

Three introduced species of Mycetophilidae (Diptera: Sciaroidea) established in New Zealand

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Abstract

The presence of introduced fungus gnats (Diptera: Mycetophilidae) in New Zealand has gone largely unnoticed due to a lengthy period with little research on this group, and a lack of generalised collecting in urban areas. *Leia arsona*, *Sciophila parviareolata*, and *S. ocreata* are reported in New Zealand for the first time. The first two species are widespread in anthropogenic habitats and have been established for more than 20 years. The third species is known from a single urban locality, suggesting it is a more recent introduction.

Keywords: fungus gnats, new records, *Leia*, *Sciophila*.

Introduction

New Zealand has a rich fauna of endemic fungus gnats (Sciaroidea, *sensu* Matile 1990). That fauna is characterised by a high proportion of primitive taxa, including a quarter of the world's Ditomyiidae and the recently discovered endemic family Rangomaramidae (Jaschhof & Didham 2002). There are, however, very few records of introduced fungus gnats established here.

The most comprehensive review of the New Zealand fungus gnats is that of Tonnoir and Edwards (1927), which is still the major reference text for students of the New Zealand fauna and badly in need of revision. Little attention has been given to the New Zealand fungus gnats since 1927, and the few faunistic studies that have included fungus gnats have generally been focussed on collections from native forest communities (e.g. Davies 1988, Didham 1997, Toft *et al.* 2001), which may not be the most likely places to encounter recently introduced species. It is therefore of little surprise that the presence of introduced Mycetophilidae should go largely unnoticed.

Of the 267 fungus gnats listed by Tonnoir and Edwards (1927), all but two species (both Sciaridae) were considered endemic. A more recent study has suggested that another four of the

Sciaridae listed as endemic in Tonnoir and Edwards may have been accidentally introduced (Mohrig & Jaschhof, 1999). In the Keroplatidae, the one known adventive species is *Orfelia nemoralis* Meigen, a European insect generally associated with pasture (Martin 1983, Macfarlane & Andrew 2002), but that also occurs in forest fragments (Toft *et al.* 2001). The only other introduced fungus gnat previously recorded in New Zealand is *Ohakunea australiensis* Colless, an Australian species established on Kawau Island, in the Hauraki Gulf, where it is sympatric with the native *O. bicolor* Edwards (Jaschhof & Hippa 2003). *Ohakunea* is a peculiar genus that has sometimes been placed within the Sciaridae (Tonnoir & Edwards 1927, Steffan 1989), but does not fit within current family concepts in Sciaroidea (Jaschhof & Hippa 2003).

Although Mycetophilidae is by far the most species-rich of the sciaroid families, there have been no previous reports of introduced species established here. Recent collecting in urban areas has confirmed the presence of at least three introduced species of Mycetophilidae. Their discovery, distinguishing features, and aspects of their biology are described in this paper.

Unless otherwise stated, specimens are in the collections of Landcare Research at Nelson (NZAC – Nelson).

Leia arsona Hutson, 1978

Leia fasciata Storå 1937: 10 (junior primary homonym of *Neoglaphyoptera fasciata* Kertész, 1902:574. Diptera: Mycetophilidae)

Leia arsona Hutson, 1978: 123

The presence of *Leia arsona* in New Zealand was first noticed during a survey of urban insects in Nelson and Wellington in December 2001. A Malaise trap (Townes 1972) was set in each of eight Nelson residential gardens, seven Wellington residential gardens, and the Wellington Zoo. From

a two-week sample, *L. arsona* was found to be present at all sites, and was the most abundant mycetophilid collected in five Nelson sites and three Wellington sites. It was also found to be the most abundant mycetophilid around the port area of Nelson, where it was commonly collected in bottle traps baited with a fermenting brown sugar solution to collect introduced wasps, and on yellow sticky traps (Toft unpubl. data).

Subsequently, Dr I. G. Andrew of Palmerston North reviewed his private collection of Mycetophilidae and located a specimen of *L. arsona* taken from Taradale, near Napier, on 25 April 1984 (pers. comm.). To date, this is the earliest record of this species in New Zealand, but it may yet occur in unsorted material from earlier collections in urban areas. Recently, RJT has found *L. arsona* to be common in a number of residential gardens in Christchurch (Jan 2003), and abundant in an industrial area of Auckland (Feb 2003). Additional specimens have been found at Mangatawhiri (M. Stanley, Dec 2002, NZAC), and Palmerston North (I. Andrew, pers. comm.). We suspect this species is widespread in New Zealand, but do not yet know the limits of its distribution, especially in the south of the South Island.

