

Materials for the Blacklist of the Central Caucasus Flora (Kabardino-Balkar Republic): Part II

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Abstract—A Blacklist of the flora of Kabardino-Balkaria has been expanded. Information about 47 species with a significant invasive potential has been added to the previously published data about 22 invasive plant species. A brief description of the history of naturalization and occurrence of these species on the described territory is presented, as well as their ecological, biological, and phytocenotic features. According to recommendations for the Black Books, all plant species from the blacklist are divided into four groups according to their invasive status.

Keywords: invasive plants, alien species, Blacklist, Kabardino-Balkaria

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INTRODUCTION

Negative ecological and socioeconomic consequences of the intentional or accidental introduction of alien species are widely discussed by the global community (Global Invasive Species Programme, 1999; Pyšek et al., 2004; Lambdon et al., 2008; Barina et al., 2013; etc.). This problem is relevant for the North Caucasian regions (including mountain zones), on territory of which a significant expansion of the habitats of invasive plant species has been observed for the last two decades (Moskalenko, 2001; Akatova et al., 2009; Akatova and Akatov, 2013; Chadaeva et al., 2018).

Under conditions of the North Caucasus, including the Kabardino-Balkarian Republic (Kabardino-Balkaria, KBR), the introduction of alien plant species is observed not only in anthropocoenoses, but also in meadow phytocoenoses important for the development of livestock breeding and recreational branches of the economy. Earlier, we published for the first time information about 22 invasive plant species observed on this territory: *Ambrosia artemisiifolia* L., *Elodea canadensis* Michaux, *Erigeron annuus* (L.) Pers., *Sorghum halepense* (L.) Pers., *Erigeron canadensis* (L.) Cronquist, *Eriochloa villosa* (Thunb.) Kunth, *Galinsoga quadriradiata* Ruiz et Pav., *G. parviflora* Cav., *Matricaria discoidea* DC., *Solanum cornutum* Lam., *Acer negundo* L., *Ambrosia trifida* L., *Bellis perennis* L., *Cannabis ruderalis* Janisch, *Cyclachaena xanthiifolia* (Nutt.) Fresen., *Elsholtzia ciliata* (Thunb.) Hylander, *Hibiscus trionum* L., *Xanthium spinosum* L., *Allium*

ramosum L., *Arthraxon hispidus* (Thunb.) Makino, *Euphorbia davidii* Subils, and *Euphorbia nutans* Lag. (Shhagapsoev et al., 2018). On the basis of field studies conducted in 2018, we obtained new data on the expansion of some of these species, which, in some cases, determined changes in their invasive status.

The purpose of this study was to expand the Blacklist of the Kabardino-Balkarian Flora on the biogeographic, ecophytocenological, historical, and archaeological findings. Together with the earlier published data, generalized information about the naturalization history, ways and vectors of invasion and expansion, and ecological and biological features of 69 species (including three new species of the KBR flora) presented in this study represents the most complete summary of invasive plants of the Central Caucasus.

MATERIALS AND METHODS

The study was performed in 2017–2018 on the territory of the Kabardino-Balkarian Republic (between 42°54′ and 44°01′ N, 42°24′ and 44°28′ E) situated within the Elbrus and Tersky zonality variants of the northern macroslope of the Central Caucasus. The republic borders Stavropol krai, North Ossetia-Alania, Karachay-Cherkessia, and Georgia.

Features of the Elbrus zonality variant include the lack of a broad-leaved forest zone and the marked xerophytization of landscapes (Sokolov and Tembotov, 1989). The zonal spectrum of this variant in limits

of the KBR includes meadow steppes (forest steppe) and steppe meadows, as well as subalpine, alpine, subnival, and nival zones. The Tersky variant is characterized by the landscape mesophytization and includes the broad-leaved forest zone and subalpine, alpine, subnival, and nival zones. In general, the climate of the plain and piedmont parts of the KBR (33 and 16% of the territory, respectively) is moderately warm and dry for the former and warm and damp for the latter, while climatic conditions of the mountain part (51%) are cold and dry.

Following Geltman (2006), the authors consider invasive species as actively naturalizing and aggressive alien species generating a numerous progeny, which expands far from parental specimens. In this case, the invasive fraction represents a part of the alien element of the flora; according to some authors (Notov et al., 2010; Vinogradova et al., 2010; etc.), it is characterized by the ability for rapid expansion and invasion into various phytocenoses, including undisturbed ones.

One of the modern approaches for classification of invasive plant species was developed on the basis of the analysis of ecological, biological, and phytocoenotic features of species, which determine the intensity of their invasion into new habitats and capacity for naturalization in communities differing in their level of anthropogenic transformation with the further change of their structure and composition. After the analysis of the aforementioned criteria, a certain “invasive status” is assigned to each species (Williamson, 1996). This status characterizes the current stage of the invasive process for the described species (Notov, A.A. and Notov, V.A., 2009). To date, methodical recommendations for the maintenance of regional Black Books have been developed on the basis of four possible statuses (Notov et al., 2010; Vinogradova et al., 2010, 2011; Baranova et al., 2016; etc.).

Status 1 includes “transformer” species able to change the state, appearance, and features of ecosystems across a large area (Pyšek et al., 2004). Such species actively occupy new habitats and naturalize in natural biocenoses, transforming their structure and composition, disturbing succession and consortive relations, replacing less competitive species, and playing the role of edificators and dominants. **Status 2** includes species introduced into disturbed, natural, and seminatural communities with the further expansion over the whole habitat, though without a complete change in the composition of these communities. **Status 3** includes species actively invading into ruderal, urban, and segetal communities (barrens, roadside ditches, urban agglomerations, arable lands, buffer zones of agricultural fields, etc.) or cultivated plants expanding beyond the borders of agricultural fields. **Status 4** includes potentially invasive species observed now as single specimens in natural, seminatural, and disturbed communities and able to regenerate at the points of invasion independently of climatic

changes; such species are often considered as invasive in the neighboring regions.

