

Copyright © 2014 Magnolia Press





http://dx.doi.org/10.11646/zootaxa.3866.4.5

http://zoobank.org/urn:lsid:zoobank.org:pub:DDA7D3D0-8C69-4A63-BC12-576368FFD06D

# A new species of *Catocala* Schrank, 1802 (Lepidoptera: Noctuidae (sensu lato): Erebinae) from Kazakhstan

# AIDAS SALDAITIS<sup>1,4</sup>, HUGO L. KONS, JR.<sup>2</sup> & ROBERT J. BORTH<sup>3</sup>

<sup>1</sup>Nature Research Centre, Akademijos str. 2, LT–08412 Vilnius-21, Lithuania. E-mail: saldrasa@gmail.com <sup>2</sup>American Entomological Institute, 3005 SW 56th Avenue, Gainesville, FL USA. E-mail: hkonsjr@yahoo.com <sup>3</sup>LepBio, LLC. E-mail: bobborth@sbcglobal.net <sup>4</sup>Corresponding author

Here we describe a new Palearctic species in the noctuid genus *Catocala*. The new species, *C. toropovi* **sp. n.**, differs from sympatric and morphologically similar *C. repudiata* Staudinger, 1888 and *C. optima* Staudinger, 1888, by wing pattern, male genitalia, and COI 5' mitochondrial DNA. It is recorded from Kazakhstan, with adults having been collected at ultraviolet lights and baited sugar ropes.

The 5' region of the mitochondrial gene Cytochrome Oxidase Subunit I (658 base pairs) was sequenced by Paul Hebert's lab at the University of Guelph as described in Hebert et al (2003), with sequences aligned by eye in Mesquite version 2.75 (Madison & Madison 2011). Hebert combination of diagnostic COI 5' characters for *C. toropovi* was obtained via the map characters function of WinClada (Nixon 2002), with *C. toropovi* existing in an unresolved polytomy with other sequenced Salicaceae-feeding species.

Genitalia were dissected by HLK after submerging abdomens in 10% KOH for approximately 48 hours. The aedeagus was removed from the capsule and photographed prior to everting the vesica with a syringe of 99% isopropyl alcohol. The capsule was photographed in several aspects with the hairs and scales covering it intact, and then after their removal. Subsequently, the capsule was separated into valve+vinculum, juxta+anellus, and uncus+tegumen. Staining using chlorozol black was used only on the ductus ejaculatorius. Prolegs and metalegs were also submerged with KOH, and then the scales and hairs were removed with fine forceps.

Genitalia photographs were taken by HLK with Automontage or GT Vision imaging systems. Three dimensional genitalic structures were photographed in 99% alcohol with fiber optic halogen lighting. Only the juxta/anellus and abdominal skins were flattened and dried between two glass slides, although the lateral images of the uncus+tegumen were obtained when these structures were held in place by a piece of convex glass. Dissections were preserved in 99% IsOH in screw cap vials with polyseal caps.

The use of some genitalic terminology for *Catocala* is inconsistent or controversial among different sources, including the terms cucullus, sacculus, valvula, saccus, and aedeagus. This paper uses terminology as shown at the web link "Genitalia Structural Terminology for *Catocala* and Related Genera" at http:// www.lepidopterabiodiversity.com/home.htm. The vesica of Catocala is highly three provided, bulbous, with radiating lobes and overlapping diverticula that are badly distorted/destroyed by slide mounting. For describing the vesica and identifying homologous lobes, HLK has developed a system that numbers lobes/diverticula present in most or all *Catocala* from 1–13 (see preceding link). Some of these lobes vary from simple to bilobed or trilobed between species or species groups, and are labeled Na, Nb when bilobed or Na, Nb, Nc when trilobed. Lobes and diverticula are labeled with this numbering system herein.

