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The Trichogramma (Hymenoptera: Trichogrammatidae) of Taiwan 【Research report】

臺灣產赤眼蜂屬(膜翅目：赤眼蜂科)之分類【研究報告】

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Abstract

Eight species of the genus *Trichogramma* Westwood (Hymenoptera: Trichogrammatidae) from Taiwan are redescribed or described and illustrated in this paper. Of the included species, *T. choui* and *T. taiwanense* are new to science, *T. longxishanense* Lin and *T. raoi* Nagaraja are new to Taiwan. A key to the all known species of Taiwanese *Trichogramma* is also presented.

摘要

赤眼蜂屬(*Trichogramma*)隸屬膜翅目、赤眼蜂科(*Trichogrammatidae*)，全世界已知之種類約150種以上，而臺灣僅記錄6種。本文記述臺灣產之8種赤眼蜂，其中*T. choui*和*T. taiwanense*為新種，*T. longxishanense* Lin和*T. raoi* Nagaraja為臺灣新記錄種。此外，並附臺灣產赤眼蜂屬已知種之檢索表。

Key words: Trichogrammatidae, *Trichogramma*, taxonomy, Taiwan, new species.

關鍵詞: 赤眼蜂科、赤眼蜂屬、分類、臺灣、新種、新記錄種

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The *Trichogramma* (Hymenoptera: Trichogrammatidae) of Taiwan

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ABSTRACT

Eight species of the genus *Trichogramma* Westwood (Hymenoptera: Trichogrammatidae) from Taiwan are redescribed or described and illustrated in this paper. Of the included species, *T. choui* and *T. taiwanense* are new to science, *T. longxishanense* Lin and *T. raoi* Nagaraja are new to Taiwan. A key to the all known species of Taiwanese *Trichogramma* is also presented.

Key words: Trichogrammatidae, *Trichogramma*, taxonomy, Taiwan, new species.

Introduction

It is very common to raise and release *Trichogramma* spp. in the field to reduce the population of pests in many countries, due to their parasitizing in pest eggs, especially lepidopterous eggs. Significantly, they are with economic importance in agricultural field, therefore the identification of species of *Trichogramma* is very important and required. So far, there are 7 species of *Trichogramma* in Taiwan, including *T. psocopterae* Chan & Chou and *T. neuropterae* Chan & Chou (Sonan, 1944; Yen, 1973; Chiu and Chen, 1986; Lin, 1994; Chan *et al.*, 1997). However, the record of *T. minutum* Riley from Taiwan is doubtful. This study redescribes 6 species, and adds 2 new species *T. choui* and *T. taiwanense*, and 2 new records *T. longxishanense* Lin and *T. raoi* Nagaraja.

Descriptions, redescriptions, and illus-

trations of 8 species of *Trichogramma*, and the key for the Taiwanese species are provided. The description is based on killed specimens mounted in Hoyer's solution on glass slides. The terminology used describing the genitalia follows Pinto (1992). Unless otherwise stated the specimens used in this study were collected by K. C. Chou. The holotypes designated in this study are deposited at the Taiwan Agricultural Research Institute, Taichung, Taiwan. Paratypes and other specimens are preserved separately at the above institution and at the collection of Department of Zoology, National Museum of Natural Science, Taichung, Taiwan.

Key to species of the genus
Trichogramma from Taiwan

1. DLA typically triangular or subtriangular, aedeagus not broad, with lateral margin not sinuated 2

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- GC round and broad, DLA broad with posterior extension acutely emarginate apically; apodemes very short
... .. *neuropterae* Chan & Chou
- 2. DLA with prominent lateral lobes 3
- DLA without prominent lateral lobes
... .. 4
- 3. DLA with narrowly rounded lateral lobes at base; antennal flagellum of male bearing less than 50 hairs; IVP broad extending to 0.38-0.44 AD.....
..... *chilonis* Ishii
- DLA with broadly rounded lateral lobes at base; antennal flagellum of male bearing more than 50 hairs; IVP extended to 0.56-0.67 AD
... .. *dendrolimi* Matsumura
- 4. IVP well developed, broad or long 5
- IVP short or inconspicuous 7
- 5. IVP long and triangular, DLA moderately constricted at base
... .. *ostrinae* Pang & Chen
- IVP broad, DLA not constricted at base6
- 6. Body small; flagellum of male relatively short, similar to those of female, mandible with 3 teeth; genitalia with VS below level of PM, posterior ends of PM extremely pointed
... .. *psocopterae* Chan & Chou
- Body large; flagellum of male 0.19-0.27 as wide as long; aedeagus triangular and broad, apodeme divergent to apex; IVP extremely broad and sclerotized ...
... .. *longxishanense* Lin
- 7. DLA horseshoe shaped at base; IVP apparently absent; ovipositor extremely long, OL/HTL= 1.35-1.5
... .. *japonicum* Ashmead
- DLA not horseshoe shaped at base; IVP present or absent; OL/HTL less than 1.15..... 8
- 8. PM almost same level of VS, IVP minute but distinct *choui* n.sp.
- PM below level of VS 9
- 9. IVP inconspicuous; DLA weakly sclerotized; hind wing with anterior vein tract 0.5-0.65 *raoi* Nagaraja
- IVP short but distinct, DLA highly

sclerotized, extending to 0.2-0.38
... .. *taiwanense* n.sp.

Trichogramma chilonis Ishii (Figs. 1-8)

Trichogramma chilonis Ishii, 1941, Kontyû, 14:173. - Lin, 1994, Systematic studies of Chinese Trichogrammatidae: 48.

Trichogramma australicum: Nagarkatti & Nagaraja, 1968: 81-96.

Trichogramma confusum Viggiani, 1976, Boll. Lab. Ent. Agric., Portici 33:182-183.

Male: Body length 0.57-0.79 mm, head width 0.23-0.33 mm, HTL 0.16-0.20 mm. Antenna: flagellum 0.15-0.19 times as wide as long, and slightly longer than HTL, 1.05-1.18 HTL; with 10 BCPS and 3 PS; flagellar setae long and sharply tapering, 44-50 in number, longest seta 2.39-2.81 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae short, about 0.25-0.28 length of posterior pair. Forewing: 0.47-0.60 mm, FWW/FWL= 0.48-0.52; longest fringe seta about 0.12-0.18 FWW; Rs1 with 3 to 7 setae, 9-32 setae between 4th and 5th vein track. Hindwing: anterior vein tract composed of 2-3 setae, extending more than 0.22-0.35 distance of middle tract, posterior vein tract with 6-10 setae, almost extending 0.39-0.52 of middle tract.

Genitalia: GC 0.47-0.59 as wide as long; AD 0.23-0.27 GL; length of DA 0.59-0.67 GL; DLA with prominent narrowly rounded lateral lobes, extending to 0.38-0.53 AD; VS far below level of tips of PM, occupying about 0.59-0.71 AD; IVP broad, 0.38-0.44 AD, entire region highly chitinized; IB narrow; VR paired, extending about 0.39-0.48 GL; VP not visible. Apodemes 0.5-0.55 AL. AL 0.97-1.07 GL and AL/HTL= 0.66-0.8.

Color: Body yellowish; pronotum, mesonotum and abdomen brownish.

Female: Body length 0.73-0.79 mm, head width 0.23-0.27 mm, HTL 0.17-0.19 mm. Antenna: club 0.48-0.52 broad as

