



A revision of *Rhaponticoides* (Asteraceae, Cardueae–Centaureinae) from Iran

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Abstract

A taxonomic review of *Rhaponticoides* in Iran is based on morphological characters of the specimens from the authors' expeditions and other herbarium collections. *Rhaponticoides lachnopus*, *R. schmidii*, *R. sect. Iranicae* and *R. sect. Ruthenicae* are proposed as new combinations. Full description for the genus *Rhaponticoides* and *R. sect. Iranicae* and *R. sect. Ruthenicae* are presented for the first time here. Three names, *R. lachnopus*, *R. ruthenica* and its synonym, are typified. A synopsis with recognized sections and species, relevant synonyms, type citations, lists of specimens examined and an identification key are provided for the genus *Rhaponticoides* in Iran. In addition, some notes about ecology and habitat of *Rhaponticoides* especially in Iran are given. Finally, the geographical distribution of all the 4 species recognized in Iran is presented and mapped.

Key words: *Centaurea*, Compositae, Flora Iranica, identification key, lectotypifications, neotypifications, new combinations, taxonomy

Introduction

Centaurea Linnaeus (1753: 909) is one of the largest genera of the family Asteraceae (Bremer 1994, Wagenitz & Hellwig 1996, Hellwig 2004). *Centaurea* s.l. is considered as a non-monophyletic genus and recent approaches have separated it into more monophyletic genera, namely *Centaurea* s. str., *Cyanus* Miller (1754: 4), *Psephellus* Cassini (1826: 488), and *Rhaponticoides* Vaillant (1754: 165) (Wagenitz & Hellwig 2000, Greuter 2003, Hellwig 2004).

According to Hellwig (2004), the genus *Rhaponticoides* comprises 32 species occurring from Portugal and Morocco in the west to Mongolia in the east. However, recently 4 new species and 4 new combinations were published in this genus (Eren 2007, Martins 2007, Doğu *et al.* 2009, Puntillo & Peruzzi 2009, Tan *et al.* 2009, Greuter & Raus 2009, Cinbilgel *et al.* 2014, Ranjbar & Negaresh 2014a). With these treatments the number of species in *Rhaponticoides* has increased to 40.

When the first revision of *Centaurea* for the flora of Iran was made by Wagenitz (1980), *C. ruthenica* Lamarck (1785: 663), *C. bachtiarica* Boissier & Haussknecht in Boissier (1875: 587), *C. lachnopus* Rechinger (1940: 152) and *C. schmidii* Wagenitz (1980: 330) were classified under *C. sect. Centaurea* as Iranian representatives of a well defined group based on the following morphological features: mostly pinnatipartite or pinnatisect leaves with serrate or remotely denticulate segments, subglabrous stems, branched above with a few large capitula, ovoid or subglobose involucre, coriaceous, nearly exappendiculate and glabrous involucral bracts with several dark longitudinal nerves near an obtuse apex, peripheral flowers yellow and strongly radiant, with staminodes (Wagenitz 1980). Two of these species were transferred to *Rhaponticoides*: *Centaurea ruthenica* by Greuter & Agababian (Greuter 2003) and *C. bachtiarica* by Martins (2007).

Studies of herbarium specimens and earlier treatments showed that the genus *Rhaponticoides* is represented by 4 species in Iran. There are still two neglected species which need to be transferred into the genus *Rhaponticoides*. We carried out a comprehensive morphological comparison between the sections and species of *Rhaponticoides* in Iran. Also, full descriptions were presented for the genus and two its sections for the first time. Finally, in order to establish the taxonomic positions of the Iranian members of *Rhaponticoides*, a literature review was performed. On the basis

of our observations two Iranian sections, namely *R. sect. Iranicae* (Agababian 1997: 894) Negaresh, *comb. & stat. nov.* (with 2 species: *R. lachnopus* (Rechinger 1940: 152) Negaresh, *comb. nov.* and *R. schmidii* (Wagenitz 1980: 330) Negaresh, *comb. nov.*) and *R. sect. Ruthenicae* (Dobroczaeva 1962: 43) Negaresh, *comb. & stat. nov.* (with 2 species: *R. bachtiarica* and *R. ruthenica*), were recognized in the genus.

Material and methods

Published sources as well as herbarium specimens from the herbaria BASU, BM, E, FUMH, G, JE, K, KU, LE, LINN, M, P, US, W and WU (acronyms follow Index Herbariorum online at <http://sweetgum.nybg.org/ih/>) were used in this study. Digitised specimens were received upon request from the relevant Herbaria, viewed via online herbarium catalogues of the Herbaria or via JSTOR (2012). A preliminary list of characters that had been or may be used in delimiting the sections and species of *Rhaponticoides* was developed. The taxonomic value of these characters was assessed by examining specimens from across the range of the genus in different regions of Iran as well as by observations in the field. The characters include the indumentum of plants, the number and ramification of stems, the shape, length, margin and dissection of leaves, the shape, size and number of involucre, the shape, size and venation of phyllaries, shape, size and texture of appendages, the color of flowers, the size, shape and color of achenes, and the shape, length and color of pappus. Measures were obtained from at least 5 replicates of each specimen and the average value was evaluated. The maximum and minimum values of the measures are given in the descriptions of taxa.

Results and discussion

Taxonomic treatment of *Rhaponticoides*

Rhaponticoides Vaillant (1754: 165). Type (designated by Agababian in Greuter 2003: 51):—*Rhaponticoides centaurium* (L.) M. V. Agab. & Greuter.

Centaurea sect. *Centaurium* Candolle (1838: 566). *Centaurea* subgen. *Centaurium* (DC.) Hayek (1901: 586). Type:—*Centaurea centaurium* L.

Bielzia Schur (1866: 409). Type:—*Bielzia schwarzenbergiana* (Schur) Schur.

Plant perennial, herbaceous, with string-like root or arising from thick rhizomes, lacking creeping underground runners, (20–)50–300 cm tall, sometimes densely covered with lanate-pubescent hairs at base. Stems single or several, simple or branched usually in upper part, often sulcate, often glabrous, sometimes arachnoid to arachnoid-tomentose, rarely loosely pilose. Leaves petiolate or sessile, often pinnatifid or pinnatisect, pinnatifid or lyrate, rarely undivided, the uppermost usually reduced, sometimes segments decurrent along the rachis, usually glabrous, occasionally with scattered hairs or thin woolly tomentose hairs, mostly tomentose to weakly pilose on axils of basal leaves. Capitula monocephalous or polycephalous, medium to large-sized, rarely small-sized, with many flowers, solitary at tips of the main stem and its branches. Involucre ovoid, broadly ovoid to subglobose, subglobose or oblong, (15–)20–35(–50) × 10–40(–50) mm, glabrous, subglabrous or loosely tomentose-arachnoid. Phyllaries multiseriate, coriaceous, yellowish or greenish, becoming dark-brown apically, conspicuously longitudinally striate with blackish, brown or green lines, obtuse or roundish at apex. Outer phyllaries suborbicular or broadly ovate; middle phyllaries broadly oblong or oblong-orbicular; inner phyllaries oblong-ovate or oblong. Appendages very small and indistinct to large, 0.5–14 mm wide, concealing minor to major part of phyllaries, membranous-scarious, hyaline or pale brown to brown, orbicular or suborbicular or spoon-shaped, the innermost oblong, conspicuously longitudinally striate with blackish or brownish nerves, sometimes decurrent, margin entire, flat to slightly undulate, undulate or lacerate. Flowers yellow in vivo, sulphury in sicco, or purple; central flowers hermaphrodite, 1.5–2 times as long as involucre, stamen filaments flattened and covered with papilliform hairs, appendages of anthers gradually acuminate at tip, stigma short-bifid; peripheral flowers sterile, indistinct or distinct, with small or large staminodes, slightly to strongly radiant, 4–5-lobed, the lobes filiform or linear, sometimes elongate-lanceolate. Achenes asymmetrically subcylindrical-truncate, oblong or lanceolate, sometimes obovate, compressed at margins, 5–11 mm long, 2–4 mm wide, brown, dark brown to blackish, transversally wrinkled in the upper part, smooth towards base, insertion areole usually large. Pappus multiseriate, double, persistent, usually as long as achenes, slightly longer, or not less than 2/3 as long, brownish or whitish, outer pappus consisting of several irregular rows of bristles flattened and scabrous on two sides, gradually longer from

