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RESEARCH ARTICLE

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Bionomics of *Clostera cupreata* (Butler) (Lepidoptera: Notodontidae) on poplar trees in Haryana

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ABSTRACT : Poplar is an important tree of agroforestry systems. Among several insect pests *Clostera* spp. pose serious threat to the poplar trees as it defoliates their leaves completely. Hisar, Haryana witnessed the outbreak of this pest during September-October months in the year 2016. Keeping that in view, biology of this insect was studied during October 2016. The total duration of immature stage was found to be 24.1 days. The fecundity of adult females recorded to be 186 eggs per female. Full grown final instar larva consumed 2.99 g. The life history information would be useful in efficient management of this pest.

KEY WORDS : *Clostera cupreata*, Poplar, Agroforestry, Biology

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INTRODUCTION

Poplar (*Populus deltoides* Bartram ex Marshall) has gained immense importance as the most suitable agroforestry tree in North Western states of India *viz.*, Haryana, Punjab, Uttra Pradesh and Uttrakhand; because of its desirable characteristics and multiple uses (Singhdoha, 2012). Deciduous nature allows crops to grow under poplar without much adverse effect on yield and yield parameters. They act as a raw material for industries like match sticks, plywood, fuel wood, etc. Poplars also help to improve socio-economic status of farmers and generate employment for rural population (Chandra, 2001).The extensively planted *P. deltoides* are threatened by several insect pests which may lead to lowering of both quantitative and qualitative traits. A total of 143 insect species found infesting different clones of poplar trees (Singh, 2004 and Ahmad and Faisal, 2012). However, *Clostera cupreata* (Butler) and *Clostera fulgurita* (Walker) are ranked as 'major pests' as during outbreaks they may cause economic loss of more than 50 per cent, along with tree mortality. The genus *Clostera* has been documented in the list of internationally important pest species (Singh *et al.*,2016). Heavy defoliation of this pest

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has been observed under Punjab condition in North India (Sohi *et al.*, 1987) but limited information was available with regard to biology, food consumption and utilization of *C. cupreata* under Haryana condition. Hence, the study was under taken to know the biology, food consumption and utilization of *C. cupreata* on poplar leaves.

Damage symptoms:

Larvae of *C. cupreata* are voracious defoliators of poplar leaves. Initial instars skeletonize the leaves gregariously by feeding on green matter of leaves (Fig. 1a). Later instars devour the leaves (Thakur, 2000) and soft tissue completely (Fig. 1b).

(a)

(b)

Fig. 1: Damage symptoms of initial (a) and later instars (b) of *C. cupreata* on poplar tree

Morphological traits :

Egg:

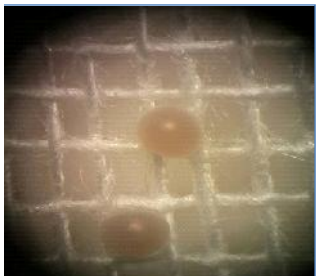
Spherical yellowish eggs are laid in groups which later turn to reddish colour prior to hatching (Fig 2a).

Larva:

Newly emerged larvae are gregarious in feeding habit and have cylindrical body with hump on first abdominal segment (Fig. 2b). Full grown larva is pale brown sparsely covered with hairs (Fig 2c).

Pupa:

The pupa is obtect, reddish brown in colour covered with silken web inside the rolled dry leaf (Fig 2d).

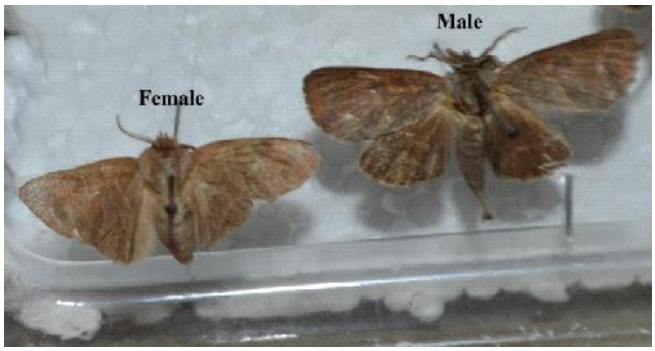


(a)

(c)

(b)

(d)



(e)

Fig. 2: Stages of *C. cupreata* (a) egg (b) early instar larva (c) full grown larva (d) pupa (e) adults

Adults:

Moths are grayish brown in colour with whitish markings on fore-wings. Male adult have analtuft whereas female have bigger size with broad abdomen (Fig 2e).

EXPERIMENTAL METHODS

The present studies on biology, food consumption and utilization were carried out during September-October, 2016 under laboratory conditions (25±2°C) in the Department of Entomology, CCS HAU, Hisar.

