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

(Lepidoptera: Saturniidae)

by

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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 gnome* (BUTLER, 1877) and is considered as a separate species; the continental *Actias artemis jordani* 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 jordani NIEPILT, 1936 *syn. nov.*) and *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. gnome* (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, IBERSKY (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 *gnome* 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. gnome* (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, 1875), A. aliena sjoeyvistis BRYK, [1949].
- A. gnome gnome (BUTLER, 1877); A. gnome mandschurica (STAUDINGER, 1892); A. gnome miyayata 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:

- BMNH: Natural History Museum, London, UK (formerly The British Museum of Natural History);
- MUBH: 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 ANKIN (Saratov, Russia), SERGEY GORDEEV (Chita, Russia), GRIGORY GRIGORYEV (St. Petersburg, Russia), EUGENY KOZIKIN (Khabarovsk, Russia), PAVEL MOROZOV (Moscow, Russia), STEFAN NAUMANN (Berlin, Germany), V. ZOLOTUHIN (Ulanovsk, 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. ZOLOTUHIN using Corel PhotoPaint X3 from photographs taken by S. GORDEEV, G. GRIGORYEV, B. GUSTAFSSON, E. KOZIKIN, P. MOROZOV, S. NEDOSHIVINA, D. SHIKOVON, D. STÜNING, P. USTYURZHAN, F. ZIERIES, and V. ZOLOTUHIN. 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 the holotype 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.
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 *A* 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 *s* 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. gnomae* (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 *H* 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 illac 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 & Wytman (1894-1897: 148) as: «Hab. CHINA, INDIA, CEYLON» with remark «Es gibt viele ähnliche Formen in Ost-Asien, und mehrere werden wohl kaum spezifisch von dieser Art verschieden.» After serial material from northern China, 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 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 signs 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 streakes. Head is green with brown shadows along sutures. 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 congens. Five names were introduced to designate their different populations in the Far East (alphabetically listed):


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

**General part**

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.
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-tsien-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 armillae, 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; gnavus 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 BTTL., 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. x. 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 jordani NIEPELT, 1936 syn. nov., Ent. Z. 4: 35, 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-tsien-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-tsien-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-tsien-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 ‘nominate’ 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.), Kuri (Yakushima Is.), Katzigudaka, Uradani, Miyagi, Okinawa (Ruy-Kyu Is.), and Karinawana.

Nomenclatorial notes: For nomenclatorial stability, ♂♂ 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. Of 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, Macrolepid. 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 Artesis ♂ | xenia JORDAN [1912] / des ZOLOTOTHIN, 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)


The species is well distinguishable from others because of external features. Wings are of bluish to yellowish-green 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 \( \sigma \) 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 \( \varphi \) 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 \( \sigma \), is really a giant specimen, of a rare yellowish colour form (col. pl. 2: 19). It resembles strongly the previous taxon but the calyx 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. artenis* (BREMER & GREY), but now, when the *taxon artenis* is attributed to the species from the specific distinct 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)


**= Actias artenis sjoqvisti** BRYK, 1948, syn. nov., Arkiv för Zoologi 41A (1): 18, fig’d. Type locality: Korea, Shuotsu. Holotype \( \sigma \) (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 some, and much longer and more slender in other. \( \sigma \) 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 \( \varphi \) 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 plate 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 is sometimes 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. artenis* (BREMER & GREY), including larval chaetotaxy and biology in Russian Primorye, was given in detail by Tschitschak & Belyaev, 1986.

**Distribution** (map 3): In Russia the species is known from Jewish Autonomy (Obuchlie, Radde, Kuldur, Tajezhnyj, Bastake Reserve), Khabarovsky Region (vill. Slavjanka of Nansaj District, Bojtjowo, Khabarovsky) and Primorye (everywhere here). In Korea it is known from Kum-gang, Kangwon, Pyong-yang, Kongosan: Utikongo, see also PAK et al., 1999; PARK, 2000. In north-eastern China it was mapped by Zhu & Wang, 1996 as *A. artenis* (BREMER & GREY). The species is rare in Japan, where it is known in sympathy 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., INOUExE 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 genital 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 postmedial 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/Saturnia/Actias_aliena_aliena.html where both species mix, and also with xenia Jordan, 1913). This makes it possible to consider *A. aliena* (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: mulezi is corrected to mulezi, and mjobergi to mjobergi, but mülleri (published before 1985) is corrected to muellertl.

