



## First record of *Megaselia scalaris* (Loew, 1866) (Diptera: Phoridae) as a facultative parasite to *Agrotis ipsilon* (Hufnagel) at Menoufia Governorate, Egypt

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### ABSTRACT

During laboratory rearing of black cutworm, *Agrotis ipsilon* in the Experimental Station of Agricultural Research, At Sers Ellyan city, Menoufia governorate, at October 2020 under  $25 \pm 2^\circ\text{C}$  and  $60 \pm 5\%$  RH conditions, for biological and toxicological studies, it was observed that the most of pupae of the black cutworm, *A. ipsilon* were destroyed and numerous of small larvae were found alive inside the pupa fluid as a parasite. The small larvae of the parasite were placed in individual glass jars and kept in the same conditions as previously mentioned for observation until pupation process was completed. Emerged adult flies of the parasite from pupae at different stages were collected and placed in glass vials to send to the laboratory of The Insect Taxonomy Department, Plant Protection Research Institute, Dokki, Giza, Egypt for identification. The taxonomic identification of adult flies was done and classified as order: Diptera, Family Phoridae, *Megaselia scalaris* (Loew) as a facultative parasite of *A. ipsilon* for the first time in Menoufia governorate, Egypt.

**Key words:** Parasite, scuttle fly, *Megaselia scalaris*, black cutworm.

### INTRODUCTION

Biological control occupied a great importance of many studies, as the use of natural enemies will help to reduce chemical control environment and food safety implications.

Parasitoids in insect science, is an insect whose larvae feed and develop within or on the bodies of other arthropods. Each parasitoid larva develops on a single individual host and eventually kills the host. All over the world more than 68000 parasitoid were named to the stage of species and more others have not yet to be named and described (John, 2015).

Humpbacked, coffin or scuttle fly, *Megaselia scalaris*, is considered as

a cosmopolitan scavenging insect. As well as it has medical importance as a cause of human myiasis. It is also had an important value in Forensic Entomology and biological control. On the other hand it attacks some plants such as corn, food and seed deposits, germinated seeds, cultivated and non-cultivated mushroom and fruits like bananas. The parasitoid behavior of the scuttle fly larvae gives this fly the ability to feed on a lot of other insects of agronomic, veterinary and medical importance, such as insects of the orders: Orthoptera, Hemiptera, Diptera, Lepidoptera and Coleoptera,

which are of agricultural importance (Ismail, 2018).

The insect is a polyphagous species. These flies can explore a large variety of environmental and ecological niches (Abdel-Gawad, 2018). Phorids are small flies (1-6 mm) found worldwide. They are known as "Scuttle fly" because they move in rapid bursts with short pauses. The genus *Megaselia* includes around 1400 species distributed in tropical and subtropical areas which capable of exploring at large variety of environments. Several authors indicated that *Megaselia scalaris* acting as a parasitoid of insects of agronomic importance (Costa *et al.*, 2007). They are also known as "humpbacked flies" due to their humpbacked appearance, and "coffin flies" because adult females are known to dig down two meters deep in order to reach buried corpses and penetrate closed containers such as coffins to lay their eggs (El-Hawagry *et al.*, 2021).

*Megaselia scalaris* has been identified as a scavenger of *Apis mellifera* in Spain. *Megaselia scalaris* can be considered as a facultative parasitoid of *Apis mellifera* under India climatic condition (Debnath and Roy, 2018). The larvae of *M. scalaris* have been described as detritivore, parasite, facultative parasite and parasitoid.

These flies consuming a wider spectrum of organic materials of both animal and plant origin than any other insects. *Megaselia scalaris* is known for overpassing double layers of cloths or fine meshes with their ovipositors leading to larvae invading insect

containers. The life cycle of *Megaselia scalaris* requires considerable levels of moisture to allow larvae development (Koch, 2013). Recently, *Megaselia scalaris* fly has been utilized as a primary player in bio-control of pest insects. The immature stages of this species have been described as detritivor, parasite and coprophagous. The adult is reported as polyphagous organism.

Field reports have demonstrated the ability of *M. scalaris* to feed on a wide range of living arthropods, including members of the orders: Diptera, Orthoptera, Lepidoptera (Chakraborty *et al.*, 2016). *Megaselia scalaris* can cause reduction on the tick egg production, but the level of this reduction still has to be determined (Andreotti *et al.*, 2003).

