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Food soiling and diet discrimination of mouse lines divergently selected for response to a nutritional toxicosis

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Abstract

Mouse lines were selected for eight generations for resistance (R) versus susceptibility (S) to growth depression from toxins in endophyte-infected tall fescue seed. To examine a possible correlated response to that selection, three experiments subsequently were conducted to examine food soiling behaviour of the mice. In Experiment 1, the average food soiling score was higher for R mice than S mice; but males had higher scores than females and soiling of the toxin-containing diet (T+) was greater than soiling of the non-toxin-containing diet (T−) only in the R line. When all mice received the T− diet during the first two weeks of Experiment 2, neither line, sex nor their interaction affected food soiling scores. During the second two weeks of Experiment 2, R mice had higher average food soiling scores than S mice on both the T− and the T+ diet; but within the R line, neither sex, diet nor their interaction significantly affected food soiling scores. In Experiment 3, when all mice had simultaneous access to both diets, bowls containing the T− diet were more heavily soiled than bowls containing the T+ diet, lines did not differ in soiling of the two diets, but males expressed greater diet soiling differences than females. In summary, after eight generations of divergent selection for growth depression from ingestion of fungal toxins, resistant and susceptible lines differed in food soiling behaviour, but not consistently across experiments. Differences could be attributable to genetic drift but might also represent correlated selection response in social, nutritional or emotional aspects of eliminative behaviour. Speculations about the biological and behavioural

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bases for observed differences may lead to testable hypotheses about how toxicosis resistance is inherited and expressed.

Keywords: Mice; *Festuca arundinacea*; Festuca poisoning; Excretion; Taste sensitivity

1. Introduction

Many populations of tall fescue grass (*Festuca arundinacea*) are infected by the symbiotic fungus, *Neotyphodium coenophialum* (Siegel et al., 1987). Such endophyte-infected plants produce toxins that are harmful to nematodes (Pedersen et al., 1988), insects (Hardy et al., 1986), birds (Conover and Messmer, 1996), domestic ungulates (Porter and Thompson, 1992) and rodents (Durham and Tannenbaum, 1998). Endophyte-infected commercial varieties of tall fescue are popular for soil stabilization and ornamental uses, but livestock consuming endophyte-infected fescue forage are prone to summer heat stress and to reduced food intake, growth, milk production and reproduction (Hoveland, 1993). Laboratory mice ingesting endophyte-infected fescue seed experience reduced reproduction and growth (Zavos et al., 1985, 1990; Godfrey et al., 1994).

The objective of the research program to which the current experiments contribute was to determine, using mice as the model organism, whether and how livestock might differ in genetic resistance to toxins contained in endophyte-infected tall fescue. Accordingly, lines of mice were selected for increased resistance (R) or increased susceptibility (S) to growth depression caused by endophyte-infected tall fescue seed in their diet (Hohenboken and Blodgett, 1997). During the course of experiments to identify physiological correlates to fescue toxicosis response, differences were noted between R and S mice and between males and females in the extent of fecal and urinary soiling of food bowl contents. Subjective food soiling scores were recorded in subsequent work. The objective of experiments reported herein was to test whether food soiling behaviour was influenced by line (past selection for susceptibility or for resistance to fescue toxicosis), diet (ground and mixed food composed of 50% fescue seed either infected or not infected with endophyte), sex or interactions among these effects. Possible explanations for observed relationships and their relevance are then provided.

2. Materials and methods

2.1. Animals and management

Mice used in the experiments were from lines divergently selected from an outbred ICR foundation population (Harlan Sprague Dawley Inc., Indianapolis, IN) for the effect on post-weaning growth of a diet containing 50% by weight of endophyte-infected fescue seed and 50% by weight of ground rodent food. Divergent selection was conducted for eight generations, followed by three generations of relaxed selection during which the