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CHROMOSOME NUMBERS IN CHIHUAHUAN DESERT CACTACEAE. III. TRANS-PECOS TEXAS[1]

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Chromosome numbers are reported for 112 collections of Cactaceae, including 102 collections of *Opuntia*. Reports are presented for 33 species in five genera and a total of 36 taxa. Two specimens were sterile. Emphasis was given to the documentation of intraspecific ploidy-level consistencies and differences, because of the current poor state of knowledge about the populational integrity of chromosome numbers in Trans-Pecos cacti and because information about ploidy levels is taxonomically significant particularly in certain genera of Cactaceae. First reports are presented for six taxa, including *Opuntia aureispina* ($2n = 11$ II), *O. tortispina* ($2n = 33$ II), and *Ancistrocactus tobuschii* ($2n = 11$ II). Chromosome numbers are now known for all but one or two of the ~104 currently recognized cactus taxa in Trans-Pecos Texas.

Key words: Cactaceae; Chihuahuan Desert; chromosome numbers; *Opuntia*; Trans-Pecos Texas.

Ongoing taxonomic studies of the Cactaceae of Trans-Pecos Texas, in the northern Chihuahuan Desert Region, have resulted in the accumulation of chromosome numbers reported here for 33 species in five genera of the family. The present reports include 112 counts for 36 taxa, with most of the chromosome numbers coming from specimens of *Opuntia*, the least understood cactus genus in the region. Chromosome numbers for most of the Trans-Pecos cactus taxa (~104) and their extraterritorial allies have been documented previously by Weedin and Powell (1978a, b, 1980) and Weedin, Powell, and Kolle (1989), through a prolific series of papers dealing with chromosome numbers in cacti of western North America (Pinkava and McLeod, 1971; Pinkava, McGill, and Brown, 1973; Pinkava et al., 1977, 1985, 1992; Pinkava and Parfitt, 1982; Pinkava, Rebman, and Baker, 1998), and by a few other authors (see particularly Index to Plant Chromosome Numbers 1967–1993, e.g., Moore, 1973, and Goldblatt and Johnson, 1996).

Previous chromosome number reports have established the utility of knowing ploidy level differences in making taxonomic interpretations in certain cactus genera, for example *Echinocereus* (Parfitt, 1987; Cota and Philbrick, 1994) and *Opuntia* (Pinkava et al., 1977, 1985, 1992; Pinkava, Rebman, and Baker, 1998; Baker and Pinkava, 1999). Prior chromosomal work in the Trans-Pecos has emphasized recording numbers for the different taxa in the region, resulting in the documentation of one or a few counts for most taxa. That objective has been continued in the current work, but considerably more attention has been directed toward evaluating the populational integrity of ploidy levels, particularly in species of *Opuntia*. Also, a conscientious effort was made to obtain chromosome numbers from the nebulous array of intraspecific morphotypes in *Opuntia*, hoping to detect any correlation between morphology and ploidy levels. In a few cases the chromosome numbers are reported under species names that may be unfamiliar to those who have followed the taxonomy of Benson (1982). In other instances chromosome numbers are associated with tentatively identified taxa, pending further taxonomic clarification of the entities involved.

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MATERIALS AND METHODS

One or more specimens of most Trans-Pecos opuntias have been established by vegetative propagation in an experimental *Opuntia* garden at Sul Ross State University (SRSU). Flower bud material was collected from plants in the *Opuntia* garden or from plants in the field, fixed in modified Carnoy's Solution (4:3:1), and standard squash techniques were used to obtain meiotic chromosome counts (Turner and Johnston, 1961). Somatic counts were obtained according to the procedure outlined in Weedin and Powell (1978a). Voucher specimens are deposited in the herbarium at Sul Ross State University (SRSC).

