

Notes on and key to the genus *Phengaris* (s. str.) (Lepidoptera, Lycaenidae) from mainland China with description of a new species

Min Wang^{1,†}, Josef Settele^{2,‡}

1 Department of Entomology, College of Natural Resources and Environment, South China Agricultural University, Guangzhou 510640, China **2** UFZ, Helmholtz Centre for Environmental Research, Department of Community Ecology, Theodor-Lieser-Str. 4, D-06120 Halle, Germany

† [urn:lsid:zoobank.org:author:D683614E-1F58-4CA8-9D80-B23BD41947A2](https://zoobank.org/urn:lsid:zoobank.org:author:D683614E-1F58-4CA8-9D80-B23BD41947A2)

‡ [urn:lsid:zoobank.org:author:391EF9D4-523E-4CA4-ACA5-333939021AC2](https://zoobank.org/urn:lsid:zoobank.org:author:391EF9D4-523E-4CA4-ACA5-333939021AC2)

Corresponding author: Josef Settele (Josef.Settele@ufz.de)

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Abstract

The lycaenid genus *Phengaris* (s. str.) from mainland China is briefly characterized, and a short identification key presented. *Phengaris xiushani* **sp. n.** is described and illustrated from northwestern Yunnan. The new species is similar to *P. daitozana* from Taiwan with respect to the wing maculation in having a whitish upperside and much smaller spots on the underside. Genitalia features are similar to *Phengaris* (*Maculinea*) *nausithous* from the western Palearctic region. The type specimens are kept in the Insect Collection, South China Agricultural University, Guangzhou, China (SCAU), and the “Senckenberg Museum für Tierkunde” in Dresden, Germany (MTD).

Keywords

Lepidoptera, Lycaenidae, *Maculinea*, Yunnan

Introduction

The large blues of the lycaenid genus *Phengaris* Doherty, 1892 (s. str.) hitherto only encompassed three species: *P. atroguttata* Oberthür, 1876, *P. albida* Leech, 1893 and *P. daitozana* Wileman, 1908. These were distributed in the area between the Oriental and

Palearctic region of E. Asia. Recently, Fric et al. (2007) treated the Palearctic genus *Maculinea* Van Eecke, 1915 as a synonym of *Phengaris* and divided the genus (s. lat.) into four species groups and eleven species.

The large blues of former *Maculinea* Van Eecke, 1915 (s. str.; see Balletto et al. in press, on recent discussions of nomenclature) belong to the most intensively studied group of butterflies in Eurasia, which is probably due to their “obscure” biology and ecology (Als et al. 2004; Barbero et al. 2009; Nash et al. 2008; Pech et al. 2004; Thomas and Settele 2004; Thomas et al. 2009). Their specialized habitat requirements have made them vulnerable to global change (Settele and Kühn 2009), including climate change and habitat alteration. Large Blue populations have suffered severe declines in Europe, and one species, *M. arion* (Linnaeus, 1758) went extinct in the UK in the 1970s, but was then reintroduced from Sweden (Thomas et al. 2009), which sparked increased interest in the conservation and habitat restoration of this species. Four *Maculinea* species are listed in the IUCN Red List of Threatened Species as ‘near threatened’ and *M. rebeli* Hirschke, 1904 as ‘vulnerable’. Three species are included in Annexes II and IV of the European Habitats’ Directive, and all European species are being monitored and intensively studied under the European research projects MacMan and CLIMIT (www.climit-project.net) (Settele et al. 2005; Settele and Kühn 2009).

Contrary to *Maculinea* in Europe, *Phengaris* (s. str. and s. lat.) in China is not so well studied and monitored due to lack of financial and personnel resources. Chou (1994) recorded 3 species in *Maculinea* (s. str.) and 2 species in *Phengaris* (s. str.) from China, Sibatani et al. (1994) recorded 6 species in *Maculinea* (s. str.) from China, Wang (1999) recorded 4 species of *Maculinea* (s. str.) from N.E. China. In their book, Wang & Fan (2002) documented 6 species in *Maculinea* (s. str.) and 3 species in *Phengaris* (s. str.) in China.

