

Formal nomenclature and description of cryptic species of the *Encyrtus sasakii* complex (Hymenoptera: Encyrtidae)

Ying Wang¹, Qing-Song Zhou^{1,2}, Hui-Jie Qiao¹, Ai-Bing Zhang³, Fang Yu^{1,2}, Xu-Bo Wang⁴, Chao-Dong Zhu^{1,2}, Yan-Zhou Zhang^{1,2*}

1 Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, Beijing 100101, China

2 University of Chinese Academy of Sciences (UCAS), No. 19A Yuquan Road, Beijing 100049, China

3 College of Life Sciences, Capital Normal University, Beijing 100048, China

4 Key Laboratory for Silviculture and Conservation of Ministry of Education, Beijing Forestry University, Beijing 100083, China

** Corresponding author E-mail: zhangyz@ioz.ac.cn*

Authors Ying Wang and Qing-Song Zhou contributed equally to this study.

Text File S1

Description of *Encyrtus* species

Encyrtus eulecaniumiae sp. nov. Wang & Zhang, Figure 6

Description.

Female (Holotype): Length about 3 mm including ovipositor sheaths. Head black in ocellar area, from anterior ocellus to top of scrobes black to brown yellow, and malar space area brown; face largely brown yellow; radicle brown mixed pale orange; scape (Figure 6a) mostly pale brown; pedicel dark brown or black; funicle with segments black; clava black; pronotum dark brown, laterally brown; thorax clothed in setae which dark brown, mesoscutum mostly black, laterally brown, scutellum black but a broad transverse yellow band on the scutellum, with a tuft of black bristles on the tip; metanotum black; tegula brown; mesopleuron pale brown; fore and hind coxae brown yellow; mid coxa mostly brown; legs otherwise brown; basal one third of fore wing hyaline, and the others infuscate, fore wing with a group of long bristles just below the apical third of the submarginal; propodeum brown dorsally, yellowish brown laterally; gaster black.

Head. In dorsal view, frontovertex about half head width; ocelli forming an obtuse angle about 120°; in front view, scrobal depression \cap -shaped; eye at least superficially bare; torulus separated from mouth margin by about one its own length; torulus separated from each other by about 4× own diameter. Antenna (Figure 6a) 13-segmented, scape cylindrical and 4.5× as long as broad; but approximate ratio of

segments from pedicel = 101: 98: 85: 81: 82: 78: 76: 87: 56: 47; F1 about 1.4× longer than wide, F2 a little longer than wide, F3 and F4 as long as wide, the last two a little wider than long; clava compact 3-segmented with transverse sutures; clypeus with three to six of conspicuous, long, suberect setae; maxillary and labial palpi 4 and 3 segmented respectively.

Thorax. Pronotum in dorsal view about one-sixth length of mesoscutum with surface sloping from posterior margin, uniformly setose and fine reticulate sculpture. Mesoscutum about 1.47× wider than long; uniformly convex, setose and fine reticulate sculpture, without notauli. Scutellum with a tuft of black bristles on the tip. Side of propodeum more or less naked below spiracle, but with a few inconspicuous, translucent setae on posterior margin above hind coxa. mesotibia with strong setae apically, but without differentiated rows of spines, and with mesotibial spur only about 1.7× as long as apical width of tibia (Figure 6e); each leg with basitarsus robust and longest, the others equal in size; the basitarsus of mesotarsus about 2× as long as wide and about as long as remaining segments. Fore wing (Figure 6c) hyaline and distinctly infuscate in the apical two-thirds; a fuscous dot below the apical two-third of the submarginal vein and robust bristle on the fuscous area. SM: MV: STV: PMV = 72:5:25:23; stigmal vein apically curved.

Gaster. Gaster very broadly sessile, with seven visible, uniformly gastral tergites; hypopygium very nearly reaching apex of gaster. Ovipositor sheaths yellow, apex one-third dark brown (Figure 6b).

Relative measurements: HW 96, FV 46, POL, 33, AOL 19, OOL 6, OCL 7, POD 5,

AOD 4, EL 58, EW 38, MS 30, SL 32, SW 7, FWL 204, FWW 83; HWL 169, HWW 53, OL 34, [MT 91]

Male: generally similar to female but for antennal structure and genitalia; yellow band on the scutellum obviously smaller than female.

***Encyrtus rhodococcusiae* sp. nov. Wang & Zhang, Figure 7**

Description.

