

## *Current State of Collections of Genus Asparagus in Bulgarian National's Herbaria*

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**Abstract.** Base on the national herbariums deposited in the country and some authors' collections, a review of the status of *Asparagus* species has been made. Information on ecology, height range and representation of Bulgarian species in herbarium collections is updated. The information is organized in a relational database, which is an important information resource and a starting point for future taxonomic and chorological studies. This study reveals the state of the art and summarizes the gaps and problems.

**Key words:** *Asparagus*, herbaria collection, SO, SOA, SOM.

### **Introduction**

The *Asparagaceae* was first proposed by JUSSIEU (1789) and includes 16 genera. These genera are often perceived as part of the *Liliaceae* by some authors (KUNTH, 1850; MELCHIOR, 1964; HUBER, 1977; CRONQUIST, 1981). The status and limits of the *Asparagaceae* family has been the subject of discussion for two centuries. In our flora the family is represented only by the type genus. In the world flora, the exact number of species of *Asparagus* L. is uncertain and is discussed, and in recent years it includes between 120-300 species that are found in a wide ecological range (KUBITZKI & RUDALL, 1998; KUBOTA *et*

*al.*, 2012; NORUP *et al.*, 2015), distributed in the temperate and tropical regions of Europe, Asia, Africa and North Australia. The genus includes dioecious and hermaphrodite species with diploid, tetra- and hexaploid chromosome levels. The differentiating between species is difficult because the diagnostic features are few, highly variable, with a different weight for taxonomic solutions from different botanists. This is why there is a rich synonymy that makes it difficult to identify the correct scientific name (GONZÁLEZ-CASTAÑÓN & FALAVIGNA, 2008).

In volume 2 of the multi-volume editions of Flora of the Republic of Bulgaria,

VALEV (1964) points to *Asparagus aphyllus* for our Black Sea (Sozopol). It also includes two ornamental species - *Asparagus plumosus* Baker and *Asparagus sprengeri* Regel. KOZUHAROV (1992) mentions *Asparagus trichophyllus* as a synonym of *Astragalus brachyphyllus*. This is probably the reason in the subsequent editions on the Flora of Bulgaria (DELIPAVLOV, 2003; ASSYOV & PETROVA, 2012) the number of species stays the same) with no notes on the evidence of the distribution of *Asparagus trichophyllus* and *Asparagus aphyllus*. In Taxonomy *Astragalus brachyphyllus* Fisch. is an unresolved name, and the most authors consider it as a nomenclatural synonym for *Asparagus trichophyllus*. In our herbarium there are no materials and because of that we do not have the proper attitude to synonymic taxonomy.

From the ecological point of view, the genus includes species with high drought tolerance and different conditions, some of them adapted to sandy and coastal areas, while others are found in forest habitats, some of them adapted to steppe and semi-desert conditions (NAIDU *et al.*, 2014). Together with the species of *Smilax* and *Ruscus*, they characterize vegetation from Mediterranean forests and play a key role in the ecology and dynamics of these forests (SCHNITZLER & ARNOLD, 2010), and can therefore be good indicators of monitoring and forest ecosystem management.

From an economic point of view, asparagus species are used as vegetable and medicinal plants. Some of these are known ornamental plants throughout the world - *Asparagus plumosus* Baker, *A. densiflorus* Kunth, *A. virgatus* Baker, *A. aethiopicus*, *A. setaceus*, *A. falcatius*, *A. scandens* (KANNO & YOKOYAMA, 2011; KUMAR *et al.*, 2016), others are used in medicine and plant protection. The species *Asparagus* are included in supplement 4 of the Biological Diversity Act (2002) and *Asparagus officinalis* in the Medicinal Plants Act (2000).

### Materials and Methods

The collections and herbarium collections in the Bulgarian national herbariums were

inspected: SOA, SO and SOM. The data from the accompanying information has been introduced in a specialized *Asparagus* database in Bulgaria with the software product dSOA (STOYANOV, 2009). The input data can be filtered by floristic areas, altitudes, UTM coordinates for the two grids used (10x10 km and 50x50 km) and additional criteria. The program has the ability to export chorological data to the Atlas Florae Europaeae standard.

