DISTRIBUTION OF *PORTULACA OLERACEA* L. (PORTULACACEAE) SUBSPECIES IN FLORIDA

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ABSTRACT

Range maps for the subspecies of *P. oleracea* (Portulacaceae) in Florida are provided. The collections are enumerated. Unusual specimens are noted and their seeds illustrated with scanning electron micrographs.

INTRODUCTION

The cosmopolitan *Portulaca oleracea* L. is an aggressive weedy colonizer. Chromosomally, the species is $x = 9$, and diploids, tetraploids, and hexaploids are known. The different cytotypes have distinctive seed size and seed coat texture, which makes subspecies determinations relatively easy (Danin et al. 1978). Matthews and Levins (1985a) stated: "Seed surface markings must be correlated with other morphology features when used in delimiting taxa," and they did not recognize subspecies or varieties of *P. oleracea* (1985b). Apparently they were not aware that seed size, shape, and markings were correlated with different chromosome numbers in this species.

The subspecies are not evenly distributed throughout the world (Danin et al. 1978; Danin 1983, 1985), but sympatric populations are frequently encountered.

Matthews and Levins (1985a) noted *Portulaca* has a large concentration of species in South America. They suggested *P. pilosa* entered Florida from the Carribean and spread northeast into North Carolina and westward along the Gulf Coast with evidence of recent migration into Arkansas (probably from Texan populations rather than coastal populations). Study of the distribution of *P. oleracea* in Florida is warranted because the state is strategically placed in possible migration zones between tropical and temperate regions. In this study, only a few specimens were found in primary habitats, such as *Godfrey 72166* from mangrove flats in Monroe County. Most specimens reported here were collected in secondary synanthropic habitats such as gardens, patches in lawns, and along roadsides.

SIDA 11(3):318–324. 1986.

METHODS

Ripe seeds were obtained from living plants or from herbarium specimens (principally from FLAS, FSU, and USF). Identifications were made from seed size and seed coat texture as determined with the dissecting microscope under diffused light. A key to the subspecies is in Danin et al. (1978). The subspecific epithets *granulatostellulata* and *papillatostellulata* were originally hyphenated, but according to Article 73.9, ICBN (Voss 1983), the hyphen should be deleted.

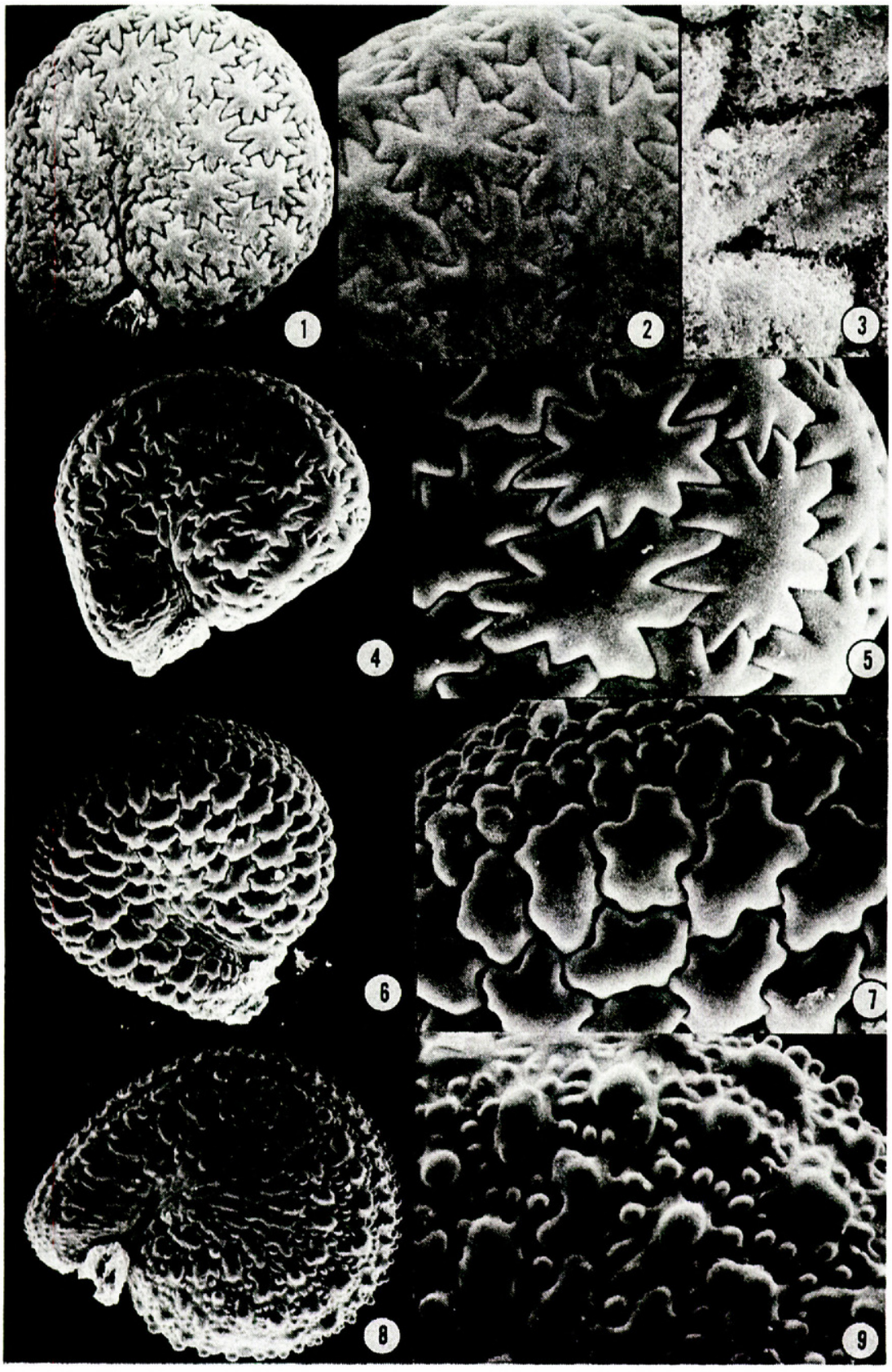
Seeds were mounted on stubs, vacuum dried, then sputter coated with 100 − 200 Å of AuPd (60/40). SEM micrographs were taken on a Cambridge Stereoscan S4-10 at 20 keV.

