Genus *Bupleurum (Apiaceae)*: current taxonomy and distribution in Bulgaria

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Abstract. In this paper, the current diversity and distribution of genus *Bupleurum* in Bulgaria are presented. Field and herbarium studies have found that in the Bulgarian flora the genus is represented by 17 species (three perennials and 14 annuals) belonging to four sections. A new key for identification of the sections and taxa is provided. For each species, the diagnostic characters are noted down, as well as its closest relatives with which it can be confused. Literature and herbarium data of the species distribution in Bulgaria are summarized and illustrated on the map, with floristic regions and UTM grid.

Key words: Bulgarian flora, *Bupleurum*, chorology, taxonomy, *Umbelliferae*

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Introduction

Bupleurum is one of the largest genera in *Apiaceae*, numbering about 150 species (Neves & Watson 2004). It is the richest genus of *Apiaceae* in the European flora (Tutin1968), with about two-thirds of the species of the genus occurring in Southeast Europe. Within its geographical range, there are three distinct centers of diversity and speciation. One of the most ancient and primary centers is the Western Mediterranean, which includes the Iberian Peninsula, Northwest Africa (Morocco, Algeria and Tunisia), and Macaronesia (the Atlantic Islands), with about 30 species, mainly with frutescent and suffrutescent habit, traditionally included in the *Bupleurum* subgenus *Tenoria* (Spreng.) Cauwet (Cauwet-Marc 1976). The second center is located in the Southeast Asia and Himalayas and is characterized by the great diversity of herbaceous perennials of *Bupleurum*, more than 40 (Wu & Raven 2005). The Balkan Peninsula and the Aegean Islands, which are part of the third center, are notable for a large number of annual species of *Bupleurum*, many of which are local endemic (Snogerup & Snogerup 2003). The most species-rich European country in *Bupleurum* is Greece, with 28 recorded taxa, of which 25 are annuals (Snogerup & Snogerup 2001). Similarly, the genus is represented in Anatolia with 46 species, 45 of which are annuals (Snogerup1972). All annuals and non-ligneous perennials are merged into the *Bupleurum* subgenus *Bupleurum*.

Half a century after the treatment of genus *Bupleurum* for *Flora Europaea* (Tutin 1968), the species diversity has increased by about 40%: from 39 to 55

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species (Hand 2011). The latest comprehensive study of the genus (Assenov 1982) in Bulgaria is now quite outdated and in need of updating. This is due to the fact that new species for the Balkans have been recorded (Stoyanov 2018, 2019) and some infraspecific taxa have been raised to the rank of specific (Snogerup & Snogerup 2001). Accumulation of new data on the taxonomy and distribution of the *Bupleurum* species and some changes in the taxonomic treatments called for a critical revision of the genus in the Bulgarian flora.

The article aims to present a contemporary taxonomic scheme of the genus *Bupleurum* in Bulgaria, to summarize its synonymy in the Bulgarian flora, and to highlight key characters of each species. A summary of the current distribution of the species is also provided.

Material and methods

The study is based on extensive plant collection of *Bupleurum* carried out in the period 2004-2018. Furthermore, an overall review of the *Bupleurum* specimens kept in the herbaria PR, PRC, SO, SOA, and SOM (herbarium acronyms follow Thiers 2021+) has been done. The present taxonomic treatment results from studying 912 specimens (including 111 personal gatherings) from Bulgarian populations.

The distribution of species is illustrated with maps using Universal Transverse Mercator (UTM) grid (10×10 km) combined with the floristic subdivision of the country. Floristic regions of Bulgaria (Fig. 1) are described according to Jordanov (1966).

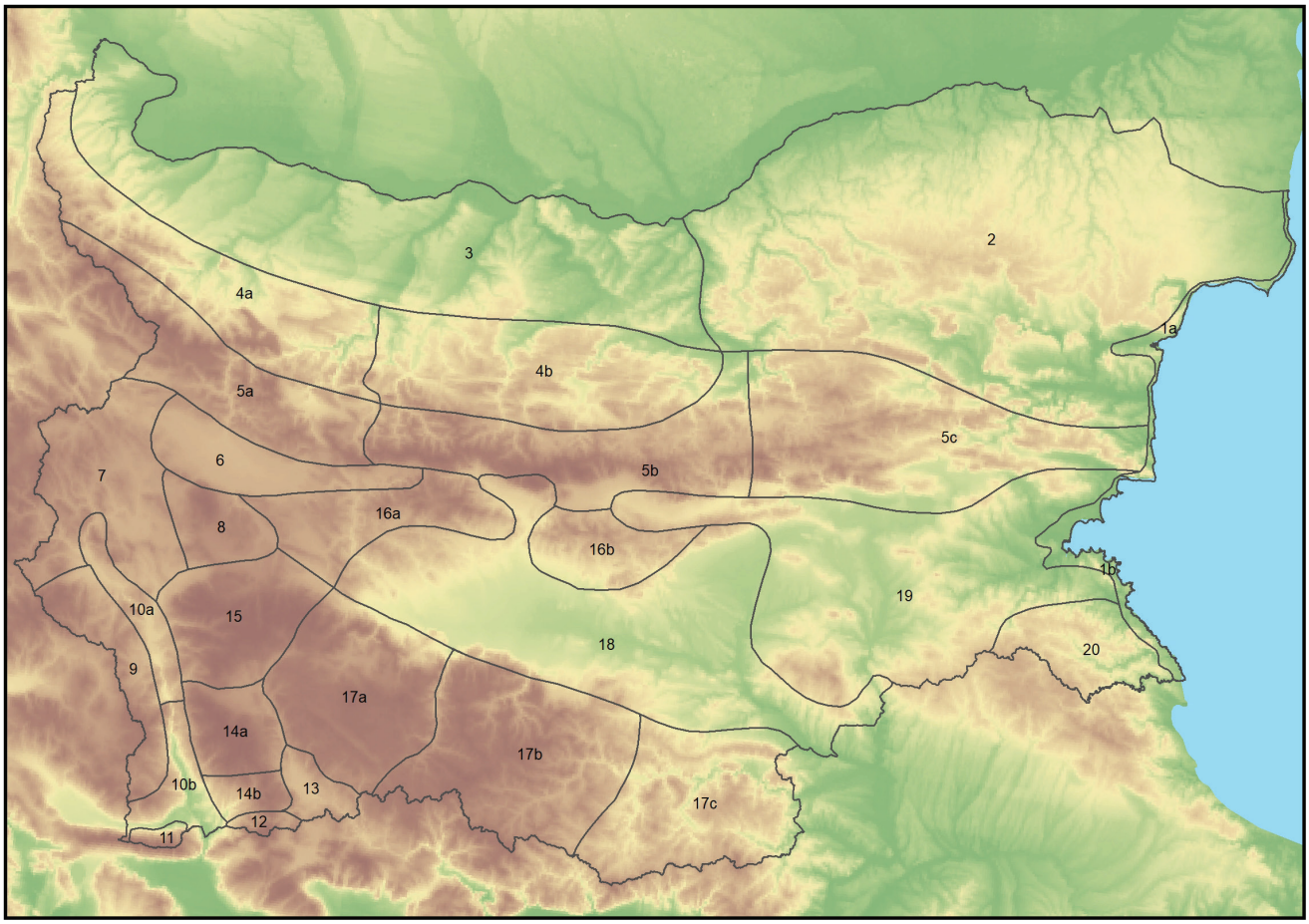

Fig. 1. Floristic regions of Bulgaria: Black Sea Coast (1a-*Northern*; 1b-*Southern*), Northeast Bulgaria (2), Danubian Plain (3), Forebalkan (4a-*Western*; 4b-*Eastern*), Balkan Range (5a-*Western*; 5b-*Central*; 5c-*Eastern*), Sofia Region (6), Znepole Region (7), Vitosha Region (8), West Frontier Mts (9), Valley of River Struma (10a-*Northern*; 10b-*Southern*), Mt Belasitsa (11), Mt Slavyanka (12), Valley of River Mesta (13), Pirin Mts (14a-*Northern*; 14b-*Southern*), Rila Mts (15), Mt Sredna Gora (16a-*Western*; 16b-*Eastern*), Rhodopi Mts (17a-*Western*; 17b-*Central*; 17c-*Eastern*), Thracian Lowland (18), Tundzha Hilly Country (19), and Mt Strandzha (20).

For each taxon, bibliographic references and a detailed list of synonymy has been prepeared. The bibliography includes citation with reference to protologues, Bulgarian *Floras* (Velenovský 1891a, 1898; Stojanov & Stefanov 1925, 1933, 1948; Stojanov & al. 1967; Assenov 1982) or other sources, in which the species was first recorded in Bulgaria, and the *Flora Europaea* (Tutin 1968).

Taxonomic treatment

The genus *Bupleurum* is represented in the Bulgarian flora by 17 species (three perennials and 14 annuals), all belonging to the subgenus *Bupleurum* and subdivided into four sections (Fig. 2). One of the species (*B. falcatum*) is presented with two subspecies. In the present study, the subdivision of the genus *Bupleurum* into subgenera (Koso-Poljansky 1913; Cauwet-Marc 1976) is accepted. At the section level, the taxonomic scheme follows Cauwet-Marc (1976) for the perennial species and Snogerup & Snogerup (2001) for the annuals.

Key to sections and species of genus *Bupleurum* occurring in Bulgaria

1. Bracts lacking, upper leaves perfoliate (**I. Sect. *Bupleurum***) .....**(1). *B. rotundifolium***

1*. Bracts 1–5, upper leaves at most amplexicaule .**2.**

2. Bracts caducous, clearly different in length and/or shape, herbaceous perennials (**II. Sect. *Bupleurotypus***)..... **3.**

2*. Bracts persistent, similar in length and shape, annuals .....**5.**

3. Bracts and bracteoles linear to oblong-lanceolate, flattened, 3-veined, with parallel venation ....**(2). *B. falcatum***

3*. Bracts and bracteoles ovate-lanceolate to ovate-elliptical, slightly concave, with reticulate venation .....**4.**

4. Leaves ovate to oblong-lanceolate, with pinnate-reticulate venation, lower pedunculate, upper amplexicaule .....**(3). *B. longifolium***

4*. Basal rosette leaves linear to linear-lanceolate, with parallel venation, upper cauline leaves oblong-lanceolate, amplexicaule .....**(4). *B. ranunculoides***

5. Bracteoles enclosing the flowers before and after anthesis, elliptical-lanceolate to ovate, flattened to navicular, straw to bright yellow at anthesis and in early fruiting stage, with ± noticeable veins, often with reticulate venation, ± scarious (**III. Sect. *Aristata***) .....**6.**

5*. Bracteoles erecto-patent to patent at all stages, linear, lanceolate to oblong-lanceolate, flattened to carinate, green, with parallel, obscure veins, herbaceous (**IV. Sect. *Juncea***) .....**8.**

6. Stems pseudo-dichotomous near the base, bracts and bracteoles flattened, ± equal in shape and size, elliptical-lanceolate, with pinnate-reticulate venation, secondary veins anastomosed, all veins prominent ..... **(7). *B. odontites***

6*. Stems pseudo-dichotomous above the middle, bracteoles ± navicular, elliptical to ovate, with three conspicuous primary veins and with obscure or lacking secondary veins ..... **7.**

7. Bracts linear-lanceolate with three parallel veins and without secondary veins, bracteoles ovate 3-veined, midvein with obscure, short, pinnate secondary veins, with awn 2–3 mm ..... **(5). *B. apiculatum***

