J. Hortl. Sci.
Vol. 6(2):118-122, 2011

Management of thrips, *Scirtothrips dorsalis* Hood, on rose under open-field and protected conditions

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ABSTRACT

Investigation on management of thrips, *Scirtothrips dorsalis* Hood on roses under open-field and protected conditions was conducted during 2008-10 at Bengaluru. Clothianidin 50 WDG 20g a.i./ha proved best in terms of efficacy and cost. Vertimac, spinosad and Garlic Barrier agriculture (GB Ag) were comparable in efficacy. GB Ag was on par with clothianidin besides being eco-friendly. GB Ag was found effective as a new molecule. Neem seed kernel extract (NSKE) proved to be superior to neem oil, pongamia oil and the commercial neem product, Nimbecidine. NSKE was also found to reduce thrips density to the extent of 64% - 88%. In rose fields where pest suppression measures are hardly practised, farmers can apply NSKE, monocrotophos or imidacloprid. Based on the cost of vertimac and spinosad, these can be recommended where cost-effective, as in commercial polyhouses growing roses.

Key words: Thrips, *Scirtothrips dorsalis*, rose, management, open-field and protected conditions

INTRODUCTION

Rose (*Rosa* spp.) is one of the most popular flowering shrubs in India as well as in other countries. Valued for their beautiful and, often, fragrant blooms, roses have been cultivated in gardens for centuries as vines, shrubs, specimen plants, ground-covers and container-plants. Commercial rose cultivation under open-field and protected structures is gaining importance with area under its cultivation increasing day by day. There is a need to provide adequate protection against various insect pests to improve quality and yield of the flowers. A large number of insects attack different parts of the rose plant from the very early stages of growth. The most common pests are thrips, aphids, scales, chaffers, termites, whiteflies, leafhoppers, mites, etc. Among these pests, thrips (*Scirtothrips dorsalis* Hood) is very important (Ananthakrishnan and Jagdish, 1968; Nair *et al*, 1991; Onkarappa and Mallik, 1998). The larvae and adults of *S. dorsalis* cause damage at all the stages in a flower (Murugan, 2000). *Scirtothrips dorsalis* alone can cause 28-95% damage (Gahukar, 2003). Due to extensive cultivation of rose by humans, the crop now needs to be managed using less pollutant-chemicals. It is important to know the insect-pest complex in rose. Several insecticides like monocrotophos, endosulfan and lambda cyhalothrin have been recommended for managing *S. dorsalis*. However, pest-suppression achieved is not to the level desired (Sridhar and Rani, 2003; Dhanajaya, 2007; murugan and Jagadish, 2004). Reddy *et al* (2001) reported that application of fipronil, followed by thiamethoxam, acetamiprid and dimethoate, were effective in controlling rose thrips. To know the efficiency of botanicals and biopesticides against damage caused by rose thrips, the present investigation was carried out.

MATERIAL AND METHODS

Field trials were conducted in the botanical garden of Lalbagh and protected cultivation in a polyhouse at Ramohally, Bengaluru (12º56' N and 77º35' E at 930m amsl). The experiment was laid out in Randomized Complete Block Design, with 5 replications. There were a total of thirteen treatments including Control (Table 1). Each treatment was imposed twice at six-day intervals. Observations on number of thrips were made a day before treatment (Pre-count) and at 3 and 5 days after treatment. Thrips (nymphs and adults) counts were recorded in five randomly-selected plants in each replication, on every date of observation. On each plant, three partially-opened flowers (one each from top, middle and bottom of the canopy), three young shoots (one each from top, middle and bottom of the canopy) and three young leaves (one each from top, middle and bottom of the canopy) were selected. The flowers, shoots and leaves were beaten against a black card-board sheet (0.3×0.3m)

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Table 1. Efficacy of botanicals, biopesticides and chemicals against rose thrips under open-field conditions at Lalbagh, Bangalore during 2008

