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Taxonomic studies in the genus *Talinum (Portulacaceae)* in Nigeria

Abstract

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Morphological analysis of *Talinum triangulare* and *T. cuneifolium* showed a general lack of discrete phenetic discontinuities. The taxonomic status of the two taxa is evaluated on the basis of comparative palynology, seed morphology and leaf anatomy. These features revealed taxonomically useful differences between them. A chromosome number of $2n = 24$ is reported for both species as new.

1. Introduction

The genus *Talinum* Adans. consists of about 50 species worldwide (Poellnitz 1934, McNeill 1974) with a predominantly austral distribution. About 30-35 species occur in North America particularly in Mexico (Rose & Standley 1911, Bogle 1969). In Nigeria, the genus is represented by two species, *T. triangulare* (Jacq.) Willd. and *T. cuneifolium* (Willd.) DC. (syn. *T. portulacifolium* (Forssk.) Asch. ex Schweinf.), which could be found growing luxuriantly in every part of the country most especially in the rainy season.

The floristic treatment of the genus by Hutchinson & Dalziel (1954) showed that these two species are very similar and almost indistinguishable morphologically. The only character that separates them is the leaf apex which may be emarginate or mucronate in *T. triangulare* but apiculate in *T. cuneifolium*. Studies of herbarium specimens and field samples of the two species for a contribution (unpublished) to the Flora of Nigeria revealed that this character is not constant. This means, therefore, that there are no reliable taxonomic characters for separating the two species in spite of the economic importance of *T. triangulare*. Apart from being a naturalised weed, *T. triangulare* is widely cultivated in gardens and large farms as a useful substitute for spinach in Nigeria and many West African countries. In Ghana this species is also widely used in fetish ceremonies (Dalziel 1956). Martin & Ruberte (1975) also reported that the leaves and stem of *T. triangulare* are eaten as salad in central and south America.

The current study was initiated to clarify the doubtful taxonomic status of these two taxa in Nigeria by investigating previously unexplored features such as the pollen, seed, leaf anatomy and chromosomes.

2. Material and methods

Nigerian specimens of *Talinum* from the following herbaria were examined: FHI, K, LUH and UPH (University of Port-Harcourt, Nigeria).

2.1 Palynology

Pollen samples were obtained from herbarium specimens. Material for light and scanning electron microscopy (SEM) were acetolysed using a modified method of Erdtman (1960). Unstained acetolysed pollen embedded in glycerine jelly and sealed in wax with number '0' cover slips were used for light microscopic studies. Data relating to pollen size were obtained by measuring 30 grains of each species. Pollen for SEM were attached to labelled stubs using double-sided adhesive tape and then coated with platinum in a Polaron E-500 sputter coating unit. Scanning electron micrographs were made on a JEOL JSM-T20 instrument at the Electron Microscopy Unit, Department of Botany, University of Reading, England.

2.2 Seed morphology

Four mature seeds taken from dried specimens of each species were examined by both the dissecting and scanning electron microscopes.

2.3 Leaf anatomy

Anatomical studies were made on dried specimens which were initially revived by boiling in water (Cutler 1978). Median sections were obtained from five specimens of each species using standard methods of wax embedding and sectioning (Peacock 1973). Sections were stained with safranin and methyl green and mounted in Canada balsam, after dehydration.

2.4. Cuticular preparations

Spirit-preserved leaves of both species were boiled in 70% alcohol for 10 minutes, cooled and bleached in 8% sodium hypochlorite solution (NaOCl) for 5 minutes. The leaves were then cleared in chlorahydrate solution for 5 minutes. Epidermal peels were obtained in 50% glycerol solution and stained with safranin. Drawings were made using a Reichert camera lucida.

2.5. Chromosome studies

Actively growing root tips were collected between 10 and 11.30 a. m. and pre-treated in 0.002 M solution of 8-hydroxyquinoline for 3–4 hours at room temperature. The root tips were then fixed in 3 : 1 acetic alcohol for 24 hours. They were later hydrolysed in 18% HCl in a water bath at 60° C for 5 minutes and then rinsed in ethanol. Root tips were macerated in a drop of FLP-orcein on a glass slide. Slides were observed and photographed using a Zeiss photomicroscope.

