



Contribution to the knowledge of Pyraloid moths (Lepidoptera, Pyraloidea) from the Andaman and Nicobar Islands, India

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ABSTRACT. The Andaman and Nicobar Islands, a biodiversity hotspot in India, hosts a diverse array of insect species, many of which are endemic to the region. The present work focuses on the pyraloid moth diversity in the Andaman and Nicobar Islands and significantly expands the knowledge of the known pyraloid moth fauna of the Andaman and Nicobar Islands, reporting new distributional records for 19 species. The work provides differential diagnoses, distributional data, and microphotographs of adult genitalia, including the first descriptions of genitalia structures for five species, namely *Tatobotys varanesalis* (Walker, 1859); *Ravanoa xiphialis* (Walker, 1859); *Nosophora albiguttalis* Swinhoe, 1890; *Nosophora conjunctalis* Walker, 1866; and *Macaretaera hesperis* Meyrick, 1886. Additionally, the documentation of seven genera new to the archipelago, viz. *Macaretaera* Meyrick, 1886; *Ravanoa* Moore, 1885; *Bocchoris* Moore, 1885; *Botyodes* Guenée, 1854; *Hemopsis* Kirti & Rose, 1987; *Zitha* Walker, 1866 and *Termioptycha* Meyrick, 1889, highlights the biogeographic significance of this underexplored region and the need for continued faunistic surveys.

Keywords: Archipelago, biodiversity, Crambidae, new record, Pyralidae

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INTRODUCTION

The order Lepidoptera, encompassing moths and butterflies, stands as one of the most expansive groups within the insect world, boasting a staggering count of over 166,300 described species (Singh et al., 2024). Within this order, the superfamily Pyraloidea emerges as a notable subset, distinguished by defining features such as a basally scaled proboscis and the presence of tympanal organs on the second abdominal segment (Solis, 2007). This superfamily holds particular significance as one of the most economically consequential groups of pests, with over 16,000 described species (Nuss et al., 2003–2024). The unique ecosystem of the Andaman and Nicobar Islands, an Indo-Malayan biodiversity hotspot, makes it a crucial environment for studying pyraloid moths, larvae of which are known for their economic impact as pests of rice, coconuts, other crops, stored products, forests, and ornamental plants. Their diverse larval feeding habits highlight the potential for substantial ecological impact within this ecosystem. The Andaman and Nicobar Islands, nestled in the Bay of Bengal, constitute a distinct archipelago within India's Union Territory. Positioned approximately halfway between the Indian peninsula and Myanmar, these islands form an arc stretching from 6° to 14° Northern Latitude and 93° to 94° Eastern Longitude. The islands' proximity to distinct regions of the Oriental realm significantly influences their biodiversity, with shared characteristics with Indo-Burmese and Indo-Malayan neighbours (Mohanraj & Veenakumari, 2011). Understanding the presence of un-documented species, shifts in distributional boundaries, and expansions in range within this group holds particular significance in the Andaman and Nicobar Islands, owing to their pivotal role as a focal point for biodiversity research in the Indo-Malayan region.

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From the Andaman and Nicobar Islands, only a few taxonomic studies on Pyraloid moths have been conducted so far. These studies, primarily relying on morphological features, were carried out by Moore (1877), Mandal and Bhattacharya (1980), Rao and Sivaperuman (2020, 2021, 2022), and Singh et al. (2022a, 2023). This group of moths remains poorly documented in the islands, leaving a substantial gap in our understanding of their diversity. This study expands the knowledge of documented pyraloid moth fauna of the Andaman and Nicobar Islands, reporting nineteen species previously unrecorded in the region. Accompanied by differential diagnosis and distributional data, the present work also presents microphotographs of adult genitalia. Notably, this study is the first to describe the genitalic structures of five species: *Tatobotys varanesalis* Walker, 1859; *Ravanoa xiphialis* (Walker, 1859); *Nosophora albiguttalis* Swinhoe, 1890; *Nosophora conjunctalis* Walker, 1866; and *Macaretaera hesperis* Meyrick, 1886 providing their first description of genitalic structures for these species. Additionally, the documentation of genera *Macaretaera* Meyrick, 1886; *Ravanoa* Moore, 1885; *Bocchoris* Moore, 1885; *Botyodes* Guenée, 1854; *Hemopsis* Kirti & Rose, 1987; *Zitha* Walker, 1866; and *Termioptycha* Meyrick, 1889 for the first time in this archipelago significantly expands their known distributions, highlighting the biogeographic significance of the Andaman and Nicobar Islands.

MATERIAL AND METHODS

Moth specimens were sampled across diverse localities within the Andaman and Nicobar Islands (Fig. 1). Specifically, 160W mercury-vapour light traps, powered by a portable Honda EP1000 generator, were deployed in conjunction with a 5 × 4 ft white sheet affixed to nearby trees or branches to attract and facilitate specimen collection (following the protocol established by Tikoca et al. (2016)). The white sheet is positioned in front of the light source with its collecting side facing towards the habitat that is being targeted. This approach allowed for targeted sampling across a range of habitats and maximized the capture of nocturnal pyraloid moths. Light traps were operated for at least three hours after sunset at each sampling site. Sampling efforts targeted seven distinct habitat types across the survey area, including primary and secondary forests, open landscapes adjacent to both primary and secondary forests, agricultural/plantation areas, secondary forest edges bordering agricultural land, and littoral (coastal) forests.

Prior to collection, adult moths were photographed using a Nikon® D5600 DSLR camera equipped with Nikon® AF-S VR Micro-Nikkor 105 mm lens. Following euthanasia with ethyl acetate vapour, specimens were subsequently sorted into morphospecies and further preserved using standardized methods as described by Robinson et al. (1994). Genitalia dissections were performed with minor modifications to the Robinson (1976) protocol, and dissected genitalia were stained with Eosin-Y for enhanced visualization. Morphological descriptions and terminology adhere to the conventions established by Klots (1970) and Munroe (1976). Genitalic structures were imaged using a Leica® M205A stereo zoom microscope equipped with a DFC 500 camera, processed with Leica® Application Suite (Version 3.IX.5, Build: 301), and further refined in Adobe® Photoshop CS6. All examined specimens have been deposited in the National Zoological Collections at the Zoological Survey of India, Andaman and Nicobar Regional Centre, Port Blair, India.

