Effect of integrated nutrient management in coconut on eriophyid mite, *Aceria guerreronis* in different agroclimatic regions

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Abstract

Coconut eriophyid mite, Aceria guerreronis *Keifer, is a serious pest of coconut in almost all coconut growing states of the country. Damage by the mites results in copra yield reduction to the tune of 20 – 30%. Field experiments were conducted in three coconut growing states viz., Tamil Nadu, Andhra Pradesh and Maharashtra to study the effect of Integrated Nutrient Management (INM) measures along with root feeding with azadirachtin. The INM package involved adoption of phytosanitary measures, raising green manure crops like sunnhemp in the basins, application of recommended fertilizers (1.3 kg of Urea; 2.0 kg of super phosphate; 3.5 kg of potash; 200 g of borax; 5 kg of neem cake; 50 kg of well decomposed farm yard manure; 1 kg of micronutrient mixture), adequate irrigation and following soil moisture conservation measures. The results of the study revealed that, INM measures along with root feeding with azadirachtin (1%) was significantly effective in reducing the extent of nut damage and mean grade index in all the locations tested.*

Keywords: Integrated nutrient management, azadirachtin, eriophyid mite, *Aceria guerreronis*

Introduction

The coconut eriophyid mite, *Aceria guerreronis* Keifer, is a serious pest of coconut and was first reported from Kerala and Tamil Nadu during 1998 by Sathiamma *et al.* (1998) and Ramaraju *et al.* (2000). Since then it has spread to almost all coconut growing tracts of the country including Andhra Pradesh, Karnataka and later to Maharashtra and the level of infestation varied from 10 to 90 per cent. The mites feed on the meristematic tissue found under the perianth of growing nuts and also adhere to the inner surface of sepals (Ramaraju *et al.,* 2000). They have a very high reproductive rate and short life span of 10-11 days. Feeding due to mites results in physical damage to the cells leading to longitudinal triangular yellow patches on the surface of the 3rd to 5th month old nut. At later stages, these triangular patches turn brown, develop further as longitudinal fissures and finally lead to warting and suberization of the nut epidermis. Damage due to mite results in drying of young buttons, premature nut drop, reduction in nut size and loss in copra yield to the tune of 20-30% (Gopal and Gupta, 2001; Nair *et al.,* 2003).

Several insecticides like monocrotophoss, methyl demeton, triazophos, dicofol and carbosulfan have been proved effective for the management of the eriophyid mite (Ramaraju *et al.,* 2000). Though pesticides are in use in various states to suppress the mite, they demand repeated applications at shorter intervals in order to maintain the mite numbers at low levels (Suganthy *et al.,* 2006). Moreover, Kurian and Peter (2007) suggest that mite population could not be maintained by use of pesticides alone and an integrated approach using nutritional and water management is necessary. The present study has been aimed at evaluating the effect of Integrated Nutrient Management measures along with root feeding with azadirachtin for the management of eriophyid mite damage.

Materials and methods

The field experiments were conducted at farmers fields *viz.,* Kottur village, Coimbatore district, Tamil Nadu (AICRP (Palms) – Aliyarnagar cenrtre), Korlapativaripalem village of East Godavari district, Andhra Pradesh (AICRP (Palms) – Ambajipeta centre)

and Karla village of Ratnagiri district, Maharashtra (AICRP (Palms) - Ratnagiri centre) during 2013-14. The experiment was conducted with three treatments viz., T1 – INM package + root feeding of azadirachtin 1% (10 ml + 10 ml water) thrice during September/ October, December/ January and March/ April, T2 – INM package and T3 – Control (farmers' practice) with 100 palms per treatment. The INM package involved adoption of phytosanitary measures, raising green manure crops like sunnhemp in the basins, application of recommended fertilizers (1.3 kg of Urea; 2.0 kg of super phosphate; 3.5 kg of potash; 200 g of borax; 5 kg of neem cake; 50 kg of well decomposed farm yard manure; 1 kg of micronutrient mixture), adequate irrigation and following soil moisture conservation measures. In each treatment, six sets (each containing approximately 100 nuts) under each treatment, were scored for nut damage and Mean Grade Index which formed six replications per treatment. Observations were recorded on the per cent nut damage and mean grade index at four months interval thrice in a year. The per cent nut damage was calculated based on the following formula (Girisha and Nandihalli, 2009).

$$\text{Per cent nut damage} = \frac{\text{Number of nuts with mite damage}}{\text{Total number of nuts observed}} \times 100$$

The mean grade index was worked out based on the 0 – 4 scale suggested by CPCRI, Kasaragod and by the following formula.

