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## Taxonomic Account of Erebidae (Lepidoptera: Noctuoidea) Pests of Tea gardens of West Bengal, India

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### Abstract

Tea is a perennial cash crop which is grown at a large scale in Northern parts of West Bengal, India with a great susceptibility to attack of variety of insect pests throughout the year. Regular field surveys were conducted in tea gardens of West Bengal from 2011 to 2013 with the objectives of collection, Preservation and identification of Lepidopteron pests. The study revealed fourteen adult moth species of the family Erebidae of which two species *Arctornis submarginata* Walker and *Somena scintillans* (Walker) have been found pests.

**Keywords:** Tea, Pest, Lepidoptera, Erebidae, West Bengal

### 1. Introduction

Tea (*Camellia sinensis* L.) is very famous beverage throughout the world. Northern parts of West Bengal in India is home to 273 tea estates where tea is grown at very large scale<sup>[18]</sup>. In fact, tea procure a substantial amount of revenue as one of the major cash crops of the country. Tea is perennial plant and hence highly susceptible to the effects of seasonal variations, diseases attacks and various pests.

The Erebidae (Lepidoptera: Noctuoidea) is largest moth family which worldwide contains 24,569 species belonging to eighteen subfamilies<sup>[11]</sup>. The adults vary greatly in body shapes, sizes and wing colorations. Because of its huge diversity in terms of species count which are abundantly found in diverse habitats, it contains many phytophagous species including some polyphagous species and pests also.



**Fig 1:** Characteristic wings of an Erebid moth

Among the superfamily Noctuoidea the Erebid moths may be identified by the wing characteristics of the adults. They typically have their forewing vein 5 arising closer to the origin of vein 4 than vein 6, in the lower part of the discal cell, so that the veins 2-5 arising from the lower parts of the cell appears to be four-branched (quadrid) (Figure 1) and similar type of splitting of vein is also seen in hind wing hence termed as quadrid hind wing (Figure 1) [13]. Till recently, in India the subfamilies Aganainae, Arctiinae and Lymantriinae have been designated as separate families under the superfamily Noctuoidea by many workers [15, 16, 17] but in very recent publications [9, 14] cladistics phylogeny as found in recent classification of Lepidoptera [11, 13] has been adopted by pioneer workers. In the present work the same classification has been followed in consensus with them.

The objective of this work is to identify the adult moths of the family Erebidae collected from tea gardens of Northern part of West Bengal and to provide a taxonomic account of these moths which is hoped to be helpful for tea growers and other amateur entomologists to identify Erebid moth pests of tea.

**Material and methods**

Moths were collected from 75 tea gardens of North Bengal during regular field survey conducted from 2011 to 2014 under the programme “Insect Pest and Pollinator of Some Major Crops in North Bengal” approved by Zoological Survey of India (ZSI). Light traps were operated using 27 Watt Philips

energy saver CFL Lamp from 6.00 p.m. to 9.00 p.m. for collecting specimens at night. At day, butterfly catching nets were used for collecting moths hiding underside of leaves and shadowed parts of tea plants or at flight. The collected specimens were then put in killing bottles containing Ethyl Acetate. Killed specimens were pinned and preserved by following standard methods [1] and photographed by using Nikon D7000 camera. Leica EZ4 and Leica EZ4 HD microscopes were used for specimens identification. The taxonomic characters such as palpi, antennae, thorax, tibial spurs, tymbal organ, wing venation and fore wing areole were used in the construction of key for identification up to generic level. For descriptions of the taxonomic characters and diagnosis of species standard literatures [2-7] have been followed along with our own observations made by comparing specimens with the reference Collections of the ZSI.

**Taxonomic Account**

Family Erebidae

Key to the subfamilies

- i. Presence of tymbal organ (Figure 2.A).....ii
- Absence of tymbal organ.....Aganainae
- ii. Hind wing with vein 8 rising out of 7 (Figure 2.B) .....Arctiinae
- Hind wing with vein 8 connected with 7 by a bar or touching it near middle of cell (Figure 2.C).....Lymantriinae

