

An Investigation of the Major Dipteran Pests on the Oyster Mushroom (*Pleurotus ostreatus*) in Korea

한국 느타리버섯 재배지에 발생하는 주요 파리류 해충에 관한 연구

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Abstract - This study was carried out to investigate the seasonal and regional occurrence and development of major pest flies on the oyster mushroom. The survey was performed in the oyster mushroom houses located at 16 places, selected randomly throughout South Korea from July to August and from October to November in 1997. The six species of flies were found including three pest species from Sciaridae, Cecidomyiidae and Scatopsidae flies. The pattern of occurrence was somewhat dissimilar depending on the survey periods and regions. Among these, the most serious and abundant pest, *Lycoriella mali* (Diptera: Sciaridae), occurred year around at the regions surveyed. In this study, *Coboldia fuscipes* (Diptera: Scatopsidae) was confirmed as a mushroom pest. Its larvae damaged the mycelium, and occurred usually in summer from July to August. The paedogenetic *Mycophila* sp. (Diptera: Cecidomyiidae) was found abundantly on the oyster mushroom bed, and caused a severe damage in fall from October to November.

Key Words - Oyster mushroom, *Lycoriella mali*, *Coboldia fuscipes*, *Mycophila* sp.

초 록 - 본 연구는 국내 느타리버섯 재배지에 발생하는 주요 버섯파리류를 조사하고, 이의 지역별·시기별 발생양상을 조사하였다. 버섯파리류 조사는 1997년 여름버섯재배기인 7~8월과 가을버섯재배기인 10~11월의 2회에 걸쳐 전국 16곳의 주요 느타리버섯 재배지에서 실시하였다. 그 결과, 국내 느타리버섯 재배지에 발생하여 버섯에 피해를 가하는 버섯파리류로서 주요 3종인 Sciaridae, Cecidomyiidae 및 Scatopsidae 파리류를 포함하여 6종이 조사되었으며, 지역 및 시기에 따라 다소 차이가 있었다. 그 중 *Lycoriella mali* (Diptera: Sciaridae)는 전국적으로 연중 발생하여 가장 문제시 되는 해충으로 조사되었다. 또 *Coboldia fuscipes* (Diptera: Scatopsidae)는 유충이 버섯 균사를 가해하였으며, 주로 7~8월에 대량 발생한 후 가을에는 그 발생량이 감소하였다. 또한 유생 생식을 하는 *Mycophila* sp. (Diptera: Cecidomyiidae)에 의한 균상 및 느타리버섯의 오염이 전국적으로 관찰되었는데, 특히 10~11월에 대량발생과 함께 그 피해가 극심하였다.

검색어 - 느타리버섯, *Lycoriella mali*, *Coboldia fuscipes*, *Mycophila* sp.

Introduction

Since artificial mushroom culture started from 1972 in

Korea, the various mushrooms have been cultivated annually. The consumption of mushroom nowadays is continuously increasing owing to better national income and the improvement of dietary habit (Kim, 1990;

Chang, 1993). The edible mushrooms, such as champignon (*Agaricus bisporu*), oyster (*Pleurotus ostreatus*), p'yogo (*Lentinus edodes*) and velvet stem (*Flammulina velutipes*) have been most commonly cultured in Korea. Among them, the oyster mushroom is known to be very productive and is consumed in large quantity in Korea (Rural Development Administration, 1996). However, pests including mushroom flies cause a serious damage due to continuous culture of the mushroom all year round (Kim, 1990).

Adults of mushroom fly are tempted into mushroom houses by smell peculiar to mycelium and then lay eggs on mushroom bed. After a few days, developing larvae feed on the mycelium and fruitbody of the mushroom, and, at the same time, they transport pests, such as nematode, mite and mold spores (Clift, 1979; Kinrus, 1978; Wetzell, 1981; Clancy, 1981; Kim and Hwang, 1996).