Seeds are illustrated to show diagnostic surface features (Figs. 1 − 9). The stellulae (plate-like epidermal cells) may have stellate radiating arms (Figs. 2, 5) or have irregularly lobed margins (Fig. 7). Stellulae may have prominently raised centers (tubercles) and papillae on the stellular arms (Fig. 9), but these features do not always occur together. The cell surfaces are usually smooth, but they may be covered with wax in some specimens (Figs. 2, 3).

DISTRIBUTION

The known distribution of *Portulaca oleracea* in Florida as determined from specimens from selected herbaria is mapped by subspecies in Figure 10 and enumerated below. It probably occurs in every county in the state, but fleshy, weedy plants (such as this species) are often neglected by collectors. Chromosome numbers are noted for each subspecies (Danin et al. 1978); no counts were made in the present study.

P. OLERACEA subsp. GRANULATOSTELLULATA (Poelln.) Danin & Baker (n = 18). **Broward Co.**: 10 mi W of Deerfield, 31 Aug 1969, *Cart 10866* (FLAS). **Hendry Co.**: Clewiston (mixed with subsp. *papillatostellulata*), 29 Dec 1984, *Danin s.n.* (FSU). **Hernando Co.**: Weeki Wachee, 25 Oct 1971, *Genella & Fleming 1062* (USF). **Hillsborough Co.**: Tampa (mixed with subsp. *nicaraguensis*), 9 Jul 1977, *Creuz 1097* (USF). **Lake Co.**: 0.5 mi W of Yalaha (mixed with subsp. *papillatostellulata*), 12 Oct 1980, *Baltzell 11235* (FLAS). **Lee Co.**: Fort Myers, 26 Dec 1984, *Danin s.n.* (FSU); Florida Forests Foundation, 20 Aug 1963, *Hoffman 11* (FLAS). **Leon Co.**: N of Tallahassee, 30 Aug 1984, *Danin s.n.* (FSU); Tallahassee (mixed with subsp. *nitida*), 11 Sep 1984, *Danin s.n.* (FSU); Tallahassee, 22 Mar 1985, *Danin s.n.* (FSU); Tallahassee, 21 Jul 1942, *Kurz s.n.* (FLAS). **Manatee Co.**: Bradenton, 18 Nov 1947, *Burgis s.n.* (FLAS). **Marion Co.**: 2 mi NW of Weirsdale, 18 Nov 1973, *Baltzell 5619* (FLAS). **Monroe Co.**: Cape Sable, 7 May 1965, *Lakela & Long 28566* (USF). **Okaloosa Co.**: Eglin Air Force Base, 21 Nov 1983, *Wilhelm 11915* (USF). **Pinellas Co.**: Clearwater, 25 Jul 1984, *Danin s.n.* (FSU); Belleair Bluffs to Belleair Shores, 24 Jul 1975, *Semple et al. 1663* (USF). **Wakulla Co.**: Panacea, 27 May 1985, *Danin s.n.* (FSU).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P. OLERACEA subsp. NICARAGUENSIS Danin & Baker (n = 9). **Brevard Co.**: Malabar Cape, 31 Dec 1974, *Lakela & Long 28072* (USF); North Merritt Island, 12 Dec 1972, *Shuey M0684* (USF). **Clay Co.