

Unique wood nymphs from China and Vietnam: *Devyatkinia singularis* gen. et spec. nov.

(Lepidoptera, Nymphalidae)

by

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Abstract: *Mycalesis unica* LEECH, 1893, distributed in W. China (Sichuan) and E. China (Fujian and Zhejiang), and its undescribed Vietnamese relative are shown to be members of a new genus, *Devyatkinia* gen. nov.; description of both is presented. This new genus is characterised by unusual wing pattern and venation, the genital structure of both sexes, the ♂ secondary sexual characters distinguishing it from other representatives of Asian *Mycalesis*. There are also significant behavioural differences.

Introduction: J. H. LEECH (1893), when describing *Mycalesis unica* LEECH, a new wood nymph species from Sichuan, noted some unusual wing pattern characters that show that this species is not closely allied to any other representatives of the genus. One of the most distinctive characters is presence of an enlarged white-pupilled subapical ocellus in cell M1 on the forewing, combined with absence of the large ocellus in cell Cu1a that is typical of all other *Mycalesis* (fig. 1 a, b, d, e).

Another remarkable feature is a large ocellus in cell Cu1a on the hindwing and series of small white-pupilled eye spots presenting in cells Cu1b, M3-M1, R5; these are, unusually for *Mycalesis*, represented on both surfaces of the wing. The description of *M. unica* was based on one female specimen so the author was therefore unable to study the ♂ secondary sexual characters such as the hair tuft or the brand in the nacreous area on the hindwing that are characteristic a number of *Mycalesis* species. Nevertheless, he was generally right in supposing that *unica* was best placed the genus *Mycalesis*. Now it is possible to assess this feature in the related Vietnamese species. Also, Leech did not refer to the extent of inflation of the veins in basal area of the forewing.

The rarity of *M. unica* LEECH is indicated by the fact that, after the original description, only a few further specimens of this species have been collected. These finds were unpublished, so the species has not been studied for more than a century. The main stimulus for us to resume studies is the discovery of a similar species in 2005 in Central Vietnam, initially attributed to *M. unica* LEECH (MONASTYRSKII, 2007; 2010; MONASTYRSKII & HOLLOWAY, 2013). Our current study shows that the Chinese and Vietnamese populations are different species belonging to a genus distinct from *Mycalesis*.

Description

Devyatkinia gen. nov.

Type species: *Devyatkinia singularis* spec. nov. (see description below)

Antennae less than half (about two-fifths) length of forewing costa, reaching the discal cell apex, club normal, well developed. Eyes hairy. Terminal segment of labial palpus short and slightly pointed. Leg structures typical of *Mycalesis* (MILLER, 1968): foretarsus bears spines, absent from dorsal part of midtibia; tibial spurs present and well developed, although the midtibia and hindtibia bear double spurs. Forewing costa and termen evenly rounded (typical of *Mycalesis*); long cilia greyish.

Venation (fig. 2a): Forewing discal cell $\frac{1}{2}$ length of costa; vein Sc and cubitus strongly swollen at base; vein 1A+2A much less strongly swollen at base than the others; discocellulars rather straight in comparison with a number of Asian *Mycalesis* and its relatives (e.g. *Lohora*), where the discocellulars are distinctly excavated between the bases of veins M1 to M3 (figs 2b and 2c). Hindwing vein Sc+R1 slightly longer than 3A (shorter in the other genera); veins M3 and Cu1a are widely separated and M2 arises much nearer M1 than M3.

Wing pattern: Upperside ground colour of both wings dark brown with slightly paler broad postmedian areas; dull yellowish subterminal and terminal fasciae on the upperside of the forewing and brighter yellowish fasciae on the upperside of the hindwing. The species show unusual enlargement of the ocellus over the forewing cell M1, whereas most of *Mycalesis* species have a well developed large ocellus in forewing cell Cu1a. The hindwing bears a very large ocellus in cell Cu1a and, varying in size, small ocelli in cells Cu1b, M3, M2, and M1 that rarely appear on the upperside in *Mycalesis* species even when well developed on the underside. Underside ground colour of both wings uniformly brown with bright creamy-yellowish postmedian bands and subterminal and terminal fasciae. Generally both wings have similar patterns on both surfaces, however some small ocelli are present in cells Cu1b, M3, M2, M1, Rs only on the underside.

