Management of thrips in mango cv. Chinnarasam

Abstract: Mango (*Mangifera indica*) is one of the most favoured fruit across the globe including India which is also known as king of fruits. In India, Andhra Pradesh is one of the major mango growing state along with Uttar Pradesh, Karnataka, Tamil Nadu, Bihar and Gujarat. Among different varieties of mango grown in AP, cv. Chinnarasam is the most popular and premium variety fetching high profits to the farmers especially in and around Nuzvid, Krishna district. Mango is often infested with sucking pests like thrips and hoppers along with rise in lepidopteran pests over the decade. Among sucking pests, thrips pose significant damage resulting in serious economic losses to the farmers. In view of this, research experiment was planned during 2021-2023 at Mango research station, Nuzvid with RBD model and the results revealed that, application of Spinosad 45% SC @ 0.25 ml/L twice at flowering stage with 15 days interval is found to be best in controlling the thrips population significantly followed by Karanj extract @ 1.5 ml/L followed by Azadiractin 10,000 ppm @ 2ml/L when compared to other treatments evaluated against thrips in mango.

Key words: Thrips, Biorational management, Emamectin Benzoate, Spinosad, *Beauveria bassiana*, Karanj extract and Mango

Introduction:

Mango (*Mangifera indica*) popularly known as "King of fruits", is major fruit crop grown in India in an area of 2400 thousand hectares with production 228.37 Lakh Tonnes. It is mainly exported to Switzerland, Singapore, Germany, and Malaysia and to some other European countries. In India, it is grown in states such as Gujarat, Maharastra, Punjab, Haryana, Delhi, Rajasthan, Bihar and Andhra Pradesh. In Andhra Pradesh, Krishna district ranks first with having highest growing area approximately 62,000 ha in 18 mandals. The popular varieties grown are Banganapalli, Totapuri, Chinnarasam and Pedda rasam. Like other fruit crops, mango is often affected with sucking pest especially thrips causing a serious problem causing huge economic losses to farmers because of quality issues on fruits for which even the exports are also affected. Among sucking pests, thrips have emerged as a significant threat to fruit crops, causing substantial yield losses (Sithanantham *et al*., 2007; Kumar *et al*., 1994; Reddy *et al*., 2019; Munj *et al*., 2020). During the reproductive phase of the crop thrips pose significant economic damage to the crop. Thrips have attained the major pest status during the recent years due to indiscriminate use of synthetic pesticides. In mango thrips damage (Using rasping and sucking type of mouth parts) leads to browning and dropping of flower

buds and flowers. Due to the high thrips populations during the reproductive stages farmers are spraying pesticides every alternate day to reduce the populations leading to heavy reliance on pesticides which is hazardous and uneconomical. Due to this heavy reliance on synthetic insecticides for the management of thrips, there is the need to evaluate the safe, sustainable and environmentally friendly and effective biopesticides and botanicals along with synthetic insecticides. In view of this the present experiment was planned with an objective of evaluating synthetic insecticides, biopesticides and botanicals along with the cultural practices.

Materials and methods:

The experiment was conducted at Dr.YSRHU-Mango Research Station, Nuzvid, Andhra Pradesh during the year 2021 to 2023 with RBD design with 10 treatments and 3 replications with two trees per replication on mango variety, Chinnarasam. The age of the trees was 10 years. Nuzvid in Andhra Pradesh is also known popularly as mango town with famous mango variety grown, Chinnarasam due to its size, colour, unique taste and aroma in that particular area. Data was then transformed into square root transformation and was analysed using the OP stat software.

The treatments imposed includes biological, chemical, biological + chemical and cultural practices. Under cultural practices the methodology followed includes a. Removal of alternate weeds hosts (0 day) b. Erection of yellow sticky traps @ 15/acre (1 day), c. Raking of soil (3^{rd} day) followed by soil application of biopesticides (Neem cake enriched with *Metarhizium anisopliae* @ 4 kgs/tree) @ 5^{th} day). All the treatments (Table 1) were imposed during Peak flowering period and second spray after 15 days interval.

