

Taxonomic studies on Idiocerini Leafhoppers (Hemiptera: Cicadellidae: Eurymelinae: Idiocerini) of Sri Lanka

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Abstract—Seven species of Leafhoppers belong to the tribe: Idiocerini of Subfamily Eurymelinae in Family Cicadellidae, are reported from Sri Lanka based on the field study. Four species of *Idioscopus*, and each one species of genera *Amritodus*, *Busoniomimus* and *Jogocerus* were described with their distribution in the country. *Busoniomimus manjunathi* Viraktamath and Viraktamath and *Jogocerus freytagi* were described for the first time from Sri Lanka.

Keywords—Idiocerini, *Busoniomimus*, *Jogocerus*, *Idioscopus*

I. INTRODUCTION

Eurymelinae is one of the largest subfamily of arboreal leafhoppers. Species of this group feed on a wide variety of trees and shrubs, including several of economic importance with some considered agricultural pests (Fletcher & Dangerfield, 2002; Gnanaswaran *et al.*, 2007). This group is distributed worldwide and includes more than 1300 species in 174 genera in 11 tribes. Based on the phylogenetic analysis with molecular and morphological characteristics, the expanded concept of Eurymelinae (Dietrich & Thomas, 2018) was confirmed and six more monophyletic groups are recognized as new tribes and status of Idiocerini is redefined by Xue, *et al.*, 2020.

Tribe Idiocerini was earlier placed as Subfamily Idiocerinae of family Cicadellidae, now confirmed as one of the tribe in Subfamily Eurymelinae, includes the species of 59 genera (Xue, *et al.*, 2020). They distributed Afrotropical, Australian, Madagascar, Nearctic, Oriental and Palearctic regions.

Among 06 genera reported from Sri Lanka, under subfamily Idiocerinae, three genera namely *Lankacerus* Viraktamath, *Neoscopus* Viraktamath and *Ceylonoscopus* Viraktamath are now placed in tribe- Megipocedrini Isaeve of Sub Family Eurymelinae. Likewise, genus *Balocha* Distant is now placed in the tribe, Balocerini of the same subfamily. But, *Amritodus* Anufriev, *Idioscopus* Baker and *Periacerus* Viraktamath & Parvathi are included in the Tribe Idiocerini (Xue, *et al.*, 2020).

Idiocerini Baker

Idiocerini Baker, 1915: 317. Type genus: *Idiocerus* Lewis, 1834:47, original designation.

Idiocerinae Baker: Evans, 1934:140

Idiocerini Baker: Xue, *et al.*, 2020:698

The tribe Idiocerini is a moderately large group of leafhoppers which shows cosmopolitan distribution. The members of this tribe are small to medium-sized wedge shaped with short broad vertex that is rounded to the front; face is broad. Lateral frontal sutures are extending to ocelli; ocelli on face; distance between ocelli is less than distance between antennal pits. Antennae are moderately long and the flagellum often with disc in males. Crown is short and broad usually striate; the pronotum does not extend beyond eyes; forewing with two or three subapical cells; Appendix developed and bordering two apical cells; hind femur with setal formula 2+0 or 2+1; subgenital plate broadened in lateral view, depressed in ventral view; style sickle-shaped, usually without pre apical lobe, often with fine or stout pre apical setae on dorsal margin; aedeagus tube-like, usually with paired processes, dorsal apodeme usually developed, gonopore on ventral margin apical or subapical (Xue, *at.al.*, 2020).

The first Idiocerini leafhopper from Sri Lanka was discovered by Melichar (1903). He described six species under Genus *Idiocerus* Lewis and all those species have now been transferred to other genera by subsequent workers. Later Distant (1908 and 1916) treated three species from the Indian Subcontinent in the genera *Idiocerus* Lewis.

When this study was planned to explore the members of Idiocerini in Sri Lanka, the Tribe was represented by only 05species of 03 genera (Melichar, 1903, Distant, 1908; Viraktamath, and Parvathi, 2002, Viraktamath, 2007 and Gnanaswaran, *et al.*, 2007).

II. MATERIALS AND METHODOLOGY

Adult leafhoppers collected in the field by sweep netting and preserved in dry method at the Museum, were processed to study their taxonomically important morphologic characteristics such as head sutures, wing venation, hind leg spinulation and genitalia of male and female (Knight, 1965). Character states were examined the specimens under a

stereomicroscope. The dissected genitalia were stored in a micro vial with fresh glycerol and pinned below the specimen from which the abdomen was removed.

