

## Survey and identification of insect pests of oyster mushroom (*Pleurotus ostreatus*) cultures in central province of Sri Lanka

R. Gnaneswaran<sup>1</sup> and H. N. P. Wijayagunasekara<sup>2\*</sup>

<sup>1</sup>Department of Zoology, Faculty of Science, University of Jaffna, Jaffna, Sri Lanka.

<sup>2</sup>Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka.

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### ABSTRACT

Mushroom cultivation in Sri Lanka was established as a profitable small industry only after 1986. The continuous growing of mushrooms on a large scale in localized areas had led to various pest infestations. The present study was conducted to investigate the pest spectrum of oyster mushroom [*Pleurotus ostreatus* (Jacq. fr.)] with the aim of recognizing the key pests in commercial mushroom cultivation in Sri Lanka. Twenty-two mushroom houses from Central Province of Sri Lanka were selected for the study. Nine species of insects were found to be associated with mushroom cultures. Among them only three species namely *Drosophila funebris* F., *Bradysia papuera* Tuomikoski and *Cyllodes bifacies* (Walker) were found to cause some damage. *Cyllodes bifacies* was distributed in about 96 per cent of the farms visited causing serious damage up to 82 per cent. It was identified as the key pest of mushrooms grown in the Central Province. This is the first instance that *C. bifacies* has been found on cultivated mushrooms. Although *Drosophila funebris* is considered as an occasional insect pest on mushroom it was identified as a major pest. *Bradysia paupera* was found to be a minor pest in this area.

**Key words:** *Bradysia paupera*, *Cyllodes bifacies*, *Drosophila funebris*, insect pest, *Mycodrosophila* sp., *Pleurotus ostreatus*.

### INTRODUCTION

Mushroom cultivation was not commercially exploited until 1986 in Sri Lanka owing to the non-availability of required technology. At present there are a considerable number of commercial mushroom cultivators in the country who concentrate mainly on oyster mushroom (*Pleurotus ostreatus*).

At the initial phase of development of this industry, there were no major pest problems. However wide expansion of the production of mushroom during the recent past has led to the development of new problems. One of the main constraints in commercialization of the mushroom production was the damage caused by insect pests (Johal and Disney 1994). In 1993, mushroom cultivations were adversely affected by insect pests leading to complete closure of some farms. However, there are no reports on the systematic study of these pests up to date. Therefore, this study was conducted to investigate the insect pest spectrum of oyster mushroom grown in the Central Province of Sri Lanka so as to determine the abundance of these insects and the damage to the crop.

### MATERIALS AND METHODS

Twenty-two mushroom farms were randomly selected to represent the whole Central Province of Sri Lanka. This sample contained large, medium and small -scale farms, which handle >500, 150-500 and <150 compost bags at a time, respectively. All the farms were monitored by making monthly visits to each of them over a period of one year (1995). An appropriate sampling programme was developed using the guidelines suggested by the Entomology Society of Canada (1994), and was used during the study.

Water filled pit traps (plastic petridishes) were used to obtain a relative estimate of the adult fly population. These traps were changed at each visit. A plate smeared with a layer of coconut oil as a sticky trap was used to take samples of flies and small beetles. A sample of compost and fruiting bodies were collected at monthly intervals from the farmers. The insects and their post embryonic stages present were separated using berlese funnel method. Marketed samples of fruiting bodies were also purchased and brought to the laboratory for the detection of any insects present in such samples. All insect species except one were photographed and their important parts sketched in order to identify

\* Corresponding author



them as far as possible. Identification was done by comparing these features with the published literature and taxonomic keys. The *Cyllodes bifacies*, which was found as the key insect pest of mushroom in the Central Province of Sri Lanka was identified with the help of International Institute of Entomology, CAB International, London, UK (Gnaneswaran and Wijayagunasekara 1996).

**RESULTS AND DISCUSSION**

During the present study nine species of insects were found to be regularly associated with oyster mushroom cultures. Nevertheless, relatively very few species appeared to be insect pests of cultivated mushrooms in the central province of Sri Lanka (Table 1).

