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Amphisbaenids, or worm lizards, are a small enigmatic suborder of reptiles (containing 4 families; ca. 140 species) within the order Squamata, which includes the more speciose lizards and snakes (Gans 1986). The name amphisbaenia is derived from the mythical Amphisbaena (Topsell 1608; Aldrovandi 1640), a two-headed beast (one head at each end), whose fantastical description may have been based, in part, upon actual observations of living worm lizards (Druce 1910). While most are limbless and worm-like in appearance, members of the family Bipedidae (containing the single genus *Bipes*) have two forelimbs located close to the head. This trait, and the lack of well-developed eyes, makes them look like two-legged worms. Their current known distribution includes extreme southwestern Mexico and Baja California (Gans 1974, 1986; Smith & Smith 1977; Papenfuss 1982). [Note: The range map provided in Gans (1986) is erroneous in that it fails to show the distribution of *Bipes* in Mexico, *Rhineura* in Florida, and *Amphisbaena* and *Cadea* in the Carribean.] This article will address and review unconfirmed rumors of *Bipes* or a *Bipes*-like species of amphisbaenid occurring in Nebraska and other parts of the United States.

In the year 1819, Major Stephen H. Long was commissioned to lead an expedition to the Yellowstone region and Rocky Mountains of the underexplored western United States (Viola 1987). On June 27, 1820, the Long Expedition (sometimes called the Yellowstone Expedition) encountered a *Bipes*-like creature in the South Platte River Valley, somewhere between the present-day towns of Ogallala, Nebraska and Julesberg, Colorado (James 1823; Campbell 1980). Thomas Say was the zoologist in the expedition who presumably collected and wrote descriptive notes of this unusual specimen. Unfortunately, the specimen was lost (it is not recorded how this occurred) and Say's valuable notes also were lost when the saddlebags in which they were transported were stolen by three deserters (James 1823). The rather sketchy description left to us was provided by Edwin James, the Long Expedition's Geologist/Botanist/Surgeon/Chronicler, rather than Thomas Say, whose descriptions of new species were published as scattered footnotes in the report. James' brief description was apparently done from memory and was reprinted recently by Campbell (1980). It reads: "We observed, in repeated instances, several individuals of a singular genus of reptiles (*Chirotes*. Cuv.) which, in form, resemble short serpents, but are most closely allied to the lizards, by

being furnished with two feet. They were so active, that it was not without some difficulty that we succeeded in obtaining a specimen. Of this (as was our uniform custom when any apparently new animal was presented) we immediately drew out a description. But as the specimen was unfortunately lost, and the description formed part of the Zoological notes and observations, which were carried off by our deserters, we are reduced to the necessity of merely indicating the probability of the existence of the *Chirotes lumbricoides* of naturalists, within the territory of the United States" (James 1823: Vol. 1, p. 484).

Edward H. Taylor (1938) flatly dismissed this account despite the fact he was convinced that *Bipes* occurred in the Huachuca and Santa Catelina Mountains of Arizona, based on oral reports by persons who were not herpetologists. Hobart M. Smith (1946) gave this unconfirmed amphisbaenid a tenative common name, the Arizona worm lizard, and in a 1950 paper coauthered with Taylor, stated confidently that *Bipes* occurs in southeastern Arizona. Campbell (1980) has pointed out that this was a "remarkable procedure" in view of the total lack of specimens or field observations made by herpetologists.

Nevertheless, Taylor thought the James account was "fictitious" and cited Harlan (1927) to support his notion. Harlan (1927) stated: "In the **Methodical Table of North American Reptilia** [his 1926 publication], we have omitted to notice a species of *Chirotes*, the existance of which in this country is indicated in Major Long's **Expedition to the Rocky Mountains**, Vol. 1, p. 484." Does this indicate that Harlan dismissed this account? It is difficult to determine just what was implied by this statement, an ambiguity that was pointed out by J. Howard Campbell, who in 1980 resurrected the unresolved debate that has persisted to this day (Maslin 1959; Dundee 1980; Gans & Pappenfuss 1980; Smith & Holland 1981; Wright & Mason 1981; Hammerson 1982; Stebbins 1985).

Gans and Pappenfuss (1980) have correctly pointed out two problems with the James account. First, *Bipes* moves too slowly to match the activity reported by James (see Gans 1974). Secondly, the Cuvierian name *Chirotes* (Cuvier 1817) at that time refered to a confussion of different organisms that included a wide variety of two-limbed and limbless amphibians and reptiles.

Further evidence for the occurrence of amphisbaenids in Nebraska comes from Dundee (1980) who reported verbal descriptions of a lizard , with only two legs near the animal's head, occurring 21 miles north of North Platte along U.S. Highway 83, in the Sand Hills. The description was provided in June, 1951, by a local rancher (A. J. Simants of

Tryon, NE) and his children. These lizards were reportedly found while "excavating for fence posts or when pulling up rotting fence posts" Dundee (1980).