The format used for reporting chromosome numbers in Results and Discussion follows that suggested by Strother (1972) and Strother and Nesom (1997). The bivalent symbol (II) denotes meiotic counts, as in $2n = 11$ II. Mitotic counts are indicated as in $2n = 22$. Reports from Trans-Pecos Texas are arranged geographically by counties from west to east. Entries marked by one asterisk (*) are first reports for the taxon, and two asterisks (**) indicate a previously unreported ploidy level. The present study is devoted mostly to reporting counts from the northern Chihuahuan Desert Region (CDR), but a few extralimital reports are also included. Principal collectors, localities, and pertinent abbreviations are: AMP (A. M. Powell); GGR (G. G. Raun); JFW (J. F. Weedin); SAP (S. A. Powell); TJW (T. J. Weedin); BBNP (Big Bend National Park); PMC (pollen mother cells). The abbreviation for vegetative progeny (veg. prog.) denotes meiotic counts obtained from the *Opuntia* garden.

RESULTS AND DISCUSSION

Opuntioideae

Opuntia aggeria Ralston & Hilsenbeck. $2n = 11$ II. Texas, Brewster Co., ~0.8 km NE of Lajitas, *AMP* and *SAP 6006*. $2n = 11$ II. BBNP, 15.3 km W of Mariscal Mt., *AMP 5216*.

The present diploid ($2n = 22$) counts support the chromosomal distinctiveness attributed to *O. aggeria* [= *Grusonia aggeria* (Ralston & Hilsenbeck) Anderson; Anderson,

1999] by Ralston and Hilsenbeck (1989, 1992), compared to the morphologically similar tetraploids (2*n* = 44) *O. grahamii* and *O. schottii.*

Opuntia atrispina Griffiths. 2*n* = 11 II. Texas, Uvalde Co., limestone hills N of Uvalde, *JFW 1661* (veg. prog.).

**Opuntia aureispina* (Brack & Heil) Pinkava & Parfitt. 2*n* = 11 II. Texas, Brewster Co., BBNP, Rooney's Place, *AMP* and *SAP 5024.* 2*n* = 11 II. Boquillas Canyon, *B. G. Hughes 802.* 2*n* = 11 II. Rooney's Place, *B. Ralston 150.*

Opuntia aureispina so far as known occurs only along the Rio Grande between Mariscal Canyon and Boquillas Canyon in Texas and in adjacent Mexico. Its closest relationship appears to be with *O. azurea* Rose (2*n* = 22, Pinkava et al., 1985, as *O.* aff. *lindheimeri* Engelm.; 2*n* ≈66, D. J. Pinkava, unpublished report, Arizona State University), a species of adjacent Coahuila and Chihuahua, Mexico.

Opuntia camanchica Engelm. & Bigelow. 2*n* = 33 II. Texas, El Paso Co., Franklin Mts., *AMP* and *SAP 6094* (veg. prog.). 2*n* = 33 II. Culberson Co., 8 km N of Kent, *AMP* and *SAP 6167.* 2*n* = 33 II. Presidio Co., ~0.8 km SE of Candelaria, *AMP* and *SAP 5998* (veg. prog.). 2*n* = 33 II. *AMP* and *SAP 5999* (veg. prog.). 2*n* = 33 II. 0.5 km SE of Redford, *AMP* and *SAP 6000* (veg. prog.). 2*n* = 33 II. Brewster Co., BBNP, S of Dogie Mt., *AMP* and *SAP 6029.* 2*n* = 33 II. BBNP, Paint Gap Hills, *AMP* and *SAP 6207* (veg. prog.). 2*n* ≈33 II. BBNP, Glenn Spring road, *B. G. Hughes 428* (veg. prog.). 2*n* = 33 II. 10.5 km NNW of Terlingua, *GGR 93-50* (veg. prog.). 2*n* = 33 II. 1.6 km W of N Reed Plateau, *AMP* and *SAP 5381.* 2*n* = 33 II. Terrell Co., 80.6 km N of Dryden, *AMP* and *SAP 6047* (veg. prog.). 2*n* ≈33 II. Val Verde Co., Pecos River high bridge, *S. Lee 20* (veg. prog.).