0 – 4 scale for calculating mean grade index (MGI)

% damage on nut surface	Scale	Grade Index	Intensity
Free of infestation	0	0	Nil
< 25	1	0 – 1.0	Mild
26 – 50	2	1.0 – 2.0	Moderate
51 – 75	3	2.0 – 3.0	High
> 75	4	3.0 – 4.0	Severe

$$\text{Mean Grade Index} = \frac{\text{(No. of nuts under Scale 0 X 0) + (No. of nuts under Scale 1 X 1) +…. + (No. of nuts under Scale 4 X 4)}}{\text{Total no. of nuts scored}}$$

Statistical analysis

All the data were subjected to Analysis of variance (ANOVA) test and means were separated based on Critical difference (P=0.05) after making appropriate transformations (Gomez and Gomez, 1994). The analysis was done using AGRES v3.01 package.

Results and discussion

The initial nut damage in different treatments before imposing the treatments stood between 40.3% and 42.6% at Aliyarnagar centre. Upon imposing the INM treatments, periodically, at 12 months after treatment (MAT) there was a gradual reduction in the extent of nut damage with 24.0% and 24.5% nut damage in INM without root feeding treatments, respectively (Table 1). At Ambajipeta centre, the initial nut damage was in the range of 58.9% to 68.7% in different treatments. At the end of one year, significant reduction in nut damage could be observed with INM + root feeding treatment recording the least nut damage of 48.4% and was on par with INM without root feeding treatment (48.5%) as against 73.3% in control plots. Comparatively higher level of nut damage was noticed in Ratnagiri centre where the initial nut damage before imposing treatments was in the range of 82.7 % and 84.1%. By the end of one year, the INM + root feeding treatment recorded the minimum nut damage (36.1%) followed by 46.4% (INM without root feeding) as against 87.2% nut damage in control. Similar reduction in nut damage to the tune of 41.9% and least grade index in Integrated Management trials were also observed by Ramaraju *et al.* (2007). The enhanced dose of potassium fertilizer from 2.0 kg/ palm to 3.5 kg/ palm also is one of the reasons for the reduction in damage by eriophyid mites as K fertiliser has been reported to impart resistance to insect and non-insect pests and especially, lowers mite attack (Mandal, 1991; Moore *et al.,* 1991; Sarkar, 2011).

The reduction in nut damage due to imposing INM treatments also reflected in the Mean Grade Index which too, reduced gradually throughout the period of study. At Aliyarnagar centre, INM with root feeding treatment exhibited a significant reduction from 1.15 (pre-treatment) to 0.68 (12 MAT) while the control plots exhibited meagre changes in the Mean Grade Index (Table 2). Similarly, at Ambajipeta, the initial MGI stood at 1.62 in INM with root feeding treatment which fell to 0.60 (12 MAT) while the control also exhibited a reduction from 2.15 to 1.53 (12 MAT). At Ratnagiri centre, the pre-treatment MGI ranged between 2.90 to 3.67 in different treatments. At 12 MAT, the INM with root feeding treatment registered an MGI of 0.90 followed by 1.32 in INM without root feeding treatment and 2.51 in control plots. In experiments conducted by Lokesh and Nandihalli (2009) soil application of recommended dose of fertilizers along with micronutrients (borax) and neem cake recorded the lowest per cent damaged nuts and grade index. The nutritional schedule of the present experiment has already been validated by Kannaiyan et al. (2000). Similarly, boron nutrition to the palm in the

Table 1. Per cent nut damage due to eriophyid mite infestation in experimental plots

