

CONTRIBUTION TO THE BIOSYSTEMATICS OF GENUS *Lathyrus* L. (*Fabaceae*, sect. *Pratensis* Bässler) IN BULGARIA

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ABSTRACT

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Sect. *Pratensis* Bässler is represented by two species in the Bulgarian flora - *Lathyrus pratensis* L. and *L. hallersteinii* Baumg. Both species are closely similar in their morphological characteristics and often difficulties arise at their determination. The available data on the distribution and morphology of both species in Bulgaria are summarized and revised in the present investigation. The macromorphological complex of features distinguishing the species is discussed. New information about karyology and pollen morphology is presented. The distribution of *L. hallersteinii* in localities of the floristic regions Central Stara Planina Mts. and Pirin Mts. is verified and three new localities were established for the floristic regions Western Stara Planina Mts, Rila Mts. and Vitosha Mts.

Introduction

Genus *Lathyrus* L. (*Fabaceae*) belongs to tribe Viciae (Adans.) DC. and comprises about 150 species distributed chiefly in Europe, Asia and North America, extending to temperate South America and tropical East Africa (Polhill & Raven, 1981).

In the Bulgarian flora the genus is represented by 29 species (Kozuharov, 1976; 1992). Two of them *Lathyrus pratensis* L. and *L. hallersteinii* Baumg. are related to section *Pratensis* Bässler. The section is characterized by the presence of one-paired leaflets, large stipules, unequally sagittate and yellow flowers. A typical feature is the presence of equally-shaped calyx-teeth (Bässler, 1966).

Both species are closely similar in their morphological characteristics and often difficulties arise in their determination. This leads to problems in presenting the correct chorological information, especially for *L. hallersteinii*. This was the main reason of conducting the present detailed investigation on sect. *Pratensis* in Bulgaria.

Material and Methods

The information for the distribution of the investigated species as well as of their macromorphological features are based on the available literature data and specimens deposited in the Herbaria of Sofia University (SO) and Institute of Botany at Bulgarian Academy of Sciences (SOM), and in personal collection.

The distribution is indicated on an UTM Grid map of Bulgaria (Scale 1: 1 500 000) (Fig. 1). The macromorphological comparison of the species is shown on Table 1.

The ecological characteristics are after Davis (1970) and Kojic (1972). The area-diagnosis after Meusel et al. (1965) is also presented.

The materials for karyological and pollen-morphological studies are collected from natural localities. The voucher specimens are deposited in the Herbarium of Sofia University (SO).

The karyotypes are investigated on metaphase plates prepared from root meristem of germinating seeds treated in hot hydrolysis and stained in chematoxilin after Gomory (Pearse, 1960). The chromosomal type is determined after the centromere index $I^C = s/s+1$ according to the classification proposed by Grif & Agapova (1986). The karyotypes and their composition are shown on Fig. 2. The absolute chromosome length ($\Sigma s+1$) and the ratio $X_{max} : X_{min}$ is also indicated.

Pollen is acetolysed according to the standard procedure (Erdtman, 1960). For LO microscopy slides are prepared by mounting the pollen in glycerol jelly. Six pollen-morphological characters are measured: P (polar diameter), E (equatorial diameter), colpus length, porus diameter, M (mesocolpium), A (apocolpium) and the P/E ratio. For SEM observation acetolysed pollen grains are coated as dry specimens with gold with the aid of a JEOL-JFC-1200 Coater. The microphotographs are obtained with JEOL-JSM-5510 SEM.

