

A new species of *Caerulea* FORSTER, 1938 from W. Guizhou

(Lepidoptera: Lycaenidae)

by

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Abstract: The genus *Caerulea* FORSTER, 1938 is reviewed, with *C. guizhouensis* spec. nov. described from W. Guizhou.

Introduction: HEMMING (1931) first noticed the genital differences between this group and its affinities in the genus *Maculinea* VAN ECKE, 1915 (this genus was recently merged into *Phengaris* DOHERTY, 1891 by FRIC et al., 2007). Based upon these differences, FORSTER (1938) erected *Caerulea* as a subgenus of *Glaucopsyche* SCUDDER, 1872 to receive this group. ELIOT (1973) raised *Caerulea* FORSTER to full genus and placed it into the *Glaucopsyche* section of the tribe Polyommattini SWAINSON, 1827. HEMMING's (1931) notes can be regarded as the definition of the genus *Caerulea* FORSTER in genital characters and we quote them as follows: "the clasps (valvae) are relatively very short and broad"; "the clasps are much wider at their distal end than at the base"; "the distal margin of the clasp is irregularly incurved and the terminal spine is broader at the base and more rounded and tapering". In external features, the genus *Caerulea* FORSTER is easily distinguishable, as the two known species are much closer to each other than to species within other genera.

HEMMING (1931) actually reviewed this genus and recognized two close species: *Caerulea coeligena* (OBERTHÜR, 1876) and *C. coelestis* (ALPHERAKY, 1897). However, the genital difference in valvae between these two species mentioned by HEMMING (1931) is now proved by our work as useless in taxonomy, falling into individual variation, as HEMMING apparently dissected very few specimens. These two species seem to be sympatric in nature, as HEMMING (1931) found that both species had been recorded from Moupin, Ta-Tsien-lou and "Frontiere orientale de Thibet" in BMNH. However, these old specimens might be roughly labeled and their correct collecting data are untraceable. On the contrary, we do not find any reliable sympatric record for these two species by any Chinese collectors, though these two species might have their ranges overlapping a little around the Baoxing area.

Unexpectedly, the junior author observed two different species occurring at the same locality of Caohai, Weining, W. Guizhou: one flew in early May, with larva feeding on *Gentiana sutchuenensis* FRANCHET, 1890 (Gentianaceae), representing *Caerulea coelestis* SUGIYAMA, 1999; another on the wings in mid and late June, with larva feeding on *Gentiana praticola* FRANCHET, 1896, representing a scientifically unknown species, described herein.

Abbreviations:

BMNH:	Natural History Museum, London.
BSNU:	Biological laboratory of Shanghai Normal University, Shanghai, P.R. China.
CHH:	Collection of Hao Huang, Qingdao, China.
CCF:	Collection of Feng Cao, Hunan, China.
HT:	Holotype.
PT:	Paratype.
TL:	Type locality.

Taxonomic accounts of *Caerulea* taxa

Caerulea coeligena (OBERTHÜR, 1876)

Diagnosis for species. The following characters are considered to be useful in distinguishing this species from the others: 1) ♂ upper side ground color more silvery and paler (deeper blue in the other two species); 2) ♀ forewing upper side black marginal band usually narrower (this character is not constant); 3) ♀ upper side with discal area in purer bluish ground color, not black-dusted (in powdered blue ground, extensively black-dusted in the other two species); 4) aedoeagus markedly thinner near the tip, just before the distal end of dorsal wall (thicker in the other two species).

Caerulea coeligena coeligena (OBERTHÜR, 1876) (figs. 11-12, 47: L)

Lycaena coeligena OBERTHÜR, 1876: 21, pl. 1, figs. 3a-b for unique ♂ (TL: Moupin, now Baoxing).

Iolana caligena (sic!): BETHUNE-BAKER, 1914: 162.

Maculinea coeligena coeligena: HEMMING, 1931: 329, type deposition in BMNH, records from Ta-Tsien-lou, "Frontiere orientale de Thibet", pl. 11, fig. 5 for valva.

Glaucopsyche (*Caerulea*) *coeligena*: FORSTER, 1938: 108. (Subgenus *Caerulea* raised to full genus by ELIOT 1973).

Caerulea coeligena: BRIDGES, 1988: II. 18; D'ABRERA, 1993: 482.

Material. Sichuan: 1 ♂ (CHH), Ya'an City, Yingjing County, Siping, 1100 m, 22.IV.2014, H. HUANG leg.. Dissected.

Remarks. Its range overlaps that of *C. c. coelestis* (ALPHERAKY) in Baoxing area, but at a lower elevation. The ♂ of this taxon differs from that of the possibly sympatric population of *C. c. coelestis* (ALPH.) by having a broader black patch at apex of forewing upper side, in addition to the characters mentioned above (under "Diagnosis for species").

Caerulea coeligena pratti (HEMMING, 1931) (figs. 13-17, 32-34, 47: M, N & O)

Lycaena coeligena: LEECH, 1893: 312.

