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A. Revision of Australian Fanniidae (Diptera: Calyptrata)

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Abstract

Australian Fanniidae are revised, and notes given on species from the adjacent regions of the Pacific and New Zealand. Mention is made of the medical and veterinary significance of the group. Thirteen species in three genera are included.

One new genus, *Australofannia*, is described with the type-species *A. spiniclunis*. Six new species are described: *Australofannia spiniclunis*, *Fannia anteroventralis*, *F. norfolki*, *F. tasmaniae*, *F. howei* and *F. capitalis*.

Introduction

The family Fanniidae is poorly represented in the southern hemisphere of the Old World, and three genera containing only 10 species are known definitely from Australia. The family includes the ubiquitous *Fannia canicularis* (Linnaeus), the lesser house fly, and the widespread but less common *Euryomma peregrinum* (Meigen), but most of the other species discussed in this paper are endemic to Australia and are restricted to the more temperate south-eastern areas.

The group was last revised in Australia, as the subfamily Fanniinae of the family Muscidae, by J. R. Malloch. He recorded *Fannia canicularis* and described a new species *australis* (Malloch 1923, p. 605); recorded *Euryomma peregrinum* (Malloch 1924, p. 146); and gave a key to genera, mentioning that a third, undescribed, species of *Fannia* was known to him (Malloch 1925, p. 38).

Elsewhere in the region, Miller (1950) has given a catalogue of the New Zealand species which are discussed further below (see p. 16), and Snyder (1965) has reviewed the species from Micronesia. More comprehensive works on other regions include revisions of the Palaearctic species by Hennig (1955) and of the Nearctic

species by Chillcott (1961), and a review of the European larvae by Lyneborg (1970). Hennig (1965) has discussed the phylogenetic structure of the group.

As the family is predominantly temperate in distribution, it is to be expected that any further Australian species will be discovered in the south-east. It is also likely that the widespread American and Pacific *F. pusio* (Wiedemann) may be introduced into Queensland, and so it has been included in the key.

The medical and veterinary significance of the family in Australia is slight. *F. canicularis* is a well known synanthrope, living in houses and around poultry farms; larvae are frequent in cases of urinogenital myiasis. *F. australis* is a tertiary sheep blowfly.

Characters Used

The characters employed here are in general use among students of Muscidae. Abbreviations for the setae and other structures are as follows:

<i>a</i>	anterior	<i>pd</i>	posterodorsal
<i>acr</i>	acrostichal setae (hairs)	<i>ph</i>	posthumeral
<i>ad</i>	anterodorsal	<i>pv</i>	posteroventral
<i>av</i>	anteroventral	<i>post</i>	postsutural
<i>d</i>	dorsal	<i>pra</i>	prealar seta
<i>dc</i>	dorsocentral setae	<i>prsc</i>	prescutellar
<i>h</i>	humeral setae <i>or</i> humeral crossvein	<i>prst</i>	presutural
<i>ia</i>	intraalar setae	<i>pvt</i>	postvertical setae
<i>mspl</i>	mesopleural setae	<i>sa</i>	supraalar setae
<i>npl</i>	notopleural setae	<i>sc</i>	subcosta
<i>ori</i>	lower orbital setae	<i>stpl</i>	sternopleural setae
<i>ors</i>	upper orbital setae	<i>v</i>	ventral
<i>p</i>	posterior	<i>vte</i>	outer vertical setae
<i>pa</i>	postalar setae	<i>vti</i>	inner vertical setae

Sources of Material

Abbreviations for museums and institutions where material is located are as follows:

AM	Australian Museum, Sydney
ANIC	Australian National Insect Collection, CSIRO, Canberra
BMNH	British Museum (Natural History), London
CAS	California Academy of Sciences, San Francisco
CMC	Christchurch Museum, Canterbury, New Zealand
DAV	Department of Agriculture, Victoria
HEP	H. E. Paterson's private collection, now in Johannesburg, South Africa
LSL	The Linnean Society, London
MNHNP	Muséum National d'Histoire Naturelle, Paris
NHNV	Naturhistorisches Museum, Vienna
NMV	National Museum of Victoria, Melbourne
QD	Queensland Department of Primary Industries, Brisbane
QU	Department of Entomology, University of Queensland, St Lucia
RSM	Royal Scottish Museum, Edinburgh
SAM	South Australian Museum, Adelaide
SPHTM	School of Public Health and Tropical Medicine, Sydney
USNM	United States National Museum, Washington D.C.
UZMC	Universitetets Zoologiske Museum, Copenhagen

Family FANNIIDAE

Diagnosis

All Fanniidae can be recognized by the possession of a true dorsal submedian seta on the hind tibia (Fig. 9) or by the extremely short vein *CuA+1A* (vein 6), an imaginary extension of which would intersect an extension of vein *2A* (vein 7) before the wing margin (Figs 1-4).

In addition, the adults have a very characteristic appearance, particularly in the male sex where the abdomen is elongate, flattened, more or less parallel-sided, and densely dusted with a more or less developed pattern of triangular or near-triangular markings. The subcosta is evenly bowed towards the costa (Fig. 5), without any sinuosity, a feature shared with only the tribe Hydrotaeini of the Muscidae. Males usually have some kind of specialized bristling or more elaborate ornamentation on the mid legs, particularly the femur and tibia. Females have broad parafrontalia, with concave margins and (usually) outwardly directed lower *ors* placed low on the frons (Fig. 12), whereas muscids have the parafrontalia with convex margins and lower *ors* proclinate or reclinate. The male genitalia are very characteristic, with a strap-like hypandrium, no praegonite, bare postgonite, and often with a bacilliform process at the base of the cercal plate which is thought to be a development of the 'processus longus'. Neither a bacilliform process nor a clearly developed processus longus occurs in Muscidae. The female ovipositor has two pairs of spiracles, there being no spiracles in the Muscidae except for the Palaearctic genus *Achanthiptera* Rondani (see Hennig 1965, p. 21).

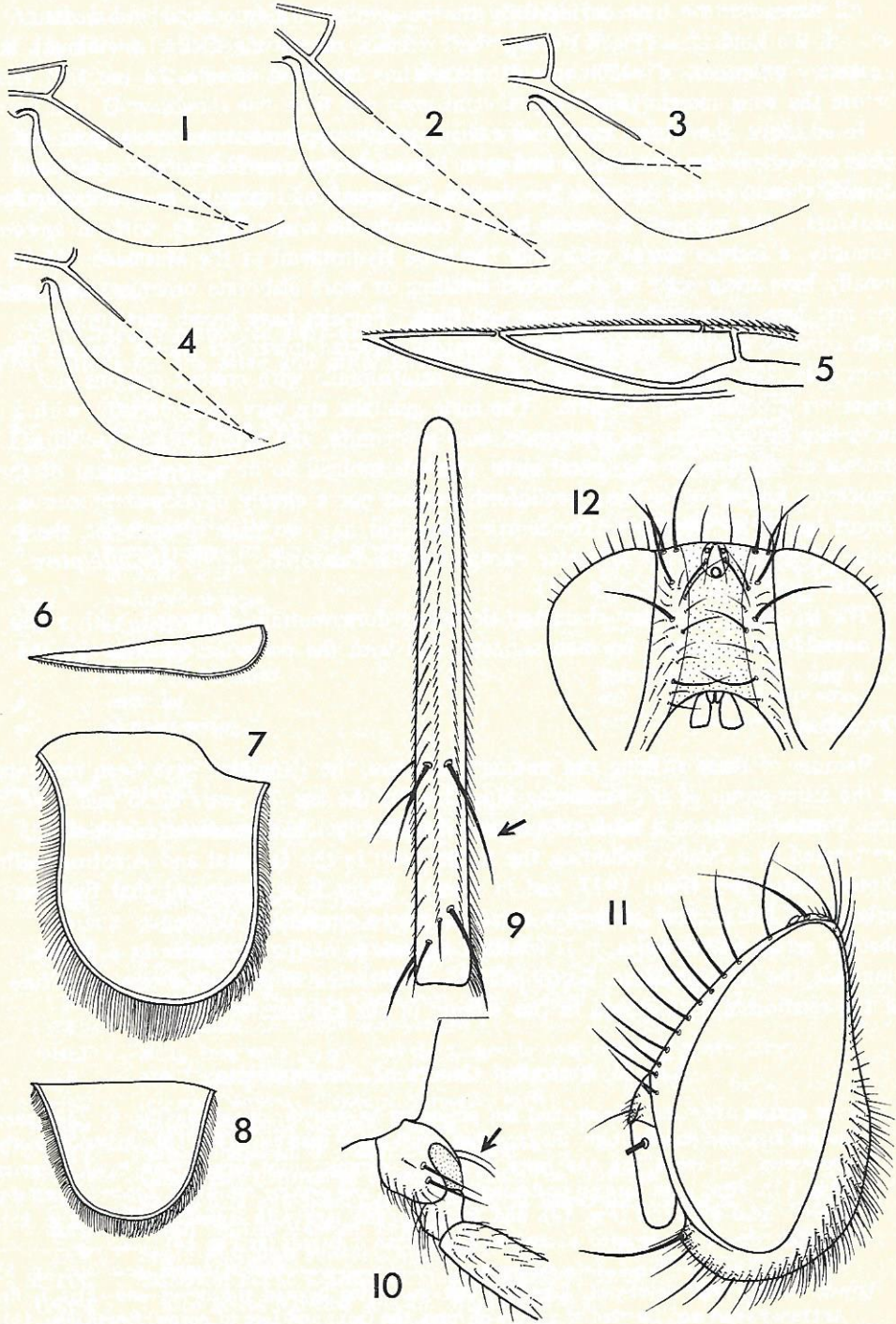
The larvae are also very characteristic, being dorsoventrally flattened, with a pair of dorsolateral processes on each segment, and with the posterior spiracles situated on a pair of raised tubercles.

Discussion

Because of these striking and unique characters, the Fanniidae have been recognized as the sister-group of the remaining Muscidae for the last 20 years or so and have been treated either as a subfamily or as a full family. In the present work they are treated as a family, following the status given in the Oriental and Afrotropical Diptera Catalogues (Pont 1977, and in press). Whilst it is recognized that the over-inflation of hierarchical categories usually tends to emphasize differences and to obscure actual relationships, it is felt that the status of the Fanniidae as a family alongside the Anthomyiidae, Scathophagidae and Muscidae presents a clearer picture of the relationships of groups in this section of the Calypteres.

Key to Australian Genera of the Fanniidae

1. Lower squama very small, linear, and not projecting beyond the upper one (Fig. 6). Antennae rather long and inserted high, the face thus much longer than usual (Fig. 13). Arista distinctly pubescent, in apical half the hairs slightly to conspicuously longer than basal diameter (Fig. 13). Hind coxa bare on posteroapical margin, and *prst acr* setulae in 3 rows. *2 prst dc*. Male: head dichoptic (Fig. 14), and mid tibia and tarsi with remarkable setae (Fig. 15). Female: lower *ors* directed backwards rather than outwards (as Fig. 14) *Australofannia*, gen. nov. (p. 5)
- Lower squama well developed, lobe-like, and projecting beyond the upper one (Figs 7, 8). Antennae short and inserted at middle of head, the frons and face of normal length (Fig. 11).



- Arista virtually bare. Hind coxa setulose on posteroapical margin (Fig. 10), or if bare then *prst acr* setulae usually in 2 rows. Male: head holoptic, but if dichoptic then 1 *prst dc* only; mid tibia and tarsi not modified in this way, the tarsi never with long setae. Female: lower *ors* directed outwards (Fig. 12) 2
2. One strong *prst dc* seta, the anterior one hardly distinct from the ground-setulae. Basal 2 antennal segments, lower interfrontalia, palpi, tip of scutellum and legs except tarsi yellow; hind coxa setulose on posteroapical margin (Fig. 10). Male: head dichoptic, no head dimorphism between the sexes *Euryomma* Stein (p. 11)
- Two strong *prst dc* setae. Antennae, frons, palpi, scutellum and legs except knees black; if femora and tibiae yellow (*norfolki*, female) then hind coxa bare on posteroapical margin. Male: head holoptic, with considerable head dimorphism between the sexes *Fannia* Robineau-Desvoidy (p. 15)

Genus *Australofannia*, gen. nov.

Type-species *Australofannia spinichunis*, sp. nov.

Diagnosis

Australofannia can be distinguished from the other Australian Fanniidae by the linear lower squama (Fig. 6).

In addition, the high face and short broad frons (Figs 13, 14), the long-pubescent arista (Fig. 13), and the strikingly ornamented male mid tibia and tarsi (Fig. 15) are very characteristic.

Description

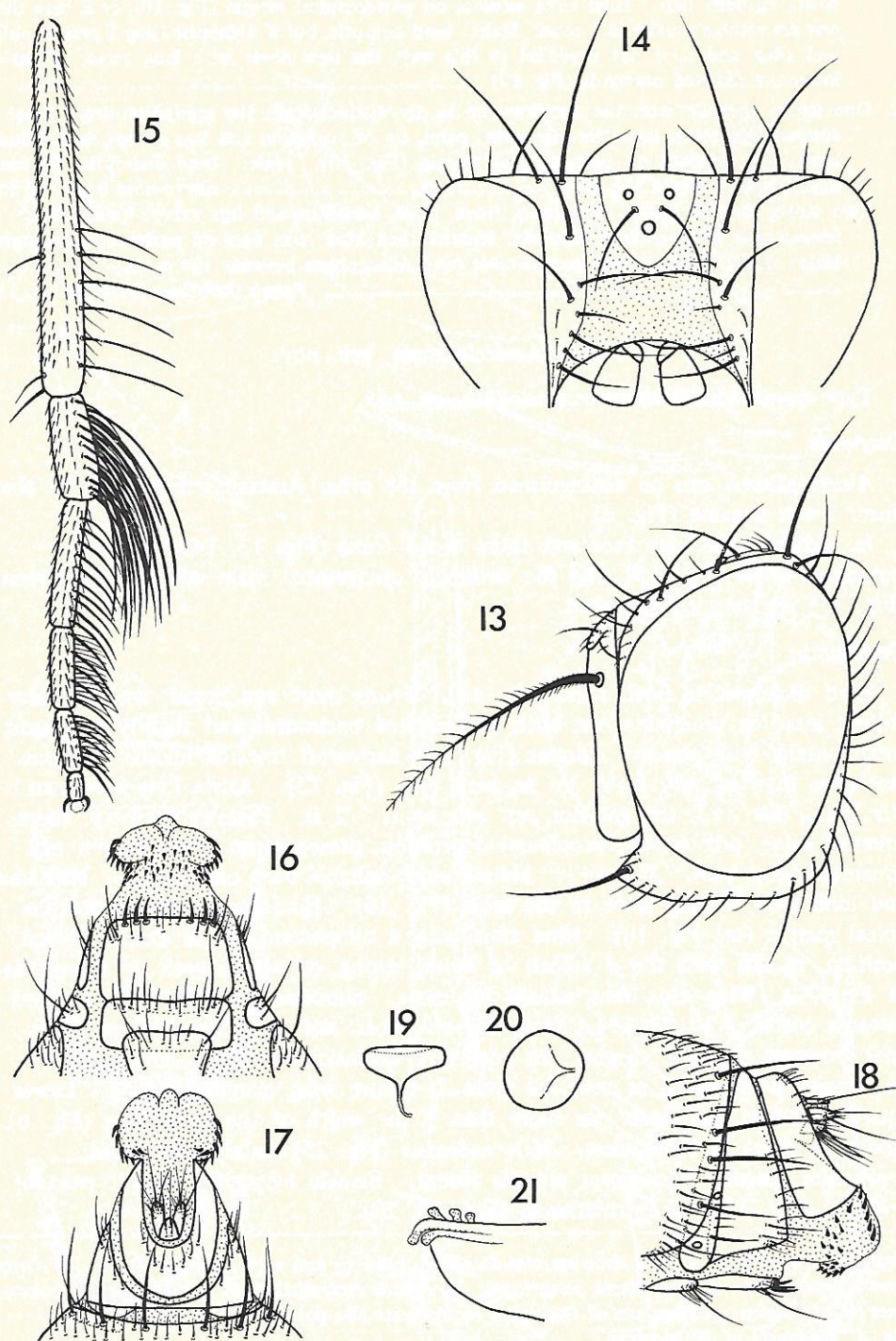
Head dichoptic in both sexes (Fig. 14). Frons short and broad, without interfrontal setae or proclinate *ors*, both *ors* directed backwards and slightly outwards; interfrontalia with concave margins (Fig. 14), narrowest towards middle of frons. Antennae inserted very high, 3rd segment long (Fig. 13). Arista long-pubescent. *Acr* 0+1. *Dc* 2+3, the anterior *prst* seta short. 2 *ia*. Postalar declivity, supra-squamal ridge, prosternum, propleural depression, pteropleuron, hypopleuron and squamopleuron bare. *Stpl* 1+1. Metathoracic spiracle bare on margins. Mid tibia and tarsi with striking setae in the male (Fig. 15). Hind coxa bare on posteroapical margin (see Fig. 10). Hind tibia with a submedian seta in exactly dorsal position, in line with the *d* apical; *d* apical strong, *ad* apical weak or absent (as in Fig. 9). Wing-veins bare, except for costa. Subcosta smoothly bent forward towards costa. Vein *CuA+1A* (vein 6) very short, not extending halfway from anal crossvein to wing margin; an imaginary extension would be intersected by an imaginary extension of vein 2*A* (vein 7) before wing margin (Fig. 1). Lower squama reduced and linear, no more than $\frac{1}{4}$ the width of the upper one (Fig. 6). Abdomen short in both sexes. Male aedeagus (Fig. 25) mainly sclerotized; praegonite absent; bacilliform process absent. Female ovipositor with 2 pairs of spiracles (Fig. 18); 2 spermathecae (Figs 19, 20).

Figs 1–4. Anal area of wing showing vein *CuA+1A* (vein 6) and vein 2*A* (vein 7) of: 1, *Australofannia spinichunis*; 2, *Euryomma peregrinum*; 3, *Fannia australis*; 4, *F. capitalis*. The broken lines show imaginary extensions of the veins, to illustrate the points of intersection.

Fig. 5. Subcosta of *F. australis*.

Figs 6–8. Lower squama of: 6, *A. spinichunis*; 7, *F. australis*; 8, *F. canicularis*.

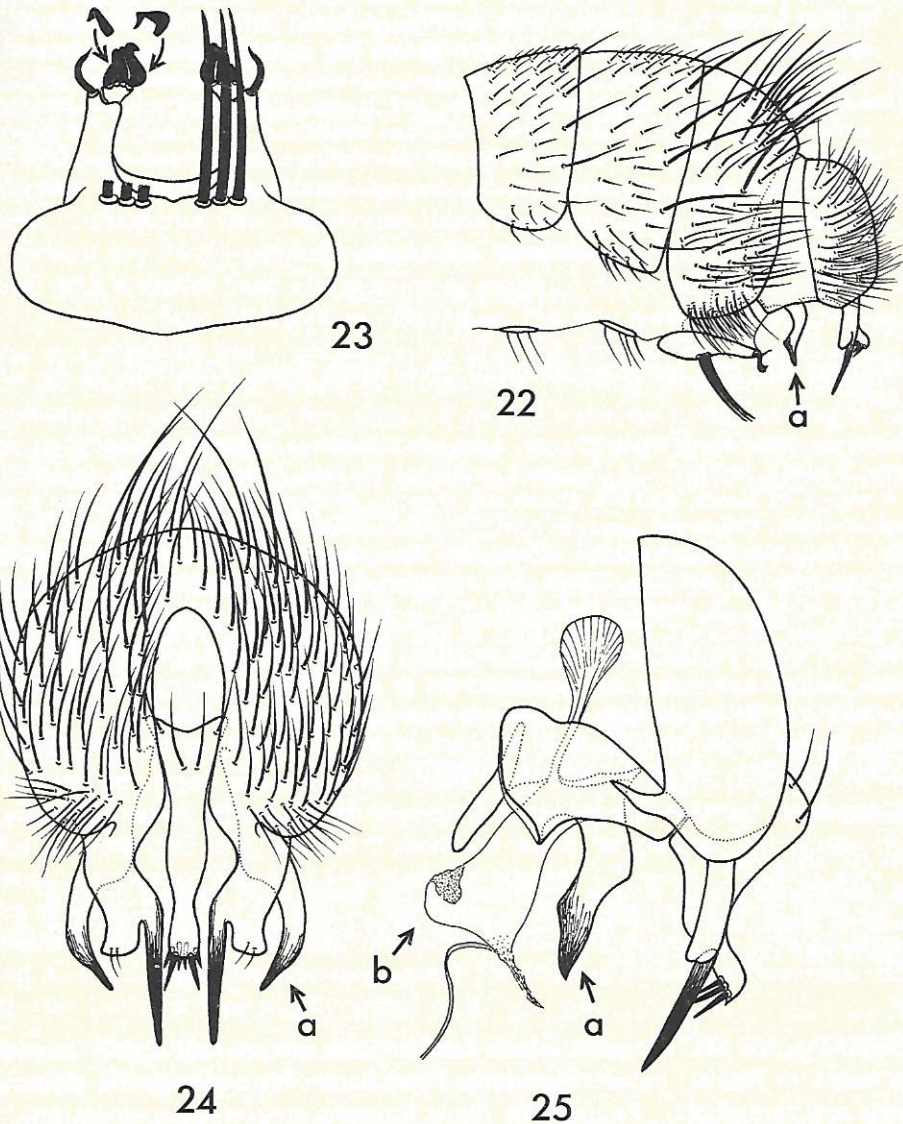
Figs 9–12. *Fannia canicularis*: 9, hind tibia, to show the submedian true dorsal seta; 10, hind coxa, to show setulae on the posteroapical margin; 11, male head in lateral view; 12, female frons and eyes in dorsal view.



Figs 13–21. *Australofannia spiniclunis*: 13, male head in lateral view; 14, male frons and eyes in dorsal view; 15, male mid tibia in dorsal view; 16, female ovipositor in ventral view; 17, female ovipositor in dorsal view; 18, female ovipositor in lateral view; 19, spermatheca in lateral view; 20, spermatheca in ventral view; 21, tip of uterine egg. Male paratype from Clyde Mountain, N.S.W., 22.ii.1965; female paratype from Fernshaw, Vic., 12.iv.1963.

Discussion

The genus has a number of similarities with *Euryomma*, such as the broad male frons, linear parafacialia, and bare scutellar disc, but other characters exclude any relationship between the two, such as the reduced lower squama, absence of setulae



Figs 22–25. *Australofannia spiniclunis*, male genitalia: 22, abdomen in lateral view; 23, fifth sternite in dorsal view; 24, male hypopygium in dorsal view; 25, hypopygium in lateral view, setae omitted from epandrium. Paratype from Mt Gibraltar, N.S.W., 24.ii.1965. *a*, postgonite; *b*, distiphallus.

on posteroapical margin of hind coxa, single tibial setae, strong *pra*, structure of female ovipositor, and structure of male genitalia, especially of the aedeagus.

Virtually all these characters, except for the genitalic ones, point to the *serena* group of *Fannia* as the point of origin for *Australofannia*. The *serena* group is exclusively Holarctic in distribution, and includes some 26 described species.

Key to Species of *Australofannia*, gen. nov.

1. Coxae, trochanters and femora yellow. Tibiae clear yellow. Mentum of proboscis yellow. Humeri reddish to yellow. Abdomen partly orange, apical part and ovipositor especially so. Arista longer pubescent, the longest hairs twice as long as basal diameter of arista *spinichunis*, sp. nov. (p. 8)
- Coxae, trochanters and femora except at tips dark brown. Tibiae dull yellow. Mentum of proboscis dark brown. Humeri black. Abdomen wholly dark brown, only tip of ovipositor orange. Arista shorter pubescent, the longest hairs slightly exceeding basal diameter of arista sp. nov., female only (p. 10)

Australofannia spinichunis, sp. nov.

(Figs 1, 6, 13-25)

Types

Holotype ♂, Clyde Mountain (landslip), New South Wales, 22.ii.1965, D. H. Colless, in ANIC.

