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Bioefficacy of medicinal and aromatic plant extracts against Coconut eriophyid mite, *Aceria guererronis* Keifer

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ABSTRACT

Studies on the bioefficacy of the botanical biocide formulations from seven different aromatic and medicinal herbs against coconut eriophyid mite, revealed that herbal formulations were significantly effective. Highest reduction in mite population was observed after fourth application in West Bengal (88.97%), followed by Karnataka (83.89%) state field trials. The highest numbers of mites per sq.cm of counting dish were observed on three month old nuts both in treated as well as untreated samples over all the trial farms.

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The coconut palm, *Cocos nucifera* L., belonging to the family Arecaceae is well known for its multifarious uses. It has been extensively grown in more than 93 countries. This plantation crop is a source of food and livelihood to billions of people across the globe. In India it occupies third position in production with 1.9 million hectares producing 14 million nuts per annum. It is primarily a small holder's crop supporting about 5 billion holdings distributed in 18 states and three union territories (Rajagopal and Aruraj 2005).

Among the various causes for lower productivity of this crop in our country is the air borne eriophyid mite (*Aceria guerreronis,* Keifer*)*, a microscopic organism that breeds and feeds on the soft meristematic tissues lying under the perianth of the young coconut has recently become a major threat to coconut industries. These devastating tiny mites aggregate in colonies and cause extensive feeding damage on the nut surface. The infestation causes mostly premature nut fall, reduced nut size, reduction in nut yield as well as copra yield besides unproductive nut formation and above all quality deterioration with an ultimate loss of 20-30% in terms of yield (Markose, 2000). The economic loss due to the coconut mite in India has been reported as 34% on an average (Nair, 2000).

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Many literatures reported the moderate control of the perianth mite through chemical acaricides that possess various limitations such as residual effect, development of insect resistance and mammalian toxicity etc. To minimize the ill effects of chemical acaricides, efforts are being made to find alternative insecticides from plants or i.e. plant origin materials as pest control agents, which have negligible effects on natural beneficial organisms, low environmental impact because of their biodegradability quality to overcome pest resistance, low cost and easy accessibility. The natural products obtained from plants are species specific in action to organisms and animals and posses manifold advantages over synthetic pesticides. These plant products provide a diverse array of structural prototypes, which can be exploited to manage a number of pests and diseases of national and international importance. Essential oils and their constituents have been reported to be potent source of environmentally safe biocides that could be explored for commercial application (Amevan *et al.* 1998). Essential oils derived from medicinal and aromatic plants have been found to exhibit insecticidal, antifeedant and repellant/attractant activities (Sharma and Malik, 2000-2001).

The present experiment was designed with an ultimate goal to test the bioefficacy of the herbal product formulated through combination of seven medicinal and aromatic plants against the eriophyid mite in coconut under field conditions.

MATERIALS AND METHODS

In CDB sponsored programme IMMT, Bhubaneswar carried out field trials at five coconut farms of coconut growing states of India namely Karnataka, West Bengal, Orissa and Andhra Pradesh (DSP and Phillips Farms) in replicated randomized block design (RBD) during 2007 and 2008. The farms were selected after an extensive survey of the mite fauna occurring in coconut in these areas. In each farm hundred plants of same age were selected to carryout the experiment. The entire plot was divided into five replications each with 20 plants. In addition to this 20 plants were taken as control plants. The sprayble botanical biocide formulated from seven characterized bioactive medicinal and aromatic herbs namely Bana tulsi (*Hyptis suaveolense*), Tulsi (*Ocimum sanctum*), Patchouli (*Pogostemon cablin*), Citronella (*Cymbopogon winterianus*), Bhuineem (*Andrographis paniculata*), Citrus (*Citrus limon*) and Soapnut (*Sapindus emarginatus*) were applied @ 25ml diluted to 250 ml in water along with 3kg of antipathogenic organic manure per plant at three months intervals. The four applications were applied in Monsoon, winter, spring and summer seasons and untreated control plants were observed for comparative study.

Data on mite population were collected through random selection of five nuts of each group (1-6 month old nuts) along with few numbers of unfertilized inflorescence from each replication at 3 months interval after the application of the botanical biocide both from treated as well as untreated plants in an attempt to observe the population distribution of mites over age of nuts and efficacy the formulated botanical biocide. The samples were then subjected to laboratory analysis. The tepals and the meristematic tissues beneath the tepals were washed with 30 ml of the 1N soap solution into a beaker. The solution was then stirred continuously for sometime and transferred onto a counting dish and allowed to settle for two minutes for easy microscopic count of mites present per square cm of the counting dish.

RESULTS AND DISCUSSION

The microscopic observation of unfertilized inflorescence both from untreated and treated samples revealed the absence of mites, implicating that mites do not infest the meristematic zones of unfertilized coconut flowers. The results corroborated with the findings of Mariau and Julia, 1970 and Hall and Espinosa, 1981.

