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# *Genus Galanthus (Amaryllidaceae) in Bulgaria: Notes about Taxonomy, Chorology and Ecology*

***Boriana Z. Sidjimova****

Institute of Biodiversity and Ecosystem Research, Department of Plant and Fungal Diversity and Resources, Bulgarian Academy of Sciences,
23 Acad. G. Bonchev Str., 1113 Sofia, BULGARIA
*Corresponding author: sidjimova@yahoo.com

**Abstract.** The aim of the present article is to collect and systematize the information on the distribution of *Galanthus elwesii* and *G. nivalis* in Bulgaria and to make some remarks on their taxonomy. A revision of Bulgarian herbarium specimens from Bulgarian herbariums and literature was carried out. Both species are given with their synonyms, some ecological characteristics and monitoring data of the represented populations. The distribution of both species by floristic regions is presented using revised materials and personal collections. New chorological data for the distribution of *G. elwesii* in floristic regions West Frontier Mts. (Mt. Osogovo), Mt. Belasica, Mesta Valley and Struma Valley (Northern) and *G. nivalis* from Black Sea Coast (Northern) are also presented.

**Key words:** *Galanthus elwesii*, *Galanthus nivalis*, chorology, ecology, distribution.

## Introduction

The species of the genus *Galanthus* L. (Amaryllidaceae) are common in Europe, Asia Minor, and the Middle East. Presented like harvests of the Spring, snowdrops have economic importance as garden plants and for the content of alkaloids with pharmacological activity. Despite hundreds of cultivated varieties, *Galanthus* spp. bulbs are among the most commonly wild-collected plants in the world (Entwistle et al., 2002). This is the reason why the trade, export and import of bulbs in the world is controlled by CITES (Convention on International Trade in Endangered Species).

Genus *Galanthus* has been the subject of numerous taxonomic revisions, but each one disagrees with others in the enumeration of species, subspecies, and varieties. New taxa are regularly described - *G. trojanus* A.P.Davis & Özhatay (Davis, 2001), *G. panjutinii* Zubov & A.P. Davis (Zubov & Davis, 2012), *G. samothracicus* Kit Tan & Biei (Tan et al., 2014), *G. bursanus* Zubov, Konca & A.P.Davis (Zubov et al., 2019) and hybrid - *G.* × *valentinei* Beck nothosubsp. *subplicatus* (Zeybek) A.P.Davis (Davis et al., 2001). The most recent taxonomic revisions describe over 20 species of *Galanthus* (Davis, 1999; Ronsted et al., 2013).

In Bulgaria, the genus *Galanthus* has been the subject of many different taxonomic decisions. Over the years 5 species, 3 subspecies, 7 varieties and one forma have been described. Velenovsky



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(1891, 1898) described 3 species from Bulgaria - *G. nivalis* L., *G. gracilis* Celak. and *G. maximus* Vel. Stoyanov & Stefanov (1923, 1933, 1948) and Jordanov (1964) accept only *G. nivalis* L. as common in Bulgaria. Stoyanov et al. (1966) gave *G. elwesii* Hook. for Bulgaria for the first time. Delipavlov (1968, 1971), based on anatomical studies, defines *G. nivalis*, *G. elwesii* and *G. graecus* Orph. ex Boiss. as species of the genus *Galanthus* in Bulgaria. Anchev (1992) indicate for distributed in Bulgaria *G. nivalis* and *G. elwesii* with three subspecies. Delipavlov (2003) gave *G. gracilis* as the most widespread species in Bulgaria. (Appendix 1A). Currently, 2 species are considered to be widespread in Bulgaria - *G. nivalis* and *G. elwesii*.

The phytochemical (Berkov et al., 2008, 2011), morphometric (Sidjimova, 2009), conservation (Sidjimova, 2014), anatomical, embryological and DNA studies (Semerdjieva et al., 2019) of the genus show significant differences between *G. elwesii* and *G. nivalis* and no further subdivisions in the studied populations of the species. The revision of the chorological information and taxonomic identity of the species is the basis for further biological and phytochemical studies and the basis for appropriate measures for the conservation and protection of the species. In Bulgaria, *G. nivalis* and *G. elwesii* are protected by Biological Diversity Act (2002). According to the IUCN criteria used for the new edition of the Red Data Book of Bulgaria (Evstatieva, 2015) both species are classified as "endangered species", with the recommendation to conserve them *in situ* and *ex situ*.

No information on the ecological and population characteristics of the species has been established in the literature.

The aim of the study is to collect and systematize the available chorological and taxonomic information on the genus *Galanthus* in Bulgaria and to provide information on some ecological characteristics of *G. elwesii* and *G. nivalis*. These data will be useful in decision making for the conservation of the two protected species.

**Material and Methods**

The subjects of this study were *G. nivalis* L. and *G. elwesii* Hook f. s. l. (Amaryllidaceae) of Bulgarian origin. The species were identified according to the taxonomic scheme of Anchev (1992). The taxonomic feature used in the identification and revision of the species was the presence or absence of green spots at the base of the inner perianth segments. The study was conducted in Bulgaria in the period from February 2002 to March 2021.

Information on distribution and taxonomic revision of herbarium specimens was based on available literature data (56 records), specimens deposited in Bulgarian Herbariums - SOA (Herbarium in Agricultural University Plovdiv) (136 specimens), SOM (Herbarium in the Institute of Biodiversity and Ecosystem Research, BAS) (24 specimens) and SO (Herbarium in the Faculty of Biology, Sofia University "St. Kliment Ochridsky") (64 specimens) and field surveys for personal collections. All revised herbarium specimens are marked with revision notes (Appendix 1B, 1C).

Voucher specimens of 15 *G. nivalis* and 54 *G. elwesii* from personal collections were deposited in the herbarium of the Institute of Biodiversity and Ecosystem Research - Bulgarian Academy of Sciences (SOM). Localities are indicated with altitude, exposure and GPS coordinates (Table 1, 2). The distribution of species follows the floristic regions of Bulgaria (Yordanov, 1966). The results are presented graphically using Excel 2010.

Monitoring of three *G. elwesii* (Shumen, Kokaliane, Bachkovo) and three *G. nivalis* populations (Belogradchik, Pasa dere, Ropotamo) was carried out in February 2015 according to the approved monitoring methodology developed for the needs of the NSEM (National System for Environmental

Monitoring). Populations were selected based on NSEM criteria for representativeness, mainly typical habitat and accessibility of the site (Gussev & Bancheva). A "separate herbaceous plant" is used as the reporting unit. Same populations were visited in 2021.

**Results**

*Galanthus nivalis* L., Sp. Pl., ed. 1 (1753) 288; Boiss., Fl. Or., 5 (1872) 144; Velen., Fl. Bulg., (1891) 539; Velen., Fl. Bulg. Suppl., (1898) 265; Stoj. Stef., Fl. Bulg., vol. 1 (1923) 257; Hayek, Prodrom. Fl. Penins. Balc., 3 (1933) 101; Stoj. Stef., Fl. Bulg., Vol. 2 (1933) 244; Lozinska., Fl. SSSR, 4 (1935) 478; Stoj. Stef., Fl. Bulg., Vol. 3 (1948) 267; Jordanov, Fl. P.R.Bulg., 2 (1964) 318; Stoj. Stef. Kitan., Fl. Bulg., vol. 4 (1966) 237; Zahariadi, Fl. R. S Rom, 11 (1966) 407; Artjushenko, Amaryllidaceae SSSR (1970) 74; Delipavlov, Izv. Bot. I-t, 21 (1971) 165; Stepanović –Veselić, Fl. SR Srbije, 7 (1986) 597; D. A. Webb, Fl. Eur., 5 (1980) 77; P. H. Davis, Fl. Turkey, 8 (1984) 370; Jovanović, Botanica Serbica (2016); *G. nivalis L. var. montanus* (Schr.) Rouy, Delipavlov, op. c., 166. – common snowdrop.