The *AMP* and *SAP 5998* and *5999* specimens are white-spined forms of the taxon. Apparent multivalents were observed in *5999* and in *AMP* and *SAP 6207.* We suspect that a hexaploid (2*n* = 66) chromosome number has been widely reported for *O. camanchica* under the name *O. phaeacantha* Engelm. var. *major* Engelm. sensu Benson (1982), e.g., in Pinkava et al. (1985) and Weedin, Powell, and Kolle (1989).

Opuntia chisosensis (Anthony) Ferguson. 2*n* = 11 II. Texas, Brewster Co., BBNP, Chisos Mts., Panther Pass, *AMP* and *SAP 5971* (veg. prog.).

Opuntia cymochila Engelm. & Bigelow. 2*n* = 33 II. Texas, Moore Co., Cactus, *JFW 1672.*

Opuntia davisii Engelm. & Bigelow. 2*n* ≈22 II. New Mexico, Chaves Co., 48.3 km N of Roswell, *JFW 1648* (veg. prog.).

A previous chromosome number report for *O. davisii* from extreme southwestern New Mexico (Pinkava, Rebman, and Baker, 1998) was also tetraploid (2*n* = 44). The only other report for this species was a diploid (2*n* = 22) count in Weedin, Powell, and Kolle (1989) from Presidio County, Texas. The Texas and Chaves County (southeastern New Mexico) populations appear to differ in certain stem, spine, and flower color characters, and they may represent distinct taxa.

Opuntia dulcis Engelm. 2*n* ≈33 II. Texas, Culberson Co., 400 m S of Kent, *AMP* and *SAP 5994* (veg. prog.). 2*n* ≈33 II. Jeff Davis Co., Adobe Canyon, *P. R. Manning 878* (veg. prog.). 2*n* ≈33 II. Presidio Co., 12.9 km E of Redford, *GGR 93-51* (veg. prog.). 2*n* ≈33 II. 3.2 km N of Bee Mt., *GGR 94-02b* (veg. prog.). 2*n* ≈33 II. Brewster Co., 6.5 km W of Terlingua, *AMP 5495.* 2*n* = 33 II. BBNP, W Chisos Mts., below the Window, *AMP* and *SAP 6072* (veg. prog.). 2*n* = 33 II. BBNP, Rooney's Place, *C. Allred 31* (veg. prog.). 2*n* ≈33 II. Terrell Co., 29 km N of Dryden, *AMP* and *SAP 6046* (veg. prog.). 2*n* ≈33 II. Potter Co., 9.7 km S of Fitch, *GGR 93-56* (veg. prog.).

A hexaploid chromosome number (2*n* = 66) apparently has been widely reported for this taxon (in part) under the name *O. phaeacantha* var. *major* (e.g., Pinkava et al., 1985; Weedin, Powell, and Kolle, 1989). Although *O. dulcis* is reported here as 2*n* = 33 II or ~33 II, meiotic configurations for several of the collections (*AMP* and *SAP 5994, 5995*; *Manning 878; GGR 93-51*; *Allred 31*) exhibited apparent multivalents along with bivalents. The identification of *AMP* and *SAP 6072* is tentative. The specimen may be *O. camanchica. Opuntia dulcis* appears to be consistently distinguished from *O. camanchica* by its taller, more upright habit, among other characters that are not well understood at present.

Opuntia cf. *edwardsii* Grant & Grant. 2*n* = 54–56. Texas, Terrell Co., near Sheffield, *S. Lee 28* (veg. prog.).

Meiotic configurations were not clearly distinguishable, but possibly included univalents, bivalents, and multivalents. For convenience the chromosome number is reported above as if it were from a mitotic count. We suspect that *Lee 28* is an interploid hybrid, possibly 4*x* × 6*x* (Grant and Grant, 1979, 1982), resembling *O. edwardsii* or *O. gilvescens* (D. L. Ferguson, personal communication, Albuquerque, New Mexico).