3. Results

The pollen of both species is more or less spheroidal. The pollen of *T. triangulare* is pantoporate with about 24–32 apertures while in *T. cuneifolium* the pollen is pantocolpate with 15 apertures in all specimens examined. *T. cuneifolium* usually have larger grains with a mean polar length of 80 μm and

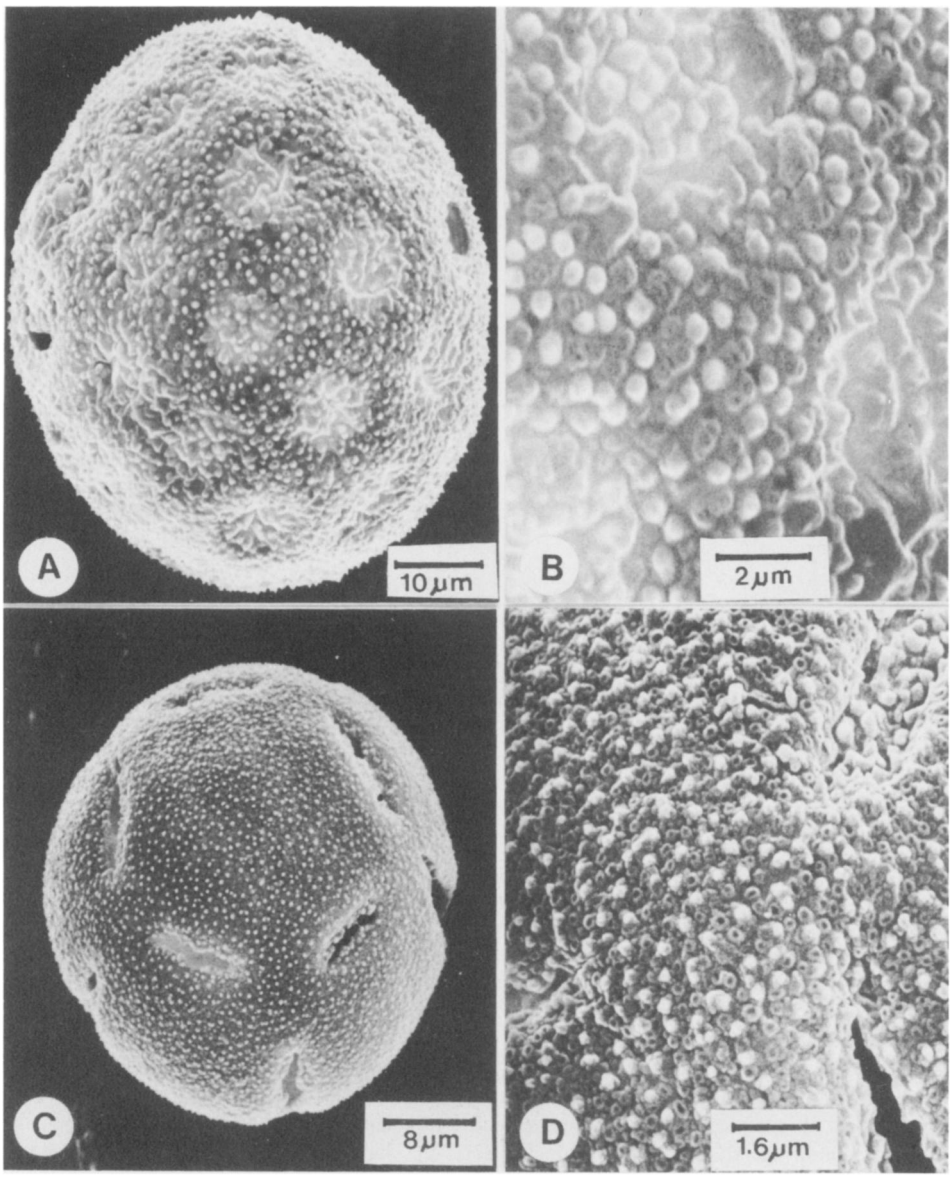

Fig. 1. Scanning electron micrographs of *Talinum* pollen. - A-B. *T. triangulare (Wit 27859,* FHI). - A. Polar view. - B. Portion of surface with pori. C-D. *T. cuneifolium (Olowokudejo & Shittu 74,* LUH). - C. Polar view. - D. Portion of surface with colpi.

