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Morphological and Physiological Traits of Wild Vetch – *Lathyrus vernus* L. (Bernh.)

Đukić, D., Olivera Aleksic
Faculty of Agriculture, Novi Sad, Serbia and Montenegro

Abstract: The paper presents morphological and physiological traits of wild vetch – *Lathyrus vernus* L. (Bernh.) the kin of the cultivated pea. Its variability and presence in the flora of Serbia is also emphasized. Content determinations of the crucial nutritive elements contained in dry matter helped determine the average concentrations of N, P, Ca, K and Na in leaf, stalk and in pod. The leaf and stalk were reported to averagely contain 2,82% N, 0,087% P, 1,879% Ca, 1,88% K and 0,079% Na, respectively. Photosynthetic pigments in leaf contained about 5,8 mg/g dry matter of the chlorophyll **a**, around 2,0 mg chlorophyll **b**, and 1,95 mg/g dry matter of carotenoids, which was considerably higher than the contents established in stalk.

Key words: wild vetch, morphological traits, the species variability, the concentrations of nutritive elements, the concentrations of pigments

Introduction

To be familiar with morphological-anatomical, physiological and biochemical traits of the wild kins of the cultivated plants as well as with their kindred relations, has become increasingly challenging and important recently. Genetic engineering, crossing and selection, as the methods of breeding, more and more frequently incorporate the positive traits of the grown plants' autochthonous kins into the grown plants themselves (Boža et al., 1993).

Some 54 species of the strain *Lathyrus* (Ball, 1972) exist in various habitats across Europe representing the kins of the grown pea. This strain comprises 26 species in the flora of Serbia (Kojić, 1972).

The goal of the paper was to study some of the more important anatomical and physiological traits of the species *Lathyrus vernus* L., primarily the concentrations of N, P, Ca, K and Na as well as those of the photosynhetic pigments.

Morphological characters of the species *Lathyrus vernus* L.

The strain *Lathyrus* (fam. Fabaceae) includes 150-200 species spread in the north hemisphere, of which *Lathyrus vernus* (L.) Bernth 1800 is the most outstanding (Tatić and Blečić, 1988) Drawing 1.

L. vernus is a perennial plant with a short, thick and a branched rhizome. The shoot is hairless or rarely slightly covered with hairs. The stalk is mostly single, upright, 20-60 cm high, with scaly leaves. The leaves consist of 2-4 pairs. The leaves are ovate, long and pointed, 3-7 cm long and 1-4 cm wide. The whiskers are 1-2,5 cm long and 2-8 mm wide, broad half-lanceolate, with tiny lancet ears. Clustered racemes are single, composed of 2-10 erect or dropped flowers 13-18mm high with 1-3mm long stalk. Calyx is like a bell, brown or violet coloured, with lower sharply pointed leaves like lancet, ¼ and ½ of the tube, and the upper much shorter and mainly triangular leaves. The crown is red-violet coloured which turns blue or green-blue upon full flowering. The flag is wrinkled, fairly longer than the wings and navicules are. The style is fully grown with hairs. The pod is straight, raised, linear 4-6 cm long and 5-8mm wide, with barely noticeable venation containing 8-14 seeds. The seeds are rounded to lentil–shaped, dark-yellow coloured, 3-4 mm in diameter (Kojić, 1972).

Species variability

Kojić (1972) pointed at differing forms of wild vetch, as follows:

- *Lathyrus vernus* var. *vernus* (Aschers et Graebn. 1910), featured with lanceolate and scaly lancet leaves, 3-4 cm long, widely spread.
- *L. vernus f. vernus* with oval-lancet leaves, with a considerable stretch
- *L.vernus f angustifolius* (Endl.) Borza 1947, with the lower lancet, and the upper elongated lancet leaves, sporadically spread
- *L. vernus* var. *flaccidus* (Radius) Arcang 1894, with linear-lancet or linear leaves, 10-14 cm long and 10mm wide, markedly spread.

Habitat and presence

The species *Lathyrus vernus* largely grows in rocky and flat limy land present in the hills. It is mostly spread in the beech, oak horn-beam and mixed forests (*Acereto-Fraxineto-caprineto-fagetum mixtum*).

