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Notes on *Epipactis condensata*, *E. rechingeri* and *E. purpurata* (Orchidaceae) in the Caucasus and Crimea**Abstract**

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The E Mediterranean species *Epipactis condensata* is reported for the first time from Russia (Krasnodar region) and Ukraine (Crimea). *E. rechingeri*, so far considered endemic to Mazandaran province in N Iran, is reported from the adjacent Lenkoran region in Azerbaijan. *E. purpurata* is reported for the first time from Crimea. A distribution map for *E. condensata* and *E. rechingeri* is given.

Additional key words: orchids, taxonomy, distribution, Russia, Ukraine, Azerbaijan.

The genus *Epipactis* Zinn in Europe is well known for its intricate systematics and confused taxonomy, comparable to that of such orchid genera as *Orchis* L. and *Dactylorhiza* Nevski. In *Epipactis*, the problematic taxa are concentrated in the *E. helleborine* alliance, which is usually placed into the type section of the genus (Irmisch 1842; Reichenbach 1850-51; Schlechter 1928; Nevski 1935; Renz 1978; Quentin 1993; Efimov 2004; Baumann & al. 2006). There is an alternative taxonomy by Klein (2005), where the type section s.l. is divided into three sections with the *E. helleborine* alliance being distributed among two sections, viz. *Ripariphilae* E. Klein and *Epipactis*. However, I do not find Klein's treatment reasonable, because the affinity of many species is still not clear.

The species belonging to *Epipactis* sect. *Epipactis* s.l. are characterized by a cup-like hypochile with a diffuse nectary in its basal part, inconspicuous lateral hypochile lobes and a short column (less than 4 mm long, excluding anther). The species of section *Epipactis* are distributed in Europe, Asia (excluding the Arabian Peninsula, the Indian subcontinent and Indochina) and in the northernmost part of Africa; two species are introduced to North America. The main diversity centres are W and Central Europe and W Asia. The number of species of the type section varies, due to the difficulties in the taxonomy, from 1-3 in older works (Reichenbach 1850-51; Ascherson & Graebner 1907) to 40-65 in recent ones (Efimov 2004; Klein 2005; Baumann & al. 2006). This is only to a minor part due to the upgrading of subspecies and varieties and mainly the result of the description of numerous new species after 1970, which are mostly closely related to *E. helleborine* (L.) Crantz. Species delimitation is further complicated by the frequent

