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## A review of the genus *Magadha* Distant, 1906 (Hemiptera: Fulgoromorpha: Achilidae)

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### Abstract

Three new species of the planthopper genus *Magadha*, *M. basimaculata* **sp. nov.**, *M. densimaculosa* **sp. nov.** and *M. intumescens* **sp. nov.**, are described and illustrated from China. The male of *M. taibaishanensis* Wang, 1989 is described for the first time. Illustrations of *M. pinnata* Chen, Yang & Wilson, 1989 and *M. redunca* Chen, Yang & Wilson, 1989 and a key to all species of the genus are given.

**Key words:** Achilid, Fulgoroidea, distribution, planthopper, taxonomy

### Introduction

The achilid genus *Magadha*, which is placed in Plectoderini, was established by Distant (1906) with *Cixius flavisigna* Walker, 1851 from India as its type species. Distant further described a new species *M. nebulosa* from Sri Lanka. Later on, 17 species were added by the following authors: Matsumura, 1914; Fennah, 1956; Chou & Wang, 1985; Wang & Wang, 1988; Wang, 1989; Chen *et al.*, 1989; Wang & Huang, 1995; Liang, 2007 and Xu & Liang, 2012.

In this paper, three new species are described and illustrated from China. The male of *M. taibaishanensis* Wang, 1989 is reported and described for the first time. Illustrations of *M. pinnata* Chen, Yang & Wilson, 1989 and *M. redunca* Chen, Yang & Wilson, 1989 and a key to all species of the genus are provided.

### Material and methods

The morphological terminology and measurements used in this study follow Chen *et al.* (1989) and Yang & Chang (2000). The color photographs were taken with a Keyence VHX-1000C camera. External morphology was observed under an Olympus SZX7 stereoscopic microscope and characters measured with an ocular micrometer. The genital segments of the examined specimens were macerated in 10% KOH and drawn from preparations in glycerin jelly using an Olympus CX41 stereomicroscope. Illustrations were scanned by a Canon CanoScan LiDE100 and imported into Adobe Photoshop CS5 for labeling and plate composition. Spinal formula refers to the numbers of apical spines of the hind tibiae and 1<sup>st</sup> and 2<sup>nd</sup> hind tarsomeres.

Specimens examined are deposited in the Institute of Entomology, Guizhou University, Guiyang, China (GUGC).

## Results

### *Magadha* Distant, 1906

*Magadha* Distant, 1906: 290.

Fennah, 1950: 143; Chou & Wang, 1985: 199; Chen, Yang & Wilson, 1989: 35; Chou *et al.*, 1999.

**Type species:** *Cixius flavisigna* Walker, 1851.

**Description.** The distinctive characters used by Fennah (1950), Chen *et al.* (1989) and Chou *et al.* (1999) are modified as follows.

Mid-sized species. Head with eyes distinctly narrower than pronotum. Vertex not declivous, broader across base than long in midline, produced before eyes about 1/3 of its length, median carina distinctly basally, obsolete distally, disk distinctly depressed, anterior margin carinate, angulately or roundly convex, triangular areolets at lateroapical angles of head distinct, lateral margins carinate, slightly foliate, diverging basad, posterior margin broadly concave. Frons slightly convex in lateral view, disk in midline longer than wide, basal margin truncate or slightly excavate, median carina percurrent, lateral margin carinate, slightly foliate laterad, sinuately diverging to below level of antennae then gradually incurved to suture. Clypeus with length in midline shorter than frons, tricarinae distinct. Rostrum reaching post-trochanter, with subapical segment shorter than apical segment. Antennae subglobose, not sunk in a depression. Ocelli separated from eyes. Eyes not, or slightly, overlapping pronotum, with lower margin not, or slightly, excavated. Pronotum in midline longer than, or same length, as behind eyes, anterior margin of disk convex-truncate, posterior margin subangulately excavated by about 115 degrees, median carina distinct, incomplete, lateral carinae slightly convex, twice as long as median carina, attaining hind margin, lateral lobe slightly inclined antero-ventrally, carinate between eye and tegula, ventral margins oblique. Mesonotum longer than vertex and pronotum combined, tricarinate, area between lateral carinae with one transverse callus at anterior third. Forewing with costal margin slightly convex, apical margin broadly convex, posterior margin with a reentrant angle of 155 degrees at apex of clavus, vein Sc+R forking proximally of Cu<sub>1</sub> fork, slightly distal union of claval veins, clavus terminating slightly distad of middle of forewing. Post-tibiae with one lateral spine between basal 1/4 to 2/5, spinal formula 7-6-6 (5).

**Male genitalia.** Pygofer in lateral view with dorsal margin at least as long as ventral margin, anterior margin broadly concave; in ventral view medioventral process entire and not divided into two branches. Genital style with 2–3 processes rising from its dorsal margin, inner surface near base with a long process directed outwards. Phallobase sheath-shaped, incompletely or bilaterally asymmetrical; dorsal lobe with apical margin incised or angularly convex in the middle; ventral lobe shorter than dorsal lobe, with apical margin incised or cleft in the middle, 2 lateral lobes distinct or obsolete.

**Distribution.** Oriental and Palearctic regions.

### Checklist of species of the genus *Magadha* including their distribution

*M. basimaculata* **sp. nov.** Distribution: China (Guangxi, Guizhou and Hainan).

*M. cervina* Fennah, 1956 Distribution: China (Sichuan).

*M. densimaculosa* **sp. nov.** Distribution: China (Guizhou).

*M. eusordida* Chen, Yang & Wilson, 1989 Distribution: China (Taiwan).

*M. fennahi* Liang, 2007 Distribution: China (Hubei, Shaanxi and Sichuan).

*M. flavisigna* (Walker, 1851) Distribution: North India.

*M. formosana* Matsumura, 1914 Distribution: China (Taiwan).

*M. guangdongensis* Chou & Wang, 1985 Distribution: China (Guangdong).

*M. guangzhouensis* Wang, 1989 Distribution: China (Guangdong).

*M. gyirongensis* Wang & Wang, 1988 Distribution: China (Tibet).

*M. intumescens* **sp. nov.** Distribution: China (Guizhou).

*M. metasequoiae* Fennah, 1956 Distribution: China (Hubei).

*M. nebulosa* Distant, 1906 Distribution: Sri Lanka (Central Province).

*M. pinnata* Chen, Yang & Wilson, 1989 Distribution: China (Guizhou, Jiangxi, Sichuan and Taiwan).

*M. redunca* Chen, Yang & Wilson, 1989 Distribution: China (Taiwan).

- M. semitransversa* Chen, Yang & Wilson, 1989 Distribution: China (Taiwan).  
*M. shaanxiensis* Chou & Wang, 1985 Distribution: China (Shaanxi).  
*M. taibaishanensis* Wang, 1989 Distribution: China (Guizhou, Henan, Shaanxi, Sichuan and Yunnan).  
*M. w-maculata* Chou & Wang, 1985 Distribution: China (Fujian).  
*M. wuyishanana* Chou & Wang, 1985 Distribution: China (Fujian).  
*M. yadongensis* Wang & Wang, 1988 Distribution: China (Tibet).  
*M. yangia* Wang & Huang, 1995 Distribution: China (Sichuan).

### Key to species of the genus *Magadha*

1. Head, pronotum, mesonotum and tegulae with numerous ivory-white to tawny dots ..... 2  
 - Not as above ..... 7
2. Central area of mesonotum with 1 large dark brown marking ..... 3  
 - Central area of mesonotum without such marking ..... 5
3. Frons with 5 pale yellow spots along lateral margin (Wang, 1989: Fig. 5) ..... *M. guangzhouensis*  
 - Frons without such spots along lateral margin ..... 4
4. Body small; gena with pale yellow dots only; costal margin of forewing with 8 small dark markings (Chou & Wang, 1985: Figs 7–9) ..... *M. guangdongensis*  
 - Body large; gena with 1 pale yellow transverse band below antennae; costal margin of forewing without marking (Wang, Huang & Wang, 1993: Fig. 7: A–C) ..... *M. gyirongensis*
5. Forewing brown, with numerous ivory-white to tawny dots (Figs 17–20, 24) ..... *M. densimaculosa* **sp. nov.**  
 - Forewing greyish white, with different sized brown to dark brown markings ..... 6
6. Forewing with 1 broad dark brown marking across base (Figs 1–4, 8); phallobase with lateroapical margin rolled-up dorsad in dorsal view (Fig. 15) ..... *M. basimaculata* **sp. nov.**  
 - Forewing without marking at base; phallobase without lateroapical margin rolled-up dorsad in dorsal view (Chen *et al.*, 1989: Fig. 14: D, J) ..... *M. formosana*
7. Disk of vertex with w-shaped black marking (Chou & Wang, 1985: Fig. 11) ..... *M. w-maculata*  
 - Disk of vertex not as above ..... 8
8. Mesonotum with anterior third pale yellow brown and posterior two-thirds dark brown between lateral carinae ..... 9  
 - Mesonotum not as above ..... 12
9. Posterior margin of frons with a broad and transverse dark brown band ..... 10  
 - Posterior margin of frons without band ..... 11
10. Width of vertex at base almost as wide as long in midline; forewing greyish brown, with numerous dark spots (Wang & Huang, 1995: Figs a, b) ..... *M. yangia*  
 - Width of vertex at base about twice as wide as long in midline; forewing fuscous, with basal two-thirds with irregular dark markings (Figs 83–86, 90) ..... *M. taibaishanensis*
11. Vertex and mesonotum brown, pronotum pale brown; frons with one foliar greyish white marking near middle, one greyish white band across base; clypeus with one large and small roundish, greyish white marking (Wang, Huang & Wang, 1993: Fig. 6: A–C) ..... *M. yadongensis*  
 - Vertex, pronotum and mesonotum ochraceous; frons and clypeus brown, with numerous yellowish brown dots (Distant, 1906: Fig. 138) ..... *M. flavisigna*
12. Head and thorax piceous, forewing fuliginous and opaque, with numerous minute ochraceous spots, apical marginal veins distinctly pale creamy-white (Distant, 1906) ..... *M. nebulosa*  
 - Head, thorax and forewing not as above ..... 13
13. Frons with at least 6 spots along lateral margin ..... 15  
 - Frons without spots along lateral margin ..... 14
14. Vertex at base 3 times as wide as long in midline; mesonotum with anterior half yellowish brown and posterior half dark brown (Fennah, 1956) ..... *M. fennahi*  
 - Width of vertex at base twice as wide as long in midline; mesonotum pale yellow and with anterior third dark brown (Chen *et al.*, 1989: Fig. 18: A) ..... *M. semitransversa*
15. Head and thorax mainly ochraceous; frons with 6 spots along lateral margin ..... 16  
 - Head and thorax not as above; frons with 7 spots along lateral margin ..... 17
16. Anal segment of male in dorsal view with lateroapical angles decurved and produced into a stout spine; medioventral process of pygofer broad and its lateroapical angles produced into short lobes, distally incurved (Fennah, 1956: Fig. 15: A–B) .....  
 ..... *M. cervina*  
 - Anal segment of male in dorsal view relatively large, apex 1.5 times wider than base; posterior margin of the medioventral process of pygofer round (Chen *et al.*, 1989: Fig. 19: F, H) ..... *M. eusordida*
17. Mesonotum with anterior third dark brown and posterior two-thirds ivory-white (Chen *et al.*, 1989: Fig. 15: A) ..... *M. reduunca*  
 - Mesonotum not as above ..... 18
18. Forewing ivory-white, with one large subtriangular dark brown marking near base, anterior margin of forewing with 8 small dark brown markings (Chou & Wang, 1985: Fig. 3) ..... *M. wuyishanana*

