

Chapter 3

Studies on the Life Cycle of *Cantao ocellatus* (Hemiptera: Scutelleridae) on *Mallotus philippensis* (Malpighiales: Euphorbiaceae) in Nagar Nigam Park, Ranchi, Jharkhand

Priti Kumari Rajak*, Poorva Mandal, Vishwajeet Prasad & Anand Kumar Thakur

University Department of Zoology, Ranchi University, Ranchi, Jharkhand, India

*Corresponding author email: kumariishika304@gmail.com

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<https://orcid.org/0009-0001-0602-691X>

ABSTRACT:- The study was conducted to study the life table parameters and distribution of the Shield bug, *Cantao ocellatus* in Nagar Nigam Park, Ranchi between March and April 2024. This bug is phytophagous and hemimetabolous. Its Life cycle is completed in three stages -Eggs, Nymphs, and Adults. On 24th March 2024, the egg was laid on the underside of the leaves of the *Mallotus philippensis* (as a host plant), and after 6 days 1st nymphal instars appeared, and several moulting took 5 to 6 days to appear 2nd, and 3rd nymphal instars. Further, after 4 days of moulting 4th, and 5th nymphal instars developed and an adult appears after 10 days of moulting. Different sizes of exuviate were also identification marks for different stages of nymphs. The average size of Males was 2.16 cm and females were 2.2cm. The presence of a dark blue spot on the abdomen also distinguishes males and females. They suck sap from the host plant. *Mallotus philippensis*'s shooting and fruiting season occurs between March and April 2024, as the season of the host plant passes away, the population of the *Cantao ocellatus* decreases drastically.

Keywords: *Cantao ocellatus*, Nymphal instars, *Mallotus philippensis*, Exuviae, size.

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1. INTRODUCTION

Cantao ocellatus is a member of the family Scutelleridae and is distributed widely across Asia. The species is characterized by its reddish to ochre body coloration, bluish-black antennae, and distinct dark markings on the pronotum and scutellum. The present chapter documents field-based observations on morphology, host association, mating behaviour, life cycle stages, and sexual dimorphism of *C. ocellatus* recorded from Nagar Nigam Park, Ranchi, Jharkhand. All descriptions and interpretations in this chapter are strictly based on observed data and direct documentation.

Cantao ocellatus (Thunberg) is a brilliantly coloured hemipteran insect belonging to the family Scutelleridae (order Hemiptera), commonly known as jewel bugs or shield-backed bugs. It is widely distributed in South and Southeast Asia, including India^{1,2}. The insect is easily recognized by its metallic green or bluish body with conspicuous red or orange ocellate spots on the scutellum, which covers almost the entire abdomen. Due to its striking coloration, it is sometimes mistaken for a beetle, but it is a true bug possessing piercing-sucking mouthparts.

Although phytophagous, *C. ocellatus* has some indirect ecological importance like it serves as prey for birds, spiders, and predatory insects. Its presence contributes to maintaining ecological balance in agro-ecosystems. The bright coloration (aposematism) acts as a defense mechanism, often reducing predation. Thus, its role is not exclusively negative; it forms part of the biodiversity of agricultural landscapes.

2. TAXONOMIC POSITION

Domain	: Eukaryota
Kingdom	: Animalia
Phylum	: Arthropoda
Class	: Insecta
Order	: Hemiptera
Suborder	: Heteroptera
Family	: Scutelleridae
Genus	: <i>Cantao</i>
Species	: <i>Cantao ocellatus</i>



Fig. 1: *Cantao ocellatus*

The genus *Cantao* includes phytophagous species that feed on plant sap. *C. ocellatus* undergoes incomplete metamorphosis (paurometabolous development), passing through egg, nymphal, and adult stages. Females

lay eggs in clusters on host plant leaves or stems. Nymphs resemble adults but lack fully developed wings and bright coloration. The insect is commonly associated with plants such as castor (*Ricinus communis*), jatropha (*Jatropha curcas*), and other Euphorbiaceae members. Both nymphs and adults feed on plant tissues by inserting their stylets into stems, leaves, or developing fruits.

Economic Importance in Agriculture

Cantao ocellatus is primarily considered a minor pest, but under favorable environmental conditions, it may attain moderate pest status. It feeds by sucking sap from tender shoots, petioles, and developing fruits. Continuous feeding can cause: (a) Wilting of young shoots, (b) Yellowing of leaves, (c) Reduced plant vigour, and (d) Premature dropping of buds or fruits^{3,4}.

