Journal of Apiculture
2023.38(2) : 103-106
DOI: 10.17519/apiculture.2023.06.38.2.103

Original research article

New Record of the Black-based Humming-bird Hawkmoth, *Macroglossum passalus* (Lepidoptera: Sphingidae) from Korea

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Abstract The black-based hummingbird hawkmoth, *Macroglossum passalus* Drury, 1773 is newly recorded from Korea. *M. passalus* can be characterized by the blackish transverse antemedial band on the forewing with the yellowish medial band on the hindwing. The female genitalia of *M. passalus* can be characterized by the tubular ostium burse, the long ductus bursae with multiple parallel stripes and posteriorly curved, and the ovate ductus bursae with a long triangular patch of minute signa. To date, seven species of the genus *Macroglossum* have been recorded in Korea.

Keywords Pollinator, Hawkmoth, Flower visit, Korea

INTRODUCTION

The hawkmoths including humming-bird hawkmoths are usually active during daytime, exhibit powerful flight maneuvers such as hovering during nectar feeding, and play an important role in the pollination of numerous plants. Hawkmoths are attracted to the wavelengths of 440 nm, which are preferred by other flower-visiting insects such as bufferflies (Scherer and Kolb, 1987a, 1987b; Kelber, 1997) and honeybees (Giurfa *et al*., 1995). The interaction between pollinators and plants is mediated by the concentration and traits of the common sugars found in nectars of flowers (Baker and Baker, 1983): some nectarivorous birds prefer sucrose and fructose to glucose (Lotz and Nicolson, 1996), bees and many hummingbirds prefer sucrose to glucose and glucose to fructose (Wykes, 1952; Stiles, 1976), butterflies and hummingbird hawkmoths prefer sucrose to fructose and fructose to glucose (Erhardt, 1991, 1992; Kelber, 2003).

The monophyly of the Sphingidae was defined based on morphology and five protein-coding nuclear genes (Kawahara *et al*., 2009). The genus *Macroglossum*, "humming-bird hawkmoth," was erected by Scopoli (1777) with the type species *Sphinx stellatarum* Linnaeus. It comprises more than 120 species worldwide (Kitching and Cadiou, 2000). The members of the genus are diagnosed by the narrow, grayish to dark gray or black forewings with transverse, often sinuous fasciae, the blackish hindwings with a broad yellow or orange medial to subbasal band, the broad thorax, and the broad abdomen that has lateral and subventral yellow or white patches and the distal fan of flattened scales (Holloway, 1987).

To date, six species of *Macroglossum* have been known in Korea (NIBR, 2019; Choi *et al*., 2020): *M. bombylans* (Boisduval, 1875), *M. corythus* Walker, 1856, *M. heliophila* (Boisduval, 1875), *M. pyrrhostictum* (Butler, 1875), *M. saga* (Butler, 1878), and *M. stellatarum* (Linnaeus, 1758). A female specimen of *M. passulus* Drury, 1773 was recently collected from the southwestern island,

Received 15 May 2023; Revised 1 June 2023; Accepted 2 June 2023
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Heuksan-do, Shinan-gun, Jeonnam. Therefore, it is reported that one of hummingbird hawkmoths, *M. passalus* was found for the first time in Korea.

MATERIALS AND METHODS

An adult humming-bird hawkmoth was collected during the night using a UV light and mounted for examination. For slide preparation of female genitalia, each specimen was prepared by boiling the abdomen in 10% KOH for approximately 20 min. Scales and tissues were removed, stained with Chlorazol black, and mounted on slides in Euparal solution. For wingspan measurements, the distance from the tip of the left forewing to the tip of the right forewing was used.

Genomic DNA was extracted from moth legs using the DNeasy Blood and Tissue Extraction Kit (Qiagen, UK) according to the manufacturer's instructions. We targeted the mitochondrial protein-coding gene (cytochrome oxidase subunit I gene, COI). The procedure from amplification to DNA sequence comparison followed Choi *et al.* (2021).

Terminology of adults, including the female genitalia, refers to Holloway (1987). All material was deposited in the Collection of Insects of the Department of Environmental Education, Mokpo National University. Abbreviations are as follows: JN, Jeollanam-do, TL, type locality.

