

THE REEVALUATION OF *PORTULACA PILOSA* AND *P. MUNDULA* (PORTULACACEAE)

JAMES F. MATTHEWS, DONNA W. KETRON
AND SANDRA F. ZANE

Herbarium, Department of Biology
University of North Carolina at Charlotte
Charlotte, NC 28223, U.S.A.

ABSTRACT

The relationship between *Portulaca pilosa* L. and *P. mundula* I.M. Johnston has been reevaluated. Herbarium and live material from Mexico, the Caribbean and the United States were analyzed and the results were correlated with chromosome numbers from the same regions. No consistent morphological characters permit the separation of the two taxa when the entire geographical range is considered. The conclusion again, is that the correct name for the species is *P. pilosa* L., with *P. mundula* I.M. Johnston as a synonym.

RESUMEN

La relación entre *Portulaca pilosa* L. y *P. mundula* I.M. Johnston a sido reevaluada. Materiel de herbario y materiel vivo de Mexico, el Caribe y 105 Estados Unidos de America fueron analizados y los resultados correlacionados con el numero de cromosomas de las misma regiones. Ningun característico morfologico compatible con la separacion de Los dos taxos pudo ser determinado cuando la region geográfica entera fue considerada. La conclusion otra vez, es que para nombrar la especie correctament se usa *P. pilosa* L. y que *P. mundula* I.M. Johnston es sinónimo.

INTRODUCTION

Preparation of the treatment for the genus *Portulaca* for the Vascular Flora of the Southeastern United States required an analysis of plants referred to as *P. pilosa* L. and *P. mundula* I.M. Johnston (Matthews and Levins 1985a, b). Over 700 specimens from 36 herbaria were examined. SEM's of seed surfaces were combined with morphological data to reach the taxonomic decisions. An expansion of this southeastern treatment for Flora of North America project has included chromosome studies, observations on living material and an expanded analysis of herbarium specimens from the southwest and west United States, Central America and the Caribbean. These additional data, when combined with more information regarding the type specimen of *P. pilosa*, have led to a reevaluation and further substantiation of the synonymy of *P. pilosa* and *P. mundula*.

MATERIALS AND METHODS

Herbarium specimens were borrowed from the following institutions for the new examination: ARIZ, ASC, ASU, BRY, CAS, COLO, DAV, DES, DUR,

HPC, ISC, JEPS, KANU, KSC, KSP, LA, MICH, MNA, MU, NMC, OKL, OKLA, PAUH, RSA(POM), SD, SRSC, TAI, TAES, TAMU, UC, UCSB, UNLV, UNM, UT, UTC, UTEP, UVST. Specimens from the previous study were reexamined from: A, FLAS, FSU, G, LL, MO, NY, SMU, TEX, UNCC, US, and USF. Live material gas studied from Quintana Roo, Yucatan; Collier and Lee Cos., FL; Lee Co., AL; Crisp Co., GA; Beaufort Co., SC; Wilson Co., TN; Benton Co., AR; Cimarron Co., OK; Brewster, Colorado, Hidalgo, Jeff Davis, Kinney and Uvalde cos., TX; Luna Co., NM. Voucher specimens for morphological and cytological verification are deposited at UNCC.

Root tip chromosomes were obtained from stem cuttings. Chemical stimulants (e.g. Rootone) when applied to the stem cuttings to induce root tip growth produced polyploid cells. These stimulants were not used. Root tips were excised into 0.1% colchicine for 1.5 hrs, fixed in 3:1 alcohol-acetic acid overnight, hydrolyzed in 1N HCl for 12-15 min at 60°C, placed in Feulgen for four hrs and squashed in a dilute Aceto-carmin stain to provide cellular detail. At least 20 root tips and a minimum of 10 metaphase figures were counted to validate the number for each population. Photographs were taken using a Zeiss Axioskop equipped with Nomarski differential interference contrast optics.

Several statistical tests were performed. For each character, a one-way analysis of variance was used to test for significant differences among the means for all populations. Tukey's unplanned comparisons also were used as *a posteriori* tests for the significance of differences in the means for all population pairs. A multivariate discriminant analysis (Blackith and Reyment 1971) was also performed on these data using the DISCRIM program of SAS (SAS 1985). In this analysis a discriminant function is generated, using both variables, which attempts to classify each of the groups (e.g. populations). The percentage of correct "classification" is indicative of the power of this discriminant function.

