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# VARIETAL RESISTANCE OF MUNGO TO THE BEAN WEEVIL, CALLOSOBRUCHUS CHINENSIS (LINN.) AND SOME CHARACTERISTICS OF FIELD INFESTATION[1]

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**The oviposition preference and survival of** Callosobruchus chinensis **(Linn.) on mungo pods of different stages of maturity were observed. The green stage was least preferred for oviposition, with few surviving eggs or larvae and plenty of adults; the black stage was preferred and with small number of trapped adults. Early harvesting is suggested to minimize infestation.**

**The resistance of 20 varieties and 46 accessions of mungo against** C. chinensis **(Linn.) was also evaluated. None of the varieties was resistant to oviposition, but resistance to larval survival was evident with EG Glabrous, EGMG 4 and EGMG 7. The mungo accession number 23, 25 and 325 of UPCA were resistant to oviposition and larval survival.**

Serious infestation by the bruchid, *Callosobruchus chinensis* (Linn.) is one of the primary problems in the storage of harvested mungo, *Phaseolus aureus* Roxb. With proper storage and fumigation facilities, losses due to this weevil may be considerably reduced but Philippine farmers have yet to attain the required level of resource capability and technical knowledge to benefit from modern grain and seed storage technology. However, the present extent of losses at the farm level may be reduced by adopting procedures which minimize the initial rate of infestation before and after harvest.

Mungo may become infested with *C. chinensis* from either one or both of two sources: 1) adult weevils in the field, possibly maintained in the wild on various cultivated and non-cultivated legumes, which lay their eggs on the pods before harvesting; and 2) residual weevil population in the farmers' storage spaces. Because the growing of mungo (and other host legumes) is seasonal, largely depending on the characteristic rainfall pattern of the region, the availability of seed legumes in farmers' storage space is also seasonal. Thus, a suitable host of the insect is not present all year round in farmers' storage spaces which suggest that on the farm level the performance and persistence of adults in the field play a greater role in the population dynamics of *C. chinensis* than the residual adult population in the storage.

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The above considerations indicate the need for more studies concerning the field population of *C. chinensis*. This study contributes to this need. Specifically, it was conducted with the following objectives: (1) To determine the weevil's ovipositional preferences for and survival on mungo pods in the field. (2) To evaluate varietal resistance against weevil oviposition and survival.

The work was conducted at the Central Experiment Station, and the Department of Entomology, University of the Philippines at Los Baños, from Sept. 1971 to Sept. 1972.

## MATERIALS AND METHODS

*Weevil oviposition in the field and survival on pods.* A field (38 x 40 m.) was grown to mungo (var. CES 14) in accordance with the recommended cultural practices concerning land cultivation and preparation, chemical pest control, fertilizer use and irrigation needs. The insecticidal spraying was, however, terminated when the plants began to flower to avoid possible disturbances to the subsequent abundance and infestation of *C. chinensis* on the pods.

Observations on the egg-laying activities of *C. chinensis* were started 64 days after planting at which time approximately one-third of the full-sized pods of each plant were already black and dry. The observed pods were tagged with appropriate color-coded threads corresponding to four categories of pod maturity, namely: (1) full-sized, green pods the external bulges of the seeds of which were not yet apparent; (2) mature, green pods with very distinct external bulges of seeds; (3) greenish-yellow to yellow pods; (4) black, dry pods. Some of the tagged pods were also carefully enclosed in small plastic bags to prevent further oviposition on them until suitable for harvesting.

To determine the adults' ovipositional preference for pods of various maturity, 200 or more of the tagged and bagged pods per maturity were sampled initially at the time of tagging and then repeated one and two weeks later. A total of 4,041 pods were sampled and examined for eggs. Of these, 3,209 were individually sealed in plastic bags and further observed for the success of eggs to develop and successfully emerge as adults from the pods. Adults emerging from each pod were recorded daily and killed by crushing them inside the bag. The individually sealed pods were finally opened and examined 10 days after the date of the last adult emergence. Adults that developed but were found dead within the pod covers were counted; these adults were trapped inside the pod.

