Nota Lepi. 37(1) 2014: 67–74 | DOI 10.3897/nl.37.7935

A remarkable new species of the genus *Catatinagma* Rebel, 1903 (Lepidoptera, Gelechiidae) from Turkmenistan

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http://zoobank.org/8A092C1D-38A1-47D9-B56C-9513184E4F6D

Received 31 January 2014; accepted 29 April 2014; published: 15 June 2014
Subject Editor: Lauri Kaila

Abstract. A new highly specialized *Catatinagma* Rebel, 1903 species is described from Turkmenistan. Both sexes have completely reduced hindwings and strongly reduced forewings. The adults are active in February, jumping amongst *Carex physodes* M. Bieb. and being associated with rodent burrows. The new species is similar to *Metanarsia trisignella* Bidzilya, 2008, in the male genitalia. Both species are placed here provisionally in *Catatinagma* Rebel, 1903, and their position within Apatetrini is briefly discussed. The adult and the genitalia of both sexes are illustrated, and the behaviour of the new species is described.

Introduction

As a result of my study of material deposited in the Zoological Institute of the Russian Academy of Sciences (Russia, Sankt-Petersburg, ZIN), a very remarkable narrow-winged species of Gelechiidae with prominent frontal process from Repetek Nature Reserve (SE Turkmenistan) was discovered.

As it turned out after a detailed examination, the species was an undescribed member of the subfamily Apatetrinae, tribe Apatetrini (Karsholt et al. 2013) but its generic assignment was unclear. A well-developed beak-shaped frontal process on the head and stenoptery in both sexes with fully reduced hindwing were recognized as external morphological specializations of the new species. The male genitalia of the new species resemble those of *Metanarsia trisignella* Bidz., but the female genitalia differ in the shape of the signum. Both species are placed provisionally in *Catatinagma* Rebel, 1903, until a more appropriate place can be found.

In addition to strongly modified wings, the new species has a very unusual behaviour. The adults hide in the burrows of rodents in cold weather. This unique life style and the rather remarkable morphology of this species justify its description in advance of a broader taxonomic revision of the Apatetrini.

***Catatinagma stenoptera* Bidzilya, sp. n.**

http://zoobank.org/83160C15-A639-4756-A9C8-31C73BC82F9D

Material. Holotype, ♂, Karakum desert, Repetek reserv[e], Carex, 3.ii.1983, Krivokhatsky (gen. slide 55/11) (ZIN). Paratypes: 1 ♂, same data as holotype (gen. prep. in glycerol); 1 ♂, same data as holotype, but 18.ii.1983, trap *Rhombomys*, night (ZIN-00002); 1 ♀, SAME data, but 15.ii.1983, trap *Rhombomys* (gen. slide 56/11) (ZIN-00005); 1 ♂, 2 ♀, Repetek, SE Karakum, Turkmenia, trap *Rhombomys*, 25.ii.1983 (ZIN-00004 ♂, ZIN-00003 ♀, ♀ gen. prep. in glycerol) (all ZIN).

Description. Adult (Figs 1–3).Wingspan 9.1-10.9 mm. Head smooth-scaled, whitish-brown, with prominent beak-shaped, pointed process, that sometimes bears additional small dorsal knob arising from middle; frons medially with depression resembling excavator bucket with three short tooth-shaped projections at bottom; labial palpus weakly up-curved, outer surface black with white basal and apical belts, inner surface white, segment 3 nearly straight, acute; segment 2 about 1.5 times width and nearly 2.5 times length of segment 3; proboscis reduced; antenna brown with very narrow whitish ring at base of each segment, pecten with numerous long white hair-like scales; forewing strongly narrowed after ¼, nearly filiform in distal half, light brown, mottled white along margins, cilia white; hindwing vestigial.

Abdomen (Figs 4–7). Male sternite VIII rectangular, without modification. Female tergite VII nearly twice length of other abdominal segments, rectangular, slightly broader than long, densely covered posteriorly with short hair-like scales, sternum VII rectangular without modification. Sternite I+II of both sexes sub-quadratical, with pair of distinct long venulae and well-developed apodemes, tergite I distinctly broader than long, strongly edged, anterolateral margin rounded, posterior margin straight.