Institutional acronyms are as follows: AFM = Alessandro Floriani (Milan, Italy); BMNH = British Museum Natural History, (London, England); ZSM = Zoologische Staatssammlung, München (Germany); NRCV = Nature Research Centre (Vilnius, Lithuania); RJB = Robert J. Borth, (Milwaukee, U.S.A); STB = Sergey Toropov, (Bishkek, Kyrgyzstan).

## Catocala toropovi Saldaitis, Kons & Borth sp. n.

(Figs 1, 2, 7, 8, 12–26, 41, 44, 47, 50, 54)

**Type material. Holotype**: male (Figs 1–2), Kazakhstan, Ili river, Barakhudzir, 25–30.viii.2013., Toropov leg., in ZSM collection; (Dissection No. 2014HLK:2006).

**Paratypes:** 9 males (Fig. 8), data as for holotype, 6 males, the same locality and collector, 5–10.viii.2012., (including Dissection No. 2014HLK:2007 and DNA Voucher No. 20379-050813-KAZ), 4 males, the same locality and collector, 23.viii.2014; 1 male, Kazakhstan, Charyn river, Sarytogai forest, 5.ix.2013., Toropov leg.; 2 males, Kazakhstan, Charyn river, Charyn vill., 6.viii.2013., Toropov leg. in the collections of AFM, NRCV, RJB and STB; 1 male (Fig. 7), Ili Gebiet [region], 15.vii. in collection BMNH.

**Diagnosis.** The wing pattern of *C. toropovi* most closely resembles that of the sympatric *C. repudiata* (Figs 3-4, 9-10), and to a lesser extent that of C. optima (Figs 5-6). Forewing Upperside: C. toropovi has a thick dark grey to black basal dash, whereas C. repudiata and C. optima lack a basal dash in both sexes. C. toropovi has diffuse dark suffusion in the CuA1-2A interspace beyond the postmedial line, lacking in C. repudiata and C. optima. The postmedial line is strongly protruded distally between veins M1 and M3 in both C. toropovi and C. repudiata, but only very slightly protruded between veins M2 and M3 in C. optima. Hindwing Upperside: The background color is reddish-pink in C. toropovi, with the pinkish cast most prominent distal to the medial black band between veins M1 and Cu2 (Figs 1, 7). In C. repudiata the background color is a lighter reddish-orange with no pink cast (Figs 3, 9–10). Hindwing Underside: The reddish scaling posterior to vein Cu1 and the posterior margin of the discal cell is distinctly paler and more diffuse in C. toropovi relative to C. repudiata, and C. repudiata lacks the pinkish cast of C. toropovi (Figs 2, 4). Wing size: The wingspan of C. toropovi is 53-58 mm, versus the larger 60-65mm of C repudiata and smaller 44-48 mm of C. optima. Head and thorax: The prothoracic scale pattern has paired convex black lines merging at a triangular point on the midline in C. toropovi (Fig. 39), paired wider, straighter black bands in C. repudiata (males only), and no distinct black bands or lines in C. optima. The pattern of tegulae has a diffuse broken grey triangular border in C. toropovi (Fig. 40), whereas there are mixed dark and light scales with no discernable border in C. repudiata and C. optima. In lateral aspect, labial palp segment 2 has the area of solid white scales limited to the basal third of the segment in C. toropovi (Fig. 39), whereas in C. repudiata it reaches the midpoint. Labial palp segment 3 has much more extensive white on the outer side in C. toropovi relative to C. repudiata. Male genitalia: Overall the male genitalia are similar to C. optima and C. repudiata, but diagnosable from each of these species. The following differences are for characters that show little variation within Catocala species where larger series have been dissected; however, only two specimens have been dissected for each of these three species. The thickened area of right valva costa extends nearly to apex of the cucullus in C. toropovi (Figs 15, 41, see black arrow), but terminates distinctly more proximally in C. optima (Fig. 42) and C. repudiata (Fig. 43). C. toropovi (Figs. 19, 47) has a denser concentration of minute short setae at the clasper apices relative to the other species (Figs. 48 & 49). The anterior concave gouge in the sclerotized pitted pattern along the midline of the anellus is deeper in C. toropovi (Figs. 18, 50, see black arrows) than in the other species (Figs 51-53). C. toropovi has sparser and shorter setae along the sides of the uncus subapically (Fig. 22) relative to C. optima, but C. repudiata and Catocala remissa Staudinger, 1892 are similar to C. toropovi for this character. The coecum of C. toropovi is thicker and more strongly bent on the dorsal side (Figs 23, 44, see black arrow) relative to the other species (Figs 45, 46). The vesica structure has multiple species specific differences among all these species, but for this paper we show only the anterior aspect (with the aedeagus nearly vertical and perpendicular to the bottom of the petri dish), which tends to be the most diagnostic aspect among closely related Catocala species. When viewed from anterior angles, diverticulum 5a (solid black arrow in Figs 16, 54, 55) is distinctly more broadly rounded in C. toropovi relative to the other species, where it is more quadrate (Figs. 56–58). Also, the apex of diverticulum 12 is more squared off in C. toropovi (Fig. 54, dashed arrow) versus more broadly rounded in the other species (example: C. repudiata, Fig. 56, dashed arrow). COI 5' Mitochondrial DNA: Four sequenced specimens of C. toropovi differ from all other sequenced Salicaceae-feeding Catocala species by the following unique combination of seven character states: 50(C), 112(C), 346(C), 457(C), 463(C), 580(C), and 601(C).

