

***Idioscopus nagpurensis* (Pruthi) (Hemiptera: Cicadellidae: Idiocerinae): A New Member of Mango Leafhopper Complex in Sri Lanka**

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ABSTRACT. *Idioscopus nagpurensis* (Pruthi), reported as the first record in Sri Lanka, is described with respect to external and internal anatomy along with other Idiocerine leafhoppers, *Idioscopus clypealis* (Lethierry), *I. nitidulus* (Walker) and *Amritodus brevistylus* Viraktamath. *Idioscopus nagpurensis* closely resembles *I. clypealis* but differs in the coloration of the clypellus and the structure of the male genitalia. A taxonomic key is provided for the identification of the four species associated with mango in Sri Lanka. The specimens of *I. nagpurensis* were collected in selected locations of Dry Zone and Wet Zone. *Idioscopus nagpurensis* formed comparatively higher percentage in leafhopper complex associated with mango foliage in Dry Zone compared to Wet Zone. In addition to mango, *I. nagpurensis* is also associated with other trees. The adult leafhoppers were also collected from *Persea gratissima*, *Mesua nagassarium*, *Nephelium lappaceum*, *Averrhoa carambola*, *Piper nigrum*, *Coffea arabica* and *Theobroma cacao*.

INTRODUCTION

Mango, *Mangifera indica* L. (Anarcadiaceae) is one of the economically important fruit crops in Sri Lanka. A large number of insect and mite species are associated with mango. Of the 308 species listed by Pena *et al.* (1998), 87 feed on fruits, 127 feed on foliage, 36 are associated with inflorescences, 33 inhabit buds and 25 feed on branches and the trunk. Among these, main pest species of mango which include fruit flies, seed weevils, tree borers and leafhoppers require management strategies. In Sri Lanka, fruit flies and leafhoppers are considered as economically important pest species. Wijesekara and Menike (1997) and Kudagamage (1998) reported that mango production in Sri Lanka is severely affected by leafhoppers feeding on foliage and bloom.

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Eighteen species of leafhoppers have been reported as pests of mango in the world (Viraktamath, 1989). Among these, five species belonging to the subfamily Idiocerinae; *Idioscopus clypealis* (Lethierry), *I. niveosparsus* (Lethierry) [now *I. nitidulus* (Walker)], *I. nagpurensis* (Pruthi), *Amritodus atkinsoni* (Lethierry) and *Amritodus brevistylus* Viraktamath - are the most important leafhopper pests of mango (Viraktamath, 1989; Pena *et al.*, 1998).

In Sri Lanka, three species of mango leafhoppers, have so far been reported (Kudagamage, 1998; Wijesekara and Menike, 1997; Manikavasagar, 1978). The species of leafhoppers in Sri Lanka have been studied by Melicher (1903); Distant (1918, 1916, 1908); Viraktamath, (1989, 1987, 1976); Viraktamath and Parvathi (2002) and Viraktamath and Viraktamath (1985). Correct identification, and biology and ecology of the pest species are the essential requirements for the development of an effective and economical management strategy. With this objective the leafhopper complex of mango in Sri Lanka was examined and the results of this study are presented here.

MATERIALS AND METHODS

This study was carried out during 2006 and 2007 at the Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya, Sri Lanka. The survey for mango leafhopper complex was carried out in ten selected mango growing areas representing Low Country Dry zone (LCDZ) and Mid Country Wet Zone (MCWZ). Samples were collected at regular intervals from mango and other nearby vegetations. Mango leafhoppers were sampled by sweep netting, hand picking, using sticky and light traps. The material was processed and labeled as suggested by Knight (1965). The Idiocerine leafhoppers were sorted out by using taxonomic keys of Dietrich (2005) and Viraktamath (2005a, 2005b). Male and female genitalia were dissected (Oman, 1949) and the structures were studied under stereoscopic binocular microscope (Mejie: x30 x 4.5). Illustrations were prepared with the help of camera lucida fitted with the stereoscopic binocular microscope (Nikon EMZ-10A) and the necessary structures were photographed using a digital camera (Yashica Digital A 5010) attached to the microscope. Measurements of various body parts were taken with the help of a standardized ocular micrometer placed in one of the eyepieces of stereoscopic microscope. Ten males and ten females were used for measurement.

Based on the characters examined and analyzed, the collected Idiocerine leafhoppers were identified in to species using the information published by Distant (1908), Baker (1915), Maldonado-Capriles (1964, 1973 and 1985), Viraktamath (1976, 1987 and 1989), Viraktamath and Viractamath (1985) and Fletcher and Dangerfield (2002).

