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Taxonomic Study of the Corn Stem Borer in Korea with Allied Species of the Genus Ostrinia (Lep. ; Pyralidae)

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韓國産 조명나방에 대한 分類學的 고찰

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Abstract

The European corn borer, *Ostrinia nubilalis* (Hübner) has been known as only one species of genus *Ostrinia* in Korea. After Mutuura and Munroe (1970) revised the genus *Ostrinia*, the name of the corn stem borer in Korea has been very confused. The critical examination of the external morphology and the genitalia revealed that species of the genus *Ostrinia* occurring in Korea are *O. furnacalis* (Guenée, *O. scapulalis* (Walker), *O. zaguliaevi* Mut. & Mun. and *O. zealis* (Guenée)

Introduction

The European corn borer, *Ostrinia nubilalis* (Hübner), has long been known as a serious pest of corn in Europe and many other countries. Mutuura and Munroe (1970) revealed that *Ostrinia nubilalis* (Hübner), commonly known as European corn borer, does not occurr in Eastern Asia in the study of "The taxonomy and distribution of the European corn borer and allied species: Genus *Ostrinia*". Its distribution is limited to Europe, North West Africa, North America and a part of Western Asia. They recognized 20 species and 24 additional subspecies as belonging to the genus *Ostrinia*. From the results of examination of genitalia and external morphology by writer, it was found 4 species occur in Korea. But there is the possibility there are more species since additional several species occur in adjacent areas: Manchuria, Siberia and Japan. Among these species, *O. furnacalis* (Guenée) is the dominant species in corn and sorghum. The larva of *O. scapulalis* was also collected from corn stems and other hosts. But the hosts of *O. zaguliaevi* Mut. & Mun. and *O. zealis* (Guenée) have not been identified yet in Korea. At present, the species boring the stem of ginger, *Zingiber officinale* Roscoe, has been treated as *O. furnacalis* (Guenée). It is not known whether it is the same species or not because of the morphological and biological characters.

The standard Korean name for the corn stem borer is Jomyung-nabang. It has been misidentified in Korean literature as *Pyrausta nubilalis* Hübner. The earliest reliable record of corn stem borer as an economic important pest in Korea was by Okamoto (1928) in "The insect pests in Korea".

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Materials and Methods

Specimens studied were collected in the adult stage throughout the country, but some were collected in larval stage on various host plants and reared in the laboratory in order to study their biology. The external morphology and the character of the genitalia were critically examined and illustrated.

In studying the genitalia:

1) The abdomen was removed from the body by severing from below with a sharp needle, or by lifting upwards with the shaft of the needle, and heated or slightly boiled in 10% potassium hydroxid for 5-10 minutes.
2) The abdomen was transfered to a small watch glass of 50% ethyl alcohol for cleaning.
3) The abdomen was stained in chlorazol black for 2-3 minutes, and remaining body contents and excess stain teased out.
4) The abdomen was transfered to 70-80 %ethyl alcohol and descaled by abrading with a pointed feather or fine flexible dissecting needle. The genitalia were pulled out from the abdomen. In the male, the aedeagus was separated from the main genitalia.
5) The genitalia was transfered to a clean dish of 99% ethyl alcohol and next Euparal Essence.
6) The genitalia was mounted in Euparal.

Result

The examination of the external morphology and characters of genitalia confirmed that the corn stem borer in Korea is *O. furnacalis* (Guenee). Also *O. scapulalis* (Walker) is a stem borer of corn and *O. zaguliaevi* Mut. & Mun. occurs in Korea.

Ostrinia furnacalis (Guenée, 1854)

Botys furnacalis Guen'ee, 1854. Species general des lepidopteres 1854:332.

Botys damoalis Walker, 1895. List spec. lep. ins. coll BM.-parts 17-18 : 656.

Botys salentalis Snellen, 1880. Tijd. Ent. 23 : 207.

Spilodes kozukalis Matsumura, 1897. Gaichu kujo Zensho 1897 : 237.

Pyrausta furnacalis, Hampson, 1899. Pro. zool. Soc. Lond. 1899 : 259.

Pyrausta polygoni Dyar, 1905. Pro. U.S. Nat. Mus. 28 : 955.

Pyrausta vastatrix Schultze, 1908. Phill. Jorn. Sci. 3 : 35.

