

# On the Picture-winged Leaf Moths (Lepidoptera: Thyrididae) from Chittagong University Campus, Bangladesh, with a report of a pouch-like structure on the caterpillar metathoracic legs of *Aglaopus decussata* Moore and notes on its life history

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**Abstract:** We studied nine morpho-species belonging to six genera of thyridid moths from the Chittagong University campus, Bangladesh. Four of them are identified to species, of which three are new records for Bangladesh. *Striglina* Guenée, 1877 was the most diverse genus, with *Striglina scitaria* (Walker, 1862) observed more than ten times, while other species were observed only once. The life history and immature stages of *Aglaopus decussata* (Moore, 1883) are described for the first time. A modification on the caterpillar metathoracic legs is reported, which makes these legs resemble boxers' hands with boxing gloves. Images of the adults of all the studied species, along with images of the female genitalia of *Aglaopus decussata* (Moore, 1883) and *Collinsa* cf. *acutalis* (Walker, [1866]), are provided. In addition, a taxonomic note on the misidentification of *Picrostomastis subrosealis* (Leech, 1889) from Bangladesh is provided.

**Keywords:** genitalia, leg modification, *Picrostomastis subrosealis*, pyraliform, *Striglina*.

## INTRODUCTION

Thyrididae comprises 940 species in 93 genera worldwide (van Nieuwerkerken *et al.*, 2011). The moths are small to large in size, with 9-90 mm wingspan (Heppner, 2008), and are widely distributed in tropical and subtropical regions in woodland habitat (Li, 1996). The species of this family are rare in comparison with many other lepidopterans and are usually represented by very few specimens in field collections (Whalley, 1976). The taxonomy of Thyrididae is largely unresolved and the family has often been considered as a polyphyletic group (Whalley, 1976) closely related to pyralid moths (Hampson, 1892; Whalley, 1976; but see Kawahara *et al.*, 2019). The caterpillars of this family are pyraloid or pyraliform with five pairs of prolegs (Hampson, 1892; Whalley, 1976).

Diagnostic characteristics of Thyrididae include the presence of a reticulated pattern on the upper and underside of both pairs of wings and, in a few species, the presence of fenestra or a clear window on the hind wing (Li, 1996). Hampson (1892) listed 55 species of thyridid moths belonging to 10 genera from India, Sri Lanka, and Myanmar, along with adjacent countries. Of them, three species were reported to occur in Bangladesh: *Dysodia ignita* Walker, 1865, *Herdonia osacesalis* Walker, 1859, and *Glanycus insolitus* Walker, 1855; while the following three species, *Banisia myrsusalis* (Walker, 1859), *Banisia myrtaea* (Drury, 1773), and *Striglina scitaria* (Walker, 1862), were reported to be distributed throughout

[erstwhile] India (Hampson, 1892). More recently, Mazumdar *et al.* (2021) reported *Picrostomastis subrosealis* (Leech, 1889) from the Chittagong University campus, Bangladesh.

The caterpillars of Thyrididae show various morphological modifications. In the caterpillar of *Calindoea trifascialis* (Moore, 1877), Darling *et al.* (2001) reported an arm-like eversible paired protuberance situated dorsoventrally on the first abdominal segment at the opening of sac-like glands producing cyanogenic compounds. The behavior of the caterpillars, along with the description of the abdominal protuberance, was discussed by Darling *et al.* (2001) and Darling (2003). The protuberance, with cyanogenic compounds secreted from the sac-like glands, is part of a defense mechanism and is considered as an adaptation for the dry, dipterocarp forest habitats of southeast Asia (Darling, 2003). Possibly, this protuberance is widely distributed in Thyrididae, but so far it has been reported only in *C. trifascialis* (Darling, 2003).

In the present paper, we studied nine morpho-species belonging to six genera of thyridid moths from the Chittagong University campus, Bangladesh. Four of them are identified to species, of which three are new records for Bangladesh. *Striglina* Guenée, 1877 was the most diverse genus, with *Striglina scitaria* (Walker, 1862) observed more than ten times, while other species were observed only once. The life history and immature stages of *Aglaopus decussata* (Moore, 1883) are described for the first time. A modification on the caterpillar metathoracic legs is reported, which makes these legs resemble

boxers' hands with boxing gloves. Images of the adults of all the studied species, along with images of the female genitalia of *Aglaopus decussata* (Moore, 1883) and *Collinsa cf. acutalis* (Walker, [1866]), are provided. In addition, a taxonomic note on the misidentification of *Picrostomastis subrosealis* (Leech, 1889) from Bangladesh is provided.

