

The *Actias* LEACH, 1815, in the Far East: how many species?

(Lepidoptera: Saturniidae)

by

VADIM V. ZOLOTUHN

received 4.XII.2009

Abstract: Six species are considered within *Actias* LEACH, 1815, of the Far East based on examination of the type material. The species *Tropaea dulcinea* BUTLER, 1881 is raised from synonymy to *Actias gnoma* (BUTLER, 1877) and is considered as a separate species; the continental *Actias artemis sjoqvisti* BRYK, 1948 **syn. nov.**, is synonymized with it. *Actias aliena* (BUTLER, 1879) and *A. xenia* JORDAN, [1912] are treated as distinct species and the following new synonymy is established: *Actias xenia* JORDAN, [1912] (= *A. artemis jordanii* NIEPELT, 1936 **syn. nov.**; = *A. artemis yakushimaensis* KISHIDA, 1994 **syn. nov.**). The lectotype is designated for *Actias xenia* JORDAN, [1912] from the Natural History Museum, London, and the neotype is designated for *Actias apollo* RÖBER, 1923 from the Museum Koenig, Bonn. The types of all species, and mature caterpillars for most of them, are illustrated.

Introduction: Saturniidae are one of the most well known groups of moths. Surprisingly, their nomenclature and identification are still very complicated for some genera, and the genus *Actias* LEACH, 1815, is among them. These problems originated because of strong individual and geographic variability of moths and their caterpillars, often enhanced by their sexual and seasonal dimorphism. It is especially strange because only two species of the genus were ever listed from the territory of Russia, Korea and Japan. Mostly they were cited as *A. artemis* (BREMER & GREY, [1853] 1852), and *A. gnoma* (BUTLER, 1877) and rarely some other taxa appeared in the lists. These are such exotic species as *A. ningpoana* C. FELDER & R. FELDER, 1862, or *A. mandschurica* (STAUDINGER, 1892). For example, IZERSKY (1999: 52) wrote «Subspecies *ningpoana* FELDER occurs rarely on the south of the Khassan District of Russia. It is considered by some authors (LAMPE, 1984) as a separate species *Actias ningpoana* FELDER, 1862». He also wrote that [*Actias*] *selene* «is one of two species native to Russia». INOUE (1976: 172) listed *mandschurica* STAUDINGER as a separate species: «*A. artemis tomariactias* BRYK, 1942, ... as a subspecies of *gnoma* from the southern Kuriles and Hokkaido, but it is possibly a junior synonym of *A. mandschurica* from the Amur and Ussuri districts».

The same situation is typical also for Japan. Only 2 species of the complex have been considered as native to the country: *Actias artemis* (BREMER & GREY, [1853] 1852), and *A. gnoma* (BUTLER, 1877) with some subspecies (INOUE, 1982, with additions after KISHIDA, 1994); a more detailed scheme, but also based on the same taxonomy, is the system used by Japanese amateurs (see Internet-resource <http://www.jpmoth.org/Saturniidae/Saturniinae>):

A. aliena aliena (BUTLER, 1879); *A. aliena sjoqvisti* BRYK, 1949.

A. gnoma gnoma (BUTLER, 1877); *A. gnoma mandschurica* (STAUDINGER, 1892); *A. gnoma miyatai* INOUE, 1976.

Thus, it is a mystery to know how many species of the genus are really native to the Far East (in the limits of Russian eastern Siberia and Far East, Korea, north-eastern China and Japan with Kuril Islands). The aim of the present article is to establish this number.

Material and methods

Approximately 500 specimens were examined from the following institutions' collections:

AMNH: American Museum of Natural History, New York, U.S.A.;

BMNH: Natural History Museum, London, UK (formerly The British Museum of Natural History);

MHUB: Zoologisches Museum der HUMBOLDT Universität, Berlin, Germany;

MWM: Entomologisches Museum WITT, Munich, Germany;

NSMT: National Science Museum, Tokyo, Japan;

RMS: Naturhistoriska Riksmuseet Stockholm, Sweden;

ZFMK: Zoologisches Forschungsinstitut und Museum ALEXANDER KOENIG, Bonn, Germany;

ZISP: Zoological Museum of Russian Academy of Sciences, Sankt Peterburg, Russia;

ZSM: Zoologische Staatssammlung, Munich, Germany;

and the private collections of: VASSILY ANIKIN (Saratov, Russia), SERGEY GORDEEV (Chita, Russia), GRIGORY GRIGORYEV (St. Petersburg, Russia), EUGENY KOSHKIN (Khabarovsk, Russia), PAVEL MOROZOV (Moscow, Russia), STEFAN NAUMANN (Berlin, Germany), V. ZOLOTUHN (Uljanovsk, Russia).

From the above material, a total of about 60 genitalia dissections were made and mounted in Euparal on glass slides using standard dissecting techniques. Illustrations were all based on the Euparal mounted preparations and photographed under magnification using Olympus Camedia C-750 Camera with Soligor Adapter Tube for Olympus and Slide Duplicator for Digital 10 Dptrs modified for object glasses. Plates were produced by V. ZOLOTUHN using CorelPhotoPaint X3 from photographs taken by S. GORDEEV, G. GRIGORYEV, B. GUSTAFSSON, E. KOSHKIN, P. MOROZOV, S. NEDOSHIVINA, D. SHOVKOON, D. STÜNING, P. USTYUZHANIN, F. ZIEREIS, and V. ZOLOTUHN. The photographed adult type specimens have not been altered, but in some of the genitalia illustrations, dissecting damage and position of separate parts has been digitally reconstructed, taking special care with regard to maintaining original proportions. Maps were compiled by the author using the same Corel PhotoPaint X3. The type location is indicated by a star marker if known exactly, while all others are represented by circles.

On the halftone plates, aedeagi are shown mostly for the type specimens only. It should be noted that the type specimens of the genus kept in the BMNH and examined for the present study, were not in the best state of preservation; abdomens of some were originally dissected after collecting and cleared out inside, damaging the genitalic capsules. Besides that, some specimens (especially *aliena* BUTLER) were originally decayed inside and partly damaged by pests, therefore the genitalic preparations consist in fact of separate sclerites. For the case of *A. aliena* BTL., therefore, the image of ♂ genitalia was reconstructed together from separate parts and the slide does not reflect the original composition of its parts.

No 'Material examined' is specially listed, in spite of the fact that more than 500 moths were investigated from different collections, because only type specimens were important for the study. Information about types is given in the corresponding parts of the article.

General part

The species within the genus are rather polymorphic, and often the characters of closely related species overlap, forming almost seamless variability. Genitalic characters are also very variable. We can divide the species of the Far East into two groups of species based on their genitalic structures (having crest-shaped uncus or having two rounded tergal lobes above uncus), but highlighting further specific diagnostic features is much more complicated. In caterpillars, coloration and size of scoli are diagnostic of the species as well, but we have very few larval images at our disposal which have been reliably identified or have had their identity confirmed by subsequent rearing through to the adult stage.

The problem became even more complicated when DUBATOLOV et al. (2007) published an article about taxonomic difficulties concerning *A. artemis* (BREMER & GREY, [1853] 1852). Here, the authors just considered a fact of the type fixation for the ♀ specimen collected near Peking [Beijing] by GASCHKEITSCH. It is the holotype by monotypy, not a syntype specimen (wrongly designated by DUBATOLOV as a Lectotype), and BREMER wrote about that clearly and unequivocally as «Diese Species wurde zuerst von mir in 1853 nach einem unvollständigem Exemplare aus Peking beschrieben» (BREMER & GREY, 1853: 16). Thus, the typus is a single specimen of very poor quality and rather worn. Doubtless, its quality made an attribution of conspecific specimens to the species very complicated for a long time. BREMER himself wrongly attributed "ein schönes Paar in Bureja-Gebirge gefangen" ("a beautiful couple collected in the Bureja Mountains") to *A. artemis* (BREMER & GREY) and illustrated both sexes of another distinct species in colour (col. pl. 1: 10, - compr. BREMER, 1864: pl. 2: 6, 7) that led to diagnostic mistakes of *A. artemis* (BREMER & GREY) for further 155 years.

The ♂ of the species was matched for the first time by ZOLOTUHIN in [2008] 2007, who synonymized the taxon previously known as *A. mandschurica* STGR. to *A. artemis* (BREMER & GREY). The situation was further clarified in ZOLOTUHIN & CHUVILIN (2009). Thus, it is not the species habitually known as "a beautiful couple from the Bureja mountains" that now should be considered as *A. artemis* (BREMER & GREY) but a larger *selene*-like one, formerly reported from Russia and Korea mostly as *A. gnoma* (BTL.) or *A. mandschurica* STGR., rarely also as *A. selene* HÜBNER, 1806. It can be diagnosed by light-yellowish green or bluish-white wing coloration, distinctly falcate apex of the forewing, long (in both sexes) tails of the hind wing with narrow base, double inner frame of the eye-spot and by the presence of double transverse dark bands on the wings, one more or less distinct and another less so. Both these bands are always present, although in ♀♀ the outer one may be diffuse and hardly visible.

Surely, genitalic characters also will distinctly separate both species. Shape of uncus is especially diagnostic there (see below).

It was already pointed out above, that in Russian literature the taxon considered was listed sometimes as *A. selene* HBN. or its subspecies, but a close relationship between both had not been found.

Actias selene (HBN.) was described as *Echidna caudata selene* HÜBNER, 1806 (Taf. 172: 1-2; Taf. 173: 3; Taf. 174: 4) after specimens of both sexes. Despite a less than successful drawing (col. pl. 1: 1) the species can be easily identified by the presence of lilac colour on the hindwing tails (col. pl. 1: 2, 3), but the very narrow forewing fasciae do not allow us to identify the type locality without some doubt remaining. It is given in KIRBY & WYTSMAN (1894-1897: 148) as: «Hab. CHINA, INDIA, CEYLAN» with remark «Es gibt viele ähnliche Formen in Ost-Asien, und mehrere werden wohl kaum spezifisch von dieser Art verschieden sein.» After serial material from northern India, southern China and Vietnam was investigated, we found that those populations have the same ground plan of genitalic peculiarities (figs 1, 2). They distinguish them well from the specimens inhabiting North China, Russia, and Korea on the one hand and inhabiting Central and Eastern China on the other. All three may be previously cited as *selene* - *artemis* - and *ningpoana* correspondingly and they are further discriminated easily after their caterpillars, despite ♂ genitalic characters being quite similar in these three species. *Actias selene* HBN. and *A. artemis* (BREMER & GREY) seem to be two species surely phylogenetically close but distinct, and originated allopatrically in different parts of the area of their common ancestor. The status of Sunda- or Taiwan populations of *A. selene* HBN. was not studied by me because it is beyond the aims of the article; in any case the name *artemis* has a time priority here. One more problem - a specification of the type locality for *A. selene* HBN. - was also not decided in the work and it is assigned to experts. Provisionally, it can be defined as northern India; and a particular location is not essential for the aim of this project.

♀ genitalia are also very diagnostic (fig. 38). The vaginal plate is distinct, ovoid to heart-shaped; sternal margins form ventrally touched pockets; narrow ductus bursae is fused with wide antrum, long, without caudal sclerotization; corpus bursae is pear-shaped, with distinct paired signa of different size.

Caterpillars of real *A. selene* HBN. (col. pl. 4: 3-5) are fine yellow-green. 2nd and 3rd thoracic segments are raised and higher than the 11th segment, and are swollen at their bases. Scoli are yellow with black basal frame on thoracic segments and on segment 11, but pinkish to orange on the remainder. Stigmal openings are yellow with light orange outer ring; suprastigmal band is whitish, with dorsal reddish brown frame which sometimes is separated to shorter spots or streaks. Head is green with brown shadows along suturae. Anal shield and anal legs are dark brown to black.

