

RESISTANCE OF MUNG (*VIGNA RADIATA*) TO *CALLOSOBRUCHUS* SPP. (COL: BRUCHIDEA)

C. M. D. DHARMASENA and S. M. C. SUBASINGHE
Regional Research Centre, Maha Illuppallama

ABSTRACT

Twelve varieties of mung were studied for seed characteristics contributing to bruchid resistance. Varieties with small seeds and glossy seed coats were shown to be associated with a higher degree of resistance than large seeds with a dull surface. The female insects find it more difficult to lay their eggs on the highly convex and shiny surfaces of small seed.

INTRODUCTION

Cowpea, mung (greengram), blackgram and soyabean occupy a substantial acreage in Sri Lanka, particularly in the dry zone. The cowpea weevils (*Callosobruchus* spp) are serious pests of stored grain legumes. Both *C. maculatus* and *C. chinensis* are found in Sri Lanka. It has been reported that these pests can destroy upto 87% of untreated cowpeas over a period of nine months (Southgate, 1958). Although proper drying to less than 10% moisture by weight of seed could reduce the cowpea weevil infestation, this is not practicable because periodical drying is necessary due to high atmospheric relative humidity.

Varietal resistance is one of the best control methods as it could be integrated with other methods like biological control and cultural practices without any illeffects. This work was undertaken to study the relationship between characters of greengram and resistance to cowpea weevils, and identify possible seed characters contributing towards resistance to these pests.

MATERIAL AND METHODS

Seeds harvested in the previous season were taken to study the following seed characters :

1000 seed volume: 1000 undamaged seeds were put into a measuring cylinder (100 ml) half filled with water. The difference between two water levels was measured upto one decimal point. This volume of water is equal to the volume of 1000 seeds (Archimedes' principle).

Visual index of shininess: One hundred seeds from each variety were put in a petridish (diameter 10 cm) and placed on a white paper. These varieties were categorized by visual observation into six classes based on lustre.

The scale 01 was assigned to the dulllest seed and 06 to the brightest. Three persons were asked to categorize the varieties and an average was taken of the three scores.

Twelve mung varieties were screened in experiments using a completely randomized design with four replications. Twenty undamaged seeds from each variety were put in a clean petridish (5 cm in diameter). Petridishes containing mung seeds were put in an insect proof wooden cage. Cowpea weevils were introduced by placing infested cowpea seeds (variety MI 35) at window stage. Mung seeds were examined under a magnifying glass ($\times 5$) on the seventh day after exposing them to cowpea weevils. The number of eggs on each seed was counted. Similarly, one hundred seeds of each variety were screened and the number of damaged seeds was counted at the end of seven weeks. The simplest and most reliable measure of bruchid resistance was the percentage of undamaged seeds without emergence holes (Redden and McGuire, 1983).

RESULTS AND DISCUSSION

Large and dull seeded varieties like MI-5 had high counts of eggs/seed and high percentage of damaged seeds, while small and shiny seeded varieties like 7704 had the lowest counts, (Table 1, 2). Oviposition by cowpea weevils was stimulated by the testa of the grain (Singh *et al* 1980). Oviposition is known to be affected by various characters such as small differences in seed coat, smoothness, convexity, plumpness, wrinkling and perhaps by size and hardness of the seed as well as its odour (Horber, 1977). The present findings are in agreement with those of Horber and Singh *et al*. Thousand seed volume was positively correlated with eggs/seed ($P=0.05$) and percentage damaged seeds ($P=0.01$) (Fig. 1). This relationship may be due to the convexity of the seed. When convexity is high the female may find it difficult to lay eggs on such surfaces. The smaller the seed the higher is the convexity. When the volume is small the surface area available for

RESISTANCE OF MUNG TO *CALLOSobrUCHUS* spp.

oviposition is also small. When eggs/seed is low, the damage by the pest is also low. The lustre of the seed coat was negatively correlated with the eggs/seed ($P=0.05$) and percentage damage ($P=0.1$) (Fig. 2). Shininess of a surface indicates its smoothness. When light rays strike a smooth surface, most of the rays are reflected in a particular direction and such surfaces appear shinny. Rough surfaces are uneven. When light rays strike such surfaces most of the rays scatter so that such surfaces appear dull. Relationship between seed lustre and eggs/seed could be explained by the behaviour of the female, who finds it difficult to move on a smooth or a shiny surface to deposit eggs. Thus number of eggs/seed on shiny greengram is reduced. When eggs/seed is low the damage by the pest is also low.

