New data on the orchids (Orchidaceae) in Bulgaria

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- Abstract. The article presents data on the distribution of 10 species and one natural hybrid of *Orchidaceae* in Bulgaria. Three species are new for the Bulgarian flora: *Serapias bergonii*, *Ophrys epirotica* and *Ophrys hebes*. *Epipactis leptochila* subsp. *naousaensis* has already been reported for Bulgaria, but without accurate distribution data. The article presents new localities of this taxon in the Rhodopi Mts, confirming its presence in the country. For the species already known for Bulgaria, new localities in the country have been reported. Most of the species are of conservation concern, with limited distribution in Bulgaria.
- Key words: Cephalanthera, Epipactis, new localities, Ophrys, Serapias, Spiranthes, Valley of River Struma, the Rhodopi Mts
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Introduction

The orchids in Bulgaria are an object of enhanced interest on the part of both professional botanists and amateurs. In the past 20 years, some new taxa have been published for the country (Petrova & Venkova 2006a, b, 2008; Zahariev 2021) and numerous new localities of the already known species have been reported (Domozetski 2023; Dimitrov & Veleva 2023). According to the 4th edition of the *Conspectus of the Bulgarian Vascular Flora* (Assyov & Petrova 2012), 71 species of the *Orchidaceae* have been recorded for the country. This number needs to be revised due to identification of new species, changes in the taxonomic status of some of the species, and further in-depth study of some genera based on recent publications. The aim of this article is to report some new orchid species and a natural hybrid for the Bulgarian flora and to provide new distribution data, mainly for the taxa of high conservation concern.

Material and methods

The data for this article were gathered in the period 2018–2024. Field research was mainly conducted in the Valley of River Struma (*Southern*) and in the Rhodopi Mts (*Eastern*), and the records mostly refer to these floristic regions. The results were presented for each species separately. The species have been arranged in alphabetical order. Each taxon was presented with notes on its general distribution in the country and taxonomic notes, whenever necessary. Habitat data and some notes on the ecology of the species were also provided. A detailed morphological description was presented for the taxa new to Bulgaria, with their main distinguishing characteristics highlighted in bold. Similar description has been also prepared for Epipactis leptochila subsp. naousaensis, with a confirmed presence now in Bulgaria. Herbarium specimens were collected from the new taxa for the country and were deposited in the Herbarium (SOM) of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences. Of the species of the genus Ophrys, only single flowers were collected for storage. The flowering period was indicated for the new taxa for Bulgaria. The distribution data of the species in the country follow the floristic regions of Bulgaria, according to the Flora of RP Bulgaria (Jordanov 1966). Distribution of the new taxa for the country was presented in a UTM grid map for each specices. The taxonomy follows Delforge (2006), and only the taxonomic status for E. leptochila sub-

and only the taxonomic status for *E. leptochila* subsp. *naousaensis* was given according to Hertel & al. (2014). For each species, photographs from different localities mentioned in the text are presented.

Results and discussion

Cephalanthera epipactoides Fisch. & C.A. Mey.

Reported localities: Bulgaria, Rhodopi Mts (*Eastern*) – Dupkata locality, W of Ivaylovgrad town, in open woodland, under coniferous trees, *ca.* 372 m, 41.5290413°N, 26.1138472°E, three specimens, 08.05.2022, *L. Domozetski* obs.; SE of Belopolyane village, on the slope of Tumbata Hill, in shrubs of *Quercus* sp. and *Juniperus deltoides*, reduced after fire, *ca.* 120 m, 41.4429096°N, 26.1745952°E, two specimens, 02.05.2023, *L. Domozetski* obs.; SE of Belopolyane village, NW of the valley of river Byala Reka, in shady places in bushes, *ca.* 109 m, 41.4419922°N, 26.1815790°E, three specimens, 02.05.2023, *L. Domozetski* obs.; SW of Belopolyane village, in open shrubs of *Quercus* sp., *Juniperus deltoides, Fraxinus ornus, Carpinus orien*-



Fig. 1. *Cephalanthera epipactoides*, albino flowering stem, Rhodopi Mts (*Eastern*), SW of Belopolyane Village, 02.05.2023 (photo L. Domozetski).

talis, along the dirt road to Odrintsi village, *ca.* 157 m, 41.4430564°N, 26.1543445°E, more than 20 specimens, few albino shoots, 02.05.2023, *L. Domozetski* obs. (Fig. 1).

This is an extremely rare species in country, rated as Critically Endangered in the Red Data Book of Bulgaria (Petrova 2015: 214). It is known only from the Rhodopi Mts (Eastern), in two localities: Likana locality, S of Ivaylovgrad town, and Dupkata locality, W of Ivaylograd town (Petrova 2015: 214). In the Dupkata locality, the species has been considered extinct (Petrova 2015: 214), but new data on its presence in that locality is published here. New localities of the species in the Ivaylovgrad District are presented above. The species probably has a wider distribution on the hills S of Belopolyane village and E of Odrintsi village. These newly discovered localities of C. epipactoides are outside the Likana Protected Area. The species is found in diverse habitats. In the Dupkata locality, it has been present in a thinned coniferous forest. The



Fig. 2. *Epipactis exilis*, Pirin Mts (*Northern*), along the road from Ilindentsi Village to Marble quarry "Murata", 25.06.2023 (photo L. Domozetski).

other localities have mostly been in the sparse shrubs of *Quercus* sp., or in the grassy and sandy areas along their periphery.

Epipactis exilis P. Delforge

Reported localities: Pirin Mts (*Northern*) – along the road from Ilindentsi village, Strumyani District, to the Murata Marble Quarry, in a dried-up ditch, *ca*. 660 m, 41.6633570°N, 23.2599007°E, a single specimen, 25.06.2023, *L. Domozetski* obs. (Fig. 2).

