Original article KOREAN JOURNAL OF APPLIED ENTOMOLOGY

한국응용곤충학회지
Korean J. Appl. Entomol. 56(2): 223-227 (2017)
DOI: https://doi.org/10.5656/KSAE.2017.05.1.081

ⓒ The Korean Society of Applied Entomology
pISSN 1225-0171, eISSN 2287-545X

First Report in Korea of the Stored Grain Pest *Cynaeus angustus* (LeConte) and a Pictorial Identification Key for Tenebrionid Pests in Stored Products

Ki-Jeong Hong* and Tae-Sung Yun

Department of Plant Medicine, Sunchon National University, Suncheon 57922, Korea

새로운 저장곡물해충 *Cynaeus angustus* (LeConte) 및 저장산물의 거저리과 해충에 대한 도해검색

홍기정* · 윤태성

순천대학교 식물의학과

ABSTRACT: The larger black flour beetle, *Cynaeus angustus* (LeConte) (Diaperinae: Tenebrionidae) is reported for the first time in Korea. *C. angustus* is economically important as an insect pest in stored products in the Nearctic region, and has been identified in several rice mills in Korea. Taxonomic diagnosis and photographs presenting the morphology of adults and larvae are provided, along with a pictorial identification key to 17 tenebrionid pests detected during quarantine in stored products in Korea.

Key words: *Cynaeus angustus*, Tenebrionidae, Pictorial identification key, Plant quarantine, New record

초 록: 북미지역에서 저장곡물해충으로 잘 알려진 거저리과의 북미쌀거저리[*Cynaeus angustus* (LeConte)]가 국내 여러 정미소에 발생하고 있음을 새롭게 보고하며, 이 미기록종에 대한 성충과 유충 사진 및 진단형질과 저장산물을 검역하는 과정에서 검출되는 거저리과 해충 17종에 대하여 도해검색자료를 제공하였다.

검색어: 북미쌀거저리(*Cynaeus angustus*), 거저리과, 도해검색, 식물검역, 미기록종

The genus *Cynaeus* was originally described to type species, *Platydema angustum* LeConte, 1851 by LeConte (1862) and was found in the desert of the Colorado River, California. This genus belonging to the subfamily Diaperinae (Tenebrionidae), characterized by the following features: lateral sides of elytra without carinae and meso- and metatibiae with a fine crenulate ridge on outer surface (Ferrer, 1995). *Cynaeus* comprises only two species: *C. opacus* Champion, 1886 (a synonym of *C. angustus*) was described from Northern Sonoran in Mexico. Another member, *C. depressus* Horn, 1870, was described from the coastal range of California, but it has not been recorded in agricultural or urban situations (Dunkel et al., 1982).

C. angustus is found under bark and around the base of Yucca plants as a scavenger and part-time predator. Originally it was restricted to the south-west USA and north-west Mexico. However it has been spread progressively to north and east regions in the 1920s and 1930s and reached as far north as southern Canada in the 1940s (Dunkel et al., 1982). In the 1990s, it was found for the first time in Sweden of other continents (Ferrer and Andersson, 2002). In addition, it has become a pest of stored grain and is spreading in its distribution.

In this paper, we report a new stored grain pest by *C. angustus* (LeConte) in Korea. Morphological photographs of

***Corresponding author:** curcul@sunchon.ac.kr
Received November 1 2016; **Revised** May 22 2017
Accepted May 25 2017

This is an Open-Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/3.0) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

adult and larva, taxonomic diagnosis, and an interactive identification key to 17 tenebrionid pests detected from grain inspections of plant quarantine in Korea are provided.

Materials and Methods

Specimens for *Cynaeus angustus* (LeConte) were collected from corrugated cardboard traps (30×30 cm) in rice mills from Korea and are deposited in the Insect Collection of Sunchon National University. Specimens using in the interactive pictorial key are preserved in the Insect Collection of Sunchon National University (SCNU) and Animal and Plant Quarantine Agency (QIA). Many pictures of specimens displayed in the key were taken using a Leica DFC2900 digital camera and stacked using the Leica Application Suite Program (LAS Version 4.6.0; http://www.leica-microsystems.com).

The following abbreviations are used in this paper: GB, Gyeongsangbuk-do Province; GG, Gyeonggi-do Province; GN, Gyeongsannam-do Province; JB, Jeollabuk-do Province; JN, Jeollanam-do Province, Korea.