- Forewing not as above. .... 19
- 19. Frons with 7 dark brown spots along lateral margin; clypeus with one longitudinal dark brown band between lateral and median carina; forewing with 10 small and 2 large brown markings along anterior margin (Chou & Wang, 1985: Figs 4, 6). . . . . *M. shaanxiensis*
- Frons with 7 ivory-yellow spots along lateral margin; clypeus and forewing not as above. .... 20
- 20. Frons with one diffuse transverse pale yellow bar across middle; mesonotum dark brown, with lateral angles ivory-yellow (Fennah, 1956). .... *M. metasequoiae*
- Frons with one transverse pale yellow bar across base and one large ivory-white marking near apex of median carina; apical two-thirds part of mesonotum between lateral carinae with ivory-white dots .... 21
- 21. Anal segment of male in dorsal view with lateroapical margin not concave; phallobase, in dorsal view, dorsal lobe of phallobase with 2 large and 2 small processes in the middle, in ventral view with ventral lobe with apical margin slightly incised in the middle (Figs 55, 60, 64–65) .... *M. pinnata*
- Anal segment of male in dorsal view with lateroapical margin concave; phallobase in dorsal view with dorsal lobe with 2 small processes near the middle, in ventral view with ventral lobe with apical margin deeply cleft in the middle (Figs 37, 42, 47–48) . . . . . *M. intumescens* **sp. nov.**

***Magadha basimaculata* sp. nov.**

(Figs 1–16)

**Measurements.** Body length (from apex of vertex to tip of forewing): male 5.1–6.0 mm (n = 49), female 6.0–7.0 mm (n = 20); forewing length: male 4.3–5.1 mm (n = 49), female 5.0–6.0 mm (n = 20).

**Coloration.** Greyish white to brown. Head, pronotum, mesonotum, and tegula brown with numerous pale yellowish brown dots (Figs 1–7). Eyes reddish brown, ocellus pale yellowish brown (Figs 1–7). Forewing greyish white, with differently sized brown to dark brown markings, with one broad dark brown marking across base (Figs 1–4, 8). Hindwing pale brown, veins dark brown. Legs light brown. Abdomen dark brown.

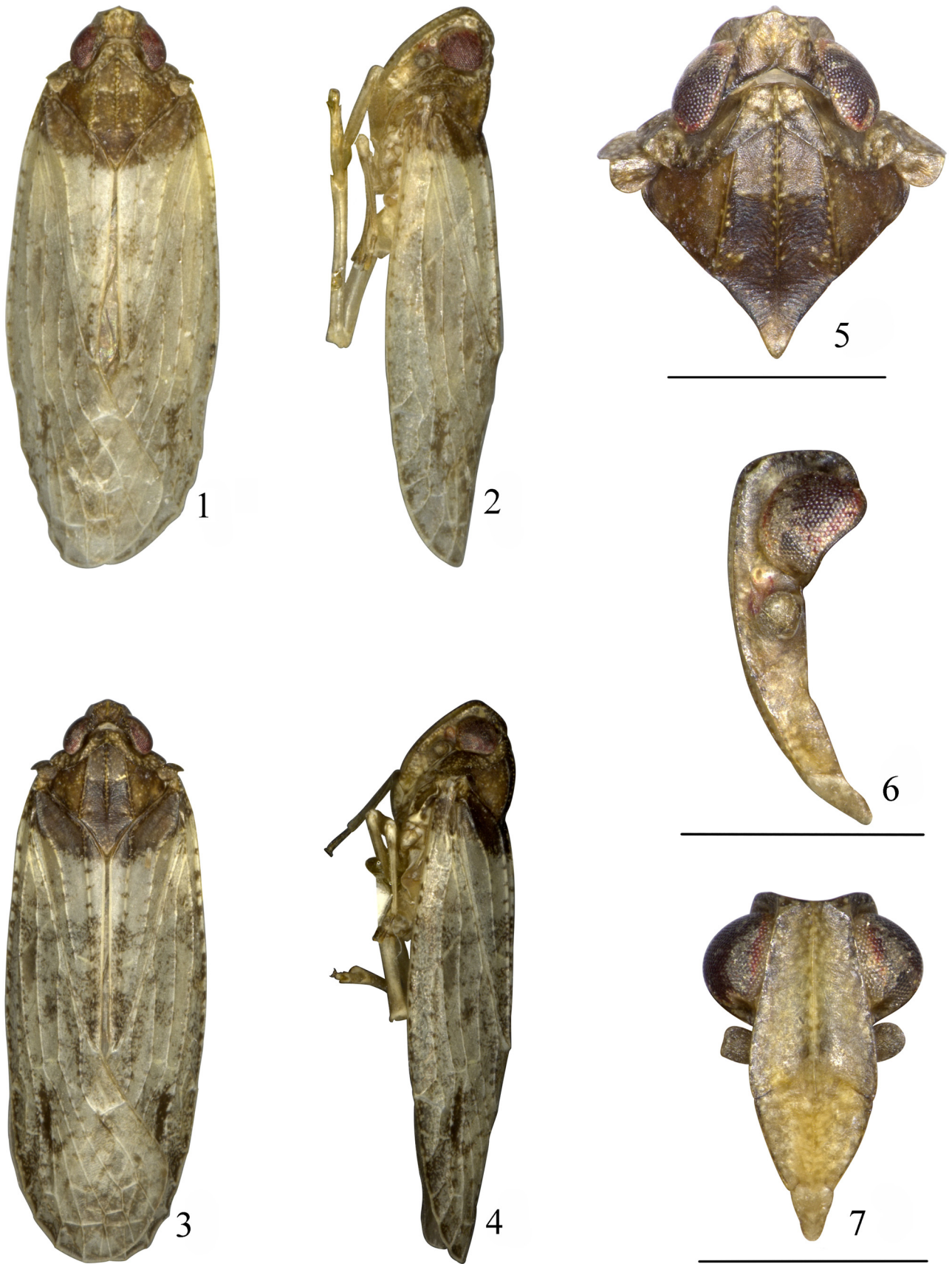
**Head and thorax.** Width of vertex at base to length in midline 2.0. Ratio length of frons in midline to maximum width 1.2, ratio maximum width to width at base 1.7. Ratio length of postclypeus in midline to length of frons 0.8. Ratio of apical to subapical segment of rostrum 1.5. Ratio length of pronotum in midline to length of vertex 0.7. Mesonotum in midline 6.4 times longer than pronotum, 2.6 times longer than pronotum and vertex combined. Forewing with ratio of length to maximum width 3.0. Hindwing with ratio of length to maximum width 1.8.

**Male genitalia.** Anal segment in dorsal view relatively short (Fig. 10), with ratio length to maximum width 0.5, apical margin distinctly concave; anal stylet large, epiproct broad with apical margin just reaching apex of anal segment. Pygofer in lateral view (Fig. 11) with dorsal margin distinctly longer than ventral margin, narrowest part at ventral third, anterior margin broadly concave, posterior margin slightly concave; in ventral view (Fig. 12), medioventral process of pygofer entire, with apical margin roundly convex. Genital style with apex angularly convex, dorsal margin rising from 2 sharp bent processes and 1 blunt straight process; inner surfaces near base with 1 fingerlike process, directed basad (Fig. 13). Aedeagus with phallobase sheath-shaped, symmetrical (Figs 15–16); in dorsal view (Fig. 15) dorsal lobe shorter than the ventral, with apical margin cleft in the middle, bilateral margin with apical half rising, rolled-up dorsad; in ventral view (Fig. 16) ventral lobe with apical margin incised in middle, each side of midline with a row of teeth; in lateral view (Fig. 14) apical half of phallobase only divided into ventral and dorsal processes, lateral lobes obsolete; ventral lobe with margin serrated, and the apex of dorsal lobe truncate.