Female (Holotype): Length including ovipositor 1.9 mm. Head black in ocellar area, frontovertex black; malar space area brown; antenna with scape yellow-brown; pedicel and flagellum dark brown; maxillary and labial palpi yellow-brown; pronotum dark brown to black, laterally brown; thorax clothed in setae which dark brown, mesoscutum mostly black, laterally brown, scutellum black but a broad transverse yellow band on the scutellum, with a tuft of black bristles on the tip; metanotum dark brown; tegula dark brown; mesopleuron pale brown; fore and hind coxae pale brown yellow (Figure 7d, f); mid coxa mostly brown (Figure 7e); legs otherwise brown; basal one third of fore wing hyaline, and the others infusate, fore wing with a group of long bristles just below the apical third of the submarginal; propodeum brown dorsally, yellowish brown laterally; gaster black.

Head. In dorsal view, frontovertex about half head width; ocelli forming an obtuse angle about 120°; in front view, scrobes quite shallow and \cap -shaped; eye at least superficially bare; torulus separated from mouth margin by about one its own length; torulus separated from each other by about 2.5× own diameter; antenna with scape

subcylindrical, 3.4× as long as broad; pedicel subtriangular, as broad as scape, 1.4× as long as broad. Antenna (Figure 7a) 13-segmented, scape cylindrical but approximate ratio of segments from pedicel = 70: 65: 55: 61:57: 55: 50: 64: 37: 32; ratio of length and width for each funicle segment: 1.3, 1, 1.02, 0.84, 0.75, 0.63; clava 3-segmented similar to *E. eulecaniumiae*, its apex with a distinctly truncation; mandible plow shaped; clypeus also with three to six conspicuous, long, suberect setae; maxillary and labial palpi 4 and 3 segmented respectively.

Thorax. Mesoscutum about 1.44× wider than long; uniformly convex, setose and fine reticulate sculpture, without notauli. Pronotum very short, about one eleventh as long as mesoscutum, with polygonal reticulate sculpture; scutellum about 1.2× as long as broad, sculpture anteriorly similar to that of mesoscutum; fore wing (Figure 7c) about 2.3× as long as broad; costal cell with more than one line of setae dorsally; SM: MV: STV: PMV = 85:5:35:32; stigma vein apically curved.

Gaster. Hypopygium very nearly reaching apex of gaster. Ovipositor sheaths yellow, apex one-third dark brown (Figure 7b).

Relative measurements: HW 93, FV 46, POL, 33, AOL 19, OOL 8, OCL 5, POD 7, AOD 6, EL 50, EW 30, MS 31, SL 31, SW 9, FWL 162, FWW 61; HWL 116, HWW 35, OL28, [MT 69]

Male: generally similar to female but for antennal structure and genitalia; yellow band on the scutellum obviously smaller than female.

***Encyrtus sasakii* Ishii, Figure 8**

Description.

Female: Length including ovipositor 2.5 mm. Ocellar area and frontovertex black; malar space area brown; antenna with scape yellow-brown; pedicel and flagellum in dorsal aspect dark brown; maxillary and labial palpi yellow-brown; pronotum black, only laterally brown; thorax clothed in setae which black, mesoscutum mostly black, laterally brown, scutellum black but a broad transverse yellow band on the scutellum, with a tuft of black bristles on the apex of scutellum; metanotum dark brown; tegula dark brown; mesopleuron brown; fore coxa pale brown (Figure 8d), mid and hind coxae mostly brown (Figure 8e, f), legs otherwise brown; basal one third of fore wing hyaline, and the others infusate, fore wing with a group of long bristles just below the apical third of the submarginal; propodeum brown dorsally, yellowish brown laterally; gaster black.

Head. In dorsal view, frontovertex about half head width; ocelli forming an obtuse angle about 120°; in front view, scrobes broadly \cap -shaped; torulus separated from mouth margin very slightly less than its own length; torulus separated from each other by about 2.0× own diameter; antenna with scape subcylindrical, 4.7× as long as broad; pedicel subtriangular, as broad as scape, 1.7× as long as broad. Antenna (Figure 8a) 13-segmented, scape cylindrical but approximate ratio of segments from pedicel= 85: 90: 81: 75:73: 64: 65: 65: 50: 44; ratio of length and width for each funicle segment: 1.55, 1.25, 1.07, 0.97, 0.77, 0.72; clava 3-segmented, its apex with a distinctly truncation; mandible plow shaped; clypeus also with four conspicuous, long, suberect

setae; maxillary and labial palpi 4 and 3 segmented respectively.

