
A REVIEW OF THE GENUS BYASA MOORE IN CHINA (LEPIDOPTERA: PAPILIONIDAE)

CHUN-SHENG WU & JIU-WEI BAI
Institute of Zoology, The Chinese Academy of Sciences, Beijing 100080, P. R. China
Email: insect@panda.ioz.ac.cn

ABSTRACT. Fourteen species of Byasa Moore are recognized in China. B. trifurca Wu & Bai is described as new to science, B. alcinous loochoan anus (Rothschild) and B. plutonius tyleri Evans are new records from China, B. confusa (Rothschild) is raised from B. alcinous confusa, B. mansonensis Fruhstorfer is synonymized with B. confusa, and B. stenoptera Chou & Gu with B. dasarada melanura (Rothschild). The taxonomic status of some subspecies are discussed, and the new forms of some species are mentioned. The male and female genitalia are illustrated and most female genitalia are described for the first time. Keys to species based on external characters and on male genitalia are provided.

Key words: Lepidoptera, Papilionidae, Byasa, new species, China, Oriental Region.

Introduction

Members of the genus Byasa Moore have usually been placed in Papilio (as laterellei-group), Polydorus or Atrophaneura. Miller (1987) treated it as subgenus Panosmia of Parides. Byasa differs from Atrophaneura by having the hind wing tailed, ostium fluted and forming a corona around the ostial opening in the female genitalia, and the apex of valva broadly rounded in male genitalia. Species of Byasa occur in Japan, Korea, China, Laos, Vietnam, Thailand, Myanmar, Northern India (including Sikkim), Nepal and Bhutan.

Jordan (1928) described 14 species from eastern Asia, of which 10 species are distributed in China. Chou et al. (1994) reported 14 species from China including a new species and 2 species raised from subspecies. This paper deals with 14 species from China. B. trifurca Wu & Bai is described as new to science, Byasa alcinous loochoan anus (Rothschild) and Byasa plutonius tyleri Evans are new records from China, B. confusa (Rothschild) is raised from B. alcinous confusa, B. mansonensis Fruhstorfer is synonymized under B. confusa, and B. stenoptera Chou & Gu under B. dasarada melanura (Rothschild). The taxonomic status of some of the subspecies is discussed and new forms of some species are mentioned. The male and female genitalia are illustrated, of which most female genitalia are newly reported. Keys to species based on external characters and on male genitalia are provided.

The holotype is deposited in the Institute of Zoology, the Chinese Academy of Sciences, Beijing, China.
References cited in the synonymy may be seen in the following general works: Bridges (1988), Chou (1994), D’Abrera (1982, 1990), Jordan (1928), Smart (1989) and Talbot (1949).

Genus Byasa Moore


Key to the species based on external characters

1. Hind wing with red spots only ................................................................. 2
   -- Hind wing with red and white spots .............................................. 9

2. Both wings especially narrow and long; hind wing apically broad, tails much shorter; ♂ upper side of wings without red spots .... B. crappies
   -- Both wings not especially narrow and long; hind wing normal, tails long ................................................................. 3

3. Termini deeply wavy in hind wing, tail short, apically widening ...................... B. plutonius
   -- Termini moderately wavy in hind wing, tail long .................................... 4

4. Tail narrow and long, not widening apically; upper side hind wing with 4 red spots ............................................................... B. mencius mencius
   -- Tail apically more or less widening .................................................. 5

5. Tail long, slightly widening apically; underside of hind wing with 7 red spots .................................................................................................................. 6
   -- Tail relatively short, clearly apically widening; underside of hind wing with 5-6 red spots ............................................................... B. daemonius

6. Red spots on hind wing small, crescent-shaped ........................................... 7
   -- Red spots on hind wing large, trapeziform ...................................... 8

7. Tail long ............................................. B. alcinous loochooanus
   -- Tail short ............................................. B. confusa

8. Spots on hind wing narrow and long, red ........................................ B. impediens impediens
   -- Spots on hind wing wide and short, salmon pink .... B. impediens febanus

