

**ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM**

Plant Abstract

Element Code: PDLNN02020

Data Sensitivity: Yes

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Pholisma sonora* (Torr. ex A. Gray) Yatsk.
COMMON NAME: Sand food, sandfood, sandroot, sand-sponge, Biatatk
SYNONYMS: *Ammobroma sonora* Torr. ex Gray
FAMILY: Lennoaceae

AUTHOR, PLACE OF PUBLICATION: *Pholisma sonora* (Torr. ex A. Gray) Yatsk.,
Phytologia 52(2): 74. 1982. *Ammobroma sonora* Torrey ex A. Gray, Mem. Am. Acad. II. 5:
327. 1854.

TYPE LOCALITY: Hills around Adair Bay, Sonora, Mexico.

TYPE SPECIMEN: HT: NY. A.B. Gray s.n., 17-19 May 1854. IT: ARIZ, NY.

TAXONOMIC UNIQUENESS: Three species within *Pholisma*; *P. arenarium*, *P. culiacana* and *P. sonora* (Warren and Laurenzi 1987). The PLANTS database (USDA 2002) reports that the species *sonora* is 1 of 2 species in the genus *Pholisma*, which is the only genus in the Family Lennoaceae. However, the distinctness of Lennoaceae as a unique family as opposed to belonging to the superfamily Boraginaceae has recently been questioned; see APG 2016 and Luebert et al. 2016 for opposing viewpoints.

DESCRIPTION: Fleshy root parasite lacking chlorophyll. The plants are grayish white and mushroom-shaped, and their height depends on the degree to which blowing sand covers the scaly stem (Armstrong 1980, in CPC 2004). Succulent stems extend 0.5–1.5 m (1.6-5.0 ft.) below the sand, 1.0-2.5 cm in diameter, and are attached to roots of nearby host plants. Each stem terminates at or near the soil surface in a single cap-like inflorescence. The scales on the stem are modified leaves. Lower scales of inflorescence (those below ground) are linear-spatulate, 1.5-2.5 cm long, glabrous, white or suffused with pale purple or violet. The upper scales (those above sand) are lanceolate, 8.0-15.0 mm long, densely puberulent with rather coarse, crisped, tawny hairs. The inflorescences form the “cap” of the mushroom-like plant protruding above the ground, 4-14 cm in diameter, bearing numerous purple flowers edged in white and arranged in a ring toward the outer edge of the cap. The central part of inflorescence is thick and somewhat concave. Each flower is surrounded by a hairy calyx, and the masses together calyces to give the inflorescence a gray-white fuzzy appearance, while protecting plants from sun and heat (Copeland 1935, in CPC 2004). Calyx lobes 6-10 in number, narrowly linear, 7.0-9.0 mm long; corolla 8.0-9.0 mm long, tubular 5.0-5.5 mm at top of stem. Fruits are capsules, breaking up into 12-20 ovoid, laterally flattened nutlets about

1.0 mm long (similar to grains of sand) and arranged in a circle; surface of brownish nutlets finely and obscurely reticulate. (Wiggins 1980; CDC 2004; DBG 2000; Falk et al., 2001).

AIDS TO IDENTIFICATION: Flower clusters look like flat buttons or powderpuffs (12.0 cm = 5.0 in. wide) on sand. While *Pholisma sonora*e occurs on shifting white sands, *P. arenaria* can be found on more stabilized (higher vegetation density) dunes of pinkish sand nearby. Inflorescences of *P. arenaria* are markedly different than *P. sonora*e, having a narrower con-shaped “cap”, and calyces with less hair. (DBG 2000). In addition, the sepals of *P. sonora*e are not plumose but glabrous. *P. sonora*e is differentiated from *Orobanche ludoviciana*, another parasitic plant, by its flat, pad-like growth form, smaller radially symmetric flowers, and light grey color of the plant (Falk, Jenkins et al. 2001).

ILLUSTRATIONS:

Color photo of Holotype specimen (NYBG, accessed 2003 in NYBG Virtual Herbarium)

Line drawing (in Falk, Jenkins et al. 2001)

Color photo (J. Rorabaugh, in Falk, Jenkins et al. 2001)

Color photo of Habitat (Dale Turner, in Falk, Jenkins et al. 2001)

Line drawing (M. Kurzius, in Felger 2000)

TOTAL RANGE: Southwestern Arizona, southeastern California (Imperial County), Baja Norte in northwestern Sonora, Mexico, and Baja California, Mexico.

