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NORBERT KILIAN & PETER HEIN

Studies in the *Compositae* of the Arabian Peninsula and Socotra – 2. *Pulicaria samhanensis* sp. nova *(Inuleae)* from Dhofar and notes on other S Arabian species of the genus

Abstract

Kilian, N. & Hein, P.: Studies in the *Compositae* of the Arabian Peninsula and Socotra – 2. *Pulicaria samhanensis* sp. nova *(Inuleae)* from Dhofar and notes on other S Arabian species of the genus. – Willdenowia 29: 187-196. 1999. – ISSN 0511-9618.

Pulicaria samhanensis from Jabal Samhan, E Dhofar, Oman, is described as a species new to science and illustrated. The species is most remarkable for its purple flowered, disciform, heterogamous capitula and its achene wall with a single layer of sclerenchymatous cells. The news species is closely related to *P. pulvinata* from coastal Jiddat al Harasis, Central Oman, and both hold a rather isolated position in the genus. The S Arabian distribution and infraspecific variation of *P.* (sect. *Platychaete*) *argyrophylla* is re-evaluated and *P. argyrophylla* var. *oligophylla* raised to subspecies rank. *P.* (sect. *Platychaete*) *omanensis* is for the first time reported from Yemen and *P. rauhii* is found to be conspecific with the former.

1. *Pulicaria samhanensis,* a new species from Dhofar, Oman

On the plateau of Jabal Samhan in Dhofar, Oman, the authors discovered a purple flowered *Compositae* with heterogamous, disciform capitula, which clearly shows the diagnostic characters of the *Inuleae* s.str. (Anderberg 1991, 1994), viz. the style branches have apically confluent and basally separated stigmatic bands, the sweeping hairs are not distributed as far down as to the bifurcation of the style, the cells of the achene epidermis each have one elongate oxalate crystal and the anthers are caudate. This undescribed species evidently does not belong to any of the few *Inuleae* genera comprising non-yellow, i.e. purple to violet flowered species, viz. *Antiphiona, Blumea* s.str. (e.g. *Blumea mollis*), *Iphionopsis, Pechuel-Loeschea, Pegolettia* or *Perralderia* (Anderberg 1991, 1994). From its achene and pappus characters the species instead perfectly fits in *Pulicaria*, in spite of the fact that hitherto not a single species of this genus was known to have another flower colour than some shade of yellow (Anderberg 1991, 1994, Gamal- Eldin 1981, 1984, 1986, Gamal-Eldin & Boulos 1993, Lack 1980, Rechinger 1980).

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Fig. 1. *Pulicaria samhanensis* – a: habit; b: flowering involucre; c: marginal pistillate flower; d: perfect disc flower. – Scale: a = 1 cm, b = 2 mm, c-d = 1 mm; drawings by Ingo Haas after the type collection.

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Pulicaria samhanensis N. Kilian & P. Hein, **sp. nova** – Fig. 1-3
Holotype: Oman, Dhofar, Jabal Samhan, summit plateau, flat rocky limestone crest near the SSE facing escarpment, 6-7 km E of the radio station, 17°08'N, 54°44'E, 1300-1400 m, 8.10.1998, *Hein (5549) & Kilian NK 5591* (B; isotypes E, K, ON, S).

Species colore corollae atroporphyreo-violaceo insignis, involucro, floribus, achaeniis et pappo *P. pulivinatae* affinis sed foliis anguste oblanceolatis, acutis, dentatis, usque ad 45 mm longis (nec obovatis vel late spathulatis, obtusis, integris, usque ad 10 mm longis) et habitu dense caespitoso (nec ramis prostratis valde ramosis congestis, tegeticulas laxas formantes) bene distincta.