According to this classification, the assignment of a specific status to a plant species occurs independently of the social and economic consequences of their invasion into a region and the corresponding economic losses or benefits; some authors pay attention to this situation (Geltman, 2006; Vinogradova et al., 2010; etc.). In this study, we used this approach for classification of invasive plants of the Kabardino-Balkarian Republic.

RESULTS AND DISCUSSION

Status 1. Earlier, this group included species common for the territory of the KBR, such as common ragweed (*Ambrosia artemisiifolia* L.) and annual fleabane (*Erigeron annuus* (L.) Pers.), which are able to invade into meadow phytocenoses; Canadian waterweed (*Elodea canadensis* Michaux), which forms mass aggregations in the settling ponds of the Maisky treatment facilities and in the Shalushka River; and johnsongrass (*Sorghum halepense* (L.) Pers.), which grows in floodplains of the main rivers of the KBR (Shhagapsoev et al., 2018). According to the results of the studies in 2018, sea buckthorn (*Hippophae rhamnoides* L.) was also added to this list.

In summer 2018, we obtained new data on the occurrence of *Ambrosia artemisiifolia* in the mountain regions of the KBR. In the case of the village of Elbrus (1700 m above sea level), the species was found within the same habitat borders as in 2017, which indicated the seed reproduction of the population. In addition, 35 shoots of *A. artemisiifolia*, some of which reached 50–100 cm in height, were found near one of the local farms. Seed expansion with hay harvested in the piedmont zone of the KBR resulted in the appearance of six flowering plants with the height of 25–70 cm near a cattle pen located on the territory of the Shkhelda climbing camp (2000 m above sea level). Single plants were also found at an elevation of 2030 m above sea level in the upper part of the Adyl-Su Canyon; they grew along a road restored after a disastrous mudflow. Probably, the fruits of this plant migrated with the soil used for road reconstruction. Similarly, infested soil became a reason for the appearance of *A. artemisiifolia* along a federal highway in the village of Terskol (2125 m above sea level).

In 2017, the upper border of the *Erigeron annuus* habitat in the mountain zone was registered 1050 m above sea level in the Baksan Gorge of the like-named canyon. In 2018, we registered an invasion of this species that occurred 3 km above the gorge (1080 m above sea level). In addition, a mass occurrence of the species was observed on subalpine meadows at an elevation of 1300 and 1700 m above sea level (village of Kendelen and Sukanskoe Canyon, respectively). Several plants were also found on a dam of the tailing pit of the Tyryauz Tungsten-Molybdenum Industrial Plant (1300 m above sea level) and near the foot of the

Elbrus Mountain (2300 m above sea level). The main way for the species expansion in mountains is seed transfer with vehicles and wind.

Hippophae rhamnoides is a shrub or small tree, whose East Asian origin is considered to be connected with the coast of the ancient Tethys Sea (present territory of the Gobi Desert), from which initial forms expanded towards the Sayan and Altai Mountains, Pamirs, Tien Shan, Tibetan Plateau, and Himalayas (Korzinnikov, 1995). One of the first mentions of the occurrence of this species in the Central Caucasus was published by Dinnik (1884). At the points of invasion located on the territory of the KBR (riverbanks, floodplains, roadsides on the plain and in piedmont and mountain regions), *H. rhamnoides* forms dense monodominant bushes, which transform wet and ruderal phytocenoses. The species was used for soil fixation in technogenic landscapes of the tailing pond of the Tyrnyauz Tungsten-Molybdenum Industrial Plant. At the same time, its range in the KBR gradually declined from 1100 ha of natural and artificial plantings in the 1970s to 700 ha in beginning of the 21st century (Shhagapsoev and Starikova, 2002). A possible reason is the intense and irrational use of the species, such as the lopping off tree branches during harvesting. For example, according to Zhashuev (2015), the state of natural bushes of the species estimated by the absolute biomass and productivity is satisfactory in the subalpine zone and unsatisfactory in the steppe meadow and forest-steppe zones of the republic. *H. rhamnoides* expands by seeds (zoochory) and root shoots; sometimes, it is also introduced by humans.

Status 2. Earlier, we included in this group the following species: Canadian fleabane (*Erigeron canadensis*), hairy cupgrass (*Eriochloa villosa*), shaggy soldier (*Galinsoga quadriradiata*), gallant soldier (*Galinsoga parviflora*), pineapple weed (*Matricaria discoidea*), and yellow nightshade (*Solanum cornutum*). According to the results of our studies in 2018, this list was supplemented with 12 more species: sweet chestnut (*Castanea sativa* Mill.), red oak (*Quercus rubra* L.), European walnut (*Juglans regia* L.), Asian sumac (*Ailanthus altissima* (Mill.) Swingle), white mulberry (*Morus alba* L.), black locust (*Robinia pseudoacacia* L.), honey locust (*Gleditsia triacanthos* L.), periwinkle (*Vinca minor* L.), Virginia creeper (*Parthenocissus quinquefolia* (L.) Planch.), whitetop (*Cardaria draba* (L.) Devs.), dog's chamomile (*Anthemis cotula* L.), and poverty rush (*Juncus tenuis* Willd.).

In 2018, some new data on the expansion of *Xanthium spinosum* in the KBR were obtained. Single low plants (10–15 cm in height) were found on a dam of the third tailing pond of the Tyrnyauz Tungsten-Molybdenum Industrial Plant. The mass presence of the species was observed in kitchen gardens and along the roads and fences of the village of Bylym (1200 m above sea level). Single specimens of the species grew in kitchen gardens and farmlands of the village of

Verkhny Baksan (1650 m above sea level). A mass presence of *X. spinosum* was observed in the composition of the highland xerophyte flora of the Syltran Canyon (1800–2000 m above sea level), where it infested pastures, causing losses in sheep breeding. According to local residents, fruits of this species were carried to the canyon in 1980s (on sheep fur). Thanks to mechanical removal of plants, the habitat area of the species in this region is reduced. On the basis of the data of 2018, *X. spinosum* was included in the list of species with the assigned status 2 (earlier it had status 3).

Mass vegetation of large (up to 50 cm in height) and abundantly flowering plants of *Erigeron canadensis* was observed on the wastelands of Tyrnyauz (1300 m above sea level). Single specimens of this species (15–20 cm in height, 100–120 heads per shoot) were found at the bus stops in the village of Elbrus (1800 m above sea level), which were constructed in 2018. To date, this location represents the highest elevational border of the species occurrence in the mountains.

