Life stages, longevity, seasonal abundance and nature of damage of *Cyllodes indicus* Grouvelle (Coleoptera: Nitidulidae) on oyster mushroom, *Pleurotus sajor-caju*

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ABSTRACT

Studies were conducted on the life stages, longevity, seasonal abundance and nature of damage of *Cyllodes indicus* commonly known as sap beetle on oyster mushroom, *Pleurotus sajor caju*. The beetle completed its life cycle in four stages viz egg, grub, pupa and adult and took 15-16 days to complete one life cycle on oyster mushroom. It appeared in the farm immediately after first showers of rain; its peak population was observed during August and September and insect remained in the farm till the termination of the crop. Both grubs and adults were found to feed on mycelium as well as sporocarps of mushroom. They fed on mycelium until the initiation of pin heads and once the pins started emerging they became the preferred site for grubs which immediately started tunneling into the growing stipe and reached pileus region where they found a suitable hiding place, pupated and newly emerged adults voraciously fed on the sporocarps. As a result of tunneling by the grubs the connection of emerging sporocarps to its substrate got weakened with occasional drooping of fruiting bodies. Visual symptoms were manifested in the form of tunnels in the gills of newly emerging fruiting bodies often referred as salt shaker pins. The adults made irregular holes in the stipe of sporocarps resulting into their deformity. The adult beetles survived for an average of 20.1 days when fed upon the sporocarps of oyster mushroom but in the absence of food their life span was reduced to just 2.7 days.

Keywords: *Pleurotus sajor-caju*; sap beetle; sporocarps; tunneling; salt shaker pins

INTRODUCTION

Oyster mushrooms (*Pleurotus* spp) are the delicate edible fungi that are second only to button mushrooms as far as global mushroom production is concerned because of their unique flavor and wing like attractive sporocarps. Unfortunately this mushroom is one of the most susceptible hosts of various pests that include insects, collembolans and mites. This inordinate susceptibility can be attributed to their lamellate fruiting bodies in which various stages of the insect find the suitable hiding space and also to the growing conditions that are most conducive for the multiplication of various pests as well. Insects belonging to two orders viz Diptera and Coleoptera hold great significance as far as damage to *Pleurotus* spp is concerned. These pests have been of great concern for the mushroom fraternity at global level because of their high occurrence and damaging potential. In India where oyster mushrooms are grown only as an additional enterprise by the marginal farmers to substantiate their income the growing conditions are almost unhygienic and uncontrolled. This leads to high rate of infestation by these insect pests eventually resulting into extremely poor crop yields. World over number of genera of beetles have been reported to be associated with oyster mushrooms (Johal et al 1992, Gnaneswaran and Wijayagunasekara 1996, Deepthi et al 2004, Mazumder et al 2008, Sharma 2010) from various mushroom growing countries of the globe. Of these coleopteran pest *Cyllodes indicus* is one species of beetles that has been most frequently observed in oyster mushroom farms in Himachal Pradesh in recent past (Kumar 2006, Sharma 2010, Devi 2012). Looking into its abundance in oyster farms in the state and with scanty previous information regarding the status of this genus in mushrooms in general and no information regarding this species in particular an attempt was made to study

the seasonal abundance, nature of damage and longevity of this insect on oyster mushroom as understanding of these aspects is of utmost significance while going for management of it.

MATERIAL and METHODS

Life stages of the *C indicus*: It was tried to observe all the life stages of the insect. Newly emerged grubs (1st instar) of *C indicus* were inoculated in Petri plates with fully impregnated mycelium of *Pleurotus sajor-caju* and the Petri plates were kept at 25 ± 1°C in the incubator. The grubs were allowed to grow by feeding on the mycelium and various mature and immature stages were observed twice a day until the adult beetle emerged out of the pupa. Magnifying lens (10X) and stereoscopic microscope (20X) were used to examine different stages of the insect.

Longevity of *C indicus*: The longevity of newly hatched adults was studied under two conditions viz when ample food was available and when no food was available. Small plastic boxes with adequate perforations in their upper body and lids were taken. The perforations were sufficiently small for the beetles to come out. Small moistened cotton piece was laid at their base. Cotton was changed every day. Freshly emerged adults of *C indicus* were placed individually in each box. One fresh sporocarp was added to each box daily. This arrangement was made in ten boxes. Another ten beetles were placed individually in similar boxes but were not fed upon the sporocarps. The boxes were maintained until the beetles placed in them survived.

Seasonal abundance of *C indicus*: Various oyster mushroom farms located in district Solan were visited and incidence of *C indicus* (grubs and adults) was recorded from April to October when cultivation of this mushroom was undertaken by the growers in the state. The bags showing visible fauna of grubs/adults were selected for the sampling. Substrate samples of 250 cc were collected from the cropping bags. These samples were brought to the laboratory and analyzed for the presence of adults and grubs of test insect under laboratory conditions. Grubs and adults of test insect were handpicked with naked eye.