Repositories: The specimens collected at the field from 2006 -2021 have been deposited in the Entomological museums of Department of Zoology, University of Jaffna, Sri Lanka, and of Department of Agriculture Biology, University of Peradeniya, Sri Lanka, have been used in this work.

III. RESULTS AND DISCUSSION

A total of 07 species belonging to 4 genera were found from field collections made in 17 districts of the country. They are *Busonomimus manjunathi*, *Jogocerus feytagi*, *Idioscopus unimaculatus*, *I.nagpurensis*, *I. clypealis*, *I. nitidulus*, and *Amritodus brevistylus*. The distribution of all species and the morphological characteristics of first three species are described in this paper, with illustrations. The rest four species have already been reported as pests of mango in Sri Lanka (Gnaneswaran *et al.*, 2017).

Taxonomic information on the genera and species reported in Sri Lanka

Busonomimus Maldonado 1977

A. Genus *Busonomimus* Maldonado 1977

Busonomimus Maldonado, 1977:491

Genus *Busonomimus* was established by Maldonado Capriles (1977) with *Idiocerus minor* Bierman as type species. It consists 05 species with two: *B. manjunathi* Viraktamath and *B. mudigerensis* (Viraktamath, 1976), have been known from India and *Busonomimus minor* (Bierman, 1908) in Indonesia. *B. mindanaensis* (Baker) –in the Philippine. *B. setulistylus* Viraktamath and Murphy – in Singapore.

The genus is characterized by transversely striate vertex, long labium reaching to or beyond hind coxae, two anteapical cells which is either closed or open behind; Pygofer with a ventral triangulate lobe on each side, posterior margin of pygofer with or without an internal process, stem of the connective longer, aedeagal shaft postulate.

Remarks: In this study *B. manjunathi* was collected from Kandy district and recorded for the first time from Sri Lanka.

Busonomimus manjunathi Viraktamath and Viraktamath (Plate:1-f, vi and Plate:2- f,vi)

Busonomimus manjunathi Viraktamath and Viraktamath, 1985:305

Colouration: As described by Viraktamath and Viraktamath (1985)

Structure: vertex wide, 3.6 times wider than its length; face transversely rugulose dorsad of ocelli, rest of the face

shagreened. Frontoclypeus convex; clypellus widened apically. Labium long; extending up to hind coxae. Pronotum and scutellum are shagreened. Pronotum 2.47 times wider than its length. Scutellum is (x 2) longer than the pronotum. Fore wing veins margined by circular pits on either side in their basal half. Those pits being more prominent along claval veins; two subapical cells with closed outer one.

Male genitalia: Male pygofer elongate and caudally angularly pointed with a long single ventral processes and an angular projection on ventral margin. Tenth segment with ventrally directed process; male genital plate widened distally with long hair-like marginal setae. Style is robust; connective longer than wide, wider at base. Aedeagus with a strongly developed basal strut, dorsal apodeme short arising almost in the middle of aedeagus, shaft is smoothly curved dorsally and much narrowed beyond gonopore. Apical 1/3 of the shaft postulate and a pair of caudally directed processes arise at base of shaft. Gonopore is sub apical.

Measurements: Male 3.9 mm long; 1.27 mm wide across eyes

Material examined: SRI LANKA: MCWZ: 1 male, Hanguranketa 20 x.2007.

Collectors: RGnaneswaran

Distribution: Sri Lanka (Hanguranketa) and India

Host plants : Clove (Sri Lanka), *Garcinia combogia* (Mercikuty *et al.*, 2002); *Garcinia gummi-gutta* (Mathew, 2005)

B. *Jogocerus* Viraktamath 1979

Viraktamath (1979) described the genus *Jogocerus* with *Jogocerus freytagi* Viraktamath as its type species from India. He discussed its relationship with other idiocerines as “*Jogocerus* resembles *Tasnimocerus* Ghauri in the shape of pronotum which is transversely rugose, but differs from it in having a narrow based clypellus and by its distinct male genitalia. It shares the character of ventral pygoferal process with *Amritodes* Anufriev. But the transversely rugulose pronotum, U-shaped aedeagus, distally excavate connective distinguishes it”.

