



Original article

## ***Galium setaceum* Lam. and *Sisyrinchium rosulatum* E. P. Bicknell, Two New Species for the Albanian Flora, Distribution and Ecology**

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### **Abstract**

The Albanian flora includes 31 taxa in the genus *Galium* and one taxon in *Sisyrinchium*, the non-native *S. angustifolium* Mill. Here we present two new species for the Albanian flora, found at Krasta Park, Elbasan, May 2019.

*Galium setaceum* Lam. was found on the southwestern side of Krasta Hill, in dry disturbed clearings of *Pinus halepensis* Mill. forest, on calcareous rocky substrate. Populations were small (<1m<sup>2</sup>) with a variable number of individuals.

*Sisyrinchium rosulatum* E. P. Bicknell, which is native to southeastern North America, is the second new taxon for the Albanian flora. Two populations of were found in moist open disturbed grassy areas in *P. halepensis* forest. The first population detected was located in the northeastern side of Krasta Hill, while the second was located at the top of the Hill.

For both taxa, specimens were collected and identified using multiple keys in the literature and specimens at the Albanian National Herbarium. Voucher specimens were deposited in the Albanian National Herbarium. In this paper we also present data on the distribution, ecology and habitat of these species, which enlarge the Albanian flora and the species' distribution range, and illustrate the floristic diversity of Krasta Park.

**Keywords:** Flora, Albania, *Galium setaceum*, *Sisyrinchium rosulatum*.

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## INTRODUCTION

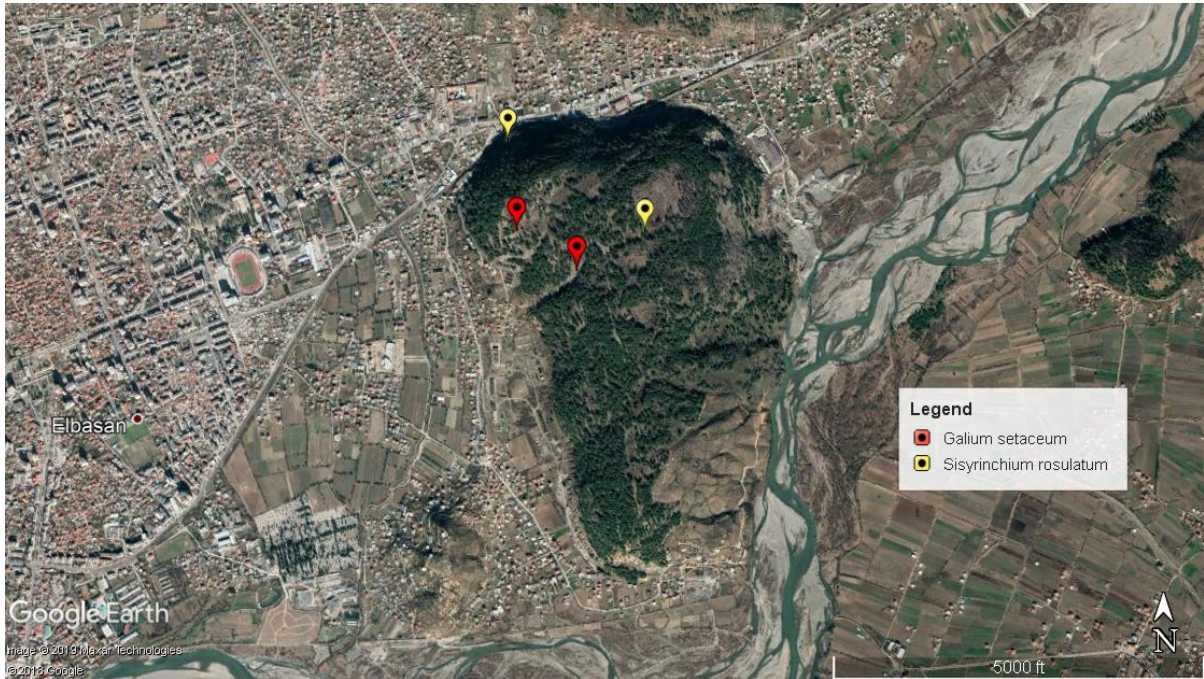
As of 2016 the Albanian flora comprised 3531 species (Pils, 2016). Although Albania is small in area, the country's geographical position, varied climate and hydrological network, and geology, result in a rich floristic diversity. In addition, many parts of the country are still relatively unknown floristically.

