Turczaninowia 26, 3: 28–49 (2023)
DOI: 10.14258/turczaninowia.26.3.3
http://turczaninowia.asu.ru

ISSN 1560–7259 (print edition)
TURCZANINOWIA
ISSN 1560–7267 (online edition)

УДК 581.526.425:581.559(470.67)

Classification of Caucasian oak (*Quercus macranthera*) forests from Dagestan (Eastern Caucasus)

N. B. Ermakov[1, 2, 3, 5]*, Yu. V. Plugatar[1, 6], Z. M. Abdurakhmanova[4, 7], Z. M. Asudulayev[4, 8], M. M. Mallaliev[4, 9]

[1] *Nikita Botanical Garden – National Scientific Center of Russian Academy of Sciences, Nikitskiy Spusk, 52, Nikita, Yalta, Republic of Crimea, 298648, Russian Federation*

[2] *N. F. Katanov Khakas State University, Lenina St., 90, Abakan, 655017, Russian Federation*

[3] *Maykop State Technological University, Pervomayskaya St., 191, Maykop, 385000, Republic of Adygeya, Russian Federation*

[4] *Mountain Botanical Garden of the Dagestan Scientific Centre of Russian Academy of Sciences, 45 Gadgiev St., Makhachkala, Republic of Dagestan, 367025, Russian Federation*

[5] *E-mail: brunnera@mail.ru; ORCID iD: https://orcid.org/0000-0001-7550-990X*

[6] *E-mail: plugatar.y@mail.ru; ORCID iD: https://orcid.org/0000-0001-5262-8957*

[7] *E-mail: zagidat.abdurahmanova88@mail.ru; ORCID iD: https://orcid.org/0000-0001-7819-7446*

[8] *E-mail: gorbotsad@mail.ru; ORCID iD: https://orcid.org/0000-0001-5370-6611*

[9] *E-mail: maxim.mallaliev@yandex.ru; ORCID iD: https://orcid.org/0000-0001-9851-2976*

* *Corresponding author*

Keywords: Asia Minor, Braun-Blanquet, broadleaved vegetation, Europe, phytodiversity, *Quercetea pubescentis*, subalpine forests.

Summary. A classification of Caucasian oak (*Quercus macranthera*) forests from Dagestan (Eastern Caucasus) using the Braun-Blanquet method has been developed. Three new associations were described: *Ranunculo buhsei–Quercetum macrantherae* ass. nov., *Betonico macrantherae–Quercetum macrantherae* ass. nov. and *Calamagrostio arundnaceae–Quercetum macrantherae* ass. nov. These communities are characterized by the leading role of sub-Mediterranean thermophilous species and Euro-Siberian meadow-steppe meso-xerophytes which allowed them to be assigned to the class *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959. The results of the study of ecological and plant-geographical properties of described communities revealed their unique feature – the presence of a large group of endemic subalpine Caucasian species. The combination of these ecologically contrasting species groups indicates moderately dry and continental climate of the oak (*Q. macranthera*) forests range in Dagestan and occurring them in the buffer zone between forest, steppe and alpine belts at altitudes of 1400–2100 m. Similar important ecological and floristic features are not typical for other forests of the class *Quercetea pubescentis* in Europe and Asia Minor. This made it possible to justify a new order *Astrantio maximae–Quercetalia macrantherae* ord. nov. containing a single alliance *Astrantio maximae–Quercion macrantherae* all. nov. Diagnostic species of the order and alliance are: *Quercus macranthera, Astrantia maxima, Alchemilla sericata, Anthemis melanoloma, Betonica macrantha, Bupleurum polyphyllum, Calamagrostis arundinacea, Carum meifolium, Chaerophyllum aureum, Cephalaria gigantea, Centaurea salicifolia, Cicerbita racemosa, Erysimum armeniacum, Geranium sylvaticum, Heracleum asperum, Iris colchica, Lathyrus cyaneus, Lilium monadelphum, Medicago glutinosa, Primula macrocalyx, Viburnum lantana, Poa longifolia, Polygonatum verticillatum, Ranunculus buhsei, Rubus saxatilis, Primula ruprechtii, Psephellus dealbatus, P. daghestanicus, Pyrethrum leptophyllum, Pedicularis chroorrhyncha, Sedum oppositifolium, Trifolium canescens, Vicia grossheimii, Vincetoxicum funebre*.

Поступило в редакцию 27.07.2023
Принято к публикации 06.09.2023

Submitted 27.07.2023
Accepted 06.09.2023

Классификация дубовых (*Quercus macranthera*) лесов Дагестана (Восточный Кавказ)

Н. Б. Ермаков[1, 2, 3], Ю. В. Плугатарь[1, 3], И. Абдурахманова[4, 3], М Асадулаев[4], М. М. Маллалиев[4]

[1] *Никитский ботанический сад – Национальный научный центр РАН, ул. Никитский спуск, д. 52, г. Ялта, 298648, Россия*

[2] *Хакасский государственный университет им. Н. Ф. Катанова, ул. Ленина, д. 90, г. Абакан, 655017, Россия*

[3] *Майкопский государственный технологический университет, ул. Первомайская, д. 191, г. Майкоп, 385000, Россия*

[4] *Горный ботанический сад – ОП Дагестанского федерального исследовательского центра РАН, ул. М. Гаджиева, д. 45, г. Махачкала, 367000, Россия*

Ключевые слова: Браун-Бланке, Европа, Малая Азия, субальпийские леса, фиторазнообразие, широколиственная растительность, *Quercetea pubescentis*.

Аннотация. Разработана классификация лесов из дуба кавказского (*Quercus macranthera*) из Дагестана (Восточный Кавказ) с использованием метода Браун-Бланке и кластерного анализа. Описаны три новых ассоциации *Ranunculo buhsei–Quercetum macrantherae* ass. nov., *Betonico macranthae–Quercetum macrantherae* ass. nov., *Calamagrostio arundnaceae–Quercetum macrantherae* ass. nov., которые экологически различаются по факторам тепло-влагообеспеченности местообитаний и подстилающих горных пород. Эти сообщества характеризуются ведущей ролью субсредиземноморских термофильных видов и евросибирских лугово-степных мезо-ксерофитов, что позволило отнести их в класс *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959. Проведенные исследования экологических и ботанико-географических свойств сообществ выявили их уникальную особенность – присутствие обширной группы субальпийских видов преимущественно эндемичного кавказского типа ареала. Сочетание этой группы растений с термофильными субсредиземноморскими термофильными и мезо-ксерофильными лугово-степными видами индицирует сухие и континентальные условия формирования дубовых (*Q. macranthera*) лесов Дагестана на границе лесного, степного и высокогорного поясов на абсолютных высотах 1400–2100 м. Проведенный сравнительный синтаксономический анализ показал, что подобные важные эколого-флористические признаки отсутствуют у других лесов *Quercetea pubescentis* в Европе и Малой Азии, что позволило обосновать описание нового порядка *Astrantio maximae–Quercetalia macrantherae* ord. nov. и единственного союза *Astrantio maximae–Quercion macrantherae* all. nov. Диагностическими видами порядка и союза являются: *Quercus macranthera, Astrantia maxima, Alchemilla sericata, Anthemis melanoloma, Betonica macrantha, Bupleurum polyphyllum, Calamagrostis arundinacea, Carum meifolium, Chaerophyllum aureum, Cephalaria gigantea, Centaurea salicifolia, Cicerbita racemosa, Erysimum armeniacum, Geranium sylvaticum, Heracleum asperum, Iris colchica, Lathyrus cyaneus, Lilium monadelphum, Medicago glutinosa, Primula macrocalyx, Viburnum lantana, Poa longifolia, Polygonatum verticillatum, Ranunculus buhsei, Rubus saxatilis, Primula ruprechtii, Psephellus dealbatus, P. daghestanicus, Pyrethrum leptophyllum, Pedicularis chroorrhyncha, Sedum oppositifolium, Trifolium canescens, Vicia grossheimii, Vincetoxicum funebre*.

Introduction

Caucasian oak (*Quercus macranthera* Fisch. et C. A. Mey. ex Hohen.) forests are unique mountain forest communities with a narrow endemic geographical range in the Caucasus and the adjacent territory of Asia Minor. They are widespread in the upper part of the forest belt at altitudes of 1400–2700 m, where, as a rule, no other types of nemoral forests can grow (Menitsky, 1984). In the Central Caucasus, the small isolated areas of oak (*Q. macranthera*) forests occur in the Greater Caucasian Ridge. They expand their range toward the Eastern part of the Greater and Lesser Caucasus, and in the semi-arid regions of Armenia and Nakhichevan, where Caucasian oak (*Quercus macranthera*) is the only tree species that predominate in forests in the upper mountain belt. In Dagestan, *Q. macranthera* forests have a discontinuous range but they are regularly found at the upper forests limit in the dry and continental internal middle-mountain area, as well as on the Greater Caucasian Ridge and its northern spurs. Further south, *Q. macranthera* forests are found in Georgia, northeastern Turkey and more widely – in northern Iran. In most published sources, information on the diversity of Caucasian oak forests is represented as short descriptions of some communities classified using the dominant system (Dolukhanov, 1955; Gulisashvili et al., 1975). All researchers note the high phytocoenotic

diversity of these forests and their rich floristic composition consisting of various ecological groups of plants: light-demanding forest mesophytes, steppe xerophytes and high-mountain cryophilous plants. There are several regional publications on the classification of Caucasian oak forests using the Braun-Blanquet method. In the earliest publication, Zohary (1963) attributed these forests to the special class *Quercetea macrantherae*, but later he (Zohary, 1973) included them in the class *Fagetea hyrcanica* (together with all Hyrcanian broad-leaved forests). Passarge (1981) assigned beech-hornbeam forests with the participation of *Q. macranthera* from the Central Caucasus – the association *Astrantio–Carpinetum caucasicae* Psssarge 1981 and the alliance *Astrantio–Carpinion caucasicae* Passarge 1981 into the *Querco–Fagetea* class system (order *Lathyro–Carpinetalia* Passarge 1981). Quezel et al. (1980) included oak-hornbeam (*Quercus macranthera, Carpinus betulus*) forests – the association *Scaligerio tripartitae–Carpinetum betuli* Akman et al. 1979 in the alliance *Carpino betuli–Acerion hyrcani* Quézel et al. 1978 (order *Querco cerridis–Carpinetalia orientalis* Quézel et al. 1980, class *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959). Subsequently, all associations of the *Carpino betuli–Acerion hyrcani* were transferred to the alliance *Trachystemono orientalis–Carpinion betuli* Corban et Willner 2020 and the latter was included in the order *Carpinetalia betuli* Fukarek 1968, class *Carpino–Fagetea* (Corban, Willner, 2020). Gholizadeh et al. (2019) proposed to consider the Hyrcanian associations of oak (*Q. macranthera*) forests from Northern Iran in the alliance *Quercion macrantherae* Djazirei ex Gholizadeh et al. 2020, order *Quercetalia pubescenti–petraeae* Klika 1933, class *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959. All the works on the classification of *Q. macranthera* forests mentioned above differ significantly in their syntaxonomic solutions. Therefore, the question of the position of these communities in the vegetation classification system remains open for the time being.

The purpose of the study is to classify oak (*Q. macranthera*) forests from Dagestan (Eastern Caucasus) using the Braun-Blanquet approach and perform a comparative syntaxonomic analysis with the syntaxa described in other regions of Asia Minor.

The ecology of *Quercus macranthera* communities is significantly different from that of other oak forests (and nemoral vegetation as a whole) of the Western Palearctic. *Quercus macranthera* is one of the most drought- and frost-resistant oak species (Menitsky, 1984). It predominates in communities in the moderately cold and cold high-mountainous areas of the Caucasus and adjacent mountain systems of Asia Minor at altitudes of 1400–2700 m, where the growing season lasts 2–2.5 months, and the mean temperature of July is 9–10 °C. In Dagestan, Caucasian oak forests occur at altitudes of 1300–2300 m, in the most continental inland areas, where the mean annual temperature is 6–9 °C, the mean temperature in July is 12–16 °C and the mean temperature in January is –3… –7 °C. This area is characterized by low values of annual precipitation – 400–600 mm. The precipitation in warm period (June – August) is 400 mm and in cold period (December – February) – 130 mm (Akaev et al., 1996). An important ecological feature is occurrence of *Quercus macranthera* forests on shales and sandstones in high-mountains and on limestones in mid-mountains. All habitats of Caucasian oak forests are dry with shallow skeletal soils on shale and calcareous bedrocks.

Materials and methods

The field research was carried out in July 2020. We sampled 24 relevés of 100 m^2 in key areas placed in three isolated massifs of *Quercus macranthera* forests (Fig. 1) from ecologically different regions: Leka mountain ridge (a spur of the Greater Caucasian Ridge, South-Eastern Dagestan), near Rutul village – 9 relevés at altitudes 1796–1905 m; Yabimeer mountain ridge (a spur of the Main Caucasian Ridge, Southern Dagestan), near Choroda village – 8 relevés at altitudes of 1600–1850 m; the Gimrinsky mountain ridge (the mid-mountain part of Inner Dagestan), near Termenlik village – 7 relevés at altitudes of 1329–1410 m. Within each relevé, the percentage cover of the tree, shrub, herb and moss layers was estimated and the cover of particular species in each layer was assessed. Percentage data of each species were converted in the seven-degree Braun-Blanquet (old) cover-abundance scale and constancy species was represented with five-degree scale (I – 1–20 %, II – 21–40 %, III – 41–60 %, IV – 61–80 %, V – 81–100 %) in final classification table. Geographical coordinates (WGS 84) and the altitude of relevés were recorded using a portable GPS device GPS map 60CSx. All relevés were input in database using the software TURBOVEG (Hennekens, Schaminée, 2001). The quantitative classification of the entire set of relevés was carried out using cluster analysis (Ward's method, Euclidian distance)

implemented in Statistica 6.0. The finalization of the classification table was done in the software Juice 7.0 (Tichy, 2002). The forest classification was carried out based on the Braun-Blanquet method (Westhoff, van der Maarel, 1973). The classification of oak (*Q. macranthera*) forests is presented in a species-by-site table, in which diagnostic species were determined for each vegetation unit. Species with an indicator value higher than 40 were considered diagnostic. Results of comparative syntaxonomic analysis are represented in the synoptic table with percentage values for constansy of species. The syntaxa names were given in accordance with the International Code of Phytosociological Nomenclature (Theurillat et al., 2020). Taxonomy: S. K. Czerepanov (1995), M. S. Ignatov et al. (2006).