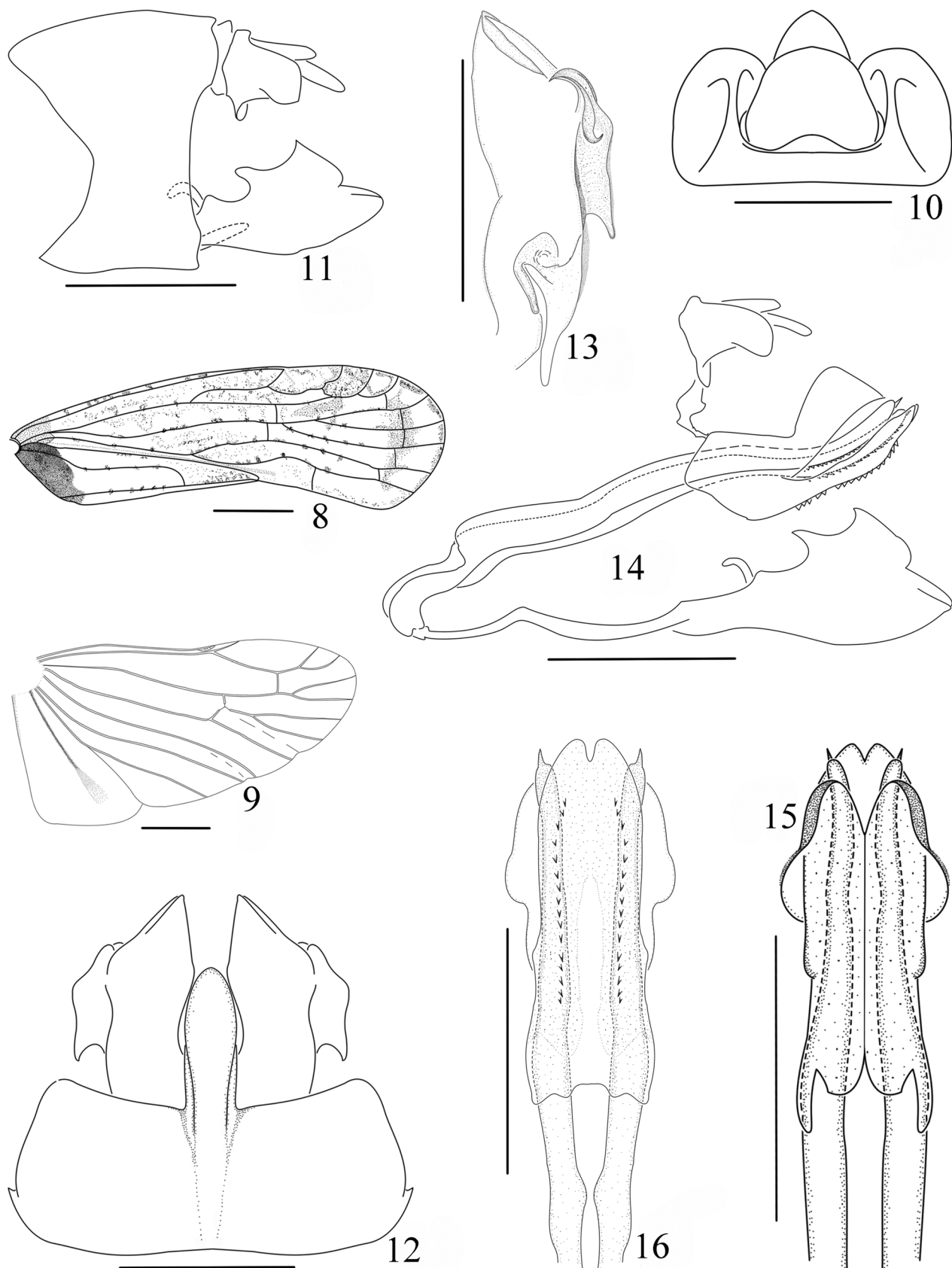
**Type material.** Holotype: ♂, CHINA, **Guizhou:** Congjiang, Yueliangshan, 12 July 2006, Q.-Z. Song. Paratypes, **Guizhou:** 16 ♂♂, 5 ♀♀, same data as holotype; 7 ♂♂, 5 ♀♀, Taipingshan, Liping, 19–23 July 2006, Q.-Z. Song; 3 ♂♂, Maolan National Natural Reserve, 4 Aug. 2006, F.-L. Xu; 2 ♂♂, 1 ♀, Maolan National Natural Reserve, 3–5 July 2010, X.-H. Hou and P. Zhang; 2 ♂♂, Maolan National Natural Reserve, light trap, 17 July 2011, J.-K. Long; 1 ♂, 2 ♀♀, Kuankuoshui National Natural Reserve, 14 Aug. 2010, J.-K. Long; 7 ♂♂, 3 ♀♀, Kuankuoshui National Natural Reserve, 14–18 Aug. 2010, J.-Q. Ni, P. Zhang, R.-H. Dai and X.-H. Hou; 1 ♂, Fodingshan, Shiqian, 18 Aug. 2010, Q.-Z. Song; 1 ♀, Dayi, Wangmo, 21–23 Aug. 2013, S.-Y. Xu. **Guangxi:** 8 ♂♂, 2 ♀♀, Dawangling, Baise, 17–19 July 2008, P. Zhang and Z.-H. Meng; 1 ♀, Bangliang, Jingxi, 1–6 Aug. 2010, S.-Y. Zhou. **Hainan:** 1 ♂, Datian National Natural Reserve, light trap, 10 July 2007, B. Zhang.

**Etymology.** The species name is derived from the Latin words “*basis*” and “*maculatus*”, which refers to the big transverse dark mark at the base of the forewing (Fig. 8).

**Distribution.** China (Guangxi, Guizhou and Hainan).



**FIGURES 1–7.** *Magadha basimaculata* sp. nov. 1. Male habitus, dorsal view; 2. Male habitus, lateral view; 3. Female habitus, dorsal view; 4. Female habitus, lateral view; 5. Head and thorax, dorsal view; 6. Head, lateral view; 7. Face. Scale bar: = 1 mm (Figs 5–7).



**FIGURES 8–16.** *Magadha basimaculata* sp. nov. 8. Forewing; 9. Hindwing; 10. Anal segment, dorsal view; 11. Male genitalia, lateral view; 12. Pygofer and genital style, ventral view; 13. Left genital style, dorsal view; 14. Anal segment, phallus, connective and style, left lateral view; 15. Apex of aedeagus, dorsal view; 16. Apex of aedeagus, ventral view. Scale bars: = 1 mm (Figs 8–9); 0.5 mm (Figs 11–16); 0.3 mm (Fig. 10).

**Remarks.** *Magadha basimaculata* is similar to *M. formosana* but differs from the latter in: forewing with one big transverse dark mark at base (no such marking in *M. formosana*); phallobase in lateral view with posterior half divided into 2 lobes (3 lobes in *M. formosana*), and in dorsal view with lateroapical margin rolled-up dorsad (not rolled-up in *M. formosana*).

***Magadha densimaculosa* sp. nov.**

(Figs 17–32)

**Measurements.** Body length (from apex of vertex to tip of forewing): male 5.0–5.8 mm (n = 102), female 6.0–6.7 mm (n = 55); forewing length: male 4.1–5.0 mm (n = 102), female 5.1–5.7 mm (n = 55).

**Coloration.** Brown to fuscous. Head, pronotum, mesonotum and forewing densely covered with small ivory-white to yellow brown spots (Figs 17–24). Eyes reddish brown, ocellus pale red. Hindwing pale brown, veins dark brown. Rostrum and legs brown. Abdomen dark brown.

**Head and thorax.** Ratio width of vertex from base to length in midline 2.0. Ratio length of frons in midline to maximum width 1.3, ratio maximum width to width at base 1.7. Ratio length of postclypeus in midline to length of frons 0.8. Ratio of apical to subapical segment of rostrum 1.4. Ratio length of pronotum in midline to length of vertex 0.7. Mesonotum in midline 6.5 times longer than pronotum, 2.7 times longer than pronotum and vertex combined. Forewing with ratio of length to maximum width 2.8. Hindwing with ratio of length to maximum width 1.8.

**Male genitalia.** Anal segment in dorsal view (Fig. 26) with ratio length to maximum width 0.6, apical margin distinctly concave, epiproct with apical margin slightly incised in the middle and slightly exceeding apical margin of anal segment. Pygofer in lateral view (Fig. 27) with dorsal margin longer than ventral margin, with the narrowest part in the middle, anterior margin broadly concave; in ventral view (Fig. 28), medioventral process of pygofer entire and narrow, with apical margin subangularly convex. Genital style relatively broad, with apex roundly convex, dorsal margin rising from 2 broad processes; inner surfaces near base with one long bent process, directed outwards (Fig. 29). Aedeagus with phallobase sheath-shaped, symmetrical (Figs 30–31); in the dorsal view (Fig. 30) dorsal lobe distinctly shorter than the ventral, and with apical margin cleft in the middle, bilateral margin rolled-up dorsad; in the ventral view (Fig. 31) ventral lobe with apical margin incised in the middle, each side of midline with a row of teeth; in lateral view (Fig. 32) the longest to the shortest lobes respectively: the ventral, the dorsal and the lateral; ventral lobe with most parts of margin serrated and the apex of dorsal lobe truncate.

**Type material.** Holotype: ♂, CHINA, **Guizhou:** Libo, Maolan National Natural Reserve, light trap, 16–17 July 2011, J.-K. Long. Paratypes, **Guizhou:** 2 ♂♂, 2 ♀♀, same data as holotype; 5 ♀♀, Maolan National Natural Reserve, light trap, 5 Aug. 1995, M.-F. Yang; 1 ♂, 10 ♀♀, Maolan National Natural Reserve, 4 Aug. 2006, F.-L. Xu; 6 ♂♂, 2 ♀♀, Maolan National Natural Reserve, 5 July 2010, X.-H. Hou; 4 ♂♂, 2 ♀♀, Maolan National Natural Reserve, 16 July 2011, Q.-Z. Song; 45 ♂♂, 6 ♀♀, Maolan National Natural Reserve, light trap, 16–20 July 2011, J.-K. Long; 20 ♂♂, 12 ♀♀, Maolan National Natural Reserve, 20 July 2011, J.-K. Long and Z.-M. Chang; 1 ♂, Yueliangshan, Congjiang, 19–23 July 2006, Q.-Z. Song; 3 ♂♂, 2 ♀♀, Taipingshan, Liping, 15–23 July 2006, Q.-Z. Song; 1 ♂, 1 ♀, Kuankuoshui National Natural Reserve, 14–18 Aug. 2010, Q.-Z. Song; 18 ♂♂, 4 ♀♀, Fodingshan, Shiqian, 10–12 Aug. 2011, Q.-Z. Song and F.-L. Xu.