In crops such as castor, which is an important oilseed crop in India, heavy infestation may reduce seed yield and oil content. Damage is often more pronounced during the vegetative and early reproductive stages. Infestation by *C. ocellatus* results in: (a) Shriveling of capsules, (b) Reduced seed size, (c) Lower germination percentage, and (d) Decreased oil recovery.

Since castor cultivation contributes to farmer income in several Indian states, persistent infestation can lead to localized economic losses. The bug shows preference for Euphorbiaceous plants but may occasionally feed on other cultivated or ornamental plants. Its polyphagous tendency increases the risk of survival across seasons, as alternate hosts help maintain populations when primary crops are unavailable.

However, compared to major pests like semiloopers or capsule borers, its economic damage is generally limited and sporadic rather than epidemic.

3. Study Area and Material Observed

The study was carried out in Nagar Nigam Park, Ranchi, Jharkhand. Specimens were observed on host plants, collected carefully, and examined both macroscopically and microscopically. A total of eleven individuals were recorded during the study period.

4. External Morphology of *Cantao ocellatus*

Adults of *C. ocellatus* are generally reddish or ochre in colour. The legs are ambulatory and well adapted for walking, comprising coxa,

trochanter, femur, tibia, and segmented tarsus. The antennae are filiform and bluish-black, consisting of scape, pedicel, and a three-segmented flagellum.

The head bears a distinct dark bluish-black median stripe and is opisthognathous, with piercing and sucking type mouthparts. The pronotum may show two to eight black spots along the anterior margin, while the scutellum bears six to eight black spots bordered by yellowish margins. The lateral angles of the pronotum are often extended into curved spines, although variation was observed among individuals.

5. HOST PLANT ASSOCIATION

5.1 Host Plant

The principal host plant recorded during the study was *Mallotus philippensis*. In India, it is known by different common names in different regions- Kamala tree / Rohini (widely used in Jharkhand, Bihar, Uttar Pradesh, Madhya Pradesh), Sinduri / Kamala (common in Ayurvedic and forest-based communities), Monkey-face tree (used in English botanical and forestry literature), Kunkumadamara (Karnataka), and Kapur gundi / Rottlera (Western and Southern India). Both unaffected and affected plants were documented. Feeding activity was observed mainly on leaves and fruits, where the insects suck sap^{4,5}.



Fig. 2: Host plant (*M. philippensis*)

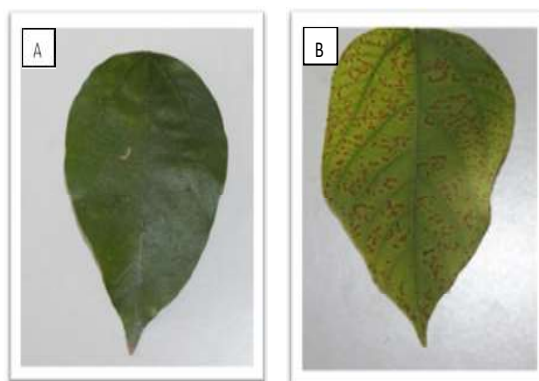


Fig. 3: Fresh leaf (A) and infected leaf (B) of host plant.

Classification of *Mallotus philippensis*

Domain: Eukaryota

Kingdom: Plantae

Division: Angiosperms

Class : Eudicots
Order : Malpighiales
Family : Euphorbiaceae
Genus : *Mallotus*
Species : *philippensis*

6. Behavioural Observations

6.1 Mating Behaviour: Mating behaviour was observed on 24 April 2024 at 5:44 PM under environmental conditions of 25 °C temperature and 35% relative humidity. Couples were observed remaining in copula for extended durations. Survivorship under high temperature conditions appeared to be poor⁶. The mating pairs remained largely inactive during copulation.



Fig. 4: Mating behaviour of *Cantao ocellatus* (A) Dorsal view, (B) Side view.

7. Life Cycle of *Cantao ocellatus*

C. ocellatus undergoes incomplete metamorphosis, passing through egg, nymph, and adult stages, with no pupal stage. The entire life cycle from egg to adult was observed to take approximately one month.