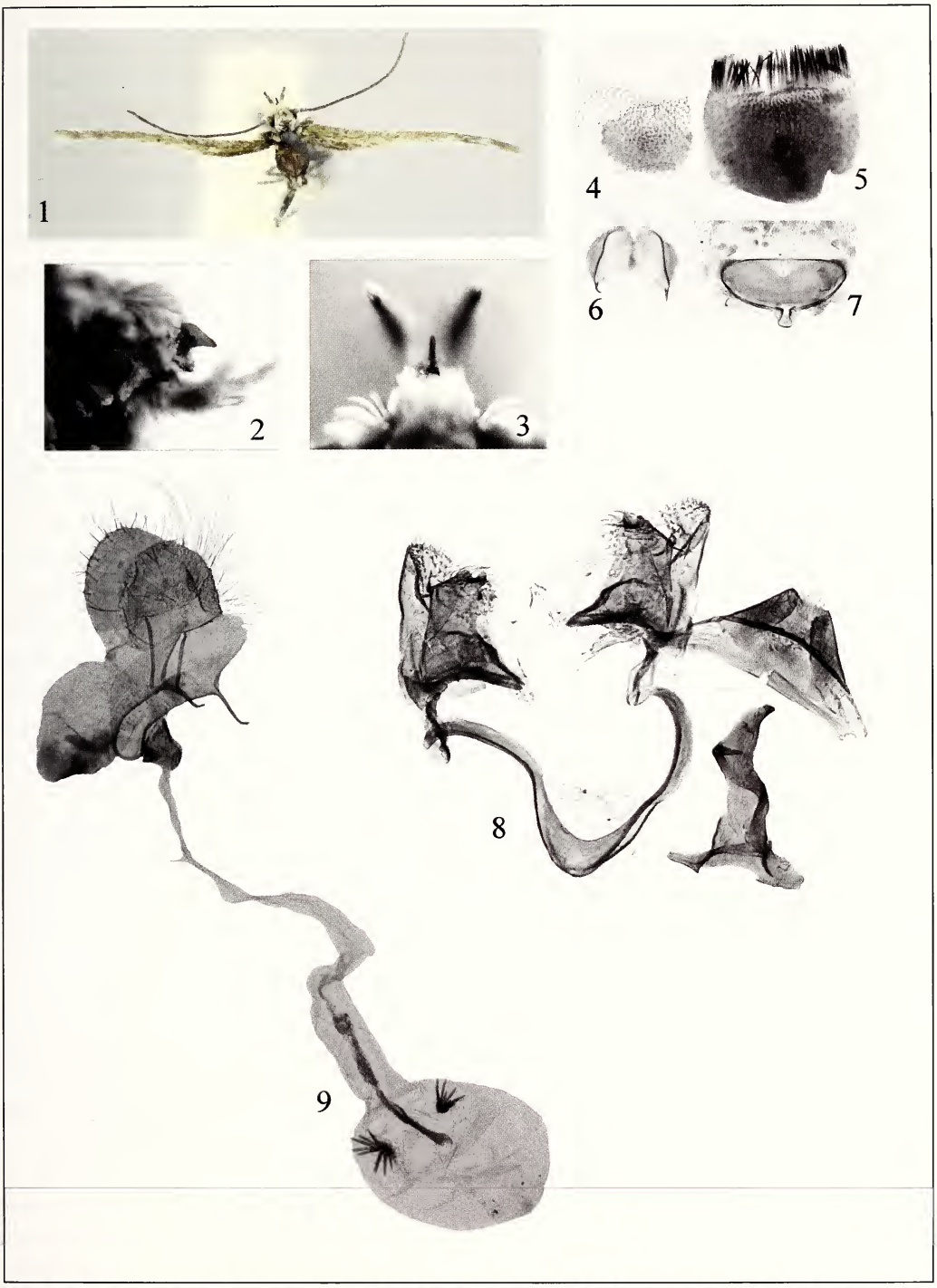
Male genitalia (Fig. 8). Uncus reduced to trapezoidal lobe with inward folded edges; gnathos absent; tegumen narrow, considerably broader than long, posterior edge strongly sclerotized; cucullus digitate, moderately broad, apex rounded, densely haired; sacculus flat, about 3/4 length of cucullus and slightly broader, posterior margin straight with two or three small teeth; transtilla lobes well developed; vinculum narrow, band-shaped, terminating in short rounded saccus; phallus longer than cucullus, with tapered lateral processes, basal half sclerotized dorsally, distal half sclerotized mainly laterally, apex beak-shaped, base bifurcated.

