Atalanta **45** (1-4): 139-150, Marktleuthen (Sept. 2014), ISSN 0171-0079

Discovery of two new species of the "elfin" butterflies from Shaanxi Province, China

(Lycaenidae, Theclinae)

by

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received 11.IV.2014

Abstract: A new species of the genus *Cissatsuma* Johnson, 1992 and a new species of the genus *Ahlbergia* Bryk, 1946 from Shaanxi province, China are described. The immature stages of these two species are briefly reported. All species of *Ahlbergia*, *Novosatsuma* and *Cissatsuma* with the ♀ previously unknown are discussed, and the following taxonomic changes are given: *Ahlbergia matusiki* (Johnson, 1992) **comb. nov.** (= *Novosatsuma matusiki* Johnson, 1992); *Cissatsuma pictila* (Johnson, 1992) **comb. nov.** (= *Ahlbergia pictila* Johnson, 1992); *Ahlbergia zhujianhuai* Huang & Wu, 2003 **syn. nov.** (= *A. circe montivaga* Johnson, 1992).

Introduction: In contrast to the richness of the "elfin" butterflies in Sichuan and Yunnan (Johnson, 1992), the Shaanxi province had been a poorly investigated province for this group. However, several Chinese collectors have been struggling to collect the "elfin" butterflies in recent years and they have yielded a rich harvest in Shaanxi province; the total number of the species of the genera *Ahlbergia* Bryk, 1946, *Novosatsuma* Johnson, 1992 and *Cissatsuma* Johnson, 1992 occurring in Shaanxi is now up to ten (Huang, unpublished data). Among these recent Chinese collections, several species and subspecies are new to science and will be described in a series of papers hereafter.

Abbrevitions

BSNU	Biological laboratory of Shanghai Normal University, Shanghai, P.R. China.
CCAM	Collection of An-Ming Chen.
CHH	Collection of Hao Huang.
CLYF	Collection of Yu-Fei Li.
CZJQ	Collection of Jian-Qing Zhu.
CZLP	Collection of Li-Ping Zhou.
FMNH	Field Museum of Natural History.
HT	Holotype.
IZAS	Institute of Zoology, Chinese Academy of Science, Beijing, P.R. China.
KIZ	Kunming Institute of Zoology, Chinese Academy of Science, Kunming, P.R. China.
PT	Paratype.
TL	Type locality

Generic classification: The generic classification of the Palaearctic "elfin" butterflies provided by Johnson (1992) is tentatively used in this work. A phylogenetic analysis of this group is needed in future to clarify the higher taxa in taxonomy. Johnson's generic classification is considered to be unreasonable, because of the following morphological observations.

1: The difference in ♂ genitalia between the genera *Ahlbergia* and *Novosatsuma* is not clearly marked as Johnson (1992) believed. Some species classified by Johnson (1992) as species of *Novosatsuma*, based upon his observations in ♂ genitalia, are now proved to have the ♀ genitalia in type of the genus *Ahlbergia* when the ♀♀ were discovered (Huang & Song, 2006; this paper), such as *N. collosa* Johnson, 1992 (Huang & Song, 2006) and *N. matusiki* Johnson, 1992 (discussed below).

2: The ♀ genital differences between the genera *Ahlbergia* and *Novosatsuma* were overvalued. *Novosatsuma pratti* (Leech, 1889), *N. collosa* Johnson, 1992 and *Ahlbergia leechuanlungi* Huang & Chen, 2005 are identical to one another in most details of wing-features, but have the ductus bursae and lamella postvaginalis of ♀ genitalia in different types defined by Johnson for different genera. It is hard to explain the extreme similarities in appearance of wings between these three species as parallel evolution.

3: The genus *Novosatsuma* was based upon *N. monstrabila* Johnson, 1992, a species with the ♀ still unknown. It is hard to say that *N. monstrabila* Johnson has the ♀ genital characters like in *N. oppocoenosa* Johnson, 1992 and *N. magnapurpurea* Johnson, 1992, of which the ♀ genitalia were considered by Johnson (1992) as in typical form for *Novosatsuma*.

Therefore, in this and the subsequent works only the genus *Cissatsuma* is well defined by ♂ and ♀ genital characters:

1: ♂ valvae in ventral view with straight or concaved lateral margins in most parts except at apex (not convex at middle part of the caudal extension of valvae);

2: ductus bursae relatively wider and longer than in the genus *Ahlbergia*. The genus *Novosatsuma* is only tentatively used for the species possessing the ♀ genitalia in type of *N. oppocoenosa* Johnson and *N. magnapurpurea* Johnson. The generic name of Johnson's *Novosatsuma* species will not be changed as the ♀ is still unknown.

***Cissatsuma zhoujingshuae* spec. nov.**

Ahlbergia arquata (auct., non. Johnson): Wang & Fan (2002: col. pl. 17, figures 11, 12).

HT ♂ (figs. 1, 2, BSNU): China, Shaanxi province, Baoji City, Fengxian County, the headwaters of Jialing River scenic area, main peak, ca. 2500 m, 14.V.2011, Li-Ping Zhou leg..

PTs: 3 ♀♀ (fig. 5, CZLP), same data as the HT; 1 ♀ (fig. 6, CZLP), larva collected on *Spiraea fritschiana* Schneid. (Rosaceae) in the same locality as HT, 6. VI. 2012, reared by Li-Ping Zhou at 1500 m, e. l. 9.III.2012; 1 ♂ (fig. 3, CZLP), larva collected on *Spiraea fritschiana* Schneid. (Rosaceae) in the same locality as HT in VI. 2012, reared by Li-Ping Zhou at 1500 m into pupa, emerging on 28 II.2013 at 550 m; 1 ♀ (fig. 7, CZLP), larva collected on *Aruncus sylvester* Kostel. (Rosaceae) in the same locality as HT, but ca. 1700 m on 23.VI.2011, reared by Li-Ping Zhou at 1500 m, emerging on 9.III.2012 at 1500 m; 1 ♂ (fig. 4, CZLP), larva collected on *Aruncus sylvester* Kostel. (Rosaceae) in the same locality as HT, but ca. 1700 m on 8.VI.2012, reared by Li-Ping Zhou at 1500 m, e. l. on 28.II.2013 at 550 m; 1 ♀ (fig. 8, CHH), Shaanxi Province, Xian City, Ningshan County, Pingheliang, 2400 m, 1.VI.2007, Hong-Liang Shi leg.; 1 ♀ (CLYF), Shaanxi Province, Xian City, Ningshan County, 15.V.2011, Yu-Fei Li leg.; 1 ♀ (CLYF), Shaanxi Province, Fengxian County, 30.IV.2011, Yu-Fei Li leg.; 2 ♀♀ (CLYF), Shaanxi Province, Xian City, Chang-an County, 28.V.1996, Yu-Fei Li leg.; 1 ♀ (CLYF), Shaanxi Province, Xian City, Chang-an County, 29.V.2010, Yu-Fei Li leg.

Etymology: This new species is named after the eldest daughter of the junior author, Jing-Shu Zhou.

Diagnosis: The examination of both, ♂ and ♀ genitalia (figs. 50-51, 58-59, 67-68, 77-78, 89-90, 99-101), proves this new species to be a member of *Cissatsuma*: the ♂ valvae in ventral view have straight lateral margins and the lamella postvaginalis of the ♀ genitalia is nearly identical to that of *Cissatsuma tuba* Johnson, 1992. This makes this new species to be easily distinguishable from most species of the genera *Ahlbergia* and *Novosatsuma,* except for a few species with the ♀ still unknown.

However, the ♂ of this new species differs remarkably from the ♂♂ of the previously known species of *Cissatsuma* simply by the very extensive blue ground colour on the upperside of both wings (figs. 1, 3, 4) and probably also by the absence of a ♂ brand on the forewing upperside (figs. 41, 42). Johnson (1992) incorrectly stated the brown ground colour in both sexes as one of the important characters in his diagnosis to distinguish the genus *Cissatsuma* from the other genera. All species included in *Cissatsuma* by Johnson (1992) have only brown ground colour on the upperside of both wings in ♂♂; but the ♀♀ of *Cissatsuma* are variable in the colour of the upperside of the wings, some of them with only brown colour and the others with blue colour extending in different degrees towards the outer margins of the wings. The brown ground colour on the upperside of both wings in the ♂♂ could be thought as a constant good character for *Cissatsuma* until the new species here described is discovered.

