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COMMUNICATION

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Taxonomic studies on the gaudy grasshoppers (Orthoptera: Pyrgomorphoidea: Pyrgomorphidae) from the northeastern states of India

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Abstract: A survey of the northeastern states of India recorded 10 species representing five genera belonging to four tribes of the family Pyrgomorphidae. For identification, in addition to conventional morphological characters, the detailed structures of male and female genitalia were also included. All the genera studied are described. Morphometry and distribution of each species are also given.

Keywords: Caelifera, Pyrgomorphidae, tribes, species, key.

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Author Details: MIK has completed PhD in Zoology, interested in taxonomy, biodiversity and ecology of insects. He has successfully completed a research project funded by UGC entitled with "Studies on the taxonomy and diversity of Acridoidea (Orthoptera) in North-Eastern States of India" (1st April, 2008 – 31st March, 2011). MKU is a Professor, Section of Entomology, research interest lies in the taxonomy, biology, ecology and biodiversity of insect pests of agricultural importance and in their biological control through the use of insect natural enemies. SU has completed PhD in Zoology, interested in taxonomy, biodiversity and ecology of insects. HN is a PhD student, interested in taxonomy, biodiversity and ecology of insects.

Author Contribution: All authors contributed equally.

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INTRODUCTION

Pyrgomorphidae is a family of the order Orthoptera under the suborder Caelifera. Its members are commonly known as Gaudy Grasshoppers in the superfamily Pyrgomorphoidea. Some members (tribes Atractomorphini and Psednurini) are green in colour while others (tribe Monistrini) have bright warning colours. The present study was based on conventional morphological characters along with a detailed study of genital structures of Pyrgomorphidae for a better understanding of the significance of morphological structures. A comparative study was done on the genitalia with reference to supra-anal plate and cerci, subgenital plate, epiphallus, and aedeagus of the male and the supra-anal plate, subgenital plate, ovipositor, and spermatheca of the female.

In the present study, Pyrgomorphidae is recognized as a family of superfamily Pyrgomorphoidea. Kirby (1910, 1914) prepared a catalogue for Acrididae (including this group) of the world and a volume of *Fauna of British India* including the fauna of Pakistan, Bangladesh, Sri Lanka, and Burma. Later, Chopard (1924a), Uvarov (1925, 1929), and Ayyar (1940) also worked on the Indian species of Pyrgomorphidae.

Kevan et al. (1970) worked on the taxonomy of the oriental taxa of Pyrgopmorphidae. Bhowmik (1964), Tandon & Shishodia (1969, 1989), Tandon (1976), Bhowmik & Halder (1983), and Usmani & Shafee (1985) worked on the taxonomy of various genera and species of Pyrgomorphinae from different parts of India.

The system of classifying grasshoppers by earlier workers was mainly based on easily recognizable externally visible characters. Slifer & King (1936), Slifer (1939, 1940, 1943), Dirsh (1957a,b), and Meinodas et al. (1982) showed the taxonomic significance of spermatheca in Acrididae.

Dirsh & Uvarov (1953) studied the apical valve of aedeagus in three species of *Anacridium*. Dirsh (1956a,b) showed the importance of aedeagus in classifying and grouping various families of Acridoidea.

Herrera & Schnidrig (1983) described the male genitalia of 64 species of Orthoptera from Navarra. Usmani & Ajaili (1993) showed the taxonomic significance of aedeagus in some Libyan species of Acridoidea. Ajaili & Usmani (1994) made comparative studies on the male subgenital and supra-anal plates and cerci in some Libyan species of Acridoidea.

Kumar et al. (2014) conducted a comprehensive study on the male supra-anal plate, cerci, and subgenital plate in 12 species of grasshoppers representing six genera under four tribes belonging to the family Pyrgomorphidae.

MATERIAL AND METHODS

A survey for collection of Pyrgomorphid specimens during 2008–2011 from grasslands and agricultural fields of northeastern states was carried out. Specimens were handpicked or collected using sweeping nets. All the collected specimens were preserved in 70% ethyl alcohol. Specimens were stretched and photographed. For genitalic studies, the apical tip of the abdomen was cut and boiled in 10% KOH solution and the genital structures were isolated. All drawings were prepared under camera lucida (Nikon SMZ 25). Descriptions of male genitalia follow the terminologies used in Dirsh (1956a). All observations on morphometry are given in millimetres.

Family: Pyrgomorphidae Brunner von Wattenwyl, 1874

Brunner von Wattenwyl. 1874. Ver. Der. Zool. Ges. 24:22.

Diagnosis: Body of variable shapes, head acutely conical, fastigial furrow present. Prosternal process present. Elytra and wings fully developed, reduced, or absent. Tympanam normally present. The lower basal lobe of hind femur longer than the upper one. Brunner's organ present except in a few genera, with thin, almost cursorial hind legs. External apical spine of hind tibia present or absent. Ectophallus differentiated; cingulum capsule-like; valves of penis paired, undivided; spermatophore sac in dorsal position. Epiphallus bridge-shaped, with dorso-lateral appendices; ancore absent; lophi hook-like. Oval sclerites absent. No stridulatory mechanism known. The Pyrgomorphidae is a very well defined family, with a peculiar phallic complex which is rather uniform through the family. The relationship with other families is rather obscure and no close affinities exist. They have some common features with Lentulidae, such as undivided paired valves of the penis and the dorsal position of the spermatophore sac, and others with Ommexechidae, such as the presence of a fastigial forrow and the paired undivided valves of the penis. All other characters, however, are so distinct that the relationship is a very remote one. Pyrgomorphidae is represented in all the tropical and subtropical parts of the world by a large number of genera, a list of which appears unnecessary.

Key to the tribes of the family Pyrgomorphidae Brunner (After Kevan & Akbar 1964)

1. Body usually depressed and usually rather strongly rugose (sometimes with plicate, longitudinal tubercles); coloration mottled brown or grayish; fastigium of vertex usually (but not always) short, blunt, broad; terminal segments of antennae incrassate, fused or partly so, often pitted; tegmina (when present) usually with small nodules on main veins; hind wings hyaline (sometimes faintly bluish) or infumated only; prosternum with reflexed, collar-like anterior margin and "double" tubercle; [phallic structures rather unspecialized; epiphallus with lateral plates having wide, basal, externo-lateral expansions, very strong, laterally directed lophi, and widely divergent appendices; ectophallus with wide basal emargination, short, broad ventral process, and central membrane of cingulum rather extensive, subquadrate or sub-rectangular; aedeagal scterites rather slender and acute, gonopore basal or mesal] ..... ***Chrotogonini*** **Bolivar, 1904**
– Note as above 2

2. Head acutely conical, fastigium of vertex usually long, acute; antennae inserted distinctly in front of ocelli; tegmina usually fully developed, usually very tapered and pointed, brachypterous forms somewhat depressed (especially in female), strongly micropterous or apterous forms unknown; inferior margin of lateral pronotal lobe very straight and usually beset with small, fine, even, granular tubercles; infero-external area of hind femur expanded, often considerably so, and displaced subventrally; posterior tibial spines rather long and sharp;[epiphallus anchor-like, or with lateral plates widely expanded and lophi bifid (when aedeagal valves are strongly decurved apically), or of more orthodox form (when aedeagal valves bear large, prominent dorsal processes and aedeagal sclerites are slightly decurved apically)] 3
– Not combining the above characters; antennae not usually inserted distinctly in front of ocelli, sometimes even behind them; tegmina, if fully developed, not usually very tapered and pointed, strongly micropterous and apterous forms frequent, brachypterous forms seldom (and, if body depressed, never) with the inferior margin of the lateral pronotal lobe remarkably straight and granular; infero-external area of hind femur not, or but little, expanded and displaced; posterior tibial spines usually shorter and blunter; [phallic structures without the above special features, if somewhat anchor-like, then very broadly so and aedeagal valves greatly enlarged (small apterous species)] ..... ***Tagastini*** **Bolivar, 1905**