Opuntia emoryi Engelm. 2*n* = 22 II. Texas, Presidio Co., near Candelaria, *AMP* and *SAP 5996.*

Opuntia engelmannii Salm-Dyck ex Engelm. var. *engelmannii.* 2*n* = 33 II. Texas, Brewster Co., 12 km W of Marathon, *GGR 93-46* (veg. prog.). 2*n* = 33 II. 12.9 km NW of Terlingua, *GGR 93-49* (veg. prog.).

**Opuntia gilvescens* Griffiths. 2*n* ≈33 II. Texas, Brewster Co., Alpine Estates, NE side of Hancock Hill, *J. L. Brady 392* (veg. prog.).

The meiotic configuration included what appeared to be numerous multivalents among bivalents. The tentative identification of *Brady 392* is by D. L. Ferguson (personal communication).

Opuntia imbricata (Haworth) DC. var. *imbricata.* 2*n* = 11 II. Texas, Hudspeth Co., Redlight Draw, near Sierra Blanca, *C. Love* s.n. (veg. prog.). 2*n* = 11 II. Presidio Co., San Antonio Canyon, W Chinati Mts., *GGR 93-68* (veg. prog.). 2*n* ≈11 II. Near bottom of Pinto Canyon, Chinati Mts., *GGR 93-69* (veg. prog.). 2*n* = 11 II. 13.9 km S of Shafter, *AMP* and *SAP 5934* (veg. prog.). 2*n* = 11 II. Brewster Co., Alpine, *J. L. Brady 244* (veg. prog.).

Opuntia imbricata (Haworth) DC. var. *argentea* Anthony. 2*n* = 11 II. Texas, Brewster Co., Mariscal Mt., E side, *B. G. Hughes 810* (veg. prog.).

Opuntia kleiniae DC. 2*n* ≈ 44. Texas, Brewster Co., BBNP, 3.2 km W of Maverick Road, toward Castolon, *JFW 1641.*

Weedin, Powell, and Kolle (1989) suggested that the populations of *O. kleiniae* along the Rio Grande, here represented by *JFW 1641*, are taxonomically distinct from those of *O. kleiniae* DC. var. *kleiniae* (2*n* = 33, 44) in the Davis Mountains.

Opuntia leptocaulis DC. 2*n* = 11 II. Texas, Hudspeth Co., ~14.5 km S of Dell City, *S. Lee 12* (veg. prog.). 2*n* = 11 II. Culberson Co., 42 km W of Orla, *AMP 5998* (veg. prog.). 2*n* = 22 II. Brewster Co., 4.8 km W of Willow Mt.,

Terlingua Ranch, *GGR 93-55* (veg. prog.). 2*n* = 22 II. BBNP, Paint Gap Hills, *AMP* and *SAP 6208* (veg. prog.). Sterile. Val Verde Co., Pecos River high bridge, *S. Lee 22* [veg. prog., no PMC, no pollen]. Sterile. Pecos River high bridge, *S. Lee 23* (veg. prog., no PMC, no pollen).

Both diploid (2*n* = 22) and tetraploid (2*n* = 44) chromosome numbers for *O. leptocaulis* are now well established in the CDR, while diploids and triploids (2*n* = 33) occur in the Sonoran Desert (Pinkava et al., 1985; Pinkava, Rebman, and Kolle, 1998). In the CDR ploidy levels appear to be correlated with morphological differences, suggesting that diploid and tetraploid taxa should be recognized. The two sterile specimens from Val Verde County did not appear to differ from other *O. leptocaulis.*

