BRIAN R. STUCKENBERG

Natal Museum, Pietermaritzburg, South Africa

A NEW GENUS AND SPECIES OF VERMILEONIDAE (DIPTERA: BRACHYCERA) FROM MADAGASCAR

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The new genus *Isalomyia* is erected for a new species, *I. irwini*, discovered in the Isalo Range of south-western Madagascar, the first vermileonid known from that island. Morphological adaptations of the proboscis for nectarivory show this taxon to be part of the Gondwanan monophylum of genera. Only the female of *I. irwini* is known, so a full account of *Isalomyia* and an assessment of its relationships cannot be given yet. The antennal form is plesiomorphic, but the remarkable way in which sensilla on the flagellomeres are distributed is distinctive and apomorphic. The wing venation shares features with the Omani species *Lampromyia umbraticola* Stuckenberg & Fisher, 1999, but these may be plesiomorphies. *I. irwini* was found in a topographically unique area with sandstone inselbergs and outcrops on the eastern margin of the Permo-Triassic sediments in western Madagascar. Landforms produced by erosion-resistant sandstone formations may provide durable larval habitats for vermileonid faunas. Such landforms are significant for vermileonid biogeography in South Africa, and could prove to be important in Madagascar.

B. R. Stuckenberg, Department of Arthropoda, Natal Museum, P. Bag 9070, Pietermaritzburg 3200, South Africa. E-mail: bstucken@nmsa.org.za

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The family of wormlion flies, Vermileonidae, appears to be a relict from Jurassic times and has an unusual biogeography (Stuckenberg 2000). It constitutes the infraorder Vermileonomorpha of the homeodactylous Brachycera, and is currently considered to be without close living relatives (Griffiths 1994, Stuckenberg 2001). The family probably dispersed during the Jurassic and Early Cretaceous. The known world fauna divides into Laurasian and Gondwanan components, with monophyly of the Gondwanan section demonstrated by synapomorphies in the male genitalia, and in elongation and other adaptations of the proboscis for flower-visiting and nectar-extraction (Stuckenberg 2000, 2001). The Laurasian component is widely though irregularly distributed in several biogeographical regions, occurring in the western Palaearctic Region and in China, and extending into the Oriental tropics in India, Malaysia, Borneo and Sumatra. In the Americas, it occurs in the south-western United States, Mexico, Guatemala, Costa Rica and some Caribbean islands (Nagatomi et al. 1999, provide a catalogue of the world fauna). With such a long history, it has been anomalous that the Gondwanan clade appeared to be restricted to Africa and Arabia, apart from two probably Late Miocene vicariant extensions from north-west Africa into Iberia (Stuckenberg 1998, 2000). No vermileonids have been found in the other Gondwana landmasses, except for a species of the Oriental genus *Vermitigris* Wheeler, 1930, which includes India in its distribution (Oldroyd 1947). However, unexpected discoveries have shown that vermileonids may be overlooked for many years: it was only in 1979 that the speciose Chinese genus *Vermiophis* Yang was described, and the presence of the family in the Arabian Peninsula was reported recently (Stuckenberg & Fisher 1999).

The occurrence of Vermileonidae in Madagascar is the latest discovery. Two wormlions were collected by Dr M. E. Irwin while searching for therevid larvae in the Isalo Range during December 1999, and were sent to me for rearing. One was in an early instar and unfortunately died, but the other was more mature and transformed into a female fly that emerged on 12 April 2001. This serendipitous find is potentially of great interest in view of the remarkable and often enigmatic biogeographical characteristics of the island. The fly is described below as representing a new genus and species, *Isalomyia irwini*.

It remains to be seen whether more vermileonid species will be found in Madagascar. Although this is an ancient, continental part of Gondwana, its Dipteran fauna is strangely unbalanced. Two other orthor-

rhaphous families similarly have only one known species in Madagascar. These are Mydidae, represented by *Afroleptomydas seyrigi* Séguy, 1960, found in southern Madagascar (Bowden 1980, transferred the species from *Leptomydas* Gerstaecker, 1868, to *Afroleptomydas* Bequaert, 1961, which is a large, otherwise Southern African genus); and Nemestrinidae, with *Nycterimyia seyrigi* Séguy, 1951, recorded from several localities in the eastern rainforest region (*Nycterimyia* is palaeotropical, ranging from South Africa to Queensland). The niche for large nectar-feeding flies seems to be poorly filled in Madagascar.

