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External Male Genitalia of the Aradidae (Hemiptera: Heteroptera)【Research report】

扁蝽科雄性外性器（半翅目：異翅亞目）【研究報告】

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Abstract

The external male genitalia of currently available species of Aradus sp. (Aradinae), Aneurus sp. (Aneurinae), Daulocoris formosanus Kormilev (Mezirinae), Mezira (Zemira) taiwanica Kormilev, and Mezira (Zemira) hsiaoi Blöte (Mezirinae) are illustrated and described. The characteristic feature of the external male genitalia in this family is the 45° counterclockwise rotation of abdominal segment IX longitudinally except in Aradus sp.

摘要

選現有標本扁蝽科種類：Aradus sp. (Aradinae)、Aneurus sp. (Aneurinae)、Daulocoris formosanus Kormilev (Mezirinae)、Mezira (Zemira) taiwanica Kormilev與Mezira (Zemira) hsiaoi Blote (Mezirinae)繪圖，敘述其雄性外性器。此科雄性外性器特殊形貌為第九節腹節（生殖節），除Aradus sp.外皆逆時針縱行45度旋轉。

Key words: Aradidae, external male genitalia, morphology

關鍵詞: 扁蝽科、雄性外性器、形態學

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External Male Genitalia of the Aradidae (Hemiptera: Heteroptera)

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ABSTRACT

The external male genitalia of currently available species of *Aradus* sp. (Aradinae), *Aneurus* sp. (Aneurinae), *Daulocoris formosanus* Kormilev (Mezirinae), *Mezira* (*Zemira*) *taiwanica* Kormilev, and *Mezira* (*Zemira*) *hsiaoi* Blöte (Mezirinae) are illustrated and described. The characteristic feature of the external male genitalia in this family is the 45° counterclockwise rotation of abdominal segment IX longitudinally except in *Aradus* sp.

Key words: Aradidae, external male genitalia, morphology

Introduction

The aedeagus of *Dysedius* sp. (Aradidae) as termed by Yang and Chang (2000: 699, Fig. 562) is actually the reservoir lumen. The description, "abdominal segment dorsal view 180 degree rotation", concerning the direction of the anterior opening is also unsuitable. Investigating the structure in much greater detail to correct these wrong judgments was the main purpose of in this study.

***Aradus* sp.** (Aradinae) Fig. 1.

Abdominal segments I-IX figured in dorsal view. Abdominal segment VIII tube-shaped, tergite developed, bifurcated, and toothed along margins apically; sternite roundly hollowed to receive segment IX. Abdominal segment IX in lateral view subquadrate, anterior opening directed cephalad, posterior opening directed dorsocaudad; posterior margin strongly sinuated behind base of segment X in dorsal view. Abdominal sternite IX smooth, caudal margin not emarginated medially. Genital styles long, slender, directed caudad. Abdominal segment X elongated quadrate in dorsal view. Abdominal segment XI retracted into segment X. Genital plates semicircular in anterodorsal view.

Phallus directed dorsad within segment IX. Connective rather shallowly curved in dorsal view. Upper portion of support bridge appearing as cross bar of connective; lower portion not carefully examined. Capitate processes present. Support tube stout in lateral view. Phallobase stout, subquadrate, in lateral

