

## Review of the genus *Nannoarctia* Kôda, s. str. (Lepidoptera, Arctiidae)

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**Abstract** The nominotypical subgenus *Nannoarctia* Kôda, 1988 is discussed. The type species of the genus should be changed to *N. takanoi* Sonan, 1934, based on incorrect determination by Kôda, 1988. Species of this group have few distinguishing characters in the male genitalia and are better separated by the wing pattern. Six species are recognized, and one species and three subspecies are described as new: *N. himalayana* spec. nov. from the Himalayas, *N. conjuncta sumbana* subsp. nov. from Sumba and Sumbawa, *N. c. javanica* subsp. nov. from Java, *N. h. nepalica* subsp. nov. from Nepal and East India. Lectotypes are designated for: *N. c. williami* (Rothschild, 1910) from Bali, *N. tripartita* (Walker, 1855) from Burma, Moulmein, and *N. obliquifascia* (Hampson, 1894) from Burma, Rangoon.

The genus *Nannoarctia* Kôda, 1988, was described for the single species, *N. integra* (Walker, 1855). The description was based on material from the Matsumura collection which consisted only of the endemic Taiwan species *N. takanoi* Sonan, 1934. Moreover, Matsumura had already incorrectly determined his specimens as *N. integra* (Walker, 1855). Dubatolov, Haynes & Kishida (2007) reviewed the composition of this genus, which contains two subgenera, the monotypic *Pseudorajendra* Dubatolov, Haynes & Kishida, 2007 for the Hindustan *N. dentata* (Walker, 1855), and a nominotypical subgenus, which includes *N. integra* (Walker, 1855) from the Philippines; *N. takanoi* (Sonan, 1934) from Taiwan; *N. obliquifascia* (Hampson, 1894) from East India and Nepal, Burma and South China; *N. tripartita* (Walker, 1855) from South China, East India and Indo-China; *N. williami* (Rothschild, 1910) from Java and Bali (Indonesia); *N. conjuncta* (Hampson, 1901) from Lombok (Indonesia). However, during the previous work, they could not satisfactorily determine specific level for these taxa due to forewing pattern variation and similar male genitalia structure.

After receiving additional material and studying specimens from the Natural History Museum (London) collection, several new species of this group were discovered, and it became possible to determine small but clear differences between the known and new species. A review of the nominotypical subgenus *Nannoarctia* Kôda is given below.

Abbreviations: BMNH—the Natural History Museum (London, U.K.); EIHU—Hokkaido University (Sapporo, Hokkaido, Japan); IZAS—Institute of Zoology, Academia Sinica (Beijing, China); NSMT—National Science Museum (Tokyo, Japan); SZMN—Siberian Zoological Museum of the Institute of Animal Systematics and Ecology, SB RAS (Novosibirsk, Russia); YK—Y. Kishida's personal collection (Tokyo, Japan); ZFMK—Zoologische Forschungsinstitut und Museum "Alexander Koenig" (Bonn, Germany); ZIN—Zoological Institute, Russian Academy of Sciences (St.-Petersburg, Russia).

### *Nannoarctia* Kôda

*Nannoarctia* Kôda, 1988, *Tyô Ga* 39: 4-6.

Type species: *Pericallia takanoi* Sonan, 1934 (= *integra* Matsumura, 1931), cited as *Aloa integra* Walker, 1855 (incorrect determination).

For the genus description, Kôda (1988) used specimens of *N. takanoi* (Sonan, 1934) from Taiwan; identification is clearly visible from his photographs. For his study he used material from Matsumura's collection in Hokkaido University (Sapporo, Japan) in which there are no *N. integra* (Walker, 1855) specimens from the Philippines.

Diagnosis. Forewing length: males 14-18 mm, females 15-18 mm. Male antennae serrate. Eyes large,

hemispheric and naked. Proboscis noticeably longer than palpi, but shorter than head width. Fore tibiae simple and without apical spine. Epiphysys approximately 1/3 of the tibia length. Middle tibiae with one apical pair, hind tibiae—with two pairs of thin spurs. Claws with a slight incision medially. Tegulae and patagiae light brown and lacking a central dark spot or band. Forewing vein  $R_2$  stalked with  $R_{3+5}$  (venation type C by Sotavalta, 1964). Tympanum with a small flattened enlargement. Forewings brown, with an oblique light band from the apex towards the wing base consisting of distinct fused or connected spots. A few white submarginal spots are sometimes present. Hindwings yellow, without any rose tint; costal margin brown; submarginal spots small if present. Head yellow with a brown spot on the vertex. Thorax dark brown. Abdomen yellow with transverse brown stripes dorsally.

Male genitalia (Figs 41–84). Uncus triangular, not narrowing to the base; collar of the proximal part of the tegumen broad. Paratergal processes (subunci) short, triangular shape and without any teeth. Valvae elongate, without additional processes or spines. Juxta short, with two lateral processes at the apex. Aedeagus sharply bent apically. Vesica with two distal and dorsal patches of dense spine-like cornuti. There are two lateral spiniculi patches at the base of vesica; the left patch is band-like and consists of small and often dense spines; the right patch consists of small rare spiniculi.

Several characters are considered to be synapomorphic for the genus: elongate finger-like valvae, presence of short triangular subunci, aedeagus strongly arched apically.

Distribution. Taiwan, South-Western and Southern China, East India, Indo-China, Himalayas, West Sundaland, Philippines.

Comments. It is difficult to determine the systematic status of many *Nannoarctia* populations. Moths in the same populations often have noticeable variability in wing spot size and different elements of the overall pattern. The situation is complicated by a similarity of male genitalia within the subgenus, but with variation in some structures such as the spine patch on the apex of the aedeagus. However, some populations in the Pacific islands are considerably distanced and include island territories where *Nannoarctia* have not been recorded. Where differences in wing pattern were found coinciding with patches of *Nannoarctia* distribution on different islands and island groups, differences in male genitalia were investigated. For determining continental species, consideration was given to the knowledge that *Nannoarctia* occur mostly in lowlands or low mountainous regions. In this case, wide and high mountain territories are considered to be barriers for species distribution. However, there are two *Nannoarctia* species (*tripartita* and *obliquifascia*) with differences in wing pattern that occur together in some parts of Indo-China; they are sympatric and there is a good evidence for their real specific status.

## TAXA FROM THE PACIFIC ISLANDS

### *Nannoarctia integra* (Walker) (Figs 2–4)

*Aloa integra* Walker, 1855; *List Specimens lepid. Insects Colln. Br. Mus.* **3**: 707; type locality: “Philippine Islands”.  
*Rajendra integra*: Kirby, 1892, *Synonymic Cat. Lepid. Heterocera* **1**: 248; Semper, 1899, *Schmett. Philipp.* **2**: 486, pl. LV, fig. 6.

