Parasitism of *Neoconocephalus* katydids by *Ormia lineifrons* Sabrosky (Tachinidae: Ormiini)

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Tachinids are endoparasitoids of insects and a few other arthropods and the vast majority of them find hosts through olfactory and visual cues (Stireman et al. 2006). However, there is one small group of tachinids that has evolved a special way of locating hosts. This group has the ability to hear mating calls of their orthopteran hosts, which are mostly crickets, katydids and mole crickets (Lehmann 2003). They are able to detect sound through their prosternum, a structure on the underside of the thorax between the front legs. The prosternum in most tachinids and other flies is a narrow sclerotized plate but in these sound-detecting tachinids it has evolved into an inflated and intricate tympanal organ (Robert et al. 1992). Mechanical coupling within this hearing organ provides accurate directional hearing that allows these flies to home in on and parasitize calling hosts (Miles et al. 1995, Hoy & Robert 1996).

These sound-detecting tachinids are believed to belong to a single evolutionary lineage and have been assigned to their own tribe, the Ormiini, in subfamily Tachininae. This small tribe has only seven genera and 71 species but is worldwide in distribution (O'Hara et al. 2020). More than half the species belong to two New World genera, *Ormia* Robineau-Desvoidy (27 species in the Nearctic and Neotropical regions) and *Ormiophasia* Townsend (16 species, all Neotropical; Gudin & Nihei 2019).

Figures 1–2. Male of *Ormia lineifrons* Sabrosky. Collection data: USA, Florida, Lake Placid, Archbold Biological Station, 20-24.iii.1972, coll. L. Edwards, R. Morse, M. Turell & R. Lederhouse (deposited in the Canadian National Collection of Insects, Ottawa). **1**. Frontal view. **2**. Left lateral view. (Photos by S.J. Henderson.)

Most studies on sound reception, host-parasitoid relationships, and other characteristics that are unique to ormiines have involved *Ormia ochracea* (Bigot), a species widespread throughout the Americas and an immigrant species in Hawaii (e.g., Cade 1975, Robert et al. 1992, Walker 1993, Mason 2021, Broder 2022). I studied a lesser known ormiine species for my Master's thesis, *Ormia lineifrons* Sabrosky (Rogers 2021, Rogers & Beckers 2022) (Figs. 1, 2). This species is widespread in the Americas and parasitizes male katydids.

Only one host species was known for *O. lineifrons* when I started my thesis, the broad-tipped conehead katydid *Neoconocephalus triops* (Linnaeus). This record was based on rearings by Burk (1982) in Florida. Another observation that had been published on *O. lineifrons* in Florida noted the two sexes "hilltopping" for mating purposes, but not during the day as do most hilltopping tachinids but just after sunset and lasting less than 15 minutes (Lederhouse et al. 1976). The authors observed the same behavior in *Ormia dominicana* Townsend, and later Wood (1996) reported similar behavior in *Ormia reinhardi* (Sabrosky) in western Quebec. The male *O. lineifrons* shown in Figs. 1–2 was one of the original specimens upon which the observations of Lederhouse et al. (1976) were based.

Figure 3. Male *Neoconocephalus robustus* host multi-parasitized by *Ormia lineifrons* (puparium in yellow circle) and nematomorph parasites (red circle). (Photo by author.)

Katydids in the genus *Neoconocephalus* Karny (Tettigoniidae) rely on acoustic communication for mating, wherein males produce species-specific calls to attract females. My thesis focused on the parasitism of *Neoconocephalus* hosts by *O. lineifrons* in the vicinity of Murray, western Kentucky (Rogers 2021). I collected *Neoconocephalus* in fields from April to September in 2019 and March to October in 2020. I found the katydids by driving on country roads at night with open windows, listening for the loud and conspicuous calls of the males. I used these calls to locate the males, which I collected and took back to the lab to rear. I also tried to attract *Ormia* to recordings of the mating calls of *N. velox* Rehn & Hebard but this was unsuccessful. I collected close to 400 katydids belonging to six *Neoconocephalus* species during the 2019 and 2020 seasons. I found four of the species parasitized by *O. lineifrons*: *N. triops*, *N. nebrascensis* (Bruner), *N. robustus* (Scudder) and *N. velox* (Rogers 2021, Rogers & Beckers 2022). Of these, the last three were new records of parasitism by *O. lineifrons*. This parasitoid exerts a strong selective force on its hosts because it inevitably kills hosts within seven to nine days after parasitization.

An additional finding I can report here, that was not reported in my thesis, was the discovery of a captured male of *N. robustus* parasitized by both *O. lineifrons* and a horsehair worm (Nematomorpha: Gordioidea), possibly *Gordius* sp. (Fig. 3). Parasitism of *N. robustus* by *Gordius* sp. was reported once before by Nutting (1953: 76) based on records from Cape Cod, Massachusetts.

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