Secondary sexual characters: Hindwing without brand in the nacreous area, and with somewhat long blackish brown hair-pencil within the base of discocellulars.

Length of forewing: Species of the new genus are usually larger than most species of *Mycalesis*: ♂ from Vietnam: 29; 29,5 mm (n= 2); ♀ 30,5; 33,0; 33,5; 34 mm (n= 4); specimens from China: ♀ 26,5; 28,0; 30; 30 mm (n= 4).

♂ **genitalia** (figs. 3a-c): Generally the ♂ genitalia of the new genus have shapes and sizes of claspers, tegumen, uncus and brachium similar to those of a number of *Mycalesis* species (TALBOT, 1947). However, the saccus (fig. 3a) is unusually long, equal to length of clasper (fig. 3b); clasper narrow, incurved ventrally with pointed apex. In the long tapering aedoeagus the fultura superior in dorsal part of anellus well sclerotised and covered with a series of six teeth (fig. 3c). Such structures have no analogues amongst other members of the Asiatic *Mycalesis* fauna. However similar teeth may be seen in some Palearctic satyrines, e.g. *Pararge*, *Lasiommata* (NEKRUTENKO, 1985).

♀ **genitalia** (fig. 3d, 3e): Both species with very similar genitalia. Intersegmental trapezoid membrane (IM) between 7th and 8th segments well sclerotised; lamella antevaginalis includes pair of lateral oval processes (LOP) blades of which surround the ostium copulatrix (OC); lamella postvaginalis is absent; ductus bursae (DB) as long as corpus bursae copulatrix (BC); the latter has ovoid shape with unpaired U- (in Chinese populations) or V-shaped (in Vietnamese) signum: a spined band; papilla analis (PA) abnormally reduced up to base at lower part, which is well sclerotized; both apophysis anterior and apophysis posterior are absent.

Bionomics: The Vietnamese species of the new genus is seasonal, recorded in montane tropical forest of Central Vietnam from the end of May to the beginning of July. Peak abundance has been observed in mid-June. In comparison with Asiatic species of the genus *Mycalesis*, the Vietnamese member of the new genus is characterized by very unusual behaviour. The peak of flying activity occurs in midday between 10 am and 15 pm. Both sexes fly in undergrowth around 1,5-3,5 m from the ground but never fly close to the ground vegetation. They fly rather swiftly, preferring sunlit forest edges with bushy trees. Perching on the tips of branches, they await peacefully for the arrival of a potential partner, but have not been observed to display territorial aggressiveness. This type of behaviour is not a characteristic of any *Mycalesis* species, which are usually slow and low-flying butterflies preferring the shade of forest undergrowth around 0,5-1,0 m from the ground.

Etymology: The new genus is named after our late friend and co-author, a talented Russian entomologist, ALEXEY L. DEVYATKIN (1957-2012).

Devyatkinia singularis spec. nov. (fig. 1 g-j)

Holotype ♀ (fig. 1 g, 1 h): Central Vietnam, Khanh Hoa Province, Dien Khanh District, Hon Ba Nature Reserve, 1500 m, 17.VI.2013, leg. A.L. MONASTYRSKII.

Paratypes (fig. 1 i, 1 j): 1 ♂, 27.V.2005, 1 ♂, 19.VI.2013, leg. A.L. MONASTYRSKII, 1 ♂, 3 ♀♀, VI. 2014, leg. local collector, same locality and habitat as holotype; 1 ♂, 20.VI.2005, 1 ♀, 18.VI.2005, Central Vietnam, Thua Thien Hue Province, Bach Ma Nat. park, 1200~1400 m, leg. A. L. MONASTYRSKII.

♀: Upperside brown. Forewing with an ocellus extending over space M1 with yellow outer ring; postmedian and subterminal and terminal lines pale; cilia yellowish brown. Hindwing with a series of five ocelli, each with a yellow outer ring; the one in space Cu1a large; post discal line pale; subterminal line prominent and terminal line pale; cilia yellowish brown. Underside. Ground colour slightly paler than on upperside. Both wings with a postmedian broad creamy-yellow line. Forewing with a large ocellus in spaces M1 and M2; a series of three dots like ocelli in spaces M3, Cu1a, Cu1b, and the whole group is enclosed by sinuous pale line; subterminal and terminal lines pale, much more distinct than on upperside, the former sinuous; cilia yellowish brown. Hindwing with seven ocelli which are similarly enclosed by a pale line as on forewing; the ocellus in space Cu1a large; subterminal and terminal lines as on forewing; cilia yellowish brown. ♀ genitalia as for the genus.