Treatment	Particulars	*Number of thrips per plant on different days					Mean
		Pre-treatment count	I Spray		II Spray		
			3-DAS	5-DAS	3-DAS	5-DAS	
T1	NSKE @5%	18.10(4.37)	10.74(3.42)	6.40(2.72)	4.84(2.41)	3.16(2.04)	6.29 (2.99)[f]
T2	Neem oil @2%	18.46(4.41)	15.36(4.04)	12.16(3.62)	8.92(3.15)	8.28(3.05)	11.18 (3.65)[h]
T3	Pongamiaoil @ 2%	18.40(4.40)	16.04(4.12)	13.20(3.77)	10.80(3.43)	9.06(3.17)	12.28 (3.78)[i]
T4	Nimbecidine @0.2%	18.60(4.42)	16.64(4.20)	14.80(3.97)	12.20(3.63)	10.16(3.34)	13.45 (3.91)[j]
T5	GB Ag @0.2%	18.20(4.38)	8.58(3.09)	4.98(2.44)	2.82(1.95)	1.98(1.72)	4.59 (2.72)[c]
T6	Spinosad- 45SC @0.04%	18.10(4.37)	8.86(3.13)	4.70(2.39)	2.44(1.85)	1.86(1.69)	4.47 (2.71)[c]
T7	Vertimec -1.9EC @0.03%	18.20(4.38)	8.24(3.04)	4.24(2.28)	2.42(1.84)	1.30(1.51)	4.05 (2.61)[a]
T8	Chlorfenapyr–10SC- .15%	18.40(4.40)	8.66(3.12)	6.44(2.72)	3.38(2.09)	2.16(1.78)	5.16 (2.79)[d]
T9	Fipronil - 5 SC @0.2%	18.50(4.40)	9.26(3.20)	7.24(2.87)	3.80(2.19)	2.32(1.82)	5.66 (2.89)[e]
T10	Clothianidin 50 WDG @20g a.i./ha	18.80(4.45)	8.06(3.01)	4.48(2.34)	2.16(1.78)	1.18(1.47)	3.97 (2.61)[a]
T11	Monocrotophos @0.15%	18.60(4.43)	10.60(3.40)	8.60(3.09)	4.78(2.40)	3.52(2.12)	6.88 (3.09)[g]
T12	Imidacloprid@200SL-0.1%	18.00(4.36)	8.403.06)	4.78(2.40)	2.74(1.93)	1.42(1.55)	4.34 (2.66)[b]
T13	Control (No spray)	18.23(4.38)	21.00(4.68	24.60(5.06)	27.00(5.29)	29.20(5.49)	25.45 (4.98)[l]
						S.Em.±	C.D. at 5%
T						0.021	0.042
D						0.012	0.025
T x D						0.048	0.090

DAS – Days After Spray
*Average of three mature flowers, young shoots and leaves five replications
Figures in parentheses indicate $\sqrt{x+1}$ transformation

separately, and the thrips that fell onto the black sheet were counted separately for each part, and averaged per plant. Observations were repeated for five plants, and numbers of thrips were averaged. The data was subjected to ANOVA after square root transformation.

