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COMPARATIVE EFFICACY OF BIO PESTICIDES AND INSECTICIDES AGAINST TOMATO THRIPS (*THRIPS TABACI* LIND.) AND THEIR IMPACT ON COCCINELLID PREDATORS

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ABSTRACT

Field studies were carried out to evaluate efficacy of biopesticides *viz., Beauveria bassiana* (2.5 kg ha^{-1}) and *Verticilliumlecani* (2.5 kg ha^{-1}) and novel insecticides *viz.,* Imidacloprid 30.5 SC (100mL ha^{-1}) and Thiomithoxam 25 WG (75g.a.i. ha^{-1}) against the thrips, *Thrips tabaci* Lind. and predatory coccinellids in tomato ecosystem. Significantly lowest thrips population was recorded in insecticidal treatments Imidacloprid 30.5 SC + Thiomithoxam 25 WG (1.15 nymphs $plant^{-1}$) followed by Thiomithoxam 25 WG (1.35 nymphs $plant^{-1}$) and Imidacloprid 30.5 SC (1.37 nymphs $plant^{-1}$) compared to bio pesticides *Beauveria bassiana + Verticillium lecani* (2.01 nymphs $plant^{-1}$) followed by *Beauveria bassiana, Verticillium lecani* (2.12 and 2.33 nymphs $plant^{-1}$ respectively) compared to control treatment recorded 6.27 nymphs $plant^{-1}$. Against coccinellids bio pesticide treatments *Beauveria bassiana, Verticillium lecani* (3.26 and 3.12 coccinellids $plant^{-5}$ respectively) were found safer following insecticides Imidacloprid 30.5 SC and Thiomithoxam 25 WG (2.64, 2.79 coccinellids $plant^{-5}$ respectively) showed lower toxic compared to control treatment (3.53 coccinellids $plant^{-5}$) in tomato ecosystem. The use of bio pesticides and neonicotinoids can be used in compatible manner in future IPM programmes for controlling thrips and reducing effect on natural enemies.

INTRODUCTION

In India, tomato was grown in an area of 36,000 ha during 1960 and the production was 74.62 lakh tonnes, respectively with a productivity of 16.29 t /ha. In 2011 it was grown in 0.865 Mha area with 16.826 Metric tonnes (MT) production and 19.5 t/ha productivity (IHD, 2011). India occupies the 2^{nd} rank in area and production of tomato after the china with 11 per cent share in the world's tomato production (IHD, 2011). During the year 2011 to 2012 leading tomato producing states are Andhra Pradesh (6,195 MT), Karnataka (2,069 MT), Madhyapradesh (1,484 MT) and Tamil Nadu (726.5 MT) in 10^{th} position (NHB, 2012). In Tamil Nadu Dharmapuri and Salem districts are leading in tomato cultivation and production.

Among the different pests thrips, *Thrips tabaci* Lindeman is an important pest of tomato crop. Both nymphs and adults cause direct damage by puncturing the epidermis of the leaves and suck out sap with modified piercing and sucking mouth parts.It causes damage directly through feeding and indirectly through the transmission of lethal plant viruses causes yield loss up to 100% (Misra., 2012). Tomato growers depend on synthetic insecticides to combat thrips. Continuous and indiscriminate use of synthetic insecticides resulted in resistance development to these insecticides which reflected on the reliability of efficacy of these insecticides and toxic to predatory coccinellids. To over come this problem testing of new molecules and bio pesticides are needed for obtaining effective control of these pests. Hence, the present study was conducted to evaluate the efficacy of some new insecticides and biopesticides effective control thrips.The neonicotinoids are to-date recommended on tomato against sucking insect pests to farmers, so far these insecticides are considered less toxic to the predators of sucking insects pests. Though laboratory or semi-field trials have demonstrated this property thrips (Lopez *et al.*, 2008) but a few studies have addressed side effects of neonicotinoids under the field conditions (Naranjo and Akey, 2004), however, field studies under natural conditions are proposed in the recent literature (Prabhakar *et al.*, 2011). Hence the attempt was made to study the effect of biopesticides *viz., Beauveria bassiana* and *Verticillium lecanii* and neonicotinoids insecticides *viz.,* Imidacloprid 30.5 SC and Thiomethoxam 25 WG against the tomato thrips and predatory coccinellids in the tomato ecosystem.