Cowpea varieties like TVu 2027 and TVu 11952 which are resistant to cowpea weevils have curved and curled pods respectively (Singh *et al*, 1985). Cowpea varieties with long peduncles which raise the pods over the canopy are less susceptible to this pest in the field because that environment is not favourable for females to lay their eggs. Identification and combination of such plant characters of mung with the size and lustre of the seed coat would be very useful in a breeding programme. Such improved varieties would be very popular among the farmers in the dry zone of Sri Lanka where cowpea weevil infestation is high. Consumer preference and nutritional value could be improved by changing the amino acid content of the seed.

ACKNOWLEDGEMENTS

Authors are grateful to Dr. M. H. J. P. Fernando for valuable guidance during this study. They are thankful to Mr. H. P. Ariyaratne and Mr. I.D.R. Peries for reading through the script and making useful suggestions. Technical assistance given by Mrs. Premila Amarasinghe is also appreciated. The authors also thank Miss. R. A. Mangala for typing the manuscript and Mr. Sarath Santha for the diagrams.

REFERENCES

- Horber, E. 1977. Resistance to pests of grain legume in the U. S. A., Pests of grain legume, ecology and control (ed) S. R. Singh, H. F. Van Enden and T. Ajibola Taylor 453 p.
- Redden, R. J. and J. McGuire. 1983. The genetic evaluation of bruchid resistance in seed of cowpea., Australian Journal of Agricultural Research, 34 (6) 707—715.
- Singh, B. B., S. R. Singh and O. Adjadi. 1985. Bruchid resistance in cowpea., *Crop Science*, 25 (5) 736—739.
- Singh, Y., H. P. Saxena and K. M. Singh. 1980. Exploration of resistance to pulse beetle, *Indian J. Ent.*, 42 (3) 375—382.
- Southgate, B. J. 1958. Systemic notes on species of *Callosobruchus* of economic importance. *Bull. Ent. Res.* 49: 591—599.

Table — 1 : Seed characters of mung varieties

Variety	1000 grain volume (cc)	Visual index of shininess
VC 1973	43.0	4
MI — 5	42.0	1
CES — 1F — 5	41.5	2
VC 2764 — A	41.5	—
TV — 79 — 3	39.5	4
CES — 1D — 2	38.5	2
TV — 79 — 6	33.1	3
TV — 79 — 11	27.1	6
7715	24.5	5
7704	21.2	5

Table — 2 : Ovipositional preference and percentage of damaged seeds by *Callosobruchus* spp on different greengram varieties

Variety	Eggs / seed 7 d. a. e	% of damaged seed 49 d. a. e
MI — 5*	7.2 a	81.5 a (64.52)
VC 2764 A	7.2 a	—
CES — 1F — 5	6.55 ab	62.5 bc (52.24)
7715	5.88 abc	46.0 de (42.71)
CES — 1D — 21	5.62 abc	58.0 cd (49.60)
VC 1973 A	5.22 abc	78.5 ab (62.37)
CES 5S × MI3 — 133F	4.85 bc	—
TV 79 — 3	4.57 bcd	51.5 cde (45.86)
Type 77*	4.45 bcd	65.5 bc (54.03)
TV 79 — 6	4.10 cd	54.75 cde (47.75)
TV — 79 — 11	3.80 cd	52.75 cde (46.61)
7704	2.78 d	41.5 e (40.11)

Numbers followed by the same letter are not significantly different at $P = 0.05$
Values within brackets are arcsin data.

d. a. e = days after exposing to *Callosobruchus* spp.

Duncan's Multiple Range Test was used to compare means.

* Recommended for cultivation by the Department of Agriculture, Sri Lanka.

RESISTANCE OF MUNG TO *CALLOSOBRUCHUS* SPP.