Epipactis exilis was reported for Bulgaria based on the revised herbarium materials and new data (Petrova & Venkova 2008). Originally it has been known from five floristic regions: the Balkan Range (*Central*), Vitosha region, Rila Mts, Rhodopi Mts (*Central*) and Mt Strandzha (Petrova & Venkova 2008: 70). Subsequently, it was also published for the following floristic regions: the Balkan Range (*Eastern*), Znepole region, Ririn Mts (*Northern*), Mt Slavyanka and Mt Belassitsa (Assyov & Petrova 2012: 179). The species



Fig. 3. *Epipactis leptochila* subsp. *nauosaensis*, Rhodopi Mts (*Central*), along the road from Teshel to Mugla Village, 30.07.2022 (photo L. Domozetski).

has already been reported for the Pirin Mts floristic region. Here published locality lay in an atypical habitat and at a relatively low altitude. The site was at the bottom of a dry ditch, with *Cornus* sp., *Quercus* sp., *Pyrus* sp. and *Populus alba*, in dry grassland with *Juniperus deltoides*, and at the edge of a coniferous forest. *Epipactis exilis* reportedly preferred shady places, usually in beech forests, predominantly on north-facing steep slopes (Petrova & Venkova 2008), between 800 and 1800 m a.s.l. (Assyov & Petrova 2012). The altitude of the reported locality was *ca*. 660 m, on W-facing slopes. The species was first observed with three specimens in 2017 and a single specimen with flowers was observed again in 2023.

Epipactis leptochila subsp. *naousaensis* (Robatsch) Kreutz [syn. *E. naousaensis* Robatsch]

Description: Rhizomatous. Stem thin, ±flexuous, 20–50 cm tall, hairy. Cauline leaves (3)5–7, fresh green-yellowish, 1(2) lower leaf short, orbicular, 3–4



Fig. 4. *Epipactis leptochila* subsp. *nauosaensis*, Rhodopi Mts (*Central*), along the road from Teshel to Mugla Village, *ca*. 5 km after Teshel, 30.07.2023 (photo L. Domozetski).

median leaves lanceolate, (5) $7-9 \times 2-3(5)$ cm, uppermost leaf narrowly lanceolate, up to 8 cm long. Lower bracts elongated, 4–6 cm long, upper bracts even longer than the flowers; inflorescence lax to dense (Fig. 3), with 10–30(40) flowers (Fig. 4), opening, pendant; sepals and petals oval-acuminate, green outside, yellow-green inside, petals occasionally slightly pinkish inside; hypochile light greenish (seldom) to dark rose inside; epichile narrow triangular 4–6 × 3–5 mm, white to rose, reflexed downwards, at base with 2 calli, crenate, rose or light greenish separated by a longitudinal groove that is normally darker, washed green; clinandrium slightly to strongly reduced, viscidium seldom present; pedicel 4–5 mm long, with a pale yellowish base.

Reported localities: Rhodopi Mts (*Central*) – along the road from Teshel to Mugla villages, Smolyan District, on the right-hand slope above the river, *ca.* 1150 m, approx. 41.6696638°N, 24.4190133°E, on the periphery of a beech forest, mostly in semi-open places, six specimens, 30.07.2022, *L. Domozetski* obs. (Fig. 3); along the road from Teshel to Mugla villages, *ca.* 5 km after Teshel, *ca.* 1105 m, 41.673639°N, 24.414926°E, on the periphery of a beech forest, mostly in semi-open places, five specimens, 30.07.2023, coll. *L. Domozetski* (SOM 179174) (Fig. 4).

Different statements obtained regarding the species status of this member of the genus *Epipactis*. Delforge singled it out as a separate species (Delforge 2006: 96). Other scholars considered it as a subspecies of E. leptochila (Hertel & al. 2014: 703), and according to Kühn & al. (2019: 66) and POWO (2024), it was a synonym of Epipactis greuteri. In this paper, Epipactis nausiensis was regarded as a subspecies of E. leptochila. That taxon was first published for Bulgaria by Delforge (2006: 96), without any precise data on its distribution in the country however. Apart from Bulgaria, Delforge also published E. naousaensis for Greece (Delforge 2006: 96). As a result of field research, E. leptochila subsp. naousaensis was discovered in the Rhodopi Mts (Central), and detailed data on its presence in Bulgaria have been given here. The characteristics in the above description were based on specimens from Bulgaria, as well as on the description published by Delforge (2006: 96) and by Hertel & al. (2014: 707-708). In the Rhodopi Mts, the species was discovered and confirmed in localities along the valley of river Tenesdere, near the road between Teshel and Mugla villages, Smolyan District. Epipactis greuteri was also found in that locality, the only known for this species in Bulgaria (Petrova & Venkova 2008), but it was not rediscovered during the field research. Epipactis leptochila subsp. naousaensis was found with small populations in two localities on the forest edge. The habitat was a thinned-out forest of Fagus sylvatica and Abies alba. The flowering period was probably in the second half of July and the beginning of August. All observations have been from the end of July. A single specimen with characteristics of E. leptochila subsp. naousaensis has also been observed along the road to Chairski Ezera chalet; however, some characters (for example, the purplish pedicel) have cast doubt on the identification of the specimen. Epipactis leptochila subsp. naousaensis is probably having a wider distribution in the Rhodopi Mts, and hybrids with E. helleborine are also possible. Map 1 presents the so far established distribution of the subspecies in Bulgaria.