This new species can be distinguished from *C. tuba* Johnson, which is the most similar in ♀ genitalia by the following combination of characters: 1. Upperside of both wings in ♂ with extensive blue ground colour, not dark brown as in *C. tuba* Johnson. 2. Upperside of both wings in ♀ with blue ground colour extending to submarginal areas, much more extensive than in *C. tuba* Johnson. 3. Postdiscal spots on the underside of both wings in both sexes remarkably broader. 4. Underside of the forewing in both sexes with ground colour more or less yellow in the distal third, outside of the postdiscal spots, not uniform reddish brown as in *C. tuba* Johnson. 5. Underside of the hindwing in both sexes with the area between discal line and postdiscal spots much paler and more yellowish than the very dark brown basal half of hindwing, not reddish brown and same-coloured as in basal half of hindwing as in *C. tuba* Johnson. 6. Discocellular bar of forewing upperside in both sexes more clearly marked. 7. Submarginal area of the hindwing underside fully powdered with white scales. According to the original description (Johnson, 1992), the ♂ of *C. tuba* Johnson has the "androconial patch at distal end of the discal cell" on upperside of forewing; however the ♂ of the new species (figs. 41, 42) has no such ♂-brand. Johnson (1992) is in error in describing the ♂-brand for some species [as in *A. frivaldszkyi* (Lederer, 1855)]; the condition of a ♂-brand in *C. tuba* Johnson needs to be reexamined in future. In ♂ genitalia, which are rather uniform throughout the genus and relatively useless in taxonomy of the "elfin" butterflies, this new species has the caudal extension of valvae remarkably straighter than in *C. tuba* Johnson. It should be noted that Johnson (1992) did not give the scale for his illustrations of ♀ genitalia, so that *C. tuba* Johnson may have the ♀ genitalia in a different size from *C. **zhoujingshuae*** **spec. nov.**

The ♀ genitalia of *C. albilinea* (Riley, 1939) is very similar in shape to both, *C. tuba* Johnson and the new species. We examined two ♂♂ (figs. 9, 43) and two ♀♀ (fig. 10) of *C. albilinea* (Riley) from northern Yunnan and illustrat here the ♂ and ♀ genitalia (figs. 75, 79, 80, 102, 103). The lamella postvaginalis of *C. albilinea* (Riley), though very similar in shape to that of *C. tuba* Johnson and the new species, is different in having a distal gap in center. In external features, *C. albilinea* (Riley) has the ♂-brand (fig. 43) clearly marked and has the wing-pattern in both sexes rather peculiar and easily recognizable.

Discussion on species with the ♀ previously unknown:

1: *Cissatsuma contexta* Johnson, 1992. TL: "Bahand", a village currently known as "Bai-han-luo" in north of the Gongshan County, NW Yunnan. Only one ♂ is known, it is originally described to have the brown ground colour on upperside of both wings and the well marked ♂-brand. D'Abrera (1993: 436-437) published a colour photo of the underside of the HT. It has the uniform reddish brown ground colour on the underside of both wings, and has

the rather thin postdiscal markings on both wings.

2: *Novosatsuma cibdela* Johnson, 1992. TL: "Chang Yang", Hubei province in central China. Only the HT is known; it is one of the three known syntypes of *Ahlbergia chalybeia* Leech. Johnson (1992) published the photos of upper- and under side, which are rather clear to show the external characters, though in black and white. This species has the thin ♂-brand on the upperside of forewing and the clearly defined submarginal markings on the underside of forewing. There is still doubt about the true identity of this specimen; it is possible that this HT of *N. cibdela* Johnson belongs to *A. chalybeia* Leech whereas the ♂ paralectotype of *A. chalybeia* Leech belongs to an undescribed species.

3: *Novosatsuma monstrabila* Johnson, 1992. TL: "Naoa Hills (probably Naga Hills), Chindwin River, northern Burma". Only the ♂ HT is known and the photos published by Johnson (1992) clearly show the characters. This species has the long ♂-brand on upperside of forewing and the clearly defined submarginal markings on underside of the forewing.

4: *Novosatsuma magnasuffusa* Johnson, 1992. TL: "Chow-pin-sa", some place in western Sichuan. Three ♂♂ are known. Photos in black and white are published by Johnson (1992); they show the dark ground colour on upperside of both wings and the very thin postdiscal markings on underside of both wings. This species was described to have a ♂-brand.

5: *Novosatsuma matusiki* Johnson, 1992. TL: "Muli", a site (now a county) in southern Sichuan very close to the north border of Yunnan. Only the ♂ HT is known and deposited in FMNH. We traced this HT in this museum through the help of Dr. James Boone. It bears the label: "Camp V. 8850', S. of Muli, 7 April.", not mentioning the collecting year. However, the other specimens of the "elfin" butterflies in the same collection bear the label: "Kelley-Roosevelt expedition. 1929". We checked the literatures concerning this Kelley-Roosevelt expedition (Osgood, 1932; Bangs, 1932; Stevens, 1934) and found that all the butterflies involved in this expedition were actually collected by Herbert Stevens who joined this expedition and accompanied the Roosevelts' as far as Lijiang and subsequently continued alone, followed the Roosevelts' and Suydam slowly from northwestern Yunnan to western Sichuan. Stevens (1934) recorded his butterfly collecting in his book and he collected some "*Satsuma chalybea*" (a name used for all the "elfin" butterflies collected in this expedition) in areas around Muli between 4. April and 11. April. The ♂ HT of *N. matusiki* Johnson (figs. 11-12 & 44, FMNH) has the size, the ♂-brand and the underside wing pattern exactly as in *Ahlbergia lynda nidadana* Huang, 2003 (figs. 13-15 & 45-46, CHH). Thus it is very possible that *N. matusiki* Johnson belongs to *A. lynda* Johnson, 1992 which is widely known from the Hengduanshan Range from Kangding in the north to the Nujiang valley in the south (Johnson, 1992; Huang, 2003). The reason why Johnson (1992) did not combine the unique ♂ HT of *N. matusiki* Johnson (from Muli, southern Sichuan) and the unique ♀ HT of *A. lynda* Johnson (from "Tatsienlu", now Kangding, western Sichuan) is probably due to the remarkable difference in wing-shape between the different sexes. Such difference in wing-shape between ♂ and ♀ is confirmed by the discovery of *A. l. nidadana* Huang from Nujiang valley (Huang, 2003). The ♀ HT of *A. l. lynda* Johnson has only scattered blue scales in the basal half of the forewing upperside and has no blue scales on the hindwing upperside, whereas the ♀ of *A. l. nidadana* Huang (fig. 16) has very extensive blue colour on upperside of both wings; thus it is reasonable to assume that the male of *A. l. lynda* Johnson is less marked with blue scales on upperside than in A. lynda nidadana. The holotype ♂ of *N. matusiki* has no blue scales on upperside of both wings except for a few blue scales near the anal lobe of hindwing, thus fits the assumption for the ♂ of *A. l. lynda* Johnson. It is very possible that *N. matusiki* Johnson is a junior synonym of *A. l. lynda* Johnson, but the formal revision needs the discovery of more ♂♂ from Sichuan in future. The ♂♂ of *A. l. nidadana* Huang (figs. 13-15, CHH) have the scattered blue scales in the basal half of the forewing upperside and have the blue marginal line and a blue postdiscal spot in space cu2 on the hindwing upperside. There is no difference in the ♂ genitalia (Johnson, 1992; Huang, 2003) between *A. l. nidadana* Huang and *Ahlbergia matusiki* (Johnson, 1992) **comb. nov.**