### Results and Discussion

The subject of analysis in this study is information from the available 355 records taken from the data from the deposited samples in the national herbariums, the distribution of the collections in the individual herbarium collections from the different floristic regions of the country is presented in Fig. 1.

The analysis of the studied materials suggests decreased scientific interest in *Asparagus* in general. A proof of this is the lack of a large number of herb samples over a period of more than 100 years - from 1887 to 2012, 312 samples of Bulgarian collections were deposited. It is also noteworthy that the authors of the collections are over 20 botanists, among them the largest number of samples were collected by: I. Cheshmedzhiev (80 records); D. Yordanov (30); N. Stoyanov (32); N. Vikotsevski (24); D. Delipavlov (17); B. Davidov (15); V. Striborni (14) and others botanists, authors of single totals, about 10 patterns are without the author of the collection. The most intense period of collection coincides with the period of active botanization and collection of information about the first volumes of the flora of the Republic of Bulgaria (between 1962-69). All this suggests the lack of purposeful research within the genus, which has led to a lagging of current information on the number of species and their distribution on the territory of our country. Taxonomic genus *Asparagus* was developed in the second volume of Flora of Republic of Bulgaria in 1964. After this period, the entry of materials in the herbariums was of low

intensity, both by regions and by authors of the collections performed sporadically in various botanical expeditions. Few are the new literature chorological data on the occurrences of *Asparagus* species.

The distribution of herbar samples from the three national herbariums by species is presented on Fig. 2.

Besides, the species distributed in Bulgaria presented in Fig. 1, in the national herbariums there are also single comparative materials of species not found in our country (including *A. trichophyllus*; *A. brachyphyllus* and *A. aphyllus*).

Based on literature data and *Asparagus* samples in Bulgarian herbariums from all available collections (Fig. 3), it is visible that there is uneven study on the territory of the country. The horizontal distribution of species in floristic regions shows the biggest diversity in the Thracian Lowland (25.3%), the Black Sea coast (16%), the Rhodopes Mts (8.7%), North-Eastern Bulgaria (8.1%) and the Tundzha hilly region 6.1%) plane (the largest number of samples were deposited from these areas). Few, often single materials are deposited from the areas of Sredna Gora Mts,

Balkan Range, Valley of Strouma River, West frontier mountains, Mt Slavyanka, Pirin, Rila and Strandzha Mts, which implies less species diversity. There are no deposited materials from the Valley of River Mesta and Belasitsa.

The deposited in the national herbarium materials of the genus *Asparagus* collected from the territory of Bulgaria are in total 7 wild species and 1 cultivated. The distribution of samples by species is presented in Fig. 4. The largest number of species is deposited by the species *Asparagus verticillatus* (102); *A. tenuifolius* (83); *A. officinalis* (71) and *A. acutifolius* (65). Few samples are represented by the species *A. maritimus* (18) and *A. trichophyllus* (8), single exicates are contained in the three herbariums of the species *A. brachyphyllus* (SOM 155784; 102339) and *A. sprengeri* (cultivar SO 12773). In the three national herbariums there is only one deposit specimen *A. aphyllus*, which is not from Bulgarian locality but it is indicate as widespread in Bulgaria, in the Black sea region to 100 m above sea level (latitude) SOA 4426 (Egipt, 1921) from ASSYOV & PETROVA (2012).

