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FIELD OBSERVATIONS ON A POPULATION OF THE LAND PLANARIAN, *BIPALIUM KEWENSE* (TURBELLARIA, TRICLADIDA), IN MIDDLE TENNESSEE

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ABSTRACT

A population of the land planarian *Bipalium kewense*, was observed weekly from October, 1973 through October, 1974, in Murfreesboro, Rutherford County, Tennessee. Records were made of maximum-minimum air and soil temperature, percent soil moisture, and numbers of sightings of worms and their fragments present under designated boards and bricks in the study area. A total of 196 sightings occurred in October, 1973, and from May through October, 1974, when mean air temperature was 65°F and mean soil temperature was 66°F. Only 27 sightings occurred from November through April, when mean air temperature was 41°F and mean soil temperature was 51°F. Each month produced some sightings, but most sightings (40) were in June, when mean air and soil temperatures were 73°F and 67°F, respectively. Soil moisture was usually above 90% for the entire period, and only asexual reproduction was observed.

INTRODUCTION

The exotic land planarian, *Bipalium kewense* Moseley 1878, has been reported from many areas of the U.S., and two apparently well established populations were found recently in Rutherford and Sumner counties, Tennessee (Chandler 1974). This worm probably has been imported into temperate regions along with plant material and soil and has been dispersed incidentally with nursery material (Hyman 1940). *Bipalium kewense* seemingly has become well adapted to the wide variations in temperature and other environmental conditions of temperate areas, but it is found more frequently in protected urban areas than in campestral situations. Barnwell (1969) discussed some adaptations that *B. kewense* would need to possess in order to be successful in temperate climates, but in these areas, few, if any, studies have been done on environmental factors *in situ* to which *B. kewense* is subjected for a considerable time. In view of this, my purpose was to make a year of observations on a population of *B. kewense* in middle Tennessee, with emphasis on changes in some environmental conditions and on fluctuations in abundance of planarians.

STUDY AREA, METHODS AND MATERIALS

Planarians were found under boards and bricks adjacent to the north and east sides of a shed at the residence of Joe Nunley, 2nd Avenue, Murfreesboro, Tennessee (Fig. 1). The study area was heavily shaded by trees from spring through autumn, and the soil was dark, predominantly of clay and silt, and about pH 6.5. This population was studied from October, 1973 through October, 1974, and weekly observations were made on maximum-minimum air and soil temperatures, soil moisture, and numbers of sightings of worms and their fragments.

Air temperature (°F) was measured with a Taylor maximum-minimum thermometer which was placed on the north side of a post in the study area (Fig. 1). For determination of soil temperature (°F), the probe of a Palmer maximum-minimum thermometer was placed about one inch in the soil under a board (Fig. 1). and the thermometer dial was mounted on a post. Soil moisture blocks were buried about two inches in the soil under a board and a group of bricks (Fig. 1), and percent soil moisture was found by inserting leads from these blocks into a battery operated Delmhorst soil moisture tester. The undersides of designated boards and bricks (Fig. 1) were examined weekly for the presence of worms and fragments of worms. Between weekly examinations, boards and bricks were not disturbed.

RESULTS

Two hundred and nine sightings of worms and 14 sightings of fragments (fission pieces) were made from October, 1973 through October, 1974. Worms and fragments were sighted more often under boards and posts (148) than under bricks (75) (Fig. 1), but a comparison of numbers of sightings per unit surface area of bricks and boards shows 26.3 sightings/sq. ft. for bricks and 15.6 sightings/sq. ft. for boards.

During October, 1973 and from May through October, 1974, 196 sightings of worms and fragments were made, when mean air temperature was 65°F and mean soil temperature was 66°F. Only 27 sightings occurred from November through April, when mean air temperature was 41°F and mean soil temperature was 51°F. Some worms were sighted each month, but the highest number of sightings (40) was in June, at which time mean maximum-minimum temperatures of the air were 81°F and 65°F, respectively, and mean maximum-minimum temperautres of the soil were 73°F and 62°F, respectively. Only three worms were sighted in December, 1973, when air temperatures did not rise above 38°F and soil temperatures reached only 59°F. Percent soil moisture was relatively high throughout the study period, and on the mean only twice dropped below 90% (Table 1).

