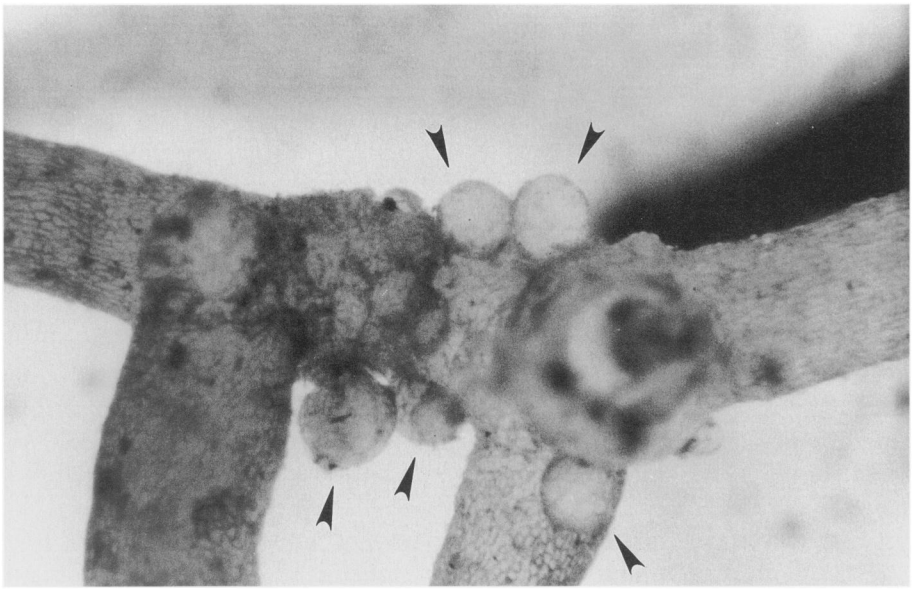

FIG. 1. Gemmae of *Botrychium pumicola* (arrows). Spherical gemmae (class 6) attached to a plant (class 3) with roots and a shoot apex that is extending up from the plane of view.

mae on four *Botrychium* species and listed six developmental classes: 1) stem with emergent leaf; 2) stem with non-emergent leaf; 3) shoot apex without leaf; 4) stem-root system without shoot apex; 5) germinated (elongated) gemmae; and 6) ungerminated (spherical) gemmae. All six developmental classes were observed in *B. pumicola*. The gemmae of *B. pumicola* are similar to those of *B. echo* W.H. Wagner in that they often remain attached to the parent plant. Gemmae representing developmental classes 3 to 6 were found attached to stems of parent plants. One collection had two attached stems, each with an emergent leaf. Presumably, this is an example of a class 1 gemma still attached to the parent.

Farrar and Johnson-Groh (Amer. J. Bot. 77:1168–1175, 1990) hypothesized that dry climatic conditions increase gemma production, specifically in *B. campestre* W.H. Wagner & Farrar, which grows in dry prairie environments. *Botrychium pumicola* also grows in a dry habitat and may be exhibiting a similar adaptive response.—FRANCISCO J. CAMACHO, Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331.

New County Records of *Botrychium lunarioides* in Texas.—*Botrychium lunarioides* (Michx.) Sw. (Ophioglossaceae), the winter grapefern, is distributed in the lower Gulf and Atlantic Coastal Plains from South Carolina to eastern Texas, but excluding peninsular Florida (Wagner and Wagner, Pp. 85–106 *in* Flora of North America Editorial Committee, eds., *Flora of North America*

north of Mexico, volume 2, Oxford Press, New York, 1993). The fern was first reported in Texas by Thomas (SouthW. Naturalist 24:395–396, 1979) based upon one specimen from San Augustine County. An additional Texas record (Thomas et al., Phytologia 48:276–278, 1981) followed shortly from collections made at Douglassville Cemetery in Cass County.

In a previous paper, Thomas (*Rare and infrequently collected plants in Oklahoma,* SouthE Oklahoma Univ. Herb. Publ. 2, 1978) provided the initial report of the species in Oklahoma, citing specimens from Choctaw and McCurtain counties, in the southeastern part of the state. In the latest treatment of the species, the distribution map of Wagner and Wagner (1993) did not include the eastern Texas and Oklahoma records mentioned above, but showed the species to be distributed in extreme southeastern Texas (the Texas Gulf Coast near southwestern Louisiana).

