

Taxonomy and General Biology of Planthopper fauna Associated with Sugarcane Crop-Ecosystems of Southern and Scarce Rainfall Zones of Andhra Pradesh

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ABSTRACT: Planthoppers being the piercing and sucking herbivores represent greatest threat to agricultural production. In the present study, nine planthopper species were collected and identified from Sugarcane crop ecosystem of southern (Chittoor and Nellore) and scarce rainfall (Kurnool) zones of Andhra Pradesh where sugarcane is the major commercial crop and because of Planthoppers, huge yield losses occur to the farming community. Systematic position includes that all these planthoppers belongs to two families (Delphacidae and Lophopidae) and three tribes (Delphacini, Lophopini, Tropidocephalini). Out of all the nine planthoppers, *Pyrilla perpusiella* (Stal) infestation is severe and it is a serious sap sucking pest of sugarcane. For easy identification of these planthoppers, an illustrated key along with diagnostic taxonomic characters were provided.

Keywords: Planthoppers, Delphacidae, Lophopidae, Sugarcane, *Pyrilla perpusiella* (Stal).

INTRODUCTION

Planthoppers are the notorious sucking pests belonging to the order Hemiptera. They are included in a single super family *i.e.*, Fulgoroidea in Fulgomorpha of Auchenorrhynchos-Hemiptera comprising twenty families. Out of all the families, Delphacids are the most diverse and economically important family of planthoppers. The chief distinctive character of the Delphacidae family is the presence of a movable spur at the tip of hind tibia. Fulgoroids can be easily distinguished from the other members of the classical “Homoptera” by two features *viz.*, anal vein in the forewing is Y-shaped *i.e.*, bifurcate and the thickened, three-segmented antennae, with a generally round or egg-shaped third segment that bears a fine filamentous arista.

Planthoppers are phytophagous in nature and they obtain their nutrition by sucking sap from phloem of plant vascular tissues. Due to the continuous feeding, they cause characteristic symptom called “hopper burn” in which the plant tissues become yellow in colour and makes the plant unfeasible for photosynthesis. Feeding by large number of planthoppers leads to the death of infested leaves and eventually leaf drop, whole plant lodging and death which in turn reduces the yields of crop. Besides being crop pests, planthoppers may also act as vectors for plant viral disease for example in sugarcane, sugarcane yellow leaf syndrome transmitted by *Saccharosydne saccharivora* (Westwood), Fiji disease virus transmitted by *Perkinsiella saccharicida* (Kirkaldy), *Perkinsiella sinensis* (Distant) and *P. vastatrix* (Kirkaldy) (Wilson, 2005). Due to the

continuous usage of insecticides, the minor pest today may attain major pest status one day. The effective management of a pest species damaging any crop cannot be undertaken without accurate identification. Correct and quick identification of planthopper species with adequate description and keys for their easy recognition are most important for managing them effectively.

MATERIAL AND METHODS

Intensive surveys were conducted and large number of planthopper specimens were collected from Southern zone (Chittoor, Nellore, YSR Kadapa districts) and Scarce rainfall (Ananthapuramu, Kurnool districts) zones in Andhra Pradesh. About 10-15 to and fro net sweepings were taken each time and planthoppers collected were aspirated from the net into a glass tube and killed with a cotton swab wetted with a few drops of ethyl acetate. The killed specimens were transferred to homeopathic vials, labelled, brought to the laboratory and dried in a hot air oven at 45-50°C, for about 5 to 6 hours. For mounting and preparing slides of genitalia the procedure suggested by Knight (1965) was followed. For describing the different body parts, the terminology suggested by O'Brien and Wilson (1985) was followed.

RESULTS AND DISCUSSION

In the present study, nine planthoppers belonging to two families *viz.*, Delphacidae, Lophopidae were presented in the Table 1.

Table 1.

Sr. No.	Crop eco-system	Name of the Planthopper	Family
1.	Sugarcane	<i>Cemus sp.</i>	Delphacidae
2.		<i>Peregrinus maidis</i> (Ashmead)	Delphacidae
3.		<i>Perkinsiella sinensis</i> (Kirkaldy)	Delphacidae
4.		<i>Pyrilla perpusiella</i> (Stal)	Lophopidae
5.		<i>Sardia sp.</i>	Delphacidae
6.		<i>Stenocranus sp.</i>	Delphacidae
7.		<i>Tagosodes pusanus</i> (Distant)	Delphacidae
8.		<i>Toya propinqua</i> (Fieber)	Delphacidae
9.		<i>Tropidocephala serendiba</i> (Stal)	Delphacidae

The key for identification of the planthoppers associated with sugarcane crop ecosystems of southern and scarce rainfall zones of Andhra Pradesh of is given here under.