Since 2017, *Eriochloa villosa* significantly extended its habitat in the country cottage districts of Nalchik and its suburb (Adiyukh settlement). The species was also observed on pebbles located in the floodplain of the Nalchik River, asphalt cracks, neglected lawns (mass growing), and barrens of Nalchik (shrubs with the height of 45–90 cm and 3–8 generative shoots).

Observations of 2018 showed that the upper elevational border of the *Galinsoga quadriradiata* and *G. parviflora* habitats in the KBR is 1700–2100 m above sea level (upper part of the Baksan Canyon). Both species grow on roadsides, in ditches, in kitchen gardens, in ruderal communities, and around farms; they often form dense bushes of shoots (up to 45 cm in height) with the projective cover of 60–90%. The species is also introduced into meadow communities on mountain slopes disturbed by grazing (the Irik-Chat Canyon).

Castanea sativa is a deciduous tree, which is considered to originate from southeastern Europe and Asia Minor. The first seeds of the species were carried to the KBR after the establishment of the Soviet power (Decree..., 1925). Today *C. sativa* is used in forest stands of the Urvan, Cherek, and Lesken forestries, and its saplings are grown in the arboretum of the KBR Ministry of Natural Resources and Ecology. The total area occupied by the species in the republic is about 500 ha. The plant easily runs wild; it can be a forest-forming species in the case of a mass reproduction by seeds or root shoots, though it is more often observed as an admixture to broad-leaved forests. The species is expanded by zoochory and anthropochory (by planting on homestead plots, streets, and town parks).

Quercus rubra is a deciduous tree originating from North America. It was first introduced into the KBR in the 1950s (Volny Aul, Kenzhe, and Kamenskoe forestries). Today this species is a forest-forming breed in some areas of the Urvan and Lesken forestries, where it grows either as a monodominant community or in

the mix with other tree breeds. The species expands by anthropochory (roadside, park, and town square vegetation) and zoochory. *Q. rubra* intensely naturalizes in forest ecosystems of European countries and is a candidate species for the Black Book of Russia (Vinogradova et al., 2010).

Juglans regia is a deciduous tree with three known centers of origin: Near Asia (Turkey, Iran, Turkmenistan, and Transcaucasia), Central Asia (Central Asia, Afghanistan, Pakistan, and Northwestern India), and China (Central and Western China; Ibragimov, 2010). The mass cultivation of this species in the southern part of Russia began in the middle of the 20th century; at the beginning of the 1970s, the total area of walnut plantations in Kabardino-Balkaria exceeded 320 ha. Today no care for walnut trees is performed in the Urvan, Baksan, and Cherek forestries, so *J. regia* runs wild, transforming to low multi-trunk or shrubby form. Such specimens are often observed in the wastelands and floodplains of the Nalchik River. The species is expanded by zoochory and is planted on homestead plots and streets and in parks of towns and settlements in the KBR up to the elevation of 1300 m above sea level (Tyrnyauz).

Ailanthus altissima is a deciduous tree originating from the Northern and Eastern China. It was first introduced in the KBR in the 1920s as greenery for towns and settlements, including mountain regions (Tyrnyauz), where it bears fruits and is propagated by root shoots. Without any control over its expansion, the species runs wild and abundantly grows on barrens and wastelands and in parks (Nalchik), along roadsides and ditches (villages of Terekskoe, Malka, and Zayukovo), in village cemeteries (village of Zayukovo), and along banks of rivers and channels (outskirts of the village of Malka and Nalchik). The species intensely propagates in a vegetative way, often forming dense monodominant bushes. Numerous seeds are spread by wind and water flows.

Morus alba is a dioecious tree or shrub originating from China. Soon after the establishment of Soviet power, some silkworm breeding plantations were established in Nalchik; simultaneously, *M. albae* plantations were arranged from stored seeds in the plain and piedmont parts of the republic (Decree..., 1924). During the post-war period, large plantations (100–150 ha each) were established every year with governmental support in the Tersky, Prokhladny, and Nalchik districts of the republic. Today mulberry plantations are mainly abandoned. Wild trees are observed along river valleys (for example, at the Aktoprak pass (1400 m above sea level) and on floodplains of the Nalchik, Malka, and Gedmysh rivers), lakesides (Maisky lakes), forest belts (Terek and Baksan districts), and railway slopes within Nalchik. At the points of invasion, the species grows as a self-sown plant and is expanded by zoochory and anthropochory (introduction).

Robinia pseudoacacia is a deciduous tree of North American origin. It has been cultivated in Kabardino-Balkaria since the 1920s, when the first seeds were specially ordered (Decree..., 1925). Now this species is represented by wild trees massively growing on floodplains of the main rivers of the KBR (Baksan, Prokhladny, Chegem, Terek, Maisky, and Zolsky districts) on the territory from plains to medium-high mountains. The species is observed on barren lands and in the floodplain of the Nalchik River as single low specimens or small groves with a dense stand up to 5 m in height. *R. pseudoacacia* is reproduced vegetatively and by seeds.

Gleditsia triacanthos is a deciduous tree of North American origin, whose seeds were also imported into Kabardino-Balkaria in the 1920s (Decree..., 1925). Today it is often observed as wild-growing plants along disturbed gravel-sand riverbanks in the Urvan, Maisky, Prokhladny, and Terek districts (10- to 12-year trees with the trunk diameter of 8–9 cm). The undergrowth of *G. triacanthos* massively grows in the inter-rail space and on railway slopes on the territory of Nalchik. There are also single trees with the height of about 40 m. The species actively grows as a self-sown plant and intensely propagates with root shoots.

Vinca minor is an evergreen perennial groundcover plant, whose origin is considered to be Western Europe (Dzhus et al., 2009). There is no reliable information on the time of the first appearance of this species in the KBR. Today *V. minor* is used as an ornamental plant on homestead plots in various settlements of the republic. The species became common in town and village cemeteries (Nalchik, Prokhladny, Nartan, and Aushiger). In 2010, the species was found among the steppe flora of the Terek-Sunzha Ridge. It forms a large projective cover (up to 100%) on flat forested riverine terraces of the Nalchik River located between the Khasanya and Aleksandrovka bridges. Seeds are dispersed by wind and water flows.

