CONTACT TOXICITIES OF TEN INSECTICIDES TO THE SUGARCANE GRUB, *LIGYRUS SUBTROPICUS* (COLEOPTERA: SCARABAEIDAE)

R. H. Cherry and J. A. Dusky
University of Florida, IFAS,
Agricultural Research and Education Center,
P.O. Drawer A,
Belle Glade, FL 33430 USA

ABSTRACT

Contact toxicities of 10 insecticides were measured for 3rd instar larvae of the sugarcane grub, *Ligyrus subtropicus* Blatchley. *L.D.₀₀* value and confidence interval, slope, and relative toxicity of each insecticide are presented as determined by probit analysis. The relative toxicities of the insecticides were carbofuran > fensulfothion > fonophos > isophenphos > 6 other insecticides tested. Associated field studies on the 2 most toxic insecticides, carbofuran and fensulfothion are discussed.

RESUMEN

La toxicidad por contacto de 10 insecticidas fueron medidas durante el tercer estado de crecimiento de las larvas de un escarabajo de la caña de azúcar, *Ligyrus subtropicus* Blatchley. El valor *L.D.₀₀* con el intervalo de confianza, la pendiente, y la toxicidad relativa de cada insecticida son presentados con los resultados del análisis probit. Las toxicidades relativas fueron como en seguida: carbofuran > fensulfothion > fonophos > isophenphos > 6 otros insecticidas. Los estudios de campo relacionados con los dos insecticidas mas toxicos, eso es, carbofuran y fensulfothion, son discutidos.

Florida's most valuable field crop, sugarcane, is grown primarily in the Lake Okeechobee area of south Florida. Since 1971, several species of Scarabaeidae have been damaging sugarcane in south Florida. Of these pests, the white grub, *Ligyrus subtropicus* Blatchley is the species of primary economic importance (Gordon and Anderson 1981). In extreme infestations, sugarcane plants fall over due to lack of support caused by the root-feeding larvae. Currently, sugarcane growers must disc-up and replant badly infested fields or, if possible, flood fields to kill grubs (Summers 1977), since no chemical control is known for this pest in sugarcane. The only information on toxicants for *L. subtropicus* is by Reinert (1979) and concerns the insecticidal control of a grub complex, including *L. subtropicus*, found in bermudagrass (*Cynodon x magonissi* Hurcombe). Unfortunately, *L. sub-
tropicus was not analyzed separately from the overall grub complex making it difficult to evaluate the efficacy of the toxicants against this species. Reported here are the contact toxicities of 10 insecticides to the sugarcane grub, L. subtropicus.

MATERIALS AND METHODS

Third instar grubs of L. subtropicus were obtained during September 1982 through April 1983 from commercial sugarcane fields in south Florida by digging under sugarcane stools. After field collection, grubs were retained at room temperature (22°C to 25°C) in 7.56 liter plastic buckets filled with muck soil and sliced carrots for food.

Acetone-insecticide solutions (2 µl/grub) were topically applied to the lateral thorax of individual grubs with a micro-syringe. The 10 insecticides (acephate, carbofuran, ethoprop, fensulfothion, fonophos, isofenphos, lindane, monocrotophos, phorate, turbufos) were technical grade material. A preliminary screening using concentrations over 5 degrees of magnitude (0.001-10%) was made for each insecticide. Thereafter, 7 intermediate dosages in geometric progression (1x, 2x, 4x, etc.) were chosen for each insecticide so that the lowest and highest would yield ca. 0 and 100% mortality, respectively. Twenty-five grubs were tested for each of the 7 dosage levels of each insecticide. After each dosage application, 5 grubs were placed in a 19 x 13 x 8 cm high plastic pan filled with moist muck soil and sliced carrots. Grubs were then maintained in a temperature cabinet in constant darkness at 20°C along with acetone treated grubs (controls). Some insecticides continued to cause mortality up to 14 days post-treatment and, hence, 14 days post-treatment was used to record mortality. Piko et al. (1978) also noted the "slow" action of several insecticides which were topically applied on the grub, Phyllonorycter anzia (LeConte). At the end of 2 weeks, most dead grubs were already decomposing and remaining grubs were considered dead if they did not twist their bodies in response to prodding with a pencil. Percent mortality was corrected for natural mortality by use of acetone-treated controls (Abbott 1925). The average weight of individual grubs tested was 3.28 g determined from 50 individuals weighed during different months during the study period. Data were subjected to probit analysis using the Statistical Analysis System (SAS) computer program (Barr et al. 1979). Relative toxicity (%) was determined by dividing the lowest LD₅₀ obtained among the 10 insecticides by the LD₅₀ of each insecticide and multiplying x 100.

