

Screening of Guava genotypes for natural infestation of fruit flies (Diptera:Tephritidae) in River Nile, Sennar and North Kordofan States, Sudan

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Abstract— The infesting species and their infestation indices of fruit flies were determined for guava genotypes (*Psidium guajava* L.), grown in River Nile, Sennar and North Kordofan States during the period from June to August 2010. Twenty genotypes were selected from each state to be evaluated, where ten mature fruits from each genotypes were harvested randomly from insecticide unsprayed trees. Fruits were brought to the laboratory and placed in individual plastic vials containing sand at the bottom to obtain the pupae. Infestation indices were estimated by means of total number of pupae/fruit. Pupal viability was then calculated based on the percentage of pupae resulted in fly emergence. Data was analyzed using analysis of variance and Duncan multiple range test for mean separations. Results showed that Guava fruits were infested by four fruit fly species *Ceratitis cosyra*, *C. quinaira*, *C. capitata* and *Bactrocera dorsalis* constitute (82.2), (0.8), (16.7), (0.3%) and 28.35, 0.01, 10.1 and 61.56% in River Nile and Sennar States respectively. While in North Kordofan State guava fruits were infested by *C. cosyra*, *C. capitata* and *B. dorsalis* 98.4, 0.4 and 1.2% respectively. All the evaluated genotypes in River Nile and Sennar States were infested by the fruit fly with varying degrees only two genotypes 15 red flesh fruit and 19 white flesh fruit in Kordofan state were found free from fruit fly infestation. Infestation was much higher in Sennar and River Nile states (32 and 29 pupae/fruit) respectively compared to North Kordofan (1.6 pupae/fruit). The higher infestation rate occurred in ripe guava fruits (33) compared to 18 and 6 pupae/fruit in mature green and immature green fruit respectively.

Keywords— Fruit fly- Guava, Screening-Sudan.

I. INTRODUCTION

Guava, *Psidium guajava* L. (Myrtaceae), is native to the American tropics and today is found in all subtropical and tropical regions (Gould & Raga 2002). The largest production in the world is registered in Brazil, where guavas are grown in commercial areas or as backyard fruits (Agrianual, 2004).

In Sudan guava is grown successfully in River Nile, Khartoum, Sennar, South Kordofan and North Kordofan states (Bedri, 1978, Abdelaziz *et al.*, 2016).

In Sudan guava is generally propagated from seeds. Seedlings are variable in both plant and fruit characteristics because of Heterozygosity. The total area grown with in Sudan is about six thousand hectare with annual production of 112000 tonnes and production/hectare is estimated to be 10-17 tonns (Gesmallah, 2009).

Wherever guavas are grown commercially, fruit flies (Diptera: Tephritidae) are the key pests, including some species of the quarantine importance (Gould & Raga 2002).

The host resistance to tephritids is an under-exploited control strategy, there are few studies concerned about plant resistance against fruit fly species in guavas.

In the Sudan, the production and exports of fruits is seriously affected by the fruit fly pest. Infestation by fruit fly reached up 90% on guava fruits in Sennar State (Abdelaziz *et al.*, 2012).

Male annihilation with a mixture of Malathion (organophosphorus insecticide) and methyl eugenol (para pheromone) is practice by the growers for area-wide control of *Bactrocera dorsalis* in Sudan, in addition to full cove sprays and sanitation. New strategies are demanded by the IPM program to guarantee safety to growers and consumers. This research study is a part of

research project financed by the Ministry of higher Education and scientific Research- Sudan, the project aiming at evaluation of guava genotypes grown in River Nile, Sennar and North Kordofan States to the Natural infestation by the fruit fly pests. In addition to the identification of the infesting species in these states.

II. MATERIAL AND METHODS

Study areas

Sixty guava genotypes were selected from guava grown in River Nile (Shendi), Sennar (Singa) and North Kordofan (Elrahad abdakana) States and evaluated for the natural infestation by fruit fly, during the period from June to August 2010. Shendi is located at latitude 16° 40' 59.99" N, longitude 33° 25' 59.99" E, Singa at latitude 13° 10' 59.7" N, longitude 33° 57' 18.43" E, while Elrahad abdakana is located at 12° 71' 66.7" N, longitude 30° 65' E. The selected genotypes are belong to two major groups: white and red flesh fruits.

