

**BIONOMICS OF *DACTYLISPA DOHERTYI* (GESTRO, 1897),
A NEW PEST OF APPLE PLANTATIONS (*MALUS DOMESTICA*
BORKH.) IN JAMMU REGION OF J & K, INDIA**

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ABSTRACT: The objective of this work is to study the biology of spiny chrysomelid, *Dactylispa dohertyi* (Gestro, 1897) on apple plantations (*Malus domestica* Borkh.) in Jammu and Kashmir. India having varied agro-climatic conditions ranging from tropical, sub-tropical to temperate conditions. Apple is a cherished and economically important fruit crop in Jammu region of J & K State which is severely attacked by both larvae and adults of the pest, Both adults and larvae defoliate Apple plants, reduce their vigour and kill tender shoots. During regular surveys in the apple orchards, the twigs of apple plantations were found damaged heavily by the pest. The infested leaves gave the appearance of being burnt. Thus, an attempt was made to study the biology of this pest in Jammu as no earlier record of the pest has been obtained from the region so far. The insects were reared in the laboratory at room temperature (10.84°C-32.87°C) and relative humidity of 26%-80% on apple plantlets. All life stages except the adults are leaf miners. There are five instar stages with length varying from 0.56±0.08 to 2.10±0.22. The incubation, larval duration and adult longevity for male and females were 4.65±.041, 11.4±2.22, and 7.9±0.69 and 4.45±0.43 days respectively. Thus, the pest has a total life span of 22.12±3.59 days. The present study is an important step in future to record the no. of generations of *Dactylispa dohertyi* on *Malus domestica*, and for the timely management of the pest.

KEY WORDS: *Dactylispa dohertyi*, *Malus domestica*, Biology, New, morphometric.

Dactylispa dohertyi is widely distributed and has been found from China (Jolivet, 1997; Maulik, 1919), Myanmar (Maulik, 1919) Philippines (Ballentes, 1991), U.S.A. (Staines, 2004) and India (Maulik, 1919; Gupta, 2007). In the authors study area, the pest has been recorded from Batote, Kishtwar and Doda Districts of Jammu Province. Beetle has already been reported as a pest of weed *Lantana camara* (Ballentes, 1991), Poaceae, Areceae, Zingiberaceae, Cyperaceae and Orchidaceae family and Zingiberales order (Staines, 2004) and Rice and Poaceae family (Jolivet, 1997). In the area of present investigator, the beetle is found defoliating apple trees for the first time in Jammu and Kashmir India.

During regular surveys in the apple orchards, the twigs of apple plantations were found damaged heavily by the larvae of *Dactylispa dohertyi*. The objective of this study was to obtain information on the biology of *Dactylispa dohertyi* on apple plantations under laboratory conditions in room temperature so as to maintain a natural environment in order to establish the peak infestation of the pest on apple plantations for its timely management strategies as it is an important pest of apples in Jammu province of J & K State. In the near future this pest may assume more serious and destructive position if adequate control measures were not undertaken immediately. This warrants attention of the orchardists of the region for its timely and proper control. So far no detailed work on the bionomics and associated studies on *Dactylispa dohertyi* on apple trees is available. Thus a need was felt by the author to conduct detailed investigations of this pest on apple trees in Jammu Province.

MATERIALS AND METHODS

Biology of this pest was studied on red delicious cultivar of *Malus domestica* under laboratory conditions from a period of June, 2008 to Dec., 2008 and again in the year 2009 in Bhandarwah area of Jammu province. The adults were collected from the infested apple orchards and reared in cages on apple leaves kept in laboratory to record observations on its life stages. The male and female moths after emergence were kept in pairs in wire mesh cages lined with filter paper for mating and egg laying. Observations were recorded daily. Morphometric measurements of eggs, different instars and adults were recorded and analyzed statistically. Measurements of morphologically important body parts were recorded by using stage and ocular micrometer scales. Duration of different stages in the lifecycle was also calculated and analyzed statistically. During the period under observation, the average maximum and minimum temperature was 29.4°C and 11.7°C respectively, and morning and afternoon relative humidity of 80% and 54% respectively.