Caterpillars of so-called '*selene*' from eastern China are quite different (col. pl. 4: 6). Their scoli are all of beautiful bluish colour, and black colouring is reduced here. Supposedly we attributed these caterpillars to a taxon *ningpoana* C. FELDER & R. FELDER, 1862, but two different forms of the moths may be distinguished under this name (col. pl. 1: 11-14). Special rearing experiments are necessary to define the attribution of such caterpillars precisely.

Chinese literature was not useful for nomenclatorial work, and all species of the genus are mixed under a few names there. It is a fact that most species of the group are incorrectly identified, even in Fauna Sinica (ZHU & WANG, 1996); therefore the cited book was very carefully used for mapping of the areas.

Thus, there is the problem of (1) defining the taxonomic status of numerous taxa already described for the former *A. artemis* (BREMER & GREY), and (2) that of the taxonomic position of the moths known for a long time under the name *A. artemis* (BREMER & GREY). All moths of the group have bilobed tergal processes of the uncus clearly outlined within all phenotypically related congeners. Five names were introduced to designate their different populations in the Far East (alphabetically listed):

aliena BUTLER, 1879, *dulcinea* BUTLER, 1881, *sjoqvisti* BRYK, 1948, *xenia* JORDAN, [1912], *yakushimaensis* KISHIDA, 1994,

Let us begin with the so-called "yellow *artemis*" inhabiting Japan.

Actias xenia JORDAN, [1912] **stat. rev.** (col. pl. 2: 15-18)

Actias artemis xenia JORDAN, [1912], Die Großschmetterlinge der Erde 2: 211. Type locality: Liu-Kiu-Insel, Okinawa. Syntypes 5 ♂♂ (BMNH) [examined].

= *Actias artemis jordani* NIEPELT, 1936 **syn. nov.**, Ent. Z. 4: 35, figs 1, 2. Type locality: [Japan] originally given as “Ta-t sien-lu” [southern China] erroneously. Holotype ♂ (AMNH) [examined].

= *Actias artemis yakushimaensis* KISHIDA, 1994 **syn. nov.**, Gekkan-Mushi No 282: 12, figs 1, 2. Type locality: Japan, Kagoshima, Yakushima I., Nagata. Holotype ♂ (NSMT) [examined].

Moths have dense yellow or greenish yellow scale cover, not semi-transparent, large rounded discal eyes bordered inside with one distinct and a second very weak bracket-shaped armillas, zig-zag grey to dark grey postmedial fasciae; moths are larger than similar congeners (wingspan about 90 mm in ♂♂).

In the ♂ genitalia (figs 25-28) uncus is with bilobed tergal processes; gnathos is weak with weakly protruded tops of the branches; costal margin of the valva is smooth, convex; juxta is with almost symmetric lateral lobes; saccular processes are longer than in related species.

In the ♀ genitalia (fig. 41), the vaginal plate is weak, almost desclerotized, atrium is cone-shaped, ductus bursae is narrow and has diffuse sclerotization caudally; corpus bursae is without signa.

JORDAN (1912) described the taxon as a subspecies of *A. artemis* (BREMER & GREY) from Liu-Kiu (Ruy-Kyu Islands). Quite distinct external characters are typical for the taxon. But, surprisingly, it was synonymized by INOUE (1982: 211) to *A. aliena* BTL., and this point of view became the norm, at least for Japanese lepidopterologists, for a long time.

However, after studying the type material this synonymization is not confirmed and should be rejected. Both taxa differ clearly, and *A. xenia* JORDAN has larger hindwing tails, more rounded eye-spots, different general shape of the wings and different general appearance, but the most distinctive character is the shape of the postmedial fascia. Separate segments of this fascia are quite different from *aliena*'s shape and curvature degree. The saturated yellow colouration is also typical at least for southern populations of *A. xenia* JORDAN; but northern moths of the species can be of the same delicate greenish ground colour as *A. aliena* BTL.

Possibly, as a result of such traditional treatment of Japanese *A. aliena* BTL., the taxon *A. artemis yakushimaensis* KISHIDA, 1994 was described, based on material collected near Nagata City on Yaku-Shima Island (col. pl. 2: 16). The taxon is indistinguishable on the presented external features from *A. xenia* JORDAN. KISHIDA pointed out in the description that *yakushimaensis* is very similar to subspecies *aliena* BTL from Honshu, Shikoku and Kyusyu, but produces both generations of ♂♂ always yellow; the spring generation of *aliena* BTL is never yellow. KISHIDA did not discuss differences of his new subspecies from *xenia* JORDAN; presumably it was unknown to him. Both are conspecific in my opinion, leading to the following new synonymy:

Actias xenia JORDAN, [1912] = *Actias artemis yakushimaensis* KISHIDA, 1994 **syn. nov.**, Gekkan-Mushi No 282: 12, figs 1, 2. Type locality: Japan, Kagoshima, Yakushima I., Nagata. Holotype ♂ (NSMT) [examined].

At the same time, one more taxon needs to be considered within the *xenia*-group. It is the poorly known *jordani* NIEPELT, 1936, originating after its description from Ta-t sien-lu (southern China) after a single ♂ and still known only after the holotype (col. pl. 2: 17). This taxon is completely identical to the moths from southern Japan. All known south Chinese *Actias* belong to another specific group, and the geographic label of the species is written negligently by pencil «Ta-t sien-lu» that forces one to doubt its correctness. Its genitalic characteristics are also identical with those of the Japanese population.

Unique similarity of the taxon with *A. xenia* JORDAN was also confirmed by Dr. STEFAN NAUMANN (Berlin, pers. comm.). Thus, one more new synonymy is established here:

Actias xenia JORDAN, [1912] = *Actias artemis jordani* NIEPELT, 1936 **syn. nov.**, Ent. Z. 4: 35, figs 1, 2. Type locality: [Japan] originally given as “Ta-t sien-lu” [southern China] erroneously. Holotype ♂ (AMNH) [examined].

It is interesting that taxa described originally as subspecies from the former *A. artemis* (BREMER & GREY), are so distinct from the ‘nominat’ subspecies. Most problems in their systematization, or unwillingness to accept and realise them, were usually explained by seasonal polymorphism (INOUE, 1982; KISHIDA, 1994), but these data were not always confirmed by rearing or breeding experiments for all taxa. We saw a good sample of reared material of different generations in the collection of ZFMK, and can therefore confirm that seasonal differences are not so considerable for the group, as was postulated or figured in “Moths of Japan”. The size of the moths differs in different generations, it is true, as well as the shape of the hindwing and its tail also, but general colour saturation and especially the wing patterning are enough stable characters.

Distribution: The species is locally known only from Japanese islands Tazawako, Otsuki, Yokohama, Nagata (Yakushima Is.), Kurio (Yakushima Is.), Katzigudaka, Uradani, Miyagi, Okinawa (Ruy-Kyu Isl.), and Karinzawa.

Nomenclatorial notes: For nomenclatorial stability, a ♂ from the syntypic series is designated here as a lectotype. The species *Actias xenia* JORDAN, [1912], was described after an unspecified number of ♂♂ now kept in BMNH, of them five syntypes were found. One of them (col. pl. 2: 15) bears the following labels (yellowish rectangular label with ink inscription «Okinawa»; larger white rectangular label with hand-written inscription in black ink in the hand of JORDAN «*Actias Artemis* | *xenia*. Type. | JORD. in SEITZ, Ma- | crolepid. II. 1911.» and white circle with blue frame and printed «Syn- | type») and is designated by me as lectotype. It is supplied with a corresponding label: red rectangle with black frame and printed “LECTOTYPE | *Actias Artemis* ♂ | *xenia* JORDAN [1912] / des. ZOLOTUHIN, 2010.” The remaining syntypic ♂♂ are considered to be paralectotypes.

Two more distinct forms from Japan have also lobed tergal processes of uncus; they are *A. aliena* BTL. and the species formerly listed from there as *A. artemis* (BREMER & GREY).

Actias aliena (BUTLER, 1879) (col. pl. 2: 19-22)

Tropaea aliena BUTLER, 1879, Ann. Mag. Nat. Hist. (5) 4: 355. Type locality: Japan. Holotype ♂ (BMNH) [examined].

The species is well distinguishable from others because of external features. Wings are of bluish to yellowish-greenish blue ground colour, in summer generations more yellowish, always with dense scale cover. Eyes of the forewing are narrow, with single armilla, which on the hindwings is sometimes with a black or dark grey frame. This frame is absent in the spring generation. Wings bear grey transversal [postmedial] fasciae between eye and outer margin; the fascia is rather distinct and sometimes slightly undulate, especially in the hindwing. Both pairs of the wings are with bright yellow cilia contrasting to the ground colour of the wings. Tails are short, wide basally; much longer in males. The moths are robust and very compact in general shape.

In the ♂ genitalia (figs 22-24) uncus is with bilobed tergal processes and gnathos is weak without any tops of the branches; costal margin of the valva is smooth, weakly convex and cucullus is generally of rhomboid shape; juxta is with equal lateral short lobes; saccular processes are medium sized.

In the ♀ genitalia (fig. 44), the vaginal plate is desclerotized, atrium is low, ductus bursae is narrow membranous without caudal sclerotization.

Caterpillars (col. pl. 4: 9) are generally very similar to those of *Actias sjoqvisti* BRYK, 1948.

Distribution: Widely distributed in Japan, but so far not recorded from the continent.

Nomenclatorial notes: The holotype, a ♂, is really a giant specimen, of a rare yellowish colour form (col. pl. 2: 19). It resembles strongly the previous taxon but the cilia are contrasting and short tails are typical for *aliena* in the accepted sense.

The third taxon is similar externally to *A. aliena* BTL. and differs in having a lighter ground colour and in the scale cover being sparse and semitransparent. Eye-spots are always without a black border. Anal corner of the forewing is angled and outer margin of the hindwing is often undulate. The species was for a long time known from Japan (also from the continent) as *A. artemis* (BREMER & GREY), but now, when the taxon *artemis* is attributed to the species from a quite distinct specific group, *dulcinea* BTL. is the name appropriate for the taxon.

Actias dulcinea (BUTLER, 1881) **stat. rev.** (col. pl. 1: 10; col. pl. 2: 23-26; col. pl. 3: 33)

Tropaea Dulcinea BUTLER, 1881, Trans. Ent. Soc. London **1881**: 14. Type locality: [Japan, Tokyo] Tokei. Holotype ♂ (by monotypy) (BMNH) [examined].

= *Actias artemis sjoqvisti* BRYK, 1948, syn. nov., Arkiv för Zoologi **41A** (1): 18, fig'd. Type locality: Korea, Shuotsu. Holotype ♂ (by monotypy) (RMS) [examined].

Wings are of bluish to greenish blue ground colour, scale cover is weak, semitransparent. Eyes of the wings are narrow, without a frame. Wings are without grey transversal [postmedial] fasciae between eye and outer margin and only very rarely it can be [hardly] visible in some ♀♀. Cilia in both pairs of the wings are similar in colour to the ground colour or just a bit more yellowish. Outer margin of the wings is wavy, especially in the hindwing. Tails are short, wide basally in ♀♀; and much longer and more slender in ♂♂.

♂ genitalia (figs 21, 29-32) are very similar to *A. aliena* BTL. but saccular processes are much shorter and gnathos has no protruded tops of the branches. All these species with bilobed tergal processes are very similar in the genitalic characters; *A. dulcinea* (BTL.) has saccular processes shorter than in the related species.

In the ♀ genitalia (figs 42, 43), the vaginal plate is weak, almost desclerotized, atrium is pocket-shaped, ductus bursae is short and caudally widened but membranous; corpus bursae bears a small signum.

