



# Taxonomic review of the genus *Nycteola* Hübner (Lepidoptera, Nolidae) from Korea including potential invasive pests

Yeong-Bin Cha<sup>‡</sup>, Un-Hong Heo<sup>§</sup>, Ulzijjargal Bayarsaikhan<sup>||</sup>, Sora Kim<sup>¶</sup>, Yang-Seop Bae<sup>#</sup>

<sup>‡</sup> Lab. of Insect Phylogenetics & Evolution, Jeonju, Republic of Korea  
<sup>§</sup> 88, Sangam-ro 79-gil, Gangdong-gu, Seoul, Republic of Korea  
| Convergence Research Center for Insect Vectors, Incheon, Republic of Korea  
<sup>¶</sup> Jeonbuk National University, Jeonju, Republic of Korea  
<sup>#</sup> Incheon National University, Incheon, Republic of Korea

Corresponding author: Yeong-Bin Cha ([cyb0201@naver.com](mailto:cyb0201@naver.com)), Sora Kim ([skim01@jbnu.ac.kr](mailto:skim01@jbnu.ac.kr)), Yang-Seop Bae ([baeys@incheon.ac.kr](mailto:baeys@incheon.ac.kr))

Academic editor: Shinichi Nakahara

Received: 29 Oct 2023 | Accepted: 18 Dec 2023 | Published: 29 Dec 2023

Citation: Cha Y-B, Heo U-H, Bayarsaikhan U, Kim S, Bae Y-S (2023) Taxonomic review of the genus *Nycteola* Hübner (Lepidoptera, Nolidae) from Korea including potential invasive pests. Biodiversity Data Journal 11: e114878. <https://doi.org/10.3897/BDJ.11.e114878>

## Abstract

## Background

The genus *Nycteola* Hübner has been mainly distributed in the Old World and usually feeds on Fagaceae and Salicaceae, but Myrtaceae and Juglandaceae have also been reported. In Korea, the number of this genus has been changed from four to three after 2007, but three or four species are listed confusingly up to now.

## New information

The Japanese endemic species *Nycteola dufayi* Sugi, 1982 are firstly reported for the Continents with its brief biology. Additionally, Korean fauna of nycteolid species are reviewed.

## Keywords

endemic species, Japan, new record, Palearctic region, synonym

## Introduction

The genus *Nycteola* was established by Hübner (1822), with the type species, *Tortrix undulana* Hübner [1799] by Prout (1901) subsequently. This genus is mainly characterised by the male abdomen: lack of a tymbal organ and anterior apodemes at the eighth segment (Holloway 2003). Additionally, the male genitalia has several noticeable features: a broad uncus with a gnathos-like structure, tegumen broadened at the base with a bunch of hair, a very complex valva convoluted with several lobes and hair and setae, a vinculum that is very long and loop-shaped, a very distinctive axe-head-shaped saccular shield and a normally slender aedeagus, sometimes partly attached to the saccular shield (Holloway 2003). In the female genitalia, triangular papillae anales are characteristic, but the ductus bursae and corpus bursae do not show unified characteristics (Holloway 2003).

The genus is mainly distributed in the Old World, especially Western Palearctic and Indomalayan Regions, as well as the New World, except for Polar Regions (Holloway 2003). They usually feed on Fagaceae and Salicaceae, but it has also been reported that they feed on Myrtaceae and Juglandaceae (Yamamoto and Sugi 1987, Holloway 2003, Sohn et al. 2005, Fibiger et al. 2009, Sasaki and Kishida 2011, Heo 2012, Beljaev et al. 2016, Jinbo et al. 2019, Heo 2021). This association implies that, if a new nycteolid species is reported anywhere, it could be suspected of being a forest pest.

In Korea, four species (*N. asiatica* (Krulikowski, 1904), *N. coreana* (Leech, 1900), *N. costalis* Sugi, 1959 and *N. degenerana* (Hübner, 1799)) have been recorded after Sohn et al. (2005). However, Kononenko and Han (2007) synonymised *N. costalis* Sugi with *N. coreana* (Leech) in some literature, but this change was not adapted by all sources (Paek et al. 2010, Sasaki and Kishida 2011, National Institute of Biological Resources 2019). Recently, Park and Lee (2021) adapted three *Nycteola* species lists.

Here, *N. dufayi* Sugi, 1982, which has only been distributed in Japan since its description, is reported for the first time on the Asiatic continent, specifically in Korea, along with a new host plant and brief biology. This species was originally described between Kyushu and Honshu (Tokyo) and was also reported to feed on Fagaceae in Japan (Sasaki and Kishida 2011, Jinbo et al. 2019).

As a result of this study, four species of Korean *Nycteola* have been confirmed. *Nycteola costalis* Sugi is a junior synonym of *N. coreana* (Leech) and *N. dufayi* Sugi is newly reported from both Korea and the continent.

## Materials and methods

Specimens examined are preserved in the collections of the Incheon National University, South Korea (INU) and the Korean National Arboretum, Pocheon, Korea (KNAE, HEO). Genitalia were dissected and examined using a Leica EZ4 stereomicroscope. Images of adults were taken by a Tucsen Dhyana 400DC digital camera attached to a Leica S6D stereomicroscope, with dome illuminator Leica LED5000 HDI. Genitalia photograph were taken using a Tucsen Dhyana 400DC digital camera mounted on a Leica S8APO stereomicroscope.

Further abbreviations:

- CB: Chungcheongbuk-do Province.
- GG: Gyeonggi-do Province.
- GW: Gangwon-do Province.
- HEO: Un-Hong Heo's private collection.
- JB: Jeollabuk-do Province.
- JJ: Jeju-do Island.
- JN: Jeollanam-do Province.
- NHMUK: The Natural History Museum, London, United Kingdom
- NIAES: National Institute for Agro-Environmental Sciences, Ibaraki, Japan.
- ZI: Zoological Institute, Academy of Sciences of the U.S.S.R., Saint Petersburg (Leningrad), Russia.

## Taxon treatments

### *Nycteola* Hübner, 1822

#### Nomenclature

*Nycteola* Hübner, 1822: 60, 66. Type species: *Tortrix undulana* Hübner, [1799] by subsequent designation by Prout (1901): 183.

*Sarothripus* Curtis, 1824 - Curtis 1824: 29. Type species: *Tortrix degenerana* Hübner, 1799.

