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Studies in the *Compositae* of the Arabian Peninsula and Socotra – 5. *Distephanus qazmi* (*Vernonieae*, *Gymnantheminae*), a remarkable new species from the island of Socotra, Yemen

Abstract

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Distephanus qazmi, recently discovered on the island of Socotra, c. 250 km off the Horn of Africa, is described as a species new to science. The palaeotropical genus *Distephanus*, which has its greatest diversity on Madagascar, differs from all other genera of the *Vernonieae* in having yellow flowers. *D. qazmi* combines yellow flowers with presence of a basal stylar node, unstructured, elongate, polarized thickening of the median endothelial cells, calcarate-caudate anther appendages and 'type A' pollen, whereas trinervate leaves with strongly ascending basal secondary veins as in some *Distephanus* species and, within the *Vernonieae*, restricted to this genus, are not present in the new species. Within *Distephanus*, the new species is unique in its scapose habit and uniseriate pappus. The pappus of *D. qazmi* is, moreover, plumose, a feature known from a single other *Distephanus* species, *D. plumosus* from Kenya, Ethiopia and Somalia, which is possibly its closest relative. The habit and diagnostic features of the new species are illustrated.

During field work on Socotra in 1996, in connection with their research on the biodiversity and conservation of the Socotra archipelago, A. G. Miller & D. A. Alexander collected an enigmatic tiny, yellow-flowered perennial *Compositae* species. In February 2000, they found the plant at a further five locations. Upon study, the collected material, in spite of its bright yellow-flowered capitula, turned out to be a member of the *Vernonieae*. This is evident, in particular, from: the homogamous capitula with perfect discoid flowers, the actinomorphic corolla deeply divided into five slender lobes, the calcarate and tailed anthers, the style with acute sweeping hairs reaching far down the bifurcation, the style branches with stigmatic areas covering the entire ventral surface and the sericeous, twin-haired achenes. Within the *Vernonieae*, yellow flowers are an odd exception, only found in a single genus, viz. *Distephanus* Cass., where this feature in some species correlates with the similarly exceptional occurrence of trinervate leaves (Robinson & Kahn 1986, Bremer 1994, Robinson 1999a, b). *Distephanus* belongs to the recently erected palaeotropical subtribe *Gymnantheminae* H. Rob. (Robinson 1999b) and has its centre of diversity on Madagascar. Further species occur on Mauritius, in SW, SE and E Africa extending

northeast to Somalia, and two in China (Humbert 1960 sub “*Vernonia* group 5-6”, Robinson & Kahn 1986, Tadesse 1992, Scott 1993, Hind 1996, Robinson 1999b). The hitherto undescribed Socotran species agrees with *Distephanus* in taxonomically relevant characters and can undoubtedly be placed in this genus, where it is unique in its scapose habit and uniseriate plumose pappus. This discovery adds a further remarkable endemic to the peculiar flora of the Socotra archipelago, where the *Vernonieae* were so far represented by only four species, all formerly placed in *Vernonia*: two widespread, *Cyanthillium cinereum* (L.) H. Rob. and *Orbivestus cinerascens* (Sch. Bip.) H. Rob., and two closely related and endemic, ‘*Vernonia*’ *cockburniana* and ‘*V.*’ *unicata* C. Jeffrey, whose correct generic placement remains uncertain.

