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**ADDITIONS, NOTES AND CHROMOSOME NUMBERS
FOR THE FLORA OF VASCULAR PLANTS
OF ORGAN PIPE CACTUS NATIONAL MONUMENT, ARIZONA**

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ABSTRACT

Recent research efforts add 52 new taxa to the flora of Organ Pipe Cactus National Monument. Chromosome counts were made for 19 individuals belonging to 12 taxa, including first counts for four taxa and a new count for an additional taxon. Seven taxa have their type locality within the Monument boundaries and five species are known in the United States only from Organ Pipe Cactus National Monument collections.

The flora of Organ Pipe Cactus National Monument, Pima County, Arizona, apparently was first extensively tabulated by W.B. McDougall (ca. 1940). Updated floras (see Bowers 1981) followed, e.g., Phillips (1967), Adams (1971), Jordan (1975) and most recently by Bowers (1980) who cites 522 taxa for the Monument. Herbarium acronyms follow Holmgren and Keuken (1974) except for ORPI which is here assigned to Organ Pipe Cactus National Monument Herbarium for convenience. Names of authors as collectors will be abbreviated as first letter of surname, e.g., BTJ 105 = Baker 105, Trushell & Johnson.

Additions. Our studies of special status plants and non-native plants (Felger 1990) reveal the following additional taxa to the flora by Bowers (1980):

LYCOPODIOPHYTA

SELAGINELLACEAE

Selaginella eremophila Maxon. Quitobaquito Hills, ca. 0.5 km NE of pond, ca. 1240 ft., F 88-113 & Zimmerman (ARIZ, ORPI); Quitobaquito, steep N-facing, granitic slopes, ca. 380 m, ca. 0.7 km NNW of pond, F 90-40, Shumaker & Wachtmeister (ARIZ, ORPI).

MAGNOLIOPHYTA - MAGNOLIOPSISIDA - Dicots

AMARANTHACEAE.

Amaranthus albus L. Alamo Canyon, Ajo Mts., Harbison s.n. (SD 26249).

APIACEAE - UMBELLIFERAE

Yabea microcarpa (Hook. & Arn.) K.-Pol. Estes Canyon, Ajo Mts., N exposure, Wirt s.n. (ARIZ 288166).

ASCLEPIADACEAE

Asclepias nyctaginifolia A. Gray. In wash just N of Post 6, Puerto Blanco Drive, Beal & Beal s.n. (ORPI 6488); just S of Monument boundary on AZ Hwy 85, Van Devender and V D 84-445 (ARIZ 251646, ORPI 2074).

ASTERACEAE - COMPOSITAE

Artemisia dracuncululus L. Alamo Canyon, Ajo Mts., in wash, Wirt s.n. (ARIZ 288659); Alamo Canyon, S. fork, BTJ 7566 (ASU 152327, ORPI 8871).

Baccharis brachyphylla A. Gray. Cherioni Wash, 5 mi N of Visitor Center, Warren, Anderson, & Johnson s.n. (ARIZ 284740).

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Centaurea melitensis L. Quitobaquito, along old irrigation ditch in pomegranite grove. below pond, F 87-251 & Fenn (ARIZ, ORPI).

Conyza coulteri A. Gray. Quitobaquito and immediate vicinity, NW side of pond, F 87-291 & Dimmitt (ARIZ 285814, ORPI 8936).

Hymenoclea monogyra Torr. & Gray. Aguajita Spring and immediate vicinity, F 87-261 & Van Houten (ARIZ 285814, ORPI 8936).

Pectis linifolia L. var. *linifolia*. Along Ajo Mountain Drive just W of Arch Canyon, Keil 11784 (ASU 85083); peaks encircled by East Loop, P 9970 *et al.* (ASU 48233).

BORAGINACEAE

Amsinckia intermedia Fisch. & Meyer. Dripping Springs, PJT 14361 (ASU 158882, ORPI); lower part of Arch Canyon, Phillips & Phillips 83-60 (ORPI 2014); Aguajita Wash, F 88-305 & Dahl; wash and water seep at International Border, F 86-103 & Lopez; Puerto Blanco Drive, Beale & Beale *s.n.* (ORPI 4679); Van Devender & V D 84-50 (ORPI 2052; Alamo Canyon, Nichol *s.n.* (ORPI 1233).