**Etymology.** The species name is derived from the Latin words “*densus*” and “*maculosus*”, which refers to the body densely covered with small indistinct spots.

**Distribution.** China (Guizhou).

**Remarks.** *Magadha densimaculosa* resembles *M. formosana*, but differs from the latter in: forewing brown, with numerous ivory-white to tawny dots (forewing ivory-white, with variegated dark brown marks, and one broad dark brown band across middle third in *M. formosana*); epiproct of anal segment with apical margin slightly incised in the middle and slightly exceeding apical margin of anal segment (epiproct with apical margin subtruncate and not exceeding apical margin of anal segment in *M. formosana*); phallobase in dorsal view with lateroapical margin rolled up dorsad (not rolled up in *M. formosana*).

*Magadha densimaculosa* is also similar to *M. basimaculata* but differs from the latter in: forewing brown, with dense small ivory-white spots (forewing ivory-white, with one broad dark brown marking across base in *M. basimaculata*); genital style in dorsal view broad, dorsal margin with 2 processes (narrow, 3 processes in *M. basimaculata*); phallobase in lateral view with apical half divided into 3 lobes (2 lobes in *M. basimaculata*).



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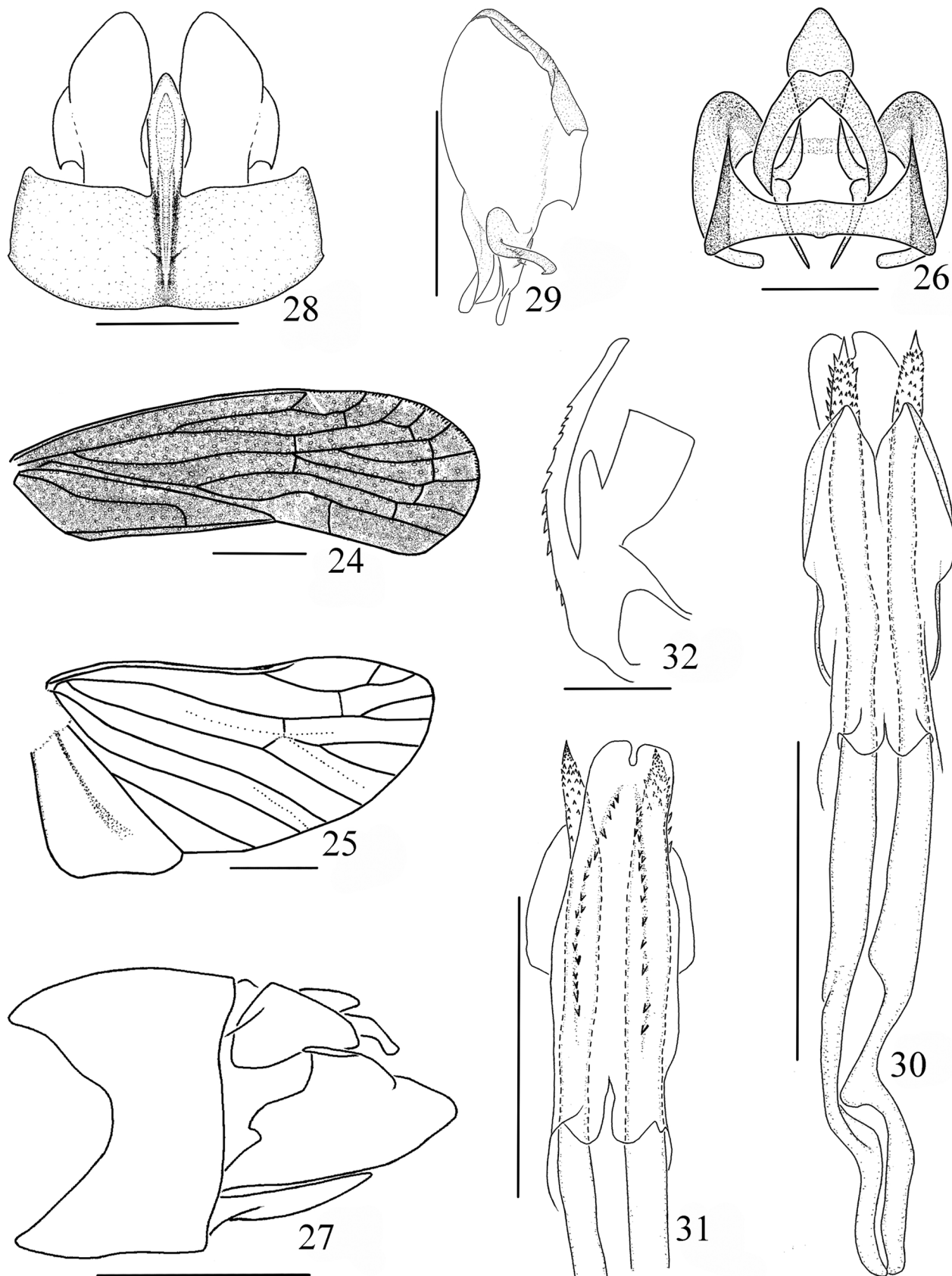
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**FIGURES 17–23.** *Magadha densimaculosa* sp. nov. 17. Male habitus, dorsal view; 18. Male habitus, lateral view; 19. Female habitus, dorsal view; 20. Female habitus, lateral view; 21. Head and thorax, dorsal view; 22. Head, lateral view; 23. Face. Scale bar: = 0.5 mm (Figs 21–23).





**FIGURES 24–32.** *Magadha densimaculosa* sp. nov. 24. Forewing; 25. Hindwing; 26. Anal segment, dorsal view; 27. Male genitalia, lateral view; 28. Pygofer and genital style, ventral view; 29. Left genital style, dorsal view; 30. Aedeagus, dorsal view; 31. Apex of aedeagus, ventral view; 32. Phallobase, right lateral view. Scale bars: = 1 mm (Figs 24–25); 0.5 mm (Figs 26–31); 0.2 mm (Fig. 32).

***Magadha intumescens* sp. nov.**

(Figs 33–50)

**Measurements.** Body length (from apex of vertex to tip of forewing): male 7.1 mm (n = 1), female 7.1–7.8 mm (n = 4); forewing length: male 6.1 mm (n = 1), female 6.1–6.6 mm (n = 4).

**Coloration.** Ivory-white to fuscous (Figs 33–39). Vertex yellowish brown, with 2 fuscous markings at lateral margins (Fig. 37). Frons fuscous, with 7 small ivory-white markings along lateral margin, base almost ivory-white, along median carina with irregular ivory-white markings, the largest marking near frontoclypeus suture (Fig. 39). Postclypeus with basal half ivory-white and apical half brown (Fig. 39). Genae fuscous, with 3 areas ivory-white as in Fig. 38. Eyes dark brown, ocellus ivory-white. Antennae and rostrum brown. Pronotum fuscous, except for area between lateral carinae, angle at ventral margin and 4 longitudinal bridges on the lateral lobe ivory-white (Fig. 37). Tegula with dorsal half pale yellowish brown and ventral half fuscous (Figs 34, 36–37). Mesonotum mainly fuscous (Fig. 37), posterior two-thirds between lateral carinae with pale yellow dots. Forewing with basal two-thirds opaque and apical third subdiaphanous, basal third mainly dark brown, middle third almost ivory-white, and apical third mainly pale gray (Figs 33–36, 40). Hindwing pale brown, veins dark brown. Legs brown, with apex of femur and base of tibiae pale yellowish brown. Abdomen dark brown.

**Head and thorax.** Ratio width of vertex from base to length in midline 1.8. Ratio length of frons in midline to maximum width 1.4, ratio maximum width to width at base 1.9. Ratio length of postclypeus in midline to length of frons 0.6. Ratio of apical to subapical segment of rostrum 1.5. Pronotum relatively short, lateral lobe with 4 longitudinal bridges, ratio length of pronotum in midline to length of vertex 0.6. Mesonotum in midline 7.5 times longer than pronotum, 2.8 times longer than pronotum and vertex combined. Forewing with ratio of length to maximum width 2.8. Hindwing with ratio of length to maximum width 1.8.

**Male genitalia.** Anal segment in dorsal view (Fig. 42) with ratio length to maximum width 1.2, apical margin broadly concave, lateroapical margin concave. Pygofer in lateral view (Fig. 43) with dorsal margin distinctly longer than ventral margin, the narrowest part at ventral third, anterior margin broadly concave; in ventral view (Fig. 45), medioventral process of pygofer entire and rectangular, with ratio length to width 1.8, along midline almost convex. Genital style distinctly longer than wide, with apex narrow, apical two-thirds of ventral margin relatively straight, 2 small processes arising from centre of dorsal margin and 1 larger process from near base of dorsal margin; inner surfaces near base with 1 fingerlike process, directed outwards (Fig. 46). Aedeagus with phallobase sheath-shaped and incompletely symmetrical (Figs 47, 49–50); in dorsal view (Fig. 47) dorsal lobe shorter than 2 lateral lobes, and with 2 processes rising from apical third, directed basad, the left process with one short blunt process and 2 spines at base, and the right one with only one sharp short process at base, the 2 lateral lobes bent toward each other apically; in ventral view (Fig. 48) ventral lobe slightly shorter than the lateral, with apical margin deeply cleft in the middle and with inside margins slightly carinal ventrad and shagreen at base. Suspensoria distinctly intumescent near anal segment (Figs 43, 44)

**Type material.** Holotype: ♂, CHINA, **Guizhou:** Wangmo, Dayi, 21–22 Aug. 2012, S.-Y. Xu. Paratypes, **Guizhou:** 2 ♀♀, same data as holotype; 1 ♀, Dayi, Wangmo, 21–22 Aug. 2012, W.-C. Yang; 1 ♀, Dayi, Wangmo, 21–22 Aug. 2012, W.-B. Zheng.

