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New records of fulgoroid planthoppers (Fulgoroidea: Delphacidae and cixidae) from India and Andhra Pradesh

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Abstract

Survey was conducted in the Rayalaseema region of Andhra Pradesh to collect planthoppers (Fulgoroidea: Hemiptera) for taxonomic studies with an objective of understanding the biodiversity of planthoppers in state of Andhra Pradesh. The planthoppers were collected by sweep netting and male genitalia were dissected for taxonomic studies. Two planthoppers species viz., *Cixiius clitellus* (Ball) and *Cixiius (Orinocixius)* sp. (Super family – Fulgoroidea and Family Cixidae) were reported for the first time from India. Four planthopper species viz., *Opiconsiva* sp., *Stenocranus* sp., *Toya bridwelli* (Distant) and *Tropidocephala serendiba* (Stal), (Super Family- Fulgoroidea and Family Delphacidae) were reported for the first time from Andhra Pradesh. The morphological and taxonomic characters along with diagrams of male genital structures and colour photographs were provided for easy identification of these new records of planthoppers.

Keywords: *Cixiius*, *Opiconsiva*, *Stenocranus*, *Tropidocephala* and *Toya*

1. Introduction

Hemiptera is a large and diverse group of insects, varying considerably in body form, wings, antennae, life histories, and food habits. Earlier researchers have recognized two orders for these insects – the Hemiptera or true bugs and the Homoptera, including cicadas, hoppers, aphids, and their allies. The name planthopper is used to refer to any insect in the superfamily Fulgoroidea (division Auchenorrhyncha; order Hemiptera). Distributed worldwide, planthoppers are phytophagous, though few are considered as pests and are included in a single superfamily i.e., Fulgoroidea. Fulgoroids are most reliably distinguished from the other members of the classical “Homoptera” by two features viz., the bifurcate (“Y”- shaped) anal vein in the forewing, and the thickened, three-segmented antennae, with a generally round or egg-shaped third segment that bears a fine filamentous arista^[1, 2].

Planthoppers belong to the superfamily Fulgoroidea in Fulgomorpha of Auchenorrhynchos-Hemiptera comprising twenty families. The economically important planthoppers were included in families viz., Cixidae, Delphacidae, Derbidae, Dictyophoridae, Eurybrachidae, Flatidae, Fulgoridae, Tettigometridae and Tropiduchidae^[3]. The Delphacidae is the largest family of planthoppers belonging to the superfamily Fulgoroidea comprising of a number of important crop pests. Delphacids are devastating pests on major agricultural crops viz., rice, sugarcane, maize, sorghum, and other cereals. The Delphacids are the most diverse and economically important family of planthoppers, comprising about 1835 species of which 55 species are known pests on 25 crops^[4]. Cixidae is the second largest family under super family Fulgoroidea and many members of the family Cixidae were reported to feed on members of the family Graminae^[5]. The present studies were conducted with an objective to study the biodiversity of planthopper fauna in the Rayalaseema region of Andhra Pradesh and to provide identification characters of new records in Indian and Andhra Pradesh.

2. Materials 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. Sweep net technique is followed for collection of the planthopper specimens. 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

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Collected planthoppers were 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. The insect specimens were mounted on thick triangular paper points with the help of gum, on the right hand side of the thorax to facilitate the examination of head, wings, legs and abdomen from all desired angles. The male planthopper specimens were gently supported on a cork piece on its back and the abdomen was gently detached from the thorax with the help of sharp needle by pressing down at the junction of the thorax and abdomen. The detached abdomen was digested with few millilitres of 10 per cent KOH (Potassium Hydroxide). The digested soft tissues or internal body contents were pressed out by means of a pair of fine needles or forceps. The male genitalia were dissected out under Binocular Stereo Zoom Microscope for detailed examination and for illustrations. For taxonomic descriptions of male genitalia and different body parts standard terminology^[3] was followed.

3. Results and Discussion

During the present studies, two planthoppers species viz., *Cixius clitellus* (Ball) and *Cixius (Orinocixius)* sp. (Super family-Fulgoroidea; Family Cixiidae) were reported for the first time from India. Four planthopper species viz., *Tropidocephala serendiba* (Stal), *Toya bridwelli* (Distant), *Stenocranus* sp. and *Opiconsiva* sp. (Super Family-Fulgoroidea; Family Delphacidae,) were reported for the first time from Andhra Pradesh. These planthoppers were taxonomically described to facilitate easy identification.