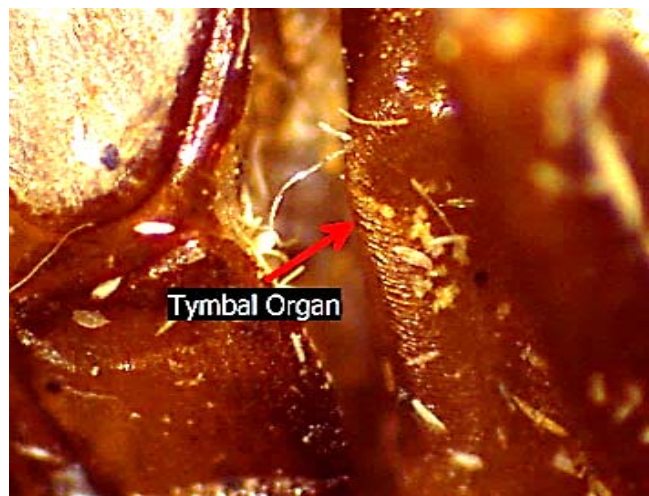


Fig 2.A: Tymbal organ

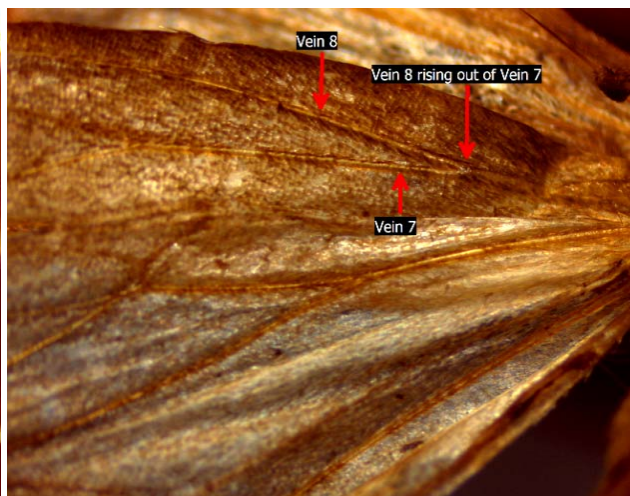


Fig 2.B: Characteristic hind wing veins 7 & 8 of Arctiinae

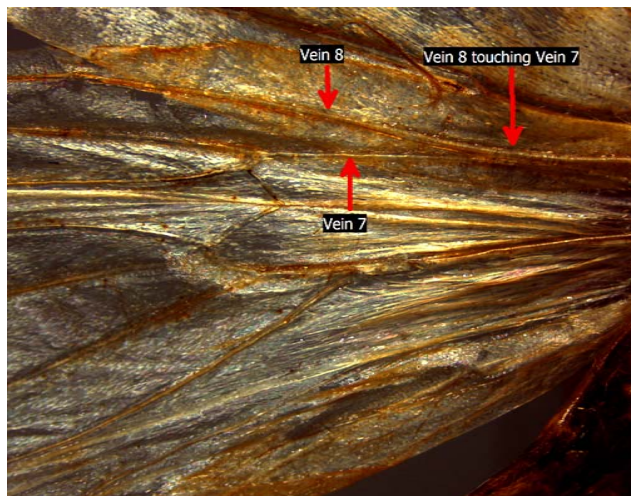


Fig 2.C: Characteristic hind wing veins 7 & 8 of Lymantriinae

**Subfamily Aganainae**

Diagnosis: Large sized and brightly coloured moths, antennae in male ciliate, filiform or slightly bipectinate (*Asota*), the pectinations slender, strongly curved and invested with a basal fan of fine cilia, tymbal organ absent, fore wing with an orbicular stigma in discal cell.

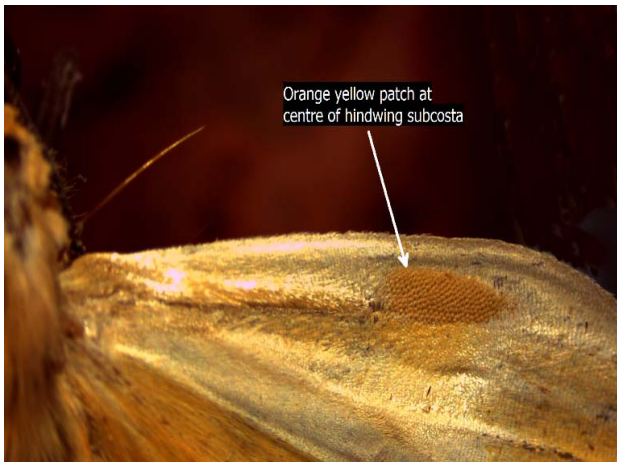
**Key to the genera**

- Presence of scaly, orange-yellow and oval patch at the center of hind wing subcostal (Figure 3).....*Asota*