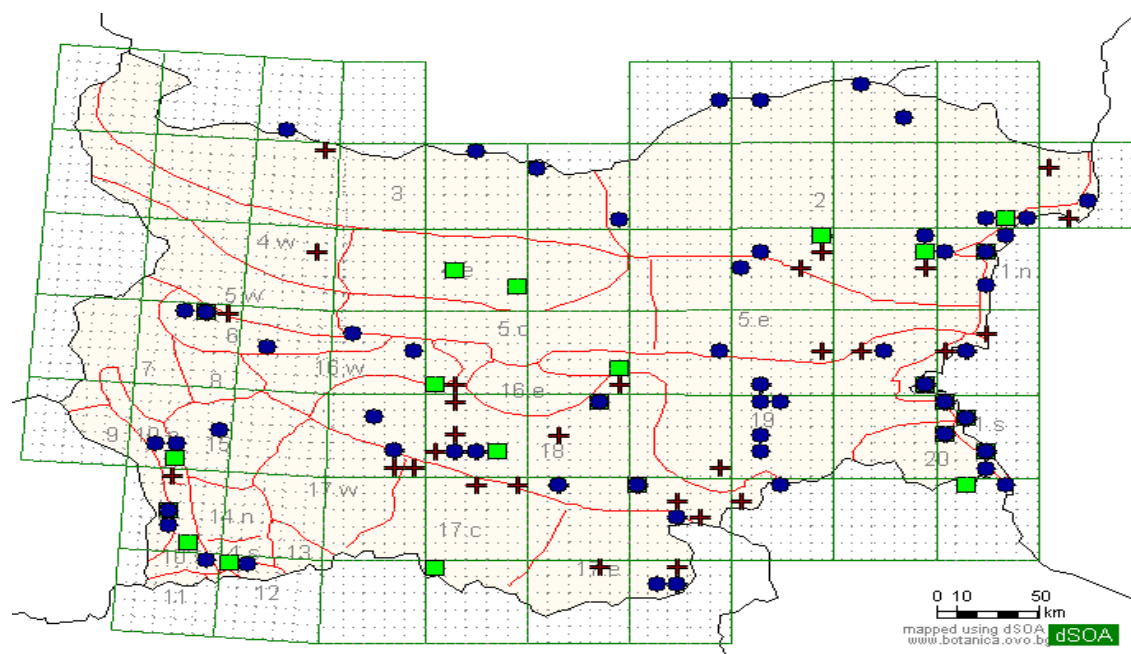


Fig. 1. Distribution map of deposited materials of the genus *Asparagus* in Bulgaria - data from herbar collections of SOM (+), SO (●) и SOA (■).

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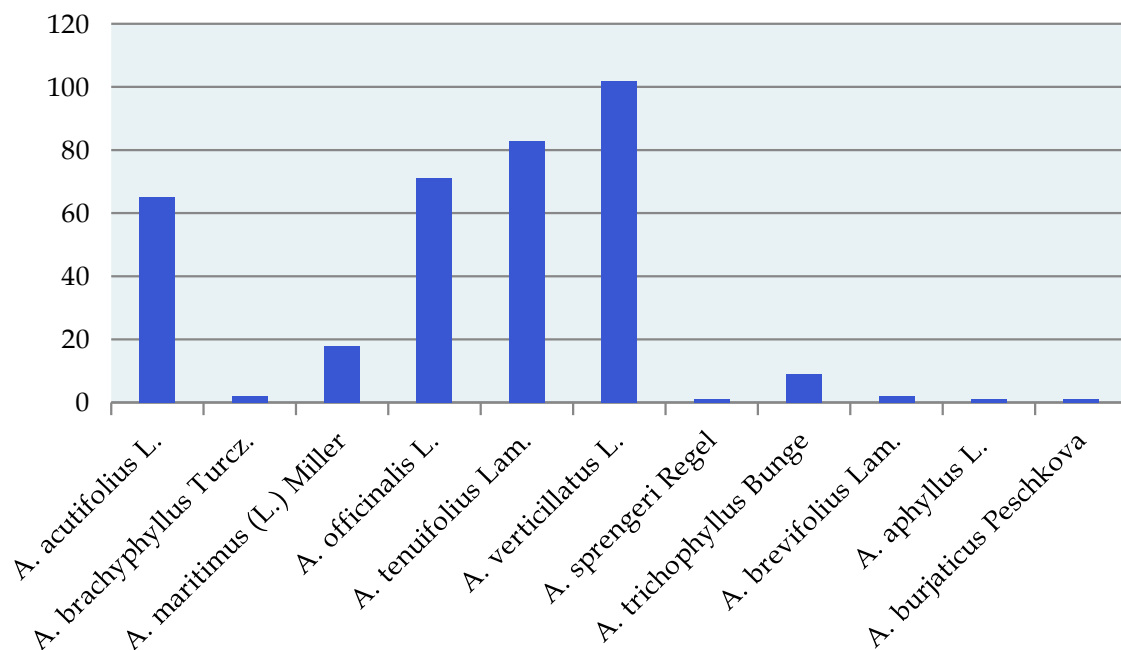


Fig. 2. Distribution of herbar samples of the genus *Asparagus* in SOA, SOM and SO by species (number of deposited samples).