Description
Subscapose, greyish white-tomentose perennial, 5-10 cm high, forming a small cushion of densely tufted leaf rosettes, each with a wiry flowering shoot, from a shortly branched rootstock. *Indumentum* of leaves, flowering shoots and outer involucral bracts, dense, persistent, of appressed white hairs up to c. 1.5-2.5 mm long and sessile glands hidden among the hairs. *Rosette leaves* oblanceolate, acute, up to 4.5 × 1.0 cm, often incurved along the mid rib, the basal 2/3 of the lamina petiole-like attenuate, the upper third with 2-5 teeth on each side. *Leaves of the flowering shoots* few, mostly in the basal half, similar to the rosette leaves but much smaller, in the upper half, if any, entire and bract-like. *Flowering shoots* ascending-erect, up to 8 cm long, each with a single terminal capitulum. *Capitula* erect, heterogamous, flowering 12-15 mm in diameter, with over 100 flowers of brownish deep purple colour (already in bud) with darker veins. *Receptacle* at fruiting c. 2 mm in diameter, very weakly convex. *Involucrum* 6-7 mm high, involucral bracts laxly imbricate, in c. 3 series (Fig. 1b) ; outer bracts similar to the upper bractlike leaves of the flowering shoot, herbaceous, greenish and with a dense, white indumentum, linear-lanceolate, 4-6 × 0.5-1 mm; the bracts of the second series linear-lanceolate, 6-7 × 0.5 mm, scarious, the margin serrulate in the upper half or third, brownish deep purple except for the greenish and pilose prominent midrib; the bracts of the innermost series similar to the second series but less purplish where covered by the bracts of the outer two series and the midrib almost glabrous, with scattered sessile glands. *Marginal flowers* pistillate, fertile, in 1 row; corolla (Fig. 1c) shorter than that of the disk flowers, 3.7-3.9 mm long, filiform and miniradiate, the erect, shortly three-toothed ray lamina longitudinally incurved or even rolled, 0.4-0.5 mm wide (not or little wider than the tube), only 0.6-1.3 mm long and exceeded by the bifurcation of the fully exserted style. *Disk flowers* perfect; corolla (Fig. 1d) 3.8-5.7 mm long, paler towards the yellowish base, tubular, with five, outside glandular lobes 0.3-0.5 mm long, exceeded by the bright yellow anthertube and style. *Achenes* (Fig. 2a) 1.7-1.9 × 0.4-0.5 mm, pale brownish, almost terete, with 5 very fine, very weak, somewhat darker ribs, pubescent of appressed-antrorse twin hairs and with a basal, annular, whitish, cartilaginous carpophor, 0.2-0.3 × < 0.1 mm. *Pappus* double (Fig. 2b); the outer coroniform pappus of lanceolate to linear-lanceolate scales up to 0.5-0.8 mm long, connate only in about the basal quarter; inner pappus 4-5 mm long, of 10-12 easily detachable bristles with spreading teeth gradually longer and more connate towards the tip, the bristles distally up to c. 0.25 mm wide (Fig. 2c-d).

Additional specimen seen
Oman: Dhofar: Jabal Samhan, 17°12'N, 54°55'E, 1600 m, dissected limestone, 23.9.1984, *Miller 6314* (E).

Achene anatomy
The achenes of *Pulicaria samhanensis* (Fig. 3) have a thin wall consisting of an one-layered epidermis, a thin sclerenchymatous layer and 5 vascular bundles beneath. The epidermis cells have rather thick walls and each cell a single longish oxalate crystal. The sclerenchymatous tissue is approximately uniform in diameter and composed of one layer of cells, which have, in cross section, a larger radial than tangential extension. Here and there, however, a single sclerenchyma

