INDIAN JOURNAL OF SCIENCE AND TECHNOLOGY

RESEARCH ARTICLE

Survey on Geometrid Moth Fauna of Hmuifang Community Forest Reserve, Aizawl, Mizoram

B Lalnghahpuii[1], Lalruatthara[1], Esther Lalhmingliani[1]*

1 Systematics and Toxicology Laboratory, Department of Zoology, Mizoram University, Aizawl, 796004, Mizoram, India

OPEN ACCESS

Received: 23-01-2023

Accepted: 09-06-2023

Published: 30-07-2023

Citation: Lalnghahpuii B, Lalruatthara , Lalhmingliani E (2023) Survey on Geometrid Moth Fauna of Hmuifang Community Forest Reserve, Aizawl, Mizoram. Indian Journal of Science and Technology 16(SP1): 19-29. https://doi.org/10.17485/IJST/v16sp1.msc3

* **Corresponding author**.

es_ralte@yahoo.in

Funding: Science and Engineering Research Board (SERB), Department of Science & Technology, Government of India under EEQ (North Eastern Region Empowerment and Equity Opportunities for Excellence in Science) number EEQ/2017/000805

Competing Interests: None

Published By Indian Society for Education and Environment (iSee)

ISSN
Print: 0974-6846
Electronic: 0974-5645

Abstract

Objectives: The present study focuses on the survey and inventory of Geometridae (Lepidoptera) of Hmuifang Community Forest Reserve, Aizawl district, Mizoram. **Methods:** The study was conducted from October 2019 to November 2020. Specimens were collected using a 160W mercury vapor lamp fitted against a white sheet hung between poles. Pinning, labeling and genitalia dissection was done in the laboratory. Identification was done by referring to relevant literature. Photographs were taken and specimens were deposited in the Entomological Collections of the Systematics and Toxicology Laboratory, Mizoram University, Mizoram, India (MZUEC). **Findings:** The specimens collected during the study yielded 55 species of Geometridae under 38 genera referring to 5 subfamilies. The subfamily Ennominae was found to be the most abundant comprising 58% followed by Geometrinae 22%, Sterrhinae 9%, Oenochrominae 9%, and Larentiinae with 1%. Among the reported species, *Sarcinodes lilacina* (Oenochrominae) was the most abundant with 6 specimens. Only a few females were encountered during the study period, the majority being males. The male and female counterpart was found only in 3 species- *Hypochrosis hyadaria*, *Tanaoctenia haliaria*, and *Sarcinodes lilacina*. The variation in abundance between subfamilies might be due to unfavorable habitat conditions and a lack of host plants. **Novelty:** Geometrid fauna of Hmuifang was updated from 37 to 72 species under five subfamilies. The documented data on Geometridae of Mizoram also increases from 112 species to 132 under 7 subfamilies.

Keywords: Geometridae; Hmuifang; Taxonomy; Diversity; Mizoram

1 Introduction

Moths of the family Geometridae are the second largest Lepidopteran family with an estimated number of 23,872 species and 3,123 subspecies referring to nine subfamilies worldwide[(1)]. This accounts for 15% of all documented Lepidopteran species[(2)]. Of the total documented geometrid moth, 2041 species under seven subfamilies has been reported from India[(3)]. They have a cosmopolitan distribution and are reportedly found

in all continents except Antarctica. Larvae of these moths are phytophagous and are common defoliators of agricultural crops. Several species show specificity to higher elevational ranges. Members of this family are best recognized by their slender body and the resting position of their delicate wings which are usually held outspread horizontally in most species. The reduction in the number of larval prolegs, and the presence of a paired tympanal organ with a central rod called ansa at the base of the abdomen in the adult Geometrid moths are an important apomorphy of moths belonging to this family[3]. The current study deals with the inventory survey on Geometrid moth fauna of the Hmuifang community forest.

2 Methodology

2.1 Study area

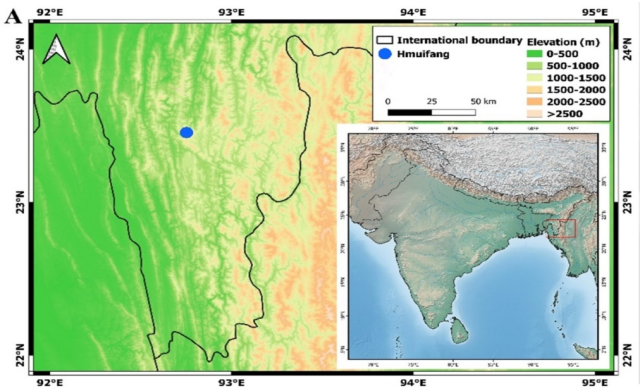

Fig 1. Map of study area

Fig 2. Picture of light trap

Hmuifang, a community forest reserve lies between 92°45'21"E — 92°46'01"E and 23°26'19"N - 23°27'26"N at a distance of 50km to the south of Aizawl at an altitude of 1619m asl (Figure 1) and is one of the major tourist attraction sites in Mizoram[4]. The first ever survey on Geometrid moths of Hmuifang community forest reserve was done by Kirti *et al* (2012) which resulted in the documentation of 3 species[5]. Smetacek & Tochhawng (2019) reported another species of geometrid moth *Doratoptera nicevillei* from the same area[6]. Later on, Saxena in his unpublished thesis reported 22 species of Geometrid moth from the area[7]. Additionally, Lalnghahpuii & Smetacek (2021) also reported the species *Xandrames latiferaria curvistriga* from Hmuifang, Mizoram[8]. Lalnghahpuii *et al* (2022) also reported 10 species belonging to the subfamily Ennominae from

Hmuifang forest area [9]. Just recently Lalnghahpuii *et al* (2023) reported *Tanaorhinus viridiluteata* from Hmuifang Community Forest [10]. The study area also houses a number of moths belonging to the family Saturniidae [11].

