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Taxonomic Review of the Australian *Drosophila setifemur* Species Group, a New Name for the *D. dispar* Species Group (Diptera: Drosophilidae)

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ABSTRACT. Examination of the holotype and a paratype of *Drosophila setifemur* Malloch, 1924 in the Australian Museum has resulted in the discovery that it is not a synonym of *D. sulfurigaster* as had previously been assumed. Instead, *D. setifemur* is a senior synonym of the widespread eastern Australian species *D. dispar* Mather, 1955. The so-called *Drosophila dispar* species group is renamed the *Drosophila setifemur* species group and *Drosophila unguicula* is removed from it. An illustrated key to Australian drosophilids with spinescent fore-femora is provided.

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The genus *Drosophila* accommodates a great range of drosophilids, with numerous aggregations at various levels between genus and species (viz. subgenus, species group, subgroup, complex, etc.). A rapidly growing body of knowledge is allowing us to know with ever increasing certainty the true genetic relationship between species. But ultimately, even when the tree that relates every lab strain and every field-sampled specimen is known with a high level of confidence, there will remain the task of affixing the taxonomically valid names to each of those samples and to biological species.

Drosophila currently has c. 1,600 described species; c. 350 are classified with *D. melanogaster* in the subgenus *Sophophora*, and another c. 730 species are treated as *Drosophila* s.str. Nearly all are attracted to fruit baits and can be established as cultures in the laboratory. The following synonymy involves *Drosophila dispar* Mather, 1955: 570 (a species in the *dispar* species group of the *Drosophila* subgenus *Sophophora*) and *D. setifemur* Malloch, 1924: 351 (a species incorrectly classified as synonymous with *D. sulfurigaster* (Duda, 1923: 48) in the *nasuta* subgroup, *immigrans* species group of *Drosophila* s.str.).

Removing *D. setifemur* from synonymy with *D. sulfurigaster* and placing it in synonymy with *D. dispar* leads to a need to rename the *Drosophila dispar* species group (established by Mather,1955).

Historical overview

When Malloch examined four specimens collected in Sydney, he found they were members of a new species which he named *Drosophila setifemur*—a fly with distinctive setation on both the posterior and anterior faces of the fore-femur. They were all females and the importance of this will become apparent below because there is marked sexual dimorphism in this species. In 1942, Patterson & Wheeler described *D. spinofemora* from a live culture originating from Honolulu, they used *spinofemora* as a name to denote distinctive but very short femoral spines. Yet another species, the widespread, peridomestic species *D. immigrans* Sturtevant, 1921: 83 also has a distinctive series of closely spaced femoral spines—seriate spinescent setulae. Patterson & Wheeler (1949) placed *D. spinofemora*, together with *D. setifemur* and 16 other species, in the *immigrans* species

group of *Drosophila* s.str. There is no indication in these studies that Patterson & Wheeler (1942, 1949) examined the *D. setifemur* holotype or paratype held in Sydney or either of the two paratypes held in the USNM (Lee *et al*., 1956) before they included it in the *immigrans* species group.

Species of the *immigrans* group are collected at fruit and breed easily under culture making them ideal for genetic studies. The University of Melbourne geneticist, A.M. Clark, reported that between Malloch's 1924 publication and 1951 no further reports or collections of *D. setifemur* "seem to have been made" (Clark, 1957). If Clark was guided by the classification of Patterson & Wheeler (1949), and there is no reason to suspect otherwise, he would have been looking for a species differing only slightly from the cosmopolitan species *D. immigrans*; no such species exists in southeastern Australia (a region where the major cities are Melbourne, Sydney and Brisbane). In northern Australia, however, several species of the *immigrans* species group are abundant. Clark wrote (1957) that, in July 1951, he was able to obtain a few individuals of "*D. setifemur*" from *Drosophila* collections made with fermenting banana bait in the vicinity of Cairns, northern Queensland. His determination of these tropical Australian flies as *D. setifemur* was a mistake. The flies were most probably *D. sulfurigaster*, a fruit-breeding species now known to be very common in Cairns but a species then not reported from Australia. (It is important to note that, in 1957, very little had been published about Drosophilidae from tropical Australia.) The consequences of Clark's mis-identification were further compounded by his decision to re-describe *D. setifemur* based on these newly collected specimens (Clark, 1957). With hindsight it is not surprising that Clark's redescription of *D. setifemur* closely matches *D. sulfurigaster* not *D. setifemur* s.str. Clark nominated no voucher specimens and appears not to have examined the *D. setifemur* type in Sydney. It is also apparent that he had not noticed a list, published by Mather just several years earlier in 1955, of species collected in northern Queensland; the list included *D. spinofemora* (= *D. sulfurigaster*) from sites near Cairns, not *D. setifemur* s.str.