**: 2.5 mi E of Middleburg, 31 May 1981, *Sauleda & Ragan 5380* (USF). **Collier Co.**: NW of Naples, 29 May 1965, *Lakela 28681A* (USF). **Dade Co.**: old field, 1 Nov 1979, *Alexander s.n.* (USF); Coral Gables, 26 Dec 1984, *Danin s.n.* (FSU); Miami Beach, 29 Dec 1984, *Danin s.n.* (FSU); Miami, 19 Sep 1980, *Sauleda 4631* (USF); Key Biscayne, 2 Nov 1965, *Craighead s.n.* (USF). Flagler Co.: Marineland, 18 Nov 1961, *Godfrey 61693* (FSU). **Franklin Co.**: Apalachicola, 30 Aug 1984, *Anderson 7545* (FSU). **Hendry Co.**: Clewiston, 30 Jun 1967, *Smith 1648* (FLAS). **Hillsborough Co.**: Tampa (mixed with subsp. *granulatostellulata*), 9 Jul 1977, *Crewz 1097* (USF); 6 mi S of River View, 1 Apr 1976, *Wunderlin et al. 5607* (USF). **Lake Co.**: Mt. Plymouth, 1 Aug 1983, *Daubenmire s.n.* (USF). **Lee Co.**: S tip Sanibel Island, 13 Mar 1954, *Cooley 2568* (FLAS, USF); Sanibel Island, 30 Mar 1968, *Brumbach 6190* (FLAS), 28 Oct 1978, *Wunderlin et al. 6188* (USF); Fort Myers, *Correll 30330* (GH); Mound Key, 13 Jul 1974, *Todd 127* (FLAS, USF). **Levy Co.**: 3.3 mi NE of Cedar Key, 11 June 1976, *Baltzell 8551* (FLAS). **Martin Co.**: 11.5 mi N of Port Mayaca, 25 Nov 1976, *Blatzell 9130* (FLAS). **Monroe Co.**: Flamingo, 1 Jan 1956, *Craighead s.n.* (FLAS); Flamingo (mixed with subsp. *papillatostellulata*), 28 Dec 1984, *Danin s.n.* (FSU); Cudjoe Key, 16 Sep 1972, *Godfrey 72166* (FSU); Key West, 25 Oct 1974, *Godfrey 74027* (FSU), 14 Sep 1979, *Hansen 6265* (USF); Long Key 14 Nov 1964, *Lakela 27929* (USF); Big Pine Key, 7 Aug 1966, *Long et al. 2241* (USF); Content Keys, 4 Jun 1967, *Long 2675* (FSU); Spanish Harbor Key, 29 Nov 1969, *Long 3026* (USF); Marathon, 27 Aug 1961, *Rossbach 2887* (FLAS). **Palm Beach Co.**: Palm Beach, 29 Jun 1967, *Cassen 99* (USF). **Pinellas Co.**: Clearwater, 25 Jul 1984, *Danin s.n.* (FSU); NE of Clearwater, 28 Sep 1970, *Genella & Fleming 349* (USF); Dunedin, 3 Oct 1976, *Genella & Fleming 2490* (USF). **Putnam Co.**: Welaka, 26 Jun 1940, *Laessle s.n.* (FLAS). **Volusia Co.**: 9 mi S of New Smyrna Beach, 27 Apr 1961, *Ray 10787* (FSU, USF).

P. OLERACEA subsp. NITIDA Danin & Baker (n = 18). **Alachua Co.**: Gainesville, 15 May 1975, *Fleck 48* (FLAS). **Collier Co.**: Marco Island, 20 Aug 1965, *Lakela 29079* (USF). **Leon Co.**: Tallahassee (mixed with subsp. *granulatostellulata*), 11 Sep 1984, *Danin s.n.* (FSU).