Tab. 1. Comparison between *Lathyrus pratensis* and *L. hallersteinii*

Feature	<i>Lathyrus pratensis</i>	<i>Lathyrus hallersteinii</i>
Stems [height, cm]	28.0 (55.5) 123.0 branched	32.0 (47.5) 50.0 simple
Stipules [size, mm]	12.0/3.0 (21.7/6.2) 40.0/12.0 smaller than the leaflets	22.0/8.0 (33.9/10.1) 44.0/14.0 longer or equaling than the leaflets
Leaflets [size, mm]	14.0/4.0 (25.6/6.3) 53.0/12.0	21.0/5.0 (31.9/6.5) 47.0/10.0
Number of flowers	6 (9) 12	2 (5) 7
Indumentum of calyx	glabrous	bristly-haired
Vexillum length / alae length	Lvexillum = Lallae	Lvexillum >>> Lallae
Vexillum unguis	½ from vexillum	¼ from vexillum
Carina apex	acute	obtuse
Juvenile legume colour	black	green

The pollen-morphological description follows the terminology after Reitsma (1970) and Punt et al. (1994). The results are presented on Fig 3.

Results and Discussion

Lathyrus pratensis L. – Central Stara Planina Mts., Buzludza locality, SO-102337

The distribution range of this species covers Europe, the Caucasus Mts., South-western and Central Asia, Siberia, Sino-Japanese and Indo-Himalayan regions, Northern and Central Africa.

Geoelement: euro-siberian

Ecology: Perennial, mesophytic to xeromesophytic species in marshes, scrubs and woodlands, on dry rocky to wet grasslands along streams, often in habitats with well-pronounced human activity, and as a

low concurrent adventive species.

It is widely distributed in Bulgaria up to 1500 m a. s. l. (Kozuharov 1976; 1992) (Fig. 1).

Lathyrus hallersteinii Baumg. – Central Rhodopes Mts., Beglika locality, SO-102337.

The distribution range of this species covers South-eastern Europe (Romania and Balkan peninsula).

Geoelement: southeastern-european

Ecology: Perennial, mesophytic species in woodlands, in glans, beech-forestlands around them, on humid places, often together with *L. pratensis*.

It is rarely distributed in Bulgaria in the floristic regions Rhodopes Mts. and Central Stara Planina Mts. up to 1000 m a. s. l. (Kozuharov 1976, 1992) (Fig. 1).