♂: Colour (shades of brown) and the wing pattern in both sides of the wings similar to the ♀, just slightly darker, with the bands and ocelli more contrasted and prominent. Secondary sexual characters on the upperside of the hindwing as for the genus. ♂ genitalia as for the genus.

Discussion: The new species is similar to *D. unica* (LEECH, 1893) **comb. nov.**, but may to be distinguished from the Chinese species on characters as follows: the female larger in size and darker; termen of forewing more or less straight; a series of ocelli enclosed by pale line on underside of both wings more distinct than in *D. unica* (LEECH) and more likely to be seen also on the upperside; subterminal line more developed on the underside of both wings; terminal line more distinct on the underside of both wings. The ♀ genitalia of *D. singularis* spec. nov. similar to *D. unica* (LEECH), however the Chinese species has the spined signum slightly longer and U-shaped rather than V-shaped.

Depository: The ♀ holotype will be deposited in Natural History Museum, London (NHML); 1 ♂, 3 ♀♀ in John O'DELL's private collection (UK) (1 paratype ♂ will be delivered to the Lepidoptera collection of NHML); 1 ♂, 1 ♀ in Toyosato Museum of Entomology (Ibaraki, Japan); 1 ♂ Tokyo University Museum (Tokyo, Japan).

Etymology: The Latin name *singularis* may be translated as “unique” or “extraordinary”, demonstrating the uniqueness of the new species.

***Devyatkinia* gen. nov.** contains the following taxa:

***singularis* spec. nov.** - C. Vietnam (Khanh Hoa, Thua Thien Hue Provinces).

***unica* (LEECH, 1893) comb. nov.** - China (Sichuan, Fujian and Zhejiang Provinces).

Comparative analysis and comments: Features of the wing venation such as the inflation of the veins at the base of the forewing and the length and shape of discal cell provide the most stable and invariable generic synapomorphic character states in Satyrinae (Nymphalidae) (PEÑA et al., 2006; MARIN et al., 2011). Whilst sometimes genital structures in both sexes of satyrids provide diagnostic features at the specific level, they are rarely useful for higher classification. The main reason for this is high variability in the structures and features that may be found in a few taxa in several allied groups - homoplasy (KUZNETZOV & STEKOLNIKOV, 2001). Nevertheless, there are a few autapomorphic features of wing pattern and genitalia that may add support to the generic concept proposed here.

The data represented in Table 1 show combinations of venation, wing patterns and secondary sexual characters to some genera of the tribe Satyrini, including the new genus *Devyatkinia*. Both Chinese and Vietnamese representatives of *Devyatkinia* show strong inflation of veins Sc and Cu at the base of the forewing, but inflation in vein 1A+2A is barely evident (fig 2 a). This combination of inflated veins clearly separates *Devyatkinia* species from Asian *Mycalesis* (fig. 2 b) and *Lohora* (fig. 2 c), where all three veins are swollen at base in all species. Also the genus *Orsotriaena* is distinct in having only vein Sc inflated (fig. 2 d). It should be mentioned here that PEÑA (2009) treated *Orsotriaena* as a member of the subtribe Coenonymphina (= Hypocystina), not Mycalesina, based on results of DNA analysis. At the same time, according to a recent molecular study (YANG & ZHANG, 2015) *Orsotriaena* should be represented as a member of the subtribe Eritina. The last system is accepted in the current work, though we admit that the true status of this genus needs additional morphological study. Similar differences in the patterns inflated veins is seen between *Devyatkinia* and other Satyrini subtribes, including Parargina (*Lopinga*) (fig. 2 e), Lethina (*Lethe*, *Neope*) (figs. 2 f, 2 g), Eritina (*Orsotriaena* and *Erites*) (fig. 2 i) and representative of the tribe Elymniini (*Elymnias*) that have only vein Sc swollen.