Nature of damage: The farms harbouring *C indicus* were surveyed and the bags showing visible fauna of grubs/adults were selected for the sampling. Substrate samples (each 250 cc) as well as infested sporocarps were collected from the cropping bags and were brought to the laboratory. Grubs and adults of test insect were handpicked with naked eye and inoculated separately @ 20 grubs/20 adults in 2 kg capacity small bags fully impregnated with the mycelium of *P sajor-caju* substrate. The bags were kept in isolation. Observations regarding visual mycelia symptoms as well as symptoms on sporocarps were recorded both in grub- as well as adult-inoculated bags.

RESULTS and DISCUSSION

Life stages of *C indicus* on *P sajor-caju*: Various life stages of *C indicus* as observed under laboratory conditions at 25°C revealed that *C indicus* completed its life cycle in four stages viz egg, grub, pupa and adult. All the stages of insect except eggs were spotted. The insect remained in grub stage from six to seven days. Three larval instars were differentiated on the basis of their size. The last instar of grub buried itself preferably below the mycelium in the substrate medium prior to pupation. The pre-pupal period remained for three to four days after which the grub was gradually converted to the pupa. Pupation was also noticed within the lamellae of sporocarps. The pupal phase remained from five to six days. Under laboratory conditions the life cycle of *C indicus* from newly hatched grub to adult was completed in 15 to 16 days. Colour differentiation in newly hatched and a mature adult was conspicuous (Plate 1). Studies on life cycle of another species, *C bifacies* conducted by Gnaneswaran and Wijayagunasekara (1996) on *P ostreatus* revealed that under the laboratory conditions pupal period lasted for five to six days and the life cycle of beetles ranged from 15 to 16 days.

Longevity of *C indicus*: The adult beetles of *C indicus* when fed upon the sporocarps of oyster mushroom on an average survived for 20.1 days. However when kept hungry their survival was as low as 2.7 days. Longevity of *C bifacies* studied earlier has been found to be 20.85 days (Wijayanti and dan Sanjes 2003). Data regarding the survival of *C indicus* have been presented in Table 1.

Seasonal abundance of *C indicus* in oyster mushroom farms: Cultivation of oyster mushrooms in the state of Himachal Pradesh is seasonal with growers switching over to the production of these mushrooms only during lean summer time when conditions for white button mushroom production are not suitable. Generally *Pleurotus* mushroom is grown

