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3-10-1982

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Merson, Mark H. and Byers, Ross E., "ORCHARD RODENT BAITS: TOXICANT EVALUATIONS AND VOLE PELLET SIZE PREFERENCES" (1982). *Eastern Pine and Meadow Vole Symposia.* Paper 34.
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ORCHARD RODENT BAITS: TOXICANT EVALUATIONS AND VOLE PELLET SIZE PREFERENCES

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Abstract: Residues of the anticoagulant rodenticide Brodifacoum in meadow voles (*Microtus pennsylvanicus*) sampled from an orchard population after broadcast treatment with the commercial bait VOLID decreased as the orchard rate of application and concentration of Brodifacoum in the bait decreased. Oral LD_{50} determinations for the experimental rodenticide EL-614 were 8.8 mg/kg for meadow voles and 24.0 mg/kg for pine voles (*M. pinetorum*). No size preference by meadow and pine voles for bait pellets from 2.38 to 4.76 mm in diameter was observed in laboratory tests.

Introduction:

Rodenticides represent a cost-effective means of controlling orchard vole numbers but their use is not without associated problems. Among these are non-target species hazard, bait acceptance, and the possibility of resistance developing after prolonged use. In our laboratory we have examined secondary poisoning hazard from the use of the anticoagulant Brodifacoum and evaluated different pellet sizes to increase bait acceptance by voles. In addition, we tested a new acute rodenticide, EL-614, against orchard voles.

Secondary poisoning hazard

In the fall of 1979 two sections of an orchard heavily infested with meadow voles (*Microtus pennsylvanicus*) were treated with a bait containing 0.005% of the anticoagulant Brodifacoum (BFC) at 10.5 or 45.9 kg per orchard hectare (Merson and Byers 1981a). BFC burdens in live voles captured from the orchard 1 day to 2 weeks after bait application (45.9 kg/ha) averaged 4.11 ± 0.21 ppm. Live voles captured from the area treated at 10.6 kg/ha carried a mean (± SE) burden of 1.97 ± 0.16 ppm BFC. In 1980 0.001% BFC bait was applied to the same orchard at 22.5 kg/ha. Meadow voles collected from this orchard at 1 to 14 days after bait application (n = 78) carried an average of 0.65 ppm BFC. Reduction in the amount of active ingredient in the bait was apparently effective in lowering BFC residue burden in the voles and, consequently, secondary poisoning hazard to vole predators.

EL-614

An experimental rodenticide, EL-614, was tested in the laboratory for efficacy against meadow and pine voles (*M. pinetorum*). EL-614 (Eli Lilly Co.) is a single-dose acute neurotoxin. Acute oral LD_{50} determinations were made for each species according to standard methods (American Society for Testing and Materials 1978). The oral LD_{50} for EL-614 in corn oil for meadow voles was 8.8 mg/kg and 24.0 mg/kg for pine voles. In 3-day choice tests against apple fruit (Merson and Byers 1981b), 70% mortality was observed in meadow voles fed 0.015% EL-614 bait. A similar level of mortality was not observed

for pine voles even at bait concentrations as high as 0.04% EL-614. There was an indication of taste aversion to pine voles with EL-614 as shown by the significant ($P < 0.05$) decline in first day bait consumption at increasing dosages.

Pellet size preference by meadow and pine voles was studied in the laboratory in 1.83 m (6 ft.) diameter water tanks. A 60 cm circle was drawn on the floor of each tank inside of which were 3 nest cans. 'Golden Delicious' apples were placed around the circle and were continuously available to the voles. Meadow or pine vole pairs of the same sex were acclimated in the tanks for 24 h. One hundred pellets of one of 3 pellet sizes (2.38, 3.18, or 4.76 mm diameter) were broadcast in the tanks outside the 60 cm circle. After 16 h, the weight and numbers of pellets handled, consumed or cached were measured. Any pellets found inside the 60 cm circle were considered cached. The number of pellets cached or consumed were called numbers handled.

No significant effect of pellet diameter was observed on pellet consumption (g) by either vole species (Table 1). There was no significant effect of pellet diameter on the number of pellets handled by either species. There was a significant effect of pellet diameter on the number of pellets cached by pine voles ($P < 0.05$) with significantly greater numbers of the 4.76 mm size found cached. This effect was influenced by the number of pellets per unit weight of each size, however. The number of 4.76 mm diameter pellets available for caching after consumption was greater than the number of 2.38 mm diameter pellets available because of the five-fold greater weight of each 4.76 mm diameter pellet. Fewer of the 4.76 mm diameter pellets had to be consumed by the pine voles to fulfill their consumption requirements.

The lack of pellet size preference by pine voles is consistent with field observations of bait removal by pine voles (Byers and Merson 1981c). These laboratory data are preliminary in nature but would also indicate a difference in bait removal between pine and meadow voles with pine voles being more prone to this type of behavior. This would also be consistent with field observations.

References

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Table 1. Pellets (100) broadcast in 1.83 m diameter tanks with meadow and pine vole pairs.

Pellet diameter	Pellets cached (No.)	Pellets consumed (g)	Pellets cached or consumed (No.)
Pine voles (pairs = 8)			
2.38 mm	40 a	2.4	92
3.18 mm	46 a	1.9	73
4.76 mm	91 b	1.4	97
Meadow voles (pairs = 6)			
2.38 mm	14	1.2	36
3.18 mm	37	1.6	56
4.76 mm	61	1.5	66

a,b Means in same column with different letters significantly different $P < .05$.