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EFFECT OF INSECT GROWTH REGULATORS (IGR) AGAINST SCIARID FLY, *BRADYSIA TRITICI* (CONQUILLET) INFESTING MILKY MUSHROOM (*CALOCYBE INDICA* P&C)

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ABSTRACT

The present investigation was conducted during May 2023 at the Mushroom Production Unit, College of Agriculture, Navsari Agriculture University, Waghai, Gujarat. Infestation of the sciarid fly *Bradysia tritici* (Conquillett) was observed from the spawning time to harvest of mushroom. Application of two insect growth regulators viz. nuvaluron 10 EC and lufenuron 2.5 EC in compost, casing, compost plus casing at 0.005 and 0.0075% were evaluated against *B. tritici*. Novaluron at 0.0075% in paddy straw plus casing recorded maximum reduction in larvae (89.37%), lowest infestation (5.78%) and highest yield (1330g) over untreated control.

Key word: Milky mushroom, insect growth regulators (IGR's), sciarid fly, *Bradysia tritici* (Conquillett), nuvaluron, lufenuron, compost, casing, compost plus casing, paddy straw

Milky mushroom (*Calocybe indica* P&C) is a tropical edible fungus, suitable for cultivation in tropical and subtropical regions for the commercial purpose or for home consumption. It is originated in India. It grows at a temperature range of 25-35^{0}C. After button mushroom and pleurotus, *C. indica* become the third commercially grown mushroom in India. Sciarid flies belonging to order Diptera and family Sciaridae commonly known as the big flies, dark winged fungus gnats, or mushroom flies feed on mushrooms and adults have the ability to produce multiple generations. These characteristics gives potential to destroy the mushroom crop. The yield reduction is directly proportion to the number of larvae present. Sciarid fly larvae feed on mycelia, hyphae and destroys pins of developing mushrooms. In high densities they also feed on compost and tunnel through stems of mushroom rendering them unmarketable. Adult of this fly can potentially vector mushroom green mould disease and consequently leads to additional crop losses (Mazin et al., 2017). The environmental and human health concerns with synthetic pesticides, and there is trend to replace these with selective and safe pesticides. The idea of controlling this pest by insect growth regulators may provide potential alternative. Most of the IGR's considered 'reduced risk' because of their target specificity and low toxicity against the environment and human beings. IGR's causes significant reduction of sciarid fly population and sporophore damage rates. The present study was carried out to test the efficacy of IGR's against sciarid fly *B. tritici*.

MATERIALS AND METHODS

The present study was carried out in the Mushroom Research Unit, College of Agriculture, Navsari Agriculture University, Waghai, Gujarat, India. The substrate was prepared by using chaff cutter machine, well dried paddy straw was cut into 8-10 cm pieces and subjected to sterilization. In present experiment, chemical sterilization technique was used. Ninety litres of water was taken in a rust proof drum of galvanized sheet of 200 litre capacity. Ten kg of straw was slowly steeped in water. In another plastic bucket, carbendazim 7.5g and 125 ml formaldehyde (37 to 40%) was dissolved and slowly poured on the already soaked straw. Straw was pressed and covered with a polythene sheet. After 15 to 18 hr the straw was taken out after draining out the excess water. Then straw was drenched with IGR's as per the treatments. The straw was used for the inoculation of mushroom spawn. The casing material was prepared using soil and pasteurized with 4% formaldehyde solution about a week in advance of casing. It is covered with polythene sheet to avoid escape of chemical and turned at two days interval so that, at the time of casing, soil is free from formalin smell. The casing material is uniformly spread in 2 to 3 cm thickness and insect growth regulators were

mixed as per treatments; 30-35^{0}C and RH 80-85% were maintained for entire cropping period. For determining the infestation, mushroom bodies were dissected and tissues were examined for presence of larvae from randomly selected samples from each replication. Then collected samples were observed to determine the % damage to the fruiting bodies. The mushroom tissues were disintegrated and number of larvae were counted for determine the % reduction in larvae in each treatment. On the basis of mushroom yield/ bag, the effectiveness of IGR's were calculated in terms of mushroom yield over untreated control.