**Description**. **Head** (Fig. 39). Vertex with predominantly grey scales but with tan scales scattered throughout and a sparse scattering of white scales. Frons transected by concave black band, mixed tan and grey scales dorsally and predominantly tan scales ventrally. Labial palp basal segment almost exclusively white, with sparse grey scales

on the lateral side; middle segment white ventrally; laterally and dorsally white in approximately basal third, blending to mostly solid grey medially, and mix of grey and pale tan to white distally; terminal segment predominately grey ventrally with scattered white scaling, and more extensive white on the inner ventral sides; dorsally and laterally a mix of grey and pale tan scales. Antennae dorsally and laterally predominantly covered by grey scales with scattered light tan scales, except on basal segments where tan scales dominate; ventrally with dense clusters of setae on distal halves of segments. Thorax (Fig. 40). Patagia predominantly grey with a scattering of white and tan scales, posteriorly with paired convex black lines converging at a triangular point at the midline. Tegulae with diffuse, broken, triangular grey line with predominantly tan fringe; a mix of grey and tan scales inside the triangle. Elsewhere a mix of grey and tan scales with scattered white, some specimens with a diffuse grey inverted V pattern. Paired tufts of hair on posterior mesothorax predominately tan with some grey and white. Ventrally with dense hairs, predominately tan on prothorax with scattered grey, white on meso- and metathorax. Wings (Figs 1, 2, 7, 8). Wingspan: Forewing length of holotype 25 mm, wingspan 55 mm; forewing length of paratypes 23-26 mm, wingspan 53-58 mm. Forewing Shape: Length of FW base to apex/length of FW apex to anal angle: mean=1.78, range=1.69–1.86, n=11. Forewing upperside: Background color predominantly grey with variable peppering of pale whitish scales. Extensive pale brown scaling inside reniform and between postmedial and subterminal lines. A pale whitish patch adjoins basal side of reniform spot and anterior side of subreniform. Basal dash prominent dark grey; widening distally to span most of the area between veins Cu2 and 2A; not quite extending distally to antemedial line. Antemedial line distinctly double, thin and dark grey except at costa where outer line is thick and black; area between veins M2 and 2A pale brown; pale whitish grey elsewhere. Antemedial line comprised of five loops: posterior loop (below vein 2A) convex, protruding basally on anterior side, second (medial) loop large and convex spanning between veins 2A and lower margin of discal cell, third loop minute and triangular, from lower discal cell margin to veinlet, fourth loop triangular and approximately twice as long as third, with apex at anterior margin of discal cell, fifth loop minute and convex, anterior to radial vein. Medial line limited to black patch between costa and the anterior margin of discal cell, and black line along basal border of reniform spot. Postmedial line thin, dark grey-black; bordered distally by thin band of pale whitish grey. Postmedial line undulations: below vein 2A convex; between Cu2 and 2A doubly dentate with distinct thickened black accent along posterior side; subreniform open, but pale band on distal side of postmedial line fused; convex loop between veins Cu1 and Cu2; very shallow and concave between veins M3 and Cu1; two dentate distally protruding teeth between veins M1 and M3 with a shallow concave division between them across vein M2; straight and angling basally between veins R5 and M1, then sharply turned basally along vein R4, roughly perpendicular to costa and thickened as small black patch slightly distal to the outer border of the reniform. Dark horizontal line above the inner margin of forewing consisting of diffuse irregular black basal dash, narrow distinct anal dash in the subterminal area and with more irregular black extending to the outer margin. Distinctive pale patch basal to the reniform spot. Reniform spot open distally, with double black outline basally with the black extending diagonally to the costa. Subterminal line a series of dentate, distally protruding chevrons with thin black distal border; one chevron between each pair of veins between R4 and 2A; half chevrons between R4 and the costa and between 2A and the inner margin. Wing margin with series of thin, black, straight to slightly concave bars between each pair of veins from R4 to 2A. Farther distally at the extreme margin, a sinusoidal, broken, thin dark grey line between veins R4 and 2A, with the distal protruding convex loops transecting the veins and basally protruding concave loops between the veins. Reniform spot roughly quadrate, with narrow, triangular basal extension along the anterior margin of the discal cell, border discontinuous grayish white; U-shaped grayish black band in posterior half; dark grayish patch on distal side between veins M2 and M3. Diffuse broad black band between veins Cu1 and 2A distal to the postmedial line. Diffuse fairly thin black band from just below apex to most distal tooth of the postmedial line between veins M1 and M2. Fringe peppered grey and black with narrow black patches along veins. Hindwing upperside: Background color reddish pink posteriorly to vein Sc+R1, with pink cast most prominent distally to the median black band between vein M1 and Cu2; extending to base where mixed with black hairs along veins. Reddish pink replaced by pale white anteriorly to vein Sc+R1. Black median band prominent, distal side sharply angled along vein M2, bulged basally between veins M2 and Cu1, curved basally in cell CuA2, and narrowly tapering terminally where projects inward/anteriorly; basal side slightly angled distally anteriorly to vein M2, making sharp right angle, then straight until curved basally in cell CuA2. Marginal black band thick anteriorly to vein Cu2, with narrow basal projections of black scales extending basally along veins M1-M3; deep concave gouge in interspace between veins Cu2 and 2A, posterior side of gouge with triangular basally pointing projection

