

ARTIFICIAL DIET FOR THE ZOYSIAGRASS BILLBUG,
SPHENOPHORUS VENATUS VESTITUS
(COLEOPTERA: CURCULIONIDAE),
AND NOTES ON ITS BIOLOGY¹

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ABSTRACT

An artificial diet was used in rearing the zoysiagrass billbug, *Sphenophorus venatus vestitus* Chittenden, to determine its life history. The diet was based on the *Heliothis* diet used by Berger. Composition and preparation of the diet are described.

The average duration of the egg, larval, and pupal stages at 22°C and 27°C were 7.7 and 6.7, 29.1 and 22.0, and 12.1 and 8.6 days, respectively. The reared adult beetles mated and were maintained for a long period of time on the diet but they did not oviposit.

The zoysiagrass billbug, *Sphenophorus venatus vestitus* Chittenden³, has been reported as a pest of various grasses in the eastern United States. It ranges from the Washington, D.C. area to Florida, and west to eastern Texas and southern Kansas (Vaurie 1951). Kelsheimer (1956) first reported it as a pest of zoysiagrass (*Zoysia* spp.) in Florida. Kerr (1964) stated that this species, while not a major turf pest in Florida, is a continuing serious problem in zoysiagrass nurseries. It is also occasionally economically damaging to bermudagrass, *Cynodon dactylon* (L.) Pers. The damage is mainly on the roots and rhizomes. Kelsheimer (1956) noted that handling cut sod squares for shipment could be very difficult because the root system is so weakened that the squares will not hold together.

Although much attention has been focused upon control, little is known concerning the biology of this insect. The purpose of this investigation was to develop a technique suitable for rearing the hunting billbug in sufficient numbers for studying its life history.

MATERIALS AND METHODS

The diet used in this study was based on the Vanderzant wheat germ diet utilized by Berger (1963) for *Heliothis* species. The composition of the diet, which is slightly modified in proportions and ingredients from Berger's, is shown in Table 1. Diet chemicals were obtained from Nutritional Biochemicals Corporation, Cleveland, Ohio. The ingredients and amounts are sufficient to make about 850 g of diet. The ingredients

¹ Florida Agricultural Experiment Station Journal Series No. 3028.

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³ Insect specimens were identified by R. E. Woodruff, Entomology Section, Division of Plant Industry, Florida Department of Agriculture.

TABLE 1.—COMPOSITION OF ARTIFICIAL DIET FOR LABORATORY REARING OF THE ZOYSIAGRASS BILLBUG, *Sphenophorus venatus vestitus* CHITTENDEN.

Ingredients	Amount
1. Water	208.5 ml
2. 22.5% potassium hydroxide	4.3 ml
3. Casein	29.2 g
4. Wesson's salts	8.5 g
5. Sucrose	22.7 g
6. 10% formaldehyde	3.1 ml
7. Mixture: 7 g methyl <i>p</i> -hydroxybenzoate plus 7 g sorbic acid in 50 ml of 95% ethyl alcohol	12.5 ml
8. Wheat germ	25.6 g
9. Alphacel	4.3 g
10. Vitamin fortification mixture*	8.5 g
11. Agar, hot, dissolved in 521 ml of water	21.3 g
12. Ascorbic acid	3.4 g
13. Streptomycin sulfate, 700 μ g/mg	118.0 mg

* Nutritional Biochemicals Corporation mixture in dextrose.

are added in the order listed to obtain good solution of materials and to minimize exposure of labile compounds to strong alkali and prolonged high temperature. Preparation of the diet is simplified by the incorporation of ingredients 1 through 10 for 2 to 3 minutes in the blender. The agar is dissolved in 521 ml of hot water, placed in an autoclave at a pressure of 15 p.s.i. for 30 minutes, and then allowed to cool briefly. The blended ingredients 1 through 10 are then mixed thoroughly with the agar and remaining ingredients in the blender. Immediately after mixing, the diet is poured into 8-dram shell vials to within 1 1/2 inches of the top. The vials are stoppered with cellucotton absorbent wadding. A flexible polyethylene mustard dispensing bottle was found to be useful for filling these vials. Vials with diet should be kept in the refrigerator until needed. To determine the life history, adult billbugs collected from an infested South Miami lawn were placed in petri dishes containing two layers of moist blotting paper. Sections of zoysiagrass runners with roots attached were provided for food. Fresh grass was supplied every 2 days. Eggs were collected daily and placed on moist blotting paper in petri dishes. Dishes were examined daily to obtain newly hatched larvae.

Newly hatched larvae were placed individually by means of a camel's hair brush in a shell vial with diet. All life cycle studies were made in incubators at 27°C and 22°C. Vials were examined daily to determine the insect stage present and to make sure the diet was not contaminated. Adults were removed from the vials after emergence. Pairs of male and female billbugs were placed in shell vials with diet to determine whether mating and oviposition would occur.

TABLE 2.—DURATION OF EGG, LARVAL, AND PUPAL STAGES OF THE ZOYSIAGRASS BILLBUG, *Sphenophorus venatus vestitus* CHITTENDEN, REARED ON AN ARTIFICIAL DIET.

°C	Egg			Hatching No.	%	Larva			Pupa		
	No.	Days Incubation				No.	Days	Duration	No.	Days	Duration
		Aver.	Range								
22	45	7.7	5-10	42	93.3	5	29.1	27-34	5	12.1	11-14
27	51	6.7	3-9	30	58.8	7	22.0	20-23	7	8.6	8-10

RESULTS AND DISCUSSION

The duration of the immature stages at 22°C was 1.2, 1.3, and 1.4 times longer for egg, larval, and pupal stages, respectively than at 27°C. The overall percent hatch for eggs at 22°C was more than 1.5 times that at 27°C (Table 2).

Larval mortality on the diet was high. Of 42 newly hatched larvae, only 5 at 22°C and 7 at 27°C completed development to the adult stage. Some of the mortality was attributable to handling larvae. In most cases where mortality occurred, there was delayed development.

Reared adults were observed to copulate, but the diet proved unsatisfactory as an oviposition site for the adult beetle. Although pairs of adults and mated females were maintained on the diet for long periods of time, no oviposition occurred. This may have been due to improper diet or to unsuitable environmental conditions.

The Berger modification of Vanderzant's wheat germ diet is promising for rearing this billbug in the laboratory and additional research to improve survival on the artificial diet should be done.

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The Florida Entomologist 51(4) 1968