

## *New Data on the Vertical Distribution of Some Species of the Flora in Bulgaria*

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**Abstract.** During field studies in different floristic regions of Bulgaria in the period 2006-2013, we found localities of *Stellaria alsine*, *Trifolium heldreichianum*, *Koeleria nitidula*, *Sieglingia decumbens*, *Stipa tirsia*, *Verbascum formanekii*, *Pedicularis leucodon*, *Saxifraga sibirnyi*, *Inula aschersoniana* and *Scilla bifolia* that expand our knowledge of the vertical distribution of these species in Bulgaria, and hence their ecological niche in the country.

**Key words:** plant species, vertical distribution, new data, Bulgaria

### **Introduction**

The vertical distribution of each plant species provides valuable information about its ecological requirements and it is cited in all "Identification handbooks", "Synopses of the flora", "Checklists" and "Floras". Until 1967 vertical distribution of species of the flora of Bulgaria was approximately marked in the reference publications with digits from 1 to 3 (STOYANOV & STEFANOV, 1948; STOYANOV *et al.*, 1966-1967). Digit 1 means that the species is spread in the lower or oak belt, which lies approximately between 0 and 1000 m altitude, digit 2 indicates that the species is spread in the mountain belt, roughly between 1000 and 2000 m altitude, and digit 3 indicates species distribution in highland (sub-alpine and alpine) zone, i.e. higher than 2000 m a. s. l. When the species occurs in more than one zone, combinations of digits are used. A dash before the digits 2 (-2) and 3 (-3) means that this species can be

found below 2000 and 3000 m altitude, respectively, and a dash after the digits 1 (1-) and 2 (2-) indicates that the species is up and above 1000, or 2000 m altitude, respectively. These markings give approximate notion about the species' vertical distribution and for many species it had never been mentioned. In the multivolume edition of the Flora of Bulgaria (YORDANOV, ed. 1963-1979; VELCHEV, ed. 1982-1989; KOZHUHAROV, ed. 1995; KOZHUHAROV, ANCHEV, eds. 2012), the vertical distribution was indicated with real altitudes, but most often only the upper limit of species distribution was specified. "Identification Guide to higher plants in Bulgaria" (KOZHUHAROV, ed. 1992) and "Identification Guide to the plants in Bulgaria" (DELIPAVLOV & CHESHMEDZHIEV, eds. 2003, 2011) indicated altitudinal distribution of the species by specific numbers, because of dividing the altitude by 1000. Dashes were

also used before or after the altitudes, like in the older literature sources; for some species the altitudinal range was listed as well.

Since 2001, a major and most accurate reference source for the vertical distribution of plant species has become the "Conspectus of the Bulgarian vascular flora", compiled by a group of Bulgarian botanists. Conspectus already had four editions, which is due to the rapid accumulation of information about the floristic richness and distribution of plant species in Bulgaria (DIMITROV, ed. 2001; 2002; ASSYOV & PETROVA eds. 2006; 2012). For example, the first edition included 3807 species of higher plants, while in the fourth edition they were 4102, i.e. 295 plant species have been added to the flora of Bulgaria, for only 11 year period. With a few exceptions, the "Conspectus" provides information about the range of altitudes (m) of distribution of each species. There are species, such as *Pseudotsuga menziesii* with no information about vertical distribution, because it has only recently been recognized as part of the adventitious flora of Bulgaria. (TASHEV *et al.*, 2012).

The purpose of the present work is to provide new data about the vertical distribution of some plants in Bulgaria, which could be considered in the next edition of the "Conspectus of the Bulgarian vascular flora" and in the publications elsewhere.

### **Materials and Methods**

The data presented have been obtained during various floristic studies in the period 2006-2013. During our work, we paid special attention to the altitude, where plant species have been found, and if different from the well-known one, herbarium specimens were collected. The exact coordinates of localities and altitudes were scored by GPS. The plant names follow THE EURO + MED PLANTBASE – the information resource for Euro-Mediterranean plant diversity (2011) and ASSYOV & PETROVA (2012).

### **Results**

Below we present descriptions of the new localities of species, found at altitudes not reported previously for the habitats of these species, thus representing new ecological niches. The following information is provided for each locality: floristic region and sub-region; geographic distribution, habitat, orography, exposition, slope, altitude, coordinates, date of collection and numbers of herbarium specimens in the Herbarium of the Institute of Biodiversity and ecosystem research – BAS (SOM). In some cases, floristic characteristic of the localities is provided. At the end we cite the references with altitudinal ranges of distribution different from these reported by us.

#### Caryophyllaceae

*Stellaria alsine* Grimm.

West Frontier Mountains. Mt Osogovo. locality Golyama chuka, in upland meadow, eastern exposition and inclination 5°, with *Luzula luzuloides* and *Lerchenfeldia flexuosa*, 1700 m a.s.l. (+200 m a.s.l.), 42°10'00.2"N, 22°35'56.5"E, 13.07.2011. coll. Al. Tashev (SOM 167596), D. Dimitrov (SOM 167613).

So far, in Bulgaria, the species has been known within the range of 1500 m a.s.l. (DELIPAVLOV *et al.*, 2011: 75; ASSYOV & PETROVA, 2012: 399).

#### Fabaceae

*Trifolium heldreichianum* Hausskn.

West Frontier Mountains. Mt Osogovo. locality Golyama chuka, in upland meadow, eastern exposition and inclination 5°, together with *Luzula luzuloides* and *Lerchenfeldia flexuosa*, 1700 m a.s.l. (+100 m a.s.l.), 42°10'00.2"N, 22°35'56.5"E, 13.07.2011. coll. Al. Tashev (SOM 167595).

So far, in Bulgaria, the species has been known within the range of 1600 m a.s.l. (DELIPAVLOV *et al.*, 2011: 217; ASSYOV & PETROVA, 2012: 421).

