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Hypochaeris arachnoidea* Poir., a hitherto neglected species in NW Africa*Abstract**

Oberprieler, Ch. & Vogt, R.: *Hypochaeris arachnoidea* Poir., a hitherto neglected species in NW Africa. – Willdenowia 32: 231-236. 2002. – ISSN 0511-9618.

The NW African *Hypochaeris arachnoidea* is reinstated, a detailed description of this annual, a full synonymy including lectotypifications, and a key to the Moroccan species of *Hypochaeris* are provided. Chromosome numbers and karyotype information for six Moroccan *Hypochaeris* species from ten populations (including one population from Ireland) are presented and compared with literature data on karyotypes in the genus.

While preparing the treatment of the genus *Hypochaeris* L. for the “Checklist of Vascular Plants of Northern Morocco” (Oberprieler in Valdés & al., in prep.), we came across plants from Morocco that did neither fit in the circumscription of *Hypochaeris radicata* L. (being annuals instead of perennials) nor of *H. glabra* L. (having a chromosome number of $2n = 8$ instead of $2n = 10$) or *H. salzmanniana* DC. (having slender and glabrous peduncles instead of inflated and hairy ones). A comparison of our plants with the type specimen of *H. minima* Desf. housed in Desfontaine’s Herbar de la Flore Atlantique (P) revealed that our plants and the type specimen belong to the same taxon. Since *H. minima* Desf. is an illegitimate name, the correct name of the species is *H. arachnoidea* Poir. In order to promote the knowledge about this hitherto neglected North African species known so far from Morocco, Algeria, and Tunisia, we provide a detailed description along with a key to the Moroccan species of *Hypochaeris* and results of a cytological survey of North African representatives of the genus.

Hypochaeris arachnoidea Desf. ex Poir., Encycl. 5: 572. 1804

≡ *Hypochaeris minima* Desf., Fl. Atl. 2: 238. 1799, nom. illeg. [non Cirillo, Pl. Rar. Neap. Fasc. 1: 29, t. 10. 1788]. – Lectotype (designated here): “Herbier de la Flore Atlantique donné au Museum, par M. Desfontaines / N° / *Hypochaeris minima*” (P).

= *Hypochoeris radicata* f. *setulosa* (Maire & Sennen) Maire in Emberger & Maire, Cat. Pl. Maroc 4: 1164. 1941 ≡ *Hypochoeris radicata* var. *setulosa* Maire & Sennen in Bull. Soc. Hist. Nat. Afrique N. 27: 241. 1936. – Lectotype (designated here): “Maroc, Ulad-Settut, Pont du Muluya, champs”, 13.4.1935, Sennen & Mauricio (BC-Sennen 819894!; isolectotype: BC-Sennen 819895!).

= *Hypochoeris multicaulis* Sennen & Mauricio, Diagn. Nouv. Pl. Esp. Maroc: 236. 1936 ≡ *Hypochoeris glabra* f. *multicaulis* (Sennen & Mauricio) Maire in Emberger & Maire, Cat. Pl. Maroc 4: 1164. 1941. – Lectotype (designated here): “Maroc, Alluvions du Muluya (Ulat-Settut)”, 12.6.1934, Sennen & Mauricio [Plantes d’Espagne N° 9453] (BC-Sennen 819891!; isolectotype: BC 81004!).

= *Hypochoeris grandiflora* Sennen & Mauricio, Diagn. Nouv. Pl. Esp. Maroc: 236. 1936. – Lectotype (designated here): “Maroc, Beni-Snassen, Berkane, steppes Muluyennes”, 14.4.1934, Sennen & Mauricio [Plantes d’Espagne N° 9454] (BC 81003!; isolectotype: BC-Sennen 819853!).

