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A new species and taxonomical notes on some other *Catocala* Schrank, 1802 (Lepidoptera, Erebidae) from China

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Abstract

A new species, *Catocala nilssoni*, **sp. n.**, from the Liaoning and Shandong Provinces of northeast China is described. The new species clearly differs in wing pattern and genitalia from any other *Catocala* species. DNA results for one specimen of the new species further confirms its morphological exclusivity. Actual *Catocala danilovi* (O. Bang-Haas, 1927) male genitalia is pictured for the first time and the taxonomical status of the related *Catocala florianii* Saldaitis & Ivinskis, 2008 is discussed.

Key words: Lepidoptera, Erebidae, Catocala, new species, China

Introduction

Much study has been devoted to this genus but new species of *Catocala* are still being uncovered, particularly in Asia. Many of these discoveries are for new species belonging to existing monophyletic groups with high structural homogeneity. Occasionally, however, new species are not clearly identifiable as members of any phylogenetic group. Here we introduce one such rare and unique species, described as new based on a single pair.

Material and methods

The moths studied were all collected at ultraviolet lights. The DNA barcodes (658 base pairs of Cytochrome Oxidase Subunit I 5' region, COI-5P) were sequenced by Paul Hebert's lab at the University of Guelph. Male and female genitalia were dissected and mounted in Euparal on glass slides. Photos of genitalia where made by Svitlana Pekarska using microscope Nikon SMZ745T and camera Moticam 2500. Photos of imago where taken by Oleg Pekarsky using camera Nikon D3000/Sigma 105, f/2.8.

Abbreviations of material depositories: ASV = Aidas Saldaitis (Vilnius, Lithuania); BMNH = British Museum Natural History (London, England); DNK = Danny Nilsson (Kalvehave, Denmark); HNHM = Hungarian Natural History Museum (Budapest, Hungary); JB = genitalia slide János Babics; MHUB = Museum für Naturkunde der Humboldt Universität (Berlin, Germany); OP = genitalia slide Oleg Pekarsky; PGM = Péter Gyulai (Miskolc, Hungary); RJB = Robert J. Borth, (Milwaukee, USA); ZFMK = Zoologisches Forschungsmuseum Alexander Koenig (Bonn, Germany).

Systematic part

Catocala nilssoni sp. n.

(Figs 1, 2, 17, 27)

Type material. Holotype: male (Fig. 1), China, prov. Liaoning, Da-gu-Shan, Gushan zhen, n. Donggang, 1-11.vii.2013, leg. Li Jingke, slide No. OP2901m (coll. PGM, later to be deposited in the HNHM).

Paratype: female (Fig. 2), China, Shandong province, Mount Laoshan, 1000 m, Qingdao City, NL 36'20, EL 120'80, 08–24.vii.2007, leg. Li Jingke, slide No. OP2722f (JB1864f), DNA No. 10255-130707-CH (coll. DNK).



1. C. nilssoni, male, HT, Liaoning



3. C. danilovi, male, HT, Russia, Ussuri



2. C. nilssoni, female, PT, Shandong



4. *C. danilovi, male*, Russia, Primorsky Krai



5. C. florianii, male, Shaanxi



7. C. florianii, female, PT, Shaanxi



6. C. florianii, female, Shaanxi



8. C. alabamae f. olivia, female, USA, Texas

FIGURES 1–8. *Catocala* ssp. adults. 1. *C. nilssoni* sp. n., male, holotype, China, Liaoning (PGM / HNHM); 2. *C. nilssoni* sp. n., female, paratype, China, Shandong (DNK); 3. *C. danilovi*, male, holotype, Russia, Ussuri (MHUB) (Gábor Ronkay photo); 4. *C. danilovi*, male, Russia, Primorsky Krai (ASV); 5. *C. florianii*, male, China, Shaanxi (ASV); 6. *C. florianii*, female, China, Shaanxi (ASV); 7. *C. florianii*, paratype, female, China, Shaanxi (ASV); 8. *C. alabamae* f., *olivia*, female, USA, Texas (RJB).



11. C. largeteaui, male, HT, Guizhou



13. C. largeteaui largeteaui, male, Sichuan

12. C. largeteaui largeteaui, female, Shaanxi







PT, male, Yunnan

PT, female, Yunnan

FIGURES 9–16. *Catocala* ssp. adults. 9. *C. mirifica*, male, Japan, W. Honshu (ASV); 10. *C. mirifica*, female, Japan, Okujo (ASV); 11. *C. largeteaui*, male, holotype, [China, Guizhou], Kouy-Tcheou (BMNH) (Gábor Ronkay photo); 12. *C. largeteaui largeteaui*, female, China, Shaanxi (ASV); 13. *C. largeteaui largeteaui*, male, [China, Sichuan], Siao-Lou (ZFMK) (Gábor Ronkay photo); 14. *C. largeteaui largeteaui*, male, China, Sichuan (ASV); 15. *C. Largeteaui yunnana*, paratype, male, China, Yunnan (ZFMK) (Gábor Ronkay photo); 16. *C. largeteaui yunnana*, paratype, female, China, Yunnan (ZFMK) (Gábor Ronkay photo).



