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INCURVARIIDAE AND PRODOXIDAE FROM THE HIMALAYAN AREA (LEPIDOPTERA: INCURVARIOIDEA)

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Abstract

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One species of Incurvariidae s. str., *Incurvaria evocata* (Meyrick, 1924), n. comb., and two species of Prodoxidae (=Lamproniidae) *sensu* Nielsen, *Lampronia quinquepunctata* n. sp. and *L. novempunctata* n. sp. from Nepal, are reported. The Incurvariidae and Prodoxidae are briefly redefined. All species and their genitalia are described and illustrated. The phylogeny and biogeography of the species are discussed: the presence of *Incurvaria* and *Lampronia* in the Himalaya adds notably to the range of the two genera. One lectotype is designated.

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* Scientific Results of Hokkaidô University Expeditions to the Himalaya, Entomology No. 42.

Introduction

Incurvariid moths from the Himalayan area are poorly known. Up to now only a single species has been described, *Chalceopla evocata* Meyrick, 1924, from Assam, which originally was placed in the Lamproniidae. This species is here allocated to *Incurvaria* Haworth, 1828; in addition, two new species of *Lampronia* Stephens, 1829, are described; both are from Nepal.

The Holarctic genus *Incurvaria* belongs to the Incurvariidae s. str., a widely distributed family in both the Southern and Northern Hemispheres. The genus is especially well represented in the temperate areas and is present only to a lesser degree in the subtropics and tropics (mainly in Australia). Species of the Incurvariidae s. str. can be recognized by the flattened scale-shaped spines on the male valva and the absence of well-defined pectinifers, which otherwise are characteristic for the constituent members of the Incurvarioidea (Nielsen & Davis, 1981; Nielsen, in preparation a).

The genus *Lampronia*, which also has a Holarctic distribution, is here assigned to the exclusively Holarctic, primarily Nearctic, family Prodoxidae (=Lamproniidae) *sensu* Nielsen (in preparation a): Prodoxids are characteristic in: (1) possesing a pair of stellate signa in the female corpus bursae and (2) the females having a posteriorly well-rounded sternum VII and a triangular tergum VII. The larvae of the prodoxids are endophagous in herbs and shrubs; apart from the gall-making larvae of the Cecidosidae, all other incurvarioid larvae are typically case-making leaf miners. By far the most well-known representatives of the Prodoxidae are the North American Yucca Moths (Davis, 1967).

The aim of this paper is to call attention to the presence of Incurvariidae and Prodoxidae in the Himalayan area, as their presence there adds markedly to the presently known range of these families. However, the presence of *Incurvaria* and *Lampronia* in the Himalayas is not surprising. The southeastern Palaearctic area and Asia may be relatively rich in incurvariid species, even though only few so far have been recognized. The genera *Paraclemensia* Busck, 1904, and *Alloclemensia* Nielsen, 1981, could both have a southeastern Palaearctic origin (Nielsen, 1981, 1982); several species of *Incurvaria* are known from Japan (Moriuti & Nielsen, unpublished) and a few species are known from Taiwan (Nielsen, in preparation b).

The only Old world genus of Prodoxidae, *Lampronia*, is represented in Japan by several species (Moriuti & Nielsen, unpublished) and is also present in Iran (Nielsen, unpublished). It is not known from Taiwan.

Neither of the two families are presently reported from China, but especially the Incurvariidae are probably well represented there.

The affinities of the species treated here are presently not fully certain because of our present limited knowledge of the eastern Palaearctic and Oriental fauna of these families. Preliminary comments on the affinities are provided under each species.

The present paper is based on the material present in the collections of the British Museum (Natural History), London, the material collected by the Hokkaidô University Scientific Expedition to Nepal Himalaya (Kumata, 1973), and the Ôsaka Prefecture University Nepal-Himalaya-Expedition 1962 (Yasuda, 1969). The material collected by the German Entomological Nepal Expeditions 1962–64 (Dierl, 1966) has also been examined, but no representatives of the presently treated

families were found in that material. An inquiry has also been made to the Zoological Survey of India, Calcutta, and Indian Agricultural Research Institute, New Delhi, but no material of the discussed families from the area in question is present there.

The following abbreviations have been used for institutions:

BMNH British Museum (Natural History), London, U.K.

EIHU Entomological Institute, Faculty of Agriculture, Hokkaidô University, Sapporo, Japan.

ELUO Entomological Laboratory, College of Agriculture, University of Ôsaka Prefecture, Ôsaka, Japan.

INCURVARIIDAE

Incurvaria evocata (Meyrick, 1924) comb. n.
(Figs. 1, 2, 5–7, 12, 13, 16–18, 23, 25)

Chalceopla evocata Meyrick, 1924, Exot. Microlepidopt. 3: 53.

Lectotype ♂ (here designated), INDIA: Assam, Meghalaya, Cherrapunji, 1922 (Fletcher) (BMNH) [examined].