MORPHOLOGY

Matthews and Levins (1985a) provided a statistical comparison of the following morphological characters that had been used by Johnston (1948) to define *P. mundula* pedicel length, capsule diameter, and seed diameter. Their results showed no significant difference for these characters for plants from FL, AL, MS, LA, AR, TX, OK, including 23 of Johnston's paratypes. An SEM analysis of seed surfaces showed that a specific seed surface pattern could not be used to separate the two taxa or to define the geographically separate populations within this red/purple flowered species.

For our new analysis, specimens were borrowed from 36 herbaria that were not sampled in the study by Matthews and Levins (1985a). An additional 280 specimens from the United States and Mexico and 10 specimens from Honduras, Cuba, Dominican Republic, Puerto Rico, and Haiti were examined. We found no readily definable differences in these specimens from the 700 examined

previously. The specimens from Central America and the Caribbean had larger capsules, stipes and seeds, but were well within the range of measurements given by Legrand (1962) for *P. pilosa*.

Since no Caribbean specimens were included in the study in 1985, measurements were made on Caribbean specimens and these measurements were combined with the original data to again compare pedicel lengths and capsule diameters (Table 1). The Caribbean specimens had the shortest pedicels, but there is overlap with the other population means, including Johnston's paratypes. The fact that the Alabama population was not significantly different is due to the small sample size for Alabama. For capsule comparisons, the picture is more complex. Johnston's paratypes group with the smaller capsules from Arkansas and Oklahoma, but with the overlap do not form a group that can be separated from capsules of the Caribbean, Texas and the remainder of the southeastern U.S.

Pedicel length and capsule diameter have been the two most commonly used measurements to define *P. mundula*. It is apparent that a univariate analysis does not support the use of these characters. To determine if these characters functioned together, a discriminant analysis was performed on pedicel length and capsule diameter on these 11 populations, as described above. It yielded misclassification percentages as follows: AL-83%, AR-50%, CAR-55%, FL-92%, JP-78%, LA-82%, MS-80%, OK-94%, TX-CP-81%, TX-HP-94%, TX-TP-74%. The misclassification (e.g. error in correctly classifying the populations based on these two characters together) was high. The discriminant function performed very poorly in separating these 11 populations.

There has been no confusion regarding the color of the petals in *P. pilosa* L. and *P. mundula* Johnston, both being red/purple. Flower color is not mentioned by Linnaeus (1753), but he references Herman (1705) and Commelin (1697), both of whom cite red/purple flowers, confirm this color for *P. pilosa*. In our examination of herbarium specimens, we occasionally found a specimen noted as having yellow flowers. In the specimens from the southwest, this often was an error in identification with the southwestern yellow-flowered species, known as *P. parvula* Gray (Correll and Johnston 1970) or as *P. halimoides* L. (Legrand 1962 and Kelley 1989). In the dried condition (e.g. lacking evident petal color) *P. halimoides* can be identified by its characteristically compact stellate, non tuberculate, seed surface. From the southeastern specimens we found only one collection noted as having yellow flowers. The seed surface was typical of *P. pilosa*. Three specimens were available. The exact data on the label are cited below: South Carolina. Beaufort Co.: W side of Lemon Island on S side of SC route 170, just W of Chechasee River. Elevation ca 1-2 m Forest of *Sabal palmetto*-*Pinus ellioti*-*P. taeda* with *Sabal minor* and *Serenoa repens*. Sandy roadside. Flowers yellow, 12 Sep 1982, D.E. Boufford, B. Bartholomew and S.A. Spongberg 23099 (A! KANU! MO!). We have visited this site three times to search for yellow-flowered plants, but have found only those with red/ purple flowers. We have attempted to germinate seeds

TABLE 1. Comparison of pedicel lengths and capsule diameters for Alabama (AL), Arkansas (AR), Caribbean (CAR), Florida (FL), Louisiana (LA), Mississippi (MS), Oklahoma (OK), Texas coastal plain (TX-CP), Texas high prairie (TX-HP), Texas Trans-Pecos (TX-TP), and Johnston's Paratypes (JP). Means connected by lines are not significantly different at the 0.05 level. (However, because of small sample sizes, some anomalous gaps occur in the extremes of the comparison.)

PEDICELS											
Pop:	CAR	AR	TX-HP	LA	MS	OK	JP	FL	TX-TP	TX-CP	AL
X	0.350	0.363	0.429	0.441	0.453	0.500	0.539	0.595	0.605	0.613	0.616
SD	0.150	0.226	0.199	0.176	0.164	0.262	0.229	0.220	0.250	0.225	0.147
N	18	8	17	17	15	17	23	38	19	16	6
CAPSULES											
Pop:	AR	OK	JP	LA	TX-HP	CAR	TX-TP	MS	FL	AL	TX-CP
X	1.875	1.924	1.965	2.212	2.336	2.400	2.426	2.447	2.518	2.600	2.619
SD	0.276	0.284	0.182	0.344	0.324	0.616	0.238	0.292	0.364	0.310	0.421
N	8	17	23	17	17	18	19	15	38	6	16

from these three specimens, but without success. Hence, we cannot explain this notation of yellow flowers. However, we are confident that the red/purple flower color is consistent for *P. pilosa* (*P. mundula*).