L. *vernus* is spread in the larger areas of Europe, except for Iceland. Towards East, it stretches as far as Siberia, Caucasus and Asia Minor. It belongs to the European floral element representing a frequent and widely expanded species (Kojić, 1972).

Gajić (1980), determined *L.vernus* as sub-middle European species, and Soo (1966) defined it as Euro-Asian (Euro-Siberian) of the more or less continental character.

Materials and Method

In order to study the traits of wild vetch (*Lathyrus vernus* L.), the plant material was collected from the localities Vrdnik (Fruška Gora) in the deciduous forest of a mixed type at the beginning of 2000. The plants were in the stage of fruit bearing. The investigation was conducted at the Institute of Biology, the Faculty of Natural Sciences and Mathematics in Novi Sad.

Within physiological studies, the concentrations of mineral matters (N, P, K, Ca, Na) and those of the chloroplast pigments were determined.

The concentration of the mineral elements was determined for leaf, stalk and pod. Prior to the analysis, fresh plant material was dried up to at 100^{o}C and ground.

The concentration of nitrogen in dry material was determined using the standard micro-Kjeldahl method (Sarić et al., 1990).

The concentration of the total P was determined spectrophotometrically with ammonium vanadate-molybdate method (Gericke et Kurmies,1952).

The concentration of the total K,Ca and Na was determined flame-photometrically (Sarić et al.,1990).

The analyses proceeded with three replicates, with results expressed in mg/100g dry matter.The concentration of the photosynthetic pigments was determined after the method of Wetstteina, extracting them from leaves by acetone (Sarić et al., 1990). Reading was done on the spectrophotometer at the particular wave lengths (chlorophyll a-662 nm, chlorophyll b-644 nm, carotenoids-440 nm).

The concentrations pertained to pigments were expressed in mg/g dry matter.

Results and Discussion

Mineral elements concentration – Mineral matters have a manifold role in the plant life. They can take part in composing organic compounds, in providing the cell osmotic potential, controlling particular biochemical processes, and others. Therefore, mineral matters can directly or indirectly influence and take part in all the plant life processess representing their necessary constituent.

At the beginning of their growth and development, nearly all the plants have higher content of N, P and K, whereas Ca and Na levels are higher over the later developing phases, with the total content of elements per plant being the highest in the older plants (Sarić et al., 1990).

N content – N contained in dry matter ranged from 1,5-4,0% (Kastori, 1998). The highest concentration of N was found in the leaves (3,48%), succeeded by that in stalk (2,17%) and by that in pod (1,37%), tab.1.

Compared to wild vetch, the forms of pea cultivated for peas had a considerably high N content, with the highest one being in leaf (4,499%), and stalk (2,432%), respectively. (Ćupina, 1993)

P content – P was found to averagely amount to 0,082%, which was considerably lower than the concentrations of N, Ca and K. The highest level of P pertained to leaf (0,105%), somewhat lower to stalk and pod (averaging 0,07%).

Alzueta and Gonzales (1981) reported the average P content in pea to be 0,13%, while Cervatio and Marudeli (1986) pointed out that P content depended on the plant ontogenesis, with P level of 0,5% found in pea. Ćupina (1993) reported the average P content to be 0,46% in the leaf, 0,28% in the stalk of the spring pea spieces, which was obviously significantly higher than the P level recorded in *L.vernus*.

Tab.1 Elements concentrated in different organs of the wild vetch (*L.vernus* L.)

Plant organ	Concentration %				
	N	P	Ca	K	Na
Leaf	3,478	0,105	2,457	1,773	0,068
Stalk	2,174	0,070	1,301	1,992	0,090
Pod	1,372	0,071	0,907	0,633	0,032
Average	2,341	0,082	1,555	1,466	0,063

Ca content – Ca level in dry matter of the wild vetch was the highest in the leaves (2,46%), succeeded by that in stalk (1,30%) and by that in pod (0,90%).