**Etymology.** The species name is derived from the Latin words “*intumescens*”, which indicates suspensoria distinctly intumescent (Fig. 44).

**Distribution.** China (Guizhou).

**Remarks.** *Magadha intumescens* is similar to *M. pinnata* but differs from the latter in: mesonotum dark brown (grayish brown in *M. pinnata*); anal segment of male in dorsal view with lateroapical margin concave (lateroapical margin round convex in *M. pinnata*); phallobase in dorsal view with dorsal lobe with only 2 small processes near the middle (with 2 large and 2 small processes in the middle in *M. pinnata*), in ventral view with ventral lobe with apical margin deeply cleft in the middle (apical margin slightly incised in the middle in *M. pinnata*).



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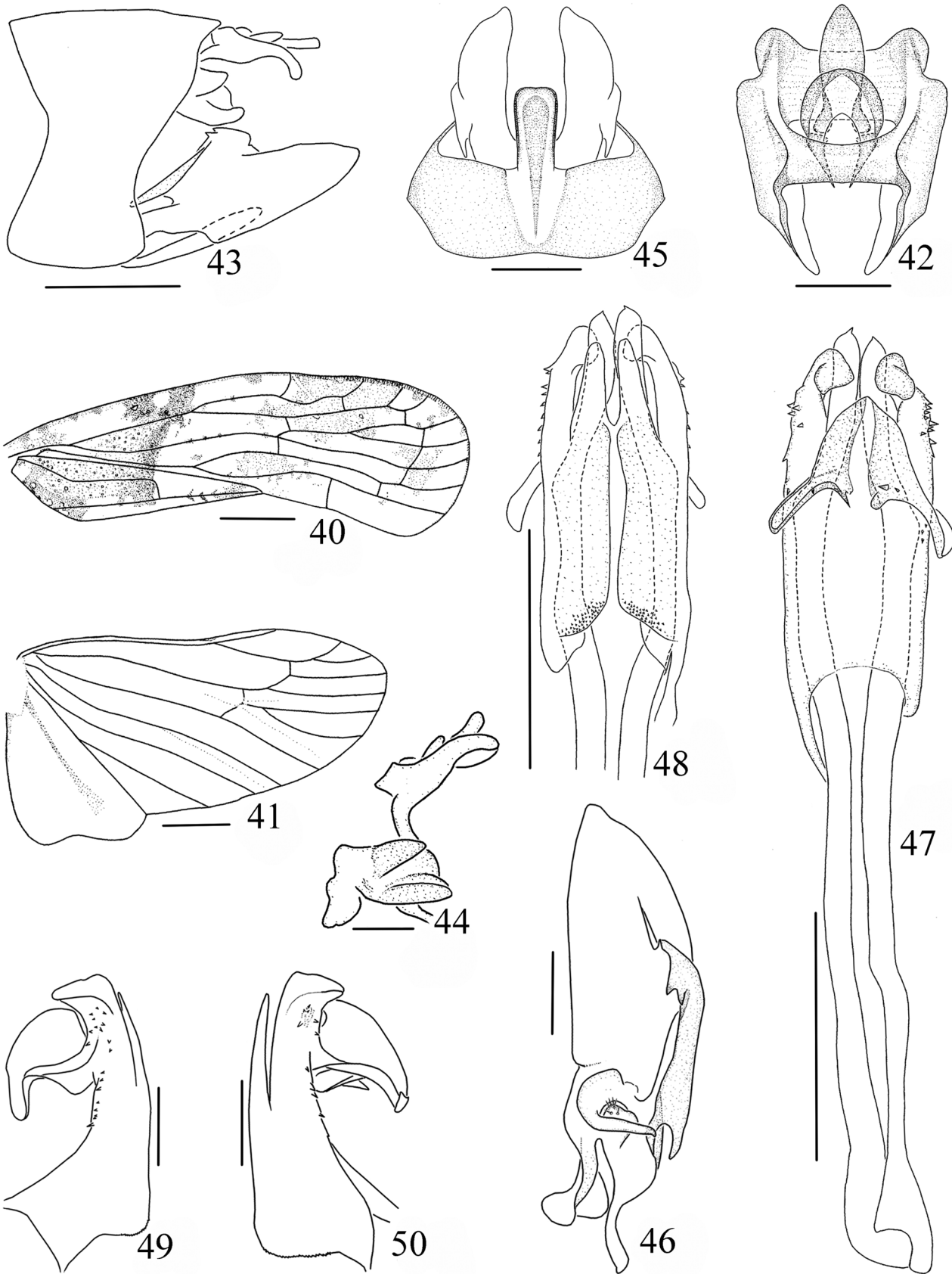


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**FIGURES 33–39.** *Magadha intumescens* sp. nov. 33. Male habitus, dorsal view; 34. Male habitus, lateral view; 35. Female habitus, dorsal view; 36. Female habitus, lateral view; 37. Head and thorax, dorsal view; 38. Head, lateral view; 39. Face. Scale bar: = 0.5 mm (Figs 21–23).



**FIGURES 40–50.** *Magadha intumescens* sp. nov. 40. Forewing; 41. Hindwing; 42. Anal segment, dorsal view; 43. Male genitalia, lateral view; 44. Anal segment and suspensoria, left lateral view; 45. Pygofer and genital style, ventral view; 46. Left genital style, dorsal view; 47. Aedeagus, dorsal view; 48. Apex of aedeagus, ventral view; 49. Phallobase, left lateral view; 50. Phallobase, right lateral view. Scale bars: = 1 mm (Figs 40–41); 0.5 mm (Figs 43, 45, 47–48); 0.2 mm (Figs 42, 44, 46, 49–50).

### ***Magadha pinnata* Chen, Yang & Wilson, 1989**

(Figs 51–66)

*Magadha pinnata* Chen, Yang & Wilson, 1989: 40.

**Material Examined.** CHINA, **Taiwan:** 1 ♂, Tengzhi, Kaohsiung, 21 Nov. 2002, X.-S. Chen; 1 ♀, Tengzhi, Kaohsiung, 12 Dec. 2007, X.-S. Chen. **Jiangxi:** 2 ♂♂, 2 ♀♀, Xiagongtang, Jiulianshan National Natural Reserve, 19 July 2009, Z.-H. Meng. **Sichuan:** 1 ♂, 3 ♀♀, Shuimogou, Guangyuan, light trap, 16 Aug. 2008, Z.-H. Meng. **Guizhou:** 2 ♀♀, Dashah Daozhen, 20–21 Aug. 2004, X.-S. Chen; 1 ♀, Maolan National Natural Reserve, 4 Aug. 2006, F.-L. Xu; 1 ♂, 2 ♀♀, Kuankuoshui National Natural Reserve, light trap, 14 Aug. 2010, X.-F. Yu; 20 ♂♂, 11 ♀♀, Kuankuoshui National Natural Reserve, 14 Aug. 2010, H. Li, J.-C. Xing, J.-K. Long, J.-Q. Ni, P. Zhang, X.-F. Yu and Y.-J. Li; 2 ♂♂, Kuankuoshui National Natural Reserve, light trap, 4 Sep. 2010, X.-H. Hou; 2 ♀♀, Leigongshan National Natural Reserve, 8–10 July 2011, J.-K. Long and W.-B. Zheng.

**Distribution.** China (Guizhou, Jiangxi, Sichuan and Taiwan).

### ***Magadha redunca* Chen, Yang & Wilson, 1989**

(Figs 67–82)

*Magadha redunca* Chen, Yang & Wilson, 1989: 38.

**Material Examined.** CHINA, **Taiwan:** 2 ♂♂, 1 ♀, Tengzhi, Kaohsiung, 21 Nov. 2002, X.-S. Chen; 1 ♀, Shanxi, Nantou, 21 Dec. 2002, X.-S. Chen.

**Distribution.** China (Taiwan).

### ***Magadha taibaishanensis* Wang, 1989**

(Figs 83–98)

