INVESTIGATION ON BIOLOGY OF OLIVE LEAF WORM *PALPITA UNIONALIS* HB. (LEPIDOPTERA: PYRALIDAE) IN CONSTANT LABORATORY CONDITIONS

Samad Khaghaninia* and Reza Farshbaf Pourabad*

* Department of Plant Protection, Faculty of Agriculture, University of Tabriz, Tabriz, IRAN.

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ABSTRACT: Olive leaf worm, as a quarantine pest in Iran, was reported in olive orchards in Roudbar city for the first time in August 1999. This insect is dispersed in Italy, Spain, Greece, west Asia, North Africa, Portugal, Sweden, Poland, Japan and tropical regions in America. The most important damage of the pest occurs on young trees, nurseries and shoots of old trees. The young larva of the pest feed beneath the leaves and as they grow larger, they consume entire leaves and buds. The he second generation, if they are abundant, feed on fruits and seeds as well. In order to control this important pest, it certain biological aspects were studied under constant laboratory conditions at 27 ºC, 65% relative humidity and 16 hours photoperiod during 1999 in Agricultural Research Center of Zandjan province using caged individual 2- year old potted olive trees of yellow cultivator. According to the results the mean developmental time, from the egg through the adult stages, lasted for 34.9 days. The average generation time, under above-mentioned conditions, was estimated to be 38 days so that it could produce 9 generations per year. The sex ratio was shown to be 1: 1.12 (male: female). The percentage mortality of immature stages appeared to be 49.45%. The mean fecundity of females was 385 (with a range of 212 - 419) with adult longevity of 14.1 (range: 8 - 26) and 12.3 days (range: 7 and max 21) for male and female individuals, respectively.

KEY WORDS: Olive leaf worm, biology, *Palpita unionalis*, Lepidoptera

Trigiani, in 1971 introduced the olive leaf moth as *Palpita* (*Margaronia*) *unionalis* (Hb.) (Santorini & Vessiliana-Alexopoulou, 1976). Then internal reproductive organs of the males and females was described by Santorini in 1976 and Kitri prepared identification keys for various species of the genus Palpita in India, based on differences between the internal and external reproductive organs (Kitri & Rose, 1992; Santorini and Vessiliana-Alexopoulou, 1976). In 1972,Balachowsky with extensive studies expressed the dispersal regions of this pest as Italy, Spain, Greece, Asia Minor, North Africa, Portugal, Tropic Regions of America and also Japan (Balachowsky, 1972). Olive leaf worm has been reported from Sweden and Poland during 1977-1988 (Ryrholm, 1988, Santorini & Vessiliana-Alexopoulou, 1976; Sevensson, 1988). The pest as a quarantine pest in Iran was first reported in olive orchards of Roudbar City in August 1999 (Saieb, 1999).

-Appearance

Grossly, through profound studies in 2000, showed that the pest has 5 instars. Young larvae are peal yellow in color becoming gradually green. Maximum body length is 18-20mm. Eggs are white and flattened with appearance reticulated and 0.5-1mm in length. The female deposits about 600 eggs. The eggs are laid singly on olive branches and leaves. The pupa is brown in color, 12-16mm in length and 3-4mm in width. The embryonic and larval developmental time are 11-30 days

and 18-25 days respectively, depending on seasonal conditions. The larva before changing into pupa, attaches a few leaves with silken filaments, and becomes pupa while spinning a cocoon.

Adults are peal or white and are seen as triangular at resting. The wings are semitransparent. Fore wings brown colored in the costal margin with two black spots in the middle. Adult with wingspan are 30mm in size. These nocturnal adults mate two days after emergence, taking 4-6 hours and females die immediately after egg lying. It overwinters as larvae. There are 2-3 and 5-6 generations in cold, temperate and tropic, semitropical regions respectively (Grossley, 2000). The pest has 10 and 5 generations per year in Egypt and Italy respectively (El- Sherif, 1977; Fodal et al., 1990).