Plagiobothrys jonesii Gray. Twin Peaks; steep, S-facing volcanic slope, T.R. Van Devender *s.n.* (ARIZ 246907).

BRASSICACEAE - CRUCIFERAE

Lesquerella tenella A. Nels. Monument, Walden *s.n.* (ASU 29395), Maxwell *s.n.* (ASU 38634); near road, 5 mi N of Sonoyta, McDougall 15 (ARIZ 48386); flat, ca. 6 mi E of AZ 85 on Camino Dos Republicas, Bowers 1040 (ARIZ 219227); along Ajo Mt. Rd., 6.5 mi NE jct. AZ 85, Daniel 2630 (ASU 130017). This taxon apparently replaces *L. gordonii* (Gray) S. Wats. in flora (Bowers, 1080); all specimens labeled as the latter are doubtful.

CACTACEAE

Opuntia acanthocarpa Engelm. & Bigel. var. *coloradensis* L. Benson. Puerto Blanco Mts., 2 km NW of Dripping Springs, BTJ 7587A (ASU 152722, ORPI 8891); 2 km NE of Puerto Blanco Mts., 1 km NNE of Red Tank Well, BTJ 7578 (ASU 152719). Distribution map in Benson (1982) also shows this variety for the Monument.

Opuntia engelmannii Salm-Dyck ex Engelm. var. *flavispina* (L. Benson) Parfitt & Pinkava (= *O. phaeacantha* Engelm. var. *flavispina* L. Benson). Quitobaquito Springs, BR 7625 (ASU 155586, ORPI 8921). The type specimen is from the Monument (see below).

Opuntia ramosissima Engelm. West boundary fence, 1 mi S of Papago Well Road, Steenbergh 1-1062-1

(ORPI 4403).

Opuntia santa-rita (Griffiths & Hare) Rose. Quitobaquito, Nichol *s.n.* (ORPI 1149). Only collection known from Monument; apparently cultivated.

COVOLVULACEAE

Ipomoea hederacea Jacq. Alamo Canyon, Ajo Mts., Clark 10939 (ORPI). Dr. D. Austin (pers. comm.) recognizes this taxon as distinct; replaces *I. hirsutula* entry in flora (Bowers, 1980).

CUCURBITACEAE

Brandegea bigelovii (S. Wats.) Cogn. Along wash, 0.5 km E of Aguajita Wash, BRTJ 7714 (ASU 159936); S of Senita Basin, 1400 ft, BRJ 7642-C (ORPI 8904); 0.7 mi N of Puerto Blanco Rd. on Senita Basin Rd., Perrill 5875 (ARIZ 281897); near Quitobaquito, 1000 ft, Peebles 14556-a (ARIZ 14161).

CUSCUTACEAE

Cuscuta salina Engelm. Quitobaquito, Harbison *s.n.* (ARIZ 89456, SD 26193), on *Suaeda moquinii*, F 89-241 & Fenn (ARIZ, ORPI).

Cuscuta tuberculata T.S. Brandegee North end Cipriano Hills, S of Bates Mts., Wirt *s.n.* (ARIZ 288658).

EUPHORBIACEAE

Argythamnia clariana Jeps. Puerto Blanco Mts., ca. 2 mi E of Visitor Center on Ajo Loop Rd., SW-facing rhyolitic rock shelter, T.R. Van Devender 85-107 (ARIZ); Twin Peaks, near Visitor Center, T.R. Van Devender *s.n.* (ARIZ).

Chamaesyce abramsiana (Wheeler) Koutnik (= *Euphorbia abramsiana* Wheeler). Arroyo of Aguajita Wash, ca. 50 m N of Border, F 86-277 & Leigh (ARIZ 270466, ORPI); Aguajita, floodplain, F 88-417 & Warren (ARIZ, ORPI).

