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Damage Caused By the Bean Bruchid, *Callosobruchus Maculatus* (Fabricius) on Different Legume Seeds on Sale in Awka and Onitsha Markets, Anambra State, South Eastern Nigeria *(Pp. 116-123)*

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Abstract
The damage caused by the bean bruchid, Callosobruchus maculatus (Fabricius) on eight different legume seeds on sale in Awka and Onitsha markets in Anambra State, Southeastern Nigeria, were studied between January and April, 2008. Clean legume seeds purchased from local markets were screened to remove previous infestations. Laboratory reared strain of bruchids from local markets were used to infest the legumes. Samples of 200g weights of different legume seeds were artificially infested with the weevils at different male: female ratios. Six different legume seeds out of the eight used were attacked by the weevils. Emergence holes and weight loss were the observed effects to the seeds. The highest number and percentage of exit holes and weight loss were observed in legumes challenged with bruchids at higher male: female ratios.

Key words: *Callosobruchus maculatus,* legume, damage, markets.

Introduction

Leguminous crops are widely grown in the tropics and subtropics for human food as well as for animal feeds. Examples include Cowpea (*Vigna unguiculata*), Pigeon pea (*Cajanus cajan*), Soya bean (*Glycine max*) and Groundnut (*Arachis hypogea*). They contain good quantities of most nutrients especially protein, vitamins and minerals. Nigeria, Brazil and Niger Republic are among the major producers of cowpea and it accounts for over 70% of world crop. Africa produces 75% of the world's crop and Nigeria is responsible for about 58% of the entire Africa's production (Okonkwo, 1989). Nigeria alone produces about 900,000 tonnes of cowpea annually, grown mainly as a secondary crop in association with staples such as maize, sorghum, millet and cassava. They are subjected to heavy losses or entire crop failure as a result of severe insect pest predation. Caswell (1968) estimated that about 37% of cowpea and other leguminous crops are lost to pests during storage for a period of nine months. Caswell (1959) and Qureshi and Halliday (1964) were of the opinion that insect pests are about the most important deteriorating agents that reduce cowpea and other species quality in stores in Nigeria.

Callosobruchus maculatus (Fabricius) is an important pest that mainly attack beans of many species, and can alternately attack other leguminous crops such as *Voandzeia subterranean* (Banbara nuts) and *Cajanus cajan* (Pigeon pea). This species of pest also attack other legume seeds such as *Glycine max* (Soya beans), *Phaseolus radiates* (Ground bean) and the varieties of *Vigna*

unguiculata (Cowpea). Two forms of the pest species have been found; the flying form and flightless form. The flying form usually disperses to new storage locations. *Callosobruchus maculatus* (F) begins its attack shortly before harvest and continues in store where it develops. This beetle is responsible for most of the losses which occur in stored bean seeds (Bangudu, 1970). Damage done to stored products takes place at different levels of storage including the producers levels, the trader and the central store levels with varying percentages (Egwuatu, 1986). All these damages affect the quality of the crops, thus affecting its market value, taints the taste of the crops and also pose a threat to human health, that is if these bruchids are eaten alongside with the food. As legumes provide the cheapest and richest source of plant protein to man and animals and are supposed to be poor man's meat, thus control of this pest is essential (Singh and Pandey, 2001). The study is aimed at determining the damage done to various legume species by *Callosobruchus maculatus* (F) through examination of insect holes and weighing of seeds before and after the experiment.

Materials and Methods

Awka is the capital of Anambra State with an estimated population of 301,657 inhabitants as of 2006 Nigeria census while Onitsha city, commercial center and river port on the eastern bank of the River Niger in Anambra State, had an estimated population of 511,000 with a metropolitan population of 509,500 according to 2006 census. Awka lies within coordinates 6°12′N and 7°04′E and Onitsha has coordinates 6°10′N and 6°47′E, both in the tropical zone of Nigeria . They experience two distinct seasons brought about by the two predominant winds that rule the area: the south western monsoon winds from the Atlantic Ocean and the North eastern dry winds from across the Sahara desert. Seven months of heavy tropical rains (April - October) are followed by five months of dryness (November - March). The Harmattan – a particularly dry and dusty period occurs for about two weeks within the dry season. The temperature is generally hot and humid in the range 27-28 degrees celsius during July through December but rising to 35 degrees celsius between February and April. Both cities are sited in a fertile tropical valley but most of the original rain forests have been lost due to clearing for farming and human settlement. Wooded savannah grassland predominates primarily to the north and east of the cities.

Legume Seeds used for the Study

Eight different legume seeds used for this study were; two varieties of *Vigna unguiculata*, viz: *Vigna unguiculata* var. brown (Brown beans) and *Vigna*

unguiculata var. white (Iron beans). Others are *Glycine max* (Soya beans), *Cucumix melon* (melon), *Arachis hypogeal* (groundnut), *Cajanus cajan* (Pigeon pea), *Phaseolus radiates* (Ground bean) and *Voandzeia subrerranea* (banbara nuts).

Preparation of the Seeds for Study

The seeds were properly picked to remove debris, dust particles and plant remains. Damaged and immature seeds were removed to ensure that the used seeds had no damage or infection before use. This was carried out in the Parasitology and Entomology laboratory of Nnamdi Azikiwe University, Awka, Nigeria.

Source of Study Insects

The Bean bruchids, *Callosobruchus maculatus* (Fabricius) used in this study were strains collected from Awka and Onitsha markets both in Anambra State. The weevils were cultured at an ambient laboratory temperature of 22^oC – 29^oC, in a storage sac containing the cowpea variety. The culture container consisted of a wide necked transparent plastic bowls with tightly fitted lids in which the top of the lid was cut open and replaced with white muslim cloth to ensure ventilation as well as prevent the escape of the beetles or contamination from wild insects. The culture was kept until the old insects died out and new ones started emerging.

