

Chenopodium hoggarense (Amaranthaceae), a new species from Algeria and Chad

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Abstract: Chenopodium hoggarense Uotila & C. Chatel., a new species of the family Amaranthaceae s.l. (Chenopodiaceae s.str.) from the Hoggar and Tibesti mountains of the Sahara, in Algeria and Chad, is described and illustrated. The species was found in quantities from the Hoggar (Ahaggar) mountains in 2019. It had been observed there earlier several times, but it was confused with C. vulvaria L. because of its similar smell and dense cover of vesicular hairs. However, it differs from C. vulvaria in growth habit, leaf shape and flower characters. Its relationships to and the identity of C. vulvaria var. incisum Maire are discussed and var. incisum is lectotypified. Chenopodium hoggarense is known only from the isolated Hoggar and Tibesti mountains.

Keywords: Africa, Algeria, Amaranthaceae, Chad, Chenopodiaceae, Chenopodium, Hoggar, new species, Sahara, taxonomy, Tibesti

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Introduction

During an excursion to the Hoggar (Ahaggar) mountains in the central Sahara in October 2019, attention was paid to a small, whitish Chenopodium L., which grew in quantities on rocks. It had a very strong smell, as in the well-known species C. vulvaria L., which is widespread from Mediterranean Europe, North Africa, Turkey and Near East to Iraq, Iran and Afghanistan (Jalas & Suominen 1980; Meusel & Weinert 1992; Uotila 1997; Groom 2015; Sukhorukov & al. 2016; Lomonosova & Uotila in press). However, morphological characters of the plants match neither C. vulvaria nor any other species of Chenopodium, and it proved to be a previously undescribed species of the genus.

Chenopodium hoggarense Uotila & C. Chatel., sp. nov. – Fig. 1, 2, 3(A–D).

Holotype: Algeria, Assekrem, pente Sud menant à l’hermitage (Hoggar) pt 7, 23°15’37”N, 05°38’02”E, 2700 m, 24 Oct 2019, Chatelain, Benhouhou, Mombrial, Mesbah, Baa & Benghanem CM874 [G (G00408262)! [Fig. 1]; isotypes: ENSA!, G (G00408265)! [H (H1777033)!].

Diagnosis — Small(579,778),(964,801) annuals, strongly smelling like rotting fish (trimethylamine) and densely covered with vesicular hairs as in Chenopodium vulvaria L., but differing from that species by red colour sometimes present on stem and leaves, erect stem with short branches, leaves much longer than broad and often mucronate to cuspidate at apex, inflorescence mostly leafless in upper 1/3 of stem and branches, paniculate, of mostly well-spaced, dense glomerules, perianth deeply split into lobes, lobes apically winged abaxially and truncate at apex.

Description — Small annuals, strongly smelling like rotting fish (trimethylamine), whitish because of dense indumentum of vesicular hairs, especially in young parts, sometimes with red colour on stems, leaf margins and perianth segments. Stem erect, green with red longitudinal stripes, 10–16(–18) cm tall, hard, branched in lower half; branches spreading to erectopatent, straight, short, usually without secondary branches. Leaves erectopatent to erect; petiole 3–5 mm long; blade trullate to ovate to elliptic-ovate, entire or very slightly 3-lobed, 9–11 × 6–7 mm, becoming ± glabrescent on upper surface and often red at least on margin when old, base obtuse, mar-

