

A NEW ADDER'S-TONGUE (*OPHIOGLOSSUM*: OPHIOGLOSSACEAE) FOR NORTH AMERICA

JAMES C. ZECH and PATRICIA R. MANNING

Department of Biology
Sul Ross State University
Alpine, TX 79832, U.S.A.

WARREN HERB WAGNER JR.

Department of Biology
University of Michigan
Ann Arbor, MI 48109, U.S.A.

ABSTRACT

The widespread Old World adder's-tongue, *Ophioglossum polyphyllum* A. Br. is reported for the first time in North America. Formerly confused with *O. engelmannii* Prantl, we now recognize as *O. polyphyllum* collections from U.S.A. (Texas and Arizona) and Mexico (Hidalgo, Oaxaca, San Luis Potosí, and Zacatecas). The earliest confirmed collection was in 1874. The two species are keyed out and illustrated, and specimens of *O. polyphyllum* are listed. The known county distribution of the species in Texas is mapped, and the habitat and phenology are briefly described.

RESUMEN

La lengua de serpiente del Viejo Mundo, muy frecuente, *Ophioglossum polyphyllum* A. Br. se cita por primera vez en Norte América. Previamente confundida con *O. engelmannii* Prantl, reconocemos ahora como *O. polyphyllum* colectas de E.E.U.U. (Texas y Arizona) y Mexico (Hidalgo, Oaxaca, San Luis Potosí, y Zacatecas). La primera colecta confirmada fue en 1874. Se ofrece una clave de identificación y se ilustran las dos especies, y se listan los especímenes de *O. polyphyllum*. Se cartografía la distribución conocida por condados en Texas, y se describen brevemente el hábitat y la fenología.

The adder's-tongues, *Ophioglossum* (Ophioglossaceae) are a small group of striking and unusual species, with the highest known chromosome numbers in the plant kingdom. The gametophytes are subterranean, the roots lack root hairs, and the leaf is made up of two parts: the sterile blade portion (trophophore) and the spore-bearing portion (sporophore). The trophophore has complex reticulate venation and is believed to be phyllodial in origin (Wagner 1979). The sporangia are deeply sunken in the apical portion of the sporophore. There are probably as many as 35 species worldwide but two areas, India and Africa, seem to be regions of maximum diversity. Many of the species occur in open arid sites and remain underground until seasonal or sporadic rains stimulate the leaves to push up through the soil and

grow to full size before discharging the spores. In America north of Mexico seven terrestrial species are traditionally recognized: *Ophioglossum pusillum* Raf., *O. vulgatum* L., *O. californicum* Prantl, *O. nudicaule* L.f., *O. petiolatum* Hook., *O. crotalophoroides* Walter, and *O. engelmannii* Prantl. However, we have recently discovered another species heretofore unknown from the New World. We originally interpreted the plants in question as a narrow form of *O. engelmannii* (Zech & Manning 1996), but subsequent study reveals a number of differences from that species, and we now identify it confidently as *O. polyphyllum* A. Br. The earliest collection was in 1874. Clausen's monograph (1938) does not even recognize this species anywhere in the world; he merely synonymized it with *O. vulgatum*. Nevertheless, we have come a long way taxonomically from the first half of this century, not only in regard to Ophioglossaceae, but Lycopodiaceae, Isoëtaceae, Thelypteridaceae, and many other pteridophyte groups. Lellinger's (1985) manual of North America pteridophytes does not list *O. polyphyllum*, nor does Flora North America north of Mexico (Wagner & Wagner 1993).

This species has an enormous range: Africa, Asia (e.g., S. China, India), Polynesia (e.g. Hawaii), and now North America. It is probably made up of a number of subspecies, but these are held together by a set of distinctive characters, described below. There is no question that it is most closely related to *O. engelmannii*. Its main point of resemblance involves the venation pattern in which the major areoles include minor areoles, a condition commonly referred to as bireticulate. In most species the major areoles of adder's-tongues possess only free included veinlets that themselves do not interconnect. Large specimens of *O. nudicaule* (the form known as *O. ellipticum* Hook. & Grev.) usually possess bireticulate veins (Wagner et al. 1984), as does the Old World *O. costatum* A. Br. (Burrows 1996). Both *Ophioglossum vulgatum* and *O. reticulatum* show a tendency toward bireticulation, but the relatively few areoles are coarser and more open. The very fine bireticulation in *O. engelmannii* and *O. polyphyllum* is quite distinctive.