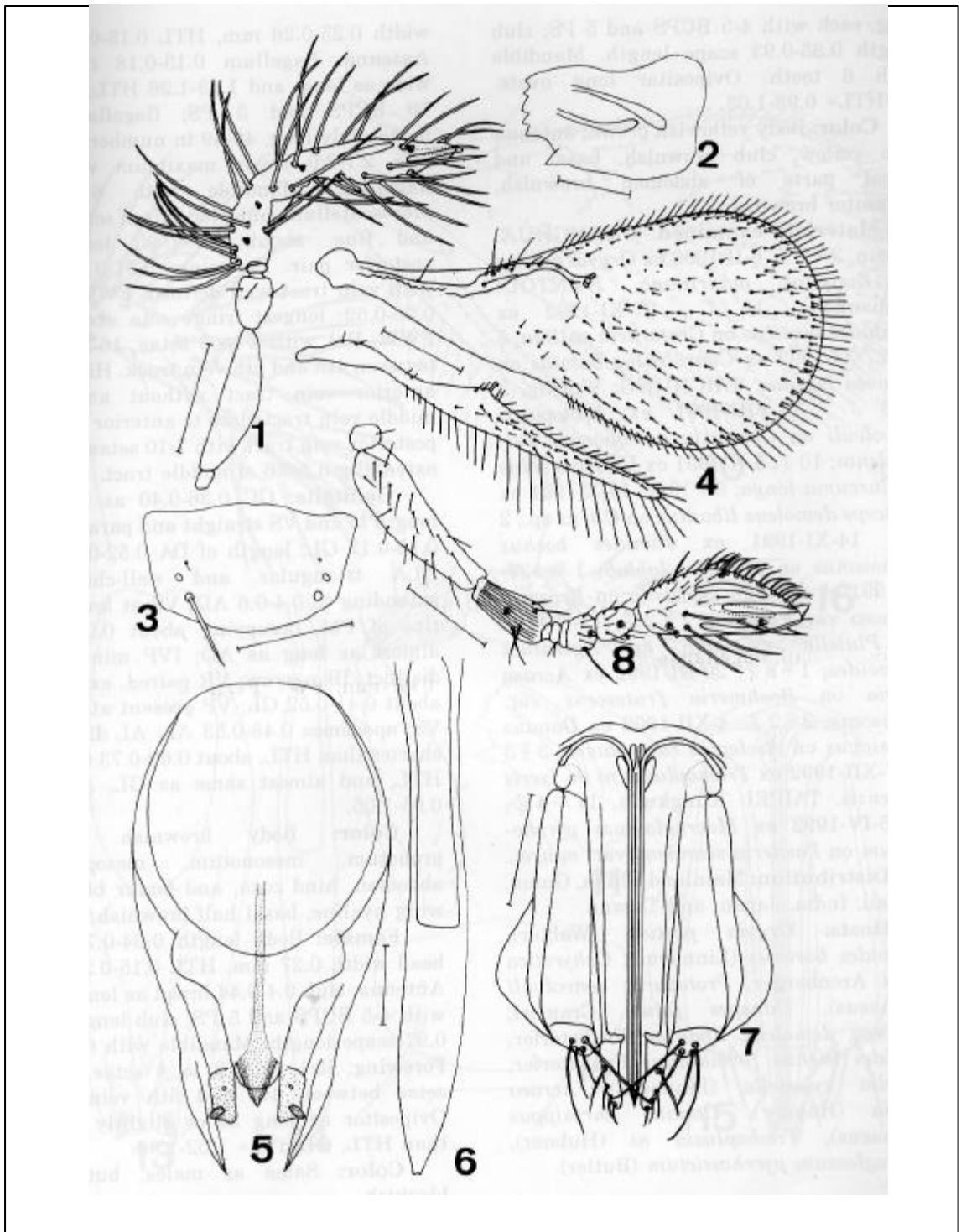


Fig.1-8. *Trichogramma chilonis* Ishii: 1-6, male; 7-8, female. 1, antenna; 2, mandible (dorsal view); 3, mesoscutellum (expanded); 4, wings; 5, genital capsule (dorsal view); 6, aedeagus (dorsal view); 7, ovipositor; 8, antenna (Scale: 2, 5, 6= 0.02 mm; 1, 3, 7, 8= 0.05 mm; 4= 0.1 mm).

long, each with 4-5 BCPS and 5 PS; club length 0.85-0.93 scape length. Mandible with 6 teeth. Ovipositor long ovate. OL/HTL= 0.98-1.03.

Color: Body yellowish brown; antenna pale yellow, club brownish, basal and apical parts of abdomen brownish, ovipositor brownish.

Materials examined: CHANGHUA: Tatsun, 2 ♀, 6-II-1993 ex *Orgyia postica* on *Zizyphus mauritiana*. NANTOU: Peishankeng, 10 ♀, 27-XI-1992 ex *Lampides boeticus* on *Crotalaria pallida*; 5 ♀, 27-XI-1992 ex *Convolvulus batatas* on *Ipomoea batatas*. TAICHUNG: Wufeng, 2 ♀, 3 ♀, 17-VIII-1991 ex *Protoparca convolvuli* on *Colocasia antiquorum* var. *esculenta*; 10 ♀, 5-X-1991 ex *Udaspes folus* on *Curcuma longa*; 9 ♀, 10 ♀, 15-X-1991 ex *Princeps demoleus libanius* on *Citrus* sp.; 2 ♀, 14-XI-1991 ex *Jamides bochus formosanus* on *Dolichos lablab*; 1 ♀, 27-XI-1991 ex *Plutella xylostella* on *Brassica oleracea* var. *capitata*; 1 ♀, 2 ♀, 17-II-1992 ex *Plutella xylostella* on *Ageratum conyzoides*; 1 ♀, 8 ♀, 20-III-1992 ex *Acraea issoria* on *Boehmeria frutescens* var. *frutescens*; 2 ♀, 2 ♀, 4-XII-1992 ex *Danaus chrysippus* on *Asclepias curassavica*; 3 ♀, 3 ♀, 7-XII-1992 ex *Trichoplusia ni* on *Ixeris chinensis*. TAIPEI: Kungkuan, 11 ♀, 4 ♀, 24-25-IV-1992 ex *Macroglossum pyrrhostictum* on *Paederia scandens* var. *mairei*.

Distribution: Mainland China, Guam, Hawaii, India, Japan, and Taiwan.

Hosts: *Orgyia postica* (Walker), *Lampides boeticus* (Linnaeus), *Ochyrotica yanoi* Arenberger, *Protoparca convolvuli* (Linnaeus), *Udaspes folus* (Cramer), *Princeps demoleus libanius* Fruhstorfer, *Jamides bochus formosanus* Fruhstorfer, *Plutella xylostella* (Linnaeus), *Acraea issoria* (Hubner), *Danaus chrysippus* (Linnaeus), *Trichoplusia ni* (Hubner), *Macroglossum pyrrhostictum* (Butler).

Trichogramma choui n. sp. (Figs. 9-16)

Male: Body length 0.55-0.69 mm, head

width 0.25-0.26 mm, HTL 0.15-0.18 mm. Antenna: flagellum 0.13-0.18 times as wide as long, and 1.13-1.26 HTL; with 9-10 BCPS and 3 PS; flagellar setae moderately long, 40-49 in number, longest seta 2.7-3.0 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae short and fine, about 0.19-0.25 length of posterior pair. Forewing: 0.51-0.53 mm, with vein tract well defined; FWW/FWL= 0.50-0.52; longest fringe seta about 0.15 FWW; Rs1 with 2 to 5 setae, 16-27 setae between 4th and 5th vein track. Hindwing: anterior vein tract without any seta, middle vein tract close to anterior margin, posterior vein tract with 7-10 setae, almost extending 0.3-0.6 of middle tract.

Genitalia: GC 0.36-0.40 as wide as long; PM and VS straight and parallel; AD 0.15-0.17 GL; length of DA 0.52-0.57 GL; DLA triangular and well-chitinized, extending to 0.4-0.6 AD; VS at level with tips of PM, occupying about 0.9-1 AD, almost as long as AD; IVP minute but distinct; IB narrow; VR paired, extending about 0.41-0.52 GL; VP present at base of VS; apodemes 0.48-0.53 AL. AL distinctly shorter than HTL, about 0.69-0.73 times of HTL, and almost same as GL, AL/GL= 0.95-1.05.

Color: Body brownish yellow; pronotum, mesonotum, mesopleurae, abdomen, hind coxa, and femur blackish; wing hyaline, basal half brownish.

Female: Body length 0.64-0.74 mm, head width 0.27 mm. HTL 0.15-0.21 mm. Antenna: club 0.4-0.44 broad as long, each with 4-5 BCPS and 5 PS; club length 0.9-0.97 scape length. Mandible with 6 teeth. Forewing: Rs1 with 2 to 4 setae, 13-27 setae between 4th and 5th vein tract. Ovipositor as long as or slightly longer than HTL, OL/HTL= 1.02-1.08.

Color: Same as males, but head blackish.

Materials examined: Holotype: ♀, TAICHUNG: Wufeng, 22-VI-1993 ex Lepidoptera on *Asclepias curassavica*.