Table 1: List of newly recorded Planthoppers

S. No.	Crop eco-system	Name of the Planthopper	Family
1	Rice	<i>Cixius clitellus</i> (Ball)	Cixiidae
		<i>Cixius (Orinocixius)</i> sp.	Cixiidae
		<i>Opiconsiva</i> sp.	Delphacidae
		<i>Stenocranus</i> sp.	Delphacidae
		<i>Toya bridwelli</i> (Distant)	Delphacidae
2	Sugarcane	<i>Tropidocephala serendiba</i> (Stal)	Delphacidae
		<i>Stenocranus</i> sp.	Delphacidae
		<i>Tropidocephala serendiba</i> (Stal)	Delphacidae

The most brief and important taxonomic and morphological characters of the above mentioned planthoppers were

Cixius clitellus (Ball) (Figs. 1-4 and Plate - A)

Colour: Head, thorax and wings ochraceous brown in colour. Veins of forewings with conspicuous dark tubercles. Scutellum dark brown in colour, Wings granulose and with fuscous maculae.

External morphology: Mesonotum with three conspicuous carinae. Tegulae large, pronotum deeply concave in anterior region. Compound eyes bulged, projected from the sides of the frons. Vertex rounded posteriorly.

Male genitalia: Pygofer broad, posterior margin of pygofer not smoothly rounded. Genital styles simple, flattened, anal tube long and narrow. Aedeagus with a pair of apical bifid processes which are ventrally directed. The longest aedeagal process is sharply down turned towards its end.

Cixius (Orinocixius) sp. (Figs. 5-8 and Plate - B)

Colour: Head, thorax and wings are pale brown in colour. Veins of forewings with faint tubercles. Scutellum light

brown in colour. Wings granulose and with faint fuscous maculae. Frons and postclypeus dark brown, edges pale coloured.

External morphology: Mesonotum with five conspicuous carinae and the carinae gradually fades off in the posterior margin. Tegulae large, pronotum deeply concave in anterior region. Compound eyes bulged, projected from the sides of the frons. Vertex rounded posteriorly.

Male genitalia: Pygofer broad, posterior margin of pygofer smoothly rounded with a conical projection. Anal tube with two conical projections. Genital styles simple, basally bifid with a broad and round top. Aedeagal shaft long and slender, with a pair of apical bifid processes. Base of the aedeagal shaft with short and stout sinuation.

Opiconsiva sp. (Figs. 9-12 and Plate - C)

Colour: Body Stramineous. Mesonotum and scutellum shiny black.

External morphology: Head including eyes narrower than pronotum. Vertex with distinct Y-shaped carinae. Frons with pale carinae, wider just above frontoclypeal suture. Genae and clypeus fuscous. Post clypeus as long as wide at base, carinae pale. Rostrum surpassing mesocoxae. Antennal scape longer than wide, pedicel longer than scape. Forewing with hyaline venation. Thorax tricarinate.

Male genitalia: Anal tube processes present and directed ventrally. Diaphragm cone shaped and sclerotized. Aedeagus tubular with dorsal basal extensions. Style broader and inner margin deeply concave.

Stenocranus sp. (Figs. 13-16 and Plate - D)

Colour: Body colouration pale yellowish brown, frons pale yellowish brown. Clypeus and genae pale yellow-brown; antennae yellowish. Forewings subhyaline with pale yellowish brown veins along apical margins; legs and abdomen yellowish.

External Morphology: Head including compound eyes distinctly narrower than pronotum. Vertex longer than broad at base with distinct Y-shaped carina. Frons tricarinate. Thorax tricarinate, lateral carinae of prothorax almost reaching the hind margin. Wings hyaline, pterostigma absent. Post-tibial spur lamellate with teeth on hind margin. Tibial spurs with 23 spines.

Male Genitalia: Pygofer often oblong 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

Toya bridwelli (Muir) (Figs. 17-19 and Plate - E)

Colour: Ochraceous.

External morphology: Head slightly narrower than pronotum. Forewings subhyaline, granulated. Vertex with distinct Y-shaped carinae.

Male genitalia: Anal tube processes paired and longer than its length. Aedeagus bulged with a row of small teeth ascending from ventro dorsal to apically on both sides. Style more or less quadrangular with a tooth like extension meso apically.

***Tropidocephala serendiba* (Melichar) (Figs. 20- 22 and Plate - F)**

Colour: Body chocolate brown, greenish tinge on the pronotum and mid mesonotum; vertex, basal half of frons, and genae green.

