

BIOLOGICAL ASPECTS ON EUPLECTRUS PLATYHYPENAE HOW.
(HYMENOPTERA: EULOPHIDAE), A LARVAL PARASITOID OF
THE FALL ARMYWORM, SPODOPTERA FRUGIPERDA J. SMITH
(LEPIDOPTERA: NOCTUIDAE).

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ABSTRACT

Some biological notes on the parasitization of the gregarious external larval parasitoid, Euplectrus platyhypenae, on the fall armyworm, Spodoptera frugiperda, as well as testing the influence of nicotine diet on both of them, were studied under laboratory conditions. Methods for rearing both the host and the parasitoid under laboratory conditions were described.

Although the durations of immature stages of both S. frugiperda as well as E. platyhypenae were longer on the nicotine-tested diet, significant difference was recorded in the case of the host. The life cycle of the parasitoid ranged 11 to 14 days under laboratory conditions, with the egg, larval and pupal stages required 3 to 4, 4 to 6 and 4 to 5 days, respectively. Longevity of both sexes and sex ratio was estimated.

INTRODUCTION

Spodoptera frugiperda J. Smith is one of the main lepidopterous pests all over the USA as well as in the middle and south America. Due to its polyphagous feeding behaviour, it attacks severely many culture, vegetable crops and many other host plants (Pencoe and Martin, 1981).

Euplectrus platyhypenae How. is one of the recorded parasitoids on the fall armyworm. It is a gregarious external parasitoids of half-grown larvae of Spodoptera spp. (Marin Acosta, 1966, Tingle et al., 1978 and Montoya Burgos, 1980) and various noctuids (Clausen, 1962).

This study reveals some biological notes on the parasitization of the wasp on the fall armyworm under laboratory conditions and testing the influence of nicotine, as one of plant allelochemicals that found effects survival, behaviour and physiology of herbivores (Barbosa et al., 1982), on the host and the parasitoid.

MATERIAL AND METHODS

In order to secure a large number of E. platyhypenae the following methods proved satisfactory for rearing the parasitoid and its host S. frugiperda in the laboratory, at $27^{\circ} \pm 2^{\circ}\text{C}$, a photoperiod of 8 and 16 hours dark and light, respectively and R. H. of $50\% \pm 5\%$.

1- Host rearing:

FAW adults were maintained in a cylindrical screen cage, covered with wrapped sheets of white paper towelling to serve as oviposition sites. The towel was changed daily. Collected eggs were placed in Mason jars and kept under the above mentioned lab. conditions till hatching. Neonate larvae were placed in plastic cups onto a commercially synthetic diet from Bio-serve, inc. either regular or nicotine depending on treatment till pupation. To prepare a nicotine diet the Bio-Serve was mixed, during the preparation, with the desired concentration of nicotine. The 0.025% (wet weight) of nicotine was selected (based on preliminary studies) as the concentration providing substantial survival of the herbivores and within the normal concentration ranges found in host plant.

2- Parasitoid rearing:

Larvae to be used for parasitization were reared in 3/4 OZ plastic cups with Bio-Serve of FAW diet for 5-6 days of age under the mentioned laboratory conditions. Larvae, which were reared on nicotine diet, were placed on regular diet for 3 days then transferred to the nicotine diet till 5-6 days old (FAW neonate are very sensitive to nicotine). When the appropriate host larval age was reached, larvae were

selected for parasitization based on the state of moult (preferred that have just finished moulting). The selected larvae were placed in an 8 OZ waxed cup with cubes of diet and droplets of honey. Into this parasitization chamber were introduced several adults of Euplectrus. After the desired amount of time (24 hours), the adults were removed and parasitized larvae were replaced individually and kept till pupation and emergence of adults. Adults of the parasitoid were maintained in a transparent plastic sweater box (10 x 12 x 7"). This cage was kept in a rearing chamber at $22 \pm 2^\circ\text{C}$ with a photoperiod of 9 hours dark and 15 hours light and a R.H. of $45 \pm 5\%$. Honey was dispensed dropwise on the inside top of the cage to serve as adult food. Required data were recorded daily.

