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Sogatella Complex (Delphacidae: Hemiptera) from Irrigated Rice Fields of Tamil Nadu

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ABSTRACT: *Sogatella* spp from irrigated rice fields in Tamil Nadu were collected during November 2021 to April 2022 from different crop growth stages. Two species *viz. S. furcifera* (Horvath, 1899) and *S. vibix* (Haupt, 1927) (Delphacidae: Hemiptera) were identified. Of the 14 locations from three districts surveyed *viz.* Coimbatore, Kanyakumari and Tanjore, *Sogatella* spp. were found to occur in Coimbatore and Kanyakumari. The relative abundance of *S. furcifera* was dominant (97.57%) over *S. vibix* (2.43%). *S. furcifera* and *S. vibix* are described and illustrated.

Keywords: *S. furcifera*, *S. vibix*, Fulgoroidea.

INTRODUCTION

India is one of the leading producers of rice. It is estimated that production of rice during 2020-21 was 122.27 million tonnes (Press Information Bureau, 2021). Among many rice production constraints, insect pest outbreaks are an important reason for yield loss. Planthoppers (Fulgoroidea: Hemiptera) are a common pest of rice, with few species of high economic importance. White backed planthopper (WBPH) *Sogatella furcifera* apart from brown planthopper (BPH) *Nilaparvata lugens* is an important sucking pest of rice causing considerable loss in rice production. Possible reasons for the sudden outbreak of WBPH in the rice ecosystem were the introduction of hybrid varieties (Sogawa, 2004) and resistance to insecticides (Su *et al.,* 2013). Direct yield loss occurs due to the sucking of plant sap which results in hopper burn, and its role as a possible vector of southern rice black-streaked dwarf virus (SRBSDV) results in indirect yield loss (Zhou *et al.,* 2008). Due to high economic loss caused in rice production by the planthoppers a correct and quick identification of the species with adequate description for their easy recognition is necessary. Information on taxonomy of the planthoppers and variation in their population density would be of immense use in the coming years. Taxonomic work and continuous record on population dynamics of the second most important planthopper pest of rice, the WBPH is scare in Tamil Nadu. The current work is undertaken to document *Sogatella* spp. present in the irrigated rice fields of Tamil Nadu and understand its population density.

MATERIALS AND METHODS

Places of collection: Planthopper collection was undertaken from the irrigated rice fields from three district of Tamil Nadu -- Cauvery Delta Zone (Tanjore), High Rainfall zone (Kanyakumari) and Western Zone (Coimbatore) in 14 places from November 2021 to April 2022.

Curation and identification: Planthoppers were collected using sweep net and light traps from the irrigated rice fields randomly in the three districts with an aspirator. The collected hoppers were killed using ethyl acetate (99%) and examined under microscope (MOTIC: SMZ143) for observing external morphology and to sort out the *Sogatella* sp. The dried specimens were card mounted and labeled. Photographs were taken using Leica M205C (LAS X Application Suite montage software) and morphometry was carried out using the above software. Male genitalia was dissected using the dissection technique followed by Knight (1965). Species confirmation was based on the taxonomic keys and literature (Asche and Wilson 1990; Barrion and Litsinger 1994; Wilson and Claridge 1991; Bartlett *et al.,* 2014).

RESULT

Among the 14 locations surveyed for planthoppers in three districts, *S. furcifera* was recorded from

Kanyakumari (6 locations), Coimbatore (2 locations) and *S. vibix* from Coimbatore (2 locations) (Table 1). *Sogatella* spp. was not recorded from Tanjore district (Table 1). The relative abundance of *S. furcifera* was dominant (97.57%) over *S. vibix* (2.43%) (Table 1). *S. furcifera* was found to be dominant in tillering and panicle initiation stage of rice and *S. vibix* during early vegetative stage and tillering stage.

The observed species of *Sogatella* are described.