9. Hind wing with 4-5 white spots, transversally arrange at middle .......... 10
   -- Hind wing with less than 3 white spots .......................................... 11

10. Hind wing broad, widest at middle .................................................. B. polla
    -- Hind wing narrow, widening from base to end ...................................... B. latreillei

11. Tail with a red spot ............................................................................. 12
    -- Tail without red spot ...................................................................... 14

12. Hind wing wide, termen deep wavy; ♂ with a large white spot, and sometimes beneath with another 1-2 small ones ................................................ 13
    -- Hind wing narrow, termen moderately wavy; ♂ with 2-3 large white spots ..................................................................................... B. dasarada

13. Hind wing with a "S"-shaped red spot on tornus, upper side hardly with lines in cell .............................................................. B. polyeuuctes
    -- Hind wing with an arched red spot on tornus, upper side distinctly with 2 black lines in cell .............................................................. B. trifurca, sp. nov.
14. Marginal area with well-developed red spots and with 1-3 large white spots on hind wing .................................................................................................................. 15
   -- Marginal area with red spots reduced, or only with 2 small white spots on hind wing ................................................................. B. dasarada melanura
15. Tornus deep concave in hind wing, underside with an irregular, large red spot red on anal area (or with 2 conjoint red spots) ............................................ 16
   -- Tornus moderately concave in hind wing, underside with 2 separate red spots on anal area ................................................................. B. mencius rhadinus
16. Underside of hind wing with 2 conjoint red dots on anal area, upper side distinctly with 2 black lines in cell ...................................................... B. nevilli
   -- Underside hind wing with an irregular, large red spot on anal area, upper side hardly with lines in cell ..................................................... B. hedistus

Key to the species based on male genitalia

1. Superuncus forking or trifurcate .............................................................................................................. 2
   -- Superuncus not forking .................................................................................................................... 4
2. Valva concave at apical margin, apex pointed ............................................................................. B. crassipes
   -- Valva convex at apical margin ........................................................................................................ 3
3. Superuncus forked ............................................................................................................................... B. polyeuctes
   -- Superuncus trifurcate .................................................................................................................... B. trifurca, sp. nov.
4. Harpe apically rounded, obtuse or very long ............................................................................... 5
   -- Harpe apically pointed .................................................................................................................. 11
5. Harpe folded in half, leafy ................................................................................................................ B. daemonius
   -- Harpe not folded ............................................................................................................................ 6
6. Harpe very long, geniculate ................................................................................................................ 7
   -- Harpe relatively short, not geniculate .............................................................................................. 9
7. Harpe with 1 large process at base ................................................................................................. B. impediens
   -- Harpe without such large process at base .................................................................................... 8
8. Ventral margin of harpe distally enlarged into a fairly prominent dentate lobe ...................... B. polia
   -- Ventral margin of harpe distally not enlarged ....................................................................... B. latreillei
9. Harpe apically widening into clavate, base with a large process ... B. nevilli
   -- Harpe not apically widening ........................................................................................................ 10
10. Harpe "<"-shaped, outer margin dentate wholly ........................................................................ B. dasarada
    -- Harpe arched, outer margin dentate in basal half ..................................................................... B. alcinous loochooanus
11. Harpe without processes at base or protruding slightly ......................................................... 12
    -- Harpe with processes at base ................................................................................................... 14
12. Harpe narrow, apical half gladiate ............................................................................................. B. confusa
    -- Harpe broad, apical 1/5 triangular ............................................................................................. 13
13. Harpe with a simple triangular median tooth ..................................................................... B. plutonius tytleri
    -- Harpe with a row of dents in outer margin ............................................................................. B. plutonius plutonius
14. Harpe large, bird-shaped, basally with 1 large and 1 small process ........................................ B. mencius
    -- Harpe relatively small, basally with a row of dents, apical 1/3 beak-shaped ................................ B. hedistus
**Byasa alcinous alcinous** (Klug)


**Distribution:** The nominate subspecies occurs in Japan and Korea.

**Byasa alcinous loochooanus** (Rothschild)


Male genitalia: Fig. 2.
Female genitalia: Fig. 23.