## MATERIALS AND METHODS

Chittagong University is situated at Zobra Village of Hathazari Upazila in Chittagong District, Bangladesh (22°27'30"-22°29'0"N & 91°46'30"- 91°47'45"E), about 6 km east of the Bay of Bengal (Haidar *et al.*, 2017). The campus comprises 1754 acres of land and is the largest university in Bangladesh. About 60% of the land area of the campus is covered by steep or very steep hills (Hossain *et al.*, 2013), and overall 72% of the land comprises hills, lakes, ponds, plains and valleys as low as 16 m above sea level (Islam *et al.*, 1979). The vegetation is semi-evergreen (Ahsan & Khanom, 2005), and a total of 665 plant species in 126 families and 404 genera have been recorded from the campus, of which 550 are dicotyledons and 115 are monocotyledons (Alam & Pasha, 1999).

Moths were observed at various locations of the Chittagong University campus from 2018 to 2021. During the day moths were observed directly within their natural habitat, while at night moths were observed at porch lights in residential areas. Specimens of only two species, *Collinsa cf. acutalis* (Walker, [1866]) and *Aglaopus decussata* (Moore, 1883), were collected using plastic boxes containing cotton soaked with acetone as a killing agent. Remaining species were photographed using a cell-phone camera.

Identification was done mainly on the basis of original descriptions, as well as descriptions given by Hampson (1892), Whalley (1976), and Whitaker *et al.* (2014). Type materials, where accessible, were examined, including images of types at the NHMUK (The Natural History Museum, London, U.K.). Caterpillars were collected and reared inside square plastic boxes with suitable ventilation and moisture. Genitalia dissection of voucher specimens was done following the procedures given by Robinson (1976).

## RESULTS

### Family Thyrididae Subfamily Siculodinae

#### Genus *Calindoea* Walker, 1863

*Calindoea* Walker, 1863, *List Spec. Lepid. Insects Colln. Br. Mus.* 27: 87.

*Type-species: Calindoea cumulalis* Walker, 1863.

*Distribution:* China and India to Solomon Islands (Robinson *et al.*, 1994).

#### *Calindoea argentalis* (Walker, [1866])

Figure 1

*Pyrallis argentalis* Walker, 1866, *List Spec. Lepid. Insects Colln. Br. Mus.* 34: 1522.

*Type-locality:* Java (Images of type material examined from NHMUK).

*Material examined:* Only one individual photographed from Shaheed Abdur Rab Hall, Chittagong University Campus (22°28'27.70"N, 91°47'07.26"E) on 4.V.2018.

*Diagnosis:* A white moth with bronze head and collar. Easily recognizable from the congeners by the following characteristics: wings are slightly striated with bronze, forewings with a prominent oval-shaped large bronze postmedial patch, a prominent elongated black ocellus in subapical region, and abdomen having bronze band proximally.

*Distribution:* Java, Borneo, Bhutan, Sri Lanka, India (Hampson, 1896; Whitaker *et al.*, 2014), Bangladesh (present study).

*Remarks:* New record for Bangladesh.

#### Genus *Collinsa* Whalley, 1964

*Collinsa* Whalley, 1964, *Ann. Mag. Nat. Hist.* (13)7: 118.

*Type-species: Dohertya roseopuncta* Warren, 1902

*Distribution:* Africa, Indo-Australian region, America (Whalley, 1971).

#### *Collinsa cf. acutalis* (Walker, [1866])

Figures 2-3

*Pyrallis acutalis* Walker, 1866, *List Spec. Lepid. Insects Colln. Br. Mus.* 34: 1523.

*Type-locality:* Indonesia (Misool) (Images of type material studied from NHMUK)

*Material examined:* BANGLADESH, Chittagong University, Fateyabad road (22°27'33.56"N, 91°48'53.54"E), 30.XI.2021, 1♀, leg. Jahir Rayhan, Sayema Jahan.

*Diagnosis:* This species is differentiated from other closely related species of *Collinsa* by the following characteristics: a whitish brown moth, forewings with distinct darker brown lines with whitish 'c'-shaped apical spot, and the hind wings with antemedial line darker and very prominent.

*Remarks:* The female genitalia is somewhat similar to that of *Collinsa acutalis* and *C. hamifera* (Moore). However, it is distinct due to the sclerotized signum and its dentition, for which the species has been provisionally identified as a member of *C. acutalis* group, pending further investigation.

#### Genus *Herdonia* Walker, 1859

*Herdonia* Walker, 1859, *List Spec. lepid. Insects Colln Br. Mus.* 19: 963.

*Type-species: Herdonia osacesalis* Walker, 1859

*Distribution:* India, Nepal, Myanmar, Thailand, China, Japan, Sundaland, Philippines, New Guinea, Bangladesh (Hampson, 1892; Inoue, 1993).

