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THE GENUS *LENOPHILA* (DIPTERA: PLATYSTOMATIDAE)

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SUMMARY

The relationships of the endemic Australian genus *Lenophila* Guérin (=*Celetor* Loew) are discussed, together with some details of the subfamily classification of the Platystomatidae. It is concluded that *Lenophila* is a rather isolated genus with some resemblance to the Scholastinae.

A key to the 6 species of *Lenophila* is given. *L. achilles, L. secta, L. danielsi,* and *L. nila* are described as new species.

Some notes are given on the biology of the species, including the apparent larval association with *Eucalyptus* in *L. dentipes* and the adult and larval association with *Xanthorrhoea* in other species.

The alimentary system and the internal reproductive systems of male and female are described.

INTRODUCTION

Lenophila is a small endemic Australian genus of flies belonging in the family Platystomatidae of the superfamily Tephritoidea. Representatives of this family were formerly included in the Otitidae (Ortalidae) but modern practice is to separate the two families rather widely within the superfamily (see Steyskal, 1961, McAlpine, 1973). The genus was until recently known as *Celetor,* but Munro (1959) has shown that *Lenophila* is the oldest available name.

Schiner (1868) erroneously recorded two species of *Lenophila* from New Zealand under the names *Lamprogaster strigipennis* and *Lamprogaster caerulea.* This mistake is based on wrongly labelled specimens of *L. dentipes, L. coerulea,* and *L. achilles* collected by the Novara expedition and still preserved in WM.

These flies have a strong superficial resemblance to certain true fruit-flies (family Tephritidae), particularly *Procecidochares, Ceratitella,* and other *Ceratitis*-like forms. This is due to similarity in body form (particularly the form of the female abdomen) and in wing markings. The deceptive resemblance caused Guérin-Méneville to give the inappropriate name *Lenophila,* which means fruit-loving. The species of *Lenophila* may be distinguished from these tephritids by the absence of a break in the costal wing vein where it joins the subcosta, by the absence of an acutely produced lobe to the anal cell (cell CuP) (though the cell itself may be acute at the posterodistal angle), and by the absence of incurved lower fronto-orbital bristles on the head. They may be distinguished from other Australian

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platystomatid genera by means of the key given by McAlpine (1973: 31-33), except for some individuals (particularly of *L. achilles*) which have no sternopleural bristle. These latter may be distinguished by the characteristic wing markings in combination with the angularly bent subcosta.

In listing material examined, we have abbreviated the names of the following collectors to the initials: G. Daniels, M. J. Fletcher, G. A. Holloway, D. K. McAlpine, D. P. Sands. The following abbreviations are used to indicate the collections housing material: AM, Australian Museum, Sydney; BM, British Museum (Natural History), London; ANIC, Australian National Insect Collection, C.S.I.R.O., Canberra; GD, collection of Mr. G. Daniels, Sydney; NMV, National Museum of Victoria, Melbourne; NSWDA, New South Wales Department of Agriculture, Rydalmere; OX, Hope Department of Entomology, University Museum, Oxford; PM, Muséum National d'Histoire Naturelle, Paris; UQ, Entomology Department, University of Queensland, Saint Lucia, Brisbane; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.; WADA, Department of Agriculture of Western Australia, Perth; WAM, Western Australian Museum, Perth; WM, Naturhistorisches Museum, Vienna.

RELATIONSHIPS

McAlpine (1973) divided the family Platystomatidae into five subfamilies and placed *Lenophila* in the subfamily Scholastinae. The Scholastinae in general are distinguished by the following characters: closure of ptilinal suture valvate, the frontal lunule broad and more or less margined above; squama forming a large lobe behind wing base; subcosta curved forwards apically, not angular or curved outwards; aedeagus with distal complex, sclerotized glans, without pair of hollow terminal filaments; lateral arms of aedeagal apodeme (fultella) symmetrical, each connected to a lateral gibbosity of hypandrium and passing within the sclerotized genital ring (or *Gabelplatte*); sclerotized cap of sperm pump simply convex (not biconvex or bituberculate); tergite 5 much shorter than tergite 3, especially in ♀ where it is usually vestigial or absent; in ♀ tergite 6 absent (except in some *Pterogenia*); tergite 4 of ♀ often reduced; aculeus of ovipositor usually slender, with narrowly rounded apex. The most typical Scholastinae belong in the genera *Asyntona* Osten Sacken, *Mesoctenia* Enderlein, *Naupoda* Osten Sacken, *Neohemigaster* Malloch, *Pterogenia* Bigot, *Scholastes* Loew, *Trigonosoma* Gray, *Zygaenula* Doleschall, and perhaps also *Paryphodes* Speiser and *Pseudoscholastes* Frey.

Though sometimes included in the subfamily Platystomatinae, the Scholastinae are very sharply differentiated morphologically and are probably not more closely related to the Platystomatinae than to the Plastotephritinae. The Platystomatinae disagree with the Scholastinae in the following points: closure of ptilinal suture not valvate, its upper lip overlapping the lunule; aedeagus with simple oval or cylindrical glans and two (rarely three) hollow terminal filaments with the gonopores at their tips; left arm of aedeagal apodeme joined to and terminating in genital ring, right arm passing within genital ring to the usually unpaired right hypandrial gibbosity; sclerotized cap of sperm pump with 2 marked gibbosities or tubercules; tergite 5 always large in ♂, rarely reduced in ♀, tergite 6 generally present but small in ♀, tergite 4 of ♀ not reduced.

The following are the characters of the subfamily Plastotephritinae which, in general, distinguish them from the Scholastinae: closure of ptilinal suture not valvate; squama forming a linear fringe, without lobe; subcosta angularly bent forward distally; tergites 4 and 5 large in both sexes; tergite 6 generally present but small; aculeus of ovipositor variable, often broad and blade-like.

McAlpine (1973) indicated that the genus *Chaetorivellia* de Meijere is intermediate morphologically between the subfamilies Plastotephritinae and Scholastinae. We have now

seen an additional species of *Chaetorivellia* and a species which shows affinities both to *Chaetorivellia* and to the *Pterogenia-Neohemigaster* complex. One species of *Chaetorivellia* shows a complete tergite 5, fully as long as tergite 3, as well as an extremely short but sclerotized tergite 6, in the female, whilst another closely similar species has only a vestigial tergite 5. The males show no reduction of tergite 5. The squama of *Chaetorivellia* has a distinct lobe (unlike the Plastotephritinae) which is, however, much smaller than that of typical Scholastinae. The contour of the subcosta in *Chaetorivellia* is typical of the Scholastinae and unlike that of the Plastotephritinae which is angularly bent forward distally. The lips of the ptilinal fissure are not valvate (in the botanical sense of the term) but the upper (postfrontal) lip overlaps the lunule which is not visibly margined above. Although this condition contrasts with that of more typical scholastines, a study of several genera suggests that the valvate condition of the ptilinal suture is not one of the most clear-cut scholastine characters.

Though McAlpine previously regarded *Chaetorivellia* as agreeing more with the Plastotephritinae than any other subfamily, it is now felt that the balance of evidence indicates a relationship to *Pterogenia* and other genera of Scholastinae, despite the exceptionally plesiomorphic condition of the female postabdomen in one species.

Lenophila resembles *Chaetorivellia* in combining characters of the two subfamilies Plastotephritinae and Scholastinae, but the combination of characters is not identical. *Lenophila* females have tergites 5 and 6 much shortened, enclosing the spiracles. Tergite 4 may be well developed but shorter than tergite 3 (as in *L. dentipes*) or completely desclerotized (as in *L. nila*). The squama has a moderately developed lobe. The upper margin of the frontal lunule is covered by the anterior margin of the postfrons. The contour of the distal part of the subcosta is unlike that of any typical scholastine genus. It is bent forward somewhat angularly away from vein 1 and then curved distally instead of forwards. It therefore resembles the angular subcosta of the Plastotephritinae and to some extent that of the family Tephritidae.

There is evidence of independent reduction of the tergites of segments 4-6 in the females in several different platystomatid lineages, e.g. within the genus *Chaetorivellia*, within the genus *Euprosopia* Macquart, within the subfamily Angitulinae, and within the group of genera related to *Cleitamia* Macquart and *Euxestomoea* Hendel. Reduction of these tergites cannot be regarded as indicating relationship of *Lenophila* to the Scholastinae without supporting evidence. As this evidence is meagre, there must remain an element of doubt regarding the position of *Lenophila* in the Scholastinae. We consider it to be rather isolated phylogenetically from other living genera. The apparent dependence of *Lenophila* species on two plant genera, *Eucalyptus* and *Xanthorrhoea*, which are endemic to and highly characteristic of the Australian Region, suggests that the genus has evolved in this region over a long period of time.

INTERNAL ANATOMY

We have dissected adults of *L. coerulea* and *L. danielsi* and these have proved to be exceedingly similar anatomically. As almost nothing is known of the internal soft parts of this family a brief account of these is given.

The *alimentary system* is typical of the Schizophora with no obvious peculiarities. The two large elongate-ovoid salivary glands have a short common duct and long individual ducts of uniform thickness. The rather short oesophagus gives rise at its posterior end to a very long, straight duct terminating in the bilobed crop. The proventriculus has the usual shape of a depressed sphere and connects by a narrow constriction to the long, convoluted mid-gut which is thicker and somewhat sacculated anteriorly. There are 4 malpighian tubules joining together in pairs a very short distance from their junction with the

alimentary canal. The prerectal region of the hind-gut is much longer than in *Calliphora* Robineau-Desvoidy (Lowne 1895: pl. 24; Imms 1957: fig. 104) and almost as long as that of *Rhagoletis* Loew (Snodgrass 1935: fig. 198). The enlarged rectal sac has the usual 2 rectal papillae on each side.

In the *male reproductive system* (fig. 51) the elongate orange-coloured testes open into slightly shorter vasa efferentia. The vas deferens terminates anteriorly in a pair of sacs, the vasa efferentia opening close together into their terminal surface, the 2 accessory glands being joined more laterally within depressions in the sacs. There is a bend and a dorsal gibbosity at about the middle of the length of the vas deferens, which is looped round the rectum as in other Cyclorrhapha.

The *female reproductive system* (fig. 50) has a pair of spherical accessory glands on long fine ducts which are thickened and muscular distally. The three spermathecae are subspherical or slightly ovoid, the vesicles brownish orange, covered with a transparent cellular envelope. At the distal end the pigmented vesicle is deeply invaginated through the centre of the spermatheca apparently forming a plug (valve ?) in the basal orifice. No ventral receptacle or morula gland could be found.

Genus **Lenophila** Guérin

Lenophila Guérin-Méneville, 1843: 200. — Munro, 1959: 47-48. Type species *Ceratitis dentipes* Guerin = *Ortalis dentipes* Macquart.

Celetor Loew, 1873: 41. — Hendel, 1914a: 113-115; 1914b: 246. — Malloch, 1929: 505. Type species *Ortalis dentipes* Macquart = *Tephritis strigipennis* Macquart (Hendel, 1914a).

Hendel (1914a) has given a detailed generic description. As this is generally accurate it need only be noted here that some species have tergite 4 of female much reduced in size, instead of having the third and fourth tergites of equal length as indicated by Hendel.

The genus includes six species, all restricted to Australia. They have been found from the Townsville district in Queensland southwards to Victoria and westwards to the Adelaide district in South Australia. A species occurs also in south-western Australia, but the genus is unknown in the more arid parts of the continent. There are no records from Tasmania, apart from Verreaux's unreliably localised material. This may not necessarily indicate the absence of the genus from that state, as relatively little collecting has been done there, and both the known host-plant genera are present.

L. dentipes, though undoubtedly related to the other five species of the genus, has diverged in a number of characters and probably represents a sister group to the rest of the genus. We therefore divide the genus into two species-groups, one of which includes only *L. dentipes*. These species groups are distinguished as follows:—

L. dentipes group	*L. coerulea* group
Third antennal segment rounded distally.	Third antennal segment mucronate anterodistally.
Anal crossvein transverse, the posterodistal angle of anal cell therefore approximately a right angle.	Anal crossvein oblique, the posterodistal angle of anal cell therefore acute.
Wing without basal black band but with pattern of spots and streaks in basal region.	Wing with definite black basal band at level of humeral crossvein.