Opuntia aff. *macrocentra* Engelm. var. *macrocentra.* 2*n* = 11 II. Texas, Presidio Co., ~48 km S of Marfa, *AMP* and *SAP 6022* (veg. prog.). 2*n* ≈ 11 II. Approximately 48 km S of Marfa, *AMP* and *SAP 6023* (veg. prog.). 2*n* = 11 II. Near Alamito Creek, ~16 km NNW of Loma Pelona, *GGR 93-71* (veg. prog.). 2*n* = 11 II. Brewster Co., BBNP, Rooney's Place, *C. Allred 30* (veg. prog.). 2*n* = 11 II. BBNP, 1.9 km W of Mariscal Mt., *AMP 5214.* 2*n* = 11 II. 3.2 km N of Bee Mt., *GGR 94-01b* (veg. prog.). 2*n* = 11 II. 3.2 km N of Study Butte, *AMP* and *SAP 6007* (veg. prog.). 2*n* = 11 II. Approximately 0.8 km N of Lajitas, *AMP 5382.* 2*n* = 11 II. S side of Elephant Mt., *AMP* and *SAP 6290.* 2*n* = 11 II. Pecos Co., ~24 km NW of Fort Stockton, *D. Miller 1129* (veg. prog.). 2*n* = 11 II. Jeff Davis Co., ~6.5 km S of Fort Davis, *P. Manning 781* (veg. prog.).

There appear to be at least two morphologically distinct populations among the diploid (2*n* = 22) counts listed above, one distributed in the southernmost Big Bend region of Trans-Pecos Texas and adjacent Mexico, and one of more northerly distribution in the Big Bend. The above listing of *O.* aff. *macrocentra* var. *macrocentra* reflects the current realization that one or both of the diploid taxa would need a new name depending upon the elucidation of *O. macrocentra* plants at the type locality near El Paso.

Opuntia aff. *macrocentra* Engelm. var. *macrocentra.* 2*n* = 11 II. Texas, Presidio Co., Big Hill, 20 km NW of Lajitas, *AMP* and *SAP 6003* (veg. prog.). 2*n* = 11 II. *AMP* and *SAP 6004* (veg. prog.). 2*n* = 11 II. *AMP* and *SAP 6005* (veg. prog.).

The Big Hill population appears to be consistently diploid (2*n* = 22), and it may represent a spine form (Weedin, Powell, and Kolle, 1989) of var. *macrocentra* with reddish, yellow, and yellowish-white spines, but there is uncertainty about its taxonomic status.

Opuntia aff. *macrocentra* Engelm. var. *macrocentra.* 2*n* = 44. Texas, Hudspeth Co., ~48 km N of Sierra Blanca, *JFW 1965.* 2*n* = 22 II. 57 km N of Sierra Blanca, *AMP* and *SAP 6241.* 2*n* = 22 II. 64 km SE of El Paso, *S. Lee 16* (veg. prog.). 2*n* = 22 II. Culberson Co., 42 km W of Orla, *AMP* and *SAP 5989* (veg. prog.). 2*n* = 22 II. Brewster Co., 35 km NE of Alpine, *AMP* and *SAP 6049* (veg. prog.).

Four apparent quadrivalents were observed in some cells of *Lee 16.* The tetraploid (2*n* = 44) population of western distribution in Trans-Pecos Texas, reported here tentatively as var. *macrocentra,* likely is deserving of separate taxonomic status. If so, the tetraploids would receive the name *O. macrocentra* var. *macrocentra* if the plants from the type locality near El Paso prove to match the tetraploids. The *O. macrocentra* complex is under study by several workers.

Opuntia macrocentra Engelm. var. *minor* Anthony. 2*n* = 22 II. 1.8 km SE of Ruidosa, *AMP* and *SAP 6027.* 2*n* ≈22 II. Texas, Presidio Co., 1.8 km SE of Ruidosa, *AMP* and *SAP 6024.* 2*n* ≈ 22 II. 1.8 km SE of Ruidosa, *AMP* and *SAP 6026.*

The three tetraploid (2*n* = 44) counts of *O. macrocentra* var. *minor* reported above were taken from individual plants believed to represent var. *minor* near the type locality. Possible quadrivalents were observed in some cells of *6026.* This taxon was reported in Weedin, Powell, and Kolle (1989) under *O.* cf. *violacea* var. *violacea* (*JFW 1166*).