Key for identification of planthopper fauna associated with sugarcane crop ecosystem

1. Hind tibia without movable apical spur (Lophopidae); Large species and size varies from 10 to 15 mm; Uniformly ochraceous coloured body, slightly paler beneath than above; Forewings are semi-opaque, more or less uniformly yellowish brown with small black spots sparsely distributed all over the wing; Cephalic process is well developed; Conjunctival hook of aedeagus is very strongly developed and slightly twisted in the middle; Aedeagal appendage is very much elongated (Fig. 4a-c and Plate.1D).....*Pyrilla perpusiella* (**Distant**)
 - Hind tibia with movable apical spur (Delphacidae).....2
2. Aedeagus broader basally and gradually narrowed towards apex and aedeagal process sickle shaped, arises from base of the aedeagus; Genital style with sclerotized curved apex and also with sclerotized serrated process arising from inner side of the style; Apical half of frons, clypeus and genae yellowish with a blackish brown spot on mid apex of frons (Fig. 9a-c and Plate 2C).....*Tropidocephala serendiba* (**Melichar**)
 - Frons tricarinate, with simple median carinae, wider at apex than base with arcuate frontoclypeal suture.....3
3. Genital styles are usually narrowed and pointed; aedeagus long, slender, and pointed apically; Anal segment processes are fused throughout the length with distal bifurcation; Forewings subhyaline with pale yellowish. brown veins along apical margins; legs and abdomen yellowish (Fig. 6a-d and Plate. 1F.).....*Stenocranus sp.*
 - Genital styles relatively flattened, trapezoidal distally and shallowly bifurcated. The lateral sides of pro and mesonotum brown or black in colour.....4
4. A pair of short spine like processes directed ventrally on the collar like anal segment; Pygofer moderately long, posterior opening slightly longer dorsoventrally than broad; A white band present along the middle line from

the anterior part of vertex to the tip of the mesonotum; Aedeagus tubular and wider basally (Fig. 7a-c and Plate 2A).....*Tagosodes pusanus* (**Distant**)

- Aedeagus tubular, but serrated subapically.....5
5. Genital styles flattened, but not trapezoidal and are broader, concave and wider in the middle with number of spines apically; Vertex very short and shallowly excavated; Diaphragm Y-shaped. Forewing without pterostigma and is light stramineous in colour; Legs normal, tibiae foliaceous, first tarsal segment is longer than the remaining two segments (Fig. 8a-c and Plate.2B).....*Toya propinqua* (**Fieber**)
 - Vertex narrow, elongated between the larger compound eyes.....6
 6. Forewing is dark brown with black fuscous markings; Aedeagus more or less straight, tubular with subapical serration, gonopore apical; Genital styles relatively short, broader medially with a deep sinuation along the inner margin and number of spines are scattered in the middle portion of the styles (Fig. 5a-d and Plate 1E).....*Sardia sp.*
 - Genital style foot shaped and not as above.....7
 7. Aedeagus tubular, slightly curved with a pair of process in the middle and another process subapically; Anal tube processes paired and shorter; Vertex is broader and more or less equal to its length; Wings are brownish in colour, veins are granulate and pterostigma present (Fig. 3a-d and Plate 1C)....*Perkinsiella sinensis* (**Kirkaldy**)
 - Aedeagus is not tubular as above and may be slightly decurved with a long flagellum or whip like.....8
 8. Vertex, pronotum reddish black with cream coloured carinae; Frons with conspicuous raised pits on either side of the median carina; Pygofer short dorsally, long and strongly convex ventrally, posterior opening relatively small, longer than broad; Anal segment collar like with a pair of slender processes directed ventrally; Diaphragm long dorsoventrally, with dorsal margin concave, deeply incised medially, medioventral process short, broader than long, quadrate (Fig. 1a-c and Plate 1A).....*Cemus sp.*

- Mesonotum with a pair of orange longitudinal bands between the white median and yellow-brown lateral carina; Pygofer slightly oblong to rounded; parameres small, bases sunken into deeply concave medioventral area, parallel basally, the apical one-third curved out and bent inward, truncated to slightly cleft apices; Anal style short and relatively small (Fig. 2a-c and Plate 1B).....*Peregrinus maidis* (Ashmead)

The most brief and important taxonomic and morphological characters of the above keyed species were provided here under for confirmation of identifications.

