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Host specificity and bioratonal management of fruit sucking moth, *Eudocima* (*Othreis*) *materna* L.

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ABSTRACT: The present investigation was carried out to test the response of fruit sucking moth, *Eudocima* (*Othreis*) *materna* L. larvae to different host plants and efficacy of biorationals under laboratory condition. Among 12 different host plants tested, *Tinospora cardifolia* (gulvel) recorded as an ideal host with successful completion of larval life with no recorded mortality. In biorationals, *Bacillus thuringiensis* @ 2 g/l was found to be best in treatment by recording higher larval mortality of 100 per cent of first and third instar and 60 per cent of fifth instar followed by *Pseudomonas fluorescens* @ 5g/l (100% of first and third instar and 56.66% of fifth instar). It concluded that, the biopesticides *viz., B. thuringiensis*, *P. luminescens* and *Beauvaria bassiana* can be used as a promising bioagents for the management of fruit sucking moth larvae.

Keywords: Biopesticides, fruit sucking moth, host plant, larval mortality

INTRODUCTION

Fruit trees of different kinds all over the world are generally attacked by the caterpillars of numerous moths in different categories, such as leaf and flower eaters and bud, bark, stem and fruit borers. But so far, we know of very few examples of Lepidoptera causing direct damage to cultivated crops in the adult stage as butterflies or moths. One of such example is, the genus *Othreis (Eudocima)* and are by far the most harmful, widespread damage causers in tropical and subtropical countries includes India, Africa, Southeast Asia, Australia and the South Pacific countries.. In India, four species of *Othreis viz.*, *O. fullonia* (Clerck), *O. materna* (Linnaus), *O. homaena* (Hubner) and *O. cajeta* (Cramer) were recorded as prominent fruit piercers.

The fruit sucking moths, *Eudocima (Othreis)* spp. are polyphagous pests. Due to their damage recorded in citrus and pomegranate crop these attains the significance as pests in various countries. In India this was first recorded as a serious pest by Lefroy and Hawlett (1909). The immature stages (caterpillar) of these insects are never found feeding on any of the fruit crops but they found feeding on the leaves of unrelated trees, shrubs and vines often located well away from the adult feeding places (Denton *et al.,* 1989). These plants are mostly belonging to the family menispermaceae. While the adult moths cause serious damage during night to tropical and subtropical fruits. The nocturnal activity of the larvae and adults, lack of knowledge on larval food plants, breeding areas and possible migratory habits of larvae and adults might be some of the factors responsible because of which contributions are very little on fruit sucking moths by Indian entomologists.

Recent increase in area under cultivation of horticultural crops such as pomegranate, orange, guava, custard apple, mango and tomato in Maharastra, India has resulted in realizing heavy losses caused by fruit-piercing moths by the farmers. The management of fruit sucking moth is rather difficult. Considering the seriousness of the problem and scanty information, the attempt was made to find out the suitable larval hosts and biorational management of larvae.

MATERIALS AND METHODS

The experiment was conducted at Department of Entomology lab at Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra in the laboratory to study the larval host specificity and biorational management against fruit sucking moth. Field survey was carried out on citrus and pomegranate orchards in the periphery of Rahuri (Dist. Ahmednagar) and Paithan (Dist. Aurangabad) to collect the moths.

The moths were collected during the night hours (18.00 to 24.00 pm) during peak fruiting season (September and October). The collected moths of *Othreis materna* were released in rearing cages and five pairs of moths were released in each cage for mating. Cages

were made up of black cloth and were tied to the bamboo which was hanged horizontally in the laboratory to protect from the ant attack. The different fruits *viz.,* citrus, pomegranate, banana, etc. were kept in the cages for food purpose of moths. The fruits were regularly replenished. The eggs were collected from the cage daily and kept in the petri plates for hatching. After hatching, the neonate larvae were reared on leaves of Gulvel (*Tinospora cardifolia)* in bowls. First and second instar larvae were reared in small plastic containers (15 × 20 cm) on fresh gulvel leaves. As the caterpillars grew they were transferred to slightly bigger containers (35 cm × 15 cm) to avoid the crowding. Third instar larvae were taken for further laboratory studies.

Thirty third instar larvae was used for their host suitability studies on different host plants under no choice test. Twelve host plants were tested mainly belongs to menispermaceae family. These include 'Kakamari' (*Anamirta cocculus*), *Cocculus hirsutus* ,'Paharvel' *(Cissampelos pariera*), 'Vatoli' (*Diploclisa glaucescens), Tiliacora acuminate,* 'gulvel' *(Tinospora cardifolia),* Panghara' (*Erythrina indica), Ipomoea sinensis, Convolvulus arvensis, Piper betle, 'Rangoon creeper' (Quisqualis indica)* and *Morus ruba*. The leaves were provided for feeding and observations were recorded on the survival and mortal larval population at every 24 hrs up to the adult development stage. This experiment was planned in CRD with three replications.