L. dentipes group	*L. coerulea* group
♂ hind trochanter enlarged, and hind femur much swollen near middle of anterior surface.	♂ hind trochanter normal, hind femur without swelling.
♀ tergite 4 more than half as long as tergite 3, shining black.	♀ tergite 4 variably developed but less than half as long as tergite 3 except in *L. achilles*, never shining black.
♂ sternite 2 unmodified.	♂ sternite 2 with tubercle or process.
♂ stipe of aedeagus not winged, without terminal process.	♂ stipe of aedeagus with winged margins, and one or two long, acuminate terminal processes.
♂ cerci very long, united only at bases.	♂ cerci shorter, united by a membrane for their whole length.

KEY TO SPECIES OF *LENOPHILA*

1. Third antennal segment rounded distally; posterodistal angle of anal cell not acute; wing without separate black band at level of humeral crossvein, but with complex pattern of streaks and spots in basal region ..... *dentipes*

— Third antennal segment mucronate anterodistally; posterodistal angle of anal cell acute; wing with separate blackish basal band, which may be dissected by fine clear lines 2

2. Face tawny, with or without a dark median stripe; wing with preapical stripe well developed, extending into second posterior cell; metasternum with pair of processes in ♂, with 2 small tubercles in ♀ ..... *achilles*

— Face creamy white with blackish median stripe; preapical stripe little developed, not reaching vein 4; metasternum unarmed 3

3. Basal dark band of wing dissected by fine clear lines ..... *secta*

— Basal dark band entire, at most invaded by some pale brown lines 4

4. ♂♂ (readily distinguished) 5

— ♀♀ (abdominal characters difficult to see in some dried specimens) 7

5. Hind tibia broadly swollen at and before middle; hind tarsus with prominent basal ventral tubercle; apophysis of sternite 2 with 2 anteriorly inclined yellow tubercles; outer surstylus narrowly elongate, slightly expanded distally with short, incurved distal section ..... *danielsi*

— Hind tibia not or very slightly swollen near middle; hind tarsus without prominent basal tubercle; apophysis of sternite 2 of different conformation; outer surstylus not very elongate 6

6. Hind tibia dorsally with preapical gibbosity bearing a dense row of strong bristles, and with a small terminal tubercle; apophysis of sternite 2 with 3 short tubercles, the anterior median one most prominent ..... *nila*

— Hind tibia with longer dorsal bristles not on a gibbosity or tubercle, with a compact preapical dorsal tubercle bearing short setulae and a shallow dorsal groove from beyond this to apex; apophysis of sternite 2 with 2 prominent posteriorly inclined tubercles ..... *coerulea*

7. Tergite 4 vestigial, not readily visible ..... *nila*

— Tergite 4 well developed, but much smaller than tergite 3 8

8. Yellow dorsal stripe behind tergite 4 expanding on each side into a very large yellow area on pleural membrane which extends below tergite 3, and almost reaches sternites; tergite 4 almost as wide as segment 7; spiracle of segment 7 on dorsal side of lateral keel ..... *coerulea*

— Yellow stripe behind tergite 4 not much expanding where it extends on to pleural membrane, and not approaching sternites, the area lying below tergite 3 entirely brown; tergite 4 much wider than segment 7; spiracle of segment 7 on ventral side of keel..... *danielsi*

Lenophila dentipes (Macquart)
Figs. 2, 8, 14, 15, 42-44, 48.

Ortalis dentipes Macquart, 1843: 210, pl. 28, figs. 5, 5a.

Tephritis strigipennis Macquart, 1851: 290-291, pl. 27, fig. 2.

Detailed synonymy as given by Munro (1959) except that the last preceding reference is wrongly given.

This species stands apart from the other five species structurally. As it is the only species of the *dentipes* species group, its distinctive characters are those tabulated above for this group. Hendel (1914b: 246-247) has given a good description which we supplement as follows:

COLORATION: occiput brown, lateral occipital region black; posterior slope of vertex with one large white spot just behind ocellar spot and a white triangularly shaped one on each side, the latter one very narrowly connected to white posterior orbital area.

ABDOMEN of ♂: sternite 2 without trace of apophysis. Outer surstylus spatulate, somewhat constricted before the rounded apical expansion; inner surstylus incurved with 2 unequal black terminal teeth; stipe of aedeagus slender, with very narrow membranous margins and two rather short terminal processes, one of which is finely acuminate; preglans almost as long as glans; cerci much longer than surstyli, free except at bases.

ABDOMEN of ♀: tergite 4 large, shining black, with spiracles in deep, narrow incisions in lateral margins; tergites 5 and 6 extremely abbreviated, transverse, with spiracles in their lateral extremities; segment 7 with spiracles situated on the lateral carinae, near anterior end.

DISTRIBUTION: New South Wales — coastal areas and Warrumbungle Range (Coonabarabran district); doubtfully Victoria and Tasmania.

TYPE MATERIAL: Port Jackson (Sydney) (holotype ♂ of *O. dentipes*, OX, examined by Froggatt (1909) and Munro (1959), not seen by authors); Australie (apparent syntypes of *T. strigipennis*, 2 ♂, No. $\frac{2}{47}$, PM, examined by an author), J. P. Verreaux. A further ♂ in PM, No. $\frac{4}{46}$ is given as "Tasmanie, Verreaux" in the register (probable erroneous locality) and is therefore probably not a type. Unfortunately the type of *O. dentipes* was not seen during a brief visit to Oxford, but its identity is not in doubt (see Munro, 1959).

OTHER MATERIAL EXAMINED: 4 mi. S of Taree, on animal dung, ii 1968 (1 ♀, AM), M. Long; Newcastle, no other data (1 ♂, UQ); Catherine Hill Bay, iv 1949 (7 ♂, 2 ♀, ANIC, 1 ♂, BM), T. G. Campbell and S. J. Paramonov; Blue Lagoon Reserve, near The Entrance, iii 1969

(13 ♂, 14 ♀, AM, 1 ♂ 1 ♀, NMV, 1 ♂ 1 ♀, SAM, 1♂ 1 ♀, USNM), G.A.H.; Woy Woy, sand bush, ix 1923 (1 ♂, AM), A.J. Nicholson; Mount White, near Gosford, iv 1949 (1 ♀, ANIC), S.J. Paramonov; Newport, near Sydney, i iv xi xii 1970-1971 (11 ♂, 11 ♀, AM, 1 ♂, 1 ♀, BM), D.P.S.; Narrabeen, near Sydney, no other data (1 ♂, UQ), x 1922 (1 ♀, AM), A. Musgrave; Lane Cove, near Sydney, i 1925 (1 ♂, AM), B. Bertram; Depot Beach, 10 mi. NE of Bateman's Bay, xii 1967 (1 ♀, ANIC), I.F.B. Common; Nelligen, iii-iv 1948 (1 ♀, ANIC), K. H. L. Key; 2 mi. E of Nelligen, xi 1949 (1 ♂, ANIC), Cane and Gemmell; Narooma, xii 1949 (2 ♀. ANIC), A. L. Dyce, v 1966 (1 ♂, NSWDA), anon.; Warrumbungle National Park, iv 1973 (11 ♂, 9 ♀, AM), M. S. Moulds and G.D.; Victoria, no other data (1 ♀, AM).

Lenophila achilles n. sp.
Figs. 7, 12, 21, 35-37, 47.

♂ ♀. COLORATION: head orange-fulvous; postfrons with black hairs except along orbital margins where hairs are yellow; ocellar spot and fronto-orbital plates black, but these black areas well separated; face concolorous with rest of head except for whitish pruinescence in antennal grooves, typically without but sometimes with median brown stripe, especially in specimens from Queensland. Posterior slope of vertex blackish with one white spot just behind ocellar spot, lateral part of slope and posterior orbital area white. Antenna, prelabrum, and palpus orange-fulvous. Thorax shining black with blue to green reflections; pleura with areas of light grey pruinescence distributed as in *L. danielsi*. Legs black, often narrowly tawny at apices of femora and bases and apices of tibiae; tarsi fulvous, slightly browned apically. Wing markings somewhat similar to those of *L. danielsi*; humeral black band enclosing some yellowish brown lines along veins; preapical band narrow but distinct, posteriorly crossing over vein 4 into second posterior cell, anteriorly fusing with large apical mark where it crosses vein 3. Haltere light brown basally, cream distally. ♂ abdomen with tergites black, largely pruinescent; tergites 2, 3, and 4 broadly margined with grey posteriorly; tergite 5 shining black; pleural membrane deep grey. ♀ abdomen with blackish tergites; tergite 2 margined posteriorly with grey; tergite 3 with yellowish brown pruinescence on each side which does not quite reach lateral margin; tergite 4 extensively brown-pruinescent; pleural membrane deep reddish brown, in life quite differently coloured from that of ♀♀ of *L. danielsi* or *L. coerulea*; a yellow transverse mark behind tergite 4, expanding below its lateral margins, in extent similar to that of *L. danielsi*.

HEAD: structurally similar to that of *L. danielsi*; height of cheek 0.17-0.22 of height of eye.

THORAX: generally as described for *L. danielsi*; metasternum of ♂ with pair of closely placed ventrally directed processes, pubescent on their posterior surfaces; metasternum of ♀ with pair of small tubercles only (metasternum of all other *Lenophila* species is unarmed in both sexes); sternopleural bristle variable, sometimes quite well developed, sometimes indistinguishable from surrounding hairs. Legs resembling those of *L. danielsi*; mid femur with a few anterior bristles near and just before middle in addition to numerous rather long posteroventral bristle-like hairs; hind tibia of ♂ (fig. 12) with very deep dorsal subapical incision, within which is a small tubercle bearing a fascicle of minute setulae; floor of incision otherwise membranous; on distal side of incision apex of tibia raised into a large dorsal tubercle; a broad gibbosity on proximal side of incision, which bears an anterodorsal comb of 11 or more very closely placed bristles, and which gradually tapers away towards the base; basal segment of tarsus slightly curved, a little excavated on anteroventral surface, slightly gibbous ventrally at base. Wing structurally similar to that of *L. danielsi*.

ABDOMEN of ♂: generally similar in structure to that of *L. danielsi*; apophysis of sternite 2 broad and low with pair of lateral tubercles, its anterior margin coinciding with the medially raised anterior margin of sternite; anterior margin of sternite 3 with raised

transverse ridge; main body of outer surstylus short and rather broad, narrowed basally, with anterodistal angle produced into a long medially directed process; inner surstylus much shorter than that of *L. danielsi,* with apical parts directed anteriorly, the translucent anterior tooth rounded, knob-like; aedeagus resembling that of *L. danielsi,* membranous wing of left side of stipe not expanded at distal extremity; tapering process at left side of distal end of stipe shorter than in *L. danielsi,* that on right side not distinguishable; cerci joined for their whole length, not emarginate distally.

ABDOMEN of ♀: somewhat similar structurally to that of *L. danielsi;* tergite 4 larger than in *L. danielsi* or *L. coerulea,* about 2/3 as long as tergite 3; tergite 5 almost completely desclerotized; spiracle 4 situated just within posterolateral margin of tergite 4; spiracle 7 situated on outer side of lateral carina of segment 7, towards its anterior extremity; pleural membrane with a single vertical series of black bristles below posterior margin of tergite 3 and another such series below posterior margin of tergite 4.

DIMENSIONS: total length, ♂ 4.3-7.0 mm, ♀ 4.4-6.1 mm; length of thorax, ♂ 1.9-2.6 mm, ♀ 2.1-2.7 mm; length of wing, ♂ 4.4-5.6 mm, ♀ 5.0-5.8 mm.

DISTRIBUTION: eastern Queensland and New South Wales; Victoria; south-eastern South Australia. Specimens in WM collected by the Novara Expedition are erroneously labelled "N. Seeland".

HOLOTYPE ♂: Royal National Park, near Sydney, 16 ii 1971 (AM), D.K.M.