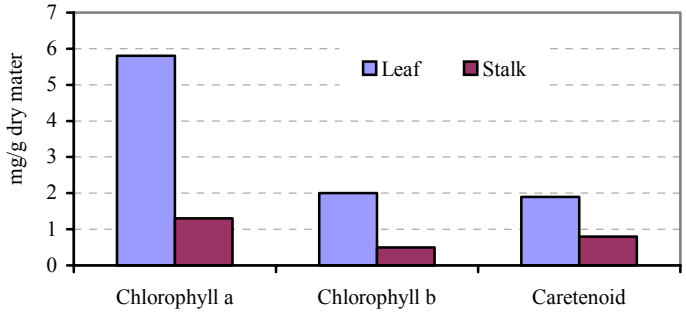
The total Ca level in the plant dry matter has a wide belt of ranges, from 0,3 to 3% depending on the plant species (Kastori, 1998). In the spring pea cultivars, Ca level was reported to be 1,99% in leaf, 1,10% in the stalk, which was surprisingly lower than being normally in this plant allowing for abundance of lime in its habitat (Ćupina,1993).

K content – Limiting values of K level are within a wide belt, depending on the plant species (Kastori, 1983). Thus, the current results revealed that K level ranged from 0,63% in pod, to 1,99% in stalk, or averaging 1,47% in the entire plant. Ćupina, 1993, reported that the spring field pea had 2,29% of K in leaf, 3,52% K in stalk, hence, its markedly lower level in *L.vernus* .

Na content – Na content in dry matter was found to range from 0,01% to 2,0%. Compared to other elements, Na contained in the dry matter of wild vetch ranged from 0,03% in the pod, to 0,09% in stalk, or averagely 0,06%. Being familiar with Na level in the plants used for fodder is of great importance, since animals generally need this element much more than plants do. The required Na level in the dry matter of fodder has to be around 0,2% in order that animals satisfy their needs for Na (Kastori,1998).

The content of photosynthetic pigments – Pigments play an important role in the process of photosynthesis. If their level is reduced in the plants, photosynthetic activity of the plants is weakened. Current results revealed that chlorophyll concentration in leaf amounted to 5,8mg/g dry matter, that in stalk to 1,2 mg/g dry matter (Fig.1.)

Fig.1. The content of the chloroplast pigments in the leaves of *L.vernus*



Compared to the chlorophyll a, that of b was markedly lower in the leaf, i.e.2 mg/g and 0,5 mg/g dry matter in the stalk. The carotenoid concentration was nearly as high as that one of chlorophyll b (Fig.1.).

Conclusion

The results of studying the morphological and physiological characters in wild vetch (*Lathyrus vernus*) suggest the following:

- The average content of N amounted to 3,48% in leaf, to 2,1% in stalk, and 2,82% in leaf and stalk, respectively.
- The average P content was reported to be 0,08% in leaf and stalk, and that of Ca 1,879% (ratio Ca : P 21,6 : 1). K level in stalk and in leaf averaged 1,88%.
- The entire plant possessed Na least, with that found in stalk and leaf averaging 0,079%.
- The content of the photosynthetic pigments was found to be the highest in the leaf, and considerably lower in the stalk.

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MORFOLOŠKA I FIZIOLOŠKA SVOJSTVA DIVLJEG GRAORA - *Lathyrus vernus* L. (Bernh.)

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Đukić, D., Olivera Aleksić
Poljoprivredni fakultet-Novi Sad

Rezime

U radu je dat prikaz morfoloških i fizioloških svojstava divljeg graora Lathyrus vernus L. (Bernh.), srodnika gajenog graška. Takođe, ukazano je na varijabilnost i rasprostranjenost ove vrste u flori Srbije. Na osnovu ispitivanja sadržaja najvažnijih hranljivih elemenata u suvoj materiji, utvrđena je prosečna koncentracija N, P, Ca, K i Na u listu, stablu i mahuni. U listu i stablu, prosečan sadržaj azota je bio 2,82%, fosfora 0,087%, kalcijuma 1,879%, kalijuma 1,88% i natrijuma 0,079%. Koncentracija fotosintetičkih pigmenata u listu bila je oko 5,8 mg/g suve materije hlorofila a, oko 2,0 mg hlorofila b, a 1,95 mg/g suve materije karotenoida, što je značajno više u odnosu na sadržaj u stablu.