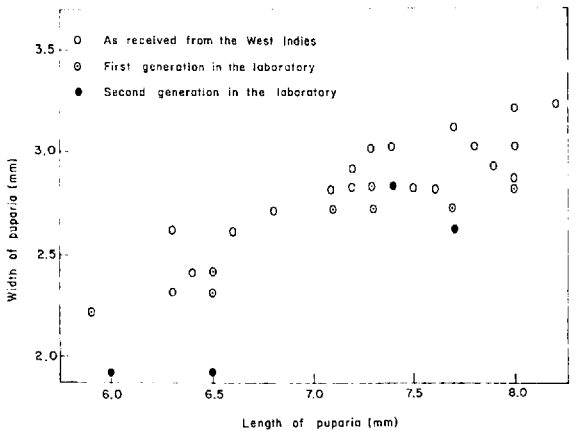

FIG. 1.—Dimensions of some of the original puparia and all the 1st- and 2nd-generation laboratory-reared puparia of the Amazon fly.

monds 1959). It is now also established in Martinique, St. Lucia, and Venezuela, but attempts to establish it in Barbados, Trinidad, Puerto Rico, Lousiana, and Antigua all failed (Bartlett 1939, Box 1938, Charpentier 1956, Simmonds 1959).

Attempts to introduce this fly into the Old World (Mauritius, Malaya, India, and now the Philippines) have all ended in failure. In Malaya, Lever (1956) was not able to inoculate any local rice borers with it. In India, Mohanraj and Saxena (1964) were able to inoculate 2 sugarcane borers, *Scirpophaga nivella* F. and *Proceras indicus* Kapur. The former yielded 10.5% parasitization but the latter was not parasitized at all.

The results of this attempt indicate that the fly was amenable to laboratory handling, i.e., mating, survival, inoculations, etc., but failed to give sufficient parasitization. It is concluded that the Amazon fly, while not strictly host specific, is not a suitable parasite of the Philippine rice stem borers.

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Prey Consumption and Development of *Thanasimus undatulus*,[1] a Predator of the Mountain Pine Beetle[2,3]

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Thanasimus undatulus Say is a common predator of the mountain pine beetle, *Dendroctonus ponderosae* Hopkins, in lodgepole pine, *Pinus contorta* Douglas, according to DeLeon (1934), who listed it as *T. dubius* (F.). *T. undatulus* was reported also as being a predator of the spruce beetle, *D. rufipennis* (Kirby), and associated scolytids in Engelmann spruce, *Picea engelmannii* Parry (Knight 1961); a predator of the fir engraver, *Scolytus ventralis* LeConte, in *Abies* species (Struble 1957); an occasional predator of *Ips* species in lodgepole pine logging slash (Reid 1957); and of the Douglas fir beetle, *D. pseudotsugae* Hopkins, in Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco (Cowan and Nagel 1965). The present study was done to obtain information on prey consumption and rate of development of *T. undatulus* to appraise more realistically

[1] Coleoptera: Cleridae.
[2] Coleoptera: Scolytidae.
[3] Received for publication Feb. 7, 1972.
[4] Research Entomologist.

the effect of this predator on populations of the mountain pine beetle in lodgepole pine.

Methods and Materials

T. undatulus adults were caught during July 1967 on lodgepole pine trees infested by *D. ponderosae* in northwestern Wyoming and taken to the laboratory in Ogden, Utah. The sex of the predator was determined by sex-related differences in the 6th abdominal sternum (Cowan and Nagel 1965).

Specimens of *T. undatulus* were paired, and each pair was placed in a separate petri dish. The pairs were provided more adult mountain pine beetles each day than they could consume. A triangular piece of white crepe paper, rolled into a cylinder 50 mm long and 6 mm diam, was laid in the petri dish as an oviposition site (Struble 1942). Eggs were removed from the paper each day and kept in petri dishes at 22°C until they hatched. Newly hatched larvae were placed individually in plastic boxes (2.5 cm^3). The boxes were kept over a saturated solution of NaCl in a closed desiccator to maintain 75% RH (Wexler and Hasegawa 1954). The desiccator was placed in an unlighted constant-temperature cabinet (22°C).