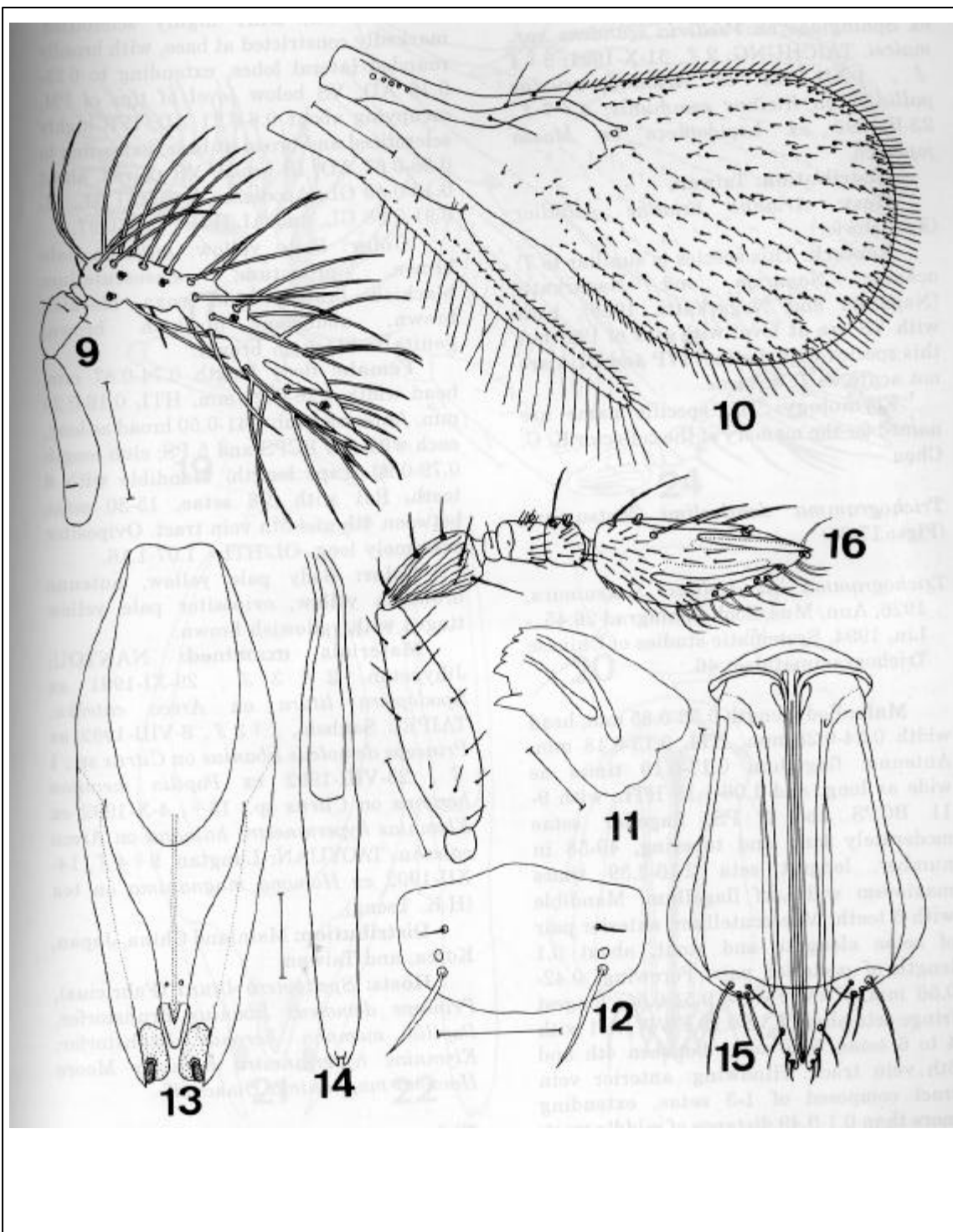


Fig.9-16. *Trichogramma choui* Chan & Chou n. sp.: 9-14, male; 15-16, female. 9, antenna; 10, wings; 11, mandible (dorsal view); 12, mesoscutellum (expanded); 13, genital capsule (dorsal view); 14, aedeagus (dorsal view); 15, ovipositor; 16, antenna. (Scale: 11, 13, 14= 0.02 mm; 9, 12, 15, 16= 0.05 mm; 10= 0.1 mm).

Paratypes: 5 1 same as holotype; NANTOU: Wushe, 1 6 , 11-13-III-1992 ex Sphingidae on *Paederia scandens* var. *mairei*. TAICHUNG: 2 , 31-X-1991; 3 4 , 1-XII-1991 ex *Ariadne ariadne pallidior* on *Ricinus communis*; 4 7 , 23-II-1992 ex Lepidoptera on *Maesa japonica*.

Distribution: Taiwan.

Host: *Ariadne ariadne pallidior* (Fruhstorfer).

Remark: This species is similar to *T. achaeae* Nagaraja and Nagarkatti (Nagaraja and Nagarkatti, 1969), both with VS are at level with tips of PM, but this species with distinct IVP and DLA are not acute as *T. achaeae*.

Etymology: The specific name are named for the memory of the collector K. C. Chou.

Trichogramma dendrolimi Matsumura (Figs. 17-24)

Trichogramma dendrolimi Matsumura, 1926, Ann. Mus. Zool. Leningrad 26:45. - Lin, 1994, Systematic studies of Chinese Trichogrammatidae: 46.

Male: Body length 0.53-0.85 mm, head width 0.24-0.28 mm, HTL 0.13-0.18 mm. Antenna: flagellum 0.17-0.19 times as wide as long, and 1.06-1.19 HTL; with 9-11 BCPS and 3 PS; flagellar setae moderately long and tapering, 49-58 in number, longest seta 2.16-2.39 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae elongate and stout, about 0.1 length of posterior pair. Forewing: 0.42-0.56 mm, FWW/FWL= 0.51-0.55; longest fringe seta about 0.12-0.19 FWW; Rs1 with 4 to 6 setae, 6-20 setae between 4th and 5th vein track. Hindwing: anterior vein tract composed of 1-3 setae, extending more than 0.1-0.49 distance of middle tract, posterior vein tract with 7-11 setae, extending 0.31-0.7 of middle tract.

Genitalia: GC 0.43-0.53 as wide as

long; AD 0.24-0.28 GL; length of DA 0.59-0.66 GL; DLA highly sclerotized, markedly constricted at base, with broadly rounded lateral lobes, extending to 0.55-0.76 AD; VS below level of tips of PM, occupying about 0.6-0.71 AD; IVP highly sclerotized and broad at base, extending to 0.56-0.67 AD; IB broad; VR paired, about 0.13-0.49 GL; Apodemes 0.45-0.51 AL, AL 0.91-0.98 GL, and AL/HTL= 0.83-0.97.

Color: Body yellow; antenna pale brown, pronotum, mesoscutellum blackish brown, hind coxa blackish brown, abdomen blackish brown, genitalia blackish brown.

Female: Body length 0.74-0.87 mm, head width 0.26-0.29 mm, HTL 0.16-0.20 mm. Antenna: club 0.41-0.50 broad as long, each with 4-5 BCPS and 5 PS; club length 0.79-0.93 scape length. Mandible with 6 teeth. Rs1 with 5-8 setae, 15-30 setae between 4th and 5th vein tract. Ovipositor extremely long, OL/HTL= 1.07-1.16.

Color: Body pale yellow, antenna brownish yellow, ovipositor pale yellow tinged with yellowish brown.

Materials examined: NANTOU: Jihyuetan, 2 3 , 29-XI-1991 ex *Spodoptera litura* on *Areca catechu*. TAIPEI: Sanhsia, 1 3 , 8-VIII-1992 ex *Princeps demoleus libanius* on *Citrus* sp.; 1 , 23-VIII-1992 ex *Papilio memnon heronus* on *Citrus* sp.; 15 , 4-X-1992 ex *Elymnias hypermnestra hainana* on *Areca catechu*. TAOYUAN: Lungtan, 9 4 , 14-XII-1992 ex *Homona magnanima* on tea (H.K. Tseng).

Distribution: Mainland China, Japan, Korea, and Taiwan.

Hosts: *Spodoptera litura* (Fabricius), *Princeps demoleus libanius* Fruhstorfer, *Papilio memnon heronus* Fruhstorfer, *Elymnias hypermnestra hainana* Moore *Homona magnanima* Diakonoff.