The Palearctic genera *Maniola*, *Hipparchia*, *Brintesia* and *Pseudochazara*, and the tropical genus *Ypthima* (all Satyrini) have a similar pattern of swollen veins to *Devyatkinia*, together relatively straight discocellulars. They also have a similar relationship between lengths of discal cells and length of the forewing. However, ♂♂ of these genera have a distinct type of secondary sexual character: a large androconial patch (or patches) on the upper surface of the forewing.

Species of *Devyatkinia* have genitalia similar in general structure to those of other Satyrinae, but both sexes show some unique and distinctive features unknown in allied genera. In particular, the ♂♂ have a long saccus, a specialised feature (A. A. STEKOLNIKOV, pers. com.). The series of teeth on the dorsal side of the aedeagus is a very distinctive character that is extremely rare in *Mycalesis*, but may indicate phylogenetic links to some groups of Palearctic satyrids. The combination of a long saccus and the series of dorsal teeth in the aedeagus is also characteristic of some Sundanian *Ragadia* (Ragadiini), but this genus has only the base of Sc swollen in the forewing, and the hindwing venation is highly abnormal (MILLER, 1968).

The ♀ genitalia of *Devyatkinia* also exhibit rather distinctive structures. The unpaired V-shaped signum and the reduction of the papilla analis are so far are unknown in other Mycalesina, indeed in Satyrinae generally.

A detailed study of morphological features in both Chinese and Vietnamese populations of the taxon formerly treated as *Mycalesis unica* LEECH led us to conclude that it represents a separate genus consisting of two species and sharing various features with genera of tribes Elymniini and Satyrini. However, several morphological characters of the new genus, especially the scheme of the wing venation, secondary sexual characters, wing colour, spot and fascia pattern, undoubtedly place it in the tribe Elymniini. In addition, the unusual behaviour and seasonal phenology of *Devyatkinia* species make it difficult to come to a final conclusion on the precise higher classificatory status of this taxon; this may only be clarified by additional molecular studies.

Biogeography: Analysis of the geography of the butterfly fauna of the Indochinese Peninsula indicates wide disjunctions in the ranges of some Sino-Himalayan wood nymphs (MONASTYRSKII, 2010; MONASTYRSKII & HOLLOWAY, 2013). Such disjunctions provide good evidence for an evolutionary scenario of expansion, isolation and speciation occurring in response to Pleistocene processes of glaciation and warming. In cooler periods, the geographical ranges of a number of Sino-Himalayan species extended southwards to reach the Indochinese Peninsula where they survived and diverged in more montane areas (MONASTYRSKII, 2010). The next warming period caused the altitude of their Indochinese habitats to move upwards, forming disjunctions in ranges of these species. The distribution of the modern representatives of *Devyatkinia* provides an example of such a scenario. It is remarkable that similar disjunctions and endemism are unknown amongst the *Mycalesis* distributed in China and Indochina, but perhaps this genus is more characteristic of lowland forest habitats that contracted in cooler periods. Thus today the genus *Devyatkinia* exhibits relict status but possibly was more diverse and wide-ranging in ‘premycalesis’ times. In spite of high local mobility and the complicated behaviour observed in both sexes, the genus *Devyatkinia* has been unable to occupy the majority of tropical and subtropical niches. On the contrary, chemoreceptor behaviour of *Mycalesis* has proved to be more advantageous. The continuous ranges of *Mycalesis* species have no disjunctions, but are sometimes characterised by a

number of contiguous subspecies. Endemicity among continental Asiatic *Mycalesis* is rather rare.

Rarity: Both Chinese and Vietnamese representatives of *Devyatkinia* are clearly very rare butterflies in comparison to other species of *Mycalesis* in mainland South East Asia. The original description of *unica* was based on 1 ♀ (B.M. Type No.Rh 2723) now preserved in the Lepidoptera collection of the NHML. In China, *D. unica* (LEECH) is now known from Sichuan Province (western population; LEECH, 1893; CHOU, 1999) and in Zhejiang Province (eastern population; CHOU, 1999). The ♀ deposited in the Zoologisches Museum A. Koenig, Bonn was collected in 1938 in the eastern Fujian (Fukien) Province.

Devyatkinia unica (LEECH) has been recorded in Central Vietnam (Khanh Hoa and Thua Thien Hue Provinces) and may be seen seasonally within more montane biotopes of coastal evergreen forest.