RESULTS AND DISCUSSION

Table 1 presents topical toxicities, 95% confidence intervals, slopes of the dosage-response lines, and relative toxicities of the 10 insecticides to third instar grubs of L. subtropicus. This grub stage is present after sugarcane is harvested in the fall-winter, and would be the logical target stage for soil insecticides which are more easily applied to fields at this time. The method of topical application used in this study has been widely used to measure insecticide toxicity (e.g., Busvine 1971). Unfortunately, this method has not been used previously on L. subtropicus and it is therefore difficult to compare our data directly with others. However, our results are
Table 1. 95% confidence interval for third instar white grubs, *Ligyrus subtropicus*, treated with 10 insecticides.

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; (µg/grub)</th>
<th>Slope&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Relative toxicity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbofuran</td>
<td>0.67</td>
<td>0.38-1.07</td>
<td>0.92</td>
</tr>
<tr>
<td>Fensulfothion</td>
<td>1.01</td>
<td>0.79-1.22</td>
<td>3.10</td>
</tr>
<tr>
<td>Fonophos</td>
<td>3.31</td>
<td>2.06-5.17</td>
<td>0.42</td>
</tr>
<tr>
<td>Isofenphos</td>
<td>3.34</td>
<td>2.04-5.28</td>
<td>1.86</td>
</tr>
<tr>
<td>Monocrotophos</td>
<td>4.42</td>
<td>3.13-7.17</td>
<td>1.61</td>
</tr>
<tr>
<td>Terbufos</td>
<td>5.36</td>
<td>4.14-6.71</td>
<td>2.21</td>
</tr>
<tr>
<td>Lindane</td>
<td>6.01</td>
<td>3.42-11.27</td>
<td>0.82</td>
</tr>
<tr>
<td>Ethoprop</td>
<td>9.46</td>
<td>7.81-11.49</td>
<td>2.37</td>
</tr>
<tr>
<td>Phorate</td>
<td>21.44</td>
<td>15.99-28.87</td>
<td>1.91</td>
</tr>
<tr>
<td>Acephate&lt;sup&gt;1&lt;/sup&gt;</td>
<td>&gt;222.20</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

<sup>1</sup>Probit analysis on log. 10 of dose.
<sup>2</sup>Saturated solution (11.1%) at 23°C applied at 2 µl/grub.

Remarkably similar to those of Pike et al. (1978) on another white grub, *P. angria*. The sequence of topical toxicity of 4 insecticides common to both studies was the same in that the carbofuran LD<sub>50</sub> < fensulfothion LD<sub>50</sub> < fonophos DI<sub>50</sub> < terbufos LD<sub>50</sub> (Table 1). Furthermore, carbofuran and fensulfothion produced the lowest LD<sub>50</sub>'s among the insecticides tested in both studies. Both of these insecticides have been shown to be consistently effective in reducing white grub populations in various field studies. In Texas, the 2 insecticides were effective against the white grub, *Phyllophaga crinita* (Burmeister) by Teetes (1973), Fuchs et al. (1974), and Huffman et al. (1976). In Ohio, fensulfothion consistently gave excellent control of cyclodiene-resistant larvae of the Japanese beetle, *Popillia japonica* (Newman) under a wide range of conditions in turf (Lawrence and Niemczyk 1976). In Florida, both carbofuran and fensulfothion was effective against a grub complex, including *L. subtropicus*, infesting bermudagrass (*Cynodon x magennsis* Hurcombe) (Reinert 1970). Carbofuran and fensulfothion are moderately persistent in soil based on their biological activity (Harris 1972).

As noted earlier, no chemical control is currently known for *L. subtropicus* in Florida sugarcane partly due to difficulties in field insecticidal evaluations for the pest. In Florida sugarcane, *L. subtropicus* is found mainly in muck soil (Gordon and Anderson 1981). Effectiveness of soil insecticides is reduced because of the high (>85%) organic content of the muck soil (Lilly 1956, Harris 1972). Furthermore, field evaluation of soil insecticides can only be made during the late fall to spring period after sugarcane fields have been harvested. At this time *L. subtropicus* is at its lowest field density making statistical analysis difficult. Data from this study are useful for selecting toxicants for more extensive field evaluation for *L. subtropicus* control in Florida sugarcane.

**ENDNOTES**

This is University of Florida, IFAS Experimental Journal Series No. 4714. Use of a trademark name does not constitute a guarantee or warranty
of the product and does not imply its approval to the exclusion of other products that may also be suitable. We thank Dr. G. H. Snyder for a statistical suggestion and Dr. J. Alvarez for the Resumen translation. This work was supported in part by a grant from the Florida Sugarcane League.

REFERENCES CITED


---

FALL ARMYWORM (LEPIDOPTERA: NOCTUIDAE) DAMAGE TO FIFTEEN VARIETIES OF SORGHUM

D. L. Anderson and R. H. Cherry
University of Florida, IFAS
Agricultural Research and Education Center
P. O. Drawer A
Belle Glade, FL 33430 USA

ABSTRACT

Feeding damage by fall armyworm, *Spodoptera frugiperda* (J. E. Smith), among 15 sorghum varieties and correlations of this damage with 5 plant variables were measured. The population distribution of the insect on plants of one variety was also measured. Results showed significant differences in