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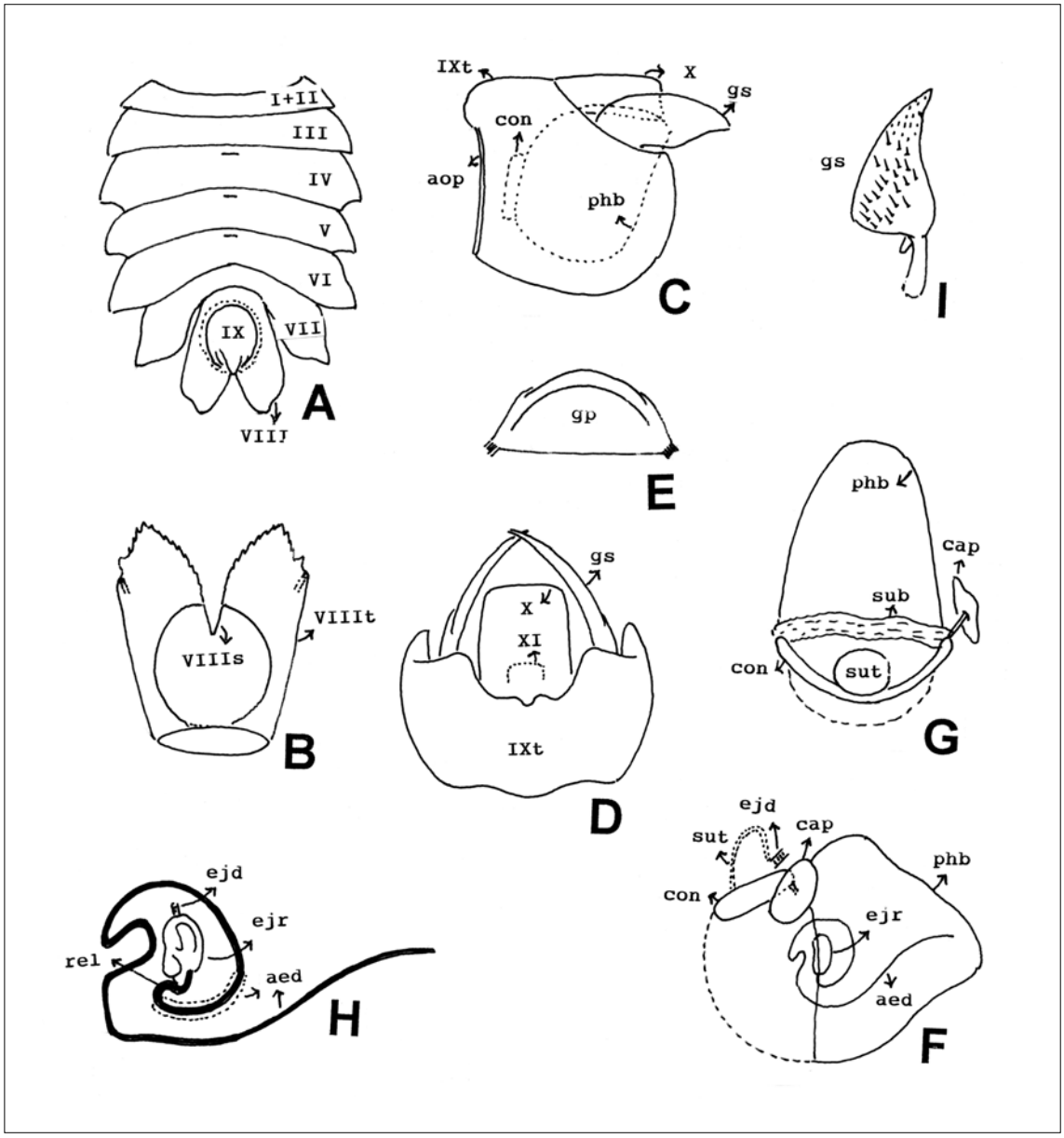

Fig. 1. *Aradus* sp. (Aradinae).
A. Abdominal segments I-IX, dorsal vieew; B. abdominal segment VIII, dorsal view; C. abdominal segments IX-X and genital styles, lateral view; D. the same, dorsal view; E. genital plates, anterodorsal view; F. phallus, lateral view; G. the same, dorsal view; H. ejaculatory duct, ejaculatory reservoir, reservoir lumen, and aedeagus, lateral view; I. left genital style, lateral view.

Abbreviations: I-XI, abdominal segments I-XI; VIIIt, IXt, abdominal tergites VIII, and IX; VIIIs, IXs, abdominal sternites VIII, and IX; aed, aedeagus; aop, anterior opening of abdominal segment IX; cap, capitate processes; con, connective; ejd, ejaculatory duct; ejr, ejaculatory reservoir; gp, genital plates; gs, genital styles; phb, phallobase; phcp, phallobasal conjunctival processes; rel, reservoir lumen; sub, support bridge; sut, support tube.

view apical 1/2 sclerotized, basal 1/2 membranous. Phallobasal conjunctival processes unrecognizable. Ejaculatory reservoir small, elongatd oval, rotated 270° clockwise. Reservoir lumen extreme long, pigmented, protruding from ventral portion of ejaculatory reservoir, curved upwards, cephalad, downwards, and finally caudad. Aedeagus membranous, its apical portion difficult to distinquish. Genital styles symmetrical in size and shape; figured in lateral view.