Opuntia cf. *macrocentra* Engelm. var. *minor* Anthony. 2*n* = 22 II. Texas, Brewster Co., N limits of Alpine, *AMP* and *SAP 6082.* 2*n* ≈ 22 II. Sul Ross Hill in E Alpine, *AMP* and *SAP 6037.* 2*n* ≈ 44. Upper Sul Ross Hill, *JFW 426.* 2*n* = 22 II. Terrell Co., 1.6 km N of Dryden, *AMP* and *SAP 6044* (veg. prog.). 2*n* = 22 II. Pecos Co., between Tunis Spring and Bakersfield, *AMP* and *SAP 5036.*

The above tetraploid (2*n* = 44) collections, distributed across much of southern Trans-Pecos Texas, are morphologically and cytologically similar to *O. macrocentra* var. *minor.* Tentatively they are reported here as var. *minor,* although Anthony (1956) described the taxon as being restricted to a narrow habitat along the Rio Grande in western Presidio and adjacent Brewster counties.

Opuntia macrorhiza Engelm. 2*n* = 22 II. Texas, Guadalupe Co., ~4.8 km SW of Seguin, *JFW 1855* (veg. prog.).

Opuntia cf. *macrorhiza* Engelm. 2*n* = 22 II. Texas, Bexar Co., 1.6 km W of Sayers (hyw. 87), *JFW 1990* (veg. prog.).

Opuntia cf. *phaeacantha* Engelm. var. *phaeacantha.* 2*n* ≈ 33 II. Texas, Jeff Davis Co., Wild Rose Pass, *J. L. Brady 355* (veg. prog.). 2*n* = 33 II. Brewster Co., 11.5 km W of Marathon, *GGR 93-47* (veg. prog.). 2*n* = 33 II. Alpine, *GGR 94-02a.*

Apparent multivalents were observed in some cells of *Brady 355.* At present the distribution of *O. phaeacantha* var. *phaeacantha* in the Trans-Pecos is not well understood. The var. *phaeacantha* is morphologically similar to certain other hexaploid (2*n* = 66) taxa and may occasionally hybridize with them.

Opuntia polyacantha Haworth var. *polyacantha.* 2*n* = 11 II. Texas, Culberson Co., SW of Guadalupe Mts., *AMP* and *SAP 5993* (veg. prog.). 2*n* = 11 II. 83.8 km N of Van Horn, *S. Lee 10* (veg. prog.). 2*n* = 11 II. New Mexico, Guadalupe Co., 22.5 km SW of Pastura, *JFW* and *TJW 496.*

Opuntia polyacantha Haworth cf. var. *polyacantha.* 2*n* = 11 II. Texas, Hudspeth Co., 47.6 km N of Sierra Blanca, *AMP* and *SAP 6234.* 2*n* = 11 II. 57.1 km N of Sierra Blanca, *AMP* and *SAP 6236.*

The diploid (2*n* = 22) collections reported from Hudspeth County bear close morphological resemblance to *O. polyacantha* var. *hystricina* (Engelm. & Bigelow) Parfitt. The plants have relatively long, projecting, dark spines and off-yellow flowers, characters that appear to match the var. *hystricina* described by Parfitt (1991), except that Parfitt recognized var. *hystricina* as both a tetraploid (2*n* = 44) and hexaploid (2*n* = 66) taxon that occurs from northwestern New Mexico west to California, but does not occur in Texas.

Opuntia pottsii Salm-Dyck. 2*n* = 22 II. Texas, Brewster Co., vacant lot in Alpine, *GGR 94-01a* (veg. prog.).

