

Papaver nigrotinctum: first records for the flora of Bulgaria and Republic of North Macedonia

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Abstract. *Papaver nigrotinctum*, so far known from Greece, SW Turkey and the Aegean islands, is reported for the first time for the Bulgarian flora. It was found in the southernmost parts of the valley of River Struma (SW Bulgaria). Based on herbarium records, it was erroneously determined as *P. apulum*. *Papaver nigrotinctum* appeared also to be novel to the flora of the Republic of North Macedonia, where based on herbarium records, it was misidentified as *P. argemone* s.l. The article presents morphological description of the species, its distinguishing characters from the morphologically most similar species *P. argemone* and *P. apulum*, as well as data about its distribution in Bulgaria and the Republic of North Macedonia.

Key words: Bulgaria, misapplied names, new records, North Macedonia, *Papaveraceae*

Introduction

So far, genus *Papaver* L. has been represented by eight native species in the Bulgarian flora: *Papaver apulum* Ten., *P. degenii* (Urum. & Jáv.) Kuzmanov, *P. dubium* L., *P. hybridum* L., *P. laevigatum* M. Bieb., *P. pinnatifidum* Moris, *P. rhoeas* L., and *P. rumelicum* Velen. (Kuzmanov 1970, Popova 2011). In the spring of 2019, during fieldwork under the project “Reproductive potential, metabolic and genetic profile in *in situ* and *ex situ* conditions of medicinal plant species from the Bulgarian flora with resource deficit – scientific base for their cultivation” in the floristic region of the Valley of River Struma, an unknown *Papaver* was discovered. The species was clearly related to the section *Argemonidium* Spach by its annual habit, setose capsule and dilated staminal filaments. However, by its cylindrical to narrowly ellipsoid capsules it was well distinguished from the two Bulgar-

ian representatives of this section—*P. apulum* and *P. hybridum*—characterized by their ovate to subglobose capsules. Initially, after consulting the relevant literature (Mowat & al. 1993, Pignatti 1982) and checking the herbarium vouchers, the collected specimens were identified as *P. argemone* L. Subsequently, it was found that *P. argemone* was considered a variable species with five subspecies: subsp. *argemone*, subsp. *davisii*, subsp. *meikleii*, subsp. *minus*, and subsp. *nigrotinctum* (Kadereit 1986). It was also confirmed that the Bulgarian findings belonged to *P. argemone* subsp. *nigrotinctum* (Fedde) Kadereit. According to the latest revision of the *Papaver* section *Argemonidium* by Aghababayan (2011), *P. argemone* and *P. nigrotinctum* Fedde should be treated as different taxa. We accepted this conception and reported the latter herein in the rank of species.

Furthermore, while checking the genus *Papaver* in the Bulgarian herbaria, we came across three specimens

determined as *P. apulum* (two from Bulgaria and one from the Republic of North Macedonia), but actually they turned out to be *P. nigrotinctum*. This stirred doubts and required revisiting the specimens of genus *Papaver* kept in the herbaria of the Republic of North Macedonia. In the result, we found that the name *P. argemone* have been used in a wider sense, instead of *P. nigrotinctum*.

The present article is aimed at clarifying these misidentifications, reporting *P. nigrotinctum* for the floras of Bulgaria and the Republic of North Macedonia and providing data on its morphology and on the closest to it species.

Material and methods

The study is based on the authors' field observations, analysis of the protologues (Linnaeus 1753, Tenore 1830, Fedde 1909), relevant literature, and selected herbarium specimens of *P. argemone*, *P. apulum* and *P. nigrotinctum* in the herbaria BP, E, JE, K, LINN, MKNH, P, PRC, SO, SOA, SOM and W (acronyms according to Thiers 2008). Some collections, available as images via digital portals, were examined online (Kew Herbarium Catalogue, Linnean Collections, Royal Botanic Garden Edinburgh Herbarium Catalogue, Vascular Plants of MNHN Paris, and Virtual Herbaria JACQ).

Field survey and plant gathering took place in May–June 2019. The Bulgarian specimens of *P. nigrotinctum* were deposited in the SOM Herbarium. Morphological description of the species was based on the Bulgarian material, as well as on relevant literature (Mowat & al. 1993; Kadereit 2002).