2.2 Sampling and specimen acquisition:

Random survey was carried out between October 2019 to November 2020 using a 160W mercury vapour bulb fitted against a white sheet hung between poles. Light trap was placed in open vegetation areas with Honda™ EP1000 portable generator as a power source (Figure 2). Specimens attracted to the light trap were collected in a killing jar containing petroleum ether following which their wings were folded and placed in butter paper. Pinning and labeling of specimens were done in the laboratory. Identification was done based on relevant literature and online sources viz., The fauna of British India [12], The moths of Borneo [13], Geometrid moths of India [3] and an online taxonomic facility of Geometridae (Lepidoptera) [14]. Genitalia dissection was performed for accurate identification following Sondhi *et al* (2020) [15]. Photographs were taken (Figures 3, 4 and 5) and the specimens were deposited in the Entomological Collections of the Systematics and Toxicology Laboratory, Mizoram University, Mizoram, India (MZUEC).

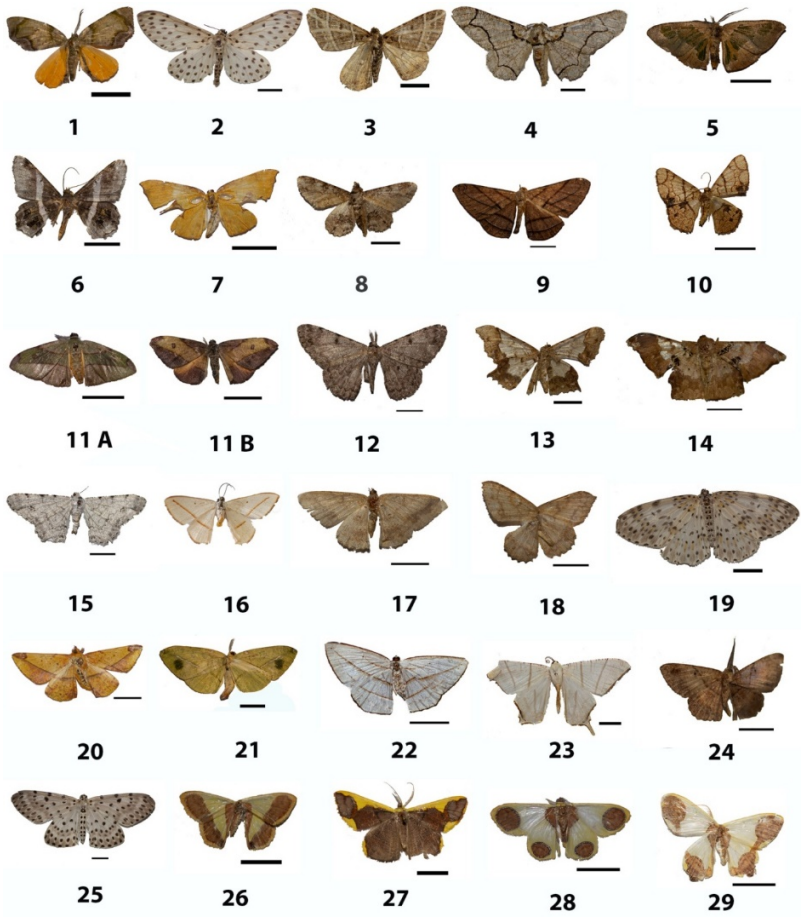

Fig 3. 1-29: Geometridae one scale bar = 0.1 mm. *1. Achrosis incitata; 2. Antipercnia belluaria; 3. Arichanna transfasciata; 4. Biston contectaria; 5. Celenna festivaria; 6. Chiasmia nora; 7. Corymica vesicularia; 8. Cleora fraternal; 9. Dalima patularia; 10. Heterostegane subtessellata; 11. Hypochrosis hyadaria (A-male; B-female); 12. Hypomecis cineracea; 13. Krananda semihyalina; 14. Krananda lucidaria; 15. Lassaba contaminata; 16. Lomographa inamata; 17. Luxiaria mittorhapes; 18. Luxiaria acutaria; 19. Metapercnia ductaria; 20. Mimomiza cruentaria; 21. Omiza miliaria; 22. Orthocabera ocernaria; 23. Ourapteryx clara; 24. Petelia medardaria; 25. Percnia felinaria; 26. Plutodes exquisita; 27. Plutodes costatus; 28. Plutodes discigera; 29. Plutodes subcaudata.*