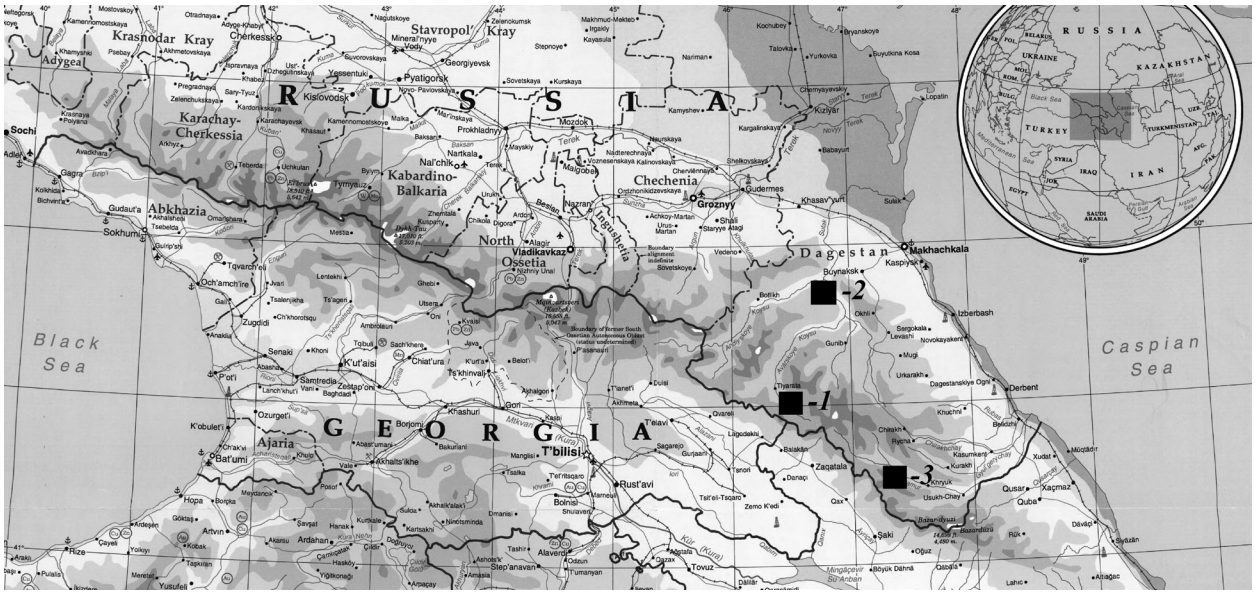

Fig. 1. Geographical locations of relevés used for the syntaxonomic analysis: 1 – relevés made by in the Yabimeer mountain ridge, near Choroda village, Dagestan (Eastern Caucasus), 2 – relevés from the mid-mountain part of Inner Dagestan, Gimrinsky mountain ridge, near Termenlik village (Eastern Caucasus), 3 – relevés from Leka mountain ridge, near Rutul village (Eastern Caucasus).

Results and discussion

The results of the cluster analysis (Fig. 2) demonstrated the division of 24 relevés into three clusters representing three ecological types of Caucasian oak (*Q. macranthera*) forests. The forest communities united in clusters 1 and 2 are significantly different ecologically since they are formed at different altitudes (respectively 1700–2000 m and 1350–1500 m) as well as on different types of bedrocks (respectively limestone rocks and shales). At the same time, clusters 1 and 2 were united into one group at a higher hierarchical level. It is explained by the predominance of drought-tolerant plant species in both types of communities due to their occurrence in the most xerophytic habitats – on steep, south-oriented slopes of mountain ridges (Gimrinskiy and Yabimeyer). The Caucasian oak forests of cluster 3 (Leka mountain ridge) are more mesophilous communities compared to the forests of clusters 1 and 2, because they occur on the shaded northern (north-western, north-eastern) moderately humid mountain slopes. The role of mesic plants is more significant in their composition. All three types of communities identified after cluster analysis were interpreted as new associations.

Betonico macranthae–Quercetum macranthera ass. nov. (Table 1, relevés 10–16; Table 2, ass. no. 18).

Caucasian oak forests on calcareous bedrocks, at the upper limit of the forest belt in the Middle-Mountains of Dagestan.

Diagnostic species: *Galium rubioides, Briza media, Inula britannica, Galium album, Pyrus caucasica, Galium valantioides, Galega orientalis, Geranium sanguineum, Teucrium chamaedrys, Laser trilobum, Dictamnus caucasicus, Elytrigia intermedia, Agrimonia eupatoria, Dianthus caucaseus, Stachys atherocalyx, Aconitum confertiflorum, Campanula alliariifolia, Epipactis helleborine, Verbascum laxum, Festuca rupicola, Echinops sphaerocephalus, Helictotrichon*

armeniacum, Stachys germanica, Senecio integrifolius, Veronica multifida, Carlina vulgaris, Crataegus rhipidophylla, Cephalaria balkharica, Campanula hohenackeri.

Nomenclature type (holotypus) – relevé 16, Table 1 (field relevé no. 9NE20).

The community was described at the upper part of the forest belt in the calcareous middle mountains of Inner Dagestan at altitudes of 1360–1410 m. It occupies warm steep and moderately steep (20–60°) slopes of eastern, south-eastern aspects of the Gimrinskiy mountain ridge. Soils are poorly developed, stony.

The tree layer (with a cover of 45–50 % and height of 13–15 m) is formed by *Quercus macranthera* with an admixture of *Fraxinus excelsior*. A light canopy favors a well-developed, poly-dominant herb layer (a cover of 75–80 %, average height of 35–40 cm) from plants of different ecology: subalpine mesophytes (*Astrantia maxima, Betonica macrantha, Calamagrostis arundinacea, Galega orientalis, Poa longifolia, Primula macrocalyx, Cephalaria balkharica, C. gigantea*), meadow-steppe xerophytes (*Carex humilis, Salvia verticillata, Phleum phleoides, Festuca rupicola, Brachypodium pinnatum, Galium rubioides, Stachys atherocalyx, Echinops sphaerocephalus*) and thermophious sub-Mediterranean species (*Teucrium chamaedrys, Laser trilobum, Clinopodium vulgare, Viola alba, Dictamnus caucasicus, Geranium sanguineum, Psephellus dealbatus, Briza media, Coronilla varia, Campanula alliariifolia*). Forest nemoral (*Salvia glutinosa, Campanula rapunculoides, Agrimonia eupatoria, Epipactis helleborine*) and hemiboreal species (*Rubus saxatilis, Fragaria vesca*) are less abundant.

Calamagrostio arundnaceae–Quercetum macrantherae ass. nov. (Table 1, relevés 17–24; Table 2, ass. no. 19).

Subalpine community of low trees (*Quercus macranthera*) – shiblyak.

Diagnostic species: *Spiraea hypericifolia, Cotoneaster integerrimus, Galium brachyphyllum, Lotus caucasicus, Senecio jacquinianus, Scabiosa owerinii, Dactylis glomerata, Linum tenuifolium, Pimpinella saxifraga, Rosa spinosissima, Leontodon hispidus, Galium aparine, Silene latifolia, Teucrium orientale, Allium kunthianum, Silene compacta, Thymus caucasicus*.

Nomenclature type (holotypus): relevé 20, Table 1 (field relevé no. 19NE20).

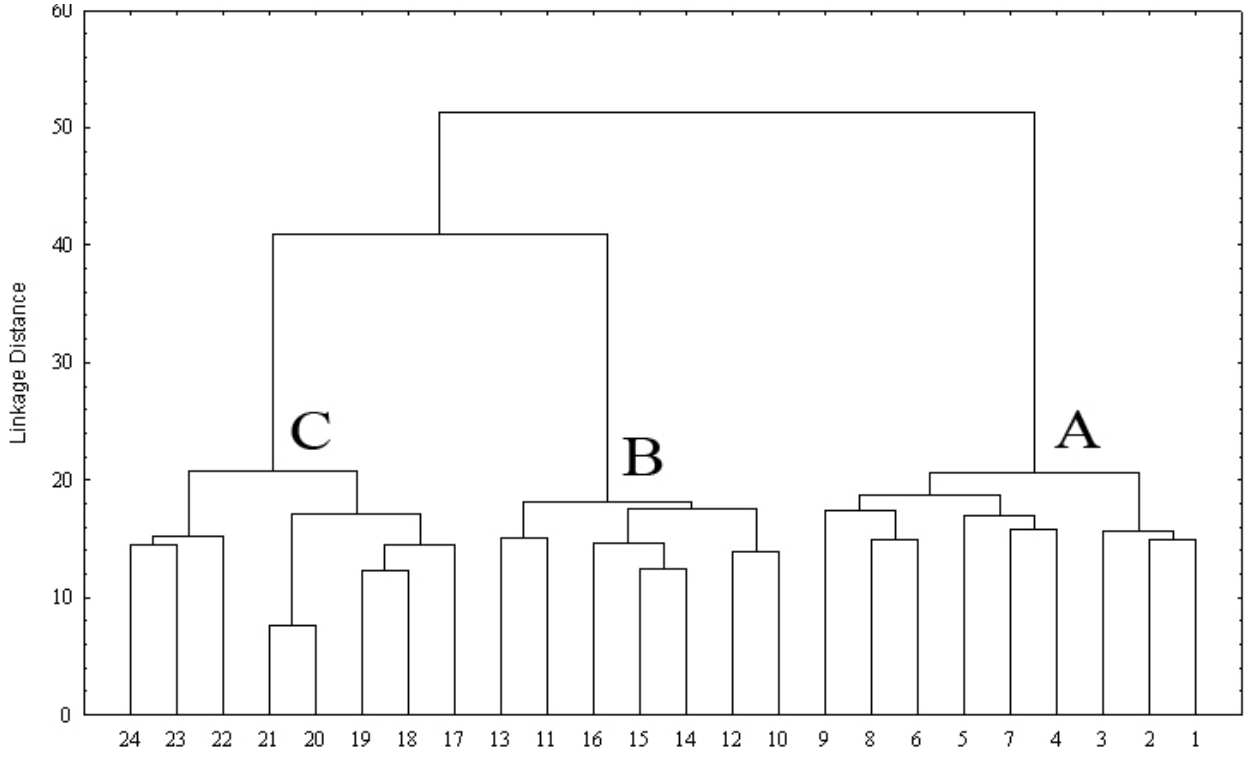

Fig. 2. Results of cluster analysis (Word's method, Euclidian distance) 24 relevés of oak (*Quercus macranthera*) forests from the Eastern Caucasus (Dagestan). Associations: A – *Ranunculo buhsei–Quercetum macrantherae* B – *Betonico macranthae–Quercetum macrantherae*, C – *Calamagrostio arundnaceae–Quercetum macrantherae*

Isolated small areas of this community surrounded by high-mountain meadow steppes are found in the subalpine belt of the Yabimeyer mountain range (the northern spur of the Greater Caucasian Ridge, South-Western Dagestan) on steep (40–60°) slopes of the south-eastern, southern and south-western aspects, at altitudes of 1800–1960 m. The soils are shallow, on shale bedrocks.

A low tree layer (a height of 6–7 m) with a cover of 45–65 % is formed by *Quercus macranthera* with an admixture of *Betula litwinowii*. A characteristic feature of the community is a decrease in the number of thermophilous sub-Mediterranean and mesophilous European nemoral species. Besides, there is an increase in the importance of Eurasian meadow-steppe xerophytes (*Spiraea hypericifolia, Rosa spinosissima, Filipendula vulgaris, Galium verum, Leontodon hispidus, Pimpinella saxifraga, Seseli libanotis*).

Ranunculo buhsei–Quercetum macrantherae ass. nov. (Table 1, relevés 1–9; Table 2, ass. no. 17).

Moderately mesophilous oak (*Q. macranthera*) subalpine forests on shaded mountain slopes.

Diagnostic species: *Dryopteris filix-mas, D. caucasica, Geum urbanum, Scrophularia mollis, Geranium robertianum, Silene multifida, Pimpinella rhodantha, Viola reichenbachiana, Urtica dioica, Lonicera orientalis, L. xylosteum, Aruncus vulgaris, Asplenium trichomanes, Hieracium prenanthoides, Sorbus aucuparia, Ribes orientale, Acer platanoides, Huynhia pulchra, Frangula alnus, Paris quadrifolia, Pinus sylvestris, Sedum spurium, Climacium dendroides, Rhodobryum roseum.*

Nomenclature type (holotypus): relevé 3, Table 1 (field relevé no. 5NE20).

The association was described on the western slope of the Leka Ridge (a spur of the Greater Caucasian Ridge), in the basin of the Lalaon River (Southern Dagestan). The community occurs on steep and moderately steep (15–60°) mountain slopes of mainly northern aspect, at altitudes of 1670–1850 m. Soils are shallow, on shale bedrocks.