GENTIANACEAE

Eustoma exaltatum (L.) Salisb. ex G. Don f. *albiflorum* Benke. Quitobaquito Springs, BR 7623 (ASU 155577, ORPI 8914), Galiano (ORPI 4705), Van Devender (ARIZ 219270, ORPI 1830), F 86-213, Straub & Warren (ARIZ 286419), Bowers 901 & Yff (ARIZ 218510), Lehto 5497 (ASU32174); between Quitobaquito and Burro Spring, Bowers 1334 (ARIZ 219492); Williams Spring, F 86-268 & Leigh (ARIZ 283584, ORPI 8940). There are other collections at ORPI but flower color not indicated. No blue-flowered forms have been reported, although notes and flowers on P9995 *et al.* (ASU 52171) indicate flowers whitish or very pale blue.

MALVACEAE

Abutilon malacum S. Wats. Pinkley Peak, Puerto Blanco Mts., N exposure, Wirt s.n. (ARIZ 288167).

Rhynchosida physocalyx (A. Gray) Fryxell (= *Sida physocalyx* A. Gray). Cheroni Wash, Warren, Anderson & Johnson s.n. (ARIZ 275933).

MOLLUGINACEAE

Mollugo cerviana Ser. Aguajita Wash, F 88-419 & Warren (ARIZ 282268).

ONAGRACEAE

Gaura parvifolia Hook. Quitobaquito, 5-20 m S of border fence, F 86-174A & Lopez (ARIZ 270742). Felger states that it is infrequent to locally common at Quitobaquito.

POLEMONIACEAE

Gilia stellata Heller. Aguajita Wash, Beale & Beale s.n. (ORPI 4621), F 88-294 & Dahl (ARIZ); wash in flats W of Bates Well Mts., roadside, Bowers 1163 & Mortensen (ARIZ 218513); 0.5 mi NE of Quitobaquito, base of Agua Dulce Mts., Gould 2993, Darrow & Haskell (ARIZ 28214); Senita Basin, Lehto 15418 & Keil (ASU 62304). Replaces *Gilia sinuata* Dougl. entry in flora by Bowers (1980).

Ipomopsis multiflora (Nutt.) V. Grant. Arch Canyon, SW of Arch, BRJ 7641 (ASU 155579, ORPI).

PORTULACACEAE

Portulaca oleracea L. var. *oleracea*. Aguajita, wash and floodplain, F 88-405, 88-432 & Warren (ARIZ, ARIZ); 0.5 mi E of border crossing station, N of border fence, F 87-318 & Dimmitt (ARIZ, ORPI).

Portulaca halimoides L. (= *P. parvula* A. Gray). Aguajita Wash, F 88-433 & Warren (ARIZ, ORPI); 0.5 km W of Lukeville Post Office, 50-100 m of boundary fence, F 87-281 & Dimmitt (ARIZ, ORPI).

PRIMULACEAE

Anagallis arvensis L. Adventive in flower bed at Resource Center, Beal & Beal s.n. (ORPI 6491).

RANUNCULACEAE

Myosurus minimus L. Quitobaquito, bordering alkaline pool, Gould 2986, Darrow & Haskell (ARIZ 20707).

SCROPHULARIACEAE

Antirrhinum cyathiferum Benth. Just N of camp-

ground at Senita Basin, BRTJ 7715 (ASU 155747, ORPI). Also reported by Thompson (1988) for "Quitobaquito," Harbison s.n. (SD).

SOLANACEAE

Calibrachoa parviflora (Juss.) D'Arcy (1989) (= *Petunia parviflora* Juss.). Quitobaquito, alkaline flat, NW of pond, F 88-317 & Dahl (ARIZ, ORPI).

Capsicum annuum L. var. *aviculare* (Dierbach) D'Arcy & Eshbaugh. Boulder Canyon, side drainage to S on steep, N-facing, shaded slope, Wilson 207 (ARIZ 282824).

Lycium californicum Nutt. var. *arizonicum* A. Gray. La Abra Valley near Santo Domingo, McDougall field no. 87 (ARIZ 15364); 3.7 mi E of Aguajita Wash, La Abra Plain, F 90-42, Conner, Shumaker & Wachtmeister (ARIZ, ORPI).

Solanum hindsianum Benth. Puerto Blanco Mts., 1.8 km NW of Red Tank Well, BRJ 7581 (ASU 152726, ORPI), 1 km S of Pinkley Peak, 1 km NW of Red Tank Well, BTJ 7568 (ASU 152329, ORPI). First cited by Mason, et al. (1986) based on a sterile collection from 1.5 km S of Pinkley Peak, 585 m elev., Jan 1986, M.L. Lechner s.n. (ARIZ 258706, ORPI 4212).