RESULTS

Taxonomic hierarchy

Phylum Arthropoda Latreille, 1829

Class Insecta Linnaeus, 1785

Order Lepidoptera Linnaeus, 1758

Family Crambidae Latreille, 1810

Subfamily Spilomelinae Guenée, 1854

Genus *Agrotera* Schrank, 1802

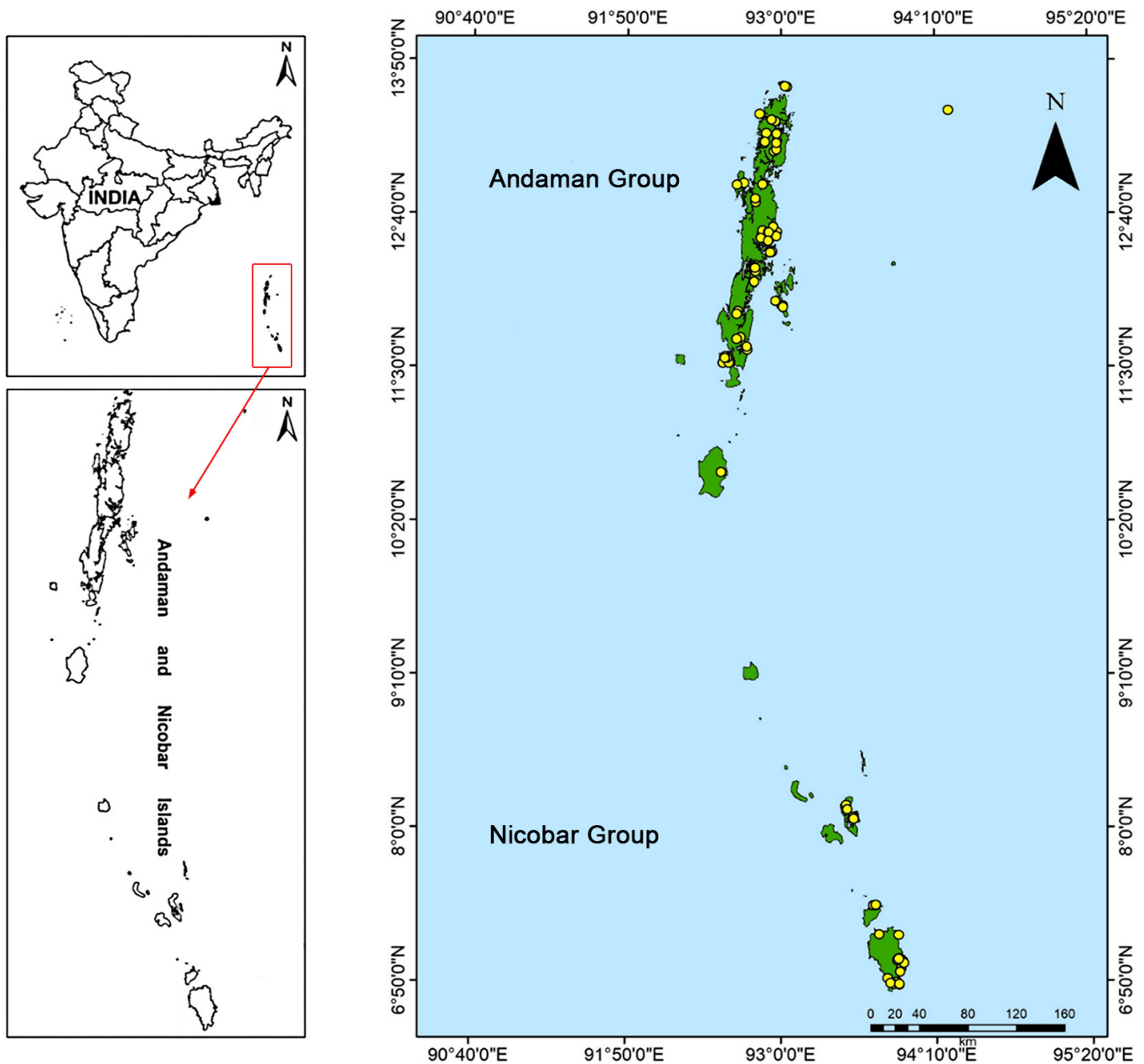


Figure 1. Map showing the survey points throughout Andaman and Nicobar Islands.

***Agrotera basinotata* Hampson, 1891 (Figs 2A, 4A, 5A)**

Agrotera basinotata Hampson, 1891:137. TL: India (Nilgiris).

Material examined. 1♂, INDIA, Andaman and Nicobar Islands, Great Nicobar Biosphere Reserve, Watch Tower, 08-XI-2018, coll. K.C. Gopi and Party (Reg. No. ZSI/ANRC/T-16621); 1♂, INDIA, Andaman and Nicobar Islands, Great Nicobar Biosphere Reserve, Steel Bridge, 22-XI-2018, coll. K.C. Gopi and Party (Reg. No. ZSI/ANRC/T-16622); 1♀, INDIA, Andaman and Nicobar Islands, Great Nicobar Biosphere Reserve, Watch Tower, 08-XI-2018, coll. K.C. Gopi and Party (Reg. No. ZSI/ANRC/T-16620); 1♂, INDIA, Andaman and Nicobar Islands, Great Nicobar Biosphere Reserve, Bird watching Point, Great Nicobar Biosphere Reserve, 14-XI-2018, coll. K.C. Gopi and Party (Reg. No. ZSI/ANRC/T-16619).

Diagnosis. Wingspan 10 mm in males. *Agrotera basionata* is closely similar to *Agrotera nemoralis* (Scopoli, 1763) in external appearance but can be separated in the male genitalia by the undivided valva, V-shaped saccus, triangularly pointed uncus and stout phallus narrowing distally, with broad apical region with numerous spines.

Distribution. Sri Lanka, India (Punjab, Assam, Meghalaya, Niligiri Hills, Chhattisgarh, Maharashtra, Tamil Nadu and Kerala, Great Nicobar Island—Present Study), Burma, Thailand, Malaysia (West Malaysia, Sabah, Indonesia), Taiwan, China, Japan, Australia (Chaovalit & Pinkaew, 2020; Reddy & Murthy, 2021; Shaffer et al., 1996; Whitaker et al., 2017).

Remarks. This is the first record of *Agrotera basinotata* from the Nicobar group of Islands, a significant range extension for this species within India. This finding underscores the need for continued biodiversity surveys in this understudied region. Representative individuals of this species were observed in traps placed in the primary forests of the Great Nicobar Islands.

Genus *Bocchoris* Moore, 1885

Bocchoris trimaculalis (Snellen, 1880) (Figs 2B, 4B, 5B)

Aediodes trimaculalis Snellen, 1880:232–233. TL: Indonesia, Sulawesi, Makassar.

Material examined. 1♂, INDIA, Andaman and Nicobar Islands, Great Nicobar Islands, Chingam Basti, 09-XI-2018, coll. K.C. Gopi and party; 1♂, INDIA, Andaman and Nicobar Islands, Great Nicobar Islands, Great Nicobar Biosphere Reserve, Bird watching Point, 14-XI-2018, coll. K.C. Gopi and Party.

Diagnosis. Wingspan 14–16 mm. *Bocchoris trimaculalis* can be distinguished from other congeners by the blackish ground colour of its wings, white tegulae, two white patches on each forewing (one each in the medial and postmedial areas), and one white patch on the medial area of the hindwing. In the male genitalia, the uncus is broad and rounded with a spinous apex, the harpe is sclerotized, the juxta is shield-shaped, the sacculus is broad at the basal third, the saccus is V-shaped, and the aedeagus is slender and lacks cornuti.

Distribution. India (Meghalaya, Assam, Great Nicobar Island—Present Study), Laos, Myanmar, Thailand, Malaysia, Indonesia (Whitaker et al., 2017).

Remarks. Previous records of *Bocchoris trimaculalis* in India were confined to the northeastern states of Meghalaya and Assam. This study significantly expands the known distribution of this species within India by documenting its presence in the Great Nicobar Island for the first time. Representative individuals of this species were observed in traps placed in the primary forests of the Great Nicobar Islands.

Genus *Botyodes* Guenée, 1854

Botyodes asialis Guenée, 1854 (Figs 2C, 4C, 5C)

Botyodes asialis Guenée, 1854:321. TL: Central India; East India / Bangladesh; Nepal.

Botys chrysothalis Mabille, 1880:cvi–cix. TL: Madagascar.

Material examined. 1♂, INDIA, Andaman and Nicobar Islands, Great Nicobar Biosphere Reserve, Watch Tower, 08-XI-2018, coll. K.C. Gopi and Party (Reg. No. ZSI/ANRC/T-16597); 1♀, INDIA, Andaman and Nicobar Islands, Great Nicobar Biosphere Reserve, Watch Tower, 08-XI-2018, coll. K.C. Gopi and party (Reg. No. ZSI/ANRC/T-16598); 1♂, INDIA, Andaman and Nicobar Islands, Galathea 42.7 km, Great Nicobar, 18-XII-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-10799).

Diagnosis. Wingspan 45–50 mm. Externally similar to other congeners in foreground colour of forewing and hindwing, but can be differentiated by prominent antemedial and postmedial irregular zig-zag markings, broad brown marginal bands of hindwings. In male genitalia, uncus curved and elongated with spines on the spatulated apex, valva oval-shaped, sclerotized costa, phallus with a robust spine-shaped cornutus.

Distribution. Africa, Borneo, China, India, Indonesia, Japan, Laos, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam, Australia (Kirti & Rose, 1990; Ko et al., 2019; Shaffer et al., 1996).

Remarks. Documented for the first time from Great Nicobar Island. Representative individuals of this species were observed in traps placed in the primary forests of the Great Nicobar Islands.

