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Revision of the family Metarbelidae (Lepidoptera) of the Oriental Region. V. Genus *Marcopoloia* Yakovlev & Zolotuhin gen. nov. from the Taiwan Island and Indo-Burma biodiversity hotspot

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Abstract

In the fifth part of the revision on the Asian Metarbelidae we describe the new genus *Marcopoloia* Yakovlev & Zolotuhin, gen. nov. (type species, by original designation: *Arbela discipuncta* Wileman, 1915). The male and female of *Marcopoloia discipuncta* (Wileman, 1915) comb. nov. are redescribed; four new species *Marcopoloia leloi* Yakovlev & Zolotuhin, sp. nov. (type locality: C. Vietnam, Gia Lai Prov., Kon Ka Kinh NP), *Marcopoloia nangmai* Yakovlev & Zolotuhin, sp. nov. (type locality: Thailand, Changwat Nan, 20 km N of Bo Luang), *Marcopoloia siniaevi* Yakovlev & Zolotuhin, sp. nov. (type locality: Myanmar (Burma), 40 km N Myitkyina, Chanc Kand village), and *Marcopoloia thaica* Yakovlev & Zolotuhin, sp. nov. (type locality: Thailand, Changwat Nan, 30 km E of Pua) are described. A new synonym is established: *Arbela discipuncta* Wileman, 1915, syn. nov. = *Arbela baibarana* Matsumura, 1927.

Key words: biodiversity, Cossioidea, Asia, Paleotropis, Metarbelidae, taxonomy, new genera, new species.

Introduction

In the fifth part of our revision on the Oriental Metarbelidae (Yakovlev & Zolotuhin 2020; 2021a–c) we examine a complex of specimens with an expressed sexual dimorphism, widely spread in Taiwan and Indochina (Myanmar, Thailand and Laos). *Arbela discipuncta* Wileman, 1915, was described on a unique female from Kanshirei (currently, Guanziling Hot Spring). It is noteworthy that the author of the first description mistakenly identified the type specimen as “one rather worn male specimen” (Wileman 1915). Matsumura (1927) described *Arbela baibarana* Matsumura, 1927, on a female from Taiwan (Horisha). Moreover, Matsumura as well as Wileman identified the holotype as a male “one male specimen was collected on the 22nd of April, 1926, by R. SAITO and K. KIKUCHI” (Matsumura 1927). In the modern collections from Taiwan we found females, analogous to the holotypes of *Arbela discipuncta* and *Arbela baibarana* together with a small number of males, very different in appearance from the females (the ratio of females and males in the collection MWM = 55:3). Similar males of other species from Myanmar, Thailand

and Vietnam were also found in MWM. The description of the new genus and four new species is given below.

Material and methods

The materials for the study were the adult Metarbelidae specimens deposited in various collections:

NHMUK – National Museum of Natural History (formerly: The Natural History Museum, London, U.K.);

MWM – Museum Witt (Munich, Germany);

ZMSU – Zoological Museum of Sapporo University (Sapporo, Japan).

The male and female genitalia were mounted in euparal on slides following Lafontaine and Mikkola (1987) and examined with an Olympus SZX16 microscope. The images were taken with the digital camera CMOS 20.7 megapixels and processed using Corel Photo-Paint 2017 software.

Taxonomical part

Marcopoloia Yakovlev & Zolotuhin gen. nov.

<https://zoobank.org/urn:lsid:zoobank.org:act:146D6420-7A74-43BB-880B-4F7D7AC22744>

Type species (designated here) *Arbela discipuncta* Wileman, 1915.

Description. Male. Size small (wingspan not exceeding 30 mm), gracile type. Antenna bipectinate, setae twice longer than antenna rod diameter. Tip of abdomen with bundle of long modified scales. Color dark. Fore wing with poorly expressed pattern. Hind wing without pattern.

Male genitalia. Uncus long, with parallel edges, apically rounded, not extended, with shallow notch on top; subscaphium long, funnel-like; gnathos arms thin, gnathos poorly expressed; valve short, rounded, with two harpes on saccular edge; juxta robust with short slightly acute lateral processes; saccus tiny with poorly expressed notch on top; phallus shorter than valve, thin, with very robust semicircular cup-like basal process and small (sometimes, spiky) cornutus.