RESULTS

BIOLOGICAL STUDIES:

Emergence of the pest:

Adult beetles start emerging in the fields from late June up to October. Adults usually feed on the green portion of the leaf, leaving only the epidermal membranes. After 4 to 6 hours of wandering about and feeding, copulation occurs. Male mounts on the back of female beetle and copulate with it. Copulation occurs for about an hour.

Egg laying:

Females lay an average of 30.2 \pm 5.11 eggs singly, partly inserted beneath the epidermis of the ventral surface of apple leaves. Egg white, small and oval; with age, turns yellow and measured 2.0-2.5 mm in length with an average of 2.1 \pm 0.21 mm and 0.56 \pm 0.08 mm in width. Fresh egg white, small, oval. Egg measured 2.1 \pm 0.21 mm length and 0.56 \pm 0.08 mm in width. Females lay an average of 30.2 \pm 5.11 eggs singly, partly inserted beneath the epidermis of the ventral surface of apple leaves.

Incubation Period:

Mature eggs turn yellowish and incubation period lasts for about 4 to 6 days with an average of 4.65 \pm 0.041 days.

Larval Stages:

The author has recorded five larval instars in the life cycle of the pest. Larva creamish, shiny, possesses well developed biting and chewing mouth parts with the help of which, larvae are able to mine inside the leaf surface. Length of the newly emerged larva is 2.10 \pm 0.31 mm. All larval stages occur inside the leaf surfaces. The lengths of second, third, fourth and final larval instars are 3.20 \pm 0.34 mm, 4.0 \pm 0.26 mm, and 4.95 \pm 0.15 mm and 5.90 \pm 0.45 mm respectively. Total larval duration of the pest ranged from a minimum of 8.0 days to a maximum of 14.0 days with an average of 11.4 \pm 2.22 (SE: 0.70) days.

Pupal duration:

Fully fed larvae undergo a short period of pre pupal duration in which larvae prepare themselves for pupation. Pre-pupal period ranged from 0.5 to 1.0 days with an average of 0.72 \pm 0.26 days. After pre-pupation larva undergoes pupation. Like larvae, pupae are also found inside the leaf surfaces. Pupal duration in *Dactylispa dohertyi* ranges from 4.0 to 6.0 days with an average of 5.35 \pm 0.70

(SE: 0.22) days. Pupa obtect, brown and oblong, about 5.35 ± 0.70 mm long and 2.60 ± 0.22 mm wide.

Adult emergence:

After an average of 5.35 ± 0.70 days of pupation, emergence of adults occurs. Total life cycle of the pest (from egg to adult) gets completed in 22.12 ± 3.59 days that ranged from a minimum of 16.5 to a maximum of 27.0 days.

Adult:

Beetle hard, brightly colored, shining, punctuate, narrow in front, broad and truncate behind and measures about 4.95 ± 0.86 mm. in length and approximately 3.10 ± 0.22 mm in width. Head small, broader than long, comprised of a pair of conspicuous, large compound eyes and a pair of long, 11-segmented filiform antennae; interocular space with a deep longitudinal impression; the collar constricted just beneath the eyes;. Head free not retracted beneath the prothorax, hypognathus; antennae 11-segmented, without spines, ferruginous, sparsely hairy, 5 apical joints; basal thick, slightly bent outwards, much smaller and rounded, the third the longest, fourth to sixth sub equal in length,; Elytra and lateral margin of pronotum with long, erect spines, usually finely black tipped, sometimes dorsal spines almost entirely brown or black; anterior margin of pronotum laterally with sub vertical 2-branched spine,, not in the same plane as 2 branched, anterior and single, posterior spine on lateral margin; anterior and posterior angles with setigerous pore; the discal, humeral and posterior marginal spines on the elytra black, anterior marginal and apical yellow, from the underside of the humeral projection a more or less well-marked black band runs obliquely backwards and stops towards the centre; the underside is darker than the upper side, sternum black. Prothorax broader than long, disc dull, flat, punctuate , with decumbent pubescence and C-shaped mark on each side and spot anterior to the scutellum; with two transverse impressions and the space between them being nearly smooth. There are two pair of spined on the anterior margin, each consisting of two spines partly fused at the base, of which the anterior one shorter,; of the three lateral spines, two anterior ones are longer and joined together at the base; posterior one being free; Scutellum broad, rounded at the apex, impressed in the centre; elytra brown, striate with the interstices closest to the suture elevated and pale yellow, particularly the second which is also thickened between two spines of the basal area, slightly dilated posteriorly, coarsely punctured, covered with pubescence; legs yellowish, testaceous, claws not fused, parallel, of similar size; venter brown, except mesepimera and metasternum blackish. Longevity of adult male and female ranged from 7.0-9.0 days and 4.0-5.0 days with an average of 7.9 ± 0.69 days and 4.45 ± 0.43 days respectively.