**Genus *Asota* (Hubner, 1819)**

*Asota egens* (Walker, 1854) (Figure 6.L)

Diagnosis: Head, thorax and abdomen orange-yellow, dorsal series of black spots on abdomen, collar and tegulae with black spots. Fore wing with five black spots at base, the veins streaked with whitish-yellow. Hind wing yellow. Underside of both wings with some black patches in and around discal cell.



**Fig 3:** Hind wing subcostal patch of *Asota* sp.

**Subfamily Arctiinae**

Diagnosis: Medium to large sized often brightly-coloured moths, antennae bipectinated, ciliated or simple, presence of tymbal organs on the metepisternum, Forewing areole often present, Tympanal organs present on the metathorax, abdomen bears a prespiracular tympanal hood.

**Key to the genera**

- i. Thorax and abdomen stoutly built (Figure 4.A).....iv
- ii. Thorax and abdomen slender (Figure 4.B) .....ii
- iii. Palpi short and extended forward (Figure 4.C) .....*Miltochrista*
- iv. Palpi upturned or porrectly upturned (Figure 4.D) .....iii
- v. Antennae ciliate (Figure 4.E) ..... *Cyana*
- vi. Antennae bipectinate (Figure 4.F)..... *Nyctemera*
- vii. Hind tibia with one pair of spurs (Figure 4.G) .....*Cretonotos*
- viii. -Hind tibiae with two pair of spurs (Figure 4.H) .....v
- ix. Palpi porrect (Figure 4.I)..... *Callimorpha*
- x. Palpi upturned (Figure 4.J).....*Argina*

**Genus *Miltochrista* Hubner, 1819**

*Miltochrista cuneonotata* (Walker, 1855) (Figure 6.D)

Diagnosis: Head, thorax, and abdomen orange suffused with flame-red. Wings bright orange; prominently suffused with flame-red. Fore wing with sub basal fuscous streaks, a curved and angulated post medial line and a curved ante medial line anastomosing in the cell with an angulated medial line, the veins of the outer area streaked with fuscous, the interspaces

streaked with flame-red, costa and cilia fuscous. Hind somewhat wing paler.

**Genus *Cyana* Walker, 1854**

*Cyana bianca* (Walker, 1856) (Figure 6.E)

Diagnosis: The forewing fasciae are flame-red, straight, variable in width, and may or may not be edged black. The male has three black discal dots in a triangle, the female has only the more costal two of these, set longitudinally. In the male, the red bands may get expanded to surround the discal spots. The hind wing varies from white to pink.

**Genus *Nyctemera* Hubner, 1820**

*Nyctemera adversata* Schaller, 1788 (Figure 6.F)

Diagnosis: Head and thorax yellowish white. The abdomen white with black bands, the extremity yellow. Tegulae with three black spots. Fore wing white with the costa dark at base, an irregular medial band sending streaks along the veins to the marginal band which extends from costa through apex to vein 3 and has three white marginal spots and dentate inner margin. Hind wing white with black patch at lower angle of cell and five sub marginal spots.

**Genus *Callimorpha* Latreille, 1809**

*Callimorpha plagiata* Walker, 1855 (Figure 6.G)

Diagnosis: Head and thorax orange, palpi and frons black, abdomen orange with black bands. Fore wing with many large yellow spots; one being placed beyond the cell and a series of elongated spots in sub marginal area. Two smaller spots in discal cell. Hind wing with medial and submarginal series of spots; some specimens with a spot at origin of vein 2.

**Genus *Cretonotos* Hubner, 1819**

*Cretonotos transiens* (Walker, 1855) (Figure 6.H)

Diagnosis: Head and thorax dark chestnut-brown. Abdomen golden yellow, with a series of dorsal black spots. Fore wing dark chestnut, the costa and cell of fore wing suffused with white. Three orbicular and reniform spots outlined in grey on discocellulars. Hind wing with a broad irregular black margin and with a black spot on discocellulars.

