

UTAH'S OPUNTIAS

by Tony Frates, Dorde W. Woodruff*, and Ty Harrison+
 (*1928-2018)
 (+1942-2017)

Note: this is an ongoing work-in-process and subject to future changes.

Plants of the genus *Opuntia* are characterized by flat stems (or subcylindric to spheric in the case of *O. fragilis*), called pads, joints, or nopales. Similar to *Cylindropuntia* and *Grusonia* (previously included within *Opuntia*, and all part of subfamily Opuntioideae), they are unique in having areoles bearing glochids (short, barbed spines) and early deciduous ephemeral leaves. Unlike *Cylindropuntia* and *Grusonia*, *Opuntia* spines do not separate into a deciduous sheath.

Dry Fruits

Tan at maturity – note: dry fruits that have been parasitized will appear fleshy

Basilaris complex – pink-red filaments, white stigmas, subspheric seeds with smaller raphe, pink inner perianth parts

Current name, with author last names and as commonly abbreviated — see end notes)	Distribution and rank (NS=NatureServe) where appropriate	2n= **	Synonyms/variants/misapplied names/comments
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<p><i>O. basilaris</i> Engelm. & Bigelow var. <i>basilaris</i></p>	<p>In Utah found only in the southwestern portion of state, principally at low elevations in Wash Co. and disjunct in southeastern Kane Co.; also in AZ, NV, CA and northern Mexico.</p> <p>Var. <i>basilaris</i> is primarily a Mojave desert species.</p>	<p>22 (2x)</p>	<p>Taxonomic treatment has remained fairly constant, but has been generally confused with <i>O. aurea</i>. May form hybrids with <i>O. erinacea</i>.</p> <p>Pads bluish-gray, flattened to somewhat curved or wavy, heart-shaped, clavate-suborbicular to broadly obovate, numerous closely-spaced glochids (10-16 most often diagonally at mid-stem)</p> <p>Taxa in the <i>O. basilaris</i> complex appear to survive over a wide range as a hardy diploid; plants in this complex are typically surrounded by polyploids with which they only occasionally hybridize.</p> <p>Reference to <i>O. brachyclada</i> by Clover (1938) occurring in the Dixie National Forest between Veyo and Enterprise in Wash Co. no doubt</p>
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			falls here.
<i>O. basilaris</i> Engelm. & Bigelow var. <i>heilii</i> Welsh & Neese	Utah endemic restricted to a small area of Emery and Wayne Cos. NS rank: G5T2T3; of conservation concern.	22 (2x)	<p>None. Counts thus far confirmed as 22 by Dean Stock (2013).</p> <p>Included as a synonym in FNA Vol. 4:145. 2003, and Pinkava (2003) under <i>O. basilaris</i> var. <i>longiareolata</i> but referred to incorrectly as <i>O. heilii</i> Welsh & Neese (it was in fact published as a variety of <i>basilaris</i> in GBN, 43(4):700. 1983).</p> <p>Occurs near the Dirty Devil/Fremont/Muddy river system, Factory Butte, Hanksville, and Blue Benches. Replaced by <i>O. nicholii</i> at higher elevations. Similar distribution to <i>Sclerocactus wrightiae</i> in <i>wrightiae</i>'s SE range.</p> <p>Light green/green pads lack or mostly lack trichomes. Pads mostly obovate, occasionally spatulate or sub-cordate, yellow glochids, usually 5-6 diagonally at mid-stem (less closely spaced than other varieties).</p> <p>Flowers in hues of pale pink, off-white/pale chartreuse to pink filaments and style; stigma pale cream; pale yellow anthers This entity is very distinct from the one below and should not have been lumped into it; the most aberrant of the basilares.</p>
<i>O. basilaris</i> Engelm. & Bigelow var. <i>longiareolata</i> (Clover & Jotter) Benson	Primarily occurs in Coconino Co. AZ (e.g. Lee's Ferry) and downstream in the Grand Canyon; in Utah relict in along the Colorado River drainage in extreme northeastern Garfield and northwestern San Juan Cos. (Cataract Canyon and just above, on the Colorado) NS rank: G5T2Q	22 (2x)	<p>See above. We disagree with FNA and any other treatment that includes var. <i>heilii</i> within this entity.</p> <p>Sometimes misspelled as "longiaureolata."</p> <p>Specific epithet is not a diagnostic character; some areoles are elongated but not all.</p> <p>Occurs along the Colorado river system. Possibility of extremely relict, sparse occurrence in Glen Canyon before the dam.</p> <p>Darker green pads contain significantly fewer trichomes than var. <i>basilaris</i>. Spatulate pads,</p>