Tichogramma japonicum Ashmead (Figs. 25-32)

Trichogramma japonicum Ashmead, 1904,

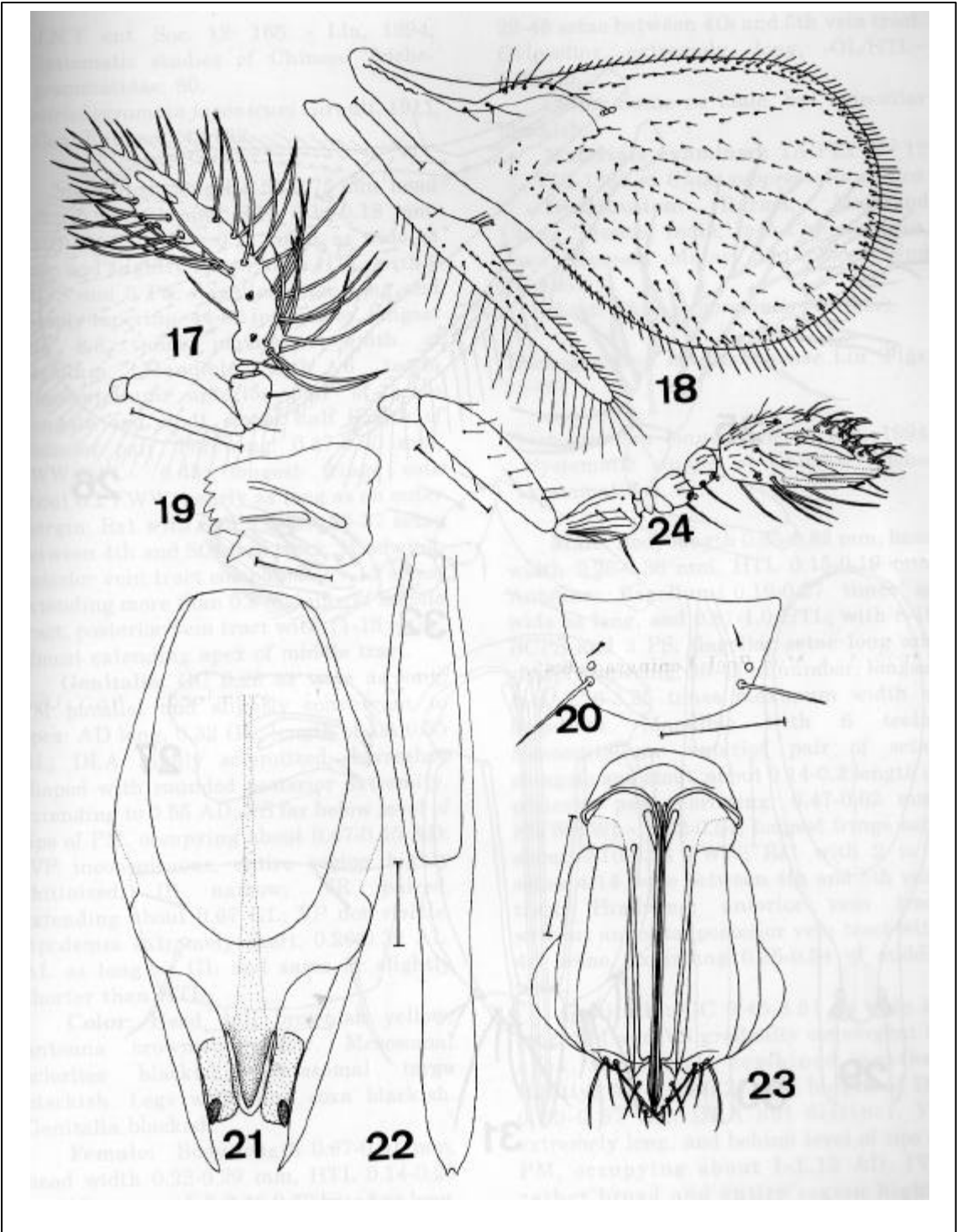


Fig.17-24. *Trichogramma dendrolimi* Matsumura: 17-22, male; 23-24, female. 17, antenna; 18, wings; 19, mandible (dorsal view); 20, mesoscutellum (expanded); 21, genital capsule (dorsal view); 22, aedeagus (dorsal view); 23, ovipositor; 24, antenna. (Scale: 19, 21, 22= 0.02 mm; 17, 20, 23, 24= 0.05 mm; 18= 0.1 mm).

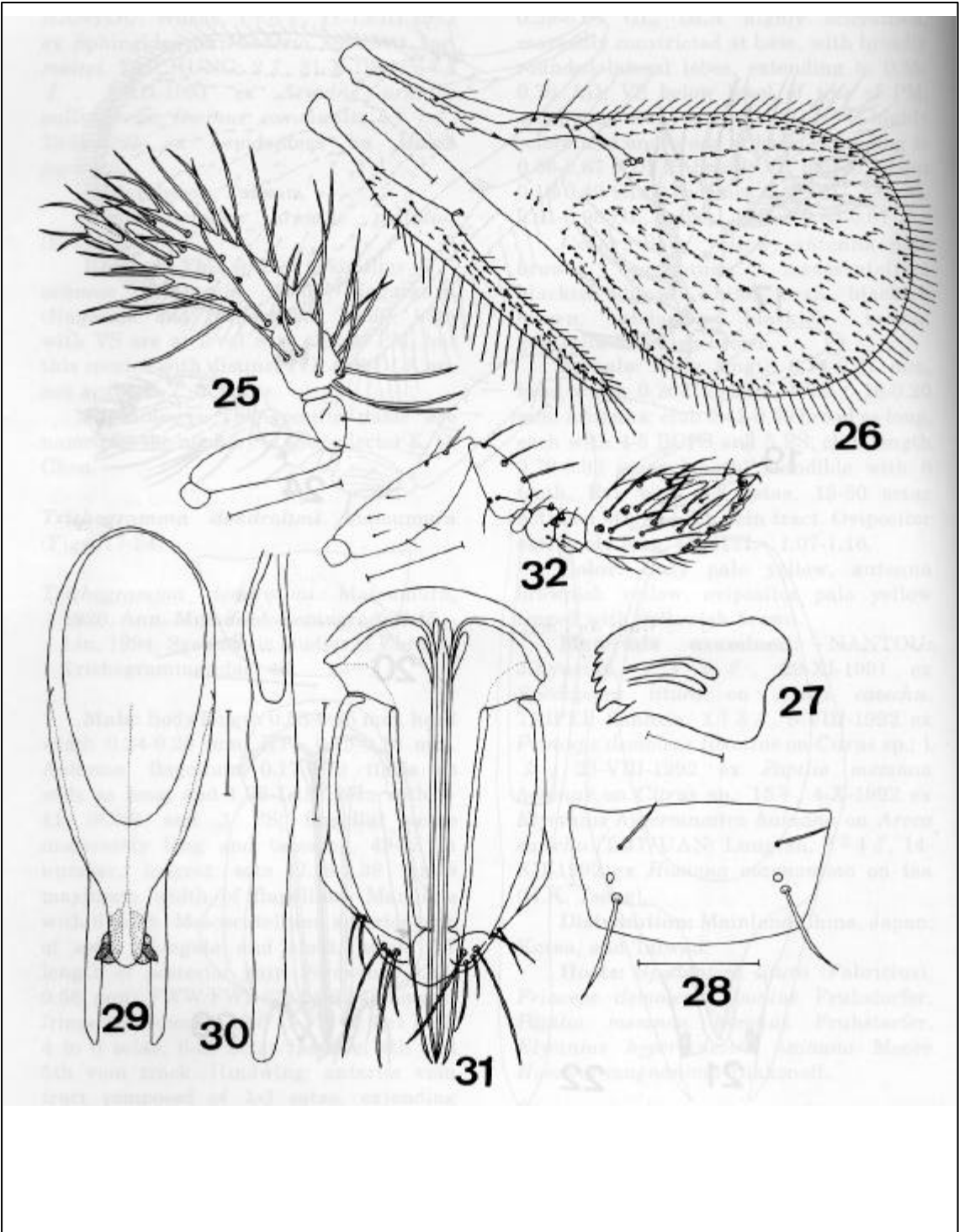


Fig.25-32. *Tichogramma japonicum* Ashmead: 25-30, male; 31-32, female. 25, antenna; 26, wings; 27, mandible (dorsal view); 28, mesoscutellum (expanded); 29, genital capsule (dorsal view); 30, aedeagus (dorsal view); 31, ovipositor; 32, antenna. (Scale: 27, 29, 30= 0.02 mm; 25, 28, 31, 32= 0.05 mm; 26= 0.1 mm).

J.N.Y. ent. Soc. 12: 165. - Lin, 1994, Systematic studies of Chinese Trichogrammatidae: 60.

Neotrichogramma japonicum Girault, 1911, Can. Entomol. 43:192.

