INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 3, No. 7, p. 132-147, 2013

RESEARCH PAPER OPEN ACCESS

Infestation patterns of the coconut mite (*Eriophyes guerreronis* Keifer) and resulting yield loss in the South Western Region of Bangladesh

Shimul Das*, Prosanta Kumar Dash, Md. Rubel Ali and Md. Abdul Mannan

Agrotechnology Discipline, Khulna University, Khulna, Bangladesh

Key words: Coconut, coconut mite, yield loss and south-western regions of Bangladesh.

doi: http://dx.doi.org/10.12692/ijb/3.7.132-147 Article published on July 25, 2013

Abstract

In the experiment, coconut was collected randomly from Khulna, Satkhira and Bagherhat districts of Bangladesh and categorized into five grades based upon infestation pattern of coconut mite on coconut. The experimental treatments of factorial experiment consisted of three locations (L_1= Khulna, L_2 = Bagherhat and L_3 = Satkhira); two varieties (V_1= Green and V_2= Brown) and five grades on the basis of mite infestation which are G_0 = nuts with no mite damage, G_1 = nuts with 1-29% surface area damage, G_2 = nuts with 30-59% surface area damage and less than 20% reduction in size, G_3 = nuts with 60-80% surface area damage, 20-30% reduction in size and G_4 = nuts with over 80% surface area damage with 30% reduction and often greatly deformed. From the study it was found that most of the cases highest values were recorded from G_0 and the lowest values were recorded from G_4. It was found that the dry weight of copra was significantly varied among the different grades. The highest dry weight (164.33g) was recorded from G_0 and the lowest (386.94g) from G_4. Among the location, the fruits collected from Khulna and Satkhira gave highest values and the lowest value was recorded from the fruits of Bagherhat district. From the experiment it was found that water loss was observed about 0, 5.5, 34.19, 50 and 62.59% in damage categories of G_0, G_1, G_2, G_3 and G_4, respectively. For the copra yield considerable loss was occurred that ware 0, 13.22, 24.90, 38.00 and 52.72% in damage categories G_0, G_1, G_2, G_3 and G_4, respectively. Observed coconut shell losses were 0, 7.28, 15.32, 24.42, and 37.17% corresponding to damage categories G_0, G_1, G_2, G_3 and G_4, respectively. Due to mite infestation about 37.17% coconut shell loss, 62.59% water loss and 52.72% copra yield loss was occurred when nuts with over 80% surface area damaged with 30% reduction of size.

* **Corresponding Author:** Shimul Das ✉ shimul04atku@gmail.com

Introduction

Coconut is a splendid creation of the planet. Coconut palm (*Cocos nucifera*) is regarded as 'Tree of heaven', because, besides providing food, shelter and employment, it also supplies raw materials for a variety of traditional rural industries. It is one of the most perennial sources of edible oil. Every part of this plant is useful and commercially important. The coconut belongs to the family Palmae, included under the lower group of flowering plants known as the monocotyledons (Bose and Mitra, 1980).

In Bangladesh, the total area of land under coconut cultivation is 39 thousand hectare and the total production of coconut is 132 metric tons (BBS, 2008). Coconut grows well in the coastal region of Bangladesh like Khulna, Bagerhat, Jessore, Satkhira, Barisal, Bhola, Chittagong, Feni, and Noakhali.

The fruits contain fleshy substance, fatty acids, lignin, alkaloids, and certain non organic substances. The mild derived from the fruits contains glucose, sticky substance albumin, tartaric acids, certain minerals and water. Ash of the leaves contains potassium. Oil contains lauric, miristic, palmitic and stireic acids and besides these it contains caprilic acid. Ripe fruit contains about 60 to 71 % of oil. Also contain various compositions from raw coconut such as water 92.32%, total solid matter 7.32%, glucose 5.5%, protein 0.62%, chlorides 0.55% and from ripe coconut such as water 91.28%, glucose 4.82%, sucrose 1.11%, chlorides 0.86%, protein 0.59%. Besides, these contain vitamins A and B (Foale, 2003).

In the coastal region of Bangladesh, air always contain more moisture and breeze gentle which is very useful for pollination and fruit set of coconut. Moisture preservation ability of coconut is very low. In coastal region water table is light deep and temperature variation is low. There is a huge scope of coconut production in the coastal region including Satkhira, Khulna and Bagerhat district. Soil and climate of this region is favorable for coconut production. But the production of coconut is not satisfactory in the region due to infestation of coconut mite.

The coconut mite, *Eriophyes guerreronis* Keifer (Acari: Eriophyidae) is a serious damaging insect pest of coconut that breeds under the perianth of coconuts (*Cocos nucifera* Beccari) where it feeds on the epidermal cells of the meristematic region. Occasionally it feeds on the apical meristem of the coconut seedling. The earliest symptom of coconut mite damage is the appearance of white streaks originating from beneath the perianth of nuts. These streaks enlarge and eventually become brown and corky (Julia and Mariau, 1979; HaIl, 1981 and Anonymous, 1985). As the nut grows the rapid cell division of the surrounding cells cause stress in the damaged areas (McCoy and Aibrigo, 1975). This results in the development of deep fissures in the pericarp, distortion and reduction in nut size, a decline in copra output (Julia and Mariau, 1979; Hall 1981; Anonymous 1985). Normally, small nuts are not bought by farm gate purchasers and heavily scarred nuts are too difficult to husk. If harvested, these nuts may be sold to copra factories at much reduced prices and in some cases; labor cost will exceed the income from sales (personal communication with farmers). 'Jelly coconuts' are often marketed locally for the liquid and the tender endosperms in these nuts.

Copra, the dehydrated endosperm of more mature coconuts, is the major coconut export product of most coconut producing countries. Estimated losses in copra yields resulting from coconut mite damage have ranged from 10% in Benin (Mariau and Julia, 1970), 16% in the Ivory Coast (Julia and Mariau, 1979), 20-30% in St. Lucia (Moore *et al*., 1989), 25% in Grenada (Hall, 1981) and 30- 80% in different areas of Mexico (Hall, 1981; Olvera-Fonseca, 1986). Julia and Mariau (1979) and Moore *et al.* (1989) found copra yield to decline with increasing severity of damage caused by the coconut mite. Mariau and Julia (1970) developed a method to visually estimate the amount of coconut mite damage to nuts. Their visual assessment technique was later modified by Moore *et al.* (1989).