Ophrys epirotica (Renz) Devillers-Tersch. & Devillers [syn. *O. sphegodes* subsp. *epirotica* (Renz) Gölz & H.R. Reinhard]

Description: Two root tubers, entire, ovoid to ellipsoid. Stem 10–35 cm tall. Basal leaves ovate or oblong-lanceolate, in a rosette. Inflorescence lax, with 3–7



Map 1. Distribution of Epipactis leptochila subsp. naousaensis in Bulgaria.

flowers; bracts leaf-like; flowers rather small; sepals yellowish-green, uniform; petals yellowish-green, olive-green to ochre, velvety, occasionally spotted with purple; lip entire, orbicular or occasionally irregular, heart-shaped and obscurely 3-lobed, relatively small 7–10 mm × 8–11 mm, no bulging or small, rounded basal swellings, dark ruby-red-brown, with sides \pm narrowly colored yellow with very short micro-hairs, attenuated on distal half; speculum narrow, blue, more often in the shape of two longitudinal lines extending from a stigmatic cavity near the lip tip; stigmatic cavity with a floor colored as lip, seldom reddish; pseudo-eyes bluish, sometimes broadly encircled by pale bluish.

Reported localities: <u>West Frontier Mts (</u>Mt Vlahina), in a grassy place along the road to the St. John Chrysostomos Church, Debochitsa village, Blagoevgrad District, *ca*. 900 m, 41.872955°N, 22.956577°E, a single plant, 27.05.2012, *L. Domozetski* obs.; two specimens, 20.05.2018, *L. Domozetski* obs. (Fig. 5) and collected single flowers from two specimens (SOM 179179 & 179180); 26.05.2019, *L. Domozetski* obs.; <u>Valley of River Struma (Southern)</u>: between Novo Hodzhovo and Piperitza villages, Sandanski District, in dry grassy places, among shrubs, *ca.* 209 m, 41.405046°N, 23.419042°E, a single plant, 16.05.2021, *L. Domozetski* obs. (Fig. 6) and collected single flower (SOM 179178); *ca.* 261 m, 41.409520°N, 23.422704°E, a single plant, 23.05.2021, *L. Domozetski* obs. (Fig. 7) and a collected single flower (SOM 179181); *ca.* 195 m, 41.4057185°N, 23.4165893°E, a single plant, 14.05.2022, *L. Domozetski* obs.

This is a new species for the Bulgarian flora. Some authors regard this taxon as a separate species (Delforge 2006: 569; Antonopoulos 2009: 282-283). Other consider the taxon as a separate subspecies of *O. sphegodes*: *O. sphegodes* subsp. *epirotica* (Pedersen & Faurholdt 2007: 189-190; Kühn & al. 2019: 251). In



Fig. 5. *Ophrys epirotica*, West Frontier Mts, along the road to the church of St. John Chrysostomos, Debochitsa Village, 20.05.2018 (photo L. Domozetski).



Fig. 7. *Ophrys epirotica*, Valley of River Struma (*Southern*), between Novo Hodzhovo and Piperitsa Villages, 14.05.2022 (photo L. Domozetski).



Fig. 6. *Ophrys epirotica*, Valley of River Struma (*Southern*), between Novo Hodzhovo and Piperitsa Villages, 14.05.2022 (photo L. Domozetski).

this study, the status of *O. epirotica* is accepted as a species, following Delforge (2006). So far, the species has been known from Albania and Greece (Delforge 2006: 569). In Greece, the species is distributed mainly in the northwestern mountainous part of the country, mainly in Epirus and Thessaly, in the southern part of Pindus and with isolated localities on the Island of Cephalonia, in the Peloponnese, in Chalkidiki and in Macedonia (Antonopoulos & Tsiftsis 2017b: 450).

In Mt Vlahina (West Frontier Mts), a single plant was found in 2012. In 2018, that plant was not found, but two more plants were encountered (Fig. 5). After 2019, the locality was destroyed due to road renewal to the St. John Chrysostomos Church and overgrazing in a very limited area in the location. The habitat was open, with shrubs on the periphery of *Quercus* spp. and *Carpinus orientalis* forests. Other orchid species found in that locality were: *Anacamptis pyramidalis, A. papilionacea, A. morio, A. coriophora, Ophrys oestrifera*, and *Himantoglossum calcaratum* subsp. *rumelicum*. Overgrazing left the entire habitat significantly degraded. The species was observed elsewhere in Mt Vlahina, near the Logodazh village, Blagoevgrad District (Antoaneta Petrova pers. comm.), but never rediscovered in that place. The locality in the Valley of River Struma has been recently discovered. Three specimens were found in three different but neighboring places. The habitat was suitable and a larger population could be presumed. The locality was on a calcareous terrain and in open grassy places with shrubs of Quercus spp., Fraxinus ornus, Juniperus deltoides, Carpinus orientalis, Paliurus spina-christi, Osyris alba, Jasminum fruticans, and Asparagus acutifolius. It clearly had a Mediterranean character, with all those species: Phillyrea latifolia, Pistacia terebinthus, Lonicera etrusca, Colchicum bivonae, Crocus olivieri, and Convolvulus holosericeus. The accompanying species of the orchids were: Anacamptis pyramidalis, Ophrys apifera, O. mammosa, O. oestrifera, Orchis purpurea, O. simia, and Himantoglossum calcaratum subsp. rumelicum. Ophrys mammosa had a dense population in that locality. However, mention deserved the fact that O. mammosa bloomed much earlier than O. epirotica. In that area, the flowering period of O. mammosa was from the end March to the end of April. In some years, some individual specimens bloomed earlier, at the beginning of March: the earliest observations for that area was on 04.03.2023. In recent years, the flowering period of O. mammosa has shifted in time, mainly to the first half of April. The latest-blooming specimens bloomed with their last flowers in the beginning of May, and in the middle of May there were no more blooming specimens. This was important because of the clear difference in the flowering period of O. mammosa and O. epirotica. In that locality, O. epirotica differed significantly in its flowering period and bloomed together with O. apifera. Blooming began strictly in mid-May and went on until the beginning of June. The distri-



Map 2. Distribution of Ophrys epirotica in Bulgaria.