Treatment	Damaged nuts (%)											
	AICRP (Palms) - Aliyarnagar				AICRP (Palms) - Ambajipeta				AICRP (Palms) - Ratnagiri			
	PTC	4 MAT	8 MAT	12 MAT	PTC	4 MAT	8 MAT	12 MAT	PTC	4 MAT	8 MAT	12 MAT
T_1 (INM with root feeding)	42.6 b (40.7)	35.4 a (36.5)	29.6 a (33.0)	24.0 a (29.3)	58.9 (50.1)	40.5 a (39.5)	46.6 a (43.1)	48.4 a (44.1)	82.7 (65.5)	67.7 a (55.4)	50.4 a (45.2)	36.1 a (36.9)
T_2 (INM without root feeding)	40.3 a (39.4)	37.6 a (37.8)	25.5 a (30.3)	24.5 a (29.7)	68.7 (56.1)	48.5 a (44.1)	49.3 a (44.6)	48.5 a (44.1)	83.1 (65.7)	73.5 b (59.0)	53.8 b (47.2)	46.4 b (42.9)
T_3 (Control)	42.3 b (40.6)	41.5 b (40.1)	40.6 b (39.6)	41.3 b (40.0)	62.2 (52.1)	70.6 b (57.2)	69.3 b (56.4)	73.3 b (58.9)	84.1 (66.5)	86.2 c (68.2)	84.2 c (66.6)	87.2 c (69.0)
C.D (P=0.05)	1.50	3.80	3.45	4.09	7.1	17.4	4.0	6.9	1.6	1.69	0.94	1.45
CV (%)	3.54	5.49	4.48	5.48	17.2	25.1	11.1	18.6	2.90	1.90	1.21	2.01

PTC – Pre treatment count; MAT – Months after treatment

Figures in parenthesis are arc sin transformed values

Values followed by a common letter are not significantly different by LSD (P=0.05)

Table 2. Mean grade index due to eriophyid mite damage in experimental plots

Treatment	Mean Grade Index											
	AICRP (Palms) - Aliyarnagar				AICRP (Palms) - Ambajipeta				AICRP (Palms) - Ratnagiri			
	PTC	4 MAT	8 MAT	12 MAT	PTC	4 MAT	8 MAT	12 MAT	PTC	4 MAT	8 MAT	12 MAT
T_1 (INM with root feeding)	1.15 (1.28)	1.01 (1.23)	0.94 a (1.20)	0.68 a (1.08)	1.62 a (1.45)	0.42 a (0.96)	0.50 a (1.00)	0.60 a (1.04)	2.90 a (1.84)	2.35 a (1.69)	1.15 a (1.28)	0.90 a (1.18)
T_2 (INM without root feeding)	1.24 (1.31)	1.10 (1.26)	1.16 b (1.28)	0.74 a (1.11)	1.49 a (1.41)	0.88 b (1.17)	0.60 a (1.05)	0.75 a (1.11)	3.67 b (2.04)	2.40 a (1.70)	1.60 b (1.45)	1.32 b (1.35)
T_3 (Control)	1.37 (1.37)	1.39 (1.37)	1.35 c (1.36)	1.45 b (1.40)	2.15 b (1.63)	1.82 c (1.52)	2.10 b (1.61)	1.53 b (1.42)	3.02 a (1.88)	3.08 b (1.89)	2.18 c (1.64)	2.51 c (1.73)
C.D (P=0.05)	0.08	0.15	0.08	0.11	0.20	0.14	0.07	0.22	0.07	0.10	0.11	0.12
CV (%)	3.7	4.1	3.2	5.3	20.3	17.6	7.5	8.9	6.9	3.6	4.6	5.4

PTC – Pre treatment count; MAT – Months after treatment

Figures in parenthesis are square root transformed values

Values followed by a common letter are not significantly different by LSD (P=0.05)

form of borax makes the palm resist mite attack as boron helps strengthen the cells of growing plant tissues (Sarkar, 2011). Raghavendra *et al.* (2008) also reported that soil application of recommended dose of fertilisers along with borax, gypsum and magnesium sulphate resulted in significant reduction in mite population, besides reducing the number of damaged nuts and MGI.

Thus imposing different INM treatments along with root feeding of azadirachtin is found to have a profound impact upon reducing the mean damage as well as Mean Grade Index.The effect of azadirachtin in reducing the mite population was earlier documented by Begum *et al.* (2013). Similarly, the effect of neem based products in reducing the per cent nut damage was also reported by Nandihalli (2009). Chandrika mohan and Nair (2000) conducted an experiment at Krishnapuram, Kerala and found that the application of 0.004 per cent azadirachtin was effective in the management eriophyid mite. Thus, it could be inferred that, INM measures along with root feeding with 1% azadirachtin (10ml + 10ml water) exhibited significant reduction in nut damage and mean grade index and the INM package developed is effective in mitigating the losses caused by coconut eriophyid mite in all the three states.