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gin entire or with a few obscure teeth, apex acute to mucronate to cuspidate; upper leaves narrowly elliptic to lanceolate (Fig. 3A). Inflorescence occupying most of plant height, composed of paniculately arranged, mostly well-spaced, dense glomerules, mostly leafless in upper 1/3 of stem and branch length, in leaf axils in lower parts. Perianth lobes 5, basally united for 1/4–2/5 of their length, 0.7–1 mm long, densely farinose, free parts spreading in fruit, abaxially with a narrow, wing-like keel in apical part, midrib strong, visible adaxially, margin broad, membranous, minutely ciliate, apex truncate, sometimes red; receptacle cupuliform to obconic (Fig. 3B–D). Stamens 5; anthers 0.3–0.4 mm long. Stigmas 2, very short, c. 0.2 mm long. Fruits mostly falling without perianth;
Chenopodium hoggarense could be an endemic species for the isolated mountains of the Sahara. Maire (1933) described 58 new taxa from the Hoggar, but they did not all prove to be endemic. It is difficult to estimate the number of taxa endemic to the Hoggar even now, but it probably does not exceed 20 among the total of 350–399 species reported from the area (Lebrun 1981; Chenoune 2005; Médail & Quézel 2018: 108). Also, C. hoggarense is probably endemic to a wider area, at least for the Hoggar and Tibesti mountains.

Etymology — the specific epithet refers to the Hoggar mountains, the core area and locality of the type collection of the species.

Remarks — Chenopodium hoggarense shares some common features with C. vulvaria, such as the smell of tri-methylamine and dense cover of vesicular hairs. However, it differs from C. vulvaria in many taxonomically essential morphological features, among others in its growth habit, presence of red colour, leaf shape, inflorescence and perianth characters (Table 1; Fig. 3). The red colour detected in 2019 on the plants of C. hoggarense may be a stress response to the extreme circumstances in the high altitude; it was not seen in the other specimens studied. Despite its smell, C. hoggarense is not necessarily closely related to C. vulvaria, which is an isolated species and phylogenetically sister to the other species of Chenopodium s.str. (Fuentes-Bazan & al. 2012; Mandák & al. 2018). A similar smell has also been reported from some other, unrelated and geographically separated

| Characters          | Chenopodium hoggarense                                                                 | Chenopodium vulvaria                                                                 |
|---------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Colour and habit    | often red on stems and leaves; stem erect; branches spreading to erectopatent, straight, short | rarely reddish; stem procumbent to ascending to erect; branches procumbent to ascending, long |
| Middle leaves       | trullate to ovate to elliptic-ovate, entire or very slightly 3-lobed, much longer than broad, margin entire to obscurely dentate, apex acute to mucronate to cuspidate | broadly trullate to rhombic-ovate, entire, slightly longer than broad, margin entire, apex obtuse to subacute, not mucronate to cuspidate |
| Inflorescence       | mostly leafless in upper 1/3 of stem and branches, paniculate, of mostly well-spaced, dense glomerules | leafy, in apical parts of stem and branches, paniculate, of loose thyrses |
| Perianth             | divided more than halfway, lobes apic ally winged abaxially, margin broad, membranous, apex truncate | divided less than halfway, lobes slightly rounded abaxially, margin narrow, membranous, apex obtuse |
| Seeds               | 1.2–1.3 × 1.1–1.2 mm                                                                 | (0.9–)1–1.2 × (0.9–)1–1.2 mm                                                       |
Chenopodium species, such as *C. hircinum* Schrad. (South America), *C. frutescens* C. A. Mey. (Siberia and Central Asia), *C. sosnowskyi* Kapel-ler (E Turkey, Caucasus and Iran), *C. detestans* Kirk (New Zealand) and some other taxa (see Mosyakin & Iamonico 2017; Lomonosova & Uotila in press; and references there- in). However, in *C. vulvaria* and *C. hoggarense* the smell is probably stronger than in other species and, at least in *C. vulvaria*, can still be de- tected from herbarium speci- mens that are several years old. The specimens of *C. hoggarense* collected in 2019 still had a very strong smell in the autumn of 2020, but by the autumn of 2021 the smell was only weakly detected by moistening and rubbing the leaves of the specimens.

*Chenopodium hoggarense* could resemble small plants with ± entire leaves of some members of the polymorphic species aggregate *C. album* L. (sensu lato) but differs from them in the smell (not known, or at least not evidently perceptible, in *C. album*), dense cover of vesicular hairs (usu- ally sparser in *C. album*), leaf shape with mucronate to cus- pidate apex (mostly acute in *C. album*) and perianth char- acters.