OTHER MATERIAL EXAMINED: *New South Wales* — Grose Vale, near Kurrajong, i 1973 (paratypes, 2 ♂, 1 ♀, AM), G.D.; Vale Lookout, near Kurrajong, i 1973 (paratype ♀, AM), G.D.; Woy Woy, ii 1972 (paratype ♂, AM), D.P.S.; Pearl Beach, near Woy Woy, vii 1971 (paratypes, 6 ♂, 4 ♀, AM), M.J.F.; West Head, Ku-ring-gai Chase, near Sydney, i 1971 (paratypes, 8 ♂, 5 ♀, AM, 1 ♂, 1 ♀, BM, 1 ♂, 1 ♀, USNM), D.K.M.; Royal National Park, near Sydney, ii vii xi 1971 (paratypes, 6 ♂, 1 ♀, AM), D.K.M.; Currarong, near Jervis Bay, xi 1970 (paratypes, 3 ♂, 1 ♀, AM), G.D.; 2 km SSE of Nadgee Hut, Nadgee Nature Reserve, via Womboyn Lake, xi 1973 (10 ♂, 11 ♀, AM), G.A.H. and D. Lunney; Halfway Creek, 29 km S of Grafton, v 1972 (7 ♂, 2 ♀, AM), D.K.M.; Mount Wambelong, Warrumbungle Range, iv 1974 (1 ♂, 1 ♀, AM), G.D. *Australian Capital Territory* — Mount McDonald, near Cotter, iii xii 1973-1974 (11 ♂, 15 ♀, ANIC), M. Gill, Z. R. Liepa. *Queensland* — 8 km E of Paluma, Townsville district, i 1970 (1 ♂, AM), G.A.H.; Mount Archer, Rockhampton, vii 1974 (1 ♂, 1 ♀, G.D.); Noosa, ii 1957 (1 ♀, UQ), V. Wienert; Deception Bay, near Redcliffe, v xii 1971-1972 (8 ♂, 2 ♀, AM), D.K.M.; Brisbane, iv 1914 (1 ♀, UQ), H. Hacker; Bunya Mountains, iv 1972 (4 ♂, 2 ♀, AM), G.D. *Victoria* — Grampians, iv 1932 (1 ♂, 3 ♀, AM), A Musgrave; 8 km S of Lah Arum, Grampians, ii 1956 (2 ♀, ANIC), I. F. B. Common. *South Australia* — Mount Compass, S of Adelaide, x 1963 (2 ♂, ANIC), H. F. Lower.

Though clearly a member of the *coerulea* species group, *L. achilles* is sharply differentiated from other species of the group in facial coloration, the development of the preapical wing stripe, the armature of the male metasternum, and the relatively large tergite 4 of ♀.

The species is named after the Greek hero Achilles, the deep incision in the ♂ tibia recalling the proverbial weakness in his heel.

Lenophila secta n. sp.
Figs. 6, 11, 20, 32-34, 46

♂ ♀: very similar to *L. danielsi* in most characters and agreeing with the description given for that species except as indicated below.

COLORATION: distinction between median tawny zone of postfrons and white orbital margins less sharply defined than in *L. danielsi*, the line of contact between these zones tinged with brown. Posterior slope of vertex blackish with 3 densely pruinescent white spots as in *L. coerulea* but lateral spots triangularly shaped and isolated from the white posterior orbital area in both sexes. Wing hyaline, with basal black band divided by pattern of clear spots and streaks as shown in fig. 6; preapical band narrow and short, posteriorly not reaching to middle of first posterior cell. Haltere light brown basally, cream distally. ♂ abdominal tergites black; tergites 2, 3, and 4 broadly margined with grey posteriorly, anterior margins of tergites 3, 4, and 5 grey; sternites and pleural membrane dark greyish brown without any other coloured markings. ♀ abdominal tergites mostly black; posterior margin of tergite 2 and anterior margin of tergite 3 grey, tergite 4 brown with its posterior margin orange; pleural membrane and sternites coloured as in *L. danielsi*.

HEAD: structurally similar to that of *L. danielsi;* height of cheek 0.19-0.27 of height of eye.

HIND LEG of ♂: tibia not swollen near middle, with short, compact and ventrally directed anterodorsal comb of bristles placed approximately at distal sixth and another more distal anterior comb of bristles, the tips of which overlap apex as shown in fig. 11; no preapical dorsal tubercle; apical dorsal margin with a prominent lobe; hind tarsus without basal tubercle.

WING as in fig. 6; setulae as described for *L. danielsi*.

ABDOMEN of ♂: apophysis of sternite 2 narrow, short and low with ventrally directed pair of lateral tubercles, tubercles from lateral view triangular as in fig. 20; outer surstylus articulated at base, its main body broad, rounded, narrowed basally and more compact than in *L. danielsi*; anterodistal part slightly bilobed, anterior lobe elongate, directed inwards; posterior lobe broad and rounded; inner surstylus a little shorter than outer surstylus, almost straight, its length approximately 1/3 of height of epandrium with cercus, both terminal teeth directed distally, the posterior one continuous with main axis of inner surstylus. Aedeagus: stipe with broad, membranous wings along each lateral margin, not much expanded at distal extremity, with terminal tapering process on the left side shorter than in *L. danielsi* and minute process on the right side; a distinct preglans; glans complex in structure; cerci joined for their whole length, not emarginate distally.

ABDOMEN of ♀: with tergite 4 greatly reduced, apparently narrowly transverse; tergite 5 divided into 2 small black-haired, lateral sclerites; spiracle of segment 7 situated immediately above lateral carina.

DIMENSIONS: total length, ♂ 5.0-5.2 mm, ♀ 4.5-5.5 mm; length of thorax, ♂ 2.1-2.2 mm, ♀ 2.0-2.6 mm; length of wing, ♂ 4.3-4.6 mm, ♀ 4.1-5.3 mm.

DISTRIBUTION: eastern Queensland and New South Wales.

HOLOTYPE ♂: Deception Bay, Queensland, 6 xii 1971 (AM), D.K.M.

OTHER MATERIAL EXAMINED: *Queensland* — 2 miles W of Paluma, i 1970 (paratype, 1 ♀, AM), G.A.H.; Pistol Gap, near Byfield, i 1970 (paratypes, 1 ♂, 1 ♀, AM), G.A.H.; Mount Archer, Rockhampton, vii 1974 (paratype ♀, GD) G.D.; Watalgan Ra., near Bundaberg, vii 1971 (paratype, 1 ♀, ANIC), H. Frauca; Eidsvold, ix 1929 (paratype, 1 ♂, ANIC) anon.; NW Bluff Ra., upper slopes, Biggenden, i 1972 (paratype, 1 ♀, ANIC), H. Frauca; Noosa, viii 1959 (paratype, 1 ♀, UQ), F. A. Perkins; Brisbane, iv v 1914-1959 (paratypes, 1 ♂, 1 ♀, UQ), H. Hacker, R. Cullinane; Ballandean, near Stanthorpe, v 1925 (paratypes, 1 ♂, 1 ♀, ANIC), H. Jarvis. *New South Wales* — 3 miles SW of Broadwater, Myall Lakes, x 1956 (paratype, 1 ♂, ANIC), P. B. Carne; Gundamaian, Royal National Park, viii 1925 (paratype, 1 ♀, ANIC), I. M. Mackerras.

Lenophila danielsi n. sp.
Figs. 1, 5, 10, 17, 19, 28-31, 45, 49-51

♂♀. COLORATION: postfrons orange-tawny with black hairs; fronto-orbital plates and ocellar tubercle black with some grey pruinescence; the very broad orbital margin of postfrons and most of parafacial white with white hairs; face creamy white with blackish brown median stripe which reaches upper margin of prelabrum but does not quite reach antennal bases; anterior part of cheek tawny to yellowish brown; posterior part of cheek whitish; occiput dark grey, entire posterior slope of vertex with whitish pruinescence, the whole posterior orbit white. Antenna tawny, with dark brown arista. Prelabrum tawny to brownish in centre, densely white-pubescent at sides. Palpus fulvous. Thorax shining black, with blue or bluish green reflections; propleuron, upper posterior part of mesopleuron, hypopleuron, pleurotergite, and postnotum densely grey-pruinescent. Legs dark brown to almost black; tarsi fulvous, becoming brownish apically. Wing hyaline, with black markings as shown in fig. 5; humeral black band not enclosing definite clear lines; only the slightest indication of a preapical band arising from the large apical black mark in first posterior cell. Haltere light brown basally, cream on distal half. ♂ abdominal tergites black; tergites 2, 3, and 4 grey on posterior margins; sternites and pleural membrane dark greyish brown; pleural and intersegmental membranes without yellow markings. ♀ abdominal tergites mostly black; posterior margin of tergite 2 and almost all of tergite 4 grey, the latter often appearing partly yellowish in preserved specimens; tergite 3 black with uniform covering of brown pruinescence and thus scarcely shining even on posterior margin; pleural membrane dark greyish brown with a pale yellow area below tergite 4, which is restricted to upper half of membrane and does not noticeably extend below tergite 3, a pale, dull yellow transverse stripe behind tergite 4 connecting the yellow areas of each side.

HEAD: approximately as high as wide and 1.6 times as high as long; height of cheek 0.22-0.30 of height of eye; eye nearly twice as high as long; the following bristles present: two pairs of upper fronto-orbitals; inner and outer verticals; a pair of small divergent postverticals; cheek bristle. Antenna extending a little more than halfway from its basal insertion to centre of epistomal margin; segment 3 oval, with a small sharp anteriorly directed point near apex; arista minutely pubescent for its whole length. Palpus moderately broad.

THORAX: length of mesoscutum 0.86-0.88 of its width across notopleural calli; scutellum short, broadly rounded, very convex dorsally, with numerous hairs except on apical part; metasternum simple, without processes or tubercles; the following thoracic bristles present: humeral, 1 + 1 notopleurals (the right posterior notopleural duplicated in holotype), supra-alar, postalar, posterior intra-alar, 1 dorsocentral, prescutellar acrostichal, 3 pairs of marginal scutellars, strong mesopleural, a distinct but somewhat weaker sternopleural. Fore femur with some irregularly placed posterodorsal bristles on distal half, and a complete series of posteroventral bristles; mid femur without definite bristles but with some longer hairs on posteroventral surface; hind femur with a few dorsal bristles distally, in ♂ as long as tibia, in ♀ slightly shorter than tibia; ♂ hind leg with the following modifications (fig. 10): tibia broadly swollen near middle on dorsal surface, rapidly contracting beyond middle, with a small preapical anterodorsal tubercle, apical dorsal margin prominent, no anterodorsal comb, but a few irregularly placed short bristles on dorsal swelling; basal segment of tarsus somewhat curved, with a large basal ventral tubercle. Wing as in fig. 5; setulae on dorsal surface of vein 1 becoming sparser basally and not extending basad of junction with radial sector; vein 3 with irregularly placed dorsal and ventral setulae; other veins bare; posterodistal angle of anal cell strongly acute (but not produced into an acute lobe as in typical tephritids); squama small, more abbreviated than in *L. dentipes*.

ABDOMEN of ♂: tergites 3, 4, and 5 subequal in length; sternite 2 with forwardly directed apophysis, divided into a pair of apical tubercles by a shallow median cleft; protandrium without trace of tergite 6; sternite 6 (or 6+7) connected to the dorsal sternite 8 on left side; outer surstylus elongate, club-shaped, with relatively short, inwardly directed anterior lobe at apex, not articulated at base; inner surstylus almost as long as outer surstylus, almost straight except for forward curvature near apex, with 3 terminal black teeth of which the middle one is vertically elongate, and a prominent anterior translucent tooth; aedeagus: stipe with broad, membranous wings along each lateral margin, and at its distal extremity a very long tapering process on the left side and a minute curved process on the right side; a distinct partly sclerotized preglans; glans large and exceedingly complex in structure.

ABDOMEN of ♀: broadly ovoid; tergite 3 large, slightly shorter than compound tergite 1 + 2; tergite 4 less than half as long as tergite 3, but rather broad, considerably broader than segment 7; tergites 5 and 6 distinct but relatively short; sternite 2 without apophysis; segment 7 (ovipositor sheath) depressed, uniformly sclerotized, without distinguishable tergite and sternite but with sharp lateral margins, not much longer than broad; spiracles 1 and 2 in pleural membrane; spiracles 3 and 4 situated just within margins of tergites; spiracles 5 and 6 well within tergites; spiracle 7 situated immediately below lateral keel well in front of middle of segment.

DIMENSIONS: total length, ♂ 4.2-5.8 mm, ♀ 4.6-5.7 mm; length of thorax, ♂ 1.7-2.4 mm, ♀ 2.3-2.6 mm; length of wing, ♂ 3.7-5.0 mm, ♀ 4.8-5.6 mm.

DISTRIBUTION: coastal New South Wales.

HOLOTYPE ♂: Royal National Park, near Sydney, 19 xii 1970 (AM), D.K.M.