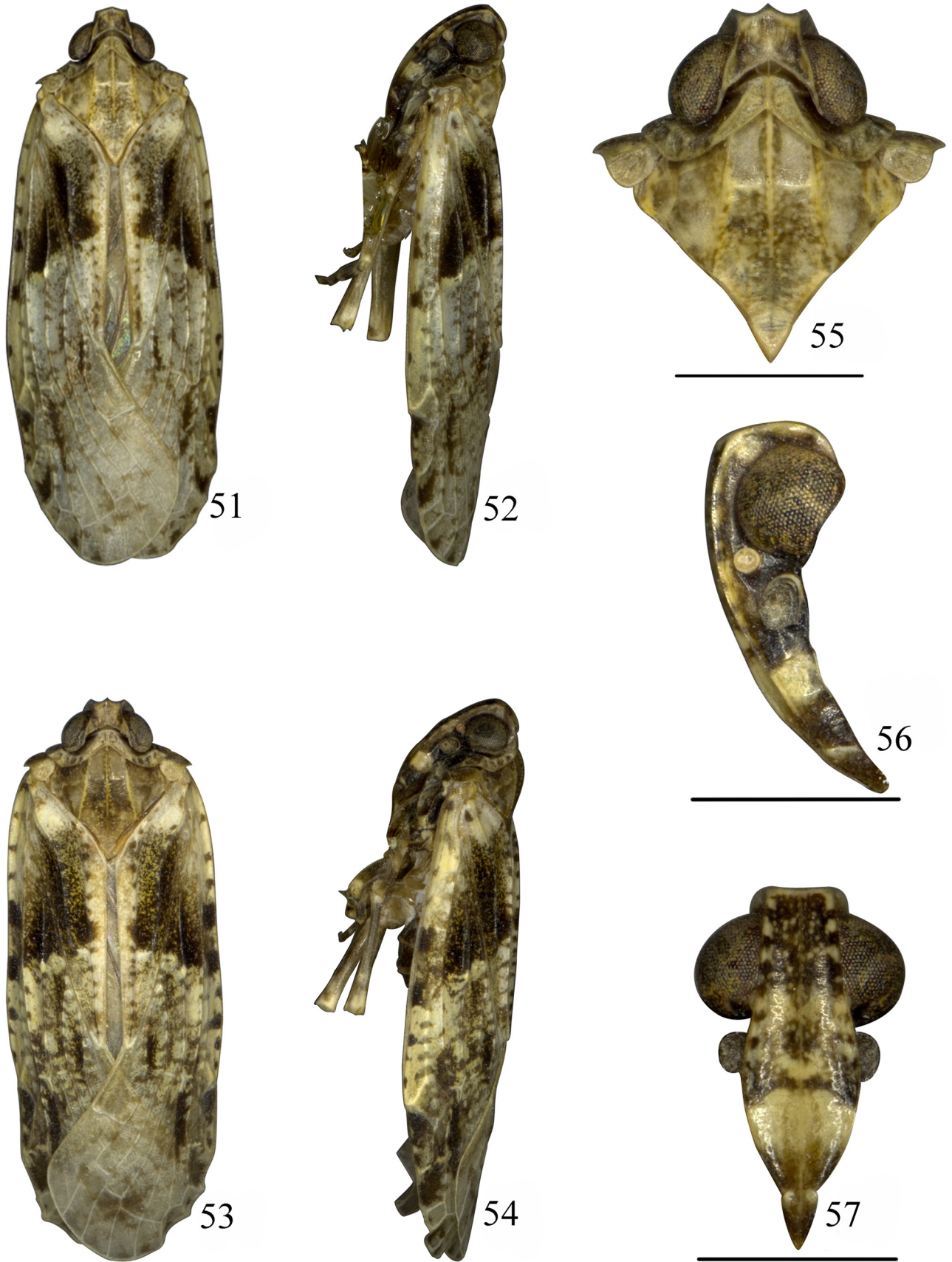
*Magadha taibaishanensis* Wang, 1989: 95.

**Measurements.** Body length (from apex of vertex to tip of forewing): male 6.4–7.6 mm (n = 37), female 6.8–8.8 mm (n = 27); forewing length: male 5.4–6.6 mm (n = 37), female 5.6–7.6 mm (n = 27).

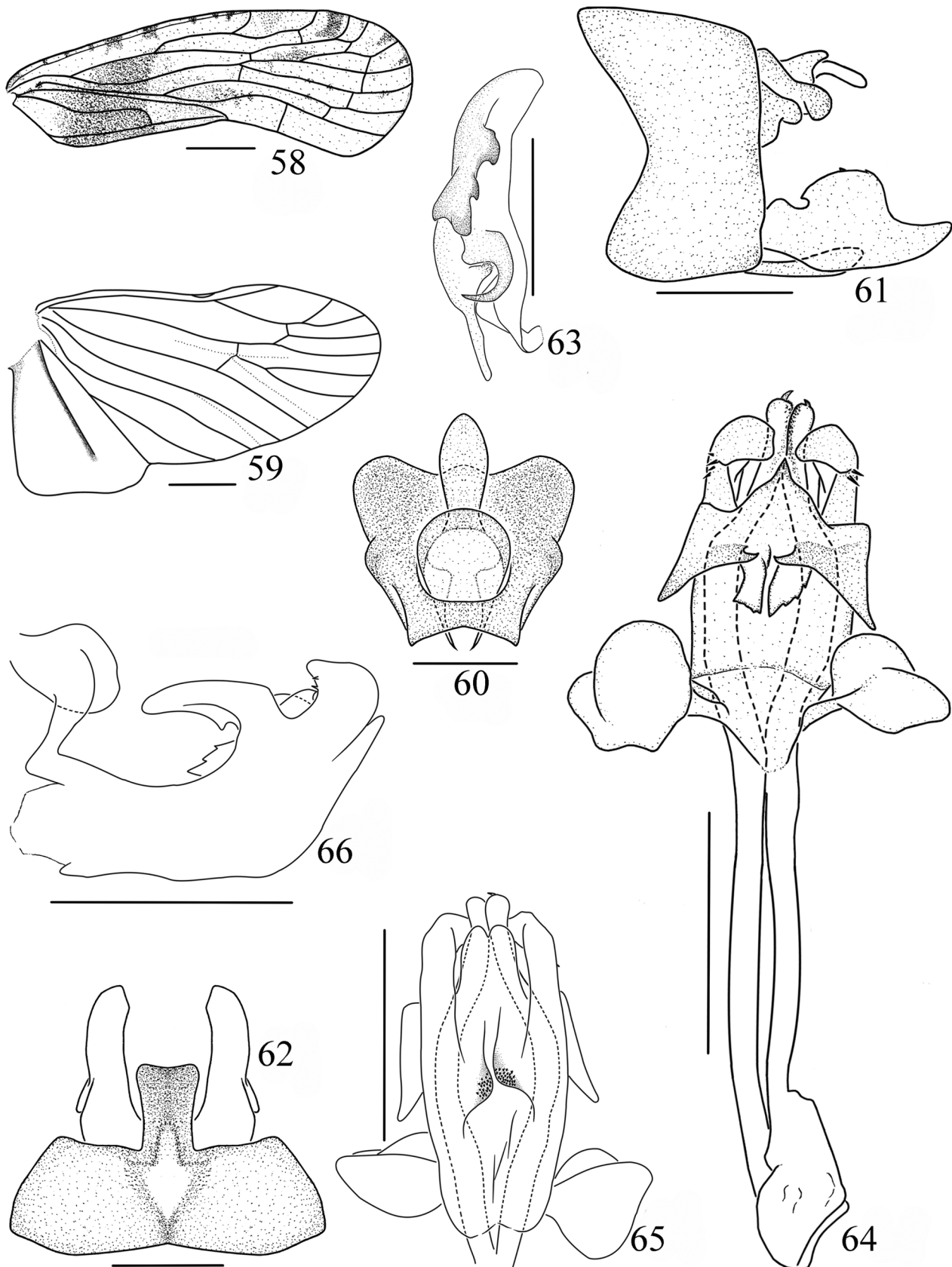
**Coloration.** Pale yellowish brown to fuscous (Figs 83–89). Vertex, pronotum and tegula pale yellowish brown (Fig. 87). Frons light brown, with 1 broad ivory-white band across the middle and 1 dark brown band at apex (Fig. 89). Clypeus ivory-white, with anteclypeus and apex of postclypeus brown. Genae fuscous, above eyes, before ocellus and across apical third with ivory-white markings, antennae brown, eyes dark brown and ocellus ivory-white (Fig. 88). Rostrum brown with apex dark brown. Mesonotum pale yellowish brown, area between lateral carinae with posterior two-thirds dark brown. Forewing fuscous, basal two-thirds with irregular dark markings (Figs 83–86, 90). Hindwing pale brown, veins dark brown. Legs pale brown. Abdomen dark brown.

**Head and thorax.** Ratio width of vertex from base to length in midline 2.1. Ratio length of frons in midline to maximum width 1.6, ratio maximum width to width at base 1.7. Ratio length of postclypeus in midline to length of frons 0.7. Ratio of apical to subapical segment of rostrum 1.2. Ratio length of pronotum in midline to length of vertex 1.2. Mesonotum in midline 3.7 times longer than pronotum, 2.0 times longer than pronotum and vertex combined. Forewing with ratio of length to maximum width 2.8. Hindwing with ratio of length to maximum width 1.7.

**Male genitalia.** Anal segment in dorsal view subquadrate (Fig. 92), as long as wide (maximum width), apical margin slightly round. Pygofer in lateral view (Fig. 93) with dorsal margin distinctly longer than ventral margin, with the narrowest part in the middle, anterior margin concave; in ventral view (Fig. 94), medioventral process of pygofer entire and rectangular, with base two-thirds convex in the midline. Genital style distinctly longer than wide, with 3 processes arising from middle of dorsal margin; inner surfaces near dorsal margin at basal third with 1 relatively long and bent process (Fig. 95). Aedeagus with phallobase sheath-shaped and symmetrical, dorsal lobe shorter than the lateral and ventral lobe (Figs 96, 98), with apical margin angularly convex in the middle (Fig. 96),



**FIGURES 51–57.** *Magadha pinnata* Chen, Yang & Wilson, 1989. 51. Male habitus, dorsal view; 52. Male habitus, lateral view; 53. Female habitus, dorsal view; 54. Female habitus, lateral view; 55. Head and thorax, dorsal view; 56. Head, lateral view; 57. Face. Scale bar: = 1 mm (Figs 21–23)

