Original Research Article

Field studies on supper parasitism of the larval pupal endoparasitiod *Opuis pallipes* on the tomato leaf miner *Liriomyza bryoniae* and the serpentine leaf miner *Liriomyza trifolii* in Libya

ABSTRACT

Super parasitism caused by *O. pallipes* females on *L. trifolii* recorded high numbers during December and April and reached its peak at December 31th recording (36 superparasitized larvae/100 parasitized ones), while the host population recorded (136 *L. trifolii* larvae/100 leaflets) at the same time. Super parasitism decreased to its lowest number at March 4th recording (6 super parasitized larvae/100 parasitized ones) where the host population recorded (251 larvae/ 100 leaflets) at the same time. While, super parasitism caused by *O. pallipes* females on *L. bryoniae* recorded high numbers during December and April and reached its peak at December 17th recording (27 super parasitized larvae/100 parasitized ones), while the host population was (73 larvae/100 leaflets), The lowest number of super parasitism was observed at march 11th (4.0 super parasitized larvae/100 parasitized ones) when the host population was (142 larvae/100 leaflets) at the same .

Keywords: Super parasitism - *O. pallipes* - *L. trifolii* - *L. bryoniae*.

1. INTRODUCTION

Braconidae (Hymenoptera) is one of the most fascinating, diverse, and beneficial groups of insects. Braconids are parasitic wasps (also called parasitoids) that are valued for their ability to kill pest insects, especially forest pests and insects that cause economic damage to crops. However, they are underused as biocontrol agents, as many species are understudied or simply unknown to science. The sheer diversity of Braconidae poses challenges for researchers to implement taxonomic, ecological, or biodiversity studies. Currently, there are more than 19,000 described species [1], making *Braconidae* the second largest family in Hymenoptera next to its sister lineage, *Ichneumonidae*. Approximately 20,000 species have been described since 2005. However, the known species likely represent only 30–50% of the actual number of species on Earth [2]. Members of *Braconidae* have a wide range of parasitic lifestyles and a few rare species are herbivorous [3]. Generally, parasitic Braconids are either ectoparasitic, feeding on the outside of their host, or endoparasitic, feeding from within their host. Braconids may cause permanent paralysis of the host upon oviposition, and thus the host can no longer continue development (Idiobiosis) [4–6]. Alternatively, some parasitoids allow their hosts to continue development throughout much of the parasitoid's life (Koinobiosis) [4]. Many Braconids can be solitary, with one individual using one host. However, others are gregarious, as multiple parasitoids from the same mother utilize the same host

[7]. Polyembryony (more than one embryo from a single egg) also occurs among some Braconids, although it is relatively rare [8]. Opiinae is a large subfamily containing over 1863 described species in 33 genera worldwide [9]. Opiines often parasitise a late larval instar, but species are known to infest eggs and early instar larvae. The most favored host families are Agromyzidae, Anthomyiidae, Tephritidae, and Ephydridae [10]. El.Khouly [11] concluded that the female of the larval –pupal endoparasitoid *O.pallipes* could successfully lays eggs in the 2nd or 3rd of *L.trifolii* instar larvae. The parasitoid eggs or larvae could successfully complete their development in the host larvae and even after pupation. So, The host size was not an important factor in parasitism. El.Khouly [12] studied the influence of adult female feeding on some biological aspects of the *O.pallipes* and found that the number of deposited eggs, number of parasitized larvae and number of super parasitized larvae per female were insignificantly high when the females fed on sugar solution 10% recording 9.1±4.5 eggs/ female, 6.7±2.8 parasitized larvae/ female and 1.7±1.8 super parasitized larvae / female, respectively with insignificant differences. They also concluded that the oviposition, postoviposition periods and the female adult longevity were significantly affected with different diet treatments.

El.Khouly [12] concluded that superparasitism caused by *O. pallipes* females on *L.trifolii* larvae reached its highest numbers at the low population levels of the host; and the reveres is true.

From the available literature a very few authors have studied the biological behavior of *O. pallipes* [11-15]. Therefore, the present investigation was undertaken to study superparasitism behavior of the larval pupal endoparasitoid *O. pallipes*.