Table 1. Treatment details:

S.No	First spray	Second spray
1	*Beauveria bassiana*10^8 @ 5 ml/L	*Beauveria bassiana*10^8 @ 5 ml/L
2	*Metarhizium anisopliae* 10^8 @ 5 ml/L	*Metarhizium anisopliae* 10^8 @ 5 ml/L
3	Azadirachtin 10,000 ppm @ 2ml/L	Azadirachtin 10,000 ppm @ 2ml/L
4	Karanj extract@ 1.5 ml/L	Karanj extract@ 1.5 ml/L
5	Spinosad 45% SC @ 0.25ml/L	Spinosad 45% SC @ 0.25ml/L
6	*Beauveria bassiana*10^8 @ 5 ml/L	Spinosad 45% SC @ 0.25ml/L
7	*Metarhizium anisopliae*10^8 @ 5ml/L	Spinosad 45% SC @ 0.25ml/L
8	Azadirachtin 10,000ppm @ 2ml/L	Spinosad 45% SC @ 0.25ml/L
9	Cultural practices	Cultural practices
10	Untreated Control	Untreated Control

Observations:

Thrips population @ No. of thrips / 12 Panicles/tree were recorded at Pre and post treatment at 1,3,5,7,10,14 days after spraying by tapping method in four directions (East, West, North,

South) (Following NCIPM protocol). During the time of harvesting, B:C ratio was calculated and the effected fruits were collected and observed as per the scale mentioned below

0 – Healthy fruits
1 – 1-25% fruit area damaged
2 – 26-50% fruit area damaged
3 – 51-75% fruit area damaged
4 – 76% and above fruit area damaged

$$\% \text{ thrips damaged will be assessed as} = \frac{\text{Sum of all numerical rating}}{\text{No. of fruit observed} \times \text{Maximum rating}} \times 100$$

Results and discussion:

The data collected on the management of mango thrips across the years 2020-21, 2021-22 and 2022-23 were pooled and subjected to analysis (Table 2). Before initiation of the treatments pre treatment counts were taken and results were nonsignificant which indicates that there is uniformity in pest population before initiation of the experiment. In untreated control thrips damage was higher compared to the treatments evaluated. Among ten treatments evaluated against thrips in mango, var. Chinnarasam, T_5 treatment *i.e* Spinosad 45% SC @ 0.25 ml/L with 5.9 and 5.8 thrips/panicle and 69 and 53 percent reduction in comparison to control after 7 days after treatment followed by T_4 treatment *i.e* Karanj extract @ 1.5 ml/L with 8.2 and 6.2 thrips/panicle and 57 percent reduction in comparison to control and were found to be best in controlling the thrips population followed by T_3 treatment *i.e* Azadirachtin 10,000 ppm @ 2ml/L with 41 and 45 percent reduction in comparison to control compared to all the treatments evaluated against thrips in mango (Table 2) and similar results have been reported by Aliakbarpour *et al*. (2011), Bana *et al*. (2015) and Gundappa and Shukla (2020). Joubert *et.al* 2023 also observed that chemical actives like spinetoram (spinosyn), formetanate (carbamate), tartar-emetic, abamectin (avermectin), and many more have proven to result in successful control of thrips on crops. Monteon-Ojeda *et.al*.2020 also reported that Spinetoram (dose 500 mL/ha) and Extract: Garlic + Chili + Cinnamon (dose 2 L/ha) registered best control efficacies against mango thrips in mexico. Meanwhile Damasia *et.al.*, 2025 reported that among treatments evaluated against hoppers and thrips in mango, Thiamethoxam @ 0.0084% was found to be best for the management of hoppers and thrips and was statistically at par with imidacloprid @ 0.005%. Whereas Haider Karar *et.al* 2022 reported that among tested insecticides percent mortality was 74.14 % for chlorfenapyr, 70.58 % for nitenpyram + chlorfenapyr and 70.51 % for Imidacloprid after post-treatment against mango thrips.

Munj *et.al* 2024 recorded that Azadirachtin 10,000 ppm @ 3 ml/L was found to be effective against the thrips in at Mohanpur and Sangareddy centres similarly in the present study Azadirachtin 10,000 ppm @ 2ml/L was the third best treatment after treatments 4 and 5. *Yeczabel Salgado*, 2024 found that Azadirachtin and cinnamon extract were best in controlling the thrips in the Ataulfo and Manila cultivars during flowering. Hence, spraying of Azadirachtin and cinnamon extract at the beginning of flowering is best in reducing the populations of thrips to minimize harm to the environment.

Bana *et.al.* 2015 and Munj *et.al* 2020 observed that *Beauveria bassiana and Metarhizium anisopliae* (IIHR oil formulation @ 0.5 ml/l) was the most effective for management of thrips on mango but in the present study *Beauveria bassiana* 10^8 @ 5 ml/L and *Metarhizium anisopliae* 10^8 @ 5 ml/L liquid formulations were used but they are not effective in managing the thrips population and the percent damage on fruits was 26 and 40. Carrillo-Arambula *et al*., 2022 observed that yellow sticky traps were more effective against *Scirtothrips sps.* with less detrimental effect on pollinators and results indicated that use of sticky traps can be deployed in mango gardens as initial monitoring tools during the initial stages of infestation hence under cultural management treatment yellow sticky traps were installed.