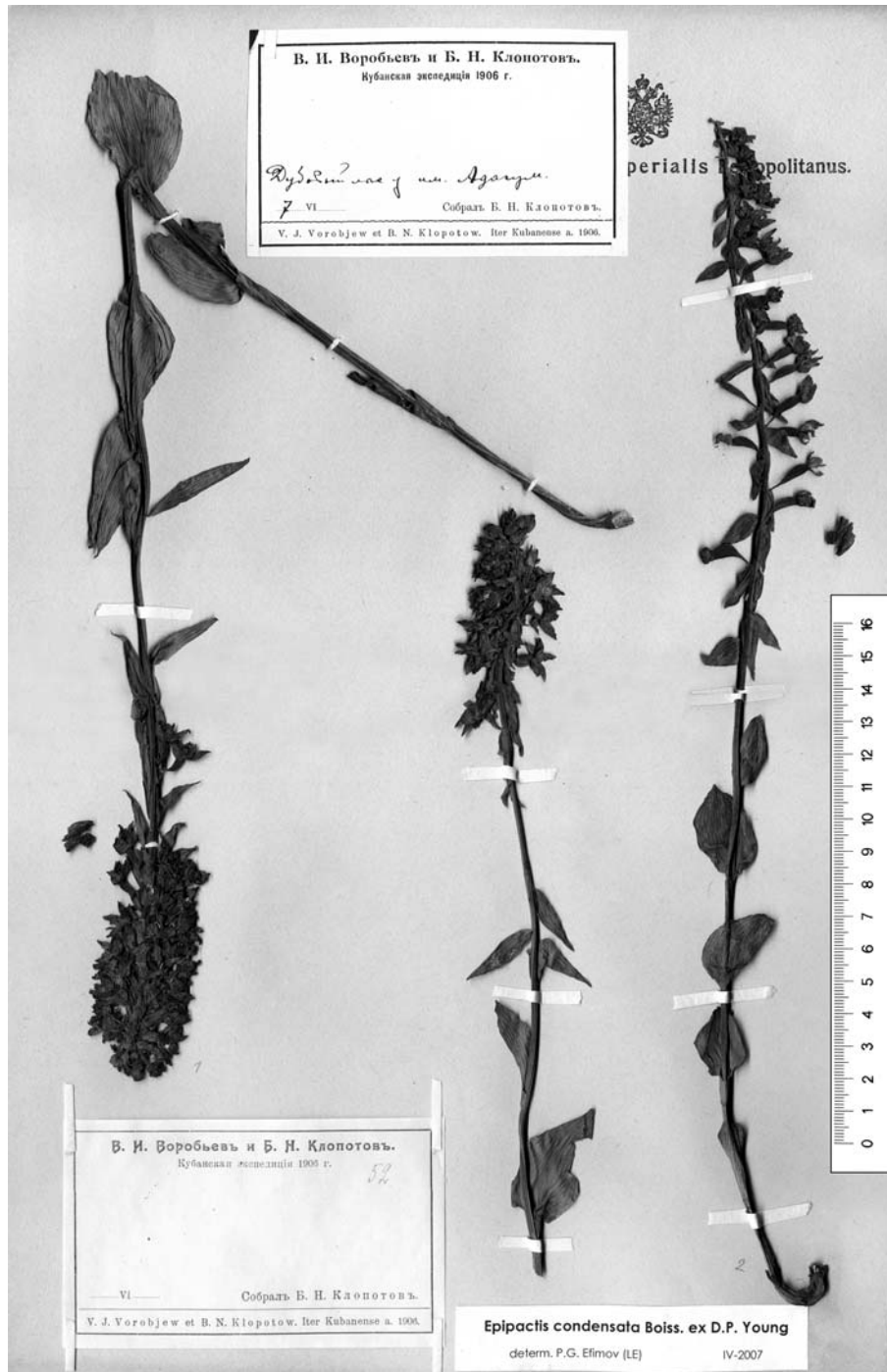


Fig. 1. *Epipactis condensata* – typical specimen from Krasnodar region, Russia (Adagum, 7.7.1906, Klopotov 52, LE).

interspecific hybridisation in this group (Efimov 2004; Blaich 2007). Some species are characterised by autogamous or cleistogamous flowers (Robatsch 1995; Klein 2005) and may be regarded as being established via autogamic genetic isolation from other populations. Some species are very faintly distinguishable from *E. helleborine* s.str. and are known only from the 'locus classicus'. However, other species of this group, including those studied here, are more clearly distinguishable, and their distribution ranges are already more or less outlined.

So far, E Europe (in the limits of the former Soviet Union) and the Caucasus have not come into the focus of detailed studies of *Epipactis* sect. *Epipactis*. The most part of this area is outside the diversity centre of the group, and only two species are widely distributed here: *E. helleborine* and *E. atrorubens* (Hoffm.) Bess., the latter, however, not confirmed for the Caucasus and Crimea. Besides, *E. microphylla* (Ehrh.) Sw. is known for a long time from the Caucasus and Crimea (Bieberstein 1819; Nevski 1935) and *E. purpurata* Sm., nom. cons. prop. (= *E. viridiflora* Krok.) from Moldova and W Ukraine (Godfery 1933; Smolyaninova 1976; Kirtoka 1979). In the Caucasus also *E. persica* (Soó) Nannf. (Torosyan 1986; Averyanov 1994; Rückbrodt & Rückbrodt 1998) occurs. Further, the presence of *E. pontica* Taubenheim and *E. leptochila* (Godf.) Godf. was expected by some authors (Rückbrodt & Rückbrodt 1998; Akhalkatsi & al. 2003). Reports from Georgia of *E. condensata* Boiss. ex D. P. Young (Meikle 1985; Baumann & al. 2003; Akhalkatsi & al. 2003) and *E. rechingeri* Renz (Akhalkatsi & al. 2003), so far have been proven to be erroneous and the plants are referable to a new taxon, *E. purpurata* subsp. *kuenkeleana* (Baumann & al. 2005; Akhalkatsi & al. 2005; Kreutz 2006).

The present contribution is based on the analysis of herbarium material preserved at the Komarov Botanical Institute, Saint Petersburg (LE), the Herbarium of the Moscow University (MW), the Main Botanical Garden, Moscow (MHA) and the Herbarium of the University of Helsinki (H).