***Cemus* sp.** (Fig. 1a-c and Plate 1A)

The forewings with blackish dots all along the veins and fuscous maculae apically. Pygofer short dorsally, long and strongly convex ventrally, posterior opening relatively small, longer than broad. Anal segment collar like with a pair of slender processes directed ventrally. Aedeagus long, slightly decurved, with a long flagellum arising at apex, dorsal margin with one or two processes. Genital styles broader basally, gradually narrowed apically with spines.

***Peregrinus maidis* (Ashmead)** (Fig. 2a-c and Plate 1B)

Light yellowish brown to yellowish orange. Pygofer slightly oblong to rounded. Genital styles small, bases sunken into deeply concave medioventral area, parallel basally, the apical one-third curved out and bent inward, truncated to slightly cleft apices. Anal style short and relatively small. Aedeagus long, narrow and whip like with processes sub apically.

***Perkinsiella sinensis* Kirkaldy** (Fig. 3a-d and Plate 1C)

Brownish black in colour with vertex, pronotum and scutellum yellowish. Wings brownish, veins granulate and pterostigma present. Anal tube processes paired and shorter. Aedeagus tubular, slightly curved with a pair of process in the middle and another process subapically. Genital style foot shaped.

***Pyrilla perpusilla* (Distant)** (Fig. 4a-c and Plate 1D)

Uniformly ochraceous colored body, slightly paler beneath than above. Forewings semi-opaque, more or less uniformly yellowish brown with small black spots sparsely distributed all over the wing. Cephalic process well developed. The length of vertex more than twice the width at base and is elongated, rectangular in shape. Conjunctival hook of aedeagus very strongly developed and slightly twisted in the middle. Phallic appendage very much elongated. Aedeagus has a sinuation on the ventral aspect.

***Sardia* sp.** (Fig. 5a-d and Plate 1E)

The colouration of vertex, thorax and forewing dark brown with black fuscous markings. The clypeus is black in colour and gradually narrows apically. Pygofer broadly rounded, posterior opening longer dorsoventrally. Anal segment collar like with a pair of moderately longer, slender processes. Aedeagus more or less straight, tubular with subapical serration, gonopore apical. Genital styles relatively short, broader medially with a deep sinuation along the inner margin

and number of spines scattered in the middle portion of the styles.

***Stenocranus* sp.** (Fig. 6a-d and Plate 1F.)

Forewings subhyaline with pale yellowish. brown veins along apical margins. Pygofer often oblongate with anal segment and long and large style projected outward, medioventral area deeply concave forming a distinctly sunken base of slender genital styles; tips of genital styles usually narrowed and pointed; aedeagus long, slender, and pointed apically. Anal segment processes fused throughout the length with distal bifurcation.

***Tagasodes pusanus* (Distant)** (Fig. 7a-c and Plate 2A)

Forewing sub transparent, longer than wide with a pattern of dark markings and pterostigma. Pygofer moderately long, posterior opening slightly longer dorsoventrally than broad. Aedeagus wider basally, gradually narrowed and tubular, 2-3 spines present sub-apically, gonopore apical. Genital styles relatively flattened, trapezoidal distally and shallowly bifurcated.

