OVIPOSITION AND LARVAL FEEDING BEHAVIOR OF ECTOMYELOIS CERATONIAE (LEPIDOTERA : PYRALIDAE) , ON POMEGRANATE FRUITS IN IRAQ .

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Abstract :

Differences in the oviposition and larval feeding behavior of pomegranate fruit moth on fruits of different sizes were studied during fruiting season of 1984 and 1985. Calyx is the most infested part by the newly hatched larva due to calyx preference by gravide female. Larvae initially feed inside the cayx tube. During first and second generations, then they complete their development inside the calyx of immature fruits, while larvae of later generations grow inside the lining layer of the pericarp of mature fruites to complete their development. More than one larva were found inside the infested mature fruits. These larvae spent winter conditions on fruit litters in the orchard. The economic damage usually resulted from pericarp infestation followed by decay due to secondary infestation and microbial growth .

INTRODUCTION :

Pomegranate fruit moth Ectomyelois ceratoniae Zell . is an important pest pf pomegranates in Iraq (1). This species infests carob pods, almonds and citrus fruits in Mediterranean basin and Western Australia, and was named carob moth (2,3,4). It is also found in Africa feeding on date fruits (5,6,7). The biology and rearing of the moth have been studied in our labratory since 1980 . Oviposition and larval feeding behavior in relation to fruit phenology in the field were the main objective of this study .During the fruiting season (April- November) of 1984-1985 pomegranate fruit development, oviposition

and larval feeding as related to fruit size and maturity were determined .

MATERIALS AND METHODS :

Field sampling : Tests were conducted in a commercially productive pomegrante orchards in south-west Baghdad city mainly growing selimi variety . The orchards was not sprayed during the fruiting season and the fruits were naturally infested by E.ceratoniae.Fruit development as weekly checked after fruit set in April during the fruiting seasons of 1984 and 1985. Weekly samples of pomegranate fruits of different sizes and maturity were taken randomly from the previous orchards . Sampling was continued through winter months to collect the dropped fruits left in the orchard. Each sample unit contains more than 150 fruit which were kept in cooling boxes (medium size) for later examination. The first mature fruits after picked from the tree initiate the time of harvest . Harvest was continued by stripping the ripe fruits from the orchard then was ended when all matured undamaged and well established fruits were pick off the trees.

Laboratory test : Pomegranate fruits at different stages of development were graded to three sizes according to fruit diameter as follows : small (< 45 mm) , medium (46-55 mm), and large fruits (> 56 mm). Each fruit was dissected longitudinally through the calyx tube looking for insect infestation . Egg, egg shell , larva and PuPa or pupal exuvia were transferred from the fruit and recorded according to fruit size .Larvae fruit Per at the time begining of the fruit set as well as during the season was compared to their number at the end of the season(October-December).This comparison neasures the response and attaction of moth female to fruits during the season and the effect of existing fruits in the orchard on larval density .

RESULTS AND DISCUSSION :

Fruit set and maturity:Pomegranate flowering starts at the first half of April and continued to the end of June.

Few flowers were noticed during the first half of July . Fruit set started at the end of April, fruit development and size en largement continued from May to August(Fig.1) Fruit maturity and harvest started in July and continued until the end of fruiting season depending on pomegranate variety (unpublished data). During this period calyx tissue as apart of the fruit takes different size and shape and this affect the state of fruit infestation. Damaged fruits left on the tree or dropped on the ground are usually left by the farmers in the orchard. They are an important source for reinfestation in the following season . Damaged fruits found after harvest showed various stages of maturity and decayed spots. They have been seen either on the tree or left on the ground . Usually the infestation of the next season fruits start from the previous fruit litters. (8). Salimi variety is a common one planted in the area, its fruits are normally infested by B. ceratoniae .

Oviposition behavior : At the begining of fruiting season infestation initiated from moths developed from overwintering larvae and emrged during March-April. Moths female lay eggs either on the new fruits or on the fruit litters left from the previous season . Females are attracted to the fruit calyx to deposite their egg singly filament within the calyx tube. Most of the eggs did not hatch due to unfertility or dry conditions. The dried unfertilized eggs were counted with the egg shells viable eggs were counted seperately (Fig. 2).

