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Laboratory evaluation of different bio-pesticides against Coconut eriophyid Mite, *Aceria guerreronis* Kiefer

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Abstract
An experiment were carried out during 2017-18 and 2018-19 to evaluate different bio-pesticides against coconut eriophyid mite, *A. guerreronis* under laboratory condition at Acarology Laboratory, Department of Agricultural Entomology, N.M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat). Among different bio-pesticides used *Hirsutella thompsonii* (Fisher) 5g/l was found most effective treatment by recording highest per cent of mite mortality (58.89%) which was followed by treatment neem oil 20ml/l (51.11%).The treatment *Beauveria bassiana* (Balsamo) 5g/l was found statistically at par with *Verticillium lecanii* (Zimmerman) 5g/l by recording 32.68 and 32.55 per cent mite mortality, respectively. The descending order of effectiveness of remaining bio-pesticides were karanj oil 20ml/l, *Paecilomyces fairnescence* (Hotmskiold) 5g/l, nergundi oil 10ml/l and *Metarhizium anisopliae* (Metschnik off) 5g/l which showed 32.29, 32.26, 31.49 and 30.74 per cent mite mortality, respectively. The treatment *M. anisopliae* 5g/l was found to be least effective.

Keywords: Coconut eriophyid mite, *A. guerreronis* and bio-pesticides

1. Introduction
Coconut palm were grown in more than 90 countries of the world, most of the world production was in tropical Asia, with Indonesia, Philippines and India. In recent years coconut is facing severe problem due to the invasion of eriophyid mite, *A. guerreronis.* However this mite species was first described in 1965 from specimen of Guerrero State, Mexico (Keifer, 1965) [1]. Feeding by this mite initially appears as a triangular patch at the level of the perianth, when the nut grows this injury on the nuts leads to warting and longitudinal fissures on the nut surface. In India during 1998, the outbreak of eriophyid mite was reported, almost 85 to 90 per cent of the nuts which showing malformation and reduction in size (Nair, 2000) [2] and 30.94 per cent losses in terms of copra and 41.74 per cent losses in husk production (Muralidharan *et al*., 2001) [3].

Presently, number of chemicals has been tested against the coconut eriophyid mite throughout the world, but those chemicals are not eco-friendly and have residual effect. Hence, there is need to search for the compounds to manage this mite which are eco-friendly. Azadirachtin arguably stands out as the most widely used botanical pesticide, which has unique features can act as an arthropod anti-feedant, growth regulator and sterilant (Mordue *et al*., 2010) [4]. Spraying of neem oil in combination with garlic (2%) mixture and Neemazal (1%) recorded 60 per cent reduction of eriophyid mite population (Fernando *et al*., 2002) [5]. The application biocide, neem oil and garlic (2%) mixture was found to be effective in reducing the mite population and nut damage Nair *et al*., 2003 [6]; Saradamma *et al*., 2000 [7] and spraying of botanical like neem oil at 10ml/l gives 55.55 and 60.84 per cent mite mortality after 7 and 8 days after treatment, respectively (Pushpa and Nandihalli (2010) [8]. The root treatment with karanja oil was found to be 63 per cent mite reduction after 5 days treatment (Das *et al*., 2015) [9]. Laboratory studies showed that the application of *P. fairnescence, B. bassiana, M. anisopliae* and *V. lecanii* showed significant reduction in mite population after 8 days of treatment (Hegade *et al*., 2016) [10].

Number of control measures mostly involving aerial application and root feeding with chemical pesticides are banned due to hazardous residue noticed. In view of this the investigation was proposed to undertake overall studies on eriophyid mite. There is practical difficulty in insecticidal spray to reach the height of coconut trees. Considering the importance

of coconut as a plantation crop in this country and the potential of this mite pest to cause extensive damage, attempt was made to evaluate efficacy of certain bio-pesticides for the management of eriophyid mite with special attention to those underneath the perianth.

2. Material and Methods

The laboratory studies on management of coconut eriophyid mite were carried out in Acarology laboratory, Department of Agricultural Entomology, N.M. College of Agriculture, Navsari Agricultural University, Navsari in completely randomized design (CRD) with nine treatments and four repetitions during the year 2017-18 and 2018-19.

A. Methodology followed

The nuts infested with coconut eriophyid mite were placed on trays filled with sterilized sand (to one-third of its capacity) and trays were moistened daily. The inner bracts of the perianth were removed smoothly and the observation of live mite were recorded from one microscopic field of 28.28mm² was made with the help of cork borer on the inner surface of bracts and perianth. The required quantity of spray solution was sprayed on the inner surface of the bracts and perianth with the help of hand sprayer. On 3rd day after spraying bracts were open to observe infected mites on the inner surface of the bracts under a stereo binocular microscope.