Ophioglossum engelmannii is apparently a strictly New World taxon, and limited to North America, including Mexico, and Central America. It is commonly referred to as "Limestone adder's-tongue" for its tendency to grow on soil layers above limestone. In the United States it usually appears during and after rains, but it may reappear in the same places during later high precipitation periods. Dean P. Whittier of Vanderbilt University has actually forced a new "brood" of leaves to form in late summer by watering a site where the plants normally appear only in the spring (pers. comm.).

A key to the two species is presented below. To see the venation of a dried specimen more clearly, a drop of 95% alcohol placed on the laminar surface will, after soaking in, clear the leaf temporarily and will not damage the

specimen. Collectors should be warned not to break off or remove the characteristic elongate brown leaf sheaths that surround the green leaf bases: collecting can be accomplished best by carefully digging up the specimens. This has the added advantage of showing the roots, and their numbers and relative sizes.

Roots 25(15–30), thinner, mostly 0.6(0.3–0.9) mm thick, yellow to dark brown, commonly somewhat crooked (dried); persistent old leaf bases numerous, 5 (2–9); trophophore narrowly ovate, attenuate proximally and distally, length/width 4, 4.8(3.2–7.7) \times 1.2(0.7–1.9) cm; sporangial clusters 1.8(0.6–2.6) \times 0.25(0.2–0.3) cm; apicula 1.0(0.3–1.8) mm. *O. polyphyllum*
 Roots 15(6–24), thicker, 0.9–1.1(0.3–2.0) mm, often darker or blackish, usually straight (dried); persistent old leaf bases few 2(1–4); trophophore broadly ovate to oblong, length/width = 3, 6.0(4.5–8.5) \times 2.0(1.5–2.5); sporangial clusters 2.5(2.0–4.0) \times 0.25(0.2–0.4) cm; apicula 0.6(0.0–1.3) mm. *O. engelmannii* (Fig. 1)

The county distribution of *Ophioglossum polyphyllum* in Texas is shown in Figure 2 (triangles) in comparison with *O. engelmannii* (dots). The map shows a dramatic difference in range between the two species. Most of the collections of *O. polyphyllum* were made along U.S. Highway 90 or on roads nearby: in Brewster County near Alpine and Marathon; in Jeff Davis County near Valentine; and in Presidio County near Marfa. On the basis of our experience, we believe that an effort ought to be made to explore much further afield in other Texas (as well as New Mexico and Arizona) counties, e.g., Hudspeth, Culberson, Reeves, Ward, Pecos, and Terrell in Texas, and also areas to the south in Mexico (e.g., Coahuila, Chihuahua, and Sonora states and southwardly adjacent states).

There are many reasons why *O. polyphyllum* was not heretofore collected, among the most important being its occurrence among grasses, the shape of the leaf resembling some monocots, and especially the very short period of appearance above ground, which after strong rains probably rarely exceeds two weeks, the latter week presenting only dying straw colored and withered blades.

Plants are found in shallow ditches and troughs along the roadsides (Fig. 3). The adjacent landscape is open rangeland. While no plant species occur consistently with *O. polyphyllum*, the two most prevalent are the grasses *Buchloe dactyloides* and *Bouteloua curtipendula*. Other, less consistent associates are *Bouteloua gracilis*, *Chloris verticillata*, *Hilaria mutica*, *Panicum obtusatum*, and *Bothriochloa* sp. Among the forbs are *Asclepias oenotheroides*, *Berlandiera lyrata*, *Cirsium texanum*, *Cooperia drummondii*, *Croton Pottaii*, *Engelmannia pinnatifida*, *Ratibida columnaris*, and *Thymophylla* sp. The vegetation is typical Chihuahuan Desert grassland, and includes such cactus genera as *Coryphantha*, *Echinocereus*, and *Opuntia*. The substrate involves various clays that are usually deep and allu-