Caucasian oak predominates the tree layer (a cover of 65–75 %, average height of 14 m). *Betula litwinowii, Pinus sylvestris, Acer platanoides* and *Populus tremula* are less abundant. The well-developed shrub layer (an average height of 1.7 m and cover of 17 %) is dominated by *Viburnum lantana, Rosa canina, Euonymus verrucosus, Prunus divaricata, Lonicera xylosteum*. Low oppressed hornbeams – *Carpinus betulus* occurs in shrub layer too. A characteristic feature of the community is the higher role of mesophilous nemoral species – *Geranium robertianum, Dryopteris filix-mas, D. caucasica, Viola mirabilis, V. reichenbachiana, Geum urbanum* indicating more humid habitat conditions due to the northern orientation of the mountain slopes. However, drought-resistant meadow-steppe, thermophilous species and subalpine mesophilous plants are also of significant importance there.

A quantitative comparative analysis of 3 described associations from the Eastern Caucasus and 12 associations of ecologically similar Euxinian and Hyrcanian moderately xerophilous forests of the *Quercetea pubescentis* class from Turkey and Northern Iran (Karaer et al., 1999; Özen et al., 2002; Ture et al., 2005; Cansaran et al., 2010; Kaya et al., 2010; Korkmaz et al., 2011; Kenar, 2017; Gholizadeh et al., 2019; Yildirim et al., 2019) was carried out to demonstrate the floristic originality of the oak (*Q. macranthera*) forests associations from Dagestan and their position in the existing vegetation classification system. The results of cluster analysis (Fig. 3) showed the position of East Caucasian associations in the cluster 1 (Fig. 3) and separation of this cluster at the highest hierarchical level from another cluster 2, which united associations of Euxinian and Hyrcanian oak forests belonging to four alliances of the order *Quercetalia pubescentis*: *Quercion macrantherae* Djazirei ex Gholizadeh et al. 2020, *Centaureo hyrcanicae–Carpinion orientalis* Gholizadeh et al., 2020, *Quercion anatolicae* Akman et al. ex Quezel et al. 1992 and *Carpino betuli–Acerion hyrcani* Quezel et al. 1980. Such a high degree of floristic originality of the described three East Caucasian associations of *Q. macranthera* forests is explained by the combination of abundant subalpine, meadow-steppe, thermophilic sub-Mediterranean, nemoral, and hemiboreal species, which is unusual for other dry oak forests of the class *Quercetea pubescentis*. This also indicates the specificity of the habitats of these oak forests growing in a dry continental climate near the eastern border of European broad-leaved vegetation. A significant number of Caucasian endemic plants increases also the floristic originality of the forest communities described in Dagestan. The synoptic table (Table 2) demonstrates and confirms the high syntaxonomic rank of East Caucasian oak forests in the *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959 class system.

Caucasian oak (*Quercus macranthera*) forests from Dagestan (Eastern Caucasus) show significant floristic and ecological differences from similar communities described in Northern Iran, Turkey and the Central Caucasus (Quézel et al., 1978, 1980; Akman et al., 1979; Gholizadeh et al., 2019). They have the

highest values of floristic diversity among all the oak forests of the Euxinian and Hyrcanian provinces (350 species in 24 relevés, 61–96 species per 100 m^2, on average 84 species per 100 m^2). Such a high floristic diversity is associated with the spreading *Quercus macranthera* communities in dry continental climate, in the buffer zone of three belts – steppe, forest and high-mountain at altitudes of 1400–2100 m. The light structure of the tree layers of oak (*Q. macranthera*) forests and significant variations in seasonal humidity and heat conditions result in the occurring in the same community the plants differing in ecology and geography – sub-Mediterranean thermophilous, Eurasian meadow-steppe xerophilous, subalpine, nemoral and hemiboreal mesophilous species. Drought-resistant sub-Mediterranean thermophilous species (*Clinopodium vulgare, Laser trilobum, Dictamnus caucasicus, Leontodon hispidus Lapsana intermedia, Silene italica, Viola alba, Geranium sanguineum, Teucrium chamaedrys, Veronica peduncularis, Berberis vulgaris, Rosa spinosissima Cotoneaster integerrimus*) and Eurasian meadow-steppe xerophytes (*Spiraea hypericifolia, Pimpinella saxifraga, Carex humilis, Carex alba, Thalictrum foetidum, Salvia verticillata, Brachypodium pinnatum, Phleum phleoides, Seseli libanotis, Coronilla varia, Festuca valesiaca, Filipendula vulgaris, Galium verum, Rhamnus cathartica, Juniperus sabina*) are the most numerous of the ecological groups of plants. It allows us to accept the opinion of Gholizadeh et al. (2019) on the belonging of East Caucasian and North Iranian oak (*Q. macranthera*) forests to the sub-Mediterranean class *Quercetea pubescentis*. At the same time, it cannot be argued that absolutely all Caucasian oak (*Q. macranthera*) forests belong to this class system. European and Euro-Siberian mesophilous nemoral species (*Carpinus betulus, Fagus orientalis, Corylus avellana, Euonymus latifolius, Daphne mezereum, Dryopteris filix-mas, Epilobium montanum, Galium odoratum, Salvia glutinosa, Brachypodium sylvaticum, Campanula rapunculoides, Geranium robertianum, Melica nutans, Polystichum braunii, Scutellaria altissima*) predominate in associations with participation *Q. macranthera* (usually mixed forests with *Carpinus betulus* and *Fagus orientalis*) from more humid and less continental areas of North-Eastern Turkey (*Scaligerio tripartitae–Carpinetum betuli* Akman et al. 1979) and the Central Caucasus (*Astrantia–Carpinetum caucasicae* Passarge 1981). Therefore, they are included in the *Carpino–Fagetea* class (Passarge, 1981; Coban, Willner, 2020). Large floristic differences are observed between associations described in the Eastern Caucasus and from geographically close territory of Northern Iran (Gholizadeh et al., 2019). The most important floristic peculiarity of Caucasian oak forests described from Dagestan is the significant participation of subalpine species (*Astrantia maxima, Betonica macrantha, Calamagrostis arundinacea, Alchemilla sericata, Poa longifolia, Carum meifolium, Geranium sylvaticum, Cephalaria gigantea, Iris colchica, Cicerbita racemose, Lilium monadelphum, Ranunculus buhsei, Heracleum asperum, Senecio jacquinianus, Cephalaria balkharica, Helictotrichon armeniacum, Galega orientalis*). They are completely absent in associations from Northern Iran, despite *Q. macranthera* communities are also common near the upper border of the forest belt at high altitudes of 2200–2700 m. This fact requires a special analysis. However, it can be assumed that the reason is that the Caucasian oak forests in Northern Iran are formed geographically in much more southern mountain systems, in a drier climate of the high-mountains which is not favorable for the mesophilous subalpine flora. Gholizadeh et al. (2019) united the Northern Iranian *Q. macranthera* oak forests with the participation of Hyrcanian species into a special regional alliance *Quercion macrantherae* Djazirei ex Gholizadeh, Naqinezhad et Chytry 2020. It was placed in the European order *Quercetalia pubescentis*, because authors could not find significant originality in the floristic compositions of the described Hyrcanian associations. Other regularities are observed in the Caucasian oak forests from Dagestan. The three associations described in this paper have a unique combination of numerous subalpine, meadow-steppe, thermophilous sub-Mediterranean, and nemoral species. This combination is not typical for the syntaxa of thermophilous *Quercetea pubescentis* forests described both in Europe and in the Asia Minor. The unique floristic features of the oak (*Q. macranthera*) forests syntaxa from Dagestan confirmed by the results of quantitative analysis as well as the special climatic conditions of their range in the buffer zone between the forest, steppe and high-mountain belts, allow us to include the described communities in the *Quercetea pubescentis* class system, in the rank of a special order ***Astrantio maximae–Quercetalia macrantherae*** ord. nov. hoc loco. Diagnostic species of the order are *Quercus macranthera, Astrantia maxima, Alchemilla sericata, Anthemis melanoloma, Betonica macrantha, Bupleurum polyphyllum, Calamagrostis arundinacea, Carum meifolium, Chaerophyllum aureum, Cephalaria gigantea, Centaurea salicifolia, Cicerbita racemosa, Erysimum armeniacum, Geranium sylvaticum, Heracleum asperum, Iris colchica, Lathyrus cyaneus, Lilium monadelphum, Medicago glutinosa, Primula*

macrocalyx, Viburnum lantana, Poa longifolia, Polygonatum verticillatum, Ranunculus buhsei, Rubus saxatilis, Primula ruprechtii, Psephellus dealbatus, P. daghestanicus, Pyrethrum leptophyllum, Pedicularis chroorrhyncha, Sedum oppositifolium, Trifolium canescens, Vicia grossheimii, Vincetoxicum funebre. Nomenclature type (holotypus) of the order is the alliance ***Astantio maximae–Quercion macrantherae*** all. nov. The diagnostic species of the alliance are the same as the diagnostic types of the order *Astrantio maximae–Quercetalia macrantherae*. Nomenclature type (holotypus) of the order is the association *Betonico macranthae–Quercetum macrantherae* ass. nov.

It should also be noted that in the western part of the Caucasus there are subalpine communities of another endemic Pontic oak species – *Quercus pontica* (Ermakov et al., 2020). They belong to the class *Betulo carpaticae–Alnetea viridis* Rejmanek ex Boeuf et al. 2014 (order *Acero trautvetteri–Betuletalia litwinowii* Ermakov et al. 2020, alliance *Quercion ponticae* Ermakov et al. 2020). These endemic subalpine Caucasian krummholz are formed in the ultrahumid climate of Colchis and unlike *Q. macranthera* forests they completely lack drought-resistant sub-Mediterranean thermophilous and meadow-steppe species.

At present, the established range of the order *Astrantio maximae–Quercetalia macrantherae* covers the moderately dry, continental high-mountain regions of the Eastern Caucasus. However, similar communities of oak (*Q. macranthera*) forests from the upper part of mountain systems in Armenia and the western part of Azerbaijan characterized by the high climate continentality and moderate humidity can be included in this order.

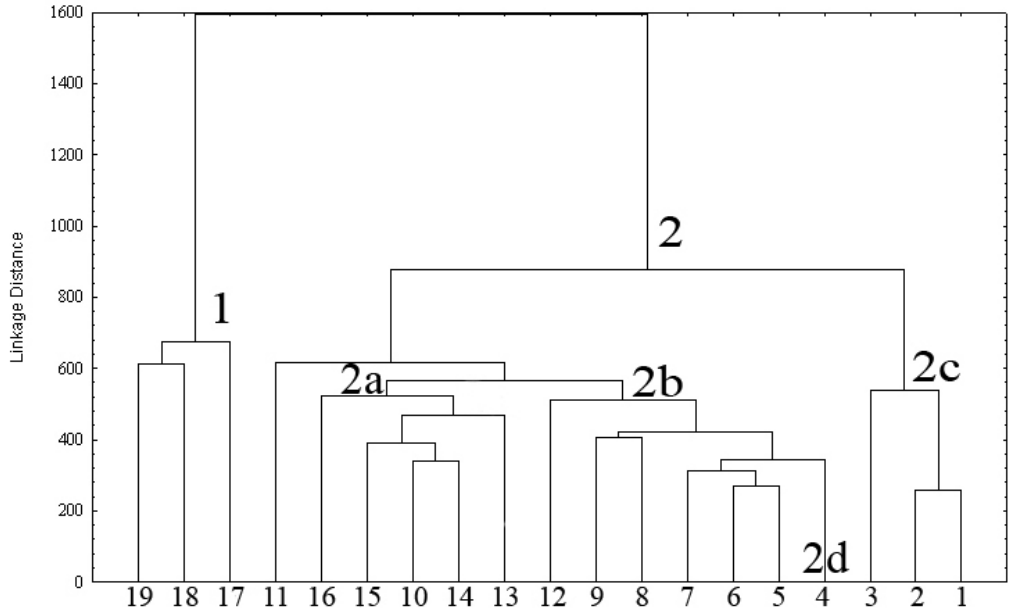

Fig. 3. Dendrogram of 19 associations of sub-Mediterranean thermophilous forests of the *Quercetea pubescentis* from the Eastern Caucasus, Asia Minor and Northern Iran. Numbering (1–19) corresponds to the association numbers in the synoptic Table 2.

Syntaxonomic Prodromus of Caucasian oak (*Q. macranthera*) forests from Dagestan:

Cl. *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959

Ord. *Astrantio maximae–Quercetalia macrantherae* ord. nov.

All. *Astrantio maximae–Quercion macrantherae* all. nov.

Ass. *Ranunculo buhsei–Quercetum macrantherae* ass. nov.

Ass. *Betonico macranthae–Quercetum macrantherae* ass. nov.

Ass. *Calamagrostio arundnaceae–Quercetum macrantherae* ass. nov.

