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Studies on life cycle of oriental fruit moth, *Grapholita molesta* Busck (Lepidoptera: Tortricidae) infesting cherry in Kashmir valley

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Abstract

The life cycle studies of oriental fruit moth under laboratory conditions showed that incubation period lasted for 7-9 days, larval period lasted for 22-26 days, pre-pupal period lasted for 2-3 days, pupal period lasted for 15-18 days, adult period lasted for 9-11 days and total duration of life cycle was 55-66 days. While, under natural conditions the duration of life cycle is reduced up to 42-52 days. Morphometric data revealed that the average body length and width of head capsule of 1st, 2nd, 3rd, 4th and 5th instar larvae were 1.7 and 0.26, 4.2 and 0.40 mm; 6.3 and 0.60 mm; 8.5 and 0.94 mm; 13.0 and 1.41 mm, respectively.

Keywords: Cherry, life cycle, morphometry, oriental fruit moth

1. Introduction

The oriental fruit moth *Grapholita molesta* Busck (Lepidoptera: Tortricidae), also known as oriental peach moth, is one of the most destructive and economically damaging pests of stone and pome fruits worldwide. The Oriental fruit moth was first described by August Busck of the U. S. Bureau of Entomology as *Laspeyresia molesta* [7]. The oriental fruit moth has a broad range of hosts within the family Rosaceae and is a native to North-western China [10]. It is earlier reported that depending on temperature, developmental times are: eggs 4-8 days; larvae 12-22 days; and pupae 10-16 days. The developmental period from egg to adult averages 30-49 days. Voltinism varies according to latitude [11]. The developmental time is affected by environmental conditions particularly temperature. Eggs, larvae and pupae develop significantly faster at 30 °C than at 22 and 25 °C [4]. Individual moths lay eggs either singularly or in small clutches for a period of 7 to 10 days. The development time for eggs is variable, usually 4-8 days from oviposition until hatch during the summer months and generally much longer during the spring and fall [8]. The fully grown larvae are 13-15 mm long and are whitish to pink. The head capsule is light brown with dark markings. There are four or five instars depending on temperature [9]. Under laboratory conditions, they generate 5 larval instars. Larvae have three pairs of true legs and four pairs of prolegs, located on the third, fourth, fifth, and sixth abdominal segments. This insect infests all stone fruits including apple and pear [12]. Keeping in view the fact, that no work has been done on the aspect of life cycle and morphometric studies of Oriental fruit moth, that is why, the present study was undertaken.

2. Materials and Methods

Life cycle studies of Oriental fruit moth were under taken under laboratory conditions in the Division of Entomology SKUAST-Kashmir, Shalimar under normal conditions. Observations with respect to various life stages were made at regular intervals in the month of May and June, 2013. Oviposited and infested fruits with caterpillars of Oriental fruit moth were collected from orchards and brought to laboratory, then infested fruits were put into jars with hibernation sites in the form of sand, loose bark and cherry twigs and jars were covered with white cloth. The jars were continuously monitored for recording the observations on various biological parameters like larval period, pre-pupal period, pupal period, longevity of adults, oviposition sites and incubation period. The specimens of different life stages were observed with the help of hand lens and under Binocular Microscope

The width of head capsule, the number of larval moultings (exuviae) and body length were used to determine the number of larval instars. These studies were confirmed by a Dyar's rule

which states that width of head capsule grow in geometrical progression. The head capsules of the larvae were measured at the widest point of the vertex using a binocular microscope. About 60 larval samples of different stages were taken for Morphometric studies.

3. Results and discussion

Life Cycle

During study it has been observed that the Oriental fruit moth, *Grapholita molesta* completes 2-3 generations every year in Kashmir and last one being partial one. However, only first generation was studied for its life cycle stages. The data depicted in Table 1 represents the developmental periods of Oriental fruit moth. The eggs were slightly convex, white to creamy in color and were laid singly. The incubation period ranged from 7-9 days (mean 8.00±1.00).

Table 1: Life Cycle of Oriental Fruit Moth, *Grapholita molesta*

Life cycle stage	Development period (days)	Mean±standard deviation
Egg period	7-9	8.00±1.00
Larval period:		
1 st Instar	2-3	2.33±0.58
2 nd Instar	3-4	3.33±0.58
3 rd Instar	4-5	4.66±0.58
4 th Instar	5-7	6.00±1.00
5 th Instar	7-9	8.00±1.00
Total larval period	22-26	24.33±2.08
Prepupal period	2-3	2.33±0.43
Pupal period	15-18	13.33±1.52
Adult Longevity:		
Male longevity	7-9	8.00±1.00
Female longevity	11-13	12.00±1.00
Total developmental period	55-66	52.33±4.08

