

Discovery of a New Pierid Butterfly, *Aporia gigantea cheni* Hsu and Chou (Lepidoptera: Pieridae), from Taiwan

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Yu-Feng Hsu and Wen-I Chou (1999) Discovery of a new pierid butterfly, *Aporia gigantea cheni* Hsu and Chou (Lepidoptera: Pieridae), from Taiwan. *Zoological Studies* 38(2): 222-227. A new subspecies of a large-sized pierid butterfly, *Aporia gigantea cheni*, is described and illustrated based upon material collected from the southern portion of the Central Range of Taiwan. Compared to the nominotypical subspecies of *A. gigantea* of western China, the new subspecies is darker, smaller, and lacking sexual dimorphism in wing patterns. The discovery of a new subspecies of a large butterfly reveals that the inventory of the butterfly fauna of Taiwan is still far from being complete. This butterfly also serves as a good illustration of zoogeographic disjunction in its distribution.

Key words: Taiwan, China, Disjunction, Lepidoptera, New subspecies.

With the study of butterflies of Taiwan started by Wallace and Moore (1866) over a century ago, the documentation of the so-called large- to medium-sized butterflies, namely, those species in the families Papilionidae, Pieridae, and Nymphalidae (*sensu* Scoble 1992), was considered to have been completed, according to Shirôzu (1986). His statement was credible since the last described larger butterfly species from Taiwan was named in the 1960s (Murayama 1961). However, during a biological survey on the southern part of the Central Range of Taiwan, a series of specimens of *Aporia gigantea* Koiwaya, a large pierid species recently described from western China, was collected. Koiwaya (1993) listed 9 specific characters useful for separation of *A. gigantea* from a phenotypically similar species, *A. largeteaui* Oberthür. The specimens from Taiwan appear to agree with *A. gigantea* in these features; however, they also possess distinct wing patterns, which make them distinguishable from samples of populations in western China and thus deserving of a subspecific status. This discovery reveals that the inventory of the butterfly fauna of Taiwan is still incomplete, although this continental island has been well collected. This statement is further sup-

ported by the multiple species of smaller butterfly species added to the lists of Taiwan fauna in recent years. For example, *Choaspes xanthopogon* (Kollar), a larger hesperiid, was found in 1986 (Hsu 1988); *Nacaduba berenice* (Herrich-Schäffer), a lycaenid, in 1988 (Hsu 1990); and *Sibatanozephyrus kuafui* Hsu and Lin, a lycaenid, in 1992 (Hsu and Lin 1994). Moreover, with *A. gigantea* currently known only from Sichuan Prov. in western China, the discovery of the population in Taiwan shows another disjunction in continuity of butterfly distribution between the montane fauna of Taiwan and that of western China. Similar examples are found in a few recently described butterfly species from Taiwan (Hsu 1988, Hsu and Yen 1997). Such long distance disjunction in faunistic distribution is best explained by past wider uninterrupted ranges of these butterflies in previous glacial periods; the extant populations being considered relicts.

MATERIAL AND METHODS

Adults were collected from the field, and pinned specimens were subsequently prepared in the

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laboratory. Dissection of genitalia was performed by first removing the entire abdomen, which was placed in 10% KOH at room temperature for 24 h to dissolve the soft tissues, then transferred to cellusolve for another 24 h for descaling, and finally placed in 70% ETOH for dissection. The dissected parts are preserved in 70% ETOH.

Host plant association was confirmed by checking the vegetation growing within the vicinity of the adult activity and by field observations of female oviposition behavior. The collected immature specimens were given a HSU rearing lot number for subsequent observations and data recording. A photocopy of the rearing lot is available upon request.

Descriptions are based on fresh specimens. Terminology of wing patterns follows Nijhout (1991). Descriptions of genitalia follow Klots (1970). Abbreviations of characters are as follows: A, abdominal segment; Sc, subcosta; R, radius; M: median vein; FL: Length of forewing; AL: Length of antenna.

Type specimens are deposited and distributed to the following collections: Department of Entomology, the Natural History Museum, London (BMNH); Department of Entomology, California Academy of Sciences, San Francisco (CAS); Department of Biology, National Taiwan Normal University, Taipei (NTNU); Insect Museum, Department of Entomology, National Taiwan University (NTUIM); Institute of Zoology, Academia Sinica, Beijing

(IZASB); Department of Entomology, National Museum of Natural Science, Taichung (NMNS); National Biosystematics Laboratory, Kyushu University, Fukuoka (KU); Chengdu Museum of Butterflies, Chengdu (CMB); Chongqing Natural History Museum (CNHM); Kadoorie Farm and Botanic Garden of Hong Kong (KFBGHK); T. Fujioka Collection, Tokyo (TF); C. C. Chen Collection, Taipei (CCC); W. I. Chou Collection, Taipei (WIC); and the C. C. Lu Collection, Changhua (CCL).