Maculinea coeligena pratti HEMMING, 1931: 329 (TL: Chang-Yang, Hubei).

Caerulea coeligena pratti: BRIDGES, 1988: II. 18; D'ABRERA, 1993: 483, figs. for ♂ & ♀ (probably type specimens) from Ichang and Chang Yang, Hubei.

Caerulea coeligena: WANG & FAN, 2002: cp. 24, figs. 9-14 for specimens from Shaanxi and Henan.

Caerulea coelestis coelestis: WANG & FAN, 2002: cp. 24, figs. 15-18 for specimens from Henan. (Misidentification).

Material. Hubei: 1 ♂ (CHH), Xiangyang City, Baokang County, Wudaoxia, Makeng-linchang, 1000 m, 1.V.2015, M. YE leg..

Chongqing: 4 ♂♂, 3 ♀♀ (CHH), Chengkou County, near Huang'anba, Dabashan Mts., 1500 m, 21.-27.IV.2008, H. HUANG leg.. **Gansu:** 5 ♂♂, 3 ♀♀ (CHH), Huixian, Fuzhen, 1300 m, 27.IV.2017, H. HUANG leg.; 4 ♂♂, 2 ♀♀ (CHH), Kangxian, 1200-1400 m, 29.IV.2017 & 2.VI.2016, H. HUANG leg..

Shaanxi: 2 ♂♂, 1 ♀ (CHH), Ningshaan, Pingheliangding, 2200 m, 1.V.2008, H. HUANG leg.. 6 ♂♂ dissected.

Remarks. The populations from Hubei (TL) belong to ssp. *pratti* (HEMMING) without doubt, being different from the nominotypical subspecies by having a more metallic blue and less whitish ground color on upper side of both sexes. However, the populations from Shaanxi, Chongqing and S. Gansu are intermediate between the two known subspecies, being variable in ground color and apical patch on forewing upper side of ♂. They are tentatively included into ssp. *pratti* (HEMMING) by having the veins less outlined with dark scales on forewing upper side of ♀, and by a viewpoint of the zoogeography (the areas around Qinling Mts. and Dabashan Mts. usually share more in butterfly fauna with the Changyang area of Hubei than with W. Sichuan). A population from Lingbao, Henan (WANG & FAN, 2002) goes even farther by having wider marginal band and darker blue ground color on both wings upper side of ♀, closely resembling that of *C. coelestis* (ALPH.) (This can explain why WANG & FAN (2002) misidentified a part of their specimens from Henan as *C. coelestis* (ALPH.)). It might be more reasonable to include all the populations and subspecies of *C. coeligena* (OBTH.) into one taxon, without a subspecific separation.

Caerulea coelestis (ALPHERAKY, 1897)

Diagnosis for species. ♂ upper side ground color deeper blue and less silvery than in *C. coeligena* (OBTH.). ♀ forewing upper side black marginal band usually wider than in *C. coeligena* (OBTH.). ♀ upper side ground color darker bluish and powdered, not so pure as in *C. coeligena* (OBTH.). Both sexes with discal spots on both wings underside nearer termen than in *C. guizhouensis* spec. nov.. Aedoeagus markedly thicker than in *C. coeligena* (OBTH.) just before the distal end of dorsal wall. Valva (not counting apical process) more rectangular in shape than in *C. guizhouensis* spec. nov., with inner margin evenly curved or obtusely angled, not nearly right-angled as in *C. guizhouensis* spec. nov..

Caerulea coelestis coelestis (ALPHERAKY, 1897) (figs. 18-20, 46: J-K)

Lycaena coeligena var.? *coelestis* ALPHERAKY, 1897: 113, unique ♂ (TL: Kham (Kang) - area between Kangding and Batang, nearer Kangding).

Lycaena coeli OBERTHÜR, 1908: 311, pl. 5, figs. 1 for ♂, 2 for ♀ (TL: NW. Ta-Tsien-Lou); HEMMING, 1931: 330, synonymy for *coelestis* ALPH.

Maculinea coelestis: HEMMING, 1931: 329, pl. 11, figs. 6-7 for valva & aedoeagus taken from PT.

Iolana (an error in editing, should be *Maculinea*) *coelestis coelestis*: HEMMING, 1931: 330, records from “Moenia” (now Jiulong), “Frontiere orientale de Thibet”, “Moupin” (now Baoxing), “Ta-pin-tze” (now Heqing, N. Yunnan- this record should belong to *dubernardi* HEMMING).

Glaucopsyche (*Caerulea*) *coelestis*: FORSTER, 1938: 108. (Subgenus *Caerulea* raised to full genus by ELIOT, 1973).

Caerulea coeligena coelestis: BRIDGES, 1988: II. 18.

Caerulea coelestis: D'ABRERA, 1993: 482, 483, figs. for both sexes from Ta Tsien Lu.

Material. Sichuan: 2 ♂♂ (CHH), Ganzi Tibetan Autonomous Prefecture, Jiulong County, 2600 m, 25-26.IV.2014, H. HUANG leg.. All dissected.