OTHER MATERIAL EXAMINED: 3 miles N of Dora Creek, near Lake Macquarie, i 1971 (paratypes, 2 ♂, 1 ♀, AM), D.K.M.; Ku-ring-gai Chase, near Sydney, xi 1970 (paratypes, 3 ♀, AM), G.D.; West Head, Ku-ring-gai Chase, i 1971 (paratypes, 2 ♀, AM), D.K.M.; Sydney, ii 1931 (paratypes, 2 ♀, AM), K. K. Spence, i 1919 (paratype ♂, UQ), G. H. Hardy; Royal National Park, ii iv xi xii 1970-1971 (paratypes, 26 ♂, 13 ♀, AM, 2 ♂, 1 ♀, BM), G.D., D.K.M.; Gundamaian, Royal National Park, i x 1926-1971 (paratypes, 3 ♂, 1 ♀, ANIC, 1 ♂, AM), I. M. Mackerras, G.D.; Goondera Ridge, near Heathcote, Royal National Park, xi 1970 (paratypes, 2 ♂, 3 ♀, AM), G.D.; Heathcote, xi 1970 (paratypes, 12 ♂, 7 ♀, AM, 2 ♂, 1 ♀, USNM, 1 ♂, 1 ♀, PM, 1 ♂, 1 ♀, MNM, 1 ♂, 1 ♀, CNC), D.K.M.; Currarong, near Jervis Bay, xi 1970 (paratypes, 7 ♂, 4 ♀, AM, 1 ♂, 1 ♀, NMV), G.D.; 5 miles S of Currarong, xi 1970 (paratype ♀, AM), G.D.

Lenophila coerulea (Macquart)
Figs. 3, 4, 9, 16, 18, 23-27

Tephritis coerulea Macquart, 1846: 212, pl. 18, fig. 15.

Trypeta Cluana Walker, 1849: 1019.

Lamprogaster caerulea. — Schiner, 1868: 285.

Celetor caerulea. — Loew, 1873: 41. — Hendel, 1914b: 247-248. — Malloch, 1929; 506.

Ortalis coerulea. — Froggatt, 1907: 308.

Lenophila caerulea. — Munro, 1959: 48-49.

Hendel has given a description which, though accurate, omits most of the characters distinguishing the species from closely related ones. This species agrees in most characters with the description here given for *L. danielsi,* but may be distinguished as given below.

COLORATION: posterior slope of vertex blackish with 3 densely pruinescent white spots, one in the middle, one on each side, the latter narrowly connected to white posterior orbit in ♂ but in ♀ the lateral spots smaller than those of ♂ and isolated from white posterior orbital area.

WING: rudiment of preapical black band usually more distinct than in *L. danielsi,* but not extending more than half way across first posterior cell.

HIND LEG of ♂: tibia not distinctly swollen near middle nor contracted beyond; preapical dorsal tubercle less close to apex than in *L. danielsi;* dorsal apical margin less prominent than in that species; an anterodorsal comb of bristles extending from just beyond middle almost to dorsal tubercle; tarsus without basal tubercle.

ABDOMEN of ♂: apophysis of sternite 2 prominent, erect, with pair of apical tubercles divergent and inclined posteriorly; sternite 3 with pair of transversely compressed tubercles joined by a transverse ridge. Outer surstylus articulated at base, its main body short and compact, bilobed distally, with posterior lobe short, broad, rounded, and anterior lobe elongate, directed inwards, more or less reaching median line. Stipe of aedeagus with terminal process of right side better developed than in *L. danielsi,* preglans shorter.

ABDOMEN of ♀: tergite 3 distinctly shining in median section, particularly near posterior margin where it is almost devoid of pruinescence; pleural membrane with very large very bright yellow area below tergite 4, extending below posterior part of tergite 3, and approaching but not reaching sternites, enclosing a pale orange spot below tergite 4, extending as a transverse stripe behind tergite 4 where it is more or less interrupted medially by a narrow pale brown area. Tergite 4 slightly narrower than segment 7; spiracles 3 and 4 in membrane very close to posterior angle of their tergites; spiracle 7 situated immediately above lateral keel.

DISTRIBUTION: eastern Queensland; coastal areas of New South Wales; Victoria. Collection dates for New South Wales include all months except April, May, and September.

TYPE MATERIAL EXAMINED: No label data, but Macquart (1846) gives "De l'Australie, Île Sidney" = Sydney (lectotype ♂ here designated of *T. coerulea* Macquart), not in good condition but characters of hind tibia and of wing pattern and head colour clearly visible, paralectotype ♂, paralectotype ♀, OX (Bigot collection); "Australasia ? Collector. One of Walker's series so named. E.A.W.", but Walker simply gives "New Holland" (lectotype ♂ here designated of *T. cluana* Walker, somewhat damaged but hind tibiae intact, BM), "Australia. Pres by the Ent. Club. B.M. 1844-12" (paralectotype ♀ of *T. cluana,* BM).

OTHER MATERIAL EXAMINED (localities only given): *Queensland* — Rockhampton (WM); Brisbane (UQ). *New South Wales* — 3 miles SW of Broadwater, Myall Lakes (ANIC); Cowan (AM); Ku-ring-gai Chase, near Sydney (AM); North Sydney (AM); Sydney (AM, NSWDA, UQ); Kurnell (NSWDA); Bundeena (AM, NSWDA); Royal National Park (AM, CSIRO); Heathcote (AM); Currarong, near Jervis Bay (AM); Nadgee Nature Reserve, via Womboyn Lake (AM). *Victoria* — Gisborne (ANIC); "Victoria" (AM).

Lenophila nila n. sp.
Figs. 13, 22, 38-41

♂ ♀: very similar to *L. danielsi* in most characters and agreeing with the description given for that species except as indicated below.

COLORATION: posterior slope of vertex blackish with 3 thinly pruinescent narrow white streaks, lateral one broadly isolated from whitish posterior orbit, a brownish spot

surrounding suture on each side of vertex. Coloration of postfrons as described for *L. secta*. Wing with a distinct rounded black spot representing preapical stripe in anterior half of first posterior cell only. ♂ abdominal tergites black; tergite 2 pale grey-pruinescent on posterior margin; tergite 3 thinly grey-pruinescent on most of surface; tergite 4 grey-pruinescent on anterior margin and more narrowly so on posterior margin; tergite 5 narrowly grey-pruinescent on anterior margin. ♀ abdomen with tergites 1-3 coloured as in *L. danielsi*; tergite 4 yellow; pleural membrane brown anteriorly, entire pleural and intersegmental membrane of segment 4 and of lateral and ventral parts of segment 3 yellow, except for a black spot behind each posterior angle of tergite 3.

HIND LEG of ♂: tibia not swollen near middle, with a short, compact, dense anterodorsal comb of bristles centred approximately at distal fifth and placed on a slight elevation; apical dorsal margin prominent, a small pubescent dorsal tubercle placed right at margin; hind tarsus without basal tubercle.

ABDOMEN of ♂: apophysis of sternite 2 slightly inclined forwards, with 3 apical tubercles, the odd median one placed anteriorly to the others. Outer surstylus broad and more compact than in *L. danielsi*, not lobed, articulated at base; inner surstylus much shorter than outer surstylus, with one translucent and 2 black terminal teeth which are directed forwards; aedeagus very similar to that of *L. danielsi*, but with both preglans and glans shorter and more compact.

DIMENSIONS: total length, ♂ 3.9-5.5 mm, ♀ 3.6-5.0 mm; length of thorax, ♂ 1.5-2.3mm, ♀ 1.5-2.4 mm; length of wing, ♂ 3.7-4.8 mm, ♀ 3.3-4.9 mm.

DISTRIBUTION: south-western Australia; south-eastern South Australia; western Victoria.

HOLOTYPE ♂: Crystal Springs, 7 miles W of Walpole, Western Australia, 14 xii 1970 (AM), G.A.H. and H. Hughes.

OTHER MATERIAL EXAMINED: *Western Australia* — same data as holotype (paratypes, 4 ♂, 2 ♀, AM, 1 ♂, 1 ♀, BM); Swan River, no date (paratypes, 2 ♂, 4 ♀, WADA), L. J. Newman; John Forrest National Park, Darling Range, i 1971 (paratypes, 11 ♂, 6 ♀, AM, 2 ♂, 2 ♀, WAM), G.A.H. and H. Hughes; Hovea, i 1934 (paratype ♂, ANIC), K. R. Norris; Deep Dene, Karridale, i 1963 (paratype ♀, ANIC), L. M. O'Halloran; 10 miles S of Margaret River, xi 1958 (paratype ♂, ANIC), E. F. Riek; Bunbury, x 1958 (paratypes, 1 ♂, 1 ♀, AM), A. Snell; King George's Sound, no other data (paratypes, 1 ♂, 1 ♀, AM). *South Australia* — 4 miles W of Yumali, i 1959 (1 ♀, ANIC), L. J. Chinnick; Keith, iii 1964 (1 ♂, AM), G. L. Bush. *Victoria* — 5 miles S of Lah Arum, Grampian Mountains, ii 1956 (1 ♂, 2 ♀, ANIC, 1 ♂, AM), I. F. B. Common.

In the Bigot Collection, University Museum, Oxford, there is a specimen of this species labelled "*Urophora rufitarsis* Macq. ♂ ♀". It is above the cabinet label "U. Rufitarsis ♀. Am. Boreal. Macq". These circumstances would normally be indicative of type material, but reference to the description of *U. rufitarsis* Macquart (1855: 143-144, pl. 7, fig. 6) shows it to be an insect from Cape of Good Hope which is quite unlike *Lenophila*. *Herina rufitarsis* Macquart and *Lonchoea rufitarsis* Macquart are also quite different insects.

The specific name *nila* is based on a Sanskrit word for blue, but is here used as a Latin adjective with feminine inflection.

HABITS AND HABITAT

Lenophila dentipes apparently lives principally in *Eucalyptus* forests. Mr. Sands' material from his garden at Newport indicates that the species can survive under suburban conditions where considerable numbers of native trees have been retained. He informs us

that the adults are attracted to fresh possum faeces (apparently for feeding), and to the crushed leaves of the rutaceous plant *Zieria smithii* Andrews.

Mr. G. A. Holloway has previously provided notes on courtship and mating of *L. dentipes* (McAlpine, 1973), which he observed on the trunk of a smooth barked *Eucalyptus* at Blue Lagoon Reserve, near The Entrance. Courting pairs faced each other for some time but did not wave or display the wings. Mr. Holloway also observed apparent oviposition. On the shaded side of a *Eucalyptus* tree he found more than forty females of *L. dentipes* and *Euprosopia tenuicornis* which appeared to be laying eggs in the sap that was exuding from beetle damage under a piece of dead bark. On investigation he found dipterous larvae in the sap, but these may be *Cairnsimyia* (family Heleomyzidae) and not platystomatids.

At Warrumbungle National Park in late April Messrs. G. Daniels and M. S. Moulds found numerous adults of *L. dentipes* resting very near the ground on trunks of smooth-barked *Eucalyptus* trees; one of the flies was concealed under bark. Several of these were soft, newly emerged specimens, and it was particularly noted that no plants of *Xanthorrhoea* grew in the immediate vicinity.

From these observations of oviposition and newly emerged adults it appears that the larval stages of *L. dentipes* may be commonly associated with *Eucalyptus* species.

By contrast with the *dentipes* species group, where the only evidence of any plant association concerns *Eucalyptus* and possibly *Zieria*, adults of all species of the *coerulea* group are associated with plants of the genus *Xanthorrhoea* (family Xanthorrhoeaceae, formerly placed in Liliaceae or Juncaceae), and there is evidence that in at least three species, the larvae also live in this plant. *Xanthorrhoea* species are commonly known as grass-trees or black boys. Like *Lenophila*, *Xanthorrhoea* is restricted to Australia, and the family Xanthorrhoeaceae is restricted to Australia, New Guinea, and New Caledonia. Adults of species of the *coerulea* group are frequently found on leaves of *Xanthorrhoea*, a fact first noted by Froggatt (1907, as *Ortalis coerulea*), and this is probably the source of most collected material of the group. The recent statement by McAlpine (1973) that specimens had been taken on flowers of *Xanthorrhoea* is an error, the specimens referred to having been taken on the leaves. Our friends G. Daniels, G. A. Holloway, and R. Mulder confirm our recent observations that these flies are always found on the leaves and not on inflorescences. This is interesting as the flowers of *Xanthorrhoea* are insect-pollinated and produce a large quantity of nectar which attracts other Diptera and Hymenoptera. The following species of *Lenophila* have been collected on leaves of *Xanthorrhoea* species: *L. achilles* (Daniels, Fletcher, Holloway, Liepa, McAlpine); *L. secta* (McAlpine); *L. danielsi* (Daniels, Holloway, McAlpine); *L. coerulea* (Froggatt, Daniels, McAlpine); *L. nila* (Holloway and Hughes).