3. Body rather heavy, somewhat depressed (especially in female), antennae inserted only a short distance in front of ocelli; infero-posterior angle of lateral pronotal lobe strongly acute; hind tarsal segments not elongate; male cerci rather specialized; [epiphallus with broad, wing-like lateral plates and lophi bifid; ectophallus with ventral process very short and pointed; endopallic apodemes with very long, forwardly directed ventral processes, aedeagal valves and sclerites very long and strongly decurved]; Southeast Asia only ..... ***Pseudomorphacridini*** **Kevan & Akbar, 1964**
– Body less robust, not depressed, or, if slightly so (some females), hind tarsal segments elongate; antennae usually inserted well in advance of ocelli; infero-posterior angle of lateral pronotal lobe not strongly acute; male cerci unspecialized; [phallic structures not as above; ventral process of ectophallus moderately long, very broad and subtruncated apically]; widespread in Old World ..... ***Atractomorphini*** **Bolivar, 1905**

Key to species of *Atractomorpha* Saussure, 1862

1. Eyes comparatively long, elongate oval 2
- Eyes comparatively short, round oval or void 3

2. Build rather short and moderatey stout; head and pronotum relatively short; fastigium of vertex shorter; lateral pronotal lobe fairly deep, without a membranous area in metazona; aedeagal valve long and slender and curved upward in lateral view ..... ***burri*** **Bolivar, 1905**
-- Build very slender; head and pronotum relatively long; fastigium of vertex arrower and longer; lateral pronotal lobe shallower, sometimes with a small membranous area in the metazona; aedeagal valves longer and more strongly curved ..... ***psittacina*** **(Haan, 1842)**

3. Generally rather small; fastigium of vertex often comparatively short; membranous area in metazona of lateral pronotal lobe usually very distinct in female and well indicated in male; hind wings normally tyrian pink to light mallow purple or pale magenta at base, but quite often rather havily infumated; aedaegal valve small and short ..... ***himalayica*** **(Bolivar, 1905)**
– Size range variable; fastigium of vertex usually comparatively somewhat longer than above; membranous area in metazona of lateral pronotal lobe variably developed, often less distinct than above; hind wings pinkish to rose red or rose at base, less frequently infumated; aedeagal valve slightly shorter or slightly longer **4**

4. Size as a rule a little smaller, body length often less than 20mm in male and 30mm in female; fastigium of vertex generally narrower apically and less flat dorsally; hind wings rose red, not infrequently infumated, at least basally; aedeagal sclerites and aedeagal valves slightly shorter and less gradually tapered ..... ***angusta*** **Karsch, 1888**
– Size generally a little larger, body length usually more than 20mm in male and 30mm in female; fastigium of vertex usually rather broad and generally very flat dorsally; hind wings rose red or rose, not frequently infumated; aedaegal sclerites and aedaegal valves slightly longer and more gradually tapered ..... ***sinensis*** **Bolivar, 1905**

Tribe Atractomorphini Bolivar, 1905

Dignosis: Body slightly robust, not depressed, or, if so slightly (some females), hind tarsal segments elongate; head elongated, acutely conical, fastigium of vertex usually long, acute, a row of fine, distinct granular tubercles extending from behind the eye across the inferior margin of the lateral pronotal lobe; infero-posterior angle of lateral pronotal lobe not strongly acute; antennae usually inserted well in advance of ocelli; tegmina usually fully developed, usually very tapered and pointed. Brachypterous forms, somewhat depressed (especially in females), strongly micropterous or apterous forms unknown; hind femur trigonal in cross section; posterior tibial spines rather long and sharp; male cerci unspecialized; ventral process of ectophellus moderately long, very broad and subtruncated apically.

Genus *Atractomorpha* Saussure, 1862

Saussure. 1862. *Ann*. *Soc*. *Ent*. *Fr*. 41: 474.

Brunner von Wattenwyl. 1898. *Abh*. *Senckenb*. *Natforsch*. *Ges*. 24(2): 234.

Diagnosis: Small to medium size; integument finely rugose; antennae slightly compressed, shorter than head and pronotum together, their bases located in front of lateral ocelli, fastigium of vertex elongated, flat, horizontal or slightly upcurved with parabolic or angular apex; apical fastigial areolae poorly developed; head narrow, acutely conical, with a row of postocular tubercles; frons strongly oblique; frontal ridge incurved, narrow and low, shallowly sulcate, with obtuse lateral carinulae. Pronotum elongated, sub-cylindrical, slightly widening backwards; dorsum slightly flattened, crossed by three fine sulci; median carina and lateral carinar weak; metazoan much shorter than prozona, its posterior margin widely obtuse-angular, almost rounded; lateral lobe with row of low marginal tubercles; prosternal process cuneiform; elytra and wings fully developed, apex of elytron acutely attenuate; tympanal organ well developed; hind femur narrow, with external lower marginal area narrow, displaced ventrally to external medial area; lower lobes of hind knee much shorter than upper one; hind tibiae in apical part with expanded margins; external apical spine present; arolium of moderate size; male supra anal plate elongate angular; cercus subconical, straight with subacute apex; Subgenital plate short, with rounded apex.

The genus is represented by five species from this region.

Atractomorpha burri Bolívar, 1905

(Image 1; Fig. 1)

Bolivar, I. 1905. *Bol*. *R*. *Soc*. *Esp*. *Hist*. *Nat*. 5: 197.

Image 1. *Atractomorpha burri* male & female

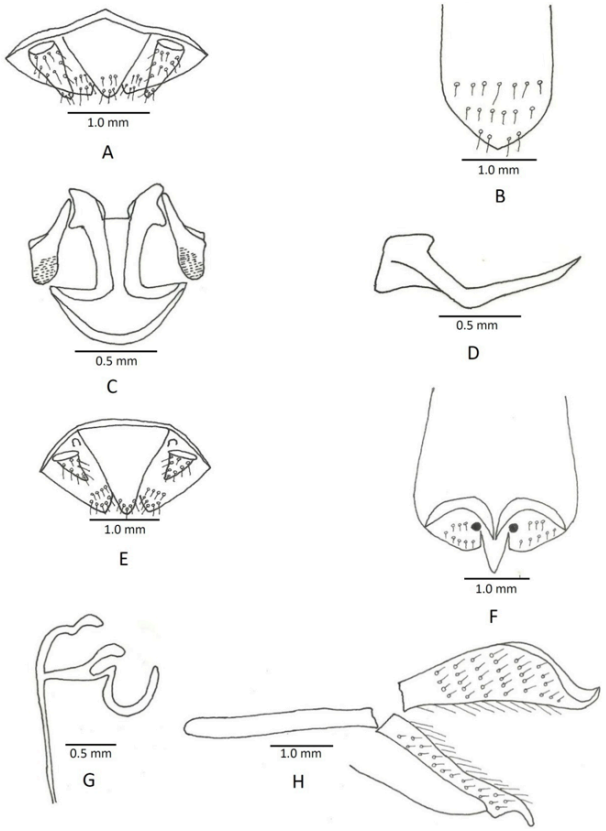

Figure 1. ***Atractomorpha burri*** **male (A–D) and female (E–H). A - supra anal plate, B - sub genital plate, C - epiphallus, D - aedeagus, E - supra anal plate, F - sub genital plate, G - spermatheca, H - ovipositor.**

Kirby, W.F. 1901. 3 (2): 332.