RESULTS AND DISCUSSION

Order Lepidoptera Linnaeus, 1758
Family Sphingidae Latreille, 1802
Genus *Macroglossum* Scopoli, 1777

***Macroglossum passalus* (Drury, 1773) (Figs. 1, 2)**
흑산벌꼬리박각시(신칭)

Sphinx passalus Drury, 1773, Illust. Nat. Hist. Exot. Insects 2: 52, t. 29. TL: Ryukyu Island, Formosa, China.
Sphinx pandora Fabricius, 1793, Ent. Syst. 3(1): 380.
Rhamphoschisma rectifascia R. Felder, 1874, Reise Novara, Lep.: 75, f. 7. TL: South India, Ceylon.
Macroglossum rhebus Moore, 1858, Cat. Lep. Ins. Mus. East India Coy 1: 263. TL: Java, N. India, S. India (Canara).

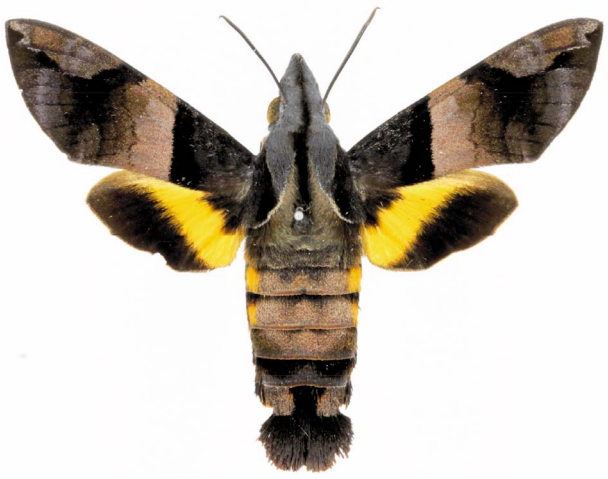

Fig. 1. Adult of *Macroglossum passalus* from Is. Heuksan-do, Shinan, Jeonnam, Korea (Wingspan 54 mm).

Macroglossa sturnus Boisduval, 1875, Spec. Gen. Lep. Het. 1.: 349.

Material examined. 1 female, Korea: JN: Shinan, Heuksan-do, 15 Sep 2022, Oh HY.
Diagnosis. Wingspan 54 mm. This large sphingid species can be distinguished by the dark brown basal part with a blackish transverse antemedial band, the light brown fascia that is followed by a medially projected blackish postmedial line of the forewing and a broad yellowish medial band of the hindwing (Fig. 1). The female genitalia of *M. passalus* can be distinguished by the simple tubular ostium bursae, long tubular ductus bursae, and ovate corpus bursae with a long triangular pouch-shaped patch of minute signa (Fig. 2).
DNA barcoding. We sequenced the COI (Genbank Accession number OG978941) and the sequence of the Korean specimen resulted in 100% similarity with the available BIN (BOLD:AAB1316) that was based on four specimens of *M. passalus* from Japan, Laos, and Vietnam (average distance 0.12% p-distance) (Ratnasingham and Hebert, 2007).
Distribution. Korea, Japan, China (southeast), Taiwan, Philippines, Indonesia, Thailand, India, and Sri Lanka.
Remarks. *Macroglossum passalus* is externally similar to *M. pyrrhostictum* but can be distinguished from the latter by the blackish basal part with a blackish transverse antemedial band on the forewing and the even-width of yellow medial band on the hindwing.

Macroglossum passalus feeds on *Daphniphyllum caly-*

Fig. 2. Female genitalia of *Macroglossum passalus* from Korea.

cinum Benth. (Daphniphyllaceae) (Hong Kong), *Photinia glabra* (Thunb.) Franch. and Sav. (Rosaceae) (Japan), and *P. lindleyana* Wight and Arn. (India) (Pittaway and Kitching, 2018).

ACKNOWLEDGEMENTS

The study was supported by a grant from the National Institute of Biological Resources (NIBR), funded by the Ministry of Environment (MOE) of the Republic of Korea (NIBR202304203, NIBR202333201).

CONTRIBUTION OF AUTHORS

Collection, HYO; investigation, resources, BS, YJC, KNG, SSK, SWC; writing, and editing, SWC; visualization, SSK; supervision, SWC; project administration, funding acquisition, SWC.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the correspondent author. The genetic data are publicly available.

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