Clark (1957) found that the strain he determined to be *D. setifemur* (but which was probably *D. sulfurigaster*), hybridized freely with *D. spinofemora* (later shown to be a synonym of *sulfurigaster*), and so he considered it a useful model for comparative genetics. Twelve years later, in a wide-ranging study, the two were both placed in synonymy (Wilson *et al.,* 1969) with a third species *D. sulfurigaster* (type locality Madang, Papua New Guinea), which is widely distributed throughout the Pacific, tropical Australasian and Oriental Regions. Once again the holotype of *D. setifemur* appears not to have been examined. Rather, it seems likely that Wilson *et al.* (1969) relied too heavily on Clark's redescription and hybridization experiments which incorrectly concluded that "*D. setifemur*" was a species morphologically indistinguishable from *D. sulfurigaster* and one that hybridized freely with it. Wilson *et al.* (1969) may also have accepted, at face value, Mather's line of argument. In reference to the northern Queensland records of "*D. setifemur"* (see Clark, 1957) and "*D. spinofemora"* (see Mather 1953, 1955), Mather (1960: 237) wrote: "In view of the fact that *D. setifemur* and *D. spinofemora* have been shown to be sibling species (Clark, 1957) and *D. setifemur* is here shown to be abundant in northern Queensland, it seems likely that what was previously referred to as *D. spinofemora* was indeed *D. setifemur*". And finally, Wilson *et al.* (1969) may have been aware of, and influenced by, a then contemporaneous study by Mather, Baimai and Bock (1969) in which *D. setifemur* was incorrectly reported as common at fruit baits at five localities in Papua New Guinea.

The resulting confusion about the true identity of *D. setifemur* can be attributed firstly, to the false assumption that it had not, after 1924, been re-collected near Sydney; secondly, to its incorrect classification in the *immigrans* species group; thirdly, to its redescription based on specimens of *D. sulfurigaster*; fourthly, to incorrect records of its frequent occurrence at fruit bait in the Australasian tropics; and finally, to the fact that Malloch had described only females and had not reported the very distinctive sexual dimorphism in this species.

When Bock (Bock, 1976) undertook a major review of Australian *Drosophila* species he followed Wheeler (in Wilson *et al.*, 1969, see above) and accepted that *D. setifemur* was a junior synonym of *D. sulfurigaster*. However, he and other Australian *Drosophila* biologists—particularly Mather, Barker and Parsons—had accumulated extensive biogeographic data showing conclusively that *D. sulfurigaster* occurred neither in New South Wales (Bock & Parsons, 1978) nor in southern Queensland (Mather, 1955; but see van Klinken, 1996: 101). It therefore puzzled Bock (1976: 10) that Malloch had apparently described a common tropical species—one never found south of 20°S latitude—from four specimens collected in Sydney at 34°S. Had *D. sulfurigaster* once occurred in Sydney? Had there been an error in application of label-data? Or was *D. setifemur* not actually a synonym of *D. sulfurigaster*, was it a species known to be common in eastern temperate Australia under a different name?

Recent re-examination of certain type specimens in the Australian Museum, Sydney, curation of several hundred ex-SPHTM specimens accessioned in 1987 and assimilation of tens of thousands of eastern Australian field records (author's collections 1980 to present), has led to a re-assessment of *D. setifemur*. Among the ex-SPHTM material were additional specimens that had, around 1924, been classified, probably by Malloch or by F. H. Taylor, as being conspecific with *D. setifemur*. Such information, together with a better understanding of the biogeography and composition of the eastern Australian drosophilid fauna and examination of the *setifemur* holotype, has answered the questions posed above. *Drosophila setifemur* Malloch, 1924 is not a junior synonym of *D. sulfurigaster*, it is a senior synonym of *D. dispar* Mather, 1955.

Specimens referred to in this study are held in the following museums:

AMS	Australian Museum, Sydney.
ANIC	Australian National Insect Collection, CSIRO, Canberra.
BMNH	The Natural History Museum, London.
BPBM	Bernice P. Bishop Museum, Honolulu.
QM	Queensland Museum, Brisbane.
SPHTM	former School of Public Health and Tropical Medicine, University of Sydney, acalyptrate flies now incorporated in AMS.
USNM	United States National Museum (Smithsonian Institution), Washington.

Genus *Drosophila* Fallén, 1823

Subgenus *Sophophora* Sturtevant, 1939

Drosophila setifemur Malloch, 1924

Drosophila setifemur Malloch, 1924, *Proc. Linn. Soc. N.S.W.* 49: 351. Holotype ♀ and 1 paratype ♀ in AMS, 2 paratype ♀♀ in USNM; type locality Sydney, New South Wales, Australia.

Not *Drosophila setifemur* sensu Clark, 1957, *Aust. J. Zool*. 5: 216–222; Mather, Baimai & Bock, 1969: 72; Wilson *et al.*, 1969: 215–216.

Not *Drosophila sulfurigaster* (Duda, 1923) *Spinulophila*, *Annls hist.-nat. Mus. natn. hung.* 20: 48; Wilson *et al.*, 1969: 215–216.

Drosophila (Sophophora) dispar Mather, 1955, *Aust. J. Zool*. 3: 570 (and as redescribed by Bock, 1976: 19). Holotype ♂ in AMS, 24 paratypes, ex type culture, in AMS (including specimens once in SPHTM), ANIC, BMNH, QM, USNM; type locality Samford, near Brisbane, Queensland. **New synonym**.

Type material examined. ***Drosophila setifemur*** female holotype (AMS K50090, registered 20 September 1924) and one female paratype (also registered AMS K50090, but given a replacement number AMS K118452 in 2005) (two female paratypes in USNM [see Malloch, 1924; Lee *et al.*, 1956] not examined). ***Drosophila dispar***, holotype ♂, allotype, 4♂♂ and 4♀♀ paratypes (AMS K67819–K67824, K233649–K233652) (16 paratypes in the following museums [2♂♂ and 2♀♀ in each according to Mather, 1955: 547]: ANIC, USNM, QM, and BMNH not examined); all ex type culture, founded from one or several females collected at Samford, southern Queensland, 22 June 1953, W.B. Mather. These are holotypes and paratypes (see statement in preamble of Mather, 1955: 547) not syntypes as indicated by Daniels (Daniels, 1978: 440).