Portulaca pilosa (*P. mundula*) consistently has hairs in the leaf axils and in the inflorescence. The length and density of hairs appears to be directly related to the heat and moisture levels during the growth of the plant. Plants that are extremely woolly in appearance have dense, long axillary hairs and short internodes so that the stem appears to be covered with hairs (Figs. 5 & 6). Growth conditions producing less dense, shorter hairs and more widely spaced internodes produce plants that appear less woolly. The same plant may exhibit both conditions. A densely woolly specimen of *P. pilosa* was collected in the desert south of Alamogordo, NM and returned to the greenhouse in NC where it continued to grow. The new branches had shorter hairs and longer internodes and the stem was less woolly. This same progression from woolly to nonwoolly was noted in the following specimen. The exact data on the label are cited below: Texas. Val Verde Co.: Rocky hillside, 14 mi S of Juno near Devils River, Rt 163. Collected 11 Oct 1975 when senescent. Subsequent growth to flowering in greenhouse. Tuberous rooted, cleistogamous, 22 Jan 1976, *W.W. Brown s.n.* (TEX!). The cleistogamous situation would result from the winter growing conditions. In our study of herbarium specimens, we checked for any correlation between the density of hairs and the pattern of the seed surface. No correlation was found. As to the variation in the pattern of seed surfaces for the red/purple flowered species, Matthews and Levins (1985a) presented SEM's of 22 surfaces found on plants collected from FL to TX. They concluded that there was an overall trend of flattened roughenings and fewer tubercles toward the north and west of the range of distribution, with most variation in the southwest part of Texas (Trans-Pecos). Seed surface pattern could not be used exclusively to define *P. pilosa*. In this analysis an unusual suite of specimens was found during the seed surface reevaluation. Three herbarium sheets were compared. The exact label data are cited below: Texas. Ward Co.: About water-filled quarries in mesquite-creosote bush formation, 5.5 mi E of Barstow. Flowers rose-pink. 11 Sep 1965, *D.S. Correll 31691* (LL! SMU! UC!) Each sheet had three specimens, and the assumption would be that these nine specimens represent a sample of the same population. The seed surface patterns present were all S-undulate (stellate), but with the following variation in tubercles: very smooth, and no tubercles; raised surfaces and slight tubercles; sharply tuberculate. These correspond to the SEM's of Matthews and Levins (1985b) as Figs. 22, 21 and 19 respectively. The sheet from LL has one specimen with smooth surfaces, one with raised surfaces and one strongly tuberculate. The sheet from SMU has two specimens with smooth surfaces and one with raised surfaces. The UC sheet has two specimens with smooth and one with raised surfaces. In some species of *Portulaca* the pattern of the seed surfaces is more predictable and species specific. This is true for *P. umbraticola* Kunth, where none

PORTULACA CYRASSAVICA PROCVMBENS



FIG. 1. Illustration of *Portulaca pilosa* L. as interpreted by Commelin, 1697.



FIG. 2. Illustration of *Portulaca pilosa* L. as interpreted by Herman, 1705.



FIG. 3. Progressive growth of *Portulaca pilosa* L., showing large, hemispherical leaves on the primary stem and small, terete leaves on the lateral branches.

of the three subspecies varies in the pattern of the seed surfaces (Matthews et al. 1992). In another species, *P. biloba* Urban, the pattern of seed surfaces is usually predictable, but some variation can be found (Matthews et al. 1991).

Growth habit is another morphological trait that appears to vary with tropical and temperate habitat. Plants in the tropics are more prostrate while those in temperate regions are suberect to erect. Tropical plants transplanted to the greenhouse in North Carolina produced more upright lateral shoots than prostrate lateral growth.