RESULTS AND DISCUSSIONS

The effect of IGR's was evaluated in terms of reduction in larvae population in different treatment. All the IGR's treatments resulted in reducing infestation as compare to untreated control. However, IGR's when incorporated in paddy straw plus casing proved significantly more effective in preventing infestation than paddy straw and casing alone in both novaluron and lufenuron (Table 1). Maximum larval reduction was recorded in the treatment of novaluron 0.0075% in paddy straw plus casing (89.37%) followed by lufenuron 0.075% in paddy straw plus casing (78.26%). Least reduction in larval infestation was observed in lufenuron at 0.005% in paddy straw alone (43.96%) and it is significantly superior over untreated control. Under laboratory conditions IGR like triflumuron, was effective in reducing larval infestation of *Lycoriella ingenua* when incorporated into the growing medium (Shamshad et al., 2009). Triflumuron incorporated into casing layer proved excellent control of larval infestation against the sciarid fly, *B. ollaris* (Erler et al., 2011). IGRs like diflubenzuron showed its effectiveness and reduce the larval infestation of sciarid fly, *L. ingenua* (Shamshad et al., 2008). Least infestation was observed in treatment applied with novaluron 0.0075% in both compost and casing (5.78%) than the compost (14.64%) and casing alone (6.98%) followed by lufenuron 0.0075% in compost and casing alone. Between novaluron and lufenuron, novaluron gave best control of sciarid fly in higher concentration. IGR's like diflubenzuron and methoprene effectively control the larvae of *L. auripla* when mixed into or drenched into the casing and increase in the yield and size of the mushroom without affecting the timing of the flushes (Shamshad et al., 2008). The yield of milky mushroom in treatment was significantly higher over control with highest yield being with treatment of novaluron at 0.0075% in paddy straw plus casing (1330g) and followed by novaluron at 0.0075% in casing alone (1211.33g). Higher % increase in mushroom yield was recorded when growing medium were treated with IGR like diflubenzuron (White, 1999).

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Table 1. Efficacy of IGR's against sciarid fly *B. tritici* infesting milky mushroom

IGR's / Substrate	Conc. (%)	Larval reduction (%)	Infested sporophore (%)	Yield (g)
T_1: Paddy straw + novaluron 10% EC	0.005	40.13 (41.55)*	26.06 (19.72)	31.48 (993.33)
T_2: Casing + novaluron 10% EC	0.005	58.35 (72.46)	16.47 (8.05)	33.58 (1127.67)
T_3: Paddy straw+ casing + novaluron 10% EC	0.005	63.58 (80.19)	15.70 (7.33)	34.46 (1188.00)
T_4: Paddy straw + novaluron 10% EC	0.0075	43.75 (47.83)	22.49 (14.64)	32.33 (1045.33)
T_5:Casing + novaluron 10% EC	0.0075	62.90 (79.23)	15.32 (6.98)	34.80 (1211.33)
T_6: Paddy straw+ casing + novaluron 10% EC	0.0075	71.03 (89.37)	13.90 (5.78)	36.77 (1330.00)
T_7: Paddy straw + lufenuron 5.4 % EC	0.005	36.41 (35.27)	26.36 (19.31)	31.12 (975.33)
T_8:Casing + lufenuron 5.4 % EC	0.005	49.59 (57.97)	24.68 (17.45)	32.83 (1078.00)
T_9: Paddy straw+ casing + lufenuron 5.4 % EC	0.005	56.83 (70.05)	16.74 (8.30)	33.76 (1145.67)
T_{10}: Paddy straw + lufenuron 5.4 % EC	0.0075	41.52 (43.96)	25.73 (18.86)	32.40 (1053.67)
T_{11}: Casing + lufenuron 5.4 % EC	0.0075	53.87 (65.22)	18.98 (10.60)	33.04 (1094.00)
T_{12}: Paddy straw+ casing + lufenuron 5.4 % EC	0.0075	62.28 (78.26)	16.48 (8.06)	34.10 (1163.00)
T_{13}: Control	-	0.28 (0.00)	41.99 (44.76)	26.07 (690.00)
	SEm±	1.045	0.39	1.09
	CD (p=0.05)	3.135	1.171	3.27
	CV %	3.790	3.23	5.95

*Figures in parentheses original values while outside are sign transformed values.

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AUTHOR CONTRIBUTION STATEMENT

Both authors equally contributed.

CONFLICT OF INTEREST

No conflict of interest.

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