Research Article

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Studies on the impact of mite infestation on nut characters and oil content in coconut variety, East Coast Tall (ECT)

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Abstract

The coconut palm, *Cocos nucifera* L., was reported to be affected by many pests. Eriophyid mite, *Aceria guerreronis* K., emerged out as a serious threat to the coconut growers in India. A comparative study on the impact of mite damage at different levels of infestation (Scale 1 – 5) on various nut characters indicated loss in important nut components like oil, copra, husk and shell at 30, 22.8, 39.2 and 12.3 per cent, respectively. The mite infested nuts had significantly low percentage of unsaturated fatty acids and high percentage of saturated fatty acid compared to that in un-infested nuts. The saturated to unsaturated fatty acid ratio also was significantly higher in mite infested nuts. Among the saturated fatty acids, medium chain fatty acids significantly increased while the long chain saturated fatty acid decreased in mite-infested nuts. The results indicate that mite infestation affected not only the nut yield but also the nut characters which determined the nut quality.

Key words: Coconut, eriophyid mite, nut characters, fatty acid, oil content

Introduction

The coconut palm, *Cocos nucifera* L., is reported to be affected by many pests. Coconut eriophyid mite, *Aceria guerreronis* K., has emerged recently as a serious threat to the coconut plantations in India. Its occurrence in India was first reported by Sathiamma *et al.* (1998) in Kerala and later the pest has rapidly spread to different coconut growing states in South India. The infestation was reported in Andhra Pradesh during 1999. This caused considerable reduction in coconut production resulting in severe economic loss to the farmer. The impact of different levels of mite infestation on various nut characters needs to be carried out in order to study the economic loss caused by this pest. Earlier studies indicated that, the changes in nut characters like size, copra content, copra and oil content etc., due to mite infestation (Muraleedharan *et al.*, 2001; Nair *et al.*, 2001; Sujatha *et al.*, 2002). However, the impact at different intensities of mite infestation on the nut characters like nut weight, husk weight, kernel weight, shell weight and fatty acid composition of oil were not studied earlier. In this paper, impact of mite infestation at differe intensities on various nut characters, oil content and fa acid composition is reported.

Materials and Methods

Fifty numbers of fully matured nuts were selecte with different grades of mite damage. The selected nu were categorized into a "5 scale" index depending the extent of damage on the nut surface. The scales we classified based on the damage intensity as per the meth described by Julia and Mariau (1979).

Scale – I : No damage scars on the nut surfa (control)

Scale – II : 1 – 10% infested area on the nut surfa

Scale – III : 11 – 25% infested area on the nut surf

Scale – IV : 26 - 50% infested area on the nut surf

Scale – V : > 50% infested area on the nut surfac

Ten nuts under each damage index were selected recording the observations on the following parame

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The parameters studied were nut size (length x breadth), whole nut weight, husk weight, dehusked nut weight, nut water content, kernel weight, shell weight, copra weight and oil yield / nut using oil expeller. Impact of mite infestation on various parameters was quantified as per cent decrease in different scales (Scale II to V) from scale I (control) nuts. Apart from these the oil from copra samples for fatty acid analysis was extracted using petroleum ether in Soxhlet apparatus (solvent extraction). The extracted oil was further subjected to methyl esterification (Padua-Resurrection and Banzon, 1979; Naresh Kumar *et al.*, 2004) and the capillary gas chromatography (GC 2010, Shimadzu, Japan) was done to detect the fatty acids (Naresh Kumar, 2005). Using this data the chromatograms were plotted. The fatty acid profile of coconut oil is expressed on percent basis. All the parameters were estimated in three replications and CD at P=0.05 was calculated using General Linear Model in SPSS statistical software.

Results and Discussion

The studies on the impact of mite infestation in different grades on the nut characters revealed that a decrease in nut size *i.e.*, 26.4 per cent was recorded in scale V over scale I, followed by scale IV, III and II with 24.3, 17.1 and 10.5 per cent reduction, respectively (Table 1). The per cent reduction in whole nut weight was found to be maximum (33.2) in scale V and it differed from scale I and II followed by scale III and IV. In case of husk weight, 51.3, 37.1, 36.5 per cent decrease compared to uninfested nuts was recorded, in scale V, IV, and III, respectively.