Opuntia cf. *schottii* Engelm. 2*n* ≈ 22 II. Texas, Brewster Co., 10.5 km NNW of Terlingua, *GGR 93-52* (veg. prog.).

This dog cholla collection resembles *O. schottii* in some

characters, approaches *O. aggeria* in other features, and is tetraploid ($2n = 44$) like *O. schottii* (Ralston and Hilsenbeck, 1989, 1992). It was located in a region where dog cholla populations are predominantly *O. aggeria*. Benson (1982) recognized *O. schottii* var. *schottii* and *O. schottii* var. *grahamii* (Engelm.) L. Benson, also a tetraploid, as freely intergrading varieties in Brewster County, Texas.

Opuntia × *spinosibacca* Anthony. $2n \approx 10$ II + 6 IV. Texas, Brewster Co., BBNP, above Hot Springs, *AMP* and *SAP 6088*, $2n = 22$ II. BBNP, Boquillas Canyon, (river mile 800.5), *B. G. Hughes 801* (veg. prog.). $2n = 22$ II. Heath Canyon area, just N of airstrip, *AMP* and *SAP 6151*.

Anaphase I segregation was regular in all of the *O.* × *spinosibacca* collections, with 22 replicated chromosomes at each pole, although ring or chain quadrivalents were observed occasionally in the samples examined, and they appeared to be present in all of the prophase I preparations of *6008*. Pinkava and Parfitt (1988) proposed that *O.* × *spinosibacca* originated through hybridization between diploid ($2n = 22$) and hexaploid ($2n = 66$) species.

Opuntia strigil Engelm. $2n = 11$ II. Texas, Pecos Co., 17.7 km N of Bakersfield, *P. R. Manning 1011* (veg. prog.). $2n = 11$ II. Approximately 19 km N of Fort Stockton, *AMP* and *SAP 6008* (veg. prog.). $2n = 11$ II. Upton Co., ~5.2 km N of Rankin, *P. R. Manning 998* (veg. prog.). $2n = 11$ II. Terrell Co., 9.7 km SSE of Sanderson, *GGR 96-31* (veg. prog.). $2n = 11$ II. Approximately 11.3 km SSE of Sanderson, *GGR 96-55b* (veg. prog.). $2n = 22$. 5.6 km E of Dryden, *JFW 1870*.

The present reports along with previous records (Weedin and Powell, 1978a; Weedin, Powell, and Kolle, 1989; Pinkava et al., 1992) suggest that *O. strigil* is diploid ($2n = 22$) throughout most of its range (Benson, 1982). One tetraploid ($2n = 44$) count has been reported (Weedin et al., 1989) from a plant in Pecos County that did not manifest morphology that was distinctive from the diploids.

**Opuntia tortispina* Engelm. & Bigelow. $2n = 33$ II. Texas, Hudspeth Co., 26.6 km N of Sierra Blanca, *AMP* and *SAP 6233*. $2n \approx 66$. Approximately 20.2 km E of Dell City, *AMP*, *SAP*, and *JFW 2834*. $2n = 33$ II. Jeff Davis Co., ~6.5 km S of Fort Davis, *AMP* and *SAP 6034*. $2n \approx 33$ II. Presidio Co., 11.2 km S of Marfa, *AMP* and *SAP 6041* (veg. prog.). $2n \approx 33$ II. Brewster Co., ~16 km SE of Alpine, *AMP* and *SAP 5929*. $2n \approx 33$ II. Approximately 16 km SE of Alpine, *AMP* and *SAP 6036*. $2n = 33$ II. Hutchinson Co., *GGR 93-52* (veg. prog.).

In collections *5929* and *6036* mostly bivalents were observed in meiosis I, but also a few multivalents and occasional univalents were seen in some prophase I configurations. The chromosomes appeared to be smaller in size than were those observed in any other *Opuntia* reported in the present study. *Opuntia tortispina* was incorporated by Benson (1982) in a concept of *O. macrorhiza* var. *macrorhiza*, and by Weniger (1984), in part, as *O. cymochila* Engelm. & Bigelow.