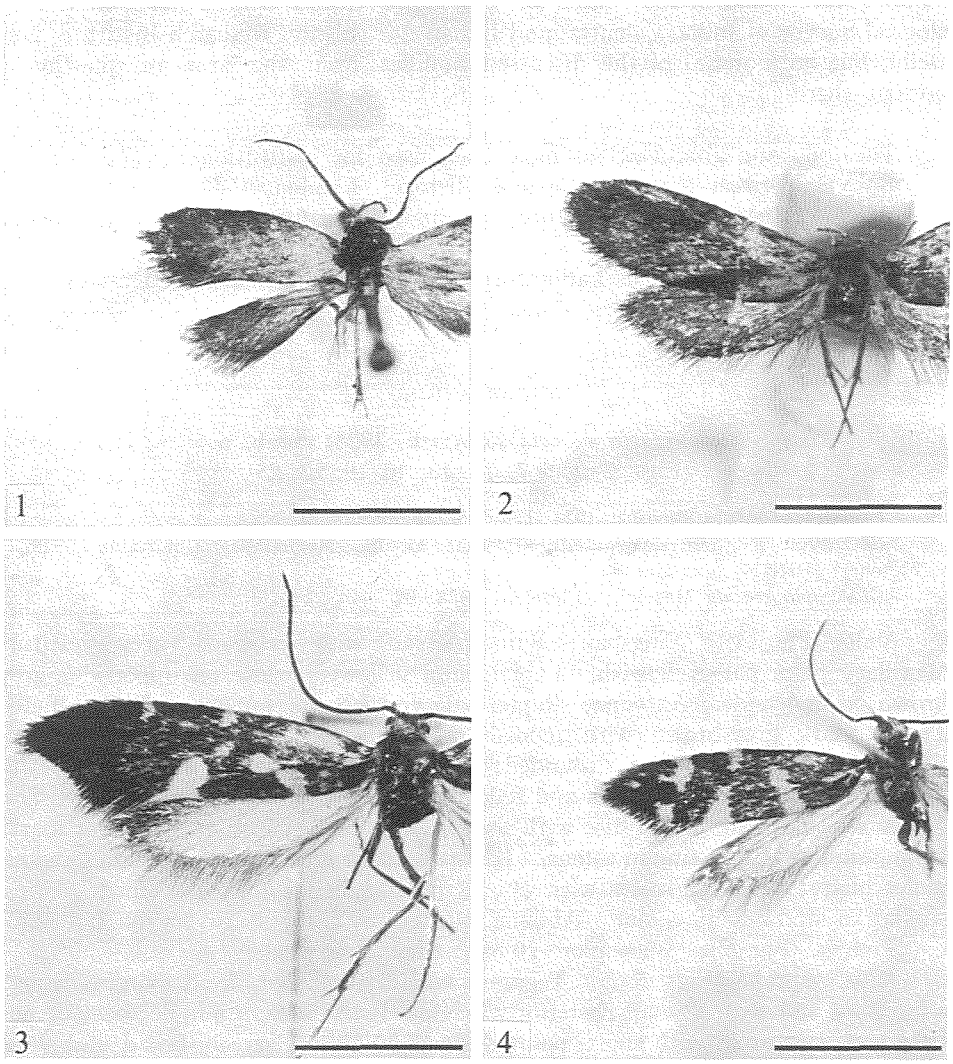
Chalceopla evocata Meyrick; Fletcher, 1933: 82.

Male (Fig. 1). Wingspan: 8 mm. Head with yellowish grey vestiture. Maxillary palpi pale yellowish. Labial palpi yellowish white on upperside, grey-brown on underside. Antennae simple, pale grey-brown, not markedly annulated. Thorax dark grey-brown with reddish violet lustre. Protibia with epiphysis. Forewing relatively broad, rounded; ground colour dark grey-brown, with scattered blackish tipped scales and reddish violet lustre, along margins with faint golden sheen, distal half of disc with scattered ice-blue reflections; without marks. Fringe similar to forewing in colour. Hindwing dark grey-brown with faint reddish violet lustre; hindwing scales with apical margins significantly darkened. Fringe similar to hindwing in colour. Abdomen dark brown above, silvery on underside.

Female (Fig. 2). Wingspan: 10 mm. Similar to male.

Male genitalia (Figs. 5–7). Tegumen broadly rounded, hind margin strongly sclerotized and with a small posteriorly produced structure in middle; base of anal tube with two areas with short, pointed setae. Valva relatively broad and short; dorsal margin with notch at one-fifth from base, slightly bent at one-third from base, weakly emarginate at two-thirds; end of valva subtruncate; ventral third of distal half of valva with scattered strong spines, most closely set along ventral margin; upper half of medial surface and ventral margin with setae and finer spines; proximal part with prominent scalelike texture. Transtilla with moderate medial and sublateral processes, lateralmost part of posterior side irregular, with microsetae. Vinculum U-shaped, slightly constricted before and after middle. Aedeagus long and slender, narrowest between base and midlength, apical third widening, with broad platelike prongs; end of ductus ejaculatorius well sclerotized, tube-shaped, innerside heavily armed with close-set pointed spines. Juxta of two long slender prongs, weakly fused anteriorly, tips pointed and diverging.

Female postabdomen (Figs. 12, 13). SVII almost quadratic, posterior margin with relatively broad, strongly sclerotized zone, irregular, with strong setae and narrow notch in middle. TVII slightly shorter than sternum, hind margin broadly



Figs. 1–4. *Incurvaria* and *Lampronia*. 1: *I. evocata* (Meyrick), ♂, India (Assam) – 2: *I. evocata* (Meyrick), ♀, India (Assam) – 3: *L. quinquepunctata* n. sp., ♂ (holotype), Nepal – 4: *L. novempunctata* n. sp., ♀ (holotype), Nepal [image reversed]. Scale: 3 mm.

rounded, with fine scattered setae.