	Of conservation concern particularly in Utah	yellow-brown glochids, typically 8-9 diagonally at mid-stem. Pink/red-pink flowers. Midway in features between var. <i>basilaris</i> and var. <i>heilii</i> .
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Polyacantha complex — white to yellow to pink-red filaments, green stigmas, seeds flat with larger raphe, inner perianth yellow to pink (listed alphabetically)

Current name	Distribution	2n=	Synonyms/variants/misapplied names/comments
<i>O. aurea</i> Baxter	Restricted endemic in western Kane Co, mainly north of Kanab; adjoining AZ); <i>O. aurea</i> x <i>O. polyacantha</i> hybrids with variable morphology occur in Zion area and northwest to Iron Co./possibly west to Bull Valley Mtns and north end of Beaver Dam Mtns. Also hybrids up Long Valley to Panguitch. NS rank: G3 (S1 in Utah but appears secure)	66 (6x)	<i>O. basilaris</i> var. <i>aurea</i> , <i>O. erinacea</i> var. <i>aurea</i> Historically confused with spineless morphotypes of <i>O. polyacantha</i> as well as with <i>O. basilaris</i> generally Pads have scattered trichomes. Hybrid forms widespread throughout southern Utah in Washington, Iron and Kane Counties and north into Garfield Co. Has yellow flowers but pink when introgressed with <i>O. polyacantha</i> or <i>O. pinkavae</i> . East of Kanab (Johnson Canyon) and south of Colorado City, AZ. Hybridizes with <i>O. pinkavae</i> . Forms large hybrid swarms in both areas.
<i>Opuntia fragilis</i> (Nutt.) Haw.	A higher elevation species scattered mainly in the central-eastern half of the state in mountain brush communities as well as sandy foothill habitats, known in Utah from Box Elder, Carbon, Davis, Duchesne, Emery, Garfield, Juab, Kane, Morgan, Piute, Salt Lake, San Juan, Sevier, Uintah, Utah, Weber and Wayne Cos. Also in AZ, CA, CO, ID, IL, IA, KS, MI, MN, MT, NV (Ribbens 2007), NM, ND, OK, OR, SD, TX, WA, WI, WY and Canada	66 (6x)	<i>O. brachyarthra</i> Rounded but often at least somewhat flattened when introgressed. Highly variable but normally distinct. Hybridizes with <i>O. polyacantha</i> and <i>O. aurea</i> where ranges overlap (may have evolved from the same group of diploid ancestors as <i>O. polyacantha</i>). In the general vicinity of Hatch, Utah it hybridizes with <i>O. aurea</i> hybrids (i.e., with <i>O. aurea</i> x <i>O. polyacantha</i>) producing some plants with pink flowers. In southeastern Utah, hybridizes with <i>O. phaeacantha</i> . Distribution in Morgan Co. has been confirmed. Small and inconspicuous, it may occur in other counties though not reported.
<i>O. pinkavae</i> Parfitt	Restricted Arizona Strip	88	<i>O. rubrifolia</i> may be a synonym

	<p>endemic in southwestern Kane Co. (not in Wash Co.); and northern Mohave and Coconino Cos., AZ</p> <p>NS rank: G3; likely of conservation concern in Utah (conservation status largely unknown, may be secure in Arizona)</p>	(8x)	<p>Hybridizes with <i>O. aurea</i>. Somewhat resembles in aspect the fleshy fruited <i>O. macrorhiza</i>. Distal spines slender, to stout; often white but can be dark red brown when new; to 6cm in length.</p> <p>Included by Benson in the various morphotypes of <i>O. erinacea</i> var. <i>utahensis</i> (which is not however a synonym of this taxon).</p> <p>Parfitt indicates that <i>O. basilaris</i> var. <i>woodburyi</i> (invalidly published) belongs here but it does not.</p>
<p><i>Opuntia</i> sp. nov. Stock or hybrid form</p>	<p>Under study. Restricted endemic occurring solely in extreme southwestern Utah (Wash. Co.)</p> <p>Of conservation concern; threats include off-road vehicles, overgrazing, habitat loss</p>	88 (8x)	<p><i>O. basilaris</i> var. <i>woodburyi</i> (invalidly published), <i>O. erinacea</i> var. <i>woodburyi</i></p> <p>A seemingly stable entity of possible hybrid origin between <i>O. pinkavae</i> and <i>O. aurea</i> and now isolated from its parent species. Distinguished by relative lack of spines, Spines often yellow, especially when new; larger size; and a distinct green color of pads. Glochids often conspicuous.</p>
<p><i>Opuntia polyacantha</i> complex: <i>Opuntia polyacantha</i> Haw. var. <i>polyacantha</i></p>	<p>While plants in northern and northeastern UT were previously placed here, it appears that this var. in fact mostly does not occur in Utah except at distant edges in Box Elder, Rich and Summit Cos.</p> <p>Reported from AZ, CO, ID, KS, MT, NE, NV, NM, ND, OK, SD, TX, WY and Canada</p>	44 (4x)	<p>Derived in part from <i>O. trichophora</i></p> <p>Hybrid entries have been assigned names within the polyacantha complex used to reference plants not referred to elsewhere below include:</p> <p><i>O. barbata</i> <i>O. heacockiae</i> <i>O. juniperina</i>, <i>O. polyacantha</i> var. <i>juniperina</i>, <i>O. erinacea</i> var. <i>juniperina</i>, <i>O. media</i></p> <p><i>O. missouriensis</i> (and in combination with numerous varietal names in addition to those mentioned here – said to occur as low as 4,200 ft in the SL Valley by Watson which was probably instead a relictual hybrid morphotype)</p>

