

Efficacy of botanicals and synthetic acaricides against *Aceria noxia* Flechtmann & Tassi, 2020 in vegetable amaranth, *Amaranthus tricolor* L.

K.P. Krishna Keerthi¹, K.M. Sreekumar^{1*}, B. Ramesha², C. Vidya³ and P.K. Sajeesh⁴

¹Department of Agricultural Entomology, College of Agriculture, Kerala Agricultural University, Padannakkad 671314, Kerala, India.

²Extension Training Centre, Kerala Agricultural University, Vorkady, Manjeshwar 671323, Kerala, India.

³Department of Agricultural Entomology, College of Agriculture, Kerala Agricultural University, Vellanikkara 680656, Kerala, India.

⁴Department of Plant Pathology, College of Agriculture, Kerala Agricultural University, Padannakkad 671314, Kerala, India.

Email: sreekumar.km@kau.in

ABSTRACT: Field experiments were carried out to test the efficacy of spiromesifen, fenpyroximate, pongamia oil soap (3%), NSKE (5%), HMO (2%), wettable sulphur and azadirachtin in controlling *Aceria noxia* Flechtmann & Tassi, 2020 (Trombidiformes, Eriophyidae) in amaranthus. Spiromesifen and fenpyroximate were found to be potent miticides and exhibited extended action in managing the mite. Pongamia oil soap and Horticultural Mineral Oil (HMO) showed immediate control of the mite population but failed to show persistence in the field. Although wettable sulphur was effective in reducing mite population, the yellow dust cover over the crop, reduced the acceptance by the farmers. NSKE and azadirachtin, failed to show the complete control over the mites. The residue of fenpyroximate was found to be above the MRL value fixed by FAO. © 2025 Association for Advancement of Entomology

KEY WORDS: Eriophyid, miticides, spiromesifen, fenpyroximate, pongamia oil soap, Horticultural mineral oil, persistence in the field, residue

INTRODUCTION

Vegetable amaranthus (*Amaranthus tricolour*) is a popular leafy vegetable grown in warm temperate and tropical areas. It is grown in India, Myanmar, Malaysia, Taiwan, tropical Africa, Central and South America, South Pacific Islands and the Caribbean islands (Tindall, 1983). Amaranthus is a sole leafy vegetable crop, cultivated in the tropical

humid region of Kerala (Celine *et al.*, 2002). The crop is raised annually in paddy lowlands, homesteads and garden lands in Kerala (Muralikrishna *et al.*, 2019). The major factor which hampers yield and productivity of amaranthus is the pest infestation. Leaf webber, tobacco caterpillar and green grasshopper infest the leaves of amaranth (Nair, 1975). Other than insects, mites belonging to Eriophyidae, Tetranychidae etc. are causing

* Author for correspondence

significant damage on the amaranthus crop worldwide (Dhooria, 2016). The major mites infesting amaranthus crops in Kerala are *Brevipalpus phoenicis* and *Tetranychus* spp. (Binisha and Bhaskar, 2013). Lenin and Bhaskar (2015) observed that amaranthus in greenhouses were also infested by *Tetranychus truncatus*. Flechtmann and Tassi (2020) reported a new eriophyid *Aceria noxia* Flechtmann & Tassi, 2020 (Trombidiformes, Eriophyidae), causing chlorotic patches and deformation in leaves of *Amaranthus viridis* in Brazil.

Eriophyidae is a major family of phytophagous mites. Out of 4600 species of eriophyid distributed worldwide, above 482 species have been reported from India (Bhardwaj *et al.*, 2023), with 127 species belonging to the *Aceria* genus (Huang, 2008). However, no reports of Eriophyidae in amaranthus were confirmed in India until first incidence was reported in Kasaragod district of Kerala in the summer months of April and May 2019. The infested amaranthus had crinkled, miniatures and malformed leaves. The plants appeared stunted in growth and shoots were seen fibrous after cutting for culinary purpose. The incidence reduced the number of harvests to at least 50 per cent and there was more than 50 per cent reduction in revenue as surveyed by the farmers of the affected area. Marketability was found to be affected due to the fibrous nature of leafy plants (Sreekumar *et al.*, 2019). Later it is confirmed that the species is *A. noxia* itself. So, different acaricides were tested for the management of this pest which is described in this paper.