Results and discussion

Papaver nigrotinctum Fedde in Engler, Pflanzenr. 40: 330. 1909; *P. argemone* subsp. *nigrotinctum* (Fedde) Kadereit in Notes Roy. Bot. Gard. Edinburgh 44: 37. 1986 (Figs 1–2).

Annual plant, up to 25 cm high; stems numerous, decumbent to ascending, occasionally branched above, seldom single suberect, patently densely setose below, appressed above. Basal leaves rosette-forming, 2–6 × 1–2 cm, petiolate, 2–3-pinnatifid, with irregular simple bristles appressed in rachis and

midrib and patent to subpatent in lamina; segments unequal in form, oblong-lanceolate, elliptic, spatulate to seldom rounded, ± revolute, acute to mucronate, with a single, 2–3 mm long, apical seta. Stem leaves subsessile, slender, with linear acuminate segments. Buds nodding, immature subglobose, mature obovate to pyriform, 0.7–1.3 × 0.5–0.8 cm, mostly sparsely setose; petals 1.5–3 × 1–2.5 cm, obovate to rounded, overlapping, orange to reddish-orange, with a black purple basal spot occupying up to one-third of their total length. Stamens 0.3–0.8 cm, with dilated dark-violet filaments and yellow anthers; capsule 10–15 mm long, cylindrical to narrowly ellipsoid, with patent setae throughout, stigmatic disc conical, with 4–6 rays and undulate margin between the rays; seeds 0.7–0.8 × 0.3–0.5 mm, semi-reniform, brown, regularly reticulate-alveolate.

Chromosome number

$2n = 14$ (Stoeva 1987; Stoeva & Ivanova 1989, as *P. apulum*). The same chromosome number was also reported for *P. nigrotinctum* by Kadereit (1986).



Fig. 1. *Papaver nigrotinctum*: A – flowering stems; B – basal part (northwards of Struma village, at the road fork to Krastiltsi village, photos Zh. Barzov).

Taxonomic notes

Papaver nigrotinctum is originally described as a hybrid between *P. argemone* and *P. apulum* (Fedde 1909) and subsequently accepted by Kadereit (1986) at subspecies level as one of the five representatives of the polymorphic complex of *P. argemone*. Presently, it is considered a distinct taxon (Aghababayan 2011, Dimopoulos & al. 2013, Strid 2016). Some of the most important diagnostic characters, noted even in the protologue, are that *P. nigrotinctum* is a small plant, with ascending stems, 10–20 cm long, with a big black-purple spot at the base of the petals and a setose capsule, 1–1.5 cm long. Considering that Fedde made that description from dried specimens, the inaccuracy regarding the colour of petals, which he indicated as “rosea”, is fully acceptable. In fact, during flowering, their colour is bright orange to reddish-orange. Before the opening of flowers, the dark spot at the base of the petal occupies almost half of its length, which could be seen in the original specimens of Heldreich. However, after their full opening the spot occupies up to one-third of the petal’s length. *Papaver nigrotinctum*

