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PILULARIA AMERICANA ON THE SANTA ROSA PLATEAU,
RIVERSIDE COUNTY, CALIFORNIA

ROBERT F. THORNE AND EARL W. LATHROP

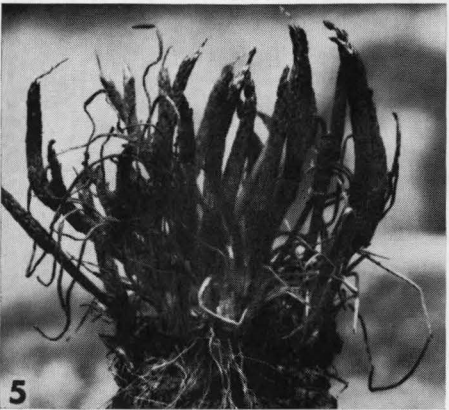
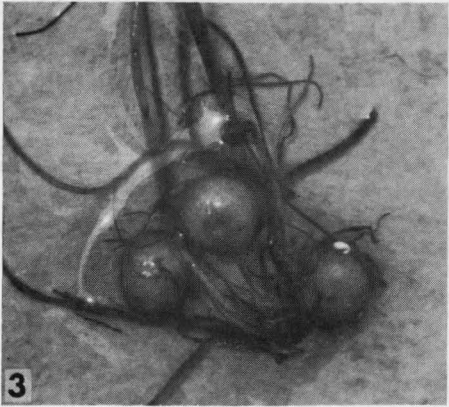
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PILULARIA AMERICANA A. BR. (MARSILEACEAE)

Pilularia americana A. Br., the American Pillwort, is an inconspicuous and highly specialized aquatic fern that is little collected. The slender, creeping, branched rhizomes are rooted in mud or fine sand and bear at the nodes a few erect, filiform leaves (2-6(-10) cm) and often a small, globose sporocarp (ca. 2-2.5 mm) (Fig. 1-3). Unlike their cousins in the genera *Marsilea* and *Regnellidium* with four and two leaflets respectively, pillworts lack leaflets though the delicate, thread-like leaves do retain the same circinate vernation. It is easy to overlook the plants or to mistake them for immature plants of *Eleocharis acicularis* (L.) R. & S. or seedlings of *Juncus* or other monocots or *Isoetes* with which they are frequently associated. The known distribution of our American species is highly disjunct both within the United States and between the United States and Chile. It is almost always an inhabitant of temporary, shallow bodies of water such as vernal pools, hog-wallows, wet depressions, fluctuating reservoirs, and ditches. It is known from shallow pools and wet depressions on granite in several counties of north central Georgia (McVaugh and Pyron, 1951; Duncan and Blake, 1965); reservoir margins in Arkansas (where collected first in 1819 near Fort Smith); a shallow creek in the Llano Uplift region of central Texas (LaMotte, 1940); a mudflat in Quanah Parker Lake of the Wichita Mts. Wildlife Refuge, Comanche County, Oklahoma (Correll, 1967); small sand hill ponds of Reno County, south central Kansas, and Cherry County, north central Nebraska (McGregor, 1950, 1967); vernal pools from Crook County, central Oregon, to the Kearny Mesa area in San Diego, California; and from Valparaiso and Valdivia Provinces in central and south-central Chile (Munoz Pizarro, 1959). It surely will be found in other areas, very likely, for example, in northern Baja California, Mexico. Its disjunct range is due presumably to long-distance dispersal of sporocarps by water birds, as in the related and often associated *Marsilea mucronata* A. Br. (Malone and Proctor, 1965).

In our survey of the large vernal marsh on the Mesa de Colorado, Santa Rosa Plateau, Santa Ana Mountains, Riverside County, southern California, the authors and their colleagues had sought *Pilularia* without success (Thorne and Lathrop, 1969). An exceptionally wet winter in 1969, however,

by filling all the depressions on the Mesa de Colorado, gave us hope of finding additional species expected on the Mesa but not previously found



there. Indeed, on the first trip to the Mesa on May 12, 1969, *Pilularia americana* was found in abundance at the western margin of the large vernal marsh as well as on the margins of smaller vernal pools farther north on the Mesa (see Fig. 1 and 2, Thorne and Lathrop, 1969). The pillwort in places actually formed dense turfs on the wet, muddy margins and in the shallow water at the edge of the marshes. It is possible that we would have overlooked a few, scattered pillworts previously, but it is not probable that we would have missed them had they been in such abundance as in May 1969.