*Varietal resistance to pod oviposition and larval survival.* In May, 1972, mungo pods of 20 varieties and 46 accessions were harvested from the seed multiplication and maintenance plots of the Plant Breeding Division, Dept. of Agronomy. The pods were brought to the laboratory for studies on varietal differences to oviposition and larval survival of *C. chinensis*.

To test for varietal oviposition preference, the pods were exposed to gravid adults inside a 2.1 x 0.8 x 0. 6 m. wire screen cage. The pods were made to stand, 1.3 cm. apart, on 208 x 3.0 cm. boards by fitting their proximal ends into holes along the length of the boards. Ten pods of each of the 20 varieties and 46 accessions were arranged in series with each of the variety and accession replicated 6 and 3 times, respectively. The replicates were distributed at random on the floor of the space of the cage.

Numerous but undetermined numbers of adult *C. chinensis* were released in the cage. To maintain a high population of actively ovipositing adults, open culture jars with actively emerging weevils were also introduced inside the cage. The pods were exposed to oviposition for a period of seven days after which these were individually examined for eggs on them.

After the examination for eggs, 10 pods per variety or accession per replicate were sealed in plastic bags and the bags were placed in 1-gal. candy jars. Here, the eggs were allowed to complete development to adults. The first generation of successfully emerging adults was counted to obtain information on varietal differences in egg-to-adult survival.

## RESULTS AND DISCUSSION

*Weevil Oviposition and Survival on Mungo Pods in the Field.* A recent study by Bato and Sanchez (1972) provides information about the life history of *C. chinensis* in this country; the report also reviews the pertinent literature about the species. The present findings provide other points important for a better understanding of the characteristics of field infestation, in addition to confirming the observation of the above authors in connection with the oviposition activities of adults on intact mungo pods in the field.

Table 1 shows the preferential oviposition of adults on pods of standing crop during the peak period of pod transformation from full-sized green to mature, dry pods. Three significant points are shown: (1) as expected, the black dry pods had more eggs on them than the younger pods. (2) the increments of eggs laid were high between yellow and black, and between green and mature-green pods. (3) the increments of eggs laid were high between the second and third weeks of observation for mature-green yellow and black pods.

The above findings suggest the following pattern of preferential oviposition on mungo pods in a field. When the pods are maturing, the first flush of egg laying activity may be signalled by a gross change of the pod surface in the form of irregularities or contours due to the bulging of the seeds. As the pods continue to mature from green to greenish-yellow, there seems to be no significant change in their suitability as oviposition sites until the pods turn black and dry when the second flush of egg laying activity may be observed. And, from then on, increments of eggs on the pods are a function of time.

TABLE 1. **Oviposition of** Callosobruchus chinensis **on pods of mungo in the field. Each figure is derived from the observation of 200-324 pod samples per maturity per week; total pods examined, 3,039.**

| Date of Sampling | POD MATURITY[a] Green | Mature | Yellow | Black | Total |
|---|---|---|---|---|---|
| | | A. Eggs per 100 pods | | | |
| Nov. 4[b] | 2.5 | 7.1 | 9.2 | 18.1 | 36.9 |
| Nov. 12 | 5.2 | 6.2 | 9.9 | 18.1 | 39.4 |
| Nov. 20 | 7.1 | 10.2 | 14.0 | 23.7 | 55.0 |
| Total | | | | | 131.3 |
| | | B. Weekly egg increment | | | |
| Nov. 4 & 12[c] | 2.7 | — | 0.7 | 0.0 | 3.4 |
| Nov. 12 & 20 | 1.9 | 4.0 | 4.1 | 4.6 | 14.6 |
| Total | | | | | 18.0 |
| | | C. Egg increment due to maturity | | | |
| Nov. 4[d] | | 4.6 | 2.1 | 8.9 | |
| Nov. 12 | | 1.0 | 3.7 | 8.2 | |
| Nov. 20 | | 3.1 | 3.8 | 9.7 | |

[a] Pod maturity during initial sampling (see text page 3)
[b] Initial sampling: only 33% of pods are black.
[c] For example: From A, 5.2 minus 2.5 equals 2.7.
[d] For example: From A, 6.2 minus 5.2 equals 1.0.