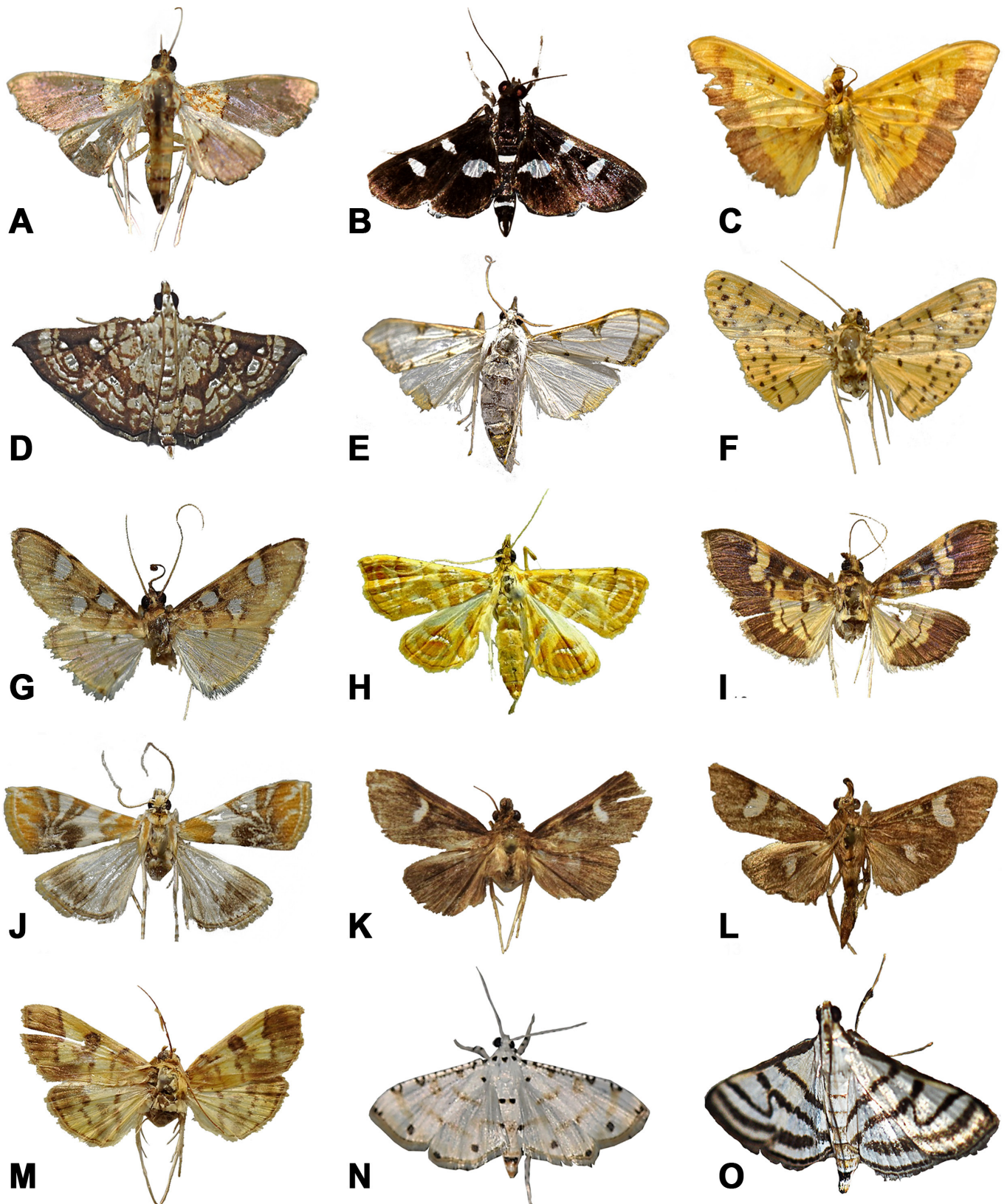


Figure 2. Adults of the pyraloid moths. **A.** *Agrotera basinotata* Hampson, 1891; **B.** *Bocchoris trimaculalis* (Snellen, 1880); **C.** *Botyodes asialis* Guenée, 1854; **D.** *Chabula trivitalis* (Swinhoe, 1895); **E.** *Cirrhochrista bracteolalis* Hampson, 1891; **F.** *Conogethes pluto* (Butler, 1887); **G.** *Cotachena alysoni* Whalley, 1961; **H.** *Daulia aurantialis* Hampson, 1896; **I.** *Hemopsis dissipatalis* (Lederer, 1863); **J.** *Macaretaera hesperis* Meyrick, 1886; **K.** *Nosophora albiguttalis* Swinhoe, 1890; **L.** *Nosophora conjunctalis* Walker, 1866; **M.** *Patania obfuscalis* Yamanaka, 1998; **N.** *Pycnarmon cribrata* (Fabricius, 1794); **O.** *Ravanoa xiphialis* (Walker, 1859).

Genus *Chabula* Moore, [1886]

Chabula trivitalis (Swinhoe, 1895) (Figs 2D, 4D, 5D)

Chabula trivitalis Swinhoe, 1895:302–303. TL: India (Shillong).

Synclera fenestralis Warren, 1896:105. TL: India (Khasi Hills).

Material examined. 3♂♂, INDIA, Andaman and Nicobar Islands, Diglipur, Bahadur Tikrey, 08-I-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-17339, T-17340, T-17341).

Diagnosis. Wingspan 10–11 mm in Male. *Chabula trivitalis* can be distinguished from its congeners by the pale-yellow ground colour of its wings, numerous brown stripes on the forewings, a thick transverse medial band, a white transparent wing window near the leading edge, and two white patches on the postmedial area forming a disrupted "B" shape. The hindwing markings are similar to those of the forewing, and the outer margin has a dark brown line.

Distribution. Korea, Taiwan, Japan, Sri Lanka, India (northeastern states of Meghalaya and Assam) (Gupta, 1994; Shibuya, 1928).

Remarks. This study documents the first occurrence of *Chabula trivitalis* in the Andaman group of islands, previously known only from the Nicobar group (Chandra, 1996; Rao & Sivaperuman, 2020). This significant range extension within the Andaman and Nicobar archipelago underscores the dynamic nature of species distributions in island ecosystems. Representative individuals of this species were observed in traps placed in the secondary forest margins of the North Andaman.

Genus *Cirrhochrista* Lederer, 1863

Cirrhochrista bracteolalis Hampson, 1891 (Figs 2E, 6A)

Cirrhochrista bracteolalis Hampson, 1891:135. TL: India (Nilgiri hills).

Material examined. 2♀♀, India, Andaman and Nicobar Islands, Great Nicobar Island, Govind Nagar, 05-IX-2018, coll. K.C. Gopi and Party (Reg. No. ZSI/ANRC/T-17118, 17120); 4♀♀, India, Andaman and Nicobar Islands, Great Nicobar Island, Gobind Nagar, 05-IX-2018, coll. K.C. Gopi and Party (Reg. No. ZSI/ANRC/T-16107, 16108, 16227).

Diagnosis. Wingspan of 35–37 mm. Externally similar to other members of this genus with whitish forewings, brownish costal margins, and whitish hindwings, *Cirrhochrista bracteolalis* can be distinguished by its female genitalia with a funnel-shaped antrum, an infundibular ductus bursa, and a rounded, membranous corpus bursa with a horn-shaped signum.

Distribution. China, India (South, North and North-east Indian States, Nicobar Islands- Present study), Sri Lanka, Taiwan, Thailand, Malaysia (Sabah), Philippines (Chen et al., 2006; Singh et al., 2023; Whitaker et al., 2017).

Remarks. Previously documented from various states across mainland India including Sikkim, Tamil Nadu, West Himalaya, Himachal Pradesh, Nagaland, Assam, Meghalaya, Manipur, Karnataka, West Bengal, Andhra Pradesh, and Maharashtra. This study reports the first occurrence of *Cirrhochrista bracteolalis* from Nicobar Islands. This new record significantly expands the known distribution of the species. Representative individuals of this species were observed in traps placed in the primary forests and from secondary forest margins of the Great Nicobar Islands.

Genus *Conogethes* Meyrick, 1884

Conogethes pluto (Butler, 1887) (Figs 2F, 4E, 5E)

Omiodes pluto Butler, 1887:121. TL: Solomon Islands (Alu).

Material examined. 1♂, Sastri Nagar, 37 km, Great Nicobar Island, 03-XI-2018, coll. B. Sumit Kumar Rao, (Reg. No. ZSI/ANRC/T-16586).

Diagnosis. *Conogethes pluto* closely resembles *Conogethes sahyadriensis* Shashank, Kammar, Mally &

Chakravarthy, 2018 in the colouration of its labial palpi, but can be differentiated through male genitalia by the evenly arched apex of the valva. Additionally, the elongate sclerotization extending from the harpe towards the valva base in *Conogethes pluto* terminates before reaching the vicinity of the ventral valva base, whereas in *Conogethes sahyadriensis* it extends further ventrally.

Distribution. Australia, India (West Himalayas, Great Nicobar – Present Study), New Guinea, Thailand (Chaovalit et al., 2019; El-Sayed et al., 2013; Sanyal et al., 2018).

Remarks. This record contributes to the increasing evidence of intricate biogeographic patterns. The presence of *Conogethes pluto* in this region raises intriguing questions about the distribution and diversity within the *Conogethes* genus. Our findings may indicate a wider but previously underreported distribution of *Conogethes pluto* across regions such as Borneo, Sumatra, and Java. Alternatively, these records could reflect cryptic diversity within the genus, highlighting the need for further investigation. Mally's collection of a *Conogethes sahyadriensis* specimen in Sabah, Borneo, suggests a broader distribution of this species across South and Southeast Asia than previously recognized (Richard Mally, pers. comm.). This observation, combined with Singh et al. (2022b) report of *Conogethes sahyadriensis* from the Great Nicobar Islands, indicates that both *Conogethes pluto* and *Conogethes sahyadriensis* may be present in the Andaman and Nicobar archipelago.

Genus *Cotachena* Moore, 1885

Cotachena alysoni Whalley, 1961 (Figs 2G, 4F, 5F, 6B)

Cotachena alysoni Whalley, 1961:101. TL: China, Chang Yang.

Material examined. 3♂♂, India, Andaman and Nicobar Islands, Great Nicobar Biosphere Reserve, Watch Tower, 05-IX-2018, coll. K.C. Gopi and Party (Reg. No. ZSI/ANRC/T-13286, T-13287, T-13288).