RESULTS AND DISCUSSION

Pre-treatment number of thrips in all the plots ranged from18.10 to 18.60 per plant, and treatment differences were non-significant (Table 1) in 2008 at Lalbagh. All the treatments were significantly effective in reducing thrips numbers compared to Control. However, clothianidin 50 WDG @20g a.i./ha was the most effective treatment, which recorded minimum thrips-density on all dates of observation. This insecticide reduced thrips-density from 18.80/plant to 1.18/plant at 5 days after the second spray (DASS). Mean thrips-density/plant was 3.97. This insecticide proved superior to all other treatments. Vertimac 1.9EC (0.03%) was on par with clothianidin which recorded thrips-density ranging from 18.20/plant to 1.30/plant, with mean density of 4.05 per plant. Next in the order of efficacy were imidacloprid (0.1%), spinosad (0.04%), GB Ag (0.2%), chlorfenafyr (0.1%), fipronil (0.2%), monocrotophos (0.15%). clothianidin, vertimac, spinosad and GB Ag were comparable in their efficacy, even though the latter two were statistically significantly-different. In the control plot, rose-thrips density per plant increased from 18.23 to 29.20 at 5 days after second spray, with a mean value of 25.45. Among botanicals, GB Ag registered minimum thrips-number and brought down thrips population from 18.20/plant (pre treatment) to 1.98/plant (5 DAS), with mean thrips-density of 4.59 per plant; its efficacy was comparable with that of insecticides. Neem Seed Kernel Extract (NSKE) @ 5% proved better than neem oil (2%), pongamia oil (2%) or Nimbecidine (0.2%). Vertimac proved to be better than spinosad. Data on effect of insecticides, botanicals and biopesticides against thrips at Lalbagh in 2009 are presented in Table 2. Pre-treatment number of thrips in all the plots ranged from 27.04 to 27.94, and treatments were statistically non-significant. Data indicated that on all dates of observation treatments were all significantly superior to Control, thereby reducing the thrips' population. However, clothianidin 50 WDG @20g a.i./ha proved to be the best on all dates of observation. This insecticide reduced thrips-density from 27.53/plant to 1.99/plant at 5 DAS. Thrips density in spinosad (0.04%) treatment was on par with clothianidin where mean thrips-density was 7.20 per plant. GB Ag was on par with clothianidin and spinosad, registering mean thrips-density of 7.59 per plant. Next in the order of efficacy were vertimac (0.03%), chlorfenafyr (0.1%), imidacloprid (0.1%), fipronil (0.2%) and monocrotophos (0.15%). Among the botanicals tested, GB Ag registered

Table 2. Efficacy of botanicals, biopesticides and chemicals against rose thrips under open-field conditions at Lalbagh, Bangalore during 2009

reatment	Particulars	*Number of thrips per plant on different days					Mean
		Pre-treatment count	I Spray		II Spray		
			3-DAS	5-DAS	3-DAS	5-DAS	
T1	NSKE @5%	26.26(5.31)	16.29(4.15)	12.57(3.68)	10.30(3.36)	5.52(2.55)	11.17 (3.81)[f]
T2	Neem oil @2%	27.14(5.30)	24.43(45.04)	16.42(4.17)	10.30(3.36)	7.16(2.85)	14.58 (4.15)[g]
T3	Pongamia oil @2%	27.04(5.29)	25.62(5.15)	17.22(4.26)	11.82(3.58)	8.23(3.04)	15.72 (4.27)[h]
T4	Nimbecidine @0.2%	27.15(5.30)	25.94(5.19)	18.00(4.35)	12.62(3.69)	9.14(3.18)	16.43 (4.34)[i]
T5	GB Ag @0.2%	27.34(5.32)	15.42(4.05)	8.31(3.05)	4.28(2.19)	2.35(1.83)	7.59 (3.31)[ab]
T6	Spinosad- 45SC @0.04%	27.18(5.30)	14.52(3.94)	8.04(3.01)	4.04(2.24)	2.21(1.79)	7.20 (3.26)[a]
T7	Vertimec -1.9EC @0.03%	27.28(5.32)	15.34(4.04)	9.25(3.20)	5.28(2.50)	2.22(1.79)	8.02 (3.37)[b]
T8	Chlorfenapyr–10SC- 0.15%	27.32(5.31)	15.61(4.07)	10.16(3.34)	6.29(2.70)	2.90(1.97)	8.74 (3.48)[c]
T9	Fipronil - 5 SC @ 0.2%	27.52(5.34)	16.66(4.20)	11.29(3.50)	6.71(2.77)	3.77(2.18)	9.61 (3.60)[d]
T10	Clothianidin 50 WDG @20g a.i./ha	27.53(5.33)	13.38(3.92)	8.24(3.04)	4.02(2.24)	1.99(1.72)	6.91 (3.25)[a]
T11	Monocrotophos @0.15%	27.54(5.34)	20.68(4.65)	19.48(3.03)	7.36(2.89)	4.03(2.24)	12.89 (3.68)[e]
T12	Imidacloprid@ 200SL-0.1%	27.94(5.38)	15.37(4.04)	11.33(3.51)	6.25(2.69)	4.10(2.25)	9.26 (3.56)[d]
T13	Control (No Spray)	27.56(5.34)	32.55(5.79)	33.37(5.86)	34.64(5.96)	33.03(5.83)	33.40 (5.76)[k]
						S.Em. ±	C.D.at 5%
T						0.032	0.063
D						0.019	0.038
T x D						0.072	0.142