MATERIALS AND METHODS

a. Preparation of pongamia oil soap: Mixed 55g of caustic soda with distilled water (100 ml) and left with no disturbance for 4 hours. The solution homogenized into the solution prepared with 55g soap stone power and pongamia oil (1 litre). The prepared pongamia oil soap solution was then kept for solidification.

b. Preparation of 'Neem Seed Kernel Extract' (NSKE 5%): The 50g seed kernel powder was kept in single muslin cloth bags and were immersed

in 1 liter of water overnight. Then bag was squeezed and taken out. The suspension with kernel extract was made up to 1 liter and used for further studies.

Experiments were carried out with farmer's variety in farmer's plots at Thaikadappuram, Kanhangad, Kasaragod district in Randomized Block Design with 8 treatments (Spiromesifen 22.9 SC @96g ai ha⁻¹, Fenpyroximate 5 EC @15g ai ha⁻¹, Pongamia oil soap (3%), NSKE (5%), Horticultural Mineral Oil (2%), Wetttable sulphur 80 WP 1600g ai ha⁻¹, Azadirachtin 3000ppm and Absolute control), and 3 replications. Application of treatments were done two times. The evaluation was carried out on severely infested plants during May and June 2019. A single treatment plot consisted of a row of 15 plants. Observations were made one day before treatment and one, three, five, seven and fourteen days after application. The top five leaf axils from three plants of each row were examined on each observation and the number of mites were counted under the stereomicroscope. The statistical analysis of data was carried out using Analysis of Variance (ANOVA). The significance between treatments was compared using 'Web Agri Stat Package' (WASP 2.0) software. To compute a per cent reduction in mite population, Henderson and Tilton formula was utilized (Henderson and Tilton, 1955).

$$\text{Corrected per cent} = \left(1 - \frac{n \text{ in Co before treatment} \times n \text{ in T after treatment}}{n \text{ in Co after treatment} \times n \text{ in T before treatment}}\right) \times 100$$

Where, n = insect population, T = treated, Co = control

Residue analysis: The shoot samples sprayed with Spiromesifen and Fenpyroximate collected during the second application (on the fifth, seventh and tenth day) were analysed at the Pesticide Residue and Analytical Laboratory, AINP on Pesticide Residue, College of Agriculture, Vellayani. The reference method followed was QuEChERS –AINPPRKAU/MOA-02 (AOAC 20th Edition 2016: Chapter 10, 2007.01) and 'European Union reference laboratory multi residue method' for fruits and vegetables using QuEChERS (GC-ECD & FPD, GC-MS) (Anonymous, 2007).

RESULTS AND DISCUSSION

Mite population in different treatments:

Table 1. Average population of *Aceria* mites in top five leaf axils per shoot recorded during the experiment