Caterpillars (col. pl. 4: 7, 8) are yellow-green in the species. The 2nd and 3rd thoracic segments are raised and oversized segment 11 is also slightly larger compared with other segments. Scoli are yellow with reddish brown basal frame on thoracic segments of the body. Stigmal openings are light orange with darker outer ring; suprastigmal band is yellowish, with dorsal reddish orange frame which sometimes is separated to short spots or streaks. Head is monochrome brown. Anal shield and anal legs are reddish brown, with narrow basal blackish-brown sclerotization. Morphology of earlier instars of the species, as for *A. artemis* (BREMER & GREY), including larval chaetotaxy and biology in Russian Primorye, was given in detail by TSCHITJAKOV & BELYAEV, 1986.

Distribution (map 3): In Russia the species is known from Jewish Autonomy (Obluchie, Radde, Kuldur, Tajezhnyj, Bastak Reserve), Khabarovsk Region (vill. Slavjanka of Nanajsk District, Bojtzovo, Khabarovsk) and Primorye (everywhere here). In Korea it is known from Kum-gang, Kangwon, Pyong-yang, Kongosan: Utikongo, see also PARK et al., 1999; PARK, 2000. In north-eastern China it was mapped by ZHU & WANG, 1996 as *A. artemis* (BREMER & GREY). The species is rare in Japan, where it is known in sympatry with the related *A. aliena* (BTL.) and is reliably known from at least Tokyo, Nagano, Takao-san and Yamanashi.

Nomenclatorial notes: 1. The species was for a long time overlooked by scientists because it was always erroneously considered as a synonym of *A. gnoma* BTL. (see, for ex., INOUE 1982: 317). At the same time, the typical specimen, the holotype by monotypy (fig. 21, col. pl. 2: 24) was never dissected, therefore its taxonomic position was never clear. The holotype was examined by me in February 2010 in BMNH leading to these unexpected results.

2. DUBATOLOV et al. (2007) proposed the name *sjoqvisti* (originally it was introduced as „*sjoqvisti*“ after a Swedish not German collector, see below) to designate the continental population of this species which they correctly considered to be distinct from *A. aliena* (BTL.) at least on the subspecific level. I see no real differences between continental populations and those of Japan if both are attributed to *A. dulcinea* (BTL.), but in case differences will be observed using another method, for example, the name *sjoqvisti* is appropriate for the continental populations.

The question about the relationship between *A. dulcinea* (BTL.) and *A. aliena* (BTL.) is still open. Surely both taxa are closely related. Their genitalic characters are very similar and caterpillars of both display no considerable differences. Hence, externally *A. aliena* (BTL.) differs easily from *A. dulcinea* (BTL.) having denser scale cover on the wings (they are therefore not semitransparent), bright yellow contrasting cilia on both wings, transversal undulate postmedian fascia and black eye frames in the summer generation. Inner eye's armilla can be double. Both taxa are found together on the islands of Japan (see http://www.jpmoth.org/Saturniidae/Saturniinae/Actias_aliena_aliena.html where both species mix, and also with xenia Jordan, 1913). This makes it possible to consider *A. dulcinea* (BTL.) as a species distinct from *A. aliena* (BTL.), but DNA analysis will be required to provide a definitive answer.

3. DUBATOLOV et al. (2007) used the transcription „*sjoqvisti*“ for the originally given „*sjoqvisti*“ taken from Article 32.5.2.1. of the Code... as a base. At the same time the Article correctly reads: “32.5.2. A name published with a diacritic or other mark, ligature, apostrophe, or hyphen, or a species-group name published as separate words of which any is an abbreviation, is to be corrected. 32.5.2.1. In the case of a diacritic or other mark, the mark concerned is deleted, except that in a name published before 1985 and based upon a German word, the Umlaut sign is deleted from a vowel and the letter „e“ is to be inserted after that vowel (if there is any doubt that the name is based upon a German word, it is to be so treated).

Examples: *nuñezi* is corrected to *nunezi*, and *mjobergi* to *mjobergi*, but *mülleri* (published before 1985) is corrected to *muelleri*”.

In the case under consideration, the name *sjoqvisti* originates from the family name of Swedish naturalist Sjöqvist (?ERIK, 1903-1975), is surely not based upon a German word and should be changed therefore to “*sjoqvisti*” not “*sjoqvisti*”.

Another group of species includes moths with uncus being crest-like, with distinct folds or sclerotized transversal rows. Sometimes uncus is laterally flattened and looking like a narrow cock crest (in *selene* prope) but in *gnoma*-group it is usually wider and flattened dorso-ventrally. Its apex can be pointed or terminates in 2-3 spines or widened and looking like a fish tail. These different kinds of

shape characterize the different taxa and were used by me to separate species. At least 3 taxa have an uncus of such shape. One of them is *A. artemis* (BREMER & GREY). Two others are known under the names *A. gnoma* (BTL.), and *A. apollo* RÖBER.

Actias artemis (BREMER & GREY), [1853] 1852 (col. pl. 1: 5-9)

Saturnia Artemis BREMER & GREY, [1853] 1852, Études ent. par MOTSCHULKY 1: 64. Type locality: [China, Beijing env.] «aux environs de Pekin». Holotype ♀ (by monotypy) (ZISP) [examined].

= *Tropaea Mandschurica* STAUDINGER, 1892, Mém. Lépid. 6: 331. Type locality: [Far East of Russia] Ussuri. Lectotype ♂ (ZHUB) [examined], designated by ZOLOTUHN & CHUVILIN, 2009.

The species is easily identified by its light greenish yellow to whitish, sometimes bluish wing colour, distinctly falcate forewing apex, long and narrow tails, especially in ♂♂, and their bases are also narrow in ♀♀. Eyes have double black frames inside, and wings double transversal postmedial grey fascia, outer band may be weakly visible in some specimens, but mostly is visible well in both sexes.

In the ♂ genitalia (figs 3-7) uncus is crest-shaped and terminates in 2-3 spines (figs 3-5) or widened and looking like a fish tail (figs 6, 7); gnathos is narrow band-shaped with heavy sclerotized and protruded serrate tops of the branches; costal margin of the valva is smooth, broadly rounded; juxta is with asymmetric lateral lobes where the left lobe is always shorter; saccular processes are long. I cannot explain the differences in the shape of uncus; it is not bound with any habitual features. Probably, it is only extreme variants of individual variability, but maybe we are working with populations of evolving semi-species; finer methods need to be used to fine such hypotheses.

In the ♀ genitalia (figs 36, 37, 39), the vaginal plate is distinct, ovoid to trapezium-shaped, probably varies geographically; sternal margins form ventrally widely separated pockets; ductus bursae is fused with antrum, long, powerful, caudally widened, with weak and diffuse sclerotization caudally; corpus bursae is pear-shaped, with single signum.

The illustration of the ♀ genitalia of the typical specimen of *A. artemis* (BREMER & GREY) was already given by DUBATOLOV et al. (2007) as a drawing (fig. 33) made by one of the co-authors, A. STRELTZOV. Hence, the illustration was so different from the ground plan of ♀ genitalia in this group, that I specially asked for the preparation (made in glycerine) by the staff of ZISP, to be sure of the accuracy of the drawing. A photo and a new drawing to compare were made to courtesy of S. NEDOSHIVINA (figs 36, 37). On the photo, the postvaginal plate is so distinctly visible, as an ovoid heavy sclerotized shield, that it is absolutely not understandable to me how such so remarkable sclerite can be overlooked by examination. The authenticity of other illustrations given in the same article is therefore also questionable, also because of the schematic picture.

Caterpillars are very characteristic in the species (col. pl. 4: 1, 2). Their ground colour is light apple-green. The 2nd and 3rd thoracic and 11th abdominal segments are prominent and distinctly superior. Scoli on these segments are yellow or orange, with distinct broad basal borders; remaining scoli are smaller, red to reddish-orange, with a narrow, sometimes very fine, basal border. Stigmal openings are light yellow orange, with a darker outer margin; suprastigmal band is as a row of interrupted dark reddish brown or reddish grey strokes. The head is green with brown darkness along suturae. Anal shield and anal legs have very dark brown to almost black sclerotized fields.

In *A. selene* (HBN.) (col. pl. 4: 3-5), head is completely brown, scoli are smaller, and suprastigmal band is red and entire; in *A. ningpoana* C. FELDER & R. FELDER, 1862, (if my identification is correct, probably more than one species is understood under the species so far - see adult col. pl. 1: 11-14 with the holotype on the fig. 12, and in caterpillar col. pl. 4: 6 scoli are bright blue and the red suprastigmal band is completely lost.

Distribution of the species needs to be studied more precisely. Now, the species is known (map 1) from the following localities. In Russia they were observed from Transbaical (Chita Region: Undino-Poselie and Urjupino; Amazar and Amazar Gorges (KOSTJUK & GOLOVUSHKIN, 1994, 2 ♂♂ in KSU), Jewish Autonomy (Kuldur and Obluchie), southern Yakutia, or Sakha Republic: Nerjungri (IZERSKY & GULJAEV, 1996), Khabarovsk Region (Khabarovsk and Nanajsk), Amur Region (Belogorsk), Primorye (Vladivostok, Slavyanka, Khassan, Andreevka, Ussurijsk, Kedrovaya Pad' Reserve). The species is known also from Korea (at least from Kum-Gang, Pyong-gang, Seoul), and north-eastern China (reliably at least from "Northern China", Shanghai and Beijing). Single specimens were observed also in Japan (Hariman, Gifu, see also http://www.jpmoth.org/Saturniidae/Saturniinae/Actias_gnoma_mandschurica.html, a version from 25 September 2009 is cited here). More material is necessary to define the southern and western border of the distribution and a zone of probable sympatry with proper *A. selene* (HBN.), from which it differs by reduced yellow wing tint, less falcate forewing apex and absence of pinkish colour on the hindwing tails; in the ♂ genitalia the costal margin of valvae is smooth, not undulate or convex.

Comments: Despite the general appearance being very characteristic for the species, the ♂ genitalic features are somewhat variable and probably *A. artemis* (BREMER & GREY) is a complex of two or three species differing by uncus shape. E. BELYAEV (Vladivostok) delivered an assumption that such differences may be connected with a generation, but this idea requires confirmation; it seems most unlikely to me that one species differs so strongly in the uncus shape and equipment in different broods.

Actias gnoma (BUTLER, 1877) (col. pl. 3: 27-32)

Tropaea gnoma BUTLER, 1877, Ann. Mag. Nat. Hist. (4) 20: 480. Type locality: Japan. Holotype ♂ (BMNH) [examined].

= *Actias artemis* subsp. *tomariactias* BRYK, 1942, Dt. Ent. Z. Iris 56: 26, pl. 1: 1. Type locality: Kunashiri, Tomari. Holotype ♀ (RMS) [examined].

Moths are light greenish blue with raised and sparse scale cover and therefore looking somewhat semitransparent. Forewing apex is slightly falcate. A single postmedial fascia is typical for the wings, at least for the forewing. Eyes are small, mostly with a fine black frame (sometimes it is absent, but mostly on the forewing). Inner half of the eye is narrower than the outer one. Apex of the hindwings is usually pointed. Hindwings have long and narrow tails in ♂♂, short and wide in ♀♀. In Japanese populations eyes are more prominent, mostly with a black circular frame.

Actias artemis tomariactias BRYK was described from Kunashir (col. pl. 3: 29), and was synonymized by INOUE (1982) to *Actias gnoma mandschurica* STGR., i. e. to *A. artemis* (BREMER & GREY) de facto. How it can be done is really a mystery, because even types of both are quite different, and both were formerly figured. At the same time the type of *A. artemis tomariactias* BRYK is a ♀ specimen of *A. gnoma* (BTL.); we have seen the same specimens in samples of reared moths of both sexes from Japanese localities.

♂ genitalia (figs 9-18): The uncus, generally crest-like, is of two different shapes. In one, its caudal part flattened as a fish tail, but basally with transversal sclerotized ridges. In the second shape, the basal part is wide and sometimes somewhat swollen, divided into two longitudinal serrate rolls, coming caudally in one, with a few apical teeth. Gnathos is distinct, sclerotized, with pointed, rarely serrate, tops of the branches. Costal edge of the valvae is smooth, concave, and saccular appendage is very long, almost reaching the top of cucullar lobe of the valve. Juxta is asymmetrical, bilobed, and the left lobe is shorter and wider.