Diagnosis. Wingspan 20–21 mm. *Cotachena alysoni* closely resembles *Cotachena pubescens* (Warren, 1892) but can be distinguished by the fuscous (dark brownish-grey) ground colour of the forewing and a larger antemedian. In the male genitalia, *Cotachena alysoni* has a blunt uncus that is comparatively shorter than that of *Cotachena pubescens*, and a U-shaped saccus.

Distribution. China, India (Sikkim, Darjeeling, Shillong – Khasis Hills, Naga Nills, Nicobar Islands – Present study), Indonesia, Japan, Korea, Laos, Malaysia, Nepal, Taiwan, Thailand, Vietnam (Whalley, 1961).

Remarks. Documented for the first time from Nicobar Islands. Representative individuals of this species were observed in traps placed in the primary forests of the Great Nicobar Islands.

Genus *Daulia* Walker, 1859

Daulia aurantialis Hampson, 1896 (Figs 2H, 6C)

Daulia aurantialis Hampson, 1896:221. TL: India, Nagaland.

Material examined. 4♀♀, 12 spec., India, Andaman and Nicobar Islands, Rangat, Parnashalla, 19-VI-2019, coll. Dr. C. Sivaperuman and Party (Reg. No. ZSI/ANRC/T-12464, T-12465, T-12466, T-12467, T-12468, T-12469, T-12470, T-12471, T-12472, T-12473, T-12474, T-12475, T-12476, T-12477, T-12478, T-12479); 5♂♂, India, Andaman and Nicobar Islands, Mahatma Gandhi Marine National Park, Alexandra Island, 19-VII-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-12480, T-12481, T-12482, T-12483, T-12484), 4♂, India, Andaman and Nicobar Islands, North Andaman, Bahadur Tikrey, 08-I-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-15260).

Diagnosis. Wingspan 18 mm. The forewing ground colour is deep yellow, with three black spots along the costal margin at the antemedial, medial, and postmedial bands. A whitish postmedial band merges with a silvery-white subterminal line near the tornus. In the female genitalia, the antrum and ductus bursae are narrow, and the corpus bursae is ovoid.

Distribution. India (Nagaland, Western ghats, Andaman Islands – Present Study), Malaysia (Sabah) (Das et al., 2020; Hampson, 1896; Klima, 1937; Whitaker et al., 2017).

Remarks. The presence of *Daulia aurantialis* was recorded for the first time in the Andaman Islands. Previously, this species had been documented in Nagaland and from the Western Ghats of India. This finding significantly extends the known geographical distribution of *Daulia aurantialis*, within India highlighting the diverse and potentially underexplored lepidopteran fauna of the Andaman Islands. Representative individuals of this species were observed in traps placed in the primary forest's margins and secondary forest margins.

Genus *Hemopsis* Kirti & Rose, 1987

Hemopsis dissipatalis (Lederer, 1863) (Figs 2I, 4G, 5G, 6D)

Botys dissipatalis Lederer, 1863:376. TL: Indonesia (Ambon Island).

Hemopsis dissipatalis Kirti & Rose, 1987:379–380.

Material examined. 2♂♂, Makachua, Little Nicobar, 14-XI-2018, Coll. B. Sumit Kumar Rao, Reg. No. ZSI/ANRC/T-16114; 1♂, Makachua, Little Nicobar, 19-XI-2018, Coll. B. Sumit Kumar Rao, Reg. No. ZSI/ANRC/T-16115; 2♀♀, Makachua, Little Nicobar, 22-XI-2018, Coll. B. Sumit Kumar Rao, Reg. No. ZSI/ANRC/T-16116; 2♀♀, Makachua, Little Nicobar, 28-X-2019, Coll. B. Sumit Kumar Rao, Reg. No. ZSI/ANRC/T-16117; 1♀, Makachua, Little Nicobar, 27-X-2019, Coll. B. Sumit Kumar Rao, Reg. No. ZSI/ANRC/T-16588; 8♂♂, Bird watching Point, Great Nicobar Biosphere Reserve, 26-XII-2019, Coll. B. Sumit Kumar Rao, Reg. No. ZSI/ANRC/T-10835; T-10836, T-10837, T-10838, T-10839, T-10840, T-10841, T-10842; 2 Ex, Bird Watching Point, Great Nicobar Biosphere Reserve, 24-IX-2019, Coll. Dr. Sivaperuman and Party, Reg. No. ZSI/ANRC/T-10844, T-10845; 1♂, Bird Watching Point, Great Nicobar Biosphere Reserve, 15-XI-2018, Coll. K.C. and Party, Reg. No. ZSI/ANRC/T-11043; 5♂, Galathea 42.7 km, Great Nicobar, 18-XII-2019, Coll. B. Sumit Kumar Rao, Reg. No. ZSI/ANRC/T-11638, T-11639, T-11640, T-11641, T-10843.

Diagnosis. Wingspan 22–24 mm. *Hemopsis dissipatalis*, is externally similar to *Hemopsis angustalis* (Snellen, 1890) but can be separated by dark brown ground colour of forewing; basal area with a light yellow reniform patch; median area with four light yellow patches; postmedial area with a light yellow, irregularly rectangular patch and a small light yellow reniform patch; wide marginal shade on hindwing. In Male genitalia by uncus membranous, without chaetae; valva broad, rounded at apex with a process on the costal margin; narrow harpe; saccus elongated and nearly rectangular; phallus with many slender, spinose arranged cornuti. In female genitalia by narrow and moderate length ductus bursae and corpus bursae with semi-circular sclerotised arc like signum.

Distribution. India (Assam), Indonesia, Japan, Korea, Laos, Nepal, Russia, Sri Lanka, Taiwan (Kirti & Rose, 1987).

Remarks. Reported for the first time from Nicobar group of Islands (Great Nicobar & Little Nicobar Islands). Representative individuals of this species were observed in traps placed in the primary forest's margins.

Genus *Macaretaera* Meyrick, 1886

Macaretaera hesperis Meyrick, 1886 (Figs 2J, 6E)

Macaretaera hesperis Meyrick, 1886:255. TL: Fiji.

Trichoptychodes delicata Swinhoe, 1894:207. TL: India (Cherrapunji).

Material examined. 1♀, India, Andaman and Nicobar Islands, North Andaman Tal Tikrey, 10-III-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-16595). 1♀, India, Andaman and Nicobar Islands, Middle Andaman, APWD Guest house-Rangat, 06-VIII-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T/17332).

Diagnosis. Wingspan 21 mm. Forewings with basally with rufous yellow colour, medial area with a white suffusion, and a triangular narrow patch extending from two-thirds of the costa to near the tornus. Marginal band rufous yellow, fringes yellow. Hindwings with a white ground colour and a dark terminal band from the apex to M3. In the female genitalia, the papillae anales are elliptical, the anterior

apophysis is double the size of the posterior apophysis, and the colliculum is lightly sclerotized. The ductus bursae is narrow, corpus bursae is sac-shaped, short, broadly attached to the ductus bursae, and lacks signa.

Distribution. Australia (Queensland), Fiji, India (Kerala, Assam, Meghalaya, Cherrapunji), Papua New Guinea, Vietnam (Hampson, 1896; de Joannis, 1930; Mathew & Menon, 1984; Gupta, 1994; Joshi et al., 2021).

Remarks. The discovery of this monotypic genus in the Andaman Islands marks a significant range extension, previously documented in India only from Northeast India and the state of Kerala. This new record confirms its presence in the Indo-Myanmar region, highlighting the biogeographic connectivity between these areas and the potential for further undiscovered diversity in the Andaman archipelago. Representative individuals of this species were observed in traps placed in the secondary forest's margins.

Genus *Nosophora* Lederer, 1863

Nosophora albiguttalis Swinhoe, 1890 (Figs 2K, 4H, 5H)

Nosophora albiguttalis Swinhoe, 1890:273. TL: Burma (Myanmar).

Material examined. 1♂, India, Andaman and Nicobar Islands, Great Nicobar Islands, Galathea 42.7 Km, 18-XII-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC-T-10825); 1 spec., India, Andaman and Nicobar Islands, Great Nicobar Biosphere Reserve, Bird watching Point, 26-XII-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-10826); 1♂, India, Andaman and Nicobar Islands, North Andaman, Bahadur Tikrey, 08-I-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-17109).

Diagnosis. Wingspan 34 mm. *Nosophora albiguttalis* closely resembles *Nosophora conjunctalis* Walker, 1866 in external appearance but can be readily distinguished by the presence of a white lunular-shaped patch at the end of the cell and the absence of discal spots on the hindwings. Further differentiation is evident in the male genitalia, where *Nosophora albiguttalis* exhibits a broad uncus with setae and a flat apical tip, a broad, nearly rectangular valva with a basally concave ventral margin, a broad juxta narrowed apically with a U-shaped saccus, and a short, stout phallus equipped with three distinct sets of cornuti.