**Drosophilid flies:** Two species of flies, *Drosophila funebris* and *Mycodrosophila* sp. were found in mushroom farms in large numbers and their distribution among mushroom houses were 68% and 72% respectively (Table 2). Identification of *Drosophila funebris* was based on the presence of two pairs of dorso-central bristles on thorax, seven rows of acrostical bristles on legs, arista of antenna possess three rays on lower side in addition to terminal fork and the length of 3rd segment of antenna about twice the width (Fig.1). *Mycodrosophila* sp. was identified by the presence of one pair of dorso central bristles on thorax.

**Damage:** Larval stages of Drosophilid flies

**Table 1. Insects infesting cultivated mushrooms (*Pleurotus ostreatus*) in central province of Sri Lanka.**

Insect	Order/Family	Habitat of Larva	Damage
<i>Drosophila funebris</i>	Diptera: Drosophilidae	fruiting body†	fruiting body
<i>Mycodrosophila</i> spp.	Diptera: Drosophilidae	fruiting body†	fruiting body
<i>Megaselia halterata</i>	Diptera: Phoridae	compost bags	no visible damage
<i>Bradysia paupera</i>	Diptera: Sciaridae	Compost (sometimes larva in the stalk)	mycelial loss, damage to the fruiting bodies
<i>Gyrophaena</i> spp.	Coleoptera: Staphylinidae	fruiting body†	No visible damage
<i>Triples</i> spp.	Coleoptera: Erotylidae	Adults on the fruiting body (larva not seen)	no visible damage
<i>Cyllodes bifacies</i>	Coleoptera: Nitidulidae	Larvae in fruiting bodies, pupae in the compost and adults on both	mycelial loss, damage to the fruiting bodies
Caterpillar	Lepidoptera: Noctuidae	fruiting body	fruiting body
Spring tail	Colembola: Entomobryonidae	compost	mycelial loss

† All stages Larvae, Pupae and Adults

**Table 2. Frequency of occurrence of insect species in oyster mushroom cultures in the central province of Sri Lanka.**

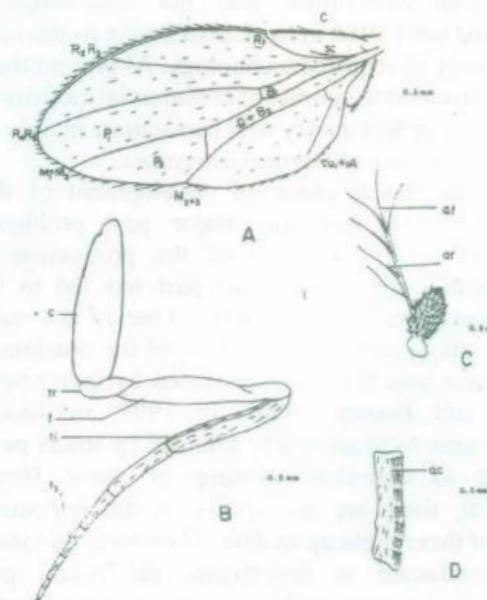
Insect species	Percentage of farms infested		
	Mid-Country N=12	Up-country N=10	Total N=22
<i>Drosophila funebris</i>	83.3	50	68.18
<i>Megaselia halterata</i>	25	0	13.63
<i>Bradysia paupera</i>	16.0	60	36.36
<i>Gyrophaena</i> spp.	75	70	72.72
<i>Triples</i> spp.	33.3	10	3.81
<i>Cyllodes bifacies</i>	100	90	95.45
Noctuid moth	8	10	9.09
Entomobryonid spring tail	58.3	70	72.72
Collembola	33.3	70	54.54

**Table 3. Percentage infestation in marketed mushroom packets (n=200) by insects in Kandy district.**

Insect species	Mean percentage of presence	Remarks
<i>Drosophila bifacies</i>	0.8	Damaged
<i>Cyllodes bifacies</i>	35	Damaged
<i>Gyrophaena</i> sp.	32	No visible damage
Undamaged	32.2	-

were observed in fruiting bodies only in about nine per cent of the mushroom houses surveyed and 0.8 per cent of the marketed samples analyzed (Table 3). *Drosophila funebris* has naturally been described as scavengers and reported as occasional pests in mushroom houses (Fletcher *et al.* 1989). It was observed that the presence of Drosophilid flies was high in those mushroom houses with poor hygienic conditions.