MATERIALS AND METHODS

The field experiment with 7 treatments including control replicated thrice was laid out in farmer's field at Kinnathukadavu, Coimbatore during 2013-14 to evaluate biopesticides and novel insecticides against tomato thrips and their safety towards predatory coccinellids. The tomato variety used in the present study was US3140. All the management practices were followed as per the Tamil Nadu Agricultural University recommendations. The various treatments of experiment comprised of *Beauveria bassiana* @ 3 kg/ha (T_1); *Verticillium lecanii* @ 3kg/ha (T_2); *Beauveria bassiana* @ 3kg/

ha + *Verticillium lecanii* @ 3 kg/ha (T_3); imidacloprid 30.5 SC @ 100 ml/ha (T_4); thiomethoxam 25 WG @ 75 g a.i./ha (T_5); imidacloprid 30.5 SC @100 mL/ha + thiomethoxam 25 WG @75 g a.i./ha (T_6) and untreated control (T_7). The observations were recorded on five randomly selected plants in each plot and reported before and after imposing the treatments. Population data of thrips and predatory coccinellids were recorded as described by Hakim *et al.* (2013) with slight modifications from randomly choosen three leaves, one each from top, middle and bottom position of the plant in each replication as precount, 1, 3, 7 and 10 days after treatment. Recorded data subjected to analysis of variance and means were compared by least significant difference. The data on population of the pests were subjected to square root transformation before statistical analysis following Gomez and Gomez (1984) to test the significance of treatment effects.

RESULTS

The mean data of three sprays to study the efficacy of biopesticides and insecticides against thrips revealed that insecticide treatments were superior over the biopesticides. However, the efficacy of biopesticides was also significantly superior over untreated control in reducing the thrips population. At the end of three sprays, the insecticide treatments imidacloprid +Thiomithoxam (1.15thrips/3leaves), thiomithoxam (1.35thrips/ 3leaves) and imidacloprid (1.37 thrips/3leaves) recorded lower thrips population and proved superior treatments is followed by biopesticide treatments *Beauveriabassiana*+ *Verticillium lecani* (2.01 thrips/ 3 leaves), *Beauveria bassiana* (2.12 thrips/3 leaves), *Verticillium lecani* (2.33 thrips/3 leaves) compared to control treatment (6.18 thrips/3 leaves) (Table 1). Among the biopesticides *B. bassiana*showed higher efficacy than *V.lecani* in controlling thrips. The effect of biopesticides and insecticides on coccinellids revealed at the end of field trail, coccinellids population was maximum in untreated control (3.53 coccilnellids/5 plants) which was followed by biopesticide plots, *Beauveria bassiana* (3.26 coccilnellids/5 plants), *Verticillium lecani* (3.12 coccilnellids/5 plants), *Beauveria bassiana*+ *Verticillium lecani* (3.02 coccilnellids/5 plants) (Table 2). The mean data of safety of insecticides on coccinellids revealed that lower coccinellids population was observed upto 3DAT. The observations on 7 and 10 DAT showed that recolonization of coccinellids in insecticide treated plots.