Table 2 presents the results based on the counts of adults derived from the eggs observed in Table 1. The results reflect the suitability of the seeds in the pods as food and habitat of the larvae. The data show that the degree of success to produce live adults was lower on eggs laid on green and mature pods, and to a lesser extent on yellow pods, than those eggs on the black pods. The lower rate of adult production on the younger pods than on the black pods was apparently due to (1) unsuccessful adult emergence from pods (trapped adults) and (2) unsuccessful egg hatching and larval mortality indicating that green, mature and yellow pods were less suitable for larval development than the black dry pods. It is of interest to note further that the reduction due to the trapped adults contributed more to the reduced adult emergence than eggs which were either infertile or due to developmental mortality. Trapping, and eventually, death of adults in the pod is apparently due to the inability of the last instar larvae to provide adult exit holes on the pod cover; and, the fact that these larvae partly fed on relatively young and moist seeds may explain the observation.

TABLE 2 **Percent survival of** C. chinensis **on field collected pods (var. CES 14). Each figure is based on the observation of 216-324 pod samples per maturity per week; total pods observed, 3,209.**

| Date of Sampling | Green | Mature | Yellow | Black |
|---|---|---|---|---|
| | A. Successfully emerged and live adults | | | |
| Nov. 4[a] | 50 | 36 | 50 | 71 |
| Nov. 12[b] | 50 | 73 | 83 | 71 |
| Nov. 20[b] | 64 | 58 | 64 | 78 |
| | B. Trapped and dead adults[c] | | | |
| Nov. 4[a] | 35 | 35 | 25 | 17 |
| Nov. 12[b] | 33 | 20 | 9 | 26 |
| Nov. 20[b] | 27 | 36 | 34 | 17 |
| | C. Unsuccessful eggs | | | |
| Nov. 4[a] | 25 | 29 | 25 | 12 |
| Nov. 12[b] | 17 | 7 | 8 | 3 |
| Nov. 20[b] | 9 | 6 | 2 | 5 |

[a] Percentage based on adults derived from eggs on bagged pods.
[b] Percentage based on adults derived from the egg counts used for Table 1.
[c] Fully developed adults but were dead inside the pods.

The above oviposition pattern and reduction of adult emergence due to trapped adults suggest that infestation in storage may be reduced by harvesting mungo pods earlier than normally practiced. Pods harvested early are more likely to contain fewer eggs, and the survival of the larvae coming from these eggs is lower than from pods harvested late.

*Varietal Resistance.* The varieties and accessions used in this study are part of the the mungo collection of the Dept. of Agronomy, UPCA. Some varieties are recommended for commercial production while the accessions are being maintained for various experimental purposes. These are listed in Table 3 which also provides some characteristics of the mature pods.

The stock culture of *C. chinensis* used was maintained in the laboratory on seeds of CES 14. For this reason, the performance of CES 14 is considered as the standard for comparative purposes. The results are presented in Table 4.

*Resistance to oviposition.* As shown in Table 3, pod size varied considerably among the varieties and accessions tested. Pods that are large provide also greater pod surface area for oviposition site than the smaller pods. Thus, to reduce bias due to differences in the available surface areas for oviposition, the numbers of eggs laid per unit area (1 sq. cm.) of pod surface were compared. Approximation of pod surface area was obtained by the use of the following: 3.1416 x diam. of pod x length of pod.

The 46 accessions, however, provide several possible sources of resistance to oviposition: accession number 23, 25, 166, 209, 286, 325 and 246 with eggs ranging from 0 to 0.4 per sq. cm. of pod surface. Accessions 23, 25, 286 and 325 are black gram mungo while accessions 166, 209 and 346 are green gram mungo. It is of interest that black gram mungo seems to be a major source of resistance to oviposition.