Genus *Jogocerus* Viraktamath.

Jogocerus Viraktamath, 1979:17

Type species *Jogocerus freytagi* Viraktamath, 1979 by original description.

Head distinctly wider than pronotum. Vertex, Pronotum, Scutellum and face dorsad of ocelli finely transversely rugose. Face including eyes wider than long. Clypellus projecting beyond genae, gradually widened distally and truncate. Pronotum about half as long as broad. Scutellum slightly longer than pronotum forewing with four apical cells and 2 or 3 subapical cells. r-m cross vein present. Moderately broad, hind femora with setal formula 2+1, crown with black spot on either side of median line, scutellum with basal triangle black (Viraktamath, 1979).

Male pygofer with or without well-developed dorsal apodemes and collar process and ventral pygofer process. Sub genital plates elongate, narrow with a few like- setae. Style with apophysis elongate, curved laterally without macrosetae on outer margin connective with anterior half broad, caudal half with 'U' shaped excavation caudally. Aedeagus with well-developed dorsal apodeme with pair of lateral processes arising sub apically. Gonopore sub apical on ventral margin.

VII sternum convexly produced posterior margin of median area narrowly concave in ventral view. 2nd valvula regularly broadened in lateral view, bearing approximately 23-25 teeth along dorsal margin.

Remarks: This genus represented by two species namely *Jogocerus freytagi* Viraktamath, from India (Viraktamath, 1979) and *Jogocerus hainanensis* Zang and Li from China (Zhang and Li, 2008). During this study both male and female specimens of *J. freytagi* were collected for the first time from Sri Lanka.

***Jogocerus freytagi* Viraktamath**(Plate:1-g, 7 and Plate:2-g,7)

*Jogocerus freytagi*Viraktamath, 1979:17

Coloration: Similar to the type species described by Viraktamath (1979). Greenish yellow when fresh; two round spots on vertex, two triangles at basal angles of scutellum black; two smaller round spots on meso sternum and two other smaller spots below the them. Abdomen greenish yellow. eyes dark brown or black.

Structure: Head 1.12 times wider than pronotum in male and 1.17 times in female. vertex, pronotum, scutellum and face, dorsad of ocelli transversely striated. Face including eyes 1.2 times wider than long. clypellus extending beyond genae, gradually widened distally and truncate. Pronotum 2.1 times broader than its length. and 3.4 times longer than median length of vertex. Scutellum slightly longer than pronotum forewings with four apical cells and 3 sub apical cells, r-m cross vein present. Moderately broad, hind femora with setal formula 2+1 crown with black spot on either side of median line, scutellum with basal triangle black.

Male genitalia: Pygofer with well-developed dorsal apodemes and collar process and ventral pygofer process, Sub genital plates elongate, narrow with a few hair like- setae .Style with apophysis elongate almost as long as genital plate, curved dorso-caudally, with serrated ventral margin. Connective as in aedeagus with well-developed dorsal apodeme of 2/3 length of the shaft. Shaft with pair of lateral processes arising sub apically. Each process with a lateral short tooth. Gonopore sub apical.

Female : Ovipositor extending beyond the pygofer. Hind margin of the seventh sternite convexly produced and projecting beyond the pygofer. Second pair of gonapophysis with series of denticles restricted to caudal 1/2 of the length.

Measurements: Male 4.56 mm long; 1.66 mm wide across eyes. Female 5.56 mm long; 1.78 mm wide across eyes.

Material examined: SRI LANKA: LCIZ 2 males, 1 female Ibbagamuwa, 23 xi.2007.

Collectors: R Gnaneswaran

Distribution: Sri Lanka (Ibbagamuwa) and India (Viraktamath, 1979)

Host plant :Atteriya (*Murraya paniculata*)

C. *Idioscopus* Baker, 1915

The genus *Idioscopus* was described by Baker (1915) with *Idiocerus clypealis* Lethierry as the type species and then was redefined by Maldonado Capriles (1964) who transferred several species of *Idiocerus* described from Oriental region, to this genus. Freytag and Knight (1966) described 7 species from Madagascar and differentiated the *Idioscopus* from *Idiocerus* by the presence of a sub apical spine on the hind femur in addition to the two apical one. So far the genus comprises nearly 30 species worldwide, with 20 out of them from the Indian subcontinent (Viraktamath, (1979), includes *I. clypealis*, *I. nagpurensis* and *I. nitidulus*, known to occur in Sri Lanka (Gnaneswaran, et al., 2007).