*Cretonotos gangis* (Linnaeus, 1763) (Figure 6.I)

Diagnosis: Head, thorax and fore wing pale pinkish brown, palpi and legs smoky black, the femora yellow, a broad dorsal band on thorax. Abdomen orange above with dorsal and lateral series of black spots. Fore wing with a broad black fascia below cell, two black spots at end of cell and a broad streak beyond the lower angle of cell. Hind wing pale, some specimens with a sub marginal series of black spots.

**Genus *Argina* (Hubner, 1819)**

*Argina argus* (Kollar, 1844) (Figure 6.J)

Diagnosis: Head and thorax pinkish-red. Abdomen pinkish-red with dorsal, ventral, and two paired lateral series of black spots. Bears two black yellow-ringed spots on collar, two on tegulae, and three on thorax. Fore wing pinkish-red with six curved transverse series of yellow-ringed black spots of variable size and number. The post medial series bifurcates towards the costa. Hind wing similar with black spots of variable size; one being at end of cell, another at origin of vein 2 and other one at its middle.

*Argina astra* (Drury, 1773) (Figure 6.K)

Diagnosis: Head, thorax and abdomen orange-yellow. The markings as in *Argina argus*. Fore wing bright orange; the black spots ringed with yellow. Hind wing paler and with similar spots as in fore wings.



Fig 4.A: Thorax and abdomen of *Argina* sp.



Fig 4.B: Thorax and abdomen of *Miltochrista* sp.



Fig 4.C: Palpi of *Miltochrista* sp.

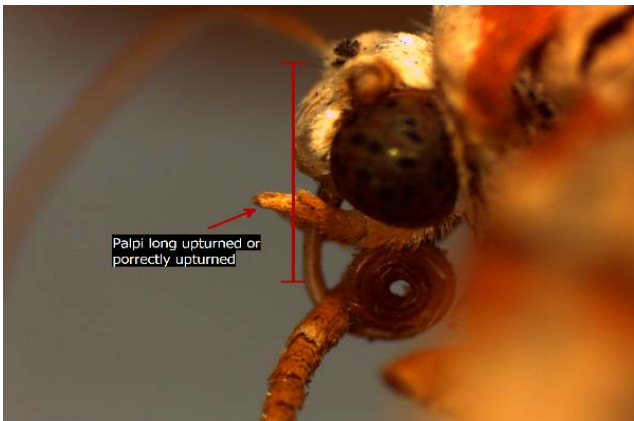


Fig 4.D: Palpi of *Cyana* sp.

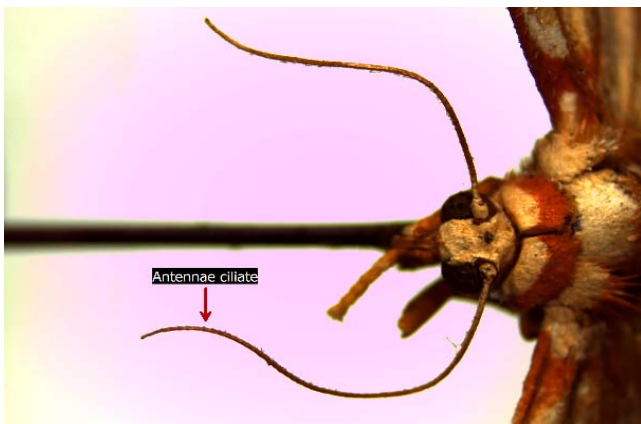


Fig 4.E: Antennae of *Cyana* sp.



Fig 4.F: Antennae of *Nyctemera* sp.



Fig 4.G: Hind tibial spurs of *Creatonotos* sp.

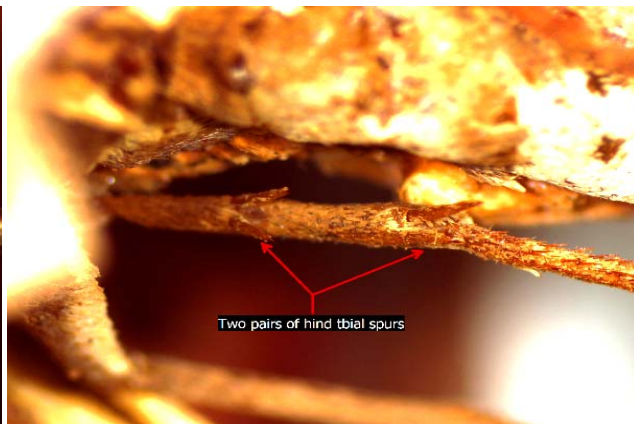


Fig 4.H: Hind tibial spurs of *Callimorpha* sp.