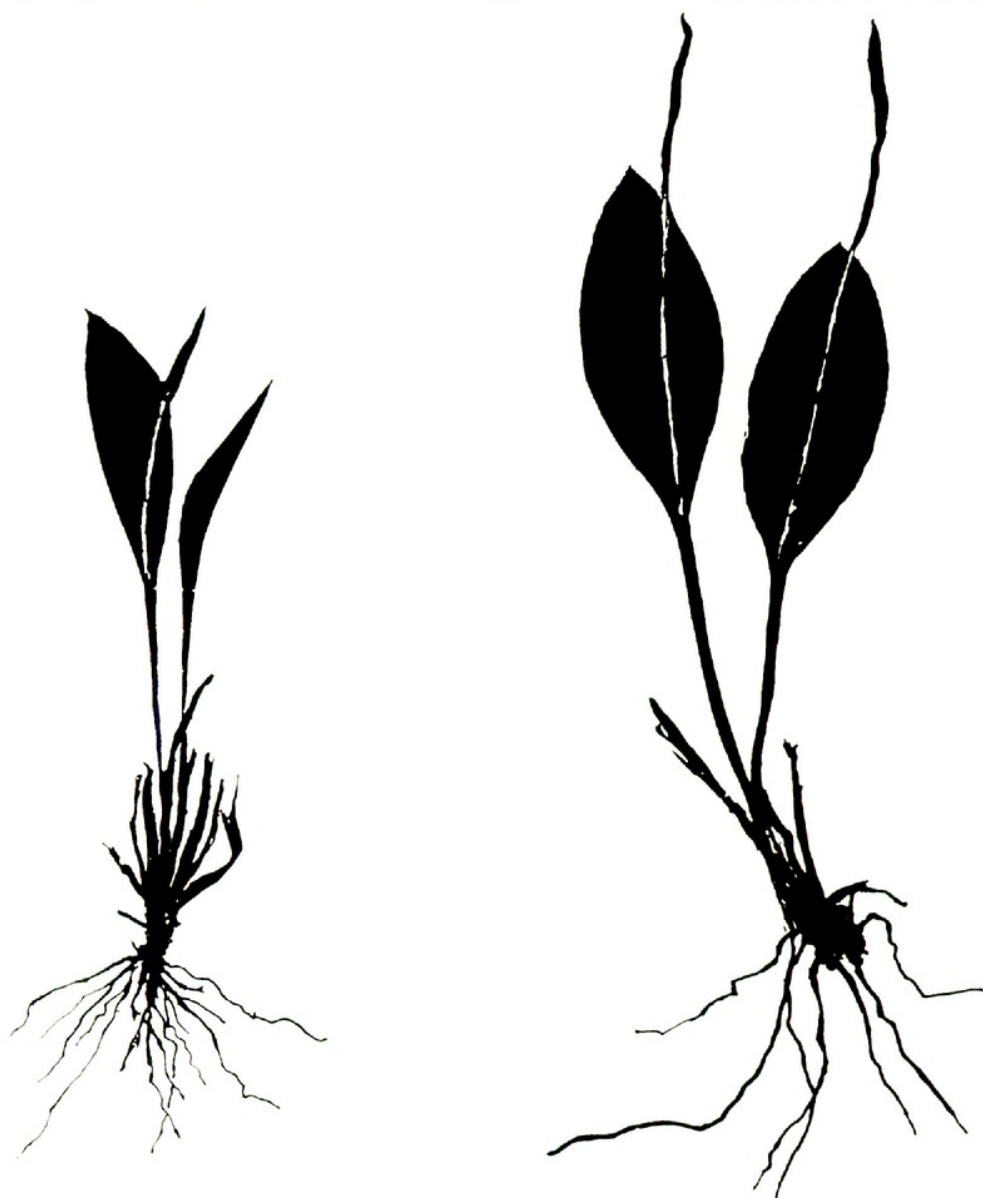


FIG. 1. A semi-diagrammatic comparison of *O. polyphyllum* (left) and *O. engelmannii* (right). Scale bar = 2 cm.

vial. Plants within adder's-tongue colonies vary from several to hundreds. Vegetative reproduction is accomplished by horizontal roots, the proliferations producing plantlets as far as ten centimeters from the genet.

Our records outside of Texas are very few, and all were previously identified as *O. engelmannii*. In Arizona it was found in "mesas around the Mustang Mts." The habitats in Mexico (what little is recorded on the labels) appear to be more or less similar to those in Texas. The Rollins and Tryon collection listed below was found in "clay soil over limestone, in shade of small arborescent *Opuntia* in *Larrea* and *Prosopis* desert," and the Reeder et

