

## Research Article

# Ecofriendly management of *Pseudodendrothrips mori* Niwa and its impact on abundance of predatory coccinellids in mulberry ecosystem

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**ABSTRACT:** Efficacy of neem oil, pongamia oil, spray of strong jet of water, and the recommended pesticide, dichlorovos (76 EC) when compared to the untreated control against the thrips, *Pseudodendrothrips mori* Niwa (Thysanoptera: Thripidae) infesting mulberry as well as their bio-safety to the predatory coccinellids were studied under field conditions. Two numbers of sprays were effected, i.e., first at 10 Days After Pruning (DAP) of mulberry garden and second at 20 DAP with the treatments as T<sub>1</sub>=Two sprays of neem oil, T<sub>2</sub>=Two sprays of pongamia oil, T<sub>3</sub>=Neem oil followed by pongamia oil, T<sub>4</sub>=Pongamia oil followed by neem oil, T<sub>5</sub>=Neem oil followed by water jetting, T<sub>6</sub>=Pongamia oil followed by water jetting, T<sub>7</sub>=Two numbers of water jetting, T<sub>8</sub>=Dichlorovos followed by water jetting, T<sub>9</sub>=Two spray of Dichlorovos and T<sub>10</sub>=Untreated Control. The population of thrips and predatory coccinellids were recorded one day prior to each spray and @ 1, 3, 7 and 10 days after each spray up to 30 DAP. The mean values revealed that highest reduction in thrips population (84.35%) was recorded with two numbers of water jetting (T<sub>7</sub>) and next best treatments were T<sub>8</sub> dichlorovos followed by water jetting (75.17%) and T<sub>5</sub> neem oil followed by water jetting (67.02%). With respect to the abundance of predatory coccinellids highest population (6.83) was recorded in the plots treated two times with water jetting, spray of pongamia oil followed by water jetting (4.82) and neem oil followed by water jetting (4.31), whereas least population was recorded with two sprays of dichlorovos (1.04). Among the various treatments, two sprays of forcible jet of water (water jetting) in 10 days interval were found superior in reducing the population of thrips and to conserve the predatory coccinellids in mulberry ecosystem.

**KEY WORDS:** Mulberry thrips, neem oil, pongamia oil, predatory coccinellids, *Pseudodendrothrips mori*, water jetting

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## INTRODUCTION

Mulberry thrip, *Pseudodendrothrips mori* Niwa (Thripidae: Thysanoptera) is a serious sap sucker of mulberry, deteriorate the leaf quality and makes it unfit for feeding silkworm. Though several species of thrips recorded on mulberry, *P. mori* is most prevalent in many part of India (Bhattacharya *et al.*, 1993; Prasad *et al.*, 1995). Rearing of silkworms with thrips affected mulberry leaves affects their growth and development and causes adverse impact on cocoon production (Sakthivel and Qadri, 2010a). Thrips menace was very high during the summer season while its incidence and damage to mulberry was recorded throughout the year. It causes about 25-50% leaf yield loss besides quality deterioration (Venugopalapillai and Krishnaswami, 1983). Application of insecticides with high toxicity and prolonged residual effects in mulberry garden is restricted because of the high sensitivity of silkworms. Dichlorovos (DDVP 76% EC) is commonly recommended to combat the pests of mulberry and widely used by the sericulture farmers (Dandin *et al.*, 2003) due to its knockdown effect cum fumigant action as well as low persistence (David and Ramamurthy, 2011).

Such repeated applications of dichlorovos in mulberry garden resulted with resistance in thrips and its population were restored shortly after treatment and cause adverse impact on cocoon production mainly in the summer months. At the same time, the chemical has been recorded highly toxic to the natural enemies of insect pests and eliminates their population in mulberry ecosystems (Sakthivel and Qadri, 2010b). However, chemical management practice is not at all possible after initiation of silkworm rearing because of its residual toxic effects to the silkworms. Considering these facts, studies were carried out to draw an effective and ecofriendly practice to combat the thrips infesting mulberry.

## MATERIALS AND METHODS

Studies were conducted in the Srivilliputtur sericulture cluster, Virudhunagar district, Tamil Nadu, India during April-July 2015 when large number of thrips population was observed in the mulberry gardens. Each plot measured 7.3 X 3.6 m with 42 mulberry plants in a paired row, i.e., (5' + 3') x 2' spacing system. Mulberry variety, MR2 was used under irrigated condition. Randomized block design was followed