In the Hoggar in 1928, R. Maire collected plants that he identified as *Chenopodium vulvaria*. He also determined specimens collected by Th. Monod from the same area during “Mission Saharienne Augiéras-Draper 1927–1928” as the same species. On the basis of these specimens, Maire (1933: 80) reported *C. vulvaria* from the summit of Atakor and several other places in the Hoggar at altitudes of 1060–3000 m. He re- corded it as very abundant on slopes and rocky plateaux of the high mountains in the upper and lower Mediterra- nean levels, from which it descended along wadis to the tropical level, particularly in cultivated places.

Maire (1933) also noted morphological differences of the Hoggar plants from the Mediterranean *Chenopodium vulvaria* and even provided a description of the former ("40–60 cm tall, rather short and ascending branches, elongated inflorescence, leaves often lobed, resembling *C. opulifolium* Schrad.")., but he neither named the taxon nor discussed the importance of this observation. The de- scription “leaves often lobed” corresponds to only two of his specimens (*Maire 1067* from Hoggar and *Maire 1063* from Tefedest), but the others have typical, ± entire leaves of *C. hoggarense*. Laperrine’s specimen (MPU276164) may indicate that also *C. opulifolium* Schrad. ex W. D. J. Koch & Ziz could have grown in the area: it was named by the collector as “Aggaouit” (the Tuareg name for *C. opulifolium*). However, Maire corrected the identification to *C. vulvaria*, with an addition “Taouit (non Aggaouit)”. 

Fig. 3. A–D: *Chenopodium hoggarense*; A: leaves; B: perianth, apical view; C: perianth, lateral view; D: perianth, basal view. – E: *Chenopodium vulvaria*, young perianth, lateral view. – Scale bars: A = 5 mm; B–E = 1 mm. – Based on the holotype. – Drawings by C. Chatelain.
Ozenda (2004: 225) mentioned Chenopodium vulvaria as an alien plant from the central Sahara; the drawing included in his flora corresponds rather well to C. hoggarense by its leaf shape and deeply lobed perianth, but the habit is not so typical, possibly due to damage from grazing animals.

Additional specimens examined

**ALGERIA:** Wilaya de Tamanrasset: Coudia du Hoggar, 1927, Monod 144 (P [P04940923]); Monod 153 (P [P04940921]); Hoggar, Laperrine s.n., in herb. Maire (MPU [MPU276163]); Atakor-n-Ahaggar, 19 Mar 1928, Maire 1061 (MPU [MPU276161]); Montibus Ahaggar, im-Amgel in cultis, 1060 m, 2 Apr 1928, Maire 1062 (MPU [MPU276167]); Montibus Ahaggar, Issekkressem, in lapidosis basalticis 2070 m, 22 Mar 1928, Maire 1068 (P [P04940924]); Hoggar-Massif, Umgebung des guelta Affilal, 2050 m, Felsen, Sand und Sumpf, 24 Mar 1980, Podlech 33352 (G); Hoggar-Massif, Assekrem Sudhänge, 2520 m, 25 Mar 1980, Podlech 33397 (G); Assekrem, Nov 1953, Quézel s.n. (MPU [MPU276159]); Hoggar au-dessus de 2000 m, s.d., Lhote s.n. (MPU [MPU276162]). — **CHAD:** Tibesti, Toussidé, 2000 m, in lapidosis basalticis, Mar 1931 Dalloni s.n. (P [P04940922]) [image seen]; Tibesti, 12 Nov 1940, Monod 7829 (IFAN [IFAN26382]) [image seen]); both specimens from Chad represent basal parts of injured plants only.

**Identity of Chenopodium vulvaria var. incisum**

Chenopodium vulvaria var. incisum Maire in Bull. Soc. Hist. Nat. Afrique N. 34: 184. 1943. – **Lectotype (designated here):** Algeria, in montibus Ahaggar Tazerouk, in alveo arenoso aminis, 1900–1950 m, 20 Mar 1928, Maire 1067 (P [P04940937]); isolectotype: MPU [MPU005496]).