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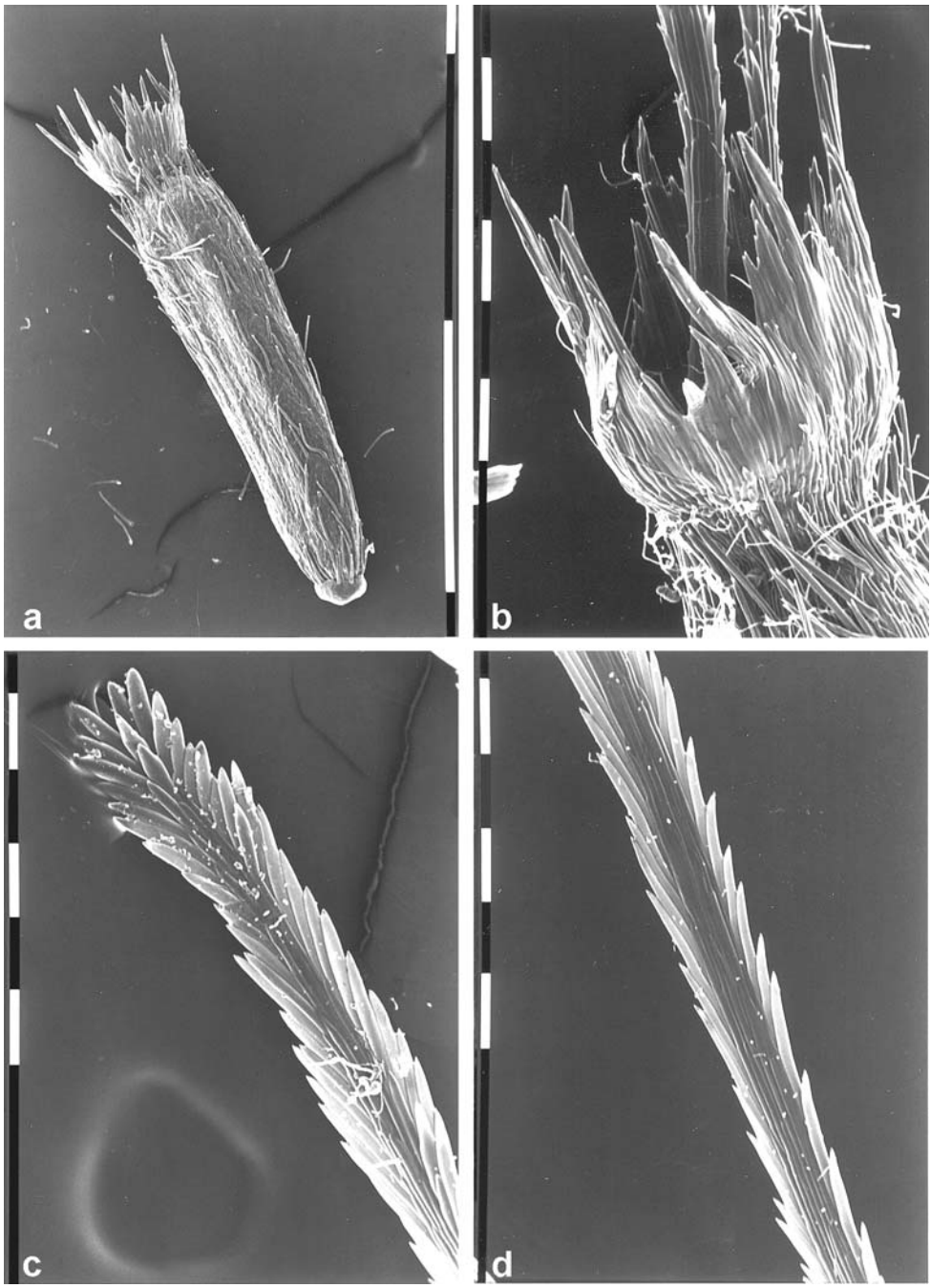


Fig. 2. *Pulicaria samhanensis* – a: achene, the bristles of the inner pappus fallen off; b: achene, detail of apex with outer coroniform pappus and a few of the bristles of the inner pappus; c-d: pappus bristle in detail, apex (c) and middle third (d). – Scale: a = 1 mm, b-d = 0.1 mm; SEM micrographs from the type collection.

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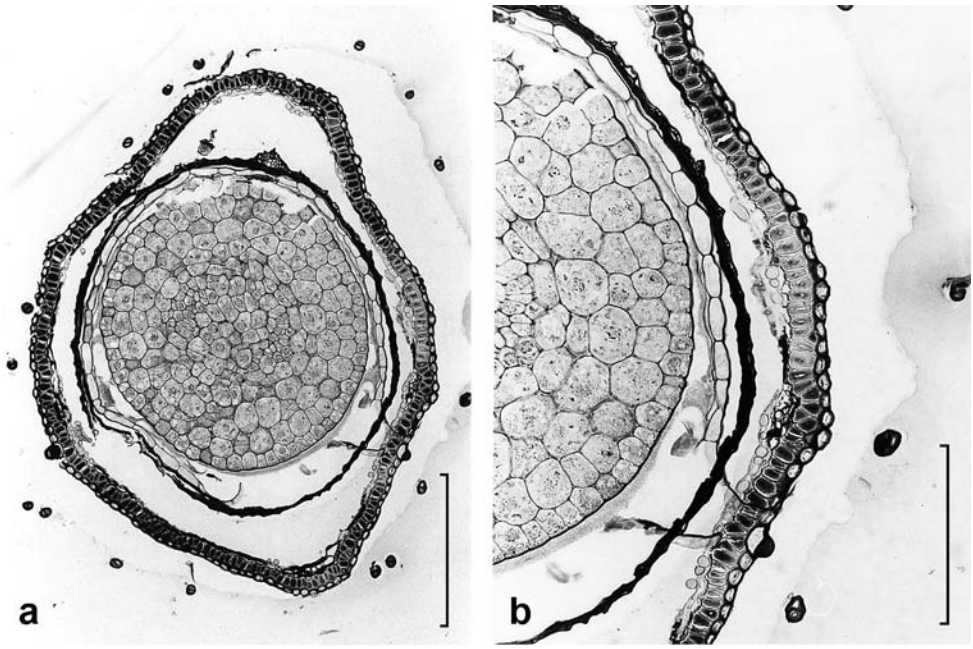