Annuals with 1-8 scape-like stems. *Rosette leaves* 18-50(-75) mm long and 4-14(-20) mm wide, obovate to narrowly obovate in outline, shallowly dentate to pinnatifid (lobed, lyrate), lamina adaxially moderately hispid with (0.9-)1.3-2.1(-2.5) mm long setae, abaxially glabrous with 0.6-1.2(-1.6) mm long setae confined to the nerves or sparsely hispid, leaf margins ± densely ciliate with 0.5-1.2 mm long setae. *Stems* erect or ascending, 6-16(-21) cm high, basally 0.5-1.1(-1.4) mm in diameter, usually branched in the upper half, apically not or only moderately incrassate and 0.7-1.4(-1.7) mm in diameter, green, basally sometimes tinged red, shallowly sulcate, basally sparsely hispid with 0.7-1.6(-2.2) mm long setae, apically glabrous, with few bracteoles. *Bracteoles* c. 1.5-5 mm long and 0.5-1.5 mm wide, triangular or ovate, abaxially glabrous, sometimes with 1-2 setae on the midrib, adaxially sparsely hairy. *Capitula* 13-25 mm in diameter. *Involucrum* at anthesis 8-15 mm long and 7-17 mm in diameter, at maturity 15-20 mm long and 15-22 mm in diameter; involucre bracts in 3-4 rows, glabrous, except for some hairs near the tip and a ± incomplete single line of (0.8-)1.1-1.6(-1.9) mm long setae along the midribs, green, apically dark green to black, sometimes flushed bluish white due to waxy coatings, with hyaline membranous margins, after dispersal of achenes involucre bracts usually reflexed; the outermost triangular to narrowly triangular, 1.5-4 mm long and 0.7-1.5 mm wide, acute, with rather narrow membranous margins; the middle ones narrowly ovate-elliptical to lanceolate, 6-13 mm long and 1.3-3 mm wide, acute, laterally with up to 1 mm wide hyaline membranous margins; the innermost lanceolate, (8-)11-17(-20) mm long and 1.7-2.7 mm wide, acute, laterally with up to 1 mm wide hyaline membranous margins, often glabrous without median row of setae. *Receptacle* at maturity c. 4-5 mm in diameter, alveolate, with up to 0.1 mm high ridges around the attachment area of each achene, paleate; pales narrowly lanceolate, at maturity up to 14-20 mm long and 1.5 mm wide, hyaline, membranous, tapering gradually into a black, filiform apex, caducous at maturity. *Ligules* yellow, the marginal greenish abaxially, 11-13 mm long; limb 7-8.5 mm long and 2-3 mm wide; apical teeth 0.4-0.8 mm long; tube 4-4.5 mm long; anther tube 2.9-3.5 mm long with 0.3-0.5 mm long apical anther appendages; style 8-9.5 mm long; style branches 1-1.1 mm long. *Achenes* homomorph or heteromorph. In *homocarpic capitula* achenes all beakless, c. 2.8-3.2 mm long and 0.7-1 mm in diameter, narrowly conical, round in cross-section, with c. 15 longitudinal rows of exocarpic scales; *pappus* biseriate; outer pappus elements bristle-like, up to 4.5 mm long; inner ones plumose and up to 8 mm long. In *heterocarpic capitula* marginal achenes beakless as described above; central ones beaked (rostrate); achene body fusiform, c. 3 mm long and 0.5-0.7 mm in diameter, with c. 15 longitudinal rows of exocarpic scales; rostrum c. 9 mm long and with 5 longitudinal rows of exocarpic scales; *pappus* biseriate; outer pappus elements bristle-like, 0.3-3 mm long; inner ones plumose and up to 8 mm long.

Chromosome number: $2n = 8$.

Key to the Moroccan species of *Hypochaeris*

1. Achenes with c. 15 longitudinal rows of exocarpic scales 2
 - Achenes with 5 transversely ribbed segments 5
2. Plants annual 3
 - Plants perennial *H. radicata* L.
3. Limb of ligules up to 5 mm long *H. glabra* L.
 - Limb of ligules longer than 5 mm 4
4. Peduncles strongly inflated, hairy *H. salzmanniana* DC.
 - Peduncles not or moderately inflated, glabrous *H. arachnoidea* Poir.
5. Plants annual *H. achyrophorus* L.
 - Plants perennial 6
6. Pappus bristles broadened basally 7
 - Pappus bristles not broadened basally *H. angustifolia* (Litard. & Maire) Maire
7. Involucral bracts glabrous besides setae
 - *H. alliatae* (Biv.) A. Galán & al. [= *H. laevigata* auct., non (L.) Ces. & al.]
 - Involucral bracts with a fine, arachnoid indumentum besides setae
 - *H. leontodontoides* Ball