Characters	Ophrys mammosa	Ophrys epirotica	Ophrys hebes	
Flowering time (in Bulgaria)	(beginning of -) end of March – beginning of May	Middle of May – end of May (- beginning of June)	Second half of April – beginning of May	
Sepals color	Dorsal sepal greenish, sometimes tinted or blotched reddish; lateral sepals mostly bicolor greenish-yellow and reddish in the lower half , rarely uniform greenish or entirely reddish	Mostly uniform yellow- greenish or whitish-green , lateral sepals rarely tinted reddish-pinkish on lower half	Mostly uniform, whitish- green, lateral sepals rarely and very limited tinted or blotched reddish-pinkish on lower half	
Petals color	Ochre, ochre-green, yellow- green or reddish, velvety	Green-ochre, velvety, sometime blotched in brown	Green-ochre velvety, rarely and very pale blotched in brown	
Lip color	Dark, ruby red-blackish or dark reddish-brown, sometimes with thin pale brown or reddish margins; rather rarely margins tinted yellow or ochre	Dark, ruby red-brown, with sides ± narrowly colored yellow	reddish-brown, mostly brown, margins broadly tinted greenish-yellow or pale brown	
Lip shape and size (long x large)	Relatively big, entire, orbicular to oboval, rarely obscurely 3-lobed, 12–17 × 10–20 mm	Relatively small, entire, orbicular or sometimes irregular, heart-shaped and obscurely 3-lobed, 7–10 mm × 8–11 mm	Relatively small, entire or often prominent 3-lobed, convex to globular, (8)9–10 × 7–8 mm	
Mammosites	With 2 large, very prominent, rounded, basal swellings	with much reduced or imperceptible basal swelling	with much reduced or imperceptible basal swelling	
Peripheral pilosity	with short micro-hairs, and submarginal attenuated band of hairs	with very short micro- hairs, attenuated on distal half	greyish hairs on shoulder, longer and very attenuated on distal half	
Speculum	Basal and central, mostly regular, with a complete H shape, grey, bluish-grey, sometimes finely edged whitish	Basal and central, mostly often irregular in form of 2 longitudinal lines, sometimes interrupted, or formig ± regular H shape, blu, bluish-grey	basal and central, varied, glossy, brown, reddish- grey or grey, finely edged white, rarely H-shaped, very often complex and fragmented, with 1–3 central ocelli	
Pseudo-eyes	Whitish to pale blue with a greyish central spot, whitish bridle and sometimes a purple eyebrow	pseudo-eyes bluish, sometimes broadly encircled by pale bluish	evident, shiny, greenish , spotted in center	
Stigmatic cavity	Floor blackish, with a bluish to whitish specular stage, only slightly contrasting	Floor colored as lip, rarely reddish, with a rather contrasting bluish to whitish specular stage	Basal field concolors with center of lip, floor of stigmatic cavity with a small greyish to whitish specular stage	

 Table 1. Morphological and ecological characteristics of Ophrys epirotica, O. hebes and O. mammosa [main distinguishing characteristics highlighted in bold].

bution of the species in the Valley of River Struma was characteristically evidenced by single specimens, relatively distant from each other. That gave rise to assumptions that the population was new and that in the coming years new specimens could be probably identified. Map 2 presents the so far established distribution of the species in Bulgaria. Table 1 presents the morphological and ecological features which help distinguish *O. mammosa* from the related taxa *O. epirotica* and *O. hebes*.

Ophrys hebes (Kalop.) E. Willing & B. Willing [syn. O. sphegodes Mill. subsp. sphegodes]

Description: Two root tubers, entire, ovoid to ellipsoid. Stem spindly, 10–30 cm high. Overall colour rather whitish-greenish. Basal leaves oblong-lanceolate, in rosette. Inflorescence lax with 3–7 small flowers; bracts whitish-green; sepals spreading, whitish-green, uniform or (seldom) tinted or blotched pale violet in the

lower part; petals green, often ochre, velvety; lip small, entire or often 3-lobed, in the Bulgarian population (8)9-10 × 7-8 mm, convex to globular, occasionally slightly bulging, pale, reddish-brown, margins broadly tinted greenish-yellow or pale brown; greyish hairs on shoulder strongly attenuated in distal half; speculum basal and central, varied, glossy, reddishgrey, finely edged white, seldom H-shaped, very often complex and fragmented, with 1-3 central ocelli; appendage small, triangular, greenish-yellow; pseudoeyes evident, shiny, greenish, spotted in center; basal field concolorous with center of lip, floor of stigmatic cavity with a small greyish or whitish specular stage. Clearly different from O. mammosa in its smaller size, overall pale green color, light greenish sepals, brownish lip, slightly bulging, very often clearly 3-lobed and with complex speculum (Fig. 8).

Reported localities: Rhodopi Mts (Eastern) – along the road from Mandritsa to Dolno Lukovo vil-



Fig. 8. Comparison of the flower of *Ophrys hebes* with *O. mammosa*, Rhodopi Mts (*Eastern*), along the road from Mandritsa Village to Dolno Lukovo Village, 06.05.2022 (photo L. Domozetski).



Fig. 9. *Ophrys hebes*, Rhodopi Mts (*Eastern*), along the road from Mandritsa Village to Dolno Lukovo Village, 01.05.2020 (photo L. Domozetski).

lages, Ivaylovgrad District, in half-shaded places in open woodland of *Quercus* sp. and *Carpinus orientalis, ca.* 100, 41.391241°N, 26.096877°E & *ca.* 124 m, 41.391086°N, 26.094736°E, three specimens, 06.05.2019, coll. *L. Domozetski* (SOM 179182); six specimens, 01.05.2020, *L. Domozetski* obs. (Fig. 9) and collected single flowers from two specimens (SOM 179183, 179184); seven specimens, 02.05.2021, *L. Domozetski* obs.; nine specimens, 06.05.2022, *L. Domozetski* obs. (Fig. 10, Map 3).