Fig. 3. *Pulicaria samhanensis,* transverse section of the achene made according to the method described by Kilian (1999) – a: overview; b: detail. – Scale: a = 0.3 mm, b = 0.1 mm; LM micrographs from the type collection.

cell is substituted by two shorter cells (Fig. 3b, arrowed). Following Gamal-Eldin (1981: 42), such a one-layered sclerenchymatous tissue is unique in *Pulicaria*, since all species anatomically studied by her had a sclerenchyma of 3-8 layers. Also in the context of the tribe in general, a one-layered sclerenchyma is unusual and was not reported from the *Inuleae* by Merxmüller & Grau (1977).

Distribution and ecology

The species is known so far only from a small area on the central summit plateau of Jabal Samhan at an elevation of 1300-1600 m. The species was already collected and recognised as new by Tony Miller in October 1984, but the plants collected by him are in a fairly young state, with most of their capitula still in bud. The species grows only some hundred meters away from the dramatically falling, thinly wooded sea facing escarpment of Jabal Samhan, on flat or gentle limestone crests, which are very sparsely covered by low shrublets and perennial herbs. The plants were found by the authors growing single or in small populations in wide sandy-loamy pockets.

Most of the summit plateau and eastern part of Jabal Samhan, including the outlying Jabal Nuss and Jabal Hasik, are on the fringe of the monsoon-affected area, distinctly drier than the other Dhofar mountains and also floristically different, perhaps forming a separate floristic unit. The whole area is still poorly investigated, but it may be indicative that it harbours also a peculiar local endemic *Lavandula* species, viz. *L. hasikensis* A.G. Mill., of which no close relatives are known (Miller 1985). One of the few known populations of this species grows at the paratype locality of *P. samhanensis*.

With respect to the floral ecology of *P. samhanensis* it may be noteworthy that the bright yellow anthers and styles contrast very conspicuously with the darkish corollae and involucral bracts, as if they would only provide some sort of background to enhance the attractancy of styles and anthers.

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Relationship

Apart from several cases where the marginal female flowers are missing, the species of *Pulicaria* have, like the vast majority of the *Inuleae* with heterogamous capitula, distinct marginal ray flowers, although their corolla sometimes little exceeds the involucre. Gamal-Eldin (1981) gives no data about the ratio of ray lamina to tube length in *Pulicaria*, but as far as we can see, the ray lamina is, independent from the total length of the corolla, usually longer or often even much longer than then tube. Only a few species such as *P. vulgaris (P.* sect. *Pulicaria)* and *P. albida (P.* sect. *Platychaete)*, have female flowers with a ray lamina somewhat shorter than the tube. The marginal flowers of *P. samhanensis* are thus exceptional.