Banerjee, S.K. and Kevan, D.K. Mc E. 1960. Treubia, 25: 165-189.

Kevan & Chen. 1969. *Zool. J. Linn. Soc*. 48: 193.

Morphological Characters: Build rather short and moderately stout; head and pronotum relatively short; fastigium of vertex shorter; pronotal lobe fairly deep, without a membranous area in metazona; outer face of hind femur rather strongly convexed and keeled; hind wings relatively long, their apices not falling much short of those of the tegmina at rest, extensively tyrian pink to light mallow purple at base.

Male genitalia: Supra anal plate elongate angular, epiproct long and narrow with obtusely conical apex, cerci as long as or slightly shorter than the epiproct, and conical at apex, paraproct smaller. Subgenital plate triangular with conical apex. Epiphallus anchor shaped bridge small, anterior projections not prominent, lateral plates broad and fused medially, broader at the base, middle piece of epiphallus much wider, lophi hooked with conical apex, appendices rod shaped, slightly expanded at apex, reaching up to the apex of lophi. Apical valve long anad narrow, apical tip pointed, longer tanan basal valve, basal valve wide at base.

Female genitalia: Supra anal plate elongated, longer than wide, apex obtusely rounded. Cercus short, longer than wide and incurved. Subgeniatal plate: posterior margin without setae, egg-guide wide at base; narrowing apically, one and half time longer than wide. Spermatheca with apical and pre-apical diverticula, pre-apial diverticulum moderately long tubular, apical diverticulum long, tubular with protuberance. Ovipositor: dorsal valve long, wide with apex pointed, slightly longer than apodeme and more than twice as long as wide, ventral valve uniformly wide, apex elongated and obtusely rounded.

Material Examined: Reg. no. 133, 9 females, 5 males, 10-x-2009, on grasses, Meghalaya, East Khasi Hills, coll. M.I. Khan.

Morphometry: (length in mm)

Male: Body 19.77, tegmina 18.61, pronotum 5.35, hind femur 11.25.

Female: Body 22.47, tegmina 19.97, pronotum 6.65,

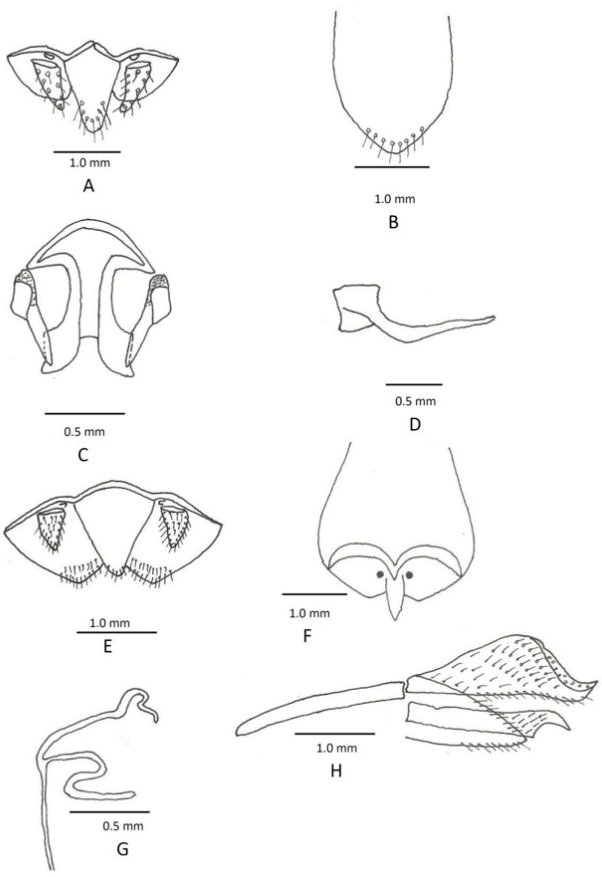

Image 2. ***Ataractomorpha psittacina*** **male (A–D) and female (E–H). A - supra anal plate, B - sub genital plate, C - epiphallus, D - aedeagus, E - supra anal plate, F - sub genital plate, G - spermatheca, H - ovipositor.**

hind femur 12.39.

Distribution: Bangladesh, Bhutan, China, Cambodia, India (Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, Mizoram, Odisha, Sikkim, Tripura & West Bengal), Laos, Malaysia, Myanmar, Nepal, Thailand, and Veitnam.

***Atractomorpha psittacina psittacina* (Haan, 1842)**

(Image 2; Fig. 2)

Haan. 1842. 16/18: 143, 146

Morphological Characters: Build very slender; head and pronotum relatively long; fastigium of vertex narrower and longer; lateral pronotal lobe shallow, sometimes with a small membranous area in the metazona; outer face of hind femur not strongly convex or keeled; hind wings normally comparatively long in relation to tegmina, not falling much short of them when at rest, usually dull magenta purple, often rather pale, at extreme base, often with dark veins and somewhat infumated, sometimes colourless.

Male genitalia: Supra anal plate elongate angular, epiproct triangular, long and broad at base with obtusely conical apex, cerci shorter than the epiproct and conical at apex, paraproct smaller. Subgenital plate rounded at apex. Epihallus anchor shaped, bridge much narrow, anterior projections not prominent with rounded apex, lateral plates fused medially, middle piece of epiphallus narrow, lophi hooked with pointed apex, appendices rod-shaped, expanded at apex, slightly far from the apex of lophi. Apical valve narrow as long as basal valve, apex tubular, basal valve wide at base.

Female genitalia: Supra anal plate triangular, longer than wide, apex obtusely rounded, cercus short, wide at base, longer than wide, narrowing apically. Subgenital plate, posterior margin smooth without setae, notched in the middle, egg-guide narrowing apically, twice as long as wide, tip pointed. Spermatheca: apical and pre-apical diverticulum long, both are long, tubular and narrow. Ovipositor: dorsal valve broad, long, slightly longer than apodeme with apical tip pointed, ventral valve uniformly broad with tip pointed.

Material Examined: Reg. no. 134, 19 females, 15 males, 21-x-2008, on grasses, Meghalaya, Rai Bhoi, coll. M.I. Khan.

Morphometry: (length in mm)

Male: Body 25.34, tegmina 21.35, pronotum 5.45, hind femur 11.49.

Female: Body 28.94, tegmina 22.50, pronotum 6.16, hind femur 12.37.

Distribution: Borneo, India (Arunachal Pradesh, Assam, Meghalaya, Rajasthan, Tripura, & West Bengal), and Malaysia.

Figure 2. *Atractomorpha psittacina* male & female

***Atractomorpha himalayica* Bolívar, 1905**

(Image 3; Fig. 3)

Bolivar, I. 1905. *Bol*. *R*. *Soc*. *Esp*. *Hist*. *Nat*. 5: 198, 204.

Navas, 1905. *Bol*. *Soc*. *Arag*. *Cienc*. *Nat*. 4: 273.

Kirby, 1910. 3(2): 332.