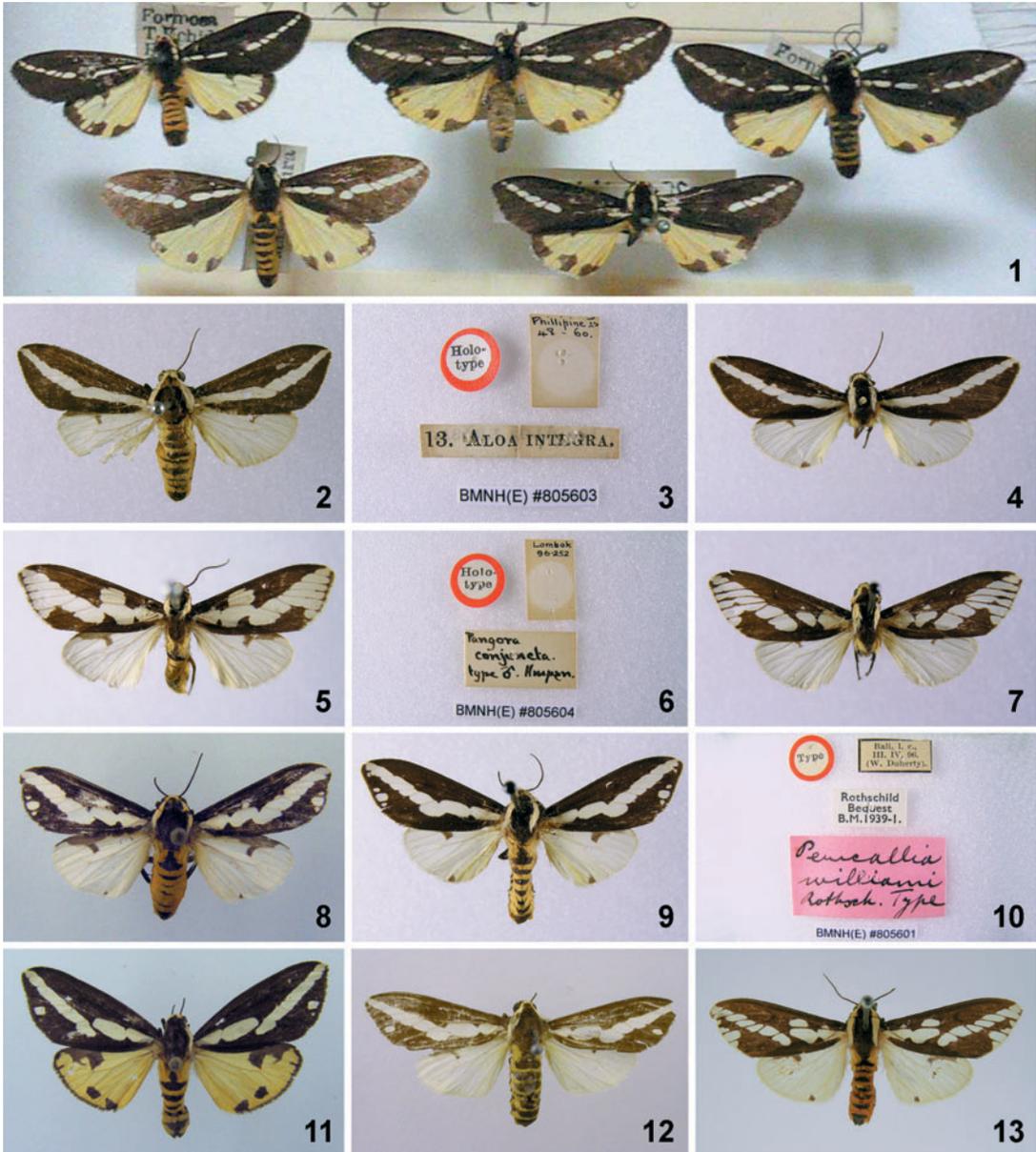
*Pericallia integra*: Hampson, 1901, *Catalogue Lep. Phal. Colln Br. Mus.* **3**: 352, 359, pl. XLVII, fig. 23; Rothschild, 1910, *Novit. Zool.* **17** (2): 171; Rothschild in Seitz, 1914, *Gross-Schmett. Erde* **10**: 256, fig. 19h; Strand, 1919, *Lep. Cat.* **22**: 262.

*Nannoarctia integra*: Dubatolov, Haynes, Kishida, 2007, *Tinea* **20**: 67.

Type material. Holotype ♂, “Holo- / type”, “Phillipine Is / 48 – 60.”, “13. ALOA INTEGRAL”, “BMNH(E) #805603”.

Additional material. PHILIPPINES, Luzon: 2 ♂ (incl. gen. slide No 4439), 1 ♀, subprov. Benquet, Klondyke, camp 1, 800 ft., 20.V.1912, A.E. Wileman (BMNH); 1 ♀, subprov. Benquet, Baguio, A.E. Wileman (BMNH); 1 ♂ (gen. slide 4433), 1 ♀, prov. Rizal, Manila, sea level, 10.VII.1912, A.E. Wileman (BMNH).

Distribution. Philippines: Luzon.



Figs 1–13. *Nannoarctia* moths from the Pacific islands. 1. *N. takanoi* Sonan, , Taiwan [=Formosa] (EIHU); 2. *N. integra* Wlk., holotype, , “Phillipine Is.” (BMNH); 3. Ditto, holotype labels; 4. Ditto, , Philippines, Luzon, subprov. Benguet, Klondyke (BMNH); 5. *N. conjuncta* Hmps., holotype, , Indonesia, Lombok (BMNH); 6. Ditto, holotype labels; 7. Ditto, , Indonesia, Lombok (BMNH); 8. Ditto, , Indonesia, Lombok (YK); 9. *N. conjuncta williamsi* Rothsch., lectotype, , Indonesia, Bali (BMNH); 10. Ditto, holotype labels; 11. *N. conjuncta williamsi* Rothsch., , Indonesia, Bali; 12. *N. conjuncta javanica* ssp. nov., holotype, , Indonesia, Java (ZIN); 13. Ditto, , Indonesia, E. Java, Trettes (BMNH).



Figs 14–22. *Nannoarctia conjuncta* moths from the Pacific islands. 14–20. *N. conjuncta javanica* ssp. nov., paratypes, Indonesia, Java: 14–15. , Nongkodjadjar (BMNH); 16. , Soekaboemi (=Sukabumi) (BMNH); 17–18. , Mt. Gedeh (BMNH); 19–20. , Tretes near Mt. Ardjuno (BMNH); 21. *N. conjuncta sumbana* ssp. nov., holotype, , Indonesia, Sumba Is. (NSMT); 22. Ditto, paratype, , Indonesia, Sumbawa Is., Tambora (BMNH).

Diagnosis. Forewings dark brown with a wide and unbroken oblique light fascia from the wingbase to apex. The oblique fascia is continuous, and without noticeable narrowing, but sometimes with waisting in one or two places behind the cell. The male is characterized by yellowish-white hindwings with a dark costal margin, and a small discal and two marginal spots mainly at the apex and tornus; in the females these spots are bright yellow and larger.

Male genitalia (Figs 41–44). Valva not tapering, broadly rounded at the apex, and mostly curved inward. Paratergal processes small. Vesica with a distal cornuti patch of strong but short spiniculi and a dorsal cornuti patch of spines. A patch of spines on the top of the aedeagus is wide and occupies much of the dorsal surface. Medial plate of the VIII abdominal sternite with a deep triangular hollow; lateral lobes tapering apically into long or short processes.

Comparison. See *N. takanoi*.

### *Nannoarctia takanoi* (Sonan) (Fig. 1)

*Pericallia integra*: Matsumura, 1931 (nec Walker, 1955), *6000 Ill. Ins. Japan Emp.*: [978], fig.; type locality: [Taiwan]" (in Japanese).

*Pericallia takanoi* Sonan, 1934, *Kontyû* 8: 213, fig. 2; type locality: "Karenko (Formosa)" [Taiwan].

*Nannoarctia integra*: Kôda, 1988, *Tyô Ga* 39 (1): 6; Inoue, Kishida, 1992, *Lepid. Taiwan* 1: 170.

Material examined. 5 , Formosa, other data not visible on the photograph (EIHU).

Distribution. Taiwan. This is probably an extinct species; it has not been recorded since the 2nd World War.

Diagnosis. Only males are known. Forewings blackish with narrow oblique light fascia abutting on

the apex and with a subapical spot mostly narrower than its length. The oblique fascia is always interrupted behind the base of vein  $Cu_2$ ; with the exception of the basal spot; the spots behind the cell are sometimes absent. Hindwings yellow with discal and submarginal, sometimes confluent, black spots.

Male genitalia (Fig. 45). There is the single male genitalia figure published by Kôda (1988). According to this illustration, valva is slightly narrowing to the apex, broadly rounded, and with a strong inwardly curving apical tip. Paratergal processes triangular, not small, and broadly rounded apically. Vesica with an apical cornuti patch composed of very small spiniculi, much weaker than the spines on the dorsal cornuti patch. The spine patch on the top of the aedeagus is not wide, and mostly occupies the dorsal surface. VIII sternite was not available for examination.

Comparison. It is curious that this species has been confused with *N. integra* for much of the XX century. It is very easy to separate the species by the forewing pattern: the oblique light band is continuous in *N. integra* and narrow and broken in *N. takanoi*. Hindwings are yellow in *N. takanoi* and yellowish-white in *N. integra*. Hindwing dark spots are large in *N. takanoi*, similar to females, and noticeably larger than in males of *N. integra*. Although the valva structure is similar in both species, the spine patch on the aedeagus is different: it is very wide in *N. integra* and less so in *N. takanoi*, and occupies more than half of the aedeagus lateral side.

***Nannoarctia conjuncta conjuncta* (Hampson), stat. nov.** (Figs 5–8)

*Pericallia conjuncta* Hampson, 1901, *Catalogue Lep. Phal. Colln Br. Mus.* **3**: 358, pl. XLVII, fig. 11; type locality: “Lombok”; Rothschild, 1910, *Novit. Zool.* **17** (2): 170; Rothschild in Seitz, 1914, *Gross-Schmett. Erde* **10**: 257, fig. 24e; Strand, 1919, *Lep. Cat.* **22**: 259.

*Nannoarctia conjuncta*: Dubatolov, Haynes, Kishida, 2007, *Tinea* **20** (1): 67.

Type material. Type ♂, “Holotype”, “Lombok / 96-252”, “Pangora / *conjuncta*. / type ♂. Hmps.”, “BMNH(E) #805604”.