The systematics of the genus *Xanthorrhoea* have been dealt with by Lee (1966) who states: "These species, however, to some extent, fall short of the standards of discreteness generally required of a species, and there are strong field indications of hybridism". Furthermore, the specific characters are often to be found in the inflorescence and the flies are seldom found on plants bearing inflorescences. Lee provides no characters for the separation of *X. media* R. Brown and *X. resinosa* Persoon on vegetative parts. It is possible that the distribution of the different species of *Xanthorrhoea* is imperfectly known, even in the Sydney district. For these reasons we have been unable to identify the host species of *Lenophila* in many cases. In the Sydney district *X. arborea* R. Brown is a readily identified species common in sandy gullies, but repeated searching of this species has failed to produce any specimens of *Lenophila*, and it is assumed to be unattractive to the flies. *X. minor* R. Brown has been examined by G. A. Holloway at Nadgee Nature Reserve and no *Lenophila* adults were seen on it, though *L. coerulea* and *L. achilles* were present in a nearby stand of *X. australis* R. Brown in dry sclerophyll forest. *X. macronema* F. Mueller has been examined in only one locality but no *Lenophila* were found on it.

Lenophila achilles is, in our experience, found on tall, arborescent plants (height of trunk or caudex usually between 1 and 2½ m) with narrow leaves. They were taken on such plants at Royal National Park and West Head, near Sydney, at Halfway Creek, near Grafton, and at Deception Bay, near Brisbane. The plants at Halfway Creek and Deception Bay may be *X. australis* but, according to Lee (1966) and Beadle, Evans, and Carolin (1972) this species is unknown in coastal areas of the Sydney district. One of the tall plants later seen in flower at Royal National Park proved to be *X. resinosa* (though outside the size range given for this species by Lee). The flies have generally been taken in open sunny situations, but at West Head *L. achilles* was taken together with *L. coerulea* under semi-shaded conditions in *Eucalyptus* forest. *L. danielsi* was found only a short distance away (c. 100 m) in open heath-country on somewhat smaller plants (perhaps *X. resinosa*). At Deception Bay one specimen of *L. secta* was found together with the specimens of *L. achilles*. Mr. Daniels informs us that he obtained *L. achilles* at Grose Vale on leaves of *Xanthorrhoea* with tall trunks, growing under Eucalyptus trees near a dry stream bed.

Lenophila danielsi and *L. coerulea* have been commonly found on somewhat smaller plants of *Xanthorrhoea* than the above at several localities in Royal National Park and at other localities in coastal New South Wales. The plants are probably either *X. resinosa* Persoon (= hastile R. Brown) or *X. media* R. Brown, but we are unable to distinguish these two species when not in flower. The flies are generally seen on plants with trunks 20-80 cm high, especially those in prominent situations. However they are rarely found on plants with inflorescences, either flowering or fruiting, and none has been seen on the young *Xanthorrhoea* plants, which are often very numerous where the flies occur. *L. coerulea* and *L. danielsi* rest longitudinally aligned with the leaf, always with the head downwards. At rest the wings are flexed over the abdomen, their long axes parallel to one another and to that of abdomen, their posterior margins overlapping. While walking, the wings are spread forwards to form a very wide angle and then flexed back with a rowing motion. During this wing-waving, the two wings are usually flexed in unison, but may be moved alternately for shorter periods and with smaller amplitude. During warm weather in the heat of the day (temperature probably not above 30°C) individuals were seen to indulge in very rapid wing-flicking which was not observed at lower temperatures. Some specimens have been seen in copula on the leaves during the morning, but more rarely in the hotter part of warm days as very few females are on the leaves at such times. On one occasion (4 xii 1970 at Royal National Park) between 5.30 and 6.30 p.m. numerous pairs of *L. coerulea* were seen *in copula* on the leaves, always facing downwards with the wings fully flexed over abdomen. On 9 xi 1974 at West Head, Ku-ring-gai Chase, numerous copulating pairs of *L. coerulea* were again encountered shortly before sunset. These observations seem to indicate that the peak of mating activity in *L. coerulea* is reached in the late afternoon.

Aggregations of these flies on individual plants could be partly due to visual attraction to the larger and more prominent plants, but occasionally we have received impressions that other factors may influence aggregation. At Ku-ring-gai Chase near Terrey Hills in heath country on 15 vi 1974, approximately 9 examples of *L. coerulea* belonging to both sexes were seen simultaneously on one plant of *X. resinosa*. Although there were some hundreds of other *Xanthorrhoea* plants in the vicinity, many of them of similar appearance to this plant, no *Lenophila* could be found on them despite a wide search. This aggregation could not be accounted for simply by the appearance or location of the plant, nor by recent emergence from the plant as all were mature individuals. Factors in aggregation could be either unusual chemical properties of the favoured plant, or attraction of the flies to each other, either chemically or visually.

G. A. Holloway informs us that he found a number of specimens of *L. nila* on *Xanthorrhoea* leaves at Crystal Springs and John Forrest National Park, Western Australia. Most of the plants on which he found them at Crystal Springs were in flower. He also

supplies the following interesting notes made on 22 i 1971 at John Forrest National Park: "Adults of *Lenophila* (*nila*) were found only on the shaded side of smooth-barked *Eucalyptus* trunks, and not on rough-barked species, only up to a level of 120 cm from the ground. They were usually in a resting position facing either up or down, more often up. When approached with a small hand net, they turned to face the net, often moving the wings in a rowing action. The wing movement increased in frequency as the net approached the specimen. Nine males and seven females were captured between 4.30 and 5.00 p.m. Conditions were very hot, the temperature registered at 2.00 p.m. that day being 43°C." These observations are of special interest as the only available indications of the resting place for species of the *Lenophila coerulea* group when they are not on *Xanthorrhoea* leaves.

The very few cases of *coerulea* group adults reared from the immature stages indicate that they live in trunks of *Xanthorrhoea*.

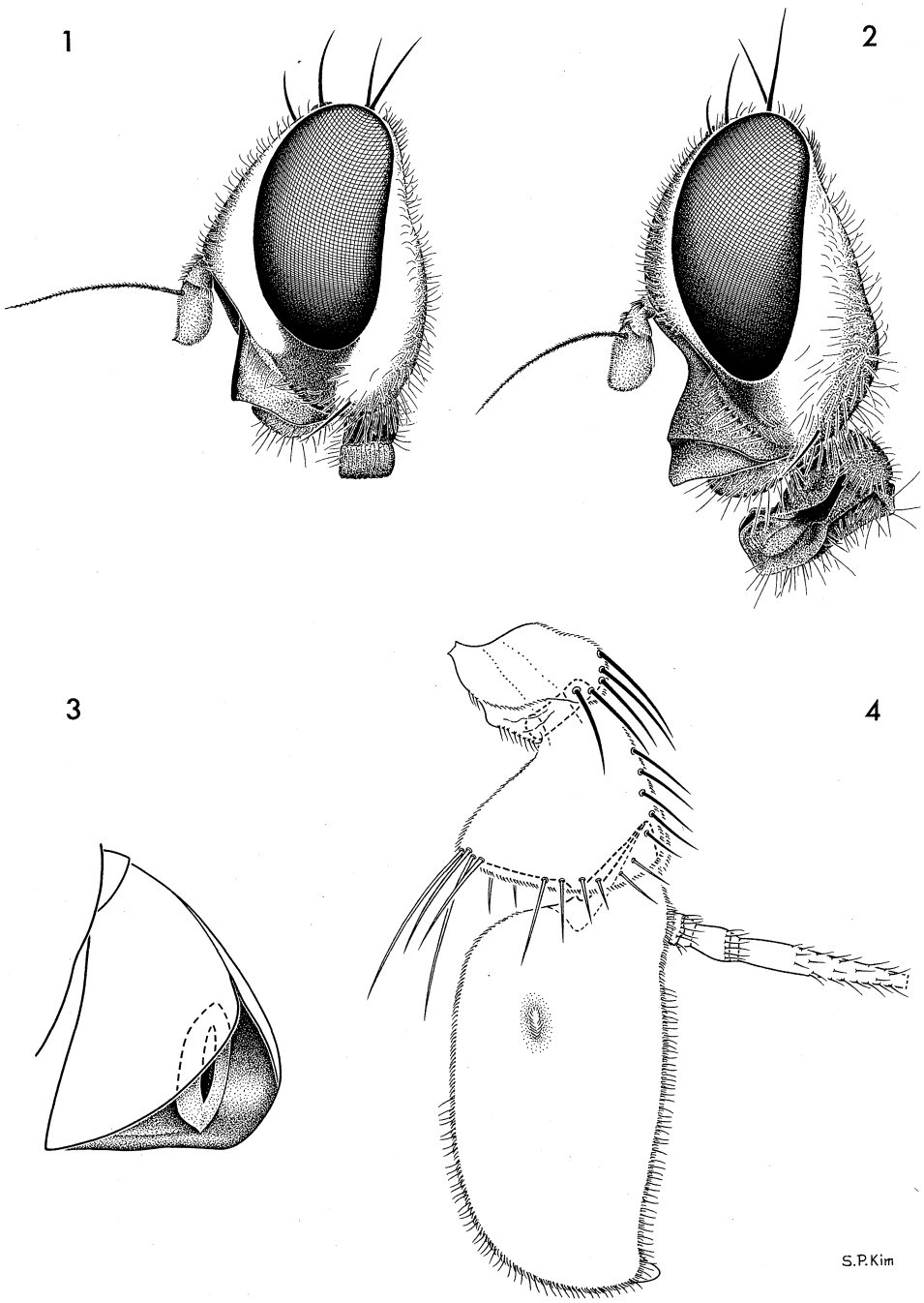
Froggatt (1896) refers to a "very pretty little fly" of "the family Trypetinae" which lives in the rotting caudex of *Xanthorrhoea* in the Sydney district. He reared several of these from the pupa, and stated that the adult "is often found upon the leaves, moving its wings up and down (as many members of this family do when resting), but is very hard to catch; common in November". He gives short descriptions of the pupa and adult. We do not think there is much room for doubt that these notes refer to a species of the *Lenophila coerulea* group, but his description of the adult is very inaccurate. Perhaps it is based on a few immature reared specimens in imperfect condition. None of Froggatt's early material can now be found, but in BM and NSWDA collections there are adults of "*Ortalis coerulea*" collected on leaves by Froggatt in 1902.

C. E. Chadwick and M. I. Nikitin collected four adults of *L. coerulea* on their laboratory window at Rydalmere, near Sydney, during the months of August and October, 1969. Mr. Chadwick has informed us that at this time he was keeping material of dead *Xanthorrhoea* trunks infested with the curculionid weevil *Trigonotarsus rugosus* Boisduval and collected at Bundeena in May 1969. He considers that this was almost certainly the source of the flies.

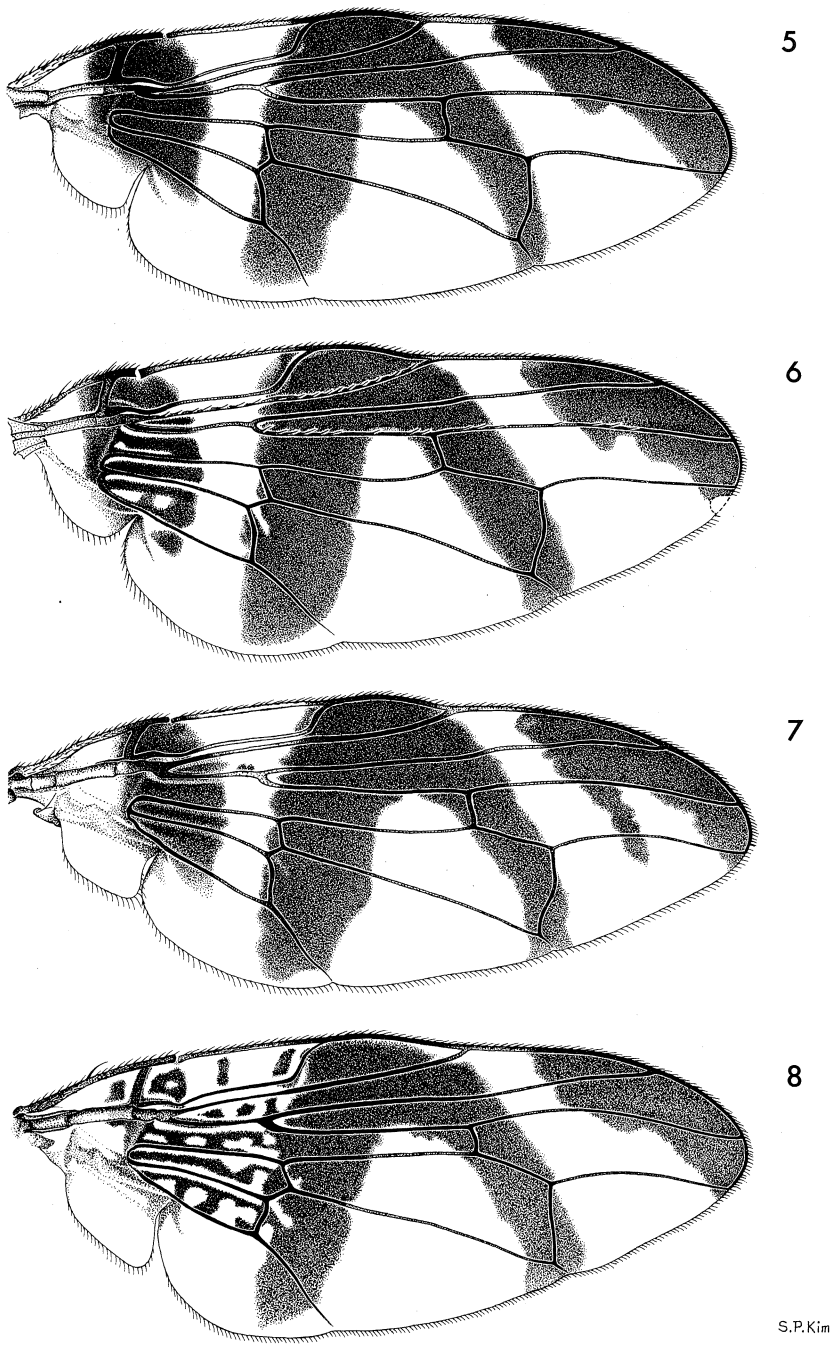
Two specimens of *Lenophila secta* in ANIC collection bear the following label data: "Ballandean (i.e. near Stanthorpe, Queensland), 21.5.25, Grasstree, H. Jarvis", and one of these also bears the label "Bred from rotting Grass-tree".