an equatorial diameter of 76 μm while in *T. triangulare* the polar length and equatorial diameter measure 65 μm and 64 μm respectively (Table 1). The pollen wall in *T. cuneifolium* is also thicker (3.0 μm) than that of *T. triangulare* (2.0 μm). The arrangement of the global apertures on the surface of the pollen usually follows a fixed geometrical pattern in each species. In *T. cuneifolium* the colpi are arranged in the form of two pentagons and five squares (Fig. 1C), while in *T. triangulare* the pores are arranged at the apices of equilateral triangles (Fig. 1A). In both species the exine is tectate and spinulose (Fig. 1B, 1D).

Table 1. Summary of the differences between *Talinum triangulare* and *T. cuneifolium*. Measurements in parentheses represent the mean while the first and last figures are the minimum and maximum respectively.

Characters		*T. triangulare*	*T. cuneifolium*
Pollen	aperture type	pantoporate	pantocolpate
	no. of aperture	24–32	15
	polar length (μm)	57 (65) 71	71 (80) 89
	equatorial diameter (μm)	54 (64) 71	71 (76) 82
	P/E ratio	101	106
	wall thickness	2.0	3.0
Seed	surface pattern	dull with 6–8 rows of broad tubercles on the keel	reticulate, smooth and shining, no tubercles
Epidermis	cell shape	isodiametric	irregular
	anticlinal wall	curved or undulate	sinuate

Scanning electron micrographs of seed surface revealed that the textural pattern is dull with 6–8 rows of broad tubercles on the keel in *T. triangulare* (Fig. 3A) while it is reticulate, smooth and shining in *T. cuneifolium* (Fig. 3B). The embryo of both species is curved around the endosperm as is found in most members of the family *Portulacaceae* (Lubbock 1892, Martins 1946, Kowal 1961).

The leaf is dorsiventral with the midrib and main veins prominent below in both species. The abaxial and adaxial epidermises are of similar thickness but the cells of the adaxial epidermis are wider (Fig. 2A, 2C). The mesophyll layer consists of large, irregularly shaped, thin-walled cells which may be up to 10 times as large as the epidermal cells. In both species there is a single principal bundle accompanied by subsidiary strands in the wings. The vascular bundle is collateral and is always supported by bundle sheaths on both surfaces (Fig. 2B, 2D). The bundle sheath is usually composed of 3–5 layers of collenchyma. Phloem fibres are usually variable in quantitiy and are more abundant in *T. triangulare* (Fig. 2B). The xylem is composed of irregular rows of large and narrow vessels separated by xylem fibres. The epidermises show 2 types of cell shape, isodiametric in *T. triangulare* (Fig. 4A) and irregular in *T. cuneifolium* (Fig. 4B). The anticlinal wall is curved or undulate in the former while it is sinuate in the later. The stomata of both species have an alternating complex of three or more C-shaped subsidiary cells of graded sizes parallel to the guard cell, an arrangement which Payne (1970) described as parallelocytic.