Economics of different treatments were worked out and marketable fruit yield at harvest revealed that, Benefit Cost ratio was more in treatment Azadirachtin 10,000ppm @ 2ml/L+ Spinosad 45% SC @ 0.25ml/L (2.4) followed by Karanj extract@ 1.5 ml/L (2.2) when compared to other treatments evaluated. Percent damage on fruits was only 9 percent in T_5 treatment *i.e* Spinosad 45% SC @ 0.25 ml/L followed by 13 percent in T_4 treatment *i.e* Karanj extract @ 1.5 ml/L (Table 3.). Thrips populations may be predicted upto 95% using thermal indices viz. growing degree days (GDD), heliothermal units (HTU) and photothermal units (PTU) which can be cumulated based on the peak population densities of the thrips followed by correlating the weather parameters and they also investigated that thrips populations and humid thermal ratio showed significant positive correlation, humid thermal index can be used in assessing the thrips population dynamics under sub-tropical environmental conditions (Gundappa *et.al* 2016 a, b). Among various management methods in controlling the thrips population, biorational method of management *i.e* using of Spinosad 45% SC @ 0.25ml/L and Karanj extract @ 1.5 ml/L is very much helpful in reducing the resurgence and buildup of pest population. Kyeongnam Kim *et.al*.2023 explored the Novel Ethyl Formate Fumigation strategy for managing yellow tea thrips (*Scirtothrips dorsalis*) in greenhouse cultivated mangoes and post-harvest storage of fruits as a safe, effective alternative to traditional pesticides the same can be implemented in other post-harvest storages for fruits.

Schoeman and Linda (2019) suggested releasing predatory mites and a predator bug (*Orius insidiosus*) against thrips in subtropical orchards as predatory mite numbers relative to thrips larvae, mites can play an important role in reducing thrips larval numbers and hence, crop damage. Liu *et al*. 2022 combined the use of food attractants with *Beauveria bassiana* to establish a trapping infection spread system for thrips. In which food attractants increase the attraction of thrips to fungal inoculation devices and facilitate the automated spread of fungal diseases among thrip populations. Affandi *et al*., 2018 recorded that, thrips *Scirtothrips dorsalis* was able to survive on weeds such as *Leucania leucochepala*, *Ipomoea triloba*, *Achalypha indica*, *Desmanthus leptophyllus* and *Azadirachta indica* as source of food. Among which, *Achalypha indica* was the most suitable host with development time (12.82 ± 0.21 days) and survivorship (33 %). whereas weeds, *Tridax procumbens*, *Momordica charantia* and *Mimosa pudica* were unable to provide the living requirement for immature developmental stage of *S. dorsalis*.

Thrips management of is the need of the hour so that the farmer is benefited economically. Hence spraying of recommended pesticide molecules in rotation at 10 days interval when the pest attains Economic Injury Level (EIL) coinciding with peak flowering was found to be effective in managing the thrips in mango.

References:

Affandi, Celia dela Rosa Medina, Luis Rey Ibanez Velasco, Pio Arestado Javier and Dinah Pura Tonelete Depositario. 2018. Development and Survivorship of *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) in Different Growth Stages of Mango and Selected Weeds. Agrivita. **40**(1): 101-106.

Aliakbarpour, H., Che Salmah, M. R. and Dzolkhifli, O. 2011. Efficacy of neem oil against thrips on mango panicles and its compatibility with mango pollinators. *Journal of Pest Science*, **84**:372-375.

Bana, J. K., Ghoghari, P. D., Kalaria, G. B., Saxena, S. P. and Shah, N. I. 2015. Efficacy of management modules against inflorescence thrips. *Pest Management in Horticultural Ecosystems*, **21**(2): 119-124.

Carrillo-Arámbula L, Infante F, Cavalleri A, Gómez J, Ortiz JA, Fanson BG, et al. (2022) Colored sticky traps for monitoring phytophagous thrips (Thysanoptera) in mango agroecosystems, and their impact on beneficial insects. PLoS ONE **17**(11): e0276865. https://doi.org/10.1371/journal.pone.0276865

DM Damasia, RP Bambharolia and HR Kachhela. 2025. Bio-Efficacy of Insecticides against Hopper and Thrips in Mango. *Pesticide Research Journal. **37*** (1) 75-79.