Like *O. mammosa* and *O. epirotica*, *O. hebes* is part of the *O. mammosa* group according to Delforge (2006: 571). However, the taxon has not been accepted by all researchers as a separate species and is included in the synonymy of the nominal subspecies of *O. sphegodes* (Pedersen & Faurholdt 2007: 178; Kühn & al. 2019: 238). In the present article, this taxon is considered a separate species, following the taxonomy proposed by Delforge (2006). Further studies are needed



Fig. 10. *Ophrys hebes*, Rhodopi Mts (*Eastern*), along the road from Mandritsa Village to Dolno Lukovo Village, 06.05.2022 (photo L. Domozetski).

on the presence and distribution of O. sphegodes in Bulgaria. The distribution of O. hebes is limited in the Balkans (Delforge 2006: 571). It is relatively widespread in Greece, mainly in the mountainous regions of Epirus, Thessaly, Pindus, in the Peloponnese and Chalkidiki, with isolated localities in the Rhodopi Mts and Western Thrace (Antonopoulos & Tsiftsis 2017b: 462). So far, the species has been found in a small locality in Bulgaria, in one floristic region: the southwestern part of the Rhodopi Mts (Eastern). The habitat is sparse shrubs of Quercus sp. and Carpinus orientalis, characterized by the presence of other orchid species: Anacamptis pyramidalis, Ophrys mammosa, O. oestrifera, Orchis purpurea, and O. simia. In 2019, three plants have been found in the first locality (see above), only one with the last flower and the others after successful fertilization. In 2020, six plants have been found at different stages of flowering (Fig. 9). A single specimen is found in the second locality,



Map 3. Distribution of Ophrys hebes in Bulgaria.



Fig. 11. *Ophrys hebes*, Rhodopi Mts (*Eastern*), along the road from Mandritsa Village to Dolno Lukovo Village, 01.05.2020 (photo L. Domozetski).

along the road from Mandritsa to Dolno Lukovo villages (Fig. 11). More specimens are likely to be found in the neighboring areas. In Bulgaria, the species blooms in late April – early May. *Ophrys mammosa* blooms at the same time, but its flowering period continues a little longer in that area. The end of the flowering of *O. hebes* coincides with the beginning of flowering of *O. oestrifera*. Map 3 presents the so far established distribution of the species in Bulgaria.

Ophrys mammosa Desf. [syn. O. sphegodes subsp. taurica (Aggeenko) Niketić & Djordjevic]

Reported localities: Bulgaria, Znepole Region – in a conifer plantation next to the abandoned Kralev Dol chalet, Pernik District, *ca.* 973 m, 42.5585146°N, 23.0592329°E, a single specimen, 27.04.2023, *L. Domozetski* obs. (Fig. 12); West Frontier Mts – along the road from Gorno Leshko to Obel villages, Blagoevgrad District, in a grassy place, among bushes of *Ju*-



Fig. 12. *Ophrys mammosa*, Znepole region, Kralev Dol hut area, 27.04.2023 (photo L. Domozetski).

niperus deltoides, ca. 877 m, 41.948131°N, 22.928990°E, a single specimen, 20.04.2020, *L. Domozetski* obs.; <u>Valley of River Struma (Southern)</u> – NE of Kulata village, Petrich District, in grassy places, ca. 153 m, 41.3982415°N, 23.3730215°E, more than five specimens, 14.04.2019, *L. Domozetski* obs. (Fig. 13); SE of Novo Hodzhovo village, Sandanski District, in a grassy place among open bushes of *Quercus* sp., *Paliurus* spina-christi, ca. 176 m, 41.4059465°N, 23.4149112°E & ca. 191 m, 41.4060215°N, 23.4167033°E, more than 20 specimens, 03-05.04.2021 (Fig. 14), 27.03.2022, *L. Domozetski* obs.; W of Piperitsa village, Sandanski District, in a grassy place among bushes of *Paliurus* spina-christi, ca. 250 m, 41.4094972°N, 23.4247090°E, six specimens, 18.03.2022, *L. Domozetski* obs.

This is the first report of the species for the Znepole Region. In the present study, the species rank of *Ophrys mammosa* is preferred, although some scholars favour the subspecies rank *O. sphegodes* subsp.



Fig. 13. *Ophrys mammosa*, Valley of River Struma (*Southern*), NE of Kulata Village, 14.04.2019 (photo L. Domozetski).



Fig. 14. *Ophrys mammosa*, Valley of River Struma (*Southern*), SE of Novo Hodzhovo Village, 03.04.2021 (photo L. Domozetski).



Fig. 15. *Ophrys* × *mulierum* (= *Ophrys mammosa* × *O. reinholdii*), Rhodopi Mts (*Eastern*): SE of BelopolyaneVillage, 03.05.2021, A & B – different specimens (photo L. Domozetski).

mammosa or as *O. sphegodes* subsp. *taurica* recently accepted in some databases (POWO 2024). This is a species with local distribution in Bulgaria, rated as Vulnerable for the country (Petrova 2009: 85). According to Assyov & Petrova (2012: 295), the species is known from the following floristic regions: Black Sea Coast (*Northern*), Northeast Bulgaria, Danubian Plain, Forebalkan, the Balkan Range, Valley of River Struma (*Southern*), Mt Belasitsa, Mt Slavyanka, Pirin Mts, Rhodopi Mts (*Central & Eastern*), Thracian Lowland, Tundzha Hilly Country, and Mt Strandzha. It has been recently reported for the West Frontier Mts and the Valley of River Mesta (Domozetski & Petrova 2021).