Genus *Sogatella* Fennah, 1956

Chloriona (Sogatella) Fennah, 1956

Type species: *Delphax furcifera* Horvarth, 1899

Diagnosis: Tiny yellowish brown planthopper with a distinct white to warm buff median vitta visible dorsally from vertex to tip of scutellum. Pygofer with U shaped diaphragm margin. Paramere at diverging angle, bifurcated apically with different depth of bifurcation. Aedeagus twisted, laterally flattened, apically pointed, opening located subapically reaching upto apex.

Keys to species of Genus *Sogatella* from Tamil Nadu.

1. Black frons, gena and clypeus (Fig. 1 b). Anal segment with narrow lateroapical angle with pair of short spinous process projected downwards (Fig. 1 c, e). Diaphragm with wide trough like lateral margins ending in tiny raised peg (Fig. 1 d). Parameres with superficially bifurcated almost similar inner, outer apical lobes (Fig. 1 f). Short median stump along outer margin of posterior pygofer opening (Fig. 1 d)……..*S. furcifera.*

- Black gena (Fig. 2b). Anal segment with wider lateroapical angle, moderately long spinous process projecting downwards (Fig. 2c, e). Diaphragm deeply concave with peg like process at each lateral end (Fig. 2 d). Parameres deeply bifurcated apically forming large outer process strongly diverging, bluntly tapering towards outside, small inner process moderately diverging (Fig. 2f)……....*S. vibix.*

1. *Sogatella furcifera* (Horvath, 1899)

Materials examined: 15♂: Tamil Nadu, Kanyakumari (21. xii. 2021; 30.i.2022; 04. i. 2022), 6♂: Tamil Nadu, Coimbatore (15.xii.2021; 16.ii.2022.), leg. FEBY ATEE.

Description: Adult (♂) Body length: 3.46 mm, width across eye: 0.55mm, width across hind margin of pronotum: 0.72mm. **Head:** Antenna yellowish brown, pedicel longer than scape by 2.5:1 Yellowish brown vertex, black frons, gena, prominent yellowish brown to pale yellow lateral, median carina. Vertex as long as wide, apex marked by fusion of the bifurcated median carina. Frons longer than wide by 2.41:1 (Fig. 1 a-b).

Thorax: Pronotum yellowish white with dark black patch beneath the eye. Mesonotum as scutellum marked by distinct pale yellow median vitta and black lateral area. Black to dark brown first and second coxa, pleura and pale yellow leg segments. Mesonotum longer than vertex and pronotum together by 1.25:1. Prominent median carina present. Forewings longer than wide by 3.37:1, sub hyaline with black pterostigma arising a little before the point of PCu + A, ending at point of PC + 1A touching wing margin, darker end vein, apical region of tegmina with somber marking. Foliaceous calcar with 25 to 30 teeth (Fig. 1 a-b).

Abdomen: Dorsally dark brown to black abdominal segment with tinge of light ochraceous buff colour along posterior margin of each segment excluding fully black to dark brown genital segment. Laterally dorsal margin of pygofer shorter than ventral margin. Lateral margin of dorsal region simple. Posteriorly opening wider than long (Fig. 1 d). Short anal segment with a pair of short spinous process projected downwards narrowly separating the anterior region of anal segment (Fig. 1 c, e). Aedeagus with 18 downward projecting spines on left 14 along right side (Fig. 1 g). Diaphragm short, wide trough like lateral margins ending in tinyraised peg (Fig. 1 d). Parameres divergent, basally wider, narrow towards apex, slight constriction just before the superficially bifurcated almost similar inner, outer lobe (Fig. 1 f). Short median stump along outer margin of posterior pygofer opening (Fig. 1 d).

2. *Sogatella vibix* (Haupt, 1927)

Materials examined: 3♂: Tamil Nadu, Coimbatore (15.xii.2021; 13.xii.2021.), leg. FEBY ATEE.

Description: Adult(♂) Body length: 3.22 mm**,** width across eye: 0.50 mm**,** width across hind margin of pronotum: 0.68 mm. **Head:** Antenna whitish yellow. Scape shorter than pedicel by 1:2.5. Light ochraceous buff vertex, frons, vertex longer than wide at base by 1.3:1; median carina branched from vertex base to apex/ median carina forked at base and merged above fastigium; light ochraceous buff clypeus with black gena. Outer, inner carina visibility obscure to prominent (Fig. 2 a-g).