There is, however, a species recently described from the coastal Jiddat al Harasis, Central Oman, *P. pulvinata* Gamal-Eldin (1986), about which is stated in the protologue to have filiform tubular marginal flowers. An examination of the isotypes and further material in the herbarium of the Royal Botanic Garden Edinburgh (E), the herbarium of the Royal Botanic Gardens Kew (K) and the National Herbarium of Oman (ON), respectively, revealed that its 3-lobed female flowers are in fact surprisingly similar to those of *P. samhanensis*. The adaxial slit between the lobes (Gamal-Eldin 1986: fig. 2D) is always distinctly longer than the other two, its length is actually variable even in flowers of the same capitulum and can reach up to 15 % of the total length of the corolla, so that the corolla then exhibits largely the same shape as in *P. samhanensis.* Both species do not show much resemblance with each other at first glance. There are strinking differences in habit, since *P. pulvinata* is a delicate, strongly branched, prostrate, mat-forming perennial, as well as in leaf shape and size, since *P. pulvinata* has obovate to broadly spathulate, obtuse and entire leaves only up to 10 mm long, but both species, on the other hand, strongly resemble each other in involucral, achene and pappus characters. This agreement in several taxonomically important features leaves little room for doubt that both species are closely related. The distribution area of *P. pulvinata* lies only about 200 km to the east of that of *P. samhanensis*. While the latter is on the fringe of the monsoon-affected area, that of the former is situated in a little elevated region outside the reach of the monsoon. It receives most of its precipitation from fog, which occurs mainly in spring and autumn at night when maritime air is drawn inland and cooled below its dew point (Fisher & Membry 1998). The region shelters other local endemics besides *P. pulvinata* (Miller & Nyberg 1991: 272).

The purplish corollae in *P. samhanensis* appear somewhat less unusual if we consider that they are of exactly the same colour as the tinge of the (apical portion of the) involucral bracts in this species, in *P. pulvinata* and a few other species, that also the apical portion of the (otherwise pale yellow) corollae of *P. pulvinata* sometimes has such a purplish tinge (as can be seen in the available herbarium material), and that, finally, the purplish colour fades and shows up some yellow near the base of the disc flower corollae in *P. samhanensis.* However, on account of the isolated position of *Pulicaria pulvinata* (Gamal-Eldin 1986) and *P. samhanensis* due to their extremely reduced ligules and the unusual habit of either species, to which the unusual achene wall anatomy could be added if also confirmed for the first species, placement in a section of their own should be considered.

2. *Pulicaria argyrophylla*

Based on the only four specimens, from Hadramaut (Yemen) and Dhofar (Oman), available at that time, Gamal-Eldin (1981) described a new variety of *Pulicaria* (sect. *Platychaete*) *argyrophylla* Franch., a species distributed in NE Somalia and S Arabia. *P. argyrophylla* var. *oligophylla* Gamal-Eldin has been distinguished from the typical variety by the dense, short and appressed, white-tomentose indumentum and the involucre of only 3 (instead of 4-5) series of bracts, of which the outer series is, moreover, somewhat leaf-like.

Our study of additional herbarium material and life plants yielded new data on the infraspecific variation and the distribution of this species, which let us come to the conclusion that Gamal-Eldin's variety deserves subspecies rank.

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Pulicaria argyrophylla subsp. ***oligophylla*** (Gamal-Eldin) N. Kilian & P. Hein, **comb. & stat. nov.** ≡ *Pulicaria argyrophylla* var. *oligophylla* Gamal-Eldin in Phanerog. Monogr. 14: 246. 1981. – Holotype: Yemen, Hadramaut, Jol, west road between Sai'un and Mukalla, 5500 ft., 1.5.1952, *Popov 571* (K!).

Typical *P. argyrophylla* is, on the Arabian Peninsula, apparently restricted to the coastal plains of E Hadramaut, where, to our knowledge, its occurrence is recorded between about 49° and 50°30'E. Its NE Somalian subpopulation seems restricted also to low altitudes, being distributed in the lowland and colline zone. *P. argyrophylla* subsp. *oligophylla*, in contrast, is distributed from E Hadramaut to Dhofar, and largely confined to the montane zone, occurring at altitudes up to about 2000 m and coming down to about 200-300 m only on less arid escarpments in Dhofar.

From the Somalian and Yemeni subpopulations of the typical subspecies, subsp. *oligophylla* is in fact consistently and clearly delimited by its evenly dense, short-hairy, tomentose indumentum. For diagnostic purposes the difference in the indumentum can best be expressed in that the involucral bracts in the typical subspecies are, due to their indumentum, long-ciliate (with many hairs in the size class of 0.5-1 mm length) and that the indumentum of neighbouring bracts is thus distinctly interwoven. In subsp. *oligophylla*, in contrast, the indumentum of the involucral bracts forms a very dense margin of about 0.1-0.2 mm. The hairs of the indumentum in both subspecies are also different in their morphology: those in subsp. *argyrophylla* are cylindrical and straight to curled, whereas those in subsp. *oligophylla* are completely collapsed, twisted, bent and thus of very irregular shape.

