Mini Review

Damage potential of *Tyrophagus putrescentiae* Schrank (Acari: Acaridae) in Oyster (*Pluerotus sajor caju*) Mushrooms

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Abstract

Mite pests are cosmopolitan and reported from many parts of the world. *T. putrescentiae* was previously described as saprophagous species that feeds on different fungi including moulds (*Eutorium*, *Penicilium*) *Fusarium*, *Alternaria*, *Geotrichum*, *Mucor* and *Trichophyton*. Oyster Mushroom is a low investment, low risk, low labour intensive, and moderate profit enterprise. Mites have been found to damage mushrooms right from spawning to harvest of the crop. Moreover, mites themselves pollute the mushrooms by the multitude of faeces that they excrete all over, making the mushrooms uneatable as a food, causes allergies and other diseases. Considering the above facts, efforts have been made to assemble the available literature in this article.

Keywords faeces, harvest, Saprophagous, *T. putrescentiae*

Introduction

Mushrooms are valuable health foods that are low in calories, high in vegetable proteins, chitin, iron, zinc, copper, fibers, essential amino acids and vitamins [1]. Despite their nutritional and medicinal values, these are attacked by a number of diseases, pests, microbial infections and viruses that might infest the fungal substrate, the mycelium and the fruiting bodies growing on the substrate. Mushroom farms are generally infested by sciarid (*Lycoriella mali*), phorid (*Megaselia halterata*) and cecid (*Mycophila speyeri*, *Heteropeza pygmaea*) flies. The larvae of sciarid flies attack compost, spawn, mycelium, and pinhead formation. Cecid larvae feed on mushroom stems or gills and adult flies carry disease causing organisms to spread diseases. Three mycophagous nematode species, namely *Aphelenchoides composticola*, *Aphelenchus avenae* and *Ditylenchus myceliophagus* along with some saprophagous (*Rhabditis* sp.) and predatory (*Seinura* sp.) nematodes were found in compost samples of white button mushroom (*Agaricus* spp.) and oyster mushroom (*Pleurotus* spp.). The saprophagous nematodes (*Rhabditis* sp.) were recorded as the predominant species with 100 percent frequency of occurrence in oyster mushroom [2]. Several types of mite species had been found to be associated with mushrooms, out of which *Histiogaster* sp., *Histiostoma* sp., *Tarsonemus myceliophagus* *Tyrophagus lantneri*, *Uroobovella* sp., *Tarsonemus dimidatus*, and *Caloglyphus mycophagus* are of frequent occurrence [3]. Reports are available on the occurrence of mites including T. *putrescentiae* as pest in oyster mushrooms [4-5]

Host Preference of *Tyrophagus putrescentiae*

The mould mite, *Tyrophagus putrescentiae* (Schrank) has a worldwide distribution and is found in a variety of habitats including cultivated mushrooms, plant seeds, green houses, soil, nest of different animals, decaying organic material and foods containing high protein and fat content with moisture in the range of 12-15 percent [6-10]. Additionally, *T. putrescentiae* feeds on different fungi including moulds (*Eutorium, Penicilium*) *Fusarium, Alternaria, Geotrichum, Mucor* and *Trichophyton* [11-15]. It showed that collected pollen was an attractive food for *T. putrescentiae* [16]. It is very common in human created habitats such as dust in urban environments, medical and laboratory facilities, farms and food industry [11-12]. It prefers grain germ, pulses, nuts, sunflower, oil rape seeds, cheese, ham and dry dog food [17-20].

This species although prefer moist conditions and feeds on soil but damage stored produces due to their ability to tolerate low humidity and a wide range of temperatures [21-23] investigated allergic mites in dust and debris samples from 135 coal mines and most of them were *Tyrophagus putrescentiae*. *T. putrescentiae* is considered as an unpleasant pest damaging fungal cultures, but in the future, the use of this species in biological control of nematodes may be considered. All active developmental stages (larvae, nymphs and adults) of *T. putrescentiae* are nematophagous [24-25]. This mite avidly consumes nematodes including *Aphelenchus avenae* and *Meloidogyne javanica* as a food resource [16, 18, 22, 26-27].