Other material examined. Numerous specimens of *Drosophila setifemur* (previously det. *D. dispar* by Mather, Bock, McEvey, Parsons, McAlpine), have been examined in the Australian Museum, the following is a list of 1923–2008 collecting localities arranged from lowest to highest latitude along Australia's east-coast, collectors include D. McAlpine, P. Parsons, C. Lambkin and S. McEvey: 12, Mt Bellenden Ker, 17.27°S (northern-most record); 2, Lake Eacham, 17.28°S; 3, The Crater NP, 17.42°S; 1, Laceys Creek, 17.85°S; 5, Paluma, 19.01°S; 1, Mt Dalrymple Rd, 21.13°S; 2, Mary Cairncross Park, 26.80°S; 1, Bunya Mountains, 26.85°S; 9, Mt Glorious, 27.33°S; 22, Samford, 27.37°S; 3, Joalah NP, 27.90°S; 1, Tamborine Mountain, 27.92°S; 3, Cunninghams Gap NP, 28.05°S; 120, Lamington NP, 28.14°S; 3, Binna Burra NP, 28.18°S; 1, Bilambil, 28.22°S; 3, Mt Warning NP, 28.40°S; 6, Toonumbar SF, 28.47°S; Tooloom Range, 28.48°S; Dome Mountain, 28.48°S; 1, Huonbrook, 28.53°S; 1, Whian Whian SF, 28.60°S; 8, Terania Creek, 28.67°S; Richmond Range, 28.81°S; Gibraltar Range, 29.47°S; Lowanna, 30.07°S; 1, Moonpar SF, 30.22°S; Bruxner Park, 30.24°S; 3, Dorrigo NP, 30.33°S; 1, Dingo Tops FP, 31.65°S; 1, Upper Allyn River, 32.13°S; Wootton, 32.31°S; 100+, Stroud garden, 32.41°S; 2, Mungo Brush, 32.53°S; 1, Palm Grove, 33.33°S; 4, Mount Wilson, 33.50°S; 1, Kurrajong, 33.55°S; 1, Mt Boyce, 33.62°S; 6, Springwood, 33.70°S; 3, Sydney, 33.88°S; 3, Palm Creek, 34.10°S; 5, Royal NP, 34.10°S; 1, Otford, 34.22°S; 2, Mt Keira, 34.40°S; 6, Mt Saddleback, 34.68°S; 3, Kangaroo Valley, 34.73°S; 1, Monga, 35.58°S; 10, Boyds Creek, 37.43°S; 1, Kinglake, 37.53°S; 1, Naghi SF, 37.55°S; 1, Hurstbridge, 37.63°S; 1, The Narrows, 37.88°S 147.97°E; 1, Ferntree Gully, 37.88°S 145.30°E (southern most Australian record, and western most Victorian record).

Redescription (based on *Drosophila setifemur*—McEvey Reg 25302, AMS K259065 male). Carina prominent but relatively narrow, ridged (ridge narrower in males, slightly broader in females). Thorax uniformly mid to dark brown. Male fore-femur plump with dense brush of erect hairs below; fore-metatarsus with a single, short, weak, curved, apical tooth; second tarsal segment with a similar tooth. Female fore-femur lacking dense brush and not unusually swollen; fore-tarsi without apical teeth. Abdomen glossy, blackish-brown, pale basally becoming black apically.

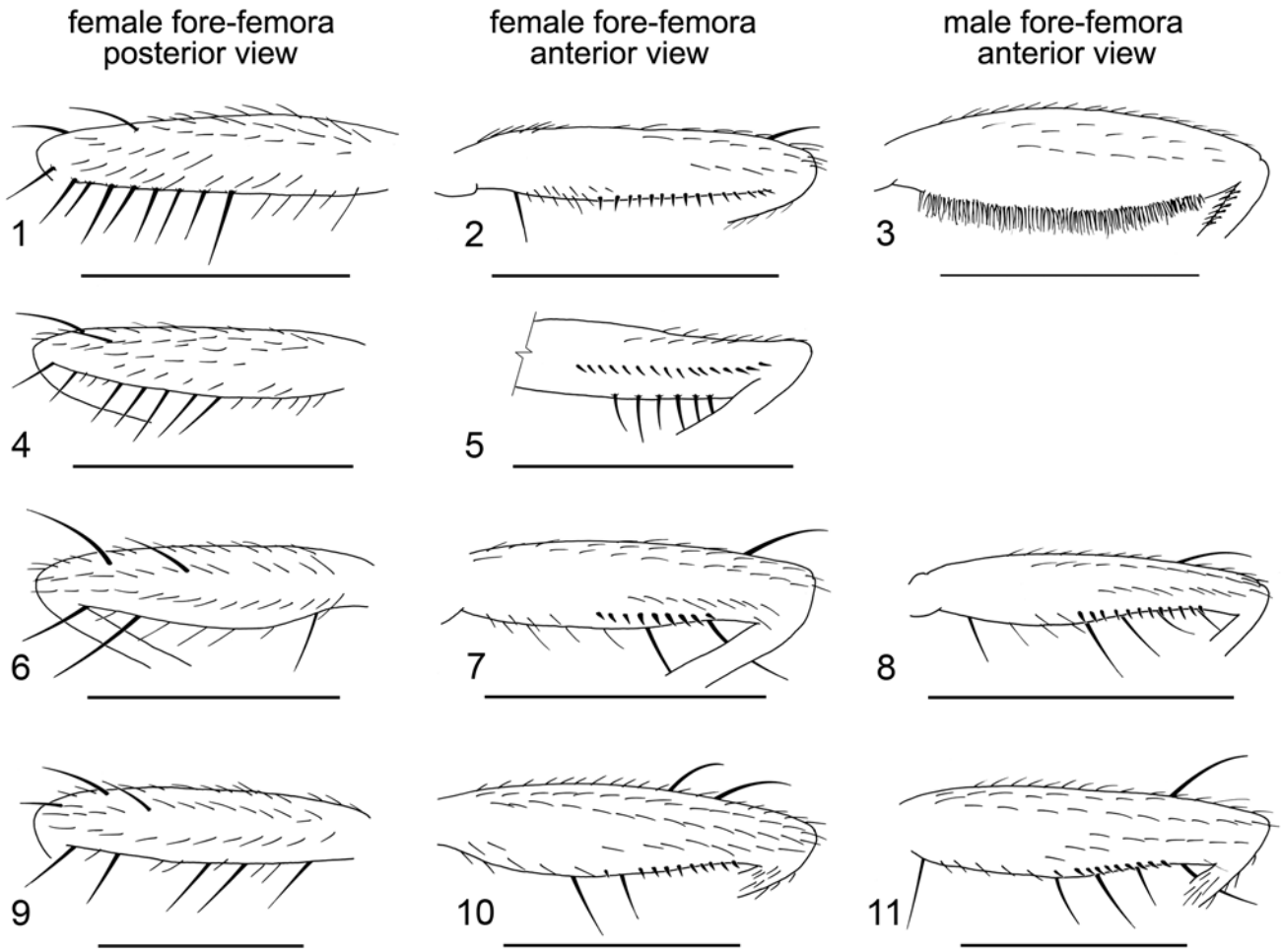
Body length. c. 2.5 mm.