In the ♀ genitalia (fig. 35, 40), the vaginal plate is distinct, low, ovoid; sternal margins form ventrally widely separated pockets; ductus bursae is fused with antrum, long, powerful, caudally widened, with distinct sclerotization caudally; corpus bursae is pear-shaped, with single weak signum.

The ground colour of the caterpillars of the species (col. pl. 4: 10, 11) varies from light green to bluish green. The 2nd and 3rd thoracic and 11th abdominal segments are prominent but more swollen than oversized. Scoli on all segments are light yellow or bluish white, with weak dark grey basal borders. Stigmal openings light yellow-orange, with slightly darker outer margin; suprastigmal band weak, yellowish, without reddish strokes. The head is green with indistinct brow.

Distribution (fig. 2): The species is widely distributed in Japan (I saw the moths from Nagoya, Tokyo, Yokohama, Nagano, Mami-kochi, Kobe) where it is the second dominant species of the genus (wit *A. aiena* BTL.). INOUE (1976: 172) cited it as very common for northern Japan, but stated that it is not known from Kyusyu and southernmost islands. The species is known also from the Kurils; from there the subspecies *A. artemis omariactias* BRYK, 1942 was described. On the continent, the species is rare and very local. In Russia the species was observed in Transbaical (Chita Region: Undino-Poselie and Urjupino) and Primorye (Sutschan = Partizansk), and is known also from Korea (at least from Pyong-gang). The species is surely widely distributed but the external similarity of two species, *A. gnoma* (BTL.), and *A. sjoqvisti* BRYK, leads to constant misidentifications in the collections and necessitates the checking of genitalic features (also visible under scale cover without preparations) of every specimen collected.

Nomenclatorial notes: *A. gnoma miyatai* INOUE, 1976 was separated on the basis of its geographical isolation to the Island of Hachijojima and distinction in the juxtal shape, where the lobes are short and somewhat clavate (*Actias gnoma miyatai* INOUE, 1976, 1976, Bull. Fac. domest. Sci. Otsuma Wom. Univ. 12: 172, pl. 7: 106, 107. Locus typicus: [Japan] Power Plant, Island of Hachijojima. Holotype ♂ (BMNH) [examined]). In external characters the subspecies is indistinguishable from the nominotypical subspecies.

The most mysterious taxon of the Japanese *Actias*-species is surely *A. apollo* RÖBER, 1923. It was described from Hyogo, central Japan, after a ♂ with a wingspan of 88 mm. Its type has not been found in spite of special searches, and the species is considered since 1982 (INOUE, 1982: 317) to be a synonym of *Actias artemis aliena* (BTL.). But I found some specimens among Japanese *Actias* which could not be attributed to any at present known species, but matched well to a description of *A. apollo* RÖBER.

In such complicated cases, 'The Code...' recommends the selection of a neotype. Let us first understand what species is determined under the name *A. apollo* RÖBER. The original description reads in English transcription: "*Actias apollo* sp. n. - This species from Middle Japan (Hiogo) is close to *selene*; I have a ♂ with wing span 88 mm which differs from a ♂ of *selene* just by absolutely another shape of the fore wing, its apex is not protruded but almost rectangular; outer margin of the fore wing is rather straight but (as the outer margin of the hind wing) is regularly weakly undulate. The hind wing is not so long as in a ♂ of *selene* but longer than in (large) *artemis*, basally broader than in *selene*. Upper side is uniformly light green, more green than in *artemis*; veins are very distinct, light brown, eyes are almost so large as in *artemis* but more distinct, yellow part of the eye is wider than in *artemis*; cilia are yellowish. Shadow-like blackish strokes present in the center of the fore wing between outer margin and eye; they situated from outer margin to a middle of central cell between 1 and 3 median veins; before it, near to a middle between these streaks and outer margin, there is one more, the shorter, more vaguer streak; besides that, distinct subbasal streak typical for *selene* is absent here; vague blackish submarginal streaks situated on the hind wing from Radius to tail base. Red enclosure of the fore wing is darker than in *artemis* but lighter than in *selene*, and its white margin going just to a middle of the central cell; front is yellowish, darker than in *selene*. The lower side is somewhat lighter and dark submarginal patterning is more distinct here but inner elements of dark patterning, contrary, is vaguer. Antennae darker (brownish) than in *selene* and *artemis*, their pectination is somewhat longer than in *selene* and distinctly darker".

Such moths with bluish ground colour, double transverse median fascia and single armilla of the eyes were found among moths with a crest-like uncus. To stabilize the nomenclature, a neotype is designated here after a ♂ from the collection of ZFMK (col. pl. 3: 34).

In the ♂ genitalia (figs 19, 20) uncus is crest-shaped and terminates in 2-3 spines but is not widened as a fish tail; gnathos is narrow band-shaped with heavy sclerotized and protruded serrate tops of the branches; costal margin of the valva is smooth, broadly rounded; juxta is with asymmetric lateral lobes where the left lobe is always shorter and wider; saccular processes are long and basally curved.

The neotype bears a white rectangular label printed «Japan | Zucht Köln | 9.85 M. Forst». It is supplied with an additional red rectangular label with a black frame and printed "NEOTYPE / *Actias apollo* ♂ / RÖBER, 1923 / des. ZOLOTUHN, 2010".

As the phenotype of the species should be clear now, nomenclatorial acts are possible. Now the following species and subspecies can be considered within the group of Far Eastern *Actias* LEACH, 1815:

selene-group

Actias artemis (BREMER & GREY, [1853] 1852)

= *Tropaea Mandschurica* STAUDINGER, 1892

Actias gnoma (BUTLER, 1877)

A. gnoma gnoma (BUTLER, 1877)

= *Actias artemis tomariactias* BRYK, 1942,

A. gnoma miyatai INOUE, 1976

Actias apollo RÖBER, 1923

dulcinea-group

Actias dulcinea (BUTLER, 1881)

= *Actias artemis sjoqvisti* BRYK, 1948 **syn. nov.**

Actias aliena (BUTLER, 1879)

Actias xenia JORDAN, [1912]

= *Actias artemis jordani* NIEPELT, 1936 **syn. nov.**

= *Actias artemis yakushimaensis* KISHIDA, 1994 **syn. nov.**

Acknowledgements: I am grateful to BERT GUSTAFSSON (RMS), MARTIN HONEY and GEOFF MARTIN (BMNH), WOLFRAM MEY (ZHUB), SUZANNE RAB GREEN (AMNH), DIETER STÜNING (ZFMK) and THOMAS WITT (MWM) for support and access to the Museums' collections; to STEFAN NAUMANN (Berlin) and EUGENY BELAEV (Vladivostok) for fruitful and useful discussions; to SVETLANA NEDOSHIVINA (ZISP) for general and technical support at all stages of the project; to VASILY ANIKIN (Saratov), ALEXANDER CHUVILIN (Tula), TATJANA and SERGEY GORDEEVs (Ulan-Ude), GRIGORY GRIGORYEV (St. Petersburg), EUGENY KOSHKIN (Khabarovsk), ALBERT

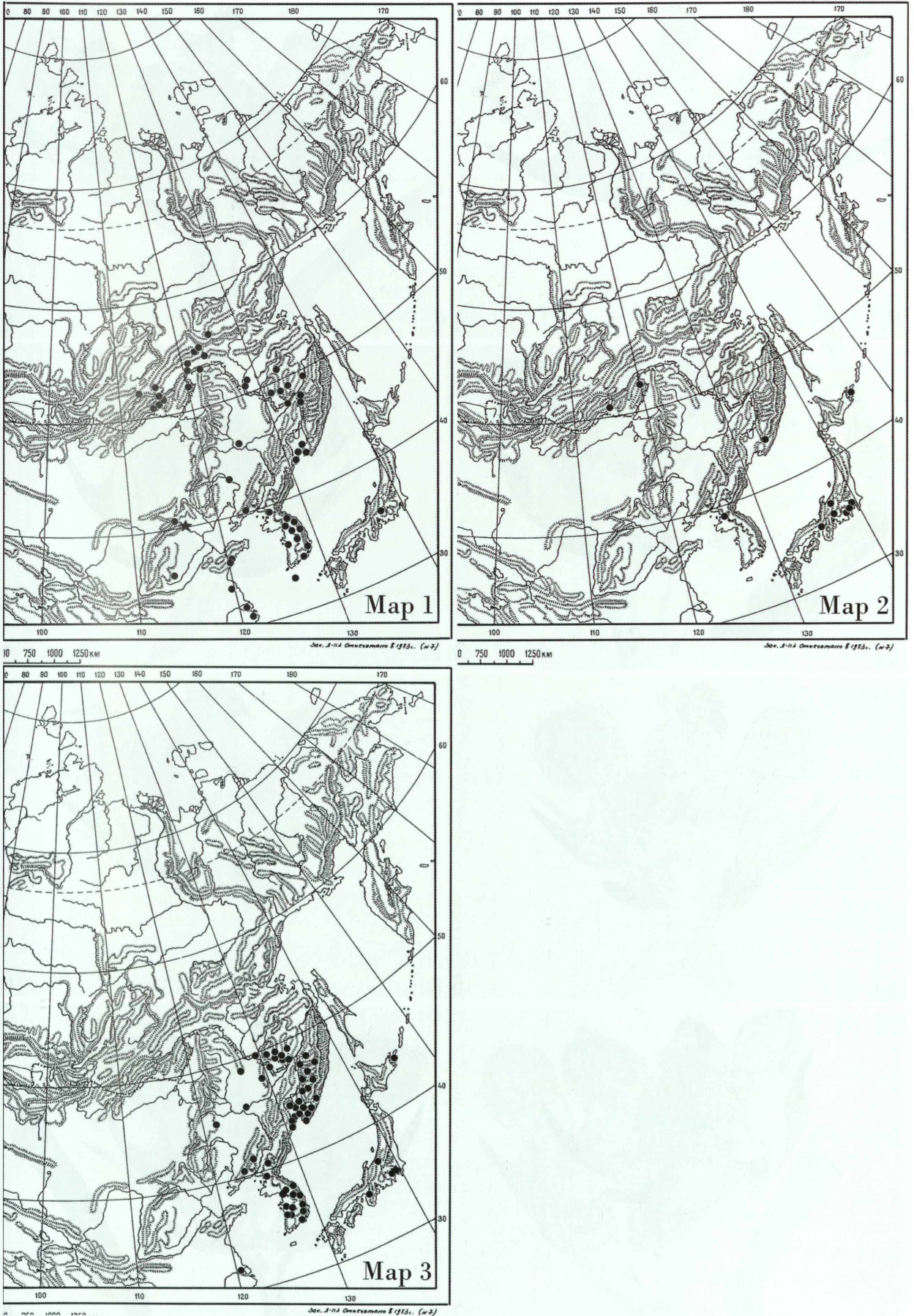
LASTUKHIN (Cheboksary), PAVEL MOROZOV (Moscow), DMITRY SHOVKOON (Samara), and PETER USTJUZHANIN (Novosibirsk) for their help in different ways during the preparation of the manuscript. Furthermore, we thank Mr. EDDIE JOHN (Cowbridge, U.K.) for linguistic assistance. Financially the investigation was supported by THOMAS-WITT-Stiftung in 2008 and 2009. The images of the typical specimens from the collection of the BMNH were figured here in courtesy of The Trustees of the Museum and caterpillars were figured in courtesy of SERGEY GORDEEV (Ulan-Ude), DIETER STÜNING (ZFMK), ANDREY ZAGORINSKY (Moscow) and FRANZ ZIEREIS (Germany). The work is part of a programme of the Department of Zoology (State Pedagogical University of Ulyanovsk) on an investigation into the biodiversity of moths.