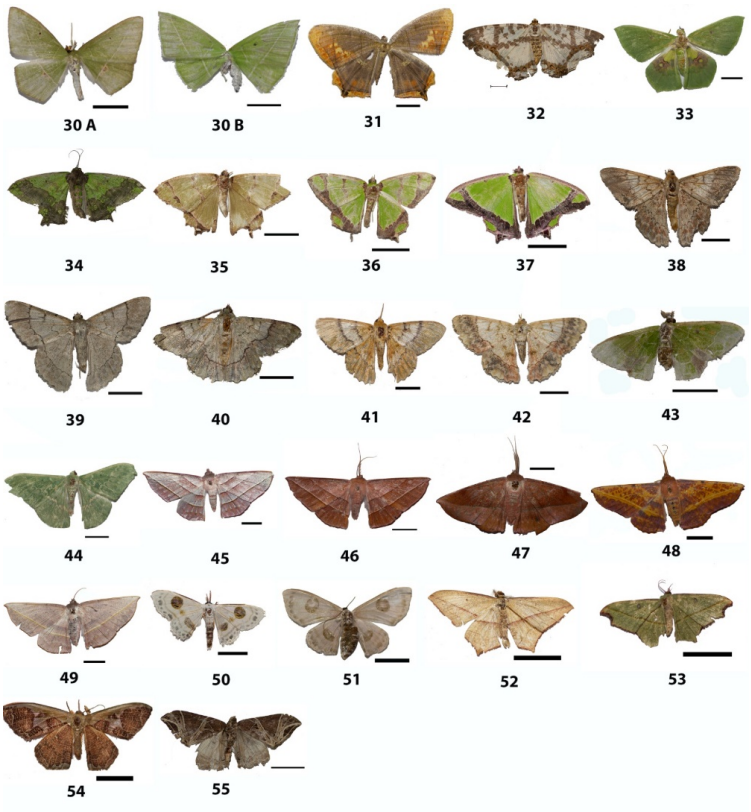

Fig 4. 30-55: Geometridae one scale bar = 0.1 mm. *30. Tanaoctenia haliaria (A-male; B-female); 31. Thinopteryx nebulosa; 32. Vindusara moorei; 33. Aporandria specularia; 34. Agathia codina; 35. Agathia lycaenaria; 36. Agathia hilarata; 37. Agathia laetata; 38. Pingasa lariaria; 39. Pingasa chlora; 40. Pingasa ruginaria; 41. Pingasa venusta; 42. Pingasa rubicund; 43. Protuliocnemis partita; 44. Tanaorhinus malayanus; 45. Sarcinodes aequilinearia; 46. Sarcinodes carnearia; 47. Sarcinodes restitutaria; 48. Sarcinodes Susana; 49. Sarcinodes lilacina; 50. Problepsis albidior; 51. Problepsis ocellata; 52. Timandra correspondens; 53. Traminda aventiaria; 54. Zythos avellanea; 55. Ecliptopera rectilinea.*

3 Results and discussion

The study reported a total of 55 species of geometer moths under 38 genera referring to 5 subfamilies: Ennominae, Geometrinae, Sterrhinae, Oenochrominae and Larentiinae. Out of these, 36 species belonging to 5 subfamilies were new reports for the Hmuifang community forest and 20 species under 4 subfamilies viz., *Corymica vesicularia, Cleora fraterna, Hypomecis cineracea, Krananda lucidaria, Ourapteryx clara, Plutodes costatus, Plutodes discigera, Agathia codina, Agathia lycaenaria, Agathia hilarata, Agathia laetata, Pingasa lariaria, Tanaorhinus malayanus, Sarcinodes carnearia, Sarcinodes restitutaria, Sarcinodes susana, Problepsis ocellata, Timandra correspondens, Traminda aventiaria* and *Zythos avellanea* were new records for Mizoram. Ennominae subfamily was the most abundant comprising 58% of the total reported species followed by Geometrinae (22%), Sterrhinae (9%), Oenochrominae (9%) and Larentiinae (2%). *Sarcinodes lilacina* belonging to Oenochrominae sub family was the most abundant amongst the species with 6 specimens encountered from the study area. Only a few females were encountered during the study period, the majority being males. The male and female counterpart was found only in 3 species namely *Hypochrosis hyadaria, Tanaoctenia haliaria* and *Sarcinodes lilacina*. The variation in abundance between subfamilies might be due to unfavourable habitat conditions and a lack of host plants. The present study fails to report 12 species of geometer moth reported previously from the study area by other author. List of specimens collected during the study are enumerated as follows:

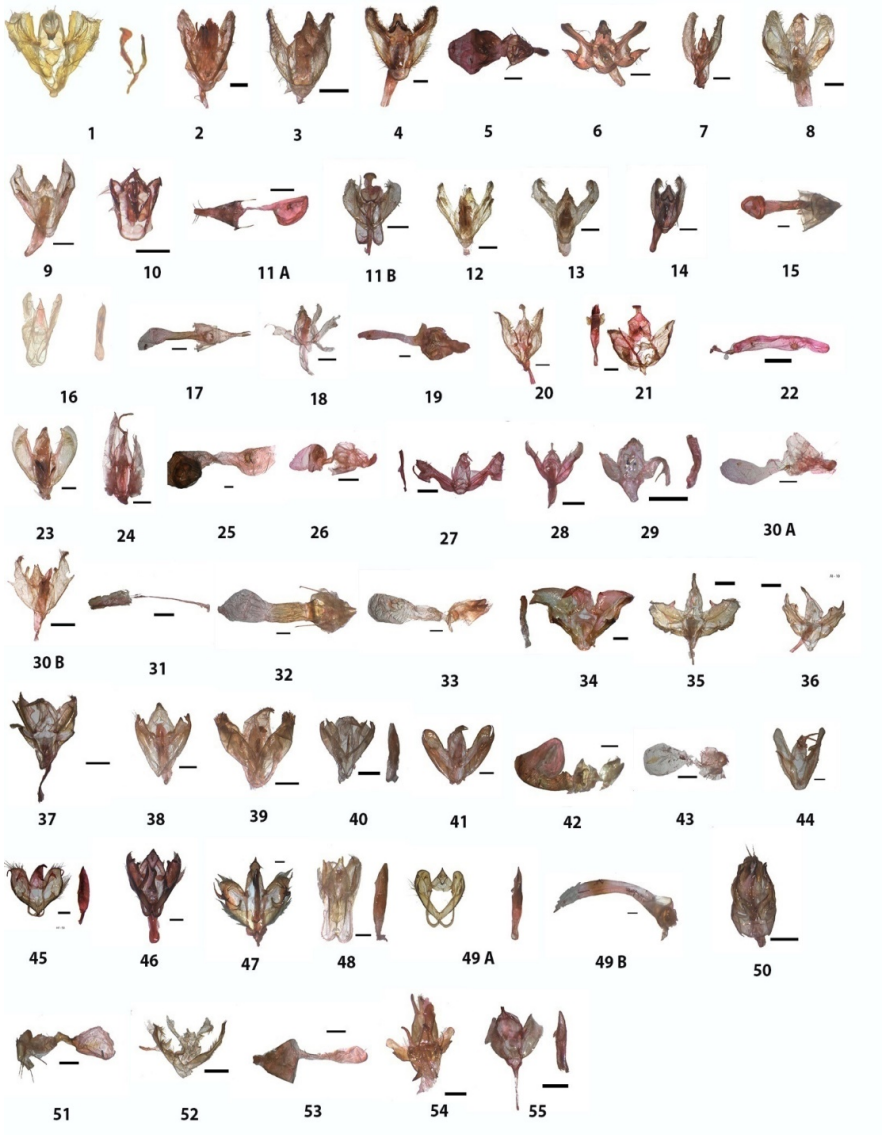

Fig 5. Genitalia of reported specimens, one scale bar = 0.1 mm: *1. Achrosis incitata (male); 2. Antipercnia belluaria (male); 3. Arichanna transfasciata (male); 4. Biston contectaria (male); 5. Celenna festivaria (female); 6. Chiasmia nora (male); 7. Corymica vesicularia (male); 8. Cleora fraterna (male); 9. Dalima patularia (male); 10. Heterostegane subtessellata (male); 11. Hypochrosis hyadaria (A-female; B-male); 12. Hypomecis cineracea (male); 13. Krananda semihyalina (male); 14. Krananda lucidaria (male); 15. Lassaba contaminata (female); 16. Lomographa inamata (male); 17. Luxiaria mittorhapes (female); 18. Luxiaria acutaria (male); 19. Metapercnia ductaria (female); 20. Mimomiza cruentaria (male); 21. Omiza miliaria (male); 22. Orthocabera ocernaria (male); 23. Ourapteryx clara (male); 24. Petelia medardaria (male); 25. Percnia felinaria (female); 26. Plutodes exquisita (female); 27. Plutodes costatus (male); 28. Plutodes discigera (male); 29. Plutodes subcaudata (male); 30. Tanaoctenia haliaria (A-female; B-male); 31. Thinopteryx nebulosa (female); 32. Vindusara moorei (female); 33. Aporandria specularia (female); 34. Agathia codina (male); 35. Agathia lycaenaria (male); 36. Agathia hilarata (male); 37. Agathia laetata (male); 38. Pingasa lariaria (male); 39. Pingasa chlora (male); 40. Pingasa ruginaria (male); 41. Pingasa venusta (male); 42. Pingasa rubicund (female); 43. Protuliocnemis partita (female); 44.Tanaorhinus malayanus (male); 45. Sarcinodes aequilinearia (male); 46. Sarcinodes carnearia (male); 47. Sarcinodes restitutaria (male); 48. Sarcinodes Susana (male); 49. Sarcinodes lilacina (A-male; B-female); 50. Problepsis albidior (male); 51. Problepsis ocellata (female); 52. Timandra correspondens (male); 53. Traminda aventiaria (female); 54. Zythos avellanea (male); 55. Ecliptopera rectilinea (male).*

3.1 Systematic account

Order: Lepidoptera

Superfamily: Geometroidea

Family: Geometridae

I.Subfamily Ennominae

1. *Achrosis incitata* (Walker, 1862)

Material examined: 27.x. 19-2♂, Hmuifang tourist lodge, Aizawl.

Diagnosis: Male 34-36mm. Adult ground color olive green suffused with fuscous. This species closely resembles *A. pallida* but differs in external genitalia features.

2. *Antipercnia belluaria* (Guenee, [1858])

Material examined: 25. xi. 20-1♂, Hmuifang tourist lodge, Aizawl.

Diagnosis: Male 68mm. Wings whitish suffused with grey with numerous black spots on both fore and hind wings.

3. *Arichanna transfasciata* Warren, 1893

Material examined: 28.x. 19-1♂, Hmuifang tourist lodge, Aizawl.

