Tropical Agricultural Research and Extension. 2 (1): 21-25, 1999

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

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Accepted 5 March 1999

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.

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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

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 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). *Drosophilia 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

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

Insect	Order/Family	Habitat of Larva	Damage
Drosophila funebris	Diptera: Drosophilidae	fruiting body†	fruiting body
Mycodrosophila spp.	Diptera: Drosophilidae	fruiting body†	fruiting body
Megaselia halterata	Diptera: Phoridae	compost bags	no visble damage
Bradysia paupera	Diptara: Sciaridae	Compost (sometimes larva in the stalk)	mycelial loss, damage to the fruiting bodies
Gyrophaena spp.	Coleoptera: Staphylinidae	fruiting body†	No visible damage
Triplex spp	Coleoptera: Erotylidae	Adults on the fruiting body (larva not seen)	no visible damage
Cyllodes bifacies	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: Entomobrionidae	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
Drosophila funebris	83.3	50	68.18
Megaselia halterata	25	0	13.63
Bradysia paupera	16.0	60	36.36
Gyrophaena spp.	75	70	72.72
Triplex spp.	33.3	10	3.81
Cyllodes bifacies	100	90	95.45
Noctuid moth	8	10	9.09
Entomobrionid 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
Drosophila bifacies	0.8	Damaged
Cyllodes bifacies	35	Damaged
Gyrophaena sp.	32	No visible damage
Undamaged	32.2	-

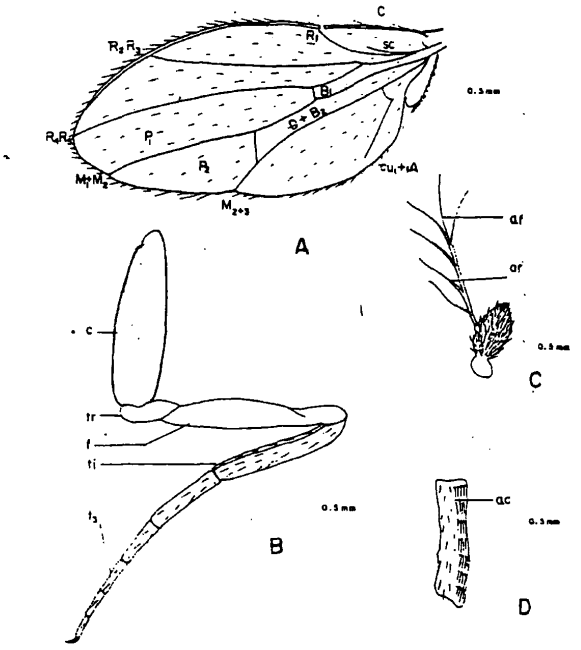

Figure 1. Structures of taxonomic value of *Drosophila funebris* (Fabricius). A. fore wing B. Antenna (aristate type) C. fore leg D. 1st tarsomere. ac. Acrostical setae in seven rows. af. apical folk, ar. Additional rays. C. Coxa, ti. tibia, tr. trochanter, t3. third tarsomere.

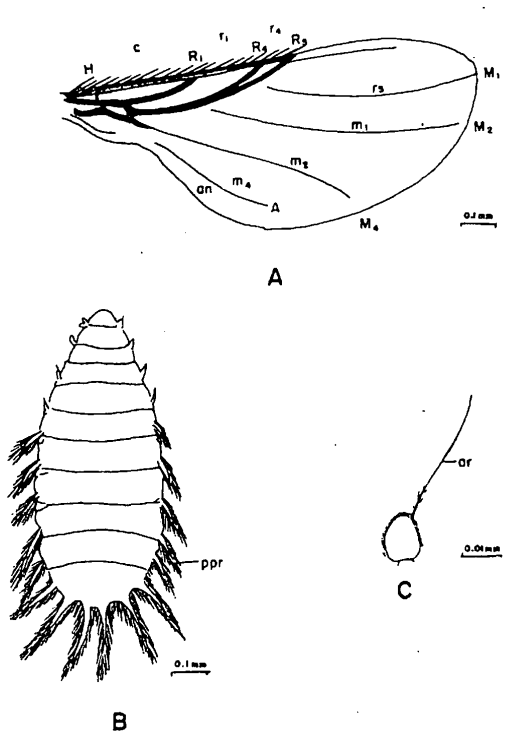

Figure 2. Features of taxonomic importance of *Megaselia halterata* (Wood). A. wing venation B. larva C. antenna. ar. arista, ppr. plumose projection (six in posterior portion)