During this study, one species namely *I. unimaculatus* (Melicher) was collected at Pereadeniya, after its first report by Melicher, 1903

***Idioscopus unimaculatus* (Melichar)** (Plate:1-d, 4 and Plate:2- d,4)

Idiocerus unimaculatus Melichar 1903: 149

Pedioscopus unimaculatus (Melichar) Baker,1915:318

"*Pedioscopus* " *unimaculatus* (Melichar), Maldonado Capriles,1972:542

Colouration: Colours as described by Melichar (1903). (Plate: 1-d,4; Plate:2-d,4)

General colour light brownish yellow. face convexed , light yellow without any marks, ocelli small clear; antennae pale yellow; eyes large, grayish pale yellow. Pronotum pale yellow, no marks, scutellum wax yellow with a large round black dot occupying the intermediate space between the base and the transverse line; tegmina brownish with paler veins, an opaque greenish yellow mark at base of clavus. Outer apical cell triangular; a dark brown spot at the tip of the 2nd apical cell; hind wings hyaline with brown veins; ventral body pale yellow; dorsal body dark brown. Legs pale yellow; at inside end of the front tibiae in males with distinct black dot, setae arising from this area dark brown; but in female either pale dot or no mark at the end of the front tibia; all the claws brown.

Structure: Vertex and face dorsad of ocelli transversely striate, rest of face shagreen. Vertex with inter ocular distance 4 times as wide as its median length. Face convex, wider than long. Labium reaching anterior extremities of hind coxae. Clypellus with wide apex and lateral margins concave. Pronotum is shagreen, 2.19 times wider than its length and 2.6 times longer than the vertex, posterior margin

slightly concave at the middle. Scutellum shagreen, slightly longer than pronotum (x 1.2). Male eighth sternite with convex hind margin. Forewing with 4 apical and 3 antepical cells, venation as in plate 1-4. Claval veins and basal parts of other veins lined with two rows of prominent pits. Hind femoral spinulation 2+1 but in some female, left femur with ill developed spines as 2+0.

Male genitalia: Pygofer is elongate. Sub genital plates elongate narrow basally than remainder, bearing long hair-like setae at dorsal and ventral margin up to the apex. Anal collar process bluntly bifurcate. Style strongly arched apophysis almost twice as long as the part anterior to articulation with connective: apophysis slightly narrowed caudally with crenulated ventral margin and with a sub apical tooth. Connective as about as wide as long aedeagus with a well-developed dorsal apodeme reaching nearly 1/3 length of shaft. A pair of sub apical long filamentous processes with serrated outer margin, extending beyond the base of the aedeagus. Shaft narrow with rounded apex. Gonopore at the 1/3 of the shaft from the apex.

Female genitalia: Seventh sternum with anterior margin convex. Ovipositor exceeding pygofer, second pair of gonophysis with slightly developed denticles restricted to 1/3th of its length.

Measurements: male 1- 3.96 ± 0.04mm ; female 1- 4.16±0.02 mm

Material examined: SRI LANKA MCWZ: 6 males, 3 females, Peradeniya, 14.iii.2006; 3 males, 3 females, Peradeniya 29.i.2007; 5 males, 3 females, Peradeniya, 12.xiii.2008; 30 males, 41 females, Peradeniya, 12.i.2009; 2 males, 5 females, Peradeniya, 14.iii.2020; 6 males, 11 females 28.i.2021.

Host plants : *Semecarpus coriacea* (Anacardiaceae)

Collectors: RGnaneswaran, UGLT Gunawardhana

Distribution : Sri Lanka (Peradeniya)

Remarks: Melichar (1903) described the species in the genus *Idiocerus* Lewis. Later Baker (1915) moved it to the genus *Pedioscopus*. But Maldonado Capriles (1972) did not accept this transfer and retained the species provisionally in *Pedioscopus* for further revision. The species has all the characters of the genus *Idioscopus* and is transferred to this genus. In this study, large number of males and females of this species were collected from its type locality (Peradeniya) in Sri Lanka after a century of its description by Melichar (1903).

The species can readily be recognized by the immaculate face and large round spot on scutellum and lemon yellow spot on forewing clavus. It externally resembles *Idioscopus spectabilis* Viraktamath from India, but differs in coloration and structure of aedeagus.