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Table 1
The main differences between *Devyatkinia* gen. nov. and some allied genera based on wing venation and male secondary sexual characters

Feature	<i>Mycalesina</i> <i>Devyatkinia</i>	<i>Mycalesina</i> <i>Mycalesis</i>	<i>Mycalesina</i> <i>Lohora</i>	<i>Eritina</i> <i>Orsotriaena</i>	<i>Eritina</i> <i>Erites</i>	<i>Parargina</i> <i>Lopinga</i>	<i>Lethina</i> <i>Lethe</i>	<i>Lethina</i> <i>Neope</i>	<i>Elymnina</i> <i>Elymnias</i>
Adult wing venation	Fig. 2a	Fig. 2b	Fig. 2c	Fig. 2d	Fig. 2i	Fig. 2e	Fig. 2f	Fig. 2g	Fig. 2h
most prominent forewing underside ocellar ring	cell M1	cell Cu1a	cell Cu1a	cells M1 and Cu1a	cell Cu1a	cell M1	a series of small ocelli	a series of ocelli	cell Cu1a + series of ocelli
most prominent hindwing upperside ocellar ring	cell Cu1a + series of small ocelli	rarely in cell Cu1a	absent	absent	a series of ocelli	cells M3 + Cu1a	cell Cu1a + series of ocelli	a series of ocelli	absent
middle and lower discocellulars vein	rather straight	strongly curved inwardly	strongly curved inwardly	strongly curved inwardly	rather straight	strongly curved inwardly	rather straight	rather straight	strongly curved inwardly
length of discal cell	1/2 forewing length	1/2 forewing length	1/2 forewing length	1/2 forewing length	3/5 forewing length	1/2 forewing length	1/2 forewing length	1/2 forewing length	2/5 forewing length
forewing vein Sc	strongly swollen at base	strongly swollen at base	strongly swollen at base	strongly swollen at base	strongly swollen at base	weakly swollen at base	weakly swollen at base	weakly swollen at base	strongly swollen at base
forewing cubitus vein	strongly swollen at base	strongly swollen at base	strongly swollen at base	not swollen at base	weakly swollen at base	not swollen at base	not swollen at base	weakly swollen at base	not swollen at base
forewing vein 1A+2A	weakly swollen at base	strongly swollen at base	strongly swollen at base	not swollen at base	not swollen at base	not swollen at base	not swollen at base	not swollen at base	not swollen at base
Male secondary sexual characters	long blackish brown hair-pencil on Up HW	Up HW costal nacreous area with hair tuft; UpFW with glandular fold on vein 1A+2A	blackish brown hair-pencil at base of HW	elongate fold enclosing a hair-pencil in space Cu1b on Up FW	Absent	wedge-shaped androconial area on Up FW	androconial patches on Up FW or both wings	androconial brand from dorsum to vein M3	androconial patch on FW + one or more patches and hair tufts on HW

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Fig. 1: *Mycalesis unica* LEECH, 1893, holotype ♀. Forewing length 30 mm. Collected by KRICHELDORFF at Moupin, [W. China, Sichuan] in July, 1890, B.M. Type No.Rh. 2723, BMNH #141945. (a) Upperside, (b) underside, (c) labels; *Mycalesis unica* LEECH, 1893, ♀; forewing length 28 mm. Collected by H. HÖNE at Kuatun, 2300 m (E. China, Fukien) 27, 40 n.Br/117, 40 ö.L., 11.7.1938, the Zoologisches Museum A. Koenig, Bonn (Germany). (d) Upperside, (e) underside, (f) labels; *Devyatkinia singularis* gen. et spec. nov., holotype ♀; forewing length 33 mm; Central Vietnam, Khanh Hoa Province, Dien Khanh District, Hon Ba Nature Reserve, 1500 m, 17.VI.2013, leg. A. L. MONASTYRSKII. (g) Upperside, (h) underside; *Devyatkinia singularis* gen. et spec. nov., paratype ♂; forewing length 29,5 mm; Central Vietnam, Khanh Hoa Province, Dien Khanh District, Hon Ba Nature Reserve, 1500 m, 27.V.2005, leg. A. L. MONASTYRSKII. (i) Upperside, (j) underside.