Leia (Meigen 1818) is a large genus found in most parts of the world, but there are no native species in New Zealand, and the only representatives in the Australasian zoogeographic region are a few undescribed species reported from Tasmania (Tonnoir 1929). *Leia arsona* is an ornate species with contrasting black and orange markings and patterned wings (Fig. 1). Using Tonnoir and Edwards (1927), *L. arsona* keys to the genus *Anomalomyia* Hutton, which is the only New Zealand genus with which *Leia* could be easily confused. In fact, *L. arsona* is often collected in association with *Anomalomyia guttata* Hutton, which is one of the most abundant native mycetophilids (Tonnoir & Edwards 1927, Toft *et al.* 2001), and is similar in appearance. The genus *Leia* is easily distinguished from *Anomalomyia* by having the costal vein (C) ending at R_5 (Fig. 2), rather than extending beyond it. *Leia arsona* is also distinguished from *Anomalomyia* by having the last section of R_1 , r-m, and the stem of M all subequal in length (Fig. 2). The dark knobs of the halteres allow rapid distinction from *A. guttata*, but not some of the other *Anomalomyia*. The male genitalia are figured in

Chandler and Ribeiro (1995).

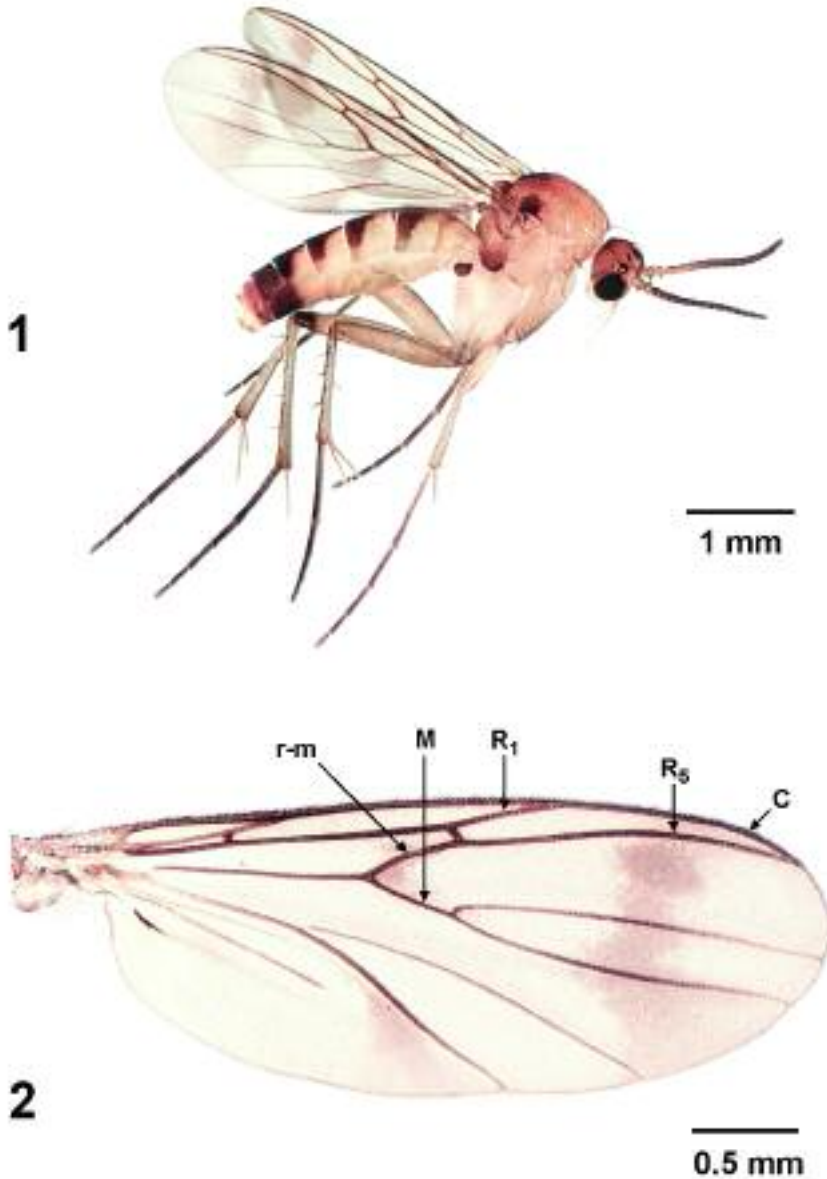
Leia arsona is one of very few Mycetophilidae known to be spread widely through trade, but its origin is uncertain. Hutson's (1978) description occurred as a result of a large infestation of "an undescribed African species" in 53 tons of rotting root ginger (*Zingiber officinale*) in a London warehouse. The warehouse infestation came to light after complaints of large numbers of flies entering a shop and office nearby. The ginger had been imported from Brazil six months earlier and Hutson recognised that *L. arsona* was most similar to a couple of species described from South America, but when he checked the collections at the British Museum he found specimens of this species from South Africa, Kenya, and the island of St Helena in the mid-Atlantic. Hutson therefore suggested *L. arsona* was probably an African species belonging to a primarily South American species group. He suggested it was unlikely that such large numbers could have developed on the ginger in six months, and it was "more likely that the fly was already present in the warehouse or its environs from a previous shipment of some African product". However, this argument is somewhat at odds with a comment in the same paper that the warehouse had previously "stood empty for several years". Hutson concedes, "While the possibility that the African records are the result of a (Neotropical) introduction cannot be ruled out, it seems inadvisable to base the description of this new species on the British material". A fire destroyed the London warehouse and all its contents shortly after the discovery of the infestation. There were no further records of this species on the British mainland for 29 years, perhaps indicating that it had arrived with the ginger.