very short outer one to middle and inner ones; inner pappus as long as outer or shorter (sometimes longer or entirely reduced), consisting of 1 row of scale-like bristles that are broader in lower part, gradually tapered above, also scabrous and connate into ring at base.

Taxonomic notes:—Agababian (1997) studied the delimitation and distribution of sections and subsections of *Centaurea* subgenus *Centaurea* on the basis of morphological criteria. According to her, *C.* subg. *Centaurea* was subdivided into three sections and seven subsections including two new sections (*C.* sect. *Vicentina* Agababian (1997: 891), *C.* sect. *Africana* Agababian (1997: 892)) and four new subsections (*C.* subsect. *Ruthenicae* Agababian (1997: 894), *C.* subsect. *Aralocaspicae* Agababian (1997: 894), *C.* subsect. *Turkestanicae* Agababian (1997: 894), *C.* subsect. *Iranicae* Agababian (1997: 897)). Greuter (2003) transferred the Mediterranean species of *Centaurea* sect. *Centaurea* to *Rhaponticoides*. But the names of non-Mediterranean species, and also sections and subsections that were recognized by Agababian have not been transferred to *Rhaponticoides* yet. It is better if these subsections are considered as sections which are more commonly accepted in the subtribe Centaureinae (Garcia-Jacas *et al.* 2000, 2001, 2006, Ranjbar & Negaresh 2014b). We transferred two subsections to *Rhaponticoides* here: *C.* subsect. *Iranicae* and *C.* subsect. *Ruthenicae*.

Key to the species of *Rhaponticoides* in Iran

1. Involucres 25–35 × 25–35 mm; appendages large, concealing the major part or the whole of phyllaries2
- Involucres 20–25 × 14–20 mm; phyllaries without appendages or with narrow scarious margin3
2. Basal and lower cauline leaves lyrate or lyrate-pinnatifid, sometimes entire, segments in 2–6(–7) pairs, terminal segment 5–8 cm wide; appendages of median phyllaries 5–10 mm wide; pappus 10–13 mm long*R. lachnopus*
- Basal and lower cauline leaves entirely pinnatisect, segments in 6–8(–9) pairs, terminal segment (1.5–)3–5 cm wide; appendages of median phyllaries 14–16 mm wide; pappus 5–7 mm long*R. schmidii*
3. Basal and lower cauline leaves with 12–15 pairs of segments, margin regularly denticulate or cartilaginous-denticulate; involucre ovoid; scarious margin of phyllaries ca. 0.5 mm wide*R. ruthenica*
- Basal and lower cauline leaves with 7–8 pairs of segments, margin usually entire, sometimes remotely inconspicuously dentate; involucre cupuliform; scarious margin of phyllaries 1–2.5 mm wide*R. bachtiarica*

I. Rhaponticoides sect. *Iranicae* (M. V. Agab.) Negaresh, **comb. & stat. nov.**

Basionym: *Centaurea* subgen. *Centaurea* sect. *Centaurea* subsect. *Iranicae* Agababian (1997: 897). Type:—*Centaurea lachnopus* Rech. f.

Plants densely covered with white lanate pubescence at base, other parts glabrous. Leaves lyrate or pinnatisect, distinctly serrate. Involucres large, 20–40(–50) × 25–40(–50) mm, subglobose or ovoid-globose, sometimes oblong. Phyllaries broadly ovoid to suborbicular; appendages large, concealing the major part or the whole of phyllaries, orbicular, the innermost oblong, decurrent, margin slightly undulate, sometimes lacerate. Flowers yellow, peripheral flowers slightly radiant, staminodes indistinct. Achenes 8–10 mm long; pappus as long as achenes, 8–10(–13) mm long (except *R. schmidii*, pappus shorter than achenes).

Taxonomic and distributional remarks:—All members of *Rhaponticoides* sect. *Iranicae* belong to Irano-Turanian element. This section comprises six species.

1. *Rhaponticoides lachnopus* (Rech. f.) Negaresh, **comb. nov.** (Figs. 1 and 2)

Basionym: *Centaurea lachnopus* Rechinger (1940: 152). *Phaeopappus lachnopus* (Rech. f.) Rechinger (1947: 285). Type:—IRAN. Prov. Semnan: Damghan-Semnan, in desertis gyps. prope Sorkheh, 1600 m, 30 June 1937, *Rechinger 1244* (lectotype W! designated here by Negaresh, islectotypes BM!, US!).

Plants perennial, herbaceous, arising from thick rhizomes up to 2 cm in diam., throughout green, 40–80 cm tall, densely covered with white lanate pubescence at base, other parts glabrous; remains of stems of the previous year present. Stems several, 5 to 15, erect, simple, sometimes producing fairly small sterile capitula, relatively sturdy, sulcate, densely leafy in lower part, otherwise without leaves, 4–5(–6) mm in diam. at base. Leaves coriaceous in vivo, rigid in sicco, variable in dissection, distinctly serrate. Sterile leaves petiolate, simple, 18–24 × 4–5 cm, lanceolate or lanceolate-oblong, sometimes lyrate, with 1–3 pairs of segments; terminal segment strongly larger, broadly ovate, oblong or lanceolate-ovate, 3–14 × 2–8 cm; lateral segments much smaller, lanceolate or oblong. Basal and lower cauline leaves petiolate, lyrate or lyrate-pinnatifid, sometimes undivided, 20–40 cm long, segments in 2–6(–7) pairs, terminal segment 5–8 cm

wide. Median cauline leaves subsessile, 6–12 cm long, lanceolate in outline, pinnatifid or lyrate, segments in 2–4 pairs, sometimes undivided. Upper cauline leaves increasingly reduced, sessile, lyrate, with 1–2 pairs of small segments at base, terminal segments larger, oblong, sometimes undivided, 5–7 cm long. Capitula solitary on long peduncles (up to 40 cm long). Involucres subglobose or ovoid-globose, truncate at base, 25–35 × 25–40 mm. Phyllaries multiseriate, imbricate, appressed, glabrous, green-yellowish, becoming dark-brown apically, conspicuously longitudinally striate. Appendages large, concealing the major part of phyllaries, conspicuously longitudinally striate with brown-blackish nerves, membranous-scarious, 5–10 mm wide, pale brown or hyaline, margin entire, flat to slightly undulate. Outer phyllaries suborbicular, 4–7 × 7–9 mm; appendices decurrent. Middle phyllaries broadly oblong or oblong-orbicular, 12–17 × 10–12 mm; appendices decurrent. Inner phyllaries oblong or narrowly oblong, 22–30 × 5–8 mm; appendices not decurrent. Receptacle densely covered with long white bristles. Flowers yellow in vivo, sulphury in sicco; central flowers hermaphrodite, 38–42 mm long, distinctly 5-veined, anther tube pale yellow, exerted; peripheral flowers sterile, with staminodes, 4–5-lobed, the lobes filiform. Achenes transversally wrinkled, 9–10 mm long, insertion areole large. Pappus multiseriate, persistent, 10–13 mm long, rarely inner row shorter.

