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New report of *Diekeana insignis* (Gorham, 1892) (Coleoptera: Coccinellidae: Epilachnini) in South Korea

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The genus and species, *Diekeana insignis* (Gorham), is reported for the first time in Korea. Male adults were collected from Geoje Island and Changwon-si, located in the southern part of South Korea. The species of *D. insignis* (Gorham) is characterized by the following morphological characteristics: body length about 9.4 mm; pronotum with transverse black marking in the middle part; each elytron with seven large black markings; penis long, slightly bent at apical part, truncate at apex; parameres narrow and as long as penis guide; penis guide narrow and pointed at apex. We herein provide habitus photographs, illustrations of morphological characters, male genitalia, and a detailed diagnosis. A partial sequence of the mitochondrial COI gene was obtained and provided mtDNA information for this species.

Keywords: Coccinellidae, Coleoptera, Epilachnini, Korea, new record

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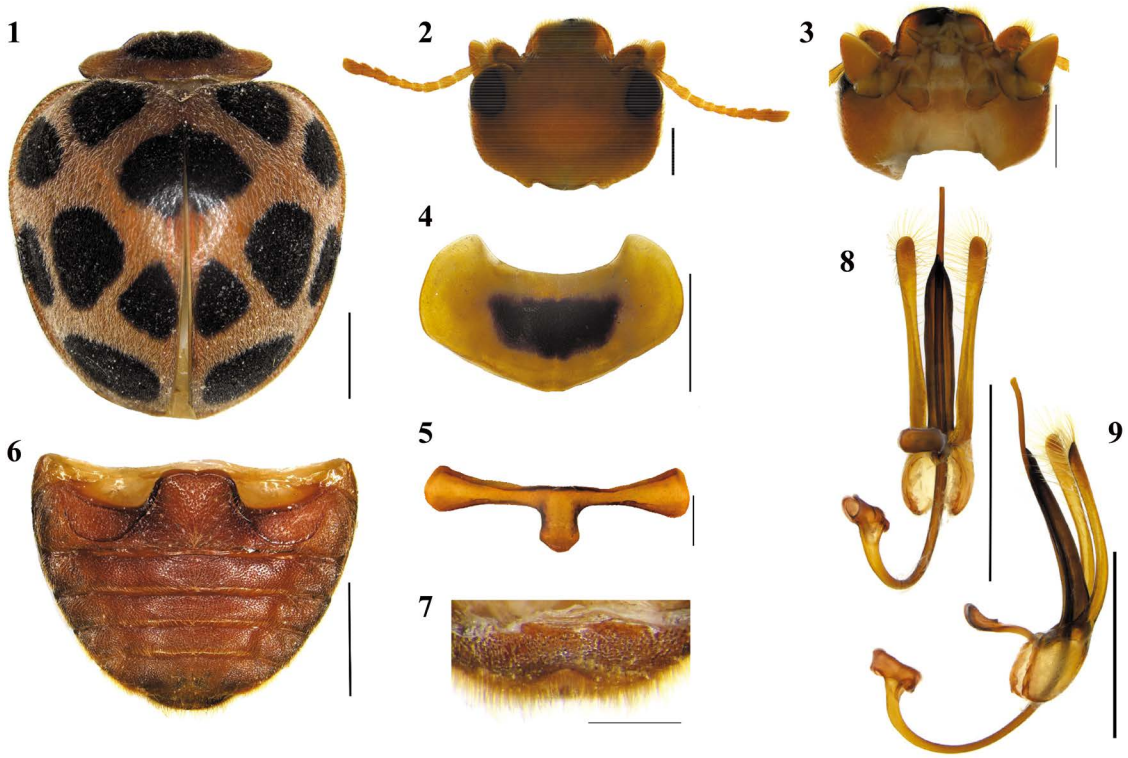
Introduction

A phytophagous ladybird beetle, *Diekeana insignis* (Gorham, 1892), has only been previously found in China (Pang *et al*., 2012). Recently, we collected male adults specimen of *D. insignis* from Geoje Island and Changwon-si, located on the southern coast of Gyeongsangnam-do in South Korea. The tribe Epilachnini Mulsant, 1846, which includes genus *Diekeana* Tomaszewska and Szawaryn, 2015, is represented by eight species distributed on the Korean Peninsula (National Institute of Biological Resources, 2019; Hong, 2021): *Epilachna admirabilis* Crotch, *E. chinensis* (Weise), *E. quadricollis* (Dieke), *Henosepilachna vigintioctomaculata* (Motschoulsky), *H. vigintioctopunctata* (Fabricius), *Subcoccinella coreae* Park and Yoon, *S. vigintiquatuorpunctata* (Linnaeus), *Cynegetis impunctate* (Linnaeus). Among them, *E. admirabilis* and *E. quadricollis* have been reclassified as *Diekeana admirabilis* (Crotch) and *Uniparodentata quadricollis* (Dieke) respectively, as a new combination (Tomaszewska and Szawaryn, 2016). According to the revision of subfamily Epilachninae in Korea by Park and Yoon (1991), it was determined that *S. vigintiquatuorpunctata*, previously documented in Korea, should be replaced by the species of *S. coreae* due to discernible distinctions in male genitalia. Consequently, the list of Korean Epilachnini species necessitates revision. From the Korean Peninsula, 79 species of Coccinellids have been reported by adding the species of *Horniolus fortunatus* (Lewis) to the recent taxonomic study (Lee, 2015; Jung *et al*., 2019). The genus *Diekeana* was established by Szawaryn *et al*. (2015) based on morphological and molecular data (COI, *16S* rRNA, *18S* rRNA and *28S* rRNA). This genus is distributed in South and South-Eastern Asia (Tomaszewska and Szawaryn, 2016), but the genus *Diekeana* had never been previously recorded in the Korean Peninsula until this study.