#### *Herdonia* sp. 1

Figure 4

*Material examined:* Single individual photographed from Shaheed Abdur Rab Hall, Chittagong University Campus (22°28'27.70"N, 91°47'07.26"E) in 2019.

*Diagnosis:* The observed species differs from *Herdonia osacesalis* Walker, the most closely similar species occurring in Bangladesh, in the basal band of the hind wings forming an angle at the outer side, and the marginal band being wider.

*Remarks:* The moth was observed during daytime resting on the leaf of a mango tree.



**Figures 1-6.** Adult moths. **1.** *Calindoea argentalis* (Walker, [1866]); **2-3.** *Collinsa* cf. *acutalis* (Walker, [1866]); **4.** *Herdonia* sp. 1; **5.** *Kanshizeia* cf. *obscuralis* (Hampson, 1893); **6.** *Aglaopus decussata* (Moore, 1883).

Genus *Kanshizeia* Strand, 1920

*Kanshizeia* Strand, 1920, *Arch. Naturgesch.* 84(A)12: 188.

*Type-species: Kanshizeia camadenalis* Strand, 1920

*Distribution:* Madagascar, Aldabra, Mauritius, Africa and north India (Whalley, 1971 [as *Hapana*]).

*Remarks:* The genus is newly recorded for Bangladesh.

*Kanshizeia* cf. *obscuralis* (Hampson, 1892)

Figure 5

*Hypolamprus obscuralis* Hampson, 1892, *Fauna Br. In.* 1: 365.

*Type-locality:* India (Sikkim) (Images of type material examined from NHMUK).

*Material examined:* Only one individual photographed from Faculty of Science Building, Chittagong University Campus (22°28'12.95"N 91°46'58.36"E) on 23.IV.2019.

*Diagnosis:* The observed species resembles the only Indian species of this genus, *Kanshizeia obscuralis* Hampson, in having an overall pale chestnut coloration with elongated forewings with straighter outer margin, and broad hind wings with rounded outer margin. Both wings are striated with darker lines forming broader bands on the forewings. There is an oblique line extending from the costa towards the inner angle of the forewings.

*Remarks:* The moth was observed only once, resting up above a wall during day time. Further study is needed to confirm the identification, including collecting and examining specimens.

*Picrostomastis subrosealis* (Leech, 1889) (presence in Bangladesh requiring confirmation)

*Microsca subrosealis* Leech, 1889, *Entomologist* 22: 66.

*Type-locality:* China (Yunnan: Ningpo) (Images of type material studied from NHMUK)

*Taxonomic note:* *P. subrosealis* is distributed in China, Hong Kong, Sri Lanka, Myanmar, Thailand, Sumatra, West Malaysia, Singapore, Brunei, Sabah, Sarawak, Java, Bali, Philippines, Australia, and India (Whitaker et al., 2014). Mazumder et al. (2021) reported this species from Chittagong University campus, Bangladesh. The image of the species provided by Mazumder et al. (2021; plate VI, figure 83) is not from Bangladesh but originated in Australia, Northern Territory, according to BOLD (2022). In BOLD, there are 4 public records of *P. subrosealis*, forming 1 BIN (DNA sequence cluster potentially representing a species), with specimens from two countries, Australia and Bangladesh, deposited in two institutions (Australian National Insect Collection, Canberra, ACT, Australia and Centre for Biodiversity Genomics, University of Guelph, Ontario, Canada), but the adult photographs are only available for Australian specimens. The DNA barcode data suggest that the specimens from Australia and Bangladesh belong to the same species, but after studying the type material and the BOLD photographs of Australian specimens, we suggest these specimens are misidentified. Instead, we suggest that they possibly belong to the genus *Microbelia* Warren, 1906, because they have wing maculation similar to *Microbelia*, namely the presence of a single black punctum in the central area of both wings and a triangular or V-shaped marking extending back from the forewing costa (Whitaker et al., 2014). If this suggestion is correct, then it follows that the putative *P. subrosealis* BOLD

specimens from Bangladesh noted by Mazumder et al. (2021) are also misidentified. We were unable to determine the identity of the specimens collected by Mazumder et al. (2021) from the Chittagong University campus, but re-examination of the Australian specimens, for which the data is present in BOLD, and the specimens from Bangladesh which were studied by Mazumder et al. (2021), is required.

## Subfamily Striglininae

Genus *Aglaopus* Turner, 1911

*Aglaopus* Turner, 1911, *Ann. Qd Mus.* 10: 97 [key], 98.

*Type-species: Aglaopus niphocosma* Turner, 1911

*Distribution:* India, Indonesia, New Guinea, Australia, China, Ethiopia (Whalley, 1976 [as *Misalina*]; Whitaker et al., 2014).

