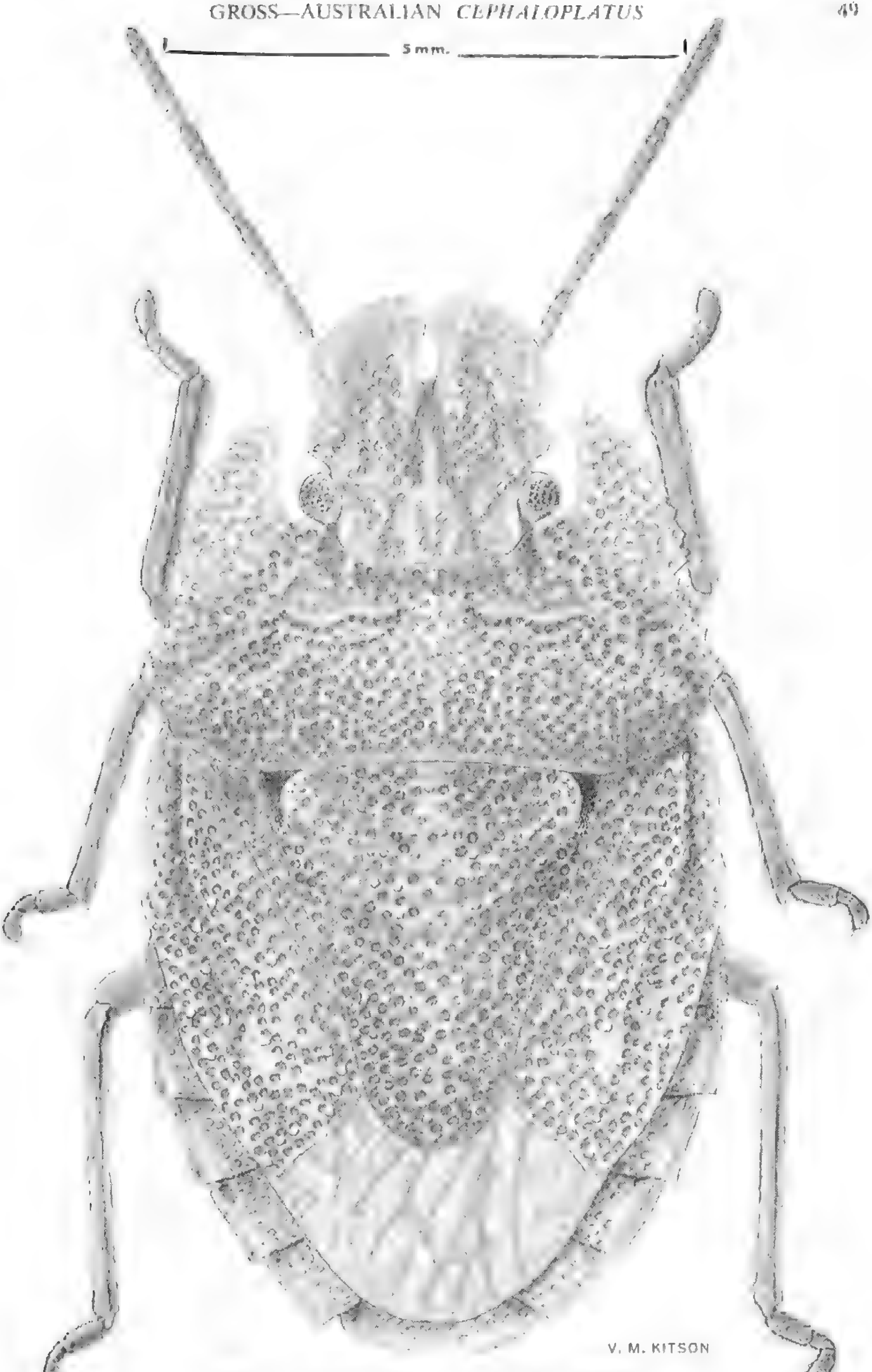

Fig. 14: *Cephaloplatus* (*C.*) *pertyi* (White).

Head with juga developed into foliaceous structures though these at their widest do not extend outwards past the level of the eyes. Lateral margins of the expanded juga slightly concave and convexly flexed laterally, then convexly rounded in turn becoming the relatively long oblique anterior margins, these anterior angles shortly rounded and the inner margins of the produced portion more or less straight and well separated from each other, though not divaricate. Eyes not very prominent and the facets occupying only the anterior half of the optic process which is inclined posteriorly. Antennae slender and five segmented, the fifth segment the longest, the first segment not reaching the apex of the jugum, yellowish but the third and fourth segments in their apical half and the whole of the fifth somewhat infuscated.

Pronotum very moderately convex on the disc, the lateral margins strongly explanately produced and the region of the anterior angles produced forward as a somewhat triangular process to almost the apex of the dorsal aspect of the anteclypeus. Anterior margin of the pronotum convexly excavate, anterolateral margins coarsely dentate or serrate, lateral angles irregularly rounded, posterolateral margins almost straight with a prominent but small tumescence just inward of the lateral angles, hind margin nearly straight.

Scutellum substantially triangular, the lateral margins rather angulately concave, the maximum concavity occurring behind the mid point, apex narrowly rounded, the disc basally somewhat raised.

Hemelytra wider than the body in their basal quarter, this portion of the corial margin denticulate or coarsely crenulate. Behind this point the lateral margins of the corium smooth and gradually converging posteriorly leaving progressively more of the connexivum exposed, hind margin of corium more or less straight. Membrane greyish hyaline with brown, mostly longitudinal, veins and some brown spots between them. Laterotergites with their posterior angles rather angulate and appearing to be somewhat produced.

Beneath mostly concolorous with the upper surface, punctations on the head and thorax coarser and sparser, those on the abdomen finer and denser. Mesosternum, metasternum, two patches at the base of the abdomen, one just behind each metacoxa, and a narrowing lateral band on the first few visible abdominal sternites infuscated. Male pygophore similar to fig. 6C.

Length: 9.75-11.0 mm.

Distribution: *Unlocalized. Holotype* ♀ (B.M.); 1 ♀, from C. French Jun. donated 15 November 1911 (N.M.); 1 ♀ (S.A.M.). *Northern Territory*. 1 ♀, 25-31 January 1968, 2 ♂♂, 4 ♀♀, 1-7 February 1968, 1 ♀, 8-14 February 1968, Horn Islet, Sir Edward Pellew Group, coll. B. Cantrell (U.Q.); 1 ♀, Port Denison; 2 ♂♂, Dip Yard Lagoon via Brock's

Creek, 8 April 1929, coll. T. G. Campbell; 1 ♀, Roper River, September-December 1910, coll. E. D. Frizelle; 1 ♂, Pt. Keats, 26 June 1952, coll Australian Museum NW Australian Party (A.M.); 2 ♂♂, Manbullo Station, Katherine, 8 July 1929, coll. T. G. Campbell; 1 ♂, Marrakai Station, coll. 28-31 July 1929, coll. I. M. Mackerras & T. G. Campbell; 1 ♂, Green Ant Creek near Dip Yard via Brock's Creek, 9 April 1929, coll. T. G. Campbell; 1 ♀, Ladysmith Yard, Turn-off Lagoon, 17 September 1930, coll. T. G. Campbell (A.N.I.C.); 1 ♀, 30 miles East of Darwin, coll. G. F. Hill; 1 ♂, 1 ♀, Borroloola, 2 October 1911, coll. G. F. Hill on Barclay Expedition; 1 ♀, King River, 24 December 1915 (N.M.); 1 ♀, Port Darwin; 1 ♂, 2 ♀♀, Darwin, coll. G. F. Hill; 1 ♂, 30 miles East of Darwin, coll. G. F. Hill; 2 ♂♂, 1 ♀, Daly River, coll. H. Wesselman; 1 ♂, 2 ♀♀, Groote Eylandt, coll. N. B. Tindale; 1 ♂, Finke River, coll. Dr. H. Basedow; 1 ♀, unlocalized, coll. S. A. White; 1 ♂, 1 ♀, unlocalized (S.A.M.); 1 ?, Darwin (Paris); series, Darwin; series, Adelaide River; 1 ♂ Stapleton, coll. G. F. Hill (B.M.); 2 ♂♂ on grass, 7 March 1961, 1 ♂, 21 March 1961, Maningrida, 5 m, Arnhem Land, coll. J. L. & M. Gressitt; 1 ♀, 128 Km South of Darwin, 11 January 1964, coll. J. Sedlacek; 1 ♂, 30 miles East of Darwin (Bishop). *Western Australia.* 1 ♀, Lulingui Station near Derby, West Kimberly, 26 August 1929, coll. I. M. MacKerras & T. G. Campbell (A.N.I.C.); 1 ♂, Roebuck Bay, 19 April 1892, coll. Kraptan (S.A.M.); 1 ♀, Wyndham, coll. Helms (Bishop). *Queensland.* 1 ♂, McIlwraith Range, 31 May 1932, coll. Darlington on Harvard Expedition; 1 ♀ Coen, Cape York Peninsula, 6 July 1932, coll. Darlington on Harvard Expedition (A.M.N.H.); 1 ♀, Yarra, June 1959, coll. J. Guerassimoff; 1 ♂, 2 ♀♀, Breakfast Creek, Silver Plains, East Coast of Cape York Peninsula, 10 August 1963, coll. J. L. Wassel; 1 ♂, 2 ♀♀, Charters Towers, 15 January 1964, coll. G. Monteith (U.Q.); 1 ♂, Retro Station near Capella, August 1929, coll. J. R. Sleven (A.M.); 2 ♂♂, 1 ♀, Eidsvold, 28 September 1929; 1 ♀, 8 miles WNW of Mt. Carbine, 20 September 1956, coll. M. J. D. White; 2 ♂♂, 5 ♀♀, Bamaga, Cape York Peninsula, 27 March-4 April 1964, coll. I. F. B. Common & M. S. Upton (A.N.I.C.); 2 ♀♀, Bluff, coll. A. M. Lea; 2 ♀♀, Mutchilba, February 1933, coll, coll. A. D. Selby (S.A.M.); 3 ♂♂, Rockhampton (Stockholm); 1 ?, Somerset (Paris); 1 ♂, 2 ♀♀, at light, Mornington Island, May 1963, coll. P. Aitken & N. B. Tindale; 1 ♂, 2 ♀♀, Appel Channel, Mornington Island, 2 June 1960, coll. P. Aitken & N. B. Tindale (S.A.M.). *Torres Straits Islands.* 1 ♂, Prince of Wales Island, August 1920, coll. J. A. Kusche (Bishop).

Remarks: The species appears to occur in the Kimberly Division of North Western Australia, the whole of the Northern Territory and in those parts of Queensland North of the latitude of the Northern Territory-South Australian border and in the Torres Straits Islands. It is much more abundant in the North of its distribution than in the South. The Finke

River specimen clearly belongs to this species but the locality label unfortunately does not indicate which state, it could have come from the North of South Australia as the Finke River runs from the Northern Territory into South Australia. It has been assumed to have come from the Northern Territory section of the river's course.

This species and the next (*explanatus* n. sp.) belong to a small section of the subgenus *Cephaloplatus* in which the juga are quite markedly expanded laterally in comparison to the preceding groups of species, reaching laterally to at least the level of the outer surfaces of the eyes. *Pertyi* is easily distinguished from *explanatus* in that the anterolateral margins of the pronotum are strongly crenulate or denticulate (finely crenulate in *explanatus*) and that there is a triangular lobe in front of the eyes (absent in *explanatus*).

Cephaloplatus (C.) explanatus sp. nov.

Fig. 15, 6D

Moderate to rather large in size, yellowish with brown punctations above and below.

Head with juga strongly developed into foliaceous structures which at their widest extend at least to the level of outer margins of the eyes, the lateral margins vaguely semicircular in outline and raised above the general level of the head so that the juga are rather inclined towards the midline. The apical angles of the juga sharply rounded, the inner margins in front of the anteclypeus almost straight, contiguous or not. Eyes not very prominent and the facets occupying only the anterior half of the optic process which is inclined posteriorly. Antennae slender and five segmented, the fourth and fifth segments the longest and subequal, the first segment not reaching the apex of the jugum, yellowish, but the fourth and fifth segments infuscated apically.

Pronotum fairly flattish, raised only a little posteriorly, the lateral margins strongly explanatory produced and the region of the anterior angles produced forward as a broad triangular process almost to the level of the apex of the anteclypeus (as seen from above). Anterior margin of the pronotum rather rectangularly excavate, anterolateral margins finely crenulate, almost entire. Lateral angles broadly rounded, posterolateral margins almost straight, hind margin also.

Scutellum substantially triangular, the lateral margins rather angulately concave, the maximum concavity occurring about the midpoint or a little behind, the apex tending a little towards being lanceolate. Scutellum basally somewhat raised and somewhat granulate on the disc.

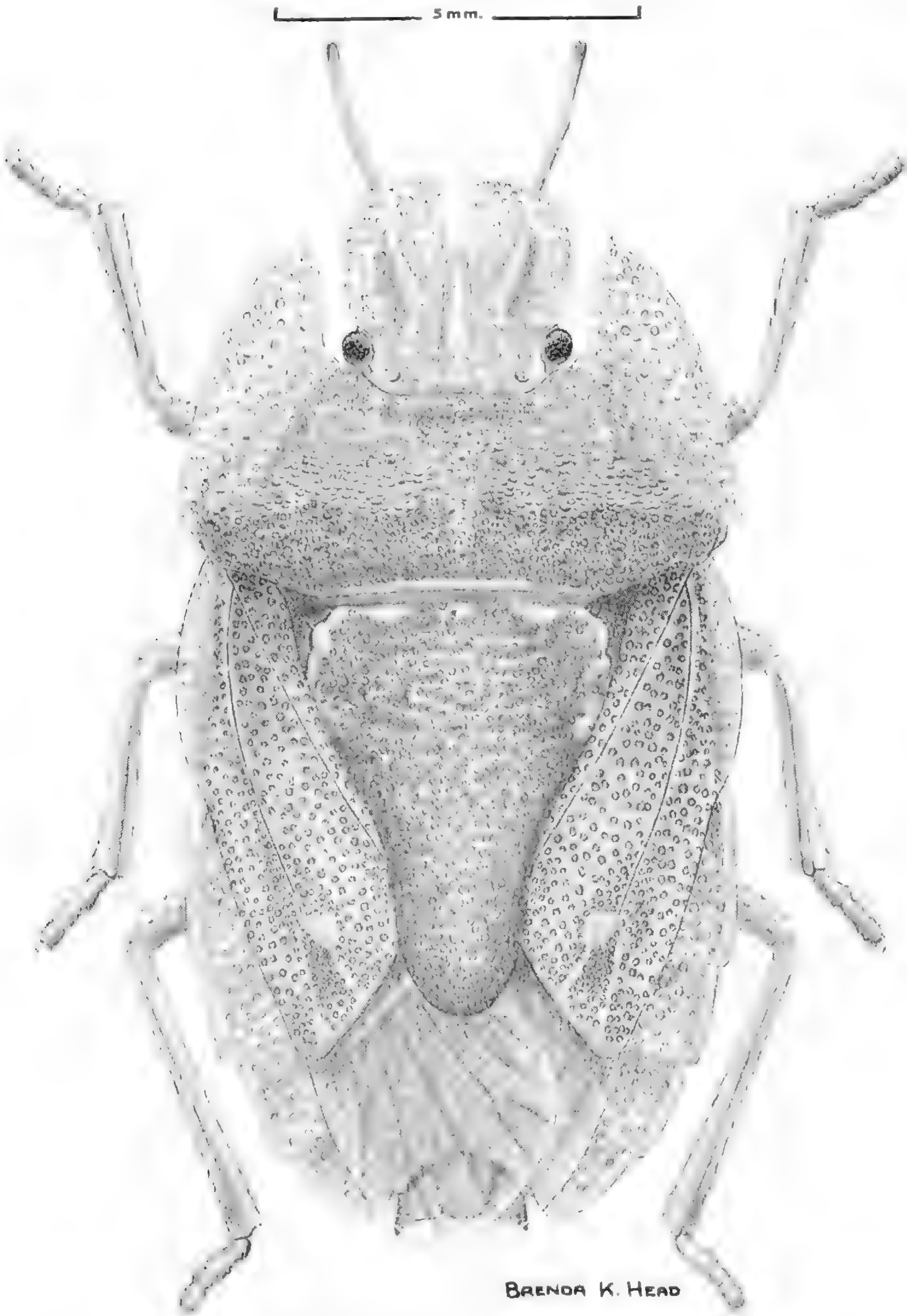

Fig. 15: *Cephaloplatus* (*C.*) *explanatus* sp. nov.

Hemelytra in their basal quarter wider than the body, this part of the corial margin somewhat produced and feebly crenulate. Behind this point the lateral margins of the corium gradually converging posteriorad leaving progressively more of the connexivum exposed, hind margin of corium rather convex. Membrane hyaline with veins almost the same color and mostly longitudinal. Laterotergites rectangular, posteriorly coarsely punctate.

Beneath concolorous with brown punctations, coarser and denser on the thorax, fine and sparse on the underside of the head, same on the underside of the juga where they are coarser and denser. Femora with a few brown granulations. Male pygophore with the apical angles produced (Fig. 6D).

Length: 10.5-13.5 mm.

Distribution: *Northern Territory. Holotype* ♂ (Reg. No. ANIC9421), Katherine, 17 April 1962, coll. I. F. B. Common (A.N.I.C.); *allotype* ♀, Daly Waters, 26 October 1962, coll. E. S. Ross & D. Q. Cavagnaro (C.A.S.). *Western Australia*. 2 *paratype* ♀♀, Upper Ord River, East Kimberley, coll. Helms (B.M.); 1 *paratype* ♂ (Reg. No. T4116), North West Australia (N.M.). *Unlocalized*. 1 *paratype* ♂, presented by Commonwealth Institute of Entomology 1948 (B.M.).

Remarks: The species seems rather rare and is easily recognized by the very foliaceously produced juga and the strongly developed laminate lateral margins of the pronotum which are strongly produced forward but not conspicuously crenulate.

Cephaloplatus (C.) reticulatus Bergroth

Cephaloplatys reticulatus Bergroth, 1895, Proc. R. Soc. Vict. 7:288. Distant, 1910, Ann. Mag. nat. Hist., (8)6:472.

Cephaloplatus reticulatus Tay, 1966, Pap. Dep. Ent. Univ. Qd. 2(4):76-77, figs.

Fig. 16, 6E.

A very distinctive and rather large species of the genus. In macroscopic appearance reddish or orange, the ground colour is actually pinkish yellow or orange, and the punctations black or dark brown. There are small to moderate sized granular structures on the hind lobe of the pronotum, the scutellum, and the hemelytra; these are rather different in appearance and form to those of the species we have treated previously, they may be better described as rugulosities.

Head with juga conspicuously and rather foliaceously expanded, produced forward well in front of the anteclypeus. Lateral margins of juga immediately in front of eye formed into a broadly triangular lobe which reaches outwards to about level of the outer margin of the eyes, this lobe

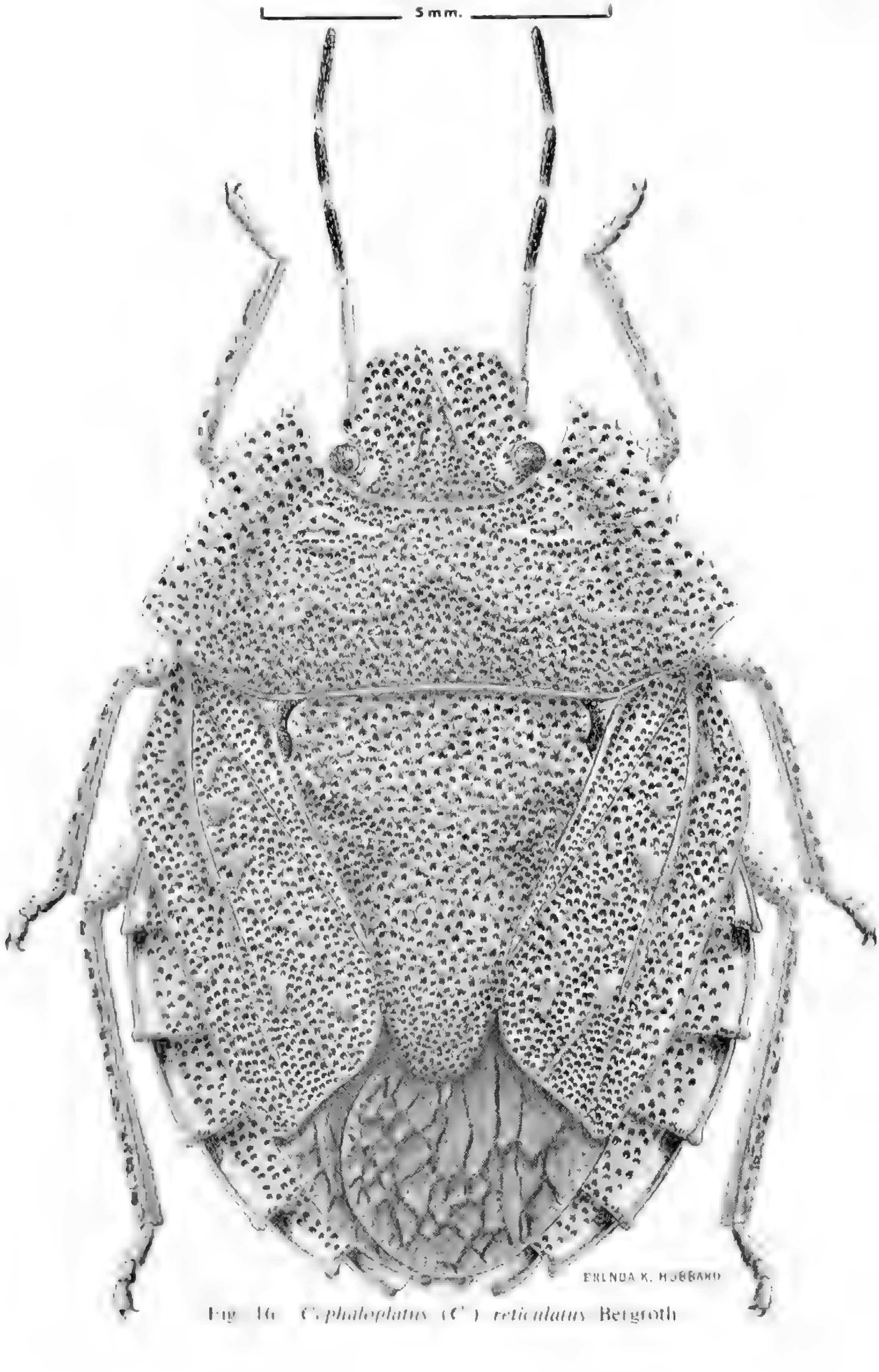

Fig. 16. *Cephaloplatus (C.) reticulatus* Bergroth

rather strongly convex above. Lateral margins of the juga anterior to this process broadly semicircularly curved to the shortly rounded apices, this curvature sometimes somewhat sinuate, interior margins of juga only slightly convex widely separated or contiguous. Lateral and anterior margins of juga somewhat raised so that the anterior portion of the head in front of the eyes is rather concave. Head moderately raised between the ocelli. Eyes fairly prominent, facets occupying all of the anterior facing surface, only the hind rather concave surface bare and somewhat flattened. Antennae a little more robust than in the other species, first segment not reaching the apices of the juga, second, fourth, and fifth segments subequal, third segment somewhat shorter. Antennae reddish or yellowish in colour all but the apex and base of the third segment and the apical half of the fourth and fifth infuscated.

Pronotum raised posteriorly, more depressed anteriorly, the anterolateral margins progressively more explanate from the lateral angles forward, the region of the anterior angles produced as a triangular process forward to about the anterior portion of the convex process on the margins of the juga (just in front of the eyes). Anterior margin of pronotum strongly concave behind the collum, just behind the eyes forming a slight angle then concave again and diverging to the apices of the anterior processes. Anterolateral margins rather sinuate, strongly denticulate, crenulate, or serrate, in many specimens tending to be somewhat flexed a little in front of the lateral angles. Punctations on the explanate lateral margins of the pronotum much larger and much less dense than on most other parts of the body. Lateral angles produced as a rather blunt lobe, posterolateral margins angulately convex, posterior margin straight or somewhat concave. Disc of the posterior part of the pronotum with scattered rugulosities, these rugulosities tending to appear in the form of short raised lines and some of these lines tending to be raised as an incipient sinuous transverse line extending across the pronotum between the lateral angles.

Scutellum much the same shape as in the other species of the genus but the angulation in the lateral margins behind the middle somewhat more pronounced, tip broadly rounded. In each basal angle of the scutellum the usual elongate black fovea, but this fovea not margined on its interior side by a smooth callous area. Whole disc of the pronotum rather irregularly rugulose in contrast to all preceding species which have been in the main granulate.

Hemelytra in their basal quarter wider than the abdomen, this portion of the corial margin formed as a convex angle in contrast to other species and interiorly and forward of this angle and between the first and outer visible vein strongly concave. Behind this point the corial margins relatively straight then strongly converging leaving almost all of the connexivum exposed. Disc of the corium covered with rugulose and raised glabrous areas. Hind margin of corium exteriorly somewhat convexly prominent, thence slightly concave interiorly, broadly convex. Membrane with veins strongly reticulate, hyaline, the veins brownish, no trace of raised brownish spots or maculae between the veins. Abdomen relatively much wider than in the other species, laterotergites concolorous but with a prominent infuscated marking exteriorly behind each incisure. Hind angle of the laterotergites strongly prominent.

Beneath concolorous with the dorsal surface, punctations more evenly distributed and somewhat denser. On the underside of the head there is a short infuscated bar immediately in front of the insertion of each antenna and a fuscous area at the base of the head behind the bucculae. All thoracic sterna are brown or piceous save the keel on the mesosternum which is yellow. A small fuscous point just above the junction between the epimeron and the episternum on each thoracic segment. On the abdomen the base of the third segment narrowly and transversely darkened, strongly punctate, medially at the base of the fourth, fifth, sixth and seventh abdominal sternites a short brownish line or bar, running longitudinally, and giving the impression of an interrupted line running the length of the abdomen medially. There is no sign of any areas of lateral infuscation. Legs reddish yellow or yellowish with on the the femora and tibia largish somewhat raised brown spots, some of those on the femora bearing a hair. Male pygophore figured (fig. 6E).

Length: 12.0-14.0 mm.

Distribution: *Queensland*. *Lectotype* ♂ (Reg. No. T4115), donated C. French Jun., 15 November 1911 (N.M.). *New South Wales*. Tibooburra, 23 May 1949, coll. K. H. L. Key (A.N.I.C.). *Victoria*. 1 ♀, Hattah, 16 June 1948, coll. C. Oke (N.M.). *South Australia*, 3 ♀♀, Leigh Creek; 3 ♀♀, South of Ediacara, 5 November 1959, coll. P. Aitken (S.A.M.). *Western Australia*. 3 ♀♀, Lennaville; 1 ♂, Wiluna, 29 August 1968, coll. F. H. Uther Baker; 1 ♀, Mullewa, coll Miss F. May (S.A.M.); series, Violet Range, E. Murchison, accessed 1904 (B.M.). *Unlocalized*. 1 ♀, donated by F. P. Spry, 5 October 1922 (N.M.).

Remarks: As for *C.* (*C.*) *granulatus* Bergroth the type of this species was not found in Helsinki, nor indeed any examples of this species. However, there was again in the collection of the National Museum of Victoria a male specimen from the C. French collection which fits Bergroth's description of *Cephaloplatys reticulatus* even to the missing fifth antennal segment, although the specimen no longer carries an indication that it came from Queensland. This male specimen is accordingly selected as the lectotype of "*Cephaloplatys reticulatus*" Bergroth and marked accordingly.

Because of its larger size and conspicuously reticulate membrane the species is one of the easiest of *Cephaloplatus* species to recognize. From the data available it appears to be restricted to drier habitats but with a rather more southern distribution than the other species.

The male and female genitalia were discussed by Tay (1966).

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RECORDS OF THE
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By W. GRANT INGLIS

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Summary

The five species described here were collected on the coast of Western Australia and represent on new species of *Praeacanthonchus*, and four species of *Paracanthonchus*, of which three are new. Both genera are referable to the family Cyatholaimidae of the Order Chromadorida, an Order in which most of the classification is based on the structure of the cuticle, the shape of the amphids and the form of the dorsal onchium in the oesophastome. However a study of *Euchromadora* de Man, 1886 and apparently similar species, all referable to the Chromadorida, has raised doubts as to the value of some of the characters, and to the way in which they have been used (Inglis, 1969).

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The five species described here were collected on the coast of Western Australia and represent one new species of *Praeacanthonchus*, and four species of *Paracanthonchus*, of which three are new. Both genera are referable to the family Cyatholaimidae of the Order Chromadorida, an Order in which most of the classification is based on the structure of the cuticle, the shape of the amphids and the form of the dorsal onchium in the oesophastome. However a study of *Euchromadora* de Man, 1886 and apparently similar species, all referable to the Chromadorida, has raised doubts as to the value of some of the characters, and to the way in which they have been used (Inglis, 1969).

Briefly, the difficulty arises because much of the classification of the family Chromadoridae, of which *Euchromadora* is a member, has been based on the distinction between a solid or a hollow dorsal onchium in association with features of the cuticle and the shape of the gubernaculum and on assumed co-variances between these characters. The previous study (Inglis, 1969) has shown that a solid dorsal onchium is associated with a number of other characters, particularly with the presence of small denticles along the anterior edge of the dorsal wall of the oesophastome and a series of transverse rows of denticles on the lateral and ventral walls of the oesophastome. In contrast, when the dorsal onchium is hollow there are no dorsal denticles and instead of transverse rows of lateral and ventral denticles there are a small number of conical denticles laterally, in one row, and two or four similar ventral denticles. Other features, particularly of the cuticle, are associated with the two groups while the shape of the gubernaculum is not convariant with these characters.

In some specimens it was difficult to decide if the dorsal onchium was unequivocably solid or hollow but in some in which it appeared solid the dentition and characters of the cuticle were similar to those otherwise only found in forms with hollow onchia. It is, therefore, likely that there are several convergent groups within the Chromadorida which culminate in superficially similar forms with complicated cuticles, solid dorsal onchia and similar gubernacula. This implies the possibility that forms with simple punctate cuticles, which are currently classified together, may also be grouped on convergent characters. All the species described here have such simple punctate cuticles and it appeared possible that their head structure would help to resolve this problem.

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COMPARATIVE ANATOMY

Cuticle

In all the species described below, with one exception, the cuticle is marked by distinct, round punctations but the occurrence and kind of lateral differentiation is variable. The amphids are spiral and "pore-complexes" are present in some species. As a result of Wright and Hope's (1968) study of the "campaniform-type" organ I use their term "pore-complex" while stressing that two types exist (Inglis, 1963). The Type-1, which Wright and Hope studied appears as a pit in the cuticle transversed by an elongate opening while the Type-2, which is generally a larger form, is similarly a pit but with a circular opening (or dome?) in the centre. The distribution of these two types still appears to be of significance.

Type-2 pores have only been found in files posterior to the amphids or on the lateral surface of the body at the level of the cloacal opening. In *P. margaretae*, which is described below, there is a file of Type-1 pores running posteriorly to the amphids. This raises the possibility that Types-1 and -2 are two expressions of the same type. This must await confirmation as such an implied distortion has never been seen when specimens of the same species are compared.

Head

The mouth opening is bounded by the usual twelve rugae and leads into an oesophastome through a cheilostome which appears to be circular in transverse optical section. There is a hollow dorsal onchium in all species. In the three species of *Paracanthonchus* in which *en face* preparations were studied the oesophastome is triangular in transverse section with two small onchia borne on a muscular pad on each ventro-lateral oesopharhabdion (Figs. 2, 8 and 14). The apparent differences are probably due to the degree to which the oesophastome is open. If this is so the condition shown for *P. margaretae* (Fig. 14) may be interpreted as the fully open condition, that for *P. cheynei* (Fig. 8) as fully closed while that for *P. kartanum* (Fig. 2) is intermediate.

The structure of the oesophastome in the three species studied corresponds to the grouping formed on other characters and the conditions are different from those described for the *Euchromadora* and *Euchromadora*-like species studied before (Inglis, 1969), particularly in the triangular oesophastome in transverse section. Nevertheless the conditions correspond more closely to those in the "hollow-toothed" forms than those in the "solid-toothed". Further work is certainly warranted and likely to be of value in clarifying the classification of the Chromadorida.

MALE

In all the species there is a series of pre-cloacal supplements on the mid-ventral surface anterior to the cloacal opening. In all four species of *Paraconthonchus* the supplements are rod-like while in the *Praeacanthonchus* species they are indistinct and tube-like. However in all cases they do not appear to open on the surface of the body, in so far as I can tell with the light microscope.

In addition to these supplements, in all species, two other structures lie close together immediately anterior to the cloacal opening which are usually called supplements but which are structurally different. In all five species these are in the form of pits in the cuticle into which a cuticular process projects from the anterior edge (Figs. 5, 20 and 23). That these "supplements" are different from those more anteriorly is not, of course, a new discovery and they occur in a wide range of Chromadorida. It appears likely that they are of taxonomic importance as they differ in shape and their function must be different from the other more anterior supplements. I propose, therefore, to call them "*cloacids*" about which more information is needed.

FEMALE

In two of the species described below there is a distinct pit in the cuticle both anterior and posterior to the vulvar opening. They are probably sense organs as a nerve process appears to project into the bottom of each.

DESCRIPTIVE SECTION

Holotype males will be deposited in the Western Australian Museum and paratypes in that institution and in the British Museum (Natural History) where unsorted samples are also held. All localities are in Western Australia.

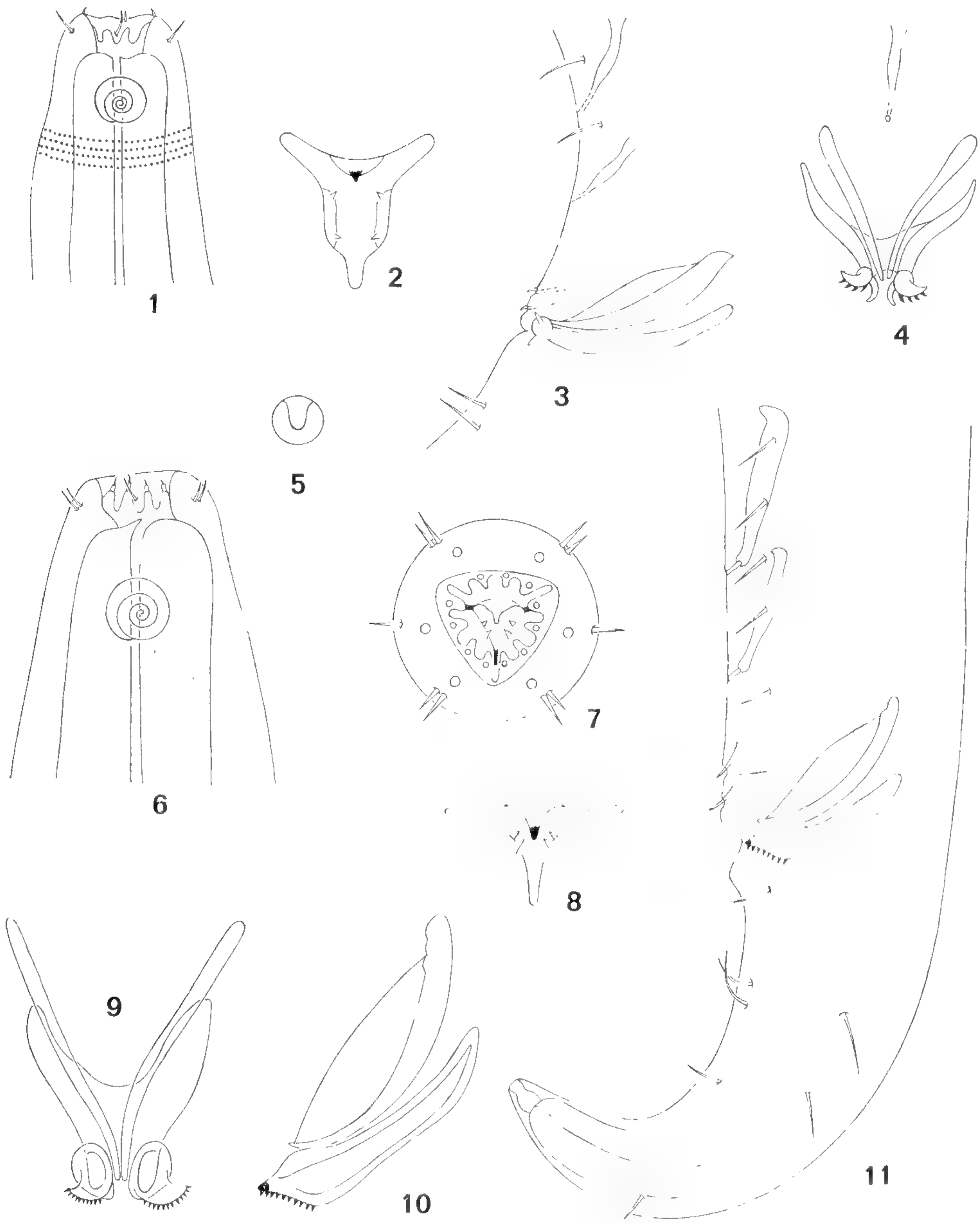
In agreement with previous policy (Wieser and Hopper, 1967: Inglis, (1969) only absolute measurements are given in the descriptions.

Paracanthonchus kartanum (Mawson, 1953)

(Figs. 1-5)

SYNONOMY

Harveyjohnstonia kartanum Mawson, 1953: Pennington Bay, Kangaroo Island, South Australia.



Figs. 1-5. *Paracanthonchus kartanum*. Fig. 1. Lateral view of head, dorsal to right. Fig. 2. Oesophastomal dentition, sketch. Fig. 3. Cloacal region. Fig. 4. Spicules and gubernaculum, ventral view. Fig. 5. Cloacid, sketch. Figs. 6-11. *P. cheynei*. Fig. 6. Lateral view of head, dorsal to left. Fig. 7. Head, *en face*. Fig. 8. Oesophastomal dentition, sketch. Figs. 9-10. Spicules and gubernaculum. Fig. 11. Lateral view, male tail.

LOCALITIES

Among weed and associated sand in hold fasts on exposed rocks, Goode Beach, Albany.

Among weed and mussels in rock pools exposed at low tide, Hall's Head, Mandurah.

Among weed and associated hold fasts and sand on a silty sheltered beach, Cheyne Beach, near Albany.

Among sea-weeds and associated sand in rock pools, Bunker Bay, Geographe Bay.

MEASUREMENTS (mm).

MALE. Body length: 0.87; 0.91; 0.99; 1.04. Body breadth: 0.043; 0.043; 0.050; 0.044. Oesophagus length: 0.152; 0.159; 0.152; 0.155. Diameter of head: 0.017; 0.017; 0.018; 0.017. Lengths of cephalic setae: 0.005; 0.005; 0.004; 0.004. Excretory pore from anterior end of body: 0.068; 0.066; 0.070; 0.069. Diameter of body at amphid: 0.024; 0.022; 0.023; 0.024. Diameter of amphid: 0.009; 0.009; 0.009; 0.009. Length of spicules: 0.027; 0.023; 0.025; 0.029. Length of gubernaculum: 0.033; 0.026; 0.033; 0.036. Length of tail: 0.078; 0.097; 0.079; 0.086. Cloacal diameter: 0.043; 0.039; 0.040; 0.036.

The cuticle is marked by fine punctations and there is no lateral differentiation. There are two lateral files of setae running the length of the body but no "pores" were seen. No dome-like Type-2 "pores" occur behind the amphids or lateral to the cloacal opening.

The six inner sense organs are setose, and there are twelve equal setae in the outer circle. The amphids are spiral with 4¼ to 4½ turns. The dorsal onchium is very small and there are two similar onchia, which arise from a raised muscular pad on each ventro-lateral wall of the oesophastome. The cheilostome and oesophastome are triangular in transverse section although I am not certain whether this reflects a constant feature or simply the degree of muscle contraction.

The tail is fairly slim. There are four well cuticularized, tubular pre-cloacal supplements on the mid-ventral surface of the body anterior to the cloacal opening which increase in size anteriorly. In addition there are two circular cloacids immediately anterior to the cloacal opening into each of which projects a small cuticular process.

The spicules are fairly massive with narrow alae. The gubernaculum is about the same width along its length with a rounded slightly swollen region posteriorly, which bears a series of four small denticles and from which arises a pair of obvious finger-like postero-dorsally directed processes.

DISCUSSION

The only marked difference between the specimens from Western Australia and those described by Mawson (1953) is in the number of turns in the spiral amphids. Mawson refers to $3\frac{1}{2}$ while I count $4\frac{1}{4}$ to $4\frac{1}{2}$, on different specimens. The difference is probably due to the method of counting.

It is worth noting that Mawson comments specifically on the increase in size of the pre-cloacal supplements anteriorly and this feature is very obvious in the Western Australian specimens.

Paracanthonchus cheynei sp. nov.

(Figs. 6-11)

LOCALITIES

Among sea-weed and hold-fasts with associated sand in 20 cm of silty, sheltered water. Cheyne Beach, near Albany. Type locality.

Among sea-weed on exposed reef in 10 cm of clear water. Radar Reef, Rottnest Island.

MEASUREMENTS (mm).

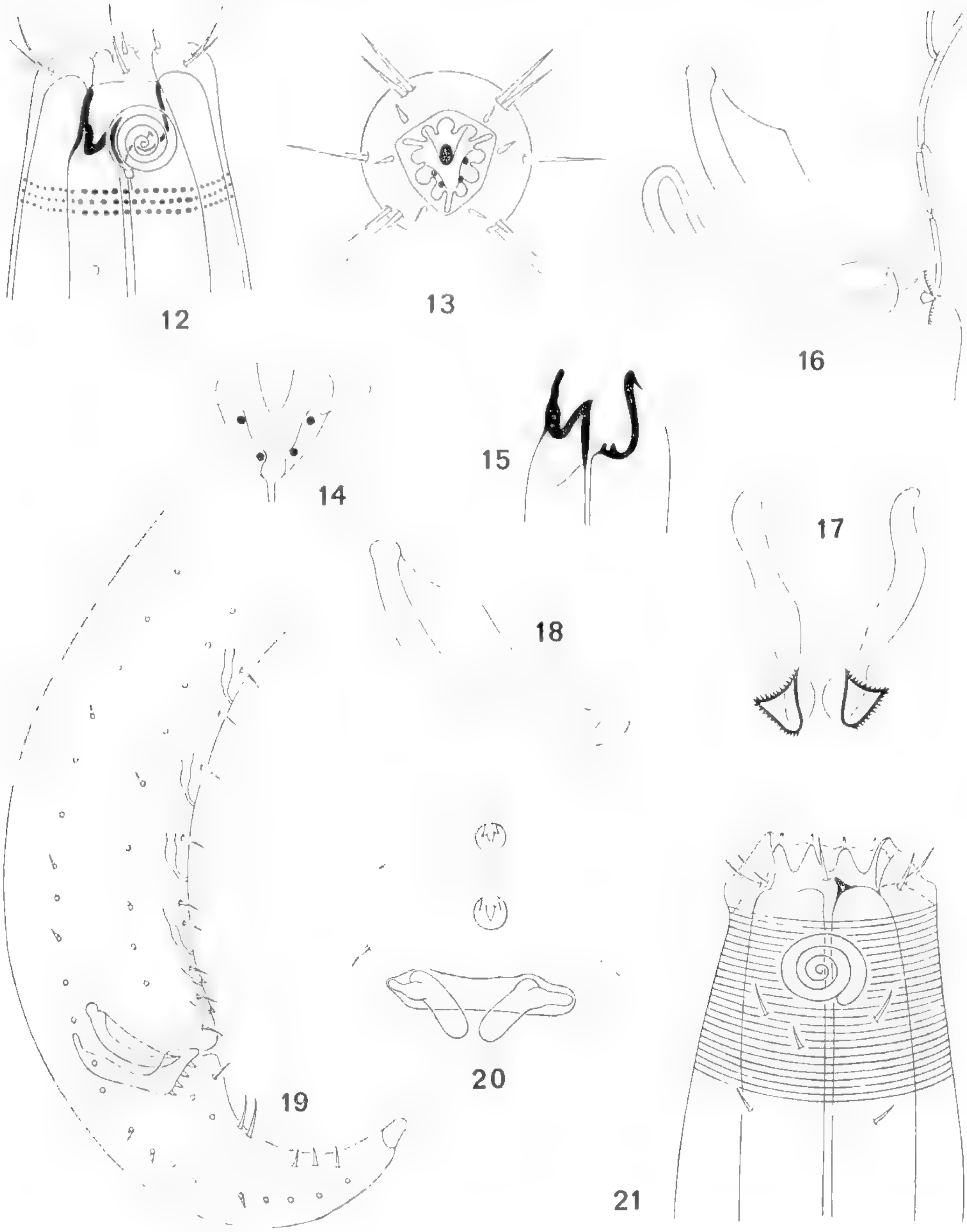
MALE. Body length: 1.24; 1.28. Body breadth: 0.052; 0.052. Oesophagus length: 0.198; 0.203. Length of cephalic setae: 0.005; 0.005. Diameter of head: 0.021; 0.023. Distance of excretory pore from anterior end of body: 0.057; 0.059. Amphid diameter: 0.010; 0.009. Length of spicules: 0.046; 0.048. Length of gubernaculum: 0.039; 0.042. Cloacal diameter: 0.046; 0.049. Length of tail: 0.125; 0.131.

FEMALE. Body length: 1.09. Body breadth: 0.059. Oesophagus length: 0.173. Length of cephalic setae: 0.005. Diameter of head: 0.025. Distance of excretory pore from anterior end of body: 0.057. Amphid diameter: 0.009. Anal diameter: 0.038. Length of tail: 0.103. Distance of vulva from anterior end of body: 0.60. Eggs: 0.062 x 0.036.

The cuticle is marked by fine punctations without lateral differentiation. There are two files of transverse Type-1 "pores" on each lateral surface of the body and four circular Type-2 "pores" in a file posterior to each amphid.

The mouth is bounded with the usual twelve rugae, the inner sense organs are six papillae and the twelve members of the outer circle are short setae all of the same length. The amphids have $4\frac{1}{4}$ spirals. The dorsal onchium is small and there are two smaller, sharp onchia on each ventro-lateral wall of the oesophastome. No ocelli were seen.

The tail is relatively stout and bears a pair of long ventral setae about one quarter tail length posterior to the cloacal opening.



Figs. 12-18. *Paracanthonchus margaretae*. Fig. 12. Lateral view of head, dorsal to left. Fig. 13. Head, *en face*. Fig. 14. Oesophastomal dentition, sketch. Fig. 15. Oesophastomal dentition, lateral view, sketch. Fig. 16. Spicules and gubernaculum, lateral view. Fig. 17. Gubernaculum, ventral view. Fig. 18. Detail of spicule. Figs. 19-21. *P. hartogi*. Fig. 19. Male tail, lateral view. Fig. 20. Ventral view of gubernaculum and cloacids. Fig. 21. Lateral view of head, dorsal to right.

MALE. There are four very prominent, strongly cuticularized pre-cloacal supplements and two cloacids with the usual cuticular processes projecting into them. The spicules are slightly bowed with sharp posterior ends and broad alae, confirmed by dissection. The gubernaculum is massive and slightly L-shaped. The posterior end is swollen with small denticles along the postero-ventral edge. In ventral view this region curves laterally and the denticles run along the posterior edge.

FEMALE. The reproductive system is double, opposed and reflexed. There are small vulvar pits in the cuticle, into which sensory processes appear to project through the base.

DISCUSSION

This species is very similar to *P. platypus* Wieser and Hopper, 1967, particularly in the shape of the gubernaculum. It differs in the series of small denticles on the posterior edge of the gubernaculum, the strongly alate spicules, the greater number of spirals in the amphids, and the absence of a spine on the anterior lip of the cloacal opening.

Paracanthonchus margaretae sp. nov.

(Figs. 12-18)

LOCALITIES

Among weed and associated hold-fasts and sand in 20 cm of silty, sheltered water. Cheyne Beach, near Albany. Type locality.

Among weed and associated sand and silt on partly exposed, fairly sheltered rocks. Windy Harbour.

Among weed and hold-fasts on rocks in 10 cm of water. Bunker Bay, Cape Naturaliste.

MEASUREMENTS (mm).

MALE. Body length: 1.28; 1.48. Body breadth: 0.048; 0.055. Oesophagus length: 0.25; 0.34. Length of cephalic setae, long/short/inner; 0.012/0.009/0.003; 0.011/0.008/0.003. Amphid diameter: 0.010; 0.010. Distance of excretory pore from anterior end: 0.069; 0.071. Spicule length: 0.048; 0.047. Gubernaculum length: 0.044; 0.045. Tail length: 0.100; 0.102. Cloacal diameter: 0.039; 0.046.

FEMALE. Body length: 1.21. Body breadth: 0.059. Oesophagus length: 0.30. Length of cephalic setae, long/short/inner: 0.013/0.011/0.004. Amphid diameter: 0.011. Distance of excretory pore from anterior end: 0.069. Tail length: 0.101. Anal diameter: 0.036. Distance of vulva from anterior end: 0.64.

The cuticle is marked by fairly strong punctations and the lateral differentiation is well developed as large, regularly arranged dots anteriorly which become less obvious posteriorly. There are eight files of transversely ridged Type-1 pores, two on the lateral, two on the dorsal and two on each ventral surface. There are three very prominent, elongate Type-1 pores, with antero-posterior openings, at the level of the cloacal opening on the males.

The cephalic sense organs of the inner circle are setae and the outer circle of ten setae consists of six long and four short. The amphids have 4¾ spirals. The oesophastome is a prominent, deep cavity which is triangular in transverse section. The dorsal onchium is large and hollow and there are two small onchia on each ventro-lateral wall of the oesophastome arising from a muscular pad. The tail is short and stout.

MALE. The four pre-cloacal supplements are relatively short and rod-like while the two cloacids have somewhat arrow-shaped processes projecting into them. The spicules bear fairly broad alae, are massive and even in width. The anterior ends are swollen and rounded while the posterior ends bear distinct rounded swellings before narrowing rapidly to a sharp posterior tip. The gubernaculum is also massive and apparently ends posteriorly in a straight dentate edge from the centre of which arises a laterally directed tooth. In ventral view however each half of the gubernaculum folds laterally at the posterior end as a triangular curved portion which has small denticles along both outer edges. The impression of a large median tooth in lateral view is due to studying the folded region from the side.

FEMALE. The reproduction system is opposed and reflexed with sensory pits anterior and posterior to the vulva.

DISCUSSION

This species is similar to *P. caleus* (Bastian, 1865) and *P. tyrrhenicus* (Brunetti, 1949) but differs from them, and all others in the genus, in the posterior end of the gubernaculum, the small number of spirals in the amphid and in the lateral differentiation.

Paracanthonchus hartogi sp. nov.

(Figs. 19-22)

LOCALITY

Among mud and weed from trawl in 35 metres. Shark Bay.

MEASUREMENTS (mm).

MALE. Body length: 1.24; 1.42. Body breadth: 0.066; 0.072. Oesophagus length: 0.22; 0.20. Length of cephalic setae, long/short: 0.0038/0.0026; 0.0039/0.0026. Diameter of amphid: 0.013; 0.012. Distance of excretory pore from anterior end: 0.056; 0.049. Spicule length: 0.049; 0.044. Gubernaculum length: 0.044; 0.039. Length of pre-cloacal supplements: 0.026; 0.024. Length of tail: 0.010; 0.011. Cloacal diameter: 0.049; 0.049.

The cuticle is marked by fine striations and there is no lateral differentiation or indication of punctations. Two files of stout setae run the length of each lateral surface of the body but no "pores" were seen.

The inner circle of cephalic sense organs was not seen and the outer circle of twelve setae consists of six long and four short. The spiral amphids consist of 3¼ spirals. No *en face* view was prepared and from the lateral aspect only a small dorsal onchium could be seen. The oesophagus is simple club-shaped and expands evenly and slightly posteriorly.

The short stout tail is curved ventrally and the four pre-cloacal supplements are prominent, well sclerotized tubes. The two cloacids are circular pits into which project arrow-head-like processes. The spicules are relatively small with narrow alae and distinctly set off semi-spherical proximal ends. The gubernaculum is L-shaped with a massive distal end which bears four prominent teeth.

DISCUSSION

The relationships of this species are a little uncertain because the cuticle is marked by fine striations with no indication of punctations. On the other hand the shape of the gubernaculum and the form of the pre-cloacal supplements is so similar to that found in some species referred to *Paracanthonchus*, that I have little hesitation in referring this Western Australian species to that genus.

In particular *P. hartogi* resembles *P. serratus* Wieser 1959 but differs from it in the square distal end of the gubernaculum and the prominent teeth on the same region, in addition to the form of the cuticle.

Praeacanthonchus cygnis sp. nov.

(Figs. 23-28)

LOCALITY

Among rocks and sea-weed in 10 cm water, Woodman's Point, Fremantle.

MEASUREMENTS (mm).

MALE. Body length: 1.60; 1.69; 1.85. Body breadth: 0.079; 0.075; 0.068. Oesophagus length: 0.22; 0.23; 0.23. Length cephalic setae, long/short: 0.008/0.009; 0.009/0.011; 0.010/0.012. Distance of excretory pore from anterior end: 0.12; 0.13; 0.12. Diameter of amphid: 0.013; 0.012; 0.013. Diameter at amphid: 0.039; 0.039; 0.035. Spicule length: 0.047; 0.048; 0.046. Gubernaculum length: 0.057; 0.061; 0.056. Length of tail: 0.15; 0.17; 0.19. Cloacal diameter: 0.073; 0.066; 0.057.

The cuticle is marked by regular punctations with a slight lateral differentiation where the punctations are irregularly arranged. The body

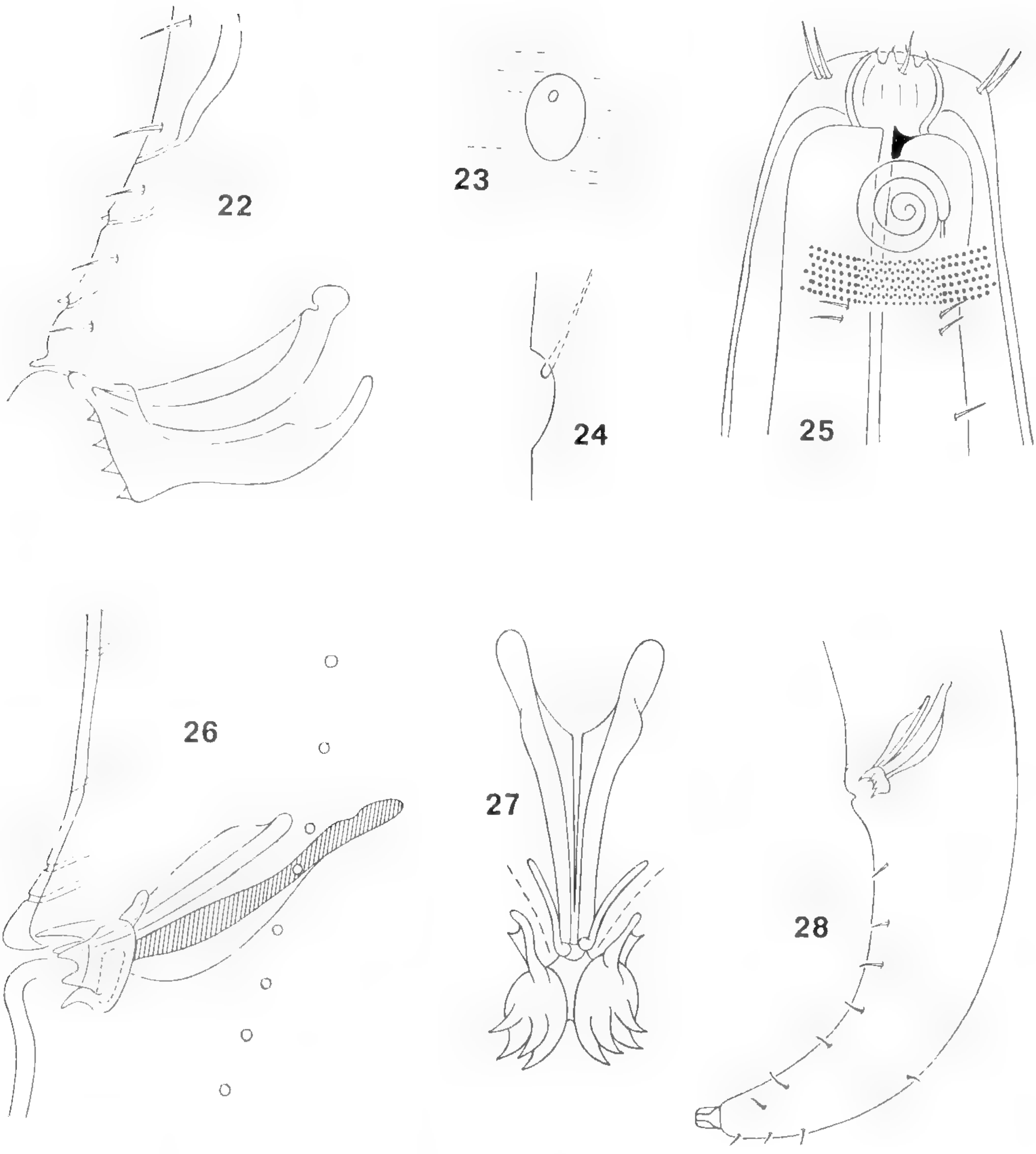


Fig. 22. *Paracanthonchus hartogi.* Detail of spicules and gubernaculum. Figs. 23-28. *Praeacanthonchus cygnis.* Figs. 23-24. Ventral and lateral views of cloacid, sketch. Fig. 25. Lateral view of head, dorsal to right. Figs. 26-27. Detail of spicules and gubernaculum. Fig. 28. Male tail, lateral view.

bears a number of short setae, and eight files of transverse Type-1 pores. A wholly lateral file of four circular Type-2 pores runs posterior to each amphid and there is a file of six such pores on each lateral surface of the body at the level of the cloacal opening.

The head is typical with an inner circle of six papillate sense organs and an outer circle of ten setae of which six are short and four are long. The amphids are spiral with 3½ to 3¾ turns each and lie relatively far posterior to the anterior end of the head. I have been unable to prepare a satisfactory *en face* view of the head but there is a small dorsal onchium and no indication of any lateral or ventral onchia in lateral view.

The tail is short and stout. There are six indistinct midventral, tubular pre-cloacal supplements. The two cloacids lying just anterior to the cloacal opening are small ovoid depressions into each of which projects a small finger-like process.

The slim spicules are about three-quarters the length of the massive gubernaculum and bear slight alae. The gubernaculum is massive distally with four strongly developed teeth. Proximally the gubereulum is slim in lateral view. The spicules run in a groove between the four-toothed posterior heads and a pair of lateral processes which arise from the main body of the gubernaculum. The body of the gubernaculum is split for almost its whole length and consists of a well sclerotized rod which bears a thin, less well sclerotized region dorsally and internally.

DISCUSSION

The combination of a typically *Cyatholaimus*-type gubernaculum, slight lateral differentiation on the cuticle, and indistinct tubular pre-cloacal supplements is diagnostic of the genus *Praeacanthonchus* Micoletzky, 1924b according to Wieser (1954). The only previously known species of this genus is *P. punctatus* (Bastian, 1865) if De Man's (1890) redescription is accepted.

P. cygnis differs from *P. punctatus* in several ways, particularly in the shape of the proximal end of the gubernaculum which is slim in *P. cygnis* but stout in *P. punctatus*; the spicules of the latter species have very wide alae while those of *P. cygnis* are narrow and the spicules of *P. punctatus* are longer than those of *P. cygnis* relative to the length of the gubernaculum.

ACKNOWLEDGMENTS

The specimens described here were collected in Western Australia while I was an exchange curator at the Western Australian Museum. I thank the Director and staff of that Museum for their assistance during my stay. Miss E. Mitchell assisted in sorting material in the British Museum (Natural History) and Mrs. B. K. Head, South Australian Museum, prepared the illustrations.

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RECORDS OF THE SOUTH AUSTRALIAN MUSEUM

THE GENUS CTENOTUS (LACERTILIA, SCINCIDAE) IN SOUTH AUSTRALIA

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BY *G. M. STORR*

Summary

Examination of the material in Australian museums reveals that 17 species and subspecies of *Ctenotus* occue in South Australia, including two new species, *C. brachyonyx* and *C. regius*, and two new subspecies, *C. uber orientalis* and *C. brooksi euclae*. A key is provided.

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By G. M. STORR

Curator of Birds and Reptiles, Western Australian Museum

SYNOPSIS

Examination of the material in Australian museums reveals that 17 species and subspecies of *Ctenotus* occur in South Australia, including two new species, *C. brachyonyx* and *C. regius*, and two new subspecies, *C. uber orientalis* and *C. brooksi euclae*. A key is provided.

INTRODUCTION

Of the 14 species of *Ctenotus* known from South Australia, all but two occur in neighbouring parts of Western Australia or the Northern Territory. My papers on the *Ctenotus* of the Eastern Division of Western Australia (Storr 1969) and of the Northern Territory (Storr 1970) thus serve as an introduction to the South Australian fauna. The reader is also referred to those papers for descriptions of the seven species and subspecies restricted in South Australia to the far north and west; they are represented by too few South Australian specimens to warrant a local description.

As the foregoing remarks imply, the arid northwest of South Australia is much richer in *Ctenotus* than the humid southeast. The differences are probably still greater than is apparent here, for much of western South Australia is virtually unexplored, and a further six taxa could eventually be found there: *dux* and *colletti nasutus* in the far northwest; *grandis*, *piankai* and *calurus* in the Great Victoria Desert; and *u. uber* on the Nullarbor Plain. Users of the key will need to bear this in mind when identifying western specimens.

C. impar has been omitted from this paper. This species is certainly known only from southwestern Australia, and the provenance of a specimen from Ooldea (SAM 9980) requires confirmation.

For the loan of specimens in the South Australian Museum (SAM), National Museum of Victoria (NMV), Australian Museum, Sydney (AM), Queensland Museum (QM), Arid Zone Research Institute, Alice Springs (NTM), and the Pianka Collection (ERP), I am grateful respectively to Mr. F. J. Mitchell, Miss J. M. Dixon, Dr. H. G. Cogger, Miss J. Covacevich, Mr. B. L. Bolton, and Dr. E. R. Pianka.

I dedicate this paper to the memory of Francis John Mitchell, late Curator of Reptiles in the South Australian Museum.

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Key to Species and Subspecies

1. Pattern consisting of longitudinal stripes and/or series of spots, but no ocelli; nasal weakly or not grooved; midbody scale rows 22-34	2
Pattern consisting solely of black-and-white ocelli; nasal strongly grooved; midbody scale rows 32-38	*pantherinus ocellifer*
2. Adults large (SVL = snout-vent length up to 95 mm.); toes slightly or not compressed; subdigital lamellae smooth or broadly callose; second supraocular longer than first; nasals separated; prefrontals usually forming median suture—*lesueurii* group ..	3
Adults small to moderately large (SVL up to 80); toes moderately or strongly compressed; subdigital lamellae keeled or narrowly callose	6
3. Vertebral stripe distinctly pale-edged	4
Vertebral stripe with little or no indication of pale edge	5
4. White midlateral stripe extending forward to lores; vertebral stripe nearly as wide as a paravertebral scale; brow subacute	*robustus*
White midlateral stripe extending forward only to arm; vertebral stripe much narrower than a paravertebral scale; brow obtuse	*saxatilis*
5. White dorsolateral and midlateral stripes moderately well developed; claws very short	*brachyonyx*
White dorsolateral and midlateral stripes absent or barely discernible; claws moderately long	*helenae*
6. Adults moderately large (SVL up to 80); subdigital lamellae obtusely keeled or narrowly callose	7
Adults small (SVL up to 62); subdigital lamellae sharply keeled and mucronate ..	11

7. Ground colour brownish; pattern consisting of dark and pale stripes and longitudinal series of pale spots—*leonhardii* group 8

   Ground colour blackish; pattern consisting solely of pale stripes—*taeniolatus* group . . 10

8. White midlateral stripe well developed (broad, straight, and extending forward to ear); blackish vertebral stripe moderately wide and narrowly margined with white; midbody scale rows 24-28 . . . . *regius*

   White midlateral stripe absent or poorly developed (not extending forward to arm); dark brown vertebral stripe narrow, with or without pale brown margin; midbody scale rows 26-34 9

9. White midlateral stripe absent or scarcely indicated; dark laterodorsal stripe enclosing a series of pale spots; nasals usually separated; prefrontals contiguous or separated . . . . *uber orientalis*

   White midlateral stripe well defined posteriorly; dark laterodorsal stripe not enclosing pale spots; nasals usually forming median suture; prefrontals usually separated . . . . *leonhardii*

10. Pale lines and stripes totalling 8 or 10, with only one line on each side between midlateral and dorsolateral stripes . . . . *atlas*

    Pale lines and stripes totalling 14 or 16, with at least 2 lines on each side between midlateral and dorsolateral stripes . . . . *quattuordecimlineatus*

11. Pattern consisting of stripes, spots, blotches and variegations; tail less than twice as long as SVL—*schomburgkii* group 12

    Pattern consisting solely of alternating dark and pale stripes; tail bright red, more than 2.3 times as long as SVL . . . . *leae*

12. Nasals usually separated (occasionally in short contact); prefrontals in contact or narrowly separated; ear lobules short to moderately long; lamellae under fourth toe 19-28; hindleg 41-56% of SVL	13
Nasals usually forming a median suture; prefrontals widely separated; ear lobules very short; lamellae under fourth toe 16-20; hindleg 33-41% of SVL	*strauchii*
13. Usually only one presubocular; plantars opposite fourth toe enlarged and keeled; prefrontals usually in contact	14
Presuboculars 2; plantars uniformly granular; prefrontals usually separated	*schomburgkii schomburgkii*
14. Head and back bright red in life (fading to pale green in alcohol)	15
Head and back pale pink or brown	16
15. Blackish vertebral stripe and laterodorsal variegations persistent in adults; lamellae under fourth toe usually fewer than 23; hindleg usually less than 47% of SVL .. .	*brooksi aranda*
Dorsal pattern obsolescent; lamellae under fourth toe usually more than 23; hindleg usually more than 47% of SVL	*brooksi brooksi*
16. Head and back pinkish white; blackish upper lateral stripe enclosing a series of pale spots	*brooksi euclae*
Head and back pale brown; blackish upper lateral stripe reduced to a series of vertically elongate, rectangular blotches	*brooksi taeniatus*

Ctenotus pantherinus ocellifer (Boulenger)

Synonymy, diagnosis and description: See Storr (1969, 1970).

Distribution: Northwestern interior. [Extralimital in Western Australia and Northern Territory.]

South Australian material: Mt. Davies (AM 17316); Erliwunyawunya, Musgrave Range (AM 17245); 98 mi. N of Cook (WAM 34522).

Ctenotus robustus Storr

Diagnosis: A member of the *lesueurii* group, distinguishable from *saxatilis* and *helenae* by sharper brow and more strongly developed pattern, *e.g.*, white midlateral stripe extending forward unbroken to ear aperture, whence it continues narrowly forward to lores.

Distribution: Southeastern and central districts, north and west to Bute. [Extralimital in eastern Australia from northeast Queensland to Victoria and in Northern Territory.]

Description: Snout-vent length (mm): 40-82 (62.7). Length of appendages (% SVL): tail 167-204 (188), foreleg 24-28 (26.2), hindleg 37-47 (42.6).

Nasals separated, not grooved. Prefrontals in contact (except in two specimens where separated by azygous scale). Supraoculars 4, first 3 in contact with frontal, first much smaller than second. Supraciliaries 8-11 (8.8), fourth to penultimate very small and tending to be concealed by moderately sharp brow. Palpebrals 9-14 (10.7). Second loreal 1.2-2.1 (1.44) times as wide as high. Upper labials 8 (rarely 9), second to fourth about twice as high as wide. Ear lobules 3-5 (3.6), acute in adults, first or second largest. Nuchals 3 or 4. Midbody scale rows 28-34 (30.4). Lamellae under fourth toe 19-23 (20.9); proximal lamellae divided and subtubercular, remainder smooth or widely callose.

Dorsally olive brown, darker on head, paler on tail. Black vertebral stripe from nape to proximal part of tail, nearly as wide as a paravertebral scale, narrowly edged with creamy white. Whitish dorsolateral line from brow to middle of tail (on which it is wider and suffused with brown), margined above by black laterodorsal stripe. Upper lateral zone blackish brown, enclosing a series of moderately large brownish-white spots; represented on tail by pale, dark-edged stripe. Whitish midlateral stripe from ear aperture to middle of tail, partly interrupted by thigh and sending down branch to insertion of arm; anteriorly represented by fine line curving under eye to lores. Lower lateral zone narrow, greyish, flecked with whitish marks.

South Australian material: Bute (SAM 1705); Mt. Osmond (SAM 10006), Waterfall Gully (SAM 9983-6, 9992, 9994-6); Encounter Bay (SAM 1697, 10010); Avenue Range (SAM 3789).

Ctenotus saxatilis Storr

Diagnosis: A member of the *lesueurii* group with dark vertebral stripe considerably narrower than a paravertebral scale and very narrowly pale-edged; white dorsolateral line; dark upper lateral zone with indistinct whitish mottling; white midlateral stripe seldom extending anteriorly as far as arm.

Distribution: Far north. [Extralimital in the Northern Territory.]

South Australian material: Erliwunyawunya, Musgrave Range (AM 17246-7); Oodnadatta (SAM 43).

Ctenotus brachyonyx sp. nov.

Holotype: D 13944 in National Museum of Victoria, collected by J. L. Hayward in June, 1969, at Annuello, Victoria (34 52'S, 142 49'E).

Diagnosis: A member of the *lesueurii* group with reduced colour pattern and extremely short claws. Further distinguishable from *saxatilis* by unmargined vertebral stripe and by some indication of pale subocular line, from *helenae* by presence of dark laterodorsal stripe and pale dorsolateral and midlateral stripes, and from *robustus* by number and nature of supraciliaries (fewer than 8, fourth to penultimate not greatly smaller than others and not tending to be hidden by brow).

Distribution: Valley of the Murray River. [Extralimital in north-western Victoria.]

Description (based on all specimens): Snout-vent length (mm): 73-83 (79.4). Length of appendages (% SVL): tail 181-214 (194), foreleg 23-25 (24.3), hindleg 38-40 (39.3).

Nasals narrowly separated, not grooved. Prefrontals usually in contact (very narrowly separated in one specimen). Supraoculars 4, first 3 in contact with frontal. Supraciliaries 6 or 7. Palpebrals 8-12 (10.5). Second loreal 1.4-2.0 (1.62) times as wide as high. Upper labials 8 or 9. Ear lobules 2-5 (3.8), subacute or truncate, rather small. Nuchals 2 or 3. Midbody scale rows 30-32 (30.6). Lamellae under fourth toe 22-24 (23.2), widely callose.

Dorsally (South Australia) brown or (Victoria) olive grey. Black vertebral stripe moderately wide, beginning narrowly on nape and ending abruptly at base of tail; little or no indication of pale edge. Indistinct dorsolateral stripe individually varying from whitish to nearly as dark as ground colour, margined above by narrow black laterodorsal stripe beginning well behind vertebral stripe and usually ending a little before it. Upper lateral zone a little darker than ground colour, with or without blackish dots or whitish flecks. Pale midlateral stripe, indistinct owing to suffusion with ground colour, extending back on to base of tail after being wholly or almost wholly interrupted by thigh; represented anteriorly by short fine line curving below eye. Lower lateral zone paler than ground colour.

Paratypes: South Australia—Purnong (NMV D 3074, 5295-6). Victoria—Cowangie (NMV D 12026); Hattah Lakes (NMV D 14213).

Ctenotus helenae Storr

Diagnosis: A greenish member of the *lesueurii* group with dark vertebral stripe very narrow and not pale-edged, and little or no indication of white dorsolateral and midlateral stripes.

Distribution: Extreme northwest (Tomkinson Range). [Extralimital in Western Australia and Northern Territory.]

South Australian material: Mt. Davies (SAM 5317, 10016).

Ctenotus regius sp. nov.

Holotype: R 24492 in Western Australian Museum, collected by G. M. Storr and A. M. Douglas on 4 October 1964 at Kingoonya, South Australia, in 30°54′S, 135°19′E.

Diagnosis: A member of the *leonhardii* group differing from *C. leonhardii* and *uber* by fully developed white midlateral stripe (extending forward to lores) and low number of midbody scale rows (28 or fewer). Distinguishable from the superficially similar *robustus* by grooved nasal and nature and number of subdigital lamellae.

Distribution: Interior of South Australia and northwestern Victoria.

Description (based on all specimens): Snout-vent length (mm): 37-74 (60). Length of appendages (% SVL): tail 191-252 (219); foreleg 24-30 (26.9); hindleg 44-58 (51.3).

Nasals separated (rarely in short contact), weakly grooved. Prefrontals in contact. Supraoculars 4, first 3 in contact with frontal. Supraciliaries 7 (rarely 8). Palpebrals 9-14 (11.3). Second loreal 1.0-2.1 (1.64) times as wide as high. Upper labials 8 (rarely 7 or 9). Ear lobules 3-6 (4.7), acute in adults, obtuse in juveniles, second or third largest. Nuchals 3-6 (4.0). Midbody scale rows 26 or 28 (rarely 24). Subdigital lamellae slightly compressed, 23-30 (26.0) under fourth toe, each with a dark brown obtuse keel or narrow callus.

Dorsally brown, darkest on back, more olive on head, paler and reddish on tail. Narrow blackish-brown vertebral stripe from nape to base of tail, narrowly margined with white. Narrow but conspicuous white dorsolateral line from brow to about middle of tail (on which it gradually merges with background), widely or narrowly margined above with blackish brown (this margin or laterodorsal stripe rarely enclosing a series of pale dots or short dashes). Upper lateral zone dark brown or reddish brown, enclosing two (occasionally one) longitudinal series of whitish dots or small longitudinally elongate spots; represented on tail by pale, dark-edged stripe. White midlateral stripe from lores to middle of tail, straight and moderately broad, interrupted by ear aperture and partly by thigh; margined below (on body) by a brown stripe which occasionally encloses some spots.

Paratypes: South Australia—Lambina (NTM 1552); Lake Eyre (NMV D3115, 3118); Killalpaninna (SAM 759); Goyders Lagoon (SAM 10342); Lakes Mulligan and Callabonna (SAM 9988-91); 6 mi. E of Vokes Hill (WAM 36605); Ooldea (NMV D352); "Overland Railway" (NMV D3045); Kingoonya (WAM 24493); Andamooka Ranges (SAM 2788, 10024-6); Yudna Swamp, Moralana (SAM 3177, 10013-4); Mern Merna (SAM 2657, 10028-9, 10031-3), "Waterfall Gully" (SAM 9993). Victoria—Cowangie (NMV D12027); Irymple (NMV D8406); Karawinna (NMV D5651); Mildura (NMV D8138); Red Cliffs (NMV D8546).

Ctenotus leonhardii (Sternfeld)

Diagnosis: A member of the *leonhardii* group with nasals usually in contact and prefrontals usually separated. Further distinguishable from *regius* by failure of white midlateral stripe to extend forward to level of arm (let alone to ear aperture); and from *uber* by absence of laterodorsal series of pale spots.

Distribution: Far north. [Extralimital in Northern Territory and Western Australia.]

South Australian material: Erliwunyawunya, Musgrave Range (AM 17248); "50 miles south of South Australian border" [presumably between Granite Downs and De Rose Hill] (SAM 9956).

Ctenotus uber orientalis subsp. nov.

Holotype: D825 in National Museum of Victoria, collected by W. A. Hall in 1911 at Ouyen, Victoria, in 35°05′S, 142°19′E.

Diagnosis: Differing from *C. u. uber* of Western Australia (Storr 1969) in its well-developed vertebral stripe and shorter tail. Distinguishable from *leonhardii* by presence of laterodorsal series of pale spots and absence or feeble development of white midlateral stripe.

Distribution: Northern interior, east of the Nullarbor Plain and Great Victoria Desert, south to central Eyre Peninsula and the Murray Mallee. [Extralimital in northern Victoria, western New South Wales and south of Northern Territory.]

Description (based on all specimens): Snout-vent length (mm); 36-80 (58.5). Length of appendages (% SVL): tail 151-214 (186); foreleg 23-30 (27.1); hindleg 39-55 (48.8).

Nasals separated. Prefrontals separated or in contact. Supraoculars 4, first 3 in contact with frontal. Supraciliaries 7 or 8 (6 in two Eyre Peninsula specimens). Palpebrals 9-13 (10.4). Second loreal 1.0-1.8 (1.42) times as wide as high. Labials 8 (occasionally 7 or 9). Ear lobules 3-7 (4.6), acute in adults, obtuse in juveniles, second or third usually largest. Nuchals 1-7 (3.9). Midbody scale rows 28-34 (31.3). Lamellae under fourth toe 19-29 (24.1), slightly to moderately compressed, each with a narrow dark callus.

Head and back olive grey, olive brown or dark brown; tail pale brown. Blackish vertebral stripe from nape to base of tail, narrowly edged with greyish white or pale brown. A laterodorsal series of pale dots or short dashes. White dorsolateral line extending from brow back for varying distances before breaking up into a series of short dashes or small spots. Broad upper lateral zone dark brown or blackish, enclosing white flecks, dots or short dashes which tend to align in three longitudinal series; upper lateral zone represented on tail by dark stippling. White midlateral stripe absent or indistinct on body (resulting from coalescence of fourth series of dashes). Lower lateral zone greyish brown, enclosing one or two series of whitish spots, dots or dashes, or flecked with white and pale grey.

Paratypes: Northern Territory—Macdonnell Ranges (SAM 10055). South Australia—Dalhousie Springs (SAM 9735); between Pernatty and South Gap Homesteads, Andamooka Ranges (SAM 2789, 9466-9); Lake Gilles (NMV D9499); Blue Range Creek, Eyre Peninsula (SAM 10122); Lake Palankarinna, 62 mi. N of Marree (SAM 3618); Mern Merna (SAM 10017, 10027, 10030); Panaramitee, near Yunta (SAM 5738); "Buchsfeld, near Adelaide" (Berlin 4719*c-d*); Turners Well (SAM 23-4); Pinnaroo (SAM 1507). New South Wales—Milparinka (SAM 10044). Victoria—Red Cliffs (NMV D2681, 2734); Ouyen (NMV D283-4, 826, 10032); Mangalore (NMV D3433); Bright (NMV D5578).

Ctenotus atlas Storr

Diagnosis: A member of the *taeniolatus* group with a total of 10 whitish dorsal and lateral stripes and lines on a blackish ground. Distinguishable from *quattuordecimlineatus* by single pale line between midlateral stripe and dorsolateral line, and no pale dorsal line between paravertebral and dorsolateral lines.

Distribution: Southern sector of Great Victoria Desert (mallee-spinifex zone) southeast through similar country round Lake Everard to eastern interior of Eyre Peninsula. [Extralimital in Western Australia and New South Wales (central-west).]

Description: Snout-vent length (mm): 38-69 (58). Length of appendages (% SVL): tail 160-221 (204), foreleg 26-30 (27.9), hindleg 35-51 (42.7).

Nasals in short contact. Prefrontals in long contact. Supraoculars normally 4, with first 3 contacting frontal (5 with 4 in one specimen). Supraciliaries 7 (occasionally 8). Palpebrals 10-12 (11.0). Second loreal 1.2-2.0 (1.52) times as wide as high. Labials 8 or 9. Ear lobules 3-7 (5.5), first 2 or 3 usually very small and acute. Nuchals 1-3 (2.2). Midbody scale rows 28-34 (30.3). Lamellae under fourth toe 20-28 (23.7), compressed, each with a narrow dark brown callus or obtuse keel.