with ten treatments and each replicated thrice. Two numbers of sprays using a knapsack sprayer were effected, i.e., first at 10 Days After Pruning (DAP) of mulberry garden and second at 20 DAP. The treatments were comprised T1=Two sprays of neem oil, T2=Two sprays of pongamia oil, T3=Neem oil followed by pongamia oil, T4=Pongamia oil followed by neem oil, T5=Neem oil followed by water jetting, T6=Pongamia oil followed by water jetting, T7=Two numbers of water jetting, T8=Dichlorovos followed by water jetting, T9=Two spray of Dichlorovos and T10=Untreated Control. Water jetting was done as recommended by Sakthivel *et al.* (2011) by diverting a portion of irrigation water from pumping system of well with adequate water pressure. The population of thrips was recorded a day prior to the treatment (pretreatment count) and 1, 3, 7 and 10 Days After Spray (DAS) from 3 leaves, one each located at top, middle and bottom of 5 randomly selected plants per plot. Simultaneously, the population of all predatory coccinellids irrespective of species per plant was also recorded. The counting was taken up during cooler hours preferably 6AM-7AM (Naranjo and Flint, 1995). Per cent reduction in population over control was calculated and the data were analyzed statistically.

## RESULTS AND DISCUSSION

Efficacy of different treatments against mulberry thrips was analyzed in comparison with untreated control and the data obtained are presented in Table 1. There was no significant difference among treatments with respect to mean population of thrips a day prior to imposing treatments. All the treatments differed significantly over untreated control in reducing the thrips incidence after one, three, seven and ten Days After Spray (DAS). The mean values revealed that highest reduction in thrips population (84.35%) was recorded with two numbers of water jetting (T7) and next best treatments were T8 dichlorovos followed by water jetting (75.17%) and T5 neem oil followed by water jetting (67.02%). The treatments of two sprays of pongamia oil (T2) and pongamia oil followed by neem oil (T4) were found on par and least effective with 43.44 % and 43.69% reductions in thrips population respectively. With respect to abundance of predatory coccinellids (table 2) highest population (6.83) was recorded in the plots treated two times with water jetting, spray of pongamia oil followed by water jetting (4.82) and neem oil followed by water jetting (4.31) whereas least population was recorded with two spray of dichlorovos (1.04).

In the present investigation the efficacy of sprays of only botanicals, viz., neem oil and pongamia oil were found comparatively lesser than that the treatment of one spray of botanical which was followed by water jetting. However, two treatments with water jetting at 10 days interval found more effective than all the treatments. Sucking pests are

naturally controlled in rainy season Horowitz, 1986; Rashid *et al.*, 2003; Galanihe *et al.*, 2010). When it rains heavily, many small insects get dislodged from plant surfaces by the combined effect of wetness and the kinetic energy of the rain drops as well as strong winds (Banjo, 2010). Thrips built up its population heavily in hot and dry climate with poor rainfall whereas high rainfall and humidity were not favorable for thrips resulting in low peaks of thrips population on mulberry (Venugopalpillai and Krishnaswamy 1980). In the absence of adequate rainfall spray of strong jet of water reduced the population of thrips below the ETL. Sakthivel *et al.* (2011) reported the high efficacy of water jetting against sucking pests of mulberry and its bio-safety to natural enemy complex in mulberry ecosystem comparable to chemical measures.

Development of resistance in the pests followed by their resurgence due to repeat applications of a chemical were reported by Dhawan and Simwat (1997) and David and Ramamurthy (2011). Similarly, Sharma and Adlakha (1986) and Tank *et al.* (2007) reported high toxicity of dichlorovos to the coccinellids predators *Cheilomenes sexmaculata* F. and *Coccinella septempunctata* L., respectively. The neem products registered far safer than chemicals to the predatory coccinellids (Sakthivel and Qadri, 2010c; Sakthivel *et al.* 2012). Though dichlorovos exhibits low persistency in the field, its fumigant and penetrant action caused knock down effect to the natural enemies and wiped-out their population immediately after spray. In the present study, besides the high efficacy of water jetting, the high population of predatory coccinellids might also have supported to subside the thrips population to a greater extent constantly.

The efficacy of water jetting is in conformity with the suggestions of Banjo *et al.* (2004), Galanihe *et al.* (2010) and Ellis and Bradley (1996) to control the sucking pests physically through spray of a steady stream of water. Similarly, Geetha Bai *et al.* (2001) recommended use of strong jet of water to wash away the eggs and nymphs of spiralling whitefly, *Aleurodicus dispersus* Russell from mulberry plants. Water jetting involves physical force which hits on the infested plant parts to dislodge and wash out the pests so that the crop is kept free from the population of the pests. The sucking pests are soft-bodied slender insects and the force of water when jetted with a reasonably high pressure lethally injures them as well as the fallen ones will be available to ground predators and this will also make their return to the host difficult (Bissdorf, 2005). Further, the plots treated with two water jetting in 10 days interval, recorded with higher leaf yield (686g/plant) than all other treatments and there was 55.90% improvement over untreated control. Water jetting besides controlling the thrips, washed out the dust sediment on the leaves which might have enhanced the photosynthetic activity of the plant

and hence the practice played additional role in increase of mulberry leaf and yield.

