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Natural Abundance and Host Plant Preference of the Larval Pupal Endoparasitoid *Opius pallipes* Wesmail (Hymenoptera: Braconidae) on the Serpentine Leafminer *Liriomyza trifolii* (Burgess) on Some Summer Host Plants

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Authors' contributions

This work was carried out in collaboration between all authors. Author ARE designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors EAAH and ABA managed the analyses of the study. Author ABA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Natural abundance and host plant preference of the endoparasitoids *O. pallipes* was studied in Ojelat region. Four host plants were studied [tomatoes (*Solanum lycopersicum*) pepper (*Capsicum annuum*) eggplant (*Solanum melongena*) and kidney bean (*Phaseolus vulgaris*)] The parasitoids showed high populations in April and May that kept the populations of the serpentine

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leafminer *L. trifolii* at low densities till the end of the season on all studied host plants. *O. pallipes* recorded two peaks of abundance on the four studied host plants recording (19, and 24 individuals/ 50 infested leaflets) on tomatoes, (18, and 16 individuals/ 50 infested leaflets) on pepper, (26 and 20 individuals/ 50 infested leaflets) on eggplant and (32, 26 individuals/ 50 infested leaflets) on kidney bean during the season of the study. *O. pallipes* showed a relatively low preference towards kidney bean and eggplant compared with pepper and tomatoes.

Keywords: O. pallipes; summer hosts; abundance.

1. INTRODUCTION

With more than 19,000 described species worldwide, parasitic wasps in the family *Braconidae* are the second largest group of Hymenoptera next to its sister lineage, *Ichneumonidae*. Among them the members of subfamily oppiine such as *Opius spp* were an effective biocontrol agents against *liriomyza spp* in Canada and other European countries [1].

More than 140 species of parasitoids as natural enemies of *Liriomyza* have been reported from the world [2]. Schuster, et al. [3] in USA, observed that the larval-pupal parasitoids in the families *Braconidae* and *Pteromalidae* were the dominant parasitoids reared from Agromyzids collected from tomato and 7 associated weeds in Florida accounting nearly 74%of the reared parasitoid adults, while the most abundant parasitoids were *Opius* spp. which accounted 43%of the total collected parasitoids and the most abundant species was *O.dissitus* accounting 38% of the total reared parasitoids. *Opiinae* is a large subfamily containing over 1863 described species in 33 genera worldwide Species of *Opiinae* are solitary koinobiont endoparasitoids of phytophagous cyclorrhaphan Diptera (Agromyzidae, *Anthomyiidae*, Cecidomyiidae, Tephritidae) [4]. Opiines often parasitise a late larval instar, but species are known to infest eggs and early instar larvae [5].

The most dominant endoparasitoid species against *Liriomyza trifolii* of the parasitoid complex were *Opius pallipes* Wesmail and *Chrysocharis parksi* [6]. McClanahan [7] found that *Opius* spp. were the most abundant parasitoid species on tomatoes infested with *L. sativa,* and *L. trifolii.* Linden [8] evaluated the combination of two European parasitoids *O. pallipes*, *D. isaea* and two American ones; *C. parksi* and *O. dimidiatus* in biological control of the Agromyzid leaf miners *L. trifolii* and *L. bryonia* in Dutch greenhouses and found that the occurrence of the tomato leaf miner *L. bryonia* from June: onwords was not a problem because of the high rate of parasitism of spontaneously occurring *D. sibirica* and *O. pallipes*, while *C. parksi* reached 45%. He also concluded that the exotic leaf miner parasitoids; *C. parksi* and *O. dimidiatus* survive in Dutch glasshouses and sometimes may have a considerable contribution to the biological control of *Liriomyza* spp., together with native parasitic species. Shahein and El-Magraby [9] concluded that the percentage of parasitism on *L. trifolii* was initially low and reached its maximum in mid-March. The percentage of parasitism by the braconid *Opius sp*. was 20.8% of the total parasitism. Ckman and Uygun [10] studied the parasitoid complex of the Agromyzid leaf miners in the Turkish fauna. They identified six parasitoids from *Braconidae* and 12 from *Eulophidae*. Among the parasitoids *Opius* spp. and *Chrysocharis* spp. were the most dominant parasitoids. Lyon [11] reported that indigenous parasites especially *C. parksi* and *O. pallipes* were introduced at the beginning of each culture to control *L.trifolii* in tomato greenhouses in combination with the eulophid *D. isaea*. Moreover *C. parksi* was shown to be the predominant parasite on tomatoes in California when *L. sativa* was a predominant leaf miner species [12]. The parasitoid *O. pallipes* played an important role as biocontrol agent on *L. trifolii* on all studied summer host plants showing low preference towards tomatoes in comparison with cowpea or kidney bean [13]. Moreover the larval pupal endoparasitoid *O. pallipes* preferred the serpentine leaf miner *L. trifolii* than *L. bryonia* as an insect host both under laboratory conditions and in open fields and, it seems to be promising parasitoid against *L. trifolii* in open fields and greenhouses [14].