		<p><i>O. polyacantha</i> var. <i>salmonea</i> <i>O. polyacantha</i> var. <i>spirocentra</i> <i>O. polyacantha</i> var. <i>watsonii</i> (collected in Summit County, about 5 miles SW of the UT-WY border and 8 miles SW of Evanston based on Watson's handwritten description on one of the specimens at which he referenced as 7,000 ft – probably closer to 6,800 ft. - and also as treated by him in 1871 where he references it as occurring above “Wahsatch station” in the Wasatch mountains – see p. 118; while small in length with possibly some <i>O. fragilis</i> influence, it appears to be a good match for var. <i>polyacantha</i> which is not common in Utah)</p> <p><i>O. rufispina</i> , <i>O. polyacantha</i> var. <i>rufispina</i></p> <p><i>O. rutila</i> (said to have occurred from Fillmore to St. George by Watson (1871))</p> <p><i>O. schweriniana</i>, <i>O. polyacantha</i> var. <i>schweriniana</i> <i>O. splendens</i></p> <p><i>O. rhodantha</i>, <i>O. erinacea</i> var. <i>rhodantha</i>, <i>O. xanthostemma</i>, <i>O. erinacea</i> var. <i>xanthostemma</i>. Reported as having magenta flowers; perhaps hybrids.</p> <p>Per Parfitt (1997), the type of <i>O. erinacea</i> var. <i>utahensis</i> is a few-spined individual within the range of this taxon. Northern Utah plants in the past referred to as <i>O. rhodantha</i> and <i>O. erinacea</i> var. <i>utahensis</i> probably belong here.</p> <p>Garrett and others misapplied morphotypes of this var. to: <i>O. utahensis</i> Purpus (a form with unknown relationships), <i>O. hystericina</i>, and <i>O. angustata</i>. The names <i>O. rhodantha</i>, <i>O. erinacea</i> var. <i>utahensis</i> (and <i>O. erinacea</i> without a varietal name) have been misapplied and often misdescribed when referencing this taxon in northern UT.</p> <p>An earlier name <i>Opuntia sphaerocarpa</i> var.</p>
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			<p><i>utahensis</i> corresponds to the valid but no longer recognized name of <i>O. erinacea</i> var. <i>utahensis</i> (Engelm) Benson (these are not the same as <i>O. utahensis</i> Purpus, but all are moot). Engelmann's type specimens for <i>O. sphaerocarpa</i> var. <i>utahensis</i> which he collected on July 19, 1859 was then in the Utah Territory but it is in present day White Pine County, Nevada. As treated by Watson (1871), this relates to the relictual hybrid discussed below.</p>
<p><i>O. polyacantha</i>* x <i>O. macrorhiza</i> x <i>O. fragilis</i></p> <p>*and potentially others</p>	<p>Many <i>Opuntia</i> in northern Utah, particularly in the Wasatch but also elsewhere, are introgressed and may be partially or completely spineless mixed in with plants that are all or mostly spiny.</p> <p>The mainly Wasatch Back plants spreading to the Wasatch Front plants (and to Tooele Co.) appear to be a relictual hybrid where the parent plants are no longer present and may therefore may represent an unrecognized entity. The Wasatch Back plants tend to have smaller cladodes and spineless and spiny plants typically exist in the same population. The receptacles/fruits are barrel-shaped, and become dry even though sometimes appearing reddish. The receptacles are naked.</p> <p>Occurring in Davis, Salt Lake, Summit, Tooele, Utah, Wasatch, Weber</p>	<p>44 (4x)</p>	<p>See some of the names listed in var. <i>polyacantha</i>. Some plants in this category may have been referred to as <i>O. polyacantha</i> var. <i>platycarpa</i> historically, under <i>Opuntia sphaerocarpa</i> var. <i>utahensis</i> as treated by Watson (1871) and/or lumped under other olders names such as <i>O. missouriensis</i> and <i>O. rhodantha</i>.</p> <p>Reduced spine to spineless plants of hybrid origin have frequently been described as new entities and/or misidentified. Typical occurrences involve plants that have cladodes that all or mostly spiny, plants that are nearly spineless, and plants that are somewhere in between. Regardless of cladode spine characters, the fruits typically lack or have few spines and a consistent elongated barrel shape with an initial reddish color but not becoming fleshy.</p> <p>Typical features of these hybrids:</p> <ul style="list-style-type: none"> *Closely-spaced areoles (more similar to <i>poly.</i> than <i>mac.</i> or <i>phaea</i>) *Obovate (or more rounded) cladodes similar to <i>mac.</i>) *Receptacle while sometimes appearing reddish becoming dry unlike the fleshy fruited forms, and mostly lacking spines (unlike <i>poly.</i>) - this could be caused by introgression with <i>O. fragilis</i> which largely lacks pericarp spines, and could explain why the shape of the fruit doesn't change to be more like a fleshy-fruited