The initial 1-3 larval instars are pinkish to creamy-white with dark heads while late larval instars are pink to almost red with brown heads. The total developmental period of larva ranged from 22-26 days (mean 24.33±2.08). Cocoons are constructed of white silken threads and can be mixed with sand, soil, bark, and fibrous material. Pupae are yellowish-brown, becoming dark brown and turning blackish just prior to the emergence of the adult. The developmental period of pupae ranged from 15-18 days (mean 13.33±1.52). Adults are small, dark gray with mottled silver pattern markings on the wings. When at rest, its wings are held roof-like over its body, the adult resembles a tent and the dorsal portion of the wings that is just above the abdomen possesses arrow like silvery pattern. The antennae are bent backwards over the wings just like horns. Males and females resemble each other, with the female being slightly larger. The longevity of female ranged from 11-13 days (mean 12±1.00), while for male 7-9 days (mean 8±1). The total developmental period of pest from egg to adult was 55-66 (mean± 52.33±4.08) days under laboratory conditions. The above observations are in accordance with earlier workers [2-8] who reported that life cycle stages of Oriental fruit moth under laboratory conditions showed that the incubation period ranged from 7-9 days, the total developmental period of larva ranged from 22-26 days, pre-pupal period ranged from 2-3 days, the developmental period of pupae ranged from 15-18 days, the developmental period of adults ranged from 11-13 days and total developmental period ranged from 55-66 days, whereas, the developmental period under natural conditions was 42-52 days (Plate 1).

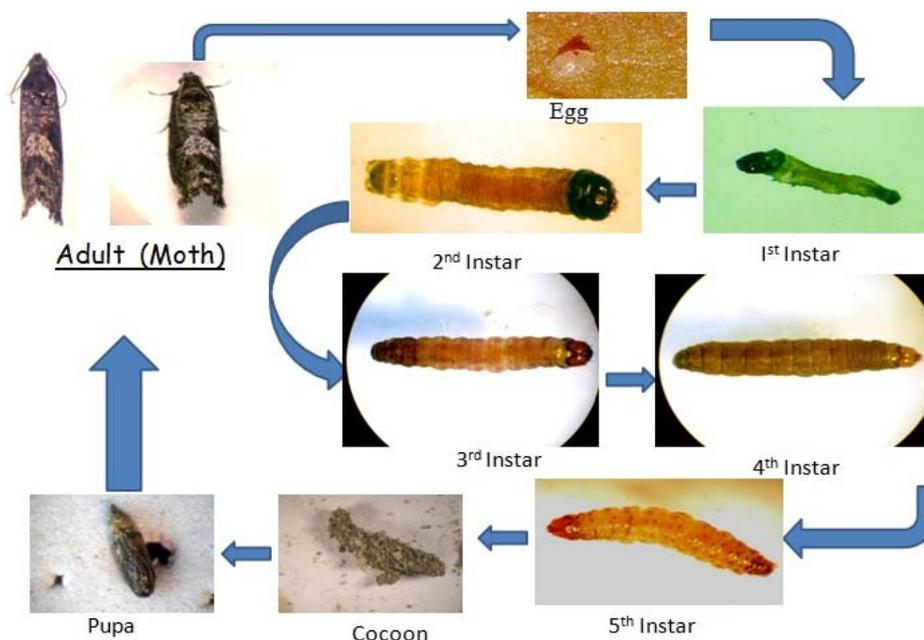


Plate 1: Life cycle stages of oriental fruit moth (*Grapholita molesta* Busck)

Morphometric data of different instar larvae of Oriental fruit moth

The data depicted in the Table 2 represent the morphometric data of different instar larvae of Oriental fruit moth. The width of head capsule, the number of larval moultings (exuviae) and body length were used to determine the number of larval instars. The average body length and width of head capsule of

I to V instar larvae were 1.7 mm and 0.26 mm, 4.2 mm and 0.40 mm, 6.3 mm and 0.60 mm, 8.5 mm and 0.94 mm and 13.0 mm and 1.41 mm, respectively. Similar findings were also reported earlier [9, 8, 1, 3], who mentioned that the 1st instar larvae are visible only by first detecting the dark head capsule. The 1st instar larvae will grow from 1.5 mm (1/16th inch) up to 8 to 13 mm (3/8th to 1/2 inch) as a 4th or 5th instar larva.

Table 2: Morphometric studies of different instar larvae of Oriental fruit moth

Instar	Mean observed head capsule width (mm)	G.P. ratio	Calculated head capsule width (mm)	Chi-Square test
I	0.26	0.40/0.26=1.56	0.26×1.53=0.40	0.00132
II	0.40	0.60/0.40=1.51	0.39×1.53=0.60	
III	0.60	0.94/0.60=1.57	0.60×1.53=0.92	
IV	0.94	1.41/0.94=1.50	0.94×1.53=1.44	
V	1.41			
		M.G.P. ratio=1.53		

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