Two varieties, EGMG 6D and MG50-10A stand out as the most preferred varieties with 1.3 and 0.9 eggs per sq. cm. of pod surface, respectively; all other varieties had eggs ranging in number from 0.5 to 0.7 per sq. cm. of pod surface. None of the varieties was less preferred than CES 14, although EGMG 4 may be a promising variety for later studies.

TABLE 3. **Some characteristics of the mungo varieties and accession tested for varietal resistance to oviposition and larval survival of** *C. chinensis*.

| Varieties or Accession No. | Average Length (cm.) | Average Diam. (cm.) | Ave. No. of Seed | Seed Color |
|---|---|---|---|---|
| A. VARIETIES | | | | |
| 1. CES 3 | 11.4 | 0.57 | 11.8 | Green |
| 2. CES 7 | 9.0 | 0.56 | 9.8 | Green |
| 3. CES 14 | 11.7 | 0.54 | 14.1 | Green |
| 4. CES 17 | 10.2 | 0.53 | 12.9 | Light green |
| 5. CES 19 | 9.5 | 0.52 | 12.1 | Green |
| 6. CES 28 | 8.9 | 0.49 | 12.5 | Light green |
| 7. CES 55 | 9.4 | 0.53 | 10.5 | Green |
| 8. CES 59 | 9.5 | 0.54 | 10.4 | Green |
| 9. CES 78 | 9.8 | 0.57 | 9.7 | Green |
| 10. CES 87 | 9.9 | 0.55 | 11.5 | Green |
| 11. MG50-10A | 8.1 | 0.51 | 9.7 | Light green |
| 12. MD15-2 | 12.0 | 0.48 | 12.4 | Light green |
| 13. EGMG 4 | 10.0 | 0.59 | 11.1 | Green |
| 14. EGMG 6D | 11.4 | 0.57 | 12.3 | Green |
| 15. EGMG 7 | 9.7 | 0.53 | 10.2 | Green |
| 16. EGMG 12 | 9.2 | 0.52 | 10.3 | Light green |
| 17. EGMG 13 | 10.8 | 0.55 | 12.2 | Green |
| 18. EGMG 16 | 9.6 | 0.53 | 11.3 | Light green |
| 19. EGMY 17 | 10.0 | 0.54 | 11.7 | Yellow |
| 20. EG Glabrous | 9.2 | 0.57 | 10.1 | Green |