Terminology and methods

Standard morphological terminology is used. T = tergite, S = sternite. The wing illustrated in fig. 7 was deliberately flattened in balsam under a coverslip, so that the position of crossvein sc-r could be seen. The spermathecae were exposed after maceration of the apical part of the abdomen in hot KOH and subsequent irrigation in water. After examination in water at low magnifications, they were transferred to warm glycerine-jelly which unfortunately caused them to shrink and distort. The spermatheca illustrated in fig. 3 is a reconstruction based on rough sketches made under low magnification, and subsequent examination at high magnifications in glycerine-jelly; the drawing may not be completely accurate. The coloring of the holotype was described after the specimen had been in ethanol for several weeks; it may not have developed its mature coloration by the time when it was preserved, and some loss of colour intensity may have resulted from preservation in the liquid.

Nomenclature of antennal components follows Stuckenberg (1999). In that study it was shown that the African vermileonid genera preserve all stages in a transformation series ranging from taxa in which the primitive flagellum with eight flagellomeres is present, to the most derived forms having flagellomeres 1-6 fused into a postpedicel with an olfactory chemosensory role, supporting an apical style composed of flagellomeres 7 and 8 which has a mechanoreceptor role. It was found that both chemoreceptor and mechanoreceptor sensilla may be present on flagellomeres 1-7 or 1-6 in taxa with the primitive complement of eight flagellomeres.

Relationships and classification

In recent publications (Stuckenberg 2000, 2001), I postulated that the Gondwanan vermileonid lineage is strongly established as monophyletic. Among its autapomorphies are specialisations of the proboscis for nectarivory: the labium has become slender and elongate to varying degrees, the labella are correspondingly modified into narrow, tubular forms, and the number of pseudotracheal branches has been extremely reduced. In the most derived forms, there is only a single, bifid pseudotrachea per labellum. Associated with this, the clypeus projects anteriorly, the most prominent clypeal forms occurring in the taxa with great elongation of the labium. *Isalomyia* is certainly a member of this lineage, as it has these proboscis modifications and strongly protruding clypeus (fig. 1), so its relationships must be sought among the African clades. The female holotype has the following notable features:

Antennal segmentation (fig. 5). – Eight flagellomeres are present, so no postpedicel has evolved; not only is this the primitive number in Brachycera, but another primitive condition is also present in that flagellomeres 1-7 have both chemoreceptor and mechanoreceptor sensilla (fig. 4). The terminal flagellomere 8 appears to have only tactile sensilla, so it has only a mechanoreceptor role for which its more slender form is appropriate. The only other vermileonid clades retaining eight flagellomeres are *Vermipardus* Stuckenberg, 1960, and *Vermilynx* Stuckenberg, 1995, both of Southern Africa; these two genera are distinctive and are not closely related to *Isalomyia* or to one another (see the conspectus of genera by Stuckenberg 2000).

Distribution of antennal sensilla (figs 4, 5). – The flagellum is relatively large, laterally flattened, and densely covered along the entire dorsal surface of flagellomeres 1-7 by tactile sensilla that appear to form almost a continuous proclinate layer. The terminal flagellomere has these sensilla over its entire surface. The only antennal form that warrants comparison is that of the Omani species *Lampromyia umbraticola* Stuckenberg & Fisher, 1999. Its antenna (fig. 6) is unique in having flagellomeres 1-6 fused into an exceptionally extended and enlarged postpedicel, bearing apically an unusually small style formed as shown of flagellomeres 7 and 8. It is also unique in having a strip of dense sensory vestiture dorsally along the entire length of the postpedicel, shown diagrammatically in fig. 6. In both *I. irwini* and *I. umbraticola* there is thus a comparable and evidently apomorphic distribution of sensilla, although their flagellar segmentation is entirely different.

Wing (fig. 7). – The wings of *I. irwini* and *I. umbraticola* are similar in shape and certain features of venation; in *I. umbraticola* (see Stuckenberg 2000, fig. 22), its short petiole and unspecialised form, retention of the crossvein m-cu, narrow fork of R_4 and R_5, and short radial-sector, are plesiomorphic (Stuckenberg & Fisher 1999); *I. irwini* has similar conditions, although the radial fork is wider. Possibly all these resemblances are plesiomorphies. In *I. irwini*, crossvein sc-r is unusually close to h, whereas in *I. umbraticola* it is about midway between the levels of h and the point of origin of the radial-sector (the usual