RANGE WITHIN ARIZONA: Yuma Desert, Southern Yuma County, along the boundary with Mexico.

SPECIES BIOLOGY AND POPULATION TRENDS

GROWTH FORM: Perennial root parasite, dying back to undifferentiated tissue at the infection site on the host plant every year.

PHENOLOGY: Reproductive March to June, failing to appear during drought. Each flower head produces hundreds of capsules and thousands of one-seeded nutlets, 1.0 mm or less in diameter.

BIOLOGY: Parasitic on plant roots, usually desert shrub host. Host plants do not appear to be depleted by *Pholisma* infestation, and *Pholisma* plants have been unearthed and weighed, with the weights exceeding those of the host plants (CDC 2004). Water is probably absorbed through the many stomata on the scale-like leaves (Yatskievych 1985, in CDC 2004). This water taken directly from the sand can then move into the host plant during times of drought stress. Therefore, the relationship between *Pholisma* and the host plant is not parasitic in the strictest sense. Dried stems may shrivel to less than 0.25% of original diameter, eventually disintegrating in sand (Armstrong 1980).

Carlquist and Guilliams (2017) examined the wood anatomy of the four species within Lennoaceae in detail. They concluded that the wood of these species is markedly different from the strands of xylem in closely related families (Ehretiaceae and Cordiaceae), most of which are woody species. Vessel structures within Lennoaceae suggest a high adaptability to arid environments; the lack of fibers in their secondary xylem is probably related to the fact that the plants are supported by sand, rather than being self-supported. Thick vessel walls, such as seen in the parasitic plant families Krameriaceae, Viscaceae, and Loranthaceae, are also a characteristic of Lennoaceae species.

HABITAT: Drifting sandy soil and other sandy areas, in low desert below 500 ft. elevation.

ELEVATION: 50 – 150 m (100- 450 ft) (NatureServe, 2022).

EXPOSURE: Open.

SUBSTRATE: Sand.

PLANT COMMUNITY: Dune scrub (creosote bush scrub) in the Sonoran Desert. Host plant species include: *Ambrosia dumosa* (white bursage), *Eriogonum deserticola* (Desert Eriogonum), *Pluchea sericea* (arrow-weed), *Psorothamnus emoryi* (Emory's Psorothamnus), *Tiquilia plicata* (Fan-leaf Tiquilia), and *T. palmeri* (Palmer's Tiquilia).

POPULATION TRENDS: Per CDC (Accessed 2004), "Only two populations are known from California and Mexico. A site documented by a herbarium specimen on U.S.-Mex. Hill was visited during 1998, and no plants were located. As the site is rather remote and undeveloped, it appears that dune stabilization by associated species has sufficiently altered the habitat to the extent that *Pholisma sonorae* can not grow there. Two years ago, *Pholisma* was located near a lemon grove, at a site documented by a herbarium specimen made by Jepson. South of the U.S.-Mexican border, far more sand dune habitat can be found, but the status of the plants is unknown for that area."

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: None (USDI, FWS, 1996)
[Category 2 (USDI, FWS 1990, 1993)]
[Category 3C (USDI, FWS 1983, 1985)]
[Category 1 (USDI, FWS 1980)]
[PTN-E (USDI, FWS 1976)]

STATE STATUS: Highly Safeguarded (ARS, ANPL 2016)
[Highly Safeguarded (ARS, ANPL 1993, 1999)]

OTHER STATUS:

Bureau of Land Management Sensitive (USDI, BLM AZ 2000, 2005, 2008, 2010, 2017)
Not Forest Service Sensitive (USDA, FS Region 3 1999, 2013)
[Forest Service Sensitive (USDA, FS Region 3 1990)]

MANAGEMENT FACTORS: Threats include off road vehicle use, and development such as conversion of dune habitat to housing and agricultural land. In addition, heavy equipment maneuvers within bombing and gunnery range of Luke AFB is also a threat to their habitat.