Female genitalia (Figs. 16–18, 23, 25). Tip of ovipositor elongate, widest in middle, lateral margins faintly serrated from blunt tip to middle. Apophyses posteriores stronger and 1.5 times longer than apophyses anteriores; anterior ends markedly swollen; posterior three-quarters well sclerotized. Two dorsolateral clusters of extremely large denticles on intersegmental membrane VIII/IX+X. TVIII strongly melanized posterolaterally, anterior half weakly sclerotized, medial keel pointed at anterior end, extending well beyond anterior margin. SVIII membranous. Apophyses anteriores gradually tapering to end, weakly sclerotized.

Vestibulum large, almost spherical, anteriormost part with scale-shaped, weakly sclerotized structures. Spermathecal vesicle flat, spherical, intima of utriculus with fine elongate spinelike structures. Duct from accessory glands with scattered granules. Ductus bursae short, one-sixth length of apophyses posteriores, membranous with fine folds, posteriormost part with fine pointed spines, often forming transverse rows. Corpus bursae small, not markedly swollen, without sclerotized structures.

Remarks. *I. evocata* can hardly be mistaken for any other described *Incurvaria* species, as most have white marks along the costa and dorsum. A few western and central Palaearctic species lack these marks but have a yellowish ground colour on the forewings. Also *koerneriella* Zeller and *takeuchii* Issiki lack forewing marks, but the former differs from *evocata* by its long and narrow forewings and the latter by its pectinate male antennae and the absence of a protibial epiphysis. *I. evocata* resembles species of *Paraclemensia*, but these have strong metallic lustrous forewings and lack the protibial epiphysis (Nielsen, 1982).

I. evocata does not belong to the group of *Incurvaria* species which have males with pectinate antennae and are lacking protibial epiphysis, and it does not show any obvious affinities to any of the other described species. Characters adding to the apparently isolated position of *evocata* are: wing pattern, shape of male tegumen, notch in hind margin of female sternum VII, narrow female ovipositor tip and short female ductus bursae and corpus bursae. A presently undescribed species from Taiwan has similar forewing colouration and shape of tegumen, but this does not necessarily indicate a close phylogenetic relationship, as this species differs markedly in other characters (Nielsen, in preparation b).

Meyrick originally described *evocata* in the Lamproniidae (as Lamproniadae, an incorrect formation of the family name based on *Lampronia* Stephens), in the genus *Chalceopla* Braun, 1921. *Chalceopla* was originally described in the Incurvariidae, but has subsequently been allocated to the family Adelidae, as it is a junior subjective synonym of *Cauchas* Zeller, 1839 (Davis, in press; Nielsen, 1980).

Fletcher (1933) referred to *evocata* as "a second species" of Incurvariidae (as Incurvariadae, an incorrect formation of the family name based on *Incurvaria* Haworth) from India. The first species he referred to (Fletcher, 1920: 195) is the record of *Eriocottis fuscatella* Zeller, 1847, from Pakistan, Karachi (Swinhoe & Cotes, 1899: 704). The specimens in question have not been examined. *Eriocottis* is currently assigned to the ditrysian Tineoidea (Nielsen, 1978).

Biology. Nothing is known about the immature stages and the host plant (Fletcher, 1933). The only specimen with the date of collecting inscribed on the specimen label was collected 18 September 1927. If this date of collecting is correct, it is most unusual, as all *Incurvaria* species with a known biology are univoltine with the adults flying from March to July, depending on latitude and altitude.