Paratypes. New South Wales: 1♂, 1♀, same data as holotype, ♂ BMNH, ♀ ANIC; 1♀, same locality, 5.v.1965, in ANIC; 1♀, 3 miles S. of Monga, 8.v.1968, Colless and Liepa, in ANIC; 2♀, 4 miles S. of Monga, 8.v.1968, Colless and Liepa, in ANIC and BMNH; 1♀, 5 miles S. of Monga, 8.v.1968, Colless and Liepa, in ANIC; 1♂, Mt Gibraltar National Park, 64 miles W. of Grafton, 24.ii.1965, D. K. McAlpine, in AM; 4♀, Mount Wilson, Blue Mountains, 17.iii.1961, D. K. McAlpine, 2 in AM, 2 in BMNH; 1♀, same locality, 2.iii.1957, in AM; 1♀, same locality, 16.iv.1971, in AM; 1♀, National Park, 20.iv.1957, D. K. McAlpine, in AM; 2♀, Wentworth Falls, Blue Mountains, 22.iv.1957, D. K. McAlpine, in AM; 2♀, same locality, 18.iii.1958, in AM and BMNH; 1♀, Wright's Lookout, New England National Park, 1.iv.1961, D. K. McAlpine, mounted on slide, in AM. Australian Capital Territory: 8♀, 11 km SW. of Uriarra, 6.iv.1976, P. Ferrar, 6 in ANIC, 2 in BMNH. Victoria: 1♀, Fernshaw, near Healesville, 12.iv.1963, D. K. McAlpine, in AM; 1♀, Warburton, 7.iv.1963, D. K. McAlpine, in AM. Tasmania: 1♂, 3♀, Hellyer Gorge, 2.ii.1967, E. F. Riek, 1♂, 2♀ in ANIC, 1♀ in BMNH.

Diagnosis

As for the genus.

A. spinichunis can be simply recognized by the linear lower squama or long-pubescent arista, and in the male sex by the short broad frons, long antennae, or modified mid tibia and tarsus.

Male

Head (Figs 13, 14). Front at middle broader than an eye, very slightly narrowing from vertex to lunula; broader than long. Eyes bare. Postocular setulae short, in a single row throughout. Parafrontalia thinly brownish grey pruinose, appearing pruinose from some points of view and entirely subshining black from others; parafacialia, where visible, and genae yellowish grey pruinose; face and occiput brownish grey pruinose. Interfrontalia black, usually reddish near lunula; frontal triangle, like parafrontalia, appearing brownish grey pruinose or subshining black, reaching about midway between the 2 *ors*. Parafrontalia quite broad, at middle a parafrontale equal to 2-3 times diameter of anterior ocellus and at this point $\frac{2}{5}$ width of interfrontalia. 2 pairs of strong inclinate *ori*, with 3 pairs of interstitials; 2 pairs of *ors*, both

directed backwards and slightly outwards, the lower one closer to inner margin of parafrontalia than to eye-margin; parafrontal setulae very short, confined to lower third of frons, in one row. Antennae black; 3rd segment long, 3 times as long as broad and reaching to epistoma; arista with the longest combined pubescence half width of 3rd antennal segment. Parafacialia tapering sharply from lunula and virtually obsolete from level of arista downwards; the upper, visible, part with a few short setulae continued from parafrontalia. Vibrissal angle slightly in front of level of profrons. Posterior eye-margin not emarginate in lateral view. Genae moderate, peristomal setae weak. Proboscis moderate, mentum yellow and thinly dusted. Palpi dark brown, a little thickened towards apex, slightly shorter than mentum of proboscis.

Thorax. Ground colour black; humeri and propleural area usually yellow to reddish. In posterior view, mesonotum thinly brownish dusted and appearing matt, but without any dusted pattern; humeri and notopleura densely brownish grey dusted, with a narrow band extending along suture to *dc*; a brownish grey dusted patch present in front of scutellum. Scutellum, like mesonotum, thinly brownish dusted and appearing matt; pleura grey or brownish grey dusted. Ground-setulae short and sparse. *Prst acr* setulae in 3 rows. *Dc* becoming progressively longer posteriorly, the anterior one very short. 1 moderate *pra*, up to half as long as 2nd *npl*. 1(-2) setulae adjacent to the prostigmatal seta. *Stpl* 1+1, the anterior one much lower than the posterior one. Disc of scutellum mainly bare apart from the setae, only 1-2 setulae in basal lateral corner.

Legs. Coxae, trochanters, femora and tibiae yellow; fore tarsi brown, the apical segments yellow; mid and hind tarsi black. Fore femur with 3 long, well spaced *pv* setae. Fore tibia without a *p* seta or a stronger *ad* setula. Mid femur of normal shape, not constricted on apical part; without ventral setae, except for a few erect *pv* setulae around middle. Mid tibia of normal shape, without a ventral mat; on *a* surface with a row of setae on apical half, standing at right angles to the tibial shaft, the longest almost twice tibial depth, and slightly ventrad of this row with a more or less well developed series of erect setulae along most of length (Fig. 15); 1 short *pd* seta. Mid tarsus (Fig. 15) with segment 1 expanded and flattened, segments 2-4 rather elongated and thin, segment 5 short and small; *ad* surfaces with a row of short strong setae on segments 1-4, those on segment 1 longest; *a* surface with series of setae, those on segment 1 very long, those on segment 2 fine, those on segments 3 and 4 dense and fine; *pv* surface with some dense fine hairs on segments 3 and 4. Hind femur bare ventrally except for 2 strong *av* setae before apex. Hind tibia with 1 *ad* and 1 *av* slightly apicad of it.

Wings. Clear. Costal spine absent. Hind crossvein straight. Squamae whitish, the margin of upper one yellow. Halteres whitish yellow.

Abdomen (Fig. 22). Ground colour orange. In dorsal and posterior views with virtually no dust and appearing subshining. Short and truncated, tergites 3-5 short and broad (Fig. 22). Segment 5 enlarged, with a prominent sternite, and hypopygium large and swollen. Setae short, but tergite 5 with some long setae, and both tergite 5 and epandrium with short dense setae (Fig. 22).

Genitalia. As in Figs 23-25. Sternite 5 very heavily spined (Fig. 23). Cercal plate elongated and terminating in some short spines. Surstyli bifurcate, the inner

fork consisting of a long, heavily sclerotized spine-like projection. Postgonite heavily sclerotized; distiphallus well developed.

Measurements. Length of body, 3.0–3.5 mm. Length of wing, 2.5–3.0 mm.

Female

Differs from the male as follows:

Head. Frons not quite as broad, about as broad as an eye, parallel-sided. Antennae not inserted so high; 3rd segment rather shorter and broader, a little over twice as long as broad.

Thorax. As in male. Basal lateral scutellar setulae usually absent.

Legs. Fore femur usually rather infuscated dorsally; mid and hind femora sometimes a little darkened in apical half. Fore femur with 2 or 3 *pv* setae. Mid femur as in male, bare ventrally. Mid tibia with normal setae, with 0 *ad* and 1 short *pd* seta. Mid tarsus normal in shape and bristling.

Wings. Squamae more uniformly creamy.

Abdomen. Ground colour mainly orange, but tergite 1+2 mainly dark and tergites 3-4 with dark hind margins of variable width; sometimes appearing wholly brown, but this possibly due to the effects of post-mortem decay. Appearing matt brownish in dorsal view but subshining in posterior view. Rather short; without special bristling, but the tip usually swollen and the ovipositor partly extruded.

Ovipositor. As in Figs 16-18. Short and rather compressed. Tergite 6 band-like, not fused dorsally; sternite 6 normal. Tergite 7 complete, narrow dorsally; sternite 7 normal. Tergite 8 complete; sternite 8 absent, replaced by areas of short stout spinules. Spiracles situated at the lower part of tergite 6. Spermathecae (Figs 19-20) large and mushroom-shaped.

Measurements. Length of body, 3.5–4.0 mm. Length of wing, 3.0–3.5 mm.

Distribution and Biology

Known only from south-east Australia (New South Wales, Victoria and Tasmania). Adult habits and life history unknown.

One uterine egg has been studied (Fig. 21). It is of the usual fanniid type (see Chillcott 1961, figs 271-272), 1.2 mm long, and elongate-oval in shape. There are two narrow dorsal flanges, and the area between them is reticulate, otherwise the egg surface is longitudinally ribbed. At each extremity, beyond and between the flanges, there is an area of small raised projections that somewhat resemble in form the anterior spiracles of a larva; they are larger at one end than at the other.

Australofannia sp.

A second species of this genus has been seen from New South Wales and Australian Capital Territory. As it is represented only by 13 females, it will not be described until males become available, but its characters are given in the key above (p. 8).

Genus *Euryomma* Stein

Euryomma Stein, 1899, p. 19.

Type-species *Euryomma hispaniense* Stein, 1899 [= *Anthomyia peregrina* Meigen, 1826], by monotypy.

Diagnosis

Euryomma can be distinguished from the other Australian Fanniidae by the single *prst dc* seta and, in cases of doubt, by the mainly yellow legs combined with setulose posteroapical margin to hind coxa.

Description

Head dichoptic in both sexes. Frons without interfrontal setae or proclinate *ors*, lower *ors* directed outwards; interfrontalia with concave margins, narrowest towards middle of frons. Arista virtually bare. *Acr* 0+1. *Dc* 1+3, the anterior *prst* seta hardly distinct from the ground-setulae. 2 *ia*. Postalar declivity, suprasquamal ridge, prosternum, propleural depression, pteropleuron, hypopleuron and squamopleuron bare. *Stpl* 1+1. Metathoracic spiracle bare on margins. Mid femur and tibia only slightly modified in male. Hind coxa setulose on posteroapical margin (see Fig. 10). Hind tibia with a submedian seta in exactly dorsal position, in line with the *d* apical; *d* and *ad* apicals strong. Wing-veins bare, except for costa. Subcosta smoothly bent forward towards costa. *CuA+1A* (vein 6) very short, not extending halfway from anal crossvein to wing margin; an imaginary extension would be intersected by an imaginary extension of 2*A* (vein 7) shortly before wing margin (Fig. 2). Lower squama of the *Phaonia* type, well developed, bare. Sternite 1 large, setulose, developed as a normal sclerite. Male aedeagus well sclerotized; praegonite absent; bacilliform process absent. Female ovipositor with 2 spiracles (Fig. 30); 2 spermathecae (Fig. 31).

Discussion

In spite of the possession of a few striking characters, the affinities of *Euryomma* lie clearly with the *canicularis* group of *Fannia* and particularly with the *pusio* sub-group (see Chillcott 1961, pp. 30-31, table I), and the following characters in addition to the general characters of this group emphasize this relationship: postocular setulae in a single row; parafacialia and genae very narrow; parafacialia setulose above; *prst acr* setulae in three rows; a single setula next to the prostigmatal seta; disc of scutellum largely bare; male mid-tibial mat largely atrophied. Chillcott himself, however, preferred to postpone any generic changes until it was possible to review the family on a world basis.

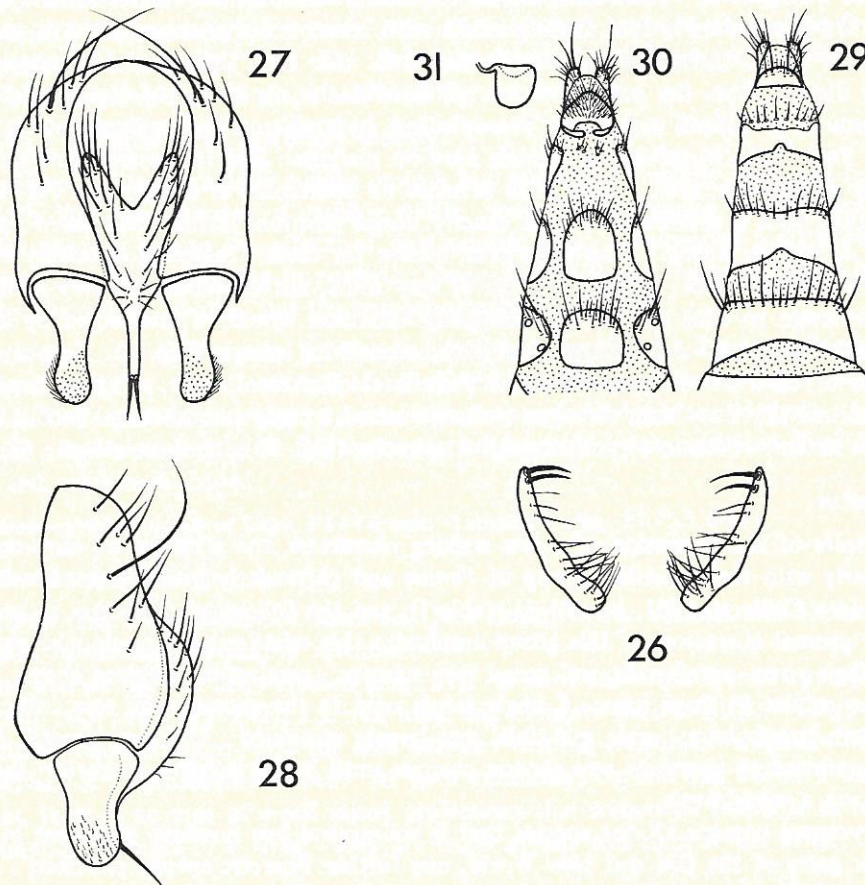
Euryomma consists of one species that is widespread but nowhere abundant in warmer parts of the Old and New World, one further Nearctic species (Huckett 1965, p. 898) and a further seven Neotropical species (Pont 1972, p. 2).

The larvae of two Panamanian species have been described, and the undescribed puparium of *peregrinum* is amongst material in the BMNH.

The genus was first recorded from Australia by Malloch (1924, p. 146), who listed a female of *peregrinum* from Sydney.

Euryomma peregrinum (Meigen)

(Figs 2, 26-31)

Anthomyia peregrina Meigen, 1826, p. 187.*Coenosia pseudomollicula* Frauenfeld, 1867, p. 450. Synonymy by Stein, 1919, p. 133.*Hoplogaster? dubia* Grimshaw, 1901, p. 43; Bryan, 1934, pp. 427, 453. Synonymy by Stein, 1919, p. 133.*Euryomma peregrinum* (Meigen). Stein, 1919, p. 133; Malloch, 1924, p. 146; Malloch, 1925, p. 38; Bryan, 1934, pp. 426, 453; Séguy, 1937, p. 180; Harrison, 1953a, p. 9; Hennig, 1955, p. 14, pl. 1 fig. 3, pl. 3 fig. 61; Lee *et al.*, 1956, p. 329; Séguy, 1960, p. 149; Chillcott, 1961, p. 224, figs 149, 149A-B, 217, 259, map 58; Campos and Peña, 1973, p. 227; Pont, 1973, p. 182; Ferrar *et al.*, 1975, p. 10.

Figs 26-31. *Euryomma peregrinum*: 26, male fifth sternite in dorsal view; 27, male hypopygium in dorsal view; 28, male hypopygium in lateral view; 29, female ovipositor in dorsal view; 30, female ovipositor in ventral view; 31, spermatheca in lateral view. Male from Hastings, New Zealand, Apr. 1947; female from Fiji, 7.x.1964.

Types

Holotype ♀ of *Anthomyia peregrina* Meigen, Hamburg, Germany, on board an American ship, in Von Winthem collection, now in NHMV [not seen]. Lectotype ♂

of *Hoplogaster? dubia* Grimshaw, Olaa I., Hawaii, in BMNH [see designation below]. Syntypes 8 specimens (sex not stated) of *Coenosia pseudomollicula* Frauenfeld, on board ship near Ceylon, probably in NHMV [not seen].

Lectotype designation for dubia Grimshaw

Grimshaw described his species from two male and four female syntypes from Olaa I., Hawaii, July 1895. I have located five of these six syntypes: one male and two females in BMNH, and one male and one female in RSM. The BMNH male is in best condition, though it lacks the left foreleg and both mid legs, and I have labelled it and designate it herewith as lectotype. The remaining syntypes, one male and three females, have been labelled as paralectotypes.

Diagnosis

As for the genus.

E. peregrinum can be recognized immediately by the mainly yellow legs, yellow palpi, and yellow basal antennal segments.

Male

Head. Frons at middle almost as broad as an eye, not broadening much from vertex to lunula. Eyes virtually bare. Postocular setulae short, in a single row throughout. Parafrontalia, parafacialia, face, genae and occiput densely grey pruinose, a little tinged with yellow. Interfrontalia brown above, reddish yellow below; frontal triangle long, reaching at least to level of lower *ors*. Parafrontalia broad, opposite lower *ors* a parafrontale equal to 3 times diameter of anterior ocellus and at this point $\frac{3}{4}$ to almost as broad as interfrontalia. 2 pairs of strong inclinate *ori*, with 4-6 short interstitial *ori*; lower *ors* usually closer to eye-margin than to inner margin of parafrontalia; parafrontal setulae in a single irregular row below lower *ors*. Basal 2 antennal segments yellow, 3rd segment black; 3rd segment $1\frac{1}{2}$ times as long as broad. Parafacialia tapering sharply from lunula and becoming linear below, at middle not quite as broad as diameter of anterior ocellus; with fine proclinate setulae on upper half, these being a continuation of the parafrontal row. Vibrissal angle well behind level of profrons. Posterior eye-margin not indented in lateral view. Proboscis moderate, mentum brown and thinly dusted. Palpi yellow, a little thickened towards apex, slightly shorter than mentum of proboscis.

Thorax. Ground colour black, scutellum yellow at tip; wholly grey to yellowish grey dusted. In posterior view, mesonotum with faint traces of 3 brownish vittae along the *dc* and *acr* rows, these more conspicuous anteriorly than posteriorly. Ground-setulae sparse but erect. *Prst acr* in 3 rows. 2 short strong *pra*, the longest not quite half as long as 2nd *npl*. 1(-2) setulae adjacent to the prostigmatal seta. Disc of scutellum mainly bare apart from the setae, only 1-3 setulae in basal lateral corner.

Legs. Coxae, trochanters, femora and tibiae yellow; tarsi black. Fore tibia with a *p* seta, with a stronger *ad* setula at apical third. Mid femur of virtually normal shape, hardly narrowed in apical part; *av* surface with a row of short *av* setae, the longest not half femoral depth, sparse near base but rather crowded on apical third; *pv* surface with a similar row of short setae, but these less evenly developed and partially duplicated in apical third. Mid tibia hardly narrowed on basal half; the ventral mat rather poorly developed and thin, the hairs semidecumbent

and rather more conspicuous in apical half than in basal. Mid metatarsus without a basal ventral crest. Hind femur bare ventrally except for 2 long *av* setae before apex and a few longer setulae towards base. Hind tibia with a single strong *ad* slightly basad of the *d* and 1 short *av* slightly apicad of it.

Wings. Clear. Costal spine absent. Hind crossvein straight. Squamae dirty white, the margins yellow; lower one well developed, projecting slightly beyond upper one. Halteres yellow.

Abdomen. Ground colour black; hind margins of tergites and/or sides of tergite 1+2 and/or corners of tergite 3 sometimes yellow; some reared males wholly orange-yellow. In posterior view densely yellowish grey dusted with a narrow undusted dark median line on tergites 3-5; those with yellow abdomen thinly whitish dusted.

Genitalia. As in Figs 26-28. Sternite 5 divided longitudinally into 2 halves (Fig. 26). Cercal plate greatly elongated ventrally and terminating in 2 spines. Surstylus smoothly rounded, without projections.

Measurements. Length of body, 3.0-3.5 mm. Length of wing, 2.5-3.0 mm.

Female

Differs from the male as follows:

Head. As in male.

Thorax. As in male.

Legs. Mid femur normal, bare ventrally but for a fine seta at base and 1-2 short *av* just beyond it. Mid tibia normal, bare ventrally.

Wings. Squamae more uniformly creamy.

Abdomen. More pointed. Ground colour as in male or wholly orange. Dusting grey to yellowish grey, with a poorly developed dark median vitta on tergites 3-5.

Ovipositor. As in Figs 29, 30. Sternites not fused to the tergites, the tergites consisting of single plates. Sternite 8 absent, represented by two groups of short setae. Spiracles situated at the lower angle of tergite 6. Spermathecae cup-shaped, dark brown.

Measurements. Length of body, 3.5-4.0 mm. Length of wing, 3.0-3.5 mm.

Distribution

Known from southern Europe (Hennig 1955, p. 15), Nearctic region (Chillcott 1961, p. 226; Hockett 1965, p. 898), Neotropical region (Pont 1972, p. 2) and St Helena I. (Pont, in press). In the Oriental region (Pont 1977), recorded from Formosa (Stein 1915, p. 28, 1916, p. 82, 1918, p. 155; Hennig 1941, p. 203), Ceylon (type-locality of *pseudomollicula* Frauenfeld), and Sumatra (Chillcott 1961, p. 226; material in BMNH). In the Australasian and Pacific regions, recorded from Norfolk I. (Pont 1973, p. 182; Ferrar *et al.* 1975, p. 10), New Zealand (Harrison 1953a, p. 9 [material seen]), Fiji (Pont 1973, p. 182), Hawaii (type-locality of *dubia* Grimshaw; Bryan 1934, pp. 426, 453), Easter I. (Campos and Peña 1973, p. 227) and New Amsterdam I. (Séguy 1960, p. 149).

In Australia known from Western Australia, Queensland, New South Wales and Victoria.

Previous Records and Material Examined

Western Australia: Shark Bay, July 1939, G. P. Whitley, 1♀, AM. **Queensland:** Maryborough, 29.vii.1904, W. Wesché, 1♂, BMNH. **New South Wales:** Sydney (Malloch 1924, p. 126).

Victoria: Melbourne, attracted to hides, skin store, 7.xi.1965, Collingwood, 2♀, BMNH and DAV.

Other Australasian material: **Norfolk Island:** 13–25.iv.1972, Dyce, Standfast and Ferrar, 1♂, ANIC (Pont 1973, p. 182). **New Zealand:** Owairaka, bred ex pupae [sic] from *Macrocystis* compost, em. 4.viii.1948, R. A. Harrison, 2♂, BMNH (Harrison 1953a, p. 9); Hastings, ex skins and hides, Apr. 1947, M. W. Carter, 1♂, BMNH. **Fiji:** on bananas, 7.x.1964, J. S. Hardie, 1♀, BMNH. **Hawaii:** Olaa Island, July 1895, Perkins, ♂ lectotype, 2♀ paralectotypes of *dubia*, BMNH, and 1♀ paralectotype, RSM.

Biology

The larva has not been described in detail or figured, but the material on which the brief notes published by Harrison are based (1953a, p. 9) is in the British Museum (Natural History) and this includes two puparia.

According to Harrison (1953a), the species was reared from skins and hides, and from *Macrocystis* compost. It is undoubtedly because of its scavenging habits that it has been able to spread to so many parts of the world during the commercial activities of man.

Genus *Fannia* Robineau-Desvoidy

Fannia Robineau-Desvoidy, 1830, p. 567.

Homalomyia Bouché, 1834, p. 89.

Type-species of *Fannia*: *Fannia saltatrix* Robineau-Desvoidy, 1830 [= *Musca scalaris* Fabricius, 1794], by monotypy. Type-species of *Homalomyia*: *Musca canicularis* Linnaeus, 1761, by designation of Westwood (1840, p. 143).

Diagnosis

Fannia can be distinguished from the other Australian Fanniidae by the presence of two *prst dc* setae and a well developed lower squama.

In addition Australian species have dark palpi and antennae, virtually bare arista, and holoptic male head.

F. capitalis, sp. nov., has the anterior *prst dc* seta very reduced, and also lacks a submedian *d* seta on hind tibia; it differs from *Euryomma peregrinum* by the dark legs.