7.1 Egg Stage

Eggs were laid two to four days after separation of mating pairs and were deposited mainly on the underside of tender leaves or occasionally on fruit clusters. Egg laying was not observed during daytime in captivity. Each egg mass contained approximately 10–150 cylindrical eggs arranged in parallel rows and firmly attached to the plant surface. Freshly laid eggs appeared yellowish-white with a glossy upper pole. As development progressed, the colour gradually changed to orange, and the developing nymphal eyes became visible as pinkish spots through the transparent eggshell. Eggs hatched within five to seven days, although hatching within a single clutch was asynchronous.

Maternal care was consistently observed, with the female remaining over the egg mass until hatching. Eggs covered by the female retained normal coloration, whereas exposed eggs at the margins were frequently parasitized.

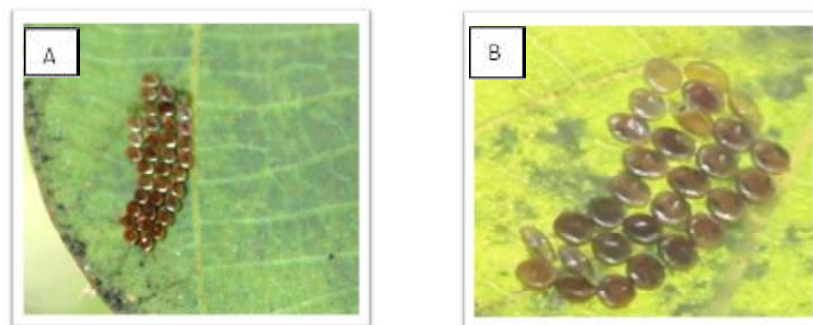


Fig. 5: (A) Eggs laid on the host plant, (B) Cluster of eggs.

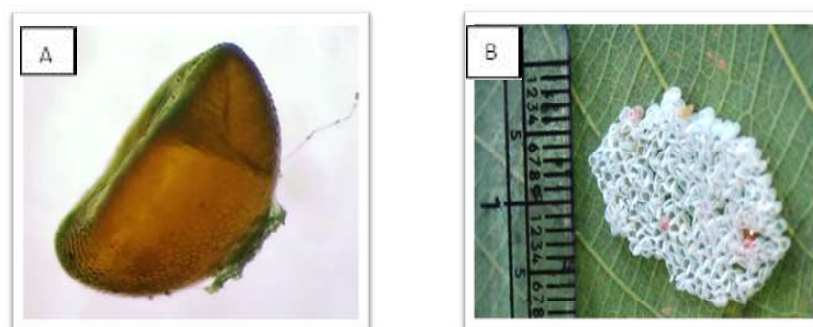


Fig. 6: (A) Microscopic view of an egg (Light Microscope, 10X), (B) Breath of egg (1.6 cm)

7.2 Nymphal Development

First Instar

The first instar measured approximately 1-5 mm in length and exhibited an oval, convex body shape. The general colour was orange, with scarlet eyes and transparent brown antennae, rostrum, and legs. Nymphs were gregarious and highly sensitive to disturbance^{7,8}.

Second Instar

The second instar measured approximately 0.25 cm. The abdomen turned pink, while the head and thorax acquired a metallic greenish hue. The abdomen showed bluish-black transverse patches. Nymphs remained gregarious and relatively inactive.

Third Instar

At approximately 0.5 cm in length, the scutellum began to develop posteriorly. The overall colour became reddish-ochre, and metallic markings near the connexivum became more prominent.

Fourth Instar

The fourth instar measured about 0.75 cm. Metallic blue coloration appeared on the head, thorax, legs, and rostrum. Wing pads became visible as blunt projections on either side of the body. Nymphs began to disperse into smaller groups.

Fifth Instar

The fifth instar measured approximately 1.3 cm. Wing pads and scutellum extended further over the abdomen, and prothoracic spines became visible. The insect attained adult form after the final moult within about one week.



Fig. 7: 1st Instar larva of pest.

8. Adult Stage and Sexual Dimorphism

Adults appeared from May to July, after which they were absent from the study area. Sexual dimorphism was subtle. Females were generally larger than males and showed a greater number of bluish-black spots on the ventral abdomen. Males were smaller and often more brightly coloured.

9. Morphometric Analysis

9.1 Female Body Length

Mean body length of females was calculated as 2.1 ± 0.14 cm

9.2 Male Body Length

Mean body length of males was calculated as 2.07 ± 0.05 cm.

HOST-PEST RELATIONSHIP

Mallotus philippensis plays a significant role as a host plant for *Cantao ocellatus*, sustaining the insect through feeding, mating, and oviposition.

