TITLE: STUDIES ON THE INFESTATION OF TWO BRUCHID INSECTS ON COWPEA AND BROADBEAN SEEDS AND THEIR CONTROL

By

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SUMMARY

The present study has four main parts:

Part 1:Dry pods susceptibility to bruchid infestation.

1- The first part was conducted to determine pods and seeds susceptibility of certain cowpea and broad bean varieties to insect infestation by *Callosobruchus maculatus* (F.) and *Callosobruchus chinensis* (L.) Five cowpea varieties (Dokki331, Tiba, Kaha1, Kafe El-Sheikh1 and Cream7) and eight broad bean varieties (Giza3, Giza843, Sakha1, Sakha4, Nubaraia1, Nubaraia2, Nubaraia3 and Misr3) were tested. The evaluation was based on certain biological parameters as total eggs number, progeny number, mean developmental periods, susceptibility index (SI), mean total holes per 5 pods, pods damage (%) and damaged seeds within the pods (%). The following is a summary of the obtained results.

1.1. The varietal susceptibility of dry cowpea pods to infestation by *C. maculatus* showed that Tiba and Cream7 were moderately susceptible (MS), while Kaha1 was resistant (R) on basis of the susceptibility index (SI) values. Kafe El-Sheikh1 and Dokki331 were moderately resistant (MR).

1.2. The varietal susceptibility of dry cowpea pods to infestation by *C. chinensis* showed that Tiba, Dokki331 and Cream7 were moderately susceptible (MS) while pods of Kaha1 were resistant. Kafe El-Sheikh1 was moderately resistant. This means that the larvae of *C. chinensis* can penetrate the pods of all cowpea varieties and begin the infestation in the field and transfered to the store.

1.3. The cowpea beetle, *C. maculatus* could not infest the mature dry broad bean pods. The infestation could not start in the field on these dry pods but could continues only on the naked shelled seeds and appears on the naked seeds in the storage facilities giving adult progeny in contrast to the pods.

1.4. The pulse beetle, *C. chinensis* was able to infest some broad bean pods of the tested varieties. On basis of the susceptibility index (SI) value, Nubaraia1 were moderately susceptible (MS), Nubaraia3 was moderately resistant (MR) and the rest varieties were resistant (R). In general, the infestation by *C. chinensis* could starts in the field on all pods of broad bean varieties in contrast to *C. maculatus*.

Part 2: Seeds susceptibility of cowpea and broad bean to infestation by *C. maculatus* (F.) and *C. chinensis* (L.).

2.1. All cowpea varieties were susceptible to infest attack by *C.*

maculatus. Dokki331 and Tiba were highly susceptible (HS) on basis of the susceptibility index (SI) value, while the rest varieties were susceptible (S). The cowpea varieties could be arranged as follows: Kaha1 was moderately resistant (MR), Cream7 and Kafr El-Sheikh1 were moderately susceptible (MS), Tiba and Dokki331 were susceptible (S) under free- choice methods.

2.2. All cowpea varieties were susceptible to infestation by *C. chinensis*. On basis of susceptibility index (SI) value Dokki331, Tiba and Kafr El- Sheikh1 were susceptible (S) while, Kaha1 and Cream7 were moderately susceptible (MS) under non-free-choice methods. Cream7 and Kaha1 was moderately resistant (MR) on the basis values of the susceptibility index under free-choice methods of infestation.

2.3. The germinative capability of cowpea seeds infested by both insects on the showed that all cowpea varieties were generally more affected with *C. maculatus* than *C. chinensis*. The lowest percent of germination was occurred in Dokki seeds, while the highest germination percent was noticed in Kafr El-Sheikh1 and Tiba seeds to *C. maculatus* and *C. chinensis*, respectively.

2.4. The susceptibility of eight broad bean seed varieties to infestation by *C. maculatus* under non- free choice method showed all varieties were moderately susceptible (MS) except Nubaraia3 was susceptible (S) based on values of the susceptibility index while all broad bean varieties were moderately resistant (MR) while Sakha1 was resistant (R) under free choice method.

2.5. The varietal susceptibility of broad bean seeds to infestation by *chinensis* showed that four broad bean varieties (Giza3, Giza843, Sakha1 and Nubaraia2) were susceptible (S) and the other four broad bean varieties (Sakha4, Nubaraia1, Nubaraia3 and Misr3) were moderately susceptible (MS) on basis of susceptibility index (SI) value under non-free choice method. Giza3 and Giza843 were the most susceptible. The other six varieties were more resistant under free choice method. Both insects are capable to infest all broad bean seeds under the storage infestation.

2.6. The germination (%) of certain broad bean seeds varieties infested by *C. maculatus* and *C. chinensis* showed that the varieties were generally more affected by both *C. chinensis* than *C. maculatus*. Giza3 showed the lowest germination (66.6-70.0%) while, Nubaraia1, Nubaraia2 and Misr3 were not affected by *C. maculatus* infestation and gave the highest percent germination.

Part 3. Natural dusts as protectants of cowpea seeds.

This part evaluated the bioactivity of six inert dusts as Diatomaceous earth (DE), KatelSouse, Nopakill (16% Sulphur), Rock phosphate, Kaolin and Bentonite compared with two chemical dusts named Malathion and Chlorpyrifos (1% D).

3.1. Diatomaceous earth (DE) affected adult mortality of *C. maculatus* and caused 68.3% after 1 day of treatment at 0.75% w/w and increased 100% mortality after 3 days of treatmeant. At 0.75% w/w Adult mortality of *C. chinensis* reached 65.0 % after 1 day of the treatment and reached 100% after 3 days.

3.2. Katelsouse (KS) at 2.0 % (w/w) caused higher adult mortality of *C. maculatus* (80.0%) after 2 days of treatment, while a complete adult mortality occurred after 4 days of treatment at 1.0 and 2.0 %w/w. In case of *C. chinensis*, adult mortality was 93.3 % and 100% after 2 days and 3 days of the treatment at 2.0 %w/w.

3.3. Nopakill was the lower effective dust on both insects which at 6.0 % w/w adult mortality was 65.0 and 56.8 % after 3 days for *C. maculatus* and *C. chinensis*, respectively. A complete adult mortality for both insects was observed after 5 days at 6.0 %.

3.4. Rock phosphate at 0.25% (w/w) gave a moderate adult mortality of 23.3% and 93.3% on *C. maculatus* after 3 and 5 days of treatment, while in case *C. maculatus*, adult mortality was lower than *C. chinensis* at the previous concentrations after 3 and 5 days. A complete mortality of *C. maculatus* occurred after 4 days at 2%, 4% and 6%. A complete mortality of *C. chinensis* occurred after 3 days at 4 and 6%, respectively.

3.5. Kaolin (K) caused adult mortality of 85.0% on *C. maculatus* after 2 days of cowpea treatment and a complete mortality occurred after 3 days of treatment at 4.0% w/w. In case of *C. chinensis*, the adult mortality reached 86.3% after 2 days at 4.0% and 100% mortality occurred after 3 days of treatment at 4.0%w/w.

3.6. Bentonite (B) dust was the least effective on both insects since the higher adult mortality of *C. maculatus* was 66.7 % and 98.3% after 3 and 5 days of the treatment at 4.0% and 0.25 %, respectively. Adult mortality of *C. chinensis*, was 28.3 % at 4.0% after 3 days of the exposure and adult mortality was 78.3% after 5 days at 0.25%.

Diatomaceous earth (Protect It) and KatelSouse were the most effective dusts against *C. maculatus* and *C. chinensi*s adults while Nopakill and Bentonite were the least effective. *C. maculatus* was more susceptible to the tested inert dusts than *C. chinensis*.

3.7. Malathion (1% D) and Chlorpyrifos (1%D):-

Malathion (1% D) affected *C. maculatus* and *C. chinensis* at 8 ppm and showed a higher mortality of 88.8% and 98.3 %, respectively after 1 day of treatmeant and 100.0 % occurred after 2 days of treatment for both insects. Chlorpyrifos (1%D) showed 93.3% and 100% on C. *maculatus* and *C. chinensis* after 1 day, after 2 days of treatment for both insects recorded 100.0 %.

Part 4. Effect of mixing Diatomaceous earth (DE) with Malathion (1%D) against *C. maculatus* and *C. chinensis*.

4.1. DE at 0.005% affected the adult mortality of *C. maculatus* and caused mortality of 40.0% and reached 100% mortality after 5 days from treatmeant at the 0.06% w/w. At 0.005 % Adult mortality of *C. chinensis* was 18.0% after 5 days from treatment and a complete mortality (100%) at 0.06 and 0.08 %w/w, after 3 days of treatmeant.

4.2. Malathion (1%D) at 0.05 ppm affected the adult mortality of *C. maculatus* in all tested concentrations and gave 13.0 -65.0 % after 1 day of treatment and 58.0% mortality occurred after 5 days from treatmeant. A complete adult mortality occurred after 3 days of treatment 4.0 ppm. The adult mortality of *C. chinensis* ranged 8- 70.0% at all concentrationsafter 1 day from treatment and increased to 38.0% at 0.05 ppm, after 5 days from treatment. The adult mortality reached 100.0% after 3 days from treatment at the high concentration (2.0 and 4.0 ppm).

4.3. Diatomaceous earth (DE) mixed with Malathion (1%) against *C. maculatus* and *C. chinensis* gave the adult mortality of 40.0 % on *C. maculatus* after 1 days from treatment at 0.005% w/w, while it reached 90.0 % after 5 days from treatment and a complete mortality (100%) occurred after 3 days of treatment at 0.03%. In case of *C. chinensis*, the adult mortality reached 30.0% after 1 day at 0.005% and 98.0% mortality occurred after 5 days from treatment and 100% after 3 days from treatment at 0, 02, 0.03 and 0.06%. LC_{50} and LC_{90} were 0.06 and 0.3, respectively to *C. maculatus* while in case *C. chinensis* were 0.08 and 0.5, respectively.