The variation in abundance in vernal pool species from year to year is one of the more fascinating phenomena of this unusual habitat. In reference to the rain pools in Tulare County, California, Tom Howell (1968) wrote, "The different years produce fantastically different growths in the Pixley area. When I first went there in May 1965, I found one bit of *Pilularia* the size of two bits; then in 1966 there was a pillwort explosion and it was one of the commonest of plants. In 1966 I laboriously collected a few plants of *Elatine*; in 1967 there were sheets of it." We must conclude that the Mesa de Colorado experienced a pillwort "explosion" in the spring of 1969.

Among the more common vernal marsh species associated with *Pilularia americana* on the Mesa de Colorado, with 1969 collection numbers in parentheses, were: *Isoetes howellii* Engelm. (37942), *I. orcuttii* A. A. Eat. (37943), *Marsilea mucronata* A. Br. (37958), *Psilocarphus brevissimus* Nutt. var. *brevissimus* (37955, 39315), *Plagiobothrys undulatus* (Piper) Jtn. (37938, 37961), *Callitriche marginata* Torr. var. *marginata* (37925, 37956, 39317) and var. *longipedunculata* (Morong) Jeps. (37926, 37941, 37957), *Downingia cuspidata* (Greene) Greene ex Jeps. ssp. *cuspidata* (37976, 39314), *Crassula aquatica* (L.) Berger (37923, 37953, 39318), *Elatine californica* A. Gray (37921, 37940, 37967, 39320), *E. chilensis* Gay (37920, 37939, 37968, 39319), *Plantago bigelovii* A. Gray (37943a, 37962), *Eleocharis acicularis* (37954), *E. macrostachya* Britt. in Small, *Juncus bufonius* L. (37964), *J. sphaerocarpus* Nees in Funk (37924, 37963), and *Lilaea scilloides* (Poir.) Haum. (37922, 37960, 39316). Less common associates were: *Gnaphalium palustris* L. (37970), *Lythrum hyssopifolium* L. (37959), *Navarretia prostrata* (A. Gray) Greene (37937), *Anagallis minima* (L.) F. H. L. Krause (37969), *Myosurus minimus* L. var. *apus* Greene (37949), *Veronica peregrina* L. ssp. *xalapensis* (H.B.K.) Pennell (37945), *Alopecurus howellii*

Fig. 1-6.—Fig. 1. Plants of *Pilularia americana* in situ on wet mud at the west margin of the large vernal marsh on Mesa de Colorado. Note crozier at lower right. The filiform fronds are mostly less than 6 cm tall, averaging perhaps 4 cm.—Fig. 2. Turf of *Pilularia americana* with surface mud removed to show buried sporocarps rising from nodes of horizontal, branching rhizomes.—Fig. 3. Plants of *Pilularia americana* removed and washed to show the small sporocarps, each 2.0–2.5 mm in diameter.—Fig. 4. Plants of *Navarretia prostrata* in desiccated and cracked mud of small vernal pool on Mesa de Colorado. Corollas whitish to pale lavender in color and plants ca. 1 cm tall, mostly forming prostrate rosettes to 10 or 15 cm across.—Fig. 5. Small, fruiting plants of *Myosurus minimus* var. *apus* removed from dried mud on vernal pool on Mesa de Colorado. Fruiting spikes ca. 3–4 cm tall.—Fig. 6. Tiny plants of *Orcuttia californica* var. *californica* in desiccated and cracked mud of small vernal pool on Mesa de Colorado. Plants ca. 3 cm tall. (All photographs by Prof. Sherwin Carlquist.)

Vasey (37944), *Deschampsia danthonioides* (Trin.) Munroe ex Benth. var. *gracilis* (Munz) Vasey (37950), and *Phalaris caroliniana* Walt. (37951).