From the available literature, few authors have studied the role of the parasitoid *O. pallipes* as biocontrol agent against *L. trifolii* in the Libyan

fauna. Therefore, the present investigation was undertaken to study the role of the endoparasitoid *O.pallipes* on some summer host plants.

2. MATERIALS AND METHODS

The present study was carried in Ojelat region – Libya from April to July 2017. Four host plants were studied [tomatoes (*Solanum lycopersicum*) pepper (*Capsicum annuum*) eggplant (*Solanum melongena*) and kidney bean (*Phaseolus vulgaris*)]. Population abundance and the effect of host plants on the parasitoids activity were evaluated according to the collected samples from the four host plants. 50 leaves infested with *L.trifolii* were taken from each host plant. Sampling took place as soon as the true newly vegetative growth was completely appeared in the experimental area and continued weekly till the end of the growing season. Collected Samples were kept in plastic bags and transferred to be examined in the laboratory. Mines were dissected under stereo binocular microscope. Leaves contained living larvae of *L. trifolii* for each sample were kept in Petri dishes (12 by 1.5 cm) under laboratory conditions till the emergence of the pest *L. trifolii* or its endoparasitoid, *O. pallipes*. Filter papers used in Petri dishes were remoistened when necessary to avoid drying. The number of parasitoids (adults) were counted and recorded for every host plant. Normal agriculture practices of irrigation and fertilization were followed and chemical control measurements were neglected.

3. RESULTS

Data presented in Fig. 1. show the numbers of the endoparasitoid *O. pallipes*.

On tomatoes the parasitoid *O. pallipes* recorded two peaks of abundance (19 and 24 individuals/ 50infested leaflets) on in 22th of April and 3rd of June, respectively.

On eggplant, the parasitoid *O.pallipes* recorded two peaks of abundance (26 and 20 individuals/ 50infested leaflets) on 22th of April and 17th of June respectively.

On pepper, the parasitoid *O.pallipes* recorded two peaks of abundance (18 and 16 individuals/ 50infested leaflets) on 22th of April and 3rd of Jnne respectively.

On kidney bean, the parasitoid *O. pallipes* recorded two peaks of abundance (32 and 26 individuals/ 50infested leaflets) on 29th of April and the 17th of June respectively.

Data presented in Table 1 indicated that, the highest average percentage of parasitsm recorded its highest rates during April recording (17.6 ± 5.9, 18.4 ± 5.0, 23.7 ± 7.3 and 22.9 ± 6.2) on tomatoes, pepper, eggplant and, kidney bean respectively while, the highest monthly average numbers of the parasitoid *O .pallipes* recorded (14.5 ± 6.65, 13.3±2.8, 17.25 ± 2.75 and 20.25 ± 5.67) during June on tomatoes, pepper, eggplant and, kidney bean respectively.

As shown in Fig. 2. kidney bean and eggplants were the most preferred host plants by the larval pupal ectoparasitoid *O. pallipes* compared with tomatoes and pepper.

