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Full Research Article

Screening of Coconut Genotypes Against Coconut Eriophyid Mite (*Aceria guerreronis* Keifer.)

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Abstract

The coconut genotypes were screened for their level of susceptibility to coconut eriophyid mite. Based on the mean damage Grade Index score none of the coconut genotypes were found to be resistant to eriophyid mite. However the genotypes, Jamica (1.37), BSI (1.51), Lono (1.65), Ganga Bondem (1.67), Banawali yellow long (1.70), Orangedwarf (1.77), Kalpwangi (1.80), F.M.S. (1.88), Guwam (1.93), West coast tall (1.82) CochinNikobar (2.01), Fiji (2.30) and Cochin China (2.35) were found to be moderately resistant to the infestation of eriophyid mite. The genotypes Seychelles (2.88), Phillipines (2.93), T×D (3.03), and Andaman Bhadi (3.09) were found to be susceptible to the eriophyid mite infestation. On the other hand the coconut genotypes SanRayman (3.35), Pratap (3.60), Banawali green long (3.60), Sheli gol (3.69), Borino (3.77), Lakshadweep (3.81), Kenya (4.22), Gawati (4.28), were found to be highly susceptible. Among the 26 coconut genotypes screened for their reaction to the coconut eriophyid mite, minimum infestation was observed in the genotypes Jamica, BSI, Lono, Guwam and Orange dwarf which are useful for the coconut growers in minimizing loss caused by eriophyid mite. Thus the impact of coconut eriophyid miteon yield parameters studied under Konkan conditions indicated that as the severity of eriophyid mite infestation increases the total weight, dehusked nut weight, husk weight, kernel weight, shell weight, length, circumference, water content loss of coconut also increase as the different damage grades increase from Grade II to Grade V.

1. Introduction

Coconut palm, *Cocos nucifera* Linn. is an important plantation crop grown in India. Among different pests infesting the crop, eriophyid mite, Aceria guerreronis (Keifer) is a serious pest in many coconut growing areas in India. The rapid outbreak of this pest in coconut plantations endangered the copra industry in India, reducing coconut yields and economic profits. This has drawn the attention of farming communities and researchers.

To date the most intractable and most damaging pest of coconut fruit is by far the eriophyid mite, A. guerreronis, commonly called "coconut mite". It was first observed on coconut plants in the state of Guerrero (Mexico) in 1960 (Keifer et al., 1965). The feeding of mite causes scarring of growing nuts resulting in nut malformation and reduced copra yields (Denise et al., 2013). The mite is inhabitant in clusters on the basal portion of the nuts below perianth. Colonization of coconuts by coconut mites takes place shortly after fertilization (Moore et al., 1989). Coconut mite populations peak on 3 to 6-month old nuts, after which, the numbers decline sharply so that nuts over nine months old have relatively low populations (Moore and Alexander, 1987). Coconut mites tend to leave nuts two to three months before the nuts are fully developed or when damage to the pericarp exceeds 15% because there is no renewal of meristematic tissues. In addition, damaged nut surfaces tend to secrete resin which traps and kills the mites (Moore and Alexander, 1987).

The incidence of the coconut mite was reported by several parts of the world (Keifer, 1965; Mariau, 1977; Howard et al., 1990).The affected area has been estimated by several workers in the various parts of south India (Haq, 1999; Reddy and Naik, 2000; Nair, 2000; Arulmozhi et al., 2002; Kirathiga et

al., 2002; Nair et al., 2002; Natarajan et al., 2002; Ramaraju et al., 2002; Sujatha and Rao, 2004; Nair et al., 2005; Sumangala and Haq, 2005; Sujatha et al., 2008; Begum and Babu, 2013;Kaimal, 2013). The pest is recently reported in the state of Maharashtra (Bagde and Pashte, 2014; Bagde et al., 2014, Bagde and Pashte, 2016) particularly in the Konkan region. However, the information on the varietal interaction with the coconut perianth mite is scarce under costal Maharashtra conditions, which is major coconut growing part of south India. Hence, the present studies were carried out to judge the level of susceptibility of coconut genotypes against coconut mite.

2. Materials and Methods

The reaction of selected twenty six coconut genotypes available at Regional coconut research station, Bhatye, Ratnagiri [16.9800° N, 73.3000° E], Maharashtra, India were screened for their level of susceptibility to coconut eriophyid mite during 2008-2009. The nuts harvested from each genotype during each harvest were visually scored for the nut surface area damage. The harvested nuts were distributed in to different damage grades as given by Julia and Mariau (1979) as described below.