Thorax. Mesoscutum about 1.60× wider than long; uniformly convex, setose and fine reticulate sculpture, without notauli. Pronotum very short, about one fifth as long as mesoscutum, with polygonal reticulate sculpture; scutellum about 1.23× as long as broad, sculpture anteriorly similar to that of mesoscutum; fore wing (Figure 8c) about 2.44× as long as broad; costal cell with more than one line of setae dorsally; SM: MV: STV: PMV = 96:7:37:37; stigmal vein apically curved.

Gaster. Hypopygium nearly reaching apex of gaster. Ovipositor sheaths yellow, apex one-third dark brown (Figure 8b).

Relative measurements: HW 101, FV 48, POL, 40, AOL 24, OOL 7, OCL 8, POD 6, AOD 8, EL 60, EW 41, MS 30, SL 40, SW 8, FWL 230, FWW 94; HWL 170, HWW 69, OL37 [MT 102] .

Male: generally similar to female but for antennal structure and genitalia; yellow band on the scutellum obviously smaller than female.

BJEG2 BJEG2 + + Beijing, Haidian 2006-v-1 YZZ *Rhodococcus sariuoni* *Sophora japonica*

Note: (+: extracted information in the study; Old Code: all the sample we list in the Chesters et al., 2012)

Table S3 Shape PCA components

	shape_PC1	shape_PC2	shape_PC3	shape_PC4	shape_PC5	shape_PC6	shape_PC7	shape_PC8	shape_PC9	shape_PC10	shape_PC11	shape_PC12	shape_PC13	shape_PC14	shape_PC15	shape_PC16	shape_PC17	shape_PC18	shape_PC19	shape_PC20	shape_PC21	shape_PC22	shape_PC23	shape_PC24	shape_PC25
Variance	0.034	0.0169	0.0111	0.0076	0.0064	0.0057	0.0054	0.0044	0.0036	0.0033	0.0032	0.0027	0.0022	0.0022	0.0019	0.0017	0.0015	0.0014	0.0012	0.0011	0.0009	0.0006	0.0004	4.00E-04	0
Proportion of Variance	0.2829	0.1406	0.0923	0.096	0.0534	0.0477	0.0452	0.0369	0.0303	0.0274	0.0266	0.0222	0.0183	0.018	0.0159	0.014	0.0121	0.0113	0.0098	0.0094	0.0075	0.0054	0.0036	3.00E-03	0
Cumulative Proportion	0.2829	0.4235	0.5158	0.5819	0.6353	0.683	0.7282	0.7651	0.7954	0.8228	0.8494	0.8716	0.8899	0.9076	0.9238	0.9379	0.9499	0.9613	0.9711	0.9805	0.988	0.9934	0.997	1.00E+00	1