Material and methods

This study is based on plants observed in the field and herbarium specimens at the Botanic Garden and Botanical Museum Berlin-Dahlem (B) and the Royal Botanic Garden Edinburgh (E). To make the *leaf venation* visible, the leaves were bleached first in 70 % ethanol at 60 °C for 4 days, then in 10 % NaOH at 60 °C for 4 days and subsequently stained in 1 % fuchsin. After each treatment the leaves were washed in water. Finally they were dehydrated in five steps, using successively pure isopropanol, 1:2, 1:1 and 2:1 mixtures of isopropanol and xylol and pure xylol, before being mounted on slides in Canada balsam. For the *light-microscopical study* of flowers, and, in particular, to study the endothelial cell thickenings, flowers were first boiled in water, then dissected and the sections mounted on slides in Hoyer’s solution (Anderson 1954), which also served as a clearing agent. For the *scanning electron microscopical study*, pollen, style, achenes and pappus were cool-sputtered with 20 nm gold-palladium. The pollen, obtained from a dry flower, was acetolysed in a 9:1 mixture of acetic acid anhydride and concentrated sulfuric acid for 12 h at 60 °C; following a technique described by Leuenberger (1976: 24) the pollen was sedimented in a watch-glass and the acetolysis mixture removed with a pipette, the sediment was washed and resedimented successively in glacial acetic acid, in aqua dest. and in ethanol, the dried pollen finally transferred with a small brush to the double-sided adhesive tape on the sample plate. The style was dissected from a flower boiled in water, then pretreated in a 6:1 mixture of 10 % sulfosuccinate and 99.5 % acetone, subsequently dehydrated, first in ethanol then in acetone, and finally critical-point-dried with CO₂.

Distephanus qazmi N. Kilian & A. G. Mill., **sp. nova**

Holotype: Yemen, Socotra, Ras Geridhon, 12°35'N 54°21'E, 627 m, exposed and windswept coastal headland, low woody-herb community, 8.3.1996, *Miller & Alexander M.14307* (E; isotype B).

Species sola praeter *Distephanum plumosum* in hoc genere pappo plumoso praedita, sed ab hac et ceteris speciebus habitu scaposo et pappo uniseriato distinguitur.

Etymology: The epithet “qazmi” is the Arabic word for “tiny” or “dwarf”.

Description

Scapose tap-rooted woody perennial to c. 3 cm high, with a shortly branched woody caudex and several very short rosette shoots on the caudex in older plants; rosettes few-leaved, axiles of former and present leaves white-woolly. *Rosette leaves* narrowly oblanceolate, up to 28 × 6 mm, shallowly lyrate, fleshy, pinnately veined (because of succulence of the leaves seen only after special preparation, Fig. 2a), when young sparsely covered, particularly on the lower surface, with short, simple trichomes, soon glabrescent. Each *rosette shoot* with one or a few 1-2 cm long, delicate flowering axes each terminated by a single capitulum; axes leafless but with few or several bracts similar to and grading into the outer involucre bracts. *Capitula* at anthesis 10-13 mm in diameter, homogamous, discoid, with 10-12 perfect flowers not exceeding the involucre. *Involucre* imbricate, at anthesis 10-11 mm long; involucre bracts all persistent, herbaceous to some-