Remarks. HEMMING (1931) stated that the unique HT of *C. coelestis* (ALPH.) was taken in “the neighbourhood, and presumably to the west of Batang by Kachkarow, the assistant of G.N. Potanine”. However, according to ALPHERAKY (1897), POTANINE left Tatsienlu to Batang on 2-14 May 1893 and returned to Tatsienlu on 10-24 June and the HT was collected on 20 May. Thus, the HT is more likely to be collected from the route between Tatsienlu and Batang and much nearer Tatsienlu than Batang.

Caerulea coelestis dubernardi (HEMMING, 1931) (figs. 21-25, 35-39, 47: G-I)

Maculinea coelestis dubernardi HEMMING, 1931: 330 (TL: Tsekou).

Caerulea coeligena dubernardi: BRIDGES, 1988: II. 18.

Material. Yunnan: 8 ♂♂, 7 ♀♀ (CHH), Lijiang, Yulongxueshan, 2800m, 13.-14.V.2014, H. HUANG leg.; 6 ♂♂, 4 ♀♀ (CHH), Diqing Prefecture, Zhongdian, Tuguancun, 2500 m, 15.V.2014, 20.IV.-3.VI.2015, H. HUANG leg.; 2 ♀♀ (CHH), Diqing, Zhongdian, Baishuitai, 2400 m, 23.-24.VI.2004, H. HUANG leg.; 1 ♀ (CHH), Diqing, Zhongdian, Hutiaoxia, 1800 m, 21.IV.2005, H. HUANG leg.; 4 ♂♂, 3 ♀♀ (CHH), Diqing, Weixi, 2900 m, 19.V.2014 & 29.IV.2015, H. HUANG leg.; 1 ♂ (CHH), Chuxiong, Dayao, Santai, 2500 m, 18.IV.2015, H. HUANG leg.. 7 ♂♂ dissected.

Remarks. HEMMING (1931) described this subspecies on 4 ♂♂, 3 ♀♀ from Tsekou, a very limited material, thus some of his diagnostic characters for distinguishing this subspecies may not work, such as the more purplish ground color on the upper side which is chiefly caused by the worn condition of the specimens. This subspecies can be distinguished from the nominotypical subspecies by the following combination of characters: 1) size frequently much smaller [but still the specimens as large as in ssp. *coelestis* (ALPHERAKY) can be found]; 2) underside ground color in both sexes darker; 3) both wings upper side of ♀ with much less blue scaling.

Caerulea coelestis chengmaica MURAYAMA, 1993 stat. nov. (fig. 10)

Caerulea coeligena chengmaica MURAYAMA, 1993: 34, fig. 1 for ♂ and ♀ (TL: Chengmai, Fang, N. Thailand).

Material. None.

Remarks. This taxon is considered herein as a subspecies of *C. coelestis* (ALPH.) instead of *C. coeligena* (OBTH.) by the very broad dark marginal band on forewing upper side of ♀, and by its range which is widely isolated from *C. coeligena* (OBTH.) by the populations of *C. coelestis* (ALPH.). It differs from all other subspecies by having a larger black apical patch on forewing upper side of ♂ and a less black-dusted blue ground color on forewing upper side of ♀.

Caerulea coelestis sora SUGIYAMA, 1999 (figs. 1-2, 5-7, 26-28, 40, 44, 46: D-F)

Caerulea coelestis sora SUGIYAMA, 1999: (TL: Qujing, NE Yunnan).

Material. Yunnan: 1 ♂ (CHH), Qujing, 1.V. 1993, X.-S. Mo leg... **Guizhou:** 9 ♂♂, 7 ♀♀ (CCF, CHH), Weining, Caohai, 2400 m, 10.V.2016 & 1.-2.V.2017, F. CAO leg.. 4 ♂♂ dissected.

Remarks. This subspecies is only slightly different from ssp. *dubernardi* (HEMMING) by having a wider black marginal band and a larger black apical patch on forewing upper side of ♂.

***Caerulea guizhouensis* spec. nov.** (figs. 3-4, 8-9, 29-31, 41, 43, 46: A-C)

HT ♂ (Figs. 31, 45-A; Length of forewing 21.7 mm): CHINA, **Guizhou**: Weining County, Caohai, Xinhe, 2300 m, 23.-24.VI.2017, F. CAO leg., deposited in BSNU. Dissected.

PTs: **Guizhou**: 4 ♂♂ (CCF, CHH), same data as HT; 4 ♂♂, 3 ♀♀ (CCF, CHH), Weining, Caohai, Dashancun, 2260 m, 19., 27.-28.VI.2017, F. CAO leg.; 3 ♂♂, 2 ♀♀ (CCF), Weining, Caohai, Dashancun, 20.VI.2018, F. CAO leg.. 3 PTs dissected.

Etymology. This new species is named after the Guizhou Province where the type series came from.

Diagnosis. This new species can be distinguished from *C. coeligena* (OBTH.) and *C. coelestis* (ALPH.) by the following combination of characters:

♂:

1) Both wings upper side ground color deep blue, not so silvery and pale as in *C. coeligena* (OBTH.).