Parthenocissus quinquefolia is a perennial liana of North American origin, which is used for wall decoration of private and municipal buildings in towns and villages of the KBR. Since the 1960s, the species has been observed in floodplain forests of the Urvan district and in forests growing on the slopes of the Bolshaya Kizilovka and Malaya Kizilovka mountains (outskirts of Nalchik). It also massively grows along the railroad and in abandoned construction sites of Nalchik and is observed near the village of Bedyk (950 m above sea level, area of 40 m²), where it winds around trees and shrubs growing at the foot of the Baksan Gorge. The species is expanded by zoochory and anthropochory (introduction).

Cardaria draba is a perennial herbaceous root-sucker plant, whose natural habitat is associated with the Old World (Southern Europe, North Africa, Western and Central Asia, and Southern Siberia (Vinogradova et al., 2010)). In the Caucasus, the species

became widely known by the middle of the 20th century (Grossgeim, 1950). *C. draba* grows under the tree canopy in the city park of Nalchik (projective cover 80–90%, plant height 35–45 cm) and forms monodominant grass on a floodplain of the Nalchik River. The species is common in pastures of the village of Kremenchug-Konstantinovskoe in the piedmont zone of the KBR. Large plants (up to 50–60 cm in height) were observed on the dam of the tailing pond of the Tyrnyauz Tungsten-Molybdenum Industrial Plant and in the meadow phytocoenoses of the neighboring mountain slopes. Seeds of *C. draba* probably migrated to the invasion points with soil and seed material and on the wheels of vehicles and agricultural machinery.

Anthemis cotula is an annual herbaceous plant presumably originating from the Mediterranean regions of Europe and North Africa. The species is common on the territory of many settlements located in the piedmont zone of the KBR (Dzhinal, Sovkhoznoe, Islamey, Shordakovo, Verkhny Kurkuhin, Belokamenskoe, Kamennomostskoe, etc.). *A. cotula* forms dense stands with the height of 30–40 cm and projective cover of 80–100% on the roadsides, in barrens, in vegetable gardens, on fallow lands, and in the first rows of agricultural fields. In the outskirts of the villages of Dzhinal and Verkhny Kurkuzhin, the species is among the co-dominants of the meadow-steppe phytocoenoses. The plant is also observed on neglected lawns and flower gardens in Nalchik and actively grows as a self-sown plant.

Juncus tenuis is a perennial herbaceous tussock plant of North American origin. In the KBR, it occurs on waterlogged sides of the Maisky lakes, forest edges, cleared places, and roadsides of dirt roads in the Urvan and Cherek districts. The species is common along ditches of the Kislovodsk–Dzhily-Su road and sometimes is present as a codominant species (projective cover is 20–40%) on wet pasturing meadows of the Northern Elbrus region (Zolsky district of the KBR). *J. tenuis* propagates by slimy seeds sticking to car wheels, soles of shoes, and animal coats. Dry seeds are spread by the wind.

Status 3. In addition to *Xanthium spinosum*, this group earlier included sugar maple (*Acer negundo*), richleaf (*Ambrosia trifida*), garden daisy (*Bellis perennis*), ruderal hemp (*Cannabis ruderalis*), sumpweed (*Cyclachaena xanthiifolia*), Vietnamese balm (*Elsholtzia ciliata*), and susan (*Hibiscus trionum*). This list was supplemented with 19 new species: common purslane (*Portulaca oleracea* L.), green amaranth (*Amaranthus retroflexus* L.), Asian knotweed (*Reynoutria japonica* Houtt.), lemon clover (*Oxalis stricta* L.), mormonweed (*Abutilon theophrasti* Medik.), Jerusalem artichoke (*Helianthus tuberosus* L.), Canadian goldenrod (*Solidago canadensis* L.), cocklebur (*Xanthium albinum* (Widder) Scholz & Sukop.), Asian copperleaf (*Acalypha australis* L.), jimsonweed (*Datura stramonium* L.), black nightshade (*Solanum nigrum* L.), horseradish

(*Armoracia rusticana* P.G. Gaertn., B. Mey. & Scherb.), barnyard-grass (*Echinochloa crus-galli* (L.) P. Beauv.), lilac (*Syringa vulgaris* L.), lucern (*Medicago sativa* L.), tomato (*Lycopersicon esculentum* Mill.), English bluegrass (*Lolium perenne* L.), eastern St. Paul's-wort (*Sigesbeckia orientalis* L.), and yellow-foxtail grass (*Setaria pumila* (Poir.) Roem. & Schult).

During expeditions arranged in 2018, we did not observe any active introduction of *Acer negundo* into the natural ecosystems of the KBR. However, we found 10 young trees in the ruderal community at the bank of the Nalchik River and 40 large fruiting trees with a large amount of undergrowth along 3.5 km of the railroad within Nalchik. If this rate of expansion is maintained at the same level, one can soon expect an introduction of *A. negundo* into seminatural and natural ecosystems of the republic.

A study of the growth node of *Ambrosia trifida* (outskirts of the village of Uruk) in 2018 showed that, in the last five years, the species enlarged its habitat, expanding by 4 km along the dirt roads and edges of agricultural fields. Today the population is represented by either small aggregations of plants or dense stands with the projective cover equal to 90–100%. A numerous second-generation undergrowth develops under the canopy of large (2–3.5 m in height) plants. With such an expansion rate, *A. trifida* may become one of the common species of the KBR flora. In 2018, we also found a large (~60 m²) focus of growth of *E. ciliata* with a 100% projective cover located on a neglected lawn in the private residential area of Baksan.