Bey-Bienko & Mistshenko 1951. 1: 275.

Morphological Characters: Generally rather small; eyes generally shorter and rather convex; fastigium of vertex often comparatively short; inter-ocular space generally slightly convex; membranous area in metazona of lateral pronotal lobe usually very distinct in female and well indicated in male; hind wings normally tyrian pink to light mallow purple or pale magenta at base, but quite often rather heavily infumated.

Male genitalia: Supra anal plate elongate angular, epiproct triangular, long and slightly wider at base with obtusely conical apex, cerci shorter than the epiproct, and conical at apex, paraproct smaller. Subgenital plate oval at apex. Epihallus anchor shaped, bridge broader, anterior projections prominent with pointed apex, lateral plates fused medially, middle piece of epiphallus with subparallel margins, lophi hooked with pointed apex, appendices rod shaped, slightly expanded at apex, slightly far from the apex of lophi. Aedeagus: apical valve long, narrow, upcurved, distinctly longer than basal valve, apical tip pointed, basal valve narrow, broad at base.

Female genitalia: Supra anal plate elongated, slightly

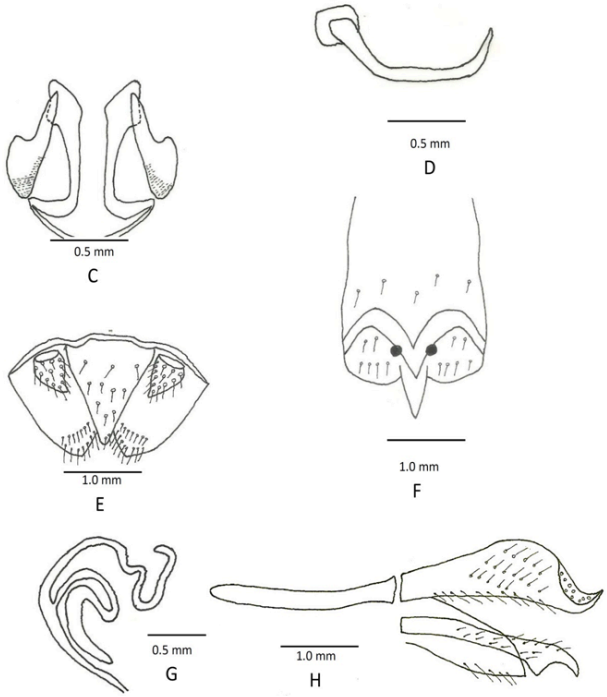

Figure 3. *Atractomorpha himalayica* male (A–D) and female (E–H). A - supra anal plate, B - sub genital plate, C - epiphallus, D - aedeagus, E - supra anal plate, F - sub genital plate, G - spermatheca, H - ovipositor.

Image 3. *Atractomorpha himalayica* male & female

longer than wide, apex rounded, cercus short, broad, one and half time as long as wide. Subgenital plate: posterior margin smooth without setae, with a notch in the middle, egg-guide broad basally, narrowing apically, twice as long as wide. Spermatheca: apical diverticulum long, narrow and tubular, pre-apical diverticulum narrow basally, broad apically. Ovipositar, dorsal valve elongated, broad medially, apical tip pointed, longer than apodeme, ventral valve uniformally broad, apex pointed.

Material Examined: Reg. no. 135, 13 females, 10 males, 11-ii-2009, on grasses, Mizoram, Aizwal, coll. M.I. Khan.

Morphometry: (length in mm)

Male: Body 18.45, tegmina 13.92, pronotum 4.24, hind femur 9.05.

Female: Body 21.53, tegmina 14.81, pronotum 5.93, hind femur 10.39.

Distribution: Bangladesh, Bhutan, China, India(Arunachal Pradesh, Assam, Nagaland, Sikkim, & West Bengal), Nepal, and southern Malaya.

***Atractomorpha angusta* Karsch, 1888**

(Image 4; Fig. 4)

Karsch. 1888. *Entom*. *Nachricht*. 14(21): 333.

Bolivar, I. 1905. *Bol*. *R*. *Soc*. *Esp*. *Hist*. *Nat*. 5: 198, 207.

Kirby, 1910. 3(2): 332.

Kevan, 1963. *Ark*. *Zool*. 16(4): 80.

Morphological Characters: Size a little smaller; eyes generally a little longer and less convex; fastigium of vertex generally narrower apically and less flat dorsally; interocular space generally flatter; membranous area in metazona of lateral pronotal lobe variably developed, often less distinct than above; hind wings rose red, not infrequently infumated, at least basally.

Male genitalia: Supra anal plate broad basally, moderately narrowing apically, as long as wide, apex rounded, cercus elongated, broad basally, narrowing apically, more than one and half time as long as wide, apex obtusely rounded. Epiphallus anchor shaped, anchorae elongated, narrow basally, broad apically. Aedeagus, apical valve narrowing apically with apex pointed, twice as long as wide, basal valve short and wide at apex.

Female genitalia: Supra anal plate broad at base, slightly narrow at apex, as long as wide, apex obtusely rounded, cercus short, broad, narrow apex, one and half time as long as wide. Subgenital plate smooth without setae, notched in the middle, egg-guide short, broad at base, narrowing apically, twice as long as wide. Spermatheca, apical diverticulum long, tubular and narrow. Pre-apical diverticulum uniformly tubular, S-shaped. Ovipositor: dorsal valve elongated, broad, slightly longer than apodeme, apical tip pointed, ventral valve uniformly broad, apical tip obtusely rounded.

Image 4. *Atractomorpha angusta* (female)

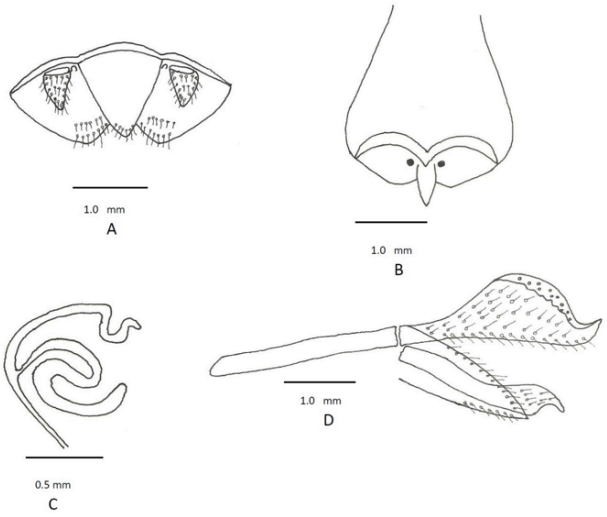

Figure 4. *Atractomorpha angusta* (female).
A - Supra anal plate, B - Sub genital plate; C - Spermatheca, D - Ovipositor

Morphometry: (length in mm)

Female: Body 20.97, tegmina 14.37, pronotum 5.71, hind femur 11.93

Material examined: Reg. no. 136, 15 females, 21-IX-2008, on grasses, Manipur, Ukhrul, coll. M.I. Khan.

Distribution: Bhutan, Cambodia, India (Andaman & Nicobar Islands, Assam, Arunachal Pradesh, Manipur, Meghalaya, & West Bengal), Indonesia, Laos, Myanmar, Malaysia, Nepal, Singapore, Thailand, and Vietnam.

***Atractomorpha sinensis* Bolívar, 1905**

(Image 5, Fig. 5)

Bolivar, I. 1905. *Bol. R. Soc. Esp. Nat*. 5: 198, 205.