The south-western coastal region of Bangladesh is very much suitable for coconut cultivation. But now the production and quality of coconut decreased due to spot on the fruits of coconut due to mite infestation and dropping of immature fruits. At present the yield of coconut in this region is very low only 40 - 50 per plant per year, which is very low in comparison to India and Sri Lanka (300-400). So, it is very urgent to solve the problem of fruit drop and spot on fruit of coconut due to mite. It will help to assess the extent of damage and loss of yield and quality due to mite infestation in different locations and different varieties of coconut and it will help to increase the quality and production of coconut in this region as well as the country. Under the above circumstances the present study has been undertaken to assess the extent of coconut mite damage on coconut of different location and varieties in the southwestern region of Bangladesh and to determine the yield losses of coconut due to mite infestation.

Materials and methods

The experiment on infestation patterns of the coconut mite on coconuts and resulting yield loss in the south western region of Bangladesh was carried out in Germplasm Centre, Horticulture and Entomology Laboratory of Agrotechnology Discipline, Khulna University, Khulna. In the study, 10 germplasm from each location were taken which were collected randomly from Khulna, Satkhira and Bagherhat Districts of Bangladesh. After collection, the fruits were studied in the laboratory to determine the different physical characters and yield loss of coconut.

Experimental design

The factorial experiment was laid out in Completely Randomized Design with three replications.

Experimental treatments

The experimental treatments consisted of the factors viz. factor A = three locations such as L_1= Khulna, L_2 = Bagherhat and L_3 = Satkhira; factor B = two varieties such as V_1= Green and V_2= Brown variety and factor C = five grades on the basis of mite infestation which are as follows:

G_0 = nuts with no mite damage

G_1 = nuts with 1-29% surface area damage

G_2 = nuts with 30-59% surface area damage and less than 20% reduction in size

G_3 = nuts with 60-80% surface area damage, 20-30% reduction in size

G_4 = nuts with over 80% surface area damage with 30% reduction and often greatly deformed.

Experimental materials

Ninety mature coconuts of five grades were selected as the experimental materials for the investigation. These fruits were collected from Khulna, Satkhira and Bagherhat districts of Bangladesh.

Collection of coconut

Observations were made on ten randomly selected trees at each location of Satkhira, Bagherhat and Khulna districts. Ten randomly selected coconuts from different varieties were selected based on varieties and grades. Each nut was graded in situ based on the basis of infestation pattern of coconut mite. Three nuts of each category and each variety were collected for this investigation.

Methods of studying Parameters

By using the following methods, physical parameters of the collected coconut fruits germplasm were studied.

Fresh weight of coconut fruits

The fruit weight was measured by an electric balance. At first, the balance was adjusted to zero mark. The fruits were cleaned and weighted by keeping the fruit on the chamber of the balance. Then the reading was taken in gram (g).

Length of coconut fruits

Fresh length of the fruits was estimated by a measuring tape. The values of these parameters were taken in centimeters (cm).

Equatorial circumference of coconut fruits

Equatorial circumference of coconut fruits was estimated by a measuring tape. The values of these parameters were taken in centimeters (cm).

Kernel length of coconut fruits

After removing husk kernel length of the coconut fruits was estimated by a measuring tape. The values of these parameters were taken in centimeters (cm).

Kernel equatorial circumference of coconut fruits

Kernel equatorial circumference of coconut fruits was estimated by a measuring tape after removing husk. The values of these parameters were taken in centimeters (cm).

Kernel weight with water

The coconut husk was removed to open the kernel and after removing kernel the weight was measured by an electric balance. At first, the balance was adjusted to zero mark. The kernel were cleaned and weighted by keeping the kernel on the chamber of the balance. Then the reading was taken in gram (g).

Kernel weight without water

After removing kernel each nut was broken, the water was released and the nut was reweighed and weight was measured by an electric balance. At first, the balance was adjusted to zero mark. The kernel were cleaned and weighted by keeping the kernel on the chamber of the balance. Then the reading was taken in gram (g).

Copra weight

The weight of pulp portion (copra) of fruit was measured by an electric balance. At first, the balance was adjusted to zero mark. After removing the fibers and shell from fruit the remaining pulp portion was estimated by keeping it in the chamber of balance and the reading was taken in gram (g).

Dry weight

The dry weight of pulp portion (copra) of fruit was measured by an electric balance. At first, the balance was adjusted to zero mark. After separating the copra, it was weighed and placed in a dryer at 70°C. After 36 hours, when the moisture content was at an average of 6%, the copra weight was taken. And the reading was measured in gram (g).

Moisture (%)

The moisture percentage was measured by the following equation-

$$\text{Moisture (\%)} = \frac{\text{Fresh weight of copra - Dry weight of copra}}{\text{Fresh weight of copra}} \times 100$$

Yield loss assessment

A sample of three coconuts of various locations and varieties were taken from each category for processing. Each coconut was labeled and taken to the laboratory. At first the fresh weight of coconut fruit, fresh length and equatorial circumference of coconut fruit were taken. Then husk was removed to open the kernel. After this the kernel weight with water, kernel length and equatorial circumference of kernel were measured and recorded. Each nut was broken, then the water released and the nut was reweighed. The endosperm was then separated, weighed and placed in a kiln at 70°C. After 36 hours, when the moisture content was at an average of 6%, the copra weight was taken. The effect of mite damage on variety, site and their interactions on copra yield was determined. The yield loss percentage of the economical parts of the coconut fruit was measured by the following equation-

$$\text{Yield loss (\%)} = \frac{\text{Grade 0- Grade X}}{\text{Grade 0}} \times 100$$

Statistical analysis

The recorded data were analyzed statistically with the help of computer package program MSTAT-C and the mean differences were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and discussion

Results of the experiment on the pattern of coconut mite infestation and resulting yield loss have been presented and discussed in this chapter. The data on fresh weight (g), length (cm),

equatorial circumference (cm) fruit, kernel length (cm), kernel equatorial circumference (cm), kernel weight with water (g), kernel weight without water (g), copra weight (g), dry weight of copra (g), moisture (%) and yield loss have been presented in tables and discussed accordingly. Result obtained from the study are presented in tabular form and discussed in this chapter under the following heading and sub headings.

Table 1. Effects of coconut mite damage among the three locations viz. Khulna, Bagherhat and Shatkhira.

Treatment	Fresh weight of coconut fruit (g)	Length of coconut fruit (cm)	Equatorial circumference of coconut fruit (cm)	Kernel length (cm)	Kernel equatorial circumference (cm)	Kernel weight with water(g)	Kernel weight without water(g)	Copra weight (g)	Dry weight (g)	Moisture (%)
Khulna	1032.73 a	21.13	38.17a	12.73	28.53a	650.33 a	455.17a	262.45a	126.22	50.85a
Bagherhat	918.33a	21.83	36.83b	12.47	25.50b	510.67 b	377.00b	222.27b	118.29	47.24b
Shatkhira	897.00 b	21.47	39.23a	13.10	27.40a	606.00 ab	447.50a	256.72a	121.45	51.99a
Significance level	0.01	NS	0.05	NS	0.01	0.01	0.01	0.01	NS	0.05
CV%	12.54	6.13	7.94	9.43	8.28	9.61	10.89	11.30	13.92	14.14

The figures having different letter(s) in a column are significantly different at 1% or 5% level and the figures having same letter(s) in a column are not significantly different by DMRT.