In Egypt the winter season is the active season of black cutworm, *Agrotis ipsilon* (Dawod, 2017). The black cutworm, *Agrotis ipsilon* is one of the major pests with a wide host range, consider one of the most important seedling pest of several economic plants, having a wide host range not only in Egypt but also in several countries (Ibrahim *et al.*, 2017).

The problems caused by pesticides and their residues have amplified the need for effective and biodegradable pesticides with great selectivity (Sharaby and El-Nojiban, 2015). It is a polyphagous serious pest of different economic plants found throughout the world as well as it is a serious pest of golf courses, vegetable plants and field corps (Ghafoor, 2011).

## MATERIALS AND METHODS

*Megaselia scalaris* stages were coincidentally found in the laboratory during the rearing process of a black cutworm, *Agrotis ipsilon* strain on castor, *Ricinus communis* L. leaves as a natural feeding at Agricultural Research Station of Sers El-Iyan, Menoufia governorate in incubator under constant conditions ( $25\pm 2^{\circ}\text{C}$  &  $60\pm 5\%$  R.H.) at October 2020. Adult flies were observed moving into glass jars which covered with piece of muslin. Some pupae of *Agrotis ipsilon* were destroyed (Fig. 1).



**Fig.1). Pupae of *Agrotis ipsilon* infesting with the parasite.**

These destroyed pupae were removed carefully and it was examined in Petri dish 10-cm in diameter. During the examination small creamy white larvae were observed into the pupae of *A. ipsilon* (Fig. 2).

These larvae were removed carefully and individually transferred into small glass jar in the laboratory under conditions as previously mentioned. Daily observation was done until pupation process. El-Hawagry *et al.*, 2021 described and illustrated the larval instar of *Megaselia scalaris*, as the color of body was almost creamy white. The larvae of *M. scalaris* passes two molts leading three larval instars.

The first and second larval instars measure 0.75 – 2 mm in length. Although the length of a larva is function of its age, this relationship varies with temperature degrees (Disney, 2008).



**Fig. 2) *M. scalaris* parasitic larvae in pupa**

The first and second instar larvae were cylindrical, narrowed toward the head, with two cephalic lobes and six sensory papillae positioned tangential to the antenna. The third instar larva of *M. scalaris* is similar to the first and second ones. However, it is creamy white and 4 mm in length. The body is cylindrical and tapers toward the head. The integument is composed dorsally and laterally of short spinous processes. The cephalic segment is composed of a pair of dorsal organs (antenna), with a pair of maxillary palp complexes and a mouthpart. The antenna is dome-shaped with one cylindrical coeloconic sensillum which placed laterally and centrally. The maxillary palp complex consists of several types of papillae (Sukontason *et al.*, 2002). After maturing the larvae instars and developed to the pupae, it transferred to a clean filter paper and daily observed (Fig.3).



**Fig. 3) Pupae of *M. scalaris***

Male larvae of *M. scalaris* pupariate two days earlier than the female larvae at 25 °C and the pupal periods of the males are also shorter (Disney, 2008).

Pupa of *M. scalaris* has a pair of long and slender pupal respiratory horns at the end of the fifth dorsal segment. There is an cephalic segment with a pair of antennae at the ventral part (El-Hawagry *et al.*, 2021). After 5-7 days from starting pupation period most dipterans adults started to emergence and were photographed (Fig. 4).



**Fig. 4) Adult of *M. scalaris* parasite after emergency**

Adult flies which were emerged from pupae at different stages were prepared and sent to the laboratory of Insect Taxonomy Department, Plant Protection Research Institute for identification. The taxonomic identification of adult flies was done and classified as order: Diptera , Family: Phoridae, *Megaselia scalaris* (Loew).

## CONCLUSION

We emphasize here the first record for coffin or scuttle fly, *Megaselia scalaris* (Loew, 1866) (Diptera: Phoridae) as a facultative parasite to black cutworm, *Agrotis ipsilon* (Hufnagel) for the first time (October 2020) in the Experimental Station of Agricultural Research, at Sers Ellyan city, Menoufia governorate. This parasite may be play an important role in the control of lepidopterous pests in Egypt and could be included in the IPM programs , but it needs more studied under field conditions.

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