Mushroom flies, such as Sciaridae, Phoridae and Cecidomyiidae have been reported to be the major pests on the mushroom cultured in Korea, and they cause severe damage to the oyster and champignon mushrooms. Recently, Kim and Hwang (1996) reported that *Lycoriella* sp. causes severe damage in the oyster mushroom house in the southern region of Korea, but its study only covers a limited region. Furthermore, developmental characteristics of the mushroom pest flies are poorly understood yet. Therefore, this study was conducted to elucidate the occurrence and developmental process of the major pest flies sampled from several regions over different periods.

Materials and Methods

Occurrence of the mushroom pest flies was surveyed in the oyster mushroom houses from 16 regions selected randomly throughout Korea from July to August and from October to November in 1997. The regions surveyed are as follows: Noksan (Kangse-Gu Pusan), Ch'ealma (Kijang-Gun Pusan), Bangu (Chung-Gu Ulsan), Saengbilyang (Sanch'eong-Gun Kyöngnam), Euireong (Euireong-Gun Kyöngnam), Jeongdong (Sach'eon-Shi Kyöngnam), Dongmyeon (Chilgok-Gun Kyöngbuk), Euisoung (Euisoung-Gun Kyöngbuk), Sambuk (Mungyong-Shi Kyöngbuk), Ungchi (Posoung-Gun Chönnam), Guam (Hwasun-Gun Chönnam), Sangjeon and Jeongcheon (Chinan-Gun Chönbuk), Janggi and Yeonggi (Kongju-Shi Ch'ungnam), Koesan (Koesan-Gun Ch'ungbuk), Okcheon (Okcheon-Gun Ch'ungbuk) and Jeongnam (Hwa-

soung-Gun Kyönggi).

Identification of the species utilized in this study was performed by sending samples collected from various localities in Korea to Dr. Mitsuhiro Sasagawa, a faculty of Kyoto Prefectural University.

Occurrence and density of the pest flies over different time and regions were estimated by collecting adult flies with aspirator from the same size of mushroom bed (1.5 × 1.5 m) at an entry in mushroom houses. In addition, larvae and pupae in mushroom beds were separated from 100 g of mushroom beds by using Berlese funnel (Berry, 1981).

The pests collected were reared in plastic petridish (9 × 1.5 cm) at 21 ± 1°C in a growth chamber with 55 ± 5% of relative humidity. Spawns of a mushroom, *F. velutipes*, were grown on Potato Dextrose Agar medium (Difco), and were supplied as a diet (Choi *et al.*, 1997). The pests were observed under the stereo microscope (× 60, Zeiss Co.).

Results and Discussion

Six species of mushroom flies were investigated in the oyster mushroom house in Korea. Among them, *Lycoriella mali* (Diptera: Sciaridae), *Coboldia fuscipes* (Diptera: Scatopsidae) and *Mycophila* sp. (Diptera: Cecidomyiidae) have occurred in large numbers and they were regarded as the major pest flies on the oyster mushroom in Korea.

L. mali investigated in this study was previously reported for developmental characteristics and life cycle (Choi *et al.*, 1997) and identification of this species was performed by Dr. Mitsuhiro Sasagawa at Kyoto Prefectural University. Lee *et al.* (1998), however, doubted that the species used in Choi *et al.* (1997) may not be the named species. Instead, they argued that the investigated species could be *Bradysia* sp. based on the identification performed by The Natural History Museum. We, however, think that this study and Lee *et al.*'s study are not in the position of the argument on this issue. On the other hand, we think that a decisive taxonomic conclusion can be generated after further investigation on this issue are made (e.g., cross examination of the species). For this reason, we are currently investigating the genetic identity of *L. mali* using a molecular marker.