7*. Bracts elliptical-lanceolate with three almost parallel veins, midvein with ± prominent pinnate secondary veins, bracteoles elliptical to ovate-elliptical, with three noticeable veins and without secondary veins, with awn up to 1 mm ..... **(6). *B. flavum***

8. Fruit surface verrucose or papillose .....**9.**

8*. Fruit surface smooth or rugulose .....**10.**

9. Rays slightly unequal, divergent; petals bright yellow; ovary and unripe mericarps glauco-pruinose, when ripe light brown with white papillae, ribs inconspicuous, styles 0.4–0.5 mm, longer than stylopodium radius .....**(13). *B. euboeum***

9*. Rays distinctly unequal, non-divergent; petals reddish-yellow; unripe mericarps pale green to

purplish, when ripe dark brown, rugulose-papillose, with winged rugulose ribs, styles 0.1–0.2 mm, shorter than the stylopodium radius .....**(17). *B. tenuissimum***

10. Umbel rays 2–3(4) .....**11.**

10*. Umbel rays 4–8 .....**15.**

11. Rays clearly divergent, almost equal, fruits 4–6 mm, with sharp, ± winged ribs .... **(16). *B. praealtum***

11*. Rays non-divergent, distinctly unequal, fruits 1.5–3 mm, with filiform, weak or obscure ribs ..... **12.**

12. Bracteoles 4 .....**13.**

12*. Bracteoles 5 ..... **14.**

13. Bracts and bracteoles carinate, with inconspicuous veins; petal bend and inflexed lobe distinctly papillose; ripe mericarps brown, with three slender vallecular vittae visible as thin strips between the ribs .....**(10). *B. asperuloides***

13*. Bracts and bracteoles ± flattened, 3-veined, with a prominent midvein; petal bend finely granulose-rugulose; ripe mericarps dark brown, with one large vallecular vittae visible as broad longitudinal purplish-brown to black strip between ribs .....**(11). *B. boissieri***

14. Virgate habit; branches standing almost straight up or slightly spreading; bracts ± flattened, clearly 3-veined, petals reddish to maroon; ripe fruits black, smooth, with filiform ribs ..... **(9). *B. affine***

14*. Branches spreading or bending downwards, the longest distinctly loose; bracts carinate, with inconspicuous veins; petals pale yellowish to reddish-yellow, distinctly papillose at bend; ripe fruits light brown, finely rugulose, without distinct ribs .....**(15). *B. pauciradiatum***

15. Umbel rays 4–5; bracts 2–3 .....**16.**

15*. Umbel rays 6–8; bracts 3–5 ..... **17.**

16. Bracts twice longer than bracteoles, very unequal, the longest one with 5–7 veins; petals yellow; ovary and fruits greyish pruinose ....**(14). *B. pachnospermum***

16*. Bracts and bracteoles very similar in shape and size, 3-veined; petals reddish to maroon, seldom yellowish; fruits black .....**(9). *B. affine***

17. Rays up to 2 cm, subequal, very divergent at all stages, mericarps up to 1.5 mm .... **(8). *B. aequiradiatum***

17*. Rays 0.5–5 cm, very unequal, ± divergent, non-divergent in fruits, mericarps usually more than 2 mm .....**(12). *B. commutatum***

I. Sect. *Bupleurum*, Tutin, Fl. Eur. 2: 346. 1968; Cauwet-Marc, Biosyst. Espèces Vivaces *Bupleurum* Medit. Occ. 3: 27. 1976.

≡ Sect. *Perfoliata* Godron in Grenier & Godron, Fl. France 1: 717. 1848; Boiss., Fl. Orient. 2: 834. 1872; Calestani, Webbia 1: 164. 1905; Wolff in Engler, Pflanzenr. 43: 38. 1910; Stoj. & Stef., Fl. Bulg. ed. 1, 2: 814. 1925.

Type: *B. rotundifolium* L. typ. cons. prop., Hitchcock & Green in Brit. Bot.: 138. 1929.

Annuals. Stems erect, unbranched or with short branches in the upper part. Leaves broadly lanceolate, ovate-lanceolate to rounded, lower semiamplexicaule, middle and upper perfoliate. Bracts lacking. Bracteoles ovate, mucronate, yellowish-green, after anthesis turning purplish-green. Mericarps ellipsoid to rounded, smooth or tuberculate, ribs filiform, oil ducts obscure, obsolete.

(1). *B. rotundifolium* L., Sp. Pl.: 236. 1753; Velen., Fl. Bulg.: 222. 1891a; Tutin, Fl. Eur. 2: 346. 1968; Assenov, Fl. RP Bulg. 8: 112. 1982.

Lectotype: *Habitat inter Europae australis segetes, Herb. Linn. 335.1* (LINN – photo!), *Rechinger* & *Snogerup* in Rechinger, Fl. Iran. 162: 269. 1987.

Diagnostic characters and similar taxa: *Bupleurum rotundifolium* is the only member of sect. *Bupleurum* in the Bulgarian flora. It differs from all other species in Bulgaria with lack of bracts and perfoliate middle and upper leaves. The closest species is *B. subovatum*, widespread across the Mediterranean. It is distinguished with its elongated elliptical leaves, acute at the top and tuberculate mericarp surface. Its nearest local-

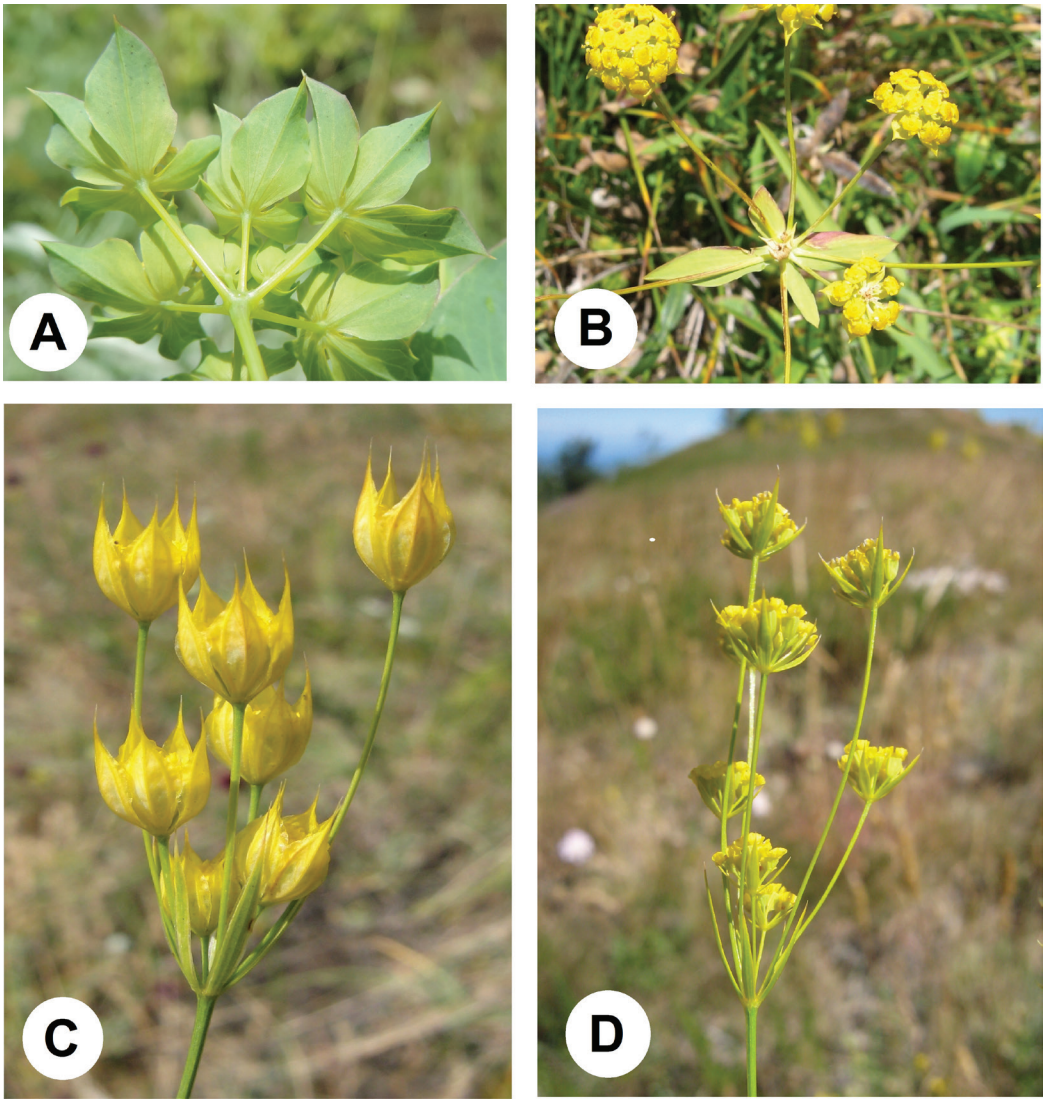

Fig. 2. Section subdivision of subgenus *Bupleurum*:
A. Sect. *Bupleurum*, bracts lacking;
B. Sect. *Bupleurotypus*, bracts caducous, clearly different in length and/or shape;
C. Sect. *Aristata*, bracts and bracteoles ± scarious, with prominent noticeable veins, enclosing the flowers before and after anthesis;
D. Sect. *Juncea*, bracts and bracteoles herbaceous, with weak ± obscure veins, erecto-patent to patent at all stages.

ities are in Greece, south of the Rhodopes. The species is most likely to be found in the lowest parts of the Eastern Rhodopes, in areas with calcareous bedrock, or in arable lands.

Distribution in Bulgaria: Across the country, up to 1000 m (Plate I. 1). In the plains and the lower mountain belt, in dry calcareous stony grasslands, among sparse scrubs and as weed in arable lands.

Global distribution: Europe, SW Asia and N Africa.

II. Sect. *Bupleurotypus* (Koso-Pol.) Cauwet-Marc, Biosyst. Espèces Vivaces *Bupleurum* Medit. Occ. 3: 28. 1976. ≡ Subgenus *Bupleurotypus* sect. *Eubupleurotypus* Koso-Pol., Acta Horti Petropol., 30(2): 164. 1913.
Lectotype (designated here): *B. ranunculoides* L.

Perennial herbs, occasionally ligneous at the base. Stems erect, branched mainly in the upper part and seldom at the base. Leaves linear, linear-lanceolate to ovate, amplexicaule, in some species the lower ones petiolate. Bracts 1–5, linear-lanceolate to ovate-lanceolate, unequal, often caducous. Bracteoles mostly five, linear to ovate, yellowish-green, after anthesis purple green to bronze. Mericarps ellipsoid, smooth, ribs noticeable, filiform to winged.

(2). *B. falcatum* L., Sp. Pl.: 237. 1753; Velen., Fl. Bulg.: 223. 1891a; Tutin, Fl. Eur. 2: 349. 1968; Assenov, Fl. RP Bulg. 8: 124. 1982.
Lectotype: *Habitat in Misniae, Vallesiae sepibus, Herb. Burser XVI(1): 10* (UPS), *Neves* & *Reduron* in Jarvis & al. (ed.), Taxon 55(1): 209. 2006.

[– *B. gramineum* sensu Velen., Fl. Bulg. (1891a) et Stoj. & Stef., Fl. Bulg. ed. 1, 2 (1925), non Vill. in Prosp. Hist. Pl. Dauphiné (1779)].

Global distribution: S, C and E Europe and Asia.

Notes: Polymorphic species, both in terms of habit (from single stems to numerous, highly branched) and in the shape and size of leaves, number of bracts, number and length of rays. Small individuals with a few short-rayed umbels develop in limestone rock habitats. Significantly more stable features are the number and shape of bracteoles, as well as the characreristics of flowers and mericarps.