Head. Arista with 4–5 branches above and 3 below plus terminal fork. Front very slightly broader than long, shining yellowish-brown; third antennal segment brownish; periorbital bands enclosing orbital and vertical bristles darker; ocellar triangle darker. Facial carina sharp and high, not broadened nor flattened below, lowest between antennal segments, highest and slightly pointed, in middle of face. Lower part of face distinctly darker than gena. Gena linear, pale; greatest width 0.1 greatest diameter of eye. Vibrissae duplicated, second about 0.9 of first. Eyes with dense fine pile. Orbital bristles in ratio 4: 1: 4; anterior reclinate fine, about equidistant between the proclinate and posterior reclinate, and slightly lateral to proclinate.

Thorax. Uniformly mid to dark brown, not vittate; lower part of postpronotum slightly paler. Acrostichal hairs in 8 irregular rows in front of dorsocentral bristles, 4–6 rows between dorsocentrals. Ratio anterior to posterior dorsocentrals 0.6. Prescutellars absent. Sterno-index 0.5–0.6. Legs pale yellowish-brown. Sex-comb of male consists only of 2 weak and slightly curved teeth, 1 apically on metatarsus, the second apically on 2nd tarsal segment (Bock, 1976: 19); because these teeth are so weakly developed, Mather (1955) is perhaps justified in describing this condition as "no sex comb". Both Bock (1976: 19) and Mather (1955: 571) refer to preapical bristles being on all tibiae; and apicals only on the mid-tibia, but I can find no clearly differentiated preapical setae on the fore tibiae in any of the males examined in this study.

Male fore-femur: plump, with numerous, fine, erect setulae brush-like on entire lower surface (Fig. 3); anteroventrally with no seriate spinescent setulae (cf. *sulfurigaster* males and females, compare Fig. 3 and Figs. 8, 11).

Female fore-femur: posteroventrally with a row of setae in slightly more than apical half (Figs. 1 and 4), all setae subequal in length, evenly spaced and shorter than or equal to the femoral diameter. In describing the holotype female Malloch wrote (1924: 351), and it is here confirmed, that the "fore-femur [is] with short closely placed fine setulae on more than the apical half of posteroventral surface, the



Figures 1–11. Fore-femora of *Drosophila setifemur, D. sulfurigaster* and *D. immigrans* showing sexual dimorphism in *D. setifemur* and setation on anteroventral and posteroventral surfaces. (1–5) *Drosophila setifemur*: (*1*), *D. dispar* Mather (= *D. setifemur* Malloch) allotype female, Samford, Queensland, AMS K67820; (*2*), *D. dispar* Mather paratype female, Samford, Queensland, AMS K67825; (*3*), *D. dispar* holotype male, Samford, Queensland, AMS K67819; (*4*) and (*5*) (the latter is a ventral view showing both anterior and posterior setation of fore-femur), *D. setifemur* female paratype, Sydney, AMS K50090. (6–8) *Drosophila sulfurigaster*: (*6*) and (*7*), female, Malololelei, Samoa, McE 21321; (*8*), male, AMS K 234064, Maple Creek, near Innisfail, Queensland. (9–11) *Drosophila immigrans*: (*9*) and (*10*), female, near Ebor, New South Wales, AMS K234065; (*11*), male, Sydney, AMS K234066. Scale 0.5 mm.

longest one, at apex, not longer than the femoral diameter". This is *not* a reference to the seriate spinescent setulae on the anteroventral surface. Female fore-femur not swollen, without brush of erect setulae below as in males (compare Fig. 2 and 3); anteroventrally with seriate spinescent setulae (Figs. 2 and 5).

Abdomen glossy, blackish-brown, paler basally, becoming black apically. Halteres yellow.