Additional material. INDONESIA: 1 ♂, Lombok I., I.1992 (YK); 1 ♀, gen. slide No 4438, Lombok, 1500 Ft., V.[18]96, Everett (Rothschild Bequest, BMNH); 1 ♀, Lombok, Sapit, 2000’ Mai-Juni 1896 (BMNH).

Distribution. Indonesia: Lombok Is.

Diagnosis. Only males are known. Forewings dark brown. Typically, the light oblique fascia is very wide, abuts on the apex, and the subapical spot is nearly two times wider than the distance between  $M_1$  and  $R_5$ . Spots from the apex to  $Cu_1$  are sometimes fused with subapical spots, but occasionally the fascia is isolated from the three submarginal light spots; the middle one of these three between  $M_3$  and  $Cu_1$  is the largest. Two large light spots behind the cell vary in shape, and are either lightly fused or isolated from each other by narrow jumpers. A spot at the hind side of the cell varies significantly in size and shape, being small, dot-like, or very large and fused with a middle spot behind the cell—as in the type specimen. Hindwings yellowish-white, with a dark costal margin, confluent discal spot, and sometimes with a dark dot in the tornus.

Male genitalia (Figs 46–49). Valvae rounded apically and lightly curved. Paratergal processes large, apically rounded, short or long. Left spine band of short broad rough spines on the aedeagus apex. Dorsal cornuti patch on the vesica of dense and moderately long spines; the apical patch consisting of small spines. Medial plate of the VIII abdominal sternite with a deep concave triangular hollow; wide lateral plates tapering to the apex.

***Nannoarctia conjuncta williami* (Rothschild), stat. nov.** (Figs 9–11)

*Pericallia williami* Rothschild, 1910; *Novit. Zool.* **17** (2): 170; **18**: t. 3, f. 16; type locality: Bali, low country”; Rothschild in Seitz, 1914, *Gross-Schmett. Erde* **10**: 256, fig. 24f; Strand, 1919, *Lep. Cat.* **22**: 269.

*Nannoarctia williami*: Dubatolov, Haynes, Kishida, 2007, *Tinea* **20** (1): 67.

Type material. Lectotype ♂, “Type”, “Bali, l. c., / III. IV. 96. / (W. Doherty)”, “Rothschild / Bequest/

B.M.1939-I.", "*Pericallia / williami / Rothsch. Type*", "BMNH(E) #805601".

Additional material. INDONESIA: 2 ♀, (incl. gen. prep. 4430), W. Bali, Prapetagoeng, 1 500 ft., V.1935, J.P.A. Kalis (Rothschild Bequest, BMNH); 1 ♀, Bali (BMNH); 2 ♀. Bali, IV 1989 (YK).

Distribution. Indonesia: Bali Is.

Diagnosis. Variable subspecies. Typically, the oblique light forewing band is broad and entirely confluent, with only two constrictions or breaks behind the cell, but occasionally the band is wide behind the cell and without constrictions. There are normally three, but occasionally one to five, submarginal spots, which are sometimes reduced to a single larger dot. Occasionally there is a small oval dot at the hind cell margin and base of  $Cu_2$ . Hindwings yellowish-white in males, with a dark costal margin, confluent discal spot, and rarely a very small dot at the tornus. Females with yellow hindwings, a dark margin, and three larger submarginal dark spots.

Male genitalia (Figs 50–51). Valvae rounded at the apex which is sharply curved inwards. Paratergal processes large, rounded apically. Spines and cornuti on the aedeagus and vesica, and the structure of the VIII abdominal sternite as nominotypical subspecies.

Comparison. It is difficult to distinguish the two subspecies, *N. c. williami* and *N. c. conjuncta*; both noticeably vary in forewing pattern and there are some specimens with nearly identical pattern. Generally the light forewing pattern is more enlarged in *N. w. conjuncta*.

Remarks. *Pericallia williami* was described for specimens from Bali and Java. However, they differ noticeably by the valva shape, being rounded at the apex in specimens from Bali and tapering in specimens from Java. Rothschild designated the specimen from Bali as typical for this taxon.

### *Nannoarctia conjuncta javanica* Dubatolov et Kishida, **ssp. nov.** (Figs 12–20)

*Aloa tripartita* (part.): Horsfield & Moore, 1859, *Catal. Lepid. Insects Mus. Nat. Hist. East-India House* 2: 360.

*Alphæa obliquifascia* (part.): Hampson, 1894; *Moths India* 2: 24; Hampson, 1901, *Catalogue Lep. Phal. Colln Br. Mus.* 3: 359y.

*Pericallia williami* (part.): Rothschild, 1910; *Novit. Zool.* 17 (2): 170; 18: t. 3, f. 28; Strand, 1919; *Lep. Cat.* 22: 269.

*Pericallia obliquifascia* (part.): Rothschild in Seitz, 1914; *Gross-Schmett. Erde* 10: 256-257 (Java); Strand, 1919; *Lep. Catal.* 22: 266-267 (Java).

Material. Holotype – ♀, INDONESIA, Java, Tengström [coll.] (ZIN). Paratypes: 2 ♀, Java, Mt. Merapi, 25.XII. 1995 (YK); E. Java, Tretes near Mt. Ardjuno, 1-2.I.1995 (YK); 1 ♀, E. Java, Nongkodjadar, 4,000', II.1934, A.M.R. Wegner (Rothschild Bequest, BMNH(E) #805616, BMNH); 2 ♀, Java (BMNH); 2 ♀, Java, Soekaboemi [=Sukabumi] (BMNH); 1 ♀, Java, Mt. Gedeh (BMNH); 1 ♀, E. Java, Tretes [Tretes], 3000', May, 1932, J. P. A. Kalis (Rothschild Bequest, BMNH); 1 ♀, Java, Nongkodjadar (BMNH); 1 ♀, Java occident, Mons Gede (BMNH); 2 ♀, Java, Mt Slamet, 10. X. 1996.

Description. Forewing length 15–16 mm. Wing pattern highly variable. In the holotype, spots of the oblique white forewing band are fused; two spots behind the cell are large with constrictions and fused with the band; submarginal spot is single. As examples of variability: forewing oblique band is sometimes crossed by dark veins; two spots behind the cell are sometimes unconnected and accompanied by a small or large spot in the cell. The white spot behind the origin of  $Cu_2$  is often wide, but occasionally present as a narrow stroke. The subapical white spot might be wide, touching the external margin, quadrangular or (in one female example), narrow. Submarginal spots vary from a small single spot between  $M_3$  and  $Cu_1$ , or a large spot accompanied by two or four smaller spots. Submarginal spots are sometimes absent in females. Male hindwings are yellowish-white, with a dark costal margin fused with a dark discal spot, and sometimes with a separate small spot at the tornus. Hindwings of females are yellow with three large submarginal spots and a dark margin.

Male genitalia (Figs 54–60). The main distinguishing character of the subspecies is the valva shape, noticeably narrowing towards apex. Paratergal processes are large, typically rounded at the apex, but sometimes tapering. Medial plate of the VIII abdominal sternite with a shallow or deep triangular



Figs 23–34. *Nannoarctia* moths from continental Asia. 23. *N. himalayana* sp. nov., holotype, ♂, India, Himachal Pradesh, Kangra valley; 24–25. *N. himalayana nepalica* sp. nov., ♀: 24. Holotype, Central Nepal, Gandaki, Pokhara; 25. Paratype, W.Nepal, Mahakali Bedh; 26–34. *N. obliquifascia* Hmps.: 26. ♀, Lectotype, Burma, Rangoon; 27. Lectotype labels; 28–29. ♂, “N. India, 43-10”, most probably from Burma; the specimen 28 was figured by Butler as the type of *N. tripartita* Wlk.; 30. ♀, Burma, Moulmein; 31. ♀, Burma, Shan, Kalaw; 32. ♀, Lower Burma; 33. ♀, Burma Moulmein; 34. ♀, Vietnam, Cue Phuong.

hollow. Apical processes of lateral plates long, spine-like, or short triangular.

Remarks. The shape of the valva clearly distinguishes this subspecies from other Sundaland subspecies. Nevertheless, we have not found any notable distinguishing wing pattern characters, so we describe it only as a different subspecies.