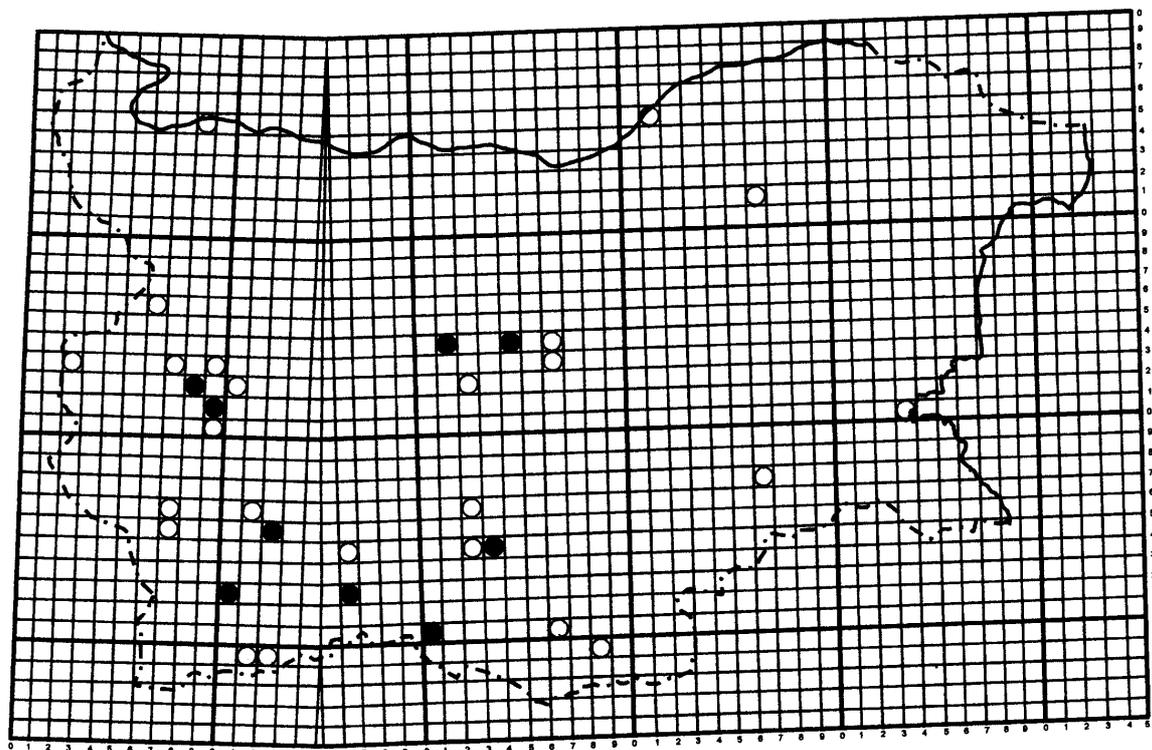


Fig. 1. The distribution of *Lathyrus pratensis* (○) and *L. hallersteinii* (●).



Fig. 2. The karyotypes of *Lathyrus pratensis* (A) and *L. hallersteinii* (B).