NS = Non significant

Table 2. Effects of coconut mite damage among the two varieties viz. Green Variety and Brown Variety.

Treatment	Fresh weight of coconut fruit (g)	Length of coconut fruit (cm)	Equatorial circumference of coconut fruit (cm)	Kernel length (cm)	Kernel equatorial circumference (cm)	Kernel weight with water(g)	Kernel weight without water(g)	Copra weight (g)	Dry weight (g)	Moisture (%)
Green variety	936.16	21.87	39.38	12.59	27.58	587.33	426.56	243.12	120.65	49.36
Brown variety	962.56	21.10	36.78	12.94	26.71	590.67	426.56	251.18	123.32	50.69
Significance level	NS	0.01	0.01	NS	NS	NS	NS	NS	NS	NS
CV%	12.54	6.13	7.94	9.43	8.28	9.61	10.89	11.30	13.92	14.14

The figures having different letter(s) in a column are significantly different at 1% or 5% level and the figures having same letter(s) in a column are not significantly different by DMRT.

NS = Non significant.

Fresh weight of coconut fruit (g)

Fresh weight of the coconut fruit was significantly varied among the fruits of different locations due to infestation of coconut mite (Table 1). The heaviest coconut fruit was recorded from Khulna (1032.73g) followed by Bagherhat (918.33g) which was statistically similar and the lowest fresh weight of coconut fruit (897.0g) was recorded from the sample of Satkhira (Table 1).

In case of variety the fresh weight of coconut fruit was not significantly differed (Table 2). However, numerically the Brown variety produced the heaver fruit (962.56g) than the variety Green (936.16g) (Table 2).

It was found that the fresh weight of coconut fruit was significantly varied among the different grades (Table 3). The heaviest fruit (1198.06g) was

recorded from nuts with no mite damage and the lowest fresh weight of coconut (659.17g) was found in nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed (Table 3).

Table 3. Effects of coconut mite damage on different grade.

Treatment	Fresh weight of coconut fruit (g)	Length of coconut fruit (cm)	Equatorial circumference of coconut fruit (cm)	Kernel length (cm)	Kernel equatorial circumference (cm)	Kernel weight with water(g)	Kernel weight without water(g)	Copra weight (g)	Dry weight (g)	Moisture (%)
G_0	1198.06a	24.28a	43.89a	14.56a	31.44a	764.72a	530.83a	339.59 a	164.33 a	51.44
G_1	1100.67a b	23.11a b	40.94ab	13.25ab	28.44ab	698.89a	477.22ab	295.58 ab	142.60 ab	50.87
G_2	942.78a b	21.11bc	38.17ab	12.39ab	26.83abc	575.83b	423.61b	248.85bc	123.41 bc	49.87
G_3	846.11bc	20.56b c	36.44bc	12.72ab	25.83bc	518.61b	401.67b	193.31 cd	101.88 cd	46.87
G_4	659.17c	18.33c	30.94c	10.91b	23.17c	386.94c	299.44c	158.40 d	77.69d	51.07
Sig. level	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NS
CV%	12.54	6.13	7.94	9.43	8.28	9.61	10.89	11.30	13.92	14.14

The figures having different letter(s) in a column are significantly different at 1% or 5% level and the figures having same letter(s) in a column are not significantly different by DMRT.

NS = Non significant.

G0 = nuts with no mite damage, G1 = nuts with 1-29% surface area damage, G2 = nuts with 30-59% surface area damage and less than 20% reduction in size, G3 = nuts with 60-80% surface area damage, 20-30% reduction in size, G4 = nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed.

Table 4. Interaction effect between variety and location as influenced by coconut mite infestation.

Interaction	Fresh weight of coconut fruit (g)	Length of coconut fruit (cm)	Equatorial circumference of coconut fruit (cm)	Kernel length (cm)	Kernel equatorial circumference (cm)	Kernel weight with water(g)	Kernel weight without water(g)	Copra weight (g)	Dry weight (g)	Moisture (%)
L_1V_1	1012.80	22.07a	41.67a	12.80	29.33a	649.00	463.33	238.09ab	118.83a	48.76
L_1V_2	1052.67	20.20b	34.67b	12.67	27.73ab	651.67	447.00	286.81a	133.60a	52.94
L_2V_1	886.67	21.53a	35.07b	12.23	24.33b	510.33	360.00	234.77ab	127.77a	45.73
L_2V_2	950.00	22.13a	38.60ab	12.70	26.67ab	511.00	394.00	209.78b	108.80b	48.75
L_3V_1	909.00	22.00a	41.40a	12.73	29.07a	602.67	456.33	256.49ab	115.35a	53.58
L_3V_2	885.00	20.93a	37.07ab	12.46	25.73ab	609.33	438.67	256.96ab	127.54a	53.58
Significance level	NS	0.01	0.01	NS	0.01	NS	NS	0.01	0.01	NS
CV%	12.54	6.13	7.94	9.43	8.28	9.61	10.89	11.30	13.92	14.14

The figures having different letter(s) in a column are significantly different at 1% or 5% level and the figures having same letter(s) in a column are not significantly different by DMRT.

NS = Non significant.

L1= Khulna, L2 = Bagherhat, L3 = Satkhira, V1= Green variety and V2= Brown variety

The interaction effect of location and variety was not statistically significant (Table 4). However, numerically the brown variety collected from Khulna gave the heaviest fruit (1052.67g) and the lowest fruit weight (885.00g) was recorded from the same variety of Satkhira (Table 4).

Table 5. Interaction effect between location and different grades as influenced by coconut mite infestation.