***Aporia gigantea cheni* ssp. nov.**

(Figs. 1-7)

Holotype ♂: TAIWAN: PINGTUNG Co., Wutai, Wutoushan, 1200 m, 4/5 Apr. 1998. Coll. C. C. Chen (NTUIM).

Paratypes: 2 ♂: same data as holotype (CCC); 16 ♂, same locality and date as holotype (1 ♂ dissected: genitalia YFH 1135), coll. W. I. Chou (BMNH, CAS, NTUIM, NTNU, WIC); 15 ♂ 2 ♀, same locality as holotype, 10/11 Apr. 1998, coll. W. I. Chou (NMNS, NTUIM, NTNU, WIC); 11 ♂ 4 ♀, same locality as holotype, 10/11 Apr. 1998 (1 ♀ dissected: genitalia YFH 1138), coll. Y. F. Hsu (BMNH, CMB, CNHM, IZASB, KFBGHK, KU, NTNU, NTUIM, TF); 4 ♂ 4 ♀, same locality as holotype, 14 Apr. 1998, coll. C. C. Lu (CCL).

Diagnosis: Extensive submarginal band and parafocal element separate white scaling of distal portions of wings forming arrow-shaped markings in *A. gigantea cheni*, in contrast to oval-shaped markings in the nominotypical subspecies. *A. gigantea cheni* lacks sexual dimorphism on wing patterns,

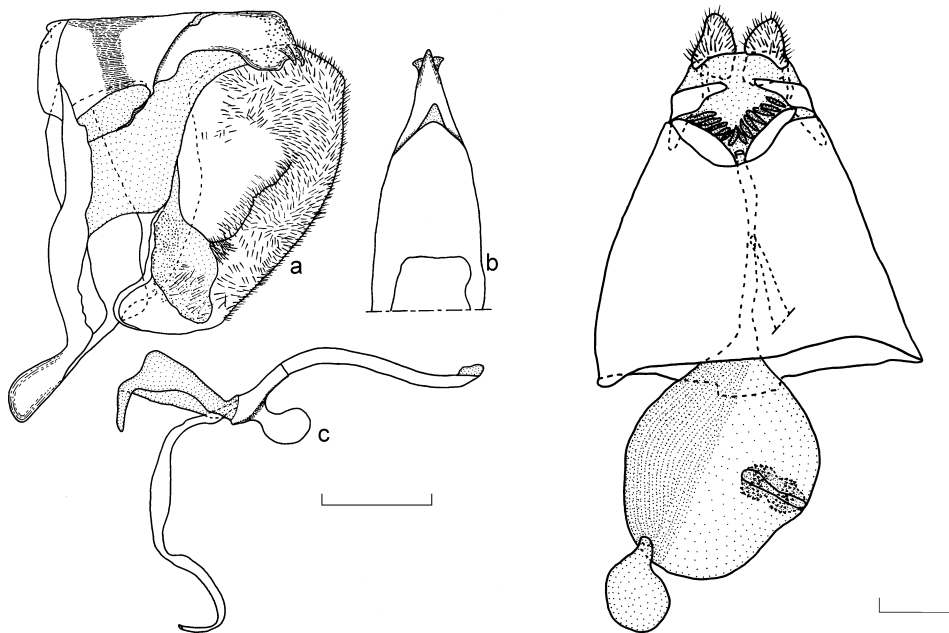


Figs. 1-4. *Aporia gigantea cheni* ssp. nov. 1. Upperside of holotype male. 2. Underside of holotype male. 3. Upperside of paratype female. 4. Underside of paratype female.

whereas prominent sexual dimorphism with whiter males is found in the nominotypical subspecies. Moreover, the size of field-collected specimens of *A. gigantea cheni* is much smaller than that of the nominotypical subspecies, with the length of forewing ranging from 34.5 to 42.5 mm (δ , $n = 49$) and 37.5 to 43.6 mm (φ , $n = 10$) for *A. gigantea cheni* vs. 40 to 51 mm (δ , data resource: Koiwaya 1993) and 44 to 54 mm (φ , data resource: Koiwaya 1993) for the nominotypical subspecies.