			<p>type</p> <p>*Cladode spine reduction is typical, sometimes like <i>mac.</i> but sometimes even more restricted to the terminal end of the pad unlike <i>mac.</i> and sometimes completely or nearly spineless (Utah <i>mac.</i> is never spineless)</p> <p>*Receptacle/mature fruit is consistently more barrel-shaped like <i>poly.</i></p> <p>*Spine clusters when present typically unlike <i>mac.</i> either more numerous or multiple major spines and/or more variable and also unlike true <i>poly.</i> in that spines not appressed to stem</p> <p>*Seeds are larger and lighter colored and more warped more like <i>poly.</i></p> <p>*Flowers are typically yellow or pink (<i>mac.</i> flowers are never all pink unless introgressed) and if yellow, usually lack the inner red tepal basal coloration always seen in true <i>mac.</i> and often in <i>phaea.</i></p> <p>For the reasons above, these plants even though sometimes appearing <i>macrorhiza</i>-like, are closely allied to <i>polyacantha</i> complex plants.</p>
<p><i>O. erinacea</i> Engelm. & Bigelow</p> <p>syn. <i>O. polyacantha</i> Haw. var. <i>erinacea</i> (Engelm. & Bigelow) Parfitt</p>	<p>Southwestern Utah (e.g., Virgin Mtns) to Zion in Virgin River Valley, becoming part of the hybrid mix in the western half of the state; also in AZ, CA and NV</p>	<p>44 (4x)</p>	<p><i>O. ursina</i>, <i>O. erinacea</i> var. <i>ursina</i>., <i>O. hystricina</i> var. <i>ursina</i></p> <p>See also some of the names listed in var. <i>polyacantha</i>.</p> <p>Contributes to the hybrid mix in the Great Basin continuing well to the north but mostly south of the Great Salt Lake and Utah Lake but absent from eastern Utah.</p>
<p>Misapplied in Utah and possibly elsewhere:</p>	<p>Absent from Utah contrary to what was previously thought.</p>	<p>44 (4x) and 66</p>	<p><i>O. hystricina</i>, <i>O. erinacea</i> var. <i>hystricina</i></p> <p><i>O. rhodantha</i> is also a name that has been used in connection with this taxon.</p>

