INCREASE IN POPULATIONS OF *CRYPTOLESTES PUSILLUS* AND *C. TURCICUS*[1] ON DIETS OF NATURAL PRODUCTS[2]

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ABSTRACT

The flat grain beetle, *Cryptolestes pusillus* (Schönherr), and *C. turcicus* (Grouvelle) were reared at a high temperature (29 ± 1°C) on 20 diets prepared from a single natural product or mixture of natural products. Wheat was the most favorable natural diet and cracked food was the most favorable form of diet. Neither *C. pusillus* nor *C. turcicus* multiplied on brown rice meal, runner peanuts, whole soybeans, cracked black-eyed peas or Purina Chow(R) with brewer's yeast; brewer's yeast was not significantly advantageous in mixed diets. *Cryptolestes pusillus* multiplied more on all diets except cracked soybeans and wheat meal than did *C. turcicus*.

The flat grain beetle, *Cryptolestes pusillus* (Schönherr), and *C. turcicus* (Grouvelle) are widely distributed, abundant, and economically important species (USDA 1965) that infest a variety of stored commodities (Davies 1949, Howe and Lefkovitch 1957). Information on the extent of damage caused by these insects is generally available (Cotton 1963), but no data are available concerning the relative buildup of the populations on different commodities. Because I was interested in the population increase of the 2 species in the South, I determined the increases in their populations at a high temperature on 20 diets prepared from a natural product or a mixture of natural products.

MATERIALS AND METHODS

Cryptolestes turcicus obtained from Canada were initially reared as a stock culture at the Savannah laboratory on a mixture of white flour, white cornmeal, and brewer's yeast (10:10:1.5 by vol). Then 4 months before the experiment, the colony was placed on a mixture of cracked, soft red winter wheat, rolled oats, and brewer's yeast (14:14:1.5 by vol), the standard diet used at this laboratory to rear the stock cultures of *C. pusillus*. The test was begun 4 months later when both species had exhibited similarly excellent population growth without excessive mortality on this diet. The procedure was similar to that described for an earlier test (LeCato and McCray 1973): 5 pairs of 1-wk-old adults of each species were placed into 1-pint (ca. 0.47-liter) jars on 200 ml of each of 20 test diets. The jars were capped with a No. 1 filter paper disc secured with a screw-type ring.

[1] Coleoptera: Cucujidae.

[2] Mention of a commercial or proprietary product in this paper does not constitute an endorsement of this product by the U. S. Department of Agriculture.

The cracked corn, wheat, brown rice, soybeans, and black-eyed peas used in the test diets were produced in a Viking(R) hammer mill equipped with a screen containing openings 3/8 in. (9.5 mm) in diam. To produce meal that would pass through a U. S. Standard no. 30 sieve, a screen containing openings 1/64 in. (0.4 mm) in diam was used. Whole shelled runner peanuts were placed in a commercial Waring(R) Blender (ca. 12,500 rpm) for 10 sec to produce cracked peanuts and for 1 min to produce peanut meal.

Moisture content was determined with a Motomco Model 919(R) moisture meter. Moisture content of corn, wheat, rice, and black-eyed peas was adjusted to ca. 12.5%. Moisture contents of soybeans and of peanuts were adjusted to ca. 12% and ca. 7%, respectively. All diets were held for 1-2 wk prior to the experiment at the experimental conditions of $29 \pm 1°C$, $65 \pm 10\%$ RH, and 12-hr light-dark cycles.

After 10 wk, the adult insects present in each jar were counted, and the number of seeding adults (10) was subtracted to determine the number of adult progeny. Each combination of diet and species of insect was replicated 5 times. Differences in multiplication were assessed by using analysis of variance and Duncan's multiple range test.

Results and Discussion

In general, wheat was the most favorable diet, and cracked food, which provided better harborage and oviposition sites, was the most favorable form of diet (Table 1). *Cryptolestes pusillus* multiplied on more diets and produced more progeny on each diet (except cracked soybeans and wheat meal) than *C. turcicus*. Neither species multiplied on rice meal, any form of runner peanuts, whole soybeans, cracked black-eyed peas, or Purina Chow(R) with brewer's yeast. Rice and soybeans in any form were generally unfavorable to both species, and neither could penetrate the seed coat of whole soybeans. Neither species increased on peanuts though *Cryptolestes* spp. do infest peanuts (Howe and Lefkovitch 1957); oil from peanuts probably limits any population increase (Thomas and Shepard 1940). The seeding adults of both species generally died on diets that were not advantageous to multiplication.

Both species produced relatively few progeny on whole grain, probably because of the small size of the adult *Cryptolestes* (ca. 1/16 inch or ca. 1.6 mm) and the relative weakness of the mouthparts (Cotton 1963). For example, *Cryptolestes pusillus* was reported unable to attack undamaged grain (Payne 1946, Davies 1949) and multiplied slowly on diets of whole corn, wheat, and rice (rice $= 2 \pm 1.7$); apparently the germ of slightly damaged kernels served as the source of food. *Cryptolestes turcicus* multiplied even more slowly on corn and wheat and not at all on rice. Diets of mixtures of natural products plus brewer's yeast did not significantly increase the populations of either species.

The temperature at which the test was conducted may have given an advantage to *C. pusillus*. Currie (1967) reported that *C. pusillus* developed faster than *C. turcicus* when the temperature was above 25°C but that the growth of populations of *C. pusillus* is limited by low temperature and low relative humidity. *C. pusillus* is most abundant in the wet tropical and warm temperate regions where it increases rapidly. *Cryptolestes turcicus* is more cold hardy than *C. pusillus* (Solomon and Adamson 1955) and is found in the moist temperate regions of the world (Howe and Lefkovitch 1957). The findings reported here and the literature (Eden 1967) indicated that *C. pusillus* is the more economically important species in the southern United States.

TABLE 1. MULTIPLICATION OF 2 SPECIES OF STORED-PRODUCT INSECTS ON 20 DIETS (5 SEEDING PAIRS).

Diets	Mean +SD no. adult progeny after 10 wk*	
	Cryptolestes pusillus	*Cryptolestes turcicus*
Corn, whole	14±2.2 ab	3±0.9a
cracked	118±19.4 e	31±3.7 c
meal	40±7.1 c	17±1.2 b
Wheat, whole	18±2.8 b	6±1.1 a
cracked	231±20.8 f	53±3.9 e
meal	13±5.9 ab	23±1.5 b
Soybeans, cracked	3±0.9 a	7±1.6 a
meal	2±0.3 a	0
Rolled oats, brewer's yeast (18:1)	6±4.7 ab	0
White flour, white cornmeal, brewer's yeast (10:10:1.5)	75±18.6 d	34±3.3 c
Cracked soft red winter wheat, rolled oats, brewer's yeast (14:14:1.5)	49±11.3 c	46±6.6 d

*Column means not followed by the same letter are significantly different ($P < 0.01$) (Duncan's multiple range test).

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