Management of sweet potato weevil through biopesticides

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ABSTRACT

Sweet potato weevil is the most disastrous pest affecting sweet potato plantation. Entomopathogenic fungi are by far one of the most effective biological control agents of sweet potato weevil due to their host-specificity. A field experiment was conducted at Central Experimental Station, Wakawali, Dapoli, Maharashtra during Kharif seasons of 2008, 2009 and 2010 to manage the weevil infesting sweet potato. The treatments included *Beauveria bassiana*, Bio-Power 1.5 per cent WP @ 6.75 kg/ha, *Metarhizium anisopliae* Stanes, Bio-Magic 1.5 WP @ 11.25 kg/ha, mustard oil cake @ 10 tonnes/ha, neem cake @ 10 tonnes/ha, yam bean seed 5 per cent aqueous extract, cassava tuber rind 5 per cent aqueous extract, garlic 5 per cent aqueous extract, control (only water) and check (dimethoate 0.05% spray). The application of *B bassiana* @ 6.75 kg/ha and application of neem cake @ 10 tonnes/ha after one month of sweet potato planting proved most effective in reducing the damage to the sweet potato tubers and number of weevils.

Keywords: Sweet potato; *Beauveria bassiana*; *Cylas formicarius*; biopesticides

Sweet potato (*Ipomea batata* L) is one of the most important root and tuber crops of the world. It has played an important role in the food systems of the tribals in particular those inhabiting marginal ecosystems having unreliable rainfall (Khatana et al 1999). In most parts of the country the storage roots are boiled and eaten or chipped, dried and milled into flour which is then used to prepare snacks and baby weaning foods (Hagenimana et al 2001). All the plant parts of sweet potato and its culls are used as livestock feed (Claessens et al 2009).

The sweet potato weevil, *Cylas formicarius* is a serious pest in the field and in storage. Even low number of larvae reduces sweet potato quality and marketable yield. The adult weevil feeds on all parts of the plant but reproduces only in the stems and roots. Many insect species attack sweet potato and the importance of different species varies between agro-ecological zones. *C formicarius* is an important pest in India and southeast Asia, Oceania, the United States and the Caribbean. The basis for successful management of sweet potato pests, diseases and nutritional disorders is integrated crop management. This implies prevention of insect infestation and infection by pathogens through the use of adequate cultural practices and the conservation of natural enemies (Ames et al 1997). Numerous studies and laboratory experiments have proven that entomopathogenic fungi are useful in the control of sweet potato weevil (Reddy et al 2014). Promising biological control agents for sweet potato weevils appear to be the fungi namely *Beauveria bassiana* and *Metarhizium anisopliae* and nematode species like *Heterorhabditis* spp and *Steinernema* spp. The fungi attack and kill adult weevils whereas the nematodes kill the larvae. Thus an attempt has been made to investigate effective and ecofriendly control measures for management of sweet potato weevil.

MATERIAL and METHODS

A field experiment was conducted at Central Experimental Station, Wakawali, Dapoli, Maharashtra during Kharif seasons of 2008, 2009 and 2010. The experiment was laid out in randomized block design with three replications and nine treatments as per the recommended package of practices. The crop was

planted at the onset of monsoon. The vines of sweet potato were planted at a spacing of 60 x 20 cm in plots of size 4.8 x 3.6 m. The treatments used were T_1 (*B bassiana*, Bio-Power 1.5% WP @ 6.75 kg/ha), T_2 (*M anisopliae*, Stanes Bio-Magic 1.5 WP @ 11.25 kg/ha), T_3 (Mustard oil cake @ 10 tonnes/ha), T_4 (Neem cake @ 10 tonnes/ha), T_5 (Yam bean seed 5% aqueous extract), T_6 (Cassava tuber rind 5% aqueous extract), T_7 (Garlic 5% aqueous extract), T_8 (Control), T_9 (Check, dimethoate 0.05% spray at monthly interval). The treatments T_1, T_2, T_3 and T_4 were applied once 30 days after planting. Treatments T_5, T_6, T_7 and T_9 were applied at an interval of one month starting from one month after planting. The chemical treatment was applied at an interval of one month after planting. At the time of harvesting to work out damage to the tubers on weight basis, 1 kg infested tubers from each treatment were kept for counting the number of weevil emergence and then analysed.