*Flowering period in Bulgaria.* Winter to spring, from mid-January to mid-March, depending on altitude, immediately after snowmelt.

*Habitat.* Occurs in moist and shady places in deciduous forests (*Acer* spp. *Carpinus betulus*, *Fagus sylvatica*, *Quercus* spp.) on calcareous soils with east or northeast exposure. The altitude ranges from 5 m (Arcutino Reserve, SOM 162924) to 1166 m a.s.l. (Bulgarka Nature Park, SOM 177466). Populations described from Balkan range occur in beech forests, while those from Strandza occur mainly in oak, maple and hornbeam forests. During the field study, populations were also observed in open meadows, in bushes and even on sand (Arcutino Reserve). The following associated herbaceous plant species were observed during the field study: *Allium* sp., *Anemone pavonina*, *Arum maculatum*, *Corydalis bulbosa*, *C. solida*, *Crocus flavus*, *Cyclamen coum*, *Euphorbia* sp., *Lamium purpureum*, *Ornithogalum* sp., *Pulmonaria officinalis*, *Ranunculus ficaria*, *Scilla bifolia*, *Veronica* sp.

*Monitoring data:* The size of the studied populations is approximately the same. The total projective cover is 1-2%, which is understandable due to the small size of the plants and the fragmented populations. In two of the populations, the ratio between generative and vegetative individuals is approximately equal. In the population of Pasha Dere, the generative individuals dominate. There the density of individuals is the highest - 1.7 individuals per $m^2$ (Table 1).

*Distribution in Bulgaria.* During the revision of herbarium materials were established 37 materials from *G. nivalis* from 5 floristic regions: Black Sea Coast (Sourthern) (13), North-Eastern Bulgaria (8), Tundzha Hilly Country (2), Balkan Range (Western) (2), Mt Strandzha (12). (Appendix C, Fig.1).

Literature data gave information for distribution from Blask Sea Coast (Delipavlov, 1968, 1971; Nikolov et al., 1994; Assyov & Petrova, 2012), North–Eastern Bulgaria (Delipavlov, 1968, 1970; Assyov & Petrova, 2012), Balkan Range (Western, Central) (Delipavlov, 1968, 1971; Tzonev, 2002; Borisova & Donchev, 2003; Assyov & Petrova, 2012; Marinov et al., 2016), Forebalkan (Western) (Delipavlov, 1968, 1970; Assyov & Petrova, 2012), Danubian plain (Delipavlov 1968, 1971) and Mt Strandza (Delipavlov, 1968, 1971; Gussev et al., 1997, 2004; Assyov & Petrova, 2012).

During the investigation were collected 15 samples from 5 floristic regions, which correspond with the distribution of the species in the country (Table 2).

*Galanthus elwesii* Hook. f., Bot. Mag., 101 (1875) t. 6166; Stoj. Stef. Kitan., Fl. Bulg., vol. 4 (1966) 237; Artjushenko, Amaryllidaceae SSSR (1970) 77; D. A. Webb, Fl. Eur., 5 (1980) 78; Delipavlov, Izv. Bot. I-t, 21 (1971) 167; *G. elwesii* Hook.f. subsp. *minor* D.A.Webb, Bot. J.

Linn. Soc. 76(4) (1978) 312; Webb, l.c.; *G. graecus* Orph. ex Boiss., Fl. Or., 5 (1882) 145; Velen., Fl. Bulg. Suppl., (1898) 265; Hayek, Prodrom. Fl. Penins. Balc., 3 (1933) 101; Zahariadi, Fl. R. S Rom, 11 (1966) 412; Delipavlov, op. c, 163; Artjushenko, op. c., 76; *G. gracilis* Čelak., Sitz. Boehm. Ges. Wiss. (1891) i. 195 t. 9; Velen, Fl. Bulg. (1891) 539; P. H. Davis, Fl. Turkey, 8 (1984) 369; *G. nivalis* L. var. *gracilis* (Čelak.) Stoj. Stef., Fl. Bulg., vol. 1 (1923) 257; Stoj. Stef., Fl. Bulg., vol. 2 (1933) 244; Stoj. Stef., Fl. Bulg., vol. 3 (1948) 267; *G. nivalis* L. var. *graecus* (Orph.) Stoj. et Stef., Stoj. Stef. Kitan., Fl. Bulg., vol. 4(1) (1966) 237; *G. maximus* Velen., Fl. Bulg. (1891) 540; Velen., Fl. Bulg. Suppl., (1898) 266; *G. nivalis* L. var. *maximus* (Velen.) Stoj. et Stef., Fl. Bulg., vol. 1 (1923) 257; Fl. Bulg., vol. 2 (1933) 244; Fl. Bulg., vol. 3 (1948) 267; *G. graecus* Orph. ex Boiss. β *[f.] maximus* (Velen.), Hayek, op. c., 102; *G. elwesii* Hook. f. *maximus* (Velen.) Stoj et Stef., Stoj. Stef. Kitan., Fl. Bulg., vol. 4(1) (1966) 237; *G. bulgaricus* Velen., Fl. Bulg. (1891) 539; *G. nivalis* L., Jordanov, Fl. P.R.Bulg., 2 (1964) 318 pp. – Elwes's snowdrop or greater snowdrop.

*Flowering period in Bulgaria.* Winter to spring, from January to May, depending on location and altitude. Flowering begins immediately after snowmelt.

*Habitat.* Deciduous forests (*Acer* spp., *Carpinus betulus*, *C. orientalis, Fagus sylvatica*, *Quercus* spp., ) on nutrient-rich soils or floodplain soils near rivers. Also found in meadows near shrubs (*Paliurus spina-cristi*, *Rubus caesius*, *Rosa canina*). On siliceous or calcareous soils, east or northeast exposure, 60 - 1700 m a.s.l. The lowest described population is from Danubian plain, near Osam River (SOM 162988) - 61 m. a.s.l. The highest population is from Rila National Park (SOM 177471) - at 1700 m. a.s.l. The following associated herbaceous plant species were observed during the field study: *Allium* sp., *Arum maculatum*, *Asarum europaeum*, *Corydalis bulbosa*, *C. solida*, *Crocus flavus*, *Erythronium dens-canis*, *Euphorbia* sp., *Lamium purpureum*, *Ornithogalum* sp., *Potentilla micrantha*, *Pteridium aquilinum*, *Pulmonaria officinalis*, *P. rubra*, *Scilla bifolia*, *Veronica* sp.

*Monitoring data:* The areas of the studied populations are close to each other. The overall projective cover is 1-2%. In two of the populations (Shumen and Kokaliane) vegetative individuals dominate. In the Bachkovo population, generative individuals dominate. The density in the Bachkovo population is the highest - 1.3 individuals per $m^2$ (Table 3).