Diagnosis: Male 48mm. Forewings brown striated with black. Hindwing smaller, the ground color orange yellow irrorated with black.

4. *Biston contectaria* (Walker, 1863)

Material examined: 25. xi. 20-1♂ Hmuifang tourist lodge, Aizawl.

Diagnosis: Male 70mm. Wings ground color white, with prominent black lines on the ante-medial and post-medial lines. The species closely resembles *B. mediolata* but differs in the prominent discal spot on the underside of the wings.

5. *Celenna festivaria* (Fabricius, 1794)

Material examined: 29.xi.19-1 ♀Hmuifang tourist lodge, Aizawl.

Diagnosis: Female 34mm. Forewing and hindwing with a large green patch on the medial area except for the costa.

6. *Chiasmia sp. cf. nora* (Walker, 1861)

Material examined: 30.x.19-1 ♂ Hmuifang tourist lodge, Aizawl.

Diagnosis: Male 42mm. Wings dark grayish fuscous. A broad whitish medial band distinct. Similar to *C. eleonora* but darker.

7. *Corymica vesicularia* Walker, 1866

Material examined: 30.x.19-1 ♂, Hmuifang tourist lodge.

Diagnosis: Male 36mm. Wings yellow, marginal lines crenulated with darker lines. A prominent fovea of hyaline membrane on the forewings.

8. *Cleora fraterna* (Moore, 1888)

Material examined: 1.xi.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 42mm. Wings ground color whitish, irrorated with brown. A prominent lunula on both wings.

9. *Dalima patularia* (Walker, 1860)

Material examined: 2.xi.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 56mm. Wings rich chocolate brown with a diagnostic array of immaculate rich brown fasciae.

10. *Heterostegane subtessellata* (Walker, [1863])

Material examined: 29.x.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 28mm. The ground color is yellow, irrorated with rust-red. Intense markings on wings and a prominent rounded rufous patch are diagnostic of this species.

11. *Chrosis hyadaria* Guenee, 1857

Material examined: 30.iii.19-1♀; 30.iii. 19-1♂, Hmuifang tourist lodge. Diagnosis: Female 34mm; Male 32mm. Wings color pale green with a purplish tinge; Forewing with a rufous patch on the costa.

12. *Hypomecis cineracea* Moore, 1888

Material examined: 27. xi. 20-1♂, Hmuifang tourist lodge.

Diagnosis: Male 54mm. Wings uniform warm grey, darker crenulated lines on both wings.

13. *Krananda semihyalina* Moore, 1868

Material examined: 2.xi.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 48mm. Wing ground color brownish grey. Both wings are crenulated, hyaline; veins, costa, and outer third of wings are grey-brown, irrorated with black.7

14. K*rananda lucidaria* Leech, 1897

Material examined: 28.x.19-1♂ Hmuifang tourist lodge.

Diagnosis: Male 48mm. Wing color brown with pale antemedial delineated with black on either side. Forewing with a blackish patch on the dorsum. Hindwing with a discal spot and an ante-medial band.

15. *Lassaba contaminata* Moore, 1888

Material examined: 16.vii. 20-1♂, Hmuifang tourist lodge.

Diagnosis: Male 54mm. Wings white with a series of costal specks, veins with small black spots. Marginal series of spots present.

16. *Lomographa inamata* (Walker, 1860)

Material examined: 30.x.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 34mm. Wings ground color white with ochreous transverse fascia from below the apex of the forewing till the middle of the hindwing.

17. *Luxiaria mittorhapes* Prout, 1925

Material examined: 25. xi. 20-1♀, Hmuifang tourist lodge.

Diagnosis: Female 40mm. Wings ground color fawn with pale fasciae. Numerous inconspicuous dark speckles on the entire wing.

18. *Luxiaria acutaria* Snellen, 1877

Material examined: 26. xi. 20-1♂, Hmuifang tourist lodge.

Diagnosis: Male 40mm. Wing color fawn with a darker post-medial band. Lines on both wings crenulated.

19. *Metapercnia ductaria* (Walker, 1862)

Material examined: 9.xi.19-1♀, Hmuifang tourist lodge.

Diagnosis: Female 66mm. Wings ground color is white, with irregular yellowish suffusion with numerous black specks on the entire wing.

20. *Mimomiza cruentaria* (Moore, 1868)

Material examined: 25.x.19-2♂, Hmuifang tourist lodge.

Diagnosis: Male 48mm. Wings ground color is yellow and irrorated with reddish brown. A double oblique line from apex to inner margin is diagnostic of this species.

21. *Omiza miliaria* Swinhoe, 1889

Material examined: 29.x.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 62mm. The wings luteous yellow, strong dark sub-marginal patch on the forewing is diagnostic.

22. *Orthocabera ocernaria* Swinhoe, 1877

Material examined: 28.x.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 38mm. Ground color white with three distinctive fulvous streaks. Marginal line of wings rusty brown.

23. *Ourapteryx clara* Butler, 1880

Material examined: 2.xi.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 68mm. Ground color white with fulvous striations on both wings. The hindwing tail is divided from the rest of the wing by a fine line of both red and blue tinge.

24. *Petelia medardaria* Herrich- Schaffer [1856]

Material examined: 30.vii.20-1♂, Hmuifang tourist lodge.