4. DISCUSSION

The larval pupal endoparasitoids, *O. pallipes* recorded two peaks of abundance on the four studied host plants recording (19, and 24 individuals/ 50infested leaflets) on tomatoes, (18, and 16 individuals/ 50infested leaflets) on pepper, (26, and 20 individuals/ 50infested leaflets) on eggplant and (32, and 26 individuals/ 50infested leaflets) on kidney bean during the season of the study. In previous investigations by EL. khouly [6], EL. khouly [13], Awadalla [15] , and Awadalla, et al [16] *O. pallipes* recorded three peaks of abundance on the summer crops and tomatoes in the open fields. The low abundance observed in this study may be resulting from the short term of the growing season and the dry climate under Libyan conditions compared with the Egyptian ones. On the other hand, the low abundance of *O. pallipes* may be explained by the high competition of the ectoparasitoid *Diglyphus isaea*. Another possible explanation is that *O. pallipes* females cannot discriminate between unparasitized hosts and those previously attacked Linden [8]. Data suggested by El-Khouly [6] concluded that correlation values between the populations of either *O. pallipes* and *C. parksi* and the population of their insect host (*L. trifolii*) on broad bean and cowpea as host plants were low. Moreover relatively low preference towards tomato plants may be explained by their small leaflets size in comparison with those of eggplants and kidney bean that attacked by low or moderate populations of *L. trifolii* combined with low or moderate populations of *O. pallipes*