2. MATERIALS AND METHODS

Seasonal abundance of the tomato leaf miner *L. bryoniae* and the serpentine leaf miner *L. trifolii*

Broad bean (*Vecia faba*), was targeted as a host plant because it has a heavy infestation by the two leaf mining insects combined with a good population of *O. pallipes*. Hundred infested leaves with *L. bryonia* and Hundred infested ones with *L. trifolii* were taken. Some leaves had the two types of infestation, only the targeted leafmining species (*L. bryonia* or *L. trifolii*) was counted in each group. Samples were kept in plastic bags and transferred to be examined in the laboratory .Number of *L. bryonia* and *L. trifolii* larvae were counted and recorded .

Superparasitism of the parasitoid *O. pallipes*

To evaluate superparasitism for the parasitoids *O. pallipes* ,100 parasitized larvae were collected. larvae were checked and the number of the parasitoid immature stages were counted according to Linden and Achterberg [14]. the leafminer larvae were dissected under the microscope. Each leaf miner larva was removed from the leaf and put in a droplet of water. At a magnification of 48x, the larvae were opened with a pair of minute tweezers. The contents of the larvae and the parasitoid immature stages spread in the droplet of water. The parasitoid eggs or larvae could be counted and recorded. Normal agricultural practices of fertilizing and irrigation were followed and no chemical control measurements were applied . Samples were taken from the appearance of the emergence of the first leaves and continued weekly until harvest.

3.RESULTS

Superparasitism on *L. trifolii*.

As shown in fig. (1), superparasitism caused by *O. pallipes* females recorded high numbers during December and April and reached its peak at December 31th recording (36 superparasitized larvae/100 parasitized ones), while the host population recorded (136 *L. trifolii* larvae/100 leaflets) at the same time. Superparasitism decreased to its lowest number at March 4th recording (6 superparasitized larvae/100 parasitized ones) where the host population was (251 larvae/ 100 leaflets) at the same time.

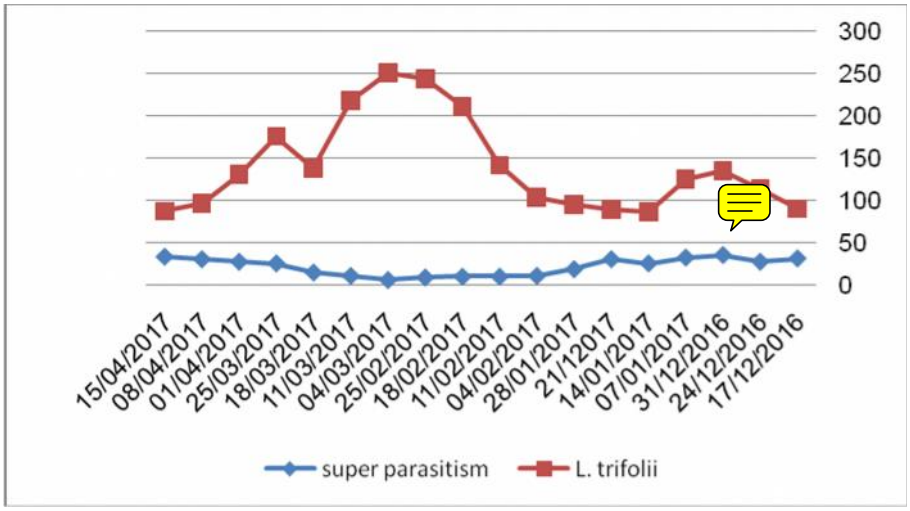

Fig (1) Superparasitism of *O. pallipes* (superparasitized larvae/100 parasitized ones) as affected by the numbers of *L. trifolii*

Superparasitism on *L. bryoniae*.

As shown in fig. (2), superparasitism caused by *O. pallipes* females recorded high numbers during December and April and reached its peak at December 17th recording (27 superparasitized larvae/100 parasitized ones), while the host population was (73 larvae/100 leaflets), The lowest number of superparasitism was observed at march 11th (4.0 superparasitized larvae/100 parasitized ones) when the host population was (142 larvae/100 leaflets) at the same time .

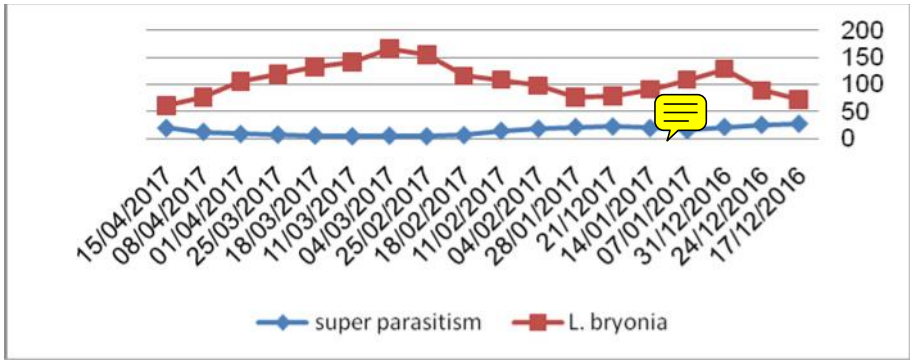

Fig (2) Superparasitism of *O. pallipes* (superparasitized larvae/100 parasitized ones) as affected by the numbers of *L.bryoniae*.