RESULTS AND DISCUSSION

The species composition of idiocerine leafhoppers collected was, *Idioscopus nagpurensis*, *I. clypealis*, *I. nitidulus* and *Amritodus brevistylus*. Of these *I. nagpurensis* forms the first record for Sri Lanka and other species have already been recorded from the country (Kudagamage, 1998; Wijesekara and Menike, 1997; Distant, 1908; Manikavasagar, 1978). These species are described below along with a key to separate them.

1. *Idioscopus nagpurensis* (Pruthi)
Plate 1 A, E; Figure. 1

Idiocerus nagpurensis Pruthi, 1930

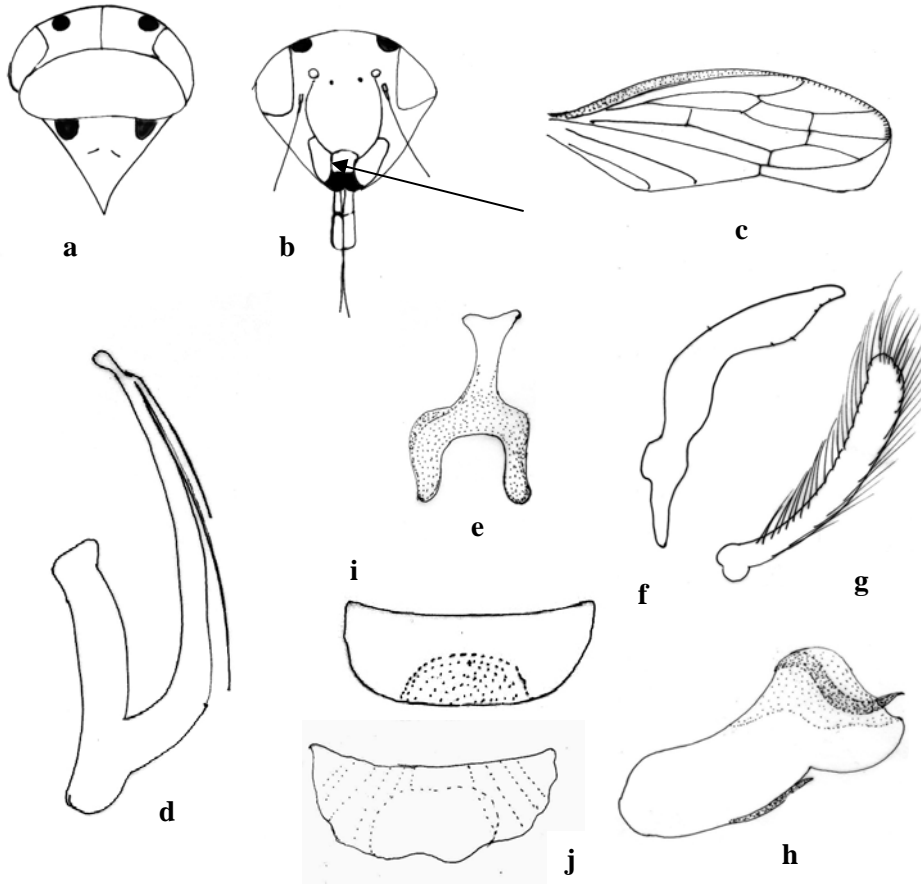


Figure 1. *Idioscopus nagpurensis* (Pruthi) male.

Note: **a:** head and thorax (dorsal view), **b:** face, **c:** fore wing, **d:** aedeagus-lateral view, **e:** connective, **f:** style, **g:** genital plate, **h:** pygofer, **i:** 8th sternum, **j:** 7th sternum-female.

Description:

Colouration: General colour light brownish yellow to brown. Eyes dark brown with lateral black markings. Two round black spots on head visible both dorsally and ventrally; two smaller spots between ocelli on face, more frequently observed in female, some times absent. Clypellus either without black spot or with black marking not occupying the entire area. Scutellum with basal triangles black. Forewing bronzy brown, costal margin yellow.