Head dark brown; tail brown. Back and sides blackish brown with a total of 10 white or brownish stripes and lines: on each side a paravertebral line from occiput to base of tail; dorsolateral line from brow to proximal quarter of tail; upper lateral line from orbit to proximal quarter of tail; narrow midlateral stripe from ear nearly to end of tail, partly interrupted by thigh, extending forward indistinctly below eye to lores; ventrolateral stripe from below and behind ear to groin, partly interrupted by arm.

Remarks: Apart from minor differences in coloration and number of midbody scales, *C. atlas* is very similar to *C. quattuordecimlineatus*, which it replaces in slightly less arid regions. The two forms could therefore prove to be conspecific. The specimen of *atlas* from 100 miles north of Cook has the beginning of a pale line between the midlateral and dorsolateral stripes, and the beginning of one between the midlateral and ventrolateral stripes; it is thus an intergrade with *quattuordecimlineatus* which was collected only 25 miles further north.

South Australian material: 100 mi. N of Cook (WAM 31863); 73 mi. N of Cook (WAM 36603); 28 mi. NE of Maralinga (WAM 36645); 10 mi. S of Everard (WAM 24515); Mt Wedge (SAM 9979); Hincks National Park, Blue Range and Verran Hill (SAM 10123-8).

Ctenotus quattuordecimlineatus (Sternfeld)

Diagnosis: A member of the *taeniolatus* group with a total of 14 pale dorsal and lateral stripes and lines on a blackish ground.

Distribution: Great Victoria Desert. [Extralimital in Western Australia and the Northern Territory.]

South Australian material: Near the Serpentine Lakes (WAM 34521), 125 mi. N of Cook (WAM 31856-7).

Ctenotus leae (Boulenger)

Diagnosis: A moderately small *Ctenotus* with dorsal and lateral pattern consisting of alternating dark and pale stripes; tail bright red and very long; midbody scale rows usually 22 or 24. Distinguishable from all members of the *taeniolatus* group by its sharply keeled, mucronate subdigital lamellae.

Distribution: Great Victoria Desert. [Extralimital in Western Australia.]

South Australian material: 10 mi. E of Golden Well (NMV D1565); "Adelaide" (holotype).

Ctenotus schomburgkii schomburgkii (Peters)

Diagnosis: A member of the *schomburgkii* group with nasals usually separated and back strongly striped with black. Further distinguishable from *strauchii* by its longer appendages and less widely separated prefrontals, and from *brooksi* by its two presuboculars and homogeneous plantars.

Distribution: Northern interior. [Extralimital in Western Australia, Northern Territory and western New South Wales.]

Description: Snout-vent length (mm): 25-50 (41). Length of appendages (% SVL): tail 165-213 (196), foreleg 25-33 (27.8), hindleg 44-55 (49.4).

Nasals narrowly separated (occasionally widely separated or in very short contact). Prefrontals narrowly separated or in short contact. Supraoculars 4, first 3 in contact with frontal. Supraciliaries usually 7, often 6. Palpebrals 7-11 (9.3). Second loreal 1.5-2.3 (1.98) times as wide as high. Labials 7 (occasionally 8). Ear lobules 2-4 (3.2), short and obtuse, first usually much the largest. Nuchals 3-5 (3.7). Midbody scale rows 24-28 (25.9). Lamellae under fourth toe 20-26 (22.5), each with a fine, sharp, dark, mucronate keel.

Head, foreback and forelegs bright reddish brown (changing to greenish in alcohol). Hindback, tail and hindlegs yellowish brown. Black vertebral line from nape to proximal quarter of tail. Black dorsal line from nape to base of tail, often breaking up into a series of dots or dashes. White dorsolateral line from brow to base of tail, margined above with black. Black upper lateral zone enclosing an irregular series of spots similar in colour to corresponding part of dorsum; represented anteriorly by a narrow loreal streak. White midlateral stripe from snout to base of tail, interrupted by ear aperture and partly by thigh. Lower lateral zone like upper but narrower and less distinctly spotted.

South Australian material: Mt. Davies, Tomkinson Range (SAM 5318, 10015); Ernabella (AM 17526); 6mi. E of Vokes Hill (WAM 31827-8); 15 mi. E of Emu (WAM 36609); 24 mi. NE of Maralinga (WAM 36640); 150 mi. N of Cook (WAM 36607-8); 144 mi. N of Cook (WAM 36604); 103 mi. N of Cook (WAM 36661); Ooldea (SAM 679, 10012); "Overland Railway" (NMV D2667, 3063, 3065); 10 mi. of Golden Well, Overland Railway (NMV D995, 1567); Kychering Soak (NMV D2671); Kingoonya (SAM 994, 10341); Birthday Well (SAM 3050); Mullaroo Peninsula (SAM 3054); Moralana (SAM 3182); Blesing Reserve (SAM 9190); "Buchsfeld, near Adelaide" (lectotype and paralectotype, Berlin 4713*a-b*).

Ctenotus strauchii (Boulenger)

Diagnosis: A member of the *schomburgkii* group with extremely short appendages and ear lobules, and little or no dorsal pattern.

Distribution: Northeastern interior, west to Lambina and south to Mern Merna. [Extralimital in Northern Territory, Queensland and New South Wales.]

Description (based on all specimens cited below): Snout-vent length (mm): 41-52 (46). Length of appendages (%SVL): tail 126-160 (148), foreleg 21-27 (23.9), hindleg 33-41 (37.3).

Nasals forming a median suture (narrowly separated in one specimen). Prefrontals moderately to widely separated. Supraoculars normally 4, with first 3 in contact with frontal (5 with 4 in one specimen). Supraciliaries 6 or 7 (9 in one specimen). Palpebrals 8-11 (9.2). Second loreal 1.4-1.9 (1.59) times as wide as high. Labials 8 (occasionally 7 or 9). Ear lobules 1-4 (usually 3; mean 2.9), very short and obtuse, first or second basally much wider than others. Nuchals 2-4 (3.2) Midbody scale rows 26-30 (27.9). Lamellae under fourth toe 16-20 (18.0), each with a sharp, mucronate keel.

Dorsally reddish brown. Vertebral stripe faint, narrow and pale-edged; or absent. Dark laterodorsal markings variable: sometimes arranged as small blotches or cross-bars, sometimes as a stripe enclosing a series of pale spots. Whitish dorsolateral line from brow to base of tail. Upper lateral zone variable: essentially consisting of narrow vertical or oblique, alternating dark and pale blotches; but fine transverse connections between dark blotches so frequent that zone could often be described as a dark stripe enclosing two series of pale spots. White midlateral stripe extending narrowly forward to below eye after bending sharply up and down around top of ear aperture. Lower lateral zone reduced to a narrow faint streak or absent.

Material: Northern Territory—Tempe Downs (NMV D280); Charlotte Waters (NMV D946). Queensland—Birdsville (QM J9743). South Australia—Lambina (NTM 1548); 10 mi. N of Clifton Hills (SAM 10345); Mern Merna (SAM 2611, 2646, 10018-23). New South Wales—Milparinka (SAM 9930, 10042-3).

Ctenotus brooksi brooksi (Loveridge)

Diagnosis: Species *brooksi* distinguishable from all other members of *schomburgkii* group by single presubocular and enlarged, keeled plantars opposite fourth toe. Subspecies *brooksi* distinguishable by red head and back, and little or no indication of dorsal and lateral pattern apart from an upper lateral series of small, blackish, rectangular blotches.

Distribution: Great Victoria Desert. [Extralimital in Western Australia and Northern Territory.]

South Australian material: Ooldea (SAM 3217); 10 mi. E of Golden Well, Trans-Australian Railway (NMV D1566).

Ctenotus brooksi aranda Storr

Diagnosis: Agreeing with *C. b. brooksi* in red head and back, but differing in fewer subdigital lamellae and stronger pattern (including pale-edged vertebral stripe and blackish laterodorsal variegations).

Distribution: Sand dunes of the Lake Eyre Basin, west to Dalhousie and south to Marree. [Extralimital in adjacent deserts of Queensland and Northern Territory.]

Description: Snout-vent length (mm): 28-55 (46). Length of appendages (% SVL): tail 140-163 (150), foreleg 24-32 (27.1), hindleg 41-50 (44.4).

Nasals in short contact or narrowly separated. Prefrontals forming a median suture. Supraoculars 4, first 3 in contact with frontal. Supraciliaries 6 or 7 (6.3). Palpebrals 9-11 (9.6). Second loreal 1.6-2.5 (2.15) times as wide as high. Usually only one presubocular, occasionally 2. Labials 7 or 8. Ear lobules 3 or 4, obtuse or subacute, second usually largest. Nuchals 2-8 (mostly 3 or 4; mean 3.7). Midbody scale rows 26. Lamellae under fourth toe 19-22 (20.2).

South Australian material: Dalhousie (NMV D207); Lake Eyre shoreline, including Hunt Peninsula and Madigan Gulf (SAM 3338, 3732, 3769, 9921, 10007, 10041, 10051, 10058-9); Marree (SAM 4704).

Ctenotus brooksi taeniatus (Mitchell)

Diagnosis: Generally similar to *C. b. aranda*, including relatively short appendages, low number of subdigital lamellae, and colour pattern; but differing in brown (rather than red) dorsal ground colour, separated (rather than contiguous) prefrontals, and weakly keeled subdigital lamellae.

Distribution: Lake Torrens Basin.

Remarks: More material is required for determining whether the high number of supraoculars (5) and supraciliaries (8) in the only known specimen (SAM 2803) is diagnostic for this taxon. Each of these counts can occur in other subspecies of *brooksi*, but only rarely and singly.

A specimen of *C. schomburgkii* from Alice Springs (NMV D166) with the unique combination of 5 supraoculars, 8 supraciliaries and 8 labials was wrongly identified as *taeniatus* by Storr (1970: 107); in so doing *taeniatus* was wrongly described as having two presuboculars.

Ctenotus brooksi euclae subsp. nov.

Holotype: R287 in Western Australian Museum, collected in 1914 by W. B. Alexander at Eucla, Western Australia, in 31°43′S, 128°53′E.

Diagnosis: Differing from all other subspecies of *brooksi* by whitish back strongly patterned with black, upper lateral zone a black stripe enclosing whitish spots, and broad white midlateral stripe.

Distribution: White sand dunes bordering the Great Australian Bight between Eyre, Western Australia, and Point Sinclair, South Australia.

Description: Snout-vent length (mm): 26-51 (43). Length of appendages (% SVL): tail 153-193 (173); foreleg 24-31 (26.8); hindleg 45-54 (48.3).

Nasals narrowly separated (occasionally in short contact). Prefrontals in contact or narrowly separated (sometimes by a small azygous scale). Supraoculars 4, with first 3 contacting frontal (5 with 4 in one specimen). Supraciliaries usually 7, occasionally 6, rarely 8. Palpebrals 9 or 10 (occasionally 11). Second loreal 1.4-2.3 (1.84) times as wide as high. Labials 7 or 8. Ear lobules 2-5 (3.6); obtuse in juveniles; acute, subacute and truncate in adults; second or third usually largest. Nuchals usually 3; occasionally 0, 2 or 4. Midbody scale rows 26 or 28, rarely 24 or 30). Lamellae under fourth toe 19-25, each with a fine, sharp, dark, mucronate keel.

Dorsally a very pale flesh colour in life (E. R. Pianka, pers. comm.), fading in alcohol to creamy white. Narrow, black, white-edged vertebral stripe. On each side of dorsum two more blackish stripes, as wide as vertebral but anteriorly wavy and posteriorly breaking up into variegations. Upper lateral zone blackish with an irregular series of pale spots variable in size and shape; upper edge of zone continuing forward through orbit to nostril as a dark narrow streak. Broad white midlateral stripe from ear aperture to hindleg. Lower lateral zone narrow, variably marked with pale grey. Upper surface of limbs boldly streaked with black.

Paratypes: Western Australia—4 mi. N of Eyre (WAM 34478-80); Eucla (WAM 288; ERP 13702, 13704, 13713-4, 13716, 13721-2, 13729-33, 13735-6, 13738-40, 13745, 13750-1, 13753, 13761, 13763-6, 13788). South Australia—Point Sinclair, 13 mi. S of Penong (WAM 36559).

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ACARINE AND OTHER MICROFOSSILS FROM THE MASLIN EOCENE, SOUTH AUSTRALIA

By R. V. SOUTHCOTT and R. T. LANGE

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INTRODUCTION

The first part of this paper, by R. T. Lange, reports the discovery, isolation and preparation of the fossils, and their palaeontological associations and age. The second part, by R. V. Southcott, deals with the systematics of the fossils and related issues.

PART I—DISCOVERY, ISOLATION AND AGE OF THE FOSSILS

The present microfossils were included in a lens of carbonaceous clay which was uncovered during 1966 by excavating machinery in a deep sand quarry of the A.B.M. Company at Maslin Beach, South Australia. The clay, discarded as dross, was observed by visiting geologists and brought to the attention of Adelaide University palaeontologists. Collections were then bagged in polythene for storage at Adelaide University, where they remain available for study.

Investigations of the clay were immediately undertaken, and are continuing. Research collections were assembled in the Botany Department, where most research on the lens is proceeding. Different fossils are revealed as different techniques are applied to the clay. When particular fossils are revealed which are within the field of local specialists, such fossils are submitted for specialist attention. Thus pollens from the lens have been dealt with by the palynological section of the South Australian Department of Mines. The present fossils, in view of their main affinity with mites, were submitted to Dr. R. V. Southcott.

The geological section in which the lens occurred is not yet the subject of publication, but is discussed in a Ph.D. thesis of the University of Adelaide (Stuart, 1969). The lens was within the North Maslin Sands, which are inferred to be of Eocene age by downward extrapolation from the Tortachilla limestone (Lindsay, 1969). Palynological studies of the lens itself (Harris, 1966) indicate a correlation with the Burrungule Member of the Knight Formation in the Gambier Embayment of the Otway Basin, southeast South Australia. The Burrungule Member in turn correlates with the *Hantkenina aragonensis* zone of the lowest middle Eocene, on the basis of planktonic foraminifera (McGowran, Harris and Lindsay, 1969) hence good evidence is provided for early middle Eocene age of the present microfossils.

Palaeontologically the present microfossils are a minor but significant part of a complex microfossil assemblage which is itself intimately associated with plant macrofossil beds. Many components of the total assemblage are demonstrably of close ecological association. The present microfossils are significant as the only animal remains thus far detected, and because they correlate in part with fossils in the Moorlands coal.

The assemblage to which they belong is dominated by a mixed angiosperm—gymnosperm flora represented by inflorescences, fruits and seeds, anthers, pollen sacs, *in situ* and dispersed pollen, perianth parts, twigs and leaves. There is no wood, and pteridophyte macrofossils are not yet recovered. Angiosperm leaves are mostly simple and net-veined, and the spectrum of their morphologies is not comparable with that of any present day South Australian communities; similarly gymnosperm leaves are not comparable with those in the South Australian region. Notably, there is a rich assemblage of leaf-inhabiting cryptogams (Lange, 1969) comparable with that described by Ruinen (1961) from the phyllosphere of Surinam jungle, and with that described from Eocene leaf beds in Tennessee by Dilcher (1965). This *in situ* microflora is dominated by foliicolous ascomycetes of a nature described from present-day material by Hansford (1946). Microthyriaceous germlings are almost ubiquitous, and palynological preparations are almost dominated by dispersed fungal spores, particularly of Dematiaceae.

It is premature to propose definite biographical affinities and ecological parallels for the assemblage, but some important points seem well established. In the independent major respects (spectrum of leaf morphologies, nature and mixture of angiosperm and gymnosperm remains, development and morphology of the phyllosphere flora) the assemblage most resembles floor litter from wet forest in which "typical" Australian elements such as *Eucalyptus* and *Callitris* are poorly represented in the angiosperm and gymnosperm floras respectively, yet where taxa like *Casuarina* are juxtaposed with plants of ranalian affinity. Of the comparisons thus far made with forest floor litters of the Australian region, the assemblage most resembles litters from wet forest such as is found in Queensland north of Brisbane.

The present suite of microfossils was revealed by palynological methods, and was observed to be almost ubiquitous in spore and pollen preparations, to which it gives a characteristic appearance. Fragments of clay about 2 cm. square were pared to expose the uncontaminated core. Cores were submerged for 24 hours in a mixture of equal volumes of HNO_3 and HCl (commercial strength) sprinkled with $KClO_3$. The resulting sludge was washed three times by centrifugation in distilled water. Sludge samples of 1 cc. were dispersed by agitation in saturated $ZnCl_2$ solution and centrifuged to partition organic particles from the clay and float them to the surface. Small samples of the surface layer were transferred to slightly acidified water and washed three times by centrifugation, safranin being added before the final centrifugation. Very small samples of the final precipitate, which was entirely of organic fragments, were dispersed in phenol glycerine jelly for microscopy. As a precaution against contamination, laboratory space was mist-sprayed before use. As a check on contamination, the isolation procedure was run blank, and slides filmed with paraffin oil were exposed and observed microscopically. Occasional winged pollen were contaminants on such slides, but no spores were detected in blank runs.

The entire procedure has been repeated in laboratories in South Australia and in Germany, with very different environments for contamination. No setae were ever detected in blank runs; indeed, deliberate search for such structures in preparations from nearby gardens and leaf litter have failed to reveal similar structures.

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PART II—SYSTEMATIC DESCRIPTION OF THE FOSSILS, AND RELATED ISSUES

A. INTRODUCTION

The present study deals with a number of microfossils, some of them recognizably acarine.

The finest specimen was a minute eriophyid mite, one of a specialized family of mites which commonly cause rusts and blisters among present-day plants. The state of preservation of this minute fossil (less than 100μ long) allows generic and specific placing. It is recorded as a new species of the genus *Aculops* Keifer.

Among the assemblage was a large number of setae, so similar in form to those of modern Acarina that there does not appear to be any reason why they should not be allotted to this Order with confidence. Some of them in fact are so similar to setae of the modern superfamilies Erythraeoidea and Trombidioidea of the superfamily Trombidiformes that it is considered that this is the correct placement of these structures. In others however, it is not possible to allot them with the same degree of precision, and some appear to belong elsewhere among the arthropods, *e.g.*, possibly Insecta. A number of varieties of setae are present, *e.g.*, clavate setae, plumose setae, a squame, sensory hairs and others.

In addition to the specimens mentioned, the assemblage included a number of hairs which, as far as the present author is aware, do not correspond to the hairs of modern arthropods, nor do they seem to be of botanical origin, on the advice of botanical colleagues. It is proposed to describe them also in this paper, so that they may be brought to the attention of other workers.

B. REMARKS ON FOSSILIZATION OF ACARINA

It is unusual for Acarina and other small arthropods to be found as fossils, and this may be attributed to their small size, fragile nature, and presumably to their residual food content making them acceptable to micro-scavengers, or susceptible to degradation by moulds or bacteria. In the case of the Acarina the most extensive fossil fauna known is for the Baltic amber (Oligocene), the mites and other small arthropods being preserved by envelopment in the aromatic and indigestible resin of the pines, with its low solubility in water. There is also one fossil erythraeoid larval mite recorded for the Cretaceous amber of Canada (see Ewing, 1937; Southcott, 1961a, pp. 373-4).

Alternative methods of preservation against destruction by scavenging or degradation are believed to have occurred. Thus for the Australian Permian insect fauna the excellent preservation of a number of primitive winged insects has been attributed to suffocation and preservation in fine volcanic dust (Tillyard, 1926, p. 470). However, these fossils are wings only, and so far no acarine fossils have been reported from this Permian fauna. Some small arthropods have been discovered in the Rhynie chert deposit of the Middle Devonian Old Red Sandstone, and among these was the earliest mite so far described, *Protacarus crani* Hirst, 1923. The mode of fossilization of these arachnids is speculative, but presumably there was originally a carbonaceous deposit, later silicified. Nevertheless, it is not unworthy of notice that very few acarine fossils have been recorded for the coal deposits of the Carboniferous period, this being possibly partly due to the conditions preceding fossilization not being conducive to the entombment and ultimate preservation of these primarily terrestrial animals, or possibly, simply because they have not been adequately looked for. Overall, the known records of fossil Acarina are not numerous, making phylogenetic speculation about the Acarina a somewhat fruitless subject (see André and Lamy, 1937, pp. 34-5; Southcott, 1961a, pp. 373-4).

The material submitted contained many specimens, in fact too many for it to be possible to describe every one, and where types of setae are extensively replicated, the paper has been limited to representative specimens of each kind.

In addition there was present a fossil rotifer, identified as ?*Keratella* sp., which is illustrated and briefly described.

All specimens have been deposited in the South Australian Museum (section of Acarology, as all slides contain setae).

C. SYSTEMATIC DESCRIPTION OF A FOSSIL ERIOPHYID MITE

ACARINA

Family **ERIOPHYIDAE** Nalepa 1898

Genus ACULOPS Keifer 1966

Aculops keiferi **sp. nov.**

Figs. 1, 2; Plate 1

Description of deutogyne ♀

Length 97μ, width 38μ. Colourless, in safranin-stained mountant on receipt. Rostrum not clearly visible. Antapical rostral setae 5μ long. Shield 39μ long by 17μ wide, more or less triangular in outline but somewhat distorted in the preparation; shield lobes rather long and sharp. Median line of shield not discernible, but there is some indication of an admedian or submedian line. Dorsal tubercles 22μ apart, dorsal setae 30μ long. Foreleg present, length uncertain. Patellar seta (genuala) 20μ long; tibia 5μ long, with tibial seta obscured; tarsus *ca* 10μ long; featherclaw identifiable, 4μ long. Hindleg obscured. Coxae obscured. Abdominal thanosome with about 18 strong resistant tergites, lacking granules or microtubercles. Sternites possess ventral granules (microtubercles), which are pointed. Lateral seta *ca* 10μ long; first ventral seta *ca* 30μ long, second ventral seta 5μ long; third ventral seta *ca* 10μ long. Accessory seta *ca* 32μ long. Genitalia not recognizable. Genital setae 14μ apart, 16μ long.

Locality

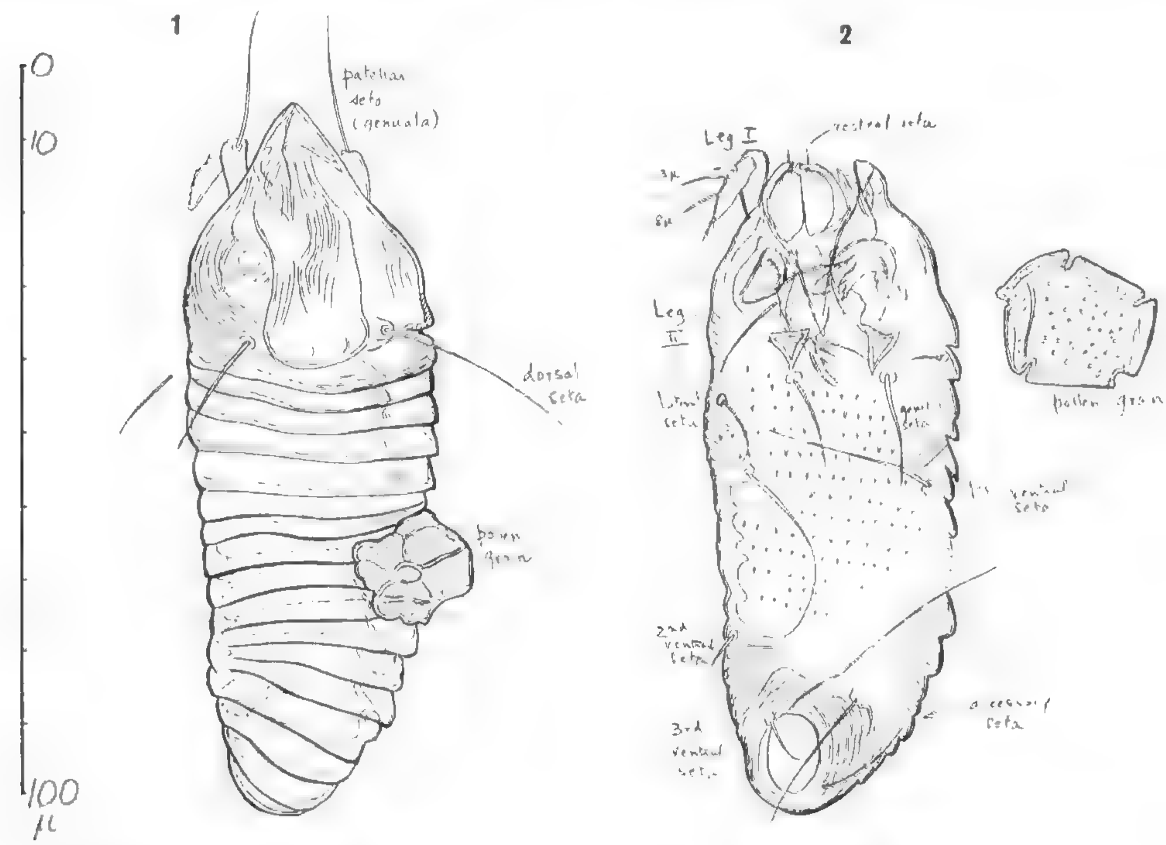
Maslin fossil beds, North Maslin Sands, South Australia.

Age

Lower middle Eocene.

Remarks

Although certain parts of this rust mite are lost, sufficient of its structure has been preserved, for classification to the species level.



Figs. 1, 2. *Aculops keiferi* sp. nov., Holotype. 1. Dorsal view, entire. 2. Ventral view, entire. Two pollen grains are also illustrated.

The specimen, by virtue of the fact that it lacks granules (microtubercles) on the tergites, is considered as a deutogyne ♀. The deutogynes (which are females) lack the more specialized processes of the protogynes, and are thereby less suitable for taxonomic description. However, as only one specimen is available and as not only is it the first fossil eriophyid to be discovered, but is also recognizably different from any modern known species of eriophyid, it requires description and appropriate taxonomic status. On the advice of Mr. Keifer it is placed in the genus *Aculops* and described as a new species. This is a genus whose affinities within the Eriophyidae are somewhat uncertain, and which may later receive further subdivision.

The species differs from other known species of *Aculops* in the following features: long rather sharp anterior shield lobe, rather long dorsal setae, tergites strong and resistant (without granules), and with pointed ventral granules.

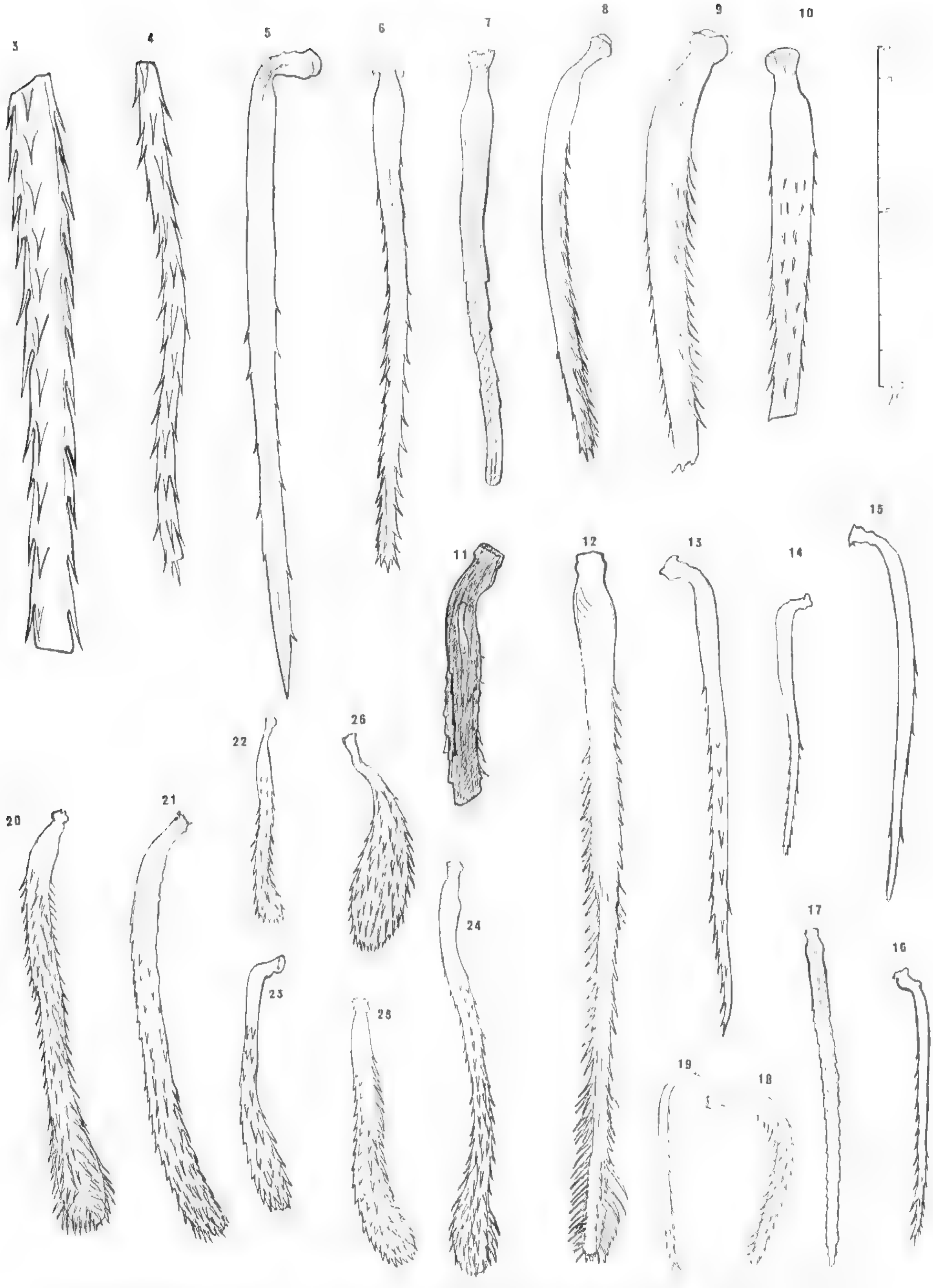
The fossil came from a mixed gymnosperm and angiosperm deposit, and as Mr. Keifer advises that deuterogyny is unknown from conifers it is deduced it is a rust mite associated with angiosperms.

The present author wishes to place on record his indebtedness to Mr. H. H. Keifer, of San Francisco, the great authority on eriophyid mites, for very considerable help with the taxonomy and other aspects of the eriophyid specimen, and it is with pleasure that the species is dedicated to him.

D. OTHER ARTHROPOD REMNANTS, INCLUDING ACARINE

Figs. 3-56

The preparations made from the deposit include a large number of arthropod remnants, many of them appearing to be recognizably acarine. Most of them are of setae, but a few are of claws, or of other structures. Reference to Figs. 3-56 shows that most of these are setae, many appearing to be normal acarine body setae with varying degrees of ciliation. These normal body setae include forms which are tapering and sword-like, while others are parallel-sided and terminally blunted while others show varying degrees of terminal expansion. Some of the setae have a distinct angulation near their origin. Some of the setae, however, are more specialized. Setae figured in Figs. 29-34, 47-53 are possibly varying types of sensory setae, not all of them corresponding to forms known to the present author from Acarina or other arthropods. The assemblage contains several specimens of tarsal claws, resembling in some degree those of modern Acarina, although not certainly placeable in that Order. One specimen shows a claw in a normal orientation to a set of tarsal setae, and some of the tarsal cuticle is faintly visible (Fig. 38).



Figs. 3-26. Setae from the Maslin assemblage, some of them appearing to be of acarine origin. For detailed description see text.

The author's familiarity with certain groups of Acarina possibly tends to bias him towards an acarine origin of many of these setae. Thus the setae figured in Figs. 3-26 resemble so strongly those of modern Erythraeoidea and Trombidioidea (Trombidiformes) that no particular difficulty is seen in attributing them to mites of these superfamilies. The other structures depicted, however, cannot be placed so readily (assuming the former attribution is correct), and probably these figures should be examined by a large number of specialists of various groups of organisms in attempt to place them. Whereas, for example, Fig. 46 represents a squame or squamous seta similar to those of certain Acarina, it is nevertheless a distinct possibility that it has come from some other arthropod group, *e.g.*, insects such as Coleoptera or Lepidoptera. On the other hand, the seta shown in Fig. 36 does not correspond to anything the author is familiar with among the Acarina, but is matched by setae the author has noted on a coleopteron (family Curculionidae, see later in the present paper and Fig. 66).

As the placement of these setae, or structures, is to a large extent a matter of opinion, it has been decided to deal with them in a purely descriptive fashion, until more definitive remnants are obtained. Thus those figured will be considered seriatim:

(1) DESCRIPTION OF SETAE OR SETAE-LIKE STRUCTURES FIGURED IN THE PRESENT PAPER

Figs. 3, 4. These are parts of the shafts of scobalae (see Southcott 1961a, b; 1963 for terminology employed), more or less cylindrical, with lightly outstanding or adnate barbs.

Fig. 5. Scobala, 191μ long, sword-shaped, angled at base, lightly barbed.

Fig. 6. Scobala, 153μ long, complete, barbed, blunt-tipped.

Fig 7 Tapering blunted scobala, 132μ long, with blunt barbs, set slightly swollen near base.

Figs. 8-11. Barbed scobalae, Nos. 10 and 11 being incomplete. In Fig. 11 the shading shows the degree of staining with the safranin.

Fig. 12. Blunted strongly barbed scobala, 215μ long.

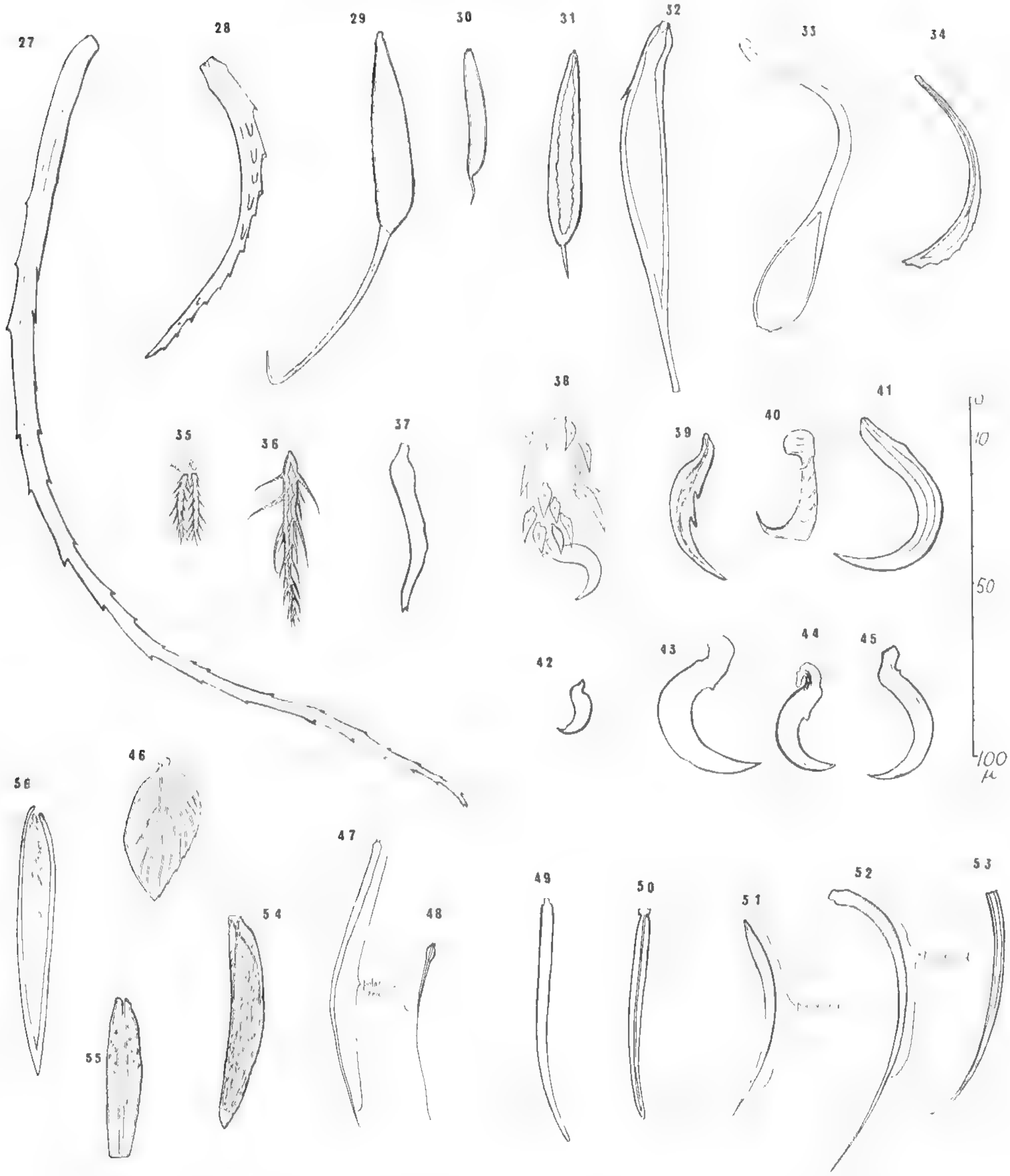
Figs. 13-16, 18, 19. Barbed scobalae with angled bases.

Fig. 17. Similar to No. 7.

Figs. 20-26. Clavate scobalae, of varying lengths and degree of clavation. In some, *e.g.*, 23, 26 there is some tendency to angulation near the origin of the seta.

Figs. 27, 28. Barbed scobalae, somewhat unusual in appearance.

Figs, 29-31. Sensory setae (sensalae) with terminal constricted piece of presumed specialized function.



Figs. 27-56. Further microfossils from the Maslin assemblage, comprising setae, claws and other, not fully identified, structures. For detailed description see text.

Fig. 32. Seta, possibly of sensory function, with swollen proximal part. Seta 96μ long.

Fig. 33. Clavate sensilla-type of seta.

Fig. 34. Another clavate seta, possibly a modified sensilla; 54μ long.

Fig. 35. Two plumose scobalae, similar to those commonly seen in modern Trombidiidae.

Fig. 36. Burr-like seta, 48μ long. This seta is similar to one figured later (see Fig. 66), from a modern coleopteron.

Fig. 37. Scobala with few ciliations, 46μ long.

Fig. 38. Group of scobalae outlining a tarsus of a leg, with a tarsal claw *in situ* (also figured in Plate 4).

Fig. 39. Tarsal claw, 41μ long, with two ventral spurs.

Fig. 40. Tarsal claw 31μ long, with 8 lateral ciliations.

Fig. 41. Simple tarsal claw.

Fig. 42. Tarsal claw 14μ long.

Fig. 43. Tarsal claw 38μ long.

Fig. 44. Tarsal claw 30μ long.

Fig. 45. Tarsal claw 39μ long.

Fig. 46. Scobala, a squame or squamala, 38μ long (also figured in Plate 3).

Fig. 47. Spinous presumably sensory seta, 102μ long. Four-fifths of the seta is optically active.

Fig. 48. As 47, 50μ long. One-third of the seta is optically active.

Fig. 49. As 47, 68μ long.

Fig. 50. As 47, 57μ long (tip apparently incomplete).

Fig. 51. As 47, curved, 64μ long. About four-fifths of its length is optically active.

Fig. 52. A more strongly curved seta, 81μ long. About two-thirds of the seta is optically active.

Fig. 53. Similar seta, apparently broken off. Specimen is 66μ long, and the whole of the specimen figured is optically active.

Fig. 54. Robust seta with light protuberances, classified as a scobala; 61μ long.

Fig. 55. Apparently similar to last, 45μ long.

Fig. 56. Structure of uncertain affinity, ?seta, 75μ long.

(2) OTHER MICROFOSSIL HAIRS OF UNCERTAIN ORIGIN

Bicorned structures

Figs. 57-59 show some peculiar bicorned optically active hairs, which are not certainly identifiable as to origin. Some variety of structure is seen within these. Thus Fig. 59 shows a more or less symmetrical hair, rather like a pickhead in shape, and 121μ across. In Fig. 58 is shown a similar structure but with one of the branches extended to about three times the length of the other, so as to be filiform. In Fig. 57 another variation is shown. In this damaged specimen only one arm is present, this residual arm being attenuated, but ending in a small projection like an elongated acorn. It is not known where these structures have originated nor have several biologists to whom they have been shown been able to place them. For the present the non-committal term "birema" is proposed for them, for the purpose of reference, pending more precise placement.

Linear hair-like structures

Another group of unidentified structures from the Maslin assemblage is shown in Figs. 60-65. These are all strongly optically active. They are linear, and ciliated or ornamented, and some are segmented.

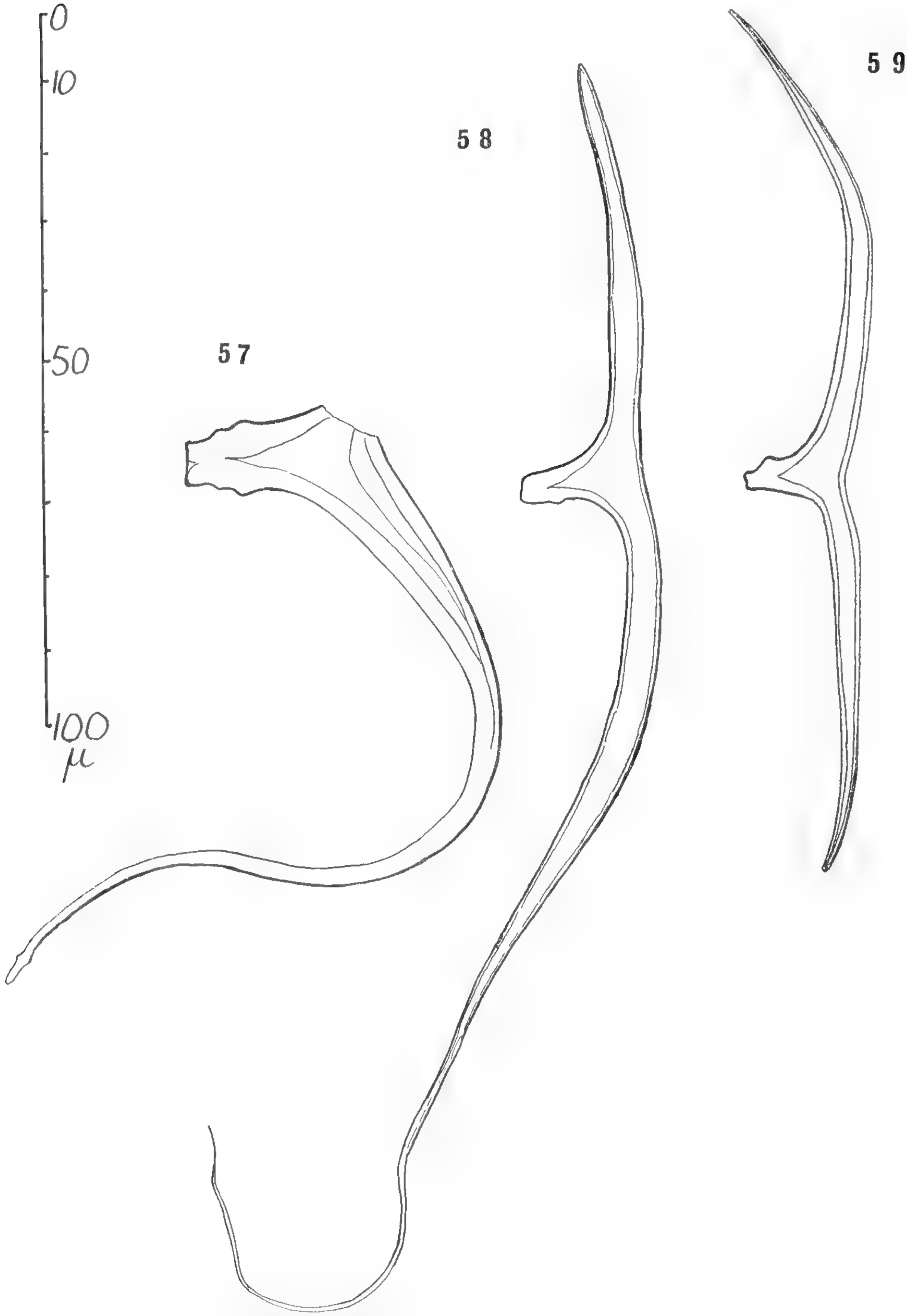
Figs. 60-62 show unsegmented barbed hairs (Fig. 61 is shown as broken for the purposes of the illustration). Fig. 60 shows a form 375μ long; Fig. 61 represents a specimen 710μ long; Fig. 62, 325μ long.

Figs. 63-64 represent segmented linear hairs, the joints being expanded in some cases to a head of three projecting angled lobes on one side (the proximal side), but more distally to pointed spurs or ciliations at the distal end of the segments (= proximal side of the joints). Fig. 63 shows a hair 670μ long; Fig. 64 shows one 184μ long.

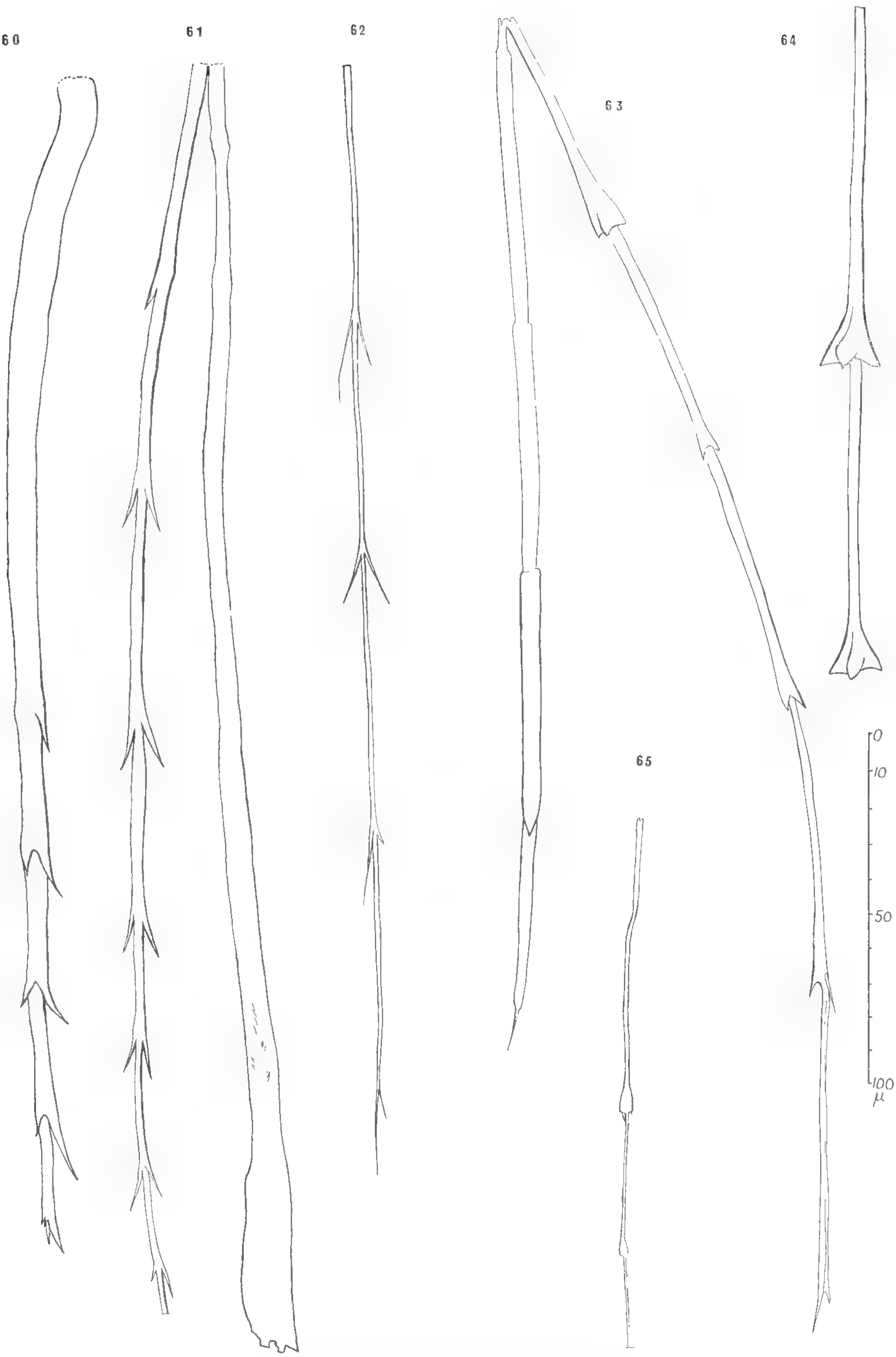
Fig. 65 shows a fine linear structure with enlargements, but without ciliations or angulations, 200μ long.

(3) Comments on the Identification of the Setae, and Comparison with Modern Material

It would appear unlikely that a fossil deposit originating from terrestrial arthropods would be restricted to a narrow taxonomic range, such as, for example, a single order or even class of these animals. Since the material submitted contained a good deal of vegetable material which had survived the treatment in Schultz solution—pollens, fungal hyphae and spores, as well as leaf cuticular remnants (many with stomata), etc.—it would be reasonable to expect it to contain chitinous remnants of a diversity of animals such as are found on leaves of tropical and temperate angiosperms as well as of the leaf and other litter below such a flora. Any worker who has examined the leaf litter of temperate and tropical angiosperm forests must have been struck by the variey of small animal life present, *e.g.*, mites, collembola, other insects, small spiders (or even larger ones), centipedes, millipedes, also polychaetes, not to mention small molluscs, leeches, opilionids, and a variety of other creatures. Among the living leaves of the forest the invertebrate fauna tends to be more restricted in its taxonomic



Figs. 57-59. Bicornuate hairlike microfossils or "biremae" (sing.: birema) from the Maslin assemblage. For description see text.



Figs. 60-65. Linear hair-like structures, of uncertain origin, from the Maslin assemblage. For description see text.

range, and perhaps insects, mites and small spiders are the commonest small animals present. While it is impossible to guess with any accuracy as to what microfauna may have been present in a particular tropical Eocene Australian forest, nevertheless it may have been expected that by the Eocene all modern groups of arthropods favouring a similar habitat would have been represented.

As most of the animal remnants among the assemblage were of setae, the author has attempted to widen his knowledge of setal forms among the arthropods by examining, for this paper, various small modern arthropods and other possible sources of such hairs. Since rather similar setae may be found in widely differing groups of arthropods, it would be unjustifiable to erect new taxa where all that is available is a seta or claw, or some cuticular fragments. Thus although a number of the setae depicted have the appearances of acarine setae, this does not identify them as such for certain, and even if so, it does not allow generic or specific placement. Squames, for example, are found in various insect groups, such as Coleoptera and

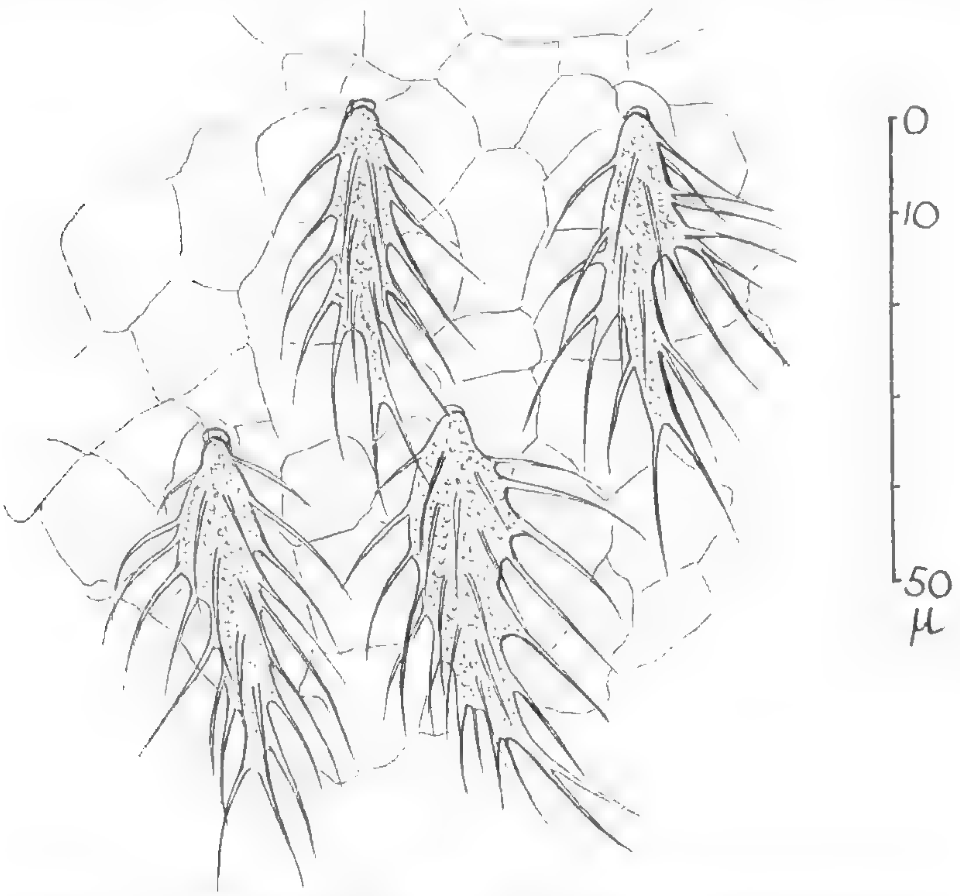


Fig. 66. Setae from trochanter of leg of modern curculionid beetle (family Curculionidae, sf. Cryptorhynchinae), ?*Diethusa* sp., from Mitcham, South Australia. Compare with Fig. 36 of the Maslin assemblage (see further in text).

Lepidoptera, as well as Acarina. In Fig. 36 was drawn a seta from some unidentified group of arthropods. Examination of various modern Australian insects has revealed a rather similar set of setae upon the trochanters of a weevil, ?*Diethusa* sp. (identified G. F. Gross), specimen RVS:A1178, from Mitcham, South Australia, 8.i.1970, R. V. Southcott (family Curculionidae, subfamily Cryptorhynchinae), of which some are drawn in Fig. 66.

The student of these remnants cannot but be struck by the faithful preservation of the physical structure of these minute fossils over this immense period of time, these remarks applying not only to the external shape, but also to such a physical characteristic as the preservation of the optical activity of the specimen. Such a finding immediately prompts the question as to what extent the chemical structure of these fossils is also preserved.

E. DESCRIPTION OF A FOSSIL ROTIFER, ?KERATELLA sp.

Text Fig. 67; Plate 4

In the Maslin assemblage was a structure accepting the safranin stain, identifiable as a loricate rotifer and provisionally allotted to the genus *Keratella*.

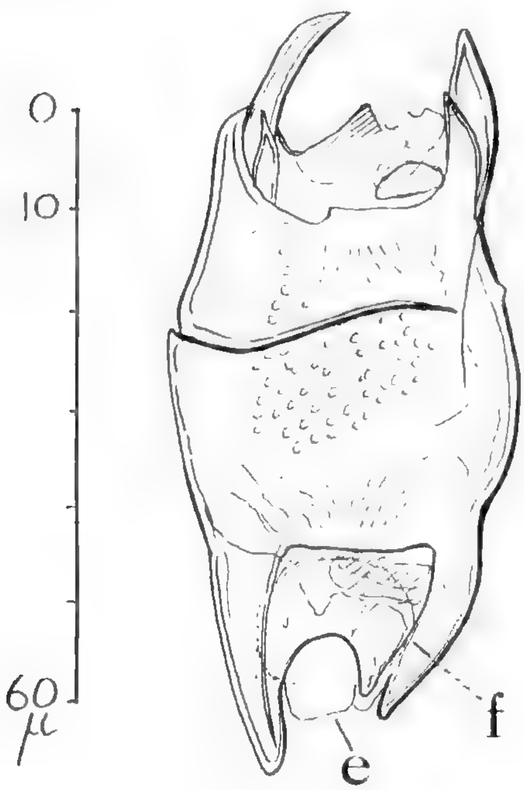


Fig. 67. ?*Keratella* sp., a fossil rotifer (Order Monogonata, superfamily Brachionoidea) from the Maslin assemblage. The structure e appears to be a parthenogenetic egg at the posterior pole of the animal, and possibly there is a larger one in a lower plane (see stippled outline, f).

Description: Length (overall) 75μ, width 32μ. The specimen consists of a central part which is a prolate spheroid, about 36μ long, and with spines projecting from each end. The structure is thus a horny lorica, smooth externally, no sculpturing being identifiable. Five spines occur at the anterior end (uppermost in Fig. 67), and there are three lorical spines at the posterior end (lowermost in Figure). The spines are strong, curved inwardly, and more or less pointed toward the tip. No corona is visible. Between the three posterior spines is a clear rounded structure, which appears to be a parthenogenetic egg (*e*), or possibly there are even two of these, one larger (*f*) than the other (compare with *e.g.* Hyman, 1951, p. 142 (her Fig. 67F)). A fracture runs transversely across the main part of the lorica.

Remarks

The specimen described appears to belong to *Keratella* or to some allied genus of the superfamily Brachionoidea (order Monogonata). The genus *Keratella* has been recorded as having the tendency for the lorica to show great diversity of form, even within a single species, and in the past many of such divergent forms have been described as different species. Many members of the *Keratella* are marine species. The material studied in the Maslin assemblage does not have a marine facies, even if we omit such characteristic elements as pollens and angiosperm leaf stomata. However loricate rotifers not unlike *Keratella*, speaking in a general sense, are not uncommon in fresh water.

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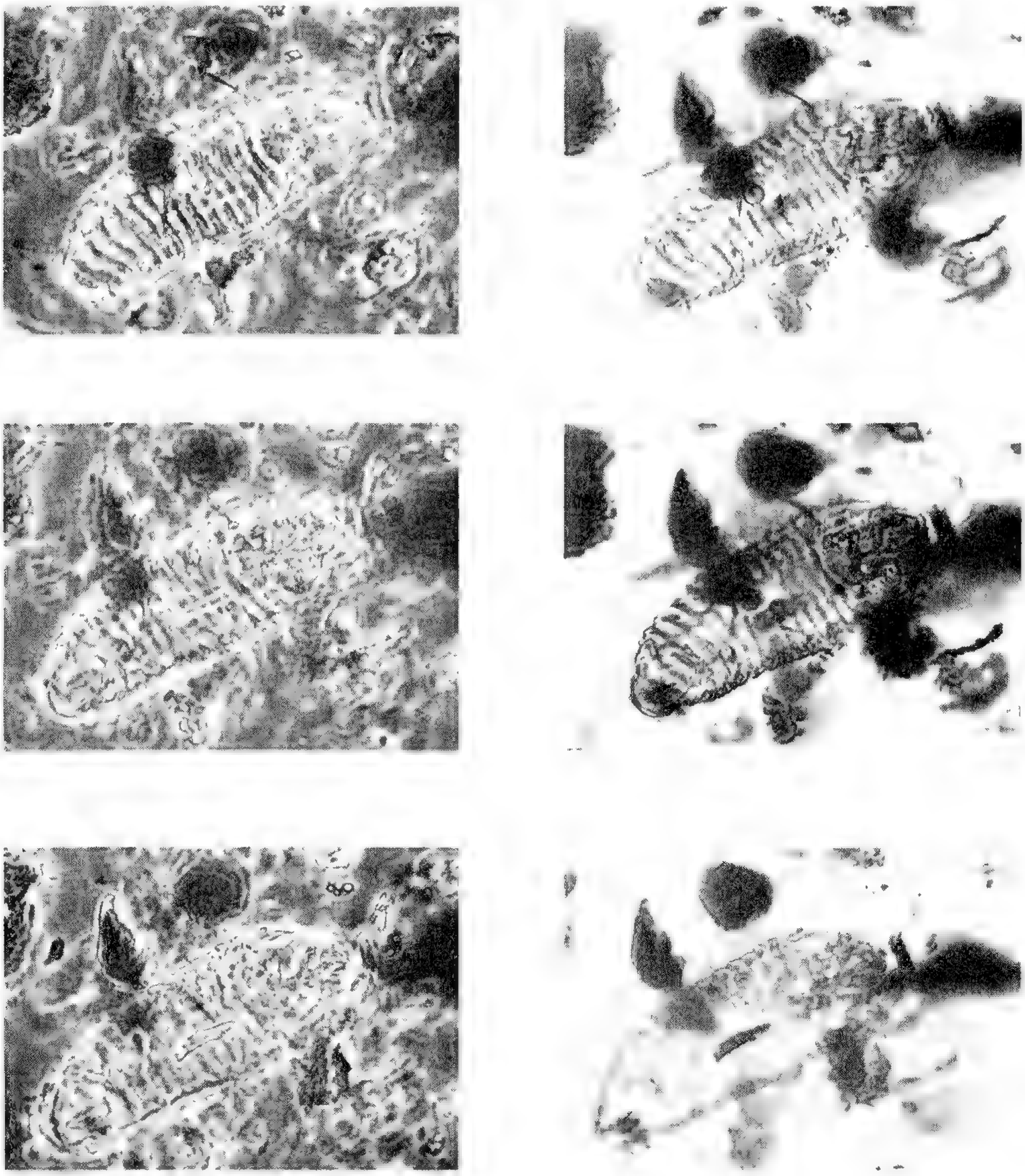

Plate 1. *Aculops keiferi* sp. nov. Holotype. Photographed in three optical planes by phase contrast (L), and normal illumination (R). 500X.

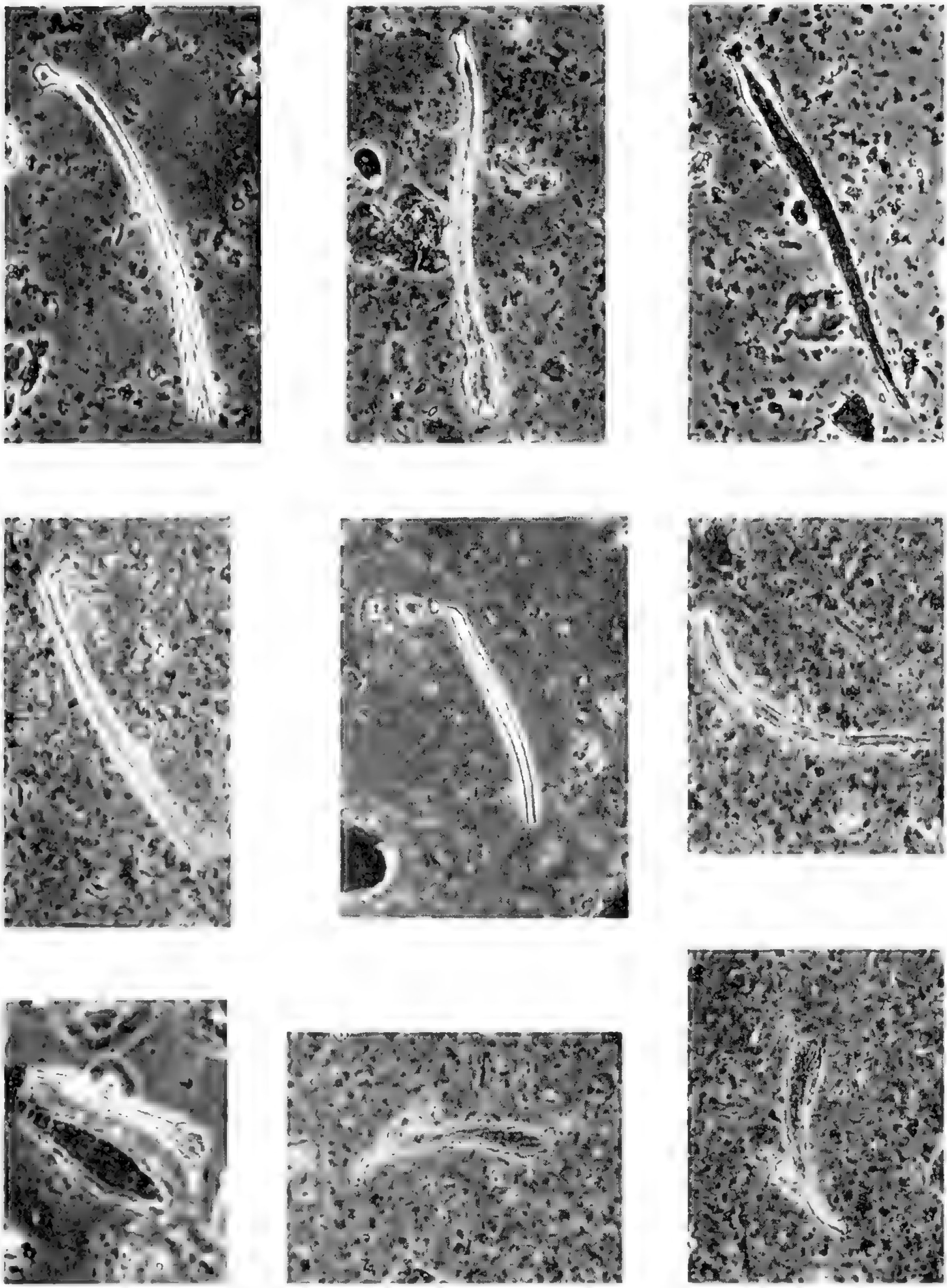

Plate 2. Various setae from the Maslin assemblage, by phase contrast. 500X
Some of these setae are also shown in the text illustrations

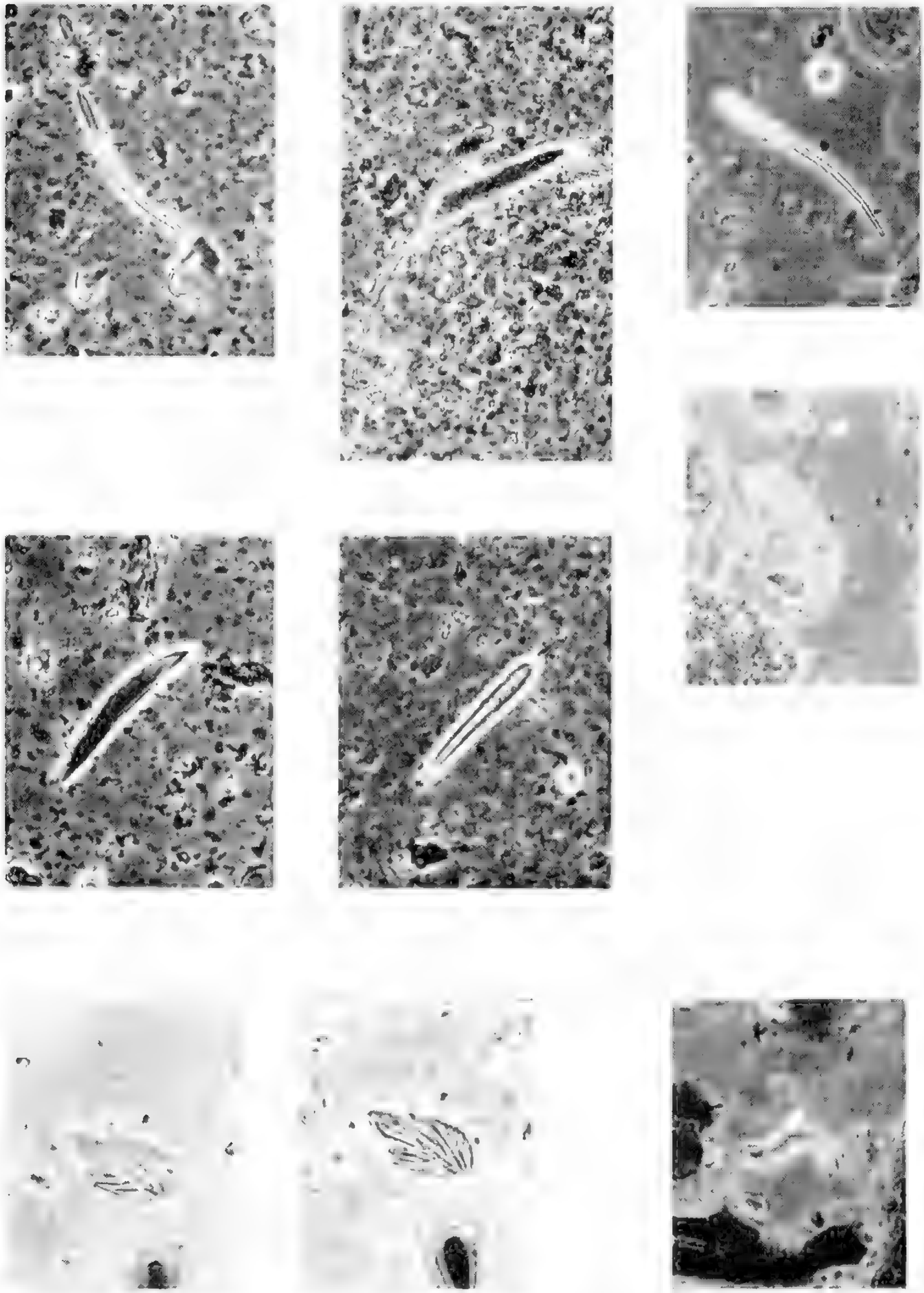

Plate 3. Various setae, a claw and other structures from the Maslin assemblage, by phase contrast. 500X. Some of these are figured also in the text-figures.

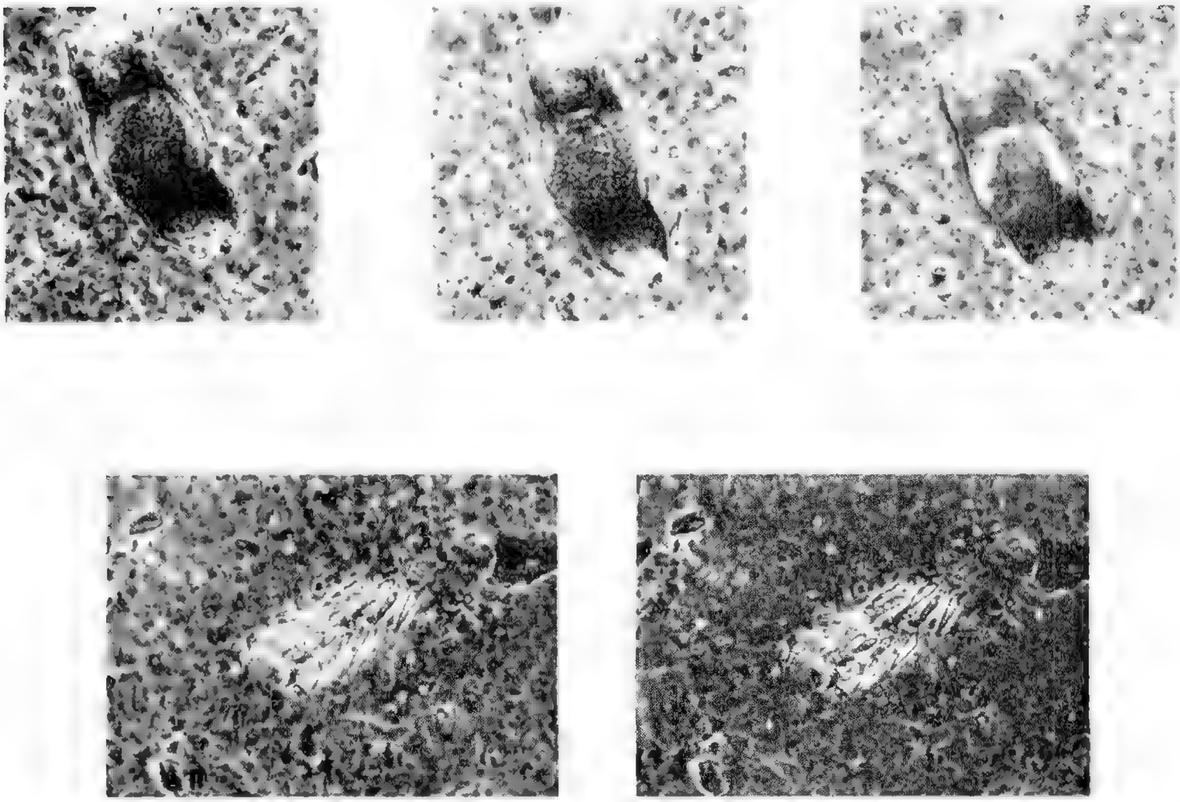

Plate 4. Above: *?Keratella* sp., a loricate rotifer from the Maslin assemblage. See further in text. By phase contrast, 500X. Three optical planes are shown. Below: Tarsal setae and claw, by phase contrast, at differing contrasts. 500X. (Also figured in Fig. 38, and commented on in text.)

RECORDS OF THE SOUTH AUSTRALIAN MUSEUM

NEMATODE PARASITES OF OCEANICA. XII. A REVIEW OF HETERAKIS SPECIES, PARTICULARLY FROM BIRDS OF TAIWAN AND PALAWAN

By

W. GRANT INGLIS, GERALD D. SCHMIDT and ROBERT E. KUNTZ

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Summary

The following species of *Heterakis* are recorded from Taiwan and Palawan: *H. variabilis* Chandler, 1926, from *Lophyra swinhoii, Bambusicola thoracica,* and *Syrmaticus mikado*, Taiwan; *H. vulvolabiata* Chandler, 1926, from *Arborophila crudigularis*, Taiwan; *H. isolonche* Linstow, 1906, from *Lophura swinhoii*, Taiwan; *H. beramporia* Lane, 1914, from *Gallus gallus*, Taiwan; *H. spumosa* Schneider, 1866, from (?) *Rallina eurizonoides*, Taiwan; and *H. indica* Maplestone, 1932, from *Surniculus lugubris minimus*, Palawan; *H. vexans* sp. nov. is described and *H. variabilis* and *H. vulvolabiata* are redescribed.

NEMATODE PARASITES OF OCEANICA. XII. A REVIEW OF HETERAKIS SPECIES, PARTICULARLY FROM BIRDS OF TAIWAN AND PALAWAN

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ABSTRACT

The following species of *Heterakis* are recorded from Taiwan and Palawan: *H. variabilis* Chandler, 1926, from *Lophura swinhoii, Bambusicola thoracica,* and *Syrmaticus mikado,* Taiwan; *H. vulvolabiata* Chandler, 1926, from *Arborophila crudigularis,* Taiwan; *H. isolonche* Linstow, 1906, from *Lophura swinhoii,* Taiwan; *H. beramporia* Lane, 1914, from *Gallus gallus,* Taiwan; *H. spumosa* Schneider, 1866, from (?) *Rallina eurizonoides,* Taiwan; and *H. indica* Maplestone, 1932, from *Surniculus lugubris minimus,* Palawan; *H. vexans* sp. nov. is described and *H. variabilis* and *H. vulvolabiata* are redescribed.

INTRODUCTION

The limits of the superfamily Heterakoidea are fairly well established. The genera, with minor exceptions, are reasonably stable while even the families and subfamilies are recognizably the same groups in the various treatments of the superfamily. A major area of disagreement, however, continues to be the division of the genus *Heterakis s.l.* into two genera on the equality or otherwise of the spicules.

López-Néyra (1947) first used equality and inequality of the spicules as a way of delimiting groups which he called *Heterakis* and *Ganguleterakis* and has been followed in this by Skrjabin and his co-workers in several publications (most recently Skrjabin, Schikhobalova, and Lagodovskaja, 1961). Because of criticism of the artificiality of this simple criterion,

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Freitas (1956) attempted to refine the distinction by defining unequal spicules as those in which the difference in length of the spicules is at least one third the length of the shorter and on this basis introduced a new name, *Raillietakis*, for species with "equal" spicules, an argument accepted by Yamaguti (1961). Madsen (1950), Inglis (1958, 1967) and Chabaud (1965) do not consider inequality of spicule length sufficient for the delimitation of genera, even as refined by Freitas, although all recognize that the structure and relative lengths of the spicules can be valuable in delimiting species.

The disagreement is partly because of the uniformity of the structures of the male tail in *Heterakis*, which supply almost all the characters useful in delimiting species, and partly, we suspect, because of a feeling that the genus is too diverse to be left as one taxon. However the inequality of spicule length is so obviously a bibliographic character that its value must be considered dubious. However, those who, like us, oppose its use have not established their case in detail, and the opportunity to do so has now arisen following the study of specimens of *Heterakis*, particularly from birds in Taiwan and Palawan, as well as specimens, particularly type material, from other hosts from other localities.

The former specimens were collected by R.E.K. and his associates of NAMRU—No. 2 during investigations of the parasite faunas of Taiwan and Palawan. The specimens were fixed in hot 70 per cent alcohol, stored in alcohol and glycerine, and cleared in glycerine or lactophenol.

MORPHOLOGICAL GROUPS

The posterior ends of male *Heterakis* are very similar, with an obvious circular pre-cloacal sucker on the mid-ventral surface of the male body anterior to the cloacal opening. The sucker has a distinct cuticular rim, with a papilliform sense-organ on the posterior margin. There are broad caudal alae supported by two pairs (sometimes three) of long pedunculate papillae lateral to the sucker (parasuctorials), four pairs of such papillae lateral to the cloacal opening (paracloacals) and one pair roughly half-way between the cloacal opening and the tip of the tail (postcloacals). In addition there are two pairs of sessile papillae around the cloacal opening (pericloacals) and a group of two pairs at the posterior end of the tail, with the phasmids immediately anterior to them. Variation in these papillae is usually restricted to a reduction in the number of para-cloacals or to the presence of an additional pair of pedunculate papillae between the para- and postcloacal papillae.

Attempts have been made to delimit species on the basis of the distribution of these papillae and on the presence or absence of an additional pair, but in most cases this has later been shown to be unsound.

In contrast, the structure of the spicules supplies the most obvious characters which delimit species and there has never been any doubt about its value. Similarly, there is no doubt that groups of species exist in which the spicules are either equal or unequal; the disagreement is about the value of separating such groups and the way in which the groups should be diagnosed The major argument about such groupings, other than simple belief statements, is that other groups can be recognized on other features of the spicules, as was pointed out very briefly by Inglis (1967). This is now considered in detail and three major groups can be recognized.

Heterakis dispar—Group

This group consists of the nominal species *H. altaica* Spaul, 1929; *H. brevispiculum* Gendre, 1911; *H. caudata* Linstow, 1906; *H. circumvallata* Linstow, 1906; *H. dispar* (Schrank, 1790) Dujardin, 1845; *H. hyperborea* Swinyard, 1931; *H. papillosa* (Bloch, 1782) Cram, 1927; *H. silindae* Sandground, 1933; *H. skarbilowitschii* Kassimov, 1946; *H. stylosa* Linstow, 1907; *H. tenuicauda* Linstow, 1883; *H. travassosi* Khalil, 1932.

In all these nominal species the spicules are nonalate, equal in length and identical in structure with spiral flanges on their posterior ends (Figs. 1-3; 5-7). These spiral flanges, which are difficult to see at low magnification, have been overlooked in some descriptions and have been described as hooks or barbs in others. In all cases, however, they are cuticular expansions of the spicules which spiral round the tip.

Within this group of twelve names there appear to be only three actual species: one characterized by a large goblet-shaped pre-cloacal sucker which lies relatively close to the cloacal opening, and by a relatively long tail; a second characterized by a similar sucker lying relatively far anterior to the cloacal opening, and by a short tail so that the para-cloacal papillae appear bunched together; and a third characterized by a long, narrow tail, relatively long spicules and by a small pre-cloacal sucker which lies low on the surface of the body.

The earliest names for these species are *H. altaica*, *H. brevispiculum* and *H. papillosa* respectively with the synonyms listed below. However the problem is by no means resolved and it is possible that more species can be recognized or even that there is only one, particularly as "*altaica*" is somewhat intermediate in form between the other two.

Provisional synonomies are (the name of an institution in parentheses indicates that type specimens are lodged there and have been studied):

Heterakis altaica Spaul, 1929. (British Museum (Nat. Hist.))
Synonymy: *H. skarbilowitschii* Kassimow, 1946.

Spaul overlooked the spicular flanges, which are well figured by Kassimow: it is possible that *H. macroura* Linstow, 1883, is this species. Freitas (1956) refers *H. altaica* to *Odontoterakis* but this is completely wrong.

Heterakis brevispiculum Gendre, 1911

Synonymy: *H. travassosi* Khalil, 1932 (Tropeninstitut, Hamburg). *H. silindae* Sandground, 1933 (Museum of Comparative Zoology, Harvard).