Ostrinia furnacalis Mut. & Mun., 1970. Mem. Ent. Soc. Can. 71 : 33

External characters:

Male. 23-28mm. Forewing ground colour pale brown with palefuscous suffusion; Costa straight to middle, then somewhat curved to apex; labial palpus correct, exceeding head by less than one-half of length of vertex; proboscis well developed. Thorax and abdomen with upperside pale brown, underside whitish. Leggs whitish, anterior part of foreleg brown; Middle tibia (Fig.4a) of male slender, without hair pencil and groove on mesal surface. Hindwing upper surface pale yellow with subterminal fuscous bands on median area; Fringe pale yellow.

Female. 24-35mm. Similar to male, but the colour is much paler.

Genitalia:

Male. (Fig. 1) Uncus trilobed; middle lobe produced; lateral lobe not broadened ventrad, rather slender. (Fig. 3a). Tegumen somewhat narrowed distally. Transtilla broad and produced ventral with medial port narrow and not sclerotized. Juxta v-shaped, sclerites, joined together by a ventral connecting piece. Valva long; costal margin slighty concave near base clasper with many scale-like spines, but these fewer than in *O.scapulalis*. Sacculus long with three or four large spines. Aedeagus stort, 4 or 5 times as long as wide; cornutus large with rounded end.

Female. (Fig. 2) Papillae anales with long dense setae; apophysis posterior weak, anterior margin ventrad of apophysis well sclerotized; Posterior lip of ostium bursae with a pair of large triangular sclerites; ductus bursae cylindrically sclerotized for a short distance, then long, corpus bursae membranous with strong, large rhomboidal signum.

Life history:

The earliest study of the life history of this species was by Okamoto (1928) under the name *Pyrausta nubilalis* (Hübner). Y.I. Lee (1968) also studied the life history and control measures under the name *Ostrinia nubilalis* (Hübner). 2 generations a year were recorded (Y.I. Lee 1968), the first period of moth activity is from late May to mid July and the second from late July to early August. The eggs are deposited in masses on the leafsheath, or under surface of leaf. One mass contains about 30-40 eggs (Okamoto, 1928). The newly laid egg is creamy white, but gradually changes to yellowish white. The hatched larvae is pale yellowish green with fuscous head, the colour of matured larvae changes to pinkish purple. The larvae bores into the stems or ears of the host plant 1-2 days after hatching. Pupation takes place in the stem of plant. Overwinters as the larval stage in Korea.

Host plants:

O. furnacalis (Guen'ee) was reported as a serious pest of maize millet in Korea. Writer (1972-1974) reared this species from *Zea mays*, *Sorghum bicolor*, *Glycine max*, *Phaseolus angularis* and *Arachis hypogaea*. There are records from Japan of rearing from *Polygonum tinctorium*, *Setaria italica*, *Panicum miliaceum*, *Zingiber officinalis*. In Thailand, this species was reared from *Zea mays*, *Sorghum vulgare*, *Hibiscus canabinus* and *Vigna sinensis*.

Distribution:

Korea, Japan, U.S.S.R., Manchuria, China, Taiwan, India, Sri Lanka, Malaysia, Singapore, Sumatra, Java, Borneo, Philippines, Moluccas, Timor, New Guinea, New Britain, Solomon Isl., Australia and Micronesia (Mutuura and Munroe, 1970).

In Korea, this species is quite common in corn, sorghum or soybean fields throughout the country. This species was frist recorded from Weonsan (Leech coll. 1886), and *Decheon.

Ostrinia scapulalis (Walker, 1859)

Botys scapulalis Walker, 1859 : 157.

Pyrausta nubilalis; Marumo, 1952 : 156. in part, fig. 1530. err. det.

Micractis varialis; Mutuura, 1954 : 20. in part, pl. 8, err. det.

Micractis varialis; Inoue, 1955 : 189, in part, err. det.

Ostrinia scapulalis; Mutuura & Munroe, 1966: 6, 1970: 44

External characters:

Male. 24-29mm. Forewing ground colour above light yellow, broadly suffused with fuscous. Antemedial line fuscous; Area between ante-and post-medial lines brownish fuscous; Beyond postmedial line a clear yellowish band; subterminal area broadly fuscous. Legs whitish, anterior part of foreleg fuscous; Middle tibia (Fig. 4b) of male very thick, with medial hair pencil and groove, Hindwing upper surface tinged with fuscous. Pale patch yellowish. Fringe pale brownish fuscous, near tornus yellowish, terminal line darker.