Plate 1a: Efficacy of bio-pesticides on *A. guerreronis* under laboratory condition

Plate 1b: Microscopic field of 28.28mm² for recording mite population

B. Observation recorded

The live mites from one microscopic field were recorded before imposing treatments of the bio-pesticides. The dead mites were counted at 3, 5, 8 and 12 days after imposing treatments. The data obtained on cumulative dead mite counts were summed up and utilized for calculation of per cent corrected mortality, converted into arcsine transformation and analyzed statistically by using completely randomized design. The per cent corrected mortality was worked out by the following formula suggested by Henderson and Tilton (1955) [11].

$$\text{Corrected per cent mortality} = 1 - \frac{Ta \times Cb}{Tb \times Ca} \times 100$$

Where,

Tb = Number of mites observed before treatment
Ta = Number of mites observed after treatment
Cb = Number of mites observed from untreated control before treatment
Ca = Number of mites observed from untreated control after treatment

3. Results

i) Year 2017-18

The results on corrected per cent mortality of *A. guerreronis* were presented in Table 1 revealed that on 3 DAS the treatment *H. thompsonii* 5g/l was showed significantly highest per cent mite mortality of *A. guerreronis* (33.83%) which was followed by neem oil 20ml/l (30.29%) and next effective treatment was *V. lecanii* 5g/l (23.11%) which was at par with nergundi oil 10ml/l (21.77%). The rest of treatments namely *B. bassiana* 5g/l, karanj oil 20ml/l and *P. fairnescence* 5g/l were found middle in order as they showed 20.41, 19.63 and 17.58 per cent mite mortality, respectively however; treatment *M. anisopliae* 5g/l was found to be least effective recording lowest mortality (16.71%) of *A. guerreronis* which was at par with *P. fairnescence*. On 5 DAS the treatment of *H. thompsonii* 5g/l maintained its superiority over other treatments by recording the maximum mortality (46.01%) and next effective treatment was neem oil 20ml/l, *B. bassiana* 5g/l and karanj oil 20ml/l with 43.22, 30.43 and 28.12 per cent mortality, respectively while treatment nergundi oil 10ml/l was statistically at par with *V. lecanii* 5g/l by recording 27.01 and 26.75 per cent mortality, respectively moreover; lowest mite mortality was recorded in treatment *P. fairnescence* 5g/l (23.67%). Further 8 DAS the treatment *H. thompsonii* 5g/l found with highest mite mortality (70.71%), followed by neem oil 20ml/l (62.11%) whereas, treatment *B. bassiana* 5g/l was found at far with treatment *P. fairnescence* 5g/l, *M. anisopliae* 5g/l, *V. lecanii* 5g/l and karanj oil 20ml/l which exhibited 40.64, 40.54, 38.88, 38.55 and 38.18 per cent mortality, respectively while the lowest mite mortality was recorded in nergundi oil 10ml/l (36.58%) however; it was statistically at par with treatment *M. anisopliae* 5g/l, *V. lecanii* 5g/l and karanj oil 20ml/l. On 12 DAS, the treatment *H. thompsonii* 5g/l maintained its superiority by recording highest mite mortality (86.23%) and was followed by neem oil 20ml/l (66.55%). The descending orders of effectiveness of remaining bio-pesticides were *P. fairnescence* 5g/l, *M. anisopliae* 5g/l, karanj oil 20ml/l, *V. lecanii* 5g/l and nergundi oil 10ml/l was showed 44.78, 42.15, 41.76, 40.98 and 40.39 per cent mite mortality, respectively.

ii) Year 2018-19

The results on corrected per cent mortality of *A. guerreronis* were presented in Table 1 revealed that 3 DAS the treatment *H. thompsonii* 5g/l found superior over all the treatments by recording highest per cent mite mortality 33.06 per cent and was followed by neem oil 20ml/l and *V. lecanii* 5g/l by recording 30.09 and 23.21 per cent mortality, respectively while next effective treatment was nergundi oil 10ml/l (21.53%) which was statistically at par with *B. bassiana* 5g/l (20.25%). The least effective treatment was *M. anisopliae* 5g/l (16.63%) which was at par with *P. fairnescence* 5g/l (17.49%). Further 5 DAS the treatment *H. thompsonii* 5g/l