In the case under consideration, the name sjoqvisti originates from the family name of Swedish naturalist SJOQVIST (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 proper) 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. artenmis (Bremer & Grey). Two others are known under the names of A. gnoma (Btl.), and A. apollo Röber.

Actias artenmis (Bremer & Grey), [1853] 1852) (col. pl. 1: 5-9)

Saturnia Artensis Bremer & Grey, [1853] 1852, Études ent. ent. Motschulky I: 64. Type locality: [China, Beijing env.] «aux envi-

rons 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 Zolotuhin & 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 ♂ uscus; it is not bound with any habitual features. Probably, it is only extreme variants of individual variabi-
ity, 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;
esternal 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. artenmis (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 (in made of 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. Nekoshin (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 particular 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
boundaries; remaining are 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; suprastigmatic 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 (Hin.) (col. pl. 4: 3-5), head is completely brown, scoli are smaller, and suprastigmatic band is red and intense; 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
suprastigmatic 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 Transbaikal (Chita Region: Undino-Poselie and Urupjino; Amazar and Amazar Gorges (Kostik
& Golovushkin, 1994, 2 ♂ in KSU), Jewish Autonomy (Kuldur and Obluchje), southern Yakutia, or Sakha Republic: Nerjungri
(Izersky & Guliaen, 1996), Khabarovsk Region (Khabarovsk and Nanajsk), Amur Region (Belogors), Primorje (Vladivostok,
Slavyanka, Khassan, Andreivka, 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”, Shanghaj and Beijing). Single spec-
cimens were observed also in Japan (Hariman, Gifu, see also http://www.jpmoth.org/Saturniidae/Saturniidae/Actias_chnoma_man-
dschurica.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 (Hin.), 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. artenmis (Bremer & Grey) is a complex of two or three species differing by uncus shape. E. Belava (Vladivostok)
delivered an assumption that such differences may be connected with a generation, but this idea requires confirmation; it seems most
unlike 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)


Actias artenmis subsp. tomariactias Bryk, 1942, Dt. Ent. Z. Iris 56: 26, pl. 1: l. Type locality: Kunishi, Tomari. Holotype ♂ (RMS) [examined].

Actias artenmis subsp. tomariaactias Bryk, 1942, Dt. Ent. Z. Iris 56: 26, pl. 1: l. Type locality: Kunishi, 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 unusually 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 artenmis tomariaactias Bryk was described from Kunashir (col. pl. 3: 29), and was synonymized by Insoue (1982) to Actias gnom-
a mandschurica Stgrl., i. e. to A. artenmis (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. artenmis tomariaactias 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 radially 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 cucullate 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 orange, with slightly darker outer margin; suprastigmatic band white, 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 Kyusu 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 Transbaikal (Chita Region: Undino-Poselie and Urijupino) and Primorye (Sutschan = Partizans), 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. sjorgest Blyk, leads to constant misidentifications in the collections and necessitates the checking of genitalian 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 Hachijo-ima and distinction in the juxtal shape, where the lobes are short and somewhat clavate. The ductus bursae is fused with antrum, long, powerful, caudally widened, with distinct sclerotization caudally; corpus bursae is pear-shaped, with single weak signum.

The most mysterious taxon of the Japanese Actias-species is surely A. apollo Röber, 1923. It was described from Hyogo, central Japan, after a c 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 (Hyogo) is close to selene; I have a c with wing span 88 mm which differs from a c 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 c 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 as 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 streakes and outer margin, there is one more, the shorter, more vague streake; besides that, distinct subbasal streake typical for selene is absent here; vague blackish submarginal streakes 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 vague. Antennae darker (brownish) than in selene and artemis, their punctuation is somewhat longer than in selene and distinctly darker’.

Such moths with blush 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 c from the collection of ZFMK (col. pl. 3: 34). In the c-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 tips 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. Först’. It is supplied with an additional red rectangular label with a black frame and printed “NEOTYPE / Actias apollo c / Röber, 1923 / des. ZOLOTUHIN, 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:

**Actias artemis** (Bremer & Grey, [1853] 1852)

= *Tropaea Mandshurica 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

**Actias dulcinea** (Butler, 1881)

= **Actias artemis sjorgest** Bryk, 1948 syn. nov.