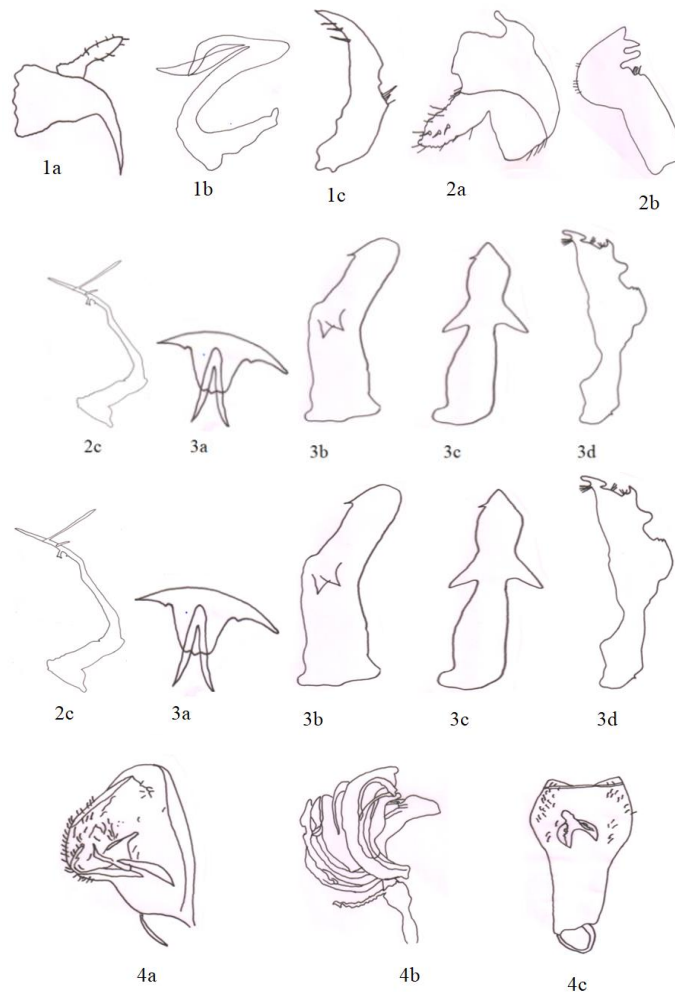
***Toya propinqua* (Fieber)** (Fig. 8a-c and Plate 2B)

Forewing without pterostigma and light stramineous. Pygofer dorsoventrally elongated with an elongated ventral opening. Diaphragm Y-shaped. A pair of moderately long slender spine like processes on collar like anal segment. Aedeagus tubular, serrated or with few teeth sub-apically below which slightly sinuated, gonopore apical. Genital styles flattened, broader, concave and wider in the middle with number of spines apically.

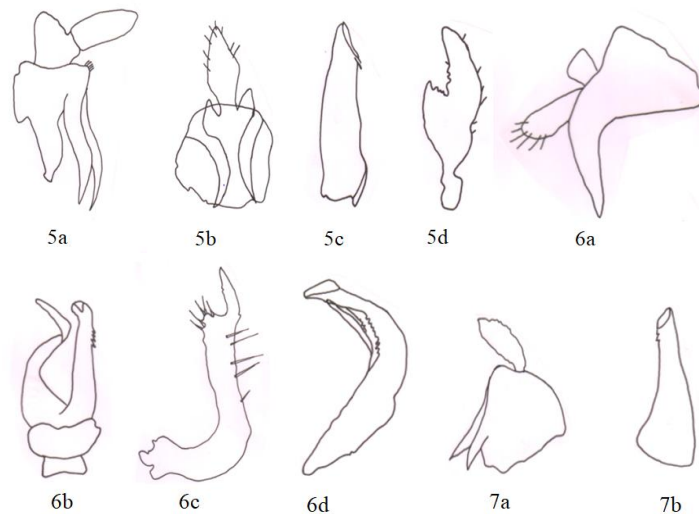
***Tropidocephala serendiba* (Melichar)** (Fig. 9a-c and Plate 2C)

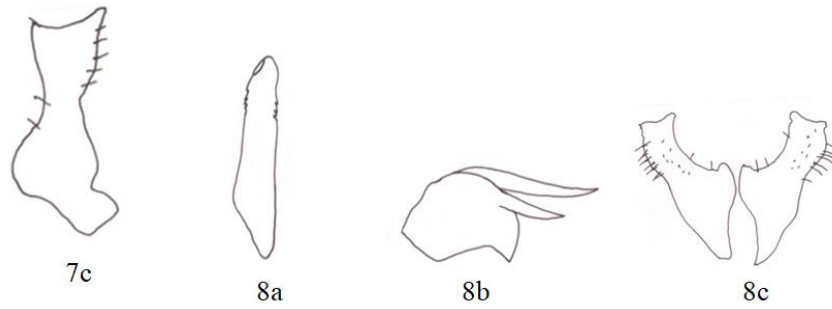
Body chocolate brown, greenish tinge on the pronotum and mid mesonotum. Anal style very much elongated and anal tube processes absent. Aedeagus broader basally and gradually narrowed towards apex and aedeagal process sickle shaped, arises from base of the aedeagus. Genital style with sclerotised curved apex and also with sclerotised serrated process arising from inner side of the style.