Results and Discussion

Taxonomic accounts

Family Tenebrionidae Latreille, 1802 거저리과

Subfamily Diaperinae Latreille, 1802 르위스거저리아과

Tribe Diaperini Latreille, 1802 르위스거저리족

Genus *Cynaeus* LeConte, 1862

Cynaeus LeConte, 1862: 233. [Type species: *Platydema angustum* LeConte, 1851]

***Cynaeus angustus* (LeConte, 1851) 북미쌀거저리**(신칭)

Platydema angustus LeConte, 1851: 149. [Type locality: USA - California]

Cyanaeus opacus Champion, 1886: 156. [Type locality: Mexico - Northern Sonoran]

Common name. Larger black flour beetle.

Diagnosis. Adult (Fig. 1): Body elongate-oblong, almost parallel-sided, weakly convex dorsally, slightly glossy, reddish brown to blackish brown colour. Head widest at eyes from above. Eyes slightly incised by side margin of head and occupied the length of 3 or 4 facets laterally. Antennae gradually enlarged to apex. Pronotum transverse, strong microsculpture between punctures, about twice as broad as long, widest at middle, with lateral margin rounded from base to angulated anterior angles, with basal margin slightly bisinuate. Elytra with intervals flat; striae more regularly impressed. Elytral margin (pseudopleuron) obviously flattened and gradually narrowing towards tip. Meso- and metatibiae with a fine crenulate ridge on outer surface. Body length 5.0-6.0 mm.

Larva [Fig. 2; referred to Spilman (1986)]: Body elateriform; 12-15 mm long when fully grown; light brown in colour. Eye spot small and elongate. 2nd antennomere 1.6 times as long as

Fig. 1. Adult habitus of *Cynaeus angustus* (LeConte).

1st; 3rd antennomere 0.7 times as long as 1st; apical seta very long. Last abdominal tergum narrowed to a single acute apex and with a pair of short setae on each side near apex. Middle trochanter with short coarse seta apically on anterior surface near ventral border, and slightly less coarse setae at same location in posterior surface; middle femur with 2 coarse short setae on ventral surface and 1 long slender seta between, with 2 coarse short setae on distal half of posterior surface and a few slender setae on anterior surface; middle tibiotarsus with 3 coarse setae on ventral surface, 1 coarse seta at apex, 1 coarse seta at basal 1/3 on posterior surface, and a few slender setae on anterior surface; middle claw with 1 coarse seta ventrally. Hind leg same as middle, but coarse setae slightly longer.

Materials Examined. [GG] 1 adult, Hwaseong Rice Processing Complex (RPC), 6. VII. 2016; 1 adult, Yongin RPC, 12. VII. 2016; [JB] 1 adult, Iksan RPC, 20. XI. 2015; 1 larva, Iksan RPC, 6.VII. 2016; 7 adults, Namwon RPC, 6.VII. 2016; 2 adults, Gochang RPC, 18. VII. 2016; [JN] 3 adults, Naju RPC, 18. VII. 2016; [GB] 3 adults, Uiseong RPC, 21. VII. 2016; [GN] 25 adults, Ulsan RPC, 20.VII. 2016; 4 adults (1 ex. shortly after emergence), 1 larva, Jinju RPC, 12. XIII. 2015; 2 adults and 2 larvae, Jinju RPC, 16. XI. 2015; 2 larvae, Jinju RPC, 21.VII. 2016.

Distribution. Korea (new record - introduced), Germany (introduced; Reibnitz and Schawaller, 2006), Finland (introduced; Ferrer and Andersson, 2002), Sweden (introduced; Ferrer, 1995), Nearctic region.

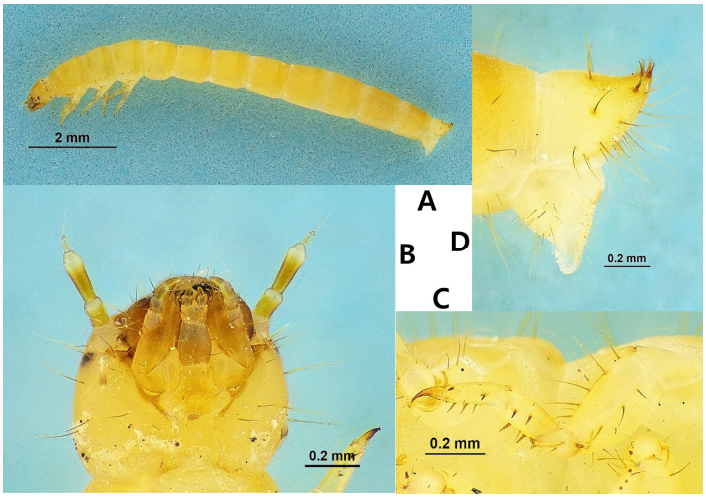

Fig. 2. Larva of *Cynaeus angustus* (LeConte). A: habitus (lateral aspect); B: head (ventral aspect); C: mesothoracic leg (posterior aspect); D: apex of abdomen (lateral aspect).