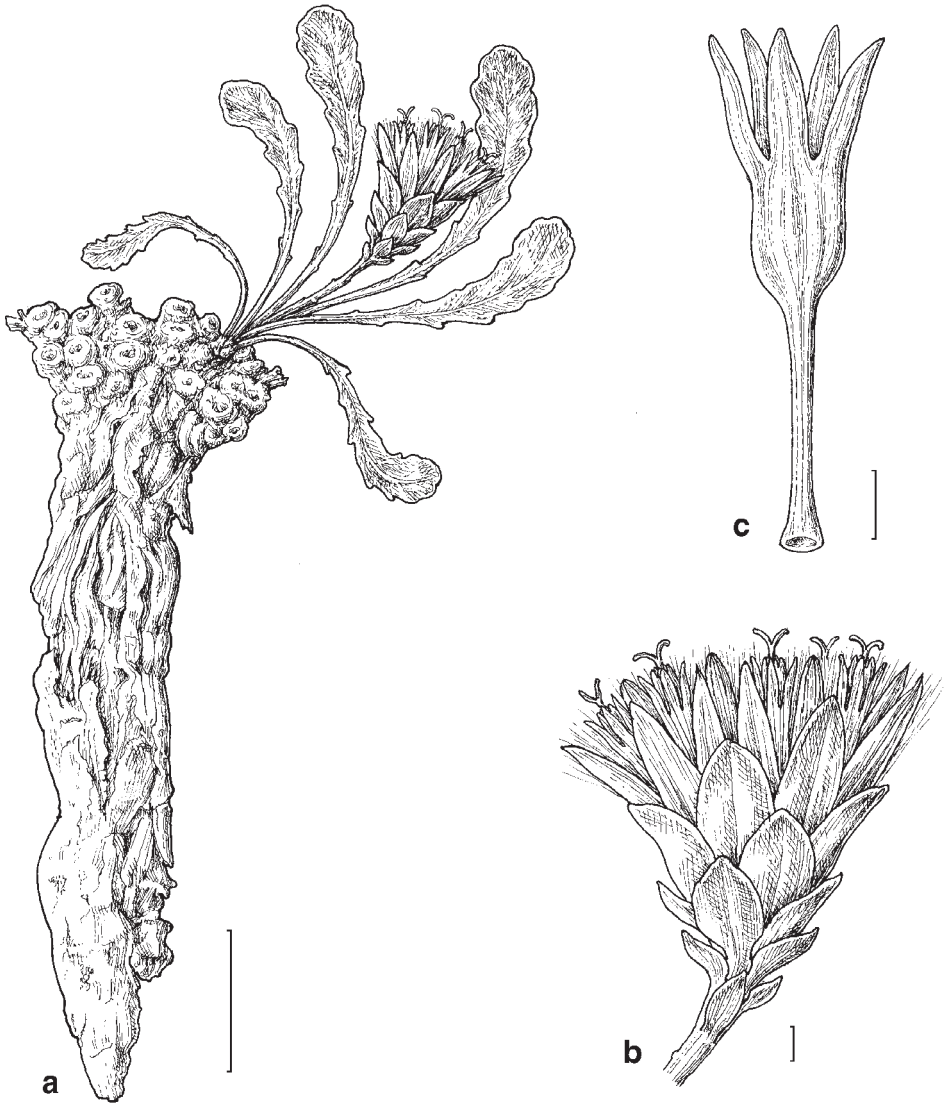


Fig. 1. *Distephanus qazmi* – a: habit; b: capitulum, c: flower. – Scale: a = 1 cm, b+c = 1 mm; drawings by Ingo Haas (Berlin) from the type collection.

what coriaceous, in 4-5 series, (dark) green except for a very narrow scarious margin, the tip acute to mucronulate; outermost involucre bracts 1.5-2 mm long, narrowly ovate, similar to the bracts on the peduncle; the bracts of the next series broadly ovate, distinctly larger, c. 3×2 mm; the following 1-2 series gradually longer and ovate-lanceolate; the innermost bracts 9-10 mm long, distinctly narrower, linear-lanceolate. *Receptacle* epaleate. *Corolla* bright yellow, 6-7 mm long, the corolla tube c. 3.5 mm long, slender, abruptly and distinctly widened at top into a campanulate limb, the corolla throat c. 2 mm long, the 5 corolla lobes almost linear to linear-lanceolate, acute, erect, $2-2.4 \times 0.4$ mm. *Style* 6-7 mm long, yellow, with semicylindrical branches 0.8-1.9 mm