L. mali was abundantly found in all regions (Fig. 1). The larvae caused severe damage by feeding on the mycelium and making tunnels through the mushroom

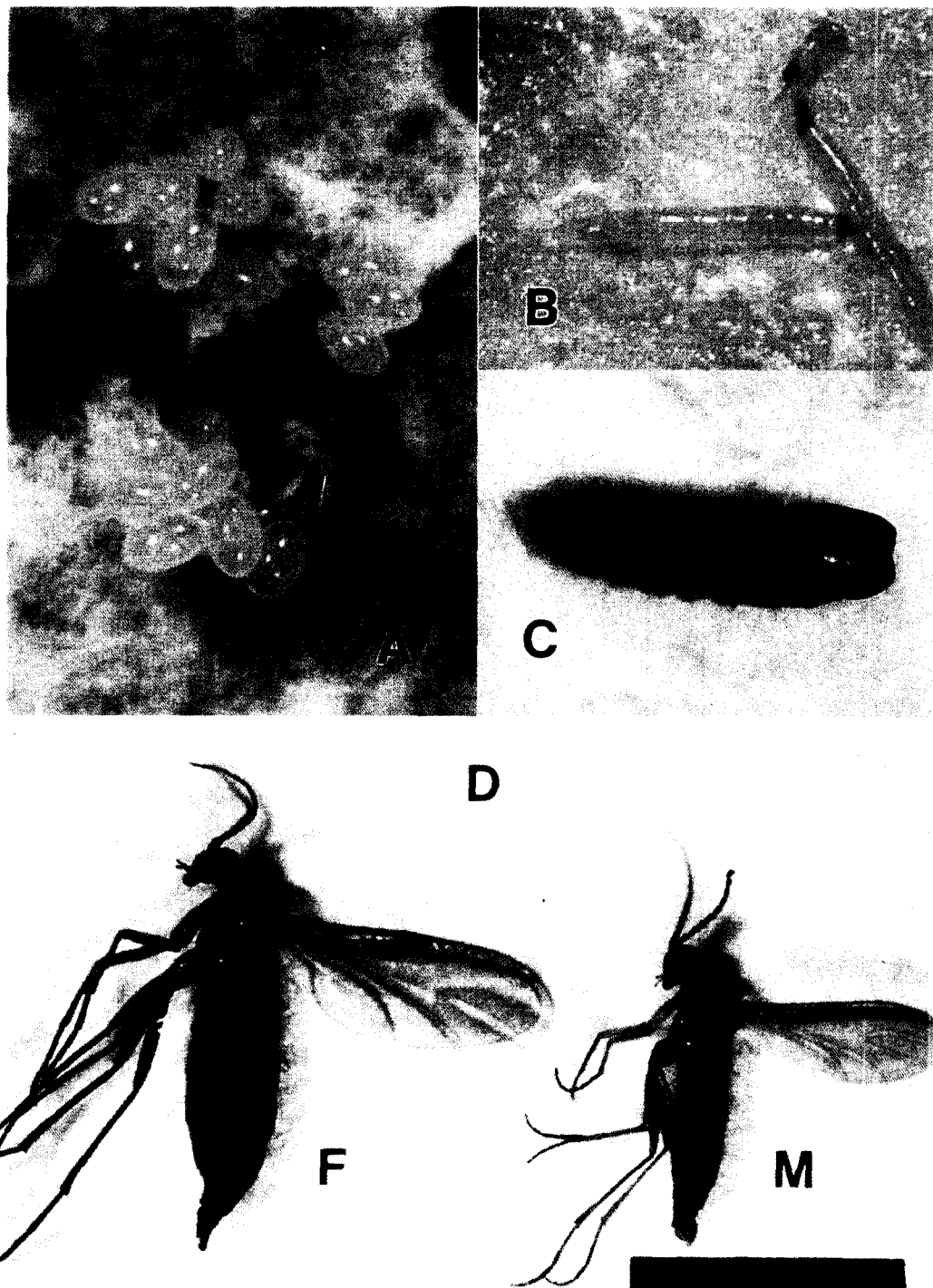


Fig. 1. *L. mali*. A: Eggs, B: Larvae, C: Pupa, D: Male (M) and female (F) of adult.

fruitbody. Choi *et al.* (1997) reported that *Lycoriella* sp. is a serious pest on the oyster mushroom because of its relatively short lifespan, 28.5 day at 21°C and egg oviposition ranging from 130 to 150. Also, Kim and Hwang (1996) reported that *Lycoriella* sp. is a most serious pest

on the oyster mushroom, and causes a severe damage in southern regions of Korea.