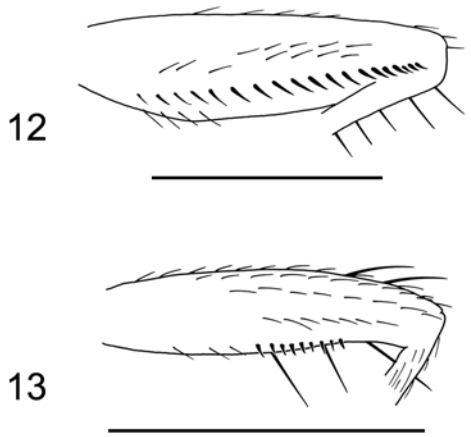
Wings (*D. setifemur* holotype AMS K50090). Hyaline. *C*-index = 2.38; *4v*-index = 2.04; *5x*-index = 1.76; *4c*-index = 1.12; *ac*-index 2.57; *M*-index = 0.61; third costal section with fringe of heavy setation on basal 0.67. Length, from humeral crossvein to apex, 2.2 mm (from axis to apex, c. 2.5 mm).

Male terminalia. Cercus very small with very long finger-like process extending from below (Mather, 1955, fig. 11C; Bock, 1976, fig. 9); the latter is translucent (not heavily sclerotized), strongly curved, tapering to a point, and protrudes well outside the body making it, and the opposing one, clearly visible under low magnification. Under high magnification several sensilla are visible on these processes subapically. Aedeagus with prominent subapical ornamentation.

Distribution. Type locality is Sydney, Australia where the species is taken frequently at fruit baits in urban bushland (Table 1). This species has been collected at numerous sites in eastern Australia (see above) from northern Queensland at the summit of Mt Bellenden Ker (1561 m) to Ferntree Gully, outer eastern suburb of Melbourne, Victoria. It apparently does not overlap with the range of *D. prodispar* Parsons & Bock, 1982, in western Victoria.

Notes

Drosophila setifemur closely resembles *D. prodispar* and is therefore probably closely related to it. The structure of the male and female terminalia, the sexually dimorphic fore-femur and the generally dark coloration of these flies make them quite unlike others in the *Drosophila* subgenus *Sophophora*.



Figures 12–13. Anteroventral setation of fore-femora of *Drosophila teratos* and *D. niveifrons*. (*12*) *Drosophila teratos*, male, Lake Eacham, Queensland, AMS K233710. (*13*) *Drosophila niveifrons*, male, Wanigela, Papua New Guinea, AMS 234063. Scale 0.5 mm (a *niveifrons* paratype [marked ex stock 14.x.1979 Kitagawa *et al*.] in BPBM has 8–9 spinescent setulae, McEvey pers. obs. 26.xi.2008).

A variety of different terms have been applied to the spinescent setulae lying in a series along the lower anterior surface of the fore-femur, and there has been a tendency to emphasize only this aspect of the femoral setation, ignoring the taxonomically useful arrangement of long setae on the posteroventral surface. Reference is made, for example, to "short, stout, spine-like bristles on lower apical part of fore femora" (Patterson & Wheeler, 1942); "comb-like series of stout bristles on femur" (Mather, 1955); "row of … short, stout, microscopic setae on the apical half of the anteroventral surface of the fore femur" (Clark, 1957); "fore femur with more or less well developed row of short stout comb-like teeth (femoral comb)" (Bock, 1976); "the comb-like bristle row on the inner side of the first femur" (Wilson *et al.,* 1969). It is only Malloch (1924) however, who made reference to the diagnostic utility of the setation on the posterior side of the fore-femur. Indeed it is the relative length and arrangement of long setae arising from the lower fore-femur on its posterior side that offers a more definitive means of separating species of the *immigrans* and *setifemur* species groups, at least in females. Males of *D. setifemur* completely lack serial spinescent setulae and have instead a thick brush of erect hairs (Fig. 3).

When comparing *Drosophila prodispar* and *D. setifemur,* Parsons & Bock wrote that both "species show the same dimorphism in carina width and hypertrophy of the fore-femur. However, examination of the genitalia under the higher powers of a stereo microscope reveals diagnostic differences in both sexes. In the male, the aedeagus is cylindrical in *dispar* [= *setifemur*] but broadly flattened in *prodispar*; a long slender curved finger-like process extending from the genital arch [sic] is visible on each side in *dispar* [= *setifemur*], while the corresponding process in *prodispar* is shorter, wider and barely curved. In the female, the egg guide in *dispar* [= *setifemur*] possesses a slender apical extension bearing fine teeth; in *prodispar* the egg guide possesses no apical extension and fine teeth are absent. These differences are evident in pinned specimens and should also be obvious in live flies" (Parsons & Bock in Bock, 1982: 53). As specimens of *D. setifemur* and *D. prodispar* examined by me in the AM have a distinctive extension of the cercus, not the genital arch, I believe the above reference to an extension of the "genital arch" (epandrium) is an error. Note also that sexual dimorphism in the width of the carina is rather subtle.

The *Drosophila setifemur* species group

Within the Drosophilidae, but not generally in the Diptera, there is an informal and hierarchical classification between the genus level and the species level. For example, the *melanogaster* "species group" accommodates a large number of species that share morphological characteristics with *D. melanogaster* (Bock & Wheeler, 1972; Bock, 1980) and are phylogenetically closely related (Lemeunier *et al.,* 1986). The "species group" is a superspecific aggregation with a rank below subgenus, it is divided into various "subgroups", subgroups are sometimes divided into "complexes", and complexes into sibling pairs, cryptic species or other loosely defined groupings of small numbers of species. (Subspecies is a rank seldom used in the Drosophilidae.) Guidelines for the application of these subgeneric and superspecific names are not offered by the ICZN and so it is difficult to affect an objective re-appraisal of the so-called "*dispar* species group", now that the correct name of the typical species is no longer *D. dispar*. There is also the untidy situation of synonymy with the "*dispar* species group" in another drosophilid genus *Zygothrica*; this clash would be rectified if the *Drosophila dispar* species group was renamed.