Smith and Holland (1981) give further creedence to the James account with mention of a two-legged lizard found by a layman on a farm southeast of Fort Collins, Colorado, and another account of a *Bipes*-like amphisbaenid, from a graduate student who stated the animal was found under a rock just west of Loveland, Colorado. Smith and Holland also suggest that James' description of vigorous activity may have been based, in part, upon mistakenly confusing the rapid activity of the many-lined skink, *Eumeces multivirgatus*, a common lizard in that region, with the behavior of *Bipes*; not surprising, when one considers that the observation was based entirely upon memory. Additional discriptions by ranchers from Fort Collins give support for the Colorado reports (Maslin *cited in* Smith & Smith 1977).

More evidence for the occurrence of *Bipes* in the U.S. is provided by Wright and Mason (1981) who found an English translation of a historical report dating back to 1877; the **Memoirs of José Francisco Palomares** (Temple 1955). This manuscript describes an early exploration of California in the 1820's which probably took place near Little Panoche Creek (La Panocha Chiquita) in the Panoche Hills of western Fresno or San Benito Counties, California. Members of this expedition encountered several creatures which fit the description of *Bipes*. In a rather melodramatic, if not lurid, narrative one of these creatures is said to have crawled into the anus of an American Indian servant, while he slept, causing such severe internal injuries with its "short, little claws, steele-like and as sharp as needles," that the victim bled to death. Althought this reads like fiction, the behavioral description is similar to that attributed to *Bipes biporus* in the La Paz area of Baja California, based upon the unconfirmed accounts of locals. The wound in this instance may have been caused by a bite; *Bipes* often preys on vertebrates larger than itself by emerging from the substrate and taking a vigorous bite, sometimes removing a considerable amount of flesh (Papenfess 1982). Additionally, the surrounding moist, sandy habitat is well suited to *Bipes* (Wright & Mason 1981).

Further, modern evidence for *Bipes* in the U.S. is provided by Robert C. Stebbins (1985) who mentions still another seemingly credible oral report from Arizona, in the Paradise Valley near Phoenix. This animal was found associated with termite galleries. Stebbins seems inclined to believe this account and suggests that more efforts should be made to locate physical evidence in the form of actual specimens.

Does *Bipes* or a *Bipes*-like amphisbaenid occur anywhere in the United States? James' account is difficult to dismiss in

light of the body of supportive, modern verbal reports. It also should be kept in mind that the ill-fated Long Expedition had such prominent naturalists as Titian R. Peale and Thomas Say. As one of the earliest zoologists to visit the Great Plains, Say is responsible for describing many of our most common vertebrates including *Crotaphytus collaris* (collared lizard), *Scincella lateralis* (ground skink), *Carphopis amoenus* (eastern worm snake), *Thamnophis proximus* (western ribbon snake), *Elaphe obsoleta* (rat snake), *Bufo cognatus* (Great Plains toad), *Blarina brevicauda* (short-tailed shrew), *Canus latrans* (coyote), *Vulpes velox* (swift fox), *Tyrannus verticalus* (Western Kingbird), and *Carduelis psaltria* (Lesser Goldfinch) (James 1823; Adler 1989). Several of these newly described organisms were collected while the members of the Long Expedition were encamped near what is today the Omaha/Council Bluffs area. His tenacity at collecting and describing new species is remarkable in view of the numerous hardships (including extended illness) he encountered out on the plains (James 1823; Weiss & Zeigler 1931). Inspired by his uncle, the famous naturalist William Bartram, Say was a dedicated scientist who cofounded the Academy of Natural Sciences in Philadelphia. It is claimed that during dire times he slept beneath the skeleton of a horse in the museum and ate nothing but bread and milk; a cost of living amounting to 75 cents per week (Weiss & Zeigler 1931; Adler 1989). Truely a remarkable man!

The fact that no actual specimens of *Bipes* exist from areas north of Baja California, Mexico may be attributed to their secretive habits. Until the 1970's, only 50 specimens of *Bipes* had been known. This was increased to ca. 3, 800 after an extensive study by Papenfuss (1982). As further proof that more species await discovery, Alvarez del Toro, the famous Mexican herpetologist, has mentioned that mutilated remains of an apparently undescribed *Bipes* were found at road construction sites in Chiapas, Mexico (*cited in* Smith & Smith 1977), a locality far to the east of the known distribution on this genus. However, these remains were not seen by him (A. del Toro *cited in* Papenfuss 1982). Papenfuss does mention accounts of *Bipes* at the Colima-Michoacón border, Tecomán, Colima, which he considers to be credible. In a recent article by Cabrera and Merlini (1990), dietary information was obtained from the amphisbaenid *Amphisbaena darwinii heterozonata* in Argentina, by collecting 53 individuals that were plowed up from the soil by a caterpillar tractor, during a two day period. Prior to that rather fortuitous collecting event, published accounts on the diet of *Amphisbaena* were scarce. In the six years that I have lived in northcentral Florida, I have only seen four living examples of the Florida worm lizard, *Rhineura floridana*, a species listed as "common" by Paul Moler (1990), and currently the only known amphisbaenid occurring in the U.S. (Gans 1967*a*). Three of these were obtained by colleges, living in Gainesville, while roto-tilling their gardens. The

fourth was captured by John M. Matter and myself in November, 1990, while using potato rakes (also called 4-pronged rake) to uncover buried mole skinks, *Eumeces egregius*, in a Rosemary scrub habitat in Levy County, near Archer, Florida. Mount (1963) also found *R. floridana* using the same technique to search for mole skinks. As an interesting aside, Ashton and Ashton (1985) claim that the "Arizona worm lizard (*Bipes*)" has been reported as "released" in Florida. This is a remarkable and totally unsubstantiated statement considering that this "species" has never been documented with a specimen from Arizona, let alone formally described!