Male: Body length 0.55-0.75 mm, head width 0.23-0.31 mm, HTL 0.14-0.18 mm. Antenna: flagellum 0.21 times as wide as long, and slightly longer than HTL; with 9 BCPS and 3 PS; flagellar setae long and sharply tapering, 44-52 in number, longest seta 2.8 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae elongate and stout, about half length of posterior pair. Forewing: 0.47-0.60 mm, FWW/FWL= 0.45; longest fringe seta about 0.2 FWW, nearly as long as on outer margin; Rs1 with 8 to 9 setae, 23-37 setae between 4th and 5th vein track. Hindwing: anterior vein tract composed of 7-11 setae, extending more than 0.8 distance of middle tract, posterior vein tract with 11-15 setae, almost extending apex of middle tract.

Genitalia: GC 0.26 as wide as long; PM parallel and slightly convergent to apex; AD long, 0.32 GL; length of DA 0.55 GL; DLA highly sclerotized, horseshoe shaped with rounded posterior extremity, extending to 0.55 AD; VS far below level of tips of PM, occupying about 0.47-0.55 AD; IVP inconspicuous, entire region highly chitinized; IB narrow; VR paired, extending about 0.67 GL; VP not visible. Apodemes extremely short, 0.26-0.32 AL. AL as long as GL and same or slightly shorter than HTL.

Color: Head dull brownish yellow; antenna brownish yellow. Mesosomal sclerites blackish; metasomal terga blackish. Legs with hind coxa blackish. Genitalia blackish.

Female: Body length 0.67-0.91 mm, head width 0.22-0.29 mm, HTL 0.14-0.20 mm. Antenna: club 0.46-0.50 broad as long, each with 4 BCPS and 4-5 PS; club length 0.85-1.0 scape length. Mandible with 6 teeth. Forewing: Rs1 with 8 to 10 setae,

29-48 setae between 4th and 5th vein tract. Ovipositor extremely long, OL/HTL= 1.35-1.5.

Color: Same as male, but ovipositor blackish.

Materials examined: TAIPEI: 9 12, VIII-1968 ex *Chilo suppressalis* on rice.

Distribution: Burma, Mainland China, French, India, Indo-China, Japan, Java, Korean, Malay, Philippines, and Taiwan.

Host: *Chilo suppressalis* (Walker).

Trichogramma longxishanense Lin (Figs. 33-40)

Trichogramma longxishanense Lin, 1994, Systematic studies of Chinese Trichogrammatidae: 62.

Male: Body length 0.65-0.83 mm, head width 0.26-0.36 mm, HTL 0.15-0.19 mm. Antenna: flagellum 0.19-0.27 times as wide as long, and 0.81-1.0 HTL; with 8-10 BCPS and 3 PS; flagellar setae long and sharply tapering, 30-42 in number, longest seta 2.76-3.25 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae elongate and stout, about 0.14-0.2 length of posterior pair. Forewing: 0.47-0.62 mm, FWW/FWL= 0.52-0.54; longest fringe seta about 0.10-0.16 FWW; Rs1 with 2 to 5 setae, 4-14 setae between 4th and 5th vein tract. Hindwing: anterior vein tract without any seta, posterior vein tract with 4-7 setae, extending 0.25-0.54 of middle tract.

Genitalia: GC 0.46-0.51 as wide as long; PM and VS gradually convergent to apex, and almost combined together tightly; AD 0.24-0.27 GL; length of DA 0.59-0.67 GL; DLA not distinct, VS extremely long, and behind level of tips of PM, occupying about 1-1.12 AD; IVP rather broad and entire region highly sclerotized, about 0.74-0.82 AD, IB broad; VR almost extending to anterior margin of GB; VP not visible. Apodemes slightly

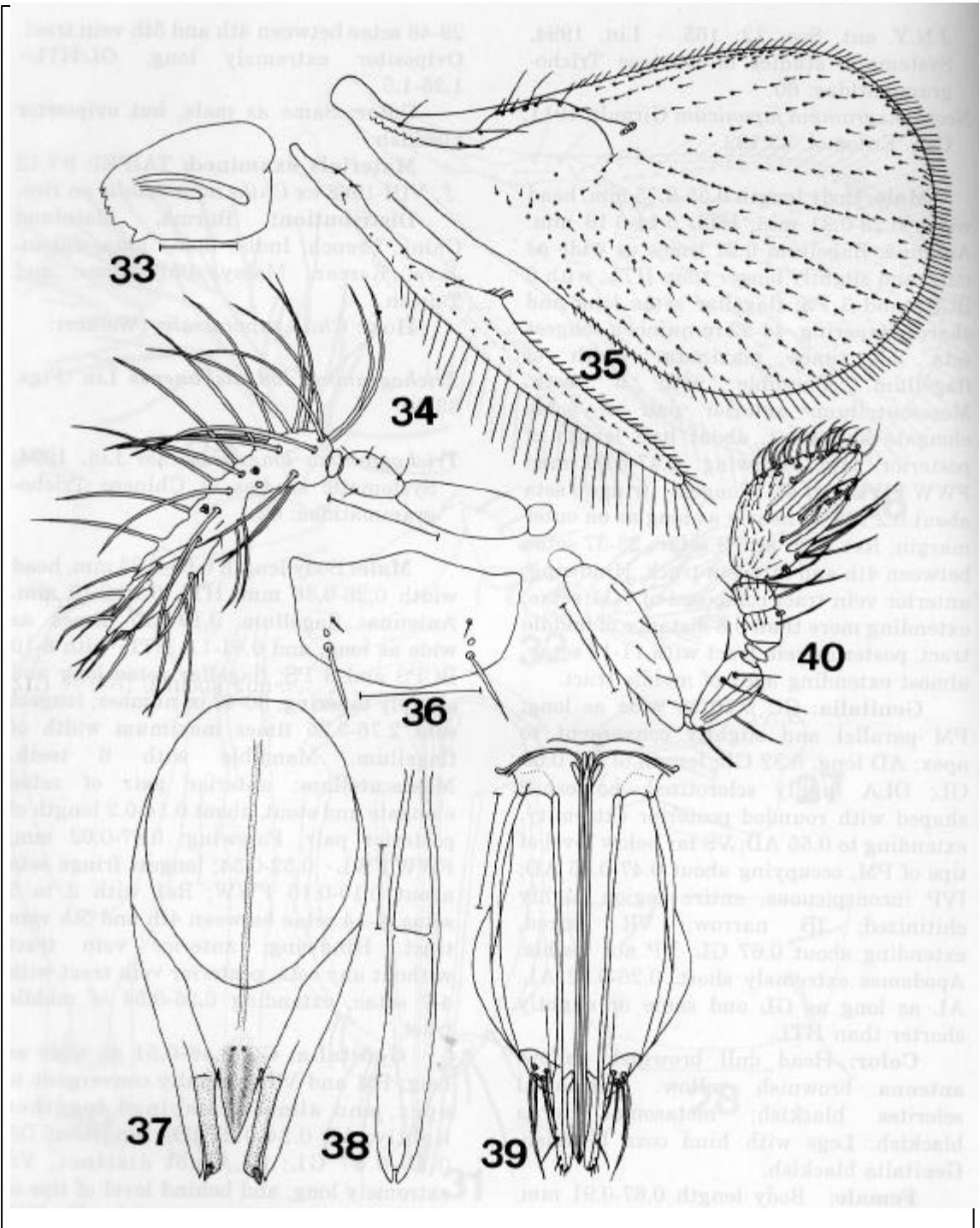


Fig. 33-40. *Trichogramma longxishanense* Lin: 33-38, male; 39-40, female. 33, mandible (dorsal view); 34, antenna; 35, wings; 36, mesoscutellum (expanded); 37, genital capsule (dorsal view); 38, aedeagus (dorsal view); 39, ovipositor; 40, antenna. (Scale: 33, 37, 38= 0.02mm; 34, 36, 39, 40= 0.05mm; 35= 0.1 mm).

divergent to apex, 0.37-0.48 AL. Aedeagus broad, more or less triangular, AL about 0.81-0.88 GL and AL/HTL= 0.62-0.74.

Head brownish yellow; antenna brownish yellow. Mesosomal sclerites blackish; Legs with hind coxa black, metasomal terga blackish.

Female: Body length 0.79-0.91 mm, head width 0.29-0.36 mm, HTL 0.17-0.18 mm. Antenna: club 0.48-0.50 broad as long, each with 5 BCPS and 4-5 PS; club length 0.87-0.96 scape length. Mandible with 6 teeth. Forewing: Rs1 with 3-4 setae, 8-12 setae between 4th and 5th vein tract. Ovipositor extremely long, OL/HTL= 1.61-1.67.