Johnston (1948) made the following statement regarding the morphological definition of *P. pilosa* vs *P. mundula*. "The name *P. pilosa* L., Sp. Pl. 445 (1753) is ultimately based on plants originating on the island of Curacao, in the Dutch West Indies off the north coast of Venezuela. Linnaeus founded his species on descriptions and illustrations given in the published works of Royen, Commelin, Herman and Plukenet. These authors treated plants, cultivated in the gardens at Amsterdam and Leiden, said to have originated in Curacao. The illustrations and comments by Commelin, Hort. Med. Amstelodam. 9, t.5 (1697), and Herman, Par. Batavus 215 cum fig. (1705), are especially complete and clear and leave little doubt as to the identity of the plant properly called *P. pilosa* L." Matthews and Levins (1985a) said: "When Johnston formulated the idea of *P. mundula* he stated that he had taken his concept of *P. pilosa* from pictures portraying the Linnaean

taxon, but there is no indication that he examined any specimens of *P. pilosa* outside of the southwestern U.S. It would be difficult, in our opinion, to develop a concept of variability of a taxon as widespread as *P. pilosa* from pictures, particularly those as stylized as Commelin's and Herman's." Figure 1 is a photograph of the Commelin plate and Figure 2 of the Herman plate. Herman notes that the tops of the leaves are flat, Commelin makes no such reference. Observations on plants grown under cultivated conditions (as would be the case in gardens in Amsterdam and Leiden) show that the leaves are often hemispherical (flat on top) instead of terete. Further observations on plants grown in our greenhouse have shown that the leaves on the primary stem are large and often hemispherical, while the leaves on lateral branches are usually smaller and more terete (Fig. 3). Plants in the wild, under dry conditions, typical of *Portulaca* habitat have larger leaves initially but during the branching growth period the new leaves are smaller and more terete. In the tropical habitats, where droughts are less severe, the plants retain the larger leaves and the new growth has larger leaves. In temperate habitats, particularly in the deserts of the southwestern U.S. and in Mexican deserts where drought is often the situation, the larger leaves will abscise and the new growth will be smaller. Plants grown in a garden, as in Amsterdam and Leiden, would be expected to exhibit the larger, hemispherical leaves. This factor may have influenced the drawings of Commelin and Herman.

Johnston (1948) does not provide any insight as to whether he sought information from the Linnaean collection. We were able to obtain a photograph of specimen 625.2 LINN, the specimen attached to the name *P. pilosa* L. (Fig. 4). This specimen is the lectotype, designated as "type" by Geesink (1969). We compared this lectotype to present day specimens. Figures 5, 6, 7 and 8 show, respectively, the type of *P. mundula* Johnston, a specimen of *P. pilosa* from Florida, and two specimens from the paratypes cited by Johnston as representing *P. mundula*. Comparison of Johnston's type and the paratypes (Figs. 4, 7 & 8) and then the specimen from FL (Fig. 6) with the type (Fig. 5) illustrates the wide range of morphological variability present in *P. pilosa* in the United States and Central America. Note that the less woolly specimens (Figs. 7 & 8) were collected at high altitude or northern latitude, representing cooler habitats.

CYTOLOGY

Steiner (1944) reported the chromosome number for *P. pilosa* as $2n = 16$. His plants were collected in Florida. Subsequent counts for this species have been by Diers (1961) $2n = 18$, Hsu (1968) $2n = 36$, Mi-i and Iwasa (1972) $2n = 16$, Kim and Carr (1990) $2n = 16$. Diers' specimen was from near Cochabamba, Bolivia, an area of 8,000 + feet altitude with a mild yearly climate. Legrand (1962) does not list any specimens of *P. pilosa* from Bolivia, nor does he indicate that the geographical distribution of this species extends into Bolivia. Hsu's specimen was from the coastal area of Taiwan. Pingtung Co.: littoral habitat, 5 Oct 1967, C.C.



FIG. 4. Lectotype of *Portulaca pilosa* L. from the Linnaean collection.

Hsu 4210 (TAI!). This specimen is pilose, the leaves are lanceolate and may be terete. The label notes yellow petals and the seed surface is non-stellate, unlike any pattern we have observed in *P. pilosa* in the western hemisphere. The report by Mi-i and Iwasa (1971) of $2n = 16$ is consistent with our results. The specimen they used was obtained from a botanical garden in Japan, but its source is unknown. They do state that the application of the name, *P. pilosa*, in Japan is in doubt and *P. pilosa* is not listed as a member of the flora of Japan by Ohwi (1984). The specimen used by Kim and Carr (1990) to obtain their count of $2n = 16$ was from a plant growing wild in Hawaii. *Portulaca pilosa* is a naturalized component of the Hawaiian flora (Wagner et al. 1990).

We have counted root tip chromosomes over a large geographical range with the following results (Table 2). Plants collected from Mexico, FL, GA, and AL had $2n = 16$ (Figs. 9, 10). However, in SC, TN, AR, OK, TX and NM the number is $2n = 8$ (Figs. 11, 12). This is consistent with Steiner's (1944) report from FL and of an unidentified species of *Portulaca* from Springdale, AR with $2n = 8$. In Steiner's opinion, this latter specimen constituted a new species, and would correspond to *P. mundula* Johnston (1948).