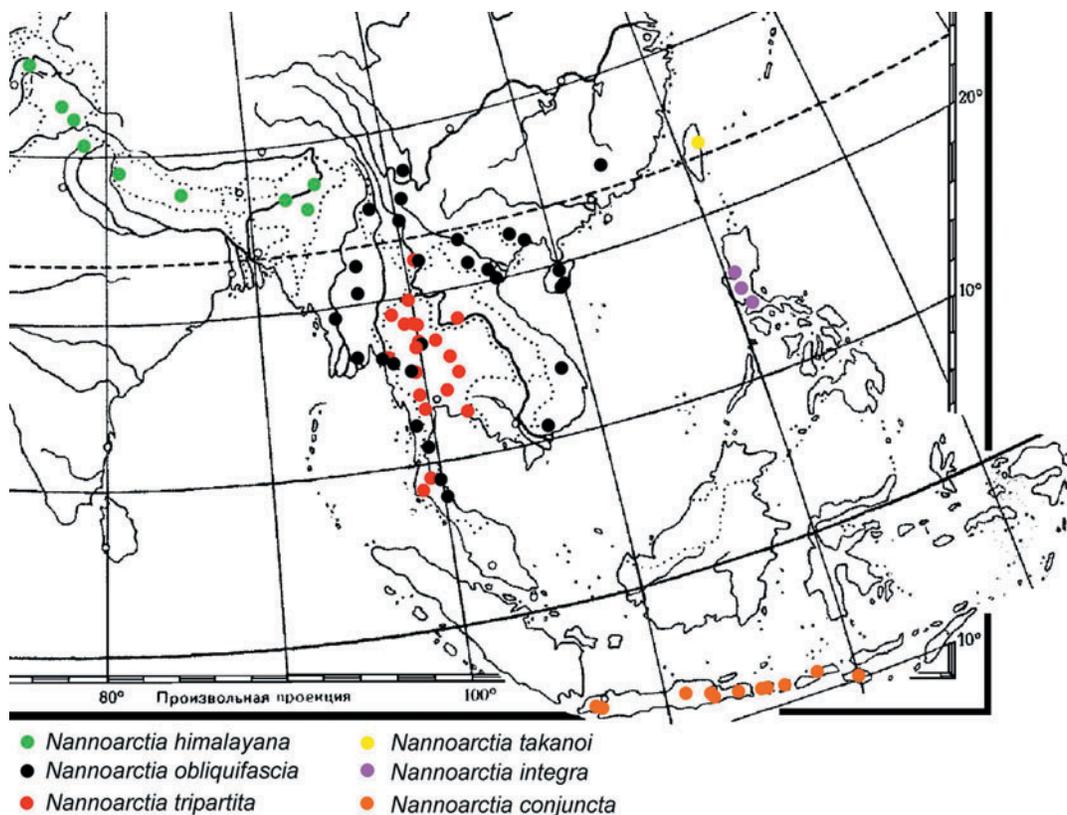
***Nannoarctia conjuncta sumbana* Dubatolov et Kishida, ssp. nov.** (Figs 21–22)

Material. Holotype – ♀, INDONESIA, Sumba I., IV.1993 (NSMT). Paratype: 1 ♀, Tambora [Sumbawa], low c., IV-V [18]98, Doherty [leg.] (BMNH).

Description. Male. Forewing length 15.5 mm in the holotype. Body pattern as in other *Nannoarctia* species. Forewing brown with an oblique yellowish-white band from the apex to the base of  $Cu_2$ , this band is clearly disrupted by dark veins. There are three spots behind the cell; the basal spot is elongate triangular (in the paratype it is divided a by dark narrow line), with a light constriction on the fore edge and at the base; middle spot is elongate oval; an almost triangular distal spot less than



Figs 35–40. *Nannoarctia tripartita* moths from continental Asia. 35. Lectotype, , Burma, Moulmein (BMNH); 36. Lectotype labels; 37. , Burma (BMNH); 38. , Thailand, Phrae Prov., Wang Chin Dist., near Mae Park (YK); 39. , Thailand, Nakhon Sawan Prov., 13 km N Mae Wong; 40. , Laos, Vientiane Prv., Rizier’e Lampii (YK).



85. Distribution map of the *Nannoarctia* species

1/2 of the distance between veins  $Cu_2$  and A, forms part of the oblique band. There are three submarginal light spots between  $M_2$  and  $Cu_2$ , the middle spot is the largest. Hindwings are whitish-yellow, with a dark costal margin, a narrow dark line at the tornus, and a discal spot.

Male genitalia (Figs 52–53). Valvae not tapering to the apex, broadly rounded and lightly curved inwards. Paratergal processes large, triangular and tapering. Left side of aedeagus with a few small and widely separate spines, not forming a band. Spine-like cornuti on the dorsal patch long, nearly twice as long as those of other subspecies. Distal cornuti patch consisting of small spines. VIII abdominal sternite structure as nominotypical subspecies.

Comparison. The reduced apical spine band on the left side of aedeagus clearly separates this subspecies from any other *Nannoarctia*.

#### TAXA FROM THE CONTINENTAL ASIA

##### *Nannoarctia himalayana* Dubatolov et Kishida, **sp. nov.** (Fig. 23)

*Alphæa obliquifascia* (part.): Hampson, 1894; *Moths India* 2: 24; Hampson, 1901; *Catalogue Lep. Phal. Colln Br. Mus.* 3: 359 (Dharmasála).

*Pericallia obliquifascia*: Rothschild, 1910, *Novit. Zool.* 17: 170 (part.) (Mandi, N.W.Himalayas); Rothschild in Seitz, 1914, *Gross-Schmett. Erde* 10: 256 (part.) (Indien); Strand, 1919, *Lep. Catal.* 22: 266 (N.W. Himalayas, Dharmasála); Kirti & Singh, 1995, *Hexapoda* 7 (1): 48-49 (part.) (Jammu and Kashmir: Ramnager ... Dharmasala (U[ttar] P[radesh])).

Material. Holotype – , [INDIA, Himachal Pradesh], Kangra Valley (BMNH). Paratype: 1 , the same label.

Distribution. The nominotypical subspecies occurs in the Himachal Pradesh province of India and probably in Kashmir.

Description. Male. Forewing length 17–17.5 mm. Forewings dark brown with two large spots behind the cell and a slightly s-shaped oblique band from the wing apex towards the middle of the hind margin. The basal spot is triangular with rounded distal edge; middle spot behind the cell oval or nearly triangular with rounded angles. The oblique band spots are large; the hindmost spot beyond  $Cu_2$  is nearly quadrangular, large, and always touching the anal vein. Hindwings light yellow with a brown costal margin, a small brown spot at the tornus and sometimes darker veins in the subapical part of the wing.

Male genitalia (Figs 61–62). Valva broad, rounded, evenly curved and not tapering to the apex. Paratergal processes short, rounded. Spine patch on the aedeagus top not wide, but occupying most of the dorsal surface. Medial plate of the VIII abdominal sternite with a distinct triangular hollow; short lateral lobes tapering apically into small processes.

Remarks. The main character of this species is the position of the oblique light forewing band originating from the wing apex, whilst in other species from Indo-China it originates from the subapical part of the costa. Within the forewing band the main distinguishing character is the larger hind spot extending up to the anal vein. On genitalia, the valvae are more robust and evenly curved, and the VIII sternite is more noticeably incised.