*Remarks:* The genus is newly recorded for Bangladesh.

*Aglaopus decussata* (Moore, 1883)

Figures 6-21

*Sonagara decussata* Moore, 1883, *Proc. Zool. Soc. Lon.* Pg. 27, pl. 6, fig. 8.

*Type-locality:* India (Type materials not examined).

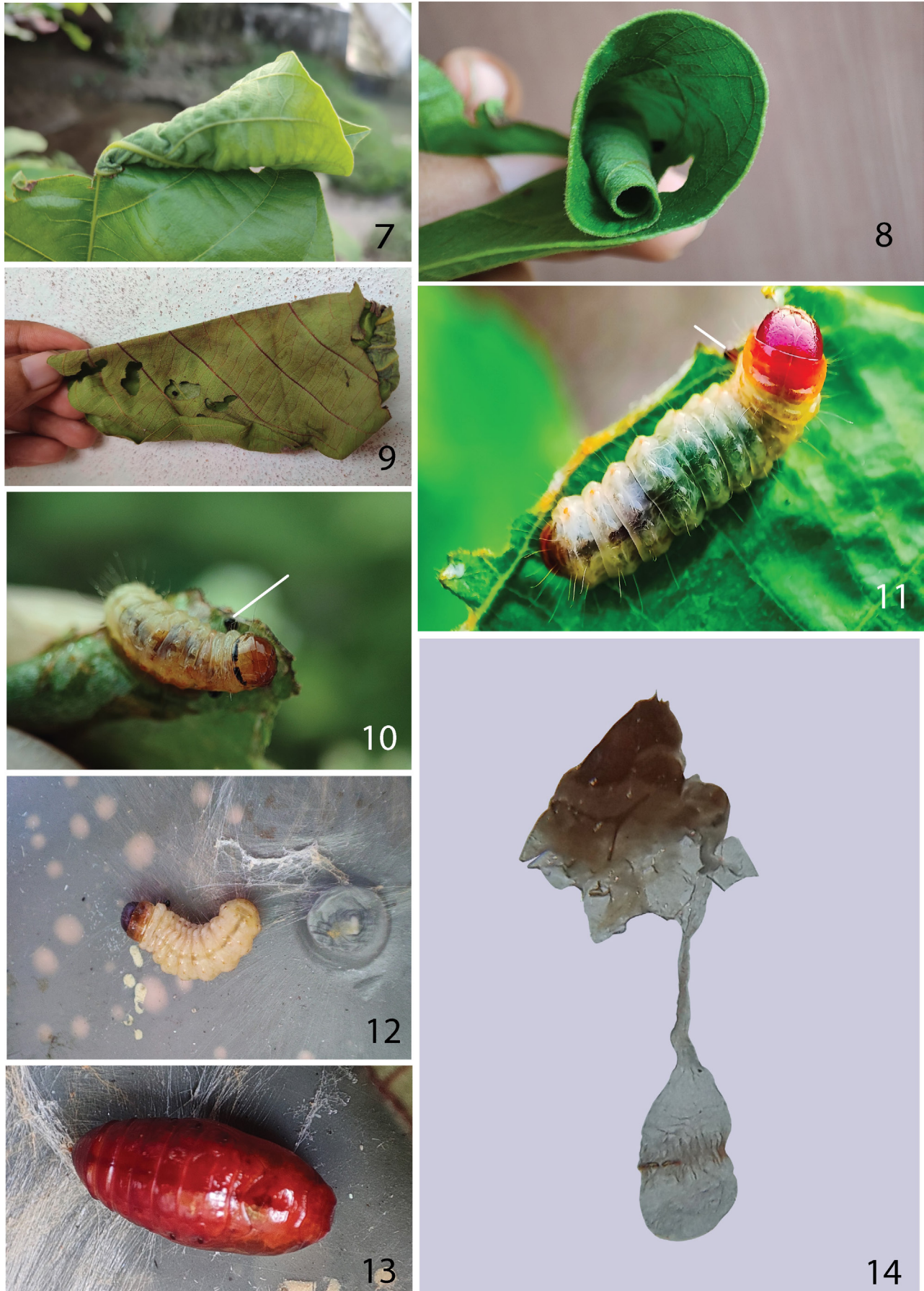
*Material examined:* BANGLADESH, Chittagong University, Faculty of Biological Science, 22°27'58.33"N, 91°46'52.14"E, 10.X.2021, 5.XII.2021, 8 caterpillars, 23.X.2021, 1♀, leg. Jahir Rayhan, Sayema Jahan.