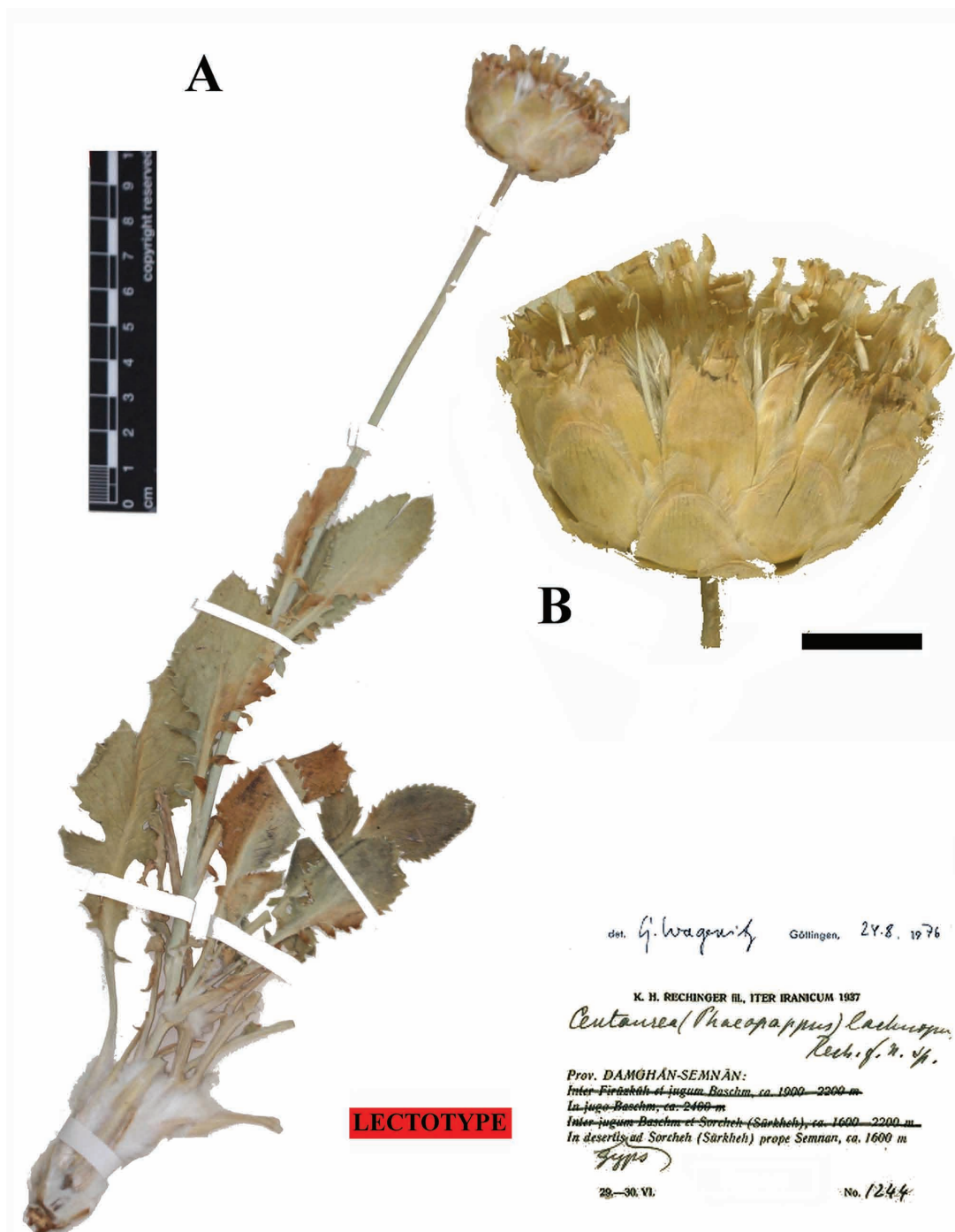


FIGURE 1. *Rhaponticoides lachnopus* (Rech.f.) Negaresh (Rechinger 1244, W). A. habit. B. close up of involucre. Scale B = 1 cm.