6: *Ahlbergia pictila* Johnson, 1992. TL: "Kopadi, Tibet", proved to be a Lamasery at Muli, southern Sichuan. "Kopadi" was incorrectly interpreted by Johnson (1992: 135) as a Tibetan site in the current western Qinghai on a map. Only the ♂ HT is known and deposited in FMNH. We traced this HT in this museum through the help of Dr. James Boone. It bears the label: "Camp I, 11200', to Kopadi, 10250', to Camp II, 9150' 11. April". Stevens (1934) recorded that he collected *Satsuma chalybea* between 10. April and 12. April, on route around Kopadi, a Lamasery at Muli. The original figures of this HT are photos in black and white, which give no useful information on the wing-pattern, because the specimen is in a bad condition with many patches of scales lost on the wings. The colour photos (figs. 17, 18, FMNH) show that the HT of *A. pictila* Johnson is nearly identical with the ♀ specimens of *Cissatsuma crenata* Johnson, 1992 (figs. 20-21, CZJQ) in all the details of wing-pattern and colouring on the underside of both wings. Beside the information in Johnson's work, we genitalised two more ♀♀ (figs. 21-24, 81-82, 91-92, 104-105, CZJQ & CCAM), one from Nujiang valley (the TL of *C. crenata* Johnson), another from Lijiang (a locality for PTs mentioned in Johnson's publication). There is no remarkable difference in the ♂ genitalia between *A. pictila* Johnson and *C. crenata* Johnson, according to Johnson's (1992) illustrations of the ♂ genitalia. Thus it is very possible that *C. crenata* Johnson is conspecific with *Cissatsuma pictila* (Johnson, 1992) **comb. nov.**, probably representing a good subspecies of the latter. The ♀ PT of *Ahlbergia zhujianhuai* Huang & Wu, 2003 (figs. 19-20, IZAS) is now proved to be a ♀ of *C. pictila* (Johnson), collected from Miyi, Panzhihua, southern Sichuan, which is adjacent to Muli. In conclusion, we believed that *C. crenata* Johnson is a good subspecies of *C. pictila* (Johnson), but the formal

revision needs more specimens to be examined in future. *Cissatsuma pictila* (Johnson) has the dark brown ground colour on upperside of both wings in both sexes, whereas *C. crenata* Johnson has the upperside of ♂ "suffused slightly with silvery blue" and has the upperside of the ♀ extensively blue at least in the basal half of the forewing.

7: *Ahlbergia chalcidis* Chou & Li, 1994. TL: Kunming, Yunnan. This species was described on the ♂ HT only. Dr. Shao-Ji Hu recently located another ♂ (figs. 25, 26) in the entomological collection of KIZ; it bears the label: "Hua-hong-dong, Kunming, 22 April 1980, Dong Da-Zhi". "Hua-hong-dong" is a famous scenic spot near the Bamboo Temple (Qiongzhu-si) at Kunming. Beside this record, Mr. An-Ming Chen collected several specimens in both sexes from Ludian, Lijiang, NW Yunnan (figs. 27-29, CCAM), which have been identified by the senior author as *A. chalcidis* Chou & Li. The ♂ and ♀ genitalia of *A. chalcidis* Chou & Li (figs. 52, 53, 60, 61, 69, 70, 83, 106) are identical to those of *A. aleucopuncta* Johnson, 1992. Thus we believ that *A. chalcidis* Chou & Li should be a good subspecies of *A. aleucopuncta* Johnson, the formal revision will be given in another paper.

8: *Ahlbergia distincta* Huang, 2003. TL: Nidadan village, Bingzhongluo Township, Gongshan County, NW Yunnan. Only one ♂ is known. It has uniform blackish brown ground colour on upperside of both wings and has a ♂-brand well marked.

9: *Ahlbergia zhujianhuai* Huang & Wu, 2003. TL: Miyi, Panzhihua, southern Sichuan. Only the HT ♂ and the PT ♀ is known. As already discussed above, the PT ♀ (figs. 19, 20) of *A. zhujianhuai* Huang & Wu is now proved to be a ♀ of *C. pictila* (Johnson). The HT (fig. 30) of *A. zhujianhuai* Huang & Wu agrees with the ♂ type specimens (fig. 31, one of paratypes in FMNH) of *A. circe montivaga* Johnson, 1992 in most details; it was wrongly combined with the ♀ of *A. pictila* Johnson so that it was regarded as a new species by Huang & Wu (2003). Several ♂♂ (fig. 32) and ♀♀ (fig. 33) of *A. circe montivaga* Johnson collected by the senior author from Yulongxueshan Mts., Lijiang have been examined in genitalia (figs. 76, 108) and the HT of *A. zhujianhuai* Huang & Wui has all genital characters in common with these specimens from Lijiang. Thus *Ahlbergia zhujianhuai* Huang & Wu **syn. nov.** is a junior synonym of *A. circe montivaga* Johnson, 1992.

10: *Ahlbergia dongyui* Huang & Zhan, 2006. TL: Nanling Nature Reserve, Ru-yang, Guangdong Province. Four ♂♂ are known as type specimens. Mr. Jian-Qing Zhu recently discovered this species from Mt. Tianmu-shan, Zhejiang and Mt. Baohua-shan, Jiangsu, and kindly sent the specimens (figs. 34, 36, CZJQ) to the senior author for examination. The ♀ genitalia of *A. dongyui* Huang & Zhan, here illustrated (figs. 84, 107), are somewhat similar to those of *A. aleucopuncta* Johnson, but differ from the latter by having the ductus bursae markedly smaller and gradually swollen towards the corpus bursae.

Important external characters:

1. No ♂-brand at apex of discocellular cell on upperside of forewing (figs. 41, 42).
2. ♂ with extensive blue ground colour on the upperside of both wings, only leaving the costal areas of both wings, the distal two fifth of forewing and the distal one fourth of hindwing black.
3. ♀ with more extensive blue ground colour on the upperside of both wings than in the ♂, only leaving the costal area of the forewing, the distal one fourth of the forewing and the the distal one fifth of the hindwing is black.
4. The forewing underside of both sexes without any clear submarginal markings or any whitish scales in the submarginal area, at most with submarginal area a little darker.
5. Postdiscal spots on the forewing underside in both sexes broad and conjoined, and outlined by white line on the outer side.
6. Discocellular bar on forewing underside in both sexes clearly marked.
7. The hindwing underside of both sexes densely clad with the scattered white scales in submarginal area of spaces m2-cu2, sometimes also in space m1.
8. The postdiscal spots on the hindwing underside of both sexes broad, triangular, nearly conjoined and all associated with a few white scales on the inner side.
9. The discal line on the hindwing underside of both sexes outlined by white line on the outer side.
10. The area between the discal line and the postdiscal spots on the hindwing underside of both sexes markedly paler and more yellowish than the dark reddish brown basal discal area and the postdiscal spots, and clad with the scattered white scales in anal and sub-anal areas (spaces cu2 and 2a).

A ♀ specimen illustrated and identified by Wang & Fan (2002: col. pl. 17, figures 11, 12) as *Ahlbergia arquata* Johnson and labeled from "E. Inner Mongolia" fits all the external characters of this new species. It most probably belongs to the new species here-described and is mislabeled.

Flight period: The collecting records of adults in the field (at 2000-2500 m) started in April 30th and ended June 1st. Adults can emerge earlier in breeding condition, based on the elevation. The junior author recorded emerging adults February 28th, 2013 at 550 m and March 9th, 2012 at 1500 m. One pair of adults, in fresh condition, was observed in copulation May 16th, 2011.

Breeding experience and biological notes: The junior author tried to breed this new species for a few times and the records are as follows.

1. Early-instar larvae (fig. 115) were collected from *Spiraea fritschiana* Schneid. (Rosaceae) at 2400m June 6th, 2011, then were reared on the host plant at 1500 m. Very few eggs (fig. 114) were found alone on the calyces of the host

plant June 16th, 2011, one of which hatched out and was confirmed to be the same species as the larvae collected earlier. The larvae chiefly fed on flowers (fig. 122), sometimes also on leaves. Each instar lasts for about one week. Pupation took place at end of June or at the beginning of July. The butterflies overwintered as pupae (figs. 120-121). Two adults emerged March 9th and March 11th, 2012 respectively, but the other pupae were parched and died.

2. Early-instar larvae were collected from *Spiraea fritschiana* Schneid. (Rosaceae) at 2000-2500 m in June, 2012, then were reared on the host plant at 1500 m. Pupation took place in summer but was not recorded precisely. Pupae were then taken to the laboratory at 550 m in November. One adult emerged February 28th, 2013.
3. Early instar larvae were collected on *Aruncus sylvester* Kostel. (Rosaceae) (figs. 118, 119) at 1700-1800 m, June 23rd, 2011, then were reared on the host plant at 1500 m. Pupation took place in summer but was not recorded precisely. One adult emerged March 9th, 2012.
4. Early-instar larvae were collected on *Aruncus sylvester* Kostel. (Rosaceae) at 1700-1800 m, June 8th, 2012, then were reared on the host plant at 1500 m. Pupation took place in summer but was not recorded precisely. Pupae were then taken to the laboratory at 550 m in November. One adult emerged February 28th, 2013.