***Aneurus* sp.** (Aneurinae) Fig. 2.

Abdominal segments V-IX figured in dorsal view. Abdominal segment VIII not carefully examined. Abdominal segment IX rotated 45° counterclockwise in lateral view; anterior opening directed ventrocephalad in the lateral view; posterior opening directed dorsocephalad, 2 openings situated oppositely in dorsal and ventral aspects. Abdominal sternite IX granulated; caudal margin not emarginated medially. Genital styles directed cephalad. Abdominal segments X and XI not carefully examined. Genital plates arched in anterodorsal view.

Phallus directed cephalad within segment IX. Connective rod-like in lateral view; dorsal view not carefully examined. Support bridge not carefully examined. Capitate processes present. Support tube small, semicircular in lateral view. Phallobase tubular in lateral view, apical 1/2 sclerotized, basal 1/2 membranous, opening extreme small, situated at ventroapical angle. Phallobasal conjunctival processes unrecognizable. Ejaculatory reservoir elongated oval, rotated 180° clockwise. Reservoir lumen tubular, slightly narrowing to apex, protruding from dorsocaudal portion of ejaculatory reservoir, apical 2/3 straight. Aedeagus membranous. Genital styles symmetrical in size and shape; figured in dorsal view.

***Daulocoris formosanus* Kormilev** (Mezirinae) Fig. 3.

Abdominal segments V-IX figured in dorsal view. Abdominal segment VIII with reduced tergite, only basal and lateral portions (may be pleurite) present; lateral portion of apices not dilated. Abdominal segment IX rotated 45° counterclockwise in view lateral; anterior opening rather long, directed ventrocephalad; posterior opening directed dorsocephalad; 2 openings situated oppositely in dorsal and ventral aspects. Abdominal sternite IX granulated; caudal margin not emarginated medially. Genital styles directed cephalad. Abdominal segment X quadrate in dorsal view. Abdominal segment XI retracted into segment X. Genital plates in anterodorsal view triangular, apex roundly produced forward medially.

Phallus directed cephalad within segment IX. Connective U-shaped in dorsal view. Support bridge with upper portion appearing as cross bar of connective in dorsal view; lower portion with apices turned upwards connecting to dorsal aspect of ejaculatory reservoir in lateral view. Capitate processes present. Phallobase slender, apical 1/2 sclerotized, basal 1/2 membranous. Phallobasal conjunctival processes as figured. Ejaculatory reservoir elongate oval, pigmented, rotated 180° clockwise, Reservoir lumen extremly long, converging to apex, protruding from dorsocaudal portion of ejaculatory reservoir, turned cephalad, then curved ventrad, finally reflected cephalad and curved caudad. Aedeagus membranous, its apical partion difficult to distinguish. Genital styles symmetrical in size and shape; left genital style figured in dorsal view.

