

RESEARCH ARTICLE

Entomological Studies of *Chaetoprocta Odata*, An Important Pest on Walnut Trees (*Juglans Regia* L.) in Kashmir Valley

Sajad Ahmad Khan*, Sanjay Bhatia and Narinder Tripathi

Entomology Laboratory, Dept. of Zoology, University of Jammu, Jammu (Tawi)-180006, Jammu and Kashmir, India
Khansajad386@gmail.com*; +91 9858618354

Abstract

Chaetoprocta odata (Hewitson) is considered as one of the most serious damage causing lepidopteron insect pests infesting walnut trees with particular reference to Kashmir. The present investigation was undertaken from 2009-2012 to study the biology of *Chaetoprocta odata* (Lepidoptera: Lycaenidae), on walnut trees *Juglans regia* in 10 districts of Kashmir valley. The findings revealed that the pest was found to cause defoliation of walnut trees and damage to the sprouting buds under heavy infestation in various areas. During the present investigation, a detailed biological study of this leaf roller and defoliator pest was carried out. It was observed that healthy, young as well as old walnut trees are under severe attack of the lepidopteron insect pest.

Keywords: *Chaetoprocta odata*, walnut trees, Kashmir valley, *Juglans regia*, defoliation, sprouting buds.

Introduction

Walnut (*Juglans regia*) is believed to have originated from Iran. In India, only the state of Jammu and Kashmir is considered as hub for walnut production being beneficial of its medicinal, economical and nutritional values. However, during the recent past it has spread to other states like Himachal Pradesh, Uttarakhand and Arunachal Pradesh. The walnut fruit industry is the backbone of the economy of the state of Jammu and Kashmir as its cultivation is directly connected to economic property of the people living in remote areas. Walnuts (*Juglans regia*) are included in FAO list of priority plants because of its nutritive value (Gandev, 2007). It is rich in Vitamin-B and richest in vitamin B-6 among all the nuts (Vigneshwara, 2011). The dry fruit of walnut has antioxidant potential (Abbasi *et al.*, 2010) and used against various diseases namely malaria (Tagrelli *et al.*, 2010), diabetes, asthma (Jaradat, 2005; Kaileh *et al.*, 2007) and prevention of coronary heart disease (Davis *et al.*, 2007). It also decreases the serum blood level (Iwamoto *et al.*, 2000).

The walnut is economically important as their products are used as protective coatings, dispersants, pharmaceuticals, cosmetics, soaps and a variety of synthetic intermediates as stabilizers in plastic formulations (Hosamani and Sattigeri, 2000; Eganathan *et al.*, 2006). Besides, having high economic value of walnut, the loss in yield and nature and extent of damage on walnut trees have not been fully explored so far. In this study, the different larval stages of the pest with their corresponding heavy loss to fruit yield and damage on transplants, standing trees and the wood have been recorded.

The published literature so far regarding *Chaetoprocta odata* is scanty with that of Masoodi and Trali (1987), during survey of fruit pests in Jammu and Kashmir reported that a Lycaenid identified as *Chaetoprocta odata* was found defoliating walnut trees. This was the first record of this species occurring in Kashmir damaging walnut. Mir and Wani (2005) has studied the pest infestation and damage to walnut plantations in Srinagar, Pulwama and Kupwara districts of Jammu and Kashmir only. The present investigation was therefore undertaken to study the detailed biology of *Chaetoprocta odata* in Kashmir which would be useful for development of management programme of the pest on the *Juglans regia*.

Materials and methods

Collection of pests: Collection of the insect pests in the adult stage was done in the field from the infested walnut trees and rearing was done in the laboratory. The field studies were conducted during the year 2009-12 in 10 districts of Kashmir valley i.e., Budgam, Kupwara, Anantnag, Baramulla, Shopian, Bandipora, Ganderbal, Kulgam, Pulwama and Srinagar. The biological studies of *Chaetoprocta odata* were conducted under laboratory conditions in the field laboratory established at Budgam area of Kashmir Province for two cropping seasons of 2010-11 and 2011-12.

Rearing of pests: The insect larvae were collected from Walnut plantations of the area and reared in the laboratory. Adult butterflies were allowed to copulate separately in wire meshed cages with dimensions of 2 ft, 1½ ft and 1 ft length, breadth and height respectively.

Table 1. Morphological characteristics of adult insect pest *Chaetoprocta odata*.