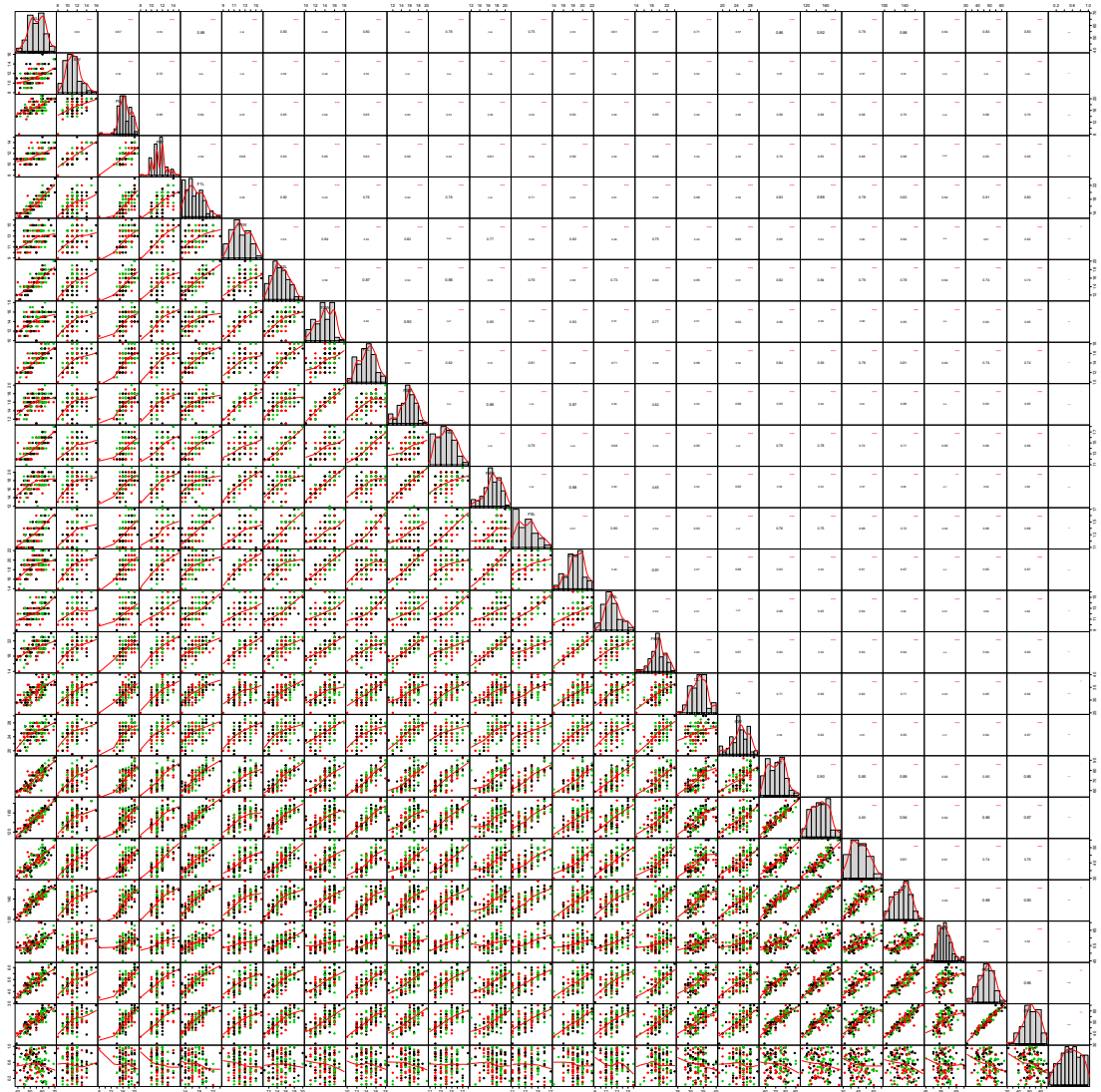


Figure S1. Matrix scatterplots and Pearson product-moment correlation coefficients of *Encyrtus* spp. based on 25 of the morphological characters.