In view of the major disjunction in range of *Pilularia americana* between the United States and Chile, it is pertinent here to mention that the following species just listed and a few other aquatics from adjacent areas on the Santa Rosa Plateau also are found in Chile: *Azolla filiculoides* Lam., *Psilocarphus brevissimus*, *Elatine chilensis*, *Lythrum hyssopifolium*, *Anagallis minima*, *Veronica peregrina*, *Carex praegracilis* W. Boott, *Juncus bufonius*, *Lilaea scilloides*, and *Zannichellia palustris* L. In grassland and oak woodland plant communities immediately adjoining the aquatic habitats on the plateau are other species showing the same kind of amphitropical distribution: *Sanicula crassicaulis* Poepp. ex DC., *Madia gracilis* (Sm.) Keck, *Pectocarya linearis* (R. & P.) DC. var. *ferocula* I. M. Johnst., *Lepidium nitidum* Nutt., *Crassula erecta* (H. & A.) Berger, *Lotus subpinnatus* Lag., *Oenothera dentata* Cav., *Microsterias gracilis* (Hook.) Greene, *Calandrinia ciliata* (R. & P.) DC., *Linaria canadensis* (L.) Dum-Cours. var. *texana* (Scheele) Penn., *Festuca megalura* Nutt., and *Muhlenbergia asperifolia* (Nees & Mey.) Parodi (Raven, 1963). Raven (1963) has also listed a number of vicariad pairs, some perhaps really conspecific, which include species found in or adjacent to our vernal marshes. The Chilean representatives are herewith listed, in each case immediately followed in parentheses by the California representative: *Blennosperma chilense* Less. (*B. nanum* (Hook.) Blake), *Amsinckia hispida* (R. & P.) I. M. Johnst. (*A. menziesii* (Lehm.) Nels. & Macbr.) *Lupinus microcarpus* Sims (*L. densiflorus* Benth.), *Linanthus pusillus* (Benth.) Greene (*L. pygmaeus* (Brand) J. T. Howell), *Myosurus patagonicus* Speng. (*M. minimus*), and *Deschampsia monandra* Parodi (*D. danthonioides*).

Pilularia americana was also collected May 17, 1969, by Dr. James Henrickson, No. 3290a, on Kearny Mesa, 1.5 miles N of Miramar along Hwy. 395, San Diego County, in vernal pools under sub-divisional death sentence. Examination of herbarium specimens from POM, RSA, and SD gave us the following additional localities for *Pilularia* in southern California, with latest collector and date in parentheses: ORANGE County: Costa Mesa (H. H. Tracy, Mar. 31, 1935); RIVERSIDE: mud flat, S of Lake Elsinore (P. A. Munz and F. W. Peirson, Apr. 29, 1922); SAN BERNARDINO: desiccating pools on clay mesa (Red Hill near Upland, I. M. Johnston, Apr. 8, 1917); SAN DIEGO: filling pools on mesas near San Diego (H. H. Tracy, Apr. 6, 1922); 1 mile N of San Marcos (F. F. Gander, May 11, 1937); vernal pools on mesa NE of Murray Dam (F. F. Gander, Apr. 20, 1937); 2 miles N of Poway Junction along Hwy. 395 (F. F. Gander, May 11, 1937); Radio Road, Chollas Heights (F. F. Gander, Apr. 27, 1937); clay depressions, Ramona (T. S. Brandegee, May 25, 1903); VENTURA: Mirror Lake, Ojai Valley (H. M. Pollard, June 15, 1955). We have examined herbarium material of *Pilularia americana* also from the following more northern counties of California: Colusa, Contra Costa, Fresno, Lake, Madera, Marin, Mendocino, Merced, Modoc, Monterey, Placer, Sacramento, San Joaquin, Solano, and Tulare, in almost all cases from mud, adobe, or other fine-grained heavy soil in vernal pools, ditches, or lake and reservoir margins. It has also been reported in

California from Santa Barbara, Santa Cruz, and Siskiyou Counties, and it surely is present in other counties as well.

ADDITIONS TO THE FLORA OF THE SANTA ROSA PLATEAU

The heavy precipitation in the winter of 1969 filled all the vernal marshes and pools and other depressions on the Mesa de Colorado. As was anticipated, careful investigation of these vernal moist habitats turned up a number of interesting species not previously found in the large marsh. These plus a few other species found during further exploration on other parts of the plateau are listed below with some of their associated plants. The species are arranged in the order in which they should occur in our florula (Lathrop and Thorne, 1968). The numbers given are those of the senior author unless otherwise specified. Dates are not listed since all collections were made on May 12, May 19, or June 6, 1969. The first set of specimens will be filed in the herbarium of the Rancho Santa Ana Botanic Garden and a second set at Loma Linda University. The many duplicates will be distributed widely.