Table 1. The quarantine data concerning *Cynaeus angustus* (LeConte) intercepted in Korean ports of entry from 1996 to Oct., 2016 on PIS (Pest Information System) database operated by Animal and Plant Quarantine Agency, Korea

Year	No. interception	Imported items	Imported countries
2004	1	Alfalfa	USA
2007	1	Soybean meal	USA
2008	3	Cotton seed, Dried Distiller's Grains with Soluble	USA
2010	2	Cotton seed	USA
2011	1	Cotton seed	USA
2014	1	Corn stalk pellet	China
2015	4	Corn gluten, Cotton seed hull pellet	China
2016 (Jan. - Oct.)	2	Corn gluten	China
Total	15		

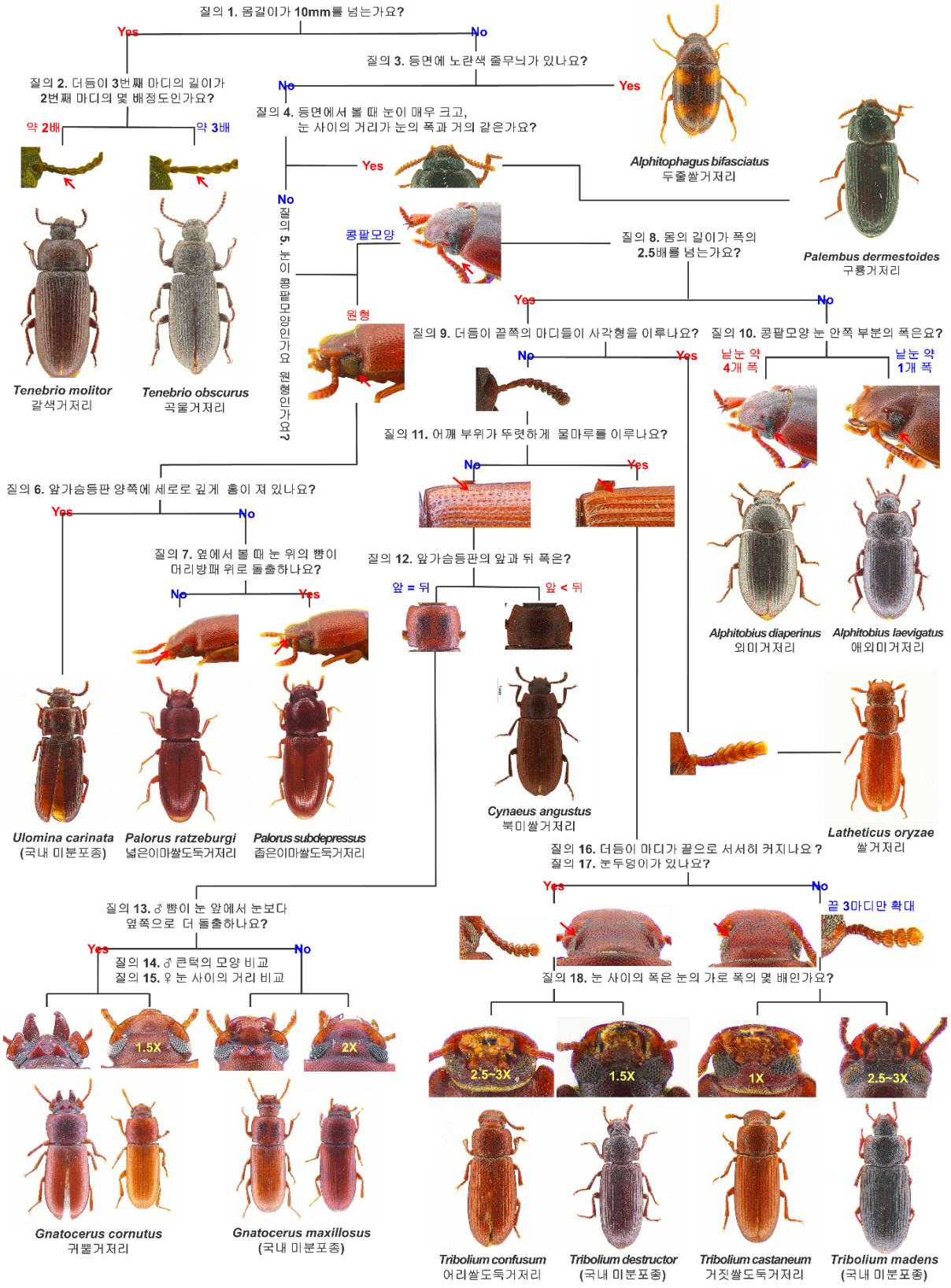

Fig. 3. A pictorial identification key to tenebrionid pests detected during quarantine in stored products in Korea, including four exotic species.

Remarks. Recently, this species has become a pest of stored grain, and its distribution was spread into northern Europe in the 1990s. In Korea, this species is probably introduced pest because it was collected various life stages from several sites throughout the year. We guess that it was established on the grain storage condition in Korea. Due to the data (Table 1) using the PIS database (Pest Information System operated by QIA, which are accumulated interception data from 1996 to present), this species was intercepted 15 times on by-products of grains from U.S.A and China after the 2000s. Because we have no information about whether this pest is distributed in China, it should be continually to need more careful inspection of Chinese goods.

A pictorial identification key to tenebrionid pests detected during quarantine in stored products in Korea

The interactive identification key (Fig. 3) has been made to easily identify tenebrionid pests of stored grains thorough matching pictures of specific characteristic corresponding to the query. This key is composed of 18 queries for 17 tenebrionid pests including 13 species distributed in Korea and 4 exotic species, and can be easily used by warehouse managers, entomological researchers and quarantine inspectors.

Acknowledgements

This research was carried out through “Inventory and monitoring of biological pathogens-carrying wildlife pests for safety management of agricultural products” (Project Code PJ01085904) supported by Rural Development Administration, South Korea.