Since Hutson's original description, *L. arsona* has been reported in large numbers infesting rotting *Gerbera* roots in nurseries in Holland (Burger *et al.* 1984). Chandler and Ribeiro (1995) established the synonymy of *L. arsona* with *L. fasciata* Storå, which was previously considered endemic in the Canary Islands, and reported it to be widespread around the tropical Atlantic and Mediterranean, with records from the Cape Verde Islands, Madeira, Azores, Algeria, Tunisia (citing Väisänen 1984), Malta, and Israel. They also reported the capture of a female from Jersey, one of the Channel Islands. Additional records include a specimen in the

Zurich Museum (Entomologische Sammlung, ETH) that was collected in Switzerland in 1991, and the only subsequent record from the British mainland consisting of a female reared from a larva found in the neck of a slightly decayed *Hippeastrum* bulb at a house in Congleton, Cheshire. This bulb may have been imported from Holland.

The biology of *L. arsona* is poorly understood. In the infestation at the London warehouse discussed

above, Hutson (1978) found the larvae and pupae “living in a silk platform” on the undersurface of the rotting root ginger. Burger *et al.* (1984) reported that the larvae lived in the fungal mycelium between the rotting roots of *Gerbera* flowers, and that they were therefore a consequence of root rot rather than the cause of it. In Israel, *L. arsona* has been reared from larvae living inside the damp funnel of a bromeliad (Chandler 1994), and in