RESULTS and DISCUSSION

The data given in Table 1 show that mean tuber damage due to weevil was minimum in T_1 (*B bassiana*, Bio-Power 1.5% WP @ 6.75 kg/ha) during 2008, 2009 and 2010 (15.86, 19.72 and 23.52% respectively) followed by T_4 (Neem cake @ 10 tonnes/ha) (16.57, 22.49 and 28.50% respectively) as compared to T_8 (Control) having 32.49, 40.14 and 54.15 per cent and T_9 (Check, dimethoate 0.05% spray at monthly interval) with 20.51, 29.01 and 38.16 per cent damage respectively. The treatments T_1 and T_4 were however at par with each other during 2008 and 2009 wrt tuber damage by the weevil. Similar trend was observed in the pooled data for three years. The treatment T_1 proved most effective with 19.70 per cent damage followed by T_4 with 22.52 per cent as compared to 42.26 and 29.23 per cent in case of control and check treatments T_8 and T_9 respectively.

The number of weevils recorded per kg of produce was minimum in the same treatments T_1 and T_4 during all the three seasons (6.66 and 15.00 in 2008, 5.66 and 8.66 in 2009, 8.00 and 11.00 in 2010 respectively) as compared to control and check treatments T_8 (17.33, 20.66 and 39.00 during 2008, 2009 and 2010 respectively) and T_9 (11.33,

Table 1. Effect of biopesticides and microbial agents on sweet potato weevil damage to tubers and weevil number

Treatment	Kharif 2008		Kharif 2009		Kharif 2010		Pooled (2008, 2009, 2010)
	Mean tuber damage (%)	Number of weevils/kg	Mean tuber damage (%)	Number of weevils/kg	Mean tuber damage (%)	Number of w eevils/kg	Mean tuber damage (%)
T_1	15.86 (23.48)*	6.66 (3.57)**	19.72 (26.33)*	5.66 (3.32)**	23.52 (28.99)*	8.00 (3.79)**	19.70 (26.27)
T_2	20.22 (26.42)	11.00 (4.29)	24.57 (29.67)	13.33 (4.60)	31.56 (34.15)	14.66 (4.82)	25.45 (30.08)
T_3	24.16 (29.36)	12.33 (4.41)	31.13 (33.90)	16.33 (5.05)	40.97 (39.77)	28.33 (6.29)	32.08 (34.34)
T_4	16.57 (24.03)	8.33 (3.83)	22.49 (28.26)	8.66 (3.93)	28.50 (32.26)	11.00 (4.28)	22.52 (28.18)
T_5	25.85(30.55)	15.00 (4.85)	33.15 (35.13)	17.00 (5.09)	44.91 (42.05)	34.66 (6.86)	34.63 (35.91)
T_6	24.84 (29.85)	13.33 (4.62)	33.40 (35.25)	18.66 (5.29)	48.78 (44.62)	36.33 (7.01)	35.67 (36.57)
T_7	22.97 (28.61)	11.66 (4.40)	27.69 (31.74)	14.66 (4.80)	35.36 (36.48)	19.66 (5.40)	28.67 (32.28)
T_8	32.49 (34.68)	17.33 (5.15)	40.14 (39.28)	20.66 (5.53)	54.15 (47.38)	39.00 (7.22)	42.26 (40.45)
T_9	20.51 (26.93)	11.33 (4.34)	29.01 (32.46)	13.00 (4.25)	38.16 (38.14)	24.33 (5.57)	29.23 (32.51)
SE±	0.88	0.23	1.072	0.256	0.93	0.135	0.87
$CD_{0.05}$	2.64	0.68	3.21	0.770	2.81	0.404	2.61

*Figures in parentheses are arc sin values, **Figures in parentheses are √ + 1 values

T_1 (*Beauveria bassiana*, Bio-Power 1.5% WP @ 6.75 kg/ha), T_2 (*Metarhizium anisopliae*, Stanes Bio-Magic 1.5 WP @ 11.25 kg/ha), T_3 (Mustard oil cake @ 10 tonnes/ha), T_4 (Neem cake @ 10 tonnes/ha), T_5 (Yam bean seed 5% aqueous extract), T_6 (Cassava tuber rind 5% aqueous extract), T_7 (Garlic 5% aqueous extract), T_8 (Control), T_9 (Check, dimethoate 0.05% spray at monthly interval)

13.00 and 24.33 during 2008, 2009 and 2010 respectively).

Therefore for the management of sweet potato weevil application of *B bassiana* @ 6.75 kg/ha or application of neem cake @ 10 tonnes/ha after one month of sweet potato planting is recommended.

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