**Specimens examined:** P. R. China: Hainan: 5♀, 8♂, Feb. 13 - Mar. 4, 1929.

**Distribution:** Hainan.

**Remarks:** This subspecies was described from Japan. It is reported here from P. R. China for the first time.

**Byasa confusa** (Rothschild), stat. nov.


Male genitalia: Fig. 1.
Female genitalia: Fig. 16.

**Specimens examined:** P. R. China: Beijing, 2♀, 2♂; Naha R.I. 1♀, Apr. 28, 1935; Henan: Shangcheng, 2♀, 3♂, Apr. 15, 1993; Hunan: Mt. Hengshan, Aug. 27, 1980; Jiangxi: Nanchang, 1♂, Aug. 18, 1982; Yunnan: Lufeng, 1♂, Aug. 1980; Sichuan: Luding (1600-2500m), 1♀, 1♂, June 30, 1980, June 20, 1983; Mt. Gongga (2340m), June 4, 1983; Wenchuan, 1♂, July 2, 1983; Fujian: Fuzhou (100-200m), 2♀, 3♂, Minhou, 1♀, 1♂, Mar. 25, 1991.

**Distribution:** P. R. China: Heilongjiang, Jilin, Liaoning, Hebei, Henan, Shandong, Shanxi, Shaanxi, Jiangsu, Jiangxi, Fujian, Guangdong, Guangxi, Sichuan, Yunnan; Taiwan.

**Remarks:** *P. alcinous confusus* and *P. alcinous mansonensis* are quite different from *P. alcinous alcinous* and *P. alcinous loochooanus* in male and female genitalia (Figs. 1, 2, 16, 23). They are, therefore, considered distinct species. On the other hand, *P. alcinous confusus* and *P. alcinous mansonensis* are not clearly differentiated each other in external characters and genitalia. Therefore, *P. alcinous mansonensis* is synonymized with *P. confusus*.

**Byasa impediens impediens** (Rothschild)


Male genitalia: Fig. 3.
Female genitalia: Fig. 17.

**Specimens examined:** P. R. China: Gansu: Kangxian Co. (1250-1450m), 3♀, 1♂, July 12, 1998; Shaanxi: Mt. Micangshan, 1♂, Aug. 13, 1993;

**Distribution:** P. R. China: Gansu, Shaanxi, Zhejiang, Anhui, Hunan, Jiangxi, Fujian, Yunnan, Sichuan.

*Byasa impediens febanus* (Fruhstorfer, 1908)


*Specimens examined:* Taiwan, 1♂, June 5, 1993.

**Distribution:** Taiwan.

**Remarks:** Some authors treated this subspecies as a distinct species by the hind wing with submarginal spots large, salmon pink. But their genitalia are same.

*Byasa daemonius daemonius* (Alpheraky)


**Distribution:** P. R. China: Xizang; North India; Myanmar.

*Byasa daemonius yunnana* (Oberthür)


**Male genitalia:** Fig. 5.

**Female genitalia:** Fig. 26.

*Specimens examined:* P. R. China: Yunnan: Dali (2100m), 1♀, 1♂, Apr. 30, 1955.

**Distribution:** P. R. China: Yunnan.

*Byasa crassipes* (Oberthür)


**Male genitalia:** Fig. 9.

*Specimens examined:* P. R. China: Yunnan: Xishuangbanna Dist. 1♂, Apr., 1996.

**Distribution:** P. R. China: Yunnan, Sichuan; Myanmar; Vietnam.

*Byasa mencius mencius* (Felder & Felder)


**Male genitalia:** Fig. 6.

**Female genitalia:** Fig. 18.

Distribution: Eastern, Central, and Western China.

Byasa mencius rhadinus (Jordan)


Specimens examined: P. R. China: Yunnan: Dali (2100m), 1♀, Apr. 30, 1955.