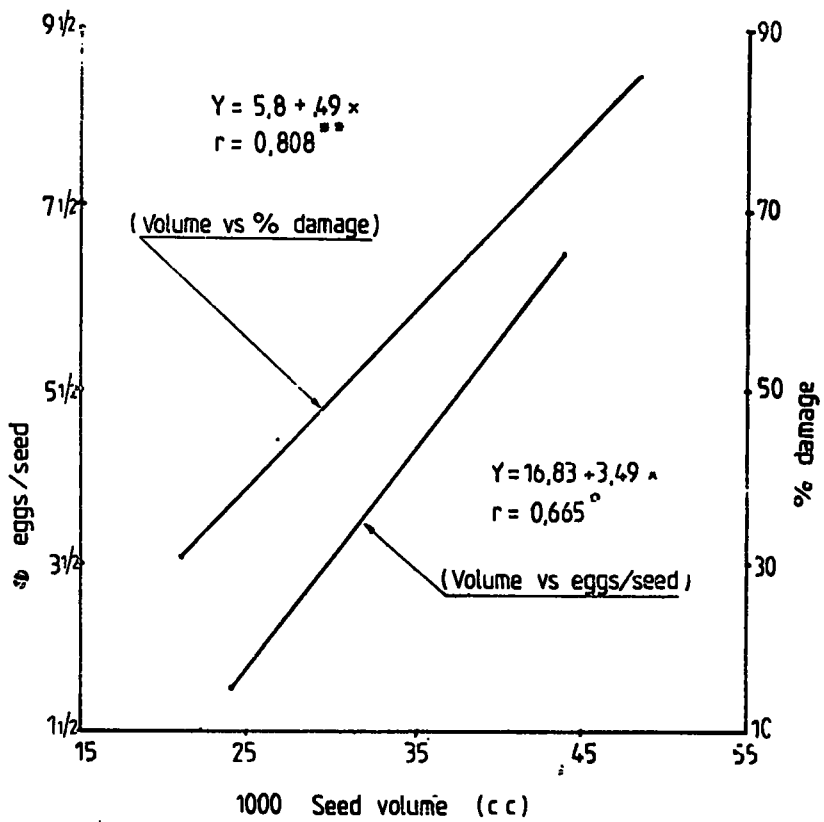


Figure 1. Relationship between the size of the mung seeds with eggs/seed and percentage of damaged seeds.

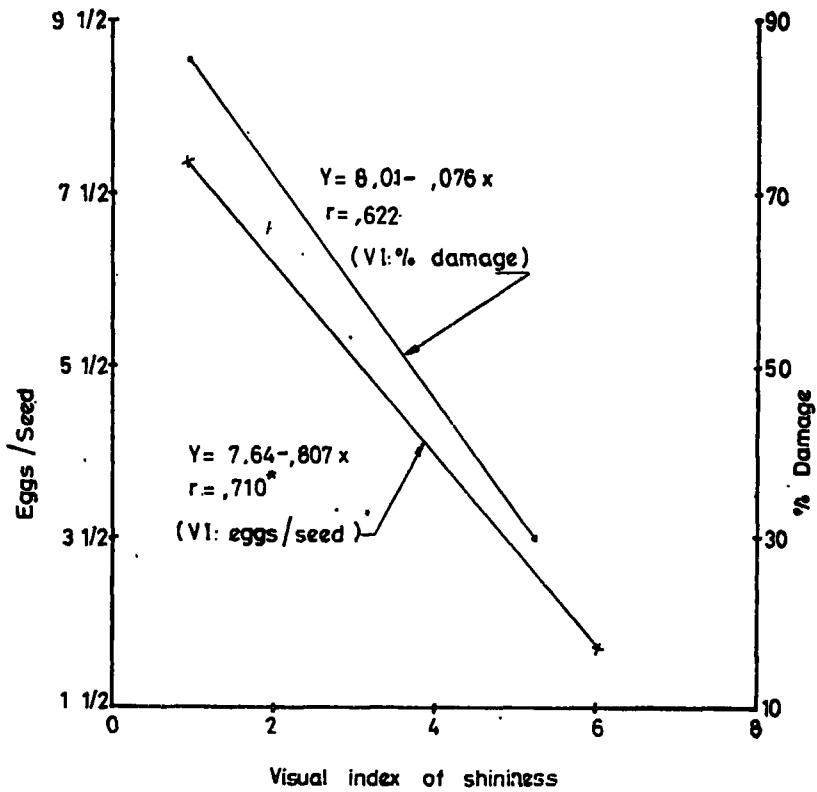


Figure 2. Relationship between the visual index of shininess of mung seeds with oviposition preference and percentage of damaged seeds.