**Damage Assessment on Stored Mungbean**

_Vigna radiata_ (L.) Wilczek and Soybean _Glycine max_ L. Merr Infested with the Common Bean Weevil, _Callosobruchus maculatus_ (F.)(Coleoptera:Bruchidae)

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**ABSTRACT**

Damages to the grains by _Callosobruchus maculatus_ (F.) on four varieties of mungbean and five of soybean were assessed. One hundred grams of each type and variety of beans plus 20 adults of _C. maculatus_ were placed in a transparent plastic container. The parameters measured were weevil density, percentage of damaged grains and percentage seed germination. In mungbean, the number of adult weevil was highest in variety MG 50-10A and lowest in V1968 (P < 0.05). Germination rate could not be assessed as beans were 100% damaged after 3 months of storage. In soybean, weevil density increased by 20-215% in all varieties except Acadian. The percentage of damaged grain was low (<8%) for all varieties. The percentage of germination is significantly highest in variety Palmetto (P < 0.05). Compared to mungbean, soybean had a lower population increase, lower percentage damaged grain and higher percentage germination. Soybean can be stored for 3-5 months with minor infestation from this pest.

**INTRODUCTION**

The bruchid, _Callosobruchus maculatus_ commonly known as common bean weevil is an important pest of stored cowpea, _Vigna unguiculata_ Walp. and other tropical grain legumes. Crop damage by _C. maculatus_-xharvest is usually less than 10% but infestation could build up rapidly during seed storage. Thirty seven to 60% of the seeds may exhibit emergence holes within 4-6 months of storage (Jotwani 1964). Losses in seed weight and quality are considerable under poor conditions of storage, a situation common in developing countries.

In 1986, Malaysia imported 284,584 tons of beans, worth 166,705 thousand ringgit (Anon. 1986). This figure is expected to increase in the following years. Data on crop loss assessment under Malaysian conditions is not available. In India, Yadav _et al_ (1968) recorded a weight loss of 15% in grams and 16% in 'kabul gram*' (Cicer arietinum).
17% in cowpea and 25% in mungbean. Similarly in Pakistan, Ahmad and Ahmad (1969), recorded a weight loss of 23% in gram and 48% in mungbean. This study was conducted to determine losses caused by *C. maculatus* on stored soybean and mungbean.

**MATERIALS AND METHODS**

*Grains*

The five varieties of soybean used in this study were Disoy, Jupiter, Acadian, KS 437 and Palmetto, obtained from the Rubber Research Institute of Malaysia (PRIM) at Sungai Buloh, Selangor. The four varieties of mungbean (EG. glabrous, U Thong, V. 1968 and MG-50-10A) were procured from the Department of Agronomy and Horticulture, Universiti Pertanian Malaysia. The beans were cleaned manually by removing contaminants and damaged kernels. Grains were conditioned for two weeks at room temperature and humidity by leaving it in the open in an aluminium tray. Average daily room temperature and relative humidity were recorded as 28 ± 3° and 85 ± 3% RH, respectively.

*Insect Culture*

Infested mungbean obtained from a nearby sundry shop were used to initiate *C. maculatus* culture in the laboratory. The weevils were further reared on mungbeans which were sterilised in an oven for 4 h at 60°C. Three to five-week-old adults of both sexes were used for the study.

*Experimental Set-Up*

One hundred grams of each variety of beans and 20 adults were placed in a transparent plastic container measuring 17cmx 10cmx 9.5cm. A 27cmx 20cm muslin cloth was used to cover each container so as to provide adequate ventilation and prevent the escape and entry of insects. The containers were set up in the laboratory with average daily temperature and relative humidity of 28 ± 3° and 85 ± 3% RH, respectively.

The treatments were replicated three times using completely randomized experimental design. After 1, 3, 5 months of storage period, the following parameters were determined vis-a-vis number of live or dead immature and adult weevils, and percentage damaged bean and seed germination. The percent damaged bean was determined using the formula of Adams and Schulten (1978).

The percent damaged grain and germination of beans after one-month storage are shown in Table 1. Beans that were examined on the third month and thereafter were 100% damaged by *C. maculatus*; thus level of grain damage could not be assessed. The percent of damaged grain at one month storage period for varieties V 1968 and U Thong is still within a tolerable range (5.8-6.0%) and the percent germination is high (89-91%). As such it is quite safe to store mungbean for a period of one month and avoid heavy infestation. Besides, the free fatty acids and uric acid content will increase with prolonged storage period (Singh et al 1982). These compounds have been proposed as sensitive indexes of incipient grain deterioration. (Pomeranz 1982).

*Results and Discussion*

**Weevil Infestation on Mungbean**

The density of *C. maculatus* increased consistently with storage period in all four varieties of mungbean tested (Table 1). At the end of the fifth month of storage, the number of adults was highest in variety MG 50-10A and lowest in V 1968 (P<0.05). Compared to the other four varieties, MG50-10A appeared to be most preferred by *C. maculatus* thus suggesting that it could be the most suitable rearing media in the laboratory. After one month of storage, the population increase in all four varieties ranged from 91 to 3967. This implies that it is not advisable to store any of the four varieties of mungbean for over a month without engaging some form of protective measures against infestation by *C. maculatus*.