##### *Nannoarctia himalayana nepalica* Dubatolov et Kishida, **ssp. nov.** (Figs 24–25)

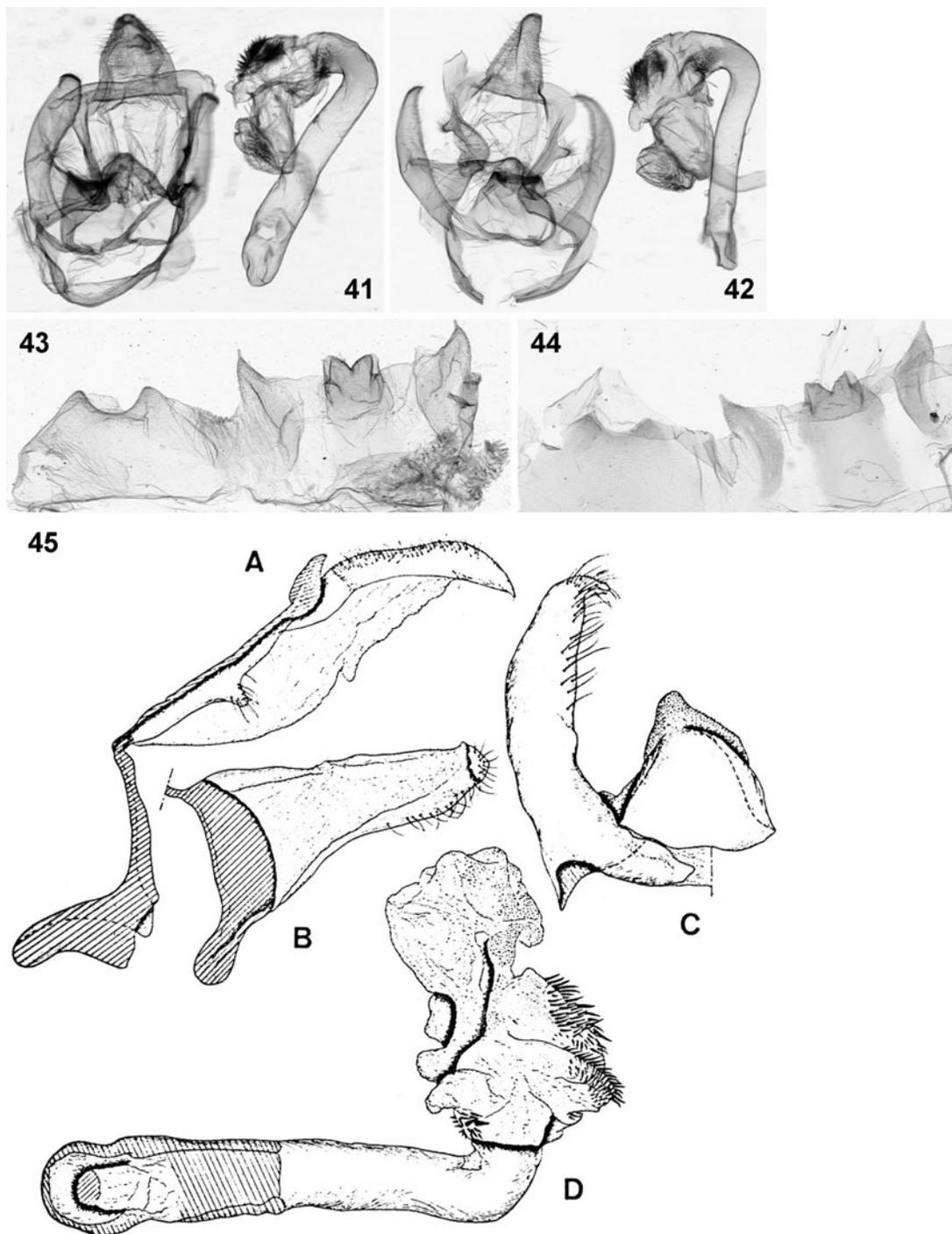
*Rajendra tripartita* (part): Cotes & Swinhoe, 1887, *Catal. Moths India* 1: 125 (Sibsagar [Assam]).

*Alphæa obliquifascia* (part): Hampson, 1894; *Moths India* 2: 24; Hampson, 1901, *Catalogue Lep. Phal. Colln Br. Mus.* 3: 359 (Assam).

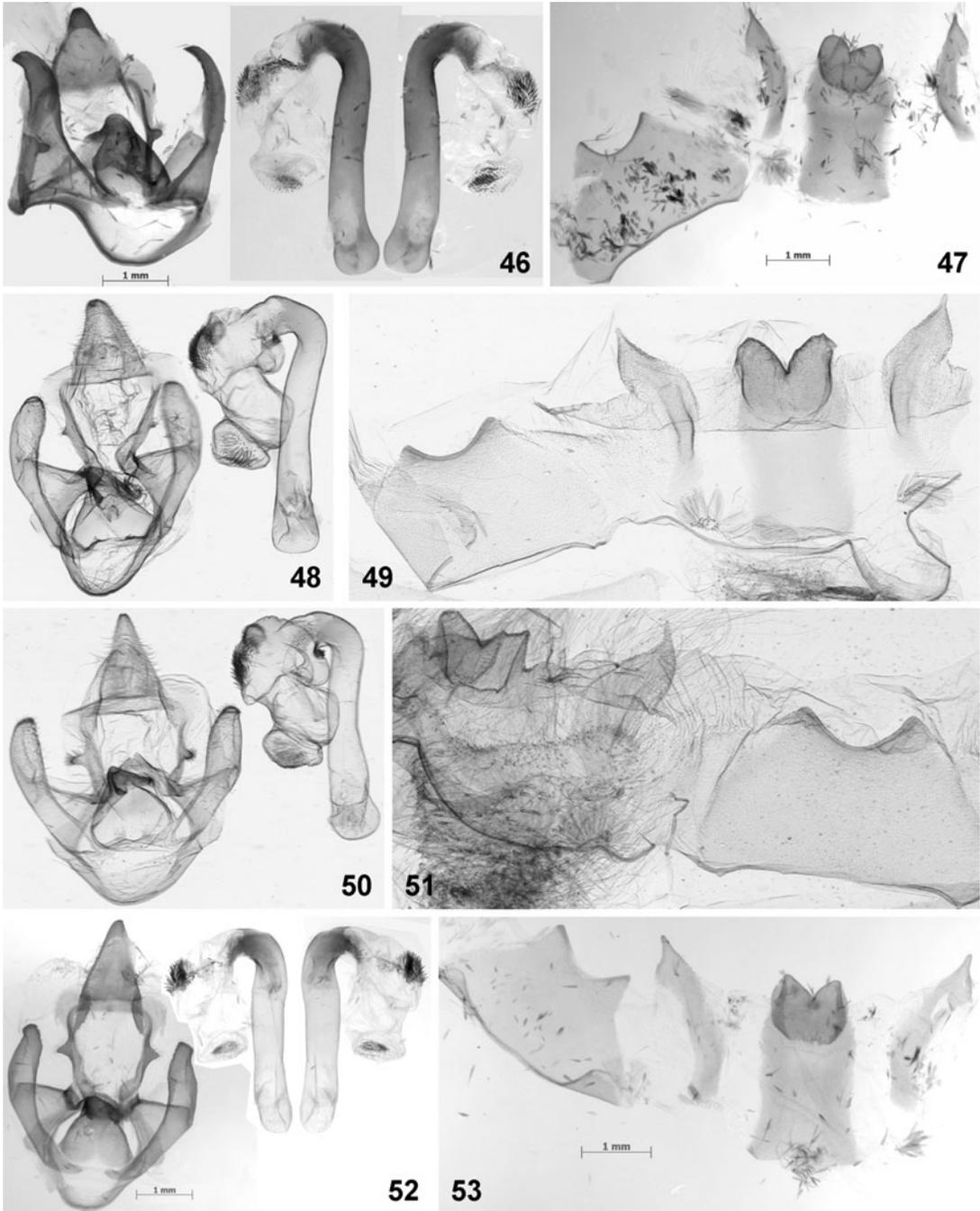
*Pericallia obliquifascia*: Rothschild, 1910, *Novit. Zool.* 17: 170 (part.) (Naga Hills, Assam); Strand, 1919, *Lep. Catal.* 22: 266 (Assam); Kirti, Singh, 1995, *Hexapoda* 7 (1): 48-49 (part.) (Uttar Pradesh: Dehradun ... Dharmasala (U[ttar] P[radesh]) ... Assam).

*Nannoarctia obliquifascia*: Kishida, 1998; *Moths of Nepal* 5: 33, pl. 132, figs. 8-9.

Material. Holotype – , Central Nepal, Gandaki, Pokhara, 850 m, 5.VIII 1992, anonymous leg.



Figs. 41–45. *Nannoarctia* male genitalia, from the Pacific islands. 41. *N. integra* Wlk., Philippines, Manila, gen. prep. No 4433, general view and aedeagus, left side (BMNH); 42. Ditto, Philippines, Luzon, gen. prep. No 4439, general view and aedeagus, left side (BMNH); 43. Ditto, Philippines, Manila, gen. prep. No 4433, VIII sclerite (BMNH); 44. Ditto, Philippines, Luzon, gen. prep. No 4439, VIII sclerite (BMNH); 45. *N. takanoi* Sonan, Taiwan, from: Kôda, 1988: A – tegumen and uncus, B – valva, inner side, C – valva, ventral side, D – aedeagus.



Figs 46–53. *Nannoarctia* male genitalia, from the Pacific islands. 46. *N. conjuncta conjuncta* Hmps., Indonesia, Lombok, general view and aedeagus, left and right sides (YK); 47. Ditto, VIII sclerite; 48. *N. conjuncta conjuncta* Hmps., Indonesia, Lombok, gen. prep. No 4438, general view and aedeagus, left side (BMNH); 49. Ditto, VIII sclerite; 50. *N. conjuncta williamsi* Rothsch., Indonesia, Bali, gen. prep. No 4430, general view and aedeagus, left side (BMNH); 51. Ditto, VIII sclerite; 52. *N. conjuncta sumbana* subsp. nov., Indonesia, Sumba, general view and aedeagus, left and right sides (NSMT); 53. Ditto, VIII sclerite.