Diagnosis: Male 32mm. Wings grayish brown with a weak medial fascia on the forewing, and two postmedial spots below costa.

25. *Percnia felinaria* Guinee, [1858]

Material examined: 16.vii. 20-1♀, Hmuifang tourist lodge.

Diagnosis: Female 88mm. Wings ground color is white suffused with a rather intense grayish color. The entire wing is covered with black specks. This species shows similarity to *Antipercnia belluaria* but has much larger wings.

26. *Plutodes exquisita* Butler, 1880

Material examined: 29.x.19-1♀, Hmuifang tourist lodge.

Diagnosis: Female 30mm. Wings ground color yellow, forewing with triangular basal patch except at costa. An oval rufous patch on the marginal area is diagnostics.

27. *Plutodes costatus* (Butler, 1886)

Material examined: 29.x.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 52mm. Forewing with three brownish triangular spurs except for the costal area which is yellow. Hindwing suffused with rufous with a narrow yellow patch at the apex.

28. *Plutodes discigera* Butler, 1880

Material examined: 3.x.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 30mm. Wings ground color yellow with a basal rufous patch. A large rounded rufous patch bounded by a silvery line with a dark zig-zag line at the center.

29. *Plutodes subcaudata* Butler, 1880

Material examined: 30.x.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 34mm. Ground color yellow, rufous patch at base, both wings with crenulated rufous patch towards costa and narrowing towards inner margin crossed by irregularly dentate line.

30. *Tanaoctenia haliaria* (Walker, 1861)

Material examined: 30.x.19-5♂1♀, Hmuifang tourist lodge.

Diagnosis: Male 48mm; Female 50mm. Ground color white, a prominent inwardly oblique white line extending from the forewing apex to the hindwing, a rufous speck at the end of the cell.

31. *Thinopteryx nebulosa* Butler, 1883

Material examined: 30.x.19-1♀, Hmuifang tourist lodge.

Diagnosis: Female 58mm. Wing ground color is orange heavily irrorated with grey, and external borders are mottled with orange. Hindwing with a blackish patch extending to the tail.

32. *Vindusara moorei* (Thierry-Mieg, 1899)

Material examined: 2.xi.19-1♀, 15. vii.20-1♀, Hmuifang tourist lodge.

Diagnosis: Female 90mm-92mm. Wings ground color is white and irrorated with grey patches. The forewing medial band runs out to an angle at the tornus and a black and yellow spot to the inner margin forms a Y-shaped fascia.

II. Subfamily Geometrinae

33. *Aporandria specularia* (Guenee, [1858])

Material examined: 29.x.19-1♀, Hmuifang tourist lodge.

Diagnosis: Female 58mm. Wings ground color pea green, forewing with a dark speck on discocellulars. Hindwing with a large lunulate pinkish mark with brown edges is diagnostic of this species.

34. *Agathia codina* Swinhoe, 1892

Material examined: 29.x.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 52mm. The wing ground color is green suffused with grey. A prominent discal speck on forewing disco cellulars. Hindwing with a prominent grayish area with a whitish patch.

35. *Agathia lycaenaria* (Kollar, [1844])

Material examined: 10.iii.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 38mm. The ground color is green, and forewing medial and post-medial bands are crenulated. Hindwing with a black patch at the apex and a white band near the tail end.

36. *Agathia hilarata* Guenee [1858]

Material examined: 30.iii.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 38mm. This species closely resembles *A. lycaenaria*. Medial band outwardly oblique, evenly curved to join costal fascia, a waved postmedial white line with a green patch below the apex.

37. *Agathia laetata* Fabricius, 1794

Material examined: 2.xi.19-1 ♂, Hmuifang tourist lodge.

Diagnosis: Male 34mm. Wings ground color green with a purplish mauve tint to the dark borders. A rounded green patch just below the apex is diagnostic.

38. *Pingasa lariaria* (Walker, 1860)

Material examined: 30.x.19-3♂, Hmuifang tourist lodge.

Diagnosis: Male 51-54mm. Wings ground color white with a pinkish tinge. Lines on both wings crenulated.

39. *Pingasa chlora* (Stoll, 1782)

Material examined: 29.x.19-3♂, Hmuifang tourist lodge.

Diagnosis: Male 42-44mm. The wing ground color is white and densely irrorated with brown. Crenulated lines originating from a speck at costa.

40. *Pingasa ruginaria* (Guenee, 1858)

Material examined: 30.x.19-2♂, 16.vii.20-2♂, Hmuifang tourist lodge.

Diagnosis: Male 45-46mm. Wings white irrorated with fuscous and grey. Whitish patches on termen and tornus of the forewing. Lines crenulated.

41. *Pingasa venusta* Warren, 1894

Material examined: 30.x.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 56mm. The male and female of this species show slight morphological differences. The ground color is greenish in males while much redder in females. A prominent white medial band on the forewing of both sexes is diagnostic.

42. *Pingasa rubicunda* Warren, 1894

Material examined: 1.xi.19-1♀, Hmuifang tourist lodge.

Diagnosis: Female 50mm. Wings ground color white, suffused with pinkish brown color. Wing fasciae are more or less similar to *P. ruginaria* but differ in coloration.

43. *Protuliocnemis partita* (Walker, 1861)

Material examined: 30.x.19-1♀, Hmuifang tourist lodge.