Heterakis dispar (Schrank, 1790) (Naturhistorisches Museum, Vienna)

Synonymy: ?*Ascaris papillosa* Bloch, 1782. *H. caudata* Linstow, 1906; *H. circumvallata* Linstow, 1906; *H. hyperborea* Swinyard, 1931; (?) *H. monticelliana* Stossich, 1892; *H. stylosa* Linstow, 1907 (Instit. für Spez. Zoo., Berlin); *H. tenuicauda* Linstow, 1883 (Brit. Mus. (Nat. Hist.)).

In the most recent redescription of *H. papillosa* to be published, Madsen (1950) failed to see the spiral flanges on the posterior ends of the spicules. However one of us (W.G.I.) has examined Madsen's material, as well as specimens from the type host (*Otis tarda*) in captivity and in the wild, and flanges are present on the spicules of all males studied. As there are no other obvious differences between the two nominal species *H. dispar* is almost certainly indistinguishable from *H. papillosa*. However, *H. dispar* is a name very widely used, particularly in veterinary literature and it is preferable that it remains unchanged. Further, the problem of delimiting the species of this group is not fully resolved. We therefore prefer to retain *H. dispar* and to treat *H. papillosa* only as a probable synonym.

In addition to these species we later describe a fourth, *H. vexans* sp. nov., which is most appropriately accommodated within this *H. dispar*-group, although the flanges on the posterior ends of the identical spicules are non-spiral.

Heterakis gallinarum—Group

This group contains *H. beramporia* Lane, 1914; *H. bonasae* Cram, 1927; *H. bosia* Lane, 1914; *H. caudebrevis* Popova, 1949; *H. gallinarum* (Schrank, 1788) Madsen, 1949 (= *H. pediocetes* Mawson, 1956 (Institute of Parasitology, McDonald College)); *H. indica* Maplestone, 1932; *H. isolonche* Linstow, 1906; *H. pavonis* Maplestone, 1932 (= *H. yamadori* Yamaguti, 1941); *H. putaustralis* Lane, 1914; *H. variabilis* Chandler, 1926; *H. vulvolabiata* Chandler, 1926.

In all these species the left spicule at least, and in some both, is alate or obviously different from the right. The most diagnostic character of the various species is the shape of the left spicule, of which the tip can be elaborate.

The major problem in this species group is the relationships between and the delimitation of those species in which the right spicule is long and slim while the left is usually short but always with broad alae and a relatively simple posterior end. These worms appear to form a cline from species with markedly unequal spicules at one extreme to species with equal spicules at the other. At one extreme is *H. gallinarum* in which the left, terminally hooked, spicule is much shorter than the right, and at the other extreme is *H. isolonche* in which the spicules are about the same length. Intermediate between the extremes are *H. variabilis* Chandler, 1926 (redescribed below), *H. putaustralis* Lane, 1914 and *H. bonasae* Cram, 1927. Basically similar to *H. gallinarum* in having a short, left spicule are *H. pavonis* Maplestone, 1932 and *H. indica* Maplestone, 1932, but in both species the left spicule has an elaborate tip.

This problem still awaits resolution but is the major reason we do not accept a split of the genus *Heterakis* on the basis of the relative lengths of the spicules. The remaining species listed are less happily included in this group and might warrant treatment as a fourth species-group. Nevertheless we leave them here at present as a matter of convenience.

Heterakis alata—Group

This group contains *H. bancrofti* Johnston, 1912; *H. alata* Schneider 1866 (= *H. arquata* Schneider, 1866 = *H. skrjabini* Cram 1927); *H. brasiliana* Linstow, 1899 (Instit. für Spez. Zoo., Berlin); *H. nattereri* Travassos, 1913.

In all the species of this group the spicules are without alae and, in most species, are slim. In none is there an elaboration of the tip of the left spicule and all occur in hosts in South America, except *H. bancrofti* which was found in an Australian host.

REMAINING SPECIES

Among the remaining species usually referred to *Heterakis*, *H. spumosa* Schneider, 1886, is probably the most widespread and best known. It is the only species of *Heterakis* which occurs in mammals and is widespread in rats throughout the World. It is characterised by equal and identical needle-like spicules, three pairs of para-cloacal papillae and no "post cloacal" pair or, another interpretation, has only two pairs of para-cloacal papillae of which the more anterior pair is very large and may represent three fused papillae. Because of these differences Lane (1914) described this species as *Ganguleterakis gangula*, having over-looked Schneider's earlier description. Since then the generic name *Ganguleterakis* has been used by some authors for a group containing so-called "equal spicule" species of *Heterakis*. This, as argued above, we do not accept but recognize that *H. spumosa* is very different from the typical *Heterakis* of birds and the recognition of a genus for *it alone* could be accepted if one so desired.

H. macrospiculum Ortlepp, 1939, *H. spalacis* Marçu, 1930 and *Ganguleterakis spalaxi* Kozlov and Yangolenko, 1967, do not appear to be species of *Heterakis*. It is possible that *H. macrospiculum* is an *Africana* species and that the other two, which are probably indistinguishable, are *Ascaridia*.

HOST AND GEOGRAPHICAL DISTRIBUTIONS

Species of the genus *Heterakis* occur widely in the caecum of ground-feeding, grain-eating birds throughout the world, with some species in water fowl and a few other hosts. The members of the *H. alata*-group are restricted to birds in South America while the other two groups occur in birds in the rest of the world. The sole exception is *H. bancrofti* Johnston, 1912, which occurs in Australia but is morphologically a member of the South American *alata*-group. Such a geographical relationship is interesting in reinforcing other Australian-Neotropical faunal relationships and so does not destroy the primarily South American relationships of the *alata*-group. It would, therefore, appear that the groups of species have arisen in response to geographical separation.

Support for this is given by the genus *Odontoterakis*, restricted to South America, in which the spicules are always simple, needle-like, and identical in structure. In this its members resemble the South American *H. alata*-group. The genus *Pseudospidodera*, in contrast, is restricted to India and related countries and the spicules are unequal with the right long and thin and the left short with broad alae (except in *P. jnanendrae* Chakravarty, 1938: but this species is in need of redescription), as in the *H. gallinarum*-group.

It is probable that *Odontoterakis* arose from the *Heterakis* species found in South American hosts while *Pseudaspidodera* arose from the *H. gallinarum*-group of species in South Asia. To this extent the species groups recognized in *Heterakis* are supported not only by the morphological and geographical data within the genus itself but also by the similar evidence supplied by the species grouped in *Pseudaspidodera* and *Odontoterakis*.

If the genus *Heterakis* is to be fragmented on the basis of spicule structure, rather than on the relative lengths of the spicules, part of it (the *gallinarum*-group) could be grouped with *Pseudaspidodera* species, part of it (the *alata*-group) with *Odontoterakis* while the remaining part (the *dispar*-group) would be left as a distinct genus. Such groupings might reflect the evolution of the group more accurately than the classification of Inglis

(1967), since *Odontaterakis* and *Pseudaspidodera* probably evolved from *Heterakis* species. Nevertheless, it is more reasonable and convenient to leave the generic groupings as they stand with *Heterakis* as one cosmopolitan genus.

The relationships of the *brevispiculum*-group remain uncertain as they could have arisen from either of the other groups. No decision on this is possible at this time although the new species described below (*H. vexans*) suggests an intermediate between the *dispar*- and *alata*-groups.

DESCRIPTIVE SECTION

All measurements are in microns unless otherwise stated and all specimens have been deposited in the collections of the U.S. National Museum Helminthological Collection, Beltsville, Maryland.

Heterakis vexans sp. nov.

(Figs. 8 and 14)

A single male was found among several *H. vulvolabiata* Chandler, 1926, obtained from the caecum (?) of a Formosan hill partridge, and appears to represent a new species.

DESCRIPTION

Morphology typical for genus. Lips (Fig. 8) rather small, with conspicuous papillae. Lateral alae prominent. Anterior end curved dorsad.

Male: 5.0 mm. long, 280 greatest width (1.0 mm. posterior to anterior end). Oesophagus (excluding pharynx) 665 long, with posterior bulb 112 greatest width. Pharynx (measured from flange tooth to junction with oesophagus) 48 long. Excretory pore 330 from anterior end. Nerve ring 216 from anterior end. Precloacal sucker (Fig. 14) 51 long, 48 wide (measured across outer margins of sclerotized wall), posterior edge 64 from anus. Tail 340 long. Spicules (Fig. 14) subequal, very stout, with similar tips, each with sharp, recurved hook at tip and subterminal inflation in lateral view. Spicules lacking alae, but each with narrow longitudinal flange along subterminal swelling. Right spicule 450 long, left spicule 380 long. Caudal papillae typical of genus but with only three pairs of paracloacals.

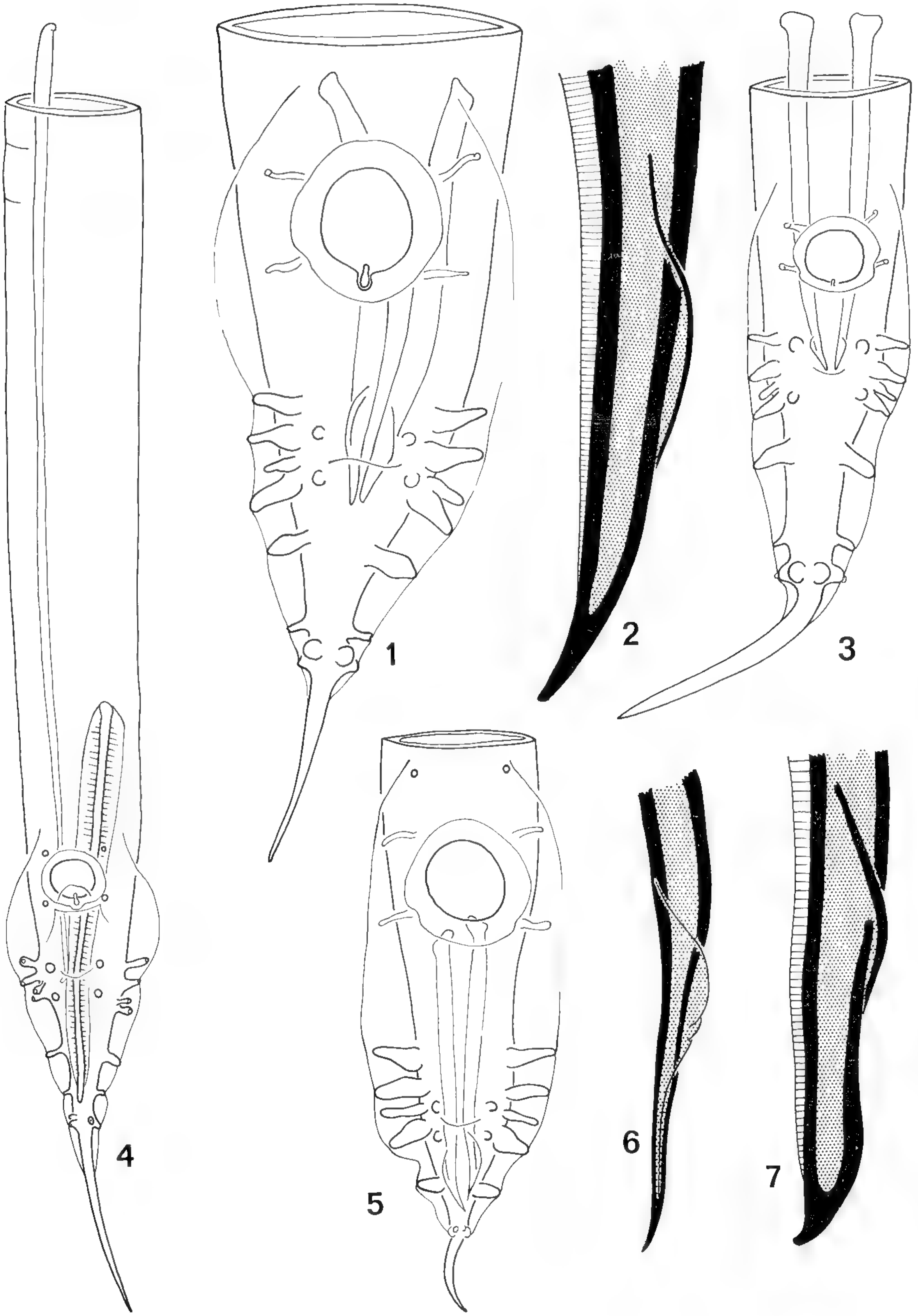
Female: Unknown.

Type host: Formosan hill partridge, *Arborophila crudigularis* (Swinhoe, 1864). (Phasianidae: Galliformes.)

Location: Probably caecum.

Type locality: Sun-Moon Lake, Nan-tou Hsien, Taiwan.

Type specimen: USNM Helm. Coll. holotype male no. 63228.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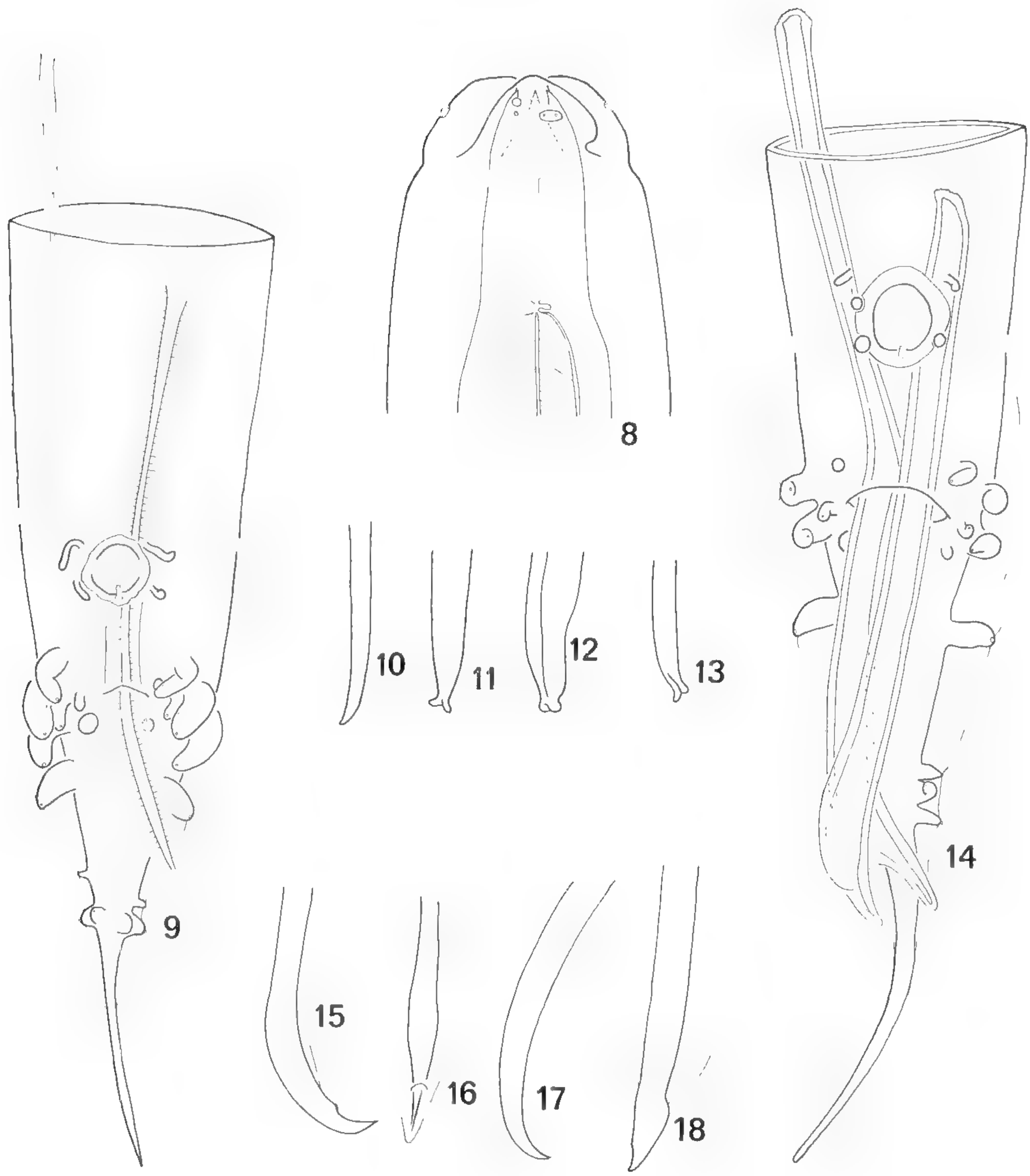

Figs. 1 and 2. *H. altaica;* 3 and 7. *H. dispar;* 4. *H. variabilis;* 5 and 6. *H. brevispiculum;* 8 and 14. *H. vexans;* 9 and 13. *H. vulvolabiata;* 10. *H. alata;* 11 and 12. *H. indica;* 15 and 16. *H. beramporia;* 17 and 18. *H. isolonche.*

Remarks: In spicule length, *Heterakis vexans* sp.n. is most similar to *Heterakis parva* Maplestone, 1931, but the spicules of that species are more slender and lack the terminal flanges characteristic of the *H. brevispiculum*-group found on *H. vexans*. The shapes of the spicules are closest to *Heterakis altaica* Spaul, 1929, from Asian galliform birds. Syntypes of this latter species were studied by one of us (W.G.I.) and the spicules are not as robust as those of *H. vexans* and they also lack the terminal hooks. Neither *H. parva* nor *H. altaica* are known to have three lateral paracloacal papillae. These papillae are variable in other species; it is common for one pair to be lost through fusion with an adjacent pair. On the other hand, *H. psophiae* Travassos, 1913, consistently has only three pairs. It will remain for subsequent discoveries of *H. vexans* to prove if this is a consistent feature of the species.

Heterakis variabilis Chandler, 1926

(Fig. 4)

The following redescription is based on twenty males and nine females from three species of gallinaceous hosts. All specimens are in excellent condition.

DESCRIPTION

Morphology typical for genus. Lips large, with characteristic papillae. Additional pair of inconspicious papillae occasionally present on each side, posterior to lips. Lateral alae prominent. Anterior end usually curved dorsad.

Male: 6.0 to 9.4 mm. long, 290 to 335 greatest width (1.0 mm. posterior to oesophagus). Oesophagus (excluding pharynx) 0.850 to 1.15 mm. long, with posterior bulb 150 to 180 greatest width. Pharynx (measured from anterior tooth to junction with oesophagus) 50 to 65 long. Excretory pore 320 to 400 from anterior end. Nerve ring 230 to 325 from anterior end. Precloacal sucker (Fig. 4) 70 to 85 long, 60 to 90 wide (measured across outer margins of sclerotized wall), posterior edge 105 to 150 from anus. Tail 410 to 670 long. Right spicule 1.20 to 1.97 mm. long, lacking alae. Left spicule 410 to 900 long, with well-developed alae. Caudal papillae typical of genus, but variable in number and location. Occasionally, a supernumerary single or pair of small, sessile papillae is present anterior to sucker.

Female: (all specimens gravid). 7.0 to 11.0 mm. long, 265 to 360 greatest width (1.0 mm. posterior to oesophagus). Oesophagus (excluding pharynx) 0.960 to 1.15 mm. long, with posterior bulb 150 to 180 greatest width. Pharynx 65 to 80 long. Excretory pore 350 to 480 from anterior end. Nerve ring 240 to 325 from anterior end. Tail 0.912 to 1.3 mm. long. Vulva salient or not, 3.35 to 5.57 mm. from posterior end. Ovijector with distal loop. Eggs (measured in ovijector) 60 to 76 by 35 to 40. Two (rarely one or three) tandem, large, postvulvar papillae.

Hosts: Swinhoe's blue pheasant, *Lophura swinhoii* (Gould, 1863); bamboo partridge, *Bambusicola thoracica sonoricox* Gould, 1862; mikado pheasant, *Syrmaticus mikado* (Ogilvie-Grant, 1906). (Phasianidae: Galliformes.)

Location: Caecum and large intestine.

Localities: Wu-lai, Tai-pei Hsien; Pu-li and Wu-sheh, Nan-tou Hsien: Ta-fu, Hua-lien Hsien; Hsin-sheh, Tai-chung Hsien; I-lan, I-lan Hsien: Taiwan.

Specimens deposited: U.S.N.M. Helm. Coll. nos. 63221-63223.

REMARKS

Chandler (1926) described this species from specimens recovered from three peacock pheasants, *Polyplectrum bicalcaratum* (L.), which had died in the Calcutta Zoological Gardens. Maplestone (1932) recorded this species from the type host in India, and Inglis (1958) found it in the type host in the London Zoological Gardens. Baylis (1936) and Madsen (1950) consider this species to be a synonym of *Heterakis isolonche* Linstow, 1906, but that species has spicules roughly equal in length while they are markedly unequal in *H. variabilis*. Inglis (1958) suggested that *Heterakis parva* Maplestone, 1931, may be a synonym of *H. variabilis*, but the present study shows this not to be the case (see below). *Heterakis variabilis* can easily be recognized by the sizes and shapes of the spicules.

The tiny papillae behind the head have not been reported previously for this species although we have seen them repeatedly in other species. Their structure and function remain problematical. Postvulvar papillae are present on every specimen of *H. variabilis* that we have studied, including subadults where they are small and appear to be developing. They always appear in tandem, are transversely elongate, and have hypodermis intruding into them. No nervous element could be seen. It seems to us unlikely that they were formed by the sucker of the male during copulation, because of their size, shape, and location. Possibly they aid in locating the male genital pore. Similar structures are known in the hookworm genus *Arthrostoma* Cameron, 1926.

Heterakis vulvolabiata Chandler, 1926

(Figs. 9 and 13)

The following redescription is based on fifteen males and ten females from six Formosan hill partridges. All specimens are in good to excellent condition.

DESCRIPTION

A small, slender heterakid, with morphology typical for genus. Lateral alae narrow. Anterior end usually curved dorsad.

Male: 4.3 to 5.1 mm. long, 168 to 196 maximum width (1.00 mm. posterior to oesophagus). Oesophagus (excluding pharynx) 530 to 650 long, with posterior bulb 80 to 120 greatest width. Pharynx 40 to 50 long. Excretory pore 240 to 300 from anterior end. Nerve ring 200 to 235 from anterior end. Precloacal sucker (Fig. 9) 31 to 40 long, 32 to 40 wide; posterior edge 30 to 50 from anus. Tail 200 to 230 long. Right spicule 460 to 570 long, very slender, needle-like, lacking alae, with simple tip. Left spicule (Fig. 13) 290 to 335 long, stout, alate, with blunt, slightly bifid tip. Caudal papillae typical of genus, but variable in number and location. Supernumerary papillae anterior to sucker not observed.

Female: (All specimens gravid). 5.0 to 7.0 mm. long, 190 to 265 maximum width (1.0 mm. posterior to oesophagus). Oesophagus (excluding pharynx) 575 to 865 long, with posterior bulb 100 to 140 greatest width. Pharynx 40 to 64 long. Excretory pore 260 to 388 from anterior end. Nerve ring 205 to 330 from anterior end. Tail 335 to 695 long. Vulva salient or not, 2.4 to 3.4 mm. from posterior end. Post vulvar papillae absent. Ovijector with tight, distal loop. Eggs (measured in uterus) 66 to 70 by 36 to 40.

Host: Formosan hill partridge, *Arborophila crudigularis.* (Phasianidae: Galliformes).

Location: Caecum and large intestine.

Localities: Pu-li, Sun-Moon-Lake, Nan-tou Hsien; Shih-men, Ping-tung Hsien, Taiwan.

Specimens deposited: U.S.N.M. Helm. Coll. no. 63220.

REMARKS

Chandler (1926) described this species from specimens recovered from *Arborophila torqueola* (Valenc.) which had died in the Calcutta Zoological Gardens. Our specimens are somewhat smaller than those of Chandler, although the spicule sizes are similar. Chandler apparently reversed the left and right spicules, for he stated the left was longer. Maplestone (1932) simply referred to a longer and shorter spicule, but he did figure the characteristically-tipped short spicule for the first time. Baylis (1936) described the right spicule as longer.

The present record is the first outside India, and the host record is also new. The species is readily recognized by its small size and the very characteristic delicate right spicule.

Heterakis beramporia Lane, 1914

(Figs. 15 and 16)

Several specimens were found in a domestic fowl, *Gallus gallus* (L.) from Tai-pei, Tai-pei Hsien, Taiwan. This is a common parasite of fowls in Asia, but appears not to have been reported previously from Taiwan. These specimens were overlooked in a previous report (Schmidt and Kuntz, 1970).

Specimens deposited: U.S.N.M. Helm. Coll. no. 63225.

Heterakis spumosa Schneider, 1866

Our data record this species from a banded crake, *Rallina eurizonoides formosana* Seebohm, 1894 (Rallidae) from Chiao-chi, I-lan Hsien, Taiwan. Since this is a cosmopolitan parasite of domestic rats and other rodents, the record seems dubious and should be viewed with suspicion. The occurrence of this parasite on Taiwan should be noted, however.

Specimens deposited: U.S.N.M. Helm. Coll. no. 63226.

Heterakis indica Maplestone, 1932

(Figs. 11 and 12)

Two males, one incomplete, were found in a drongo cuckoo, *Surniculus lugubris minimus* Baker (Cuculidae), at Terabanan Concepcion, Palawan, Republic of the Philippines. This is a new host record, although it has been reported from domestic fowls from Palawan by Schmidt and Kuntz (1970). The species was adequately described by Maplestone (1932) and by Li (1933) (as *H. lingnamensis*). Inglis (1958) hesitated to recognize this species, since specimens were not available for study. The present study fully supports the status of the species.

Specimens deposited: U.S.N.M. Helm. Coll. no. 63227.

Heterakis isolonche Linstow, 1906

(Figs. 17 and 18)

(Syn. *H. putaustralis* Maplestone, 1922; *H. tragopanis* Lal, 1942.)

Several specimens were found in the caecum and large intestine of a Swinhoe's blue pheasant, *Lophura swinhoii*, from Chun-yeh, Ping-tung Hsien, Taiwan. These are new host and locality records. This well-known parasite has been recorded from a wide range of galliform birds in Asia, Europe and North America and was adequately redescribed by Li (1933).

Specimens deposited: U.S.N.M. Helm. Coll. no. 63224.

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RECORDS OF THE SOUTH AUSTRALIAN MUSEUM

SUPERFICIAL MANDIBULAR MUSCULATURE, VOCAL SACS AND THE PHYLOGENY OF AUSTRALO-PAPUAN LEPTODACTYLID FROGS

By MICHAEL J. TYLER

SOUTH AUSTRALIAN MUSEUM
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Summary

Two major groups of genera can be distinguished among Australo-Papuan leptodactylid frogs on the basis of the presence or absence of attachments of the Musculus intermandibularis upon the M. submentalis. These groups correspond to the Cycloraninae and Myobatrachinae respectively except that *Cyclorana* cannot be associated with either. *Cyclorana* lacks the attachments of the intermandibularis upon the submentalis, characteristic of the Cycloraninae, and differs from the Myobatrachinae and Cycloraninae in have the intermandibularis differentiated into separate elements at the apex of the mandibles.

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SYNOPSIS

Two major groups of genera can be distinguished among Australo-Papuan leptodactylid frogs on the basis of the presence or absence of attachments of the Musculus intermandibularis upon the M. submentalis. These groups correspond to the Cycloraninae and Myobatrachinae respectively except that *Cyclorana* cannot be associated with either. *Cyclorana* lacks the attachments of the intermandibularis upon the submentalis, characteristic of the Cycloraninae, and differs from the Myobatrachinae and Cycloraninae in having the intermandibularis differentiated into separate elements at the apex of the mandibles.

In the majority of genera the vocal sac is a unilobular submandibular structure but in *Notaden* it is bilobular and supramandibular. *Heleioporus* and *Neobatrachus* lack vocal sacs, but it is concluded that the buccal cavity is an effective resonance chamber because in these genera the floor of the mouth can be depressed to further increase the capacity of a large buccal cavity. It is argued that the ancestral stock from which the Australo-Papuan genera are derived lacked a vocal sac.

Morphological divergence in hyomandibular structures currently used to distinguish leptodactylid sub-families is reported, and the different evolutionary mechanisms by which such divergence may have arisen are discussed.

INTRODUCTION

Parker (1940), in his monograph of the leptodactylid frogs of the Australian Geographical Region, recognises two sub-families, the Myobatrachinae and the Cycloraninae, largely from a study of the thigh musculature, hyoid and tongue, supplemented by data from Trewavas (1933) on the hyoid and larynx. Although features of the hyoid, larynx, and tongue supported such a clear-cut division Parker nevertheless acknowledged that the Myobatrachinae might be, "a group of frogs derived from the Cycloraninae by the evolution of the same type of feeding mechanism on more than one occasion".

Because the superficial mandibular musculature often provides a reliable index of generic and sub-familial relationships in the Hylidae (Tyler, 1971a), I made similar studies to establish the extent of divergence and taxonomic and phylogenetic significance of such structures in the Australian leptodactylid sub-families.

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In the course of these studies data were also recorded for a few genera on some of the characters considered by Parker (1940) to be, "possibly of considerable taxonomic value" (*e.g.*, site of attachment of the Mm. sternohyoideus and petrohyoidei upon the hyoid plate, and the shape of the hyoid alary processes). These data permit a reassessment of Parker's suggestion.

MATERIALS, METHODS AND TERMINOLOGY

Representatives of the following genera and species were examined:

Adelotus brevis.

Crinia georgiana, C. glauerti, C. haswelli, C. laevis, C. leai, C. parinsignifera, C. riparia, C. signifera, C. victoriana.

Cyclorana alboguttatus, C. australis, C. brevipes, C. cultripes, C. dahli, C. platycephalus.

Glauertia orientalis, G. russelli.

Heleioporus albopunctatus, H. barycragus, H. eyrei, H. inornatus, H. psammophilus.

Kyarranus sphagnicolus.

Lechriodus papuanus, L. platyceps.

Limnodynastes convexiusculus, L. dorsalis, L. fletcheri, L. ornatus, L. peroni, L. spenceri, L. tasmaniensis.

Metacrinia nichollsi.

Mixophyes fasciolatus.

Myobatrachus gouldi.

Neobatrachus centralis, N. pelobatoides, N. pictus, N. sutor, N. wilsmorei.

Notaden bennetti, N. melanoscaphus, N. nichollsi.

Philoria frosti.

Pseudophryne bibroni, P. corroboree, P. dendyi, P. semimarmorata.

Taudactylus acutirostris, T. diurnus.

Uperoleia rugosa.

The methods employed, muscle terminology, descriptive synonymy and a description of the generalised anuran superficial mandibular musculature and vocal sac structure are presented in detail elsewhere (Tyler, 1971a). That terminology is therefore only summarised here so that this paper can be considered alone.

The anuran superficial mandibular muscles consist of (1) the M. submentalis which is an ovoid and customarily araphic muscle at the apex of the mandibles, so described in the following text as "normal". (2) The M.

intermandibularis which arises as a thin flat sheet from the lateral lingual surface of the mandibles between the submentalis and the jaw articulation, and (3) the M. interhyoideus which arises principally from the anterior cornu of the hyoid and unites anteriorly with the posterior border of the intermandibularis.

In some genera the intermandibularis is differentiated by the presence of supplementary elements which lie ventral to the customary sheet of muscle. The nomenclature of the supplementary elements is derived from the position on the mandible from which they arise, *e.g.*, "apical" or "lateral".

The term "vocal sac" is here restricted to the epithelium lined chamber developed as an extension of the floor of the mouth, and customarily lying dorsal to the superficial mandibular muscles and ventral to the hyoid plate (see Fig. 1). The vocal sac and the superficial mandibular muscles comprise the "vocal sac structure".

COMPARATIVE MORPHOLOGY OF SUPERFICIAL MANDIBULAR MUSCULATURE AND VOCAL SACS

Adelotus (Fig. 2A)

The M. submentalis is normal but partially obscured by the intermandibularis which attaches upon its ventral surface. The interhyoideus is poorly developed and anteriorly underlies the intermandibularis. The interhyoideus arises from the anterior cornu and there is a slender ligamentous attachment to the posterior face of the squamosal.

The vocal sac apertures extend along the lingual margin of the mandibles for almost the entire length of the intermandibularis. The vocal sac lies almost completely above the intermandibularis.

Crinia

The submentalis and intermandibularis are normal except that the latter is reduced postero-medially in association with an increased development of the interhyoideus. During the embryology of *C. georgiana* and *C. haswelli* the anterior development of the intermandibularis is arrested so that this muscle remains separate from the posterior border of the submentalis. The interhyoideus arises partly from the anterior cornua and partly from the squamosal; it is well developed posteriorly with a large median lobe extending far beyond the post-articular extremities of the mandibles.

The vocal sac lies above the intermandibularis and interhyoideus (Fig. 1). The apertures are relatively long, extending approximately one half of the total length of the mandibles.

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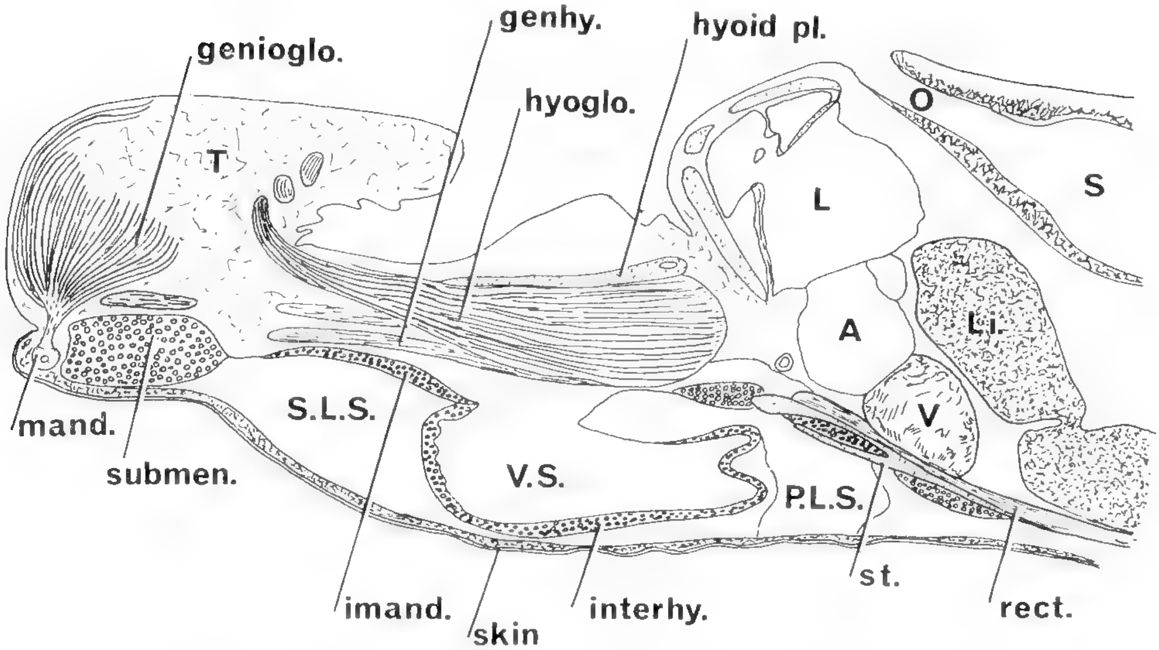

Fig. 1. Mandibular region of male *Crinia signifera* in sagital section.

Key to abbreviations—A — heart (auricle); genhy. = Musculus geniohyoideus; genioglo. = Musculus genioglossus; hyoglo. = Musculus hyoglossus; hyoid pl. = hyoid plate; imand. — Musculus intermandibularis; interhy. = Musculus interhyoideus; L. = larynx; Li. = liver; mand. = mandible at symphysis; O. = oesophagus; P.L.S. = pectoral lymphatic sac; rect. = Musculus rectus abdominus; S. = stomach; S.L.S. = submandibular lymphatic sac; st. = sternum; submen. = Musculus submentalis; T. = tongue; V. = heart (ventricle); V. S. = Vocal sac.

Cyclorana

The submentalis is small in all members of the genus and normally araphic. (A distinct median raphe occurred in a single individual of *C. cultripes.*) The intermandibularis is differentiated by the development of an apical element arising on each side of the submentalis, an element similar to that characterising the Australian hylids (Tyler, 1971a, Fig. 4A). In *C. alboguttatus* and *C. dahli,* a small group of the most anterior fibres of this apical element are directed forwards and attach medially upon the ventral surface of the submentalis, but in the remaining species there is neither overlap nor attachment.

The interhyoideus is extremely well developed posteriorly, particularly in *C. platycephalus* where there is a conspicuously large posterior lobe. There is, however, considerable variation in the site of origin of that muscle. In *C. australis, C. brevipes* and *C. dahli* this muscle arises entirely from the anterior cornua with an extensive region of attachment extending to a point beneath the eustachian tubes. In *C. alboguttatus* and *C. cultripes* although the majority of the fibres are attached to the anterior cornua, approximately ten per cent of them attach on the posterior arm of the squamosal. The extreme condition is exhibited by *C. platycephalus* where such fibres arise in equal proportions from the squamosal and anterior cornua.

The slit-like vocal sac apertures are short, extending for less than one-quarter of the length of the mandibles, with their anterior margins almost on a level with the posterior limit of the apical element of the intermandibularis, and the posterior margins near the fusion of the interhyoideus with the customary element of the intermandibularis.

In male *C. platycephalus* the corium of the skin in contact with the superficial mandibular muscles is frequently intensely pigmented black, and the dull greyish external appearance of the submandibular skin would appear to be entirely caused by this deep pigmentation.

Examination of a series of tadpoles and transforming juvenile specimens of *C. australis* (stages 41-46), revealed that the sequence of ontogeny of the mandibular muscles is similar in all respects, to that reported from Australo-Papuan hylids by Tyler (1971a).

Glauertia

The submentalis is normal but the intermandibularis does not extend anteriorly to meet it, so that small portions of the geniohyoideus are exposed. The interhyoideus is well developed extending posteriorly beyond the post-articular portions of the mandibles: this muscle arises in a broad sheet from the squamosal and anterior cornua.

The vocal sac apertures are long and broad, bordered by the anterior cornua on one side and the geniohyoideus on the other, and extending for a distance equivalent to one half of the total length of the mandibles. The vocal sac is extensive and occupies almost the entire area above the intermandibularis and interhyoideus.

Heleioporus (Fig. 2D)

The submentalis is extremely large but completely covered ventrally by the intermandibularis which is firmly attached to it medially. The interhyoideus arises from the anterior cornua with an intimate proximal attachment to the inferior surface of the eustachian tubes.

Members of this genus lack vocal sacs. The lining of the mouth on each side of the tongue is markedly pleated and the geniohyoideus extremely loose.

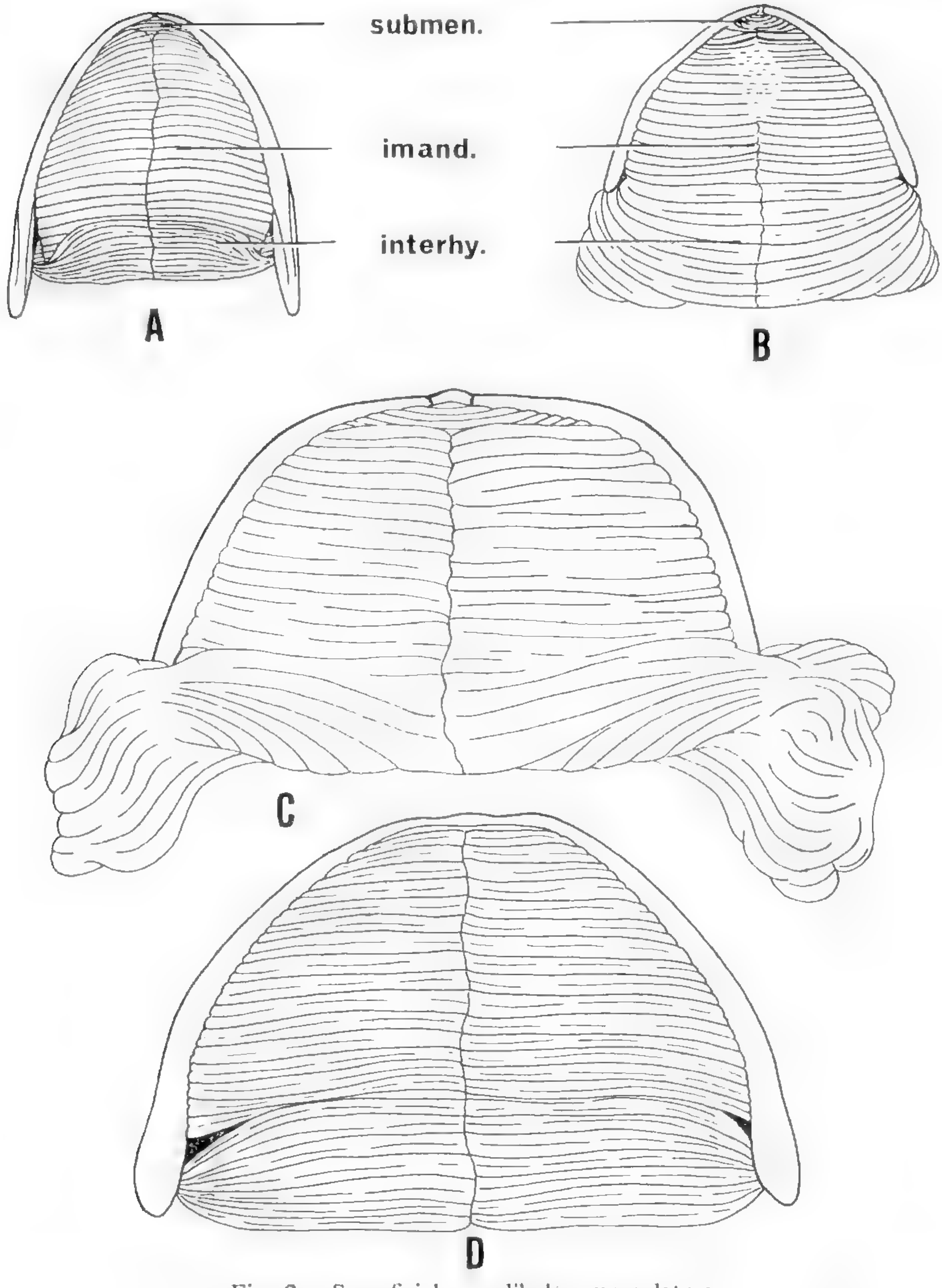

Fig. 2. Superficial mandibular musculature.

A = *Adelotus brevis;* B = *Myobatrachus gouldi;* C = *Notaden nichollsi;* D = *Neobatrachus centralis.* Key to abbreviations—imand. = Musculus intermandibularis; interhy. = Musculus interhyoideus; submen. = Musculus submentalis.

Kyarranus

The submentalis is of moderate size and partially obscured by the attachment of the anterior fibres of the intermandibularis. Direct attachment of the intermandibularis fibres to the mandible is confined to the posterior half of the latter. Anteriorly the fibres run initially parallel to and then diverge from the mandible, and the attachment to the mandible is *via* transparent connective tissue. The interhyoideus is well developed.

The vocal sac apertures lie parallel to the posterior half of the pre-articular portion of the mandible. The vocal sac lies above the entire surface of intermandibularis and interhyoideus.

Lechriodus

The submentalis is of moderate size and its posterior border is partially obscured by the attachment of fibres of the intermandibularis upon it. The intermandibularis bears a median aponeurosis. The interhyoideus is not well developed.

Vocal sac and vocal sac apertures are present in *L. fletcheri* and *L. papuanus*, but not in *L. platyceps*. The vocal sac is extensive, occupying most of the area above the interhyoideus and intermandibularis.

Limnodynastes

The submentalis is broad and partially obscured by the intermandibularis. The extent to which the intermandibularis intrudes upon the ventral surface of the submentalis varies from species to species, being most extensive in *L. dorsalis* where only a V-shaped portion of the submentalis is visible behind the apex of the mandibles. The other extreme is exhibited by *L. ornatus* and *L. spenceri*, in which the anterior fibres of the intermandibularis are transversely directed so that the visible segment of the submentalis is larger and almost semicircular.

In most species the interhyoideus arises solely from the anterior cornua but in a few individuals of *L. dorsalis* and *L. tasmaniensis* slender attachments to the squamosal occur. Postero-medial development of the interhyoideus is most pronounced in *L. ornatus* and *L. spenceri*, and overlies a portion of the pectoral musculature.

Vocal sac apertures extend for almost the entire length of the intermandibularis. The vocal sac lies above the intermandibularis and interhyoideus.

For illustrations of the superficial mandibular musculature and inflated vocal sac structure of *L. tasmaniensis* see Tyler (1971b).

Metacrinia

The submentalis is normal and completely visible. The intermandibularis is not differentiated into separate elements but individual superficial fibres, particularly those arising at the anterior ends of the mandibles, are directed obliquely and posteriorly and thus overly those directed transversely. The interhyoideus arises solely from the anterior cornua. In the mid-line there is a bell-shaped aponeurosis at the junction of the intermandibularis and interhyoideus.

On their dorsal surfaces the intermandibularis and interhyoideus are directly attached to the broad geniohyoideus. The vocal sac apertures are short and located close to the mandible directly anterior to the posterior limit of the intermandibularis. The vocal sac is confined to the area above the interhyoideus.

Mixophyes

The submentalis is large, its posterior border hidden by transversely directed fibres of the intermandibularis. The intermandibularis bears a median aponeurosis near the junction with the narrow interhyoideus. The interhyoideus arises partly from the anterior cornua and partly from the squamosal.

The vocal sac apertures are long, equivalent to more than one third of the length of the mandible. The vocal sac is large, laterally extending along the entire length of the intermandibularis and interhyoideus, medially to the apex of the aponeurosis.

Myobatrachus (Fig. 2B)

The submentalis is small and normal. The most anterior fibres of the intermandibularis are directed anteriorly but do not appear to underly the submentalis. The interhyoideus is extremely thin and extends posteriorly into a large median lobe. The segment of the interhyoideus lying behind the post-articular portion of the lower jaws is not entirely muscular but consists of muscle fibres broadly separated by connective tissue.

The vocal sac apertures are approximately one-quarter of the total length of the mandibles. The posterior border of the aperture is on a level with the posterior limit of the intermandibularis. The vocal sac lies above almost the entire intermandibularis and interhyoideus and there are slight lateral extensions following the anterior cornua behind the jaws.

Neobatrachus

The submentalis is large and, in those species in which the tip of the mandibles is particularly blunt (*e.g., N. wilsmorei*), it is almost semi-circular in shape.

Anteriorly the intermandibularis overlies the submentalis and attaches to it in the midline. The interhyoideus arises entirely from the anterior cornua. On their contiguous border the only evidence of interpenetration of fibres of the interhyoideus and intermandibularis occurs medially.

Vocal sacs are absent in all members of the genus, and the intermandibularis and interhyoideus closely adhere to the muscles lying dorsal to them The lining of the mouth between the mandible and lateral border of the tongue is extensively folded (Fig. 3) as in *Heleioporus*.

Notaden (Fig. 2C)

The submentalis is elongated, compressed and partly obscured by the attachment of the intermandibularis upon its ventral surface. In *N. bennetti* and *N. nichollsi* the interhyoideus arises solely from the anterior cornua but in *N. melanoscaphus* the muscle arises in equal portions from the anterior cornua and the tympanic annulus. The interhyoideus is unusually well developed proximally, the fibres being directed posteriorly from the anterior cornua creating a lateral extension to the vocal sac. In adult males the interhyoideus is markedly convoluted and the giant bundles of fibres are not always contiguous being separated, particularly in the median portion, by connective tissue.

The vocal sac appertures are bounded by the anterior cornua, commencing at the point where these pass above the geniohyoideus, and extending for a distance equivalent to one third of the total length of the mandibles. The development of bilobular supramandibular pouches to the vocal sac in members of this genus is unique amongst Australo-Papuan leptodactylids, and may be associated with the extremely obtuse mandibles and the associated reduction of the site of attachment for the superficial mandibular muscles.

Philoria

The submentalis is large and composed of two separate transverse segments of which the smaller anterior is attached solely to the prominent mento-meckelian bones, whilst the larger posterior segment arises from the dentaries.

The intermandibularis is an extensive muscle whose anterior fibres diverge from the transverse path, passing forwards to attach upon and almost completely obscure the posterior segment of the submentalis. On the anterior one-third of the jaw there is thus no direct attachment of muscle fibres to the mandibles, and contact is maintained by connective tissue. The interhyoideus arises solely from a particularly extensive region of the anterior cornua and terminates distally at a point midway between the mandible and the geniohyoideus lateralis. The interhyoideus has a prominent posterior lobe.

The vocal sac apertures are rather oblique, extending anteriorly from the point where the anterior cornua pass above the geniohyoideus lateralis, and posteriorly to the posterior limit of the intermandibularis on the mandible.

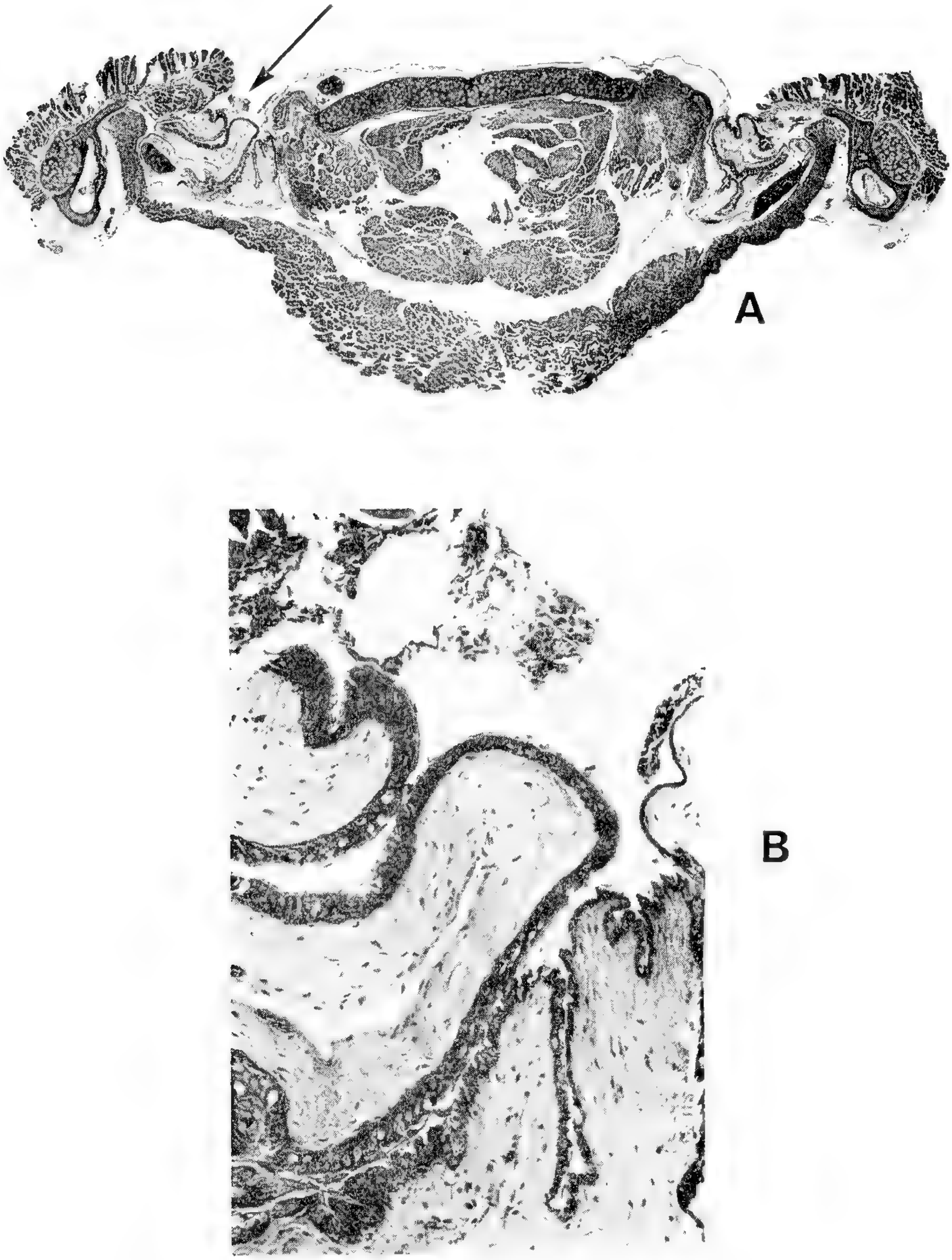

Fig. 3. Mandibular region of male *Neobatrachus pictus* in transverse section.

Sectioned posterior to tongue; skin removed. A = entire mandibular region; B. = enlargement of floor of mouth lateral to mandible (position indicated by arrow in figure 3A).

The vocal sac is large, occupying the posterior half of the intermandibularis and the entire interhyoideus.

Pseudophryne

The submentalis is normal. The intermandibularis is not differentiated but anteriorly the superficial ventral fibres are directed obliquely and posteriorly, so that they overly the deeper and transversely directed fibres. The interhyoideus arises entirely from the anterior cornua and is well developed posteriorly.

The vocal sac apertures are long, extending for a distance equivalent to approximately one-half of the total length of the mandible and are obliquely situated. The vocal sac is rather posterior in position and largely confined to the vicinity of the interhyoideus.

Taudactylus

The submentalis is composed of two segments in *T. acutirostris*, a small anterior portion arising solely from the mento-meckelian bones, which partly overlies the larger segment arising from the dentaries. No such separation occurs in *T. diurnus*.

There is an elongate, median, longitudinal aponeurosis to the anterior half of the intermandibularis adhering completely to the deep musculature. The interhyoideus arises partly from the anterior cornua and partly from the posterior arm of the squamosal.

In *T. acutirostris* the vocal sac apertures are rather oblique and posterior in position, being bounded by the anterior cornua and extending medially to the point where the cornua pass above the geniohyoideus. The vocal sac is largely confined to the interhyoideus. Neither vocal sac apertures nor vocal sac were detected in the *T. diurnus* examined.

Uperoleia

The superficial mandibular musculature is similar to that of *Glauertia*. The only difference of note is that in *Uperoleia* the vocal sac apertures are slit-like and bounded solely by the anterior cornua.

HYOMANDIBULAR FEATURES AND LEPTODACTYLID PHYLOGENY

Although Parker (1940) considered a wide variety of morphological characters, the only ones that supported the recognition of two major groups of genera were features of the larynx, tongue and hyoid. Laryngeal characters however were not examined by Parker who relied on the observations of Trewavas (1933). As the latter examined only single representatives of one myobatrachine and three cycloranine genera, the value of laryngeal anatomy as a source of taxonomic criteria is unknown in this group.

The tongue of the Myobatrachinae was found by Parker to be a slender organ in contrast to the broad cycloranine tongue. The characteristic features of the hyoid noted by Trewavas (1933) were summarised by Parker as follows:

"Cycloraninae (*Heleioporus*, *Limnodynastes* and *Mixophyes*).

(1) Alary process narrow proximally, but expanded distally (pedunculate).

(2) M. omohyoideus present.

(3) Mm. sternohyoideus and petrohyoidei attached at the lateral edges of the hyoid plate.

Myobatrachinae (*Crinia*).

(1) Alary process of the hyoid a wing-like expansion of almost the whole lateral margin of the hyoid plate, without narrow stalk.

(2) M. omohyoideus absent.

(3) Mm. sternohyoideus and petrohyoideus anterior inserted on the ventral surface of the hyoid, reaching the middle line in the posterior part of this insertion."

In this summary Parker employed a certain amount of licence because the *Mixophyes* differed from the above cycloranine definition in the following respects: the alary process is simply a small, triangular protuberance in the figure (Trewavas, 1933, Fig. 28), and the sternohyoideus is attached to the body of the hyoid plate; at no point does that muscle reach the lateral borders of that plate. Parker's justification for ignoring such discrepancies was that Trewavas examined a juvenile specimen.

Parker noted that loss of the omohyoideus is believed to have occurred many times in the Anura. Accordingly he considered it to be of little taxonomic significance, and did not report its presence or absence in genera other than those examined by Trewavas. He did examine the shape of the alary processes and the sites of attachment of the petrohyoideus and sternohyoideus on the hyoid, and reported that their conditions in the different genera corresponded to the above subfamilial definitions. Current delimitation of these subfamilies therefore really depends upon these two characters in conjunction with that of the tongue.

In the study reported here I examined these characters in a few genera, and in *Notaden* and *Philoria* my observations conflict with those of Parker. Subsequently, I analysed the structures in terms of their function, and considered the various ways in which such morphological divergence could have arisen, before attempting to re-evaluate the phylogenetic significance of the characters.

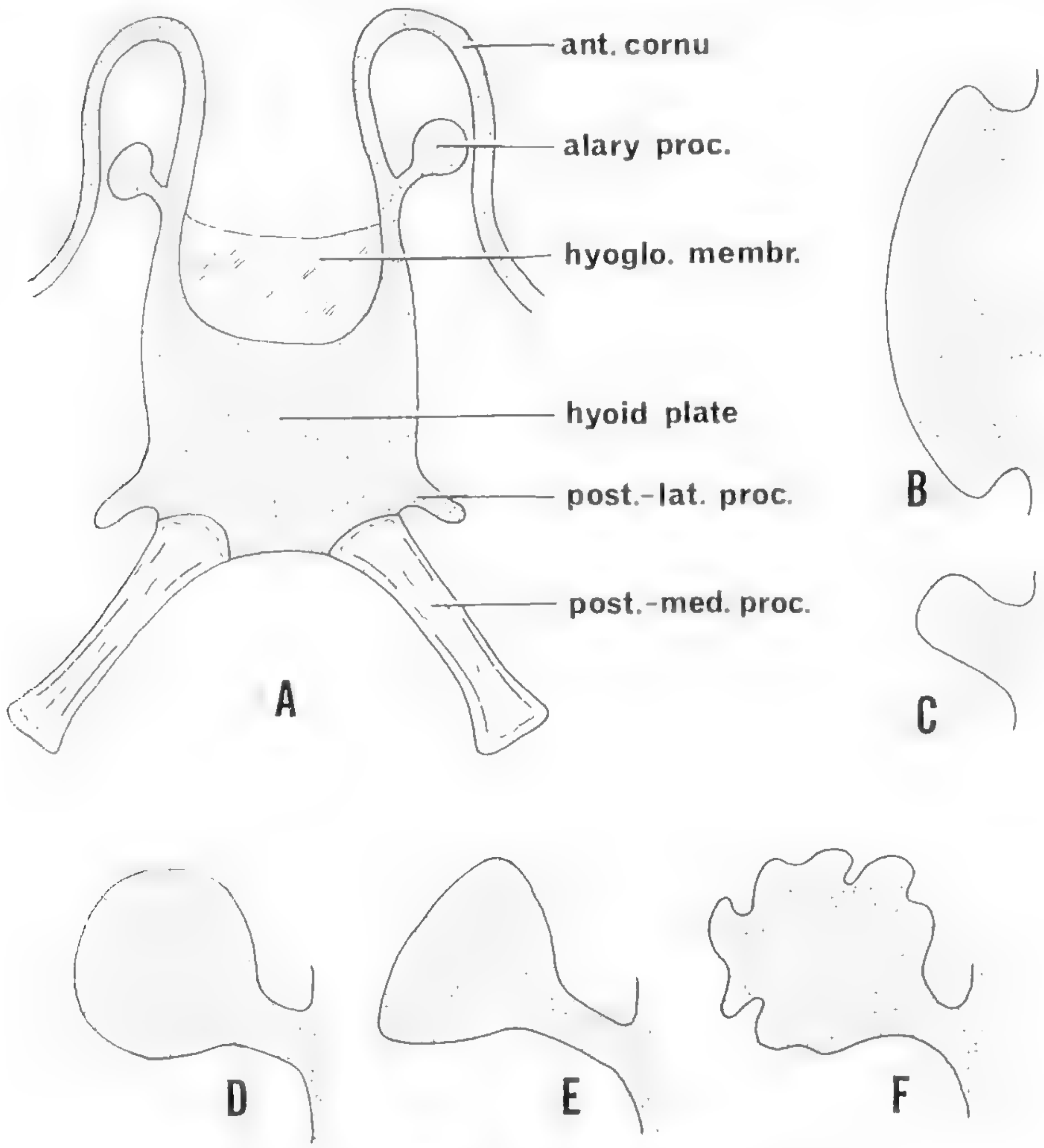

Fig. 4. Hyoid plate and variation in alary processes.
A. generalised hyoid plate, B-F alary processes, for explanations see text on page 14.
Key to abbreviations—alary proc. = alary process; ant. cornu = anterior cornu; hyoglo. membr. = hyoglossal membrane; post.-lat. proc. = postero-lateral process; post.-med. proc. = postero-medial process.

The hyoid plate is a thin sheet lying in a horizontal plane between and posterior to the mandibles. It is customarily entirely cartilaginous and extremely pliable in life. Occasionally however it may be partly or entirely calcified, or partly ossified. Up to four pairs of distinct processes arise from the borders of the plate: anterior cornua from the anterior surface, alary and postero-medial processes from the lateral margin, and postero-lateral from the postero-lateral corner (Fig. 4A). Loss of one or more pairs of the first three of these has occurred in many anuran genera.

In the literature the term "alary process" is applied to two quite different hyoid structures: (1) a broad "wing-like" extension of the entire lateral edge of the plate such as occurs in myobatrachine genera (Fig. 4B), or (2) a more restricted, discrete process extending from part of the lateral border on a level with the superior margin of the plate. This latter type can be a simple extension rounded terminally, which may be as broad proximally as distally (Fig. 4C), or may be pedunculate with a circular (Fig. 4D), oval (Fig. 4E) or even irregular (Fig. 4F) terminal margin.

The Mm. petrohyoideus and sternohyoideus attach upon the hyoid plate at one of two positions: either along the lateral border of the plate or upon the body of the plate.

In both subfamilies the lateral, lingual margin of the muscles follows the axis of the proximal portion of the anterior cornua. If the wing-like alary processes in the Myobatrachinae are regarded as "optional extras", the lateral lingual borders of the sites of muscle attachment are seen to be similar to those in the Cycloraninae.

There are no muscles attached to wing-like alary processes whilst, in contrast, the petrohyoideus attaches to the proximal portion of the pedunculate type which thus provides an increase in the site available for attachment. In contrast I think that the wing-like processes only support the floor of the mouth. I only arrived at this conclusion by the elimination of all other possibilities. I have, however been unable to demonstrate a consistent association between the presence of this process and broad mandibles: a feature which might conceivably influence the evolution of such a structure, while remembering Gans (1966) stricture that the present architecture of a structure is not necessarily moulded by its present function.

In cycloranine genera such as *Heleioporus* in which the distal portion of the pedunculate alary process is extremely large, a structurally supporting role similar to that proposed for the myobatrachine alary process is indicated. Where it is small its ability to perform a similar function is considered unlikely. From a consideration of the available data the possibility that wing-like and pedunculate alary processes are not homologous structures cannot be dismissed. However, to regard the presence or absence of wing-like alary processes a character of taxonomic value appears justified. Thus although the fact that I have not seen distal dilations to the discrete processes in *Notaden* and *Philoria* necessitates a change in the diagnosis of the subfamily Cycloraninae to accommodate the variation in the alary processes, it does not materially affect the taxonomic value of the character.

The differences in the positions occupied by hyoid muscles, as described here, may have been the result of two independent evolutionary mechanisms. One, a major alteration of a skeletal component providing attachment, as exhibited by the gross structural change of the mandibles of *Notaden*, and the other ontogenetic heterochrony.

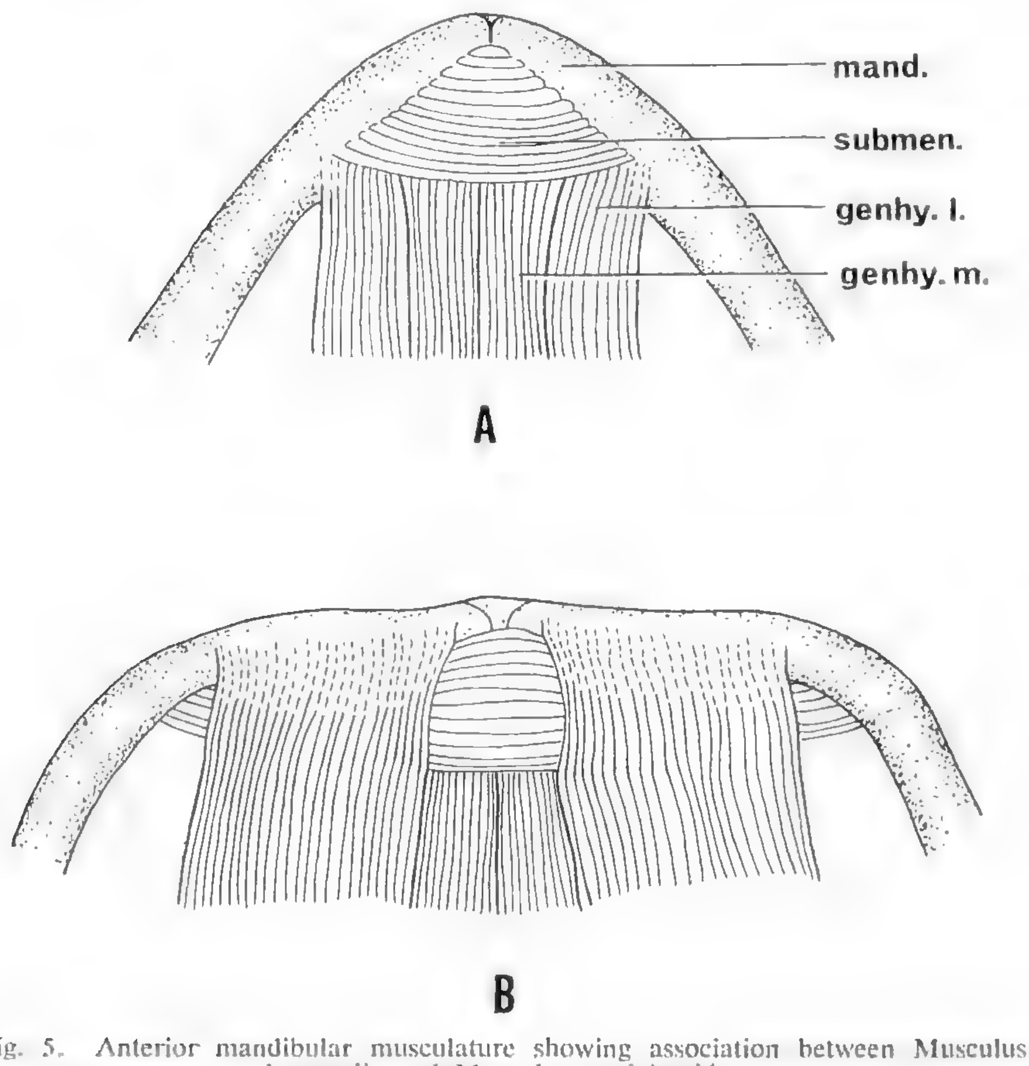

Fig. 5. Anterior mandibular musculature showing association between Musculus submentalis and Musculus geniohyoideus.

A. generalised anuran in ventral aspect; B. *Notaden nichollsi*. Musculus intermandibularis removed. Key to abbreviations: genhy. l. = Musculus geniohyoideus lateralis; genhy. m. = Musculus geniohyoideus medialis; mand. = mandible; submen. = musculus submentalis. The ligamentous portion of the geniohyoideus lateralis of *N. nichollsi* is represented by broken lines.

The M. geniohyoideus lateralis of all anurans previously reported in the literature is attached upon the lateral lingual surface of the mandible immediately posterior to or dorsal to the submentalis (Fig. 5A). But for a very slight, initial mediad inclination the fibres of this muscle follow the longitudinal axis. In *Notaden* the mandibles are exceptionally blunt anteriorly, and the submentalis is extremely elongate. If in this genus the geniohyoideus lateralis remained in its customary position in relation to the lateral end of the submentalis, the fibres of the muscle would follow a path at an acute angle to the longitudinal axis.

It is evident that *Notaden* has retained the ancestral condition: the muscle remains attached to the mandible near the mandibular symphysis, but by means of a membrane, and the submentalis now passes partly beneath this membrane, and partly beneath the geniohyoideus lateralis (Fig. 5B). The major influence here has evidently been that of retention of direct opposition of sites of muscles origin and attachment, suggestive of an inevitability in these sites to maintain functional efficiency.

Ontogenetic heterochrony must be regarded as a potential source of modification to the positions occupied by adjacent muscles. During ontogeny the retardation of the development of one or the acceleration of another occupying an adjacent site, could clearly permit fibres of one to intrude upon and occupy a portion of the site normally occupied by the other. In genera such as *Glauertia* such a process could be responsible for the more inferior margin to and exposure of the mandibular site of the geniohyoideus, associated with the arrested development of the intermandibularis.

Parker (1940) noted that in the Myobatrachinae the sternohyoideus reaches the midline in the posterior portion of the insertion on the hyoid plate, contrasting with the cycloranine condition where it is a more slender muscle and does not. My observations on *Notaden* do not agree with those of Parker. In all specimens examined the sternohyoideus is a massive muscle which occupies almost the entire ventral surface of the hyoid plate (reaching the midline throughout its length). In the face of such marked variation between the material we have examined, the medial limit of the site of the sternohyoideus upon the hyoid plate does not constitute a character by which the two subfamilies can be distinguished.

SUPERFICIAL MANDIBULAR MUSCULATURE AND VOCAL SACS AS INDICES OF LEPTODACTYLID PHYLOGENY

The two subfamilies of Australo-Papuan leptodactylid frogs currently recognised can now be distinguished on the basis of one consistent difference in the superficial mandibular musculature. In the Cycloraninae the most anterior fibres of the intermandibularis attach upon the ventral surface of the submentalis, while such attachments are absent in the Myobatrachinae (Table

1). Unfortunately *Cyclorana* differs from other cycloranine genera in lacking the attachments otherwise characteristic of the subfamily. The genus differs further from both cycloranine and myobatrachine genera by having the intermandibularis differentiated into separate elements.

In all the cycloranine genera except *Cyclorana* the nature of the attachments is similar, involving transversely oriented fibres of the intermandibularis. The differences existing between genera are the extent to which these fibres underly the submentalis, but it is difficult to express quantitatively the proportion of the submentalis so hidden from view. This is unfortunate because the data presented here indicate that the extent of such attachment is taxonomically significant, because there is a close similarity in this character in genera currently considered to have a close phylogenetic relationship on the basis of other evidence. For example, *Neobatrachus* is recognized as a valid

TABLE 1

Subfamily	Genus	*Intermandibularis/ Submentalis* connection	Supplementary elements of *Intermandibularis*	Vocal Sac
Myobatrachinae..	*Crinia*	Absent	Absent	Unilobular and submandibular
Myobatrachinae..	*Glauertia*	Absent	Absent	Unilobular and submandibular
Myobatrachinae..	*Metacrinia*	Absent	Absent	Unilobular and submandibular
Myobatrachinae..	*Myobatrachus*..	Absent	Absent	Unilobular and submandibular
Myobatrachinae..	*Pseudophryne* ..	Absent	Absent	Unilobular and submandibular
Myobatrachinae..	*Taudactylus* ...	Absent	Absent	Unilobular and submandibular or absent
Myobatrachinae..	*Uperoleia*	Absent	Absent	Unilobular and submandibular
Cycloraninae	*Adelotus*	Present	Absent	Unilobular and submandibular
Cycloraninae	*Cyclorana*	Absent	Present	Unilobular and submandibular
Cycloraninae	*Heleioporus* ...	Present	Absent	Absent
Cycloraninae	*Kyarranus*	Present	Absent	Unilobular and submandibular
Cycloraninae	*Lechriodus*	Present	Absent	Unilobular and submandibular or absent
Cycloraninae	*Limnodynastes* .	Present	Absent	Unilobular and submandibular
Cycloraninae	*Mixophyes*	Present	Absent	Unilobular and submandibular
Cycloraninae	*Neobatrachus* .	Present	Absent	Absent
Cycloraninae	*Notaden*	Present	Absent	Bilobular and supramandibular
Cycloraninae	*Philoria*	Present	Absent	Unilobular and submandibular

genus largely on biological data, and Parker (1940) did not distinguish it morphologically from *Heleioporus*. Correspondingly, the ventral surface of the submentalis is completely covered by the intermandibularis in both genera, a feature not shared by any of the others.

Vocal sacs are present in all genera except *Heleioporus* and *Neobatrachus*, one species of *Lechriodus* (*L. platyceps*) and one species of *Taudactylus* (*T. diurnus*). Absence of vocal sac may be considered a primary feature when it is characteristic of a family (*e.g.*, Ascaphidae and Discoglossidae) or secondary in genera where the vast majority of species possess vocal sacs, but one or two do not (*Hyla* and *Litoria*, see Tyler, 1971a). In the former case there is no evidence that vocal sacs have ever evolved, whereas in the latter the interpretation is one of loss.

The vocal sac structures of the other Australo-Papuan leptodactylid genera are unilobular in form and submandibular in position, except in *Notaden*, where they are bilobular and supramandibular.

Heleioporus and *Neobatrachus* in which there are no vocal sacs, have large domed buccal cavities which can evidently be further enlarged by depression of the floor of the mouth, as indicated by the presence of longitudinal pleating of the floor. The capacity of the buccal cavity is therefore adequate to act as an effective resonance chamber and so performs the role of the vocal sac. Both groups of evidence suggest that resonance chambers have evolved independently at least twice amongst Australo-Papuan leptodactylids, and that the ancestral stock from which this family is derived lacked them.

In summary the myological data demonstrates that the superficial mandibular musculature of Australo-Papuan leptodactylids indicate the existence of two major groups of genera, which correspond to the two subfamilies recognised by Parker (1940), but with neither of which *Cyclorana* is readily associated. Within these groups the muscle architecture of the Myobatrachinae represents the primitive condition and that of the Cycloraninae a derived state in which the path of some of the fibres has been modified. Thus this evidence does not support Parker's (1940) tentative suggestion that the Myobatrachinae could have been derived from the Cycloraninae.

It has been demonstrated elsewhere (Tyler, 1971a), (i) that superficial mandibular muscles are conservative in the evolutionary sense; (ii) that differentiation of the intermandibularis is a derived state constituting a major evolutionary development, and (iii) that some hylid sub-families are characterised by possession of similar supplementary elements of the intermandibularis.

Therefore the presence of supplementary elements of the intermandibularis in *Cyclorana* and their absence from other cycloranine genera are grounds for questioning the sub-familial disposition of *Cyclorana*. In contrast the form of the supplementary elements in *Cyclorana* is identical to that possessed by all Australo-Papuan hylids with which it shares other morphological and behavioural characteristics (Tyler, 1970). Further comparative studies of leptodactylids and hylids are currently being undertaken to clarify the familial disposition of *Cyclorana,* and redefinition of the Cycloraninae and the Myobatrachinae is deferred pending completion of these studies.

Note added in proof.

Since the above was written a reassessment of the evolutionary relationships of the Australo-Papuan genera has appeared in a revision of the Leptodactylidae by Lynch (Misc. Publ. Univ. Kansas Mus. Nat. Hist. (53): 1-238 (1971)). Lynch supports recognition of the sub-families proposed by Parker (1940) and maintained here, but has proceeded a stage further in recognizing two tribes within the Cycloraninae. He associates *Cyclorana* with *Heleioporus, Mixophyes, Neobatrachus* and *Notaden* as the members of one, and considers this tribe the most primitive. Therefore our conclusions differ principally in that I dispute the sub-familial disposition of *Cyclorana,* but Lynch does not.

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PLANIGALE GILESI (MARSUPIALIA, DASYURIDAE); A NEW SPECIES FROM THE INTERIOR OF SOUTH EASTERN AUSTRALIA

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By PETER F. AITKEN

South Australian Museum

SUMMARY

Planigale gilesi a new species of dasyurid marsupial is described and figured. Field notes on the specimens examined are included.

PLANIGALE GILESI*

Diagnosis: A robust Planigale (plate 1) differing from all other species of *Planigale* by the possession of only two premolar teeth in each upper and lower jaw.

Holotype: South Australian Museum no. M8406; adult male puppet skin and skull with torso in spirit, collected on 29 June 1969 by Messrs. P. Aitken, A. Kowanko, J. Forrest and J. Howard.

Type Locality: No. 3 Bore, Pastoral Property of Anna Creek, South Australia (lat. 28° 18′S., long. 136° 29′ 40″E.).

Paratypes: No. 3 Bore, Anna Creek, South Australia. Male puppet skins and skulls: South Australian Museum nos. M8407, 25 July, 1969, P. Aitken, A. Robinson and M. Stanley; M8408 and M8409, 26 November 1969, P. Aitken, J. Forrest and J. Glover. Male in spirit: SAM no. M8410, 27 July 1969, P. Aitken, A. Robinson and M. Stanley. Female in spirit with skull extracted: SAM no. M8411, 25 August 1970, A. Kowanko and J. Glover.

Bellata, New South Wales (lat. 29° 55′S., long. 149° 47′E.). Female in spirit with skull extracted; Australian Museum no. M7033, 27 February 1945, J. Kirkby. Male in spirit with skull extracted: AM no. M7393, May 1948.

Brewarrina, New South Wales (lat. 29° 57′S., long. 146° 51′E.). Male in spirit with skull extracted: AM no. M7819, 1954, K. Turnbull. Female in spirit with skull extracted: AM no. M7820, 1954, K. Turnbull.

Lake Cawndilla, Kinchega National Park, New South Wales (lat. 32° 30′S., long. 142° 18′E.). Male in spirit: AM no. M9190, 20 May 1969, M. Gray.

Descriptive Methods: Pelage colour nomenclature follows the standards of Ridgway (1912). All body weights are in grams and all anatomical measurements are in millimetres with the terminology, unless otherwise stated, after Cockrum (1955). Skull measurements were taken with Helios dial

* In honour of Ernest Giles (1835-97) the most intrepid of Australian explorers and, like this planigale, an accomplished survivor in deserts.

12th June, 1972

calipers under a binocular microscope at various magnifications up to x20. Flesh dimensions were obtained from freshly killed material in the case of South Australian Museum specimens and from spirit preserved material in the case of Australian Museum specimens. All measurements were made by the author.

External Features: Dorsally the soft, dense fur is 8 mm long on the rump where the basal 5 mm are sooty black, the median 2.5 mm are pinkish cinnamon and the apical 0.5 mm are fuscous. The fur is 4 mm long on the crown and 1 mm long on the muzzle where it becomes more bristly with virtually no sooty black base. Interspersed with the fur are medially-thickened fuscous black spines 10.5 mm long on the rump reducing to 2 mm on the muzzle. The back is thus a brindled cinnamon colour from rump to rhinarium, although two of the skins examined (SAM nos. M8408 and M8409) have much paler spines and, in consequence, less brindled appearances. A single ring of fuscous black hairs is present around each eye and there is a dark patch in front of each eye where the tips of the fur are fuscous black. Mysticial vibrissae number approximately 16 on each side, are up to 12 mm long and are predominantly fuscous black. Other vibrissae per side are: supra-orbital, 2, fuscous black; genal, 8, some fuscous black, others white; ulnar carpal, 3, white; anconeal, 1, white; median antebrachial, 1, white; submental, 4, white. In addition there are 4 white, interramal vibrissae.

On the cheeks, flanks and shoulders, behind the ears and inside the ears, the fuscous tips of the fur are markedly reduced and spines are virtually absent. These areas are thus pinkish cinnamon in colour.

Ears rounded and slightly fleshy, each with a weak ventral lobe defined by a shallow notch in the posterior margin, an antero-dorsal overfold and a posteriorly concave, anteriorly pointed, untwisted supratragus 3.5 mm long by 2.5 mm broad. Externally, the basal segment of each ear is naked with a surrounding apical area thinly covered by short pinkish cinnamon hairs. Internally, the concha and supratragus of each ear carry irregularly spaced, fine white bristles and each pinna has two thick tufts of pinkish cinnamon hairs originating on the postero-internal margin, one immediately above the ventral lobe the other at crown level. The remainder of each pinna is more thinly covered with short, pinkish cinnamon hairs.