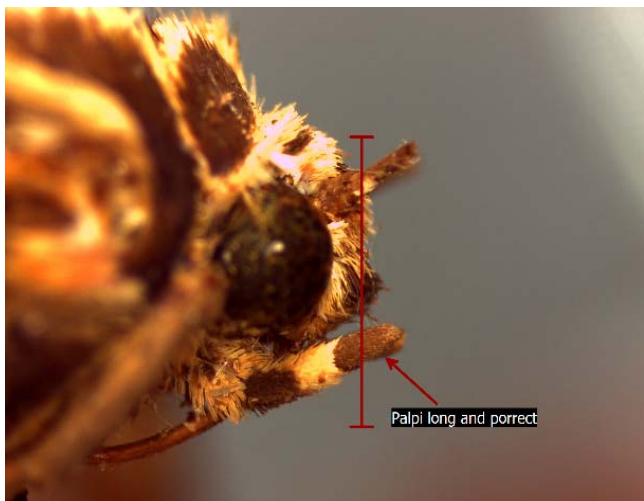


Fig 4.I: Palpi of *Callimorpha* sp.

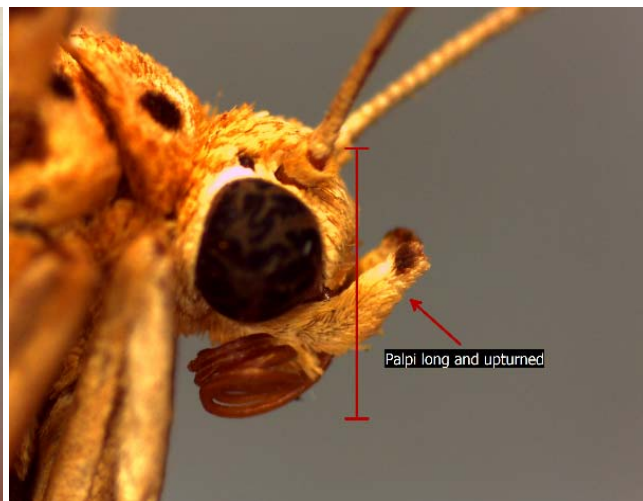


Fig 4.J: Palpi of *Argina* sp.

**Subfamily Lymantriinae**

Diagnosis: Small to medium sized moths, antennae of both sexes strongly bipectinated, the pectinations longer in male, a thoracic tympanum as well as a prespiracular counter-tympanal hood present as found in the Arctiinae, fore wing areole can be present or absent, often with long, hair-like scales on thorax and abdomen.

**Key to the genera**

- i. Forewing areole present (Figure 5.A).....ii
- Forewing areole absent (Figure 5.B).....iii
- ii. Palpi upturned (Figure 5.C).....*Arctornis*
- Palpi correct (Figure 5.D).....*Orgyia*
- iii. Hind wing vein 5 absent (Figure 5.E).....*Somena*
- Hind wing vein 5 present (Figure 5.F).....iv
- iv. Forewing vein 10 initiates near the cell (Figure 5.G).....*Lymantria*
- Forewing vein 10 initiates near the apex (Figure 5.H).....*Euproctis*

**Genus Arctornis Germar, 1810**

*Arctornis submarginata* Walker, 1855 (Figure 6.A)

Diagnosis: Head with two blackish brown bars on the frons between the antennal bases and dorsal part of the eyes. The palps, antennal bases and dorsal part of the eyes blur into each other. The palpi basally yellowish-orange but turn blackish

towards the apex. The wings are dull satiny white. The forewing bears a small black discal spot.

**Genus Orgyia Ochsenheimer, 1810**

*Orgyia* sp.

**Genus Somena Walker, 1856**

*Somena scintillans* (Walker, 1856) (Figure 6.B)

Diagnosis: Head yellow, thorax brown, abdomen yellow, the anal tuft orange. Fore wing ground colour purple- brown, speckled with dark scales which extends as two spurs across the yellow marginal area below the apex and to center of margin, sometimes not reaching the margin, costa often yellow. Hind wing yellow or fuscous brown with a broad yellow margin.