The evaluation procedures:

To evaluate the different genotypes three rounds were conducted and ten mature fruits from each genotypes were harvested from insecticide unsprayed trees. Fruits were brought to the biology laboratory, University of Gezira, and placed in individual plastic vials containing sand at the bottom to obtain the pupae.

Further experiments were also conducted to determine the most susceptible stages of guava fruits.

Infestation indices were estimated by means of total number of pupae/fruit. Pupal viability was then calculated based on the percentage of pupae resulted in fly emergence. The emerged fruit fly adults were kept in cages and fed in a nourishing media composed of sugar and yeast in a ratio of 4:1, respectively (Lux *et al.*, 2003), for few days to complete their development and coloration. Then the emerged adults were kept in 70% ethanol for identification.

Data analysis:

Data was analyzed using analysis of variance and Duncan multiple range test for mean separation.

III. RESULTS AND DISCUSSION

Identification of the infesting species:

Results of this study showed that guava fruits were infested by four species, *Ceratitis cosyra*, *C.capitata*, *C.quinaria* and *Bactrocera dorsalis* in both River Nile and Sennar States. *C. cosyra* is the dominant fruit fly species causing damage to guava fruits in River Nile State constitutes 82.2% while *Bactrocera dorsalis* is the dominant one in Sennar State constitute 61.56% (species complex) (Table 5 & 9).

Previous studies conducted in Sennar State showed that *B. dorsalis* is the dominant fruit fly species in guava account

for 84% of species complex (Gesmalla *et al.*, 2012). This decrease in the pest population could be attributed to the intensive control measures conducted in this state against *B. dorsalis* using a mixture of Metyl Eugenol and Malathion insecticides. In North Kordofan State guava fruit were infested by three species, *C. cosyra*, *C. capitata* and *B. dorsalis* constituting 98.4%, 0.4% and 1.2 respectively (Table 11).

Screening of guava genotypes

Infestation indices of the genotypes and pupal viability showed significant differences on the first, second and third round in River Nile State. Except for genotype 7 and 16, the infestation rate is ranged between 13-47 pupae /fruit for all the screened genotypes.(Table 1).

The genotype 16 red flesh fruit scored the highest infestation rate (51.5) while the genotype 7 white flesh fruit scored the lowest infestation rate 11.9 pupae per fruit (Table 4). All the screened guava genotype in Sennar State were found infested by the fruit fly pest with varying degrees (Table 6). There is a significant differences in infestation rate and pupal viability among the tested genotypes (table 6 and 7). The highest infestation rate (52.4) was recorded in the genotype 7 red flesh fruit while the genotype 4 red flesh fruit scored the lowest infestation rate (9.1) pupae/fruit (Table 8).

Results of this study showed that there is a significant differences in infestation rate and pupal viability in the tested genotypes in Kordofan State. The infestation rate in this State is very low and ranged between 0-4.03 pupae/fruit (Table 10). Two genotypes 19 white flesh fruit and 15 red flesh fruit were found free from fruit fly infestation. The genotype 4 white flesh fruit scored the higher infestation rate 4.03 pupae/ fruit in Kordofan State (Table 10).

Generally the infestation rate in North Kordofan State is very low compared to Sennar and River Nile states. Results of this study showed that guava fruits were infested in all fruit stages, but the higher infestation rate occurred in ripe fruits (33) compared to 18 to 16 pupae/fruit in mature green and immature green fruit respectively (Table 2).

IV. CONCLUSIONS

1. The fruit fly species *C. cosyra* is the dominant species in River Nile and North Kordofan States while *D. dorsalis* is the dominant one in Sennar State.
2. All the screened genotypes were found infested by the fruit fly pest except the genotypes 19 and 15 from North Kordofan State which were they found free from fruit fly infestation.

3. The higher infestation rate occurred during the ripe fruit stage, this should be considered when planning to manage this pest.

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Table.1: Infestation indices by fruit fly species of guava fruit collected from 20 genotypes in River Nile (Shendi), Sudan.