Structure: Vertex and face dorsad of ocelli transversely striate, rest of face shagreen. Clypellus wide apex with lateral margins concave. Pronotum, shagreen, twice as wide as long, posterior margin slightly concave. Scutellum, shagreen, longer than pronotum. Male eighth sternite with convex hind margin

Male genitalia: Pygofer elongate with anterior basal fracture and tergal apodeme ventral margin with a small spine-like process almost at distal 0.33. Sub genital plate elongate, flattened narrowed up to the half of the length and then broadened, reaching apex of pygofer lobe; bearing long hair-like setae in marginal raw extending from the basal region to the apex. Style, robust, anterior part before articulation nearly 0.33 as long as apical apophysis, latter with blunt apex and fine setae on dorsal margin. Connective short, Y-shaped with pigmented lateral arms. Aedeagus with prominent stout basal apodeme reaching 0.75 length of shaft, aedeagal shaft tapering caudally from base to slightly knobbed apex, with two pairs of unequal elongate sub apical processes directed antero-ventrally along the shaft, outer pair longer reaching 80 % of the shaft length, inner pair short less than half as long as longer pair, the ratio of the length of two pair is 1:2.42, both pairs are serrated.

Female genitalia: Hind margin of seventh sternite incurved in the middle and pigmented medially.

Measurements: Male 3.6 mm long, 1.3-1.5 mm wide across eyes. Female 3.6-3.8 mm long, 1.4 - 1.6 mm wide across eyes.

Material examined: SRI LANKA: (LCDZ): 36 males, 48 females, Thirunelvely, 16.ii.2006; 9 males, 12 females, Nallur, 18.ii.2006; 6 males, 11 females, Atchuvvely, 19.ii.2006; 17 males, 15 females, Chavakachcheri, 16.ii.2006; 44 males, 62 females, Maha Illupalama, 07.ii.2007.

SRI LANKA (MCWZ): 5 males, 9 females, Nalanda, 19.ix.2006; 7 males, 3 females, Thibbattumulla, 22.ii.2007; 2 males, 4 females, Waththegama, 18.xi.2006; 6 males, 8 females, Peradeniya, 14.iii.2006; 11 males, 16 females, Kundasale, 22.ix.2006; 5 males, 5 females, Gelioya, 13.ii.2007; 4 males, 6 females, Doluwa, 14.ix.2006; 3 males, 4 females, Nawalapitiya, 20.iv.2006; 8 males, 5 females, Kegalle, 04.iv.2006.

Collectors: UGLT Gunawardana, R Gnaneswaran and T Nagalingam.

Remarks: *Idioscopus nagpurensis* and *I. clypealis* closely resemble each other but differ in the coloration of the clypellus and relative size of the aedeagal processes. *I. nagpurensis* is more prevalent in the Dry zone area than the wet zone compared to other areas surveyed. Adults were collected from mango (*Mangifera indica*), jambola (*Citrus maxima*), avocado (*Persea gratissima*), na tree (*Mesua nagassarium*), rambuttan (*Nephelium lappaceum*), carambola (*Averrhoa carambola*), teak (*Tectona grantis*), pepper (*Piper nigrum*), coffee (*Coffea arabica*) and cocoa (*Theobroma cacao*).

2. *Idioscopus clypealis* (Lethierry)

