

NEW RECORDS OF DELPHACID PLANTHOPPERS (HEMIPTERA: DELPHACIDAE) KNOWN FROM BANGLADESH IN COASTAL RICE ECOSYSTEM

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ABSTRACT

The planthoppers (Hemiptera: Auchenorrhyncha) associated with rice ecosystem in different areas of Dumki Upazilla in Patuakhali were studied during October 2013 to April 2014 to identify the species. Results revealed that 4 planthopper species, *Nisia nervosa* (Motschulsky, 1863), *Nilaparvata lugens* (Stål, 1854), *Sogatella furcifera* (Horváth, 1899), *Sardia rostrata* (Wilson & Claridge, 1991) were recognized from the above area. Among them two planthoppers (*N. nervosa* and *S. rostrata*) were newly recorded from Bangladesh. All species of planthoppers were redescribed with male genitalia and proper illustrations.

Keywords: Planthopper, rice, species, taxonomic key, male genitalia.

INTRODUCTION

The Auchenorrhyncha is generally regarded as a suborder of the Hemiptera. Auchenorrhyncha has adopted varied life habits on nearly all continents and islands (except Antarctica) and there may be around 42,000 species described worldwide (Deitz, 2008). The species of Auchenorrhyncha, especially planthopper are of a great concern to agriculture because several species are significant pests of a number of important crop plants, and they reach high population densities thereby damaging crops and/ or they are vectors of bacteria, phytoplasma, or viral pathogens. Wilson (2005) reported that planthoppers (Hemiptera: Fulgoromorpha) are of concern to agriculture in the Southeastern United States because of their potential to cause significant damage to economically important plants. In the field level of Bangladesh, people are treating such species as simply planthopper without confirming their identity at species level. Therefore, before knowing ecology, physiology and management strategies, detailed taxonomic work of this species are barely necessary for correct identification. Ahmed *et al.* (1970)

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reported some economically important planthoppers in paddy fields of East Pakistan (now Bangladesh). Works on planthopper, especially Delphacid planthoppers have been done by Sohi & Pathania (2012), Mushtaq (1984) and Distant (1906) in some localities of Bangladesh. Ishihara & Lippole (1969) reported several species under eight genera mostly on rice in Bangladesh. Khan (1968-1972) worked on the delphacid planthoppers of Pakistan including the former East Pakistan (now Bangladesh). The broad objective of this work is to give a comprehensive account of planthoppers found in rice ecosystems of Dumki Upazilla and preparation of taxonomic key for the identification of common species found in rice ecosystem. The planthoppers are a cosmopolitan group of insects placed in the infraorder Fulgoromorpha (superfamily: Fulgoroidea) which includes approximately 12,400 described species under 2,200 genera in 21 families widely distributed all over the zoogeographical regions of the world (Bourgoin 2012). Hafizal & Idris (2014) reported that Delphacidae (planthopper) and Cicadellidae (leafhopper) population are main insect pests of rice plants. But they are treating many species wrongly with many more misidentifications due to lack of proper taxonomic knowledge and keys to family, genus and species of such insects. Dupo & Barrion (2009) found that sixty-five species of planthoppers representing three subfamilies-Asiracinae (4 species), Stenocracinae (4 species), and Delphacinae (57 species)- all associated with rice agroecosystems in tropical Asia are taxonomically treated. Of the total, three genera of Delphacinae- *Nilaparvata* Distant, 1906; *Laodelphax* Fennah, 1963; and *Sogatella* Fennah, 1964- are economically important. Asche & Wilson (1990) reported that the Delphacid planthopper genus *Sogatella* Fennah was redefined and a key provided to males of the fourteen included species. This work includes lists of those species considered pests of economically important plants grown in the region, a summary of morphological features used for identification, a revised key for identification of planthoppers to family, a key to the economically important delphacids, and a list of literature useful for planthopper identification. The present research work has been carried out to collect and identify the specimen of Auchenorrhyncha for ensuring the distributional range with taxonomic importance and to revise and arrange of planthoppers taxonomically in accordance with the modern reasonable classification system.

