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Bioefficacy of organic and inorganic insecticides against cardamom Thrips, *Sciothrips cardamomi* Ramk

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Abstract
Cardamom thrips, *Sciothrips cardamomi* Ramk. Is one of the important key pest of cardamom in hill and coastal zone of Karnataka. Several newer molecules and botanical insecticides were evaluated against cardamom thrips at farmers field, Mudigere, Karnataka during 2017-18. Among the insecticide evaluated, significantly lower mean number of thrips per leaf sheath and panicle was recorded in the treatment fipronil 5% SC @ 1ml/l, acetamiprid 20% SP @ 0.2g/land thiamethoxam 25% WG @ 0.25g/l (0.31, 0.31 and 0.33 no./leaf sheath respectively) and (0.02, 0.05 and 0.07/panicle respectively). However, the bio rational treatments (azadirachtin 1% EC and spinosad 45% SC) were recorded higher mean number of thrips per leaf sheath and panicle, but lower than untreated control. Significantly lower per cent capsule damage were also recorded in the treatments fipronil 5% SC (6.82%), thiamethoxam 25% WG (8.22%) and acetamiprid 20% SP (8.68%). Finally, the marketable yield (kg/ha) was also significantly highest in the treatment Fipronil 5% SC, acetamiprid 20% S Pand thiamethoxam 25% WG (724.2, 722.3 and 704.4 kgs/ha respectively).

Keywords: Cardamom thrips, Insecticide, *Sciothrips cardamomi*, Botanicals

Introduction
Cardamom thrips (*Sciothrips cardamomi* Ramk.) (Thysanoptera: Thripidae) is the most destructive and persistent insect pest of cardamom (*Elettaria cardamomum* Maton), is one of the commercial high value spice crop, mainly grown in India, Guatemala and Sri Lanka. In India, the crop is mainly grown in Kerala, Karnataka and Tamil Nadu (Gopakumar & Chandrasekar 2002; Devasahayam 2006) [1, 2]. Adults and nymphs of cardamom thrips damage the plants by lacerating and sucking sap from shoots, panicles (inflorescences and capsules) resulting in shedding of flowers and immature capsules and 'scab' formation on mature capsules. The infested capsules shrivel and lack the usual aroma and fetches a lower price in the market. The extent of capsule damage by cardamom thrips is 60%- 90% and the estimated crop loss is 45%-48% (Gopakumar & Chandrasekar 2002; Dharmadasa *et al.* 2008) [1, 3]. A schedule of 4-9 sprays with insecticide groups like organophosphates, synthetic pyrethroids, phenylpyrazole and neonicotinoids were recommended against the pest (Gopakumar & Chandrasekar 2002; Dharmadasa *et al.* 2008) [1, 3]. In the present study, eight insecticides were evaluated to know their efficacy against cardamom thrips under field conditions.

Material and methods
Seven years old cardamom clumps of M-2 variety were selected for the study. Randomized Block Design (RBD) was followed with ten treatments and replicated thrice. The treatments were imposed twice, first spray at 30-40 per cent capsule formation and second spray at after one and half month of first spray in the farmers field Mudigere, Karnataka.
All the treatments were applied using knap sack high volume sprayer during morning hours. Spray application was made @ of 1000 litres of spray fluid per hectare. Type of sprayer and sprays used were similar for both first and second spray. Only water spray was given to the control plots. Day before imposing of treatments, number of thrips were counted and recorded on randomly selected five clumps per each plot (6X3mts). Further thrips population was counted at 1, 5 and 10 days after each spray. Further, mean of two sprays were calculated analysed. The per cent incidence of thrips was assessed by counting the infested capsules by using the formula

$$\text{Per cent capsule infested} = \frac{\text{Total no. of infested capsules}}{\text{Total no. of capsules observed}} \text{X100}$$

The data obtained from the different treatments were computed to determine the mean values. The mean values were subjected to statistical analysis by single factor ANOVA after making necessary transformation whenever required. The treatment details were given in the table 1.