The logical course of action, and the one adopted here, is to replace the name "*Drosophila dispar* species group" with the name "*Drosophila setifemur* species group". This is done in anticipation of confusion that might result were nothing done. In light of the current systematic uncertainties due to the polyphyletic assemblage of species in *Drosophila* (O'Grady & DeSalle, 2008) it would be premature to consider erecting a new genus or new subgenus to accommodate *D. setifemur* and *D. prodispar* although the atypical male terminalia (especially the acuminate extension of the lower cercus and the form of the ventral projections of the epandrium are quite unlike any other in the *Drosophila* subgenus *Sophophora*) offers a suitable starting point for such a consideration. The typical species of the species group is *D. setifemur*, and *D. prodispar* is the only other member. Prior to the present investigation, however, it was generally accepted that the "*Drosophila dispar* species group" had three species (e.g., Ashburner *et al*., 2005) viz. *D. dispar* [= *setifemur*], *D. prodispar* and *D. unguicula* Okada & Carson, 1983:138. Okada & Carson (1983) speculated that *D. unguicula* from Papua New Guinea "seems to belong to the *dispar* [=*setifemur*] species group" but the "cercus [is] with a strong black spur ventrally" and in this respect it is quite unlike *D. setifemur* which has instead a long acuminate process with subapical trichose hairs. *Drosophila unguicula* has not been examined in this study but in light of the description and illustrations offered by Okada and Carson and the detailed examination of the *D. setifemur* and *D. prodispar* genitalia in the present study, it is concluded that *D. unguicula* should be excluded from the *setifemur* species group.

Other species examined. ***Drosophila prodispar*** Parsons & Bock, in Bock, 1982: 51, four paratypes as follows: 1, Paradise, Otway Rd., Vic., off fronds, 20.v.1975, P.A. Parsons, AMS K72928; 1, Paradise, Otway Rd, Victoria off tree ferns, 21.v.1975, P.A. Parsons, AMS K72929; 2, River on Horden Vale Rd., Otway Rd., Vic., dampish habitat, off sedge 12.ix.1975, P.A. Parsons, AMS K232905 and AMS K232906. ***Drosophila teratos*** Bock, 1982: 89.—holotype, [Royal] National Park N.S.W. 3.11.1956, D.K. McAlpine, AMS K73142; Lake Eacham NP Qld, swept off fungi, June 1983, P.A. Parsons, AMS K233710 (det Bock, 1983) fore-femur figured (Fig. 12); QLD: 28.212°S 153.141°E, Lamington NP IBISCA Qld, Plot# IQ-500-B 514 m, 21–26 Jul. 2007, rainforest, Lambkin, Starick, Monteith, Malaise trap 23186, QM T155510 (det McEvey, 2008). ***Drosophila sulfurigaster*** (Duda).—numerous specimens examined in the AMS from islands of the Pacific Ocean: Papua New Guinea, New Ireland, Fiji, Samoa, New Caledonia, Loyalty Islands, Vanuatu, Solomon Islands, Marquesas, Moorea and Tahiti; specimens in the AMS from the Oriental Region: Vietnam, Malaysia, Borneo, Luzon, Guam and Christmas Island (Indian Ocean); and specimens in the AMS from Australia (see Figs. 6–8): Moa I. (10.2°S), Thursday I., Mt Adolphus I., Heathlands (11.7°S), Iron Range, Claudie Rv., Gordon Ck (12.7°S), Cooktown (15°S), Cape Tribulation (16.2°S), Mossman Gorge, Kuranda, Cairns (16.9°S), Mulgrave Rv. (17.2°S), Palmerston NP, Maple Ck (17.6°S), Paluma (19°S), Townsville (19.3°S), Campaspe Rv (20.4°S). ***Drosophila (Drosophila) niveifrons*** Okada & Carson, 1982: 407.—1♂, PNG, Wanigela, 9°16'S 149°08'E, 12–28 Feb 2003, S.F. McEvey, McE 20105, AMS 234063; fore-femur figured (Fig. 13). ***Drosophila (Drosophila) immigrans*** Sturtevant.—1♀, NSW Pinegrove HS, 13km SW Ebor, 1130m, 30°29.935'S 152°16.014'E, banana 17–18 January 2000, Barker McEvey Polak Starmer, McE 14225, AMS 234065; fore-femur figured (Figs. 9–11).

A key to Australian species of *Drosophila* with seriate spinescent setulae on fore-femur

Seven *Drosophila* species that occur in temperate and tropical forests of eastern and northeastern Australia and New Guinea could be confused with *Drosophila setifemur* because, except for males of *D. setifemur*, they all have seriate spinescent setulae anteroventrally on the fore-femur—the following key allows them to be correctly identified.