Morphological Characters: Size generally a little larger; fastigium of vertex usually rather broad and generally very flat dorsally; pronotum with distinct carinae; lateral pronotal lobes without membranous area; hind wings rose red or rose, not frequently infumated.

Male genitalia: Supra anal plate elongate angular, epiproct triangular, long and wider at base with obtusely conical apex, cerci shorter than the epiproct and conical at apex, paraproct smaller. Subgenital plate flat and globular at apex. Epihallus anchor shaped, bridge wider, anterior projections prominent with hook like apex, lateral plates fused medially, broader at base, middle piece of epiphallus slightly narrow, lophi hooked with obtusely conical apex, appendices rod shaped, much expanded at apex, slightly far from the apex of lophi. Aedeagus apical valve elongated, uniformly tubular, upcurved, apex obtusely rounded, basal valve short and broad.

Female genitalia: Supra anal plate broad at base, slightly narrowing apically, as long as wide, apex rounded, cercus short, broad, narrowing apically, apex blunt, one

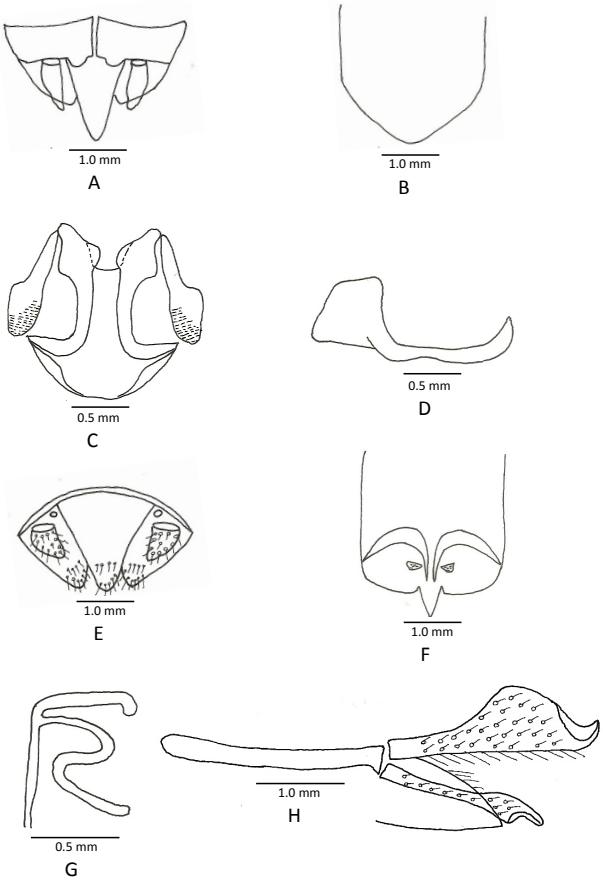

Figure 5. *Atractomorpha sinensis*: male (A–D) & female (E–H). A - Supra anal plate, B - Sub genital plate, C - Epiphallus, D - Aedeagus, E - Supra anal plate, F - Sub genital plate, G - Spermatheca, H - Ovipositor

Image 5. *Atractomorpha sinensis* male & female

and half time as long as wide. Subgenital plate, posterior margin smooth without setae, notched in the middle, egg-guide short, broad basally, narrowing apically, one and half time as long as wide. Spermatheca, apical and pre-apical diverticulum, narrow, tubular, diverticulum shorter than pre-apical diverticulum. Ovipositor, dorsal valve broad, with apical tip obtuse, slightly shorter than apodeme, ventral valve narrow, uniformally broad, apical tip bluntly rounded.

Material Examined: Reg. no. 137, 23 females, 18 males, 28-x-2008, on paddy field, Nagaland, Dimapur, coll. M.I. Khan.

Morphometry: (length in mm)

Male: Body 22.43, Tegmina 17.54, Pronotum 3.90, Hind femur 10.92

Female: Body 25.49, Tegmina 18.74, Pronotum 4.90, Hind femur 11.82

Distribution: Bhutan, India (Assam, Jammu & Kashmir, Meghalaya, and West Bengal), Indonesia, Myanmar, Sri Lanka

Tribe Chrotogonini I. Bolivar, 1904

Bolivar, I. 1904. *Bol*. *R*. *Soc*. *Esp*. *Hist*. *Nat*. 4:90.

Diagnosis : Body usually depressed and usually rather strongly rugose (sometimes with plicate, longitudinal tubercles); coloration mottled brown or greyish; fastigium of vertex usually (but not always) short, blunt, broad; terminal segments of antennae incrassate, fused or partly so, often pitted; tegmina (when present) usually with small nodules on main veins; hind wings hyaline (sometimes faintly bluish) or infumated only; prosternum with reflexed, collar like anterior margin and double tubercle; epiphallus with lateral plates having wide, basal, externo-lateral expansions, very strong, laterally directed lophi, and widely divergent appendices; ectophallus with wide basal emargination, short, broad ventral process, and central membrane of cingulum rather extensive subquadrate or sub-rectangular; aedeagal sclerites rather slender and acute, gonopore basal or medial.

Key to genera of the tribe Chrotogonini I. Bolivar

1. Body strongly depressed; dorsum of pronotum strongly tuberculate; middle femur short, much shorter than head and pronotum together; hind femur with lower basal lobe longer than upper lobe; hind tibial spurs shorter than basal tarsal semment; arolium large; valve of cingulum narrow ..... ***Chrotogonus*** **Serville, 1838**

— Body slightly depressed; dorsum of pronotum never strongly tuberculate; middle femur thin and strongly elongated, as long as or longer than head and pronotum together; hind femur with lower basal lobe shorter than upper lobe; hind tibial spurs longer than basal tarsal segment arolium large; valve of cingulum broad ..... ***Tenuitarsus*** **Bolivar, 1904**

Key to species of *Chrotogonus* Serville, 1838

1. Tegmina slightly reaching near apex of hind knee ; wings hyaline, slightly shorter than tegmina .... ***armatus*** **Steinmann, 1965**

– Tegmina surpassing the apex of hind knee; much shorter than the length of tegmina ; aedeagus rather broad with sclerites and valves rather blunt apically ..... ***oxypterus*** **Blanchard, 1836**

Genus *Chrotogonus* Serville, 1838

Serville. 1838. *Hist. nat. des insectes*. *Orthoprteres* 702.

Navas. 1904. *Bol*. *Soc*. *Arag*. *Cienc*. *Nat*. 3: 133.

Diagnosis : Small and robust; body depressed, integument strongly tuberculate; antennae thick, slightly widening in apical half, shorter than head and pronotum together; fastigium of vertex short, angular, concave; apical fastigial areolae large, with sharp marginal carinulae; occipital carina present; frontal ridge between antennae strongly compressed and protruding forwards, with slit-like sulcus, below almost obliterated. Pronotum above flattened, with posterior angle of lateral lobes spread sidewise, strongly tuberculate, with irregular, interrupted, median and lateral carinae, crossed by three sulci; metazona longer than prozona, its posterior margin angular; anterior margin of prosternum strongly expanded, collar like, covering lower part of mouth with a pair of posterior lateral tubercles; elytra and wings fully developed, shortened and vestigial; tympanum absent or vestigial; hind femur moderately slender; hind tibiae depressed and expanded towards apex; external apical spine absent; internal pair of spurs much longer than external; arolium of medium size; male supra anal plate angular; cersus short, obtusely conical; subgenital plate short, subconical, with obtuse apex; epiphallus with large, strongly curved, acute lophi.