Key to subspecies of *B. falcatum*

1. Lower leaves petiolate, umbels 3–7-rayed, rays 0.5–3 cm, straight, divergent. Bracts 3–5, clearly different in length and shape ..... **(2.1). *B. f.*** subsp. ***falcatum***

1*. All leaves sessile, umbels 6–12-rayed, rays 2–5 cm, arcuate, slightly divergent. Bracts 0–2, linear, unequal ..... **(2.1). *B. f.*** subsp. ***cernuum***

(2.1) *B. falcatum* subsp. ***falcatum***

Distribution in Bulgaria: Black Sea Coast (*Southern*), Danubian Plain, Forebalkan (*Western*), Balkan Range (*Central* and *Eastern*), Znepole Region, Vitosha Region, Valley of River Struma (*Northern*), Rila Mts, Mt Sredna Gora, Rhodopi Mts (*Western* and *Central*), Thracian Lowland (Plate I. 2), up to 1500 m. In the plains and in the lower and middle mountain belts, often on limestone.

(2.2) *B. falcatum* subsp. ***cernuum*** (Ten.) Arcang., Comp. Fl. Ital., ed. 2: 590. 1894; Tutin, Fl. Eur. 2: 349. 1968. *B. cernuum* Ten., App. 1 Cat. Hort. Neap.: 38. 1815.

Type: Italy, *montis Virginis et Matesii*.

= *B. orbelicum* Velen. in Sitzungsber. Königl. Böhm. Ges. Wiss., Math.-Naturwiss.: 47. 1890; Velen., Fl. Bulg.: 222. 1891 ≡ *B. gramineum* var. *orbelicum* (Velen.) Stoj. & Stef., Fl. Bulg. ed. 1, 2: 816. 1925. **Holotype**: Bulgaria, *in graminosis alpinis m. Rila, 08.1889, J. Velenovský* (PRC 451430!).

= *B. diversifolium* Rochel in Bot. Reise Banat: 40. 1838; Velen., Fl. Bulg. Suppl.: 133. 1898 ≡ *B. gramineum* subsp. *diversifolium* (Rochel) Stoj. & Stef., Fl. Bulg. ed. 1, 2: 815. 1925.

[– *B. gramineum* sensu Velen., Fl. Bulg. (1891a) et Stoj. & Stef., Fl. Bulg. ed. 1, 2 (1925), non Vill., Prosp. Hist. Pl. Dauphiné (1779)].

[– *B. sibthorpianum* auct. Bulg., non Sm. in Sibth. et Sm., Fl. Gr. Prodr. 1: 179 (1806)].

Notes: In the latest *Floras* of Bulgaria, the name *B. sibthorpianum* has been misused for the alpine forms of *B. falcatum*, which presently refer to the infraspecific taxon *B. falcatum* subsp. *cernuum*. Actually, *B. sibthorpianum*, described from the calcareous mountains of the Peloponnese in Greece and representing a narrow-leaved form of *B. falcatum* subsp. *falcatum*, appears to be synonymous with the latter.

Distribution in Bulgaria: Balkan Range (*Western* and *Central*), Vitosha Region, West Frontier Mts (Mt Osogovska), Mt Belasitsa, Pirin Mts, Rila Mts, 1500–2500 m (Plate I. 3). In the mountains, mainly on siliceous substrates, seldom on limestone, usually in stony pastures.

(3). *B. longifolium* L., Sp. Pl.: 237. 1753; Velen., Fl. Bulg. Suppl.: 133. 1898; Tutin, Fl. Eur. 2: 346. 1968; Assenov, Fl. RP Bulg. 8: 113. 1982.

Lectotype: *Habitat Gottingae, inque monte Jura Helvetiae, Herb. Burser XVI(1): 2* (UPS), *Neves* & *Reduron* in Jarvis & al. (ed.), Taxon 55(1): 210. 2006.

Diagnostic characters and similar taxa: *Bupleurum longifolium* is distinguished by its obovate to rounded bracts and bracteoles, broadly elliptical petiolated basal leaves and oblong ovate sessile cauline leaves, cordate and amplexicaule at the base. Leaves with pinnate-reticulate venation. Similar broadly elliptical petiolated basal leaves are also characteristic of *B. falcatum* subsp. *falcatum*, but in the latter veins are arcuate. *Bupleurum longifolium* and *B. rotundifolium* are similar in their oblong-ovate to round stem leaves, but in the former, they are amplexicaule, with a broad cordate base, while in the latter, they are perfoliate. Furthermore, *B. rotundifolium* is annual and has no bracts. *Bupleurum longifolium* resembles *B. ranunculoides* in the umbel structure. Both species have 3–5 ovate to rounded bracts, but in the former, flower pedicels are 2–3 mm long, and in the latter, they are up to 1 mm.

Distribution in Bulgaria: Balkan Range (*Central* – Triglav massif, northwards of peak Mazalat, Armankaya locality and in the river valleys of Tazha and Praskalska), Znepole Region (Mt Paramunska) (Plate I. 4). In the beech belt, seldom above the upper forest line. None of the cited localities have been confirmed during the present study. The species is included in the *Red Data Book of R. Bulgaria* as Critically Endangered (Stoyanov 2015).

Global distribution: C and E Europe – from C France to W Russia, southwards to N Balkans.

(4). *B. ranunculoides* L., Sp. Pl.: 237. 1753; Tutin, Fl. Eur. 2: 349. 1968; Stoyanov, Phytol. Balcan. 10(2-3): 187. 2004.
Lectotype: *Habitat in Helvetia & Pyrenaeis*, *Herb. Burser XVI(1): 8* (UPS), *Neves & Reduron* in Jarvis & al. (ed.), Taxon 55(1): 210. 2006; **Epitype**: *Herb. Clifford: 104, Bupleurum 3* (BM 000558361), *Neves & Reduron* in Jarvis & al. (ed.), Taxon 55(1): 210. 2006.

Diagnostic characters and similar taxa: The taller individuals of this species with its habit, shape of basal and stem leaves, shape of umbels and number of umbel rays are similar to *B. falcatum* subsp. *cernuum*. The latter is characterized by its linear, acuminate and almost identical bracts and bracteoles, while in *B. ranunculoides,* bracts and bracteoles are unequal, lanceolate to ovate, obtuse and the uppermost leaves have a wide cordate amplexicaule base.

Distribution in Bulgaria: Vitosha Region (peak Belchova Skala), 1800–1850 m (Plate I. 5). In mountain stony grasslands and among sparse scrubs of *Juniperus sibirica*. The only population of the species in Bulgaria occupies an area of about 2 ha. The species is included in the *Red Data Book of R. Bulgaria* as Critically Endangered (Stoyanov 2015).

Global distribution: Europe – in the mountainous regions of the Iberian Peninsula, Apennines and Balkans, Alps and Carpathians.

III. Sect. *Aristata* Godron in Grenier & Godron, Fl. France 1: 724. 1848.
≡ Sect. *Eubupleura* subsect. *Aristata* (Godron) Briq., Monogr. Bupl. Alp. Marit.: 52. 1897; Stoj. & Stef., Fl. Bulg. ed. 1, 2: 817. 1925 ≡ Sect. *Isophyllum* subsect. *Aristata* (Godron) Tutin, Fl. Eur. 2: 346. 1968 ≡ Sect. *Aristata* subsect. *Aristata* p. p., S. Snogerup & B. Snogerup, Willdenowia 31: 225. 2001.
Type: *B. aristatum* Bartl. (= *B. veronense* Turra).
= Sect. *Glumacea* Boiss., Fl. Orient. 2:835. 1872; Calestani, Webbia 1: 165. 1905 ≡ Sect. *Eubupleura* subsect. *Glumacea* (Boiss.) H. Wolff in Engler, Pflanzenr. 43: 39. 1910.

Annuals. Stems erect, pseudo-dichotomously branched from the middle, seldom from near the base, with numerous umbels. Basal leaves linear to linear-lanceolate, sessile or seldom short-petiolate, middle and upper stem leaves sessile, semiamplexicaule, with 3–5 parallel veins, acuminate. Bracts 2–5, lanceolate, elliptical to ovate-lanceolate, 3–5-veined, occasionally with pinnate secondary veins. Bracteoles five, enclosing the flowers before and after anthesis, elliptical-lanceolate to ovate, often navicular, awned, semi-transparent, straw to bright yellow at anthesis and in early fruiting stage, ± scarious, 3–7-veined and without or with ± conspicuous secondary veins. Mericarps ellipsoid, smooth, with weak filiform ribs and single vallecular vittae.

(5). *B. apiculatum* Friv., Flora 18: 335. 1835; Velen., Fl. Bulg.: 225. 1891a; Stoj. & Stef., Fl. Bulg. ed. 2: 759. 1933 et *op. c.* ed. 3: 834. 1948; Stoj., Stef. & Kitanov, Fl. Bulg. ed. 4, 2: 781. 1967; Tutin, Fl. Eur. 2: 347. 1968; Assenov, Fl. RP Bulg. 8: 114. 1982; *B. glumaceum* var. *apiculatum* (Friv.) Stoj. & Stef., Fl. Bulg. ed. 1, 2: 817. 1925.
Type: Rumelia, Frivaldszky (syntypes BP 273845!, WU 0069470 – photo!).
[– *B. semidiaphanum* sensu Velen. Fl. Bulg. (1891a) et *B. glumaceum* var. *semidiaphanum* sensu Stoj. & Stef., Fl. Bulg. (1925), non Boiss. (1859)].
[– *B. flavicans* sensu Velen. Fl. Bulg. Suppl. (1898) et *B. glumaceum* var. *flavicans* sensu Stoj. & Stef., Fl. Bulg. (1925), non Boiss. & Heldr. (1859)].
[– *B. sulphureum* sensu Velen. Fl. Bulg. Suppl. (1898) et *B. glumaceum* var. *sulphureum* sensu Stoj. & Stef., Fl. Bulg. (1925), non Boiss. & Balansa (1859)].
[– *B. baldense* subsp. *gussonei* sensu Assenov, Fl. RP Bulg. 8 (1982), non (Arcang.) Tutin in Heywood, Feddes Repert. 74 (1967)].

Diagnostic characters and similar taxa: Bracts five, with three parallel veins, awned, narrowly lanceolate,

± herbaceous, twice longer than bracteoles. Umbel rays unequal. Bracteoles five, elliptical to ovate-elliptical, at flowering pale yellow, in the fruit stage straw yellow, with three main veins and short obscure secondary veins, long-awned, awn more than 2 mm. The bracteoles are similar in shape and size to those of *B. flavum*, but in the latter they are translucent, 3-veined and without secondary veins, and the awn is up to 1 mm. Furthermore, at anthesis the bracteoles are bright yellow.

Distribution in Bulgaria: Black Sea Coast (*Northern*), Northeast Bulgaria, Balkan Range (*Central* and *Eastern*), Sofia Region, Znepole Region, Vitosha Region, West Frontier Mts, Valley of River Struma, Mt Slavyanka, Valley of River Mesta, Rila Mts, Mt Sredna Gora, Rhodopi Mts, Thracian Lowland, Tundzha Hilly Country, up to 1500 m (Plate I. 6). In stony grasslands, on calcareous and sandy substrates.

Global distribution: Balkan Peninsula – S and NE Bulgaria, Republic of N Macedonia, E Serbia, NE Greece, and Romanian Dobrogea.