Female (known only for the type species of the genus) slightly bigger than male, color lighter. Antenna bipectinate, setae shorter than in male. Fore wing brown with rounded discal spot, postdiscally with poorly expressed bands. Hind wing without pattern.

Female genitalia. Ovipositor very short, posterior apophyses twice shorter than anterior apophyses, ostium wide, funnel-like, ductus short, membranous, bursa bag-like, without signa.

Diagnosis. The new genus differs from the known genera of Oriental Metarbelidae in the following characters:

- the expressed sexual dimorphism (in this characteristic, it is close to *Orgyarbela* Yakovlev & Zolotuhin, 2020);
- the narrow long uncus without expressed extension on top (in this, it is close to *Squamura* Heylaerts, 1890);
- the very extended cup-like basal process on the phallus, which is an apomorphic feature of the new genus.

Composition. The genus includes five species: *Marcopoloia discipuncta* (Wileman, 1915) comb. nov., *M. leloi* Yakovlev & Zolotuhin, sp. nov., *M. nangmai* Yakovlev & Zolotuhin, sp. nov., *M. siniaevi* Yakovlev & Zolotuhin, sp. nov., and *M. thaica* Yakovlev & Zolotuhin, sp. nov.

Distribution. Myanmar, Taiwan, Thailand, Vietnam. South-Easter China and Southern Korea?

Etymology. The new genus is named after Marco Polo (1254– 1324), a Venetian merchant, explorer and writer who traveled through Asia along the Silk Road between 1271 and 1295. His travels are recorded in *The Travels of Marco Polo*, a book that described to Europeans the mysterious culture and inner workings of the Eastern world, including the wealth and great size of the Mongol Empire and China in the Yuan

Dynasty, giving the first comprehensive look into China, Persia, India, Japan and other Asian cities and countries.

***Marcopoloia discipuncta* (Wileman, 1915) comb. nov.**

Figs 1–4, 9–10, 15

Arbela discipuncta Wileman, 1915, The Entomologist, 48: 18.

Type locality: Kanshirei [23°20'0"N 120°30'0"E, Guanziling Hot Spring, Baihe District, Tainan, Taiwan].

Type material: holotype (female) in NHMUK.

= *Arbela baibarana* Matsumura, 1927, **syn. nov.**

Journ. Coll. Agric. Hokk. Imp. Univ. 19 (1): 48.

Type locality: Formosa (Horisha) [23° 58' N, 120° 58' E, Puli, Nantou County, Taiwan].

Type material: holotype (female) in ZMSU.

Material examined. 1 female (holotype), Kanshirei, Formosa, 1000 ft., 27.iv.1908, A.E. Wileman (NHMUK); 1 female (holotype of *Arbela baibarana* Matsumura), Horisha, 22.iv.1926, R. Saito & K. Kikuchi (ZMSU); 1 male, 23 females, Taiwan, Prov. Ping-Tung, Huang-Lion Recreation Area, 210 m, 06.iii.1996, leg. Gy. Fabian & L. Nemeth (MWM, GenPr-Heterocera MWM – 24.603); 2 males, 20 females, Taiwan, Prov. Ping-Tung, 10 km SE Mutan, 470 m, 07–10.iii. 1996, leg. Gy. Fabian & L. Nemeth (MWM, GenPr-Heterocera MWM – 24.604); 1 female, Taiwan, Prov. Nantou, Huisun Forest Area, 500 m, 15 km N Puli, 12–13.iv.1997, leg. Csorba & Ronkay (MWM); 1 female, Taiwan, Prov. Ilan Chilan, Forest Recreation Area, 500 m, 14.iv.1997, leg. Csorba & Ronkay (MWM); 3 females, Taiwan, Prov. Nan-Tou, 5 km W Lishan hot spring, 22.iv.1997, leg. Fabian & Kovacs (MWM); 1 female, Taiwan, Prov. Pingtung, 10 km NW Ssulín, 21.iii.1996, 350 m, leg. Csosvari & Steger (MWM); 2 females, Taiwan, 2 km N Tupan, 29.iii.1996, 350 m, leg. Csosvari & Steger (MWM); 4 females, Taiwan, Prov. Tsoyuan, Myng Chir Forest Recreation Area, 1160 m, 29.ii.1996, leg. Gy. Fabian & L. Nemeth (MWM).