Plate 1 B, F; Figure 2

Idiocerus clypealis Lethierry 1889: 252

Idiocerus nigroclypeatus Melichar 1903: 148; Synonymised by Distant 1908:187

Idioscopus clypealis (Lethierry) Baker, 1915: 339

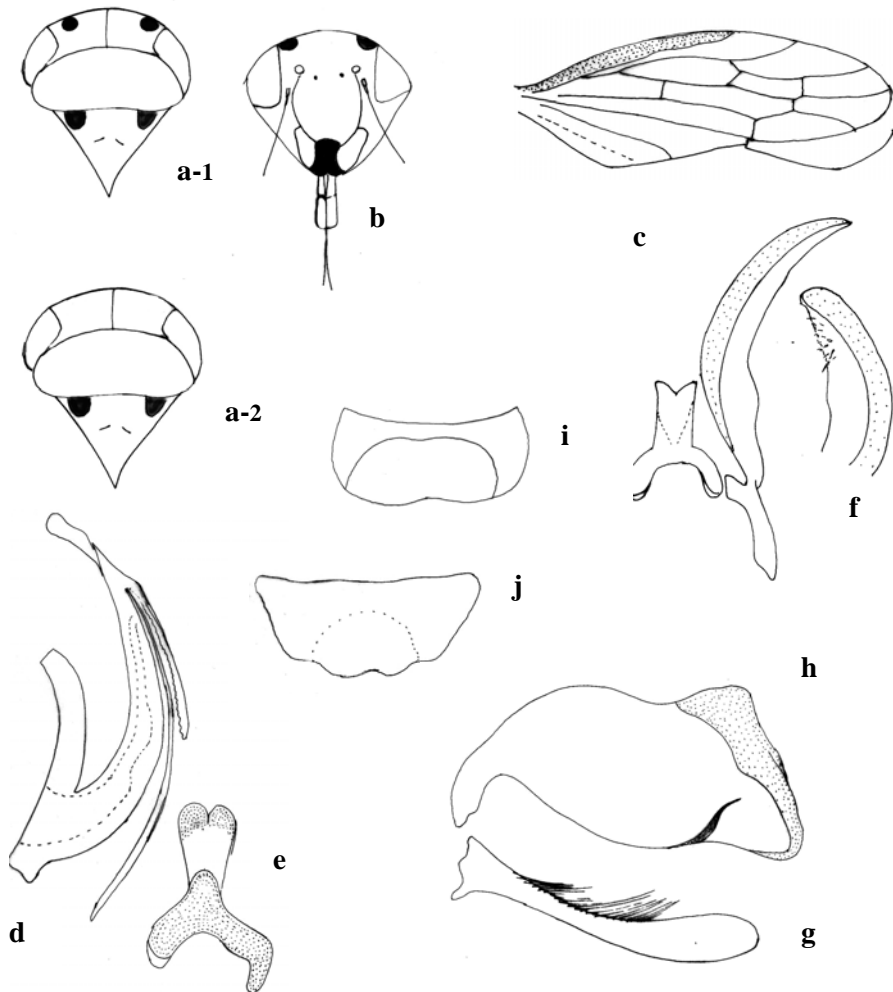


Figure 2. *Idioscopus clypealis* (Lethierry)

Note: **a:** head and thorax (dorsal view) a-1 female; a-2: male, **b:** face, **c:** fore wing, **d:** aedeagus- lateral view, **e:** connective, **f:** style, **g:** male genital plate, **h:** phygofer, **i:** 8th sternum – male, **j:** 7th sternum - female.

Description:

Colouration: similar to that of *I. nagpurensis* but paler. Female insects are with two black spots on anterior margin of the head. Males usually lack these spots, but occasionally a few males have them. Clypellus is uniformly, entirely black. Females may or may not possess two small black spots between the ocelli.

Structure: Similar to that in *I. nagpurensis*.

Male genitalia: Pygofer long narrow caudal half heavily pigmented. Sub genital plate elongate, flattened, narrowed at base, widest at about basal 0.33 of the length, reaching apex of pygofer lobe; bearing long hair-like setae in dorsal marginal raw extending from the basal region towards the apex. Styles strongly arched, apical apophysis longer than anterior part beyond articulation with connective, gradually narrowed to pointed-apex, with short setae on dorsal margin. Connective short, Y-shaped with pigmented lateral arms. Aedeagus with slender basal apodeme reaching 0.33 length of shaft, aedeagal shaft as in *I. nagpurensis*, with two pairs of unequal elongate subapical processes, outer pair longer reaching base of aedeagus, inner pair short, more than half as long as longer pair, the ratio of the length of two pair is 1:1.5.

Female genitalia: Similar to that in *I. nagpurensis*.

Measurements: Male 3.5-4.0 mm long; Female 3.6-4.1 mm long; both 1.4-1.5 mm wide across eyes.

Material examined: SRI LANKA: (LCDZ): 18 males, 22 females, Thirunelvely, 16.ii.2006; 9 males, 6 females, Nallur, 10.ii.2006; 2 males, Atchuvvely, 19.ii.2006; 9 males, 7 females, Chavakachcheri, 16.ii.2006; 22 males, 38 females, Maha Ilupalama, 07.ii.2007;.

SRI LANKA (MCWZ): 12 males, 16 females Nalanda, 19.ix.2006; 11 males, 9 females, Thibbattumulla, 22.ii.2007; 9 males, 10 females, Waththegama 18.xi.2006; 26 males, 21 females, Peradeniya, 14.iii.2006; 39 males, 43 females, Kundasale, 22.ix.2006; 5 males, 9 females, Gelioya, 13.ii.2007; 24 males, 20 females, Doluwa, 14.ix.2006; 19 males, 21 females, Nawalapitiya, 20.iv.2006; 12 males, 9 females, Kegalle, 04.iv.2006. Collectors: UGLT Gunawardana and R. Gnaneswaran.