**Table 1.** Monitoring data of studied *G. nivalis* populations.

| **Index** | **Belogradchik** | **Pasa dere** | **Ropotamo** |
|---|---|---|---|
| Area (dka) | 13 | 15 | 18 |
| Projective cover (%) | 1 | 2 | 1 |
| Vegetative individuals (%) | 55 | 28 | 49 |
| Generative individuals (%) | 65 | 72 | 51 |
| Density of individuals ($m^2$) | 0,7 | 1,7 | 0,7 |

**Table 2.** Personal collections of *G. nivalis*.

| No. | Locality |
|---|---|
| 1 | North-Eastern Bulgaria: Above Obrochishte village, 219 m. a.s.l. E exposition, 43.38155 N 28.07075E, 27.02.2004, coll. B. Sidjimova (SOM 162923) |
| 2 | North-Eastern Bulgaria: Carkva village, oak forest,120 m. a.s.l., E exposition, 43.416883N 27.984600E, 21.02.2002, coll. B. Sidjimova (SOM 162985) |

| | |
|---|---|
| 3 | Black Sea Coast (Northern): Pasha dere, "Limana", 7 m. a.s.l., E exposition, 43.10918N 27.92358E, 26.02.2014, coll. B. Sidjimova (SOM 169988) |
| 4 | Black Sea Coast (Northern): Aladza Monastery, near Varna, 245 m. a.s.l., E exposition, 43.277478N 28.016479E, 20.02.2002, coll. B. Sidjimova (SOM 163456) |
| 5 | Black Sea Coast (Sourthern): Primorsko, near Ropotamo River, "Lavskata glava" locality, 9.7 m a.s.l., E exposition, 42.308000N 27.723533E, 19.02.2002, coll. B. Sidjimova ( SOM 162920) |
| 6 | Black Sea Coast (Sourthern): near Primorsko, oak forest, 5,8 m. a.s.l., E exposition, 42.252317N 27.710150E, 19.02.2002, coll. B. Sidjimova ( SOM 162921) |
| 7 | Black Sea Coast (Sourthern): Arkutino Reserve, 5 m. a.s.l., E exposition, 42.32572N 27.73056 E, 01.03.2006, coll. B. Sidjimova (SOM 162924) |
| 8 | Black Sea Coast (Sourthern): Kiten, after Diavolska river, near the road in bushes on sand, 2 m. a.s.l., E exposition, 42.25597N 27.74863E, 01.03.2006, coll. B. Sidjimova ( SOM 163092) |
| 9 | Black Sea Coast (Sourthern): Camping "Coral", sea pine plantation, 7 m. a.s.l., NE exposition, 42.21507 N 27.78985 E, 25.03.2016, coll. B. Sidjimova (SOM 177463) |
| 10 | Balkan Range (Central): In Balgarka NaturePark, Balgarka Holiday Resort, 1166 m. alt, NE exposition, N42.76354 E25.49345, 05.04.2016, coll. B. Sidjimova ( SOM 177466) |
| 11 | Balkan Range (Central): In Balgarka NaturePark, above Cheresha village, 1016 m. a.s.l., N exposition, N42.75097 E25.59975, 04.04.2016, coll. B. Sidjimova ( SOM 177467) |
| 12 | Balkan Range (Western): Belogradchik, "Venetza", 575 m. a.s.l., NE exposition, 43.623683N 22.676717E, 23.03.2004, coll. B. Sidjimova ( SOM 162930) |
| 13 | Znepole region: Filipovci village, "Sekirica" locality, 756 m. a.s.l., NW exposition, 42.836383N 22.696950E, 25.03.2004, coll. B. Sidjimova (SOM 162931) |
| 14 | Mt Strandza: Zabernovo village, "Tomova bahcha" locality, 167 m. a.s.l., W exposition, 42.078033N 27.582117E, 10.02.2005, coll. B. Sidjimova (SOM 162986) |
| 15 | Mt Strandza: Gramatikovo village, "Kachul" Forestry, 68 m. a.s.l., NW exposition, 42.022633N 27.650000E, 10.02.2005, coll. B. Sidjimova (SOM 162925) |

**Table 3.** Monitoring data of studied *G. nivalis* populations.

| **Index** | **Shumen** | **Kokaliane** | **Bachkovo** |
|---|---|---|---|
| Area, dka | 13 | 14 | 16 |
| Projective cover (%) | 1 | 1 | 2 |
| Vegetative individuals (%) | 65 | 67 | 44 |
| Generative individuals (%) | 35 | 33 | 56 |
| Density of individuals ($m^2$) | 0,7 | 0,7 | 1,3 |

*Distribution in Bulgaria:* During the revision of herbar specimens from genus *Galanthus* in Bulgarian herbariums were established 195 materials of *G. elwesii* from 14 floristic regions: North–Eastern Bulgaria (22), Danubian plain (6), Forebalkan (1), Balkan Range (Western) (21), Sofia region (4), Znepole region (3), Vitosha region (3), Valley of River Struma (Southern) (1), Mt Pirin (2), Mt Rila (4), Mt Sredna gora (Western) (3), Rhodopes Mts. (74), Thracian plain (21), Tundza hilly region (19) (Apendix D, Fig 1). Delipavlov (1968, 1971) accept *G. graecus* like wide spread in Bulgaria and for the distribution of *G. elwesii* indicates only North–Eastern Bulgaria, Danubian plain and Forebalkan (Western). Tzonev (1997) reported *G. elwesii* from Danubian plain and Borisova & Donchev (2003) and Marinov et al. (2015) - from Balkan Range (Western, Central). According to Assyov & Petrova (2012), *G. elwesii* is widespread in Bulgaria in

all floristic regions, except Mt Slavyanka, Black Sea Coast (Northern and Southern) and Mt Strandza.

During the study, 53 specimens were collected from 15 floristic regions. No data on the distribution of species in the floristic regions Black Sea Coast (Northern and Southern), Mt Slavyanka, Thracian Plain and Mt Strandza were found in the literature, herbarium collections and during the field survey. New chorological data on species distribution in the floristic regions West Frontier Mts., Mt Belasitsa, Struma Valley (Northern) and Valley of River Mesta are presented. (Table 4). Information on distribution of *Galanthus* species in Vitosha Mountain has not been confirmed for 90 years. In 2015, two populations of the species were reintroduced in places in Vitosha region, known from literature (Urumov 1930). In 2016 Gyurova & Savev published the results of their work. During my visit to the sites it was noted that the species naturalizes very successfully.

**Discussion**

Information on 5 species, 3 subspecies, 7 varieties and one form of genus *Galanthus* for the territory of Bulgaria was summarized from available literature and herbarium materials. This information was systematized according to the adopted taxonomic scheme (Anchev, 1992), and the synonyms of *G. nivalis* and *G. elwesii* were given in citation blocks. Thirty seven materials of *G. nivalis* and 195 of *G. elwesii* were revised with revision notes in herbarium collection in the country.

Investigations of the distribution of *G. nivalis* in Bulgaria have confirmed the findings of Delipavlov (1968, 1971) that this species has a limited distribution, especially in eastern Bulgaria. Revised herbarium specimens and personal collections show that the species occurs only in 5 floristic regions of the country. Most of the localities are from the floristic regions of Black Sea Coast (Southern) (13 revised and 5 personal) and North-Eastern Bulgaria (8 revised and 4 personal). New chorological data for two localities of *G. nivalis* from the Black Sea coast (Northern) are presented. In the Znepole region there is only one locality from a personal collection. (Fig. 1, Table 2, Appendix C).

**Table 4.** Personal collections of *G. elwesii.*

| No | Locality |
|---|---|
| 1 | Danubian Plain: Vladimirovo village, by the road to „Gradeshki“ Monastery, 78 m. a.s.l., N exposition, 43.537833N 23.387833E, 22.02.2002, coll. B. Sidjimova (SOM 163459) |
| 2 | Danubian Plain: The valley of the Chernelka River, between the villages of Kartozhabene and Gortalovo, 175 m. a.s.l., SE exposition 43.334917N 23.550200E, 29.02.2004, coll. B. Sidjimova (SOM 162906) |
| 3 | Danubian Plain: Levski town, the bridge of Osam river, 61 m. a.s.l., NE exposition, 43.353500N 25.181917E, 26.02.2006, coll. B. Sidjimova (SOM 162988) |
| 4 | North-Eastern Bulgaria: On the road Popovo - Byala, before the village of Koprivets, 265 m. a.s.l., SW exposition, 43.416883N 27.984600E, 29.02.2004, coll. B. Sidjimova (SOM 162927) |
| 5 | North-Eastern Bulgaria: The village of Prolaz, before Targovishte, 323 m. a.s.l., NE exposition, 43.17177N 26.50150E, 10.02.2021, coll. B. Sidjimova (SOM 162905) |
| 6 | North-Eastern Bulgaria: The village of Moravitsa, before the town of Omurtag, 43.16415 N, 26.06418 E, 277 m. a.s.l., NE exposition , 21.02.2002, coll. B. Sidjimova ( SOM 162915) |
| 7 | North-Eastern Bulgaria: Shumen plateau, the monument "1300 years Bulgaria", 454 m. a.s.l. , W exposition, 43.259783N 26.916233E,21.02.2002, coll. B. Sidjimova (SOM 162916) |
| 8 | North-Eastern Bulgaria: Shumen plateau, "Bukata" Reserve, 555 ma.s.l., NE exposition, 43.016667N 23.816667E, 28.02.2004, coll. B. Sidjimova (SOM 163462) |