maintained its superiority over other treatments by recording the maximum per cent mite mortality (46.76%) however; this treatment was at par with neem oil 20ml/l (45.75%) whereas, the remaining treatments *viz*., *P. fairnescence* 5g/l, nergundi oil 10ml/l, *V. lecanii* 5g/l and *M. anisopliae* 5g/l exhibited 27.24, 26.94 26.80 and 24.92 per cent mortality against *A. guerreronis*, respectively. Likewise 8 DAS the treatment *H. thompsonii* 5g/l and neem oil 20ml/l was found to be effective by recording 69.65 and 62.69 per cent mite mortality, respectively whereas the rest of the treatments *viz*., *P. fairnescence* 5g/l, karanj oil 20ml/l, *B. bassiana* 5g/l, *M. anisopliae* 5g/l and *V. lecanii* 5g/l recorded 40.25, 39.54, 39.00, 38.96 and 38.75 per cent mite mortality, respectively. Further 12 DAS the treatment *H. thompsonii* 5g/l maintained its superiority over other treatments by recording the maximum per cent mite mortality (84.88%) which was followed by treatment neem oil 20ml/l (68.17%) and *P. fairnescence* 5g/l (46.57%) whereas, remaining bio-pesticides *viz*., karanj oil 20ml/l, *B. bassiana* 5g/l, *M. anisopliae* 5g/l, *V. lecanii* 5g/l and nergundi oil 10ml/l were showed 42.50, 42.49, 42.31, 42.24 and 40.94 per cent mortality respectively.

iii) Overall pooled

It can be seen from overall pooled data (Table 2) on corrected per cent mortality of coconut eriophyid mite after 3, 5, 8 and 12 DAS revealed that the treatment *H. thompsonii* 5g/l was found to be most effective treatment by recording highest per cent of mite mortality (58.89%) with next effective treatment of neem oil 20ml/l (51.11%) whereas, the treatment *B. bassiana* 5g/l found statistically at par with *V. lecanii* 5g/l by recording 32.68 and 32.55 per cent mite mortality, respectively while descending order of effectiveness of remaining bio-pesticides were karanj oil 20ml/l, *P. fairnescence* 5g/l, nergundi oil 10ml/l and *M. anisopliae* 5g/l which showed 32.29, 32.26, 31.49 and 30.74 per cent mite mortality, respectively however; the treatment *M. anisopliae* 5g/l was found to be least effective and it was statistically at par with nergundi oil 10ml/l.

Table 1: Effect of bio-pesticides on mortality of coconut eriophyid mite, *A. guerreronis* under laboratory condition (2017-18)

Sr. No.	Treatments	Conc.	No. of live mites/28.28mm^2 (Pre-count)		Corrected per cent mortality (2017-18)				Corrected per cent mortality (2018-19)			
			2017-18	2018-19	3 DAS	5 DAS	8 DAS	12 DAS	3 DAS	5 DAS	8 DAS	12 DAS
1	*H. thompsonii*	5g/l	86	85	35.56 (33.83)	42.70 (46.01)	57.23 (70.71)	68.25 (86.23)	35.09 (33.06)	43.14 (46.76)	56.57 (69.65)	67.17 (84.88)
2	*B. bassiana*	5g/l	84	84	26.86 (20.41)	33.47 (30.43)	39.60 (40.64)	38.24 (38.32)	27.06 (20.25)	33.15 (29.88)	38.64 (39.00)	40.67 (42.49)
3	*V. lecanii*	5g/l	84	86	28.73 (23.11)	31.14 (26.75)	38.37 (38.55)	39.80 (40.98)	28.80 (23.21)	31.15 (26.80)	38.49 (38.75)	40.52 (42.24)
4	*M. anisopliae*	5g/l	82	83	24.13 (16.71)	30.24 (25.38)	38.56 (38.88)	40.48 (42.15)	24.06 (16.63)	29.94 (24.92)	38.62 (38.96)	40.57 (42.31)
5	*P. fairnescence*	5g/l	85	85	24.78 (17.58)	29.10 (23.67)	39.54 (40.54)	42.00 (44.78)	24.71 (17.49)	31.43 (27.24)	39.38 (40.25)	43.03 (46.57)
6	Neem oil	20ml/l	81	86	33.39 (30.29)	41.10 (43.22)	52.02 (62.11)	54.67 (66.55)	33.83 (30.09)	42.56 (45.75)	52.34 (62.69)	55.66 (68.17)
7	Nergundi oil	10ml/l	83	85	27.80 (21.77)	31.31 (27.01)	37.20 (36.58)	39.45 (40.39)	27.64 (21.53)	31.26 (26.94)	37.31 (36.75)	39.77 (40.94)
8	Karanj oil	20ml/l	83	84	26.29 (19.63)	32.03 (28.12)	38.16 (38.18)	40.25 (41.76)	26.24 (19.56)	32.60 (29.04)	38.97 (39.54)	40.68 (42.50)
SE.m. ±					0.32	0.24	0.67	0.67	0.27	0.66	0.37	0.52
C.D. 5%					1.00	0.69	1.96	1.96	0.79	1.92	1.07	1.53
C.V. (%)					2.42	1.40	3.16	2.96	1.92	3.82	1.74	2.27