The main host of pest is olive and alternative hosts are Jasmine, Strawberries and Vibernum. Olive leaf worm is one of the important olive pests in Italy, Egypt and Greece (El-Hakim & El-Helmy, 1982; El-Kifl et al., 1974; Longo, 1992; Pertich, 1988; Vassiliana & Santonivi, 1973). The most important damage of the pest occurs on young trees, nurseries and shoots of old trees (Grossley, 2000; Pinto & Salemo, 1995; Triggiani, 1971). Young larva feed on lower surface of leaf and as they grow larger, they consume entire leaves and buds and in second generation, they feed on fruits and seeds if they reach to high population levels (Grossley, 2000). Referring to Fodal's studies, if 90% of branches have been damaged, loss rate of yield will not be more than 20% (Fodal et al., 1990).

To control the pest, agrotecnical, biological and in the case of heavy infestations of leaves, chemical methods are recommended. Removing the infested twigs and shoots is one of the best control methods (Pertich, 1988; Triggiani, 1971). Based on investigations in Italy, larvae of *Syrphus corollae* F. and adults of following species: *Apanteles syleptae* F., *A. xanthostigmus* (Hal) and *Nemorilla maculosa* (Mg) have been introduced as predator and parasitoids respectively (El-Hakim & Hanna, 1982; El-Sherif, 1977; Fodal et al., 1990; Pinto & Salemo, 1995; Triggiani, 1971). Jardak (Jardak et al., 1979) reported a new Trichogramma species named as *T. olea* in France and Yugoslavia's olive orchards through his investigation on natural enemies. Based on Fodal's studies about chemical control of olive leaf worm, it was proved that *Bacillus thurengiensis* causes mortality on larva (Fodal, 1976).

Among the effective insecticides to control the pest carbaryl, methidathion, fenthion and dimethoate have been recommended (Fodal & Mule, 1990).

MATERIAL AND METHODS

Because of lack of water in olive leaves, cut branches dry soon, therefore to study biology of olive leaf worm, potted olive trees caged individually were used (Badavi et al., 1976). For this purpose, two-year-old olive trees of yellow cultivator, the dominate native olive cultivator in Tarom region, were planted in plastic pots with 20cm in diameter and 17cm in deeps with mixed soft sand soil and natural fertilizer in equal rate. All trees were cleared of other insects and spiders using number 2 brush then were placed in individual cages. The cages consisted of trance plastic cylinder 20cm in diameter and 55cm in deeps made from 0.45mm width PVC layer. The upper surface of the cages was covered by fine mesh muslin terylene to prevent the escape of the adult moths and also the entering of other insects (Fig. 1).

To study of various aspects of pest biology in constant condition an EHRET incubator made in Germany were used. Experiments were accomplished in constant laboratory conditions of 27° C and 65% relative humidity and 16 hours

photoperiod (Badavi et al., 1976; Santorini & Vessiliana-Alexopoulou, 1976). To study the development time and mortality rate of various life stages of the pest, the pupae were collected from olive trees in olive research station in Gilvan city, then they were placed into rearing dishes.

After the mating the newly emerged adults, two fertilized females were released into each caged olive seedling and after 24 hours, all adults as well as eggs except 15 eggs were removed. The experiment was accomplished with 8 plotted seedlings (Fig. 2).

The daily observations were made by means of a hand lens to determine development time and mortality rate until the emergence of new adults.

Sex ratio in laboratory populations was measured by determining the newly emerged adults. To study the adult fecundity and longevity, newly emerged adults were needed so, a number of pupae were collected from above mentioned orchards and maintained in rearing dishes. Two pairs of males and females from newly emerged adults within a period of 24 hours were released on each caged seedling. The experiment was started with 6 caged seedlings and continued with the counting of the produced eggs every other day and daily countings of the adult mortalities along with sex determination of all dead individuals.