Acknowledgements

We are very grateful to Ramazan Alibegovich Murtazaliev for his great assistance in identifying complex plant taxa. The study was supported by the grant of the Russian Science Foundation No. 22-24-00527, https://rscf.ru/project/22-24-00527/

Table 1

Syntaxa of *Quercus macranthera* forests from Dagestan (Eastern Caucasus)

																													Syntaxa constancy	
Altitude (m)		1808	1753	1822	1850	1677	1700	1817	1609	1740	1410	1316	1359	1308	1361	1321	1360	1905	1930	1959	1883	1890	1796	1800	1857					
Aspect (°)		5	360	270	339	360	350	315	300	250	30	360	90	130	90	90	70	270	240	270	90	270	250	240	150					
Slope (°)		45	30	60	40	15	15	40	30	35	20	15	60	30	30	25	60	45	60	50	55	50	60	40	50					
Cover tree layer (%)		65	70	70	65	75	70	80	80	60	45	50	50	40	50	40	45	50	45	50	60	65	60	60	45					
Cover shrub layer (%)		15	12	25	15	18	10	20	20	3	5	12	5	7	4	5	8	5	5	5	17	15	15	18	10					
Cover herb layer (%)		60	60	65	55	60	60	40	60	60	80	75	75	80	80	75	75	75	80	75	70	75	75	70	70					
Height of tree layer (m)		14	15	14	13	15	15	16	19	15	14	16	13	14	15	15	14	7	6	6	7	7	7	7	6					
Field relevé no.		2NE20	4NE20	5NE20	1NE20	3NE20	3ZA20	1ZA20	2ZA20	4ZA20	6NE20	11NE20	7NE20	12NE20	8NE20	10NE20	9NE20	13NE20	14NE20	15NE20	19NE20	1M20	16NE20	17NE20	18NE20					
Relevé no.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24					
Diagnostic species of the *Ranunculo buhsei–Quercetum macrantherae*																														
Geum urbanum	hl	1	2	1	+	2	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	.		
Climacium dendroides	ml	1	+	.	+	1	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	.		
Dryopteris filix-mas/D. caucasica	hl	2	2	2	2	2	2	2	2	.	.	r	.	.	.	.	.	.	+	+	.	.	+	.	.	V	I	II		
Scrophularia mollis	hl	+	+	+	+	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.		
Geranium robertianum F	hl	1	1	.	1	2	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.		
Silene multifida	hl	+	+	1	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.		
Pimpinella rhodantha	hl	+	2	+	+	.	.	+	+	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	IV	I	.		
Viola reichenbachiana F	hl	.	+	1	+	+	+	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	IV	.	I		
Urtica dioica	hl	+	.	1	+	+	+	+	1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	IV	.	I		
Lonicera xylosteum F	s1	2	2	2	2	.	2	2	2	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	IV	II	.		
Aruncus vulgaris	hl	1	.	+	1	+	.	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.		
Hieracium prenanthoides	hl	+	2	1	+	.	+	.	+	+	.	.	.	.	+	+	.	+	+	1	.	.	.	.	.	IV	II	II		
Sorbus aucuparia	t1	.	1	1	2	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.		
Ribes orientale	s1	1	.	2	+	2	1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	III	.	I		
Rhodobryum roseum	ml	.	+	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	III	.	I		
Acer platanoides F	hl	.	2	+	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.		
Huynhia pulchra	hl	+	.	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.		
Frangula alnus	s1	.	+	1	+	.	.	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.		
Paris quadrifolia F	hl	.	.	+	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.		
Pinus sylvestris	t1	2	.	.	2	.	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.		
Pinus sylvestris	s1	+	+	.	+	.	.	.	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.		
Sedum spurium	hl	1	.	.	2	.	.	2	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.		
Asplenium trichomanes	hl	.	.	+	+	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.		
Lonicera orientalis	s1	.	2	.	.	.	1	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.		
Diagnostic species of the *Betonico macranthae–Quercetum macrantherae*																														
Galium rubioides	hl	.	.	.	.	.	.	.	.	.	2	2	2	2	2	2	2	.	.	.	.	.	.	.	.	.	V	.		
Briza media	hl	.	.	.	.	.	.	.	.	+	+	2	+	2	2	2	+	.	.	.	.	.	.	.	.	I	V	.		
Inula britannica	hl	.	.	.	.	.	.	.	.	.	+	1	1	.	2	2	+	.	.	.	.	.	.	.	.	.	V	.		
Galium album	hl	.	.	.	.	.	.	.	.	.	+	2	+	2	1	.	2	.	.	.	.	.	.	.	.	.	V	.		
Pyrus caucasica	s1	.	.	.	.	.	.	.	.	.	+	1	.	+	+	+	1	.	.	.	.	.	.	.	.	.	V	.		
Galium valantioides	hl	.	.	.	.	.	.	+	.	.	+	+	.	1	+	+	+	.	.	.	.	.	.	.	.	I	V	.		

Table 1 (continued)

Galega orientalis	hl	.	.	.	.	.	.	.	.	.	2	2	2	2	1	2	.	2	.	.	.	.	.	1	.	.	V	II
Geranium sanguineum QP	hl	.	.	.	.	.	.	.	.	.	+	2	2	2	2	2	2	.	.	.	.	.	.	.	.	.	V	.
Teucrium chamaedrys QP	hl	.	.	.	.	.	.	.	.	.	.	2	1	2	.	1	2	.	.	.	.	.	1	.	.	.	IV	I
Laser trilobum QP	hl	.	.	.	.	.	.	.	.	.	.	1	.	2	1	1	2	.	.	.	.	.	.	.	.	.	IV	.
Dictamnus caucasicus QP	hl	.	.	.	.	.	.	.	.	.	.	.	+	+	+	1	2	.	.	.	.	.	.	.	.	.	IV	.
Elytrigia intermedia	hl	.	.	.	.	.	.	.	.	.	+	.	2	.	1	+	+	.	.	.	.	.	.	.	.	.	IV	.
Agrimonia eupatoria	hl	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.	.	.	.	.	.	IV	.
Dianthus caucaseus	hl	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.	.	.	.	.	.	IV	.
Stachys atherocalyx	hl	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	+	.	.	.	.	.	.	.	.	.	IV	.
Aconitum confertiflorum	hl	.	.	.	.	.	.	.	.	+	+	.	+	.	+	+	.	.	.	.	.	.	.	.	.	I	III	.
Campanula alliariifolia	hl	.	.	.	.	.	.	.	.	.	.	.	+	.	2	1	2	.	.	.	.	.	.	.	.	.	III	.
Epipactis helleborine F	hl	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	.	.	.	.	.	.	.	.	.	III	.
Verbascum laxum	hl	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	+	.	.	.	.	.	.	.	.	.	III	.
Festuca rupicola	hl	.	.	.	.	.	.	.	.	.	.	.	1	+	+	+	.	.	.	.	.	.	.	.	+	.	III	I
Echinops sphaerocephalus	hl	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	.	+	.	III	I
Helictotrichon armeniacum	hl	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	1	.	.	.	.	.	.	.	.	.	III	.
Stachys germanica	hl	.	.	.	.	.	.	.	.	+	.	.	.	+	+	+	+	.	.	.	.	.	.	.	.	I	III	.
Senecio integrifolius	hl	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	III	.
Veronica multifida	hl	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	+	.	III	I
Carlina vulgaris	hl	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	III	.
Crataegus rhipidophylla	s1	.	.	.	.	.	.	.	.	.	.	2	+	2	.	.	.	.	.	.	.	.	.	.	.	.	III	.
Cephalaria balkharica	hl	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	III	.
Campanula hohenackeri	hl	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	III	.
Diagnostic species of the *Calamagrostio arundnaceae–Quercetum macrantherae*																												
Spiraea hypericifolia	s1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	1	2	2	1	1	2	.	.	V
Cotoneaster integerrimus QP	s1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	+	+	+	1	1	1	.	+	.	I	V
Galium brachyphyllum	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	1	+	1	+	.	.	V
Lotus caucasicus	hl	.	.	.	.	.	.	.	.	+	.	.	+	1	.	.	.	+	+	.	+	+	+	.	1	I	II	IV
Senecio jacquinianus	hl	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	+	+	+	+	1	.	.	.	I	I	IV
Scabiosa owerinii	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	+	+	.	.	IV
Dactylis glomerata	hl	.	+	.	.	.	.	.	.	.	.	1	.	.	.	.	+	1	+	.	+	+	.	1	.	I	II	IV
Linum tenuifolium	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	+	+	.	.	IV
Pimpinella saxifraga	hl	.	+	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.	.	1	+	+	.	+	.	I	II	III
Rosa spinosissima QP	s1	.	.	1	.	.	.	.	.	.	.	+	.	.	.	.	.	1	.	1	+	1	.	.	.	I	I	III
Leontodon hispidus QP	hl	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	+	+	.	.	+	.	II	III
Galium aparine	hl	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	+	+	.	1	1	.	.	.	II	.	III
Silene latifolia	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	2	.	.	+	.	.	.	.	III
Teucrium orientale	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	+	.	.	III
Allium kunthianum	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	+	.	.	III
Silene compacta	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	+	.	.	III
Thymus caucasicus	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	.	1	.	.	III
Daignostic species of the *Astrantio maximae–Quercion macrantherae* and *Astrantio–Quercetalia macrantherae*																												
Quercus macranthera	t1	4	4	4	4	4	4	4	4	4	3	4	3	3	3	3	3	3	3	4	4	4	4	4	3	V	V	V
Quercus macranthera	t2	.	.	.	.	.	.	.	2	.	2	2	2	2	2	2	2	.	.	.	.	.	.	.	.	I	V	.
Quercus macranthera	hl	2	2	+	+	1	2	.	.	.	.	1	1	2	+	.	1	.	.	.	.	.	.	.	.	IV	IV	.
Primula macrocalyx	hl	2	2	2	2	.	1	+	.	+	1	2	2	2	2	2	2	1	2	1	1	1	2	2	2	IV	V	V
Betonica macrantha	hl	2	2	1	.	2	1	+	.	.	1	2	1	1	2	2	+	2	2	2	2	1	+	.	+	IV	V	V
Astrantia maxima	hl	2	1	+	1	.	+	+	.	.	2	1	1	+	+	+	+	2	2	2	2	2	.	+	.	IV	V	IV

Table 1 (continued)

Calamagrostis arundinacea	hl	+	.	.	+	+	2	+	+	1	2	1	2	2	2	+	+	+	2	2	2	2	.	2	2	IV	V	V
Viburnum lantana	s1	2	2	2	1	+	2	.	+	.	.	2	2	2	1	1	1	1	+	+	1	1	.	1	.	IV	V	IV
Carum meifolium	hl	+	+	.	+	+	+	.	+	+	+	+	+	+	1	+	+	.	+	+	+	.	+	+	+	IV	V	IV
Chaerophyllum aureum	hl	2	2	2	+	2	1	1	2	1	+	+	+	.	2	+	1	2	2	.	.	.	.	+	1	V	V	III
Alchemilla sericata	hl	2	1	2	.	+	.	1	1	2	+	.	+	+	.	.	+	+	+	.	1	1	1	1	2	IV	III	V
Centaurea salicifolia	hl	+	1	+	.	+	+	.	.	1	1	+	.	.	+	.	.	2	2	+	2	1	.	1	.	IV	III	IV
Poa longifolia	hl	+	1	.	.	+	2	.	.	2	.	2	2	2	.	.	1	+	.	2	2	1	2	.	.	III	III	IV
Polygonatum verticillatum	hl	+	2	2	1	2	.	1	.	+	.	.	.	.	.	.	.	+	1	+	+	+	.	1	.	IV	.	IV
Geranium sylvaticum	hl	2	2	2	.	2	2	.	1	1	+	+	.	.	.	.	.	2	2	2	.	.	2	1	.	IV	II	IV
Cicerbita racemosa	hl	2	1	.	+	+	+	.	+	.	.	.	.	.	.	.	.	+	1	1	+	+	.	.	.	IV	.	IV
Rubus saxatilis	hl	1	.	2	1	1	1	.	2	.	2	2	2	.	2	.	2	.	.	.	.	.	.	.	.	IV	IV	.
Iris colchica	hl	.	.	.	.	.	.	.	.	+	+	1	+	2	.	2	1	+	1	2	1	1	.	1	.	I	V	IV
Vincetoxicum funebre	hl	+	+	+	.	1	+	+	1	+	.	.	.	+	+	2	2	.	.	.	.	.	.	+	+	V	III	II
Ranunculus buhsei	hl	2	2	2	.	1	.	+	+	+	+	.	2	+	+	.	.	.	.	.	.	.	.	.	.	IV	III	.
Heracleum asperum	hl	+	+	+	+	+	.	.	1	1	.	+	.	.	.	.	.	.	.	+	.	.	.	+	.	IV	I	II
Primula ruprechtii	hl	.	.	.	.	.	+	.	.	+	+	+	.	.	.	+	.	.	.	.	.	.	+	.	1	II	III	II
Anthemis melanoloma	hl	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.	+	+	.	.	+	1	+	2	+	.	V	IV
Psephellus dealbatus	hl	.	.	.	.	.	.	.	.	.	.	1	.	+	+	2	2	.	2	+	1	1	2	2	2	.	IV	V
Bupleurum polyphyllum	hl	.	.	.	.	.	.	.	.	.	+	.	1	1	1	2	2	1	.	.	+	+	+	+	2	.	V	IV
Pyrethrum leptophyllum	hl	.	.	.	.	.	.	.	.	.	.	1	.	1	+	1	2	.	.	1	+	+	.	1	.	.	IV	III
Medicago glutinosa	hl	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	+	.	+	.	+	+	+	1	.	.	III	IV
Cephalaria gigantea	hl	.	.	.	.	.	.	+	.	1	.	.	+	.	2	+	.	.	+	+	.	.	.	.	+	II	III	II
Lathyrus cyaneus	hl	+	+	1	+	.	.	.	.	1	.	.	.	.	+	.	+	.	+	+	.	.	.	+	+	III	II	III
Trifolium canescens	hl	1	2	1	.	.	.	+	.	2	.	+	+	.	.	.	1	+	.	.	2	.	2	2	2	III	III	IV
Vicia grossheimii	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	2	2	+	+	.	1	.	III	IV
Sedum oppositifolium	hl	.	+	2	+	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	+	1	1	.	III	.	IV
Psephellus daghestanicus	hl	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	+	.	.	1	.	.	.	.	2	.	III	II
Erysimum armeniacum	hl	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	+	.	.	.	.	+	.	.	.	III	II
Pedicularis chroorrhyncha	hl	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	.	.	.	.	+	.	.	.	III	II
Lilium monadelphum	hl	.	.	.	.	.	+	+	+	+	.	.	.	.	+	.	.	.	.	.	.	.	+	.	+	III	I	II
Diagnostic species of the *Quercetea pubescentis*																												
Poa nemoralis	hl	2	2	2	2	.	2	2	2	2	+	2	2	+	1	.	1	2	2	2	2	2	2	2	2	V	V	V
Clinopodium vulgare	hl	.	+	+	.	.	+	+	+	2	1	2	1	1	2	2	1	2	2	2	2	1	2	2	1	IV	V	V
Carex humilis	hl	1	1	2	1	.	1	.	.	.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	III	V	V
Carex alba	hl	.	+	.	+	1	.	.	.	2	.	+	.	.	+	.	+	+	2	1	.	.	.	2	.	III	III	III
Thalictrum foetidum	hl	1	1	2	1	+	+	+	1	1	.	.	+	.	+	+	+	+	.	1	+	+	1	2	1	V	III	V
Lapsana intermedia	hl	1	2	2	1	2	+	+	+	.	.	.	.	.	.	.	.	+	.	+	.	+	.	+	.	V	.	III
Viola alba	hl	+	.	+	.	+	+	.	.	.	+	2	.	+	+	+	.	.	.	.	.	.	.	.	+	III	IV	I
Veronica peduncularis	hl	.	.	+	.	+	+	+	.	+	+	+	+	+	+	.	+	+	+	.	1	+	+	+	+	III	V	V
Berberis vulgaris	s1	+	.	1	+	1	.	2	2	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	1	IV	.	III
Origanum vulgare	hl	1	.	.	.	.	+	+	+	.	+	+	+	1	+	+	+	+	+	+	+	+	+	2	.	III	V	V
Euonymus verrucosus	s1	.	1	2	+	2	1	.	2	+	+	+	.	+	.	.	.	.	.	+	2	1	+	.	.	IV	III	III
Salvia verticillata	hl	.	.	.	.	.	.	.	.	.	1	.	+	+	.	+	+	+	+	+	1	1	+	1	2	.	IV	V
Brachypodium pinnatum	hl	.	.	.	.	.	.	.	.	.	3	.	2	2	2	2	2	2	.	.	1	1	.	2	2	.	V	IV
Phleum phleoides	hl	.	.	.	.	.	.	.	.	.	.	+	2	+	.	+	1	1	1	+	1	1	2	.	2	.	IV	V
Viola mirabilis	hl	2	2	2	1	2	1	+	+	+	1	2	.	2	.	.	.	.	.	.	.	.	.	.	.	V	III	.
Seseli libanotis	hl	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	+	2	r	1	2	2	1	2	2	.	III	V
Coronilla varia	hl	2	.	.	.	.	.	.	.	.	.	.	.	+	1	1	1	.	2	2	2	2	+	.	1	I	III	IV