***Mezira (Zemira) taiwanica* Kormilev** (Mezirinae) Fig. 4.

Abdominal segments V-IX figured in

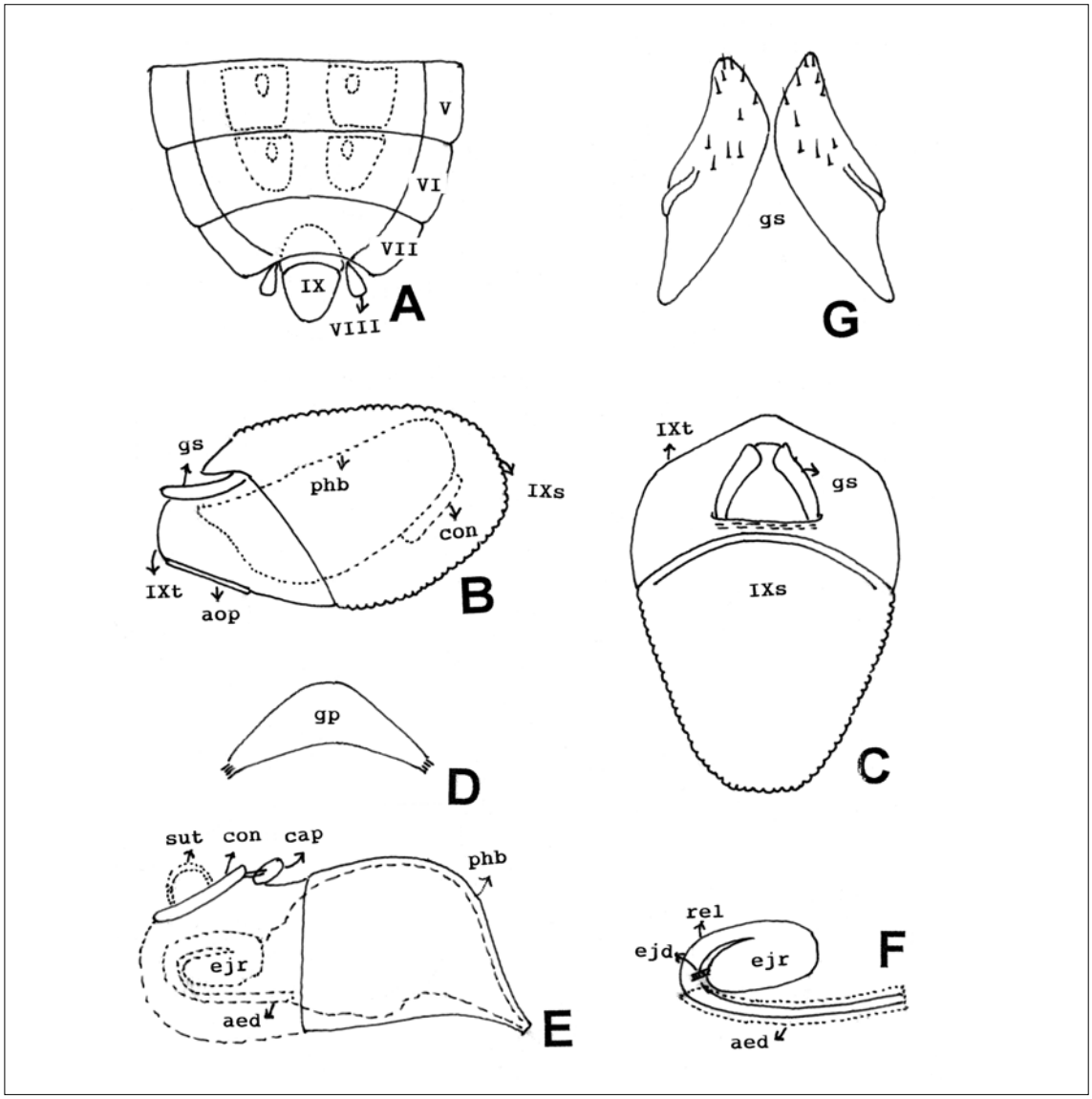

Fig. 2. *Aneurus* sp. (Aneurinae).
A. Abdominal segments V-IX, dorsal view; B. abdominal segment IX and genital styles, lateral view; C. the same, dorsal view; D. genital plates, anterodorsal view; E. phallus, lateral view; F. ejaculatory duct, ejaculatory reservoir, reservoir lumen, and aedeagus, lateral view; G. genital styles, dorsal view.
Abbreviations given in Fig. 1.

dorsal view. Abdominal segment VIII with reduced tergite, its small basal portion membranous, lateral portion (may be pleurite) of apices roundly dilated. Abdominal segment IX rotated 45° counterclockwise in lateral view; anterior opening directed ventrocephalad; posterior opening directed dorsocephalad; 2 openings situated oppositely in dorsal and ventral aspects. Abdominal sternite IX granulated; caudal margin deeply emarginated medially, both margins with