Epipactis condensata Boiss. ex D. P. Young in Jahresber. Naturwiss. Vereins Wuppertal 23: 106. 1970 ≡ *Epipactis helleborine* subsp. *condensata* (Boiss. ex D. P. Young) Sunderm., Europ. Medit. Orchid., ed. 3: 41. 1980. – Holotype: [Turkey], Bounarbachi [Pınarbaşı] prope Smyrnam [Izmir], 26.6.1854, *Balansa* 779 (G, isotype: LE).

Diagnostic features. – *Leaves* 4-7(-10), usually green, small, up to 6.5 cm long and 2 cm wide, shorter or slightly longer than internodes, sometimes some leaves clustering in the upper part of the stem. *Raceme* erect, dense, rarely rather loose, 10-45-flowered; inflorescence rachis and ovary rather densely pubescent. *Ovary* narrowly ovate towards fruiting time. *Flowers* yellowish green, usually not widely opening (facultative autogamy?). – Fig. 1.

Affinity. – This species was usually thought to be most closely related to *Epipactis viridiflora* and *E. rechingeri* (Young 1970; Renz 1978; Renz & Taubenheim 1983; Meikle 1985), differing from them by the much more pubescent rachis and ovary, greyish to yellowish green leaves that are not tinged violet on both sides, the yellowish green, not widely opening flowers, the usually denser inflorescence, the narrowly ovate (instead of cylindrical) ovary, and the habitat (sparse woodlands instead of shady forests). However, I regard this species, probably together with *E. troodi* Lindb. f. from Cyprus and Turkey, as related to *E. helleborine* s.str., differing from it by shorter leaves, a much more pubescent ovary, different colouration of flowers and leaves, etc. Due to the pubescent ovary and inflorescence rachis, *E. condensata* was sometimes mistaken for *E. atrorubens*, and most probably, misdetermined material of both *E. condensata* and *E. microphylla* is the only ground for the reports of *E. atrorubens* from Crimea and the Caucasus.

Fig. 2A-B illustrates the results of a Principal Component Analysis (PCA, computed with the program Statistical 7.1) of the variability of *Epipactis condensata* and *E. helleborine* from Krasnodar region of Russia (Fig. 2A) and from the Crimea (Fig. 2B). All measurements for the analysis were made on the herbarium material at the Komarov Botanical Institute (LE). Measurements of 10 characters and 7 ratios based on these measurements were included as variables in the analysis (Table 1). The graphs (Fig. 2A-B) clearly confirm that *E. condensata* and *E. helleborine* are morphologically distinct.

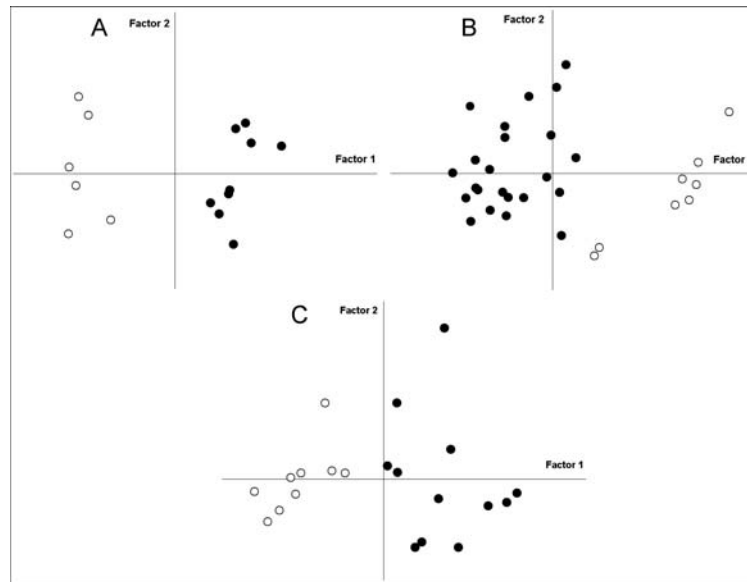


Fig. 2. Graphs based on the results of a PCA of the morphological variability of *Epipactis condensata*, *E. rechingeri* and *E. helleborine*. – A: *E. condensata* (○) and *E. helleborine* (●) from Krasnodar region, Russia; B: *E. condensata* (○) and *E. helleborine* (●) from the Crimea, Ukraine; C: *E. rechingeri* (○) and *E. helleborine* (●) from Azerbaijan. Further explanations in the text.

