CONTROL OF HOUSE FLY AND STABLE FLY BREEDING IN RHINOCEROS DUNG WITH AN INSECT GROWTH REGULATOR USED AS A FEED ADDITIVE

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Abstract: An insect growth regulator (IGR), Thompson-Hayward TH 6040 (*N*-(4-chlorophenyl)-*N*'-(2,6-difluorobenzoyl)urea), incorporated in the feed of rhinoceroses at rates of 1 and 0.1 mg/kg inhibited development of *Musca domestica* L. and *Stomoxys calcitrans* (L.) in the feces.

INTRODUCTION

Zoological parks at more than 200 localities in the United States are generally within the boundaries of municipalities; thus insect problems associated with these confined animals, over 40,000 mammals, tend to overflow into the communities.[3] At one of these parks, Lion Country Safari in Grand Prairie, Texas, feces from white rhinoceroses provided an excellent rearing media for house flies, *Musca domestica* L. Although good sanitation procedures and insecticides were employed judiciously for fly control, an easier, more efficient method of handling these insects was sought by the management. Research underway with insect growth regulators (IGRs) at the Veterinary Toxicology and Entomology Research Laboratory, College Station, Texas, was therefore of interest.

The purpose of the research reported here was to investigate inhibition of the breeding of the house fly and the stable fly, *Stomoxys calcitrans* (L.), in feces of rhinoceroses when an experimental IGR was incorporated in pelleted feed given daily to the animals.

MATERIALS AND METHODS

The IGR, Thompson-Hayward TH 6040 (*N*-(4-chlorophenyl)-*N*'-(2,6-difluorobenzoyl)urea), was provided by Thompson-Hayward Company, Kansas City, Kansas, as a 96% technical air-milled powder.[1] TH 6040 was incorporated in extruded pellets at the rate of 243.2 g of active ingredient per ton (0.0267%), a dosage providing a daily intake of approximately 1 mg/kg by each of 19 rhinoceroses for a period of 60 days if they were fed 200 lb of pellets each day. An additional three tons of pellets were formulated with an amount of TH 6040 to provide 0.1 mg/kg daily intake when 150 lb of pellets were fed daily for 40 days.

Feces from rhinoceroses were collected daily for four days before TH 6040 was incorporated in the diet. Thereafter, fresh droppings were collected each morning. The feces collected on each date were mixed and divided into one 200 g sample and into six 400 g subsamples. The subsamples were placed in 1 l beakers. Three each were seeded with 100 house fly eggs, and three each were

[1] Mention of a pesticide or proprietary product in this paper does not constitute a recommendation or an endorsement of this product by the USDA.

seeded with 100 stable fly eggs. All six subsamples were held at 26 C for 22 days, and emerged adults were counted. The percentage of development inhibited was corrected for mortality in the control (established during the pre- and post-chemical feeding periods by Abbott's formula). The 200 g samples were frozen daily, and the level of TH 6040 determined using methods developed for liquid chromatography.[3]

After 60 days of feeding the 1 mg/kg dosage, no chemical was fed for 14 days. Then the 40-day trial with the 0.1 mg/kg dose of TH 6040 was begun.

In addition, rhinoceroses were observed daily for clinical signs of toxicity to the TH 6040 by a veterinary toxicologist and the consulting veterinarian for Lion Country Safari. Since animals were not fed together, each could be observed separately during the twice daily feeding period. Appetite, frequency and character of urination and defacation, and behavior were noted during the feeding periods when all 19 animals could be seen.

RESULTS

House fly and stable fly bioassays showed that TH 6040 fed at a rate of 1 mg/kg was 100% effective in inhibiting adult emergence in feces of rhinoceroses from the fifth day after treatment was initiated. Five days after the end of the 60 day feeding period, the feces again supported development of house flies and stable flies. The highest percentages of emergence, 70% for house flies and 23% for stable flies, were reached 10 days later.

The 40 day feeding test of 0.1 mg/kg gave a similar pattern and results for the inhibition of house fly and stable fly development in the feces.

The levels of TH 6040 determined by liquid chromatography reflected the results of the bioassays. Overall average residues ranged from 1.8 to 12.1 ppm and averaged 5.65 $\pm$ 2.68 ppm for the 60 day period. Levels could not be determined for the 40 day test because the lower limit of detection was only 0.1 ppm, and the level in the feces was lower than this.

DISCUSSION

IGR TH 6040 interferes with cuticular development in pupae of house flies and stable flies when ingested by the larvae and no adults emerge.[4] Thus, house fly development is effectively inhibited in feces of cattle that consumed TH 6040 incorporated into mineral blocks.[5] Also, the face fly, *Musca autumnalis* De Geer, and house fly was controlled in bovine feces when TH 6040 was used as a feed additive.[1] However, these studies were with a ruminant; the rhinoceros is monogastric. Rhinoceroses readily consumed both levels of treated pellets without avoidance. No clinical signs of toxicity to TH 6040 were observed.

Feces remaining in the rhinoceros area at the park were checked weekly for fly breeding, and none was found during either test. Thus, incorporation of the chemical in feed provided an easy, efficient method of fly control.

The same approach may be a feasible method for fly control in other dung-producing animals in the park; however, some species of wildlife could be susceptible to toxic properties of this experimental chemical.

Larval and adult stages of the scarabaeid, *Aphodius lividus* (Olivier), were found in rhinoceroses feces so treatment had no apparent effect on this insect.

Acknowledgements

We thank Dave Gordy and Ken Klimek of the Agricultural Research Service, U.S. Department of Agriculture, College Station, Texas, for their technical assistance, and R. D. Gordon and D. M. Anderson of the Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland, for identification of the adult and larvae *A. lividus*.

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Received for publication 31 March 1975