Two new species of the genus *Ficobracon* van Achterberg and Weiblen (Hymenoptera: Braconidae) from China, expanding its host range

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Abstract

Syconia of figs (Moraceae: *Ficus* spp.) harbour many wasp species, mostly belonging to several genera of chalcidoids (Hymenoptera: Chalcidoidea). In contrast, only two genera of Braconidae (Hymenoptera: Ichneumonoidea) with a few known species are found in syconia belonging to the subgenus *Urostigma*. The braconid fig wasps have an infrequent occurrence with low population density and are rarely encountered. Two new species, *Ficobracon rhiknosus* sp. nov., from figs of the subgenus *Urostigma*, and *F. codonatus* sp. nov., from figs of the subgenus *Sycidium* are described. Our previous experiments firmly support the suggestion that the *Ficobracon* species are parasitoids of non-pollinating chalcidoid fig wasps in the syconia.

Key words: *Ficobracon*, new species, *Ficus*, fig syconia

Introduction

A large number of wasps (Hymenoptera) (both species and individuals), are found in the syconia of figs (Moraceae: *Ficus* spp.). The vast majority belong to Chalcidoidea, including pollinating wasps (Agaonidae) and non-pollinating wasps (other chalcidoid families). Only two genera of Braconidae, the New World *Psenobolus* Reinahrd, 1885 (Doryctinae) and Old World *Ficobracon* van Achterberg and Weiblen, 2000 (Braconinae), have been reported from figs (Ramírez and Marsh 1996, van Achterberg and Marsh 2002, van Achterberg and Weiblen 2000).

According to the limited data available about their host and biology, these braconid fig wasps tend to be parasitoids of non-pollinating fig wasp species (Ramírez and Marsh 1996, van Achterberg and Marsh 2002, van Achterberg and Weiblen 2000, Wu et al. 2013). Their associated fig species mainly belong to the monoecious subgenus *Urostigma* (Ramírez and Marsh 1996, van Achterberg and Marsh 2002, van Achterberg and Weiblen 2000), and only one species of *Ficobracon* (described as a new species in present paper) is associated with *F. tinctoria gibbosa* belonging to the gynodioecious subgenus *Sycidium* (Wu et al. 2013).

The braconid fig wasps are rarely found within fig wasp communities, not only by the low number of species and genera, but also for these two *Ficobracon* species, by the low population density and occasional seasonal occurrence (unpublished data).

In 2000 the genus *Ficobracon* was established by van Achterberg and Weiblen based on *Ficobracon brusi* from *Ficus wassa* Roxb. in Papua New Guinea (van Achterberg and Weiblen 2000). Yang and Chen (2006) added a second species, *F. dazhulanensis*, from China (Chen and Yang 2006).

Here we describe two new species: *F. codatum* sp. nov. reared from *Ficus tinctoria gibbosa* (Blume) Corner in Hainan, China and *F. rhiknosus* sp. nov. reared from *Ficus microcarpa* L. and *F. benjamina* L. in Yunnan, China.
Materials and methods

Approximately 1–3 days before maturing, figs were collected and placed into fine-mesh bags, allowing the wasps to emerge naturally from the syconia. All emerged wasps were collected and preserved in 95% ethanol and stored at -20°C for further morphological studies. Ethanol-preserved type specimens were subsequently dried with an EMS 850 Critical Point Drier prior to mounting on small white points for further examination using a Nikon SMZ800 microscope. Photographs were obtained with a Nikon AZ100 microscope and figures edited with Adobe Photoshop CS3. Absolute measurements are used for body length, and relative measurements for all other dimensions.

Descriptions

Diagnosis (based on females): Antenna with 20–27 segments, the last antennal segment with apical spine; clypeus convex, not separated from face, with ventral margin thin and upcurved; propleuron smooth and flat; mesoscutum smooth, partly glabrous, only near notauli and medio-posteriorly setose; scutellum wide, semi-circular and flat; median carina of propodeum anteriorly absent (van Achterberg and Weiblen 2000); Fore wing: angle between veins 1-SR and C+SC+R about 55°, vein 3-M strongly sclerotized; tarsal claws ventrally convex and with rounded lobe (van Achterberg & Weiblen 2000); second and third tergites united to a wide syntergite, medially second tergite approximately twice as long as third tergite; ovipositor with teeth ventro-apically (van Achterberg and Weiblen 2000); hypopygium protruding apically beyond metasoma, narrowly truncate medio-apically.