***Chrotogonus* (*Chrotogonus*) *oxypterus* (Blanchard, 1836)** (Image 6; Fig. 6)

Blanchard, 1836. *Ann*. *Soc*. *Ent*. *Fr*. 5: 622.

Walker, F. 1870. 4: 793.

Bolivar, I. 1902. *Ann*. *Soc*, *ent*. *Fr*. 70: 603.

Kirby, 1901. 3 (2): 301.

Morphological Characters: Small to medium sized insect. Body becomes robust and compressed. Antennae filliform, nine segmented, shorter than head and pronotum together. Head and pronotum more tuberculated. Tegmina surpassing the tip of hind femur, veins with small tubercles. Hind femur stout, reaching up

to the tip of abdomen. Hind tibiae nearly equal to hind femur with eight outer and nine internal spines.

Male genitalia: Supra anal plate angular with broad and short epiproct, cerci as long as or slightly longer than the epiproct, obtusely conical at apex, paraproct broad and slightly longer than epiproct. Subgenital plate triangular and conical at the end. Epiphallus bridge shaped, bridge moderately slender, slightly wider and long; anterior projection prominent with angular tip; lateral plates separated medially, lophi with curved apices, apex acute; lateral appendices rod shaped and hooked at the end, apex pointed and reaching the tip of lophi. Aedeagus, apical valve slightly upcurved, apex pointed, longer than basal vave. Basal valve broad, much wide at base.

Material Examined: Reg. no. 138, 8 males, 3.x.2011, on grasses, Arunachal Pradesh, East Siang, Pasighat, coll. M.I. Khan.

Morphometry: (length in mm)

Male: Body 15.23, Tegmina 5.31, Pronotum 4.34, Hind femur 8.31

Distribution: Bangladesh, India (Andhra Pradesh, Bihar, Chhattisgarh, Goa, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Odisha, Tamil Nadu, Uttar Pradesh & West Bengal), and Sri Lanka

***Chrotogonus* (*Chrotogonus*) *armatus* Steinmann, 1965**

(Image 7; Fig. 7)

Steinmann. 1965. *Mus*. *Praze*. 36: 293.

Kevan, 1977. 16: 539.

Morphological Characters: Body yellowish brown with metazona of pronotum and mid of hind femur outer and upper surface white. Antennae eleven segmented, shorter than head and pronotum together. Lateral carina of pronotum represented by weak lines only in metazona. Tegmina slightly reaching up to the apex of hind femur. Hind tibiae with seven outer and eight inner spines.

Male genitalia: Supra anal plate angular with broad and long epiproct, cerci shorter than the epiproct, broad and obtusely rounded at apex, paraproct is also broader and as long as or slightly longer than the epiproct. Subgenital plate broad and rounded at the apex. Epihallus bridge shaped, bridge more slender, slightly narrow and elongated; anterior projection less prominent; lateral plates separated medially, lophi with curved apices, apex acute; lateral appendices rod shaped and hooked at the end, apex expanded and crossing the tip of lophi. Aeadegus apical valve narrow, tubular, as long as basal valve, basal valve broad, wide.

Material Examined: Reg. no. 139, 5 males, 2.x.2011, on grasses, Arunachal Pradeh, East Siang, Pasighat, coll.

Image 6. *Chrotogonus* (*Chrotogonus*) *oxypterus*

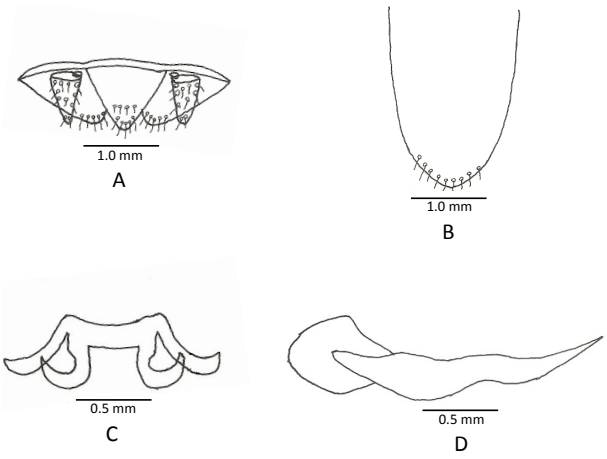

Figure 6. *Chrotogonus* (*Chrotogonus*) *oxypterus* (male)
A - Supra anal plate, B - Sub genital plate, C - Epiphallus, D - Aedeagus

M.I. Khan.

Morphometry: (length in mm)

Male: Body 15.12, Tegmina 5.29, Pronotum 4.43, Hind femur 8.21

Distribution: Afghanistan, Bangladesh, India (Andhra Pradesh, Assam, Bihar, Jammu & Kashmir, Uttar Pradesh & West Bengal), Nepal and Pakistan.

Genus Tenuitarsus Blivar, 1904

Bolivar, I. 1904. *Bol*. *R*. *Soc*. *Esp*. *Hist*. *Nat*. 4: 90.

Bey- Bienko & Mistshenko. 1951. 1: 279 [296].

Figure 7. ***Chrotogonus* (*Chrotogonus*) *armatus* male**

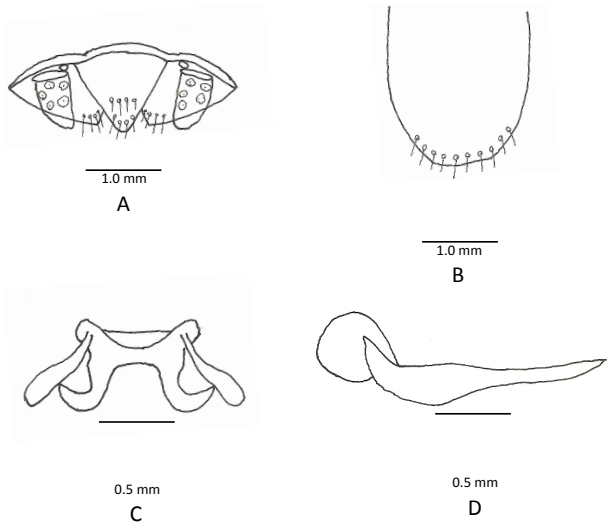

Figure 7. ***Chrotogonus* (*Chrotogonus*) *armatus* (male)**
A - Supra anal plate, B - Sub genital plate, C - Epiphallus, D - Aedeagus

Diagnosis: Small and slender; body slightly depressed, integument rugose and hairy; antennae in apical half thickened, with fused segments, shorter than head and pronotum together; fastigium of vertex short, sloping forwards, slightly concave, with obtuse angular apex and deep; large apical fastigial areolae and sharp marginal carinulae; weak occipital carina present; frontal ridge between antennae compressed and protruding forwards, with slit-like sulcus, below almost obliterated. Pronotum subcylindrical, widening backwards, tuberculate, with weak linear median carina, crossed by three sulci, lateral carinae absent, metazona about as long as prozona, its posterior margin rounded; anterior margin of prosternum strongly expanded, collar like, covering lower part of mouth; elytra and wings fully developed; tympanum absent; middle femur and tibiae elongated, thin; hind femur slender, with lower basal lobe slightly shorter than upper one; hind tibiae slightly expanded in apicl half; external apical spine absent; spurs of hind tibiae strongly elongated, longer than basal tarsal segment, thin, internal pair longer than external; all tarsi thin, slightly elongated; arolium very small; male supra anal plate angular; cercus short, obtusely conical; subgenital plate short, widely subconical; epiphallus with large lophi, moderately curved at apices.