1 Vibrissa single ..... *Drosophila teratos*

—— Vibrissa double 2

2 Males 3

—— Females 8

3 Fore femur distinctly swollen (often collapsed and flattened in pinned specimens), densely hirsute ventrally along its entire length, and without distinctive series of spinescent setulae in apical, anteroventral, half (Fig. 3); terminalia characterized by a pair of long, slender, semi-translucent, appendages usually visible without dissection 4

—— Fore femur not distinctly swollen, rarely collapsed in pinned specimens, diameter of fore-, mid-, and hind-femora subequal, ventral surface with a few scattered hairs near base only, with distinctive series of short spines in apical, anteroventral, half (Figs. 8, 11–13); many setae on posteroventral surface of fore-femur longer than femoral diameter; terminalia without slender appendages as described above 5

4 Appendages of terminalia tapering to a point apically and strongly curved, Eastern Australia ..... *Drosophila setifemur*

—— Appendages of terminalia blunt apically and not strongly curved, western Victoria ..... *Drosophila prodispar*

5 Thorax and abdomen blackened ventrally; weakly developed seriate spinescent setulae on fore-femur ..... *Drosophila rubida* Mather, 1960

—— Thorax and abdomen not blackened ventrally; strongly developed seriate spinescent setulae on fore-femur 6

6 Abdominal tergites with broad apical black bands dorsally only, fringe of heavy setation in about 0.3–0.4 of third costal section (common at fruit baits and compost in cool temperate Australia, peridomestic worldwide distribution), front without distinctive silvery pruinescence ..... *Drosophila immigrans*

—— Abdomen largely pale, stramineous (straw yellow), fringe of heavy setation in about 0.5–0.7 of third costal section (tropical northeastern Australia, north of 20°S latitude), front with distinctive pruinescence in males only 7

7 Male fronto-orbits only, with distinct silvery pruinescence, visible especially at acute angles ..... *Drosophila sulfurigaster*

—— Male frons entirely covered with distinct silvery pruinescence, visible especially at acute angles ..... *Drosophila niveifrons*

8 Female fore-femur with short closely spaced setae on more than the apical half of posteroventral surface, the longest one, at apex, not longer than the femoral diameter (Figs. 1, 4); C-index about 2.4 (third costal section not less than a third the length of the second section); facial carina narrow; thorax brown, abdomen blackish-brown, subshining ..... *Drosophila setifemur* and *D. prodispar*

—— Female fore-femur with four or five widely spaced bristles on the entire length of posteroventral surface, the longest one, at or near middle, as long as or longer than the femoral diameter (Figs. 6, 9); C-index 3.7–4.7, facial carina very broad ..... *Drosophila immigrans, D. rubida, D. sulfurigaster, D. niveifrons*

Biogeography and habitat preference

A comprehensive morphological and genetic study of *Drosophila setifemur* and *D. prodispar*, especially where their ranges meet (or almost meet) near Melbourne, Victoria, could lead to a convenient new model for studying environmental adaptation, speciation and interspecific hybridization (note that *setifemur* × *prodispar* hybridization is currently unknown). *Drosophila prodispar* appears to occur only in the *Otway Natural Region* (Barlow, 1985) west of Melbourne while *D. setifemur* occurs in eastern Australia from just east of Melbourne to Queensland (*Howe, Nepean, McPherson* to *Cape York Natural Regions*).

Extensive fruit-baiting in Tasmania and the islands of Bass Strait might result in the discovery of additional isolated populations or even other species, although there is no evidence that any drosophilid speciation has resulted from sea-level rise in Bass Strait (Parsons & Bock, 1977).

Atkinson (1985) has recorded *D. setifemur* (as *D. dispar*) on Black Apple *Planchonella australis* at Bruxner Park (30.2°S 153.1°E) near Coffs Harbour but numerous other fruits, flowers and fungi appear to be suitable for breeding. Moxon *et al*. (1982) report it as common at fruit and mushroom baits "from north Queensland–Victoria especially in floristically depauperate forests." My collection records also indicate that it is common in fern and bracken (*Pteridium*) habitats, and is attracted to composted and rotting vegetables, flowers of *Syzygium,* rotting fruits of, for example, *Citrus, Feijoa,* and *Opuntia,* rotting mushrooms and other fungus, and it is taken in Malaise and pitfall traps. Parsons & Bock (1977) also note that *D. setifemur* (as "*D. dispar"*) is attracted to both mushroom and fermented fruit baits throughout its range, particularly in tree fern, *Eucalyptus–Acacia* and sedge habitats, but interestingly, to the west of Melbourne, they collected flies (which, by inference, must have been *D. prodispar*) only by sweeping and not at all by fruit- or mushroom-baiting. This suggests that it may be difficult to establish *D. prodispar* in culture.

Collection records for drosophilid flies collected at fruit bait in the *Nepean Natural Region* (which includes Sydney, Barlow, 1985), indicate that *Drosophila setifemur* is the most common species when using this method in natural or semi-natural habitats (Table 1).

Table 1. The most frequently collected species of Drosophilidae using fruit baits in semi-natural habitats in the Sydney region with approximate abundance ratio indicated as a percentage (pooled data, variation between traps can be large).

Drosophila setifemur Malloch, 1924	29%
Drosophila immigrans Sturtevant, 1921	19%
Drosophila simulans Sturtevant, 1919	17%
Scaptodrosophila lativittata (Malloch, 1923)	11%
Drosophila pseudotakahashii Mather, 1957	9%
Drosophila serrata Malloch, 1927	6%
Drosophila melanogaster Meigen, 1830	3%
Scaptodrosophila sydneyensis (Malloch, 1927)	3%
Scaptodrosophila claytoni van Klinken, 1997	2%
Scaptomyza australis Malloch, 1923	1%

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References

Ashburner, M., K.G. Golic & R.S. Hawley, 2005. *Drosophila : A Laboratory Handbook*. 2nd ed. Cold Spring Harbor, New York: Cold Spring Harbor Laboratory Press.