DISCUSSION

The present results showed that neonicotinoids kept the thrips population below the economic threshold level.The present findings are in comparable with Bharpoda *et al* (2014); who reported reduced thrips population in thiomethoxam and imidacloprid treated cotton plots. Similar results are obtained by Ghelani (2014) and Kalyan *et al.* (2012).The results also showed that bio pesticide treated plots are superior than control treatment in thrips reduction.Similar results were obtained by Singh *et al.* (2011); Ghelani (2014), who reported that although biopesticides were effective in reducing the thrips population, they cause moderate mortality compared to insecticides.The higher efficacy of *B. bassiana* against thrips than *V. lecanii* are accordance with Singh *et al.* (2011) who reported entomopathogenic fungi are less effective but among the entomopathogenic fungi *B. bassiana* performed better in reducing the thrips population. The present findings also in line with Arthurs *et al.* (2013) who reported thrips were relatively less susceptible to fungi.

The results showed that biopesticides are safe to natural enemies'*viz.*,coccinellids.The present findings are in agreement with Hansraj *et al.* (2013) who observed no significant difference in coccinellid population in plots sprayed with *B. bassiana* and *V. lecani* compared to untreated control. Similar results were obtained by Huang *et al.* (2012); Prasad *et al.* (2011); Smith and Krischik (2000); Thungrabeab and Tongma (2007) who reported application of *B. bassiana* was safer to coccinellids, further studies are also supported by Ren *et al.* (2010) who reported *V. lecani* was found to have no adverse

Table 1: Effect of bio pesticides and insecticides against thrips population in tomato ecosystem

	Mean number of thrips per plant*												
	First spray					Second spray				Third spray			
Treatments	PC	1DAT	3DAT	7DAT	10DAT	1DAT	3DAT	7DAT	10DAT	1DAT	3DAT	7DAT	10DAT
T_1	5.33 (2.31)	1.00 (1.09)[c]	1.73 (1.32)[c]	3.20 (1.87)[cd]	4.13 (2.02)[c]	1.00 (1.11)[b]	1.40 (1.22)[cd]	2.13 (1.56)[d]	2.73 (1.79)[d]	0.80 (1.04)[bc]	1.00 (1.11)[b]	1.00 (1.13)[c]	2.13 (1.62)[c]
T_2	5.60 (2.35)	1.20 (1.17)[c]	1.93 (1.38)[c]	3.40 (1.96)[d]	4.33 (2.06)[c]	1.20 (1.14)[b]	1.60 (1.33)[d]	2.53 (1.66)[e]	2.93 (1.82)[d]	1.13 (1.15)[c]	1.20 (1.17)[b]	1.13 (1.15)[c]	2.13 (1.62)[c]
T_3	5.67 (2.37)	1.13 (1.15)[c]	1.53 (1.26)[c]	2.93 (1.84)[c]	3.73 (1.92)[b]	1.13 (1.15)[b]	1.20 (1.17)[c]	2.00 (1.50)[c]	2.40 (1.70)[c]	0.73 (1.02)[b]	0.93 (1.10)[b]	0.80 (1.04)[b]	2.00 (1.58)[c]
T_4	5.73 (2.39)	0.40 (0.86)[b]	0.80 (1.01)[b]	1.73 (1.40)[b]	2.40 (1.53)[a]	0.33 (0.84)[a]	0.60 (0.94)[b]	1.33 (1.21)[b]	1.73 (1.42)[b]	0.20 (0.78)[a]	0.40 (0.86)[a]	0.93 (1.10)[bc]	1.20 (1.17)[b]
T_5	6.07 (2.46)	0.33 (0.86)[b]	0.67 (0.95)[ab]	1.53 (1.36)[b]	2.33 (1.52)[a]	0.47 (0.88)[a]	0.73 (0.97)[b]	1.20 (1.17)[b]	1.53 (1.33)[a]	0.20 (0.80)[a]	0.53 (0.92)[a]	0.87 (1.08)[bc]	1.07 (1.16)[b]
T_6	6.60 (2.56)	0.13 (0.77)[a]	0.40 (0.86)[a]	1.00 (1.11)[a]	2.20 (1.47)[a]	0.00 (0.71)[a]	0.13 (0.77)[a]	0.93 (1.07)[a]	1.60 (1.32)[a]	0.00 (0.71)[a]	0.40 (0.86)[a]	0.60 (0.94)[a]	0.93 (1.09)[a]
T_7	5.33 (2.29)	5.73 (2.49)[d]	5.95 (2.54)[d]	6.15 (2.58)[e]	6.45 (2.64)[d]	6.73 (2.69)[c]	6.95 (2.73)[e]	7.10 (2.76)[f]	7.30 (2.79)[e]	5.25 (2.40)[d]	5.65 (2.48)[c]	5.82 (2.51)[d]	5.95 (2.54)[d]
S. Ed ±	-	0.09	0.061	0.051	0.033	0.070	0.061	0.023	0.028	0.070	0.061	0.023	0.028
CD @ 0.05	-	0.19	0.13	0.11	0.07	0.15	0.13	0.05	0.06	0.15	0.13	0.05	0.06