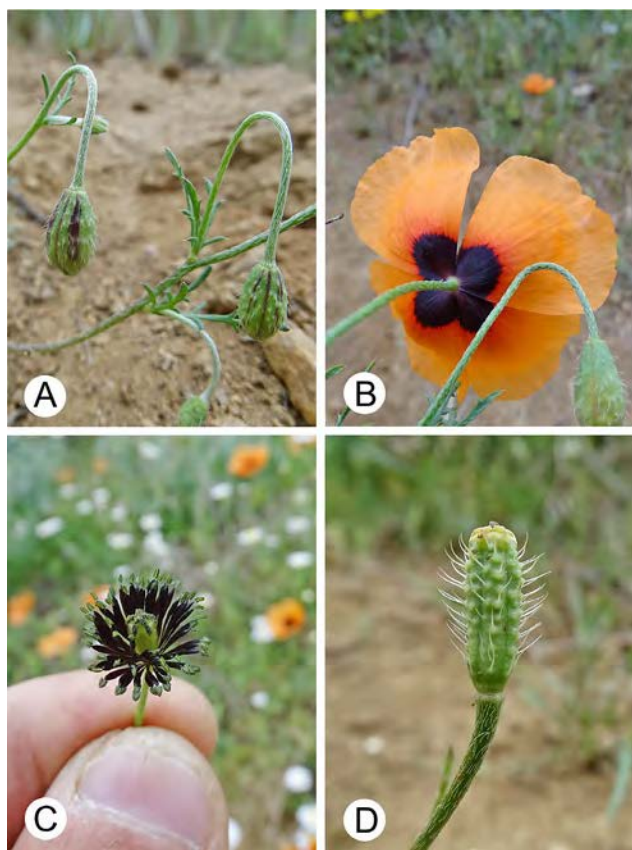


Fig. 2. *Papaver nigrotinctum*: A – buds; B – petals, external view; C – stamens and ovary; D – capsule (northwards of Struma village, at the road fork to Krastiltzi village, photos Zh. Barzov).

resembles *P. apulum* by its widely obovate, overlapping and more or less orange petals, but the petal base of the latter is slightly darker, reddish or pale-violet, without any distinct black blotch. *Papaver argemone* s. str. is clearly distinguished from *P. nigrotinctum* and *P. apulum* by its narrower, not overlapping scarlet-red petals, with a small diffuse dark spot near the base.

Another important diagnostic character of *P. nigrotinctum* is the form of segments of the basal leaves. A great variability of segments can be observed even in only one leaf – from oblong-lanceolate and elliptic to spatulate and, occasionally, even rounded. It was not accidental that in the protologue Fedde (1909) had described var. *rotundilobium*, thus emphasizing the variability of that trait. On the other hand, *P. argemone* and *P. apulum* characteristically have relatively uniform leaf segments, lanceolate and oblong-obovate, respectively.

Finally, the peculiarities of the fruits should be discussed as a most valuable feature in the taxonomy of *Papaver*. Kadereit & Leins (1988) illustrated in detail the capsule characteristics of the subspecies of *P. argemone* complex. Among its five constituent taxa, *P. nigrotinctum* has characteristically the shortest capsule, usually less than 15 mm, mostly narrowly ellipsoidal in form and entirely setose, while the other representatives have a capsule longer than 15 mm, clavate to elongate cylindrical, and more or less partly setose. Obviously, with its small ellipsoid capsule, occasionally even shorter than 10 mm, *P. nigrotinctum* seems similar to and has been confused with *P. apulum* in the Bulgarian flora. The latter has also a small capsule (5–10 mm long), also thoroughly setose, but ovate in form and with soft, mostly appressed setae. *Papaver hybridum*, the species with the greatest distribution area among the representatives of section *Argemoidium*, is clearly distinguished by its stigmatic disc with 6–10 rays (versus 4–6 rays in *P. argemone* complex and *P. apulum*) and widely ovate to subglobose capsules (Fig. 3).

A comparison of the most important characters of *P. nigrotinctum*, *P. argemone* and *P. apulum* (Table 1) have shown a clear distinction between these three taxa.

Some peculiarities in the biology of *P. nigrotinctum* found by the authors should be noted. It has a long flowering period (from mid-April to mid-June) although it is an annual species. Often an individual gradually forms numerous stems and thus young

buds, flowers and fruits can be observed at the same time. Mention deserves the fact that the petals are quickly caducous, often lasting only for a few hours in the morning and, therefore, the flowering stems could not be seen for the rest of the day. This might be the reason why the species is difficult for recognition, despite its attractive blooms, and is still known in a small number of localities.



Fig. 3. Comparison of capsules of *Papaver nigrotinctum* (A), *Papaver argemone* (B), *Papaver apulum* (C) and *Papaver hybridum* (D) (photos S. Stoyanov).

Revisiting of herbarium records

In the Republic of North Macedonia, the first herbarium record of *P. nigrotinctum*, misidentified as *P. apulum*, dated back to 1917. The specimen was collected in the area of Gabrovo village, Strumitsa district (then within the borders of Bulgaria) by the Bulgarian botanist Nikolay Stojanov who was working then on the flora of Mt Belasitsa (Stojanov 1921). That locality is also mentioned in the *Flora of the Republic of Macedonia* (Micevski 1993). After the revision of that record and checking of other specimens in MKNH, it was found that *P. apulum* occurred only in the southwestern part of the Republic of North Macedonia, in the area of Bitolja.