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References

Begum N, Ramesh Babu 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 :** 20-23.

Chandrika mohan and Nair C P R 2000. Distinguish the nut infestation by Eriophyid mite and Coreid bug in coconut. *Indian Coconut Journal* **31 :** 60-61.

Girisha R C and Nandihalli B S. 2009. Seasonal abundance and varietal reaction of coconut perianth mite , *Aceria guerreronis* Keifer in Dharwad area. *Karnataka Journal of Agricultural Sciences* **22 :** 606-608.

Gomez K A and Gomez A A 1994. Statistical procedures for Agricultural Research, John Wiley and Sons, New York. Pp 207-215.

Gopal G and Gupta A 2001. Has *Hirsutella thompsonii* the wherewithal to counter coconut eriophyid mite scourge? *Current Science* **80 :** 831-836.

Kannaiyan S Doraiswamy S Rabindra R J Ramakrishnan G and Bhaskaran R 2000. Integrated packages for the management and control of coconut eriophyid mite. Scientific Workers Conference, 19-20 July, 2000, TNAU, Coimbatore. Pp 99-109.

Kurian A and Peter K V 2007. Chapter 5: Coconut, ***In:*** Commercial Crops Technology, Horticulture Science Series – 8, New India Publishing agency, New Delhi. Pp 192-193.

Lokesh B R and Nandihalli B S 2009. Management of coconut perianth mite, *Aceria guerreronis* (Keifer) through nutrition. *Karnataka Journal of Agricultural Sciences* **22 :** 603-605.

Mandal R C 1991. Coconut Production and Protection Technology, Agro Botanical Publishers, New Delhi, India. Pp 61-150.

Moore D Ridout M S and Alexander L 1991. Nutrition of coconuts in St. Lucia and relationship with attack by coconut mite, *Aceria guerreronis* (K.) *Tropical Agriculture* **68 :** 41-44.

Nair C P R Rajan P and Chandrika M 2003. Coconut eriophyid mite, *Aceria guerreronis* Keifer – An overview. *Indian Journal of Plant Protection* **33 :** 1 – 10.

Nandihalli B S 2009. Utilisation of botanicals in the management of the coconut perianth mite, *Aceria guerreronis* Keifer. *Journal of Plant Protection Sciences* **1 :** 63-65.

Raghavendra Y Nandihalli B S and Aswathanarayana R N 2008. Management of coconut perianth mite, *Aceria guerreronis* Keifer through plant nutrition. *Annals of Plant Protection Sciences* **16 :** 294-297.

Ramaraju K Varadarajan M K Bhaskaran E V Kavitha J and Pretheep Kumar P 2007. Integrated management of eriophyid mite, *Aceria guerreronis* Keifer on coconut in Tamil Nadu, India. *Cord* **23 :** 58.

Ramaraju K Natarajan K Sundara Babu P C and Rabindra R J 2000. Studies on coconut eriophyid mite, *Aceria guereeronis* K., in Tamil Nadu, India. **In:** International Workshop on Coconut Mite (*Aceria guerreronis*), Fernando, L.C.P., de Moraes, G.J. and Wickramananda, I.K. (eds.), Coconut Research Institute, Sri Lanka, 6–8 January 2000. Pp 8-9.

Sarkar P K 2011. Invasive coconut perianth mite, *Aceria guerreronis* Keifer and their sustainable management. *Journal of Crop and Weed* **7 :** 184-190.

Sathiamma B Radhakrishnana Nair C P R and Koshi P K 1998. Outbreak of a nut infesting eriophyid mite, *Eriophyes guerreronis* (K.) in coconut plantations in India. *Indian Coconut Journal* **29 :** 1-3.

Suganthy A Ramaraju K Kuttalam S and Chandrasekaran S 2006. Bioefficacy of spiromesifen (Oberon®) 240SC against coconut eriophyid mite, *Aceria guerreronis* Keifer and determination of residues. *Journal of Entomology* **3 :** 325-330.

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