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Comparative efficacy of neem products, essential oils and synthetic insecticides for the management of onion thrips, *Thrips tabaci* Lindeman

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ABSTRACT : Field experiments were conducted at Indian Institute of Horticultural Research, Bengaluru, India to study the bio-efficacy of neem seed powder extract (NSPE) (4%), neem soap (NS) (1%), essential oils of Basil or Tulsi *(Ocimum tenuiflorum* syn. *O. sanctum*), (0.2%) and scented *Geranium,* (*Pelargonium graveolens*), (0.2%) along with commonly used synthetic insecticides *viz.*, dimethoate (0.06%), acephate (0.075%) and fipronil (0.05%) against onion thrips, *Thrips tabaci* Lind. during summer 2011 and 2012. All the treatments of botanicals, essential oils and insecticides significantly reduced thrips incidence during both the seasons. Fipronil was the most effective treatment in reducing thrips and also in increasing yield during both the seasons. However, *Basil* was at par with fipronil in reducing pest incidence and increasing yield. The NS and NSPE also reduced thrips incidence and were at par with acephate and dimethoate. When yields were considered, plots treated with NSPE, NS, *Basil* and *Geranium* and dimethoate were at par during both seasons. This study clearly illustrated that neem products and essential oils can be used as components of thrips IPM.

Keywords : Essential oils, *Geranium,* neem, *Ocimum,* onion thrips, *Thrips tabaci*

INTRODUCTION

Onion thrips (*Thrips tabaci* Lindeman) is a very serious pest of onion causing more than 50 per cent yield loss. Thrips are effectively managed by synthetic insecticides worldwide. However, efforts to develop alternative strategies to manage this pest by alternative technologies have been continuing. Neem has been found to be a very good alternative to synthetic insecticides (Schumeterer, 2002) and neem seed kernel extract (NSKE) has been found effective against this pest (Vijayalakshmi *et al*., 1995 ; Krishna Kumar, 2008). As an alternative to NSKE, the Indian Institute of Horticultural Research, Bengaluru has developed pulverised neem seed powder extract (NSPE) and neem soap (NS) for managing insect pests (Krishna Moorthy and Krishna Kumar, 2002 and 2011). Essential oils are also finding increased attention as alternatives to the use of synthetic insecticides in recent years (Isman, 2000). Laboratory studies by us have shown that spray of commercially available essential oils at 0.2 per cent concentration kills early instar caterpillars of diamondback moth (*Plutella xylostella* L.) (Unpublished work by the authors). So far very little information is available on their bio-efficacy under field conditions. Therefore, field experiments were conducted to test the bio-efficacy of the NS, NSPE and essential oils of *Basil*, *Ocimum tenuiflorum* (syn. *O. sanctum*) commonly called as *Tulsi,* and scented *Geranium* (*Pelargonium graveolens*) against onion thrips during summer season of 2011 and 2012. The results of the two trials are reported here.

MATERIALS AND METHODS

Field experiments were conducted during summer 2011 and 2012 at the experimental farm of the Indian Institute of Horticultural Research, Bengaluru. Onion variety *Arka Kalayan* was transplanted in ridges with a spacing of 50 x 10 cm on 25th January and 12th February during 2011 and 2012 respectively. During first season, first spray was given at 30 days after planting (DAP). However, during the second season spray was given only after 40 DAP when the pest incidence was high at around 100/plant. This was done to know whether botanicals and essential oils can be used as alternatives to synthetic insecticides under such conditions. Spray treatments of NSPE (4%), NS (1%), *Basil* (0.2%), *Geranium* (0.2%), dimethoate (0.06%), acephate (0.075%) and fipronil (0.08%) were given using a gator sprayer delivering 1000 l/ha. Before spraying, a commercially available sticker (@0.5 ml/litre of spray fluid) was mixed. A pulveriser was used to powder dry cleaned whole seeds of neem to a very fine consistency before the start of the experiments during both the seasons and stored in a cool dry place at room temperature in a gunny bag. Forty grams of pulverized neem seed powder was soaked in 200 ml water