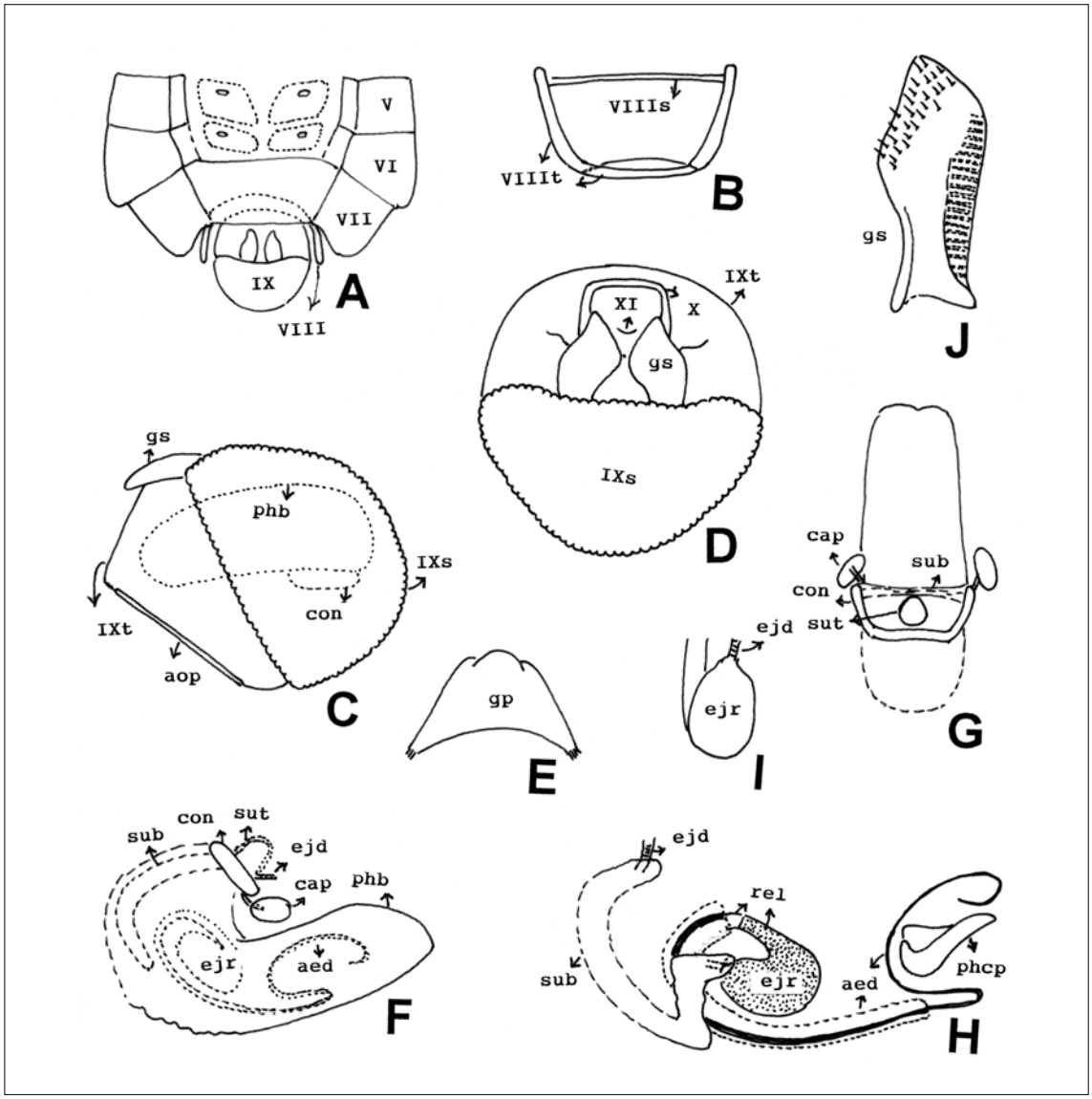

Fig. 3. *Daulocoris formosanus* Kormilev (Mezirinae).
A. Abdominal segments V-IX, dorsal view; B. abdominal segment VIII, dorsal view; C. abdominal segment IX and genital style, lateral view; D. abdominal segments IX-XI and genital styles, dorsal view; E. genital plates, anterodorsal view; F. phallus, lateral view; G. the same, dorsal view; H. ejaculatory duct, support bridge, ejaculatory reservoir, reservoir lumen, aedeagus, and phallobasal conjunctival process, lateral view; J. left genital style, dorsal view.
Abbreviations given in Fig. 1.

setae. Genital styles directed cephalad. Abdominal segment X transversely oval in dorsal view. Abdominal segment XI retracted into segment X. Genital plates triangular in anterodorsal view, apex rounded.

