Evaluation of certain spices for the control of *Callosobruchus maculatus* (Fabricius) (Coleoptera: Bruchidae) in cowpea seeds

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Cowpea, *Vigna unguiculata* (Linnaeus) (Leguminosae), an important tropical and subtropical legume, is the main source of dietary protein in many African countries. The cowpea seed beetle, *Callosobruchus maculatus* (Fabricius) causes severe damage to cowpea seeds (Caswell 1975; Singh 1987), and is a major constraint in cowpea storage, particularly on a small-scale farming level (Javaid et al. 1993). The damage is done by the larvae feeding inside the seeds. The damaged seeds lose weight, market value and are generally unacceptable for human consumption.

Various insecticides have been recommended to reduce losses caused by *C. maculatus* (Compton et al. 1993; Tyler 1978), but chemical control is not feasible at a subsistence level (Caswell 1975). Chemical control has been difficult to implement because of the high cost of insecticides and fear of poisoning (Echendu 1991). Owing to technical and financial constraints, farmers in many developing countries do not implement chemical control of *C. maculatus*, and insecticides also have various other negative side effects. To overcome these problems, there is a need to investigate safer alternative methods of control, particularly at a subsistence farming level. The use of plant derivatives and spices is one of the oldest methods known to control storage pests. Many small-scale farmers have used spices for the control of insect pests of seeds since early times. Some plant products and spices such as garlic, ginger, turmeric and black pepper have been reported to have potential for pest control (Stoll 1988; Grainge et al. 1985; Pranata 1985). Plant derivatives are currently receiving greater attention because they are biodegradable and safer for non-target organisms. A study was consequently undertaken to evaluate the effect of commonly used spices in powder form against *C. maculatus* in cowpea seeds in Botswana.

Details of the spices and other treatments are provided in Table 1. Spices were obtained from a local retail shop. Black pepper and cloves were ground using an electrical grinder and others were purchased in powder form. Fifty grams of cowpea seeds (Black-Eye variety) were weighed and placed in 0.5 l glass jars. One gram of spice powder was mixed thoroughly with seeds in each glass jar.

Two pairs of *C. maculatus* (0–24 hours old) were...
Table 1. Efficacy of certain spices against *Callosobruchus maculatus* in cowpea seeds.  

<table>
<thead>
<tr>
<th>Common names of spices</th>
<th>Scientific names</th>
<th>Plant parts used</th>
<th>Oviposition (eggs/jar)</th>
<th>Weight loss of seeds (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloves</td>
<td><em>Eugenia caryophyllus</em></td>
<td>Flowers</td>
<td>0.00 d</td>
<td>0.00 c</td>
</tr>
<tr>
<td>Ginger</td>
<td><em>Zingiber officinale</em></td>
<td>Rhizome</td>
<td>125.50 ab</td>
<td>45.50 a</td>
</tr>
<tr>
<td>Turmeric</td>
<td><em>Curcuma domestica</em></td>
<td>Rhizome</td>
<td>70.35 bc</td>
<td>42.95 a</td>
</tr>
<tr>
<td>Black pepper</td>
<td><em>Piper nigrum</em></td>
<td>Fruits</td>
<td>21.75 cd</td>
<td>1.17 c</td>
</tr>
<tr>
<td>Chilli pepper</td>
<td><em>Capsicum frutescens</em></td>
<td>Fruits</td>
<td>97.75 ab</td>
<td>44.85 a</td>
</tr>
<tr>
<td>Garlic</td>
<td><em>Allium sativum</em></td>
<td>Bulbs</td>
<td>92.75 a</td>
<td>43.32 a</td>
</tr>
<tr>
<td>Wood ash</td>
<td><em>Combretum imberbe</em></td>
<td>Stems</td>
<td>21.50 cd</td>
<td>19.50 b</td>
</tr>
<tr>
<td>Malathion (1.5 %)</td>
<td>—</td>
<td>—</td>
<td>0.00 d</td>
<td>0.00 c</td>
</tr>
<tr>
<td>Control (untreated)</td>
<td>—</td>
<td>—</td>
<td>145.00 a</td>
<td>46.70 a</td>
</tr>
</tbody>
</table>

1. Means with the same letter in each column are not significantly different at $P = 0.05$ level according to Duncan's multiple range test. An arcsine transformation was applied to the data on percentage weight loss.

introduced into each jar. Malathion (1.5 % powder) and ash of the motswere tree (*Combretum imberbe*) were also included in the experiment for comparison (Tyler 1978).