TABLE 3. **Cont'd.**

| Varieties or Accession No. | Average Length (cm.) | Average Diam. (cm.) | Ave. No. of Seed. | Seed Color |
|---|---|---|---|---|
| | | B. ACCESSIONS | | |
| 1. No. 3 | 7.7 | 0.45 | 12.2 | Green |
| 2. No. 20 | 8.2 | 0.46 | 12.2 | Yellow |
| 3. No. 23 | 4.5 | 0.53 | 7.2 | Black |
| 4. No. 25 | 3.9 | 0.49 | 10.1 | Black |
| 5. No. 27 | 7.8 | 0.48 | 10.1 | Light green |
| 6. No. 28 | 7.7 | 0.44 | 11.4 | Light green |
| 7. No. 30 | 8.0 | 0.46 | 10.8 | Light green |
| 8. No. 49 | 8.0 | 0.44 | 10.9 | Green |
| 9. No. 51 | 6.1 | 0.32 | 11.6 | Light green |
| 10. No. 57 | 7.1 | 0.44 | 9.4 | Light green |
| 11. No. 58 | 6.8 | 0.43 | 11.6 | Light green |
| 12. No. 73 | 7.2 | 0.41 | 10.1 | Light yellow |
| 13. No. 88 | 7.3 | 0.54 | 8.6 | Light green |
| 14. No. 95 | 8.3 | 0.53 | 10.3 | Green |
| 15. No. 99 | 7.7 | 0.46 | 8.9 | Light green |
| 16. No. 130 | .6 | 0.32 | 11.3 | Black |
| 17. No. 153 | 8.6 | 0.48 | 11.6 | Light green |
| 18. No. 156 | 8.1 | 0.39 | 12.9 | Green |
| 19. No. 161 | 7.8 | 0.45 | 13.4 | Light green |
| 20. No. 166 | 7.9 | 0.48 | 10.1 | Light green |
| 21. No. 177 | 9.2 | 0.53 | 12.0 | Green |
| 22. No. 191 | 9.5 | 0.52 | 11.3 | Light green |
| 23. No. 194 | 8.3 | 0.43 | 12.4 | Light green |
| 24. No. 195 | 9.2 | 0.48 | 12.4 | Green |
| 25. No. 200 | 11.6 | 0.48 | 13.1 | Light green |
| 26. No. 203 | 7.7 | 0.51 | 10.4 | Green |
| 27. No. 204 | 7.3 | 0.39 | 12.3 | Light green |
| 28. No. 205 | 8.5 | 0.48 | 10.2 | Light green |
| 29. No. 208 | 7.1 | 0.41 | 10.3 | Light green |
| 30. No. 209 | 8.6 | 0.53 | 10.3 | Light green |
| 31. No. 210 | 10.4 | 0.52 | 13.0 | Green |
| 32. No. 226 | 6.8 | 0.38 | 10.3 | Light green |
| 33. No. 245 | 7.9 | 0.40 | 11.8 | Light green |
| 34. No. 259 | 8.1 | 0.42 | 11.4 | Light green |
| 35. No. 264 | 7.7 | 0.40 | 12.6 | Green |
| 36. No. 286 | 5.2 | 0.50 | 7.5 | Black |
| 37. No. 291 | 6.4 | 0.43 | 10.0 | Light green |
| 38. No. 292 | 6.9 | 0.43 | 9.9 | Light green |
| 39. No. 299 | 5.8 | 0.41 | 10.1 | Yellow green |
| 40. No. 301 | 6.4 | 0.43 | 10.3 | Light green |
| 41. No. 304 | 6.1 | 0.40 | 9.8 | Light green |
| 42. No. 305 | 5.7 | 0.40 | 7.3 | Light green |
| 43. No. 306 | 6.4 | 0.41 | 9.9 | Light green |
| 44. No. 325 | 4.8 | 0.53 | 6.7 | Black |
| 45. No. 346 | 8.4 | 0.43 | 11.3 | Light green |
| 46. No. 347 | 6.0 | 0.39 | 9.0 | Light green |

*Resistance to survival.* Table 4 also shows the percent successful development (egg to adult emergence) based on the counts of emerged adults derived from the eggs observed in the ovipositional preference evaluation. Again, survival on CES 14 is used as the comparative standard of susceptibility.

Among the varieties, CES 7, CES 87, EGMG 12 and MD15-2 had higher ratios of eggs which developed and finally emerged as adults than CES 14; these varieties may be considered susceptible varieties. The varieties EG Glabrous, EGMG 4 and EGMG 7 had much lower ratios of emerged adults than CES 14, and are considered relatively resistant varieties.

Compared to the varieties, the accessions had a much wider range of differential resistance to survival in having survival ratios from 0 to a maximum of 41.7% (Acc. No. 304). Within this range, accessions in which 30% or more and 10% or less of the eggs survived to adult stage are arbitrarily considered susceptible and resistant, respectively. Thus, accessions 130, 166, 208, 304, 305 and 347 are susceptible while accessions 23, 25, 203, 259, 286 and 325 are resistant to survival. It is significant to note again that the black gram accessions

TABLE 4. **Varietal resistance of mungo to oviposition and survival of** Callosobruchus chinensis **on pods.**