A review of the specimens of *P. argemone* from the Republic of North Macedonia stored in the MKNH confirmed the assumption that name was probably used *sensu lato* in the flora of North Macedonia and revealed that all records belonged to *P. nigrotinctum* (see *Revised specimens*).

In Bulgaria, the first herbarium record of *P. nigrotinctum*, confused with *P. apulum*, dated back to 1924. The specimen was collected in the area of Sliven town. That was the only locality in Southeast Bulgaria, while the rest were in Southwest Bulgaria, in the valley of River Struma (see *Author-collected and revised specimens*). In that valley, the influence of the Mediterranean climate was the strongest and it served as one of the pathways of penetration of Mediterranean floristic elements into Bulgaria. Another corridor for migration of Mediterranean species to Bulgaria was the Tundzha River Valley, which correlates with the locality near Sliven.

Table 1. Comparison of morphological characters and chromosome numbers of selected species of genus *Papaver* section *Argemonidium*.

CHARACTER	<i>P. nigrotinctum</i>	<i>P. argemone</i>	<i>P. apulum</i>
STEMS	decumbent to ascending, up to 25 cm	ascending to erect, 20–75 cm	ascending to erect, 20–50 cm
BASAL LEAVES	2–3-pinnatipartite, segments unequal in form, oblong-lanceolate, elliptical to spatulate, acute to mucronate, densely irregularly setose	1–3-pinnatipartite, segments similar in form, linear-lanceolate to triangular-lanceolate, acuminate, scattered subpatent setose	2–3-pinnatipartite, segments similar in form, broadly triangular to oblong-obovate, obtuse or acute, sparsely setose to subglabrous
PETALS	widely obovate, overlapping, orang to reddish orang, with large distinct black purple spots at the base	obovate, not or slightly overlapping, scarlet red to dark red, darker at the base or with small diffuse black spots	widely obovate, overlapping, orang to reddish orang, reddish or pale violet at the base, but without distinct spot
CAPSULES	(7–)10–15 mm long, cylindrical to narrowly ellipsoidal, entirely setose, setae mostly patent	(10–)15–20(–25) mm long, clavate to narrowly fusiform, entirely setose or glabrous below, setae subpatent	5–10 mm long, ovate to subglobose, entirely setose, setae mostly appressed or sometimes patent above
$2n$ (Kadereit 1986)	14	40, 42	12

In conclusion, *P. apulum* in the Bulgarian flora and *P. argemone* in the flora of the Republic of North Macedonia have been both misapplied names instead of *P. nigrotinctum*.

Distribution

Initially, *P. nigrotinctum* had been recorded from the southernmost parts of mainland Greece (Peloponnese) and the Greek Aegean islands (the Cyclades) (Fedde 1909). Subsequently, it was also reported from the Turkish Aegean islands (as subsp. *nigrotinctum*) (Davis & al. 1988). Kadereit (1990) illustrated in detail the distribution of all subspecies of his *P. argemone* complex, and subsp. *nigrotinctum* was mapped for the Aegean and adjacent mainland Greece and Turkey. In the same article he emphasized that *P. argemone* subsp. *argemone*, which occurred naturally from the Western Mediterranean to the Northwestern Balkans, with a synanthropic spread northwards to Scandinavia, was absent from the range of the other subspecies confined to the Eastern Mediterranean. In his work on the *Flora Hellenica*, Kadereit (2002) indicated that there were no verified reports for *P. argemone* subsp. *argemone*, although according to Jalas & Suominen (1991) that subspecies occurred in the northeastern part of Greece, and that most of the earlier records of *P. argemone* belonged to subsp. *nigrotinctum*. Furthermore, he commented that

the records of *P. argemone* from Former Yugoslavia (cf. Jalas & Suominen 1991) needed confirmation. His doubts were quite justified because the present study has found that all herbarium specimens of *P. argemone* from the Republic of North Macedonia (part of Former Yugoslavia) in fact belonged to *P. nigrotinctum*. Correspondingly, there were two points on the map of *P. argemone* subsp. *argemone* in the European part of Turkey (cf. Jalas & Suominen 1991) which most likely also represented *P. nigrotinctum* and, therefore, should be checked out.