*Mean of three replications, Values in parentheses are $\sqrt{X + 0.5}$ transformed values; DAT-Days After Treatments; In a column means followed by a common letter(s) are not significantly different by LSD ($p = 0.05$).

Table 2: Effect of bio pesticides and insecticides against coccinellids population in tomato ecosystem

Treatments	Number of coccinellids per five plant *												
	First spray				Second sprey				Third spray				
	PC	1DAT	3DAT	7DAT	10DAT	1DAT	3DAT	7DAT	10DAT	1DAT	3DAT	7DAT	10DAT
T1	2.00 (1.56)	3.00 (1.86)^{a}	3.00 (1.86)^{a}	5.00 (2.34)^{a}	6.00 (2.55)^{a}	2.67 (1.77)^{a}	3.00 (1.86)^{ab}	4.00 (2.12)^{a}	4.00 (2.12)^{ab}	3.67 (2.04)^{a}	3.00 (1.86)^{ab}	4.00 (2.11)^{ab}	2.33 (1.68)^{ab}
T2	2.67 (1.77)	3.00 (1.86)^{a}	3.33 (1.95)^{a}	4 (2.12)^{ab}	5 (2.34)^{ab}	2 (1.56)^{a}	3 (1.86)^{ab}	3 (1.87)^{ab}	4.67 (2.24)^{a}	3.33 (1.95)^{a}	3.33 (1.95)^{ab}	3.67 (2.04)^{b}	2.67 (1.77)^{ab}
T3	2.00 (1.58)	2.67 (1.77)^{a}	3.00 (1.87)^{a}	4.00 (2.11)^{ab}	6.00 (2.54)^{a}	2.00 (1.56)^{a}	3.00 (1.87)^{ab}	3.00 (1.86)^{ab}	4.00 (2.12)^{ab}	3.67 (2.04)^{a}	3.00 (1.87)^{a}	4.00 (2.12)^{ab}	2.00 (1.58)^{ab}
T4	2.00 (1.56)	1.33 (1.34)^{bc}	2.33 (1.68)^{c}	4.67 (2.27)^{a}	5.00 (2.34)^{ab}	1.00 (1.22)^{b}	3.00 (1.86)^{ab}	3.33 (1.95)^{ab}	4.00 (2.12)^{ab}	1.00 (1.22)^{b}	3.33 (1.95)^{b}	4.00 (2.12)^{ab}	2.00 (1.58)^{ab}
T5	1.00 (1.17)	1.67 (1.44)^{b}	3.00 (1.87)^{b}	5.00 (2.34)^{a}	6.00 (2.54)^{a}	2.00 (1.58)^{a}	2.67 (1.77)^{ab}	2.00 (1.58)^{bc}	3.00 (1.86)^{bc}	1.00 (1.22)^{b}	4.00 (2.12)^{b}	5.00 (2.35)^{ab}	2.67 (1.77)^{a}
T6	1.00 (1.17)	0.67 (1.08)^{c}	2.33 (1.68)^{c}	3.00 (1.86)^{b}	4.00 (2.11)^{b}	0.33 (0.88)^{c}	2.00 (1.58)^{b}	1.33 (1.27)^{c}	2.00 (1.58)^{c}	0.33 (0.88)^{c}	2.67 (1.77)^{c}	3.67 (2.04)^{b}	2.00 (1.56)^{b}
T7	2.33 (1.68)	3.00 (1.87)^{a}	4.00 (2.12)^{a}	5.33 (2.41)^{a}	6.33 (2.89)^{ab}	2.67 (1.77)^{a}	3.33 (1.95)^{a}	4.00 (2.12)^{a}	4.33 (2.19)^{ab}	3.00 (1.87)^{a}	4.00 (2.12)^{a}	4.10 (2.15)^{a}	3.00 (1.87)^{a}
S. Ed $\pm$	-	0.149	0.112	0.126	0.149	0.131	0.149	0.200	0.173	0.112	0.103	0.112	0.140
CD @ 0.05	-	0.32	0.24	0.27	0.32	0.28	0.32	0.43	0.37	0.24	0.22	0.24	0.30