**Opuntia* sp. $2n = 11$ II. Texas, Brewster Co., BBNP, Boquillas Canyon, *B. G. Hughes 800* (veg. prog.).

This report is for one plant from a population of suberect prickly pears that so far as known is restricted to the Boquillas Canyon area. The plants have medium-size obovate to orbicular cladodes with pale reddish spines usually less than 1.5 cm long, which are distributed mostly in distal areoles. The population may represent an undescribed taxon, or may have resulted through hybridization between entities such as *O. rufida* Engelm. and *O. macrocentra* that are sympatric in the Boquillas Canyon area.

Cactoideae

**Ancistrocactus tobuschii* W. T. Marshall ex Backeberg. $2n = 11$ II. Texas, Kinney Co., Kikapoo Cavern State Natural Area, *M. Lockwood 517*.

The chromosome number of *A. tobuschii* corresponds with previous reports for the genus (Weedin and Powell, 1978a; Ross, 1981).

Coryphantha duncanii (Hester) L. Benson. $2n = 11$ II. Texas, Brewster Co., BBNP, River Road, *AMP 5373*.

Echinocereus dasyacanthus Engelm. $2n \approx 22$ II. Texas, Brewster Co., N end of Reed Plateau, W of Terlingua, *AMP* and *SAP 5384*.

Echinocereus enneacanthus Engelm. in Wislizenus var. *enneacanthus*. $2n = 11$ II. Texas, Brewster Co., BBNP, between Black Dike and W entrance to River Road, *JFW* and *TJW 431*.

Echinocereus stramineus Engelm. ex Ruempler in Foerster. $2n = 22$ II. Texas, Brewster Co., BBNP, Persimmon Gap, *AMP 5389*. $2n = 22$ II. BBNP, River Road, 2.7 km W of paved road to Rio Grande Village, *AMP 5564*.

The two counts listed here for *E. stramineus* are consistent with the previous two reports for the species (Weedin, Powell, and Kolle, 1989), and suggest that *E. stramineus* and the closely related diploid ($2n = 22$) *E. enneacanthus* (Benson, 1982) are distinguished consistently by ploidy level.

Echinocereus triglochidiatus Engelm. var. *triglochidiatus*. $2n = 22$; $2n = 11$ II. Colorado, Chaffee Co., adjacent to Ruby Mt., *JFW 1579b*.

This count contributes to the as yet poorly documented concept (Ferguson, 1989) that *E. triglochidiatus* is consistently diploid ($2n = 22$), apart from the tetraploid ($2n = 44$) *E. coccineus* Engelm., which has been treated as conspecific by some previous authors (Benson, 1982; Taylor, 1985). The var. *triglochidiatus* has been previously reported as var. *gonacanthus* (Engelm. & Bigelow) Boissevain and perhaps under other names as well.

**Echinocereus viridiflorus* Engelm. var. nov. $2n = 11$ II. Texas, Presidio Co., Solitario Dome, *AMP* and *SAP 6012*.

Six other members of the *E. viridiflorus* species complex, which presently includes ~10 taxa (Blum et al., 1998), have been reported as $2n = 22$ (Pinkava et al., 1977, 1985; Weedin and Powell, 1978a, b; Weedin, Powell, and Kolle, 1989).

Echinocereus viridiflorus Engelm. var. *russanthus* (Weniger) A. D. Zimmerman (in prep.). $2n = 11$ II. Texas, Brewster Co., BBNP, near K-Bar camp, *B. Ralston 151*.

Echinomastus warnockii (L. Benson) Glass & Foster. $2n = 11$ II. Texas, Brewster Co., BBNP, near River Road, 2.7 km W of paved road to Rio Grande Village, *AMP 5372*.

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