2.1. Classification of coconut palms in different category

After calculating mean damage Grade Index, the different genotypes were classified into four categories as given by Julia and Mariau (1979) and accordingly the genotypes were classified into resistant, moderately resistant, susceptible and highly susceptible as given below (Table 1).

Table 1: Genotype categories as given by Julia and Mariau (1979)

Mean damage grade index score	Classification
0-1.0	Resistant
1.1-2.5	Moderately resistant
2.6-3.5	Susceptible
3.6-5.0	Highly susceptible

2.2. Estimation of losses

To estimate the yield loss due to the attack of eriophyid mite, a total of 5 nuts were observed in each category (1−5 Scale adopted by Julia and Mariau, 1979) and observed for total weight, dehusked weight, husk weight, kernel weight, length, circumference, water content, shell weight.

2.2.1. Loss in total weight

$$\text{Percentage reduction over Grade I} = \frac{\text{Av. wt. of whole nut in Grade I} - \text{Av. wt. in respective grades}}{\text{Av. wt of whole nut in Grade I}} \times 100$$

2.2.2. Loss in dehusked weight

$$\text{Percentage reduction over Grade I} = \frac{\text{Av. wt. of dehusked nut in Grade I} - \text{Av. wt. in respective grades}}{\text{Av. wt. of dehusked nut in Grade I}} \times 100$$

2.2.3. Loss in husk weight

$$\text{Percentage reduction over Grade I} = \frac{\text{Av.wt of husk of nut in Grade I} - \text{Av. wt. in respective grades}}{\text{Av. wt. of husk in Grade I}} \times 100$$

2.2.4. Loss in kernel weight

$$\text{Percentage reduction over Grade I} = \frac{\text{Av. kernel wt. of nut in Grade I} - \text{Av. wt. in respective grades}}{\text{Av. wt. of kernels nut in Grade I}} \times 100$$

2.2.5. Loss in length

$$\text{Percentage reduction over Grade I} = \frac{\text{Av.length of nut in Grade I} - \text{Av. wt. in respective grades}}{\text{Av. length of nut in Grade I}} \times 100$$

2.2.6. Loss in circumference

$$\text{Percentage reduction over Grade I} = \frac{\text{Av. circumference of nut in Grade I} - \text{Av. wt. in respective grades}}{\text{Av.circumference of nut in Grade I}} \times 100$$

2.2.7. Loss in water content

$$\text{Percentage reduction over Grade I} = \frac{\text{Av. water content of nut in Grade I} - \text{Av. wt. in respective grades}}{\text{Av.water content of nut in Grade I}} \times 100$$

2.2.8. Loss in shell weight

$$\text{Percentage reduction over Grade I} = \frac{\text{Av. shell wt. of nut in Grade I} - \text{Av. wt. in respective grades}}{\text{Av. shell wt. of nut in Grade I}} \times 100$$

3. Results and Discussion

3.1. Screening of coconut genotypes against eriophyid mite (A.guerreronis) in Konkan region

The mite infestation (%) on different coconut genotypes (Table 2) existing at Regional Coconut Research Station, Bhatye, Dist. Ratnagiri varied from 33.34 to 100. Max. nuts were infested in Kenya, Seychelles Borino, San, Raymon, T×D, Pratap, Fiji, B. greenlong, Lakshadweep (100%). The minimum percentage nuts were infested in Jamica (33.34%) followed by BSI (40.82). The extent of damage caused by mite in each genotype is shown in Table 1. Based on the mean damage Grade Index score none of the coconut genotypes was found to be resistant to eriophyid mite. However, the genotypes, Jamica, BSI, Lono, Ganga Bondem, Banawali yellow long, Orange dwarf, Kalpwangi, F.M.S., Guwam, West coast tall, Cochin Nikobar, Fiji and Cochin China were found to be moderately resistant to the infestation of eriophyid mite. The genotypes Seychelles, Phillipines, T×D and Andaman Bhadi were found

Table 2: The percentage of nuts harvested in each damage category in different genotype