Treatments	First application of treatments						Second application of treatments					
	1 DBA	1 DAA	3 DAA	5 DAA	7 DAA	14 DAA	1 DBA	1 DAA	3 DAA	5 DAA	7 DAA	14 DAA
Spiromesifen 22.9 SC @ 96g ai ha ⁻¹	244.000 (15.599)	0.000 (0.707) ^d	4.000 (2.114) ^d	5.777 (2.401) ^e	9.223 (3.033) ^f	20.557 (4.519) ^d	163.110 (12.753)	0.000 (0.707) ^d	1.443 (1.189) ^e	5.110 (2.231) ^e	8.777 (2.957) ^{ef}	11.890 (3.437) ^e
Fenpyroximate 5 EC @ 15g ai ha ⁻¹	277.110 (16.636)	0.000 (0.707) ^d	0.223 (0.832) ^e	2.557 (1.585) ^f	6.000 (2.445) ^g	13.553 (3.675) ^d	163.110 (12.753)	0.000 (0.707) ^d	1.557 (1.202) ^e	5.223 (2.284) ^e	7.113 (2.666) ^f	17.667 (4.202) ^d
Pongamia oil soap (3%)	276.667 (16.629)	0.000 (0.707) ^d	4.223 (2.171) ^d	6.667 (2.575) ^e	10.557 (3.245) ^{ef}	20.777 (4.554) ^d	165.890 (12.870)	0.000 (0.707) ^d	5.330 (2.302) ^d	7.890 (2.809) ^d	12.000 (3.464) ^d	16.000 (3.992) ^d
NSKE 5%	278.333 (16.676)	35.890 (6.018) ^b	42.220 (6.532) ^b	51.557 (7.178) ^b	64.557 (8.033) ^b	146.997 (12.123) ^b	176.557 (13.286)	15.447 (3.974) ^b	27.223 (5.213) ^b	40.447 (6.355) ^b	55.780 (7.466) ^b	76.333 (8.735) ^b
HMO (2%)	276.223 (16.620)	0.000 (0.707) ^d	3.000 (1.865) ^d	7.557 (2.746) ^{de}	11.780 (3.432) ^{de}	27.110 (5.199) ^{cd}	164.220 (12.809)	0.000 (0.707) ^d	1.880 (1.320) ^e	5.110 (2.231) ^e	8.553 (2.015) ^{ef}	17.447 (4.175) ^d
Wettable Sulphur 80WP	278.553 (16.687)	0.000 (0.707) ^d	4.223 (2.171) ^d	9.443 (3.068) ^d	13.000 (3.604) ^d	27.557 (5.247) ^{cd}	157.557 (12.551)	0.000 (0.707) ^d	2.333 (1.510) ^e	4.333 (2.075) ^e	10.443 (3.232) ^{de}	17.667 (4.198) ^d
Azadirachtin 3000ppm	285.553 (16.892)	21.777 (4.717) ^c	29.89 (5.511) ^c	43.223 (6.569) ^c	56.000 (7.483) ^c	70.333 (7.699) ^c	155.557 (12.470)	8.330 (2.972) ^c	14.777 (3.843) ^c	23.777 (4.867) ^c	33.417 (5.765) ^c	56.890 (7.542) ^c
Control (Water spray)	267.337 (16.350)	273.110 (16.541) ^a	278.557 (16.705) ^a	284.887 (16.878) ^a	289.887 (17.026) ^a	324.223 (18.005) ^a	160.447 (12.663)	165.000 (12.663) ^a	197.447 (14.051) ^a	227.557 (15.083) ^a	256.223 (16.006) ^a	299.443 (17.304) ^a
CD (0.05)	NS	5.262 (0.374)	3.015 (0.335)	5.288 (0.423)	4.138 (0.282)	33.693 (2.526)	NS	4.668 (0.331)	3.472 (0.494)	6.423 (0.485)	5.853 (0.454)	4.707 (0.379)

*In a column means followed by different letters are statistically significant; Values in parentheses are arc sin values

Uniform population (244.00 to 285.55 mites) was observed in top five leaf axils per shoot, a day before the first application. The plots sprayed with acaricides, pongamia oil, HMO and wettable Sulphur recorded no population of mite a day after the spray. However, mites were seen in plots sprayed with azadirachtin (21.777 mites) and NSKE (35.890 mites), both were statistically different (Table 1).

The third day observation recorded fenpyroximate (0.223 mites) as the superior treatment, followed by HMO @ 2 per cent (3 mites) and spiromesifen (4 mites). After five days of application, fenpyroximate recorded the least population (2.557 mites), significantly different to other treatments. This was followed by spiromesifen, pongamia oil soap, HMO and wettable sulphur, with average population of 5.777, 6.667, 7.557 and 9.443 mites, respectively and were on par to each other. A week after the spray, fenpyroximate showed the least population of six mites. The next best result was given by spiromesifen sprayed plots with 9.223 mites. Other treatments, pongamia oil soap, HMO,

wettable sulphur recorded significantly similar populations of 10.557, 11.780 and 13.000 mites respectively. Two weeks after the spray, fenpyroximate maintained the dominance among the treatments in controlling the population (13.553 mites). This was followed by the statistically similar results of spiromesifen, pongamia oil soap, HMO, wettable sulphur and azadirachtin, with a population mean of 20.557, 20.777, 27.110, 27.557 and 70.333 mites respectively.

During second application, a uniform population in the range of 160.447 to 176.557 mites were observed in the field, a day before the spray. On the first day after the application there was complete absence of mites on plants treated with acaricides, pongamia oil, HMO and wettable sulphur. On the third day, the least mean population was seen in plants sprayed with spiromesifen (1.443 mites), succeeded by fenpyroximate sprayed plots (1.557 mites). Other acaricides, which are on par to the former were HMO and wettable sulphur, with mean population of 1.880 and 2.333 mites, respectively. On the fifth day, wettable sulphur showed

maximum effectiveness in managing the population (4.333 mites). Spiromesifen, HMO, fenpyroximate showed statistically similar results with 5.110, 5.110 and 5.223 mites respectively. On the seventh day, population was lowest in fenpyroximate sprayed plants (7.113 mites). This was statistically similar with the results of spiromesifen and HMO with respective mean populations of 8.777 and 8.553 mites. Wettable sulphur (10.443 mites) and pongamia oil soap (12.000 mites) recorded the next best treatment. Two weeks after the treatment, the lowest count was observed in the plot sprayed with spiromesifen (11.890 mites). An average population of 17.447, 16.000, 17.667 and 17.667 mites were observed in plots sprayed with HMO, pongamia oil soap, fenpyroximate and wettable sulphur, respectively.