Rhinarium naked, fuscous black with a complete median groove, no philtrum and semicircular nostrils directed antero-laterally.

Ventrally the fur is soft with no spines and is 5 mm long on the belly where the basal half is dark mouse gray and the apical half is pinkish buff. On the interramal region the fur is 1.5 mm long and pinkish buff throughout. Two of the skins examined (SAM nos. M8408 and M8409) have paler ventral fur, basally deep mouse gray and apically pale olive buff. The fur on their interramal regions is also pale olive buff.

Scrotum pendulous with fuscous black pigmented skin and a thick covering of pinkish buff hairs (pale olive buff on SAM nos. M8408 and M8409).

Pouch equipped with 12 teats and filled with fine, white hairs up to 6 mm long. It varies in development amongst the three females examined. In one (SAM no. M8411) it is an oval depression approximately 4 mm long by 3 mm wide with scarcely perceptible antero-lateral lips. In another (AM no. M7033) it is an anteriorly deepened pocket with a transverse postero-ventral opening 3.5 mm wide. In the third (AM no. M7820) it is an irregular, mammary area up to 18 mm in diameter with a fleshy, peripheral lip 2.5 mm deep.

Tail slightly incrassated, tapering towards the tip and sometimes fattened for two-thirds of its length, in which cases basal incrassation is more obvious (SAM nos. M8407, M8408 and M8410). It is bicoloured with a thin covering of stiff hairs 3.5 mm long, increasing to 4.5 mm on the distal third of the underside, but with no brush. Dorsally the hairs are pinkish cinnamon with fuscous tips, although fuscous tipping may be much reduced or absent (SAM nos. M8407 and M8408) and some totally fuscous hairs occur at the distal extremity. Ventrally the hairs are the same colour as the apical half of the belly fur, either pinkish buff or pale olive buff throughout. The hairs of the tail tend to grow in ragged whorls based between 4 and 5 mm apart and in those specimens with fattened tails the whorl hairs become very divergent, producing a rather sparse covering at their apices through which the fuscous black pigmented tail skin can clearly be seen. In such specimens, therefore, the tails exhibit faint patterns of alternating light and dark transverse bands (SAM nos. M8407 and M8408).

Both fore and hind feet well covered above by short pinkish cinnamon hairs with a fringe of silvery hairs bordering each naked sole. Soles of fore feet fuscous, soles of hind feet fuscous black (colours fade in spirit). Fore feet each 4 mm broad with 5 strongly clawed digits (formula: $3>4>2>5>1$) and 6 well developed pads. Soles and pad-bases coarsely granular with granules up to 0.3 mm across. Each pad-base is surmounted by a finely striated apical pad: 1st interdigital round, 0.6 mm in diameter; 2nd and 3rd interdigitals oval, 0.5 x 0.9 mm; 4th interdigital oval, 0.6 x 0.8 mm; hypothenar proximo-internally flattened and shaped like a bulbous hook with an external shaft, greatest breadth 0.8 mm by 1.6 mm long; thenar proximally flattened, demi-oblong, 0.8 mm broad. Hind feet (plate 2) each 3.5 mm broad across the bases of digits 2-5 with 4 clawed digits and a clawless hallux (formula: $3>4>2>5>1$) plus 6 well developed pads. Soles and pad-bases coarsely granular with granules up to 0.4 mm across, although one larger granule, 0.5 mm in diameter, is usually present near the external margin of each sole between the 3rd interdigital and hypothenar pads and a few others of similar size occur on each heel. Each pad-base is surmounted by a finely striated apical pad. 1st (hallucal), 3rd and 4th interdigitals oval, 0.7 x 1 mm; 2nd interdigital oval, 0.7 x 1.1 mm; hypothenar oval, 1.4 x 0.8 mm; thenar disto-internally bulbous crescentic, greatest breadth 0.9 mm by 1.5 mm long.

Dimensions of the soles and pads were obtained from a specimen that had been preserved in 70% spirit for approximately 6 months (SAM no. M8410). Some other specimens, examined after much longer immersion in spirit, had apparently narrower hind feet and shrunken pad-bases that had become confluent with the soles.

Flesh dimensions of selected specimens are presented in Table 1. Spirit preserved specimens with extracted skulls were not measured.

Table 1. Flesh Dimensions of *Planigale gilesi*

Measurement	♂ Holotype M8406 (SAM) Anna Creek	♂ M8407 (SAM) Anna Creek	♂ M8408 (SAM) Anna Creek	♂ M8409 (SAM) Anna Creek	♂ M8410 (SAM) Anna Creek	♂* M9190 (AM) Kinchega	♀ M8411 (SAM) Anna Creek
Body length ..	71.5	79	78	73	77	63	58
Tail length....	72	72	60	—	69	63	59
Length of hind foot (without claws)	10.8	11.4	11	10.5	10.8	10.4	9.6
Height of ear (from notch)	9.2	10.5	10.3	10.4	10.5	8.7	9.5
Weight	9 (starved)	17	15	—	15	—	—

* Measured from spirit

Skull Characters (plates 3a, b, c, d): Dorsal aspect of cranium flat with extremely thin bones, a minute sagittal crest and insignificant lambdoidal crests. Zygomatic arches evenly convex. Interorbital region flat and unridged with bevelled edges, a slight median depression at the posterior extremities of the nasals and the anterior half of the median frontal suture irregularly dentate. Post-orbital processes barely discernible or absent with no pronounced post-orbital constriction. Anterior halves of nasals either parallel sided or marginally expanded in front, posterior halves flared, the greatest width across the nasals being at their points of contact with the fronto-maxillary sutures. Postero-dorsal tips of premaxillae truncated.

A pair of slim, anteriorly pointed, incisive foramina pierce the palate with their posterior extremities between the canines. Two narrow, sometimes dissimilar, posterior palatal vacuities are also present with their anterior margins between M^{2-2} and their posterior margins between M^{3-3}. Pterygoid hamulae slender and deeply hooked behind. Alisphenoid bullae bulbous, the greatest breadth of each bulla being approximately equal to the minimum distance between both bullae. Each periotic bulla with a markedly inflated distal crescent separated by a shallow sulcus from a less inflated proximal segment and abutted on its postero-mesial wall by the anteriorly flanged, blunt para-occipital process.

Dental formula: $I\,\frac{4}{3}:\ C\,\frac{1}{1}:\ P\,\frac{2}{2}:\ M\,\frac{4}{4}$. Teeth, upper jaw: I^1 prominent, set apart from I^{2-4}, which are smaller with I^2 equal in size to I^3 and both larger than I^4 by crown height but not crown length. I^{2-4} each with a buccal and a lingual cingulum and a minute talon that is most marked on I^4. Canine bucco-lingually flattened with a complete cingulum and three times as high as I^4, from which it is separated by a diastema of 0.5 mm. In three specimens examined (SAM no. M8501, AM nos. M7033 and M7819) a distinct talon is also present on each canine. Premolars bucco-lingually flattened, each with a buccal and a lingual cingulum, a minute anterior cusp and a relatively longer talon. The anterior cusp is most obvious on the first premolar and the talon is largest on the second premolar. First premolar set apart from the canine and two thirds as large as the second premolar by both crown height and crown length, second premolar offset longitudinally in line with the posteriorly broadened rostrum. Molars moderately high cusped with M^4 lacking the entire posterior half. M^{1-4} each with a dorsally displaced protocone. M^{1-3} each with a postero-lingual cingulum, a dominant metacone, a relatively much lower paracone and a parastyle, mesostyle and metastyle, of which the parastyle in M^1 is antero-dorsally displaced and the mesostyle in M^3 is reduced in height compared with the same cusp in either M^1 or M^2. M^{2-4} each with an anterior cingulum.

Teeth, lower jaw: Incisors slightly procumbent, each with a bucco-lingually flattened incisal edge and a lingual cingulum. I_1 not set apart from and twice as high as I_2, which in turn is a little larger than I_3 by both crown height and crown length. A minute talonid is present on I_3. Canine twice as high and three times as long as I_3 with a lingual and a buccal cingulum plus a talonid. Pre-molars bucco-lingually flattened, the first two-thirds as large as the second by both crown height and crown length, each with a talonid and a buccal and a lingual cingulum. Molars high cusped with M_4 lacking the postero-buccal quarter. M_{1-4} each with an antero-buccal cingulum, a posterior cingulum and a dominant protoconid, plus a metaconid and a paraconid, both of which are relatively much lower, the latter being particularly low in M_1. Each also with a minute entoconid plus a hypoconid and a hypoconulid, of which the hypoconid is almost totally suppressed in M_4, is highest in M_1 and decreases evenly in height through M_{2-3}, whereas the hypoconulid is highest in M_4 and equal and lower in height through M_{1-3}.

Skull and tooth dimensions are presented in Table 2.

TABLE 2. **Skull and Tooth Dimensions of *Planigale gilesi***

Measurements		♂ Holotype M8406 (SAM) Anna Creek	♂ M8407 (SAM) Anna Creek	♂ M8408 (SAM) Anna Creek	♂ M8409 (SAM) Anna Creek	♀ M8411 (SAM) Anna Creek	♂ M7033 (AM) Bellata	♀ M7393 (AM) Bellata	♂ M7819 (AM) Brewarrina	♀ M7820 (AM) Brewarrina
Condylo-premaxilla length		20.6	20.6	20.4	19.6	17.6	19.7	20.8	21.0	—
Palatilar length (including spine).		10.2	10.4	10.1	9.5	8.4	9.5	10.0	10.1	—
Zygomatic breadth............		11.5	11.5	11.1	10.7	9.8	10.5	10.8	11.7	—
Cranial breadth		9.9	9.6	9.5	9.4	8.8	9.1	9.8	9.6	—
Least interorbital constriction ..		4.6	4.6	4.5	4.5	4.3	4.4	4.4	4.4	4.6
Greatest breadth across lachrymals		6.5	6.6	6.3	6.0	5.5	6.1	6.2	6.2	6.3
Maxillary breadth at first premolars		3.8	3.9	3.5	3.6	3.3	3.4	3.6	3.8	—
Greatest width across upper molars		6.5	6.5	6.6	6.3	6.0	6.5	6.8	6.6	6.7
Depth of cranium in front of bullae		4.3	4.3	4.3	4.1	3.8	4.1	3.9	4.4	—
Length of incisive foramen......		1.5	1.5	1.3	1.2	1.2	1.5	1.5	1.7	—
Length of palatal vacuity		1.5	1.3	1.0	1.2	1.1	1.1	1.1	1.7	1.4
Width of palatal vacuity		0.5	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.4
Length of bullae (alisphenoid +periotic)		4.9	5.0	5.0	—	—	4.8	5.0	5.1	—
Greatest breadth of alisphenoid bulla		3.0	2.8	2.8	—	—	2.6	2.7	2.6	—
Length of nasals		8.2	8.5	8.7	7.7	6.5	7.7	—	8.4	—
Greatest width of nasals		3.6	3.4	3.7	3.4	2.9	3.2	3.2	3.2	3.6
Length of mandible		14.4	14.4	14.3	13.0	12.0	14.7	14.5	—	—
Length of mandibular symphysis		2.7	2.5	2.6	2.4	2.6	2.8	2.7	2.4	2.4
Length of maxillary tooth row (alveolar)		9.2	9.3	9.1	8.9	8.1	9.2	9.8	9.4	—
Length of mandibular tooth row (alveolar)		7.8	8.1	7.9	7.5	7.2	8.1	8.4	8.0	8.0
Crown length M^{1-4} (inclusive) ..		4.5	4.4	4.3	4.3	4.1	4.6	4.9	4.5	4.5
Crown length of 1st premolar	upper	0.7	0.6	0.7	0.6	0.6	0.7	0.7	0.7	0.7
	lower	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.6	0.7
Crown length of 2nd premolar	upper	0.9	0.9	0.9	0.8	0.8	0.9	0.9	0.9	0.9
	lower	0.9	0.9	0.9	0.9	0.8	0.9	1.0	0.9	0.9
Crown height of 1st premolar	upper	0.4	0.4	0.5	0.4	0.4	0.5	0.5	0.5	0.4
	lower	0.5	0.4	0.5	0.5	0.5	0.5	0.4	0.4	—
Crown height of 2nd premolar	upper	0.7	0.7	0.8	0.6	0.6	0.7	0.7	0.7	—
	lower	0.8	0.7	0.8	0.7	0.7	0.6	0.7	0.7	—

Field Notes: No. 3 Bore, Anna Creek, is situated at the north-eastern tip of an isolated belt of sandridges, which transect the stony desert tableland south of the Neales River on the western side of Lake Eyre North, approximately 70 km north-east of Anna Creek homestead. The bore was originally sunk in 1917, but was redrilled in 1966 when an unsuccessful attempt was made to control its output with casing. No mound has formed around the bore-head through which 3,337,000 litres of water erupt daily via a circular hole 7 m in diameter. On leaving the bore-head the water flows down a meandering bore-drain for about 300 m before spreading out to form a shallow swamp. Beyond the swamp the water continues to trickle across the tableland for up to 600 m through an expanding system of branched, attenuating channels, in which the water depths are variable. In consequence, the extremities of the channels are often dry, but on such occasions the water table has never been found more than 15 cm below their beds. Water temperature at the bore-head is 48°C cooling to below 40°C at the entrance to the swamp. Water salinity is 3,614 parts per million in the bore-drain, which is flanked by a thin, white mineral crust deposited on its banks. Desert gobies (*Chlamydogobius eremius*) and hardyheads (*Craterocephalus eyresii*) abound in both the bore-drain and the swamp.

The tableland adjacent to the bore, where the average rainfall is less than 125 mm per annum, is vegetated by a well spaced, shrub steppe community dominated by nitre-bush (*Nitraria schoberii*) with salt-bushes (*Atriplex velutinella* and *A. angulata*) plus another chenopod (*Babbagia dipterocarpa*).

The area influenced by the bore is vegetated by a separate community comprising three distinct plant associations.

1. A bulrush association (plate 4), not found more than 1 m from surface water, growing in mud along the edges of the bore-drain and both in and around the swamp. This association is dominated by tall, dense stands of bulrush (*Typha angustifolia*) basally augmented with tussocks of a small sedge (*Cyperus laevigatus*).

2. A sand-spurry association growing in periodically inundated clearings along the channels. This association is dominated by low mats of sand-spurry (*Spergularia marina*) admixed with love grass (*Eragrostis dielsii*) and scattered examples of a small sedge (*Scirpus maritimus*), pop salt-bush (*Atriplex spongiosa*) and an "everlasting" (*Helipterum floribundum*).

3. A sedge association (plate 5) growing around the bore-head, over the moist ground between the channels and flanking the bullrushes along the bore-drain. This association is

dominated by thick, interwoven clumps of umbrella sedge (*Cyperus gymnocaulus*) occasionally entangled with bushes of a samphire (*Arthrocnemum leiostachyum*). Odd examples of a bindyi (*Bassia ventricosa*) and ruby salt-bush (*Enchlaena tomentosa* var. *glabra*) are also found throughout the association.

All specimens of *Planigale gilesi* collected at No. 3 Bore were trapped in Sherman live animal traps baited with a mixture of rolled oats, honey, peanut paste and beef dripping. Two captures were made in the bulrush association along the bore-drain and four others in the sedge association, two within 2 m of the bore-head and two between the channels less than 3 m from an inundated sand-spurry clearing. Both the bulrush and sedge associations offer superb sanctuaries for small mammals since each provides a formidable barrier against aerial and terrestrial predators, an internal supply of food and nesting materials and an effective insulation against extremes of temperature and humidity. In August, 1969, a comparison of ambient temperatures with those in a natural runway under the sedge association revealed that over a 24 hour period temperatures under the sedge remained fairly constant between 9°C. (0630 h) and 15°C. (1400 h), whereas ambient temperatures fluctuated between 1°C. (0630 h) and 21°C. (1100 h) (M. Stanley, unpublished). It is probable that the high humidity resulting from moist conditions under both the bulrush and sedge associations remains equally constant.

In captivity examples of *Planigale gilesi* do not display either distinct nocturnal or distinct diurnal rhythms, but exhibit short bursts of acitvity spread throughout each 24 hour period and in view of the protection and insulation afforded by their habitat it is feasible that their activity patterns might be similar in the wild. Brown desert mice (*Pseudomys desertor*), which are abundant throughout the sedge association at No. 3 Bore, appear to be most active at night, but can also be trapped quite readily during the day. Thus indicating that in this habitat they too are not strictly orientated to either nocturnal or diurnal activity.

Other mammals inhabiting No. 3 Bore are stripe-headed sminthopses (*Sminthopsis frogatti*), which are fairly common throughout the sedge association; long-haired rats (*Rattus villosissimus*), which have a permanent breeding colony confined to the bulrush association; house mice (*Mus musculus*) of which a few occur in the sedge association around the bore-head; and rabbits (*Oryctolagus cuniculus*), which fluctuate in numbers and burrow on the fringes of the sedge association and around the nitre-bushes in the surrounding tableland. Visiting mammals observed at or near the bore have been numerous dingoes (*Canis familiaris dingo*), some red foxes (*Vulpes*

vulpes), occasional feral domestic cats (*Felis catus*) and small mobs of feral Arabian camels (*Camelus dromedarius*), feral donkeys (*Equus asinus*) and brumbies (*Equus caballus*). Domestic cattle (*Bos taurus*) also water at the bore.

Damage to the bore vegetation by rabbits appears to be insignificant and damage to the ground by the hooves of the other introduced herbivores is slight and limited to the edges of the swamp, which is the only place where the water is cool enough and still of sufficient depth for comfortable drinking. Other bores and springs in the surrounding region are not so free of hoof damage, their vegetated banks being stamped regularly into inhospitable bogs of mud and dung. No small native mammals have been captured at any of these sites despite intensive trapping. The introduced carnivores probably prey on *Planigale gilesi* occasionally, but in all the dingo and red fox scats examined rabbits remains were the only mammalian residue. No cat scats were found. Possible avian predators observed over the bore have been whistling eagles (*Haliastur sphenurus*), fork-tailed kites (*Milvus migrans*), brown hawks (*Falco berigora*) and barn owls (*Tyto alba*). Possible reptilian predators caught in the sedge association have been King brown snakes (*Pseudechis australis*) and sharp-snouted snakes (*Pseudonaja acutirostris*).

Scats of *Planigale gilesi* removed from traps in which their producers had been captured contained fragments of insects exoskeletons, indicating that these planigales are at least partially insectivorous. In captivity they consumed meal beetle larvae, early instar locusts and small moths with avidity. Chopped lambs liver was also accepted, but with less enthusiasm. Habitat data for examples of *Planigale gilesi* captured other than at No. 3 Bore are confined to the Kinchega specimen (AM no. M9190), which according to the collector was also taken from a sedge association adjacent to water.

The breeding period for members of *Planigale gilesi* has yet to be determined. Of the three females examined two have undeveloped pouches. One of the latter (SAM no. M8411) was collected in winter (25 August) and the other (AM no. M7033) was obtained in late summer (27 February). The third female (AM no. M7820) has a lactating pouch, but the exact date of her collection is unknown. Males in the series examined show insufficient variation in scrotal size for this character to be used as a reliable guide to breeding activity.

Relationships: Four species of *Planigale* have been described previously: *P. ingrami* (Thomas), 1906, from the north of the Northern Territory, but known also from eastern and northern Queensland (Troughton, 1928); *P. subtillissima* (Lönnberg), 1913, from the Kimberly district of Western Australia; *P. tenuirostris* Troughton, 1928, from north-central and north-western New South Wales and south-western Queensland, but known also from east-central South Australia (SAM no. M8405); and *P. novaeguineae* Tate and Archbold, 1941, from Papua. The range of *Planigale gilesi* overlaps that of *P. tenuirostris* in north-western New South Wales. All four species differ from *Planigale gilesi* by the possession of 3 premolar teeth in each upper and lower jaw. Lönnberg (1913) actually described *P. subtillissima* as lacking P_{4-4}, but Tate (1947) in a review of the genus corrected this error after re-examining the holotype.

ACKNOWLEDGEMENTS

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Plate 1. *Planigale gilesi* ♂; M8410 (SAM), Anna Creek, South Australia. (Photo by Roman Ruehle.)

Plate 2. Hind foot of *Planigale gilesi*; M8410 (SAM). (Photo by Roman Ruehle.)

Plate 3. (*a*) Skull of *Planigale gilesi;* dorsal view of cranium and upper jaws (holotype). (Photo by Roman Ruehle.)

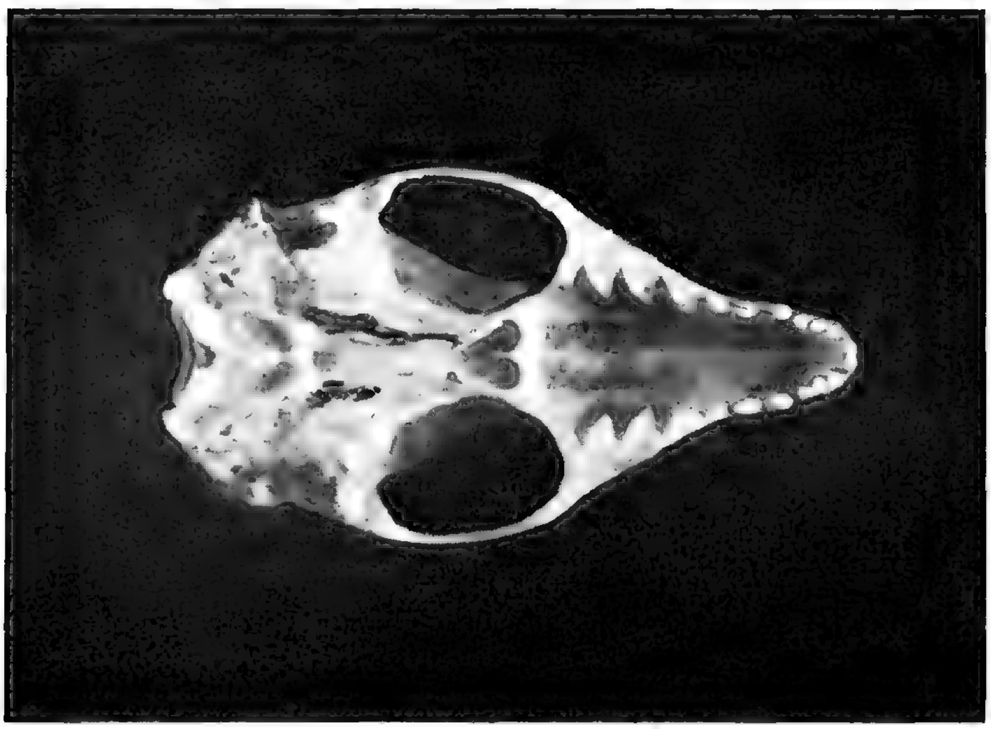

Plate 3. (*b*) Skull of *Planigale gilesi;* ventral view of cranium and upper jaws (holotype). (Photo by Roman Ruehle.)

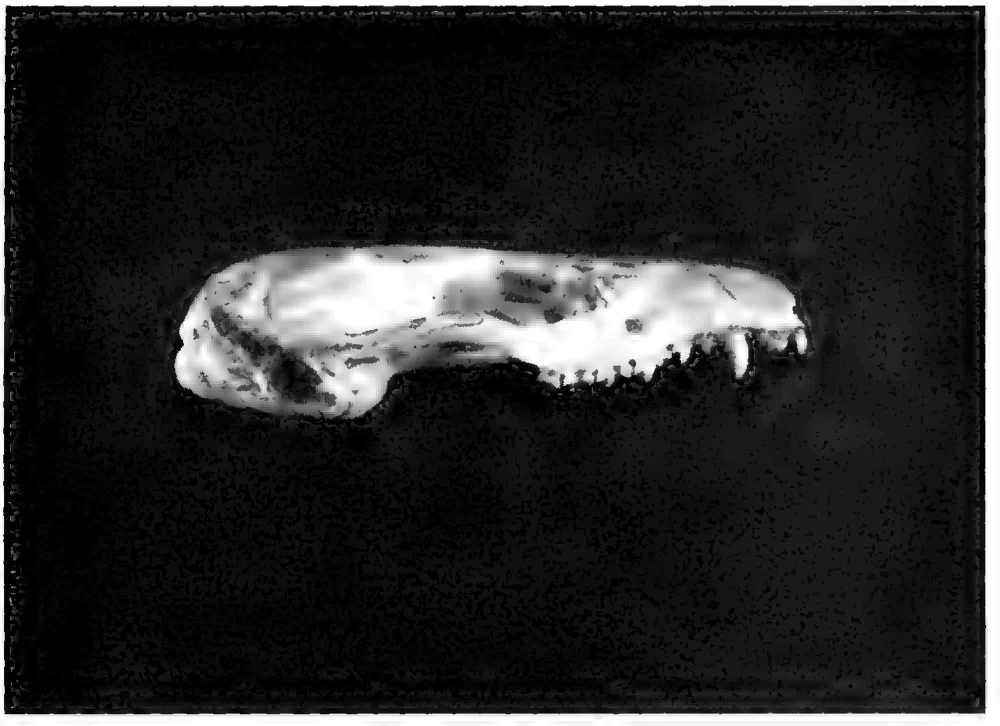

Plate 3. (*c*) Skull of *Planigale gilesi;* lateral view of cranium and upper jaws (holotype). (Photo by Roman Ruehle.)

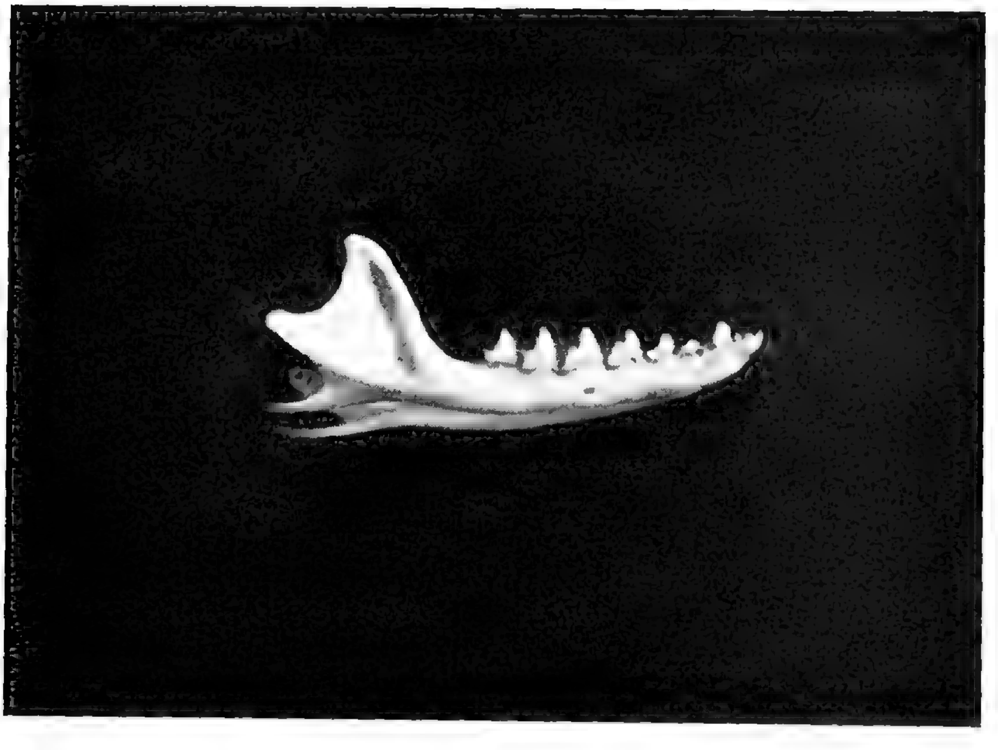

Plate 3. (*d*) Mandible of *Planigale gilesi;* lateral view (holotype). (Photo by Roman Ruehle.)

Plate 4. Bore-drain and bullrush association; No. 3 Bore, Anna Creek, South Australia. (Photo by the author.)

Plate 5. Sedge association; No. 3 Bore, Anna Creek, South Australia. (Photo by the author.)

RECORDS OF THE
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AN ANNOTATED CHECKLIST OF THE NATIVE LAND MAMMALS OF THE NORTHERN TERRITORY

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Summary

Until now, the Northern Territory has lacked a checklist of its native land-mammals. To fill this gap I offer the present compilation. It is modelled on Dr. G. M. Storr's *List of Northern Territory Birds*, and based mainly on records derived from the literature and from unreported material in museums, especially that in the Northern Territory Museum, Alice Springs. All records used have been carefully considered, and a number of critical and seemingly anomalous specimens re-examined. Those responsible for the identification of material are gratefully acknowledged below.

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The text is straightforward and needs few words of introduction. Under *Range* all known localities are listed unless the species is common and widespread, when range limits only are detailed. The distribution maps, however, show as accurately as possible all records used; records from Bathurst and Melville islands and a few from Groote Eylandt, lacking further localization, have merely been plotted within the boundaries given. Under *Status* appear what few remarks on abundance and habitat seem justified. Under *Taxonomy* will be found notices of recent taxonomic changes and a perfunctory coverage of trinomial nomenclature.

My purpose throughout has been to provide a summary of the available information, by which further records may be readily evaluated.

LIST OF SPECIES

With a few exceptions the scientific nomenclature follows Ride (1970). Where a locality record is unqualified by a bibliographical reference or the abbreviated name of an institution, it has been taken from one of the two main references, Finlayson (1961) and Johnson (1964).

Abbreviations of Institutions—

AM: Australian Museum, Sydney.

AMNH: American Museum of Natural History, New York.

BMNH: British Museum (Natural History), London.

CSIRO: CSIRO Division of Wildlife Research, Canberra.

MCZ: Museum of Comparative Zoology, Harvard University, Cambridge, Mass.

Issued 8 January, 1973

MVZ: Museum of Vertebrate Zoology, University of California, Berkeley.

NMV: National Museum of Victoria, Melbourne.

NTM: Northern Territory Museum (Zoology), Alice Springs (at present housed at the Arid Zone Research Institute).

QM: Queensland Museum, Brisbane.

SAM: South Australian Museum, Adelaide.

USNM: United States National Museum, Smithsonian Institution, Washington DC.

WAM: Western Australian Museum, Perth.

MONOTREMES

Tachyglossus aculeatus (Shaw, 1792). Spiny Ant-eater

Range and Status: Rocky areas and isolated outcrops throughout. In the Tanami Desert, recorded amongst the giant mounds of *Nasutitermes triodiae* (NTM files, 1965).

Taxonomy: The northern populations were referred to the race *T.a.acanthion* (Collett, 1884) by Johnson (1964); see also Griffiths (1968).

MARSUPIALS

Antechinus bellus (Thomas, 1904). Fawn Antechinus

Map 1

Range: South Alligator district; Coburg Peninsula (NTM 1961, CSIRO 1965); between Mount Borradaile and Oenpelli (NTM 1968); Cape Arnhem Peninsula.

Status: Fairly common in some areas, inhabiting woodland.

Because *Antechinus flavipes* is similar to *A. bellus*, the specimen from Port Essington recorded by Thomas (1888 : 292) and a second from the Daly River recorded by Collett (1897 : 334) as "*Phascogale flavipes leucogaster*" may be referable to *A. bellus*, and not to the quite different *A. bilarni* as suggested by Johnson (1954 : 78).

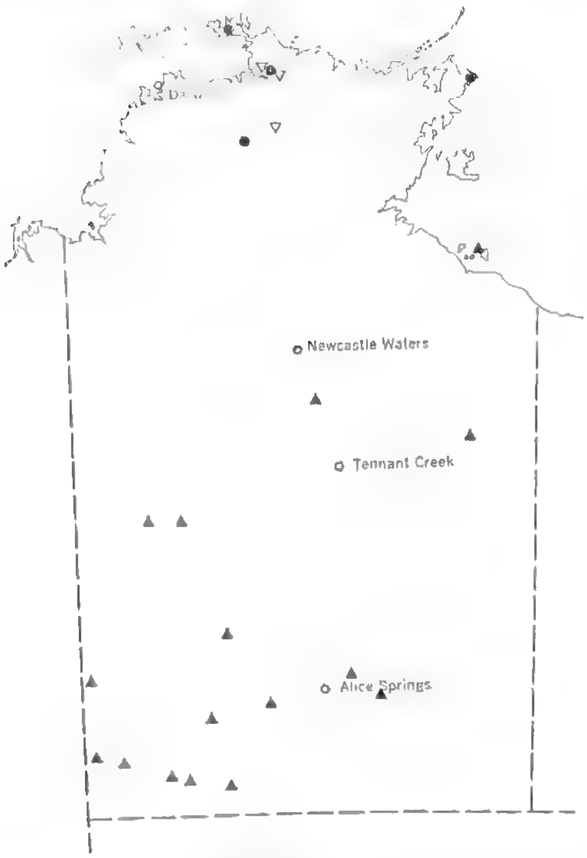
Antechinus maculatus Gould, 1851. Pigmy Antechinus

Map 2

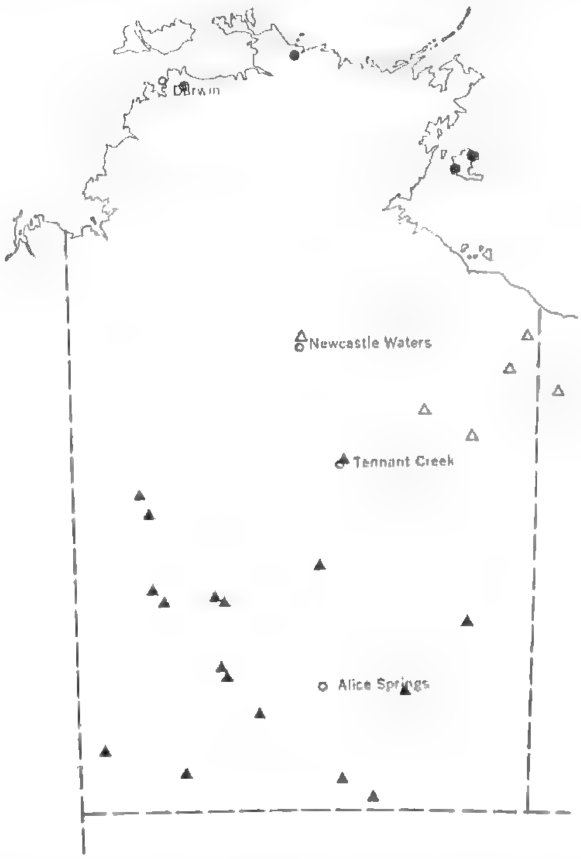
Range: King River, north-east of Oenpelli (NMV 1915); Humpty Doo (AM, WAM); Groote Eylandt. [Bentinck Island, north-western Queensland (SAM 1962).]

Status: Unknown. Of the five specimens from Groote Eylandt only one is accompanied by habitat notes: "[Umbakumba] . . . near the crest of a sandy ridge paralleling the shore, where wattle scrub is the dominant vegetation" (Johnson 1964 : 440). P. F. Aitken, *in litt.*, reports that he secured the Bentinck Island specimen in conditions similar to those recorded by Johnson.

The specimens collected in pandanus fringes, paperbark fringes and thorn scrub on the floodplain of the Adelaide River at Humpty Doo, listed as *Planigale ingrami* by Davies (1960) are referable to the present species (M. Archer, *in litt.*).



Map 1



Map 2

Taxonomy: The race *A. m. sinualis* (Thomas, 1926) was described from Groote Eylandt. Archer, pers. comm., plans to transfer this species to the genus *Planigale*, in which case the present vernacular name will be inappropriate.

Antechinus macdonnellensis (Spencer, 1896). Red-eared Antechinus
Map 1

Range: North to The Granites (AM 1952), Helen Springs (AM, reg'd 1928), Alexandria and North Island, Sir Edward Pellew Group (Keith 1968), east in the south to Ringwood (NTM 1959).

Status: Widespread, and in some areas, *e.g.*, the Petermann Ranges, common, becoming rarer and more scattered in the northern part of its range; mainly amongst rocks, frequenting major ranges and isolated outcrops alike. Two specimens from the Tanami Desert, however (NTM 1964, 1970) were trapped at the bases of the giant mounds of *Nasutitermes triodiae* in belts of *Melaleuca glomerata*.

Taxonomy: Ride (1964 : 62) placed *A. mimulus* (Thomas, 1906, type-locality Alexandria) in the synonymy of *A. macdonnellensis*.

Antechinus bilarni Johnson, 1954. Harney's Antechinus

Map 1

Range and Status: Uncommon, amongst rocks in rugged sandstone country of the western escarpment of Arnhem Land: Oenpelli; Mount Borradaile (NTM 1968); Deaf Adder Creek (NTM 1969).

Taxonomy: Ride (1970) placed *bilarni* in the synonymy of *A. macdonnellensis*, but Michael Archer (pers. comm.) on the basis of further studies, considers that for the present it is best maintained as a separate species.

Planigale ingrami (Thomas, 1906). Ingram's Planigale

Map 2

Range: Gulf of Carpentaria drainage and the Barkly Tableland: [Lawn Hill Creek area, north-western Queensland, *vide* Troughton 1965 : 29-30 and remarks under A. de Lestang in Appendix I] Red Bank Mine (AMNH 1959); upper Nicholson River (NTM-CSIRO 1967); Alexandria; Brunette Downs (NTM 1970); Newcastle Waters (AMNH 1960).

Status: Apparently not uncommon; blacksoil plains, dry swamps and the perennial watercourses of the Gulf drainage. One of the Nicholson River specimens was trapped amongst rocks at Block Waterhole. Remains of this species were frequent in bird of prey pellets collected on the cracking blacksoil plains of Brunette Downs in 1970. See Van Deusen (1969).

Phascogale calura Gould, 1844. Red-tailed Phascogale

Map 5

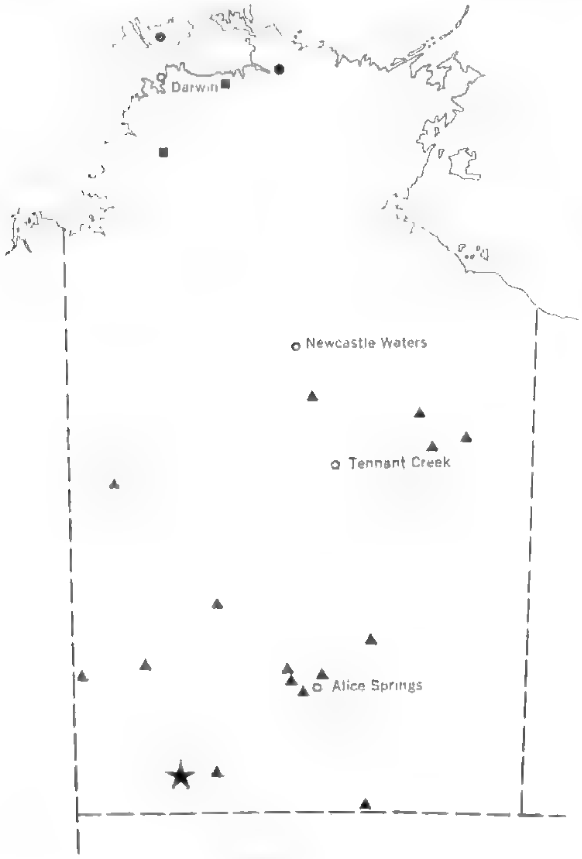
Range and Status: Alice Springs (Spencer 1896b : 30); Barrow Creek and Tennant Creek (NMV 1901, two specimens obtained by Spencer & Gillen). No other records.

Phascogale tapoatafa (Meyer, 1793). Grey-tailed Phascogale

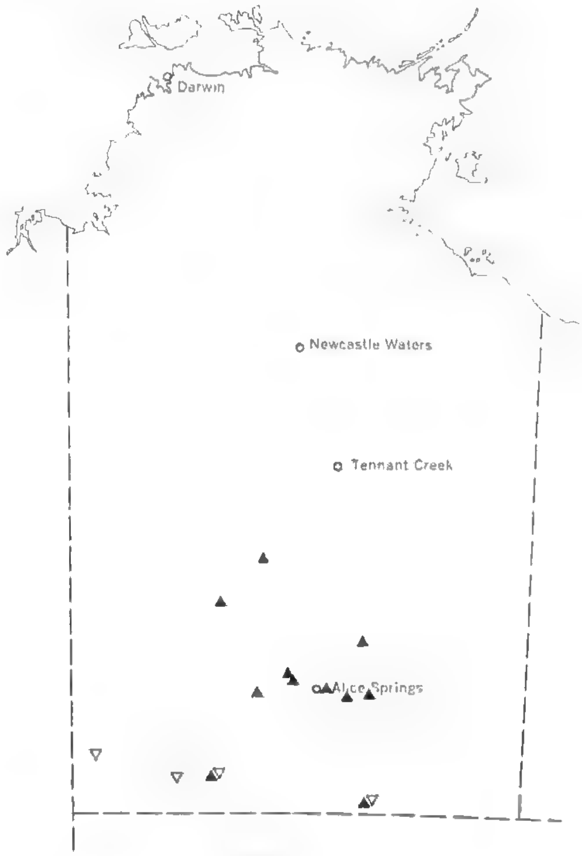
Map 5

Range: Upper South Alligator River; Oenpelli (NTM 1957); near Patonga at 13° 00′, 132° 22′, one dead on road (NTM); Patonga, others inside buildings at night, June 1969 (D. Egan, pers. comm.); Yirrkala (AM 1946).

Status: Widespread but not common. The Oenpelli specimen was caught by a cat. The Yirrkala specimen, collected by W. Harney, bears the comment "climbs and sleeps in trees". The Patonga district is one of lightly-wooded country with laterite ridges.



Map 3



Map 4

Taxonomy: The NT populations are generally referred to *P. t. pirata* Thomas, 1904.

Sminthopsis crassicaudata (Gould, 1844). Fat-tailed Sminthopsis

Map 4

Range: North to Willowra and the Bundey River drainage.

Status: Widespread, and following good seasons locally common. Prefers more densely vegetated areas and softer soils than the next species (sandhills, seasonal swamps, bore overflows and creeks).

Taxonomy: The NT populations are generally referred to *S. c. centralis* Thomas, 1902.

Sminthopsis froggatti (Ramsay, 1887). Stripe-faced Sminthopsis

Map 3

Range: North to Tanami (Glauert 1933 : 21) and Brunette Downs (NMV 1968, NTM 1970).

Status: Widespread and seasonally common; analysis of a large number of pellets of Letter-winged Kite, *Elanus scriptus* and Barn Owl, *Tyto alba* collected on Brunette Downs in April 1970 showed that *S. froggatti* had been an abundant prey species. It appears to prefer more open habitats and harder ground than does *S. crassicaudata*. On the Barkly Tableland in April 1970 it was found on treeless blacksoil plains, living in cracks in the earth (P. K. Latz and D. Howe, pers. comm.); P. Byrne (in Spencer 1896b : 34) wrote that around Charlotte Waters *S. froggatti* seemed to prefer the stony tablelands whilst *S. crassicaudata* preferred the softer ground near the creeks and amongst the sandhills.

Taxonomy: Ride (1970) placed *Sminthopsis larapinta* Spencer, 1896 in the synonymy of *S. froggatti*. Troughton (1965 . 36; see also 1964 : 318) placed *Sminthopsis stalkeri*, Thomas, 1906 (based on two specimens from Alexandria and Alroy Downs) in the synonymy of *S. crassicaudata*. Dr. Ride, however (*in litt.*), regards *stalkeri* as a synonym of *S. froggatti*.

Sminthopsis hirtipes Thomas, 1898. Hairy-footed Sminthopsis

Map 5

Range: Station Point, Charlotte Waters; Lake Mackay area.

Status: Unknown. No recent localized material from the NT. There is in the SAM a specimen collected 10 miles north of Warburton Mission, eastern WA, in May 1968.

Sminthopsis psammophila Spencer, 1895. Large Desert Sminthopsis

Map 3

Range and Status: The holotype (NMV) was collected by the Horn Expedition on 18 June 1894 between Kurtitina Well and Ayers Rock, in sandhill-*Triodia* country with groves of desert oak *Casuarina decaisneana* in the swales (Spencer 1896a : 84). E. Cowle, one of the collectors, professed to having seen the same species in the James Range, though on habitat this may be doubted.

Remains of this species have recently been identified by Michael Archer in owl pellets (NTM) collected in August 1962 from a cave at Ayers Rock. In 1969 P. F. Aitken obtained four live specimens from two localities in the Lock and Kyancutta districts of the Eyre Peninsula, SA, in sandhill country with *Triodia* and mallee (Aitken 1971).

Sminthopsis murina ooldea Troughton, 1964. Troughton's Sminthopsis

Map 4

Michael Archer, *in litt.*, has referred specimens from the Petermann Ranges (WAM 1970), Ayers Rock (NTM 1962), Curtin Springs (NTM

1970) and Charlotte Waters (NMV) to this taxon, which he is elevating to specific rank. The possibility that *Sminthopsis murina constricta* Spencer, 1896 is referable to this taxon should be investigated.

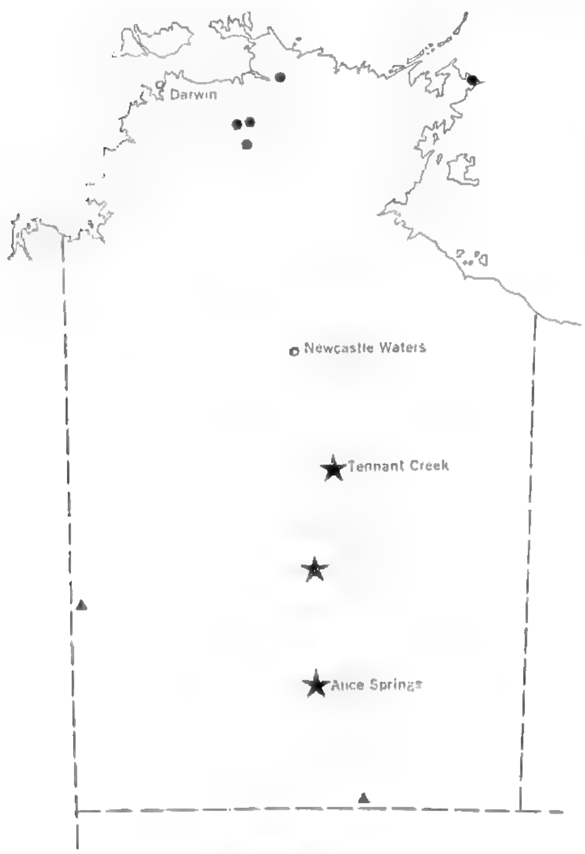
Sminthopsis rufigenis Thomas, 1922. Red-cheeked Sminthopsis

Map 3

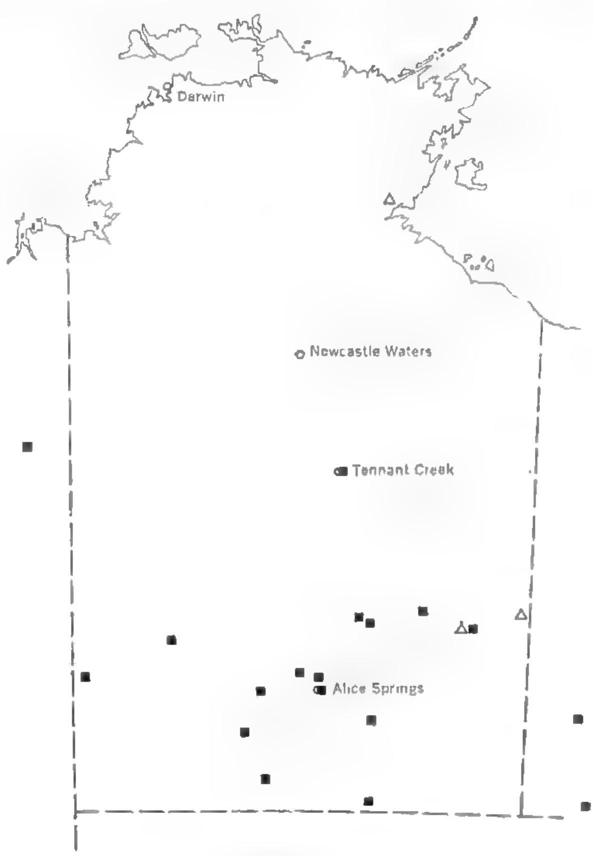
Range and Status: Specimens known from Oenpelli (WAM, donated 1960), and Melville Island (SAM 1913) (Michael Archer, *in litt.*).

Troughton (1964 : 319), under *S. lumholtzi*, listed specimens from the open blacksoil plains of the Barkly Tableland, NT, and western-central Queensland. In view of the fact that all Australian specimens of *S. rufigenis* so far seen by Archer are from wooded localities in the coastal drainage, Troughton's material should be re-examined.

Taxonomy: Ride (1970) relegated *Sminthopsis lumholtzi* Troughton & Iredale, 1934 to the synonymy of *S. rufigenis*, which was described from the Aru Islands. The type-locality of *lumholtzi* is Herbert Vale on the Herbert River of eastern Queensland, not to be confused with Herbert Vale on the Herbert River north-west of Camooweal, north-western Queensland.



Map 5



Map 6

Sminthopsis nitela Collett, 1897. Daly River Sminthopsis.

Map 3

Range and Status: Described from the Daly River. Michael Archer, *in litt.*, has provisionally referred to this taxon a specimen from the Four-mile Hole, Wildman River (NTM 1968).

Antechinomys laniger (Gould, 1856). Eastern Antechinomys

Map 6

Range: Lidicker & Marlow (1970) gave the range of this species as south-central NSW north to the Cunnamulla district of south-central Queensland, with an isolated record from Cedar Bay, north Queensland.

Material in NMV and SAM not examined by these authors shows that *A. laniger* occurs also in the NT: Tarlton Downs (NMV, 18 November 1955); Tobermorey (SAM, coll. C. Watts, 21 September 1968); between Mangajera and Wajelai billabongs, Roper River (SAM, 4 specimens, coll. N. Tindale, 1921). In the QM there are specimens from Cheepie and Charleville, Queensland; a further example in the QM labelled *A. laniger*, from Malbon, north-western Queensland, is mounted and not available for study.

Status: In the NT, unknown. The Roper River specimens were apparently from a salt-marsh near the river's mouth (see Gazetteer). These specimens and the Cedar Bay example, which represents an equally isolated occurrence, should be critically compared with material from further south to see whether they really belong to *A. laniger* or merely resemble that species in the small size of the auditory bullae.

Antechinomys spenceri Thomas, 1906. Western Antechinomys

Map 6

Range: North to [Canning Stock Route near Sturt Creek, WA] Tennant Creek, east to Tarlton Downs, [Sandringham, south-western Queensland].

Status: Not uncommon following good seasons, in a variety of country, including sandhills, mulga and gidgea woodland, mitchell grass plains and gibbers.

Taxonomy: See Lidicker & Marlow (1970).

Dasyurus geoffroii Gould, 1841. Western Native-Cat

Map 7

Range: [Well 46, Canning Stock Route, WA, *vide* Glauert 1933 : 18]

Barrow Creek (NMV 1901) and Alice Springs (NMV, donated by Spencer in 1916).

Status: Finlayson (1961) considered this species to have been formerly widespread in Central Australia, but now a rare and vanishing form. Spencer (1897 : 5) recorded an incomplete skin probably of this species from Crown Point.

Taxonomy: The NT populations are generally referred to the nominate race. Ride (1970) relegated *Dasyurinus* to the synonymy of *Dasyurus*.

Dasyurus hallucatus Gould, 1842. Northern Native-Cat

Map 7

Range: Mainly coastal and subcoastal, from the Daly River east to Cape Arnhem Peninsula, inland to the Pine Creek district; Groote Eylandt. There is an isolated occurrence at Alexandria*.

Status: Inhabits rocky areas, in which it is sometimes abundant, and eucalypt woodland.

Taxonomy: The race *D. h. nesaeus* (Thomas, 1926) has been described from Groote Eylandt; populations from the NT mainland are generally referred to the nominate race. Ride (1970) relegated *Satanellus* to the synonymy of *Dasyurus*.

Dasycercus cristicauda (Krefft, 1867). Mulgara

Map 2

Range: North to [Hall's Creek, WA, *vide* Glauert 1933 : 20] 20° 09′, 130° 15′ in the Tanami Desert (AM 1965) and Tennant Creek, east to Tarlton Downs (SAM 1956).

Status: Not uncommon following good seasons, mainly in sandhill *Triodia* country, though the specimens from the Tanami Desert were trapped in a belt of *Melaleuca glomerata* around a claypan.

Dasyuroides byrnei Spencer, 1896. Kowari

Map 7

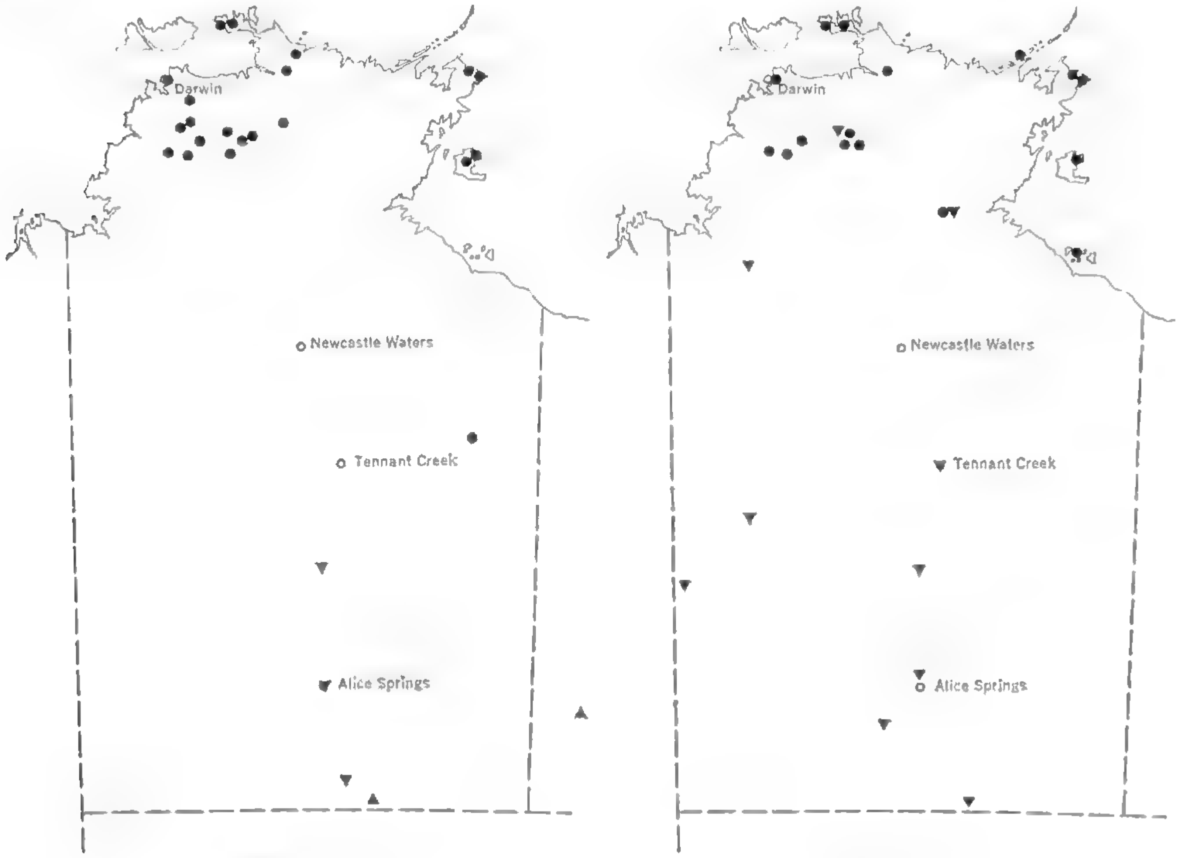
Range and Status: Inhabits gibber-sandhill associations of the Lake Eyre basin, occurring marginally in the NT at Charlotte Waters (NMV 1895, AM 1895). Four specimens from "Illamurta" (NMV 1895) and one from "Barrow Creek" (NMV 1901) have almost certainly been abusively labelled, for neither of these localities lies near gibber-sandhill country.

Although the species has not been recorded in the NT since 1901, it has for the last three or four years been tolerably common in areas of south-western Queensland and north-eastern SA: Sandringham (NTM 1970, a pair, retained in captivity) and Cordillo Downs (Aitken 1970 : 44).

* Five specimens from this locality in the BMNH, collected by W. Stalker in 1905-06, were kindly checked as to species by Miss P. D. Jenkins, *in litt.*

[**Myrmecobius fasciatus** Waterhouse, 1836. Numbat

As this species occurred formerly in WA west of the Petermann Ranges, and in the extreme north-western part of SA, it almost certainly occurred also in the adjoining south-western NT, although no record exists from this area.]



Map 7 Map 8

Notoryctes typhlops (Stirling, 1889). Marsupial Mole
Map 17

Range: North to [Sturt Creek, WA] Napperby (R. Darken, pers. comm.), east to Charlotte Waters. The reports from Wauchope and Arltunga may be doubted in view of the absence of sandhills at these localities.

Status: Inhabits sandhills; widespread but rarely encountered.

Isoodon macrourus (Gould, 1842). Brindled Bandicoot
Map 8

Range: Mainly coastal and subcoastal, from the Daly River east to Cape Arnhem Peninsula, inland to Mount Shoobridge and Mount McMinn (NMV 1912); Elcho Island; Groote Eylandt; Sir Edward Pellew Group (Keith 1968). The specimen in the MCZ from The Granites, listed by Tate (1948) as of this species, represents such an isolated record that it should be re-examined for possible confusion with *I. auratus*.

Status: Not uncommon, frequenting thick grass and other dense undergrowth, with or without tree cover.

Isoodon auratus (Ramsay, 1887). Golden Bandicoot

Map 8

Range: [Northern Canning Stock Route; Hall's Creek, WA] Victoria River (Depot No. 1?; collected by Elsey, *vide* Thomas 1904 : 228); South Alligator River; Mount McMinn (NMV 1912); The Granites (MCZ 1932, SAM 1936, AM 1952); Lake Mackay and Ethel Creek (SAM 1932); Tennant Creek and Barrow Creek (NMV 1901); Alice Springs (Burt Plain), Henbury and Charlotte Waters (NMV, donated by Spencer in 1916).

Status: According to Finlayson (1961) this species in Central Australia "survives in considerable numbers" within an area north of Lake Amadeus north to about Winnecke Creek and east to the lower Sandover River. This is no longer so. The last authentic record appears to be of the specimen collected at The Granites in May 1952 by the Australian Museum. This species was most frequent in the extensive sandplain-spinifex areas.

Little is known of its status in the northern part of its range, where it appears to be marginally sympatric with *I. macrourus*.

Perameles eremiana Spencer, 1897. Desert Bandicoot

Map 10

Range: Burt Plain, and sandhills about 40 miles north-east of Charlotte Waters (Spencer 1897).

Status: This species, perhaps never common, has declined to vanishing-point since the 1930's. Finlayson (1961 : 160) stated that it still persisted in "sectors 5 and 7", *i.e.*, the Tanami Desert. There appears to be no authentic record of its occurrence in this area; the vague records from The Granites mentioned by Finlayson and Troughton (1965 : 67) are probably referable to *Isoodon auratus*.

Macrotis lagotis (Reid, 1837). Bilby

Map 9

Range: North to [Sturt Creek, WA] Lake Buck (NTM files, 1965), Attack Creek (NMV 1966) and Dalmore Downs (NTM 1969).

Status: Once common, now generally rare, though still not uncommon in certain areas; mainly on sandy soils. In the Tanami Desert Wildlife Sanctuary it frequents the *Melaleuca glomerata* thickets associated with the Old Marsh Bed, where it burrows both in the level ground and into the bases of the giant mounds of *Nasutitermes triodiae*. See Newsome (1962), Smyth & Philpott (1968) and Watts (1969).

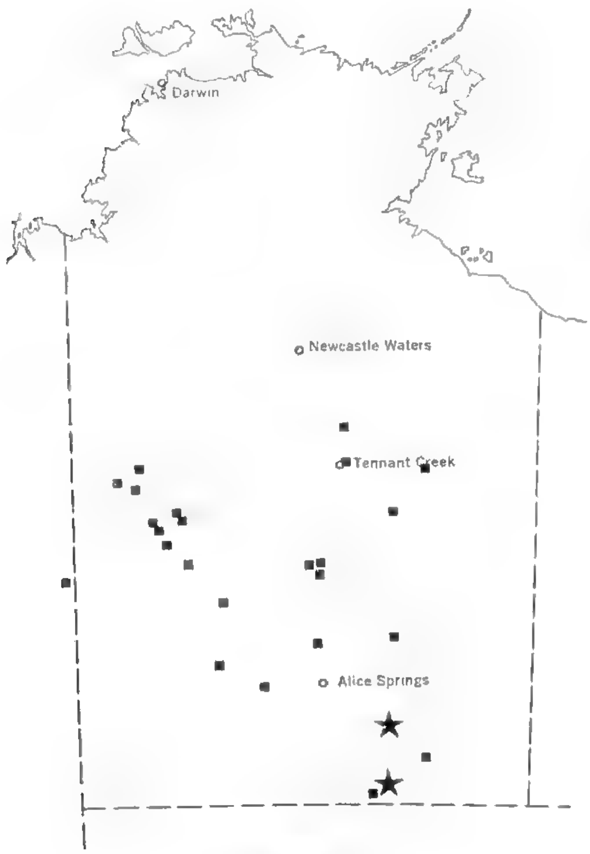
Taxonomy: The NT populations are generally referred to *M. l. sagitta* Thomas, 1905.

Macrotis leucura (Thomas, 1887). Lesser Bilby

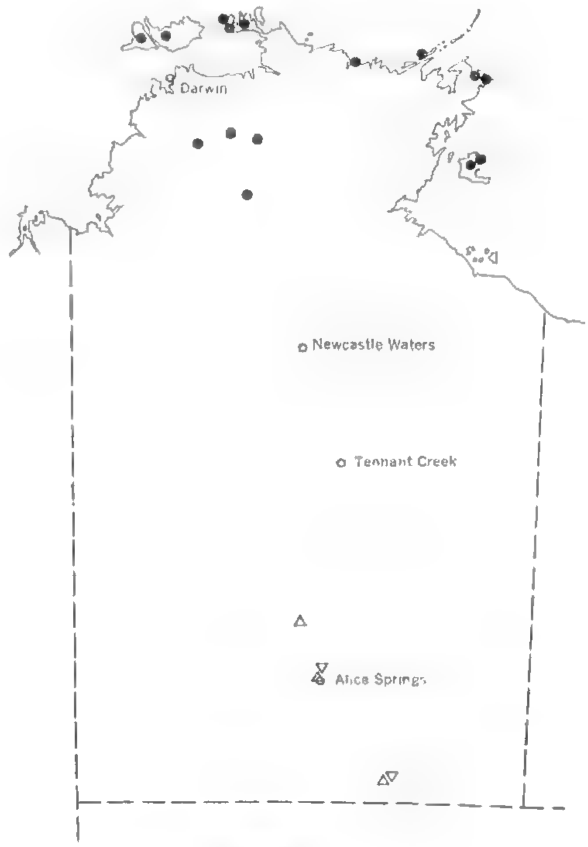
Map 9

Range and Status: Sandhills about 40 miles north-east of Charlotte Waters (NMV 1895); "Barrow Creek" (NMV 1901). A skull with lower jaw was recently found in a nest of the Wedge-tailed Eagle *Aquila audax* amongst sandhills 14 miles south-south-east of Steele Gap, in January 1967, by P. Hanisch (NTM). The nest was not in use and there is no simple way of dating the skull. This species appears to be restricted to sandhills; Finlayson (1932, 1935b) who collected 12 specimens near Cooncherie, north-eastern SA in December 1931, found its burrows only in sandhills, while in the same area *M. lagotis* burrowed only in the flat ground. The three specimens in the NMV labelled "Barrow Creek" probably came from further afield, as there are no sandhills close to this locality (see Gazetteer).

Taxonomy: Troughton (1965) and Ride (1970) placed *Macrotis minor* (Spencer, 1897) in the synonymy of *M. leucura*.



Map 9



Map 10

Chaeropus ecaudatus (Ogilby, 1838). Pig-footed Bandicoot

Map 10

Range: Ryan Well (SAM 1891); 40 miles north-east of Charlotte Waters (NMV 1895); Alice Springs (NMV, donated by Spencer in 1916).

Status: No recent records. I can find no basis for the Barrow Creek record given by Finlayson (1961).

Petaurus breviceps Waterhouse, 1839. Sugar Glider

Map 10

Range: Mary River east to Cape Arnhem Peninsula and inland to the Katherine River; Bathurst Island (AM); Melville Island; Elcho Island; Groote Eylandt.

Status: Generally uncommon, though Johnson (1964 : 452) found it comparatively abundant in the vicinity of Port Langdon, Groote Eylandt, in 1948. Woodland.

Taxonomy: The NT populations are generally referred to *P. b. ariel* (Gould, 1842).

Petropseudes dahli (Collett, 1895). Rock-haunting Ringtail

Map 11

Range: Mary River; Oenpelli; Union Town; Nellie Creek; South Alligator River; Red Bank Mine near Wollogorang (AMNH 1959); Groote Eylandt (NTM, specimen in captivity obtained by Miss D. Levitt, 1970).

Status: A rock-frequenting species, widespread and locally common. Dahl recorded it as fairly numerous in Arnhem Land; Tunney collected eight specimens from Nellie Creek and 16 from the South Alligator; the Spalding-Peterson Expedition found it "abundant" at Red Bank Mine in 1959 (Hosmer, *in litt.*).

Trichosurus vulpecula (Kerr, 1792). Brush-tailed Possum

Map 11

Range and Status: Spencer (1896b : 16-17) mentioned this species as "occurring everywhere amongst the eucalypts which border the river-beds" in Central Australia. Davidson (1905a : 8) recorded that while he was in the Murchison and Davenport Ranges (November 1897-February 1898) "small opossums [were] found by the natives in the gums along the creek banks". Terry (1937 : 100) found one in a hollow log west of the McEwin Hills in 1932.

Finlayson (1961) considered that an inexplicable collapse in its numbers in Central Australia had occurred since the 1930's. At present it is a rare but persistent and possibly increasing species in this area, recent records being: Arthur Creek and Plenty River (Finlayson 1961); Glen Helen Station, 1959 (NTM files); Hatches Creek, two captured on trunks of river redgum, *Eucalyptus camaldulensis*, and released, 1968 (R. Berry, pers. comm.); Charley Creek (NTM 1968); Bushy Park (CSIRO 1966, 1969). Other, earlier, records given by Finlayson are from Wollara and Lake Mackay, the latter possibly referring to Terry's 1932 record.

Taxonomy: Spencer (*loc. cit.*) referred to the Central Australian populations as "var. *typicus*". Although it seems likely that they do belong to the nominate race, this has yet to be demonstrated.

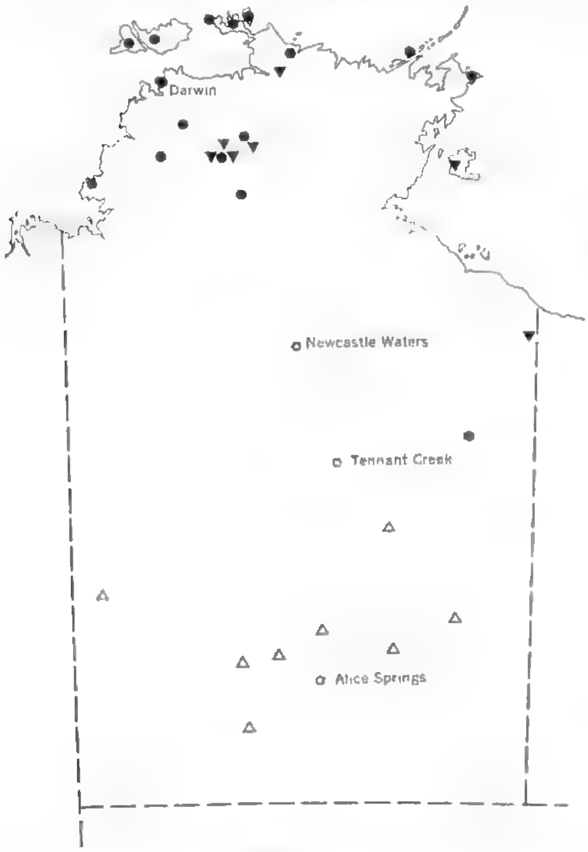
Trichosurus arnhemensis Collett, 1897. Northern Brush-tailed Possum

Map 11

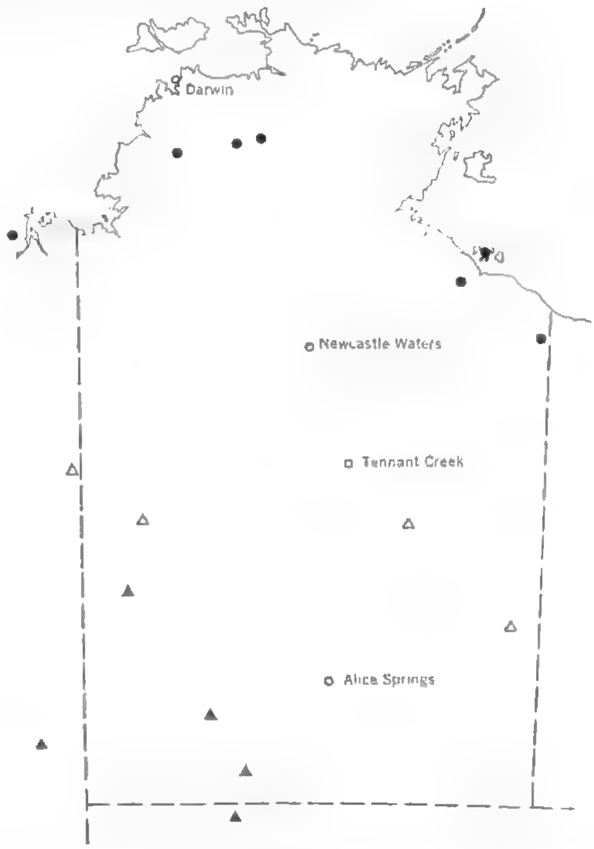
Range: South to [Hall's Creek, WA] Katherine River and Alexandria*; Bathurst Island; Melville Island (AM); Croker Island; Elcho Island.

Status: Not uncommon, in woodland with hollow roosting-trees available. In Darwin it is sometimes found in gardens and buildings.

Taxonomy: Once regarded as a well-marked race of *T. vulpecula*, this form has now been accorded the rank of species (Ride 1970).



Map 11



Map 12

* Two specimens in the BMNH from Alexandria (collected by Stalker) were kindly checked for me by Mr. J. Calaby.

Bettongia lesueur (Quoy & Gaimard, 1824). Burrowing Rat-Kangaroo
Map 12

Range: North to northern Lake Mackay, a point between the western Macdonnell Ranges and the Stuart Bluff Range, the Elkedra district and the Sandover drainage, east to between the Tarlton and Toko Ranges; possibly north to the Tanami Desert (Finlayson 1958b, based mainly on native reports and records of abandoned warrens).

Status: No authenticated records since the 1930's. If the species survives at all in the area, which is doubtful, it may do so in the Lake Amadeus-Lake Mackay regions and in the Elkedra-Sandover River-Plenty River area.

Once locally common, with colonies living in large warrens; in grassy and herbaceous loam flats within the major ranges, open mulga and ironwood parks skirting the ranges, and in sandridge areas, where, as elsewhere, its warrens were usually made in firm loam at slight elevations on undulating swales and not in the sandridges proper. Giles (1889 : 280) found great numbers of this species honeycombing low limestone ridges in the dry bed of Lake Christopher, eastern WA, in late January 1874, and Finlayson (1958b : 243) noted a similar occurrence between the Stuart Bluff Range and the western Macdonnell Ranges in 1950, though the animal had long been extinct there.

". . . the large 'rabbit' warrens recorded by M. Terry in 1929 in the Tanami district in approximately 28° South and 129° 51′ East, would almost certainly be warrens of *Bettongia lesueuri* doubtfully parasitized by rabbits" (Finlayson 1958b : 241). This rendering is peculiarly Finlayson's. Terry's notes apply to the year 1928, not 1929. 28 S does not run through the NT. Furthermore, Terry gave details of *two* areas in the Tanami district where he observed large warrens:

(1) [Between Larrangannie Bluff and the "westward mate of Killi-Killi", *i.e.*, at *ca.* 19° 40′, 128° 58′, WA near the NT border] " . . . low east-west sandhills and rabbit warrens amongst travertine [a kind of limestone] mounds on the plain in between. The presence of either so far north was news.

"From this time onwards, increasing as we worked away south, indications of the northward migration of the rabbit were continually found. But not one solitary bunny did we see till long after, close to Alice Springs. Despite burrows dug out where droppings seemed fresh, we got no nearer to solving the problem as to whether they were hibernating, unusually shy, or killed off by the drought" (Terry 1930 : 133).

(2) [Between hill 47 (Johnson's Hill) and hill 49 (Murdoch Cliffs), *i.e.*, at *ca.* 20° 44′, 129° 59′] ". . . we came to a huge rabbit warren hacked about and gouged out like a battlefield, eloquent testimony to many a busy black fellow getting a cheap feed. This great sandmound, intermingled with travertine, was distinctive for numerous native orange trees, down by whose roots the bunnies had burrowed" (Terry 1930 : 178).

Terry recorded *seeing* rabbits only once in the Tanami Desert, a pair between Mount Solitaire and the Lander River.

Taxonomy: Wakefield (1967) synonymized *Bettongia penicillata anhydra* Finlayson, 1957 with *B. lesueur*. The specimen upon which *anhydra* was based came from the Lake Mackay area at *ca* 22° 02′, 129° 47′.

[**Bettongia penicillata** Gray, 1837. Brush-tailed Rat-Kangaroo

As *B. p. anhydra* Finlayson, 1957 has been placed in the synonymy of *B. lesueur*, no specimens of this species are known from the NT. In view of the similarity, in form and habit of nesting, between *B. penicillata* and *Lagorchestes* spp., I cannot accept as unequivocal the evidence adduced by Finlayson (1958b) for the existence of *B. penicillata* in the NT, past or present. It is probable that the northern records from the Barkly Tableland and Gulf drainage listed by Finlayson are referable to the Spectacled Hare-Wallaby, *Lagorchestes conspicillatus*, which is there widespread and not uncommon.]

Lagorchestes conspicillatus Gould, 1842. Spectacled Hare-Wallaby

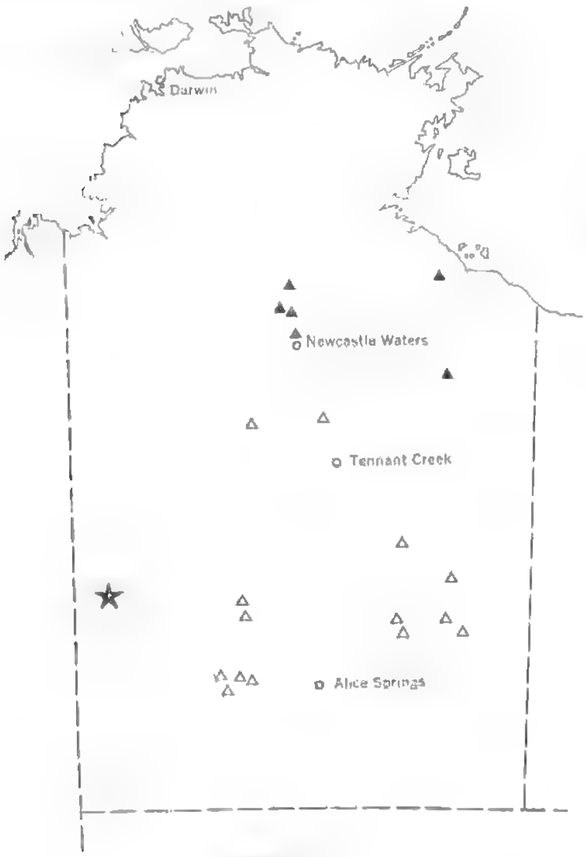
Map 13

Range: Daly Waters, Borroloola and upper Creswell Creek districts south to the Macdonnell Ranges, Huckitta and Tarlton Downs (see below). A neglected record is of a specimen collected by G. F. Hill "80 miles N of Chewings' Well" (*i.e.*, about 105 miles west of Banka Banka) in July 1911 (NMV).

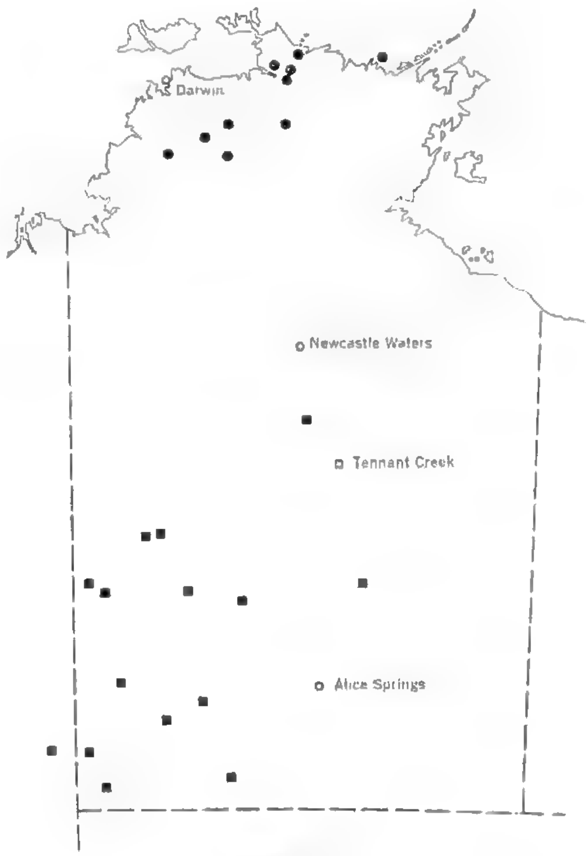
Status: Formerly common in dense *Acacia* and other shrub thickets amongst the central ranges, but now apparently absent from this area. Still fairly common, however, in *Acacia* thickets in the northern parts of its range, notably in low thickets amidst taller woodland such as *Acacia shirleyi*, lancewood: 6 miles south of Dunmarra (NTM 1961); upper Creswell Creek, 80 miles north of Alexandria (captured and released, 1964), 33 miles north of Newcastle Waters (NTM 1968); 18 miles west of Dunmarra (NTM 1968); Daly Waters area (NTM 1968); 42 miles west-south-west of Borroloola (NTM 1969); all the museum specimens were road-casualties.

Finlayson's records of *Bettongia penicillata* from Tanumbirini, Nutwood and other northern localities are probably referable to this species.

Taxonomy: The NT populations are generally referred to *L. c. leichhardti* Gould, 1853.



Map 13



Map 14

Lagorchestes hirsutus (Gould, 1844). Western Hare-Wallaby
Map 14

Range: [Canning Stock Route between wells 28 and 43, and north of Sladen Waters, WA; south of Tomkinson, Mann and Musgrave Ranges, northern SA] Docker Creek; Mount Jenkins; Lake Amadeus area; between Mount Conner and Murrachurra, 20 miles to the east; Dare's Plain, George Gill Range; Wytookarri; northern Lake Mackay; McEwin Hills; Mount Doreen; west of Warburton Creek; north of the Sandover about 40 miles west of the Bundy junction; west of Banka Banka; Tanami Desert (NTM, see below).

Status: Formerly locally common in spinifex-sandridge country, occurring in often widely separated colonies, this species has declined drastically since the 1930's. The only recent records are of two small colonies on isolated sandhills in the Tanami Desert Wildlife Sanctuary (observations 1958, 1966 (dead animal found), 1967 and 1970). Little of the extensive sandridge country north of Lake Amadeus and east of Lake Mackay has been zoologically surveyed recently, however, and it is there that this species may still be found in some numbers.

Taxonomy: The NT populations are generally referred to the nominate race.