Distribution. Myanmar, China (Hongkong), India (Assam, Haryana, Maharashtra, Manipur, Meghalaya, Nagaland, Tripura, West Bengal, Andaman and Nicobar Islands-Present Study), North Vietnam (Caradja & Meyrick, 1933; Kendrick, 2002; Mathew, 2006).

Remarks. Documented for the first time from the Andaman and Nicobar Islands. Representative individuals of this species were observed in traps placed in both primary forest's margins and secondary forest margins.

Nosophora conjunctalis Walker, 1866 (Figs 2L, 4I, 5I)

Nosophora conjunctalis Walker, 1866:1483. TL: Indonesia.

Material examined. 2♂♂, India, Andaman and Nicobar Islands, North Andaman, Bahadur Tikrey, 08-I-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-16085, T-16086); 2 spec., India, Andaman and Nicobar Islands, North Andaman, Bahadur Tikrey, Diglipur, 08-I-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-16087); 3♂♂, India, Andaman and Nicobar Islands, North Andaman, Chainpur, 17-X-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-16088, T-16089, T-16090)

Diagnosis. Externally similar to *Nosophora albiguttalis* but can be differentiated by small rectangular shaped whitish patch in cell followed by a large white lunular post medial patch from sub-costa to M3. The male genitalia further differentiate this species, as it possesses an uncus with a noticeable indentation, broad transtilla arms, and a narrow gnathos band. The vinculum and saccus are V-shaped, while the valva is rectangular in form. Additionally, the phallus is characterized by a pair of curved cornuti, which further aids in its identification.

Distribution. Borneo, Australia (Hampson, 1896), India (Das et al., 2020; Gupta, 1994; Reddy & Murthy, 2021).

Remarks. Significantly expanding its known range, this species, previously documented only in mainland India (Assam, Kerala, and West Bengal), has now been recorded for the first time in the Andaman and Nicobar Islands (North Andaman and Great Nicobar). Representative individuals of this species were observed in traps placed in secondary forest margins.

Genus *Patania* Moore, 1888

Patania obfuscalis (Yamanaka, 1998) (Figs 2M, 4J, 5J)

Pleuroptya obfuscalis Yamanaka, 1998:106. TL: Nepal, Bagmati.

Material examined. 1♀, India, Andaman and Nicobar Islands, North Andaman, Madhupur, 12-I-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-16601); 2♂♂, India, Andaman and Nicobar Islands, Rangat, Multipurpose Agricultural Farm-Panchwati, 18-VI-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-17151, T-17152).

Diagnosis. Wingspan 26–30 mm. *Patania obfuscalis* is externally similar to *Patania plagiatalis* (Walker, 1859) but can be separated by orbicular brown patch at medial area connecting fuscous tornus of forewing. In male genitalia by smoothly rounded uncus, ear-shaped valva with slightly produced costa at 2/3rd with cluster of setae. Phallus short spine-shaped with apically produced spine, bunch of cornuti. In female genitalia, corpus bursae globular, with a small orbicular signum.

Distribution. Nepal, China, India (Sikkim, Mizoram), Laos (Singh et al., 2022a; Xu & Du, 2016; Yamanaka, 1998).

Remarks. Externally, *Patania obfuscalis* can be distinguished from *Patania iopasalis* (Walker, 1859), *Patania clava* Xu and Du, 2016, and *Patania shompen* Singh & Ahmad, 2022 by the shorter labial palpi. In male genitalia, *P. obfuscalis* is distinct from all the three closely similar species by the middle of costa slightly inflated and bearing a cluster of setae (Singh et al., 2022a). Representative individuals of this species were observed in traps placed in lowland secondary forests and plantations on Andaman group of Islands.

Genus *Pycnarmon* Lederer, 1863

Pycnarmon cribrata (Fabricius, 1794) (Fig. 2N)

Phalaena cribrata Fabricius, 1794:215. TL: India.

Spilomela caberalis Guenée, 1854:284. TL: Indonesia (Java).

Pycnarmon cribrata: Hampson, 1896:258.

Material examined. 1 spec., India, Andaman and Nicobar Islands, Watch Tower, Great Nicobar Biosphere Reserve, 08-XI-2018, coll. K.C. Gopi and Party.

Diagnosis. Wingspan 20–22 mm. *Pycnarmon cribrata* differs from congeners by spotted black costal pattern, black dot on the centre of thorax with black spot on tegula, basal area with a black spot on the inner margin of forewing, indistinct medial line black, apical area with a black patch on both wings.

Distribution. Australia, Congo, India, Indonesia, Japan, Kenya, Korea, Laos, Madagascar, Sierra Leone, South Africa, Sri Lanka, Taiwan, Zambia (Singh et al., 2022b).

Remarks. Recorded for the first time from the Andaman and Nicobar Islands.

Genus *Ravanoa* Moore, 1885

Ravanoa xiphialis (Walker, 1859) (Figs 2O, 6F)

Zebronia xiphilais Walker, 1859:483. TL: Sarawak, Borneo.

Zebronia bilineolalis Walker, 1866:1350. TL: Mysol.

Material examined. 1♀, India, Andaman and Nicobar Islands, Great Nicobar Islands, Great Nicobar Biosphere Reserve, Watch Tower, 08-XI-2018, coll. K.C. Gopi and Party.

Diagnosis. Wingspan 22 mm. Foreground colour white on both the wings, forewings with basally broader black costal margin, antemedial and medial straight black bands, postmedial band inwardly connected with the medial band, broad sub-terminal band, black terminal band on forewing. In female genitalia, papillae anales small, anterior apophysis longer than the posterior pair, ductus bursae short, antrum sclerotized, corpus bursae broad and elongated with small scobination of signum.

Distribution. Burma, Borneo (Sarawak), Malaysia India (Kerala, Tripura), Sri Lanka (Singh et al., 2022b).

Remarks. *Ravanoa*, a genus represented by a single species, is now recorded for the first time on Great Nicobar Island in the Nicobar archipelago. While previously documented in the Indian states of Kerala and Tripura, this new finding expands the known range of the species to the Nicobar Islands.

Genus *Tatobotys* Butler, 1881

Tatobotys varanesalis (Walker, 1859) (Figs 3A, 6G)

Botys varanesalis Walker, 1859:719. TL: Malaysia, Borneo, Sarawak.

Material examined. 1♀, India, Andaman and Nicobar Islands, Swarajdeep, Radha Nagar, 13-XI-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T/17718).

Diagnosis. Wingspan 29 mm. Foreground light orange, forewing with black coastal margin, basal and sub-basal area with straight black band, orbicular and reniform spot bordered with black, post medial band black, terminal band wide and black. Hindwing with the same maculation without spots. Abdomen with each segment marked with blackish triangular patch with silver scales. In female genitalia, papillae anales broad and elliptical, anterior apophysis longer than the posterior ones, antrum sclerotized, ductus bursae very short, corpus bursae elongated and without signum.

Distribution. Borneo, Darjeeling, Calcutta (Singh et al., 2022b, Walker, 1859).

Remarks. *Tatobotys varanesalis* is now recorded for the first time in the Andaman Islands. While previously documented in the Indian state of West Bengal (specifically, Darjeeling and Calcutta), this is the third known location for the species, expanding its documented range to the Andaman Islands. Representative individual of this species was observed in traps placed in mangrove forest margin adjacent to Agricultural field.

Family Pyralidae Latreille, 1809

Subfamily Pyralinae Latreille, 1809

Genus *Zitha* Walker, 1866

Zitha torridalis (Lederer, 1863) (Figs 3B, 4K, 5L)

Asopia torridalis Lederer, 1863:342. TL: Ceylon (Sri Lanka).

Material examined. 1♂, India, Andaman and Nicobar Islands, Great Nicobar Islands, Galathea 42.7 Km, 18-XII-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-17170), 1♂, India, Andaman and Nicobar Islands, Great Nicobar Biosphere Reserve, Bird Watching point, 14-XI-2018, coll. K.C. Gopi and Party (Reg. No. ZSI/ANRC/T-16628).

Diagnosis. In male genitalia uncus elongated and apically blunt, gnathos short and tongue-shaped, juxta broad and shield-shaped, saccus v-shaped, harpe short thorn-like, phallus long and slender without cornuti.

Distribution. India (several states), Thailand, Borneo, and Myanmar (Singh et al., 2022b).