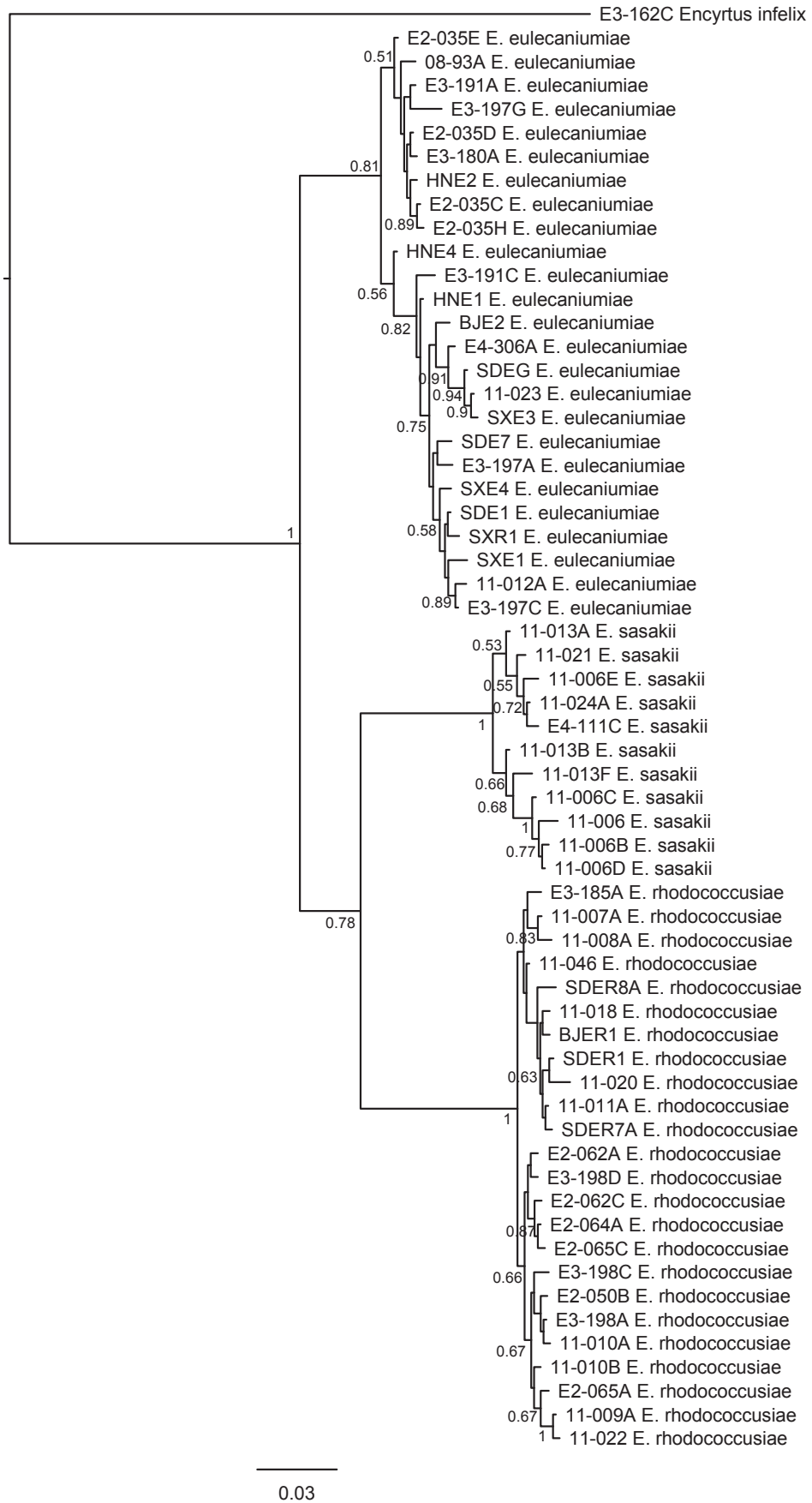


Figure S2. Bayesian inference phylogeny of *Encyrtus* spp. constructed by MrBayes based on COI dataset.

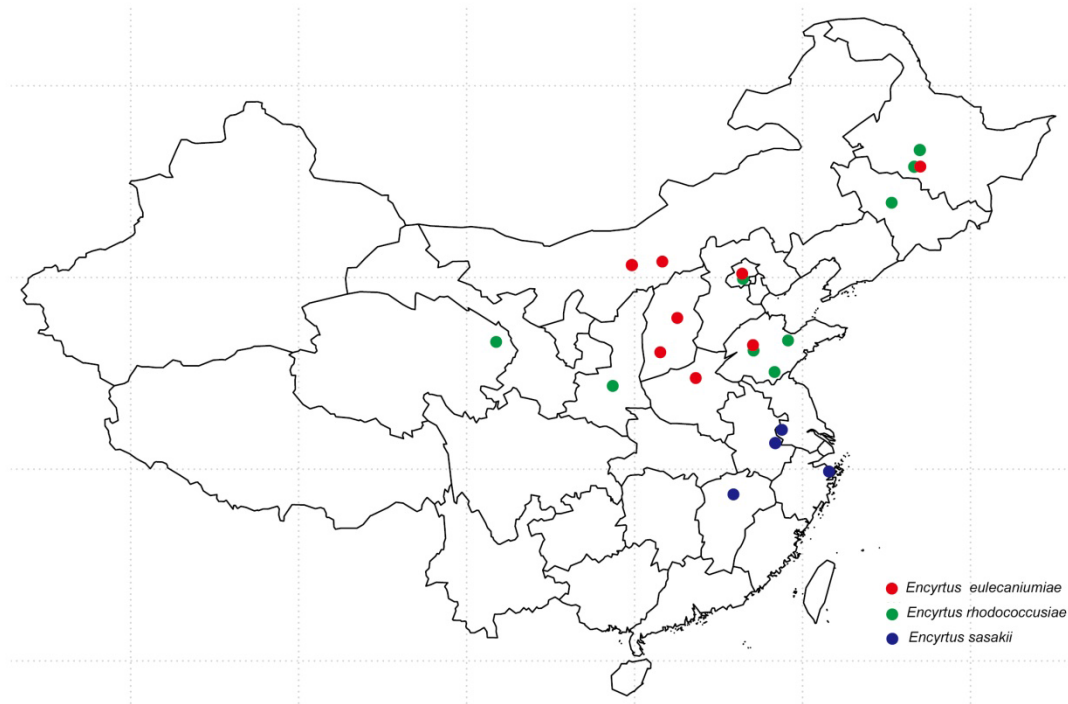


Figure S3. Sampling sites of *Encyrtus* spp. in China. This figure was drawn in “R” using the mapdata package created by R Development Core Team⁶⁷, and the map will not have a copyright dispute.