Larval fruit feeding behavior: Usually calyx is the first infested part of the fruit and the larvae of the first and second generations establish themselves their for the entire larval development time. At third, fourth and later generations, tissue prefrence causes an effect on larval feeding behavior , they migrate through a feeding tunnel into the pericarp tissue to feed on the lining layer . Previous studes on larval feeding on pomegranate fruit tissues (9) showed that the calyx tissue was suitable for larval development than percicarp . Larval feeding behavior on plant tissue was discussed which showed that feeding depends on host plant chemistry (10). However, pericarp infestation did not associate to tissue perference by moth femal but happend as a result of larval migration from calyx tissue to internal parts of the fruit. Most of the third and fourth instar larvae were found feeding on the lining layer of the pericarp of mature fruits whene some these larvae attend last instar

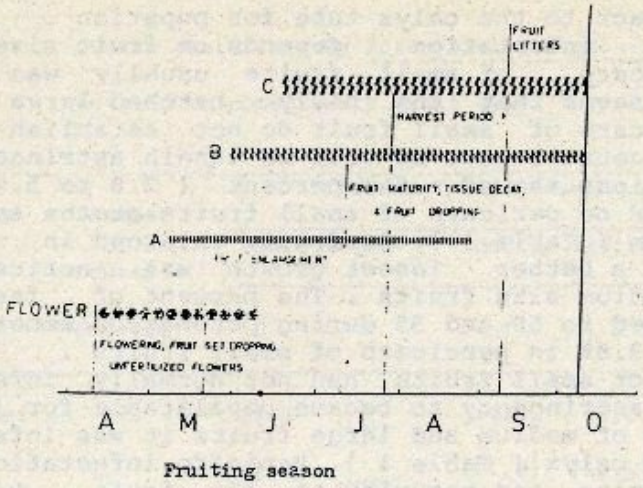

Fig.1. Flowering and fruit development of pomegranates *Punica granatum* in Iraq
(Fruit sizes : A: small (<45 mm) , B: medium (46 - 55 mm) , and C ; large (> 56 mm) .

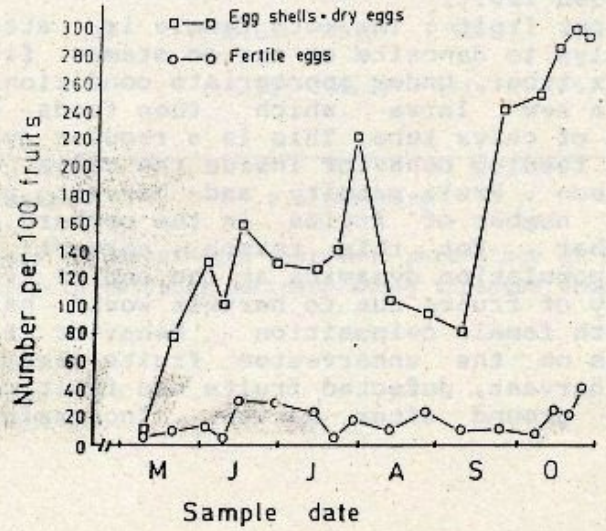

Fig.2. *Ectomyelois ceratoniae* eggs density in pomegranate fruits during fruiting season.

they migrate back to the calyx tube for pupation .

Pericarp infestation depends on fruit size and maturity .Pericarp of small fruits usually was not infested . It seems that the newly hatched larva when feeds on pericarp of small fruit do not establish well due to tissue constituents as well as tannin astringency. Field observations showed a few percent (3.8 to 5.9 %) of larvae feed on pericarp of small fruits at the end of fruiting season (Table 1). As fruits enlarged in size and matured, a better insect growth was noticed on pericarp of medium size fruits . The percent of feeding larvae increased to 50 and 55 during October-December, in comparison to 3.8% in percicarp of small fruits .

Pericarp of small fruits had not normally infested due to its is astringency to became unpalatable for larval feeding,but of medium and large fruits it wss infested at higher rate calyx (Table 1). Pericarp infestation is a function of size. and maturity of the fruit . Larval feeding on pericarp lining layer was similar to the feeding on almond fruits (4) and to the behavior of other lepidopterous larvae as well as leaf mining larvae (11) , Chemical composition of pericarp tissue may have an effect on larval feeding since the larva avoid tanin containing tissues of small fruit, and maturity causes a decreasing in tannin content (12) which casue the larva to feed on pericarp of ripe fruits causing a secondary infestation by other insect species (13). However , fruit decay taks place during July-October due to a secondary infestation by other insects , however pericarp infestation causes a more economical loss due to poor quality of damaged fruit.