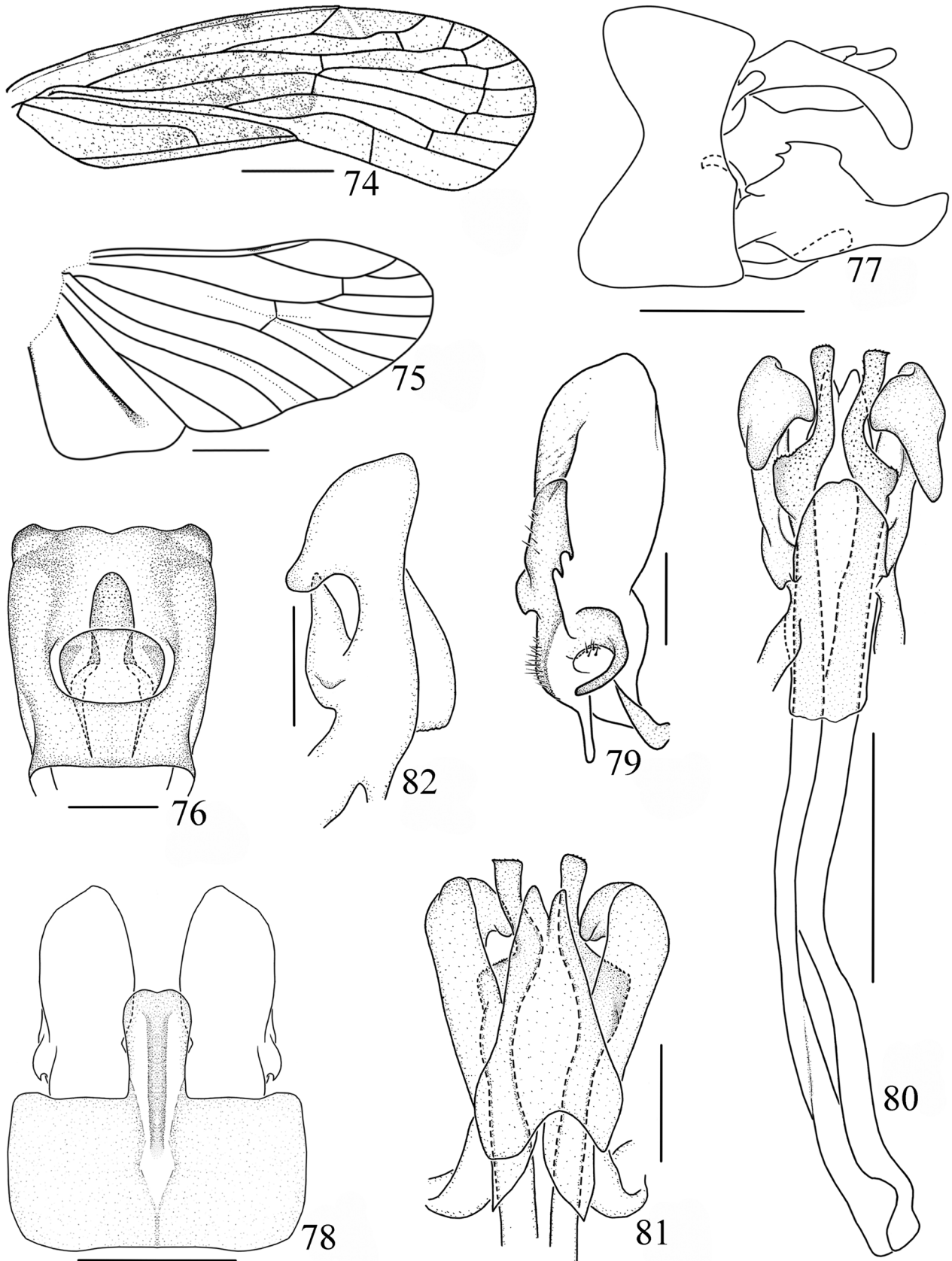


**FIGURES 58–66.** *Magadha pinnata* Chen, Yang & Wilson, 1989. 58. Forewing; 59. Hindwing; 60. Anal segment, dorsal view; 61. Male genitalia, lateral view; 62. Pygofer and genital style, ventral view; 63. Right genital style, dorsal view; 64. Aedeagus, dorsal view; 65. Apex of aedeagus, ventral view; 66. Phallobase, left lateral view. Scale bars: = 1 mm (Figs 58–59); 0.5 mm (Figs 61–66); 0.2 mm (Fig. 60).



**FIGURES 67–73.** *Magadha redunca* Chen, Yang & Wilson, 1989. 67. Male habitus, dorsal view; 68. Male habitus, lateral view; 69. Female habitus, dorsal view; 70. Female habitus, lateral view; 71. Head and thorax, dorsal view; 72. Head, lateral view; 73. Face. Scale bar: = 0.5 mm (Figs 21–23).





**FIGURES 74–82.** *Magadha redunca* Chen, Yang & Wilson, 1989. 74. Forewing; 75. Hindwing; 76. Anal segment, dorsal view; 77. Male genitalia, lateral view; 78. Pygofer and genital style, ventral view; 79. Right genital style, dorsal view; 80. Aedeagus, dorsal view; 81. Apex of aedeagus, ventral view; 82. Phallobase, left lateral view. Scale bars: = 1 mm (Figs 74–75); 0.5 mm (Figs 77–78, 80); 0.2 mm (Figs 76, 79, 81–82).



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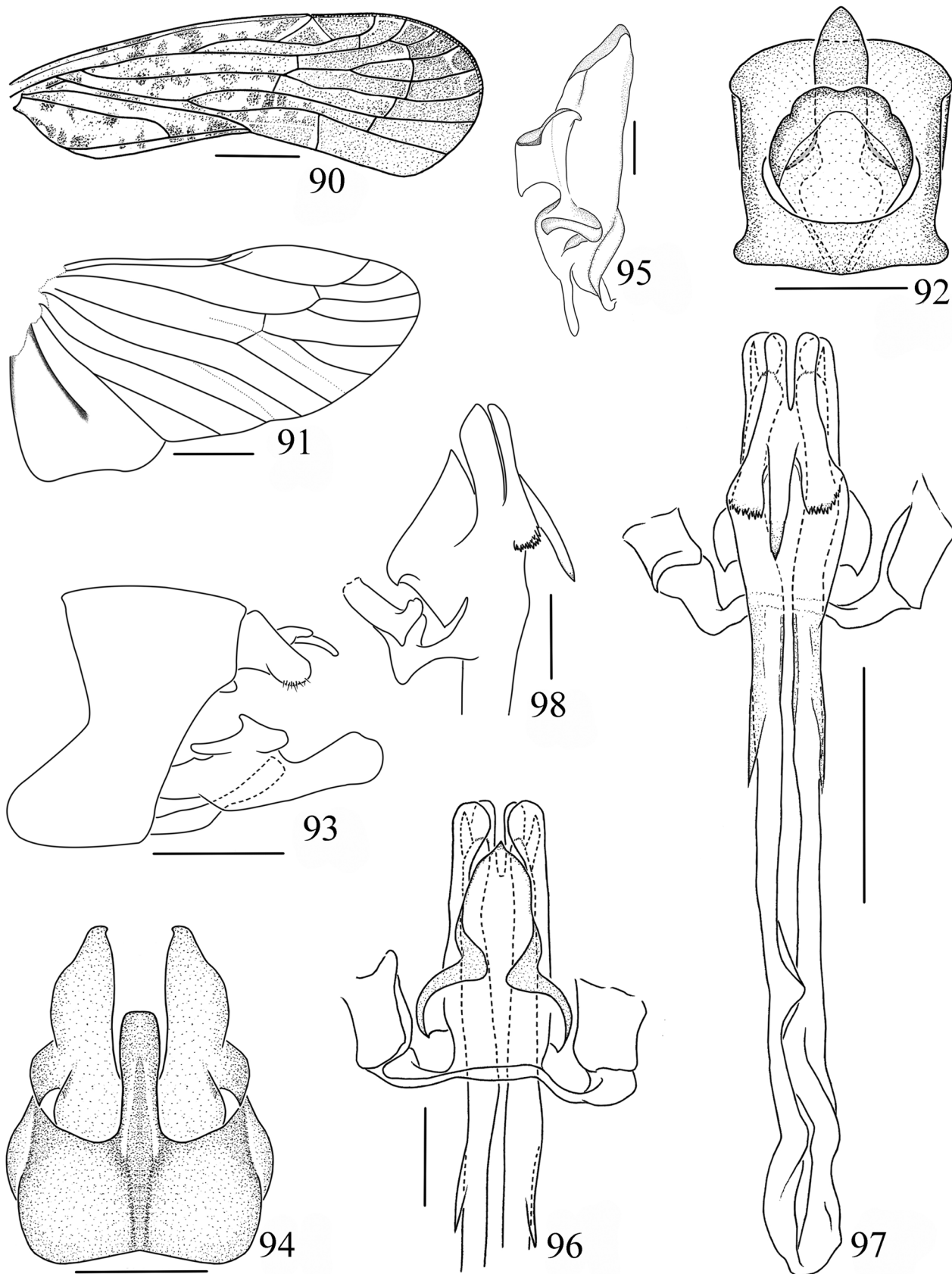