In the course of a Chinese-German workshop on butterfly conservation held in Guangzhou in December 2009, we examined specimens kept in the Insect Collections of the South China Agricultural University, which led to the discovery of a *Phengaris* species which had not previously been reported. We herewith describe the new species.

Materials and methods

We investigated 5 dried specimens collected by netting during day time from Nujiang County on the 24th of July 2006. Pictures of mounted adults were taken with a Nikon Coolpix 990 digital camera. The whole abdomen of the holotype was removed and macerated in boiling 10% NaOH liquid for 3–4 minutes. The genitalia was checked and mounted on a slide in glycerin under the Leica 12.5 stereoscope. The genitalic photos were taken with a Nikon Coolpix 990 connected to an eye lens of the stereoscope. All the images were processed with Adobe Photoshop 6.0. The type specimens are deposited in the Insect Collections, Department of Entomology, South China Ag-

ricultural University, Guangzhou, China (1 male holotype and 3 female paratypes) and the “Museum für Tierkunde” in Dresden, Germany (1 male paratype).

Description

Phengaris xiushani Wang & Settele sp. n.

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Type material. Holotype male (SCAU): China, Yunnan, Nujiang County, alt. 2800 m, 24.VII.2006, Min WANG & Xiaoling FAN leg. Paratypes. One male and three females, same data as holotype.

Male. Forewing length 21 mm, antenna length 9.5 mm.

Forewing upperside ground colour whitish, with black margin gradually broadened from tornus to the mid of termen and then sharply widened to apex, where overlapped with three darker black dots, one traceable smaller spot each in the mid of space M3 and distal cell. Cilia are white checkered with black. Underside ground color same as upperside, with black spots in mid and distal cell, and postdiscal, submarginal and marginal series. Postdiscal series with the spots in spaces M1 and M2 prominently shifted outwardly. Submarginal series is much broader than marginal series.

Hindwing upperside ground color similar to that on forewing, with traceable markings which shine through from the underside. Cilia almost white, with fine black checkers at the end of each vein. Underside ground color same as upperside, with black spots consisting of discal, postdiscal, submarginal and marginal series, as well as a black spot each at basal and mid space Sc+R1. The black spot of postdiscal series in space CuA2 shifted outwardly.

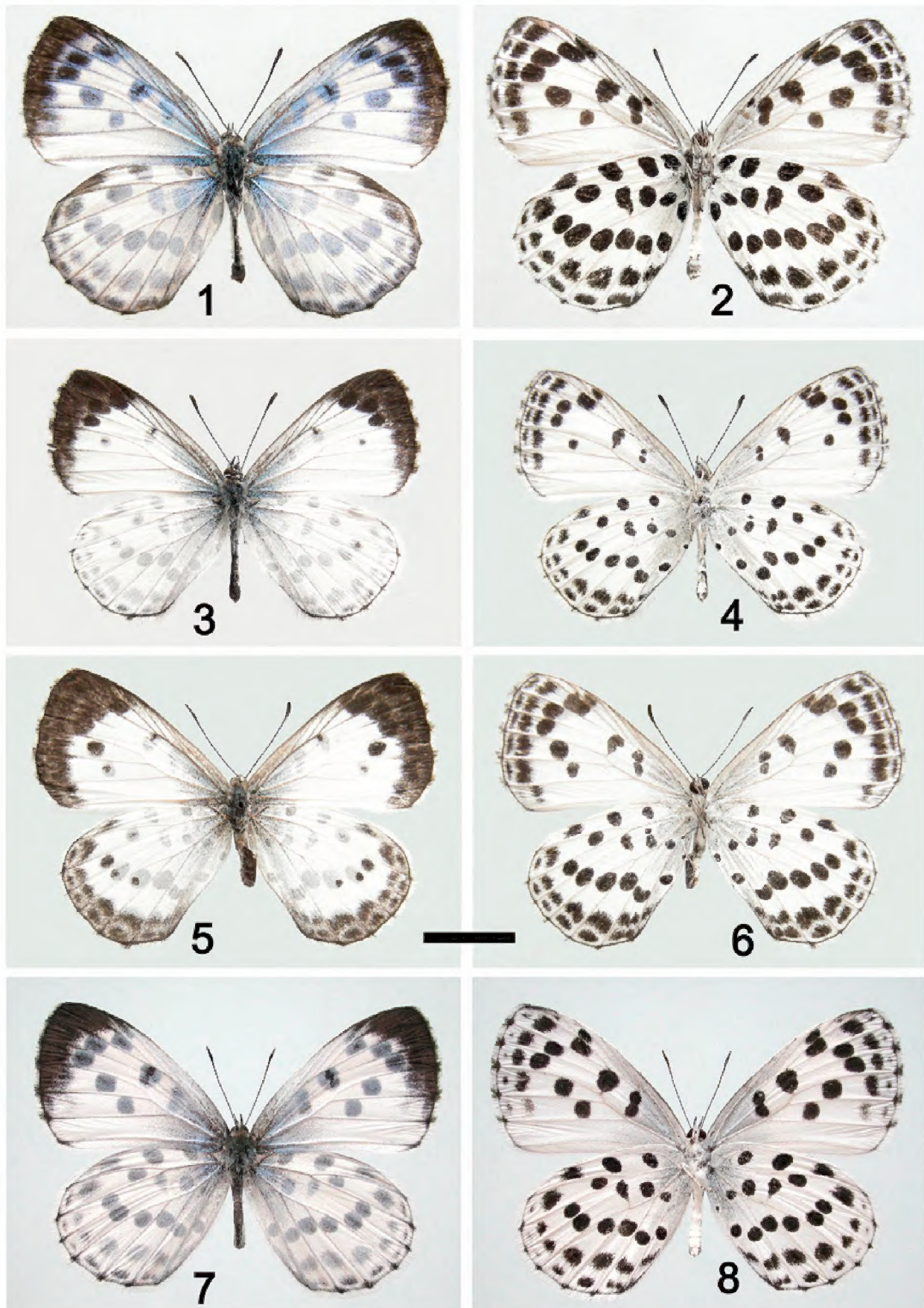
Male genitalia. Heavily sclerotized, tegumen broad and large, vinculum narrow, saccus absent, brachia stout and short, valve oblong, with a projection distally, juxta V-shaped, aedeagus stout with elaborate distal structure.