(6). *B. flavum* Forssk., Fl. Aegypt.-Arab.: 205. 1775; Stoj., Stef. & Kitanov, Fl. Bulg. ed. 4, 2: 781. 1967; Tutin, Fl. Eur. 2: 346. 1968; Assenov, Fl. RP Bulg. 8: 114. 1982.
Holotype: Dardanelles, *Forsskål cent. 7 no. 23* (C).
= *B. thracicum* Velen., Sitzungsber. Königl. Böhm. Ges. Wiss., Math.-Naturwiss. Cl. 1892: 381. 1892; Velen., Fl. Bulg. Suppl.: 135. 1898.
[– *B. glumaceum* sensu Velen. Fl. Bulg. (1891a) et Stoj. & Stef., Fl. Bulg. (1925), non Sm. (1806)].
[– *B. apiculatum* p. p. sensu Stoj. & Stef., Fl. Bulg. ed. 2 (1933) et *op. c.* ed. 3 (1948), non Friv. (1835)].

Diagnostic characters and similar taxa: Bracts and bracteoles widely elliptical, ± scarious, translucent, awned, awn up to 1 mm, bright yellow at anthesis. Bracteoles with three elevated main veins and without secondary veins. *Bupleurum apiculatum* has similar bracteoles, but in contrast, it has, short, secondary veins between main veins and a longer awn, exceeding 2 mm. The two species are well distinguished in the shape and venation of bracts – in *B. apiculatum* they are narrowly lanceolate, herbaceous to slightly scarious, with three parallel main veins, while in *B. flavum* bracts are elliptical, with three arcuate main veins and clear secondary venation.

Distribution in Bulgaria: Black Sea Coast (*Southern*), Balkan Range (*Eastern*), Rhodopi Mts (*Eastern*), Thracian Lowland, Tundzha Hilly Country, up to 500 m (Plate II. 1). In the plains and foothills, in dry stony grasslands, mainly on siliceous substrates.

Global distribution: SE part of the Balkan Peninsula (SE Bulgaria, NE Greece and the European part of Turkey), the Aegean Islands, W and S parts of Asia Minor.

(7). *B. odontites* L., Sp. Pl.: 237. 1753; Velen., Fl. Bulg.: 226. 1891a; Stoj. & Stef., Fl. Bulg. ed. 1, 2: 818. 1925.
Lectotype: *Habitat in alpibus Vallesiae, Herb. Linn. 335.11* (LINN – photo!), *Reduron* in Snogerup & Snogerup (ed.), Willdenowia 31: 225. 2001.
= *B. fontanesii* Guss., Fl. Sic. Prodr.: 313. 1827; Velen., Fl. Bulg. Suppl.: 137. 1898; Stoj. & Stef., Fl. Bulg. ed. 2: 759. 1933 et *op. c.* ed. 3: 835. 1948; Stoj., Stef. & Kitanov, Fl. Bulg. ed. 4, 2: 781. 1967; Tutin, Fl. Eur. 2: 347. 1968; Assenov, Fl. RP Bulg. 8: 116. 1982.

Diagnostic characters and similar taxa: The only Bulgarian representative with reticulate venation of bracts and bracteoles. Umbels short pedunculate or subsessile, flower pedicels quite unequal. *Bupleurum odontites* has lanceolate, flattened bracteoles, while in the other two species of the section *Aristata* they are ovate-elliptical, ± navicular.

Distribution in Bulgaria: Thracian Lowland (between the villages of Shtit and Raykova Mogila, Svilengrad district), Tundzha Hilly Country (Elhovo and Topolovgrad districts), up to 200 m (Plate II. 2). In ruderal grassy places, at roadsides, on the periphery of arable lands and occasionally as weed in the fields. The species probably has an adventitious origin. It is included in the *Red Data Book of R. Bulgaria* as Endangered (Stoyanov 2015).

Global distribution: S Europe (casual, probably introduced), Crimea, N Africa, Asia Minor, and the Middle East.

IV. Sect. *Juncea* (Briq.) Calestani, Webbia 1: 166. 1905.
≡ Sect. *Eubupleura* subsect. *Juncea* Briq., Monogr.

Bupl. Alp. Marit.: 97. 1897; Wolff in Engler, Pflanzenr. 43: 39. 1910; Stoj. & Stef., Fl. Bulg. ed. 1, 2: 815. 1925, p. p. ≡ Sect. *Isophyllum* subsect. *Juncea* (Briq.) Tutin, Fl. Eur. 2: 347. 1968 ≡ Sect. *Aristata* subsect. *Juncea* (Briq.) S. Snogerup & B. Snogerup, Willdenowia 31: 264. 2001.

Lectotype: *B. junceum* L. (= *B. praealtum* L.), *S. Snogerup* & *B. Snogerup*, Willdenowia 31: 264. 2001.

= Sect. *Graminea* Boiss., Fl. Orient. 2: 835. 1872, p. p.

= Sect. *Annua* [unranked] *Trachycarpa* Lange in Willkomm & Lange, Prodr. Fl. Hisp. 3: 68. 1880 ≡ Sect. *Eubupleura* subsect. *Trachycarpa* (Lange) Briq., Monogr. Bupl. Alp. Marit.: 108. 1897; Wolff in Engler, Pflanzenr. 43: 39. 1910 ≡ Sect. *Trachycarpa* (Lange) Calestani, Webbia 1: 165. 1905 ≡ Sect. *Isophyllum* subsect. *Trachycarpa* (Lange) Tutin, Fl. Eur. 2: 348. 1968.

Annuals. Stems erect, with pronounced main stem, with shorter or longer lateral branches or pseudo-dichotomously branched only in the upper part, umbels numerous at top and laterally of the branches. Leaves linear to linear-lanceolate, sessile and semiamplexicaule, with 3–5 parallel veins. Bracts 2–5, linear to elliptical-lanceolate, 1–5-veined, herbaceous. Bracteoles 4–5, erecto-patent to patent at all stages, linear to oblong lanceolate, with 1–3 main veins, withous secondary veins, acute to acuminate, flattened or carinate, herbaceous. Mericarps ellipsoid to prismatic, smooth to verrucose, with weak or filiform ribs. Vallecular vittae 1–3, seldom more.

(8). *B. aequiradiatum* (H. Wolff) Snogerup & B. Snogerup, Willdenowia 31: 302. 2001; *B. commutatum* var. *aequiradiatum* H. Wolff in Engler, Pflanzenr. 43: 84. 1910; Stoj., Stef. & Kitanov, Fl. Bulg. ed. 4, 2: 780. 1967; *B. commutatum* subsp. *aequiradiatum* (H. Wolff) Hayek, Repert. Spec. Nov. Regni Veg. Beih. 30(1): 975. 1927 [Prodr. Fl. Penins. Balcan. 1]; Tutin, Fl. Eur. 2: 348. 1968; Assenov, Fl. RP Bulg. 8: 120. 1982.

Lectotype: Bulgaria, Nova Mahala [Stoevo village, Asenovgrad district], 08.1906, V. Stříbrný (SOM 55206!; isolectotypes BP 274070!, PR 859562!, PR 859563!), *Stoyanov*, Phytotaxa 392(3): 205. 2019.

Diagnostic characters and similar taxa: Top umbels 6–8-rayed, rays up to 20 mm, ± equal, clearly divergent (Fig. 3A). Mericarps ± rouded, *ca.* 1.5 mm long, pedicels as long as mericarps. During flowering, *B. aequiradiatum* resembles *B. praealtum*, but the latter has 3(–4)-rayed umbels. It is also similar to *B. commutatum*, but the latter has longer, unequal rays, non-divergent in fruits, pedicels 2–3 times longer than mericarps, and ellipsoid mericarps, exceeding 2 mm.

Distribution in Bulgaria: Black Sea Coast, Northeast Bulgaria, West Frontier Mts (Mt Osogovska), Rhodopi Mts (*Central* and *Eastern*), Thracian Lowland, Tundzha Hilly Country, up to 700 m (Plate II. 3). In dry grasslands and sparse scrubs, on calcareous and siliceous substrates.

Global distribution: C and E parts of the Balkans Peninsula (C and N Greece, Republic of N Macedonia, SE Serbia, S and E Bulgaria, and Romanian Dobrgea, Stoyanov 2019) and W part of Asia Minor (Stoyanov 2020). Recorded for Crimea (Wolff 1910), where it most likely has been confused with *B. gerardi* All. It is erroneosly reported for Croatia (Snogerup & Snogerup 2001) and Albania (Barina & al. 2011).

(9). *B. affine* Sadler, Fl. Comit. Pest. 1: 204. 1825; Stoj. & Stef., Fl. Bulg. ed. 1, 2: 817. 1925; Tutin, Fl. Eur. 2: 348. 1968; Assenov, Fl. RP Bulg. 8: 122. 1982.

Type: Hungary, *ad sepes vinearum um den Blocks- und Adlerberg Budae et in graminosis arenosis siccis circa Pestinum sat frequens* (syntype BP 627618!).

= *B. gerardi* Jacq., Fl. Austr. 3: 31. 1775, non All. (1774); Velen., Fl. Bulg.: 225. 1891a; Stoj. & Stef., Fl. Bulg. ed. 1, 2: 817. 1925.

= *B. gerardi* var. *breviradiatum* Rchb., Iconogr. Bot. Pl. Crit. 2: 56. 1824 ≡ *B. breviradiatum* (Rchb.) Wettst., Biblioth. Bot. 5(Heft 26): 52. 1892; Velen., Fl. Bulg. Suppl.: 135. 1898.

Variability: Among the Bulgarian populations of the species there are two morphotypes, more or less distinguishable by their habit and partly by the color of petals. One of them has virgate habit, relatively short branches (5–6 cm), standing almost straight up, non-divergent rays, and reddish to maroon petals. In the past, it has been considered a separate species: *B. breviradiatum*. The other morphotype has spreading lateral branches, 10–15 cm long, slightly divergent umbel rays and yellow to reddish-yellow petals. The differences between the two morphotypes are minor

and they are now considered as part of the infraspecific variability of the species.

Diagnostic characters and similar taxa: Usually virgate habit, bracts and bracteoles oblong linear-lanceolate, 3-veined. Umbel rays quite unequal, often non-divergent, petals reddish to reddish-yellow and unripe mericarps dark green to reddish-green (Fig. 3B). *Bupleurum affine* is similar to *B. pachnospermum*, but the latter is pseudo-dichotomously branched in the upper part, and has longer spreading branches, divergent rays, elliptical-lanceolate unequal bracts and bracteoles, the largest bract 5–7-veined, bright yellow petals, and glauco-pruinose ovary and unripe mericarps.

Distribution in Bulgaria: Across the country, up to 1200 m (Plate II. 4). In dry grasslands, sparse scrubs, riparian meadows, on sandy, calcareous and siliceous substrates.

Global distribution: C and SE Europe (from Pannonian-Carpathian region to the Balkans), Crimea, Caucasus, NW part of Asia Minor.

(10). *B. asperuloides* Heldr. ex Boiss., Diagn. Pl. Orient. ser. 2, 6: 76. 1859; Velen., Fl. Bulg. Suppl.: 133.