Larval density per fruit : The moth female is attracted to the fruit calyx to deposite on egg on stamen filament inside the calyx tube . Under appropriate conditions, the egg hatchs to a new larva which then feeds on the interior tissue of calyx tube. This is a regular oviposition and larval feeding behavior inside the calyx during early fruit season . Fruit matuity and harvest cause a decrease in number of fruits in the orchard during September-December . For this reason , harvest would disturb insect population dynamics at the end of fruiting season. Scarcity of fruits due to harvest would have an influence on moth female oviposition behavior forcing them to lay eggs on the unharvested fruits remained on the tree after harvest, defected fruits and fruit debrise dropped on the ground after harvest . Increasing egg

Table 1. Tissue preference by Ectomyelois ceratoniae larvae as related to pomegranate fruit size.

Sample date	Number of fruits checked	Infested fruits/feeding site (number) and %					
		Small fruits		medium fruits		Large fruits	
		C	P	C	P	C	P
October	355	21.0	___	11.0	46.0	2.0	12.0
		(22.8)	___	(11.9)	(50.0)	(22.0)	(13.0)
November	515	46.0	09.0	23.0	127.0	09.0	22.0
		(19.5)	(03.8)	(09.8)	(53.0)	(03.8)	(09.3)
December	161	33.0	10.0	22.0	93.0	02.0	10.0
		(19.4)	(05.9)	(12.9)	(54.7)	(01.2)	(05.9)
Total	1031	80.0	19.0	56.0	266	13.0	44
		(16.7)	(4.0)	(11.7)	(55.7)	(02.7)	(09.2)

C : calyx P : pericarp

Numbers in parenthesis represent percentage of fruit contain larva feeding in calyx or pericarp among infested fruits.

density per fruit will cause an increase in number of larvae per fruit (Fig.3). The number was increased from one during fruiting season to three or four and somtime twelve larvae per fruit during October , November and December, respectively. The pericarp of ripe fruit and fruit litters were served in addition to oviposition as abetter habitat . Also they serve as agood protection sites for larvae during winter conditions and carry most of larval population throughout the post harvest period . This population of larvae would be as a good source for reinfestation of the new fruits in the next fruiting season .

Sanitation as a method of orchard management (8,14) by removing all fruit forms from the orchard is another good measure in preventing oviposition on dropped fruits.

This study provide informations on post harvest fruit damage. In view of foregoing , it would be possible to predict moth activity and infestation from diapaused larval population of the previous season , since the insect spent winter on fruit litters .

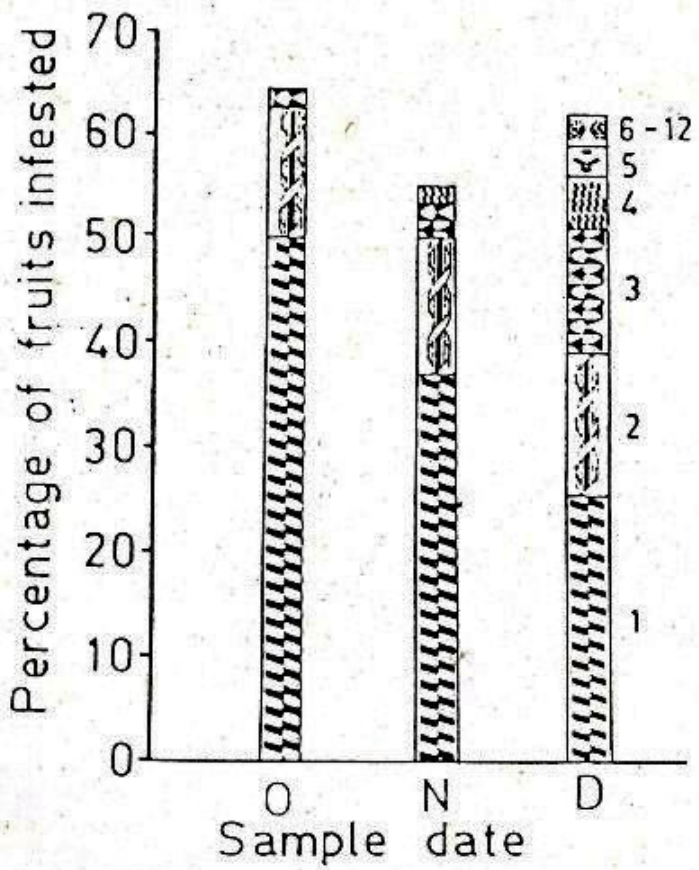

Fig.3. Ectomyelois ceratoniae larval density in pomegranate fruit at the end of fruiting season (Arabic numbers represent number of larva per fruit).