On the other hand, according to the Euro+Med PlantBase based on the data of Nikolić (1994), *P. nigrotinctum* was also reported for the flora of Croatia, but that record seemed quite doubtful. The only specimen of *P. nigrotinctum* available in the Flora Croatica Database (Nikolić 2015), by its habit and ovate capsules, definitely belonged to the circum-Adriatic *P. apulum*.

According to the present-day literature data, the area of *P. nigrotinctum* covers almost all Greece, including the Aegean islands (Dimopoulos & al. 2013, Strid 2016), and the Aegean part of Southwest Turkey (Güner & al. 2012). In the present study, it was found that the species occurs much further northwards and its area occupies South Bulgaria (with localities mostly in southwestern part of the country) and the central and eastern parts of the Republic of North Macedonia (Fig. 4).

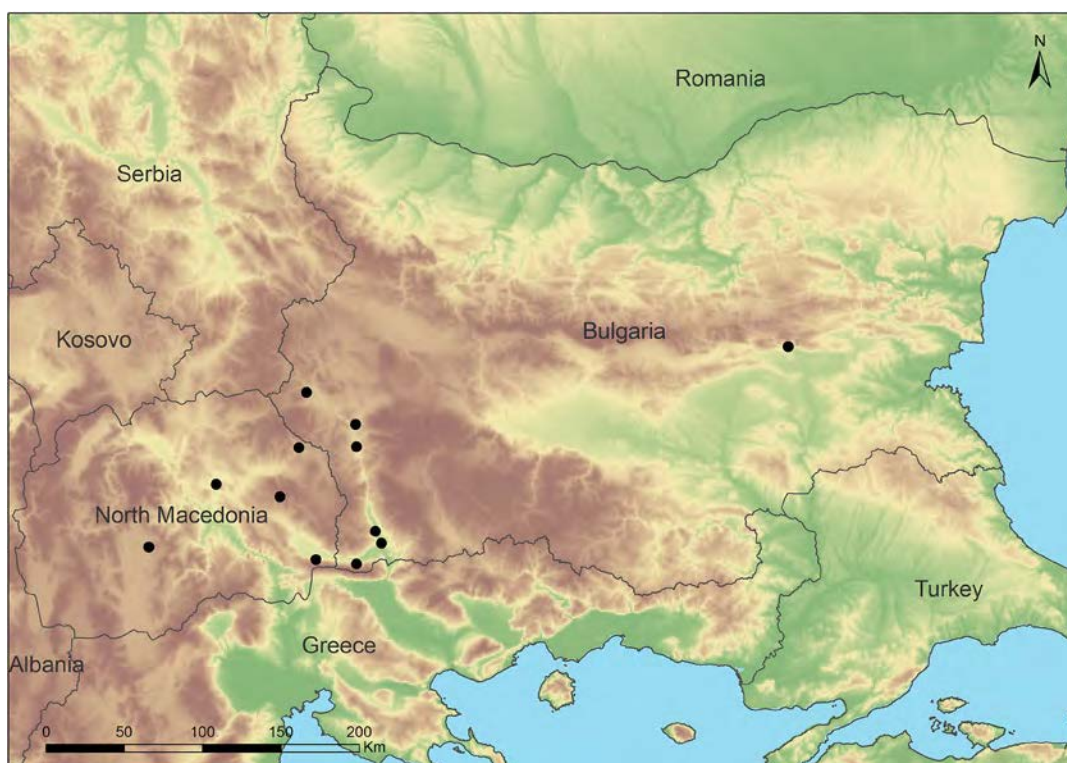


Fig. 4. Distribution map of *Papaver nigrotinctum* (black solid circles) in Bulgaria and the Republic of North Macedonia.