In this study, we report the genus *Diekeana* for the first time as part of the Korean Coccinellid fauna basis on *Diekeana insignis* (Gorham, 1892) and provide diagnostic characters with partial sequences of mitochondrial cytochrome *c* oxidase subunit I (COI).

Materials and Methods

The adult male specimens were collected by a sweeping net near the tractional pond in Geoje Island and Changwon Marine Park, South Korea. After collection, samples were preserved in 80% ethanol and sorted by taxa, including the family Coccinellidae. Identification with external morphology was observed under stereoscopic (Nikon SMZ800N) and compound microscopes (Nikon Eclipse 50i). All char-



Figs. 1–9. Male of *Diekeana insignis* (Gorham, 1892): 1) dorsal habitus; 2) head, dorsal view; 3) mouthparts, ventral view; 4) pronotum, dorsal view; 5) prosternal process, ventral view; 6) abdomen, ventral view; 7) abdominal ventrite VI; 8) genitalia, ventral view; 9) genitalia, lateral view. Scale bars = 0.5 mm (2, 3, 5, 7), 2.0 mm (1, 4, 6, 8, 9).

acteristic morphological photographs of the species were taken using a Dhyana 400DC camera (Tucsen Photonics, China) attached to a Leica S Apo (Wetzlar, Germany) stereomicroscope. Multiple images were combined using the Z-stack program (Z-Stack Combine System, Delta Bio, Korea) and edited in Adobe Photoshop CS6. The examined male specimens are deposited in the DASARI Research Institute of BioResources (DRIBR), in Daejeon, South Korea. The genomic DNA was extracted from the thorax of male specimen. The primer pair C1-J-2183 (5-CAA CAT TTA TTT TGA TTT TTT GG-3) and TL2-N-3014 (5-TCC AAT GCA CTA ATC TGC CAT ATT A-3) was used to amplify an 829 base pairs (bp) of the COI gene (Simon *et al*., 1994). The obtained sequence was deposited in GenBank.

Taxonomic Accounts

Family Coccinellidae Latreille, 1807
Subfamily Epilachninae Mulsant, 1846
Tribe Epilachnini Mulsant, 1846

Genus *Diekeana* Tomaszewska and Szawaryn, 2015

Diekeana Tomaszewska and Szawaryn, 2015: 562. Type species: *Epilachna alternans* Mulsant, 1850 (orig. descr.).

Epilachna Chevrolat in Dejean, 1837 (e.p.); Szawaryn *et al*., 2015: 552, 562, 566.

Diagnosis. (modified from Tomaszewska and Szawaryn, 2016). Genus *Diekeana* can be distinguished from other genera of Coccinellidae by following characters: body oval, strongly convex dorsally, with surface pubescent; head without dorsal antennal grooves; antennomere 1 shorter (less than 1/3 of total length of antenna); eyes with inner orbits closer posteriorly; mandibular incisor edge multidentate; prothoracic hypomeron simply punctate, prosternal process with lateral carinae; metaventral postcoxal lines joined on metaventral process; inner margin of metanepisternum with serration; mid and hind coxae simple without tubercles; tibiae without oblique carina near apex and coxites being spindle-shaped; claws do not form cordate pattern.

***Diekeana insignis* (Gorham, 1892) (Figs. 1–9)**

남방곱추무당벌레

Epilachna insignis Gorham, 1892: 84 (orig. descr.); Pang *et al*., 2012: 13 (note).

Epilachna fairmairei Frivaldszky, 1892: 121 (descr.).