| | |
|---|---|
| 9 | North-Eastern Bulgaria: The "Madarsky konnik" plateau, 450 m. a.s.l., NW exposition 43.266667N 27.116667E, 29.02.2004, coll. B. Sidjimova (SOM 162912) |
| 10 | North-Eastern Bulgaria: Between the villages of Sirakovo and Sarnino, 231 m. a.s.l., NE exposition, 43.650000N 28.283333E, 27.02.2004, coll. B. Sidjimova ( SOM 162908) |
| 11 | North-Eastern Bulgaria: Between the villages of Kalinata and Vasilevo, "Chernata Gora" locality, 192 m. a.s.l., NE exposition, 43.62410N 28.18748E, 27.02.2004, coll. B. Sidjimova (SOM162909) |
| 12 | North-Eastern Bulgaria: The Obrochishte village, by the road to Balchik, 219 m. a.s.l., E exposition, 43.38155N 28.07075E, 20.02.2002, coll. B. Sidjimova (SOM 162922) |
| 13 | North-Eastern Bulgaria: The village of Tsarkva village , Dobrich region, 117 m. a.s.l., E exposition, 43.416883N 27.984600E, 21.02.2002, coll. B. Sidjimova ( SOM 162907) |
| 14 | North-Eastern Bulgaria: Tervel Forestry, 193m. alt NE exposition, 43.68383N 27.3200E, 20.02.2002, coll. B. Sidjimova ( SOM 162984) |
| 15 | Forebalkan (Western): Bozhenitsa village, Botevgrad, "Mishovite Kamani" locality, 450 m. a.s.l., NW exposition, 43.016667N 23.816667E, 24.03.2004, coll. B. Sidjimova (SOM 163093) |
| 16 | Forebalkan (Eastern): Yoglav village, Kamaka locality, 126 m. a.s.l., N exposition, 43.198055N 24.817632 E, 26.02.2003, coll. B. Sidjimova (SOM 162932) |
| 17 | Forebalkan (Eastern): Sevlievo, the forest on the way to "Momina salza" hut, 400 m. a.s.l., NE exposition, 43.196110N 25.112778E, 22.02.2002, coll. B. Sidjimova (SOM 162918) |
| 18 | Forebalkan (Eastern): Slopes along the main road Veliko Tarnovo – Targovishte, 295 m.a.s.l., NW exposition, 43.066667N 25.650246E, 26.02.2003, coll. B. Sidjimova (SOM 162907) |
| 19 | Balkan Range (Central): Balgarka Nature Park "Uzana" locality, 1016 m.a.s.l., NW exposition, 42.75097N 25.59975E, 05.04.2016, coll. B. Sidjimova (SOM 177468) |
| 20 | Balkan Range (Western): Below Baba peak, 1500 m. a.s.l., NE exposition, 42.751439N 24.006312E, 18.03.2004, coll. B. Sidjimova (SOM 162929) |
| 21 | Balkan Range (Central): above the village of Hristo Danovo, 750m. a.s.l., N exposition, 42.729432N 24.613471E, 01.04.2003, coll. B. Sidjimova (SOM 163466) |
| 22 | Balkan Range (Central): "Kozya stena" Reserve, 1500 m. a.s.l., NE exposition, 42.786854N 24.559853E, 01.04.2003, coll. B. Sidjimova ( SOM 163488) |
| 23 | Balkan Range (Eastern): Nature park "Sinite kamani", on the way to "Karandila" locality, 848 m.a.s.l., W exposition, 42.747539N, 413305 E, 18.02.2002, coll. B. Sidjimova ( SOM 162917) |
| 24 | Balkan Range (Eastern): Karnobat, "Markeli" locality, 212 m. a.s.l., E exposition, 42.637217N 26.897700E, 18.02.2002, coll. B. Sidjimova (SOM 162914) |
| 25 | Mt Sredna Gora (Western): Ihtiman, "Nivata" locality, over "Mativir" river, 600 m. a.s.l., N exposition, 42.418620N 23.892567E, 05.03.2004, coll. B. Sidjimova ( SOM 162934) |
| 26 | Mt Sredna Gora (Western): Below Bogdan peak, 1502 m.a.s.l., NE exposition, 42.60568N 24.45145E, 21.02.2016, coll. B. Sidjimova ( SOM 177463) |
| 27 | Mt Sredna Gora (Eastern): Stara Zagora, "Mechi Kladenets" locality, 348m alt, E exposition, 42.433037N 25.543833E, 10.05.2003, coll. B. Sidjimova (SOM 163370) |
| 28 | Znepole region: Trun town, "Mogilata" locality, 772 m.a.s.l., NW exposition, 42.689667N 23.857778E, 19.02.2004, coll. B. Sidjimova (SOM 162933) |
| 29 | Znepole region: Kraishte, above the village of Lyalintsi, Paramunska Mountain, below "Strazhata" peak, 954m alt, NEexposition, 42.774781N 22.751772E, coll. B. Sidjimova (SOM 177474) |
| 30 | West Frontier Mountains: Osogovo, above the village of Zhilentsi, 1349 m.a.s.l., E exposition, N42.23775 E22.61370, 17.03.2016, coll. B. Sidjimova (SOM 177469) |

31 Sofia region: Kokalyane village, under the fortress "Urvich", 610m. a.s.l., NW exposition, 42.555791N 26.428444E, 20.03.2002, coll. B. Sidjimova ( SOM 163471)

32 Sofia region: Makotsevo village, "Sinigerov dol" locality, 633m. a.s.l., NE exposition, 42.691044N 23.819134E, 18.03.2004, coll. B. Sidjimova ( SOM163470)

33 Rila Mts: Rila National Park, above the village of Bistritsa, "Argacha" locality, 1365 m. a.s.l., NW exposition, N42.07869 E23.22630, 29.04.2015, coll. B. Sidjimova ( SOM 177470)

34 Rila Mts: Rila National Park, "Chakalitsa" locality, on the road to Predela, 1700 m.a.s.l., NE exposition, N41.98442 E23.31718, 12.05.2015, coll. B. Sidjimova (SOM 177471)

35 Pirin Mts (Southern): Musomishte village, "Karacheto" locality, 550 m. a.s.l., E exposition 41.547459N 23.749398E, 19.02.2004, coll. B. Sidjimova (SOM 162910)

36 Pirin Mts (Southern): Before the village of Gospodintsi, "Trudovashkata chesma" locality, m. a.s.l., E exposition, 41.654842N 23.730121E, 19.02.2004, coll. B. Sidjimova ( SOM 162910)

37 Mt Belasitsa: Near the path from "Hvoynova Polyana" hut to "Vejkata" peak, 948 m.a.s.l., NE exposition, 41.250783N 25.245366 E, 09.07.2016, coll. B. Sidjimova (SOM 173711)

38 Valley of Struma river (Northern): Below "Bliznatsite" peak, in the region of Zemen town, 589 m. a.s.l.,NW exposition, 42.452629 N 22.710993E, 21.02.2015, coll. B. Sidjimova (SOM 173472)

39 Valley of Mesta river: Hadjidimovo village, the chapel "St. Dimitar ", 450 m. a.s.l., SW exposition, 42.807886N 22.624542E, 25.03.2004, coll. B. Sidjimova ( SOM 162933)