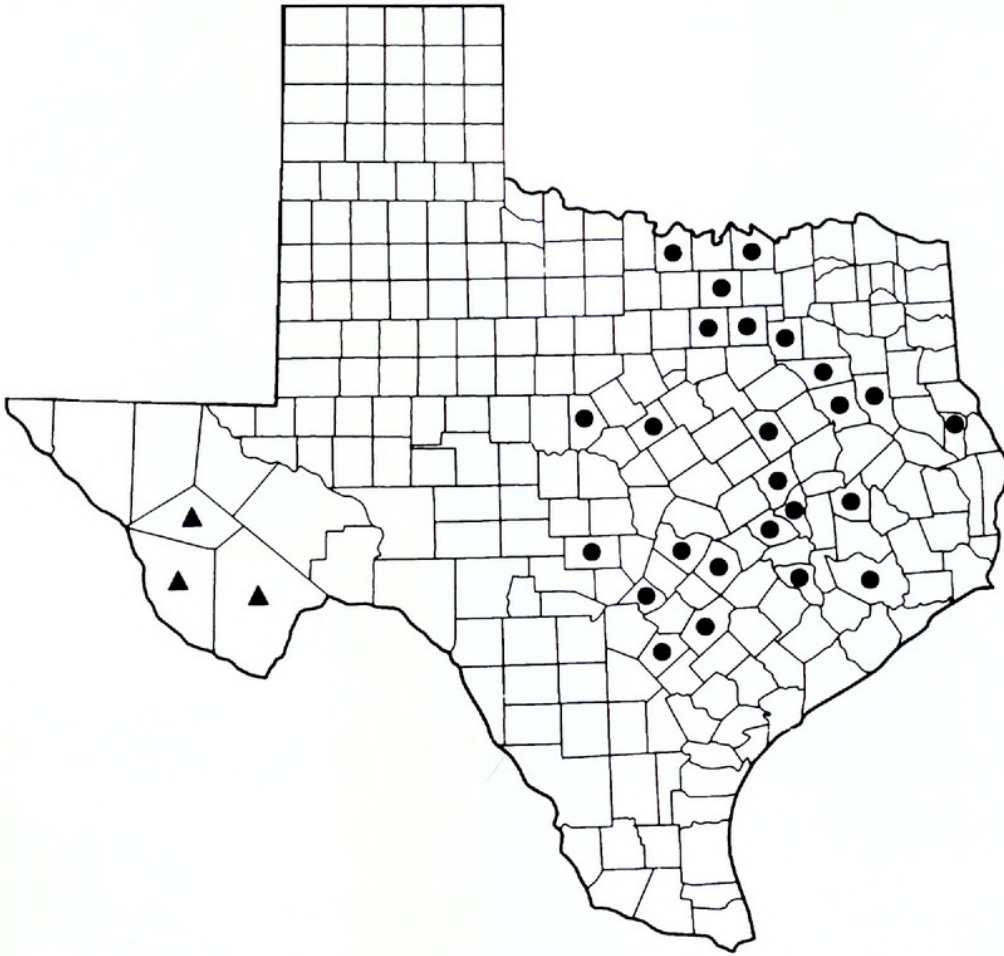


FIG. 2. Presently confirmed county records in Texas for *O. polyphyllum* (triangles) and *O. engelmannii* (dots).

al. collection in "thorn savannah in the open among *Euchloë dactyloides* and *Bouteloua stolonifera*." The Pringle and Purpus Mexican collections lack habitat data.

Collection citations: U.S.A. ARIZONA: Mustang Mountains, 13 Sep, C. G. Pringle in 1884, (GRAY). TEXAS. (Collections made along Hwy 90 and deposited in SRSC, unless otherwise indicated. **Brewster Co.:** 5.5 mi E of Marathon N of Hwy 90, 7 Jun 1995, Manning 896; 5.9 mi W of Marathon S of Hwy 90, 20 Jun 1995, Manning 897; 6.5 mi E of Alpine S of Hwy 90, 8 Jul 1995, Manning 914; 12 mi W of Marathon S of Hwy 90, 5 Jul 1995, Manning s.n.; 6.5 mi W of Marathon N of Hwy 90, 24 Jun 1996, Manning 959; 5.7 mi E of Marathon, 11 Jun 1995, A.M. Powell & S.A. Powell 6085; 6.0 mi E of Marathon N of Hwy 90, 13 Jun 1997, Manning 1013; 17 Jun 1997, Manning & Zech 1017A (MICH); 24 Jun 1997, Manning & Zech 1017B (MICH); 6.2 mi E of Marathon S of Hwy 90, 14 Jul 1997, Hansen et al. 40; 6.3 mi S of Brewster/Pecos Co. line, 30 Jun 1997, Manning 1034. **Jeff Davis Co.:** 7.8 mi W of Valentine E of Hwy 90, 11 Jul 1995, Manning 915; 25 Jun 1997, Manning & Zech 1020 (MICH); 0.2 mi SE of 505/166 jct. on loop 166, 14 Aug 1971, Keil 1699 (GRAY); 25 Jun 1997, Manning & Zech 1031 (MICH). **Presidio Co.:** 0.1 mi E of Marfa, 26 Jul 1995, Manning 925.