with apex on vein 2A. Fringe white, with convex black patches at ends of veins M1-Cu2. Apical patch white, with few scattered reddish pink scales. Forewing underside: Background color pale white. Marginal band thick and black but with diffuse margins, especially on distal side anteriorly where it blends into grayish white area between the marginal band and outer margin. Termen with the same thin undulating line present dorsally. Medial and basal bands wide and black, diffusely fused together between vein 2A and the veinlet dividing the cell between veins Cu2 and 2A. Hindwing underside: Medial black band of similar shape as dorsally but lacking sharp right angle on the basal side. Marginal black band of similar shape as dorsally, but diffused with white scaling anteriorly and marginally, and narrow basal projection of black scales only present along vein M3. Background color pale white distally to median band and anteriorly to vein Cu; likewise basally to the median band and anteriorly to the posterior margin of the discal cell. Posteriorly to these areas the pale white is diffused with pinkish red scaling of the same color as upperside background, with heaviest concentration of reddish pink basal to the median band. Fringe pale white with sparse black scales. Legs. Foreleg (Figs 31-34): Profemur with two laterally flattened spines dorsally at apex in a shallow concave pit with raised sides, otherwise lacking spines (this may be a developmental anomaly, as most *Catocala* individuals have a single laterally flattened profemoral spine in this position). Protibia unspined, but with small convex sulcus with radiating spines near basal extremity on the inner side. Protibial flange in shallow ovuloid pit, ventral margin of flange with conspicuous row of short setae. Protarsomeres 1-4 with three ventral rows of large triangular spines, and two rows of minute hair-like curved spines between them; protarsomere 5 with four rows of large triangular spines, with two rows of minute hair-like spines in-between. Minute hair-like spines present on lateral sides of tarsomeres; tarsomere 1 with row of 5 on each side, plus three more minute hair-like spines dorsal to these; protarsomere 2 with row of 3, protarsomere 3 with three, protarsomeres 4 and 5 with two (both on distal half). Scattered minute hair-like spines present along the dorsal midline of tarsomeres. Protarsomere 5 with pair of elongate, narrow, tubular spines dorsally at apex, then curving ventrally at apex. Pretarsus simple, arolium with darkly sclerotized rectangular base, translucent grayish and ovuloid distally. Midleg: Not examined. Hindleg (Figs 36-38): Sclerotization pattern typical for Catocala, with femur sclerotized throughout, mesotibia translucent white except at base, metatarsomere 1 translucent white except at apex, remaining tarsomeres sclerotized throughout. Metafemur unspined, mesotibia with single subapical spine on outer side near ventral margin. Metatarsomeres 1-4 with three ventral rows of large triangular spines, and two rows of minute hair-like spines between them. Metatarsomere 5 with four rows of large triangular spines, but distinctly shorter than in other segments, inner two rows with distinctly shorter spines than in outer two rows; rows of minute hair-like spines between inner and outer rows. Minute, curved, hair-like spines on lateral and dorsal surfaces of metatarsomeres as described for protarsi. Pretarsus and aerolium as described for foreleg. Abdominal Pattern. Scale pattern grey dorsally, white and pale tan ventrally. Abdominal cuticle. Tergite 1: As shown in Fig. 29, posterior to black arrow tips. Tergites 2-7 (Fig. 27): Lateral sides slightly concave; anterior sides of T3-T6 slightly concave on sides, slightly convex in middle; posterior sides of T3-T6 nearly straight to slightly concave, becoming progressively more concave posteriorly. Anterior side of T2 narrowly convex on sides, with paired broad concave depressions except at midpoint where narrowly fused with T1, posterior side distinctly convex. T3-T6 anterior margin of sclerotized patches slightly convex. Tergite 8: (Fig. 30): Sclerotization pattern with a diamondshaped unsclerotized area in center of sclerotized area, sclerotized area with convex anterior margin. Sides of segment convex anteriorly, concave posteriorly, posterior margin slightly concave at midpoint. Segment widest at base. Paired pockets on anterior side of segment triangular, with strongly concave membranous border between them. Sternites 2–7: (Fig. 28): Lateral sides weakly concave (S3–S7), strongly concave (S2); anterior edge concave on sides, convex in middle (S3–S7), strongly concave (S2); posterior side weakly convex (S2–S4), weakly concave (S5–S7). Anterior margin of sclerotized area fairly straight (S3), convex (S4–S7). Sternite 8 (Fig. 30): Sides broadly concave, posterior margin strongly convex on sides, strongly concave in middle. Anterior margin slightly concave on sides, slightly convex in middle. Anterior margin of sclerotized area concave on sides, convex in middle. Male genitalia (Figs 12–26, 41, 44, 47, 50, 54). Capsule (Figs 12–14): Juxta and vinculum strongly fused with valvae, vinculum weakly fused with tegumen, vinculum arms laterally expanded and weakly fused midventrally, diaphragma membranous except for juxta/anellus. Valvae (Figs 15, 41): Outer surfaces densely covered with elongate tan colored hairs and scales except for anterior portion of sacculus (Fig. 12); inner surface of "cucullus" (or the membranous valvae structure in the equivalent position-the use of "cucullus" in Catocala is controversial due to questions of homology) with shorter scales and hairs along ventral margin. Sacculus with short triangular posterior extension at fusion with cucullus, not longer than wide; inner side densely covered with