The involucre of subsp. *oligophylla* is composed of consistently less bracts, lacking the innermost linear row(s). Some variation exists, however, in the shape of the outermost bracts. They may, as is the case in subsp. *argyrophylla*, be almost linear, at most equal in length to the inner bracts and thus bract-like or, at the other extreme, distinctly oblanceolate and longer than the other bracts, and then in fact somewhat leaf-like (sometimes even with small teeth). Between both extremes all transitions occur and no clear correlation with general leaf shape, geography or elevation was found.

In addition, both subspecies show some difference in achene characters: the achenes of subsp. *oligophylla* are usually somewhat more slender, darker brown, hairy all over and glandular on the apex (Fig. 4c-d), while those of subsp. *argyrophylla* are usually stouter, paler brown, hairy on base and apex only, and not or sparsely glandular on the apex (Fig. 4a-b). The specimens, in particular of subsp. *argyrophylla*, however, show a considerable variation with respect to these characters, so that the examples shown in Fig. 4 represent extremes of a continuum rather than demonstrate a real discontinuity between both taxa.

Selected specimens examined ["etc." stands for further duplicates to be distributed]
Pulicaria argyrophylla subsp. *argyrophylla* (from Arabia only)
YEMEN: Hadramaut: Zwischen al-Mukalla und ar-Riyan, 10 m, sandig-kalkige Küstenzone, 30.8.1993, *Al-Gifri & Kürschner 8968* (herb. Kürschner); between Tokham and Ghafit [14°44'N, 49°12'E], 200 ft, on sandy or stony ground, 25.12.1893, *Lunt 67* (K, holotype of *P. leucophylla*); Straßenzufahrt nach Riyan-Airport, 30 m, sandiger Straßenrand, 2.4.1996, *Raab-Straube 96326b* (herb. Raab-Straube), *Hein 96-954* (B, herb. P. Hein); Shihr [14°46'N, 49°40'E], outside town, sand, 1 km from sea shore, 50 m, 14.6.1987, *Boulos & al. 16941* (K); 3 km W of Schechir [= Shihr], 0.5 km W of the oil terminal, 30 m, 28.2.1999, *Mies 1521* (B); Wadi Aidid, 5 km NW Hami [= 14°51'N, 49°56'E], near Moyad village, calcareous rocks, 120 m, 14.6.1987, *Boulos & al. 16978* (K); El Hami [14°51'N, 49°56'E], östlich von Schecher [= Shihr], *Schweinfurth 188* (G, K, WU); 10 km E of Qusay'ir, 50-100 m, 15°N, 50°25'E, roadsides, 23.9.1998, *Ghazanfar, Hein & Kilian NK 5057* (B, etc.), *PH 4859* (herb. P. Hein, etc.).

Pulicaria argyrophylla subsp. *oligophylla*
YEMEN: HADRAMAUT: Mukalla - Sayun road, 15°01'N, 48°49'E, 1430 m, 7.10.1992, *Thulin & al. 8185* (K); ibid., top of Jol plateau, 1500 m, 14°59'N, 48°43'E, 21.3.1996, *Hein 96-304* (B, herb. P. Hein); ibid., Abdullah Quatim, c. 1400 m, 3.2.1998, *Mies 1195* (B).