Description of immature stages: Egg (fig. 114) oblate spheroidal, pale bluish green in colour, and full of papillae on surface. Early-instar larva (fig. 115) pale green in colour, with two white longitudinal bands on dorsal surface which are symmetrical along the pale green midline, and with a pale yellowish longitudinal lateral line on each side, bearing several longitudinal series of protuberances on which many setae are placed. In comparison with the early-instar larva, the final-instar larva (figs. 116-119, 122) with anterior part more markedly wider than the posterior part, and with setae relatively shorter in proportion to size of the body. Final-instar larva feeding on *Spiraea fritschiana* (figs. 116-117, 122), green in colour, clearly marked with a pale yellowish longitudinal lateral line on each side, and with the two pale dorsal bands replaced by two series of pale yellowish spots in association with dark green spots on the medial side. Final-instar larva feeding on *Aruncus sylvester* (figs. 118-119), less greenish and more bluish in colour than that feeding on *Spiraea fritschiana*, with the two pale dorsal bands merged into a single wide dorsal band in association with very dark spots. The larva became darker and purplish on the day just before pupation. The pupa (figs. 120-121) is dark brown and often mottled, full of short setae on the surface.

Ahlbergia liyufeii spec. nov.

HT ♀ (fig. 37, BSNU): China, Shaanxi Province, Baoji City, Fengxian County, the headwaters of Jialing River scenic area, main peak, ca. 1500 m, larva collected from *Lonicera tragophylla* Hemsl. (Caprifoliaceae) on 27.V.2011 and reared by Li-Ping Zhou at 1500 m, emerging on 8.IV.2012 at 1500 m.

PTs: 2 ♂♂, 7 ♀♀ (fig. 38, CZLP, CHH), larvae or eggs collected from *Lonicera tragophylla* Hemsl. (Caprifoliaceae) at the same locality as HT on 27.V. - 6.VI.2011 and reared by Li-Ping Zhou at 1500 m, emerging on 4.IV.-26.IV.2012 at 1500 m; 1 ♂, 1 ♀ (CZLP), same locality as HT, 1500 m, 23. V. 2011, Li-Ping Zhou leg.; 1 ♂, 1 ♀ (CLYF), Shaanxi Province, Huxian County, 21.IV.2012, Yu-Fei Li leg.; 4 ♀♀ (CLYF), Shaanxi Province, Chang-an County, 22.IV.2012, Yu-Fei Li leg.; 1 ♂, 1 ♀ (CLYF), Shaanxi Province, Chang-an County, 1.V.2001, Yu-Fei Li leg.; 1 ♀ (CLYF), Shaanxi Province, Chang-an County, 26.IV.2003, Yu-Fei Li leg.; 3 ♂♂, 2 ♀♀ (fig. 35, CLYF, CHH), Shaanxi Province, Chang-an County, 23.IV.2005, Yu-Fei Li leg.; 1 ♂, 1 ♀ (CLYF), Shaanxi Province, Baoji City, 6.V.2001, Yu-Fei Li leg.; 1 ♀ (CLYF), Shaanxi Province, Yaoxian County, Xiangshan, 5.V.2012, Yu-Fei Li leg.

Etymology: This new species is named in honor of Mr. Yu-Fei Li, who discovered many interesting butterflies from Qinling Mts., Shaanxi in the recent years.

Diagnosis: This new species is very similar to the species included in the *Ahlbergia leechi* group by Johnson (1992), sharing the following peculiar characters with this group: outer margin of the hindwing more smoothly curved and less crenated than in all the other "elfin" butterflies from the Palaearctic, and ductus bursae gradually enlarged caudally to full width of lamella postvaginalis. Thus the new species is chiefly compared with *Ahlbergia nicevillei* (Leech, 1893) and *A. leechii* (De Niceville, 1893) and it can be easily distinguished from both of them as follows:

1. Marginal blue line on the hindwing upperside entering space r5 in both sexes.
2. Submarginal area of the underside of both wings suffused with whitish scales in both sexes.
3. Discal line of the hindwing underside more clearly marked in both sexes, more or less associated with whitish scales on outer side, especially with whitish suffusion in space cu1 which is not present in both *A. nicevillei* (Leech) (figs. 39-40) and *A. leechii* (De Niceville).
4. Basal area of the hindwing underside sparsely suffused with whitish scales in both sexes.
5. Postdiscal markings on the forewing underside more continuous, with the marking in space m3 less shifted out in both sexes.
6. Tip of valva (fig. 56) in ♂ genitalia more sharply pointed than in both *A. nicevillei* (Leech) (fig. 57) and *A. leechii* (De Niceville).
7. ♀ genitalia (figs. 109-110) with narrower lamella postvaginalis than in both *A. nicevillei* (Leech) (figs. 111-113) and *A. leechii* (De Niceville).

Discussion: With the marginal blue line on the hindwing upperside entering space r5, this new species closely resembles

A. caesius Johnson. But the two species are easily distinguishable from each other by the different shape of the outer margin of the hindwing and the different position of the postdiscal spot in space m3 on the forewing underside. In ♀ genitalia (Johnson, 1992), *A. caesius* Johnson has the ductus bursae much narrower than the lamella postvaginalis at the junction between them.

The species of *Ahlbergia*, *Novosatsuma* and *Cissatsuma,* with the ♀ still unknown, have been fully discussed in the foregoing part on *Cissatsuma* ***zhoujingshuae*** **spec. nov**. All of them have a more crenated outer margin on the hindwing than in *Ahlbergia* ***liyufeii*** **spec. nov**.

It should be noted that this new species is sympatric with *A. nicevillei* (Leech) in Qinling Mts., Shaanxi. A ♂ of *A. nicevillei* (Leech) was recently collected by Mr. W.-W. Mao from Ningshan County, Shaanxi. The immature stages of *A. nicevillei* (Leech) were recently reported by Mr. Liang Ding in a website, with photos of an egg and a grown larva posted; they are markedly different from those of *A.* ***liyufeii*** **spec. nov**. as follows: 1. egg not polygonally sculptured; 2. grown larva slenderer, with more conspicuous protuberances and reddish colouring on the dorsal surface.

Important external characters:

1. ♂-brand (fig. 49) clearly marked at the apex of the discocellular cell on the upperside of the forewing, a little smaller than in *A. nicevillei* (Leech).
2. ♂ with extensive blue suffusion on the upperside of both wings, only leaving the costal areas of both wings, the distal two fifth of the forewing and the submarginal area of the hindwing is black.
3. ♀ with denser blue suffusion on the upperside of both wings than in the ♂.
4. Both sexes with continuous a blue marginal line in spaces cu2-r5 on the hindwing upperside.
5. Both sexes with extensive and dense whitish suffusion in the submarginal areas on the underside of both wings.
6. Outer margin of the hindwing smoothly curved, not so crenated.
7. Postdiscal markings on the forewing underside more or less continuous, with one in space m3 hardly shifted out.
8. Anal whitish suffusion just outside of discal line entering space cu2.

Flight period of adults: The collecting records of the adults in the field (at 1000-1500 m) started April 21st until May 23rd. Adults can emerge earlier under breeding condition. The junior author noticed that adults emerged April 4th, 2012 at 1500 m.

Breeding experience and biological notes: The junior author bred this new species in sufficient numbers and the records are as follows.

1. Early-instar larvae were collected from the flowers of *Lonicera tragophylla* Hemsl. (Caprifoliaceae) at 1500 m in May, 2010, then were reared on the host plant at 1500 m. The larvae could simulate the flowers of *Lonicera tragophylla* in colour, changed from green (figs. 127, 130-131) to yellow (figs. 128-129) in accordance with the colour of flowers in different periods. The grown larvae (after the first instar; figs. 126-131) would curl up and fall on the ground when the inhabited flowers were rocked; they would keep still for a long time and then crawled back to the plant. The final-instar larvae turned into reddish brown in colour just before pupation, stopped eating and crawled everywhere for about two days to search for a right place to pupate; then they kept still and curled up, turned into pre-pupae lasting for two days. Pupation took place at the end of June or the beginning of July. The butterflies overwintered as pupae (figs. 132-133). Two adults emerged in the following spring.