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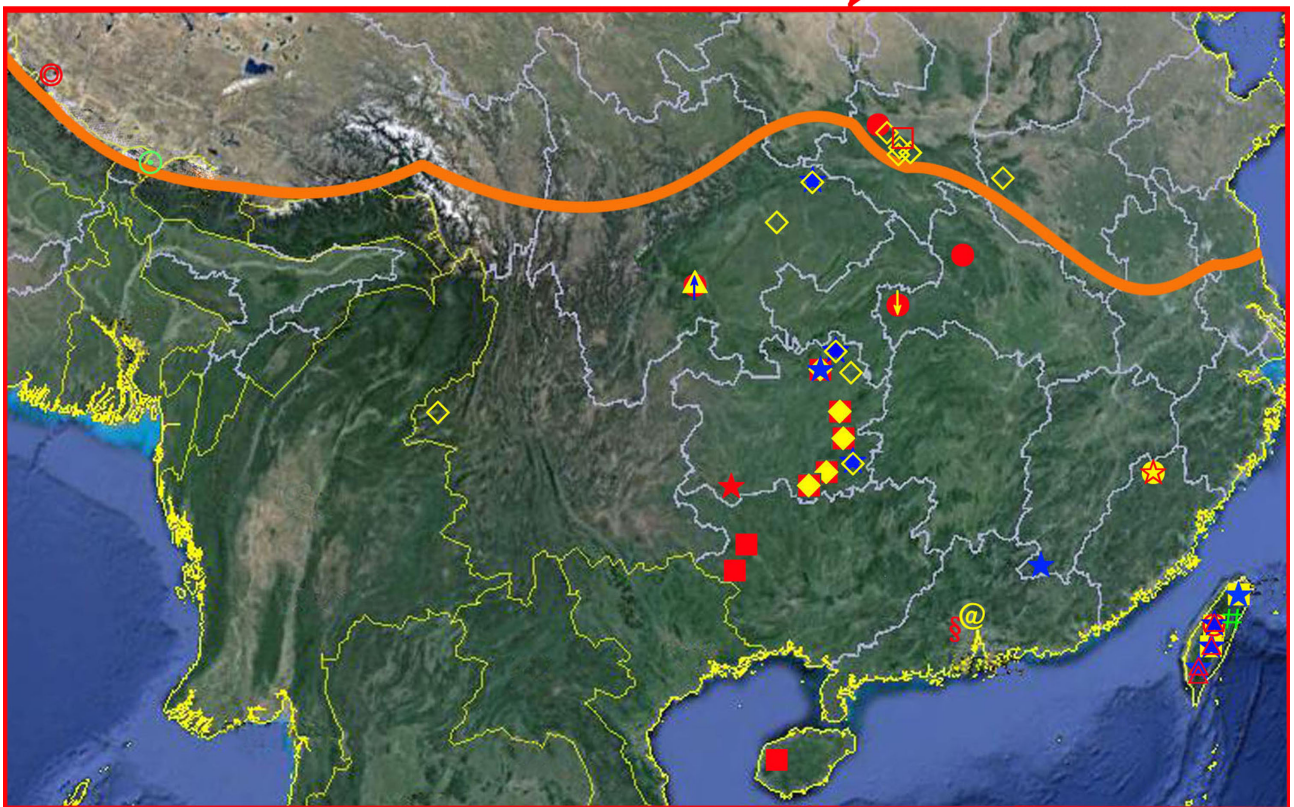
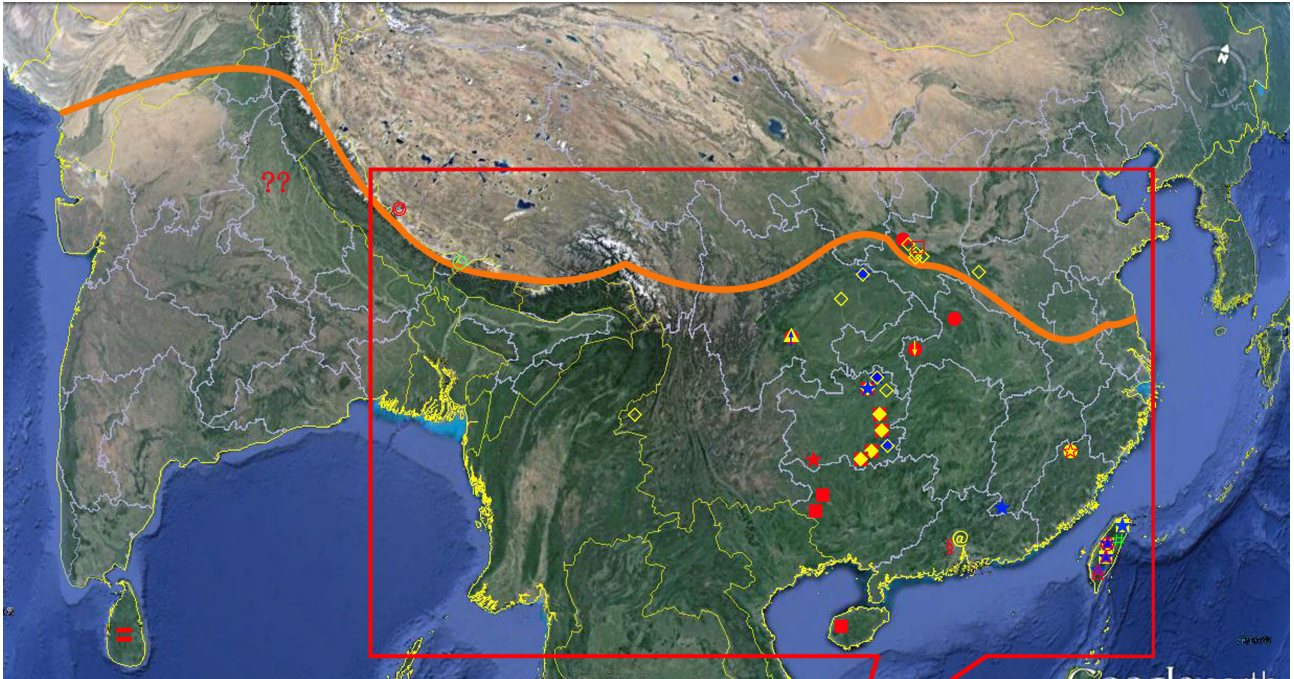


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**FIGURES 83–89.** *Magadha taibaishanensis* Wang, 1989. 83. Male habitus, dorsal view; 84. Male habitus, lateral view; 85. Female habitus, dorsal view; 86. Female habitus, lateral view; 87. Head and thorax, dorsal view; 88. Head, lateral view; 89. Face. Scale bar: = 0.5 mm (Figs 87–89).



**FIGURES 90–98.** *Magadha taibaishanensis* Wang, 1989. 90. Forewing; 91. Hindwing; 92. Anal segment, dorsal view; 93. Male genitalia, lateral view; 94. Pygofer and genital style, ventral view; 95. Right genital style, dorsal view; 96. Apex of aedeagus, dorsal view; 97. Aedeagus, ventral view; 98. Phallobase, left lateral view. Scale bars: = 1 mm (Figs 90–91); 0.5 mm (Figs 93–94, 97); 0.2 mm (Figs 92, 95–96, 98).



**FIGURE 99.** *M. basimaculata* sp. nov. (■); *M. cervina* (▲); *M. densimaculosa* sp. nov. (◆); *M. eusordida* (●); *M. fennahi* (●); *M. flavisigna* (??); *M. formosana* (○); *M. guangdongensis* (§); *M. guangzhouensis* (@); *M. gyirongensis* (◎); *M. intumescens* sp. nov. (★); *M. metasequoiae* (↓); *M. nebulosa* (■); *M. pinnata* (★); *M. redunca* (△); *M. semitransversa* (#); *M. shaanxiensis* (□); *M. taibaishanensis* (◇); *M. w-maculata* (☆); *M. wuyishanana* (●); *M. yadongensis* (○); *M. yangia* (↑). Boundary of Oriental and Palearctic regions (—).

each lateral margin dorsad rising from 1 valviform process (Figs 96, 98); ventral lobe (Fig. 97) with apical margin deeply cleft in the middle, ventral surface ventrad rising from 3 processes, directed basad, the middle one long, spine-like, 2 others symmetrical beside the midline, each with many sharp teeth apically (Figs 97–98)

**Material Examined.** CHINA, **Shaanxi:** 2 ♂♂, Taibaishan National Natural Reserve, light trap, 11 July 2012, Z.-M. Chang; 3 ♂♂, 3 ♀♀, Foping National Natural Reserve, 15–17 July 2010, H. Li and Z.-H. Fan; 1 ♀, Foping National Natural Reserve, 4–7 Aug. 2010, P. Zhang; 2 ♂♂, 1 ♀, Heihe Forest Park, Zhouzhi, 9–12 Aug. 2010, Y.-L. Zheng and Z.-M. Chang. **Henan:** 6 ♂♂, 2 ♀♀, Niufushan National Natural Reserve, 2 July 2010, H. Li and Z.-H. Fan; 1 ♂, 2 ♀♀, Taiping, Xixia, 30 July–1 Aug. 2010, H. Li and Z.-H. Fan. **Sichuan:** 1 ♂, Qianfoshan, Mianyang, light trap, 13 Aug. 2007, Z.-H. Meng; 2 ♂♂, 2 ♀♀, Shuimogou, Guangyuan, light trap, 16 Aug. 2008, Z.-H. Meng; 1 ♂, Labahe, Quantian, 25 July 2012, H. Li. **Yunnan:** 1 ♂, Tengchong, 13 Aug. 2006, Z.-G. Zhang. **Guizhou:** 1 ♂, Dashahe, Daozhen, X.-S. Chen; 1 ♂, Mayanghe National Natural Reserve, 6 Oct. 2009, Y.-J. Li; 2 ♂♂, 1 ♀, Leigongshan National Natural Reserve, 13–14 Sep. 2005, Z.-Z. Li and B. Zhang; 8 ♂♂, 6 ♀♀, Leigongshan National Natural Reserve, light trap, 2–4 July 2011, J.-K. Long; 3 ♂♂, 5 ♀♀, Leigongshan National Natural Reserve, 4–6 July 2011, J.-K. Long; 2 ♂♂, 2 ♀♀, Leigongshan National Natural Reserve, light trap, 3–6 July 2011, W.-B. Zheng; 1 ♂, 2 ♀♀, Leigongshan National Natural Reserve, 5 July 2011, W.-B. Zheng.

**Distribution.** China (Guizhou, Henan, Shaanxi, Sichuan and Yunnan) (new records for Oriental region).

**Remarks.** Wang (1990) described *M. taibaishanensis* based on 1 female specimen from Taibaishan National Natural Reserve, Shaanxi Province, China. Two of the male specimens examined and described here were collected in the same locality as holotype and show similar markings on head and thorax.

## Discussion

The genus *Magadha* now consists of 22 species. The majority of species (18 species) are distributed in the Oriental region, especially in southern China (16 species). The remaining four species (*M. gyirongensis*, *M. shaanxiensis*, *M. taibaishanensis* and *M. yadongensis*) are found in the Palaearctic region but near the boundary of the Oriental and Palaearctic regions (Fig. 99). This strongly suggests that *Magadha* is an Oriental genus.

In all recorded species of *Magadha* where both sexes are known, the external morphological characteristics (especially coloration) vary little between the male and female (Figs 1–4, 17–20, 33–36, 51–54, 67–70, 83–86; Chen *et al.*, 1989; Wang & Wang, 1988). The only exception appears to be that the overall body length of the female is larger than the male.

*Metasequoia glyptostroboides* is currently the only known host record for the genus (Fennah, 1956). However, the ecology of the majority of described species (including the species described in this paper) is largely undocumented, and further research is required.

## Acknowledgements

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