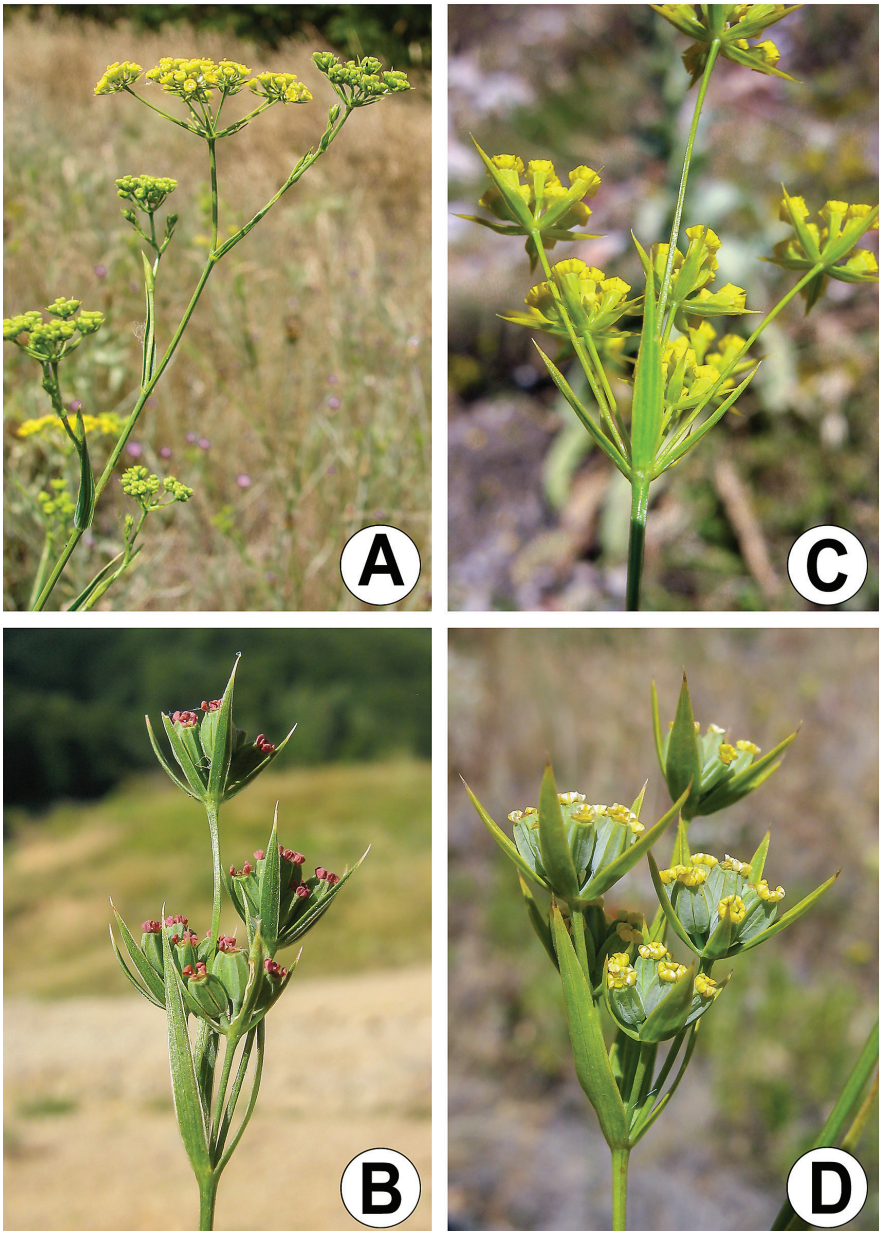

Fig. 3. Morphology of umbels in *B. aequiradiatum* (**A**), *B. affine* (**B**), *B. commutatum* (**C**), and *B. pachnospermum* (**D**) (photographs by Stoyan Stoyanov and Zoran Nikolov).

1898; Tutin, Fl. Eur. 2: 348. 1968; Assenov, Fl. RP Bulg. 8: 122. 1982.

Lectotype: Greece, *in vinetis prope pagum Rachova in regione inferiori m. Parnassi, alt. 2500' circ., 26.08.1856, Heldreich 513, Herb. Graec. Norm. 3386* (isolectotypes BP 273946-273948!, BP 479670!, G 00359449 – photo!), *Pimenov* in Snogerup & Snogerup (ed.), Willdenowia 31: 276. 2001.

[– *B. sintenisianum* sensu Wolff in Engler, Pflanzenr. 43 (1910) et Hayek, Repert. Spec. Nov. Regni Veg. Beih. 30(1) (1927), non Uechtr. in Kanitz, Pl. Roman. (1879-1881), nom. nud., based on *Sintenis no. 474a* from Romania (LD!)].

Diagnostic characters and similar taxa: Bracteoles four, conspicuously carinate. Petals distinctly verrucose at the bend and inflexed lobe. Unripe mericarps prismatic to semi-ellipsoid with weak ribs, when ripe, the three vallecular vittae stand out on the mericarp surface as three thin parallel lines between the ribs. Among the Bulgarian representatives, *B. boissieri* also has four bracteoles, but they are almost flattened, with distinct veins and the petals are without papillae, only granulose at bend. By its habit, characteristics of the umbels and presence of verrucae at petal bend, *B. asperuloides* is quite similar to *B. pauciradiatum*, but the latter has five bracteoles and its mericarps are rugulose, with obscure ribs.

Distribution in Bulgaria: Black Sea Coast, Balkan Range (*Eastern*), Valley of River Struma, Rhodopi Mts (*Eastern*), Thracian Lowland, Tundzha Hilly Country, up to 800 m (Plate II. 5). In dry stony grasslands and on the margins of sparse scrubs, in the plains and lower parts of the mountains, on calcareous and siliceous substrates.

Global distribution: S and E parts of the Balkans (Bulgaria, Republic of N Macedonia and Greece), Crimea, SW Russia (Black Sea coastal area of Krasnodar Krai Region) and W part of Asia Minor.

(11). *B. boissieri* Post, Bot. J. Lin. Soc. 24: 426. 1888; Stoyanov, Phytotaxa 392(3): 205. 2019.

Lectotype (designated by *M.G. Pimenov* & *F. Jacquemoud* in Stoyanov, Phytotaxa 392(3): 205. 2019): Turkey, *in sylvaticis montis Amani* [Amanos Mountains], *23.09.1884, G. Post 91* (G 00150141, photo!).

= *B. sintenisianum* Uechtr. in Kanitz, Pl. Roman.: 207. 1879-1881. Type (designated by Snogerup & Snogerup, Willdenowia 31: 207. 2001): Romania, *Dobrudscha, Babadagh, Wald von Tschukarowa [Ciucurova], 24.08.1872*, *P. Sintenis 474a* (LD 1078470!), nom. nud.

= *B. uechtritzianum* Stoyanov, Phytol. Balcan. 16(1): 66. 2010. Holotype: Bulgaria, *Ruse district, Dve Mogili Municipality, east and northeast of Ostritsa village, 210 m, 43°32.067' N, 25°59.000' E, 28.08.2009, S. Stoyanov & I. Kolev* (SOM 165541!).

Diagnostic characters and similar taxa: Bracteoles four, ± flattened, 3-veined. Unripe mericarps with noticeable purplish-brown to dark-brown longitudinal stripes between the ribs due to the dark content of the vallecular oil ducts. Among the Bulgarian representatives, *B. asperuloides* has also four bracteoles, but they are carinate, and its petals are with verrucae at the petal bend. Furthermore, the two species differ in the number of their vallecular vittae – single in *B. boissieri*, and three per vallecula in *B. asperuloides*.

Distribution in Bulgaria: Black Sea Coast (*Northern* – above Bolata bay, Kaliakra Reserve; W of Balchik town; at the villages of Obrochishte and Lyahovo, Balchik district; Frangensko Plateau, above Aksakovo town), Northeast Bulgaria (in the valley of Cherni Lom river, between the villages of Ostritsa and Katselovo, Ruse district), up to 300 m (Plate II. 6). In dry stony grasslands and on the margins of sparse scrubs of *Paliurus spina-christi* and *Carpinus orientalis*, on limestone and marl substrates.

Global distribution: NE part of the Balkans (NE Bulgaria and Romanian Dobrogea), Crimea and SW Asia (Turkey, Syria and Georgia).

(12). *B. commutatum* Boiss. & Balansa in Boiss., Diagn. Pl. Orient. ser. 2, 6: 75. 1859; Velen., Fl. Bulg.: 224. 1891a; Stoj. & Stef., Fl. Bulg. ed. 1, 2: 816. 1925; Stoj. & Stef., Fl. Bulg. ed. 2: 759. 1933 et *op. c.* ed. 3: 834. 1948; Stoj., Stef. & Kitanov, Fl. Bulg. ed. 4, 2: 780. 1967 (sub *B. c.* var. *commutatum*); Tutin, Fl. Eur. 2: 348. 1968 (sub *B. c.* subsp. *commutatum*); Assenov, Fl. RP Bulg. 8: 119. 1982 (sub *B. c.* subsp. *commutatum*).

Lectotype: Turkey, B2 Izmir, *Vignes au-dessus de Birghui (Tmolus occidental.), 23.07.1854, Balansa 36* (G 00330131 – photo!), *Pimenov* in Snogerup & Snogerup (ed.), Willdenowia 31: 296. 2001.
= *B. laxum* Velen., Österr. Bot. Z. 41: 397. 1891b; Velen., Fl. Bulg. Suppl.: 134. 1898 ≡ *B. commutatum* var. *laxum* (Velen.) Velen., Fl. Bulg.: 225. 1891a; Stoj. & Stef., Fl. Bulg. ed. 1, 2: 816. 1925; Stoj. & Stef., Fl. Bulg. ed. 2: 759. 1933 et *op. c.* ed. 3: 834. 1948.
Isotype: Bulgaria, *in graminosis ad Rilo Selo, 07.1889, J. Velenovský* (BP 415137!).
[– *B. australe* sensu Velen., Fl. Bulg. Suppl. (1898), Stoj. & Stef., Fl. Bulg. ed. 2 (1933), *op. c.* ed. 3 (1948), Stoj., Stef. & Kitanov, Fl. Bulg. ed. 4, 2 (1967) et *B. gerardi* var. *australe* sensu Stoj. & Stef., Fl. Bulg. ed. 1, 2 (1925), non Jordan, Pug. Pl. Nov. (1852)].
[– *B. gerardi* sensu Assenov, Fl. RP Bulg. 8 (1982) et Tutin, Fl. Eur 2 (1968), non All. in Mélang. Philos. Math. Soc. Roy. Turin 5 (1774)].

Diagnostic characters and similar taxa: Umbel rays distinctly unequal, up to 50 mm, ± divergent at anthesis, non-divergent in fruit stage (Fig. 3C). Bract and bracteole margins entire or inconspicuously serrulate only at apex. Mericarps ellipsoid, *ca.* 2.5 mm long, with filiform ribs. *Bupleurum commutatum* resembles *B. aequiradiatum*, but the latter has almost equal rays, up to 20 mm, divergent at all stages, bract and bracteole margins serrulate, and mericarps up to 1.5 mm, with weak ribs.

In the Bulgarian herbaria, many specimens of *B. commutatum* have been found misidentified as *B. gerardi* All. The two species have some similarities in the habit and characteristics of umbels, but they are well distinguished in the morphology of flowers and fruits. *Bupleurum commutatum* has petals 0.9 mm wide, while in *B. gerardi* they are almost twice narrower, up to 0.5 mm. Furthermore, the stylopodium of *B. commutatum* is as wide as mericarp and styles are ca. 0.5 mm, exceeding the stylopodium radius, while in *B. gerardi* stylopodium is narrower than mericarp and styles are up to 0.2 mm. In conclusion, it was found that *B. gerardi* does not occur in Bulgaria (Stoyanov 2019).