Miss Z. R. Liepa has sent us adults of *L. achilles* which she reared from larvae found by M. Gill among the leaf-bases of *X. australis* at Mount McDonald near Canberra. This presumably means that the larvae were in the outer part of the trunk, which is formed by the compacted leaf bases.

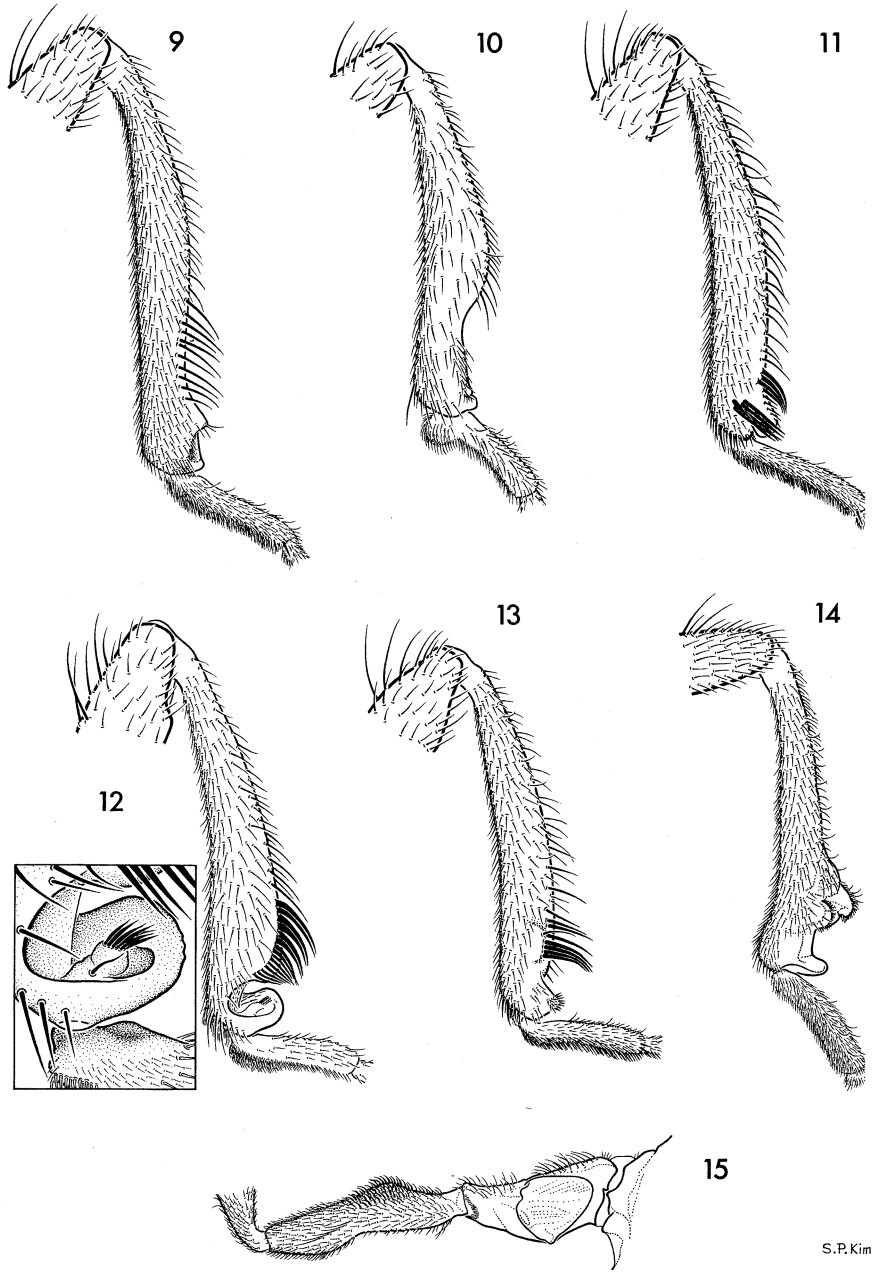
N. Scarlett informs us (*in litt.*) that he has reared *L. achilles* from larvae found in the rotting pith of *Xanthorrhoea australis* on the plateau area of the Brisbane Range, Victoria, on 2 ix 1967. Adults emerged on 14 i 1968. The plants were suffering from die-back due to *Phytophthora cinnamomi*, a fungal root parasite.



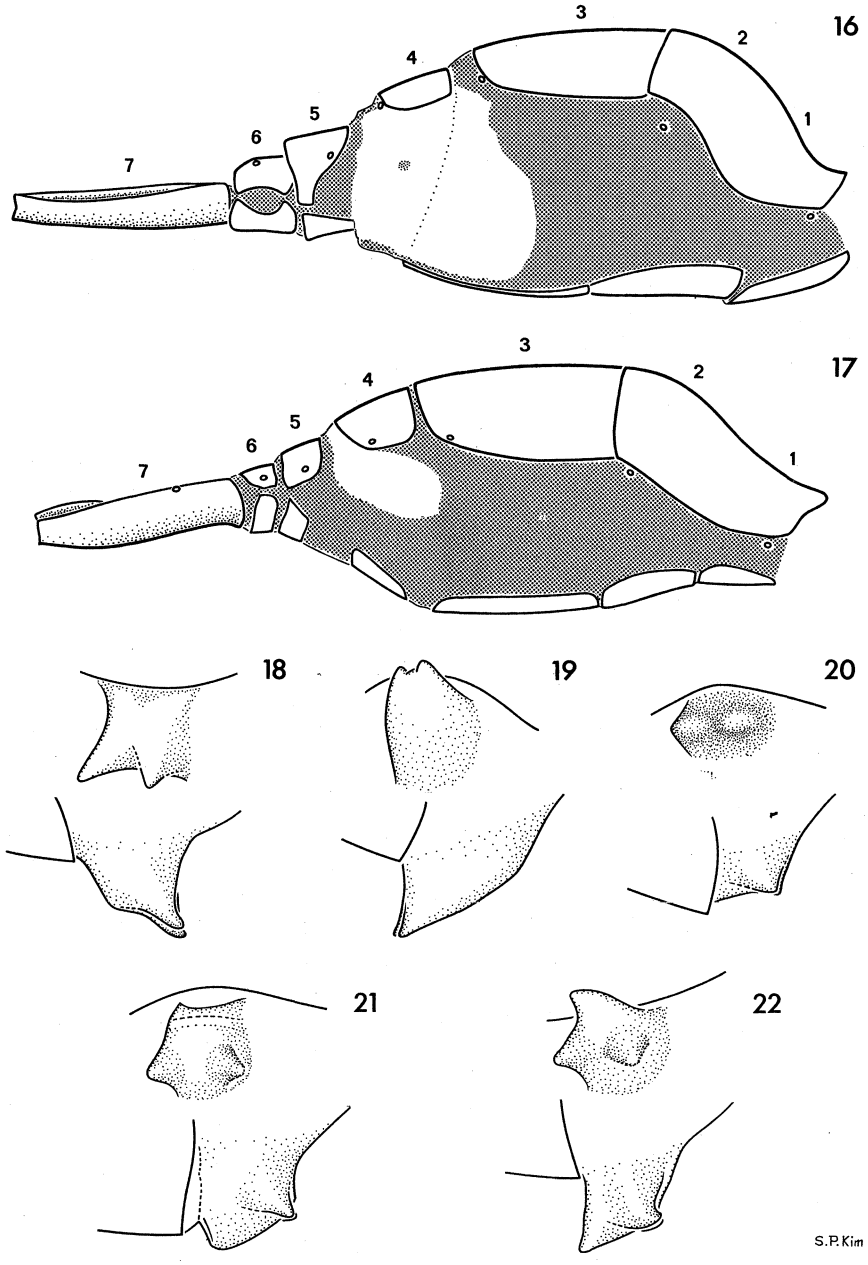
Figs. 1-4. 1, *Lenophila danielsi,* head of holotype. 2, *L. dentipes,* head. 3, *L. coerulea,* first and second antennal segment showing socket for attachment of third segment. 4, *L. coerulea,* right antenna, internal structures shown in broken lines.



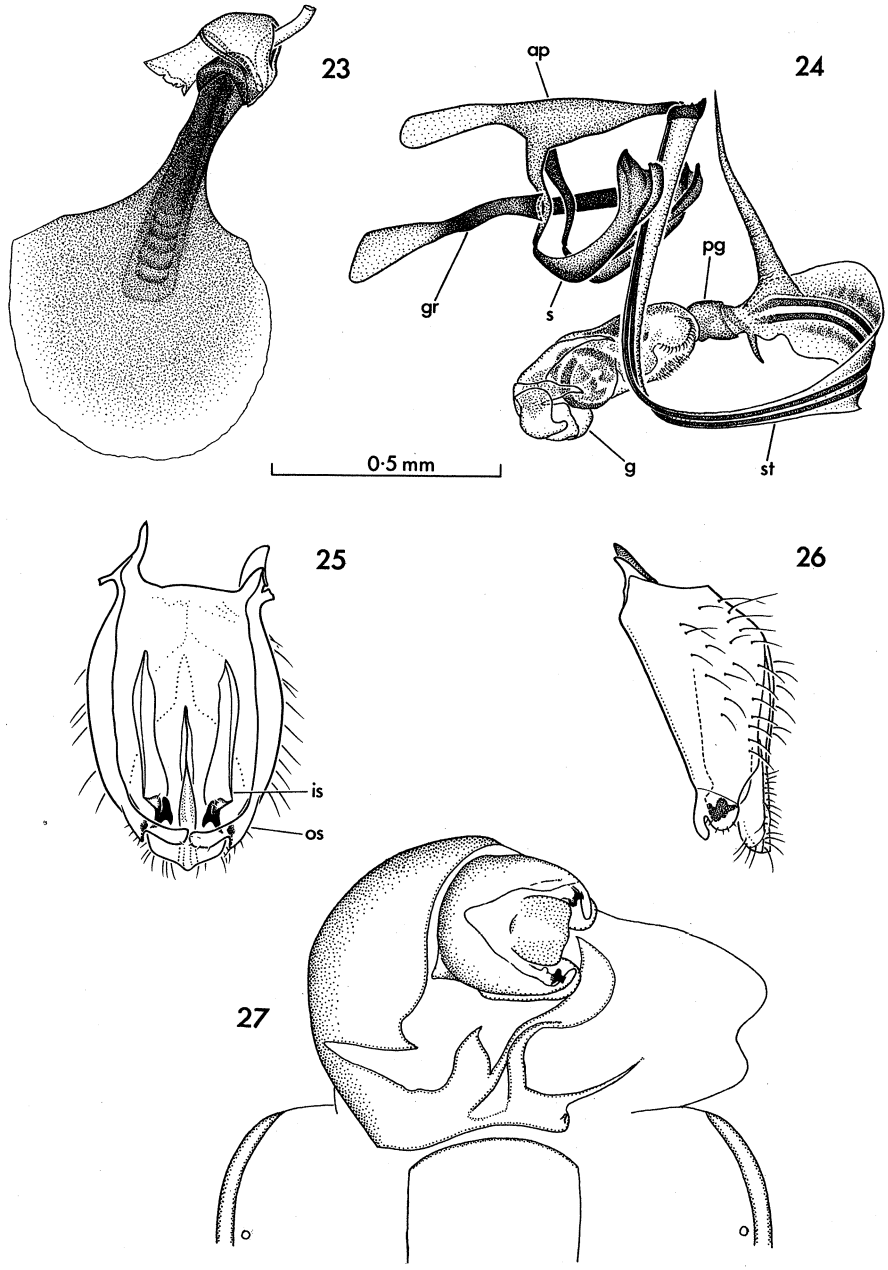
Figs. 5-8. Wings of *Lenophila*. 5, *L. danielsi*, holotype. 6, *L. secta*, holotype. 7, *L. achilles*, holotype. 8, *L. dentipes*.