Female. 26-31mm. Like thoes of male, but wing ground colour paler than male.

Genitalia:

Male. Generally similar to that of *O. furnacalis* without constant difference, but middle lobe of uncus strongly produced; lateral lobe broadened ventrad (Fig. 36) and the number of spines on the sacculus averaging less than in *O. furnacalis*.

Female. Similar to that of *O. furnacalis*, but the ventral part of eighth tergite less sclerotized than *O. furnacalis*,

Life history:

The larvae of *O. scapulalis* (Walker) is found in *Glycine max* and *Zea mays*. Mutuura and Munroe (1970) reported this larva lives on *Petasites japonicus*, *Xanthium strumarium*, *Vigna sinensis*, *Phaseolus chrysantus* and *Glycine soja*.

Distribution:

Korea, Japan, Eastern-China, Eastern-Europe, North-India. This widely occurring species was divided into six subspecies by Mutuura and Munroe (1970). The Korean specimen examined by them was from Weonsan, (Leech coll. 1886), North Korea and belonged to subspecies, *O. scapulalis perpapacifica* Mut. & Mun.

Ostrinia zaguliaevi Mutuura and Munroe, 1970

*The correct present name of Daisen and Gensan (Mutuura & Murroe 1970; 35) are Decheon, Korea and Weonsan, North Korea.

Ostrinia varialis; Auctorum, in part, err. det.

Ostrinia zaguliaevi Mut. Mun., 1970. Mem.Ent. Soc. Can. 71 : 48

External characters:

Male. 30-35 mm. Forewing ground colour yellowish. broadly suffused with fuscous. Beyond antemidial line a yellowish patch. Area between ante-and post-medial lines stongly fuscous. Beyond postmedial line a distinct yellowish band between postmedial line and broadly fuscous subterminal line. Fringe yellowish. The middle tibia of the male is very thick, with strong hair pencil and groove. Hindwing with a large clear-yellowish patch between postemedial and subterminal fuscous area.

Genitalla:

Male. Uncus broader, median lobe not so produced. Sacculus with two or three spines, usually simple, and usually well separated by a spineless incurvature. But sometimes a large spine at distal corner with together small spines.

Female. Similar to *O. scapulalis*.

Life history: Not known.

Distribution:

Korea, Eastern Siberia, Japan, Ryukyu Islands, Eastern China.

In Korea, several specimens were deposited without locality, but two specimens was collected from Sohuksan Island (Ⅵ. 1974 Choi coll.) which is located far off the south-west coast of the Korean peninsula.

Remarks:

According to Mutuura amd Munore (1970), five subspecies of *O. zaguliaevi* were recognized. However I wonder if this Korean species would be good subspecies of its geographical loction.

Ostrinia zealis (Guenée 1894)

Botys zealis Guenee, 1854 : 332

Botys varialis Bremer, 1864 : 69

Pyrausta holoxuthalis Hampson, 1913 : 25

Ostrinia varialis; Mutuura and Munroe 1966 :

This species was recorded by Mutuura and Munroe (1970 : 52) as subspecies; *O. zealis lipatrialis* Mut & Mun. Three females from Korea; no record of locality and date, were included in their examined materials, but I haven't found this species yet in Korea.

Distribution:

Korea, Far-Eastern U.S.S.R., Japan, China, N-India.

摘　　要

옥수수. 조등의 대해충으로서 세계적으로 널리 알려져온 조명나방은 1970년 카나다의 Mutuura & Munroe에 의해 20 종으로 재분류 발표되었다. 그에 의하면 조명나방 ; European corn borer *Ostrinia nubilalis* (Hübner)은 Europe 지역에만 분포되는 종으로 우리나라에서 발생되는 종은 그것과 다른 종임이 분명해 졌으나 이에 대한 확실한 종명이 현제까지 밝혀지지 않았었다.

필자는 전국(남한)에서 채집된 표본들을 대상으로 분류동정해본 결과 한국에 분포하는 Ostrinia 속의 종으로는 *O. furnacalis*(Guenée), *O. scapulalis*(Walker), *O. zaguliaevi* Mut. & Mun. 등 3종이 밝혀졌으며 Mutuura & Munroe에 의해 한국의 분포가 기록된 *O. zealis*(Guenée)는 발견되지 않았다.