Damage:

Dactylispa dohertyi is a defoliator during the vegetative stage of the apple trees. The larvae of the pest are leaf miners whereas the adult beetles are external feeders. The larvae or the grubs mine or tunnel inside the leaves as leaf miners.. Then the larvae feed on the green tissues using their mandibulate mouth parts. During emergence, the adult beetle cuts its way out from the leaves. Adult beetles are seen on the apple plantation during june to october in the area under investigation. The adult beetle feeds on the green portion of the leaf, leaving only the epidermal membranes. The feeding damage shows as characteristic white streaks along the long axis of the leaf. Soon after hatching, the larvae mine into the leaf between the epidermal membranes, producing irregular longitudinal white patches. The damage starts from the site of oviposition near the leaf tip and extends towards the base of the leaf blade. The affected leaves gradually wither and die. Beetles are found damaging the leaf surface and the soft twigs of the

apple trees. Sometimes beetles are observed to completely defoliate the leaves which ultimately retard growth of the plant. Adult beetles are active fliers and have migratory habits. Often, it migrates to fields several kilometres away.

Symptoms of damage:

- ✓ Scraping of the upper surface of leaf blade leaving only the lower epidermis as white streaks parallel to the midrib.
- ✓ Tunnelling of the larvae through leaf tissues causes irregular translucent white patches that are parallel to the leaf veins.
- ✓ Damaged leaves wither off.
- ✓ Damaged leaves turn whitish and membranous.
- ✓ Apple leaves appear burnt when severely infested.

The damage symptoms are seen as elongated, clear, feeding marks as white streaks of uneaten lower epidermis between the parallel leaf veins. Likewise the presence of the insect confirms its damage.

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Table 1. Morphometric measurements of different life stages.

STAGE	BODY LENGTH		BODY WIDTH	
	(Min-Max)	Mean±SD	(Min-Max)	Mean±SD
Egg	2.0-2.5	2.1±0.21	0.5-0.7	0.56±0.08
First instar	1.5-2.5	2.10±0.31	0.5-0.7	0.56±0.08
Second instar	2.7-3.5	3.20±0.34	0.80-1.0	0.88±0.09
Third instar	3.5-4.0	4.0±0.26	1.0-1.25	1.02±0.04
Fourth instar	4.0-5.0	4.95±0.15	1.5-1.80	1.56±0.13
Fifth instar	5.5-6.0	5.90±0.45	2.0-2.5	2.10±0.22
Pupa	5.0-6.0	5.35±0.70	2.5-3.0	2.60±0.22
Adult	4.0-6.5	4.95±0.86	3.0-3.5	3.10±0.22

Table 2. Life cycle duration of different stages.

STAGE	DURATION OF DAYS		MEAN±SD	SEM
	MIN.	MAX.		
Incubation period	4.0	6.0	4.65±.041	0.12
Total Larval Period	8.0	14.0	11.4±2.22	0.70
Prepupation	0.5	1.0	0.72±0.26	0.08
Pupation	4.0	6.0	5.35±0.70	0.22
Life cycle(egg to adult emergence)	16.5	27.0	22.12±3.59	1.13
Adult longevity (Male)	7.0	9.0	7.9±0.69	0.21
Adult Longevity (Female)	4.0	5.0	4.45±0.43	0.13

Figure 1-6. Life cycle of *Dactylispa dohertyi*. 1. Egg., 2. Larva, 3. Pupa, 4-5. Adults, 6. Damage.