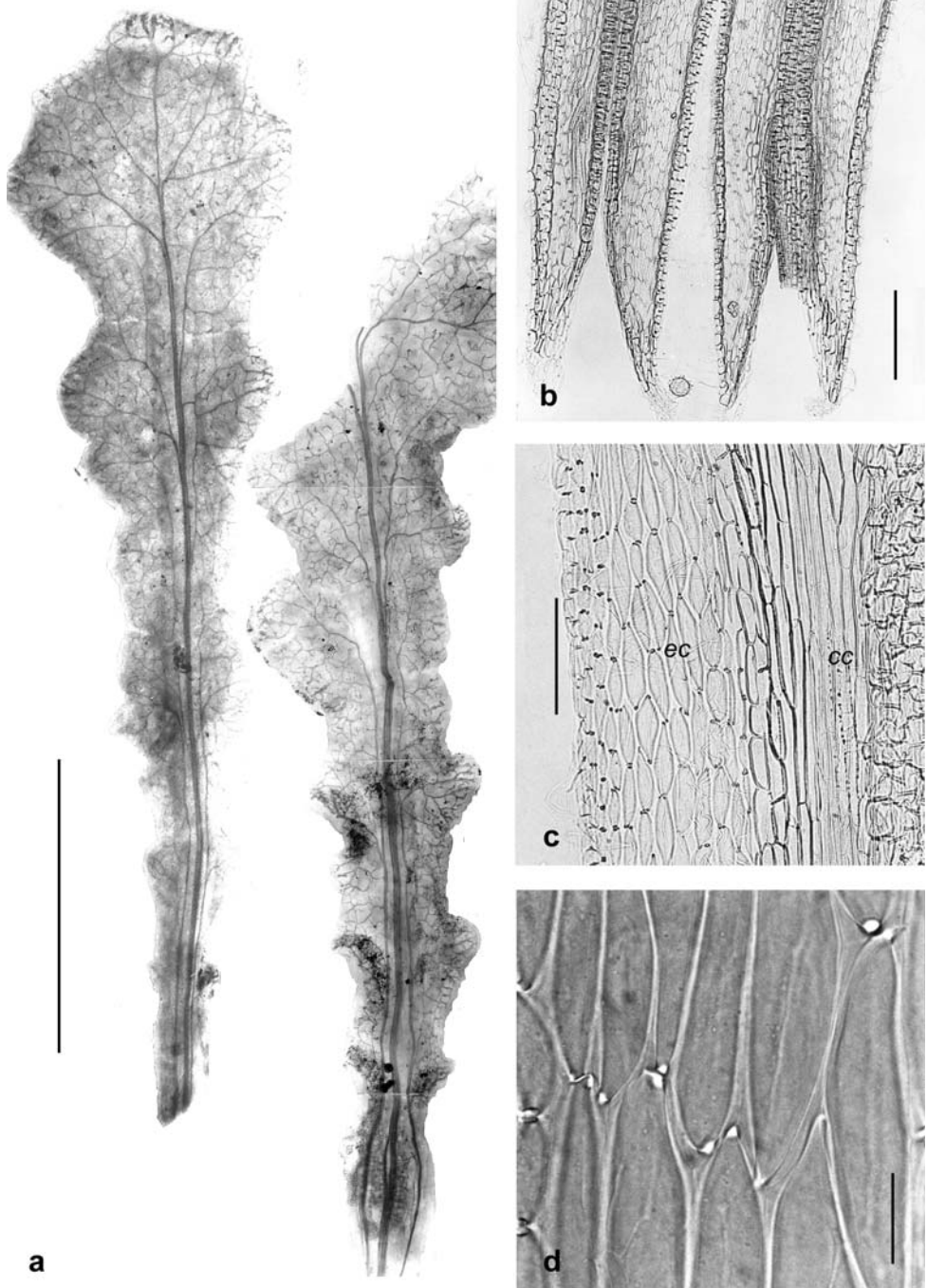


Fig. 2. *Distephanus qazmi* – a: leaf venation, leaves prepared as stated in the text; b: two anthers with basal appendages, abaxial view; c: endothelial tissue with median endothelial cells (ec) and connective cells (cc); d: median endothelial cells with unstructured wall thickening pointed at both ends. – Scale: a = 5 mm, b = 0.2 mm, c = 0.1 mm, d = 0.02 mm; all from the type collection.