<p><i>O. polyacantha</i> Haw. var. <i>hystricina</i> (Engelm. & Bigelow) Parfitt</p>	<p>Type locality: Colorado Chiquito (Little Colorado River) and San Fransico Mountains in northeastern AZ.</p> <p>Also in: AZ, CA, CO, NV and NM</p> <p>The 4x and 6x plants would not likely belong to the same taxon as has been previously described; and in fact it is unclear whether this is even a valid taxon.</p>	<p>(6x)</p>	<p>The 66 chromosome plants which occupy a large area in the Colorado Plateau are <i>O. nicholii</i> or introgressed <i>O. nichollii</i>. This includes three specimens taken by and counted by Dr. Bruce Parfitt from eastern Carbon County that he placed within <i>O. polyacantha</i> var. <i>hystricina</i>.</p> <p>There are plants in southeastern Utah including San Juan and Grand Cos. and elsewhere that seemingly are a morphological match for “<i>hystricina</i>.” To the extent these are hexaploids in southeastern Utah, they would more likely represent introgressed <i>O. nicholli</i>. In the western half they may instead represent introgressed tetraploid <i>O. erinacea</i>. If these plants represent true reproducing populations, then <i>O. erinacea</i> var. <i>hystricina</i> might be an appropriate name for them (in the Great Basin for example).</p>
<p><i>O. nicholii</i> Benson syn. <i>O. polyacantha</i> Haw. var. <i>nicholii</i> (Benson) Parfitt</p>	<p>Formerly thought to be restricted to Glen Canyon drainage in Garfield , Kane, San Juan Cos., but now known to occupy a larger area in southeastern Utah's canyon country including Carbon, Emery,Garfield, Grand, Kane, Piute, Sevier, San Juan and Wayne (often introgressed)</p> <p>Also occurs in northern Coconino Co., AZ including the Lee's Ferry area and west towards Flagstaff</p> <p>NS Utah rank: S1S2</p> <p>But not now likely to be of conservation concern</p>	<p>66 (6x)</p>	<p>Most of what was thought to be <i>O. hystricina</i> in southeastern Utah is this entity.</p> <p>This form should be recognized at the species level. It is a distinct form derived from ancient ancestors in common with <i>O. polyacantha</i>. It has no relationship to <i>O. phaeacantha</i> as often described in the literature. It does hybridize however with <i>O. phaeacantha</i> particularly in southeastern Utah forming reduced spine hybrids.</p> <p><i>O. nicholii</i>, <i>O. hystricina</i> var. <i>nicholii</i></p> <p>Hybridizes with <i>O. phaeacantha</i> in southeastern Utah.</p> <p>Occurs east of <i>O. aurea</i> and <i>O. pinkavae</i> but hybridizes with <i>O. pinkavae</i> in House Rock Valley, AZ</p>
<p><i>O. trichophora</i> (Engelm. & J.M.</p>	<p>In Utah, occurs only in Emery (?), Grand and San</p>	<p>22 (2x)</p>	<p>Treated by Parfitt (1991, see p. 87) and previously by us as a morphotype within the</p>

<p>Bigelow) Britton & Rose</p> <p>syn: <i>O. polyacantha</i> Haw. var. <i>trichophora</i> (Engelm. & Bigelow) Coulter</p>	<p>Juan Cos.</p> <p>Curving/curly/flexible hair-like appressed spines and small stem segments</p> <p>Reported also from AZ, CO, NM and TX.</p>	<p><i>O. polyacantha</i> complex but which has been found to be diploid, and appears to in fact be an ancestral plant whose genes have been passed along in tetraploid plants and hence the reason for Parfitt's observation that it is found in the range of the species.</p> <p>More properly recognized at the species level.</p> <p><i>O. trichophora</i>, <i>O. polyacantha</i> var. <i>trichophora</i>, <i>Opuntia missouriensis</i> var. <i>trichophora</i></p>
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Fleshy fruits

At maturity orange to red or very dark red throughout. Listed alphabetically.

White to yellow filaments, yellow to green stigmas, seeds flat with larger raphe, inner perianth yellow (sometimes with red base) to orange-red

Current name	Distribution and rank	2n=	Older names/comments
<p><i>O. chlorotica</i> Engelm. & Bigelow</p>	<p>Limited distribution in Utah in Wash. Co. (a state rare species); also in AZ, CA, NV, NM and Mexico</p> <p>NS Utah rank: S1; of conservation concern in Utah</p>	<p>22 (2x)</p>	<p><i>O. palmeri</i> may be a synonym</p> <p>Known to hybridize with <i>O. phaeacantha</i> elsewhere</p> <p>Typically in south/southwestern facing sandstone rock crevices</p> <p>To be sought in southwestern Kane Co. (plants occur within two miles of the Utah border southwest of the Coral Pink Sand Dunes, in Mohave Co., AZ)</p>
<p><i>O. macrorhiza</i> Engelm. var. <i>nov.</i> Frates, Woodruff & Harrison</p>	<p>Primarily in Salt Lake and Davis Cos. but also in Weber and the eastern edge of Box Elder, and to be expected in Cache Co. Distant and ongoing hybridization is evident with <i>O. polyacantha</i> var. <i>hystricina</i> with more significant ongoing contact in northern</p>	<p>44 (4x)</p>	<p>At species level, some prior references used in Utah have included:</p> <p><i>O. compressa</i> var. <i>macrorhiza</i>; <i>O. mesacantha</i> var. <i>macrorhiza</i>.</p> <p><i>O. compressa</i> without the inclusion of a varietal name was formerly used to refer to this entity in Utah</p> <p>Not synonymous with <i>O. utahensis</i> Purpus (the type of which is uncertain and the</p>