Here are some data on the populations demonstrating lack of the characteristic "mammoses" on the lip base of the flowers (Figs. 12–14). Furthermore, the lip is more rounded or irregular, relatively small (up to 11–12 mm long), occasionally the periphery lightens to almost yellow. The speculum is occasionally H-shaped, but often complex, irregular in shape (Figs. 12, 14). These characteristics refer to the species O. hansreinhardii distributed in Albania and Greece (Antonopoulos 2009: 262-263; Antonopoulos & Tsiftsis 2017b: 402; Paulus & Hirth 2017). Furthermore, these plants start blooming relatively earlier (early March - middle of April) than the "classic" O. mammosa. Flowering ends around mid- to the end of April; at higher altitudes, an extension of the flowering period is possible to the beginning of May (for comparison, see O. epirotica which blooms strictly in the second half of May). In the Znepole Region, flowering has been observed at the end of April, but the higher altitude of the place should be also considered. However, mention deserves the fact that transitional specimens have been also found, which demonstrate to one or another degree "mammoses" on the lip base. Given that the species status of O. hansreinhardii is not accepted by all researchers (Pedersen & Faurholdt 2007: 191-192; POWO 2024), and that in some publications *O. mammosa* is even accepted as a subspecies of *O. sphegodes* (Pedersen & Faurholdt 2007: 191-192; Kühn & al. 2019: 256), all these variations are treated here within the *O. mammosa* species.

Ophrys × *mulierum* H. Baumann & Künkele (syn. Ophrys × kozanica B. Willing & E. Willing) = Ophrys mammosa × Ophrys reinholdii)

Reported localities: Rhodopi Mts (*Eastern*) – SE of Belopolyane village, E of Odrintsi village, Ivaylovgrad District, in grassy places among shrubs of *Paliurus spina-christi*, *ca*. 68 m, 41.4354957°N, 26.1743166°E, 02.05.2020, a single plant, *L. Domozetski* obs.; 03.05.2021, seven specimens, *L. Domozetski* obs. (Fig. 15A, B); 07.05.2022, up to 10 specimens, *L. Domozetski* obs. (Fig. 16); 02.05.2023, up to 10 specimens, *L. Domozetski* obs. (Fig. 17).

This is the first report of a natural hybrid, identified as Ophys mammosa × O. reinholdii, for Bulgaria. It has been discovered in the Rhodopi Mts (Eastern), S of Belopolyane village. The habitat is dense bushes of Paliurus spina-christi with presence of Quercus sp. An extremely common orchid species in this locality is O. mammosa. A single specimen identified as a hybrid was observed for the first time in 2020. In 2021, 2022 and 2023, the site was revisited and up to 10 specimens have been observed demonstrating hybrid characteristics (Figs. 15-17). The hybrid has been identified according to Antonopoulos (2009: 311), who gives it as a hybrid Ophrys reinhardiorum \times O. mammosa (for O. reinhardiorum, see the comment on O. reinholdii). In the Bulgarian specimens, when compared to O. mammosa, the lip is more distinctly tripartite, often forming two lateral lobes, more densely hairy. The color is darker, almost black, the speculum is usually divided into two segments, shiny, outlined with a white stripe. Despite a targeted search for O. reinholdii in the area, the species has not been found, but may presumably grow nearby. Most of the site is difficult to access because of the dense bushes of *P. spina-christi*. Occurrence of new localities of O. reinholdii in the Eastern Rhodopi Mts is highly probable. So far, a discovery of a hybrid Ophrys mammosa × O. reinholdii from Bulgaria has not been reported.



Fig. 16. *Ophrys* × *mulierum* (= *Ophrys mammosa* × *O. reinholdii*), Rhodopi Mts (*Eastern*): SE of Belopolyane Village, 07.05.2022 (photo L. Domozetski).



Fig. 17. *Ophrys* × *mulierum* (= *Ophrys mammosa* × *O. reinholdii*), Rhodopi Mts (*Eastern*): SE of Belopolyane Village, 02.05.2023 (photo L. Domozetski).



Fig. 18. Ophrys reinholdii, Valley of River Struma (Southern), Pchelina hill, N of General Todorov Village, 06.04.2024, A & B – different specimens (photo L. Domozetski).

Ophrys reinholdii Fleischm.

Reported localities: Valley of River Struma (Southern) – on the western slope of Pchelina hill, N of General Todorov village, Petrich District, in grassy places among sparse bushes of *Paliurus spina-christi*, ca. 102 m, 41.4637074°N, 23.2690862°E, three specimens, 15.04.2023, *L. Domozetski* obs.; five specimens, 06.04.2024, *L. Domozetski* obs. (Figs. 18A, B).

This was a new species for that floristic region and a new locality of the species in West Bulgaria. The discovered population was small. It was found in a site that has been regularly visited for the past 10 years. The occurrence of *O. reinholdii* in that locaion and the small population suggested a recent distribution of the species in the Valley of River Struma, probably from some localities in Greece. A very common orchid species with a large population in the same locality was *O. mammosa*. The entire newly recorded

population of O. reinholdii consisted of specimens with greenish sepals, tinted reddish. A different species - O. reinhardiorum - was described by Hannes Paulus from Greece (Paulus 2008). That species had characteristically smaller flowers and greenish sepals, in contrast to the pinkish sepals and larger flowers of O. reinholdii. Paulus also described the different pollinators of the two taxa. According to his description, the plants from the population found in the Valley of River Sturma could be identified as O. reinhardiorum. According to the Atlas of the Greek Orchids, O. reinhardiorum was mainly distributed in the mountainous central northern part of the country, while O. reinholdii was distributed mainly in the Peloponnese and the western part of the country, on some islands and in a few isolated locality southwards of the Rhodopi Mts (Antonopoulos & Tsiftsis 2017b: 362, 358). Also, in the Atlas of the Greek Orchids, the difference