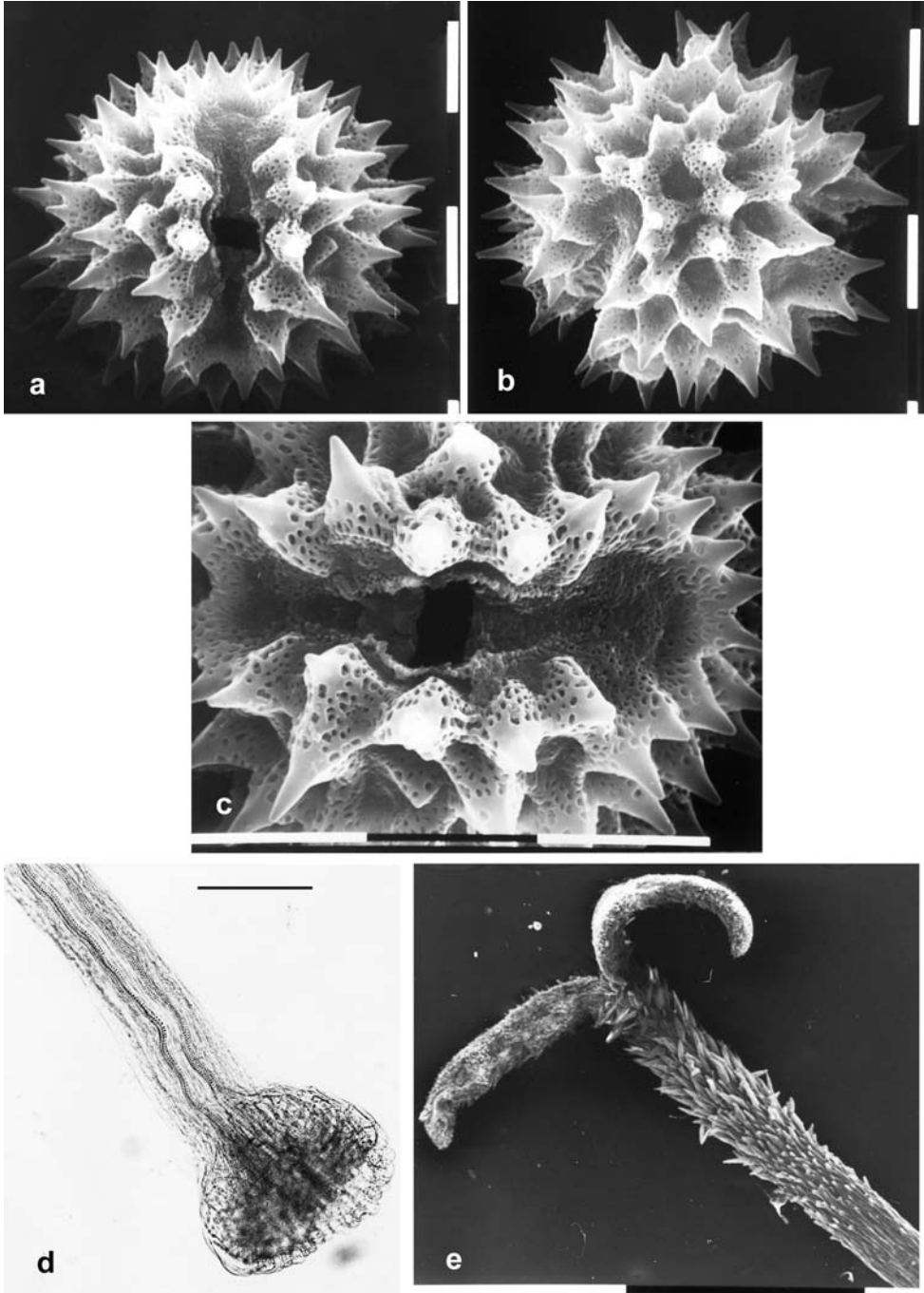


Fig. 3. *Distephanus qazmi* – a-c: pollen, a: colpar view, b: near polar view; c: colpar view in detail showing the microperforate tectum; d-e: style, d: basal stylar node, e: style branches and collecting hairs. – Scale: a-c = 10 μ m, d = 0.2 mm, e = 1 mm; all from the type collection.