Table 1 (continued)

Festuca valesiaca	hl	.	+	.	.	.	.	1	.	.	.	.	+	+	.	.	.	+	+	.	.	.	+	1	2	II	II	IV
Filipendula vulgaris	hl	.	.	+	.	.	.	.	.	.	.	r	.	+	.	.	.	+	1	+	+	1	2	1	.	I	II	V
Silene italica	hl	.	+	.	.	2	+	+	.	.	.	.	+	2	.	+	.	.	.	.	.	.	.	.	.	III	III	.
Euphorbia seguieriana	hl	.	.	.	.	.	.	.	.	.	1	.	+	+	1	+	1	.	+	.	+	.	.	+	+	.	V	III
Galium verum	hl	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	+	.	+	+	.	.	+	.	II	III
Rhamnus cathartica	s1	.	.	.	.	.	.	.	.	.	.	2	.	.	+	+	1	.	1	.	.	.	1	.	.	.	III	II
Juniperus sabina	s1	1	+	2	+	.	.	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	IV	.	I
Other species:																															
Rosa canina	s1	2	2	1	+	1	1	.	1	1	.	2	2	.	2	2	2	2	2	2	2	2	2	2	.	V	IV	V
Fragaria vesca	hl	2	2	2	2	+	2	+	1	2	.	2	.	2	2	1	.	1	1	1	+	+	2	.	.	V	III	IV
Rumex acetosa	hl	+	+	.	+	.	.	.	.	+	+	+	+	.	+	+	.	+	+	.	.	.	+	+	+	III	IV	IV
Campanula rapunculoides F	hl	+	.	2	+	1	+	.	.	+	+	.	+	1	+	2	2	1	2	1	1	1	2	2	2	IV	V	V
Salvia glutinosa F	hl	2	2	2	2	1	2	.	2	1	.	2	+	1	2	2	+	.	.	.	.	.	.	.	.	V	V	.
Cruciata laevipes	hl	+	1	+	.	.	+	+	+	+	+	+	.	.	1	.	.	+	.	+	+	+	.	+	.	IV	III	IV
Carex digitata F	hl	.	2	.	1	+	.	+	+	.	.	.	+	.	2	.	2	.	.	.	.	.	2	1	.	III	III	II
Acer platanoides F	s1	.	.	2	2	2	+	1	.	.	.	+	.	+	.	.	+	.	.	.	.	.	.	.	.	III	III	.
Polygonatum glaberrimum	hl	2	2	2	2	2	+	.	1	.	.	.	.	.	+	.	1	1	2	1	2	1	1	1	.	IV	II	V
Lamium album	hl	+	+	1	+	2	2	.	2	.	.	+	.	.	.	.	.	+	+	1	.	.	.	.	+	IV	I	III
Solidago virgaurea	hl	+	1	1	+	2	.	+	+	1	+	+	.	.	+	.	.	.	.	.	.	.	.	+	.	.	V	III	I
Achillea millefolium	hl	1	.	.	.	.	+	.	.	+	+	+	+	+	+	+	+	3	+	+	+	+	1	+	1	II	V	V
Melampyrum arvense	hl	.	+	.	.	.	.	.	.	.	.	+	+	+	+	+	+	.	.	.	+	+	+	1	+	I	V	IV
Hieracium umbellatum	hl	.	.	1	.	.	.	.	.	2	+	.	1	.	+	+	1	2	1	.	.	.	+	2	2	II	IV	IV
Hypericum hirsutum	hl	.	+	+	.	.	.	+	+	.	+	.	.	.	.	.	.	+	.	+	+	+	+	.	1	III	I	IV
Arabis mollis	hl	.	.	+	1	+	+	.	.	.	.	+	.	.	+	+	+	.	.	.	.	.	.	.	.	III	III	.
Turritis glabra	hl	.	.	.	.	.	.	.	.	.	.	.	+	2	+	+	+	.	+	+	+	+	.	.	.	.	IV	III
Cirsium echinus	hl	+	+	+	+	.	+	.	.	.	.	+	+	+	+	+	+	.	.	.	.	.	.	.	+	III	V	I
Epilobium montanum	hl	.	.	2	+	.	1	1	1	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.	.	III	.	IV
Melica uniflora F	hl	+	+	.	.	.	+	.	+	+	+	2	+	1	1	+	.	.	.	.	.	.	.	.	.	III	V	.
Cystopteris fragilis	hl	+	.	+	+	.	1	+	+	+	.	.	.	.	.	.	.	+	+	.	.	.	+	.	+	IV	.	III
Plagiomnium sp.	ml	1	+	2	.	1	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.
Polygonatum orientale	hl	+	.	.	.	.	+	2	1	+	.	.	+	2	2	2	2	.	.	.	.	.	.	.	.	III	IV	.
Carpinus betulus F	s1	+	1	1	.	r	.	.	.	+	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	III	III	.
Fraxinus excelsior F	s1	2	.	.	.	.	.	.	.	.	.	.	1	1	+	1	1	.	.	.	.	.	.	.	.	I	IV	.
Fraxinus excelsior F	t2	.	.	.	.	.	.	.	.	.	.	.	2	.	2	1	.	.	.	.	.	.	.	.	.	.	III	.
Tilia cordata	s1	.	.	.	.	.	.	.	1	+	.	+	.	+	.	.	+	.	.	.	.	.	.	.	.	II	III	.
Cerastium davuricum	hl	+	+	.	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	III	.	II
Geranium platypetalum	hl	2	1	.	2	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	+	III	.	II
Prunus divaricata	s1	1	+	2	1	2	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	III	II	.
Seseli peucedanoides	hl	+	+	.	.	+	.	+	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	III	II	.
Anthriscus sylvestris	hl	.	.	.	.	+	.	.	.	.	.	+	.	.	+	.	.	1	.	+	+	+	.	.	.	I	II	III
Luzula multiflora	hl	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	.	.	II	.	III
Trifolium alpestre	hl	.	.	+	+	1	.	.	.	1	.	+	+	+	.	.	1	+	2	.	.	2	.	.	.	III	III	II
Quercus macranthera	s1	1	2	2	.	.	.	.	1	.	2	.	1	.	1	.	2	.	.	.	.	.	.	.	.	III	III	.
Trifolium pratense	hl	+	1	+	+	.	.	1	.	.	.	1	.	2	+	.	2	2	+	+	.	.	.	.	1	III	III	III
Carpinus betulus F	t2	.	.	.	.	.	.	.	.	.	.	2	.	.	+	1	2	.	.	.	.	.	.	.	.	III	.	
Sorbus aucuparia	s1	1	.	1	.	.	.	.	2	.	1	2	.	1	.	.	+	.	.	+	.	.	.	.	.	II	III	I

Species with low occurrence: Species with low occurrence: *Abietinella abietina* (ml) – 15(+), 17(+), 22(+); *Acer campestre* (s1) – 5(+); *Acer laetum* (s1) – 1(+), 5(+); *Acer platanoides* (t1) – 4(2), 5(2), 7(2); *Acer platanoides* (t2) – 8(1); *Acer*

