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PISUM ELATIUS IN THE FLORA OF BULGARIA

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Abstract

At the Northern Black Sea coast – Kaliakra cape and Yailata (Kamen briyag) are identified as two localities of *Pisum elatius*. *Pisum elatius* is one of the priority species of wild relatives of grain legumes crops group, more specifically for the cultivated pea (*Pisum sativum*). The localities are quoted at the flora of Bulgaria and have been confirmed by the team annually for the period 1998 – 2020. Plant morphological description in the flowering phase and bean formation is done and the structure, size and populations vulnerability are described. The differences in the species at both localities are found in the plant's habitus, height and positioning. Seeds from the species have been collected for *ex situ* collection. **Key words:** *Pisum elatius*, Flora of Bulgaria, expeditions, *in situ*, *ex situ* collection

BRIEF COMMUNICATION

The wild species *Pisum elatius* has been observed at places distant from the typical Mediterranean plant associations, including several Black sea territories of Bulgaria, Crimea, Georgia and Hungary. It was spotted on slopes with metamorphic gravel as well as in rocky areas where plants have typically creeping growth (Ben-Ze`ev and Zohary, 1973; Blixt and Williams, 1982; Kosterin et al., 2020; Mikic et al., 2009; Zohary & Hopf, 1993).

Many authors believe that *Pisum elatius* is a separate species, while others associate it with the cultivated pea as classifying it as its ecotype (Falk and Holsinger, 1991; Ladizinsky, 1988a; Makasheva, 1983). Van der Maesen (1978) determines it as a separate species, a central form a cultivated pea. Kaznowski (1926) considers that it is a subspecies of *Pisum sativum* L.

According to the flora of Bulgaria, *Pisum elatius* can be found in the Balkan mountain range (Stara Planina), in the Eastern Rhodope Mountains and along the Northern Black Sea coast (https://bgflora.net/index_bg.html).

This has been confirmed in 1998 by the American scientist Kaiser (1998) and the Bulgarian team (ECO NET Project).

The team's expeditions were carried out in 1997 – 2020 to determine the natural habitats of *Pisum elatius* as a part of international projects for biodiversity conservation (Angelova, 2007; Angelova et al. 2018).

During the expeditions (1997/1999) with Prof. Delipavlov and Prof. Cheschmedzhiev the locality of *Pisum elatius* at Kaliakra cape has been marked. Later in 2002 – 2004, it has been marked at the archaeological reserve Yailata near Kamen briyag area (Fig.1). The expeditions have been held annually during the flowering and maturing phases. The structure, the size of the populations and their vulnerability has been described. During our research, the registered locality at Kaliakra cape represents 3-4 small spots of 10 -15 plants spread in several places along the steep rocky slope. The rocks forming the cape represent hard dramatic limestone and conglomerates, soldered with clay, rich in iron oxides, which gives the typical reddish shade. This karst landscape is covered with diverse (above 450

species) plants with steppe character. The species typical for Kaliakra capes are *Artemisia pedemontana*, *Asphodeline lutea*, *Crithmum maritimum*, *Goniolimon besseranum*, *Iris pumila*, *Limonium meyeri*, *Medicago falcata*, *Nepeta ucranica*, *Opopanax bulgaricum*, *Paeonia tenuifolia*, *Scandix australis*, *Stipa lessingiana*, *Silene caliacrae*.

The archaeological reserves Yailata

represent a seaside terrace occupying an area of 300 da. It is divided by the sea with a rocky massif. The population of *Pisum elatius* marked there is spread out on compact spots within a larger area. The main accompanying species are from *Poaceas* family, *Vicia ssp*, *Lathyrus ssp*. There is a large locality of *Paeonia pererina* in the proximity of the species (Fig.1).



Fig. 1 *Pisum elatius* on the Northern Black Sea

The morphological description of the plants is made in the flowering phase, and in the ripening phase – the characteristic of pod and seeds. The differences between the species from the two localities are found in the height and positing of the plant.

The morphological description was created through the Bulgarian flora.

The stems of the species are semi-upright or semi-laid, slightly branchy, plain. The inflorescence is mostly one color, rare two colors. Corolla is in dark violet, the seed wing – light purple. The pod is wide, lineal, yellow or brown, hard to break. The number of the seeds is from 6 to 10, round, finely warty, dark-brown to black in color. The seeds we found during our examination vary in surface and color. These features, however, have a modification nature and are of no taxonomic significance.

Our scientific team's investigation is directed towards the creation of the *ex situ* collection and the conservation of the seeds in a Gene bank.

Many authors identified ineffective seed germination, outside of their habitat. It is a result of their waterproof cover, which causes problems in species incorporation in *ex situ* conditions. The direct seed sowing, collected from their habitats at full ripening, shows zero germination, while seeds with no cover, the results are better with 4-5%. The authors emphasize that the seed collections must be at full ripening (Abbo et al., 2008; Ladizinsky, 1988a; Ladizinsky and Abbo, 2015; Smýkal et al., 2017).

Our experiments for direct sowing in the field outdoors confirm the foreign studies. They also proof unsuccessful (0% germination) for the establishment of *ex situ* collection. The preliminary seed soaking and cover removing increased the germination up to 2 % (Abbo et al., 2008; Angelova et al. 2018; ECO NET Project).

The foreign authors note the good and successful results at crossing *Pisum sativum* and *Pisum elatius* as well as their reciprocal

combinations (Drozd, 1965; Cousin, 1974; Kosterin et al., 2020; Makasheva, 1983; Smýkal et al., 2017). A hybrid high seed productivity, reaching in F₁ high values is observed. Hybrids with a high number of productive plants are identified, with light-colored seeds and not that hard seed cover as for *Pisum elatius*. Plants from *Pisum elatius* were isolated in 1998, resistant to *Mycosphaerella pinodes*, which could be promising resistance donors (Kaiser et al., 1998; Ladizinsky and Abbo, 2015).

CONCLUSION

We found out that the habitat at Kaliakra cape is more vulnerable, as the plants are outside exposed to the sun, strong winds and erosion, as well as constant tourist flow. The habitat of the Yailata Archaeological Reserve is more protected. The plant communities are compact with a larger number of plants from the accompanying species and with more limited tourist access.

To maintain *Pisum elatius in situ* with annual monitoring is of special importance to species preservation. To seek effective methods for seed germination and creation of *ex situ* collection, concerning pea breeding, is as well important.

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