Krasta Park is a popular park located southeast of the city of Elbasan. In spring 2019, by exploring the flora in different areas of this Park, we found two new species for the Albanian flora *Galium setaceum* and *Sisyrinchium rosulatum*. *Galium setaceum* was found on the southwestern side of Krasta Hill, in dry disturbed clearings in *Pinus halepensis* forest with small populations (<1m<sup>2</sup>) and a variable number of individuals. Because *G. setaceum* is present and native in adjacent countries it is assumed to be native to Albania. *Sisyrinchium rosulatum*, native to southeastern North America, is the second new taxon for the Albanian flora. Two populations of it were found in moist open disturbed grassy areas in *P. halepensis* forest. The first population detected was located in the northeastern side of Krasta Hill, while the second was located at the top of the Hill.

The documentation of these species enlarges the Albanian flora number and the distribution range and illustrates the remarkable floristic diversity of Krasta Park, which is still under study.

## Material and Methods

Krasta Park is located 2 km east of downtown Elbasan and bounded on the east by Shkumbini River and encompasses 1.7 km<sup>2</sup> (41° 06' 53' N, 20° 06' 44" (Google Earth 2019), 140–290 m asl). The substrate is calcareous and often quite rocky. The dominant topographic feature of the Park is Krasta Hill (Fig. 1). The Park was previously a military reservation and was used for lime production. Today much of the park is grazed by goats, sheep and cattle. Planted conifers cover much of the park with planted *Pinus halepensis* by far the most common tree with small areas of planted *Pinus nigra* Arnold, *Cupressus sempervirens* L. and *Thuja orientalis* L. These trees are presently being partially logged and planting of *P. halepensis* saplings is ongoing. During our field expeditions and observations, carried out by the authors on May 2019 at Krasta Hill, specimens were collected and identified using multiple keys in the literature: Flora Europaea (Tutin et al., 1964, 1968, 1972, 1976, 1980), Flora d'Italia (Pignatti, 1982), Flora of Albania (Paparisto et al., 1988; Qosja et al., 1992, 1996; Vangjeli et al., 2000), Flora of North America (FNA, 2002), Illustrated Flora of Albania (Pils, 2016), Distribution Atlas of Vascular Plants in Albania (Barina et al., 2017) and comparisons with specimens at the Albanian National Herbarium in Tirana. For map locations we used Gaia GPS (2019) and Google Earth (2019). *Galium setaceum* was first detected on April 26, 2019 and *Sisyrinchium rosulatum* on May 17, 2019.