Redescription. Male. Length of fore wing 11.5–13 mm. Antenna bipectinate, setae twice longer than antenna rod diameter. Tip of abdomen with bundle of long modified scales. Fore wing brown, with small black spot in discal cell, poorly expressed pattern of strokes along costal edge, marginal area mottled (dark-brown on veins, ocher between veins), fringe mottled (dark-brown on veins, ocher between veins). Hind wing dark-brown, anal angle brown, fringe ocher.

Male genitalia. Uncus long, with parallel edges, apically rounded, small shallow notch on top; subscaphium long, funnel-like; gnathos arms thin, gnathos poorly expressed; valve short, rounded, crescent long harpe in basal third on saccular edge of valve, short thin rod-like harpe on saccular edge in medium third; juxta robust with short slightly acute lateral processes; saccus tiny, with poorly expressed notch on top; phallus shorter than valve, thin, with very wide semicircular cup-like basal process; spiky cornutus in vesica.

Female. Length of fore wing 14–15 mm. Antenna bipectinate, setae shorter than in male. Fore wing from brown to ocher, with round discal spot, poorly expressed bands postdiscally. Hind wing brown, without pattern, fringe ocher.

Female genitalia – see generic description.

Diagnosis. Most close to *M. leloi*, from which it differs in the poorly modified, small harpes and poorly expressed pattern on the fore wing.

Biology. Flight period: February–April.

Distribution. Taiwan. Probably distributed in the South-Eastern China (Fujian Province) and Southern Korea (Huang *et al.* 1990; Park *et al.* 2006). Huang *et al.* (1990) writes “the metarbelid *Arbela baibarana* [*Squamura discipuncta*] infesting *Casuarina* trees”, using data on the Fujian Province in China. The discovery of the female of Metarbelidae “*Squamura* sp.” in South Korea (Daecheong Island) (Park *et al.* 2006) was very interesting. Probably, both reports (judging by the distribution) refer exactly to *M.*

discipuncta (Wileman, 1915), but the finds confirmed by the factual material and photos, according to GBIF (Lin 2021; Lin & Shih 2021), are only from Taiwan.

***Marcopoloia leloi* Yakovlev & Zolotuhin, sp. nov.**

<https://zoobank.org/urn:lsid:zoobank.org:act:D2280652-5E97-4AC5-9E8A-BDC85BFBAF57>

Figs 5, 11, 15

Material. Holotype, male, C. Vietnam, Gia Lai Prov., Kon Ka Kinh NP, general office, 820 m, 14°11.32'N / 108°18'E, 12–13.iii.2012, leg. V. Zolotuhin (MWM, GenPr-Heterocera MWM – 28.016).

Description. Male. Length of fore wing 10 mm. Antenna bipectinate, setae twice longer than antenna rod diameter. Tip of abdomen with bundle of long modified scales. Fore wing brown, with small black spot in discal cell, small black spots along costal and hing edge of wing, marginal area ocher, fringe mottled (dark-brown on veins, ocher between veins). Hind wing dark-brown, anal angle brown, marginal area ocher, fringe ocher, base of fringe brown.

Male genitalia. Uncus long, with parallel edges, apically rounded, slightly extended, small semicircular notch on top; subscaphium long, funnel-like; gnathos arms thin, gnathos poorly expressed; valve short, rounded, with long finger-like harpe on saccular edge in basal third and shorter finger-like harpe on saccular edge in medium third; juxta robust, with short, slightly acute lateral processes; saccus tiny with poorly expressed notch on top; phallus shorter than valve, thin, with very wide semicircular cup-like basal process, vesica with spiky cornutus.

Female unknown.

Diagnosis. Most close to *M. discipuncta*, from which it differs in the bigger finger-like harpes and the mottled pattern on the fore wing.

Distribution. Central Vietnam.

Etymology. The new species is named after Lê Lợi (1384–1433), a Vietnamese rebel leader who founded the Later Lê dynasty and became the first emperor of the restored kingdom of Đại Việt after it had been conquered by the Ming dynasty.