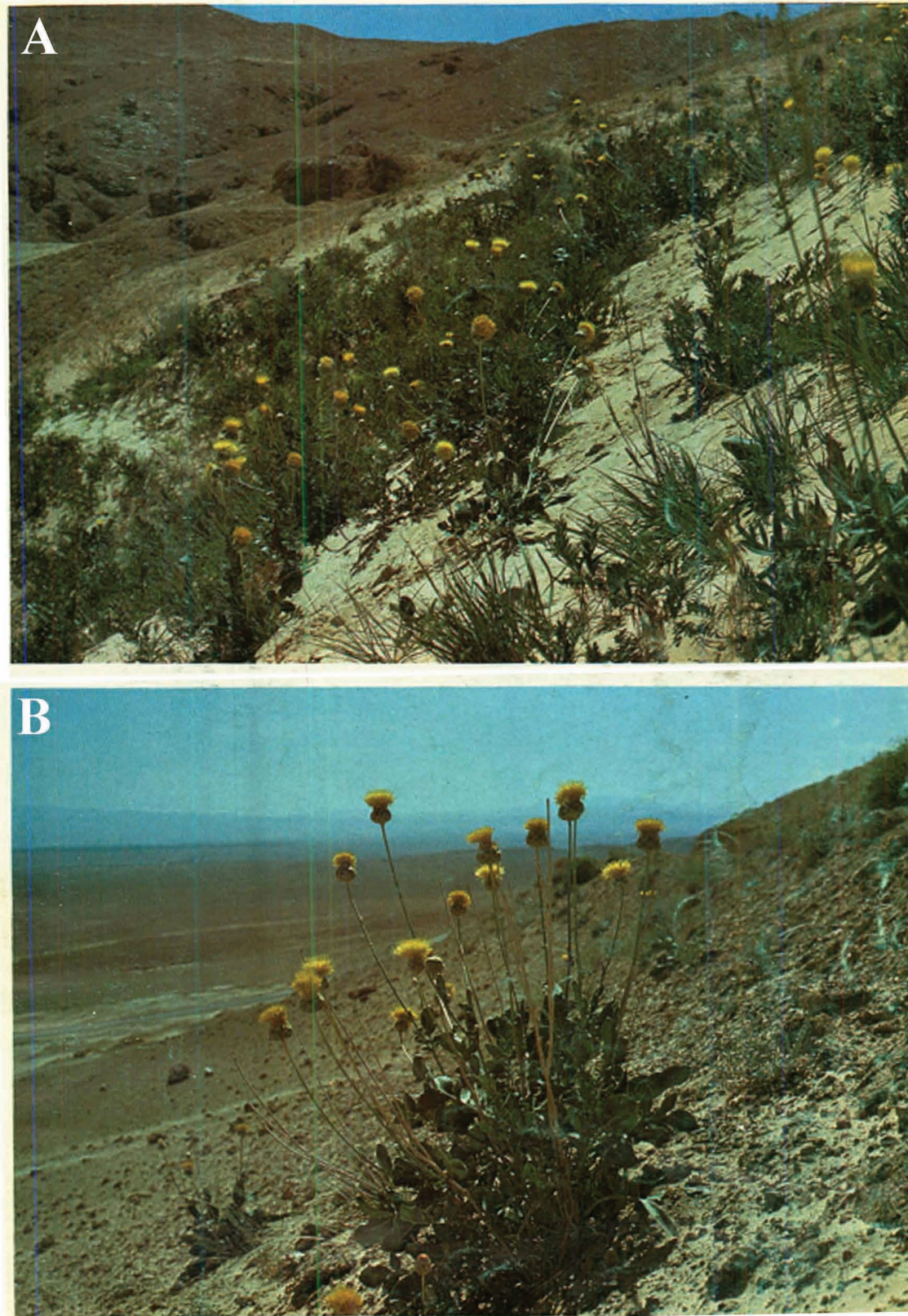


FIGURE 2. *Rhaponticoides lachnopus* (Rech.f.) Negaresh; after Wagenitz (1980). **A** and **B.** habit and habitat.

Taxonomic and distributional remarks:—*Rhaponticoides lachnopus* is a rare endemic of Semnan Province, N Iran (Fig. 3). According to Wagenitz (1980), the species occurs in a limited area. It grows on clay hills, in mid-montane zones, on gypsum fields, at elevations of 1300–1600 m (Fig. 2). *Rhaponticoides lachnopus* is similar to *R. schmidii* in its indumentum, margins of leaves and color of flowers. However, it differs from *R. schmidii* in the presence of sterile leaves, basal and lower cauline leaves lyrate or lyrate-pinnatifid, sometimes undivided, segments in 2–6(–7)

pairs, terminal segment 5–8 cm wide (*vs.* pinnatisect, segments in 6–8(–9) pairs, decurrent along the rachis, terminal segments (1.5–)3–5 cm wide), median cauline leaves lyrate or pinnatifid (*vs.* pinnatisect), appendages concealing the major part of phyllaries, 5–10 mm wide, margin entire, flat to slightly undulate (*vs.* totally concealing the phyllaries, 14–16 mm wide, strongly decurrent, denticulate, irregular lacerate or strongly undulate), and also pappus 10–13 mm long, usually outer as long as inner (*vs.* 5–7 mm long, inner pappus with unequal bristles: adaxial bristles 7–10 mm long, abaxial bristles 4–6 mm long). *Rhaponticoides lachnopus* grows at lower elevations than those of *R. schmidii*.

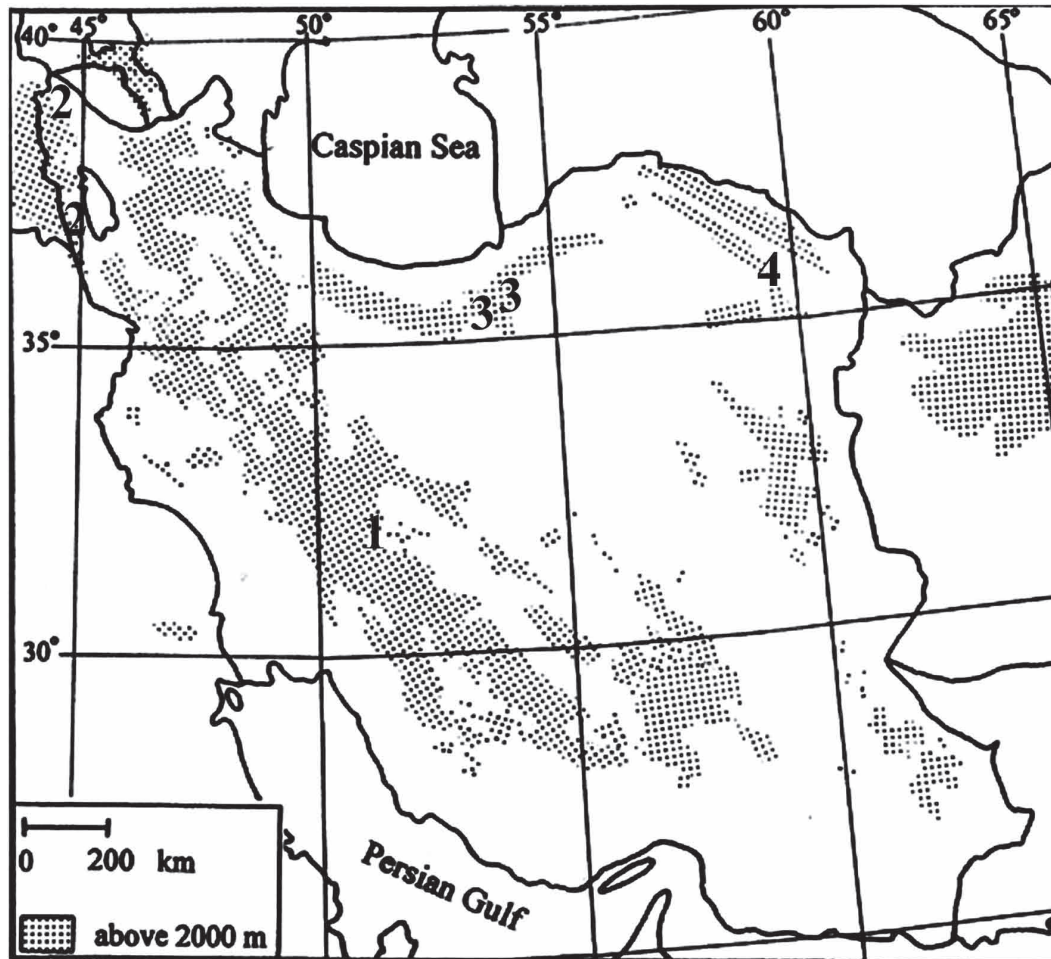


FIGURE 3. Distribution of *Rhaponticoides bachtiarica* (1), *R. ruthenica* (2), *R. lachnopus* (3), and *R. schmidii* (4) in Iran.

Chromosome numbers:—Unknown.

Selected specimens examined:—IRAN. Prov. Semnan: 2–7 km above Sorkheh, 1300–1400 m, 29 May 1975, *Rechinger* 52155 (E!), 52207 (W!), 52155 (W!; two sheets).

2. *Rhaponticoides schmidii* (Wagenitz) Negaresh, **comb. nov.** (Figs. 4–6)

Basionym: *Centaurea schmidii* Wagenitz (1980: 330). Type:—IRAN. Prov. Khorasan: Bar village, in stepposis montanis, 1780–2530 m, 28 June 1956, *Schmid* 6291 (holotype W!, isotypes E!, G!).