References

- BREMER, O. (1861): Neue Lepidopteren aus Ost-Sibiriens und dem Amur-Landes, gesammelt von RADDE und MAACK, beschreiben von OTTO BREMER. - Bull. l'Acad. Imper. Sci. St. Petersburg **5**: 480-481, St. Petersburg.
- BREMER, O. (1864): Lepidopteren Ost-Sibiriens, insbesondere des Amur-Landes, gesammelt von den Herren G. RADDE, R. MAACK und P. WULFFIUS. - Mém. l'Acad. Imper. Sci. St. Petersburg **8** (1): 104, St. Petersburg.
- BREMER, O. & W. GREY (1852 [1853]): Diagnoses de Lépidoptères nouveaux trouvés par MM. TATARINOFF et GASCHKEWITSCH aux environs de Pekin. - Études ent. par Motschulsky **1**: 58-67, St. Petersburg.
- BREMER, O. & W. GREY (1853): Beiträge zur Schmetterlings-Fauna des noerdlichen China's: 1-23, St. Petersburg.
- BRYK, F. (1948): Zur Kenntnis der Großschmetterlinge von Korea. Pars II. Macrofrenatae II (finis): Notodontidae, Lymantriidae, Saturniidae, Brahmaeidae, Drepanidae, Epipleminidae, Lasiocampidae, Arctiidae, Thyatiridae, Noctuidae, Geometridae. Heteroneura: Fam.: Cochliidae, Zygaenidae. Tineidae: Fam.: Cossidae, Psychidae. Mit 7 Tafeln. - Arkiv för Zoologi **41** A (1): 1-225, Almqvist & Wiksell Boktryckeri, Uppsala.
- DUBATOLOV, V. V., LVOSKY, A. L. & A. N. STRELTZOV (2007): To a taxonomic status of *Actias artemis* (BREMER et GREY) (Lepidoptera, Saturniidae). - Zhivotnyj mir Dalnego Vostoka **6**: 102-104 Blagovestchensk (in Russian).
- HÜBNER, J. (1806): Sammlung exotischen Schmetterlinge **1**: Taf. 172: 1-2; Taf. 173: 3; Taf. 174: 4. - Augsburg.
- INOUE, H. (1976): Some new and unrecorded moths belonging to the families of Bombyces and Sphinges from Japan (Lepidoptera). - Bulletin of Faculty of Domestic Sciences, Otsuma Woman's University **12**: 153-179, Tokyo.
- INOUE, H. (1982): Fam. Saturniidae. In: SUGI, H. (ed.). Moths of Japan **1**. - Kodansha, Tokyo.
- IZERSKY, V. V. (1999): Bombycoid moths (Fam. Bombycidae, Endromididae, Lasiocampidae, Brachmaeidae [sic!], Saturniidae, Sphingidae) and prominents (Fam. Notodontidae) of Siberia and the Far East: 51-59, Kiev (in Russian).
- IZERSKY, V. V. & A. P. GULYAEV (1996): News on a distribution and biology of *Actias selene* (Lepidoptera, Saturniidae). - Vestnik zoologii No **4-5**: 35, Kiev (in Russian).
- KIRBY, W. F. & P. WYTSMAN (1894-1897): J. HÜBNER & C. GEYER. Lépidoptères exotique (1806-1837): 148. Nouvelle édition. Revue corrigée et augmentée. London - Bruxelles.
- KISHIDA, Y. (1994): Description of a new subspecies of *Actias artemis* from Yakushima I., Southern Kyushu (Lepidoptera, Saturniidae [sic!]). - Gekkan-Mushi No **282**: 12-13 (in Japanese).
- KOSTJUK, I. YU. & M. I. GOLOVUSHKIN (1994): To the knowledge of Lepidoptera, Heterocera of the Eastern Transbaikalia Range. - Trudy zapovednika "Daurysky" **2**: 51-57 (in Russian).
- PARK, K. T. (2000): Lepidoptera (Arctiidae, Lymantriidae, Lasiocampidae, Sphingidae). Economic Insects of Korea **1**. Insecta Koreana Suppl. **8**: 1-276. - National Institute of Agricultural Science and Technology, Suwon.
- PARK, K. T., KIM, S. S., TSHISTIAKOV, YU. A. & Y. D. KWON (1999): Illustrated Catalogue of Moths in Korea (I) (Sphingidae, Bombycoidea, Notodontidae). In: PARK, K. T. (ed.): Insects of Korea. Ser. 4. Korea Research Institute of Bioscience and Biotechnology & Center for Insect Systematics.
- STAUDINGER, O. (1892): Die Macrolepidopteren des Amurgebiets. I. Theil. Rhopalocera, Sphinges, Bombyces, Noctuae. In: N. M. RROMANOFF, Mém. sur les Lépid. **6**: 83-658, Petersburg.
- TSHISTIAKOV, JU. A. & E. A. BELYAEV (1986): Morphology of the preimaginal instars of *Actias artemis* BREMER et GRAY, 1853 [sic!] (Lepidoptera, Saturniidae) and peculiarities of its biology in Primorye. - [Sistematika i ekologiya cheshuekrylykh Dalnego Vostoka SSSR]: 70-79, Vladivostok (in Russian).
- ZHU, H.-F. & L. WANG (1996): Fauna Sinica. Insecta **5**. Lepidoptera. Bombycidae, Saturniidae, Thyrididae. Beijing, Science Press.
- ZOLOTARENKO, G. S. (1975): Species of the genus *Actias* LEACH (Lepidoptera, Saturniidae) in the fauna of the USSR. - Taxonomia i ekologiya zhivotnykh Sibiri: 53-61, Novosibirsk (in Russian).
- ZOLOTUHIN, V. V. (2007): Taxonomic remarks on the species *Actias artemis* (BREMER & GREY [1853] 1852) (Lepidoptera, Saturniidae). - Entomologicheskie i parazitologicheskie issledovaniya v Povolzhie **6**: 12-14, Saratov (in Russian).
- ZOLOTUHIN, V. V. & A. V. CHUVILIN (2009): On the specific compound of the genus *Actias* LEACH, 1815 (Lepidoptera, Saturniidae) of Russia. - Eversmannia **19-20**: 21-31, Tula (in Russian).

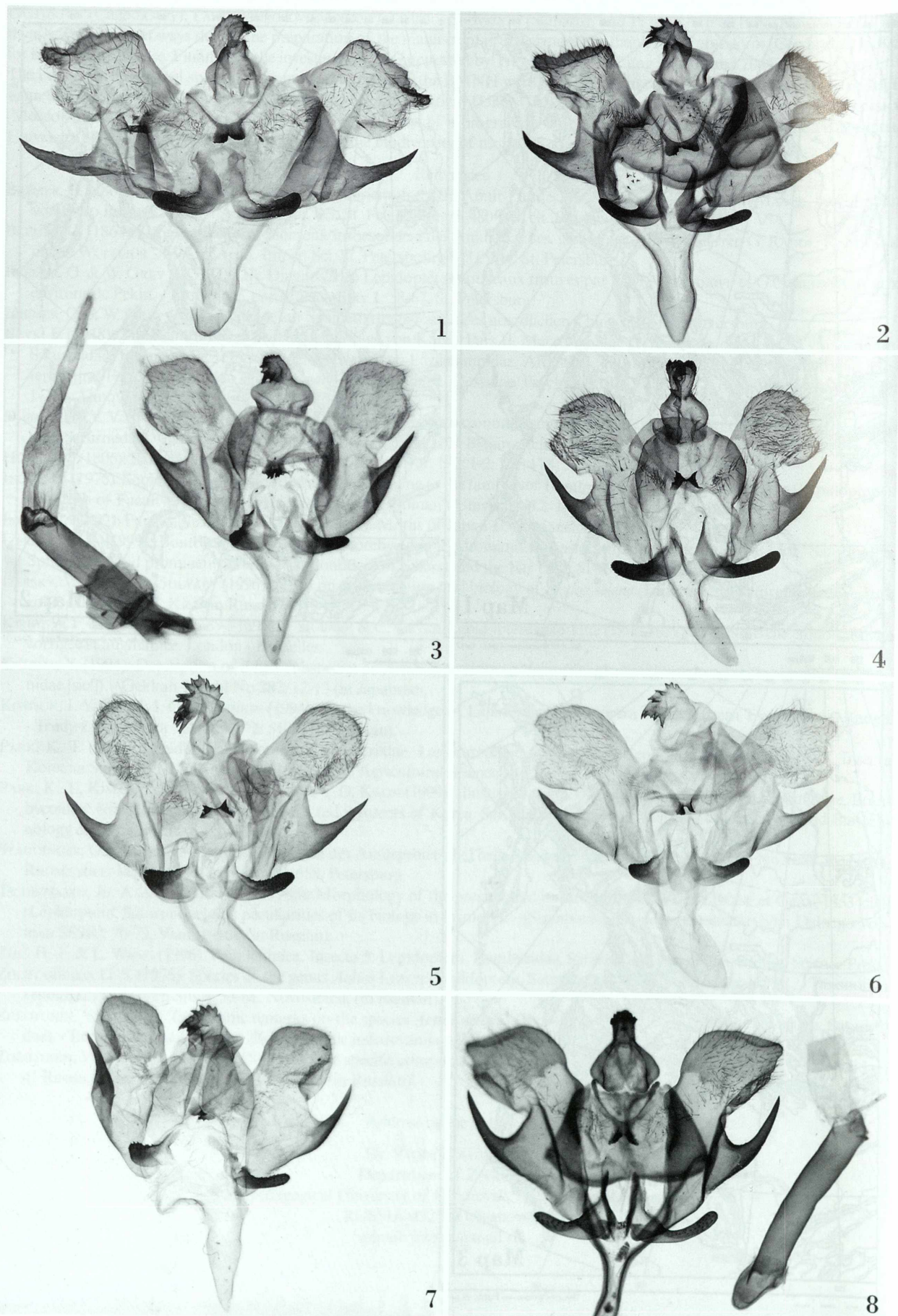
Address of the author

Dr. VADIM ZOLOTUHIN
Department of Zoology
State pedagogical University of Ulyanovsk, Pl. 100-letiya Lenina 4
RUSSIA-432700 Ulyanovsk
e-mail: v.zolot@mail.ru



Maps 1-3: Distribution of continental *Actias* species.

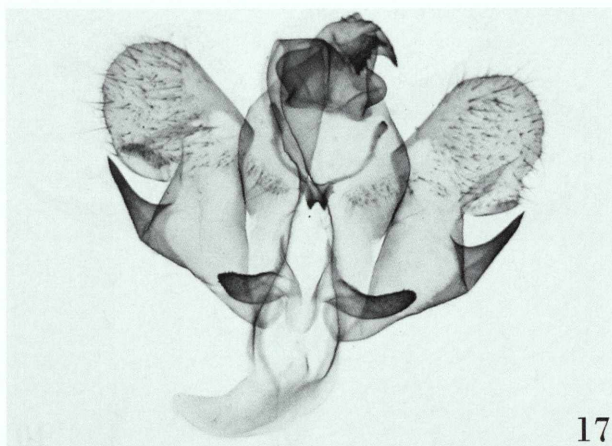
1: *A. artemis* (BREMER & GREY, [1853] 1852), 2: *A. gnoma* (BUTLER, 1877), 3: *A. dulcinea* (BUTLER, 1881).



Figs 1-8: ♂♂ genitalia of *Actias* spp. (1-2) *A. selene* (HÜBNER, 1806): (1) India, Assam, ex ovo (MWM); (2) N. Vietnam, Fan-si-pan, Sa Pa env., 1500 m (CVZU); (3-7) *A. artemis* (BREMER & GREY, [1853] 1852): (3) Lectotype of *Tropaea mandshurica* STAUDINGER, 1892, Ussuri (ZHUB); (4) Russia, Amur reg., Obluchie (coll. A. CHUVILIN); (5) Russia, Kuldur (MWM); (6) Russia, Far East, Slavyanka (MWM); (7) N. Japan (ZFMK). 8. *A. ningpoana* C. FELDER & R. FELDER, 1862, holotype, China, Ningpo [sic!] (BMNH).