Both nymphs and adults extract sap from leaves, shoots, and fruits using piercing-sucking mouthparts, leading to chlorosis, reduced photosynthetic efficiency, premature leaf drop, and overall decline in plant vigour. Heavy and prolonged infestations can weaken plants, affecting their growth and productivity, particularly in forest margins, agroforestry systems, and mixed cropping landscapes where *M. philippensis* commonly occurs.

From a socioeconomic perspective, it is an economically important tree for rural and tribal communities, as it is used in traditional medicine, dye production (kamala dye), and forest-based livelihoods. Damage caused by *C. ocellatus* can reduce leaf and fruit quality, thereby lowering the yield and market value of plant-derived products. For farmers and forest-dependent communities, such infestations may result in economic losses, increased labour for monitoring and control, and reduced income from non-timber forest products. At a broader scale, persistent pest pressure on economically useful host plants can indirectly affect the Indian rural economy by impacting small-scale livelihoods, traditional industries, and sustainable utilization of forest resources.

DEVELOPMENTAL STAGES			
	MINIMUM DURATION (DAYS)	MAXIMUM DURATION (DAYS)	MEAN
Incubation Period	4	6	5
1st Instar	3	5	4
2nd Instar	3	5	4
3rd Instar	3	5	4
4th Instar	4	6	5
5th Instar	7	9	8

Standard deviation of Female BODY LENTH (cm)							
Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 5	Sample No. 7	Sample No. 8	Sample No. 9
2	2.2	2.2	2.3	2.4	2.4	2.6	2.8

Parameter	Value
Number of Samples (n)	8
Mean	2.36 cm
Standard Deviation (SD)	±0.25
Standard Error (SE)	±0.09
Range	2.0–2.8 cm

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Standard deviation of Male Body Length (cm)		
Sample No. 1	Sample No. 2	Sample No.3
1.9	2.0	2.3

Parameter	Value
Number of Samples (n)	3
Mean	2.07 cm
Standard Deviation (SD)	±0.21
Standard Error (SE)	±0.12
Range	1.9-2.3 cm



Fig 8 :- Female *C. ocellatus*. Pair of dark blue dot on abdomen region.



Fig 9 :- Male *C. ocellatus* Dark blue dot absent on the abdomen region.



Fig. 10 :- 5th nymphal instar of *C. ocellatus*.



Fig. 11 :- 2nd and 3rd nymphal instar, (Online source)

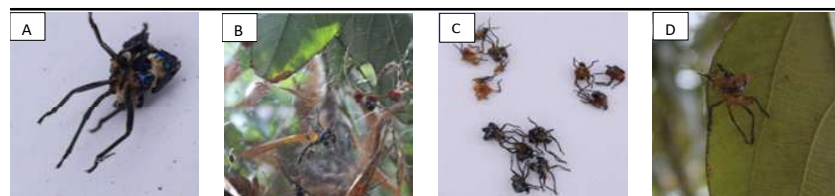


Fig. 12 :- Exuviae of different molting stages.
Some pheromones are responsible for molting (Imprinting).
Different size of exuvie from different instars.



Fig. 13: - Microscopic view (10x) on (A) Dorsal portion of *C. ocellatus*.
(B & C) Lateral portion of *C. ocellatus*.

CONCLUSION

The present study provides valuable insights into the life cycle, morphology, behavioural patterns, host association, and morphometric variations of *Cantao ocellatus* observed in Nagar Nigam Park, Ranchi, Jharkhand. The insect exhibited incomplete metamorphosis with distinct egg, nymphal, and adult stages, and its developmental duration was closely associated with environmental conditions and host plant availability. Maternal care, sexual dimorphism, moulting patterns, and feeding behaviour were important biological observations recorded during the investigation.

The study further highlighted the ecological and economic significance of the host-pest relationship between *Cantao ocellatus* and *Mallotus philippensis*. Continuous sap feeding by both nymphs and adults adversely affected the physiological condition and productivity of the host plant, thereby potentially influencing forest-based livelihoods and small-scale rural economies dependent on economically important plant resources.

Detailed documentation using photographs, microscopic observations, morphometric analyses, and developmental records contributed to a better understanding of the biology and ecology of this phytophagous hemipteran insect. The findings of the present work may

serve as a baseline reference for future studies on pest ecology, insect-plant interactions, biodiversity conservation, and integrated pest management strategies in agroforestry and forest ecosystems of Jharkhand and adjoining regions.

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