Percentage reduction in mite population:

Cent per cent reduction was observed after the first day of spray of acaricides in both rounds of application. NSKE and azadirachtin, achieved 92.460 and 86.970 per cent reduction, respectively (Table 2).

The third day witnessed fenpyroximate as the superior treatment, with a reduction per cent of 99.93, followed by HMO (99.86 %), pongamia oil soap (98.58 %), wettable sulphur (98.50 %), spiromesifen (98.32 %), azadirachtin (89.83 %) and NSKE (85.13 %). Fenpyroximate sprayed plots recorded 99.02 per cent reduction on the fifth day, followed by spiromesifen (97.72%) and pongamia oil soap (97.65%).

The next best treatments were HMO (97.41%) and wettable sulphur (96.77%). A reduction was observed in azadirachtin (85.69%) and NSKE (82.43%) sprayed plots. After a week, fenpyroximate again proved the best treatment with a per cent reduction of 98.01. The oils, pongamia oil soap and HMO showed 96.51 and 95.98 per cent reduction of mites respectively. Spiromesifen sprayed plots reduced the population by 95.77 per cent. The least efficient treatments were botanicals, azadirachtin (81.84%) and NSKE (78.33%). Two weeks after the spray, highest reduction was observed in fenpyroximate applied plots (95.97%). This was succeeded by pongamia oil soap and

spiromesifen, with respective population reduction of 93.81 and 92.70 per cent. The former observations were on par with results of fenpyroximate. Statistically similar results were observed in plots sprayed with HMO (91.80%) and wettable sulphur (91.74%). NSKE recorded 56.05 per cent reduction.

The first day of observation of the second application, both azadirachtin and NSKE had the lesser efficiency of 94.74 and 91.42 per cent. On the third day, maximum per cent reduction was observed in spiromesifen (99.32%), followed by on par results of fenpyroximate (99.13%), HMO (99.07%) and wettable sulphur (98.76%). On the fifth day, wettable sulphur showed the highest reduction of 97.84 per cent. HMO, spiromesifen and fenpyroximate had the next best reduction per cent (97.68, 97.64 and 97.57%). The less effective ones were azadirachtin and NSKE (with 88.94 and 83.41%). A week after the spray, fenpyroximate showed the highest percentage of reduction (97.09%), followed by HMO (96.64%), spiromesifen (96.34%), wettable sulphur (95.55%) and pongamia oil soap (95.34%). Two weeks of observation, spiromesifen, pongamia oil soap, HMO, fenpyroximate and wettable sulphur were statistically similar in results (95.89, 94.65, 94.09, 93.85 and 93.75% respectively). Significant variant results in NSKE (76.60%) and azadirachtin (79.97%) were observed.

The results obtained from the study clearly revealed fenpyroximate has the best miticidal action on all the respective days of observation in the first season. In the second application, it proved the best treatment after spiromesifen, which was on par with the former on the third, fifth and seventh days after treatment. This is similar to the results from the pesticide evaluation studies of Azevedo *et al.* (2013) against *A. litchii*, in which fenpyroximate recorded the highest mortality followed by sulfur, abamectin and hexythiazox. Spiromesifen, evidenced as the best treatment on all days, after fenpyroximate during first application. The second application revealed the highest control of spiromesifen on the fifth and seventh observation days. This is like the findings of Suganthi *et al.* (2006), in which

Table 2 Percentage reduction in *Aceria* mite population on amaranthus after the application of acaricides