Female genitalia (Fig. 9). Papilla analis rounded, with straight basal edge, densely covered with short setae except for patch of long hair-like setae arising from dorsal margin; apophyses anteriores about one-half length of apophyses posteriores, straight, terminally curved; tergite and sternite VIII extremely narrow, strongly sclerotized, ribbon-shaped; lateral part of segment VIII evenly sclerotized, band-shaped; ostium rounded, opening near anterior edge of sternite VIII; antrum short, funnel-shaped; ductus bursae long, membranous, posterior half thin, anterior half moderately wide; corpus bursae globular; signum paired, with long spines arising from rounded plate.

Diagnosis. The new species is easily recognizable both externally and in the genitalia characters. For details see the Discussion.

Distribution. SE Turkmenistan (Repetek Nature Reserve).

Derivation of name. The specific name refers to the extremely narrowed forewing, the most characteristic feature of this species.



Figs 1–9. *Catatingama stenoptera* sp. n. 1. Adult, holotype. 2. Head, lateral view. 3. Head, view from above; 4. Male sternum VIII (gen. slide 55/11). 5. Female tergum VII (gen. slide 56/11). 6. Male sternum I+II (gen. slide 55/11). 7. Male tergum I (gen. slide 55/11). 8. Male genitalia (gen. slide 55/11). 9. Female genitalia (gen. slide 56/11).

Biology. The new species is hitherto only known from the Repetek Nature Reserve, SE Turkmenistan. The adults were collected from 3rd to 25th of February. According to field observations by Viktor A. Krivokhatsky, who collected the type-series, the adults were active during the warm days when they were seen jumping on the sand. They have also been collected by sweeping amongst *Carex physodes* M. Bieb. (Cyperaceae). This plant is most likely the host for this species, although the preimaginal stages have not yet been found. The adults have also been observed and collected in the burrows of the great gerbil (*Rhombomys opimus* (Lichtenstein, 1823)) and the long-clawed ground squirrel (*Spermophilopsis leptodactylus* (Lichtenstein, 1823)) (Mammalia, Rodentia, Muridae, Sciuridae). The moths go deeply into the burrows at night and when there is frost in the daytime.

Discussion

Wing reduction and biology. Within the family Gelechiidae species with different degrees of wing reduction are known in eleven genera, but are most common in *Megacraspedus* Zeller, 1839, *Ephysteris* Meyrick, 1908, *Kiwaia* Philpott, 1930, and *Sattleria* Povolný, 1965 (Sattler 1991). The forewing transformation, for the majority of such Gelechiidae species, resulted in forewing reduction of length and width in the apical one-third. As a result the forewings become "lanceolated": their basal half remains nearly of usual width, whereas the distal portion is considerably narrowed towards the apex. According to the classification proposed by Sattler (1991) such species must be called "brachypterous", whereas the species described here has to be treated as "stenopterous", having the forewing strongly reduced in width without any significant reduction in length. Brachyptery and other cases of wing reduction are mainly restricted to the female sex. *Megacraspedus dolosellus* (Zeller, 1839), *Eulamprotes libertinella* (Zeller, 1872) and all species of the genus *Sattleria* are some examples of brachypterous Palaearctic Gelechiidae. Wing reduction in both sexes is a rather rare phenomenon that is known in about 25 species from different families of Lepidoptera world-wide (Karsholt & Sattler 1998; Sattler 1991). In Gelechioidea real stenoptery is only known in the female of *Pleurota marginella* (Denis & Schiffermüller, 1775), Oecophoridae, and previously has not been observed within Gelechiidae, making *C. stenoptera* sp. n. the first case of stenoptery in both sexes in that family.