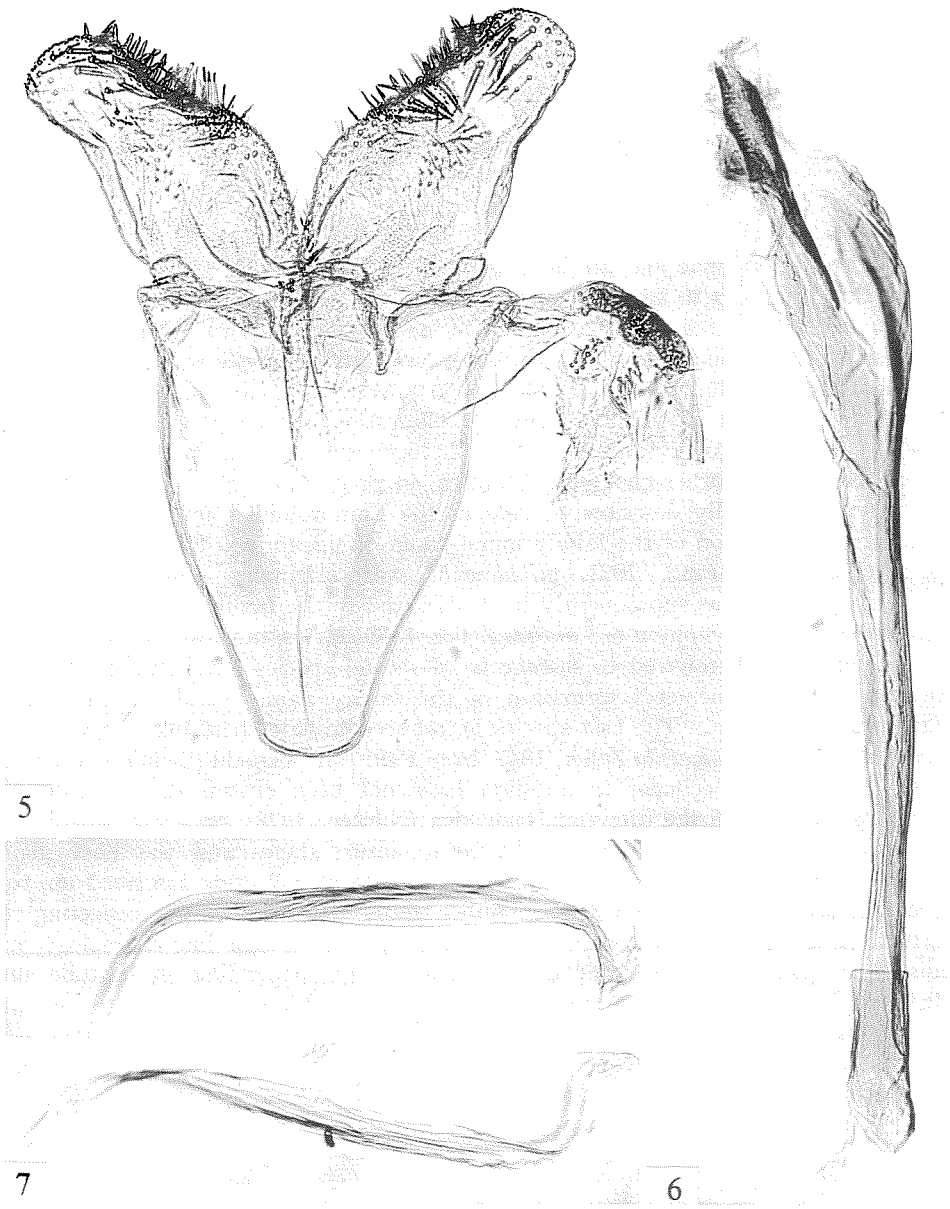
Distribution. India (Assam).

Material examined. INDIA: 1♂, Assam, Cherrapunji (collector unknown) (BMNH); 1♀, Assam (Khasis), Shillong, 1600 m, 18. ix. 1927 (Fletcher) (BMNH).

Prodoxidae

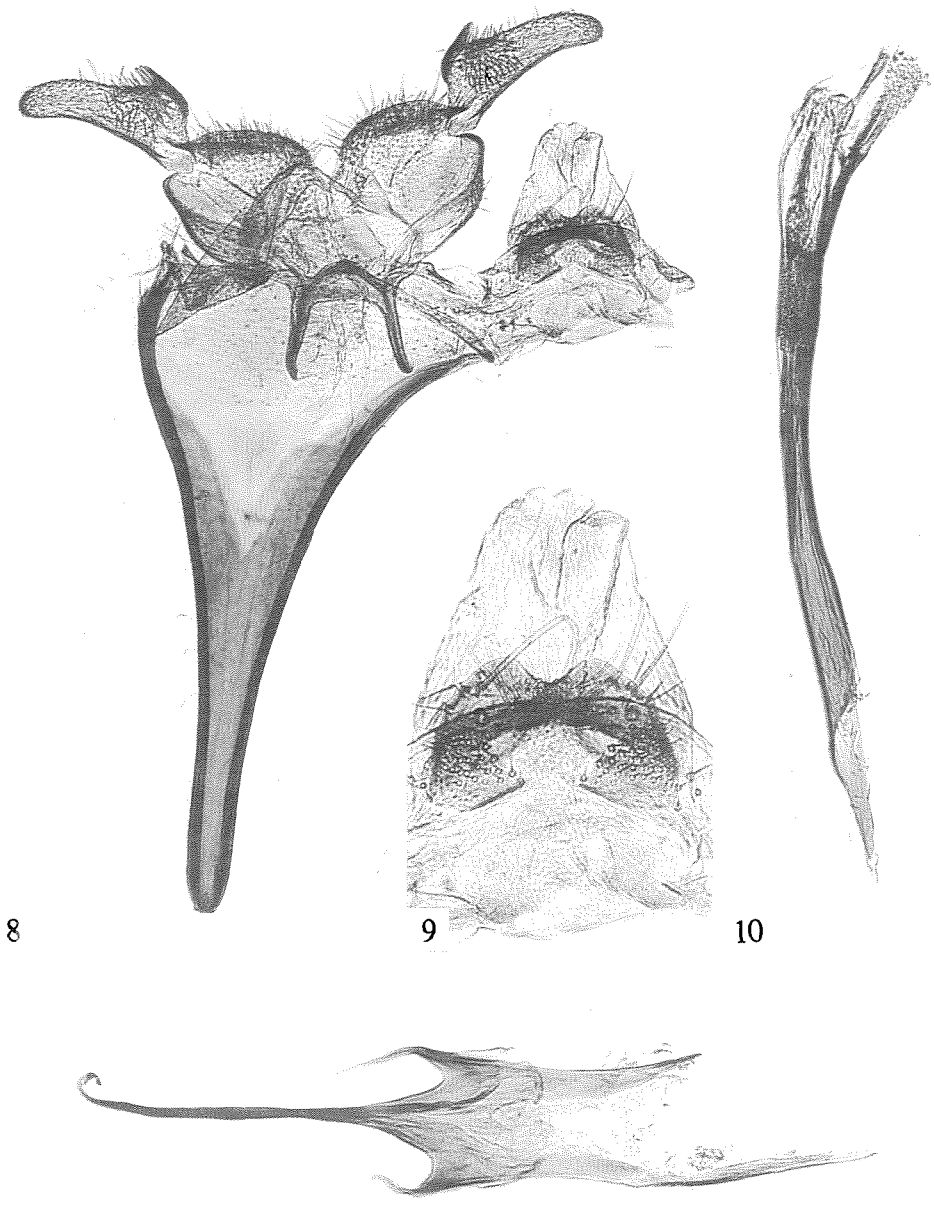
Lampronia quinquepunctata sp. n.
(Figs. 3, 8–11)