<p>Davis County, and with intermittent zones of ongoing contact northward. So far only known from along the western flank (i.e. the Wasatch Front) of the Wasatch Mtns. Occurs slightly to the interior of the central to northern Wasatch range where where Lake Bonneville was able to penetrate.</p> <p>Very limited occurrences of the species occur in Garfield, Kane and San Juan Cos. (although in San Juan Co. plants are hybrids with <i>O. trichophora</i>) are likely best classified as <i>O. macrorhiza</i> var. <i>macrorhiza</i>.</p> <p>Increasingly rare, of conservation concern.</p> <p>U.S. distribution of <i>Opuntia macrorhiza</i> as a whole is somewhat uncertain due to many misidentifications, FNA reports as : AZ, AK, CO, KS, MO, NM, OK, TX and Mexico as reported by FNA, however, this misses reports in IL, LA, OH, NE, SD, and WI (some of which may be confused with other species/morphotypes)</p> <p>USDA indicates also ID and MT however we</p>	<p>specimen is not a match)</p> <p>A canyon rims/higher elevation species. Poorly understood, greatly confused with <i>O. phaeacantha</i>, <i>O. aurea</i> and varieties of <i>O. polyacantha</i> with which it also hybridizes.</p> <p>Diploid counts $2n=22$ first reported by Majure (2012) from Texas.</p> <p>Baker (2009) reports $2n=55$ for a, <i>O. macrorhiza</i> x <i>O. phaeacantha</i> from Arizona Hybridizes with <i>O. polyacantha</i> and others. See also Lucas (2012) where diploids in eastern Texas and southeastern New Mexico are discussed.</p> <p>Suspected to hybridize with <i>O. pinkavae</i> or involved in its lineage or both.</p> <p>Plants in Weber Co. and Box Elder are somewhat more introgressed.</p> <p>Reports of the species from southwestern Utah including Zion National park largely in error, or involve possible hybrid plants including small pockets in eastern Washington and southwestern Kane) Cos., frequently misidentified, and has been misreported as being abundant; overall status uncertain with hybrid forms; not in La Sals and not verified elsewhere except for the Glendale Bench in Kane Co. area and near the eastern border of Zion National Park plus one small unusual occurrence under investigation in the Natural Bridges Monument area where there is introgression with <i>O. trichophora</i>. East/West Kaibab Plateau plants in adjoining AZ below 7000' are somewhat <i>O. phaeacantha</i> influenced but appear to be strongly related.</p> <p>With respect to historical reports of <i>O. stenochila</i>, see end notes.</p>
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	have reviewed the lone ID specimen and consider it at best a hybrid; MT is unconfirmed		
<i>O. engelmannii</i> Salm-Dyck ex Engelm. var. <i>engelmannii</i>	Mainly Wash Co., also San Juan. Also in: AZ, CA, NV, NM, TX and Mexico	66 (6x)	<p>Large upright plants with concolor yellow flowers, white spines. This form is widely introgressed with <i>O. phaeacantha</i> in southern Utah's Virgin River valley and may only be in relatively pure form within Zion Canyon. Appears to be maintaining its form within large population of <i>O. phaeacantha</i> by apomictic reproduction.</p> <p><i>O. discata</i>, <i>O. phaeacantha</i> var. <i>discata</i>, <i>O. megacarpa</i>. <i>O. procumbens</i>, <i>O. angustata</i></p> <p>A lower elevation species. Hybridizes with <i>O. phaeacantha</i>; often confused with that taxon. See discussion elsewhere re: <i>O. woodsii</i></p> <p>The name <i>O. tenuispina</i> was used by Angus Woodbury in 1933 to refer to Zion NP occurrences of <i>O. engelmannii</i>. <i>O. tenuispina</i> is a synonym of <i>O. pottsii</i> (<i>O. macrorhiza</i> var. <i>pottsii</i>) which does not occur in Utah.</p>
<i>O. phaeacantha</i> Engelm. var. <i>phaeacantha</i>	Beaver, Millard (Wah Wah Mtns), eastern/northeastern Sevier (Upper Ivie Creek; Link Canyon), Garfield, Grand, Iron, Kane, Millard (NW end of Wah Wah Mtns), San Juan, Washington, and (eastern to central-western) Wayne Cos. Also in: AZ, CA, CO, KS, NV, NM, OK, SD (?), TX and Mexico	66 (6x)	<p><i>O. phaeacantha</i> var. <i>major</i>, <i>O. gilvescens</i>, <i>O. phaeacantha</i> var. <i>laevis</i>, <i>O. laevis</i> (the spineless "laveis" form is known from the Beaver Dam wash area in Wash. Co.), <i>O. angustata</i> (a name that has been misapplied to some Utah specimens)</p> <p><i>O. woodsii</i> Backeb. (or <i>O. x woodsii</i>) is also a name synonymized by some sources to this taxon but more properly refers to hybrids with <i>O. engelmannii</i> from Zion Park and into the Virgin River Valley.</p> <p><i>O. phaeacantha</i> has a more northerly distribution in Utah that has been previously documented and may be a Holocene relict, and more responsible for creating reduced spine hybrids that has previously been realized. Welsh 23187A places it in</p>