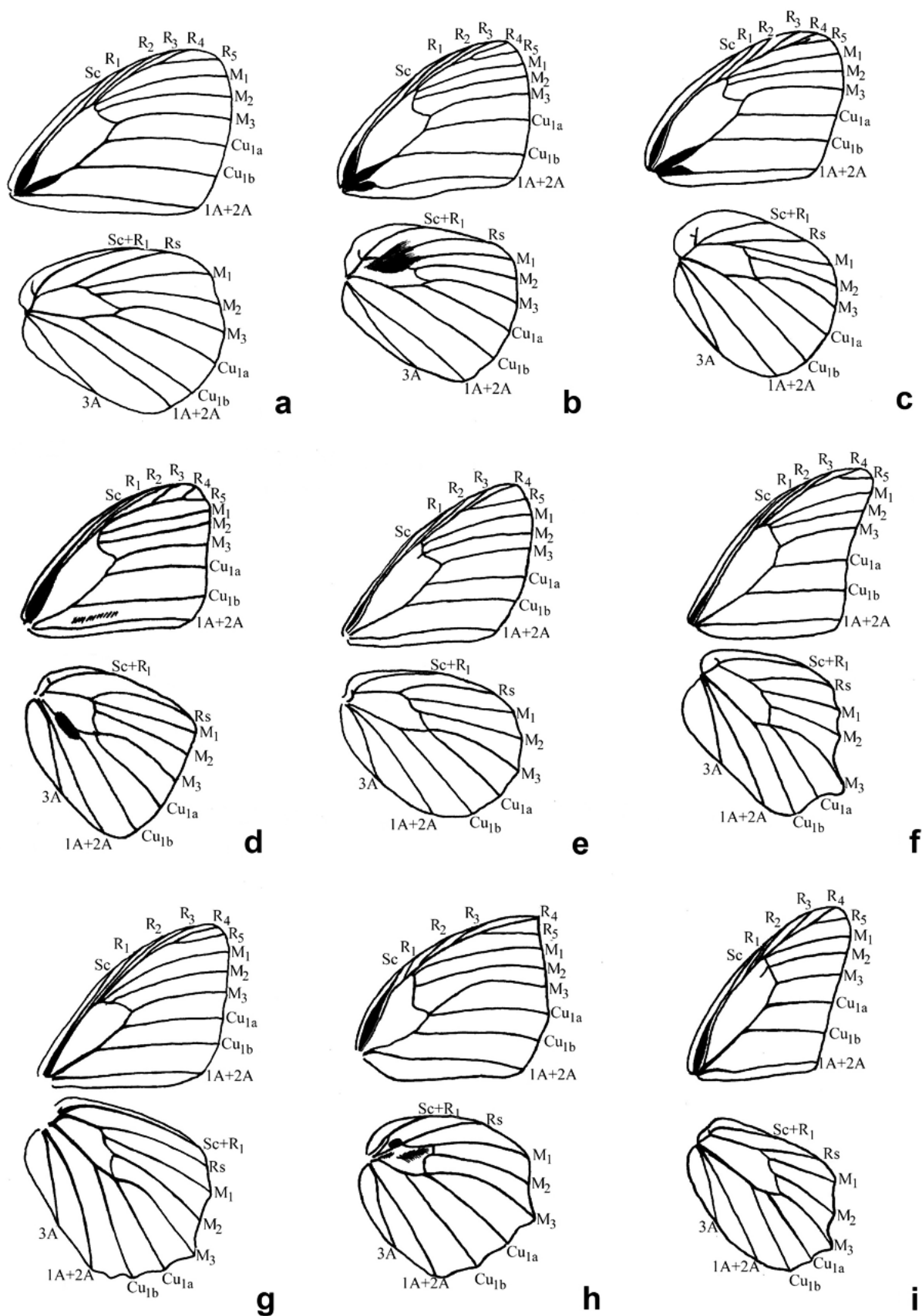


Fig. 2: *Devyatkinia* and allied Satyrinae species wing venation: (a) *Devyatkinia singularis* gen. et spec. nov.; (b) *Mycalesis gotama* MOORE, 1857; (c) *Lohora dexamenus* HEWITSON, 1862; (d) *Orsotriaena medus* (FABRICIUS, 1775); (e) *Lopinga deidamia* (EVERSMANN, 1851); (f) *Lethe chandica* (MOORE, 1857); (g) *Neope muirheadi* (C. & R. FELDER, 1862); (h) *Elymnias hypermnestra* (LINNAEUS, 1763), (i) *Erites angularis* MOORE, 1878.