MATERIALS AND METHODS

Taxonomic study on rice planthoppers was done to identify, describe and illustrate the species in Bangladesh. The laboratory works were carried out in the Department of Entomology at Patuakhali Science and Technology University (PSTU), Dumki, Patuakhali during October 2013 to April 2014. Geographically, the area is covered

Gangetic Tidal Floodplain and falls under Agroecological Zone (AEZ-130). The area lies at 0.9 to 2.1 meter above mean sea level (Iftekhar & Islam 2004). This region occupies a vast area of tidal floodplain land in the south-west part of Patuakhali district.

Collection: Planthoppers were collected by a sweeping net (30 cm diameter) from boro rice field. Sweeping was done from the basal portion of the plants as far as possible including the interspaces between plants. The planthoppers of 10 sweeps from each field were collected separately in a plastic bag. The collected specimens were killed directly keeping into the refrigerator at -20°C and properly preserved, identified, sorted and counted in the laboratory of the Department of Entomology, PSTU. For confirming the species, male genital structure after preparation following the special taxonomic technique was examined using a stereoscopic microscope connected with a digital camera.

Curating and specimen preparation: Collected specimens were killed in various ways by placing them directly into 70% ethyl alcohol. Preserved specimen was dipped in 99% ethyl alcohol for 2-3 seconds to wet the specimen, then placed in distilled water for 3-5 minutes.

Genital segment was separated by inserting a minute pin and kept in a test tube filled with 5-6 ml water, 1-2 pellets of 10% KOH, and 1-2 drops of filtered, saturated solution of Chlorazol black E powder in a hot water (80-90°C) bath for 3-5 minutes for clear observation. Then the segments were observed in glycerine jelly using a stereoscopic microscope (Zoom Stereo Microscope, BTB-3A).

Image and line drawing: Photographs of the specimen were made using digital camera, and multifocus system using software (Helicon Focus 5.1). The line drawings of the genital segment were prepared by using HP scanner and adobe photoshop CS₃.

RESULTS AND DISCUSSION

The planthoppers (Hemiptera: Auchenorrhyncha) associated with rice ecosystem of Dumki Upazilla were collected and studied taxonomically at species level. The following four planthoppers fauna were recognized in current investigation: *Nisia nervosa* (Motschulsky 1863), *Nilaparvata lugens* (Stål 1854), *Sogatella furcifera* (Horváth 1899), *Sardia rostrata* (Wilson & Claridge 1991). These species were comprehensively studied, and taxonomic description with proper illustrations were provided here under.

***Nisia nervosa* (Motschulsky 1863) Figure 1 (A-J)**

Livilla nervosa Motschulsky, 1863: 1-153

Nisia nervosa: Matsumara, 1908: 2; 1915: 158, 184 (Korean peninsula); Claridge & Wilson, 1981: 21; Anuferiev & Emeljanov, 1988: 467; Kwon & Huh, 1995: 41; 2001: 318-319; Rahman, 2012: 249-251.

Description: Body length (including forewing): male 3.5-4.2mm (N= 08), female 4-4.5mm (N= 12); forewing length: male 3-3.6mm (N= 08) and female 3.5-4mm (N=12)

Coloration: General color brown. Vertex, pronotum, frons and clypeus yellowish brown except lateral margin, dark brown. Rostrum yellow except apex, fuscous. Eyes blackish brown, ocelli brown to pale yellow. Mesonotum brown with median carina. Forewing cells varying from white to pale translucent brown, veins generally from yellowish brown to brown, specially veins in area of sensory pits dark brown to black. Wing waxy white, vein light brown. Thorax, legs and abdomen from yellowish brown to infuscated brown.

Head and thorax: Head with eyes distinctly narrower than pronotum (1:1.22), short. Vertex in dorsal view with two triangular posterolateral aerolets widely separated from each other, not nearly approaching in the middle line. Frons longer in middle line than widest part (1.6:1), longer than clypeus medially (1.20:1). Clypeus without lateral carinae, elevated medially. Apical segment of rostrum longer than wide. Antennae slightly long, second antennomere 2 times longer than widest part (2:1), flagellum originated from apical point. Lateral and median ocelli present. Forewings slender, about 2.5 times as long as widest part.

