Effect of Ronnel on the Honey Bee

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EFFECT OF RONNEL ON THE HONEY BEE

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ABSTRACT

LD₅₀ for worker honey bees of unknown ages exposed to topical applications was 1.5 micrograms/bee in 24 hours. LD₅₀ for similar bees fed ronnel in sugar syrup was 3.0 micrograms/bee in 24 hours. Honey bees did not visit materials treated with ronnel in laboratory tests where bees had a choice between food with and without ronnel added.

SEVERE losses of adult honey bees (Apis mellifera L.) apparently poisoned by ronnel, an organic-phosphorothionate pesticide, were reported by Howard Taylor of eastern South Dakota. His bees apparently visited mineral feed meal containing 6 percent ronnel. Most beekeepers in eastern South Dakota establish colonies in April using three frames of brood, bees and new queens brought in from the south. Very few beekeepers over winter their colonies in the area. The bees soon consume the available supply of stored pollen in the combs and begin foraging for fresh pollen. Losses of adult bees usually occur about three weeks after being installed in colonies and are especially noticeable during periods of pollen dearth when bees visit cattle feed lots in search of a pollen substitute. Bees will collect such materials as grain dust, feed meal dust, and other materials and carry them back to the hive. However, the nurse bees are unable to utilize such materials and brood rearing stops and the adult bee population of the hive begins to dwindle until sufficient natural pollen is again available.

Johansen (1966) reported that ronnel was not hazardous if applied to crops when bees are not foraging. Atkins, et al. (1970) reported LD₅₀ in microgram per bee of 5.739 slope volume 2.10 when bees were dusted in a vacuum bell-jar duster. I sought (1) to determine the dose of ronnel (micrograms per bee) that would cause 50 percent mortality (LD₅₀) when it was topically applied and when it was fed to bees in sugar syrup; and (2) to test visitation to replicates of material treated and untreated with ronnel in a controlled flight room.

METHODS AND MATERIALS

Chemicals. The chemicals used in this study were provided as follows: Moorman' RID-EZYR medicated mineral feed meal containing 6 percent ronnel. Johanneson (1966) reported that ronnel was not hazardous if applied to crops when bees are not foraging. Atkins, et al. (1970) reported LD₅₀ in microgram per bee of 5.739 slope volume 2.10 when bees were dusted in a vacuum bell-jar duster. I sought (1) to determine the dose of ronnel (micrograms per bee) that would cause 50 percent mortality (LD₅₀) when it was topically applied and when it was fed to bees in sugar syrup; and (2) to test visitation to replicates of material treated and untreated with ronnel in a controlled flight room.

Fig. 1. Topical application of ronnel.

Fig. 2. Toxicity of ronnel in sugar syrup.

Graphs show effects of Ronnel over a 24-hour period.
ronnel, ronnel analytical standard 99.4 percent pure; ronnel technical grade 98.4 percent pure; and Trolene® 18 insecticidal salt premix containing 18 percent ronnel.

The analytical methods used for the analysis of ronnel were those of Dow Chemical Co., Midland, Michigan. The ronnel analytical standard was turned over to Joseph C. Street, Professor, Animal Science, who used the methods in the analysis of any suspect samples of bees and other materials.

**Topical application of ronnel pesticide in the laboratory.** Tests to determine the dermal LD₅₀ were made in November, 1972, in the Laboratory at Logan, Utah. Worker honey bees of unknown ages were taken in bulk from the top story of a strong colony, anesthetized with carbon dioxide, treated by applying acetone dilutions of the material with a Dutky-Fest microinjector to the thorax, caged, and held in an incubator maintained at 28.3 to 30.0°C (83-86°F). Bees used for controls were treated with acetone only. Each dose was tested against four groups of 10 bees each. Subsequently, the bees were fed by placing the cages over 5 ml. watch glasses containing 50 percent sugar syrup. Mortality was determined after 24 hours.

Tests to determine the oral LD₅₀ were made by feeding acetone dilutions of the ronnel mixed with 50 percent sugar syrup to caged bees. The bees were fed by placing the cages over 5 ml. watch glasses containing the treated or untreated sugar syrup. Check bees were given acetone only in sugar syrup. The test bees were held in an incubator maintained at 28.3 to 30.0°C and mortality was determined after 24 hours.

**Bee visitations to ronnel.** Four replications of materials treated or untreated with ronnel and placed in small dishes in the flight room were tested as follows:

- **Experiment I:** Pollen, feed salt (NaCl), soybean flour, and Moorman's RID-EZY medicated mineral meal feed containing 6 percent ronnel.
- **Experiment II:** Pollen, feed salt, soybean flour, rolled oats and molasses, and RID-EZY meal (6 percent ronnel).
- **Experiment III:** Pollen, feed salt, soybean flour, RID-EZY meal (6 percent ronnel) and pollen mixed with Dow Trolene (6 percent ronnel).

The materials were offered to the bees for from one hour to one day. Each test was repeated three times.

**RESULTS**

The LD₅₀ for the material was derived graphically from the mortality-survival data. The LD₅₀ for worker honey bees of unknown ages exposed to topical applications of ronnel was 1.5 micrograms per bee in 24 hours (Fig. 1). The LD₅₀ for similar workers fed ronnel in sugar syrup was 3.0 micrograms per bee in 24 hours (Fig. 2).

The only ronnel treated material visited by bees was the pollen + trolene (6 percent ronnel) tested in Experiment 3, and this material was only visited when it was placed next to a dish of untreated pollen. Honey bees readily collected the untreated pollen in all 3 experiments (8.24, 8.5 and 7.25 bees per observation, respectively).

**DISCUSSION AND CONCLUSIONS**

Ronnel will kill bees by contact and ingestion, but bees do not normally visit materials treated with ronnel in laboratory tests where bees have a choice between food with and without ronnel added. To the contrary, the same feed containing ronnel seemed to repel bees in controlled laboratory comparison/choice tests.

**REFERENCES**