Joubert, E.1, Fourie, G.2, Slippers, B.2, Hoffman, C.3 and Weldon, 2023. Evaluation of different integrated pest management (IPM) strategies for the management of thrips in avocado orchards. C. South African avocado growers association yearbook 46.

Li, Y.; He, X.; Han, L.; Huang, Z.; He, M. 2022. Comparison of droplet deposition performance between caterpillar mist sprayer and six-rotor unmanned aerial vehicle in mango canopy. Smart Agric., 4, 53–62. [Google Scholar]

Gundappa, Adak T, Shukla PK. 2016 a. Appraisal of Thrips Population Dynamics in Mango using Weather Based Indices. Vegetos **29**:3.

Gundappa, S. Adak T, Shukla PK. 2016 b. Humid thermal ratio as a tool to assess the mango thrips dynamics under subtropical climatic conditions. Journal of environmental biology. **37**(6):1239-1245.

Gundappa, S. and Shukla, P. K. 2020. Mango thrips management. Special leaflet published by Director, ICAR-Central Institute for Subtropical Horticulture, Lucknow, 2020.

Haider Karar, MuhammadUmar Javed, Muhammad Yaseen, Muhammad,Amjad Bashir , Asif Sajjad, Muhammad Essa, Muhammad Wajid, Muhammad Mubashir, Ghulam Mustafa , Muh ammad Zubair, Salwa Alreshaidan, Sagheer Atta, Muhammad Ibrahi, ReemA. Alajmi. 2022. Comparative efficacy of conventional vs new chemistry insecticides against mango thrips,S*scirtothrips dorsalis* hood (Thripidae: Thysanoptera). *Journal of King Saud University Science*. **34**:(7).

Kumar, S., Patel, C. B., Bhatt, R. J. and Rai, A. B. 1994. Population dynamics and insecticidal management of the mango thrips, Scirtothrips dorsalis Hood (Thysanoptera: Thripidae) in South Gujarat. *Pest Management and Economic Zoology*, **2**:59-62.

Kyeongnam Kim, Dongbin Kim,Soon Hwa Kwon, Gwang-Hyun Roh,Sangman Lee, Byung-Ho Lee 1ORCID andSung-Eun Lee.2023. A Novel Ethyl Formate Fumigation Strategy for Managing Yellow Tea Thrips (*Scirtothrips dorsalis*) in Greenhouse Cultivated Mangoes and Post-Harvest Fruits. *Insects* **2023**, *14*(6), 568.

Monteon-Ojeda, A., Damian-Nava, A., Cruz Lagunas, B., Duran-Trujillo, Y., Piedragil-Ocampo, B., Grifaldo-Alcantara, P. F., Hernandez-Castro, E., García-Escamilla, P.1.2020. Efficacy of botanical and biorational insecticides for thrips control (Thysanoptera: Thripidae) in mango trees in Veracruz, Mexico. Revista Bio Ciencias 7, e1031.

Munj, A. Y., Reddy, P. V. R., Gundappa and Irulandi, S. 2020. Efficacy of entomopathogen formulations against thrips *Scirtothrips dorsalis* Hood on mango: A multilocation study. 26(2): 179- 183.

Munj A. Y., P.V. Rami Reddy, Anamika Kar, Sachin Chavan, J. K. Bana, R.V. Kadu, A. Nithish, K. Manasa and Prakash Patil.2024. Management of thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) in mango using botanicals: a multilocation study. Pest management in horticultural ecosystems.29(2):190-195.

Reddy, P. V. R., Gangavishalaxi, P. M. and Verghese, A. 2019. Entomopathogenic fungus N. anisoplie: A potential non chemical option for management of thrips. *Journal of Entomology and Zoology Studies*, **7**: 638-640.

Schoeman, S.P. & Linda, L. 2019. Quantifying and controlling thrips and scales in avocado. SAAGA Yearb. 42: 76-81.

Sithanantham, S., Vartharajan, R., Ballal, C. R. and Gangavishalakshy, P. N. 2007. Research status and scope for biological control of sucking pests in India: Case study of thrips. *Journal of Biological Control*, **21**(special issue): 1-19.