Exhibiting a different chromosome number is not sufficient reason to design-

TABLE 2. Collectors and localities for chromosome voucher specimens of *P. pilosa*.

$2n$	Voucher
16	MEXICO. Quintana Roo: Yucatan, 25 Jul 1990, <i>Matthews s.n.</i> (UNCC).
16	FLORIDA. Lee Co.: Ft. Myers, 25 May 1990, <i>Matthews s.n.</i> (UNCC).
16	FLORIDA. Collier Co.: Big Cypress Nature Preserve, 3 Jan 1991, D & S. <i>Black s.n.</i> (UNCC).
16	ALABAMA. Lee Co.: Loachapoka, 26 Mar 1992, <i>Allison 1702</i> (UNCC).
16	GEORGIA. Crisp Co.: Little Rock Ch., 26 Mar 1992, <i>Allison s.n.</i> (UNCC).
8	SOUTH CAROLINA. Beaufort Co.: Lemon Island, 12 Oct 992, <i>Matthews s.n.</i> (UNCC).
8	TENNESSEE. Wilson Co.: Cedars of Lebanon St. Pk., 5 Jul 1981, <i>Allison 1821</i> (UNCC).
8	ARKANSAS. Benton Co.: Sprindale, 16 Aug 1973, <i>Smith 1763</i> (UNCC).
8	OKLAHOMA. Cimarron Co.: 21 Aug 1984, <i>J. & C. Taylor s.n.</i> (UNCC).
8	TEXAS. Brewster Co.: Big Bend National Park, 29 Sep 1990, A.M. & S.A. <i>Powell 5650</i> (UNCC).
8	TEXAS. Colorado Co.: New Ulm, 9 Sep 1990, <i>K. Northrup s.n.</i> (UNCC).
8	TEXAS. Hidalgo Co.: Edinburg, 30 Sep 1990, <i>B. Lonard s.n.</i> (UNCC).
8	TEXAS. Jeff Davis Co.: Mitre Peak, 27 Sep 1990, <i>M. Lockwood & M. Forstner 25</i> (UNCC).
8	TEXAS. Kinney Co.: Kickapoo Caverns St. Pk.: 4 Aug 1990, <i>T. Keeney 10076</i> (UNCC).
8	TEXAS. Uvalde Co.: Knippa, 23 Sep 1990, <i>T. Keeney 10070</i> (UNCC).
8	NEW MEXICO. Luna Co.: Florida Mts., R.D. Worthington s.n. (UNCC).

nate a new species. This is particularly true in the Portulacaceae. Lewis' extensive work with *Claytonia virginica* showing three ploidy levels, a diploid represented by $n = 8, 7$ and 6 races, a triploid of $n = 12$ and 11, and a tetraploid of $n = 16, 15$ and 14 (Lewis & Semple 1977) illustrate the multiplicity of chromosome numbers in another genus in this family. Our report (Matthews et al. 1992) on the occurrence of $2n = 18, 36$ and 54 in *P. umbraticola* Kunth, and the various literature reports of polyploidy in *P. oleracea* L. with $2n = 18, 36$, and 54 (Danin et al. 1978, Khullar & Dutta 1973, Steiner 1944, and Hagerup 1932) substantiate the variable levels of ploidy in *Portulaca*.

We think it is important that the $2n = 8$ and 16 is different from most of the chromosome numbers in the genus. The usual base number is $n = 9$. This makes the red/purple-flowered *P. pilosa* cytologically different from most of the other species in the genus. Steiner's report for *P. smallii* P. Wilson as $2n = 16$ is in error and should be $2n = 18$, which will be detailed in a later paper, along with a new report for the yellow-flowered, *P. rubricaulis* Kunth, of $2n = 16$.

CYTOLOGICAL AND MORPHOLOGICAL RELATIONSHIPS

Since the two cytodesmes are geographically distinct, we decided to determine if there was a correlation of chromosome number with pedicel length and capsule diameter. Table 3 shows a comparison of the 15 populations from which we counted chromosomes and from which we were able to measure the characters. For both pedicel length and capsule diameter, both the $2n = 8$ and $2n = 16$ populations are distributed across the entire range. All the populations overlap, although the least overlap is in the extremes, but there is no correlation with the

TABLE 3. Comparison of pedicel lengths and capsule diameters for known chromosome no. (#) populations from Alabama (AL), Florida (FL, Collier and Lee cos.), Georgia (GA), Mexico (MX), New Mexico (NM), Oklahoma (OK), Tennessee (TN), Texas (TX, Brewster, Colorado, Hidalgo, Jeff Davis, Kinney, Uvalde cos.). Means connected by lines are not significantly different at the 0.05 level. (However, because of small sample sizes, some anomalous gaps occur in the extremes of the comparison.)