Male (Fig. 3). Wingspan: 14 mm. Head vestiture white on frons below



Figs. 5–7. *Incurvaria evocata* (Meyrick), male genitalia, slide BMNH 20438. 5: Tegumen, valvae, vinculum – 6: Aedeagus – 7: Juxta (separated at base).

antennal sockets, dark grey-brown on vertex, neck tufts dull straw yellowish, mixed with scattered blackish scales. Maxillary palpi greyish white. Labial palpi yellowish white on medial surface and above, otherwise lead-grey mixed with white. A raised tuft of yellowish hairlike scales below compound eyes. Antenna

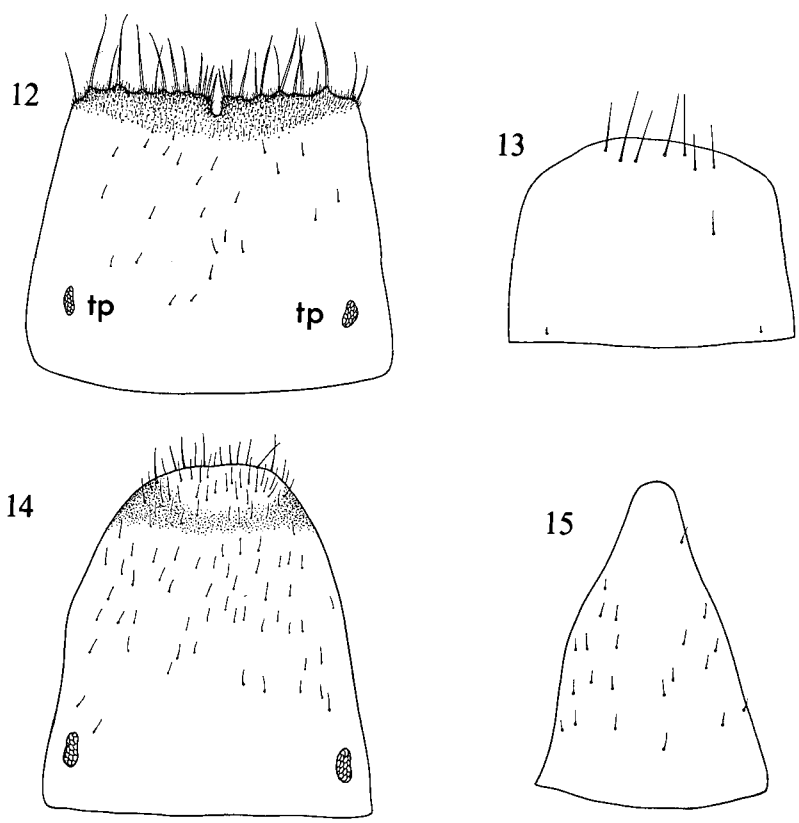


Figs. 8–11. *Lampronia quinquepunctata* n.sp., male genitalia, slide ESN 2113. 8: Tegumen, valvae, vinculum – 9: Tegumen – 10: Aedeagus – 11: Juxta.

