Effect of varieties of kerstings groundnut and storage containers on the population growth of *Piezotrachelus varium* Wagner

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SUMMARY

The susceptibility of three varieties of kerstings groundnut (*Kerstingiella geocarpa* Harms.) to the infestation of *Piezotrachelus varium* Wagner syn. *Apion varium* Wagner, during the rainy season and the rate of multiplication of the pest in different storage containers were evaluated in 1988 and 1989. NSK 2 variety was most resistant to the pest damage during storage, followed by Ex-Mali variety. NSK 1 variety was the most susceptible. The multiplication rate of *P. varium* in the containers was highest in the cemented earthen container followed, in decreasing order, by ordinary earthen container, tin, glass, plastic and polythene. It is concluded that NSK 2 variety of kerstings groundnut is most resistant to damage by *P. varium* while polythene is the best storage container.

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RÉSUMÉ

OBASI, M. O.: *Effets des variétés de* Kerstingiella geocarpa *et des récipients de stockage sur la croissance de* Piezotrachelus varium *Wagner.* La susceptibilité de trois variétés de *Kerstingiella geocarpa* Harms. à l'infestation de *Piezotrachelus varium* Wagner syn. *Apion varium* Wagner, pendant la saison de pluie et le taux de multiplication des insectes nuisibles dans des récipients de stockage différent ont été evalués en 1988 et 1989. La variété *NSK 2* était très résistante aux dégats causés par des insectes nuisibles pendant le stockage, suivi par la variété *Ex-Mali*. La variété *NSK 1* était la plus susceptible. Le taux de multiplication de *P. varium* dans le récipient fabriqués à partir de la matière de terre et de ciment, suivi dans l'ordre décroissant par les récipients fabriqués à partir de la matiere de terre seulement, d'étain, de verre, de plastique et de polythène. Il est conclue que la variété *NSK 2* de *Kerstingiella geocarpa* est la plus résistante aux dégats causés par *P. varium* tandis que le polythène est le meilleur récipient pour le stockage.

Introduction

Kerstings groundnut or groundbean (*Kerstingiella geocarpa* Harms.; syn. *Macrotyloma geocarpa* Harms.; Marechal & Baudet) is an underexploited indigenous African leguminous crop cultivated mainly in Nigeria, Mali, Burkina Faso, Benin and Togo. Nigeria, like most African countries, is facing a serious food crisis manifest in the inadequate protein intake of its people. The low protein intake has been attributed to the increasingly high cost of traditional sources of animal protein (Singh *et al.*, 1987).

The search for alternative sources of inexpensive protein has led to increased kerstings groundnut utilization at the home level. The importance of this legume is now recognized as a potential nutritional crop because of high content of protein, carbohydrate, crude fibre and calories in the seed, and sufficient mineral content in seeds, pods and leaves (Hepper, 1963; Obasi & Ezedinma, 1991). One major constraint to its widespread cultivation in Nigeria has been that of low seed yield (Ikeorgu, 1988; Obasi, 1989). This situation is worsened because harvested seeds stored for human consumption are easily infested by insect pests, the most destructive being the bean weevil

(Piezotrachelus varium Wagner syn. *Apion varium* Wagner) (Obasi, 1989).

P. varium is a small shiny black economic insect pest about 3 mm long with a long slender snout. It infests dry pods in the field and continues its attack into stored grains, especially in southern Nigeria where it often attains a pest status (Ezueh, 1978). In a survey of the estimated losses in yield in Nigeria, Singh (1978) attributed 18 per cent yield losses in kerstings groundnut to *P. varium.*

Previous work by Agboola (1982) and Arthur (1989) suggested that damage by bean weevils can be controlled only by the use of insecticides. But conflicting reports appear in literature on the effectiveness of insecticides in controlling bean weevils. Whintney (1972), Singh (1973) and Singh (1975) reported results ranging from good control to significant increase in damage by *Callosobruchus* spp. through the use of insecticides in stored legume seeds in Nigeria. Singh, Aagerwal & Girish (1985) reported the effect of development of *P. varium* grubs on the quantitative loss in stored cowpeas (*Vigna unguiculata* (L.) Walp.) treated with insecticides. Similarly, Adams (1986) observed weight loss in preserved cowpeas and soyabeans (*Glycine max* (L.) Merr.) due to population growth of *Callosobruchus maculatus.*

Several authors (Hall, 1970; Adeniji, 1977; Agboola, 1980, 1982) have emphasized the economic importance to save crop produce from deterioration and waste. Recommendations given in these reports have not gained wide application for socio-economic reasons. Thus, testing insecticides against storage pests has continued unabated. It is necessary, therefore, to search for a more acceptable and effective means to minimize storage damage due to bean weevils.

This paper reports the effect of different types of containers on the population growth of *P. varium* in three varieties of kerstings groundnut cultivated in Nigeria.

Materials and methods

Three kerstings groundnut varieties NSK 1, NSK 2, and Ex-Mali and six different types of cylindrically-shaped containers of approximately uniform volume were used. Each container measured about 30 cm in height and 20 cm in diameter. Prior to the experiment, the containers were sterilized by thorough cleaning with cotton wool deeply soaked in 1 per cent sodium hypochlorite solution. Moisture content of each variety was determined by keeping known weight of seed in a ventilated oven at 60 °C till constant weight was achieved. One of the containers was made up of transparent white glass while the others were non-transparent and consisted of white plastic, black polythene, metallic white tin, and brown-coloured ordinary earthen containers as well as an ash-coloured cemented earthen container.