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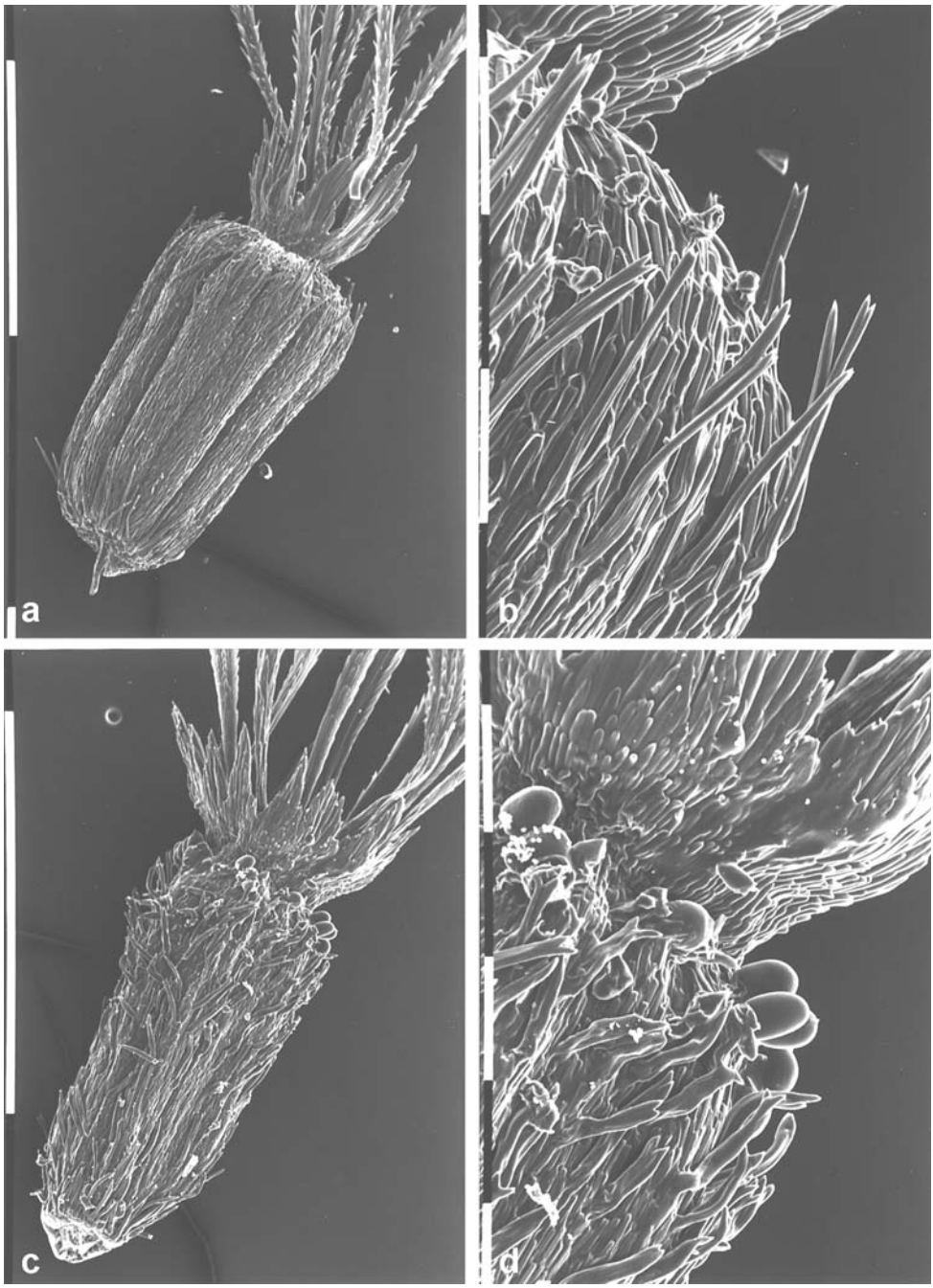


Fig. 4. *Pulicaria argyrophylla* – a-b: achene of *P. argyrophylla* subsp. *argyrophylla,* overview (a) and almost eglandular apex (b); c-d: achene of *P. argyrophylla* subsp. *oligophylla*, overview (c) and glandular apex (d). – Scale: a,c = 1 mm, b,d = 0.1 mm; a-b from *Hein 96-954* (B), b-c from *Hein & Kilian NK 5333* (B).

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OMAN: DHOFAR: J. Qamar, coastal mountains W of Mughsayl, 16°52'N, 53°45'E, 100-320 m, 9.8.1998, *Hein & Kilian PH 5568* (B, herb. P. Hein, etc.); Jabal Qara along track between Raysut and Qaftawt, rocky ridge, 750 m, 17°03'N, 53°54'E, 3.10.1998, *Hein & Kilian NK 5333* (B, etc.); ibid., c. 950 m, 16°51'N, 53°25'E, 5.10.1998, *Hein & Kilian NK 5431* (B, ON, etc.), *PH 5355* (herb. P. Hein, etc.); J. Samhan, summit plateau, 17°08'N, 54°44'E, 1300-1400 m. 8.10.1998, *Kilian & Hein NK 5590* (B, ON, etc.); ibid., 17°07'N, 45°44'E, 1200-1250 m, 8.10.1998, *Hein & Kilian PH 5514* (B, herb. P. Hein, etc.).