PEDICELS															
Pop:	TN	OK	MX	TX-JD	FL-C	TX-K	TX-B	TX-H	SC	FL-L	AL	TX-U	TX-C	GA	NM
#:	8	8	16	8	16	8	8	8	8	16	16	8	8	16	8
X	.211	.222	.230	.243	.275	.367	.388	.443	.557	.578	.578	.617	.625	.700	.725
SD	.078	.097	.067	.053	.095	.150	.112	.237	.257	.249	.148	.117	.292	.208	.225
N	9	9	10	7	4	6	8	7	7	9	6	8	7	8	
CAPSULES															
Pop:	OK	NM	TN	TX-K	TX-JD	TX-H	FL-C	TX-C	FL-L	SC	GA	TX-B	TX-U	MX	AL
#:	8	8	8	8	8	8	16	8	16	8	8	16	16		
X	1.49	1.65	1.78	2.00	2.13	2.17	2.17	2.21	2.24	2.30	2.33	2.35	2.58	2.67	2.77
SD	.196	.214	.156	.385	.243	.335	.275	.300	.375	.374	.214	.302	.376	.424	.466
N	9	8	9	6	7	7	4	8	9	7	7	8	6	10	9

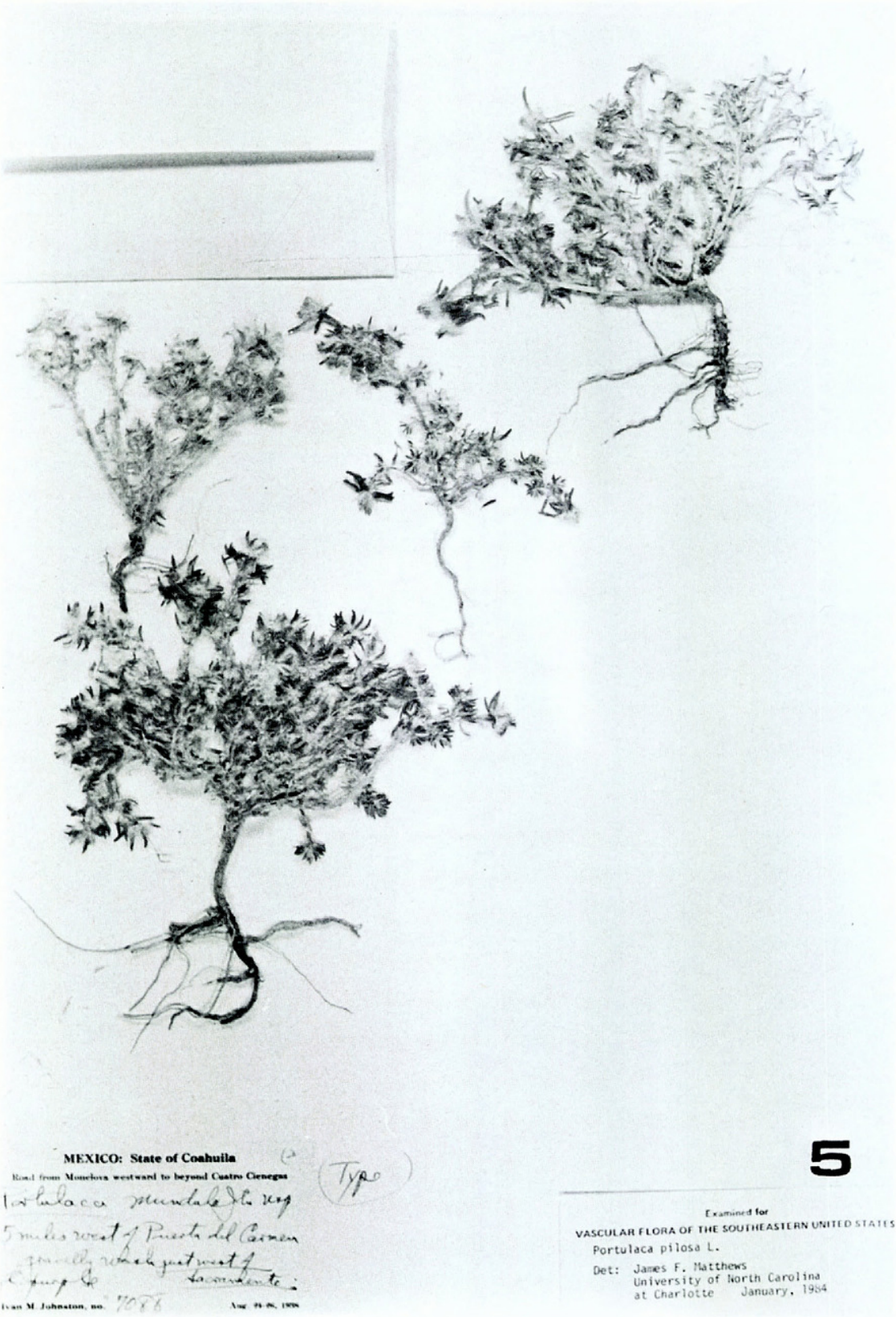


FIG. 5. Type of *Portulaca mundula* Johnston, densely pilose from the desert habitat in Coahuila, MX.



FIG. 6. Densely pilose specimen of *Portulaca pilosa* L. from Tampa, FL, collected in 1891.



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FIG. 7. Sparsely pilose paratype of *Portulaca mundula* Johnston from Osage Co., OK., a cooler habitat.

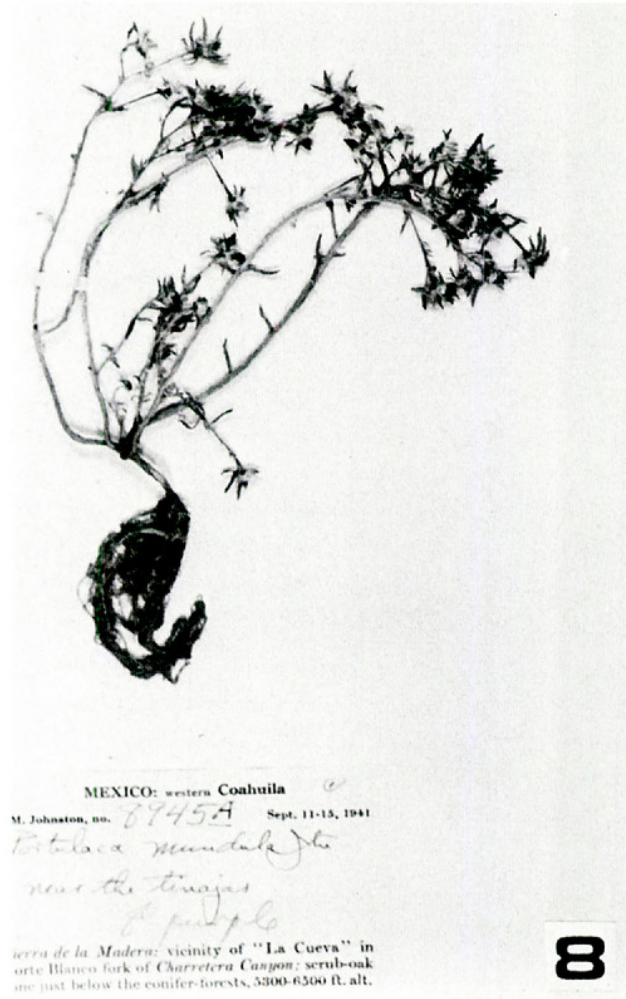


FIG. 8. Sparsely pilose paratype of *Portulaca mundula* Johnston from the higher elevations in Coahuila, MX.

chromosome number. Several gaps occur in the comparison of the capsule diameter due to the small sample sizes. To test the multivariate effect of pedicel length and capsule diameter, a discriminant analysis was performed on the 15 populations, as described above. Misclassification percentages are as follows: AL(16)-56%, FLC(16)-75%, FLL(16)-100%, GA(16)-71%, MEX(16)-30%, NM(8)-38%, OK(8)-22%, SC(8)-100%, TN(8)-44%, TXB(8)-88%, TXC(8)-100%, TXH(8)-100%, TXJ(8)-71%, TXK(8)-83%, TXU(8)-83%. In general, the discriminant function performed poorly in separating the populations of the two cytodemes, based on these two characters.

CONCLUSION

Portulaca pilosa L. exists as a tetraploid in Mexico and in the lower southeastern United States. In the upper southeast and westward into the southwest it is a diploid. Morphological features are not consistent with ploidy levels and no consistent morphological characters are apparent. There is one morphological