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**Weevil Infestation on Soybean**

The adult weevil density increased by 20-215% with storage period in all varieties except Acadian (Table 2) where the increase was only 10% after 3 months of storage, remaining so till the fifth month. Variety Disoy had the highest infestation of *C. maculatus* adults with an increase of over 200% over a 3 months period with no increase during the first month. This indicates that *C. maculatus* may require more than 30 days to slowly multiply in soybean. By the third month the percent population increase was in the range of 10% (variety Acadian) to 80% (variety Disoy). The lower rate of multiplication of
**DAMAGE ASSESSMENT ON STORED MUNGBEAN AND SOYBEAN BY THE COMMON BEAN WEEVIL**

### TABLE 1

Effects of *Callosobruchus maculatus* infestation on four varieties of mungbean in storage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Storage Period (mths.)</th>
<th>No. of weevils¹</th>
<th>% damaged grain</th>
<th>% germination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Variety</td>
<td></td>
<td>A</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>EG. Glabrous</td>
<td></td>
<td>235</td>
<td>2972</td>
<td>3526</td>
</tr>
<tr>
<td>MG. 50-1OA</td>
<td></td>
<td>185</td>
<td>3750</td>
<td>3987</td>
</tr>
<tr>
<td>V1968</td>
<td></td>
<td>185</td>
<td>2771</td>
<td>3335</td>
</tr>
<tr>
<td>U Thong</td>
<td></td>
<td>101</td>
<td>2749</td>
<td>3602</td>
</tr>
</tbody>
</table>

¹Mean 176a 3060.5b 3612.5c 9.4a 100b 100b 87a Ob Ob

¹ Data includes mature and immature insects

²Values within columns followed by the same letter are not significantly different at P=.05 by DMRT

⁻Values within rows followed by the same letter are not significantly different at P = .05 by DMRT

C. *maculatus'* soybean was due to the presence of saponins which inhibit larval development (Applebaum'a£ 1965). Saponins may be regarded as specific metabolic defense mechanisms of soybean which have evolved against insects.

The percentage of damaged grain is considered low (<8%) for all the varieties. During the one-month storage period, no damaged grains were recorded (based on the presence of emergence holes). Howe and Currie (1964) reported that the development period (larval to adult) and survival (percent adult emergence) of *C. maculatus* was low on soybean and that body size was smaller, which explains the low increase in the number of *C. maculatus* and the low percentage damaged soybeans observed in our study.

Generally, the percent germination decreased during storage up to the fifth month. Variety KS 437 had the lowest average percent germination (15%) while variety Palmetto had the highest average (83.3%). The latter variety supported the lowest population of *C. maculatus* and suffered the least grain damage. It is advisable then for soybean food manufacturers and farmers to select Palmetto if the soybean is to be stored for about 6 months.

Compared to mungbean, soybean appeared to be more resistant to attack by *C. maculatus*, resulting in a lower increase in numbers and damaged grain.

### TABLE 2

Effects of *Callosobruchus maculatus* infestation on five varieties of soybean in storage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Storage Period (mths.)</th>
<th>Density increase¹</th>
<th>% damaged grain</th>
<th>% germination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Variety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disoy</td>
<td></td>
<td>20</td>
<td>36</td>
<td>63</td>
</tr>
<tr>
<td>KS437</td>
<td></td>
<td>20</td>
<td>29</td>
<td>51</td>
</tr>
<tr>
<td>Jupiter</td>
<td></td>
<td>20</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Palmetto</td>
<td></td>
<td>20</td>
<td>24</td>
<td>32</td>
</tr>
<tr>
<td>Acadian</td>
<td></td>
<td>20</td>
<td>22</td>
<td>22</td>
</tr>
</tbody>
</table>

³Mean 20a 27.8a 39.2b 0b 1.29b 3.33a 66.2a 35.6b 24.11c

¹Data includes mature and immature insects

²Values within columns followed by the same letter are not significantly different at P=.05 by DMRT

Values within rows followed by the same letter are not significantly different at P=.05 by DMRT

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For consumption purposes, a storage period of 5 months is considered safe irrespective of varieties. On the other hand, for breeding and seed production, soybean seeds should not be stored for more than 3 months at 28° and 85% RH. Variety Palmetto would be the best variety for such purposes.

It would be advisable for researchers working on C. maculatus to select mungbean over soybean as the most suitable rearing media in the laboratory, without special reference to varietal difference.

Overall, the result of this study implicates that the genes for resistance to C. maculatus may be present in both mungbean and soybean. Therefore, more extensive search in the different germplasm collections may yield sources of resistance to this pest. Further research on the control of Bruchids would enable farmers to harvest and store the beans free of the problems by the common bean weevil.

REFERENCES


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