(SZMN). Paratypes: INDIA, Uttar Pradesh: 1 ♂, Dehra Dun (BMNH); NEPAL: 3 ♀, same locality as holotype, V-VIII. 1992, anonymous leg. (YK); 1 ♀, Mahakali, Banku, 660 m, 20.II 1995, anonymous leg. (YK); 7 ♂, Mahakali, Bedh, 700 m, 21-22.VI 1995, anonymous leg. (SZMN, YK); 1 ♂, Mahakali, Dhep, 850m, 23. VI. 1995, anonymous leg. (YK); 1 ♀, Mahakali, Siru Bagar, 980m, 24. VI. 1995, anonymous leg. (YK); INDIA, Assam: 3 ♀, Tezporé (BMNH), 1 ♂, Dibrugrah (BMNH).

Distribution. Nepal; India: Uttar Pradesh, Assam; probably, Nagaland.

Description. Male. Forewing length 16-18 mm. Forewings dark brown with two elongate spots behind the cell and a narrow oblique band from the wing apex towards the middle of the hind margin. The basal elongate spot is often fused with the more distal spot to form a band beyond the cell. Medial spots of the band are sometimes large, with the remaining spots often reduced in size, more strongly so at the apex. The hind spot beyond Cu<sub>2</sub> is triangular, small, and noticeably not touching the anal vein. Hindwings light yellow, with a brown costal margin and a small brown spot at the tornus. Female similar but hindwings with large brown spots along the costa and external margin.

Male genitalia (Figs 63–72). Valva slightly tapering to apex, rounded at the top, and lightly curved inwards. Paratergal processes may be triangular or rounded, variable in size, but usually not short. Vesica with a distal cornuti patch consisting of strong but short spines (not spiniculi) whilst those on the dorsal cornuti patch are at least twice as long. Sclerotized spine-bearing band on the left side of the aedeagus top is well expressed, with three rows of spines. Medial plate of the VIII abdominal sternite with a nearly triangular but occasionally rounded hollow; lateral lobes tapering apically into long narrow almost pointed processes.

Remarks. The main characters of the subspecies is the distinctly narrow forewing band and small size of the triangular hind spot, not widening to vein A.

### *Nannoarctia tripartita* Walker, **stat. rev.** (Figs 35–40)

*Aloa tripartita* Walker, 1855 (main variation [ $\alpha$ ]), *List Specimens lepid. Insects Colln. Br. Mus.* **3**: 706 (East Indies).

*Alphæa tripartita* (part.): Hampson, 1894, *Moths India* **2**: 24; Hampson, 1901, *Catalogue Lep. Phal. Colln Br. Mus.* **3**: 359 (Moulmein).

*Rajendra tripartita* (part.): Swinhoe, 1890, *Trans. Ent. Soc. Lond.* **1890**: 185 (Moulmein).

*Pericallia tripartita*: Hampson, 1901, *Catalogue Lep. Phal. Colln Br. Mus.* **3**: 358 (Moulmein); Hampson, 1905, *J. Bombay Nat. Hist. Soc.* **16**: 213; Rothschild, 1910, *Novit. Zool.* **17**: 170 (part.) (Moulmein); Strand, 1919, *Lep. Catalog.* **22**: 269 (part.) (Burma: Moulmein).

*Nannoarctia tripartita*: Cerny & Pinratana, 2009, *Arctiinae Thailand*: 167-168, 264, pl. 33, figs. 330a, 330b, 330c.

*Nannoarctia obliquifascia*: Cerny & Pinratana, 2009, *Arctiinae Thailand*: 265, pl. 32, fig. 331c.

Type material. Lectotype – ♀, “Type” [of *tripartita*, main var.], “E. Indies / Moulmein. / 43-43”, “11. ALOA TRIPARTITA.”, “BMNH(E) #805600” (BMNH), by present designation.

Additional material. BURMA (MYANMAR): 1 ♂ (gen. slide No. 4437), “Burma. / Moore Coll. / 94-106”, “BMNH(E) #805612” (BMNH); THAILAND: 1 ♀, Phrae Prov., Wang Chin Dist., near Mae Park, 13.VI.1993, M. Nishimura leg. (YK); 2 ♂, Prae prov., 70 km SE Lampang, 17°55,5' N, 100°03,7' E, h=393 m, by light, 20.VIII 2009, V.K.Zinchenko leg. (SZMN); 14 ♀, Phitsanulok Province, District Muang, Subdistrict Huaro, village No. 7, 16°53' 22.70" N 100°16' 4.87" E, UV light trap, 22-24.XI 2008, R. Breithaupt leg. (SZMN); 1 ♀, Nakhon Sawan Prov., 13 km N Mae Wong Vil., 15°54' N 99°33,3' E, h=113 m, by light, 10.VIII 2009, V.K.Zinchenko leg. (SZMN); LAOS: 1 ♀, Vientiane Prv., Rizierè Lampii, 25.VII.1992 (YK).

Distribution. Burma (Myanmar), Thailand, Laos, China (Yunnan).

Description. Female. Forewing length 15–18 mm. Body coloration as other species of *Nannoarctia*. Forewings dark brown, with a transverse (slightly oblique) band starting at the costa between bifurcations R<sub>2+5</sub> / M<sub>1</sub> and R<sub>2</sub> / R<sub>3+4</sub>, and not crossing vein A; it is strongly narrower than in males. In the holotype there are two very large spots behind the cell that are connected by a narrow petiole; the

posterior spot is accompanied by a small (but occasionally larger) whitish dot in the cell. The two large spots behind the cell are separate or slightly fused by a narrow connection. Spots in the cell vary in shape and size. In the specimen from Moore's collection, two or three spots are situated at the external margin between  $M_2$  and  $Cu_1$ . Hindwings yellow, with a large dark discal spot and three spots at the apical, cubital and tornal position on the external margin. All medial and first cubital veins are marked with dark scales.

Male. Forewing length 14–17 mm. Body coloration as other species of *Nannoarctia*. Forewings brown, with a transverse oblique postdiscal band, which also begins on the costa between bifurcations  $R_{2+5} / M_1$  and  $R_2 / R_{3+4}$ . This band envelops the cell and extends to the hind margin, sometimes with a small spot behind vein A. Between and behind the cell and vein A, there are two very large spots which are accompanied by two smaller spots at the hind vein of the cell. Occasionally spots behind the cell and in the cell are fused forming a wide band. Typically, there is a large submarginal spot between  $M_3$  and  $Cu_1$  accompanied by two small lateral dots. Hindwing yellow, with a brown costal margin, a confluent discal spot, a wide stroke at the apex, and an angulated spot at the tornus. (In females all spots are larger and often veins from the cell apex to margin are darker).

Male genitalia (Figs 73–74). Valvae slightly narrowing to the apex and lightly curved inwards. Paratergal processes large, nearly triangular. On the left side of the aedeagus apex is a narrow band of small broad rough spines. A plate on left side consists of thinly distributed spiniculi. A large dorsal patch of cornuti on vesica consists of long spines, while the apical plate is small and consists of spiniculi. Medial plate of VIII abdominal sternite with a triangular hollow; lateral lobes with narrow apical processes.