A cytological survey of North African species of *Hypochaeris*

Due to both a comprehensive aneuploid series of chromosome numbers ($x = 6, 5, 4,$ and 3) and a high diversity in karyotypes realised in *Hypochaeris*, this genus has been studied cytologically very intensively within the past 15 years (e.g. Mugnier & Siljak-Yakovlev 1987, Barghi & al. 1989, Ruas & al. 1995). The mentioned studies showed that the complete aneuploid series is only observed in species distributed in Europe and the Mediterranean, while all South American species have a basic chromosome number of $x = 4$. On the other hand, the Old World representatives are characterised by rather symmetrical and unimodal karyotypes, while the New World species constantly show strongly asymmetrical and bimodal karyotypes; the only exception being *H. robertia* from the Tyrrhenian Islands, the Italian peninsula, Sicily, and Tunisia, which exhibits a karyotype very similar to those known from the South American species of the genus. The present contribution adds new karyotype information for the three Maghrebian endemics *H. arachnoidea*, *H. angustifolia*, and *H. leontodontoides* along with reports of karyotypes for Moroccan (and one Irish) populations of *H. achyrophorus*, *H. alliatae* and *H. radicata*.

Material and methods

Hypochaeris achyrophorus L. – Population 1: Morocco, Rif oriental, Col du Nador, 14 km E Boured on road S 312 to Taza, mudstone, 1350 m, 34°44'N, 4°01'W, 17.6.1992, Vogt 9522 & Oberprieler 3959 (B); Population 2: Morocco, Rif oriental, Col du Nador, c. 10 km NW Aknoul on road S 312 to Boured, mudstone, 1340 m, 34°43'N, 3°08'W, 17.6.1992, Vogt 9526 & Oberprieler 3963 (B).

Hypochaeris alliatae (Biv.) A. Galán & al. – Population 1: Morocco, Prov. de Taza, Moyen Atlas, surroundings of Taffert along the road from Ahermoumou (Ribat-el-Kheyr) to Jebel Bou Iblane (4803), 1400-1600 m, limestone, 33°40'N, 4°15'W, 25.6.1989, Oberprieler 1903 (B); Population 2: Morocco, Prov. de Taza, Moyen Atlas, Jebel Bou Iblane, surroundings of the Refuge de Taffert near the road (4803), 1830-1930 m, cedar forest, 33°39'N, 4°10'W, 25.6.1989, Oberprieler 1953 (B); Population 3: Morocco, Moyen Atlas, 18km S Taza along road S311 to Gouffe de Friovato and Djebel Tazzeka, W-facing limestone rocks under *Quercus ilex*, 1200 m, 34°08'N, 4°02'W, 15.6.1992, Vogt 9467 & Oberprieler 3904 (B).

Hypochaeris angustifolia (Litard. & Maire) Maire – Morocco, Prov. d'Er-Rachidia, 4 km S of Boumia along the road to Tounfite (3427), 1560 m, 32°42'N, 5°06'W, 30.6.1989, Oberprieler 3340 (B).

Table 1. Summary of karyotype asymmetry values of the present survey and from other published data. Intrachromosomal and interchromosomal asymmetry were calculated as defined by Romero Zarco (1986; A1 and A2) and Barghi & al. (1989; AsI and R).

