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 genotype 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.

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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 cadges 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 Bactocera 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/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. dorclais 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 | 12.8 (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 (5.5) 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) cd |
| 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 |

Means followed by different letters are significantly different at 5% level according to Duncan’s Multiple Range Test. Numbers between parentheses are transformed data √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 | 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) ef |
| 11 (W)    | 0.0 (1.0) e  | 11.1 (2.7) d  | 52.9 (6.7) abc |
| 12 (W)    | 1.5 (1.3) e  | 1.6 (1.3) e   | 44.9 (6.3) abc |
| 13 (W)    | 0.4 (1.1) e  | 2.9 (1.5) e   | 49.1 (6.6) abc |
| 14 (R)    | 49.6 (6.8) a | 27.3 (4.3) bc | 40.0 (6.4) abc |
| 15 (R)    | 8.2 (2.5) cb | 5.9 (2.5) d   | 51.1 (6.8) abc |
| 16 (R)    | 2.1 (1.4) de | 16.2 (3.1) d  | 16.4 (3.9) de |
| 17 (R)    | 0.2 (1.0) e  | 1.2 (1.6) e   | 6.0 (2.4) efg |
| 18 (R)    | 2.0 (1.6) de | 12.0 (3.3) bc | 10.0 (3.1) ef |
| 19 (R)    | 0.6 (1.2) e  | 4.5 (2.2) d   | 28.8 (5.2) cd |
| Mean      | 6 (1)        | 18 (3)        | 3 (5)         |
| SE ±      | 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 | 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    |
| 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  |

Means followed by different letters are significantly different at 5% level according to Duncan’s Multiple Range Test. Numbers between parentheses are transformed data √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).

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 √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 | C. cosyra | C. quinaria | C. capitata | B. invadens |
|-----------|-------------------------|-----------|-------------|-------------|-------------|
| 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          | -           |
### 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 (3.2) de | 9.0 (3.2) ghi |
| 5 (R)     | 27.1 (5.7) cde | 18.1 (3.9) bcde| 22.0 (4.7) cdef|
| 6 (W)     | 37.2 (5.7) bcde| 25.5 (4.5) abcd| 31.0 (5.6) abcd|
| 7 (R)     | 63.6 (7.8) ab  | 51.2 (5.3) abcd| 42.4 (6.2) abc|
| 8 (R)     | 30.2 (5.2) cde | 40.6 (6.2) ab | 17.5 (3.9) efg |
| 9 (W)     | 39.8 (6.2) bcde| 21.7 (4.2) abcd| 30.0 (5.5) bcde|
| 10 (R)    | 32.9 (6.4) cde | 32.1 (5.4) abcd| 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) dde| 7.3 (2.6) hi   |
| 13 (R)    | 51.1 (6.8) abcd| 11.2 (3.3) e  | 4.2 (1.9) ij   |
| 14 (R)    | 44.8 (6.3) abcd| 13.4 (3.4) cde| 35.8 (5.2) bcd|
| 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 (6.4) abc| 33.4 (5.2) bcd|
| 17 (W)    | 32.2 (5.2) cde | 38.2 (5.7) abcd| 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) abcd| 46.0 (6.8) ab  |
| 20 (W)    | 33.2 (5.6) bcde| 44.1 (5.5) abcd| 39.2 (6.1) abc |
| SE<sub>n</sub> | 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 √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  |
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)        | 39.1(38.7) abc       | 56 (48.7) fg            |
| 8( R)        | 45.1(40.5) ab        | 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) abed           | 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<sub>±</sub>  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 $\sqrt{x}+1$. 

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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 | C. cosyra | C. capitata | C. quinaria | B. invadens |
|--------------|-----------------------|-----------|-------------|-------------|-------------|
| 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      | 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)d     |
| 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            |
| 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 | C. cosyra | C. capitata | B. invadens |
|--------------|-----------------------|-----------|-------------|-------------|
| 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%) |