D. *Amritodus* Anufriev 1970

Genus *Amritodus* was established by Anufriev (1970), with *Idiocerus atkinsoni* (Lethierry) as its type species. Four

species of *Amritodus* have been described from Indian subcontinent and they all are serious pests of mango (Viraktamath, 1989). They are *A.atkinsoni* (Lethierry) Anufriev (1970), *A.brevistylus* Viraktamath (1976); *A.saeedi* Ahamed *et al.*, (1980) in Pakistan, *A.brevis* Viraktamath (1987). Of those, presence of two species such as *A.atkinsoni* and *A.brevistylus*, have already been reported from Sri Lanka (Melichar, 1903, Wijesekara and Menike, 1997) respectively. However, *A.atkinsoni* was not found in any sites that surveyed during this study. *A.brevistylus* was recorded throughout the country along with *Idioscopus* species (Gnaneswaran, *et al.*, 2007)

E. *Periacerus* Viraktamath and Parvathi 2002

The genus *Periacerus* was described by Viraktamath and Parvathi (2002) with *Idioscopus lalithae* Viraktamath as the type species. Two other species: *Periacerus lankensis* Viraktamath and Parvathi (Sri Lanka) and *P.bidentatus* Viraktamath and Parvathi (India) were also described by same authors. No species in this genus were collected during this study.

IV. DISCUSSION

Idiocerini feed and breed on a wide variety of trees and shrubs. Like other cicadellids, when they occur in large numbers through sucking sap from tender leaves, shoots and flowers. In addition, they affect indirectly by excretion of honeydew that enhance the growth of shooty mold on leaves and fruits (Viraktamath, 1989). Only one species, *Idiocerus populi* (L.), has been recorded as a vector of an unknown organism that produces 'witches broom disease' on Poplar (Webb, 1983).

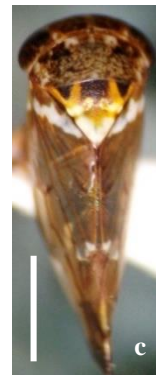
I.nagpurensis is more prevalent in the Dry zone area of Sri Lanka than the wet zone and associated with many other tree crops apart from mango (Gnaneswaran, *et al.*, 2007). Both males and females of *Jogocerus freytagi* Viraktamath –one of the two species reported from Indian subcontinent, found on *Murraya paniculata* (Rutaceae) in intermediate zone. *Idioscopus unimaculatus* Melichar (1903) found only in its type locality- Peradeniya, after a century of its description. It breeds on *Semecarpus coriacea* belongs to Anacardiaceae and prevail throughout the year. The adults were also found on non-breeding host, *Mesua nagassarium* in the same location but not on Mango. Morphological study of male and female genitalia of *Amritodus* genus collected from different ecological locations confirmed the presence of *A.brevistylus* along with *Idioscopus clypealis* and *Idioscopus nitidulus* species but not *A.atkinsoni* in anywhere.



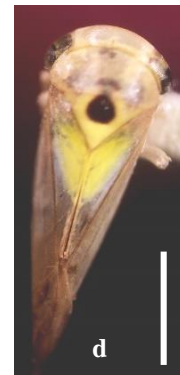
Idiocerus clypealis
Lethierry



Idioscopus nagpurensis
(Pruthi)



Idioscopus nitidulus
(Walker)



Idioscopus unimaculatus
(Melichar)



Amritodus brevistylus Viraktamath,



Busoniomimus manjunathi
Viraktamath & Viraktamath,



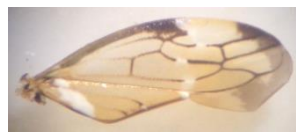
Jogocerus freytagi Viraktamath



Fore wing of a



Fore wing of b



Fore wing of c



Fore wing of d



Fore wing of e



forewing of f
with two sub-apical cells



Fore wing of g

Plate 1:

Habitus and forewing of species of Idiocerini leafhoppers recorded in Sri Lanka

Scale=0.05 mm

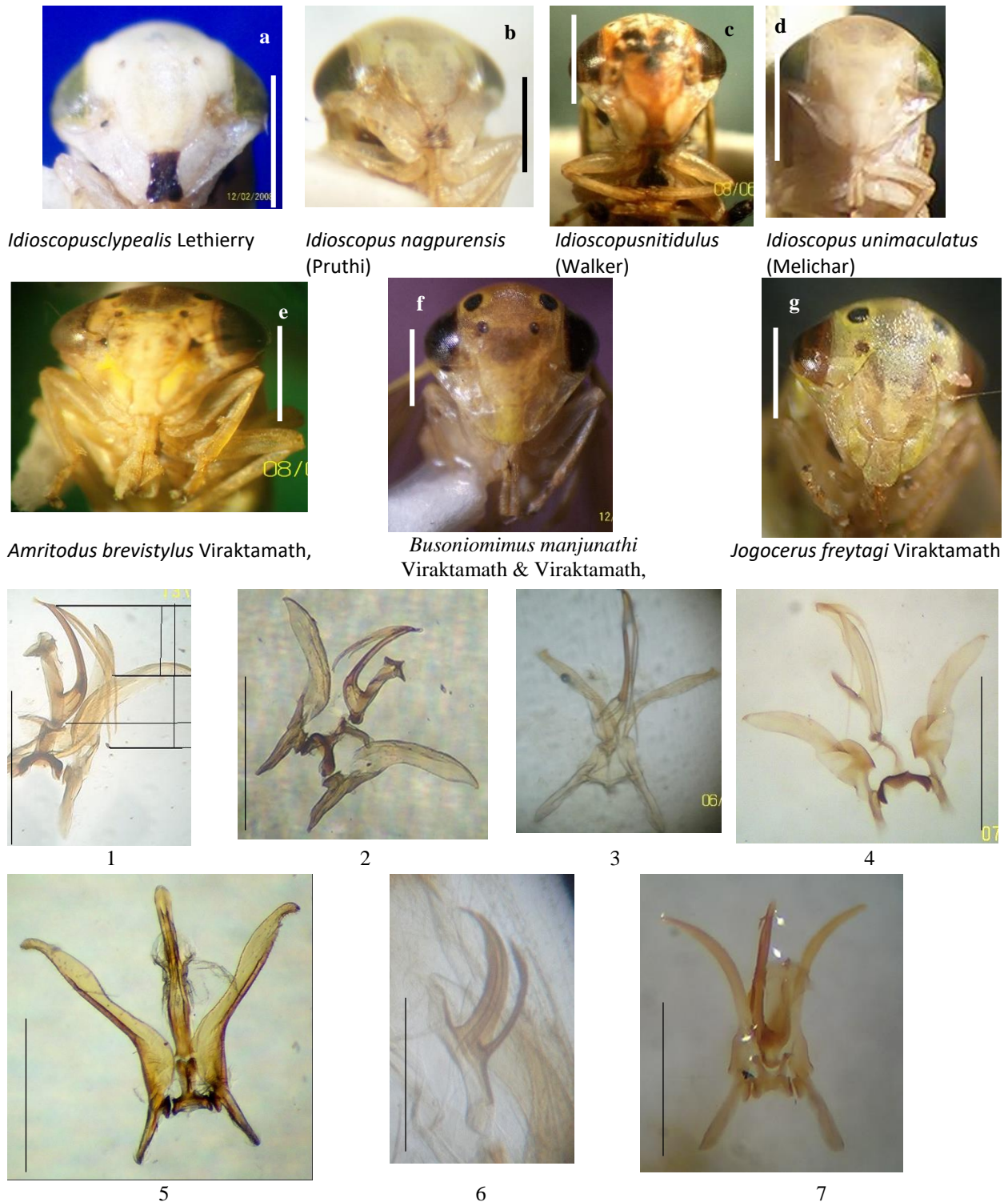


Plate 2: Face and male genitalia of species of Idiocerini leafhoppers recorded in Sri Lanka.

a-g : face of male scale = 0.05mm ; 1-7 Genitalia of male – Scale= 0.005mm

a,1: *Idioscopus clypealis* Lethierry **b,2:***Idioscopus nagpurensis* (Pruthi) **c,3:** *Idioscopus nitidulus* (Walker) **d,4** *.Idioscopus unimaculatus* (Melichar)**e,5:** *Amritodus brevistylus* Viraktamath, **6,f:** *Busoniomimus manjunathi* Viraktamath & Viraktamath, **7,g:** *Jogocerus freytagi* Viraktamath

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