Remarks — Maire (1943) described Chenopodium vulvaria var. incisum from Hoggar and Tefedest with the description given in Maire (1933), but without the reference to C. opulifolium. Further, he did not mention anything of the smell, but the placement of the variety under C. vulvaria might at least suggest the presence of a similar smell. He also noted that this plant was mentioned unnamed in his study from the central Sahara in 1933 and that it grows also in Tibesti. He reproduced the same description and geographical information in his Flore de l’Afrique du Nord (Maire 1962), in which he accepted var. incisum as the only lower taxon of C. vulvaria from the central Sahara. However, neither the type material of var. incisum nor the specimens determined by Maire as
The specimens collected or determined by Maire seem to represent two kinds of plants, one with almost entire leaves (typical Chenopodium hoggarense) and another with three-lobed leaves (typical var. incisum). In growth habit and type of inflorescence, var. incisum resembles C. hoggarense, which is also the case if they both have a similar smell. But the distinctly three-lobed leaves of var. incisum do not match the plants of C. hoggarense seen in 2019 or many other specimens, all with fully or almost entire leaves. However, such leaf dimorphism is not completely unknown in Chenopodium, e.g. seen at least in Asiatic C. novopokrovskyana (Aellen) Uotila and North American C. pratericola Rydb.

Chenopodium opulifolium and C. vulvaria var. incisum resemble each other because they can both be strongly farinose and may have three-lobed leaves with acute or even mucronate apices. But the leaves of C. opulifolium are as broad as long, sometimes even broader, and the margins are more distinctly dentate, whereas leaves of var. incisum are only narrowly three-lobed, otherwise weakly dentate if at all. Furthermore, the growth habit of C. opulifolium is usually strongly branched, the branches long and fairly spreading, also in the inflorescence, whereas var. incisum has only short branches from basal parts of the stem and the branches of the inflorescence are short and erectopatent. Maire (1962) reported C. opulifolium only from the N part of North Africa. However, the variation in characters of C. opulifolium in North Africa seems to be different and wider than is typically reported from Europe. Even C. album occurs in North Africa. It is variable and the growth habit may resemble that of var. incisum. But its leaves are larger, with variable shape and dentation, but never in the combination seen in var. incisum.

Because there are some doubts about the identity of Chenopodium vulvaria var. incisum, its position is left open here.

**Uses** — Gast & al. (1972) and Gast (2000) reported that Chenopodium vulvaria (under the name of Taouit, in Tamasheq), which grew on the slopes of the Atakor and of the Adrar des Ifoghas between 1000 and 2700 m, could be very abundant there in rainy years. Then seeds were collected in quantities by the Tuaregs of the Ahaggar and they ground flour from them to be used in pancakes or porridge-like cereal or to “bulk out” cereal dishes, e.g. mixed with wheat or millet. Gast (2000) also noted that flour/seeds lacked the smell, so unmistakably present in the leaves. Spare seeds were even sown deliberately for future crops. Seeds were also considered good against tropical fever, which is why people travelling by caravans to Sudan carried them as a medicinal plant. Obviously this plant is C. hoggarense, no other Chenopodium has been observed at this altitude in such quantities. The use and even sowing by Tuaregs may explain the occurrence
of C. hoggarensense in cultivated places, as reported by Maire (1933, as C. vulvaria), and intentional carrying by caravans might have caused spreading along their routes.

Additional specimens examined — Algeria, Wilaya de Tamanrasset, Hoggar (without precise locality), Laperrine s.n. (MPU [MPU276164]); Montis Tefedest annem Ageilil in humidis, 1200 m, 11 Apr 1928, Maire 1063 (MPU [MPU276166] mixed with Chenopodium murale (L.) S. Fuentes & al.).

Author contributions

P.U. and C.C. described the new species and carried out the herbarium research, field collections were made by C.C., F.M., M.M., S.Ba., S.Be. and A.N.B. All authors contributed to the text and approved the final version of the manuscript.

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