DAS – Days After Spray
*Average of three mature flowers, young shoots and leaves from five replications
Figures in parentheses indicate √x+1 transformation

Table 3. Efficacy of botanicals, biopesticides and chemicals against rose thrips under polyhouse at Ramohally during 2008

Treatment	Particulars	*Number of thrips per plant on different days					Mean
		Pre-treatment count	I Spray		II Spray		
			3-DAS	5-DAS	3-DAS	5-DAS	
T1	NSKE-5%	25.18(5.19)	17.28(4.27)	9.38(3.22)	5.46(2.54)	4.32(2.30)	9.11 (3.48)[d]
T2	Neem oil @2%	25.10(5.08)	19.32(4.50)	18.00(4.35)	14.8(3.97)	11.00(3.46)	15.78 (4.27)[h]
T3	Pongamia oil @2%	25.20(5.11)	20.96(4.68)	18.40(4.40)	15.22(4.03)	11.82(3.58)	16.60 (4.26)[i]
T4	Nimbecidine @0.2%	25.14(5.11)	21.00(4.68)	19.50(4.52)	16.48(4.18)	12.74(3.70)	17.43 (4.43)[j]
T5	GB Ag @0.2%	25.63(5.15)	15.90(4.11)	8.96(3.15)	4.92(2.43)	4.04(2.24)	8.46 (3.40)[c]
T6	Spinosad @45SC@0.04%	25.14(5.11)	15.58(4.07)	8.24(3.04)	3.98(2.23)	3.28(2.07)	7.77 (3.29)[b]
T7	Vertimec-1.9EC@0.03%	25.00(5.09)	15.62(4.07)	8.18(3.02)	3.96(2.23)	3.04(2.01)	7.70 (3.29)[b]
T8	Chlorfenapyr-10SC @0.15%	25.40(5.13)	16.14(4.13)	8.46(3.07)	4.98(2.44)	3.72(2.17)	8.33 (3.39)[c]
T9	Fipronil - 5 SC @0.2%	25.12(5.11)	19.60(4.53)	11.24(3.49)	7.12(2.84)	5.16(2.48)	10.78 (3.69)[e]
T10	Clothianidin 50 WDG @ 20g a.i./ha	25.60(5.15)	15.12(4.01)	7.20(2.86)	4.02(2.24)	2.78(1.94)	7.28 (3.24)[a]
T11	Monocrotophos @0.15%	25.40(5.13)	21.40(4.73)	15.31(4.03)	12.77(3.71)	10.42(3.38)	14.98 (4.19)[g]
T12	Imidacloprid-200SL @0.1%	25.80(5.17)	15.74(4.09)	11.38(3.51)	9.14(3.18)	6.52(2.74)	10.70 (3.74)[f]
T13	Control (No Spray)	25.40(5.14)	30.40(5.60)	33.40(5.86)	35.80(6.06)	38.20(6.26)	34.45(5.79)[l]
						S.Em. ±	C.D.at 5%
T						0.021	0.042
D						0.012	0.025
T x D						0.047	0.094

DAS – Days After Spray
*Average of three matured flowers, young shoots and leaves from five replications
Figures in parentheses indicate √x+1 transformation

minimum thrips population and brought down thrips population from 27.34/plant (pre-treatment) to 2.35/plant on 5 DAS, with mean thrips-density of 7.59 per plant. Its efficacy was comparable to that of chemical insecticides. NSKE 5% proved better than Neem oil (2%), pongamia oil (2%) and Nimbecidine (0.2%). Neem oil and pongamia oil were found superior to the commercial neem product Nimbecidine.