Insect rearing and identification:

C. cupreata larvae were brought from the established nursery plants of poplar clone G-48 at Department of forestry, C.C.S. Haryana Agricultural University, Hisar and were fed with poplar leaves the same clone until they developed into the pupae. The pupae were kept incubated at 25±2°C until the emergence of adults. A total of ten adult pairs of *C. cupreata* were caged in the glass jars (diameter 10 cm , height 15 cm) and covered with muslin cloth. The adult diet having 10 per cent sugar solution dipped in cotton swab was hung inside the jar. Data of pre-oviposition, oviposition period, post-oviposition period, adult longevity and fecundity were recorded subsequently. Dead adults were collected, pinned and sent for identification at Division of Entomology, Indian Agricultural Research Institute (IARI), New Delhi.

The eggs laid on the muslin cloth were collected daily and counted throughout the oviposition period of *C. cupreata* females. Twenty eggs were transferred to leaves of G-48 poplar clone using camel hair brush and were kept in the beaker with top covered with muslin cloth. A group of ten neonates were reared on poplar leaves which fed gregariously for first three days thereafter, larvae were reared individually in Petri dishes until pupal stage. Ten pupae attached to leaves were kept in petri dishes at 25±2°C. Observations like egg incubation period, larval duration, pupal duration were recorded daily. In addition, initial weight of poplar leaf given to larvae, weight of larvae, weight of faeces and final weight of unconsumed food were recorded daily to calculate food consumption and nutritional indices as per Waldbauer (1968) from last larval instar of *C. cupreata*.

The following formulae were used according to Waldbauer (1968) to calculate CI (consumption index), AD (approximate digestibility), ECI (efficiency of conversion of ingested food) and RCR (relative growth rate):

CI = E/A AD (%) = (E–F)/E

ECI (%) = P/E RGR = P/(A x T)

where, A = Mean dry weight of insect over unit time, E = Dry weight of food consumed, F = Dry weight of feces produced, P = Insect dry weight gain and T = Duration of feeding period.

EXPERIMENTAL RESULTS AND ANALYSIS

The life history traits of *C. cupreata* are summarized in Table 1. The present study recorded the egg incubation period of 3.2 days which is consistent with the similar period (3.32 days) recorded by Singh *et al*. (2016) on G-48 poplar clone. Singh (2004) recorded the egg incubation period of *C. fulgurita* in the range of 3 to 5.85 days on PL-1 clone of poplar. Total larval duration was observed to be 12.6 days in the present study which is close to the similar observation (14.25 days) recorded by Singh *et al*. (2016). Pupal period in the present study lie the range (4.1 to 116.7 days) of pupal period recorded by Singh *et al.* (2016). The

Table 1: Life history parameter values (Mean ± SE) of *C. cupreata* on poplar clone G-48

Sr. No.	Biological parameters	Duration (days)
1.	Egg duration	3.2±0.15
2.	Larval duration	12.6±0.16
3.	Pupal duration	7.8±0.2
4.	Total immature duration	24.1±0.31
5.	Pre-oviposition period	1.3±0.15
6.	Oviposition period	2.3±0.15
7.	Pre-oviposition period	1.8±0.13
8.	Adult longevity	5.4±0.16
9.	Fecundity*	186.4±3.0

* Number of eggs/female

Table 2 : Food consumption and utilization indices of *C. cupreata* on leaves of poplar clone G-48

Food consumption (g/ larva)	CI	AD (%)	ECI (%)	RGR
2.99±0.06	0.31±0.006	70.9±0.58	5.29±0.10	$0.016 \pm 5.26 \times 10^{-5}$

summation of egg, larval and pupal period gives total immature period which was 24.1 days. Fecundity of female was observed to 186 eggs per female which was slightly lower than those recorded (232 eggs/female) by Singh *et al*. (2016) on G-48 clone under field conditions. Oviposition period of female *C. cupreata* was of 2.3 days which is slightly different from those recorded by Singh *et al*. (2016). It can be concluded that the observation of life history traits in the present study were close to the previous study. Slight deviation in the results can be explained on account of different condition of experimental observation.

Food consumption and nutritional indices *of C. cupreata*:

Scanty information is available regarding quantitative aspects of *C. cupreata* feeding on poplar leaves. The present investigation recorded the mean consumption of 2.99 g of leaves of poplar clone G-48 by single final instar larva of *C. cupreata*. The CI, AD, ECI and RGR were recorded to be 0.31, 70.9, 5.29 and 0.016, respectively. 70.9 per cent approximate digestibility indicates that final instar larvae could digest only 70.9 per cent of diet fed to the final instar larvae (Table 2). The results related to utilization indices were in contrast to those recorded by Singh (2004) on *C. fulgurita*.

Conclusion:

It is essential to study life history traits of this pest owing to the loss it inflicts to the commercial forestry crop like poplar. This study would be beneficial in understanding pest biology which would be fruitful to the pest management efforts.

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