Note. – Since *Epipactis condensata* and *E. helleborine* are probably closely related and partly sympatric, hybridisation between them is possible (Kreutz 1998). Some plants from Crimea (near Alupka) and the Caucasus (near Novorossiysk) may in fact be hybrids.

Phenology. – Flowering from June to early July.

Geographic distribution and habitat. – Turkey, Cyprus, Lebanon, W Syria, Ukraine (Crimea), Russia (Krasnodar region) (Fig. 3). The typical habitat is sparse woodlands on basic soils.

Material examined. – UKRAINE: CRIMEA: Mt Karadagh, 25.6.1926, *Transchel s.n.* (LE); Alupka, 6.1876, *Egorov s.n.* (LE); Zelenogor'ye, riv. Arpat, 2.6. 1990, *Schvedchikova s.n.* (MW); Krym, [without locality], 1837, *Il'in s.n.* (MHA); Laspi, 22.6.[without year], *herb. Steven s.n.* (H 1239487). – RUSSIA: KRASNODAR REGION: Adagum, 7.7.1906, *Klopotov 52* (LE); Kabardinka, 29.5.1966, *Gogina, Proskuryakova s.n.* (MHA).

Epipactis rechingeri Renz in *Orchidee* 24: 253. 1973 ≡ *Epipactis viridiflora* subsp. *rechingeri* (Renz) H. Baumann & R. Lorenz in *J. Eur. Orch.* 37: 713. 2005. – Holotype: Iran, Mazandaran, south from Sang-deh, east from Pol-e Safid, 1400 m, 21.8.1972, *Renz 10716* (G).

Diagnostic features. – *Rhizome* usually vertical, about 3-5 cm long, with several adventitious roots. *Leaves* (2-)3-4(-5), purplish, small, up to 5 cm long and 2 cm wide, shorter or slightly exceeding the internodes. *Raceme* long, not dense, 8-45-flowered; inflorescence rachis minutely pubescent. *Ovary* subglabrous, at fruiting time symmetrically cylindrical, not curved, usually about 5-6 mm long. *Flowers* rose-violet or green-purplish, widely opening. – Fig. 4.

Affinity. – As already mentioned by Renz (1978), *Epipactis rechingeri* is very similar to *E. purpurata* from Europe in most morphological features. *E. purpurata* differs from it by usually more numerous, slightly longer leaves, and longer, narrowly ovate, slightly curved fruits. The

Table 1. The measurements of *Epipactis condensata* from Crimea, Ukraine (1), and the Krasnodar region, Russia (2); of *E. helleborine* from Crimea, Ukraine (3), the Krasnodar region, Russia (4), and Azerbaijan (5); and of *E. rechingeri* from Azerbaijan (6). – M = means, s = standard deviations.

	1		2		3		4		5		6	
	M	s	M	s	M	s	M	s	M	s	M	s
Plant height [cm]	40	9	41.3	3.2	50	12.5	54.4	8.7	52.4	9.9	39.9	9.9
Inflorescence length [cm]	12.3	6.3	12.5	2.3	12.7	4.5	15.2	3.9	15	4.3	14.1	4.5
Length of the largest leaf [mm]	47.6	8.1	39.8	8.8	88.3	24.1	89.1	22.6	89.5	20.2	43.3	4.7
Width of the largest leaf [mm]	19.9	4.8	25.5	4.2	38.6	10.2	37.4	9.6	45.8	12.6	18.2	4
Distance between base of the largest leaf and its broadest width [mm]	15.8	4.5	11.8	2.1	25.3	9	28.9	7.2	32.6	10.5	16.7	2.8
Number of green stem leaves	3.9	0.4	3.8	0.8	5.9	1.1	6.9	0.8	5.8	1.1	3.3	1.4
Length of the internode above the largest leaf [mm]	28.5	7.4	35.8	5.8	18.1	6.7	23.6	4.2	28.2	10.4	32.8	5.7
Flower number	25.8	11.6	35.8	7.2	19.4	7.5	21.9	6.3	22.8	11.9	21.6	12
Density of pubescence on the ovary (measured by eye, valued by a number from 1 to 5)	4.6	0.5	4	0.6	1.4	0.7	1.2	0.4	1.8	0.8	1.2	0.4
Density of pubescence on the inflorescence rachis (measured by eye, valued by a number from 1 to 5)	4.6	0.5	3.5	0.5	2.4	1	1.8	0.7	2.9	1.1	3.3	0.5
Ratio length of the internode above the largest leaf / length of the largest leaf	0.6	0.2	0.9	0.2	0.2	0.1	0.3	0.1	0.3	0.1	0.8	0.1
Ratio number of green stem leaves / plant height	0.1	0	0.1	0	0.1	0	0.1	0	0.1	0	0.1	0
Ratio length of the largest leaf / plant height	1.3	0.4	1.0	0.2	1.8	0.4	1.7	0.4	1.8	0.5	1.2	0.3
Ratio inflorescence length / flower number	0.5	0.1	0.4	0.1	0.7	0.2	0.7	0.1	0.7	0.2	0.7	0.2
Ratio inflorescence length / plant height	0.3	0.1	0.3	0.1	0.2	0	0.3	0	0.3	0.1	0.4	0.1
Ratio length of the largest leaf / width of the largest leaf	2.5	0.9	1.6	0.3	2.4	0.7	2.4	0.5	2	0.3	2.5	0.5
Ratio length of the largest leaf / distance between base of the largest leaf and its broadest width	3.2	0.8	3.4	0.5	3.6	0.7	3.1	0.6	2.9	0.8	2.6	0.4