Species	Pop.	2n	Chromosome set	AsI	R	A1	A2
<i>H. achrophorus</i>	1	12	6m+2m-sat+2sm-m+2sm-sat	60.7	1.7	0.34	0.19
	2	12	8m+2m-sat+2sm-sat	59.2	1.6	0.40	0.16
<i>H. alliatae</i>	1	12	4m+4sm+4st-sat	67.9	1.9	0.52	0.22
	2	12	4m+2m-sm+2sm+4st-sat	67.1	1.8	0.49	0.21
	3	12	4m+2m-sm+2sm+2sm-sat+2sm-st-sat	67.3	2.3	0.50	0.24
<i>H. angustifolia</i>		8	2m+2m-sat+2sm-sat+2st-sat	66.3	2.3	0.47	0.35
<i>H. arachnoidea</i>		8	4m+4m-sat	57.6	1.3	0.27	0.10
<i>H. leontodontooides</i>		12	4m+2m-sm+2sm+4sm-sat	64.1	2.1	0.44	0.26
<i>H. radicata</i>	1	8	2m+2m-sm+2sm+2sm-sat	62.9	1.5	0.40	0.14
	2	8	6m+2m-sat	57.6	1.3	0.34	0.13
Mugnier & Siljak-Yakovlev (1987):							
<i>H. illyrica</i>		10	4sm+4sm-sat+2st	71.0	1.6	0.59	0.18
<i>H. maculata</i>	1	10	4sm+4sm-sat+2st	70.0	1.4	0.57	0.14
	2	20	8sm+8sm-sat+2sm-st+2st	70.0	1.6	0.57	0.15
Barghi & al. (1989):							
<i>H. alliatae</i> [sub <i>H. laevigata</i>]		12	4m+4sm+2sm-sat+2st-sat	63.6	1.7	0.40	0.20
<i>H. cretensis</i>		6	4m+2m-sat	56.1	1.8	0.23	0.27
<i>H. glabra</i>		10	6m+2sm+2sm-sat	61.7	1.3	0.36	0.10
<i>H. radicata</i> subsp. <i>neapolitana</i>		8	2m+2m-sm+2sm+2sm-sat	62.4	1.5	0.38	0.15
<i>H. radicata</i> subsp. <i>radicata</i>		8	4m+2m-sat+2sm	61.7	1.4	0.37	0.13
<i>H. robertia</i>		8	2m+4sm-sat+2st-sat	71.9	4.5	0.48	0.59
Ruas & al. (1995):							
<i>H. brasiliensis</i>		8	4m+4st	71.3	3.2	0.52	0.45
		8	4m+4st	71.9	3.8	0.49	0.54
<i>H. megapotamica</i>		8	4m+4st	73.3	4.0	0.53	0.48
<i>H. microcephala</i> var. <i>albiflora</i>		8	4m+2sm+2st	72.5	2.8	0.54	0.44
<i>H. pampasica</i>		8	2sm-sat+2sm+4st	74.7	3.6	0.62	0.49
<i>H. radicata</i>		8	2m+2m-sm+2sm-sat+2sm	62.0	1.6	0.37	0.15
<i>H. radicata</i> [sub <i>H. glabra</i>]		8	4m+2m-sat+2sm	60.2	1.5	0.33	0.14
<i>H. rosenfurtii</i>		8	2m+2sm-sat+4st	74.2	3.5	0.58	0.46
<i>H. variegata</i>		8	4m+2sm+2st	72.1	3.4	0.46	0.48

Hypochaeris arachnoidea Poir. – Morocco, Prov. Figuig, road P 32 between Bouarfa and Figuig, north-facing slopes of Djebel Grouz c. 23 km W Figuig, mountains c. 6 km S of road P 32, rocks and stony slopes, 1100-1300 m, 32°08'N, 1°24'W, 1.5.1993, Vogt 10574 & Oberprieler 5022 (B).

Hypochaeris leontodontooides Ball – Morocco, Prov. d'Er-Rachidia, Grand Atlas, gorge Arhbalou n'Oussaka between Jebel Masker and Jebel Bou Ijallabene, S of Assaka, 1950-2000 m, limestone, 32°22'N, 5°22'W, 2.7.1989, Oberprieler 3399 (B).

Hypochaeris radicata L. – Population 1: Morocco, Moyen Atlas, Forêt de Jaaba, c. 15 km SE of El Hajeb on road to Ifrane (S 309), *Quercus canariensis* wood, 1400 m, 33°36'N, 5°17'W, 9.6.1992, Vogt & Oberprieler 3816 (B); Population 2: Ireland, Co Kerry, Beara Peninsula, Dereen Gardens near the shore of Kenmare River, 12.8.1994, Oberprieler 8373 & Ueckert (B).

Root tips were obtained either by growing plants in the Botanic Garden Berlin-Dahlem or by germinating achenes in petri dishes. In both cases root tip meristems were pretreated with hydroxy-chinoline (0.002 molar aqueous solution) for 4 h, fixed in 96 % ethanol/glacial acetic acid (3:1)