Twenty eight species of planthoppers belonging to the families viz., Delphacidae, Lophopidae, Meenoplidae and Cixiidae of Fulgoroidae were described by Wilson and Claridge (1991) on rice and sugarcane. *Pyrilla aberrans* was reported by Mustaque and Akbar (1998) on sugarcane, rice, maize and sorghum. In India from rice and sugarcane ecosystems, 23 delphacid planthoppers belonging to Delphacidae family were reported by Rao and Chalam (2007). Five planthoppers of delphacidae family viz., *Cemus* sp., *Nilaparvata lugens*, *Sogatella furcifera*, *Sardia rostrata*, and *Tagasodes pusanus* were reported by Shashank (2009) which are associated with rice and sugarcane crop ecosystems from Karnataka. Hasibuan *et al.*, (2021) identified two planthoppers viz., *Peregrinus maidis*, *Stenocranus pacivicus*, belonging to Delphacidae family were identified in Lampung Province on corn plants. Faruq *et.al.*, (2018) identified four planthopper species from rice ecosystems. Ramya *et.al.*, (2018) reported two new species of planthoppers in the genera *Parasogata* and *Eoerysa* from Northeast India.

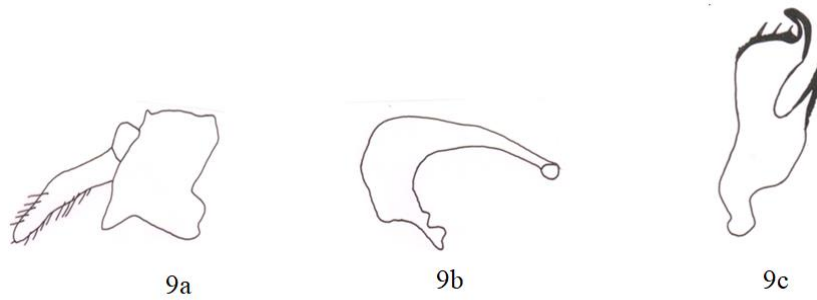


Figs. 1-4 1a-c *Cemus* sp. 1a. anal tube; 1b. aedeagus, lateral view; 1c. style. **Figs.2a-c** *Peregrinus maidis* (Ashmead) 2a. anal tube; 2b. style; 2c. aedeagus, lateral view; **Figs. 3a-d.** *Perkinsiella sinensis* (Kirkaldy) 3a. anal tube; 3b & 3c aedeagus (different orientations); 3d. Style; **Figs. 4a-c.** *Pyrilla perpusilla* (Distant): 4a. genital style, lateral view; 4b. aedeagus; 4c. anal tube.





Figs. 5-8. 5a-d. *Sardia* sp.: 5a. & 5b. anal tube (different orientations); 5c. aedeagus, lateral view; 5d. style; **Figs. 6a-d.** *Stenocranus* sp.: 6a. anal tube; 6b & 6c. aedeagus, different orientations; 6d. style; **Figs. 7a-c.** *Tagasodes pusanus* (Asche and Wilson):7a. anal tube;7b. Aedeagus; 7c. Style; **Figs. 8a-c.** *Toya propinqua* (Fieber): 8a. aedeagus, lateral view; 8b. Anal tube; 8c. Style



Figs. 9 a-c *Tropidocephala serendiba* (Melichar) 9a. anal tube; 9b. aedeagus, lateral view; 9c. style.



(A) *Cemus* sp.



(B) *Peregrinus maidis* (Ashmead)



(C) *Perkinsiella sinensis* (kirkaldy)



(D) *Pyrilla perpusiella* (Distant)



(E) *Sardia* sp.



(F) *Stenocranus* sp.

PLATE 1.



(A) *Tagasodes pusanus* (Asche and Wilson)



(B) *Toya propinqua* (Distant)



(C) *Tropidocephala serendiba* (Stal)

PLATE 2.

CONCLUSIONS

In the present studies, nine planthopper species belonging to family Delphacidae and Lophopidae from sugarcane crop eco systems were collected, identified, described and illustrated for easy and quick identification. An identification key well supported with illustrations was also provided which will be useful aid to identify the planthoppers by research and extension workers. The accurate identification of planthopper fauna associated with a particular agro-ecosystem is very much needed along with their identification key to formulate integrated management strategies whenever they attain pest status.

Declaration. I hereby declare that research paper entitled “Taxonomy and General Biology of Planthopper fauna associated with Sugarcane crop-ecosystems of Southern and Scarce rainfall zones of Andhra Pradesh” submitted to Acharya NG Ranga Agricultural University for the award of degree of Master of Science in Agriculture is the result of original research work done by me under the supervision of Dr. M.S.V. Chalam, Professor, department of Entomology, S.V. Agricultural College, Tirupati, ANGRAU.

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Conflict of Interest. None.

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