2) A ♀ was observed laying eggs on buds or calyces of *Lonicera tragophylla* May 23rd, 2011; it flew around the host plant and laid only one egg at each bud (fig. 123) or calyx she selected, the egg-laying lasted for dozens of seconds. A few eggs were collected and hatched into larvae (fig. 125) May 27th, 2011 or the following days. They were reared on the host plant, feeding on flowers. Pupation took place at end of June. The butterflies overwintered as pupae. Several adults emerged March 4th-26th, 2012.

Description of the immature stages: Egg (fig. 123) small, with a diameter about 1 mm, oblate spheroidal, pale green in colour, with surface polygonally sculptured. First instar larva (figs. 124-125) pale yellow, suffused with whitish long setae. The grown larvae (figs. 126-131) nearly unicolour, yellow or green in accordance with the flowers they inhabit, at most with faint markings in slightly changed colour; they suffused with shorter and shorter setae in proportion to size of body when the instar increasing. Larvae in all instars without conspicuous protuberances on the surface of the body, which are fully developed in *Cissatsuma* ***zhoujingshuae*** **spec. nov.** and *Ahlbergia frivaldszkyi* (Lederer, 1855). The final instar larva became darker and reddish brown on the day just before pupation. The pupa (figs. 132, 133), about 9 mm long and 6 mm in width, black and often mottled, full of short setae on the surface

Acknowledgements: We wish to express our thanks to Mr. Ren-Bin Zhu, who helped to identify the host plants of the "elfin" butterflies, and to Mr. Wen-Hao Sun, who helped us in communication with Mr. Ren-Bin Zhu. Our thanks are also due to Mr. Jian-Qing Zhu, Mr. An-Ming Chen and Mr. Yu-Fei Li, who allowed the senior author to examine the specimens preserved in their private collections. We also thank Dr. James Boone for his help in taking photos of the type specimens kept in FMNH and Dr. Shao-Ji Hu for his help in taking photos of the specimen kept in KIZ.

References

Bangs, O. (1932): Birds of western China obtained by the Kelley-Roosevelts expedition. - Field Museum of Natural History Publication 314, Zoological Series **18** (11): 343-379, Washington DC.

d'Abrera, B. (1993): Butterflies of the Holarctic Region **3**. - Hill House, Melbourne.

Huang, H. & K. Song (2006): New or little known elfin lycaenids from Shaanxi, China. - Atalanta **37** (1/2): 161-167, Würzburg.
Huang, H. & C.-S. Wu (2003): New and little known Chinese butterflies in the collection of the Institute of Zoology, Academia Sinica, Beijing -1. - Neue Ent.Nach. **55**: 115-143, Marktleuthen.
Johnson, K. (1992): The Palaearctic "Elfin" Butterflies (Lycaenidae, Theclinae). - Neue Ent. Nach. **29**: 1-141, Markltleuthen.
Osgood, W. H. (1932): Mammals of the Kelley-Roosevelts and Delacour Asiatic Expeditions. - Field Museum of Natural History Publication 312, Zoological Series **18** (10): 193-339, Washington DC.
Stevens, H. (1934): Through Deep Defiles to Tibetan Uplands. The Travels of a Naturalist From the Irrawaddy to the Yangtse. - London.
Wang, M. & X.-L. Fan (2002): Butterflies Fauna Sinica: Lycaenidae. - Henan Science & Technology, Zhengzhou.

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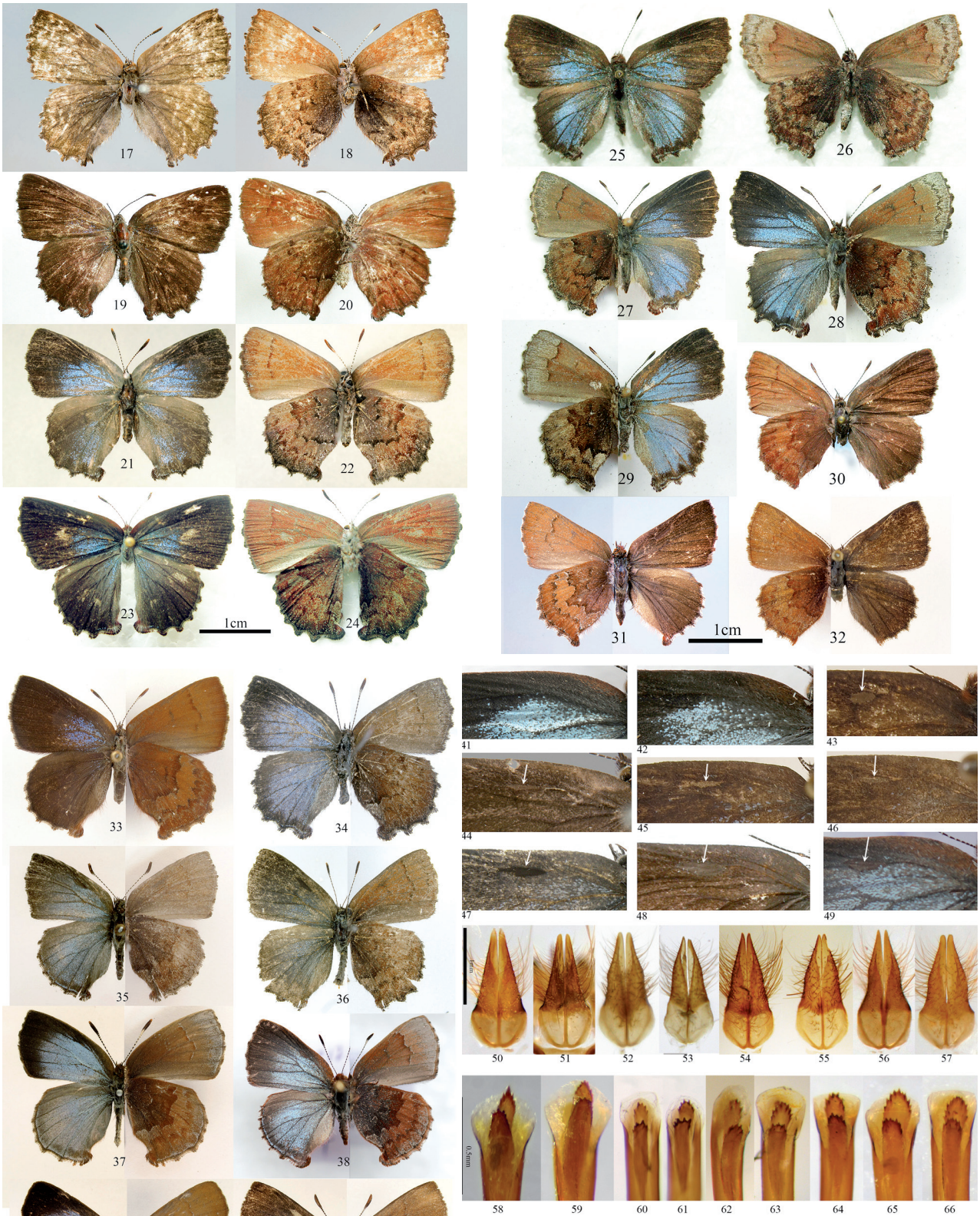
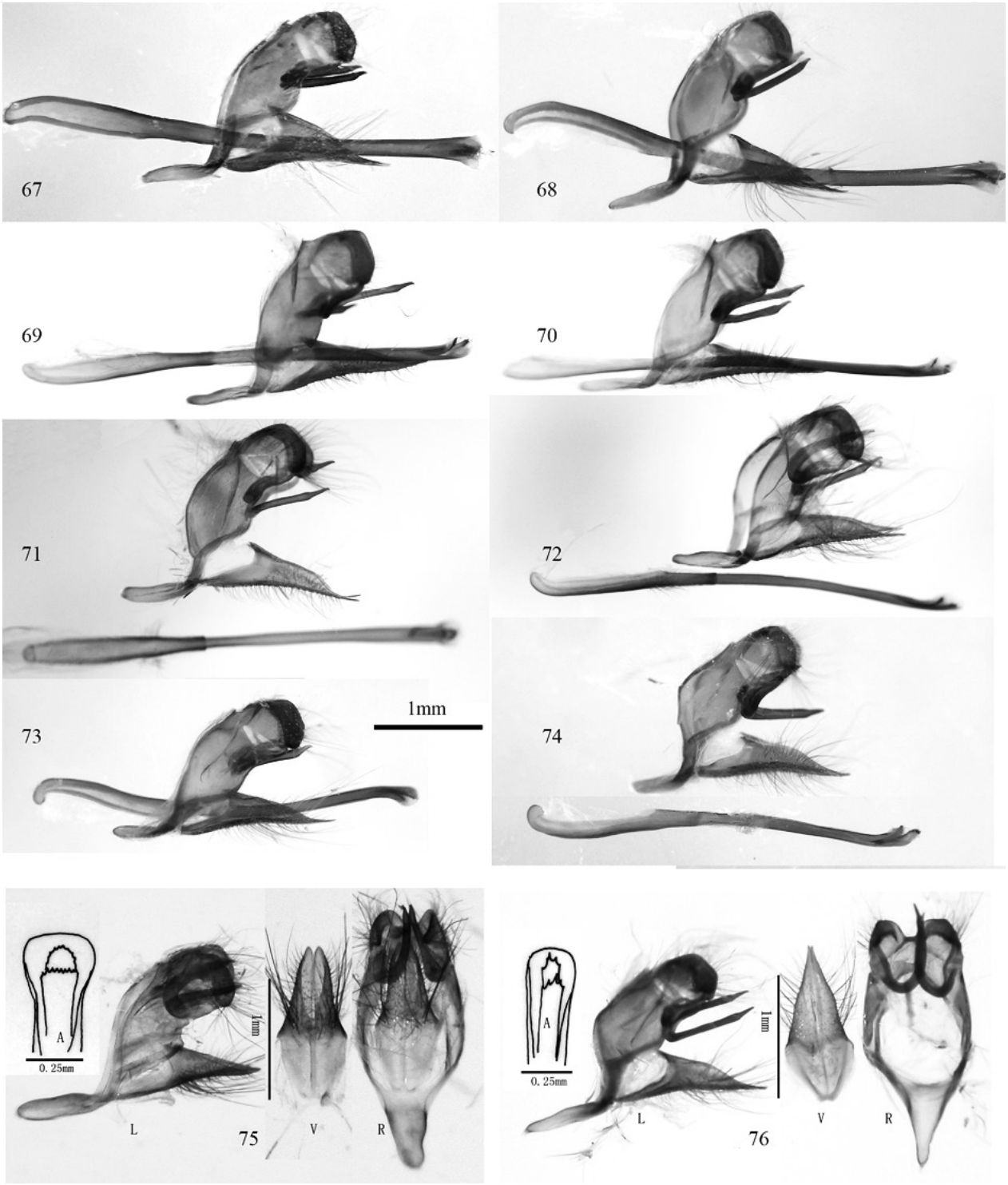
Figs. 1-8: *Cissatsuma* ***zhoujingshuae*** **spec. nov**. (1, 2) HT ♂, upper- and underside; (3, 4) PTs ♂ ♂, upper- (left half) and underside (right half); (5-8) PTs ♀♀, upper- (left half) and underside (right half).
Figs. 9, 10: *Cissatsuma albilinea* (Riley, 1939), (9) ♂, (10) ♀ upper- (left half) and underside (right half), Dongchuan, E Yunnan.
Figs. 11, 12: *Ahlbergia matusiki* Johnson, 1992 , HT ♂, upper- and underside (FMNH), Muli, S Sichuan.
Figs. 13-16: *Ahlbergia lynda nidadana* Huang, 2003, (13-15) PT ♂ ♂, (16) HT ♀, upper- (right half) and underside (left half), Gongshan, NW Yunnan..
Figs. 17-20: *Cissatsuma pictila* (Johnson, 1992) **comb. nov.**, (17, 18) HT ♂ (FMNH), Kopadi, Muli, S Sichuan, upper- and underside; (19, 20) ♀, Miyi, Panzhihua, S Sichuan, upper- and underside.