Male genitalia: In dorsal view, anal segment with lateral margins nearly parallel, each lateroapical with a finger-like process, subapically tumid with hairs, about 2 times longer than wide in dorsal aspect, anal styles sets near base. Pygofer with dorsolateral angle not produced. Adeagus, in lateral view, short, broad, flattened, oblique, apically strongly deflexed, dorsal surface convex. Genital styles angulately curved at middle with two lobes near base, inner lobe trifurcate apically, outer lobe with numerous teeth-like process at apex and hairy.

Materials examined: 23 male, PSTU farm, Dumki, Patuakhali, BD, 14 January, 2014; M. A. Rahman; 20 female, PSTU farm, Dumki, Patuakhali, BD, 14 January, 2014; 7 male, Jhatra, Dumki, Patuakhali, BD, 9 Nov, 2013; 5 female, , Jhatra, Dumki, Patuakhali, BD, 9 Nov, 2013; 2 male, Rajakhali, Dumki, Patuakhali, BD, 19 Nov, 2013; 4 female, Rajakhali, Dumki, Patuakhali, BD, 19 Nov, 2013; all same collector.

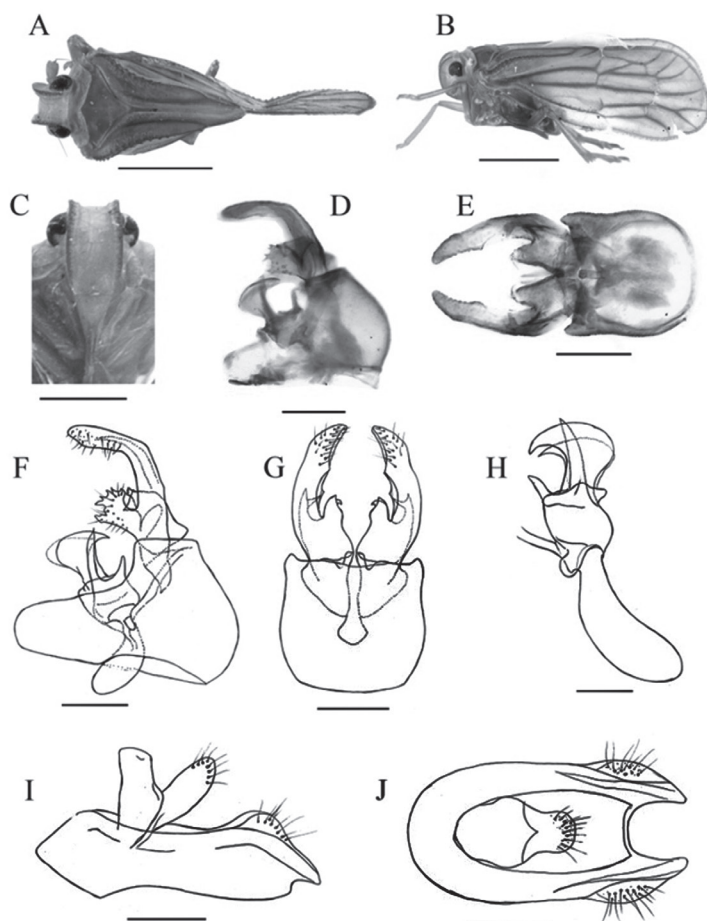


Fig. 1. *Nisia nervosa* (Motschulsky 1863); A. Male (dorsal view); B. Ditto (ventral view); C. Frons; D, F. Male genital block (left lateral view); E, G. Ditto (ventral view); H. Aedeagus (right lateral view); I. Anal segment (lateral view); J. Ditto (dorsal view)

Host plants: *Citrus spp*, *Hordeum sativum*, *Oryza sativa*, *Panicum miliaceum*, *Saccharum officinarum*, *Solanum tuberosum* and *Triticum aestivum*.

Distribution: Bangladesh (new record), Iran, Korea and United Arab Emirates

***Nilaparvata lugens* (Stål 1854); Figure 2 (A-H)**

Delphax lugens: Stål, 1854: 246 (Java).

Liburnia oryzae: Okamoto, 1924: 1-11

Nilaparvata oryzae: Kato 1933: 19 (Korea).

Nilaparvata lugens: Matsumura and Ishihara, 1945: 64 (Korea).