The percentage reduction in the weight of dehusked nut and kernel weight recorded was highest in scale V, and was found to differ from nuts in Scale I (Table 1 and 2). The per cent decrease in the mean shell weight of the nuts in Scale V over Scale I was 16.4 and the values were found to be same in the grades II and III. The mean copra weight was minimum in scale V followed by Scale IV, correspondingly maximum per cent decrease in copra weight, compared to scale I, was recorded in scale V followed by scale IV, III and II.

Regarding weight of oil obtained using the expeller, a distinct difference was noticed among the nuts infested at different scales. It is evident that, with an increase in the mite damage, progressive per cent reduction in oil weight also increased over un-infested nuts. Only 47 per cent of oil could be extracted (63 gm of oil from 127 gm of copra) in severely affected nuts, whereas 55 per cent of oil could be extracted (117gm from 213 gm copra) in the nuts free from coconut mite infestation. The oil recovery decreased by 8 per cent in highly infested nuts (scale V) as compared to that in uninfested nuts. This reflects the influence of mite on percent oil extraction along with its influence on all other traits like weight of nut, husk, kernel, shell and nut water content. These results implicate the effect of mite infestation levels on oil yield which in turn influence the coconut oil prices as it is used as a raw material in many industries (Naresh Kumar et al., 2000).

Table 1. Impact of mite infestation on nut characters of coconut

Treatments	Nut size (cm^2)	Whole nut weight (gm)	Husk weight (gm)	Dehusked nut weight (gm)	Kernel weight (gm)	Water content (ml)	Shell weight (gm)	Copra weight (gm)	Oil weight (gm)	% Oil extraction (by expeller)
Scale I (Control)	333	1297	657	640	353	85	140	213	117	55.0
Scale II	298	920	447	547	267	52	127	192	98	51.0
Scale III	276	910	417	517	250	53	127	178	90	50.5
Scale IV	252	910	413	497	250	48	120	160	76	47.5
Scale V	245	867	320	497	243	50	117	127	63	47.0
SEM	3.40	35.36	27.17	14.27	6.73	6.90	3.85	7.65	3.59	-
CD(5%)	11.04	114.67	88.11	46.30	21.82	22.37	12.48	24.81	11.64	-

Table 2. Per cent decrease in different nut components of mite infested nuts (Scale II to V) over uninfested (Scale I) nuts

Treatments	Percent decrease over uninfested nuts (Scale I)									
	Nut size	Whole nut weight	Husk weight	Dehusked nut weight	Kernel weight	Water content	Shell weight	Copra weight	Oil weight	Difference in oil extraction
Scale II	10.5	29.1	32.0	14.4	24.4	38.8	9.3	9.9	16.2	4.0
Scale III	17.1	29.8	36.5	14.5	29.2	37.6	9.3	16.4	23.1	4.5
Scale IV	24.3	29.8	37.1	22.3	29.2	43.5	14.3	24.9	35.0	7.5
Scale V	26.4	33.2	51.3	22.3	31.2	41.2	16.4	40.4	46.2	8.0
Mean	19.6	30.5	39.2	18.4	28.5	40.3	12.3	22.9	30.1	6.0

The present results are in tune with the studies made by Nair *et al.*, 2001, which indicated the loss in varying degrees of mite infestation pertaining to weight of nut, husk, kernel, copra and oil, which were affected with increase in intensity of infestation. The data showed considerable difference in the infested nuts of scale III, IV and V from uninfested nuts with respect to economic products *viz.*, husk, copra and oil content with 39.2, 22.9 and 30.1 per cent decrease, respectively.

The results on oil extraction indicated that, the oil percentage and content in copra decreased drastically in mite-infested nuts as compared to that of uninfested nuts (Table 2). This may be due to the rapid decline in copra weight/nut with the increasing level of mite infestation. This implies that the mite-infested nuts yield less copra and oil. A sudden reduction in oil yield/nut in mite-infested nuts was reported earlier as well (Muraleedharan *et al.*, 2001). They also reported that the decrease in oil yield/nut at different infestation levels was not so high but the decrease in copra and husk content at increased infestation levels.