**Figure 1.** Krasta Park (Image Google Earth, 2019)

### Results

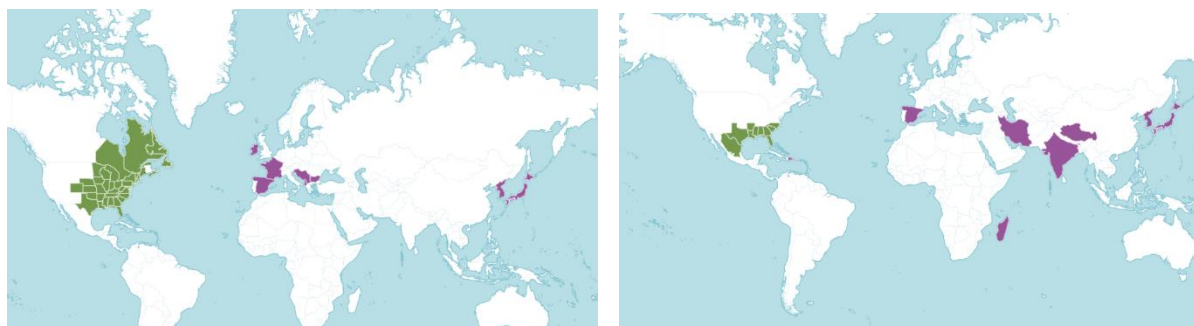
The genus *Galium* in the Albanian flora is represented by 28 taxa according to Qosja et al., (1996), 29 taxa according to Barina et al., (2017) and 31 taxa according to Pils (2016). *Sisyrinchium* is not represented in Qosja et al., (1996), and by one non-native species in Barina et al., (2017) and Pils (2016).

Worldwide the genus *Galium* has 659 accepted species (The Plant List, 2013). The native range of *Galium setaceum* includes Afghanistan, Algeria, Balears, Bulgaria, Canary Is., Cyprus, Djibouti, East Aegean Is., Egypt, France, Greece, Gulf States, Iran, Iraq, Italy, Kirgizstan, Kriti, Lebanon-Syria, Libya, Morocco, Pakistan, Palestine, Sardegna, Sicilia, Saudi Arabia, Sinai, Socotra, Somalia, Spain, Sudan, Transcaucasus, Tunisia, Turkey and Yugoslavia (Iljanic, 1980; Elkordy, 2015; Kewscience, 2019) (Fig. 2) and now is found in Albania by the authors.



**Figure 2.** Distribution map of *G. setaceum* (Kewscience, 2019)

The genus *Sisyrinchium* worldwide has 201 accepted species (The Plant List, 2013). This genus, which is native to North America, is represented in Albania by one non-native species, *S. angustifolium* Mill., a widely introduced species in Europe, which was first reported as present in Albania by Barina et al., (2013). *Sisyrinchium angustifolium* is widespread in Europe whereas *S. rosulatum* is known only from Spain (Euro+Med Plant Base, 2019; Kewscience, 2019) (Fig. 3), however, *S. rosulatum* is not present Flora Europaea (Tutin et al., 1980). Both *Sisyrinchium* species are considered weedy throughout their introduced ranges (FNA, 2002). *Sisyrinchium* is a complex polyploid taxon in which the species are not always easily distinguished and *S. angustifolium* and *S. montanum* have been considered synonymous by several authors (FNA, 2002). The worldwide distribution of *S. rosulatum* as a naturalized introduced species includes Dominican Republic, Hawaii, India, Iran, Japan, Korea, Madagascar, New Caledonia, Puerto Rico, Spain and Tibet (Kewscience, 2019) (Fig. 3) and in Italy (Nicolella & Ardenghi, 2013) and Bhutan (Gyeltshen et al., 2019).



**Figure 3.** Distribution map of *S. angustifolium* (left) and *S. rosulatum* (right). Purple areas represent the introduced range (Kewscience, 2019).

During our field work at Krasta Park we found specimens of:

*Galium setaceum* Lam. Enycl. (J. Lamarck & al.) 2(2): 584(1788) (*G. capillare* Cav., *G. decaisnei* Boiss., *G. eriospermum* Chaix ex Schult. & Schult f., etc.) Steno-Medit-SW-Asiat (Fig. 4). Populations were small (<1m<sup>2</sup>) with a variable number of individuals, which were mature and in flower and fruit.



**Figure 4.** *Galium setaceum* at Krasta Park on May 03, 2019

**Locations:** The two populations were located at 41° 6' 57" N, 20° 6' 32" E and 41° 7' 2"N, 20° 6' 21"E (Gaia GPS 2019). Both populations were at about 224 m elevation.

**Ecology:** The populations were found in dry disturbed and grazed clearings of *Pinus halepensis* forest, in calcareous rocky substrate near footpaths.