The genus is represented by a single species from this region.

***Tenuitarsus orientalis* Kevan, 1959** (Image 8; Fig. 8)

Kevan, 1959. *Publ*. *Cult*. *Comp*. *Diamant*. *Angola.* 43: 21.

Kevan. 1977. 16: 532.

Shishodia, Chandra & Gupta. 2010. *Rec*. *Zool*. *Surv*. *India*, *Misc*. *Pub*., 314: 135.

Kumar, Usmani & Kumari. 2014. *J*. *Entomol*. *Res*. *Soc*. 16(1): 23.

Morphological Characters: Body slightly depressed, integument rugose and hairy; antennae shorter than head and pronotum together; fastigium of vertex short, slightly concave; large apical fastigial areolae and sharp marginal carinulae. Pronotum subcylindrical, widening backwards, tuberculate, with weak linear median carina, crossed by three sulci, lateral carinae absent, metazona about as long as prozona, its posterior margin rounded; elytra and wings fully developed; middle femur and tibiae elongated, thin; hind femur slender, with lower basal lobe slightly shorter than upper one; hind tibiae slightly expanded in apical half.

Male genitalia: Supra anal plate angular with broad and small triangular epiproct, cerci as long as or slightly longer than the epiproct and obtusely conical at apex, paraproct also broader and equally or smaller than the epiproct. Subgenital plate broad and rounded at the apex. Epiphallus bridge shaped, bridge small and slightly wider; anterior projection less prominent with conical apex; lateral plates separated medially, lophi with curved apices, apex obtusely conical; lateral appendices rod shaped and pointed at the apex and crossing the tip of lophi. Aedeagus, apical valve much narrower, apex

Image 8. *Tenuitarsus orientalis* male & female

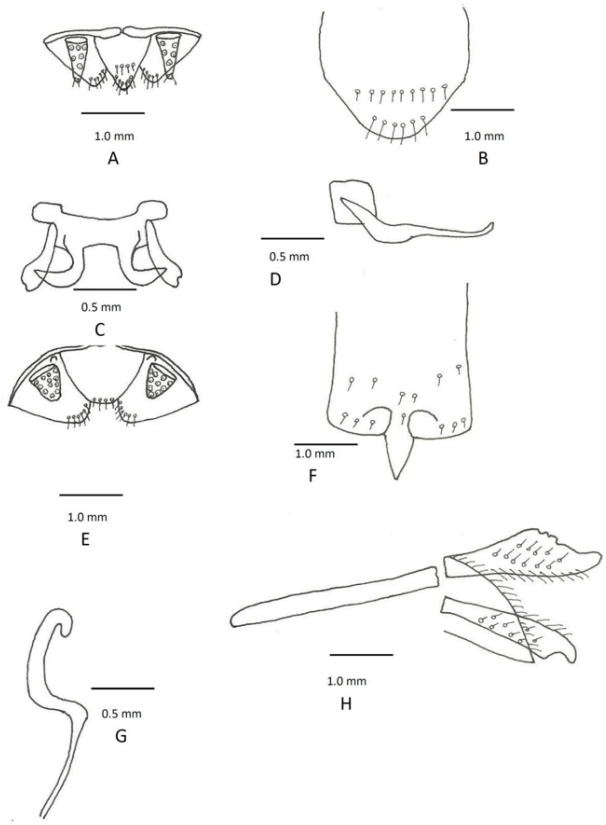

Image 8. *Tenuitarsus orientalis* male (A–D) and female (E–H). A - supra anal plate, B - subgenital plate, C - epiphallus, D - aedeagus, E - supra anal plate, F - sub genital plate, G - spermatheca, H - ovipositor.

obtuse, as long as basal valve, basal valve uniformaly broad, wide at base.

Female genitalia: Supra anal plate short, broad, wider than long, apex rounded, cercus short, broad, slightly longer than wide, apex obtuse, much shorter than supra anal plate. Subgenital plate, posterior margin smooth, round, without setae, egg-guide cone shaped, longer than wide, apex obtuse. Spermatheca, single apical diverticulum which is S- shaped, tubular and uniformly broad. Ovipositor, dorsal valve short, broad, apical tip rounded, external edge serrated, much shorter than lateral apodeme, ventral valve short, uniformly broad, apical tip obtusely rounded.

Material Examined: Reg. no. 140, 6 females, 31.i.2009, in paddy field, Assam, Guwahati, Bongra, 15 males, 28-X-2008, on paddy field, Assam, Lakhimpur, North Lakhimpur, coll. M.I. Khan.

Morphometry: (length in mm)

Male: Body 20.43, Tegmina 5.16, Pronotum 4.19, Hind femur 12.17

Female: Body 23.64, Tegmina 6.32, Pronotum 5.32, Hind femur 13.75

Distribution: Bhutan, India (Assam, Arunachal Pradesh, West Bengal & Rajasthan), Myanmar, and Pakistan.

Genus *Tagasta* Bolívar, 1905

Bolivar, I. 1905. *Bol. R. Soc. Esp. Hist. Nat.* 5: 111.

Willemse, 1928. *Zool. Mededelingen* (Leiden). 11(1): 5.

Diagnosis: Body slightly compressed. Head conical,

shorter than the pronotum, tempora widened in front, only separated by a short suture, front very oblique, frontal ridge much flattened, hardly sulcated, shortly compressed between the antennae; the latter concolorous, filiform and inserted between the eyes. Eyes rounded; ocelli distinct, cheeks granulated. Pronotum pubescent, roundly truncate in front, obtusely angulated, with the median carina very slightly indicated, lateral carinae obsolete; the prozona considerably longer then the metazona; the lower margin oblique, subsinuate bordered with whitish, the anal angle obtuse nearly rectangular. Tegmina not or scarcely longer than the hind femora, with costal area considerably expanded near the base. Wings distinctly shorter than the tegmina, red or hyaline. Legs long and slender; hind tibiae with rounded spines. Female. Subgenital plate smooth, without setae.

The genus is represented by a single species from this region.

***Tagasta indica* Bolívar, 1905** (Image 9; Fig. 9)

Bolivar, I. 1905. *Bol*. *R*. *Soc*. *Esp*. *Hist*. *Nat*. 5: 112-114.

Morphological Characters: Oilvaceous in colour; fastigium of vertex equilaterally triangular; antennae inserted near the eyes; pronotum rounded in front and obtusely angulated behind; median carina almost and lateral carinae wholly absent; tegmina as long as hind femora, with a brown spot at the base; hind wings one-fifth shorter than tegmina.

Female genitalia: Supra anal plate broad, as long as wide, apex rounded, cercus short, broad basally, narrow apically, one and half time as long as wide, apex obtusely rounded. Subgenital plate, smooth without setae, egg-guide broad basally, narrowing apically, slightly less than two times as long as wide, apex rounded. Spermatheca with single diverticulum, long, uniformly broad, S-shaped. Ovipositor, dorsal valve long, broad, slightly longer than lateral apodeme, external edge serrated, apical tip pointed, ventral valve long, uniformly broad, apical tip long, obtusely rounded.

Material Examined: Reg. no. 141, 13 females, 21.x.2008, on paddy field, Meghalaya, Rai Bhoi, Umran, coll. M.I. Khan.