Three groups of 5 *T. undatulus* larvae each were fed *D. ponderosae* larvae as follows: Group 1 was fed small larvae (ca. 4 mg), Group 2, medium-size larvae (ca. 8 mg), and Group 3, large larvae (ca. 12 mg). At the outset, each larva was examined daily to determine whether prey had been eaten and whether the predator had molted; 1 prey was provided daily. However, late in the feeding period when the predators could be checked only 1 or 2 times weekly, 3–4 prey were added during each examination. After the predators stopped feeding, they were placed in cotton for pupation and subsequently examined ca. 2 times monthly.

Whenever a larva of *T. undatulus* died, it was replaced by another in the same stage. However, data were used only when the larva was observed from one molt to the next or from molt to cessation of feeding in the case of 3rd instars.

Results and Discussion

Rate of Development

The larval period of *T. undatulus* from hatching to cessation of feeding averaged 67.8 days (range 56–75) for Group 1 larvae, 64.2 days (range 53–72) for Group 2, and 56.4 days (range 50–74) for Group 3 (Fig. 1A). First and 2nd instars in Group 3 required more time to complete development than those in Group 2 and almost as much time as those in Group 1. First and early 2nd instars in Group 3 required up to 2 days to kill large prey; this probably explains why these instars took longer to develop. First and 2nd instars in Group 1 took the longest of any group to develop, probably because of the small prey that they received.

Third instars in Groups 1 and 2 completed feeding in about the same time, but 3rd instars in Group 3 took much less time, presumably because of the larger prey that they received. However, the cause for similarity in feeding time of 3rd instars in Groups 1 and 2 was not determined.

The overall developmental period (hatching to adult) was about the same in the 3 groups. All larvae (except 3 that died) remained in the larval stage after the feeding period ended for ca. 10 months (until July 1968). When examined in early August, most had transformed to pupae, and a few had become adults. By mid-August,

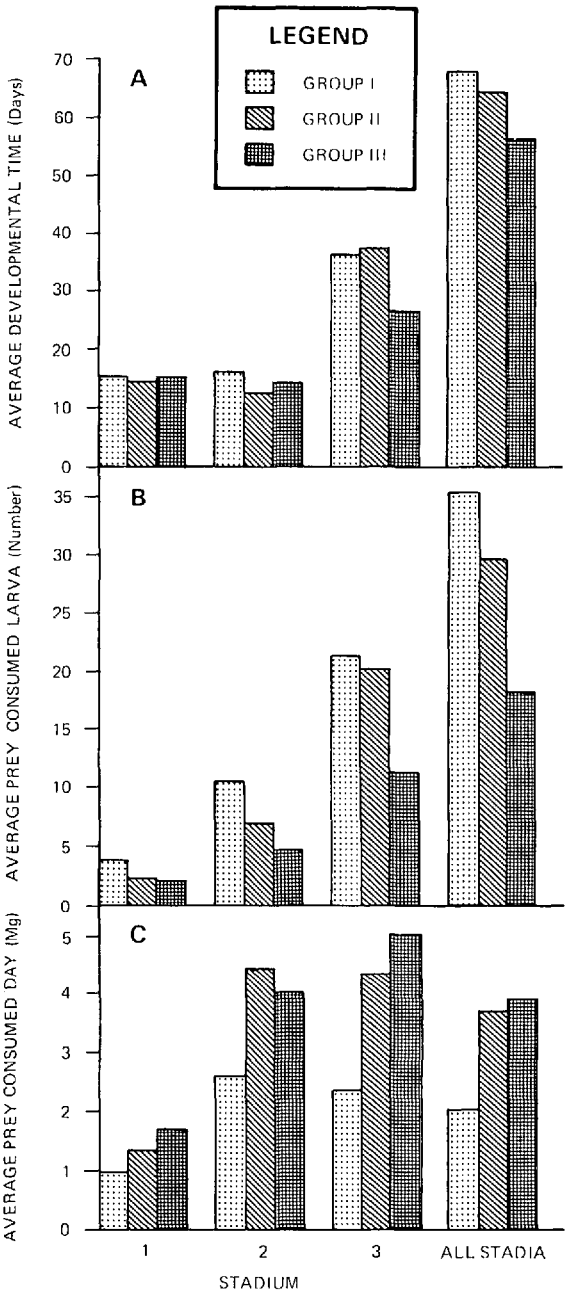

FIG. 1.—Developmental time and consumption of *D. ponderosae* by *T. undatulus*. (A) Average developmental time; (B) average number of prey consumed during development; (C) average weight of prey consumed per day.

all but two were adults; both were still larvae when last checked in January 1969.