**Other species:** *Linaria simplex*, *Euphorbia peplus*, *E. helioscopia*, *Geranium sp.*, *Anagallis arvensis*, *Convolvulus althaeoides*, *Hymenocarpus circinatus*, *Sherardia arvensis*, *Saponaria calabrica*, *Petrorhagia saxifraga*, *Anchusa cretica*, *Ononis spinosa*, *Capsella bursa-pastoris*, *Poa sp.*, and *Clypeola jonthlaspi*

**Description:** Annual, 3-30 cm, stems slender, more or less erect, finely retrose aculeolate or glabrous, leaves in whorls (4)6-8(10), narrowly linear to filiform, glabrous or sparsely hairy, margin somewhat recurved, with papilliform teeth. Inflorescence lax, broadly ovoid somewhat squarrose; bracts

3-5 mm, with hooked hairs, pedicel 1-3 mm, corolla 0.5 mm in diameter. Fruit with dense, hooked hairs, rarely glabrescent (Tutin et al., 1976; Pignatti, 1982).

*Sisyrinchium rosulatum* E. P. Bicknell (*S. brownie* Small, *S. exile* E. P. Bicknell) – annual blue-eyed grass (Fig. 5) described in Bicknell (1899), is native to southeastern North America, and represents the authors' second new taxon for the Albanian flora, first found on Krasta Hill on May 17, 2019. The populations were small (<1m<sup>2</sup>), with 20 - 30 individuals.



**Figure 5.** *Sisyrinchium rosulatum* at Krasta Park on May 17 and 22, 2019

**Locations:** The two populations were found at 41° 7' 15" N 20° 6' 19" E and 41° 7' 1" N 20° 6' 44" E (Gaia GPS 2019). The first population was located at about 274 m and the second at about 217m asl.

**Ecology:** The populations were found in moist open disturbed grazed grassy areas in *P. halepensis* forest.

**Other species:** *Sherardia arvensis*, *Myosotis* sp., *Bellis perennis*, *Rubus ulmifolius*, *Hieracium* sp., *Capsella bursa-pastoris*, *Plantago* sp., *Aegilops triuncialis*, *Oxalis corniculata*, *Potentilla reptans*, *Trifolium* sp., *Vicia* sp., *Carlina* sp., *Anemone pavonina*, *Sanguisorba minor*, *Poa* sp., *Dactylis glomerata*, *Euphorbia peplus*, *Taraxacum* sp., *Achillea millefolium*, *Thymus longicaulis*, *Cirsium* sp., and *Carex* sp.

**Description:** Perianth campanulate basally, flaring distally, tepals lavender, pink, magenta, yellow or occasionally lavender, plants annual or occasionally short-lived perennial. Stem with 1-2(-3) nodes, filaments connate basally or occasionally to ½ length, inflated basally, stipitate-glandular on proximal 0.5-0.8 mm, capsule ± globolose, bicolored, sutures and sometimes apex purplish, intrasuture surface tan (FNA, 2002).

Our specimens of *S. rosulatum* differ from *S. angustifolium*, which has widely flaring or reflexed from the base perianth and is not campanulate.

### **Conclusions**

*Galium setaceum* and *Sisyrinchium rosulatum* are new species for the Albanian vascular flora. The finding of *Galium setaceum* as a native species, enlarges its occurrence in the Mediterranean and fills a gap in the distribution of the species. The reason for the presence of *S. rosulatum* is undetermined, however, a possibility is that seeds were present in the soil of the pine saplings that were planted in the vicinity (FNA, 2002; Nicoletta and Ardenghi, 2013). *Sisyrinchium rosulatum* is potentially invasive and a potential threat to native species and natural habitats, and for this reason, the presence and size of the populations of this species should be monitored (FNA, 2002.)

### **Additional Declaration**

Research and publication ethics principles were comply with in this study. Authors contributed equally to the study.

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