elongate setae, (Fig. 15). Additional elongate setae scattered along posterior margin of sacculus on inner side. Ventral inner sides of sacculus with concave indentation along margin of clasper base (Fig. 13). Left cucullus clear and membranous. Right cucullus with a variable extent of faint sclerotization along posterior border with costa, and just below the ventral margin (Fig 15). Cucullus with scattered elongate setae on inner surface along ventral margin, densest anteriorly. Left costa heavily sclerotized and of similar width throughout, broadly rounded apically and slightly extending beyond cucullus (Fig. 15). Right costa similar but slightly wider (Fig. 15). Dorsally both costae smooth and narrow. Claspers similar, dorsoventrally flattened basally, laterally flattened distally, curved ventrally/inward distally. Clasper apices covered with scattered minute short setae, apices only slightly expanded relative to subapical area (Fig. 20). Ventral and dorsal margins of clasper base with patches of elongate setae, denser and covering a larger area on ventral margin, with scattered shorter setae extending distally along ventral margin. Ventral margin of left clasper weakly convex basally, then weakly concave distally; ventral margin of right clasper strongly concave, dorsal margin weakly concave at base. Viewed from ventral side, both claspers with outer margins (bordering the valvae) strongly concave basally, strongly convex distally, inner margins (opposite the valvae) strongly convex basally, strongly concave distally. Juxta (Fig. 19): Two elongate slightly asymmetrical lobes, right lobe slightly shorter, both narrowest posteriorly, progressively widening anteriorly, with a narrow band of darker sclerotization along inner margin. Lobes narrowly fused to anellus at posterior apex, touching each other at posterior end but not fused together. Pitted pattern of anellus barely extending to juxta lobes at extreme posterior and posterior-outer edges. Anellus (Fig. 19): Lobes fused together throughout and appearing as a single sclerotized plate, slightly asymmetrical with shallow concave posterior indentation on the outer margin of left lobe. Remainder of outer margin of left lobe nearly straight, outer margin of right lobe concave, posterior apex broadly rounded, anterior edges of both lobes convex except for small concave notch at the anterior corners. Wide band of sclerotized dense shallow depressions (pits) in medial area except at posterior apex (these characters may vary intraspecifically in related species), both lobes with concave notch in band of sclerotized depressions at anterior edge (black arrow). Uncus (Figs 22-23): Tubular, progressively narrowing distally, posterior margin strongly convex, anterior margin strongly concave; terminating in heavily sclerotized curved spine, laterally appearing pointed apically but narrowly rounded in dorsoventral view. Scattered lateral setae, no more than slightly longer than width of uncus, decreasing in density apically. Tuba analis (Fig. 21): Membranous except for scaphium, and dorso-posterior semicircular patch of lighter sclerotization extending out from the base of the scaphium on each side. Scaphium an elongate rectangular plate terminating slightly dorsally to the uncus apex. Aedeagus (Figs 24-26): Translucent throughout. Coecum robust, strongly bent. Aedeagus bent at posterior margin of coecum, and before ventral