Genotypes	Means number of pupae/fruit		
	June 2010	July 2010	August 2010
1 (W)	39.2 (6.2) ab	7.5 (2.7) d	68.1 (8.3) a
2 (W)	33.5 (5.4) bc	33.5 (5.7) ab	12 (2.8) efg
3 (R)	67 (7.6) ab	45.4 (6.6) a	30.2 (5.2) cd
4 (W)	53.3 (6.6) ab	28.8 (5) ab	41.4 (6.1) abc
5 (W)	26.2 (4.5) d	29.2 (5.1) ab	62.1 (7.5) ab
6 (W)	56.6 (7.4) ab	39 (6.2) ab	39.7 (6.1) bc
7 (W)	1.2 (1.5) e	27.3 (5) ab	7.6 (1.7) fg
8 (W)	31.7 (5.2) bc	38.2 (5.7) ab	0.0 (1.0) g
9 (W)	10.5 (2.5) e	26.9(4.8) ab	40.2 (6) dcd
10 (W)	16 (3.2) e	23 (4.7) ab	11.9 (2.7) efg
11 (W)	6 (2.5) e	21.4 (4.4) c	52.9 (6.7) abc
12 (W)	13.8 (3.7) d	18.6 (4.1) c	43.8 (6.3) abc
13 (W)	8.5 (2.5) e	20.2 (4.7) d	44.9 (6.3) abc
14 (R)	0.0 (1.0) e	20.7 (3.9) c	49.1 (6.6) abc
15 (R)	42.6 (5.8) bc	12 (3.2) d	40.0 (6.4) abc
16 (R)	80.2 (8.5) a	23.2 (4.6) c	51.1 (6.8) abc
17 (R)	50.2 (6.9) ab	10.1 (3.1) d	16.4 (3.9) de
18 (R)	28.8 (4.7) d	4.5 (2) d	6.0 (2.4) efg
19 (R)	42.1 (5.9) bc	9.4 (2.8) d	10.0 (3.1) ef
20 (R)	33.4 (5.1) bc	7.2 (2.6) d	28.8 (5.2) cd
SE _±	0.75	0.57	0.65
CV (%)	48	41	40

Means followed by different letters are significantly different at 5% level according to Duncan's Multiple Range Test. Numbers between parentheses are transformed data $\sqrt{x+1}$.

Table.2: Infestation indices by fruit fly species of guava fruit collected different stage from 20 genotypes in River Nile (Shendi), Sudan.

Genotypes	Means number of pupae/fruit		
	IMG	MG	Ripe fruit
1 (W)	15.6 (3.9) b	27.3 (5.2) bc	68.1 (8.3) a
2 (W)	10.3 (2.9) bc	23.8 (4.2) bc	12 (2.8) efg
3 (R)	0.0 (1.0) e	101.3 (9.6) a	30.2 (5.2) cd
4 (W)	15.3 (2.8) c	42.8 (5.5) b	41.4 (6.1) abc
5 (W)	1.0 (1.2) e	23.6 (4.2) bc	62.1 (7.5) ab
6 (W)	10.1 (2.5) cd	27.1 (4.3) bc	39.7 (6.1) bc
7 (W)	0.0 (1.0) e	10.9 (2.4) d	7.6 (1.7) fg
8 (W)	1.6 (1.3) e	0.6 (1.1) e	0.0 (1.0) g
9 (W)	0.0 (1.0) e	14.7 (3.3) bc	40.2 (6) dcd
10 (W)	0.0 (1.0) e	2.2 (1.5) e	11.9 (2.7) efg
11 (W)	0.0 (1.0) e	11.1 (2.7) d	52.9 (6.7) abc
12 (W)	0.0 (1.0) e	4.8 (1.7) e	43.8 (6.3) abc
13 (W)	1.5 (1.3) e	1.6 (1.3) e	44.9 (6.3) abc
14 (R)	0.4 (1.1) e	2.9 (1.5) e	49.1 (6.6) abc
15 (R)	49.6 (6.8) a	27.3 (4.3) bc	40.0 (6.4) abc
16 (R)	8.2 (2.5) cb	5.9 (2.5) d	51.1 (6.8) abc
17 (R)	2.1 (1.4) de	16.2 (3.1) d	16.4 (3.9) de
18 (R)	0.2 (1.0) e	1.2 (1.6) e	6.0 (2.4) efg
19 (R)	2.0 (1.6) de	12.0 (3.3) bc	10.0 (3.1) ef
20 (R)	0.6 (1.2) e	4.5 (2.2) d	28.8 (5.2) cd
Mean	6(1)	18(3)	33(5)
SE \pm	0.38	0.69	0.65
CV (%)	62	66	40

Means followed by different letters are significantly different at 5% level according to Duncan's Multiple Range Test. Numbers between parentheses are transformed data $\sqrt{x+1}$.

Table.3: Pupal viability by fruit fly species of guava fruit collected from 20 genotypes in River Nile (Shendi), Sudan.

Genotypes	Means number of pupae/fruit		
	June 2010	July 2010	August 2010
1 (W)	64.7 (54.4) a	68.2 (56.3) b	85.2 (68.3) ab
2 (W)	46.8 (42.4) c	73.4 (59.6) b	78.7 (64.9) b
3 (R)	48 (44.1) b	65 (54.8) b	93.3 (78.1) a
4 (W)	73.4 (60) a	69.2 (57.2) b	78 (63.6) b
5 (W)	60.5 (52.1) a	62.6 (53.5) b	68.5 (56.5) bc
6 (W)	61.1 (53.1) b	58.9 (51.2) b	58 (50) c
7 (W)	44.3 (41.8) c	75.4 (61.4) b	52.3 (46.5) d
8 (W)	52.2 (46.1) c	45.4 (43.8) d	50 (45.2) d
9 (W)	60.6 (52.1) e	43.5 (41.3) d	66.8 (55.9) c
10 (W)	71 (57.6) e	60.1 (51.7) b	73.2 (59.1) bc
11 (W)	67.2 (55.5) e	53.2 (48.3) c	75.7 (64.3) b
12 (W)	43 (41.1) d	58.6 (50.8) b	73.5 (64.4) b
13 (W)	43.1 (40.6) d	36.4 (28) d	82 (66.2) b
14 (R)	50 (45.2) b	51.3 (46) d	80.7 (65.7) b
15 (R)	44.6 (41.9) c	69.3 (58.3) b	41 (39.9) de
16 (R)	40.1 (39.1) d	55.5 (48.7) c	47.5 (43.5) de
17 (R)	63.8 (53.4) a	74.2 (64.3) ab	32.3 (26) e

18 (R)	48 (44) b	63.1 (54.4) b	52.3 (47.7) c
19 (R)	46.1 (42.9) b	78.6 (64.3) ab	59.3 (52) c
20 (R)	58 (50.2) a	90.5 (75.6) a	56.2 (48.9) c
SE \pm	0.86	1.08	1.11
CV (%)	22.75	24.36	21.04

Means followed by different letters are significantly different at 5% level according to Duncan's Multiple Range Test. Numbers between parentheses are transformed data $\sqrt{x+1}$.

Table.4: Mean fruit weight of guava genotypes, their infestation indices by fruit flies and the respective pupal viability in River Nile (Shendi), (n = 60)

Genotype no.	Mean fruit weight (g)	Mean no. of pupae/fruit	Pupal viability
1(W)	12	38.3 (5.8) ab	72.7 (59.6)a
2(W)	16	26.3(5) ab	66.3(55.3) ab
3 (R)	28	47.5(6.8) ab	68.7(39) ab
4(W)	25	41.2(6.4) ab	73.5(60) a
5(W)	62	39.2(6.2) ab	63.8(54) ab
6(W)	33	45.1(6.7) ab	59.3(51.4) ab
7(W)	50	11.9(3.1) b	57.3(49.9) ab
8(W)	80	23.3(4.2) ab	49.2(45) ab
9(W)	66	25.9(4.9) ab	56.6(49.7) ab
10(W)	50	16.9(4.1) ab	68.1(56.1) ab
11(W)	75	26.8(4.8) ab	65.3(56.1) ab
12(W)	81	25.4(4.9) ab	58.3(52.1) ab
13(W)	66	24.5(4.7) ab	53.8(44.9) ab
14(R)	41	23.3(4.1) ab	60.6(52.3) ab
15(R)	33	31.5(5.4) ab	51.6(46.7) ab
16(R)	25	51.5(7) a	47.7(41.7) ab
17(R)	70	25.6(4.8) ab	56.7(47.9) ab
18(R)	33	13.1(3.4) ab	54.4(48.7) ab
19(R)	20	20.5(4.3) ab	61.3(53) ab
20(R)	33	23.1(4.6) ab	68.2(58.2) b
SE \pm	-	1.09	0.72
CV(%)	-	37.63	16.68

W = White flesh fruit. R = Red flesh fruit.

Means followed by different letters are significantly different at 5% level according to Duncan's Multiple Range Test. Numbers between parentheses are transformed data $\sqrt{x+1}$.

Table.5 : Fruit flies species and numbers of their specimens infesting guava of 20 genotypes (n=30) in River Nile (Shendi), (2010).

Genotypes	Total number of species	<i>C. cosyra</i>	<i>C. quinaria</i>	<i>C. capitata</i>	<i>B. invadens</i>
1 (W)	391	387	-	4	-
2 (W)	417	377	-	40	-
3 (R)	753	694	11	48	-
4 (W)	867	770	2	73	22
5 (W)	722	634	3	85	-
6 (W)	512	402	11	98	1
7 (W)	249	235	-	14	-
8 (W)	316	215	16	85	-
9 (W)	411	361	3	47	-

10 (W)	342	313	3	26	-
11 (W)	484	465	-	19	-
12 (W)	475	449	4	22	-
13 (W)	495	405	-	90	-
14 (R)	449	302	8	139	-
15 (R)	20	-	-	20	-
16 (R)	467	307	1	158	1
17 (R)	329	185	-	144	-
18 (R)	159	56	7	93	3
19 (R)	375	256	-	117	2
20 (R)	438	310	-	128	-
Total	8671	7123	69	1450	29
%	-	82.2	0.8	16.7	0.3

Table.6: Infestation indices by fruit fly species of guava fruit collected from 20 genotypes in Sennar (Singa), Sudan.

Genotypes	Means number of pupae/fruit		
	June 2010	July 2010	August 2010
1(R)	23.4 (4.6) def	17.4 (3.7) bcde	0.6 (0.9) j
2(R)	18.0 (3.9) ef	12.7 (3.1) de	0.6 (0.9) j
3 (R)	53.6(6.9) abcd	14.0(3.6) bcde	33.0(5.7) abcd
4(R)	9.3(2.6) f	9.0(3) de	9.0 (3) ghi
5(R)	27.1(5) cde	18.1(3.9) bcde	22.0(4.7) cdef
6(W)	37.2(5.7) bcde	25.5(4.5) abcde	31.0(5.6) abcde
7(R)	63.6(7.8) ab	51.2(5.3) abcde	42.4(6.2) abc
8(R)	30.2(5) cde	40.6(6.2) ab	17.5(3.9) efgh
9(W)	39.8(6.2) bcde	21.7(4.2) abcde	30.0 (5.5) bcde
10(R)	32.9(6.4) cde	32.1(5.4) abcde	8.7(2.6) hi
11(W)	78.8(8.6) a	33.1(5.5) abcde	27.2(4.3) defg
12(R)	33.1(5.5) bcde	16.7(3.8) dcde	7.3(2.6) hi
13(R)	51.1(6.8) abcd	11.2(3) e	4.2(1.9) ij
14(R)	44.8(6.3) abcd	13.4(3.4) cde	35.8(5.2) bcdef
15(W)	48.1(6.5) abcd	53.5(6.8) a	36.2(5.8) abcd
16(W)	68.7(7.3) abc	44.7(6) abc	33.4(5.2) bcdef
17(W)	32.2(5) cde	38.2(5.7) abcde	58.5(7.2) a
18(W)	44.6(6.2) bcde	53.3(6.7) a	17.4(3.8) fgh
19(W)	57.2(7.3) abc	35.2(4.9) abcde	46.0(6.8) ab
20 (W)	33.2 (5.6) bcde	44.1(5.5) abcde	39.2(6.1) abc
SE _±	18.0	0.19	17.0
CV (%)	37.5	52.5	36.9

Means followed by different letters are significantly different at 5% level according to Duncan's Multiple Range Test. Numbers between parentheses are transformed data $\sqrt{x+1}$.

Table.7: Pupal viability by fruit fly species of guava fruit collected from 20 genotypes in Sennar (Singa), Sudan.

Genotypes	Means number of pupae/fruit		
	June 2010	July 2010	August 2010
1(R)	15.5 (16.6) d	75.1 (61.9) abcd	100 (90.4) a
2(R)	53.1 (48.4) ab	83.2(67.6) abc	100 (90.4) a
3 (R)	56.1(50.4) a	86.0(72.2) ab	71 (57.7) ef
4(R)	46.4(43) abc	64.0(53.4) cd	86.9 (73.5) bcd
5(R)	23.2(27.4) cd	77.0(67.8) abc	50 (45.2) g
6(W)	28.3(31.9) bc	86.8(75.2) a	57 (49.2) fg

7(R)	39.1(38.7) abc	72.0(58.5) bcd	56 (48.7) fg
8(R)	45.1(40.5) abc	77.2(64.7) abc	81.6 (69.6) bcd
9(W)	38.6(36.9) abc	85.2(67.8) abc	61 (51.6) fg
10(R)	53.8(47.5) ab	87.4(74.1) a	91.2 (77.7) bc
11(W)	44.0(41.5) abc	65.7(54.7) cd	87.3(73.4) bcd
12(R)	59.3(52.6) a	77.0(62.2) abcd	95.6(81.9) ab
13(R)	54.6(49) ab	87.0(71.9) ab	83.4 (68.8) cde
14(R)	53.0(47) ab	88.0(74.6) a	90.2 (77.9) bc
15(W)	55.5(48.6) ab	81.9(66.8) abc	74.5 (63.4) de
16(W)	56.1(49.8) a	59.5(49.7) d	86.4(72.9) bcd
17(W)	31.8(32.3) bc	70.5(58) bcd	83.7(71.3) bcd
18(W)	45.8(42) abc	75.2(62) abcd	87.4(76.4) bc
19(W)	40.6(39.7) abc	71.4(58.6) bcd	57(49.3) fg
20 (W)	41.5(40.1) abc	76.4(63.1) abcd	96.1(81) abc
SE \pm	1.2	1.0	1.2
CV (%)	39.0	22.0	18.0

Means followed by different letters are significantly different at 5% level according to Duncan's Multiple Range Test. Numbers between parentheses are transformed data $\sqrt{x+1}$.

Table.8: Mean fruit weight of guava genotypes, their infestation indices by fruit flies and the respective pupal viability in Sennar (Singa), (n = 60)

Genotype no.	Mean fruit weight (g)	Mean no. of pupae/fruit	Pupal viability
1(R)	21	13.8 (3.3) de	63.5(56.3) ab
2(R)	6	10.4(2.9) e	78.7(68.8) a
3 (R)	50	33.5(5.6) abc	71(60.1) ab
4(R)	32	9.1(3) e	65.7(56.6) ab
5(R)	30	22.4(4.7) bcde	50(45.8) b
6(W)	66	31.2(5.6) abc	57.3(52.1) ab
7(R)	28	52.4(7.2) a	55.7(48.7) ab
8(R)	40	29.4(5.3) abcd	67.9(58.2) ab
9(W)	33	30.5(5.2) abcd	61.6(52.1) ab
10(R)	25	24.5(4.8) bcde	77.4(66.4) a
11(W)	112	46.3(6.6) ab	65.6(56.4) ab
12(R)	30	19(4.2) cde	77.3(53.5) a
13(R)	41	22.1(4.2) cde	75(63.2) a
14(R)	30	31.3(5.4) abcd	77(66.5) a
15(W)	25	45.9(6.7) ab	70.6(59.6) ab
16(W)	50	48.9(6.9) ab	77.3(66) ab
17(W)	100	42.9(6.5) ab	62(53.8) ab
18(W)	75	38.4(6) abc	69.4(60.1) ab
19(W)	60	46.1(6.7) ab	56.3(49.2) ab
20(W)	41	38.8(6.2) abc	71.3(61.4) ab
SE \pm	-	0.64	0.44
CV(%)	-	20.7	9.42

Means followed by different letters are significantly different at 5% level according to Duncan's Multiple Range Test. Numbers between parentheses are transformed data $\sqrt{x+1}$.

Table.9: Fruit flies species and numbers of their specimens infesting guava of 20 genotypes (n=20) in Sennar (Singa), June and July 2010

Genotype no.	Total number of flies	<i>C. cosyra</i>	<i>C. capitata</i>	<i>C. quinaria</i>	<i>B. invadens</i>
1	194	14	0	5	175
2	209	20	0	22	167
3	405	175	1	59	170
4	80	52	0	28	0
5	260	72	0	12	176
6	336	117	0	0	219
7	600	200	0	26	374
8	460	41	0	7	412
9	300	146	0	6	148
10	371	84	0	67	220
11	490	239	0	73	178
12	269	65	0	39	165
13	346	135	0	45	166
14	334	98	0	43	193
15	644	138	0	68	438
16	692	136	0	268	288
17	370	119	0	27	224
18	617	108	0	3	506
19	781	237	0	2	542
20	310	92	0	12	206
Total	8068	2288(28.35%)	1(0.01%)	812(10.1%)	4967(61.56%)

Table.10: Mean fruit weight of guava genotypes, their infestation indices by fruit flies and the respective pupal viability in North Kordofan (Elrahad abdakana) (n= 60)

Genotype no.	Mean fruit weight (g)	Mean no. of pupae/fruit	Pupal viability
1(W)	50	2.6(0.78)ab	56.2(48.9)de
2(W)	64	1.4(0.61)ab	60.1(51.4)cd
3 (W)	83	2.16(0.78)ab	63.4(53)bcd
4(W)	85	4.03(0.88)ab	59(50)cd
5(R)	50	1.93(0.69)ab	80.1(67)a
6(R)	27	0.53(0.39)ab	45(42)ef
7(R)	25	3.43(0.96)a	60.5(51)cd
8(R)	43	3.3(0.9)a	58.3(50)cd
9(W)	43	1.2(0.54)ab	72(58)abc
10(W)	42	0.66(0.37)c	26(30)g
11(W)	31	1.13(0.58)ab	72(58)abc
12(W)	31	0.56(0.04)bc	75(60)ab
13(R)	35	1.66(0.53)ab	60.1(51)cd
14(R)	44	0.2(0.3)cd	20(26)g
15(R)	60	0(0.23)d	0(0)h
16(R)	50	1.66(0.63)ab	75.2(61)ab
17(R)	75	0.46(0.4)cd	40(37)f
18(W)	87	3.6(0.93)a	80(67)a
19(W)	45	0(0.23)d	0(0)h
20(R)	60	1.9(0.7)ab	69(56)abc
SE±	-	0.19	0.48
CV(%)	-	76	39

Means followed by different letters are significantly different at 5% level according to Duncan's Multiple Range Test.
Numbers between parentheses are transformed data $\sqrt{x+1}$.

Table.11: Fruit flies species and numbers of their specimens infesting guava of 20 genotypes (n=10) in North Kordofan (Elrahad abdakana) June and July 2010

Genotype no.	Total number of flies	<i>C. cosyra</i>	<i>C. capitata</i>	<i>B. invadens</i>
1	49	49	0	0
2	26	26	0	0
3	39	39	0	0
4	65	59	0	6
05	49	49	0	0
6	7	7	0	0
7	59	57	0	2
8	66	65	0	1
9	27	27	0	0
10	6	6	0	0
11	25	25	0	0
12	14	14	0	0
13	33	33	0	0
14	1	1	0	0
15	0	0	0	0
16	37	37	0	0
17	7	7	0	0
18	99	99	0	0
19	0	0	0	0
20	37	34	3	0
Total	646	634 (98.4%)	3 (0.4%)	9 (1.2%)