Phallus directed cephalad within segment IX. Connective in dorsal view

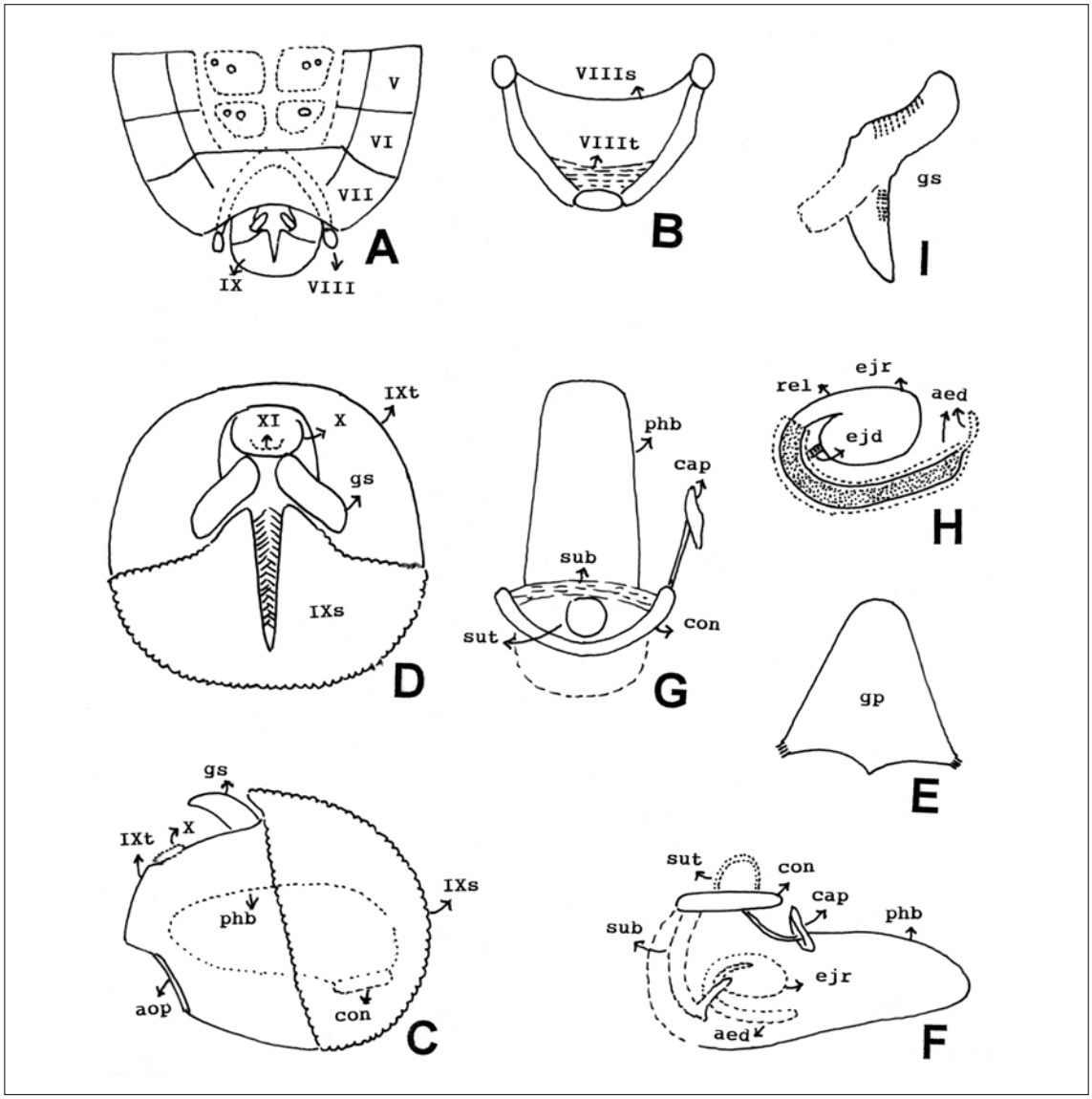

Fig. 4. *Mezira* (*Zemira*) *taiwanica* Kormilev (Mezirinae).
A. Abdominal segments V-IX, dorsal view; B. abdominal segment VIII, dorsal view; C. abdominal segments IX-X and genital styles, lateral view; D. the same, dorsal view; E. genital plates, anterodorsal view; F. phallus, lateral view; G. the same, dorsal view; H. ejaculatory duct, ejaculatory reservoir, reservoir lumen, and aedeagus, lateral view; I. left genital style, dorsal view.
Abbreuiations givenin Fig. 1.

shallowly curved. Support bridge with upper portion appearing as cross bar of connective in dorsal view; lower portion turned upwards connecting to dorsal aspect of ejaculatory reservoir in lateral view. Capitate processes present. Support tube semicircular in lateral view. Phallobase converging to apex in lateral view, apical 2/3 sclerotized, basal portion membranous. Phallobasal conjunctival

processes unrecognizable. Ejaculatory reservoir elongated oval, rotated 180° clockwise. Reservoir lumen short, with same width throughout except that it abruptly narrows at apex. Aedeagus membranous, its apical partion difficult to distinguish. Genital styles symmetrical in size and shape; left genital style figured in dorsal view.