Among these pest flies, *C. fuscipes* is reported for the first time as a mushroom pest in Korea. The developmental process of *C. fuscipes* is shown in Fig. 2. The

larva is known to feed on all kinds of decaying materials, such as cannery waste and mammal excrements (Shiraki, 1981). In this study, we found that *C. fuscipes* larvae feed on the mycelium of the oyster mushroom. While adult did not feed on mycelium, it preferred to walk on the surface of spawn bed.

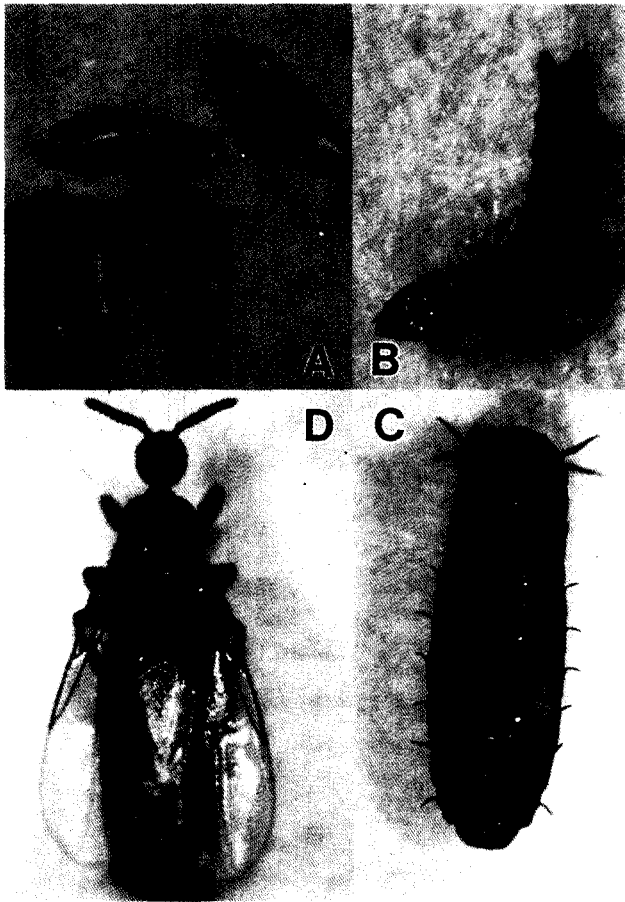


Fig. 2. *C. fuscipes*. A: Eggs, B: Larva, C: Pupa, D: Adult.

As shown in Fig. 3, *Mycophila* sp. was found to be one of the major mushroom flies on the oyster mushroom in Korea. The paedogenetic *Mycophila* sp. was also observed from barnyard manure to mushroom fruitbody (Hussey *et al.*, 1960; Chung and snetinger, 1968). In general, this species is quite small in size, with wing span of 0.9 mm, and the reproduction of larval paedogenesis was relatively high (Sanui and Yukawa, 1986). Larvae of *Mycophila* sp. caused a severe damage in the stripe and lamella of the mushroom as well as in the mushroom beds.

Table 1. describes the occurrence of the major oyster mushroom pest flies such as *L. mali*, *C. fuscipes* and *Mycophila* sp. during the survey periods from various regions. *L. mali* was abundantly found throughout the survey periods and regions and was the most dominant pest fly on the oyster mushroom in Korea.

The previous studies also reported that *Lycoriella* sp. were found to be abundant and caused serious damage (Choi *et al.*, 1997; Kim and Hwang, 1996). Our result is consistent with previous report that the occurrence of *Lycoriella* sp. is high in spring as well as in fall (Kim and Hwang, 1996). *C. fuscipes* was also widely occurred in all survey regions. However, the occurrence of *C. fuscipes* in summer was apparently higher than that in fall. On the other hand, the occurrence of *Mycophila* sp. was obviously higher in fall than that in summer. In this survey, however, there was no strong relationships between high incidence and region.