long; base of the shaft abruptly widened in a distinct sclerenchymatous node (Fig. 3d); collecting hairs long, acute, reaching far down the bifurcation (Fig. 3e). *Anthers* yellow, glabrous, including appendages 3.3–3.7 mm long, calcarate and very shortly caudate, basal appendages 0.6 mm long, the sterile part only a narrow rim (Fig. 2b), apical sterile appendages rounded, 0.3 mm long; endothecium with polarized cell wall thickenings, median endothelial cells with an unstructured, elongate wall thickening pointed at both ends (Fig. 2c–d). *Achenes* (fully mature not seen) at anthesis c. 3 mm long, densely covered with antrorse-appressed twin hairs (Fig. 4a). *Pappus* uniseriate, of c. 15, white, plumose, dorsiventrally flattened, 6–7 mm long bristles, with unicellular fimbriae 0.2–0.6 mm long (Fig. 4a–c). *Pollen* c. 40 µm in diameter, of ‘type A’, tricolporate, echinate and sublophate with microperforate tectum continuous between the spines (Fig. 3a–c).

Distribution and ecology

Distephanus qazmi is endemic to the island of Socotra where it is found on the limestone plateau at altitudes between 330 and 660 m. It is so far known from a single coastal headland in the NE of the island and at several, inland and coastal, sites on the limestone plateau in the west and south-west of Socotra. In all the known sites *D. qazmi* grows in exposed, windswept places where it is found in cracks in the limestone and in thin soils and fine rock debris overlying limestone pavement. In general the vegetation of the limestone plateau comprises a mosaic of shrubland, woody-herb communities and grassland with the height and composition of the vegetation much reliant on exposure to the wind and soil depth. The niche occupied by *D. qazmi* is at the extreme, exposed end of these vegetation types and comprises a sparse covering of dwarf woody-based herbs, cushion-plants and dwarf shrubs with bare rock and rock debris much in evidence. Several Socotran endemics are more or less restricted to this specialized niche including: *Melhania* sp. ined., *Heliotropium* sp. ined., *Lotus mollis* Balf. f., *Farsetia* sp. ined., *Launaea crepoides* Balf. f. and *Exacum gracilipes* Balf. f. When some of the more widespread endemic shrubs, including *Croton socotranus* Balf. f., *Jatropha unicostata* Balf. f., *Ormocarpum caeruleum* Balf. f. and *Lycium sokotranum* Wagner & Vierh., are associated with this habitat, they are represented by dwarf or prostrate forms. Other plants commonly found in this association are *Oldenlandia pulvinata* Balf. f., *Convolvulus sarmentosus* Balf. f., *Leucas flagellifolia* (Balf. f.) Gürke and *Teucrium balfourii* Vierh.

Further specimens seen

SOCOTRA: Near Wadi Tehan on the dip slope of the Western Plateau, 12°59'N, 53°51'E, sparse vegetation on thin soil overlying limestone pavement on rolling plateau, 600 m, 5.2.2000, *Alexander & Miller* A33 (E); Western plateau, 12°56'N, 53°51'E, limestone plateau with dwarf shrubland, 660 m, 6.2.2000, *Miller & Alexander* [obs., sterile]; headland near Ra's Kattanahan, 12°37'N, 53°54'E, dwarf shrubland on limestone plateau overlooking sea, 330 m, 9.2.2000, *Miller & Alexander* [obs., sterile]; headland near Ra's Kattanahan, 12°37'N, 53°57'E, in rock debris on limestone plateau overlooking sea, 470 m, 9.2.2000, *Miller & Alexander* [obs., sterile]; Qatriah, E of Ra's Kattanahan, 12°34'N, 53°66'E, 480 m, thin soils and rock debris on limestone plateau, close by to relict *Boswellia* woodland, 480 m, 10.2.2000, *Miller & Alexander* [obs., sterile].

