

13

LAND PLANARIAN

(*Bipalium pennsylvanicum*)



A new species of flatworm was discovered three decades ago in a suburb of Philadelphia. Introduced into North America from Asia, it specializes in preying on earthworms.

Figure 13.1 Land planarium (*Bipalium pennsylvanicum*) found consuming an earthworm in a garden near Spring City, Chester County, Pennsylvania. Identification was based on papers by Robert E. Ogren and Joseph K Sheldon, who first discovered this species.¹

In 1978 Joseph K. Sheldon at Eastern College in St. Davids, a suburb of Philadelphia, discovered a wormlike animal with a head shaped like a hammerhead. It has three stripes down its back and grows to a length of 80 millimeters (3 inches). Sheldon found it beneath logs around a vegetable garden and under stones on the college campus. He also found it in his home garden 2.4 kilometers from the campus. Four years later a population was discovered on the campus of Ursinus College in Collegeville, Pennsylvania, after a student walking across the grassy campus noticed one on his shoe.²

Robert E. Ogren of Wilkes University in Wilkes-Barre, Pennsylvania, determined that the animal was a terrestrial planarian, or flatworm (Phylum Platyhelminthes), that had not previously been described. Ogren deduced that it had been introduced into this country from Asia, where its genus, *Bipalium*, is endemic. He named the new species *Bipalium pennsylvanicum*. It is the second member of this genus living outdoors in southeastern Pennsylvania.³ The first is *Bipalium adventitium*, widely distributed in North America⁴ and common in New York,⁵ especially in New York City.⁶

How flatworms attack earthworms

Both planarians, sometimes called turbellarians in reference to their taxonomic class (Turbellaria), are specialized predators of earthworms. *B. adventitium* tracks earthworms by following their mucous trails, and pursues them into their tunnels, where it blocks their escape.⁷

It digests its prey alive before consuming it:

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. 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 liquefied 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 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 mean weight gain by *Bipalium* during feeding was 89 mg +/- 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.⁸

In North America *B. adventitium* has been reported to feed on fourteen species of earthworms,⁹ including individuals fifty-five times its own weight.¹⁰ Two of these species (*Lumbricus terrestris* and *Aporrectodea rosea*) are common in our garden in Center City. *B. pennsylvanicum* also feeds on earthworms, and not on arthropods or gastropods (slugs and snails).¹¹

Exotic flatworms depleting populations of earthworms in Europe

Introduction of an exotic planarian onto the Faroe Islands and Northern Ireland has reduced populations of earthworms.¹² *Bipalium* in North America has not been shown to deplete populations of earthworms, but its full impact may take time to develop. Populations of exotic planarians predatory on earthworms are spreading in North America and Europe. Typically the planarian is first detected in or near gardens, and then spreads to surrounding areas.¹³ Ogren concluded that transfer of soil used in horticulture distributed the worms in Pennsylvania.¹⁴

I have yet to find planarians in gardens in Center City, but the animals are easy to miss. Peter K. Ducey, who has studied the natural history of *Bipalium*, suggests looking for them feeding on earthworms on paved walkways in city parks and university campuses at dawn after rain.¹⁵

North American terrestrial flatworms first appeared in Center City

Exotic terrestrial planarians had an auspicious beginning in Pennsylvania. In 1851 Joseph Leidy discovered the first one in North America. He found it under a flowerpot in his garden at his home at 1302 Filbert Street,¹⁶ currently the location of Philadelphia's Criminal Justice Center, a block from City Hall. Leidy described the species and named it *Rynchodemus sylvaticus*. He also found it in woods along the Schuylkill River and Wissahickon Creek, now part of Fairmount Park.¹⁷ This species, also present in Europe, was likely introduced into North America.¹⁸ It has since been reported in five states,¹⁹ but the worm, which feeds on soil insects rather than on earthworms,²⁰ has yet to become abundant.²¹



Figure 13.2 Philadelphia's Criminal Justice Center, site of Joseph Leidy's nineteenth-century home and the discovery of North America's first land planarian, *Rynchodemus sylvaticus*, under a flowerpot in his garden.

Infestations of planarians theoretically could take a toll on *Photinus* fireflies, whose larvae, like *Bipalium*, are specialized predators of earthworms. In the laboratory, *Bipalium* did not prey on beetle larvae.²² Conceivably, firefly larvae prey on *Bipalium*, which is soft-bodied like earthworms.

Barriers to observing planarians and their ecological impact

Defining the relationship between *Photinus*, *Bipalium*, and earthworms is problematic. Measurement of populations of animals thinly distributed in soil is imprecise. Techniques for monitoring their interactions underground have yet to be developed. Expertise that encompasses all three animals would require a team of dedicated specialists.

American robins (*Turdus migratorius*) commonly hunt earthworms in turf in Schuylkill River Park. Fireflies flash profusely in June and July. Earthworms are abundant in gardens here. If *Bipalium* flatworms have infested Center City, they have yet to take an obvious toll.



Figure 13.3 American robin (*Turdus migratorius*) grabbing an earthworm in Schuylkill River Park.

Postscript

Since I completed writing this chapter, *Bipalium pennsylvanicum* was discovered in Philadelphia. In September 2014, Heather Rinehart sent me a photograph of this worm, which she found at Bartram's Garden, approximately three kilometers from Center City.