DAT- Days after treatments, *Mean of three replications, Values in parentheses are $\sqrt{X + 0.5}$ transformed values In a column means followed by a common letter(s) are not significantly different by LSD (p = 0.05)

effect on survival of coccinellid beetles.

The study on the safety of imidacloprid and thiomethoxam found less toxic to coccinellid population in tomato ecosystem. The present findings are in line with Muthukumar *et al.* (2007) who reported application of imidacloprid and thiomethoxam showed toxic to coccinellids in cauliflower ecosystem. Similar results were obtained Awasthi *et al.* (2013) in cotton, Prasad *et al.* (2011) in brinjal, Waffa (2011) in tomato ecosystem and Thania and Mathew (2012) in chilli ecosystem. The present findings are also supported by Muthukumar *et al.* (2007) who observed decreased coccinellid population upto 3DAT in imidacloprid and thiomithoxam treated plots. Similar results were obtained by Prasad *et al.* (2011) who reported imidacloprid and thiomithoxam showing toxic to coccinellids upto 7DAT in brinjal ecosystem.The non-selective organophosphate and pyrethroidsinsecticides can bring serious problems of reduction in the population of beneficial insects on the crops all over the world. The present studies have shown that neonictinoids and bio pesticides can be suitable candidates for inclusion in Integrated Pest Management of thrips because these have proved comparatively less toxic to predators than non-selective insecticides.

REFERENCES

Arthurs, Aristizabal and Avery 2013. Evaluation of entomopathogenic fungi against chilli thrips, *Scirtothripsdorsalis*. *J. Insct. Sci.* **13:** 1-16.

Awasthi, N. S., Barkhade, U. P., Patil, S. R. and Lande, G. K. 2013. Comparative toxicity of some commonly used insecticides to cotton aphid and their safety to predatory coccinellids. *The Bioscan.* **8(3):** 1007-1010.

Bharpoda, T. M., Patel, N. B., Thumar, R. K., Bhatt, N. A., Ghetiya, V., Patel, H. C. and Borad, P. K. 2014. Evaluation of insecticides against sucking insect pestsInfesting BT cotton BG-II. *The Bioscan.* **9(3):** 977-980.

Ghelani, M. K. 2014. *Field efficacy of newer insecticides against major sucking pests of Bt cotton. 2nd international conference on agricultural and horticultural sciences.*

Gomez, K. A. and Gomez, A. A. 1984. Statistical procedures for agricultural research, 2nd edition, A wileyinterscience publication, *J. Wiley and Sons*, New York. pp. 302-307.

Hakim Ali Sahito, Muhammad Babar Arain, Bhugro Mal, Muhammad SamiullahChanna, Khalid Hussain, D. 2013. Efficacy of Different Insecticides against Thrips on Peas, PisumSativum (L.) in Vivo Condition. *J. Agric. Sustain.* **3(1):** 65-77.