Thus, it can be concluded that among the various treatments, two spray of forcible jet of water in 10 days

interval was found superior in reducing the population of thrips and to conserve the predatory coccinellids in mulberry ecosystem. Unlike chemical measures, water jetting could be employed at any moment when the pest population crosses the ETL even after initiation of silkworm rearing.

**Table 1. Effect of non-chemical management practices on the population of *Pseudodendrothrips mori* Niwa in mulberry (Nos./leaf)**

Treatment		First spray (10 DAP)					Second spray (20 DAP)				Mean (*)	leaf yield (gm/Plant) (**)
First spray	Second spray	PTC	1DAS	3DAS	7DAS	10DAS	1DAS	3DAS	7DAS	10DAS		
T <sub>1</sub> Neem oil	Neem oil	66.33	43.16	35.35	21.68	23.33	18.35	11.67	12.06	16.45	22.75 (59.60)	580 (31.81)
T <sub>2</sub> Pongamia oil	Pongamia oil	63.57	49.28	40.53	36.17	40.40	26.78	18.92	19.29	23.50	31.85 (43.44)	533 (21.13)
T <sub>3</sub> Neem oil	Pongamia oil	60.18	46.87	33.67	23.23	27.00	25.46	19.66	20.70	23.00	27.44 (51.27)	576 (30.90)
T <sub>4</sub> Pongamia oil	Neem oil	63.00	47.55	37.50	34.52	43.71	30.66	27.15	13.35	19.27	31.71 (43.69)	583 (32.50)
T <sub>5</sub> Neem oil	Water jetting	65.25	44.13	33.33	20.69	25.16	5.33	6.65	5.17	8.15	18.57 (67.02)	620 (40.90)
T <sub>6</sub> Pongamia oil	Water jetting	61.89	45.20	41.05	35.15	43.13	12.28	9.20	10.73	13.33	26.25 (53.39)	603 (37.04)
T <sub>7</sub> Water jetting	Water jetting	66.14	11.66	12.83	10.28	12.63	3.67	4.00	5.86	9.56	8.81 (84.35)	686 (55.90)
T <sub>8</sub> DDVP	Water jetting	61.63	18.15	13.36	17.19	28.66	6.25	10.03	9.20	8.95	13.98 (75.17)	666 (51.36)
T <sub>9</sub> DDVP	DDVP	64.27	15.10	19.63	20.40	26.29	10.73	18.53	23.66	28.28	20.32 (63.92)	598 (35.90)
T <sub>10</sub> Control	Water spray	64.09	55.35	59.75	61.67	61.78	58.39	55.55	50.18	47.90	56.32	440
C.D.@5%		NS	3.32	3.27	4.88	4.13	1.85	1.10	2.33	1.08	3.33	48.00

PTC: Pre-treatment count, DAS: Days after spray. Figures in the parentheses are percent reduction(\*) / improvement (\*\*)  
over control

**Table 2. Effect of non-chemical management practices on the population of predatory coccinellids in mulberry ecosystem (Nos./plant)**

Treatment		First spray (10 DAP)					Second spray (20 DAP)				Mean
First spray	Second spray	PTC	1DAS	3DAS	7DAS	10DAS	1DAS	3DAS	7DAS	10DAS	
T <sub>1</sub> Neem oil	Neem oil	3.65	1.16	2.86	3.25	4.59	1.19	2.55	5.78	5.30	3.33
T <sub>2</sub> Pongamia oil	Pongamia oil	4.00	2.39	1.88	3.33	4.16	2.56	3.00	4.78	5.66	3.47
T <sub>3</sub> Neem oil	Pongamia oil	3.87	1.93	2.13	3.18	3.95	2.33	3.65	4.52	5.83	3.44
T <sub>4</sub> Pongamia oil	Neem oil	4.13	2.73	1.15	3.87	4.55	1.63	1.56	2.40	4.92	2.85
T <sub>5</sub> Neem oil	Water jetting	3.99	1.09	1.10	2.89	3.96	4.65	6.23	6.71	7.92	4.31
T <sub>6</sub> Pongamia oil	Water jetting	3.93	2.48	1.80	3.25	4.60	5.32	6.60	7.35	7.20	4.82
T <sub>7</sub> Water jetting	Water jetting	4.25	5.33	5.89	6.55	6.30	6.05	7.39	8.32	8.83	6.83

T <sub>8</sub> DDVP	Water jetting	3.88	0.00	0.00	0.86	1.33	3.00	5.14	6.37	6.66	2.92
T <sub>9</sub> DDVP	DDVP	4.10	0.00	0.30	1.13	1.58	0.00	0.63	1.42	3.33	1.04
T <sub>10</sub> Control (Water spray)	Water spray	3.73	4.67	5.55	7.20	7.13	7.86	8.12	8.65	8.76	7.24
C.D.@5%		NS	0.32	0.47	0.31	0.38	0.23	0.44	0.35	0.58	0.39

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