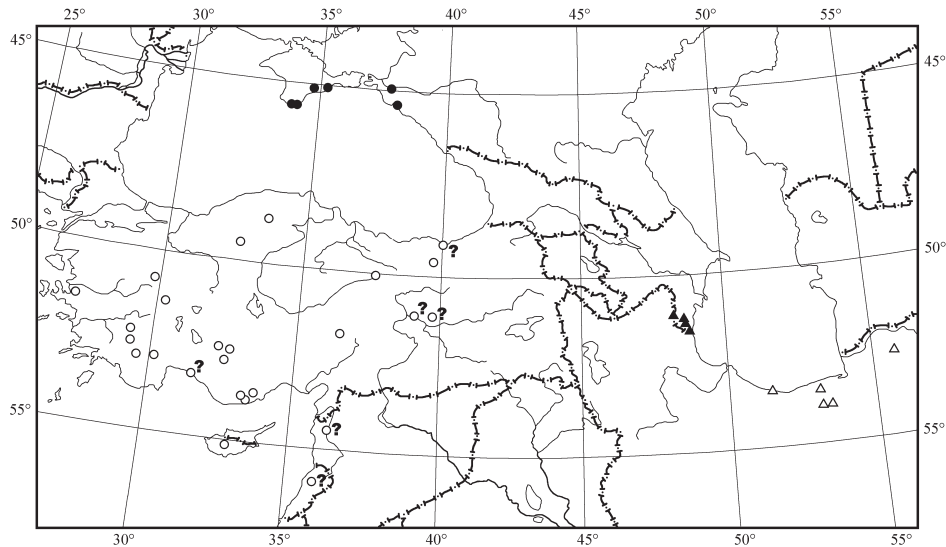


Fig. 3. The distribution ranges of *Epipactis condensata* (●,○) and *E. rechingeri* (▲,△). – Solid symbols = newly discovered localities based on herbarium data; empty symbols = literature data (Renz 1978; Renz & Taubenheim 1983; Rückbrodt & al. 1992); ? = only approximately localised reports.

morphological affinity of both species with respect to the reduced and purplish coloured leaves and the purplish stem may be a result of a higher degree of mycotrophy. Taking into account (1) a disjunction between the distribution ranges of *E. purpurata* and *E. rechingeri*, and (2) the presence of occasionally saprophytic forms of *E. helleborine*, which are known across its distribution range, some being completely without chlorophyll and white, a high degree of mycotrophy in both species may have been arisen independently. This would support considering *E. purpurata* and *E. rechingeri* as distinct taxa. However, it is probably a rational way treating *E. rechingeri* as a subspecies of *E. purpurata* (Baumann & al. 2005; Kreutz 2006).

Fig. 2C illustrates the results of the PCA of the variability of *Epipactis rechingeri* and *E. helleborine* from Azerbaijan. All measurements (Table 1) for this analysis were made on herbarium material of the Komarov Botanical Institute (LE). It is visible from the graph (Fig. 2C) that *E. rechingeri* and *E. helleborine* are morphologically clearly distinct.

Phenology. – Flowering from the end of July to August.