Remarks: *I. clypealis* occurs along with *I. nagpurensis* but its number is higher in mid country area than in Dry zone. The adults were collected from pepper (*piper nigrum*), cocoa (*Theobroma cacao*), teak (*Tectona grantis*) rambuttan (*Nephelium lappaceum*), karambola (*Averrhoa carambola*), jambola (*Citrus maxima*), asoka (*Polyalthea longifolia*) and na trees (*Mesua nagassarium*)

3. *Idioscopus nitidulus* (Walker)

Plate 1 C, G; Figure 3

Idiocerus nitidulus Walker 1870:322

Idiocerus niveosparsus Lethierry, 1889:252

Idioscopus niveosparsus (Lethierry) Maldonado Capriles 1964:94

Idioscopus nitidulus (Walker): Maldonado Capriles 1973:181

Description:

Colouration: Dark brown. Face reddish brown with various black markings in male, paler in female. Genae with white markings. Pronotum with diffused brown or dark brown spots or markings without any pattern. Scutellum with two basal triangles and a

median spot between them of various shape black. Forewing with oblique white mark at base and obscure transverse white mark at apex of clavus.

Structure: Labium shows sexual difference; Males have apically expanded labium compared to females which have labium of uniform width throughout. Upper part of head dorsad of ocelli striate. Lora slightly raised, clypellus strongly constricted in the middle and expanded apically. Forewing with a small closed third subapical cell.

Male genitalia: Pygofer elongate, with an anterior basal fracture. Sub genital plates elongate narrow slightly wider basally than remainder bearing long hair-like setae in dorsal marginal extending from basal third towards but not reaching the apex, a tuft of long hair-like setae around apex and extending on to ventral margin and a small group of short hair like setae on ventral margin near apex. Style parallel sided, slightly broad at base, abruptly narrowed at the apex to form a spine-like apex. Connective T-shaped with the dorsal thin hyaline keel (Figure 3c). Aedeagus with basal apodeme reaching nearly half length of shaft, aedeagal shaft evenly curved dorsally from base with gonopore on posterior surface near broadly rounded apex, with two pairs of unequal, smooth, filamentous processes extending towards the base of aedeagus.

Female genitalia: Seventh sternum pigmented mid anteriorly anterior margin concave hind margin bi sinuately, Ovipositor exceeding pygofer. Second pair of gonapophysis with denticles restricted to caudal 1/3th of the length, dorsal margin of denticle asymmetrical and with a dorso-median notch.

Measurements: Male 4.4-4.7 mm long, Female 4.5-4.8 mm long, both 1.7-2.0mm wide across eyes.

Material examined: SRI LANKA: (LCDZ): 3 males, 2 females, Thirunelvely, 16.ii.2006; 2 males, 6 females, Nallur, 10.ii.2006; 2 males, Atchuvvely, 19.ii.2006; 12 males, 7 females, Chavakachcheri, 16.ii.2006; 17 males, 11 females, Maha Illupalama, 07.ii.2007.

SRI LANKA (MCWZ): 3 females, Nalanda, 19.ix.2006; 3 males, 3 females, Thibbattumulla, 22.ii.2007; 4 males, 7 females, Waththegama, 18.xi.2006; 39 males, 48 females, Peradeniya, 14.iii.2006; 23 males, 31 females, Kundasle 22.ix.2006; 7 males, 9 females, Geliyoa, 13.ii.2007; 24 males, 20 females, Doluwa, 14.ix 2006; 5 males, 7 females, Nawalapitiya, 20.iv.2006; 4 males, 5 females, Kegalle, 04.iv.2006.

Collectors: UGLT Gunawardana and R Gnaneswaran.

Remarks: *Idioscopus nitidulus* can be differentiated from both *I. clypealis* and *I. nagpurensis* by the shape of the clypellus, raised lora and by the transverse white band at base of forewing. It can be differentiated from *Amritodus* by the absence of black spots on pronotum apart from the differently shaped structure of male genitalia. Adults were collected on *Mangifera indica* and *Polyalthea longifolia*.