The jars were covered with fine muslin cloth secured with rubber bands and were arranged in a randomized complete block 3 design with four replications. The experiment was conducted at room temperature, at about 25 ± 2 °C.

Eggs were counted 10 days after infestation and the weight loss of seeds was recorded 70 days after infestation. The percentage weight loss was converted into arcsine, data were subjected to an analysis of variance, and significant means were separated by using Duncan’s multiple range tests (Steel & Torrie 1980).

There were significant differences between the treatments with respect to oviposition and weight loss (Table 1). The highest number of eggs was observed in the untreated control. No eggs were observed on the seeds which were mixed with malathion and powdered cloves. Also, the number of eggs laid by females in treatments with wood ash, black pepper and cloves did not differ statistically from those in the malathion treatment. However, there were no significant differences in oviposition in the untreated control and treatments with garlic, ginger, turmeric and chilli pepper.

The data on percentage weight loss indicated no significant difference in the treatment with malathion, black pepper and cloves (Table 1). There was also a lower weight loss in the treatment with wood ash.

The effectiveness of cloves against *C. maculatus* requires further study. Black pepper also gave encouraging results. The use of black pepper is considered to be an inexpensive means of protecting cowpea in storage from infestation (Ivbijaro & Agbaje 1986). In previous studies, brown pepper (*Piper guineense* Schum) yielded promising results against the cowpea seed beetle (Ivbijaro & Agbaje 1986; Olaifa & Ehrun 1988; Ivbijaro 1990). The results of the present study are supported by the previous findings. However, the effectiveness of garlic, ginger and chilli powder was generally lower than in the previous reports (Echendu 1991; Ajaji *et al.* 1987; Ofuya 1986; Stoll 1988) and this could be attributed to the lower dosage levels used in our study. However, the objective of the study was to investigate the most economical method of pest control. Fresh spices might have provided better results.

Some of the spices clearly provided encouraging results which stimulate the need for further studies on the evaluation of dosage levels. The spices are not toxic to human beings and their use in storage pest control should be exploited. More research on the screening, economics, development and promotion of plant products is suggested because it can play an important role in the management of various pests at small-scale farming level in developing countries.

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REFERENCES


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Procecidochares utulis Stone (Diptera: Tephritidae: Oedaspidini) in South Africa

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When Freidberg & Kaplan (1992) revised the Afrotropical Oedaspidini, they were unaware of the release of Procecidochares utulis Stone (Diptera: Tephritidae) in South Africa nearly 10 years earlier. This release was made to control crofton weed, Ageratina adenophora (Sprengel) King & Robinson, also referred to as Eupatorium adenophorum Sprengel (Asteraceae), an ornamental plant that became a weed, introduced into South Africa before 1948 (Kluge 1991). The establishment of P. utulis in South Africa was reported in the agricultural and biological control literature (Kluge 1991; Julien 1992), but not in taxonomic publications. As a result of their being unaware of this introduction, P. utulis was not included in Freidberg & Kaplan’s (1992) revision, nor was the genus Procecidochares Hendel included in their key to Old World genera of Oedaspidini, despite the fact that P. utulis, a Neotropical species, had previously been introduced into several Old World countries.

During a recent visit by one of us (A.F.) to South Africa, a population of this species (adults, galls and immature stages) was encountered in the gardens of the Union Buildings, Pretoria, where it was released in 1984 and has persisted (Neser, pers. comm.). The purpose of this note is, therefore, to inform the general entomological community that P. utulis is established in South Africa (and therefore...