The larvae passed through 3 stadia; head-capsule measurements for the 3 instars averaged: 0.34 mm (range 0.30–0.35, N = 15); 0.62 mm (range 0.50–0.70, N = 15); and 1.13 mm (range 0.85–1.30), N = 15). These averages are in close agreement with those reported by Cowan and Nagel (1965) and Kline and Rudinsky (1964). No abnormal biology was noted, such as that which occurs in *Enoclerus sphegeus* F. and was

related by Amman (1970) to the amount of prey consumed in the 1st stage.

Prey Consumption

Numbers of prey consumed by *T. undatulus* larvae averaged: Group 1, 35.4 (range 27.0–43.5); Group 2, 29.6 (range 25.0–36.5); and Group 3, 18.2 (range 18.5–23.5) (Fig. 1B). The number of prey consumed by Group 1 larvae averaged 20% more than prey consumed by Group 2 larvae and 94% more than that consumed by Group 3 larvae. However, on a weight-per-day basis, Group 2 larvae consumed 77% and Group 3 larvae consumed 86% more prey than Group 1 larvae. Average daily consumption of prey ranged between ca. 1 mg/day by 1st instars of Group 1 to ca. 5 mg/day by 3rd instars of Group 3 (Fig. 1C).

If small prey had been abundant, the number and quantity of prey consumed by Group 1 larvae probably would have increased considerably. However, the similar amounts consumed by Group 2 and 3 larvae indicate that these larvae were almost satiated and that prey consumption probably would not increase much beyond the quantities reported here. Realistically, a *T. undatulus* larva during development could be expected to consume between 18 and 43 *D. ponderosae* larvae, depending upon prey size and abundance.

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Influence of Position and Color of Male-Baited Traps on Captures of Boll Weevils[1,2,3]

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The male boll weevil, *Anthonomus grandis* Boheman, after feeding on cotton, produces a pheromone that attracts both sexes of weevils (Cross and Mitchell 1966, Keller et al. 1954, Bradley et al. 1968). Also, boll weevils respond to spectral wavelengths from 315 to 665 nm, with response peaking between 490 and 515 nm (Hollingsworth et al. 1964). Similarly, Taft et al. (1969) found that overwintered weevils responded to painted traps and plants which reflected most strongly from 500 to 550 nm.

The present experiment was therefore conducted at the Southeastern Cotton Insects Investigations Laboratory at Florence, S. C., in 1970 and 1971, to determine the influence of the color and position of oblique-funnel pheromone traps (Cross et al. 1969) on the capture of overwintered boll weevils.

Materials and Methods

1970 Experiment

Three colorless, 3 green, and 3 blue oblique-funnel traps (Cross et al. 1969) were constructed from clear ⅛-in. acrylic plastic, from 3/16-in. green acrylic plastic, and from ⅛-in. gray-blue vinyl plastic, respectively. The funnel sections of all traps were made from bronze screen (1/16-in. mesh), but those for the green traps were painted with green paint (the funnels of the other traps were left unpainted). The reflectance of the 3 colors was determined with an ultraviolet and visible wavelength monochromator and a photomultiplier microphotometer.

In the test, the traps were baited with 2-day-old unmated boll weevils from the laboratory colony which were fed on fresh cotton squares (provided 3 times a week) and held in individual screen or plastic cylinders. They were replaced weekly. Captured weevils were removed 3 times a week.

On Apr. 10, the 9 traps were positioned as shown in Fig. 1 around a 20-acre field (12 acres of cotton and 6.4 acres of tobacco) situated near Darlington, S. C., that has a history of heavy boll weevil infestations and high survival of overwintered weevils. The crops are rotated in the field each year except for 2 small sections that are planted to small grain and soybean; in 1969 (the season before the test was begun), the section farthest from the buildings was planted in cotton but in 1970 it was left fallow. The initial assignment of trap colors to position was random, but each week thereafter to the end of the test on July 31, the traps were moved 1 position counterclockwise around the field. Estimates of infestations in the cotton were made once

[1] Coleoptera: Curculionidae.

[2] In cooperation with the South Carolina Agricultural Experiment Station, Florence 29501. Received for publication 27 Jan., 1972.

[3] Mention of a proprietary product does not constitute endorsement by the USDA.