Thorax: Yellowish white pronotum with dark yellowish brown patch underneath compound eye. Lateral and middle carina prominent. Mesonotum with whitish yellow median vitta, brownish lateral area. Mesonotum longer than vertex and pronotum together by 1.24:1, mesonotum and pronotum by 2.5:1. Mesopleura with a black triangular marking, metapleura with two adjacent black patch. Leg tips black, while rest of the thorax, leg segments pale yellow white. Forewing longer than wide by 3.4:1, semitransparent without pterostigma. Calcar with 21-22 teeth (Fig. 2 a).

Abdomen: Dark brown to black colour with pale yellow tinge at each segmental margin excluding the all brown pygofer. Dorsal margin of pygofer shorter than ventral margin, lateral dorsal margin simple. Anal segment short with wider lateroapical angle, moderately long spinous process projecting downwards (Fig. 2 c, b). Aedeagus with approximately 16-18 along left side, 8 on right side (Fig. 2 g). Diaphragm deeply concave with peg like process at each lateral end (Fig. 2 d). Parameres almost uniformly broad excluding a shallow constriction along the mid half length. Apex deeply bifurcated forming large outer process strongly diverging, bluntly tapering towards outside, small inner process moderately diverging (Fig. 2 f).

DISCUSSION

From the three locations under the study *S. furcifera* was recorded from Kanyakumari and Coimbatore and exhibited a higher abundance (97.57%) than *S. vibix* (2.43%) which was observed only in Coimbatore (Table 1). Contrary to the report of Catindig *et al.* (2009)

where *S. furcifera* was observed in high numbers from light trap collection from Aduthurai, Tanjore district in 2009.The present study did not document *S. furcifera* from Tanjore district. Earlier records on *Sogatella* sp. from rice ecosystems of Tamil Nadu include Chelliah and Gunathilagaraj (1990), Gunathilagaraj and Kumar (1997a, b), Rao and Chalam, (2007), Kumaresan *et al*. (2016), Kiruba *et al.* (2006). None of the earlier reports has documented *Sogatella* sp. from Kanyakumari district, *S. vibix* from Coimbatore district. This is the first report of *S. furcifera* from Kanyakumari and *S. vibix* from Coimbatore. Based on the taxonomic description carried out, it is suggested that apart from the common key characteristics like shape of diaphragm, paramere which is widely used to confirm the two species of *Sogatella*, *S. furcifera*, *S. vibix* short median stump along with outer margin of paramere opening when viewed posteriorly, length of anal segment spine can also be used as additional species confirmational characters.

Table 1: Relative abundance of *Sogatella* sp. in irrigated rice ecosystems of Tamil Nadu.

Sr. No.	Family/ Scientific name	Tanjore	Kanyakumari	Coimbatore	Relative Abundance (%)
1.	*Sogatella furcifera* (Horvath)	×	✓	✓	97.57
2.	*Sogatella vibix* (Haupt)	×	×	✓	2.43