Fig. 19. Serapias bergonii, Valley of River Struma (Southern), N of Samuilovo Village, 27.05.2023 (photo L. Domozetski).

in the flowering period was specifically noted: *O. reinholdii* bloomed earlier, in March and April, and *O. reinharidorum* bloomed from the end of April to the beginning of June (Antonopoulos & Tsiftsis 2017b: 358, 362). In Bulgaria, the population discovered in the Valley of River Struma demonstrated a relatively early flowering in the first half of April. The earliest observation was on 06.04.2024. This contradicted the flowering period presented for *O. reinhardiorum* in Greece. However, *O. reinharidorum* was now accepted as a separate species by many authors. They considered *O. reinhardiorum* as a synonym to *O. reinholdii* subsp. *reinholdii* (Kühn & al. 2019: 316; POWO 2024).

Ophrys reinholdii is an extremely rare species in Bulgaria, rated as Endangered in the *Red List of Bulgarian Vascular Plants* (Petrova 2009) and in the *Red Data Book of Bulgaria* (Petrova 2015: 562). It is originally known from few localities in Mt Strandzha (Petrova 2015). Subsequently, it has been also discovered in the Eastern Rhodopi Mts (Hristov & al. 2018). In the Eastern Rhodopi Mts, the species probably has a wider distribution and new localities may be discovered (see comment about the natural hybrid *O. reinholdii* \times *O. mammosa*).

Serapias bergonii E.G. Camus [syn. S. vomeracea subsp. laxiflora (Soó) Gölz & H.R. Reinhard] (Fig. 19)

Description: Slender orchid, 15-40(50) cm tall. Stem green-washed-brown at the tip; often base of stem and leaves streaked red. Leaves 5–9, lanceolate, 6–14 cm long, uppermost 1–2 bract-like. Bracts 18–55 mm long, longer than hood, washed purple; inflorescence lax, elongated with (2)3–12(20) flowers, medium to small; hood lilac-green; lip 18–29(35) mm long, pale red to deep brown-purple; hypochile 10–13 mm × 11–15 mm, kidney-shaped to obcordate, seldom wedge-shaped, centre greenish-yellow to pale pinkish or ochre, with short hairs, lateral lobes blackish-purple; epichile lanceolate, (10)12–18(20) mm × 4–7.5 mm (Figs. 20A, B), pale ocher to pale purplish, pendant to turned down and back, sparsely hairy to almost hairless.

Reported localities: Valley of River Struma (Southern) - SE of Novo Hodzhovo village, Sandanski District, in a grassy place among open bushes of Quercus, Paliurus spina-christi, 252 m, 41.4087225°N, 23.4220060°E, a single flowering stem, 23.05.2021 & 14.05.2022, L. Domozetski obs.; N of Samuilovo village, Petrich District, along a dirt road, in open bushes of Quercus sp. and Paliurus spina-christi, ca. 219 m, 41.3912504°N, 23.0895267°E, 23 flowering stems, 27.05.2023, coll. L. Domozetski obs. (SOM 179176); N of Samuilovo village, Petrich District, close to a dam wall, in an open grassy place, 194 m, 41.3940956°N, 23.0878648°E, more than 80 flowering stems, together with S. vomeracea, 27.05.2023, coll. L. Domozetski (SOM 179175) (Fig. 19); three flowering stems at the beginning of flowering, 07.04.2024, L. Domozetski obs.; Rhodopi Mts (Eastern) - along the road from Dolno Lukovo to Meden Buk villages, Ivaylovgrad District, in a moist grassy place, ca. 122 m, 41.3707099°N, 26.0558078°E, five flowering stems, among prevailing S. vomeracea and with and intermediate flowering stems, 06.05.2022, L. Domozetski obs.; 06.05.2023, coll. L. Domozetski (SOM 179177); in



Fig. 20. Serapias bergonii: A. epichile measures, Rhodopi Mts (*Eastern*), along the road from Dolno Lukovo Village to Meden Buk Village, 06.05.2023; B. flower measures, Valley of River Struma (*Southern*), N of Samuilovo Village, 07.04.2024 (photo L. Domozetski).

a meadow along the road from Meden Buk to Cherna Cherkva villages, Ivaylovgrad District, in a moist grassy place, *ca.* 141 m, 41.3703013°N, 26.0388563°E, three flowering stems, 06.05.2023, *L. Domozetski* obs.; in a meadow along the road from Gorno Lukovo to Cherna Cherkva villages, in a grassy place, *ca.* 284 m, 41.3555435°N, 26.0663060°E, four flowering stems, 07.05.2023, *L. Domozetski* obs..

Serapias bergonii is distributed in South Italy (including Sicily), the southern part of the Balkans, on the western periphery of Asia Minor, Crete and Cyprus (Kühn & al. 2019: 349). In Greece, that species is rather common, distributed almost throughout the country (Antonopoulos & Tsiftsis 2017a: 310-311). Localities of *S. bergonii* very close to the border with Bulgaria along river Struma in the Greek part are also known (Antonopoulos & Tsiftsis 2017a: 310). Based on a photo of Serapias sp. from the Rupite area in the Valley of River Struma (Southern), Antoaneta Petrova (pers. com.) suggested for the first time a presumable discovery of S. bergonii in Bulgaria. In 2021, during field research, a single flowering stem of Serapias has been found SE of Novo Hodzhovo village, Sandanski District. After a detailed examination the flowering stem has been identified as S. bergonii (Fig. 21). Furthermore, a careful study in 2022 and 2023 of the flowering stems from the Rhodopi Mts (Eastern) has identified characteristics of S. bergonii (Figs 20A). Again, in the Valley of River Struma (Southern), in 2023, an extensive population of Serapias has been discovered. Information about the locality has been kindly provided by Lyudmila Boyadzhieva - a GIS analyst, to whom the author extends thanks here. That population is located near river Strumeshnitsa. It is composed of S. vomeracea and S.