Diagnosis: Female 32mm. Wing grass green, outer area white. Forewing with a dark patch on the anal angle, hindwing with a similar but larger patch on the apex.

44. *Tanaorhinus malayanus* Inoue, 1992

Material examined: 30.x.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 62mm. Wings ground color green with a slightly produced apex. Ante, medial, and post-medial lines crenulated with a yellowish tinge.

III. Subfamily Oenochrominae

45. *Sarcinodes aequilinearia* (Walker, 1860)

Material examined: 30.x.19-3♂, 17.vii.20-4♂, Hmuifang tourist lodge.

Diagnosis: Male 51-54mm. Wings pinkish-grey, forewing with apex produced; three equidistant oblique rufous lines are diagnostic.

46. *Sarcinodes carnearia* Guenee, 1858

Material examined: 28.x.19-4 ♂, 27. xi.20-2 ♂, Hmuifang tourist lodge.

Diagnosis: Male 62-64mm. Wings pinkish, fasciae resembles *S. aequilinearia* but differs in the two oblique transversal lines on both wings.

47. *Sarcinodes restitutaria* (Walker, 1863)

Material examined: 25.xi.20-2♂, Hmuifang tourist lodge.

Diagnosis: Male 70mm. Wings pinkish with weak fasciae. An oblique double line from the apex to the inner margin of the forewing extending to the medial area of the hindwing is diagnostic.

48. *Sarcinodes susana* (Swinhoe, 1891)

Material examined: 2.xi.19-2♂, Hmuifang tourist lodge.

Diagnosis: Male 60mm. Wings fuscous, irrorated with yellow and red. A prominent oblique line from the apex to the inner margin on the forewing. Hindwing with a similar medial line. These species have rather prominent facies easily recognizable from their cogeners.

49. *Sarcinodes lilacina* Moore, 1888

Material examined: 29.x.19-2♂, 3♀; 25. xi.20-1♂, 1♀, Hmuifang tourist lodge.

Diagnosis: Male 55-60mm; Female 64-66mm. In this species, the three equidistant lines on *S. aequilinearia* is replaced by a single oblique yellow line from the apex to the middle of the inner margin.

IV. Subfamily Sterrhinae

50. *Problepsis albidior* Warren, 1899

Material examined: 29.x.19-2♂, Hmuifang tourist lodge.

Diagnosis: Male 40mm. Wings white with forewing having a large rounded ocellus at end of cell with a silver ring fuscous spot situated below it. Hindwing with elongated, oval white centered patch at end of the cell.

51. *Problepsis ocellata* (Frivaldszky, 1845)

Material examined: 28.x.19-1♀, Hmuifang tourist lodge.

Diagnosis: Female 36mm. Wings silky white, forewing with a large rounded ocellus at the end of the cell (as in *P. albidior*). Hindwing with an elongated fulvous mark on discocellulars and below the cell. Both wings with waved and curved post-medial bands.

52. *Timandra correspondens* Hampson, 1895

Material examined: 4.xi.20-1♂, Hmuifang tourist lodge.

Diagnosis: Male 30mm. Wings fulvous yellow with a reddish speck on discocellulars. Oblique line arising from apex to the middle of inner margin. Hindwing with medial line oblique. The postmedial line on both wings is indistinct and crenulated. Shows similarity with *T. responsaria* but is more intensely colored.

53. *Traminda aventiaria* (Guenee, [1858])

Material examined: 25.xi.20-1♀, Hmuifang tourist lodge.

Diagnosis: Female 30mm. Wings color green, with an oblique line from the costa near the apex to the middle of the inner margin. Termen below apex strongly notched.

54. *Zythos avellanea* Prout, 1932

Material examined: 2.xi.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 46mm. Wings chocolate brown, with pale costa. A prominent whitish medial band on the forewing. Hindwing with a white speck at the end of the cell.

V. Subfamily Larentiinae

55. *Ecliptopera rectilinea* Warren, 1894

Material examined: 3.xi.19-1♂, Hmuifang tourist lodge.

Diagnosis: Male 44mm. Forewing brown striated with bands. The large brown triangle at the center of the costa is diagnostic of this species.

4 Conclusion

The study is centered on documenting the Geometrid moth fauna of Hmuifang community forest which yielded 55 species under 38 genera with Ennominae being the most abundant subfamily and Larentiinae the least. The study provides an updated checklist of the Geometrid fauna of Hmuifang from 37 species to 72 species under five subfamilies: Ennominae, Geometrinae, Larentiinae, Oenochrominae and Sterrhinae. Similarly, the documented data on Geometridae of Mizoram also increases from 112 species including all preceding reports to 132 species under 7 subfamilies. The species-level inventory provides baseline data on geographical range extensions of the species, a prerequisite for the management and conservation of natural habitats hence the current study on inventory will serve as indispensable for ecological monitoring. As far as geographical area of the study region and number of species of geometer moth recorded during the present study are considered and compared, it reflected the diversity and richness of geometer moths in Mizoram.

