NOTE

BIOASSAY OF THE PERSISTENCE OF *BACILLUS THURINGIENSIS* ON SORGHUM PANICLES

Key Words: Persistence, *Bacillus thuringiensis,* sorghum, bioassay, *Trichoplusia ni.*

J. Entomol. Sci. 22(3): 210-211 (July 1987)

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Persistence of *Bacillus thuringiensis* Berliner on crop foliage is often a limiting factor in the use of this microbial insecticide in selected agricultural systems. For example, ca. 64% of the original activity of *B. thuringiensis* is lost within 24 h after application to soybean foliage (Ignoffo, C. M., D. L. Hostetter, and R. E. Pinnell. 1974. Environ. Entomol. 3: 117-19). Similarly, the half-life of its toxicity on cotton foliage is 47 h, irrespective of the dosage level applied (Beegle, C. C., H. T. Dulmage, D. A. Wolfenbarger, and E. Martinez. 1981. Environ. Entomol. 10: 400-1). Initial density of the infective units and the rate and pattern of decline in the numbers and quality of these infective units are important parameters in determining effective field dose and the degree of control obtained with a microbial agent (Pinnock, D. E., and R. J. Brand, pp. 655-665. *In* H. D. Burges [ed.], Microbial Control of Pests and Plant Diseases 1970 - 80, Academic, London, 1981).

We undertook the study reported herein to define the field persistence of *B. thuringiensis* on panicles of grain sorghum. In Georgia, sorghum panicles are attacked by several lepidopteran pests including *Heliothis zea* (Boddie), *Spodoptera frugiperda* (J. E. Smith), *Celama sorghiella* (Riley), and *Ostrinia nubilalis* (Hübner). Larval feeding generally begins on the sorghum flowers and continues on the developing grain for a period of 2 to 3 weeks or until the grain hardens and matures.

Bacillus thuringiensis was applied as a wettable formulation (Dipel, Abbott Laboratories, North Chicago, IL) to two separate plantings of grain sorghum in August 1982 at a rate of 1.1 kg of formulation per ha. Applications were made with a hand-operated compressed-air sprayer directing the nozzle to opposite sides of each panicle to achieve thorough coverage. The plants had ceased flowering and the developing grain was in soft dough at the time of application in both tests. Untreated areas in both plantings served as experimental checks. Average maximum and minimum temperatures recorded during the sampling period were 30 and 18.3°C (86.5 and 65.0°F), respectively. No rainfall was measured during this interval.

Toxicity of the *B. thuringiensis* on the sorghum grain was measured 0, 24, 48, and 168 h after application by bioassaying samples of the grain against neonate *Trichoplusia ni* (Hübner) larvae. At each postapplication interval, four 5-gram samples of grain were randomly selected from the treated and untreated plots of each test and returned to the laboratory for assay. A 0.5-gram subsample of grain was then taken from each grain sample and macerated in a tissue grinder with 2 ml of sterile distilled water. A 0.06-ml droplet of the solution was smeared on the surface of a semisynthetic wheat-germ diet (with no antibiotics added) contained in individual 30-ml plastic creamer cups. After allowing the surfaces to air-dry, neonate *T. ni* larvae were placed individually in the cups. Depending upon availability of larvae, 20 to 60 larvae were used for each replicate in the two tests. Mortality was recorded 10 days after placement of larvae on the diet.

Results of the two tests were combined and Abbott's formula was applied to correct for mortality observed in the checks. Natural mortality in the untreated checks was 4.8, 11.2, 35.6, and 39.4% at 0, 24, 48, and 168 h after application, respectively. Resultant toxicity of *B. thuringiensis* at the sampling intervals is presented in Table 1. Approximately one-half of the original activity (0-h postapplication) of *B. thuringiensis* was lost within 24 h after application to the sorghum panicles. All activity was lost by 7 days after application.

Table 1. Bioassay of the field persistence of *Bacillus thuringiensis* (Dipel) on sorghum panicles as it relates to its toxicity to neonate *Trichoplusia ni* larvae.

Postapplication interval (hours)	Corrected avg. % mortality*	% OAR†
0	26.5 (330)	100.0
24	13.0 (472)	49.1
48	13.5 (165)	50.9
168	0.0 (180)	0.0

* Avg. % mortality corrected for natural mortality in untreated checks by Abbott's formula; total no. of larvae in bioassay in parenthesis.

† Percentage of original activity remaining as based on avg. % infection at 0-h treatment interval.

Rapid decrease in the activity of *B. thuringiensis* on sorghum panicles coupled with the relatively initial high dosage levels required to kill *H. zea* and *S. frugiperda* larvae (Gardner, W. A., and J. R. Fuxa. 1980. Fla. Entomol. 63: 439-47) limit the use of this microbial insecticide in managing the lepidopteran complex attacking grain sorghum panicles. — Wayne A. Gardner and Jonathan A. Hornby,[1] Department of Entomology, College of Agriculture Experiment Stations, Experiment, GA 30212. (Accepted for publication February 18, 1987)

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