Characters and relationship

The new Socotran species agrees with *Distephanus* not only in core features, viz. yellow flowers and the distinct basal stylar node (Fig. 3d), but also in other respects (Robinson & Kahn 1986): the unstructured, pointed-elongate shape of the thickening of the median endothelial cells (Fig. 2c–d), which seems to be unusual in the *Vernonieae*, the calcarate-caudate basal anther appendages (Fig. 2b) and the echinate sublophate ‘type A’ (Keeley & Jones 1979) pollen (Fig. 2b–d; see also Robinson & Kahn 1986: fig. 3–6, Tadesse 1992: fig. 1).

Two types of leaf venation occur within *Distephanus*. Some species have trinervate leaves, which are characterized by a conspicuous, strongly ascending basal pair of secondary veins (see, e.g., Humbert 1960: fig. 29(27), 31(1, 7), 32(4, 13)). This type of venation is very unusual in the

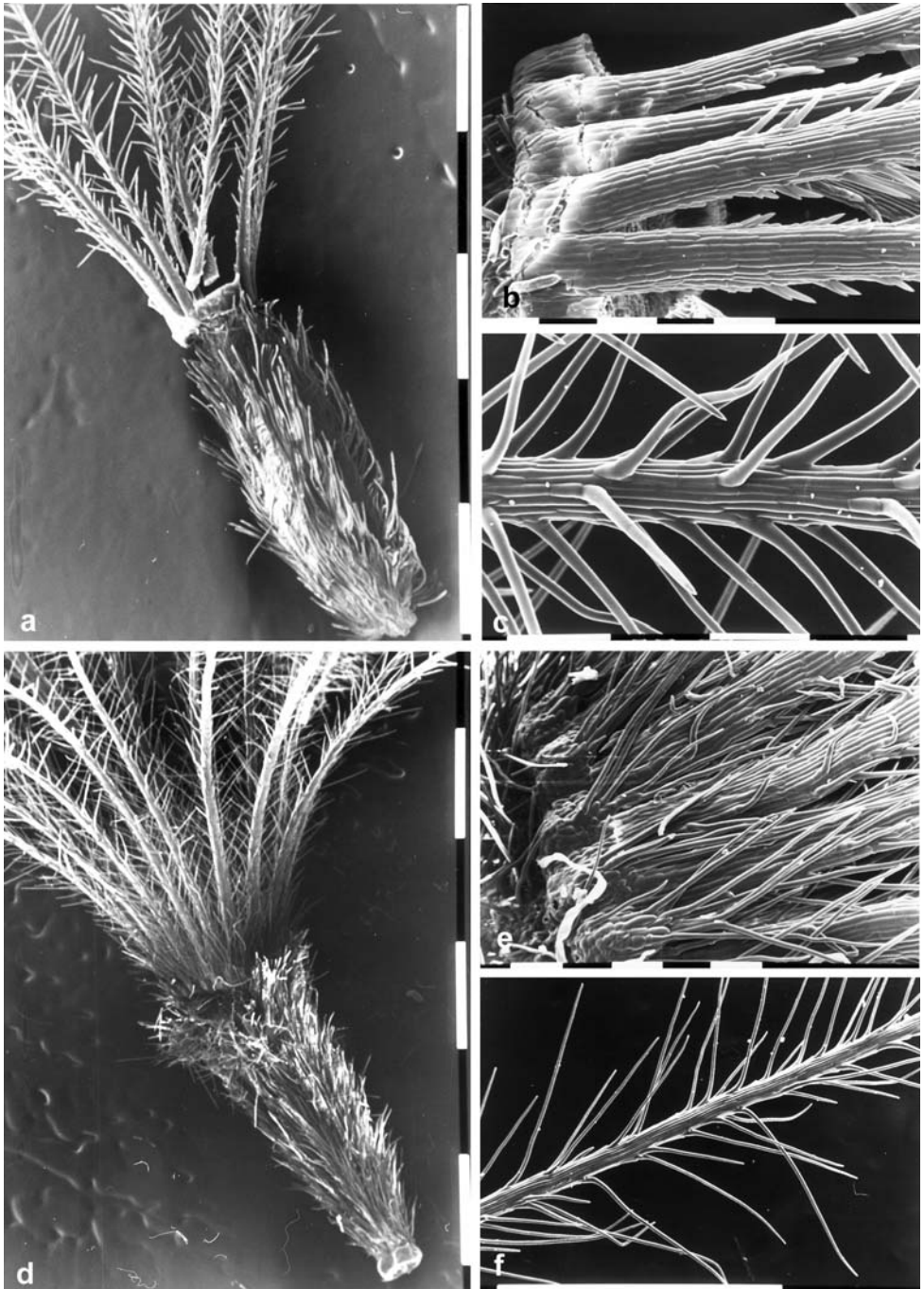


Fig. 4. *Distephanus*, achenes and pappus – a-c: *D. qazmi*, a: achene and pappus in overview, b: base of uniseriate pappus, c: part of a plumose pappus bristle; d-f: *D. plumosus*, d: achene and pappus in overview, e: base of double pappus, e: part of a plumose pappus bristle. – Scale: a, d, f = 1 mm, b-c, e = 0.1 mm; a-c: from the type collection; d-f: specimen from Kenya, Lag Ola, 3°53'N, 40°54'E, 23.5.1952, Gillett 13277 (B).

tribe and only present in *Distephanus* (Robinson & Kahn 1986, Robinson 1999b). The other species of *Distephanus* have the usual pinnately veined leaves. The leaf venation of *D. qazmi*, which because of succulence is only visible after special preparation, is of the usual pinnate type (Fig. 2a). The three parallel veins entering the leaf base are a rather common feature in the *Vernonieae* (H. Robinson, pers. comm.).

Distephanus qazmi is remarkable within the genus in several respects. Most strikingly, the species is a scapose rosette plant. This habit, whilst found in a few other palaeotropical genera of the tribe, was previously unheard of in *Distephanus* and the whole of the *Gymnantheminae*, where all known species are shrubs, small trees or lianas. However, *D. qazmi* has at least a distinct woody caudex. Its leaves are reduced in size (however, similar small leaves are known in a few other species such as *D. antandroy* Humb.) and are somewhat succulent. The succulent leaves and low habit of *D. qazmi* are apparently an adaptation to the shallow soils and arid, wind-swept hills and headlands of Socotra where only low-growing xeromorphic perennials are able to survive.