Literature Cited

Champion, G.C., 1886. Tenebrionidae. Pp. 137-264. In: Biolologia Centrali-Americana. Insecta. Coleoptera Heteromera (part). Vol. IV, part 1. [1884-1893]. London: R.H. Porter, 572 pp., 23 pls.

Dunkel, F.V., Barak, A.V., Harein, P.K., 1982. Geographical Distribution of *Cynaeus angustus* (LeConte) (Coleoptera: Tenebrionidae) and its Association with Stored Products. Journal of Biogeography 9(4), 345-352.

Ferrer, J., 1995. A key to the flour beetles of the genus *Tribolium* MacLeay in Sweden (Coleoptera, Tenebrionidae), with distributional notes. Ent. Tidskr. 116(3), 123-126.

Ferrer, J., Andersson, B., 2002. Species of *Cynaeus* found in Sweden and Finland, with a note on the identity between *Cynaeus depressus* (Horn, 1870) and *Cynaeus opacus* (Champion, 1886) syn. conf. (Coleoptera, Tenebrionidae, Diaperini). Entomofauna Zeitschrift für Entomologie 23(12), 145-148.

Horn, G.H., 1870. Revision of the Tenebrionidae of America, north of Mexico. Transactions of the American Philosophical Society, New Series 14, 253-404.

Latreille, P.A., 1802. Histoire naturelle, générale et particulière des crustacés et des insectes. Ouvrage faisant suite aux oeuvres de Leclerc de Buffon, et partie du Cours complet d’Histoire naturelle rédigé par C.S. Sonnini, membre de plusieurs Sociétés savantes. Tome troisième. Paris: F. Dufart, x + 467 + [1] pp.

LeConte, J.L., 1851. Descriptions of new species of Coleoptera from California. Annals of the Lyceum of Natural History, New York 5, 125-216.

LeConte, J.L., 1862. Classification of the Coleoptera of North America. Smithsonian Miscellaneous Collections 3, 209-286.

Reibnitz, J., Schawaller, W., 2006. *Cynaeus angustus* (Leconte, 1851) (Coleoptera: Tenebrionidae), eine neue Adventivart in Mitteleuropa? Mitt. ent. V. Stuttgart 41, 153-154.

Spilman, T.J., 1986. Identification of Larvae and Pupae of the Larger Grain Borer, *Prostephanus truncatus* (Coleoptera, Bostrichidae), and the Larger Black Flour Beetle, *Cynaeus angustus* (Coleoptera, Tenebrionidae). Proc. Third International Working Conference Stored Product Entomol. Oct. 23-28.1983. Kansas State University. Manhattan, Kansas, 44-53.