The nuts of one month old onwards showed the presence of mites as well as signs of infestation. The highest number of mites / cm^2 of counting dish were found on three months old nuts and thereafter it declined slowly both in treated as well as untreated samples (Fig. 1), the findings lend support to the reports of Moore and Alexander, 1995; Ramaraju *et al*. 2002 and Fernando *et al*. 2003 where they have

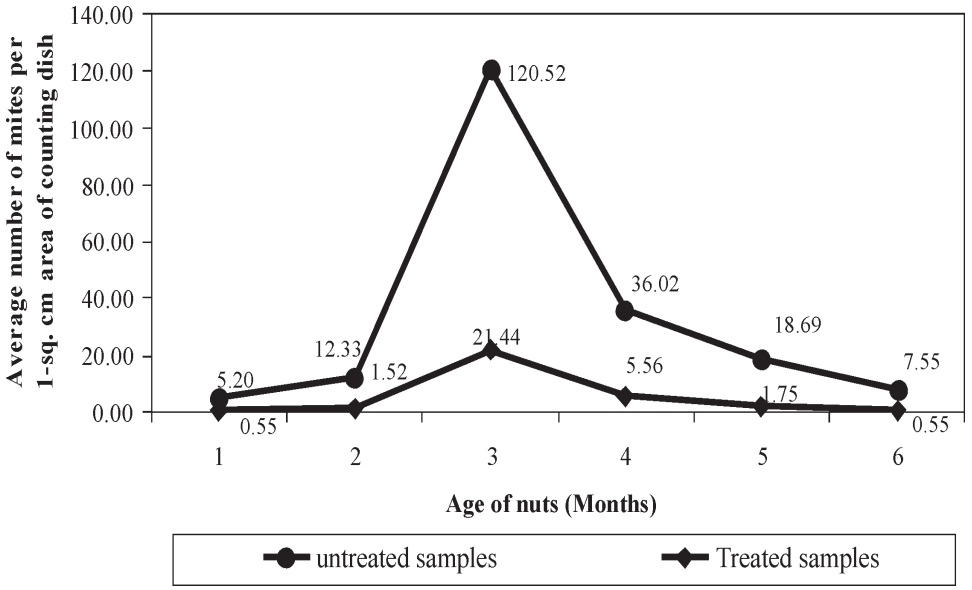

Fig. 1. Population dynamics of coconut perianth mite over age of nuts

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Table 1. Field evaluation of combined effect of medicinal and aromatic plant extracts on population of *Aceria guerreronis.*

Treatments	Mean mite population per 1- sq. cm area of counting dish[2]														
	Karnataka Farm			West Bengal Farm			Orissa Farm			DSP Farm			Phillips Farm		
	control	treated	% population reduction	control	treated	% population reduction	control	treated	% population reduction	control	treated	% population reduction	control	treated	% population reduction
I	31..10	12.79[a]	58.87	16.92	8.57[b]	49.35	11.06	7.37[c]	33.46	16.96	12.79	24.55	31.40	23.90[e]	23.88
II	57.44	14.77 [a]	68.86	30.92	8.81 [b]	71.50	15.10	5.61 [c]	62.84	22.96	5.18[d]	77.42	66.00	20.83 [e]	68.44
III	69.79	15.12 [a]	78.33	47.69	9.71 [b]	79.63	35.10	10.65	69.66	35.04	7.38 [d]	78.93	46.10	13.43 [e]	70.86
IV	23.91	3.85	83.89	40.16	4.75	88.17	21.14	4.42 [c]	79.09	41.14	7.84 [d]	80.94	41.14	7.84	80.94
SEm ±	10.17	2.64	-	6.62	1.09	-	5.26	1.35	-	5.51	1.60	-	7.28	3.62	-
CD at 5%	32.34	8.39	-	21.05	3.46	-	16.73	4.29	-	17.52	5.09	-	23.15	11.51	-

Mean of five replications; I - Three months after first application ; II- Three months after second application; III- Three months after third application; IV- Three months after fourth application; Mean followed by common superscript are not significantly different from each other at 5% level following CD test.

mentioned that after fertilization, the coconut fruits of all stages are susceptible to mite attack but in general, peak populations occur in 3-7 months old coconut fruits. Anonymous 1985, reported that coconut mites tend to leave nuts two to three months before the nuts are fully developed or when the damage to the pericarp exceeds 15% because there is no renewal of the meristematic tissues.

Mite population per square cm of dish in untreated samples varied from 11.06 to 69.79 over all the five trial farms (Table. 1), the highest range being observed in Karnataka (23.91-69.79 mites/sq.cm). At first treatment count a higher population reduction of 58.87% (12.79 mites/ sq.cm) was also observed in Karnataka. This was followed by West Bengal, Orissa, DSP Farm and Phillips Farm, which recorded 49.35%, 33.46%, 24.55% and 23.88% population reduction, respectively. However population reduction was not increased to a higher level. The subsequent applications showed encouraging results, hence, fourth round of application was given. At fourth treatment count a higher population reduction of 88.17% (4.75 mites/ sq.cm) was observed in West Bengal followed by Karnataka, (DSP Farm, Phillips Farm, Andhra Pradesh) and Orissa which recorded 83.89%, 80.94%, and 79.09% population reduction, respectively.

It can be concluded that combined formulation of the essential oil extracts of Bana tulsi, Tulsi, Patchouli, Citronella, Bhuineem, Citrus and Soapnut and the organic herbal manure were significantly effective in controlling *Aceria guerreronis* under field conditions.

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