A comparison of the pattern of numbers of sightings and fluctuations in mean temperatures per month shows a distinct decline in sightings at times of low temperatures and a rather dramatic increase in sightings as temperature began to rise in May (Fig. 2). As expected, fluctuations in mean soil temperatures per month were less than those of air (Fig. 2). Mean monthly soil temperatures were never above 74°F or below 39°F, whereas mean monthly air temperatures attained a high of 86°F and a low of 16°F (Fig. 2). The highest

recorded weekly maximum was 90°F for air and 75°F for soil, and the lowest recorded weekly minimum was 12°F for air and 36°F for soil.

Sexual reproduction in *B. kewense* was not observed during this study either in the field or laboratory, but worms did undergo asexual reproduction, which is characterized by the formation of fragments or pieces of worms pinched off the posterior end. Although only 14 sightings of fragments were observed in the field, the ratio of fragments to worms was greatest during times of low temperature (Fig. 2).

Other invertebrates common under bricks and boards were centipedes, isopods, and slugs. None of these was observed to feed upon *B. kewense* or *vice versa*, but *B. kewense* did feed on earthworms in the study area and laboratory.

TABLE 1: *Numbers of sightings of* Bipalium kewense *and fragments per month, mean monthly maximum-minimum air and soil temperatures, and percent soil moistures October, 1973 through October, 1974.*

Months	Worms Sighted	Fragments Sighted	Mean Temp. °F AIR Max.	AIR Min.	SOIL Max.	SOIL Min.	Av. % Soil Moisture
Oct 1973	35	3	64	42	66	56	86
Nov	4	0	57	27	62	47	95
Dec	3	0	31	16	52	41	94
Jan 1974	1	3	58	29	56	43	96
Feb	2	3	46	20	52	39	95
Mar	5	2	68	32	60	45	96
Apr	4	0	67	36	63	50	96
May	18	0	76	47	69	59	97
Jun	40	0	81	65	73	62	94
Jul	26	0	82	62	73	68	95
Aug	31	2	86	62	74	69	94
Sep	24	1	76	50	72	61	92
Oct	16	0	74	35	62	52	86