40 Rhodopes Mts (Western): On the road Belovo-Yundola, near the river Yadenitsa, 776 m. a.s.l., NE exposition, 42.144200N 23.960317E, 19.03.2003, coll. B. Sidjimova (SOM 162919)

41 Rhodopes Mts (Central): Kuklen village, near the Monastery "St. Kozma and Damyan", 450 m. a.s.l., NE exposition, 42.029321N 24.769497E, 16.03.2004, coll. B. Sidjimova (SOM 163461)

42 Rhodopes Mts (Central): Ruen village, oak forest above the chapel "St. Ilia", 600 m.a.s.l., NE exposition, 42.010823N 24.798877E, 19.03.2002, coll. B. Sidjimova ( SOM 162928)

43 Rhodopes Mts (Central): Muldava village, over "St Petka Muldavska" Monastery, 443m. a.s.l., E exposition, 41.976267N 24.923018E, 16.03.2004, coll. B. Sidjimova (SOM 162905)

44 Rhodopes Mts (Central): Around Trigrad, 1350 m. a.s.l., NE exposition, 41.620924N 24.383002E, 25.03.2004, coll. B. Sidjimova ( SOM 162983)

45 Rhodopes Mts (Central): Bachkovo Monastery, around the path to the "Marziganitsa" hut, 485 m. a.s.l., NE exposition, 41.938472N 24.859972E, 09.03.2002, coll. B. Sidjimova (SOM 163463)

46 Rhodopes Mts (Central): Narechenski Bani, "Soleno Izvorche" locality, beech forest, 530m. a.s.l., W exposition, 41.899729N 24.740890E, 16.03.2004, coll. B. Sidjimova (SOM 163464)

47 Rhodopes Mts (Eastern): Momchilgrad, next to the greenhouses by the river, 300m. a.s.l., E exposition, 41.511550N 25.390973E, 01.04.2003, coll. B. Sidjimova (SOM 163460)

48 Tundza Hilly Country: Topolovgrad region, around Visegrad peak, 812 m.a.s.l., NE exposition, 41.993371N 26.329675E,19.02.2002, coll. B. Sidjimova (SOM 163458)

49 Tundza Hilly Country: The hills northeast of Topolovgrad, Paliurus spina-cristi bushes, 123m. a.s.l., E exposition, 42.093056N 26.331389E, 14.03.2004, coll. B. Sidjimova (SOM 163458)

50 Tundza Hilly Country: Yambolski Bakadjik, "Inje" hut, 430m. a.s.l., E exposition,42.451083N 26.649300E, 01.03.2006, coll. B. Sidjimova ( SOM 162989)

51 Tundza Hilly Country: The Jinot village, in bushes near the bridge in front of the village, 181m. a.s.l., E exposition, 42.499387N 26.650633E, 01.03.2006, coll. B. Sidjimova (SOM 163457)

52 Tundza Hilly Country: Tenevo village, Protected area "Debelata koria", 115 m.a.s.l., SE

| | |
|---|---|
| | exposition, 42.358363N 26.541001E, 20.02.2015, coll. B. Sidjimova ( SOM 177464) |
| 53 | Tundza Hilly Country: Yambol region, Hunting farm "Ormana", 129 m. a.s.l., SE exposition, N42.52818 E26.52055, 20.02.2016, coll. B. Sidjimova ( SOM 177465) |

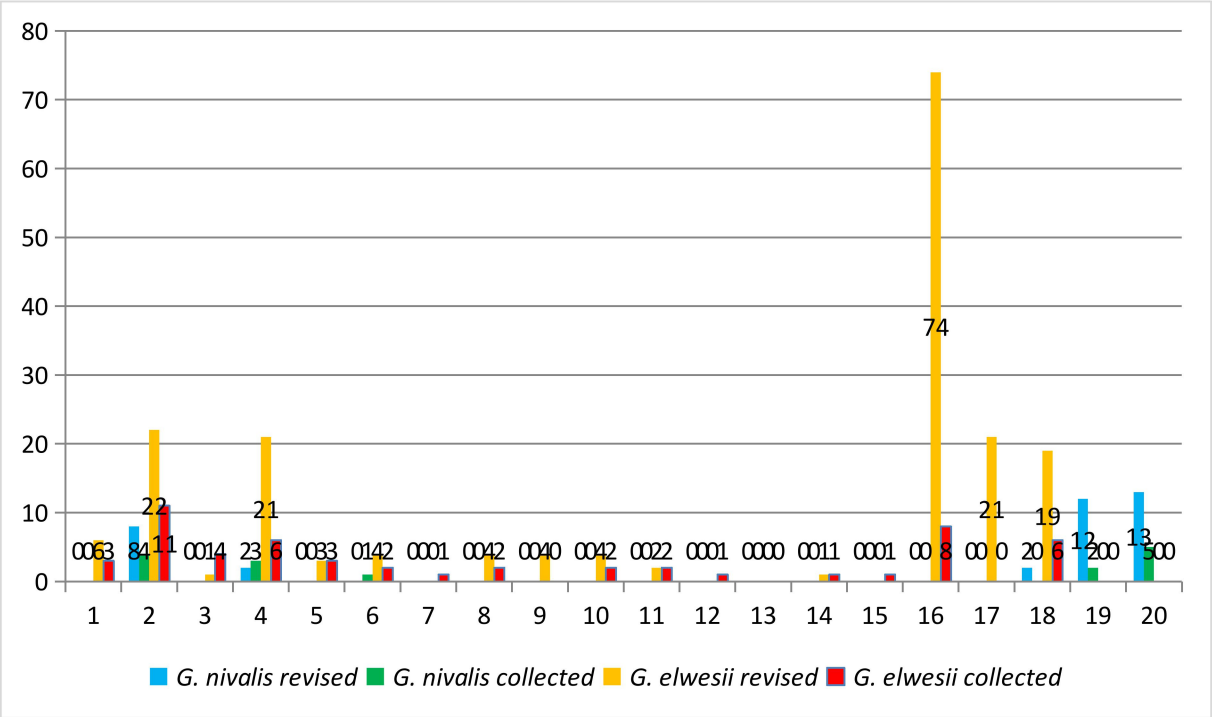


**Fig 1.** Distribution of *G. elwesii* and *G. nivalis* (revised chorological plates and personal collections) in the floristic regions of Bulgaria, without subregions. (1. Danubian Plain; 2. North-Eastern Bulgaria; 3. Forebalkan; 4. Balkan Range; 5. Mt Sredna Gora (Northern and Southern); 6. Znepole region; 7. West Frontier Mountains; 8. Sofia region; 9. Vitosha region; 10. Rila Mts; 11. Pirin Mts (Southern); 12. Mt Belasitsa; 13. Mt Slavyanka; 14. Valley of Struma river; 15. Valley of Mesta river; 16. Rhodopes Mts; 17. Thracian Plane; 18.Tundza Hilly Country; 19. Mt Strandza; 20. Black Sea Coast (Northern and Southern).)

*G. elwesii* has a wide distribution throughout the country. In the past, the species was widely distributed in the vicinity of Sofia (Lyulin Mountain, Vitosha, Lozen Mountain) (Urumov, 1929). Today, only a few sites are known in the floristic regions of Sofia. Most of the findings of the species in herbariums are from the Rhodope Mts. No any herbarium records of *G. elwesii* were found in 5 floristic regions - Western Frontier Mountains, Mt Belasitza, Mt Slavyanka, Valley of Mesta river, Mt Strandza and on the Black Sea Coast (Northern and Southern). As a result of the present study, data on the distribution of *G. elvesii* were not found only from the floristic regions of Black Sea Coast, Mt. Strandzha and Mt. Slavyanka.

The personal collections made during the survey confirm the ratio of about 5:1 between the localities of *G. elwesii* and *G. nivalis*.