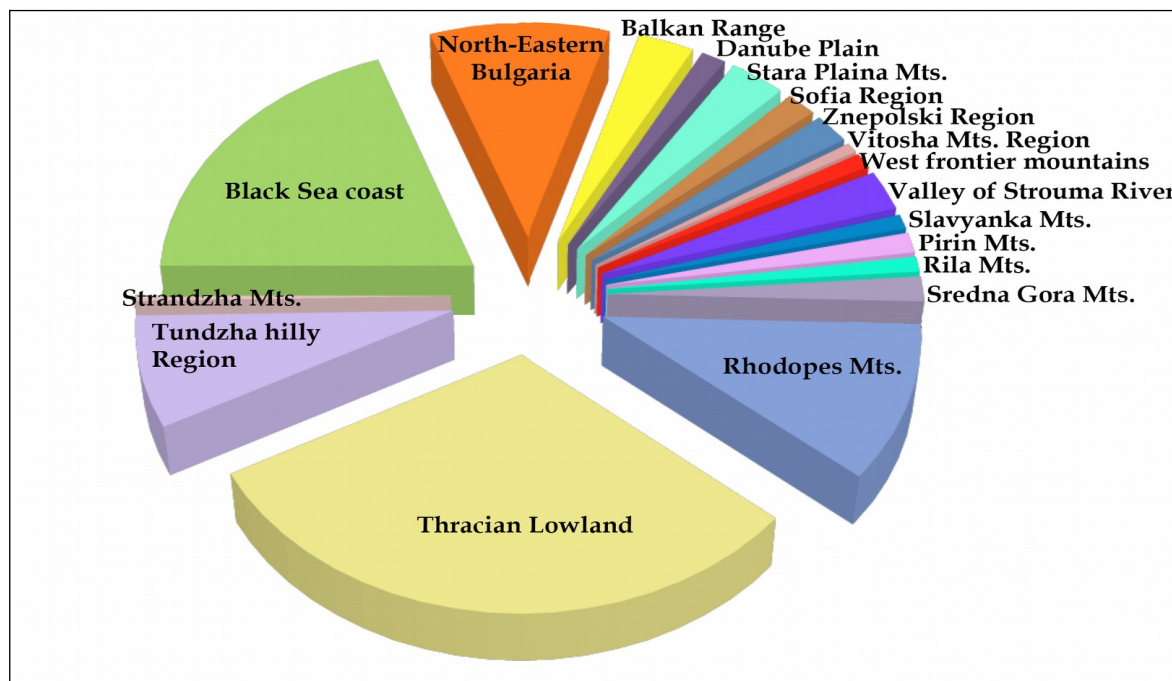


Fig. 3. Quantitative distribution of the available herbal collection of *Asparagus* by floristic areas.

