

Unexpected records of spear-winged fly larvae (Diptera: Lonchopteridae) from New Zealand streams

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Introduction

The purpose of this note is to report the unexpected finding of dipteran larvae belonging to the family Lonchopteridae in aquatic samples taken from South Island streams. Because lonchopterid larvae are not included in New Zealand keys to either terrestrial or aquatic insects I provide a brief description of a larva and summarise aspects of the larval biology.

The Lonchopteridae, spear-winged or pointed-wing flies, occur in many parts of the world, but no species are endemic to New Zealand. The adult flies are small, brownish or yellowish insects 2-5 mm long with pointed wings that are folded flat above the abdomen at rest (Harrison 1950; Bartak 2008). Although several genera have been erected in the family, Klymko and Marshall (2008) considered there was little justification for dividing the group into multiple genera and all extant lonchopterids are generally treated as belonging to a single genus, *Lonchoptera* Meigen.

The cosmopolitan *L. bifurcata* (Fallén) is the only species found in New Zealand. This species was initially reported by Harrison (1950) from the Auckland area as *Lonchoptera dubia* Curran, which along with *L. furcata* Fallén (a name also found in the New Zealand literature) are now considered to be synonyms of *L. bifurcata*. Subsequently, adults were taken in sweep samples from pastures at numerous localities throughout the North Island (Cumber and Harrison 1959) and records posted on the NatureWatch New Zealand website (<http://naturewatch.org.nz>) between 2013 and 2017 indicate it has a distribution extending from at least Whangarei to Dunedin. Unlike other species of *Lonchoptera*, *L. bifurcata* is parthenogenetic, with several ‘chromosomal races’ showing small differences in wing venation being recognised in North America by Stalker (1956). More recently,

Ochman et al. (1980) demonstrated clonal variation within *L. bifurcata* using starch gel electrophoresis.

The main habitat of larvae is generally considered to be amongst dead leaves and other decaying vegetation (Smith 1996; Bartak 2008). Ferrar (1987) stated they preferred to live amongst leaves in a humid environment, and Brindle and Smith (1978) also emphasised their need for moisture. The larvae of *L. nigrociliata* Duda have been found under small rocks on shingle shorelines (Drake 1996) and at least two species have been found in springs and seeps (Klymko and Marshall 2008; Omelkova et al. 2013). Additionally, Smith (1996) commented that *L. bifurcata* had been found on brussels sprouts and turnips and speculated that transportation with vegetables combined with its parthenogenetic reproduction might explain its cosmopolitan distribution.

Little is known about the biology or ecology of lonchopterid larvae. However, Baud (1970) reported that *L. bifurcata* and *L. lutea* Panzer had six larval instars and that larval + pupal development took 34-48 days at 20±2°C. Given their preferred habitat appears to be amongst decaying plant material it is not surprising that larvae are thought to be saprophagous, ingesting fine organic particles and associated microorganisms such as bacteria and fungi (Stalker 1956; Baud 1970; Jones 1979; Bartak 2008). Ferrar (1987) considered they scraped microbes from fallen leaves and noted that known gut contents included fungal spores, coccoid algal cells, pollen, fine humic materials, fungal hyphae, testate amoebae and bacteria. The gut contents of the *L. bifurcata* larva shown in Figure 1 included fine organic and inorganic particles, algal filaments, fungal hyphae and spores.

Larval morphology

The anatomy and external morphology of the larva of *Lonchoptera* was described in detail (in German) by de Meijere (1900) and subsequent descriptions have been provided by Whitten (1956) and Peterson (1987). The cephalopharyngeal skeleton was described by Ferrar (1987). I follow the terminology of Peterson (1987) in defining the thoracic segment with the serrated anterior margin as the metathorax, posterior to which the first two abdominal segments are fused together. In contrast, earlier authors considered the metathorax of Peterson to be the mesothorax. Larvae are ventrally flattened and dorsally rounded, about twice as long as wide and up

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to 4 mm long (Foote 1991). Pairs of long filaments are present on the thorax and at the posterior end of the abdomen.

The mobile head is not sclerotised. The sclerotised metanotum has a prominently serrated anterior margin. The first two abdominal segments are fused, as are the last two abdominal segments. The abdomen bears seven notal plates, which have a finely mottled appearance produced by large numbers of very small, slightly raised, hexagonal protrusions. In life, larvae have a yellowish grey-green colour, but alcohol-preserved material I have seen is white or yellowish-white. Colourless, striated plates occur laterally on most body segments. Larvae lack eyes, legs or prolegs and are amphineustic with functional spiracles on the first thoracic and last abdominal segments (Whitten 1956).

New Zealand larvae (*Lonchoptera bifurcata*)

Material examined

Four alcohol-preserved larvae collected in stream samples and referred to me for identification.

1 larva, Tent Burn, Beachcroft Road, Southbridge, 8 January 2009, Michelle Greenwood, University of Canterbury.

1 larva, Waipahi River near The Cairns, SE of Gore. 7 February 2010, Amber Sinton, EOS Ecology, Christchurch.

1 larva, small spring-fed stream in pasture, Ashburton Forks, 18 March 2015, Haley Devlin, University of Canterbury (mounted on slide).

1 larva, tributary of Lower Pahaoa River, Wairarapa, 23 March 2017, Nick Hempston, EOS Ecology, Christchurch.