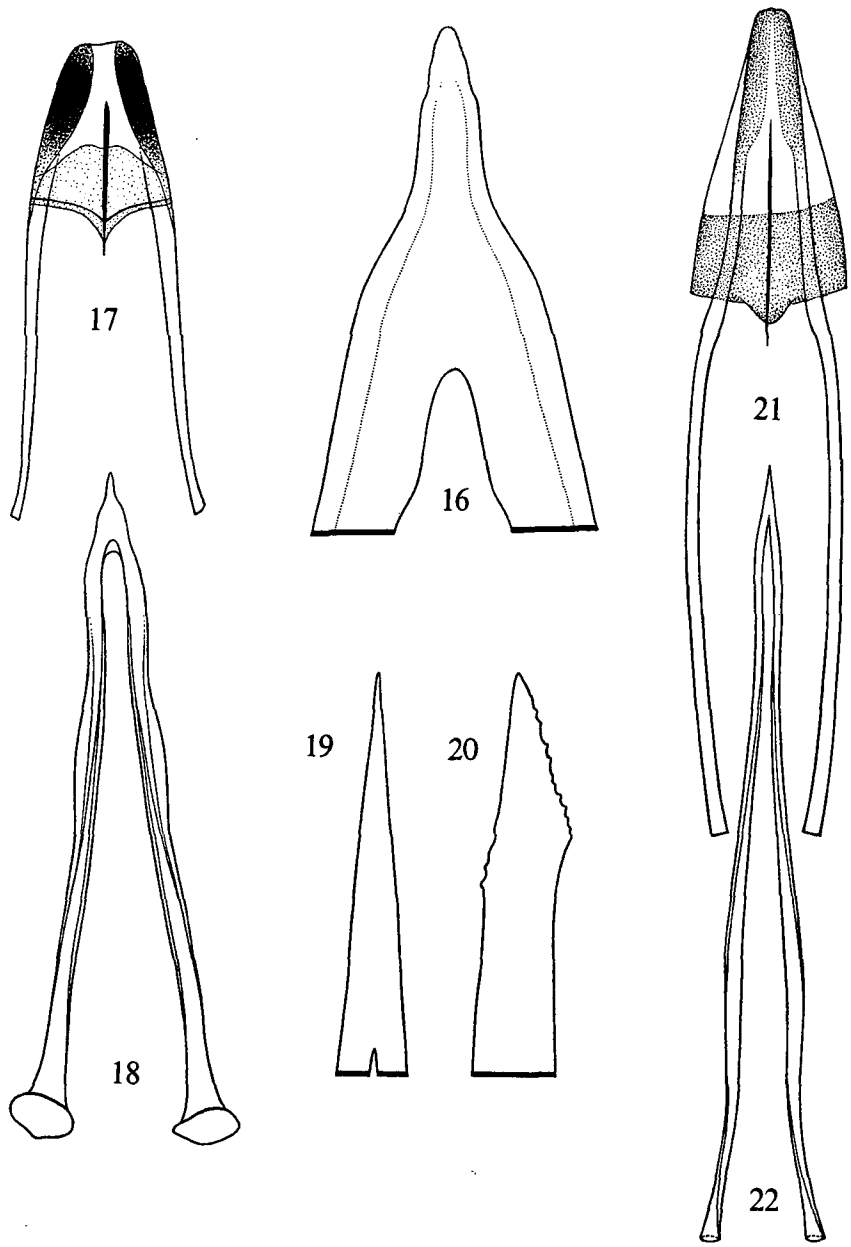
reaching 0.6 of forewing length, flagellum of 32 cylindrical segments; scape and pedicel with appressed lamellar lead-grey scales, pecten of less than ten whitish hairs, flagellum without scale cover. Thorax and tegulae dark lead-grey. Forewing relatively narrow, apex slightly produced; ground colour grey-brown with faint violet and reddish sheen, costal margin white; with five white marks: three along costa at one-, two- and three-quarters, marks small, of almost equal size, innermost rounded and hardly reaching costa, two distal subrectangular with short end reaching to costa; dorsum with two prominent marks: one outwards-curved from one-third, divided into two rounded parts by fold; one inwards-curved from before tornus. Fringe dark violet grey-brown, middle portion between apex and tornus white on terminal half. Hindwing sparsely scaled, most densely scaled along margins, proximal part of hindwing whitish owing to colour of wing membrane, scales dark grey. Abdomen dark lead-grey above, yellowish white below. Hind tibia white with dorsal row of fine long yellowish hairs.

Female. Unknown.

Male genitalia (Figs. 8–11). Uncus well defined, posterior margin emarginate in middle, anterior margin with large membranous area, lateral part with a paired curved structure; posterior part with scattered long setae, anterior part with close-



Figs. 12–15. Female *Incurvaria* and *Lampronia*, sternum VII (Figs. 12, 14) and tergum VII (Figs. 13, 15). 12, 13: *Incurvaria evocata* (Meyrick), slide BMNH 20439 – 14, 15: *Lampronia novempunctata* n. sp., slide ESN 2114. Abbreviation: tp, tuberculate plate.

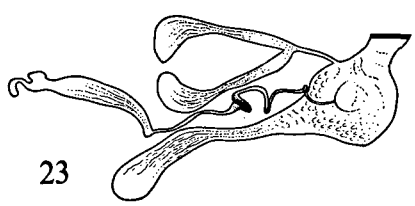


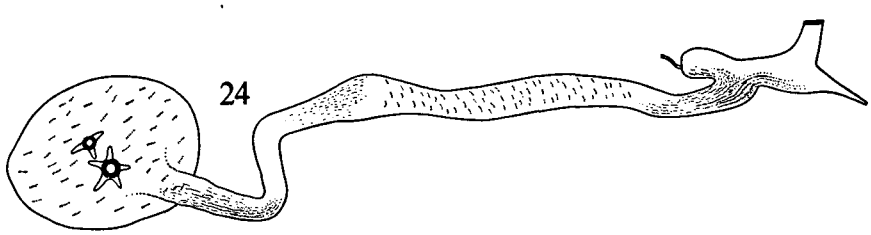
Figs. 16–22. Female *Incurvaria* and *Lampronia*, tip of ovipositor (Figs. 16, 19, 20), segment VIII and apophyses anteriores (Figs. 17, 21) and apophyses posteriores (Figs. 18, 22). 16–18: *I. evocata* (Meyrick), slide BMNH 20439, tip of ovipositor (Fig. 16) in dorsal view – 19–22: *L. novempunctata* n. sp., slide ESN 2114, tip of ovipositor in dorsal view (Fig. 19) and lateral view (Fig. 20).