Description

Male holoptic, female dichoptic. Female frons without interfrontal setae or proclinate *ors*, lower *ors* directed outwards (Fig. 12); interfrontalia with concave margins (Fig. 12), narrowest towards middle of frons. Arista virtually bare. *Acr* 0+1. *Dc* 2+3, the anterior *prst* seta strong, except in *capitalis*, sp. nov. 2 *ia*, the anterior one sometimes weak. Postalar declivity, suprasquamal ridge, prosternum, propleural depression, pteropleuron, hypopleuron and squamopleuron bare. *Stpl* 1+1. Metathoracic spiracle bare on margins. Mid femur and tibia with the ventral setae modified in the male, sometimes with quite striking ornamentations. Hind tibia with a submedian seta in exactly dorsal position (Fig. 9), in line with the *d* apical, absent only in *capitalis*, sp. nov.; *d* apical strong, *ad* apical weak or absent. Wing-veins bare, except for costa. Subcosta smoothly bent forward towards costa (Fig. 5). *CuA*+1*A* (vein 6) very short, not extending halfway from anal crossvein to wing margin; an imaginary extension would be intersected by an imaginary extension of

vein 2A (vein 7) well before wing margin, but closer to wing margin in *capitalis*, sp. nov., than in the other species. Lower squama of the *Phaonia* type, well developed, bare (Figs 7, 8). Sternite 1 large, setulose, developed as a normal sclerite and not as a scale attached to the thorax. Male aedeagus largely membranous; praegonite absent; often with a bacilliform process at the base of the cercal plate. Female ovipositor with 2 pairs of spiracles; 2 or 3 spermathecae.

Discussion

The genus *Fannia* is a large and principally Holarctic genus. There are some 160 Holarctic species: the Nearctic species have been revised by Chillcott (1961) and the Palaearctic by Hennig (1955). In the southern hemisphere the genus is poorly developed, being most numerous in South America where there are 61 species, largely from the Andean and Patagonian subregions (Pont 1972). In Africa there are 10 species (Pont, in press); a key has been given to most of these by Emden (1941). Eighteen species are recorded from the Oriental region, but most are from China and the Himalayan mountains, and only represent an extension of the Palaearctic fauna (Pont 1977). Only *prisca* Stein and *leucosticta* (Meigen) are widely distributed in the Oriental region, and *pusio* (Wiedemann) in the Pacific region.

One of the many merits of Chillcott's (1961) monograph was his attempt to trace the phyletic lines within the Fanniidae and to establish a series of species-groups in which to assemble the numerous and varied species. These groups were based primarily on a consideration of the Holarctic fauna, with some reference to the Neotropical fauna, and in the present work I have tried to assign the Australian species to Chillcott's groups. With a few exceptions the species fit well, but some are extremely difficult to place, such as *australis* Malloch, and these must belong to a much older faunal layer than do the other endemic species.

In assessing the antiquity of the Fanniidae and their place in the Australian fauna, it is worth pointing out that a male of what is almost certainly the modern *Fannia scalaris* (Fabricius) has been recorded from Baltic amber by Hennig (1966).

In Australia, Malloch (1924, p. 605) recorded *canicularis* (Linnaeus) and described *australis* as new from New South Wales. In a later paper (1925, p. 38) he alluded to a third species which he did not describe for lack of adequate material.

Miller (1950, p. 119) listed four species from New Zealand. However, the species *badia* Hutton, *fuliginosa* Hutton and *fulvescens* Hutton belong to the genus *Spilogona* Schnabl, and *canicularis* is the only known species from New Zealand.

Knowledge of the larvae was summarized by both Hennig (1955) and Chillcott (1961), but more recently the larval taxonomy has been completely revised by Lyneborg (1970). In the present paper I have not described any larvae, but where I have seen larval material I have mentioned it so that it is available for future workers.

Parasites of a *Fannia* from Australia and New Zealand have been listed by Legner and Olton (1968).

The medical and veterinary significance of *Fannia* in Australia is probably slight. There is little in the modern literature to indicate that the problems with *canicularis* are of any significance when compared with other houseflies, bushflies or blowflies. Johnston and Bancroft reported on an unidentified small dark *Fannia*, breeding in cowdung, which they were unable to culture in the laboratory. They found that it did not act as a vector of bovine onchocerciasis under experimental conditions

(1920*b*, p. 39) but they could not examine its potential as a *Habronema* host (1920*c*, p. 75). It seems most likely that they were dealing with *australis*, but it is equally likely that they were not dealing with a *Fannia* at all.

Key to Australian Species of *Fannia*

1. Hind coxa bare on posteroapical margin (see Fig. 10). *Prst acr* setulae usually in only 2 rows. Upper postocular setulae in 1 row. Hind tibia with 1 *ad* seta. Female: parafacialia bare 2
- Hind coxa with 1–3 setulae on posteroapical margin (Fig. 10). *Prst acr* setulae in 3 rows. Female: parafacialia often with setulae on upper part 5
- 2(1). Knob of halteres black. Only 1 setula adjacent to the prostigmatal seta. *Prst acr* setulae in 3 rows virtually from the neck onwards. *Pra* setulae short, shorter than the adjacent ground setulae. Dark species, mesonotum with broad dark vittae and a small amount of dark brown (male) or grey (female) dust. Male: fore femur with a row of long fine *av* setae in basal half, longer than femoral depth; mid tibia with the *d* preapical shifted basad, to apical quarter; hind femur (Figs 38, 39) with a ventral swelling at apical third bearing dense fine setae, with several stout *av* spines beyond it, and with rows of dense fine bushy setae on *p* to *pv* surfaces basad of it. Female: mesonotum conspicuously vittate; abdomen thinly grey dusted *anteroventralis*, sp. nov. (p. 18)
- Knob of halteres yellow. Several setulae adjacent to the prostigmatal seta. *Prst acr* setulae mainly in 2 rows, sometimes a 3rd row beginning at suture. *Pra* setulae stronger, the anterior one $\frac{1}{2}$ length of 2nd *npl*. Lighter species, mesonotum densely yellowish brown to grey dusted, without undusted vittae and with at most weak traces of darker dusted vittae. Male: fore femur without *av* setae; mid tibia with the *d* preapical in its normal preapical position; hind femur not shaped as above and with different bristling, either with a row of stout spines on *av* surface or without special setae and only 3–4 *av* setae. Female: mesonotum without or with faint vittae; abdomen densely dusted, grey to yellowish grey or brownish yellow 3
- 3(2). Thorax and abdomen yellowish brown dusted. Male: hind femur simple, with 4 moderate *av* setae on apical half and a group of loosely clustered *pv* setae at apical quarter; mid femur with the setae on *av* and *pv* surfaces finer, sparser, less spine-like. Female: trochanters, femora and tibiae yellow, usually femora apically and tibiae basally a little darkened *norfolki*, sp. nov. (p. 22)
- Thorax and abdomen grey dusted. Male: hind femur modified, with a number of stout spines along most of *av* surface and with numerous fine setae along *pv* surface (Figs 49, 60); mid femur with the setae on *av* and *pv* surfaces stouter, denser and more spine-like. Female: legs black, except for knees 4
- 4(3). Male: frons broader, at narrowest point over width of 3rd antennal segment; eyes with short but distinct pubescence; 5–8 pairs of strong *ori*; mid tibia with 2 *pd* setae; mid femur with the *av* setae denser and in several rows; hind femur (Fig. 49) with the longest *pv* on 3rd quarter much longer than femoral depth. Female: parafacialia broader, at middle slightly broader than width of fore tibia at base *tasmaniae*, sp. nov. (p. 25)
- Male: frons narrower, at narrowest point not as broad as 3rd antennal segment; eyes bare; 12–14 pairs of strong *ori*; mid tibia with 1 *pd* seta; mid femur with the *av* setae sparser and in a single row; hind femur (Fig. 60) with the longest *pv* on 3rd quarter at most as long as femoral depth. Female: parafacialia narrower, at middle slightly narrower than width of fore tibia at base *howei*, sp. nov. (p. 30)
- 5(1). Hind tibia with 3 or more *av* setae. (*c.* 5 setulae adjacent to prostigmatal seta. Upper postocular setulae in one row. Fore tibia with a strong *ad* setula at apical quarter.) Male: mid coxa with several stout spines on anterior margin that are curved at tips (Fig. 68); mid tibia with a strong triangular ventral projection beyond middle (Fig. 69). Female: parafacialia bare *scalaris* (Fabricius) (p. 33)
- Hind tibia with 1–2 *av* setae. Male: mid coxa with normal setae; mid tibia ventrally with only a mat of soft fine hairs or virtually bare except for ground-setulae. Female: parafacialia with setulae on upper part, but bare in some *australis* (which has upper postocular setulae in 2 rows) and in *capitalis* (which lacks the submedian *d* seta on hind tibia) 6

- 6(5). Hind tibia with the submedian *d* seta absent. Small dark species with little dust; hind tibia with 1 *ad* seta; prostigmatal seta surrounded by several setulae; postocular setulae in one row. Male: ventral mat on mid tibia very thin and poorly developed; frons with 8–10 *ori* but no *ors*. Female: parafrontalia undusted on upper $\frac{2}{3}$ and parafacialia bare *capitalis*, sp. nov. (p. 35)
Hind tibia with the submedian *d* seta present and strong 7
- 7(6). Halteres black. Postocular setulae in 2 rows almost from vertex. Prostigmatal seta surrounded by 5–8 setulae. Hind tibia with only 1 *ad* seta. Mesonotum with subshining black undusted vittae. Abdominal pattern consisting of a narrow median undusted vitta on all tergites in both sexes. Lower squama very large, projecting far beyond upper one (Fig. 7) *australis* Malloch (p. 38)
Halteres yellow. Postocular setulae in a single row. Prostigmatal seta with only 1 adjacent ground-setula. Hind tibia with several *ad* setae. Mesonotum with the vittae, when present, consisting of dark dust and therefore not shining. Abdominal pattern not consisting of a median line: either triangulated or spots or absent. Lower squama normal, projecting only a little beyond upper (Fig. 8) 8
- 8(7). Abdomen usually yellow at base, at the sides of tergites (1+2)–4 in male but usually only on tergite 1+2 in female, sometimes, however, abdomen entirely dark in ground colour. Disc of scutellum with numerous setulae placed around the sides and before tip. Mesonotum grey dusted, with dark brown dusted vittae. Fore tibia with a stronger *ad* setula in apical half. Male: *ors* present (Fig. 11); mid tibia with a dense mat of soft uniform hairs on ventral surface, about $\frac{1}{4}$ of tibial depth (Fig. 90); abdomen with a line of dark triangular spots along middle of tergites (1+2)–5; parafacialia broader, nowhere narrower than diameter of anterior ocellus, bare. Female: abdomen grey dusted and without spots; frontal triangle confined to area of ocellar tubercle, at most reaching a little beyond upper *ors* *canicularis* (Linnaeus) (p. 43)
Abdomen black in ground colour. Disc of scutellum almost bare apart from the setae, with about 3 setulae that are placed in basal lateral corners. Mesonotum black, almost matt, without vittae except in *leucosticta* female, which has 3 black spots on each intermediate abdominal tergite. Fore tibia without an *ad* setula. Male: *ors* absent; mid tibia with the ventral mat very thin and poorly developed; abdomen with 3 dark spots on tergites 3 and 4; parafacialia linear, at middle as broad as diameter of anterior ocellus, almost always with short proclinate setulae on upper half. Female: abdomen black and subshining, or grey dusted and with 3 dark spots on the intermediate tergites; the dusted frontal triangle extending to level of lower *ors* 9
- 9(8). Male: hind tibia (Fig. 98) with 1 *av* and 0 *pv* setae; hind femur (Fig. 97) without a preapical swelling, with the *av* setae only slightly longer than femoral depth and not curled at tips; squamae dark brown; tergite 1+2 without grey dust except narrowly on hind margin; mesonotum with some brown dust in front of scutellum. Female: abdomen with some grey dusting on at least tergites 4 and 5, often more extensively dusted, these tergites often with a trimaculate pattern; parafrontalia entirely grey pruinose; mesonotum dull grey dusted, often tinged with bluish, with 3 more or less conspicuous dark brown dusted vittae *leucosticta* (Meigen) (p. 50)
Male: hind tibia (Fig. 106) with numerous *av* and *pv* setae; hind femur (Fig. 105) with a preapical swelling bearing a number of long fine *av* setae that are longer than femoral depth and are curled at tips; squamae creamy; tergite 1+2 broadly grey dusted at sides; mesonotum with some grey dust in front of scutellum. Female: abdomen subshining black, without dusted pattern; parafrontalia thinly grey pruinose, partly subshining especially on inner margins; mesonotum matt but without dusted vittae, with some light grey dust on humeri and before scutellum *pusio* (Wiedemann) (p. 54)

Fannia anteroventralis, sp. nov.

(Figs 32–39)

Types

Holotype ♂, Macquarie Pass, New South Wales, light trap, 9.x.1969, Common and Upton, in ANIC.

Paratypes: 2♂, same data as holotype, ANIC and BMNH; 1♂, 5 miles NW. of Augusta, Western Australia, 4.iv.1968, I. F. B. Common and M. S. Upton, in ANIC; 1♀, Brown Mountain, Bega district, New South Wales, 8.iii.1963, D. H. Colless, in ANIC; 1♂, The Jungle, Mt Tomah, 900 m, New South Wales, 22.xii.1962, E. S. Ross and D. Q. Cavagnaro, in CAS; 2♀, Cheltenham, Victoria, 20-26.i.1973, E. A. Fonseca, in BMNH; 1♀, Hellyer Gorge, Tasmania, 2.ii.1967, D. E. Havenstein, in ANIC.

Diagnosis

F. anteroventralis differs from all other Australian Fanniidae by having black halteres in combination with a bare posteroapical margin to hind coxa.

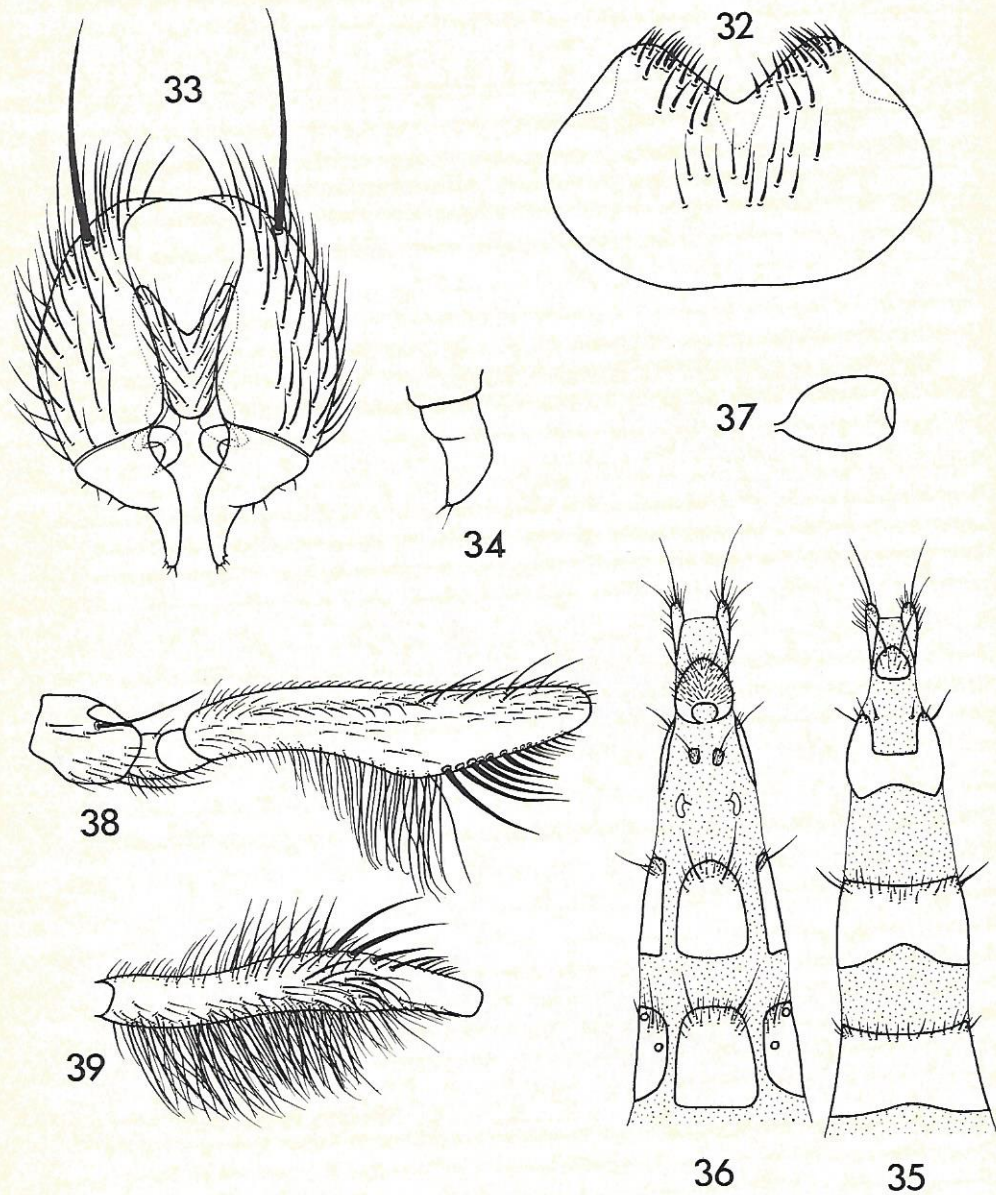
F. australis is the only other Australian fanniid with dark halteres, but that species is much smaller and has the hind coxa setulose on posteroapical margin.

Male

Head. Frons slender, at narrowest point only a little if at all broader than diameter of anterior ocellus. Eyes virtually bare. Postocular setulae short, except at vertex, in a single row throughout. Viewed from above, parafrontalia silvery white pruinose on lower half, brownish pruinose above that and matt on upper quarter; parafacialia silvery white pruinose; face, genae and occiput grey. Parafrontalia linear throughout most of their length, even at lunula not much broader than diameter of anterior ocellus; interfrontalia visible only as a seam for most of its length, where the parafrontalia touch. 11-19 pairs of inclinate *ori*, with few interstitials, reaching almost to ocellar tubercle. Antennae black, 3rd segment twice as broad as long. Parafacialia very slender, at middle hardly as broad as diameter of anterior ocellus, narrowing below. Vibrissal angle slightly behind level of profrons. Posterior eye-margin not emarginate in lateral view. Proboscis comparatively long, mentum thin, thinly dusted. Palpi black, slender, as long as mentum of proboscis.

Thorax. Ground colour black, subshining. In posterior view with dense brownish grey dust on humeri, notopleura, and a fascia along suture at sides; a broad *post* band covering the area outside *ia*, over postalar callus, and the prescutellar part of mesonotum; 3 narrow vittae running through the *acr* and *dc* rows, faint before suture. Scutellum brownish grey dusted, except at base, rather thinly so medially. Pleura dull grey dusted. Ground-setulae short and sparse. *Prst acr* triserial. 2 short *pra*, shorter but stronger than the adjacent ground-setulae. Only 1 setula adjacent to the prostigmatal seta. Disc of scutellum bare on a small central area, with many setulae (20-25) placed around margins and before tip.

Legs. Black. Tarsi not modified. Fore femur with the *pv* setae long on apical $\frac{2}{3}$, absent on basal $\frac{1}{3}$; just over basal third of *av* surface with a row of long fine setae, longer than femoral depth. Fore tibia without a *p* seta or an *ad* setula. Mid femur of almost normal shape; on *av* surface with a row of sparse (about 5) but strong setae on just over basal half that merge into a comb-like row of short dense strong setae covering most of apical half; on *pv* surface with a row of short setae on basal half, finer and more numerous than the *av*, merging in apical half into a double comb-like row of short dense setae which are longer and finer than the *av*. Mid tibia on ventral surface flattened on basal third, with 2 shallow emarginations at base and at basal third, virtually bare on this part; rather thickened after basal third and here covered with a mat of hairs $\frac{1}{3}$ - $\frac{1}{2}$ of tibial depth; the *d* preapical placed at apical $\frac{3}{4}$; 1 *ad* and 2-3 *pd* setae, all short. Mid metatarsus without a



Figs 32–39. *Fannia anteroventralis*: 32, male fifth sternite in dorsal view; 33, male hypopygium in dorsal view; 34, male surstylus in lateral view; 35, female ovipositor in dorsal view; 36, female ovipositor in ventral view; 37, spermatheca in lateral view; 38, male hind femur and trochanter in anterior view; 39, male hind femur, slightly posterior of ventral. Male genitalia and Fig. 38 of paratype, Macquarie Bay, N.S.W., 9.x.1969; female paratype from Brown Mountain, N.S.W., 8.iii.1963; Fig. 39 of holotype.

basal ventral crest. Hind coxa bare on posteroapical margin; outer (anterior) margin with a strong seta. Hind femur (Figs 38, 39) strikingly modified, curved and with a ventral swelling at apical third; *av* to *v* surfaces with dense fine setulae after basal quarter, increasing in length and producing a tuft of setae at the beginning of the swelling equalling femoral depth; the swelling bearing several stout *av* setae, and the rest of *av* surface with densely placed short setae; *p* to *pv* surfaces covered with a continuous brush of long fine very dense setae from base to the swelling, ending in a tuft that coalesces with the *av* one; the part after the swelling with a few fine short *pv* setae. Hind tibia with 1 *ad* at the same level as the submedian *d*, and 2 *av* apical of it.

Wings. Uniformly weakly smoky. Costal spine inconspicuous. Hind crossvein rather sinuous. Squamae dirty white; the margins and fringe dirty yellow with the outer part of upper one brown, occasionally margins and fringe wholly brown; lower one well developed and projecting beyond upper one. Knob of halteres black.

Abdomen. Ground colour black. Densely grey dusted, tinged with brownish from some angles; in posterior view with a broad indented median vitta on tergite 1+2, a narrow one on tergites 3 and 4 and sometimes also indicated on tergite 5; the vitta on tergites 2 and 3 tending to be triangulated and thinly dusted when viewed from rather dorsal of posterior.

Genitalia. As in Figs 32-34. Cercal plate rounded at tip. Surstyli simple, curved. Bacilliform process present, corkscrew shaped. (One dissection.)

Measurements. Length of body, 5.0-6.0 mm. Length of wing, 4.0-5.0 mm.

Female

Differs from the male as follows:

Head. Frons at middle not as broad as an eye, broadening gradually from vertex to lunula. Parafrontalia silvery white pruinose on lower third, otherwise entirely grey pruinose. Interfrontalia black. Parafrontalia broad, opposite lower *ors* a parafrontale equal to 3 times diameter of anterior ocellus and at this point $\frac{1}{2}$ - $\frac{2}{3}$ width of interfrontalia. 9-10 pairs of *ori*; lower *ors* slightly closer to inner margin of parafrontalia than to eye-margin; parafrontal setulae in one irregular row below lower *ors*. 3rd antennal segment a little shorter and stouter. Parafacialia rather broader, at lunula twice as broad as diameter of anterior ocellus, narrowing below as in male; bare. Vibrissal angle below level of profrons. Palpi rather more thickened.

Thorax. Mesonotum densely grey dusted, partially tinged with brownish, with a different pattern of dark vittae than in male: a pair of moderate paramedian vittae between outer *acr* row and *dc*, running from neck to *prsc* setae; a pair of *prst* patches between *dc* and *ph*; a pair of *post* vittae between *dc* and *ia*. Scutellum grey dusted, as mesonotum.

Legs. Fore femur without *av* setae. Fore tibia with or without a stronger *ad* setula in apical quarter. Mid femur normal, bare ventrally except for some more erect *av* setulae on basal half. Mid tibia normal, bare ventrally; 1 *ad* and 2 *pd* setae, all short. Hind femur normal; bare ventrally and usually without any *av* setae, but with a short preapical comb of *av* setulae (New South Wales), with 2 setae among the comb (Victoria and Tasmania). Hind tibia with 3 short *av* (Tasmania).

Wings. Mainly clear. Squamae white with yellow margins; fringe of upper one brown on outer part.

Abdomen. Shorter and more pointed. Thinly grey dusted, without any undusted areas.

Ovipositor. As in Figs 35, 36. Tergites 6-8 separated from sternites 6-8. Tergite 8 consisting of a single plate. Sternite 8 reduced to 2 small weakly chitinized plates. Spiracles situated in tergite 6, at side and at ventral angle. 3 spermathecae (Fig. 37), dark brown, moderate in size, more or less pear-shaped. (One dissection.)