Female. Similar to male, but slightly larger, black margins of both wings are well developed.

Distribution. Yunnan, China.

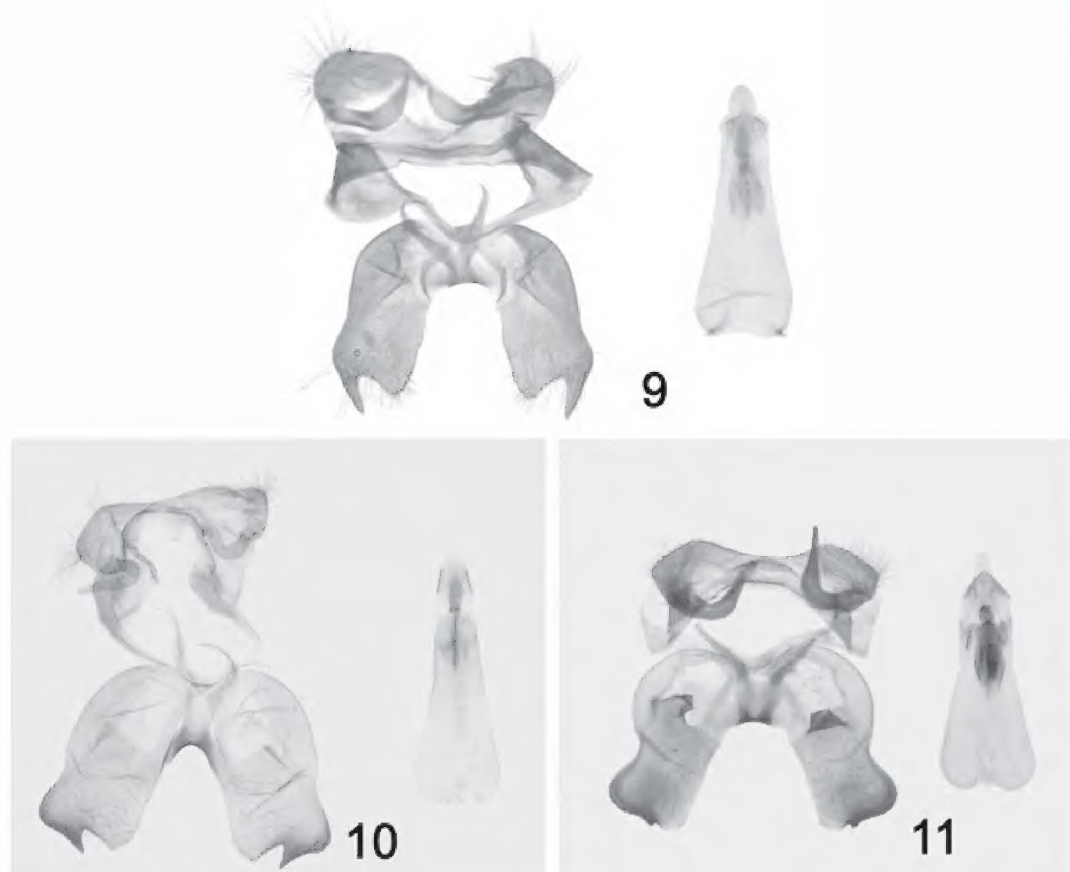
Diagnosis. Superficially, the species is similar to *P. daitozana* as shown in Shirôzu's book (1960) from Taiwan in having whitish ground color on upperside and smaller black spots on underside, but the black spot in space CuA1 of the postdiscal series is distinctly shifted outwards, also the valva of the male genitalia with its dorsal part is not so well inflated distally and, compared with drawings in Higgins (1975), has similar genitalia to the Palaearctic *P. (Maculinea) nausithous* (Bergsträsser, 1779). The species is also easily recognized from *P. atroguttata* (Figs 1, 2, 10) and *P. albida* (Figs 7, 8, 11) by the wing maculation and genitalia features.