Description: *Male* (Figs. 1, 2): FL 39.98 ± 2.08 mm ($n = 49$). AL 17.69 ± 0.85 mm ($n = 49$). **Head:** Hairy, clothed with black hairs on vertex and frons; eye semi-spherical, bright red; labial palpus hairy, porrect, pointed, projecting anteriorly; 3-segmented, each segment approximately equal in length, 1st and 2nd segments covered with long black mottling with creamy-white hairs, 3rd segment covered by appressed black hairs; maxillary reduced, invisible; proboscis black, unscaled; antennae smooth-scaled, dark brown. **Thorax:** Clothed with black hairs, mottled with white. Legs with tibial spur formula 0-2-2, covered by appressed black scaling but femur with attached long black hairs ventrally. White scaling present on outer surfaces of femurs and tibiae, forming a longitudinal line. Pretarsal claws laterally flattened, bifid. **Forewing:** 11 veins, M_1 forked with R_3 at distal $0.27 \times R_3$ length, R_{4+5} forked with R_3 at distal $0.67 \times R_3$ length; costa nearly straight,

curved near base, termen convex, apex rounded, dorsum straight. Ground color of upperside creamy white with extensive dark brown scaling distally and along veins. Proximal and distal bands of central symmetry system fused, forming a broad dark brown patch at distal end of discal cell. Parafoveal element forming a dark brown stripe parallel to termen. Submarginal band extensive, forming a dark brown margin of wing. Dark brown pattern greatly expanded along all veins with creamy-white markings. Underside patterns and coloration similar to those of upperside but with dark brown scaling less extensive. Fringe dark brown. **Hindwing:** 9 separate veins, with outward-curving humeral vein near base of $Sc + R_1$. Upperside coloration similar to that of forewing but with less-extensive dark brown scaling. Proximal and distal band of central symmetry system hardly recognizable. Posterior portion of parafoveal element declining into a faint band. Basic coloration of underside similar to that of upperside but dark brown scaling further reduced. An orange wing root band present proximal to humeral vein. Fringe dark brown, slightly longer than that of forewing. **Abdomen:** Clothed with appressed dark brown scaling but with extensive creamy-white scaling laterally. **Male genitalia** (Fig. 5): Sclerites of 9th segment forming a complete ring. Uncus approximately equal to tegumen in length, conjoined with latter along a narrow membranous, linear area. Dorsal surface of tegumen and



Figs. 5-6. Genitalia of *Aporia gigantea cheni* ssp. nov. **5.** Male, drawn from genitalic dissection YFH 1135, **a.** lateral view of sclerites of 9 + 10 genitalic segments with right valva attached, **b.** dorsal view of tegumen and uncus, **c.** lateral view of phallus (scale bar = 1 mm). **6.** Female, drawn from genitalic dissection YFH 1138 (scale bar = 1 mm).



Fig. 7. Hostplant of *Aporia gigantea cheni* ssp. nov., *Mahonia oiwakensis*, growing on a rocky cliff at the type locality (as indicated by arrow).



Fig. 8. A cluster of eggs of *Aporia gigantea cheni* ssp. nov. attached on the underside of a leaflet of *Mahonia oiwakensis* (as indicated by arrow).

uncus smooth. Caudal end of uncus enlarged, flattened laterally, forming a ridge with irregular margin dorsad, bearing a pair of down-curved hooks at terminal end. Saccus produced, club-like, approximately 0.57x length of tegumen. Phallus cylindrical, downcurved posteriorly, re-bent caudally; phallobase approximately 0.40x length of aedeagus. Coecum penis forming a pendent oval lobe hanging ventrad. Valva densely setose, large, lobe-like; sacculus forming a serrated ridge dorsad.

Female (Figs. 3, 4): FL 42.55 ± 2.90 mm ($n = 10$); AL 18.16 ± 0.98 mm ($n = 10$). External features, wing shape, and patterns basically identical to those of males, except scaling of wings translucent. *Female genitalia* (Fig. 6): Corpus bursae oval, with appendix bursae attached cephalically. Lateral 1/2 of corpus bursae densely covered by minute pinules. Point of origin of ductus seminalis located at midpoint of ductus bursae; double, elongate signa present side by side, forming longitudinal sclerotized