***Marcopoloia nangmai* Yakovlev & Zolotuhin, sp. nov.**

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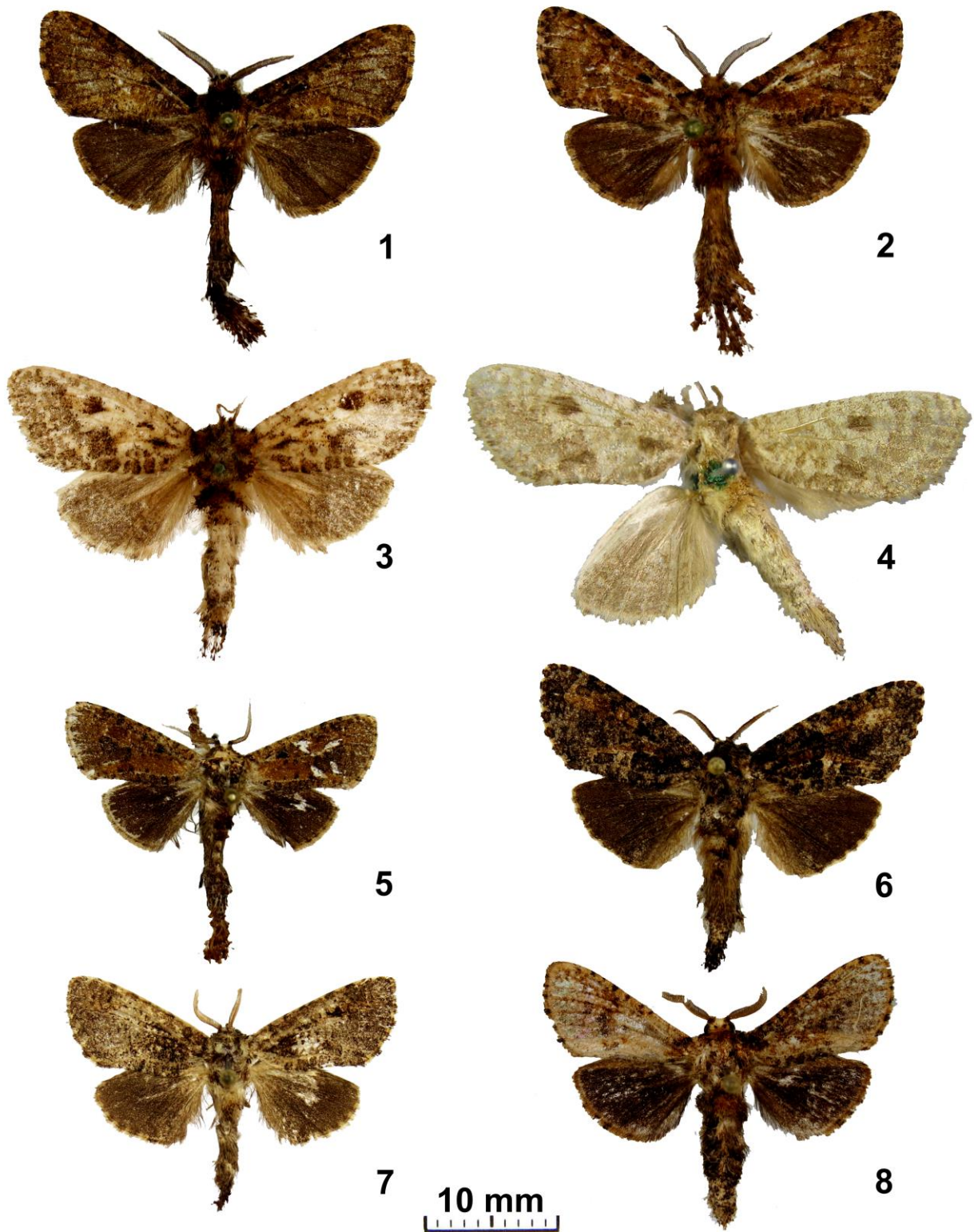
Figs 6, 12, 15

Material. Holotype, male, Thailand, Changwat Nan, 20 km N of Bo Luang, 1150 m, 29.iii.1998, leg. Tibor Csovári & Pal Steger (MWM, GenPr-Heterocera MWM – 28.015).