♀:

2) Both wings upper side ground color dark blue and black dusted, not so clean as in *C. coeligena* (OBTH.).

Both sexes:

3) Both wing underside ground color much darker than in *C. coeligena* (Oberthür).

4) Discal spots on both wings underside markedly nearer wing-base than in both *C. coeligena* (OBTH.) and *C. coelestis* (ALPH.).

5) Both wings underside with submarginal area less marked by pale and dark markings than in both *C. coeligena* (OBTH.) and *C. coelestis* (ALPH.).

♂ genitalia:

6) Aedoeagus thicker than in *C. coeligena* (OBTH.) just before the distal end of dorsal wall.

7) Valva (not counting apical process) less rectangular than in both *C. coeligena* (OBTH.) and *C. coelestis* (ALPH.), with inner margin incurved nearly in a right angle, not in an obtuse angle as in *C. coeligena* (OBTH.) and *C. coelestis* (ALPH.).

Discussion. This new species is sympatric with *C. coelestis* (ALPH.). However, there is apparent ecological isolation between these two species: *C. coelestis* (ALPH.) flies on wings chiefly in early May, with larva feeding on *Gentiana sutchuenensis* FRANCHET, whilst the new species flies in mid and late June, with larva feeding on *Gentiana praticola* FRANCHET. Besides the morphological differences in adults as stated above, the ovum of the new species has the micropyle markedly smaller and most of the pits on the surface slightly larger than in *C. coelestis* (ALPH.).

Host plant. *Gentiana praticola* FRANCHET in nature.

Bionomics. Univoltine. Adults emerged by mid June in nature. Eggs were present by the end of June, laid singly on petal or calyx of the host plant.