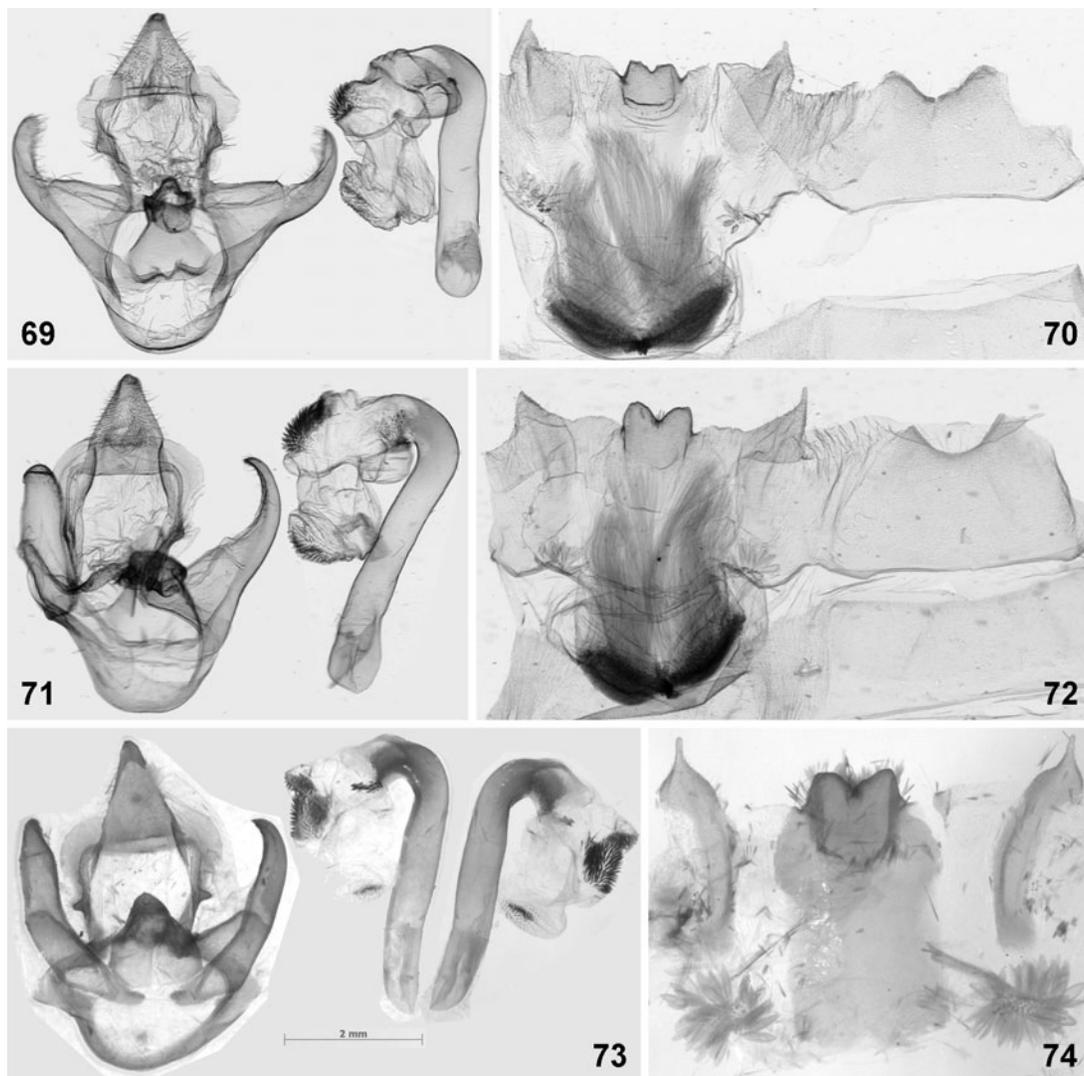
Remarks. This species fully corresponds to Walker's main description of *Aloa tripartita*. However, he included four specimens in the type series; three of them were described as variations  $\beta$ ,  $\gamma$  and  $\delta$ . We have found two of them ( $\gamma$  and  $\delta$ ) each with labels "N. India"; the third specimen with the same label (var.  $\beta$ ) could not be traced. The specimen that corresponds to the main original description (var.  $\alpha$ ) is now deposited in BMNH and originated from "E. Indies, Moulmein" and Archdeacon Clerk's collection. It is specifically different from the other two specimens in the type series (labeled "N. India"). It is unfortunate that the first type designation of *Aloa tripartita* was published by Butler (1881) in the "Illustrations of typical specimens of Lepidoptera Heterocera in the collection of the British Museum", together with a good colour figure of the specimen that matches var.  $\delta$  by Walker (1855), and not to the main variation! This figure was replicated in Seitz's atlas (Rothschild, 1914) and remains the only published figure of any specimen from Walker's type series. However, on discovering that Butler's type did not correspond to the typical variation of *tripartita*, Hampson (1894, 1901) returned to the original description, and secondarily designated the specimen from Moulmein from Clerk's collection (and also incorrectly cited two females) as a type of his *Pericallia tripartita*. He did not figure it either in 1901 or 1920 and did not clarify the problem between the two species. Moreover, he cited Butler's figure for his *Pericallia tripartita*, despite the contradiction between his key to the species and Butler's figure. The only persons to correctly separate the two *Nannoarctia* species in the Indochinese fauna were Cerny & Pinratana (2009), who also published good colour figures of both species. So, in spite of the incorrect *tripartita* type designation by Butler (1881), although it was the first accepted designation and accompanied by a good illustration, we accept the designation by Hampson (1894, 1901) as the most accurate – a decision which has also been confirmed by Cerny & Pinratana (2009).

### *Nannoarctia obliquifascia* (Hampson) (Figs 26–34)

*Aloa tripartita* Walker, 1855 (var.  $\beta$ ,  $\gamma$ ,  $\delta$ ), *List Specimens lepid. Insects Colln. Br. Mus.* **3**: 706-707; Butler, 1881; *Ill. Typ. Lep. Het. Br. Mus.* **5**: 35, pl. 86, fig. 4. Type label of the figured, probably, is not correct; such coloured moths occur in "East Indies", Burma (=Myanmar).

*Rajendra tripartita*, Butler, 1881, *Ill. Typ. Spec. Lep. Het. Coll. Brit. Mus.* **5**: 35 (North India [false!]); Cotes & Swinhoe, 1887, *Catal. Moths India* **1**: 126 (part.) (Rangoon); Swinhoe, 1890, *Trans. ent. Soc. Lond.* **1890**: 185 (part.) (Rangoon); Kirby, 1892, *Syn. Catal. Lep. Het.* **1**: 248 (N. India [false!]).

*Pericallia obliquifascia* Hampson, 1894, *Moths India* **2**: 24; type locality: "Burma, Rangoon" (from the lectotype);



Figs 69–74. *Nannoarctia* male genitalia, from continental Asia. 69. *N. himalayana nepalica* subsp. nov., paratype, India, Assam, Dibrugrah (BMNH); 70. Ditto, VIII sclerite; 71. *N. himalayana nepalica* subsp. nov., paratype, India, Assam, Tezapore (BMNH); 72. Ditto, VIII sclerite; 73. *N. tripartita* Wik., Laos, Vientiane Prov., Rizierè Lampii (YK); 74. Ditto, VIII sclerite.

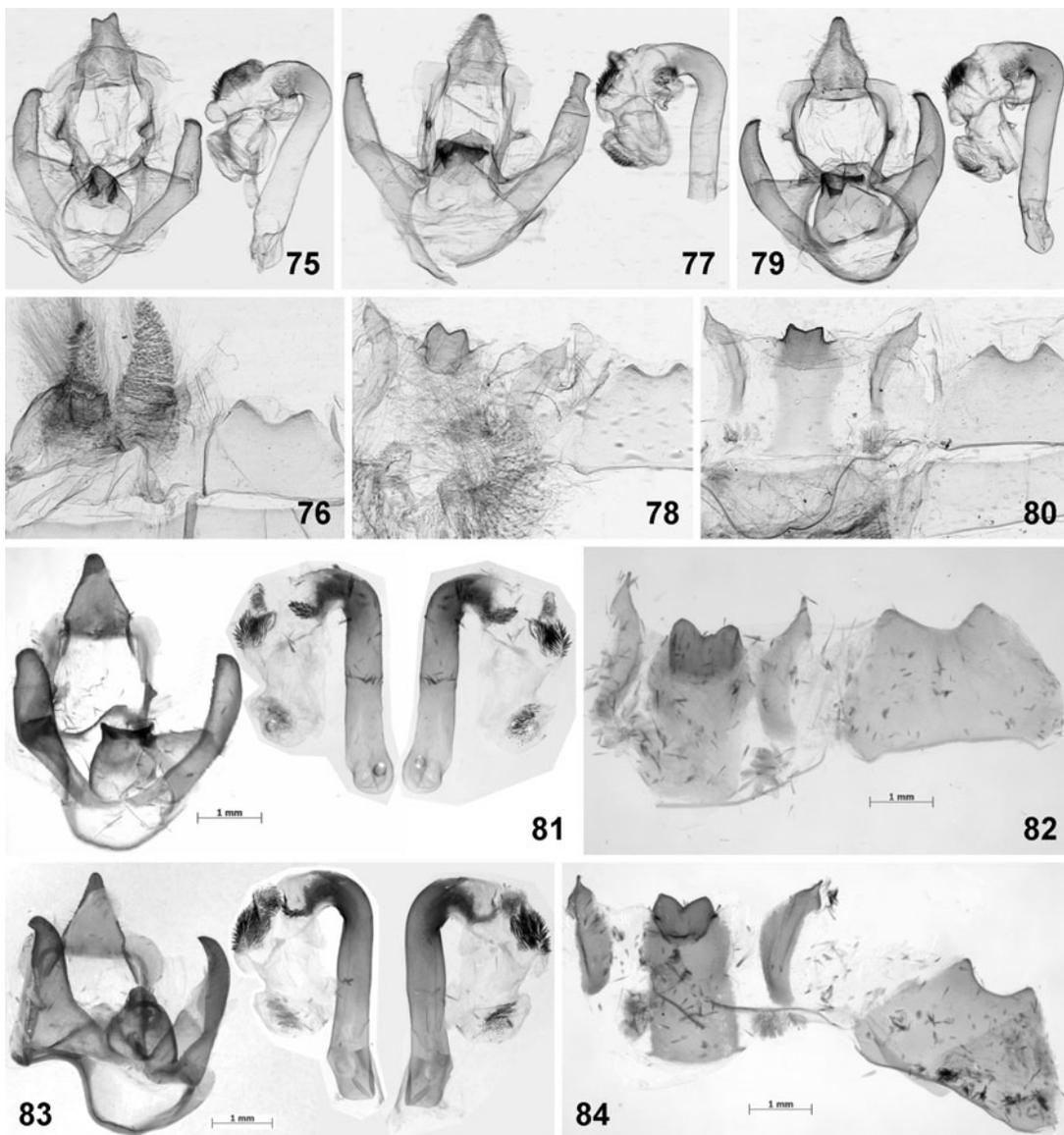
Hampson, 1901, *Catalogue Lep. Phal. Colln Br. Mus.* **3**: 358-359, pl. XLVII, fig. 12; Hampson, 1905, *J. Bombay Nat. Hist. Soc.* **16**: 213; Rothschild, 1910, *Novit. Zool.* **17**: 170 (part.) (Moulmein; Lower Burma; Rangoon; Maymyo, Shan States; Chengmai, Hainan); Rothschild in Seitz, 1914, *Gross-Schmett. Erde* **10**: 256-257 (Malakka); Strand, 1919, *Lep. Catal.* **22**: 266 (Burma, Rangoon, Thaetmyo, Dawnat Hills); Candeze, 1927: 78 (Louang-Prabang); Fang, 1982, *Iconographia Heterocerorum Sinicorum* **2**: 222, fig. 1636 (Yunnan); Fang, 1985, *Economic Insect fauna of China* **33**: 71, pl. VII, fig. 106 (Yunnan).