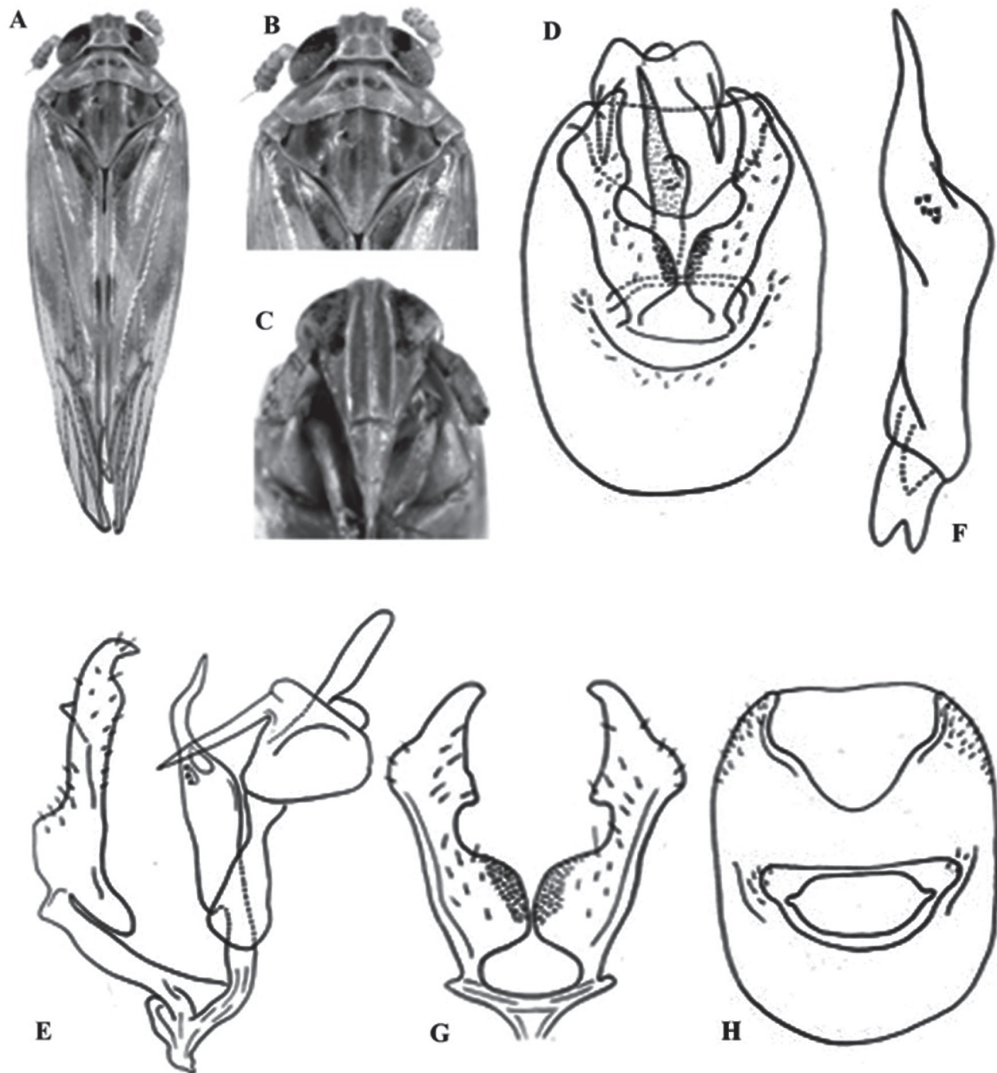


Fig. 2. *Nilaparvata lugens* (Stål 1854); A. Male (dorsal view); B. Head and thorax; C. Frons; D. Male genitalia; E. Ditto (lateral view); F. Aedeagus (ventral view); G. Parameres; H. Genital segment

Description: Body length (including forewing): male 2.8-3.5mm (N= 07), female 3.8 4mm (N= 05); forewing length: male 3-3.3 mm (N= 07) and female 3.5-3.8mm (N= 05)

Coloration: General color yellowish-brown to dark brown; forewings hyaline, with apex of claval area black. Ocelli blacks and large.

Head and thorax: Head with eyes distinctly narrower than pronotum (0.5: 1.5), short. Vertex quadrate, nearly as long as wide, apical margin transverse, carina of vertex faintly developed, submedian carinae not merged apically, basal compartment wider than base and than its greatest length about 1.7:1; frons longer in middle line than wide at widest point about 2.2:1, widest at level of ocelli, lateral carinae almost straight, median carina forked at basal fourth; antennae passed frontoclypeal suture, with basal segment longer than wide about 2:1, tibial spur with 24-29 teeth; forewing longer than widest point about 3.3:1.