Lagorchestes asomatus Finlayson, 1943. Least Hare-Wallaby
Map 13

Range and Status: Known only from the holotype (skull) in the SAM; from an animal taken in the flesh by Michael Terry a few miles east of northern Lake Mackay in 1932. Finlayson (1943) gave the position as 22 15′, 129° 30′, but Terry's route strikes 129° 30′ at 22° 04′.

Onychogalea lunata (Gould, 1840). Crescent Nail-tailed Wallaby
Map 15

Range: [South of Tomkinson, Mann and Musgrave Ranges, northern SA] south of Basedow Range; north of Ehrenburg Range; Red Bank, near Mount Sonder; Bond Springs; Alice Springs; Huckitta; between Jervois Range and Tarlton Range; [near the Warburton Range, WA, 1964, *vide* Ride 1970].

Status: Extremely rare and little-known; few recent records.

Taxonomy: Frith & Calaby (1969) suggested that this species may be conspecific with the next.

Onychogalea unguifera (Gould, 1841). Northern Nail-tailed Wallaby
Map 15

Range: [Sturt Creek, northern WA] Tanami (NTM 1959, 1970); Katherine (1967); 15 miles N of Katherine (SAM 1966); Marrakai, Adelaide River plains (1968); Brock's Creek; Roper River Mission (1966); Banka Banka (NTM 1965); Elliott area (NTM 1961, 1962, 1968, SAM 1966); Beetaloo (NTM 1959); Borroloola (NMV 1911); near Cape Crawford (NTM 1969); "north-eastern corner of Arnhem Land" (Thomson 1949 : 65).

Status: Widespread and not uncommon; lightly-wooded floodplains in the north, and open long-grass woodland and shrub-savannah in the south; occasionally on rocky slopes, as in the Tanami Range.

Taxonomy: The NT populations are generally referred to the nominate race.

Petrogale penicillata (Griffith, 1827) *sensu* Ride 1970. Brush-tailed Rock-Wallaby
Map 16

Range: Central Australia: Petermann Ranges, Mount Olga, Ayers Rock, Mount Conner, George Gill Range, Macdonnell Ranges, east to the Sandover and Bundey River drainages, north to the Kintore Range, Mount

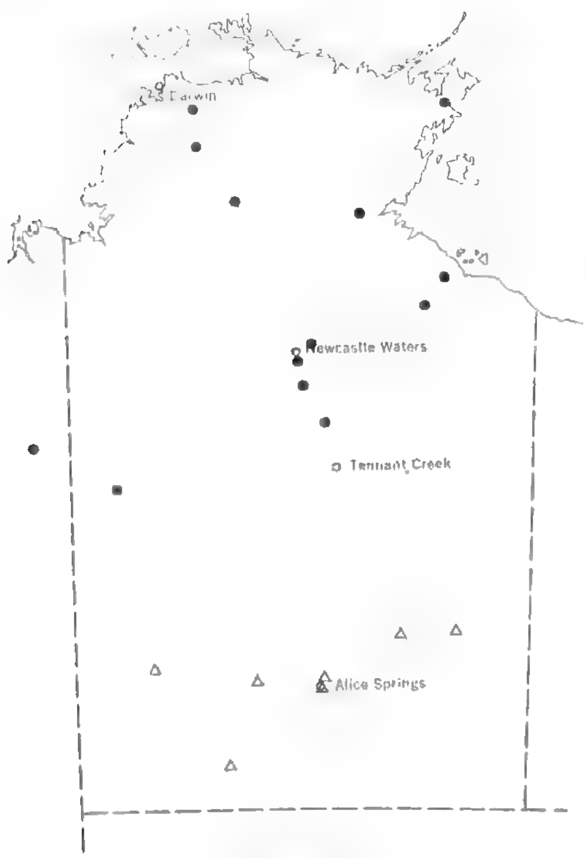
Doreen (25 miles west of), Cockatoo Creek and the Davenport Range (Finlayson 1961 and NTM records).

Arnhem Land: north-western escarpment: King River Range; Mount Borradaile (NTM 1968); Oenpelli; Deaf Adder Creek (NTM 1969).

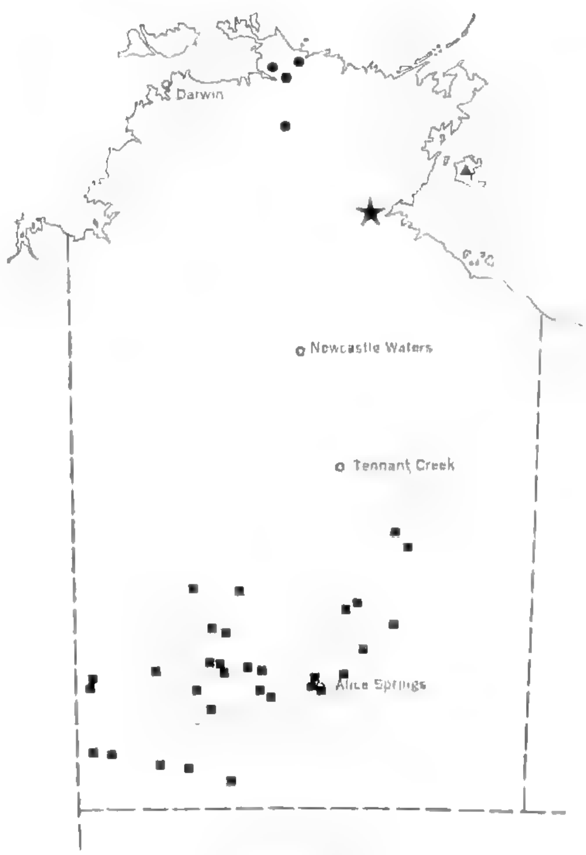
Status: In Central Australia, widespread and locally fairly common. in rocky hills and ranges, especially in the vicinity of shady gaps and gorges with an abundance of rock ledges and scree slopes. In Arnhem Land locally common on sandstone cliffs, outcrops and scree (talus) slopes.

Taxonomy: The Central Australian populations have yet to be subspecifically assessed (Finlayson 1930 : 179) but are generally referred to *P. p. lateralis* Gould, 1842. The Arnhem Land form *venustula* Thomas, 1926, resembles the Central Australian one in colour and patterning but is smaller.

Ride (1970) included two other nominal taxa within *P. penicillata*: *P. wilkinsi* Thomas, 1926 and *P. longmani* Thomas, 1926. Each is known only by two specimens collected in 1925, *wilkinsi* from the Roper River Mission and *longmani* from Groote Eylandt. More material is needed before a clear picture can be obtained of the taxonomy and distribution of these northern *Petrogale*.



Map 15



Map 16

Petrogale brachyotis Gould, 1841. Short-eared Rock-Wallaby

Map 12

Range: [Forrest River, WA (AM 1952)] Daly, South Alligator and Mary River drainages (Thomas 1926); Gimbat, headwaters of the South Alligator (AM 1969); Macarthur River and the Sir Edward Pellew Group (Keith 1968); Red Bank Mine (AMNH 1959).

Status: Apparently local but fairly common where found. Inhabits low rockfaces and low rocky hills with large tumbled boulders rather than the more rugged escarpment country of *P. P. venustula*. (For a photograph of its habitat in the Pellews see that given for the habitat of *Zyzomys argurus* in Keith 1968, *fide* Keith, *in litt.*).

Taxonomy: The populations of the Daly, Mary and South Alligator rivers were described as *P. b. signata* by Thomas (1926).

Peradorcas concinna (Gould, 1842). Little Rock-Wallaby

Map 14

Range: Daly River; Brock's Creek; Nellie Creek; Mary River; King River, north-east of Oenpelli; Milingimbi, Crocodile Islands; Mount Borradaile-Cooper Creek (NTM 1968); Deaf Adder Creek (NTM 1969); East Alligator River (NMV, purchased 1922).

Status: Locally common, in rocky areas. The NTM specimens were taken on open rock flats and tables with scattered boulders (*P. p. venustula*, when it occurred in the same areas, was usually found on scree and boulder-strewn slopes and cliffs).

Taxonomy: The NT populations are generally referred to *P. c. canescens* Thomas, 1909.

Unidentified rock-wallabies have been reported from Mount Alexander, north-eastern Arnhem Land (Wilkins 1928 : 260) and in the high sandstone ranges of the Macarthur River between Clyde and Western creeks (Barnard 1914 : 211).

Macropus agilis (Gould, 1842). Agile Wallaby

Map 17

Range: [Forrest River Mission (AM 1952)] Victoria River east to the Macarthur River, inland to the Katherine River; Bathurst Island (NMV 1912); Crocodile Islands; Elcho Island; Sir Edward Pellew Group (Keith 1968); straggling to Elliott area (NTM 1961).

Status: Locally abundant on subcoastal plains and flood-plains of the larger rivers; grass-pandanus association, grassy forest; recorded also in mangrove swamps and on beaches.

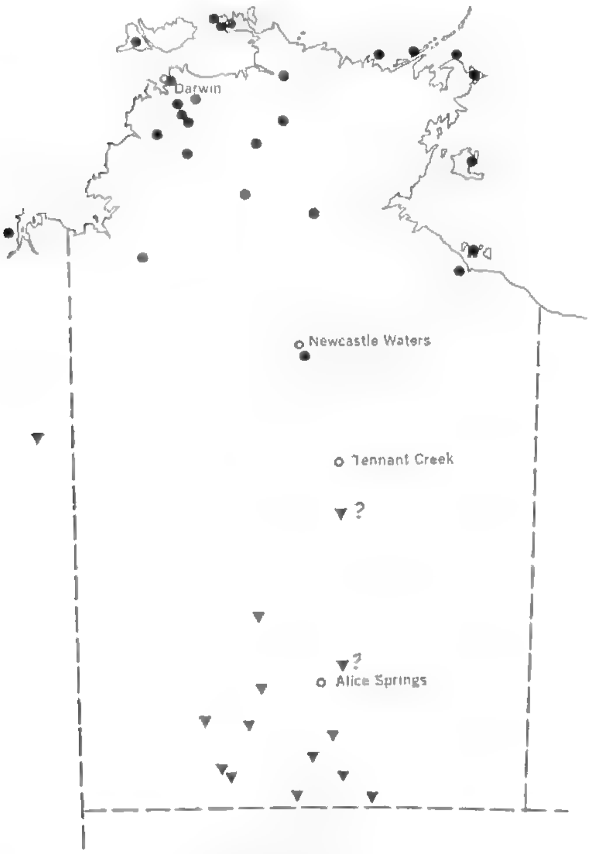
Taxonomy: See Ride (1970) for the transfer of this species from *Wallabia* to *Macropus*. The NT populations are generally referred to the nominate race.

Macropus robustus (Gould, 1841). Euro

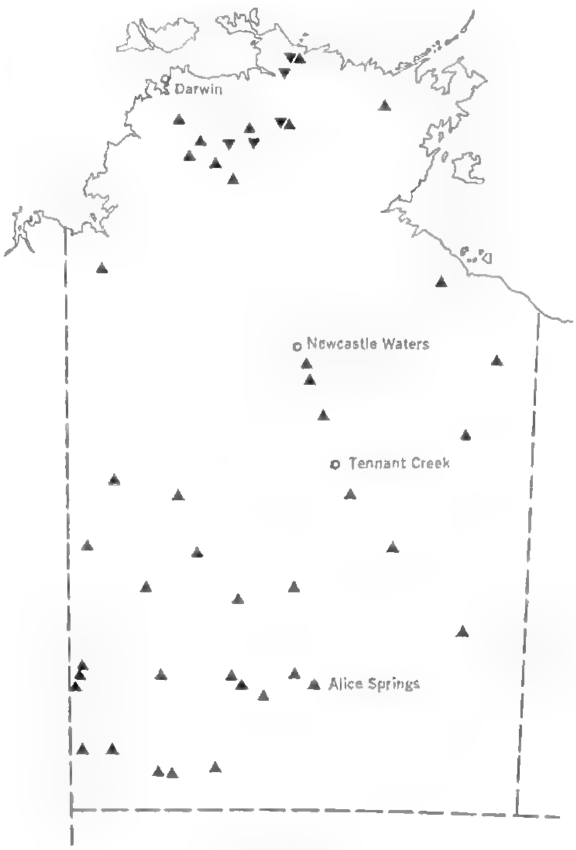
Map 18

Range and Status: Throughout the NT; fairly common, on slopes of ranges and isolated hills.

Taxonomy: B. Richardson, *in litt.*, considers the northern populations referable to *M. r. woodwardi* Thomas, 1901 (syn. *M. r. alligatoris* Thomas, 1904), and the central populations to *M. r. erubescens* Sclater, 1870.



Map 17



Map 18

Macropus bernardus (Rothschild, 1904). Small Black Wallaroo

Map 18

Range: Western escarpment of Arnhem Land: Mary River (SAM 1913); King River Range (Wilkins 1928 : 168); Oenpelli (NMV 1912-1914); Deaf Adder Creek (NTM 1969); head of the South Alligator River.

Status: Locally not uncommon, in rugged sandstone and granite ranges.

Taxonomy: Previously considered by some workers to be a race of *M. robustus*, with which, however, it is now known to be partly sympatric (Parker 1971a).

Macropus antilopinus (Gould, 1842). Antilopine Wallaroo

Map 19

Range: South to [the Negri River, WA] Victoria River, Edith River and Wimul Swamp (SAM 1966), and east to Cape Arnhem Peninsula.

Status: Less common than *M. robustus*; on grassy and wooded plains, often in the vicinity of hilly country into which it retreats when disturbed.

Taxonomy: See Frith & Calaby (1969).

Megaleia rufa (Desmarest, 1822). Red Kangaroo

Map 19

Range: North to the Pedestal Hills (Davidson 1905b : 42), 50 miles north-west of Lake Surprise (NTM files, 1964), Daly Waters (S. A. Parker, *ms.*, 1969) and Alexandria.

Status: Widespread and locally common; mainly associated with mulga (*Acacia aneura*) and lancewood (*Acacia shirleyi*) on plains, avoiding the extensive spinifex-sandridge areas.

RODENTS

Hydromys chrysogaster Geoffroy, 1804. Water Rat

Map 23

Range: Daly River east to Cape Arnhem Peninsula, inland to Brock's Creek; Melville Island; Groote Eylandt; Sir Edward Pellew Group (Keith 1968).

Status: Not uncommon, in lagoons and creeks (mainly freshwater).

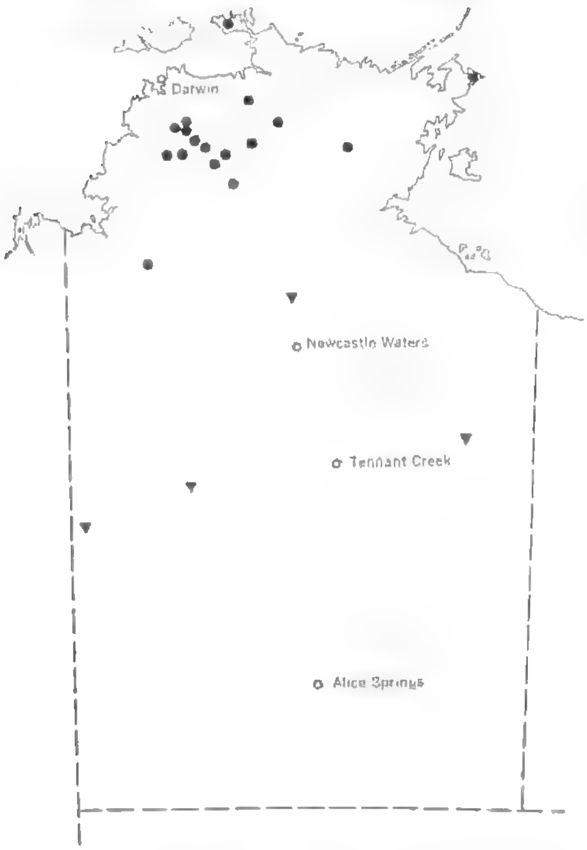
Taxonomy: Tate (1951) assigned the NT populations to the small-molared race *H. c. beccarii* Peters, 1874. The large-molared race *H. c. reginae* Thomas & Dollman, 1909 may possibly enter the NT from western Queensland.

Xeromys myoides Thomas, 1889. False Swamp-Rat

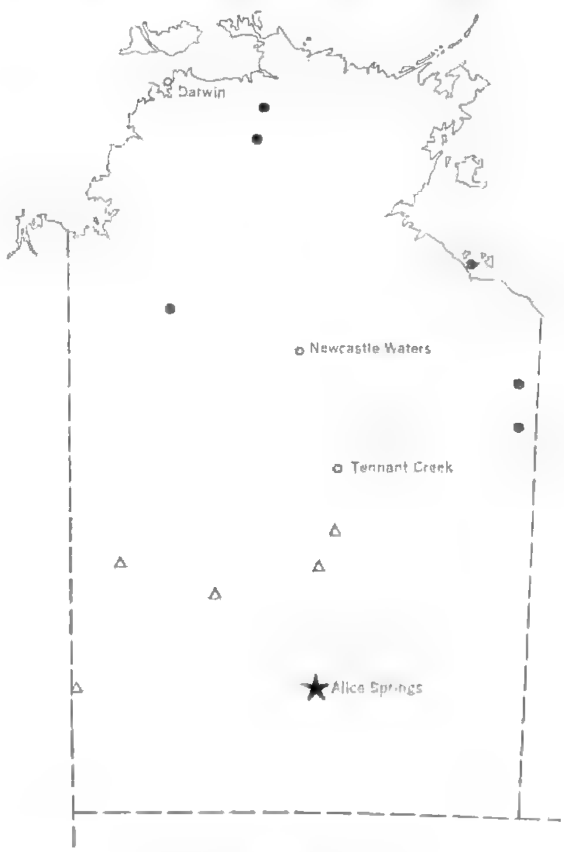
Map 23

Range and Status: One specimen collected on the South Alligator River by Tunney in 1903; otherwise known only from six specimens taken in the Mackay area of Queensland, five from a permanent swamp thickly covered with tall grass, shrubs and pandanus (Ride 1970).

Tunney's specimen is dated 5 September (J. Mahoney, *in litt.*). For most, if not all, of the period 24 August-19 October 1903 Tunney worked the coastal plain and tidal section of the South Alligator (Storr 1966 : 64).



Map 19



Map 20

Pseudomys desertor Troughton, 1932. Brown Desert-Mouse

Map 20

Range and Status: Rare and little-known. Waite (1898 : 128) listed specimens from "Porcupine Sandhills, Wycliffe Creek", "Barrow Creek" and "Untaünua, Porcupine Grass, Alice Springs"*. The only subsequent records are: specimen trapped on claypan amongst sandhills east of the Bonython Range at 23° 42′, 129° 02′ (BMNH 1967); specimen dug from a *Notomys* burrow at Yuendumu (SAM 1968); remains from recent owl pellets found in cave 64 miles south-south-west of The Granites in the Highland Rocks, low lateritic rises and outcrops in sandhill country (NTM 1970).

Waite's remarks indicate that some of the specimens were taken in spinifex, at Wycliffe Creek on sandhills. Finlayson (1941) recorded the habitat of specimens from northern SA as "sandy loam covered by giant spinifex". P. F. Aitken, *in litt.*, considers this species to be normally an inhabitant of sandhill country, but mentions finding a thriving colony in tussocks of the perennial sedge *Cyperus gymnocaulos* growing on the margins

* The Alice Springs record was inadvertently omitted from map 20.

of a bore-drain near The Neales, western Lake Eyre: the population was possibly living on a nearby sandhill when the bore was put down.

The term "Untaünua" relating to the Alice Springs specimen is probably the Aranda name for the species rather than a locality (see note under *Notomys longicaudatus*).

Pseudomys gracilicaudatus (Gould, 1845). Chestnut Native-Mouse
Map 20

Range: Humbert River (CSIRO 1968); Nourlangie area (CSIRO 1962); 50 miles north-east of Pine Creek on the South Alligator River (MVZ 1964); upper Nicholson River and Tin Creek (NTM-CSIRO 1967); South West Island, Sir Edward Pellew Group (Keith 1968, as *P. nanus*).

Status: Widespread and locally not uncommon; rocky wooded areas usually near or along watercourses.

Pseudomys fieldi (Waite, 1896). Alice Springs Mouse
Map 20

Range and Status: Known only from the damaged holotype collected at "Alice Springs" in June 1895.

Taxonomy: See Troughton (1937).

Pseudomys forresti (Thomas, 1906). Forrest's Mouse
Map 22

Range: Springvale and George Creek (NTM-CSIRO 1967); Alexandria; Brunette Downs (NTM 1966, 1970); Alroy Downs (NTM 1970); Georgina Downs (NTM 1970); Frazer River; Harts Range; Hamilton Downs (NTM 1961, 1962); Alice Springs; Burt Creek (NTM 1961); Wollara.

Status: Seasonally fairly common on the open blacksoil plains of the Barkly Tableland. Elsewhere uncommon or rare: caught on an open grassy plain on Hamilton Downs, in the bases of *Triodia* clumps at Wollara, and in the vicinity of soakages with stands of tall dense paperbark and eucalypt at Springvale and George Creek.

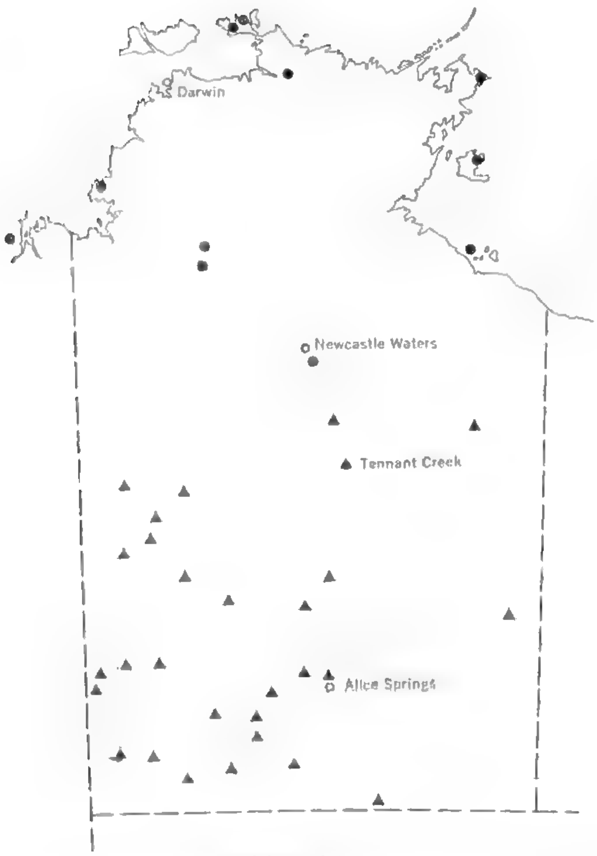
Taxonomy: *P. waitei* (Troughton, 1932) has been relegated to the synonymy of *P. forresti* by Ride (1970).

Pseudomys delicatulus (Gould, 1842). Little Native-Mouse
Map 21

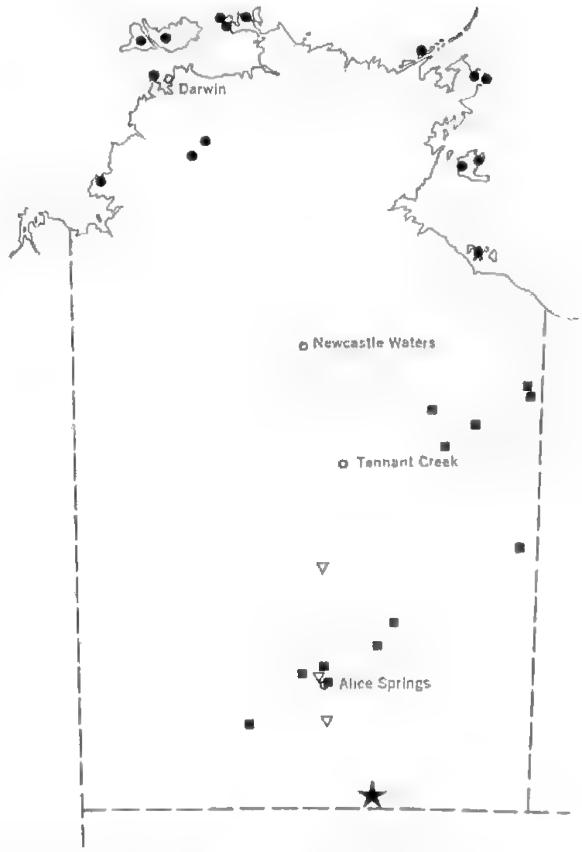
Range: South to Delamere (SAM 1966) and Elliott (NTM 1968); West Island, Sir Edward Pellew Group (Keith 1968); Groote Eylandt.

Status: Widespread and fairly common, on sandy soils with cover varying from sparse herbage to shrubby woodland.

Taxonomy: The nominate race inhabits the mainland while *P. d. mimulus* Thomas, 1926 occurs on Groote Eylandt (Johnson 1964).



Map 21



Map 22

Pseudomys hermannsburgensis (Waite, 1896). Sandy Inland Mouse
Map 21

Range: North to Tanami (AM 1952), Banka Banka and Alexandria, east to Manners Creek (NTM 1969).

Status: Widespread and seasonally common, generally in the same areas as the Brown Hopping-Mouse, *Notomys alexis* (*q.v.*).

Leporillus apicalis (Gould, 1853). White-tipped Stick-nest Rat
Map 25

Range and Status: Stick-nest rats were first reported in the Centre by Giles: nests found in dense mulga-dominated scrubs between Mount Peculiar and Mount Udor in September 1872 (Giles 1889 : 57); nest noted in dense scrub near Mount Squires, eastern WA, in October 1873, "not the first we have seen by many on this expedition" (Giles 1889 : 209), a remark that Finlayson (1941 : 228) rendered as "along the 26° parallel between Ayers Range and the Cavanagh Range"; nest in dense scrub in the vicinity of Lightning Rock, eastern WA, in late November 1873 (Giles 1889 : 232).

The Horn Expedition of 1894 apparently did not encounter this species at first hand; Spencer, who received two specimens from Field of Alice Springs, wrote (1896b : 11) that it was evidently a rare form. Probably the last record from the Centre is of a pair captured eight miles west of Mount Crombie, north-western SA, in 1933. Finlayson (1941 : 228) attributed the species' decline mainly to overhunting by aborigines.

Notomys aquilo Thomas, 1921. Northern Hopping-Mouse
Map 23

Range and Status: Groote Eylandt, where it is not uncommon in sandy areas: Umbakumba (Johnson): 'open forest between Angurugu River and Umbakumba' (D. Levitt, *in litt.*).

Taxonomy: Ride (1970) considered *N. carpentarius* Johnson, 1959 to be conspecific with *N. aquilo*, which was described from the Cape York Peninsula.

Notomys alexis Thomas, 1922. Brown Hopping-Mouse
Map 23

Range: North to the Tanami Desert, Banka Banka, Alroy and Alexandria.

Status: The most widespread member of the genus in the NT, seasonally very common. Occurs on loamy to sandy soil with various plant associations, usually *Triodia* and light shrub cover, but also mulga and dense melaleuca (*Melaleuca glomerata*).

Taxonomy: See Finlayson (1940); Aitken (1968). *N. a. alexis* occupies most of the range described above. *N. a. everardensis* Finlayson, 1940 has been collected in the south at Henbury and *N. a. alexis* > < *everardensis* in the Basedow Range.

Notomys cervinus (Gould, 1853). Fawn-coloured Hopping-Mouse
Map 22

Range and Status: Charlotte Waters (SAM no date, from P. Byrne). See note below.

Taxonomy: See Aitken (1968).

Notomys fuscus (Wood Jones, 1925). Dusky Hopping-Mouse
Map 22

Range and Status: Charlotte Waters (NMV 1895). See note below.

Taxonomy: See Aitken (1968).

Notomys longicaudatus (Gould, 1844). Long-tailed Hopping-Mouse
Map 22

Range: "Urwaitcha burrows", Burt Plain; Mount Burrell; Barrow Creek*.

Status: No records since 1901-2, when Spencer and Gillen obtained a large series from Barrow Creek.

* Amongst recent owl pellets from a cave 64 miles SSW of The Granites in the Highland Rocks area is a premaxillary-maxillary fragment of a large *Notomys* considered by J. Mahoney, *in litt.*, to belong to either *N. longicaudatus* or *N. amplus*.

Spencer (in Waite 1898 : 121) considered that the species he had referred to as *Hapalotis mitchelli* in the Horn Report was in fact *Notomys longicaudatus*. This would not be wholly true, however, as he collected 13 specimens of *N. alexis* on the expedition at Reedy Rockhole and Bagot's Creek (NMV), which he would have listed as *mitchelli* in the Horn Report. In this report Spencer (1896b : 10) wrote under *Hapalotis mitchelli* "The native name at Charlotte Waters is Ulabaiya", which Troughton (1965 : 320) misquoted as "the aboriginal name about Burt Plains was given as 'Ulabaiya' by Baldwin Spencer". Unfortunately there are no specimens of *N. alexis* from Charlotte Waters collected by Spencer himself, and no extant specimens of *N. longicaudatus* from this locality at all, so the association by Finlayson (1961) of Spencer's Ulabaiya (which Finlayson misspelt Ulubaiya) with *N. longicaudatus* is unsatisfactory. Finlayson (*loc. cit.*) further gave Allabaiya as the East Aranda name for "*Notomys* spp. close to *alexis* but not specifically identified".

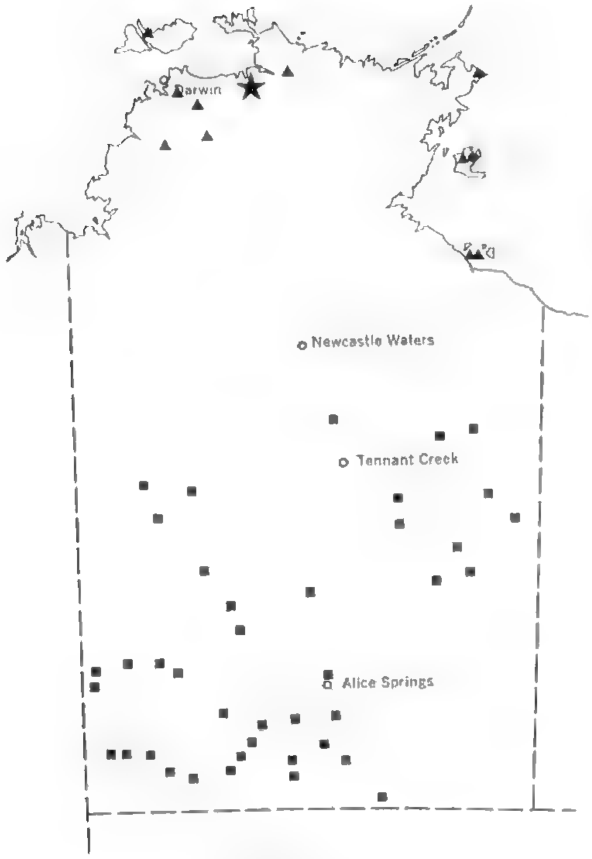
The significance of "Urwaitcha burrows" in connexion with the Burt Plain specimens (Waite 1898) has not been appreciated. Aranda of the Alice Springs district gave me a similar name "Uraritcha" for a large hopping mouse. This apart, it is reasonable to assume that in writing "Urwaitcha" Gillen was recording the aboriginal name of the species. Cf. "Oorarrie", the Wonkanooroo name given by Finlayson (1961) for *N. cervinus*.

I cannot trace the Mount Burrell specimen listed by Finlayson. Possibly it was collected by T. W. Cornock in 1891 (see Appendix 1), and is the spirit specimen without data in the SAM.

Notomys amplus Brazenor, 1936. Short-tailed Hopping-Mouse
Map 22

Range and Status: Known only from the two specimens collected at Charlotte Waters in 1896 (NMV). See note below.

NOTE: *Notomys cervinus* and *N. fuscus* apparently have their headquarters in the sandhill-claypan-gibber associations of the southern Lake Eyre Basin, the former burrowing mainly in claypans and the latter in sandhills (an ecological separation found also between *Macrotis lagotis* and *M. leucura*) (Finlayson 1939; Aitken 1968 and *in litt.*). Both species occur marginally and sporadically in the NT (Charlotte Waters 1895, 1896) during periods of increase. Byrne (in Spencer 1896b : 11) wrote in July 1895, after good rains, "The jerboa-like rodents are coming from the eastwards and they almost amount to a plague here", and in September 1895 "they have again become so scarce that the blacks have difficulty in securing a specimen". *Notomys amplus* may similarly have its centre of distribution outside the NT. Mitchell's Hopping-Mouse *Notomys mitchellii* (Ogilby, 1838) has been taken at Birdsville in south-western Queensland (Tate 1951 : 259) and may, with the other species discussed here, appear in the southernmost NT during good seasons.



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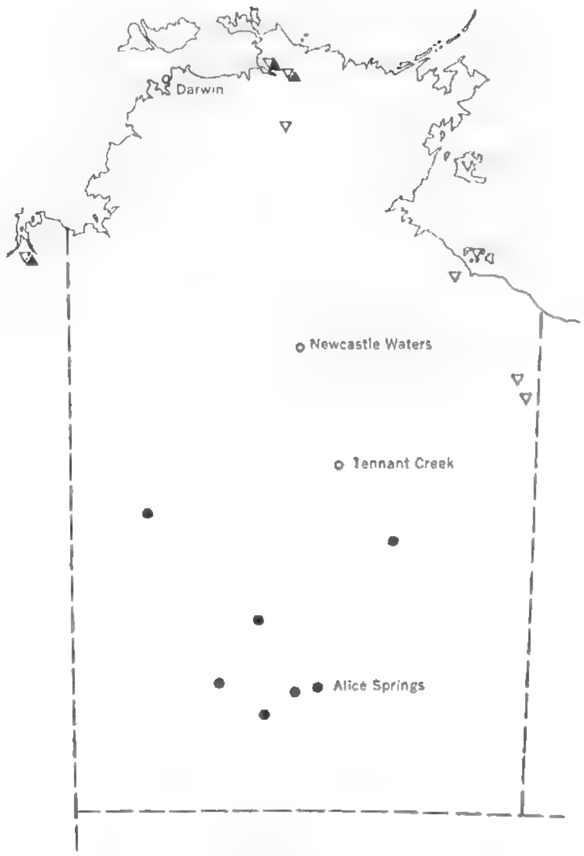


Map 24

Zyzomys argurus (Thomas, 1889). Common Rock-Rat

Map 24

Range: [Parry's Creek, near Wyndham, WA] Cooper Creek (NTM 1968); Deaf Adder Creek (NTM 1969); Oenpelli; Boroloola (NMV 1901-2); upper Nicholson River and Springvale (NTM-CSIRO 1967); Groote Eylandt; Sir Edward Pellew Group (Keith 1968).

Status: Common, amongst boulders and on rocky substrate areas at the bases of rocky hills.

Zyzomys pedunculatus (Waite, 1896). Waite's Rock-Rat

Map 24

Range: Alice Springs and Illamurta (1890's); Hugh Creek (1935); Napperby Hills (1950); The Granites (AM 1952); Davenport Range (1953); Haast's Bluff Settlement, Derwent River (NTM 1960).

Status: Rare and little-known; range country and isolated rocky outcrops. The Haast's Bluff specimen was caught raiding a stock-camp. See Finlayson (1961).

The vernacular name employed by Ride (1970), Macdonnell Range Rock-Rat, is considered no longer appropriate.

Zyzomys woodwardi (Thomas, 1909). Woodward's Rock-Rat
Map 24

Range and Status: Rare and little-known; rocky sandstone outcrops of the north-western escarpment of Arnhem Land: Oenpelli; Mount Borradaile (NTM 1968). [Parry's Creek, near Wyndham, W.A.]

Mesembriomys gouldii (Gray, 1843). Black-footed Tree-Rat
Map 25

Range: Daly River area north-east and east to Cape Arnhem Peninsula, inland to Katherine River; 5-mile bar, Macarthur River (NMV 1911); Melville Island.

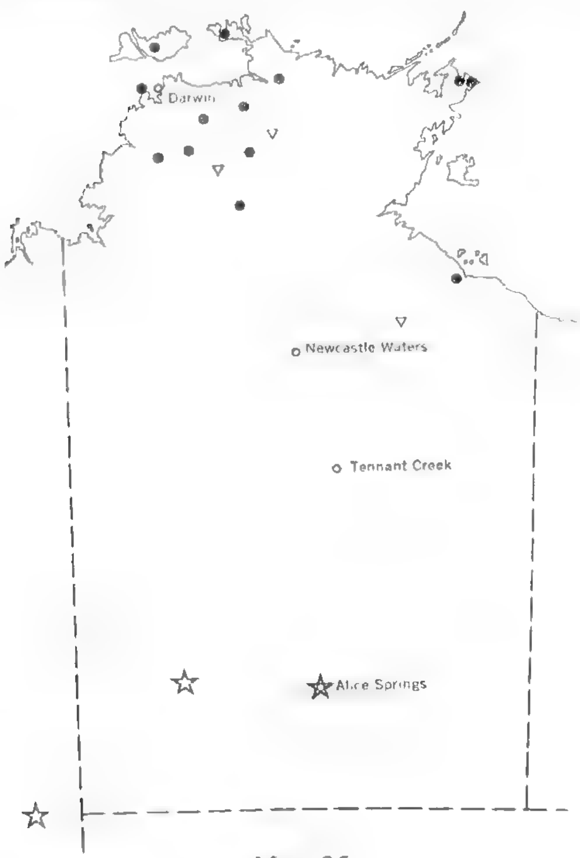
Status: Not uncommon in tall woodland with hollow trees, especially along watercourses and near the coast.

Taxonomy: The race *M. g. melvillensis* Hayman, 1936 was described from Melville Island; see Johnson (1964).

Mesembriomys macrurus (Peters, 1876). Golden-backed Tree-Rat
Map 25

Range: Nellie Creek (1903); Deaf Adder Creek (NTM 1969); Balanbrinni (NMV 1901).

Status: Much less frequently collected than *M. gouldii*; wooded water-courses.



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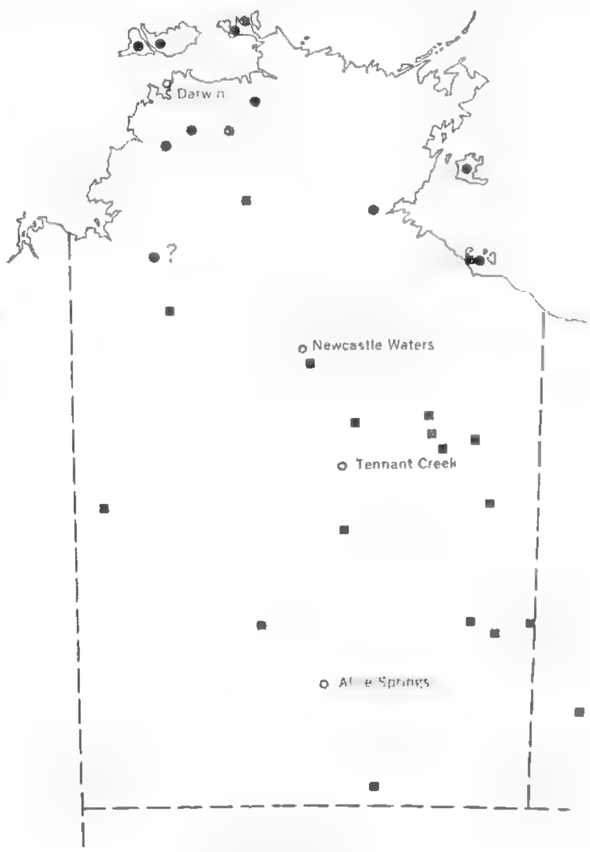


Map 26

Conilurus penicillatus (Gould, 1842). Brush-tailed Tree-Rat

Map 26

Range: Daly River area north-east and east to the South Alligator River and Coburg Peninsula; Roper River Mission (AMNH 1959); Bathurst Island (NMV 1916); Melville Island; Groote Eylandt; Centre Island, Sir Edward Pellew Group (Keith 1968).

Status: Not uncommon, along the coast and on the subcoastal plains, with hollow trees; recorded on Coburg Peninsula actually on the tideline and amongst hollow beach-casuarinas (*Casuarina equisetifolia*) (Gilbert, in Troughton 1965 : 311).

Taxonomy: The race *C. p. melibius* Thomas, 1921 has been described from Melville Island. The provenance of the Elsey specimen upon which the name *Conilurus hemileucurus* Gray, 1858 was based has yet to be precisely determined: most of Elsey's zoological material was collected at the Victoria River Depot No. 1.

Melomys Thomas, 1922. Mosaic-tailed Rats

Map 22

Range: Port Keats, north-east and east to Cape Arnhem Peninsula, inland to Douglas River and Brock's Creek; Bathurst Island (NMV 1916); Melville Island; Elcho Island; Groote Eylandt; Sir Edward Pellew Group (Keith 1968).

Status: Not uncommon, especially near the coast; grassy pandanus fringes of fresh- and salt-water streams and lagoons, and the edges of monsoon forest, in the vicinity of damp ground; mangroves. On Groote Eylandt, reported entering occupied houses (D. Levitt, *in litt.*).

Taxonomy: See Tate (1951); Johnson (1964). Tate considered most of the above range to belong to forms of *Melomys cervinipes* (Gould, 1852), with the exception of Groote Eylandt, occupied by *M. lutillus mixtus* Troughton, 1935. Ride (1970) and Calaby, *in litt.*, are of the opinion that the NT populations of the genus are in need of a thorough revision before a clear picture of their taxonomy and nomenclature can be obtained.

Rattus tunneyi (Thomas, 1904). Tunney's Rat

Map 27

Range: Douglas River; Mary River; Brock's Creek; Oenpelli; Coburg Peninsula (CSIRO 1965); Melville Island; Sir Edward Pellew Group (Keith 1968); Calvert River (QM 1969); Tennant Creek; Alice Springs.

Status: Widespread but apparently local. In the Pellews this species is the most numerous and widespread rodent, burrowing extensively in the well-drained sandy ridges (Keith 1968). Elsewhere it has been trapped along creeks. There have been no records of the Central Australian populations subsequent to Spencer's donation to the NMV in 1916; the dates of collection of Spencer's specimens are not precisely known but some at least were obtained during the period 1894-1897. Of the female from Tennant Creek listed by Waite (1898 : 124), which could not be traced by Brazenor (1936), the skull without skin is in the SAM reg. no. M. 2411).

Taxonomy: The race *R. t. melvilleus* Thomas, 1921 has been described from Melville Island, and *R. t. dispar* Brazenor, 1936 from Alice Springs.

Rattus colletti Thomas, 1904. Northern Territory Dusky Field-Rat
Map 27

Range: King River, north-east of Oenpelli (BMNH, coll. Wilkins, 1924); South Alligator River; Beatrice Hill (NTM 1961, 1967).

Status: Very local but not uncommon where found; clay flats and marshy areas.

Taxonomy: Ride (1970) synonymized *R. colletti* with *R. sordidus* (Gould, 1858) but subsequent chromosome studies have suggested that the former should for the present be maintained as a separate species (J. Mahoney, *in litt.*).

Rattus villosissimus (Waite, 1898)*. Long-haired Rat
Map 26

Range and Status: This species appears, from its distribution during the less favourable seasons, to have its headquarters in the Lake Eyre basin-Georgina-Diamantina drainage, where it occurs in highly-localized colonies around bore-drains, reedy springs and other wet, densely-vegetated spots (P. F. Aitken, *in litt.*, P. K. Latz and D. Howe, pers. comm.). At intervals (of five to seven years according to Finlayson 1939, 1941) that may be correlated with the amelioration of conditions by one or successive seasons of good rains, the species undergoes a spectacular increase, reaching plague proportions in the Georgina drainage and on the Barkly Tableland, generally on open plains in the vicinity of creeks and bores. It may swarm for several years before declining in numbers as spectacularly as it increased. Such plagues are accompanied by equally notable build-ups of predators, especially the Letter-winged Kite, *Elanus scriptus*, whose movements appear to be closely-tied to those of the rat (Parker 1971b), and the Barn Owl, *Tyto alba*.

In the NT. peripheral localities reached by the rat are: South-West Island, Sir Edward Pellew Group (Keith 1968), Katherine (CSIRO 1968); Humbert River (CSIRO 1968); Mongrel Downs (1968, J. Mahood, pers.

* Date of publication given incorrectly as 1897 by Iredale & Troughton (1934 : 73) and Ride (1970 : 227).

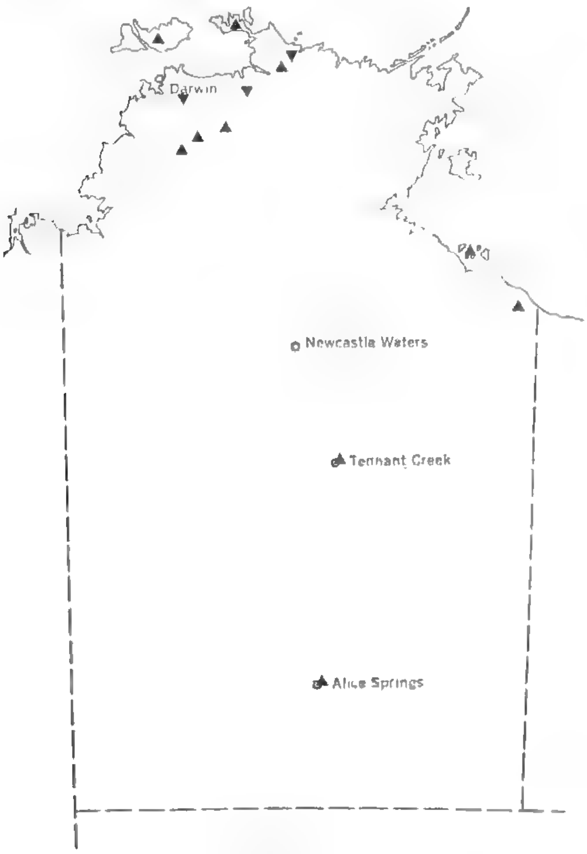
comm.); Napperby Creek; Delny (NTM 1968); Tarlton Range; Marqua (NTM 1968); Pituri Creek; New Crown (possibly from the Dalhousie Springs colony, *fide* P. F. Aitken, *in litt.*).

CARNIVORES

Canis familiaris Linnaeus, 1758. Dingo

Range and Status: Widespread and locally common.

Taxonomy: Australian populations are generally referred to *C. f. dingo* Meyer, 1793. The earlier name *Canis antarticus* [*sic*] Kerr, 1792 was suppressed in Opinion 451 of the International Commission on Zoological Nomenclature, 1956.



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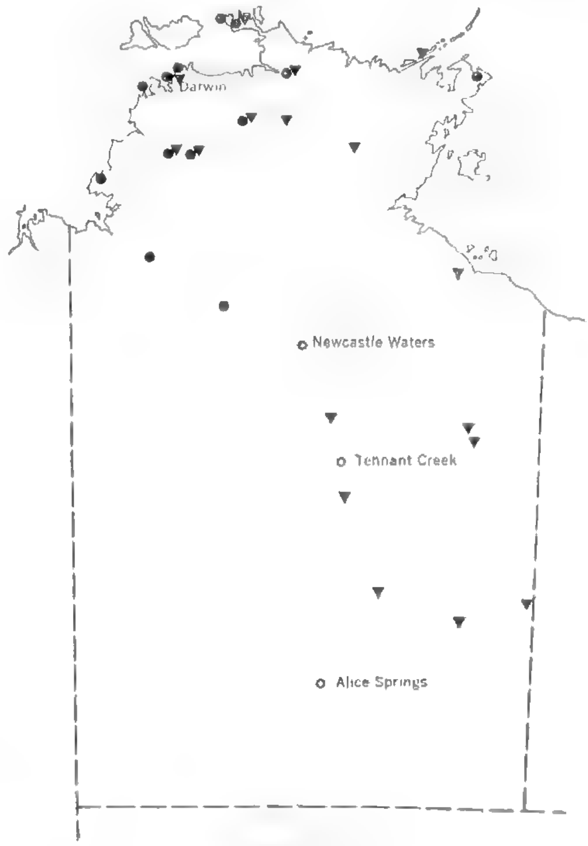


Map 28

BATS

Pteropus scapulatus Peters, 1862. Little Red Flying Fox

Map 28

Range: Mainly coastal districts, inland to Deaf Adder Creek (NTM 1969), Wimul Swamp (SAM 1966) and Borroloola (NMV 1912); Elcho Island. With the flowering of eucalypts it may move much further south, and has been reported from Buchanan Creek and Playford Creek on the Barkly Tableland (regularly), Banka Banka, Frew River and Davenport and

Murchison Ranges (frequently; specimen from McLaren Creek, NTM December 1965) and Arthur Creek, Pituri Creek and Sandover River (occasionally). In adjoining western Queensland it moves seasonally down the Georgina (D. Howe, pers. comm.).

Status: A blossom-feeder, common in the northern part of its range, usually in eucalypt and eucalypt-pandanus woodland, in a variety of country from coastal flats to sandstone gorges. Observed roosting beneath the dry skirts of pandanus (S. A. Parker, *ms.*) and in paperbarks (*Melaleuca*) along watercourses (J. L. McKean, *in litt.*).

Pteropus alecto Temminck, 1837. Black Flying Fox
Map 28

Range: Mainly coastal and subcoastal: Victoria and Daly Rivers east to the South Alligator River and Cape Arnhem Peninsula; sometimes further inland, as at McColl's Bore, Armstrong River (NTM 1958).

Status: More of a fruit-eater than the preceding; recorded in large numbers from monsoon forest, riverine thickets and mangroves.

Taxonomy: The Australian populations belong to the race *P. a. gouldii* Peters, 1867 (Johnson 1964).

Macroglossus lagochilus Matschie, 1899. Northern Blossom Bat
Map 29

Range: Darwin area (W. P. Walsh, *in litt.*); Melville Island (SAM 1913); Coburg Peninsula (CSIRO 1965); Tortilla Flats, Adelaide River (NTM 1967).

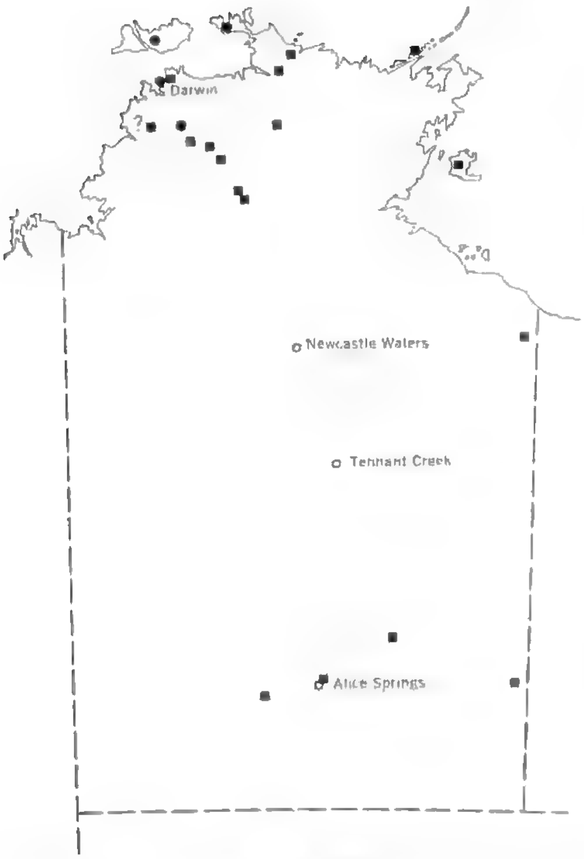
Status: "Sometimes locally abundant. Present throughout the year in Darwin Botanical Gardens, with apparent peak in spring and early summer (up to 20 seen feeding in same tree). At Rapid Creek, species taken in *Tristania lactiflua* forest fringing stream margin" (W. P. Walsh, *in litt.*). The Tortilla Flats examples, three, were mistnetted in an arcade in dense riverine bamboo.

Taxonomy: The Australian populations belong to the race *M. l. nanus* Matschie, 1913 (McKean, *in litt.*).

Taphozous georgianus Thomas, 1915. Common Sheath-tailed Bat
Map 30

Range and Status: Throughout the NT; common, roosting in caves and mineshafts.

Taxonomy: McKean & Price (1967) regarded the northern populations as *T. g. troughtoni* Tate, 1952, and suggested that the central populations may represent the nominate race.



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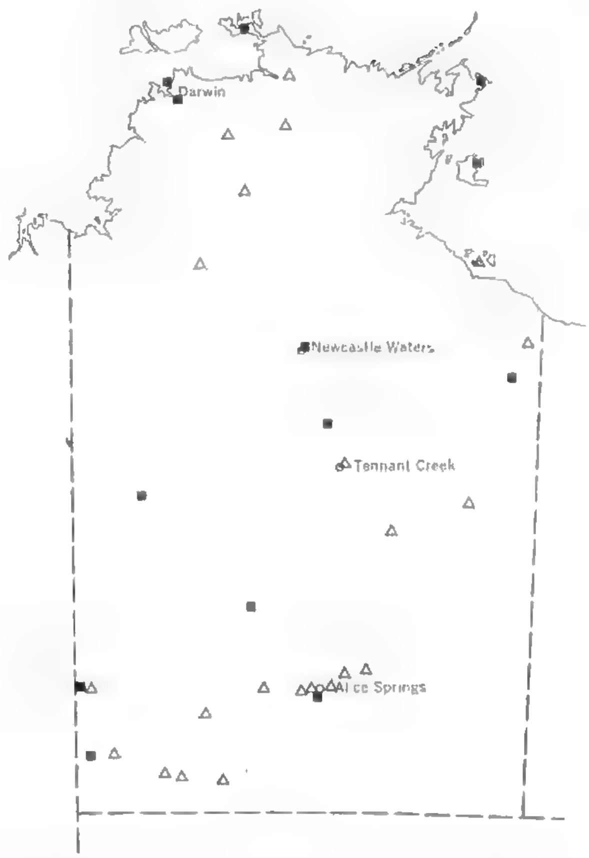


Map 30

Taphozous flaviventris Peters, 1867. Yellow-bellied Sheath-tailed Bat
Map 30

Range: Point Charles (NMV 1938); Darwin; Lake Deane (W. P. Walsh, *in litt.*); Coburg Peninsula (CSIRO 1965); Deaf Adder Creek (NTM 1969); Cape Arnhem Peninsula; Groote Eylandt; Block Waterhole, upper Nicholson River (NTM-CSIRO 1967); Tanami Desert at 20° 09′, 130° 15′ (NTM, AM 1965); Newcastle Waters (NTM 1959); Banka Banka (CSIRO 1968); Warburton Creek-Tower Creek junction; Temple Bar Creek (CSIRO 1968); Petermann Ranges and Bonython Range (BMNH 1967).

Status: Widespread but possibly less common than *T. georgianus*. Roosts in hollow trees; several of the above specimens were shot over water.

Macroderma gigas (Dobson, 1880). Ghost Bat
Map 29

Range: Macallum Creek area (Finlayson 1958a); Darwin; Mount Wells, Pine Creek, Cutta Cutta and Owenia Rockshelter, colonies (W. P. Walsh, *in litt.*); Oenpelli (MCZ, NMV 1918); King River, north-east of Oenpelli (NMV 1915); Elcho Island (J. McKean, *in litt.*); Deaf Adder Creek (NTM 1969); Ronans Cave (SAM 1966); Groote Eylandt (AM); Red Bank Mine (AMNH 1959); Frazer River, Field River, Alice Springs, Mount Conway, Ellery Creek (Finlayson 1958a : 923).

Status: Rare and vanishing in Central Australia, but locally abundant in the north. A cave-dweller.

Taxonomy: *M. g. saturata* Douglas, 1962 is available for the darker northern populations.

Hipposideros ater Templeton, 1848. Dusky Horseshoe Bat
Map 32

Range: Owenia Rockshelter (W. P. Walsh, *in litt.*); Douglas River; Oenpelli; King River, north-east of Oenpelli (NMV 1915); Deaf Adder Creek (NTM 1969); Cutta Cutta (SAM 1966, CSIRO 1969).

Status: Uncommon, apparently needing pitch-dark caves with humidity near saturation-point (W. P. Walsh, *in litt.*). Mainly in sandstone areas.

Taxonomy: See McKean & Price (1967). The Australian populations belong to *H. a. aruensis* Gray, 1858.

Hipposideros diadema (Geoffroy, 1813). Diadem Horseshoe Bat
Map 32

Range and Status: Known from the NT by 13 specimens mistnetted amongst tall paperbarks (*Melaleuca*) in a sandstone gorge on Deaf Adder Creek in September 1969 (NTM, CSIRO). Doubtless a cave-dweller, as it is in Queensland.

Taxonomy: This isolated population has been described as a new subspecies, *H. d. inornatus* McKean, 1970.

Hipposideros stenotis Thomas, 1913. Lesser Warty-nosed Horseshoe Bat
Map 32

Range and Status: Three of the four NT records are from the western escarpment of Arnhem Land: Mary River, two collected from caves in May 1895 by Dahl, who found the species not uncommon; King River north-east of Oenpelli, two collected from "sandstone cliffs" in 1915 by McLennan (NMV); Deaf Adder Creek, one taken by hand from crevice high in sandstone cliff in September 1969 by D. Howe (NTM). The fourth record is from the Gulf drainage: specimen from Red Bank Mine area near Wollogorang in 1959 (AMNH).

Rhinonicteris aurantius (Gray, 1845). Orange Horseshoe Bat
Map 33

Range: Darwin (AM); Port Essington; Adelaide River (NMV 1912); Oenpelli; Maranboy (AM); Cutta Cutta and Smokey Creek (W. P. Walsh, *in litt.*).

Status: "Widespread and common near the coast; distribution may change seasonally. The Cutta Cutta population is *c.* 50,000 at present unless I have seriously miscalculated the ratio of *Rhinonicteris* to *Hipposideros ater* there" (W. P. Walsh, *in litt.*, 1970).

Gould quoted the following observation (requoted in Johnson 1964 : 474), that on the Coburg Peninsula this bat "retires during the daytime to the hollow spouts and holes of the various species of *Eucalypti*". All subsequent observations of the roosting of this species, however, indicate that it is a cave-dweller.

Tadarida australis (Gray, 1839). White-striped Bat
Map 31

Range: Scattered localities from the Petermann Ranges (BMNH 1967) north-east to the Stuart Bluff Range (NTM 1961) and Allambi (NTM 1968).

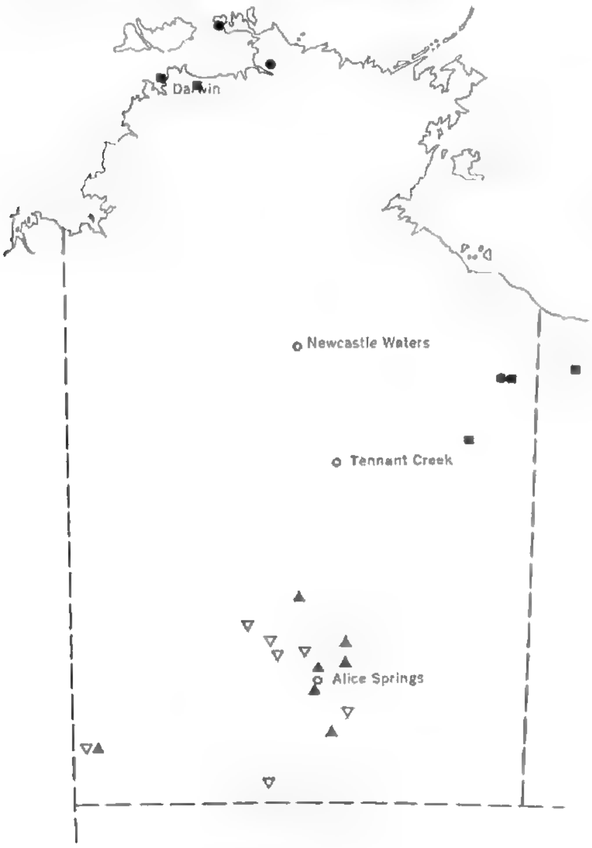
Status: Locally common.

Tadarida loriae (Thomas, 1897). Little Northern Scurrying Bat
Map 31

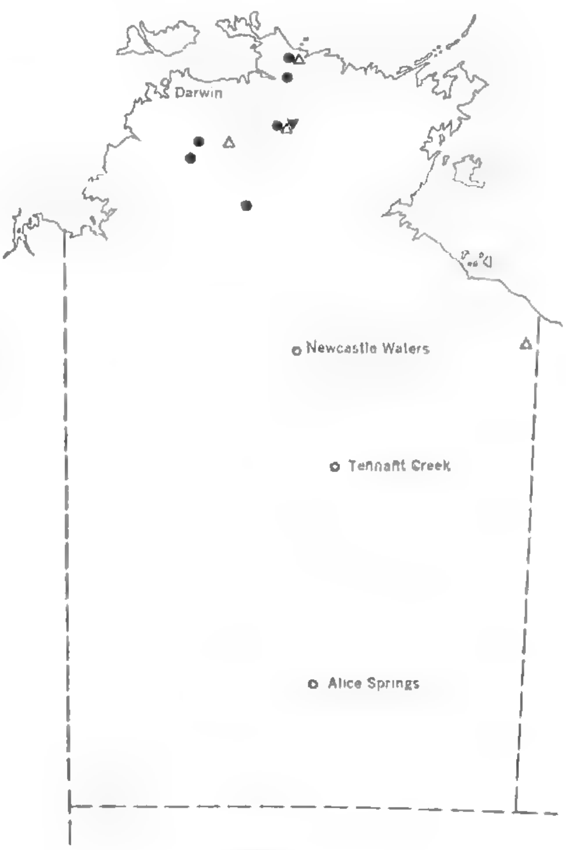
Range: Coburg Peninsula; Mount Borradaile (NTM 1968); Seven-Ten Waterhole, upper Nicholson River (NTM-CSIRO 1967).

Status: Uncommon; the NTM specimens were shot or netted over waterholes at dusk.

Taxonomy: *T. l. cobourgiana* Johnson, 1959 was based on specimens from the Coburg Peninsula.



Map 31



Map 32

Tadarida planiceps (Peters, 1866). Little Flat Bat

Map 31

Range: Lasseter's Cave, Petermann Ranges (NTM 1969); Alice Springs area (NTM 1955, 1960, 1969); 14-mile Bore, Alcoota (CSIRO 1968); Maryvale (NTM 1970); Ross River (NTM 1970); Tea Tree Well (NTM 1963).

Status: Widespread but apparently uncommon; roosting in hollow logs and branches.

Tadarida jobensis (Miller, 1902). Northern Mastiff Bat

Map 31

Range: Darwin (AM); near White Stone Creek, Marrakai (NTM 1969); Alexandria; Seven-Ten Waterhole, upper Nicholson River (NTM-CSIRO 1967); [Doomadgee, north-western Queensland (SAM 1963)].

Status: Apparently uncommon; roosting in tree-hollows.

Taxonomy: The Australian populations belong to the race *T. j. colonica* (Thomas, 1906).

Myotis adversus (Horsfield, 1824). Large-footed Myotis

Map 35

Range: Coburg Peninsula (CSIRO 1965); Seven-Ten Waterhole, upper Nicholson River (NTM-CSIRO 1967); Melville Island (NMV 1938).

Status: Uncommon and local. Recorded roosting close to water, in caves and culverts (within smaller crevices rather than on the bare walls) and in hollow trees.

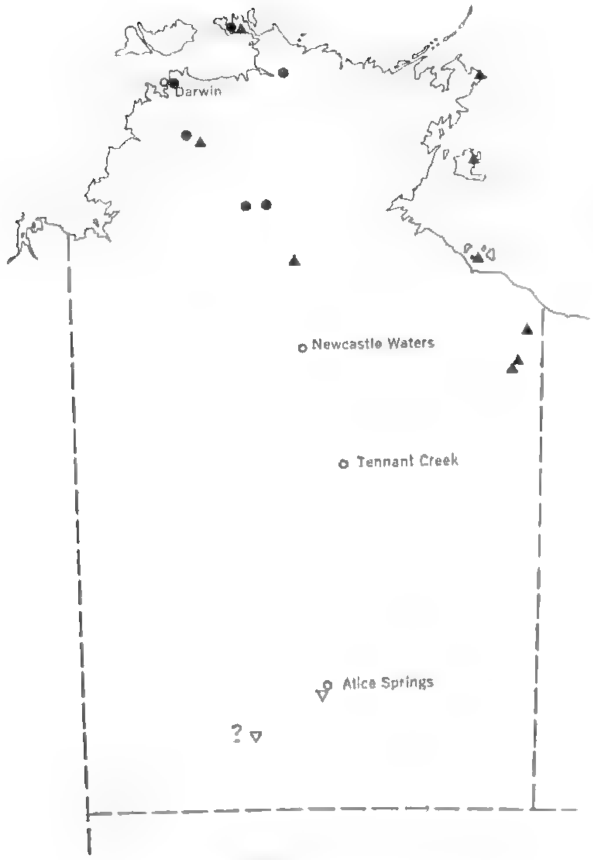
Taxonomy: The Australian populations belong to the race *M. a macropus* (Gould, 1855); see McKean & Hall (1965).

Chalinolobus gouldii (Gray, 1841). Gould's Wattled Bat

Map 34

Range and Status: Widespread and common in the south, north to the upper Nicholson River (NTM-CSIRO 1967) and Banka Banka; further north only two isolated records: Douglas River (Johnson 1964) and Coburg Peninsula (NTM 1961). Roosts in tree hollows and amongst leaves.

Taxonomy: The name *C. g. venatoris* Thomas, 1908 (type-locality Alexandria) is employed for the northern populations. Central Australian populations are variable and represent a cline between *C. g. venatoris* and the nominate race (J. L. McKean, *in litt.*).



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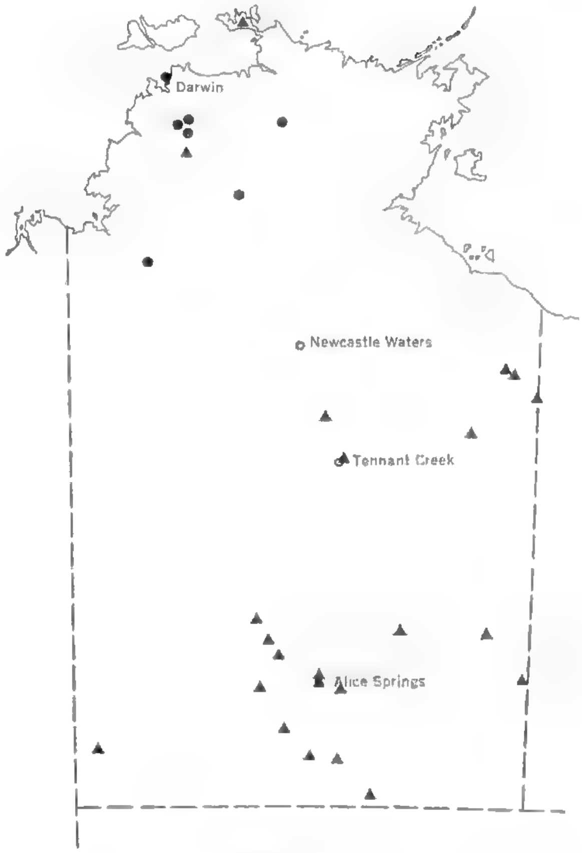


Map 34

Chalinolobus morio (Gray, 1841). Chocolate Bat
Map 33

Range and Status: In the NT known with certainty only by six specimens netted over Quarantine Bore, 12 miles south-south-west of Alice Springs, in 1969 (NTM). Finlayson (1961) listed "*Chalinolobus* cf. *morio*" from Wollara.

Chalinolobus nigrogriseus (Gould, 1856). Hoary Bat
Map 33

Range: Brock's Creek; Coburg Peninsula (CSIRO 1965); Cape Arnhem Peninsula; Groote Eylandt; Sir Edward Pellew Group (Keith 1968); Red Bank Mine (AMNH 1959); China Wall and Block Waterhole, upper Nicholson River (NTM-CSIRO 1967); 47 miles north of Daly Waters (NTM 1961).

Status: A northern species. Widespread but uncommon. Recorded roosting in rock crevices.

Taxonomy: The NT populations belong to the race *C. n. rogersi* Thomas, 1909 (H. M. Van Deusen, *in litt.*).

Eptesicus Rafinesque, 1820. Little Bats
Map 35

Range and Status: Throughout the NT, common; roosting in caves and mineshafts.

Taxonomy: The name *E. pumilus caurinus* Thomas, 1914 is generally used for the NT populations of this genus. In view of the remarks of McKean & Price (1967) and McKean, *in litt.*, concerning the need for a revision of Australian *Eptesicus*, no specific name is here used.

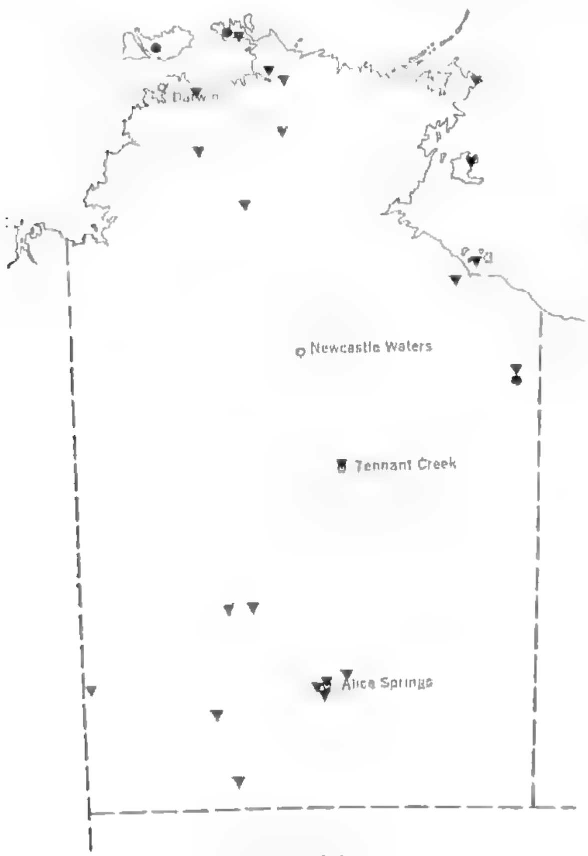
Nycticeius balstoni (Thomas, 1906). Broad-nosed Bat

Map 36

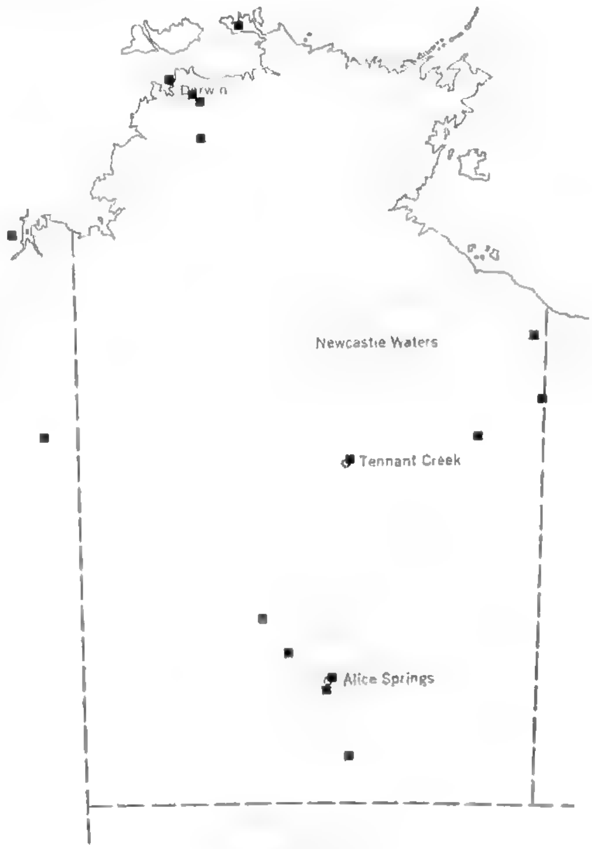
Range: [Forrest River Mission (AM 1952); Sturt Creek, WA] Darwin; Fogg Dam (CSIRO 1964); Marrakai HS (NTM 1963); 46 miles south-east of Adelaide River town (NTM 1958); Red Bank Mine (AMNH 1959); Border Waterhole (NTM-CSIRO 1967); Alexandria; Tennant Creek; Napperby Creek (NTM 1969); Karanji Bore (NTM 1963); Alice Springs area (NTM 1960, 1965, 1969); Horseshoe Bend.

Status: Widespread and locally common. A specimen from Wire Creek was one of five roosting in a hollow tree-limb with two *Tadarida planiceps*.

Taxonomy: The northern populations are generally referred to *N. b. caprenus* (Troughton, 1937) and those of Central Australia to nominate *N. b. balstoni*. J. L. McKean, *in litt.*, considers that the type of *Scotophilus greyii* Gould, 1858 (type-locality Port Essington) may prove to belong to the taxon at present known as *N. b. caprenus*.



Map 35



Map 36

Miniopterus schriebersii (Kuhl, 1819). Bent-wing Bat

Map 34

Range: Darwin area; Tortilla Flats (NTM 1967); Virginia Mine (W. P. Walsh, *in litt.*); nine miles west of Katherine (SAM 1966); Deaf Adder Creek (NTM 1969); Timber Creek (NMV 1963).

Status: Locally common, in deep caves, mineshafts and abandoned buildings. W. P. Walsh, *in litt.*, estimated the Virginia Mine colony to number more than 50,000 bats. The nine Deaf Adder Creek specimens were shot in sandstone gorges, six over a waterhole.

Taxonomy: The NT populations are generally referred to *M. s. orianae* Thomas, 1922.

Nyctophilus geoffroyi Leach, 1821. Lesser Long-eared Bat

Map 37

Range: North to False Smoke Hills (AM 1965), Tennant Creek, Alexandria and Springvale (NTM-CSIRO), with an isolated record from the Katherine area (NTM).

Status: Scattered but locally not uncommon. Roosts in trees, occasionally in caves and rock-crevices.

Taxonomy: The NT populations are generally referred to *N. g. pallescens* Thomas, 1913.

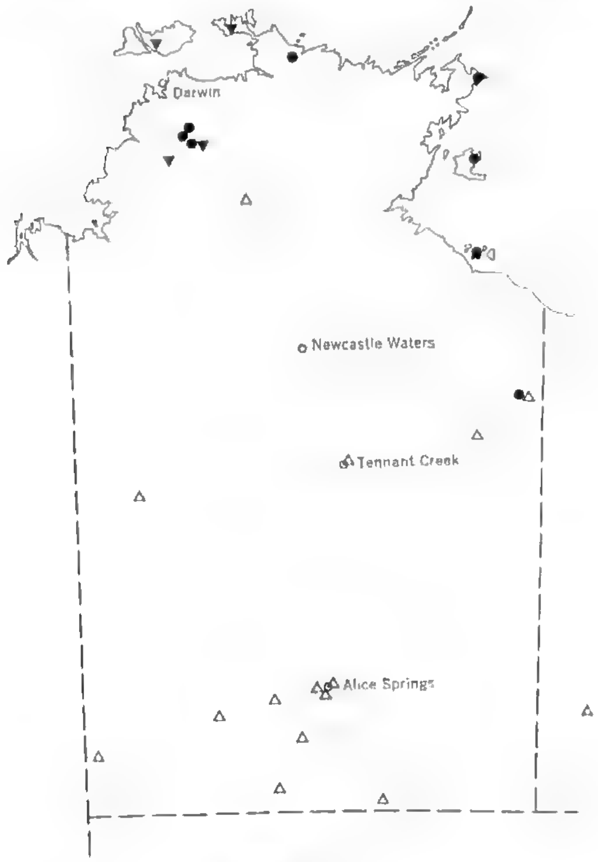
Nyctophilus bifax Thomas, 1915. North Queensland Long-eared Bat

Map 37

Range: Daly River; Brock's Creek; Melville Island; Coburg Peninsula (CSIRO 1965).

Status: Unknown. Dahl found it abundant around the Uniya Mission on the Daly River in 1894. Of the Brock's Creek specimens, one was flying over a waterhole, the other clinging to the bark of a tree in daylight (Johnson 1964 : 479).

Taxonomy: The NT populations belong to the race *N. b. daedalus* Thomas, 1915 (Johnson 1964).



Map 37

Nyctophilus arnhemensis Johnson, 1959. Arnhem Land Long-eared Bat
Map 37

Range: King River, north-east of Oenpelli (NMV 1915); Tortilla Flats, Adelaide River (NTM 1967); Brock's Creek; Cape Arnhem Peninsula; Groote Eylandt; Sir Edward Pellew Group (Keith 1968); Springvale (NTM-CSIRO).

Status: Little-known but probably not uncommon; in dense tall paperbark woodland, passages in monsoon forest and the gloomy arcades of dense riverine bamboo. Found roosting beneath the bark flaps of large paperbarks.

Taxonomy: There is a possibility that *Nyctophilus arnhemensis* is a junior synonym of *Nyctophilus walkeri* Thomas, 1892, which name was based on a single specimen from the Adelaide River (J. L. McKean, *in litt.*).

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Appendix I

NOTES ON COLLECTORS AND COLLECTIONS

These notes are not exhaustive. In the main they treat new information and obscure points, encountered during the checklist's preparation, that would be of value in the compilation of a comprehensive bibliography. See also Whittell (1954) and M. Specht (1964).

Cahill, P. (-). Between 1912 and 1920 Cahill collected birds in the Oenpelli-East Alligator River area, most of these are now in the NMV. In 1913 he donated a specimen of *Mesembriomys gouldii*. In 1922 the NMV purchased from Mrs. Marie Cahill five specimens of *Macropus bernardus* and one of *Peradorcas concinna* collected by Cahill.

Cornock, Thomas W. (-). Went as an assistant with Edward (later Sir) Charles Stirling (then Hon. Director, South Australian Museum) in 1890-91 when Stirling accompanied the Governor of South Australia, the Earl of Kintore, to the NT. In the SAM there are a few bird specimens of Cornock's, labelled "Mount Burrell, 1891" and "Port Darwin, March 1891". Possibly he obtained the Mount Burrell specimen of *Notomys longicaudatus* (*q.v.*).

Dahl, K. (1871-1951). Victoria River—Daly River—Mary River—South Alligator River, 1894-1896 (Dahl 1926). Dahl's notebooks and the great majority of his collections are in the University of Oslo, Norway. A comprehensive study of this material has yet to supersede the piecemeal accounts by Collett and Thomas.

De Teliga, G. W. (-). See Schevill, W. E.

Dodd, Walter Dempsey (1891-1969). Born 27 March 1891 at Toowong, Queensland. In 1913 Dodd collected mammals and birds (now in SAM) on Melville Island, Bathurst Island and the upper Mary River. His Melville Island birds were written up by Zietz (1914a, 1914b); his mammals have never formed the subject of a report. Dodd died 17 May 1969 at Brisbane.

Elsey, J. R. (1834-1858). Accompanied A. C. Gregory's 1855-1856 expedition across northern Australia. Most of his zoological material (now in the BMNH) was obtained at the Victoria River Depôt No. 1. Although Elsey concentrated on birds, he obtained a few mammals, most of which are now without their data. See Chisholm (1964, 1966) and Macdonald & Colston (1966).

Finlayson, H. H. (1895-). An authority on the mammals of Central Australia. Honorary Curator of Mammals at the South Australian Museum from 1940 to 1966, he amassed a large private collection, the inaccessibility of which is a source of regret amongst mammalogists. Finlayson's crowning paper on Central Australian mammals appeared in 1961.

Gillen, F. J. (1855-1912). Born 28 October 1855. Accompanied W. Baldwin Spencer on several expeditions. Some, if not all, of the early material from the Burt Plain north of Alice Springs was obtained by Gillen. Gillen died of amyotrophic lateral sclerosis on 5 June 1912.

Hill, G. F. (1880-1954). Naturalist on the Barclay Exploring Expedition to Central Australia and the Northern Territory, 1911-1912; Government Entomologist, NT, 1912-1917. No complete report was ever published concerning the results of the Barclay Expedition, on which Hill made collections (now in the NMV) of birds, mammals, reptiles, insects and plants. For a dated itinerary of the outward stage of this expedition (Oodnadatta to the Macarthur River) see Ewart & Davies (1917, map). Other notes may be found in Hill (1913) and Campbell & Kershaw (1913). Hill's notebooks of 1911-1912, mostly in shorthand, together with those of H. Vere Barclay, are in the Commonwealth Archives, Canberra; the journal of the expedition's surveyor, R. McPherson, is in the office of the Lands and Survey Branch, Northern Territory Administration, Darwin. The study and publication of material relating to this expedition would be a most valuable undertaking. Hill died at Sydney on 18 January 1954.