P. OLERACEA subsp. PAPILLATOSTELLULATA Danin & Baker (n = 27). **Duval Co.**: Holly Oaks Forest, 17 May 1965, *Creager 424* (FLAS). **Escambia Co.**: Pensacola, 16 Aug 1983, *Wilhelm 11741* (USF). **Hendry Co.**: Clewiston (mixed with subsp. *granulatostellulata*), 29 Dec 1984, *Danin s.n.* (FSU). **Indian River Co.**: 4 mi S of Vero Beach, 9 Apr 1962, *Godfrey & Reinert 61480* (FSU). **Lake Co.**: 0.5 mi W of Yalaha (mixed with subsp. *granulatostellulata*), 12 Oct 1980, *Baltzell 11235* (FLAS). **Pinellas Co.**: Clearwater, 25 Dec 1984, *Danin s.n.* (FSU). **Monroe Co.**: Flamingo (mixed with subsp. *nicaraguensis*), 28 Dec 1984, *Danin s.n.* (FSU).

P. OLERACEA subsp. STELLATA Danin & Baker (n = 27). **Hillsborough Co.**: Egmont Key, 1 Sep 1978, *Crewz 1480* (USF).

Figures 1–9. Scanning electron micrographs of selected *Portulaca oleracea* seeds. 1. *Lakela 27374* (subsp. *stellata* X subsp. *nicaraguensis?*). 2. *Lakela 27374*, with typical stellulae of subsp. *stellata*. 3. *Lakela 27374*, surface detail showing waxy covering characteristic of many subsp. *nicaraguensis* specimens. 4. *D'Arcy 2942* (affin. subsp. *nitida?*). 5. *D'Arcy 2942*, with non-waxy stellulae that are individually much larger than those in Fig. 2. 6. *Godfrey 61693* (subsp. *nicaraguensis*, the non-waxy form). 7. *Godfrey 61693*, with perforations along the sutures between the stellular arms. 8. *Danin s.n.* in 1985 (subsp. *granulatostellulata*). 9. *Danin s.n.* in 1985, with tubercles and papillae on the epidermal plates.

PROBLEMATIC SPECIMENS

The following specimens are not comfortably assigned to any subspecies. They are not mapped in Fig. 10, but are illustrated in Figs. 1–5. They possibly represent new subspecific taxa or hybrids.

Lakela 27374 (FLAS, USF) from Fort de Soto Park in Pinellas County has rather diverse seed size. A few seeds have size and shape like those of subsp. *stellata* but are covered with wax as in subsp. *nicaraguensis*. Figures 1–3 are of an unusually small seed of *Lakela 27374* with the stellate epidermal cells of subsp. *stellata* and the waxy covering (and smaller seed size) of subsp. *nicaraguensis* (Fig. 3). These specimens probably represent hybrids between the two subspecies.

D'Arcy 2942 (FLAS) from Indian River Island in Indian River County has seeds similar to those of subsp. *nitida* in size and shape, but the specimen has linear rather than obovate leaves. The epidermal cells of the seeds are stellate as in subsp. *nitida* (Figs. 4, 5), but the individual cells are much larger in D'Arcy's specimen (i.e. there are fewer cells across the face of the seed) than they are in typical subsp. *nitida*.

DISCUSSION

Legrand, in a study of American species of *Portulaca* (1962), noted variation in seed surface features in *P. oleracea*, but he did not recognize any varieties or subspecies taxonomically. Matthews and Levins (1985a) found that seed surface markings were not helpful in distinguishing some other species of *Portulaca*. They did not cite the study of Danin et al. (1978) in either of their papers, and even though they noted some variability in seed coat features in *P. oleracea*, they followed the taxonomy of Legrand. We have found that seed size and surface texture are of considerable taxonomic utility in distinguishing subspecies of *P. oleracea*. All the Florida collections were easily assigned subspecies with the exception of the two mentioned as problematic specimens. Unfortunately, the different subspecies (cytotypes) are not distinguishable vegetatively, and chromosome numbers and seed ultrastructure are not useful for identification of subspecies in the field.

The cytotypes of *P. oleracea* are not evenly distributed on a world-wide basis, and they show an uneven distribution in Florida as well. The subtropical subsp. *nicaraguensis* is the most frequently collected in Florida (Fig. 10). Its range in Florida is apparently part of the original distribution of the subspecies rather than due to human interference. Migration routes for this subspecies from central America and the Carribean into Florida appear to be similar to those noted for *P. pilosa* (Matthews and Levins 1985a). Subspecies *stellata* is generally found at higher latitudes; its

occurrence in Florida is surprising and does not reflect migration from the tropics.