Measurements. Length of body, 4.5-5.0 mm. Length of wing, 4.0-4.5 mm.

Distribution and Biology

Known only from southern Australia (Western Australia, New South Wales, Victoria and Tasmania).

Adult habits and larvae completely unknown.

Variation

Despite the difference in thoracic markings between the male and female, I believe that the sexes are correctly associated since there are so many striking characters in common, such as 2 short *pra*, 1 prostigmatal ground-setula, 1 *ad* and 2 *pd* setae on mid tibia, and black halteres.

Relationships

F. anteroventralis is most closely related to *tasmaniae*, sp. nov., and probably belongs to the *pretiosa* group of Chillcott (1961, p. 142). The discussion under *tasmaniae* (p. 30) is also relevant here.

Fannia norfolki, sp. nov.

(Figs 40-44)

Fannia sp. nov. B; Pont, 1973, p. 183; Ferrar *et al.*, 1975, p. 10.

Types

Holotype ♂, Norfolk Island, 13-25.iv.1972, A. L. Dyce, H. A. Standfast and P. Ferrar, in ANIC.

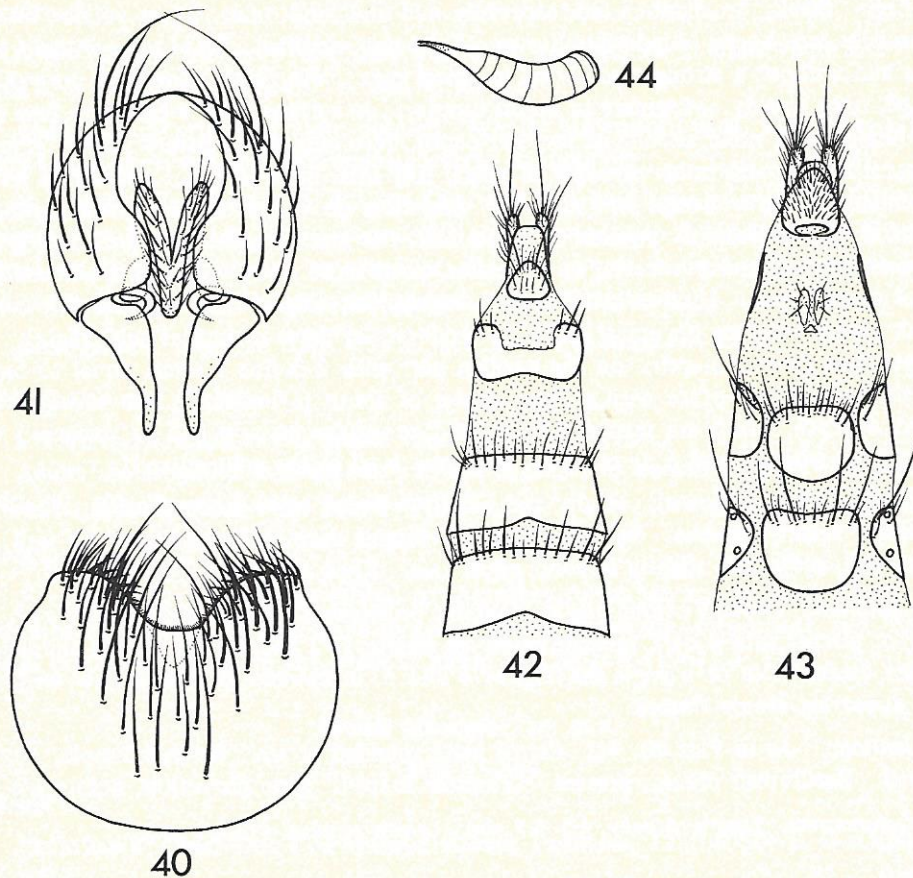
Paratypes: **Norfolk Island:** 6♀, same data as holotype, 4 ANIC and 2 BMNH; 1♂, Mar. 1971, K. L. S. Harley, in ANIC; 2♀, Country Road, 100 m, site J105, 14.viii.1974, F. Jowett, in BMNH; 1♀, July 1975, F. Jowett, in BMNH; 1♀, Rocky Point Reserve, 50 m, site J117, 15.iii.1975, F. Jowett, in BMNH.

Diagnosis

F. norfolki can be distinguished from other species of Australian *Fannia* by the combination of bare posteroapical margin of hind coxa and hind femur with only four moderate setae on *av* surface in male; and by the yellow femora and tibiae in the female. The yellowish brown dust on thorax and abdomen gives this species a characteristic appearance in both sexes.

Male

Head. Frons at narrowest point 3-4 times diameter of anterior ocellus, as broad as to slightly broader than width of 3rd antennal segment. Eyes virtually bare. Post-ocular setulae short, except at vertex, in a single row throughout. Viewed from above, parafrontalia silvery white pruinose on all but upper fifth; parafacialia silvery white pruinose; face, genae and occiput grey to brownish grey. Parafrontalia rather slender throughout, at middle of frons a parafrontale half as broad outside *ori* as interfrontalia; at lunula half as broad as 3rd antennal segment; interfrontalia



Figs 40-44. *Fannia norfolki*: 40, male fifth sternite in dorsal view; 41, male hypopygium in dorsal view; 42, female ovipositor in dorsal view; 43, female ovipositor in ventral view; 44, spermatheca in lateral view. Male holotype; female paratype from Norfolk I., 13-25.iv.1972.

conspicuous throughout. 12-14 pairs of inclinate *ori*, with a few interstitials, reaching almost to ocellar tubercle. Antennae black, weakly reddish at base, 3rd segment hardly twice as long as broad. Parafacialia narrow, at middle one-third width of 3rd antennal segment, hardly narrowing below; bare. Vibrissal angle slightly behind level of profrons. Posterior eye-margin almost straight in lateral view. Proboscis short, mentum moderate, dusted. Palpi black, rather swollen apically, as long as mentum of proboscis.

Thorax. Ground colour black. Mesonotum densely yellowish brown dusted, with faint indications of a pair of darker paramedian vittae between the outer *acr* and *dc* rows, running from neck midway to scutellum, and also of a pair of *prst* patches between *dc* and *ph* and of a pair of *post* vittae between *dc* and *ia*. Scutellum wholly brown to yellowish brown dusted. Pleura yellowish to brownish grey dusted, tinged with grey. Ground-setulae short and sparse. *Prst acr* biserial. *Pra* moderate, over half length of 2nd *npl*, with a short setula behind and slightly mesad of it. 7 or more setulae surrounding the prostigmatal seta. Disc of scutellum bare on a central area, 13-16 setulae placed around margin and before tip.

Legs. Black; trochanters red, especially mid and hind ones; knees yellow, especially fore knees; hind tibia brown. Tarsi not modified. Fore tibia without *p* seta and without a stronger *ad* setula in apical part. Mid femur of almost normal shape, only weakly emarginate in apical quarter; *av* surface with a complete row of moderate setae, none as long as femoral depth, becoming progressively shorter along femoral length, and rather stronger in apical half than in basal half; *pv* surface with a similar but rather denser row of setae. Mid tibia on ventral surface rather flattened in basal half and slightly swollen in apical half, the mat of hairs $\frac{1}{3}$ or $\frac{1}{2}$ tibial depth; apparently 1 *ad* and 1 *pd* seta, as in female, both short. Mid metatarsus without a basal ventral crest. Hind coxa bare on posteroapical margin. Hind femur with a very weak ventral swelling on apical third; 4 moderate *av* setae on apical half, slightly longer than femoral depth; on the swollen part with 2-3 fine *v* setae, equal to femoral depth, and on *pv* surface with a loose cluster of about 6 fine setae, also subequal to femoral depth, which are preceded by some fine setulae on *v*, *p* and *pv* surfaces. Hind tibia with *ad* and 1 *av* at about the same level as the submedian *d*.

Wings. Clear, yellowish costally and basally. Costal spine inconspicuous. Hind crossvein weakly sinuous. Squamae creamy, margins deep yellow; lower one well developed, projecting slightly beyond upper one. Knob of halteres deep yellow.

Abdomen. Ground colour black. Densely brownish dusted, a little tinged with grey in places, with a dark median patch on tergite 1+2 and a very weakly indicated darker dusted vitta or triangle on tergites 4 and 5, in extreme posterior view tergites 3-5 appearing evenly dusted.

Genitalia. As in Figs 40, 41. Cercal plate rounded at tip. Surstyli simple, curved. Bacilliform process present, corkscrew shaped. (One dissection, holotype.)

Measurements. Length of body, 4.5-5.5 mm. Length of wing, 4.0-4.5 mm.

Female

Differs from the male as follows:

Head. Frons at middle as broad as an eye, broadening gradually from vertex to lunula. Parafrontalia wholly pruinose, brownish grey or yellowish grey according to point of view; parafacialia grey rather than silvery white pruinose. Interfrontalia black. Parafrontalia broad, opposite lower *ors* a parafrontale equal to 3 times diameter of anterior ocellus and at this point $\frac{2}{3}$ width of interfrontalia. *c.* 7-9 pairs of *ori*; lower *ors* closer to inner margin of parafrontale than to eye-margin; parafrontal setulae in 2 rows below lower *ors*. Parafacialia rather broader than in male, bare; at middle about half width of 3rd antennal segment. Vibrissal angle below level of profrons.

Thorax. Indications of darker marks on mesonotum sometimes extremely faint. *Pra* shorter, at most half length of 2nd *npl*. 5-9 setulae surrounding the prostigmatal seta. 7-9 setulae placed around margin of scutellum.

Legs. Coxae dark above, orange below; trochanters, femora and tibiae orange-yellow, the femora apically and the tibiae basally usually a little darkened; tarsi black. Mid femur normal, bare ventrally except for an erect hair at base and a few erect *av* setulae near base. Mid tibia normal, bare ventrally; 1 *ad* and 1 *pd* seta. Hind femur normal, bare ventrally except for 2 *av* setae before apex, rarely with a 3rd weaker *av*. Hind tibia with the *ad* and *av* sometimes slightly basad of the submedian *d*.

Wings. Membrane more uniformly yellowish, deep yellow at base. Squamae yellow to deep yellow on disc as well as margin.

Abdomen. Shorter and more pointed. Wholly brownish dusted, sometimes a little tinged with grey, without any undusted areas or markings.

Ovipositor. As in Figs 42, 43. Tergites 6-8 separated from sternites 6-8. Tergite 8 consisting of a single plate. Sternite 8 reduced to 2 small weakly chitinized plates. Spiracles situated in tergite 6, at side and at ventral angle. Spermathecae (Fig. 44) dark brown, elongate pear-shaped. (One dissection.)

Measurements. Length of body, 4.5-5.0 mm. Length of wing, 4.0-4.5 mm.

Distribution and Biology

Known only from Norfolk Island (Pont 1973, p. 183).

Adults are attracted to dung and carrion, and also to human sweat (Ferrar *et al.* 1975, p. 10). Larval habitat unknown.

Relationships

F. norfolki is most closely related to the other Australian species with a bare posteroapical margin to hind coxa (*anteroventralis*, *howei* and *tasmaniae*), and like them probably belongs to the *pretiosa* group of Chillcott (1961, p. 142).

Fannia tasmaniae, sp. nov.

(Figs 45-56)

Types

Holotype ♂, Great Dog I., Furneaux Group, Tasmania, 14.iii.1950, T. G. Campbell, in ANIC.

Paratypes. **Tasmania:** 1♂, Little Dog I., 23.xii.1952, R. Mykytowycz, in BMNH; 1♀, Half-way Scrub, Babel I., Furneaux Group, 21.iii.1950, T. G. Campbell, in ANIC; 3♂, Bruny I., 8.ii.1966, M. Whitten, 2 in ANIC, 1 in BMNH; 1♀, Fisher I., near Lady Barron, Flinders I., 12.iii.1950, T. G. Campbell, in ANIC; 1♀, Great Dog I., Furneaux Group, 19.iii.1952, J. H. Calaby, in ANIC; 1♀, Little Dog I., Furneaux Group, 8.iii.1952, J. H. Calaby, in BMNH; 1♀, South Arm, 24.i.1966, R. Fullerton, in ANIC. **South Australia:** 3♂, 4♀, Seal Bay, Kangaroo I., 21.v.1965, D. E. Havenstein, 1♂, 2♀ in BMNH, 2♂, 2♀ in ANIC; 9♂, 2♀, Stokes Bay, Kangaroo I., 23.v.1965, D. E. Havenstein, 2♂ in BMNH, 7♂, 2♀ in ANIC; 1♀, Kangaroo I., 2.ix.1963, D. A. McArthur, in ANIC. **New South Wales:** 1♀, Five Islands, 11.xii.1938, D. F. Waterhouse, in ANIC.

Diagnosis

F. tasmaniae differs from other Australian Fanniidae except for *howei*, sp. nov., by the bare posteroapical margin to hind coxa, yellow halteres, modified male hind femur (Fig. 49) and dark female legs.

It differs from *howei* as stated in the key (p. 17), and also by the structure of the genitalia in both sexes.

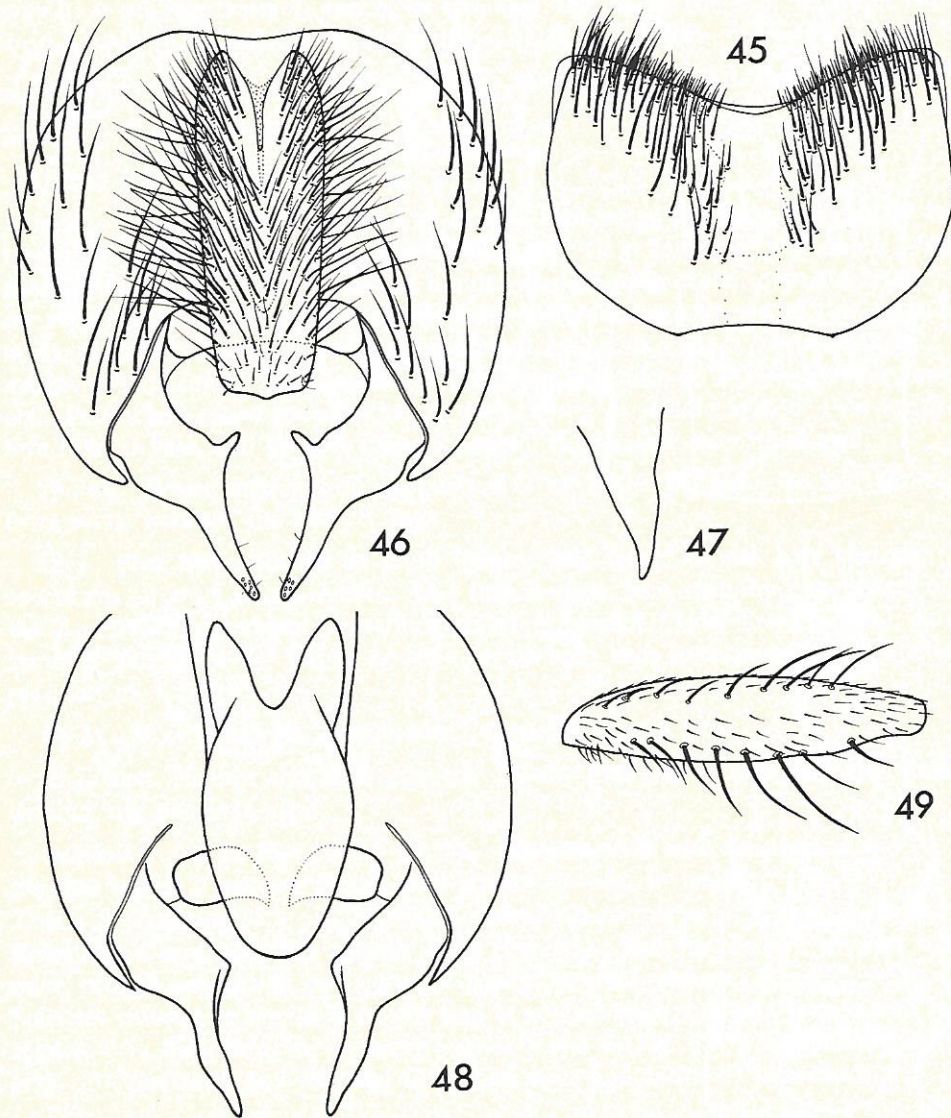
Male

Head. Frons at narrowest point about 4 times diameter of anterior ocellus, broader than width of 3rd antennal segment. Eyes with short and sparse but distinct pubescence. Postocular setulae short, except at vertex, in a single row throughout. Viewed from above, parafrontalia silvery white pruinose, more grey near vertex; parafacialia silvery white pruinose; genae, face and occiput grey to brownish grey. Parafrontalia rather slender throughout, at middle of frons a parafrontale half as broad outside *ori* as interfrontalia, at lunula half as broad as 3rd antennal segment; interfrontalia conspicuous throughout. 5-8 pairs of inclinate *ori*, with few interstitials, reaching almost to ocellar tubercle. Antennae black, 3rd segment hardly twice as long as broad. Parafacialia moderate, at middle half width of 3rd antennal segment, hardly narrowing below; bare. Vibrissal angle below level of profrons. Posterior eye-margin almost straight in lateral view. Proboscis short, mentum rather thick, dusted. Palpi black, slender, as long as mentum of proboscis.

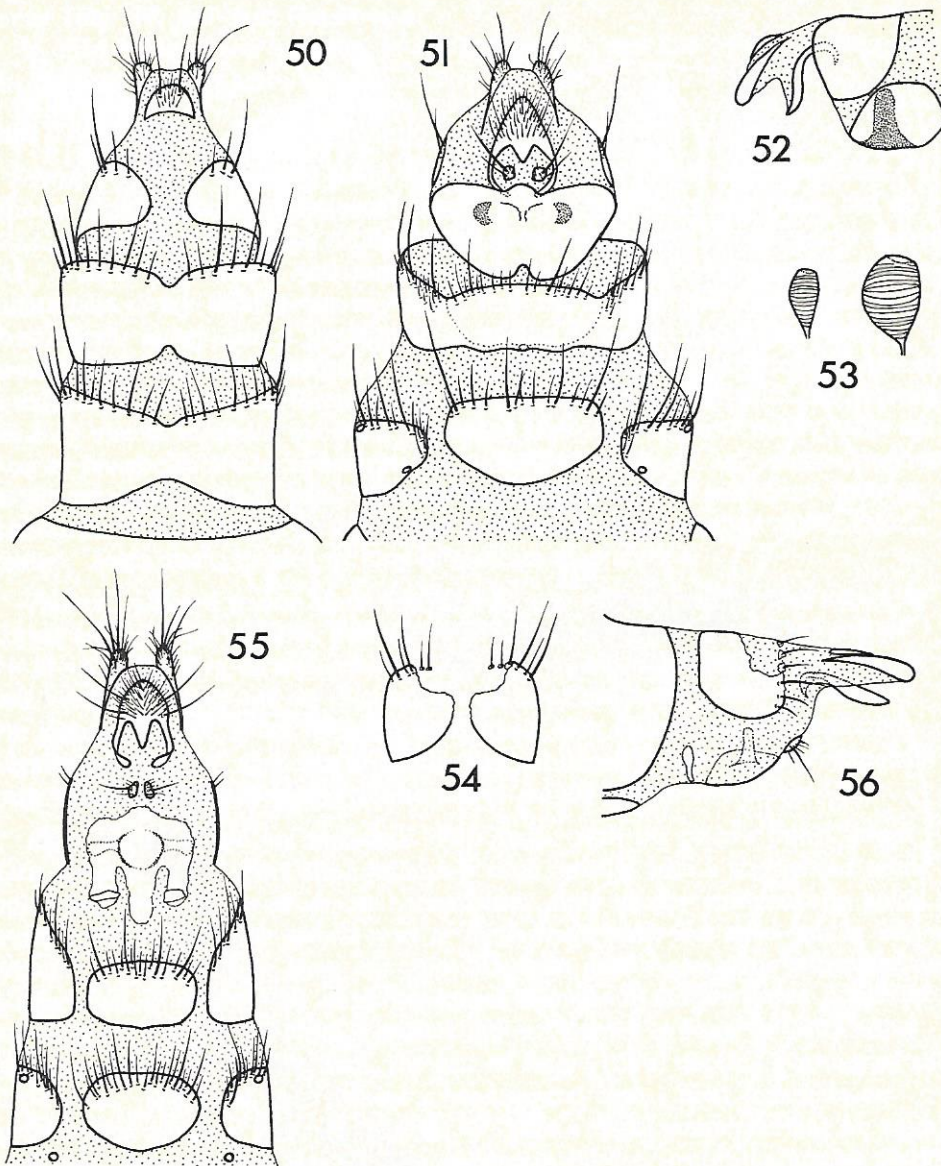
Thorax. Ground colour black, wholly dull grey dusted. Mesonotum appearing darker brown in dorsal view, this resolving itself in posterior view into a pair of broad vittae between *dc* and *acr* rows and paired patches between *ph* and *prst dc* and between *post dc* and *ia*. Ground-setulae short and sparse. *Prst acr* biserial. *Pra* short and stout, closer to suture than to *sa*, with a short setula behind and slightly mesad of it. 6-8 setulae surrounding prostigmatal seta. Disc of scutellum bare on central area, about 15 setulae placed around margin and before tip.

Legs. Black. Tarsi not modified. Fore femur with the *pv* row rather longer than femoral depth. Fore tibia without *p* setae, usually with a stronger *ad* setula in apical half. Mid femur of almost normal shape, only weakly emarginate in apical quarter; *av* surface with several rows of dense short comb-like setae, not as long as femoral depth, becoming stout and spine-like from middle onwards; *pv* surface with similar rows of setae which are rather longer throughout and are rather stouter in apical half. Mid tibia on ventral surface rather flattened in basal half and rather suddenly thickened in apical half, the mat of hairs $\frac{1}{3}$ tibial depth; 1 strong *ad* and 2 *pd* setae. Mid metatarsus without a basal ventral crest. Hind coxa bare on posteroapical margin. Hind femur (Fig. 49) with a slight ventral swelling on apical third; *av* surface with a row of setae on median third or more, the longest slightly longer than femoral depth, all of them strong and stout; *pv* surface with several rows of short fine hairs on basal half, merging on 3rd quarter into a loose pluriserial cluster of several long moderate and fine setae which are much longer than femoral depth. Hind tibia with 1 *ad* at the same level or slightly apicad of the submedian *d*, and 1 *av* (exceptionally 2) slightly apicad of the *ad*.

Wings. Faintly smoky, brownish towards base. Costal spine inconspicuous. Hind crossvein weakly sinuous. Squamae yellowish white, the margins deeper yellow; lower one well developed, projecting slightly beyond upper one. Knob of halteres yellow.



Figs 45–49. *Fannia tasmaniae*, male: 45, fifth sternite in dorsal view; 46, hypopygium in dorsal view, setae on upper part of hypandrium omitted; 47, surstylus in lateral view; 48, hypopygium in dorsal view, all setae omitted; 49, hind femur in anterior view. Figs 45–47 of paratype from Great Dog I., Furneaux Group, Tas., 14.iii.1950; Fig. 48 of paratype from Stokes Bay, Kangaroo I., S.A.; Fig. 49, holotype.



Figs 50–56. *Fannia tasmaniae*, female: 50, ovipositor in dorsal view; 51, ovipositor in ventral view; 52, tip of ovipositor in lateral view; 53, spermathecae in lateral view; 54, tergite 8; 55, ovipositor in ventral view; 56, tip of ovipositor in lateral view; Figs 50–53 of paratype from Fisher I., Tas., 12.iii.1950; Figs 54–56 of paratype from Seal Bay, Kangaroo I., S.A., 21.v.1965.

Abdomen. Ground colour black. Densely yellowish grey dusted, with undusted triangular markings on tergites 1+2 to 4; a thinly dusted triangle or vitta sometimes present also on tergite 5.

Genitalia. As in Figs 45-48. Cercal plate truncated at tip. Surstyli with a strong projection on inner surface, varying in size according to the angle of viewing. Bacilliform process small, pointed on the facing surfaces. (2 dissections.)