| Varieties or Accession No. | AVERAGE NUMBER OF | | | Percent of Eggs Developed To Adult |
|---|---|---|---|---|
| | Eggs Per Pod[a] | Eggs Per cm.$^2$ | Adult Per Pod[b] | |
| | A. MUNGO VARIETIES | | | |
| 1. CES 3 | 13.5 | 0.6 | 1.8 | 13.3 |
| 2. CES 7 | 8.5 | 0.6 | 1.8 | 21.2 |
| 3. CES 14 (Standard) | 9.6 | 0.5 | 1.9 | 19.8 |
| 4. CES 17 | 11.6 | 0.7 | 1.6 | 13.8 |
| 5. CES 19 | 9.1 | 0.6 | 1.3 | 14.3 |
| 6. CES 28 | 10.3 | 0.7 | 1.2 | 11.6 |
| 7. CES 55 | 12.0 | 0.7 | 2.1 | 17.5 |
| 8. CES 59 | 10.3 | 0.6 | 1.6 | 15.5 |
| 9. CES 78 | 11.5 | 0.6 | 1.7 | 14.8 |
| 10. CES 87 | 10.5 | 0.6 | 3.1 | 29.5 |
| 11. MG50-10A | 12.8 | 0.9 | 2.0 | 15.6 |
| 12. MD15-2 | 13.8 | 0.7 | 3.1 | 22.5 |
| 13. EGMG 4 | 10.0 | 0.5 | 0.6 | 6.0 |
| 14. EGMG 6D | 23.3 | 1.3 | 2.9 | 12.4 |
| 15. EGMG 7 | 10.3 | 0.6 | 0.6 | 5.8 |
| 16. EGMG 12 | 8.3 | 0.6 | 1.9 | 22.9 |
| 17. EGMG 13 | 11.6 | 0.7 | 1.7 | 14.7 |
| 18. EGMG 16 | 10.0 | 0.6 | 1.6 | 16.0 |
| 19. EGMY 17 | 12.9 | 0.7 | 1.9 | 14.7 |
| 20. EG Glabrous | 9.5 | 0.6 | 0.6 | 6.3 |

TABLE 4. **Cont'd.**

| Varieties or Accession No. | AVERAGE NUMBER OF Eggs Per Pod[a] | Eggs Per cm.$^2$ | Adult Per Pod[b] | Percent of Eggs Developed To Adults |
|---|---|---|---|---|
| B. ACCESSIONS | | | | |
| 1. No. 3 | 12.4 | 0.9 | 1.3 | 10.5 |
| 2. No. 20 | 7.5 | 0.6 | 1.4 | 18.7 |
| 3. No. 23 | 2.6 | 0.3 | 0.0 | 0.0 |
| 4. No. 25 | 0.1 | 0.0 | 0.0 | 0.0 |
| 5. No. 27 | 8.0 | 0.7 | 1.9 | 23.8 |
| 6. No. 28 | 10.4 | 1.0 | 1.9 | 18.3 |
| 7. No. 30 | 14.7 | 1.2 | 1.5 | 10.2 |
| 8. No. 49 | 9.9 | 0.9 | 2.3 | 23.2 |
| 9. No. 51 | 4.1 | 0.7 | 0.9 | 22.0 |
| 10. No. 57 | 5.2 | 0.5 | 1.2 | 23.1 |
| 11. No. 58 | 5.0 | 0.6 | 1.4 | 28.0 |
| 12. No. 73 | 7.4 | 0.8 | 1.1 | 14.9 |
| 13. No. 88 | 6.1 | 0.5 | 1.5 | 24.6 |
| 14. No. 95 | 9.5 | 0.7 | 1.9 | 20.0 |
| 15. No. 99 | 5.8 | 0.5 | 1.0 | 17.2 |
| 16. No. 130 | 4.8 | 0.7 | 1.7 | 35.4 |
| 17. No. 153 | 11.7 | 0.9 | 1.6 | 13.7 |
| 18. No. 156 | 8.6 | 0.8 | 1.5 | 17.4 |
| 19. No. 161 | 13.9 | 1.2 | 1.1 | 7.9 |
| 20. No. 166 | 4.1 | 0.3 | 1.4 | 34.1 |
| 21. No. 177 | 7.8 | 0.5 | 1.1 | 14.1 |
| 22. No. 191 | 7.2 | 0.5 | 1.7 | 23.6 |
| 23. No. 194 | 7.2 | 0.5 | 1.7 | 23.6 |
| 24. No. 195 | 6.5 | 0.5 | 0.7 | 10.8 |
| 25. No. 200 | 15.0 | 0.8 | 4.2 | 28.0 |
| 26. No. 203 | 6.0 | 0.5 | 0.5 | 8.3 |
| 27. No. 204 | 6.9 | 0.8 | 1.3 | 18.8 |
| 28. No. 205 | 9.5 | 0.7 | 1.6 | 16.8 |
| 29. No. 208 | 5.0 | 0.5 | 2.0 | 40.0 |
| 30. No. 209 | 6.2 | 0.4 | 1.2 | 19.4 |
| 31. No. 210 | 8.9 | 0.6 | 1.1 | 12.4 |
| 32. No. 226 | 7.3 | 0.8 | 2.0 | 27.4 |
| 33. No. 245 | 7.3 | 0.7 | 0.9 | 12.3 |
| 34. No. 259 | 13.9 | 1.3 | 1.2 | 8.6 |
| 35. No. 264 | 5.4 | 0.5 | 1.5 | 27.8 |
| 36. No. 286 | 4.1 | 0.4 | 0.0 | 0.0 |
| 37. No. 291 | 5.3 | 0.6 | 1.2 | 22.6 |
| 38. No. 292 | 5.7 | 0.6 | 1.2 | 21.1 |
| 39. No. 299 | 7.3 | 0.9 | 1.5 | 20.5 |
| 40. No. 301 | 4.1 | 0.5 | 1.0 | 24.4 |
| 41. No. 304 | 3.6 | 0.5 | 1.5 | 41.7 |
| 42. No. 305 | 3.8 | 0.5 | 1.2 | 31.6 |
| 43. No. 306 | 5.9 | 0.7 | 1.3 | 22.0 |
| 44. No. 325 | 3.0 | 0.4 | 0.2 | 6.6 |
| 45. No. 346 | 4.1 | 0.4 | 1.1 | 26.8 |
| 46. No. 347 | 6.1 | 0.8 | 2.2 | 36.1 |