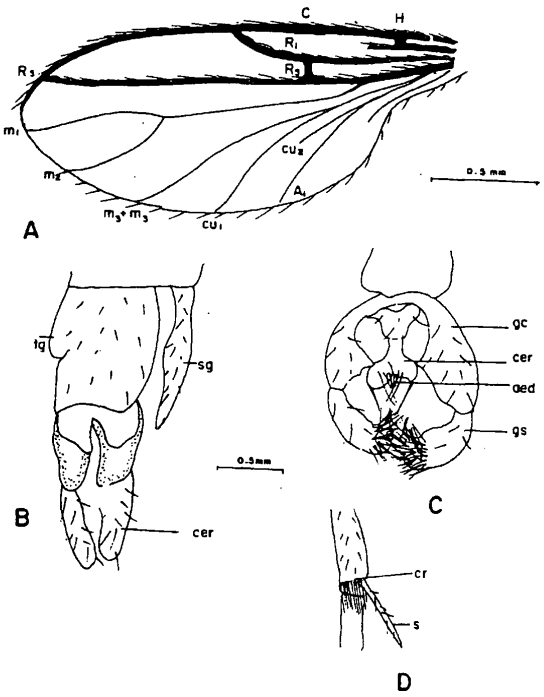

Figure 3. Morphological structures of taxonoic importance of *Bradysia paupera* adult. A. Fore wing, B. Female genetalia C. Male genetalia D. Pro tibia of male showings characteristic arrangement of bristels ade- adeagus, cer- cercus, cr-crest of bristles, gc- gonocoxite, gs- gonostyle, sp- spur, s9- 9th abdominal sternum, t9- ninth abdominal tergum.

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 results 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.

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: *Triplex* 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

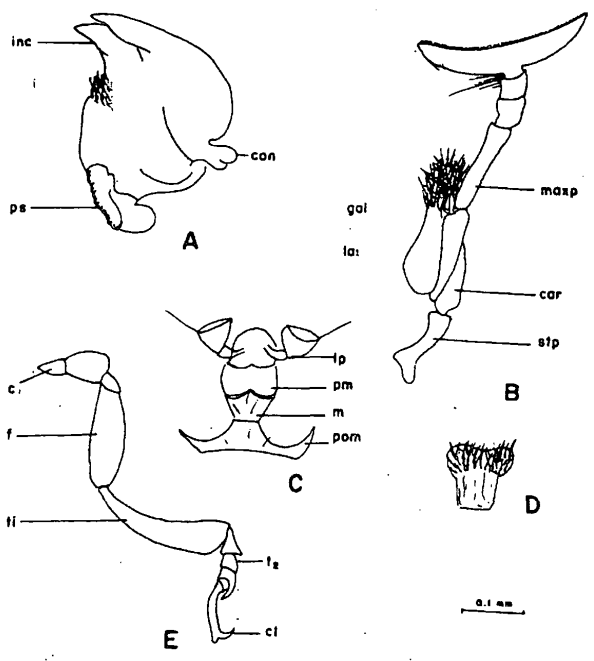

Figure 4. Morphological structures of taxonomic importance of *Triplex* sp. A. Mandible left), B. Maxilla (left), C. Labium, D. Labrum, E. leg, cl- claw, car -cardo, c- coxa, con- condyle, f- femur, gal- galea, inc-incisor, la-lacinia, lp- labial palp, m- mentum, maxp- maxillary palp, pm- prementum,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

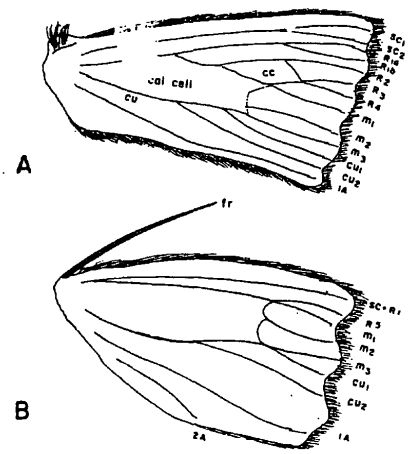

Figure 5. Wing venation of noctuid moth found on *P. ostreatus*. A. fore wing, B. hind wing, fr- frenulum.

were yellow in colour. *Cyllodes bifacies* is a new pest of the cultivated mushroom (Gnaneswaran 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 entomobrionid 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.

ACKNOWLEDGEMENTS

The authors wish to thank the Director, Postgraduate Institute of Agriculture, University of Peradeniya for financial assistance and Mr S.R. Seneviratne, Asst. Director of Agriculture, Department of Agriculture, Peradeniya, for his help in field survey.

REFERENCES

Clift AD 1979 The identity, economic importance and control of insect pests of mushrooms in New South Wales, Australia. Mushroom Sci.X.(II):367-383.

Clift AD and Larson SF 1984 The incidence and ecology of *L. mali* (Fitch) Diptera: Sciaridae in the commercial culture of two species of mushroom wazzu in New South Wales. Genetics and Applied Entomology. 16: 49-56.

Entomological Society of Canada 1994 Terrestrial Arthropod Biodiversity: Planning a Study and Recommended Sampling Techniques. A brief note prepared by the Biological Survey of Canada (Terrestrial Arthropods). Supplement to the Bulletin of the Entomological Society of Canada. 26(1) March 1994.

Fletcher JT, White PF and Gaze RH 1989 Mushrooms: Pest and disease control. 2nd Ed. Intercept Andovev Hants 5:111-152.

Gnaneswaran R and Wijayagunasekara HNP 1996 Biology of *Cyllodes bifacies* Walker (Coleoptera:Cucujoidea:Nitidulidae), a pest

of oyster mushroom (*Pleurotus ostreatus*) in Sri Lanka. Trop. Agric. Res. 8:377-390.

Hussey NW, Read WH and Hesline JJ (eds.) 1969 The pest of protected cultivation: The biology and control of the glass-house and mushroom pests. Edward Arnold Ltd. London. pp. 404.

Johal KK and Disney RHL 1994 Phoridae (Diptera) as pests of cultivated oyster mushrooms (*Agaricales:Pleurotaceae*) in India. Bull. Ento. Res. 84:247-254.