Measurements. Length of body, 4.5-5.5 mm. Length of wing, 4.0-5.0 mm.

Female

Differs from the male as follows:

Head. Frons at middle as broad as an eye, broadening gradually from vertex to lunula. Parafrontalia and parafacialia entirely grey to yellowish grey pruinose. Interfrontalia black, sometimes reddish at lunula. Parafrontalia broad, opposite lower *ors* a parafrontale equal to 3 times diameter of anterior ocellus and at this point $\frac{3}{4}$ width of interfrontalia. About 8 pairs of *ori*; lower *ors* midway between inner margin of parafrontale and eye-margin; parafrontal setulae in 2-3 rows below lower *ors*. Parafacialia rather broader than in male, bare; at middle broader than width of fore tibia at base, and broader than in *howei*. Palpi rather more thickened.

Thorax. Brown markings on mesonotum rather better defined. Occasionally an extra setula between the *prst acr* rows.

Legs. Fore tibia with the *ad* setula longer. Mid femur normal, bare ventrally except for an erect setula at base. Mid tibia normal, bare ventrally; the apical of the 2 *pd* sometimes absent, sometimes a 2nd *ad* present. Hind femur normal, bare ventrally except for 2-3 strong *av* setae before apex and, sometimes, with a moderate preapical *pv*.

Wings. More yellowish towards base. Squamal margins paler.

Abdomen. Shorter and more pointed. Wholly dull grey to yellowish grey dusted, without any undusted areas.

Ovipositor. As in Figs 50-52, 55, 56. Segments 6-8 with the tergites and sternites separate, but one female with sternite 7 fused to tergite 7 (Fig. 51). Tergite 8 consisting of a pair of plates. Sternite 8 consisting of 2 small posterior plates and a very indefinite anterior plate (Fig. 55) which has 2 small anterior areas more strongly sclerotized and a pair of conical internal processes (Figs 52, 56). Spiracles situated in tergite 6, at side and at ventral angle, but one female with spiracle 6 in the membrane between tergites 5 and 6 (Fig. 55). 3 spermathecae (Fig. 53), one small and pale and the others large and dark. (3 dissections.)

Measurements. Length of body, 4.5-5.5 mm. Length of wing, 4.0-5.0 mm.

Distribution and Biology

Known only from south-eastern Australia (New South Wales, South Australia, Tasmania).

Adult habits and larvae completely unknown.

Variation

There is some variation in the male and female genitalia of this species. In the male (Figs 46, 48), the cercal plate varies slightly in outline, but the differences in

the projection on inner surface are due to slightly different angles of viewing. In the female there is more apparent variation, though some is due to different degrees of sclerotization of the parts: for example, sternite 8 is usually of the form shown in Fig. 55, and the shape shown in Fig. 51 is possibly the result of insufficient clearing. The same applies to the apparent fusion of tergite 7 and sternite 8 in Fig. 51. The position of spiracle 6 does seem to vary (Figs 51, 55).

Relationships

F. tasmaniae probably belongs to the *pretiosa* group of Chillcott (1961, p. 142), but, as Chillcott remarks, this is a rather heterogeneous group and the inclusion of species such as the Nearctic *arcuata* Chillcott and a large number of similar Neotropical species certainly justifies the inclusion of *tasmaniae* and its immediate relatives.

Species of the *pretiosa* group usually have tibial setae duplicated on at least one tibia, but in *tasmaniae* this is shown only in the male, which has 2 *pd* on mid tibia. The swollen hind femur, presence of a bacilliform process in the male hypopygium, and presence of three spermathecae (one smaller than the others) confirm relationship with *arcuata* and further Neotropical species of the *pretiosa* group.

According to the late Dr Chillcott (in conversation), the *pretiosa* group is most richly developed in South America.

Fannia howei, sp. nov.

(Figs 57-64)

Fannia sp. nov. A; Pont, 1973, p. 182; Ferrar *et al.*, 1975, p. 10.

Types

Holotype ♂, North Bay, Lord Howe Island, 24.ii.1971, D. K. McAlpine, in AM.

Paratypes. **Lord Howe Island:** 1♀, same data as holotype, in AM; 1♀, on beach, North Bay, 21.ii.1971, D. K. McAlpine, in AM; 2♀, Blinky Beach, 25.ii.1971, D. K. McAlpine, in AM and BMNH; 2♂, 5♀, North Bay, 19.ii.1957, Z. Liepa, 1♂, 4♀ in ANIC, 1♂, 1♀ in BMNH; 1♀, 30.xi.1955, S. J. Paramonov and Z. Liepa, in ANIC; 1♀, near Johnson's Beach, at light, Dec. 1966, E. Britton, in ANIC; 4♂, 9♀, Salmon Beach, Dec. 1972, Z. Liepa, 3♂, 6♀ in ANIC, 1♂, 3♀ in BMNH; 5♂, 5♀, same data, at light, 4♂, 4♀ in ANIC, 1♂, 1♀ in BMNH; 2♀, Ned's Beach, Dec. 1972, Z. Liepa, in ANIC; 11♂, 2♀, Boat Haven, Dec. 1972, Z. Liepa, 9♂, 2♀ in ANIC, 2♂ in BMNH. **Norfolk Island:** 1♂, Duncombe Bay, 300 ft, 13.vii.1968, M. S. Upton, in ANIC; 3♂, Mt Pitt, 850 ft, 12.vii.1968, M. S. Upton, 1 in BMNH, 2 in ANIC; 4♂, 18♀, 13-25.iv.1972, A. L. Dyce, H. A. Standfast, P. Ferrar, 3♂, 14♀ in ANIC, 1♂, 4♀ in BMNH.

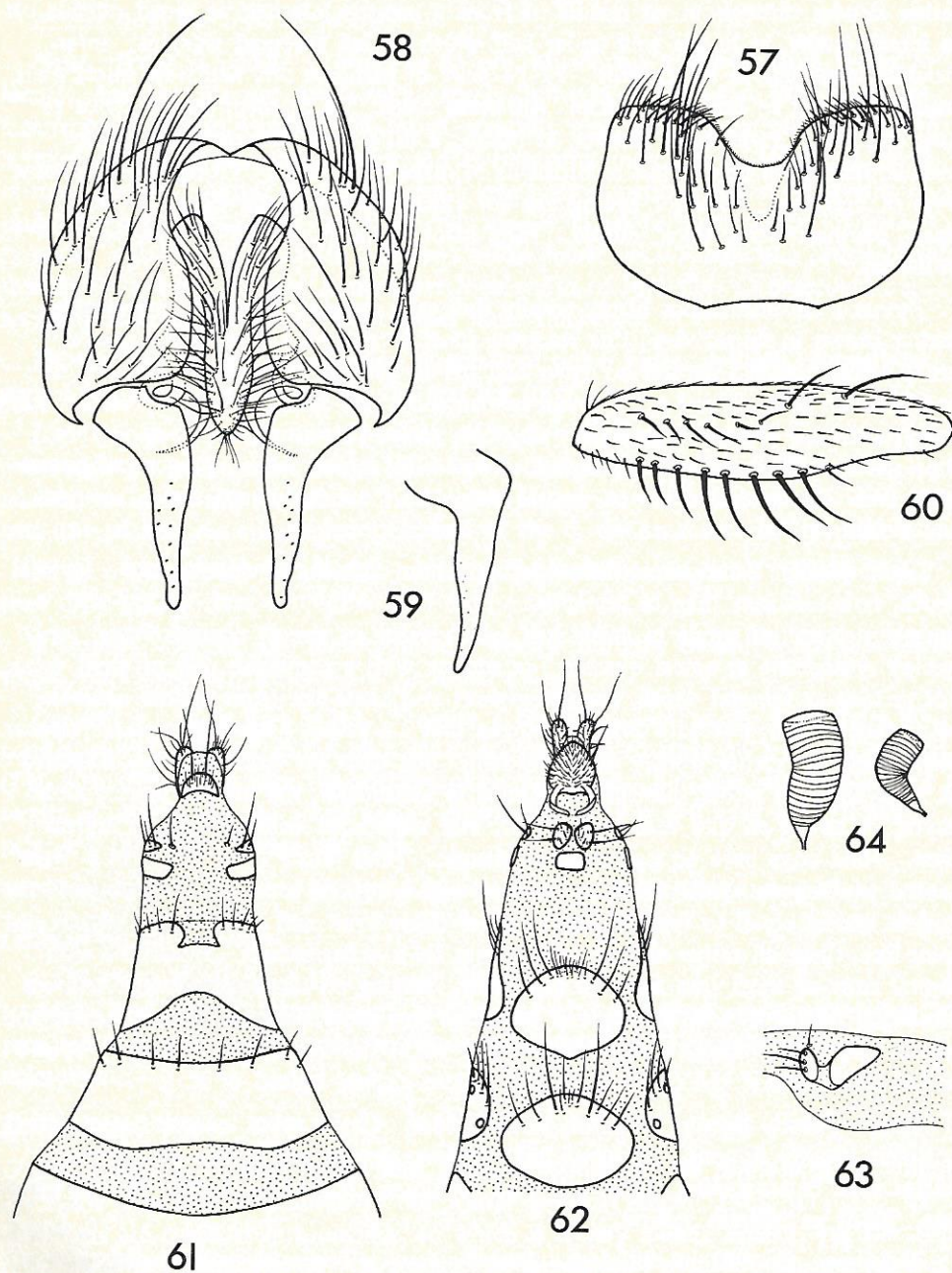
Diagnosis

P. howei differs from other Australian Fanniidae except for *tasmaniae*, sp. nov., by the bare posteroapical margin to hind coxa, yellow halteres, modified male hind femur (Fig. 60) and dark female legs.

It differs from *tasmaniae* as stated in the key (p. 17), and also by the structure of the genitalia in both sexes.

Male

Head. Frons at narrowest point almost 3 times diameter of anterior ocellus, slightly narrower than in *tasmaniae*. Eyes virtually bare. Postocular setulae short except at vertex, in a single row throughout. Viewed from above, parafrontalia silvery white pruinose at least on lower half, otherwise grey pruinose; parafacialia



Figs 57–64. *Fannia howei*: 57, male fifth sternite in dorsal view; 58, male hypopygium in dorsal view; 59, male surstylus in lateral view; 60, male hind femur in anterior view; 61, female ovipositor in dorsal view; 62, female ovipositor in ventral view; 63, female tergite 8 in lateral view; 64, spermathecae in lateral view. Figs 57 and 58 of holotype; Figs 59 and 63 of paratypes from Norfolk I., 13–25.iv.1972; Figs 60–62 and 64 of paratypes from North Bay, Lord Howe I., 19.ii.1957.

silvery white pruinose; genae, face and occiput grey to brownish grey. Parafrontalia rather slender throughout, at middle of frons a parafrontale half as broad outside *ori* as interfrontalia, at lunula well under half width of 3rd antennal segment; interfrontalia conspicuous throughout. 12-14 pairs of inclinate *ori*, with few interstitials, reaching almost to ocellar tubercle. Antennae black, 3rd segment hardly twice as long as broad. Parafacialia slender, at middle a little over diameter of anterior ocellus, narrowing below, not as broad as in *tasmaniae*; bare. Vibrissal angle below level of profrons. Posterior eye-margin not emarginate in lateral view. Proboscis short, mentum rather thick, dusted. Palpi black, slender, as long as mentum of proboscis.

Thorax. Ground colour black, wholly dull grey dusted. Mesonotum appearing darker brown in dorsal view, this resolving itself in posterior view into a pair of broad vittae between *dc* and *acr* rows and paired patches between *ph* and *prst dc* and between *post dc* and *ia*. Ground-setulae short and sparse. *Prst acr* biserial, sometimes triserial at suture. *Pra* short and stout, closer to suture than to *sa*, with a short setula behind and slightly mesad of it. 6-10 setulae surrounding prostigmatal seta. Disc of scutellum bare on central area, 15-20 setulae placed around margins and before tip.

Legs. Black. Tarsi not modified. Fore femur with the *pv* row equal to femoral depth, rather shorter than in *tasmaniae*. Fore tibia without *p* seta, usually with a slightly stronger *ad* setula in apical half. Mid femur of almost normal shape; only weakly emarginate in apical quarter; *av* surface with a comb-like row of short setae, not as long as femoral depth, becoming short and spine-like from middle onwards; *pv* surface similar, but with pluriserial rows that are rather longer throughout, appear denser, and are rather stouter on apical half. Mid tibia on ventral surface flattened in basal half and rather suddenly thickened in apical half, the mat of hairs $\frac{1}{3}$ tibial depth; 1 strong *pd* and 1 short *ad* seta. Mid metatarsus without a basal ventral crest. Hind coxa bare on posteroapical margin. Hind femur (Fig. 60) with a slight ventral swelling on apical third; *av* surface with a row of setae on median third, the longest almost equal to femoral depth, all of them stout and the last 2-4 strong and spine-like, these all rather shorter and stouter than in *tasmaniae*; *pv* surface with several rows of short fine hairs on basal half, merging on third quarter into a loose pluriserial cluster of several long and moderate fine setae, these all rather shorter and sparser than in *tasmaniae*. Hind tibia with 1 *ad* at the same level or slightly apicad of the submedian *d* and (occasionally) 1 *av* also slightly apicad of it.

Wings. Faintly smoky, brownish towards base. Costal spine inconspicuous. Hind crossvein weakly sinuous. Squamae dirty yellow, almost pale brown on margins, darker than in *tasmaniae*; lower one well developed, projecting slightly beyond upper one. Knob of halteres yellow.

Abdomen. Ground colour black. Densely grey or brownish grey dusted, with undusted triangular markings on tergites (1+2)-4, and sometimes also with a fainter weakly triangular mark on tergite 5.

Genitalia. As in Figs 57-59. Cercal plate pointed at tip. Surstyli simple, curved. Bacilliform process present, corkscrew shaped.

Measurements. Length of body, 4.5-5.0 mm. Length of wing, 4.0-4.5 mm.

Female

Differs from the male as follows:

Head. Frons at middle as broad as an eye, broadening gradually from vertex to lunula. Parafrontalia and parafacialia entirely dull grey to yellowish grey pruinose. Interfrontalia black. Parafrontalia broad, opposite lower *ors* a parafrontale equal to 3 times diameter of anterior ocellus and at this point usually $\frac{3}{4}$ to almost as broad as interfrontalia. About 10 pairs of *ori*; lower *ors* sometimes midway between inner margin of parafrontale and eye-margin but usually closer to inner margin of parafrontale; parafrontal setulae in 2-3 rows below lower *ors*. Parafacialia rather broader than in male, bare; at middle narrower than width of fore tibia at base, and narrower than in *tasmaniae*. Palpi rather more thickened.

Thorax. The brown markings on mesonotum rather better defined. Sometimes with a few short setulae between the *prst acr* rows.

Legs. Fore tibia with the *ad* setulae stronger. Mid femur normal, bare ventrally except for an erect hair at base. Mid tibia normal, bare ventrally. Hind femur normal, bare ventrally except for 1 (rarely 2) strong *av* seta before apex. Hind tibia with the *ad* seta sometimes slightly apicad of the *d*, the *av* absent in 1 female.

Wings. More yellowish towards base. Squamae sometimes more orange-yellow than dirty yellow.

Abdomen. Shorter and more pointed. Wholly dull grey dusted, sometimes rather tinged with brownish, without any undusted areas.

Ovipositor. As in Figs 61-63. Sternite 7 not fused with tergite 7. Tergite 8 consisting of 2 pairs of plates, each more or less fused to form an L-shaped pattern (Fig. 63). Sternite 8 with the anterior plate very small. Spiracles situated in tergite 6, at side and at ventral angle. Spermathecae (Fig. 64) with 1 small and pale, and the other 2 large and dark.

Measurements. Length of body, 4.5-5.5 mm. Length of wing, 4.0-5.0 mm.

Distribution and Biology

Known only from Lord Howe I. and Norfolk I.

Adults are attracted to dung and carrion, and also to human sweat when their persistence may be mildly irritating (Ferrar *et al.* 1975, p. 10). Larval habitat unknown.

Relationships

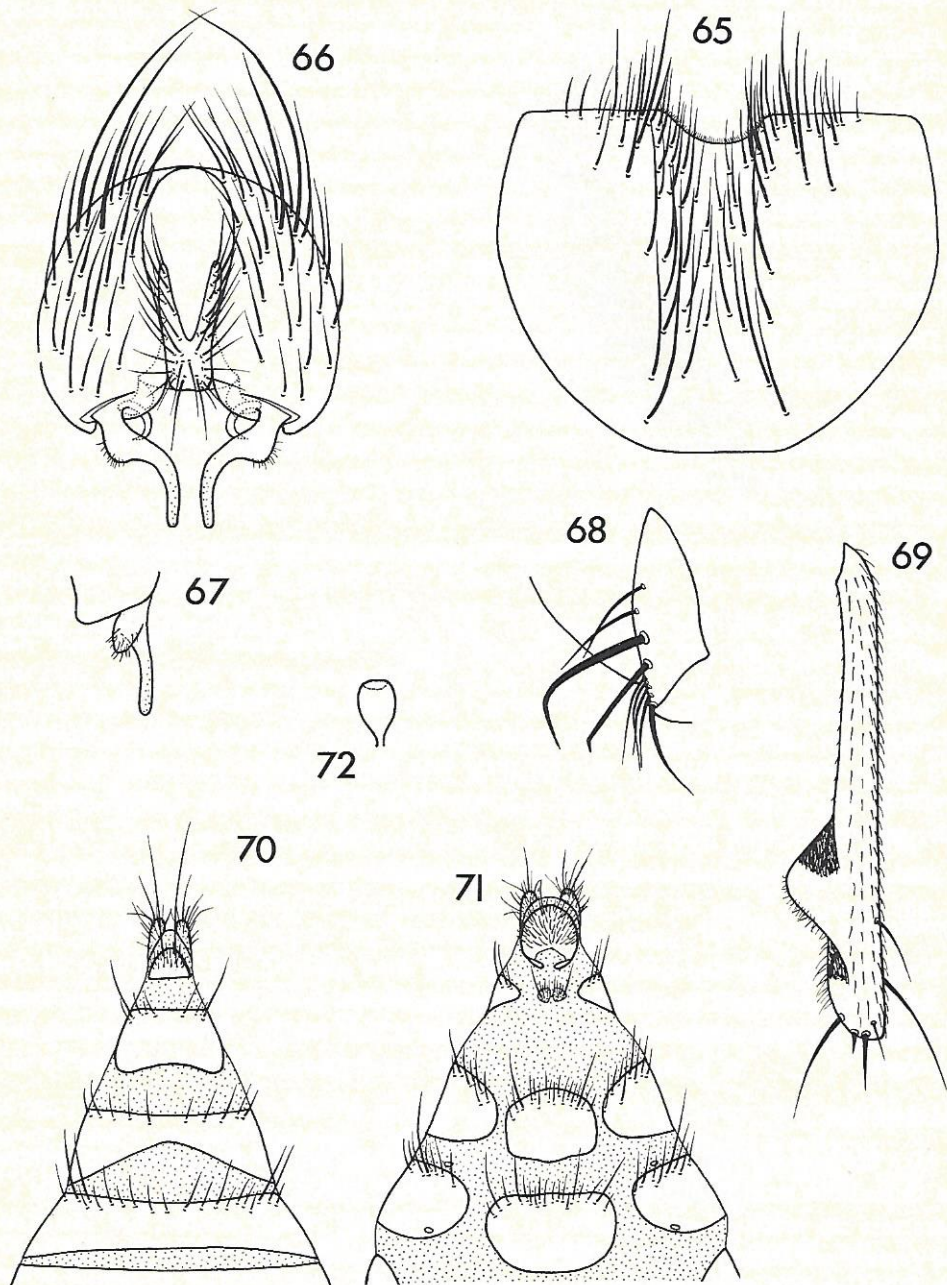
Like *tasmaniae*, *Fannia howei* most probably belongs to the *pretiosa* group, although the single tibial setae might lead to the *postica* group (Chillcott 1961, p. 103). Its characters are much as in *tasmaniae*, to which it is very closely related, but the male and female genitalia differ very strikingly. *F. howei* lacks a bacilliform process, but this is absent in some members of the *pretiosa* group.

Fannia scalaris (Fabricius)

(Figs 65-72)

Musca scalaris Fabricius, 1794, p. 332.

Fannia scalaris (Fabricius). Place, 1916, p. 5; Johnston and Bancroft, 1920a, p. 182; Hennig, 1955, p. 81, figs 5, 11, 14, pl. 1 fig. 16, pl. 4 fig. 67; Chillcott, 1961, p. 61, figs A-F,



Figs 65–72. *Fannia scalaris*: 65, male fifth sternite in dorsal view; 66, male hypopygium in dorsal view; 67, male surstylus in lateral view; 68, male mid coxa in lateral view; 69, male mid tibia in anterior view; 70, female ovipositor in dorsal view; 71, female ovipositor in ventral view; 72, spermatheca in lateral view. Male and female from Redhill, Somerset, England.

4, 4a, 222, 233, 273, map 3; Zumpt, 1965, p. 44, figs 49, 50b; Hennig, 1966, pp. 1-12, figs 1-6; Lyneborg, 1970, p. 13, figs 1a, 3, 4; Greenberg, 1971, pp. 255-8.

Types

Syntypes, 2 specimens, 'Hafniae' [= Copenhagen, Denmark], in UZMC [not seen; see Chillcott, 1961, p. 63; Zimsen, 1964, p. 491].

Diagnosis

F. scalaris males may be easily recognized by the presence of several stout hook-like spines on the anterior margin of the mid coxa (Fig. 68) and a stout triangular ventral projection on the mid tibia (Fig. 69). The female differs from other Australian Fanniidae with setulae on the posteroapical margin of the hind coxa by having three or more *av* setae on hind tibia. The male and female genitalia are illustrated in Figs 65-67 and 70-72.

Discussion

I have not seen any Australian specimens of *scalaris*, but it has been recorded from Australia, and presumably the Adelaide district, by Place (1916, p. 6). This record may well be based on a misidentification, but it seems quite possible that the species was at one time introduced into the temperate parts of Australia; it may be introduced again, but does not appear to be an Australian species at the present time. Johnston and Bancroft (1920a) stated that they had not found the species in southern Queensland.

The adult has been described by Hennig (1955) and Chillcott (1961) in revisions of Palaearctic and Nearctic Fanniidae. The larva has been described by Lyneborg (1970). Greenberg (1971) has listed the associated disease and other organisms, whilst Zumpt (1965) has discussed its relationship to myiasis. The adult of what appears to be this species has been found in Baltic amber (Hennig 1966).

Distribution and Biology

Virtually cosmopolitan, in temperate areas of the northern and southern hemispheres. Not in New Zealand.

F. scalaris is commonly known as the 'latrine fly'. In the temperate northern hemisphere the adults occur everywhere and especially around latrines and middens. The larvae breed in all kinds of decaying excrement, garbage, rotting vegetables, etc.