extension over vesica, fairly straight in-between. Left flank of posterior ventral extension ("hood" over everted vesica) with a deep basal concave gouge and a convex posterior expansion, right flank convex basally and distally while concave medially, apex slightly concave. Two of the four sclerotized chords sometimes present on the ventral hood in *Catocala* are clearly present (Fig. 26, black arrows), the left outer chord (top arrow) and left inner chord (bottom arrow), both of which extend almost to the apex of the hood and are roughly parallel (Fig. 26, black arrows). Ductus ejaculatorius (Figs 17, 18): Slender region with distinct bend just before scoop-shaped region. Scoop-shaped region strongly convex on outer side with small concave gouge basally, inner side strongly concave. Vesica (Fig. 16): Vesica diverticulum 1 trilobed, partially underneath diverticula 2 and 5a; 1a the most elongate of the three lobes, fang-shaped with outer side convex, inner side concave, and apex narrowly rounded; 1b a minute convex bulge; 1c also a convex bulge but about 1/3 the width of 1b. Diverticulum 2 lacking subdiverticulum on the left side, elongate and gradually tapering to a narrowly rounded apex, strongly bent roughly 90° apically. Diverticulum 3 a broadly rounded simple convex bulge. Diverticulum 4 a simple convex bulge with apex somewhat squared off. Diverticulum 5 with two distinct lobes, the basal (5a) a broadly rounded convex bulge, with a second indistinct shallow concave bulge on the right side; the distal (5b) fang-shaped, pointed apically, with the left side convex and the right side concave. Diverticulum 6 large and broad, much wider than high, broadly rounded on dorsal corner but more squared off on ventral corner, appearing slightly bilobed. Diverticulum 7 much smaller than 6, distinctly less than  $\frac{1}{2}$  the volume, a simple convex bulge of comparable length and height. Diverticulum 8 a broad and shallow convex bulge curving around right and apical sides of ventral aedeagus hood, several times as wide as high. Diverticulum 9 distinctly bilobed, with lobe 9a ventral to lobe 9b, both lobes shallow convex bulges wider than high, but with 9a relatively higher and 9b relatively wider. Diverticulum 10 a very broad simple convex bulge several times as wide as high. Diverticulum 11 indistinct, not discernable from most angles, only a very slightly raised broad convex lobe. Diverticulum 12 triangular with a narrowly rounded apex, slightly wider than high. Diverticulum 13 a simple convex bulge wider than high, not discernable from most angles and best seen in lateral aspect with the aedeagus hood orientated down. Much of vesica covered with minute inward projecting triangular teeth. Vesica membranous throughout except for the area ventral of diverticulum 8 and dorsal of the aedeagus hood; this area pigmented with light sclerotizarion and the inward projecting triangular teeth are larger than elsewhere and pigmented with contrastingly darker sclerotization. **Rectum/Intestine** (Fig. 35). Rectum sculptured throughout with small ovuloid shapes with slightly raised walls. Intestine approximately 150 mm, narrower apical area an additional 10 mm (note the apparent shape of the rectum in *Catocala* varies within species depending on how much fluid is trapped inside when it is dissected out, and it is difficult to expand it as the walls are fragile and rupture easily).