MAGNOLIOPHYTA - LILIOPSIDA - Monocots

CYPERACEAE

Eleocharis rostellata (Torr.) Torr. Quitobaquito, above pond, F 87-296 & Dimmitt (ARIZ 277097, ORPI 8979), seeps above pond, F 88-319 & Dahl (ARIZ 280042, ORPI).

POACEAE - GRAMINEAE

Aristida californica Thurb. var. *glabrata* Vasey. Along AZ 85, 4 km S of North Entrance, Reeder 8218 & Reeder (ARIZ 271705, ASU 158058); along AZ-85, F 87-334 & Dimmitt (ARIZ, ORPI).

Cenchrus echinatus L. Along road, 0.5 mi E of border crossing station, F 87-319 & Dimmitt (ARIZ 275906, ORPI).

Dactyloctenium aegyptium (L.) Willd. Quitobaquito, F 87-289 & Dimmitt (ARIZ 276861, ORPI 8953).

Echinochloa colonum (L.) Link. Wash 2 mi NE of Visitor Center on Ajo Loop Rd, T.R. Van Devender & V D 84-451 (ARIZ 251638); along road, 0.5 mi E of border crossing station, F 87-323 & Dimmitt (ARIZ 275908, ORPI). Replaces *E. crusgalii* entry in flora (Bowers, 1980).

Eriochloa acuminata (Presl.) Kunth ex Roem. & Schult. var. *acuminata*. Residential area, ca. 1 km NE of Visitor Center, F 86-266 & Leigh (ARIZ); along road,

0.5 mi W of Lukeville Post Office, *F 87-281 & Dimmitt* (ARIZ 286184, ORPI); along road, 0.5 mi E of border crossing station, *F 87-314 & Dimmitt* (ARIZ 286183, ORPI 8971).

Panicum antidotale Retz. Along road, 2.2 mi E of border crossing station, *F 87-329 & Dimmitt* (ARIZ 285775, 285776, ORPI 8986).

Pennisetum ciliare (L.) Link. Quitobaquito, base of granitic hills just W of pond, *F 88-448 & Warren* (ARIZ, ORPI); near Growler Valley rain gauge, *Anderson s.n.* (ORPI); 4 mi W of Bates Well, *Anderson s.n.* (ORPI).

Pennisetum setaceum (Forssk.) Chiov. Roadside, ca. 1 mi N of jctn. Ajo Mt. Drive and AZ 85, *F 87-333 & Dimmitt* (ARIZ, ORPI).

Poa annua L. Quitobaquito, in marsh, *Darrow 2405, Gould & Haskell* (ARIZ 18084).

Setaria griesbachii Fourn. Bed of wash, Alamo Canyon, Ajo Mts., *Goodding 474-45 & Supernaugh s.n.* (ARIZ 26770).

Setaria Liebmannii Fourn. Alamo Canyon, Ajo Mts., rocky slopes, *Goodding & Reeder s.n.* (ARIZ 13941, ASU 88243).

Sorghum halepense (L.) Pers. Along road, 1 mi E of border crossing station, *F 87-325 & Dimmitt* (ARIZ 286185, ORPI 8984).

JUNCACEAE

Juncus balticus Willd. var. *mexicanus* (Willd.) Kuntze. Quitobaquito and immediate vicinity, *F 87-287 & Dimmitt* (ARIZ, ORPI 8939).

POTAMOGETONACEAE

Potamogeton pectinacea Pers. Quitobaquito pond, *F 86-270 & Leigh* (ARIZ 269762, ORPI 8962), *F 87-295 & Dimmitt* (ARIZ 276611, ORPI 8948), *F 88-455 & Warren* (ARIZ, ORPI).

RUPPIACEAE

Ruppia maritima L. Quitobaquito pond, with coiled peduncles, *F 86-222, Straub & Warren* (ARIZ 283929, ORPI).