The fern is currently included on the preliminary list of peripheral and disjunct plant species by the Texas Natural Heritage Program (*Peripheral and disjunct plant species of Texas,* unpublished report, Texas Parks and Wildlife Department, 1995). The following comments are intended to amplify the known distribution of this species in Texas and adjacent areas.

Recent collections of *B. lunarioides* in east-central Texas indicate that the species is more widespread within the state (Fig. 1). Other than for Navarro County, the new records are in the Post Oak Savannah Region of the state, with the Navarro County location classified as being within the Blackland Prairie Region or in part of an extension of the Post Oak Woods/Forest in the Blackland Prairie Region. All specimens previously cited by Thomas (1979) and Thomas et al. (1981) were from the eastern part of the Pineywoods Region. The San Augustine site is about 32 km from the state line of central Louisiana, whereas the Cass County record is approximately the same distance from southwestern Arkansas. The new locations extend the known distribution of the species from 161 to 273 km to the west. This may indicate, especially when the Oklahoma distribution is considered, that the species is to be expected in similar habitats throughout the intervening areas of the Pineywoods and Post Oak Savannah Regions of Texas.

SPECIMENS EXAMINED.—**TEXAS:** Anderson Co., Cedar Creek Cemetery, between Longlake and Elkhart on Texas Hwy 294, 135 m, 14 Mar 1995, *Holmes 7602* (BAYLU); Cass Co., Smyrna Cemetery on E side of Texas Hwy. 77, ca. 4 miles NW of the Louisiana State line NW of Rodessa, LA and SW of Atlanta, TX, 31 Mar 1988, *Thomas 103695, Dorris, & Slaughter* (NLU); Freestone Co., Fairfield Lake State Recreation Area, 6 miles NE of Fairfield, Chancellor Cemetery, 22 Feb 1995, *Do 324* (BAYLU); New Hope Cemetery, 18 Mar 1995, *Singhurst 3029* (BAYLU); Falls Co., Williams Cemetery, ca. 5 miles S of Kosse on Texas Hwy. 14, 17 Mar 1995, *Singhurst 3004* (BAYLU); Henderson Co., Ash Cemetery, just SE of Murchison on Texas Hwy. 31, 17 Mar 1995, *Holmes 7610* (BAYLU); Leon Co., Texas Hwy. 3, 1.5 mi S of jct. with U. S. Hwy. 79 at Winn Cemetery, 110 m; 3 Mar 1995, *Gooch 63, Stevens, & Holmes* (BAYLU); Limestone Co., McKenzie Cemetery, 12 Mar 1995, *Singhurst 3024* (BAYLU); Cobb Cemetery, 12 Mar 1995, *Singhurst 3025* (BAYLU); Ferguson Cemetery, off Texas Hwy. 937, ca. 2 mi NW of the Robertson Co. line, 12 Mar 1995, *Singhurst 3020* (BAYLU); Milam Co., Old Providence Cemetery, 20 Mar 1995, *Singhurst 3201* (ASTC); Navarro Co., Midway Cemetery, ca. 7 mi NE of Streetman, 18 Mar 1995, *Singhurst 3028* (BAYLU); Robertson Co., Texas Hwy. 979 at jct. with Texas Hwy. 2096 at Bald Prairie Cemetery, 98 m; 3 Mar 1995, *Stevens 82, Gooch, & Holmes* (BAYLU); Seale Round Prairie Cemetery, off Texas Hwy. 937,

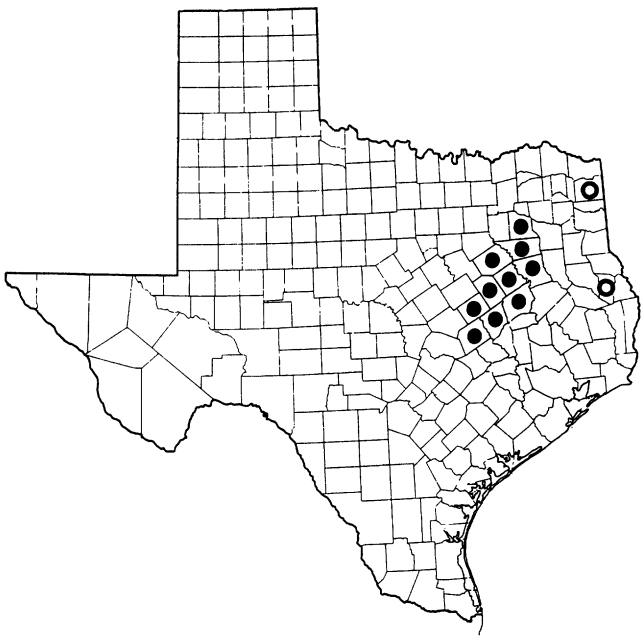

FIG. 1. Documented distribution of *Botrychium lunarioides* in Texas. Open circles indicate distribution reported by Thomas (1979) and Thomas et al (1981). Closed circles indicate new records.