Color: Lighter than male, body brownish yellow. Mesosomal sclerites and metasomal terga brownish except apical half. Antenna brownish yellow. Legs with hind femur blackish.

Materials sexamined: TAIPEI: 7 14 , 30-XI-1991 ex *Suastus gremius* on *Rhapis excelsa*; 1 , 21-VI-1992 ex *Macroglossum pyrhostictum* on *Paederia scandens* var. *mairei*.

Distribution: Taiwan (new record), Mainland China.

Hosts: *Macroglossum pyrhostictum* (Butler) and *Suastus gremius* (Fabricius).

Trichogramma ostrinae Pang & Chen (Figs. 41-48)

Trichogramma ostrinae Pang & Chen, 1974, Acta Entomol. Sinica 17:444. - Lin, 1994, Systematic studies of Chinese Trichogrammatidae: 54.

Male: Body length 0.53-0.85 mm, head width 0.24-0.27 mm, HTL 0.15-0.16 mm. Antenna: flagellum moderately long, 0.15-0.18 times as wide as long, and 1.15-1.27 HTL; with 9 BCPS and 3 PS; flagellar setae moderately long, tapering gradually from base to near apex, 38-46 in number, longest seta 3-3.17 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: with anterior pair of setae

short and fine, about 0.16-0.19 length of posterior pair. Forewing: 0.49 mm, with vein tract well defined, FWW/FWL= 0.49; longest fringe seta about 0.17 FWW; Rs1 with 3 to 4 setae, 11-19 setae between 4th and 5th vein track. Hindwing: with middle vein tract prominent and complete to apex; anterior vein tract usually absent but occasionally with one seta, extending more than 0.15-0.2 distance of middle tract, posterior vein tract with 7-9 setae widely spaced, almost extending 0.5-0.58 length of middle tract.

Genitalia: GC 0.41-0.47 as wide as long; PM parallel and slightly convergent to apex; AD 0.21-0.26 GL; length of DA 0.54-0.60 GL; DLA well sclerotized, subtriangular, acuminate at apex, abruptly narrowed posterior to basal constriction, extending to 0.39-0.62 AD; VS nearly same level as DLA, occupying about 0.42-0.69 AD; IVP long and narrow, distinctly pointed apex and below that of DLA and VS, extending to 0.80-0.85 GL; IB narrow; VR paired, extending about 0.18-0.47 GL; VP not visible. Apodemes 0.51-0.53 AL. AL/GL= 0.97-1.07, and AL/HTL= 0.68-0.86.

Color: Body yellow; head pale yellow lightly infuscate; antenna pale brown; pronotum brown; abdomen brown; legs light yellow, with hind femur brownish yellow.

Female: Body length 0.71-0.79 mm, head width 0.24-0.31 mm, HTL 0.16-0.19 mm. Antenna: club 0.41-0.49 broad as long, each with 5 BCPS and 4-5 PS; club length 0.81-0.91 scape length. Mandible with 6 teeth. Forewing: Rs1 with 4-7 setae, 14-32 setae between 4th and 5th vein tract. Ovipositor: OL/HTL= 0.98-1.05.

Color: Similar to male, but lighter than male. Body pale yellowish brown, antenna pale brown, head pale yellowish brown. Mesoscutellum brown, abdomen yellowish brown.

Materials examined: CHANGHUA: 1 2 , 26-VIII-1991 ex *Agrius convolvuli* on *Colocasia antiquorum* var. *esculenta*.

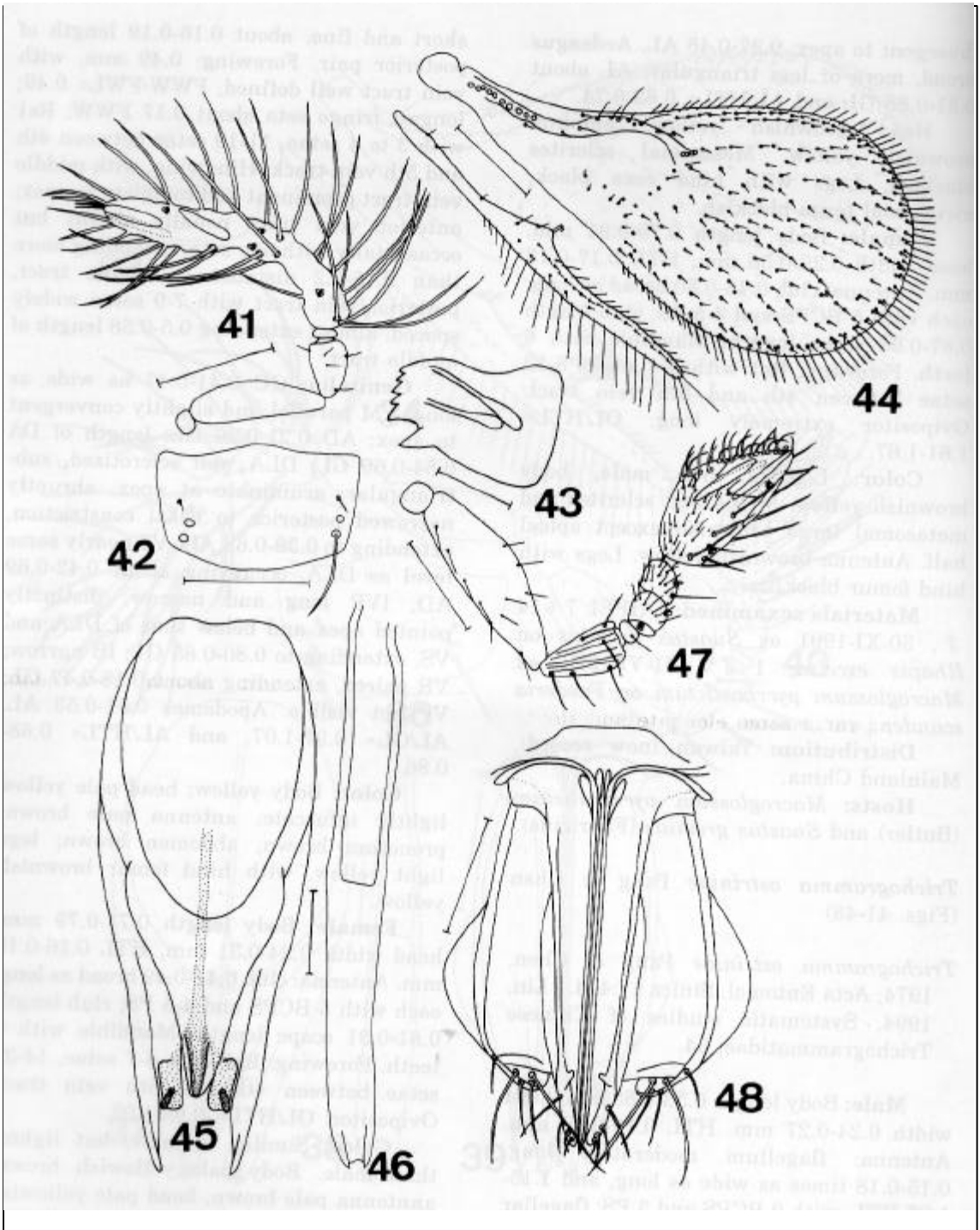


Fig. 41-48. *Trichogramma ostriniae* Pang & Chen: 41-46, male; 47-48, female. 41, antenna; 42, mesoscutellum (expanded); 43, mandible (dorsal view); 44, wings; 45, genital capsule (dorsal view); 46, aedeagus (dorsal view); 47, antenna; 48, ovipositor. (Scale: 43, 45, 46= 0.02mm; 41, 42, 47, 48= 0.05mm; 44= 0.1 mm).

TAICHUNG: Wufeng, 10 11 , 23-VI-1992 ex *Ostrinia furnacalis* on *Zea mays*; 9 21 , 30-VI-1993 ex Pyralidae on *Solanum melongena*. TAINAN: 3 16 , 23-VIII-1991 ex *Ostrinia furnacalis* on *Zea mays*.

Distribution: Mainland China, Hawaii, and Taiwan.

Hosts: *Ostrinia furnacalis* (Guenee).

Trichogramma raoi Nagaraja (Figs. 49-56)

Trichogramma raoi Nagaraja, 1973, *Oriental Insects* 7: 279. - Lin, 1994, *Systematic studies of Chinese Trichogrammatidae*: 58.