Analysis of the results showed that the two species are to some extent geographically isolated. In Strandzha and on the Black Sea Coast floristic regions, only *G. nivalis* was found. In North-Eastern Bulgaria, two sympatric populations of *G. elwesii* and *G. nivalis* were established. Nearby localities of both species were

identified for the Tran region (Znepole floristic region). General floristic regions for both species, but with a clear dominance of *G. elwesii*, are Balkan Range and the Tundza Hilly Country. No data were found on the distribution of *Galanthus* species in Mt Slavyanka (Fig. 1).

Both species prefer shady places with rich soils. Deciduous forests are a common habitat. Associated species are plants of the spring ephemeral complex. Observations in *G. elvesii* habitats show that the larger plants grow in sites characterized by high atmospheric and soil moisture - in oak woodlands on nutrient-rich soils or on floodplain soils near rivers. Smaller plants are found in dry, open habitats, under shrubs, or in *Carpinus orientalis* forests. These results confirm the conclusions of Sidjimova (2009) that smaller plants are the result of phenotypic variability in the adaptation of the species to drier habitats.

Populations of *G. nivalis* and *G. elwesii* with approximately equal size and mosaic structure were monitored. The age structure shows a slight predominance of vegetative individuals in *G. elwesii* and generative individuals in *G. nivalis*. The project cover is about 1% and the density is about 1/m$^2$. From the monitoring data, it can be concluded that all monitored populations are in a favorable condition at the time of monitoring.

**Conclusions**

The systematized taxonomic information on the genus *Galanthus* in Bulgaria and the revision of 37 *G. nivalis* and 195 *G. elwesii* herbarium specimens according to the taxonomic scheme of Anchev (1992) provide a basis for further studies of the species. The collected new chorological data on the distribution of *G. elwesii* in West Frontier Mts. (Osogovo), Mt Belasica, Valley of Struma river (Northern) and the Valley of Mesta river, new chorological data of *G. nivalis* from Black Sea Coast (Northern) and the confirmation of old data, unconfirmed for decades, as well as the described ecological characteristics of the species are of great importance for taking appropriate protective measures for bouth protected species. Initial monitoring data for the species indicate that their populations are in stable condition. The measures taken to protect both species (Biodiversity Act, 2002; Evstatieva, 2015) in Bulgaria are adequate and ensure good development of the species.

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**APPENDIX**

**A** *Galanthus* taxa, regarded as distributed in Bulgaria in different literature sources. In brackets are given synonyms of the taxon, according to this source.

| Literature sources | Taxon, synonyms in brackets |
|---|---|
| Velenovsky (1891) | *Galanthus nivalis* L. |
| Velenovsky (1898) | *Galanthus gracilis* Celak. (*G. bulgaricus* Vel.)<br>*Galanthus maximus* Vel. |
| Stoyanov & Stephanov (1923) | *Galanthus nivalis* L.<br>var. *gracilis* Čelak.<br>var. *maximus* Vel. (*G. maximus* Vel.) |
| Stoyanov & Stephanov (1933) | *Galanthus nivalis* L.<br>var. *gracilis* Čelak. (*G. gracilis* Celak; *G. graecus* Orph.)<br>var. *maximus* Vel. (*G. maximus* Vel.) |
| Hayek (1933) | *Galanthus nivalis* L.<br>*Galanthus graecus* Orph.ex Boiss (*G. bulgaricus* Vel.; *G. gracilis* Celak) |
| Stoyanov & Stephanov (1948) | *Galanthus nivalis* L.<br>var. *gracilis* Čelak. (*G. gracilis* Celak; *G. graecus* Orph.)<br>var. *maximus* Vel (*G. maximus* Vel.) |
| Jordanov (1964) | *Galanthus nivalis* L. s.l |
| Stoyanov & all. (1966) | *Galanthus nivalis* L.<br>var. *nivalis*<br>var. *graecus* (Orph.) Stoj. et Stef. (*G. gracilis* Celak; *G. graecus* Orph., *G. bulgaricus* Vel.)<br>*Galanthus elwesii* Hook. f. *maximus* Vel. (*G. maximus* Vel.) |
| Artjusenko (1970) | *Galanthus nivalis* L.<br>*Galanthus. elwesii* Hook.<br>var. *maximus* (Vel.) (*G. maximus* Vel.; *G. graecus* Orph. var. *maximus* (Vel.)Hayek.)<br>*Galanthus graecus* Orph. ex Boiss (*G. nivalis* ssp. *graecus* (Orph. ex Boiss.) Gottlieb-Tannenhain; *G. bulgaricus* Vel.; *G. gracilis* Celak.) |
| Delipavlov (1971) | *Galanthus nivalis* L.<br>var. *montanus* (Schur.)Rouy.<br>var. *nivalis* L.<br>*Galanthus graecus* Orph.ex Boiss (*G. bulgaricus* Vel.; *G. gracilis* Celak; *Galanthus nivalis* L. var. *gracilis* (Čelak.) Stoj. et Stef.)<br>var. *maximus* (Vel.) Beck. (*G. maximius* Vel.; *G. nivalis* var. *maximus* Vel.; *G. elwesii* f. *maximus* (Vel.) Stoj.,Stef.,Kitan.; *G. elwesii* var.*maximus* (Vel.)Beck.)<br>*Galanthus elwesii* Hook. |
| Webb (1978) | *Galanthus nivalis* L.<br>*Galanthus elwesii* Hook. fil. (*G. maximus* Vel.; *G. elwesii* var. *maximus* (Vel.) G.Beck.; *G. graecus* var. *maximus* (Vel.)Hayek; *G. nivalis* var. *maximus* (Vel.)Stoj. et Stef.; *G. graecus* Orph. ex Boiss.; *G. nivalis* ssp. *graecus* (Orph. ex Boiss.) Gottl.-Tann.) -<br>ssp. *elwesii*<br>ssp. *minor* D.A.Webb. |

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|---|---|
| Anchev (1992) In: Kozuharov (ed) | *Galanthus nivalis* L.<br>*Galanthus elwesii* Hook. fil.<br>ssp. *elwesii*<br>ssp. *minor* Webb. (*G. graecus* auct. bulg.)<br>ssp. *maximus* (Vel.) Kož. et Andr. |
| Anchev (1999) In: Petrova & all. | *Galanthus nivalis* L.<br>*Galanthus elwesii* Hook. fil. |
| Davis (2000) | *Galanthus nivalis* L.<br>*Galanthus elwesii* Hook. fil. (*G. graecus* Orph. ex. Boiss, *G. maximus* Vel.; *G. bulgaricus* Vel.)<br>*Galanthus gracilis* Čelak. (*G. elwesii* Hook. f. subsp. *minor* Webb; *G. graecus* auct. non Orph. ex Boiss., pro parte: Stern) |
| Delipavlov (2003) | *Galanthus nivalis* L.<br>*Galanthus elwesii* Hook. fil<br>*Galanthus gracilis* Čelak. (*G. graecus* Orph. ) |