Male genitalia: Pygofer subovate, widest at about midlength, dorsolateral angle slightly produced caudally; parameres relatively long, inner bases swollen almost touching each other, prominently concave at mid-inner area, slightly concave toward converging apices, outer apicolateral half moderately swollen; aedeagus long and slender, tapering apically, with teeth along caudal margins, broad medially, apex usually upturned left. Pygofer with opening wider than long in posterior view, lateral margins not well defined; anal segment in deep emargination of pygofer, parameres large, inner margin roundly emarginate at middle, inner angle strongly projected, apex pointed, viewed caudolaterally.

Materials examined: 11 male, PSTU farm, Dumki, Patuakhali, BD, 13 Nov, 2013; M. A. Rahman; 8 female, PSTU farm, Dumki, Patuakhali, BD, 13 Nov, 2013; 7 male, Jhatra, Dumki, Patuakhali, BD, 2 Nov, 2013; 8 female, Jhatra, Dumki, Patuakhali, BD, 2 Nov, 2013; 3 male, Rajakhali, Dumki, Patuakhali, BD, 19 Nov, 2013; 6 female, Rajakhali, Dumki, Patuakhali, BD, 19 Nov, 2013; all same collector.

Host plants: *Leersia hexandra* Sw. Maize, Millets, many grasses and rice

Distribution: Australia, Bangladesh, Bhutan, Burma, China, Fiji, India, Indonesia, Japan, Kampuchea, Korea, Laos, Malaysia, Nepal, Pakistan, Papua New Guinea, Philippines, Solomon Islands, Sri Lanka, Taiwan, Thailand and Vietnam.

***Sogatella furcifera* (Horváth 1899); Figure 3 (A-G)**

Liburnia furcifera: Okamoto, 1924: 281-13.

Sogata furcifera: Kato, 1933a: 19 (Korea).

Description: Body length (including forewing): male 3.5-3.8mm (N= 08), female 3.5-4mm (N= 07); forewing length: male 3-3.5mm (N= 08) and female 3.8-4mm (N= 07)

Coloration: Yellow to yellowish brown; pronotum white with black areas behind eyes; frons, clypeus, genae, lateral areas of mesonotum, coxae I and II, and pleura