Interaction	Fresh weight of coconut fruit (g)	Length of coconut fruit (cm)	Equatorial circumference of coconut fruit (cm)	Kernel length (cm)	Kernel equatorial circumference (cm)	Kernel weight with water(g)	Kernel weight without water(g)	Copra weight (g)	Dry weight (g)	Moisture (%)
$L_1 G_0$	1243.33	22.83	44.00	14.33ab	33.00	839.17a	560.83	365.01a	169.03	53.67ab
$L_1 G_1$	1209.50	22.67	41.83	13.67abc	31.33	805.83ab	507.50	322.72ab	143.55	55.96a
$L_1 G_2$	1080.83	21.33	37.83	12.50bcd	26.83	622.50cd	428.33	261.61c	124.35	52.32ab
$L_1 G_3$	929.17	20.67	35.00	12.00bcd	26.83	545.00def	437.50	196.10defg	106.03	45.38ab
$L_1 G_4$	700.83	18.17	32.17	11.17cd	24.67	439.17fgh	341.67	166.82fg	88.13	46.89ab
$L_2 G_0$	1136.67	25.17	41.67	13.17bcd	29.67	628.33cd	475.00	314.42b	169.93	46.13ab
$L_2 G_1$	1049.17	23.50	38.33	12.41bcd	27.17	602.50cde	422.50	241.44cd	137.27	42.47b
$L_2 G_2$	890.83	21.00	38.17	11.83bcd	26.50	529.17defg	396.67	225.28cde	120.93	46.32ab
$L_2 G_3$	806.68	20.50	36.00	13.83abc	24.00	470.83efg	353.33	179.96efg	96.84	45.83ab
$L_2 G_4$	708.33	19.00	30.00	11.08cd	20.17	322.50h	237.50	150.26g	66.46	55.46a
$L_3 G_0$	1214.17	24.83	46.00	16.17a	31.67	826.67a	556.67	339.34ab	154.04	54.52a
L_3G_1	1043.33	23.17	42.00	13.67abc	26.83	688.33bc	501.67	322.57ab	146.99	54.18a
L_3G_2	856.68	21.00	38.50	12.83bcd	27.17	575.83cde	445.83	259.67c	124.95	50.97ab
L_3G_3	802.50	20.50	38.33	12.33bcd	26.67	540.00def	414.17	203.93def	102.77	49.42ab
l_3G_4	568.33	17.83	30.67	10.50d	24.66	399.17gh	319.17	158.12fg	78.48	50.86ab
Significance level	NS	NS	NS	0.01	NS	0.01	NS	0.05	NS	0.05
CV%	12.54	6.13	7.94	9.43	8.28	9.61	10.89	11.30	13.92	14.14

The figures having different letter(s) in a column are significantly different at 1% or 5% level and the figures having same letter(s) in a column are not significantly different by DMRT.

NS = Non significant.

L1= Khulna, L2 = Bagherhat, L3 = Satkhira, G0 = nuts with no mite damage, G1 = nuts with 1-29% surface area damage, G2 = nuts with 30-59% surface area damage and less than 20% reduction in size, G3 = nuts with 60-80% surface area damage, 20-30% reduction in size, G4 = nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed.

The interaction effect of location and different grades was not statistically significant (Table 5). However, numerically the interaction of L_1G_0 produced the heaviest fruit (1243.33g) and the lowest fruit weight (568.33g) was recorded from L_3G_4 (Table 5).

It was found from the experiment that the fresh weight of coconut fruit was significantly influenced by the interaction between variety and different grades (Table 6). The heaviest fruit weight (1259.44g) was recorded from V_2G_0 and the lowest fruit weight (594.44g) was recorded from V_2G_4 (Table 6).

The interaction effect of location, variety and different grades was not significantly varied due to coconut mite infestation (Table 7). However, numerically the interaction $L_1V_2G_0$ produced the heaviest fruit (1363.33g) and the lowest fruit weight (480.00) was recorded from $L_3V_2G_4$ (Table 7).

Table 6. Interaction effect between variety and different grade as influenced by coconut mite infestation.

Interaction	Fresh weight of coconut fruit (g)	Length of coconut fruit (cm)	Equatorial circumference of coconut fruit (cm)	Kernel length (cm)	Kernel equatorial circumference (cm)	Kernel weight with water(g)	Kernel weight without water(g)	Copra weight (g)	Dry weight (g)	Moisture (%)
$V_1 G_0$	1136.67abc	25.11a	44.00	14.33	31.11ab	745.00ab	512.78ab	330.54ab	160.19ab	51.59
$V_1 G_1$	1013.00abcd	22.89abcd	41.78	13.00	27.33abc	648.33bc	447.78abc	268.96bcd	125.95bc	51.74
$V_1 G_2$	921.67bcde	21.11cde	39.11	12.22	27.44abc	580.00cd	420.00dcd	260.95cde	125.43bc	51.41
$V_1 G_3$	885.56cde	20.78de	38.00	12.57	27.22abc	533.33cde	415.56bcd	187.43fg	105.35cd	43.47
$V_1 G_4$	723.89ef	19.44e	34.00	10.83	24.78cd	430.00ef	336.67de	167.70g	86.33cd	48.56
$V_2 G_0$	1259.44a	23.44ab	43.78	14.78	31.78a	784.44a	548.89a	348.63a	168.48a	51.29
$V_2 G_1$	1188.33ab	23.33abc	40.11	13.50	29.56abc	749.44ab	506.67ab	322.19abc	159.25ab	49.99
$V_2 G_2$	963.89bcde	21.11bcde	37.22	12.56	26.22bcd	571.67cd	427.22bcd	236.75def	121.39bc	48.33
$V_2 G_3$	806.67def	20.33e	34.89	12.89	24.44cd	503.89de	387.78cd	199.23efg	98.41cd	50.27
$V_2 G_4$	594.44f	17.22f	27.89	11.00	21.56d	343.89f	262.22e	149.10g	69.05d	53.58
Sig. level	0.01	0.05	NS	NS	0.01	0.01	0.01	0.01	0.01	NS
CV%	12.54	6.13	7.94	9.43	8.28	9.61	10.89	11.30	13.92	14.14

The figures having different letter(s) in a column are significantly different at 1% or 5% level and the figures having same letter(s) in a column are not significantly different by DMRT.

NS = Non significant.

V1= Green variety and V2= Brown variety, G0 = nuts with no mite damage, G1 = nuts with 1-29% surface area damage, G2 = nuts with 30-59% surface area damage and less than 20% reduction in size, G3 = nuts with 60-80% surface area damage, 20-30% reduction in size, G4 = nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed.

The fruit length (cm)

The fruit length of coconut was not significantly varied among the different location (Table 1). However, numerically the highest fruit length (21.83cm) was recorded from Bagherhat and the lowest fruit length (21.13cm) was recorded from Khulna (Table 1).

In case of variety the fruit length of coconut was significantly varied (Table 2). The highest fruit length (21.87cm) was recorded from Green variety and the lowest (21.10cm) from the Brown variety (Table 2).

The fruit length of coconut was significantly varied among the different grades (Table 3). The longest fruit (24.28cm) was recorded from nuts with no mite damage and the shortest fruit (18.33cm) was recorded from nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed (Table 3).