Atkinson, W.D., 1985. Coexistence of Australian rainforest Diptera breeding in fallen fruit. *Journal of Animal Ecology* 54: 507–518.
http://dx.doi.org/10.2307/4495

Barlow, B.A., 1985. A revised natural regions map for Australia. *Brunonia* 8: 387–392.
http://dx.doi.org/10.1071/BRU9850387

Bock, I.R., 1976. Drosophilidae of Australia. I. *Drosophila* (Insecta: Diptera). *Australian Journal of Zoology, Supplementary Series* 40: 1–105.

Bock, I.R., 1980. Current status of the *Drosophila melanogaster* species-group (Diptera). *Systematic Entomology* 5: 341–356.
http://dx.doi.org/10.1111/j.1365-3113.1980.tb00420.x

Bock, I.R., 1982. Drosophilidae of Australia. V. Remaining genera and synopsis (Insecta: Diptera). *Australian Journal of Zoology, Supplementary Series* 89: 1–164.

Bock, I.R., & P.A. Parsons, 1978. Australian endemic *Drosophila.* IV. Queensland rain forest species collected at fruit baits, with descriptions of two species. *Australian Journal of Zoology* 26: 91–103.
http://dx.doi.org/10.1111/j.1365-3113.1978.tb00106.x

Bock, I.R., & M.R. Wheeler, 1972. The *Drosophila melanogaster* species group. *University of Texas Publications* 7213: 1–102.

Clark, A.M., 1957. Hybridization between *Drosophila setifemur* and *D. spinofemora*. *Australian Journal of Zoology* 5: 216–222.
http://dx.doi.org/10.1071/ZO9570216

Daniels, G., 1978. Type specimens of Diptera in the Australian Museum. *Records of the Australian Museum* 31: 411–471.
http://dx.doi.org/10.3853/j.0067-1975.31.1978.222

Lee, D.J., M. Crust & C.W. Sabrosky, 1956. The Australasian Diptera of J.R. Malloch. *Proceedings of the Linnean Society of New South Wales* 80: 289–342.

Lemeunier, F., J.R. David, L. Tsacas & M. Ashburner, 1986. The *melanogaster* species group. In *The Genetics and Biology of Drosophila*, ed. M. Ashburner, H.L. Carson and J.N. Thompson Jnr. London: Academic Press.

Malloch, J.R., 1924. Notes on Australian Diptera. IV. *Proceedings of the Linnean Society of New South Wales* 49: 348–359.

Mather, W.B., 1953. A survey of the *Drosophila* fauna of southeast Queensland. *Drosophila Information Service* 27: 101.

Mather, W.B., 1955. The genus *Drosophila* (Diptera) in eastern Queensland. I. Taxonomy. *Australian Journal of Zoology* 3: 545–582.
http://dx.doi.org/10.1071/ZO9550545

Mather, W.B., 1960. Additions to the *Drosophila* fauna of Australia. *University of Queensland Papers, Department of Zoology* 1: 229–239.

Mather, W.B., V. Baimai & I.R. Bock, 1969. The genus *Drosophila* in New Guinea. *Drosophila Information Service* 44: 72.

Moxon, L.M., R.S. Holmes & P.A. Parsons, 1982. Comparative studies of aldehyde oxidase, alcohol dehydrogenase and aldehyde resource utilization among Australian *Drosophila* species. *Comparative Biochemistry and Physiology* 71B(3): 387–395.
http://dx.doi.org/10.1016/0305-0491(82)90399-6

O'Grady, P., & R. DeSalle, 2008. Out of Hawaii: the origin and biogeography of the genus *Scaptomyza* (Diptera: Drosophilidae). *Biology Letters* 4(2): 195–199.
http://dx.doi.org/10.1098/rsbl.2007.0575

Okada, T., & H.L. Carson, 1983. Drosophilidae from banana traps over an altitudinal transect in Papua New Guinea. I. Descriptions of new species with notes on newly recorded species. *International Journal of Entomology* 25(2–3): 127–141.

Parsons, P.A., & I.R. Bock, 1977. Australian endemic Drosophila. I. Tasmania and Victoria, including descriptions of two new species. *Australian Journal of Zoology* 25: 249–268.
http://dx.doi.org/10.1071/ZO9770249

Patterson, J.T., & M.R. Wheeler, 1942. Description of new species of the sub-genus *Hirtodrosophila* and *Drosophila*. *University of Texas Publications* 4213: 67–109.

Patterson, J.T., & M.R. Wheeler, 1949. Catalogue of described species belonging to the genus *Drosophila*, with observations on the geographical distribution. *University of Texas Publications* 4920: 207–233.

Sturtevant, A.H., 1939. On the subdivision of the genus *Drosophila*. *Proceedings of the National Academy of Sciences, United States of America* 25: 137–141.
http://dx.doi.org/10.1073/pnas.25.3.137

van Klinken, R.D., 1996. Understanding diversity in ecological communities: a study of Australian Drosophilidae with emphasis on the *coracina* group of *Scaptodrosophila* species. Doctoral thesis, Department of Entomology, University of Queensland, Brisbane, Australia.

Wilson, F.D., M.R. Wheeler, M. Harget & M.P. Kambysellis, 1969. Cytological relations in the *Drosophila nasuta* subgroup of the *immigrans* group of species. *University of Texas Publications* 6918: 207–253.

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