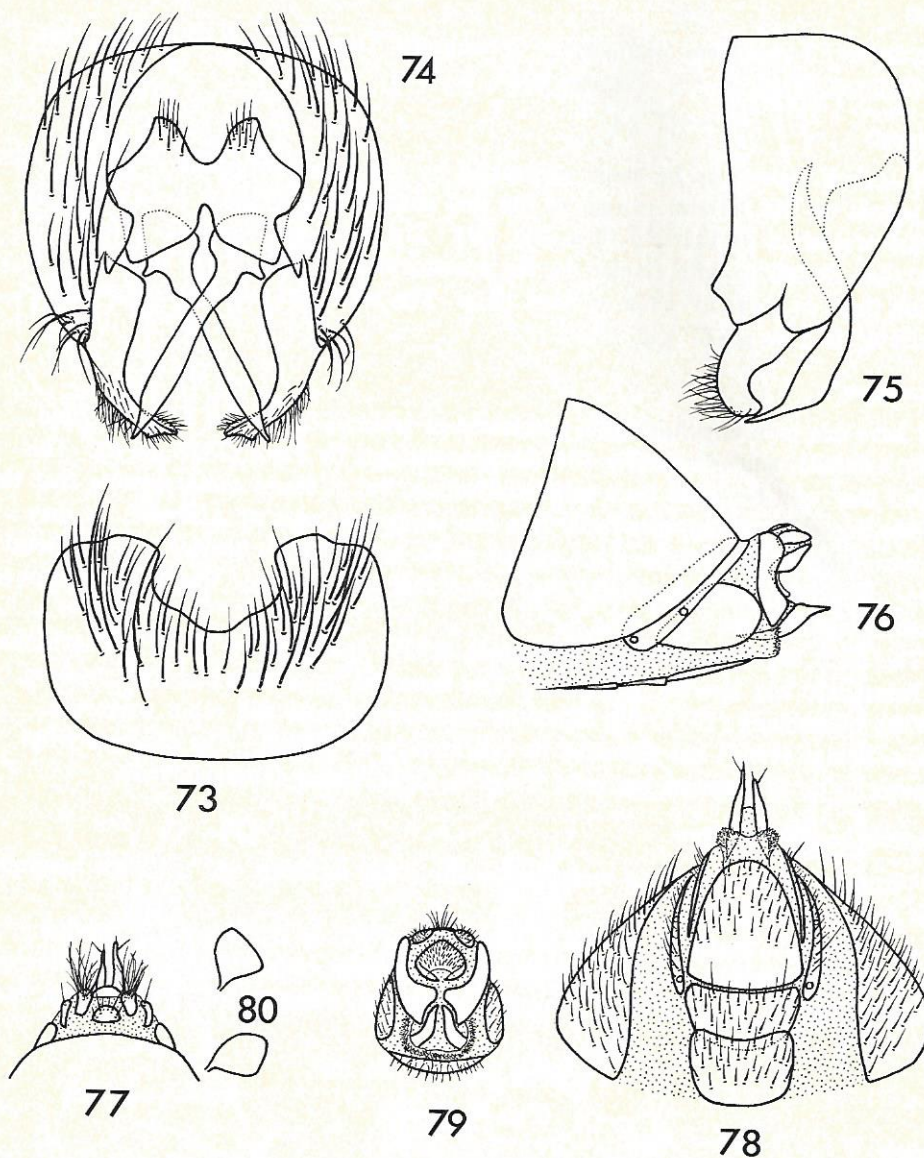
Fannia capitalis, sp. nov.

(Figs 4, 73-80)

Types

Holotype ♂, Black Mountain, Australian Capital Territory, light trap, 14.ii.1966, I. F. B. Common, in ANIC.

Paratypes: **Australian Capital Territory:** 1♂, same locality as holotype, 31.xii.1963, in ANIC; 1♀, same locality, 15.xii.1965, in BMNH; 1♂, 1♀, same locality, 12.xi.1965, D. H. Colless, ♂ in BMNH, ♀ in ANIC; 1♀, Blundell's, sweeping grass, 14.iv.1931, L. F. Graham, in ANIC. **New South Wales:** 1♀, Goonoo State Forest, 5 miles S. of Mendooran, on decaying snails, 1-3.v.1970, D. K. McAlpine and G. A. Holloway, in AM; 1♂, Wellington, 26.xi.1949, S. J. Paramonov, in ANIC.



Figs 73–80. *Fannia capitalis*: 73, male fifth sternite in dorsal view; 74, male hypopygium in dorsal view; 75, male hypopygium in lateral view, setae on epandrium and cercal plate omitted; 76, female ovipositor in lateral view, setae omitted; 77, female ovipositor in dorsal view; 78, female ovipositor in ventral view; 79, female ovipositor in apical view; 80, spermathecae in lateral view. Male paratype from Black Mountain, A.C.T., 31.xii.1963; female paratype from Blundells, A.C.T., 14.iv.1931.

Diagnosis

F. capitalis can be distinguished from the other Australian Fanniidae by the absence of the submedian dorsal seta on hind tibia.

Male

A black mainly shining species.

Head. Frons at narrowest point about 3-4 times diameter of anterior ocellus. Eyes virtually bare. Postocular setulae short, except at vertex, in a single row throughout. Viewed from above, parafrontalia silvery white pruinose on lower $\frac{1}{2}$ - $\frac{2}{3}$, otherwise grey; parafacialia silvery white pruinose; face whitish, genae and occiput brown to brownish grey. Parafrontalia rather slender throughout, at middle of frons a parafrontale half as broad outside *ori* as interfrontalia, at lunula about half width of 3rd antennal segment; interfrontalia conspicuous throughout. 8-12 pairs of fine inclinate *ori*, including some short interstitials, reaching almost to ocellar tubercle. Antennae black, 3rd segment 2-2 $\frac{1}{2}$ times as long as broad. Parafacialia comparatively broad above, but tapering very sharply below, obsolete before level of antennal tip; bare. Vibrissal angle well behind level of profrons. Posterior eye-margin not emarginate in lateral view. Proboscis moderate, mentum thin, mainly dusted. Palpi black, slender, as long as mentum of proboscis.

Thorax. Ground colour black; with no visible dust, except for some thin greyish dust on humeri and notopleura, and appearing subshining from all points of view. Ground-setulae short but dense. *Prst acr* setulae 3- to 4-serial. Anterior *prst dc* about half length of posterior one. 2 short *pra*, the anterior one a little longer and stronger than the ground-setulae. 2-3 setulae adjacent to prostigmatal seta. Disc of scutellum bare on a central area, 10-13 setulae placed around margins and before tip.

Legs. Black. Tarsi not modified. Fore femur with the *pv* row equal to femoral depth. Fore tibia without a *p* seta or *ad* setula. Mid femur of almost normal shape, hardly narrower than usual on apical quarter; *av* surface only with ground-setulae; *pv* surface with a row of rather uniform short setae, the longest slightly over half femoral depth, the row duplicated on third quarter. Mid tibia little narrowed on basal half; the ventral mat poorly developed and thin, the hairs semidecumbent, evenly developed along tibial length; 1 *ad* and 1 *pd* seta, both short, the *ad* sometimes vestigial. Mid metatarsus without a basal ventral crest. Hind coxa with 2 setulae on posteroapical margin. Hind femur bare ventrally except for 1 moderate and 1 strong *av* seta on apical third. Hind tibia with the submedian *d* seta absent; 1 *ad* and 1 *av* seta, at apical third, the *av* slightly basad of the *ad*.

Wings. Clear, creamy at base. Costal spine inconspicuous. Hind crossvein weakly sinuous. Squamae white, margins creamy; lower one well developed, projecting slightly beyond upper one. Knob of halteres yellow.

Abdomen. Ground colour black. Thinly dulled by dust, appearing alternately subshining or matt according to point of view, without any dusted pattern.

Genitalia. As in Figs 73-75. Cercal plate small, weakly cleft; with 2 long rod-like strongly sclerotized crossed projections at tip, that are weakly attached to cercal plate at their sub-basal inner angles. Surstyli simple, curved. Bacilliform process absent. (One dissection.)

Measurements. Length of body, 3.5 mm. Length of wing, 2.5 mm.

Female

Differs from the male as follows:

Head. Frons at middle not as broad as an eye, broadening gradually from vertex to lunula. Parafrontalia on lower third and parafacialia silvery white pruinose, upper $\frac{2}{3}$ of parafrontalia subshining black. Interfrontalia black. Parafrontalia broad, opposite lower *ors* a parafrontale equal to 4 times diameter of anterior ocellus and at this point slightly broader than interfrontalia. About 8-10 pairs of *ori*; lower *ors* usually midway between inner margin of parafrontale and eye-margin; parafrontalia with only 2-3 setulae below lower *ors*. 3rd antennal segment shorter, at most twice as long as broad. Parafacialia as in male. Proboscis shorter, mentum dusted. Palpi much more enlarged and spatulate, almost as broad as width of 3rd antennal segment.

Thorax. As in male.

Legs. Fore tibia with a short *ad* setula at apical quarter in 1 female. Mid femur normal, bare ventrally except for a setula at base. Mid tibia normal, bare ventrally. Hind femur and tibia as in male.

Wings. As in male.

Abdomen. Shorter and more pointed. Matt or subshining according to point of view, as in male.

Ovipositor. As in Figs 76-79. Very short. Sternites 6-8 not fused to the tergites, and tergites 6-8 divided dorsally. Sternite 8 consisting of 2 projecting plates, resembling egg-guides. Spiracles situated in tergite 6, at side and at ventral angle. 3 small dark brown spermathecae (Fig. 80). (One dissection.)

Measurements. Length of body, 3.0 mm. Length of wing, 2.5 mm.

Distribution and Biology

Known only from Australia (Australian Capital Territory and New South Wales). Adult habits and larvae completely unknown.

Relationships

F. capitalis belongs to the *canicularis* group of Chillcott (1961, p. 185), but its relationship to the other species is not obvious. It has some characters in common with the *pusio* subgroup, but the genitalia, and in particular the highly modified male cercal plate, are quite unlike any species in the group. The two crossed bar-like extensions are attached loosely to the cercal plate at one corner of their basal part, and are in my opinion homologous with the modifications found in other species-groups of *Fannia*, such as the *carbonaria* and *mutica* groups, and are not homologous with the bacilliform process (*processus longus*).

Fannia australis Malloch

(Figs 3, 5, 7, 81-86)

Fannia australis Malloch, 1923, p. 605; Malloch, 1925, p. 38; Tillyard and Seddon, 1933, p. 12; Fuller, 1934, p. 17; Mackerras and Fuller, 1937, pp. 262, 264; Séguy, 1937, p. 164; Seddon, 1947, pp. 12, 35; Seddon, 1951, p. 40; Lee *et al.*, 1956, p. 309; Zumpt, 1965, p. 45; Hennig, 1965, p. 18.

Types

Holotype ♂, Sydney, New South Wales, in AM [examined].

According to Lee *et al.* (1956), there are six paratypes in the United States National Museum. The location of the allotype and five remaining paratypes is not known.

Diagnosis

F. australis differs from the other Australian Fanniidae by the black halteres combined with setulae on the posteroapical margin of hind coxa, or by the presence of a second row of postocular setulae from the vertex.

F. anteroventralis is the only other Australian fanniid with black halteres, but that species has hind coxa bare on the posteroapical margin, and postocular setulae uniserial.

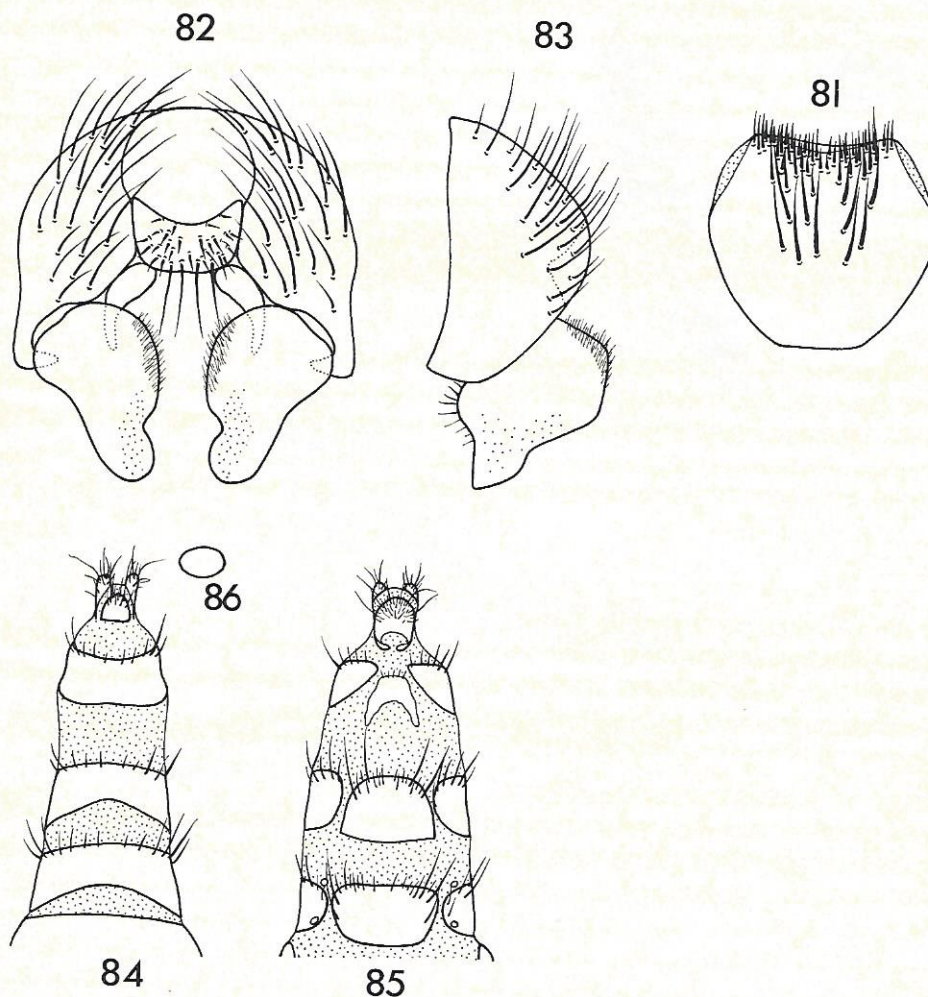
Male

Head. Frons at narrowest point about 3 times diameter of anterior ocellus. Eyes bare. Postocular setulae short except at vertex, with a 2nd row of short regular setulae beginning almost at vertex. Viewed from above, parafrontalia silvery white pruinose on lower two-thirds, matt grey on upper third; parafacialia silvery white pruinose; genae, face and occiput grey. Parafrontalia rather slender, at middle of frons a parafrontale rather narrower outside *ori* than interfrontalia, at lunula just over half width of 3rd antennal segment; interfrontalia distinct throughout. 11-12 pairs of uniform inclinate *ori*, with few interstitials, reaching almost to ocellar tubercle; 1 pair of reclinate *ors*. Antennae black, 3rd segment hardly twice as long as broad. Parafacialia narrow, at middle less than half width of 3rd antennal segment, gradually tapering below; bare. Vibrissal angle behind level of profrons, rather sharply turned up from peristoma. Posterior eye-margin almost straight in lateral view. Proboscis moderate, mentum quite slim, dusted. Palpi black, slender, as long as mentum of proboscis.

Thorax. Ground colour black. Mesonotum densely greyish dusted, whiter towards neck, often appearing almost bluish tinged, with undusted black vittae as follows: a pair of paramedian vittae between *acr* and *dc*, running from neck to *prsc acr* or even to scutellum; a pair of *prst* patches between *dc* and *ph*; and a pair of *post* vittae between *dc* and *ia* running from suture to *prsc dc*, tapering posteriorly, narrowly joined to the paramedian vittae at suture. Pleura thinly grey dusted, scutellum densely grey or brownish grey dusted on entire disc. Ground-setulae quite long, dense and erect. *Prst acr* triserial. 2, rarely 3, short stout *pra*, stronger but not longer than the adjacent ground-setulae, each about half length of 2nd *npl*. 5-8 setulae surrounding the prostigmatal seta. Disc of scutellum bare on central area, with rather numerous setulae around margins and before tip.

Legs. Black. Tarsi not modified. Fore femur with the *pv* row hardly longer than femoral depth. Fore tibia without *p* seta or *ad* setula. Mid femur only weakly emarginate in apical quarter; *av* surface with a row of short setae from base to apex, none as long as femoral depth, shorter and denser along apical third; *pv* surface with several close-set rows of setae from base almost to apex, the basal ones long and fine, becoming progressively shorter, stouter and denser towards apex. Mid tibia of normal shape, simple, with a weakly developed mat of short hairs that even in

apical half hardly equal $\frac{1}{3}$ of tibial depth; 1 *ad* and 1 *pd* seta in apical half. Mid metatarsus without a basal ventral crest. Hind coxa with 1-3 short setulae on posteroapical margin. Hind femur without *pv* setae, and without *av* setae except for 2-3 preapicals equal to femoral depth. Hind tibia with 1 *ad* at the same level as the submedian *d*, and 1 *av* at the same level or slightly apicad of it.



Figs 81-86. *Fannia australis*: 81, male fifth sternite in dorsal view; 82, male hypopygium in dorsal view; 83, male hypopygium in lateral view; 84, female ovipositor in dorsal view; 85, female ovipositor in ventral view; 86, spermatheca in lateral view. Male from Heathcote, N.S.W., 24.x.1970; female from Pittsworth, Qld, 30.x.1965.

Wings. Clear, veins brown. Costal spine inconspicuous. Hind crossvein weakly sinuous. Squamae white, margins yellowish, fringes pale; lower one very strongly developed and lobe-like, projecting far beyond upper one (Fig. 7). Knob of halteres black.

Abdomen. Ground colour black. Densely whitish grey to bluish grey dusted, with the triangular pattern almost obsolete; all tergites with a very slender undusted

median vitta, not expanded anywhere, and rather diffuse thinly dusted bands along hind margins.

Genitalia. As in Figs 81-83. Cercal plate small and reduced. Bacilliform process present.

Measurements. Length of body, 3.0-5.0 mm. Length of wing, 2.5-4.5 mm.

Female

Differs from the male as follows:

Head. Frons at middle as broad as an eye, broadening gradually from vertex to lunula. Parafrontalia wholly grey pruinose, without any shine even at vertex, merging evenly with the silvery white parafacialia. Interfrontalia black, reddish in front only in reared specimens. Parafrontalia broad, opposite lower *ors* a parafrontale equal to 3 times diameter of anterior ocellus and at this point $\frac{3}{4}$ width of interfrontalia. 5-7 pairs of *ori*; lower *ors* midway between inner margin of parafrontale and eye-margin; parafrontal setulae in 1 row below lower *ors*. Parafacialia broader than in male at lunula; the parafrontal setulae usually descending on to parafacialia as far as level of arisal insertion, but sometimes not reaching below lunula. Palpi rather more thickened.

Thorax. *Prst acr* sometimes 4-serial.

Legs. Mid femur normal in shape, with a few short ventral setae near base that merge into the ground-setulae further apicad. Mid tibia normal, bare ventrally. Hind femur with 1 or 2 *av* setae.

Abdomen. Shorter and more pointed. Dusted as in male, but tergal hind margins dusted on the disc and only the median vitta remaining undusted.

Ovipositor. As in Figs 84, 85. Tergites 6-8 consisting of single plates. Sternites 6-8 separated from the tergites, and also consisting of single plates. Sternite 8 poorly sclerotized, apparently rather variable and indefinite in extent. Spiracle 6 situated at ventral angle of tergite 6, and spiracle 7 in the intersegmental membrane. 3 spermathecae, small, dark, egg-shaped (Fig. 86).

Measurements. Length of body, 3.0-6.0 mm. Length of wing, 2.5-5.5 mm.

Distribution

Only known from Australia, where it appears widespread in southern Western Australia, southern Queensland, New South Wales, Australian Capital Territory, Victoria, South Australia and Tasmania.

Previous Records and Material Examined

Western Australia: Crawley, 6.viii.1934, 1♀, ANIC; Denmark, Mar. 1950, 1♂, ANIC; Midland, 11.x.1965, 2♂, 1♀, ANIC; 16 [miles] S. of Nannup, 12.xi.1958, 1♀, ANIC; Nedlands, light trap, 26.viii-2.ix.1960, 1♂, ANIC; Perth, 20.x.1967, 1♂, 2♀, HEP; Treen Brook, 5 miles W. of Pemberton, 17.xii.1970, 1♀, AM.

Queensland: Brisbane, no date, 1♂, SPHTM; Brisbane, bred ex poultry litter, 12.xii.1961, 1♀, BMNH; Pittsworth, 30.ix.1965, 4♀, BMNH, and 2♀, QU.

New South Wales: Back Yamma State Forest, 11.xii.1964, 1♂, 1♀, ANIC, 1♂, BMNH; 9 miles E. of Braidwood, bred from struck sheep, 2.ii.1972, 2♂, 3♀, ANIC, and 1♀, BMNH; 9 miles E. of Braidwood, blowfly trap, 22.ii.1972, 2♀, ANIC; same locality, 23.ii.1972, 3♀, ANIC, 1♀, BMNH; same locality, 28.ii.1972, 1♀, ANIC; same locality, 2.iii.1972, 1♀, ANIC; Bronte, near Sydney, 13.xi.1960, 1♀, AM; Bullawa Creek, near Narrabri, 11.xi.1964, 1♀, AM; Carrathool,

1920, 1♂, ANIC; Casula, 20.xi.1957, 1♂, BMNH; Forbes, 10.xi.1964, 1♂, ANIC; Mt Gladstone, 3500 ft, 21.ii.1969, 1♂, NMV; Goonoo State Forest, 5 miles S. of Mendooran, 3-5.x.1970, on dead kangaroo, 1♂, 1 intersex, AM, 3-5.x.1970, 1♂, AM, 1-3.v.1970, on decaying snails, 1♀, AM; Gordon, ex fly trap, 5.xi.1940, 6♀, AM, 1♀, BMNH; Harden, 15.xi.1964, 1♀, ANIC; Heathcote, near Sydney, 24.x.1970, 1♂, AM; Mt Kaputar, 5000 ft, Narrabri, 17.xii.1965, 1♀, ANIC; 55 km N. of Mildura, Silver City Highway, 27.iii.1975, 1♀, ANIC; Narrandera, 6.xi.1966, 1♂, BMNH; Newport, 12-16.xi.1972, 1♂, BMNH; Somersby Falls, W. of Gosford, 28.xii.1968, 1♂, ANIC; Sydney, 29.x.1922, K.50114 (Health Dept), holotype ♂, AM; Sydney, 30.x.1923, 1♂, SPHTM; Sydney, no date, 4♂, 1♀, SPHTM, 1♂ BMNH; Sydney, Australian Museum, Dec. 1957, 1♂, AM; Therribri, Nov. 1932, 3♂, 9♀, ANIC, 1♂, 3♀, BMNH; Wellington, 26.xi.1949, 7♂, 1♀, ANIC, 2♂, BMNH; Mt Wilson, Blue Mountains, on decaying snails, 14.iii.1970, 2♀, AM, 1♀, BMNH.

Australian Capital Territory: Black Mountain, light trap, various dates 1956-69: 3, 6, 7, 19, 20, 21, 24, 25, 31.i, 9♂, 6♀, ANIC, 1♂, 1♀, BMNH; 15, 18, 19, 26, 28.ii, 2♂, 3♀, ANIC, 1♀, BMNH; 1, 8, 21, 29.iii, 1♂, 3♀, ANIC; 7.v, 1♀, ANIC; 10.ix, 1♂, ANIC; 11, 19, 20, 23.x, 3♂, 1♀, ANIC; 5, 9, 23, 27.xi, 1♂, 4♀, ANIC, 1♀, BMNH; 3, 4, 5, 6, 14, 15, 16, 19, 21, 31.xii, 6♂, 12♀, ANIC, 1♂, 2♀, BMNH; Black Mountain, ex blowfly trap, Oct. 1956, 6♀, ANIC, 1♀, BMNH; Canberra, Fuller (1934, p. 17) and Mackerras and Fuller (1937, p. 264); Canberra, rotten cabbage, 20.iii.1930, 1♀, ANIC; same data, 31.iii.1930, 2♂, ANIC; same data, 4.iv.1930, 3♀, ANIC, 1♂, BMNH; Canberra, 27.iii.1930, 1♂, ANIC; Canberra, Sept. 1932, 5♀, ANIC; Canberra, 11.ix.1932, 1♀, ANIC; Canberra, 25.iii.1930, 1♀, ANIC; Canberra, no date, 1♀, ANIC; Canberra, 5.xii.1951, 1♀, ANIC; Canberra, ex carrion, Feb. 1951, 4♂, 2♀, ANIC, 2♂, 1♀, BMNH; Canberra, bred fowl manure, Jan. 1954, 2♂, 2♀, ANIC; Canberra, 9.x.1962, 1♀, ANIC; Canberra, trapped, 20-21.xii.1951, 1♀, ANIC; Canberra, ex liver, 24.xi.1959, 2♂, 3♀, ANIC; Hall, bred from cowdung, Dec. 1952, 2♀, ANIC; Mt Gingera, in horse dung, 23.i.1952, em 9-10.ii.1952, 1♀, ANIC; Sutton, liver trap, 12.v.1975, 1♂, ANIC; Tidbinbilla Reserve, bred from emu dung, 7.ii.1972, 2♀, ANIC, BMNH; same data, 24.ii.1972, 2♀, ANIC, 1♀, BMNH; Weetangera, from *Eutermes* mound, 8.xi.1933, 1♂, 2♀, ANIC.