Characteristics	Male	Female
Forewings	Two	Two
Hind wings	Two	Two
Body segments	(3) Head, thorax and body	(3) Head, thorax and body
Antennae	One pair	One pair
Legs	Three pairs	Three pairs
Compound eyes	One pair	One pair
Proboscis	One	One
Color	Dull violet-blue dorsally creamy white with spherical marks ventrally. The adult lepidopteron pest bears no remarkable difference in color, size, structure etc. of their bodies in different districts of Kashmir valley.	Glossy brown dorsally and creamy white with spherical marks ventrally. The adult lepidopteron pest bears no remarkable difference in color, size, structure etc. of their bodies in different districts of Kashmir valley.
Resting state	Vertical position to its wings and lower creamy white colored surface of wings remains visible.	Vertical position to its wings and lower creamy white colored surface of wings remains visible.
Flying state	Upper blue surface of wings become visible intermittently	Upper blue surface of wings become visible intermittently
Forewings	Two	Two

Each pair was observed for pre-mating, mating, pre-oviposition and oviposition behavior and duration. Newly hatched larvae were then transferred to sterile paired petri dishes, lined with moist filter paper and provided with fresh walnut leaves and twigs. The food and filter paper lining were changed with fresh stock on subsequent days. Larvae were observed daily and examined for their biological information such as moulting, duration, size of each larval instar, pupation, pupal period and emergence.

Experimental observations: All the observations of life history stages were recorded. The specimens were preserved later on following standard methods.

Results and discussion

Morphological studies: Adult and larval morphology of *Chaetoprocta odata* is given in Table 1 and 2. Morphological characteristics of pupa of *Chaetoprocta odata* is given in Table 3.

Appearance of the pest: The larval phase starts appearing from March to June is given as:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
		▨	▨	▨	▨						

The adult *Chaetoprocta odata* start appearing from June to July is given as:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
					▨	▨					

Emergence of adult: When the butterfly adult increases and matures in parts, the pressure is exerted and the pupal covering is burst and adult lepidopteron insect pests are released out that start moving immediately in search of nectar of flowers.

Table 2. Morphological characteristics of larval stages of insect pest *Chaetoprocta odata*.

1 st Instar	
Shape	Cylindrical larva
Color	light green
Duration	6-12 d (2010-11) and 8-15 d (2011-12) March to April
2 nd Instar	
Shape	Ventrally flat, dorsally oblong, haired and segmented
Color	Dark green
Duration	18-22 d (2010-11) and 19-27 d (2011-2012) April-May
3 rd Instar	
Shape	Long, cylindrical and stationery larva without hairs
Color	Dark brown
Duration	8-10 d (2010-11) and 8-12 d (2011-12) May-June

Table 3. Morphological characteristics of pupa of adult *Chaetoprocta odata*.

Shape	Cylindrical body
Color	Light brown initially and dark brown just before adult emergence
Duration	24 d (2010-2011), 19-22 d (2011-12)

The color of the pupae turns light brown from dark brown a day before adult emergence. The imago emerged by splitting the pupal case antero-posteriorly up to less than half of total pupal length. The butterfly although able to walk initially hanged itself for 5 to 10 min before the wings were fully expanded. During course of study, the adults emerged in the morning hours between 5 to 10.30 a.m. The emergence starts from second fortnight of month of May up to the first fortnight of month of June. The emergence of the adults is synchronized with increase in temperature and humidity and thus, emergence period varies from year to year as it is related to environmental factors.

Plate 1. a. Male and b. female of *Chaetoprocta odata*.



Precopulatory behavior: After emergence, the male and female counterparts were paired and released inside the separate rearing cages and routine encounters between male and female partners have been experienced that evoked the sexual alertness in male member. After feeding, on the cotton soaked with honey solution, put inside the rearing cages, they start showing courtship behavior to undergo copulation. The small sized dull violet blue look bearing males was seen mating with large sized glossy brown look bearing females (Plate 1). The couples undergo mating at the bottom of rearing cages and remain under compromised posture for more than 1 h.

Egg laying: The female adult after hovering over host plant twigs was seen depositing her egg mass on selected part of host plant twigs. The egg mass is very difficult to identify as it camouflage with host twigs. The egg mass contains about 14-22 eggs. A group of rounded creamy white eggs has been observed on bark surface of the walnut twig. The cluster comprises of 10-13 eggs. The eggs were laid during winter under debris or fallen leaves. On approach of summer season, the eggs hatch and neonate larvae are formed that coincides with the sprouting of buds. The egg mass with its covering give it a brownish black color giving a camouflage bark appearance of the walnut.

Incubation period: The incubation period is period from egg lying to egg hatching. The incubation period varies from 245-260 d during 2010-2011 and 240-250 d during 2011-2012 because of varying temperature and humidity.

Hatching: The first instar larva emerges from the egg case by gnawing away an irregular hole with the help of its mandibles and wriggles out by enlarging the slit through the peristaltic movements. Emergence leads in an irregular split antero-posteriorly at least half way down the egg capsule length.

Post hatching and feeding behavior of larva: The neonate larvae after coming out from the egg shell started feeding on buds before it started actual feeding on the foliage. The neonate caterpillars were cylindrical in shape and light green in color.

Duration of larval stage: The total larval period of *C. odata* was found to range from 32 to 44 d and 35-54 d with the mean of 38.00 and 44.50 d during 2010-11 and 2011-12 respectively because of varying environmental factors. Duration of different life stages of *Chaetoprocta odata* during 2010-11 and 2011-12 is given in Table 4 and 5.