**Genus Lymantria Hubner, 1819**

*Lymantria marginalis* (Walker, 1862) (Figure 6.C)

Diagnosis: Males have light forewing fasciation except at the costa where there are broad, blackish marks. The hind wings are mainly white. The females are similar, with clear 'V' shaped and narrower medial band. The hind wing is paler and does not bear any marginal marks.

**Genus Euproctis Walker, 1865**

*Euproctis* sp.



Fig 5.A: Fore wing areole of *Arctornis* sp.

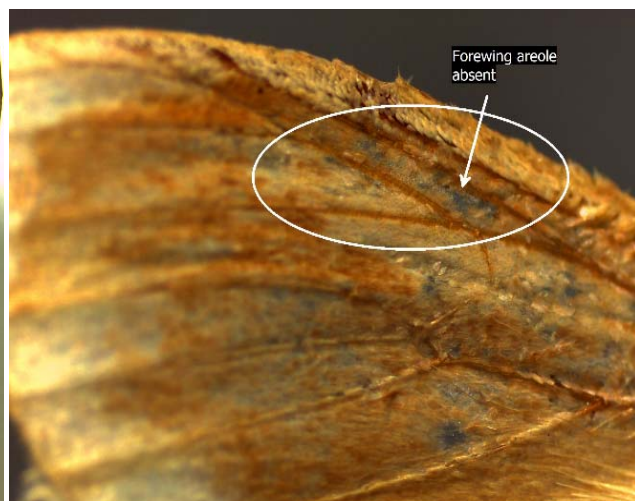


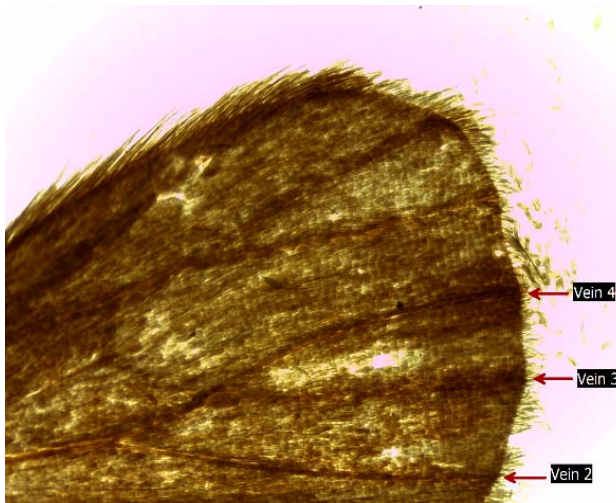
Fig 5.B: Absence of fore wing areole in *Somena* sp.



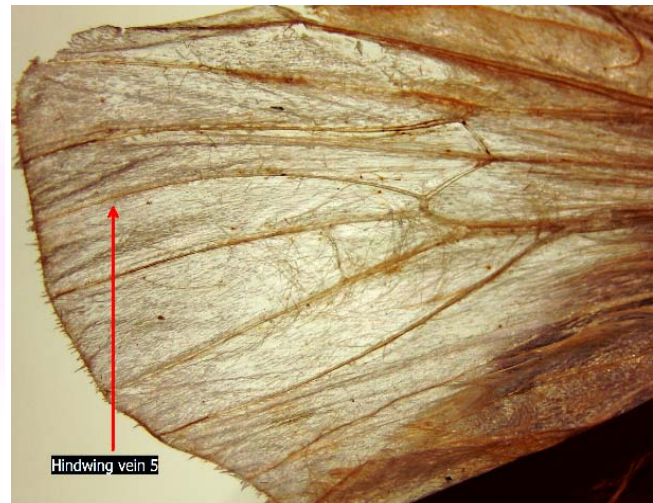
**Fig 5.C:** Palpi of *Arctornis* sp.