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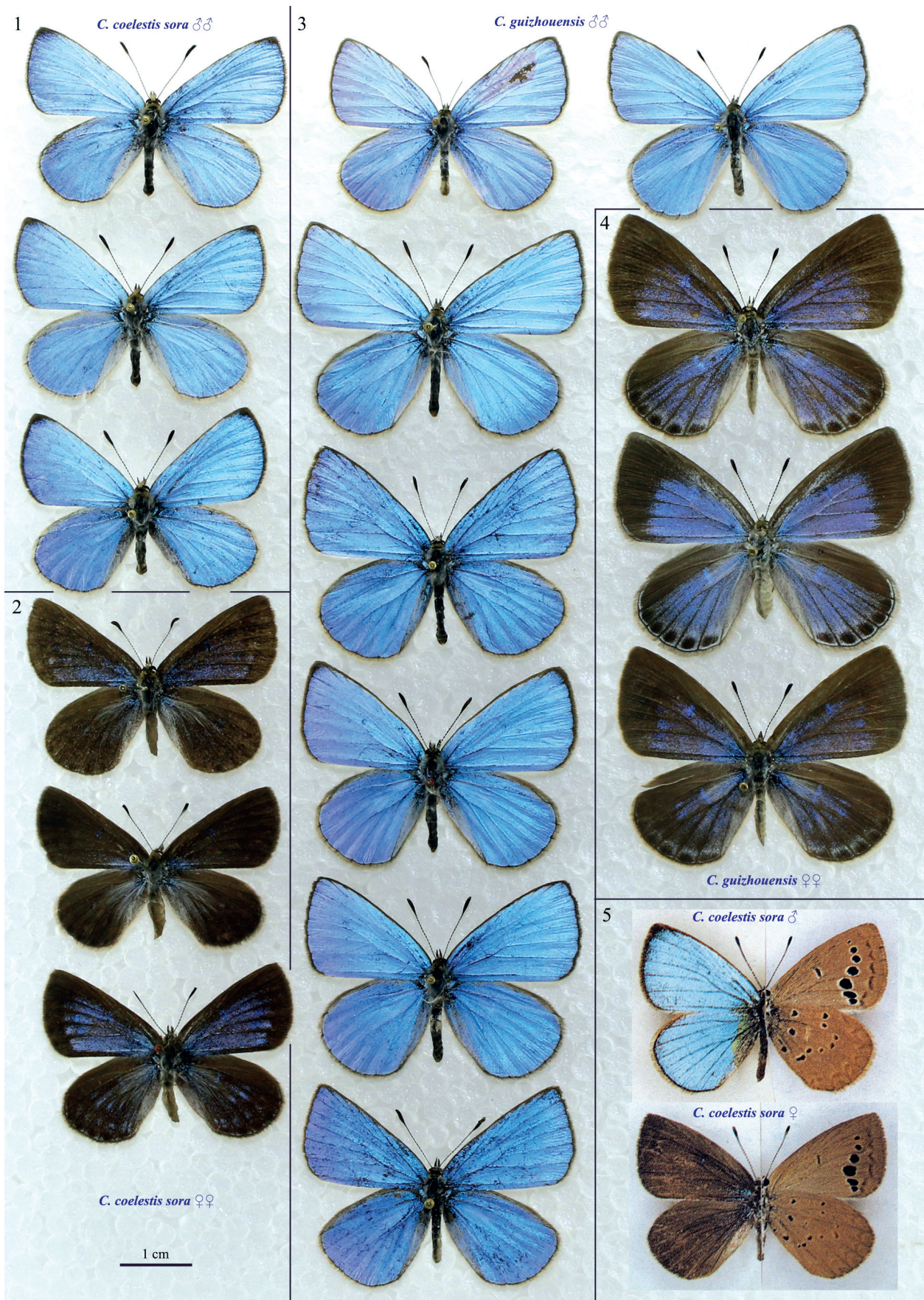
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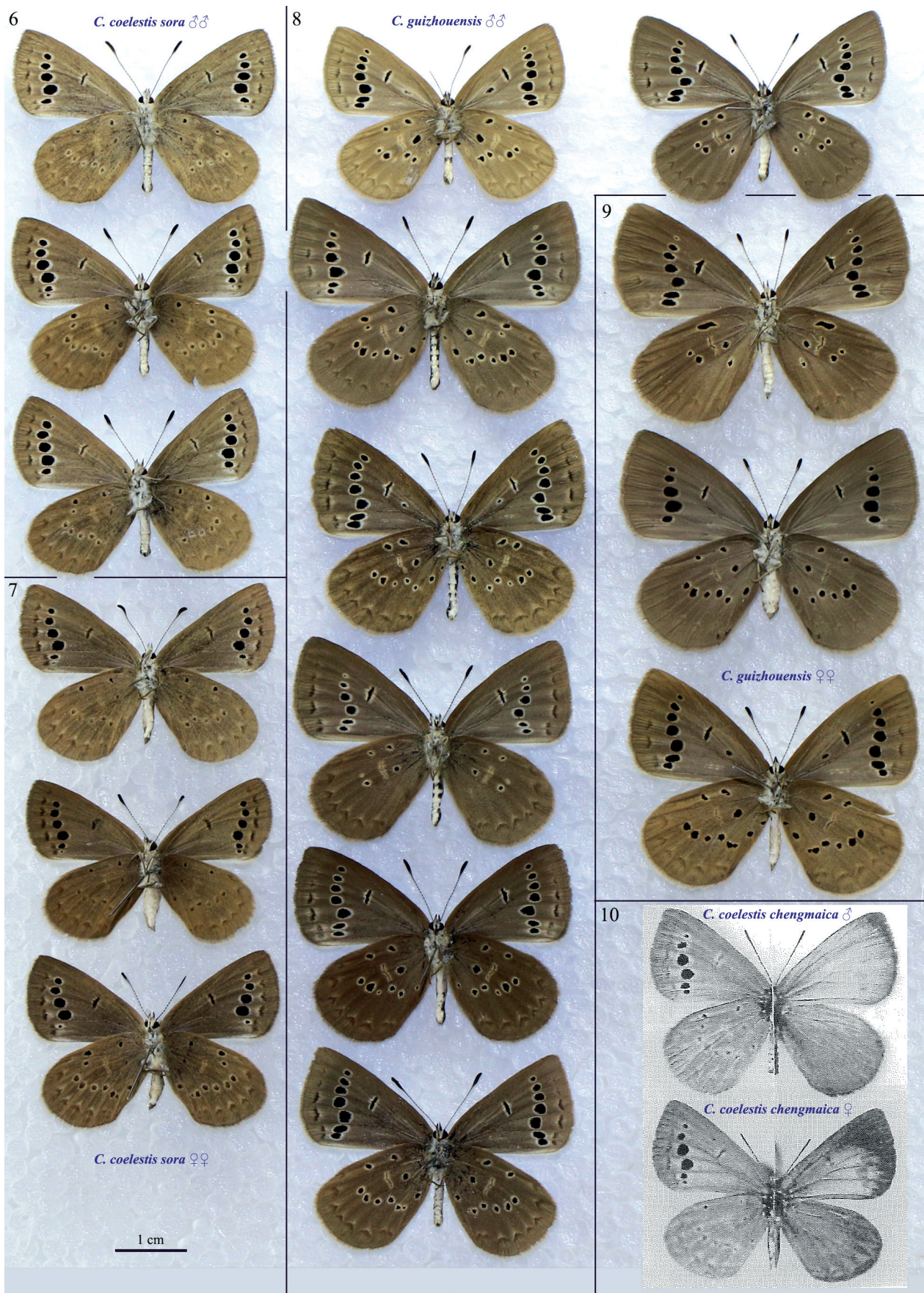
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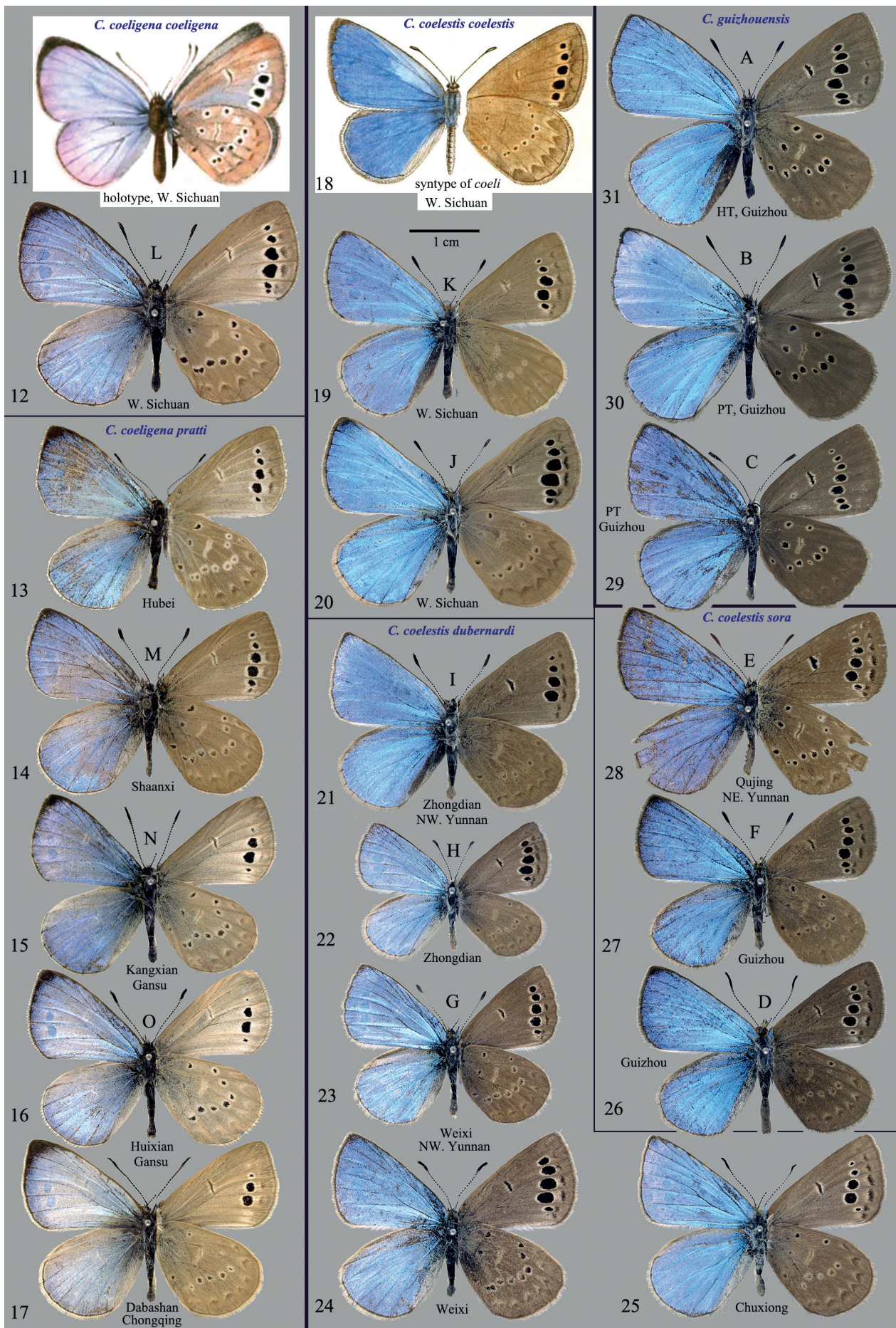
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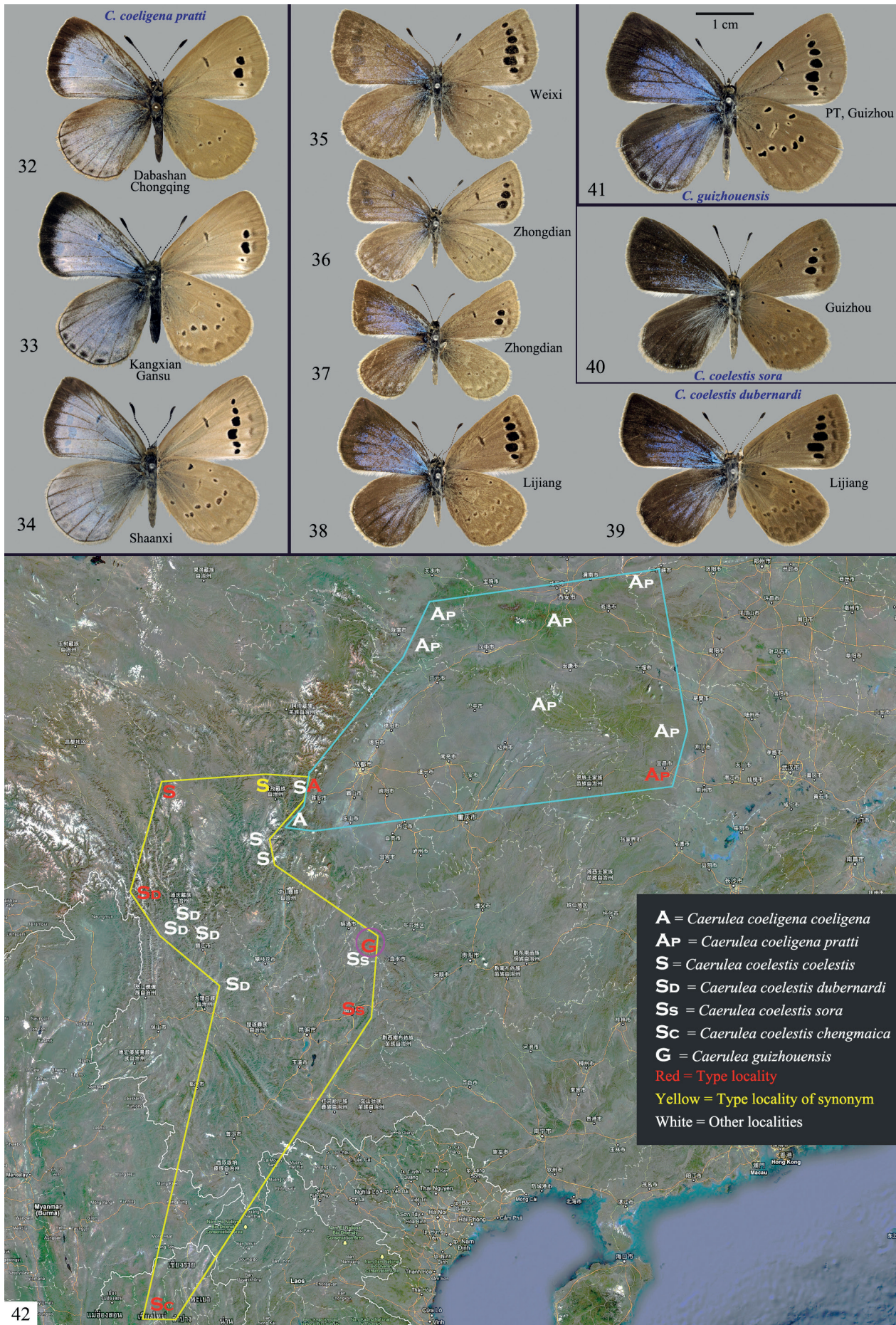
Figs. 1-5: Habitus of *Caerulea* taxa. (1-2) *C. coelestis sora* SUGIYAMA, 1999 (Weining, Guizhou, 2400 m, 1.-2. V. 2017), upper side; (1) ♂; (2) ♀; (3-4) *C. guizhouensis* **spec. nov.** (Weining, Guizhou, 2260 m, 19.-20. VI. 2017 & 2018), upper side; (3) ♂; (4) ♀; (5) *C. coelestis sora* SUGIYAMA, 1999, HT ♂ and PT ♀, after SUGIYAMA (1999) (left half- upper side, right half- underside).



