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Adaptive radiation in the subgenus *Scaptodrosophila* of Australian *Drosophila*

UNTIL a recent survey, based on the two major museum collections of Australia¹, the Australian *Drosophila* fauna was poorly known and few endemic species had been described. This survey covered 81 species including 40 described as new. The world total of *Drosophila* species is known to exceed 1,250 (ref. 2); the Australian fauna thus represents about 6% of this total. By comparison with the world *Drosophila* fauna, the Australian total contains a disproportionately large number of species (45 out of 81) in the subgenus *Scaptodrosophila*, most of them endemic although a few are also known from neighbouring South-east Asian and/or Pacific regions. The Australian *Drosophila* fauna is therefore unique in that nowhere else have members of the subgenus *Scaptodrosophila* so dominated the *Drosophila* fauna of a large region.

The three other major subgenera are poorly represented. The eleven known Australian *Hirtodrosophila* species are all endemic to Australia, but in the subgenera *Drosophila* and *Sophophora*, each of which contains more than 500 species worldwide³, four species only of *Sophophora* are endemic to Australia; these subgenera are represented in Australia principally by the cosmopolitan species, although a few of the South-east Asian/New Guinean species extend into northern Australia.

Of the *Scaptodrosophila* species, only three are endemic to south-western Australia; a further two occur in both east and west, and the remainder have southern and/or northern distributions in the eastern part of the continent only¹. Laboratory culture of most species has proved very difficult, complicated by the almost complete lack of information on ecology and life histories; there are some indications that the larvae of at least some species may be leaf miners pupating in soil. Equally, phylogenetic lineages within the subgenus are substantially unknown¹. The Australian *Scaptodrosophila* radiation does not, of course, compare with the famous speciation in the subgenus *Drosophila* in Hawaii⁴, in which small area more than 350 species have already been described—about four times the total number of known Australian species in the genus *Drosophila* and seven times the number of known Australian *Scaptodrosophila*; but the Hawaiian proliferation is a special case unmatched in any other comparably small region of the world.

The major *Scaptodrosophila* radiation in Australia has thus occurred in the eastern part of the continent, and within this region many of the species seem to be restricted to the southern part of the country (especially Victoria and New South Wales). One of the more common species is *D. inornata* Malloch, which is frequently closely associated with tree ferns (*Dicksonia* spp.)⁵. The most favourable habitats for *Drosophila* species in south-eastern Australia seem to be wet sclerophyll/rain forest areas characterised by tree ferns and various other ferns. All habitats, including a few sheltered habitats without tree ferns, have permanent water, and often a deep layer of rotting leaf litter⁶. Most of the *Scaptodrosophila* species are not attracted to baits and so far can only be collected by intensive sweeping.

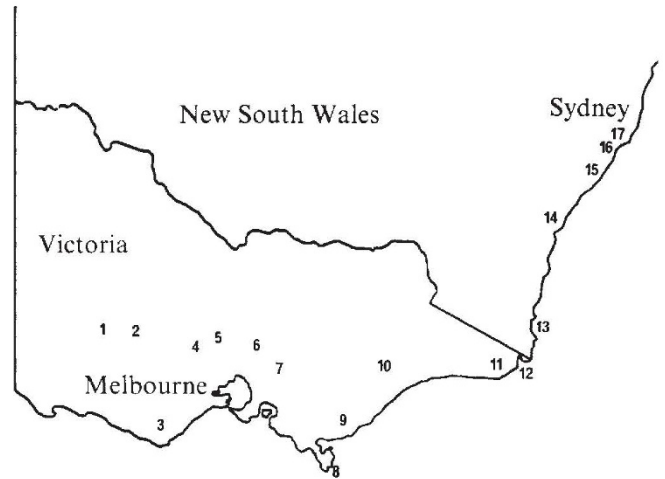


Fig. 1 Map of Victoria and south-eastern New South Wales indicating continental islands where endemic *Drosophila* spp. have been found.

Extensive spring and summer collections have recently been made in habitats of the above type in Victoria and the east coast of southern New South Wales (Fig. 1). More than 2,000 *Scaptodrosophila* representing at least twelve species, at least two of them new, were collected in damp habitats. Locality records of the museum collections¹ reveal the likelihood that most of the remaining known species are confined to damp habitats. It seems likely in view of the number of sites at which collections are still to be made that further species await discovery; in any case species once regarded as extremely rare are now known to be relatively common and widespread.

The damp habitats most favourable to *Scaptodrosophila* species are normally isolated from one another, often by considerable distances. Localities of major habitats sampled so far are indicated in Fig. 1. The temperature/humidity requirements of the flies are such that migration among many of the habitats in summer, especially in Victoria, must be impossible⁶. This is because Victoria has a hot dry summer during which the habitats are damp, cool refuges, offering temperature-humidity conditions compatible with survival of *Drosophila* species, but outside these refuges the environmental stress would be excessive. (Similar environmental constraints occur for the cosmopolitan species⁷.) There is, therefore, the possibility of studying the evolutionary biology of *Scaptodrosophila* species in essentially continental islands which have probably been separated for at least 6,000 yr, that is after the end of an era of high precipitation, high temperature and high rainfall⁸.

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