Conclusion

Chaetoprocta odata is one of the most serious destructive pests infesting *Juglans regia*. The walnut trees are important by virtue of their economical, nutritional, medicinal values. Therefore, the preliminary biological studies on the *Chaetoprocta odata* assume a special significance. To prevent further species distribution of *Chaetoprocta odata*, the movement of pest must be restricted. At present, there is no official confirmation of such a pest distribution in the region. There is a need to carry out the studies at molecular levels also. The control of *Chaetoprocta odata* should be holistic, utilizing biological control practices. The ongoing threat of the further spread of *Chaetoprocta odata* requires a region wide campaign to be launched.

Acknowledgements

Authors acknowledge the Head, Department of Zoology for providing the laboratory facilities for carrying out the research work.

Table 4. Duration of different life stages of *Chaetoprocta odata* under laboratory conditions during 2010-11.

Stage	Month	Duration (d)				
		Range		Mean		
Egg	July-March	245-260		252.5		
Larvae						
1 st Instar	March-April	6-12		9		
2 nd Instar	April-May	18-22		20		
3 rd Instar	May	8-10		9		
Total larval period	-	32-44		38		
Adult	-	-		-		
Male	June-July	15-21		18		
Female	June-July	19-24		21.5		
Sex ratio		Male	Female	Total	Percent emergence	Sex ratio
		37	41	78	85	47:43: 52.56

Table 5. Duration of different life stages of *Chaetoprocta odata* under laboratory conditions during 2011-12.

Stage	Month	Duration (d)				
		Range			Mean	
Egg	July-March	240-250			245	
Larvae						
1 st Instar	March-April	8-15			11.5	
2 nd Instar	April-May	19-27			23	
3 rd Instar	May	8-12			20	
Total larval period	-	35-54			44.5	
Adult	-	-			-	
Male	June-July	16-27			21.5	
Female	June-July	22-30			26	
Sex ratio		Male	Female	Total	Percent emergence	Sex ratio
		60	70	130	90	46.15: 53.84

References

- Abbasi, M.A., Raza, A., Riaz, T., Shahzadi, T., Rehman, J.M., Shahwar, D., Siddiqui, S.Z., Chaudhary, A.R. and Ahmad, N. 2010. Investigation on the volatile constituents of *Juglans regia* and their *in vitro* antioxidant potential. *Pak. Acad. Sci.* 47: 137-141.
- Davis, L., Stonehouse, W., Loots, D.T., Petersen, J., Van Der Westhuizen, F., Hanekom, S.J. and Jerling, J.C. 2007. The effects of high walnut and cashew nut diets on the antioxidant status of subjects with metabolic syndrome. *Eur. J. Nutr.* 46: 155-164.
- Eganathan, P., Subramanian, H.M.S.R., Latha, R. and Srinivasa Rao, C. 2006. Oil analysis in seeds of *Salicornia Brachiata*. *Ind. Crops Prod.* 23: 177-179.
- Gandev, S. 2007. Budding and grafting of the walnut (*Juglans regia* L.) and their effectiveness in Bulgaria (Review). *Bulgar. J. Agri. Sci.* 13: 683-689.
- Hosamani, K.M. and Sattigeri, R.M. 2000. Industrial utilization of *Rivea Ornata* seed oil: A moderate source of vernolic acid. *Ind. Crops Prod.* 12: 93.
- Iwamoto, M., Sato, M., Kono, M., Hirooka, Y., Saka, K., Takeshita, A. and Imaizumi, K. 2000. Walnuts lower serum cholesterol in Japanese men and women. *J. Nutrit.* 130: 171-176.
- Jaradat, N.A. 2005. Medical plants utilized in Palestinian folk medicine for treatment of Diabetes mellitus and cardiac diseases. *J. Al-Aqsa Univ.* 19: 128-177.
- Kaileh, M.B., Berghea, W.V., Boonec, E., Essawib, T. and Haegemana, G. 2007. Screening of indigenous Palestinian medicinal plants for potential anti-inflammatory and cytotoxic activity. *J. Ethnopharmacol.* 113: 510-516.
- Masoodi, M.A. and Trali, A.R. 1987. Record of *Chaetoprocta odata* Hewitson (Lycaenidae: Lepidoptera) on walnut trees in Kashmir. *Ind. J. Plant Protection.* 15: 213.
- Mir, G.M. and Wani, M.A. 2005. Severity of infestation and damage to walnut plantation by important insect pests in Kashmir. *Ind. J. Plant Protection.* 33(2): 188-193.
- Tagarelli, G., Tagarelli, A. and Piro, A. 2010. Folk medicine used to heal malaria in Calabria (southern Italy). *J. Ethnobiol. Ethnomed.* 6: 27.
- Vigneshwara, V. 2011. Walnuts: Need to expand cultivation. *Market Survey.* pp.13-15.