*Axia* Hübner, 1825 - Hübner 1825: 395. Type species: *Phalaena revayana* Scopoli, 1772.

*Symitha* Walker, 1866 - Walker 1866: 1731. Type species: *Symitha nolalella* Walker, 1866.

*Subrita* Walker, 1866 - Walker 1866: 1744. Type species: *Subrita bilineatella* Walker, 1866.

*Sarotricha* Meyrick, 1888 - Meyrick 1888: 924 (emend.). Type species: *Sarotricha exophila* Meyrick, 1888.

*Icasma* Turner, 1902 - Turner 1902: 90. Type species: *Icasma minutum* Turner, 1902.

*Dufayella* Capuse, 1972 - Capuse 1972: 89. Type species: *Sarrothripus revayana* var. *asiatica* Krulikovsky, 1904.

### Type species

*Tortrix undulana* Hübner, 1799

### Diagnosis

This genus is characterised by its rectangular forewing, with a variety of markings. Their venation is typical triline (M3 and CuA1 stalked in the hindwing). The tymbal of abdomen absent, but the 8<sup>th</sup> segment is noticeable. The male genitalia has broad uncus, basally expanded tegumen, long loop like vinculum and the very distinct axe-head-shaped saccular shield, with very complexed valva. The female genitalia do not have characteristic features, but usually have triangular to acute ovipositor lobes (genus characteristics after Holloway (2003)).

## ***Nycteola asiatica* (Krulikovsky, 1904)**

### Nomenclature

*Sarrothripus revayana* var. *asiatica* Krulikovsky, 1904 - Krulikovsky 1904: 91. Type locality: [USSR]: [Turkmen SSR], Transcaspicae, Aschabad. Types in coll. ZI.

*Sarrothripus populana* Patocka, 1953 - Patocka 1953: 77. Type locality: South Slovakia.

*Sarrothripus hungarica* Kovács, 1954 - Kovács 1954: 306. Type locality: Hungary: Batorliget.

*Nycteola pseudasiatica* Sugi, 1959 - Sugi 1959: 277. Type locality: Japan: Tokyo.

*Nycteola revayana* (Scopoli, 1772) - Kim et al. 1982 - Kim et al. 1982: 415 (misidentification)

*Nycteola asiatica*: Pak, 1959 - Pak 1959: 38; Inoue 1982: 377, 794; Poole 1989: 704; ESK and KSAE 1994: 374; Kononenko et al. 1998: 140; Kononenko and Han 2007: 72; Paek et al. 2010: 304; Sasaki and Kishida 2011: 183; Heo 2012: 358; Kim et al. 2016: 141; National Institute of Biological Resources 2019: 605; Park and Lee 2021: 615.

## Materials

- a. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *asiatica*; country: Korea; stateProvince: CB; locality: Oksam S.A.; eventTime: 02-05-1997; individualCount: 1; sex: 1 male; lifeStage: adult; catalogNumber: INU-12088; recordedBy: Lee, Ahn, Oh & Lee; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 80630AF7-7BB1-55CE-BCBC-18965A9AA88C
- b. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *asiatica*; country: Korea; stateProvince: GG; locality: Suchung-dong, Osan-si; eventTime: 21-04-1998; individualCount: 5; sex: 2 males, 3 females; lifeStage: adult; catalogNumber: INU-12081, -12082, -12083, -12084, -12085; recordedBy: Kwon Y.D. & Lee H.K.; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 8A95D123-08CF-5946-8D39-C50260881FF3
- c. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *asiatica*; country: Korea; stateProvince: GG; locality: Mt. Yongmun, Yangpyeong-gun; eventTime: 28-07-2000; individualCount: 1; sex: 1 male; lifeStage: adult; catalogNumber: INU-12086; recordedBy: Lee & Kim; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 51CF2F05-5594-5353-87AB-70C0FBB45784
- d. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *asiatica*; country: Korea; stateProvince: GG; locality: Yangsu-ri, Yangpyeong-gun; eventTime: 29-08-2004; individualCount: 1; sex: 1 female; lifeStage: adult; catalogNumber: INU-12087; recordedBy: Bae et al.; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 230CF269-1B13-5EEC-8B49-1D0A325E2175
- e. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *asiatica*; country: Korea; stateProvince: GW; locality: Gangwon National Univ., Chuncheon; eventTime: 26-04-2003; individualCount: 3; sex: 1 male, 2 females; lifeStage: adult; catalogNumber: INU-11843, -11845, -11846; recordedBy: Park et al.; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 09479FC7-DFD8-5EFF-81EB-D1B2864E98E6
- f. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *asiatica*; country: Korea; stateProvince: GW; locality: Gangwon National Univ., Chuncheon; eventTime: 01-05-2003; individualCount: 7; sex: 2 male, 5 females; lifeStage: adult; catalogNumber: INU-11847, -11920, -11921, -11922, -11923, -11924, -11925; recordedBy: Park et al.; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: EA7AC41C-A3A1-504E-9120-F548DCA443DB
- g. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *asiatica*; country: Korea; stateProvince: JB; locality: Mt. Daedunsan, Wanju-gun; eventTime: 13-05-2000; individualCount: 1; sex: 1 male; lifeStage: adult; catalogNumber: INU-12089; recordedBy: Bae et al.; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 9B9E5732-09D5-5829-A8A3-87A4695880EC
- h. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *asiatica*; country: Korea; stateProvince: JB; locality: Temp. Naesosa, Buan-gun; eventTime: 02-05-2004; eventRemarks: Host plant: *Salix koreensis*; individualCount: 1; sex: 1 female; lifeStage: adult; catalogNumber: INU-11610;

recordedBy: Bae et al.; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 4733AA7F-9C35-5B95-9EB0-2A3942B2E604

- i. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *asiatica*; country: Korea; stateProvince: GG; locality: Exotic trees garden, Gwangneung; verbatimCoordinates: 37°45'23.65"N 127°09'45.96"E; eventTime: 18-04-2005; individualCount: 1; sex: 1 female; lifeStage: adult; catalogNumber: INU-11841; recordedBy: Byun B.K.; otherCatalogNumbers: KNAE25608; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 7F3D4C32-BF93-56B9-B310-379F9BA54D1A
- j. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *asiatica*; country: Korea; stateProvince: GG; locality: Lake Yuklim, Gwangneung; verbatimCoordinates: 37°44'54.73"N 127°04'50.09"E; eventTime: 10-06-2008; individualCount: 1; sex: 1 female; lifeStage: adult; catalogNumber: INU-9191; recordedBy: Park S.Y., Lee B.W., Kim S.R., Kwon D.H.; otherCatalogNumbers: KNAE198091; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 3903DF46-8B3F-5248-A140-29CD31A5AEC7

## Description

**Adults.** (Fig. 1a, b) Length of forewing 10–12 mm in both sexes, wingspan 22–27 mm. Antenna filiform in both sexes. Head and thorax grey. Ground colour of forewing grey; black sub-basal line indistinct; costal half of double antemedial line bent, dorsal half zigzagged; medial fascia ochrous, black or indistinct, but noticeable costally; a reddish-ochrous discal dot near postmedial line; postmedial line doubled, unclear, somewhat zigzagged, wavy; subterminal line dotted, angled twice. Ground colour of hindwing pale ivory, darkening towards termen. Abdomen grey.