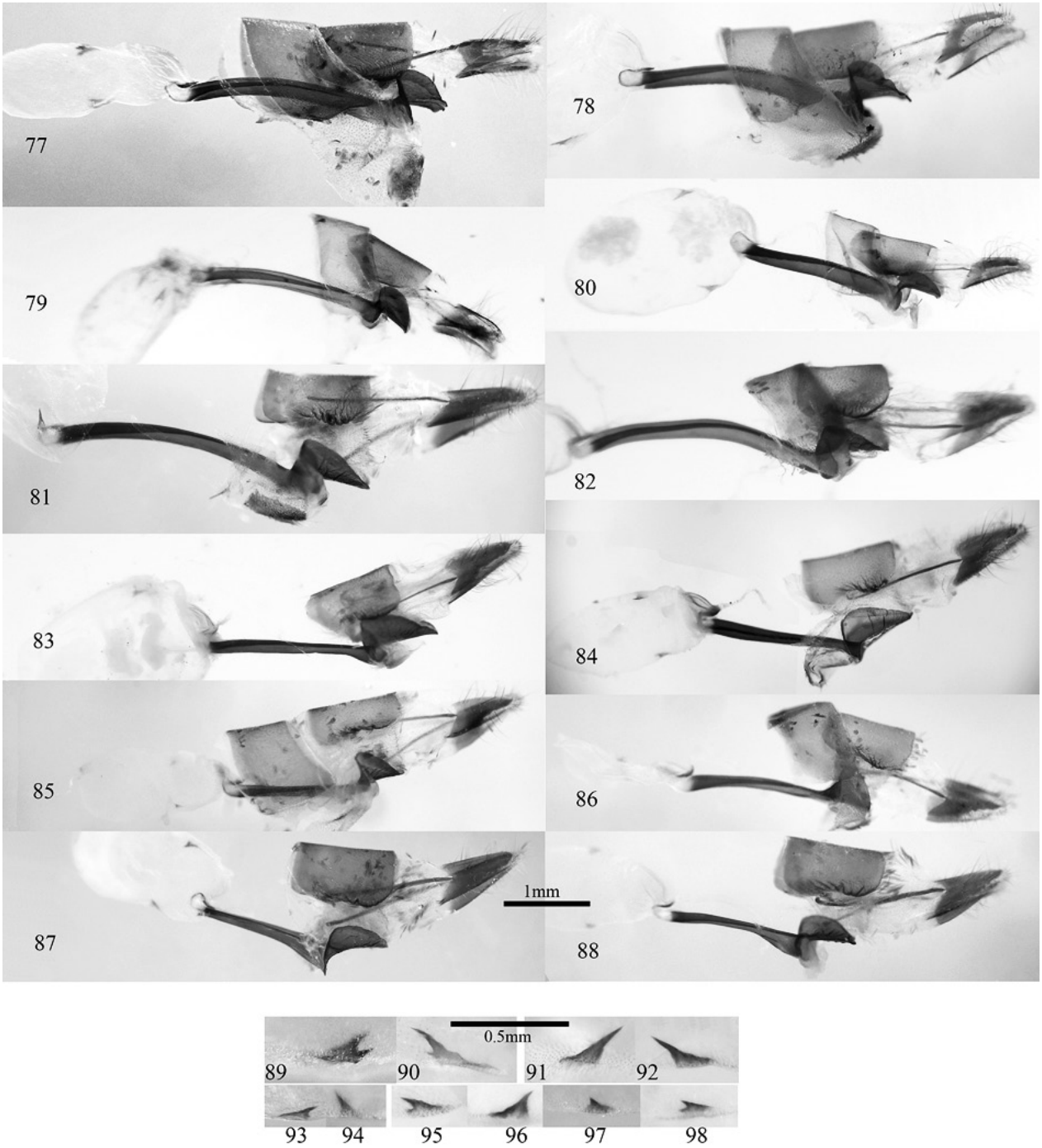
Figs. 21-24: *Cissatsuma crenata* Johnson, 1992, (21, 22) ♀, Gongshan, NW Yunnan; (23, 24) ♀, Lijiang, NW Yunnan. **Figs. 25-29**: *Ahlbergia chalcidis* Johnson, 1992, (25, 26) ♂, Kunming, N Yunnan; (27, 28) ♂♂, Lijiang, NW Yunnan; (29) ♀, Lijiang. **Figs. 30-32**: *Ahlbergia circe montivaga* Johnson, 1992, ♂♂, upper- (right half) and underside (left half); (30) HT of *Ahlbergia zhujianhuai* Huang & Wu, 2003 **syn. nov.** (IZAS), Miyi, Panzhihua, S Sichuan; (31) PT (FMNH), "Rinshau to mainyuh", between Lijiang and Yongning; (32) Lijiang. **Fig. 33**: *Ahlbergia circe montivaga* Johnson, 1992, ♀, Lijiang, upper- (left half) and underside (right half). **Figs. 34, 36**: *Ahlbergia dongyui* Huang & Zhan, 2006, (34) ♀, (36) ♂, Tianmushan, Zhejiang, upper- (left half) and underside (right half). **Figs. 35, 37, 38**: *Ahlbergia* ***liyufeii*** **spec. nov.**, (35) PT ♂, Chang-an, Shaanxi; (37) HT ♀, Fengxian; (38) PT ♂, Fengxian. **Figs. 39, 40**: *Ahlbergia nicevillei* (Leech, 1893), (39) ♀, (40) ♂Tianpingshan, NW Hunan. **Figs. 41-49**: Discocellular cell of the ♂ forewing upperside, with ♂-brand marked by white arrow. (41, 42) *Cissatsuma* ***zhoujingshuae*** **spec. nov.**; (43) *C. albilinea* (Riley, 1939); (44) HT *Ahlbergia matusiki* (Johnson, 1992) **comb. nov.**; (45-46) *A. lynda nidadana* Huang, 2003; (47) *A. chalcidis* Johnson, 1992; (48) *A. circe montivaga* Johnson, 1992; (49) *A.* ***liyufeii*** **spec. nov. Figs. 50-57**: ♂ valvae in ventral view under the same scale. (50-51) *Cissatsuma* ***zhoujingshuae*** **spec. nov.**; (52-53) *Ahlbergia chalcidis* Johnson, 1992; (54-55) *A. dongyui* Huang & Zhan, 2006, Zhejiang; (56) *A.* ***liyufeii*** **spec. nov.**; (57) *A. nicevillei* (Leech, 1893). **Figs. 58-66**: Tip of the aedeagus to show the cornuti. (58, 59) *Cissatsuma* ***zhoujingshuae*** **spec. nov.**; (60, 61) *Ahlbergia chalcidis* Johnson, 1992; (62, 63) *A. dongyui* Huang & Zhan, 2006, Zhejiang; (64) *A.* ***liyufeii*** **spec. nov.**; (65, 66) *A. nicevillei* (Leech, 1893).