Results and Discussion

Thrips incidence on leaf sheath

The pooled data on efficacy of various insecticidal treatments along with botanicals evaluated during 2017-2018 in reducing the infestation of cardamom thrips on leaf sheath and have been depicted in table 1 and table 2.

Table 1: Bio efficacy of organic and inorganic insecticides against *Sciothrips cardamom* on cardamom leaf sheath

Sl. No.	Treatments	Dose/l	Mean no. of thrips/Leaf sheath				
			DBS	DAS	5 DAS	10 DAS	Pooled data
1	Thiamethoxam 25% WG	0.25g	2.02 (1.59)	0.35 (0.91)	0.33 (0.90)	0.32 (1.06)	0.33 (0.90)
2	Dimethoate 30% EC	1.7ml	2.04 (1.59)	0.61 (1.04)	0.57 (1.01)	0.54 (1.23)	0.57 (1.03)
3	Acephate 75% SP	1.0g	2.07 (1.60)	0.50 (0.98)	0.49 (0.98)	0.48 (1.20)	0.49 (0.99)
4	Carbosulfan 25% EC	2.0ml	2.12 (1.62)	0.53 (1.01)	0.51 (0.98)	0.48 (1.20)	0.50 (0.99)
5	azadirachtin 1% EC	2.0ml	2.33 (1.68)	1.48 (1.40)	1.46 (1.39)	1.47 (1.73)	1.47 (1.40)
6	Fipronil 5% SC	1.0ml	2.21 (1.65)	0.32 (0.89)	0.32 (0.89)	0.31 (1.05)	0.31 (0.89)
7	Spinosad 45% SC	0.25ml	2.17 (1.63)	1.22 (1.31)	1.21 (1.29)	1.19 (1.62)	1.20 (1.28)
8	Acetamiprid 20% SP	0.2g	2.19 (1.64)	0.34 (0.90)	0.31 (0.89)	0.30 (1.04)	0.31 (0.89)
9	Control		2.05 (1.60)	2.44 (1.71)	2.32 (1.64)	2.40 (2.18)	2.32 (1.65)
	SEm+/_		-	0.04	0.05	0.09	0.05
	CD @ 5%		NS	0.11	0.14	0.26	0.16
	CV%		-	0.60	0.83	1.22	0.90

Note: NS- Not significant

Table 2: Bio efficacy of organic and inorganic insecticides against *Sciothrips cardamom* on cardamom panicle

Sl. No.	Treatments	Dose/l	Mean no. of thrips/panicle				
			DBS	DAS	5 DAS	10 DAS	Pooled data
1	Thiamethoxam 25% WG	0.25g	1.20 (1.30)	0.08 (0.76)	0.07 (0.75)	0.08 (0.76)	0.07 (0.75)
2	Dimethoate 30% EC	1.7ml	1.45 (1.39)	0.34 (0.90)	0.32 (0.91)	0.34 (0.91)	0.33 (0.91)
3	Acephate 75% SP	1.0g	1.22 (1.31)	0.15 (0.80)	0.13 (0.79)	0.18 (0.82)	0.15 (0.80)
4	Carbosulfan 25% EC	2.0ml	1.40 (1.38)	0.41 (0.95)	0.41 (0.94)	0.41 (0.94)	0.41 (0.95)
5	azadirachtin 1% EC	2.0ml	1.29 (1.34)	1.03 (1.24)	1.02 (1.23)	0.92 (1.19)	0.99 (1.22)
6	Fipronil 5% SC	1.0ml	1.33 (1.35)	0.00 (0.71)	0.00 (0.71)	0.08 (0.76)	0.02 (0.72)
7	Spinosad 45% SC	0.25ml	1.29 (1.34)	0.94 (1.19)	0.91 (1.19)	0.89 (1.17)	0.91 (1.19)
8	Acetamiprid 20% SP	0.2g	1.32 (1.35)	0.05 (0.75)	0.04 (0.74)	0.05 (0.75)	0.05 (0.74)
9	Control		1.34 (1.36)	1.97 (1.55)	1.95 (1.55)	2.18 (1.63)	2.03 (1.58)
	SEm+/_		-	0.06	0.06	0.05	0.04
	CD @5%		NS	0.17	0.19	0.16	0.13
	CV%		-	1.11	1.25	1.06	0.87