overnight, filtered through double layered nylon mesh to prevent the powdered neem seed particles from clogging the nozzle and volume was made to 1 L to prepare 4 per cent solution for spraying. To prepare 100 L of spray fluid, 4 kg of pulverized neem seed powder is required. Neem soap was prepared in the laboratory. Essential oils were supplied by M/S Aroma Trading Co., Bengaluru, India. Sprays were given at 10 days interval, four times during 2011 and three times during 2012. The experiment design was Randomised Block Design (RBD) with three replications. Observations were recorded by using the non-destructive method by carefully examining the inner leaf sheaths and growing parts of the plants. For this purpose, 10 plants were selected in random in each plot and carefully observed. The data on the thrips incidence in different plots on individual dates were tabulated treatment wise and yield was converted to tonnes per hectare and subjected to analysis of variance (ANOVA) to separate the means. Data on thrips incidence were transformed to Log (X+1) transformation before analysis.

RESULTS AND DISCUSSION

The pest incidence under different treatments and corresponding yield during the two years are provided in Tables 1 and 2. During 2011, the results indicate that fipronil was the best treatment by recording 7.93 to 28.33 thrips/plant as compared to 38.87 to 83.33 thrips/plant on different observation dates recorded in control. Sprays of *Basil* and NSPE were at par with fipronil on three observation dates (50, 60 and 70 DAP). While plots treated with *Basil* recorded thrips incidence of 12.07 to 30.67/plant, NSPE recorded 12.7 to 35.00 /plant. Sprays of *Geranium* was at par with fipronil on two observation dates (60 and 70 DAP). The treatments of NSPE, *Basil* and *Geranium* were at par with each other on all observation dates. However, sprays of NS, acephate and dimethoate were at par with fipronil on one date of observation only and these treatments are at par with each other on three observation dates (50, 60 and 70 DAP). As far as yield is considered, though fipronil recorded highest yield (31.25 t/ha), all other treatments, namely, *Basil*, NSPE, Neem soap and acephate were at par with fipronil. These treatments recorded 30.66, 30.38, 29.54 and 29.78 t/ha, respectively. However, *Geranium* treated plots recorded 28.17 t/ha and were at par with NS, NSPE, *Basil* treated plots.

In the following season, thrips incidence was moderate (73.33 to 101.33/plant) (Table 2). Very high incidence of thrips was observed on 40 DAP when first spray was given. The incidence of thrips in different treatments was found to be significantly different at 50 and 60 DAP only. Again during this season, *Basil* and NS were as effective as fipronil in reducing thrips incidence on these two dates. Treatments of NSPE and dimethoate were on par with fipronil one date of observation only when thrips incidence was considered. During this season also *Basil*, *Geranium*, acephate and fipronil treated plots were on par with each other in increasing yield which recorded 36.87, 33.59, 32.65 and 36.53 t/ha respectively. NS and NSPE treated plots recorded 30.90 and 31.91 t/ha and were on par with dimethoate, *Basil* and *Geranium* treated plots. Control plot recorded 20.59 t/ha. The studies conducted for two seasons showed that *Basil* was on par with fipronil in reducing thrips incidence on all dates except one (25-3-2011). During season II, in spite of the high incidence of thrips before start of spray the essential oils of both *Basil* and *Geranium* increased the yield and were on par with fipronil and acephate (Table 2). NS and NSPE were also effective in reducing thrips incidence and increasing the yield as compared to control and recorded yield on par with basil. Homemade neem extract was found to reduce onion thrips (Vijayalakshmi, 1995 ; Krishna Kumar, 2008). Present study has shown that neem products like NSPE, neem soap can be effective alternatives to synthetic insecticides like dimethoate, acephate and fipronil and can be used in IPM programmes. This is also in conformity of our earlier finding that NSPE and NS are effective in reducing okra fruit borer *Erias vitella* F. (Krishna Moorthy and Krishna Kumar, 2012). Though NSKE and NSPE are effective, they have not become very popular to expected level among growers due to the difficulty in their preparation and difficulty in timely availability of seeds. Therefore, we developed neem soap and now this is made available to farmers commercially by transferring the technology to many *Krishi Vigyan Kendras* (KVK) and a few private firms in Karnataka, Tamil Nadu, Kerala, Andhra Pradesh and Maharastra. Hence, Neem soap can be used as alternative to synthetic insecticides. Further, essential oils like *Basil* and *Geranium* also have good potential as components in thrips IPM programmes. Not much information is available on the use of essential oils in insect pest management. Most of the research in essential oils is confined to the laboratory studies. However, Reitz *et al.* (2008) have found that spray of essential oils have reduced spotted wilt disease in tomato, though it did not reduce vector thrips (*Frankliniella* spp.) population. They also found that mixing kaolin (an inert adjuvant) with essential oils before spray has increased plant yield. Now we are reporting the field efficacy of essential oils on onion thrips as compared to neem products and