Management needs are challenging, as dunes must remain unstabilized in order for *Pholisma* to persist. Conversion of these dunes to agricultural fields, housing developments, highways, and recreational sites is increasing, and will hasten the extinction of *Pholisma sonorae*.

PROTECTIVE MEASURES TAKEN: A small section of habitat in the Algodones dunes in California, have been set aside for preservation to improve populations of several threatened sand dune associated plants including *Pholisma sonorae*.

SUGGESTED PROJECTS: Search for additional populations, protect large dunes that contain populations of this species (NatureServe 2022).

According to CDC (accessed 2004), “Since seeds do not germinate reliably, and no means of perpetuating them in cultivation has been found, the species does not lend itself readily to ex situ conservation. For this particular species, in situ conservation efforts are the key to perpetuation.”

The total range of this plant is probably more widespread than what herbarium records show; several iNaturalist observations put the species as occurring along the Gulf of Santa Clara coastline in Sonora, Mexico (iNaturalist 2022).

LAND MANAGEMENT/OWNERSHIP: BLM – Yuma Field Office; DOD – Barry M. Goldwater Air force Range; Private.

SOURCES OF FURTHER INFORMATION**REFERENCES:**

- Angiosperm Phylogeny Group (APG). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. Bot J Linn Soc. 2016; 181(1): 1-20.
- Arizona Revised Statutes, Chapter 7. 1993. Arizona Native Plant Law. Appendix A.
- Arizona Revised Statutes, Chapter 7. 1999. Arizona Native Plant Law. Appendix A.
- Arizona Revised Statutes, Chapter 7. 2016. Arizona Native Plant Law. Appendix A.

- Armstrong, W.P. 1980. Sand food: a strange plant of the Algodones dunes. *Fremontia*. pp. 3-9
- Carlquist, S. and C.M. Guilliams. 2017. Distinctive wood anatomy of the root-parasitic family Lennoaceae (Boraginales). *International Association of Wood Anatomists Journal* 38(1): 3-12.
- Center for Plant Conservation (CPC). CPC National Collection Plant Profile, *Pholisma sonorae*. http://ridgwaydb.mobot.org/cpcweb/CPC_ViewProfile.asp?CPCNum=3407. Accessed: 1/26/2004.
- Desert Botanical Garden. 1993. Annual Report. pp. 86-87.
- Desert Botanical Garden (DBG). 2000. *Pholisma sonorae*, Sand Food abstract. Accessed: 1/26/2004 from http://desertbotanical.org/Collections/pholisma_sonorae.html.
- Falk, M., P. Jenkins, et al; Arizona Rare Plant Committee. 2001 Arizona Rare Plant Guide. Published by a collaboration of agencies and organizations. Pages unnumbered.
- Felger, R.S. 2000. Flora of the Gran Desierto and Río Colorado of Northwestern Mexico. The University of Arizona Press. Tucson, Arizona. Pp. 336-338.
- Hickman, J.C., Ed. 1993. The Jepson Manual, Higher Plants of California. University of California Press. Berkeley, California. P. 734.
- iNaturalist. 2022. Available from <http://iNaturalist.org>. Accessed Feb. 11, 2022.
- Integrated Taxonomic Information System (ITIS). Retrieved 1/26/2004 from ITIS, <http://www.itis.usda.gov>.
- Jaeger, E.C. 1969. Desert wild flowers. Revised Edition. Last Printing 1988. Stanford University Press. Stanford, California. Pp. 180, 182.
- Kelly, K., and J. McGinnis. 1994. Highly Safeguarded Protected Native Plants of Arizona. Arizona Department of Agriculture, Native Plant Protection Program. Phoenix, Arizona.
- Lehr, J.H. 1978. A catalogue of the flora of Arizona. Desert Botanical Garden, Phoenix, Arizona. p. 114.
- Luebert, F., L., Cecchi, M.W., Frohlich, M., Gottschling, C.M., Guilliams, K.E., Hasenstab-Lehman, H.H., Hilger, J.S., Miller, M., Mittelbach, M., Nazaire, et al. 2016. Familial classification of the Boraginales. *Taxon* 65(3):502–522.
- Missouri Botanical Garden – TROPICOS, Nomenclatural Database. *Pholisma sonorae* (Torr. & A. Gray) Yatsk. http://mobot.mobot.org/cgi-bin/search_vast. Accessed: 26 Jan 2004.
- Nabhan, G. 1980. *Ammobroma sonorae* Torr., an endangered parasitic plant in extremely arid North America.
- NatureServe. 2003. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. Arlington, Virginia. Available: <http://www.natureserve.org/explorer>. (Accessed: January 16, 2004).
- NatureServe. 2022. NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available <https://explorer.natureserve.org/>. (Accessed: March 31, 2022).
- Southwest Environmental Information Network (SEINet). 2022. <http://southwestbiodiversity.org/index.php>. Accessed January 27, 2022.
- Shreve, F. and I.L. Wiggins. 1964. Vegetation and flora of the Sonoran Desert. Stanford University Press, Stanford California. pp. 1075-1076.