Distribution in Bulgaria: Balkan Range (*Central*), Sofia Region, Znepole Region, Vitosha Region, West Frontier Mts, Valley of River Struma (*Southern*), Mt Belasitsa, Mt Slavyanka, Pirin Mts, Rila Mts, Mt Sredna Gora, Rhodopi Mts, Thracian Lowland, Tundzha Hilly Country, 100–1500 m (Plate III. 1). In dry stony grasslands, on siliceous, serpentine and sandy substrates, seldom on limestone, southwards of Stara Planina Mts.

Global distribution: C part of the Balkan Peninsula (S Bulgaria, SE Serbia, Republic of N Macedonia, and N Greece), W and C parts of Asia Minor. It is erroneosly reported for Crimea (Snogerup & Snogerup 2001), but in fact the cited specimens belong to *B. gerardi* All.

(13). *B. euboeum* Beauverd & Topali, Candollea 7: 260. 1937; Snogerup & Snogerup, Willdenowia 31: 268. 2001.
Holotype: Greece, *in locis maritimis arenosis prope urbem Chalkis Euboeae copiosissimum, 22.06.1935, Topali & Beauverd 504* (G 00367653 – photo!).
[– *B. marschallianum* auct. Bulg. non C.A. Mey. (1831)].
[– *B. tenuissimum* subsp. *gracile* sensu Assenov, Fl. RP Bulg. 8 (1982) et Tutin, Fl. Eur. 2 (1968), non (M. Bieb.) H. Wolff in Engler, Pflanzenr. 43 (1910)].

Diagnostic characters and similar taxa: Bracts three, petals yellow, fruits ovate, covered with small white papillae, ribs obscure, styles 0.4–0.5 mm. Among the Bulgarian representatives, only *B. euboeum* and *B. tenuissimum* have warty formations on the mericarp surface. However, the latter has 4–5 barcts, reddish-yellow petals, mericarps with yellowish verrucae and conspicuous winged rugulose ribs, and style up to 0.2 mm, shorter than the stylopodium radius.

Distribution in Bulgaria: Valley of River Struma (*Southern* – in the area of mineral baths near Marikostinovo village, Petrich district), Thracian Lowland (near Plovdiv town) (Plate III. 2). In saline grasslands. South Bulgaria is the northern limit of the species area. It has probably re-expanded its range via migration of waterfowl.

Global distribution: S Bulgaria, coastal parts of Greece (including the Aegean Islands), Republic of N Macedonia (Stoyanov & Ćušterevska 2021), and W part of Asia Minor.

(14). *B. pachnospermum* Pančić, Fl. Princ. Serb.: 329. 1874 (in clavi); Velen., Fl. Bulg.: 225. 1891a; Stoj. &

Stef., Fl. Bulg. ed. 2: 759. 1933 et *op. c.* ed. 3: 834. 1948; Stoj., Stef. & Kitanov, Fl. Bulg. ed. 4, 2: 780. 1967; *B. junceum* var. *pachnospermum* (Pančić) Stoj. & Stef., Fl. Bulg. ed. 1, 2: 816. 1925.

Type: Serbia, *in rupestribus Vrške Čuke, 1868, Pančić 6408* (BEOU – photo!, sub *B. pruinosum* Pančić, nom. nud.).

= *B. gerardi* subsp. *glaucocarpum* Borbás, Term. Füz. 19: 221. 1896 ≡ *B. commutatum* subsp. *glaucocarpum* (Borbás) Hayek, Repert. Spec. Nov. Regni Veg. Beih. 30(1): 975. 1927 [Prodr. Fl. Penins. Balcan. 1]; Tutin, Fl. Eur. 2: 348. 1968; Assenov, Fl. RP Bulg. 8: 119. 1982.

Diagnostic characters and similar taxa: Stem pseudo-dichotomous in the upper part, rays ± divergent, unequal, bracts and bracteoles elliptical-lanceolate, the longest bract has 5(–7) clear veins, petals bright yellow, ovary and unripe mericarps glauco-pruinose (Fig. 3D). In habit, *B. pachnospermum* resembles *B. affine*, but the latter has non-divergent rays, linear-lanceolate bracts and bracteoles, reddish to maroon petals, and unripe mericarps are dark green to purplish green.

Distribution in Bulgaria: Forebalkan (*Western* – Vrashka Chuka), Sofia Region, Znepole Region (Mt Chepan and Mt Konyavska), Vitosha Region, Thracian Lowland (Stoevo village, Asenovgrad district and Besaparski Hills), 200–1200 m (Plate III. 3). In dry stony calcareous grasslands.

Global distribution: C Europe (Austria, Hungary and the Czech Republic) and W and C parts of the Balkans.

(15). *B. pauciradiatum* Fenzl ex Boiss., Fl. Orient. 2: 848. 1872; Stoyanov, Phytotaxa 365(2): 140. 2018; *B. asperuloides* var. *laxum* Fenzl in Tchihatch., Asie Min. Bot. 1: 418. 1860.

Type: Turkey, *iter Cilicicum in Tauri alpes "Bulgar Dagh", supra Gülek, 30.06.1853, Th. Kotschy 78* (holotype W 0075794 – photo!; isotype LE 00015709 – photo!).

Diagnostic characters and similar taxa: Branches virgate, spreading or bending downwards, the longest distinctly loose, petals 0.3–0.4 mm wide, distinctly papillose at bend, ripe fruits light brown, finely rugulose, ribs obscure. Among the Bulgarian representatives, *B. asperuloides* also has papillae on petal bend, but it has four bracteoles (versus five in *B. pauciradiatum*), the petals are 0.7–0.8 mm wide, and the three vallecular vittae stand out on the mericarp surface as three thin parallel lines between the filiform ribs.

Distribution in Bulgaria: Black Sea Coast (*Northern* – above Bolata bay, Kaliakra Reserve) (Plate III. 4).

Global distribution: Turkey (S Anatolia and Mt Amanos) and Bulgaria (locally – above Bolata bay, Kaliakra Reserve).

(16). *B. praealtum* L., Fl. Monsp.: 12. 1756; Tutin, Fl. Eur. 2: 347. 1968; Assenov, Fl. RP Bulg. 8: 118. 1982.

Lectotype: *Dodoens, Stirp. Hist. Pempt.: 633 (left figure)*, *Snogerup* in Davis, Fl. Turkey 4: 408. 1972.

= *B. junceum* L., Sp. Pl. ed. 2: 343. 1762; Velen., Fl. Bulg.: 224. 1891a; Stoj. & Stef., Fl. Bulg. ed. 1, 2: 816. 1925; Stoj. & Stef., Fl. Bulg. ed. 2: 758. 1933 et *op. c.* ed. 3: 834. 1948; Stoj., Stef. & Kitanov, Fl. Bulg. ed. 4, 2: 780. 1967.

= *B. junceum* var. *multiflorum* Velen., Fl. Bulg.: 224. 1891a; Stoj. & Stef., Fl. Bulg. ed. 1, 2: 816. 1925; Stoj. & Stef., Fl. Bulg. ed. 2: 758. 1933 et *op. c.* ed. 3: 834. 1948.

Diagnostic characters and similar taxa: Bracts three, umbels 3-rayed, rays clearly divergent, almost equal, bracteoles 4–5, distinctly shorter than the flowers. The leaves ± keel-shaped, folded along the midrib. Mericarps are the largest among the representatives of the genus, reaching 6 mm. By its habit, *B. praealtum* is similar to *B. aequiradiatum*, but the latter has 5–8-rayed umbels, 4–5 bracts and its fruits are much smaller, *ca.* 1.5 mm.

Distribution in Bulgaria: Across the country, up to 1200 m (Plate III. 5). In dry calcareous grasslands and sparse scrubs, seldom on sandy and siliceous substrates, from the plains up to the oak belt in the mountains.

Global distribution: C, S and SE Europe.

(17). *B. tenuissimum* L., Sp. Pl.: 238. 1753; Stoj. & Stef., Fl. Bulg. ed. 3: 834. 1948; Stoj., Stef. & Kitanov, Fl. Bulg. ed. 4, 2: 781. 1967; Tutin, Fl. Eur. 2: 348. 1968 (sub *B. t.* subsp. *tenuissimum*); Assenov, Fl. RP Bulg. 8: 124. 1982 (sub *B. t.* subsp. *tenuissimum*).

Lectotype: *Linnaean Herbarium Stockholm no. 116.13* (S!), *Reduron* in Snogerup & Snogerup (ed.), Willdenowia 31: 264. 2001.

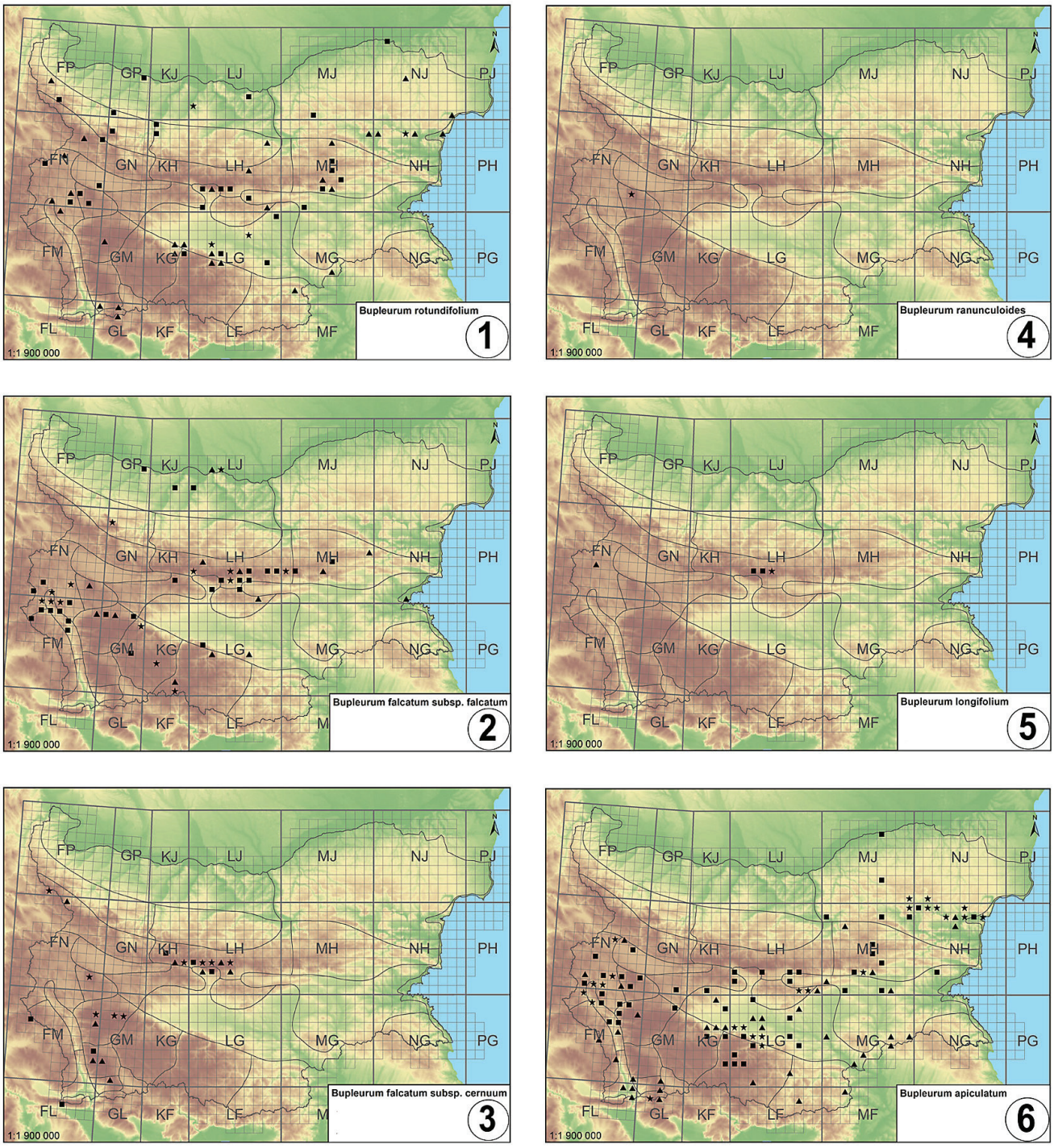

Plate I. Distribution maps of the *Bupleurum* species in Bulgaria:
1. *B. rotundifolium*; **2.** *B. falcatum* subsp. *falcatum*; **3.** *B. falcatum* subsp. *cernuum*; **4.** *B. longifolium*; **5.** *B. ranunculoides*; **6.** *B. apiculatum* (▲– herbarium records; ■ – literature data; ★ – herbarium and literature data).