**Phorid flies:** Larval, pupal and adult stages of



**Figure 1. Structures of taxonomic value of *Drosophila funebris* (Fabricius). A. fore wing B. Antenna (aristate type) C. fore leg D. 1st tarsomere. ac. Acrostical setae in seven rows. af. apical fork, ar. Additional rays. C. Coxa, ti. tibia, tr. trochanter, t3. third tarsomere.**

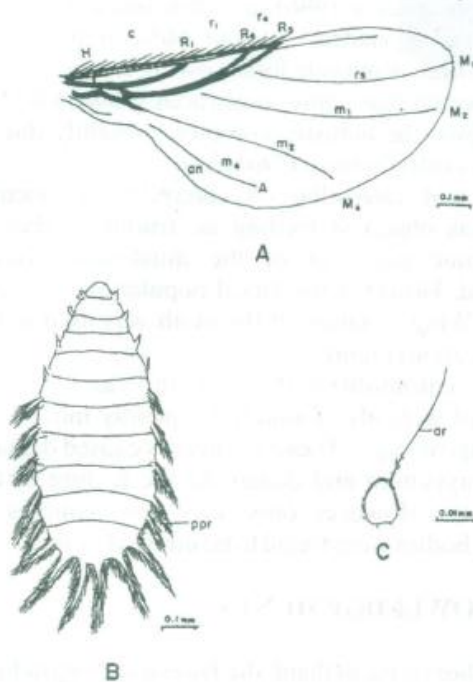


Figure 2. Features of taxonomic importance of *Megaselia halterata* (Wood). A. wing venation B. larva C. antenna. ar. arista, ppr. plumose projection (six in posterior portion)

*Megaselia halterata* were collected from about 13% of the total farms visited (Fig. 2).

Damage: *Megaselia halterata* has been recorded as one of the serious pests in mushroom houses in several countries (Clift 1979; Hussey *et al.* 1969). However no visible damage to the mushroom crop was noticed in the surveyed areas during this study.

Sciarid flies: *Bradysia paupera* (Family Sciaridae) has been reported as a serious insect pest of the mushroom crop in European countries (Fletcher *et al.* 1989) but the present study revealed that their abundance and damage to the crop was of minor significance. It was reported that the larval density for threshold value was 42/10g compost (Clift and Larsson 1984), but here it was only 14/10g of compost. This situation may result in the increase of natural population of black ants, which feed on sciarid larvae. Features used for identification are shown in Figure 3.

Damage: The larva of *B. paupera* had tunnelled the stalk by moving to the fruiting bodies from the compost. As a result, the young fruiting bodies were wilted and mature ones were feebly attached to the substratum.

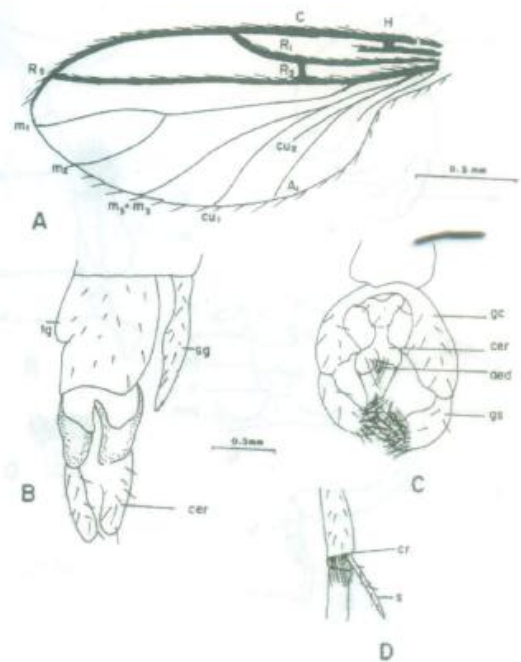


Figure 3. Morphological structures of taxonomic importance of *Bradysia paupera* adult. A. Fore wing, B. Female genitalia C. Male genitalia D. Pro tibia of male showing characteristic arrangement of bristles. gc- gonocoxite, gs- gonostyle, sp- spur, s9- 9th abdominal sternum, t9- ninth abdominal tergum.