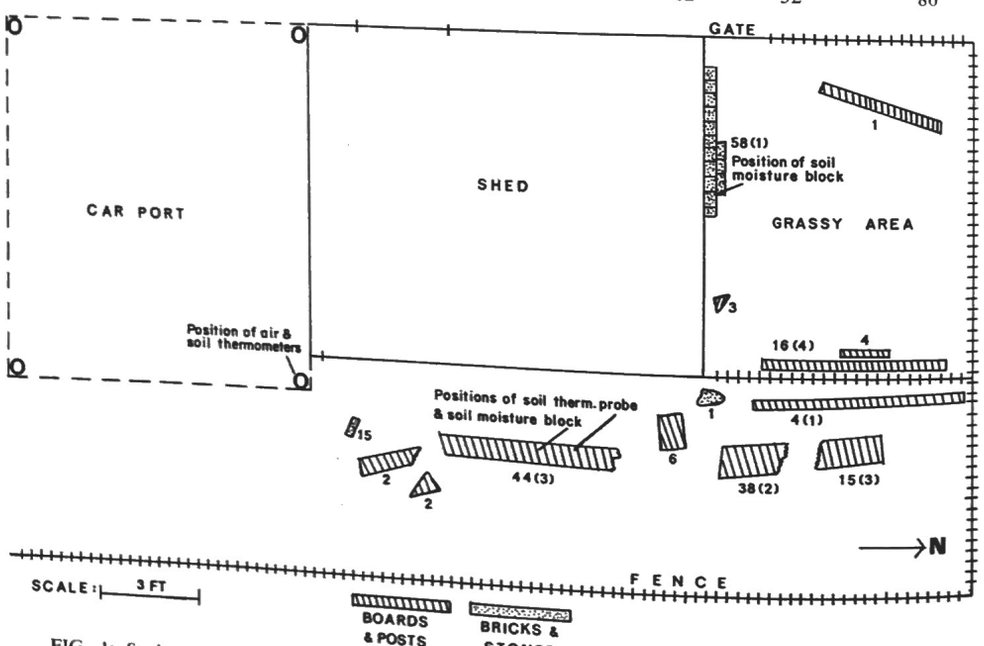

FIG. 1: *Study area for* Bipalium kewense, *2nd Avenue, Murfreesboro, Rutherford County, Tennessee showing total numbers of sightings of worms and fragments (in parentheses) under boards and bricks from October, 1973 through October, 1974.*

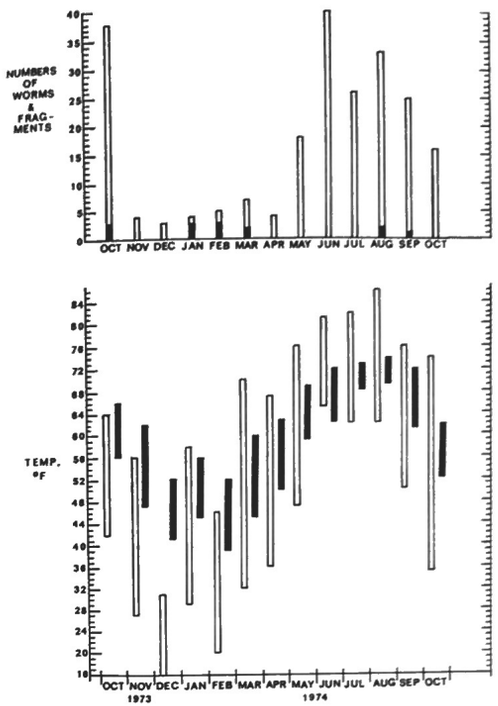

FIG. 2: *Comparison of numbers of worms (open bars) and fragments (solid bars) of* Bipalium kewense *sighted per month and fluctuations in mean monthly air temperatures (open bars) and soil temperatures (solid bars).*

Discussion

Although the winter of 1973-74 was not severe in Murfreesboro, subfreezing air temperatures and low soil temperatures did occur, and *B. kewense* successfully *withstood* these temperatures and appeared in large numbers once higher temperautres were reached. Thus, it seems that an originally tropical land planarian has become well adapted to the temperature regime of a temperate region. The matter of where these worms go during periods of low temperature was not resolved; however, some speculation seems appropriate. Olgren (1955) made field observations in New York on another land planarian, *Rhynchodemus sylvaticus*, and reported that they were primarily soil rather than surface inhabitants and that they retreated into the soil during unfavorable conditions. In my study, several samples of the first few inches of soil and of a compost pile in the study area were examined during winter for worms and fragments, but none was found in either case. Another possible retreat, which could not be investigated was the soil beneath the floor of the shed in the study area (Fig. 1). It is highly probable that worms went into this region at times of low ttmperature and returned to the undersides of boards and bricks adjacent to the shed during periods of favorable temperature.

Hyman (1951) stated that *B. kewense* never becomes sexual in temperate areas, but Connella and Stern (1969) did observe sexual specimens in the field and laboratory in New Orleans, which might be considered a semi-tropical habitat. In my study, several specimens of *B. kewense* were maintained in a large, covered jar that contained soil from the study area. Asexual reproduction occurred repeatedly, but sexual reproduction was not evident.

Phillips and Dresden (1973) extracted a collagenolytic enzyme from *B. kewense* and postulated that it may serve to degrade collagen in the cuticle of earthworms. The feeding of *B. kewense* on earthworms has been documented by several workers (Wallen 1954, Barnwell 1967, Olewine 1972), and this was verified several times in my laboratory. Another land planarian, *Geoplana vaga*, was observed to feed on the common pill bug (Olewine 1972), and Klots (1960) reported that *Bipalium adventitium* fed on slugs. Both pill bugs and slugs were numerous in the Murfreesboro habitat, and quite possibly *B. kewense* used these as a food source, but there was no positive evidence of this.

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