*Diagnosis:* Externally, *A. decussata* is closely similar to the other members of *Aglaopus glareola* (Felder & Rogenhofer, 1875) species group, which includes *A. glareola*, *A. ferocia* (Whalley, 1976), *A. decussata*, *A. industa* (Whalley, 1976), *A. sordida* (Pagenstecher, 1892), and *A. gemmulosa* (Whalley, 1976), but it is quite distinct in genitalia characteristics. The female genitalia (Fig. 14) have the papillae analis shorter, and the bursa copulatrix with paired spiny signa and a sclerotized patch of spines.

*Notes on life history:* The life history of *Aglaopus decussata* (Moore, 1883) has not been previously described, and it is documented here for the first time.

*Caterpillar* (Figs. 7-12, 15-21): A final instar caterpillar (Figs. 11, 15) was collected on 10 October 2021 feeding on a leaf of *Litsea monopetala* (Roxb.) Pers. (Lauraceae) inside a conical leaf shelter (Figs. 7-9) made by rolling the leaf near the tip. The conical shelter had several holes made by the caterpillar while feeding. The final instar caterpillar (Fig. 11) is stout, cream-colored and somewhat translucent (internal organs are visible from the outside), and has numerous setae on the body. The thoracic legs are black with modified hind legs, and the prolegs are cream-colored. The chaetotaxy was not studied. The head, frontal part of the prothorax, and tip of the abdomen are reddish-brown. There is a trace of a dark dorsal line on the body.

During another field visit on 5 December 2021 in the same location, the same plant was found to be covered with numerous larval conical shelters. Seven caterpillars among them were collected in the early instar stages, but the attempt to rear them was unsuccessful as they died after a week. The conical shelter was opened up intentionally, and we observed that the caterpillars again rolled up the leaves, but not in a



**Figures 7-14.** *Aglaopus decussata* (Moore, 1883); 7-9. conical leaf shelter; 10. early instar caterpillar (collected on 5th December, 2021); 11. final instar caterpillar; 12. pre-pupating stage; 13. pupa; 14. genitalia. (White line indicates modified metathoracic legs).

conical fashion, rather in a simple rolling fashion similar to that of tortricid leaf rollers. The prothoracic shield of these early instar caterpillars (Fig. 10) has a dark black line broken in the middle which was observed as faded in the final instar caterpillar (collected on 10 October, 2021).

A peculiar modification (Figs. 10-11 & 15-21) of the metathoracic legs was observed in all the caterpillars studied herein. Each caterpillar has a dark black pouch-like modification on the distal part of the metathoracic legs which is easily recognizable and very prominent. The pouch is variable in size (0.5-1.5 mm) and contains yellowish liquid of unknown type. Because of the modified pouch-like structure, the metathoracic legs resemble the hands of boxers wearing boxing gloves.

Pupa (Fig. 13): The final instar caterpillar collected on 10 October 2021 started to pupate on 13 October 2021 outside the leaf shelter with the pre-pupating stage (Fig. 12, 16) darker with a dark brown head and thorax. The dorsal dark line is prominent. Secretion of silk was observed but no cocoon was made. The pupa is stout and dark red, formed on a bed of silken threads instead of a cocoon.

Adult (Fig. 6): A female moth emerged from the pupa on 23 October 2021. The wings are brownish with small dark spots, and the forewing has a dark spot at the end of the discal cell and one below it near the inner margin. At the end of almost all wing veins there are paired dark small spots on the outer margin at the base of the fringe. The base of the forewing and collar are dark. There is a notable depression at the base of the abdomen dorsally.

*Distribution:* India, Thailand, West Malaysia, Sabah, Sarawak, Sumatra, Java, West Papua, Philippines, Taiwan (Whitaker *et al.*, 2014), Bangladesh (present study).

*Remarks:* New record for Bangladesh.

#### Genus *Striglina* Guenée, 1877

*Striglina* Guenée, 1877, *Ann. Soc. ent. Fr.* (5) 7: 283.

*Type-species:* *Striglina lineola* Guenée, 1877

*Distribution:* Old World tropics and subtropics to Australia, temperate Asia to Japan (Whalley, 1976).

*Remarks:* Among all the recorded genera, this genus was found to be the most diverse.

#### *Striglina castaneata* Hampson, 1914

Figure 22

*Striglina castaneata* Hampson, 1914, *Ann. Mag. Nat. Hist.* (series 8) 14: 109.

*Type-locality:* Singapore (Images of type material studied from NHMUK).

*Material examined:* Only one individual was photographed from Shaheed Abdur Rab Hall, Chittagong University Campus (22°28'27.70"N, 91°47'07.26"E) on 24.XI.2019.

*Diagnosis:* *Striglina castaneata* differs from other congeners in the absence of the prominent median fascia or patches on the forewing and hind wing. The median fascia in this species is inconspicuous, thin, discontinuous, and runs from the forewing stigma to the hind wing dorsum. It is a red-brown moth with dark reticulations, more prominent on the distal half of the forewing and hind wing.