Habitats

In Bulgaria, *P. nigrotinctum* appears to grow in semi-natural open and variously disturbed dry grasslands, on sandy-clay to gravelly soils. In these habitats, which manifest a considerable presence of ruderal species, it was found in compact groups of about few hundred individuals. In the first site, northwards of village Struma, the species occupied a roadside banquet and a slightly eroded slope above the road, subjected to intensive grazing, and close to a sheepfold. In the second place, between the villages of Novo Delchevo and Levunovo, *P. nigrotinctum* was found in two adjacent groups, in an extensively ruderal pasture, part of which turned into an illegal dump. In these two localities, co-occurring species were: *Achillea coarctata*, *Aegilops triuncialis*, *Alkanna tinctoria*, *Anchusa officinalis*, *Anthemis arvensis*, *Astragalus hamosus*, *Bromus tectorum*, *Caucalis platycarpus*, *Centaurea solstitialis*, *Consolida regalis*, *Convolvulus cantabrica*, *Crepis setosa*, *Cynodon dactylon*, *Cynosurus echinatus*, *Dasyphyrum villosum*, *Elymus repens*, *Erodium cicutarium*, *Eryngium campestre*, *Filago arvensis*, *Malva sylvestris*, *Marrubium peregrinum*, *Medicago minima*, *Onobrychis aequidentata*, *Onopordum illyricum*, *Papaver dubium*, *Plantago lagopus*, *P. lanceolata*, *Taeniatherum caput-medusae*, *Sisymbrium loeselii*, *Phleum paniculatum*, *Teucrium polium*, *Thymus striatus*, *Vulpia myuros*, etc.

Appendix. List of *specimina visa*.

Author-collected specimens. *Papaver nigrotinctum*: Bulgaria. Valley of River Struma (*Southern*): 2 km northwards of Struma village, Sandanski district, in semi-natural dry grasslands at the road fork for Krastiltsi village, 120 m, 41.55865°N, 23.23125°E, 13.05.2019, Zh. Barzov (SOM 176778, 176779); *loc. ibid.*, 22.05.2019, Zh. Barzov (SOM 176780, 176781); *loc. ibid.*, 04.06.2019, S. Stoyanov (SOM 176782); westwards of the motorway between Novo Delchevo and Levunovo villages, Sandanski district, in semi-natural dry grasslands, 120 m, 41.49233°N, 23.28041°E, 05.06.2019, S. Stoyanov (SOM 176783); *loc. ibid.*, 41.49165°N, 23.28171°, 05.06.2019, S. Stoyanov (SOM 176784, 176785).

Revised specimens. *Papaver nigrotinctum*: Bulgaria. Sliven, 03.04.1924, N. Stojanov & B. Stefanov (SOA 4305!), sub *P. apulum*; Westwards of Sovolyano village, Kyustendil district, in dry grassy places above the left bank of river Bistritsa, 05.06.1975, M. Ančev (SOM 130540!), sub *P. apulum*; along the road be-

tween Kolarovo and Samuilovo villages, Blagoevgrad district, in ruderal places, 14.05.1981, P. Panov (SOM 142570!), sub *P. hybridum*; Valley of River Struma, between Blagoevgrad and Kocherinovo towns, at the road fork for Riltsi village, in grassy places, 07.07.1984, M. Stoeva (SOM 3761!, chromosome voucher), sub *P. apulum*; Valley of River Struma, at Boboshevo railway station, 03.06.1987, M. Stoeva (SOM 3768!, chromosome voucher), sub *P. apulum*; **the Republic of North Macedonia.** Strumitsa district, around Gabrovo village, 05.1917, N. Stojanov (SOA 7943!), sub *P. apulum*; Sveti Nikola district, Ovche Pole, around Delisinci village, in hilly pastures, 26.05.1961, K. Micevski (MKNH 021537, photo!), sub *P. argemone*; Delchevo district, Lukovica village, in hilly pastures, 565 m, 31.05.1973, K. Micevski (MKNH 021528, 021536, photos!), sub *P. argemone*; Prilep district, along the road towards Treskavec Monastery, 750 m, 29.05.1986, K. Micevski (MKNH 021532, photo!), sub *P. argemone*; Shtip district, Plachkovica Mountain, 1350 m, 14.06.1989, K. Micevski & V. Matovski (MKNH, photo!), sub *P. argemone*.

Examined specimens for comparison.