*Pericallia tripartita*, Rothschild, 1910 (part.), *Novit. Zool.* **17**: 170 (Lower Burma; Moulmein); Rothschild in Seitz, 1914, *Gross-Schmett. Erde* **10**: 256 (Burma); Candeze, 1927: 78 (Laokay; Vientiane); Fang, 1985, *Economic Insect fauna of China* **33**: 71, pl. VII, fig. 107 (Hainan).

*Cretonotus obliquifascia nigrescens* Mell, 1935, *Mitt. Dt. ent. Ges.* **6**: 38; type locality: “Nordkwangtung (Tsatmukngao südlich Linping)”.

*Alphaea obliquifascia*, Daniel, 1943, *Mitt. münch. ent. Ges.* **33** (3): 741 (Kwangtung sept., Lienping).

*Nannoarctia tripartita*, Fang, 2000, *Fauna Sinica (Insecta)* **19**: 350, pl. XV, fig. 4 (Sichuan, Hainan); Dubatolov,



75–84. *N. obliquifascia* Hmps. male genitalia. 75. Burma, Moulmein, gen. prep. No 4432 (BMNH); 76. Ditto, VIII sclerite; 77. Burma, Moulmein, gen. prep. No 4431 (BMNH); 78. Ditto, VIII sclerite; 79. Burma, gen. prep. No 4434 (BMNH); 80. Ditto, VIII sclerite; 81. Burma, Kalaw (YK); 82. Ditto, VIII sclerite; 83. Vietnam, Cuc-Phuong (SZMN); 84. Ditto, VIII sclerite.

Haynes, Kishida, 2007, *Tinea* **20**: 67.

*Nannoarctia obliquifascia*, Fang, 2000, *Fauna Sinica* **19**: 349-350 (Yunnan, Hainan, Guangxi); Dubatolov, Haynes, Kishida, 2007, *Tinea* **20**: 67.

*Nannoarctia obliquifascia*, Cerny & Pinratana, 2009: Arctiinae Thailand: 168, 265, pl. 32, fig. 331a, 331b.

Type material. Paralectotypes of *tripartita*: 1 (var.  $\delta$ ) by Walker, 1855, “N. India / 43.-10” [the label is incorrect], “BMNH(E) #805617” (BMNH), 1 (var.  $\delta$ ) by Walker, 1855, “N. India / 43.-10” [the label is incorrect], “BMNH(E) #805618” (BMNH). *obliquifascia*, lectotype, “Type”, “Burma, / Rangoon. / 80-96.”, “*Alphæa* / *obliquifascia*. / type . Hmps.”, “BMNH(E) #805602” (BMNH). *nigrescens*, paratype, Nordkwangtung (ZFMK).

Additional material. BURMA (MYANMAR): 10 ♂, 2 ♀, Maulmein (BMNH); 2 ♂, 2 ♀; Lower Burma (BMNH); 2 ♂, 1 ♀, Rangoon (BMNH); 1 ♂, Lower Burma, Thayetmyo, Sept. [18]93, E.Y. Watson leg., 94-4 (BMNH); 1 ♂, Donaut Hs. (Dawnat Hills), Tenasserim, 95-37, de Niceville leg. (BMNH); 1 ♂, North Burmah, Cutter, Joicey Bequest, Brit. Mus. 1934-120 (BMNH); 1 ♂, Shan States, Maymyo, VI-VIII 1902, Hauxwell leg. (BMNH); 1 ♂, Shan States, Kalaw, 20-30.V 2003, anonymous leg. (YK). THAILAND: 2 ♂, 1 ♀, Phitsanulok Province, District Muang, Subdistrict Huaro, village No. 7, 16°53' 22.70" N 100°16' 4.87" E, UV light trap, 22-24.XI 2008, R. Breithaupt leg. (SZMN); 1 ♂, Nakhon Sawan Prov., 13 km N Mae Wong Vil., 15°54' N 99°33,3' E, h=113 m, by light, 12.VIII 2009, V.K.Zinchenko leg. (SZMN). VIETNAM: 1 ♂, Tonkin, Montes Mauson (BMNH); 1 ♂, Tonkin occ., Reg. De Hoa Binh (BMNH); 2 ♂, Prov. Ninh-Binh, Reserve Cuc-Püông Dabg forêt tropic pluv., 160-200 m, 14.X 1963, T. Pócs leg. (SZMN), 23-26.IX 1996, B. Tanaka leg. (SZMN); Prov. Son La, Naniu, 8.V 1986, V. Kuznetsov leg. (ZIN); 1 ♂, South Vietnam, Prov. Gia lai – Cong Tum, Kannak, Gialai-Kontum, 600 m, 8.XI 1988, V. Kuznetsov leg. (ZIN); 1 ♂, South Vietnam, Saigon (BMNH).

Distribution. Burma (Myanmar), Thailand, Vietnam, Malakka (Malay Peninsula), South China: Southern Sichuan, Yunnan, Guangxi, Guangdong, Hainan.

Diagnosis. The main character of this species is the position of the oblique band extending from the subapical part of the costa and distal from the origin of R<sub>2</sub>. Otherwise, the species is very variable in size and presence of spots: three submarginal spots between M<sub>2</sub> and Cu<sub>2</sub> are large or small, reduced to a single spot between M<sub>3</sub> and Cu<sub>1</sub>, or entirely absent. The light spot in the cell may also be large, of variable shape, small, dot-like, or absent. The oblique band and two spots beyond the cell are often large, but may also be reduced in size. Males always have small dark spots on light yellow hindwings; females have bright yellow hindwings with larger spots. Nominotypical specimens from South Burma, Vietnam and SW China have a large hind spot on the oblique forewing fascia which almost touches the anal vein. The light spot beyond the origin of Cu<sub>2</sub> is also large, of a triangular, quadrangular, or broad oval shape, but never strip-like.

Male genitalia (Figs 75–84). Valvae lightly curved, slightly narrowing to a smoothly inward curving apex. Paratergal processes vary in shape and size; often large, broadly triangular or small and finger-like. On the left side of the aedeagus is a more or less broad band covered with 2–3 rows of rough spines and a wide plate consisting of scarce spiniculi. On the vesica there is a large patch of cornuti consisting of long spines; the apical patch is smaller with smaller spines (in *N. tripartita* the apical patch is even smaller and consists of spiniculi). Medial plate of VIII abdominal sternite variable, usually with a broad rounded hollow in specimens from Burma, and a triangular hollow in specimens from Vietnam; apical processes of the lateral lobes usually narrow and long, but occasionally broad at the base.

Remarks. It is noted from determinations in the BMNH collection, “*N. tripartita*” specimens were separated from “*N. obliquifascia*” by the presence of an additional white spot in the cell, and white spots at the external margin. These characters vary significantly by presence and expression even within the same populations (Rangoon in Burma, Cuc Phuong in North Vietnam).

The taxon *nigrescens* is characterized by a narrow light forewing pattern; the hind spot of the oblique band is small, nearly triangular and does not extend to the middle part of the space between Cu<sub>2</sub> and A; the white spot beyond the origin of Cu<sub>2</sub> is strip-like. Such specimens rarely occur outside the distribution of *N. obliquifascia*. The wing pattern is considered to be within the normal pattern of variation for the species.

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