*Distribution:* Singapore, China, India, West Malaysia, Brunei,

Philippines (Whalley, 1976; Whitaker *et al.*, 2014), Bangladesh (present study).

*Remarks:* New record for Bangladesh.

#### *Striglina scitaria* (Walker, 1862)

Figure 23

*Drepanodes scitaria* Walker, 1862, In *List Spec. Lepid. Insecta Colln. Br. Mus.* 26: 1488.

*Type-locality:* Sri Lanka (Images of type material studied from NHMUK)

*Material examined:* More than 10 individuals from various locations of the Chittagong University Campus including Shaheed Abdur Rab Hall (22°28'27.70"N 91°47'07.26"E) and Faculty of Biological Science (22°27'58.33"N 91°46'52.14"E). Figure 23 was taken from the Shaheed Abdur Rab Hall on 28.III.2018.

*Diagnosis:* Externally, the species is allied to several other species together forming the *S. scitaria* species group. The species of this group are best identified by the male genitalia. *Striglina scitaria* has a variable wing pattern, but externally it can be distinguished from the other species of the group by the hind wing, in which the subsidiary transverse line is strongly curved at the middle and continues towards the tornus.

*Distribution:* India, Sri Lanka, China, Taiwan, Korea, Japan, Maldives, Nepal, Myanmar, Vietnam, Thailand, Laos, Malaysia, Brunei, Indonesia, Philippines, Australia, Fiji, Bangladesh (Hampson, 1892; Whitaker *et al.*, 2014).

*Remarks:* A very common moth in comparison to other species, being observed more than ten times during the study period, especially in the cold season. The hostplants of this species, *Acacia*, *Cassia* (Fabaceae), *Terminalia* (Combretaceae), and *Mangifera indica* L. (Anacardiaceae), are abundant in the study area. In addition, during the winter season, another hostplant of this species, beans (*Phaseolus*, Fabaceae), is cultivated almost everywhere by the local people (for hostplant data see Robinson *et al.*, 2010).

#### *Striglina* sp. 1

Figure 24

*Material examined:* Only one individual photographed from Shaheed Abdur Rab Hall, Chittagong University Campus (22°28'27.70"N 91°47'07.26"E) on 04. V. 2018.

*Diagnosis:* The suffusions on the diagonal line are thin and the moth is considerably larger in comparison with *S. scitaria*.

*Remarks:* Because of its considerably larger size and thin suffusion on the diagonal line, the moth appears to be allied to *Striglina irsecta* Whalley, 1976.