The results on fatty acid analysis indicated that the mite infested nuts had significantly low percentage of unsaturated fatty acids (Fig 1; Table 3) and high saturated fatty acid percentage than uninfested nuts. However,

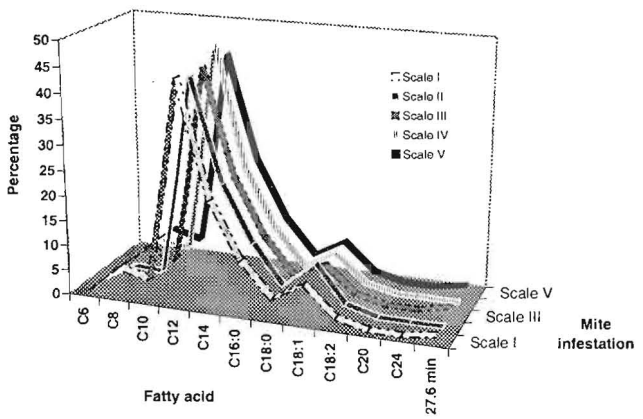

Fig 1. Fatty acid profile of coconut oil extracted from nuts infested with eriophyid mite at different intensity scales, Scale – I: No scars on the nut surface; Scale – II: 1 – 10% infested area on the nut surface; Scale – III: 11 – 25% infested area on the nut surface; Scale – IV: 26 - 50% infested area on the nut surface; Scale – V: > 50% infested area on the nut surface.

differences for percentage of fatty acid groups among the infestation levels were not significant. Consequently, the saturated to unsaturated fatty acid ratio also was significantly higher in mite infested nuts. Among the saturated fatty acids, medium chain fatty acids significantly increased while the long chain saturated fatty acid decreased in mite-infested nuts. However, among the mite infestation levels, the differences were not significant, except for MCFAs, which were significantly high in Scale V nuts. These results indicate that the mite infestation affected not only the oil percentage and content but also the fatty acid profile. Among the individual fatty acids, C6:O (0.17% in scale I to 0.44% in Scale III) and C8 (3.91 in scale I to 5.78 in scale III) were higher in scale III, while C12 was higher in scale V (42.15 in scale I to 46.24 in scale V), whereas all other long chain fatty acids were more in the control uninfested nuts. This indicated that in mite infested nuts, the long chain fatty acid synthesis, particularly that of unsaturated fatty acids is reduced may be due to non-availability of enough ATP energy in infested nuts. The fatty acid synthesis is influenced by the external factors as well (Goyne *et al.*, 1979). The results indicate that the mite infestation caused damage not only in terms of oil yield but also to the fatty acid composition as indicated earlier (Naresh Kumar *et al.*, 2004a, 2005).

The above studies revealed that, the intensity of mite damage has pronounced effect on copra content/nut which in turn reflected on the oil yield. Apart from this mite infestation severely reduced the husk and shells thus causing considerable economic loss not only to the farmer but also to the coconut based industries. Considerable percentage reduction in nut size (~20%), husk (39%) and oil percentage (30%) was also noticed due to mite infestation. The mite infested nuts had significantly low percentage of unsaturated fatty acids and high percentage of saturated fatty acids compared to that of uninfested nuts. The saturated to unsaturated fatty acid ratio also was significantly higher in mite infested nuts. Among the saturated fatty acids, medium chain fatty acids significantly increased while the long chain saturated fatty acid decreased in mite-infested nuts.

Table 3. The composition of type of fatty acid groups in coconut oil

Fatty acid	Scale I	Scale II	Scale III	Scale IV	Scale V	CD at P=0.05
Unsaturated fatty acids (%)	11.1	8.5	8.9	9.0	8.5	0.8
Saturated fatty acids (%)	88.9	91.3	91.1	91.0	91.6	1.1
Saturated fatty acids /unsaturated fatty acids ratio	8.0	10.7	10.2	10.1	10.8	0.26
Medium chain saturated fatty acids (%)	50.4	53.0	54.5	52.9	55.8	1.7
Long chain saturated fatty acids (%)	38.5	38.4	36.6	38.1	35.8	1.0

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