Figs. 67-74: ♂ genitalia in lateral view under the same scale. (67, 68) *Cissatsuma* ***zhoujingshuae*** **spec. nov**.; (69, 70) *Ahlbergia chalcidis* Johnson, 1992; (71-72) *A. dongyui* Huang & Zhan, 2006; (73) *A.* ***liyufeii*** **spec. nov.**; (74) *A. nicevillei* (Leech, 1893).

Fig. 75: ♂ genitalia of *Cissatsuma albilinea* (Riley, 1939) (fig. 9). (A) tip of aedeagus; (L) genitalia in lateral view; (V) valvae in ventral view; (R) ring in ventral view.

Fig. 76: ♂ genitalia of *Ahlbergia circe montivaga* Johnson, 1992 (fig. 32). (A) tip of aedeagus; (L) genitalia in lateral view; (V) valvae in ventral view; (R) ring in ventral view.

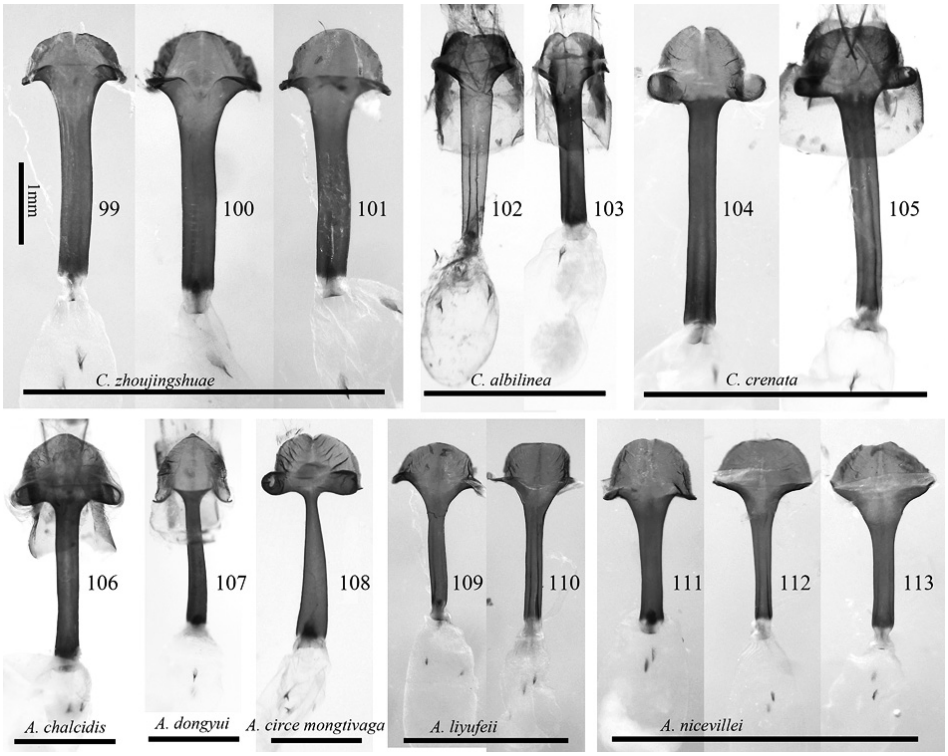


Figs. 77-88: ♀ genitalia in lateral view under the same scale. (77, 78) *Cissatsuma* ***zhoujingshuae*** **spec. nov**.; (79, 80) *C. albilinea* (Riley, 1939); (81, 82) *C. crenata* Johnson, 1992; (83) *Ahlbergia chalcidis* Johnson, 1992; (84) *A. dongyui* Huang & Zhan, 2006, Zhejiang; (85, 86) *Ahlbergia* ***liyufeii*** **spec. nov.**; (87, 88) *A. nicevillei* (Leech, 1893).

Figs. 89-98: Signum on the inner surface of the corpus bursae under the same scale. (89, 90) *Cissatsuma* ***zhoujingshuae*** **spec. nov**.; (91, 92) *C. crenata* Johnson, 1992; (93-94) *A.* ***liyufeii*** **spec. nov.**; (95-98) *A. nicevillei* (Leech, 1893).

Figs. 99-113: Lamella postvaginalis, lamella antevaginalis and ductus bursae in ventral view under the same scale. (99-101) *Cissatsuma* ***zhoujingshuae*** **spec. nov**.; (102, 103) *C. albilinea* (Riley, 1939); (104) *C. crenata* Johnson, 1992 (figs. 21, 22); (105) *C. crenata* Johnson, 1992 (figs. 23, 24); (106) *Ahlbergia chalcidis* Johnson, 1992 (fig. 29); (107) *A. dongyui* Huang & Zhan, 2006 (fig. 34), Zhejiang; (108) *A. circe montivaga* Johnson, 1992 (fig. 33); (109, 110) *A.* ***liyufeii*** **spec. nov.**; (111-113) *A. nicevillei* (Leech, 1893).