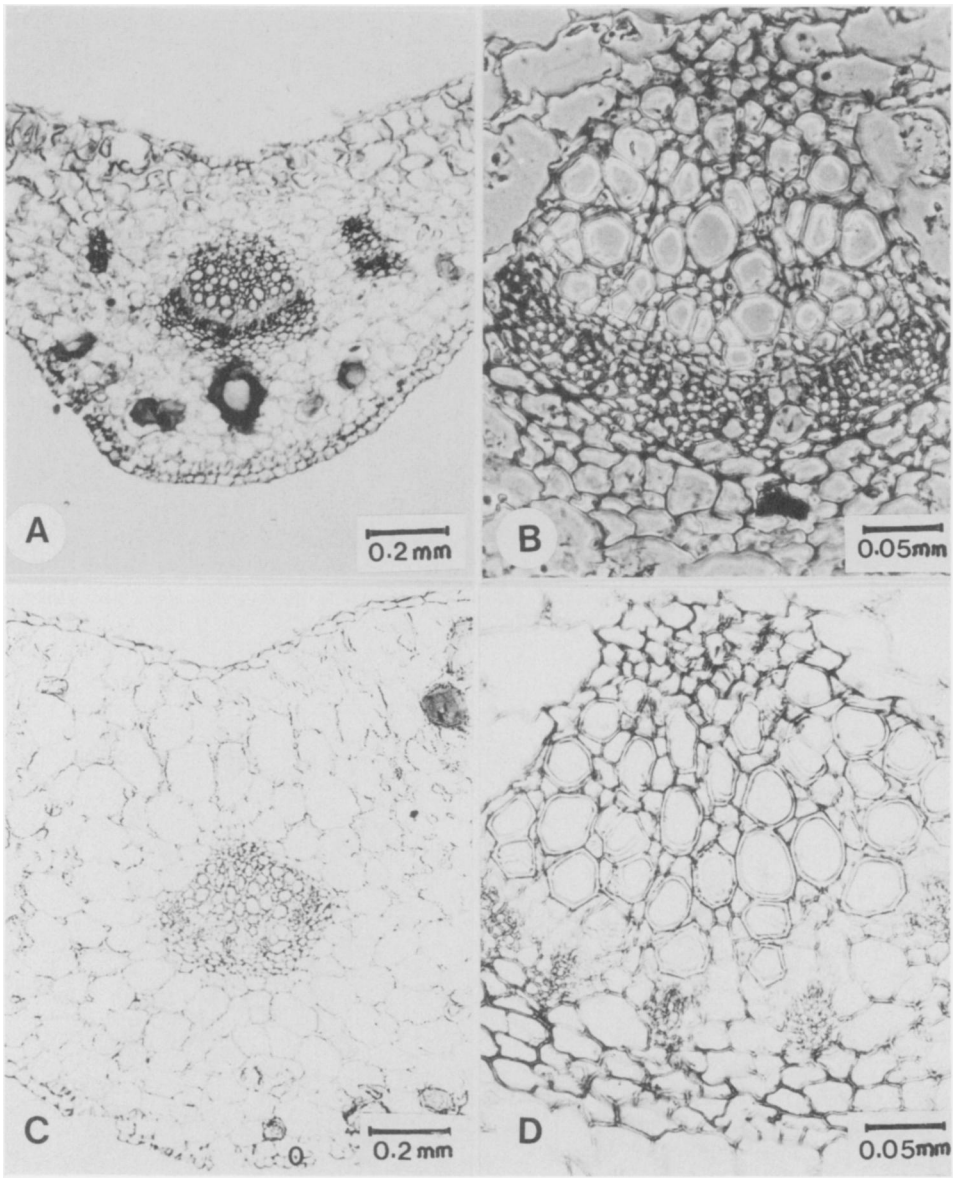

Fig. 2. Photomicrographs of cross sections of mature leaves of *Talinum*. A–B. *T. triangulare* (*Nyananyo 65*, UPH). A. Cross section through median region. B. Main vascular bundle. C–D. *T. cuneifolium* (*Olowokudejo 36*, LUH). – C. Cross section through median region. – D. Main vascular bundle.