Clothianidin was found to be the most effective, recording minimum thrips-number on all date of obsevation. This insecticide reduced thrips density from 25.60 per plant (pre-treatment count) to 2.78 per plant at 5 DAS, with mean thrips-density of 7.28 per plant. Next best in the order of efficacy were spinosad and vertimac, which were on par with each other statistically. Mean thrips-density per plant was 7.70 in spinosad and vertimac. Next best were: GB Ag (0.2%) and chlorfenafyr (0.1%). Clothianidin, vertimac, spinosad, GB Ag and chlorfenafyr were comparable in their efficacy, even though the latter two were statistically significantly-different from the first two. NSKE was superior to monocrotophos and imidacloprid recording 4.32 thrips/ plant (compared to 6.52 thrips/plant with imidacloprid and 10.42 thrips/plant with monocrotophos at 5 DAS) (Table 3). GB Ag registered minimum thrips-density. NSKE proved better than neem oil (2%), pongamia oil (2%) and Nimbecidine (0.2%). Spinosad proved better over vertimac. Neem oil and pongamia oil were found superior to the commercial neem product, Nimbecidine.

Pre-treatment population of thrips in all the plots ranged from 34.10 to 34.90 per plant, and treatment-differences were statistically non-significant (Table 4). There were significant differences among all treatments when the means were compared. Clothianidin was found to be the best at reducing thrips-density per plant from 34.64 (pre-treatment) to 1.97 at 5 DAS, with mean thrips count of 8.10 per plant. Next best in order of efficacy were spinosad, GB Ag, vertimac and fipronil. NSKE was found to be superior to imidacloprid and monocrotophos. NSKE reduced thrips-density per plant from 34.54 (pre-treatment) to 4.04 at 5 DAS. Neem oil and pongamia oil were superior to the commercial neem product Nimbecidine. In control, thrips-density per plant was high at 5 DAS (34.57/plant) in the Control. Even though statistically significant differences were observed among treatments, reduction in density of thrips with clothianidin, spinosad, GB Ag and vertimac were comparable (mean thrips-density per plant was 8.10, 8.52, 8.87 and 9.02/plant, respectively). GB Ag, in addition, is eco-friendly and sustains pollinators and biocontrol agents. Among the botanicals tested, GB Ag registered minimum thrips-density per plant at 5 DAS (2.66). NSKE proved to be better than neem oil (2%), pongamia oil (2%) or Nimbecidine (0.2%). Spinosad proved better than vertimac.

Continuous and indiscriminate use of chemical insecticides against rose thrips has led to development in insects of resistance and resurgence, and has led to environmental pollution. It is important to manage the pest rationally. The two-year experiment conducted at two locations, showed that Clothianidin was most effective in reducing thrips-density. When per cent control was calculated, it was noticed that monocrotophos reduced thrips-

Table 4. Efficacy of botanicals, biopesticides and chemicals against rose thrips under polyhouse at, Ramohally during 2009