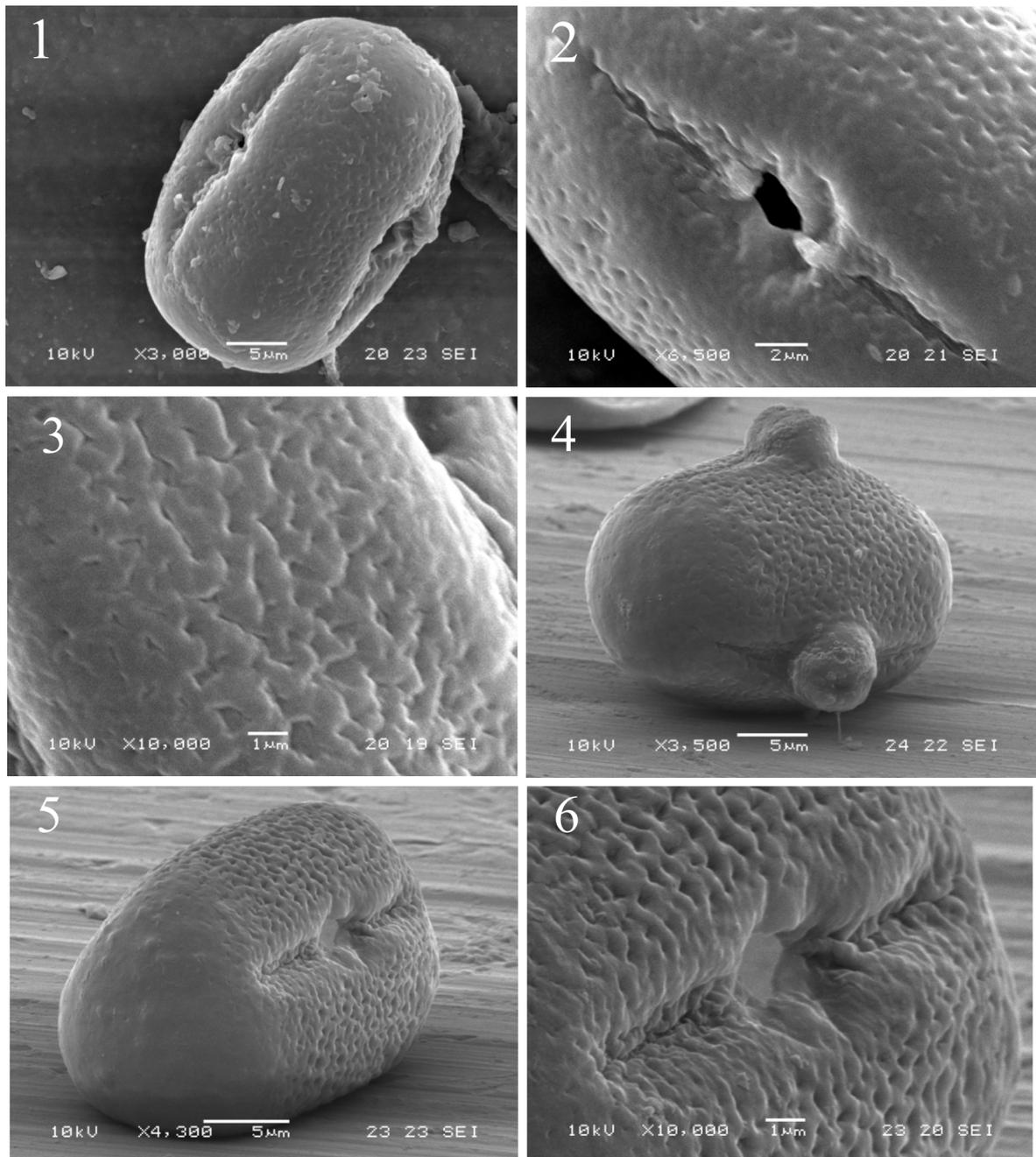


Fig. 3. The SEM microphotography of pollen grains of *Lathyrus pratensis* (1 - equatorial view; 2 - aperture; 3 - ornamentation in the mesocolpium) and *L. hallersteinii* (4 - equatorial view; 5 - polar view; 6 - ornamentation around colpus).

Macromorphology

The morphological features of the greatest importance for the delimitation of *L. pratensis* from *L. hallersteinii* are the following: the height and branching of the stem, the ratio between length of the stipules and length of the leaflets, the number of flowers in a raceme, indumentum of the calyx, the ratio between length of the vexillum and length of the alae, length of the vexillum unguis, the carina apex, and the colour of the juvenile legume (Tab. 1). Following these features the herbarium specimens determined as *L. pratensis* must be related to *L. hallersteinii* (SO 45083, 46876, 46877, 66233, 66234, 90309, 92169, SOM 129750, 135507, 147304, 153358). On the basis of this conclusion the distribution of *L. hallersteinii* in the floristic regions Central Stara Planina Mts. and Pirin Mts. is confirmed and three new localities are established for the floristic regions Western Stara Planina Mts, Rila Mts. and Vitosha Mts.

Karyology

Lathyrus pratensis L. (Fig. 2-A).

Chromosome number: $2n = 14$. This number confirms previous data (Kozuharov & al., 1975, Fedorov 1969: 302, Goldblatt & Johnson 1990: 89, 1991: 104, 1996: 115, 2000: 71, Shopova & al. 1990,). Polyploid variants with $2n = 16, 21, 28$ on the basis of $x = 7$ have not been observed.

Karyotype: $2n = 2x = 6M + 4SM + 2I + 2MSAT$. The investigated karyotype is slightly asymmetrical. These results differ from previous data (Kozuharov & al. 1975) by the absence of acrocentric chromosomes. The karyotype presented by Shopova & al. (1990) consists only of metacentric and submetacentric chromosomes ($2n = 2M + 10SM + 2SMSAT$). A pair of metacentric chromosomes (the first in length) carries large satellites. The karyotype has one submetacentric chromosome pair of different in size chromatides. Total length of the karyotype: $\Sigma s+1 = 99.4 \mu\text{m}$. Ratio $X_{\text{max}} : X_{\text{min}} : 1.4 : 1$.

Lathyrus hallersteinii Baumg. (Fig. 2-B).

Chromosome number: $2n = 14$. This number is reported for the first time for a population from Bulgaria. Previous to the present study no karyological data for this species was available.