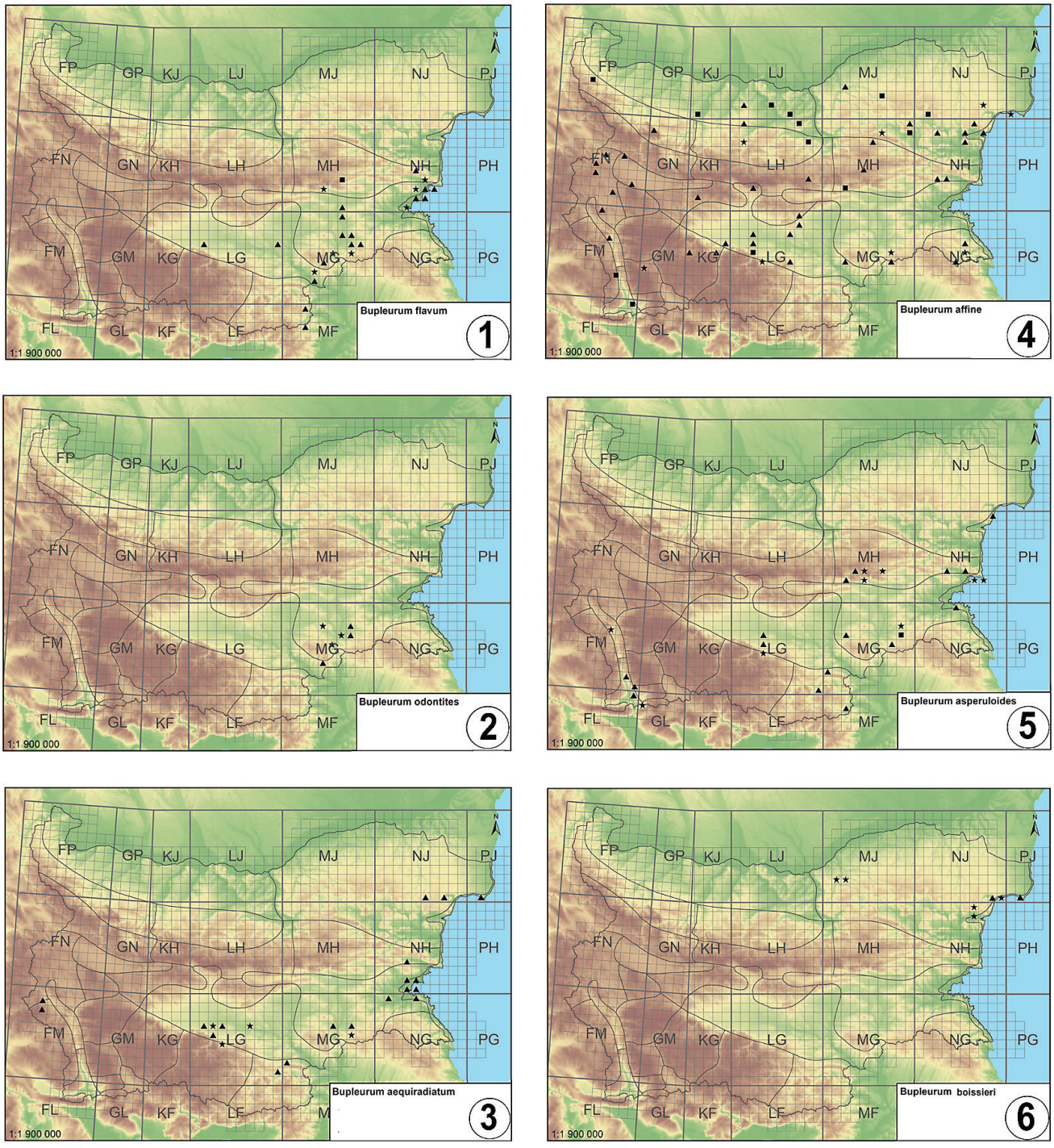

Plate II. Distribution maps of the *Bupleurum* species in Bulgaria:
1. *B. flavum*; **2.** *B. odontites*; **3.** *B. aequiradiatum*; **4.** *B. affine*; **5.** *B. asperuloides*; **6.** *B. boissieri*
(▲– herbarium records; ■ – literature data; ★ – herbarium and literature data).

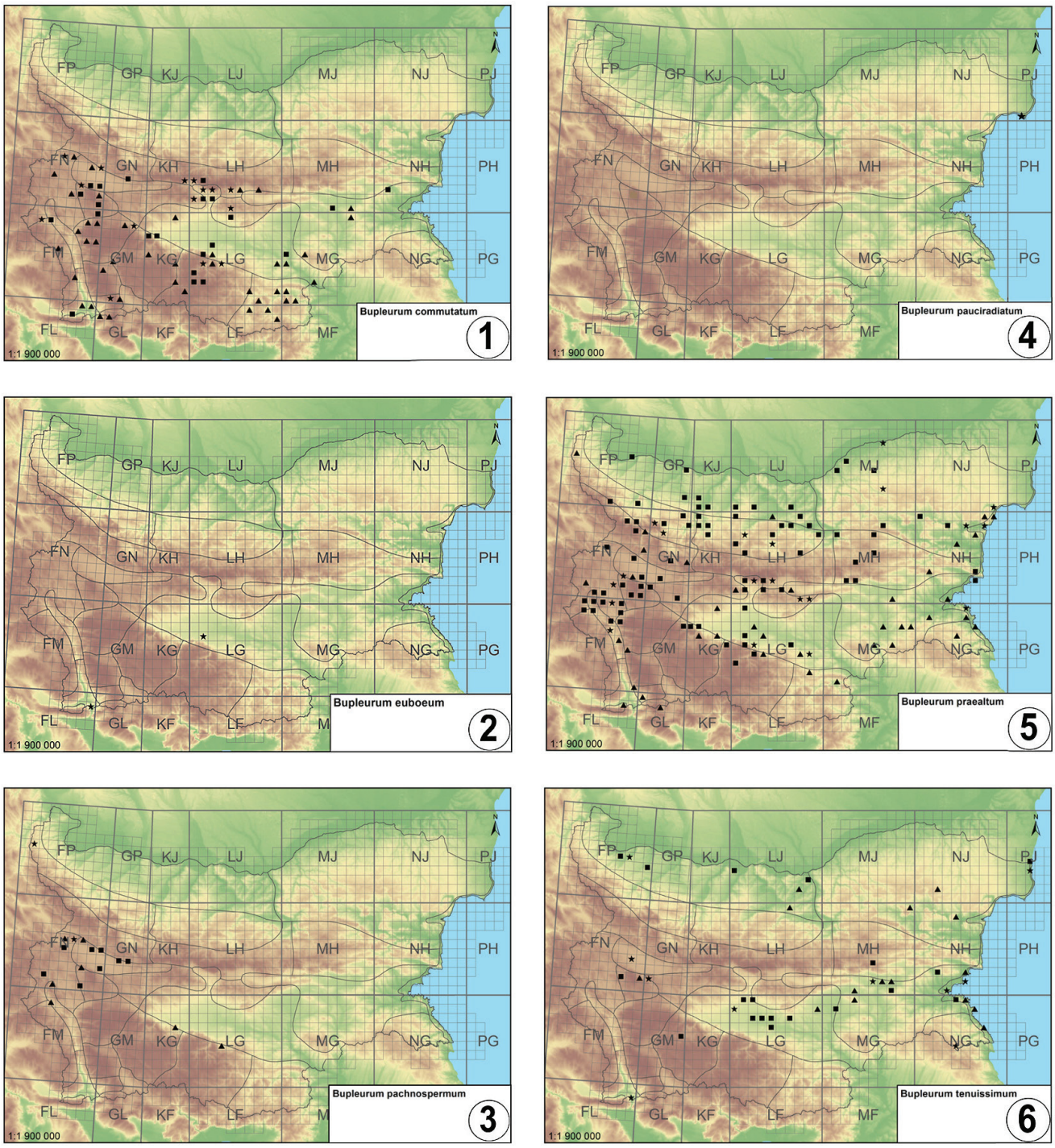

Plate III. Distribution maps of the *Bupleurum* species in Bulgaria:
1. *B. commutatum*; **2.** *B. euboeum*; **3.** *B. pachnospermum*; **4.** *B. pauciradiatum*; **5.** *B. praealtum*; **6.** *B. tenuissimum*
(▲– herbarium records; ■ – literature data; ★ – herbarium and literature data).

Diagnostic characters and similar taxa: Glaucous plant, bracts 4–5, fruits ± rounded, with yellowish verrucae and conspicuous winged rugulose ribs, and style up to 0.2 mm, shorter than the stylopodium radius. By its long, spreading arcuate lateral branches, the species can be confused with *B. asperuloides*, especially in the flowering stage. Among the Bulgarian representatives, only *B. tenuissimum* and *B. euboeum* have warty formations on the mericarp surface. However, the latter has mericarps with whitish papillae (not yellowish), obscure ribs, and styles 0.4–0.5 mm, longer than the stylopodium radius.

Distribution in Bulgaria: Black Sea Coast, Northeast Bulgaria, Danubian Plain, Balkan Range (*Eastern*), Sofia Region, Vitosha Region, Valley of River Struma (*Southern*), Mt Sredna Gora (*Western*), Rhodopi Mts (*Western*), Thracian Lowland, Tundzha Hilly Country, Mt Strandzha, up to 700 m (Plate III. 6). It predominantly occurs in saline habitats, in the lower parts of the country.

Global distribution: Europe, NW Africa and NW part of Asia Minor.

Conclusion

The following changes have occurred as compared to the last comprehensive taxonomic treatment of the genus *Bupleurum* by Assenov (1982): three new species have been found for the Bulgarian flora – *B. ranunculoides*, *B. pauciradiatum* and *B. boissieri*, and the distribution of the recently reported species *B. euboeum* (Snogerup & Snogerup 2001) has been confirmed; three taxa, *B. baldense* subsp. *gussonei*, *B. gerardi* and *B. tenuissimum* subsp. *gracile*, erroneously recorded for Bulgaria, have been excluded; and the misused name, *B. sibthorpianum*, has been replaced with *B. falcatum* subsp. *cernuum*.

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References

Arcangeli, G. 1894. Compendio della flora italiana. Ed. 2. Ermanno Loescher, Torino & Roma.

Assenov, I. 1982. *Bupleurum* L. – In: **Velchev, V.** (ed.), Fl. Reipubl. Popularis Bulgaricae. Vol. **8**, pp. 109-125. In Aedibus Acad. Sci. Bulgaricae, Serdicae (in Bulgarian).