Remarks. Documented for the first time from Nicobar group of Islands. Representative individuals of this species were observed in traps placed in both primary forest's margins

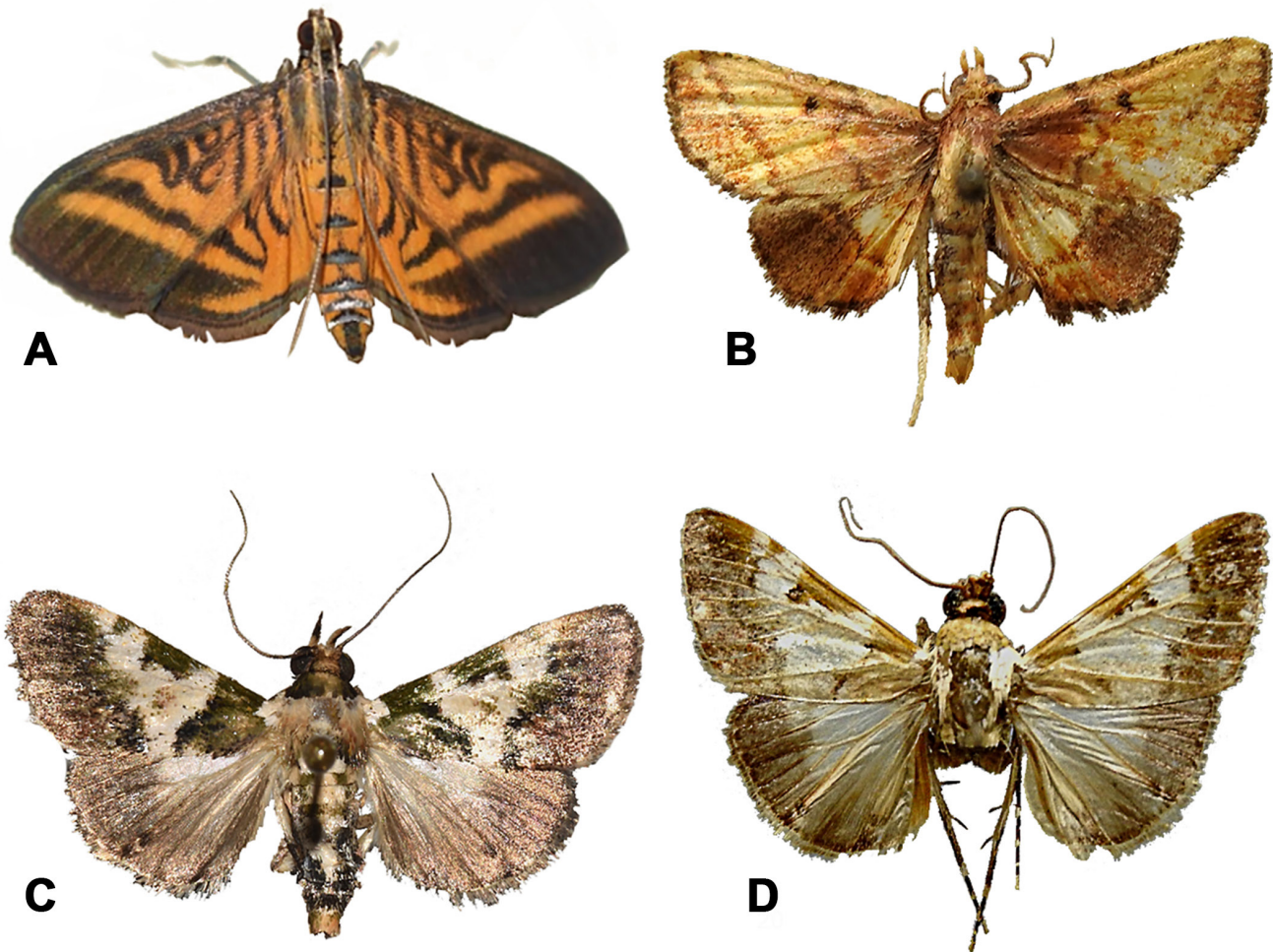


Figure 3. Adults of the pyraloid moths. **A.** *Tatobotys varanesalis* Walker, 1859; **B.** *Zitha torridalis* (Lederer, 1863); **C.** *Termioptycha albifurcalis* (Hampson, 1916); **D.** *Termioptycha cornutitricifurca* Rong & Li, 2017.

Subfamily Epipaschiinae Meyrick, 1884

Genus *Termioptycha* Meyrick, 1889

Termioptycha albifurcalis (Hampson, 1916) (Figs 3C, 6H)

Macalla albifurcalis Hampson, 1916:144–145. TL: India (Travancore, Pirmád).

Salma albifurcalis (Hampson): Solis, 1992:287.

Termioptycha albifurcalis (Hampson): Heppner & Inoue, 1992:91.

Material examined. 1♀, India, Andaman and Nicobar Islands, Great Nicobar Biosphere Reserve, Watch tower, 21-VIII-2019, coll. B. Sumit Kumar Rao (Reg. No. ZSI/ANRC/T-16118).

Diagnosis. Wingspan 28 mm. *Termioptycha albifurcalis* is similar to *Termioptycha margarita* (Butler, 1879) but can be separated by a rounded white patch at the middle of the termen and in female genitalia by the long uniformly narrow antrum.

Distribution. China, Malaysia, Sri Lanka, Thailand, India (Kerala, Great Nicobar Islands-Present Study) (Ranjan et al., 2022; Rong et al., 2017).

Remarks. While *Termioptycha albifurcalis* has been documented from the states of Kerala and Maharashtra, Singh et al. (2022b) mistakenly claimed its presence in the Andaman and Nicobar Islands citing Sondhi et al. (2021). Upon reviewing Sondhi et al. (2021) findings, it was concluded that their claim of this species' presence on the Andaman and Nicobar Islands was erroneous. The present study marks the first official record of *Termioptycha albifurcalis* from the primary forests of Great Nicobar Island.