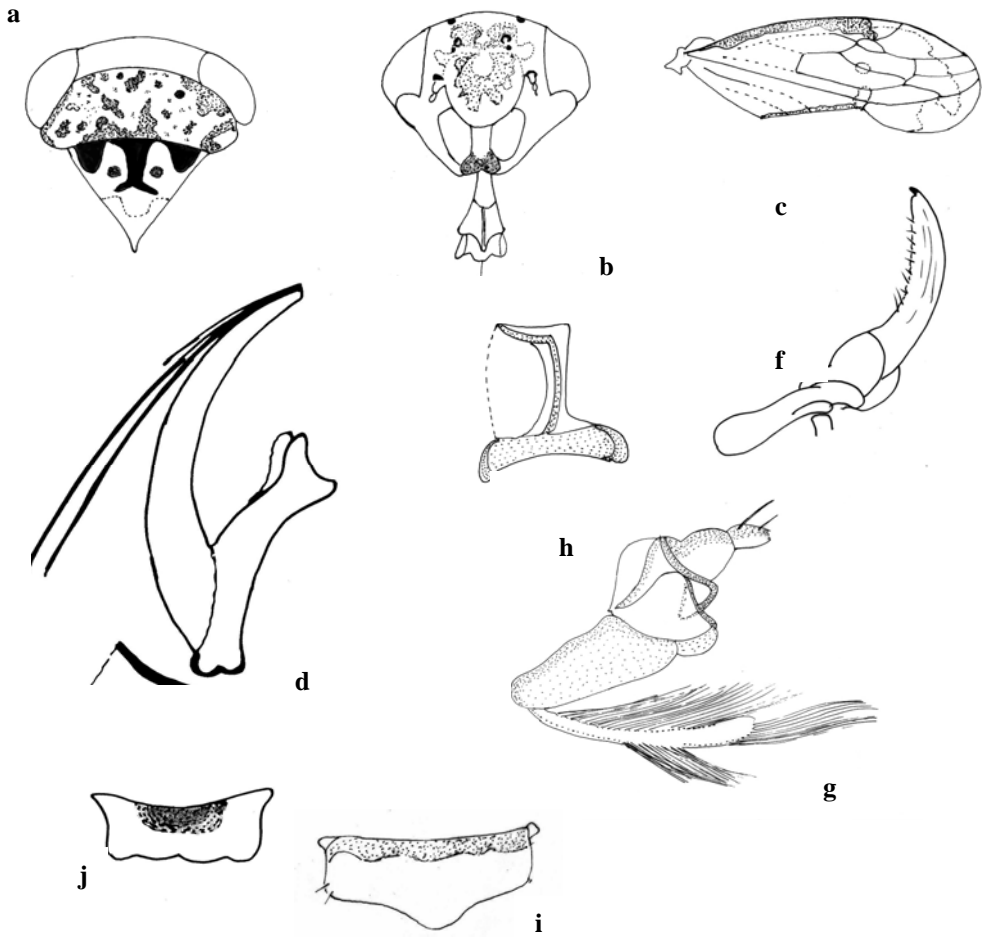


Figure 3. *Idioscopus nititulus* (Walker) male

Note: (a) head and thorax –dorsal view, (b) face, (c) fore wing, (d) aedeagus -lateral view, (e) connective, (f) style, (g) genital plate, (h) pygofer, (i) 8th sternum, (j) 7th sternum -female.

4. *Amritodus brevistylus* Viraktamath

Plate 1 D, H; Figure 4

Amritodus brevistylus Viraktamath, 1976

Description:

Colouration: Yellowish brown to brown with a pair of black spots on upper part of the face and another pair on anterior margin of the pronotum; basal triangle of scutellum brownish to black