**B *Galanthus* taxa found in the chorological literature and herbariums in Bulgaria**

**1. Galanthus elwesii Hook. f.:** Delipavlov (1968), Delipavlov (1971), Tzonev (2002), Delipavlov & Chesmedziev (ed) (2003); SO 97162 (Tzonev); SOA 04145 (Delipavlov); SO 58673 (Koeva); SOM 121447, SO 12984, 12983, 12985 (Simeonovsky); SOM 159628, 159631, 159829, 159634, 159630 159633, 159632 (Sopotlieva).
**2. *Galanthus elwesii Hook. f. subsp. elwesii***: Anchev (1992).
**3. *Galanthus elwesii Hook. f. subsp. maximus* (Velen.)Beck.:** Kozuharov (1992), SO 99150 (Tzonev); SOA 32414 (Delipavlov); SOM 13606 (Davidoff, J.M.Tzar Boris III); SOM 13603 (Davidoff, Radev), SOM 13613 (Davidoff).
**4. *Galanthus elwesii Hook. f. subsp. minima*:** Anchev (1992), Tzonev(1997).
**5. *Galanthus elwesii Hook. f. subsp. balcanicus* Dav.:** SOM 13604, 13605 (Davidoff); SOM 13608 (J.M.Tzar Boris III).
**6. *Galanthus elwesii Hook. f. var. maximus* (Velen.)*:*** SOM 13612 (Davidoff, Nejchev); SOM 13609 (Toshev, Davidoff).
**7. *Galanthus elwesii* Hook. f. *var. orbelicus* Dav.:** SOM 13610, 13611 (Davidoff).
**8. *Galanthus elwesii* Hook. f. f. *maximus* (Velen.)Stoj. & Stef.:** SO 29898 (Ganchev, Vichodcevsky).
**9. *Galanthus gracilis* Čelak**.: Čelakovsky (1891), Toshev (1903), Urumov (1897, 1901, 1906, 1909, 1913, 1917, 1923, 1929, 1935a, 1935b, 1937); SO 12994, 12993, 12991, 12992 (Stribrny).
**10. *Galanthus graecus* Orph. ex Boiss.:** Delipavlov (1968); SOA 45539, 45540 (Dimitrov, Delipavlov); SOA 33823, 33818, 32462, 04154, 04155, 32409, 32408, 32445, 04142, 04143, 04150, 32441, 32442, 32396, 32397, 33827, 32399, 32436, 32437,32443, 32459, 32458, 32451, 32453, 32440, 32425, 32424, 32454, 32455, 32438, 32431, 04159, 04163, 45536, 45541, 45542, 27444, 32410, 32444 (Delipavlov); SOA 04161-04165, 40510, 04149, 45543, 32405, 32406, 04179, 36613, 04175, 36608, 04153 (Delipavlov, Popova); SOA 45537, 45538 (Delipavlov, Chaushev); SOA 36602, 42998, 42999, 45536, 50739, 04147, 34766, 44804, 40510, 50734 (Popova); SOA 27446 (Popova, Tzvetanov); SOA 34738 (Stribrny); SOA 04176, 32398, 44863, 04175, 04176, 30439, 40542, 31172, 31173, 31174 (Ceshmedziev).
**11. Galanthus graecus Orph. ex Boiss. var. maximus:** SOA 04171, 04156, 32407, 04146, 32441, 04157, 04166, 04177, 04161, 04162, 04164, 04165 (Delipavlov); SOA 27448 (Popova).

**12.** ***Galanthus nivalis*** **L.:** Yavashev (1890), Velenovsky (1891, 1898), Toshev (1895, 1903), Kovachev (1890, 1892), Urumov (1897, 1898, 1901, 1904, 1905, 1906, 1908a, 1908b,1908c, 1909, 1913, 1917, 1919, 1925, 1926, 1928, 1929, 1930, 1935a, 1935b); Stoyanov (1966); Delipavlov & Angeliev (1970); Delipavlov (1968, 1971), Kozhuharov (1992); Nikolov et al. (1994); Evstatieva & Vitkova (1999); Evstatieva & Hardalova (2000); Gussev et al. (1997, 2004); Delipavlov & Cheshmedzhiev (2003); Assyov & Petrova (2012); SOA 32413, 27441, 04181, 04182, 04183, 32402, 32403, 04183, 324000, 324001, 32434, 32429, 32430, 32435, 32412, 32424, 04182, 32404, 32415, 32416, 32417, 32418, 32419, 32432, 32433, 32446, 32420, 32421, 32422, 32446, 32447, 32448, 32427, 32428 (Delipavlov); SOA 27447, 27449 – (Delipavlov, Slovakova); SO 83719 (Drianovsky); SO 98451 (Georgiev); SO 13025,13026, 13022, 13027, 13028 (Georgiev); SO 13018 (Grigorov, Jordanov); SO 30097 (Ivancheva); SO 13033, 13019, 13019 (Jordanov); SO 26805, 92655 (Jordanov, Ac. Янев); SOA; SO 13032 (Kitanov); SO 35722 (Mustafov); SO 13030, 13021 (Nejchev); SOM 139481 (Rohod); SO 13037 (Rohod, Vichodcevsky); SOA 36609, 36562, 29564 (Popova); SO 13016, 13026 (Toshev); SO 13035 (Tzvetkov, N. Vihodcevsky); SO 100669, 00703 (Tzonev); SOM 13036, 103195, 13034, 46662- N. Vihodcevsky; SO 29550 (Vasileva); SO 18304, 29555, 29563, 29562, 29559, 29558, 20772, 29557, 20777, 20778, 20775, 20774, 20776, 29551, 29553, 29554, 29556, 20771, 20779, 20780, 20773, 29552, 29561, 29560, 29550 (Vasileva); SO 13029 (Valev), SO 86636 (Yanev).

**13.** ***Galanthus nivalis*** **L. var.** ***gracillis*** **Celak.:** SO 13024 (Jordanov)

**14.** ***Galanthus maximus*** **(Velen.) Stoj. & Stef.:** Kovachev (1900); Velenovsky (1898, 1891), Nejchev (1903, 1908), Urumov (1898,1901, 1905, 1906, 1908, 1909, 1913,1925, 1928, 1929,1930, 1935); SOM 13602, 13607 (Davidoff); SOA 32423, 33819, 33820, 04169, 04170, 04172, 04173, 04172 (Delipavlov); SO 12982 (Georgiev); SO 12999 (Nejchev); SO 13001, 13000, 83718, 12996; 12997,12998, 12995, 34738 (Stribrny); SOM 103197, 103716, 13002 (Vihodcevsky).

**C. Revised herbarium plates from** ***Galanthus nivalis,*** **arranged by floristic regions**

**Black Sea Coast (Sourthern) (13):** SOA 04181, 04182, 04183 (4.02.1964, 23.02.1966, Delipavlov); SOA 32413, 27441 (3.02.1963, Delipavlov); SOA 32402, 32403, 32404, 32415, 32416, 32417 (3.02.1963, Delipavlov); SOA 32418, 32419 (04.02.1964, 04.02.1964, Delipavlov)

**North-Eastern Bulgaria (8):** SOA 324000, 324001 (28.03.1965, Delipavlov); SOA 32434 (27.02.1968, Delipavlov); SOA 32429, 32430 (Delipavlov); SOA 32435, 32412 (27.03.1964, Delipavlov); SOA 32424 (27.02.1968, Delipavlov)

**Tundza Hilly Country (2)** SOA 27447, 27449 (Delipavlov, Slovakova)

**Balkan Range (Western) (2)** SOA 36609, 36562 (04.03.1979, Popova)

**Mt Strandza (12):** SO 98451 (20.02.1977, Georgiev); SOA 32432, 32433 (15.03.1964, Delipavlov); SOA 32446, 32420, 32421, 32422, 32446, 32447, 32448, 32427, 32428 (05.02.1964, Delipavlov)

**D. Revised herbarium plates from** ***Galanthus elwesii*** **arranged by floristic regions**

**1. North–Eastern Bulgaria (22):** SO 13025, 13026 (05.03.1894, Georgiev); SO 35722 (20.03.1973, Mustafov); SOA 33823, 33818 (01.03.1969, Delipavlov); SOA 32462 (27.03.1964, Delipavlov); SOA 27446 (25.02.1972, Popova, Cvetanov); SOA 32441 (25.03.1964, Delipavlov); SOA 32444 (29.03.1964, Delipavlov); SOA 04154, 04155 (23.03.1964, Delipavlov); SOA 32409, 32408 (26.03.1965, Delipavlov); SOA 04142, 04143, 04150 (24.03.1964, Delipavlov); SOA 32442 (29.03.1964, Delipavlov); SOA 27444 (10.03.1968, Delipavlov); SOA 04169, 04170 (15.03.1967, Delipavlov); SOM 13607 (03.03.1895, Б. Davidoff); SOA 32410 (05.03.1965, Delipavlov); SOA 04172 (25.03.1964, Delipavlov)