Hundred grams of seed of each variety was placed in the different types of containers in replications of ten. Five pairs of freshly-emerged adults of *P. varium* were released separately in each container after which they were closed with perforated lids and were kept in well ventilated and protected cages for observations. The experiment was performed at the Research and Teaching Farm of University of Nigeria, Nsukka (Latitude 6° 52'N; at 400 m above mean sea level) during the 1988 and 1989 rainy season (April to July) under room temperature and humidity conditions. Minimum and maximum temperatures and relative humidity ranged from 20.3 to 23.7 °C; 28.8 to 34.4 °C and 52 to 85 per cent respectively.

The first observation was made at 45 days from the date of release of insect and subsequent samplings were taken at intervals of 15 days each until 120 days. Only the adult weevils were counted as an index of population growth. The moisture content of each variety during the period of observation was determined only at 120 days. The suitability or unsuitability of a particular variety of kerstings groundnut or container was assessed on the basis of increase or decrease in number of adult weevils respectively.

The experiment was set up as a 3 × 6 factorial in a split plot design. Varieties was used as mainplot and storage containers as subplot. Data collected

was analysed statistically using the analysis of variance procedure described by Steel & Torrie (1960). The treatment effects were compared either by the *F*-LSD procedure (Carmer & Swanson, 1971) or the Duncan's new multiple range test.

Results and discussion

A significant effect of container and variety of kerstings groundnut on the multiplication of *P. varium* was observed (Table 1). The insects multiplied most in the cemented earthen container and least in the polythene. The multiplication rate in different containers in decreasing order was: cemented earthen container > ordinary earthen container > tin > glass > plastic > polythene. Most of the differences in number of insects in different containers were significant ($P<0.001$). However, the rate of weevil multiplication on NSK 1 variety in ordinary earthen and tin containers were not significant. The difference in plastic and polythene containers in NSK 1 and NSK 2 varieties of kerstings groundnut was also not significant. In Ex-Mali variety, the non-significant value was observed only between tin and glass containers.

Table 1 also shows that there is considerable effect of variety of kerstings groundnut on the reproduction of the bean weevil. Among the three varieties, NSK 1 was the most susceptible to infestation. The susceptibility of the varieties in decreasing order was NSK 1 > Ex-Mali > NSK 2. The susceptibility rate was highly significant in containers and among varieties of kerstings groundnut under investigation.

TABLE 1

Population Growth of Piezotrachelus varium *in Different Containers and Three Varieties of Kerstings Groundnut*

Kerstings groundnut varieties	*Initial number of adult* P. varium	*Mean (with SD) of insect population in different containers at 120 days*						
		Cemented earthen container	*Ordinary earthen container*	*Tin*	*Glass*	*Plastic*	*Polythene*	*Mean*
NSK 1	10	110.7 ±11.5	85.2 ±6.4	84.2 ±5.2	71.5 ±8.5	50.2 ±4.9	48.2 ±5.4	75.0
Ex-Mali	10	92.5 ±9.3	71.2 ±7.8	66.1 ±5.8	64.9 ±6.4	42.2 ±4.3	33.1 ±2.1	61.7
NSK 2	10	66.9 ±9.0	55.7 ±4.1	45.7 ±2.4	37.7 ±4.0	29.2 ±3.1	25.7 ±3.3	43.5
Mean		90.0a*	70.7b	65.3c	58.0d	40.5e	35.7e	
F-LSD (P=0.001)		Varieties of kerstings groundnut 5.21		*Means in the row with the same letter do not differ significantly (P=0.001) by Duncan new multiple range comparison.				

The moisture content at 120 days was highest (15.8%) in NSK 1 and lowest (10.4%) in NSK 2 with Ex-Mail (12.3%) intermediate. It appeared that the varieties NSK 2 and Ex-Mali, in addition to having low moisture content, were also less susceptible to infestation of *P. varium*. While the previous workers (Singh, *et al.*, 1985) could not establish any definite relative variation in the effect of *P. varium* between local and hybrid varieties of cowpea studied, the present observation clearly indicates that NSK 2 variety is more resistant to *P. varium* infestation than NSK 1 and Ex-Mali varieties. Ex-Mali was, however, more resistant than NSK 1. The increase in population of bean weevils appears to be directly proportional to the moisture content of

the seeds, a view which agrees with that of Pingale & Girish (1980), Gangwar & Dasgupta (1985). In the present study, it was observed that NSK 1 variety had the highest moisture content followed by Ex-Mali and NSK 2. The increase in the population of weevils was also found to be in the same order.

Moisture in seed is dependent upon the properties of the material used for the storage (Khare *et al.*, 1972; Singh, Singh & Chhotoo, 1977; Agboola, 1982). Out of the six evaluated storage containers, the multiplication rate of *P. varium* was highest in the cemented earthen container and lowest in polythene. It can, therefore, be presumed that the micro-environmental changes which occurred during the period of insect development might be more favourable in the case of cemented earthen container and least favourable in polythene container. Due to the more porous nature of the earthen containers, ventilation was probably better for insect development than in the other containers. This might be the reason for the greater rate of multiplication of the weevils in earthen containers. Thus, it can be concluded that out of the three kerstings groundnut varieties studied, NSK 2 is least susceptible to infestation by *P. varium* and polythene is the best storage container.

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