***Mezira* (*Zemira*) *hsiaoi* Blöte** (Mezirinae) Fig. 5.

Abdominal segments V-IX figured in dorsal view. Abdominal segment VIII not carefully examined. Abdominal segment IX 45° rotated counterclockwise in lateral view; anterior opening directed nearly ventrad, posterior opening directed dorsocephalad; 2 openings situated oppositely in dorsal and ventral aspects. Abdominal sternite IX granulated; caudal margin shallowly emarginated. A pair of lobe-like processes between genital styles, above both sides possibly being the parandria as in Leston (1955: 65). Genital styles directed cephalad. Abdominal segment X transverse in dorsal view. Abdominal segment XI retracted into segment X. Genital plates triangular in anterodorsal view.

Phallus directed cephalad within segment IX. Connective U-shaped in dorsal view. Support bridge with upper portion appearing as cross bar of connective in dorsal view; lower portion with apices turned upwards connecting to dorsal aspect of ejaculatory reservoir in lateral view. Capitate processes present. Phallobase slender in lateral view, apical 2/3 sclerotized, basal portion membranous. Phallobasal conjunctival processes paired. Ejaculatory reservoir elongated oval, rotated 180° clockwise. Reservoir lumen long, pigmented, distinctly coverging to apex, protruding from dorsocaudal portion of ejaculatory reservoir, turned cephalad, then curved caudad, and finally upwards, and caudad. Aedeagus membranous, its apical portion difficult to distinquish. Genital styles symmetrical in size and shape; left genital style figured in dorsal view.

Discussion

Leston (1955: 65) mentioned "Beneath the harpagones and arising externally from the walls of the genital segment are a pair of processes, hypandia; they are outgrowths of the segmental wall and desclerotized basally." In the examined species in this investigation, these structures are unrecognizable except in *Mezira* (*Zemira*) *hsiaoi*. There is a pair of lobe-like processes between its genital styles, above both sides of the emargination of abdominal sternite IX. Perhaps these are the hypandia as in Leston (1955).

In this study, the characteristic feature of abdominal segment IX with the 45° counterclockwise rotation longitudinally is the judgment at present. This judgment concerns both the anterior and posterior openings of abdominal segment IX. Judgment as to the 180° rotation (Yang and Chang, 2000) is unsuitable.

The judgment of the ejaculatory reservoir being rotated clockwise 180° based is based on the hypothesis that the ejaculatory reservoir is connected to the ejaculatory duct at its anteroventral portion, and protrudes into the reservoir lumen at its caudoventral portion.

It is believed that abdominal segment IX with a 45° counterclockwise rotation longitudinally, the ejaculatory reservoir rotation degree; the emargination of abdominal sternite IX, and the length of the reservoir are useful characters for phylogenetic analysis of the family.