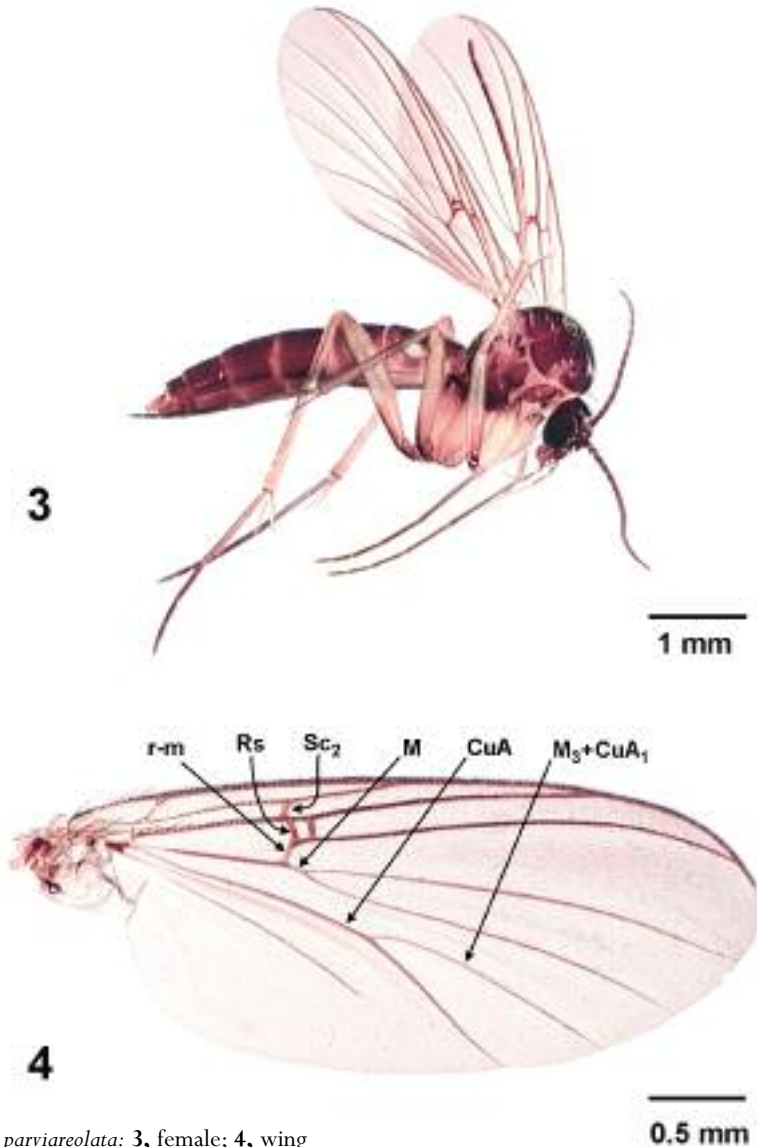
Figs. 1, 2. *Leia arsona*: 1, male; 2, wing venation.

Tunisia there has been a suggested association with date palms (Väisänen 1984). It is clear that, given an abundant food supply, *L. arsona* can reach very high densities and become a nuisance for those living or working in the close vicinity (Hutson 1978, Burger *et al.* 1984).

In the Mediterranean and Atlantic islands, *L. arsona* is anthropophilous and often associated with cultivated areas (Chandler 1994). This appears consistent with the situation in New Zealand, as

this species has not been found in native forest (Toft *et al.* 2001, Toft unpublished data, Jaschhof pers. comm.), nor was it found in a recent comparison of introduced and native scrub communities near Nelson (Harris *et al.* in press). Its favoured habitats include urban gardens, industrial areas and shipping ports—a further indication of its propensity to be transported around the world.

In the subtropical part of its range, *L. arsona* is active through most of the year. In New Zealand, records currently extend from November to April.



Figs. 3, 4. *Sciophila parviareolata*: 3, female; 4, wing venation.

Sciophila parviareolata Santos Abreu, 1920

Sciophila parviareolata Santos Abreu, 1920: 28

Sciophila hirta authors, not Meigen, 1818, misid.

The genus *Sciophila* Meigen is primarily Holarctic, with few species known from the southern hemisphere and none native to the Australasian region (Matile 1989). The earliest known *Sciophila* in New Zealand was a female found on the window of a Palmerston North house by Dr I. G. Andrew on 16 October 1983 (Andrew collection). This was tentatively identified as *S. hirta* Meigen, a common British species. Six other, apparently conspecific, *Sciophila* specimens have been collected by RJT: 1♂, yellow bottle trap baited with fermenting brown sugar, port of Nelson, 28 Nov–7 Dec 2001 (specimen in PJC collection); 1♂, mini-Malaise trap, port of Nelson, 4–11 Dec 2001; 1♀, mini-Malaise trap, port of Nelson, 28 Feb–7 Mar 2002; 1♀, on window, Landcare Research, Nelson, 5 Sep 2002; 1♂, Malaise trap, Hillmorton, Christchurch, 8 Jan–4 Feb 2003; 1♀, Ilam, Christchurch, 8 Jan–4 Feb 2003.

Sciophila parviareolata has often been confused with *S. hirta*, as the two appear inseparable, apart from features of the male genitalia (Chandler 2001). Indeed, the two species were previously synonymised by Zaitzev (1982). All male specimens from New Zealand are consistent with *parviareolata* rather than *hirta*, and it is therefore reasonable to accept that the females are also *parviareolata*.