Plants perennial, herbaceous, arising from very thick rhizomes up to 3 cm in diam., green throughout, 70–100 cm tall, densely covered with white lanate pubescence at base, other parts glabrous; remains of stems of the previous year present. Stems several, 5 to 30(–40), sometimes single, erect or ascending, usually branched in upper part, sometimes producing fairly small sterile capitula, relatively sturdy, sulcate, densely leafy in lower part, other parts of stem aphyllous, 4–5(–6) mm in diam. at base. Leaves firm, pinnate and distinctly serrate. Basal and lower cauline leaves petiolate, lanceolate in outline, 17–30 cm long, pinnatisect, segments in 6–8(–9) pairs; terminal segments wider, ovate, 2–4 × (1.5–)3–5 cm; lateral segments oblong or lanceolate, (1–)3–5 × (0.3–)0.8–1.5 cm, decurrent along the rachis. Median cauline leaves subsessile, 13–20 cm long, pinnatisect, segments in ca. 8 pairs; segments equal in size, oblong, sometimes lanceolate, decurrent along the rachis. Upper cauline leaves increasingly reduced, sessile, lyrate, with 1–3 pairs of segments; terminal segment longer, narrowly oblong, denticulate, with a distinct mucro up to 2 mm long; lateral

segment small, acute at apex, entire. Capitula few (2–3), solitary on short to long peduncles (3–15 cm long). Involucre oblong or subglobose, truncate at base, 25–28 × 25–30(–35) mm. Phyllaries multiseriate, coriaceous, yellowish-brown, becoming dark-brown apically, conspicuously longitudinally striate with brown-blackish lines, rounded at apex. Outer phyllaries broadly ovate, 3–7 × 3–6 mm; middle phyllaries ovate-oblong to oblong, 12–15 × 6–8 mm; inner phyllaries oblong, 13–20 × 2–3 mm. Appendages large, totally concealing the phyllaries, conspicuously longitudinally striate with brown-blackish nerves, membranous-scarious, orbicular, the inner ones broadly oblong, 8–10 mm long, 14–16 mm wide, strongly decurrent, denticulate, irregular lacerate or strongly undulate. Receptacle densely covered with long white bristles. Flowers yellow in vivo, sulphury in sicco; central flowers hermaphrodite, 35–40 mm long, distinctly 5-veined, anther tube pale yellow, exserted; peripheral flowers sterile, slightly radiant, with staminodes, 4–5-lobed, the lobes filiform. Achenes asymmetrically subcylindrical-truncate or oblong, sometimes oblong-undulate, compressed at margins, 9–11 mm long, 3–4 mm wide, brown, dark brown to blackish, rarely yellowish and shiny, transversally wrinkled in the upper part, smooth towards base, glabrous; insertion areole large, ca. 2 mm long, yellowish. Pappus multiseriate, persistent, scabrous, brownish to blackish, 5–7 mm long; inner pappus with unequal bristles: adaxial bristles 7–10 long, abaxial bristles 4–6 mm long.

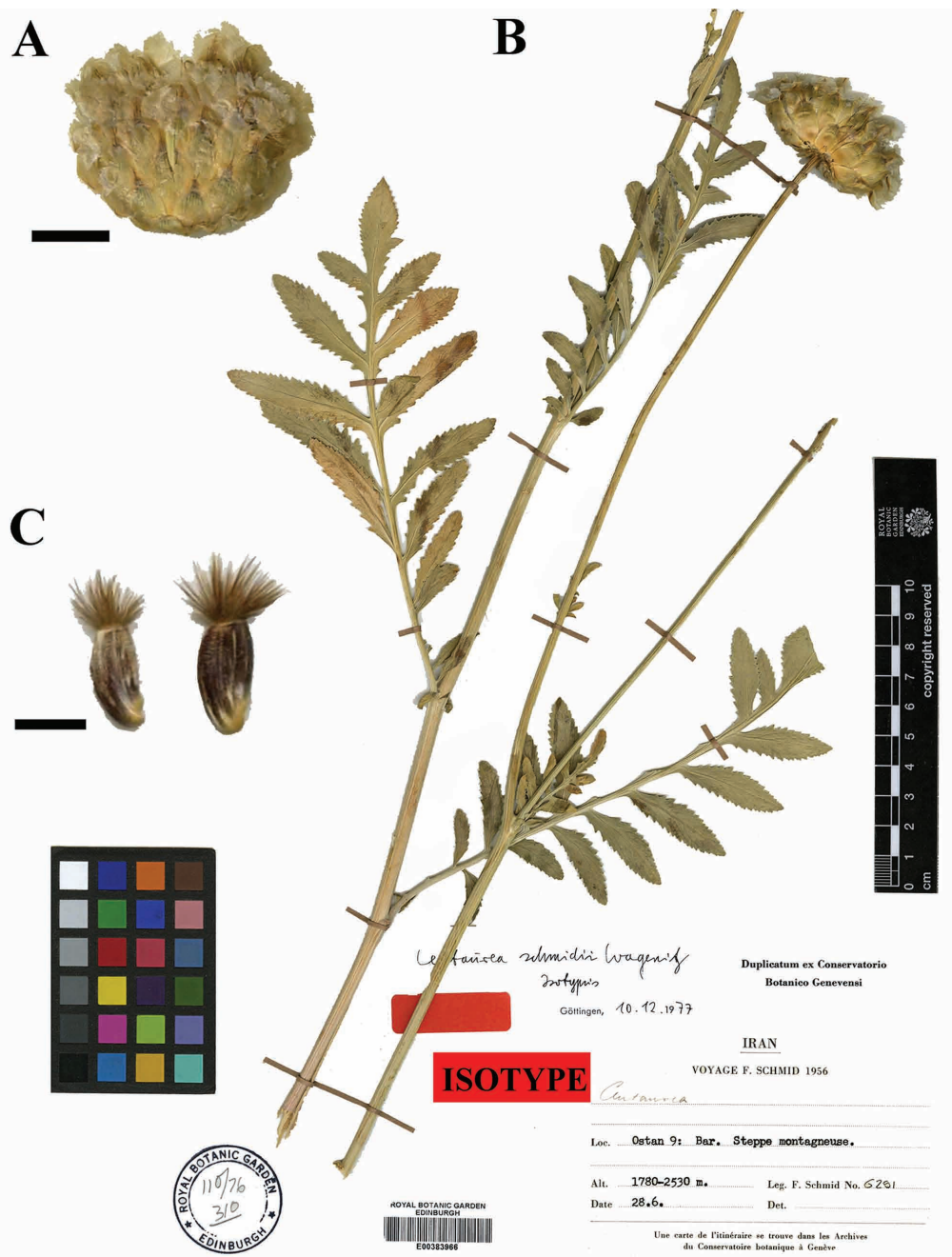


FIGURE 4. *Rhaponticoides schmidii* (Wagenitz) Negaresh (Schmid 6291, E). A. close up of involucre. B. habit. C. close up of achenes with pappus. Scale A = 1 cm, B = 5 mm.

Taxonomic and distributional remarks:—*Rhaponticoides schmidii* is a rare endemic of the vicinities of Bar village in Khorasan Province, NE Iran (Fig. 3). It is the only species of the genus *Rhaponticoides* with that special pappus type (inner pappus with unequal bristles: adaxial bristles 7–10 mm long, abaxial bristles 4–6 mm long). By this morphological character, *R. schmidii* is similar to members of the genera *Mantisalca* Cassini (1818: 142) and *Oligochaeta* (Candolle 1838: 671) Koch (1843: 42), but differs from them by many characters. *Rhaponticoides schmidii* is also the only species of *R.* sect. *Iranicae* with the pappus shorter than achenes (vs. pappus as long as achenes). It grows in steppes, rocky or stony slopes, dry rubble, on lake margins, scattered between *Rosmarinus* and *Amygdalus* shrubs, in montane zones, at elevations of 1750–2600 m (Fig. 5). It closely resembles *R. lachnopus* in its habit.