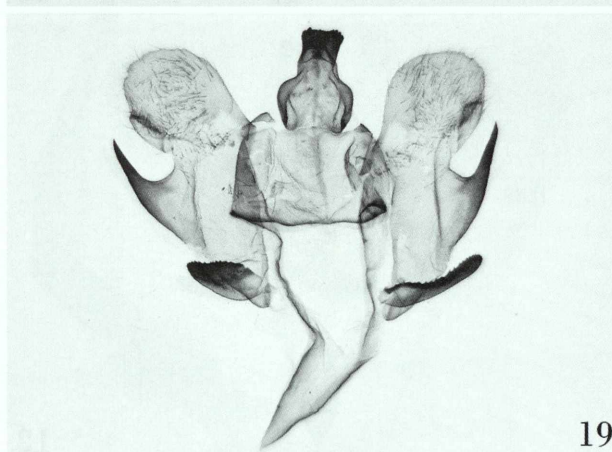
Figs 9-16: ♂♂ genitalia of *Actias gnoma* (BUTLER, 1877). (9) Holotype of *Tropaea gnoma* BUTLER, 1877, Japan (BMNH); (10) Japan (MWM); (11) Russia, Amur, Kul'dur (MWM); (12) Korea, Kum-gang (MWM); (13) Korea, Pyongyang (MWM); (14) Korea, Pyonyang (MWM); (15) Korea, Seoul (MWM); (16) *A. gnoma miyatai* INOUE, 1976, holotype, Japan, Power Plant, Hachio-jima (BMNH).