pseudoplatanus (hl) – 11(+); *Acer trautvetteri* (t2) – 7(1); *Acer trautvetteri* (s1) – 4(1), 19(+); *A. trautvetteri* (hl) – 1(+); *Achillea biserrata* (hl) – 20(+), 21(+); *Acinos arvensis* (hl) – 11(+); *Aconitum nasutum* (hl) – 5(1), 9(+); *A. orientale* (hl) – 9(+), 10(+); *Aconogonon alpinum* (hl) – 19(+); *Aegonychon purpureo-caeruleum* (hl) – 14(+); *Agrostis tenuis* (hl) – 17(+), 21(+), 22(+); *Alyssum murale* (hl) – 15(+), 24(+); *Androsace villosa* (hl) – 20(+), 21(+), 23(+); *Anemonastrum fasciculatum* (hl) – 10(1); *Anthemis species* (hl) – 13(1); *Arabis sagittata* (hl) – 6(+), 11(+), 16(+), 21(+), 24(+); *A. turrita* (hl) – 6(+), 8(1); *Arnebia pulchra* (hl) – 1(+); *Artemisia absinthium* (hl) – 7(+); *A. chamaemelifolia* (hl) – 7(+); *A. procera* (hl) – 21(+); *A.vulgaris* (hl) – 17(+); *Asplenium septentrionale* (hl) – 9(+), 22(+); *Aster amelloides* (hl) – 13(1), 14(+), 22(+), 23(+), 24(2); *Astragalus danicus* (hl) – 22(+); *A. melilotoides* (hl) – 18(+), 22(+); *Asyneuma campanuloides* (hl) – 4(+), 5(+), 6(1), 17(1); *Betonica officinalis* (hl) – 11(+), 13(2); *Betula litwinowii* (t1) – 2(2), 3(2), 4(2), 20(2), 21(2), 22(2); *B. litwinowii* (s1) – 10(+); *Bromopsis riparia* (hl) – 3(+), 12(2), 24(+); *Calamagrostis epigeios* (hl) – 20(+), 21(+); *Campanula argunensis* (hl) – 7(+); *C. collina* (hl) – 7(+), 8(+), 10(+); *C. glomerata* (hl) – 12(2); *C.lambertiana* (hl) – 11(2), 14(2), 19(+), 23(+); *C. longistyla* (hl) – 2(+), 6(+), 7(1); *Campanula sp.* (hl) – 14(+); *Cardamine impatiens* (hl) – 4(+), 7(+); *Carex capitellata* (hl) – 2(+), 11(+); *C. caryophyllea* (s1) – 16(+); *C. polyphylla* (hl) – 2(+), 10(+), 19(1); *Carex* sp. (hl) – 22(+); *C. ulobasis* (hl) – 8(1); *Cerastium arvense* (hl) – 2(+); *C. holosteoides* (hl) – 9(+), 20(+), 21(+); *Corallorhiza trifida* (hl) – 4*; *Crepis caucasica* (hl) – 3(2), 5(+), 8(+), 18(+), 19(+); *Cruciata glabra* (hl) – 6(+), 7(+), 15(+); *Daphne glomerata* (s1) – 1(+), 3(+); *D. mezereum* (s1) – 2(1), 4(+); *Deschampsia flexuosa* (hl) – 10(+), 12(1); *Dianthus cretaceus* (hl) – 19(2), 22(+); *Doronicum orientale* (hl) – 2(+); *Dracocephalum ruyschiana* (hl) – 19(+), 23(+); *Elymus caninus* (hl) – 4(+), 19(1); *Erigeron orientalis* (hl) – 24(+); *Euonymus europaeus* (s1) – 6(2), 8(2), 9(1); *E. latifolius* (s1) – 12(+); *Euphorbia virgata* (hl) – 21(+); *Euphrasia sp.* (hl) – 20(+), 21(+); *Fagus orientalis* (s1) – 11(+), 12(+); *F. orientalis* (t2) – 14(1), 16(2); *Festuca arundinacea* (hl) – 2(+), 14(+), 16(+), 17(+), 20(+); *F.gigantea* (hl) – 3(+); *F. ovina* (hl) – 1(+); *F. pratensis* (hl) – 2(+); *Fraxinus excelsior* (t1) – 11(2); *F. excelsior* (hl) – 5(2), 12(1); *Galatella linosyris* (hl) – 19(+); *Galium mollugo* (hl) – 22(+), 23(+); *G. odoratum* (hl) – 2(1), 9(2), 11(+); *Gentiana septemfida* (hl) – 1(+), 4(+); *Geranium pratense* (hl) – 17(+); *Goodyera repens* (hl) – 4(r); *Grossularia uva–crispa* (s1) – 4(2), 5(+), 8(+), 18(+), 22(+), 23(+); *Gymnadenia conopsea* (hl) – 10(+); *Gypsophila elegans* (hl) – 17(+), 24(+); *Helianthemum grandiflorum* (hl) – 12(+); *Hieracium erythrocarpum* (hl) – 2(+); *H. piloselloides* (hl) – 3(+), 22(+), 24(+); *Hylotelephium caucasicum* (hl) – 13(+), 15(+), 17(1), 18(1), 19(1), 20(1); *Hypericum perforatum* (hl) – 6(+), 9(+), 11(+), 18(1), 22(1); *Inula salicina* (hl) – 13(+), 14(+); *Juniperus oblonga* (s1) – 2(+), 8(2), 22(2), 23(2), 24(2); *Knautia montana* (hl) – 17(+); *Lathyrus laxiflorus* (hl) – 1(+), 2(+); *L. pratensis* (hl) – 1(+), 16(+); *Ligustrum vulgare* (s1) – 15(+); *Linum hypericifolium* (hl) – 1(+), 4(+), 10(+), 18(+), 20(+), 21(+); *L. nervosum* (hl) – 17(+), 23(+); *Listera cordata* (hl) – 6(+); *Lithospermum officinale* (hl) – 6(+), 7(+); *Lysimachia verticillaris* (hl) – 11(+); *Melandrium album* (hl) – 23(+), 24(+); *Melica transsilvanica* (hl) – 20(+), 21(+), 22(+); *Mespilus germanica* (s1) – 11(1), 16(+); *Moehringia lateriflora* (hl) – 12(+); *Myosotis sylvatica* (hl) – 24(+); *Neottia nidus–avis* (hl) – 1(+), 9(+); *Nepeta grandiflora* (hl) – 14(+), 16(+); *Oberna behen* (hl) – 1(+), 9(+), 13(+), 14(+), 15(+); *O. multifida* (hl) – 8(+); *Orobanche gamosepala* (hl) – 16(+), 19(+), 20(+), 21(+); *Oxalis acetosella* (hl) – 5(+), 6(2), 8(2); *Padus avium* (s1) – 5(+), 7(1); *Pedicularis condensata* (hl) – 9(+); *Peltigera aphthosa* (ml) – 4(+), 17(+); *Phleum pratense* (hl) – 8(1), 17(1); *Pimpinella tragium* (hl) – 17(+); *P. tripartita* (hl) – 6(+); *Plagiomnium medium* (ml) – 4(2); *Plantago major* (hl) – 17(+); *P. saxatilis* (hl) – 22(+), 23(+), 24(+); *Platanthera bifolia* (hl) – 6(+); *P. chlorantha* (hl) – 1(+), 2(+); *Poa species* (hl) – 2(+); *Polemonium acutiflorum* (hl) – 5(+); *Polygala vulgaris* (hl) – 2(+), 4(+), 17(+), 20(+); *Polygonatum multiflorum* (hl) – 5(+), 20(+), 21(1); *Polygonum convolvulus* (hl) – 17(+), 18(+), 22(+), 23(+); *Polypodium vulgare* (hl) – 3(1), 6(+), 8(+), 9(1), 19(+), 21(+), 23(+); *Populus tremula* (t1) – 1(2); *P. tremula* (s1) – 22(1), 23(+); *Potentilla adenophylla* (hl) – 24(+); *P. argentea* (hl) – 7(+); *P. foliosa* (hl) – 22(+); *P. micrantha* (hl) – 4(+), 5(+), 6(+), 8(+), 10(+), 15(+), 23(+); *P. verna* (hl) – 18(+), 20(+), 21(+); *Primula cordifolia* (hl) – 17(2); *Prunella vulgaris* (hl) – 1(+), 2(+), 7(+), 8(+); *Prunus caspica* (s1) – 5(+), 7(1); *Pyrethrum parthenifolium* (hl) – 4(+), 7(+), 16(2), 21(1), 22(2); *Ranunculus caucasicus* (hl) – 4(+), 6(+), 7(+), 17(+), 22(2); *R. oreophilus* (hl) – 4(+), 8(1); *Rosa oxyodon* (s1) – 23(+); Rosa *sp.* (s1) – 14(1); *Rubus caucasicus* (s1) – 8(+); *R. idaeus* (s1) – 17(+), 18(+), 19(+); *Salix caprea* (t1) – 2(2), 4(2), 5(2); *S. veriviminalis* (hl) – 12(1); *Scabiosa bipinnata* (hl) – 13(+), 16(+); *Scrophularia divaricata* (hl) – 7(+); *Scrophularia nodosa* (hl) – 11(+); *S. rupestris* (hl) – 19(+), 22(+); *Scutellaria oreophylla* (hl) – 21(+), 22(+), 24(+); *Securigera varia* (hl) – 7(+), 9(1); *Sedum hispanicum* (hl) – 21(1), 24(2); *Selaginella helvetica* (hl) – 4(+); *Sempervivum caucasicum* (hl) – 9(+), 22(+); *Senecio lapsanoides* (hl) – 5(+), 11(+), 15(+); *S. racemosus* (hl) – 9(+); *Senecio* sp. (hl) – 14(+); *Sesleria phleoides* (hl) – 12(+), 13(1); *Silene saxatilis* (hl) – 22(+); *S. vulgaris* (hl) – 19(+), 20(+), 21(+); *Sobolewskia caucasica* (hl) – 6(+), 7(+), 18(+); *Sorbus aucuparia* (t2) – 11(1); *S. aucuparia* (hl) – 1(+), 2(1); *Stachys officinalis* (hl) – 11(+); *S. sylvatica* (hl) – 7(1), 8(+); *Stellaria holostea* (hl) – 6(+), 18(r), 19(+); *S. nemorum* (hl) – 1(+); *Stellaria* sp. (hl) – 20(+); *Swida australis* (s1) – 1(2), 16(+); *Symphytum asperum* (hl) – 6(+), 8(1), 17(+), 18(+), 23(+); *S. caucasicum* (hl) – 5(+), 24(+); *Tanacetum parthenifolium* (hl) – 17(1), 19(+), 20(+); *Taraxacum officinale* (hl) – 4(r); *Thalictrum minus* (hl) – 11(+), 18(1), 19(+), 20(1), 21(+); *Thesium ramosum* (hl) – 22(+); *Tilia begoniifolia* (s1) – 5(+); *T. begoniifolia* (hl) – 2(1); *Tragopogon graminifolius* (hl) – 19(+), 22(+); *Trifolium ambiguum* (hl) – 4(+), 7(1); *T. arvense* (hl) – 21(+); *T. campestre* (hl) – 4(+), 20(+), 21(+); *T. medium* (hl) – 17(+); *Trifolium* sp. (hl) – 19(2); *Tripleurospermum ambiguum* (hl) – 9(1); *Ulmus glabra* (s1) – 14(+); *Valeriana officinalis* (hl) – 12(+), 17(+), 18(+), 19(+); *V. tiliifolia* (hl) – 1(1), 3(2), 4(2), 12(+), 19(+); *Veronica chamaedrys* (hl) – 7(2), 8(+), 9(1); *V. gentianoides* (hl) – 12(+), 17(+), 18(+), 24(+); *V. hederifolia* (hl) – 5(+), 7(1); *V. propinqua* (hl) – 6(1); *Vicia balansae* (hl) – 10(+), 14(+); *V. tenuifolia* (hl) – 1(+); *Vinca herbacea* (hl) – 15(2); *Viola hirta* (hl) – 5(+); *Ziziphora puschkinii* (hl) – 17(+).

Notes: All relevés were performed in Dagestan Republic. Authors: N. Ermakov, Z. Abdurakhmanova, M. Mallaliyev. Dates: relevés no. 1, 2 – 07 VIII 2020; 3–5 – 08 VIII 2020; 6, 7 – 09 VIII 2020; 8–12 – 10 VIII 2020; 13–20 – 12 VIII 2020.

Localities: near Rutul village – 1 – 9; near Termenlik village – 10 – 16, near Choroda village – 17 – 24.
Coordinates: 1 – 41°30′03.3″N, 47°23′39.5″E; 2 – 41°30′10.3″N, 47°23′43.7″E; 3 – 41°30′01.3″N, 47°23′38.5″E; 4 – 41°30′00.1″N, 47°23′38″E; 5 – 41°30′14″N, 47°23′52.6″E; 6 – 41°30'6.0"N, 47°23'30.0"E; 7 – 41°30'0.0"N, 47°23'24.0"E; 8 – 41°30'12.0"N, 47°24'6.0"E; 9 – 41°30'6.0"N, 47°23'30.0"E; 10 – 42°43′59.1″N, 46°39′03.5″E; 11 – 42°44′24.7N″, 46°59′16″E; 12 – 42°44′08.1″N, 46°59′08.6″E; 13 – 42°44′24.3″N, 46°59′17.6″E; 14 – 42°44′12.1″N, 46°59′10.2″E; 15 – 42°44′16.5″N, 46°59′13.7″E; 16 – 42°44′09.8″N, 46°59′09.2″E; 17 – 41°59′11.6″N, 46°29′19.1″E; 18 – 41°59′11.6″N, 46°29′20.4″E; 19 – 41°59′12.8″N, 46°29′22.1″E; 20 – 41°59′18.6″N, 46°29′29.7″E; 21 – 41°59′21.1″N, 46°29′33.2″E; 22 – 41°58′41″N, 46°29′58.2″E; 23 – 41°58′41.4″N, 46°29′57.7″E; 24 – 41°59′11″N, 46°2905.6″E.
Designations here and in table 2: t1 – tree layer, higher sublayer; t2 – tree layer, lower sublayer; s1 – shrub layer; hl – grass layer; ml – moss layer; diagnostic species: F – class *Carpino–Fagetea sylvaticae*; PUB – class *Quercetea pubescentis*.

Table 2

Synoptic table of the *Quercetea pubescentis* syntaxa from Euxinian and Hyrcanian provinces

Association (ass.) no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
Differential species (DS) of the ass. *Fago orientalis–Quercetum macrantherae* Gholizadeh et al. 2020																			
Fagus orientalis F	99	33	30	7	.	30	.	.	.	.	.	.	.	.	.	.	.	57	.
Polystichum aculeatum F	67	22	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cardamine impatiens/ parviflora F	56	22	.	14	.	.	.	.	.	.	.	.	.	.	.	.	22	.	.
DS ass. *Aceri hyrcani–Quercetum macrantherae* Klein et Lacoste ex Gholizadeh et al. 2020																			
Acer hyrcanum PUB	56	99	45	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cervaria cervariifolia	33	67	.	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
DS ass. *Querco macrantherae–Betuletum pendulae* Ejtehadi et al. ex Gholizadeh et al. 2020																			
Betula pendula	.	.	99	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca ovina	.	.	75	.	.	.	.	.	.	.	.	.	.	.	4	.	11	.	.
Thalictrum minus	.	11	75	.	.	.	.	10	.	.	.	.	.	.	.	.	.	14	50
Bupleurum falcatum	.	22	75	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dionysia aretioides	.	.	70	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Allium rubellum	.	.	70	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum lenkoranicum	22	.	65	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bromopsis benekenii F	11	11	60	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum nervosum	.	.	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25
Cervaria caucasica	.	.	55	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scabiosa hyrcanica	.	.	55	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gypsophila aretioides	.	.	55	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acer platanoides F	.	.	50	7	.	.	.	.	.	.	.	.	.	.	.	.	78	43	.
Crucianella filifolia	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum usitatissimum	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Heracleum persicum	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Delphinium elbrusense	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thlaspi hastulatum	.	11	45	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rosa hemisphaerica	.	.	45	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pimpinella peregrina	.	.	45	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
DS ass. *Centaureo hyrcanicae–Carpinetum orientalis* Gholizadeh et al. 2020 and all. *Centaureo hyrcanicae–Carpinion orientalis* Gholizadeh et al. 2020																			
Quercus castaneifolia	.	.	.	64	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mespilus germanica F	22	11	.	50	.	.	.	.	.	.	.	30	.	.	.	.	.	29	.
Viscum album	11	.	.	43	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acer cappadocicum	33	22	.	43	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea hyrcanica	11	.	.	43	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 2 (continued)