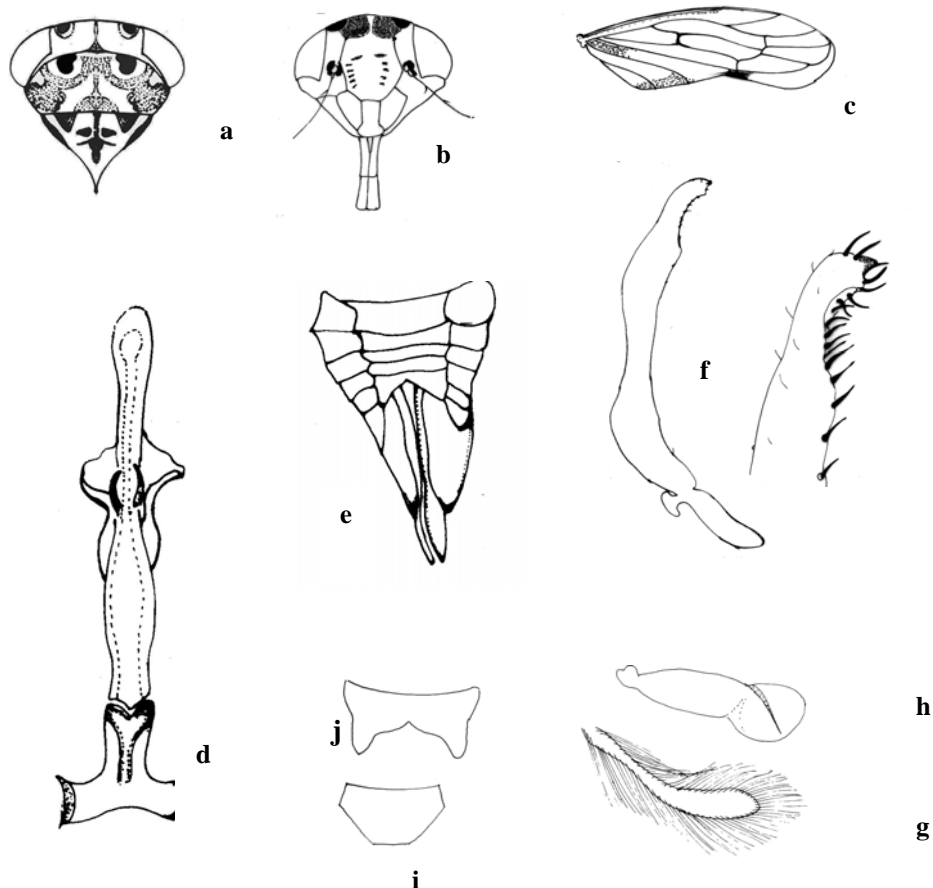


Figure 4. *Amritodus brevistylus* Viraktamath

Note: (a) Head and thorax (dorsal view); (b) face, (c) fore wing, (d) aedeagus and connective, (e) abdomen -female, (f) style, (g) male genital plate, (h) phygofer, (i) 8th sternum-male, (j) 7th sternum - female.

Structure: upper part of the face and vertex finely transversely striate. Vertex short, shorter medially than next to eyes. Lorum slightly raised from the general surface. Clypellus widened at apical region. Labium shows sexual difference; Males have apically expanded labium compared to females which have labium of uniform width throughout. Pronotum shorter than scutellum, shagreened. Forewing with four apical cell and two subapical cells, inner subapical cell open behind.

Male genitalia: Male phygofer longer than height, with a basal anterior fracture and a ventral elongate process. Subgenital plate with basal short segment, leaf-like unpigmented with long hair-like setae. Style elongate with a short anterior lobe, apical apophysis long apex slightly curved caudally, with short fine setae. Connective T-shaped with a prominent dorsal keel, stem bilobed. Aedeagusa with elongate preatrium, longer than shaft, aedeagal

shaft slightly curved, with a basal pair of spine-like processes, dorsal apodeme plate-like, gonopore subapical.

Female genitalia: Seventh sternum with a deep median concavity on hind margin with pointed lateral lobes. Ovipositor exceeding pygofer. Second pair of gonapophysis with denticles restricted to caudal 1/4th of the length, dorsal margin of denticle asymmetrical and with a dorso-median notch.

Measurements: Male 5.0 - 5.3 mm long; 1.9 - 2.0 mm wide across eyes. Female 5.3 - 5.6 mm long; 2.0 - 2.2 mm wide across eyes.

Material examined: SRI LANKA: (LCDZ): 27 males, 24 females, Thirunelvely, 16.ii.2006; 11 males, 19 females, Nallur, 10.ii.2006; 16 males, 20 females, Atchuvally, 19.ii.2006; 13 males, 18 females, Chavakachcheri, 16.ii.2006; 29 males, 33 females, Maha Illupalama, 07.ii.2007.

SRI LANKA (MCWZ): 3 males, 4 females Nalanda, 19.ix.2006, 3 females, Thibbattumulla 22.ii.2007; 5 males, 2 females, Waththegama, 18.xi.2006; 30 males, 41 females, Peradeniya, 14.iii.2006; 28 males, 24 females, Kundasala, 22.ix.2006; 11 males, 2 females, Geliyoia, 13.ii.2007; 4 males, 7 females, Doluwa, 14.ix.2006; 4 male., 3 females, Navalapitiya, 20.iv.2006; 16 males, 10 females, Kegalle, 04.iv.2006.

Collectors: UGLT Gunawardana and R Gnaneswaran.

Remarks: *Amritodus brevistylus* specimens were collected from *Mangifera indica* and *Polyalthea longifolia*.

Key to Idiocerine leafhoppers of Sri Lanka associated with mango.

1. Pronotum with a black spot anteriorly on either side of median line; male with aedeagus elongate without elongate processes near apex of shaft *Amritodus brevistylus* Viraktamath
Pronotum without black spots; aedeagus with elongate processes near apex of shaft.....2
2. Head with two large, round black spots visible both in dorsal and ventral aspects.....3
Head without such round black spots..... 4
3. Clypellus in both sexes entirely black without leaving any pale area at base; aedeagus with the longer pair of processes 0.75 as long as shaft or longer *Idioscopus clypealis* (Lethierry)
Clypellus without black marking or with partial black area exposing pale basal margin; aedeagus with the longer pair of processes less than 0.75 as long as shaft *Idioscopus nagpurensis* (Pruthi)
4. Clypellus entirely black; apex of aedeagal shaft pointed; forewing without transverse white marking near base and with two closed subapical cells male *Idioscopus clypealis* (Lethierry)