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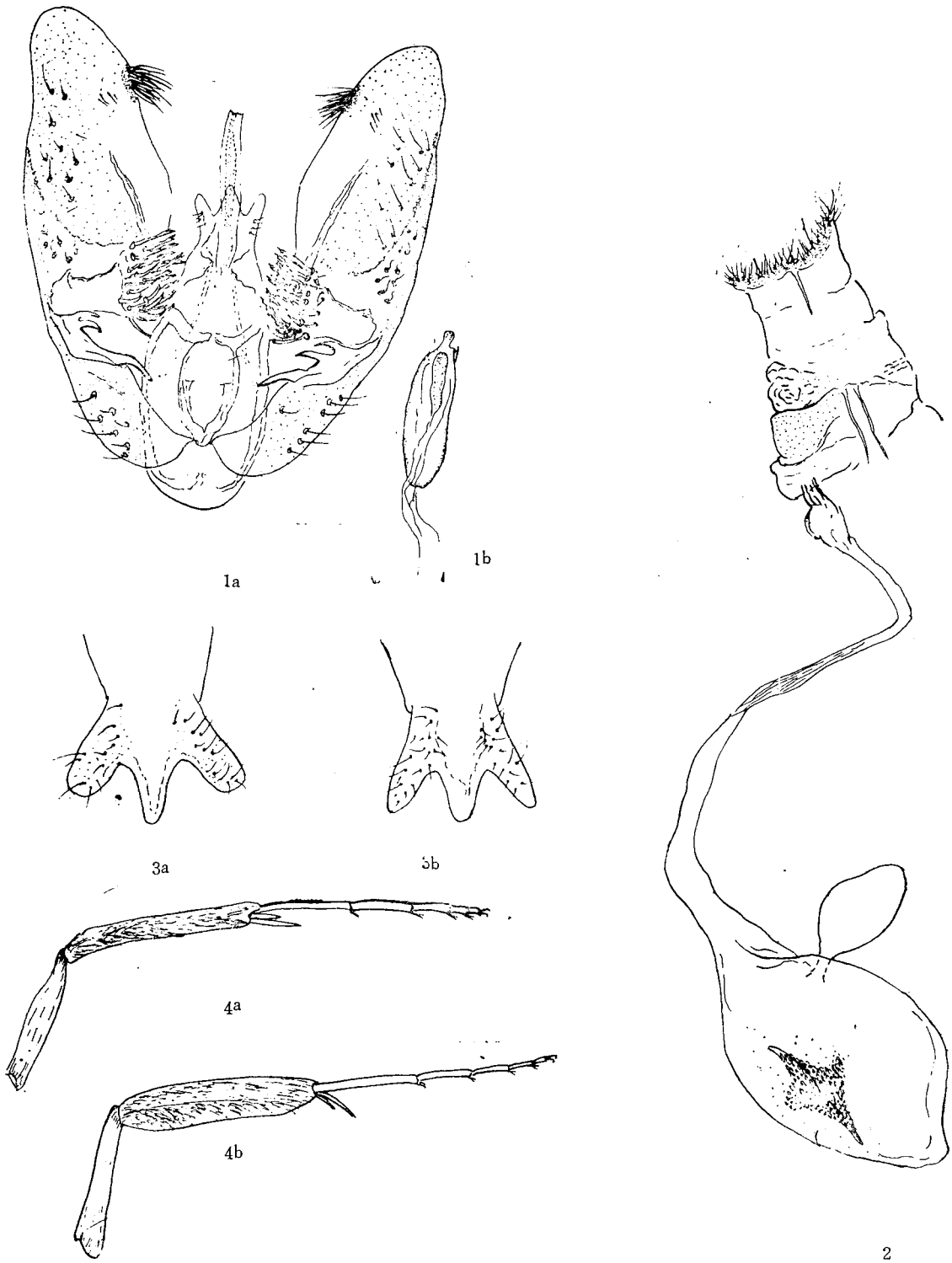

Fig. 1-4, la;male genitalia of *O. furnacalis*, lb;aedeagus
2; female genitalia of *O. furnacalis*, 3a; uncus of *O. furnacalis*
3b; uncus of *O. scapula* iis, 4a;middle leg of *O. furnacalis*
4b; middle leg of *O. scapulais*