The different biopesticides were evaluated against 1st, 3rd and 5th instar larvae of fruit sucking moth (*Othreis materna*). Ten different treatments *viz., Bacillus thuringiensis* (Delfin) @ 1g/l and 2g/l, *Photorhabdus luminescens* (Bioprahar) @ 2.5ml/l and 5ml/l, *Beauveria bassiana* (Phule *Beauveria*) @ 2.5g/l and 5g/l, *Metharhizum anisopliae* (Phule *Metarhizium*) @ 2.5g/l and 5g/l and Neem Seed Extract (NSE) @ 50g/l including untreated control evaluated against larval instars. The experiment was planned in completely randomized block design with three replications.

Bioassay studies were carried out by Leaf dip method for stomach poisons *i.e,* bacterial suspensions and botanicals and contact poisons *i.e,* fungal powders given by spraying method. In leaf dip bioassay method a fresh, uniform size *T. cardifolia* leaf discs (5 x 5 cm) was immerse in biopesticide solution for ten seconds with gentle agitation. The leaf discs were dipped in distilled water which served as control. The excess insecticidal fluid present on the leaf discs was allowed to drift-off and the discs were air dried under a ceiling fan. The treated leaf discs were transferred individually to glass petriplates (11x2.5 cm) with leaf axil surface facing upwards. The first, third and fifth instar larvae (10 larvae/ replication) were released in each treatment. In spraying method the required dilutions of biopesticides were prepared using distilled water and sprayed on first, third and fifth instar larvae of test insects. For every treatment three replications of thirty larvae were treated. The treated larvae were transferred to the glass petriplate (11x2.5cm) containing *T. cardifolia* leaves. The treated larvae of both methods were kept under ambient condition in the laboratory.

The larval mortality was recorded at 24, 48, 72 and 96 hrs after treatment. While, recording the observations moribund larvae giving no response to probing considered as dead. The corrected mortality was carried out by using the Abbott's (1925) formula.

RESULTS AND DISCUSSION

Host suitability study

The results of suitability of larval host plants are presented in table 1. It revealed that out of twelve tested host plants of fruit sucking moth, *O. materna* survived only on leaves of *T. cardifolia* as 100 per cent and completed its development. This indicated that *T. cardifolia* was found to be the suitable host. They did not fed leaves of other test plants (unsuitable) under

Table 1. Per cent survival of larvae of fruit sucking moth on different test plants

Name of Host plant	Number of larvae released	Number of survived larvae	Per cent survived of larvae
Anamirta cocculus	30	0	0
Cocculus hirsutus	30	0	0
Cissampelos pareira	30	0	0
Diploclisia glaucescens	30	0	0
Tiliacora acuminate	30	0	0
Tinospora cardifolia	30	30	100
Erythrina indica	30	0	0
Ipomoea sinensis	30	0	0
Convolvulus arvensis	30	0	0
Piper betle	30	0	0
Quisqualis indica	30	0	0
Morus ruba	30	0	0

Table 2. Bioefficacy of biorational insecticides against different larval stages of fruit sucking moth

Treatment	Per cent larval mortality											
	1st instar				3rd instar				5th instar			
	24 h	48 h	72 h	96 h	24 h	48 h	72 h	96 h	24 h	48 h	72 h	96 h
B. thuringiensis 1 g/lit	43.33 (41.17)	90.00 (71.57)	100.00 (90.00)	-	33.33 (35.26)	83.33 (65.90)	96.66 (79.47)	100.00 (90.00)	20.00 (26.57)	40.00 (39.23)	43.33 (41.17)	50.00 (45.00)
B. thuringiensis 2 g/lit	80.00 (63.43)	100.00 (90.00)	-	-	70.00 (56.79)	96.66 (79.47)	100.00 (90.00)	-	40.00 (39.23)	53.33 (46.91)	56.33 (48.64)	60.00 (50.77)
P. luminescens 2.5 ml/lit	40.00 (39.23)	46.66 (43.08)	70.00 (56.78)	70.00 (56.78)	36.63 (37.25)	43.33 (41.17)	60.00 (50.77)	63.33 (52.73)	26.67 (31.09)	40.00 (39.23)	43.33 (41.17)	43.33 (41.17)
P. luminescens 5.0 ml/lit	90.00 (71.57)	96.66 (79.46)	100.00 (90.00)	-	86.67 (68.59)	93.33 (75.03)	96.66 (79.47)	100.00 (90.00)	33.33 (35.26)	46.66 (43.08)	50.00 (45.00)	56.66 (48.83)
B. bassiana 2.5 g/lit	10.00 (18.43)	10.00 (18.43)	30.00 (33.21)	30.00 (33.21)	6.66 (14.96)	16.67 (24.10)	16.67 (24.10)	20.00 (26.57)	0.00	13.33 (24.41)	13.33 (24.41)	20.00 (26.57)
B. bassiana 5.0 g /lit	60.00 (50.77)	73.33 (58.90)	76.66 (61.11)	76.66 (61.11)	53.33 (46.91)	60.00 (50.77)	60.00 (50.77)	70.00 (56.79)	0.00	20.00 (26.57)	23.33 (28.88)	26.67 (31.09)
M. anisopliae 2.5 g/lit	10.00 (18.43)	20.00 (26.56)	30.00 (33.21)	30.00 (33.21)	6.66 (14.96)	16.66 (24.09)	23.33 (28.88)	26.66 (31.09)	0.00	6.66 (14.96)	13.33 (21.41)	13.33 (21.41)
M. anisopliae 5.0 g/lit	43.30 (41.15)	60.00 (50.77)	80.00 (63.43)	80.00 (63.43)	36.66 (37.26)	53.33 (46.91)	53.67 (47.10)	73.00 (58.69)	0.00	20.00 (26.57)	26.67 (31.09)	30.00 (33.21)
Neem Seed Extract 50 g/lit	50.00 (45.00)	90.00 (71.57)	90.00 (71.57)	90.00 (71.57)	6.66 (14.96)	20.00 (26.57)	30.00 (33.21)	36.66 (37.26)	6.66 (14.96)	13.33 (24.41)	16.66 (24.09)	16.66 (24.09)
Untreated control	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE (m) ±	0.35	0.25	0.67	0.67	0.76	0.96	0.73	0.33	0.36	0.50	0.39	0.29
CD at 1%	1.41	1.04	2.68	2.68	3.08	3.88	2.96	1.34	1.46	2.03	1.58	1.19