The interaction effect of variety and location was significantly varied as influenced by coconut mite infestation (Table 4). The longest fruit (22.07cm) was found in the Green variety collected from Khulna which was statistically similar to the Green variety collected from Bagherhat (21.53cm), and the shortest

fruit (20.20cm) was observed in Brown variety collected from Khulna (Table 4).

The interaction effect of location and different grades were not significantly influenced by coconut mite infestation (Table 5). However, numerically the longest length of fruit (25.17cm) was recorded from L_2G_0 and the lowest fruit length (17.83cm) was produced by L_3G_4 (Table 5).

Table 7. Interaction effect among the location, variety and different grade as influenced by coconut mite infestation.

Interaction	Fresh weight of coconut fruit (g)	Length of coconut fruit (cm)	Equatorial circumference of coconut fruit (cm)	Kernel length (cm)	Kernel equatorial circumference (cm)	Kernel weight with water(g)	Kernel weight without water(g)	Copra weight (g)	Dry weight (g)	Moisture (%)
$L_1 V_1 G_0$	1123.33	24.00	44.33	14.00	32.33	748.33bcd	518.33bcde	325.15	151.98bcde	53.33
$L_1 V_1 G_1$	1142.33	23.00	44.67	14.00	30.00	768.33bc	450.00defgh	258.37	107.35hijk	58.35
$L_1 V_1 G_2$	1011.67	22.67	41.33	12.67	27.33	658.33cde	450.00defgh	258.43	130.26defghi	49.37
$L_1 V_1 G_3$	955.00	21.33	41.33	12.33	29.67	590.00efgh	498.33bcdef	191.79	112.60ghijk	41.07
$L_1 V_1 G_4$	831.67	19.33	36.67	11.00	27.33	480.00ghi	400.00hij	156.73	91.95jklm	41.66
$L_1 V_2 G_0$	1363.33	21.67	43.67	14.67	33.67	930.00a	603.33a	404.87	186.08a	54.01
$L_1 V_2 G_1$	1276.67	22.33	39.00	13.33	32.67	843.33ab	565.00abc	387.08	179.74ab	53.57
$L_1 V_2 G_2$	1150.00	20.00	34.33	12.33	26.33	586.67efgh	406.67ghij	264.78	118.43fghij	55.28
$L_1 V_2 G_3$	903.33	20.00	28.67	1167	24.00	500.00fghi	376.67hij	200.41	99.46ijkl	49.68
$L_1 V_2 G_4$	570.00	17.00	27.67	11.33	22.00	398.33ijkl	283.33klm	176.91	84.30klmn	52.13
$L_2 V_1 G_0$	1070.00	25.33	38.67	13.33	27.00	636.67def	436.67efghi	333.03	181.53ab	45.50
$L_2 V_1 G_1$	1020.00	22.67	37.00	12.00	25.00	583.33efgh	401.67ghij	239.00	143.88cdefg	38.75
$L_2 V_1 G_2$	850.00	19.67	36.33	11.33	25.00	530.00efghi	380.00hij	241.04	133.85defgh	44.41
$L_2 V_1 G_3$	810.00	20.67	33.33	13.67	23.67	460.00hijk	330.00jkl	185.39	105.69hijkl	42.19
$L_2 V_1 G_4$	683.33	19.33	30.00	10.83	20.33	341.67jkl	251.67lm	174.58	73.88lmn	57.81
$L_2 V_2 G_0$	1203.33	25.00	44.67	13.00	31.67	620.00defg	513.33bcde	295.82	158.34abcde	46.76
$L_2 V_2 G_1$	1078.33	24.33	39.67	12.83	29.33	621.67defg	443.33defghi	243.09	130.66defghi	46.18
$L_2 V_2 G_2$	931.67	22.33	40.00	12.33	28.00	528.33efghi	413.33fghij	209.52	108.00hijk	48.24
$L_2 V_2 G_3$	803.33	20.33	38.67	14.00	24.33	481.67ghi	376.67hij	174.52	87.98jklmn	49.44
$L_2 V_2 G_4$	733.33	18.67	30.00	11.33	20.00	303.33l	223.33m	125.94	59.04n	53.11
$L_3 V_1 G_0$	1216.67	26.00	49.00	15.67	33.33	850.00ab	583.33ab	333.46	147.05cdef	55.94
$L_3 V_1 G_1$	876.67	23.00	43.67	13.00	27.00	593.33efgh	491.67cdefg	308.71	126.63efghi	58.13
$L_3 V_1 G_2$	903.33	21.00	39.67	12.67	30.00	551.67efgh	430.00efghi	283.39	112.17ghijk	60.45
$L_3 V_1 G_3$	891.67	20.33	39.33	11.67	28.33	550.00efgh	418.33fghij	185.10	97.74ijkl	47.15
$L_3 V_1 G_4$	656.67	19.67	35.33	10.67	26.67	468.33hij	358.33ijk	171.79	93.15jklm	46.22
$L_3 V_2 G_0$	1211.67	23.67	43.00	16.67	30.00	803.33ab	530.00abcd	345.21	161.03abcd	53.11
$L_3 V_2 G_1$	1210.00	23.33	41.67	14.33	26.67	783.33bc	511.67bcde	336.41	167.35abc	50.23
$L_3 V_2 G_2$	810.00	21.00	37.33	13.00	24.33	600.00efgh	461.67defgh	235.94	137.74cdefgh	41.48
$L_3 V_2 G_3$	713.33	20.67	37.33	13.00	25.00	530.00efghi	410.00fghij	222.76	107.79hijk	51.69
$L_3 V_2 G_4$	480.00	16.00	26.00	10.33	22.67	330.00kl	280.00klm	144.45	63.81mn	55.49
Sig. level	NS	NS	NS	NS	NS	0.01	0.05	NS	0.05	NS
CV%	12.54	6.13	7.94	9.43	8.28	9.61	10.89	11.30	13.92	14.14

The figures having different letter(s) in a column are significantly different at 1% or 5% level and the figures having same letter(s) in a column are not significantly different by DMRT.

NS = Non significant.

L1= Khulna, L2 = Bagherhat, L3 = Shatkhira, V1= Green variety , V2= Brown variety, G0 = nuts with no mite damage, G1 = nuts with 1-29% surface area damage, G2 = nuts with 30-59% surface area damage and less than 20% reduction in size, G3 = nuts with 60-80% surface area damage, 20-30% reduction in size, G4 = nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed.

The interaction effect of variety and different grades were significantly influenced by coconut mite infestation (Table 6). The highest fruit length (25.11cm) was recorded from V_1G_0 and the lowest fruit length (17.22cm) was recorded from V_2G_4 interaction (Table 6).