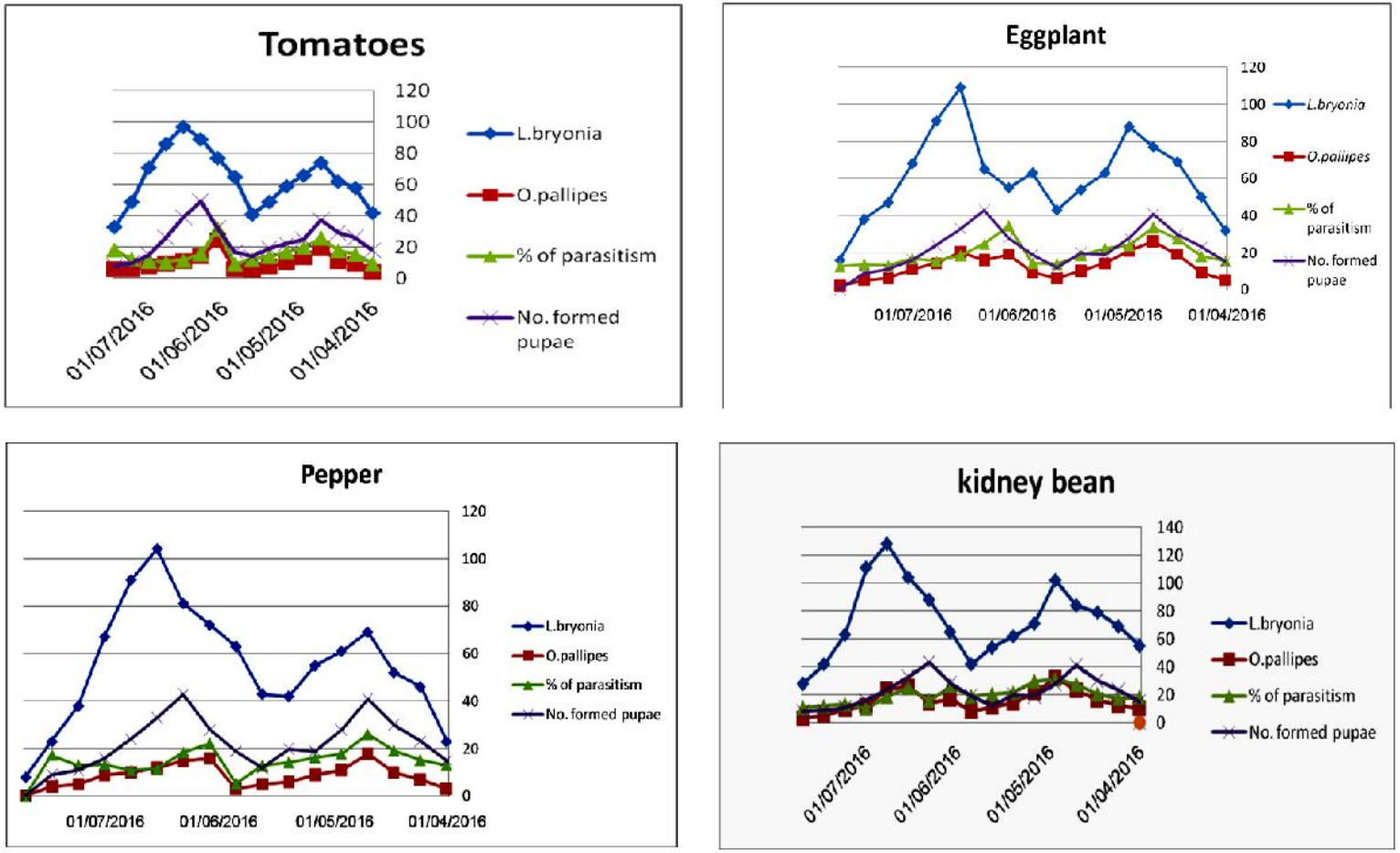

Fig. 1. Natural abundance and percentages of parasitism of the endoparasitoids *O. pallipes* combined with the population activity of *L. trifolii* on summer host plants

Table 1. Monthly average numbers and percentages of the endoprasitids *O. pallipes* on four summer host plants

Months	tomatoes (*Solanum lycopersicum*)		pepper (*Capsicum annuum*)		eggplant (*Solanum melongena*)		kidney bean (*Phaseolus vulgaris*)	
	O. pallipes	**% Parasitism**	***O. pallipes***	**% Parasitism**	***O. pallipes***	**% Parasitism**	***O. pallipes***	**% Parasitism**
April	11.2 ± 3.86	17.6 ± 5.9	9.8±5.5	18.4 ± 5.0	16.0 ± 8.71	23.7 ± 7.3	18.60 ± 8.98	22.9 ± 6.2
May	7.0 ± 2.16	13.1 ± 3.3	5.8±2.5	4.2 ± 4.8	9.75 ± 3.30	17.2 ± 3.9	13.50 ± 5.56	22.7 ± 4.7
June	14.5 ± 6.65	17.3 ± 9.9	13.3±2.8	15.8 ± 5.5	17.25 ± 2.75	23.2 ± 8.5	20.25 ± 5.67	21.5 ± 4.9
July	6.3 ± 0.57	13.9 ± 4.1	4.5±3.7	11.0 ± 7.6	6.0 ±3 .74	13.9 ± 2.4	7.25 ± 4.03	11.5 ± 1.1
Mean ± S.D	9.75+3.83	15.5± 2.3	8.35± 4.0	12.35 ± 5.25	12.25 ± 5.3	19.5 ± 4.76	14.9 + 5.85	19.65 ± 5.5

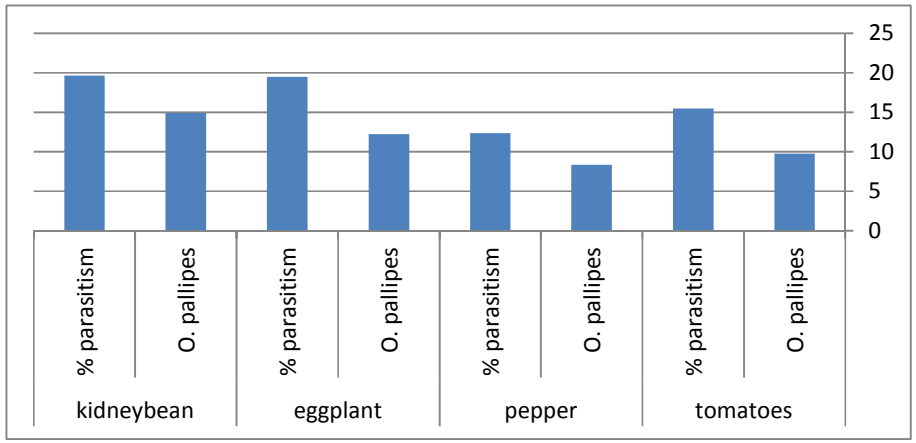

Fig. 2. Total average numbers and percentages of parasitism of the endoprasitid *O. pallipes* on four summer host plants

on the same host plants. The endoparasitoid *O. pallipes* preferring the low density of its insect host EL. khouly, et al. [14] and that the parasitoid adults slightly affected the female parasitoid selection of host plant type on which the host larvae where located [17].

5. CONCLUSION

The average monthly rates of parasitism were the highest on kidney bean (19.65 ± 5.5), followed by eggplants (19.5 ± 4.76) tomatoes (15.5± 2.3) and paper (12.35 ± 5.25) respectively with low preference towards kidney bean .

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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