Portulaca oleracea is an annual species of Iran–Turan origin (Byalt, 2004). Since the 1990s, this species has massively grown on barrens and sandy places of the floodplain of the Nalchik River. Now at this location, we observe large specimens, whose lying stems cover an area up to 50 cm in diameter. In recent years, the species has often been observed in small parks and on the streets of Nalchik and towns of the Baksan and Chegem districts; it grows in asphalt cracks, on barrens, construction sites, and neglected lawns. The projective cover of *P. oleracea* on homestead plots and vegetable gardens may reach 90–100%. This plant infests agricultural crops and gardens in the piedmont zone of the KBR. Sometimes this species is grown by locals as a food plant. It produces numerous small seeds, which spread with water and wind.

Amaranthus retroflexus is an annual herbaceous plant of North American origin. To date, the species is common in all regions of the republic as a segetal weed. It also grows on waste lands of settlements (dumps, construction sites, barrens), on roadsides, in asphalt cracks, on fallow lands, and around cattle pens. Some large specimens growing in the floodplain of the Nalchik River may reach 150 cm in height. The upper elevational border of *A. retroflexus* habitat was registered in the Baksan Canyon (1800–2300 m above sea level), where plants grew in vegetable gardens and

around farms (specimens with the height up to 150 cm), as well as along the roads and cattle-driving paths. Sometimes low plants with stretched shoots are introduced into phytocoenoses of sandy mountain slopes disturbed by grazing and form a projective cover reaching 80% (Irik-Chat Canyon). Numerous seeds are spread with the wind and water flows, as well as together with seed material, vehicles, etc.

Reynoutria japonica is a perennial plant, whose natural habitat covers Japan, Korea, and China (Anjen and Park, 2003). Today the species is used for planting of greenery in settlements of the KBR. It often runs wild, spreading to neglected lawns, barrens, and roadsides. In spite of frequent removal of shoots during the vegetation period, their repeated appearance from the soil is observed. On a wasteland located on a floodplain of the Nalchik River, the species forms a dense monodominant stand on an area of 12 m² and reaches 2–2.5 m in height. Large stands of wild plants were observed in the floodplain of the Sukhaya Shalushonka River. The species uncontrolledly grows in the city cemetery in Nalchik. The upper elevational border of the species expansion was registered at an elevation of 1200–1300 m above sea level in the village of Bylym (single aggregations of fruiting shoots (up to 40–50 cm in height) at the edges of vegetable gardens) and Tyrnyauz (flowerbeds). The plant actively reproduces by rhizome and stem fragments transported with soil or water flows. *R. japonica* is able to transform natural communities irrespective of their species composition; it destroys the pavement, house footings, and hydraulic facilities and is included in the top 100 most dangerous invasive species according to the version of the International Union for Conservation of Nature and Natural Resources (100 of the World's..., 2018).

Oxalis stricta is a perennial rhizome plant originating from North America. The species was first registered on the territory of the KBR in 1956 (outskirts of Nalchik (Kushkhov, 1987)). The author noted that the species probably came to the countryside from a greenhouse culture and with imported seed material. Today *O. stricta* is observed as a weed massively growing on the streets of settlements located in the plain and piedmont zones of the republic; it grows in the cracks of the asphalt and concrete walls, as well as on neglected lawns. The flowering occurs up to the middle of November, though in some years the plant vegetates during the whole winter period. The species is resistant to weeding and intensely reproduces both vegetatively and generatively.

Abutilon theophrasti is an annual plant of North American origin. It massively grows along agricultural fields and dirt roads, as well as around farms of the Urvan, Lesken, and Maisky districts of the KBR; the height of single specimens may exceed 2.5 m. The species infests cultivated crops and actively invades into the first rows of maize fields. A sparse growth of *A. theophrasti* is observed along federal highways in the plain

and piedmont zones. More than 120 specimens with the height of 1.5–2 m and projective cover of 80% were observed on an area of about 300 m² on a barren located in the floodplain of the Nalchik River. The upper elevational border of the species expansion was registered in the village of Elbrus: single plants with the height of 15–30 cm (1–5 flowers per shoot) grew near several farms (invasion with seed material) and along a federal highway (invasion with the soil during construction of roadsides and bus stops). In all cases, plants, which blossom at the end of September, do not have enough time to form full-valued fruits before the beginning of autumn frosts. Along with man-caused introduction, seeds are spread by wind and water.

Helianthus tuberosus is a perennial plant originating from North America. There are no reliable data on the time of its introduction; however, it is known that this plant was cultivated on the territory of the KBR as early as the 18th and 19th centuries. Kabardinians used its tubers to prepare soups, flat cakes, and baked puddings (Shhagapsoev, 2003). From the 1950s, *H. tuberosus* was grown as a forage crop on many collective farms of the republic. Today the species is often cultivated in vegetable gardens and homestead farms as a food and ornamental crop. Wild-growing specimens were observed on the borders of agricultural lands of the Lesken district near the village of Uruk, where they formed dense bushes (1.5–2 m in height) on an area of 60 m². The species occurs on barrens, neglected lawns, and in the parks of Nalchik. Since 2016, it has been growing on the floodplain terrace of the left bank of the Nalchik River, where it forms aggregations of large specimens reaching 2.5–3 m in height. Intensely propagating by tubers, it infests the first rows of agricultural crops in the plain and piedmont zones of the KBR. The upper altitudinal border of its habitat was registered on an abandoned homestead plot near the settlement of Neutrino (upper part of the Baksan Canyon, 1600 m above sea level).

Solidago canadensis is a perennial species originating from North America. This ornamental plant is often grown in flowerbeds and on homestead plots of settlements of the KBR located in plain, piedmont, and medium-high mountain (Tyrnyauz) zones. A single case of wheat field infestation was registered in the Chegem district of the republic. In addition, the massive uncontrolled expansion of this plant occurred in the Nalchik cemetery, where hundreds of tall (2.5–3 m) shoots grow on an area of 15000 m² or more. The species also forms dense monodominant bushes with the height of 50–100 cm and the projective cover of 90% on a 60-m² area along the railroad within the borders of Nalchik. In addition, an aggregation of *S. canadensis* shoots was observed in 2018 in the park zone of Nalchik; the occupied area reached 6 m².