Morphometry: (length in mm)

Female: Body 33.57, tegmina 21.91, pronotum 8.54, hind femur 18.71.

Distribution: Bhutan, India (Andaman & Nicobar Islands, Arunachal Pradesh, Meghalaya, Nagaland. Sikkim, Tripura, & West Bengal), and Myanmar.

Genus *Pseudomorphacris* Carl, 1916

Carl, 1916. *Revue Suisse de Zool*. 24(6): 465.

Figure 9. *Tagasta indica* female

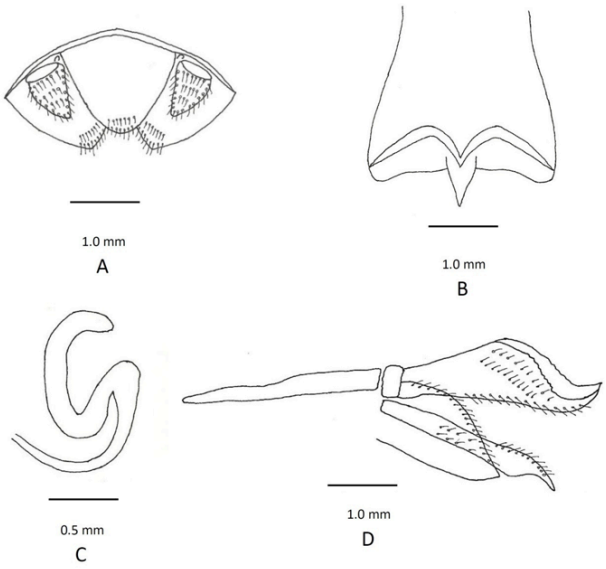

Image 9. *Tagasta indica* female. A - supra anal plate, B - subgenital plate, C - spermatheca, D - ovipositor.

Kevan, 1963. *Ent*. *Monthly mag*. 98: 208.

Kevan, 1977. 16: 345.

Diagnosis: Body of medium size, somewhat depressed; integument rugose, antennae slightly compressed, shorter than head and pronotum together, inserted only a short distance in front of ocelli. Fastigium of vertex flattened, usually long acute. Apical areolae poorly developed. Head subconical, elongated, shorter than pronotum. Frons oblique. Frontal ridge sulcate with obtuse lateral carinae. Pronotum elongated,

slightly widening backwards, dorsum slightly flattened, crossed by three cerci, median carina and lateral carina weak; metazona shorter than prozona, posterior margin obtuse angular; infero-posterior angle of lateral pronotal lobe strongly acute. Prosternum with anterior margin thickened, completely lacking tubercles. Prosternal process cylindrical. Tegmina fully developed, usually tapered and pointed. Posterior tibia round and have superior obtuse lobes, posterior tibial spine rather sharp and long; hind tarsal segment not elongate, external apical spine present, arolium of moderate size. Male supra anal plate elongate, apex obtusely rounded, subgenital plate elongate, apex rounded.

The genus is represented by a single species from this region.

***Pseudomorphacris notata* (Brunner von Wattenwyl, 1893)** (Image 10; Fig. 10)

Brunner von Wattenwyl. 1893. *Ann*. *Mus*. *Civ*. *Stor*. *Nat*. *Genova*. 213(33): 130.

Bolivar, I. 1905. *Bol*. *R*. *Soc*. *Esp*. *Hist*. *Nat*. 5: 112.

Kirby, 1910. 3(2): 330.

Morphological Characters: Body-form more slender and stout than *Atractomorpha* Saussure and *Tagasta* Bolivar. Head somewhat narrower at base; tegmina at rest reaching approximately to hind knee, with a black spot with yellow tinge at the base; hind wings distinctly purplish, not falling far short of tegmina when at rest; hind tibiae pink; male cerci, in lateral view, less strongly curved or bent.

Male genitalia: Supra anal plate elongate, one and half times long as wide, apex obtusely rounded, cercus elongate, twice as long as wide, broad basally, narrowing apically, apex obtusely rounded. Subgenital plate elongated, apex rounded. Epiphallus, anchore short, lophi triangular, dorso-lateral appandages tubular. Aedeagus, apical valve narrow, tubular, slightly excurved, apex obtuse, basal valve uniformaly broad, as long as apical valve.

Female genitalia: Supra anal plate short, broad, wider than long, apex obtusely rounded, cercus short, broad basally, narrowing apically, longer than wide, apex obtuse. Subgenital plate, posterior margin straight, smooth without setae, egg-guide elongate, narrowing apically, twice as long as wide, apex pointed. Spermatheca with single apical diverticulum, uniformaly broad, curved. Ovipositor, dorsal valve broad, external edge slightly serrated, three times as long as wide, distinctly shorter than lateral apodeme, apical tip pointed, ventral valve uniformaly broad, apical tip obtuse.

Material Examined: Reg. no. 142, 23 females, 18 males, 21.x.2011, on grasses, Tripura, Pencharthal (North Tripura), 13 females, 9 males, 25-X-2011, on grasses, Mizoram, Aizwal, coll. M.I. Khan.

Morphometry: (length in mm)

Male: Body 25.42, tegmina 8.18, pronotum 5.27, hind

Figure 10. *Pseudomorphacris notata* male & female

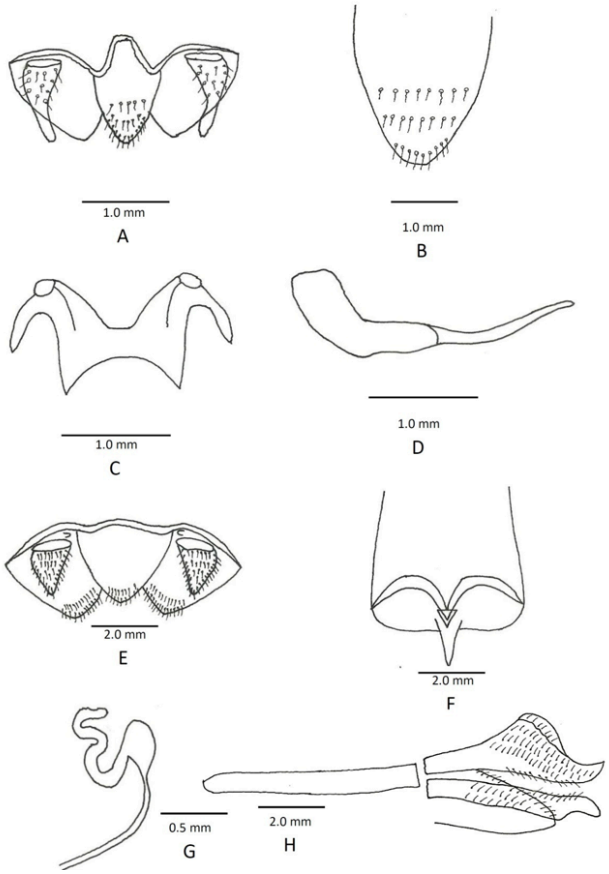

Image 10. *Pseudomorphacris notate* male (A–D) and female (E–H). A - supra anal plate, B - sub genital plate, C - epiphallus, D - aedeagus, E - supra anal plate, F - sub genital plate, G - spermatheca, H - ovipositor.

femur 6.71.

Female: Body 28.73, tegmina 9.27, pronotum 6.71, hind femur 7.83.

Distribution: Bangladesh, India (Assam, Mizoram, & Tripura), Myanmar, and Thailand.

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