Victoria: Bamawm, 12.x.1965, 2♀, ANIC.

South Australia: Adelaide, 18.xi.1886, 1♂, SAM; Sleaford Bay, Oct., Nov. 1959, 1♂, 1♀, ANIC; Old Olton Downs, Simpson Desert, 19.ix.1972, 1♂, ANIC.

Tasmania: Hellyer Gorge, 2.ii.1967, 1♀, ANIC.

No locality, bred from fungus, Feb. 1933, 3♂, 1♀, ANIC, 1♀, BMNH; from black ewe field strike, 20.iv.1932, 1♂, ANIC [both probably A.C.T.].

Biology

Adults of *australis* have been collected in light-traps and in various kinds of blowfly trap, and they have also been found at carrion (decaying kangaroo, decaying snails). They occur at up to 3500 ft. Larvae breed in all kinds of decaying plant and animal matter, and the following foods are recorded on data labels on the material I have seen: rotten cabbage, fungus, *Eutermes* mound, fowl dung, poultry litter, emu dung, horse dung, cowdung, liver, carrion and struck sheep. Fuller (1934, p. 17) included *australis* in a list of species visiting or breeding in carrion.

Examples of the undescribed puparium are in ANIC.

F. australis has a very slight importance because of its relationship to sheep strike. It was found in one case of sheep strike by Mackerras and Fuller (1937, p. 264), which formed 0.2% of blowfly incidence, and has been classified as a tertiary sheep blowfly (Tillyard and Seddon 1933, p. 12): i.e. larvae have never been found to invade the skin, but have been found in dead wool lifted from old strikes or occasionally in living but stained wool or even in accumulations of moist faeces. It thus lives as a scavenger and not as a parasite of the sheep. Seddon (1947, 1951) has mentioned *australis* in his reviews of the diseases of domestic animals, and so has Zumpt (1965) in his monograph on myiasis.

Relationships

The affinities of *F. australis* are obscure. The species seems to be closest to the *canicularis* group (Chillcott 1961, p. 186), and possesses several characters of this group, such as the simple male mid tibia, presence of *ors* in the male, reduced *pra*, etc. It differs, however, from all species of the group by having a second row of postocular setulae, beginning almost at the vertex, and by the structure of the genitalia in both sexes: the male has the cercal plate broad, surstylus without an anterior basal process, bacilliform process present, and hypandrium elongate and forwardly directed, whilst the female has three spermathecae.

Other striking characters are the single *ad* seta on hind tibia, the absence of a well developed pair of *prst acr* setulae, the black halteres, the very enlarged lower squama, and the dark undusted vittae on mesonotum.

Fannia canicularis (Linnaeus)

(Figs 8-12, 87-93)

Lesser housefly

Musca lateralis Linnaeus, 1758, p. 597. [Suppressed by I.C.Z.N. (1969).]

Musca canicularis Linnaeus, 1761, p. 454. [Unjustified replacement name for *lateralis* Linnaeus, 1758.]

Homalomyia canicularis (Linnaeus). Frauenfeld, 1867, p. 452; Schiner, 1868, p. 298; Verrall, 1879, p. 238; Grimshaw, 1901, p. 30; Hutton, 1901*b*, p. 73; Enderlein, 1903, pp. 205, 227, 250, 254; Hutton, 1904, p. 350; Enderlein, 1909, pp. 466, 491.

Anthomyia canicularis [error]. Bigot, 1885, p. 296.

Homalomyia fraxinea Hutton, 1901*a*, p. 75; Hutton, 1901*b*, p. 172; Hutton, 1904, p. 127; Lamb, 1909, p. 126; Miller, 1910, p. 234; Stein, 1919, p. 135. Synonymy by Malloch (1930, p. 305).

Fannia canicularis (Linnaeus). Stein, 1910, p. 556; Miller, 1910, p. 233; Cleland, 1912, p. 149; Cleland, 1913, p. 566; Cleland, 1914, p. 155; Cleland *et al.*, 1919, p. 173; Johnston and Bancroft, 1920*a*, p. 182; Miller, 1921, p. 321; Miller, 1922, p. 335; Malloch, 1923, p. 605; Malloch, 1925, p. 38; Tillyard, 1926, p. 374; Bryan *et al.*, 1926, p. 69; Ferguson, 1927, p. xxiv; Malloch, 1929, pp. 152, 156; Mackerras, 1929, p. 206; Malloch, 1930, p. 305; Bryan, 1934, pp. 426, 453; Fuller, 1934, p. 17; Karl, 1935, p. 40; Séguy, 1937, p. 165; Miller, 1939, pp. 21, 24, pl. 1 fig. 8; McKeown, 1944, p. 233; James, 1947, pp. 8, 129, figs 71, 72; Evans, 1948, pp. 160, 163; Miller, 1950, pp. 119, 144-6, 151; Harrison, 1953*b*, p. 270; Harrison, 1954, pp. 78, 79; Harrison, 1955, p. 209; Hennig, 1955, p. 32, figs 3, 4, 8, 15, pl. 1 fig. 7, pl. 4 fig. 66; Lee *et al.*, 1956, p. 31; Séguy, 1960, p. 150; Chillcott, 1961, p. 188, figs 129, 129*A-D*, 203, 261, 271, 272, 283, map 44; Butler and Usinger, 1963, p. 243; Zumpt, 1965, p. 43, figs 47, 48, 50*a*; Gay, 1966, pp. 13, 37, 39; Lee, 1968, p. 23; Colless and McAlpine, 1970, p. 733; Greenberg, 1971, pp. 63, 245; Chadwick and Nikitin, 1971, p. 47; Dreux, 1971, p. 340; Séguy, 1971, p. 348; Martyn *et al.*, 1972, p. 14.

Limnophora fraxinea (Hutton). Séguy, 1937, p. 263. [Also listed by Séguy (1937, pp. 165, 460) as a synonym of *canicularis*.]

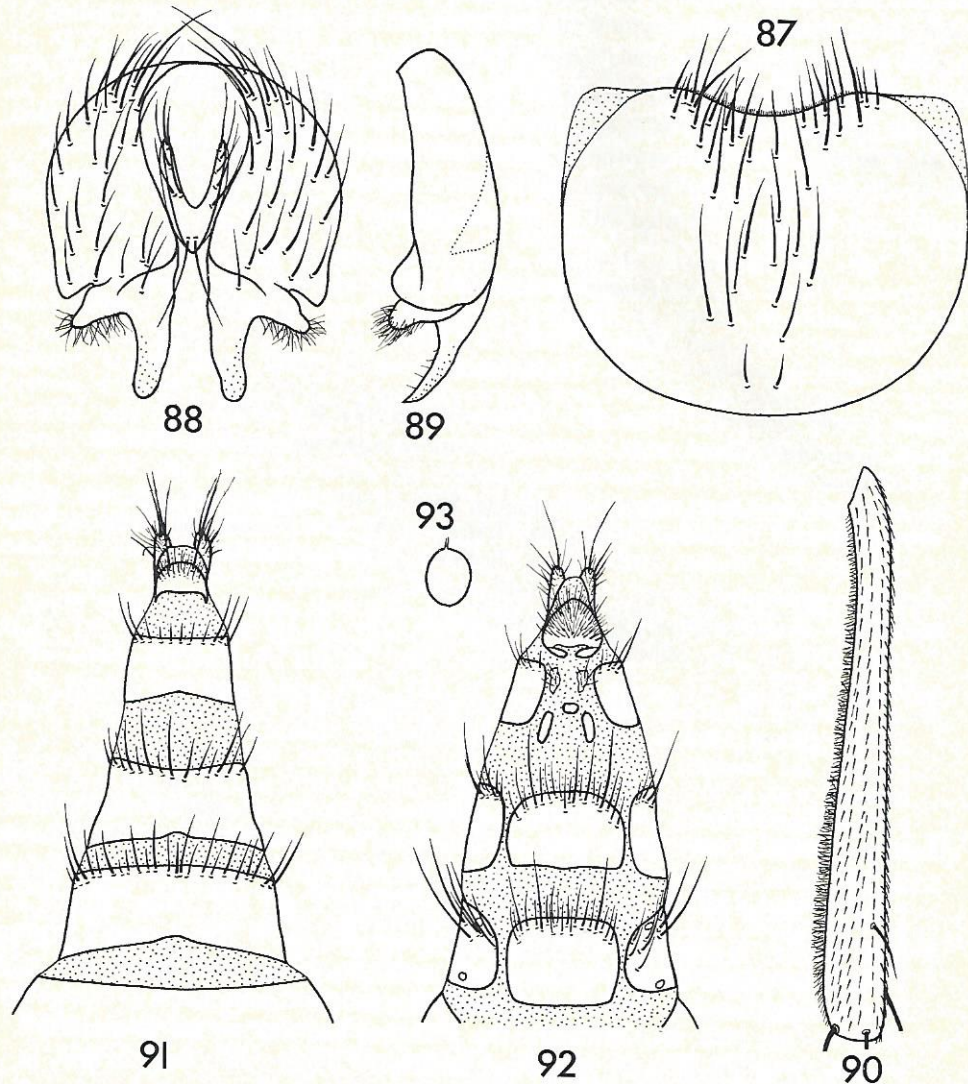
Fannia sp.; Cleland, 1921, p. 264; Taylor, 1938, p. 3.

Types

Syntypes 2♂, of *Musca lateralis* Linnaeus (and of *Musca canicularis* Linnaeus), Europe, in LSL [examined]. Lectotype ♀ of *Homalomyia fraxinea* Hutton, Christchurch, New Zealand, in CMC [see designation below].

Note on the Nomenclature of canicularis Linnaeus

This species was originally described as *lateralis* Linnaeus (1758, p. 597), and the name *canicularis* was subsequently published as an arbitrary and unjustified replacement name (Linnaeus 1761, p. 454). This was pointed out, apparently for the first



Figs 87-93. *Fannia canicularis*: 87, male fifth sternite in dorsal view; 88, male hypopygium in dorsal view; 89, male hypopygium in lateral view, setae omitted from hypandrium and cercal plate; 90, male mid tibia in anterior view; 91, female ovipositor in dorsal view; 92, female ovipositor in ventral view; 93, spermatheca in lateral view. Male and female from Nowra, N.S.W., 4.viii.1924.

time, by Hockett (1965, p. 894) and an application was subsequently made to the International Commission on Zoological Nomenclature that the name *lateralis* should be suppressed for the purposes of the Laws of Homonymy and Synonymy, in order to preserve *canicularis* as the name of the lesser housefly. This name was extremely

well known, and had been widely and consistently used for over 200 years. The name *lateralis* was duly suppressed (ICZN 1969).

Lectotype Designation for fraxinea Hutton

Hutton based his species on a series of both sexes from Christchurch, without specifying a holotype. Through the kindness of Dr R. A. Harrison and Miss F. Tunnicliffe, I have examined this type-series, which is in the Canterbury Museum, Christchurch, and have found that there are two male and six female syntypes.

Only the females belong to the genus *Fannia*, and one of these is already labelled as type. I have labelled this female, and designate it herewith, as lectotype of *fraxinea*. It lacks the right mid leg and some tarsal segments from left fore and hind legs, but is otherwise in excellent condition. It is conspecific with *canicularis*, and the synonymy given by Malloch (1930) can be confirmed.

The remaining two male and five female syntypes have been labelled as paralectotypes. The males belong to the genus *Spilogona* Schnabl, whilst the females are *canicularis*.

I have also studied some of Hutton's later material of *fraxinea*. Three specimens from the Antipodes Is consist of two males and one female of a species of *Limnohelina* Malloch; and two examples from Auckland Is consist of one male of a *Limnohelina* and one female of *canicularis*.

Diagnosis

F. canicularis can usually be recognized by the yellow base to the abdomen, but some specimens, particularly females, have the abdomen entirely dark. They may be distinguished from other Australian Fanniidae with setulae on the posteroapical margin of hind coxa by the uniform dense mat of hairs on mid tibia in the male (Fig. 90), and by the entirely grey dusted abdomen, lacking any pattern or markings, in the female.

Male

Head. Frons at narrowest point 2-3 times diameter of anterior ocellus, at most equal to width of 3rd antennal segment. Eyes bare. Postocular setulae short, except at vertex, in a single row throughout. Viewed from above, parafrontalia and parafacialia silvery white pruinose throughout; genae, face and occiput grey. Parafrontalia rather slender, at middle of frons a parafrontale narrower outside *ori* than interfrontalia, at lunula a little over half width of 3rd antennal segment; interfrontalia conspicuous throughout. 10-13 pairs of inclinate *ori*, with few interstitials, reaching almost to ocellar tubercle and culminating in a pair of strong reclinate *ors*. Antennae black, 3rd segment twice as long as broad. Parafacialia moderate, at middle half width of 3rd antennal segment, narrowing a little below; bare. Vibrissal angle behind level of profrons. Posterior eye-margin almost straight in lateral view. Proboscis moderate, mentum quite thin, dusted. Palpi black, a little dilated in apical half, as long as mentum of proboscis.

Thorax. Ground colour black, wholly grey or brownish grey dusted. Mesonotum mainly brownish grey dusted, usually with at least traces of 3 moderate darker brown dusted vittae running through the *dc* and *acr* rows, but these often diffuse or indistinct, or sometimes very distinct and well marked. Scutellum usually with an indistinct darker brown dusted median vitta. Ground-setulae sparse but quite erect and

long. *Prst acr* 3-serial, several of the outer setulae quite long. 1-2(-3) short strong *pra*, $\frac{1}{4}$ length of 2nd *npl*. 1 setula adjacent to the prostigmatal seta. Disc of scutellum bare on a central area, with numerous setulae placed around margin and before tip.

Legs. Black, knees and basal $\frac{1}{6}$ - $\frac{1}{7}$ of tibiae, or even $\frac{1}{4}$ of fore tibia, conspicuously yellow. Fore tibia without *p* seta, with a stronger *ad* setula at apical quarter. Mid femur of almost normal shape, only slightly narrower than usual on apical third; *av* surface with a few short setae on basal half, not as long as femoral depth, merging into a rather comb-like row of ground-setulae on apical half; *pv* surface with a row of strong setae, as long as femoral depth on basal half but becoming shorter and more close-set on apical half. Mid tibia of normal shape, along entire ventral surface with a mat of short soft uniform pubescence that equals $\frac{1}{4}$ or at most $\frac{1}{3}$ tibial depth (Fig. 90); 1 *ad* and 1 *pd* seta. Mid metatarsus without a basal ventral crest. Hind coxa with 2 setulae on posteroapical margin. Hind femur with 2-3 strong *av* setae on apical third, which slightly exceed femoral depth and sometimes with some longer setulae on basal half of this surface; *pv* surface with some longer ground-setulae on basal half, about half femoral depth. Hind tibia with 1 strong *ad* at about the same level as the submedian *d*, which forms part of a row of short *ad* setae, and 1-2 *av* setae.

Wings. Clear. Costal spine inconspicuous. Hind crossvein weakly sinuous. Squamae yellowish white or white, the margins more yellow; lower one well developed, projecting slightly beyond the upper one. Halteres yellow.

Abdomen. Ground colour mainly black; tergites 1+2 and 3, and sometimes also tergite 4, usually extensively pale at sides, but this pale colour sometimes reduced or even entirely absent. Densely pale grey to yellowish grey dusted, with an undusted or weakly dusted parallel-sided median vitta on tergites 1+2 to 5, and thinly dusted hind margins on tergites 4 and 5; the vitta only occasionally appearing partially triangulated.

Genitalia. As in Figs 87-89. Cercal plate small, deeply cleft. Surstyli with a small projection at upper anterior corner. Bacilliform process absent.

Measurements. Length of body, 5.5-6.5 mm. Length of wing, 4.5-5.5 mm.

Female

Differs from the male as follows:

Head. Frons at middle as broad as an eye, broadening gradually from vertex to lunula. Parafrontalia and parafacialia entirely and densely grey pruinose, the parafrontalia sometimes tinged with yellow. Interfrontalia black; the dusted frontal triangle confined to the area of the ocellar triangle. Parafrontalia broad, opposite lower *ors* a parafrontale equal to 3-4 times diameter of anterior ocellus and at this point $\frac{2}{3}$ - $\frac{3}{4}$ width of interfrontalia. 6-7 pairs of *ori*; lower *ors* slightly closer to inner margin of parafrontale than to eye-margin or midway between the two; parafrontal setulae in 1-2 rows below lower *ors*. 3rd antennal segment a little shorter, $1\frac{1}{2}$ times as long as broad. Parafacialia as in male, though broader at lunula; the parafrontal setulae descending on to the parafacialia as far as level of arisal insertion. Palpi a little more thickened.

Thorax. Mesonotum often less extensively brown dusted, and scutellum also greyer.

Legs. Mid femur normal, bare ventrally except for an erect setula at base and sometimes a short *av* just beyond it. Mid tibia normal, bare ventrally. Hind femur with only ground-setulae on the ventral surfaces except for 2-3 *av* on apical third.

Wings. More yellowish towards base.

Abdomen. Shorter and more pointed. Ground colour dark, with the yellow colour much less evident and usually limited to tergite 1+2; sometimes entirely dark. Thinly grey dusted, often partially tinged with yellow or brown, without any markings or pattern.

Ovipositor. As in Figs 91, 92. Sternites not fused to tergites, the tergites consisting of single plates. Sternite 8 divided into a number of small plates. Spiracles situated at the lower angle of tergite 6. 2 spermathecae (Fig. 93); small, round, dark brown.

Measurements. Length of body, 4.5-5.0 mm. Length of wing, 4.0-5.5 mm.

Distribution

F. canicularis occurs commonly throughout temperate areas of the world, but is more sporadic or totally absent from truly tropical areas. It is easily spread by commerce, and the early travellers found it on their ships: for example, Frauenfeld, the zoologist on the 'Novara', found it on board in the Indian Ocean between St Paul's Island and Ceylon (1867, p. 452). More recently it has been intercepted in New Zealand on an aircraft from Australia (Laird 1951) and in Australia from Holland and the U.S.A. (Chadwick and Nikitin 1971). It has been trapped on a Pacific Ocean weather ship located to the south-east of Japan (Asahina and Turuoka 1970).

In the Oriental region it is known only from India, Ceylon, Nicobar Is and China (Pont 1977). From the Pacific region it is recorded only from New Guinea (Karl 1935), Hawaii (e.g. Grimshaw 1901; Bryan 1934) and Ocean I. (Bryan *et al.* 1926; Butler and Usinger 1963) in addition to Australia and New Zealand, and is apparently absent from other Pacific islands (e.g. Malloch 1929).

It is recorded from the subantarctic islands of Marion (Dreux 1971; Séguy 1971), Kerguelen (Verrall 1879; Enderlein 1903, 1909), St Paul (Schiner 1868) and New Amsterdam (Enderlein 1903, 1909; Séguy 1960).

In Australia it is most common in the temperate southern areas (Western Australia, Queensland, New South Wales, Australian Capital Territory, Victoria, South Australia and Tasmania).

Previous Records and Material Examined

'Australia': Bigot 1885; Cleland 1913; Cleland *et al.* 1919; Tillyard 1926; McKeown 1944.
Western Australia: James 1947; Albany, 30.viii.1970, 2♂, ANIC; Albany, public urinal, 31.viii.1970, 6♂, 2♀, ANIC, 2♂, BMNH; Eucla, on window, 3.ix.1970, 2♀, ANIC, BMNH; Jerramungup, 111 miles NE. of Albany, in car, 31.viii.1970, 1♀, ANIC; Nedlands, fly trap, 17.vi.1959, 1♂, ANIC; Nedlands, fly trap, 30.vi.1959, 1♀, ANIC; Nedlands, 26.iii.1941, 1♂, ANIC.
Queensland: Brisbane (Johnston and Bancroft 1920a); Brisbane, no date, 4♂, 1♀, SPHTM, 1♂, BMNH; Brisbane, in house, no date, 1♀, SPHTM; Brisbane, in house, Dec. 1925, 1♂, 1♀, SPHTM; Brisbane, in house, Sept. 1929, 1♂, SPHTM; Dalby, ex white French millet, Dec. 1969, 1♂, 1♀, QD; Yeppoon, 30.xi.1965, 1♂, NMV.
New South Wales: Cleland 1912, 1921; intercepted from Holland and U.S.A. (Chadwick and Nikitin 1971); Milson I., Lower Hawkesbury River (Cleland 1914); Sydney (Stein 1910; Malloch 1923; Mackerras 1929; Lee 1968); Argalong, Buccleugh, no date, 1♀, USNM; Broad-

water, Oct. 1927, 2♀, ANIC; Bronte, near Sydney, 8.xi.1955, 1♀, AM; same locality, 18.xi.1960, 1♀, AM; same locality, 13.xi.1960, 7♂, AM, 1♂, BMNH; Cabramatta, 5.i.1964, 5♀, BMNH, 5.ii.1964, 8♀, BMNH, 14.xii.1965, 1♂, BMNH, 5.x.1965, 1♂, BMNH, 12.xi.1965, 1♀, BMNH, 6.x.1965, 1♀, BMNH; Concord West, 24.ix.1950, 1♂, ANIC; Cremorne, Sydney, 4.ix.1960, 1♀, ANIC; East Gordon, 6.viii.1956, 1♂, 1♀, AM; Ermington, 12.xi.1958, 1♂, AM; Gordon, fly trap, 5.xi.1940, 1♀, AM; Gosford, 11.iii.1967, 1♀, BMNH; Homebush, 13.i.1931, 1♀, USNM; Jervis Bay, xi and xii.1924, 2♀, BMNH; Killara, on fermenting *Pittosporum* sap, 18.vi.1945, 1♀, BMNH; Merimbula, 4.ix.1956, 1♂, 1♀, ANIC; Narrabeen, 24.viii.1958, 6♂, 5♀, ANIC, 1♂, 1♀, BMNH; Newport, 2-6.xi.1972, 1♂, BMNH; North Bondi, 7.ix.1962, 1♀, AM; same locality, 9.xii.1962, 1♀, AM; same locality, 20.viii.1962, 1♀, AM; Nowra, 4.viii.1924, 3♂, 4♀, Oct. 1924, 1♀, Nov. 1924, 1♂, 1♀, Dec. 1924, 2♂, 1924, 2♂, 1931, 1♂, all BMNH; Sydney, dead in lamp housing, 17.iii.1960, 1♀, SAM; Sydney University, W/A trapping, 21-24.x.1963, 1♀, SPHTM; Sydney, bred larvae, Dec. 1934, 1♀, ANIC; Sydney, Dec. 1909, 1♀, BMNH; Sydney, Wills Tobacco Factory, 16.iii.1944, 1♂, AM; Tent Hill, in closet, 14.xii.1910, 1♀, BMNH.

Australian Capital Territory: Canberra (Fuller 1934); Ainslie, fowl manure, 3.xi.1950, 4♂, 4♀, ANIC, 1♂, 1♀, BMNH; Black Mountain, ex blowfly trap, Oct. 1956, 10♀, ANIC, 2♀, BMNH; Black Mountain, bred from soil at laboratory, 11.iv.1934, 1♀, ANIC; Black Mountain, light trap, various dates 1954-65: 12, 15.i, 2♂, ANIC; 8.ii, 1♂, ANIC; 10-15.iii, 1♀, ANIC; 19.iv, 1♀, ANIC; 10.ix, 3♀, ANIC; 30.x, 1♂, ANIC; 25, 27.xi, 2♂, ANIC, BMNH; 14, 17, 27.xii, 2♂, 1♀, ANIC; Canberra, 27.ix.1950, 1♂, 13.ix.1971, 1♀, 22.iii.1954, 1♀, 7.x.1970, 1♀, 19.viii.1958, 1♂, all ANIC; Canberra, reared fowl manure, em 13.xi.1950, 1♀, ANIC; Canberra, from soil coll. 23.ii.1966, em 16.iii.1966, 4♂, 3♀, ANIC, 1♂, 1♀, BMNH; Canberra, 18.ii.1965, 3♂, ANIC, 1♂, BMNH; Canberra, on bovine dung, 12.x.1970, 1♀, ANIC; Canberra, 25.viii.1958, 3♀, ANIC, 1♀, BMNH.