ca 2 miles SE of the Limestone Co. line, 12 Mar 1995, *Singhurst 3022* (BAYLU); San Augustine Co., Liberty Hill Baptist Church Cemetery, 2.3 miles N of Texas Hwy. 21 by Texas Hwy. 147, 16 Feb 1972, *Thomas 27495* (NLU); Van Zandt Co., Purtis Creek State Recreation Area, at jct. of Farm Market Road 316 and Gosham Road, 4 May 1995, *Singhurst 3261* (BAYLU).

Botrychium lunarioides occurs in loose sandy soils covered by sparse, low vegetation that is exposed to full sun and not subject to flooding, cemeteries being ideal. Associated vegetation includes *Ophioglossum crotalophoroides* Walter (Ophioglossaceae), *Hedyotis boscii* DC., *H. crassifolia* Raf. (Rubiaceae), *Plantago* spp. (Plantaginaceae), *Nothoscordum bivalve* (L.) Britton (Liliaceae), *Senecio ampullaceus* Hook. (Compositae), *Viola* spp. (Violaceae), *Luzula* spp. (Juncaceae), and other late winter-early spring vegetation. All central Texas locations from which the plant is reported had fairly large populations of the fern. For example, in the Cedar Creek Cemetery (Anderson County) 50 plants were observed in the immediate collection area, 75–100 plants in the Ash Cemetery (Henderson County), over 30 plants in the Chancellor Cemetery (Freestone County), over 100 individuals in the Midway Cemetery (Navarro County), and 125–150 plants in Seale Round Prairie Cemetery (Robertson County).

Botrychium lunarioides has been described by Lellinger (*A field manual of the ferns & fern-allies of the United States & Canada,* Smithsonian Institution Press, Washington, D.C., 1985) as very rare and by Radford et al (*Manual of the vascular flora of the Carolinas,* University of North Carolina Press, Chapel

Hill, NC, 1968) as extremely rare. In a treatment of the ferns and fern allies of Louisiana, Thieret *(Louisiana ferns and fern allies,* Lafayette Natural History Museum Association, Lafayette, LA, 1980) reported the abundance of the plant as common (several hundred plants) in some locations to only one or two plants in other locations. He remarked that large populations are only known from Alabama and Claiborne and Desoto parishes in Louisiana.

Several reasons may explain why this plant is only now discovered and documented in east-central Texas. Faircloth et al. (Amer. Fern J. 65:28, 1975) and Thomas (1979) concluded that the rarity of *B. lunarioides* may be an artifact of its inconspicuous nature, thus the plant is overlooked in general collecting. Often the sporophore is the only visible part of the fern because the trophophore may lie very close to the ground and may be camouflaged by surrounding vegetation. Our experience has shown that the brown sporophore blends in well with the inflorescences of *Luzula,* which is very common and just beginning to flower at the time that *Botrychium* is sporulating. Furthermore, Thomas et al. (1981) observed *B. lunarioides* to remain dormant during dry springs, further obscuring its presence. They concluded that this may be the cause of the wide variation in observable population levels. The plant also appears early, before the prime collecting season. Additionally, the widespread nature and abundance of the fern in east-central Texas appears to support the comments of Diamond et al. (Texas J. Sci. 39:203–221, 1987) that the vegetation of the Post Oak Savannah (and Cross Timbers) is not well known. This implies a need for extensive field work in Texas focusing on "peripheral" plants species and the transition areas of the eastern to western floras of the United States, which basically includes eastern and east-central Texas (the Post Oak Savannah and western part of the Pineywoods).

We wish to thank R. Dale Thomas and Charles M. Allen for use of the herbarium and facilities at NLU and the Texas Parks and Wildlife Department for partial financial support and permission to study in Fairfield Lake State Recreation area.—L. H. Do, R. D. Gooch, J. R. Stevens, and W. C. Holmes, Department of Biology, Baylor University, Waco, TX 76798-7388; J. R. Singhurst, Public Lands Division, Texas Parks and Wildlife Department, Mexia, TX 76667.