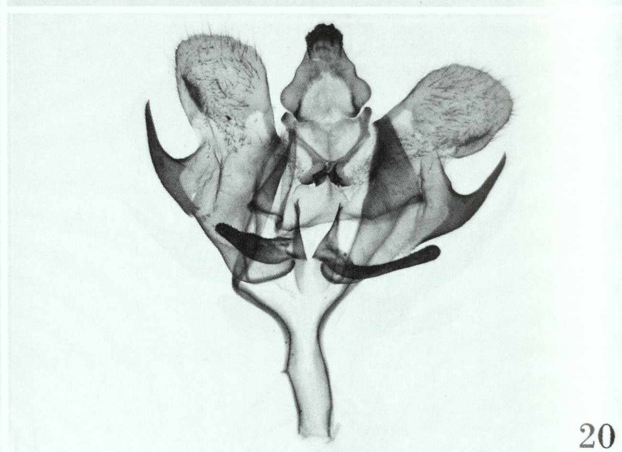
17



18



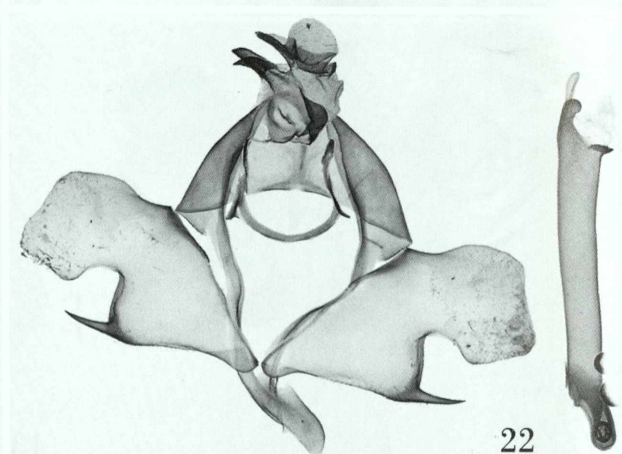
19



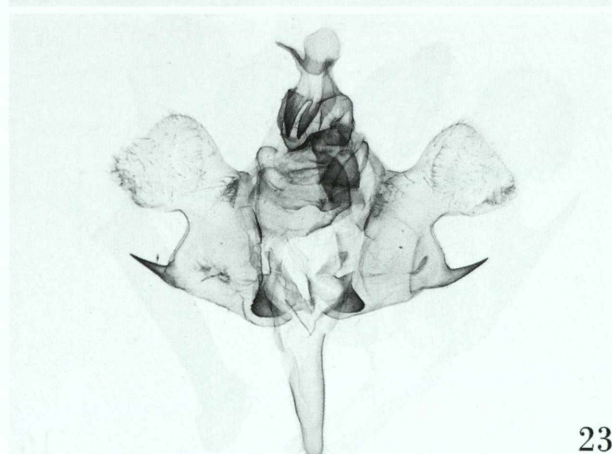
20



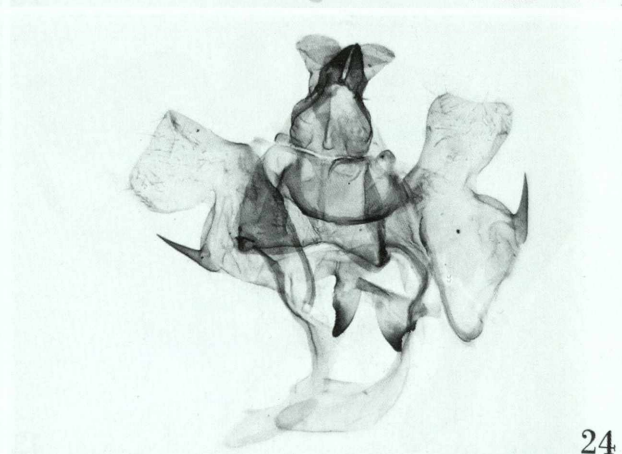
21



22

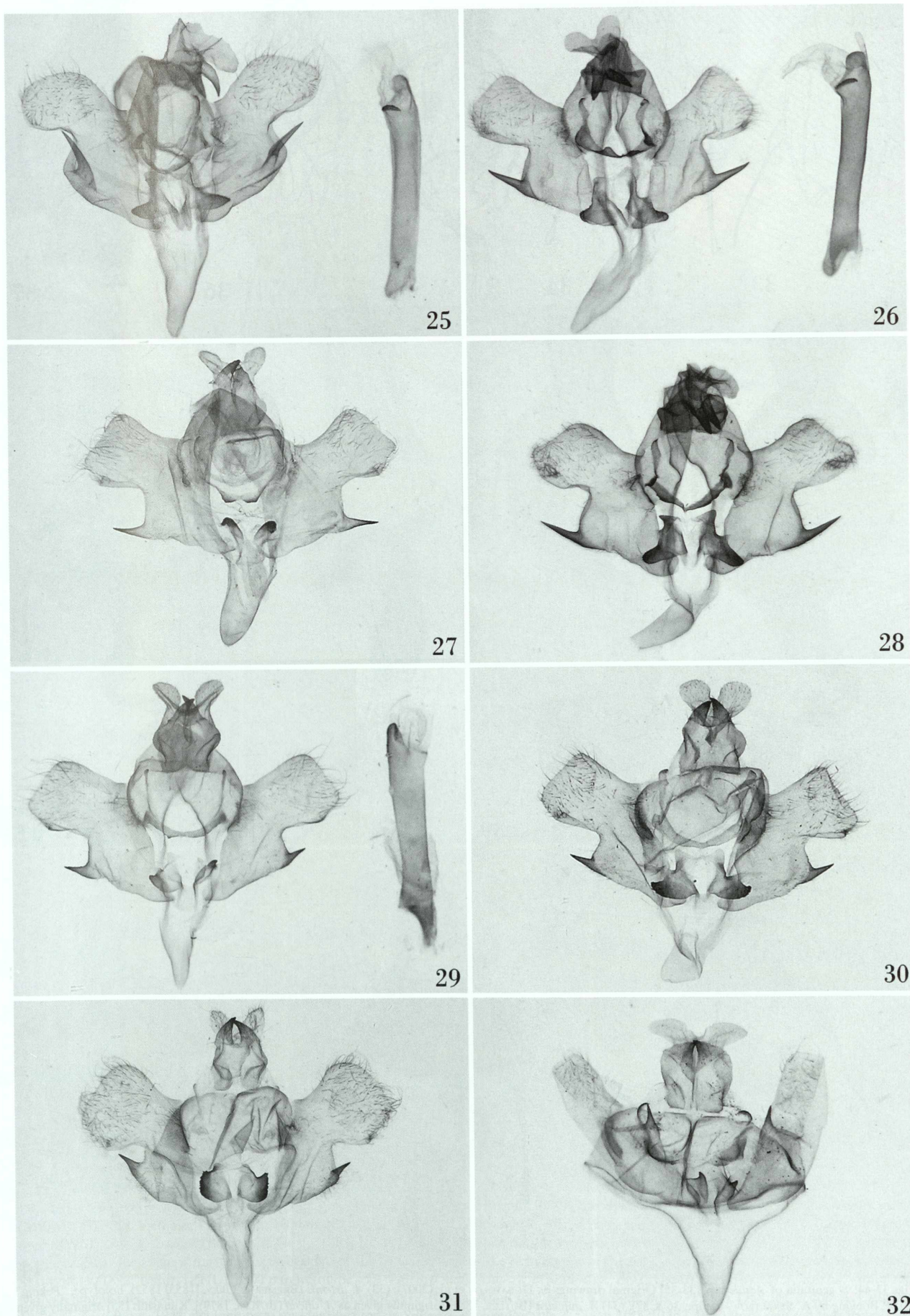


23

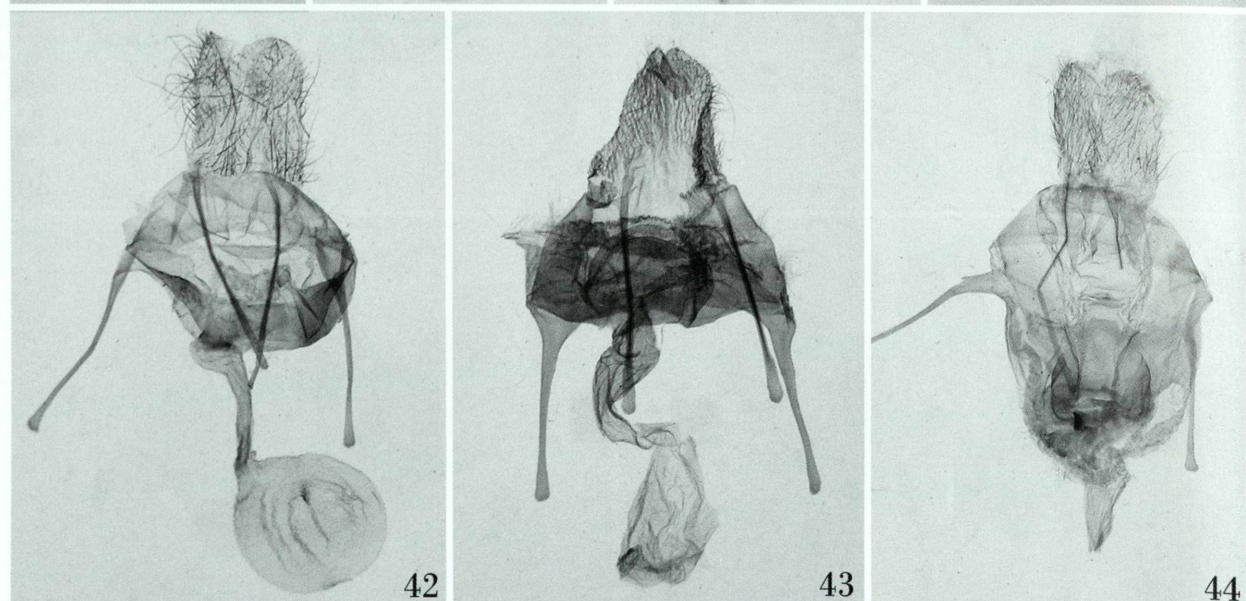
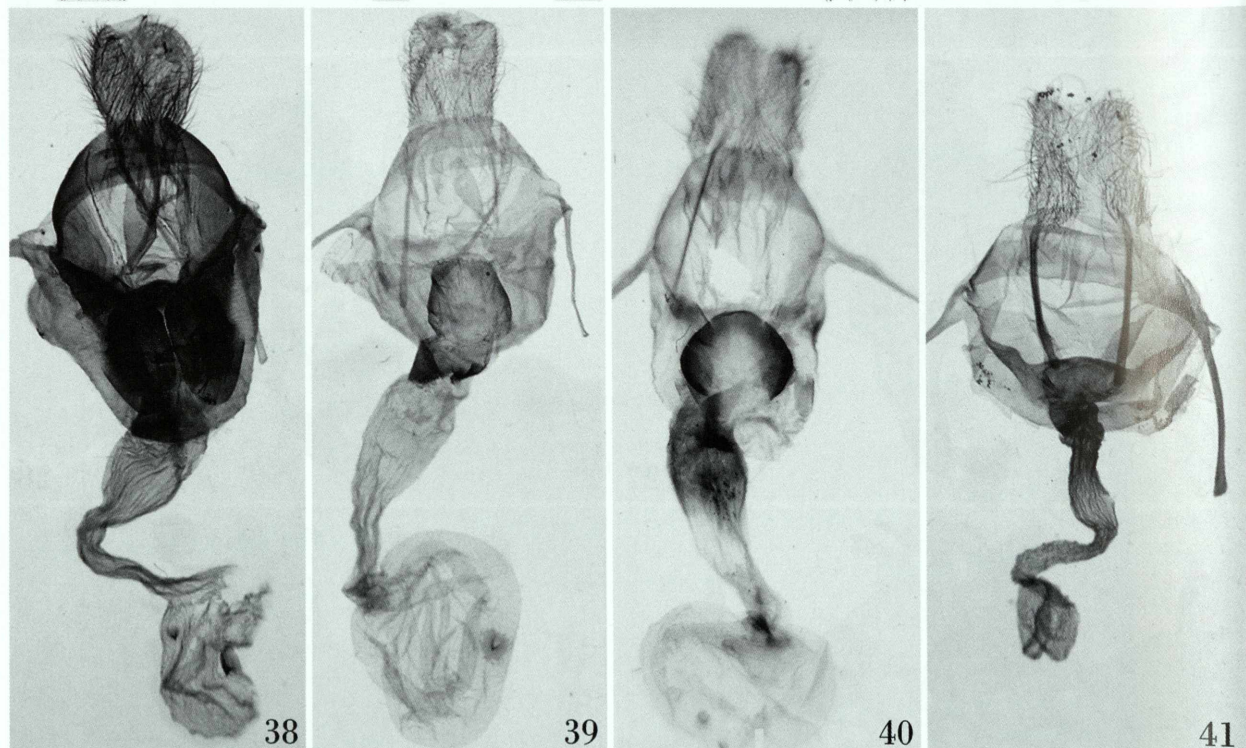
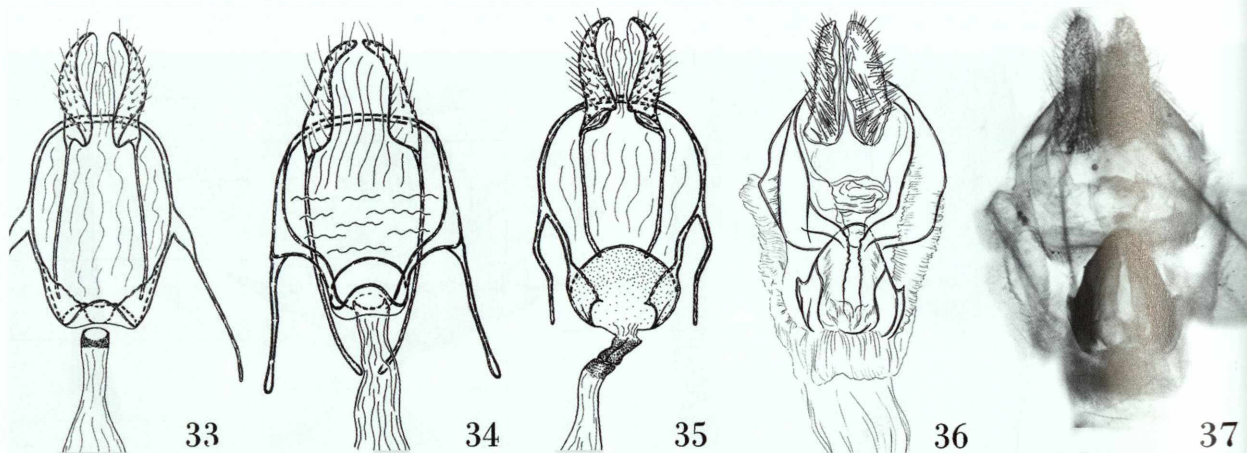


24

Figs 17-24: ♂♂ genitalia of *Actias* spp. (17-18) *A. gnoma* (BUTLER, 1877): (17) Japan, Yokohama (ZFMK); (18) Japan, Kobe (ZFMK); (19-20) *A. apollo* RÖBER, 1923: (19) neotype, Japan, Zucht IX 1985 (ZFMK); (20) Japan, Yokohama (ZFMK); (21) *A. dulcinea* (BUTLER, 1881), holotype, "Tokei" (BMNH); (22-24) *A. aliena* (BUTLER, 1879): (22) holotype, Japan (BMNH); (23) Japan, Honshu, Nagoya, ex ovo, spring generation 4.VII.1991 (ZFMK); (24) same but summer generation, 13.VII.1991 (ZFMK).



Figs 25-32: ♂♂ genitalia of *Actias* spp. (25-28) *A. xenia* JORDAN, [1912]: (25) paralectotype of *Actias artemis xenia* JORDAN, Japan, Liu-Kiu-Insel, Okinawa (BMNH); (26) holotype of *Actias artemis jordani* NIEPALT, 1936, [Japan] originally given as "Ta-tsien-lu" (AMNH); (27) Japan, Yamanashi, Otsuki, Fukushima, Koganesawarindo (MWM); (28) Japan, Yokohama (ZFMK); (29-32) *A. dulcinea* (BUTLER, 1881): (29) holotype of *Actias artemis sjögqvisti* BRYK, Korea, Myokosan (RMS); (30) Russia, Ussuri reg., Barabasch-Levada (coll. A. CHUVILIN); (31) Korea, kangwon (MWM); (32) Japan (MWM).



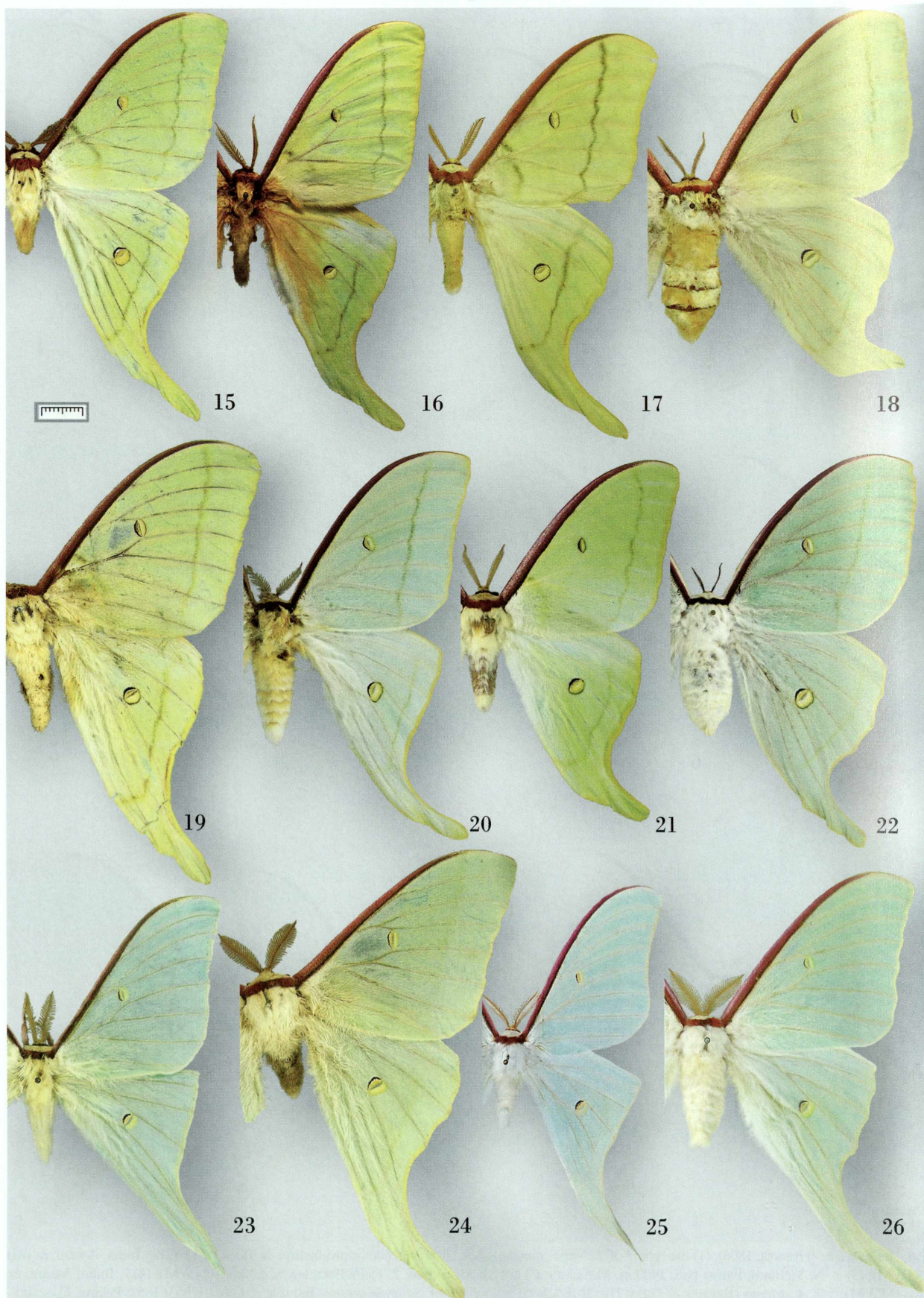
Figs 33-44: ♀♀ genitalia of *Actias* spp. (33-35) Original drawings ex DUBATOLOV et al. (2007): (33) *A. artemis* (BREMER & GREY, [1853] 1852), holotype, "Peking" (ZISP, drawing by A. STRELTZOV - compr. 36 & 37); (34) *A. dulcinea* (BUTLER, 1881) [originally given as *A. aliena* (BUTLER, 1879)], Kunashir; (35) originally given as *A. gnoma* (BUTLER, 1877), Amur Region; (36) *A. artemis* (BREMER & GREY, [1853] 1852), holotype, "Peking" (ZISP, drawing by S. NEDOSHIVINA - compr. 33 & 37); (37) *A. artemis* (BREMER & GREY, [1853] 1852), same, a photograph (ZISP); (38) *A. selene* (HÜBNER, 1806), India, Assam, ex ovo (MWM); (39) *A. artemis* (BREMER & GREY, [1853] 1852), Russia, Ussuri, Kazakewitsch (MWM); (40) *A. gnoma* (BUTLER, 1877), holotype of *Actias artemis tomariactias* BRYK, 1942, Ins. Kunashiri, Tomari (RMS); (41) *A. xenia* JORDAN, [1912], Japan (MWM); (42) *A. dulcinea* (BUTLER, 1881), Japan (MWM); (43) *A. dulcinea* (BUTLER, 1881), Rusia, S. Primorie, Kedrovaja Pad' (MWM); (44) *A. aliena* (BUTLER, 1879), Japan, Zucht (ZFMK).