Other remarkable features of the new species are its uniseriate and plumose pappus, two features that are very rare in the *Vernonieae*. In *Distephanus* the pappus is typically double, with an outer series of mostly short scales or scale-like bristles and an inner series of scabrid, dorsiventrally flattened bristles. There is, however, a second member of the genus with plumose pappus bristles, *D. plumosus* (O. Hoffm.) Tadesse (Fig. 4d-f), which has only recently been recognized as belonging to *Distephanus* (Tadesse 1992). Its plumose bristles are similar to those in our species: the fimbriae are also unicellular but somewhat longer, and the scales of the outer pappus are reduced to pulvinus-like structures, which alternate with the bristles of the inner series and are terminated by small tufts of hairs, which are similar to the pinnae of the plumose inner bristles (Fig. 4e). The plumose bristles of these two species (Fig. 4c+f) and the scabrid bristles of other *Distephanus* species (in which the teeth of the bristles vary somewhat in length between the different species), are obviously homologous, the pinnae of the plumose bristles being prolonged teeth.

Whether the similarity of *Distephanus qazmi* and *D. plumosus* in pappus features indicates close relationship needs further investigation. Interestingly, *D. plumosus* is distributed in Kenya, Ethiopia and Somalia, and is thus the only species of *Distephanus* with a distribution adjacent to *D. qazmi*. *D. plumosus* is a shrub to 2 m high, growing on limestone in open *Acacia-Commiphora* woodland (in sched. Gillett 13277, B), with larger, entire, broadly elliptical leaves, larger capitula and larger, yellow to orange flowers. The leaves of *D. plumosus* are also somewhat fleshy and both species are rather similar in indumentum characters.

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