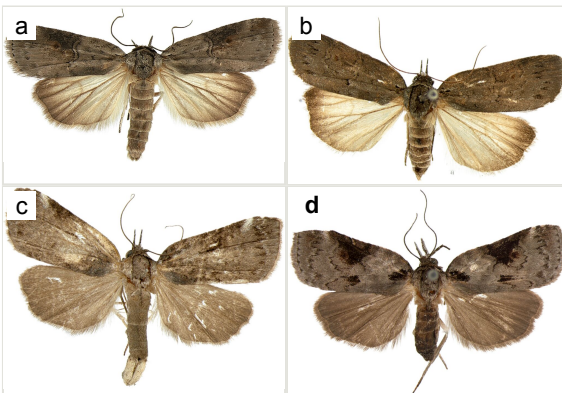


Figure 1.

Adults of Korean *Nycteola asiatica* (Krulikovsky) and *coreana* (Leech).

a: *N. asiatica*, male; [doi](#)

b: *N. asiatica*, female; [doi](#)

c: *N. coreana*, male; [doi](#)

d: , female (Japanese sample). [doi](#)

**Male genitalia.** (Fig. 2a, c, e) Uncus sclerotised, truncate, apically rounded, with subsclaphium. Tegumen narrow, peniculus trapezoidally expanded. Transtilla weakly sclerotised. Valva trapezoid; costal margin straight with a finger-shaped process; apical lobe hairy; harpe-like process towards apex, apically clothed with long setae; ventro-distal lobe complex and convolute. Sacculus shield elongated spatulate, partly fused to aedeagus. Vinculum rather elongated U-shaped. Aedeagus short, stout, with a band of cornuti and a rather large conspicuous cornutus. Eighth tergite costally diagonal wing-shaped plate with two short clavate processes anteriorly, postero-laterally weakly sclerotised; 8<sup>th</sup> sternite with anteriorly bent H-shaped plate.

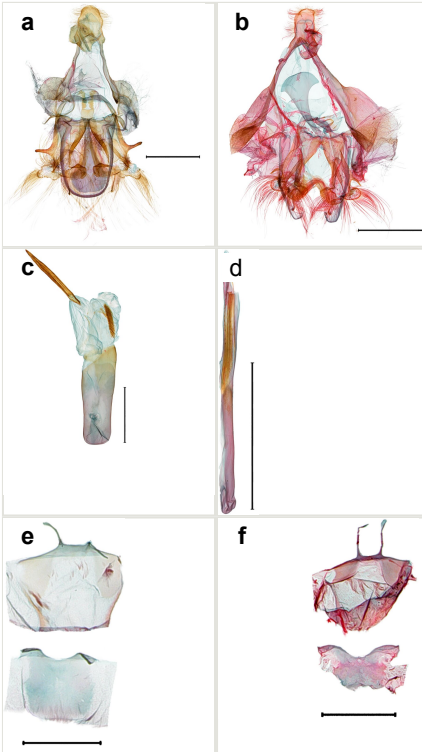


Figure 2.

Male genitalia of *N. asiatica* and *N. coreana*. Scale bar: 1 mm.

- a: *N. asiatica* (INU-12086), genital capsule; [doi](#)
- b: *N. coreana* (INU-12096), genital capsule; [doi](#)
- c: *N. asiatica*, aedeagus; [doi](#)
- d: *N. coreana*, aedeagus; [doi](#)
- e: *N. asiatica*, 8<sup>th</sup> segments; [doi](#)
- f: *N. coreana*, 8<sup>th</sup> segments. [doi](#)

**Female genitalia.** (Fig. 3a) Apophyses anteriores half-length of apophyses posteriores. Ostium bursae membranous. Ductus bursae membranous, intertwined with a strong sclerite, with cervix bursae. Corpus bursae membranous, weakly wrinkled, strongly curved. Appendix bursae absent.

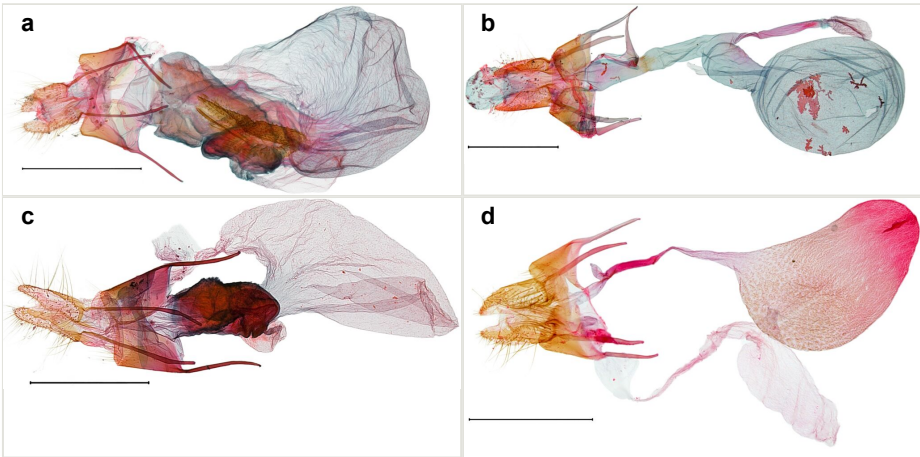


Figure 3.