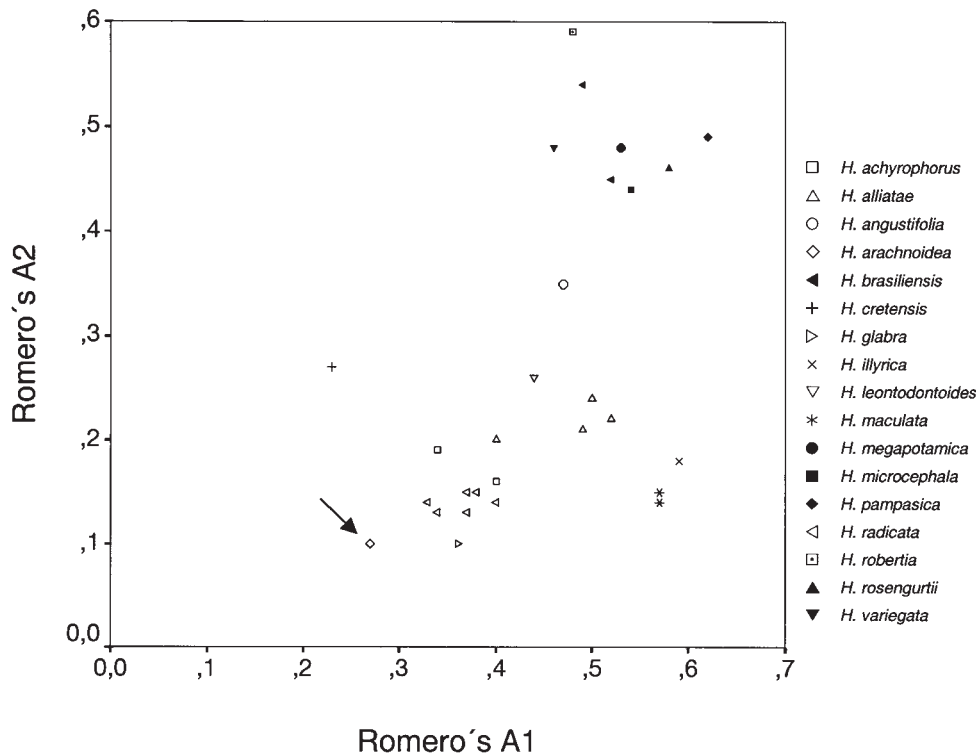


Fig. 1. Intrachromosomal (A1) and interchromosomal (A2) asymmetry in Mediterranean (open symbols) and S American (filled symbols) representatives of *Hypochaeris*, an arrow indicating the position of *H. arachnoidea*. Indices A1 and A2 were assessed using the formulare of Romero Zarco (1986).

and refrigerated. Hydrolysis was carried out with 1-2 N hydrochloric acid for 10 min at 60 °C. For chromosome staining root tips were squashed in aceto-orcein. The determination of homologues and their description follows Levan & al. (1964). At least twenty metaphase stages were examined for every population (with the exception of *H. leontodontoides* where only 5 metaphase stages were obtained due to the lack of more seed material). Camera-lucida drawings of the chromosomes were made with a Zeiss Standard 16 microscope and measured with a Wild M5A binocular for arm lengths. The other variables provided in the tables were calculated on the basis of these measurements. Arm ratio of a chromosome is expressed by the ratio long arm / short arm, the karyotyp asymmetry index (AsI) by the ratio long arms in chromosome set / total chromosome length in the set $\times 100$, following Arano & Saito (1980), and R represents the ratio longest pair / shortest pair in the chromosome set. In addition, intrachromosomal asymmetry index (A1) and karyotype asymmetry (A2) were also assessed following the methods described by Romero Zarco (1986).

Results

While chromosome number reports for *Hypochaeris arachnoidea* and *H. angustifolia* are given here for the first time, our counts for the other species are in accordance with already published chromosome numbers (e.g. Dahlgren & al. 1971 for *H. achyrophorus*, Barghi & al. 1989 for *H. alliatae* [sub *H. laevigata*], Quezel 1957 and Galland 1990 for *H. leontodontoides*, and numerous counts for *H. radicata*).

Karyotype data for each taxon and population are reported in Table 1, along with karyotype information available from the literature (Barghi & al. 1989, Mugnier & Siljak-Yakovlev 1987, Ruas & al. 1995). The morphometric data on the chromosomes for each taxon and population are reported in Table 2 (see Electronic supplement, <http://www.bgbm.fu-berlin.de/bgbm/library/publikat/willd32/oberprieler&vogt.htm>). Intrachromosomal and interchromosomal asymmetry of karyotypes as expressed by the indices A1 and A2 (Romero Zarco 1986) are also presented in the scatter plot of Fig. 1.

It is obvious that the main discontinuity in the data set is between the European and Mediterranean representatives of *Hypochoeris* on the one hand and the South American species (and *H. robertia*) on the other. This difference is mainly due to the bimodal karyotype in the latter group (high A2 values) when compared to the higher interchromosomal symmetry in the former. However, the here reported karyotype of *H. angustifolia* exhibits a somewhat intermediate position between these two groups. On the other hand, the karyotype found in *H. arachnoidea* appears to be one of the most symmetrical in the whole genus, with all chromosomes being metacentric and very similar to each other in size. As all karyotypes found in *H. radicata* populations appear to be more asymmetrical, we consider this observation a further evidence for the taxonomic independence of the annual *H. arachnoidea* from its perennial counterpart *H. radicata*.

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