Hosmer, William I. (*ca.* 1930-). Born in Ireland. An Australian-based herpetologist, leader of the 1960 Spalding-Hosmer Expedition, which visited the NT (specimens, including a few mammals, in AMNH). Also on the 1959 Spalding-Peterson Expedition.

Hoy, C. M. (-). Douglas River and Brock's Creek, 1920. Hoy's specimens are in the USNM and were detailed by Johnson (1964).

Johnson, David Horn (1912-). Born Albany, Oregon, 9 September 1912. Curator of Mammals, United States National Museum, 1941-68. Mammalogist on the 1948 American-Australian Expedition to Arnhem Land (Johnson 1964).

Lestang, Albert de (-). A Frenchman, an amateur naturalist who lived on a small property named Adel's Grove some 90 miles south-west of Burketown on Lawn Hill Creek, north-western Queensland. His main interest appears to have been botany, and he sent plant collections to the Queensland Herbarium, Brisbane. Troughton (1965: 29-30) mentioned a series of *Planigale ingrami* (*q.v.*) in the AM collected by de Lestang.

McLennan, W. R. (1882-1935). Coastal NT west to the King River (north-east of Oenpelli), 1915 (McLennan 1917). Although McLennan concentrated on birds, he obtained a few mammals (now in the NMV) from the sandstone ranges of the King River, which Wilkins (*q.v.*) visited in 1924. In ornithological literature McLennan's name is frequently spelt Maclennan (*e.g.*, Whittell 1954) and M'lennan. However, McLennan is the form appearing on his birth-certificate and used by him in his letters (Mrs. T. Kloot, Archivist, Royal Australasian Ornithologist Union, *in litt.*).

Peterson, Russell Francis (1922-). Born 11 June 1922 at Montclair, New Jersey. Mammalogist associated with the AMNH 1952-59. Led the 1959 Spalding-Peterson Expedition to Queensland and the NT (specimens in AMNH). Now a free-lance editor, author and artist, living in Jamestown, Rhode Island, U.S.A. His several books include a popular work on bats (Peterson 1964).

Schevill, W. E. (-). Member of the 1931-32 Harvard Australian Expedition. In the MCZ there is a collection of 48 mammal specimens collected in the Hermannsburg, Barrow Creek and Teatree Well areas in 1932 by Schevill & G. W. De Teliga. Although Tate mentioned a few of these specimens in his revisions, the collection was never reported in its entirety. See Loveridge (1934: 244-5).

Spalding, Philip (*ca.* 1903-). Financed the 1959 Spalding-Peterson Expedition and the 1960 Spalding-Hosmer Expedition.

Spencer, W. B. (1860-1929). Zoologist on the Horn Expedition to Central Australia in 1894. He made several subsequent trips to the NT, some with F. J. Gillen (see Spencer & Gillen 1912, Spencer 1928). Spencer's contacts of 1894 (P. Byrne of Charlotte Waters, E. Cowle of Illamurta, *et al.*) continued sending him mammals for some years. "The Spencer mammal collection is a valuable one of both historical and scientific significance. However, the passage of time has resulted in considerable difficulty in identification of much of the type material. Some specimens have vanished, possibly destroyed, while others have lost most of their data" (Dixon 1970 : 105). One might add that in other cases, as with the "Barrow Creek" material (see Gazetteer), some of the specimens seem to have been incorrectly localized. Details of the Horn Expedition itinerary more precise than those found in the Horn Report appear in Winnecke (1897).

Stalker, W. (1879-1910). Alroy Downs, Alexandria Station, 1905-1906. At that time Alexandria covered a far greater area than now (see Ingram 1907). Restriction of the provenance of Stalker's material to present-day Alexandria is therefore unsatisfactory, and work needs to be carried out on a dated itinerary. Stalker's material is in the BMNH.

Terry, M. (1899-). In the 1920's and 1930's Terry explored large tracts of Central Australia, notably the Tanami Desert and the Lake Mackay-Lake Amadeus regions. He obtained mammals for H. H. Finlayson, amongst them the holotypes of *Lagorchestes asomatus* and *Bettongia penicillata anhydra*. Terry's books on these surveys (1925, 1927, 1930, 1931, 1937) are full of the most interesting detail.

Thomson, D. F. (1901-1970). "Donald Thomson went in 1935 to Arnhem Land . . . He made an extensive zoological collection, now at Melbourne University, primarily as a background to the study of the ecology and food-gathering habits of the aborigines. The material has been worked upon, but no systematic publication has been made of the collections, mainly mammals, reptiles and amphibians" (M. Specht 1964 : 5). During Thomson's later years at least, these collections were not available to workers. Their critical examination and publication is a matter of the first importance.

Thomson died on 13 May 1970 at Eltham, Victoria. His ashes were scattered from a plane over Caledon Bay in north-eastern Arnhem Land.

Tindale, N. B. (1900-). Roper River 1921; Groote Eylandt 1921-1922. Tindale collected a few mammals (now in the SAM), which have not been reported. See Tindale (1925).

Tunney, J. F. (1871-1929). Arnhem Land, 1902-1903. Tunney's large bird and mammal collections are dispersed amongst the BMNH, WAM, USNM and AMNH. Storr (1966), using information from Tunney's bird specimens, elucidated much of Tunney's itinerary in the NT. A study of the mammal labels, in conjunction with Storr's findings, would prove a most profitable exercise.

Wilkins, Sir George Hubert (1888-1958). For Wilkins' activities in the northern NT during 1924 and 1925, consult his book (1928). His collections, which include a good number of mammal specimens, were deposited in the BMNH, although paratypes of several new forms were presented to the Queensland Museum. Wilkins' "King River" is not the tributary of the Katherine River as Thomas (1926) thought, but the King River north-east of Oenpelli and south of the Goulburn Islands (Wilkins 1928 : 200; Johnson 1964 : 455). Wilkins' collections have not yet been fully reported.

Wilkins died overnight 30 November-1 December 1958. Some months later Commander James Calvert, U.S. Navy, carried his ashes north beneath the Polar Ice where they were scattered on 17 March 1959.

Appendix II

GAZETTEER OF PLACE-NAMES

Latitudes are south, longitudes east, to the nearest minute. Positions given for cattle stations are those of the present homesteads. See also Storr 1967 : 71-83

Adelaide River, rises at 13° 25′, 131° 00′, flows N into Van Diemen Gulf at 12° 13′, 131° 14′

Adelaide River, town on the Adelaide River where it is crossed by Stuart Highway 72 miles S of Darwin, at 13° 15′, 131° 07′

Alexandria, cattle station on Barkly Tableland, 19° 03′, 136° 42′. See Appendix 1 under W. Stalker.

Alice Springs, town on the Todd River, 23° 42′, 133° 51′. Early material labelled "Alice Springs" sometimes came from further afield: some of Gillen's specimens so labelled were actually from the Burt Plain.

Allambi, cattle station, 24° 13′, 134° 25′.

Alroy (Downs), cattle station on Barkly Tableland, 19° 17′, 136° 03′.

Angurugu River, Groote Eylandt, estuary at 13° 58′, 136° 24′.

Arltunga, former gold town, 23° 25′, 134° 43′.

Arnhem Land, formerly denoted the far north of the NT between the Timor Sea and the Gulf of Carpentaria; now generally restricted to the Aboriginal Reserve in the eastern two-thirds of this area. The greater part is occupied by the predominantly sandstone Arnhem Land Plateau, the flanks of which are known as the Arnhem Land Escarpment.

Arthur Creek, crossed by Jervois Stock Route at 22° 41′, 136° 41′.

Attack Creek, crossed by Stuart Highway at 19° 02′, 134° 08′.

Ayers Range, 25° 55′, 133° 09′.

Ayers Rock, 25° 21′, 131° 02′.

Bagot Creek (Camp 23 of the Horn Expedition, 1894), leaves George Gill Range at 24° 24′, 131° 48′. Not to be confused with the Bagot Creek 9 miles W of Hermannsburg.

Balanbrinni (on label of *Mesembriomys macrurus*, NMV): Spencer (1928 : 552) referred to "a small waterhole on the Leila Creek, called Ballanbrini". Leila Creek is a tributary of the upper Macarthur River. I have failed to find a waterhole of this name. Lying on Spencer & Gillen's route between O.T. Downs and Leila Creek there is a Balanbrini Creek (a tributary of the Limmen Bight River) crossed at 16° 35′, 135° 20′. Pending further research, one must leave the Ballanbrini Waterhole of Spencer & Gillen on the track between O.T. Downs and the Leila-Macarthur junction.

In the NMV there are several bird specimens from this expedition labelled "Ballanginie", possibly a variant spelling of the above.

Banka Banka, cattle station on Stuart Highway, 18° 47′, 134° 03′.

Barkly Tableland, north-eastern region of plains of great pastoral value, about 300 miles long by 100 miles wide, orientated NW-SE between 17° and 20°S; bounded in the N and NE by the Gulf of Carpentaria drainage (Carpentaria fall), in the W and S by semi-desert, and in the SE by the Georgina basin.

Barrow Creek, small town on Stuart Highway, 21° 31′, 133° 53′. Spencer & Gillen called here in 1901 and 1902; some of their specimens labelled "Barrow Creek", however, may have come from elsewhere (see remarks under *Dasyuroides byrnei* and *Macrotis leucura*). Indeed, it is possible that material collected further south and further north was despatched from Barrow Creek and so labelled upon its receipt in Melbourne. Similarly, "Alice Springs" and "Tennant Creek" may often have denoted points of despatch rather than of provenance. (Dr. G. M. Storr, *in litt.*, now considers that the seven specimens of *Ctenotus robustus* Storr (Scincidae) obtained by Spencer and labelled "Barrow Creek" were actually collected considerably further north.)

Basedow Range, 25° 05′, 132° 05′.

Bathurst Island, immediately W of Melville Island, 11° 40′, 130° 20′.

Beatrice Hill, 35 miles ESE of Darwin, 12° 39′, 131° 19′.

Beetaloo, cattle station, 17° 14′, 133° 47′.

Bentinck Island, Qld, in Gulf of Carpentaria at 17° 03′, 139° 30′.

Birdsville, Qld, town at 25° 54′, 139° 21′.

Block Waterhole, upper Nicholson River, 17° 56′, 137° 09′.

Bobby's Well = Kurtitina Well, *q.v.*

Bond Springs, cattle station, 23° 33′, 133° 56′.

Bonython Range, WA near the NT border, 23° 38′, 128° 59′.

Border Waterhole, NT/Qld border, 18° 36′, 138° 00′.

Borroloola, small town on the Macarthur River, 16° 04′, 136° 18′.

Brock's Creek, station on North Australian Railway, 27 miles SE of Adelaide River, 13° 28′, 131° 25′.

Brunette Downs, cattle station on Barkly Tableland, 18° 38′, 135° 57′.

Buchanan Creek, left-bank tributary of the Playford 12 miles SE of Alexandria.

Bundey River, begins at 22° 50′, 134° 35′, flows NE into the Sandover at 21° 45′, 135° 37′.

Burt Creek, crossed by Stuart Highway 37 miles N of Alice Springs, 23° 12′, 133° 45′.

Burt Plain, in broadest sense the entire plain immediately N of the western and central Macdonnell Ranges, but usually restricted to sector N of Alice Springs. Some of Gillen's "Alice Springs" material came from the Burt Plain.

Bushy Park, cattle station, 22° 54′, 133° 56′.

Calvert River, flowing NE into Gulf of Carpentaria at 16° 16′, 137° 45′.

Camooweal, Qld, town, 19° 55′, 138° 08′.

Cantyteina Well = Kurtitina Well, *q.v.*

Cape Arnhem Peninsula, 12° 20′, 136° 50′.

Cape Crawford, northern point of an *inland* sandstone range, 16° 39′, 135° 48′.

Carmichael('s) Crag, western George Gill Range, 24° 13′, 131° 33′.

Cavanagh Range, WA, 26° 13′, 127° 56′.

Cavenagh Range = Cavanagh Range.

Cedar Bay, Qld, 15° 49′, 145° 22′.

Central Australia, officially (formerly) the NT south of 20°.

Centre Island, Sir Edward Pellew Group, 15° 41′, 136° 46′.

Charleville, Qld, town, 26° 24′, 146° 15′.

Charley Creek, begins S of Mount Hay at 23° 34′, 133° 06′, flowing N to floodout at 23° 07′, 132° 59′.

Charlotte Waters, waterhole on Coglin Creek at 25° 55′, 134° 54′, with the former telegraph station half a mile to the S at Station Point. Coglin Creek divides sandhill country to the N from gibber plains to the S. Only here do the Lake Eyre basin gibber associations intrude into the NT, which may explain the occurrence here and nowhere else in the NT of *Dasyuroides byrnei, Notomys fuscus, N. cervinus* and the bird *Ashbyia lovensis* (Gibber Bird).

Cheepie, Qld, small town, 26° 38′, 145° 01′.

China Wall, escarpment on left bank of upper Nicholson River, 17° 46′, 137° 13′.

Clyde Creek (marked Glyde River on current 1 : 250,000 sheet), right-bank tributary of the Macarthur River which it joins at 16° 25′, 136° 08′.

Coburg (Cobourg) Peninsula, north-western extremity of mainland at 11° 20′, 132° 15′.

Cockatoo Creek, 22° 06′, 132° 08′.

Cooncherie, SA, waterhole at *ca.* 26° 48′, 139° 29′, *ca.* 18 miles S of Old Clifton Downs HS.

Cooper Creek, rises in the NW escarpment of Arnhem Land, flows into estuary of East Alligator River at 12° 07′, 132° 41′. NTM collections were formed within 2-3 miles of Mount Borradaile (*q.v.*).

Cooper Creek, drainage channels from the junction of the Barcoo and Thomson rivers in SW Qld at 25° 10′, 142° 55′, flowing SW into Lake Kopperamanna, NE SA, at 28° 35′, 138° 45′.

Coulthard's Well = Kurtitina Well, *q.v.*

Creswell Creek, begins 17° 44′, 136° 40′, floods out at 18° 18′, 135° 05′.

Crocodile Islands, off N coast, centred on 12° 00′, 135° 00′.

Croker Island, off N coast, 11° 10′, 132° 35′.

Crown Point, table-topped hill on the Finke River at 25° 30′, 134° 23′. The site of Old Crown Station is 2 miles SSW at 25° 32′, 134° 23′.

Curtin Springs, cattle station, 25° 19′, 131° 45′.

Cutta Cutta (Katherine Caves), 16 miles S of Katherine.

Dalhousie Springs, SA, hot springs and permanent swamps, 26° 31′, 135° 29′.

Dalmore Downs, cattle station on Barkly Tableland, 19° 45′, 135° 59′. Not to be confused with Delmore Downs on the Bundey River.

Daly River, flowing NW from the confluence of the Katherine and the Flora at 14° 25′, 131° 39′ into the Timor Sea at 13° 23′, 130° 18′.

Daly River Mission (formerly Uniya), on the lower Daly at 13° 45′, 130° 41′.

Daly Waters, town near Stuart Highway, 16° 15′ 133° 20′.

Dare's Plain, 17 miles NW of King's Canyon, 24° 01′, 131° 35′.

Darwin, city on NW coast, 12° 28′, 130° 51′.

Davenport Range, centred on 20° 50′, 135° 00′.

Deaf Adder Creek, rises on Arnhem Land Plateau, flows W into Nourlangie Creek at 12° 59′, 132° 48′. NTM collections were mainly from the sandstone escarpment at *ca.* 13° 06′, 132° 56′.

Delamere, cattle station in Victoria River basin, 15° 44′, 131° 32′.

Delny, cattle station, 22° 33′. 134° 49′.

Desert Block (formerly part of Napperby), part of Amburla station, 23° 04′, 133° 01′.

Diamantina River, flows SW through SW Qld, into the Lake Eyre basin.

Docker Creek = Docker River.

Docker River, aboriginal settlement on watercourse of same name. Petermann Ranges, 24° 48′, 129° 02′.

Douglas River, rises NW of Pine Creek, flows W into the Daly River at 13° 41′, 131° 09′

Dunmarra, cattle station on Stuart Highway, 16° 40′, 133° 23′.

East Alligator River, rises on Arnhem Land Plateau, flows NW to the coast at 12° 10′, 132° 35′.

Edith River, siding on North Australian Railway where it crosses the Edith River at 14° 12′, 132° 02′.

Ehrenburg Range, 23° 17′, 130° 21′.

Elcho Island, off N coast, 11° 57′, 135° 44′.

Elkedra, cattle station, 21° 10′, 135° 28′.

Ellery Creek: Finlayson (1958a) gave a locality for *Macroderma gigas* as "the Ellery Creek gorge in the James Range at about lat. 24° 5′ S. and long. 132° 49′ E.". This places us on the Finke River near its junction with Ellery Creek; 24° 05′ strikes Ellery Creek at 132° 50′.

Elliott, town on Stuart Highway, 17° 34′, 133° 31′.

Ethel Creek, begins at western end of Treuer Range, flows W to floodout at 22° 12′, 130° 04′.

False Smoke Hills: I have submitted this name to the NT Geographical Nomenclature Committee, to be used for the feature at 20° 04′, 130° 10′ in the Tanami Desert incorrectly named Smoke Hills on a recent 1 : 250,000 The Granites sheet. The true Smoke Hills, named by Davidson (1905b : 55) and referred to by Terry (1930), are at 20° 15′, 129° 55′, and are marked as Cave Hill on some recent maps. I overlooked this error when drawing up a previous gazetteer (Parker 1969 : 71). Material affected is that collected in the vicinity of "Smoke Hills" (= False Smoke Hills) by the Australian Museum in 1965.

Field River: Finlayson (1958a) under *Macroderma gigas*, gave the position of "caves on the Field River" as about 23° 34′, 137° 53′. This places us amongst sand dunes, most unlikely country for caves. L. Corbett, who visited the Field River in 1968, was told by station hands at Tobermorey that bat caves existed in hills to the westward of Smith's Bore. The hills in question are almost certainly the Mount Knuckey group at 23° 32′, 137° 42′.

Fogg Dam, 12° 34′, 131° 18′.

Forrest River Mission, WA, 26 miles NW of Wyndham, at 15° 11′, 127° 51′.

Four-mile Hole, Wildman River, 12° 36′, 132° 13′.

Fourteen-mile Bore, Alcoota Station, 23° 01′, 134° 29′.

Frazer River (Frazer Creek), right-bank tributary of the Bundey, which it joins at 22° 22′, 135° 15′.

Frew River, begins in Davenport Range at 21° 00′, 135° 00′, flows NE towards Barkly Tableland to floodout at 19° 58′, 135° 40′.

George Creek, south of upper Nicholson River, crossed by track at 18° 15′, 137° 16′. Not to be confused with creeks of the same name in the Victoria and Mary River drainages.

George Gill Range, 24° 20′, 131° 45′.

Georgina Downs, cattle station, 21° 07′, 137° 39′.

Georgina River, begins SE of Barkly Tableland, flows SSE through W Queensland.

Gimbat, homestead on the South Alligator at 13° 34′, 132° 36′.

Glen Helen, cattle station, 23° 25′, 132° 15′.

Groote Eylandt, large island in the Gulf of Carpentaria, 14° 00′, 136° 40′.

Haast's Bluff, aboriginal settlement in western Macdonnell Ranges, 23° 27′, 131° 53′, 10 miles SW of mountain of same name.

Hall's Creek, WA, old township at 18° 15′, 127° 47′, 8 miles E of new Hall's Creek.

Hamilton Downs, cattle station, 23° 32′, 133° 16′.

Harts Range (Depôt), former mining camp at 23° 00′, 134° 55′. The present police station is *ca.* 2 miles to the N.

Hatches Creek, mining township, 20° 56′, 135° 12′.

Henbury, cattle station, 24° 33′, 133° 15′.

Hermannsburg, mission station on the Finke River, 23° 57′, 132° 47′.

Horseshoe Bend, cattle station, 25° 13′, 134° 13′.

Huckitta, cattle station, 22° 54′, 135° 27′.

Hugh Creek = Hugh River.

Hugh River, begins in western Macdonnell Ranges, flows SE into the Finke River at 25° 02′, 134° 10′.

Humbert River, cattle station, 16° 29′, 130° 39′.

Illamurta, former police camp 26 miles S of Hermannsburg at 24° 21′, 13° 41′.

James Range, 24° 15′, 133° 05′. In broader sense includes the Krichauff Range.

Jervois Range, 22° 37′, 136° 15′.

Karanji Bore, 23° 17′, 133° 08′.

Katherine, town on Stuart Highway and Katherine River, 14° 28′, 132° 16′.

Katherine Caves = Cutta Cutta (*q.v.*).

Katherine River, rises on Arnhem Land Plateau, flows W into the Daly River at 14° 25′, 131° 39′.

King River, rises on Arnhem Land Plateau, flows NE to the coast at 11° 50′, 133° 32′. This is the river worked by McLennan in 1915 and Wilkins in 1924; it has been confused by Thomas and others with the King River that flows into the upper Katherine.

King River Range, a name used by Wilkins (1928) for rocky hills 15 miles up the river from its mouth. Johnson (1964 : 455) reckoned this camp to be at 11° 56′, 133° 25′. According to McLennan (1917) the ranges along the King River are of sandstone.

King's Canyon, George Gill Range, 24° 15′, 131° 34′. A "tourist" name, which some diehard Central Australians refuse to use. The native name for this remarkable canyon and the creek that issues from it is Wudalka.

King's Creek, strictly speaking, the creek that flows SW out of King's Canyon to floodout at 24° 25′, 131° 25′. Formerly used also for the feature now known as King's Canyon.

Kintore Range, 23° 21′, 129° 23′.

Kurtitina Well, a native well (now probably quite obliterated) between Lake Amadeus and Ayers Rock at 25° 02′, 131° 14′.

Kyancutta, SA, township, 33° 08′, 135° 34′.

Lake Amadeus, large salt-lake, 24° 50′, 131° 00′.

Lake Buck, Tanami Desert, 19° 38′, 130° 20′.

Lake Christopher, WA, salt-lake, 24° 44′, 127° 34′.

Lake Deane, 12° 44′, 131° 01′.

Lake Eyre, SA, huge salt-lake, 28° 30′, 137° 20′.

Lake Mackay, large salt-lake on WA/NT border, 22° 20′, 129° 00′.

Lake Surprise, Tanami Desert, on the Lander River at 20° 12′, 131° 49′.

Lasseter's Cave (incorrectly Lassiter's), Hull River, Petermann Ranges, 25° 01′, 129° 24′.

Lightning Rock, WA, 26° 04′, 127° 45′.

Lock, SA, township, 33° 34′, 135° 46′.

Macallum Creek: Finlayson (1958a) under *Macroderma gigas*, gave the locality "the tableland scarp in the Macallum Creek area at about lat. 13° 16′S. and long. 130° 44′E." This places us a little SE of *a* Macallum Creek in the Reynolds River area. As the "tableland scarp" referred to is probably meant to be that of the Arnhem Land Plateau, the Macallum Creek in question may be the one further east (a tributary of the Margaret River), crossed by a track at 13° 16′, 131° 27′.

Macarthur River (incorrectly McArthur), begins on the Barkly-Carpentaria divide, flows NE into the Gulf of Carpentaria at 15° 50′, 136° 40′.

McColl's Bore, Armstrong River at *ca.* 16° 39′, 131° 51′.

Macdonnell Ranges, collective name for ranges along 23° 40′, between 131° 00′ and 135° 00′.

McEwin Hills, 22° 00′, 129° 35′.

Mackay, Qld, town on E coast, 21° 09′, 149° 11′.

McLaren Creek, crossed by Stuart Highway at 20° 20′, 134° 14′.

Malbon, Qld, small town, 21° 04′, 140° 18′.

Mangajera Billabong, Roper River (Tindale), probably Mungejirri Yaalput Waterhole, 14° 32′, 135° 15′, on the Wukointyarra Plains, a salt-marsh area near the mouth of the Roper.

Mann Range, NT/SA border, centred on 26° 05′, 130° 00′.

Manners Creek, cattle station, 22° 07′, 137° 59′.

Maranboy, siding on North Australian Railway 30 miles ESE of Katherine at 14° 40′, 132° 39′. Maranboy police station is 14 miles NE.

Marqua, cattle station, 22° 49′, 137° 21′.

Marrakai, cattle station, 12° 48′, 131° 22′.

Mary River, rises on Arnhem Land Plateau E of Pine Creek, flowing NNW to the coast at 12° 17′, 131° 40′. The species collected on this river by Dahl and Dodd indicate that the two collectors worked the rugged country of the upper reaches.

Melville Island, large island W of Coburg Peninsula, 11° 35′, 131° 00′.

Milingimbi, mission station on island of same name off N coast at 12° 05′, 134° 55′; one of the Crocodile Islands.

Mongrel Downs (Tallalah Downs), cattle station, 20° 34′, 129° 44′.

Mount Alexander, 12° 11′, 136° 40′.

Mount Borradaile, 12° 04′, 132° 51′.

Mount Burrell, former overland telegraph depôt on the Hugh River at 24° 36′, 133° 55′. Later became Old Maryvale HS. A hill of the same name lies 4 miles SE. See Appendix I, under Cornock.

Mount Conner, 25° 30′, 131° 53′.

Mount Conway, 23° 45′, 133° 26′.

Mount Crombie, SA, 26° 39′, 130° 50′.

Mount Doreen, cattle station, see Vaughan Springs.

Mount Heughlin, 23° 21′, 132° 14′.

Mount Jenkins, 25° 39′, 129° 40′.

Mount McMinn (Spencer, 1911), right bank of the Roper River at 14° 43′, 134° 22′.

Mount Olga, 25° 16′, 130° 44′.

Mount Peculiar, 23° 26′, 131° 16′.

Mount Razorback, 23° 32′, 132° 27′.

Mount Riddoch, cattle station, 23° 02′, 134° 40′.

Mount Riddock = Mount Riddoch.

Mount Shoebridge = Mount Shoobridge.

Mount Shoobridge, 13° 32′, 131° 19′. Tinfields of same name 2 miles W.

Mount Solitaire, Tanami Desert, 20° 32′, 131° 14′.

Mount Sonder, 23° 35′, 132° 34′.

Mount Squires, WA, 26° 13′, 127° 29′. Not to be confused with Mount Squire(s), NT, 25° 19′, 134° 18′.

Mount Udor, 23° 30′, 131° 01′.

Mount Wells, 13° 30′, 131° 43′.

Murchison Range, centred on 20° 15′, 134° 25′.

Murrachurra (Murrathurra) Springs, 25° 27′, 132° 14′.

Musgrave Ranges, SA, 26° 15′, 131° 30′.

Napperby, cattle station, 22° 31′, 132° 45′.

Napperby Creek, crossed by North-West Stock Route at 22° 49′, 132° 35′.

Napperby Hills, those running W-E past Napperby HS.

Negri River, rises at 17° 40′, 129° 25′, flows NW into the Ord River, WA.

Nellie Creek, 17 miles NE of Pine Creek.

Newcastle Waters, small town 17 miles NW of Elliott at 17° 22′, 133° 22′.

New Crown (Point), cattle station on the lower Finke River at 25° 42′, 134° 50′.

Nicholson River, begins at 17° 35′, 137° 00′, flows E into Qld.

Nourlangie, safari camp, 12° 46′, 132° 39′.

Nutwood (Downs), cattle station, 15° 49′, 134° 09′.

Oenpelli, mission station on western escarpment of Arnhem Land 6 miles E of the lower East Alligator River at 12° 20′, 133° 03′.

Old Marsh Bed, a great depression in the Tanami Desert containing a chain of salt-lakes and claypans, characterized by dense stands of *Melaleuca glomerata* and the giant mounds of *Nasutitermes triodiae*. Most pronounced from *ca.* 20° 09′, 130° 15′ (swinging SW, S, SE and E) to *ca.* 20° 50′, 130° 37′.

Oqualpi Plain, 35 miles NW of Hermannsburg, a once-famous haunt of the Oqualpi, *Lagorchestes conspicillatus* (Finlayson 1961 : 167).

Owenia Rockshelter, 13° 30′, 131° 12′.

Painter Spring, 14 miles NW of Alice Springs, 23° 35′, 133° 42′.

Palmer Creek = Palmer River.

Palmer River, right-bank tributary of the Finke, which it joins at 24° 46′, 133° 23′.

Parry's Creek, WA, small watercourse 17 miles SE of Wyndham.

Patonga, 12° 55′, 132° 41′.

Pedestal Hills, Tanami Desert, 20° 34′, 129° 17′.

Petermann Ranges, 25° 00′, 129° 30′.

Pine Creek, town on Stuart Highway, 13° 50′, 131° 50′.

Pituri Creek, flows past Tobermorey HS, crossing the NT/Qld border 2 miles SSW.

Playford Creek = Playford River.

Playford River, begins on Carpentaria-Barkly divide, flowing SW and W past Alexandria.

Plenty River, begins in Mount Riddoch area, flows E and SE to floodout in northern Simpson Desert at 24° 20′, 137° 00′.

Point Charles, on coast 15 miles WNW of Darwin.

Port Essington, inlet on N coast of Coburg Peninsula, 11° 15′, 132° 10′. Also used for former settlement on its shores, officially known as "Victoria".

Port Keats, mission station on W coast at 14° 14′, 129° 32′.

Port Langdon, inlet on NE coast of Groote Eylandt.

Quadjinta (Quajinta), see Yaringa.

Quarantine Bore, 12 miles SSW of Alice Springs.

Rapid Creek, 7 miles NNE of Darwin.

Red Bank (Redbank), gorge in the western Macdonnell Ranges halfway between Mount Razorback and Mount Sonder.

Red Bank (Redbank) Mine, *ca.* 18 miles W of Wollogorang at 17° 11′, 137° 45′.

Reedy Rockhole, George Gill Range, 24° 18′, 131° 36′.

Ringwood, cattle station, 23° 50′, 134° 56′.

Ronans Cave, near Katherine, 14° 28′, 132° 13′.

Roper River, rises near Maranboy, flows E into Gulf of Carpentaria at 14° 43′, 135° 23′.

Roper River Mission, on the lower Roper at 14° 44′, 134° 44′.

Ross River, tourist camp, 23° 36′, 134° 29′.

Ryan(s) Well, on Stuart Highway, 22° 43′, 133° 23′.

Sandover River, formed by junction of Muller Creek and Waite Creek at 22° 30′, 134° 31′, flows NE to floodout at *ca.* 21° 30′, 137° 00′.

Sandringham, Qld, cattle station, 24° 03′, 139° 04′.

Seven-Ten Waterhole, on the upper Nicholson River, 18° 00′, 137° 17′.

Sir Edward Pellew Group, islands in Gulf of Carpentaria opposite the Macarthur River estuary, centred on 15° 35′, 136° 50′.

Sladen Waters (incorrectly Sladden), WA, a short watercourse flowing through the Pass of the Abencerrages, Rawlinson Ranges, at 24° 58′, 128° 17′, about 5 miles N of Giles meteorological station.

Smokey Creek, 13° 10′, 131° 06′.

South Alligator River, rises on Arnhem Land Plateau, flows N to the coast at 12° 12′, 132° 23′.

South West Island, Sir Edward Pellew Group, 15° 35′, 136° 52′.

Springvale, south of the upper Nicholson River, 18° 30′, 137° 32′. Not to be confused with the Springvale 4 miles SW of Katherine.

Station Point, see Charlotte Waters.

Steele Gap, in eastern Rodinga Range, 24° 24′, 135° 05′, leading south into the Simpson Desert.

Stuart Bluff Range, centred on 22° 46′, 132° 30′.

Sturt Creek, WA, cattle station on watercourse of same name, 19° 09′, 128° 09′.

Tanami, a gorge containing two long-lasting rockholes (the Camel Waterholes of A. A. Davidson), in the range of the same name, 19° 58′, 129° 40′. The main Tanami goldfields are three miles E.

The correct (aboriginal) pronunciation is Tanami (Gee 1910 : 5). Nowadays the name is frequently pronounced Tanamai, however (Italian transcription).

Tanami Desert (Tanami semi-desert), a shrub-savannah area lying roughly between 18° 00′-22° 00′ and 129° 00′-134° 00′. First explored by A. A. Davidson, to whose account (Davidson 1905b) readers are referred.

Tanami Desert Wildlife Sanctuary, an area of 14,490 square miles in the Tanami Desert. Holds good numbers of *Macrotis lagotis* and contains the only extant colonies of *Lagorchestes hirsutus* known in Central Australia.

Tanumbirini, cattle station, 16° 09′, 134° 51′.

Tarlton Downs, cattle station, 22° 39′, 136° 54′.

Tarlton Range, hills to the S of Tarlton Downs HS.

Teatree Well, small town on Stuart Highway, 22° 08′, 133° 25′.

Temple Bar Creek, crossed by Adelaide Road 12 miles SSW of Alice Springs.

Tennant Creek, town on Stuart Highway, 19° 39′, 134° 11′, 7 miles S of watercourse and former telegraph station of same name.

The Granites, former goldfield, 20° 34′, 130° 21′, Tanami Desert.

The Neales, SA, drainage channels entering NW Lake Eyre.

Timber Creek, police station, 15° 39′, 130° 28′, near A. C. Gregory's Victoria River Depôt No. 1.

Tin Creek, south of upper Nicholson River, crossed by track at 18° 38′, 137° 47′.

Tobermorey, cattle station, 22° 17′, 137° 56′.

Toko Range, lies across NT/Qld border at *ca.* 22° 45′, 138° 00′.

Tomkinson Ranges, extreme NW corner of SA, 26° 10′, 129° 20′.

Tortilla Flats (Upper Adelaide River Experimental Station), 13° 05′, 131° 13′.

Tower Creek, begins N of Napperby, flows into Warburton Creek at 22° 12′, 132° 33′.

Umbakumba, mission station on NE part of Groote Eylandt.

Union (Town), former gold town 8 miles NNW of Pine Creek at 13° 43′, 131° 49′.

Uniya, former name of Daly River Mission (*q.v.*).

Vaughan Springs, site of the new Mount Doreen HS, at 22° 18′, 130° 52′. The old HS is at 22° 03′, 131° 19′.

Victoria River, rising at *ca.* 18° 00′, 130° 00′, flowing NW into the Joseph Bonaparte Gulf at 15° 00′, 129° 35′.

Victoria River Depôt No. 1, on the lower Victoria River at 15° 37′, 130° 27′. The provenance of most of Elsey's zoological collections.

Virginia Mine. 13° 10′, 131° 03′.

Wajelai Billabong (Tindale), not found but probably on the Wukointyatra Plains near the mouth of the Roper River; near Mangajera Billabong (see *Antechinomys laniger*).

Warburton Creek, begins NW of Napperby, flows into Crown Creek at 22° 03′, 132° 30′.

Warburton Mission, WA, 26° 09′, 126° 32′.

Wauchope, small town on Stuart Highway at 20° 39′, 134° 13′.

Well 28, Canning Stock Route, WA, 22° 39′, 123° 45′.

Well 43 (Billowaggi Well), Canning Stock Route, WA, 21° 12′, 125° 58′.

Well 46 (Kuduarra Well), Canning Stock Route, WA, 20° 08′, 126° 17′.

West Island, Sir Edward Pellew Group, 15° 35′, 136° 34′.

Western Creek, left-bank tributary of the Macarthur River, which it joins at 16° 16′, 136° 12′.

White Stone Creek, Marrakai plains, isolated watercourse crossed by the Woolner track at 12° 33′, 131° 29′. Not to be confused with creek of same name in Tortilla Flats area.

Willowra, cattle station on the Lander River at 21° 14′, 132° 38′.

Wimul Swamp, on Wilton River at *ca.* 13° 36′, 134° 18′.

Winnecke Creek, northern Tanami Desert, begins *ca.* 18° 56′, 130° 02′, floods out 18° 32′, 131° 39′.

Wire Creek, crossed by Adelaide Road 14 miles SSW of Alice Springs at 23° 50′, 133° 49′.

Wollara (Wallara), now a tourist ranch, 24° 38′, 132° 17′. Not located by Lidicker & Marlow (1970 : 222).

Wollogorang, cattle station, 17° 13′, 137° 57′.

Wycliffe Creek, crossed by Stuart Highway 11 miles S of Wauchope.

Wyndham, WA, town, 15° 28′, 128° 06′.

Wytookarri (Wylookarri), rockhole at 23° 36′, 129° 46′. Also called Marnpie, which, according to Terry (1937 : 139), is a native name for the Common Bronzewing, *Phaps chalcoptera*.

Yaringa (specimen of *Bettongia lesueur* obtained by Finlayson): variously cited as: "Yaringa, 12 miles S.W. of King's Creek in the George Gill Range" (Finlayson 1958b : 245), "Yaringa Creek, at the western end of the George Gill Range" (Finlayson 1958b : 249) and "a water called Yaringa a few miles south of Quadjinta", the latter being "15 miles west of Carmichael's Crag, on the eastern border of the Central Australian Reserve" (Finlayson 1935b : 91). On the map in Finlayson (1935c), Quadjinta (Quajinta) and Yaringa are marked on what is probably Laurie's Creek, the next watercourse W from King's Creek. If it is Laurie's Creek then it has been extended much too far SE. Yaringa would therefore be W to NW of King's Creek, not SW.

Yirrkala, mission station on NE coast at 12° 15′, 136° 53′.

Yuendumu, aboriginal settlement, 22° 15′, 131° 48′.

KEY TO MAPS

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● *Antechinus bellus*
▲ *A. macdonnellensis*
▽ *A. bilarni*

Map 2
● *Antechinus maculatus*
△ *Planigale ingrami*
▲ *Dasycercus cristicauda*

Map 3
● *Sminthopsis rufigenis*
■ *S. nitela*
▲ *S. froggatti*
★ *S. psammophila*

Map 4
▲ *Sminthopsis crassicaudata*
▽ *S. murina ooldea*

Map 5
▲ *Sminthopsis hirtipes*
★ *Phascogale calura*
● *P. tapoatafa*

Map 6
■ *Antechinomys spenceri*
△ *A. laniger (sensu lato)*

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● *Dasyurus hallucatus*
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△ peripheral localities of reported range
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★ *Lagorchestes asomatus*
L. conspicillatus
△ Finlayson (1961) and earlier
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● *Onychogalea unguifera*
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Map 18
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Map 20
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Map 25
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Map 26
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Map 30
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Map 31
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Map 32
△ *Hipposideros stenotis*
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Map 33
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Map 34
▲ *Chalinolobus gouldii*
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Map 35
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Map 36
■ *Nycticeius balstoni*

Map 37
▼ *Nyctophilus bifax*
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RECORDS OF THE
SOUTH AUSTRALIAN
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MORETHIA (LACERTILIA, SCINCIDAE,) SOUTH AUSTRALIA

By MICHAEL SMYTH

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MORETHIA (LACERTILIA, SCINCIDAE), SOUTH AUSTRALIA

BY MICHAEL SMYTH

Summary

The genus *Morethia* Gray, 1845 was formerly part of *Ablepharus* Lichtenstein, 1823 (Fuhn, 1969). As more knowledge has accumulated about our local skinks, it has become obvious that the genus needs revision; the collection of the South Australian Museum contains many specimens under the name *M. lineoocellata* (Dumeril and Bibron, 1839) which can in fact be easily distinguished from it. This paper gives diagnostic characters and, where necessary, descriptions for *M. adelaidensis* (Peters), *M. boulengeri* (Ogilby), *M. butleri* (Storr), *M. lineoocellata* and *M. taeniopleura* (Peters).
I dedicate this paper to the memory of John Mitchell, late Curator of Herpetology in the South Australian Museum, who was for several years my mentor as I learned herpetology.

THE GENUS MORETHIA (LACERTILIA, SCINCIDAE) IN SOUTH AUSTRALIA

By MICHAEL SMYTH

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INTRODUCTION

The genus *Morethia* Gray, 1845 was formerly part of *Ablepharus* Lichtenstein, 1823 (Fuhn, 1969). As more knowledge has accumulated about our local skinks, it has become obvious that the genus needs revision; the collection of the South Australian Museum contains many specimens under the name *M. lineoocellata* (Duméril and Bibron, 1839) which can in fact be easily distinguished from it. This paper gives diagnostic characters and, where necessary, descriptions for *M. adelaidensis* (Peters), *M. boulengeri* (Ogilby), *M. butleri* (Storr), *M. lineoocellata* and *M. taeniopleura* (Peters).

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Genus **MORETHIA** Gray

Morethia Gray, 1845, *Catalogue of the specimens of lizards in the collection of the British Museum*, p. 65.

Type-species: *Ablepharus lineoocellatus* Duméril and Bibron, 1839.

I have accepted Fuhn's (1969) distinction of this genus from *Ablepharus* on the basis of skull structure. All members are without moveable eyelids, the eye being covered by a transparent disc. All are pentadactyl. The two frontoparietals and the interparietal are fused into a single scale. The parietals meet in the mid-line.

Morethia adelaidensis (Peters)

Figs. 1, 6

Ablepharus (*Morethia*) *anomalus* (*adelaidensis*) Peters, 1874, Sber. Dt. Akad. Wiss., Phys.—Math. Klasse, Juni 1874, 376 (formerly Monatsb. K. Preuss. Akad. Wiss. Berlin).

Ablepharus lineo-ocellatus var. *adelaidensis* Boulenger, 1887, *Catalogue of the lizards in the British Museum*, 3: 349. (Part). "S. Australia."

Lectotype: Kat. Nr. 4733 in the Museum für Naturkunde, Berlin. Adelaide. Schomburgk. Snout-vent length 5.05 cm. (This is the largest of the three specimens under this catalogue number.)

Issued 31 August, 1972.

Diagnosis: Five supraciliaries; the third, fourth and fifth all penetrate between the supraoculars.

Subdigital lamellae acutely unicarinate or tricarinate. Palmar tubercles elongate, apically acute.

Description: Snout-vent length up to 55 mm. Intact tail 120-165% of snout-vent length.

Supranasals present, widely separated, separate from or fused to a small postnasal. Prefrontals narrowly separated. Frontonasal wider than long. Frontal longer than wide, in contact with first and second supraoculars. Four supraoculars, the second the largest. Frontoparietals and interparietal fused into a single large scale as wide as long, in contact with the second, third and fourth supraoculars. One pair of nuchals. Seven

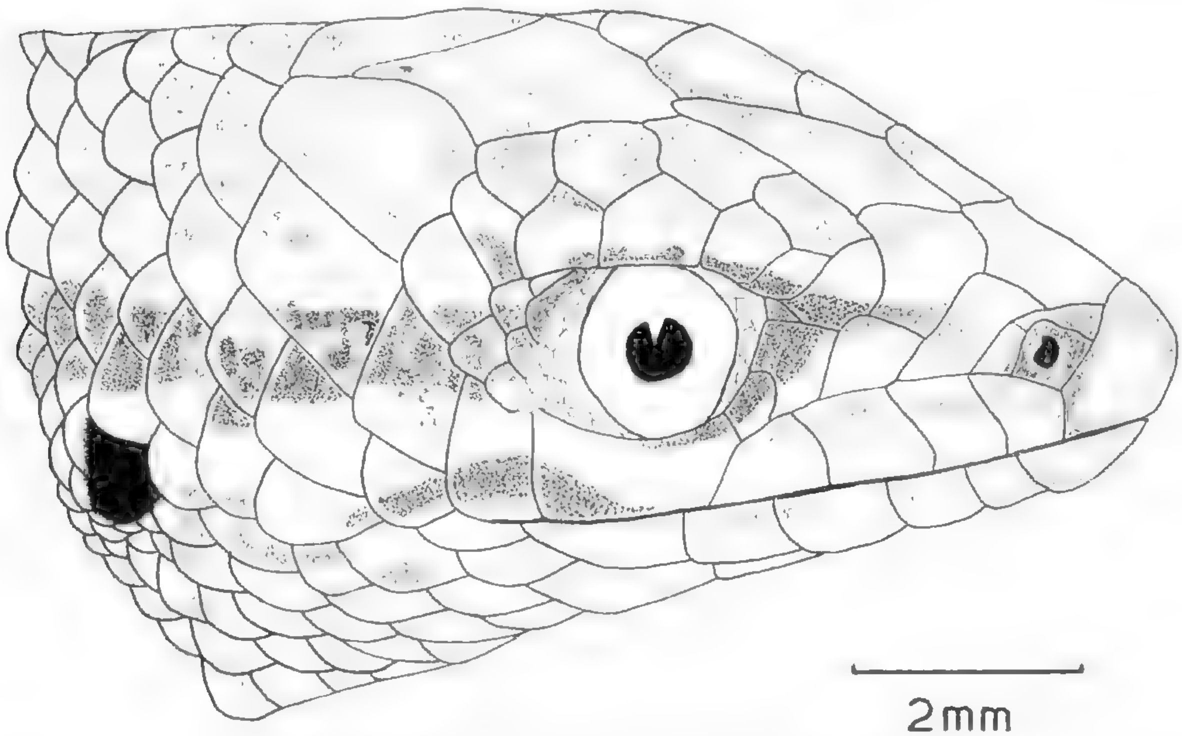

Fig. 1. Head of *Morethia adelaidensis*, Wingfield, S. Aust.

labials, the fifth the largest, entirely subocular. Eye entirely surrounded by granules. Five supraciliaries, the second the smallest, the third, fourth and fifth about equal in size and all penetrating between the supraoculars (Fig. 1).

Subdigital lamellae acutely unicarinate or, in some specimens, tricarinate. There are 18-24 under the fourth toe, mean 19.5, mode 19. Palmar tubercles elongate and apically acute. The forelimbs when adpressed barely reach the eye.

Midbody scale rows 26-34, usually 28 or 30; mean 29.4.

Colour in life, grey or olive-grey above; some specimens are browner, and specimens from Ooldea are distinctly ferruginous. There are usually two broad black interrupted dorso-lateral lines from the back of the head onto the anterior parts of the tail, sometimes continued down the tail as a single mid-dorsal line. Along each side is an interrupted and irregular white line extending from the upper labials, through the ear, above the forelimb, and along the side to the hindlimb. Above this is a darker band, often strongly speckled with lighter markings; below is a weaker, speckled dark band. Ventral surface white. The males in breeding condition develop an orange colour all around the edges of the ventral surfaces, extending onto the inside surfaces of both fore and hind limbs and being particularly prominent around the vent and under the anterior part of the tail.

Specimens from the Lake Eyre Basin are distinctly paler, and in some the dorsal and lateral black bands are barely visible.

Distribution: In South Australia, so far recorded from the arid north-east, extending south into the coastal habitat along the edges of the Gulfs and west across the Nullarbor Plain into Western Australia (Fig. 6).

Remarks: Peters (1874), in describing *M. taeniopleura*, compared it with specimens of what he called *Ablepharus* (*Morethia*) *anomalus* (*adelaidensis*). The specimens available to Peters at the time included three from Adelaide which are clearly *M. adelaidensis* as described above. It is from among these that I have designated a lectotype.

Boulenger (1887) distinguished *adelaidensis* as a variety of *M. lineoocellata*, and his brief description fits Peters's specimens. But the specimens Boulenger lists under this name include, as well as *M. adelaidensis*, several *boulengeri* as well. The inadequacy of both Peters's and Boulenger's descriptions have compelled me to redescribe *M. adelaidensis* in detail.

Specimens examined: In the South Australian Museum: R1018 Hughes, S.A. (30° 42′ S, 129° 31′ E) (2 specimens); R2585 Price, S.A. (34° 18′ S, 130° 00′ E); R3076 North Tent Hill, S.A. (32° 20′ S, 137° 27′ E); R3186 Yudna Swamp, Moralana Stn., S.A. (31° 32′ S, 138° 21′ E) (2 specimens); R3323 Lake Eyre North, Lake Eyre South (2 specimens); R3431 Lake Callabonna, S.A. (29° 45′ S, 140° 04′ E); R3590 Coward Springs, S.A. (29° 24′ S, 136° 49′ E); R3836 south end of Lake Torrens, S.A. (31° 00′ S, 137° 50′ E) (2 specimens); R3842 Kokatha Hills, S.A. (31° 16′ S, 135° 15′ E); R4014 Accalana Crossing, Strzelecki Ck., S.A. (29° 14′ S, 139° 58′ E); R4990 Lake Coongie, S.A. (27° 11′ S, 140° 10′ E); R5281 Abracurrie, 30 mi. (54 km) W. Eucla, W.A. (31° 48′ S, 128° 23′ E); R5283 Ceduna, S.A. (32° 07′ S, 133° 40′ E); R5347

Nullarbor HS, S.A. (31° 26′ S, 130° 55′ E); R5864 St. Kilda, S.A. (34° 45′ S, 138° 31′ E); R5946 "Palmerston, N.T." (now Darwin; this locality is probably in error) (16 specimens); R10882, R10883 Ooldea, S.A. (30° 30′ S, 131° 50′ E); R11945 Pt. Germein, S.A. (33° 01′ S, 138° 01′ E); R12013 Edithburgh, S.A. (35° 06′ S, 137° 44′ E); R12689-91, 6 mi. (10 km) N. Pt. Pirie, S.A. (33° 05′ S, 138° 00′ E); R12692-3 Wingfield, S.A. (34° 51′ S, 138° 32′ E); unregistered, "Reuther Collection" (10 specimens) no locality (probably from Killalpaninna or Kopperamana Missions, S.A., respectively 28° 36′ S, 138° 33′ E and 28° 34′ S, 138° 40′ E).

In the British Museum (Natural History): 64.10.27.9 and 10 "S. Australia"; 1905.10.31.35 and 36, 100 mi. (161 km) S. Lake Eyre, S.A.

In the Museum für Naturkunde, Berlin: Kat. Nr. 4733 Adelaide.

I have also seen specimens from Pt. Gibbon S.A. (33° 47′ S, 136° 47′ E).

Morethia boulengeri (Ogilby)

Figs. 2, 6

Ablepharus boulengeri Ogilby, 1890, Rec. Aust. Mus., 1: 10-11.

Lectotype: R690 in The Australian Museum, Sydney. Presumably collected by McCooey at Brawlin, New South Wales (34° 44′ S, 148° 02′ E).

Diagnosis: Six supraciliaries; the first and third are the largest, and the third, fourth, fifth and sixth are successively smaller.

Subdigital lamellae obtusely unicarinate, palmar tubercles rounded.

This species closely resembles *M. butleri*, but is distinguishable by its larger third supraciliary, its much less acutely keeled subdigital lamellae, and its rounded palmar tubercules.

Description: Snout-vent length in adult males 35-55 mm, in adult females 40-57 mm. Intact tail 125-165% of snout-vent length.

Supranasals present, widely separated, often fused with the small postnasal. Prefrontals usually separated. Frontonasal wider than long. Frontal longer than broad, contacting the first and second supraoculars. Four supraoculars, the second the largest. Frontoparietals and interparietal fused into a single large scale about as long as broad, contacting the second, third and fourth supraoculars. (Ogilby describes a separate interparietal, but all three syntypes, and all other specimens I have examined, have the interparietal fused with the frontoparietals.) One pair of nuchals.

Seven labials (sometimes eight), the fifth the largest, entirely subocular. Eye surrounded by granules. Supraciliaries six, the first and third the largest, the first penetrating between the prefrontal and first supraocular, the third penetrating between the first and second supraoculars. The fourth, fifth and sixth supraciliaries do not penetrate between the supraoculars, and decline regularly in size so that their medial margins form a regular slightly curving line (Fig. 2). Ear suboval, usually with smaller granules more or less projecting from the anterior edge.

Five fingers and toes. Lamellae under the fourth toe 15-23, mean 19.5, mode 19, obtusely unicarinate. Palmar tubercules rounded. The forelimbs when adpressed reach just beyond the eye.

Midbody scale rows 26-32, mean 29.7, mode 30.

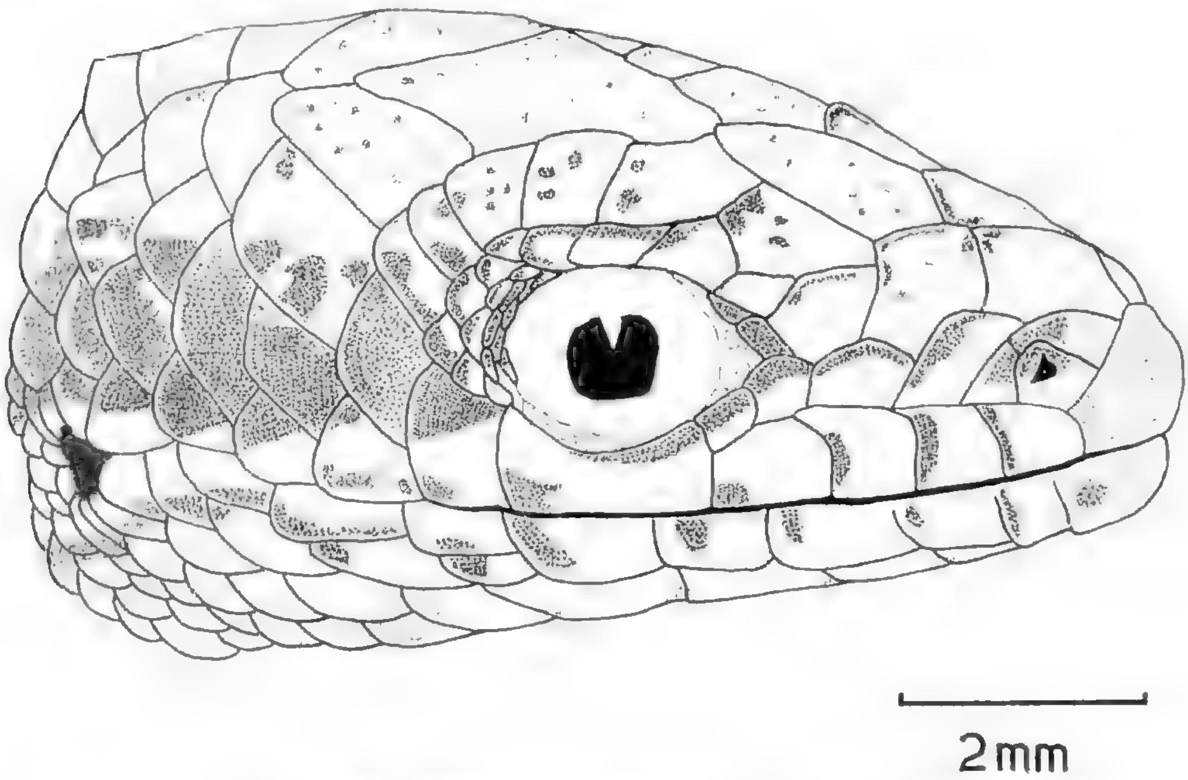

Fig. 2. Head of *Morethia boulengeri*, Salter Springs, S. Aust.

Colour almost identical to *M. butleri*. A uniform brown above; most or all of the dorsal scales have 2-5 (usually 3) fine black lines running along them, diverging posteriorly; often these lines are expanded and merge into a black spot or streak, sometimes giving the appearance of interrupted lines of spots or streaks down the back, but more often distributed irregularly.

A pure white stripe on each side begins on the upper labials and runs under the eye, through the ear, above the forelimb and along the flank to the hindlimb. This white stripe is very prominent, being edged above and usually below by black stripes. The upper of these black stripes, usually three scale rows wide, is usually very regular and clearcut on its lower margin, and runs from the eye to the hindlimb or a little beyond, frequently becoming less prominent posteriorly. The lower black side-stripe is narrow, irregular and often interrupted.

Ventral surfaces silver-white. In adult males in breeding condition the throat becomes bright orange.

The tail of juveniles is pale fawn.

Distribution: Throughout the north of the State and as far south as a little north of Adelaide and the Murray Mallee south of the River Murray (Fig. 6). Occurs in the interior of all mainland States.

Remarks: This species is remarkably uniform in colour and morphology over its range in South Australia. It is sympatric with *M. adelaidensis* over much of its range, with *M. taeniopleura* in the Northern Territory, and with *M. lineoocellata* in several parts of South Australia. It is not yet known to be sympatric with *M. butleri*, which it closely resembles.

Specimens examined: In the South Australian Museum: R524 Moolooloo Stn., S.A. (30° 59′ S, 138° 35′ E); R721 "Victoria" (3 specimens); R870 Wynbring, S.A. (30° 33′ S, 133° 32′ E); R1573 Hermannsburg, N.T. (23° 57′ S, 132° 45′ E) (2 specimens); R2602 (2 specimens), R2648 Mernmerna, S.A. (31° 36′ S, 138° 23′ E); R3159 "Black Swamp, S.A." (an unidentifiable locality); R3186 Yudna Swamp, Moralana Stn., S.A. (31° 32′ S, 138° 21′ E); R3304 Wilpena Pound, S.A. (31° 30′ S, 138° 37′ E) (5 specimens); R3313 Wonoka Ck., S.A. (31° 50′ S, 138° 24′ E); R320 Mt. Aroona, S.A. (30° 34′ S, 138° 21′ E); R3426 6 mi. (10 km) S.W. Wooltana HS., S.A. (30° 25′ S, 139° 25′ E); R3683 no locality; R3767 Lake Eyre, S.A. (28° 40′ S, 137° 10′ E); R3849 Kondoolka HS., S.A. (32° 01′ S, 134° 53′ E) (2 specimens); R3938 S. branch Balcanoona Ck., S.A. (30° 37′ S, 139° 38′ E) (3 specimens); R4011 Cordillo Downs HS., S.A. (26° 43′ S, 140° 38′ E) (5 specimens); R4012 Innamincka HS., S.A. (27° 43′ S, 140° 45′ E); R4352 Wangoroh HS., Balranald N.S.W. (34° 38′ S, 143° 34′ E); R4990 Lake Coongie, S.A. (27° 11′ S, 140° 10′ E) (2 specimens); R5484 "Murray Scrub, S.A." (5 specimens); R5526-7 Loxton, S.A. (34° 27′ S, 140° 34′ E); R5946 "Palmerston, N.T." (now Darwin; this locality is probably in error); R6008 St. Mary Peak, S.A. (31° 30′ S, 138° 33′ E); R10359 Goyders Lagoon, S.A. (26° 52′ S, 139° 00′ E) (2 specimens); R10360 (3 specimens); R10361 Glengyle HS., Queensland (24° 48′ S, 139° 31′ E); R10936 Paralana Hot Springs, S.A. (30° 12′ S, 139° 27′ E); R10962 Yudnamutana Gorge, S.A. (30° 12′ S, 139° 17′ E); R11745 Cradock, S.A. (32° 05′ S, 138° 30′ E); R11936 North Mulga HS., S.A. (30° 17′ S, 139° 32′ E); R11942-4 Wertaloona HS., S.A. (30° 38′ S, 139° 21′ E); R11947-51 Bibliando HS., S.A. (31° 51′ S, 139° 07′ E); R12477 Lincoln Gap Stn., S.A. (32° 37′ S, 137° 35′ E); R12677, 8 mi. (13 km) W. of Purnong, S.A. (34° 52′ S, 139° 32′ E); R12678-9, 4 mi. (7 km) E. of Mantung, S.A. (34° 36′ S, 140° 03′ E); R12680 Eba, S.A. (34° 04′ S, 139° 36′ E); R12681-2, 1 mi. (2 km) W. of Telowie, S.A. (33° 02′ S, 138° 04′ E); unregistered, Moorilyanna Well, S.A. (26° 51′ S, 132° 59′ E).

In the Australian Museum, Sydney: R687-9 presumably from Brawlin, N.S.W. (34° 44′ S, 148° 02′ E).

In the British Museum (Natural History): 74.4.29.1286-8 "Sandhurst, Victoria"; 90.9.1.4-6 "Brawlin, N.S.W.".

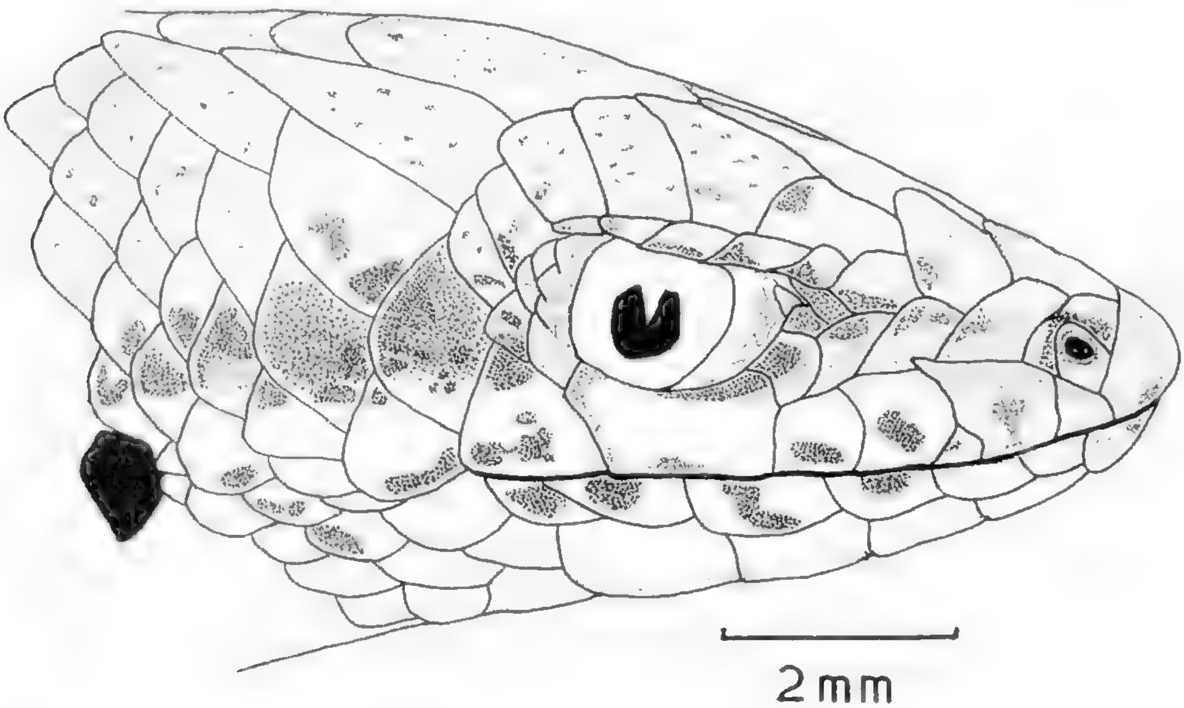

Fig. 3. Head of *Morethia butleri*, Western Australia. Drawn in profile; the others are drawn from slightly above.

Morethia butleri (Storr)

Fig. 3

Ablepharus butleri Storr, 1963, West Aust. Nat., 9: 46-7.

Diagnosis: Supraciliaries form "a straight-sided series of 6 scales, the first of which is largest" (Storr, 1963) (Fig. 3). Subdigital lamellae acutely unicarinate, palmar tubercles apically acute.

Remarks: This species was described from the arid eastern part of Western Australia. Its range probably extends into western South Australia, and I have tentatively ascribed a single specimen from Ooldea (S.A. Museum

R687) to this species. In this specimen the supraciliaries are not as linear as in the Western Australian specimens, and the line separating them from the supraoculars is curved rather than straight. As a result the supraciliary ridge, so prominent in the Western Australian specimens, is absent, and the supraorbital area is slightly convex rather than flat.

Morethia lineoocellata (Duméril and Bibron)

Figs. 4, 6

Ablepharus lineo-ocellatus Duméril and Bibron, 1839. Erpétologie général, 5: 817. "Nouvelle-Hollande."

Cryptoblepharus lineo-ocellatus Gray, 1845, *Catalogue of the specimens of lizards in the collection of the British Museum*, p. 65. "Swan River."

Morethia anomalus Gray, 1845, *Ibid*, p. 65. "W. Australia."

Diagnosis: Six supraciliaries; the fourth is the largest, and the third, fourth, and sometimes the fifth penetrate between the supraoculars.

Subdigital lamellae obtusely keeled; palmar tubercles apically rounded.

Description: Snout-vent length up to 53 mm. Intact tail 120-160% of snout-vent length.

The head shields are very similar to those of *M. boulengeri*, except for the supraciliaries. In nearly all South Australian specimens only the third and fourth penetrate between the supraoculars: the fourth, fifth and sixth are successively smaller (Fig. 4). But in two specimens from west of Spencer Gulf, namely from Wynbring and from the Hundred of Nicholls, the fifth supraciliary is very nearly as large as the fourth and penetrates between the third and fourth supraoculars; and in a juvenile from St. Francis Island the fifth supraciliary, though smaller than the fourth, does penetrate.

Supranasal shields are present in all South Australian specimens.

Subdigital lamellae obtusely keeled; there are 14-22 under the fourth toe, mean 18.4, mode 19. Palmar tubercles apically rounded.

Midbody scale rows 24-31, mean 27.1, mode 28.

Colour: grey above. The dorsal ocellations which give this species its name consist each of a single scale, the middle third of which is white and the two outer thirds black. The ocellation is very variable. On one specimen from central Eyre Peninsula (R10143) ocellations are quite absent, but on specimens from the islands off the west coast of Eyre Peninsula they are bold and numerous, extending from the neck to the end of the tail, and onto the fore and hindlegs.

There is an irregular black stripe along each side, above an irregular white stripe, sometimes faint, running through the ear, over the forelimb and back as far as the hindlimb. These lateral stripes are also very variable, but are never as even or as bold as in *M. boulengeri*. In some specimens they are scarcely visible beyond the foreleg. They are best expressed in the most ocellated individuals.

The male in the breeding season develops a bright orange or orange-pink throat.

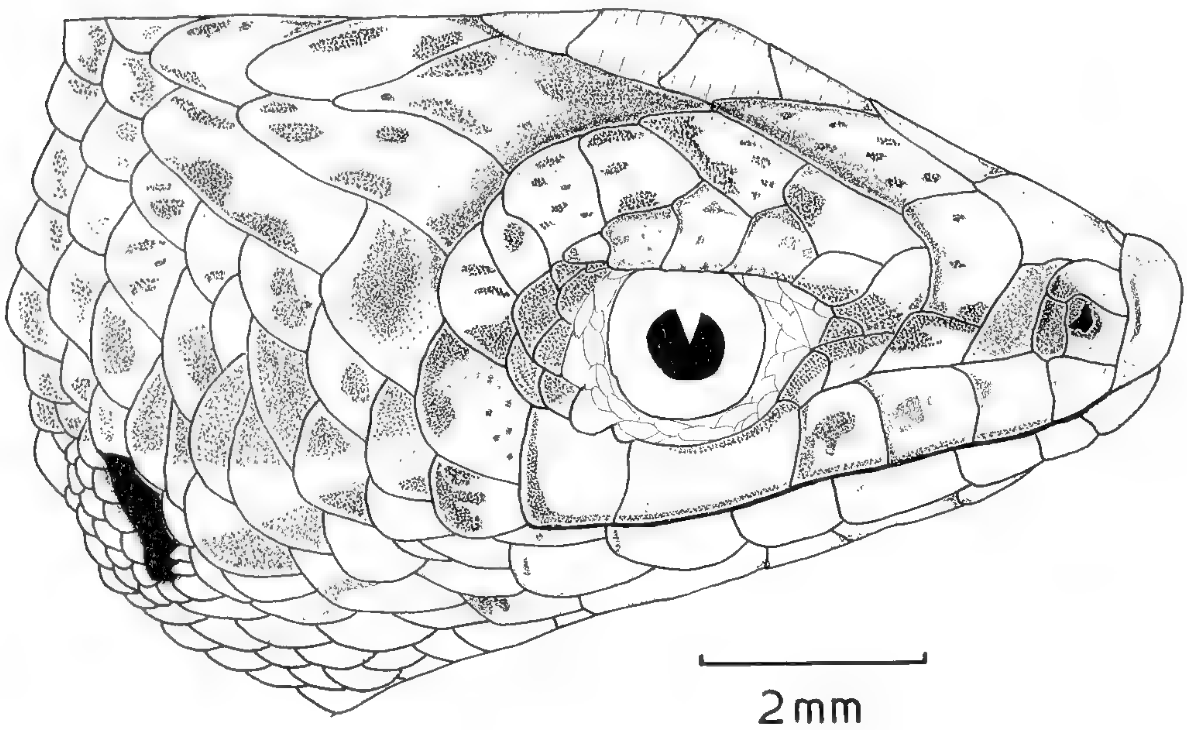

Fig. 4. Head of *Morethia lineoocellata,* Mallala, S. Aust.

Distribution: This is a southern species, confined to the cooler parts of the State (Fig. 6) including many of the offshore islands. It also occurs in Western Australia and Victoria.

Remarks: Gray (1845) described *Morethia anomala* from "W. Australia", distinguishing it from *M. lineoocellata* because the former, but not the latter, had supranasal scales. All South Australian specimens have supranasals, but I have not used the name *anomala* for them because the the presence or absence of supranasals is unlikely, by itself, to be a good specific distinction.

Most South Australian specimens of *M. lineoocellata* apparently differ from many Western Australian specimens in that in the former the fifth supraciliary is smaller than the fourth and does not penetrate between the supraoculars. Whether this is a good specific distinction, or merely a variant, I cannot judge on the South Australian material; a careful study of the material from Western Australia, where both forms are apparently common, is required.

Meanwhile it should be noted that Loveridge's (1934) use of the name *Morethia lineoocellata anomala* for "the eastern skinks which are characterized by the almost invariable presence of supranasals and a higher than average number of mid-body scale rows", is invalid; he was doubtless referring to *M. adelaidensis* or *M. boulengeri*, more likely the latter.

Specimens examined: In the South Australian Museum: R4, R5 between Tanunda and Murray flats, S.A.; R558 Purnong, S.A. (34° 52′ S, 139° 37′ E); R870 Wynbring, S.A. (30° 33′ S, 133° 32′ E); R968 Wilkawatt, S.A. (35° 23′ S, 140° 22′ E); R1699 Encounter Bay, S.A. (35° 35′ S, 138° 36′ E); R2456 Davenport Ck., S.A. (32° 10′ S, 133° 26′ E); R2457 "Palmerston N.T." (now Darwin; this locality is probably in error) (35 specimens); R2458 Kangaroo Is., S.A. (5 specimens); R2473 Flinders Is., S.A. (33° 44′ S, 134° 31′ E); R2482 St. Francis Is., S.A. (32° 30′ S, 133° 18′ E); R2585 Price, S.A. 34° 18′ S, 138° 00′ E); R3060 North of Buckleboo, S.A. (32° 55′ S, 136° 12′ E); R3271 Naracoorte, S.A. (36° 58′ S, 140° 44′ E); R8396 Hambidge National Park, S.A. (33° 22′ S, 135° 56′ E); R9005 the southeast of County Chandos, S.A. (35° 16′ S, 140° 47′ E); R9262-5 Bascombe Well National Park, S.A. (33° 37′ S, 135° 21′ E); R9509 Flinders Is., S.A.; R10143, R10159 Hd. of Nicholls, Hincks National Park, S.A. (33° 51′ S, 135° 51′ E); R10155, R10167 Hincks National Park, S.A.; R10196, R10218 Flinders Is., S.A.; R10216, R10217 Pearson Is., S.A. (33° 57′ S, 134° 16′ E); R10299, R10300 Franklin Is., S.A. (32° 27′ S, 133° 39′ E); R10881 Moonlight Tank, Victoria (35° 45′ S, 141° 23′ E); R12444 Streaky Bay, S.A. (32° 48′ S, 134° 13′ E); R12610 Big Heath National Park, S.A. (37° 03′ S, 140° 33′ S) (5 specimens); R12683 Aldinga Scrub, S.A. (35° 19′ S, 138° 27′ E); R12684 Spalding Cove, Port Lincoln, S.A. (34° 47′ S, 135° 58′ E) (2 specimens), R12685 Mallala, S.A. (34° 26′ S, 138° 31′ E); R12686 6 mi. (10 km) N.E. Renmark, S.A. (34° 09′ S, 140° 48′ E); unregistered, Eyre's Sand Patch, W.A. (32° 16′ S, 126° 18′ E) (3 specimens).

In the British Museum (Natural History): 1946.8.15.75 "W Australia" (syntype of *M. anomala* Gray).

In the Museum für Naturkunde, Berlin: Kat.-Nr. 1355-7. Australia.

Morethia taeniopleura (Peters)

Figs. 5, 6

Ablepharus (Morethia) taeniopleurus Peters, 1874, Sber. Dt. Akad. Wiss., Phys.-Math. Klasse, Juni 1874, 375-6. (Formerly Monatsb. K. Preuss. Akad. Wiss. Berlin.) Port Bowen, N.E. Australia.

Diagnosis: Four supraciliaries, the third the largest.

A bold white dorsolateral stripe on each side, from rostral shield to the tail; successively below it a dark band, another white band, and usually a narrow dark line.

Description: A relatively small member of the genus, obviously flattened dorsoventrally. Snout-vent length up to 42 mm. Tail 130-160% of snout-vent length (3 specimens only).

Supranasals present, widely separated. A small postnasal. Frontonasal wider than long. Prefrontals well separated. Frontal longer than wide, contacting the first and second supraoculars. Four supraoculars, the second

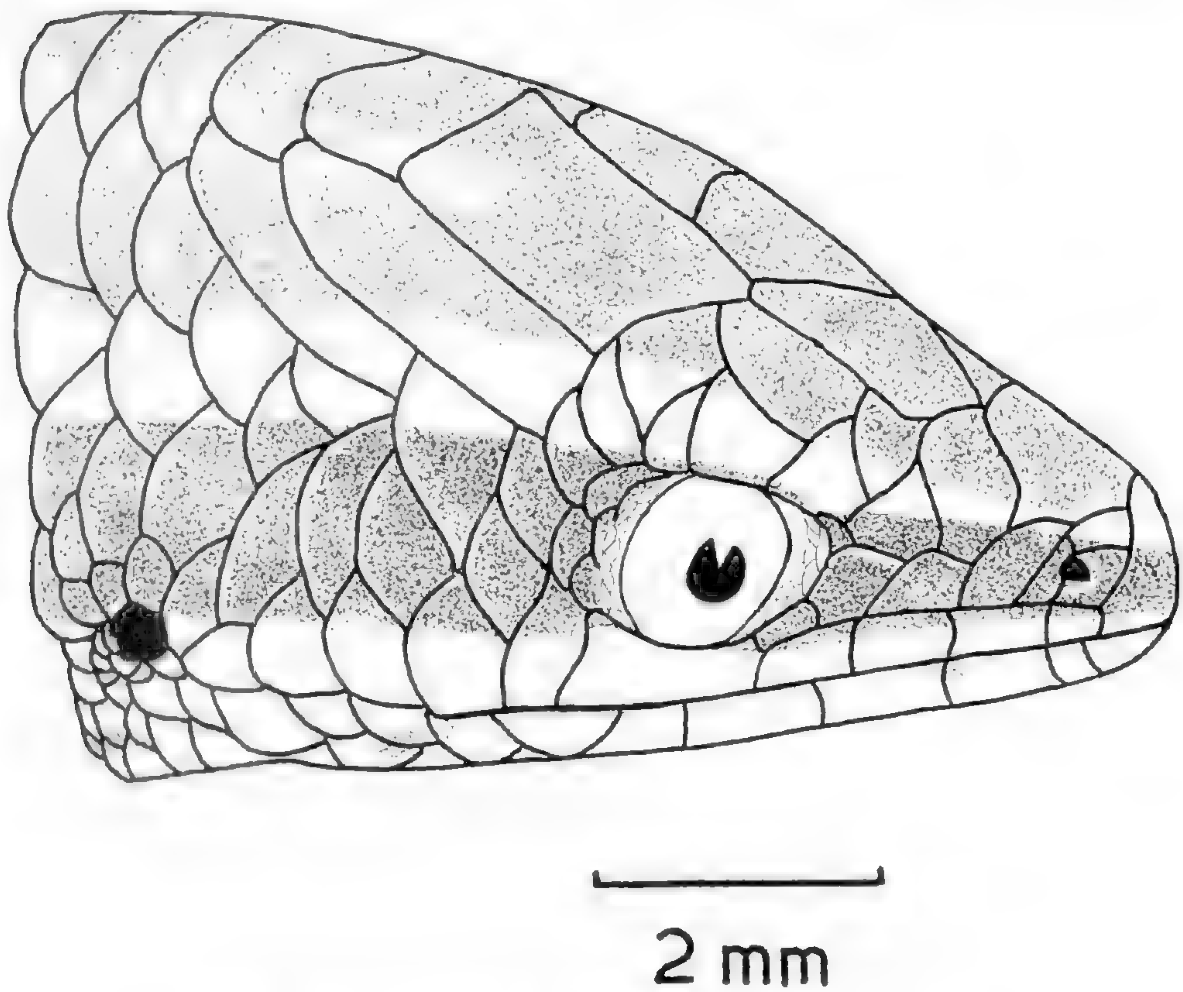

Fig. 5. Head of *Morethia taeniopleura*, Hermannsburg, N.T.

the largest. Frontoparietals and parietal fused into a single scale about as broad as long, with rather concave borders, contacting the second, third and fourth supraoculars. Parietals meeting in the midline. One pair of nuchals, almost as large as the parietals.

Seven labials, the fifth the largest. Eye surrounded by granules. Four supraciliaries, the first penetrating between the prefrontal and the first supraocular, the second penetrating between the first and second supraoculars, the third, which is the largest, penetrating between the second and third supraoculars. The fourth, which is the smallest, does not penetrate (Fig. 5).

Five fingers and toes. Lamellae under the fourth toe 17-21, mean 19.2, mode 19, acutely unicarinate. Palmar tubercles somewhat elongated.

Midbody scale rows 26-28, mean 26.5.

This species is very distinctively patterned. In old specimens in alcohol the back is dark brown-black; Peters, however, described it as olive-green, and Lucas and Frost (1895) give it as greenish-black. In Northern Territory specimens there is a faint pale vertebral stripe. In specimen from the Pilbara in Western Australia, however, this stripe is silvery white, extending from the middle of the frontal shield onto the tail. Two prominent silvery-white bands one scale row wide meet across the rostral shield and extend back through the supraciliaries and dorsolaterally down the body onto the tail. Below each of these is a black lateral band two scale rows wide, running back from the rostral to a little behind the hindlimb; it includes the eye and passes above the ear and the limbs, getting paler as it goes. Below it is another white band extending along the upper lip, taking in the ear, running over the forelimb and along the side. Its lower margin is bounded by a narrow, irregular, spotted black line which often does not extend far behind the forelimb. Legs pale, spotted with black. Tail pale fawn in spirit specimens, but might be red in life (Lucas and Frost, 1895). Undersurface white.

Distribution: So far not recorded from South Australia, but it undoubtedly occurs in the Far North of the State. Apparently widespread in the Northern Territory; Mitchell (1955) records it from Arnhem Land. Also in northern Western Australia and Queensland.

Remarks: Lucas and Frost (1895) described *A. lineoocellatus* var. *ruficaudus* from Goyder River (25° 45′ S, 134° 30′ E) and Bagot Creek (24° 40′ S, 131° 45′ E), both in the Northern Territory. Later they gave a coloured illustration of it (Lucas and Frost 1896). These specimens were clearly *M. taeniopleura*. On the other hand, Werner's (1910) description of *A. taeniopleurus* from around Kalgoorlie in Western Australia is a good description of *M. butleri*.