Xanthium albinum is an annual plant originating from North America. To date, the species has become common in the republic. It massively grows on soil

substrates on the floodplain of the Nalchik River (plants 50–70 cm high) and forms monodominant bushes on barrens and wastelands and along irrigation channels and ditches in the piedmont zone (villages of Kamlyukovo, Atazhukino, Zhankhoteko, Zayukovo, and Belokamenskoe) and medium-high mountains (villages of Kendelen, Bylym, Bedyk, Kamennomostskoe, Kichmalka, and Dzhinal). In the case of manured soils or fallow lands, the species forms dense monodominant bushes with the height of ~2 m. The lower plants (up to 50 cm in height) grow sparsely along roadsides (Baksan Gorge, village of Bylym) and at the edges of crop fields, where they infest the first rows of maize and sunflower (Baksan, Chegem, and Zolsky districts of the KBR). The species is present in the community of an overgrazed pasture near the village of Zayukovo. The upper elevational border of the species expansion is 2100 m above sea level (Adyl-Su Canyon), where it grows as single plants along a road and forms fruits, which do not have time to ripen prior the coming of stable autumn frosts in November. The fruits of this species were probably carried there with soil used for the reconstruction of the road destroyed by a mudflow in 2017. The species expands by zoochory, since its seeds are able to catch on animal hair.

Acalypha australis is an annual plant of South American origin. In 2009, the species was noted by us for the first time on the territory of the KBR; the plants grew on railway slopes in the settlement of Adiyukh located near Nalchik (Tsepkova and Taumurzaeva, 2016). By 2015, the species was observed on homestead plots, along fences and walls, and on neglected lawns of Nalchik. To date, *A. australis* is one of the most common weeds of the Nalchik flora; it forms dense bushes with the height of 30–70 cm and projective cover of 70–90%, growing in flower beds, on homestead plots, wastelands, neglected lawns, and in the park zone. It massively grows along the walls of houses, in asphalt cracks, and along the railway. The species was also observed in vegetable gardens and on roadsides of the Chegem district. The first shoots appear at the end of May. Within one vegetation period, several generations appear owing to the nonsimultaneous fruit ripening and realization of the soil bank of seeds. The seed dormancy period is no more than 5–7 days, laboratory germination capacity is 85–98%, and the viability of seedlings is 80–100%. Shoots appear during a period of 4–5 months from the beginning of a germination experiment. Numerous small seeds are spread by wind, water flows, and vehicles and also with infested seed material.

Datura stramonium is an annual herbaceous plant, which probably originates from Central America or the Trans-Caspian steppe regions. The exact time of its invasion into the KBR is not known reliably. The species usually grows on barrens, construction sites, roadsides, and near cattle pens. In the case of a barren located on a floodplain of the Nalchik River, tall (up to 160 cm in height) plants form a 80% projective cover

on an area of ~100 m². Dense bushes of this species were observed at a construction site located near the Dubki market in Nalchik, on a roadside in the bottom part of the Baksan Canyon (road patrol station), and along vegetable gardens and wastelands of the villages of Zayukovo, Zhankhoteko, and Kendelen. Single specimens with the height of 30–40 cm were found on the barrens of Tyrnyauz. The upper elevational border of the species expansion in the KBR is 1800 m above sea level (15 plants with the height up to 40 cm were found on a manured area near a farm located in the village of Elbrus). The species reproduces by seeds, which spread by vehicles or with soil and seed material.

Solanum nigrum is an annual herbaceous plant probably of Australian origin (Australia, New Zealand). The species is common in the plain, piedmont, and mountain zones of the KBR. It massively grows on floodplain barrens and along the railway within the borders of Nalchik (stretched shoots with the height up to 20 cm), on abandoned homestead plots and roadsides, and along fences of the settlement of Adiyukh. Some aggregations of plants were observed in vegetable gardens and near farms of the settlement of Neutrino and the village of Elbrus (the shoot height was 10–20 cm and the projective cover was 20–80%), near cattle pens on the territory of the Skhelda climbing camp (30 plants with the height up to 60 cm), and in the settlement of Terskol (single low plants with the height of 10–20 cm). The species propagates by seeds via endozoochory and anthropochory (spreading with seed material or by vehicles and trains).

Armoracia rusticana is a perennial herbaceous plant of European origin (presumably Southern and Central Europe). In recent years, the species became common on the territory of most of the settlements in the plain, piedmont, and mountain parts of the KBR. Plants with a height of 30–170 cm are observed everywhere on lawns, barrens, and wastelands; in vegetable gardens; along fences, roads, and ditches; and in park and recreational zones; single specimens also grow in asphalt cracks. An uncontrolled expansion of *A. rusticana* was observed in the cemetery of Prokhladny. The species was found in forest belts, under the canopy of roadside vegetation, and along the roadsides of the main highways of the republic. Plants actively propagate by root fragments, forming projective cover at the level of 60–100%. The species is resistant to overgrazing and is able to grow after a double mowing within the vegetation period. The upper elevational border of the species expansion in the KBR is 2100–2200 m above sea level (outskirts of cattle pens located in the settlement of Terskol, the Adyl-Su Canyon). The species propagates by anthropochory (introduction as a food and spice plant), root fragments, and seeds.

Echinochloa crus-galli is an annual herbaceous species presumably originating from tropical Eurasia. Long-awned and short-awned forms of the species are common on lawns, in flowerbeds, on barrens, river-

banks, agricultural fields, fallow lands, and in the outskirts of farms located in the plain and piedmont zones of the KBR. At the end of October 2018, we found 20 fruiting shrubs with the height of 25–35 cm near a cattle pen located on the territory of the “Shkhelda” climbing camp. Seeds of this plant were probably carried into the high-mountain zone together with grain forage or hay for cattle. The species forms a lot of small seeds, which are spread by wind, zoochory, and vehicles or together with seed material.

Syringa vulgaris is a perennial deciduous shrub, whose natural habitat covers the Balkan-Carpathian region. It is widely cultivated on homestead plots, on streets, and in parks of settlements of the KBR as an ornamental melliferous plant and is able to run wild. In the wild-growing form, the species was observed around abandoned homestead areas located in the outskirts of Nalchik and also in the Tersky, Prokhladny, and Maisky districts. It also grows along railways, often forming monodominant bushes on an area of 12–30 m². The species propagates over barrens and in floodplains of the plain and piedmont zones. In the mountains, relatively low (1.5–2 m) shrubs can be found at an elevation reaching 2100 m above sea level. Plants reproduce vegetatively (root shoots and stub shoots); seeds are dispersed by the wind.