4. DISCUSSION

The larval pupal endoparasitoid *O. pallipes* prefers the low densities of its host which occurred in the first and last month of the growing season, so *O. pallipes* females didn't find enough host larvae to distribute their reproductive output in solitary parasitism, by the time when *L. trifolii* is highly abundant this behavior occurrs at very low numbers. The same behavior also occurring on *L.bryoniae* but because *O. pallipes* showed low preference towards *L.bryoniae*, so the relatively low populations of *O. pallipes* on *L.bryoniae* combined with low numbers of superarasitised larvae compared with *L. trifolii* (Fig 3). Superparasitized larvae/females recorded by El-Khouly [11] were 2.1 and 1.7 on the second and third instars of *L. trifolii* larvae with no significant differences.

In a laboratory study *O. pallipes* females showed highly preference towards *L. trifolii* larvae than *L. bryonia* in a choice test and less preference towards *L. trifolii* in no choice test. A possible explanation is that in no choice test either *L. trifolii* or *L. bryonia* larvae were the only available host so *O. pallipes* females had to lay eggs and feed on the available insect host, while in the choice test the parasitoid females had the chance to choose their preferred host [12]. The preference of *L. trifolii* may be due to mining behavior of its larvae that mines the upper palisad mesophyll of the leaflets, while *L. bryonia* larvae mines the spongy mesophyll [16], more over the nutrition contents of *L. trifolii* larvae may be more preferred to *O. pallipes* females than *L. bryonia*. Linden [13] used *O. pallipes* which thought to be the promising parasitoid against *L. bryonia* in Dutch greenhouses but *O. pallipes* failed to control *L. bryonia*. Dissection of the leaf miner larvae showed that *O. pallipes* females could successfully put the eggs but the eggs were encapsulated and failed to developed

5.CONCLUSION

It could be concluded that superparasitism caused by *O. pallipes* females reached its highest numbers at the low population levels of the insect host on either *L. trifolii* or *L. bryonia* with low preference towards *L. trifolii.* In fact further studies on this behavior should be undertaken because *O. pallipes* is describing as a solitary parasitoid.

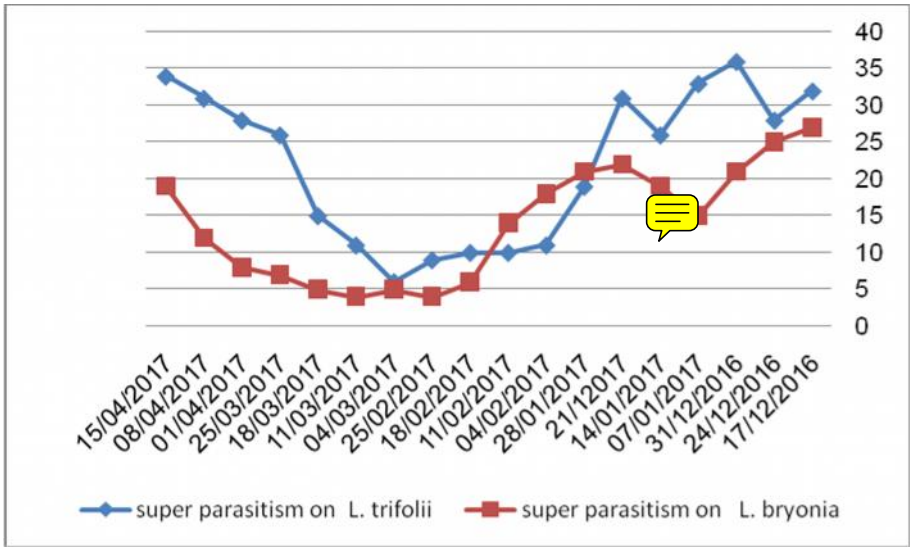

Fig (3) :Superparasitism of *O. pallipes* on *Lbryoniae* and *L. trifolii* .

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