RESULTS AND DISCUSSION

1- Developmental periods of the host:

At $27^\circ \pm 2^\circ\text{C}$, a photoperiod of 8 and 16 hours dark and light, respectively and R.H. of $50\% \pm 5\%$, the duration of the immature stages of the fall armyworm S. frugiperda when fed on regular diet lasted 12 - 15 days, with an average of 13.65 ± 0.15 days, 8 - 10 days, with an average of 8.71 ± 0.11 days and 21 - 25 days with an average of 22.25 ± 0.21 days for larval, pupal and total developmental periods. The same parameters prolonged, when the host was fed on the (0.025%) nicotine diet under the above mentioned laboratory conditions. These periods reached the average of 17.88 ± 0.30 days (ranged 15 - 21 days), 8.92 ± 0.14 days (ranged 8 - 10 days) and 26.67 ± 0.18 days (ranged 24 - 30 days) for larval, pupal and total developmental periods.

Statistical analysis (t-test) of the obtained data indicated that highly significant difference occurred between both feeding diets on the duration of the immature stages, especially the larval and total developmental periods, while no difference in the pupal period, the pupal weight (0.1839 g/pupa) and the sex ratio (1:1) was recorded.

2- Influence of nicotine diet on the parasitoid:

2-1. Durations and life cycle:

The egg of E. platyhypenae is white in color when first laid but changes to brownish-black or black as incubation progresses. Hatching took place in about three days under the mentioned laboratory conditions and was accomplished by a longitudinal splitting of the chorion along the median dorsal line. Highest mortality of developing parasitoid occurred prior to hatching. Feeding began immediately and the eggshell attached the larva to the host, and to it the successive exuviae were added. Three larval instars were recorded. The body contents of the host were sucked out. The larvae, after the completion of feeding, left their position on the dorsum and found their way beneath the host, where they arranged themselves transversely and spin delicate cocoons within which to pupate.

The duration of various stages of E. platyhypenae when parasitizing S. frugiperda, that fed on regular and 0.025% nicotine diet under the mentioned laboratory conditions are presented in Table (1).

Data recorded in Table (1) indicates that a relatively short life cycle ranged 11-14 days on both types of diet. In spite of the development time of most of the parasitoid stages from nicotine - treated fall armyworm being longer, statistical analysis (t-test) revealed no significant difference between the duration of the stages of the parasitoid on both types of diet. This could be interpreted by less influence of nicotine, because of the external feeding of the parasitoid. On the contrary, significant difference was obtained by the author (El-Heneidy 1985) when the same concentration of nicotine (0.025%) was used for the internal parasitoids

Cotesia (Apanteles) mariniventris and Hyposoter annulipes on the same host. The different influences of allochemicals on the parasitoids were affected by the feeding habits and sites of the larval parasitoids (Barobsa et al. 1982).

Table 1: Duration of different stages of E. platyphypenae under laboratory conditions when the host was fed on regular and nicotine diet.

Stage	Duration in days	
	Regular diet	Nicotine diet
Egg	3.88 ± 0.18 (3-4)	3.43 ± 0.20 (3-4)
Larva		
First instar	1.33 ± 0.21 (1-2)	1.33 ± 0.21 (1-2)
Second instar	1.60 ± 0.45 (1-2)	1.29 ± 0.20 (1-2)
Third instar	2.29 ± 0.31 (1-3)	2.40 ± 0.24 (2-3)
Total larval period	4.36 ± 0.10 (4-6)	4.51 ± 0.21 (4-6)
Prepupa	>1-1	>1-1
Pupa	4.48 ± 0.08 (4-5)	4.44 ± 0.18 (4-5)
Total developmental period	12.21 ± 0.16 (11-14)	12.44 ± 0.38 (11-14)

2-2. Oviposition:

Oviposition began within a day or two after emergence of adults. It occurred mostly at day light. Eggs are not deposited on host larvae about to moult. In the act of oviposition, the female stands upon the body of the host, usually on the thorax or the first abdominal segments, and the eggs were placed in groups (3 - 11 egg/group) not closely spaced, in rows, upon the integument, to which they are attached. Parathenogenetic reproduction resulted to male progeny only.

2-3. Sex ratio:

The mean sex ratio between adults of E. platyphypenae emerged under laboratory conditions was 1 ♀ : 2.2 ♂ on regular diet and 1 ♀ : 3.5 ♂ on nicotine diet.

2-4. Longevity:

Adults were relatively long-lived (females longevity, ranged between 39-72 days, with an average of 62.75 ± 2.73 days and that of males 46-77 days, with an average of 61.42 ± 3.18 days).

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