C. optima, male, Kazakhstan.

C. optima, male, Kazakhstan, underside.

FIGURES 1–6. *Catocala* adults. 1. *C. toropovi*, male, holotype, Kazakhstan, Ili river (ZSM); 2. *C. toropovi*, male, holotype, underside (ZSM); 3. *C. repudiata*, male, Kazakhstan, Charyn river (NRCV); 4. *C. repudiata*, male, underside (NRCV); 5. *C. optima*, male Kazakhstan, Syr-Darya river (NRCV); 6. *C. optima*, male, underside (NRCV).



FIGURES 7–11. *Catocala* adults and biotope. 7. *C. toropovi*, male, paratype, Kazakhstan, Ili river (BMNH); 8. *C. toropovi*, male, paratype, Kazakhstan, Ili river (AFM); 9. *C. repudiata*, Kazakhstan, female, Prov. Almaty (NRCV); 10. *C. repudiata*, male China, Xinjiang (AFM); 11. Kazakhstan, Ili river, Barakhudzir. Type locality of *Catocala toropovi* (S. Toropov picture).



FIGURES 12–26. Male genitalic structures of C. toropovi (Holotype).



FIGURES 27-40. Male abdominal and leg structures, rectum, head, and thorax of C. toropovi (Paratype, 2014HLK:2007).



FIGURES 41-58. Comparison of selected male genital structures for C. toropovi, C. optima, and C. repudiata.