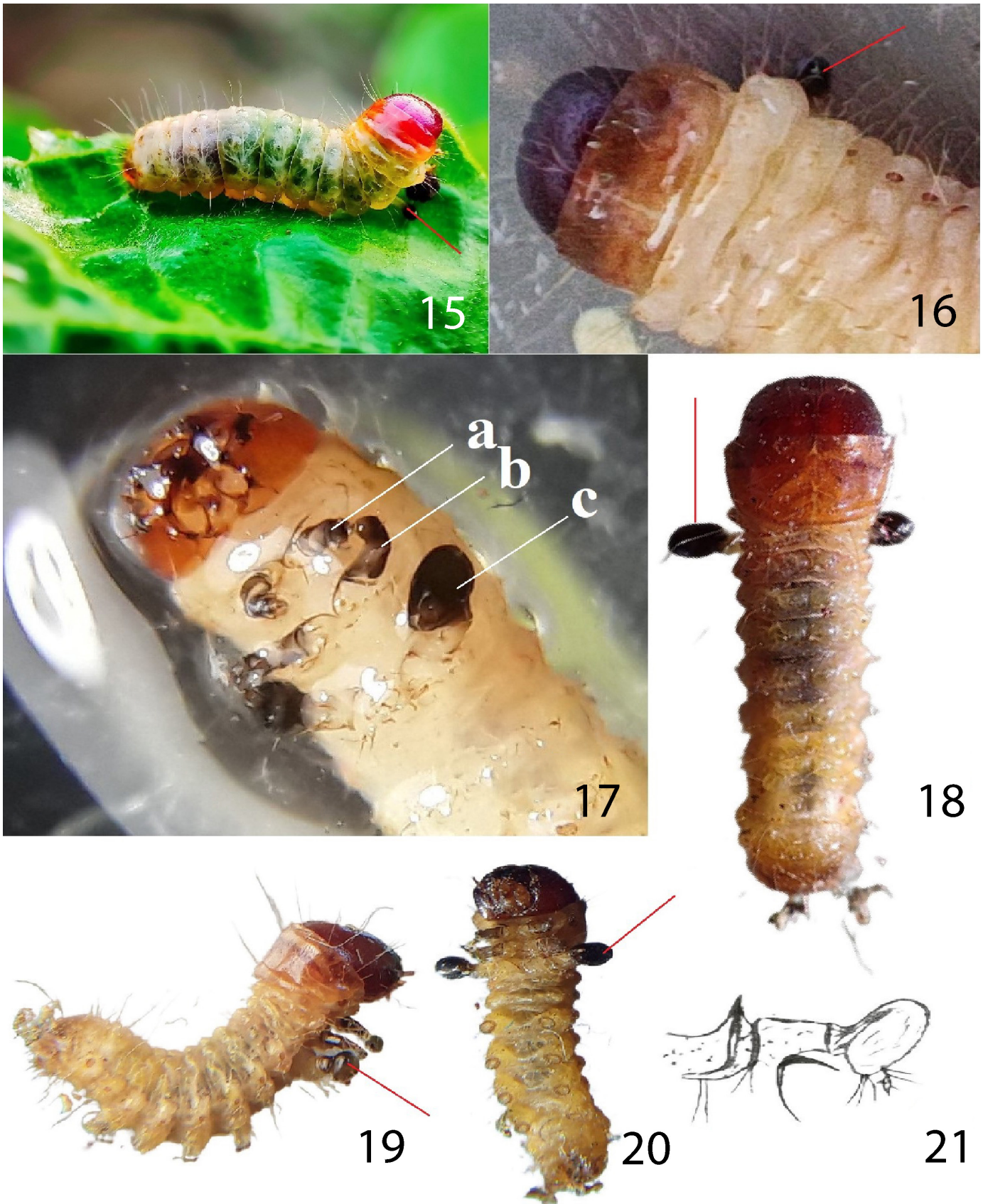
#### *Striglina* sp. 2

Figure 25

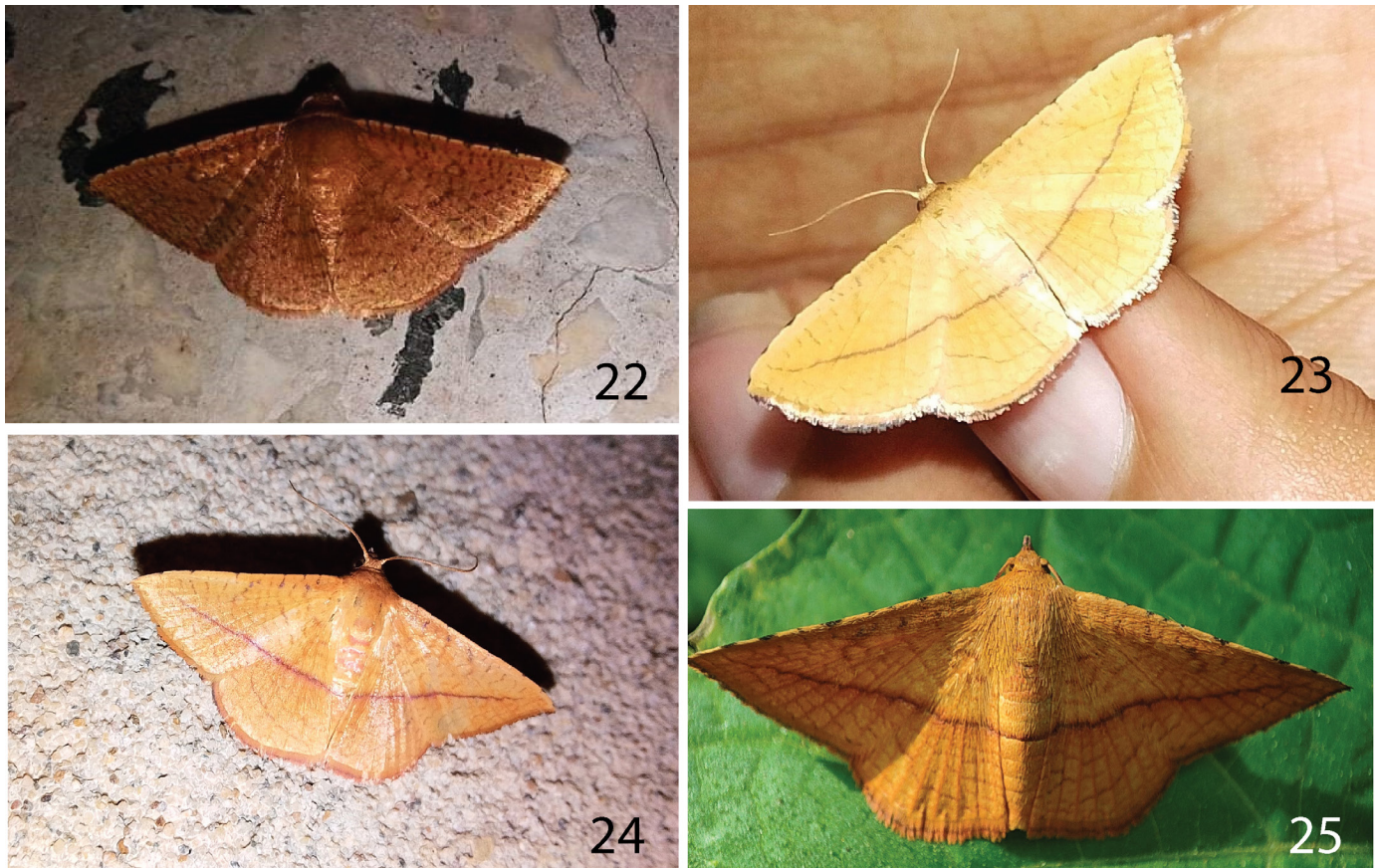
*Material examined:* Only one individual photographed from Faculty of Science, Chittagong University Campus (22°28'12.95"N, 91°46'58.36"E) on 10. X. 2021.