An important limiting factor in the current distribution of *Bipes* seems to be latitude; none occur north of Baja California, Mexico (Smith & Smith 1977; Papenfuss 1982). However, an organism that lives below the surface, often as deep as one meter (Smith & Smith 1977; Papenfuss 1982), may not be seriously influenced by climate. The habitat of worm lizards thought to inhabit Colorado and Nebraska share a common feature in that it includes sand dunes and sand dune isolates consisting primarily of eolian (wind-blown) sands deposited 10, 000 to 1.5 million years ago (Swinehart 1989). This is good habitat for a burrowing organism. Low elevation alluvial sands should also provide the right habitat for amphisbaenids. It should not be forgotten that extinct amphisbaenids once occurred in Nebraska and Colorado; fossil *Rhineura* approximately 11 - 12 million years old are known from both of these states (Gans 1967*b*).

Lastly, Colorado, Nebraska and Arizona are known to have isolated or disjunct populations of reptiles (Hammerson 1981, 1982; Lynch 1985; Stebbins 1985). The disjunct, relic, and marginal populations of reptiles in the Nebraska Sand Hills include *Kinosternon flavescens* (yellow mud turtle) (Imler 1945; Seidel 1978), and the recently discovered populations of *Eumeces septentrionalis* (northern prairie skink) along the Elkhorn River (Lynch *cited in* Freeman 1989), *Storeria occipitomaculata* (redbelly snake) near Gothemberg, Dawson Co. (Peyton 1989), and *Arizona elegans* (glossy snake) south of Thedford, Thomas Co. (Freeman 1989; Gubanyi 1990). Add to this the endemic population of Niobrara woodrats, *Neotoma floridana baileyi* (Jones *et al.* 1983), and an unconfirmed report (no voucher exhists) of the kingsnake, *Lampropeltis getula*, also near the Niobrara River in Boyd County (Hudson 1942; Lynch 1985). Also, it must be kept in mind that Nebraska's only endemic species of plant, *Penstemon haydenii* (blowout penstemon), is limited to the Sand Hills (Kaul 1989; Farrar 1990). Should it be surprising that a heretofore undescribed animal awaits discovery in the Nebraska Sand Hills?

Given the large body of verbal records, we need to confirm, with a voucher specimen, whether an amphisbaenid does occur in Nebraska. This may be achieved by going to the localities

previously mentioned, and using an ordinary potato rake or shovel to dig them up. Try areas with damp sand beneath logs, riverside drift-wood and boards, especially after heavy rains. Also try pulling up old, rotting fence posts. Papenfuss (1982) achieved success by digging into riverbanks, and at the bases of fenceposts and shrubs. Be on the lookout for termite galleries, a favored habitat. The presence of *Bipes* can be indicated by a network of tunnels 1/4 - 3/8 inch (6 - 9 cm) in diameter (Stebbins 1985). Raking through gopher (*Geomys* sp.) mounds could prove as profitable as it does for worm lizard collecting in Florida (Mount 1963). Another place to search includes the small alpine meadows associated with the Niobrara River Valley. Regardless of the fact that no worm lizard sightings have come from this area, I suspect that there may be a discovery or two awaiting the diligent collector working in this unique habitat.

To date there are no voucher specimns of *Bipes* in Nebraska or other regions of the United States. As such, it would be incorrect to list this "species" on faunal checklists until verified by physical evidence. If found, suspect specimens should be turned in to a local university along with accurate data (specific locality, date, habitat, etc.) for proper validation. I encourage anyone living in the aforementioned regions to search for these creatures. Who knows what you will find? Your perseverance may be rewarded with the herpetological discovery of the century. A task that has been called "a challenge to future naturalists that is likely to be even more frustrating than the search for the Loch Ness monster" (Smith & Holland 1981).

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Erratum

In Volume 12, Number 1, of ***Nebraska Herpetological Newsletter***, in the article titled "Do worm lizards occur in Nebraska?" by L.A. Somma, the information on *Bipes* preying upon vertebrates (p. 3, bottom of 3rd paragraph) is incorrectly attributed to Papenfuss (1982). The source of this dietary information actually was obtained from C. Mattison (1989. ***Lizards of the World***. Facts on File, New York.). In addition there are several spelling errors ("borrowing" for "burrowing," and a Quayle-like version of "potato"), on pages 5 and 6.