FIGURE 5. *Rhaponticoides schmidii* (Wagenitz) Negaresh (Joharchi & Nasseh 34279, FUMH). **A.** inflorescence. **B.** habit and habitat. Scale **A** = 10 cm, **B** = 20 cm.

This species is also related to *R. jerhardii* (Agababian 1997: 897) Ranjbar & Negaresh (2014a: 14), especially because of the indumentum, leaf dissection and color of flowers. However, it differs from *R. jerhardii* in its stem being densely leafy in the lower part, upper parts without leaves (vs. the stem being foliate loosely throughout), terminal segments of leaves wider than lateral ones (vs. terminal segments as large as lateral ones), and also inner pappus shorter than outer, inner pappus with unequal bristles: adaxial bristles 7–10 mm long, abaxial bristles 4–6 mm long (vs. inner pappus as long as the outer). *Rhaponticoides schmidii* grows at higher elevations than those of *R. jerhardii*.

Chromosome numbers:—Unknown.

Selected specimens examined:—**IRAN.** Prov. Khorasan: NW Neyshabur, Bar village, 1800 m, 25 June 2002, Joharchi & Nasseh 34279 (FUMH!, duplicate BASU!); NW Neyshabur, Bar village, 2000 m, 29 June 2006, Zangui 34877 (FUMH!, duplicate BASU!); NW Neyshabur, W mountains of the Bar village toward waterfall, 36° 31' 2.01" N, 58° 46' 3.43" E, 1920 m, 9 June 2013, Joharchi 45068 (FUMH!, duplicate herb. Negaresh!: two sheets).

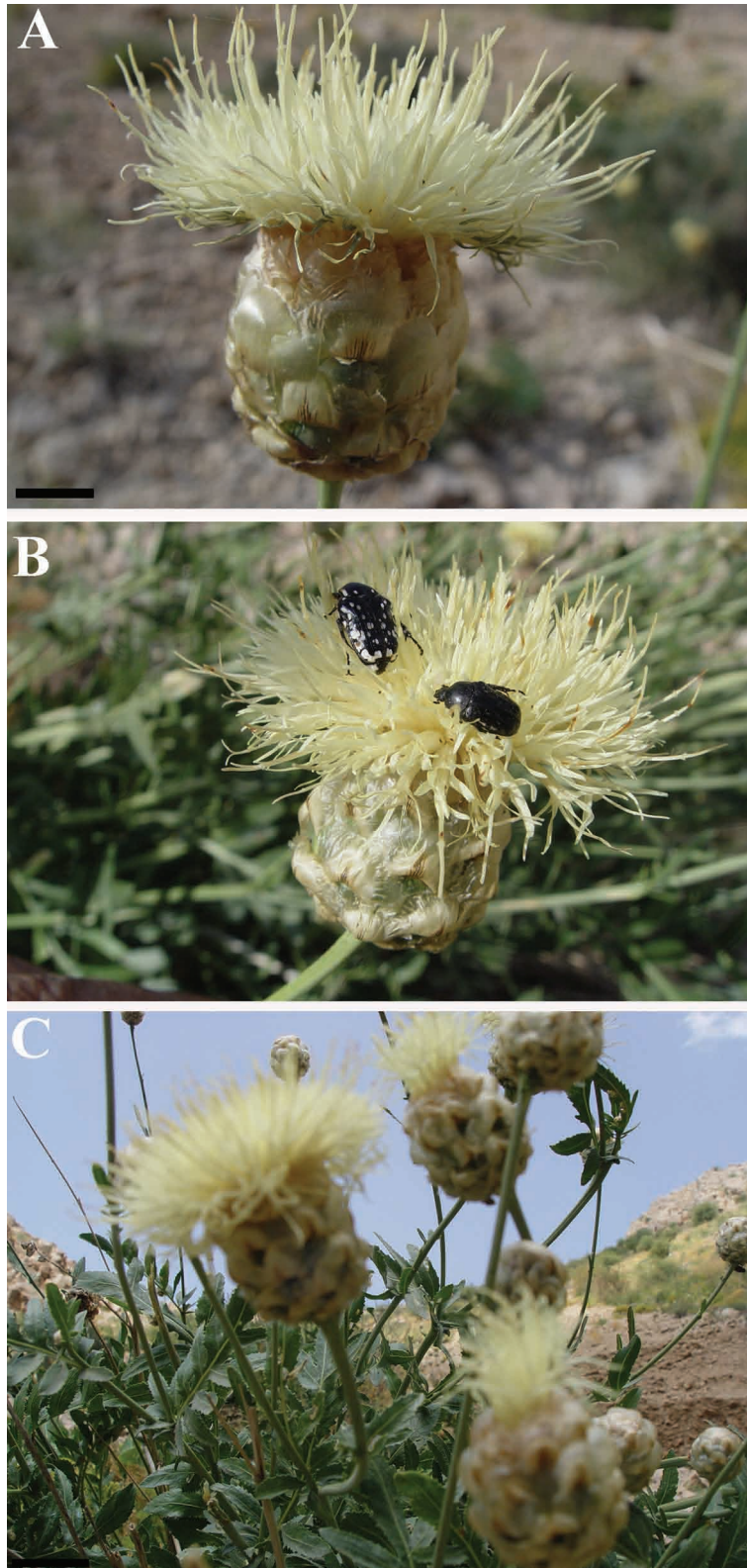


FIGURE 6. *Rhaponticoides schmidii* (Wagenitz) Negaresh (Joharchi & Nasseh 34279, FUMH). **A.** capitulum (focused on several dark brownish nerves). **B.** capitulum with two pollinators. **C.** focused on median and lower cauline leaves with serrate margins. Scale A = 1 cm, C = 2 cm.

II. *Rhaponticoides* sect. *Ruthenicae* (Dobrocz.) Negaresh, comb. & stat. nov.

Basionym: *Centaurea* subgen. *Centaurea* ser. *Ruthenicae* Dobrocz. in Dobroczajeva & Kotov (1962: 43). *Centaurea* subgen. *Centaurea* sect. *Centaurea* subsect. *Ruthenicae* Agababian (1997: 894). Type:—*Centaurea ruthenica* Lam.

Plants densely covered with white lanate pubescence at base, other parts glabrous. Leaves entirely divided, pinnatifid, margin regular denticulate or cartilaginous-denticulate, sometimes entire. Involucres medium-sized, 15–20(–25) × 10–20 mm, ovoid or ovoid-oblong, rarely cupuliform. Phyllaries broadly ovoid to suborbicular, without distinct appendages, or with very narrow scarious margins up to 1(–2.5) mm wide, margin entire to slightly undulate. Flowers yellow, peripheral radiant, staminodes indistinct. Achenes 6–8 mm long; pappus usually shorter than achenes, (4–)6–13(–16) mm long, inner bristles usually strongly shorter than outer ones.

Taxonomic and distributional remarks:—*Rhaponticoides* sect. *Ruthenicae* is the largest section of *Rhaponticoides* and comprises 15 species. It is also the most widespread section of the genus, ranging from SE Spain to S Europe, E Turkey to Magnolia and NW China. *Rhaponticoides* sect. *Ruthenicae* is the only section whose members are present in the Eurasian-Circumboreal region. Altogether, members of *Rhaponticoides* sect. *Ruthenicae* belong to Eurasian-Circumboreal, Mediterranean and Irano-Turanian elements.