Key to species of Ficobracon van Achterberg and Weiblen (females)

1 Length of ovipositor sheath 0.8–0.9 times as long as fore wing and 1.4 times as long as hind tibia; sublateral grooves of second tergite distinct .................................................. 2
- Sublateral grooves of second tergite absent; Vein CU1a of fore wing long, close to wing margin sublateral grooves of second tergite obsolete ................................................. 3
2 Vein 2-M of fore wing shorter than vein 3-M; third tergite largely smooth, without vertical striation .......................................................... F. brusi van Achterberg & Weiblen
- Vein 2-M of fore longer than 3-M; third tergite with vertical striation ................................................. F. dazhulanensis Yang & Chen
3 Fore wing angle between veins 2-SR and 2-M about 60°; medial area of first tergite largely smooth and with medial groove; ovipositor sheath 3.1 times as long as hind tibia, 1.4–1.6 times metasoma and 0.67–0.76 times fore wing .......................................................... F. codonatus Huang & van Achterberg sp. nov.
- Fore wing angle between veins 2-SR and 2-M about 30°; first tergite largely surface densely coarsely rugose, without medial groove; ovipositor sheath 3.6 times as long as hind tibia, 2.4 times as long as metasoma and 0.95 times fore wing .......................................................... F. rhiknosus Huang & van Achterberg sp. nov.

Ficobracon codonatus Huang & van Achterberg, sp. nov.

(Figures 1–18)

Material examined. Holotype ♀: CHINA: Hainan, Danzhou, Chinese Academy of Tropical Agricultural Sciences, VIII.2007, ex Ficus tinctoria gibbosa (Blume) Corner, T. Wu. Paratypes: 4 ♀, 3 ♂, topotypic and same data. All type specimens are deposited in Institute of Zoology, Chinese Academy of Sciences.

Description. Female (holotype). Body length 3.0 mm, fore wing length 3.2 mm.

Head: Antenna with 23 segments (Fig. 9); first flagellar segment as long as second flagellar segment; length of first, second and penultimate flagellar segments respectively 2.5, 2.1 and 2.0 times their width. Height of head less than width across eyes (13:15) (Fig. 2); face with a brown spot malar space approximately one third length of eye (Fig. 2); anterior tentorial pits normal; clypeal ventral margin thin and slightly upcurved, width 0.4 times width of face (Fig. 2); maxillary palp 4-segmented, subequal in length; labial palp 3-segmented, segments subequal in length; POL:OD:OOL = 2:2:7.
FIGURES 1–10. F. codonatus sp. n. Female. Figs 1, 2 and 7, holotype. Figs 3–6 and 8–10, paratype. 1. habitus, lateral view; 2. head, frontal view; 3. mesosoma, dorsal view; 4. propodeum, dorsal view; 5. mesosoma, lateral view; 6. first and second tergites, dorsal aspect; 7. fore wing and hind wing; 8. antenna with 21 segments; 9. antenna with 23 segments; 10. fore leg and metasoma, lateral view.
Mesosoma: Mesosoma longer than high (10.5:9.0) (Fig. 5); mesopleuron large and smooth, with some setae; metapleuron covered by long setae, with a black posterior rugose margin (Fig. 5); notauli shallow and posteriorly obsolescent (Fig. 3); mesoscutum largely glabrous and smooth but with many long setae along notauli; scutellar sulcus distinctly crenulate, deep, wide and straight; scutellum smooth (Fig. 4); metanotum very short; propodeum...
smooth, as long as scutellum, with medio-longitudinal carina on its posterior half, and with a dark-black posterior margin (Fig. 5).

Wings (Fig. 7): Fore wing: r:3-SR:SR1 = 5:10:42; 2-SR:3-SR:r-m = 2:2.3:1.3; angle between veins 2-SR and 2-M about 57; CU1a straight and long. Hind wing: M+CU:1-M = 1:4; 2-M as long as 1-M.

Legs: Length of hind femur, tibia and basitarsus 4.2, 7.5 and 5.0 times their width, respectively; length of coxa, trochanter, femur and tibia in ratio of 3:2:5:6 (Fig. 10); hind tarsal segments in ratio of 8:4:3:2:3 (Fig. 10); tibia slightly longer than femur; fore and middle tarsi slender.

Metasoma: Length of first tergite 1.1 times its apical width, medial area largely smooth, bell-shaped and divided by medial groove, posteriorly coarsely rugose (Fig. 6); sublateral grooves rugose-punctate, converging to medial groove at anterior margin; second tergite approximately as long as third tergite, second tergite largely smooth, submedial grooves finely rugose, sublateral grooves absent (Fig. 6); third tergite largely rugose-reticulate; second and base of third tergite with sharp lateral crease; other following tergites smooth and transverse. Ovipositor sheath 1.6 times as long as metasoma, 0.76 times as long as fore wing and approximately 3.1 times hind tibia, long setose. Hypopygium long and narrow, apically acute.

Male. (Figures 11–18). Antenna 20–23 segments; first tergite apically narrowly coarsely rugose, without medial groove (Fig. 17); third to sixth tergites black, largely with fine punctures and rugose margin dorsally (Fig. 18).

Colour (Fig. 1, 11). Body yellow, antenna, hind tibiae, tarsal claws, ovipositor sheath, pterostigma, ventral part of mesopleuron, and largely third tergite brown, groove of pronotum, propodeum, scutellar sulcus, side of scutellum, propodeum largely and first tergite and second tergite medially dark brown or black; wings subhyaline.