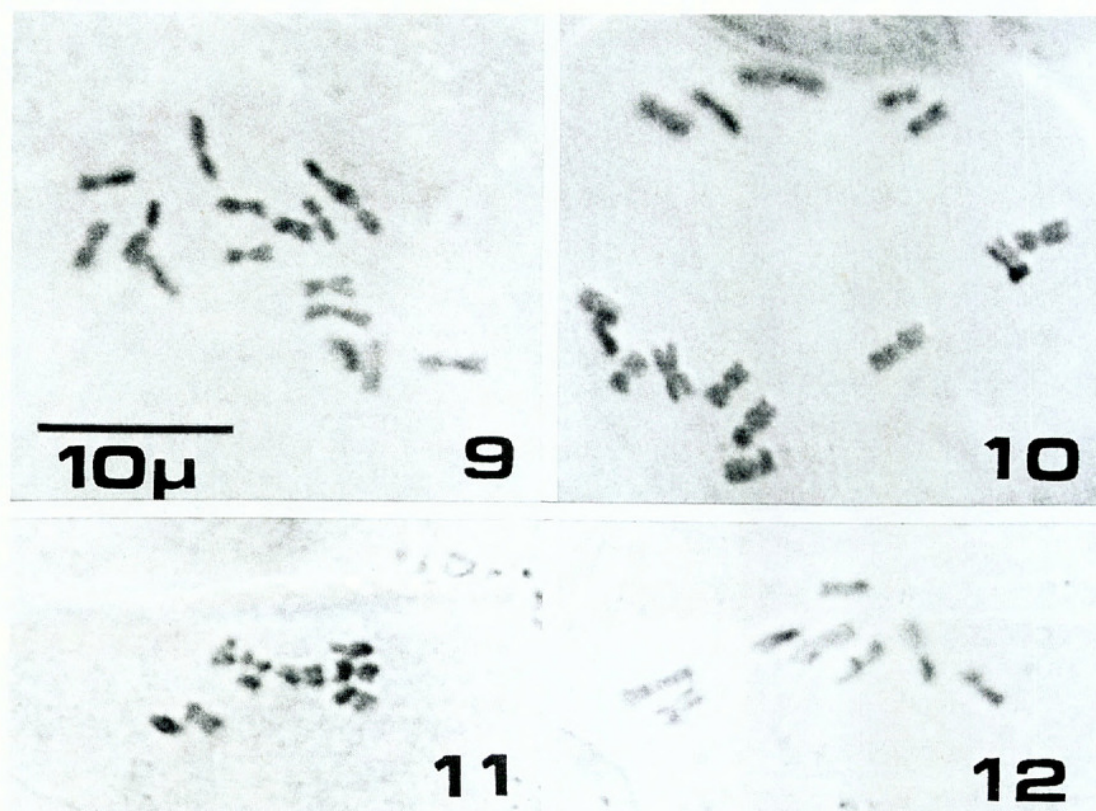


FIG. 9. Root tip chromosomes of *Portulaca pilosa* L. from Mexico. Quintana Roo: Median of main highway at Capt. Cove Restaurant, Cancun, 25 Jul 1990, *Matthews s.n.* (UNCC).

FIG. 10. Root tip chromosomes of *Portulaca pilosa* L. from Florida. Lee Co.: Sandy roadside, McGregor Blvd. at San Carlos Blvd., Ft. Myers, 25 May 1990, *Matthews s.n.* (UNCC).

FIG. 11. Root tip chromosomes of *Portulaca pilosa* L. from South Carolina. Beaufort Co.: Roadside, SC 170, W side of Lemon Island, W of Chechasee River, 12 Oct 1990, *Matthews s.n.* (UNCC).

FIG. 12. Root tip chromosomes of *Portulaca pilosa* L. from Texas. Brewster Co., Near LH Creek, Meriwether ranch, ca. 16 mi S of Alpine, 13 Sep 1990, *D. Brown s.n.* (UNCC).

taxonomic entity existing from the Caribbean up through Florida, into the southeastern United States, across into the midwest and southwestern United States into the Mexican desert, having two cytotypes that are related ($2n = 8$ and 16) in comparison with the remainder of the genus (mostly $2n = 18$). These cytotypes can be distinguished morphologically only when extremes of morphological expression, apparently dictated by geography, climate and habitat, are compared. Hence, *P. pilosa* L. in the United States is a widely variable species, having $2n = 8$ and 16 . It has red/purple flowers, pilose leafaxils and inflorescences that vary from moderately to densely woolly. The seed surfaces are S-undulate (stellate) with or without tubercles.

A question may arise as to why infraspecific categories are not recommended, such as was done by Legrand (1962), where he recognized *P. pilosa* var. *mundula* (I.M. Johnst.) Legrand. At this point in the evolution of this species, even though

two cytotypes exist, there are no geographical separations nor any morphological traits that can be used to distinguish two entities in the United States. When such distinctions do exist, and contribute to a functional taxonomy for the group, we recognize them, as we did for *P. umbraticola* Kunth (Matthews & Ketron 1991).

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