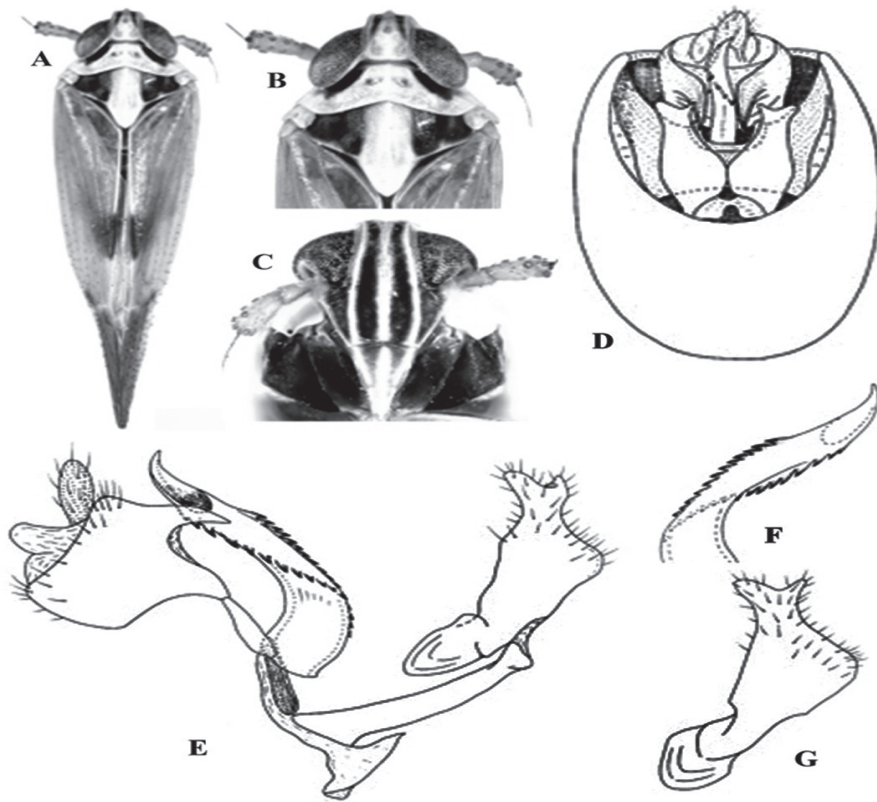


Fig. 3. *Sogatella furcifera* (Horváth 1899); A. Male (dorsal view); B. Head and thorax; C. Frons; D. Male genitalia; E. Ditto (lateral view); F. Aedeagus; G. Paramere

all black; abdomen and pygofer dark brown; forewings hyaline with brown spot at end of clavus.

Head and Thorax: Vertex submedially almost as long as wide at base, obtusely rounded toward frons, lateral carinae straight, submedian carinae merged apically, basal compartment wider basally than greatest length 1.6:1; frons at midline longer than wide at broadest part, lateral carinae shallowly convex, median carina simple; clypeus basally wider than frons at apex; antennae surpassing frontoclypeal suture, segment I longer than wide at apex, shorter than segment II about 1:1.8; tibial spur with about 25 teeth; forewings longer than widest part about 3.3:1.

Male genitalia: Pygofer slightly narrower dorsally than ventrally in profile, opening almost as long as wide viewed posteriorly, laterodorsal angle obtusely rounded, weakly produced; with around 18 teeth at left and 14 at right side, two rows separated

basally; anal segment short, lateroapical angles of pronotum distinctly separated, opening of parameres with dorsal margin evenly curved upward, ventral margin with a broad lobe medially; parameres divergent, each with outer angle widely formed, inner angle formed as long as outer one, apically acute.

Materials examined: 4 male, PSTU farm, Dumki, Patuakhali, BD, 03 Nov, 2013; M. A. Rahman; 3 female, PSTU farm, Dumki, Patuakhali, BD, 03 Nov, 2013; 2 male, Jhatra, Dumki, Patuakhali, BD, 2 Nov, 2013; 1 female, , Jhatra, Dumki, Patuakhali, BD, 2 Nov, 2013; 4 male, Rajakhali, Dumki, Patuakhali, BD, 19 Nov, 2013; 2 female, Rajakhali, Dumki, Patuakhali, BD, 19 Nov, 2013; all same collector.

Host plants: Millets, Maize, Many grasses and Rice

Distribution: Afghanistan Australia, Bangladesh, Bhutan, Burma, China, India, Indonesia, Japan, Kampuchea, Korea, Laos, Malaysia, Mongolia, Nepal, Papua New Guinea, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand and Vietnam

***Sardia rostrata* (Wilson & Claridge 1991); Figure 4 (A-D)**

Sardia rosatrata: Melichar, 1903, 96

Sardia: Ishihara, 1949, 2:82

Sardia rosatrata: Yang, 1989. 6: 282

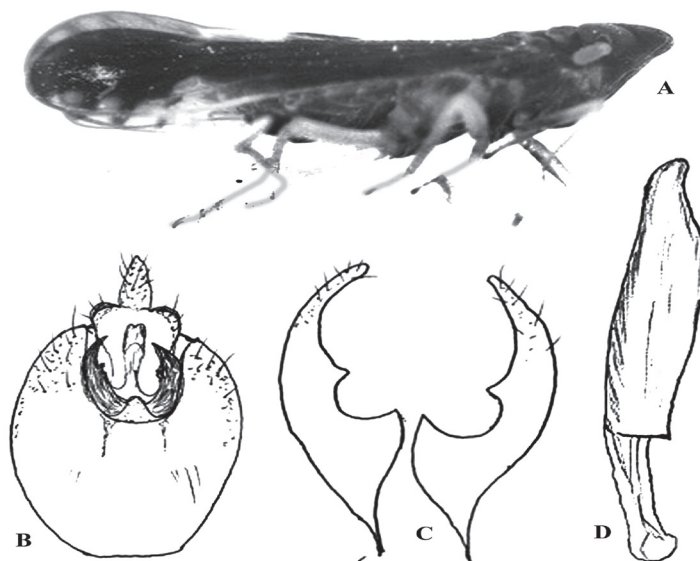


Fig. 4. *Sardia rostrata* (Wilson & Claridge 1991); A. Male (ventral view); B. Male genitalia; C. Parameres; D. Aedeagus