DS ass. *Carpino orientalis–Quercetum cerridis* Kaya et al. 2010																				
Crepis foetida	.	.	.	.	70	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hippocrepis emeroides	.	.	.	.	50	.	30	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthemis albida	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus finitimus	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Avena barbata	.	.	.	.	50	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.
DS ass. *Carpino betuli–Acerion hyrcani* Quezel et all. 1980																				
Quercus iberica	.	.	30	29	.	90	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pinus pallasiana	.	.	.	.	.	70	.	.	.	10	.	.	.	.	.	.	.	.	.	.
Euphorbia amygdaloides	22	11	.	36	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.
DS ass. *Querco boissieri–Carpinetum orientalis* Kaya et al. 2010																				
Quercus boissieri PUB	.	.	.	.	30	.	90	.	.	.	.	.	.	.	.	.	.	.	.	.
Pistacia palaestina	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.
Campanula hemschinica	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.
Crataegus microphylla	22	11	.	36	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhus coriaria PUB	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.
Phillyrea latifolia	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.
DS ass. *Corno mari–Quercetum cerridis* Korkmaz et al. 2011																				
Viola odorata F	11	.	.	29	.	.	.	70	30	.	.	.	.	.	.	.	.	.	.	.
Lathyrus tukhtensis	.	.	.	.	.	.	.	50	10	.	.	.	.	.	.	.	.	.	.	.
Ruscus aculeatus PUB	.	.	.	.	.	.	.	50	30	10	.	.	.	.	.	.	.	.	.	.
Sorbus umbellata	.	.	.	.	.	.	.	50	.	.	.	.	10	.	.	.	.	.	.	.
Nepeta sulphurea	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.
Scutellaria albida	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.
DS ass. *Cephalanthero rubrae–Quercetum cerris* Karer et al. 1999																				
Ononis pusilla	.	.	.	.	.	.	.	10	70	.	.	.	.	.	.	70	.	.	.	
Trifolium campestre	.	.	.	.	.	.	.	.	70	30	.	.	.	.	40	.	11	.	25	
Scabiosa columbaria	.	.	.	.	.	.	.	.	70	.	46	.	.	.	.	50	.	.	.	
Pistacia terebinthus	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	
Myosotis ramosissima	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	
Trigonella coerulescens	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	
Dianthus orientalis	.	.	30	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	
DS ass. *Argyrolobio biebersteinii–Quercetum cerridis* Ture et al. 2005																				
Doronicum orientale	.	.	.	.	.	.	.	50	.	90	.	.	.	.	.	.	11	.	.	
Galium rotundifolium PUB	11	.	.	7	.	.	.	.	.	70	.	.	.	.	.	.	.	.	.	
Euphorbia stricta	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	
Hypericum calycinum	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	
DS ass. *Sideritido amasiacae–Quercetum pubescentis* Yidirim et al. 2019																				
Scutellaria salviifolia	.	.	.	.	10	.	.	.	.	.	85	.	.	.	.	30	.	.	.	
Ornithogalum pyrenaicum	.	.	.	.	.	.	.	.	.	.	85	.	.	.	.	.	.	.	.	
Thymus spyleus	.	.	.	.	.	.	.	.	.	.	85	.	.	.	.	.	.	.	.	
Erysimum cuspidatum	.	.	.	.	.	.	.	10	.	.	77	.	.	.	.	.	.	.	.	
Trifolium pannonicum	.	.	.	.	.	.	.	10	.	.	77	.	.	.	68	30	.	.	.	
Ceterach officinarum	.	.	.	.	.	.	.	.	.	.	54	.	.	.	.	.	.	.	.	
Polygala supina	.	.	.	.	50	.	.	.	.	.	69	.	.	.	.	.	.	.	.	
Securigera orientalis	.	.	.	.	.	.	.	.	.	.	69	.	.	.	.	.	.	.	.	
Prunella laciniata	.	.	.	.	.	.	.	.	.	.	62	30	.	.	.	.	.	.	.	
Asyneuma rigidum	.	.	.	.	.	.	.	30	.	.	62	.	.	.	20	50	.	.	.	

Table 2 (continued)

Salvia dichoantha	.	.	.	.	.	.	.	.	.	.	62	.	.	.	.	.	.	.	.	
Centaurea urvillei	.	.	.	.	.	.	.	.	.	.	54	.	.	10	.	.	.	.	.	
Crataegus orientalis	.	.	.	.	.	.	.	.	.	.	54	.	.	.	4	10	.	.	.	
Bromopsis tomentella	.	.	.	.	.	.	.	.	.	.	54	.	10	.	.	.	.	.	.	
Bromus japonicus	.	.	.	.	.	.	.	.	.	.	54	.	.	.	.	.	.	.	.	
Helianthemum oelandicum	.	.	.	.	.	.	.	.	.	.	54	.	.	.	.	.	.	.	.	
Coronilla scorpioides	.	.	.	.	.	.	.	.	.	.	54	.	.	.	.	.	.	.	.	
Minuartia umbellifera	.	.	.	.	.	.	.	.	.	.	54	.	.	.	.	.	.	.	.	
Polygala pruinosa	.	.	.	.	.	.	.	.	.	.	54	.	.	.	.	30	.	.	.	
Pilosella piloselloides	.	.	.	.	.	.	.	.	.	.	46	30	30	.	4	.	.	.	.	
Allium scrodoprasum	.	.	.	.	.	.	.	.	.	.	46	.	.	.	.	.	.	.	.	
Jurinea pontica	.	.	.	.	.	.	.	.	.	.	46	.	.	.	.	.	.	.	.	
Elytrigia trichophora	.	.	.	.	.	.	.	.	.	.	46	.	.	.	.	.	.	.	.	
Scutellaria orientalis	.	.	.	.	.	.	.	.	.	.	46	.	.	.	.	.	.	.	.	
Leontodon asperrimus PUB	.	.	.	.	.	.	.	.	30	.	46	.	10	30	.	.	.	.	.	
Viola sieheana F	.	.	.	.	.	.	.	10	10	.	46	.	.	.	20	.	.	.	.	
Tragopogon buphthalmoides	.	.	.	.	.	.	.	.	.	.	46	.	.	.	.	.	.	.	.	
Stachys byzantina	.	33	.	.	.	.	.	.	.	.	46	.	.	.	.	.	.	.	.	
DS ass. *Carpino orientalis–Quercetum cerridis* Cansaran et al. 2010																				
Chamaecytisus pygmaeus	.	.	.	.	.	.	.	.	.	.	.	70	.	.	16	.	.	.	.	
Fibigia eriocarpa	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	50	.	.	.	
Dianthus zonatus	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
Achillea grandifolia	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
Inula conyza	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
Crocus speciosus	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
Silene dichotoma	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
Hypericum origanifolium	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
Hesperis matronalis	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
Bupleurum gerardii	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
Cardamine hirsuta	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
Psephellus hypoleucus	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
Conringia clavata	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
Cruciata taurica PUB	.	.	.	.	.	.	.	.	.	.	23	50	.	.	.	50	.	.	.	
Trigonella monspeliaca	.	.	.	.	.	.	.	.	30	.	.	50	.	.	.	.	.	.	.	
Silene dichotoma	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	
DS ass. *Asphodelino–Quercetum pubescens* Kenak 2017																				
Helichrysum plicatum	.	.	.	.	.	.	.	.	.	.	.	.	90	.	.	.	.	.	.	
Asphodeline damascena	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	.	.	.	
Allium rotundum	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	.	.	.	
Bromus squarrosus	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	.	.	.	
Astracantha microcephala	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	30	.	.	.	
Apera intermedia	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	.	.	.	
Ziziphora clinopodioides	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	.	.	.	
Arenaria serpyllifolia	.	11	10	7	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	
Inula montbretiana	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	
Anthemis tinctoria	.	.	.	.	.	.	.	.	.	.	46	.	70	.	.	.	.	.	.	
Minuartia oreina	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	
Pilosella cilicica	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	

Table 2 (continued)

Scabiosa argentea	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	.	.	.		
Rumex acetosella	.	.	5	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.		
Vincetoxicum fuscatum	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.		
Ferula rigidula	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.		
DS ass. *Junipero oxycedri–Quercetum pubescentis* Ture et al. 2005																					
Genista lydia	.	.	.	.	.	.	.	.	.	.	.	.	.	90	.	.	.	.	.		
Cistus creticus	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.		
Cruciata glabra	.	.	.	.	.	.	.	.	.	50	.	.	.	50	.	.	.	.	.		
Crupina crupinastrum	.	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	.	.		
Onobrychis aequidentata	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.		
Veronica pectinata	.	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	.	.		
Holosteum umbellatum	.	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	.	.		
Thymus longicaulis	.	.	.	.	.	.	.	.	.	50	.	.	.	50	.	.	.	.	.		
DS ass. *Trifolio medii–Quercetum anatolicae* Akman et al. ex Quezel et al. 1992 (incl. *Pyro elaeagrifoliae–Quercetum anatolicae* Akman et al. 1979)																					
Trifolium medium	.	.	.	.	.	.	.	10	10	.	.	.	.	.	64	.	.	.	13		
Fibigia clypeata PUB	.	.	.	.	.	.	.	.	.	.	.	.	10	10	52	.	.	.	.		
Geranium pyrenaicum	.	.	25	.	.	.	.	.	.	.	.	30	.	.	48	.	.	.	.		
Lotus aegaeus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	.	.	.	.		
Myosotis sylvatica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	.	.	.	13		
DS ass. *Onobrychido tournefortii–Quercetum pubescentis* Karaer et al. 1999																					
Jurinea consanguinea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	90	.	.	.		
Phlomis pungens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.		
Alyssum erusulum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.		
Helianthemum canum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16	70	.	.	.		
Linaria corifolia	.	.	.	.	.	.	.	.	.	.	46	.	.	.	.	70	.	.	.		
Pilosella hoppeana	.	.	.	.	.	10	.	.	50	.	.	.	.	.	.	70	.	.	.		
Onobrychis tournefortii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.		
Silene compacta	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	70	.	.	50		
Hedysarum nitidum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
Dianthus floribundus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
Aegilops geniculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
Allium paczoskianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
Rumex tuberosus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
Scleranthus uncinatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
Helichrysum armenium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
Veronica orientalis	.	.	.	.	.	.	.	.	30	.	.	.	.	.	16	50	.	.	.		
Silene montbretiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
Paronychia chionea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
Stachys iberica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
Thymus parnasicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
Aristolochia maurorum	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	50	.	.	.		
Erysimum crassipes	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.		
DS ass. *Ranunculo buhsei–Quercetum macrantherae* ass. nov.																					
Viola mirabilis F, PUB	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	99	43	.		
Climacium dendroides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	89	.	.		
Dryopteris filix- mas/ caucasica F	33	11	10	.	.	.	.	.	.	.	.	.	.	.	.	.	89	14	38		

Table 2 (continued)

Plagiomnium medium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	78	.	.
Geranium robertianum F	11	11	.	14	.	.	.	.	.	.	.	.	30	.	.	.	.	78	.	.
Aruncus vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67	.	.
Lonicera xylosteum F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	78	29	.
Pimpinella rhodantha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67	14	.
Oberna multifida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67	.	.
Frangula alnus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	56	.	.
Sedum spurium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	56	.	.
Pinus sylvestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	56	.	.
Paris quadrifolia F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	.	.
DS ass. *Betonico macranthae–Quercetum macrantherae* ass. nov.																				
Galium rubioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	99	.
Geranium sanguineum PUB	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	99	.
Pyrus caucasica	.	.	.	.	.	.	.	.	.	.	.	.	30	.	.	.	.	.	86	.
Galega orientalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	86	25
Galium album	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	86	.
Inula britannica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	86	.
Galium valantioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	86	.
Dianthus caucaseus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	71	.
Dictamnus caucasicus PUB	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	71	.
Agrimonia eupatoria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	71	.
Stachys atherocalyx	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	71	.
Elytrigia intermedia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	71	.
Campanula alliariifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	57	.
Helictotrichon armeniacum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	57	.
Festuca rupicola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	57	13
Echinops sphaerocephalus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	57	13
Stachys germanica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	57	.
Aconitum confertiflorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	57	.
Verbascum laxum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	57	.
Tephroseris integrifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	43	.
Campanula hohenackeri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	43	.
Carlina vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	43	.
Cephalaria balkharica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	43	.
DS ass. *Calamagrostio arundnaceae–Quercetum macrantherae* ass. nov.																				
Spiraea hypericifolia	.	.	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	99
Seseli libanotis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	43	99
Galium brachyphyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	88
Filipendula vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	29	88
Cotoneaster integerrimus PUB	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	88
Scabiosa owerinii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75
Lotus caucasicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	29	75
Senecio jacquinianus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	14	63
Linum tenuifolium	.	.	.	.	.	.	.	.	.	.	.	.	30	.	.	.	.	.	.	63
Festuca valesiaca	11	.	.	.	.	.	.	.	.	.	23	.	.	90	.	.	.	22	29	63
Silene latifolia	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50
Allium kunthianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50

Table 2 (continued)

Teucrium orientale PUB	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	50
Thymus caucasicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50
DS all. *Quercion macrantherae* Djazirei ex Gholizadeh et all. 2020																				
Paeonia wittmanniana	78	56	15	21	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium odoratum F	78	56	20	36	.	10	.	.	.	.	.	30	.	.	.	.	22	14	.
Berberis integerrima	22	11	55	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Berberis orthobotrys	33	44	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asplenium adiantum-nigrum	56	33	5	36	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sanicula europaea F	44	22	.	43	.	.	.	.	.	.	.	30	.	.	.	.	.	.	.
Campanula glomerata	33	44	45	14	.	.	.	.	.	.	.	.	.	.	10	.	14	.
Festuca drymeja	78	44	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euonymus latifolius	56	22	25	29	.	.	.	.	.	.	.	.	.	.	.	.	14	.
Sedum stoloniferum	56	56	20	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sorbus aucuparia	67	33	70	.	.	.	.	.	.	.	.	.	.	.	.	89	57	13
Drymosiphon grandiflorus	56	56	.	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola caspia	44	44	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fraxinus excelsior F	67	44	10	21	.	.	30	.	.	.	.	.	.	.	.	22	86	.
Juniperus communis	22	33	45	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lonicera orientalis	33	44	45	.	.	.	.	.	.	.	.	.	.	.	.	44	.	.
DS all. *Astrantio–Quercion macrantherae* nov. and ord. *Astrantio–Quercetalia macrantherae* nov.																				
Astrantia maxima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67	99	75
Betonica macrantha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67	99	88
Calamagrostis arundinacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	78	99	88
Alchemilla sericata	22	11	.	.	.	.	.	.	.	.	.	.	.	.	.	78	57	88
Poa longifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	56	57	63
Carum meifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	78	99	75
Geranium sylvaticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	78	29	63
Heracleum asperum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	78	14	25
Centaurea salicifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67	43	75
Cephalaria gigantea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22	43	38
Iris colchica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	86	75
Cicerbita racemosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67	.	63
Lathyrus cyaneus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	56	29	50
Lilium monadelphum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	14	25
Hypericum hirsutum	22	11	15	.	.	.	.	.	.	.	.	.	.	.	.	67	29	75
Melampyrum arvense	.	.	.	.	10	.	.	.	.	.	.	.	.	.	10	11	86	63
Cirsium echinus	.	.	10	.	.	.	.	.	.	.	.	50	.	.	.	56	86	13
Hieracium hypoglaucum	22	33	.	.	.	.	.	.	.	.	.	.	.	.	.	78	29	38
Hieracium umbellatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22	71	63
Betula litwinowii	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33	14	38
Polygonatum glaberrimum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	78	29	88
Trifolium canescens	22	22	.	.	.	.	.	.	.	.	.	.	.	.	.	56	43	63
Vincetoxicum funebre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	89	57	25
Ranunculus buhsei	11	11	20	.	.	.	.	.	.	.	.	.	.	.	.	78	57	.
Polygonatum verticillatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	78	.	75
Primula macrocalyx	22	33	.	.	.	.	.	.	.	.	.	.	.	.	.	78	99	99
Primula ruprechtii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22	43	25