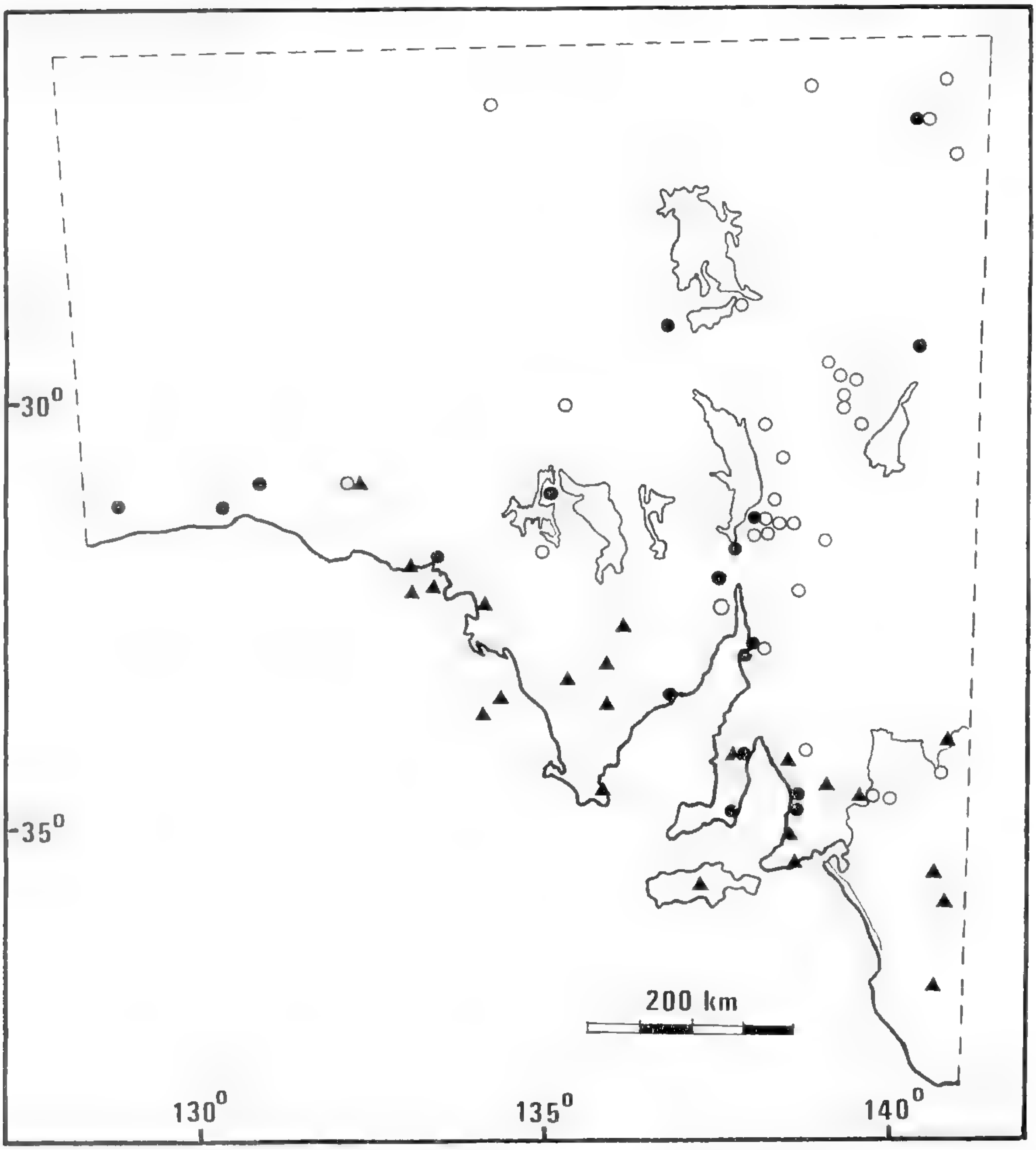

Fig. 6. The known distributions of *M. adelaidensis* (●), *M. boulengeri* (○), and *M. lineoocellata* (▲) in South Australia.

Specimens examined: In the South Australian Museum: R1573 Hermannsburg, N.T. (23° 57′ S, 133° 32′ E) (3 specimens); R1684 Cockatoo Creek, N.T. (15° 46′ S, 129° 08′ E); R2181 Darwin, N.T.; R3463 Pilgangoora Well, W.A. (20° 33′ S, 119° 00′ E); R4658 Tambrey HS., W.A. (21° 38′ S, 117° 36′ E); R4659 Mt. Herbert, W.A. (21° 19′ S, 117° 12′ E); R10321 6 mi. (10 km) N. Yuendumu, N.T. (22° 16′ S, 131° 49′ E).

ACKNOWLEDGMENTS

I wish to thank Miss A. G. C. Grandison of the British Museum, Dr. Harold Cogger of the Australian Museum, Dr. Terry Houston of the South Australian Museum, Dr. Günther Peters of the Berlin Museum, and Dr. Glen Storr of the Western Australian Museum, for the loan of specimens. Keith Newgrain and Beverley Jones drew the profiles and the map. Glen Storr and Dr. Derek Duckhouse patiently advised me on nomenclature.

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A NEW SPECIES OF TROPOSODON BARTHOLOMAI; FROM THE EARLY PLEISTOCENE KANUNKA FAUNA, SOUTH AUSTRALIA (Macropodinae; Marsupialia)

By COLIN R. CAMPBELL

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Summary

The genus *Troposodon* was proposed by Bartholomai (1967) for *Sthenurus minor* Owen, 1877 and its synonym *Halmatrurus vinceus* De Vis, 1895 (lectotype QM F3577), the designated holotype (*Sthenurus minor*, BM (NH) 48409) being from late Cenozoic deposits in Talbragar Country, County Bligh, New South Wales. Bartholomai (*ibid.*) has adequately discussed the taxonomic history of the genus and it will not be repeated here.

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Department of Paleontology, University of California, Berkeley

INTRODUCTION

The genus *Troposodon* was proposed by Bartholomai (1967) for *Sthenurus minor* Owen, 1877 and its synonym *Halmaturus vinceus* De Vis, 1895 (lectotype QM F3577), the designated holotype (*Sthenurus minor*, BM(NH) 48409) being from late Cenozoic deposits in Talbragar Country, County Bligh, New South Wales. Bartholomai (*ibid.*) has adequately discussed the taxonomic history of the genus and it will not be repeated here.

Material from Lake Kanunka (Katipiri Sands, Kanunka Fauna), South Australia in the collections of the Museum of Paleontology, University of California, Berkeley includes a complete mandible and some isolated upper teeth of a new species of *Troposodon*, herein designated as *T. kenti*. This form reveals the previously unknown complete morphology of the lower incisor and details of the coronoid area.

Specimens of *T. minor* available for comparative study included a single P_3 (AM F4069), a cast of the holotype (UCMP 55822), and a cast of an incomplete mandible of BM(NH) 50063a (UCMP 55829). In May 1971 I was able to examine the extensive collections of *T. minor* in the Queensland Museum, and I thank Mr. Alan Bartholomai for his courtesy at that time, and for his valuable comments on the manuscript of this study.

Thanks are also due to Drs. W. A. Clemens and R. H. Tedford for their comments on the manuscript, and to Mrs. Pat Lufkin and Mr. Owen Poe for the figures.

All measurements are in millimetres unless otherwise stated.

Family MACROPODIDAE Owen, 1839

Subfamily MACROPODINAE Thomas, 1888

Genus *TROPOSODON* Bartholomai, 1967

Type Species **Sthenurus minor** Owen, 1877

REVISED GENERIC DIAGNOSIS

Moderately large to large; palate entire; upper incisors unknown. P^2 subrectangular to subtriangular in basal outline; longer anteroposteriorly relative to P^3 than in known species of *Protemnodon*; longitudinal crest

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slightly labiad of midline, with cusps anteriorly, posteriorly, and posterolingually; latter two cusps joined by transverse ridge; lingual basin and lingual cingulum well developed; broadest posteriorly. dP^3 molariform, low crowned, subrectangular in basal outline; swollen laterally at lingual extremity; forelink and midlink reduced; shelf-like areas behind lophs more completely developed than in *Macropus*, *Megaleia* and *Sthenurus*. P^3 with main crest labiad of midline, subtriangular approaching subrectangular in basal outline; well defined lingual basin and cingulum; posterolingual cusp connected to posterior cusp of main crest by transverse ridge. Eruption of P^3 coincides with that of M^4 in *T. minor*. Upper molars with essentially constant pattern; forelink weak or absent, moderately low to high midlink. Mandible with moderately deep, elongate symphysis; prominant genial crest to below P_3; geniohyal pit shallow to moderately deep; ramus with definitive groove laterally, from acute diastemal crest to below anterior molars; pterygoid fossa deep; inferior dental canal extending forward to below P_3; temporal crest at right angles to horizontal ramus. I_1 small, oval in section, encircled by enamel; large, flat, horizontal wear facet dorsally; known completely only in *T. kenti*. P_2 slender, short, subtriangular approaching subrectangular in basal outline; weak labial and lingual vertical ridges; main crest L-shaped in *T. minor*; tooth unknown in *T. kenti*. dP_3 molariform, subrectangular, slightly constricted across median valley; shelf-like areas anterior to lophid crests in *T. minor*; tooth unknown in *T. kenti*. P_3 elongate, robust, subtriangular in basal outline; main crest a little labiad of midline, L-shaped; lingual base of crown variably swollen; vertical lingual and labial ridges produce cuspules along crest. Lower molars relatively low-crowned, subrectangular; anterior cingulum well developed; posterior cingulum well developed in *T. minor*, poorly so in *T. kenti*. Ornamented shelf-like areas present anterior to lophid crests in *T. minor*, minimally ornamented in *T. kenti*. Forelink and midlink strong; antero-labial fossette present in trigonid basin of *T. minor*; weak ridge descends from entoconid to posterior cingulum in *T. kenti*, but not in *T. minor*.

DISCUSSION

The reason why Owen (1877) failed to recognize *Troposodon* as a genus distinct from *Sthenurus* was due to his long standing confusion of the upper dentition of *Protemnodon* with that of *Sthenurus* (Stirton, 1963). *Troposodon* appears more closely allied to *Protemnodon* and those species of *Macropus* bearing large premolars than to any other macropodid group (Tedford, 1966).

It is here considered probable that the ancestry of *Troposodon* was close to the common mid-late Tertiary origin of *Protemnodon*, *Sthenurus*, and *Wallabia* as envisaged by Stirton (1963) and Woodburne (1967), and possibly represented by the late Miocene *Hadronomas* Woodburne, 1967. The evidence is largely derived from comparison of the premolars, and to some extent the molars. In P^2 of *Protemnodon* there are strong vertical labial and lingual ridges, a variably developed lingual cingulum terminating opposite the high anterior cusp and enclosing a lingual basin; longer than any upper molar and usually wider posteriorly. All these features are found in *Troposodon*, and the major structural change required to produce a *Troposodon* structure is development of a crest connecting the posterior and postero-lingual cusps, at right angles to the main crest. Such a change is already intimated or present in some species of *Protemnodon* where in P_2 the main crest is slightly inturned postero-lingually or complete.

The upper molars of *Protemnodon* (and *Megaleia*) have suggestions of apical basins above the loph crests, a feature quite characteristic of *Troposodon*. The midlink in these two genera is lower and does not turn so abruptly posteriorly as in *Troposodon*, and the paracone spur does not turn sharply lingually but runs up into the median valley directly posteriorly from the paracone and only near the base of the protoloph does it turn inward to the bottom of the valley. Thus a basin is not formed on the posterior face of the protoloph in these genera, but its structural elements are present. A comparable condition prevails on the metaloph.

Troposodon, with its ornamented brachy-hypsodont molars and broad, crested premolars, plus the vertical ascending ramus modified basally for the attachment of heavy jaw musculature, probably occupied a grazing or grazing-browsing niche. The extension of the inferior dental canal forward to a point below P_4 indicates that the mandibles could be precisely manipulated in actions related to cropping with the incisors and cutting with the premolars (Ride, 1959). The relatively short diastema probably reflects feeding on heavier vegetation which requires less manipulation in the mouth to form an ingestible bolus than is the case for soft grasses.

It will be most instructive to discover the nature of the postcranial skeleton, and that of the cranium and upper incisor dentition in *Troposodon*. Seemingly, the Pleistocene Katipiri Sands in South Australia offer the best hopes for such a find at present.

Troposodon kenti sp. nov.[1]

Hypodigm: The entire known sample.

Holotype: SAM P14507: complete adult left mandible with I_1, P_3-M_4, collected by the late Ruben A. Stirton in 1961. Teeth fully erupted and well worn. Figs. 1-3.

[1] In memory of the four students shot at Kent State University, Ohio, U.S.A., on May 4, 1970. This paper was in preparation at that time and the event served to remind that the freedom of thought so necessary to human progress, including science, is not yet guaranteed, and that scientists along with all people should strive to make irrevocable that guarantee.

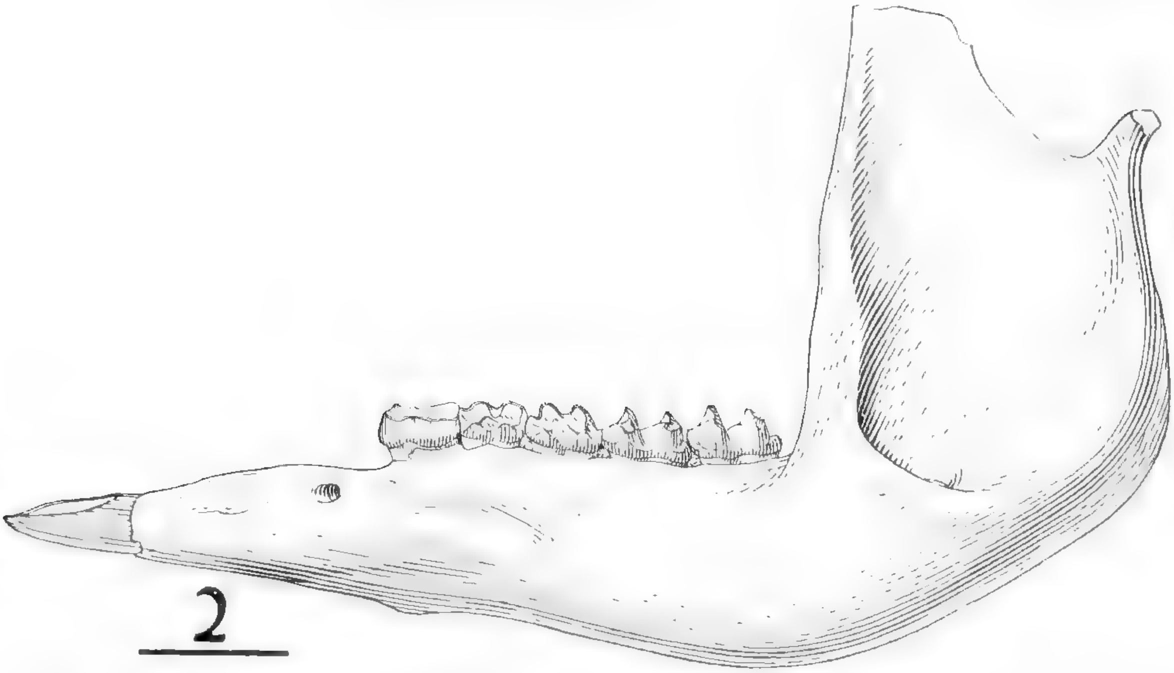

Fig. 1. *Troposodon kenti* Campbell, n. sp., holotype (SAM P14507), UCMP locality V5772, Stirton Quarry (Lake Kanunka); Kanunka Fauna, Katipiri Sands. Left mandible with I_1; P_3-M_4, complete but for tip of coronoid process. Labial view. Scale in cms.

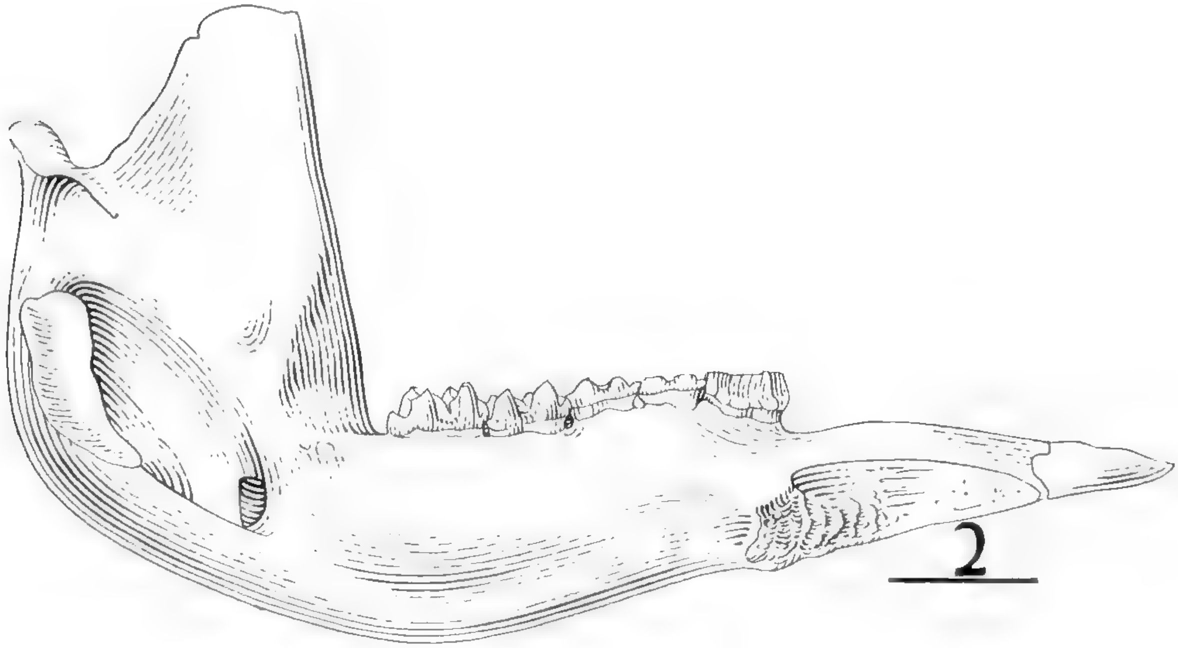

Fig. 2. *Troposodon kenti* Campbell, n. sp., holotype (SAM P14507), UCMP locality V5772, Stirton Quarry (Lake Kanunka); Kanunka Fauna, Katipiri Sands. Left mandible with I_1; P_3-M_4, complete but for tip of coronoid process. Lingual view. Scale in cms.

Fig. 3. *Troposodon kenti* Campbell, n. sp., holotype (SAM P14507), UCMP locality V5772, Stirton Quarry (Lake Kanunka); Kanunka Fauna, Katipiri Sands. Left mandible with I_1; P_3-M_4, complete but for tip of coronoid process. Occlusal view. Scale in cms.

Paratypes: UCMP 56898, LdP^3; UCMP 56907, RM$_2$ or M$_3$, two LM^2 or M^3, RM^1; UCMP 56920, RP^2; UCMP 56921, RM^3; UCMP 60805, RM^3, LM^3; UCMP 60825, LP^3, RM^3 or M^4. Figs. 4 and 5.

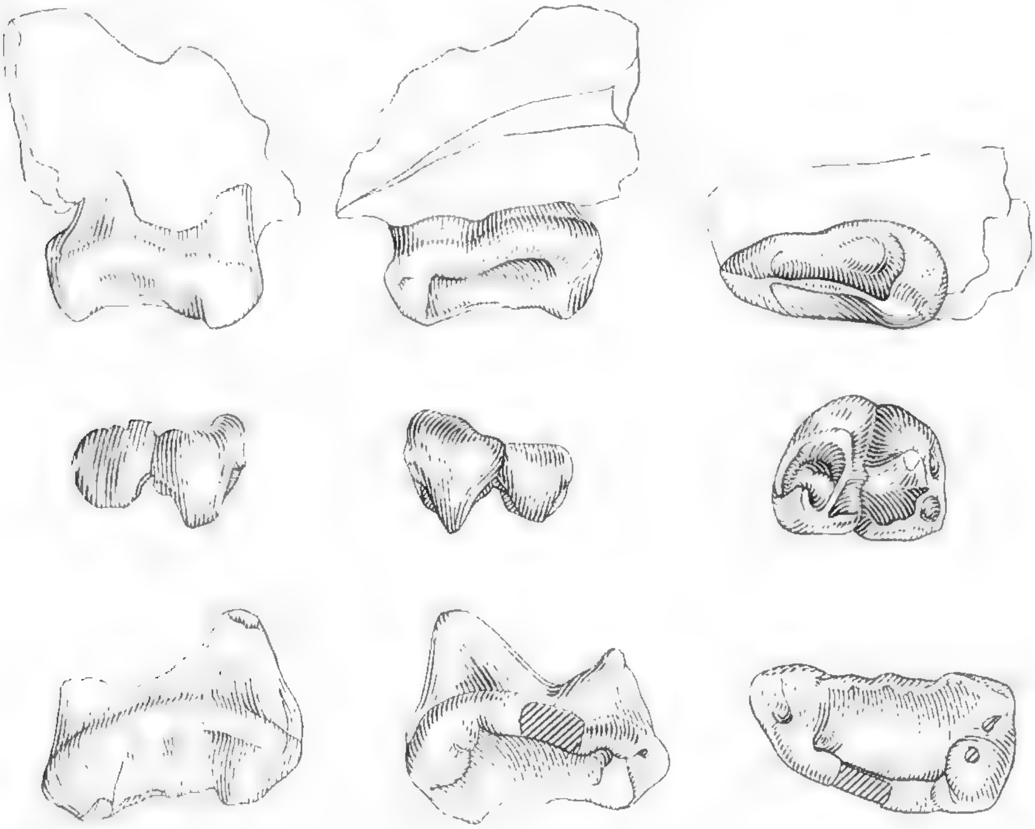

Fig. 4. *Troposodon kenti* Campbell, n. sp., paratypes. Top row: RP^2, UCMP locality V5772, No. 56920. Centre row: LdP^3, UCMP locality V5772, No. 56898. Lower row: LP^3, UCMP locality V5773, No. 60825. Labial, lingual, and occlusal views (left to right). Anterior to right. Scale × 1.5 natural size.

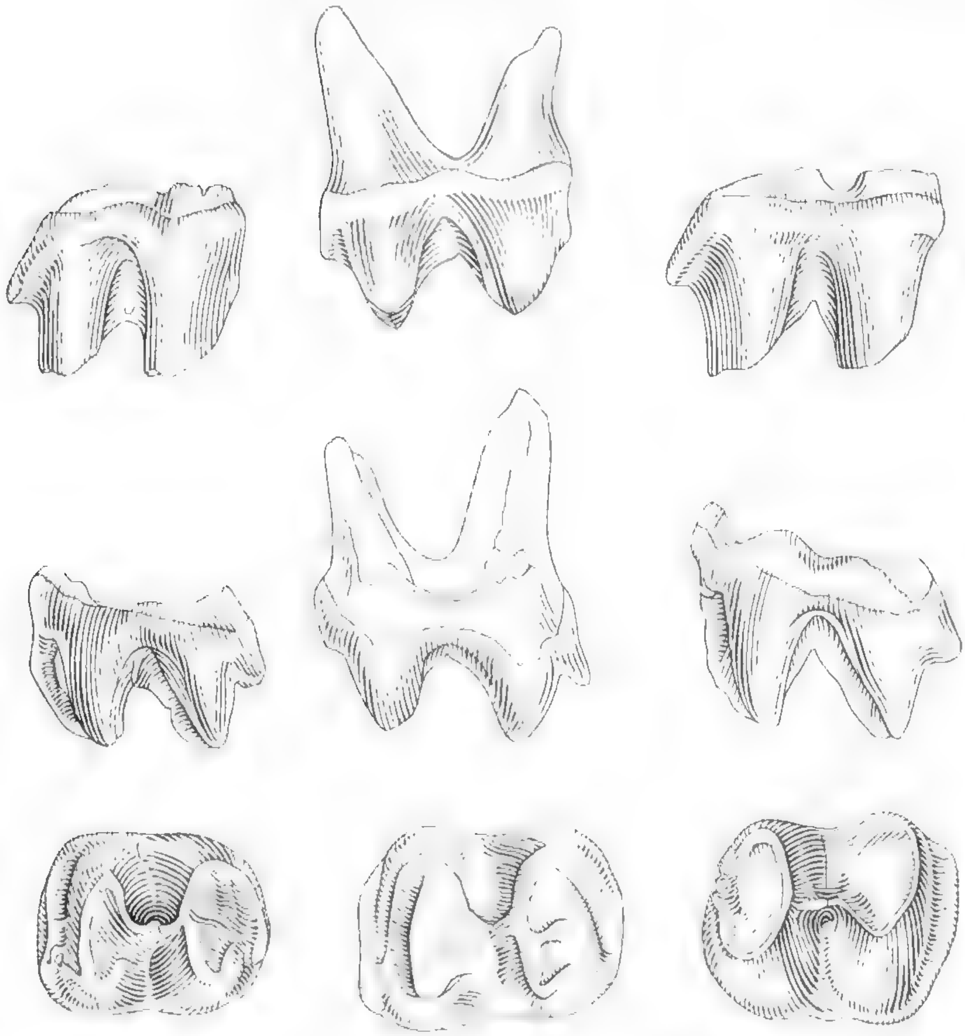

Fig. 5. *Troposodon kenti* Campbell, n. sp., paratypes. Top row: RM^{1-3}, labial view. Centre row: RM^{1-3}, lingual view. Lower row: RM^{1-3}, occlusal view. RM^1 (left column) UCMP 56907. LM^2 (middle column) UCMP 56907, drawn reversed. RM^3 (right column) UCMP 56921. All from UCMP locality V5772. Scale × 1.5 natural size.

Type locality: UCMP locality V5772, Lake Kanunka site 1 or Stirton Quarry. A quarry in the basal Katipiri Sands (Stirton, Tedford, and Miller, 1961) at foot of the northern bluffs forming the western side of Lake Kanunka, eastern Lake Eyre Basin, South Australia.

Age: ?Early Pleistocene, Kanunka Fauna (Stirton, *et al.*, *ibid.*).

Other localities: UCMP locality V5773 only. This includes a number of local accumulations of fossil material at base of Katipiri Sands along its contact with the Etadunna Formation around an isolated hill immediately east of the type locality.

Specific diagnosis: *Troposodon kenti* can be distinguished from *T. minor* via the following diagnostic characters. Larger dental dimensions; L-shaped longitudinal crest of P_3 swollen postero-lingually, conspicuous paraconid bearing lingually descending ridge. M_1 hypolophid approximately equal in width to protolophid; accessory ridge from metaconid to forelink weaker than in *T. minor*. Two or more weak vertical ridges between paracone and metacone on P^2 cf. two which are low and broad on *T. minor*, shallow lingual basin traversed by anterior low, broad ridge; labial base of crown swollen. On dP^4 the anterior cingulum is narrow, midlink weak, transverse valley V-shaped, lingual stylar cusp absent, apical shelves above loph crests poorly ornamented, all these in contradistinction to *T. minor*. P^3 broadest medially, paracone apex close to anterior extremity of longitudinal crest, metacone higher than hypocone, hypocone rounded, posterior cingulum absent, posterior fossette absent, lingual cingulum well developed, anterolingual pit in lingual basin, lingual basin lacking transverse ridges, anterior fossette present. Accessory links in upper molars paralleling forelink absent, apical shelves above loph crests minimally ornamented. See Tables 4 and 5.

The most useful of these characters diagnostically are the greater dental dimensions than *T. minor* and the apical shelves on the molars being minimally ornamented. The broader diagnosis offered above should aid in identification of limited dental samples of *T. kenti*.

Description of holotype:

I_1: exposed portion short, vertically oriented flattened oval in section; elongate ellipsoid wear facet occupies almost full exposed length dorsally; enamel extends around circumference except for dentine exposed dorsally on horizontally flattened wear facet. Figs. 1-3.

P_2 and dP_3 unknown.

P_3: elongate, robust, longitudinal crest curves sharply lingually at posterior end of tooth; prominent vertical lingual ridge descends from a conspicuous cusp at the anterior apex of the crest; behind this three or four less prominent vertical lingual and labial ridges are present, each originating at minor cuspules on crest; postero-lingual expansion reasonably prominent. Major wear facet an elongate strip labial to and dorsally common with longitudinal crest, indicating P_3 occluded with lingual face of P^3. Tooth heavily worn occlusally. Fig. 3.

$M_1 < M_2 < M_3 < M_4$: molars subrectangular in basal outline; hypolophid as broad as protolophid in M_1 and M_2, almost so in M_3, but narrower in M_4. Width of trigonid basin (area between protolophid crest and anterior cingulum) a little less than distance between lophid crests. Forelink moderately high and strong, descending antero-lingually from the protoconid to a point a little labial of the longitudinal midline where it turns anteriorly and runs to the reasonably well developed anterior cingulum, contacting its approximate midpoint. Forelink occasionally with subsidiary ridging similar to *T. minor*. No antero-labial fossette in trigonid basin; subsidiary ridge from forelink near point of anterior flexion runs lingually across anterior face of protolophid, fading out before reaching metaconid on M_4, probably reaches metaconid on M_3 where it creates an unornamented shelf-like area on foreslope of protolophid. Moderately strong midlink descends antero-lingually from hypoconid to point midway down hypolophid foreslope, there turning anteriorly to meet very short ridge which vertically descends the mid-line of protolophid hindslope, accessory ridge from point of midlink flexion extends lingually in shallow downcurve, fades out before meeting entoconid on M_3, shorter and abrupty downcurved in M_4, but creates a small shelf-like area on hypolophid foreslope in M_3 and M_4; M_1 and M_2 too worn to reveal nature of this ridge. Talonid basin broadly U-shaped labially, somewhat less broadly lingually; small deep pit on basin floor immediately lingual to midlink on M_3 and M_4, again not visible on M_1 and M_2 due to wear. No ornamentation on lophid faces. Posterior cingulum present but less developed than anterior cingulum. Short, poorly developed ridge descends vertically from entoconid to posterior cingulum. Figs. 1-3

TABLE 1 Standard Mandibular Measurements of *Troposodon kenti*

N.B.—Parentheses indicate estimated measurements. After Plane (1967) Fig. 5

1.	Length of horizontal ramus from incisor alveolus to postalveolar process	124.0
2.	Length of incisor —P_3 diastem.	45.0
3.	Depth of ramus below M_2, taken between roots	31.0
4.	Depth of ramus below M_3, taken between roots	33.0
5.	Length of cheek tooth row, P_3—M_4, taken at base of crown	69.5
6.	Distance from posterior edge of mental foramen to P_3	9.0
7.	Height of hypoconid on unworn M_3, measured from base of enamel	5.0
8.	Height of condyle above alveolar border	61.0
9.	Height of ascending ramus above alveolar border	(88.5)
10.	Depth of mental foramen below dorsal border of ramus	2.5
11.	Width of jaw below M_3, taken between roots	17.5

Mandible: Figs. 1-3. Table 1. Horizontal ramus deep, relatively thick; symphysis large, not ankylosed, extremely rugose posteriorly, extending from anterior extremity of mandible at base of I_1 and expanding posteriorly as a skewed ellipsoid to terminate below the posterior end of P_3; flanged postero-ventrally into a distinct genial crest below P_3, basal margin acute. Geniohyal pit slightly indents posterior margin of symphysis; very shallow, indistinct. Diastema moderately short, about three fourths lengths of cheek tooth row, slightly convex upward in lateral view, crest sharply rounded;

mental foramen very close to crest, almost circular, in posterior third of diastema length. Short eminence present labially at level of mental foramen, not reaching foramen or anterior extremity of symphyseal region; underlying shallow trough fades posteriorly into mental foramen. Shallow labial depression extends from between mental foramen and P_3 postero-ventrally to fade out below posterior end of M_2 about midway down horizontal ramus. Digastric fossa well developed, extending from below transverse valley of M_3 near ventral border of horizontal ramus to below posterior moiety of M_4 where it fades into a very shallow post-digastric sulcus bounded anteriorly by a very weak digastric process. Shallow depression opens posteriorly into pterygoid fossa but is not confluent with digastric fossa antero-ventrally, there being a low, rounded, intervening region of the lingual ramus wall. Post-alveolar shelf short, well developed postalveolar process postero-lingually, and low postalveolar ridge medially which turns upward to traverse the mesial wall of the ascending ramus and meet the temporal crest about midway along its length, above large mandibular foramen. Pterygoid fossa well developed, deeply excavated labially for insertion of superficial portion of medial pterygoid muscle; medial border greatly expanded for insertion of deep portion of medial pterygoid muscle, forming flanged edge of fossa, especially near angular process. Condyle well developed, articular surface roughly elliptical with long axis oriented antero-lingually to postero-labially; extending labially to level of posterior masseteric eminence, but slightly damaged lingually. Fovea pterygoidea for lateral pterygoid-temporalis muscle insertion a triangular pit beneath condyle on mesial face of condyle neck; bounded antero-dorsally by short sharp crest originating on condyle in region of mandibular notch. Perpendicular to alveolar margin the temporal crest ascends to top of slightly damaged coronoid process; posterior slope of coronoid process a slightly concave curve descending into mandibular notch. Masseteric crest raised to about level of alveolar margin; masseteric fossa moderately large, vertically elongated flattened oval in shape with large masseteric foramen on ventro mesial wall; leading into short masseteric canal where deep anterior fibres of the medial masseter and a slip of the deep masseter insert. Nature and extent of inferior dental canal not visible, but it probably reaches to beneath the sectorial P_3 (Ride, 1959; Abbie, 1939). Angular portion of ascending ramus expands dorsally in posterior view into a wine-glass shape at region of angle.

Description of paratypes:

UCMP 56920, P^2: Fig. 4. Subtriangular approaching subrectangular in basal outline; broader posteriorly than anteriorly; longitudinal crest concave in side view, straight. Apex of paracone about one quarter distance along crest from anteriormost point; labial and lingual vertical ridges extremely weak, transect crest, two very small cuspules present but probably more visible in less worn state. Metacone high, at posterior end of crest; hypocone low, worn, connected to metacone by low transverse crest which descends lingual face of metacone, passes through hypocone and turns anteriorly as a low sinuous lingual cingulum being highest a little anterior to the midpoint of the longitudinal crest; cingulum and crest converge anteriorly but with cingulum expanding lingually and paralleling crest for a short distance before terminating at a vertical lingual ridge descending from paracone apex, and matched by a similar labial ridge. Lingual basin shallow, subtriangular tending subrectangular in shape, traversed anteriorly by a low broad ridge emanating from the highest point of the lingual cingulum. Labial base of crown moderately swollen, not quite to extent that would justify description as a labial cingulum. Posterior ridge from metacone descends vertically and turns lingually to fade out on posterior wall of hypocone. No posterior cingulum, but attrition with M^1 has produced a wear facet in this location. No posterior fossette.

UCMP 56898, dP^4: Fig. 4. Molariform, subrectangular in basal outline, unconstricted across median valley, swollen at lingual extremity; lophs low, bowed anteriorly, metaloph slightly wider than protoloph. Anterior cingulum low, narrow, short, extending from ridge descending vertically from paracone to anterior base of protocone with slightly developed forelink meeting it at longitudinal axis of crown. Midlink weak, descending postero-labially from apex of paracone then turning posteriorly to meet metaloph low down and lingual to midline, a little labiad of hypocone apex. Small shelf-like area with minor ornamentation present posterior to protoloph crest; short ridge passing posteriorly from paracone apex descends almost vertically to floor of V-shaped median valley to meet a similar ridge descending anteriorly from apex of metacone. Relatively strong ridge descends postero-labially from apex of hypocone to terminate below apex of metacone, forming a small posterior cingulum; met by ridge descending almost vertically from metacone, and by secondary ridge descending from crest of metaloph labiad of midline, thus delimiting shelf-like area below metaloph crest. No lingual stylar cusp below protocone in single known specimen.

UCMP 60825, P^3: Fig. 4. Subrectangular in basal outline, broadest point midway along length; longitudinal crest almost straight, lower than apices of paracone and metacone, slightly concave labially; apex of paracone close to anterior extremity of crown on longitudinal crest; three sets of very weak vertical labial-lingual ridges transect crest, producing small cuspules. Metacone highest cusp, near posterior extremity of crown on longitudinal crest, united to lower rounded hypocone by low posterior transverse ridge; no definitive posterior cingulum, this area bearing a wear facet produced by attrition with M^1; no posterior fossette. Anterior ridge from hypocone descends sharply and continues anteriorly to form a well developed lingual cingulum, highest point just posterior to paracone; converges slightly with longitudinal crest anteriorly to enclose subrectangular, shallow lingual basin with somewhat sinuous floor profile and bearing small pit-like indentation at antero-lingual corner: small antero-lingual fossette anterior to crest connecting paracone and lingual cingulum. Labial cingulum weakly developed, bearing two prominent swellings midway between paracone and metacone at base of crown; poorly defined stylar cusp at anterior extremity of crown on base of anterior paracone slope. Major wear facet along full length of lingual slope of longitudinal crest.

Upper molars. UCMP 60805, LM^1, RM^3; UCMP 56907, two LM^2 or M^3, RM^1; UCMP 56921, RM^2. Fig. 5. Closely resemble those of *T. minor*. Subrectangular in basal outline, very slightly constricted across median valley; lophs low, bowed anteriorly; metaloph slightly broader than protoloph in M^1, equal or slightly narrower in M^2 and M^3, M^4 unknown. Anterior cingulum low, broad, ascending labially; forelink absent in six teeth known; labial extremity of cingulum united to paracone by slight vertical ridge ascending antero-labial face of protoloph; two or three faint parallel ridges occasionally present in labial moiety of anterior cingulum shelf and protoloph face. Lingual margin of median valley sometimes variably swollen laterally. Moderately strong ridge descends postero-labially from protocone, turning posteriorly across broadly U-shaped median valley as a moderately low midlink to unite with extremely short ridge from near midpoint of metaloph, weaker ridge from paracone descends postero-lingually to turn posteriorly and closely parallel midlink into floor of median valley, delimiting a shelf-like area below protoloph crest which is variably but minimally ornamented by subsidiary ridges and tubercles in M^1 to M^3, M^4 unknown. Strong ridge curves postero-labially from hypocone to near postero-labial base of crown where it terminates in a minor swelling of weak posterior cingulum in M^3, or in that position in M^1 and M^2 where posterior cingulum is absent; weaker ridge descends postero-lingually from metacone towards ridge from hypocone, delimiting a shelf-like area below metaloph crest which is variably but minimally ornamented by subsidiary ridges and tubercles in M^1 to M^3. Base of protoloph below protocone usually with variable stylar cusp.

DISCUSSION

The occurrence of *Troposodon* at Lake Kanunka in the ?early Pleistocene constitutes an important extension of the known geographic range of the genus. The Katipiri Sands in which the specimens described were found is composed of channel and floodplain deposits resting disconformably upon the unfossiliferous Tirari Formation at the type locality, Katipiri Waterhole on Cooper's Creek, and also at Lake Palankarinna and Lake Pitikanta where the channels occasionally cut into the top of the

Etadunna Formation (?late Oligocene). The deposits at Lake Kanunka produced *Troposodon*, and are of further interest because the fauna contained is apparently somewhat older than the fauna at the type locality of the formation, called the Malkuni Fauna, and considered to be late Pleistocene in age.

The Kanunka fauna contains a diverse assemblage of invertebrates and vertebrates, including crayfish, lungfish, teleosts, turtles, lizards, crocodiles, cormorants, ducks, swans, a murid, dasyurids, a thylacoleonid, two vombatids, potoroine, sthenurine, and macropodine macropodids, and a diprotodontid smaller than *Diprotodon*, possibly *Euowenia* (Stirton, Tedford and Miller, 1961).

This fauna, yet to be fully studied and described, contains a diversity of carnivores and herbivores indicative of a situation characterized by areas of forest and grassland, possibly in the form of savannah, and probably riparian areas since the existence of watercourses is amply evidenced geologically. Potoroines, macropodines, and sthenurines are browsing-grazing forms favouring savannah locales; the murids, dasyurids, and possibly vombatids indicate the presence of low cover in the form of shrubs or grasses, and if their present distribution is a faithful guide, a rainfall of 20-30 inches per annum in a seasonal climate such as prevails over much of the east coast of Australia today.

As discussed earlier, *Troposodon* probably occupied a *Sthenurus*-like niche, that of a large grazing or grazing-browsing herbivore probably favouring the savannah areas and travelling to water to drink.

STATISTICS

The statistics performed require some discussion. In all cases the samples involved are too small (*i.e.*, < 10) for reliable conclusions derived from statistical comparison to be made. Bartholomai (1967) showed that populations of *T. minor* from eastern and western Darling Downs were not separable on the basis of dental dimensions. His samples were adequate for Student's t Test, and the data for his eastern population were chosen for comparison with the samples here studied (Table 2) because the dental representation was more complete than in the western population. In numerous cases in the present study only one specimen was available for comparison, and although the test applied is perfectly valid (Simpson, Roe and Lewontin, 1960, pp. 182-3), its limitations due to the lack of variation considered are self-evident, as are the limitations of Student's t Test on samples of less than ten.

Thus the statistics are not intended for use as definitive taxonomic tests, but rather as indications of trends which may be better revealed when larger samples become available for statistical comparison.

In the case of *T. kenti*, of twenty tests performed, sixteen involved one specimen, two involved two specimens, and two involved four specimens. In twelve of these the values of P (> 0.05 at 5% level of significance) indicate that the null hypothesis of no difference must be accepted, and that the teeth tested fall into the dimensional range of teeth from the eastern Darling Downs sample of *T. minor*. In eight cases the values of P (< 0.05 at 5% level) indicate the null hypothesis must be rejected, and the teeth concerned be considered as members of a different population (Table 3). The ratio of acceptances to rejections is taken to indicate that given a larger sample, the probability for consistently testable significant differences is reasonably high. This, plus the morphologic differences best represented in Tables 4 and 5 are considered adequate grounds for the designation of new specific rank, in the purely morphologic sense available to palaeontology. The facts of geographic and possible temporal isolation of the populations compared are supporting grounds which cannot be quantified, but are real none-the-less.

TABLE 2 Dental Measurements of *Troposodon* spp.

Specimen and Species	Length	Width Posteriorly	Width Protoloph	Width Protolophid
Troposodon kenti—				
P^2 UCMP 56920	12.0	6.2		
dP^3 UCMP 56898	9.5		8.7	
P^3 UCMP 60825	15.2	7.7		
M^1 UCMP 56907	13.0		10.9	
M^2 UCMP 56907	14.0		11.0	
M^3 UCMP 56907	14.5		10.1	
UCMP 60805	15.3, 14.9		10.7, 10.0	
UCMP 56921	15.7		11.2	
M^4 UCMP 60825	15.7		11.4	
P_3 UCMP 56897	13.8	6.5		
M_1 UCMP 56897	11.3			8.9
M_2 UCMP 56897	12.9			10.7
M_3 UCMP 56897	15.0			12.3
UCMP 56907	16.0			10.8
M_4 UCMP 56897	16.0			12.6
cf. *Troposodon minor*—				
P_2 UCMP 45192	8.4	4.8		
dP_3 UCMP 45192	9.5			6.0
P_3 UCMP 45149	12.0	6.5		
M_1 UCMP 45192	11.0			7.6
UCMP 45149	11.0			7.5
M_2 UCMP 45192	13.0			9.0
UCMP 45149	12.6			8.9
M_3 UCMP 45192	13.8			10.0
UCMP 45149	14.7			10.3
M_4 UCMP 45149				10.6

TABLE 3 Comparison of Means of Samples of *Troposodon* Bartholomai, from Eastern Darling Downs and Kanunka Fauna

Character	*Troposodon minor* (Owen)					*Troposodon kenti* nov.					Comparison of Means	
	N	$\overline{X}$	OR	s^2	s	N	$\overline{X}$	OR	s^2	s	t	P
P^2 length	1	11.60				1	12.0					
Width metaloph	0					1	6.2					
DP^3 length	3	10.83	10.7-11.0			1	9.5					
Width protoloph	2	7.75	7.7- 7.8			1	8.7					
P^3 length	12	14.45	13.3-16.4	0.9027	0.9501	1	15.2				0.7583	0.4 —0.5
Width metaloph	11	7.51	6.6- 8.5	0.4268	0.6533	1	7.7				0.0027	>0.9
M^1 length	14	11.83	10.1-13.8	0.7930	0.8905	1	13.0				1.2680	0.2 —0.3
Width protoloph	11	9.27	8.0- 9.8	0.3281	0.5728	1	10.9				1.6558	0.1 —0.2
M^2 length	14	13.44	11.8-14.7	0.9734	0.9866	1	14.0				0.5483	0.6
Width protoloph	14	10.49	9.2-11.5	0.6098	0.7809	1	11.0				0.6309	0.5
M^3 length	11	14.90	12.8-15.9	0.9799	0.9899	4	15.1	14.5-15.7	0.2666	0.5163	0.3794	0.7
Width protoloph	11	11.36	10.2-12.3	0.5566	0.7461	4	10.5	10.0-11.2	0.3133	0.5597	2.9432	0.01—0.02
M^4 length	3	14.23	13.7-15.1	0.5742	0.7578	1	15.7				1.6798	0.2
Width protoloph	2	11.30	11.2-11.4	0.0200	0.1415	1	11.4				0.4707	0.7
P_3 length	11	11.35	10.8-12.1	0.1268	0.3561	1	13.8				6.5869	<0.001
Width posteriorly	11	5.53	4.7- 6.0	0.1473	0.3839	1	6.5				2.4191	0.02—0.05
M_1 length	23	11.83	10.8-12.4	0.1584	0.3980	1	11.3				1.3035	0.2
Width protolophid	20	7.44	6.8- 8.1	0.1278	0.3575	1	8.9				3.9854	0.001
M_2 length	27	13.22	11.8-14.3	0.3348	0.5787	1	12.9				0.5429	0.6
Width protolophid	25	9.18	8.5-10.7	0.2215	0.4707	1	10.7				3.1661	0.01—0.001
M_3 length	30	13.98	12.8-16.0	0.7057	0.8399	2	15.5	15.0-16.0	0.5000	0.7071	2.4898	0.02
Width protolophid	27	10.23	9.5-11.4	0.2713	0.5208	2	11.6	10.8-12.3	1.1300	1.0630	3.3956	0.01—0.001
M_4 length	21	15.35	14.0-16.5	0.4695	0.6852	1	16.0				0.9266	0.3 —0.4
Width protolophid	20	10.48	9.8-11.7	0.2819	0.5310	1	12.6				2.0584	0.05

TABLE 4 Summary and Comparison of Diagnostic Dental Characters in the lower Teeth of the Species of *Troposodon*

	Character	*Troposodon minor*	*Troposodon kenti*
P_2		Longitudinal crest turns abruptly postero-lingually Crest L-shaped i.e. no postero-labial ridge	Tooth unknown
dP_3		Hypolophid much broader than protolophid	Tooth unknown
P_3		Longitudinal crest turns abruptly postero-lingually; thus crest L-shaped. Variably swollen lingually	Longitudinal crest L-shaped. Swollen postero-lingually. Conspicuous paracone with lingually descending ridge
Lower Molars	Relative width of lophids	Hypolophid>protolophid M_1; M_{2-3};<M_4	Hypolophid=protolophid M_{1-2}; almost equal M_3;<M_4
	Forelink ornamentation	Occasionally with subsidiary ridging	Without subsidiary ridging
	Accessory ridge from metaconid to forelink	Present, moderately strong	Present, weaker than in *T. minor*
	Apical shelves below lophid crests	Present, ornamented M_{1-2} with ridges and tubercles	Present, unornamented

TABLE 5 Summary and Comparison of Diagnostic Dental Characters in the Upper Teeth of the Species of *Troposodon*

	Character	*Troposodon minor*	*Troposodon kenti*
P^2	Vertical ridges	Two, low and broad, between paracone and metacone	Two or more, weak
	Lingual cingulum ..	Unites with base of crown below paracone	Low, sinuous, terminates at vertical lingual ridge descending paracone
	Lingual basin......	Shallow, unornamented	Shallow, traversed by anterior low broad ridge
	Labial cingulum....	Absent	Labial base of crown swollen
dP^4	Anterior cingulum..	Broad	Narrow
	Midlink...........	Strong	Weak
	Transverse valley...	U-shaped	V-shaped
	Lingual stylar cusp..	Present below protocone	Absent in single known tooth
	Apical shelves above loph crests	Present, variably ornamented	Present, less ornamented than *T. minor*
P^3	Width	Broadest posteriorly	Broadest medially
	Paracone apex	$\frac{1}{4}$ length along longitudinal crest from anterior point	Close to anterior extremity of longitudinal crest
	Vertical ridges transecting crest	Up to five sets	Three or four sets
	Cusp heights	Hypocone approximately same height as metacone	Metacone highest, hypocone low and rounded
	Posterior cingulum.	Narrow, short	Absent
	Posterior fossette...	Present, between posterior cingulum and ridge connecting hypocone and metacone	Absent
	Lingual cingulum...	Low	Well developed
	Lingual basin.... .	Shallow, traversed by low broad ridges	Shallow, with antero-lingual pit
	Anterior fossette .	Absent	Present, antero-lingual to crest connecting paracone and lingual cingulum
	Labial cingulum ...	Labial base of crown slightly swollen	Weak, with two prominent swellings midway along length
Upper Molars	Representation	M^{1-4} known	M^{1-3} known
	Forelink	Reduced or absent, labiad to crown axis	Absent
	Accessory links	Slight, parallel forelink in labial moiety of anterior cingular shelf	Absent

SUMMARY AND CONCLUSIONS

A new species of *Troposodon* Bartholomai, 1967 is described and named *T. kenti.* It is from the ?early Pleistocene Kanunka Fauna at Lake Kanunka (UCMP localities V5772 and V5773) in the basal Katipiri Sands of the Lake Eyre Basin, South Australia (Stirton, Tedford and Miller, 1961). It can be consistently differentiated on morphologic grounds from *T. minor* (Owen), 1877, but is represented too poorly numerically for definitive statistical differentiation. A large left mandible with M_{3-1} (QM F4378) from the ?late Pliocene Chinchilla Formation and Fauna on Darling Downs, Queensland, falls into the size range of *T. kenti* and is morphologically very similar. It may represent the presence of *T. kenti* sympatrically and approximately contemporaneously with *T. minor*, but the possibility of its being a very large specimen of *T. minor* cannot be ruled out with the particular morphology available.

Stratigraphic representation of this genus is too poor to allow a phylogenetic sequence to be established. *T. minor* is present in both the ?late Pliocene Chinchilla Fauna and the ?early Pleistocene Darling Downs Fauna on Darling Downs in south-eastern Queensland, a time range overlapping the ?early Pleistocene provenance of the Kanunka Fauna in South Australia.

The ancestry of *Troposodon* is considered to have been close to the mid to late Tertiary divergence of *Protemnodon, Sthenurus,* and *Macropus* from a common ancestor, possibly similar to the ?late Miocene macropodid *Hadronomas* Woodburne, 1967 from the Alcoota Fauna (Northern Territory).

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RECORDS OF THE SOUTH AUSTRALIAN MUSEUM

RHODACARIDAE (Acari: Mesostigmata) FROM NEAR ADELAIDE, AUSTRALIA

I. SYSTEMATICS

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Summary

Twenty-five species of Rhodacaridae belonging to 14 genera are listed as collected from the environs of Adelaide, South Australia. Two new genera (*Athiasella* and *Solugamasus*) and 12 new species (*Gamasiphis lenifornicatus, G. saccus, Geogamasus minimus, Gamasellus cophinus, G. grossi, Acugamasus elachyaspis, Hiniphis bipala, Rhodacaroides minyaspis, Solugamasus mustela, Antennolaelaps aremenae, A. celox, Onchogamasus virguncula*) are described. The description of adult *Gamasellus concinnus* (Womersley, 1942) is extended and measurements are given for adults of all listed species. The larvae of 4 species (*Gamasiphoides propinquus, Gamasellus concinnus, G. cophinus, Acugamasus semipunctatus*) are described.

RHODACARIDAE (ACARI : MESOSTIGMATA) FROM NEAR ADELAIDE, AUSTRALIA

I. SYSTEMATICS

By DAVID C. LEE,
South Australian Museum, Adelaide

ABSTRACT

Twenty-five species of Rhodacaridae belonging to 14 genera are listed as collected from the environs of Adelaïde, South Australia. Two new genera (*Athiasella* and *Solugamasus*) and 12 new species (*Gamasiphis leniforniicatus, G. saccus, Geogamasus minimus, Gamasellus cophinus, G. grossi, Acugamasus elachyaspis, Hiniphis bipala, Rhodacaroides minyaspis, Solugamasus mustela, Antennolaelaps aremenae, A. celox, Onchogamasus virguncula*) are described. The description of adult *Gamasellus concinnus* (Womersley, 1942) is extended and measurements are given for adults of all listed species. The larvae of 4 species (*Gamasiphoides propinquus, Gamasellus concinnus, G. cophinus, Acugamasus semipunctatus*) are described.

INTRODUCTION

The Rhodacaridae is a group of mainly free-living, ground inhabiting, predatory mites, most common and diverse in form in Southern Temperate regions.

The present study on Systematics formed part of a thesis for the degree of M.Sc., University of Adelaide, on rhodacarids from the environs of Adelaide, South Australia. Further papers will deal with the Ecology (part II) and Behaviour (part III) of these mites.

The rhodacarids studied were from 4 sites between the summit of Mount Lofty and the coast-line of the Adelaide Plain. The "*Sites*", to be described more fully in part II, are as follows:—

(1) *Summit.* Approximately 18 km from the sea. Near the summit of Mount Lofty (715 m), the highest hill overlooking the Adelaide Plain.

(2) *Foothills.* Approximately 16 km from the sea. Near the First Waterfall, at the head of the deepest stretch of Waterfall Gully which has recently eroded back from where First Creek flows from the foothills below Mount Lofty on to the Adelaïde Plain.

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(3) *Plains.* Approximately 8 km from the sea. Heywood Park Unley; a suburban park on the Adelaide Plain.

(4) *Coastal.* Approximately 1.5 km from the sea. Grange Golf Course.

The terminology and diagnoses of taxa are as used by Lee (1970) except when otherwise indicated. Measurements are in micrometres, to the nearest 5 for lengths and 2.5 for breadths. The idiosomal length given is the average followed in parentheses by the number of specimens measured and the range of their lengths. Other measurements given for a specimen near to the average length are the lengths and breadths of the movable cheliceral digit (*ch*), the palp (*pa*) and the legs (*I*, *II*, *III* or *IV*).

Specimens selected for description have been registered in the collection of the South Australian Museum.

Family RHODACARIDAE Oudemans, 1902

Subfamily RHODACARINAE Oudemans, 1902

Genus RHODACARUS Oudemans, 1902

Rhodacarus roseus Oudemans

Rhodacarus roseus Oudemans, 1902, p. 50.

FEMALE. Not figured.

Measurements: idiosomal length—275 (1 from Summit Site) or 490 (3 from Plains Site. 450-510, measured for appendage lengths and genu breadths); appendage lengths—*ch* 100, *pa* 140, *I* 405, *II* 285, *III* 245, *IV* 360; genu breadths—*pa* 22.5, *I* 25, *II* 32.5, *III* 27.5, *IV* 32.5. The female from the Summit Site differs from previously described specimens from the Plains Site in being smaller with very indistinct punctations on the idiosoma and an opisthonotal seta *Z3* of similar length to seta *Z2* rather than to *Z5*.

MALE. Not figured.

LOCAL. *Summit Site*—female (197061), moss, 26.4.1968. *Plains Site*—3 females (N196879-N196881).

REMARKS. Specimens of *R. roseus* from the Plains Site have already been described (Lee, 1970, p. 29). One smaller female, differing from these as indicated above, was collected from the Summit Site and is for the time being regarded as belonging to the same species. This species has also been recorded from the Palaearctic region.

Genus RHODACARELLUS Willmann, 1935

Rhodacarellus silesiacus Willmann

Rhodacarellus silesiacus Willmann, 1936, p. 282.

FEMALE. Not figured.

Measurements: idiosomal length—305 (1); appendage lengths—*ch* 30, *pa* 90, *I* 230, *II* 140, *III* 115, *IV* 200; genu breadths—*pa* 17.5, *I* 22.5, *II* 27.5, *III* 22.3, *IV* 25. The general appearance is as given for this species by Sheals (1958), but at the posterior end of the idiosoma the setal lengths and markings on the shields conform to those figured for this species by Athias-Henriot (1961, figs. 283, 284 and 291).

MALE. Not collected.

LOCAL. *Foothills Site*—female (N197062), moss, 9.5.1968.

REMARKS. The only previous record of *Rhodacarellus* occurring in Australia is of a female (N1968280) from Millicent, about 400 km south of Adelaide (Lee, 1970), which I have since identified as *R. silesiacus*. This species has also been recorded from the Nearctic and Palaearctic regions.

Subfamily GAMASIPHINAE Lee, 1970

Genus GAMASIPHIS Berlese, 1904

Gamasiphis australicus Womersley

Gamasiphis (*Heteroiphis*) *australicus* Womersley, 1956a, p. 521.

FEMALE. Not figured.

Measurements: idiosomal length 390 (3 from Foothills Site, 360-430); appendage lengths—*ch* 40, *pa* 100, *I* 290, *II* 250, *III* 190, *IV* 265; genu breadths—*pa* 17.5, *I* 22.5, *II* 30, *III* 22.5, *IV* 22.5.

MALE. Not figured.

LOCAL. *Foothills Site*—3 *females* (N197063-N197065), moss or plant litter, 7.1968-2.1969. *Plains Site.*

REMARKS. *G. australicus* from the Plains Site is described (Lee, 1970, p. 50) and appears to be identical with specimens from the Foothills Site. The only other record of this species is of the type which was collected at Mylor, about 8 km south of the Summit Site.

Gamasiphis fornicatus Lee

Gamasiphis fornicatus Lee, 1970, p. 51.

FEMALE. Not figured.

Measurements: idiosomal length—500 (20, 480-510); appendage lengths—*ch* 72, *pa* 165, *I* 360, *II* 310, *III* 305, *IV* 385; genu breadths—*pa* 20, *I* 25, *II* 42.5, *III* 30, *IV* 30.

MALE. Not figured.

Measurements: idiosomal length—490 (6, 470-490).

LOCAL. *Summit Site*—10 females (N197066-N197075) and 3 males (N197076-N197078), moss or plant litter, 1968-1969. *Foothills Site*—14 females (N197079-N197092) and 4 males (N197093-N197096), moss or plant litter, 1968-1969.

REMARKS. *G. fornicatus* is also recorded from Mount Remarkable, about 260 km north of the Summit Site. No differences were noticed between the type specimens and those from near Adelaide.

Gamasiphis lenifornicatus Lee, n.sp.

FEMALE. Fig. 1; A,B,C,D,E.

Measurements: idiosomal length—390 (1); appendage lengths—*ch* 40, *pa* 135, *I* 305, *II* 225, *III* 220, *IV* 305; genu breadths—*pa* 17.75, *I* 22.25, *II* 30, *III* 25, *IV* 25. One pair of pre-endopodal shields. Split between exopodal and peritrematal shields does not extend posterior to stigma, and the peritrematal shield is broadly fused to the notal shield. No conspicuous lateral fissure on notal shield. Leg chaetotaxy is abnormal for rhodacarids (not as *Gamasellus*) in lacking 3 setae on leg IV; seta *pl* on the genu (2, 5/2, 0); setae *pd* 2 and *pl* 2 on the tibia (2, 4/2, 1). The tectum is conspicuously fimbriated. The idiosoma is acutely convex dorsally and the dorsal setae are unusually long. Sternal setae are nearly in a straight line so that a line joining setae *st*2, *st*3 and *st*4 enclose an angle of more than 95°; excepting the atypical *Hydrogamasus* this is a unique attribute within the Gamasiphinae. On legs II-IV, tarsal setae *ad*1 and *pd*1 are subequal in length to pretarsus and bear a broad hyaline flap.

MALE. Fig. 1; F,G,H.

Measurements: idiosomal length—350 (6, 340-370). The distribution of shields is as for the female except on the venter of the podosoma. The spermadactyl is slightly longer than the movable cheliceral digit, and has a hyaline, spatulate tip. On leg II, setae *av* on the femur and genu are modified to spurs.

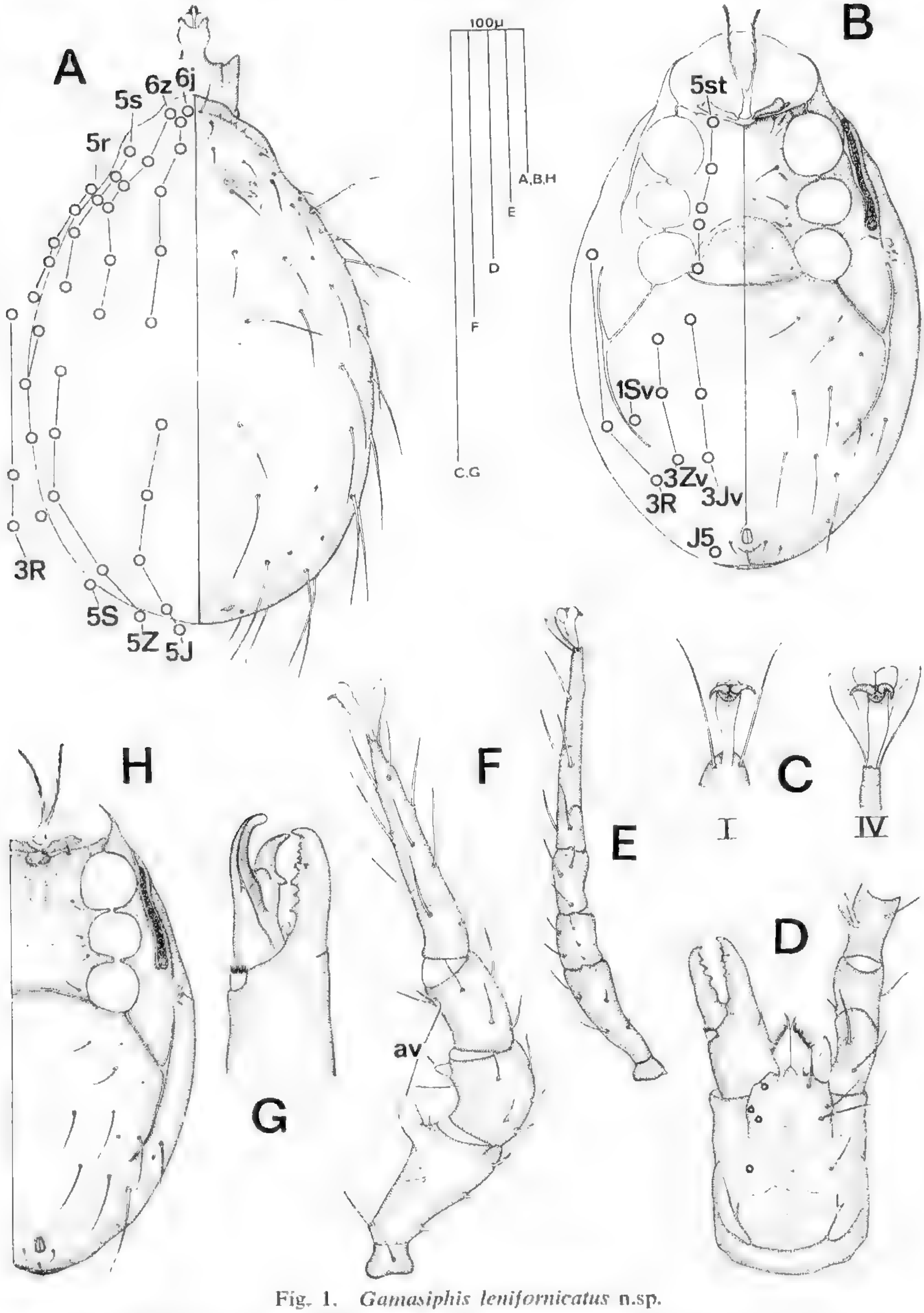

Fig. 1. *Gamasiphis leniforniicatus* n.sp.

A-E, female: A, soma, dorsum; B, idiosoma, venter; C, pretarsi I and IV; D, gnathosoma, venter; E, leg IV (part), dorsal setae.

F-H, male: F, leg II (part), antero-lateral; G, chelicera; H, idiosoma, venter.

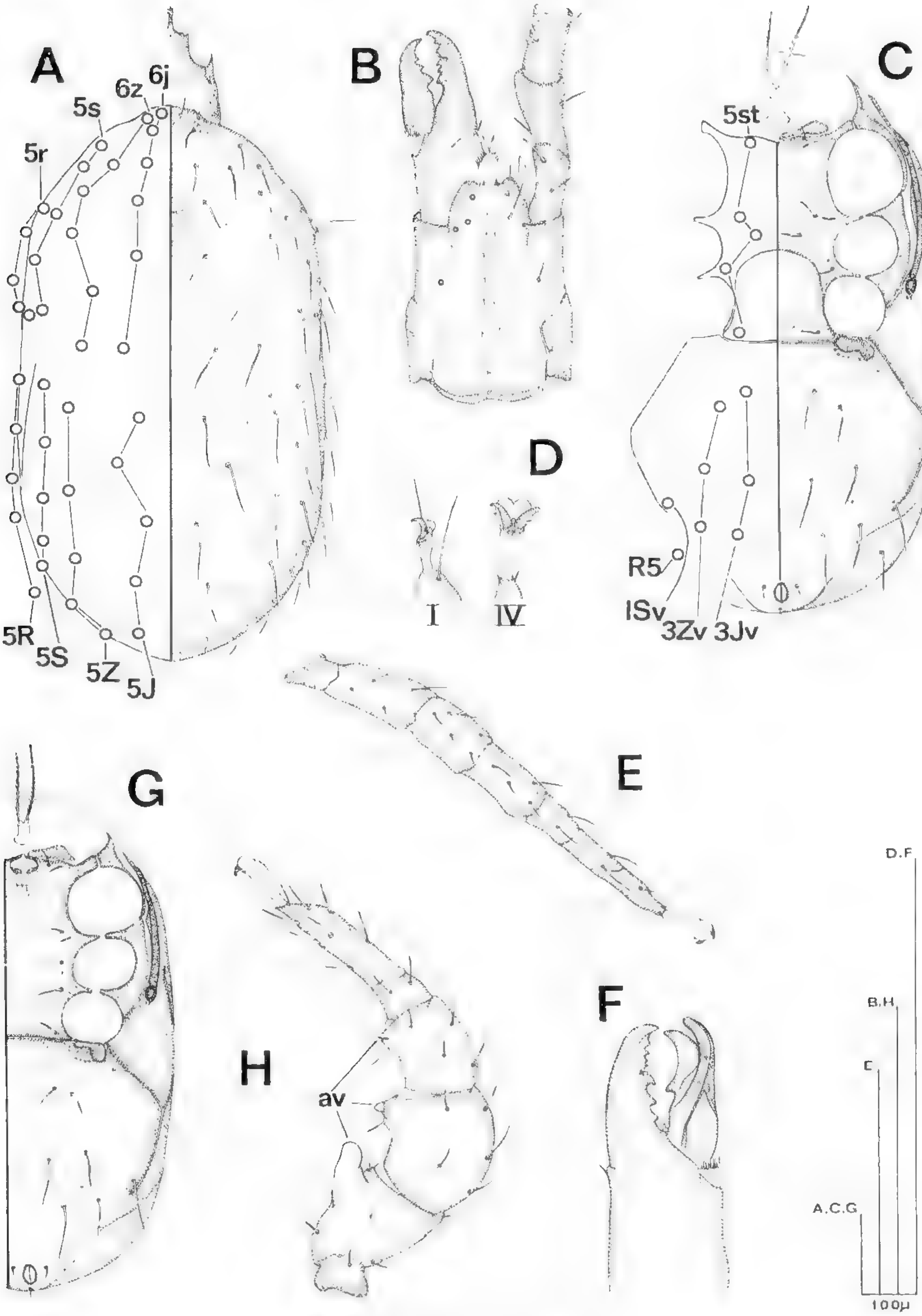

Fig. 2. *Gamasiphis saccus* n.sp.

A-E, female: A, soma, dorsum; B, gnathosoma, venter; C, idiosoma, venter; D, pretarsi I and IV; E, leg IV (part), dorsal setae.

F-H, male: F, chelicera; G, idiosoma, venter; H, leg II (part), antero-lateral.

LOCAL. *Summit Site*—holotype female (N197097) and allotype male (N197098), plant litter, 24.4.1969; and 5 paratype males (N197099-N1970103), moss or plant litter, 6-8.1968.

REMARKS. The idiosoma of *G. lenifornicatus* is globular, but to a lesser degree to that of *G. fornicatus*. The leg chaetotaxy is unique amongst rhodacarids in lacking seta *pd*2 on the adult tibia IV. The male tibia II is unusual within the genus (*G. saccus* n.sp. is the only other species of *Gamasiphis* with this attribute) in having a setose seta *av*.

Gamasiphis saccus Lee, n.sp.

Female. Fig. 2; A,B,C,D,E.

Measurements: idiosomal length—350 (3, 350-360); appendage lengths—*ch* 40, *pa* 120, *I* 270, *II* 210, *III* 190, *IV* 240; genu breadths—*pa* 15, *I* 22.5, *II* 32.5, *III* 25, *IV* 25. One pair of pre-endopodal shields. Split between exopodal and peritrematal shields extends backward from stigma to divide exopodal IV. Lateral fissure runs almost parallel to edge of opisthonotal shield. Leg chaetotaxy is normal for rhodacarids (as *Gamasellus*). The idiosoma is unusually flattened dorsally for a species of *Gamasiphis*. There is a conspicuous pit on the anterior edge of the ventro-anal shield bordering acetabulum IV. This pit appears to be lined by a fine pile. On legs II-IV, tarsal setae *ad*1 and *pd*1 are simple and less than a quarter of the length of the pretarsus.

MALE. Fig. 2; F,G,H.

Measurements: idiosomal length—340 (3, 330-350). The distribution of shields is as for the female except on the venter of the podosoma. Spermadactyl is slightly longer than the movable cheliceral digit and, although blunter, similar in shape. On leg II, setae *av* on the femur and genu are modified to spurs.

LOCAL. *Summit Site*. *Foothills Site*—holotype female (N1970104), allotype male (N1970105), 2 paratype females (N1970106 and N1970107) and 2 paratype males (N1970108 and N1970109), moss, 21.6.1968.

REMARKS. *G. saccus* is easily recognized by the large pit on the posterior edge of acetabulum IV. It is also unique amongst species of *Gamasiphis* in having the same leg chaetotaxy as *Gamasellus*. Specimens from the Summit Site are indistinguishable from those described.

Genus EUEPICRIUS Womersley, 1942

Euepicrius filamentosus Womersley

Euepicrius filamentosus Womersley, 1942, p. 170.

FEMALE. Not figured.
Measurements: idiosomal length—500 (10, 470-550); appendage lengths—*ch* 60, *pa* 140, *I* 755, *II* 445, *III* 440, *IV* 490; genu breadths—*pa* 22.5, *I* distal 25, *II* 45, *III* 42.5, *IV* 47.5.

MALE. Not figured.
Measurements: idiosomal length—490 (10, 460-530).

LOCAL. *Summit Site. Foothills Site*—10 females (N1970110-N1970119) and 10 males (N1970120-N1970129), moss or plant litter, 1968-1969.

REMARKS. The above specimens of *E. filamentosus* are indistinguishable from the type specimens (N1970130-N1970139) which are from Glen Osmond and Long Gully (2 localities within 8 km of the Foothills Site). A female of an undescribed species from Waimamaku, New Zealand, was incorrectly listed as belonging to *E. filamentosus* in the original description.

Genus GAMASIPHOIDES Womersley, 1956a

Gamasiphoides propinquus Womersley

Gamasiphis (*Gamasiphoides*) *propinqua*[1] Womersley, 1956a, p. 528.

FEMALE. Not figured.
Measurements: idiosomal length—800 (5, 780-840, measured for appendage lengths and genu breadths) or 600 (2); appendage lengths—*ch* 80, *pa* 220, *I* 570, *II* 430, *III* 420, *IV* 550; genu breadths—*pa* 35, *I* 47.5, *II* 60, *III* 50, *IV* 55.

MALE. Not figured.
Measurements: idiosomal length—730 (4, 720-730) or 540 (1).

LARVA. Fig. 3; A,B,C,D,E,F.
Measurements: idiosomal length—320 (4, 270-350). Seta *al* on palp genu is spatulate. Tectum anterior margin is basically trispinate with numerous spinules, and the three spines are of approximately equal size. Idiosomal shields clearly defined. Idiosomal setae are simple. Opisthonotal seta *Z3* (*Z1* and *Z2* are absent) is about half as long as seta *Z4*.

[1] Mr. R. Domrow of Queensland has pointed out (private correspondence: 30.9.1970) that according to the International Code of Zoological Nomenclature, Art. 30 (*a*) (ii), *oides* is masculine and therefore the original ending of this species name should be changed.

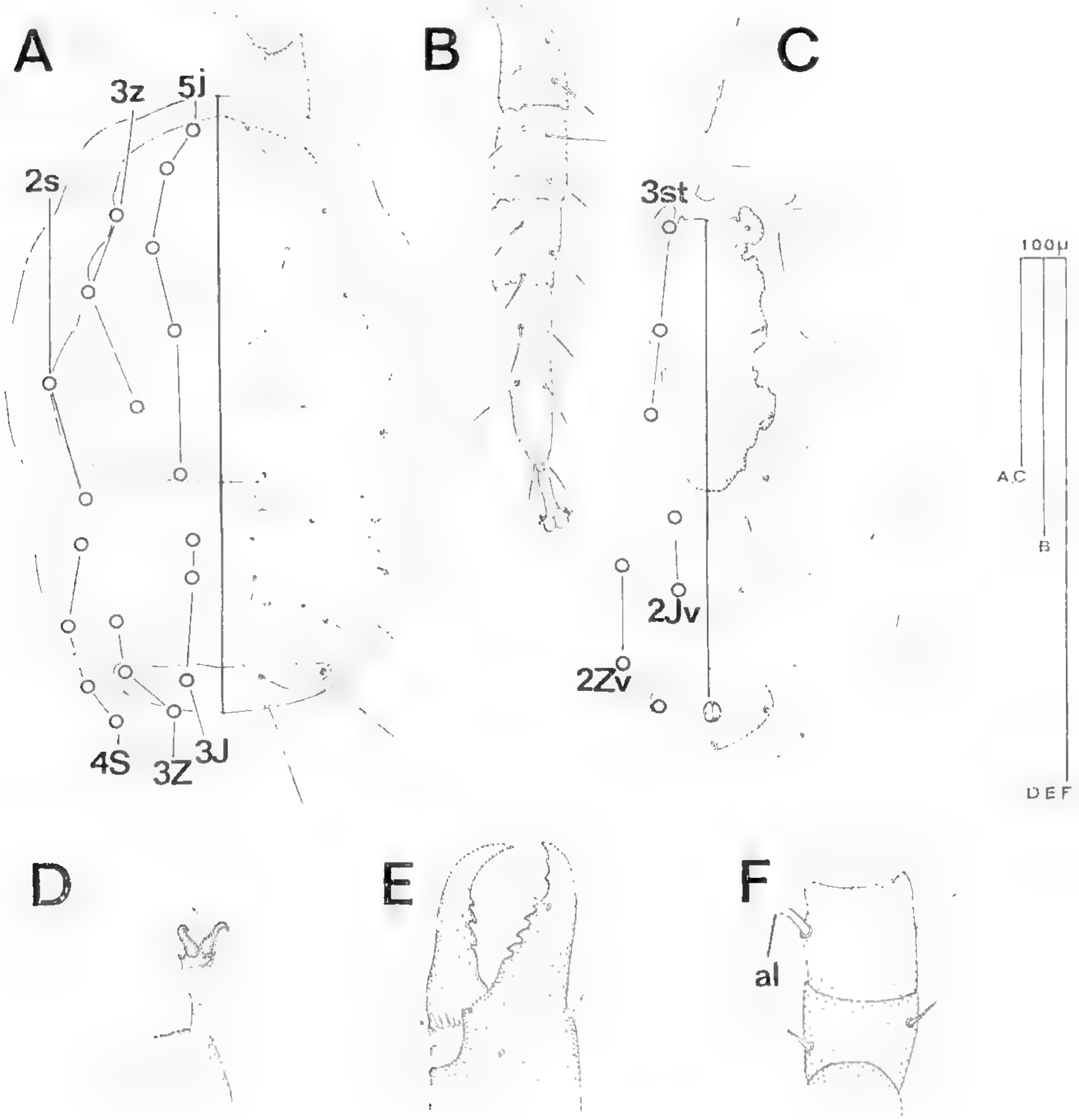

Fig. 3. *Gamasiphoides propinquus* (Womersley)

A-F, larva: A, soma, dorsum; B, leg III (part), dorsal setae; C, idiosoma, venter; D, pretarsus I; E, chelicera; F, palp femur and genu, venter.

LOCAL. *Summit Site*—5 normal-sized females (N1970145, N1970146, N1970150-N1970152), 4 normal-sized males (N1970147, N1970148, N1970153, N1970154) and 4 larvae (N1970159-N1970162), plant litter, 5.1968-1.1969; 2 small females (N1970142 and N1970143) and 1 small male (N1970144), plant litter, 2-4.1969.

REMARKS. Most of the above specimens are indistinguishable from the types of *G. gamasiphoides*, collected from Belair National Park about 8 km south of the Summit Site, and from specimens described by Lee (1970,

p. 63), collected higher up Mount Lofty than the Summit Site. Specimens only distinguishable by their smaller size were collected at the end of the summer dry season, a period during which normal-sized adults have not, as yet, been found.

Subfamily OLOGAMASINAE Ryke, 1962

Tribe OLOGAMASINI

Genus ATHIASELLA Lee, n.gn.

Heydeniella Richters, *dentata*-complex: Lee, 1970, p. 101.

Type-species: *Hydrogamasus dentatus* Womersley, 1942.

DIAGNOSIS. Small to large mites. Holonotal shield. Ventro-anal shield of female discrete, while on male it is usually fused to the notal shield and always fused to peritrematal and expodal IV shields. Sterno-metasternal shield of female never fused to endopodal IV shield. Single pair of pre-endopodal shields. Twenty pairs of podonotal setae. Leg chaetotaxy may be normal for rhodacarids (as *Gamasellus*) but usually there is one less ventral seta on genu IV (2, 5/1, 1). On palp genu, seta *al*1 pectinate with at least 12 lateral prongs and seta *al*2 broadly cuneate in distal half. Dorsal setae all simple, tapering. Spermathecal access duct opens distally on dorsal surface of trochanter III. Spermadactyl is never conspicuously longer than the movable cheliceral digit and lies parallel to it. The male corniculus is slightly attenuated and on a raised base. On the male leg II at least setae *av* on the femur, genu and tibia are modified to spurs. Pretarsus I is pedunculate and conspicuously smaller than other pretarsi. Legs I and IV are long (0.90 or more of idiosomal length) and there is considerable variation in leg thickness (using breadth of genu: I is 0.65 or less of II; III is 0.85 or less of IV).

REMARKS. Nominate species of *Athiasella* were grouped (Lee, 1970) in the *dentata*-complex of *Heydeniella*. These species are however distinguishable from species of *Heydeniella* by the recognizable location of the orifice to the spermathecal access duct, the discrete female ventro-anal shield and the modification of seta *av* on the male tibia II to a spur.

Athiasella dentata (Womersley)

Hydrogamasus dentatus Womersley, 1942, p. 149.

Heydeniella dentata (Womersley): Lee, 1970, p. 105.

FEMALE. Not figured.

Measurements: idiosomal length—740 (14, 720-780); appendage lengths—*ch* 125, *pa* 270, *I* 750, *II* 570, *III* 520, *IV* 790; genu breadths—*pa* 35, *I* 42.5, *II* 82.5, *III* 47.5, *IV* 60.

MALE. Not figured.

LOCAL. *Summit Site*. *Foothills Site*—14 females (N1970163-N1970176), plant litter, 27.3.1969. *Plains Site*.

REMARKS. All stages of *A. dentata* from the Foothills Site have been described (Lee, 1970), and except for slight variations in their size are indistinguishable from specimens from the other sites. So far, specimens with a long "tooth" on trochanter IV (includes types) have only been collected on the Adelaide Plain or in the Mount Lofty Ranges. A form with a shorter "tooth" is found in the Flinders Ranges and the Hummock Ranges at localities 120-280 km north-west of the Foothills Site (Lee, 1970).