Note: NS- Not significant

Day before Spray (DBS) there is no significant difference was recorded among the treatments with respect to cardamom thrips. Day After Spray (DAS) fipronil 5% SC @ 1ml/l of water, acetamiprid 20% SP @ 0.2g/l and thiamethoxam 25% WG @ 0.25g/l (0.32, 0.34 and 0.35 no. of thrips/leaf sheath, respectively) recorded significantly lower mean number of thrips per leaf sheath and they were on par with each other. The next best treatments which receives lower mean number of thrips per leaf sheath were recorded in acephate 75% SP @ 1.0g/l, Carbosulfan 25% EC @2.0ml/l and standard check chemical Dimethoate 30% EC @ 1.7ml/l. However, botanical insecticides, azadirachtin 1% EC @ 2.0ml/l and spinosad 45% SC @0.25ml/l (1.48 and 1.22 no./leaf sheath) recorded significantly higher population of thrips per leaf sheath but lower than untreated control (2.44 no./leaf sheath) (Table 1).

At five and 10 days after spray similar trend was recorded in reducing the thrips population per leaf sheath. The pooled data on number of thrips per leaf sheath was again significantly lower in the treatment fipronil 5% SC @ 1ml/l, acetamiprid 20% SP @ 0.2g/l and thiamethoxam 25% WG @ 0.25g/l (0.31, 0.31 and 0.33 no./leaf sheath, respectively). However, acephate 75% SP @ 1.0g/l, Carbosulfan 25% EC @2.0ml/l and Dimethoate 30% EC @ 1.7ml/l was recorded next best treatment in reducing number of thrips (0.49, 0.50 and 0.57 no./leaf sheath, respectively). Significantly higher population of thrips was recorded in azadirachtin 1% EC @ 2.0ml/l and spinosad 45% SC @0.25ml/ltreatments (1.47 and 1.20 no./leaf sheath) but lesser than untreated control (2.32 no./leaf sheath).

Thrips incidence on panicles

Day before spray there is no significant difference among the treatment with respect to mean number of thrips per panicle. However, day after spray there is a significant reduction in thrips population was recorded in the treatment fipronil 5% SC @ 1ml/l, acetamiprid 20% SP @ 0.2g/l and thiamethoxam 25% WG @ 0.25g/l (0.00, 0.05 and 0.08 no. of thrips/panicle, respectively) and they were statistically on par with each other. Next best treatment in reducing the of thrips population was recorded in acephate 75% SP @ 1.0g/l, Dimethoate 30% EC @ 1.7ml/l and Carbosulfan 25% EC @2.0ml/l (0.15, 0.34 and 0.41 no. of thrips/panicle, respectively). Further, significantly highest population was recorded in the treatments azadirachtin 1% EC @ 2.0ml/l and spinosad 45% SC @0.25ml/l (1.03 and 0.94 no. of thrips/panicle), but lower than control (1.97 no. /panicle).

At five and 10 DAS similar trend was recorded in reducing the thrips population per panicle. The pooled data of DAS, 5 and 10 DAS revealed that fipronil 5% SC @ 1ml/l of water, acetamiprid 20% SP @ 0.2g/l and thiamethoxam 25% WG @

0.25g/l recorded significantly lower number of thrips per panicle (0.02, 0.05 and 0.07 no. of thrips/panicle, respectively) and they were statistically on par with each other. Further, acephate 75% SP @ 1.0g/l, Dimethoate 30% EC @ 1.7ml/l and Carbosulfan 25% EC @2.0ml/l are next best treatment in recording lower number of thrips (0.15, 0.33 and 0.41 nos. /panicle, respectively). Significantly higher population was recorded in treatment azadirachtin 1%EC @ 2.0ml/l and spinosad 45% SC @0.25ml/l (0.99 and 0.91 nos./panicle) but, lower than untreated control (2.03 no./panicle) (Table 2).