set fine setae. Tegumen short, posterior margin broadly rounded. Anal tube prominent, conical, medially with scalelike structures. Valva strongly constricted in middle; proximal half broad, distal half narrow, almost parallel-sided; dorsal margin angled towards constricted part, slightly concave on distal narrow part, with few, scattered setae; ventral margin gradually rounded, proximal half with several rows of setae and spines, distal half with an unstalked pectinifer of 15–16 blunt strong spines on a small hump just after constriction, a slightly swollen area with many pointed spines just above pectinifer; tip of valva rounded. Transtilla almost H-shaped, medial part rounded, sublateral arms strong and long. Vinculum long and narrow, Y-shaped, distal half almost parallel-sided. Aedeagus long and slender, tube-shaped; surface of subapical zone with scalelike structures, apical portion on one side with fine hair-like spines arranged in rows; base of vesica with clustre of fine spines and one prominent thorn-shaped cornutus; a narrow rectangular structure arising from tip. Juxta a narrow almost H-shaped plate, one short end emarginate and one with a long narrow process.

Remarks. This species and *L. novempunctata* n. sp., which also occurs in Nepal, differ from other *Lampronia* species by the narrow elongate forewings, the slightly produced forewing apex and the whitish grey, sparsely scaled hindwings. *L. quinquepunctata* differs from *novempunctata* by its white costa (as ground colour in *novempunctata*) and the distinct white zone in the forewing fringe neither reaching to apex nor to tornus, whereas the white portion in *novempunctata* reaches both the apex and the tornus. *L. novempunctata* also has four more white forewing spots as the basal spot, the distal dorsal spot and the two apical spots are absent in *quinquepunctata*.

Based on the external characters mentioned above, *quinquepunctata* and *novempunctata* differ significantly from all other *Lampronia* species, and may thus appear to represent an isolated, monophyletic Himalayan group. The male genitalia of *quinquepunctata* and the female genitalia of *novempunctata* are in several features (shape of valva, aedeagus, vinculum and juxta and shape of female ovipositor tip) similar to those of the Palaearctic *redimitrella* Zeller, *standfussiella*





Figs. 23, 24. Female genitalia of *Incurvaria* and *Lampronia*, vestibulum, ductus bursae and corpus bursae. 23: *I. evocata* (Meyrick), slide BMNH 20439. – 24: *L. novempunctata* n. sp., slide ESN 2114.

Zeller and *morosa* Zeller (see e.g., Wojtusiak, 1976; Razowski, 1978; Zagulajev, 1978) and four Nearctic species currently in the genus *Tanysaccus* (Davis, 1978; in press). The phylogenetic significance of these similarities is yet uncertain.

Biology. The single specimen was collected in early June at 3300 m.a. s.l. in an area with scattered *Acer* and *Rhododendron* shrubs (Kumata, pers. comm.). The immature stages and host plant are unknown. The larvae of *Lampronia* are endophagus, and the host plants are most frequently herbs or shrubs of Saxifragaceae or Rosaceae.

Distribution. Nepal.

Material examined. Holotype ♂, NEPAL: Gosainkund, 3300 m, 7. vi. 1968 (Kumata). Genitalia slide ESN 2113 (EIHU).

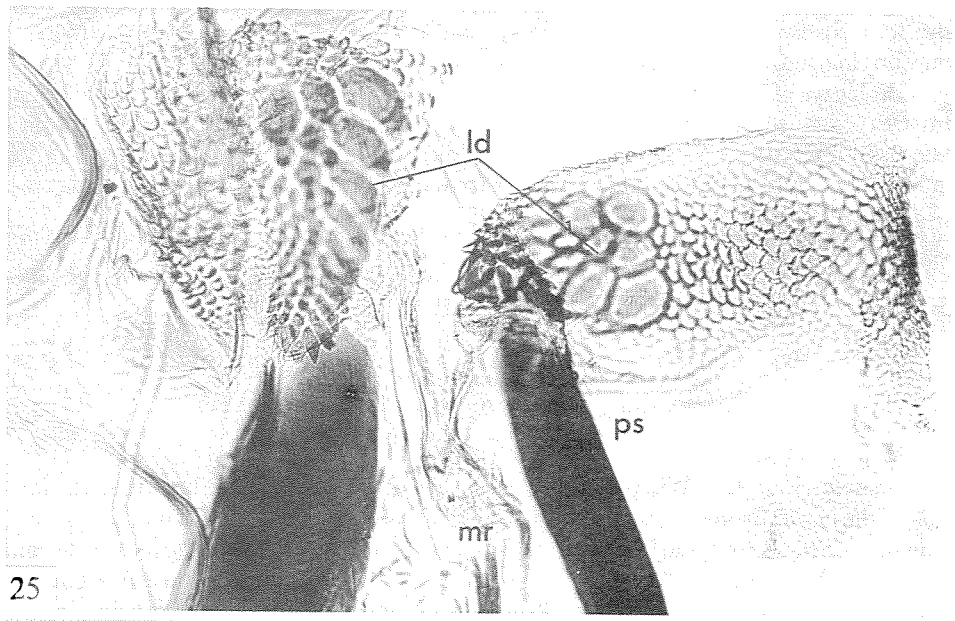
Lampronia novempunctata sp. n.
(Figs. 4, 14, 15, 19–22, 24, 26)