Female genitalia of *Nycteola* Hübner spp. Scale bar: 1 mm.

a: *N. asiatica* (INU-12085); [doi](#)

b: *N. coreana* (INU-11953, Japanese sample); [doi](#)

c: *N. degenerana* (INU-11844); [doi](#)

d: *N. dufayi* (INU-11973). [doi](#)

### Diagnosis

This species can be distinguished from other congeners by its a reddish discal dot on the forewing and pale ground colour of hindwing in the adult. In the male genitalia, only *asiatica* have aedeagus with a conspicuous spinous cornutus and a row of cornuti fields. In the female genitalia, its large convolute ductus bursae can identify it from others.

### Distribution

Korea, Japan, China, Russian Far East, Nepal, N India, Afghanistan, Turkmenistan, Central Asia, Iran, the Middle East, Turkey, Caucasus, European part of Russia, Europe (Kononenko et al. 1998, Fibiger et al. 2009, Sasaki and Kishida 2011, Beljaev et al. 2016).

### Ecology

**Host plant:** *Salix eriocarpa*, *S. koreensis*, *S. koriyanagi* (Salicaceae) (Heo 2012, Jinbo et al. 2019).

### Notes

While it is noted that Pak (1959) initially reported the species in Korea, he recorded it as a previously reported species. Nonetheless, based on our findings and current available literature, we believe this to be the first official record of the species in Korea.



Kim et al. (1982) only reported *N. revayana* (Scopoli), but this species has not been listed up to now.

## *Nycteola coreana* (Leech, 1900)

### Nomenclature

*Sarothrips coreana* Leech, 1900 - Leech 1900: 518. Type locality: Korea: Gensan. Holotype: male, in coll. NHMUK.

*Nycteola costalis* Sugi, 1959 - Sugi 1959: 278. Type locality: Japan: Tokyo: Takao-san.

*Nycteola costalis*: Poole, 1989 - Poole 1989: 704; Sohn et al. (2005): 220; Paek et al. 2010: 304; Kim et al. (2016): 141; National Institute of Biological Resources 2019: 605.

*Nycteola coreana*: Pak, 1959 - Pak (1959): 38; Kim et al. 1982: 415; Poole 1989: 704; ESK and KSAE 1994: 374; Kononenko and Han (2007): 72; Paek et al. 2010: 304; Kim et al. (2016): 141; National Institute of Biological Resources 2019: 605; Park and Lee 2021: 615.

### Materials

- a. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *coreana*; country: Korea; stateProvince: JJ; locality: Seongpanak, Jeju-si; eventDate: 26-07-2003; individualCount: 1; sex: 1 male; catalogNumber: INU-12096; recordedBy: Lee, Kim & Song; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: BE5B9666-A3C2-5C63-BC7E-F02CDC5D5386
- b. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *coreana*; country: Japan; stateProvince: Nagasaki; locality: Ayumodoshi(1), Tsushima; verbatimCoordinates: 34°09'12.96"N 129°12'58.48"E; eventDate: 22-06-2015; individualCount: 1; sex: 1 female; catalogNumber: INU-11953; recordedBy: Bae Y.S., Park B.S., Na S.M. Lee D.J.; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 4A0FB28B-DF31-529C-BB9A-785FC1683202

### Description

**Adults.** (Fig. 1c, d) Length of forewing 9 mm in male, 11 mm in female, wingspan 20–24 mm (Sohn et al. 2005). Antenna filiform in both sexes. Head and thorax grey. Ground colour of forewing grey; longitudinal basal fascia black; black medial line undulate, wavy; medial fascia black, triangular; a blackish streak under medial fascia; postmedial line undulate, wavy; subterminal line somewhat indistinct, undulate, wavy. Ground colour of hindwing dark grey. Abdomen grey.

**Male genitalia.** (Fig. 2b, d, f) Uncus stout, rounded end, with subscaphium. Tegumen narrow, broadened basally. Valva triangular; costal margin almost straight with a bent spinous process; apex lobe hairy, supported by harpe-like process towards apex; tornal

lobe hairy; ventral margin somewhat wavier than costal margin. Saccular shield anchor-shaped, partly fused to aedeagus. Vinculum rectangular. Aedeagus long, slender, with a double-bladed saw-shaped cornutus. Eighth tergite costally horizontal wing-shaped plate with two long clavate processes anteriorly; postero-laterally weakly sclerotised, with a membranous pouch posteriorly; 8<sup>th</sup> sternite with butterfly-shaped plate.

**Female genitalia.** (Fig. 3b) Apophyses anteriores somewhat longer than apophyses posterior. Ostium bursae membranous, narrow to ductus bursae. Ductus bursae membranous, with weakly sclerotised area in 1/3 from posterior; appendix bursae based on 2/3 of ductus bursae. Corpus bursae ovate.

### Diagnosis

This species can be distinguished from other congeners by its a conspicuous triangular black costal patch with a tornal black dot on the forewing in the adult. In the male genitalia, only the *coreana* has a significantly slender aedeagus with a saw-shaped cornutus and a row of cornuti fields. In the female genitalia, its noticeable appendix bursae at ductus bursae can identify it from others.

### Distribution

Korea, Japan (Sasaki and Kishida 2011).

### Ecology

**Host plant:** *Quercus* spp., *Q. acuta*, *Q. glauca* (Fagaceae) (Yamamoto and Sugi 1987, Sohn et al. 2005, Heo 2021).

### Notes

This species was firstly recorded from the Korean Peninsula by Leech (1900). Sohn et al. (2005) recorded *N. costalis* Sugi from Wando Is. from South Korea, but it was synonymised by Kononenko and Han (2007) as *N. coreana*. According to our findings in this study, while Poole (1989) was the first to describe *N. coreana* as a new combination from *Sarothripsus* to *Nycteola*, an earlier combination was discovered in the bibliography of Pak (1959).

## ***Nycteola degenerana* (Hübner, 1799)**

### Nomenclature

*Tortrix degenerana* Hübner, 1799 - Hübner 1799: pl.2, fig. 8. Type locality: Europe.

*Nycteola degenerana hesperica* Dufay, 1958 - Dufay 1958: 112. Type locality: [France]: Pyrenees: St.-Pierra d'Irrube.

*Nycteola degenerana eurasiatica* Dufay, 1961 - Dufay 1961: 434. Type locality: [Russia]: Moscow.

*Nycteola degenerana eurasiatica*: Ronkay and Park, 1993 - Ronkay and Park (1993): 65.