FIGURES 17–19. Catocala ssp. male genitalia. 17. C. nilssoni sp. n., holotype, prep. OP2901m; 18. C. danilovi, prep. OP3316m; 19. C. florianii, prep. OP3315m.

Diagnosis. Catocala nilssoni (Figs 1, 2) differs from all other Catocala species and does not appear to belong to any known *Catocala* species group. Based on a combination of wing pattern and DNA it appears most similar to the C. danilovi-florianii species group and the C. mirifica Butler, 1877 species (Figs 9-16) complex. The new species is the only Palearctic Catocala whose forewings have a broad black patch extending from the inner margin to CU2 and from the antemedial area to the postmedian line. This ground pattern appears in Catocala alabamae Grote, 1875 which has a similar forewing patch in its rare form *olivia* H. Edwards, 1880 (Fig. 8) which has shown up twice in a reared brood of otherwise nominative C. alabamae (Jeff Slotten pers. com. 2005). This large dark patch also shows up in *Catocala minuta* Edwards W.H., 1865 (= *parvula* W. H. Edwards, 1865) and with only two known specimens of C. nilssoni it remains uncertain whether this patch is present in all individuals. In C. mirifica (Figs 9, 10) and Catocala largeteaui Oberthür, 1881 (Figs 11-14) the black area is only in the apical part of the forewings. Catocala nilssoni also differs from C. mirifica and C. largeteaui by the wider and shallower loop formed by its hind wing median band. The new species is significantly larger than C. danilovi (wingspan of 49-56 mm vs. 42–43 mm) (Figs 3, 4) and has forewings with a pale brown background compared to the teal-grey in C. danilovi. The hind wings of C. nilssoni have a broader orange-yellow area as in C. danilovi. New species male genitalia (Fig. 17) differ from those of C. danilovi (Figs 18, 20-23) and C. florianii (Figs 19, 20-23) by being more symmetrical (valvae similar in size and in shape), much larger in size with smooth costal margin of valva, larger, elongated harpe and longer, curved aedeagus, whereas genitalia of C. danilovi and C. florianii characterized by smaller size, marked asymmetry (left valva narrower with dentate costal margin, right valva larger with humped costal margin), shorter harpe with concave apex and shorter, almost straight aedeagus. Catocala nilssoni male genitalia differ considerably from those of the C. mirifica species group (Figs 24–26) in size, form and structure of the valvae, harpe, aedeagus and especially the vesical. New species male genitalia considerably larger in size than male genitalia of C. mirifica species group, costal sclerotization of the left valva is wide, its apex acute, harpe tapering with elongated, narrow tips, aedeagus curved, vesica globular, male genitalia of C. mirifica species group valval costa noticeably narrower with digitiform apical extension, tough, thick, bar-like harpe with blind tips, straight aedeagus, irregular shaped vesica with two large, elongated medial diverticula. Female genitalia of the C. nilssoni (Fig. 27) are similar to C. mirifica species group (Figs 28-30) but noticeably larger in size with longer antrum, which is constricted posteriorly, its anterior part with parallel edges, whereas C. mirifica species has shorter antrum with conical anterior part of antrum.