*Diagnosis:* This moth differs from *S. scitaria* in the origination of the diagonal line from the forewing costal margin, and in the curvature of the post-median line on the hind wing.

*Remarks:* The wing maculation suggests that this moth may be related to *Striglina propatula* Whalley, 1974.



**Figures 15-21.** *Aglaopus decussata* (Moore, 1883), Caterpillars with modified metathoracic leg. **15.** final instar caterpillar; **16.** pre-pupating stage; **17.** frontal part in ventral view (a. foreleg; b. mid leg; c. hind leg); **18.** dorsal view; **19.** lateral view; **20.** ventral view; **21.** sketch of hind (metathoracic) leg. (Red lines indicate pouch on the metathoracic leg).



Figures 22-25. Adult moths. 22. *Striglina castaneata* Hampson, 1914; 23. *Striglina scitaria* (Walker, 1862); 24. *Striglina* sp. 1; 25. *Striglina* sp. 2.

## DISCUSSION

Thyridid moths have assumed pest status on many occasions. *Striglina scitaria* has been reported as a leaf roller in cultivated plants such as *Sesbania bispinosa* (Jacq.) W. Wight, *Erythrina* sp. (Fabaceae), *Mangifera indica*, *Populus* sp. (Salicaceae), and *Terminalia bellirica* (Gaertn.) Roxb. (Robinson *et al.*, 2010). Sapota Midrib Borer *Banisia myrsusalis elaralis* (Walker, 1859) caused more than 10% damage to Sapota *Manilkara zapota* (L.) P. Royen (Myrtaceae) in the hill region of Karnataka state in India (Satish *et al.*, 2013). The present study documents *Litsea monopetala* (Lauraceae) as the first host plant record of *Aglaopus decussata* (Moore, 1883). *Aglaopus glareola* (Felder & Rogenhofer, 1875), a closely related species of *A. decussata*, is known to feed on *Camelia sinensis* (L.) Kuntze (Theaceae) and *Cinnamomum zeylanicum* J. Presl (Lauraceae) (Robinson *et al.*, 2010).

Protecting biodiversity needs a good understanding of the floral and faunal diversity of our surrounding environment. Bangladesh, being one of the most human-dominated parts of the world, is under threat of biodiversity loss due to different anthropogenic pressures (Mukul *et al.*, 2018). The current study on the diversity of thyridid moths along with the life history data on *Aglaopus decussata* will help in building up knowledge of biodiversity for further conservation efforts. Comprehensive taxon sampling may reveal more species in this family as well as give further important knowledge on the life history of this little-known group of moths.

The metathoracic leg modification of the caterpillars of *Aglaopus decussata* is an important finding of this study. After reviewing published data and works on the immature stages of different species of Thyrididae, no report of such modification could be found. Published data on the caterpillars of the other species of *Aglaopus* do not mention anything about this kind of modification. This type of organ modification is possibly a new report for Thyrididae and may be an adaptation for the caterpillars to live inside leaf shelters, or for defense against predators, or to withstand certain environmental conditions. Further study will be conducted to understand the function of this structure and its role in the survival of the caterpillars.

Information on the life history of not only the Thyrididae but also other moth groups is still lacking or scarce. The modified abdominal protuberance as mentioned in Darling (2001) and the modifications to the leg reported in the present study exemplify the numerous mysterious and yet to be discovered aspects of Lepidoptera biology. From the evolutionary perspective, the origin and adaptive benefit of such modifications could be an important topic for future study.

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