*Nycteola degenerana*: Poole (1989): 704; Kononenko et al. (1998): 140; Kononenko and Han (2007): 72; Paek et al. 2010: 304; Sasaki and Kishida (2011): 183; Beljaev et al. 2016: 404; Kim et al. (2016): 141; National Institute of Biological Resources 2019: 605; Park and Lee 2021: 615.

## Materials

- a. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *degenerana*; country: Korea; stateProvince: GW; locality: Mt. Kyebang, Hongcheon; eventDate: 26-05-1996; individualCount: 1; sex: 1 male; lifeStage: adult; catalogNumber: INU-11609; recordedBy: Bae, Paek & Lee; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 67A18872-ECA7-58D9-B624-A2F8866A5EE0
- b. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *degenerana*; country: Korea; stateProvince: GW; locality: Gangwon National Univ., Chuncheon; eventDate: 26-04-2003; individualCount: 1; sex: 1 female; lifeStage: adult; catalogNumber: INU-11844; recordedBy: Park et al.; identifiedBy: Y.B. Cha; dateIdentified: 2022; language: en; collectionCode: Insect; basisOfRecord: PreservedSpecimen; occurrenceID: 48D13D20-EBB4-5E69-97E3-3D9C012EF9D8

## Description

**Adults.** (Fig. 4a, b) Length of forewing 11–12 mm in both sexes, wingspan 25 mm. Antenna filiform in both sexes. Head and thorax greenish-grey. Ground colour of forewing greenish-grey; basal band angled, fuscous; sub-basal line parallel to basal line; antemedial line indistinct; medial line and postmedial line doubled, wavy; subterminal line undulated. Ground colour of hindwing pale grey, darkening towards termen. Abdomen pale grey.

**Male genitalia.** (Fig. 5a, c, e) Uncus sclerotised, triangular, rounded end, with subscaphium. Tegumen narrow; peniculus round trapezoidally expanded. Transtilla weakly sclerotised. Valva costal margin bent with a short spinous process; apex lobe hairy; harpe-like process towards apex, apically clothed with long hair; ventro-distal lobe complex and convolute. Sacculus sclerotised. Saccular shield elongated spatulate, axe-head-shaped; partly fused to aedeagus. Vinculum rather elongated U-shaped. Aedeagus long, slender, broadened in apical 1/3, carina process snail-shell-shaped. Eighth tergite costally diagonal wing-shaped plate with two short clavate processes anteriorly, with postero-laterally weakly sclerotized; 8<sup>th</sup> sternite anteriorly curved H-shaped.

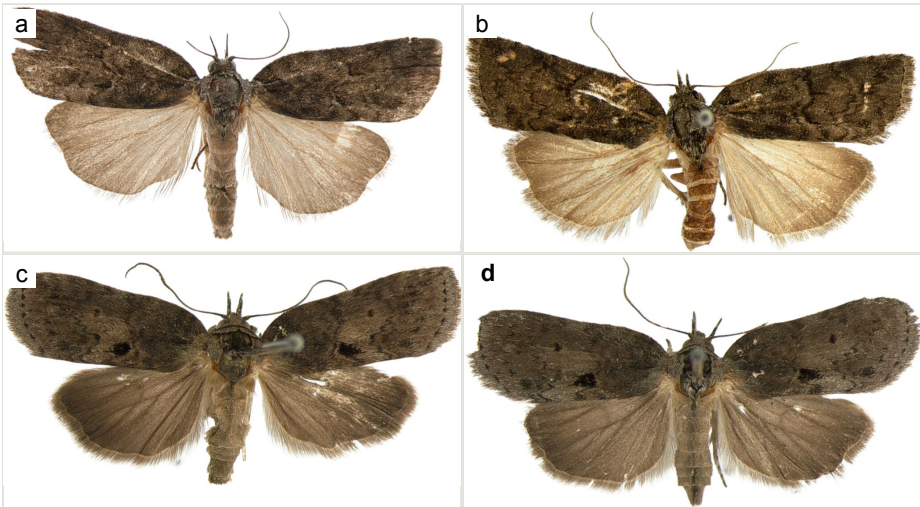


Figure 4.

Adults of Korean *Nycteola degenerana* Hübner and *Nycteola dufayi* Sugi.

a: *N. degenerana*, male; [doi](#)

b: *N. degenerana*, female; [doi](#)

c: *N. dufayi*, male; [doi](#)

d: *N. dufayi*, female. [doi](#)

**Female genitalia.** (Fig. 3c) Apophyses anteriores somewhat shorter than apophyses posterior. Ostium bursae membranous. Ductus bursae short, sclerotised, stout, with cervix bursae. Corpus bursae somewhat peanut-shaped. Appendix bursae absent.

### Diagnosis

This species can be distinguished from other congeners by its fuscous green forewing colour in the adult. In the male genitalia, only *degenerana* have aedeagus with a conspicuous snail-shell-shaped carina process. In the female genitalia, its well sclerotised ductus bursae with somewhat peanut-shaped corpus bursae can identify it from others.

### Distribution

Korea, Spain, France, Switzerland, Italy, Slovenia, Austria, Czech, Germany, Poland, Slovakia, Rumania, Ukraine, Belarus, Lithuania, Latvia, Estonia, Norway, Sweden, Finland, Russia, Central Asia, northern China, Mongolia (Beljaev et al. 2016, Joshi et al. 2021).