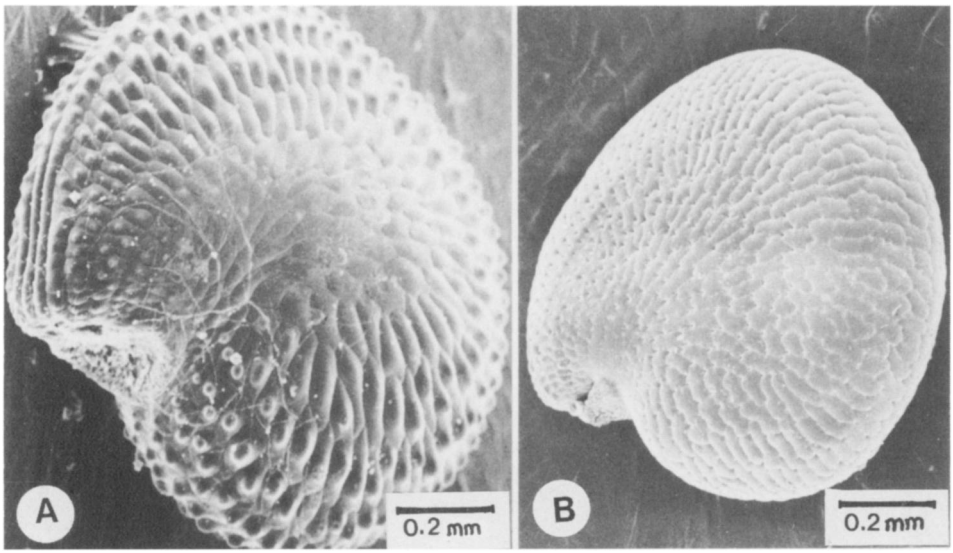

Fig. 3A–B. Seeds of *Talinum*. – A. *T. triangulare* (*Olowokudejo 31,* LUH). – B. *T. cuneifolium* (*Olowokudejo 58,* LUH).

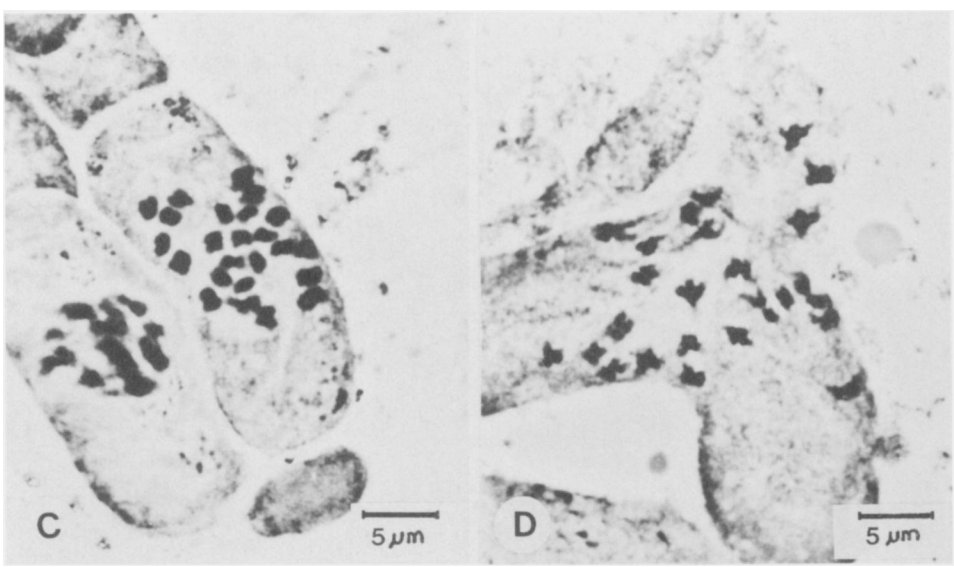

Fig. 3C–D. Mitotic metaphase plates of *Talinum*. – C. *T. triangulare,* 2n = 24 (*Nyananyo 65,* UPH). – D. *T. cuneifolium,* 2n = 24 (*Olowokudejo 36,* LUH).