Tyrophagus putrescentiae and other pest of mushrooms

Use of old manure in compost, poor hygiene, sanitation in mushroom houses [28] and Dipterans flies as vectors for mites [22] are responsible for mite infestation in cultivated mushrooms. In India, seventy species of mites are associated with stored products including mushroom have been reported. The important pest species are *Acarus* sp., *Tyrophagus* sp., *Suidasia* sp., *Glycyphagus* sp., *Lardoglyphus* sp. and *Lepidoglyphus* sp. [12]. Among the different groups, Astigmata constitutes a dominant group in stored products ecosystem followed by Prostigmata and Mesostigmata [29]. Fifty four mite species had been found associated with mushrooms [30] out of which *Histiogaster* sp. [29, 31] *Histiostoma* sp. *Tarsonemus myceliophagus*, *T. lantneri*, *Caloglyphus mycophagus T. putrescentiae*, *Uroobovella* sp. were considered economically important pests. *T. putrescentiae* is one of the potential vectors of parasitic fungi such as *Aspergillus flavus*, *A. niger*, *Mucor racemosus* and *Nectria haematococca* which may cause economic damage in mushroom beds. *Oppia sp*. *Hypoaspis* sp. [32-34] *fimicolus Bakerdania* sp., *Luciaphorus* sp., *Parasitus* spp.[35-36], *Parasitus bituberosus Parasitus consanguineus* [37-38] were found to be associated with cultivated mushrooms.

Among the insect pests, sciarid flies Hump backed flies, cecid flies, springtails [37-38] and beetles [39-40] are predominant pests. Twenty-one nematode species representing two orders, *Aphelenchida* and *Tylenchida* have been reported to cause damage to mushroom cultivation in various parts of the world. Out of these 20 belong to four genera, *Aphelenchoides*, *Aphelenchus*, *Paraphelenchus* and *Seinura* under the order *Aphelenchida* and one species *Ditylenchus myceliophagus* belongs to the order *Tylenchida*. In India eight species of *Aphelenchoides* and *Ditylenchus myceliophagus* has been recorded from mushroom beds. Three *mycophagous* nematode species, i.e *Aphelenchoides composticola*, *A. avenae* and *Ditylenchus myceliophagus* along with some *saprophagous* (*Rhabditis* sp.) and predatory (*Seinura* sp.) nematodes were found in compost samples in villages of Sonipat district, Haryana, India. [12-13].

Abiotic stresses on mite development

Mites are reported from mushroom beds throughout the season. Jiang et al. [41] reported the presence of mites from September to March on temperate mushroom whereas they recorded mites in mushroom compost from April to June.

Temperature is an important factor affecting the development of mites. At favorable temperatures and 90 to 100 percent relative humidity, the *T. putrescentiae* female can lay an average of 437 eggs [42-43]. This revealed that temperature is an essential factor controlling the developmental time and life cycle of *Tyrophagus similis*. Nagesh and Reedy [34] showed that in wet condition, mold mites in the 20ºC and 25ºC temperature range remained alive for 31 days with no food. Under moist conditions (12 -18 % moisture) and warm summer temperature, a generation can be completed in 8 to 21 days. As the temperature falls, the length of the life cycle increases greatly. The mold mite breeds readily above 30 ºC. The mold mite is less tolerant to low temperature and cannot develop below 10 ºC. However, in an inactive state, this mite can survive 0ºC. The optimum temperature for the development and reproduction of *T. putrescentiae* and *Aleuroglyphus ovatus* is 25°C [11]. Low and high temperatures had negative effects on all immature stages and on the life cycle of both *T. putrescentiae* and *A. ovatus*. The duration of phorid development is temperature dependent and may vary between 15 days (24-27ºC) to 50 days (16-21ºC). The weight loss of the Shiitake mushroom caused by *T. putrescentiae* and *A. ovatus* increased with increasing temperature [9, 15].

Effect of infestation on biochemical composition of *Pluerotus sajor caju*

The mushroom mite, *Luciaphorus perniciosus* (Acari: Pygmeporidae) is the most important mite causing yield losses in mushroom production. According to Royse et al. [44] the most important factor in evaluating the nutritional value of mushrooms is their dry weight content, which generally lies between 5 and 15 percent of *P. sajor caju* fruit bodies. Variations in sugars content of mushroom might be due to variation in substrate and agroclimatic conditions. Maximum amount of carbohydrates (55.99/100gm) was found in *P. ostreatus* (white strain) cultivated on wheat straw, while the minimum amount of carbohydrates (35.26g/100g) was found in *P. ostreatus* (white strain) cultivated on cotton waste. Crude protein content of *P. sajor caju* fruit bodies varied between 27.4 and 34.8 percent. It is known that the protein content of mushrooms varies with the kind of substrate chosen, due to differential nature of the nutrient supply [25, 30, 32, 33].

Cabrera et al. and Gulati [45-47] reported that *T. myceliophagus*, *T. confuses* and *T. floreicolus* occur in thousands on mushroom body and the affected tissue becomes reddish, while base and stalk turn brown in colour. Accordingly *Pygmephous* sp. feed on mushroom mycelium below the casing layer. Presence of the mites in the compost delayed the development of mushroom mycelium. Percent loss in total sugar, reducing sugar, non-reducing sugar, starch, protein content of compost was in the range of 10.47 to 24.60%, 22.89 to 68.67%, 0 to 0.92%, 16.33 to 33.33%, 0 to 10%, respectively due to *T. putrescentiae* infestation.

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