Male: Body length 0.50-0.55 mm, head width 0.20-0.22 mm, HTL 0.11-0.14 mm. Antenna: flagellum 0.14-0.17 times as wide as long, and 1.14-1.25 HTL; with 8-10 BCPS and 3 PS; flagellar setae long and tapering, 37-44 in number, longest seta 2.8-3.3 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae elongate and stout, about 0.2-0.24 length of posterior pair. Forewing: 0.35-0.42 mm, FWW/FWL= 0.45-0.5; longest fringe seta about 0.13-0.2 FWW; Rs1 with 2 to 5 setae, 9-27 setae between 4th and 5th vein tract. Hindwing: anterior vein tract composed of 0-2 setae, extending more than 0.29-0.37 distance of middle tract, posterior vein tract with 4-8 setae, extending 0.4-0.56 middle tract.

Genitalia: GC 0.36-0.40 as wide as long; AD 0.22-0.26 GL; length of DA 0.55-0.63 GL; DLA very narrow, weakly sclerotized with acute posterior extremity, and far below level of VS, extending to 0.5-0.65 AD; VS slightly below level of PM, occupying about 0.71-0.8 AD; IVP inconspicuous; IB narrow; VR apparently single, extending nearly to anterior margin of GB; with 2 VP distinct. Apodemes 0.42-0.56 AL, AL 0.75-0.92 GL and AL/HTL= 0.68-0.85.

Color: Body brownish yellow; pronotum, mesonotum, pleurae, abdomen,

and coxae blackish.

Female: Body length 0.55-0.78 mm, head width 0.21-0.28 mm, HTL 0.14-0.17 mm. Antenna: club 0.37-0.41 broad as long, each with 4-5 BCPS and 5 PS; club length 0.44-0.47 scape length. Mandible with 6 teeth. Ovipositor long, OL/HTL= 1.0-1.06.

Color: Same as male, abdomen yellowish at apex.

Materials examined: NANTOU: Huisun, 2 , 28-X-1992 ex *Trichoplusia ni* on *Bidens pilosa* var. *minor*. TAICHUNG: Wufeng, 1 , 26-II-1992; 10 4 , 28-II-1992; 1 , 14-X-1992; 5 1 , 15-X-1992; 7 1 , 19-X-1992; ex *Trichoplusia ni* on *Boehmeria frutescens* var. *frutescens*; 2 4 , 20-III-1992 ex *Acraea issoria* on *Boehmeria frutescens* var. *frutescens*; 1 1 , 30-III-1992 ex *Trichoplusia ni* on *Brassica oleracea* var. *capitata*; 1 1 , 23-IV-1992 ex *Trichoplusia ni* on *Ageratum conyzoides*.

Distribution: India, Mainland China, and Taiwan (new record).

Hosts: *Acraea issoria formosana* (Fruhstorfer) and *Trichoplusia ni* (Hubner).

Trichogramma taiwanense n. sp. (Figs. 57-64)

Male: Body length 0.64-0.73 mm, head width 0.25-0.30 mm, HTL 0.13-0.16 mm. Antenna: flagellum 0.14-0.18 times as wide as long, and 1.25-1.38 HTL; with 9-10 BCPS and 3 PS; flagellar setae long and tapering, 37-54 in number, longest seta 2.5-3.16 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae short and fine, about 0.19-0.28 length of posterior pair. Forewing: 0.46-0.54 mm, FWW/FWL= 0.51-0.55; longest fringe seta about 0.14-0.17 FWW; Rs1 with 3 to 5 setae, 4-13 setae between 4th and 5th vein tract. Hindwing: anterior vein tract usually absent but occasionally with one setae, extending about 0.61 distance of middle tract, posterior vein tract with 4-9

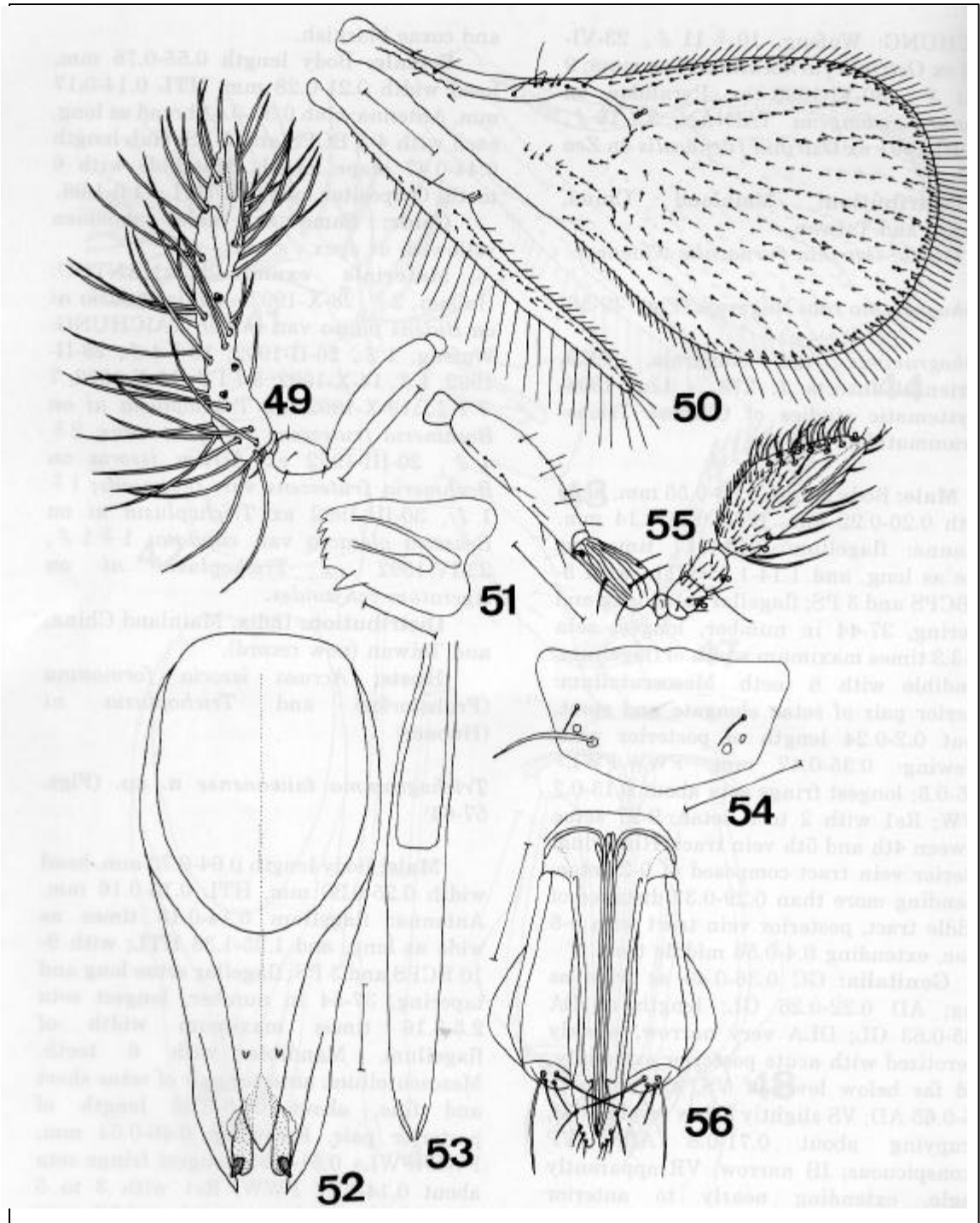


Fig. 49-56. *Trichogramma raoi* Nagaraja: 49-54, male; 55-56, female. 49, antenna; 50, wings; 51, mandible (dorsal view); 52, genital capsule (dorsal view); 53, aedeagus (dorsal view); 54, mesoscutellum (expanded); 55, antenna; 56, ovipositor. (Scale: 51, 52, 53= 0.02mm; 49, 54, 55, 56= 0.05mm; 50= 0.1 mm).