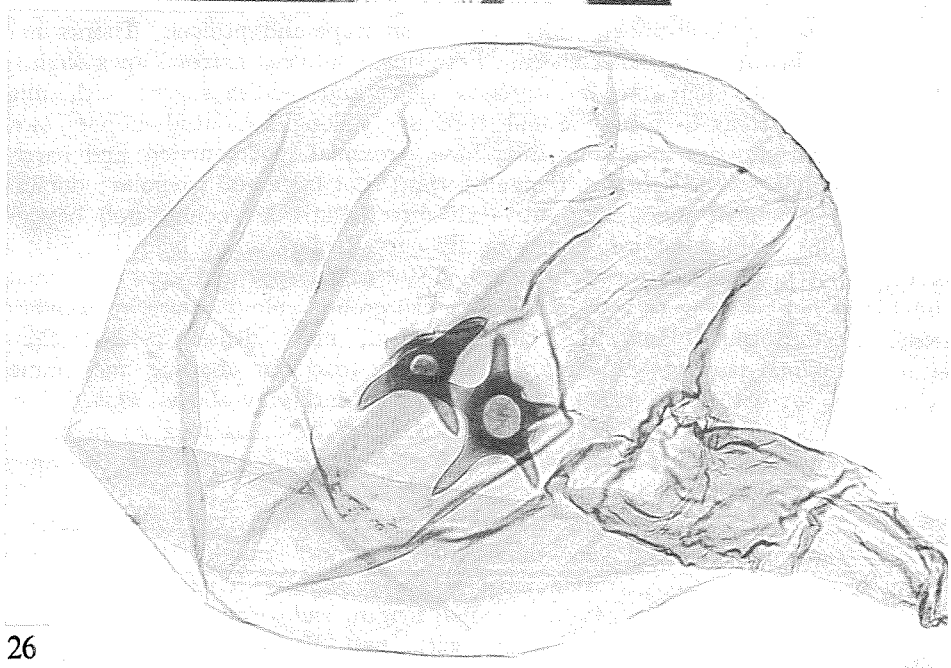
Male. Unknown.

Female (Fig. 4). Wingspan: 12 mm. Head vestiture dark brown with faint violet sheen on frons and vertex, neck tuft pale yellow. Maxillary palpi dark brown. Labial palpi dark brown with yellowish white zone at base of second segment. Antenna reaching 0.6 of forewing, flagellum with 28 cylindrical segments; pecten yellowish white; scape, pedicel and proximal half of flagellum with appressed lamellar violet-brown scales, shining on scape and pedicel. Thorax and tegulae dark brown with violet sheen. Forewing relatively narrow, apex slightly produced; ground colour dark brown with violet and reddish sheen; with nine white marks: a streak from base in fold; three spots along costa at about one-, two- and three-quarters, size increasing from base, proximal spot rounded and barely reaching margin, second spot subtriangular, third spot large and irregular; dorsum with three prominent marks: an outwardly directed streak reaching well beyond middle of disc from one-third, one inwardly curved mark from before tornus, a rounded spot just beyond tornus; between distal costal spot and apex two small white spots not reaching to margin. Fringe like ground colour before apex, white from apex to tornus. Hindwing sparsely scaled, most densely scaled along termen, proximal part of hindwing whitish owing to colour of wing membrane, scales dark grey with faint golden sheen. Abdomen dark grey above, white below.

Female postabdomen (Figs. 14, 15). SVII three times as long as preceding sterna, hind margin rounded, posterior third with scattered setae. TVII two times length of preceding terga, almost triangular, tip blunt.

Female genitalia (Figs. 19–22, 24, 26). Tip of ovipositor bilaterally flattened, elongate triangular in lateral view, dorsal margin almost straight, ventral margin serrate from base to tip, serration most dense on slightly elevated basal part. Apophyses long and slender, of almost equal length, end of posteriores flattened. Intersegmental membrane VIII/IX+X with fine denticles. Segment VIII elongate and narrow, moderately sclerotized, medial keel narrow and fine; SVIII membranous apart from a weakly sclerotized anterior portion. Cloaca long, half as long as ductus bursae. Vagina one-quarter length of ductus bursae. Vestibulum elongate, with dense longitudinal folds. Papillae at inception of ductus spermatheca very large. Ductus bursae long, one-and-a-half times length of apophyses, anterior end sinuous, posterior end with close-set transverse folds, preceding portion with transverse rows of 2–7 minute spines followed by a short portion with





Figs. 25, 26. Female genitalia of *Incurvaria* and *Lampronia*, details. 25: *I. evocata* (Meyrick), intersegmental membrane VIII/IX+X with extremely large denticles, slide BMNH 20439. – 26. *L. novempunctata* n. sp., corpus bursae, slide ESN 2114. Abbreviations: ld, large denticles in intersegmental membrane; mr, posterior end of medial keel on tergum VIII; ps, posterolateral strongly sclerotized part of segment VIII.

scattered pointed spines; anterior end without spines. Corpus bursae with rows of parallel, fine pointed spines and two prominent stellate signa, each with a central weakly sclerotized area; larger signum with five rays and small one with three rays.

Remarks. See under *L. quinquepunctata.*

Biology. The single specimen was collected in the middle of July at an altitude of 2400 m. No further details are available on the locality. Immature stages and host plant unknown.

Material examined. Holotype ♀, NEPAL: NE. Nepal, Taplejung, Rakhato, 2400 m, 15. vii. 1962 (Yasuda). Genitalia slide ESN 2114 (ELUO).

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