Medicago sativa is a perennial herbaceous plant presumably originating from Southwestern (Central) Asia. It is cultivated as a forage plant in the piedmont and mountain regions of the KBR (Chegem, Baksan, Urvan, Zolsky, Elbrus, and Cherek districts), as well as on irrigated fields of the plain zone (Maisky and Prokhladny districts). The plant may run wild. It grows on fallow lands, wastelands, barrens, and river banks and sometimes in meadow phytocoenoses and occurs from plains to medium-high mountains. In the case of barrens located on the floodplain of the Nalchik River, it forms low (up to 30 cm in height) bushes with the projective cover of 90–100%. In the Tynyauz recreation zones, the species is represented by single large specimens (50–80 cm in height) growing along roadsides and on barrens. The species propagates by seeds.

Lycopersicon esculentum is a perennial (annual in cultivation) plant which is native to South America. In the KBR, it is cultivated as an important vegetable plant from plains to medium-high mountains (1700 m above sea level). Wild-growing plants are observed on wastelands, construction sites, and floodplains (the Nalchik River) and at the edges of agricultural fields in the plain and piedmont parts of the republic. The species propagates by zoochory and anthropochory.

Lolium perenne is a perennial loose-bunch grass originating from Western Europe (North Africa, Near Asia). The species is common on the territory of Kabardino-Balkaria (from plains to medium-high mountains), where it grows on lawns, wastelands, roadsides, and barrens and around farms. In August 2018, the species was observed on an area of 25 m² located on

the Azau clearing at the foot of the Elbrus Mountain (2350 m above sea level). More than 200 separate and aggregated dense shrubs consisting of generative and vegetative shoots were observed on a sandy-rocky slope covered by thin vegetation, which indicated the seed and vegetative renewal of the population. The invasion of the species into the mountains probably took place with soil and/or building materials used for construction of objects of skiing infrastructure.

Sigesbeckia orientalis is an annual herbaceous plant whose origin is considered to be the tropical regions of Eurasia, America, and Africa. On the territory of the KBR, it occurs sporadically as a weed plant growing along roadsides and on neglected lawns and barrens, as well as in gardens and vegetable gardens of the piedmont zone. The species propagates by seeds spreading with the wind and epizoochory.

Setaria pumila is an annual herbaceous tropical and subtropical plant with a large secondary habitat. In the KBR it grows on barrens, roadsides, and wastelands of settlements covering the territory from the piedmont zone to medium-high mountains (for example, Tynyauz). The species invades into disturbed (overgrazed) meadow phytocoenoses, infests agricultural fields, and grows around farms and in disturbed habitats (the dam of the tailing pond of the Tynyauz Tungsten-Molybdenum Industrial Plant). The plant rarely occurs around cattle pens and on sandy cattle-driving paths and roadsides in the upper part of the Baksan Canyon (1800–2000 m above sea level). The species reproduces by seeds, which are spread by the wind and zoochory.

Status 4. In addition to the four species mentioned earlier (Chinese chives (*Allium ramosum*), small carpetgrass (*Arthraxon hispidus*), David’s spurge (*Euphorbia davidii*), and nodding spurge (*Euphorbia nutans*)), 15 potentially invasive plant species have been described. These new species are as follows: scabish (*Oenothera biennis* L.), Devil’s Beggartick (*Bidens frondosa* L.), garget (*Phytolacca americana* L.), wild cucumber (*Echinocystis lobata* (Michx.) Torr. & A. Gray.), river locust (*Amorpha fruticosa* L.), western ragweed (*Ambrosia psilostachya* DC.), Asiatic dayflower (*Commelina communis* L.), orange daylily (*Hemerocallis fulva* L.), smoking bean (*Catalpa bignonioides* Walter.), purple morning glory (*Ipomoea purpurea* (L.) Roth.), creeping Euphorbia (*Euphorbia humifusa* Willd.), wavyleaf basketgrass (*Oplismenus undulatifolius* (Ard.) P. Beauv.), Indian strawberry (*Duchesnea indica* (Andrews) Focke), Colorado spruce (*Picea pungens* Engelm.), and Amur cork tree (*Phellodendron amurense* Rupr.).

In 2018, we revealed *Allium ramosum* in the upper part of the Baksan Canyon, where it grew on a steppe meadow near the settlement of Neutrino. Thus, the upper elevational border of its habitat within the republic was 1600 m above sea level.

Oenothera biennis is a biennial herbaceous plant originating from North America. In the KBR it was

observed mainly in cultivation as an ornamental plant used on homestead plots and in flowerbeds. We also observed single cases of a dense bush formation on the roadsides along agricultural fields of the Urvan and Chegem districts. The species is common in the Nalchik cemetery and is occasionally found in floodplains of the piedmont zone. Seeds are spread by wind and waterflows. In the case of the North Caucasus, wild-growing plants of *O. biennis* were also observed in Stavropol krai (floodplain areas of the Podkumok River near the village of Pyatigorsky (Serebryanaya and Galkin, 2014)); on the roadsides, floodplains, and wastelands at the cordons of the Caucasian State Nature Biosphere Reserve, up to the elevation of 1400 m above sea level (Akatoва and Akatov, 2013); and in floodplain forests of the Belaya River and its tributaries (Litvinskaya and Savchenko, 2016).