Putative hybrids are known from Yucatan (Danin et al. 1978) and Florida (interspecific and intraspecific, respectively). This suggests the Gulf of Mexico region is an area of active speciation for *Portulaca oleracea*. This species is well suited for detailed cytogenetic studies at the population level because sympatric subspecies occur.

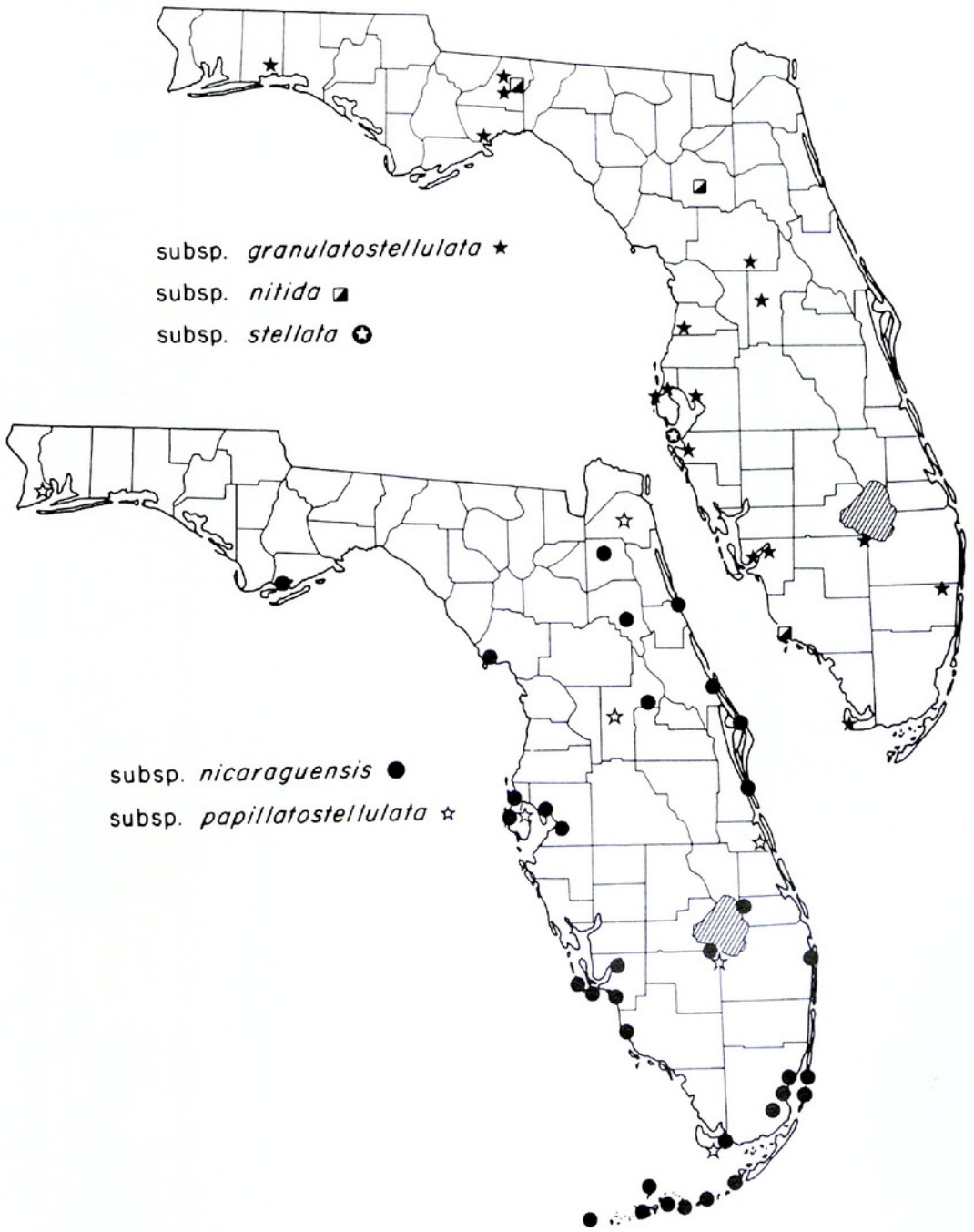

Figure 10. Distribution of *Portulaca oleracea* subspecies in Florida.

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