Table 8. Yield loss of different economical part of coconut due to mite infestation.

Grade	Coconut shell loss (%)	Loss of water (%)	Loss of copra yield (%)
G_0	0e	0e	0e
G_1	7.28d	5.5d	13.22d
G_2	15.32c	34.91c	24.90c
G_3	24.42b	50.00b	38.00b
G_4	37.17a	62.59a	52.72a
Sig. level	0.01	0.01	0.01
CV%	0.05	0.73	0.87

G0 = nuts with no mite damage, G1 = nuts with 1-29% surface area damage, G2 = nuts with 30-59% surface area damage and less than 20% reduction in size, G3 = nuts with 60-80% surface area damage, 20-30% reduction in size, G4 = nuts with over 80% surface area damage with 30% reduction and often greatly deformed.

The interaction effect of the location, variety and different grades were not significantly influenced by coconut mite infestation (Table 7). However, numerically the highest fruit length (26.00cm) was recorded from $L_3V_1G_0$ and the lowest fruit length (16.00cm) was recorded from $L_3V_2G_4$ (Table 7).

Equatorial circumference of coconut fruit (cm)

Equatorial circumference of coconut fruit was significantly varied among the different location at 5% level (Table 1). The highest equatorial circumference of coconut fruit was recorded from the fruits of Satkhira (39.23cm) and the lowest (36.83cm) was recorded from the sample of Bagherhat (Table 1).

In case of variety equatorial circumference of coconut fruit was significantly differed (Appendix 1). The highest equatorial circumference of coconut fruit (39.38cm) was recorded from the Green variety and the lowest (36.78cm) was recorded from the Brown variety (Table 2).

Equatorial circumference of coconut fruit was significant at 1% level and varied among the different grades (Table 3). The highest equatorial circumference (43.89cm) was recorded from nuts with no mite damage followed by nuts with 1-29% surface area damage (40.94cm) and the lowest equatorial circumference (30.9cm) was recorded from nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed (Table 3).

The interaction effect of variety and location was significantly varied as influenced by coconut mite infestation (Table 4). Among the interaction the highest equatorial circumference (41.67cm) was recorded from the Green variety collected from Khulna followed by the Green variety collected from Satkhira (41.40cm) and lowest equatorial circumference (34.67cm) was recorded from the Brown variety collected from Khulna (Table 4).

The interaction effect of location and different grades were not significantly influenced by coconut mite infestation (Table 5). However, numerically the highest equatorial circumference (46.00cm) was recorded from L_3G_0 and the lowest (30.00cm) was recorded from L_2G_4 (Table 5).

The interaction effect of variety and different grades were not significantly influenced by coconut mite infestation (Table 6). However, numerically the highest equatorial circumference (44.00cm) was recorded from V_1G_0 and the lowest equatorial circumference (27.89cm) was observed from V_2G_4 (Table 6).

The interaction effect of location, variety and different grades were not significantly influenced by coconut mite infestation (Table 7). However, numerically the $L_3V_1G_0$ was produced the highest equatorial

circumference (49.00cm) and the lowest (27.67cm) was produced by $L_1V_2G_4$ (Table 7).

Kernel length of coconut fruit (cm)

Kernel length of coconut fruit was not significantly varied among the different locations (Table 1). However, numerically the highest kernel length of coconut fruit (13.00cm) was produced by the fruits of Satkhira and the lowest (12.47cm) was recorded from the sample of Bagherhat (Table 1).

In case of variety kernel length of coconut fruit was not significantly differed (Table 2). However, numerically the highest kernel length of coconut fruit (12.94cm) was recorded from the Green variety and the lowest kernel length of coconut fruit (12.59cm) was found from the Brown variety (Table 2).

The kernel length of coconut fruit was significant at 1% level among the different grades (Table 3). The highest kernel length (14.56cm) was produced by nuts with no mite damage and the lowest kernel length (10.91cm) was recorded from the sample of the nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed (Table 3).

The interaction effect of variety and location was not significantly varied (Table 4). However, numerically the highest kernel length of coconut fruit (12.80cm) was observed in the Green variety collected from Khulna and the lowest (12.23cm) was recorded from the Green variety collected from Bagherhat (Table 4).

The interaction effect of location and different grades were significantly varied by the coconut mite infestation (Table 5). The highest kernel length (16.17cm) was recorded from L_3G_0 followed by L_1G_0 (14.33cm) and the lowest kernel length (10.5cm) was recorded from L_3G_4 (Table 5).

The interaction effect of variety and different grades were not significantly varied by the coconut mite infestation (Table 6). However, the highest kernel length (14.78cm) was recorded from V_2G_0 followed by V_1G_0 (14.33cm) that are statistically similar and the lowest kernel length (10.83cm) was recorded from V_1G_4 (Table 6).

The interaction effect of location, variety and different grades were not significantly influenced by coconut mite infestation (Table 7). However, numerically the highest kernel length (16.67cm) was recorded from $L_3V_2G_0$ and the lowest kernel length (10.33cm) was produced by $L_3V_2G_4$ (Table 7).

Kernel equatorial circumference of coconut fruit (cm)

Kernel equatorial circumference of coconut fruit was significantly varied among the different location at 1% level of significance (Table 1). The highest kernel equatorial circumference of coconut fruit was recorded from the fruits of Khulna (28.53cm) followed by Satkhira (27.40cm) which were statistically similar and the lowest kernel equatorial circumference of coconut fruit (25.50cm) was observed from the sample of Bagherhat (Table 1).

In case of variety kernel equatorial circumference of coconut fruit was not significantly varied (Table 2). However, numerically the highest kernel equatorial circumference of coconut fruit (27.58cm) was recorded from the Green variety and the lowest (26.71cm) was recorded from the Brown variety (Table 2).

The kernel equatorial circumference of coconut fruit was significant at 1% level and varied among the different grades (Table 3). In case of kernel equatorial circumference of coconut fruit, the highest (31.44cm) was recorded from the sample of nuts with no mite damage the lowest (23.17cm) was observed from the sample of nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed (Table 3).

The interaction effect of variety and location was significantly varied at 1% level (Table 4). Among the interaction the highest kernel equatorial circumference (29.33cm) was recorded from the Green variety collected from Khulna followed by the Green variety collected from Satkhira (29.07cm) which were statistically similar and the lowest kernel equatorial circumference (24.33cm) was recorded from the Green variety collected from Bagherhat (Table 4).

The interaction effect of location and different grades were not significantly influenced by coconut mite infestation (Table 5). However, the highest kernel equatorial circumference (33.00cm) was recorded from L_1G_0 followed by L_1G_1 (31.33cm) and L_3G_0 (31.67cm) which were statistically similar and the lowest (20.17cm) were observed from L_2G_4 (Table 5).