Figs. 6-10: Habitus of *Caerulea* taxa. (6-7) *C. coelestis sora* SUGIYAMA, 1999 (Weining, Guizhou, 2400 m, 1.-2.V.2017), underside; (6) ♂; (7) ♀; (8-9) *C. guizhouensis* **spec. nov.** (Weining, Guizhou, 2260 m, 19.-20.VI.2017-2018), underside; (8) ♂; (9) ♀; (10) *C. coelestis chengmaica* MURAYAMA, 1993, HT ♂ and PT ♀, after MURAYAMA (1993) (right half- upper side, left half- underside).



Figs. 11-31: Habitus of *Caerulea* taxa ♂♂. (11-12) *C. coeligena coeligena* (OBERTHÜR, 1876); (11) HT (after OBERTHÜR, 1876); (12) Yingjing, Sichuan; (13-17) *C. coeligena pratti* (HEMMING, 1931); (13) Xiangyang; (14) Ningshaan; (15) Kangxian; (16) Huixian; (17) Dabashan; (18-20) *C. coelestis coelestis* (ALPHERAKY, 1897); (18) syntype of *coeli* OBERTHÜR (after OBERTHÜR, 1908); (19-20) Jiulong; (21-25) *C. coelestis dubernardi* (HEMMING, 1931); (21-22) Tuguancun; (23-24) Yulongxueshan; (25) Dayao; (26-28) *C. coelestis sora* SUGIYAMA, 1999; (26-27) Weining; (28) Qujing; (29-31) *C. guizhouensis* spec. nov.; (29-30) PTs; (31) HT.



Figs. 32-41: Habitus of *Caerulea* taxa ♀♀. (32-34) *C. coeligena pratti* (HEMMING, 1931); (35-39) *C. coelestis dubernardi* (HEMMING, 1931); (40) *C. coelestis sora* SUGIYAMA, 1999; (41) *C. guizhouensis* spec. nov.. (Left half- upper side, right-half- underside).
Fig. 42: Distribution of *Caerulea* taxa.