Dharmadasa *et al.* (2008) [3] reported that the regent 50SC (fipronil 5g/l SC), actara 25WG (thiamethoxam 25% WG), calypso 240SC (thiacloprid 240g/l SC) and match 50EC (luferon 50g/l EC) was found effective against per cent pod damage due to thrips. Similarly, Sarkar *et al.* (2016) [4]; Jacob *et al.* (2015) [5] also reported newer generation insecticides found effective as compare to older molecules. Further, Jhonson Stanley *et al.* (2014) [6], reported neem-based insecticides found effective as compare to untreated control supports the present study.

Table 3: Effect of Insecticides molecules on yield and B: C ratio of cardamom

Sl. No.	Treatments	Yield (Kgs/ha)	Per cent capsule damage	Percent yield increase over control	Cost of protection (Rs/ha)	Total cost of production (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	C: B ratio
1	Thiamethoxam 25% WG	704.4	8.22	56.26	1500	63500	493080	429580	1:6.76
2	Dimethoate 30% EC	506.5	17.42	39.19	5100	67100	354550	287450	1:4.28
3	Acephate 75% SP	621.5	12.45	50.40	4000	66000	435050	369050	1:5.59
4	Carbosulfan 25% EC	502.5	14.67	38.68	4000	66000	351750	285750	1:4.32
5	azadirachtin 1% EC	410.6	38.76	20.40	4000	66000	287420	221420	1:3.35
6	Fipronil 5% SC	724.2	6.82	57.34	1700	63700	505610	441910	1:6.93
7	Spinosad 45% SC	442.0	30.76	30.29	6000	68000	309400	241400	1:3.55
8	Acetamiprid 20% SP	722.3	8.68	57.45	750	62750	506940	444190	1:7.07
9	Control	308.1	52.82	-	-	60000	215670	155670	1:2.59

Gross return = Yield X Market price (700Rs/Kg)
Net return = Gross return - Total cost

Significantly lower per cent capsule damage due to cardamom thrips was recorded in treatment fipronil 5% SC @ 1ml/l of water, thiamethoxam 25% WG @ 0.25g/land acetamiprid 20% SP @ 0.2g/l (6.82, 8022 and 8.68 per cent capsule damage, respectively) and they are statistically on par with each other. The yield obtained from different treatments varied from 302 to 724.2 kgs/ha. Significantly higher marketable capsule yield of 724.4 kgs/ha was obtained with fipronil 5% SC @ 1ml/l of water followed by acetamiprid 20% SP @ 0.2g/l (722.3 kgs/ha) and thiamethoxam 25% WG @ 0.25g/l (704.4kgs/ha) and they were on par with each other.

Mean cardamom yield gram per bush was recorded significantly highest in thiamethoxam (335.54g/bush), lufenuron (304.98g/bush), but lower than Fipronil (262.99g/bush) reported by Dharmadasa *et al.* (2008) [3]. The slight variation in yield in present study may be due to location and the thrips population.

The cost economics indicated that the treatments acetamiprid 20% SP @ 0.2g/l recorded net returns of Rs.444190 which if followed by fipronil 5% SC @ 1ml/l (Rs.441910) and thiamethoxam 25% WG @ 0.25g/l (Rs.429580) as compare to the existing standard check Dimethoate which recorded Rs. 287450. The highest B: C ratio of 7.07 was recorded in acetamiprid 20%SP @ 0.2g/l followed by fipronil 5% SC @ 1ml/l (6.93) and thiamethoxam 25% WG @ 0.25g/l (6.76). The newer insecticides were found to be effective to manage cardamom thrips on cardamom recorded higher marketable yield which also resulted in higher net profit and B: C ratio (Table 3).

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