PILULARIA AMERICANA A. Br. (Fig. 1-3) was collected on wet mud and in shallow water at the N margin of the large vernal marsh on the S end of Mesa de Colorado, elev. ca. 2050 ft, Rancho California, Santa Rosa Plateau (37919, 37966, 39321); and on the desiccated margin of a small vernal marsh, ca. 7 acres, N of the large marsh (Lathrop 7034). The associated species are listed above.

RHUS TRILOBATA Nutt. ex T. & G. var. *MALACOPHYLLA* (Greene) Munz is apparently rare in chaparral, on dry slopes near small stream, 8 miles W of Murrieta on truck trail between Tenaja Road and Los Alamos Canyon (39324, Lathrop 7110), where associated especially with *Adenostoma fasciculatum* H. & A. (39326), *Ceanothus crassifolius* Torr. (39332), *Garrya veatchii* Kell. (39331), *Lonicera subspicata* H. & A. var. *johnstonii* Keck (39325), *Paeonia californica* Nutt. ex T. & G. (39329), *Solanum xanti* A. Gray (39334), *Castilleja foliolosa* H. & A. (39327), *Monardella lanceolata* A. Gray (39328), *Silene laciniata* Cav. (39330), and *Penstemon heterophyllus* Lindl. ssp. *australis* (Munz & Jtn.) Keck (39333).

DOWNINGIA CUSPIDATA (Greene) Greene ex Jeps. ssp. *CUSPIDATA* is one of the most abundant species in the vernal marshes on Mesa de Colorado. Normally the corollas are lavender to bright blue with a yellow spot in a white area on the lower lip but a few plants with all white corollas were collected (39314b, Lathrop 7100).

SAGINA OCCIDENTALIS S. Wats. is apparently rare for only one plant was found on the grassy bank of a small stream 8 miles W of Murrieta on truck trail between Tenaja Road and Los Alamos Canyon (39337).

SPERGULARIA BOCCONII (Scheele) Foucaud was found only along the road to the ranch headquarters E of Mesa de Colorado, elev. ca. 2000 ft (Lathrop 7076). It is a naturalized weed from Europe.

EUPHORBIA CRENULATA Engelm. was collected twice on the grassy top of Mesa de Colorado near the vernal marshes (37934, 37977). Among its associates were *Lomatium utriculatum* (Nutt.) C. & R., *Calycadenia tenella* (Nutt.) T. & G., *Lasthenia chryso-stoma* (F. & M.) Greene, *Layia platyglossa* (F. & M.) A. Gray ssp. *campestris* Keck, and various grasses.

GARRYA VEATCHII Kell. is apparently a rare shrub in the chaparral for it was found only on dry slopes near a small stream (39331, Lathrop 7111), with *Rhus trilobata malacophylla* and the other plants listed above with that species.

MECONELLA DENTICULATA Greene was collected once on a grassy bank at the edge of chaparral in Los Alamos Canyon near junction with San Mateo Canyon, 12 miles NW of Murrieta (Lathrop 7021).

NAVARRERIA PROSTRATA (A. Gray) Greene (Fig. 4) was found on the desiccated margin or bed of small vernal marshes N of the large marsh on Mesa de Colorado (37929,

37937, 37981, *Lathrop* 7053). It was usually associated with *Isoetes howellii* (37930, 37942), *I. orcuttii* (37943), *Pilularia americana*, *Psilocarphus brevissimus brevissimus*, *Plagiobothrys undulatus* (37931, 37938), *Callitriche marginata longipedunculata* (37941), *Downingia cuspidata cuspidata* (37933), *Elatine californica* (37940), *E. chilensis* (37939), *Plantago bigelovii* (37943), *Veronica peregrina xalapensis* (37945), *Eleocharis acicularis*, *Lilaea scilloides* (37932), *Juncus bufonius* (37928), *J. sphaerocarpus* (37927), and *Alopecurus howellii* (37944).

MYOSURUS MINIMUS L. var. **APUS** Greene (Fig. 5) was collected only on the desiccated margins of small vernal marshes N of the large marsh on Mesa de Colorado (37949, *Lathrop* 7061), where associated especially with *Pilularia americana*, *Psilocarphus brevissimus brevissimus*, *Navarretia prostrata* (37981), *Deschampsia danthonioides gracilis* (37950), and *Phalaris caroliniana* Walt. (37951, 37983).