Wing reduction in both sexes characterizes the species that inhabit mainly small oceanic islands, costal localities (e.g. dunes) and high mountain area with continuous strong winds (Heppner 1991; Sattler 1991; Karsholt & Sattler 1998). *Ephysteris brachyptera* Karsholt & Sattler, 1998, from Madeira and at least two undescribed *Ephysteris* species from the Tuva Mountains (Karsholt & Sattler 1998) and Mongolia (Bidzilya *in press*) are examples of brachyptery in both sexes in Palaearctic Gelechiidae. Brachyptery in females is much more common and observed in addition to the above cases, in a large number of species with imagos active during the cold season. *C. stenoptera* sp. n. undoubtedly falls into this group of "winter" moths. The adults were found in winter time in the Karakum desert. Among Turanian Gelechioidea species with winter activity of the imago are known only in Ethmiidae: *Dasyethmia hiemalis* Danilevsky, 1969, from the sands of south-eastern Kazakhstan (middle course of the Chu river) flies in the daytime in January. The males of this species are densely haired, the females are unknown but probably wing-reduced (Shovkoon 2010). *Cheimoptena pennigera*

Danilevsky, 1969 (Geometridae) is another winter moth described from the south-eastern Kazakhstan but also known from Repetek (Krivokhatsky 1985c). The female of this species is apterous, the males are capable of flight and densely haired, as an adaptation for activity under low temperatures.

Adults of *C. stenoptera* are flightless, they move by jumping. The jumping and/or running may be considered as a regular way of locomotion for many flightless species, that mainly occurs in habitats with sparse vegetation and exposed soil, although jumping is quite common in many fully winged species capable of flight (Sattler 1991). It is unknown whether jumping is the only way of locomotion in *C. stenoptera* or whether the adults can also walk or run. However, it is clear that *C. stenoptera* is a quite mobile species: both sexes were found deep in rodent burrows, where they hide at night and during frost also in the day time. The association of *C. stenoptera* with rodent burrows is the most interesting behavioural phenomenon of this species. The great gerbil and the long-clawed ground squirrel are quite common in the sand deserts of Turkmenistan. The first species is considered ecologically one of the most important mammals, whose activity (mainly digging holes) considerably affects the local landscape. Many invertebrate species are associated with the great gerbil and inhabit its burrows. According to observations in the Repetek Nature Reserve (Krivokhatsky 1985a) about 345 animal species, mainly insects, were found in the burrows of great gerbil and other rodents. The Coleoptera (121 species of which 54 are obligate residents), Hymenoptera (50 species / 5 obligate) and Hemiptera (29 species / 6 obligate) predominate amongst the insects. The Lepidoptera with 15 species occupy the fourth position. Only two species - *Calycobathra calligoni* Sinev, 1979, and *Asclenia decolorella* Sinev, 1980 (both Cosmopterigidae) - overwinter in the burrows of the great gerbil and are considered as permanent residents (Krivokhatsky 1985b). *C. stenoptera* is the third species strongly associated with the great gerbil's burrows. In contrast to the Momphidae species, the adults of *C. stenoptera* use rodent burrows as a refuge during the period of their activity in winter time, but not for overwintering in them.

The host plant of *C. stenoptera* is unknown. The adults have been observed amongst *Carex physodes*, but *Haloxylon* spp., *Kochia* spp. (Chenopodiaceae) and *Ephedra strobilacea* Bunge (Ephedraceae), which are common in the habitats of *C. stenoptera*, are also possible candidates for the host plant of this species.

The function of frontal processes in Gelechiidae remains unclear. It was suggested that species pupating under ground use the frontal process to bore through the soil after emerging from the pupa. However, as it was correctly noted by Sattler (1976), many species in the same habitats manage perfectly well without such modifications. Frontal modifications occur independently in several gelechiid genera from different subfamilies and tribes, such as *Ornativalva* Gozmány, 1955 (Anomologinae), *Athrips* Billberg, 1820 (Gelechiinae), *Caulastrocecis* Chrétien, 1931 (Apatetrinae) and others. In the Apatetrinae the frontal modifications are common and were observed in Palaearctic *Catatinagma* as well as in the South African genera *Cerofrontia* Janse, 1951, and *Rhynoceros* Bidzilya & Mey, 2011. As most species with frontal modifications are restricted to arid areas, one may suspect some relationship of this modification to occurrence in arid habitats, but not as an adaptation to the cold season.