Table 2 (continued)

Veronica peduncularis	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	56	86	88
Rumex acetosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	71	63
Pimpinella saxifraga	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	29	50
Chaerophyllum aureum	56	56	25	.	.	.	.	.	.	.	.	.	.	.	.	.	99	86	50
Solidago virgaurea	22	22	45	.	.	.	.	.	.	.	.	.	.	.	.	.	89	43	13
Carex humilis	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	56	99	99
Carex alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	43	50
Anthemis melanoloma	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	86	75
Bupleurum polyphyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	86	75
Euphorbia seguieriana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	86	50
Luzula multiflora	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	22	.	50
Medicago glutinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	43	63
Hylotelephium caucasicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	29	50
Pedicularis chroorrhyncha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	43	25
Psephellus daghestanicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	43	25
Psephellus dealbatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	71	88
Pyrethrum leptophyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	71	50
Ribes orientale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	56	.	13
Sedum oppositifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	.	63
Rubus saxatilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67	71	.
Salvia glutinosa	22	56	.	14	.	.	.	.	.	.	.	.	.	.	.	.	89	86	.
Seseli peucedanoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	29	.
Turritis glabra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	71	50
Vicia grossheimii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	43	75
Phleum phleoides	.	.	40	.	.	.	.	.	.	.	.	.	.	.	.	.	.	71	88
Salvia verticillata	.	.	.	.	.	.	.	30	.	.	.	.	.	.	.	.	.	71	99

DS cl. *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959, ord. *Quercetalia pubescenti–petraeae* Klika 1933 and all. *Carpino betuli–Acerion hyrcani* Quezel et al. 1980, all. *Quercion anatolicae* Akman et al. ex Quezel et al. 1992

Quercus pubescens	.	.	.	.	30	.	.	.	.	90	99	.	90	90	99	90	.	.	.
Quercus cerris	.	.	.	.	90	90	.	90	90	90	.	90	.	30	.	.	.	.	.
Carpinus orientalis	11	56	35	99	90	90	90	90	70	.	.	70	.	.	.	.	.	.	.
Clinopodium vulgare/ umbrosum	56	22	30	29	.	10	.	50	30	50	.	50	.	.	52	10	67	99	99
Lapsana communis/ intermedia	56	78	55	21	.	.	.	70	.	.	.	30	.	.	28	50	89	.	50
Lathyrus laxiflorus	22	11	.	29	50	70	30	90	30	30	.	50	.	.	4	.	22	.	.
Securigera varia	33	.	25	.	10	.	.	50	10	30	.	50	.	50	72	30	22	57	75
Teucrium chamaedrys	.	.	.	.	.	10	.	50	.	50	38	30	30	.	36	50	.	71	13
Juniperus oxycedrus	.	.	.	.	30	30	50	70	70	30	85	70	90	90	32	50	.	.	.
Cephalanthera rubra	.	.	.	.	50	.	30	50	70	.	.	30	.	.	.	30	.	.	.
Silene italica	11	22	.	14	.	.	.	50	.	.	54	50	.	.	44	.	44	43	.
Poa nemoralis	78	78	20	43	.	.	.	30	.	.	.	.	.	.	28	.	89	86	99
Teucrium polium	.	.	.	.	50	.	.	.	.	.	.	.	70	50	.	50	.	.	.
Asperula involucrata	.	.	.	.	30	30	.	70	70	.	38	30	.	.	4	30	.	.	.
Briza media	.	.	.	.	.	.	70	.	.	.	46	70	.	30	8	.	11	99	.
Viburnum lantana	44	33	60	.	.	.	.	.	.	.	85	30	.	.	24	.	78	86	75
Helianthemum nummularium	.	.	65	.	.	10	.	.	70	.	77	.	.	.	44	30	.	.	.

Table 2 (continued)

Thalictrum foetidum	33	.	55	.	.	.	.	.	.	.	.	.	.	.	.	.	99	57	88
Brachypodium pinnatum	22	22	45	.	.	.	.	30	.	.	.	.	.	.	.	50	.	86	63
Leontodon hispidus	33	22	55	.	.	.	30	.	.	.	.	.	.	.	.	.	.	29	50
Viola alba/suavis	22	22	.	50	.	.	.	.	.	.	.	.	.	.	.	.	44	71	13
Laser trilobum	11	11	.	14	.	.	.	.	30	.	.	.	.	.	.	.	.	71	.
Campanula rapunculoides	11	.	.	.	.	.	.	50	10	10	.	30	.	.	16	.	67	86	99
Sorbus torminalis	56	56	.	64	.	50	.	70	.	.	.	.	.	.	.	.	.	.	.
Dactylis glomerata	22	11	5	29	30	.	.	.	90	10	69	.	50	50	48	.	11	29	63
Origanum vulgare	11	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	99	88
Trifolium alpestre	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	44	57	38
Cornus mas	.	.	.	.	10	.	.	90	.	.	.	30	.	.	.	.	.	.	.
Dorycnium pentaphyllum	.	.	.	.	30	30	.	.	70	.	46	30	.	.	4	50	.	.	.
Dorycnium graecum	.	.	.	.	.	.	.	.	.	70	.	30	.	50	28	.	.	.	.
Jasminum fruticans	.	.	.	.	.	.	30	10	30	.	.	.	.	70	4	.	.	.	.
Psoralea bituminosa	.	.	.	.	30	.	30	.	50	.	.	30	.	50	.	.	.	.	.
Pyrethrum parthenium	11	33	45	21	.	.	50	50	.	.	.	.	.	.	.	.	.	.	.
Galium aparine	.	.	10	21	.	.	.	.	.	.	.	30	.	.	72	.	22	.	50
Berberis vulgaris	.	22	30	.	.	.	30	.	.	.	.	.	.	.	.	.	67	.	50
Pyrethrum poteriifolium	.	.	.	.	.	.	.	50	50	.	46	.	.	.	32	50	.	.	.
Rhamnus cathartica	.	44	40	7	.	.	.	.	.	.	.	.	.	.	.	.	.	57	25
Cirsium hypoleucum	.	.	.	.	.	.	.	10	.	90	.	70	.	.	.	.	.	.	.
Prunus cerasifera/spinosa	11	22	.	29	.	.	.	.	.	.	62	.	.	.	.	.	56	29	.
Alyssum turkestanicum	.	.	.	.	.	.	.	.	.	.	54	.	30	70	.	.	.	.	.
Rosa spinosissima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	14	50
Lonicera etrusca	.	.	.	.	.	.	30	50	.	.	.	.	.	.	12	.	.	.	.

REFERENCES / ЛИТЕРАТУРА

Akaev B. A., Ataev Z. V., Gadzhiev B. S., Gadzhieva Z. H., Ganiev M. I., Gasanguseynov M. G., et al. 1996. *Fizicheskaya geografiya Dagestana* [*Physical geography of Dagestan*]. Makhachkala: School. 380 pp. [In Russian] (***Акаев Б. А., Атаев З. В., Гаджиев Б. С., Гаджиева З. Х., Ганиев М. И., Гасангусейнов М. Г. и др.*** Физическая география Дагестана. Махачкала: Школа, 1996. 380 с.).

Akman Y., Barbero M., Quezel P. 1979. Contribution to the study of forest vegetation in Mediterranean Anatolia. *Phytocoenologia* 5: 1–79. [In French]. DOI: 10.1127/phyto/5/1978/1

Cansaran A., Kaya Ö. F., Ertekin A. S., Ketenoğlu O. A. 2010. A phytosociological study on Karaömer Mountain of North Anatolia (Amasya, Turkey). *Acta Bot. Gallica* 157(1): 65–88. DOI: 10.1080/12538078.2010.10516190

Coban S., Willner W. 2019. Numerical classification of the forest vegetation in the Western Euxine Region of Turkey. *Phytocoenologia* 49, 1: 71–106. DOI: 10.1127/phyto/2018/0274

Czerepanov S. K. 1995. *Vascular plants of Russia and adjacent states (the former USSR)*. Cambridge: Cambridge University Press. 516 pp.

Doluhanov A.G. 1955. Typological sketch of mountain forests from Georgian and oriental oak. *Trudy Tbilissk. Bot. Inst.* 17: 73–160. [In Russian] (***Долуханов А. Г***. Типологический очерк горных лесов из грузинского и восточного дуба // Труды Тбилисского ботанического института, 1955. Т. 17. С. 73–160).

Ermakov N. B., Plugatar Yu. V., Leiba V. D. 2020. Endemic *Quercus pontica* C. Koch. communities from the Colchic Province and new syntaxonomical concept for the Caucasian subalpine krummholz vegetation. *Botanica Pacifica. A journal of plant science and conservation* 9, 2: 1–9.

Gholizadeh H., Naqinezhad A., Chytrý M. 2019. Hyrcanian forest vegetation database. *Phytocoenologia* 49: 209–210. DOI: 10.1127/phyto/2018/0315

Gholizadeh H., Naqinezhad A., Chytrý M. 2020. Classification of the Hyrcanian forest vegetation, northern Iran. *Applied Vegetation Science* 23: 107–126. DOI: 10.1111/avsc.12469

Gulisashvili V. Z., Makhatadze L. B., Prilipko L. I. 1975. *Rastitelnost Kavkaza* [*Vegetation of Caucasus*]. Moscow: Science. 233 pp. [In Russian] (***Гулисашвили В. З., Махатадзе Л. Б., Прилипко Л. И.*** Растительность Кавказа. М.: Наука, 1985. 233 с.).

Hennekens S. M., Schaminée J. H. J. 2001: TURBOVEG, a comprehensive data base management system for vegetation data. *Journal of Vegetation Science* 12: 589–591. DOI: 10.2307/3237010

Ignatov M. S., Afonina O. M., Ignatova E. A., Abolina A., Akatova T. V., Baisheva E. Z., et al. 2006. Check-list of mosses of East Europe and North Asia. *Arctoa* 15: 1–130. DOI: 10.15298/arctoa.15.01

Karaer F., Kilinc M., Kutbay H. G. 1999. The Woody Vegetation of the Kelkit Valley. *Turkish Journal of Botany* 23: 319–344.

Kaya Ö. F., Cansaran A., Yildinm C. 2010. A syntaxonomical investigation of forest and pseudomaquis on transitional area in the central Black Sea region (Amasya, Turkey). *Acta Bot. Gallica* 157(3): 469–482. DOI: 10.1080/12538078.2010.10516223

Kenar N. 2017. Phytosociological investigations of steppe and steppe forest vegetation in the south-east part of Central Anatolia of Turkey. *Journal of the Faculty of Forestry Istanbul University* 67(2): 203–219. DOI: 10.17099/jffiu.322422

Korkmaz H., Engin A., Kutbay H. G., Yalcin E. 2011. A syntaxonomical study on the scrub, forest, and steppe vegetation of the Kızılırmak valley. *Turkish Journal of Botany* 35: 121–165. DOI: 10.3906/bot-0908-152

Menitsky Y. L. 1984. *Duby Azii* [*Oaks of Asia*]. Leningrad: Science. 316 pp. [In Russian] (***Меницкий Ю. Л.*** Дубы Азии. Л.: Наука, 1984. 316 с.).

Özen F., Kilinc M. 2002. The Flora and Vegetation of Kunduz Forests (Vezirköprü / Samsun). *Turkish Journal of Botany* 26: 371–393.

Passarge H. 1981. Carpineta in kartalinischen Kaukasus. *Phytocoenologia* 9: 533–545.

Quézel P., Barbero M., Akman Y. 1980. Contribution áľétude de la végétation forestière ďAnatolie septentrionale. [Contribution to the study of forest vegetation of Northern Anatolia]. *Phytocoenologia* 8(3–4): 365–519. DOI: 10.1127/phyto/8/1980/365

Theurillat J.-P., Willner W., Fernández-González F., Bültmann H., Čarni A., Gigante G., Mucina L., Weber H. 2020. *International Code of Phytosociological Nomenclature*. 4th edition. Applied Vegetation Science. DOI: 10.1111/avsc.12491

Tichý L. 2002. JUICE, software for vegetation classification. *Journal of Vegetation Science* 13: 451–453. DOI: 10.1111/j.1654–1103.2002.tb02069.x

Ture C., Tokur S., Ketenoglu O. 2005. Contributions to the syntaxonomy and ecology of the forest and shrub vegetation in Bithynia, Northwestern Anatolia, Turkey. *Phyton* 45(1): 81–115.

Westhoff V., van der Maarel E. 1973. The Braun-Blanquet Approach. In: R. H. Whittaker (ed.). *Ordination and classification of communities.* Dordrecht: Dr. W. Junk. Pp. 617–626.

Yildirim C., Erkan Yalcin E., Cansaran A., Korkmaz H. 2019. Syntaxonomic analysis of forests, shrubs, and steppes of Tavşan Mountain (Amasya, Turkey). *Turkish Journal of Botany* 43: 409–419. DOI: 10.3906/bot-1809-18

Zohary M. 1963. *On the geobotanical structure of Iran.* Jerusalem: Weizmann Science Press of Israel. 113 pp.

Zohary M. 1973. *Geobotanical foundations of the Middle East*. Vol. 1–2. Stuttgart: Gustav Fischer Verlag. 739 pp.