ZANNICHELLIACEAE

Zannichellia palustris L. Quitobaquito, *Benson 9939* (ARIZ 18481), *F 86-270 & Leigh* (ARIZ), *Peebles 14566* (ARIZ 92069); small stream from spring to pond, *Mason 1676* (ARIZ 134452).

Notes. *Tumamoca macdougalii* Rose (Cucurbitaceae) was relocated in the Monument after 39 years, just to the east of Dos Lomitas, T18S R5W S14 NE¼, 1430 ft (BRJ

7638, ASU 155741, ORPI), but since has been destroyed by javelina activity. The only previous collection was in 1951 from Dripping Springs (*Supernaugh & Ledding 453*, ORPI 1280).

Chromosome numbers. Meiotic chromosome counts were ascertained for the following Monument plants. First counts for a taxon are indicated by an asterisk (*), new counts by double asterisk (**).

ASTERACEAE

Perityle ajoensis Todsén

2n = 17II North of mouth of Boulder Canyon, *BRJ 7643* (ASU 154792)(identification fide A.M. Powell).

CACTACEAE

Echinocereus engelmannii (Parry ex Engelm.) Lem. var. *acicularis* (Engelm. & Big.) Engelm. ex Rümpler
2n = 22II Puerto Blanco Mts., 2 km WNW of Dripping Springs, *BTJ 7584* (ASU 152721, ORPI 8922).

Echinocereus nicholii (L. Benson) Parfitt (= *E. engelmannii* var. *nicholii* L. Benson)

2n = 11II 1.8 km NW of Red Tank Well, *BTJ 7580* (ASU 152724, ORPI 8892); Puerto Blanco Mts., *BTJ 7579* (ASU 152718, ORPI 8893).

**Echinomastus erectocentrus* (Coulter.) Britt. & Rose var. *acunensis* (Marshall) Bravo (= *Neolloydia erectocentra* (Coulter.) L. Benson var. *acunensis* (Marshall) L. Benson)

2n = 11II Puerto Blanco Mts., 2.5 km NW of Dripping Springs, 525 m, *BTJ 7586* (ASU 153147, pop. voucher).

Opuntia acanthocarpa Engelm. & Bigel. var. *coloradensis* L. Benson

2n = 11II Puerto Blanco Mts., 2 km NW of Dripping Springs, *BTJ 7587A* (ASU 152722, ORPI 8891); 2 km NE of Puerto Blanco Mts., 1 km NNE of Red Tank Well, *BTJ 7578* (ASU 152719).

Opuntia bigelovii Engelm.

2n = 11III Puerto Blanco Mts., 1.8 km NW of Red Tank Well, *BTJ 7582* (ASU 152716, ORPI 8924); W end of Puerto Blanco Mts., 1.3 km E of Aguajita Wash, 6 Mar 1988, *BTJ 7583* (ASU 152720, ORPI 8894).

Opuntia fulgida Engelm. var. *fulgida*

2n = 11III Estes Canyon picnic area at base of trail to Estes Canyon, 2.5 km S of Mt. Ajo, *BT 7753* (ASU 161422, ORPI). This is the first triploid count south of the Florence, Arizona, region.

**Opuntia kunzei* Rose (= *O. stanlyi* Engelm. var. *kunzei* (Rose) L. Benson)

2n = 22II Aguajita Wash, *BJR 7613* (ASU 154786, ORPI).

CAPPARIDACEAE

Atamisquea emarginata Miers

$2n = 8_{II}$ 350 m E of Aguajita Wash, BRJ 7612 (ASU 858018, ORPI). This is a first count of this monotypic genus for North America, the same number as reported by Covas and Schnack (1946) for a specimen from Region de Cuyo, Argentina.

AGAVACEAE

**Agave deserti* Engelm. subsp. *simplex* H.S. Gentry

$2n = 30_{II}$ Ajo Mts., Bull Pasture, BT 7755 (ASU 161423, ORPI), BT 7757 (ASU 161361, ORPI), BT 7759 (ASU 161414, ORPI).