Note: *Figures in parentheses are original values while those outside are arcsine transformed values, DAS: Days after Spraying

Table 2: Effect of bio-pesticides on mortality of coconut eriophyid mite, *A. guerreronis* under laboratory condition (Pooled)

Sr. No.	Treatment	Conc.	(Pre-count)	Corrected per cent mortality (Pooled data)				Overall pooled
				3 DAS	5 DAS	8 DAS	12 DAS	
1	*H. thompsonii*	5g/l	85.5	35.33(33.44)	42.93(46.38)	56.90(70.18)	67.68(85.55)	50.71 (58.89)
2	*B. bassiana*	5g/l	84.0	26.96(20.33)	33.30(30.15)	39.12(39.82)	39.46(40.41)	34.71(32.68)
3	*V. lecanii*	5g/l	85.0	28.77(23.16)	31.15(26.77)	38.43(38.65)	40.16(41.61)	34.63(32.55)
4	*M. anisopliae*	5g/l	82.5	24.09(16.67)	30.10(25.15)	38.59(38.92)	40.53(42.23)	33.33(30.74)
5	*P. fairnescence*	5g/l	85.0	24.75(17.53)	30.27(25.46)	39.46(40.39)	42.52(45.67)	34.25(32.26)
6	Neem oil	20ml/l	83.5	33.61(30.19)	41.83(44.48)	52.18(62.40)	55.17(67.36)	45.70(51.11)
7	Nergundi oil	10ml/l	84.0	27.72(21.65)	31.29(26.98)	37.26(36.67)	39.61(40.66)	33.97(31.49)
8	Karanj oil	20ml/l	83.5	26.26(19.60)	32.31(28.58)	38.56(38.86)	40.46(42.13)	34.50(32.29)
SE.m. ±								
Treatment (T)				0.22	0.35	0.35	0.43	0.33
(Y × T)				0.31	0.49	0.49	0.60	0.47
C.D. 5%								
Treatment (T)				0.62	0.99	0.73	1.21	0.88
(Y × T)				NS	NS	NS	NS	NS
C.V. (%)				2.18	2.89	2.31	2.63	2.50

Note: *Figures in parentheses are original values while those outside are arcsine transformed values,
DAS: Days after Spraying

4. Discussion

All the tested bio-pesticides were effective in reducing coconut eriophyid mite population at 3, 5, 8 and 12 days after treatment however; the maximum per cent of mite mortality was obtained at 12 days after imposition of treatments. Finally as considers overall experimental data (Table 2) it's revealed that spraying of *H. thompsonii* 5g/l found most effective followed by treatment neem oil 20ml/l while application of other acaropathogens *viz*., *B. bassiana* 5g/l, *V. lecanii* 5g/l, *P. fairnescence* 5g/l and *M. anisopliae* 5g/l were also proved to be superior as compared to control however; the lowest mite mortality was recorded from the treatment *M. anisopliae*. In past Kumar (2009) [12] who noted that two formulation of *H. thompsonii viz*., Mycohit-LG20 at one per cent and Mycohit-OS at one per cent on coconut eriophyid mite capable of bringing down the mite population up to 90 per cent. Similarly, Hegade *et al.* (2016) [10] reported 38.75 per cent of mite mortality was obtained after application of *H. thompsoni* 5g/l. Sujatha *et al.* (2005) [13] reported that spraying of azadirachtin 5ml/l recorded maximum reduction of 66.17 per cent followed by spraying of azadirachtin at 4ml/l with 62.17 per cent reduction in eriophyid mite population after 21 days of treatment. Pushpa and Nandihalli (2008) [14] also recorded neem oil 3.0 per cent was reducing 46.98 and 59.86 per cent of mite population after 14 and 21 days after spraying, respectively. In past Mikunthan and Manjunatha (2009) [15] who found that spraying of bio-pesticides *viz*., *B. bassiana* 10^8 spores/ml, *M. anisoliae* 10^9 spores/ml and *L. lecanii* 10^9 spores/ml gives 32.4, 32.7 and 27.1 per cent mite mortality, respectively. The root feeding with botanicals *viz*., karanja oil, neem oil and castor oil gave a significant results after 4 days treatment by abolishing 90 per cent mites for next 6 months by Das *et al.* (2015) [9] which is not concur with present findings. There was discrepancy in past findings on per cent mortality of *A. guerreronis* might be due to difference in concentration of bio-pesticides and type of formulation used for study purpose, application methodology followed during course of investigation and prevailing agro-climatic conditions existing in particular locality.