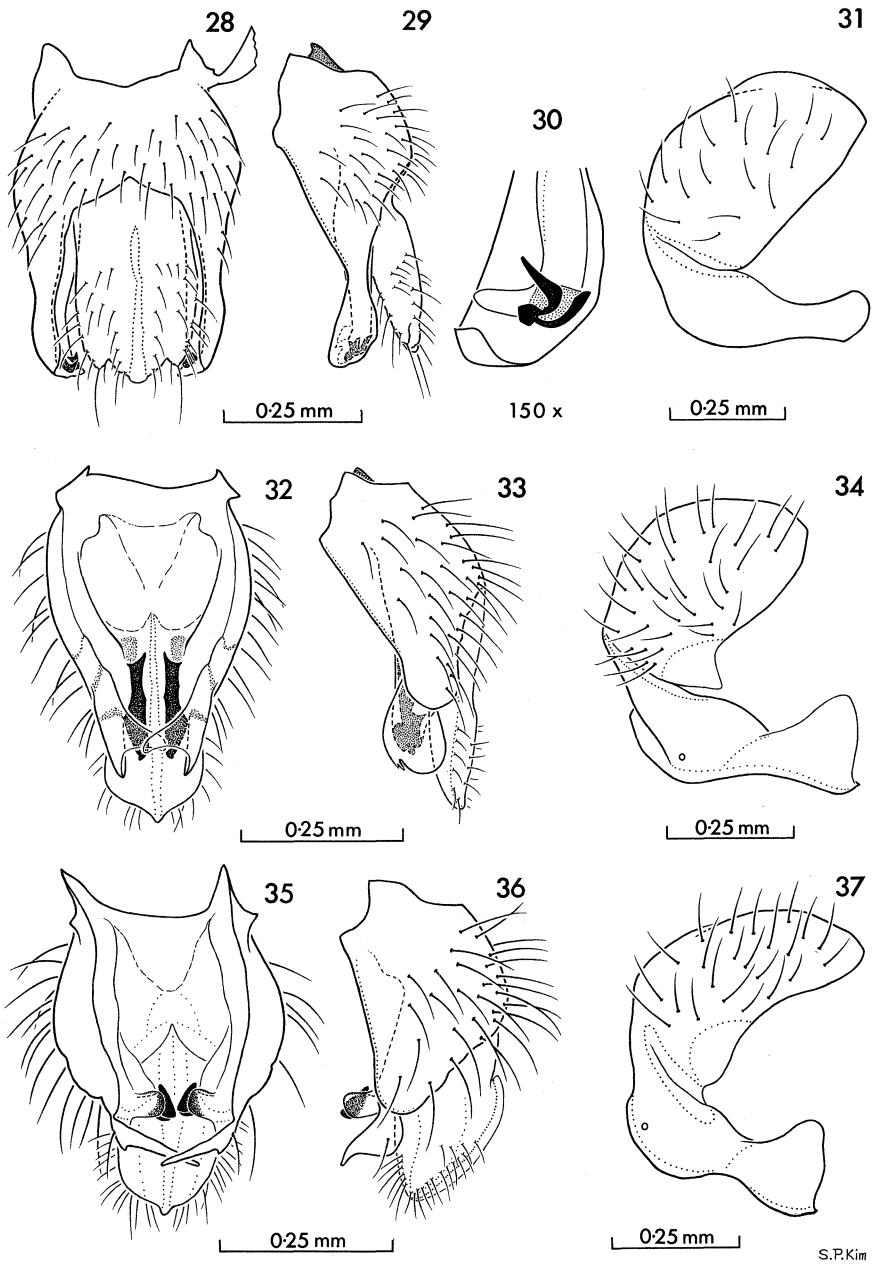
Figs. 9-15, left hind legs of male *Lenophila*. 9, *L. coerulea*, tibia and basitarsus. 10, *L. danielsi*, tibia and basitarsus of holotype. 11, *L. secta*, tibia and basitarsus of holotype. 12, *L. achilles*, tibia and basitarsus of holotype, inset detail of apex of tibia, X 400. 13, *L. nila*, tibia and basitarsus of holotype. 14, *L. dentipes*, tibia and basitarsus. 15, *L. dentipes*, coxa, trochanter, and femur from above.



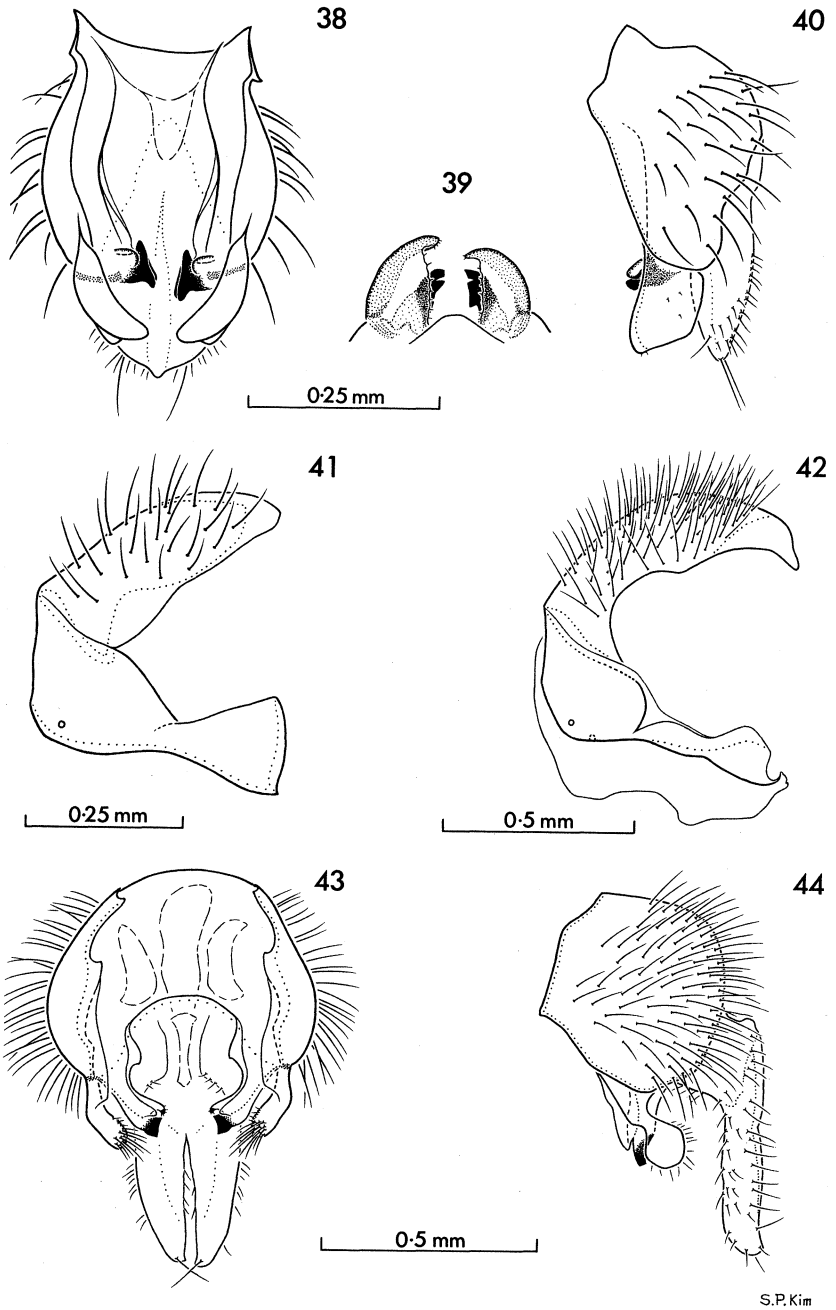
Figs. 16-22. 16, *Lenophila coerulea*, abdomen of female drawn from fresh material. 17, *L. danielsi*, the same. 18-22, processes of male sternite 2, ventral oblique view and left lateral view of each. 18, *L. coerulea*. 19, *L. danielsi*. 20, *L. secta*. 21, *L. achilles*. 22, *L. nila*.



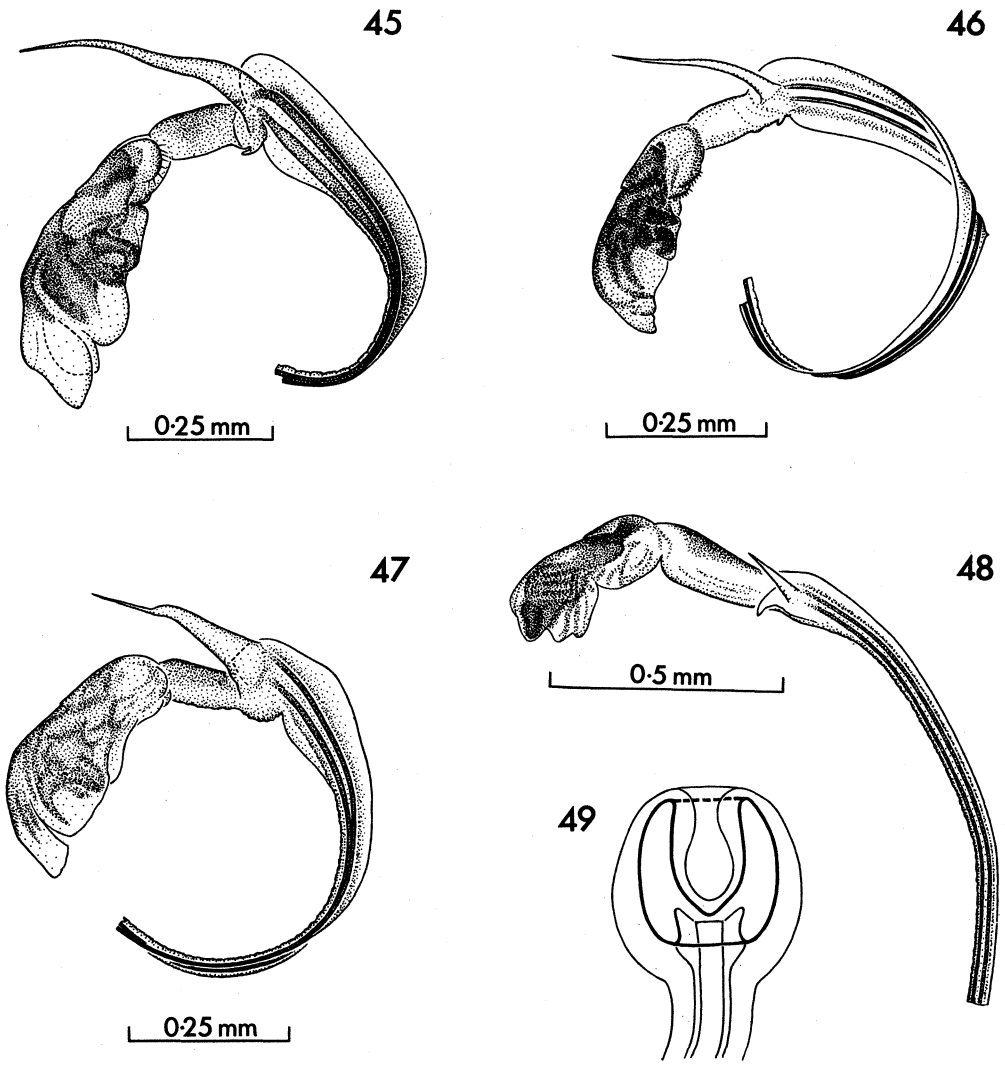
Figs. 23-27, *Lenophila coerulea*, male genitalia and associated parts. 23, sperm pump from left side, muscular parts removed. 24, aedeagus and associated basal structures from left, left arm of genital ring cut away. 25, epandrium from in front. 26, epandrium from left side. 27, postabdomen, ventral aspect. ap, aedeagal apodeme. g, glans of aedeagus. gr, genital ring. is, inner surstylus. os, outer surstylus. pg, preglans, lateral sclerites of sternite 9. st, stipe of aedeagus.