*Figures in the parentheses are subjected to arc sine transformed values.

no choice test. Similar type of studies are also conducted by several workers (Bhumannavar and Viraktamath, 2001; Mohite *et al.,* 2004 and Ramkumar *et al.*, 2010). They reported that *T. cardifolia* is the ideal host for the development of fruit sucking moth, *Othreis* spp.

Bioefficacy study

The data on the efficacy of different biorational pesticides against first, third and fifth instar larvae of fruit sucking moth are presented in table 2.

1st instar

The results of biorationals on first instar for the response revealed that *P. luminescens* @ 5.0 ml/L recorded higher mortality (90%) followed by *B. thuringiensis* @ 2 g/L (80%) at 24 hrs. rest of the biorational treatments were recorded larval mortality in the range of 10 - 60 per cent. While, at 48 hrs 100 per cent mortality was achieved by *B. thuringiensis* @ 2 g/L followed by *P. luminescens* @ 5.0 ml/l (96.66%). However, at 72 hrs two more treatments like *P. luminescens* @ 5.0 ml/L and *B. thuringiensis* @ 1 g/L achieved 100 per cent mortality. At 96 hrs, Neem Seed Extract @ 50 g/L recorded 90 per cent mortality followed by *M. anisopliae* @ 5 g/L (80%). The lower dose of *B. bassiana* and *M. anisopliae* @ 2.5 g/L was found to be less effective (30%) against first instar larvae. Similar types of studies are also conducted against different lepidopteran larvae like, *Galleria mellonella* (Shahina *et al.*, 2011), castor semilooper (Devi and sudhakar, 2006), *Spodoptera litura* (Vijayavani *et al.,* 2009) with the above mentioned any biorationals.

3rd instar

The third instar larval mortality was varied and recorded in the range of 6.66 – 86.67 and 16.66 – 96.66 per cent in the tested biorational pesticide at 24 hrs and 48 hrs, respectively. At 72 hrs, *B. thuringiensis* @ 2 g/ lwas found to be most effective by achieving 100 per cent mortality. Treatments *i.e., P. luminescens* @ 5.0 ml/L and *B. thuringiensis* @ 1 g/L were also effective to kill larvae (100%) up to 96 hrs. The remaining treatments were recorded the considerable mortality (20 - 73%) and found to be less effective against the third instar larvae. In citrus, *B. thuringiensis* was tested against leaf miner and founds effective (90%), was also similar with the present case (Basheli, 2000); similarly, *B. bassianna* and *M. anisopliae* recorded 95-100 per cent mortality in *Chillo partellus* (Tefera and Pringle, 2003).

5th instar

The result indicated that the treatments *viz., B. bassiana* @ 2.5 g/L it, *B. bassiana* @ 5.0 g/L, *M. anisopliae* @ 2.5 g/L and *M. anisopliae* @ 5.0 g/L were recorded absolutely no mortality of fifth instra larvae at 24 hrs. Other treatments were also less effective against larval mortality by recording 6.66 – 40.00 per cent at 48, 72 and 96 hrs. At 5th instar though there is no 100 per cent mortality in any of the treatments but the effective treatments was again *B. thuringiensis* @ 2 g/L (60%) followed by *P. luminescens* @ 5.0 ml/L (56.66%) and *B. thuringiensis* @ 1 g/L (50%) at 96 hrs. whereas, the least mortality was recorded in *M. anisopliae* @ 2.5 g/L (13.33%).

Larvae of fruit sucking moth, though it is feeding on several alternate hosts, *T. cardifolia* founds the ideal hosts for its growth and development. *B. thuringiensis,* if used at 2.0 g/L can manage the larvae to the greater extent sometimes up to 100 per cent. In contrary, *M. anisopliae* @ 2.5 g/L was least effective biopesticide. Overall, *B. thuringiensis*, *P. luminescens* and *B. bassiana* can be used as a promising biopesticides to reduce the population of fruit sucking moth.

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