In contrast, other three pest flies were also observed in small quantity on the oyster mushroom (Fig. 4). Larvae collected from the damaged oyster mushroom were reared in the growth chamber with *F. velutipes* as a diet and the adults were emerged from the larvae. However, the three pest flies are not identified yet.

Table 1. The occurrence of major dipteran pests on the oyster mushroom over different periods and various regions in Korea

Region (Province)	Jul. ~ Aug.			Oct. ~ Nov.		
	<i>L. mali</i>	<i>C. fuscipes</i>	<i>Mycophila</i> sp.	<i>L. mali</i>	<i>C. fuscipes</i>	<i>Mycophila</i> sp.
Kyönggi	++	+		+	+	
Kyöngnam	++	++	+	+++	+	+++
Kyöngbuk	+++	+		+		++++
Ch'ungnam	++	+++		++	+	++
Ch'ungbuk	++	+		+		++
Chönnam	++++		+++	++		+++
Chönbuk	++	++++		++	++	++

※ Frequency of occurrence: +; 1-50, ++; 50-100, +++; 100-250, ++++; above 250 flies.

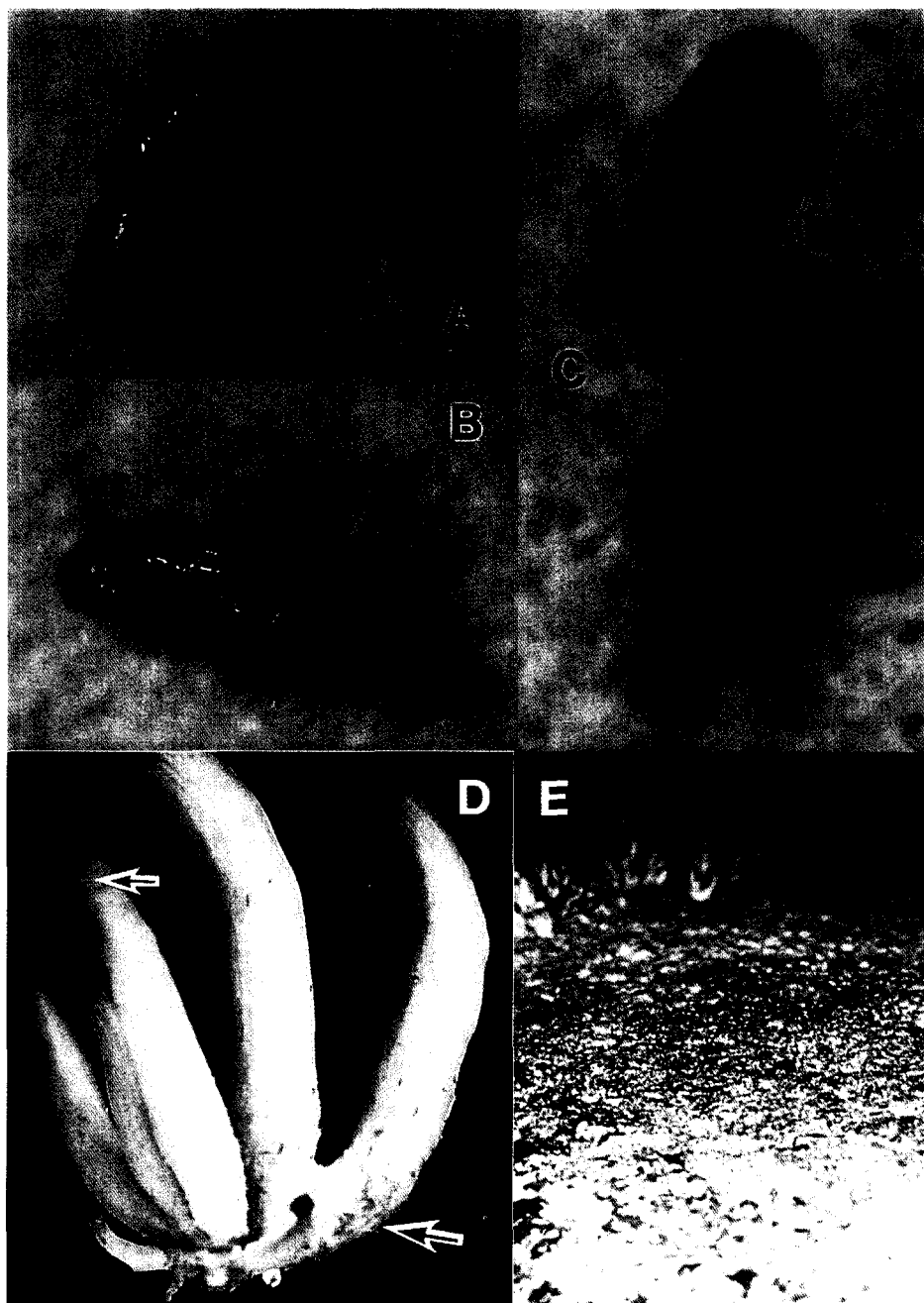