### Ecology

**Hostplant:** *Salix caprea* (Salicaceae) (Fibiger et al. 2009).

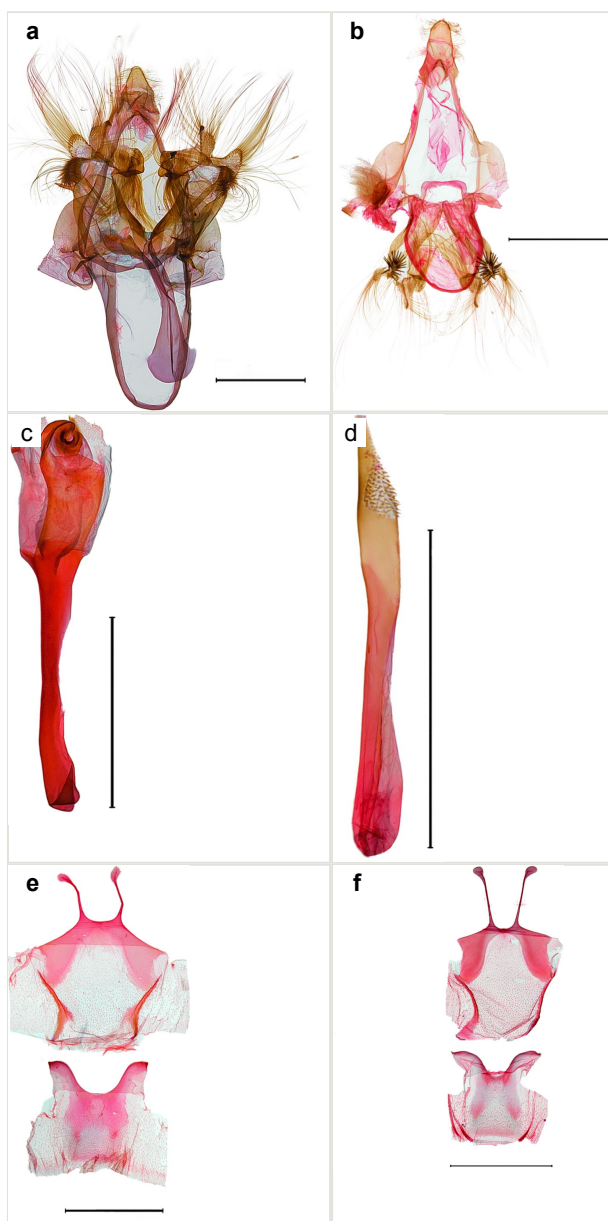


Figure 5.

Male genitalia of *N. degenerana* and *N. dufayi*. Scale bar: 1 mm.

a: *N. degenerana* (INU-11609), genital capsule; [doi](#)

b: *N. dufayi* (INU-11972), genital capsule; [doi](#)

c: *N. degenerana*, aedeagus; [doi](#)

d: *N. dufayi*, aedeagus; [doi](#)

e: *N. degenerana*, 8<sup>th</sup> segments; [doi](#)

f: *N. dufayi*, 8<sup>th</sup> segments. [doi](#)

## Notes

This species was firstly recorded from the Korean Peninsula by Ronkay and Park (1993) from North Korea as *Nycteola degenerana eurasiatica* Dufay and South Korea by Kononenko and Han (2007). According to Beljaev et al. (2016), the species is distributed in India; however, it was not listed in the study conducted by Joshi et al. (2021). Therefore, we do not accept the distribution of the species in India.

## *Nycteola dufayi* Sugi, 1982

### Nomenclature

*Nycteola dufayi* Sugi in Inoue, 1982 - Inoue 1982: 794. Type locality: Japan: Honshu: Tokio [Tokyo]: Takaosan. Holotype: male, in coll. NIAES.

*Nycteola dufayi*: Poole, 1989 - Poole 1989:704; Sasaki and Kishida, 2011 - Sasaki and Kishida 2011: 183.

### Materials

- a. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *dufayi*; country: Korea; stateProvince: JN; locality: Mt. Wanguisan, Suncheon-si; eventDate: 02-08-2016; eventRemarks: Host plant: *Quercus serrata*, emerged 13. VIII. 2016; individualCount: 2; sex: 2 males; catalogNumber: INU-11971, -11972; recordedBy: Heo W.H.; identifiedBy: Y.B. Cha; dateIdentified: 2022; rightsHolder: Un-Hong Heo; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: 09064A2D-F535-5108-844E-B823FDA35776
- b. class: Insecta; order: Lepidoptera; family: Nolidae; taxonRank: species; genus: *Nycteola*; specificEpithet: *dufayi*; country: Korea; stateProvince: JN; locality: Mt. Wanguisan, Suncheon-si; eventDate: 02-08-2016; eventRemarks: Host plant: *Quercus serrata*, emerged 11. VIII. 2016; individualCount: 1; sex: 1 female; lifeStage: adult; catalogNumber: INU-11973; recordedBy: Heo W.H.; identifiedBy: Y.B. Cha; dateIdentified: 2022; rightsHolder: Un-Hong Heo; collectionCode: Insects; basisOfRecord: PreservedSpecimen; occurrenceID: E0D66A07-C0CB-5C62-8EAA-5AF871C62F27

### Description

**Adults.** (Fig. 4c, d) Length of forewing 9–10 mm in both sexes, wingspan 19–21 mm. Antenna filiform in both sexes. Head and thorax brownish-grey, with a black strigular on tegula. Ground colour of forewing brownish-grey; basal and sub-basal lines indistinct fuscous grey; antemedial line irregularly dentate; medial area bright grey with a small, dark grey discal dot and a large black dot near dorsal margin; medial line wavy, dentate; postmedial line dotted, wavy; terminal margin triangular dotted on each vein. Ground colour of hindwing fuscous grey. Abdomen fuscous grey.

**Male genitalia.** (Fig. 5b, d, f) Uncus sclerotised, rounded end, with subsclaphium. Tegumen narrow; peniculus roundly expanded. Transtilla weakly sclerotised. Valva narrow; costal margin bent; apex lobe with hairy; subapical lobe with series of distinct

spines; harpe-like process towards apex, apically clothed with long, stout setae; ventro-distal lobe complex and convolute. Sacculus sclerotised. Saccular shield elongated spatulate, somewhat axe-head-shaped; partly fused to aedeagus. Vinculum U-shaped. Aedeagus long, slender, slightly bent with spinule vesica; carina process porrect. Eighth tergite costally horizontal wing-shaped plate with two long clavate processes anteriorly, postero-laterally weakly sclerotised; 8<sup>th</sup> sternite anteriorly angled H-shaped.

**Female genitalia.** (Fig. 3d) Apophyses anteriores somewhat shorter than apophyses posterior. Ostium bursae membranous, narrow. Ductus bursae sclerotised posteriorly and membranous anteriorly. Corpus bursae pyriform. Appendix bursae absent.

### Diagnosis

This species can be distinguished from other congeners by its a small reddish discal dot with a large black dot near dorsal margin on the forewing in the adult. In the male genitalia, only *dufay* have distinctive aedeagus with spinule vesica. In the female genitalia, its long slender ductus bursae can identify it from others.

### Distribution

Korea (new record), Japan (Sasaki and Kishida 2011).

### Ecology

**Host plant:** *Quercus glauca*, *Q. gilva*, *Q. salicina*, *Castanopsis sieboldii sieboldii* (Fagaceae) (Jinbo et al. 2019). *Quercus serrata* (Fagaceae) (new record).

### Notes

This species has been only recorded from Japan, but newly recorded from the continent herein with a new host plant. Here, we show the brief biology of this species in Fig. 6.

## Discussion

The Korean *Nycteola* group was discussed. This group is mainly distributed in the Old World and is sometimes widely spread (Holloway 2003). Amongst them, only three species are recorded in Korea, and four in Japan (Sasaki and Kishida 2011). For almost 40 years, the *Nycteola* fauna of both countries has not changed, but this report highlights the discovery of the Japanese endemic species *N. dufayi* Sugi.

This report is worth considering in the context of global warming and invasive species. According to Sasaki and Kishida (2011), this species has only been recorded in Honshu, Shikoku and Kyushu and it was suspected that the Kanto area is the northern limit. These regions are located further south and are normally warmer than the northern area. During this study, three larvae were found on Mt. Wanguisan, at the centre of Suncheon City and



were reared and hatched (Fig. 6). Additionally, as it is located to the southwest of Japan, it may not be affected by the westerly airstream, but perhaps only by typhoons. Therefore, the Japanese endemic species *N. dufayi* might become invasive outside of Japan due to global warming, allowing it to inhabit more northern areas. In Japan as well, *N. dufayi* Sugi's distribution may shift northwards. Therefore, it could serve as an indicator of climate change.

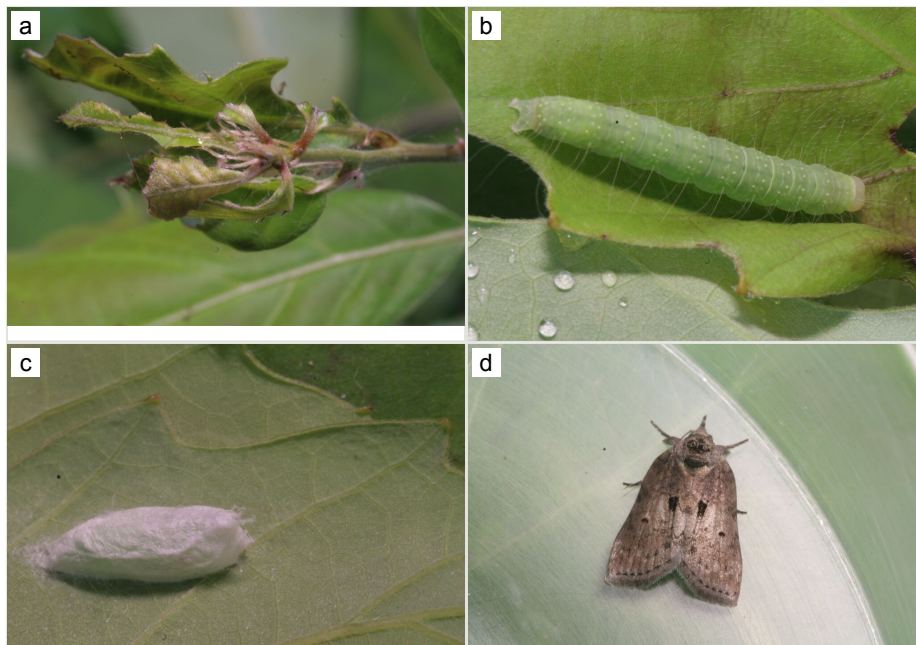


Figure 6.

Brief biology of *Nycteola dufayi* Sugi; Photo: Un-Hong, Heo.

a: Host plant (*Quercus serrata*); [doi](#)

b: Final instar larva; [doi](#)

c: Cocoon; [doi](#)

d: Newly hatched adult. [doi](#)

## Identification keys

### Key of the genus *Nycteola* Hübner in Korea

1	Adult hindwing ground colour creamy and dark grey veins noticeable	<i>N. asiatica</i>
–	Adult hindwing ground colour fuscous and dark grey veins unnoticeable	2
2	Adult forewing with a distinct triangular patch on costal margin	<i>N. coreana</i>



–	Adult forewing without triangular patch	3
3	Adult forewing with a large black dot near tornal margin and hindwing dark grey	<i>N. dufayi</i>
–	Adult forewing with a small black dot near tornal margin and hindwing pale grey	<i>N. degenerana</i>

## Acknowledgements

**Acknowledgments:** We are grateful to the Animal Diversity laboratory team, I.N. Kim, T.G. Lee, C.M. Jang, H. Kim, J.N. Kim and S.H. Choi (Incheon National University, Incheon, Republic of Korea). Additionally, we appreciate the lab of the insect Phylogenetics & Evolution team, J. Kim, J. Park, I.W. Jeong, H.Han and D. Ra (Jeonbuk National University, Jeonju, Republic of Korea). We extend our thanks to Dr. Wes Bicha, Oak Ridge National Laboratory, Tennessee, USA for carefully reading the draft. At last, we give grateful thanks to Drs. B.W Lee and I.K. Kim (Korea National Arboretum, Pocheon, Republic of Korea) for lending specimens for research.

This work was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (2020R111A1A01069466) and Korea Institute of Planning and Evaluation for Technology in Food, Agriculture and Forestry (IPET) through Agriculture, Food and Rural Affairs Convergence Technologies Program for Educating Creative Global Leader Program (or Project), funded by Ministry of Agriculture, Food and Rural Affairs (MAFRA) (no.321001-03). Additionally, this work was supported by a grant from the Honam National Institute of Biological Resources (HNIBR), funded by the Ministry of Environment(MOE) of the Republic of Korea (HNIBR202301209).

## References

- Beljaev E, Anikin V, Baryshnikova S, Dubatolov V, Efetov K, Zolotuhin V, Kovtunovich V, Kozlov M, Kononenko V, Lvovsky A (2016) Annotated catalogue of the insects of Russian far East. Volume II. Lepidoptera. Dalnauka, Vladivostok, 812 pp.
- Capuse I (1972) Über den Genitalapparat der *Nycteola*-Arten (Lep. Noctuidae), nebst Beschreibung einer neuen Untergattung *Dufayella*. Entomologische Zeitschrift 82: 87-92.
- Curtis J (1824) British entomology: being illustrations and descriptions of the genera of insects found in Great Britain and Ireland: containing coloured figures from nature of the most rare and beautiful species, and in many instances of the plants upon which they are found. Printed for the Author, Londo.
- Dufay C (1958) Mise au point de la synonymie des *Nycteola* Hb. (*Sarrothripus* Curt.) europeanes (Lep. Noctuidae. Nycteolinae). Bulletin mensuel de la Société linnéenne de Lyon 27: 108-120.

- Dufay C (1961) Les *Nycteola* Hübner (Sarrothripus Curtis) de la collection Staudinger. Description d'une espèce nouvelle d'Asies centrale et antérieur (Lep. Noct.). Deutsche Entomologische Zeitschrift, N.F. 8: 431-440.
- ESK, KSAE (1994) Check list of Insects from Korea. Konkuk University Press
- Fibiger M, Ronkay L, Steiner A, Zilli A (2009) Subfamily Nolinae Bruand, 1846. In: Fibiger M, Ronkay L, Steiner A, Zilli A (Eds) Pantheinae–Bryophilinae. Noctuidae Europaeae, Volume 11. Entomological Press, Sorø, 89-148 pp.
- Heo UH (2012) Guide book of moth larvae. EcoNature, Seoul, 520 pp.
- Heo UH (2021) Guidebook of moth larvae 3. EcoNature, Seoul, 430 pp.
- Holloway JD (2003) The moths of Borneo: Nolidae, Part 18. Southdene Sdn. Bhd., Kuala Lumpur, 279 pp.
- Hübner J (1799) Sammlung europäischer Schmetterlinge. Volume 7. Tortrices. J. Hübner, Augsburg, 53 plates pp.
- Hübner J (1822) Systematisch–alphabetisches Verzeichniss aller bisher bey den Fürbildungen zur Sammlung europäischer Schmetterlinge: angegebenen Gattungsbenennungen: mit Vormerkung auch augsburgischer Gattungen, von Jacob Hübner. Bey dem Verfasser zu Finden, Augsburg, 81 pp.
- Hübner J (1825) Verzeichniss bekannter Schmettlinge. Bey dem Verfasser zu Finden, Augsburg, 431 pp.
- Inoue H (1982) Nolidae. In: Inoue H, Sugi S, Kuroko H, Moriuti S, Kawabe A (Eds) Moths of Japan I & II. Kodansha, Tokyo, I: 660–668, II: 342–343, pls. 154, 229, 278, 349-354 pp.
- Jinbo U, Owada M, Arita Y (2019) Butterflies and moths recorded in the Institute for Nature Study, Tokyo (2016–2019). Miscellaneous Reports of the Institute for Nature Study 51: 73-108.
- Joshi R, Singh N, Kuni N (2021) A catalogue of Nolidae Bruand, 1846 from India (Lepidoptera, Noctuoidea). Zootaxa 5034: 1-112.
- Kim CW, Nam SH, Lee SM (1982) Illustrated flora & fauna of Korea. Vol. 26 (8). Ministry of Education
- Kim S, Choi S, Kononenko V, Schintmeister A, Sohn J (2016) Revised List of the Korean Noctuoidea Based on Latest Classification. Entomological Research Bulletin 32 (2): 138-160.
- Kononenko VS, Ahn SB, Ronkay L (1998) Illustrated catalogue of Noctuidae in Korea (Lepidoptera). Korea research institute of bioscience and biotechnology & Center for insect systematics, Chunchon, 507 pp.
- Kononenko VS, Han H (2007) Atlas genitalia of Noctuidae in Korea (Lepidoptera). In: Park K (Ed.) Insects of Korea [11]. Junghaeng-sa, Seoul, 464 pp.
- Kovács L (1954) New data relating to systematical and zoogeographical problems of some Macrolepidoptera. Annales Historico-Naturales Musei Nationalis Hungarici, Series Nova 5 46: 305-315.
- Krulikovsky L (1904) Small Lepidoptera notes. Revue Russe d'Entomologie 4: 90-92.
- Leech JH (1900) Lepidoptera Heterocera from China, Japan, and Corea. Part IV. Transactions of the Entomological Society of London 1900: 511-663.
- Meyrick E (1888) Revision of Australian Lepidoptera. II. Proceedings of the Linnean Society of New South Wales, Second Series 2: 835-928.
- National Institute of Biological Resources (2019) National Species list of Korea. Designzip, Incheon, 988 pp.

- Paek MK, Hwang JM, Jung KS, Kim TW, Kim MC, Lee YJ, Cho YB, Park SW, Lee HS, Ku DS, Jung JC, Kim KG, Choi DS, Shin EH, Hwang JH, Lee JS, Kim SS, Bae YS (2010) Checklist of Korean Insects. Nature & Ecology, Seoul, 598 pp.
- Pak S (1959) A handlist of Korean moths. Forest Experiment Station, Seoul, 42 pp.
- Park JK, Lee JE (2021) Check list of Insects from Korea. Paper and Pencil, 105 pp.
- Patočka J (1953) Murky rodu *Sarothripus* - skudci topolu. Zoologické a Entomologické Listy 2: 76-88.
- Poole RW (1989) Noctuidae. Lepidopterorum Catalogus. (New Series, Fascicle 118). Part 1–3. E.J.Brill, Leiden, 1314 pp.
- Prout LB (1901) Corrections in generic nomenclature. The entomologist's record and journal of variation 13: 183-184.
- Ronkay L, Park K (1993) New faunistic data on the family Noctuidae (Lepidoptera). Insecta Koreana 10: 53-74.
- Sasaki A, Kishida Y (2011) Nolidae. In: Kishida Y (Ed.) The standard of moths in Japan II. Gakken Education Publishing, Tokyo, 170–189 pp.
- Sohn J, Ronkay L, Kim S, Cho SW (2005) A taxonomic report of six Noctuidae species (Lepidoptera) new to Korea. Entomological Research 35 (4): 219-226.
- Sugi S (1959) New species of the quadrifid subfamilies of the Noctuidae from Japan (1) (Lepidoptera). Tinea 5 (1): 277-285.
- Turner AJ (1902) New genera and species of Lepidoptera belonging to the family Noctuidae. Proceedings of the Linnean Society of New South Wales 27: 77-136.
- Walker F (1866) List of the specimens of lepidopterous insects in the collection of the British Museum. Part. XXXV, Supplement. Part 5. Edward Newman, London, 1515-2040 pp.
- Yamamoto M, Sugi S (1987) Noctuidae (except Herminiinae). In: Sugi S (Ed.) Larvae of larger moths in Japan. Kodansha, Tokyo, 185-239 pp.