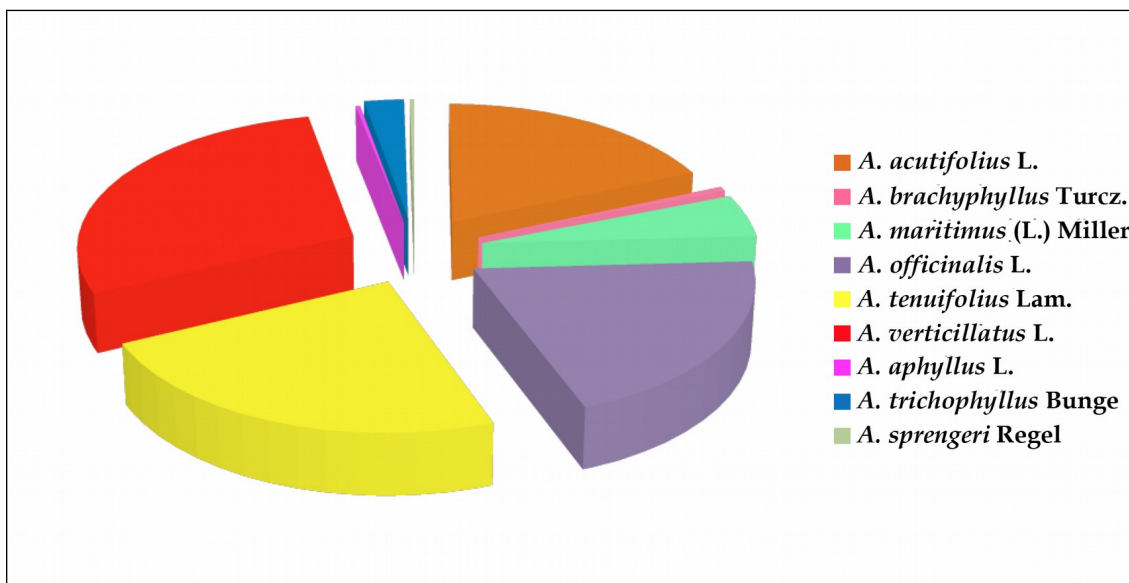


Fig. 4. Grouping of Bulgarian herbar samples of *Asparagus* in national herbariums by species (number of deposited samples).

By vertical distribution of the species composition in the country (Fig.5) the biggest diversity is observed in the plains up to 500 m altitude - low and rare forests, open, rocky and bushy habitats, etc., in general, natural or semi-natural locations. Wider range with respect to the vertical distribution range from 0 to 2020 m above sea level is observed in *Asparagus verticillatus* and *A. tenuifolius* from 0 to 1500 m above sea level. In the field and foothill areas are met *A. officinalis* (0-1100 m above sea level). The field species reaching the foothill range in a vertical boundary are the species *A. brachyphyllus* - until 700 m above sea level, *A. maritimus* and *A. acutifolius* until 200 m above sea level.

Some samples with inaccurate or incomplete topographical information are not included in the analysis (about 72 samples).

Regarding the life forms, the species distributed in Bulgaria are hemicryptophytes. Includes perennial root species with reduced flake leaves and filamentous photosynthetic structures - phylloclades of different shape, length. Flowers of the same-sex, with adhesion perigone shapes. Fruit is fleshy, berry. The flowering period is between May and June, and fruiting is July-August. These are also the predominant months of the herbarium collections.

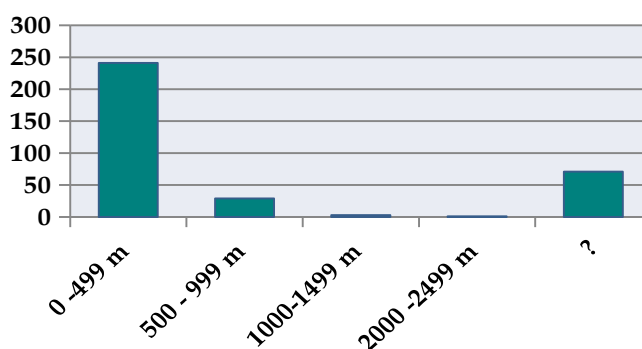


Fig. 5. Vertical distribution of *Asparagus* herbaceous samples in Bulgaria (? - samples with inaccurate or no accompanying information on the height range).

## Conclusions

The analysis of the literary data and the inventory conducted on the *Asparagus* species in Bulgaria allows us to make the following summaries and conclusions regarding the state of the herbarium collections in Bulgaria:

- A The information on the ecological requirements and the habitats' height range as well as the phenology of the Bulgarian representatives of the genus *Asparagus* are updated and summarized.

- The revised herbarium collections do not give full information about the distribution of *Asparagus* species in Bulgaria, or cast doubt on the participation of certain species proven by single herbal materials. Some of the materials have incomplete horology or inaccurate data regarding the localities. Another part has been deposited more than 100 years ago - not proven by contemporary collections, which suggests limiting the range for some of the species in Bulgaria.

- In terms of life forms, the Bulgarian species are dioecious, whit rhizomes, geophytes (hemicryptophytes). The largest taxonomic diversity of the genus *Asparagus* in our country is observed in the field and the foothills. In the upward direction the number of species decreases. The horizontal distribution shows a bigger variety of species in the Thracian Lowland, the Black Sea coast, the Rhodopes, the Tundzha hilly region and North-Eastern Bulgaria.

For the first time in the country, all available *Asparagus* herbar samples are included in a relational database, which is the starting point for further theoretical and practical developments concerning the availability of materials from Bulgarian species in the national herbariums SO, SOA, SOM.

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Received: 24.10.2018

Accepted: 15.04.2019