Sr. no.	Cultivars	Nuts in each damage category (%)					Total no. of nuts	Nuts damaged by mite (%)	Mean damage grade index score
		Grade I	Grade II	Grade III	Grade IV	Grade V			
1.	Jamica	66.66	29.62	3.70	0.00	0.00	54	33.34	1.37
2.	BSI	59.18	30.61	10.20	0.00	0.00	49	40.82	1.51
3.	Kenya	0.00	0.00	22.22	33.33	44.44	63	100.0	4.22
4.	Orange dwarf	43.54	35.48	20.96	0.00	0.00	62	56.46	1.77
5.	Guwam	51.85	31.48	16.66	0.00	0.00	54	48.15	1.93
6.	Kalpwangi	45.65	28.26	26.08	0.00	0.00	46	54.35	1.80
7.	Saiachlishe	0.00	37.77	35.55	26.66	0.00	45	100.0	2.88
8.	Lono	48.93	36.17	14.89	0.00	0.00	47	51.07	1.65
9.	CochinNicobar	46.66	16.66	25.00	11.66	0.00	60	53.34	2.01
10.	Cochin China	29.82	31.57	19.29	12.28	7.01	57	70.18	2.35
11.	Borino	0.00	0.00	40.81	40.81	18.36	49	100.0	3.77
12.	Sun Raymon	0.00	17.64	43.13	25.49	13.72	51	100.0	3.35
13.	T×D	0.00	38.18	29.09	23.63	9.09	55	100.0	3.03
14.	Ganga Bondem	47.16	41.50	7.54	3.77	0.00	53	100	1.67
15.	Shelai Gol	0.00	0.00	40.38	50.00	9.61	52	52.84	3.69
16.	Gawati	0.00	0.00	14.28	42.85	42.85	49	100	4.28
17.	Banawali Yellow Long	50.00	30.00	20.00	0.00	0.00	50	100	1.70
18.	B.Yellow Round	0.00	20.28	60.86	15.94	2.89	69	50	3.01
19.	Pratap	0.00	0.00	56.92	26.15	16.92	65	100	3.60
20.	B.Green Long	0.00	0.00	54.16	31.25	14.58	48	100	3.60
21.	Fiji	0.00	76.92	15.38	7.69	0.00	52	100	2.30
22.	Philippines	0.00	27.65	55.31	12.76	4.25	47	100	2.93
23.	Lakshadweep	0.00	0.00	37.73	43.39	18.86	53	100	3.81
24.	F.M.S.	43.18	29.54	22.72	4.54	0.00	44	56.82	1.88
25.	West Coast Tall	31.70	56.09	9.75	2.43	0.00	41	68.30	1.82
26.	Andaman Bhadi	0.00	30.23	39.53	20.9	9.30	43	100	3.09

to be susceptible to the eriophyid mite infestation. On the other hand the coconut genotypes SunRayman, Pratap, Banawali green long, Sheli gol, Borino, Lakshadweep, Kenya, Gawati, were found to be highly susceptible. The results of present investigations are in conformity with the results of Muthia and Bhaskaran (1999) who found that Cochin China, Ganga Bondem recorded minimum percentage of nuts damaged by the mite. Girisha and Nandihalii (2009) also recorded least damage grade (1.40) in Gangabondem coconut. Similarly Muthiah and Rajarathiam (2002) recorded that BSI was moderately tolerant to the coconut mite attack.

3.2. Estimation of yield loss

Impact of coconut eriophyid mite A. gurreronis on yield parameters studied under Konkan conditions are presented in Table 3 to 7. Losses in coconut due to eriophyid mite were studied. It was found that the losses of nut in Grade II were, 3.40% in total weight, 2.40% in dehusked nut weight, 5.54% in husk weight, 6.26% in shell weight, 4.12% in kernel weight, 4.10% in length, 9.56% in circumference and 5.95% in water content over Grade I (healthy nut).

The losses observed in nut of Grade III were, 8.10% in total weight, 6.72% in dehusked nut weight, 10.9% in husk weight, 10.10% in shell weight, 9.23% in kernel weight, 16.07% in length, 13.07% in circumference and 15.85% in water content over Grade I (healthy nut). In Grade IV losses were observed as 23.70% in total weight, 25.39% in dehusked nut weight, 20.51% in husk weight, 14.67% in shell weight, 16.61% in kernel weight, 24.80% in length, 21.39% in circumference and 27.30% in water content over Grade I.

The losses observed in nut of Grade V were, 47.60% in total

Table 3: Grade wise measurements of eriophyid mite affected nuts

Sr. no.	Para meters	Grade wise measurements nut^{-1}				
		Grade I	Grade II	GradeI II	Grade IV	Grade V
1.	Total wt. (g)	860.67	830.90	790.67	656.27	450.60
2.	Nut wt. without husk (g) (dehus-ked nut)	570.23	556.57	531.90	425.43	314.17
3.	Husk wt. (g)	290.43	274.33	258.77	230.83	136.40
4.	Shell wt. (g)	100.60	94.30	90.43	85.83	71.53
5.	Kernel wt. (g)	168.33	161.40	152.80	140.37	123.43
6.	Length (cm)	24.82	23.81	20.83	18.67	16.50
7.	Circum-ference (cm)	31.34	28.33	27.23	24.60	16.97
8.	Water content (ml)	184.37	173.40	155.13	134.03	112.50