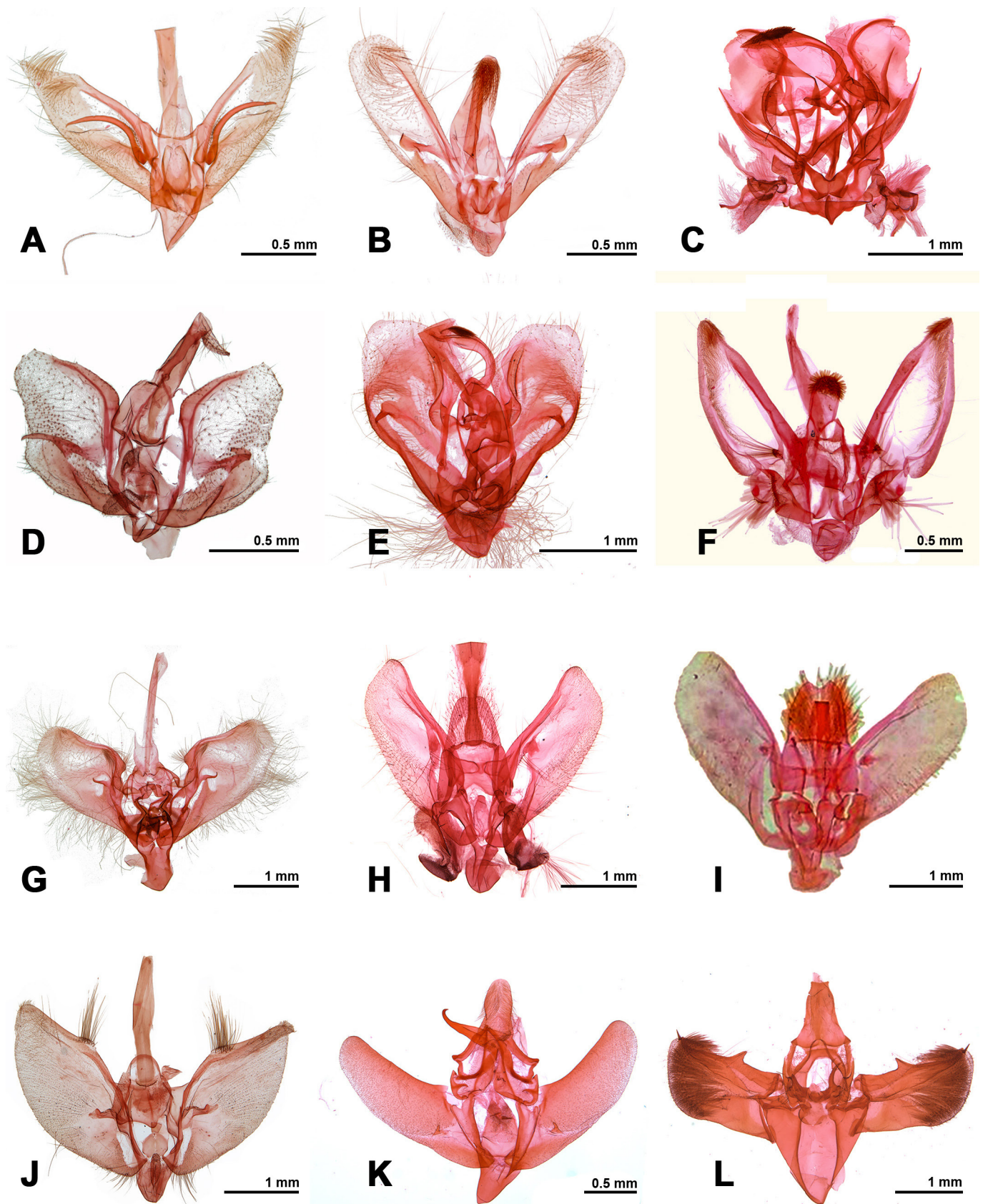


Figure 4. Male genitalia of the pyraloid moths. **A.** *Agrotera basinotata* Hampson, 1891; **B.** *Bocchoris trimaculalis* (Snellen, 1880); **C.** *Botyodes asialis* Guenée, 1854; **D.** *Chabula trivitalis* (Swinhoe, 1895); **E.** *Conogethes pluto* (Butler, 1887); **F.** *Cotachena alysoni* Whalley, 1961; **G.** *Hemopsis dissipatalis* (Lederer, 1863); **H.** *Nosophora albiguttalis* Swinhoe, 1890; **I.** *Nosophora conjunctalis* Walker, 1866; **J.** *Patania obfuscalis* Yamanaka, 1998; **K.** *Zitha torridalis* (Lederer, 1863); **L.** *Termioptycha cornutitrifurca* Rong & Li, 2017.

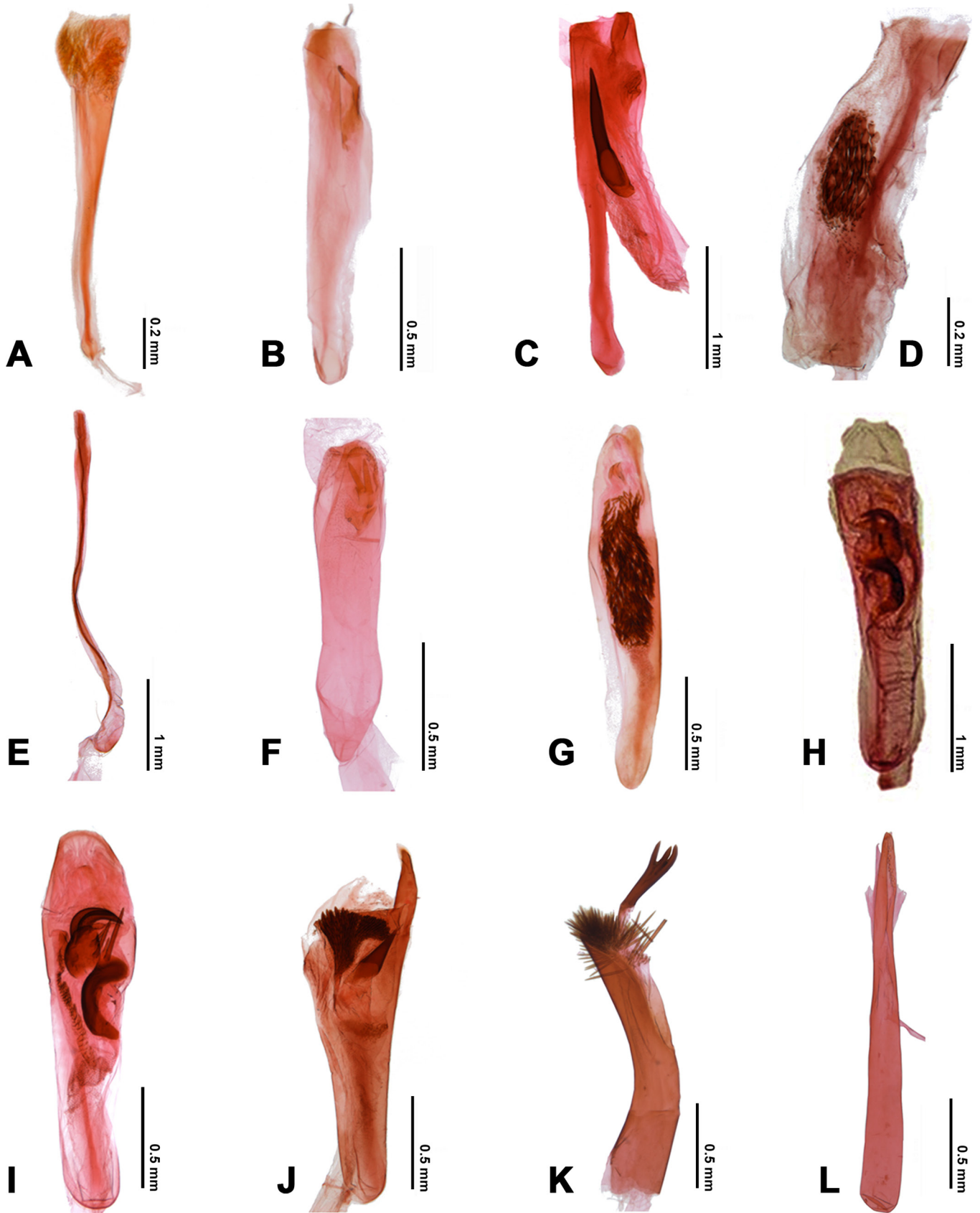


Figure 5. Phallus in the pyraloid moths. **A.** *Agrotera basinotata* Hampson, 1891; **B.** *Bocchoris trimaculalis* (Snellen, 1880), 1854; **C.** *Botyodes asialis* Guenée, 1854; **D.** *Chabula trivitalis* (Swinhoe, 1895); **E.** *Conogethes pluto* (Butler, 1887); **F.** *Cotachena alysoni* Whalley, 1961; **G.** *Hemopsis dissipatalis* (Lederer, 1863); **H.** *Nosophora albiguttalis* Swinhoe, 1890; **I.** *Nosophora conjunctalis* Walker, 1866; **J.** *Patania obfuscalis* Yamanaka, 1998; **K.** *Termioptycha cornutitrifurca* Rong & Li, 2017; **L.** *Zitha torridalis* (Lederer, 1863).