Variation. Body length 1.8–3.0 mm. Antenna with 20–23 segments (Fig. 8, 9); face may be without spot; groove on pronotum of female, mesopleuron ventrally, propodeum and first tergite sometimes largely yellow; antenna of male sometimes yellow; third to sixth tergites sometimes yellow, sometimes without punctures and rugose margin dorsally, ovipositor sheath 1.4–1.6 times metasoma and 0.67–0.76 times fore wing.

Distribution. China (Hainan).

Biology. This braconid species can be found in both male and female syconia of the gynodioecious fig tree, Ficus tinctoria gibbosa. It seems to be a parasitoid of Neosycophila sp. (Chalcidoidea: unplaced family: Epichrysomallinae), a phytophagous galler of F. tinctoria gibbosa (Wu et al. 2013).

Etymology. After “codonos” (Greek for “bell”) because of the bell-shaped medial area of the first metasomal segment.

Ficobracon rhiknosus Huang and van Achterberg, sp. nov.
(Figures 19–31)

Material examined: Holotype ♀: CHINA, Yunnan, Mang, Exotic Botanical Gardens, 15.XI.2011, ex Ficus benjamina L., Da-wei Huang, Paratypes: 2 ♀, 1 ♂, topotypic and same data. 1 ♀, 1 ♂. CHINA, Yunnan, Xishuangbanna Tropical Botanical Garden, 22.III.2003, ex Ficus microcarpa L.Wen-quan Zhen. All type specimens are deposited in Institute of Zoology, Chinese Academy of Sciences.

Description. Females (holotype): Body length 2.3 mm, fore wing length 2.8 mm.

Head: Antenna with 22 segments (Fig. 21); first flagellar segment slightly longer than the second flagellar segment (25:22); length of first, second and penultimate flagellar segments, respectively, 3.3, 2.7 and 2.0 times their width. Height of head less than width across compound eyes (9:11) (Fig. 20); malar space approximately one third of the length of eyes. anterior tentorial pits normal; ventral clypeal margin thin and slightly upcurved, width 0.5 times width of face; maxillary palp 4-segmented; fourth segment the longest, 1.5 times as long as third segment; labial palp 3-segmented; POL:OD:OOL = 5:4:13.

Mesosoma slightly longer than high (35:37); mesopleuron large and smooth, with some setae; metapleuron covered by long setae, with a black and rugose posterior margin; notauli shallow and almost obsolete; mesoscutum largely glabrous and smooth but with many long setae along notauli; scutellar sulcus distinctly crenulate, deep, wide and straight (Fig. 23); scutellum smooth; metanotum very short; propodeum smooth, slightly shorter than scutellum.
Wings (Fig. 22): Fore wing: r:3-SR:SR1 = 9:15:42; 2-SR:3-SR:r-m = 2:3:1.3; angle between veins 2-SR and 2-M about 31; CU1a straight and long,. Hind wing: M+CU:1-M = 1:4; 2-M as long as 1-M.

Legs: Length of hind femur, tibia and basitarsus of hind leg 4.5, 5.3 and 4.0 times their width, respectively; length of coxa, trochanter, femur and tibia in ratio of 2.2:2.0:4.0:4.5; 5 tarsi in ratio of 9.0:4.5:3.0:2.4:5.4.

Metasoma: First tergite largely surface densely coarsely rugose (including medial area), without medial groove, sublateral grooves converging in anterior margin (Fig. 25); medially second tergite approximately 1.5 times as long as third tergite, second tergite largely smooth, submedial grooves finely rugose, sublateral grooves absent; third tergite largely smooth; second and third tergite with transverse and sublateral grooves (Fig. 25), following tergites smooth and transverse. Ovipositor sheath 2.4 times as long as metasoma, 0.95 times fore wing and approximately 3.6 times hind tibia, long setose. Hypopygium long and narrow, apically acute.

Male. (Figures 26–31) body length 2.0 mm. Antenna with 22 segments. Hind wing: M+CU:1-M = 1:3. First tergite apically narrowly coarsely rugose, without groove (Fig. 30). Third, fourth and fifth tergite largely smooth, with fine punctures and rugose margin dorsally (Fig. 31).

Colour (Fig. 19, 26). Body yellow, antennal flagellum of female, apical part of antenna of male, hind tibia, tarsal claws, ovipositor sheath, pterostigma, ventrally mesopleuron and female third and fourth tergites largely brown; scutellar sulcus, side of scutellum, largely propodeum and first tergite of female and grooves of tergites dark brown or black; wings subhyaline.

Variation. Body length 1.9–2.9 mm. Antenna with 21–22 segments. Propodeum largely and first tergite sometimes brown; ventrally mesospleuron sometimes yellow.

Distribution. China (Yunnan).

Biology. This species is associated with Ficus benjamina and F. microcarpa, which belong to the subgenus Urostigma.

Etymology. Name derived from “rhiknos” (Greek for “wrinkled”), because of the largely rugose first tergite.

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References