- Thackery, R.A. and M.F. Gilman. 1931. A rare parasitic food plant of the Southwest. Smithsonian report for 1930. Government Printing Office, Washington, D.C. pp. 409-416.
- The New York Botanical Garden. NYBG Specimens Detailed Results. http://scisun.nybg.org:8890/searchdb/owa/wwwcatalog.detail_list. Accessed: 1/26/2004.
- Torrey, J. 1864. On *Ammobroma*: a new genus of plants allied to *Coraphyllum* and *Pholisma*. Annals of the Lyceum of Natural History of New York. 8:51-56.
- USDA, Forest Service Region 3. 1990. Regional Forester's Sensitive Species List.
- USDA, Forest Service Region 3. 1999. Regional Forester's Sensitive Species List.
- USDA, Forest Service Region 3. 2013. Regional Forester's Sensitive Species List.
- USDA, NRCS. 2002. The PLANTS Database, Version 3.5 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
- USDI, Bureau of Land Management. 2000. Arizona BLM Sensitive Species List. Instruction Memorandum No. AZ-2000-018.
- USDI, Bureau of Land Management. 2005. Arizona BLM Sensitive Species List.
- USDI, Bureau of Land Management Region 2. 2008. Arizona BLM Sensitive Species List.
- USDI, Bureau of Land Management Region 2. 2010. Arizona BLM Sensitive Species List.
- USDI, Bureau of Land Management Region 2. 2017. Arizona BLM Sensitive Species List.
- USDI, Fish and Wildlife Service. 1976. Endangered and Threatened Wildlife and Plants: Proposed Endangered Status for Some 1700 U.S. Vascular Plant Taxa. Federal Register 41(117): 24551.
- USDI, Fish and Wildlife Service. 1980. Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species; Notice of Review. Federal Register 45(242): 82486.
- USDI, Fish and Wildlife Service. 1983. Endangered and Threatened Wildlife and Plants; Supplement to Review of Plant Taxa for Listing as Endangered or Threatened Species; Proposed Rule. Federal Register 48(229): 53661.
- USDI, Fish and Wildlife Service. 1985. Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species; Notice of Review. Federal Register 50(188): 00001.
- USDI, Fish and Wildlife Service. 1990. Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species; Notice of Review. Federal Register 55(35): 6219.
- USDI, Fish and Wildlife Service. 1993. Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species; Notice of Review. Federal Register 58(188): 51181.
- USDI, Fish and Wildlife Service. 1996. Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa That Are Candidates for Listing as Endangered or Threatened Species; Notice of Review. Federal Register 61(40): 7596-7613.
- Warren, P.L. and A.W. Laurenzi. 1987. Rare plant survey of the Yuma District. Final Report of P.O. No. AZ-950-PH6-0540. Submitted to U.S. Bureau of Land Management, Yuma District Office. pp. 71-74.

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ADDITIONAL INFORMATION:

Historically, the stems of the plants were eaten raw or roasted by O'odham (often called "sand people") and Cocopa Native American tribes. When roasted they resemble, in flavor, well-browned yams. The stem is somewhat sweet and juicy, providing food as well as liquid for thirsty travelers. The O'odham called it "biatatk" (bia, sand or sandhills, + tatk, root).

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