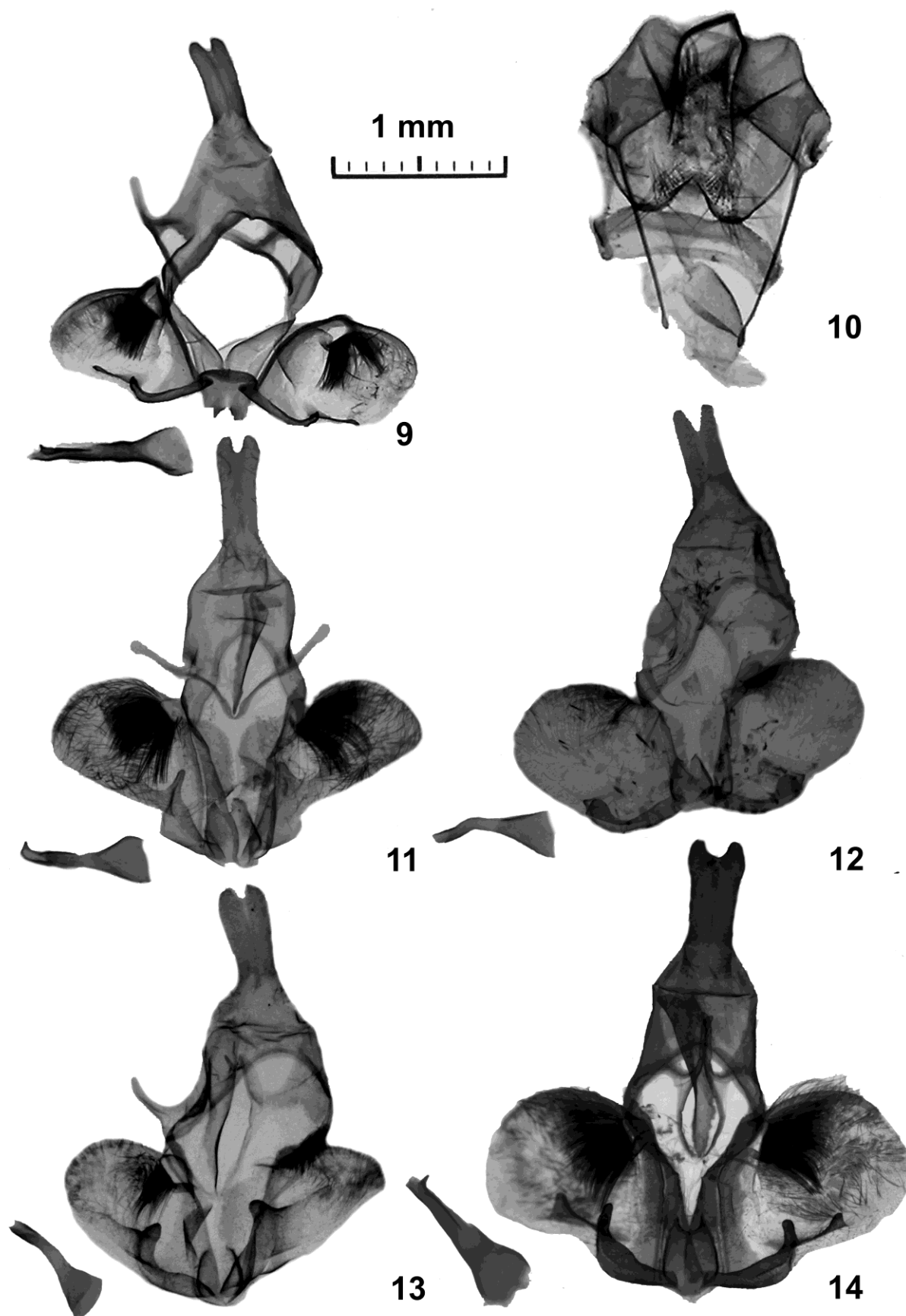
Description. Male. Length of fore wing 12.5 mm. Antenna bipectinate, setae twice longer than antenna rod diameter. Tip of abdomen with bundle of long modified scales. Fore wing dark-brown, with poorly expressed brown portions discally and postdiscally, marginal area and fringe mottled (dark-brown on veins, ocher between veins). Hind wing dark-brown, anal angle brown, marginal area and fringe mottled (dark-brown on veins, ocher between veins).

Male genitalia. Uncus long, with parallel edges, apically rounded, with long triangular notch on top; subscaphium long, funnel-like; gnathos arms thin, gnathos poorly expressed; valve short, rounded, thick curved harpe with mastoid apex in basal third of saccular edge, small mastoid harpe in medium third of saccular edge; juxta robust, with short, slightly acute lateral processes; saccus tiny, with poorly expressed notch on top; phallus shorter than valve, thin, with very wide semicircular cup-like basal process, strongly curved in medium third, with long rod-like cornutus.