Distribution: P. R. China: Yunnan.

Remarks: Some authors treated this subspecies as a distinct species because the hind wing has 2 large white spots, which is quite different from the nominate subspecies. However, the genitalia of this subspecies is similar to that of the nominate subspecies. The two subspecies occur together in Dali, Yunnan Province, but the adults emerge in April (rhadinus) and June (mencius) respectively.

Byasa nevilli (Wood-Mason)


Male genitalia: Fig. 4.
Female genitalia: Fig. 19.

Specimens examined: P. R. China: Yunnan: Kunming, 3♀, 7♂, Apr. 7, 1941, Binchuan Co., 1♂, June 16, 1982, Shizong Co., 1♀, Aug. 28, 1992; Sichuan: Luding Co. (1920m), 1♂, June 12, 1983

Distribution: P. R. China: Yunnan, Sichuan; India: Sikkim.

Remarks: Some specimens only have one large white spot on the upper side of the hind wing (Fig. 27, new form).

Byasa hedistus (Jordan)


Male genitalia: Fig. 12.
Female genitalia: Fig. 20.

Specimens examined: P. R. China: Yunnan: Shizong Co., 1♂, May 27, 1992, Kunming, Western Hills, 3♂, Apr. 15, 1941, Jianshui Co., 1♂, Apr. 20,
1933, Pu’er Co. (1400m), 1♀, Apr. 19, 1955, Yimen Co., 1♂, June 8, 1980; Fujian: Wuming Co., Mt. Wansongshan (2400m), 1♂*, May 18, 1980.

**Distribution:** P. R. China: Yunnan, Fujian.

**Remarks:** The species is the first record from Fujian. The specimens from Fujian and Yimen (Yunnan) differ from the other specimens by having another large white spot on the hind wing at space r₁ (Fig. 28, new form).

**Byasa plutonius plutonius** (Oberthür)


**Male genitalia:** Figs. 7.

**Female genitalia:** Fig. 22.

**Specimens examined:** P. R. China: Sichuan: Mt. Gonggashan (2340m), 1♀, July 9, 1984, 8♂*, June 5-11, 1983, Wenchuan Co. (900-1600m), 2♂*, July 1, 26, 1983; Yunnan: Yiliang Co. (2500m), 1♂*, May 17, 1980, Mt. Yulong (2900m), 1♀, July 14, 1961.

**Distribution:** P. R. China: Yunnan, Sichuan, Xizang; India: Sikkim, Bhutan; Nepal.

**Byasa plutonius tytleri** Evans


**Male genitalia:** Fig. 8.

**Specimens examined:** P. R. China: Shaanxi: Mt. Huashan, 1♂*, June 9, 1936.

**Distribution:** India; P. R. China: Shaanxi.

**Remarks:** This subspecies was described from Assam, India. It is a new record from China.

**Byasa polyeuctes polyeuctes** (Doubleday)


**Male genitalia:** Fig. 15.

**Female genitalia:** Fig. 21.


**Distribution:** P. R. China: Henan, Shanxi, Shaanxi, Yunnan, Xizang; Vietnam; Thailand; Sikkim; Nepal.

**Byasa polyeuctes lama** (Oberthür)


Distribution: P. R. China: Sichuan; India: Kashmir.

Byasa polyeuctes termessa (Fruhstorfer)


Specimens examined: Taiwan, 1♀, 1♂, May 6, 1935.

Distribution: Taiwan.

Byasa trifurca Wu & Bai, sp. nov. (Figs. 29, 30)

Male: Wing expanse 95 mm. Antennae black; palpi, thorax and abdomen crimson beneath; head and thorax above anteriorly crimson, rest of thorax and abdomen black. Wings black, fore wing grayish white along veins. Upper side of hind wing with a large white spot and 3 narrow submarginal red spots, tail with a red spot. Underside similar to upper side except for another small white spot beneath the large one and a small red spot on tornus. Scent-wool grayish brown.