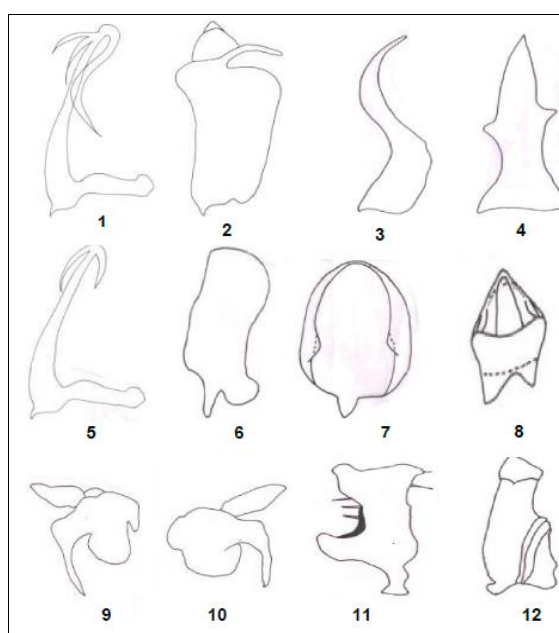
External morphology: Vertex slightly elongated between the eyes. Forewings subhyaline, granulated, claval base tinged with pale yellow. Vein M with a small, elevated mound-like brown spot before and after cross veins. Sc+R with a pale white-yellow spine. Forewings longer than abdomen, veins granulate with black coloured maculae near clavus and pterostigma present.

Male genitalia: Anal style very much elongated and anal tube process 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.

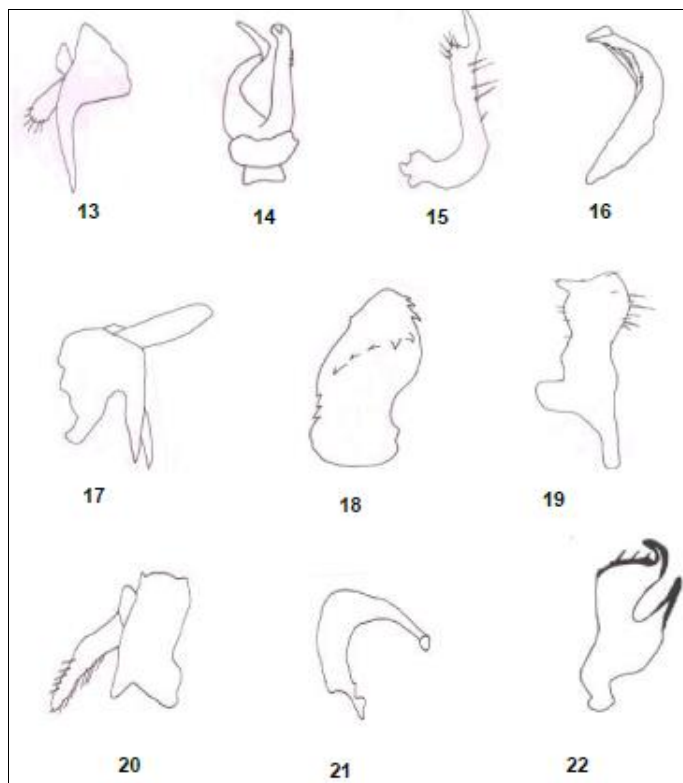
Nilaparvata lugens (Stal), *Sogatella furcifera* (Horvath) and *Laodelphax striatellus* (Fallen) were considered as major pests on rice from Japan and along with these planthoppers twenty other planthopper species belonging to genera viz., *Tagosodes*, *Sogatodes* and *Harmalia* were reported [6]. A comprehensive account of leafhopper and planthoppers found on rice in the major rice growing areas of world was published [7] describing 28 species of planthoppers belonging to the families of Delphacidae, Lophopidae, Meenoplidae and Cixiidae belonging to super family Fulgoroidea. Seven planthopper species belonging to three genera viz., *Nilaparvatha*, *Sogatella* and *Harmalia* associated with different rice ecosystems of Andhra Pradesh were reported [8]. A study of planthopper diversity from sugarcane and rice crop ecosystems of South India revealed the existence of 23 planthopper species of which, *Nilaparvata lugens*, *Sogatella furcifera*, *S. kolophon*, *S. vibix*, *Tagosodes pusanus*, *Harmalia anacharsis* and *Pyrilla perpusilla* [9] were considered as major pests. Eight planthopper species viz., *Pyrilla perpusilla pusana* (Distant); *Toya propinqua* (Fieber); *Tagosodes pusanus* (Distant); *Tethron* Sp., *Sogatella furcifera* (Horvath); *Sogatella kolophon* (Kirkaldy); *Harmalia anacharsis* (Fennah) and *Peregrinus maidis* (Ashmead) from sugarcane crop ecosystems of North Coastal Zone of Andhra Pradesh were reported [10].