Treatments	First application, reduction% - in DAA					Second application, reduction% - in DAA				
	1	3	5	7	14	1	3	5	7	14
Spiromesifen	100 ^a	98.32 ^b	97.72 ^b	95.77 ^b	92.70 ^{ab}	100 ^a	99.32 ^a	97.64 ^a	96.34 ^a	95.89 ^a
Fenpyroximate	100 ^a	99.93 ^a	99.02 ^a	98.01 ^a	95.97 ^a	100 ^a	99.13 ^a	97.57 ^a	97.09 ^a	93.87 ^a
Pongamia oil soap	100 ^a	98.58 ^b	97.65 ^b	96.51 ^b	93.81 ^{ab}	100 ^a	97.32 ^b	96.49 ^a	95.34 ^a	94.65 ^a
NSKE	86.97 ^c	85.13 ^d	82.43 ^e	78.33 ^d	56.05 ^d	91.42 ^c	87.23 ^d	83.41 ^c	79.89 ^c	76.60 ^c
HMO	100 ^a	98.86 ^{ab}	97.41 ^{bc}	95.98 ^b	91.80 ^b	100 ^a	99.07 ^a	97.68 ^a	96.64 ^a	94.09 ^a
Wettable Sulphur	100 ^a	98.50 ^b	96.77 ^c	95.64 ^b	91.74 ^b	100 ^a	98.76 ^{ab}	97.84 ^a	95.55 ^a	93.75 ^a
Azadirachtin	92.46 ^b	89.83 ^c	85.69 ^d	81.84 ^c	71.08 ^c	94.74 ^b	92.15 ^c	88.94 ^b	84.94 ^b	79.97 ^b
Control	0.00 ^d	0.00 ^e	0.00 ^f	0.00 ^e	0.00 ^e	0.00 ^d	0.00 ^e	0.00 ^d	0.00 ^d	0.00 ^d
CD (0.05)	2.32	1.20	0.73	1.43	4.03	1.51	1.48	2.38	2.18	2.29

*In a column means followed by different letters are statistically significant; Values in parentheses are arc sin values

spiromesifen was found to be superior to triazophos in controlling coconut *Aceria* mite, and reduced population to 17.89 per cent, on the seventh day. The translaminar action of spiromesifen was superior in its action among nine miticides tested against aloe mite, *A. aloinis*, and can be recommended as a treatment either alone or along with cultural methods (Villavicencio *et al.*, 2014).

Pongamia oil soap also proved good control on the mite population and can be used as one of the best options for organic farmers. The oil soap brought the control of mite to 96.51 per cent, a week after the spray. This is different from the observations of Begum *et al.* (2013), in which pongamia leaf extract and ginger extract tested the least effective plant products among neem leaf extract, neem oil, azadirachtin, neem oil based azadirachtin, garlic extract in controlling coconut perianth mite, *A. guerreronis* Keifer.

By the seventh day of treatment, HMO reduced population (95.98% in the first application and 96.64% in the second application). This is similar to the subsequent reduction in population of pink citrus rust mite, *Aculops pelekassi* (Keifer) from the first to the third spray, with HMO only foliar spray programs in selected locations of Florida (Childers, 2011). Wettable sulphur was also a better treatment when compared to all the respective treatments except botanicals, which did not fail to reduce the pest population. The drawback of this

treatment was the white dusty appearance on the leaves, which will deter the consumers. This was on par with the best treatment of the season. According to Navik *et al.* (2015), wettable sulphur reduced *Calepitrimerus azadirachtae* on neem, by 49.61 per cent on the third day of spray.

Azadirachtin recorded population reduction (81.84 and 71.08% in the seventh and fourteenth days of observation respectively). This is against to the findings of Bagde *et al.* (2014), who observed that neemazal 5 per cent spray, along with root feeding, reduced *A. guerreronis* by 23.43 and 38.07 per cent over control after one and two weeks of time. Both the botanicals, NSKE and azadirachtin never met the need, and the mite population were on increasing direction. Botanicals, as of the previous season, failed to meet the target and the plant counted a greater number of live mites, compared to other treatments during second treatment. This is against the findings of Pushpa and Nandihalli (2008), which stated NSKE 5 per cent as the superior one among neem oil and neemazal in controlling population of coconut perianth mite, *A. guerreronis*.

Residue analysis: The analysis detected fenpyroximate residues on an average 0.29 mg kg⁻¹, 0.30 mg kg⁻¹ and 0.22 mg kg⁻¹ in the cuttings collected after 5, 7 and 10th days after treatment. The MRL value fixed by European Union and FAO is 0.01mg kg⁻¹. The residue of spiromesifen was

found to be in BQL (Below Quantitative Level) in which the LOQ (Limit of Quantification) is 0.01 mg kg⁻¹

ACKNOWLEDGEMENT

The authors are thankful to Kerala Agricultural University for the financial support.