	Cos. with scattered occurrences in other counties in the southern half of the state.		northeastern Sevier near its border with Emery and Sanpete Cos line, and it is known from the Fremont Junction area where various hybrids are also found (with both <i>O. fragilis</i> and <i>O. cf. Nicholii</i>) and also the northwestern end of the Wah Wah Mtns based on a report by Kipp Lee. In Colorado, its most northerly known distribution is about seven miles north of Boulder in Boulder County, Colorado (roughly the same latitude as northern Utah Co./Tooele Co. in Utah).
<i>O. phaeacantha</i> Engelm. var. <i>castorea</i> Welsh & Atwood	Utah endemic in the Beaver Dam Wash/ Mtns, Wash Co. Extent of rarity unknown; included in UNPS 2009 watch list; conservation concern unknown	66? (6x)	Named in 2003. Not accepted as a valid segregate by some authorities. These large flowered/fruited forms are largely restricted to the wash area where non-native <i>O. santa-rita</i> were planted by local ranchers. It is not known if hybridization has occurred. This form deserves further study.

Introduced and possibly escaped: cacti are commonly used in horticulture throughout the state. These are usually confined to private or public gardens. Washington Co.'s favorable climate allows for the possibility of some imported plants persisting and creating biologic confusion.

Current name	Distribution	2n=	Synonyms/variants/misapplied names/ comments
<i>O. engelmannii</i> Salm-Dyck ex Engelmann var. <i>linguiformis</i> (Griffiths) B. D. Parfitt & Pinkava	Introduced in Utah in the Beaver Dam Wash, Wash. Co. Considered as an escapee even in Arizona (Breslin et al. 2015). Native to Texas and Coahuila Mexico (Pinkava 2003)	66 (6x)	<i>Opuntia linguiformis</i> <i>Opuntia lindheimeri</i> var. <i>linguiformis</i> Introduced in the vicinity of Lytle Ranch (see for example Harper 2001-143 at UVSC). Apparently cold hardy (has survived cold winters in Salt Lake County in a commercial/restaurant planting.)
<i>O. santa-rita</i> (Griffiths & Hare) Rose	Introduced in Utah in the Beaver Dam Wash, Wash. Co.	22 (2x)	<i>Opuntia chlorotica</i> var. <i>santa-rita</i> <i>Opuntia violacea</i> var. <i>santa-rita</i> * (*Harper 2001-14 at UVSC initially identified as <i>Opuntia violacea</i> likely should be here)

	Native to southern Arizona where it hybridizes with <i>O. chlorotica</i> ; popular in cultivation in central and southern Arizona (Breslin et al. 2015), and Sonora Mexico	Established plants were observed on the Terry's Ranch in the late 1940's to early 50s by A. Dean Stock (pers. comm.). A gas station at Beaver Dam, Arizona had a cactus collection; local ranchers acquired plants from the station and planted them in the Beaver Dam Wash. A large plant still exists in front of the main building at BYU's Lytle Ranch Preserve. Not determined if plants have become naturalized in area.
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END NOTES:

*As a result of other changes in more modern treatments of the Cactaceae, all species in Utah that fall into the genus *Opuntia* are plants with flat pads since the chollas previously called *Opuntia acanthocarpa*, *O. echinocarpa* and *O. whipplei* now fall under the genus *Cylindropuntia*, and *O. pulchella* is now placed under *Grusonia*.