Clypellus not black; apex of aedeagal shaft bluntly rounded; forewing with transverse white marking near base and with a closed third subapical cell
*Idioscopus nitidulus* (Walker)

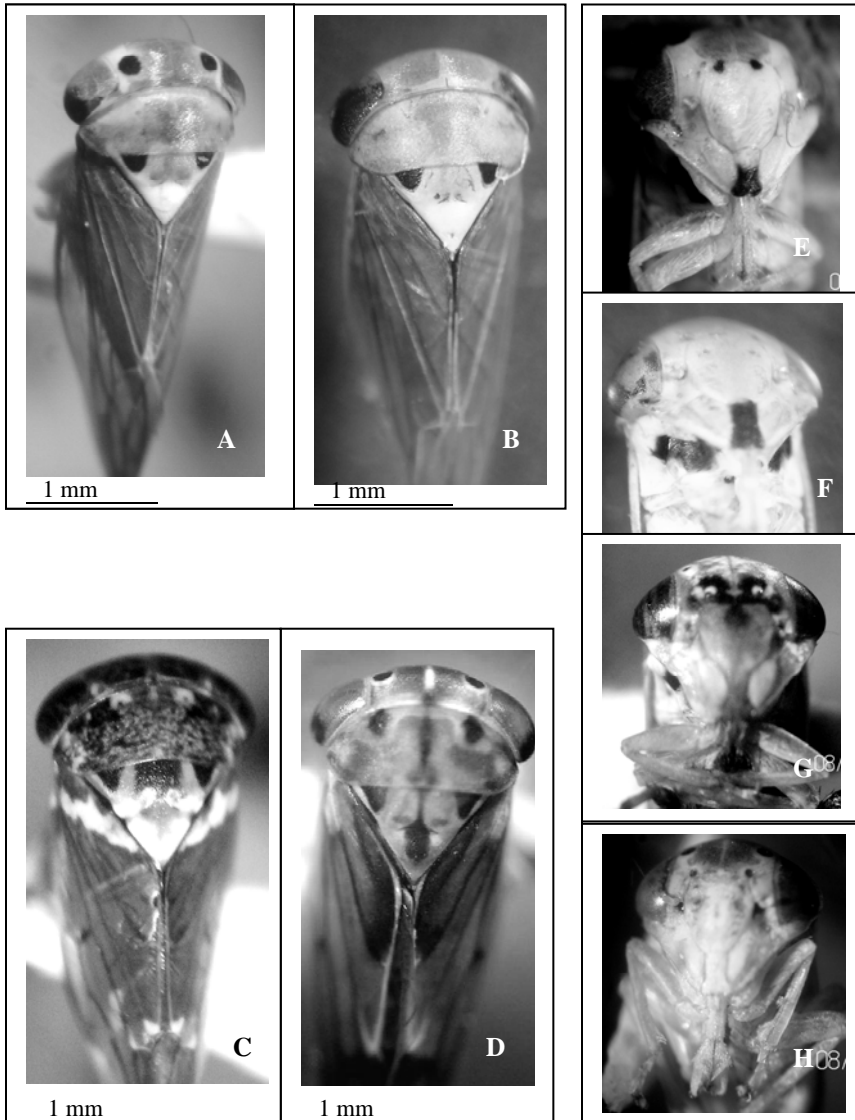


Plate 1. Members of mango leafhopper complex (Sub family: Idiocerinae) in Sri Lanka

(A)- *Idioscopus nagpurensis* (Pruthi) –male, (B) *Idioscopus clypealis* (Lethierry)-male, (C) *Idioscopus nitidulus* (Walker) – male, (D) *Amritodus brevistylus* Viraktamath -male, (E) Face of *I. nagpurensis* –male, (F) Face of *I. clypealis* –male, (G) Face of *I. nitidulus* – male, (H) Face of *A. brevistylus*- male.

CONCLUSIONS

Idioscopus nagpurensis (Pruthi) is recorded as a new member of the mango leafhopper complex in Sri Lanka. The three species of *Idioscopus* on mango have similar male genitalia having two pairs of slender long processes to aedeagal shaft, but they differ in the shape of the aedeagal shaft and relative lengths of the shaft processes in addition to external colour characters. The fourth species, *Amritodus brevistylis* possesses sinuate aedeagus with a pair of short spine-like processes on the ventral side of the shaft. *Idioscopus nagpurensis* exists in all surveyed areas; comparative prevalence of this species is high in Jaffna and Anuradhapura districts- low land dry zone. This species is associated with many other tree crops apart from mango.

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