5. Conclusion

It can be seen from present investigation that highest per cent mortality of coconut eriophyid mite, *A. guerreronis* was recorded from acaropathogenic fungus *H. thompsoni* 5g/l and plant origin product neem oil 20ml/l. To overcome the indiscriminate usage of harmful pesticides in coconut ecosystem, the application of these bio-pesticides was proved to be most useful against coconut eriophyid mite.

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7. References

1. Keifer HH. Eriophyid studies B-14. California. Department of Agriculture Bureau of Entomology, 1965, 20.
2. Nair GM, Mathew TB, Saradamma K and Beevi N. Infestation of coconut mite (*Aceria guerreronis* K) in Southern Indian state, Kerala. In proceedings International Workshop on coconut Eriophyid Mite CRI, Sri Lanka, 2000, 32-40.
3. Muralidharan K, Mathew J, Thamban C, Amarnath CH, Kumari A, Chandrika M, *et al*. Pilot sample survey on the incidence and yield loss due to Eriophyid mite on coconut in Alappuzha District. Indian Coconut Journal. 2001; 32:28-32.
4. Mordue AJ, Morgan ED and Nisbet AJ. Azadirachtin a natural product in insect control. In: Gilbert LI, Gill SS, editors. Insect Control: Biological and Synthetic Agents. Elsevier/Academic, 2010, 185-203.
5. Fernando LCP, Wickramananda, Aractchige NS. Status of coconut mite *Aceria guerreronis* Keifer in Srilanka, In: Proceeding of the International workshop on coconut mite (*Aceria guerreronis*). Eds. IRCRI, Sri Lanka, 2002, 1-8.
6. Nair CPR, Rajan P, Chandrika M. Coconut eriophyid mite *Aceria guerreronis* Keifer-An Overview. Indian Journal of Plant Protection. 2003; 33:1-10.
7. Saradamma K, Beevi SN, Mathew TB, Sheela MS and Visalakshi A. Eriophyid mite, *Aceria guerreronis* Keifer infesting coconut palm in Kerala, Paper presented in The 4th International 16th National Symposium on recent trends in life Sciences 7th-9th February, 2000, Department of Aquatic Biology and Fisheries, University of Kerala, India, 2000, 12-15.
8. Pushpa V, Nandihalli BS. Evaluation of pesticides and biopesticides against the coconut eriophyid mite, *Aceria guerreronis* Keifer under laboratory conditions. Karnataka Journal of Agriculture Science. 2010; 23(1):178-179.
9. Das S, Dolai A, Kumar S, Chakrabortty A and Mondal S. Insecticidal/Acaricidal efficacy of different formulation of plant oil against coconut eriophyid mite, *Aceria guerreronis.* International Journal of Zoology and Research. 2015; 5(5):27-32.
10. Hegade PB, Desai VS, Raut AL, Narangalkar P, Prabhudesai SS. Eco-friendly management of coconut eriophyid mite *Aceria guerreronis* (Keifer) (Acarina: Eriophyidae) with bio-pesticides under laboratory condition. The Bioscan. 2016; 11(4):30-33.
11. Henderson CF, Tilton EW. Test with acaricides against the brown wheat mite. Journal of Economic Entomology. 1955; 48(2):151-166.
12. Kumar S. *Hirsutella thompsonii* as a mycoacaricide for *Aceria guerreronis* on coconut in India: research, development and other aspects. Trends in Acarology, 2009, 441-444.
13. Sujatha A, Rao CV, Rao G. Efficacy of eco-neem plus against coconut eriophyid mite, *A. guerreronis* (Keifer). Journal of Applied and Zoology Studies. 2005; 16(2):126-127.
14. Pushpa V, Nandihalli BS. Bio-efficacy of botanicals in the management of coconut eriophyid mite, *Aceria guerreronis* Keifer. Journal of Plant Protection Environment. 2008; 5(1):90-94.
15. Mikunthan G and Manjunatha M. Fusarium species: acaropathogenic fungi as potential control agents against coconut mite, *Aceria guerreronis*. Trends in Acarology, 2009, 445-447.