Victoria: no data, 1♂, BMNH; Cheltenham, 11.i.1973, 1♂, BMNH; Cheltenham, 20-26.i.1973, 8♂, 4♀, BMNH; Melbourne, 7, 8.x.1913, 1♂, 2♀, NMV; Melbourne, no date, 1♂, SAM; Lower Tarwin, no date, 1♂, NMV; Seaford, 2.xii.1964, 1♀, ANIC.

South Australia: no data, 1♂, SAM; Adelaide, no date, 1♂, 1♀, SAM, 10.x.1909, 1♀, SAM, 21.ii.1953, 1♀, CAS; Gilberton, 8.i.1948, 1♂, SAM; Kangaroo I., Rocky River, 22.v.1965, 2♂, ANIC; 'Kurlge', Blackwood, 850 ft, 23.viii.1960, 1♂, SAM; same locality, light trap, 46°, 29.viii.1960, 1♂, SAM; same locality, MVL, 61°, 3.xi.1957, 1♀, SAM; Naracoorte, bat cave, guano, 6-8.x.1956, 3♀, SAM; Oakland Park, Adelaide, 21.xii.1966, 1♂, ANIC; Port Augusta, public urinal, 6.ix.1970, 6♂, ANIC, 1♂, BMNH; Port Pirie, animal cage, 6.ix.1970, 5♂, 3♀, ANIC, 2♂, 1♀, BMNH; Purnong, 29.xii.1911, 1♀, NMV; Rose Park, 8.ix.1963, 1♂; Sleaford Bay, 4.xii.1958, 1♂, 1-2.i.1959, 1♂, 20-23.vii.1959, 1♀, Jan. 1960, 1♀, all ANIC; same locality, Nov. 1959, 1♂, 3♀, ANIC, 1♀, BMNH.

Tasmania: Evans 1948; Martyn *et al.* 1972; Campbell Town, 16.i.1948, 1♂, ANIC; Hobart, no date, 1♂, SAM; Mangalore, 1908, 1♂, BMNH.

New Zealand: Hutton 1901a; Miller 1910, 1921, 1922, 1939, 1950; Malloch 1923, 1930; Tillyard 1926; on aircraft from Australia (Laird 1951); no data, 1♂, 2♀, BMNH [named by Hutton as *fraxinea*]; no locality, 1909, 1♂, 1♀, BMNH; Auckland, Titirangi, Dec. 1964, 2♂, 1♀, BMNH; Christchurch, no date, ♀ lectotype and 5♀ paralectotypes of *fraxinea*, CMC; Otago, no date, 1♂, BMNH.

Antipodes Islands: Hutton 1901b and Lamb 1909 (as *fraxinea* [misidentification]); Miller 1950; Harrison 1953b, 1954.

Auckland Islands: Hutton 1901b (as *fraxinea*); Lamb 1909 (as *fraxinea*); Miller 1950; Harrison 1954, 1955.

Variation

There exists in Australia a dark form of this species, in which the abdomen is entirely black in ground colour in both sexes,* the mesonotum is darker in general appearance because the dust is more uniformly brownish and the vittae much darker

* One male was dissected, and when placed in potassium hydroxide the abdomen produced an immediate dark precipitate and eventually assumed the colour that is usual in males of this species, i.e. with pale basal tergites. Some examples of this 'dark form' are obviously specimens that have fed on a dark substance such as dung.

brown, the female parafrontalia usually have some brownish dust, and the tibiae are more narrowly reddish at base, especially the fore tibia. In all other respects, however, this form is identical with typical *canicularis* and it seems most probable that this is a dark outdoor but rare form such as occurs in Europe (e.g. Fonseca 1968, p. 68). The male genitalia of the two forms have been compared, and are identical.

This dark form undoubtedly belongs to *canicularis*, and is not the same as the Oriental *indica* Chillcott or *prisca* Stein, both of which differ from *canicularis* by, amongst other characters, the presence of several setulae around the prostigmatal seta.

Biology

This is a common indoor species in the more temperate areas of Australia, and because of its habits it has been suspected of having some medical significance for man; females visit foodstuffs, and also carrion and decaying vegetable matter for the purpose of oviposition, but their precise hygienic and epidemiological importance is still uncertain (Greenberg 1971, p. 63). It is also very common around poultry houses, and outbreaks of vast *canicularis* infestations are almost always in the vicinity of poultry farms.

In Australia, Cleland (1912, p. 149; 1914, esp. p. 160) has studied the seasonal occurrence of *canicularis* and its habits. He found it to be most abundant in spring and early summer. Mackerras (1929) found that around Sydney there was a definite rise in populations in autumn and a greater rise in spring; for the rest of the year the species was always present though distinctly scanty.

Its relationship to disease in Australia was discussed by Cleland (1913) and its negative role in the spread of poliomyelitis by Cleland *et al.* (1919). Fuller (1934) included *canicularis* in a list of species breeding in or associated with carrion. More recently Lee (1968) has discussed its role in public health, and from the figures given for the Sydney fly survey it is clear that *canicularis*, at 0.41% of the total catch, plays a comparatively minor role in the filth-fly problem.

The larvae have been recorded from an enormous variety of habitats and appear to be able to breed in all the habitats recorded for the family. Chillcott (1961, p. 191) has listed these records, which range over decaying vegetables and fruit, manure, decaying animal matter, carrion, bird and insect nests, and excrements ranging from those of man to mouse. The larvae have also been recorded rarely in cases of aural and traumatic myiasis, and more frequently in cases of urinogenital and intestinal myiasis. According to Zumpt (1965, p. 44) the larvae cause a true myiasis in the urinogenital tract, whereas reported cases of rectal myiasis are usually a pseudo-myiasis where larvae have been ingested with food. No cases of human myiasis in Australia caused by *Fannia* were recorded by Taylor (1938).

In New Zealand, *canicularis* is recorded as a secondary sheep blowfly (Miller 1922, 1939), living in soiled wool of infested sheep together with larvae of *Calliphora stygia* (Fabricius) and *Calliphoroides antennatis* (Hutton). However, it is not known to be associated with sheep in Australia.

The larva has been described and illustrated by Lyneborg (1970).

Relationships

F. canicularis belongs to the group and subgroup of this name (Chillcott 1961, p. 185). The subgroup is well represented in the Holarctic and Neotropical regions, and also includes the Oriental *prisca* Stein and *indica* Chillcott.

Fannia leucosticta (Meigen)

(Figs 94-98)

Anthomyia leucosticta Meigen, 1838, p. 328.*Fannia leucosticta* (Meigen). Séguy, 1937, p. 170; Emden, 1948, p. 168; Hennig, 1955, p. 57, pl. 3 fig. 47, pl. 4 fig. 69; Chillcott, 1961, p. 218, figs 148, 148a, 211, map 56; Snyder, 1965, p. 274; Lyneborg, 1970, p. 18, fig. 10; Greenberg, 1971, p. 64.

Type

Holotype ♂, Aachen, Germany [presumed, not stated], in MNHNP [examined].

Note on the Holotype

Meigen described this species from an unspecified number of males, without stating the locality. The material in his own collection, now in MNHNP, consists of a single male, which was seen by Stein (1900, p. 154) and has been sent to me for study through the kindness of Dr L. Matile. There is no material in the collection of Meigen's friend and correspondent von Winthem, now in NHMV, according to Dr R. Lichtenberg (letter of 14 April 1976). I have accordingly labelled the Paris male as holotype.

The holotype is in excellent condition. It is labelled by Meigen 'leucosticta ♂' followed by two almost illegible lines that appear to read 'Anthomyia 7. Band'. It agrees with *leucosticta* as it has always been understood (e.g. by Hennig 1955).

Diagnosis

F. leucosticta can be distinguished from all other Australian *Fannia* except for *pusio* (Wiedemann) by the narrow and almost linear parafacialia and genae. Males of the two species are also characterized by the trimaculated dark pattern on the intermediate abdominal tergites, and females by the long frontal triangle that reaches to the level of lower *ors*.

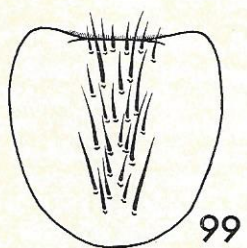
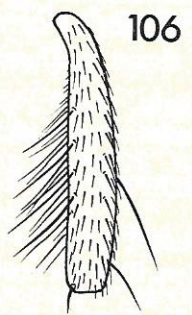
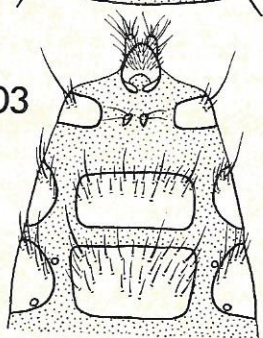
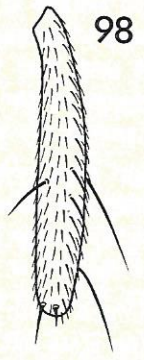
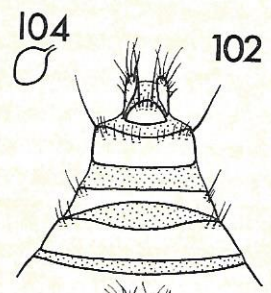
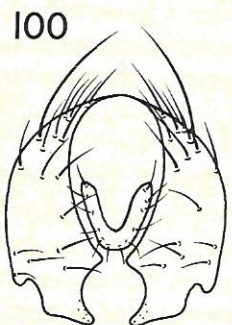
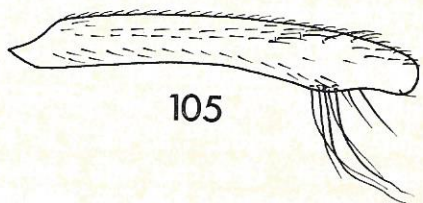
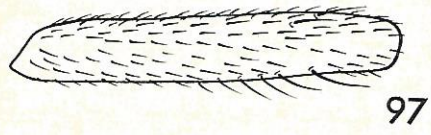
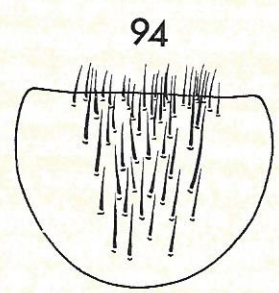
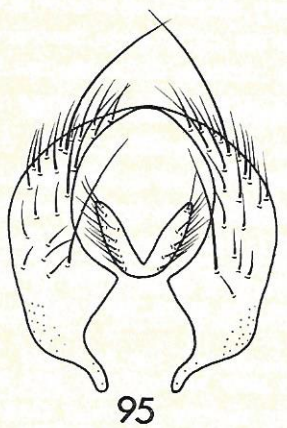
F. leucosticta differs from *pusio* by the characters given in the key, of which the most obvious are the simple hind femoral and tibial bristling of the male (Figs 97, 98) and the trimaculated pattern on the abdomen of the female.

Male

Head. Frons at narrowest point about twice diameter of anterior ocellus, half width of 3rd antennal segment. Eyes bare. Postocular setulae short, even at vertex, in a single row throughout. Viewed from above, parafrontalia and parafacialia silvery white pruinose throughout; genae and face grey, occiput mainly brown. Parafrontalia slender, at middle of frons a parafrontale outside *ori* a little broader than interfrontalia, at lunula only half width of 3rd antennal segment; interfrontalia distinct throughout but linear. 9-11 pairs of inclinate *ori*, with few interstitials, reaching almost to ocellar tubercle; *ors* absent. Antennae black, 3rd segment $1\frac{1}{2}$ -2 times as

Figs 94-98. *Fannia leucosticta*: 94, male fifth sternite in dorsal view; 95, male hypopygium in dorsal view; 96, male surstylus in lateral view; 97, male hind femur in anterior view; 98, male hind tibia in anterior view. Male from Baltimore, U.S.A.

Figs 99-106. *Fannia pusio*: 99, male fifth sternite in dorsal view; 100, male hypopygium in dorsal view; 101, male surstylus in lateral view; 102, female ovipositor in dorsal view; 103, female ovipositor in ventral view; 104, spermatheca in lateral view; 105, male hind femur in anterior view; 106, male hind tibia in anterior view. Male from Honolulu, Hawaii; female from Florida, U.S.A.



long as broad. Parafacialia very narrow, at middle as broad as diameter of anterior ocellus and linear below this point; with fine proclinate setulae on upper half. Vibrissal angle well behind level of profrons. Genae strikingly narrow. Posterior eye-margin almost straight in lateral view. Proboscis short, mentum only thinly dusted. Palpi black, little swollen in apical part, slightly longer than mentum of proboscis.

Thorax. Ground colour black. Mesonotum appearing matt and without dusted pattern: some grey dust present on humeri, notopleura and at sides along suture, and in posterior view with some brown dust in front of scutellum that extends a short distance forwards along *dc* and *acr* lines. Scutellum brown dusted on disc, pleura thinly grey dusted. Ground-setulae sparse. *Prst acr* 2-serial in front, becoming 3-serial behind. (1-)2-3 short *pra*, the longest $\frac{1}{3}$ length of 2nd *npl*. 1 setula adjacent to the prostigmatal seta. Disc of scutellum mainly bare apart from the setae, with only about 3 setulae in basal lateral corner.

Legs. Black, knees and base of fore tibia yellow. Fore tibia without a *p* seta or a stronger *ad* setula. Mid femur of almost normal shape, only slightly narrower than usual on apical quarter; *av* surface with a row of short setae on basal half, not equal to femoral depth, replaced in apical half by a comb-like row of stout setulae; *pv* surface with some slightly longer setae on basal half, and on apical half with a double row of rather dense setulae. Mid tibia narrowed on basal third; the ventral mat rather poorly developed and thin, the hairs semi-decumbent, evenly developed along entire tibial length; 1 *ad* and 1 *pd* seta, both short. Mid metatarsus without a basal ventral crest. Hind coxa with a setula on posteroapical margin. Hind femur (Fig. 97) on *av* surface with 3 setae on apical half, equal to femoral depth, and with 2-3 series of strong setulae in basal half; *pv* surface with several series of stronger setulae on basal half, some more *p* than *pv*, culminating on 3rd quarter in a loose cluster of about 4 setae that are as long as femoral depth; the *av* and *pv* setae and setulae more elongated and more numerous in the Solomon Is males. Hind tibia (Fig. 98) with a partial row of short *ad* setae, and 1 *av* seta.

Wings. Weakly smoky, more conspicuously so near base. Costal spine absent. Hind crossvein rather sinuous. Squamae smoky brown, the lower one darker than upper one; lower one darker than upper one; lower one well developed, projecting beyond upper one. Halteres deep to dull yellow.

Abdomen. Ground colour black. In posterior view densely grey dusted with the following areas left undusted matt black: tergite 1+2 except on hind margin; 3 large subquadrate spots on tergites 3 and 4, the median one not reaching to hind margin and the lateral ones well separated from both fore and hind margins, all 3 usually almost confluent on tergite 3; a small fore marginal spot on tergite 5.

Genitalia. As in Figs 94-96. Cercal plate small, deeply cleft. Surstyli short, upper anterior edge slightly produced. Bacilliform process absent.

Measurements. Length of body, 4.0 mm. Length of wing, 3.0 mm.

Female

Differs from the male as follows:

Head. Frons at middle rather narrower than an eye, broadening a little from vertex to lunula. Parafrontalia and parafacialia entirely and densely grey pruinose, sometimes a little tinged with yellow. Interfrontalia black; the dusted frontal

triangle extending to the level of lower *ors*. Parafrontalia broad, opposite lower *ors* a parafrontale equal to 3 times diameter of anterior ocellus and at this point half width of interfrontalia. About 6 pairs of *ori*; lower *ors* rather closer to eye-margin than to inner margin of parafrontale; parafrontal setulae in 1-2 irregular rows below lower *ors*. 3rd antennal segment a little shorter and stouter. Parafacialia linear as in male, though broader at lunula; the fine proclinate setulae present.

Thorax. Mesonotum, with scutellum and pleura, wholly dull grey dusted; mesonotum with 3 narrow brown dusted vittae running along *dc* and *acr* rows, from mid-*prst* area almost to scutellum. *Pra* setulae a little longer.

Legs. Knees only inconspicuously pale. Mid femur normal, bare ventrally except for an erect setula at base and a short *av* just beyond it. Mid tibia normal, bare ventrally. Hind femur bare ventrally except for 2 *av* before apex.

Wings. Clear, yellowish towards base. Squamae whitish, with creamy margins. Halteres yellow.

Abdomen. Shorter and more pointed. Densely grey dusted; some of the bristle-dots rather large; with dark brown to black markings as follows: a pair of lateral spots on tergite 1+2 or whole tergite mainly darkened; tergite 3 with a pair of large lateral spots and a small partial median vitta, these sometimes almost wholly fused together; tergite 4 with a pair of smaller lateral spots and a broad partial median vitta; tergite 5 with a narrow partial median vitta and usually with a pair of small dark spots.

Ovipositor. Identical with that of *pusio*, as in Figs 102-103. 2 round dark spermathecae, as in *pusio* (Fig. 104).

Measurements. Length of body, 4.0 mm. Length of wing, 3.5 mm.

Distribution

F. leucosticta is widely distributed through the warmer parts of the Old World, and also occurs in North America (Chillcott 1961, p. 219, map 56). It is widespread through the southern Palaearctic region (Hennig 1955, p. 58) and the Ethiopian region including the Malagasy subregion (Pont, in press). In the Oriental region (Pont 1977) it is known from China (Fan 1965, p. 59), Formosa (Stein 1915, p. 28, 1918, p. 154; Hennig 1941, p. 203), Java (Stein 1909, p. 243, 1920, p. 53) and Sumatra (Stein 1920, p. 72).

From the Australasian region it is known only from the Solomon Is (Emden 1948, p. 168) and Palau in the Caroline Is (Snyder 1965, p. 272). It is recorded for the first time from Papua and Australia in this paper.

Material Examined

Queensland: Brisbane, bred from poultry droppings, 12.xii.1961, P. Ranby, 1♀, BMNH; Cardwell, 8.xii.1962, K. R. Norris, 2♀, ANIC; Eidsvold, 1924, Bancroft, 1♂, SPHTM; Malanda, 8.iv.1944, K. R. Norris, 1♂, ANIC; Meteor Downs near Springsure, near Trap T51, 20.xi.1930, I. M. Mackerras, 1♀, ANIC.

Papua New Guinea: North District, The Mangalase, SSW. of Popondetta, 2500-3000 ft, Aug. 1964, R. Pullen, 1♀, ANIC.

Solomon Islands: Tulagi, 21.vi.1934, R. A. Lever, 1♂, BMNH; same locality, 7.viii.1934, 1♂, BMNH; same locality, 19.x.1934, 1♀, BMNH.

Variation

The ovipositor in all specimens that I have dissected is identical with that of *F. pusio* and does not show the differences that are apparent from Chillcott's (1961) figs 209 and 211. Tergites 6 and 7 have the hind margins flat, and not slightly bowed as in Chillcott's fig. 211, and spiracle 7 is situated in the intersegmental membrane and not in tergite 6. There are two round dark spermathecae, as in *pusio*.

My dissections, in the BMNH, are of females from Turkey, Ceylon and the U.S.A.

Biology

Adults are frequently attracted to carrion, and in other regions turn up regularly in blowfly and other fly traps.

Like other species of the genus, *leucosticta* breeds in various kinds of decaying animal matter, ranging from birds nests, dead insects, and dung of various kinds. In Australia it has been reared from poultry droppings.

The larva has been described by Lyneborg (1970).

Relationships

F. leucosticta, together with *pusio*, belongs to the *pusio* subgroup of the *cunicularis* group (Chillcott 1961), a subgroup that also includes three Nearctic and a large number of Neotropical species.

Fannia pusio (Wiedemann)

(Figs 99-106)

Anthomyia pusio Wiedemann, 1830, p. 437.

Fannia pusio (Wiedemann). Stein, 1919, p. 132; Buxton and Hopkins, 1927, p. 60; Malloch, 1929, p. 156; Bryan, 1934, pp. 426, 453; Séguy, 1937, p. 173; Bohart and Gressitt, 1951, p. 109, pl. 3, 13; Lee *et al.*, 1956, p. 331; Suehiro, 1960, p. 296; Chillcott, 1961, p. 213, figs 144, 144A, 209, 280, map 52; Snyder, 1965, p. 273; Greenberg, 1971, pp. 64, 255; Campos and Peña, 1973, p. 227.

Fannia glabella Bezzi, 1928, p. 174; Malloch, 1929, p. 156; Greenwood, 1929, p. 352; Séguy, 1937, p. 168; Lee *et al.*, 1956, p. 319; Hennig, 1965, p. 18; Pont, 1970, p. 420.

Types

Lectotype ♂ of *Anthomyia pusio* Wiedemann, South America, in UZMC [see designation below]. Holotype ♀ of *Fannia glabella* Bezzi, Fiji, Lautoka, in BMNH (Pont 1970, p. 420).

Lectotype Designation for *pusio* Wiedemann

Wiedemann described his species from an unspecified number of specimens of both sexes in the Royal Museum of Copenhagen, and Zimsen (1954, p. 26) stated that two specimens were located in UZMC. These were both sent for study through the kindness of Dr L. Lyneborg. One is a male, slightly immature, the thorax crushed by the rather stout pin, and both mid legs missing. It is labelled by Wiedemann 'Anthom. pusio W. Am. mer.?'. The second specimen is a female, also with the thorax damaged by the stout pin, and all legs missing except for the forelegs. I have labelled and designate herewith the male as lectotype and the female as paralectotype.

Both specimens are conspecific and agree with *pusio* as it has always been understood (e.g. Chillcott 1961).

Note on the Synonymy of glabella Bezzi

The synonymy of *glabella* with *pusio* was tentatively proposed by Malloch (1929). I can now confirm this after comparison of the type-series of *glabella* with that of *pusio* and with a series of *pusio* in the BMNH, and I have compared the ovipositor of a paratype of *glabella* with that of *pusio*.

Diagnosis

F. pusio can be distinguished from all other Australian *Fannia* except for *leucosticta* (Meigen) by the narrow and almost linear parafacialia and genae. Males of these two species are also characterized by the trimaculated dark pattern on the intermediate abdominal tergites, and females by the long frontal triangle that reaches to lower *ors*.

F. pusio differs from *leucosticta* by the characters given in the key, of which the most obvious are the dense ventral hind femoral and tibial bristling of the male (Figs 105, 106) and the subshining abdomen of the female. The male and female genitalia are illustrated in Figs 99-104.

Discussion

I have not seen any Australian specimens of *pusio*, but it is a widespread if uncommon species in the Pacific. It may well be introduced into Australia in the near future.

The adult has been described by Chillcott (1961) and Snyder (1965) in their revisions of Nearctic and Micronesian species. The egg and puparium have been illustrated by Bohart and Gressitt (1951) who also give a detailed account of the life history; the larva is illustrated by Chillcott (1961). A summary of the life history and a list of associated disease and other organisms have been given by Greenberg (1971).

Distribution and Biology

F. pusio is common in tropical and subtropical America (Chillcott 1961; Pont 1972), and it has been recently recorded from the Cameroun (Disney 1973).

In the Pacific region it is recorded from Samoa (Buxton and Hopkins 1927; Malloch 1929), Fiji (Bezzi 1928, as *glabella*), Hawaii (e.g. Bryan 1934) and Midway Atoll (Suehiro 1960), Caroline Is (Snyder 1965), Ocean I. (Snyder 1965), Wake I. (Snyder 1965) and Easter I. (Campos and Peña 1973).

The adults are often found associated with man, and the larvae breed in all kinds of decaying vegetable and animal matter, especially shellfish and rotting meat at a late stage of decay. For a detailed account, see Bohart and Gressitt (1951).

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