Treatment	Particulars	*Number of thrips per plant on different days					Mean
		Pre-treatment count	I Spray		II Spray		
			3-DAS	5-DAS	3-DAS	5-DAS	
T1	NSKE @5%	34.54(5.96)	24.38(5.04)	12.28(3.64)	7.30(2.88)	4.04(2.24)	12.00 (3.95)^{f}
T2	Neem oil @2%	34.64(5.96)	28.28(5.41)	18.86(4.45)	16.22(4.14)	13.22(3.77)	19.15 (4.75)^{j}
T3	Pongamia oil @2%	34.04(5.91)	29.32(5.50)	18.80(4.45)	15.37(3.04)	13.95(3.86)	19.36 (4.76)^{j}
T4	Nimbecidine @0.2%	33.10(5.93)	30.40(5.60)	20.20(4.60)	16.12(4.13)	14.393.91)	20.26 (4.86)^{k}
T5	GB Ag @0.2%	34.43(5.94)	20.32(4.61)	8.30(3.05)	4.20(2.28)	2.66(1.91)	8.87(3.52)^{c}
T6	Spinosad- 45SC@0.04%	34.33(5.95)	19.71(5.55)	8.18(3.03)	4.07(2.25)	2.12(1.76)	8.52(3.51)^{b}
T7	Vertimec-1.9EC@0.03%	34.35(5.95)	19.24(4.49)	9.17(3.19)	5.27(2.50)	2.40(1.81)	9.02 (3.60)^{d}
T8	Chlorfenapyr-10SC @0.15%	34.18(5.93)	19.65(4.54)	12.59(3.68)	8.96(3.11)	6.56(1.74)	11.94 (4.00)^{g}
T9	Fipronil - 5 SC @0.2%	34.72(5.97)	21.58(4.75)	11.31(3.50)	6.62(2.76)	3.93(2.21)	10.86 (3.84)^{e}
T10	Clothianidin 50 WDG @20g a.i./ha	34.64(5.97)	18.26(4.38)	8.06(3.01)	4.12(2.26)	1.97(1.72)	8.10 (3.47)^{a}
T11	Monocrotophos @0.15%	34.56(5.96)	22.37(4.83)	17.33(4.28)	15.55(4.07)	13.20(3.76)	17.11 (4.58)i
T12	Imidacloprid-200SL @0.1%	34.40(5.94)	21.14(4.70)	15.41(4.05)	32.46(366)	9.42(3.22)	19.61 (4.32)^{h}
T13	Control (No Spray)	35.11(6.00)	35.30(6.02)	34.37(5.94)	35.34(6.03)	34.57(5.96)	34.90 (5.99)^{m}
						S.Em. ±	C.D. at 5%
T						0.015	0.029
D						0.008	0.017
T x D						0.033	0.065

DAS – Days After Spray

*Average of three mature flowers, young shoots and leaves from five replications

Figures in parentheses indicate $\sqrt{x+1}$ transformation

numbers from 58% to 62% under the polyhouse, compared to that in open-field at Lalbagh where 82% to 85% control was realized. Similar results were obtained with imidacloprid too, where the control ranged from 70% to 75% under polyhouse, and 85% to 92% in Lalbagh under open-field. This is due to the, regular and continuous use of common insecticides like monocrotophos and imidacloprid in cultivation. This has exposed thrips to insecticides in open fields and polyhouses, and has resulted in development of resistance to insecticides in thrips.

In the Botanical gardens, Lalbagh, no chemicals are used and rose is being grown organically. Therefore, all the chemicals used resulted in effective suppression of thrips. GB Ag was found to be equally effective as the newer molecules. NSKE was also found to reduce thrips-density from 64% to 88%. NSKE proved superior to neem oil, pongamia oil and the commercial neem product, Nimbecidine. Hence, for effective management of rose thrips, in those rose plots where control measures are hardly applied, farmers can opt for NSKE, monocrotophos or imidacloprid.

With respect to effectiveness, clothianidin proved to be the best. Next in order of efficacy was GB Ag which, in addition, is eco-friendly with the advantage of sustaining pollinators and biocontrol agents. It is recommended in situations where thrips population is in the initial stage of build-up; or, it can be alternated with application of clothianidin. Based on the cost, vertimac and spinosad, can be recommended wherever cost-effective, like in commercial rose-polyhouses and in other similar situations. These results are comparable with those of Nair *et al* (1991) who reported dimethoate and phosphamidon @0.05%, monocrotophos and endosulfan @0.1% reduced damage to the plant bud. Dadmal *et al* (2001) reported that neem-based insecticides, viz., Achock (1%) recorded 66.18 % and NSKE @5% recorded 61.37 % reduction in thrips population 4 days after spray. Balasingam *et al* (2003) reported neem seed water-extract and garlic sap extract to record lowest thrips count across seasons and highest dry-pod yields in chilli.

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(MS Received 12 May 2011, Revised 25 November 2011)