Table 4: Reduction in yield parameters over healthy nuts of Grade I due to eriophyid mite infestation on coconut parameters

Sr. no.	Parameters	% reduction in Grade II over Grade I		
		Grade I	Grade II	Reduction (%)
1.	Total weight (g)	860.67	830.90	3.4
2.	Nut wt. without husk (g) (dehusked nut)	570.23	556.57	2.4
3.	Husk weight (g)	290.43	274.33	5.54
4.	Shell weight (g)	100.60	94.30	6.26
5.	Kernel weight (g)	168.33	161.40	4.12
6.	Length (cm)	24.82	23.81	4.10
7.	Circumference (cm)	31.34	28.33	9.56
8.	Water content (ml)	184.37	173.40	5.95

weight, 44.99% in dehusked nut weight, 53.00% in husk weight, 28.89% in shell weight, 26.67% in kernel weight, 32.52% in length, 31.65% in circumference and 38.98% in water content over Grade I (healthy nut). Thus the impact of coconut eriophyid miteon yield parameters studied under Konkan conditions indicated that as the severity of eriophyid mite infestation increases the total weight, dehusked nut weight, husk weight, kernel weight, shell weight, length, circumference, water content loss of coconut also increases as the different damage grades increases from Grade II to Grade V.

Table 5: Reduction in yield parameters over healthy nuts of Grade I due to eriophyid mite infestation on coconut parameters

Sr. no.	Parameters	% reduction in Grade III over Grade I		
		Grade I	Grade III	Reduction (%)
1.	Total wt. (g)	860.67	790.67	8.1
2.	Nut wt. without husk (g) (dehusked nut)	570.23	531.90	6.72
3.	Husk weight (g)	290.43	258.77	10.9
4.	Shell weight (g)	100.60	90.43	10.10
5.	Kernel weight (g)	168.33	152.80	9.23
6.	Length (cm)	24.82	20.83	16.07
7.	Circumference (cm)	31.34	27.23	13.07
8.	Water content (ml)	184.37	155.13	15.85

Table 6: Reduction in yield parameters over healthy nuts of Grade I due to eriophyid mite infestation on coconut parameters

Sr. no.	Parameters	% reduction in Grade IV over Grade I		
		Grade I	Grade IV	Reduction (%)
1.	Total wt. (g)	860.67	656.27	23.7
2.	Nut wt. without husk (g) (dehusked nut)	570.23	425.43	25.39
3.	Husk weight (g)	290.43	230.83	20.51
4.	Shell weight (g)	100.60	85.83	14.67
5.	Kernel weight (g)	168.33	140.37	16.61
6.	Length (cm)	24.82	18.67	24.80
7.	Circumference (cm)	31.34	24.60	21.39
8.	Water content (ml)	184.37	134.03	27.30

The most crucial aspect of mite attack has been attributed to the loss in copra weight, estimated to almost reach 32% (Haq and Sobha, 2010). The present findings are in conformity with (Muralidharan et al., 2001) who reported 30.94% and 41.74% losses in terms of copra and husk, respectively in Alappuzha district of Kerala. Beevi et al., 2003 also reported that losses

Table 7: Reduction in yield parameters over healthy nuts of Grade I due to eriophyid mite infestation on coconut parameters

Sr. no.	Parameters	% reduction in Grade V over Grade I		
		Grade I	Grade V	Reduction (%)
1.	Total wt. (g)	860.67	450.60	47.60
2.	Nut wt. without husk (g) (dehusked nut)	570.23	314.17	44.90
3.	Husk weight (g)	290.43	136.40	53.00
4.	Shell weight (g)	100.60	71.53	28.89
5.	Kernel weight (g)	168.33	123.43	26.67
6.	Length (cm)	24.82	16.50	33.52
7.	Circumference (cm)	31.34	16.97	31.65
8.	Water content (ml)	184.37	112.50	38.98

due to husk damage have been estimated particularly because of the reduction of fiber length by and the consequent extra cost for de-husking.

4. Conclusion

Coconut genotypes Jamica, BSI, Lono, Ganga Bondem, Banawali yellow long, Orange dwarf, Kalpwangi, F.M.S., Guwam, West coast tall, Cochin Nikobar, Fiji and Cochin China were found to be moderately resistant to the infestation of eriophyid mite, which are useful for the coconut growers in minimizing loss caused by eriophyid mite. Thedata regarding the tolerance level helpful in breeding programs of coconut cultivars for development of resistant varieties to mite infestation.

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