Karyotype: $2n = 2x = 8M + 2SM + 2I + 2MSAT$. The slightly asymmetrical karyotype is characterized by a relatively homogenous composition of metacentric (M), submetacentric (SM) and intercentric (I) chromosomes. A pair of chromosomes with satellites is established. The satellites are attached to the first in length chromosome of metacentric type. The size of the chromosomes in this karyotype varies between 6.4

μm and 7.2 μm . The shortest and the longest chromosomes are of metacentric type. Total length of the karyotype: $\Sigma s+1 = 96.8 \mu\text{m}$. Ratio $X_{\text{max}} : X_{\text{min}} : 1.1 : 1$.

Pollen morphology

Lathyrus pratensis L. (Fig. 3-1, 2, 3).

Pollen class: 3-zonocolporate.

Pollen type: Prolate (P/E = 1.48).

Outlines: Equatorial view – rectangular-obtuse-convex; Polar view – triangular-obtuse-convex.

Apertures: Ectocolpi – straight, with acute ends, broader at the equator, colpus membrane finely granulated; Endopori – circular.

Ornamentation: Perforate, clearly visible in the mesocolpium and completely absent in the apocolpium.

Exine: Thicker in the mesocolpium (0.75 μm), and slightly thinner in the apocolpium; The exine structure is composed of foot layer, columellae and tectum.

Measurements: P - 33.2 (36.9) 41.1 μm , E - 22.9 (24.0) 28.4 μm , colpus length - 22.9 (25.1) 27.7 μm , porus diameter - 4.0 (5.1) 6.0 μm , M - 11.9 (15.5) 18.2 μm , A - 11.1 (13.3) 15.8 μm .

Lathyrus hallersteinii Baumg. (Fig. 3-4, 5, 6).

Pollen class: 3-zonocolporate.

Pollen type: Prolate (P/E = 1.47).

Outlines: Equatorial view – rectangular-obtuse-convex; Polar view – triangular-obtuse-convex.

Apertures: Ectocolpi – straight, with acute ends, broader at the equator, colpus membrane finely granulated; Endopori – circular.

Ornamentation: Perforate, clearly visible in the mesocolpium and completely absent in the apocolpium.

Exine: Thicker in the mesocolpium (0.75 μm), and slightly thinner in the apocolpium; The exine structure is composed of foot layer, columellae and tectum.

Measurements: P - 30.0 (35.4) 40.3 μm , E - 18.9 (24.2) 28.4 μm , colpus length - 20.5 (26.2) 29.2 μm , porus diameter - 3.6 (4.6) 6.3 μm , M - 9.5 (12.5) 17.4 μm , A - 7.9 (10.4) 15.8 μm .

Conclusions

Both species *Lathyrus pratensis* L. and *L. hallersteinii* Baumg. are closely similar in their macromorphological, pollen-morphological and karyological characteristics.

The macromorphological complex of features distinguishing the species is: height and branching of the stem, ratio – length of stipules to length of leaflets,

number of flowers in a raceme, indumentum of calyx, ratio – length of vexillum to length of alae, length of vexillum unguis, carina apex, colour of juvenile's legume.

The chromosome number $2n=14$ for *L. pratensis* confirms previous data. The number $2n=14$ is reported for the first time for a population of *L. hallersteinii* in Bulgaria. The karyotypes are slightly asymmetrical, consisting of M, SM and I chromosomes. The establishment of heteromorphic chromosome pairs in the karyotypes of *L. pratensis* testifies to significant chromosomal rearrangements in the course of evolutionary processes.

The pollen morphology of both species is comparatively homogenous. The pollen grains are 3-zonocolporate of *prolat*-type, the tectum is perforate. The pollen morphology confirms their close relationships.

The distribution of *L. hallersteinii* in localities of the floristic regions Central Stara Planina Mts. and Pirin Mts. is verified. Three new localities were established for the floristic regions Western Stara Planina Mts, Rila Mts. and Vitosha Mts. This taxon is rarely distributed and its populations have to be placed under control and protection.

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