Table 2: Morphometric studies on planthopper fauna (in millimetre)- (average of 10 specimens)

S. No.	Planthopper species	Length of body	Length of wing	Inter-ocular distance	Pronotum width	Width of insect	Width of head	Scutellum width	Length of Parameres	Width of Parameres	Length of aedeagus	Width of aedeagus
1.	<i>Cixius clitellus</i> (Ball)	7.22	6.62	0.48	1.62	2.65	1.25	1.02	0.25	0.15	0.38	0.09
2.	<i>Cixius</i> (<i>Orinocixius</i>) sp.	7.45	6.35	0.52	1.95	2.42	1.20	0.98	0.21	0.14	0.29	0.07
3.	<i>Opiconsiva</i> sp.	3.25	2.38	0.22	0.75	0.98	0.74	0.51	0.19	0.15	0.42	0.08
4.	<i>Stenocranus</i> sp.	4.89	3.95	0.22	1.09	1.27	0.90	0.81	0.20	0.17	0.29	0.08
5.	<i>Toya bridwelli</i> (Distant)	3.45	2.75	0.90	0.20	0.71	0.69	0.41	0.16	0.13	0.22	0.08
6.	<i>Tropidocephala serendiba</i> (Stall)	4.10	3.35	0.34	0.65	1.01	0.51	0.50	0.21	0.18	0.31	0.08



Figs 1-4: *Cixius clitellus* (Ball): 1. aedeagus; 2. anal tube process; 3. genital style lateral view; 4. genital style dorsal view. Figs. 5-8. *Cixius* (*Orinocixius*) sp.: 5. aedeagus; 6. genital style; 7. anal tube dorsal view; 8. anal tube caudal view. Figs. 9-12. *Opiconsiva* sp.: 9 & 10. Anal tubes (different orientations), 11. Style; 12. Aedeagus, lateral view.



Figs 13-16: *Stenocranus* sp.: 13. Anal tube; 14 & 15. Aedeagus, different orientations; 16. Style; Figs. 17-19. *Toya bridwelli* (Muir): 17. Anal tube; 18. Aedeagus, lateral view; 19. Style; Figs.20-22: *Tropidocephala se*

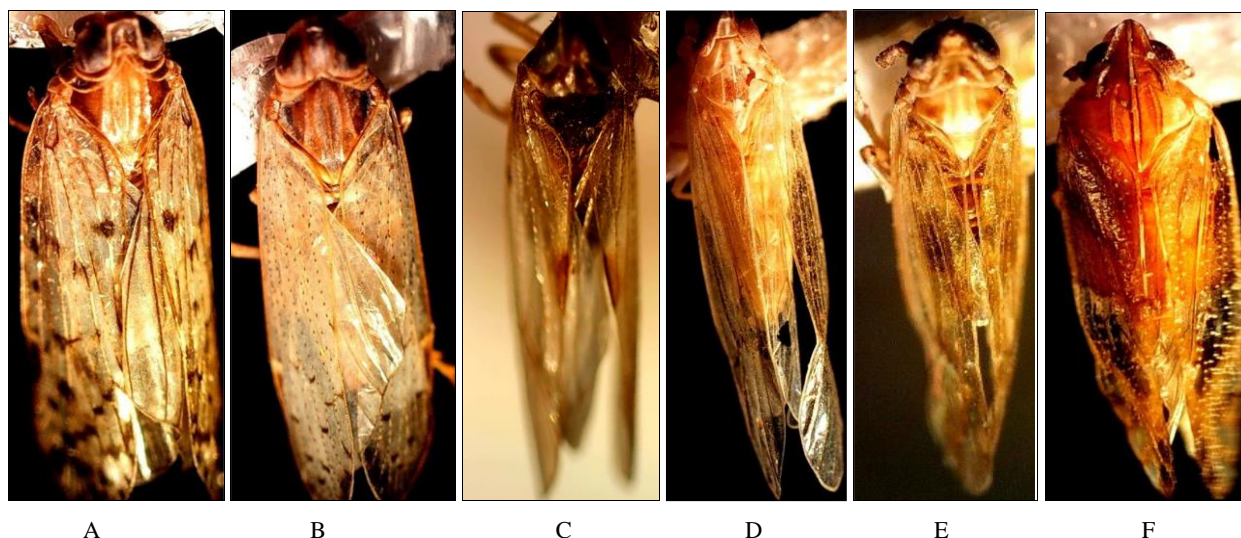


Plate A: *Cixiius clitellus* (Ball); **Plate B:** *Cixiius (Orinocixius)* sp.; **Plate C:** *Opiconsiva* sp. **Plate D:** *Stenocranus* sp. **Plate E:** *Toya bridwelli* (Distant); **Plate F:** *Tropidocephala serendiba* (Stal)

4. Conclusion

In the present studies, Two planthoppers species viz., *Cixiius clitellus* (Ball) and *Cixiius (Orinocixius)* sp. were reported for the first time from India. Four planthopper species viz., *Stenocranus* sp., *Opiconsiva* sp., *Toya bridwelli* (Distant) and *Tropidocephala serendiba* (Stal) were reported for the first time from Andhra Pradesh. Important morphological characters, male genital characters and colour photographs were provided for identification of these species.

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