**2.Danubian plain (6):**SO 97162 (07.04.1993, Tzonev); SO 99150 (15.02.1977, Tzonev); SO 100669 (03.2000, Tzonev); SOA 32414 (12.02.1966, Delipavlov); SOA 04145 (24.03.1964, Delipavlov); SOA 04160 (18.03.1966)
**3.Forebalkan (1):**SOM 13612 (02.1896, Б. Davidoff; Nejchev).
**4. Balkan range (21):** SO 29898 (28.01.1960, Ganchev, Vichodcevsky); SO 58673 (31.03.1974, Koeva); SO 13002 (30.03.1960, Vichodcevsky); SO 12999 (03.1900, Nejchev); SO 13030 (1889, Nejchev); SO 13021 (22.01.1897, Nejchev); SO 13023, 13026 (13.02.1897, Toshev); SO 13022 (22.04.1891, Georgiev); SOA 27448 (28.02.1972, Popova); SOA 40542 (01.05.1984, Ceshmedziev); SOA (02.1904); SOA 31172, 31173, 31174 (12.03.1977, Ceshmedziev); SOA 34766 (16.04.1978, Popova); SOA 04171 (25.03.1964, Delipavlov); SOM 13606 (13.04.1921, Davidoff; J.M.Tzar Boris III).; SOM 103197 (30.03.1960, Vichodcevsky); SOM 103716 (30.03.1960, Vichodcevsky); SOM 13609 (02.04.1893, Toshev; Davidoff); SOM 13602 (23.04. 1915, Б. Davidoff).
**5. Sofia region (4):** SO 13032 (10.04.1949, Kitanov)**;** SO 13034 (26.02.1960, Vichodcevsky); SOA (03.1920); SOM 13603 (4.03.1923, Davidoff, Radev); SOM 103195 (26.02.1960, Vichodcevsky).
**6. Znepole region (4):**SO 13027, 13028 (25.03.1892, Georgiev)**;** SO 30097 (10.04.1971, Ivancheva); SOA (03.1914)
**7. Vitosha region (4):** SO 12982 (02.04.1889, Georgiev); SO 13029 (10.04.1961, Valev); SO 83719 (02.1930, Drianovsky); SOA (05.1923)
**8. Valley of Struma riverStruma Valley (1):** SOA 32445 (14.02.1966, Delipavlov)
**9. Pirin Mts (2):** SOA 45537; 45538 (03.03.1970, Delipavlov, Chaushev)
**10. Rila Mts (4):** SOM 13605 (25.03.1911, B Davodoff); SOM 13604 (25.02.1912, Б. Davidoff); SOM 13610; 3611 (25.02.1912, Б. Davidoff)
**11. Sredna gora Mt (Western) (3):** SO 12983, 12985 (07.04.1968, Simeonovsky); SOM 121447 (7.04.1968, Simeonovsky);
**12. Rhodopes Mts (74):** SO 12994 (23.03.1894, Stribrny); SO 12993 (23.03.1895, Stribrny); SO 12991, 12992 (03.1895, Stribrny)SO 13001, 13000 (13.03.1898, Stribrny); SO 83718 (Stribrny); SO 12995 (03. 1895, Stribrny); SO 12996, 12997 (13.03.1893, Stribrny); SO 12998 (03.1893, Stribrny); SO 18304 (04.1970, Vasileva); SO 29555; 29563 (08.02.1972, Vasileva); SO 29562 (06.02.1972, Vasileva); SO 29559 (15.02.1972, Vasileva); SO 29558 (13.02.1972, Vasileva); SO 20772 (14.02.1972, Vasileva); SO 29557 (11.02.1972, Vasileva); SO 20777; 20778 (04.02.1972, Vasileva); SO 20775 (09.02.1971, Vasileva); SO 20774 (05.02.1971, Vasileva); SO 20776 (07.02.1971, Vasileva); SO 29551 (18.03.1972, Vasileva); SO 29553 (19.02.1972, Vasileva); SO 29554 (19.02.1972, Vasileva)SO 29556 (13.02.1972, Vasileva); SO 20771; 20779 (14.02.1972, Vasileva); SO 20780 (14.02.1971, Vasileva); SO 20773 (24.02.1971, Vasileva); SO 29552 (20.03.1972, Vasileva); SO 29561 (06.02.1972, Vasileva); SO 29560 (17.03.1972, Vasileva); SO 29550 (28.03.1972, Vasileva); SOA 04147 (12.03.1963, Popova); SOA 04161-04165 (16.03.1964, Delipavlov, Popova); SOA 40510, (20.02.1966, Delipavlov § Popova); SOA 36613 (06.02.1976, Delipavlov § Popova); SOA 36608, 04153 (14.02.1979, Delipavlov, Popova); SOA 32398 (13.03.1965, Ceshmedziev); SOA 04149, 04166 (23.03.1964, Delipavlov); SOA 44863 (26.03.1985, Ceshmedziev); SOA 45543 (26.02.1967, Delipavlov); SOA 50734 (31.01.1971, Popova); SOA 33819, 33820 (16.03.1969, Delipavlov); SOA 32405, 32406 (30.03.1964, Delipavlov); SOA 44804 (23.03.1986, Popova); SOA 04156, 04157 (20.03.1964, Delipavlov); SOA 32406 (30.03.1964, Delipavlov); SOA 04176 (09.02.1958); SOA 34738 (03.1905, Stribrny); SOA 04175 (01.03.1953); SOA 40510 (06.02.1976, Popova); SOA 04177 (01.03.1959, Delipavlov); SOA 04179 (07.04.1963, Delipavlov);

SOM 159628 (08.03.2002, Sopotlieva); SOM 159631 (08.03.2002, Sopotlieva); SOM 159829 (08.03.2002, Sopotlieva); SOM 159633 (05.03.2002, Sopotlieva); SOM 159632 (06.03.2002, Sopotlieva); SOM 159634; 159635 (04.03.2002, Sopotlieva); SOM 159630 (07.03.02, Sopotlieva);
**13. Thracian plain (21):** SO 29564 (25.02.1972); SO 13037 (11.02.1968, Rohod, Vichodcevsky); SOA 33827 (10.03.1968, Delipavlov); SOA 32396, 32397 (07.03.1965, Delipavlov); SOA 04163, 32399 (19.02.1966, Delipavlov); SOA 32443 (06.03.1964, Delipavlov); SOA 32459, 32458, 32451, 32453, 32454, 32455 (27.03.1970, Delipavlov); SOA 32438 (15.03.1965, Delipavlov); SOA 32431 (12.02.1966, Delipavlov); SOA 45539, 45540 (28.02.1970, Delipavlov, Dimitrov); SOA 50739 (02.03.1971, Popova); SOA 04159 (23.03.1960, Delipavlov); SOA (04.1929); SOM 139481 (03.02.1979, Rohod).
**14. Tundza hilly country (19):** SO 13033 (09.03.1972, Jordanov); SO 13018 (04.1927, Grigorov & Jordanov); SOA 32436, 32437 (25.03.1970, Delipavlov); SOA 04173, 04172 (22.03.1975, Delipavlov); SOA 32407, 04146 (12.03.1964, Delipavlov); SOA 45536 (22.03.1970, Popova); SOA 30439 (06.03.1974, Ceshmedziev); SOA 45541, 45542 (09.03.1970, Delipavlov); SOA 42998, 42999 (02.04.1985, Popova); SOA 32440 (07.03.1970, Delipavlov); SOA 32425 (29.03.1964, Delipavlov); SOA 32424 (30.03.1965, Delipavlov); SOA 36602 (16.03.1079, Popova); SOM 13613 (02.1926, Davidoff).