Yeczabel Salgado-Gantes, Paul Garcia-Escamilla, Yuridia Durán-Trujillo, Elías Hernández-Castro, Héctor Ramón Segura-Pacheco, and y Teolincacihuatl Romero-Rosales "Biorational Management of Thrips in Mango in Guerrero, Mexico," *Southwestern Entomologist* 49(4), 1507-1516, (20 November 2024). https://doi.org/10.3958/059.049.0417

Table 2. Evaluation of different spray schedules against thrips in mango (Number/panicle)

S. No	Treatments	Pre Count	No. of thrips/ Panicle (First spray)				No. of thrips/ Panicle (Second spray)			
			7 DAS	Percent reduction over control	14 DAS	Percent reduction over control	7 DAS	Percent Reduction over control	14 DAS	Percent reduction over control
1.	T_1	16.50 (4.12)	13.21e (3.70)	31.34	18.82g (4.39)	13.43	12.13h (3.55)	31.89	15.83f (3.91)	22.13
2.	T_2	16.89 (4.17)	19.12i (4.4)	0.62	21.33i (4.56)	1.88	15.94g (4.13)	10.49	15.45d (3.98)	24.00
3.	T_3	18.41 (4.34)	11.33c (3.43)	41.11	16.20c (4.08)	25.48	7.94c (2.89)	55.41	10.98c (3.37)	45.99
4.	T_4	18.21 (3.98)	8.21b (2.96)	57.32	12.03b (3.50)	44.66	6.23a (2.58)	65.01	8.82b (3.04)	56.61
5.	T_5	17.61 (4.23)	5.92a (2.52)	69.23	9.84a (3.21)	54.73	5.82b (2.50)	67.32	9.63a (3.17)	52.63
6.	T_6	16.90 (4.17)	15.13f (3.78)	21.36	17.40e (4.23)	19.96	8.02e (2.73)	54.96	10.24d (3.27)	49.63
7.	T_7	17.81 (4.27)	17.64h (4.15)	8.31	18.62h (4.32)	14.35	9.02d (3.08)	49.35	10.20d (3.27)	49.82
8.	T_8	16.52 (4.12)	13.10d (3.68)	31.91	16.92d (4.17)	22.17	9.14f (3.01)	48.68	11.48c (3.44)	43.53
9.	T_9	17.22 (4.19)	15.42h (3.98)	19.85	17.37f (4.22)	20.10	13.24i (3.70)	25.65	14.32e (3.64)	29.56
10.	T_{10}	16.89 (4.17)	19.24j (4.44)	--	21.74j (4.57)	--	17.81g (4.27)	--	20.33 (4.56)	--
	S.E (m)±	0.03	0.01	--	0.01	--	0.014	--	0.013	--
	C.D @ 5%	NS	0.03	--	0.04	--	0.04	--	0.04	--
	CV %	2.2	4.9	--	6.2	--	0.99	--	1.10	--

Figures in the parentheses are square root (√x+1) transformed values; DAS- Days after spraying

Table-3.Cost benefit ratio calculation of different insecticides tested against thrips in mango

S.No	Treatments	Pesticide cost Rs/Kg/L	Total cost of Pl. Prot./ Trt. Rs.	Marketable Yield Kg/Trt.	Net gain over control Kg/Trt.	Realization over control Rs/Trt.	BC ratio	% Damage on fruits
1.	*Beauveria bassiana* 10^8 @ 5 ml/L	1320	115	36	5.5	192.5	1.6	26
2.	*Metarhizium anisopliae* 10^8 @ 5 ml/L	460	92	32.5	2.0	70	0.76	40
3.	Azadirachtin 10,000 ppm @ 2ml/L	2240	180	40.2	9.7	339.5	1.88	22
4.	Karanj extract@ 1.5 ml/L	2860	129	37.8	7.3	255.5	2.2	13
5.	Spinosad 45% SC @ 0.25ml/L	18000	252	44	13.5	472.5	1.9	9
6.	*Beauveria bassiana* 10^8 @ 5 ml/L, Spinosad 45% SC @ 0.25ml/L after 15 days	1320+18000	241	39	8.5	297.5	1.23	22
7.	*Metarhizium anisopliae* 10^8 @ 5ml/L, Spinosad 45% SC @ 0.25ml/L after 15 days	460+18000	218	36	5.5	192.5	0.88	34
8.	Azadirachtin 10,000ppm @ 2ml/L, Spinosad 45% SC @ 0.25ml/L after 15 days	2240+18000	216	44.5	14	490	2.4	24
9.	Cultural practices	130+100	295	34	3.5	122.5	0.41	32
10.	Untreated Control	---	---	30.5	---	---	---	44

Market price of the fruits – Rs. 125/Kg, Average price of fruits 40-50/Kg., Labour charges @ 400/day