



## *Megaselia scalaris* (Loew): A Parasitoid of *Spodoptera frugiperda* (J. E. Smith)

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The fall armyworm *Spodoptera frugiperda* (J.E. Smith) is a major pest on maize crop. Managing the pest in safer ways include utilization of biological control agents instead of chemical insecticides. Among various natural enemies, a phorid, *Megaselia scalaris* (Loew, 1866) has been found to infest FAW both in fields and laboratory conditions but its potency against the pest is still questionable.

**Key words:** Phorid, *Megaselia scalaris*, *Spodoptera frugiperda*, Parasitoid, Management

### Introduction

The fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) is a highly polyphagous agricultural insect pest infesting varieties of host plants, especially corn. Biological control has been used for management of FAW for many years and it has gained renewed interest because of problems caused by the intensive use of pesticides. Most concentrated efforts for biological control appear to be directed towards the 'rear and release' under augmentation, importation and conservation. The occurrence and parasitism rate of FAW parasitoids varies significantly between localities, crop practices, stage of the plant, and season. This information is needed to assess the potential value of the existing larval parasitoid fauna in controlling FAW (Ruíz-Nájera *et al.*, 2007). In India, FAW has become a major threat in maize cultivation since its invasion in 2018 (Deshmukh *et al.*, 2021).

It is vital to investigate the natural enemies and their dynamics with respect to the host insect through field surveys to know their importance (Molina-Ochoa *et al.*, 2003). There are parasitoids belonging to Hymenoptera and Diptera which are found infesting FAW. Five dipteran parasitoids belonging to family Tachinidae (*Archytas marmoratus* (Townsend), *Lespesia archippivora* (Riley), *Archytas* sp., and *Winthemia* sp.) and *Megaselia scalaris* (Loew, 1866) from Phoridae are well known.

Phorids are also called as scuttle flies, humpbacked flies, coffin flies. Globally, over 4000 species under 230 genera of phorids are found, with 1700 species in *Megaselia* genus alone (Arafat *et al.*, 2024). *Megaselia scalaris* has known to be infesting late-instar larvae of FAW from Americas and the Caribbean Basin in 2003 (Molina-Ochoa *et al.*, 2003). In addition to later instars (5<sup>th</sup> and 6<sup>th</sup> instars), it has been noticed on pupae with a parasitism rate of 1.04 percent in Mexico (Ruíz-Nájera *et al.*, 2007). In India, the species was recorded as a laboratory parasitoid of FAW when 30-40 maggots of *M. scalaris* were observed emerging out from the dead pre-pupa and pupa of laboratory-reared FAW (Deshmukh *et al.*, 2021).

## Habit and habitat of *Megaselia scalaris*

*Megaselia scalaris* is a facultative omnivorous parasite, parasitoid, synanthropic, phytophagous, and coprophagous species capable of exploring a large variety of ecological niches. Adults feed primarily on sugars, while maggots are detritivores feeding on food of both animal and plant origin. They primarily thrive in moist unsanitary vicinities such as dumpsters, rotting meat, vegetable remains, trash containers, public washrooms, homes, and sewer pipes, supported by the unique behavior of maggots swallowing air when exposed to pools of liquid allowing them to float. They are endoparasitoids of American cockroach, *Periplaneta americana*, *Nezara viridula*, attacking any developmental stage (Arafat et al., 2024; Bugguide, 2024; Deshmukh et al., 2021; El-Hawagry et al., 2021).

Due to their exceptional tiny size and capability to penetrate tightly closed containers, they are well known laboratory pests on arthropod cultures and also hold a stand in forensic Entomology. Additionally, there are reports of accidental human myiasis underscoring their medical importance,

## Biology

The adult flies are yellowish brown with many long bristles (Fig. 1) and they are 1-6mm long. Females have a narrow extension of last (6<sup>th</sup>) abdominal tergite, while males have a distinct terminalia (Deshmukh et al., 2021).

Mature females lay up to 1-15 pearl white color eggs on the outer surface of late-instar larvae, pre-pupae and pupae of the FAW (Fig. 2). Eggs hatch in 1-2 days after oviposition. Neonates are creamy white in color. There are 3 larval instars of 1-8mm length lasting for 5-8 days. Pupae are coarctate type, amphineustic, light brown in color and possess respiratory tube or thoracic horn. Female pupae are bigger than male pupae and they last for 10-11 days, while adults live for 6-7 days (Deshmukh et al., 2021; El-Hawagry et al., 2021).



Even though *M. scalaris* has been observed infesting FAW in both fields and in labs, utilizing it as a potential biological control agent is questionable. They mostly (84.3%) prefer to saprophagously develop on meridic diet (Fig. 3), and as necrophagous on dead larvae (12.7%). Its development as an endoparasitoid occurred in 2.2 and 0.7% in third and fifth instar larvae, respectively. This suggests that it has no potential as a biological control agent for FAW (Acevedo-Alcalá et al., 2023).

## Conclusion

*Megaselia scalaris* is a facultative parasitoid having a wide host range. The species has high reproductive capability and exceptional adaptability making it thrive in the least explored habitats. Phorids can cause significant issues in the laboratory rearing of insects, and it is crucial to address this problem in a manner that does not harm the culture. Utilizing the species as one among the potent biocontrol agents requires more research.

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