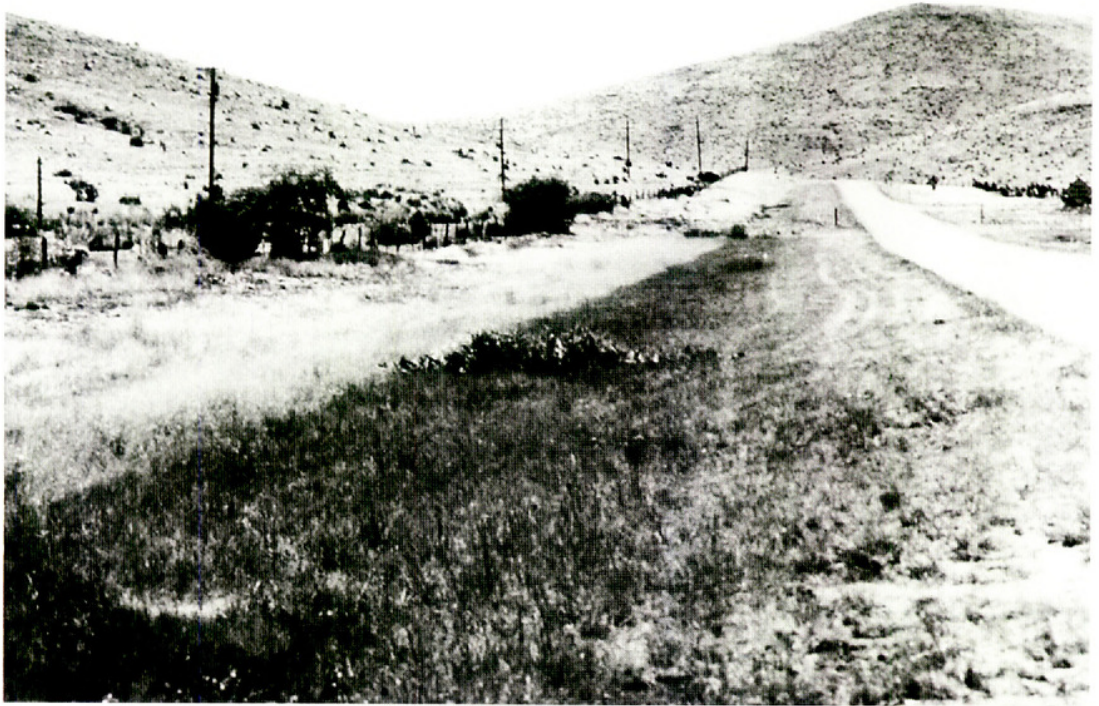


FIG. 3. Habitat of *O. polyphyllum* in shallow roadside ditch. TX: Jeff Davis Co., along loop 166.

MEXICO. Hidalgo: Hill, near El Gallo, 7000 ft, 17 Aug 1902 C.G. Pringle (GH). Oaxaca: Los Marañjos, vicinity of San Luis Tultitlanapa, Puebla, near Oaxaca, May 1908, C.A. Purpus 3152 (GH). San Luis Potosí: 15 mi NE of San Luis Potosí, 6500 ft, 4 Sep 1961, J.R. Reeder, C.G. Reeder, & T.R. Soderstrom 3300 (GH). Zacatecas: 32 mi N of Fresnillo, 25 Nov 1958, 7000 ft, R.C. Rollins and R.M. Tryon (GH).

There is no easily projected certainty about when the plants will appear. Continuous drought will prevent the leaves from expanding and extending above the soil. However, the best months in general are June and July, whenever several rains occur. Apparently, chance rainy periods at any other time, however, will bring forth an "out-of-season" growth, and we now have records from May, August, September, October, November, and December. Our impression is that *O. polyphyllum* "lies in wait" for rain, emerges through tightly compacted soil that has been softened by the water, and then has a fairly short time span to reproduce and disperse spores. However, based upon greenhouse observations, even when water availability is not a factor, trophophores will tend to die back following spore production and dispersal.

It should be noted that *O. polyphyllum* is ecologically a "loner," in the sense that it does not occur microsympatrically along with other species of *Ophioglossum* (or *Botrychium*). Other Ophioglossaceae are noted for forming "genus communities," members of the same or closely related genera that

co-occur syntopically (Wagner & Wagner 1983). To illustrate the usual situation, in the United States in the region from the Carolinas to Arkansas and southward, we find *O. nudicaule*, *O. crotalophoroides*, and *O. petiolatum* (plus the ophioglossaceous *Botrychium biternatum* and *B. lunarioides*) together in the same habitat, sometimes side by side and intermixed with each other. But this is evidently not the case with *O. polyphyllum* according to Burrows (1996) who writes that in Africa *O. polyphyllum* is "The one species of *Ophioglossum* that is rarely found as a component of genus communities."

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