Staphylinid beetles: *Gyrophaena* sp. was found in very large numbers in about 72% of the farms. The adult beetles inhabited only the developing fruiting bodies at all stages except at the earliest stage. About 32% of the marketed sample contained adult beetle but no visible damage was observed.

Erotylid beetle: *Triples* sp. was also found in wild edible mushrooms in the Kandy district. The adults of this beetle were collected from only about 33% of the farms surveyed (Figure 4).

Nitidulid beetles: *Cyllodes bifacies* (Walker) was distributed in almost all the farms surveyed (Table 1). These beetles were poor fliers and were moving along the compost bags and also among the fresh fruiting bodies. Adults concentrated more on the developing fruiting bodies and it was also noted that they never remained in the rotting fruiting bodies. Larval stages were found to be associated with the fruiting bodies (Gnaneswaran and Wijayagunasekara 1996).

Damage: The fruiting bodies inhabited by the larvae were found to be in a perished condition and



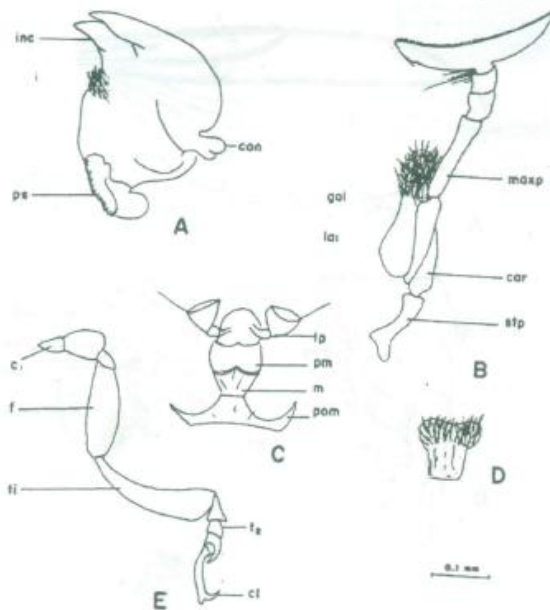


Figure 4. Morphological structures of taxonomic importance of *Triplex* sp. A. Mandible (left), B. Maxilla (left), C. Labium, D. Labrum, E. leg. cl- claw, car-cardo, c- coxa, con- condyle, f- femur, gal- galea, inc- incisor, la- lacinia, lp- labial palp, m- mentum, maxp- maxillary palp, pm- prementum, ps- prostheca, p m- postmentum, stp- stipe, ti- tibia, t2- second taxsomere

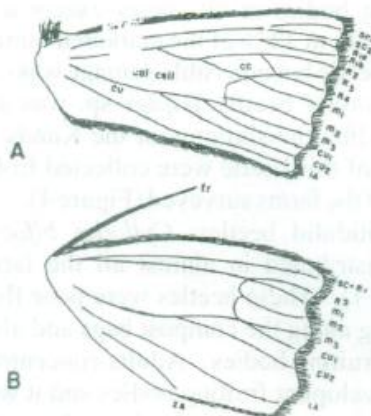


Figure 5. Wing venation of noctuid moth found on *P. ostreatus*. A. fore wing, B. hind wing, fr- frenulum.

were yellow in colour. *Cyllodes bifacies* is a new pest of the cultivated mushroom (Gnanewaran and Wijayagunasekara 1996) and distributed in almost all the farms visited. About 86% of the farms suffered high economic losses owing to this pest. It was reported that some mushroom growers had to close down the industry completely mainly due to the heavy infestation of *C. bifacies*.

Noctuid caterpillar: A caterpillar of noctuid moth was observed feeding on fruiting bodies in about nine per cent of the mushroom houses surveyed. However the larval population was very small. Wing venation of the moth was used in the identification (Figure 5).

An entomobryonid springtail and Neelid springtail were also found to frequently inhabit the old compost bags. These springtails caused damage to the mycelium and denatured the texture of the compost. However only very few samples of fruiting bodies were found to be infested by them.

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