The Repetek Nature Reserve, where *C. stenoptera* has been found, represents the southern sand deserts of the Turanian province (Karakum desert). The area is characterized by an

arid continental climate with hot summers and cold winters. The mean annual temperature is +16.3°C, with the average summer temperature ranging +29–33°C (with a record high of +50.1°C); temperatures below freezing are usually observed from December to February (with a record low of -31°C). The average precipitation is 117 mm per year with a maximum in winter and spring (Zapovednik Repetek 1990). The climate of Repetek is in general similar to that of the type localities of *D. hiemalis* and *Ch. pennigera*, but the winter is milder. Although these three winter species occur under very similar climatic conditions, *C. stenoptera* has rather different morphological and biological adaptations for the cold season. The phenomenon of wing reduction in cold season moths was discussed in detail by Sattler in his review of the wing reduction in Lepidoptera (Sattler 1991).

Although our current knowledge of the distribution, habitat preferences, host plants and behaviour of *C. stenoptera* is rather limited it seems clear that the regular occurrence of *C. stenoptera* in the burrows of the great gerbil and the long-clawed ground squirrel is a permanent adaptation for surviving under a low temperature, at least in the Repetek.

Systematics

The monotypic genus *Catatinagma* with the only included species *C. trivitellum* Rebel, 1903, was considered for a long time as a synonym of *Apatetris* Staudinger, 1879. Its status has been recently revised and it was recalled from synonymy, whilst another monotypic genus, *Coloptilia* Fletcher, 1940, has been synonymized with *Catatinagma* (Junnilainen & Nupponen 2010). According to Junnilainen & Nupponen (2010), the head with a strongly developed frontal process within a crater-like depression and a short, nearly straight labial palpus are considered as external characteristic features of *Catatinagma*. The male genitalia are characterized by a sacculus that is strongly separated from the valva, a reduced gnathos and membranous uncus. A paired brush-shaped signum is typical for the female genitalia of *Catatinagma* (Junnilainen & Nupponen 2010).

The genus *Catatinagma* in this new concept comprises three species: *C. trivitellum* Rebel, 1903, *C. kraterella* Junnilainen & Nupponen, 2010 and *C. conchylidella* (Hofmann, 1898) (type-species of *Coloptilia*). Whilst it is evident that the first two species are congeneric, the proximity of *C. conchylidella* to them, and consequently the synonymy of *Coloptilia* with *Catatinagma*, remains in doubt due to considerable differences between the male genitalia of *C. trivitellum* and *C. conchylidella* (see Junnilainen & Nupponen 2010: 6, pl. 2).

The male genitalia of *C. stenoptera* resemble those of *Metanarsia trisignella* Bidzilya, 2008, having a short digitate cucullus in combination with a short, apically serrated sacculus. The female genitalia of both species differ in the shape of the signum: triple whisk-shaped in *M. trisignella* and paired, covered with strong spines in *C. stenoptera*. *M. trisignella* was described in *Metanarsia* Staudinger, 1871, based on the close similarity of its male genitalia to the other members of this genus, although a reduced gnathos and triple whisk-shaped signum as well as a prominent frontal process are characteristic features of *Catatinagma,* but not *Metanarsia* (Bidzilya 2008). *C. trivitellum* is the second species in addition to *M. trisignella* which appears to be intermediate between *Metanarsia* and *Coloptilia* according to the current diagnosis of these genera. It should be noted that the male genitalia of both species are more like those of *C. conchylidella* than those of *C. trivitellum* and *C. kraterella*. Despite differ-

ences in the shape of the signum, both species seem to be closer relatives of each other than any other genera of Apatetrini. The recent attempts of finding an appropriate position for such "problematic" species within the tribe Apatetrini based on traditional morphological characters usually resulted either in their provisional association with collective genera of unclear definition (Sakamaki 2000; Nel & Varenne 2012) or in the establishment of new genera for the most exceptional cases (Bidzilya & Mey 2011). The possibility cannot be excluded that both species require a separate genus. However, it seems more appropriate at the present stage to place them in *Catatinagma* (*Catatinagma trisignella* (Bidzilya, 2008) **comb. n.**)), until a global revision of Apatetrini supported by DNA-studies can be provided.

Acknowledgements

I express my gratitude to Dr Sergei Yu. Sinev (ZIN) for his assistance during my work with the collection and Dr Viktor A. Krivokhatsky (ZIN), who kindly provided information about behavior of the new species. I am very grateful to Dr Klaus Sattler (the Natural History Museum, London), Jaakko Kullberg (Finnish Museum of Natural History) and an anonymous reviewer for their valuable comments and linguistic correction of an earlier version.

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