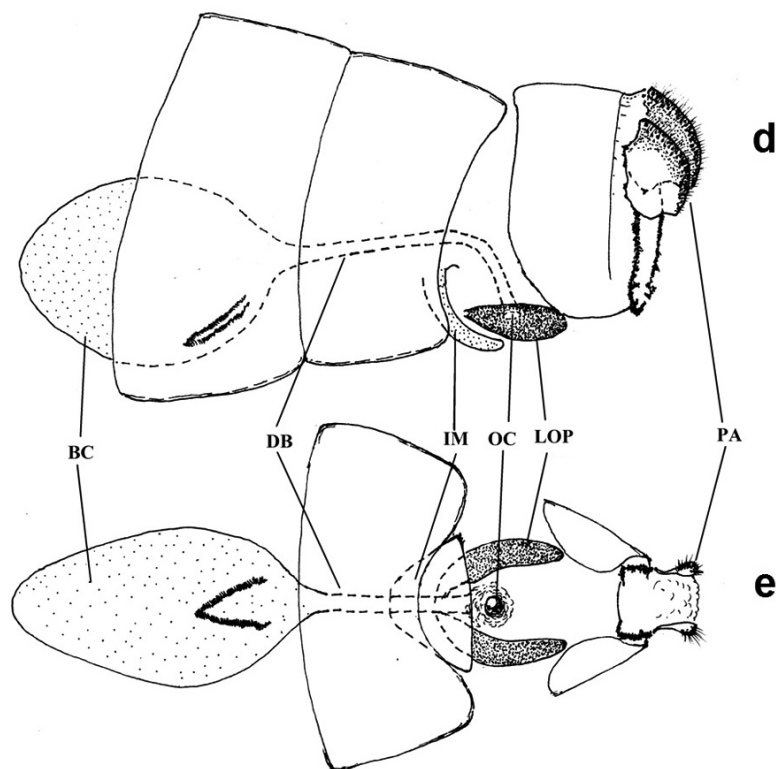
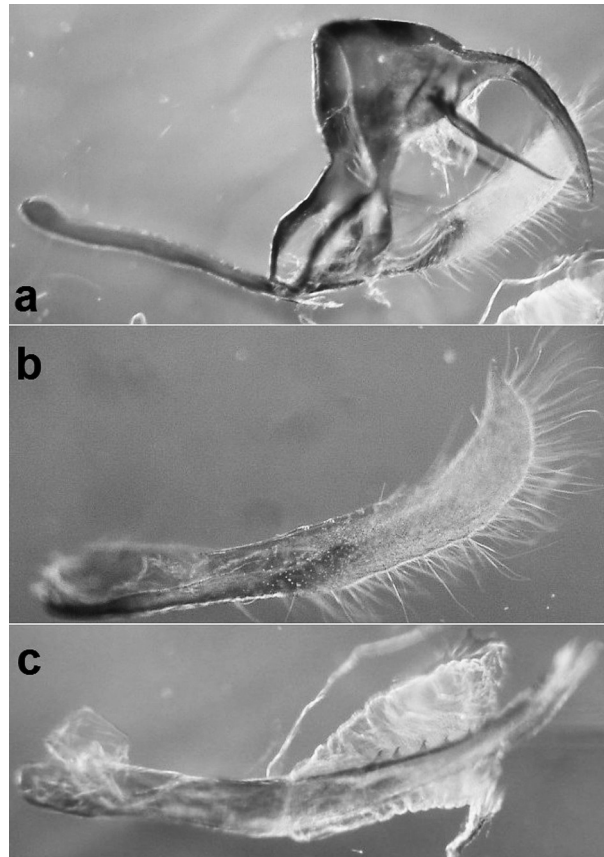


Fig. 3: ♂ and ♀ genitalia of *Devyatkinia singularis* gen. et spec. nov. (a) General view at the ♂ genitalia armature in lateral aspect without aedoeagus; (b) right clasper in lateral view; (c) aedoeagus in lateral view. ♀ genitalia of *Devyatkinia singularis* gen. et spec. nov. (d) General plan in lateral view; (e) in ventral view.

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