bergonii (Figs. 19, 20B), with only *S. bergonii* present in some places in that locality. The site is very suitable for orchids and the following accompanying species have been observed: *Anacamptis morio*, *A. papilionacea*, *A. laxiflora*, *Spiranthes spiralis*, and *Himantoglossum calcaratum* subsp. *rumelicum*. *Serapias vomeracea* has been reported for the Valley of River Struma in 2021 (Popatanasov 2021), but there has been no data on the morphometry of the identified plants and the published data probably refer to *S. bergonii*. Measurements of the different parts of the flower are needed to correctly distinguish *S. bergonii* from *S. vomeracea*. For this purpose, the article presents a detailed description of *S. bergonii* and the key characteristics of *S. bergonii* and *S. vomeracea* are summarized in Table 2. In both floristic regions, the two species often grow together but separate populations of *S. bergonii* have also been found. That species has been also reported as subspecies of *S. vomeraceae* (Kühn & al. 2019: 349-350). The two species often grow together in Greece, and intermediate flowering stems are known (Antonopoulos & Tsiftsis 2017a: 310-311), which makes identification difficult. However, even in mixed populations, there are flowering stems that clearly show characteristics



Map 4. Distribution of Serapias bergonii in Bulgaria.

Table 2. Key diagnostic features of Serapias bergonii and S. vomeracea.

Species	Habitus	Lip: length (mm)	Hypochile: length (mm)	Hypochile: width (mm)	Epichile: length (mm)	Epichile: width (mm)
S. bergonii	Slender	18-29(35)	10-13	11–15	(10)12-18 (20)	4-7.5
S. vomeracea	Robust	28-44	12–17	17–25	18-30	8-13



Fig. 21. Serapias vomeracea, Valley of River Struma (Southern), N of Samuilovo Village, 27.05.2023 (photo L. Domozetski).

of *S. bergonii*. In this publication, *S. bergonii* is presented for the first time as a new species for the Bulgarian flora. The flowering period is mainly observed at the end of April and continues throughout May until the beginning of June. In the locality near river Strumeshnitsa, the beginning of flowering of individual flowering stems has been observed in the first half of April (earliest observation from 07.04.2024). Map 4 presents the so far established distribution of the species in Bulgaria.

Serapias vomeracea (Burm. f.) Briq. (Fig. 21, 22)

Reported localities: Valley of River Struma (Southern) – N of Samuilovo village, Petrich District, close to a dam wall, in an open grassy place, 194 m, 41.3940956°N, 23.0878648°E, more than 50



Fig. 22. *Serapias vomeracea* – epichile measures, Valley of River Struma (*Southern*), N of Samuilovo Village, 27.05.2023 (photo L. Domozetski).

specimens, together with *S. bergonii*, 27.05.2023, *L. Domozetski* obs. (Fig. 21).

This was a new locality of the species in the floristic region of the Valley of River Struma. It was discovered in the valley of river Strumeshnitsa (a tributary to river Struma), northwards of Samuilovo village. A large population of *S. vomeracea* was discovered together with *S. bergonii*. This data confirmed the presence of the species in the Valley of River Struma. It could be assumed that all newly discovered localities of *Serapias* in that floristic region have resulted from the expansion of the range of *S. bergonii* and *S. vomeracea* northwards. In Bulgaria, *S. vomeracea* has been so far reported with a limited distribution at the Black Sea Coast (*Southern*), Mt Strandzha and the Rhodopi Mts (*Eastern*). There were old records from Mt Slavyanka



Fig. 23. *Spiranthes spiralis*, Valley of River Struma (*Northern*), E of Simitli town, 23.09.2021 (photo L. Domozetski).

but no specific locality was known (Assyov & Petrova 2012; Petrova 2015). Recently, the species was also published for the Valley of River Struma (*Southern*) based on material found near the road between Chuchuligovo and Dolno Spanchevo villages (Popatanasov 2021). On the basis of the published photographs, the presented specimen could be identified rather as *S. bergonii*. Unfortunately, no exact but only approximate locality data have been published. Despite searches, no population was found for revision.

Spiranthes spiralis (L.) Chevall. (Fig. 23)

Reported localities: <u>Valley of River Struma (North-</u> <u>ern)</u> - E of Simitli town, in a grassy place with shrubs of *Juniperus deltoides*, *ca*. 428 m, 41.8931577°N, 23.1347012°E, nine specimens, 23.09.2021, *L*. Domozetski obs. (Fig. 23); <u>Valley of River Mesta</u> – E of Bogolin village, Satovcha District, in a grassy place with shrubs of *J. deltoides*, *ca.* 755 m, 41.5375578°N, 23.9619943°E, a single specimen, 24.09.2022, *L. Domozetski* obs.; NE of Zhizhevo village, Satovcha District, in a grassy place with shrubs of *J. deltoides*, *ca.* 915 m, 41.5580969°N, 24.0078792°E, more than 50 specimens, 24.09.2022, *L. Domozetski* obs.; valley of river Kanina, NW of Leshten village, Garmen District, in a grassy place with shrubs of *J. deltoides*, *ca.* 793 m, 41.6397639°N, 23.8149473°E, nine specimens, 25.09.2023, *L. Domozetski* obs.

So far, this species has been reported from all floristic regions except the Valley of River Struma (*Northern*), Valley of River Mesta and Northeast Bulgaria (Assyov & Petrova 2012). Recently, it has been published for the Valley of River Struma (*Southern*) floristic region from a different locality (Domozetski & Petrova 2021).

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