Female unknown.



Figures 1–8. Adult specimens of *Marcopoloia*: 1. *M. discipuncta*, male, Taiwan, Prov. Ping-Tung, 10 km SE Mutan, 470 m, 07–10.iii. 1996, leg. Gy. Fabian & L. Nemeth (MWM); 2. *M. discipuncta*, male, Taiwan, Prov. Ping-Tung, Huang-Lion Recreation Area, 210 m, 06.iii.1996, leg. Gy. Fabian & L. Nemeth (MWM); 3. *M. discipuncta*, female, holotype of *Arbela discipuncta* Wileman, Kanshirei, Formosa, 1000 ft., 27.iv.1908, A.E. Wileman (NHMUK); 4. *M. discipuncta*, female, holotype of *Arbela baibarana* Matsumura, Horisha, 22.iv.1926, R. Saito & K. Kikuchi (ZMSU); 5. *M. leloi*, holotype (MWM); 6. *M. nangmai*, holotype (MWM); 7. *M. siniaevi*, holotype (MWM); 8. *M. thaica*, holotype (MWM).



Figures 9–14. Genitalia of *Marcopoloia*: 9. *M. discipuncta*, male, Taiwan; 10. *M. discipuncta*, female, Taiwan; 11. *M. leloi*, holotype; 12. *M. nangmai* (MWM); 13. *M. siniaevi* (MWM); 14. *M. thaica* (MWM).

Diagnosis. Clearly differs from other species of the genus in the long triangular notch on the top of the uncus, the poorly expressed harpes and the phallus strongly curved in medium third.

Distribution. Northern Thailand.

Etymology. The new species is named after the Nang Mai – female fairies of Thai mythology.

***Marcopoloia siniaevi* Yakovlev & Zolotuhin, sp. nov.**

<https://zoobank.org/urn:lsid:zoobank.org:act:86D48543-609F-4503-9522-8CBC838B03DC>

Figs 7, 13, 15

Material. Holotype, male, Myanmar (Burma), 40 km N Myitkyina, Chanc Kand village, 236 m, 23–24.iv.1998, leg. Murzin & Siniaev (MWM, GenPr-Heterocera MWM – 28.017).

Description. Male. Length of fore wing 13.5 mm. Antenna bipectinate, setae twice longer than antenna rod diameter. Tip of abdomen with bundle of long modified scales. Fore wing brown, with poorly expressed dark-brown pattern, marginal area ocher, fringe mottled (dark-brown on veins, ocher between veins). Hind wing dark-brown, anal angle brown, marginal area and fringe mottled (dark-brown on veins, ocher between veins).

Male genitalia. Uncus long, with parallel edges, apically rounded, slightly extended, shallow semicircular notch on top; subscaphium long, funnel-like; gnathos arms thin, gnathos poorly expressed; valve short, rounded, with thick semicircular harpe in basal third of saccular edge and small semicircular harpe in medium third; juxta robust, with short, slightly acute lateral processes; saccus tiny, with poorly expressed notch on top; phallus shorter than valve, thin, with very wide semicircular cup-like basal process, slightly curved in medium third, rod-like cornutus in vesica.

Female unknown.

Diagnosis. The new species differs from the known species of the genus in the mottled pattern on the fore wing and in the thick semicircular harpe in the basal third of the valve.

Distribution. Northern Myanmar.

Etymology. The new species is named after Viktor Siniaev (Moscow), my friend and well known collector of the Lepidoptera.

***Marcopoloia thaica* Yakovlev & Zolotuhin, sp. nov.**

<https://zoobank.org/urn:lsid:zoobank.org:act:60455324-865F-4949-9A99-F70745BD50E2>

Figs 8, 14–15

Material. Holotype, male, Thailand, Changwat Nan, 30 km E of Pua, 1700 m, 8.iv.1998, leg. Tibor Csovári & Pal Steger (MWM, GenPr-Heterocera MWM – 31.857).

Description. Male. Length of fore wing 11 mm. Antenna bipectinate, setae twice longer than antenna rod diameter. Tip of abdomen with bundle of long modified scales. Fore wing light-brown, with poorly expressed dark-brown pattern of strokes and blurred bands throughout all wing, marginal area and fringe mottled (dark-brown on veins, ocher between veins). Hind wing dark-brown, marginal area and fringe ocher.