Description. Forewing length of holotype male 22 mm, wingspan 49 mm; forewing length of paratype female 26 mm, wingspan 56mm. Head, collar brown-grey, tegulae light grey, abdomen grey with yellow hair-like scales. Grey-brown forewings with mostly indistinct markings other than a broad black patch extending from the antemedial area to the postmedian line and from above the inner margin to CU2 with darker brown shading extending distally from the patch to the outer margin and also at the apex. Faint brown antemedial line forming convex loop above the patch; median line diffused and dark brown from the costal margin to the anterior edge of the two faint concentric circles forming the reniform; postmedial line sharp and black extending obliquely to most distally pointing tooth between veins M1 and M2 becoming pale but still discernible at second most distal tooth between veins M2 and M3 down to inner margin; subterminal line pale and diffuse becoming darker at last two undulations above the margin. Area between postmedial and subterminal lines richer brown distal to the black patch. Hindwings orange-yellow; median black hindwing band forming unconstricted loop from wing base but bulging between veins M2 and CuA1, terminal band broad and even, nearly broken at tornus; prominent orangeyellow apical patch; fringe orange-yellow with black patches at ends of veins. Underside of forewings greyish cream; basal and terminal fields greyish black; postmedian fascia intensive black. Underside of hindwings in basal field yellow; median band not forming visible loop, reaching dorsum; edge of dorsum blackish yellow; subterminal band without full disjunction in tornal edge. Male genitalia (Fig. 17). Uncus relatively short, narrow, evenly curved, apically with fine hook; tegumen elongated; juxta sclerotized, double elongated segments; vinculum with strong saccus; valvae slightly asymmetrical, oval-shaped with acute apex; costal margins heavily sclerotized with upper part slightly serrated. The sclerotization of the costal margin of left valva is wider than on the right valva, and runs along the full length, whereas the sclerotization on the right valve is narrower, present only in proximal part and reaches roughly the middle of the valva. Harpe large and wide at the base, tapering with an elongated, evenly curved apical part; aedeagus strongly sclerotized, elongated, cylindrical, curved; caecum elongated; carinal plate massive, strong, evenly curved; vesica membranous, main part globular, multidiverticulate, distal tube long. Female genitalia (Fig. 27). Ovipositor large, elongated, relatively narrow; papilla analis elongated, broadly rounded at apex and oval shaped, hairy with thin, short seta; apophyses posteriors strong, long; apophyses anteriores shorter than apophyses posteriores; ostium bursae as wide as antrum; antrum long, heavily sclerotized, cylindrical with parallel margins, constricted posteriorly; ductus bursae short, heavily sclerotized, tapering; corpus bursae membranous with cylindrical upper part and globular main part.

Molecular analysis. DNA barcoding results based on percentage differences with one specimen of C. nilssoni appear consistent with the morphology. Full length 658 base pair sequences of the Cytochrome Oxidase Subunit 5' Region (CO1-5P) gene were prepared by the University of Guelph's Barcode of Life Data Systems (BOLD) by methods described in Hebert et al. (2003). Molecular variation based on the Kimura two-parameter distance model for COI DNA barcodes between a single specimen of C. nilssoni follow: two C. danilovi 3.94%; two C. florianii at least 4.11%; six Catocala largeteaui yunnana (Mell, 1936) at least 3.97%; nine C. largeteaui 4.42%; two C. *mirifica* at least 4.75%. The specimen of *C.nilssoni* had the following sequence for COI 5^c positions 1 to 658: AACTTTATATTTTATTTTTGGGATTTGAGCAGGAATAGTAGGAACTTCATTAAGATTATT AATTCGAGCTGAATTAGGTAATCCTGGATCTTTAATTGGAGATGATCAAATTTATAATAC AGGATTTGGTAATTGATTAGTACCTTTAATATTAGGAGCTCCTGATATAGCTTTCCCTCG TATAAATAATATAAGTTTTTGACTTCTACCCCCCTCATTAACTTTACTAATTTCGAGAAG AATTGTAGAAAACGGAGCAGGAACTGGATGAACAGTTTATCCCCCCCTTTCTTCTAACAT ATCAATTCTAGGAGCTATTAACTTTATTACTACAATTATTAATATACGATTAAATAATTT AATATTTGATCAAATACCTTTATTTGTTTGAGCTGTAGGAATTACTGCATTCCTTCTTCT TCTTTCATTACCAGTATTAGCCGGAGCTATTACTATACTTTTAACTGATCGAAATTTAAA



FIGURES 20–21. *Catocala danilovi & C. florianii* aedeagus vesica structures. 20. *C. florianii*, prep. OP3315m & *C. danilovi*, prep. OP3316m; 21. *C. florianii*, prep. OP3315m & *C. danilovi*, prep. OP3316m.



FIGURES 22–23. Catocala danilovi & C. florianii aedeagus vesica lateral view. 22. C. florianii, prep. OP3315m & C. danilovi, prep. OP3316m; 23. C. florianii, prep. OP3315m & C. danilovi, prep. OP3316m., opposite side.

Biology and distribution. Both specimens of *C. nilssoni* were collected in July at light in the mountains of northeast China. In 2007 in Shandong Province a female was found at an elevation of 1000 meters on Mount Lao and in 2013 a male was collected in Liaoning Province in the Da-gu Mountains.

Etymology. The new species is named after Danny Nilsson (Kalvehave, Denmark) for his obsession with entomology and providing the first specimen for our study.