Diagnosis. Adults of *D. insignis* can be recognized by the following combination of characters: Body length 9.4 mm, width 7.8 mm (one male), oval, and strongly convex dorsally, with yellowish pubescence. Dorsum (Fig. 1) reddish brown with several large black markings. Head (Fig. 2) reddish brown, concealed under pronotum; clypeus narrow, not projecting in front of eyes; antennae short, as long as head width, with 11 antennomeres; antennomere 1 large and stout; antennomere 2 more or less stout, 1/2 length of antennomere 1; antennomere 3 long and slender; antennomeres 4 and 5 slender, shorter than antennomere 3, equal in length; antennomeres 6−8 shortest, equal in length; antennomeres 9−11 elongate, truncate at apex. Mandibles longer than wide, multidentate (more than three long teeth, with several small teeth in dorsal and apical view). Maxillae (Fig. 3) large; maxillary palp with four palpomeres; palpomere 1 slender; palpomere 2 longer than wide, more or less stout; palpomere 3 shortest and stout; palpomere 4 broadly securiform. Labial palps slender, with three palpomeres; approximate ratio of palpomeres as 1.0 : 3.0 : 3.5. Pronotum (Fig. 4) wider than long, with transverse large black marking in middle part; anterior angle protruding and rounded, posterior area broad and rounded. Scutellum visible, triangular, with fine punctures. Elytra reddish brown, convex dorsally, densely pubescence; each elytron with seven large black markings. Prosternum and hypomeron finely punctate; prosternal process (Fig. 5) longer than wide, with two carinae, round at apex. Legs short and flattened; femora widened; tibiae slender, tibial spur formula 1-2-2; mid and hind tibiae without carina; tarsal formula 4-4-4; tarsomeres 1 and 2 large, lobed ventrally; tarsomere 3 shortest; tarsomere 4 elongate and cylindrical; tarsal claws long and bifid. Abdomen (Fig. 6) with six ventrites, wider than long; abdominal postcoxal line incomplete, ending at 1/3 length of abdominal ventrite I, not reaching posterior margin of ventrite; abdominal intercoxal process wide; abdominal ventrites I−VI with punctate; abdominal ventrite V longer than ventrite VI, slightly emarginate in middle part; abdominal ventrite VI (Fig. 7) narrowest, with densely setae, more or less wide emarginate in middle part. Male genitalia as figured (Figs. 8, 9).

Material examined. KOREA: 3♂, Gyeongsangnam-do, Changwon-si, Masanhappo-gu, Gapo-ro, 11.vii. 2021, leg. S.B. Son & I.C. Shin; 1♂, Gyeongsangnam-do, Geoje-si, Dongbu-myeon, Osong-ri, (34°47′58.44″N, 128°35′17.36″E, 24 m a.s.l.), 3.v.2022, leg. S.W. Jung & Y.H. Kim.

Distribution. Korea (South), China (Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Jiangxi, Shaanxi, Sichuan, Yunnan).

Mitochondrial DNA (mtDNA) sequence of *Diekeana insignis*. Total 829 bp (accession number OQ706052) COI showing 99.25% similarity to the reference sequence of the *Epilachna insignis* (accession number KP123271.1) from China. The partial mitochondrial cytochrome *c* oxidase subunit I (COI) gene sequence is shown in the below:

ACATCCGGAAGTTTATATTTTAATTCTTCCT
GGATTTGGAATAATTTCTCATATTATTAGC
CAAGAAAGAGGGAAAAAAGAAGCTTTTGGCT
CATTAGGAATAATTTATGCTATAATAGCAATTG
GATTACTAGGATTTGTAGTTTGAGCTCAT
CATATATTTACAGTAGGAATAGATGTTGACACTC
GAGCTTATTTTACCTCAGCAACAATAATTATTG
CAGTTCCTACTGGTATTAAAATTTTTTCAT
GATTAGCAACTCTTCATGGAGTTCAATTTA
ATTTTAGACCTTCACTTTTTTGAGTTCTAG
GATTTTTATTCTTATTTACAATTGGTGGATTA
ACAGGAGTTGTATTAGCAAATTCATCTATT
GATATTATTCTTCATGACACATACTATGTTG
TAGCTCATTTTCATTATGTTCTTTCAATAGG
GGCCGTTTTTGCAATTATAGCCGGATTTGTC
CATTGATTTCCTTTATTTACAGGTTTTAATCT
TAACAGAAAACTTTTAAAAATTCAATTTATTG
TAATATTTATTGGAGTAAACTTAACTTTTTTC
CCTCAACATTTTTTAGGGTTAGCAGGTATAC
CCCGACGATATTCTGATTATCCAGATGCTTATTTA
ATGTGAAATAAAATTTCCTCTATTGGATCAATA
ATTTCTTCTATTAGAATTATTTTTTTTATATTA
ATTATTTGAGAAAGATTTTATAGATTCCGTATA
AGAATTATAAGAATTAGAATACCTTCCTTA
ATAGAATGATTTCAATTAACTCCTCCAAATGAA
CATAGATATTCAGAAATTCCTATACTGTCAATA
ATTTTC

Remarks. Gorham (1892) described *Epilachna insignis* based on the collection on Mr. Pratt in China (Kiu-kiang) as a new species. Pang *et al.* (2012) reported 20 species of Chinese *Epilachna* Chevrolat including *E. insignis*, with digital illustrations of the habitus, male and female genitalia. However, no description or other morphological illustrations were provided. According to Tomaszewska and Szawaryn (2016), some parts of genus *Epilachna*, including *E. insignis*, have been transferred to the genus *Diekeana* based on morphological and molecular characters. We collected four adult male specimens from southern part of south Korea and provide a detailed diagnosis for the first time herein. The species of *Diekeana insignis* can be distinguished by the following morphological characters: pronotum with transverse black marking in middle part, elytra strongly convex with densely pubescence, each elytron with seven large black markings, penis long, slightly bent at apical part, truncate at apex, parameres narrow and as long as penis guide in lateral view, penis guide narrow and pointed at apex.

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