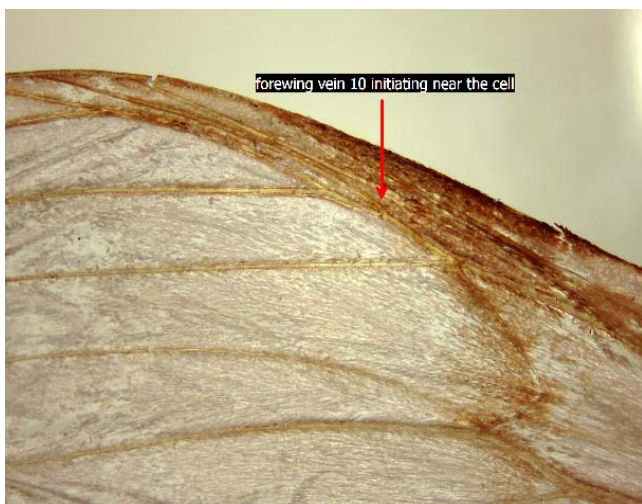
**Fig 5.D:** Palpi of *Orgyia* sp.



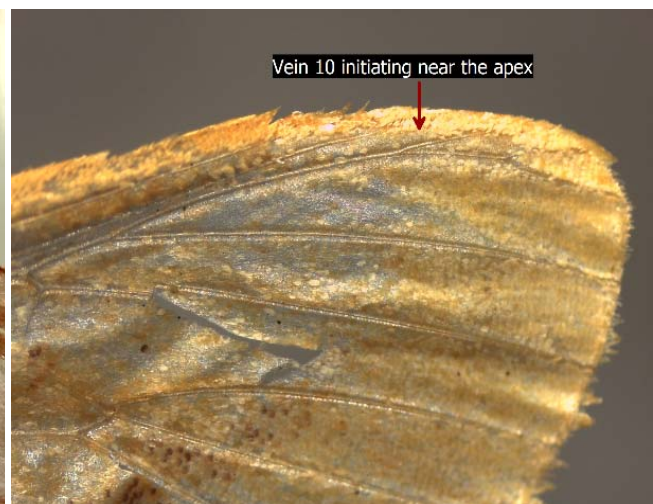
**Fig 5.E:** Absence of vein 5 in Hind wing of *Somena* sp.



**Fig 5.F:** Hind wing vein 5 of *Lymantria* sp.



**Fig 5.G:** Fore wing vein 10 of *Lymantria* sp.



**Fig 5.H:** Fore wing vein 10 of *Euproctis* sp.

**Discussion**

The Erebid moths are polyphagous herbivores which occupy habitats like crop fields, forest ecosystems and at the juxtaposition of these two. The tea gardens in North Bengal provide absolutely similar type of habitats for these moths to survive. As a result of the present work fourteen species have

been identified from North Bengal tea gardens. These pertain to twelve genera belonging to three subfamilies. The Subfamily Arctiinae has highest number of genera and species (6 and 8 respectively), followed by the subfamily Lymantriinae (5 genera and 5 species) and the subfamily Aganainae (1 genera and 1 species). Of these, *Arctornis*

*submarginata* Walker is reported defoliator of mature and young leaves [10] and *Somena scintillans* (Walker) is reported as minor pest of tea [8]. During field surveys a number of specimens of species *Nyctemera adversata* Schaller and *Arctornis submarginata* Walker were collected from tea plantations at day time. *Cretonotos transiens* (Walker) were collected comparatively more in number on light at night. The species *Asota egens* (Walker) has been observed only twice during the survey period. It prefers lowland forests with some preferences for secondary forest [5]. The rest of the species have been collected occasionally.

Since precise identification of the pests is essential for deployment of biological or chemical pest control, the role of classical taxonomy becomes very important if any bio-control programme is to be initiated. In these scenario, classical taxonomy in addition to modern day identification tools like

DNA taxonomy becomes very essential for the identification of pests [12].

As far as the present work is concerned, we have restricted to classical taxonomy of Erebid pests only. The taxonomic characters have been used in such a way that can be conveniently understood and followed by tea growers, amateur entomologist and common people working in similar fields.

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Fig 6.A: *Arctornis submarginata*



Fig 6.B: *Somena scintillans*



Fig 6.C: *Lymantria marginalis*



Fig 6.D: *Miltochrista cuneonotata*



Fig 6.E: *Cyana bianca*



Fig 6.F: *Nyctemera adversata*



Fig 6.G: *Callimorpha plagiata*



Fig 6.H: *Cretonotos transiens*



Fig 6.I: *Cretonotos gangis*



Fig 6.J: *Argina argus*



Fig 6.K: *Argina astrea*



Fig 6.L: *Asota egens*

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