**Agave deserti* subsp. *simplex* X *A. schottii* var. *schottii*

$2n = 30_{II} + 30_{I}$ Ajo Mtns., Bull Pasture, Hodgson 4478, Ramsden & DeLamater (DES 30831, 32693, + flowers in fluid; ORPI 3174). Meiosis I is irregular with 30 chromosomes going to each pole and 30 lagging at the equatorial plane of cell. The morphology of the plant is intermediate of the two parent species, but more similar to *A. schottii* as expected since it possesses two genomes of *A. schottii* and only one of *A. deserti* ssp. *simplex*. The plant superficially resembles *A. schottii* var. *treleasei* (Toumey) Kearney & Peebles.

***Agave schottii* Engelm. var. *schottii*

$2n = 60_{II}$ Ajo Mts., Bull Pasture, BT 7754 (ASU 161428, ORPI), BT 7756 (ASU 161424, ORPI), BT 7758 (ASU 161425, ORPI). Only other count (Granick 1944) is a diploid count from a plant from the Santa Rita Mts., Arizona.

Type collections. Taxa with type locality within the boundaries of Organ Pipe Cactus National Monument are:

ASTERACEAE

Machaeranthera arizonica Jackson & Johnson (1967)

Low, rocky hillsides and sandy soil around Quitobaquito Springs, 31 Mar 1962, Jackson & Johnson 3043-1 (KANU; isotype: ARIZ 161931!; also paratypes, including one collection from near Quitobaquito, Peebles 14560 (ARIZ 98084) which is also a paratype of *M. arida* Turner & Horne (1964). Both taxa have been combined by Turner (1986) as *M. coulteri* (A. Gray) Turner & Horne var. *arida* (Turner & Horne) Turner.

Perityle ajoensis Todsén (1974)

Crevices in a seeping, N-facing volcanic cliff, ca. 3000 ft, above Marker 14, Bull Pasture Trail, 22 Oct 1972, Todsén 2292 (NY; isotypes NMC, SRSC, ARIZ, ORPI 4441!).

CACTACEAE

Echinomastus acunensis W.T. Marshall (1953)

Acuna Valley, rocky hill with creosote bush, 2 Jan 1951, *Supernaugh s.n.* (Lectotype: DES 786!; isolecotype: ORPI 1450!).

Opuntia acanthocarpa Engelm. & Bigel. var. *major* (Engelm.) L. Benson (1969). Basionym: *O. echinocarpa* Engelm. & Bigel. var. *major* Engelm. Headquarters, Organ Pipe Cactus National Monument, Steenbergh 5-2662-1 Neotype; POM 306088; isoneotype: ORPI).

Opuntia phaeacantha Engelm. var. *flavispina* L. Benson (1974)

Alamo Canyon, Ajo Mts., 2300 ft, 27 Apr 1939, Nichol s.n. (POM 306987; isotypes: ARIZ 64930, 83680; ORPI 1147!; U.S. Natl. Park Service Herb., Santa Fe).

FAGACEAE

Quercus ajoensis C.H. Muller (1954)

Main (south) fork of Alamo Canyon (between 2375 and 2675 ft) in sparse streamside woodland in the otherwise openly shrubby mts., 15 Aug 1952, Muller & Tucker 9519 (SBCA; isotypes; ORPI 934!, etc.; numerous paratypes).

ROSACEAE

Vauquelinia californica (Torr.) Sarg. subsp. *sonorensis* Hess & Henrickson (1987)

Arch Canyon, 12 mi E of visitor center, in Ajo Mts., 2 Jun 1978, Hess & Wilhelm 4259 (MOR; isotypes: "to be distributed"; also paratypes).

Unique U.S. collections. Plant species known in the United States only from Organ Pipe Cactus National Monument collections are: (1) *Matelea cordifolia* (Gray) Woods. (Asclepiadaceae), (2) *Perityle ajoensis* Todsén (Asteraceae), (3) *Atamisquea emarginata* Miers (Capparidaceae), (4) *Antirrhinum watsonii* Vasey & Rose (Scrophulariaceae) (replaces *A. kingii* Wats. entry in flora by Bowers (1980) (two collections known: Between Diaz Mt. and Sweetwater Wash, 24 Feb 1973, Schmitt & Dakan s.n. (ORPI 3071!) (identification fide D.M. Thompson); Baker 7707 (ASU 159935), and (5) *Solanum hindsianum* Benth. (Solanaceae) (known from only the three collections cited above).

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