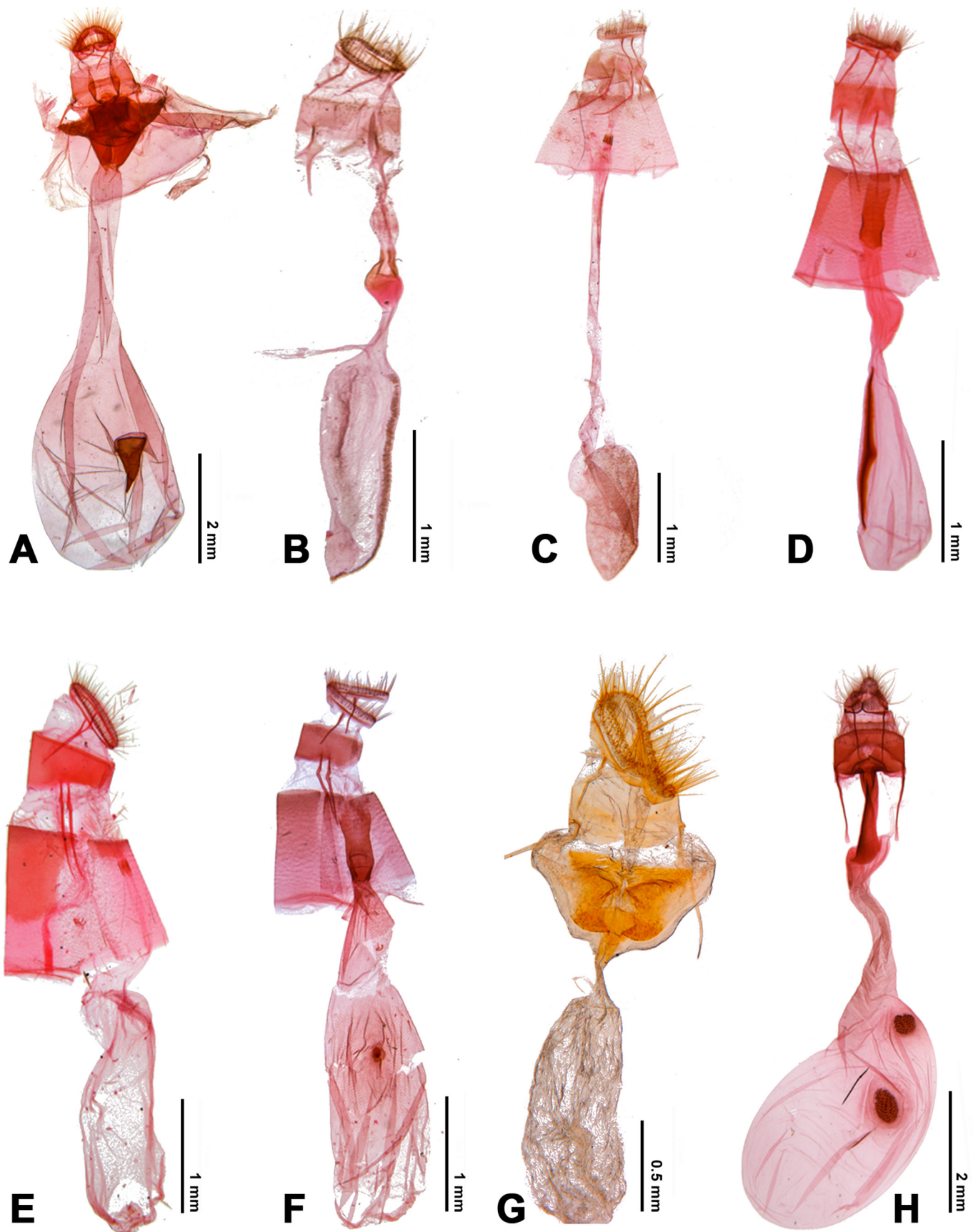


Figure 6. Female genitalia of the pyraloid moths. **A.** *Cirrhochrista bracteolalis* Hampson, 1891; **B.** *Cotachena alysoni* Whalley, 1961; **C.** *Daulia aurantialis* Hampson, 1896; **D.** *Hemopsis dissipatalis* (Lederer, 1863); **E.** *Macaretaera hesperis* Meyrick, 1886; **F.** *Ravanoa xiphialis* (Walker, 1859); **G.** *Tatobotys varanesalis* Walker, 1859; **H.** *Termiopchyta albifurcalis* (Hampson, 1916).

***Termioptycha cornutitrifurca* Rong & Li, 2017 (Figs 3D, 4L, 5K)**

Termioptycha cornutitrifurca Rong & Li [in Rong et al., 2017:163. TL: Bubang (China).

Material examined. 3♂♂, India, Andaman and Nicobar Islands, Great Nicobar Island, Afrabay, 16-XI-2018, coll. K.C. Gopi and Party (Reg. No. ZSI/ANRC/T/17139, T-17140, T-17141).

Diagnosis. Wingspan 27 mm. This species is closely similar to *Termioptycha longispina* Rong & Li, 2017, but it can be distinguished by the presence of straight spines on the lateral lobes, which are approximately half the length of the uncus, and the presence of uniform cornuti uniform in basal two-third and trifurcated in distal one-third.

Distribution. China and India (Sikkim, Meghalaya, Mizoram, Karnataka, Great Nicobar Islands—Present Study) (Ranjan et al., 2022; Rong et al., 2017).

Remarks. Recently reported by Ranjan et al. (2022) from several states of India. This study validates the presence of *Termioptycha cornutitrifurca* within the Indo-Malayan regions, affirming its distributional range in this ecologically diverse area. Representative individuals of this species were observed in traps placed in primary forest.

DISCUSSION

Island biogeography examines the distinctive ecological and evolutionary patterns in oceanic island ecosystems which are characterized by high levels of endemism and the development of specialized evolutionary adaptations (Whittaker & Fernández-Palacios, 2007; Gillespie, 2007). The isolated nature of oceanic island facilitates the emergence of unique ecosystems, fostering the evolution of species in relative isolation and giving rise to exceptional biodiversity within limited geographical confines (Brown et al., 2013; Leigh et al., 2007, Sivaperuman et al., 2018). However, island ecosystems are acutely susceptible to anthropogenic perturbations and environmental disturbances, underscoring the critical importance of conservation initiatives aimed at preserving their intricate biota (Braje et al., 2017; Russell & Kueffer, 2019; Fordham, & Brook, 2010). The diversity of Pyraloid moths in the Andaman and Nicobar Islands is comparatively low, with a total of 263 species reported so far: 222 species in the family Crambidae and 41 species in the family Pyralidae (Reddy & Murthy, 2021; Singh et al., 2022b; Singh et al., 2023; Rao & Sivaperuman, 2020, 2021, 2022). The meticulous documentation of nineteen novel pyraloid moth records in this study, including differential diagnoses and distributional data, constitutes a substantial addition to the existing corpus of lepidopterological knowledge in this region. Our current work has primarily identified species within the subfamilies Spilomelinae, Pyraustinae, Pyralinae and Epipaschiinae. However, the subfamilies Crambinae, Musotiminae, Glaphyriinae, Acentropinae, Odontiinae, and Phycitinae have not been fully explored in Andaman and Nicobar Islands, indicating the need for further detailed investigation. Additionally, the thorough documentation of genitalia morphology for five previously identified species enhances our taxonomic understanding and aids in the accurate assessment and identification. The documentation of genera like *Macaretaera*, *Ravanoa*, *Bocchoris*, *Botyodes*, *Hemopsis*, *Zitha*, and *Termioptycha* for the first time in the islands marks a significant expansion of their known distributions. Furthermore, the ongoing examination of the material collected from our past surveys (2018–2022) is expected to enhance the existing species inventory suggesting that the true diversity of pyraloid moths in the study area could be significantly higher. Current estimates indicate that potentially up to two-thirds more species remain to be identified beyond the current count.

The findings outlined in this study hold significant importance offering valuable insights into moth diversity within the Andaman and Nicobar Islands, renowned as a biodiversity hotspot in India and globally (Venkataraman, & Sivaperuman, 2018). The discovery of these species in the Andaman and Nicobar Islands, despite their documented presence in geographically proximate countries suggest that their range within this biogeographic region may be more extensive than previously understood. These findings highlight the critical importance of continued faunistic surveys in island archipelagos like the Andaman and Nicobar Islands. Such surveys contribute to a comprehensive understanding of regional biodiversity, provide insights into species dispersal mechanisms, and inform conservation policies and

management strategies in fragmented island ecosystems. This comprehensive investigation accentuates the imperative for sustained entomological surveys and rigorous taxonomic scrutiny to fully delineate the intricate biodiversity of this under-sampled ecosystem. Further research, including genetic analyses and ecological studies, could shed light on the origins and dispersal history of species in the region. These additional investigations would enhance our understanding of the unique biota characteristic of insular environments, ultimately informing the development of evidence-based conservation strategies specifically tailored for the preservation of these distinct island ecosystems.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: B.S.K.R.: collection and identification of specimens, writing of the original manuscript, preparing plates; S.P: survey and project supervisor, review and editing. The authors read and approved the final version of the manuscript.

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AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the National Collections of ZSI (Zoological Survey of India) and are available from the curator, upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study only included arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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ارتقای شناخت شب‌پره‌های پیرالوئید (*Lepidoptera, Pyraloidea*) در جزایر آندامان و نیکوبار، هند

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 ۲ گروه مطالعات جانوری هند، مرکز منطقه‌ای آندامان نیکوبار، بندر بلیر، جزایر آندامان و نیکوبار، هند

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چکیده: جزایر آندامان و نیکوبار، به عنوان منطقه غنی تنوع زیستی در هند، میزبان مجموعه‌ای متنوع از گونه‌های حشرات است که بسیاری از آن‌ها بومی این منطقه هستند. مطالعه کار حاضر بر تنوع شب‌پره‌های پیرالوئید در جزایر آندامان و نیکوبار تمرکز داشته و دانش موجود درباره این شب‌پره‌ها در این جزایر را با ثبت داده‌های جدید از انتشار ۱۹ گونه به‌طور قابل‌توجهی گسترش می‌دهد. در این مقاله خصوصیات افتراقی، اطلاعات مربوط به انتشار گونه‌ها و همچنین تصاویر اندام زادآوری حشرات بالغ به همراه توصیف‌های مختصر این ساختارهای برای پنج گونه به نام‌های *Nosophora albiguttalis*؛ *Ravanoa xiphialis* (Walker, 1859)؛ *Tatobotys varanesalis* (Walker, 1859)؛ *Macaretaera hesperis* Meyrick, 1886 و *Nosophora conjunctalis* Walker, 1866؛ Swinhoe, 1890 شد. علاوه بر این، ثبت اطلاعات هفت جنس جدید برای این مجمع‌الجزایر به نام‌های *Macaretaera* Meyrick, 1886؛ *Hemopsis* Kirti & Rose, 1987؛ *Botyodes* Guenée, 1854؛ *Bocchoris* Moore, 1885؛ *Ravanoa* Moore, 1885 و *Zitha* Walker, 1866 و *Termioptycha* Meyrick, 1889، نشان‌دهنده اهمیت بیوجغرافیایی این منطقه کمتر کاوش‌شده و ضرورت تداوم برنامه سرشماری‌های جانوری در آن می‌باشد.

واژگان کلیدی: مجمع‌الجزایر، تنوع زیستی، Crambidae، رکورد جدید، Pyralidae