5 Declaration

Presented in 4th Mizoram Science Congress (MSC 2022) during 20th & 21st October 2022, organized by Mizoram Science, Technology and Innovation Council (MISTIC), Directorate of Science and Technology (DST) Mizoram, Govt. of Mizoram in collaboration with science NGOs in Mizoram such as Mizo Academy of Sciences (MAS), Mizoram Science Society (MSS), Science Teachers' Association, Mizoram (STAM), Geological Society of Mizoram (GSM), Mizoram Mathematics Society (MMS), Biodiversity and Nature Conservation Network (BIOCONE) and Mizoram Information & Technology Society (MITS). The Organizers claim the peer review responsibility

6 Acknowledgement

We are deeply grateful to Isaac Zosangliana and K. Lalhmangaiha for their help in fieldwork. The financial assistance provided by the Science and Engineering Research Board (SERB), Department of Science & Technology, Government of India under EEQ (North Eastern Region Empowerment and Equity Opportunities for Excellence in Science) number EEQ/2017/000805 is also highly acknowledged.

References

1) Rajaei H, Hausmann A, Scoble M, Wanke D, Plotkin D, Brehm G, et al. An online taxonomic facility of Geometridae (Lepidoptera), with an overview of global species richness and systematics. *Integrative Systematics: Stuttgart Contributions to Natural History*. 2022;5(2):145–192. Available from: https://doi.org/10.18476/2022.577933.
2) Van Nieukerken EJ, Kaila L, Kitching IJ, Kristensen NP, Lees DC, et al. Order Lepidoptera Linnaeus, 1758. In: Zhang, Z.-Q. (Ed.) Animal biodiversity: An outline of higherlevel classification and survey of taxonomic richness. *Zootaxa*. 2011;3148(1):212–221. Available from: https://doi.org/10.11646/zootaxa.3148.1.2.
3) Kirti JS, Chandra K, Saxena A, Singh N. Geometrid moths of India. New Delhi, India. Nature Books India. 2019;p. 1–296.
4) Mizoram PR. A study in comprehensive geography. New Delhi, India. Northern Book Centre. 2019;p. 41–54.
5) Kirti JS, Saxena A. An inventory of family Geometridae (Lepidoptera) from North-East India. *Journal of Applied Biosciences*. 2012;38(1):28–43. Available from: https://www.researchgate.net/publication/339129736_An_inventory_of_Family_Geometridae_from_North_East_India.
6) Tochhawng L, Smetacek P. New Record of Doratoptera nicevillei (Lepidoptera: Geometridae: Ennominae) in Mizoram, India. *Journal of Bombay Natural History Society*. 2019;116(January-December). Available from: https://www.bnhsjournal.in/index.php/bnhs/article/view/132659.
7) Saxena A. Taxonomic Studies on family geometridae lebideptera from north east India. Punjab, India. 2014. Available from: https://hdl.handle.net/10603/77638.

8) Lalnghahpuii B, Lalruatthara H, Lalhmingliani E. Geometridae (Ennominae) Lepidoptera from Mizoram, India. Part 1. *Bionotes journal*. 2022;24(1&2):116–135. Available from: https://entosocindia.org/image/catalog/bionotes/Bionotes%20pdf%20papers/Vol.%2024%201-2/116-135.pdf.
9) Lalnghahpuii B, Smetacek P. The genus Xandrames Moore, 1867 (Insecta: Lepidoptera: Geometridae) in India. *Bionotes journal*. 2021;23(4):185–189. Available from: https://entosocindia.org/image/catalog/bionotes/Bionotes%20pdf%20papers/Vol.%2023%20(4)%20December%202021/FINAL-%20BIONOTES-DECEMBER-2021.pdf.
10) Lalnghahpuii B, Lalruatthara E, Lalhmingliani E. First record of Tanaorhinus viridiluteata Walker, 1861 (Lepidoptera: Geometridae: Geometrinae) from Mizoram, India. *Journal of Threatened Taxa*. 2023;15(4):23075–23082. Available from: https://doi.org/10.11609/jott.7290.15.4.23075-23082.
11) Lalhmingliani E, Gurusubramanian G, Lalremsanga HT, Lalronunga S, Lalrinchhana C. Wild silk moths (Lepidoptera: Saturniidae) of Hmuifang community forest, Aizawl Mizoram: Conservation concerns. In: Issues and Trends of Wildlife Conservation in Northeast India. 2014.
12) Hampson GF. Fauna of British India, including Ceylon and Burma;vol. III. Blanford WT, editor;London. Taylor and Francis. 1895. Available from: https://www.biodiversitylibrary.org/item/180173#page/3/mode/1up.
13) Holloway JD. The Moths of Borneo: Family Geometridae, Subfamily Ennominae. In: Malayan Nature Journal;vol. 47. 1994;p. 1–309.
14) Raaei H, Hausmann A, Scoble M, Wanke D, Plotkin D, Brehm G, et al. An online taxonomic facility of Geometridae (Lepidoptera), with an overview of global species richness and systematics. *Integrative Systematics: Stuttgart Contributions to Natural History*. 2022;5(2):145–192. Available from: https://doi.org/10.18476/2022.577933.
15) Sondhi S, Basu DN, Sondhi Y, Kunte K. Anew species of MetallolоA new species of Metallolophia Warren, 1895 (Lepidoptera: Geometridae: Geometrinae), and notes on M. opalina (Warren, 1893), from eastern Himalaya, Indiaphia Warren. *Zootaxa*. 2020;4838(2):289–297. Available from: http://biodiversitylab.ncbs.res.in/media/SondhiEtal_MetallolophiaTaleensisSpNov_2020_Zootaxa.pdf.