**Cacti generally: x=11

Author abbreviations of Utah native species:

Baxter Edgar M. Baxter (1903-1967)

Benson Lyman D. Benson 1909-1993 (often abbreviated as L. Benson or L.D. Benson)

Backeb. Curt Backeberg (1894-1966)

Clover & Jotter Elzada U. Clover (1897-1980), Mary Lois Jotter (Lois Jotter Cutter) (b. 1914)+

Engelm. & Bigelow George Engelmann (see below) and John M. Bigelow (1804-1878)

Engelm. George Engelmann (1809–1884)

Haw. Adrian H. Haworth (1768–1833)

Neese Elizabeth J. Neese (1934-2008)

Nutt. Thomas Nuttall (1786–1859)

Parfitt Bruce D. Parfitt (1953-2009)

Welsh & Atwood Stanley L. Welsh (b. 1928) and N. Duane Atwood (b. 1938)

+Clover and Jotter were the first women to float completely through the Colorado system (1938)

Taxa either indicated elsewhere as occurring in Utah but which do not actually occur here, or which no longer have any direct conceptual relationships with our plants:

O. martiniana (syn. *O. littoralis* var. *martiniana*) — not a distinguishable taxon

O. covillei was also used to distinguish certain plants from *O. phaeacantha* (mainly to distinguish Benson's *O. littoralis* var. *martiniana* so in that sense the two are synonymous, but, these names now do not apply to Opuntias in Utah and have no direct connection to any of our plants as currently

understood; these names have been since synonymized with taxa that occur elsewhere.

O. humifusa, an eastern U.S. species which does not occur in Utah

O. debreczyi, described in 2005 by an overseas author based on a plant in horticulture since 1973 and purported by some to extend into Utah appears to be an *Opuntia fragilis* hybrid and relates to morphotypes that may not comprise a taxon and cannot in any event be considered as appropriate for use for any *Opuntia* species in Utah and probably also not elsewhere.

O. stenochila (*O. compressa* var. *stenochila*, an unresolved name, has been synonymized by some under *O. macrorhiza*) was reported as being collected in Edward Palmer in 1870 (s.n.), probably in Washington County (Palmer was in Washington County in June of 1870 - he stayed in the St. George area from June 7 to June 17, 1870 and was in the Beaver Dam Mountains on June 18 after which he left Utah that year). The Utah collection of “*stenochila*” could be something closer to *O. pinkavae*, or perhaps hybrid involving *O. phaeacantha*. He was in the Fillmore area circa June 2 in Beaver County following and so the exact location of the collection is uncertain (it doesn't contain an exact date apparently).

Acknowledgements:

We gratefully acknowledge the contributions and suggestions made by *Opuntia* researchers Drs. A. Dean Stock and Lucas Majure (University of Florida and Desert Botanical Gardens). Both Stock and Majure have made numerous chromosome counts of materials from Utah and adjoining states.

Special thanks to various herbarium curators and collection managers at Utah State University, the University of Utah and in particular the late Ann Kelsey of the Garrett Herbarium, and BYU, and many others in different states.

Field and other observations at various times have been contributed by Kipp Lee, Blake Wellard, Walt Fertig and Bill Gray.

Coloradans Scott Smith and the late Dale Denham provided valuable insight and materials with respect to the distribution of certain pricklypear taxa in their state for comparison with Utah materials, particularly with respect to *Opuntia macrorhiza*.

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Revision history: First draft: 11/25/09; updated: 11/27/09; 8/22/10, 11/8/10, 11/13/10,12/3/10, 12/5-6/10,12/30/10,1/27/11,2/22/11, 7/29/11, 11/25/11,2/20/12 and revised/reviewed for the first on-line edition in February 2012; updated 5/30/13, June 2014, March 2016, Nov 2017 additional escapee, Oct 2018 author updates, hybrid description expanded, *phaeacantha* distribution updated, March 2019 adding Clover references and comments re: *stenochila* and *brachyclada* historical references, May 2019 Coulter reference and *platycarpa* syn. and Utah Basilares reference. Citation to this article:

Frates AJ, Woodruff DW, Harrison T. 2012-2020. Utah's Opuntias. Salt Lake City, UT: Utah Native Plant Society; [accessed 2019 month-day]. <http://www.unps.org/UtahOpuntias.pdf>.