Remarks. While the new species clearly differs from the *C. mirifica* species group it is noted that the *C. mirifica* species group remains largely unresolved. We sequenced 18 individuals from this group obtaining 8 different haplotypes within 5 groups with sequences varying by no more than one base pair. *Catocala largeteaui* differs in COI from the *C. mirifica* by only 0.62% and was hypothesized by Ishizuka (1982) to be a subspecies of *C. mirifica*. A greater 3.3% COI variation occurs between *C. largeteaui* and its subspecies, *C. largeteaui yunnana* (Figs 15, 16, 26, 30) which has a uniformly dark forewing unlike the pale forewing with contrasting dark apical region of *C. largeteaui* (Figs 11–14). While little variation was observed in the female genitalia some potential male genitalia differences in the anterior rosette of the vesica exist between *C. largeteaui* and its subspecies but more dissections of sequenced specimens are needed to confirm these differences and better determine how many valid species are present in the *mirifica* group.



FIGURES 24–26. *Catocala* ssp. male genitalia. 24. *C. mirifica*, prep. OP3317m; 25. *C. largeteaui largeteaui*, prep. OP2718m; 26. *C. largeteaui yunnana*, paratype, prep. JB1441m.



FIGURES 27–30. *Catocala* ssp. female genitalia. 27. *C. nilssoni* sp. n., paratype, prep. JB1864f & OP2722f; 28. *C. mirifica*, prep. OP2714f; 29. *C. largeteaui largeteaui*, prep OP2719f; 30. *C. largeteaui yunnana*, paratype, prep. JB1442f, (7th abdominal segment not removed).

Catocala danilovi (Figs 3, 4, 18, 20–23) and *C. florianii* (Figs 5–7, 19, 20–23) do have male genitalia differences but not those diagnosed in the original *C. florianii* description. When *C. florianii* was described in 2008 authors Saldaitis & Ivinskis, lacking specimens of *C. danilovi*, used *C. danilovi* male genitalia figures from Park *et al.* 2006 for their diagnosis. Upon the authors obtaining and dissecting a *C. danilovi* male specimen it became clear that the Park *et al.* (the same genital picture was used in Kononenko, 2010) *C. danilovi* genitalia figure relied upon was instead *Catocala moltrechti* O. Bang-Haas, 1927. While similar the *Catocala danilovi* (Figs 18, 20–23) male genitalia differ from those of *C. florianii* (Figs 19, 20–23) by the form of the right valva costa in addition to the cuculus, harpae, aedeagus and especially the vesica structure.

The *C. danilovi* holotype figured in Park *et al.* 2006 was also incorrect. The *C. danilovi* holotype (Fig. 3) is instead shown in Kononenko (2010: Plate 12, Fig. 7) where the male is the holotype rather than the female shown in Fig. 8.

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Hungary) for genitalia photography and P. Hebert's BOLD (Barcode of Life Data Systems) lab at the University of Guelph sequenced COI 5' for our *Catocala* samples.

References

Bang-Haas, O. (1927) *Horae Macrolepidopterologiae regionis palaearcticae. Vol. 1.* Kupky and Dietze, Dresden, 128 pp. Butler, A.G. (1877) On new species of *Catocala* and *Sypna* from Japan. *Cistula Entomologica*, 2, 241–246.

Edwards, H. (1880) Description of some new species of Catocala. Bulletin of the Brooklyn Entomological Society, 2, 93-97.

Edwards W.H. (1865) Descriptions of certain species of *Catocala*, found within the United States. *Proceedings of the Entomological Society of Philadelphia*, 2, 508–512.

Grote, A.R. (1875) On North American Noctuae. Proceedings of the Academy of Natural Science of Philadelphia, 27, 418–427.

Hebert, P.D.N., Cywinska, A., Ball, S.L. & de Waard, J.R. (2003) Biological identifications through DNA barcodes. *Proceedings of the Royal Society B*, 270, 313–321. https://doi.org/10.1098/rspb.2002.2218

Ishizuka, K. (1982) Some questions about Catocala in East-Asia, III. Gekkan-Mushi, 140, 13–16. [in Japanese]

- Kononenko, V.S. (2010) Micronoctuidae, Noctuidae: Riculinae Agaristinae (Lepidoptera). Noctuidae Sibiricae. Vol. 2. Entomological Press, Soro, 475 pp.
- Mell, R. (1936) Beiträge zur fauna Sinica. XVIII. Noch unbeschriebene Chinesische Lepidopteren (V). Deutsche Entomologische Zeitschrift. Entomologischen Vereins Iris zu Dresden, 50, 49–90.

Oberthür, C. (1881) Lépidoptéres de Chine. Etudes d' Entomologie, 6, 1–22.

- Park, K.T., Han, H.L. & Ronkay, L. (2006) Catocala of Korea (Lepidoptera, Noctuidae). *In: Insects of Korea. Vol. 10.* Center for Insect Systematics, Korea, pp. 1–111.
- Saldaitis, A. & Ivinskis, P. (2008) Catocala florianii, a new species (Lepidoptera, Noctuidae) from China. Acta Zoologica Lithuanica, 18 (2), 124–126.

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