Figs. 28-37. Male postabdominal structures of *Lenophila*. *L. danielsi:* 28, epandrium from behind; 29, epandrium from left side; 30, detail of apices of right surstyli, medial view; 31, sclerites of protandrium. *L. secta:* 32, epandrium from in front; 33, epandrium from left side; 34, sclerites of protandrium. *L. achilles:* 35, epandrium from in front; 36, epandrium from left side; 37, sclerites of protandrium.



Figs. 38-44. Male postabdominal structures of *Lenophila*. *L. nila:* 38, epandrium from in front; 39, apices of surstyli from below; 40, epandrium from left side; 41, sclerites of protandrium. *L. dentipes:* 42, sclerites of protandrium; 43, epandrium from in front; 44, epandrium from left side.



Figs. 45-49. Aedeagi of *Lenophila*. 45, *L. danielsi*. 46, *L. secta*. 47, *L. achilles*. 48, *L. dentipes*. 49, spermatheca of *L. danielsi*.

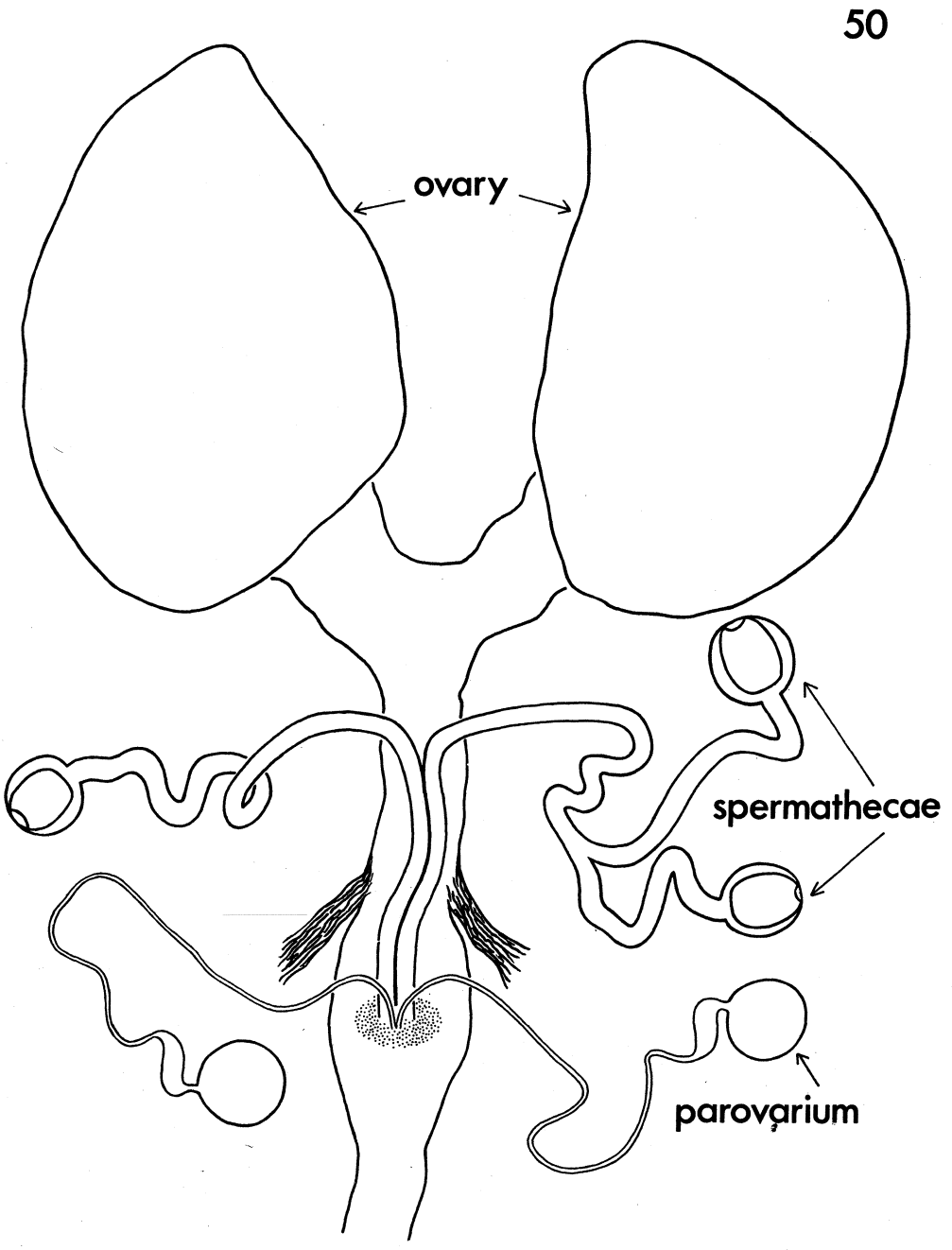


Fig. 50. *Lenophila danielsi,* female reproductive system.

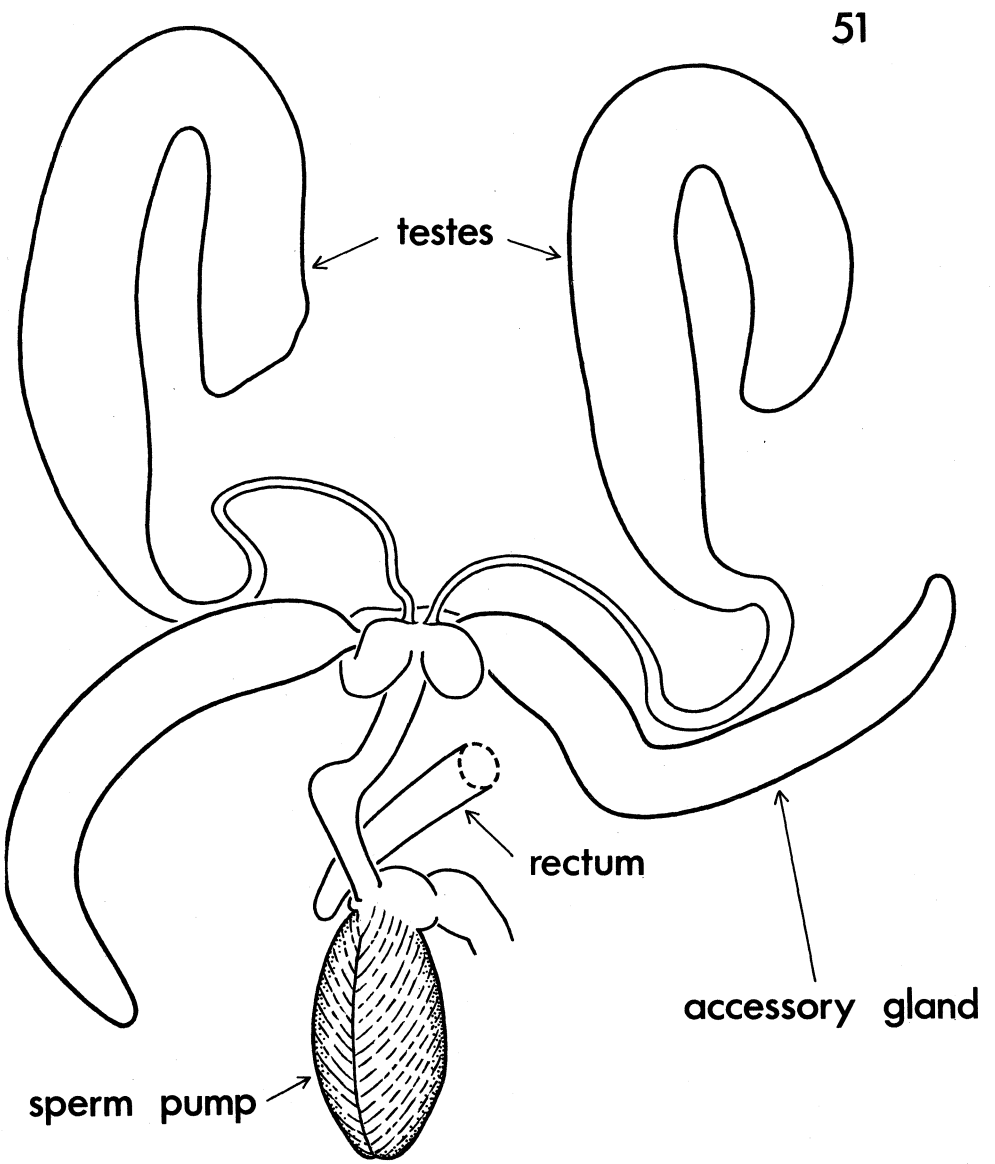


Fig. 51. *L. danielsi,* male reproductive system.

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POSTSCRIPT. The statement of Lower (1970. *Rec. South Aust. Mus.* 16(2):50) that *C. caerulea* is the type of *Celetor* by original designation is incorrect as Loew indicated no type species.

G. Daniels recently collected *L. dentipes* at Byfield State Forest, Yeppoon district, Queensland, significantly extending the known distribution.

REFERENCES

Beadle, N. C. W., O. D. Evans and R. C. Carolin, 1972. Flora of the Sydney Region. A. H. and A. W. Reed, Sydney. 724 pp.

Froggatt, W. W., 1896. The Entomology of the Grass-trees (*Xanthorrhoea*). *Proc. Linn. Soc. N.S.W.* 21: 74-87.

——— 1907. Australian Insects. William Brooks, Sydney. 449 pp.

——— 1909a. Report on parasitic and injurious insects. Official report on fruit fly and other pests in various countries. *N.S.W. Dept. of Agriculture.* 115 pp., 8 pl.

——— 1909b. Fruit flies (family Trypetidae). *Farmers' Bull., Sydney.* 24: 56 pp., 8 pl.

Guerin-Meneville, M., 1843. Monographie d'un genre de Muscides, nomme *Ceratitis. Rev. zool.* 6: 194-201.

Hendel, F., 1914a. Diptera, Fam. Muscaridae, Subfam. Platystominae. *Gen. Ins.* 157: 179 pp., 15 pl.

——— 1914b. Die Arten der Platystominen. *Abhandl. Zool.-Bot. Ges. Wien* 8: 1-410, pl. 1-4.

Imms, A. D. (revised O. W. Richards and R. G. Davies), 1957. A general textbook of Entomology. 9th ed. Methuen, London. 886 pp.

Lee, A. T., 1966. Xanthorrhoeaceae. *Contr. N.S.W. Nat. Herb., (Flora Series)*, 34: 42 pp.

Loew, H., 1873. Monographs of the Diptera of North America, Part III. *Smithson. Misc. Coll.* 256: 351 pp.

Lowne, B. T., 1895. The anatomy, physiology, morphology, and development of the blow-fly (Calliphora erythrocephala), 2. R. H. Porter, London. Pp. 352-778.

McAlpine, D. K., 1973, July (erroneously given as 1972). The Australian Platystomatidae (Diptera, Schizophora) with a Revision of Five Genera. *Mem. Aust. Mus.* 15: 256 pp.

Macquart, P. J. M., 1843. *Dipteres Exotiques,* 2, pt. 3: 304 pp., 36 pl.

——— 1846. *Diptères Exotiques,* Supplément 1: 238 pp., 20 pl.

——— 1851. *Diptères Exotiques,* Supplément 4, pt. 2: 161-364, pl. 15-28.

Malloch, J. R., 1929. Notes on Australian Diptera. XXII. *Proc. Linn. Soc. N.S.W.* 54: 505-516.

Munro, H. K., 1959. *Lenophila* Guérin-Méneville, a Genus of Otitidae (Diptera). *Proc. R. Soc. Qld.* 70: 47-50, pl. 2.

Schiner, J. R., 1868. *Reise der Fregatte Novara* etc., Zool. 2, Abt. 1B, Diptera: 388 pp., 4 pl.

Snodgrass, R. E., 1935. Principles of Insect Morphology. McGraw-Hill, New York. 667 pp.

Steyskal, G. C., 1961. The genera of Platystomatidae and Otitidae known to occur in America north of Mexico (Diptera, Acalyptratae). *Ann. ent. Soc. Amer.* 54: 401-410.

Walker, F., 1849. *List of the Specimens of Dipterous Insects in the Collection of the British Museum.* 4: 689-1172.

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