Figs. 114-122: Immature stages of *Cissatsuma* ***zhoujingshuae*** **spec. nov**., (114) egg on calyx of *Spiraea fritschiana* (16. VI.2011); (115) early-instar larva in dorsal view (8.VI.2011); (116) final-instar larva on *Spiraea fritschiana*, lateral view (30.VI.2011); (117) final-instar larva on *Spiraea fritschiana*, dorsal view (6.VII.2011); (118, 119) final-instar larva feeding on *Aruncus sylvester* (23.VI.2011); (120) pupa in dorsal view (30.VI.2011); (121) pupa in lateral view; (122) final-instar larvae feeding on flowers of *Spiraea fritschiana* (29.VI.2012).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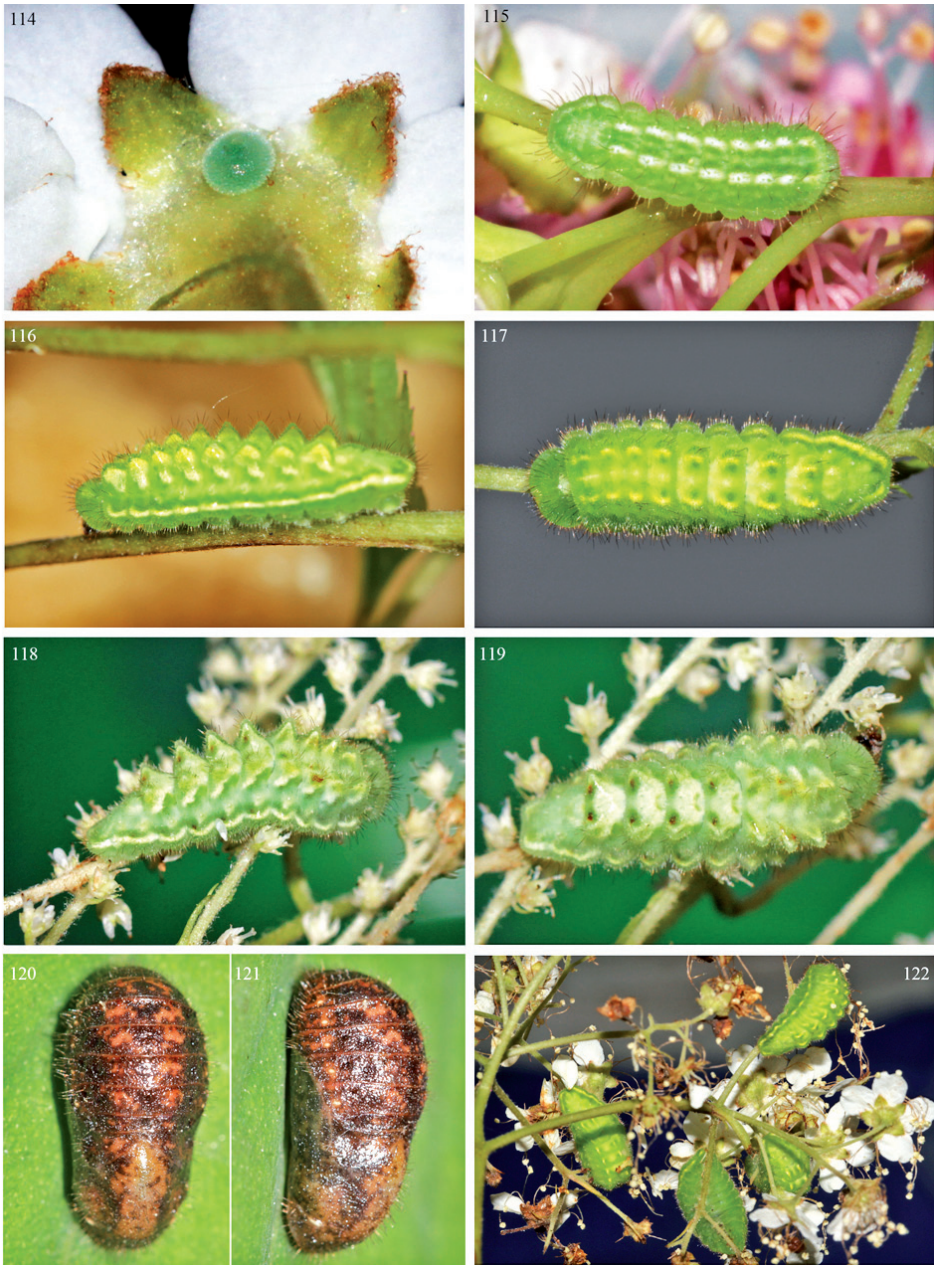
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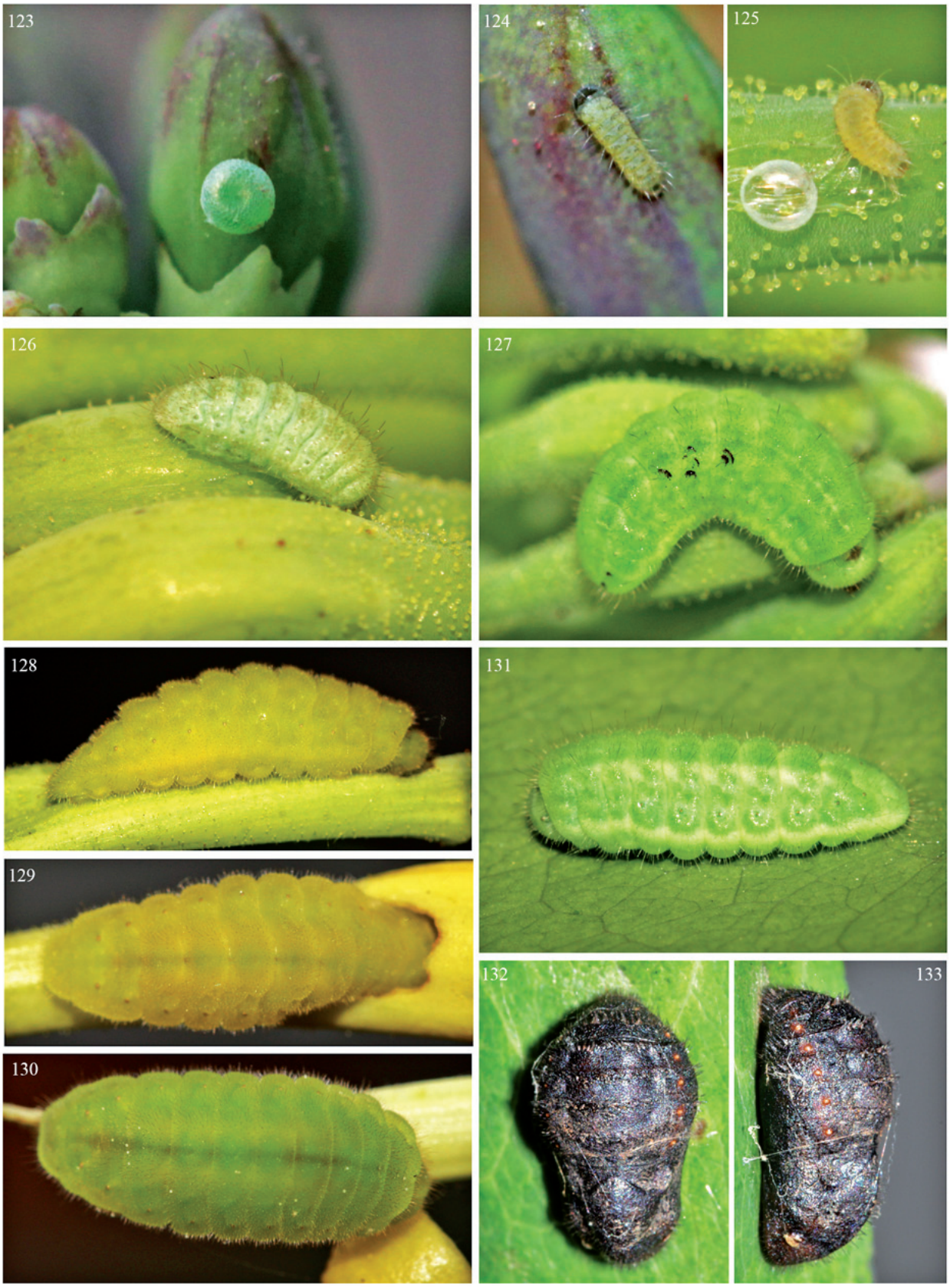

Figs. 123-133: Immature stages of *Ahlbergia* ***liyufeii*** **spec. nov.** (123) egg on bud of *Lonicera tragophylla* (27.V.2011); (124) L1 larva in dorsal view on bud of *Lonicera tragophylla* (27.V.2011); (125) L1 larva just hatched out (9.VI.2011); (126) grown larva feeding on flower (9.VI.2011); (127) grown larva feeding on flower (9.VI.2011); (128-130) final-instar larvae (16.VI.2011); (131) grown larva (10.VI.2013); (132) pupa in dorsal view (20.VI.2011); (133) pupa in lateral view.