The Experimental Setup

Two hundred grams (200g) of different legume seeds were weighed into culture vials. The vials were appropriately labeled with the scientific names of the legumes. Three replicate samples and controls were prepared for each type of treatment under study.

Challenging the Legumes with *Callosobruchus maculatus*

One day old beetles taken from the culture were used to infect the seeds in each container in a male: female ratio of 10:10, 15:10 and 10:15. The adult females were distinguished by distinct black spots on both sides of the elytra while the adult males have brown elytra but without black spots. Each vial containing the legume seeds infested with weevils were covered with a muslim cloth to prevent either entrance or escape of insects from the vial as well as to allow ventilation into the samples. These vials were allowed to stand on the laboratory table undisturbed alongside with the uninfected controls. The weevils mated and laid eggs on the legume seeds. The samples were observed daily for six weeks. Data on the final weight of the seeds

(weight loss), nature of damage and the number of seeds with holes to undamaged seeds were taken.

Determination of the Weight of the Seeds
Weight loss was determined by calculating the difference in weight of the legumes before and after the experiment.

Data Analysis
The different legume seeds were carefully examined, those with holes sorted out from those without holes, percentage of damaged seeds determined by calculations. Post-experimental weights were compared with pre-experimental weights and the differences tested with Analysis of Variance (ANOVA).

Results
From Table 1, *Vigna unguiculata* var. white (iron beans) produced the highest number of holes 483 (59.3%) while *Glycine max* produced the least 16 (1.6%). *Cucumix melon and Arachis hypogea* were not damaged by the bruchids.

From Table 2, *Vigna unguiculata* var. white (iron beans) had the highest percentage weight loss of 26.97% while *Glycine max* had the least percentage of weight loss of 1.05%. *Cucumix melon and Arachis hypogea* were not attacked by the bruchids.

From Table 3, the bruchids were introduced in ratios of 1 male to 1 female (10:10), 3 males to 2 females (15:10) and 2 males to 3 females (10:15). All the bruchids, irrespective of their sex ratio, established, attacked and damaged the legume seeds except *Cucumix melon and Arachis hypogea.* Bruchids introduced with more males or more females caused higher weight loss than when they were introduced in a ratio of equal males to females or vice versa. The weight loss was highest when more males than females were introduced in the ratio of 3 males to 2 females. The weight loss caused to the legume seeds was highest in *V. unguiculata* varieties followed by those of *Phaseolus radiates, Voandzeia subterraneaa, Cajanus cajan* and *Glycine max* (soya beans).

Discussion
Vigna unguiculata var. white (iron beans) were most severely damaged than other legume seeds used in the present study and this agrees with the report of Sharmila and Roy (1994), who reported that cowpea seeds (*V. unguiculata*) were the most suitable food for this weevil because of its

reduced larval duration which facilitates higher production and enhanced population growth. Since most insects are known to deposit their eggs on future larvae food, hence the population buildup of *C. maculatus* on *Vigna unguiculata* var. white is a clear indication that the nature of the food media is an important factor for oviposition.

Seeds challenged with higher male: female ratios of bruchids were more damaged than those challenged with lower male: female or equal male: female ratios. Samples treated with more males than females caused severe damage, since a single female has been observed to mate several times with different males (depending on the number of times a female bruchid would mate in order to continue producing eggs). Statistically, the differences between the treatments with respect to adult emergence and weight loss were significant ($P<0.05$) thus agreeing with the report of Javid *et al* (1993).

The damage caused by these weevils resulted to severe weight loss to the legume seeds thus reducing its quality, quantity and market value. Uncontrolled attacks of the weevils to stored bean products and subsequent weight loss will invariably lead to hunger in the society as the original weight and quality of the legumes before infestation that gives maximum satisfaction when consumed has been drastically reduced by the bruchids.

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Table I: Damage done to the legume seeds by assessing the number of holed seed

Seed Variety	Number of holed seeds	% frequency
Vigna unguiculata var. white	483	59.3
Cajanus cajan	33	3.4
Glycine max	16	1.6
Vigna unguiculata var. brown	459	52.4
Phaseolus radiates	188	20.2
Voandzeia subterranean	181	22.5
Cucumix melon	0	0
Arachis hypogea	0	0

Table II: Percentage weight loss in the different legumes

Seed Variety	Weight before experiment (g)	Weight after experiment (g)	Weight loss (g)	% of weight loss
Vigna unguiculata var. white	200	146.07	53.93	26.97
Cajanus cajan	200	193.59	6.41	3.21
Glycine max	200	197.90	2.09	1.05
Vigna unguiculata var. brown	200	162.71	37.29	18.65
Phaseolus radiates	200	183.65	16.35	8.17
Voandzeia subterranean	200	184.04	15.96	7.98
Cucumix melon	200	0	0	0
Arachis hypogea	200	0	0	0

Table III: Percentage weight loss of the legume seeds to bruchids introduced at different male: female ratios.

Sex ratio of bruchids	Weight loss (in percentage) in different legume seeds							
	Vigna unguiculata var. white	*Cajanus cajan*	*Glycine max*	*Vigna unguiculata* var. brown	*Voandzeia subterrea*	*Pheseolus radiatus*	*C. melon*	*A. hypogea*
10:10	42.55	11.63	3.16	38.15	23.10	21.57	0	0
15:10	55.83	15.58	6.20	51.59	27.22	30.47	0	0
10:15	48.66	12.82	3.86	44.87	21.93	24.27	0	0