Hansraj, S. and Rajendra, N. 2013. Evaluatio of microbial agents and bio-products for the management of mustard aphid, *Lipaphiserysimi* (Kalt.) *The Bioscan.* **8(3):** 747-750.

Huang, Ali, Ren, W. and Zhang 2012. Influence of entomopathogenic fungus *BeauveriabassianaonPrynocoria congener* (Billberg) (coleopteran: coccinellidae) under laboratory conditions. *Pakistan J. Zoo.* **44(1):** 209-216.

Kalyan, R. K., Saini, D. P., Urmila, Jambhulkar, P. P. and Abhishek, P. 2012. Comparative bioefficacy of some new molecules against jassids and whitefly in cotton. *The Bioscan.* **7(4):** 641-643.

Lopez Jr., J. D., Fritz, B. K., Latheef, M. A., Lan, Y., Martin, D. E. and Hoffmann, W. C. 2008. Evaluationof toxicity of selected insecticides against thripson cotton in Laboratory Bioassays. *J. Cotton Sci.***12:** 188-194.

Misra 2012. Field efficacy of a new molecule of insecticide against tomato thrips and its impact on coccinellid predators. *SAARC J. Agri.* **10(1):** 63-70.

Muthukumar, M., Sharma, R. K. and Sinha, S. R. 2007. Field efficacy of biopesticides and new insecticides against major insect pests and their effect on natural enemies in cauliflower. *Pestic. Res. J.* **19(2):** 190-196.

Naranjo, S. E. and Akey, D. H. 2004. Comparativeefficacy and selectivity of acetamiprid for themanagement of *Bemisiatabaci*. *Arizona Cotton Rept*. p.138.

Prabhaker, N., Castle, S. J., Naranjo, S. E., Toscano, N. C. and Morse, J. G. 2011. Compatibility of twosystemic neonicotinoids, imidacloprid andthiamethoxam, with various natural enemies ofagricultural pests. *J. Econ. Entomol.* **104(3):** 773-781.

Prasad, C. S., Ghananand, T. and Lok, N. 2011. Effect of insecticides, bio-pesticides and botanicals on the population of natural enemies in brinjal ecosystem. *VEGETOS.* **24(2):** 40-44.

Ren, S. X., Ali, S., Huang, Z. and Wu, J. H. 2010. *Lecanicillium muscarium*as microbial insecticide against whitefly and its interaction with other natural enemies. *Current Research, Technology and Education Topics in Applied Microbiology and Microbial Biotechnology*. pp. 339-348.

Singh, B. K., Pandey, J. G., Gupta, R. P. and Abraham, V. 2011. Efficacy of entomopathogenic fungi for the management of onion thrips, *Thripstabaci* Lind. *Pest Manag. Hort. Ecosyst.* **17(2):** 92-98.

Smith, S. F. and Krischik, V. A. 2000. Effects of Biorational Pesticides on Four Coccinellid Species (Coleoptera: Coccinellidae) having Potential as Biological Control Agents in Interiorscapes. *J. Econ. Entomol.* **93(3):** 732-736.

Thania Sara Varghese and Thomas Biju, M. 2012. Evaluation of newer insecticides against chilli aphids and their effect on natural enemies. *Pest Manag. Hort. Ecosyst.* **18(1):** 114-117.

Thungrabeab, M. and Tongma, S. 2007. Effect of entomopathogenic fungi, *Beauveriabassiana*(Balsam) and *Metarhiziumanisopliae*(Metsch) on non target insects. *KMITL Sci. Tech. J.* **7:** 8-12.

WafaaA Al-Kherb. 2011. Field efficacy of some neonicotinoid insecticides on whitefly *Bemisiatabaci*(Homoptera: Aleyrodidae) and its natural enemies in cucumber and tomato plants in al-qassium region, KSA. *J. Entoml.* pp. 1-11.