Biotope of *C. guizhouensis* (Caohai, Weining, 2260m)



Biotope of *C. coelestis sora* (Mazha, Weining)



Biotope of *C. coelestis sora* (Caohai, Weining, 2450m)



Living female of *C. guizhouensis*



Ovum of *C. coelestis sora* on petal of host plant



Living female of *C. coelestis sora* on host plant



Host plant of *C. guizhouensis* (*Gentiana praticola*)

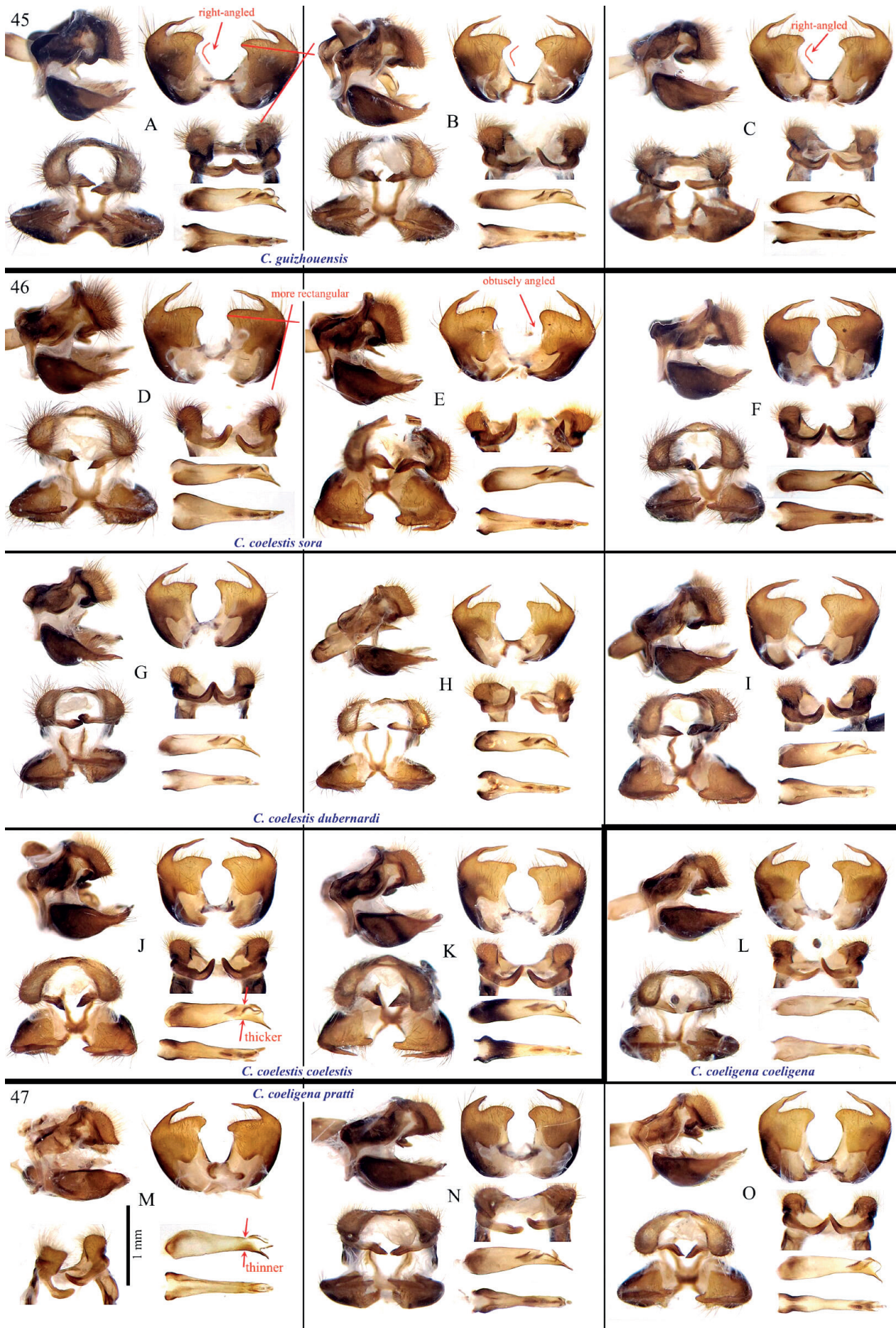


Ovum of *C. guizhouensis* on calyx of host plant



Host plant of *C. coelestis sora*
(*Gentiana sutchuenensis*)

Figs. 43-44: Field observations. (43) *C. guizhouensis* spec. nov.; (44) *C. coelestis sora* SUGIYAMA, 1999.



Figs. 45-47: ♂ genitalia consisting of whole genitalia in lateral view (left top), of genitalia in posterior view (left bottom), of valvae in dorsal view (right top), of scaphium in ventral view (right center), and of aedeagus in lateral and dorsal views (right bottom). (45) *C. guizhouensis* spec. nov.; (46) *C. coelestis* (ALPHERAKY, 1897); (47) *C. coeligena* (OBERTHÜR, 1876). Specimens alphabetically labeled as in Figs. 11-31.

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