Colour plate 1



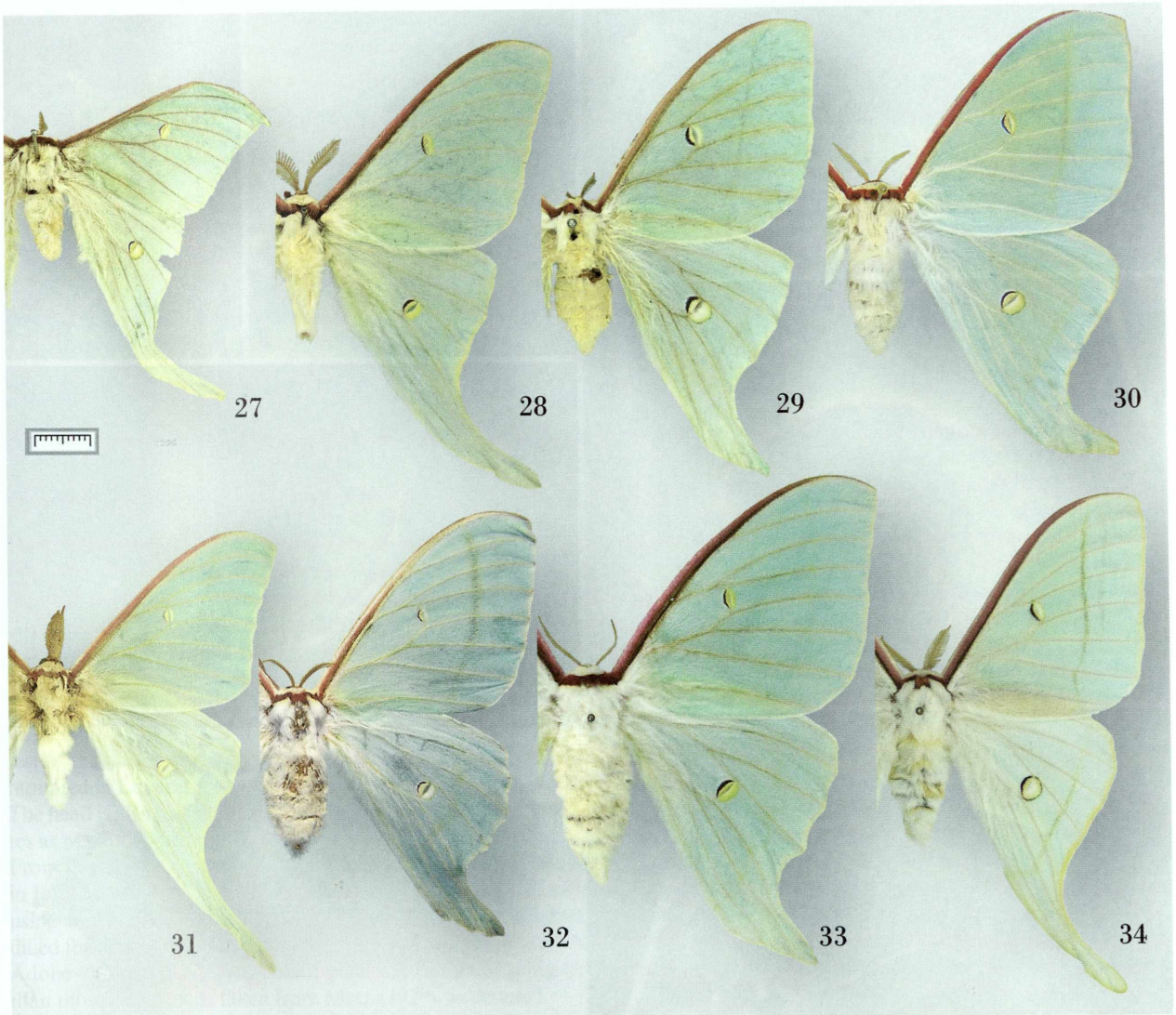
1-4: *Actias selene* (HÜBNER, 1806): (1) the type ♂ of *Echidna caudata selene* HÜBNER, 1806 (reproduction of Taf. 172: 1); (2) ♂, India, Assam, ex ovo (MWM); (3) ♂, N. Vietnam, Fan-si-pan, 1400 m, Mai-chau, 40 km SE Moc-chau, 7.-15.IV.1995, leg. V. SINJAEV (MWM); (4) ♀, India, Assam, ex ovo (MWM). 5-9: *A. artemis* (BREMER & GREY, [1853] 1852): (5) holotype ♀ of *Saturnia artemis* BREMER & GREY, [1853] 1852, Peking, GASCHKE-WITSCH (ZISP) - the image is mirror backup because of the bad condition of the right couple of the wings; (6) lectotype ♂ of *Tropaea mandschurica* STAUDINGER, 1892, Ussuri (ZHUB); (7) paralectotype ♀ of *Tropaea mandschurica* STAUDINGER, 1892, Ussuri (ZHUB); (8) ♂, Russia, Amur reg., Malyi Khingan mts., 5.-15.VII.1988, leg. et coll. A. CHUVILIN; (9) ♀, Russia, Amur reg., Malyi Khingan mts., 5.-15.VII.1988, leg. et coll. A. CHUVILIN. 10: *A. sjoqvisti* BRYK, 1948, the long-term misidentification as *Saturnia artemis* BREMER & GREY, [1853] 1852, the ♀ from «ein schönes Paar» sensu BREMER (1864), Bureja, RADDE (ZISP). 11: *A. [gr. selene]* near *ningpoana* C. FELDER & R. FELDER, 1862, eastern China (courtesy: F. ZIEREIS); 12: *A. ningpoana* C. FELDER & R. FELDER, 1862, holotype ♂, China, Nincpo [sic!] (BMNH); 13: *A. ? ningpoana* C. FELDER & R. FELDER, 1862, ♂, China, Ningpo (ZHUB); 14: *A. ? ningpoana* C. FELDER & R. FELDER, 1862, ♀, China, Ningpo (ZHUB).

Colour plate 2



15-18: *A. xenia* JORDAN, [1912]: (15) Lectotype ♂ of *Actias artemis xenia* JORDAN, Japan, Liu-Kiu-Insel, Okinawa (BMNH); (16) holotype ♂ of *Actias artemis yakushimaensis* KISHIDA, 1994, Japan, Nagata D., Yakushima I., 6.VIII.1972, T. WATANABE (NSMT); (17) holotype ♂ of *Actias artemis jordani* NIEPOLT, 1936, [Japan] originally given as "Ta-tsien-lu" (AMNH); (18) ♀, Japan, FLUSSEIN leg. (MWM). 19-22: *A. aliena* (BUTLER, 1879): (19) holotype ♂, Japan (BMNH); (20) ♂, Japan, Honshu, Nagoya, ex ovo, 13.VII.1991, leg. Y. ARITA, Zucht of D. STÜNING (ZFMK); (21) ♂, Japan, Honshu, Nagoya, ex ovo, 31.VII.1991, leg. Y. ARITA, Zucht on Quercus of D. STÜNING (ZFMK); (22) ♀, Japan, Honshu, Nagoya, ex ovo, 4.VII.1991, leg. Y. ARITA, Zucht of D. STÜNING (ZFMK) 23-26: *A. dulcinea* (BUTLER, 1881): (23) holotype ♂ of *Actias artemis sjöqvisti* BRYK, Korea, Myokosan, 1935, STEN BERGMAN (RMS); (24) holotype ♂ of *Tropaea dulcinea* BUTLER, 1881, "Tokei" (BMNH); (25) ♂, Russia, Ussuri reg., Barabasch-Levada, 1.-6.VII.2002, leg. et coll. A. CHUVILIN; (26) ♂, Sutschan, 1894, leg. DÖRRIS (ZHUB).

Colour plate 3



27-30: *A. gnoma* (BUTLER, 1877): (27) Holotype ♂ of *Tropaea gnoma* BUTLER, Japan (BMNH); (28) ♂, Russia, Asia or., Sikhota alin [sic!] mts., Sutshan, 24.VI.1935 (MWM); (29) holotype ♀ of *Actias artemis tomariactias* BRYK, 1942, Ins. Kunashiri, Tomari, S. BERGMAN (RMS); (30) ♀, Japan, Zucht ex p., I.VIII.1985, leg. F. DIEMER (MWM); 31, 32: *A. gnoma miyatai* INOUE, 1976: (31) holotype ♂, Japan, Power Plant, Hachio-jima, 14.IV.1961, A. SUZUKI (BMNH); (32) paratype ♀, Japan, Miharayama, Hachio-jima, ex egg, winged on 22.IX.1975, T. MIYATA (NSMT). 33: *A. dulcinea* (BUTLER, 1881), ♀, Askold, leg. DÖRRIS (ZHUB). 34: *A. apollo* RÖBER, 1923, neotype ♂, Japan, Zucht IX 1985, M. FÖRST (ZFMK).

Figs 35-41. Wing eyes: forewing above and hindwing below. 35: *A. selene* (HÜBNER, 1806), ♂, India, Assam (MWM). 36: *A. artemis* (BREMER & GREY, [1853] 1852), lectotype ♂ of *Tropaea mandschurica* STAUDINGER, 1892, Ussuri (ZHUB). 37: *A. xenia* JORDAN, [1912], ♂, Japan, Yokohama, Anfang 1912 (ZFMK). 38: *A. aliena* (BUTLER, 1879), ♂, Japan, Honshu, Nagoya, ex ovo 13.VII.1991 (ZFMK). 39: *A. dulcinea* (BUTLER, 1881), ♂, Russia, Amur, Kuldur, VII 1990 (ZFMK). 40: *A. gnoma* (BUTLER, 1877), ♂, Japan (ZFMK). 41: *A. apollo* RÖBER, 1923, neotype ♂, Japan, Zucht IX 1985 (ZFMK).

Colour plate 4



1-11: Mature caterpillars of *Actias* spp. (1) *A. artemis* (BREMER & GREY, [1853] 1852), Russia, Transbaical, Chita Region, Uryupino, VIII 2009 (courtesy: S. GORDEEV); (2) *A. artemis* (BREMER & GREY, [1853] 1852), Russia, Transbaical, Chita Region, Undino-Poselie, vill. Kaziken, on *Betula*, 2.VIII.2001 (courtesy: S. GORDEEV); (3) *A. selene* (HÜBNER, 1806), South China (courtesy: A. ZAGORINSKY); (4) *A. selene* (HÜBNER, 1806), Northern Vietnam, Fan-Si-Pan Mts., env. of Sa-Pa vill., 15.V.2006, on *Melastoma* (photo: V. ZOLOTUHIN); (5) the same caterpillar, ventral view showing head colouration (photo: V. ZOLOTUHIN); (6) *A. [gr. selene]* near *ningpoana* C. FELDER & R. FELDER, 1862, Eastern China (courtesy: F. ZIEREIS), an adult seen on col. pl. 1: 11; (7) *A. dulcinea* (BUTLER, 1881), Far East of Russia, Southern Primorye, 25.IX.2009 (photo: V. ZOLOTUHIN); (8) *A. dulcinea* (BUTLER, 1881), Far East of Russia, Southern Primorye, Khasan District, vill. Andreevka, IX 2006 (courtesy: P. MOROZOV); (9) *A. aliena* (BUTLER, 1879), Japan, Honshu, Nagoya, VI 1991 (courtesy: D. STÜNING); (10) *A. gnoma* (BUTLER, 1877), Japan; (11) *A. gnoma* (BUTLER, 1877), Japan (courtesy: D. STÜNING).

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Neue Entomologische Nachrichten](#)

Jahr/Year: 2011

Band/Volume: [67](#)

Autor(en)/Author(s): Zolotuhin Vadim V.

Artikel/Article: [The Actias Leach, 1815, in the Far East: how many species? \(Lepidoptera: Saturniidae\) 40-56](#)