Sciophila parviareolata is a small, dark-bodied species with yellowish thoracic setae and pale yellow legs (Fig. 3). All segments of the antennal flagellum are dark. The tip of the hind femur is usually darkened, but this can be vaguely indicated in some specimens. The wings are unpatterned with an even covering of macrotrichia and microtrichia on the membrane. Using the key of Tonnoir and Edwards (1927) to identify a *Sciophila* will take you to a couplet separating the genera *Parvicellula* Marshall and *Morganiella* Tonnoir and Edwards, but it will not match either of those taxa due to characteristics of the wing venation. *Sciophila* is easily distinguished from *Parvicellula* by having CuA forked rather than simple, and is distinguished from *Morganiella* by having Sc₂ close to the base of Rs (Fig. 4), rather than well distal to it. *Sciophila parviareolata* is also distinguished from *Morganiella*

by having the base of M₃+CuA₁ complete, and the stem of M very short, being no longer than r-m or the base of Rs.

The type locality of *S. parviareolata* is the Canary Islands, but given its anthropogenic dispersal ability, it is difficult to know whether it is native there. It is allied to Palearctic species, and the distribution records include Portugal, Spain, and the UK (Chandler 2001). It is also established on the remote Gough Island in the South Atlantic, where it is the only known mycetophilid, and thought to have arrived there with building materials or crates (Jones *et al.* 2003). It has been in Britain since at least 1886, but the only records in the last 60 years have been from the gardens of Buckingham Palace (Chandler 2001).

The biology of *S. parviareolata* is unknown. Several other *Sciophila* species have been reared from fungal sporophores, and the closely related *S. hirta* feeds on a wide range of fungi (Hutson *et al.* 1980). In Britain most of the *S. parviareolata* records are from indoors, and Jones *et al.* (2003) suggested they might breed on fungi associated with household timber. Two out of the five New Zealand records are also from indoors, and the remaining three are from industrial areas of the port of Nelson. Unlike *L. arsona*, it only occurs in low numbers.

Sciophila ocreata Philippi

Sciophila ocreata Philippi, 1865: 625

Six males and five females of another species of *Sciophila* were collected in a series of Malaise trap samples from the perimeter of a large warehouse at Wiri, Auckland, from January to March 2003. Comparison with material in the British Museum (BMNH) confirmed this species is *S. ocreata*, which belongs to a South American group of species. The known native range is restricted to central Chile at a latitude parallel to Auckland, with records from Los Andes and the Marga-Marga Valley (Freeman 1951). It has also been collected on the Juan Fernández Islands (Freeman 1953), 700 km off the Chilean coast, perhaps indicating a propensity for being shipped about in a way similar to *S. parviareolata*. This species was relatively common around the Wiri warehouse, and probably has a wider distribution around Auckland at least, but this has yet to be confirmed.

In contrast to *S. parviareolata*, this species has the



Fig. 5. *Sciophila ocreata*, female.

basal antennal flagellomere pale brown, with subsequent segments becoming darker, and the thorax is variegated with pale brown (Fig. 5). The wing venation is similar to the previous species. The males are easily distinguished from those of *S. parviareolata* by the deep U-shaped emargination of the ninth tergite. PJC is preparing a separate publication in which *S. ocreata* and the related South American species will be redescribed.

Discussion

Both *L. arsona* and *S. parviareolata* have been present in New Zealand for more than twenty years and appear widespread, although we do not yet know if their range is still extending or whether they can invade native habitats. *Leia arsona* is very abundant in anthropogenic habitats and it may be competing with native fungus gnats, such as the related *Anomalomyia guttata*, which often occurs sympatrically. *Sciophila ocreata* is currently known from just one locality and may be a more recent addition to the fauna.

Like the majority of other alien species, these fungus gnats are able to take advantage of human transportation networks for long-distance dispersal. Hence the centres of new populations of such species are most likely to be found in urban areas. That we are only now reporting the establishment of these flies is due largely to a lack of research on the New Zealand mycetophilid fauna since the Tonnoir and Edwards (1927) review, but

also because there has been scant attention given to general sampling in urban areas as opposed to native habitats. Sampling conducted in these anthropogenic habitats is usually focussed on detecting particular pests and alien species of known medical or economic concern. The three species discussed here were quickly identified as potential aliens because they belong to genera not previously found in New Zealand. Other introduced fungus gnats could be hidden in globally-distributed genera with an abundance of undescribed endemic species (e.g. *Zygomysia* and *Tetragoneura*).

It is likely many other small invertebrates have established here undetected. The establishment of apparently 'harmless' species, such as fungus gnats, seems to pose no obvious economic or environmental threats. However, for the majority of introduced invertebrates, we remain largely ignorant of both their actual and potential impacts.

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