Geographic distribution and habitat. – Iran (Mazandaran), Azerbaijan (Lenkoran) (Fig. 3). The typical habitat is shady *Fagus* forests.

Material examined. – AZERBAIJAN: LENKORAN: Chayuzi, riv. Vilyaschchay, 6.9.1982, Zaytseva, Kostyleva s.n. (MHA); Khush, 29.6.1931, Shipchinskij 380 (LE, MW); 20-22 km from Lenkoran to Lerik, 29.7.1963, Bobrov, Tzvelev 1041 (LE); Dongobyn - Havzavua, 12.8.1897, Alexeenko 2676 (LE); Havzavua - Girdani, fl. Havzaaru, 12.8.1897, Alexeenko 2677 (LE); Sijov – Tazdy-Pok, vicinity of Hamurat, 3.8.1897, Alexeenko 2678 (LE); Gazho, 25.8.1928, Prilipko s.n. (LE); vicinity of Alasha, 25.5.1898, Levandovskij s.n. (LE); same locality, 13.8.1931, Shipchinskij 1079 (LE); same locality, 14.8.1931, Shipchinskij 1097 (LE, MW).

Epipactis purpurata Sm., Engl. Fl. 4: 41. 1828, nom. cons. prop. (see Taxon 56: 592, no. 1702. 2007) – Holotype: Herb. Smith no. 1395.7 (LINN).

= *Epipactis viridiflora* Krock., Fl. Siles. 3: 41. 1814. – Neotype (designated by Baumann &



Fig. 4. *Epipactis rechingeri* – typical specimen from Azerbaijan (20-22 km from Lenkaran to Lerik, 29.7.1963, Bobrov, Tzvelev 1041, LE).