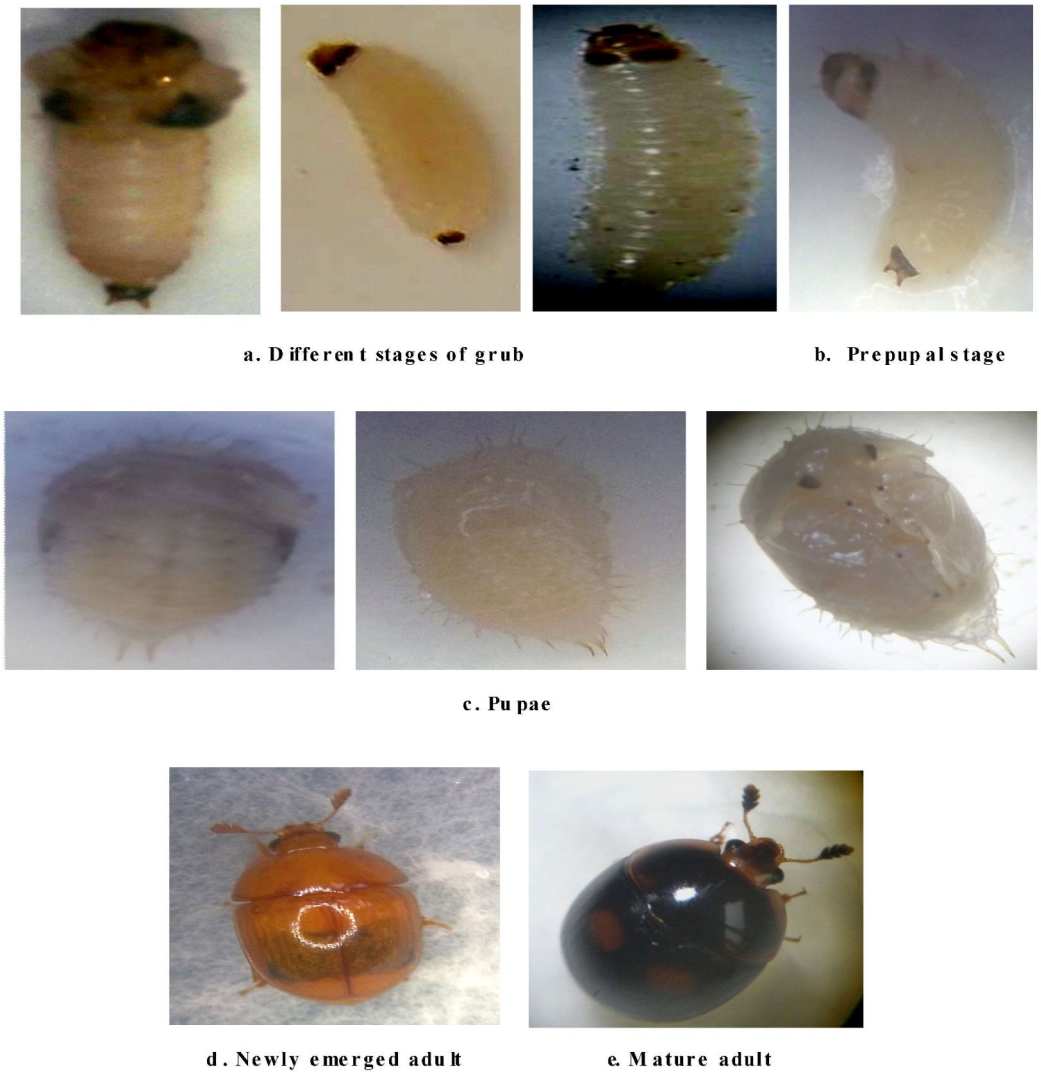

Plate 1. Different stages of *Cyllodes indicus*

from the month of April to October. Survey regarding abundance of *C indicus* in the farms during this period revealed that this beetle registered its presence in the farms in low counts only after initiation of rainy season somewhere in second fortnight of June. The population multiplied fast and peak population was observed during August and September. The insect remained in the farm till the cropping ceased. Mazumder et al (2001) recorded high population of *Scaphisoma tetrastictum* infesting *P ostreatus* from the month of May to August. Deepthi et al (2004) also recorded a heavy incidence of *S nigrofasciatum* infesting *P florida* during June to August. Highest number (12.35) of adults of *S tetrastictum* per fruit body was observed in oyster mushroom farms from March to November (Mazumder et al 2008). These studies indicated that though with slight variations higher summer temperature and high humidity were more conducive for the beetles to multiply.

Nature of damage of *C indicus* on *P sajor-caju*: Observations recorded on nature of damage of *C indicus* revealed that both grubs and adults fed on the mycelium as well as sporocarps of *P sajor-caju*. The grubs and adults devoured the mycelium until the sporocarps started emerging. Once the pin head formation initiated the grubs started making tunnels in the emerging pins, moved along with the growing stipe and reached the pileus region where they hid themselves within the lamella. They preferred to feed

a. Tunneling in the sporocarps

b. Weak attachement of the sporocarp to the substrate

c. Fringing of sporocarps

d. Holes in the sporocaprs

Plate 2. Visual symptoms produced by *Cyllodes indicus* on *Pleurotus sajor-caju*

upon the soft tissues of stipe, gills and pileus. When the insect fed upon the newly emerging pin attached to the mycelium present in the substrate it weakened the connection of emerging sporocarp and stipe to its substrate resulting in the drooping of the fruiting bodies. The insect completely destroyed the gills of sporocarps by making tunnels in the gills. This symptom is commonly referred as salt shaker pins perforated by larval tunnels. Also the grubs had the strong tendency to hide in the gills of sporocarps as these were observed in high counts when gill lamellae were observed carefully and it was near impossible to clean these infested sporocarps of the grubs. Fringing of sporocarps was also observed in case of severe infestation. The adults made irregular holes in the stipe as well as hymenium of sporocarps resulting into their deformity (Plate 2).

Contrary to these observations, Johal et al (1992) reported symptom-less infestation of *C whiteii* on sporocarps of *P sajor-caju* which eventually collapsed or drooped after three to five days of pin head initiation followed by a complete loss. However Mazumder et al (2001) found characteristic symptoms of small irregular holes in the hymenium and stipe of oyster mushrooms infested with grubs and adults of *S tetrasitctum*. Similar symptoms of holes all over the fruiting bodies and tunneling in the stipe, gills and lower portion of pileus caused by *Staphylinus* sp and *S nigrofasciatum* were observed by Deepthi et al (2004).

Table 1. Longevity of *C indicus* adults on *P sajor-caju*

Treatment	*Survival in days
T1: With food	20.1
T2: Without food	2.7

Significant at 5% level of confidence, *Average of ten replications

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