Table 1. Thrips incidence in onion as affected by different treatments (2011)

Treatment	40 DAP	50 DAP	60 DAP	70 DAP	Yield (t/ha)
Neem soap (1.0%)	20.13^{e}(3.05)	43.33^{b}(3.75)	43.67^{b}(3.79)	26.33^{ab}(3.30)	29.54^{ab}
Pulverised neem seed powder extract (4.0%)	12.87^{c}(2.62)	29.33^{ab}(3.40)	35.00^{a}(3.58)	24.00^{ab}(3.18)	30.38^{ab}
Essential oil Basil (0.2%)	12.07^{bc}(2.57)	21.67^{ab}(3.10)	30.67^{a}(3.45)	25.00^{ab}(3.26)	30.66^{ab}
Essential oil Geranium (0.2%)	15.53^{cd}(2.80)	35.00^{b}(3.56)	28.67^{a}(3.39)	25.00^{ab}(3.25)	26.78^{b}
Dimethoate (0.06%)	18.67^{de}(2.97)	31.67^{ab}(3.48)	42.00^{b}(3.76)	30.00^{b}(3.42)	28.17^{b}
Acephate (0.075%)	10.20^{b}(2.41)	20.67^{ab}(3.07)	38.67^{b}(3.67)	29.33^{b}(3.41)	29.78^{ab}
Fipronil (0.05%)	7.93^{a}(2.19)	19.33^{a}(2.96)	28.33^{a}(3.37)	20.67^{a}(3.07)	31.25^{a}
Control	38.87^{f}(3.66)	73.33^{c}(4.30)	83.33^{c}(4.43)	56.00^{c}(4.04)	15.58^{c}
CD (P=0.05)	0.21	0.52	0.21	0.27	4.23
CV%	4.44	8.99	3.35	4.79	9.05

Figures in parenthesis are log (x+1) transformed values

Table 2. Thrips incidence in onion as affected by different treatments (2012)

Treatment	40 DAP	50 DAP	60 DAP	70 DAP	Yield (t/ha)
Neem soap (1.0%)	94.67 (4.56)	57.50^{abc}(4.01)	43.00^{ab}(3.76)	6.80(1.98)	30.90^{b}
Pulverised neem seed powder extract (4.0%)	98.00(4.60)	38.67^{ab}(3.68)	49.00^{bc}(3.91)	7.67(2.10)	31.91^{b}
Essential oil Basil (0.2%)	97.67(4.59)	58.75^{abc}(4.04)	45.33^{ab}(3.80)	6.67(1.98)	33.59^{ab}
Essential oil Geranium (0.2%)	99.67(4.61)	69.17^{bc}(4.25)	51.33^{bc}(3.93)	9.67(2.27)	32.65^{ab}
Dimethoate (0.06%)	95.67(4.57)	72.50^{bc}(4.28)	42.00^{ab}(3.74)	10.33(2.42)	29.90^{b}
Acephate (0.075%)	101.33(4.63)	55.63^{ab}(3.68)	38.67^{ab}(3.68)	2.33(1.00)	36.53^{a}
Fipronil (0.05%)	95.33(4.56)	32.75^{a}(3.47)	32.75^{a}(3.47)	4.60(1.71)	36.87^{a}
Control	96.00(4.57)	84.38^{c}(4.45)	68.83^{c}(4.24)	7.67 (2.12)	20.59^{c}
CD (P=0.05)	NS	0.63	0.46	NS	4.55
CV%	2.37	6.47	6.47	26.48	8.22

Figures in parenthesis are log (x+1) transformed values

synthetic insectiides. However, further studies have to be done to reduce the dosage of essential oils to bring down the cost by developing suitable eco-friendly formulations.

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