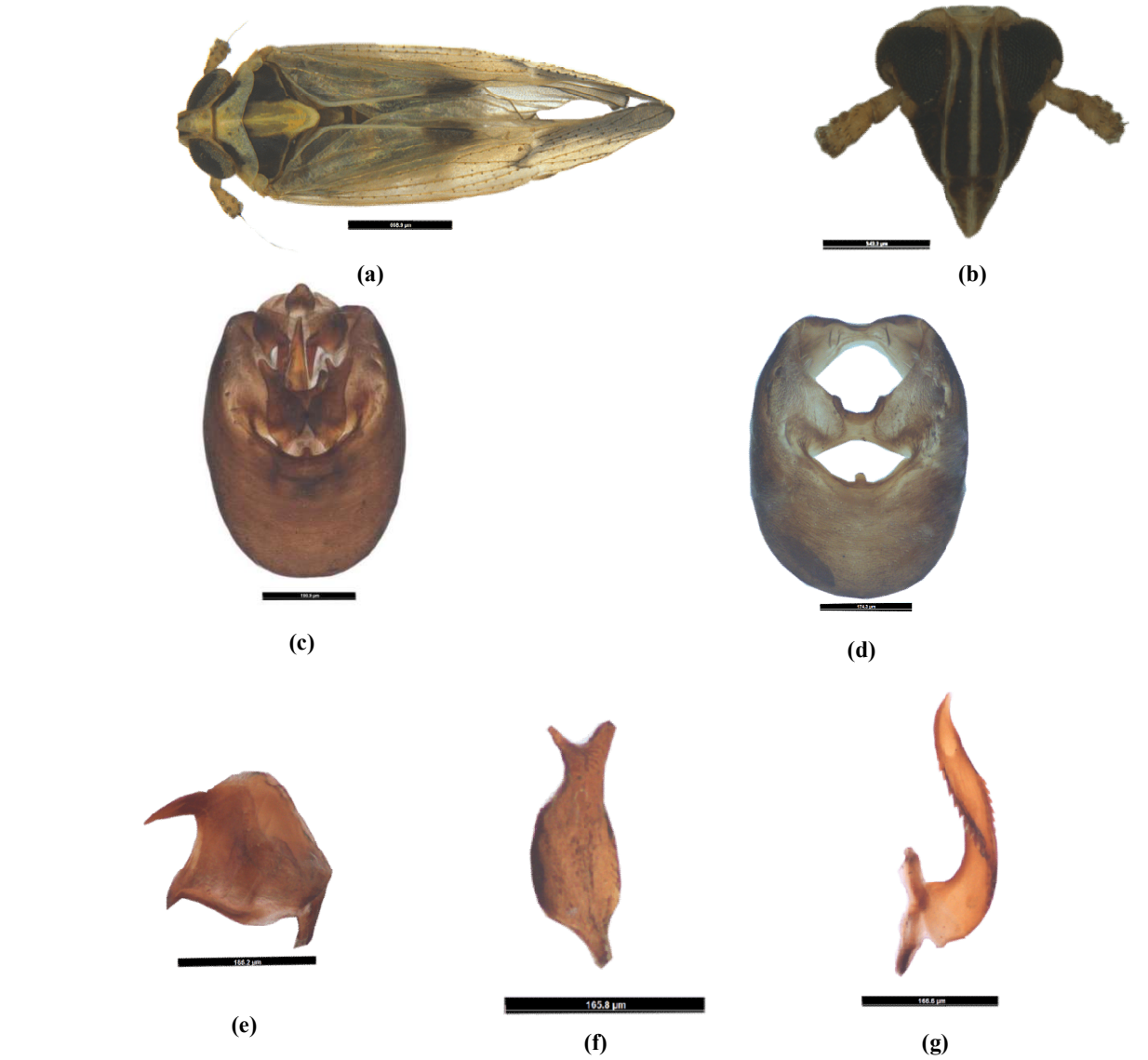

Fig. 1 (a-g). ***Sogatella furcifera*** a) Male habitus - dorsal view; b) Face; c) Male genital - posterior view; d) Pygofer- posterior view; e) Anal segment- lateral view; f) Paramereg; g) Aedeagus.