Description

A larva (length 3.1 mm) mounted in lactophenol-PVA is shown in Figures 1 and 2. A 5th instar larva of *L. bifurcata* figured by Bode (1973) was 2.8 mm long, suggesting that the New Zealand specimens are final (6th) instar larvae.

Morphological features that can be seen are as follows. The head bears two pairs of short appendages: maxillary palps that are 1-segmented and have a broad base and 2-segmented antennae, which are three times longer than the maxillary palps. The cephalopharyngeal skeleton is prominent and bears a pair of curved mouth hooks. Three pairs of long filamentous processes are present on the thorax. The first pair (length 0.46 mm) arises from the pronotum, whereas the other two pairs extend from the serrated anterior margin of the metanotum.

The more central filaments are the longest (0.63 mm) and the more lateral pair, the shortest (0.36 mm). A complex 'spine' with a bifid distal section is present at the base of each lateral metanotal filament. Similar spines of variable length arise from each of the lateral striated plates, which also bear short, pointed spines anterior to the more complex, distally bifid spines. Anterior spiracles with very short stalks are prominent on the pronotum and black posterior spiracles are present on longer stalks antero-lateral to the long (0.55 mm) posterior spines. The raised protrusions on the dorsal surface can be seen as dotted hexagons in Figure 2.

Comments

Most descriptions of lonchopterid larvae state there are two pairs of long anterior filaments and one pair of long posterior filaments. In contrast, *L. bifurcata* clearly has three pairs of long anterior filaments as seen in Figure 2 and in the figure provided by Baud (1973). The reason for this discrepancy is that the lateral metanotal filament is much shorter in other species that have been illustrated in the literature (i.e. *L. fallax* de Meijere, *L. lutea*, *L. tristis* Meigen) and in books and monographs in which unidentified Lonchoptera larvae are figured (e.g., Brindle and Smith 1978, Peterson 1987, Foote 1991, Courtney et al. 2000). Because many described species of *Lonchoptera* are not known as larvae it is unclear whether long lateral metanotal filaments occur in other species.

It is also unknown whether larvae of *L. bifurcata* occur naturally in streams or whether individuals present in aquatic samples were taken fortuitously or accidentally. Streams where they have been found are in pastoral land with a variety of shrubs, grasses and emergent macrophytes at their margins. Given that they require access to air for gas exchange and require a moist or humid microenvironment it is likely that suitable larval habitat in streams or rivers

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would be at the channel margin or amongst debris or stones which break the surface of the water.

Figure 1. A slide-mounted larva of *Lonchoptera bifurcata* collected at the Ashburton Forks showing the general body form, anterior and posterior filaments, lateral spines posterior spiracles and gut contents dominated by detritus.

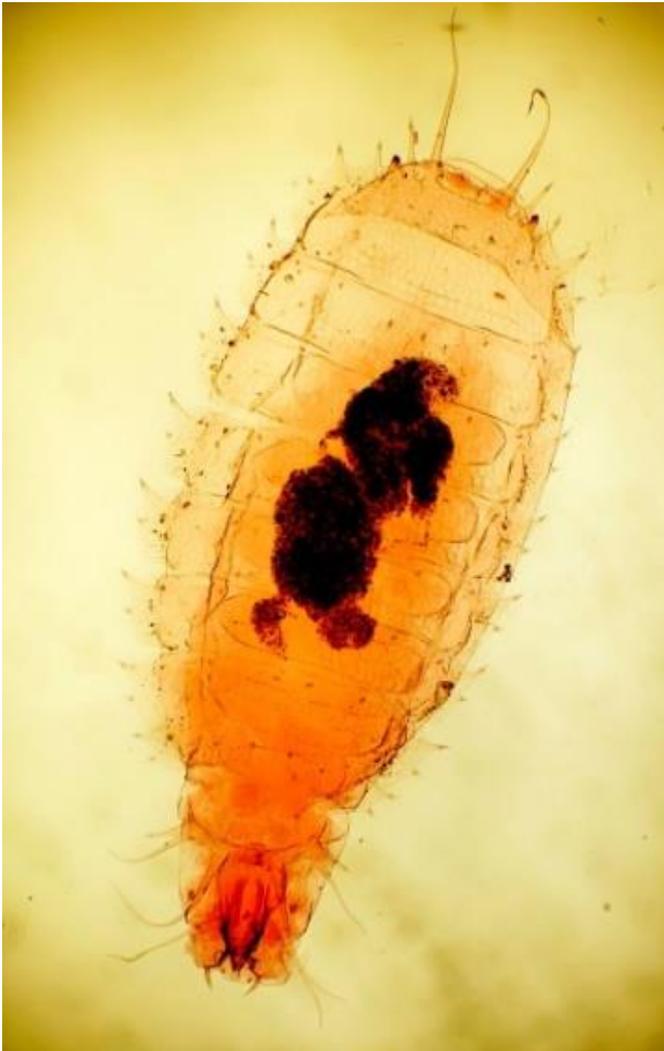


Figure 2. Anterior end of larva showing antennae, maxillary palps, cephalopharyngeal skeleton, anterior spiracles and long anterior filaments. A lateral abdominal plate with associated spines can be seen at the upper right of the figure.



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