Male genitalia (Figs. 11-11a): Superuncus forked at base, second branch forked again at end. Socius large, broadly foliar. Valva broad, apically narrower slightly; harpe plate-shaped, the half near costa sclerotized slightly and wavy along outer margin, the other half slightly toothed and terminating in a large process in outer margin. Aedeagus short and thick, apex obtuse.


Distribution: P. R. China: Sichuan.

Etymology: The name was derived from Latin "tri" (= three) and "furca" (= fork).

Remarks: The new species is allied to _B. polyeuctes polyeuctes_ (Doubleday), but differs from the latter by the following characters:

1. Upper side of hind wing: (a) with a narrow, arched red spot on tornus; (b) tail spot smaller; (c) the small red admarginal spot at the end of vein Cu1 hardly visible; (d) cell distinctly with 2 black lines.

2. Male genitalia: (a) superuncus trifurcate. This character is not found in any known species of the genus; (b) upper half harpe sclerotized slightly and waved obviously in outer margin [outer margin harpe straight and toothed in _B. polyeuctes polyeuctes_ (Doubleday)].

Byasa dasarada dasarada (Moore)


_Atrophaneura dasarada_ (Moore): Bridges, 1988, I: 79.


Distribution: The nominate subspecies occurs in India (Assam, Sikkim), Bhutan, Nepal, and Myanmar.
Byasa dasarada ouvrardi (Oberthür)


Female genitalia: Fig. 24.
Specimens examined: P. R. China: Yunnan: Zhenkang Co., 1620m, 1♀, May 10, 1955.
Distribution: P. R. China: Yunnan, Sichuan.

Byasa dasarada melanura (Rothschild)


Male genitalia: Fig. 10.
Distribution: P. R. China: Hainan.
Remarks: *B. stenoptera* Chou & Gu was described from Hainan. Comparison of the adults and the male genitalia of this species with those of *B. dasarada melanurus* Rothschild from Hainan, confirmed that they are conspecific.

Byasa latreillei latreillei (Donovan)


Distribution: P. R. China: Xizang; India: Sikkim.

Byasa latreillei kabrua (Tytler)


Male genitalia: Fig. 13.
Female genitalia: Fig. 25.
Distribution: P. R. China: Guangxi, Sichuan, Yunnan; North India.

Byasa polla de Niceville


Male genitalia: Fig. 14.
Specimens examined: None.
Distribution data: P. R. China: Yunnan; Myanmar; Thailand; Laos; India.
Discussion

The species of *Byasa* may be arranged under two groups: Group A includes *Byasa alcinous*, *loochoanus*, *plutonius*, *impediens*, *daemonius*, *mencius mencius*, and *crassipes*. These are without large white spots on hind wing. Group B, with large white spots on hind wing, includes the other species of the genus. Species under Group A do not have clear cut external characters to differentiate them (except *B. crassipes*) but can be easily distinguished by the genitalia. The same is true for *B. dasarada*, *polyeuctes* and *trifurca* of Group B. It is, therefore, necessary to examine the genitalia in order to correctly identify the species of this genus.

Acknowledgments

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References

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Figs. 1-5. Male genitalia: 1, *B. confusa* (Rothschild); 2, *B. alcinous loochooanus* (Rothschild); 3, *B. impediens impediens* (Rothschild); 4, *B. nevilli* (Wood-Mason); 5, *B. daemonius yunnana* Oberthür.
Figs. 6-9. Male genitalia: 6, *B. mencius mencius* (Felder & Felder); 7, *B. plutonius plutonius* (Oberthür); 8, *B. plutonius tytleri* Evans; 9, *B. crassipes* (Oberthür).
Figs. 16-21. Female genitalia: 16, *confusa* (Rothschild); 17, *B. impediens impediens* (Rothschild); 18, *B. mencius mencius* (Felder & Felder); 19, *B. nevilli* (Wood-Mason); 20, *B. hedistus* (Jordan); 21, *B. polyeuctes polyeuctes* (Doubleday).