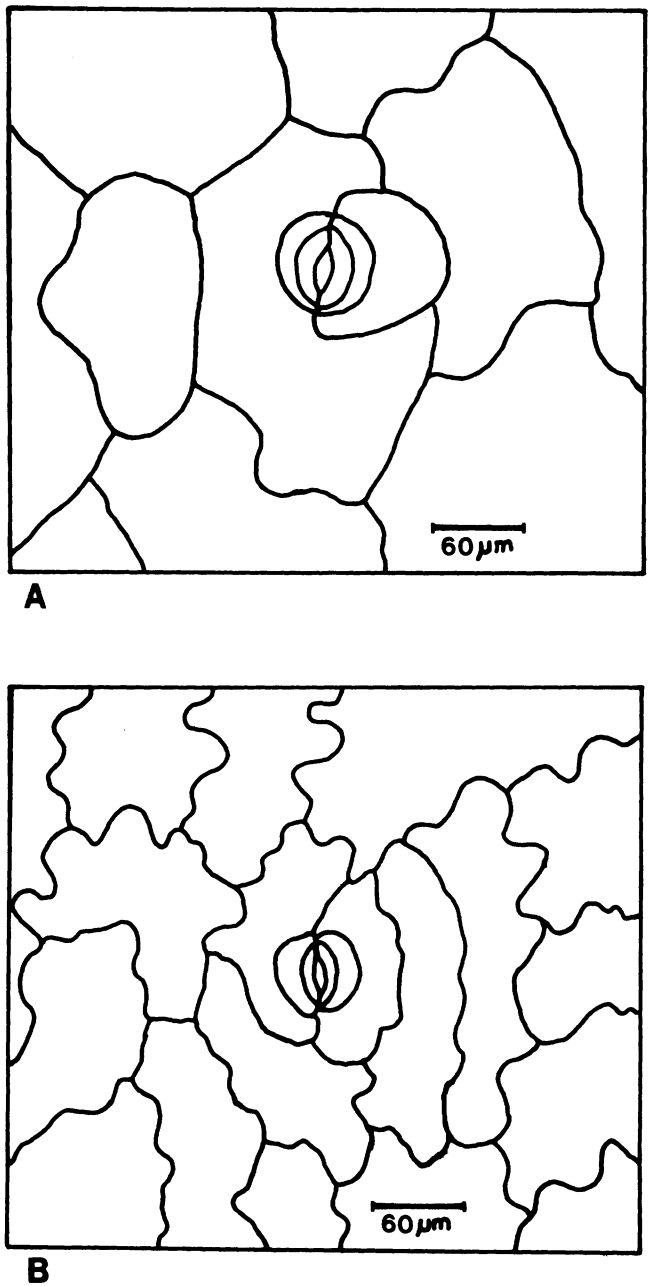

Fig. 4. Epidermises of *Talinum*. - A. *T. triangulare* (*Nyananyo 65,* UPH). - B. *T. cuneifolium* (*Olowokudejo 36,* LUH).

A diploid chromosome number of 2n = 24 was recorded for both species (Fig. 3C, 3D). This number has never been reported for either of the two species.

4. Discussion

The main distinguishing characters between *T. triangulare* and *T. cuneifolium* are summarised in Table 1. Pollen features, seed and epidermal surfaces provide characters of taxonomic significance in these two species of the genus *Talinum* in Nigeria. The pantoporate pollen of *T. triangulare* with 24–32 apertunes differs conspicuously from that of *T. cuneifolium* which is pantocolpate with 15 apertures. The size and wall thickness of the pollen also constitute important distinguishing characters in these species (Table 1). Although pollen variation has been reported in the order Centrospermae (Franz 1908, Erdtman 1952, Nowicke 1975, Nowicke & Skvarla 1979) and the family *Portulacaceae* (Alioshina 1963, Nilsson 1967), yet it is of great interest to note such differences in pollen characters as reported in this investigation could be found in two morphologically similar species which grow in the same general area.

Seed coat ornamentation and epidermal features also support the specific dinstinctness of both species. Seed structure has been found to be of particular significance in several groups of flowering plants such as the *Caryophyllaceae* where it produces taxonomic criteria at all levels of the hierarchy (Stace 1980). In the *Portulacaceae,* the four European subspecies of *Montia fontana* L. are distinguished almost solely on seed morphology (Walters 1964). The transverse sections of the leaf showed that both species are similar anatomically and have vascular bundles of the C_3 type in contrast to the C_4 type found in *Portulaca,* a related genus (Welkie & Caldwell 1970, McNeill 1974).

The diploid number of 2n = 24 reported in this work is highly significant because it has never been recorded for the genus. Sugiura (1938, 1940) reported a chromosome number of 2n = 48 while Steiner (1944) reported 2n = 72, for *T. triangulare.* These results show that *Talinum* is a cytologically variable genus. A comprehensive cytotaxonomic survey of the genus world wide would reveal the role of polyploidy in the evolution of *Talinum.*

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