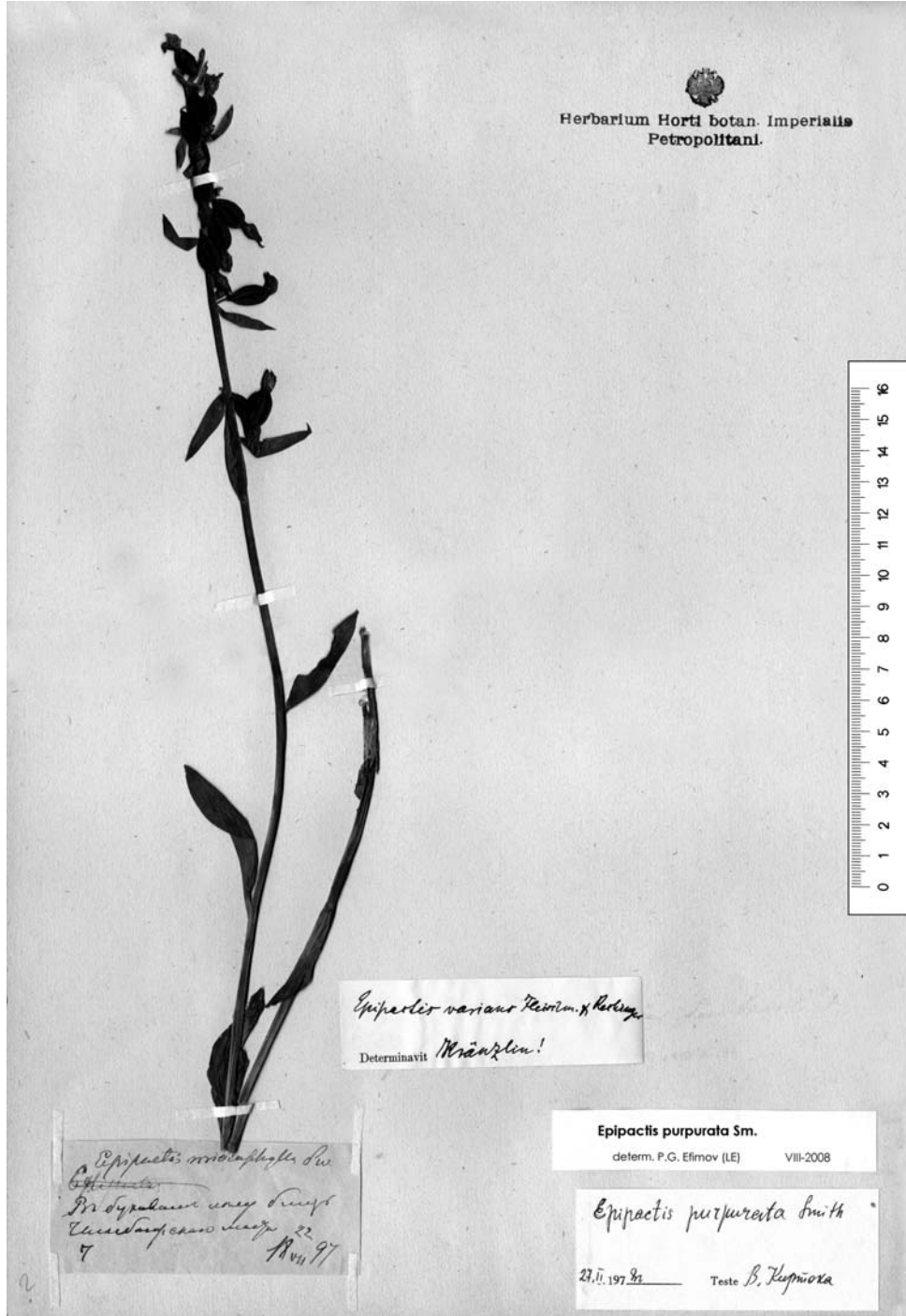


Fig. 5. *Epipactis purpurata* – typical specimen from Crimea (Riv. Tchaanbair, 22.7.1897, Golde s.n., LE).

Künkele in J. Eur. Orch. 31: 628. 1999): [icon] “*Epipactis latifolia* [var.] *brevifolia*”, H. G. Reichenbach, Icon. Fl. Germ. Helv. 13/14: t. 134(II). 1851.

This is a well-known species with a wide distribution in Europe. In the territory of the former USSR it has been known from W Ukraine and Moldowa (Godfery 1933; Kirtoka 1979). Here it is reported for the first time from Crimea. The sheets at LE were already so determined by Kirtoka. Using the data by Baumann & al. (2005) and Akhalkatsi & al. (2005), the material can be further identified as *E. purpurata* subsp. *purpurata*. One of the specimens of *E. purpurata* from Crimea is shown in Fig. 5.

Specimens examined. – CRIMEA: Near Nikita, 400-500 m, 19.7.1960, *Belyanina s.n.* (MHA); Kokkoz [Sokolinoe], 22.7.1897, *Golde s.n.* (LE); riv. Tchaanbair [Kokkozka basin near Sokolinoe], 22.7.1897, *Golde s.n.* (LE); Laspi, [s.d.], *herb. Steven s.n.* (H 1239488).

Key to the species of *Epipactis* sect. *Epipactis* in the Caucasus and Crimea

1. Ovary and inflorescence rachis clearly densely pubescent 2
 - Ovary and inflorescence rachis sparsely pubescent or subglabrous 3
2. Sepals shorter than 7 mm; leaves up to 3(-3.5) cm long, shorter than internodes, usually tinged with purple; flowers 5-15(-20) *E. microphylla* (Ehrh.) Sw.
 - Sepals longer than 7 mm; leaves up to 6.5 cm long, sometimes shorter but usually longer than internodes; flowers 10-45 *E. condensata* Boiss.
3. Rachis of inflorescence glabrous or subglabrous; stem 10-50(-60) cm high; leaves (2-)3(-4), well developed, green; flowers 2-15(-20); viscidium lasting only for a short time *E. persica* (Soó) Nannf.
 - Rachis of inflorescence ± pubescent; stem (15-)25-70(-100) cm high; leaves either 4-12, well developed, green, much exceeding internodes, or (2-)3-4(-5), reduced, purplish, shorter or slightly exceeding internodes; flowers 10-150; viscidium well-developed 4
4. Leaves green or (very rarely) slightly purplish, 4-12, well developed, usually 1.5-4 times exceeding internodes; rhizome usually horizontal *E. helleborine* (L.) Crantz
 - Leaves tinged with purple, (2-)3-4(-5), reduced, less than 1.5 times exceeding internodes (but sometimes several leaves clustering in the upper part of the stem); rhizome usually vertical 5
5. Leaves usually (2-)3-4(-5); ovary cylindrical towards fruiting time, not curved, 5-7 mm long *E. rechingeri* Renz
 - Leaves usually 3-6(-12); ovary narrowly ovate and slightly curved towards fruiting time, (6-)12 mm long *E. purpurata* Sm.

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