Description: Body length (including forewing): male 3.5-4mm (N= 03), female 3.8-4.5mm (N= 04); forewing length: male 3-3.1mm (N= 03) and female 3.5-3.6mm (N= 04)

Coloration: Black planthopper except for yellowish white antennae, rostrum, femora I and II, tibiae, and tarsi; whitish along leg III, apex of scutellum, and basal two-thirds of hind claval margins; forewings opaque, pale black, whitish to transparent between Sc and another three areas along anterior margins between Sc2 and R1, R1 and Rs, and Rs and M1, and darker toward tip of clavus.

Head and thorax: Head distinctly narrowed frontally forming a subacute and ridge-like tip; vertex at base and anterior of eyes 2.35 times longer than wide; basal compartment with indistinct arm of Y carina but stem visible; pronotum a little shorter than half length of vertex; combined length of vertex and pronotum longer than mesonotum by about 1.33 times; lateral carina of pronotum concave to slightly converging before reaching the hind margin; basal segment of antennae distinctly shorter than segment II.

Male genitalia: Pygofer visibly wider ventrally than dorsally, laterodorsal angle not produced, lateral margins weakly defined; aedeagus short but robust with few subapical teeth; anal segment with lateroapical angles each developed medially into long spinose processes, wide apart, directed ventral; parameres subparallel, rounded upper area, inner margin slightly concave, basal angle obtuse laterocaudally.

Materials examined: 3 male, PSTU farm, Dumki, Patuakhali, BD, 02 Nov, 2013; M. A. Rahman; 2 female, PSTU farm, Dumki, Patuakhali, BD, 02 Nov, 2013; 5 male, pstu farm, Dumki, Patuakhali, BD, 13 Nov, 2013; 2 female, pstu farm, Dumki, Patuakhali, BD, 13 Nov, 2013; 3 male, pstu farm, Dumki, Patuakhali, BD, 19 Nov, 2013; 1 female, pstu farm, Dumki, Patuakhali, BD, 19 Nov, 2013; all same collector.

Host plants: Barley, *Colcasia esculenta*, Maize, Rice, *Sesbania*, Sugar Cane and Wheat

Distribution: Australia, Bangladesh (new record), China, France, Iran and Sri-Lanka

CONCLUSION

From the findings of the present research it can be concluded that four planthopper species were recognized from Dumki Upazilla. Among them two planthopper species (*Nisia nervosa* and *Sardia rostrata*) were newly recorded from Bangladesh.