REFERENCES :

1. Khairee , I.M., Sulaiman , S.S. and Abdulla , M.Kh. Pomegranate fruitmoth infesting pomegranate fruits. Minist. Agric. and Agrarian Reform. Div. Gen. Pl. Prot., Entomol. Dept. Tech. Bull . 1978 (In Arabic).
2. Heinrich, C., American moths of the subfamily phycitinae-Bull. U.S.A. Nat. Mus. No. 207. 1956.
3. Carrero , J.M., La " Barreneta Del Naronjo " Ectomyelois ceratoniae Zell . Ecologia Y Meelios De Lucha. Boletin De Patologia Vegetal Y Entomol Agricola. 29 : 317-366, 1966 (In spain).
4. Michael, p. The carob moth. J. Dep. Agric. west Aust. 9 : 81-82, 1968 .
5. Shafik, M., Constant temperature hot air sterilizer for the control of Ephestia and Myelois on dates Bull. de la Soc. Fouad L er d Entomol. 22 : 233-245, 1938.
6. Corbet, A.S., and Tams, W.H.T., Keys for the identification of the Lepidoptera infesting stored products. Proc. Zool Soc. London 113: 68, 1983 .
7. Lepigre , A., Essais de Lutts Sur L Arbre contre la Pyrale des Dattes• (Myelois ceratoniae Zell.) Annales des Epiphyties 14 : 85-101, 1963 .
8. Al-Izzi, M.A.J., Al-Maliky, S.K., Younis, M.A. and Jabbo, N.F., Bionomics of Ectomyelois ceratoniae on pomegranates in Iraq . Environ. Entomol . 14 : 149-153, 1985 .
9. Al-Izzi, M.A.J., Effect of pomegranate fruit tissues on Ectomyelois ceratoniae larval growth and parasitization. Proc. of the 4 th. Sc. Conf., Scientific Pesearch Council, Baghdad, Iraq Paper no. 1-2-6 .
10. Smiley, J., Plant chemistry and the Evolution of host specificity : New evidence from Heliothis and Passiflorn. Science 201 : 745-747, (1078).
11. Feeny, P., Seasonal changes in oak leaf tainnins and nutrients as a cause of spring feeding by winter moth caterpillars. Ecology, 51:565-581,1970.
12. Goldstein, J.L. and Swain, T., Changes in Tannins in Ripening Fruits. Phytochemistry 2: 371-383,1963.
13. Al-Izzi, M.A.J., A survey on some insect pest and their parasites on pomegranate fruits in Iraq . NRC-62 Iraq Atomic Energy Comm., 14 pp, 1982 .
14. Rield, H., and Detar, J.E., post-harvest codling moth infestation on pears-a potential threat for next years crop. California Agric. November : 14-17, 1977 .

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سلوكية وضع البيض وتغذية يرقات دودة ثمار الرمان (اكتومايلوس سيراتونيباي) على الرمان في العراق

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المستخلص :

درست الاختلافات في انتشار يرقات دودة ثمار الرمان داخل الثمار ، وبصورة خاصة الثمار ذات الاحجام المختلفة الموجودة خلال موسم الاثمار للسنوات ١٩٨٤ ، ١٩٨٥ . اتضح ان القمع هو الجزء الذي يصاب اولا باليرقات الحديثة الفقس والسبب يعود ان القمع هو الجزء المفضل من قبل الاناث لوضع البيض داخله .

تتغذى اليرقات داخل القمع وتكمل نموها داخل قمع الثمار الغير ناضجة خلال الجيل الاول والثاني للحشرة ، اما يرقات الاجيال اللاحقة فتكمل نموها بالتغذية على الجدار الداخلي لتخت الثمرة . يزداد عدد اليرقات داخل الثمرة في نهاية الموسم وقد تقضي فترة الشتاء على بقايا الثمار المتروكة داخل البستان . يحصل الضرر الاقتصادي من خلال تغذية اليرقات داخل الثمرة وكذلك يحصل تخيس للثمار نتيجة الاصابة الثانوية بالحشرات والفطريات .