VERONICA AMERICANA (Raf.) Schw. was found only in a small stream 8 miles W of Murrieta on truck trail between Tenaja Road and Los Alamos Canyon (39339), mixed with *V. comosa* Richt., and associated with such other aquatics as *Anemopsis californica* Hook. (39340), *Callitriche heterophylla* Pursh var. *Bolanderi* (Hegelm.) Fern. (39341), *Eleocharis montevidensis* Kunth var. *parishii* (Britt.) V. Grant (39345), *Lilaea scilloides* (39346), *Lemna gibba* L. (39344), *Potamogeton foliosus* Raf. (39343), and *Zannichellia palustris* L. (39342, *Lathrop* 7078).

VERONICA COMOSA Richt. (39338) was collected with *V. americana* and the species listed immediately above.

CALOCHORTUS ALBUS Dougl. ex Benth. was found in rocky soil in a shaded grassy area under oak woodland ca. 2 miles beyond turn-off to ranch headquarters, elev. ca. 2000 ft (37984, *Lathrop* 7058).

ORCUTTIA CALIFORNICA Vasey var. **CALIFORNICA** (Fig. 6) is a rare vernal marsh grass known previously from only six stations in Baja California and Los Angeles, Riverside, and San Diego Counties of southern California (Moran, 1969). It was scattered over the desiccated and cracked muddy bottom of a small vernal marsh NW of the large vernal marsh on Mesa de Colorado (37971, *Lathrop* 7123), where it was associated chiefly with *Isoetes howellii* (37974), *Eryngium aristulatum* Jeps. var. *parishii* (C. & R.) Mathias & Const. (37975), *Psilocarphus brevissimus brevissimus* (37973), *Plagiobothrys undulatus* (37972), *Downingia cuspidata cuspidata*, and *Navarretia prostrata*.

PHALARIS CAROLINIANA Walt. was found only on the desiccated margins of a small vernal marsh N of the large marsh, Mesa de Colorado (37951, 37983), where associated especially with *Phalaris minor* Retz (*Lathrop* 7066), *Deschampsia danthonioides gracilis*, *Lolium temulentum* L. (37982), and other grasses.

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SUMMARY

Pilularia americana, American pillwort, is added to the vernal marsh flora of the Santa Rosa Plateau of Riverside County, California. Its disjunct geographic and ecological distribution, annual fluctuations, and common vernal marsh associates are listed or discussed. Thirteen other species are also added to the known flora of the Santa Rosa Plateau and are listed with their associated species. With these additions, the flora of the Plateau, some 45,000

acres, consists of at least 18 pteridophyte species (in 15 genera of 10 families), 1 conifer, 360 dicots (in 215 genera of 62 families), and 104 monocots (in 49 genera of 11 families) for a total of 483 species in 280 genera of 84 families. Seventy-four of the species are believed to be introduced and 409 indigenous to the Plateau.

REFERENCES CITED

- Correll, H. B. 1967. *Pilularia americana* A. Braun in Oklahoma. Amer. Fern J. 57: 31-32.
- Duncan, W. H., and D. Blake. 1965. Observations on some ferns in Georgia. Amer. Fern J. 55: 145-153.
- Howell, J. T. 1968. Personal communication.
- LaMotte, C. 1940. *Pilularia* in Texas. Amer. Fern J. 30: 99-101.
- Lathrop, E. W., and R. F. Thorne. 1968. Flora of the Santa Rosa Plateau of the Santa Ana Mountains, California. Aliso 6 (4): 17-40.
- McGregor, R. L. 1950. *Pilularia americana* in Kansas. Amer. Fern J. 40: 187-188.
- . 1967. *Pilularia americana* A. Braun new to Nebraska. Amer. Fern J. 57: 136.
- McVaugh, R., and J. H. Pyron. 1951. Ferns of Georgia. Univ. Georgia Press, Athens. 195 p.
- Malone, C. K., and V. W. Proctor. 1965. Dispersal of *Marsilea mucronata* by water birds. Amer. Fern J. 55: 167-170.
- Moran, R. 1969. Orcutt grass is where it is (but why?) Environ. Southwest, August, 1969: 3-5.
- Munoz Pizarro, C. 1959. Sinopsis de la flora chilena. Univ. Chile, Santiago. 840 p.
- Raven, P. H. 1963. Amphitropical relationships in the floras of North and South America. Quart. Rev. Biol. 38: 151-177.
- Thorne, R. F., and E. W. Lathrop. 1969. A vernal marsh on the Santa Rosa Plateau of Riverside County, California. Aliso 7 (1): 85-95.