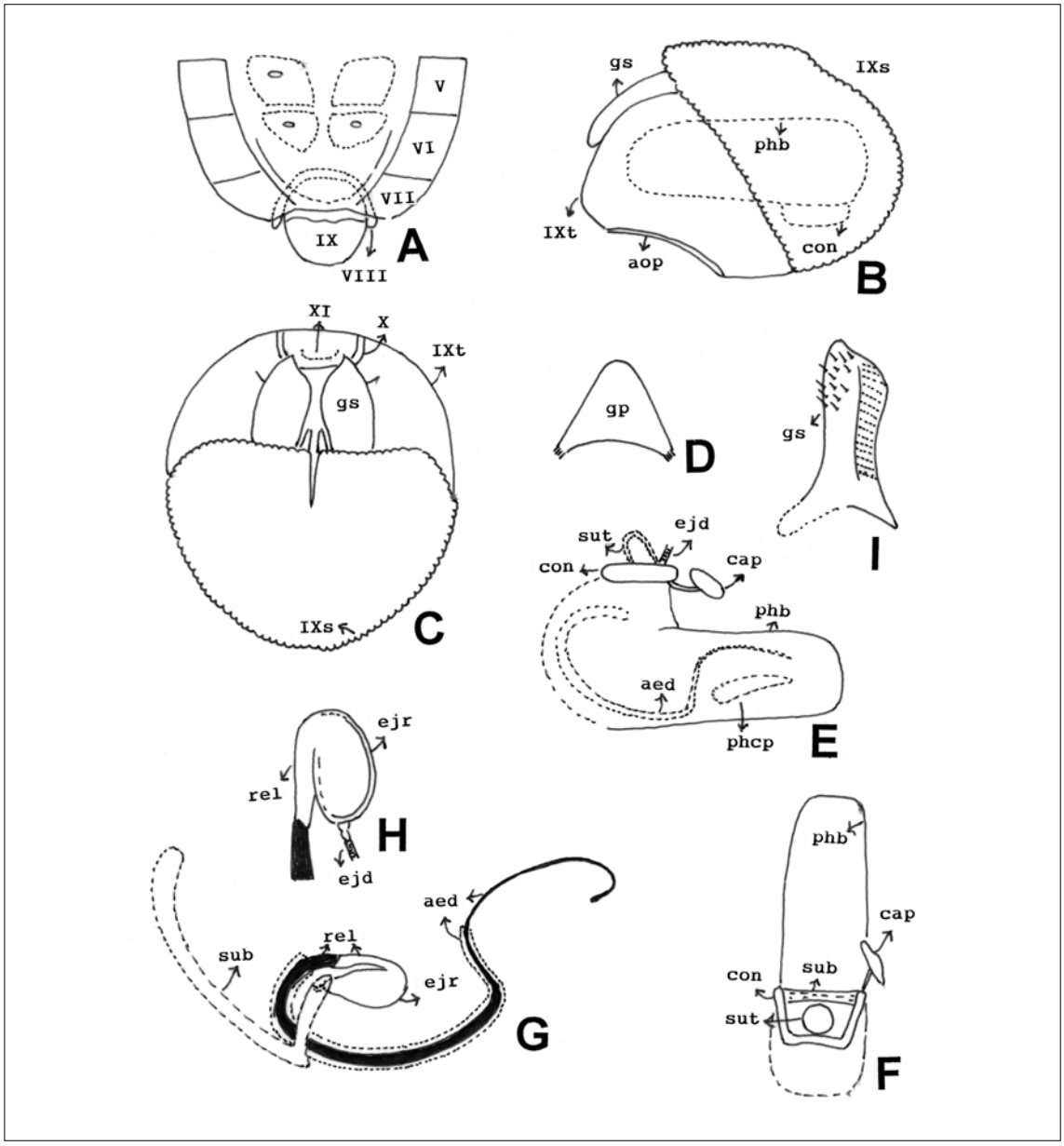

Fig. 5. *Mezira* (*Zemira*) *hsiaoi* Blöte (Mezirinae).

A. Abdominal segments V-IX, dorsal view; B. abdominal segment IX and genital style, lateral view; C. abdominal segments IX-XI and genital styles, dorsal view; D. genital plates, anterodorsal view; E. phallus, lateral view; G. the same, dorsal view; G. support bridge, ejaculatory duct, ejaculatory reservoir, reservoir lumen, and aedeagus, lateral view; H. ejaculatory duct, ejaculatory reservoir, and reservoir lumen, slightly to the right of ventral view; I. left genital style, dorsal view.

Abbreuiations given in Fig. 1.

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扁蝽科雄性外性器（半翅目：異翅亞目）

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摘　　要

選現有標本扁蝽科種類：*Aradus* sp. (Aradinae)、*Aneurus* sp. (Aneurinae)、*Daulocoris formosanus* Kormilev (Mezirinae)、*Mezira* (*Zemira*) *taiwanica* Kormilev 與 *Mezira* (*Zemira*) *hsiaoi* Blöte (Mezirinae)繪圖，敘述其雄性外性器。此科雄性外性器特殊形貌爲第九節腹節（生殖節），除 *Aradus* sp.外皆逆時針縱行 45 度旋轉。

關鍵詞：扁蝽科、雄性外性器、形態學