REFERENCES

- AHMED, M., SAMAD, K. & MALIK, K. 1970. Some commonly found leafhoppers in paddy fields of East Pakistan. *Pak. J. Sci. Res.* **22**(3-4), 191-198.
- ANUFRIEV, G. A. & EMELJANOV, A. F. 1988. Volume II: Homoptera and Heteroptera. In: PA Lehr (ed.). *Keys to the insects of the far East of the USSR in Six Volumes*, Pp. 317-496. Nauka Publishing House, Leningrad, Moscow.
- ASCHE, M. & WILSON, M. R. 1990. The delphacid genus *Sogatella* and related groups: A revision with special reference to rice-associated species (Homoptera: Fulgoroidea). *Syst. Entomol.* **15**, 1-42.
- BOURGOIN, T. 2012. FLOW: Fulgoromorpha Lists On the Web, 1997-2012. Version 7, updated February 17, 2012. <http://flow.snv.jussieu.fr/cgi-bin/entomosite.pl>.
- CLARIDGE, M. F. & WILSON, M. R. 1981. The leafhopper and planthopper fauna of rice field in South East Asia. *Acta Entomol. Fennica.* **38**, 21-22.
- DEITZ, L. L. 2008. Dr Metcalf: a resource on cicadas, leafhoppers, planthoppers, spittlebugs, and treehoppers. <http://www.lib.nesu.edu/specialcollections/digital/metcalf/introduction.html> [accessed 14 April 2012].
- DISTANT, W. L. 1906. *The fauna of British India, including Ceylon and Burma*. Rhynchota 3 (Heteroptera-Homoptera). London: Taylor & Francis, Pp: 503.
- DUPO, A. L. B. & BARRION, A. T. 2009. Taxonomy and general biology of delphacid planthoppers in rice agroecosystems. *International Rice Research Institute*. Pp 3-156.
- HAFIZAL, M. M. & IDRIS, A. B. 2014. Temporal Population Abundance of Leafhopper (Homoptera: Cicadellidae) and Planthopper (Homoptera: Delphacidae) as Affected by Temperature, Humidity and Rice Growth Stages. *Acad. J. Entomol.* **7**(1), 1-6.
- IFTEKHAR, M. S. & ISLAM, M. R. 2004. Managing mangroves in Bangladesh: A strategy analysis. *J. Coastal Conserv.* **10**, 139-146.
- ISHIHARA T. 1949. Revision of the Araeopidae of Japan, Ryukyu Islands and Formosa. *Sci. Rep. Matsuyama Agric. Coll.* **2**, 1-102.
- ISHIHARA, T. & LIPPOLE, L. 1969. Leafhoppers of rice fields In East Pakistan. *Agr. Univ. Matsuyume.* 1-6.
- KATO, M. 1933a. Notes on some Manchurian Homoptera, collected by Mr. K. Kikuchi. *Ent. World.* **1**(1), 2-19.
- KATO, M. 1933b. Three colour illustrated insects of Japan. Fasc. 3 (Homoptera). Koseikaku Co. Tokyo, 9(+50)+11pp. (in Japanese).

- KHAN, R. J. 1968. A study of the Deiphacid planthopper species (Homoptera: Fulgoroidea: Delphacidae) of East and West Pakistan. (PhD thesis).
- MATSUMURA, S. 1908. Neue Cicadinen aus Europa und dem Mittelmeergebiet. *J. College Sci. Imperial Univ. Tokyo*. **23** (6), 1-46.
- MELICHAR, L. 1903. Homoptera Fauna Von Ceylon, Verlag Von Felix L. Demes Berlin Pp: 1-248.
- MOTSCHULSKY, V. I. 1863. Essai d'Un catalogue des insectes de l'île Ceylan. *Bulletin de la Societe Imperiale des Naturalistes de Moscou*. **3**, 1-113.
- MUSHTAQ, S. 1984. Morphotaxonomical studies of some families of Fulgoroidea found in Pakistan and adjoining countries (Homoptera: Fulgoroidea). Thesis form PhD. Department of Zoology, University of Karachi, Pakistan, 387pp.
- OKAMOTO, H. 1924a. The insect fauna of Quelpart island (Saishiu-to). *Bull. Agr. Exp. Stat. Gov. Gen. Chosen*. **1** (2), 47-233.
- OKAMOTO, H. 1924b. Study on planthoppers injurious to rice plant in Chosen. *Bull. Agr. Exp. Stat. Gov. Gen. Chosen*. **12**, 37pp.
- RAHMAN, M. A. 2012. Taxonomic revision of the infraorder Fulgoromorpha from Korea (Homoptera: Auchenorrhyncha). (PhD thesis). Pp: 1-331
- SOHI, A. S. & PATHANIA, P. C. 2012. Taxonomic status of Typhlocybinae leafhoppers (Homoptera: Auchenorrhyncha: Cicadellidae) known from Pakistan and Bangladesh. *J. Insect Sci.* **25** (1), 1-23.
- STÅL, C. 1854. Nya Hemiptera. *Ofversigt af Kongliga Svenska Vetenskaps-Akademiens Förhandlingar. Stockholm*. **11**, 231-255.
- WILSON, S. W. 2005. Keys to the families of fulgoromorpha with emphasis on planthoppers of potential economic importance in the Southeastern United States (hemiptera: auchenorrhyncha). *Florida Entomol.* **88**(4), 464-481.
- WILSON, M. R. & CLARIDGE, M. F. 1991. Hand book for identification of leafhoppers and planthoppers of Rice CAB International, Wallingford, Oxon OX10 8DE 142 Pp.
- YANG, C. T. 1989. Delphacidae of Taiwan (II). NSC Special Publication. **6**, 1-334.

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