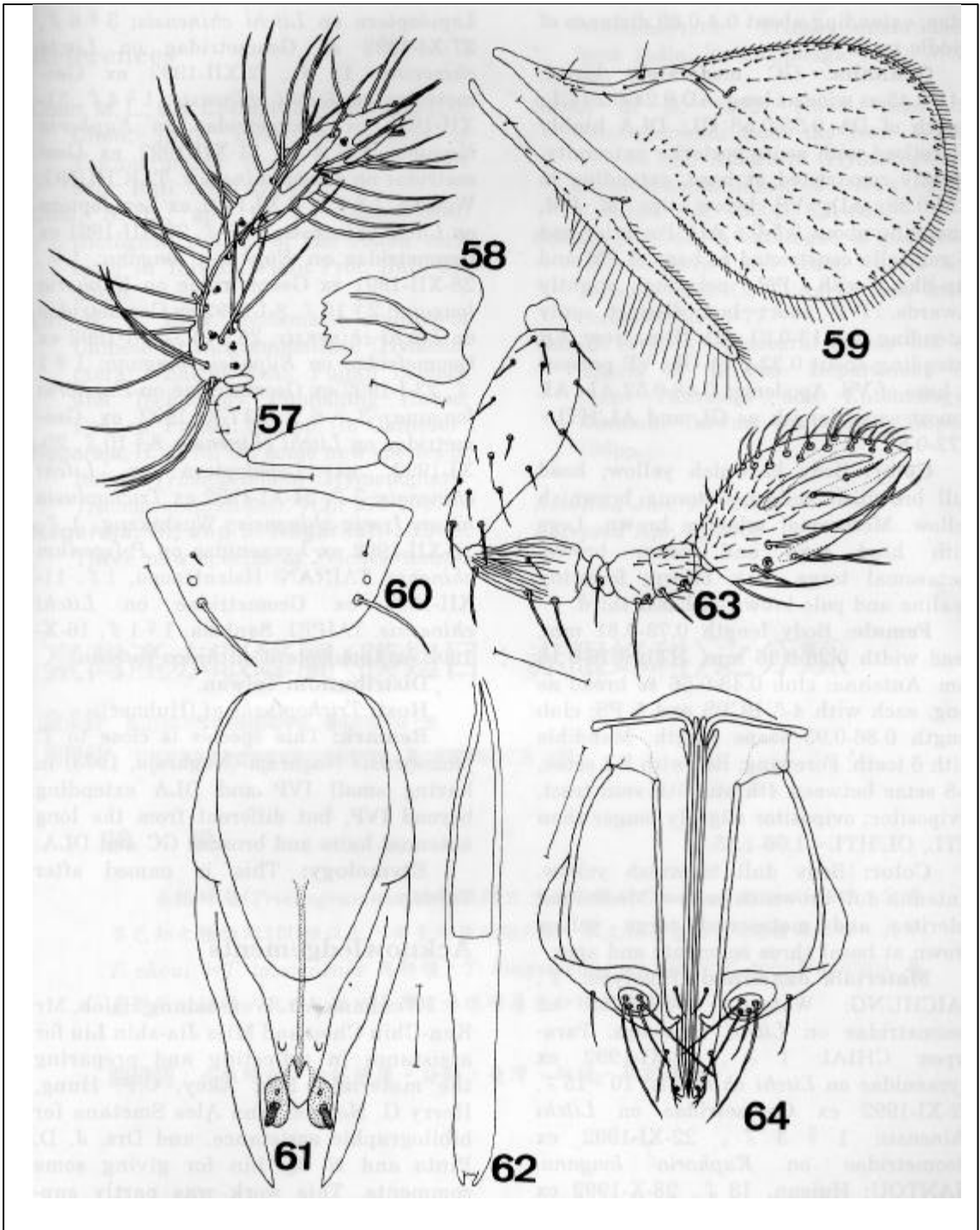


Fig. 57-64. *Trichogramma taiwanense* n. sp.: 57-62, male; 63-64, female. 57, antenna; 58, mandible (dorsal view); 59, wings; 60, mesoscutellum (expanded); 61, genital capsule (dorsal view); 62, aedeagus (dorsal view); 63, antenna; 64, ovipositor. (Scale: 58, 61, 62= 0.02mm; 57, 60, 63, 64= 0.05mm; 59= 0.1 mm).

setae, extending about 0.4-0.69 distance of middle tract.

Genitalia: GC moderately broad, 0.41-0.45 as wide as long; AD 0.24-0.29 GL; length of DA 0.53-0.58 GL; DLA highly sclerotized with acute posterior extremity, slightly constricted at base, extending to 0.22-0.38 AD; VS below tips of PM, occupying about 0.5-0.6 AD; Posterior end of genitalia constricted at base of PM and cup-like, with PM pointing slightly inwards. IVP short but distinct, only extending to 0.13-0.21 AD; IB narrow; VR extending about 0.32-0.71 GL; VP present at base of VS. Apodemes 0.48-0.52 AL, AL almost same length as GL and AL/HTL= 0.72-0.81.

Color: Body brownish yellow; head dull brownish yellow; antenna brownish yellow. Mesosomal sclerites brown. Legs with hind coxa and femur brown, metasomal terga dark brown; forewing hyaline and pale brown at basal third.

Female: Body length 0.73-0.81 mm, head width 0.26-0.36 mm, HTL 0.16-0.18 mm. Antenna: club 0.48-0.56 as broad as long, each with 4-5 BCPS and 5 PS; club length 0.86-0.93 scape length. Mandible with 6 teeth. Forewing: Rs1 with 2-4 setae, 5-8 setae between 4th and 5th vein tract. Ovipositor: ovipositor slightly longer than HTL, OL/HTL= 1.06-1.15.

Color: Body dull brownish yellow. Antenna dull brownish yellow. Mesosomal sclerites and metasomal terga yellow brown at basal three segments and apex.

Materials examined: Holotype: , TAICHUNG: Wufeng, 17-XI-1992 ex Geometridae on *Litchi chinensis*. Paratypes: CHIAI: 1 , 22-XI-1992 ex Lycaenidae on *Litchi chinensis*; 10 15 , 22-XI-1992 ex Geometridae on *Litchi chinensis*; 1 3 , 22-XI-1992 ex Geometridae on *Euphoria longana*. NANTOU: Huisun, 13 , 28-X-1992 ex Lepidoptera on weed; Tsaotun, 3 21 , 4-XI-1992 ex Lepidoptera on *Litchi chinensis*; 2 , 13-XI-1992 ex Geometridae on *Litchi chinensis*; 7 26 , 19-XI-1992 ex

Lepidoptera on *Litchi chinensis*; 3 6 , 27-XI-1992 ex Geometridae on *Litchi chinensis*; 11 , 2-XII-1992 ex Geometridae on *Litchi chinensis*; 1 4 , 31-XII-1992 ex Geometridae on *Euphoria longana*; 1 2 , 31-XII-1992 ex Geometridae on *Litchi chinensis*. TAICHUNG: Wufeng, 1 1 , 7-XI-1991 ex Lepidoptera on *Litchi chinensis*; 2 3 , 26-XII-1991 ex Geometridae on *Euphoria longana*; 1 , 28-XII-1991 ex Geometridae on *Euphoria longana*; 2 10 , 8-I-1992 ex Geometridae on *Litchi chinensis*; 26 14 , 8-I-1992 ex Geometridae on *Euphoria longana*; 1 1 , 23-I-1992 ex Geometridae on *Euphoria longana*; 3 6 , 17-XI-1992 ex Geometridae on *Litchi chinensis*; 8 10 , 20-XI-1992, ex Lepidoptera on *Litchi chinensis*; 7 , 24-XI-1992 ex *Trichoplusia ni* on *Ixeris chinensis*; Wushikeng, 1 , 18-XII-1992 ex Lycaenidae on *Polygonum chinense*. TAINAN: Hsientsaopu, 1 , 11-XII-1992 ex Geometridae on *Litchi chinensis*. TAIPEI: Sanhsia, 1 1 , 16-X-1992 ex Lepidoptera on *Areca catechu*.

Distribution: Taiwan.

Host: *Trichoplusia ni* (Hubner).

Remark: This species is close to *T. plasseyensis* Nagaraja (Nagaraja, 1973) in having small IVP and DLA extending beyond IVP, but different from the long antennal hairs and broader GC and DLA.

Etymology: This is named after Taiwan.

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臺灣產赤眼蜂屬(膜翅目：赤眼蜂科)之分類

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摘 要

赤眼蜂屬(*Trichogramma*)隸屬膜翅目、赤眼蜂科(Trichogrammatidae)，全世界已知之種類約150種以上，而臺灣僅記錄6種。本文記述臺灣產之8種赤眼蜂，其中 *T. choui* 和 *T. taiwanense* 為新種，*T. longxishanense* Lin 和 *T. raoi* Nagaraja 為臺灣新記錄種。此外，並附臺灣產赤眼蜂屬已知種之檢索表。

關鍵詞：赤眼蜂科、赤眼蜂屬、分類、臺灣、新種、新記錄種。