FIGURE 7. *Rhaponticoides bachtiarica* (Boiss. & Hausskn.) Martins (*Haussknecht s.n.*, W).

3. *Rhaponticoides bachtiarica* (Boiss. & Hausskn.) Martins (2007: 43). *Serratula bachtiarica* Boissier & Haussknecht in Boissier (1875: 587). *Centaurea bachtiarica* (Boiss. & Hausskn.) Hayek & Bornmüller in Hayek (1926: 272). Type:—IRAN. Prov. Chahar Mahal and Bakhtiari: Tang-e Mahmuod, in declivibus dumetosis et in planitie Ardell, Bakhtiari, July 1868, *Haussknecht s.n.* (holotype G!, isotypes JE!: two sheets, W!). Fig. 7.

Plants perennial, herbaceous, glabrous, green-brownish throughout, 80–100 cm tall. Stems erect, simple or branched above (with a few short branches), sulcate, densely leafy in lower to median parts. Leaves coriaceous, pinnate. Basal and lower cauline leaves long-petiolate, pinnatipartite, oblong in outline; segments in 7–8 pairs, 4.5–7 × 0.5–2.2 cm, lanceolate, oblong or lanceolate-oblong, basally asymmetric, decurrent along the rachis, margin usually entire, sometimes remotely inconspicuously dentate, acute at apex. Median cauline leaves subsessile, 15–17 cm long, lanceolate in outline; segments in 6–7 pairs, 1.5–6(–7) × 0.2–1 cm, sometimes terminal segment longer, oblong, sometimes ± retrorse, decurrent along the rachis, margin entire, acuminate at apex. Upper cauline leaves sessile, simple, undivided, 6–8 × 0.7–0.9 cm, lanceolate, narrowed toward base, entire. Capitula few, 2-cephalous, solitary on long peduncles (up to 15 cm long). Involucres cupuliform, truncate at base, ca. 22 × 15–16 mm. Phyllaries multiseriate, imbricate, appressed, glabrous, yellowish-green, longitudinally striate, obtuse, with narrow scarious pellucid entire margin (1–2.5 mm wide). Outer phyllaries suborbicular, 2–5 × 2–6 mm; middle phyllaries broadly oblong or oblong-orbicular, 10–12 × 6–8 mm; inner phyllaries oblong or narrowly oblong, 14–16 × 3–5 mm; scarious margin lacerate. Receptacle densely covered with long white bristles. Flowers pale yellow. Achenes immature; pappus double, persistent, whitish, outer ca. 6 mm long, inner shorter.

Taxonomic and distributional remarks:—*Rhaponticoides bachtiarica* is a very rare endemic to Chahar Mahal and Bakhtiari Province, S Iran (Fig. 3). It is only known from the type locality (Tang-e Mahmoud) and probably grows in steppes of montane zones. *Rhaponticoides bachtiarica* is similar to *R. ruthenica* in its indumentum, dissection of leaves and color of flowers. However, it differs from *R. ruthenica* by its basal and lower cauline leaves with 7–8 pairs of segments, margin usually entire, sometimes remotely inconspicuously dentate (*vs.* segments in 12–15 pairs, margin regularly denticulate or cartilaginous-denticulate), capitula few, 2-cephalous (*vs.* several, 2–7-cephalous), involucre cupuliform (*vs.* ovoid), appendages of phyllaries 1–2.5 mm (*vs.* 0.5 mm) wide, and also pappus ca. 6 mm (*vs.* 4–6 mm) long.

Chromosome numbers:—Unknown.

4. *Rhaponticoides ruthenica* (Lam.) M.V. Agab. & Greuter in Greuter (2003: 61). *Centaurea ruthenica* Lamarck (1785: 663). *Centaureum ruthenicum* (Lam.) Koch (1851: 417). Type:—AFGHANISTAN. Ghorat: Darrah-e Ghuk prope Puni, 2200 m, 6 June 1971, *Podlech 21933* (KU! neotype designated here by Negaresh). Fig. 8.

Centaurea schwarzenbergiana Schur (1855: 4). *Bielzia schwarzenbergiana* (Schur) Schur (1886: 409). Type:—ROMANIA. Cluj, *Schur s.n.* (JE! lectotype designated here by Negaresh, isolecotypes JE!, M!).

Plants perennial, herbaceous, green throughout, 40–150 cm tall, densely covered with white lanate pubescence at base, other parts glabrous. Stems solitary or few, erect, usually branched in upper part, rarely simple, sulcate, loosely leafy throughout, 5–6 mm in diam. at base. Leaves entirely divided, pinnatipartite, margin regular denticulate or cartilaginous-denticulate. Lower and median cauline leaves petiolate, segments in 12–15 pairs, linear or linear-lanceolate, 3–7 × (0.1–)0.3–0.9 cm, terminal segment equal with lateral ones and usually decurrent along the rachis, acuminate at apex. Upper cauline leaves increasingly reduced, sessile, segments in 5–6 pairs, linear to narrowly linear, terminal segment longer, 1–3 mm long, shallowly denticulate or entire. Capitula several, 2–7-cephalous, solitary on short to long peduncles (1–15 cm long). Involucres ovoid, truncate at base, 20–25 × 14–20 mm. Phyllaries multiseriate, coriaceous, yellowish-brown, becoming dark-brown apically, conspicuously longitudinally striate with green or brown lines, rounded at apex. Outer phyllaries broadly ovate, 2–6 × 3–6 mm, middle phyllaries ovate-oblong to oblong, 7–12 × 6–7.5 mm, both without a distinct appendage, or with a very narrow scarious margin ca. 0.5 mm wide; margin entire to slightly undulate. Inner phyllaries oblong, 13–20 × 2–3 mm, with brown scarious margins, oblong, lacerate or undulate. Receptacle densely covered with long white bristles. Flowers yellow in vivo, sulphury in sicco; central flowers hermaphrodite, 22–24 mm long, anther tube pale yellow, exerted; peripheral flowers sterile, radiant, with staminodes, 4–5-lobed, the lobes filiform. Achenes transversally wrinkled, 6–8 mm long. Pappus double, persistent, whitish or brownish; outer pappus 4–6 mm long, inner pappus strongly shorter, 1–2 mm long.

Taxonomic and distributional remarks:—*Rhaponticoides ruthenica*, even in narrow circumscription, is widely distributed in Afghanistan, Armenia, Belarus, Caucasus, China, Kazakhstan, Kyrgyzstan, Romania, NW Iran, NW

Pakistan, SE Turkey, Tajikistan, Ukraine, Uzbekistan, W Siberia, Middle Asia and Central Europe (Tzvelev 1963, Wagenitz 1980, Bădăraș *et al.* 2001, Duran *et al.* 2014, Ranjbar & Negaresh 2014a). *Rhaponticoides ruthenica* is the only species of the genus that is distributed in both Mediterranean and Irano-Turanian regions. This species has the widest distribution range among the species of the genus. *Rhaponticoides ruthenica* grows in steppes, forest steppes and mesoxerophytic bushy submediterranean habitats from west Palaearctis (Bădăraș *et al.* 2001). In addition, it can be expected to grow on stony slopes, meadows, follow fields, outcrops of chalk and limestone, in mid-montane zone, at elevations of 1600–3300 m. In Iran, *R. ruthenica* closely resembles *R. bachtiarica* in its habit.