3. *Pulicaria omanensis* and *P. rauhii*

Pulicaria omanensis Gamal-Eldin (1981) was first described from a single collection from Dhofar, Oman. Subsequently some additional collections from Dhofar as well as from coastal Central Oman were made (specimens cited by Gamal-Eldin 1986) and a new subspecies from Central Oman near Ras ad Daqm (19°40'N, 57°45'E), *P. omanensis* subsp. *milleri* Gamal-Eldin (1986), deviating in leaf and involucral bract characters was established. More recently the species has also been collected on the island of Al Hallaniya E of Dhofar (see *McLeish 1616*, below). The species is apparently confined to drier habitats, since in Dhofar it occurs only in the coastal plains, in dry places of the foothills and lower escarpments as well as in the N facing predesert zone, but not in the more humid zones.

Infraspecific variation is considerable, in particular regarding leaf shape and consistency, leaf margin and indumentum, but seems to some larger extent due to environmental conditions. The leaves are linear-oblanceolate to broadly lanceolate, attenuate towards the narrow, semiamplexicaule to clasping base, the tip is typically provided with a short mucro and somewhat bent back, the margin is entire or has a few horny teeth in the distal half or is, to the other extreme, dentate all along the margin. The indumentum of long hairs strongly varies in density and the plants are correspondingly green to greyish green, the lamina may either be thin or slightly fleshy. Several plants, including the holotype, from different localities in Dhofar and coastal Central Oman have galls in the leaf axils looking like small cotton-wool balls.

In 1998, *P. omanensis* was collected by the authors also in SE Yemen. This collection made it necessary to consider the delimitation between *P. omanensis* and *P. rauhii* Gamal-Eldin. *P. rauhii*, which has some stronger similarity to *P. omanensis,* was described by Gamal-Eldin (1981) from a single, rather poor specimen from coastal Hadramaut but placed in *P.* sect. *Vieraeopsis* and not in *P.* sect. *Platychaete* as the latter species, in particular for the pale yellow ray laminas, the branching of the synflorescence and the morphology of the pappus bristles (Gamal-Eldin 1981: 208). Besides the holotype no further material is known of this species. An analysis of the holotype revealed that *P. rauhii* is apparently misplaced in *P.* sect. *Vieraeopsis* and actually conspecific with *P. omanensis.* Not only the leaves, involucre, flowers and achenes of the holotype perfectly fit in the range of variation of *P. omanensis* but also the pappus. The number of bristles is rather difficult to establish in the holotype as they are easily deciduous but is clearly higher than 7-10 (in one case 13 could be counted). The bristles are rather narrow but not significantly different from those of *P. omanensis*. The authors' collection, which was made not far from the type locality of *P. rauhii,* as well as a second collection from the same region seen be the authors look much similar to the type and at the same time confirm the agreement of the Yemeni collections with *P. omanensis*. Since both names were published simultaneously, we place the much less used name *P. rauhii* into the synonymy of *P. omanensis*.

Pulicaria (sect. *Platychaete*) *omanensis* Gamal-Eldin in Phanerog. Monogr. 14: 230. 1981. – Holotype: Oman, Dhofar, Ayan cross roads, 600 m, 6.5.1978, *Berkeley 23* (E!)
= *Pulicaria rauhii* Gamal-Eldin in Phanerog. Monogr. 14: 206. 1981, **syn. nov.** – Holotype: [Yemen, Hadramaut], 20 km W Mukalla, 500 m, 13.3.1964, *Rauh & Lavranos 13215* (K!).

Additional specimens seen from Yemen
HADRAMAUT: N of Mi'yan al Masajid, just S of Wadi Arf, c. 14°51'N, 49°30'E, 200-300 m, sparse,

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contacted *Acacia-Commiphora* vegetation, 20.9.1998, *Hein & Kilian NK 4995* (B); Riyan, in dry wadi beds of the coastal plain, S of the old airport, 100 m, 3.2.1998, *Mies 1196* (B).

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