**Actias aliena** (Butler, 1879)

**Actias xenia** Jordan, [1912]

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

= **Actias artemis yokushinaensis** Kishida, 1994 syn. nov.

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selenes-group

dulcinea-group
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Maps 1-3: Distribution of continental *Actias* species.  
Figs 1-8: α♂ 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, Artem reg., Obluchie (coll. A. Chuvilin); (5) Russia, Kuldur (MWM); (6) Russia, Far East, Slavyanka (MWM); (7) N. Japan (ZFMK). 8. *A. ningpoana* C. Elder & R. Elder, 1862, holotype, China, Ningpo [sic!] (BMNH).
Figs 9-16: dtr genitalia of *Actias gnomata* (Butler, 1877). (9) Holotype of *Tropaea gnomata* Butler, 1877, Japan (BMNH); (10) Japan (MWM); (11) Russia, Amur, Kul'dur (MWM); (12) Korea, Kum-gang (MWM); (13) Korea, Pyongang (MWM); (14) Korea, Pyonyang (MWM); (15) Korea, Seoul (MWM); (16) *A. gnomata miyutai* Inoue, 1976, holotype, Japan, Power Plant, Hachio-jima (BMNH).
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* ROBER, 1923: (19) neotype, Japan, Zucht IX 1985 (ZFMK); (20) Japan, Yokohama (ZFMK); (21) *A. dulcinea* (BUTLER, 1881), holotype, “Tokoi” (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) Actias xenia JORDAN, 1912. (25) paralectotype of Actias artemis xenia JORDAN, Japan, Liu-Kiu-Insel, Okinawa (BMNH); (26) holotype of Actias artemis jordani NEUPERT, 1936, [Japan] originally given as "Ta-tsien-lu" (AMNH); (27) Japan, Yamanashi, Otsuki, Fukashiro, Koganesawarindo (MWM); (28) Japan, Yokohama (ZFMK); (29-32) Actias dulcinea BUTLER, 1881: (29) holotype of Actias artemis sjöqvisti 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. Streltsov - 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), Russia, S. Primorie, Kedrovaja Pad' (MWM); (44) A. aliena (Butler, 1879), Japan, Zucht (ZFMK).
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. Sinijaev (MWM); (4) ♀, India, Assam, ex ovo (MWM). 5-9: Actias 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 mandscharica Staudinger, 1892, Ussuri (ZHUH); (7) paralectotype ♀ of Tropaea mandscharica Staudinger, 1892, Ussuri (ZHUH); (8) ♀, Russia, Amur reg., Malyi Khingan mts., 5.-15.VII.1988, leg. et coll. A. Chuvilen; (9) ♀, Russia, Amur reg., Malyi Khingan mts., 5.-15.VII.1988, leg. et coll. A. Chuvilen; (10) Actias 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: Actias gr. selene near ningpoana C. Elder & R. Elder, 1862, eastern China (courtesy: F. Ziereis); 12: Actias ningpoana C. Elder & R. Elder, 1862, eastern China (courtesy: F. Ziereis); 13: Actias ? ningpoana C. Elder & R. Elder, 1862, ♀, China, Ningpo (ZHUB); 14: Actias ? ningpoana C. Elder & R. Elder, 1862, ♀, China, Ningpo (ZHUB).
1-11. Mature caterpillars of Actias spp. (1) A. artemis (Bremer & Grey, [1853] 1852), Russia, Transbaikal, Chita Region, Uryupino, VIII 2009 (courtesy: S. Gordeev); (2) A. artemis (Bremer & Grey, [1853] 1852), Russia, Transbaikal, Chita Region, Undino-Poselie, vill. Kaziken, on Betula, 2.VIII.2001 (courtesy: S. Gordeev); (3) A. selene (Hubner, 1806), South China (courtesy: A. Zagorinsky); (4) A. selene (Hubner, 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 (Butler, 1862), Eastern China (courtesy: F. Zihrle), an adult see 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. Stuning); (10) A. gnoma (Butler, 1877), Japan; (11) A. gnoma (Butler, 1877), Japan (courtesy: D. Stuning).