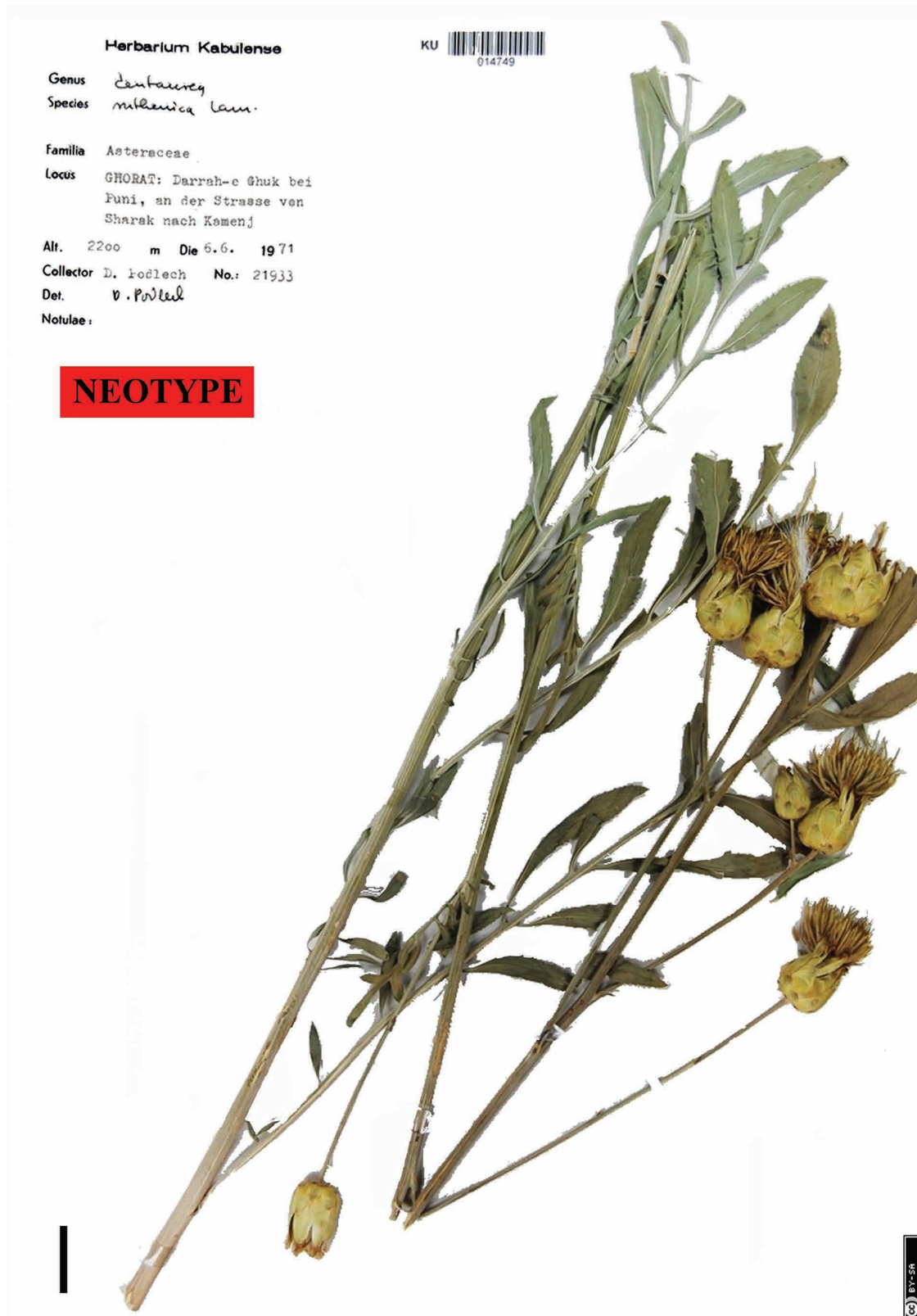


FIGURE 8. *Rhaponticoides ruthenica* (Lam.) M. V. Agab. & Greuter (Podlech 21933, KU). Scale A = 2 cm.

Chromosome numbers:—Tonian (1980), Agababian & Goukasian (1994) and Gaffari & Shahraki (2001) reported the same chromosome number $2n = 2x = 30$ for *Centaurea ruthenica*.

Selected specimens examined:—**IRAN.** Prov. Azerbaijan: Chalil Kuh, in faucibus NW Selvana, in rupium fissuris, 1750–2000 m, *Rechinger 48895* (W!); Ghogeh Dagh, W Bazaragn, 2100–2250 m, *Lamond 4994* (E!); *W. Rechinger 43984* (E!, W!). **AFGHANISTAN.** Ghorat: Darrah-e Ghuk prope Puni, 2200 m, 6 June 1971, *Podlech 21933* (KU!); Wakhan: in valle Daryao Baroghil, 3200–3300 m, *Anders 7850* (W!); Bamian: Band-e Amir ad lacum Band-e Panir, 2800 m, *Rechinger 18407-b* (W!). **KYRGYZSTAN.** 17 August 1998, *Robertson et al. 5851* (E!); 25 August 1998, *Robertson et al. 6003* (E!). **TURKEY.** B9 Ağrı: Patnos, Karakuyu village road, 1681 m, 8 August 2009, 39°20'040"N, 42°44'521"E, *Duran & Doğan 8730* (KNYA!).

Geographical distribution and ecology of *Rhaponticoides* in Iran

According to Takhtajan (1986), the genus *Rhaponticoides* is restricted to three floristic regions of the Holarctic floristic kingdom: the Eurasian-Circumboreal, the Mediterranean and the Irano-Turanian regions. Agababian (1997) demonstrated that the Mediterranean species are few, taxonomically well defined and little variable, whereas the non-Mediterranean species are polymorphic with intermediate forms and very local. Among the species of *Rhaponticoides* in Iran only *R. ruthenica* is widespread and grows in both the Mediterranean and the Irano-Turanian regions. Other species are restricted to the Irano-Turanian region and are endemic to Iran. According to Tzvelev (1963), *R. ruthenica* is widely but irregularly distributed species; it is not entirely homogeneous and includes somewhat weakly separated ecogeographical races. *Rhaponticoides bachtiarica*, *R. lachnopus* and *R. schmidii* are very rare in Iran and known only from a narrow area or the type locality (Fig. 3). Being clear-cut, the Irano-Turanian species have disjunct or narrow relict distributions which are remains of formerly big populations. *Rhaponticoides lachnopus* and *R. schmidii* are endemic to north and northwestern Iran, respectively, whereas *R. bachtiarica* is endemic to southern Iran. It seems that local endemism plays an important role in this genus. The species of *Rhaponticoides* are found in steppes, stony slopes, outcrops of chalk and limestone, fallow fields, rocky or stony slopes, dry rubble, limestone cliffs, gypsum fields, among scattered shrubs, open woods and shrubs, forests, dry meadows, near conglomerate slope site, in forest steppes and mesoxerophytic of mid- and high-montane zones. They prefer mountainous regions with dry and windy conditions and do not form dense populations. In Iran, *Rhaponticoides lachnopus* is the only species which occurs at elevations below 1600 m, whereas the prevailing altitudes for *Rhaponticoides* are between 1600–3300 m.

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