Male genitalia. Uncus long, with parallel edges, apically rounded, slightly extended, with shallow semicircular notch on top; subscaphium long, funnel-like; gnathos arms thin, gnathos poorly expressed; valve short, rounded, with long finger-like harpe in basal third of saccular edge and shorter finger-like harpe in medium third; juxta robust, with short slightly acute lateral processes; saccus tiny, with poorly expressed notch on top; phallus shorter than valve, thin, with very wide semicircular cup-like basal process, spiky cornutus in vesica.

Female unknown.

Diagnosis. In the genital structure, the species is close to *M. nangmai*, from which it differs in the contrast light-brown fore wing. In the male genitalia, the uncus is significantly thicker than in *M. nangmai*.

Distribution. Northern Thailand.

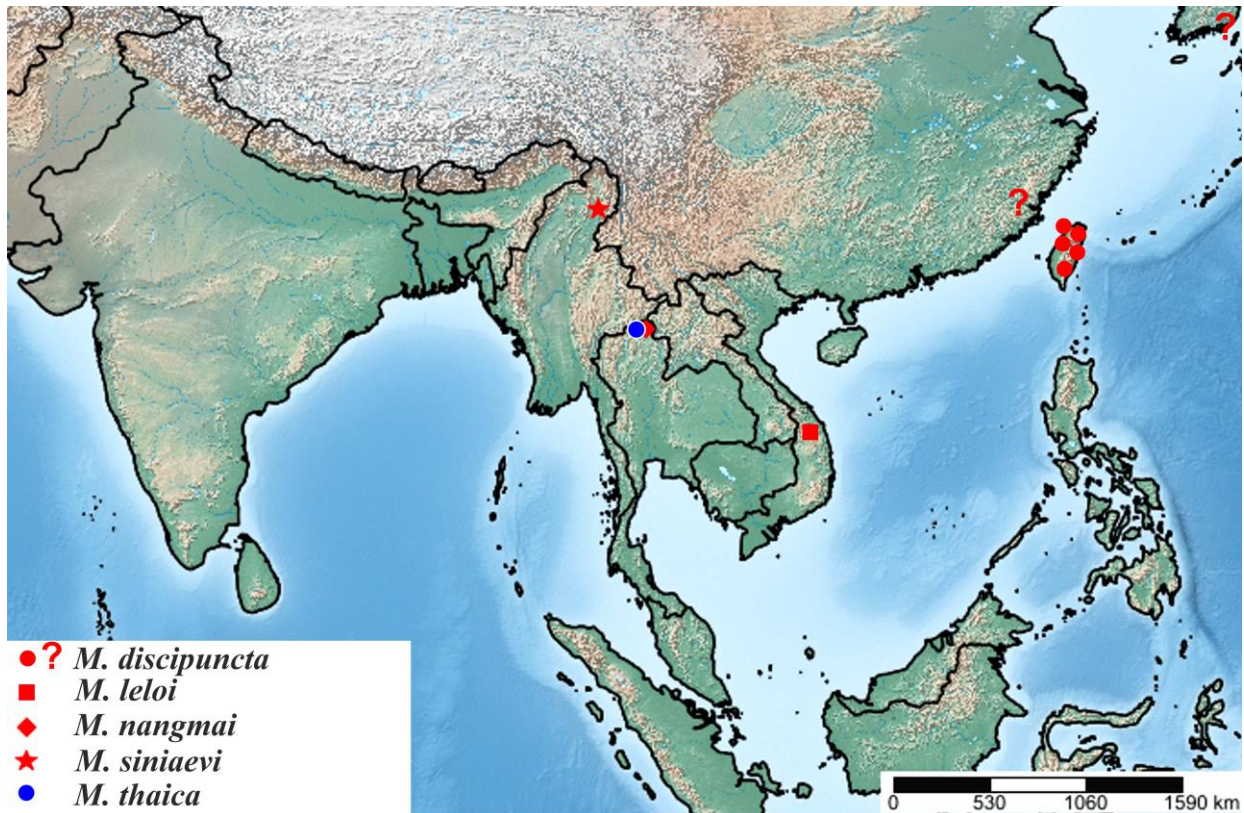


Figure 15. Distributional map of *Marcopoloia*.

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