REFERENCES

- Anonymous (2007) Official Methods of Analysis 2007.01, Pesticide Residues in Foods by Acetonitrile Extraction and Partitioning with Magnesium Sulfate. Available from: http://www.weber.hu/PDFs/QuEChERS/AOAC_2007_01.pdf. (Accessed on 14 April, 2024).
- Azevedo L.H., Moraes G.J., Yamamoto P.T and Zanardi O.Z. (2013) Development of a Methodology and Evaluation of Pesticides Against *Aceria litchii* and Its Predator *Phytoseius intermedius* (Acari: Eriophyidae, Phytoseiidae). Journal of Economic Entomology 106 (5): 2183–2189.
- Bagde A.S., Patil P.D. and Pashte V.V. (2014) Studies on efficacy of neem bio-pesticides against eriophyid mite (*Aceria guerreronis* Keifer). The Bioscan 9(1): 341–346.
- Begum N., Babu R.H.N. and Poojitha D.R. (2013) Efficacy of botanicals/ biopesticides against active stages of eriophyid mite *Aceria Guerreronis* (k) in Machenahalli, Shimoga, Karnataka. Discovery Science 3 (9): 20–23.
- Bhardwaj S., Sharma I., Sur S. and Gupta S.K. (2023) Eriophyid mites (Acari: Eriophyoidea) from Himachal Pradesh, India: New mite and host plant records. The Pharma Innovation Journal 12(10): 689–694.
- Binisha K.V. and Bhaskar H. (2013) Mite fauna associated with major vegetable crops of Thrissur district, Kerala. ENTOMON 38(1): 47–52.
- Celine V.A., Gokulapalan C. and Nair S.R. (2002) Evaluation of vegetable amaranthus for yield and leaf blight resistance under Kerala conditions. Vegetable Science 29: 198–199.
- Childers C.C. (2011) Assessment of an integrated pest mite and disease management program on Florida citrus utilizing 224°C or 235°C horticultural mineral oils (HMO). Zoosymposia 6: 139–151.
- Dhooria M.S. (2016) Fundamentals of Applied Acarology. Springer, Singapore. 470pp.
- Flechtmann C.H.W. and Tassi A.D. (2020) An *Aceria* species (Prostigmata, Eriophyidae) from Amaranthus in Brazil. Persian Journal of Entomology 9 (4): 311–319.
- Henderson C.F. and Tilton E.W. (1955) Tests with acaricides against the brown wheat mite. Journal of Economic Entomology 48: 157–161.
- Huang K.W. (2008) *Aceria* (Acarina: Eriophyoidea) in Taiwan: five new species and plant abnormalities caused by sixteen species. Zootaxa 1829: 1–30.
- Lenin N. and Bhaskar H. (2015) Mite pests of vegetable crops under protected cultivation in Kerala. ENTOMON 41 (4): 309–312.
- Muralikrishna P., Matthew T.B., Paul A. and Nithya P.R. (2019) Evaluation of bio-efficacy of new generation insecticides, botanicals and microbial insecticides on leaf webber of amaranth. Journal of Entomology and Zoology Studies 7(5): 516–520.
- Nair M.R.G.K. (1975) Insects and Mites of Crops in India. (2nd Ed.). Indian Council of Agricultural Research, New Delhi. 408pp.
- Navik O.S., Manjunatha M., Kumaraswamy M.C. and Latha M. (2015) Efficacy of entomopathogenic fungi and acaricidal molecules on mite, *Calepitrimerus azadirachtae* Channa Basavanna (Acari: Eriophyidae) on neem. Journal of Eco-friendly Agriculture 10(1): 53–57.
- Pushpa V. and Nandihalli B.S. (2008). Bioefficacy of botanicals in the management of coconut eriophyid mite, *Aceria guerreronis* Keifer. Journal of Plant Protection and Environment 5 (1): 90–94.
- Sreekumar K.M., Srinivasa N. and Sivamoorthy R. (2019) First report of incidence of eriophyid mite *Aceria* sp. on Amaranthus. ENTOMON 44(4): 309–310.
- Suganthi A., Ramaraju K., Kuttalam S. and Chandrasekharan S. (2006) Bio efficacy of Spiromesifen (Oberon) 240 SC against Coconut Eriophyid Mite *Aceria guerreronis* Keizer and Determination of Residues. Journal of Entomology 3(4): 325–330.
- Tindall H.D. (1983) Vegetables in the Tropics. Mc Milan Publishers, Hong Kong. 527pp.
- Villavicencio L.E., Bethke J.A., Dahlke B., Mey B.V. and Corkidi L. (2014) Curative and preventive control of *Aceria aloinis* (Aceria: Eriophyidae) in Southern California. Journal of Economic Entomology 107(6): 2088–2094.