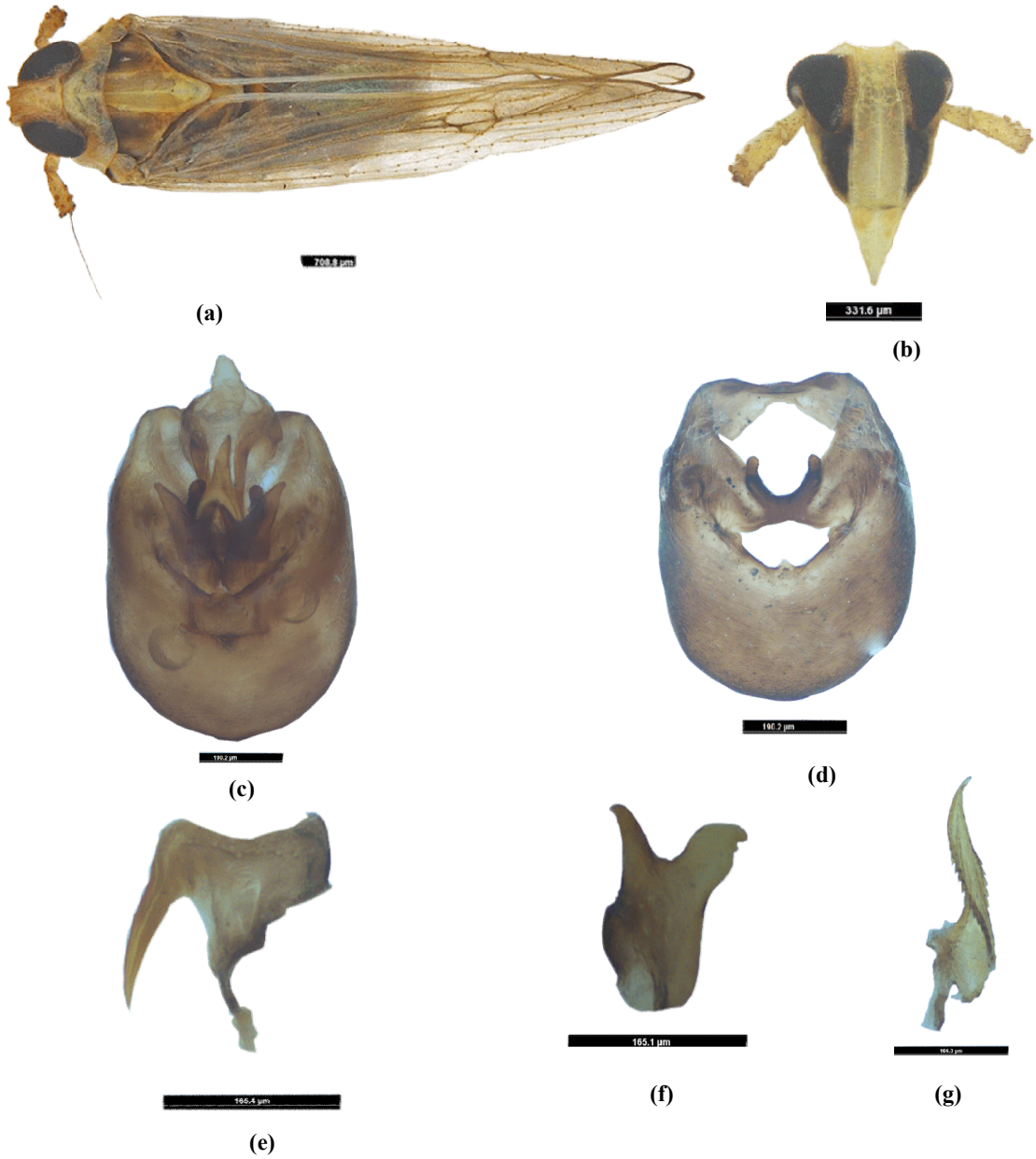

Fig. 2 (a-g). ***Sogatella vibix*** a) Male habitus - dorsal view; b) Face; c) Male genitalia- posterior view; d) Pygofer- posterior view; e) Anal segment- lateral view; f) Parameren; g) Aedeagus.

CONCLUSION

In spite of being a major devastating pest of rice, records on *Sogatella* sp. distribution and their relative abundance from rice ecosystems of Tamil Nadu is limited. Careful and consistent study on the species complex of major pest genus is essential to understand their seasonal abundance relative to one another, possibility of vectoring disease causing phytopathogen and cases of introduction of invasive species into the country.

FUTURE SCOPE

The present study will complement the data collected in the future to study the distributional pattern of *Sogatella* sp. from other irrigated rice ecosystems of Tamil Nadu.

Author Contributions Statement. The first author has done the research as a part of Master's programme while rest of the authors have contributed in planning, guiding and implementation of the research work as advisory committee.

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Conflict of Interest. None.

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