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## Feeding Behavior of a Terrestrial Turbellarian Bipalium adventitium

ABSTRACT: An exotic, terrestrial turbellarian Bipalium adventitium Hyman (Tricladida, Bipalidae) was found in Syracuse, N.Y. This animal preys upon earthworms (Lumbricus terrestris, Bimastos tenuis), and details of its feeding behavior are described. Under laboratory conditions the turbellarian can subdue and feed upon earthworms up to 30 times its own weight. The mean increase in weight was 82%.

### Introduction

During September and October 1968, 30 exotic, terrestrial turbellarians were found at an organic gardening site near Syracuse, N. Y. These turbellarians were preying on earthworms after both types of worms were forced from the soil following heavy rains. Other species of terrestrial turbellarians have been reported to feed on annelids and mollusks (Kevan, 1962; Jennings, 1969).

I identified the turbellarians as *Bipalium adventitium* Hyman (Bipalidae, Terricola, Tricladida) after the description of Hyman (1943). This species is orange-brown with a single, dark-brown line extending the entire length of the dorsum. The anterior edge of the lunate head has six, small, contractile protrusions, probably sensory receptors, that alternately and gently touch the substrate over which the animal glides. The weight range of 14 *Bipalium* was 7-126 mg with a mean  $(\pm s_E)$  of  $49 \pm 8$  mg. Range in length was 40-70 mm with a mean  $(\pm s_E)$  of  $57 \pm 2$  mm.

#### Methods

I conducted 14 feeding trials all at temperatures of 22 C under daylight conditions. The turbellarians were kept in leaf litter and their predatory behavior was observed in the laboratory. The objectives of the feeding studies were as follows: 1. to record the mode of predation; 2. to determine the feeding time; 3. to record weight gain after feeding; 4. to observe size relationships of the predator and prey. The earthworms Lumbricus terrestris and Bimastos tenuis were offered as prey. For each trial a Bipalium and an earthworm were placed together in a closed petri dish containing a wet filter paper. The turbellarian was allowed to feed to cessation, and all events were timed.

#### RESULTS

Upon introduction both worms moved normally within the enclosed petri dish. The Bipalium moved about on its ventral creeping sole with the head held slightly above the surface and touching only the anterior protrusions as the head dipped laterally in a rocking motion (Fig. 1). Under these conditions, contact between the two worm species was the result of chance meeting. The Bipalium did not appear to be attracted to the earthworm until head contact was made. Upon contact, the turbellarian immediately crawled onto the earthworm's body. The earthworm did not react until the broad translucent pharynx of the Bipalium was extended over the segments (Fig. 1). At that instant the annelid moved tortuously and excessive exudations of mucus resulted. Occasionally turbellarians were forced off the body by this action, particularly with larger earthworms. Segments over which the pharynx was extended were always found to be liquified and soon after swollen. Once permanent attachment by the pharynx was attained liquefaction continued until small earthworms (100-200 mg) were almost completely consumed. Large holes a centimeter wide were formed as portions of larger earthworms (Lumbricus terrestris) were digested. As extracellular digestion occurred, streams of material could be seen passing through the pharynx into the predator's digestive tract causing the anterior portion of the *Bipalium* to swell. While feeding, the turbellarian hung flaccidly (Fig. 1) as the earthworm became motionless. No earthworm recovered.

Feeding by *Bipalium* lasted an average of 45 minutes on earthworms weighing less than 600 mg. Multiple sites were attacked on 4-5 g earthworms and feeding was completed in an average of six hours. The weight increase while feeding on large earthworms (>200 mg) averaged 82 mg compared to an average increase of 110 mg when earthworms were smaller. The mean weight gain by *Bipalium* during feeding was  $89 \pm 12$  mg or 82% of body weight. After feeding, the *Bipalium* crawled away from the victim, curled into a knot-like position, and remained somewhat motionless for several days.

#### DISCUSSION

I found *B. adventitium* reported from temperate regions only one other time. Hyman (1954) found 10 specimens in Millwood, Westchester Co., N.Y., 35 miles north of New York City. Prior to 1954, Hyman (1943, 1951) records it only from gardens in the Berkeley, California, area, whereas, a similar species, *Bipalium kewense* Moseley, is reported from gardens and greenhouses in more temperate regions. I suspect my specimens were introduced into this region on greenhouse stock.



Fig. 1.—*Bipalium adventitium:* A.—Lunate head showing sensory projections and alternating dipping motion. B.—Turbellarian attacking earthworm with pharynx extending over segments. C.—After firm attachment turbellarian hangs flaccidly while extracellular digestion occurs.

Jennings (1963) states that the simple cylindrical pharynx of the triclad is thrust into the body of the prey where fragmentation occurs. However, B. adventitium extended a broad funnel-like pharynx over the segments of the prey and food was gradually digested beneath it. Slow penetration and ingestion resulted, rather than thrusting followed by internal fragmentation. The extracellular digestive action by the pharynx, as described by Jennings (1969), was well illustrated.

Laboratory conditions may have altered natural responses. Members of Terricola are nocturnal in natural habitats (Hyman, 1951) and all of my observations were made under daylight conditions. Also, earthworms confined in petri dishes had no means of escaping the turbellarians. These factors should be realized before applying these data to field conditions.

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