Barina, Z., Pifkó, D. & Mesterházy, A. 2011. Contributions to the flora of Albania, 3. – Willdenowia, **41**: 329-339.

Beauverd, G. & Topali, S.-P. 1937. Plantae novae Graecae. – Candollea, **7**: 255-278.

Boissier, E. 1859. Diagnoses plantarum orientalium novarum, ser. 2, 6. Apud B. Hermann, Lipsiae & Apud J.-B. Baillière, Parisiis.

Boissier, E. 1872. Flora Orientalis. Vol. **2**. Apud H. Georg, Bibliopolam, Genevae et Basileae.

Borbás, V. 1896. Nomenclature explanations (Nomenklaturai fejtegetések). – Term. Füz., **19**: 209-224.

Briquet, J. 1897. Monographie des Buplèvres des Alpes Maritimes. – In: **Burnat, E.** (ed.), Matériaux pour servir à l'histoire de la flore des Alpes Maritimes. Georg & Co, Bale et Genève.

Calestani, V. 1905. Contributo alla sistematica delle Ombellifere d'Europa. – Webbia, **1**: 89-170.

Cauwet-Marc, A-M. 1976. Biosystématique des Espèces Vivaces de *Bupleurum* L. (*Umbelliferae*) du Bassin Méditerranéen Occidental. PhD Thesis (3 vols). Université des Sciences et Techniques du Languedoc, Perpignan.

Forsskål, P. 1775. Flora Aegyptiaca-Arabica. Mölleri, Hauniae (Copenhagen).

Frivaldszky, E. 1835. Succinctae diagnoses specierum plantarum novarum europaeo-turcicarum in catalogo meo occurrentium. – Flora, **18**(1): 331-336.

Grenier, M. & Godron, M. 1848. Flore de France. Vol. **1**. J.-B. Baillière, Paris.

Gussone, G. 1827. Florae Siculae Prodromus. Vol. **1**. Ex Regia Typographia, Neapoli.

Hand, R. 2011. *Apiaceae* Lindl. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity (accessed 20 January 2022). http://ww2.bgbm.org/EuroPlusMed/PTaxonDetail.asp?NameCache=Apiaceae&PTRefFk=7500000

Hayek, A. 1927. Prodromus Florae Peninsulae Balcanicae 1. – Repert. Spec. Nov. Regni Veg. Beih., **30**(1): 961-1193.

Heywood, V.H. 1967. Flora Europaea Notulae Systematicae ad Floram Europaeam spectantes. – Feddes Repert., **74**: 1-37.

Hitchcock, A.S. & Green, M.L. 1929. Standard species of Linnaean genera of Phanerogamae (1753-1754), pp. 111-195. – In: International Botanical Congress. Cambridge (England), 1930. Nomenclature. Brit. Bot. His Majesty's Stationery Office, London.

Jacquin, N.J. 1775. Florae Austriacae. Vol. **3**. Leopoldi Joannis Kaliwoda, Viennae.

Jarvis, C.E., Reduron, J.-P., Spencer, M.A. & Cafferty, S. 2006. Typification of Linnaean plant names in *Apiaceae*. – Taxon, **55**(1): 207-216.

Jordan, A. 1852. Pugillus Plantarum novarum. J.-B. Baillière, Paris.

Jordanov, D. (ed.) 1966. Flora Reipublicae Popularis Bulgaricae. Vol. **3**. In Aedibus Acad. Sci. Bulgaricae, Serdicae (in Bulgarian).

Kanitz, A. 1879-1881. Plantas Romaniae hucusque cognitas. Apud E. Demjén, Claudiopoli [Cluj-Napoca].

Koso-Poljansky, B. 1913. Epitome Bupleurorum Rossiae. – Trudy Imp. Bot. Sada Petra Velikago [Acta Horti Petropolitani], **30**(2): 135-333.

Linnaeus, C. 1753. Species Plantarum. Laurentii Salvii, Holmiae.

Linnaeus, C. 1756. Flora Monspeliensis. Excud. L.M. Höjer, Upsaliae.

Linnaeus, C. 1762. Species Plantarum. Ed. 2. Laurentii Salvii, Holmiae.

Meyer, C.A. 1831. Verzeichniss der Pflanzen, welche während der, auf Allerhöchsten Befehl, in den Jahren 1829 und 1830 unternommenen Reise im Caucasus un in den Provinzen am westlichen Ufer des Caspishen Meeres gefunden und eingesammelt worden sind. Buchdruckerei der Kaiserlichen Akademie der wissenschaften, St. Petersburg.

Neves, S. & Watson, M.F. 2004. Phylogenetic relationships in *Bupleurum* (*Apiaceae*) based on nuclear ribosomal DNA ITS sequence data. – Ann. Bot. (Oxford), **93**: 379-398.

Pančić, J. 1874. Flora principatus Serbiae (Flora kneževine Srbije ili vaskularne biljke, koje y Srbije divlie rastu). Državne Štamparije, Beogradu (in Serbian).

Post, G. 1888. Diagnoses Plantarum Novarum Orientalium. – Bot. J. Linn. Soc., **24**: 419-441.

Rechinger, K.H. & Snogerup, S. 1988. *Bupleurum* L. – In: **Rechinger, K.H.** (ed.), Flora Iranica. Vol. **162**, pp. 269-297. Akademische Druck- und Verlagsanstalt, Graz.

Reichenbach, H.G.L. 1824. Iconographia botanica seu plantae criticae. Vol. **2**. Fredericum Hofmeister, Lipsiae.

Rochel, A. 1838. Botanische Reise in das Banat im Jahre 1835. Gustav Heckenast, Pesth.

Sadler, J. 1825. Flora Comitatus Pestiensis. Pars I. Nobilis Matthiae Trattner de Petróza, Pestini.

Sibthorp, J. & Smith, J.E. 1806. Florae Graecae prodromus. Vol. **1**. Richardi Taylor et socii, Londini.

Snogerup, S. 1972. *Bupleurum* L. – In: **Davis, P.H.** (ed.), Flora of Turkey and the East Aegean Islands. Vol. **4**, pp. 393-418. Edinburgh Univ. Press, Edinburgh.

Snogerup, S. & Snogerup, B. 2001. *Bupleurum* L. (*Umbelliferae*) in Europe – 1. The annuals, *B.* sect. *Bupleurum* and sect. *Aristata.* – Willdenowia, **31**: 205-308.

Snogerup, S. & Snogerup, B. 2003. Local endemism in European annual *Bupleurum* (*Umbelliferae*). – Bocconea, **16**(2): 751-755.

Stojanov, N. & Stefanov, B. 1925. Flora of Bulgaria. Ed. 1, Vol. **2**. State Printing House, Sofia (in Bulgarian).

Stojanov, N. & Stefanov, B. 1933. Flora of Bulgaria. Ed. 2. Guttenberg Press, Sofia (in Bulgarian).

Stojanov, N. & Stefanov, B. 1948. Flora of Bulgaria. Ed. 3. Univ. Press, Sofia (in Bulgarian).

Stojanov, N., Stefanov, B. & Kitanov, B. 1967. Flora of Bulgaria. Ed. 4, Vol. **2**. Naouka & Izkoustvo, Sofia (in Bulgarian).

Stoyanov, S. 2004. A new perennial *Bupleurum* species for the Bulgarian flora. – Phytol. Balcan., **10**(2-3): 187-190.

Stoyanov, S. 2010. A new annual *Bupleurum* (*Apiaceae*) species from Northeast Bulgaria and Romanian Dobrogea. – Phytol. Balcan., **16**(1): 65-74.

Stoyanov, S. 2015. *Bupleurum longifolium* L. (p. 203), *Bupleurum ranunculoides* L. (p. 204), *Bupleurum odontites* L. (p. 421). – In: **Peev, D. & al.** (eds). Red Data Book of the Republic of Bulgaria. Vol. **1**. Plants and Fungi. IBER-BAS & MOEW, Sofia.

Stoyanov, S. 2018. Taxonomic redefinition of *Bupleurum pauciradiatum* and *B. wolffianum* (*Apiaceae*). – Phytotaxa, **365**(2): 130-144. https://doi.org/10.11646/phytotaxa.365.2.2

Stoyanov, S. 2019. Contribution to the taxonomy and distribution of *Bupleurum boissieri*, *B. aequiradiatum* and *B. gerardi* (*Apiaceae*) in the Balkans. – Phytotaxa, **392**(3): 197-216. https://doi.org/10.11646/phytotaxa.392.3.3

Stoyanov, S. 2020. *Bupleurum aequiradiatum* (H. Wolff) Snogerup & B. Snogerup, *Bupleurum commutatum* Boiss. & Balansa, *Bupleurum gerardi* All, pp. 331-332. – In: **Raab-Straube, E. von & Raus, Th.** (ed.), Euro+Med-Checklist Notulae, 12. – Willdenowia, **50**(2): 305-341. https://doi.org/10.3372/wi.50.50214

Stoyanov, S. & Ćušterevska, R. 2021. *Bupleurum euboeum* Beauverd & Topali, *Bupleurum gerardi* All., pp. 364-365. – In: **Raab-Straube, E. von & Raus, Th.** (ed.), Euro+Med-Checklist Notulae, 14. Willdenowia, **51**(3): 355-369. https://doi.org/10.3372/wi.51.51304

Tchihatcheff, P. 1860. Asie Mineure. Botanique. Vol. **1**. Gide, Paris.

Tenore, M. 1815. Ad Catalogum plantarum Horti Regii Neapolitani Anno 1813 editum Appendix Prima. Ex Typographia Amuliana, Neapoli.

Thiers, B. 2021+ [continuously updated]. Index herbariorum: a global directory of public herbaria and associated staff. – New York Botanical Garden. Available from: http://sweetgum.nybg.org/ih/

Tutin, T.G. 1968. *Bupleurum* L. – In: **Tutin, T.G., Heywood, V.H., Burges, N.A., Moore, D.M., Valentine, D.H., Walters, S.M. & Webb, D.A.** (eds), Flora Europaea. Vol. **2**, pp. 345-350. Cambridge Univ. Press, Cambridge.

Velenovský, J. 1890. Plantae novae Bulgaricae. – Sitzungsber. Königl. Böhm. Ges. Wiss. Prag., Math.-Naturwiss. Cl. **1**, 1890: 39-59.

Velenovský, J. 1891a. Flora Bulgarica. Descriptio et enumeratio systematica plantarum vascularium in principatu Bulgariae sponte nascentium. Prague.

Velenovský, J. 1891b. Nachträge zur Flora Bulgarica. – Österr. Bot. Z., **41**: 397-400.

Velenovský, J. 1892. Neue Nachträge zur Flora Bulgarica. – Sitzungsber. Königl. Böhm. Ges. Wiss. Prag., Math.-Naturwiss. 1892: 369-390.

Velenovský, J. 1898. Flora Bulgarica. Supplementum I. Prague.

Villars, M. 1779. Prospectus de l'Histoire des plantes de Dauphiné. L'Imprimeire Royale, Grenoble.

Wettstein, R. 1892. Beitrag zur Flora Albaniens. – Biblioth. Bot., **5** (26): 1-103.

Willkomm, M. & Lange, J. 1880. Prodromus florae Hispanicae. Vol. **3**. E. Schweizerbart, Stuttgartiae.

Wolff, H. 1910. *Umbelliferae-Apioideae-Bupleurum, Trinia* et reliquae *Ammineae* heteroclitae. – In: **Engler, A.** (ed.), Pflanzenreich, **43**. Berlin.

Wu, Z. & Raven, P.H. (eds) 2005. Flora of China. Vol. **14**. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis.