

## Two Newly Recorded Species of Family Crambidae (Lepidoptera, Pyraloidea) in Korea with DNA Barcodes

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### ABSTRACT

The family Crambidae is a large and diverse taxonomic group with over 10,000 species reported worldwide. This paper reports on two species of Crambidae that are new to the Korean insect fauna: *Pagyda recticlavata* Qi & Li, 2020, and *Schoenobius gigantella* (Denis & Schiffermüller, 1775). The identification of these two species is fully supported by both DNA barcode sequences and detailed morphological characteristics. Additionally, comprehensive descriptions, photographs of adults and genitalia, along with extensive DNA sequence information, are provided to facilitate further research. This study significantly enhances our understanding of the biodiversity and distribution within this family.

**Keywords:** Crambidae, Pyraustinae, Schoenobiinae, new record, DNA barcode, Korea

### INTRODUCTION

The family Crambidae, commonly known as grass moths, belongs to the superfamily Pyraloidea and comprises more than 10,000 species worldwide, with more than 260 species recorded in Korea (Munroe and Solis, 1999; Nuss et al., 2003–2024; Choi et al., 2020). The wingspan of adults in this family is usually 10.0–80.0 mm, and the shape of forewings varies from long to narrow and is characterized by the absence of an axis in the uncus of the male genitalia (Bae et al., 2008).

In this study, *Pagyda recticlavata* Qi & Li, 2020 and *Schoenobius gigantella* (Denis & Schiffermüller, 1775) are reported for the first time from Korea. All available information, illustrations of adults and genitalia, DNA barcodes for species are provided.

### MATERIALS AND METHODS

All specimens examined in this study were collected using

light traps, after which they were deposited in the Entomological Collection of the Korea National Arboretum. Images of the adults were taken using a digital camera (Canon EOS 550D; Canon Inc., Tokyo, Japan). The genitalia were dissected under a stereomicroscope (Nikon SMZ445; Nikon, Tokyo, Japan), following the method described by Holloway et al. (1987), and mounted on slide glass using Canada balsam as the mounting medium. Images of the genitalia were taken using a digital camera attached on microscope (Leica M205C; Leica Microsystems, Wetzlar, Germany).

Genomic DNA was extracted from the hind legs of the dried specimens, using a DNeasy Blood & Tissue Kit (QIAGEN, Germany) following the manufacturer's protocol. The CO1 gene was amplified using a SimpliAmp Thermal Cycler (Life Technologies Holdings Pte Ltd., Singapore) with the primers LepF1 (ATTCAACCAATCATAAAGATATTGG) and LepR1 (TAAACTTCTGGATGTCCAAAAAATCA) (Hebert et al., 2004). PCR conditions following the protocol provided by the Biodiversity Institute of Ontario, University of Guelph (<https://ccdb.ca/>). DNA sequencing was performed by Macrogen, Inc.

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(Seoul, Korea), and the sequences were aligned and manually adjusted using Geneious Prime (version 2022.2.2, Geneious, Auckland, New Zealand).

The aligned sequences were analyzed using MEGA 10.2.6 (MEGA, The Pennsylvania State University, University Park, PA, USA) using the neighbor-joining (NJ) method. The Kimura 2-parameter model was employed, and 1,000 bootstrap iterations were performed to construct the NJ tree. In addition, the nucleotide sequences registered in the BOLD systems were used to confirm the genetic distance between each species and the degree of concordance within the same species.

Abbreviations for localities in Korea are as follows: CB, Chungcheongbuk-do; GB, Gyeongsangbuk-do; HNUSEL, Systematic Entomology Laboratory, Hannam University, Korea; KNA, Korea National Insect Collection, Korea National Arboretum, Korea.

## SYSTEMATIC ACCOUNTS

Order Lepidoptera Linnaeus, 1759  
Family Crambidae Latreille, 1810  
Subfamily Pyraustinae Meyrick, 1890

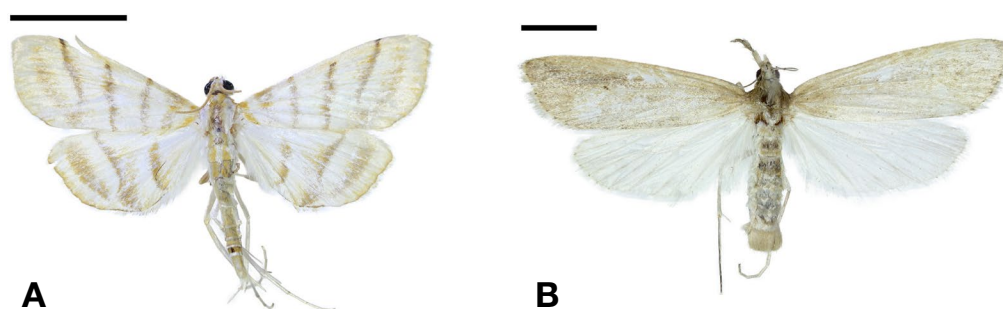
Genus *Pagyda* Walker, 1859

*Pagyda* Walker, 1859: 487. Type species: *Pagyda salvalis* Walker, 1859.

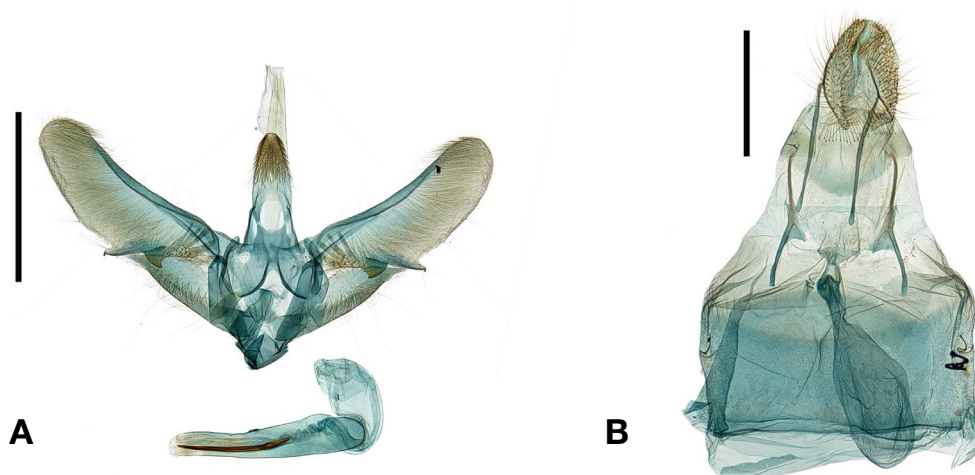
<sup>1</sup>\**Pagyda recticlavata* Qi & Li, 2020

*Pagyda recticlavata* Qi & Li, 2020: 19. 34–36, figs. 5C, 8B. 19. Type locality: China, Guangxi Zhuang Autonomous Region.

**Adults** (Fig. 1A). Wingspan 19.0–20.0 mm. Head light yellow; antennae bright ochre-yellow. Thorax silvery white, with two

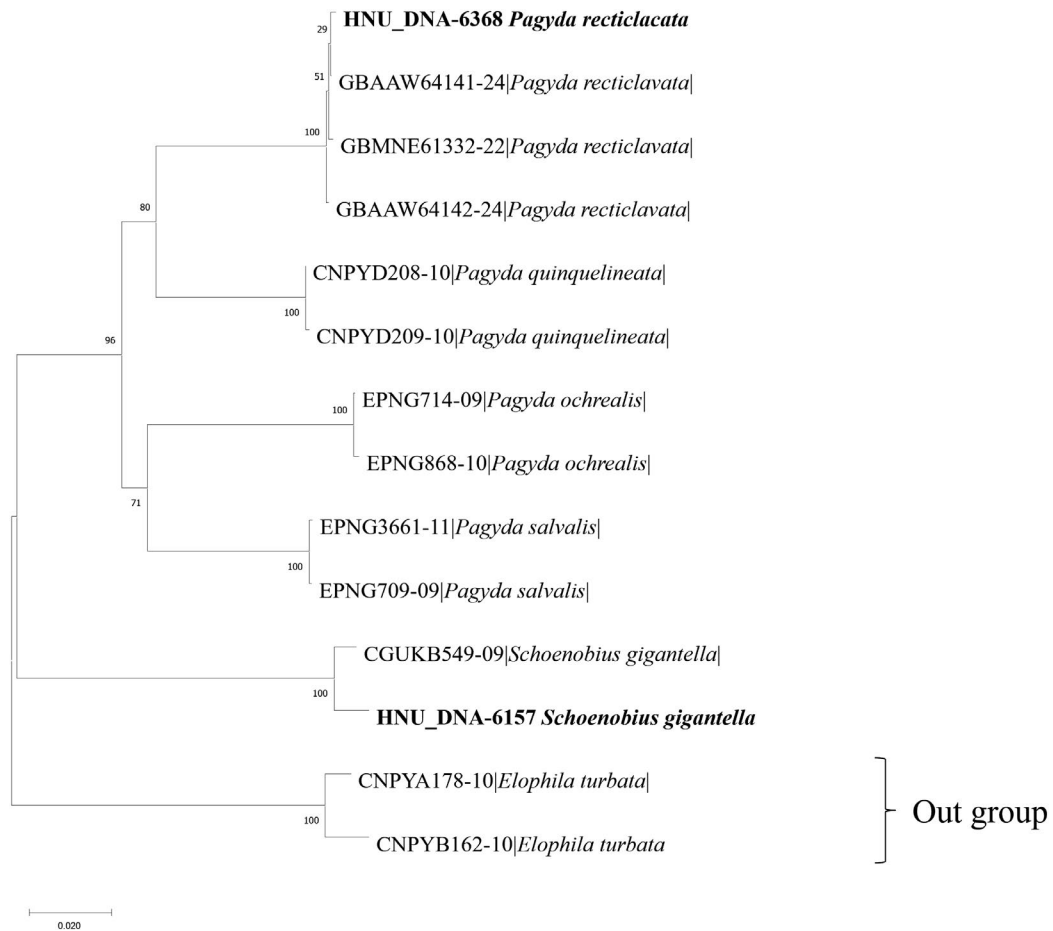


**Fig. 1.** Adults of the Crambidae. A, *Pagyda recticlavata* Qi & Li, 2020; B, *Schoenobius gigantella* (Denis & Schiffmüller, 1775). Scale bars: A, B=0.5 mm.



**Fig. 2.** Male and female genitalia of the Crambidae. A, *Pagyda recticlavata* Qi & Li, 2020; B, *Schoenobius gigantella* (Denis & Schiffmüller, 1775). Scale bars: A, B=0.1 mm.

Korean name: <sup>1</sup>\*연노랑네줄들명나방 (신칭)



**Fig. 3.** Neighbor-joining tree of the Crambidae COI sequence data.

light yellow longitudinal lines. Ground color of forewings bright yellow with milky white; four dark brown longitudinal stripes. first stripe thicker than other stripes and slants outward; second and third stripes run straight from costa to the hind margin; fourth stripe slants inner side; subterminal line thick, light brown and meets fourth stripe at the hind margin. Ground color of hindwings milky white mixed bright yellow, with two thick dark brown longitudinal stripes; the end of first stripe slightly curved inner side; the end of second stripe slightly curved outward; subterminal line dark brown and similar to the subterminal line of forewing.

**Male genitalia** (Fig. 2A). Uncus finger-shaped with short setoes at apex. Tegumen arched, sclerotized along the margin. Valva long, oval-shaped, gradually narrowing at apex, with dense long setose ventrally. Editum flat, possesses 9–10 thick hairs. Sella triangular, with a slightly curved tip. Juxta slightly sclerotized. Vinculum wide inverted triangular, with a sac-shaped membrane hanging from bottom. Phallus cylindrical, membranous, gradually becomes thinner toward apex; cornutus spine-shaped, almost 2/3 length of phallus.

**Female genitalia.** Unknown in the Korean peninsula.

**Material examined.** Korea: [CB] 1♂, Boeun-gun, Maromyeon, Galpyeong-ri, Gwangi, 19 Jun 2021 (BK Byun), genitalia slide no. HNUSEL-7040 coll. KNA.

**Distribution.** Korea (new record), China (Qi and Li, 2020).

**Host plants.** Unknown.

**DNA barcode.** NJ tree constructed monophyly of *P. recticlavata*, which registered in BOLD (BIN ID: BOLD: GBAAW64141-24, GBMNE61332-22, GBAAW64142-24) was strongly supported (bootstrap value = 100) (Fig. 3) and DNA barcode showed 99.69% genetic similarity to *P. recticlavata* in BOLD.

Subfamily Schoenobiinae Duponchel, 1846

Genus *Schoenobius* Duponchel, 1836

*Schoenobius* Duponchel, 1836: 8, 22. Type species: *Tinea gigantella* Denis & Schiffermüller, 1775.

*Erioproctus* Zeller, 1839: 169. Type species: *Tinea gigantella* Denis & Schiffermüller, 1775.

<sup>1</sup>\**Schoenobius gigantella* (Denis & Schiffermüller, 1775)  
*Tinea gigantella* Denis & Schiffermüller, 1775: 135. Type locality: Austria, vicinity of Vienna.  
*Palparia fumea* Haworth, 1811: 483. Type locality: Great Britain.  
*Chilo spurcatellus* Walker, 1863: 142. Type locality: Great Britain, England.  
*Schoenobius gigantellus majoralis* Hampson, 1896: 917. Type locality: Afghanistan.  
*Schoenobius majoralis* var. *fulvalis* Joannis, 1929: pl. 5, fig. 16. Type locality: Tonkin, Hanoi, Vietnam.  
*Schoenobius gigantella* ab. *punctivittellus* Erfurth, 1933: 23–29, pl. 5, fig. 3. Type locality: Austrica, Wien-Stadlau.  
*Schoenobius gigantella* f. *nigristriellus* Popescu-Gorj, Olaru & Draghia, 1972: 193. Type locality: Romania, Caraorman.  
*Schoenobius sasakki* Inoune, 1982(1): 310; 1982(2): 224, pl. 36, figs. 28, 29, pl. 298, fig. 8, pl. 299: 9. Type locality: Japan.

**Adults** (Fig. 1B). Wingspan 41–42 mm. Head yellowish light ocher; labial palpus protruded downward; antennae blackish brown. Thorax dark ochreous. Ground color of forewings bright milky ocher; faint dark brown spots extending from the center to the apex. Ground color of hindwings silvery white.

**Male genitalia.** Unknown in the Korean peninsula.

**Female genitalia** (Fig. 2B). Papillae anales tube-shaped, round, narrowed, covered with long hairs on the surrounded, short hairs on the inside. Anterior apophyses well-developed and same length of the posterior apophyses. Posterior apophyses bifurcated in middle and slightly curved outward. Ostium bursae inverted triangle of thin membranous. Ductus bursae short, with slightly sclerotized edges, almost 1/2 length of the corpus bursae; becomes increasingly membranous toward the apex. Corpus bursae long, oval-shaped, membranous, without signum.

**Material examined.** Korea: [GB] 1♀, Gimcheon-si, Nongsomyeon, Yeonmyeong-ri, Wolgok Sang, 28 May 2022 (BK Byun), genitalia slide no. HNUSEL-7008 coll. KNA.

**Distribution.** Korea (new record), China, Europe.

**Host plants.** *Glyceria maxima* (Hartm.) Holmb [Poaceae], *Phragmites australis* (Cav.) Trin. ex Steud [Poaceae] (Chen and Wu, 2014).

**DNA barcode.** NJ tree constructed monophyly of *S. gigantella* which registered in BOLD (BIN ID: BOLD: CGUKB549-09) was strongly supported (bootstrap value = 100) (Fig. 3) and DNA barcode showed 98.65% genetic similarity to *S. gigantella* in BOLD.

**Remarks.** There is a variation, with or without a dark fus-

cous longitudinal fascia, from the base to the outer margin of the forewing (Chen and Wu, 2014).

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## CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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