Athiasella relata (Womersley)

Hydrogamasus relatus Womersley, 1942, p. 151, not *Hydrogamasus relatus*: Womersley, 1956a, p. 530.

FEMALE. Not figured.

Measurements: idiosomal length—540 (8, 510-570); appendage lengths—*ch* 95, *pa* 205, *I* 540, *II* 390, *III* 345, *IV* 510; genu breadths—*pa* 27.5, *I* 30, *II* 50, *III* 32.5, *IV* 42.5.

MALE. Not figured.

Measurements: idiosomal length—540 (9, 520-550).

LOCAL. *Summit Site* and *Foothills Site*—8 females (N1970181-N1970188) and 9 males (N1970189-N1970197), moss or plant litter, 4-9.1968. *Plains Site*.

REMARKS. *A. relata* is similar to *A. dentata*, but smaller and the female lacks a conspicuous "tooth" on trochanter IV, while the male has a straight, needle-like spermadactyl (Womersley, 1942, fig. 6A). *A. relata* has only been previously recorded from Glen Osmond which is close to the Foothills Site. Specimens of an undescribed species from Taringa, Queensland, were incorrectly listed as belonging to *A. relata* by Womersley (1956a).

Genus GEOGAMASUS Lee, 1970

Geogamasus howardi Lee

Geogamasus howardi Lee, 1970, p. 96.

FEMALE. Not figured.

Measurements: idiosomal length—330 (10, 310-340); appendage lengths—*ch* 40, *pa* 125, *I* 300, *II* 220, *III* 180, *IV* 295; genu breadths—*pa* 15, *I* 17.5, *II* 33, *III* 22.5, *IV* 25.

MALE. Not figured.

Measurements: idiosomal length—310 (10, 300-320).

LOCAL. *Summit Site*—10 females (N1970198-N1970207) and 10 males (N1970208-N1970217), plant litter, 9.1968. *Foothills Site.*

REMARKS. The above specimens are slightly larger than the types from Mount Burr, about 400 km south of the Summit Site, which is the only other locality record of the species.

Geogamasus minimus Lee, n.sp.

FEMALE. Fig. 4; C.

Measurements: idiosomal length—260 (10, 250-270); appendage lengths—*ch* 25, *pa* 95, *I* 245, *II* 170, *III* 140, *IV* 200; genu breadths—*pa* 12.5, *I* 15, *II* 27.5, *III* 17.5, *IV* 22.5. Similar to *Geogamasus howardi* but two characters are conspicuously different. There is a broad strip of striated cuticle between the ventro-anal shield and the exopodal IV shield, which is subequal to the distance between the genital seta (*st*5) and the posterior margin of the genital shield. On genu IV there is no seta *pv*.

MALE. Fig. 4; B,D.

Measurements: idiosomal length—240 (10, 220-250). Similar to *G. howardi* but three male characters are conspicuously different. The spermadactyl has no elaborate hinge, although it can coil up. On trochanter II, seta *al* is enlarged, bent into an "L" shape and spatulate, but the distal limb is less than twice the length of the proximal limb. On tarsus II, the ridge that is regarded as homologous to seta *ad*3 borders a conspicuous ventro-lateral depression.

LOCAL. *Summit Site*—holotype female (N1970218), allotype male (N1970219), 11 paratype females (N1970220-N1970230) and 11 paratype males (N1970231-N1970241), moss or plant litter, 1968-1969. *Foothills Site.*

REMARKS. *G. minimus* is smaller, and more like the only other nominal species of *Geogamasus* from Australia—*G. howardi*—than the South American species. *G. minimus* is unique in *Geogamasus* in having fewer leg setae than *Gamasellus*. Specimens from the Foothills Site are indistinguishable from those described.

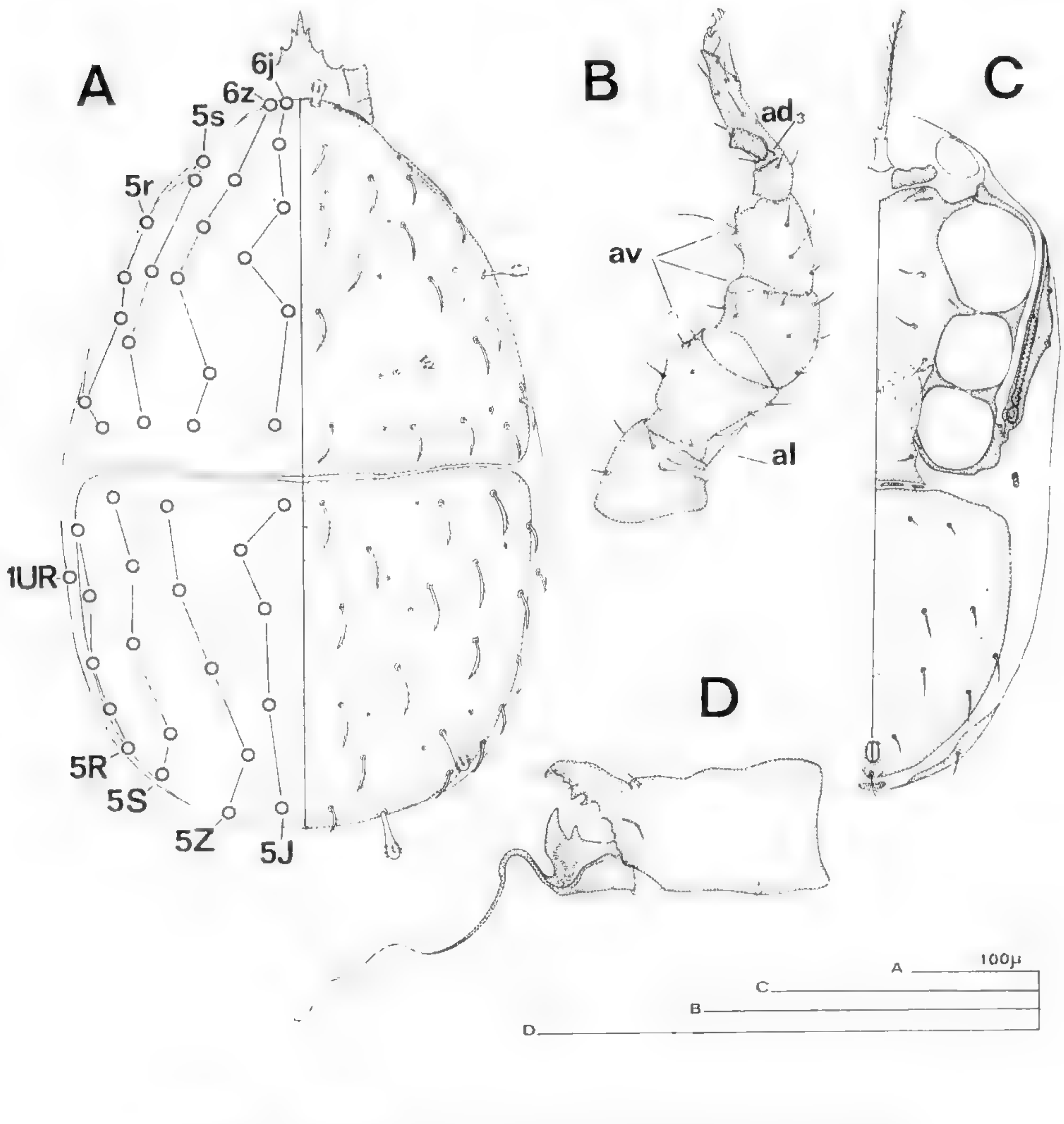

Fig. 4. *Gamasellus grossi* n.sp. and *Geogamasus minimus* n.sp.

A, *G. grossi*, female, soma, dorsum.

B-D, *G. minimus*: B, male leg II (part), antero-lateral; C, female idiosoma, ventral; D, male chelicera.

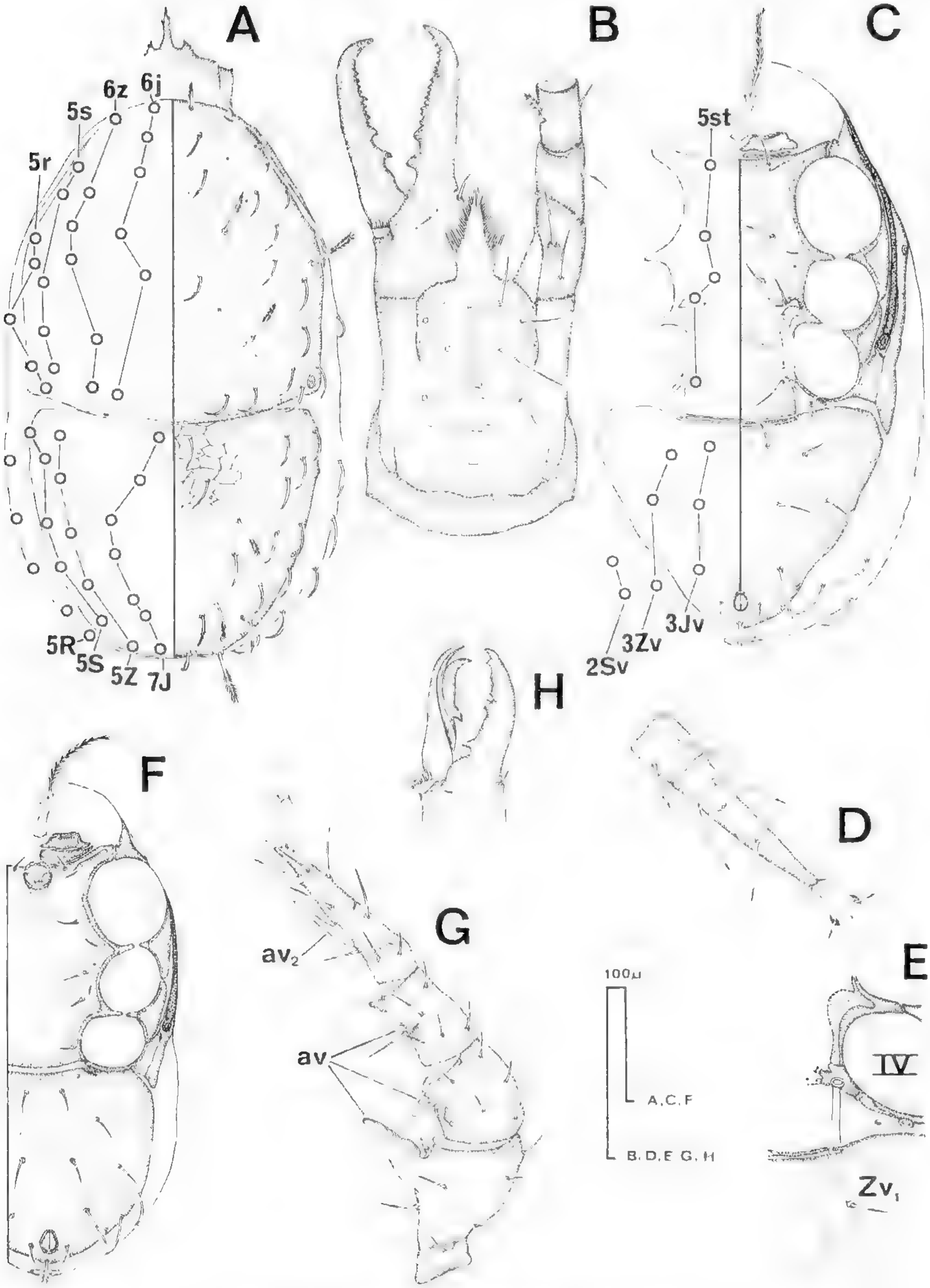

Fig. 5. *Gamasellus concinnus* (Womersley)

A-E, female: A, soma, dorsum; B, gnathosoma, venter; C, idiosoma, venter; D, tarsus IV, dorsal setae; E, region of acetabulum IV, showing spermathecal access tube.

F-H, male: F, idiosoma, venter; G, leg II (part), antero-lateral; H, chelicera.

Tribe GAMASELLINI Hirschmann, 1962
Genus GAMASELLUS Berlese, 1892
FALCIGER-complex

Gamasellus concinnus (Womersley)

?*Digamasellus concina* Womersley, 1942, p. 159.
Digamasellus concinna Womersley: Womersley, 1956a, p. 537.
Cyrtolaelaps concinnus (Womersley): Womersley, 1961, p. 194.

FEMALE. Fig. 5; A,B,C,D,E.

Measurements: idiosomal length—500 (10, 490-510); appendage lengths—*ch* 105, *pa* 180, *I* 550, *II* 400, *III* 340, *IV* 475; genu breadths—*pa* 25, *I* 27.5, *II* 52.5, *III* 37.5, *IV* 47.5. Three pairs of pre-endopodal shields; the anterior and posterior pairs are slim and inconspicuous, the former so much so that it was not noted in the original description. The peritrematal shield is separate from the ventro-anal shield; this agrees with original description but not with my examination of the holotype which has a narrow strip of shield connecting the posterior point of the peritrematal shield to the ventro-anal shield. There is a reduction in the extent of the opisthosomal shields so that the dorsal setae in row *R* and ventral seta *Zv*3 are on striated cuticle. Podonotal seta *z*1 is setose and inconspicuous, and not similar to *j*1 as originally described. Seta *al*1 on the palp genu has 6 lateral prongs. The dorsal setae on the tarsi are either setose or slightly lanceolate in contrast to most such setae on other Australian species in the *Gamasellus falciger*-complex which are conspicuously spatulate.

MALE. Fig. 5; F,G,H.

Measurements: idiosomal length—470 (10, 450-480). Posterior pair of pre-endopodal shields is as large as the central pair. The ventro-anal shield is fused to exopodal IV shield and is larger than on the female since it carries 2 more pairs of setae (*Zv*3 and *Sv*1). On leg II, setae *av* or *av*2 on the femur, genu, tibia and tarsus are modified to spurs; seta *pv* on the femur and genu are spine-like; and there are non-setous spurs on the genu and tibia.

LARVA. Fig. 7; A,B,C,D,E,F.

Measurements: idiosomal length—230 (10, 210-250). Seta *al* on palp genu is spine-like with 6 lateral prongs. Tectum anterior margin is basically trispinate with spinules, and central spine is longer than lateral spines. Sternal shield not clearly defined. Idiosomal setae are simple or, if long, faintly pilose. Opisthonotal seta *Z*3 (*Z*1 and *Z*2 are absent) is subequal to seta *Z*4. There are 12 or more teeth on fixed cheliceral digit.

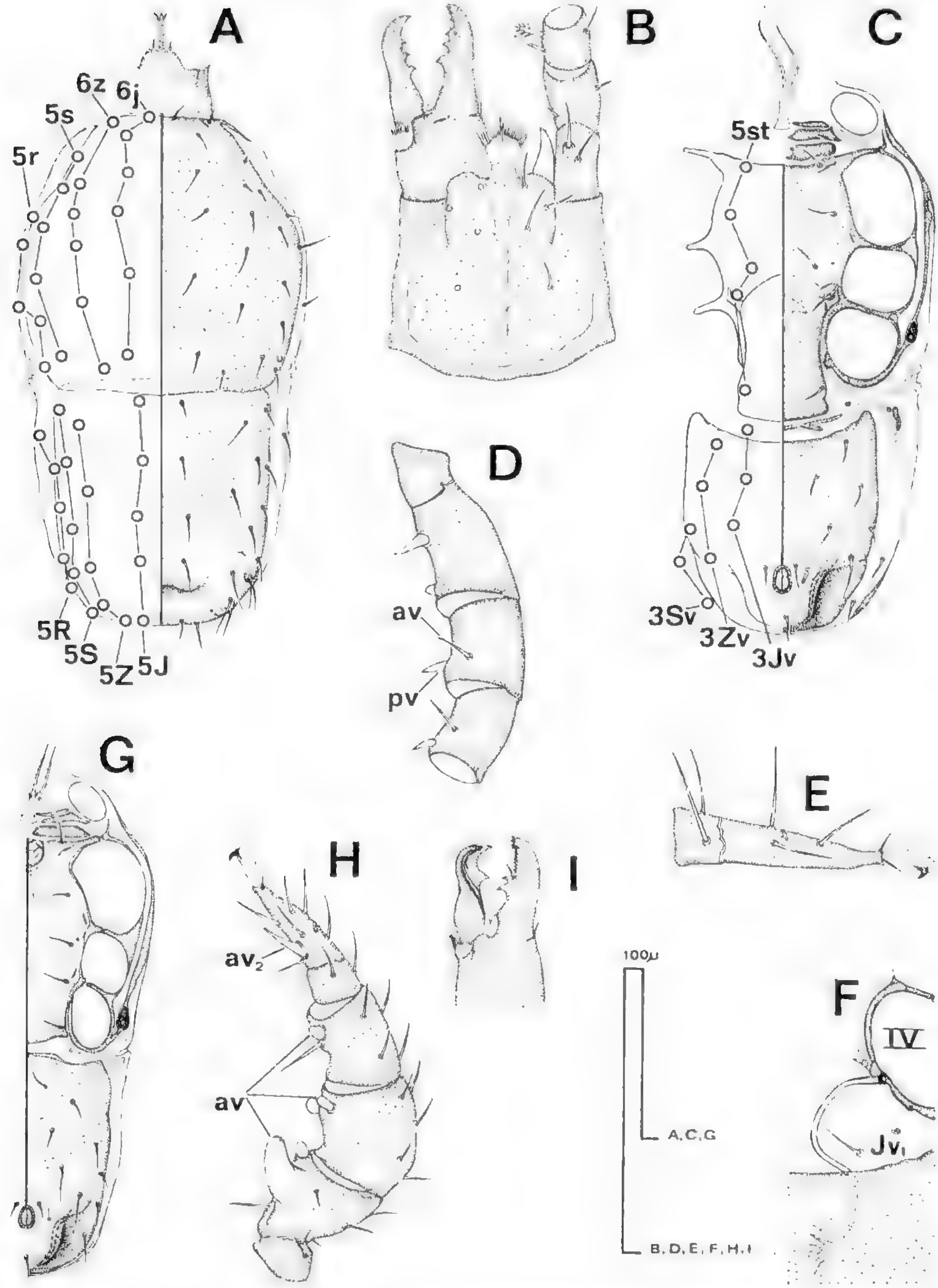

Fig. 6. *Gamasellus cophinus* n.sp.

A-F, female: A, soma, dorsum; B, gnathosoma, venter; C, idiosoma, venter; D, leg IV (femur-tibia), antero-lateral; E, tarsus IV, dorsal setae; F, region of acetabulum IV, showing spermathecal access tube.

G-I, male: G, idiosoma, venter; H, leg II (part), antero-lateral; I, chelicera.

LOCAL. *Summit Site*—10 females (N1970244-N1970253), 10 males (N1970254-N1970263), larva containing protonymph (N1970264) and 16 other larvae (N1970265-N1970280), moss or plant litter, 1968 and 1969. *Foothills Site*.

REMARKS. The above specimens are indistinguishable from the holotype female (N1970242) and allotype male (N1970243) collected from Belair National Park (the only other locality record of this species) about 8 km south of the Summit Site, except that the peritrematal shield on the female is separate from the ventro-anal shield. The unequal leg proportions of *G. concinnus* resemble those of *Athiasella* rather than of characteristic species of *Gamasellus* (e.g., *G. tragardhi*) in which the legs are subequal in size. The larva is easily distinguished from the rhodacarid larvae collected near Adelaide by its large number of cheliceral teeth.

Gamasellus cophinus Lee, n.sp.

FEMALE. Fig. 6; A,B,C,D,E,F.

Measurements: idiosomal length—310 (10, 290-310); appendage lengths—*ch* 45, *pa* 90, *I* 265, *II* 180, *III* 160, *IV* 220; genu breadths—*pa* 15, *I* 20, *II* 27.5, *III* 20, *IV* 27.5. The distribution of ventral idiosomal shields is similar to other members of the *falciger*-complex, but less extensive in that the peritrematal shield is slim, and the ventro-anal shield does not extend laterally to merge with the metapodal shield nor anteriorly to carry seta *Jv*1. The chaetotaxy is as for the *falciger*-complex except on the opisthosoma where the homologies are not clear (possibly the extra seta in row *Sv* is homologous with the seta previously labelled UR1—see Lee, 1970, fig. 281). Seta *al*1 on the palp genu has 6 lateral prongs as in *Gamasellus concinnus*, but the prongs are proportionately larger. The idiosoma is dorso-ventrally flattened and sub-rectangular in outline. At the posterior end of the opisthosoma there is a ridge on both the dorsal and ventral shields. The ventral ridge is the most heavily sclerotized and convoluted. *G. cophinus* is unique within the genus in having only setose dorsal setae on the adult with no recognizable adhesive exudate on the notum. Leg IV is large and has a number of stout, spine-like ventral setae.

MALE. Fig. 6; G,H,I.

Measurements: idiosomal length—280 (10, 270-290). The ventro-anal shield extends further forward than in the female so that it carries seta *Jv*1, but there is still a substantial strip of striated cuticle between it and the ventral shields on the podosoma. The spermadactyl lies close to the movable cheliceral digit, but distally to the single tooth they are separated. On leg II, setae *av* on the femur, genu, tibia, seta *av*2 on the tarsus, seta *pv*1 on the femur and seta *pv* on the genu are enlarged into spurs or spines.

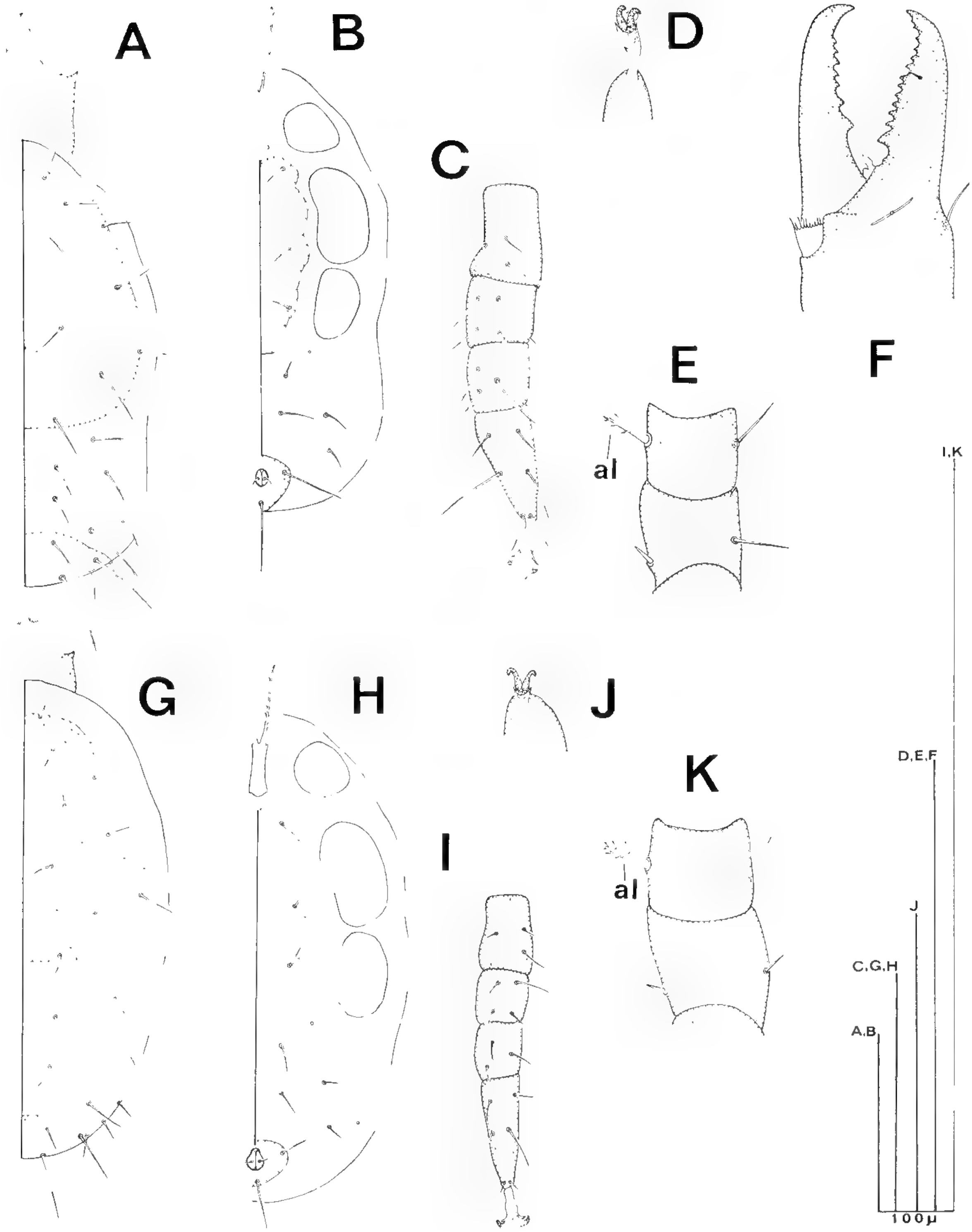

Fig. 7. *Gamasellus* larvae

A-F, *G. concinnus* Womersley: A, soma, dorsum; B, idiosoma, venter; C, leg IV (part), dorsal setae; D, pretarsus I; E, palp femur and genu, venter; F, chelicera.

G-K, *G. cophinus* n.sp.: G, soma, dorsum; H, idiosoma, venter; I, leg IV (part), dorsum; J, pretarsus I; K, palp femur and genu venter.

LARVA. Fig. 7; G,H,I,J,K.

Measurements: idiosomal length—210 (1). Seta *al* on palp genu is spine-like with 6 lateral prongs. Tectum anterior margin is basically trispinate with numerous spinules, and the central spine is longer than lateral spines although the spines are not so well developed as in *Gamasellus concinnus*. Idiosomal shields not clearly defined. Idiosomal setae are simple. Opisthonotal seta *Z3* (*Z1* and *Z2* are absent) is about half as long as seta *Z4*. There are 4 or 5 teeth on fixed cheliceral digit.

LOCAL. *Summit Site*—holotype female (N1970281), allotype male (N1970282), 14 paratype females (N1970283-N1970296) and 9 paratype males (N1970297-N1970305), moss, 7.6.1968-12.9.1968. The morphotype larva (N1970306) was bred from adults from Summit Site, moss, 9.8.1968. *Foothills Site*.

REMARKS. *G. cophinus* is an atypical species of *Gamasellus*: I group it in the *falciger*-complex because of the distribution of idiosomal shields (especially the 3 pairs of pre-endopodal shields), the chaetotaxy, the location of a conspicuous spermathecal access duct, the spine-like seta *av2* on the male tarsus II and the pronged seta *al1* on the palp genu which is similar to the homologous seta on *G. concinnus*. Attributes dissimilar to those of other species of *Gamasellus* are regarded as having evolved relatively recently, being adaptive to living in the narrow pore spaces of the more mineral soil layers. Such attributes are the dorso-ventral flattening of the idiosoma, with no fusion between the podosomal and opisthosomal shields in the male as well as the female, the short, simple idiosomal setae and the large, spiny leg IV. I regard the resemblance of *G. cophinus* to the type of species of *Rhodacaroides* as superficial. Specimens from the Foothills Site are indistinguishable from those described.

Gamasellus grossi Lee, n.sp.

FEMALE. Fig. 4; A.

Measurements: idiosomal length—550 (2s, 540-560): appendage lengths—*ch* 55, *pa* 130, *I* 365, *II* 310, *III* 295, *IV* 420; genu breadths—*pa* 25, *I* 42.5, *II* 50, *III* 40, *IV* 42.5. On the notum only 3 pairs of podonotal setae (*j1*, *z5* and *r2*) and 2 pairs of opisthonotal seta (*Z5* and *S4*) are pilose and spatulate, standing out at right angles to the cuticle.

MALE. Not figured.

Measurements: idiosomal length—520 (3, 510-530).

LOCAL. *Coastal Site*—holotype female (N1970307), allotype male (N1970308), paratype female (N1970309) and 2 paratype males (N1970310 and N1970311), moss, 10.6.1965.

REMARKS: *G. grossi* is very similar to two other species of *Gamasellus* from South Australia: *G. tragardhi* and *G. cooperi*. *G. grossi* can be distinguished from these species by the number of pilose and spatulate dorsal setae. Otherwise it is so similar to *G. tragardhi* (see Lee, 1970, p. 135) that a complete description has not been given. *G. grossi* has also been collected from Eyre Peninsula, South Australia—2 females (N19715 and N19716) and 2 males (N19717 and N19718), moss, Mount Wedge, col. G. F. Gross, 26.9.1964.

Gamasellus tragardhi (Womersley)

?*Digamasellus tragardhi* Womersley, 1942, p. 161.

Cyrtolaelaps tragardhi (Womersley): Womersley, 1961, p. 194.

Gamasellus tragardhi (Womersley): Lee, 1970, p. 135.

FEMALE. Not figured.
Measurements: idiosomal length—640 (10, 620-670); appendage lengths—*ch* 60, *pa* 150, *I* 390, *II* 345, *III* 320, *IV* 450; genu breadths—*pa* 25, *I* 52.5, *II* 60, *III* 47.5, *IV* 50.

MALE. Not figured.
Measurements: idiosomal length—620 (10, 560-660).

LOCAL. *Summit Site*—10 females (N1970312-N1970321) and 10 males (N1970322-N1970331), plant litter, 16.8.1968. *Foothills Site*.

REMARKS. *G. tragardhi* is also recorded from Adelaide, Bridgewater (about 6 km southeast of the Summit Site) and near Wilmington (about 280 km north of Summit Site). The specimens from the Summit and Foothills Sites are indistinguishable from the types.

Genus ACUGAMASUS Lee, 1970

PUNCTATUS-complex

Acugamasus punctatus (Womersley)

?*Digamasellus punctatus* Womersley, 1942, p. 160.

Cyrtolaelaps punctatus (Womersley): Womersley, 1961, p. 194.

FEMALE. Not figured.
Measurements: idiosomal length—605 (4, 560-630); appendage lengths—*ch* 105, *pa* 180, *I* 550, *II* 425, *III* 385, *IV* 500; genu breadths—*pa* 27.5, *I* 42.5, *II* 55, *III* 45, *IV* 47.5.

MALE. Not figured.
Measurements: idiosomal length—580 (5, 560-600).

LOCAL. *Summit Site*—4 females (N1970332-N1970335) and 5 males (N1970336-N1970340), plant litter, 10.4.1969.

REMARKS. *A. punctatus* is also recorded from Adelaide and the Belair National Park about 8 km south of the Summit Site. The specimens from the Summit Site are indistinguishable from the holotype female (N1970341) and the allotype male (N1970342).

Acugamasus elachyaspis Lee, n.sp.

FEMALE. Fig. 8; A,B,C,D,E.
Measurements: idiosomal length—470 (3, 460-480); appendage lengths—*ch* 85, *pa* 170, *I* 505, *II* 350, *III* 305, *IV* 400; genu breadths—*pa* 25, *I* 30, *II* 37.5, *III* 30, *IV* 32.5. The idiosomal shields are distributed as on other females of the *punctatus*-complex, but they are the least extensive, for example the opisthonotal shield is so narrow that it only carries setal row *J* and *Z* and one seta from row *S*. The chaetotaxy only differs from other species in the *punctatus*-complex in having 4 setae in row *UR*. None of the setae on the idiosoma and legs are spatulate and only a few are pilose. No spermatheceal access duct is visible (the structure on the adaxial edge of acetabulum IV—fig. 8C—is the genital apodeme and attached muscles).

MALE. Fig. 8; F,G,H.
Measurements: idiosomal length—430 (2, 420 and 440). The distribution of idiosomal shields is as on the female except on the venter of the podosoma. This contrasts with other Australian members of the *punctatus*-complex in which the males have a section of the podonotal shield, carrying at least setae *r*2 and *r*4, that is split away posteriorly from the rest of the shield and fused to the peritrematal shield. Seta *st*5 is on striated cuticle. The spermadactyl is short and twists under the movable cheliceral digit so its spatulate tip lies close to the adaxial surface of the digit. On leg II, setae *av* on the femur, genu and tibia are enlarged into spurs while setae *pv*1 on the femur and *pv* on the genu are spine-like.

LOCAL. *Coastal Site*—holotype female (N1970343), allotype male (N1970344), 2 paratype females (N1970345 and N1970346) and 1 paratype male (N1970347), moss, col.: M. Fagg, 23.5.1965.

REMARKS. *A. elachyaspis* is the smallest species in the *punctatus*-complex, has the simplest setae and is the most sparsely covered by shields.

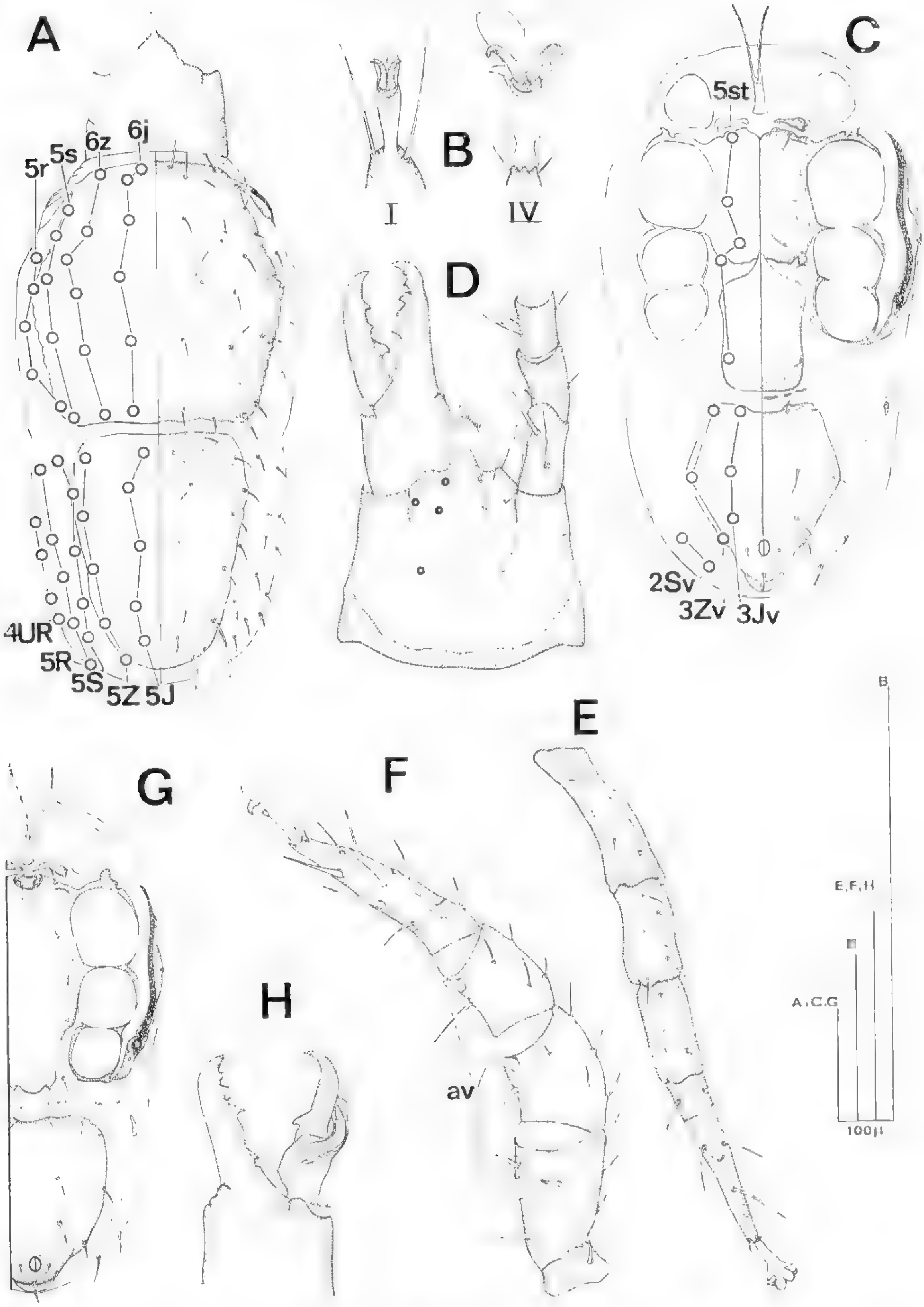

Fig. 8. *Acugamasus elachyaspis* n.sp.

A-E, female: A, soma, dorsum; B, pretarsi I and IV; C, idiosoma, venter; D, gnathosoma, venter; E, leg IV (part), dorsal setae.

F-H, male: F, leg II (part), antero-lateral; G, idiosoma, venter; H, chelicera.

Acugamasus semipunctatus (Womersley)

?*Digamasellus semipunctatus* Womersley, 1942, p. 163.

Digamasellus semipunctatus Womersley: Womersley, 1956a, fig. 20.

FEMALE. Not figured.

Measurements: idiosomal length—725 (4, 700-760); appendage lengths—*ch* 135, *pa* 240, *I* 710, *II* 480, *III* 450, *IV* 620; genu breadths—*pa* 30, *I* 55, *II* 65, *III* 52.5, *IV* 55. Opisthonotal shield is reticulated and the podonotal shield is rugose, but neither shield has the raised punctations that are characteristic of the notal shields of *A. punctatus*.

MALE. Not figured.

Measurements: idiosomal length—670 (4, 650-690). On leg II, setae *av* on the femur, genu and tibia are modified to spurs, while seta *pv*1 on the femur and seta *pv* on the genu are spine-like. There is a non-setous spur on the antero-lateral surface of genu II.

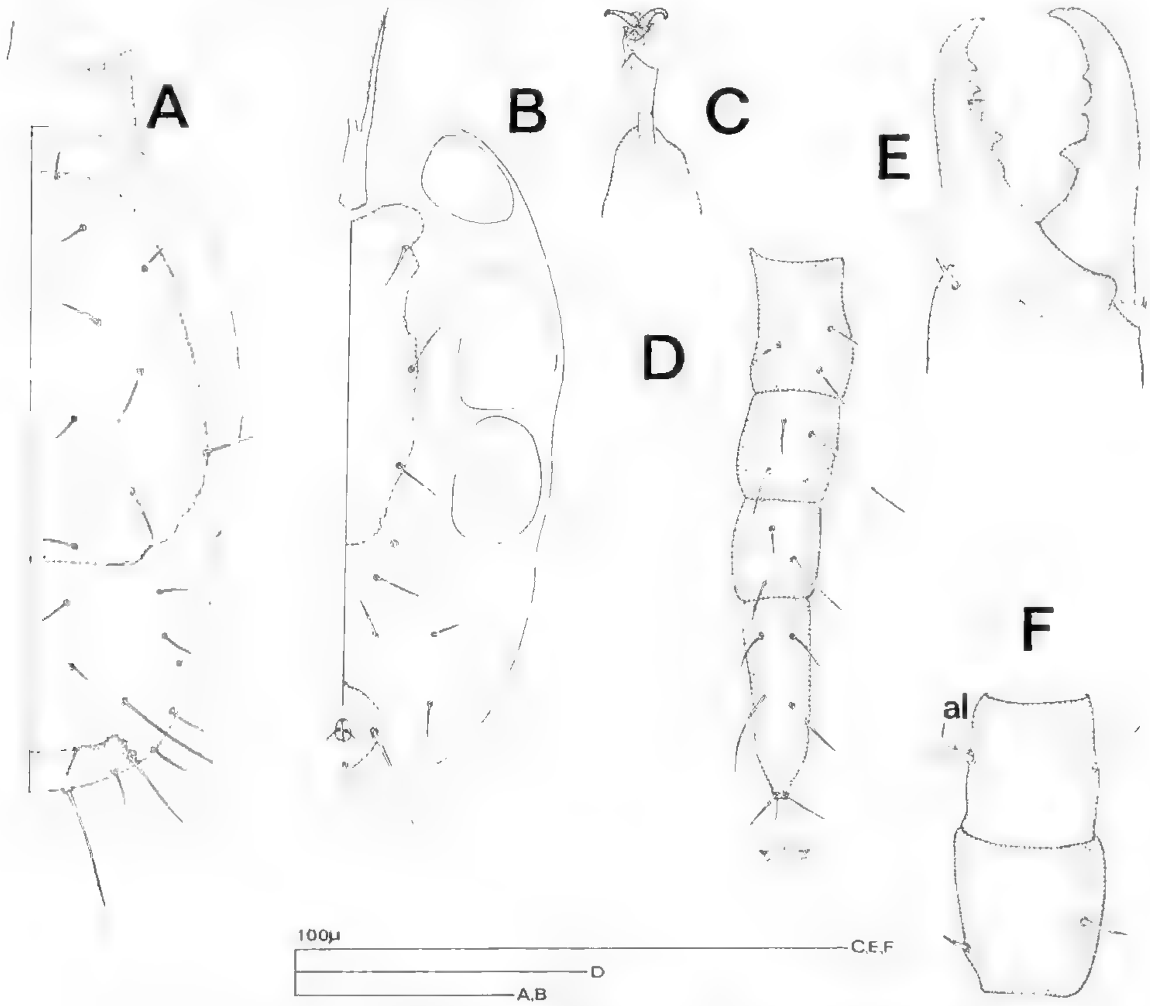

Fig. 9. *Acugamasus semipunctatus* (Womersley) larva
A, soma, dorsum; B, idiosoma, venter; C, pretarsus I; D, leg III (part), dorsal setae; E, chelicera; F, palp femur and genu, venter.

LARVA. Fig. 9; A,B,C,D,E,F.

Measurements: idiosomal length—340 (3, 320-360). Seta *al* on palp genu is lanceolate with one basal prong as in the adult. Tectum anterior margin is basically trispinate with numerous spinules, and central spine is longer than lateral spines. Idiosomal shields clearly defined. Idiosomal setae simple. Opisthonotal seta *Z3* (*Z1* and *Z2* are absent) subequal in length to seta Z4.

LOCAL. *Summit Site*—larva (N1970397), litter, 24.4.1969 and larva (N1970398) bred from adults from this Site. *Foothills Site*—4 females (N1970350-N1970353) and 4 males (N1970354-N1970357), moss, 24.5.1968, and larva (N1970399) containing protonymph, moss, 5.8.1968.

REMARKS. *A. semipunctatus* is the largest species in the *punctatus*-complex. Its name is misleading, since it does not bear any notal punctations similar to those on *A. punctatus.* Womersley (1942) describes these punctations on the podonotal shield, but has drawn this shield as being rugose. The females from the Summit and Foothills Sites are indistinguishable from the holotype female (N1970348), moss, Bridgewater (about 6 km south-east of the Summit Site). A male (N1970349) labelled "allotype", moss, Muston, Kangaroo Island (about 65 km south-west of the Summit Site and separated from the mainland by 11 km of sea) is probably the specimen drawn by Womersley (1956a) with no text description. This male differs from those from near Adelaide in not having a non-setous spur on genu II, but is otherwise indistinguishable.

Genus HINIPHIS Lee, 1970

Hiniphis bipala n.sp.

FEMALE. Fig. 10; A,B,C,D.

Measurements: idiosomal length—300 (3, 300); appendage lengths—*ch* 35, *pa* 100, *I* 205, *II* 185, *III* 140, *IV* 190; genu breadths—*pa* 15, *I* 20, *II* 27.5, *III* 17.5, *IV* 17.5. The notal shield is divided in two. The metasternal shield is fused to the endopodal IV shield. The dorsal and ventral shields are widely separated by striated cuticle except for the narrow anterior fusion of the peritrematal and podonotal shields. Exopodal III shield is not split. The idiosomal chaetotaxy is as for *Hiniphis hinnus* except that there are 3 setae in row *Sv*. Leg chaetotaxy is normal for rhodacarids (as

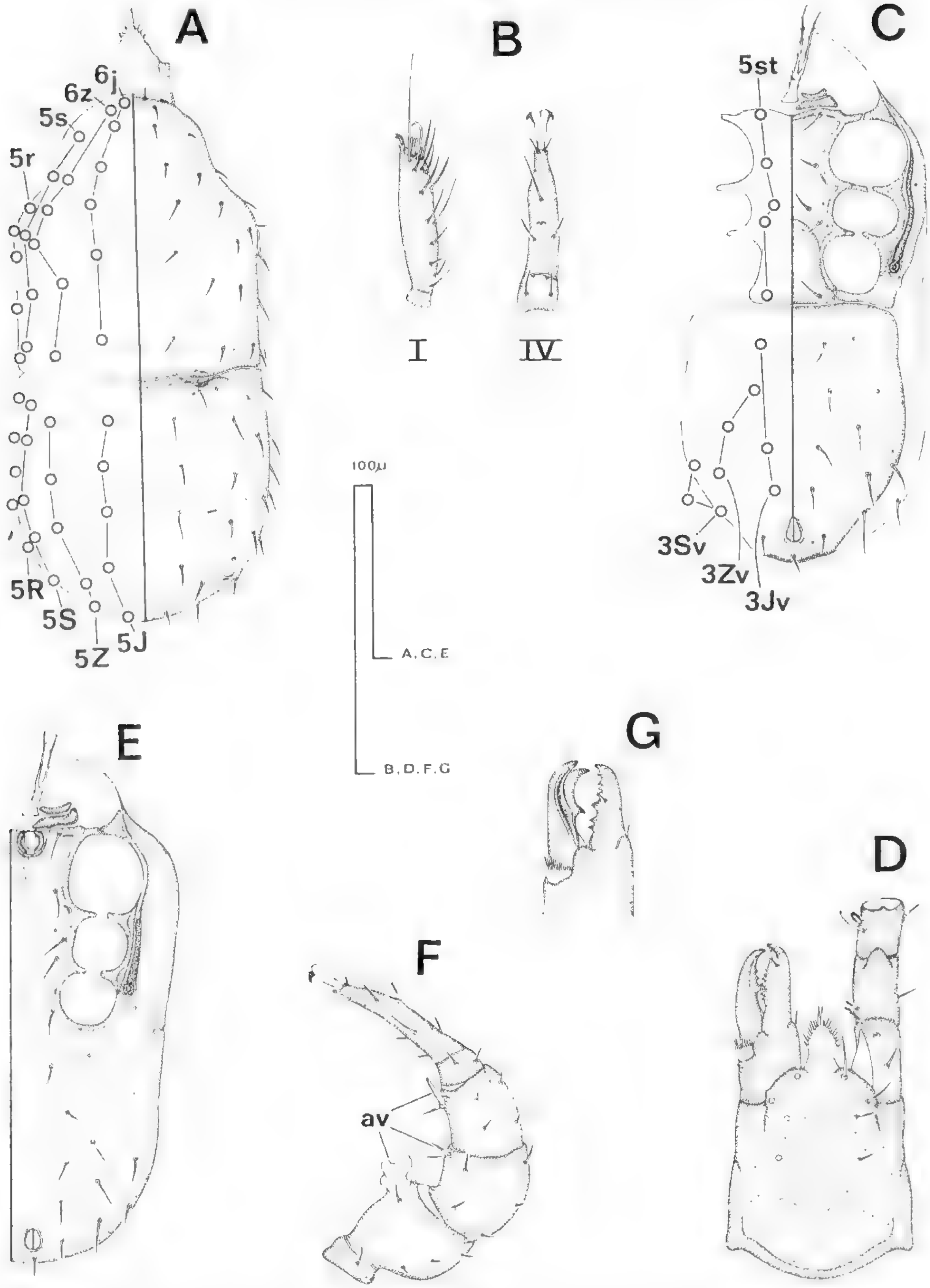

Fig. 10. *Hiniphis bipala* n.sp..

A-D, female: A, soma, dorsum; B, tarsi I and IV, dorsal setae; C, idiosoma, venter; D, gnathosoma, venter.

E-G, male: E, idiosoma, venter; F, leg II (part), antero-lateral; G, chelicera.

Gamasellus). On the palp genu, seta *al*1 is spine-like with about 4 pairs of short, fine lateral prongs. On the palp femur there is a conspicuous non-setous tubercle near the ventro-distal edge. There is a pair of conspicuous pits near the anterior margin of the opisthonotal shield. No recognizable spermathecal access duct.

MALE. Fig. 10: E,F,G.

Measurements; idiosomal length—290 (2, 280-300). Idiosoma is encased in a single continuous shield with a dorsal split, except for the discrete pre-endopodal and anterior exopodal shields. The spermadactyl lies close to the movable cheliceral digit but distally to the single tooth they are separated. There is a tubercle on the palp femur similar to that of the female. On femur II, seta *av* is enlarged to a lumpy tubercle and seta *pv*1 is modified to a small, globular tubercle. Seta *av* on tibia II is spine-like, but seta *av* on genu II is only very slightly stouter than the other setae.

LOCAL. *Summit Site*—holotype female (N1970358), allotype male (N1970359), 2 paratype females (N1970360 and N1970361) and one paratype male (N1970362), plant litter, 5 or 12.8.1968.

REMARKS. *H. bipala* is the only species allotted to *Hiniphis* other than the type (*H. hinnus*). The males of these two species are similar, but the distribution of idiosomal shields on the females differ in that the dorsal shields are extensively fused to the ventral shields of *H. hinnus*. On the other hand females of both species have two attributes (fusion of the metasternal and endopodal IV shields, and separate podonotal and opisthonotal shields) not found together on other females of Ologamasinae, although they occur together in *Euepicrius* (Gamasiphinae) and *Onchogamasus virguncula* (Sessiluncinae).

Genus RHODACAROIDES Willmann, 1959

Rhodacaroides minyaspis Lee, n.sp.

FEMALE. Fig. 11; A,B,C,D.

Measurements: idiosomal length—300 (5, 300-310); appendage lengths—*ch* 80, *pa* 115, *I* 310, *II* 250, *III* 220, *IV* 280; genu breadths—*pa* 25, *I* 25, *II* 27.5, *III* 25, *IV* 32.5. The extent of the idiosomal shields is unusually reduced; only part of setal row *J* and *Z* are on the opisthonotal shield; the peritrematal shield hardly exists; there is no ventral shield so that setae in row *Jv* and *Zv* are on striated cuticle. The dorsal chaetotaxy of the idiosoma is reduced, with only 12 pairs of setae on the opisthonotum. Leg chaetotaxy is normal for rhodacarids (as *Gamasellus*). On the palp genu, seta *al*1 is spine-like with 4 prongs on one side and 2 prongs on the other side. On the palp femur there is a small, non-setous tubercle on the mid-ventral surface. No spermathecal access duct is visible. Pretarsus I is absent.

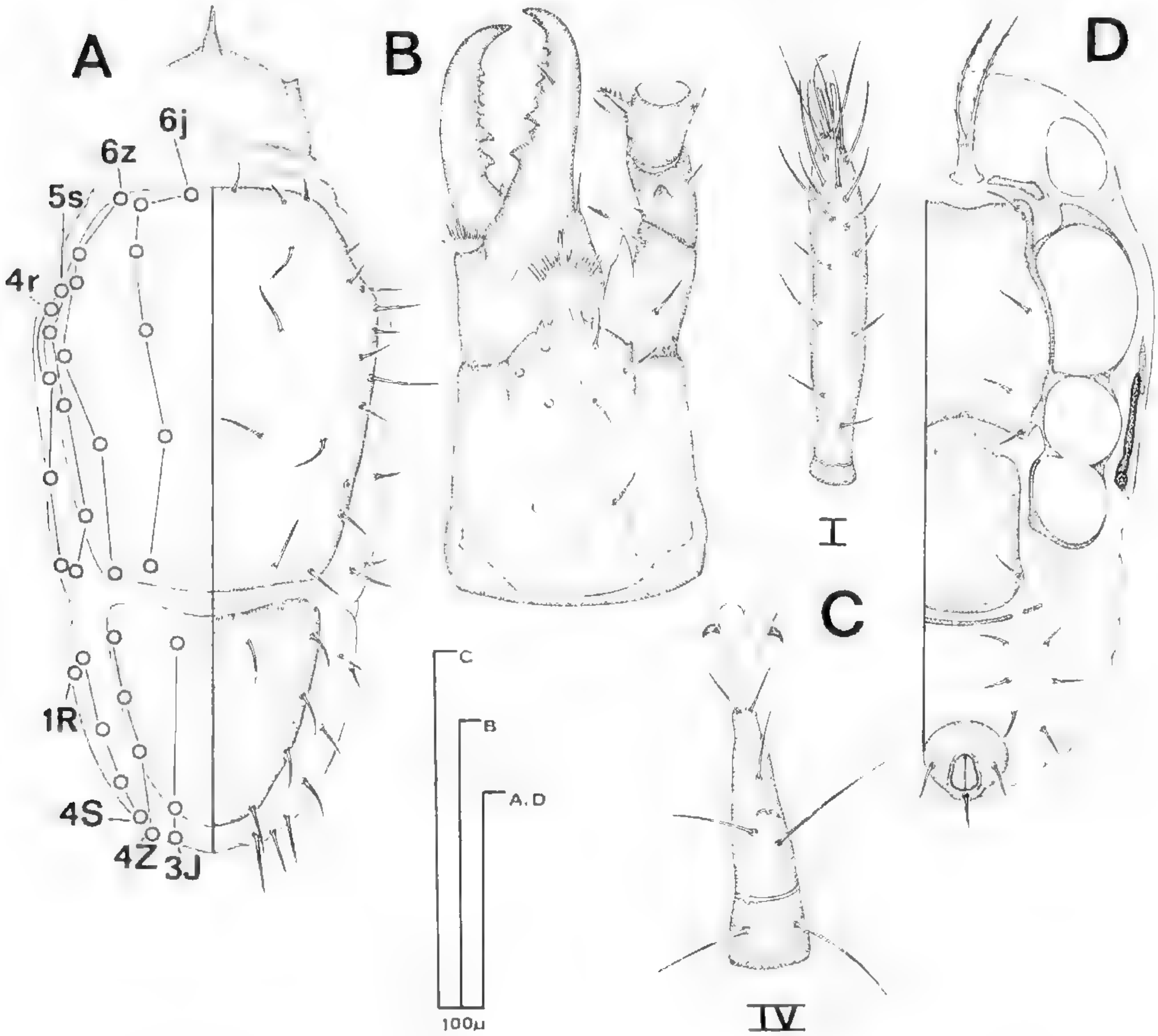

Fig. 11. *Rhodacaroides minyaspis* n.sp., female
A, soma, dorsum; B, gnathosoma, venter; C, tarsi I and IV, dorsal setae; D, idiosoma, venter.

MALE. Not known.

LOCAL. *Summit Site*—holotype female (N1970363) and 4 paratype females (N1970364-N1970367), plant litter, 12.8.1968 (holotype) or 10 or 24.4.1969.

REMARKS. *R. minyaspis* is unique amongst rhodacarids in having only an anal shield on the venter of the opisthosoma. Because I have no males of this species it is tentatively grouped in *Rhodacaroides*. There are 3 nominal species in the genus, and *R. minyaspis* is more similar to *R. costai* from South America than to the type (*R. aegyptiacus*) from Egypt.

Genus SOLUGAMASUS Lee, n.gn.

Type-species: *Solugamasus mustela* Lee, n.sp.

DIAGNOSIS. Small mites. Separate podonotal and opisthonotal shields. Ventro-anal shield discrete in both sexes. Sterno-metasternal shield of female never fused to endopodal IV shield. Two pairs of pre-endopodal shields (in series rather than parallel). Twenty-two pairs of podonotal setae. Leg chaetotaxy is normal for rhodacarids (as *Gamasellus*). On palp genu, seta *al*1 has two pairs of lateral prongs and seta *al*2 is lanceolate. Dorsal setae all simple, tapering. Location of spermathecal access duct is unknown. The spermadactyl is strongly recurved. On the male leg II at least setae *av* on the femur, genu and tibia are modified to spurs. Pretarsus I sometimes absent. Legs I and IV are long (0.9 or more of idiosomal length) and there is medium variation in leg thickness) using breadth of genu: I is approximately 0.8 of II; III is approximately 0.75 of IV).

REMARKS. *Solugamasus* is similar to *Rhodacaroides*, but I recognize it as a distinct genus because of the strongly recurved spermadactyl in the male. A recurved spermadactyl occurs in widely differing rhodacarid genera such as *Rhodacarus*, *Pyriphis* and *Sessiluncus* but its occurrence never varies within a genus. The female of the only nominal species in *Solugamasus* is easily distinguished from the 3 nominal species of *Rhodacaroides* by, among other attributes, its unusually short idiosomal setae. On the other hand, I do do not specify any female attributes as distinguishing these two genera.

Solugamasus mustela Lee, n.sp.

FEMALE. Fig. 12; A,B,C,D.

Measurements: idiosomal length—290 (7, 270-300); appendage lengths—*ch* 50, *pa* 90, *I* 280, *II* 240, *III* 200, *IV* 290; genu breadths—*pa* 17.5, *I* 20, *II* 25, *III* 20, *IV* 27.5. The extent of the idiosomal shields is reduced so that setae *r*3, *r*4, *R*1 and *Zv*1 are on striated cuticle. The opisthonotal chaetotaxy is reduced to 12 pairs of setae. On the palp genu, seta *al*1 has two pairs of lateral prongs very near the tip. On the palp trochanter, seta *av* is spine-like and set on a tubercle. The idiosomal setae are simple and very short. Pretarsus I is absent.

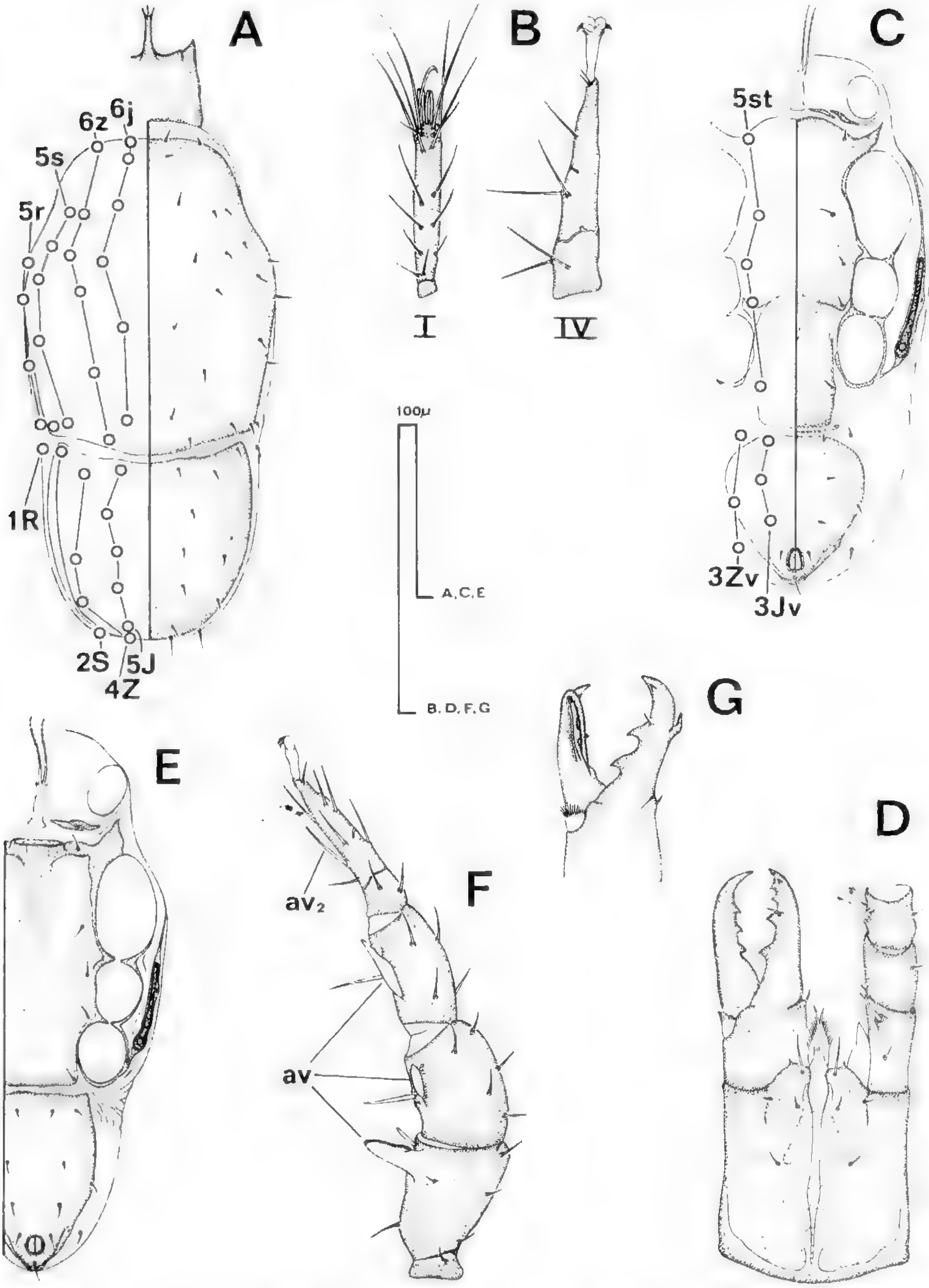

Fig. 12. *Solugamasus mustela* n.sp..
A-D, female: A, soma, dorsum; B, tarsi I and IV, dorsal setae; C, idiosoma, venter; D, gnathosoma, venter.
E-G, male: E, idiosoma, venter; F, leg II (part), antero-lateral; G, chelicera.

MALE. Fig. 12; E,F,G.

Measurements: idiosomal length—270 (3, 270-280). The distribution of idiosomal shields is similar to the female, but the anterior shoulders of the ventro-anal shield extend forward to carry seta *Zv*1. The spermadactyl is strongly recurved and there is a small dorsal process on the fixed digit. On leg II, seta *av* on the femur, genu and tibia are enlarged into spurs while some other ventral setae are long and spine-like.

LOCAL. *Foothills Site*—holotype female (N1970368), allotype male (N1970369), 6 paratype females (N1970370-N1970375) and 2 paratype males (N1970376 and N1970377), moss and plant litter, 9.5.1968-30.1.1969.

REMARKS. See remarks on genus.

Subfamily SESSILUNCINAE Lee, 1970

Genus ANTENNOLAELAPS Womersley, 1956b

Antennolaelaps aremenae Lee, n.sp.

FEMALE. Fig. 13; A,B,C,D,E.

Measurements: idiosomal length—745 (3, 720-760); appendage lengths—*ch* 75, *pa* 210, *I* 870, *II* 570, *III* 525, *IV* 730; genu breadths—*pa* 32.5, *I* 55, *II* 75, *III* 52.5, *IV* 55. Horizontal outline of idiosoma is nearly parallel-sided. The pre-endopodal shields lie very close to the sterno-metasternal shield but are probably separate from it. The opisthonotal chaetotaxy is reduced to 15 pairs of setae (as *Antennolaelaps testudo*). Leg chaetotaxy is normal for rhodacarids (as *Gamasellus*). On the palp genu, seta *al*1 has 4 pairs of lateral prongs, and seta *al*2 is lanceolate. On the gnathosoma, the fourth hyposternal seta is pilose. The idiosomal setae are all simple and some podonotal setae are very small. Pretarsus I is pedunculate.

MALE. Fig. 13; F,G,H.

Measurements: idiosomal length—690 (4, 670-710). Ventro-anal shield is not fused to the sternito-genital or exopodal IV shield; on the other hand it is more extensive than in the female so that posteriorly there is hardly any striated cuticle between it and the notal shield. The tectum bears an extra pair of spinules on the central spine that are not present on the females.

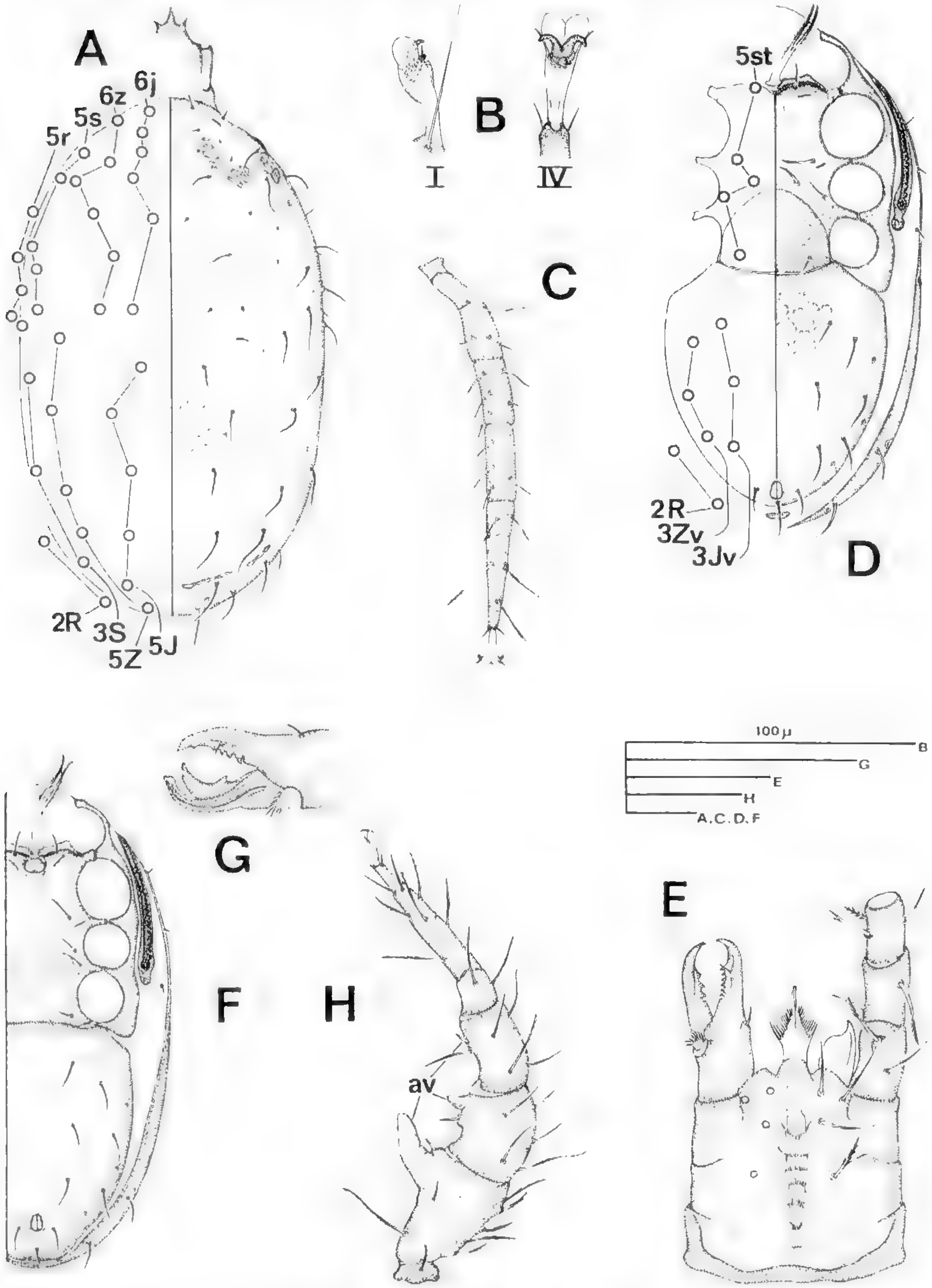

Fig. 13. *Antennolaelaps aremenae* n.sp..
A-E, female: A, soma, dorsum; B, pretarsi I and IV; C, leg IV (part), dorsal setae; D, idiosoma, venter; E, gnathosoma, venter.
F-H, male: F, idiosoma, venter; G, chelicera; H, leg II (part), antero-lateral.

The spermadactyl is of similar shape to the movable cheliceral digit except that the tip is almost spatulate. On leg II, setae *av* on the femur and genu are enlarged into spurs, while seta *av* on the tibia is spine-like.

LOCAL. *Summit Site*—allotype male (N1970380), 2 paratype females (N1970381 and N1970382) and 3 paratype males N1970383-N1970385), moss or plant litter, 9.5.1968-12.8.1968. *Foothills Site*—holotype female (N1970379), moss, 24.5.1968.

REMARKS. *A. aremenae* is the largest species in the genus and its idiosoma is nearly-parallel sided, as for *A. celox*, in contrast to the 3 species described from Queensland which are suboval or subcircular in horizontal outline. There are many attributes which distinguish this species from the 3 previously described species (see Lee, 1970), amongst which is the variable size of the podonotal setae with both very small and averaged sized setae in rows *j* and *z*. *A. aremenae* is unusual amongst species of Sessiluncinae in having sexual dimorphism in the size of the ventro-anal shield.

Antennolaelaps celox Lee, n.sp.

FEMALE. Fig. 14; A.

Measurements: idiosomal length—545 (5, 530-560); appendage lengths—*ch* 55, *pa* 160, *I* 600, *II* 460, *III* 400, *IV* 580; genu breadths—*pa* 25, *I* 40, *II* 50, *III* 37.5, *IV* 40. *A. celox* is similar to *A. aremenae*. The following attributes differ: it is smaller; the fourth hypostomal seta is not pilose; there is a semicircular ridge around sternal pore 2 and seta *st*2 (as on male see fig. 14B); there are 18 pairs of opisthonotal setae; the longer opisthonotal setae are pilose and more of the dorsal setae are very small, including some on the opisthonotum.

MALE. Fig. 14; B and D.

Measurements: idiosomal length 505 (3, 500-510). Ventro-anal shield is of similar size to that of the female so that posteriorly there is a conspicuous strip of striated cuticle between it and the dorsal shield. On leg II, seta *pv* on the genu is pilose and of a similar length to seta *pv* on the tibia.

DEUTONYMPH. Fig. 14; C.

Measurements: idiosomal length—415 (2, 410-420). The majority of dorsal setae are nearly as long as the distance between their setal bases in contrast to their small size in the adult.

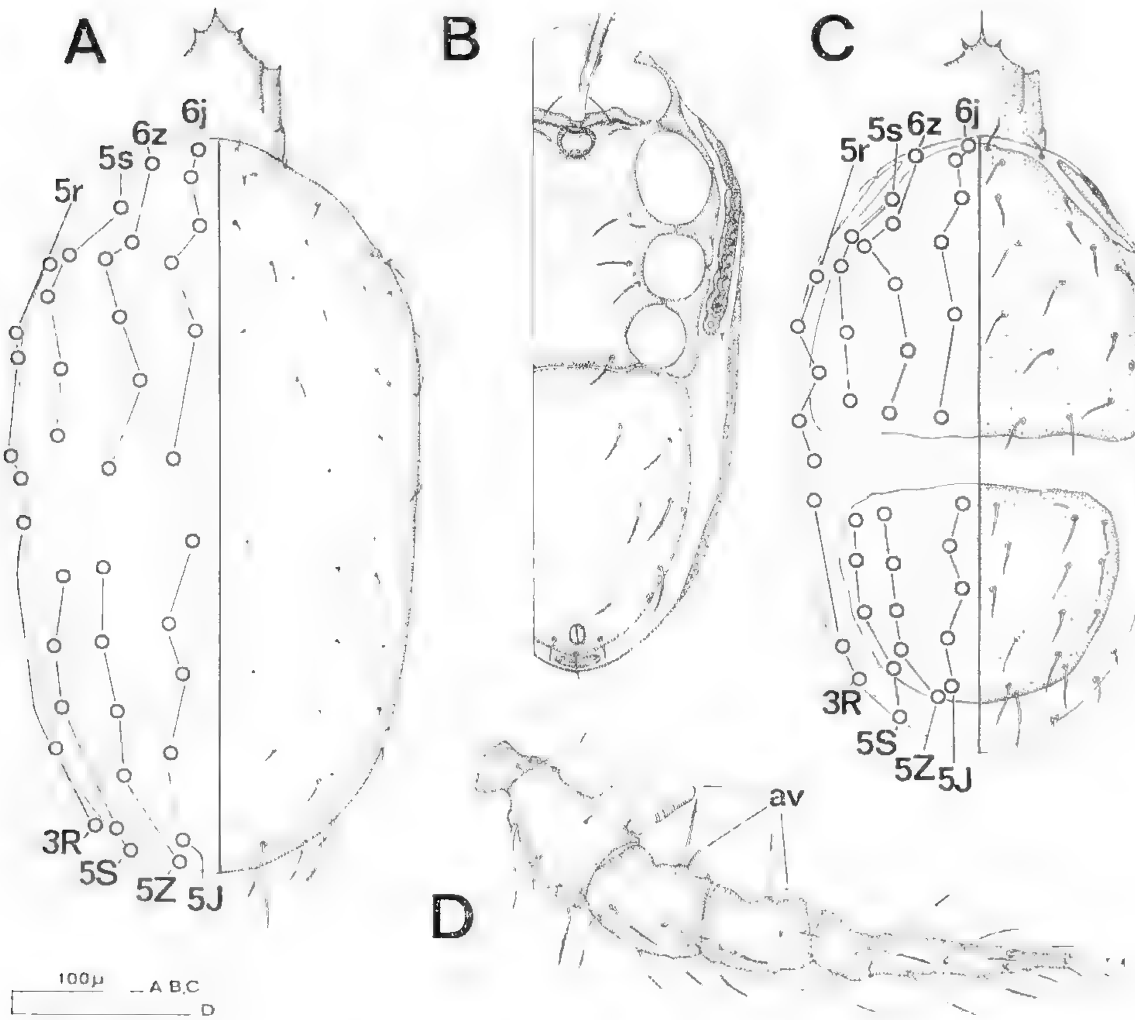

Fig. 14. *Antennolaelaps celox* n.sp..
A, female, soma, dorsum; B, male, idiosoma, venter; C, deutonymph, soma, dorsum; D, male, leg II, antero-lateral.

LOCAL. *Summit Site*—holotype female (N1970386), allotype male (N1970387), 4 paratype females (N1970388-N1970391), 2 paratype males (N1970392 and N1970393), one morphotype deutonymph (N1970394) and one paratype deutonymph (N1970395), moss or plant litter, 9.5.1968-4.7.1968. *Foothills Site*.

REMARKS. *A. celox* is similar to *A. aremenae*, but smaller and more dorsal setae are very small. Specimens from the Foothills Site are indistinguishable from those described.

Genus ONCHOGAMASUS Womersley, 1956b

Onchogamasus virguncula Lee, n.sp.

FEMALE. Fig. 15; A,B,C,D,E,

Measurements: idiosomal length—310 (1); appendage lengths—*ch* 40, *pa* 110, *I* 275, *II* 200, *III* 175, *IV* 255; genu breadths—*pa* 15, *I* 20, *II* 30, *III* 17.5, *IV* 25. Separate podonotal and opisthonotal shield, with opposing edges touching. Three pairs of pre-endopodal shields. The sterno-metasternal shield is fused to endopodal IV shield. Ventro-anal shield is discrete, but its anterior edge lies very close to the ventral podosomal shields. Exopodal II and III shields are split. The peritrematal shield is free posteriorly. Idiosomal chaetotaxy—6*j*, 6*z*, 5*s*, 5*r*: 5*st*: 3*Jv*, 3*Zv*, 2*Sv*, 3 *anal*. Leg chaetotaxy is abnormal for rhodacarids (not as *Gamasellus*) in lacking seta *pd*4 on tarsus IV. Movable cheliceral digit has at least 5 teeth. On palp genu, seta *al*1 pilose with 5 pairs of lateral prongs and seta *al*2 is spine-like. Dorsal setae simple and tapering. On the sternum, a line joining setae *st*2, *st*3 and *st*4 would enclose an angle of less than 95°. Pretarsus I present but not pedunculate. Femur IV with 2 non-setous tubercles on ventral surface.

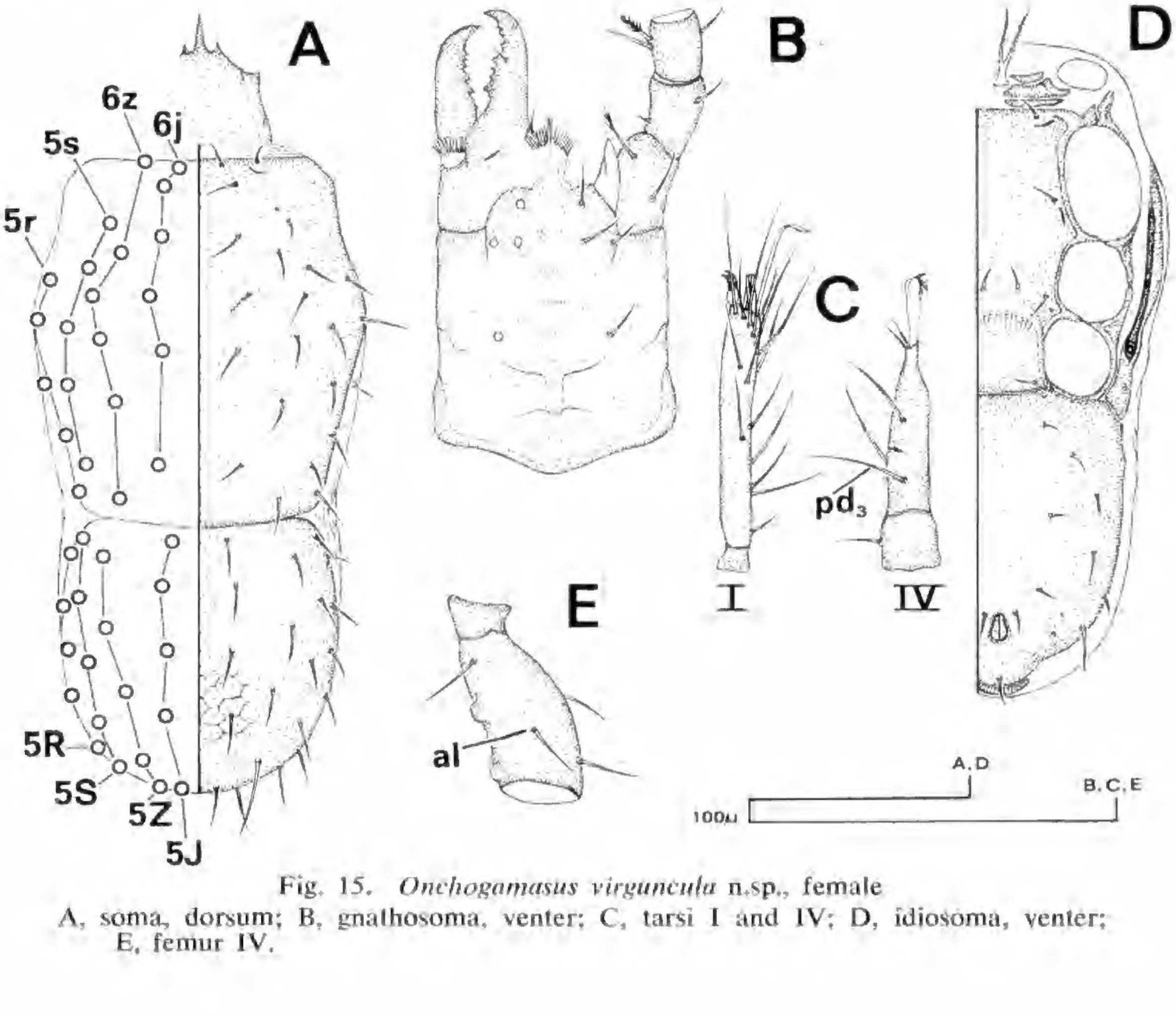

Fig. 15. *Onchogamasus virguncula* n.sp., female
A, soma, dorsum; B, gnathosoma, venter; C, tarsi I and IV; D, idiosoma, venter; E, femur IV.

MALE. Not known.

LOCAL. *Summit Site*—holotype female (N1970396), plant litter, 5.8.1968.

REMARKS. Amongst species of Sessiluncinae, *O. virguncula* is unique in having 3 pairs of pre-endopodal shields, and the only other species with a divided dorsal shield belongs to *Paragamasellevans*. The chaetotaxy is unique amongst rhodacarids; combining the absence of seta *pd*4 on tarsus IV (as *Gamasellopsis*) with an otherwise normal leg chaetotaxy (as *Gamasellus*). Because of the position of the female sternal setae (which would be diagnostic of *communis*-complex) and the absence of fusion between the peritrematal and exopodal shields (diagnostic of *pumilio*-complex), I revoke my previous concept (Lee, 1970, p. 189) of *Onchogamasus* including two species-complexes. Furthermore, the attributes of *O. virguncula* lessen the gap between the attributes of *Onchogamasus* and those of *Gamasellopsis* and *Gamasitus*, so that if males of the types of these 3 genera prove to be similar the possibly synonomy of these names should be considered.

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