RESULTS AND DISCUSSION

- Development time of embryonic, larval and pupal stages:

Development time from embryonic to adult stages under laboratory constant conditions is indicated in Table 1.

Mean development time from the egg (Fig. 3) to the adult was estimated 34.9 days, where, Vassiliana and Santonivi (1973) mentioning it to be 21-26 days at 23.4°C.

Development time of various instars (Fig. 4) except the first one increased as the growing advanced, and it may be due to the fact that the older larvae spend more time in finding the most suitable feeding sites.

-Generation number:

Duration of total life cycle was recorded as 38 days, which is in accordance with the findings of Fodale and Mule i.e. 24 days and 39 days at 17° C and 26° C respectively (Fodal & Mule, 1990). Based on data obtained, it appears that the pest under constant laboratory condition could have 9 generations a year and this is confirmed by the studies of Badawi and et al. in Egypt at 27.5° C (Badavi et al., 1976).

-Sex ratio:

Out of 70 adults (Fig. 5) examined, 37 individuals were females thus the sex ratio was found to be 1: 1.12. The sex ratio mentioned by Fodal and mule (1990) was 1: 1.16.

-Mortality rate of immature stages:

The mortality rate of immature stages at laboratory constant conditions is mentioned in Table 2. Percentage mortality of immature stages was estimated to be 49.45%.

According to Loi's findings under constant temperature of 10°C-35°C, the percentage mortality was 100% and less than 50% at 10° C-35° C and 13°C-30° C respectively (Loi, 1990). As the optimal development temperature for this insect has been recorded to be 27° C, it is more likely that examining the larvae by taking them out of their refuges had caused delayed larval development.

Table 2 shows that, the egg stage with 23% mortality was the most susceptible stage, whilst the susceptibility of the larvae was decreased as they grew up more so no mortality could be observed amongst the fifth instar larvae.

-Female fecundity and adult longevity:

The mean fecundity of adult females was 385 (range: 212 - 419) under constant condition whereas, Badawi and et al. mentioned it as 414 under constant conditions of 27.5° C and 65% relative humidity (1). Loi (1990) has expressed the mean number of eggs per female as 320 at 25° C. The present study showed that the longevity of the male is more than that of female. The mean longevity of adult male was 14.1 days (range: 8 - 26 days) and for that of the adult female being 12.3 days (range: 7 - 21 days). It is in accordance with the Loi's findings, which were 13.5 days for females and 15.3 days for males (Loi, 1990).

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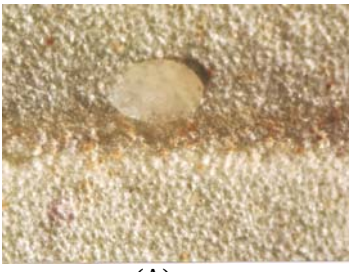
Fig. 1. Two-years old potted olive tree caged individually.

Fig. 2. Arrangement of potted olive trees caged individually in incubator.



(A)

(B)

Fig. 3. Egg, large scale size A; small scale size B

(A)

(B)

Fig. 4. Larvae, fifth instar A; first instar B.

(A) (B)

Fig. 5: Adults, male A; female B.

Table 1- Development time of life stages of olive leaf worm *Palpita unionalis* Hb. Under constant laboratory conditions.

Life stages	Egg	Instar larvae					Pupa
		1st	2nd	3rd	4th	5th	
Number examined	92	85	81	78	76	76	70
Mean development time ± Standard error(x± SE)	3.3±0.76	3.8±0.78	3.5± .7	3.8±.53	4.3±.75	5.5± .94	11.2±1.2

Table 2- Percentage mortality of the egg, larval and pupal stages of olive leaf worm *Palpita unionalis* Hb. Under constant laboratory conditions.

Life stages	Egg	Instar larvae					Pupa
		1st	2nd	3rd	4th	5th	
Number examined	120	92	85	81	78	76	76
%Mortaliy	23	7.6	4.7	3.7	2.56	-	7.89