There are several taxa names published previously in mainland China and neighboring countries now treated as subspecies of *P. atroguttata* or separate species: *juenana*



Figures 1–8. *Phengaris* spp. 1–2 *P. atroguttata* 3–6 *P. xiushani* 7–8 *P. albida* (1 3 5 7 upperside 2 4 6 8 underside); black bar = 1 cm

(Forster, 1940) from Dali, Yunnan; *lampra* (Röber, 1926) from Assam, India; *intermedia* Oberthür, 1916 from Tianquan, Sichuan. Examination of the types of the above mentioned taxa, except for *juenana* (Forster, 1940), showed that *lampra* (Röber, 1926) belongs to *P. atroguttata* in having a black spot at basal cell C, whereas *intermedia* Oberthür, 1916 is identical to *P. albida*. Though the type of *juenana* (Forster, 1940) was not inspected in our study, we can postulate from Forster's original description that



Figures 9–11. Male genitalia of *Phengaris* spp. **9** *P. xiushani* sp. n. **10** *P. atroguttata* **11** *P. albida*

the taxon is related to *lampra* (Röber, 1926) and belongs to *P. atroguttata*, which was verified by Huang (2003).

The name *dohertyi* Hemming appeared in D’Abrera (1993) for a taxon from Naga Hills and northern Myanmar, but could not be found in any further literature. It is possible that the name *dohertyi* was never published (John E. Chainey, personal communication).

Biological notes. The species occurs together with *P. atroguttata* in one locality, which we assume is their usual habitat within undisturbed forested mountains (Fig. 12); many adults were flying together. Only one locality was encountered during a 6 days field trip.

Etymology. The specific name refers: (a) to the beautiful mountain on the slopes of which it was found (Xiu-Shan in Chinese means “beautiful mountain”), and (b) more importantly we dedicate this species to Dr. Xiushan LI who brought the two authors of this description together and who has committed much of his life to research on ecology and conservation of butterflies (e.g. Li et al., 2006, 2010).