Fig. 3. *Mycophila* sp. (Diptera: Cecidomyiidae). A: Larva, B: Pupa, C: adult, D: The oyster mushroom damaged. *Mycophila* sp. larvae on the stripe and lamella of mushroom are represented by arrows. E: The mushroom bed damaged by *Mycophila* sp. larvae.

In conclusion, this survey has shown that six species of mushroom flies occur in the oyster mushroom house in Korea. Among them, *L. mali*, *C. fuscipes* and *Mycophila* sp. can be considered to be the major pest flies on the oyster mushroom in Korea. Especially, *L. mali* occurred most abundantly in the oyster mushroom houses annu-

ally. In this study, *C. fuscipes* was also confirmed as a mushroom pest fly.

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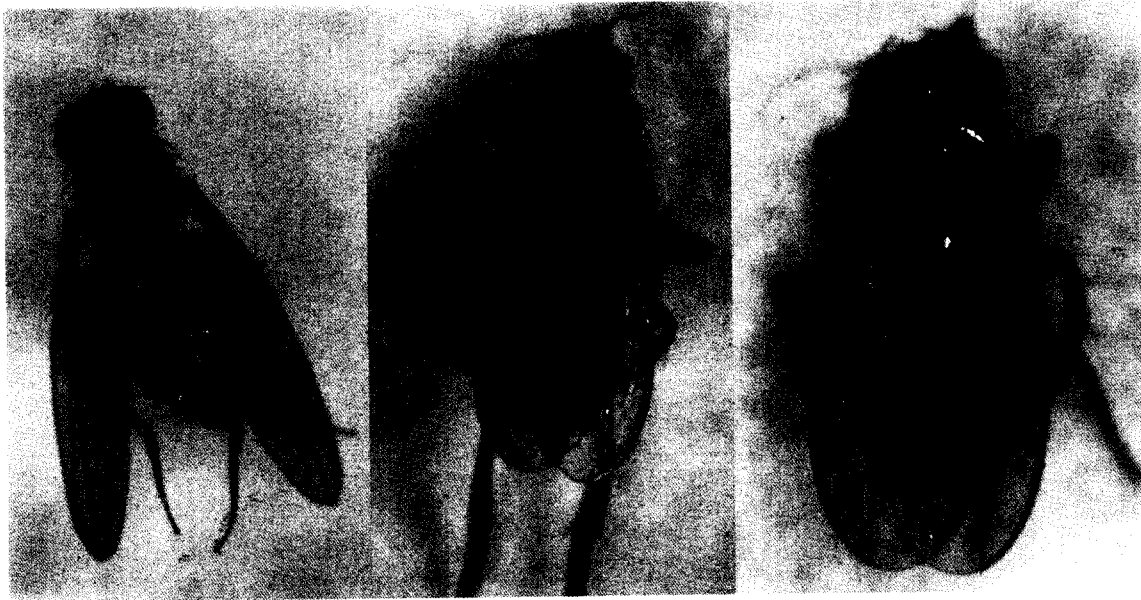


Fig. 4. Three mushroom pest flies collected from the oyster mushroom damaged. Three flies are not identified yet.

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