The interaction effect of variety and different grades were significantly varied by the coconut mite infestation (Table 6). Among the interaction the highest kernel equatorial circumference (31.78cm) was recorded from V_2G_0 and the lowest (21.56cm) was recorded from V_2G_4 (Table 6).

The interaction effect of location, variety and different grades were not significantly influenced by coconut mite infestation (Table 7). However, numerically the highest kernel equatorial circumference (33.67cm) was recorded from $L_1V_2G_0$ and the lowest kernel equatorial circumference (20.00cm) was observed from $L_2V_2G_4$ (Table 7).

Kernel weight with water (g)

Kernel weight with water was significantly varied among the coconut fruits of different locations due to coconut mite infestation (Table 1). The highest kernel weight with water was recorded from the sample of Khulna (650.33g) and the lowest (510.67g) was produced by the fruits of Bagherhat (Table 1).

In case of variety the kernel weight with water was not significantly varied (Table 2). However, numerically the heaviest kernel with water (590.67g) was produced by Green variety and the lowest (587.33g) was recorded from Brown variety (Table 2).

It was found that the kernel weight with water was significantly varied among the different grades (Table 3). The heaviest kernel with water (764.72g) was recorded from nuts with no mite damage followed by nuts with 1-29% surface area damage (698.89g) which were statistically similar and the lowest kernel weight with water (386.94g) was recorded from nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed (Table 3).

The interaction effect of variety and locations were not significantly varied as influenced by coconut mite infestation (Table 4). However, the heaviest kernel weight with water (651.67g) was recorded from Brown variety collected from Khulna and the lowest (510.33g) was recorded from Green variety collected from Bagherhat (Table 4).

The interaction effect of location and different grades were significantly varied (Table 5). The highest kernel weight with water (839.17g) was recorded from L_1G_0 followed by L_3G_1 (826.67g) which were statistically similar and the lowest (322.50g) was recorded from L_2G_4 (Table 5).

The interaction effect of variety and different grades were significantly influenced by coconut mite infestation (Table 6). The heaviest kernel weight with water (784.44g) was recorded from V_2G_0 and lowest (343.89g) was observed from V_2G_4 (Table 6).

The interaction effect of location, variety and different grades were significantly influenced by coconut mite infestation (Table 7). Among the interaction, the heaviest kernel weight with water (930.00g) was recorded from $L_1V_2G_0$ and the lowest kernel weight with water (303.33g) was found in $L_2V_2G_4$ (Table 7).

Kernel weight without water (g)

Kernel weight without water was significantly

varied among the coconut fruits of different locations due to infestation of coconut mite (Table 1). The highest kernel weight without water was recorded from the fruits of Khulna (455.17g) followed by Satkhira (447.50g) which were statistically similar and the lowest (377.00g) was recorded from the sample of Bagherhat (Table 1).

In case of variety kernel weight without water was not significantly differed due to coconut mite infestation (Table 2). However, numerically the Green variety and the Brown variety was produced same kernel weight without water (Table 2).

It was found that the kernel weight without water was significantly varied among the different grades (Table 3). The highest kernel weight without water (530.83g) was recorded from nuts with no mite damage and the lowest kernel weight without water (299.44g) was recorded from nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed (Table 3).

The interaction effect of variety and locations were not significantly varied as influenced by coconut mite infestation (Table 4). However, the highest kernel weight without water (463.33g) was recorded from the Green variety collected from Khulna and the lowest (360.00g) was recorded from the Green variety collected from Bagherhat (Table 4).

The interaction effect of location and different grades were not significantly varied (Table 5). However, the highest kernel weight without water (560.83g) was recorded from L_1G_0 and the lowest (322.50g) was recorded from L_2G_4 (Table 5).

The interaction effect of variety and different grades were significantly influenced by coconut mite infestation at 1% level (Table 6). The highest kernel weight without water (548.89g) was recorded from V_2G_0 and the lowest kernel weight without water (262.22g) was recorded from V_2G_4 (Table 6).

The interaction effect of location, variety and different grades were significantly influenced by coconut mite infestation (Table 7). Among the interaction the heaviest kernel weight without water (603.33g) was produced by $L_1V_2G_0$ and the lowest (223.33g) was produced by $L_2V_2G_4$ interaction (Table 7).

Copra weight (g)

Copra weight was significantly varied among the fruits of different locations due to infestation of coconut mite (Table 1). The highest copra weight was recorded from the fruits collected from Khulna (262.45g) and the lowest copra weight (222.27g) was found in the fruits of Bagherhat (Table 1).

In case of variety, copra weight was not significantly differed (Table 2). Numerically the highest copra weight (251.18g) was produced by the Green variety and the lowest (243.12g) was recorded from the Brown variety (Table 2).

It was found that the copra weight was significantly varied among the different grades (Table 3). The highest copra weight (339.59g) was recorded from the nuts with no mite damage followed by nuts and the lowest copra weight (158.40g) was observed from the nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed (Table 3).

The interaction effect of variety and locations were not significantly varied as influenced by coconut mite infestation (Table 4). The highest copra weight (286.81g) was recorded from Brown variety collected from Khulna and lowest (209.78g) was recorded from Brown variety collected from Bagherhat (Table 4).

The interaction effect of location and different grades were significantly varied (Table 5). The highest copra weight (365.01g) was recorded from L_1G_0 and the lowest copra weight (150.26g) was recorded from L_2G_4 (Table 5).

The interaction effect of variety and different grades were significantly influenced by coconut mite infestation at 1% level (Table 6). The highest copra weight (348.63g) was recorded from V_2G_0 and lowest (149.10g) was observed from V_2G_4 (Table 6).

The interaction effect of location, variety and different grades were not significantly influenced by coconut mite infestation (Table 7). However, numerically the highest copra weight (404.87g) was recorded from $L_1V_2G_0$ and the lowest copra weight (125.94g) was produced by $L_2V_2G_4$ (Table 7).

Dry weight (g)

Dry weight of copra was not significantly varied among the coconut fruits of different locations due to infestation of coconut mite (Table 1). Numerically the highest dry weight was recorded from the fruits of Khulna (126.22g) and the lowest (118.29g) was recorded from that of Bagherhat (Table 1).

In case of variety dry weight of copra was not significantly differed by the experiment (Table 2).). However, numerically the highest dry weight (123.32g) was produced by Green variety and the lowest (120.65g) was recorded from Brown variety (Table 2).