***Papaver nigrotinctum*: Greece.** Achaia, in collibus siccis prope Neo-Corinthum, nec non ad radices Acrocorinthi, 26.04.1885, Heldreich 816 (isolectotypes SO 25173!; E 00062051, photo!; PRC 454298–454301, photos!; JE 00021125–00021128, photos!; W 1886–0003806, 1930–0000701, 1930–0005559, photos!; P 00789729–00789732, 02557967, 02681428, 03357790, photos!); Lesvos, Ayiaassos, N facing slope 100 m, S of police station, 28.04.1978, J.R. Edmondson & M.A.S. McClintock 2227 (E 00402325, photo!); **Turkey.** Muğla, Bay East of Datça Port, 18.04.1965, P. Davis 41325 (E 00402331, photo!). ***Papaver argemone*:** Linnean Collections (type, LINN 669.2, photo!); **France.** Moisson, Aiffres (Deux-Sèvres), 02.05.1894, A.J. Gamain (BP 999!); **Portugal.** Villa Nova de Gaya, Areinho, 05.1898, G. Sampaio (BP 27204!); Serra de Portalegre, 2 km da cidade, entre Reguengo e Portalegre, campos cultivades, 23.06.1959, A. Fernandes, J. Matos & A. Sarmiento (SOM 119275!); **Poland.** Krzemionki prope Cracoviam, 06.1931, E. Panow (BP 540929!); Silesia Inferior, Wrocław-Żerniki, in pascuis, 18.05.1966, J. Anioł (SOM 122273!); **Czech.** Moravia australis, Znojmo, in agris incultis prope pagum Harvaniky, 290 m, 14.05.1950, F. Švestka (BP 473867!, 684863!); **Denmark.** Zealand, Haraldsted Sø, N of Ringsted, fallow field, 19.07.1972, J. Svendsen (SOM 128583!).

***Papaver apulum*: Italy.** In Apuliae pratis montanis, 05.1830, Tenore (lectotype K 000653113, photo!); Prov. Vicenza, prope Rossano, ex agro Bassanensi, 05.1872, J. Ball (BP 132692!); Calabria, inter segetes prope Calanzaro, sol. granit., 15.05.1877, Huter, Porta & Rigo 215 (BP 132706!; P 03167603, photo!); Flora Attica, in m. Parnethe pr. Dekeliam (hod. Tatoï), 05.1878, Heldreich (P 03167551, photo!); Prov. Verona, in arvis circa vicum Rivoli, sol. calcar., 25.05.1887, Rigo (BP 132691!, 132698!); Italia septentr., Prov. Verona, in arvis et inter segetes circa vicum Rivoli, sol. calcar., 09.06.1889, Rigo (BP 132694!); Italia bor., Alp. Pedemont., ad messes in vall. Cluson, 05.1892, E. Rostan (SO 25172!; BP 132693!, 132695!; P 02681424, photo!); Italiae bor., Monte Pastello, 06.1902, Rigo (P 02681873!, photo!); Prov. Verona, in arvis et inter segetes circa vicum Rivoli, sol. calcar., 182 m, 17.04.1904, G. Rigo (BP 132793!); Prov. Apulia, Taranto, loco dicto Gravina in Accettullo, in saxosis calcareis aridis, 60 m, 18.04.1920, C. Lacaita (BP 133615!); **the Republic of North Macedonia.** Bitolja district, Mt. Pelister, in dry sandy and grassy places, 19.05.1951, A. Todorovski (MKNH 021527, photo!). **Greece.** Cyclades, Eparchia Parou, Paros Island, S of Lefkes at junction to Aspro Chorio, on abandoned agricultural terraces with loamy soil on gneiss, 500 m, 37°02'30"N, 25°15'E, 25.04.1991, Th. Raus & Ch. Schiers 16260 (P 02681533, photo!), sub *P. nigrotinctum*. **Albania.** Delvinë district, mount Mal Kojinolithar above village Krongji, in rocky grassland, on limestone, 423 m, 39.91258°N, 20.17022°E, 10.05.2014, Z. Barina, D. Pifkó & G. Puskás (BP 767843!), sub *P. dubium*; Gjirokastër County, Mal Pus above village Klondjë, in mountain grassland, on limestone, 1068 m, 40.157981°N, 19.983153°E, 14.06.2016, Z. Barina, K. Baráth & G. Puskás (BP 770407!); Gjirokastër district, Mali i Gjerë above Gjirokastër, in dry grassland, on limestone, 1263 m, 40.054221°N, 20.094764°E, 16.06.2016, Z. Barina, K. Baráth & G. Puskás (BP 770614!).

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