[a] Based on 6 and 3 replications for varieties and accessions, respectively; each replicate consisting of 10 pods.

[b] First generation adults, derived from eggs in [a].

23, 25 and 325 are resistant to larval survival; in fact, of the eggs laid on accessions 23, 25 and 286 (another black gram mungo) none successfully developed into adults and emerged from the pods.

Several investigations have shown that resistance of mungo to bean weevils is due largely to adverse effects on the development of the young larvae (Howe and Curie, 1964) and inhibition of adult development (Applebaum and Guez, 1972).

Considering the varieties and accessions in the separate evaluation of resistance to oviposition and survival in the above, the correspondence of resistance to the oviposition and survival criteria used was observed with the variety EGMG 4 and the accessions 23, 25 and 325. It is suggested, therefore, that these mungo lines be studied in separate, more detailed experiments as possible sources of resistance against *C. chinensis* infestation.

## SUMMARY AND CONCLUSION

1. The oviposition preferences of *C. chinensis* for mungo pods of various maturity of CES 14 in the field, and for dried pods of 20 varieties and 46 accessions were studied in the laboratory. The resistance to survival against the weevil of the different varieties and accessions was evaluated in the laboratory.

2. The pattern of oviposition of the adults in the field seems to be as follows: The first flush of egg laying activity is apparently triggered by a gross change of pod surface contour resulting initially from the bulging of seeds during the mature green stage; there is no apparent differential preference or increase of oviposition on greenish-yellow or yellow pods until these become dry and markedly preferred as oviposition sites. To reduce population build-up, pods should be harvested as early as possible.

3. Adult mortality was due to the inability of fully developed imagoes to exit from the pod cover. Trapping of live adults inside intact pods occurs when exit holes are not provided and built on the pod cover but are built instead on the seed coat.

4. Comparative evaluation of 20 varieties for resistance to oviposition on the pods, and subsequently the survival of the weevils derived from these deposited eggs, revealed that the variety EGMG 4 is a promising variety. A similar evaluation of resistance in 46 accessions showed that the following UPCA accessions are possible sources of resistance: accession number 23, 25 and 325.

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