Short key to *Phengaris* (s. str.) of mainland China

- 1 Underside forewing without black discal spot in cell *P. daitozana*
- Underside forewing with a prominent black discal spot in cell **2**
- 2 Hindwing underside with a black spot at the basal cell C..... *P. atroguttata*
- Hindwing underside without a black spot at the basal cell C..... **3**
- 3 Valva of male genitalia with a prominent process distally *P. xiushani*
- Valva of male genitalia with a well reduced process *P. albida*



Figure 12. Habitat of *P. atroguttata* and *P. xiushani* sp. n. in northwestern Yunnan, alt. 2800m

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References

- Als TD, Vila R, Kandul NP, Nash DR, Yen SH, Hsu YF, Mignault AA, Boomsma JJ, Pierce NE (2004) The evolution of alternative parasitic life histories in large blue butterflies. *Nature* 432: 386–390.
- Balletto E, Bonelli S, Settele J, Thomas JA, Verovnik R, Wahlberg N (in press) Case 3508 - *Maculinea* Van Eecke, 1915 (Lepidoptera: LYCAENIDAE): proposed precedence over *Phengaris* Doherty, 1891. *Bulletin of Zoological Nomenclature* 67(2) June 2010.
- Barbero F, Thomas JA, Bonelli S, Balletto E, Schönrogge K (2009) Queen ants make distinctive sounds that are mimicked by a butterfly social parasite. *Science* 323: 782–785.
- Chou I (1994) *Monographia Rhopalocerorum Sinensium*. Henan Scientific and Technological Publishing House, Zhengzhou.
- D'Abrera B (1993) Butterflies of the holarctic region, part 3: Nymphalidae (concl.), Libytheidae, Riodinidae, Lycaenidae. Hill House, Melbourne.
- Fric ZK, Wahlberg N, Pech P, Zrzavy J (2007) Phylogeny and classification of the *Phengaris*–*Maculinea* clade (Lepidoptera: Lycaenidae): total evidence and phylogenetic species concepts. *Systematic Entomology* 32: 558–567.
- Higgins LG (1975) *The classification of European butterflies*. Collins, London.
- Huang H (2003) A list of butterflies collected from Nujiang (Lou Tse Kiang) and Dulongjiang, China with descriptions of new species, and revisional notes. *Neue Entomologische Nachrichten* 55: 3–114
- Li XS, Zhang YL, Luo YQ, Settele J (2006) Study on life history, life table, habitat and conservation of *Byasa impediens* (Lepidoptera: Papilionidae). *Acta Ecologica Sinica* 10: 3184–3197.
- Li XS, Luo YQ, Zhang YL, Schweiger O, Settele J, Yang QS (2010) On the conservation biology of a Chinese population of the birdwing *Troides aeacus* (Lepidoptera: Papilionidae). *Journal of Insect Conservation* 14: 257–268.
- Nash DR, Als TD, Maile R, Jones GR, Boomsma JJ (2008) A mosaic of chemical coevolution in a Large Blue butterfly. *Science* 319: 88–90.
- Pech P, Fric Z, Konvicka M, Zrzavy J (2004) Phylogeny of *Maculinea* blues (Lepidoptera: Lycaenidae) based on morphological and ecological characters: evolution of parasitic myrmecophily. *Cladistics* 20: 362–375.
- Settele J, Kühn E (2009) Insect conservation. *Science* 325: 41–42.
- Settele J, Kühn E, Thomas JA (Eds) (2005) *Studies on the ecology and conservation of butterflies in Europe, Vol. 2: Species ecology along a European gradient: Maculinea butterflies as a model*. Pensoft, Sofia/Moscow.
- Settele J, Shreeve T, Konvicka M, Van Dyck H (Eds) (2009) *Ecology of butterflies in Europe*. Cambridge University Press, Cambridge.
- Shirôzu T (1960) *Butterflies of Formosa in Colour*. Hoikusha, Osaka.
- Sibatani A, Saigusa T, Hirowatari T (1994) The genus *Maculinea* van Eecke, 1915 (Lepidoptera: Lycaenidae) from the East Palaearctic Region. *Tyô to Ga* 44: 157–220.
- Thomas JA, Settele J (2004) Evolutionary biology: Butterfly mimics of ants. *Nature* 432: 283–284.
- Thomas JA, Simcox DJ, Clarke RT (2009) Successful conservation of a threatened *Maculinea* butterfly. *Science* 325: 80–83.

Wang M, Fan X (2002) Butterflies Fauna Sinica: Lycaenidae. Henan Scientific and Technological Publishing House, Zhengzhou.

Wang Z (Eds) (1999) Monographia of original colored & size butterflies of China's Northeast. Jilin Scientific and Technological Publishing House, Changchun.