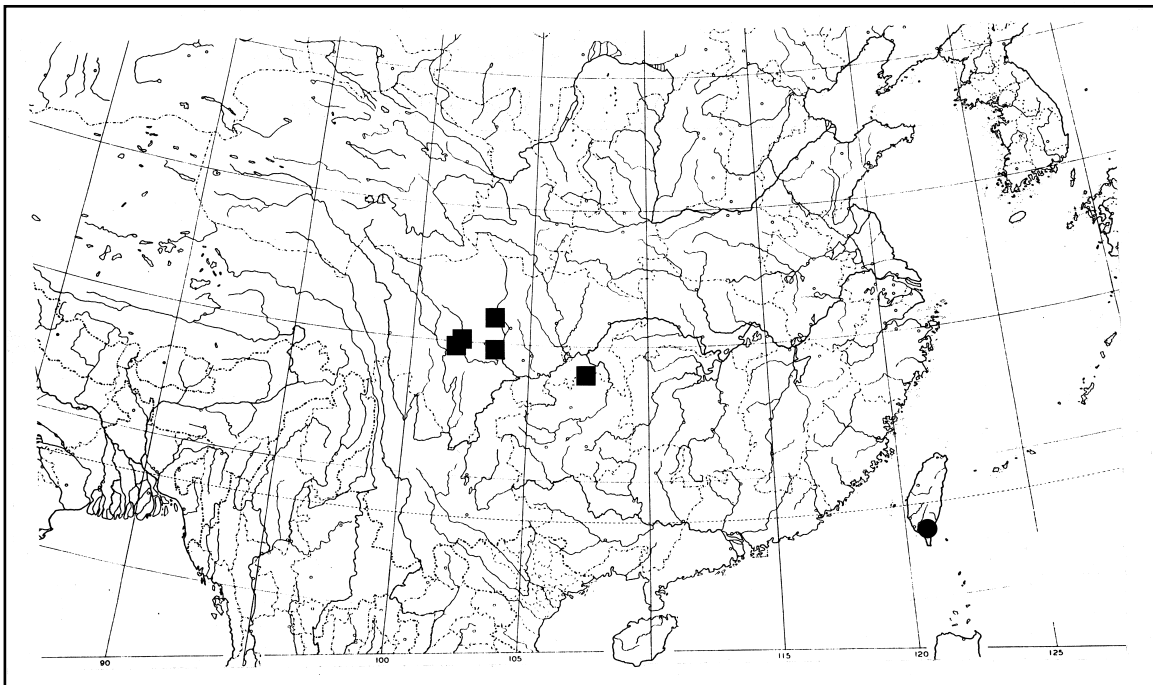


Fig. 9. Distribution of *Aporia gigantea gigantea* Koiwaya (squares) and *A. gigantea cheni* ssp. nov. (circle).

bands near distal end of corpus bursae. Signum invaginated, forming a transverse patch with anterior and posterior, medial cleft; 2 longitudinal bands of prominent teeth present on inner surfaces. A8 weakly sclerotized, with sternite reduced; apophyses anteriores short, conical. A9 + 10 with apophyses posterior forming short bar; papillae anales setose, ovate in shape. Lamella antevaginalis forming a pair of large folded oval sclerites by ostium bursae. Lamella postvaginalis forming a series of sac-like folds bearing minute trichomes.

Host association: The confirmed larval host of *A. gigantea cheni* is *Mahonia oiwakensis* Hayata (Berberidaceae) (HSU 98D19, Fig. 7), a plant endemic to Taiwan growing on rocky cliffs at higher elevations (Lu and Yang 1996). Koiwaya (1997) reported that larvae of the nominotypical subspecies *A. gigantea gigantea* feed on an unidentified *Mahonia* species. Judging from the morphology of the plant shown on the attached photograph in his article (p. 4, fig. 1), the plant is undoubtedly *M. bealei* (Fortune) Carrière based on the diagnoses provided by Anonymous (1972).

Biology: Eggs were laid in a single-layered cluster on the underside of the leaflet of the host (Fig. 8). The example of HSU 98D19 had 226 eggs in a cluster. Hatched larvae devoured the lower epidermis and leaf tissues above it, leaving window-like feeding patterns on the leaves. Larvae also spun weak webs around the bases of leaflets.

Voltinism: univoltine; adult occurs in spring (April).

Distribution (Fig. 9): This new subspecies is endemic to Taiwan. The nominotypical subspecies is found flying in Sichuan Prov. of continental China.

Etymology. This new subspecies is named after the discoverer of the butterfly, Mr. Chang-Ching Chen, a prominent coleopteran investigator.

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臺灣截脈絹粉蝶 *Aporia gigantea cheni* ssp. nov. 之發現

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本文根據從臺灣中央山脈南段獲得之材料記述及圖示一大型粉蝶截脈絹粉蝶的新亞種。與分布於中國大陸西部的原亞種比較，臺灣亞種的色澤較黑、體型較小，且翅膀斑紋樣式缺乏雌雄二型性。此大型新亞種蝴蝶之發現說明臺灣地區的蝶相雖經一世紀以上的調查，仍未完備。截脈絹粉蝶在臺灣之發現可視為動物地理上隔離分布又一良好例證。本新亞種之亞種名係紀念發現者鞘翅目昆蟲研究家陳常卿先生。

關鍵詞：臺灣，中國，隔離分布，鱗翅目，新亞種。

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