It was found that the dry weight of copra was significantly varied among the different grades (Table 3). The maximum dry weight (164.33g) was recorded from the nuts with no mite damage followed by the nuts with 1-29% surface area damage(142.60g) and the lowest dry weight (77.69g) was recorded from the nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed (Table 3).

The interaction effect of variety and locations were significantly varied as influenced by coconut mite infestation (Table 4). The highest dry weight (133.60g) was recorded from Brown variety collected from Khulna and the lowest (108.80g) was recorded from the Brown variety collected from Bagherhat (Table 4).

The interaction effect of location and different grades were not significantly varied (Table 5). However, the heaviest dry weight (169.93g) was recorded from L_1G_0 and the lowest (66.46g) was recorded from L_2G_4 (Table 5).

The interaction effect of variety and different grades were significantly influenced by coconut mite infestation at 1% level (Table 6). The highest dry weight (168.48g) was recorded from V_2G_0 and the lowest (69.05g) was recorded from V_2G_4 (Table 6).

The interaction effect of location, variety and different grades were significantly influenced by coconut mite infestation (Table 7). Among the interaction the highest dry weight (186.08g) was produced by $L_1V_2G_0$ and the lowest dry weight (59.04g) was recorded from $L_2V_2G_4$ (Table 7).

Moisture (%)

Moisture percentage was significantly varied among the coconut fruits of different locations due to infestation of coconut mite (Table 1). The highest moisture percentage was recorded from the fruits of Satkhira (51.99%) followed by that of Khulna (50.58%) which were statistically similar and the lowest moisture percentage (47.24%) was observed from the Bagherhat (Table 1).

In case of variety moisture percentage was not significantly differed where the highest moisture percentage (50.69%) was recorded from Green variety and the lowest (49.36%) was recorded from Brown variety (Table 2).

It was found that the moisture percentage was not significantly varied among the different grades (Table 3). However, the highest moisture percentage (51.44%) was recorded from the nuts with no mite damage and the lowest (46.87%) was recorded from the nuts with over 80% surface area damage with 30% reduction of size and often greatly deformed (Table 3).

The interaction effect of variety and locations were not significantly varied by coconut mite infestation where the highest moisture percentage (53.58%) was recorded from the Brown variety collected from Satkhira and lowest (45.73%) was recorded from the Green variety collected from Bagherhat (Table 4).

The interaction effect of location and different grades were significantly varied (Table 5). The highest moisture percentage (55.96%) was recorded from L_1G_1 followed by L_2G_4 (55.46%), L_3G_0 (54.52%) L_3G_1 (54.18%) which were statistically similar and the lowest (42.47%) was recorded from L_2G_4 (Table 5). The interaction effect of variety and different grades were not significantly influenced by coconut mite infestation where the highest moisture percentage (53.58%) was recorded from V_2G_4 and the lowest (43.47%) was recorded from V_1G_3 (Table 6).

The interaction effect of location, variety and different grades were not significantly influenced by coconut mite infestation (Table 7). However, among the interaction the highest moisture percentage (60.45%) was produced by $L_3V_1G_2$ and the lowest moisture percentage (38.75%) was recorded from $L_2V_1G_1$ (Table 7)

Yield loss of different economical part of coconut due to mite infestation

Due to coconut mite infestation considerable yield loss of economical part occurred and it was increased with the increase of severity of mite infestation (Table 8). The highest coconut shell loss (37.17%) was observed in nuts with over 80% surface area damage with 30% reduction in size and often greatly deformed followed by (24.42%) in nuts with 60-80% surface area damage plus 20-30% reduction in size and the lowest coconut shell loss (0%) was recorded from nuts with no mite damage followed by (7.28%) in nuts with 1-29% surface area damage (Table 8).

The highest water loss (62.59%) was observed in nuts with over 80% surface area damage with 30% reduction in size and often greatly deformed and the lowest water loss (0%) was recorded from nuts with no mite damage (Table 8).

The highest copra loss (52.72%) was observed in nuts with over 80% surface area damage with 30% reduction in size and often greatly deformed and the lowest copra loss (0%) was recorded from nuts with no mite damage (Table 8).

Acknowledgement

The author reveals immense pleasure to express heartfelt indebtness and deepest sense of gratitude to his honorable teachers, Dr. Md. Abdul Mannan, Professor, and other affiliated teachers and lab technicians, Agrotechnology Discipline, Khulna University, for their kind and painstaking guidance, compassionate help and inspiration in all phases of the study and preparation of the manuscript.

References

Anonymous. 1985. Pests of economic importance to the Caribbean coconut industry. Presented at the coconut mite control workshop, 19-21 June 1985. St. Lucia. 6-17.

BBS. 2008. Statistical Year Book, Bangladesh Bureau of Statistics. Ministry of Planning, Government of the Peoples Republic of Bangladesh. 171.

Bose TK, Mitra SK. 1980. Fruits: Tropical & Subtropical. Nobodut and Co. Ltd. New Delli. 32-34.

Foale M. 2003. The Coconut Odyssey: the bounteous possibilities of the tree of life. Australian Centre for International Agricultural Research. Accessed 2009. 5-30.

Gomez AK, Gomez AA. 1984. Statistical Procedure for Agricultural Research. Intl. Rice Res. Inst. John Willey and Sons. New York. 1-340.

Hall RA. 1981. Unpublished. Report on 1981 Mission to Mexico - Mite damage and possibilities of its control. 11-23.

Julia JF, Mariau D. 1979. New research on the coconut mite *E. guerreronis* (K), in the Ivory Coast. Oléagineux (France) **34,**181-189.

Mariau D, Julia JF. 1970. Acariasis caused by *A. guerreronis* (Keifer), pest of the coconut palm. Oléagineux **25,** 459-464.

Mariau D. 1969. *Aceria guerreronis*: Récent ravageur de la cocoteraie Dahoméenne. Oléagineux **24,** 209-272.

McCoy CW, Aibrigo LG. 1975. Feeding injury to the orange caused by the citrus Rust mite, *Phyllocoptruta oleivora* (Prostigmata: Eriophyoidae). Annals of the Entomological Society of America **68,** 289-297.

Moore D, Alexander L, Hall RA. 1989. The coconut mite, E. guerreronis Keifer in St. Lucia: yield losses and attempt to control it with acaricide, polybutene and Hirsutellafungus. Tropical Pest Management **35,** 83-89.

Singh RB. 1993. Fruit Production in the Asia-Pacific region. Research and Development of Fruits in Asia Pacific Region (ed. R. B. Singh), RAPA/FAO, Bangkok. 1-26 and 57-68.

Werth E. 1983. Distribution, Origin and Cultivation of the Coconut Palm (in periodical: Ber. Deutschen. Bot. Ges. **51,** 301-304.