### Female. Unknown.

**Biology and distribution.** Nineteen male specimens were collected at ultraviolet light during August 2012 and 2013 in southeast Kazakhstan. Habitat at the collection site is a leafy forest (tugay) on the floodplains of the Ili River and its tributary Charyn, dominated by *Populus diversifolia* Schrenk ex Fisch. & C. A. Mey, *Halimodendron* sp. and bushes of *Elaeagnus commutata* Bernh. ex Rydb., and a few grasses, *Glycyrrhiza* sp. A single old specimen from the same vicinity is in the BMNH with a stated collection date of 15 July, earlier than all recent records. In the Ili locality the floodplain is less than 500 meters wide and all moths were collected about 150 meters away from the river, between 11.30 P.M. and 2.30 A.M. Other Salicaceae-associated *Catocala* collected with *C. toropovi* included *C. repudiata, C. optima, C. remissa* and *C. artobolevskiji* Sheljuzhko, 1943.

**Etymology**: Named after prominent Central Asian Lepidoptera specialist Sergey Toropov, whose collecting first brought this species to our attention.

**Remarks.** Other species/specimens with genitalia illustrated: <u>Dissection No. 2014HLK:2009</u>: *C. optima*, male, Kazakstan, Ili River, Barakhudzir, 6.viii.2013, Toropov leg. (RJB); <u>Dissection No. 2010HLK:614</u>: *C. optima*, male, DNA Voucher No.: 6115-050906-TA, Tadjikistan, Darvaz Mountains, Tigrovaya Balka Reserve, 30.viii–10.ix.2006, V. Gurko (RJB); <u>Dissection No. 2014HLK:2010</u>: *C. repudiata*, male, China, Xinjiang, W. Taklimekan desert, Yarken He River valley, tugay forest, 1140 m, N 39° 21.953' E 78° 11.639', 9–12.vi.2013, Floriani leg. (RJB); <u>Dissection No. 2013HLK:1742</u>: *C. repudiata*, male, DNA Voucher No.: 6083-050802-TA, Tadjikistan, W. Pamir Mountains, Rushan District, 1000 m, 5.viii.2002. V. Gurko.

Supplemental plates with larger and more extensive images are available at *http://www.lepidopterabiodiversity.com/home.htm* under "Supplemental Plates for Published Articles."

<u>COI 5' Mitochondrial DNA</u>: *C. toropovi* specimen [GenBank No. KJ960234] has the following sequence for COI 5' positions 1-658. A single position was polymorphic among four sequenced specimens: 619(C&T).

#### Acknowledgements

Detailed reviews with many helpful suggestions for improving this manuscript were provided by Lawrence F. Gall (Yale University, United States) and Alberto Zilli (BMNH, England). We thank Sergey Toropov (Bishkek, Kyrgyzstan) for collecting the specimens and providing information about its habitat. Lawrence F. Gall (Yale University, United States) located and photographed the specimen from the BMNH, and Tomas Zubacikas (Vilnius, Lithuania) helped with imago pictures. David Wahl and the American Entomological Institute provided use of the GT Vision imaging system, and Dan Young (Entomology Department, University of Wisconsin-Madison) provided use of the Automontage imaging system. Kyle Johnson and Gerry Goth provided support and accomodations during our imaging research at the University of Wisconsin-Madison.

#### References

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. http://dx.doi.org/10.1098/rspb.2002.2218 Madison, W. & Madison, D. (2011) Mesquite: a modular system for evolutionary analysis. *Version 2.75*. Available from: http://mesquiteproject.org (accessed 27 August 2014)

Nixon, K. (2002) WinClada Software. Published by the author, Ithaca, New York.

Sheljuzhko, L. (1943) Neue palaarktische Catocalinen. Deutsche Entomologische Gesellschaft Iris zu Dresden, 57, 55-66.

Staudinger, O. (1888) Centralasiatische Lepidopteren. Entomologische Zeitung. Entomologischen Vereine zu Stettin, 49, 1-65.

Staudinger, O. (1892) Lepidopteren des Kentei-Gebirges. Deutsche Entomologische Gesellschaft Iris zu Dresden, 5, 300-393.