#### Poaceae

*Koeleria nitidula* Velen.

West Frontier Mountains. Mt Osogovo. Under peak Malak Ruen, in upland meadow, south-west exposition and inclination 2°, 2190 m a.s.l. (+1190 m a.s.l.), 42°09'43.0"N, 22°31'56.6"E, 13.07.2011. coll. D. Dimitrov (SOM 167620).

So far, in Bulgaria, the species has been known within the range of 900-1000 m a.s.l. (DELIPAVLOV ed., 2011: 501; ASSYOV & PETROVA, 2012: 247).

*Sieglingia decumbens* Bernh.

West Frontier Mountains. Mt Osogovo. Locality Kulin kamak., 1670 m a.s.l. (+170 m a.s.l.), 42°09'43.0"N, 22°31'56.6"E, 12.07.2011. coll. D. Dimitrov (SOM 167621).

So far, in Bulgaria, the species has been known within the range of 1500 m a.s.l. (DELIPAVLOV ed., 2011: 501; ASSYOV & PETROVA, 2012: 384).

*Stipa tirsia* Steven.

Rhodopi Mts (*Central*): Above the village Zhrebovo, on limestone rocks in the community of *Juniperus communis*. In the upper part of a slope, east-southeast exposition and inclination 15°, 1340 m a.s.l. (+240 m a.s.l.), KG-80, 41°34'19.8"N, 24°25'09.9"E, 7.09.2006. coll. Al. Tashev, A. Vitkova (SOM 164050, 164051).

This Euro-Asian species was reported from sea level to 700-1000 m a.s.l. (DELIPAVLOV ed., 2011: 515; ASSYOV & PETROVA, 2012: 401).

Scrophulariaceae

*Verbascum formanekii* Borbas ex Formanek

West Frontier Mountains. Mt Osogovo. Locality Mlachka reka, between a forest of *Fagus sylvatica* and a forest road on a slope, south-east exposition, inclination 15°, 1445 m a.s.l. (+445 m a.s.l.), 42°10'27.4"N, 22°36'34.8"E, 14.07.2011. coll. Al. Tashev (SOM 167599).

So far, this Bulgarian endemic species was reported up to 1000 m a.s.l. (DELIPAVLOV ed., 2011: 347; ASSYOV & PETROVA, 2012: 434).

*Pedicularis leucodon* Griseb.

West Frontier Mountains. Mt Osogovo. Under peak Malak ruen, on upland meadow dominated by *Alchemilla* spp., on a slope, south-west exposition, inclination 30°, 2192 m a.s.l. (+1192 m a.s.l.), 42°09'43.0"N, 22°31'56.0"E, 14.07.2011. coll. Al. Tashev (SOM 167600).

So far, this Bulgarian endemic species has been known only at altitude up to 1000 m a.s.l. (DELIPAVLOV ed., 2011: 353; ASSYOV & PETROVA, 2012: 307).

Saxifragaceae

*Saxifraga stribrnyi* (Velen.) Podp.

Rhodopi Mts (*Central*): Between village Bachkovo and town Asenovgrad, on limestone terrain, on the right bank of the Chepelare river (Chaya). 245 m a.s.l. (-265 m a.s.l.), KG-82, 41°59'31.2"N, 24°52'28.1"E, 30.04.2008. coll. Al. Tashev (SOM 164668).

So far, this Bulgarian endemic species was reported at 500 - 2200 m a.s.l. (DELIPAVLOV ed., 2011: 169; ASSYOV & PETROVA, 2012: 368).

Asteraceae

*Inula aschersoniana* Steven.

Rhodopi Mts (*Central*): Above the village Zhrebovo, on limestone rocks in the community *Juniperus communis*. In the upper part of a slope, east-southeast exposition and inclination 15°, 1340 m a.s.l. (+240 m a.s.l.), KG-80, 41°34'19.8"N, 24°25'09.9"E, 7.09.2006. coll. Al. Tashev, A. Vitkova (SOM 163700).

So far, this Bulgarian endemic species was reported from sea level to 1000 m a.s.l. (DELIPAVLOV ed., 2011: 388; ASSYOV & PETROVA, 2012: 237).

Liliaceae

*Scilla bifolia* L.

The Tundja Hilly Plain: Ormana locality, close to the town of Yambol, in flooded forest in the community of *Quercus robur*, *Acer campestre*, *Cornus mas*, *Galanthus elwesii* etc. In a lowland forest, W-SW exposition and inclination 3°, 130 m a.s.l. (-870 m a.s.l.), 42°31'44.18"N, 26°31'13.3"E, 6.03.2013. coll.

Al. Tashev (SOM 169420, 169422).

In the herbarium of BAS (SOM) there are specimens of *Scilla bifolia*, without mentioning the altitude, but it is obviously far below 1000 m a.s.l. For example: *Strandzha*: By Tsarskoto kladenche, at the Veleka river, lands of the village Sinemorets. 23.03.1994. coll. Ant. Petrova & T. Meshinev (SOM 159188, 169422). *Black Sea Coast (South)*: On the north bank of the Ropotamo river, opposite the natural landmark "Lion's Head". 13.03.1978. coll. D. Peev (SOM 137155).

The fact that this species has been known for all floristic regions of Bulgaria, many of which are located in lowlands, it expressively shows that it is distributed in many places below 1000 m asl. So far, this Pontic sub-Mediterranean species has been reported from 1000 to 2000 m asl (ASSYOV & PETROVA, 2012: 371).

### Conclusion

This work presents new data on the vertical distribution of 10 species from the Bulgarian flora that can expand our knowledge of their ecological niche. The data presented can be used in preparation of new publications about the flora in Bulgaria.

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