Bidens frondosa is an annual herbaceous plant originating from North America. In the KBR, this species was first observed in 2018 on four small (2–8 m²) local plots in Nalchik, including a neglected lawn, construction site, sandy sediments in the floodplain of the Nalchik River, and a roadside in a private housing sector of the city. The flowering stage occurs in August–September, and the fruiting takes place in November. Each plant with height of 40–50 cm forms 60–80 inflorescences, which form up to 25–30 well-filled seeds each. The average productivity coefficient of seeds is 90%. A 5-month germination of freshly collected seeds was unsuccessful, which was probably caused by their long dormancy period. The main way of the species expansion in the republic is probably an occasional introduction of seeds with construction materials, by wheels of vehicles, and by water flows. Within the Caucasus, wild-growing plants of this species were revealed for the first time in the 1980s in the Republic of Abkhazia (Ignatov, 1988). Since 1995, the species has been observed in the Republic of North Ossetia–Alania (Komzha, 2004) and in Stavropol krai (Glazkova, 2006). The species grows on the cordons and river shoals located on the territory of the Caucasian State Nature Biosphere Reserve and its outskirts up to the elevation of 1582 m above sea level (Akatoва and Akatov, 2013), as well as in floodplain forests of the Belaya River and its tributaries (Litvinskaya and Savchenko, 2016). According to the existing data, *B. frondosa* is an aggressive weed able to significantly expand its habitat; it replaces aboriginal species *B. tripartita* L. and *B. cernua* L. in their typical habitats (Vinogradova et al., 2010).

Phytolacca americana is a perennial herbaceous plant originating from North America. In the KBR it is cultivated as an ornamental plant in the settlements of the plain and piedmont zones. The species may run wild; mass aggregations of plants were observed on wastelands in the floodplain of the Nalchik River. Single specimens and small aggregations were revealed on neglected lawns and roadsides of Nalchik. The plant has been observed for a long time as a weed species on

the Black Sea coast. Today it is common in river valleys and on roadsides, forest edges, and barrens of Krasnodar krai; it grows on the territory of the Khosta yew-and-boxwood tree grove and near the cordons of the Caucasian State Nature Biosphere Reserve (Akatoва and Akatov, 2013).

Echinocystis lobata is an annual climbing plant originating from North America. It occurs sporadically in rural places and on abandoned construction sites of Nalchik and grows on bushes located on the bank of the Sukhaya Shalushonka River near the city cemetery. In 2013, single specimens were found in the outskirts of the village of Uruk. The species propagates by anthropochory (introduction) and by seeds. Naturalized *E. lobata* was observed in the second half of the 20th century on wastelands and in riverside communities of the Republic of Dagestan (Makhachkala) and the Republic of North Ossetia–Alania (Vladikavkaz, Alagir) (Komzha and Popov, 1990). The species is able to transform riverside shrub phytocenoses.

Amorpha fruticosa is a deciduous shrub of North American origin. Since the 1970s, it has been observed on the roadsides and in the forest belt near the village of Chernaya Rechka (Urvan district). The species is planted on the streets of Nalchik (for example, on the territory of the Kabardino-Balkarian State Agrarian University). In 2011, several large (1.5–3 m in height) flowering shrubs were found in the composition of the steppe meadow situated near the Prokhladny highway. The species propagates by anthropochory (introduction) and by seeds. *A. fruticosa* is described as a cultivated plant, which often runs wild (in thickets of bushes) and is present in the Northwestern Caucasus flora (Zernov, 2010) and on the territory of the Khosta yew-and-boxwood tree grove in the Caucasian State Nature Biosphere Reserve (Akatoва and Akatov, 2013).

Ambrosia psilostachya is a perennial herbaceous root-sucker plant originating from North America. The species was first observed in the KBR on the railway slopes within Nalchik (September 20, 2018): 22 flowering plants with the height of 70–120 cm grew on an area of 24 m². During the repeated examination of the territory arranged on November 5, 2018, we observed the phase of the mass seeding of plants (70–320 large fruits per shoot). A 5-month germination of freshly collected cypselas was unsuccessful (long-term dormancy period). Obviously, the species introduction into the KBR took place via the railway. The plant is reproduced by seeds and vegetatively via formation of horizontal roots with numerous renewal buds already at the early developmental stages. In the Caucasus regions, *A. psilostachya* was registered on the territories of Krasnodar krai (all species foci were completely eliminated by 1990; Moskalenko, 2001), Stavropol krai, and the Republic of Abkhazia (Neshchadim, 2014). The species was included in the list of quarantine plants with a limited expansion on the territory of the Russian Federation. The species is able to actively occupy new ter-

ritories, dominate in plant communities, and invade into natural phytocoenoses (Moskalenko, 2001). The pollen of this plant is highly allergenic and is able to cause hay fever.

Commelina communis is an annual herbaceous plant originating from East Asia. In the KBR, the species was first revealed in the 1950s by Yu.I. Kos: the plants grew among other weeds in the yards of the residential area of Nalchik (Kos, 1959). We also observed this species in Nalchik in 2018. Aggregations of stretched and ascending shoots were revealed in six sites located near fences, on neglected lawns and homestead plots, and in flowerbeds. The species flowers in August–September and abundantly bears fruit in November. It spreads by seeds and by anthropochory (as an ornamental house plant). In the Caucasus, the plant is observed along brooks, in shady forests, and on wastelands of Krasnodar krai (Zernov, 2010), including on the territory of the Khosta yew-and-boxwood tree grove and cordons of the Caucasian State Nature Biosphere Reserve (Akatova and Akatov, 2013), and on wastelands of the Karachay-Cherkess Republic (Zernov and Onipchenko, 2011). Wild-growing plants have also been observed since the 1930s in the Republic of Abkhazia and the Republic of North Ossetia–Alania (Tsertsvadze, 1938). The species is able to infest vegetable gardens, agricultural fields, and meadows.

Hemerocallis fulva is a perennial herbaceous plant probably originating from the East Asia (Japan, China). It is widely planted on streets in settlements of the KBR. In 2011, wild-growing plants were observed in the floodplain of the Terek River (meadow area bordering a floodplain forest near an abandoned holiday village). In 2018, the species was found on a roadside near a subalpine meadow located 3 km above the village of Kendelen (1300 m above sea level). The expansion of *H. fulva* beyond the borders of its cultivation area probably occurs with the discarded rhizome-containing soil. Wild-growing plants were also found on the roadsides and in the floodplain forest of the Khosta yew-and-boxwood tree grove located on the territory of the Caucasian State Nature Biosphere Reserve (Akatova and Akatov, 2013).

Catalpa bignonioides is a deciduous tree originating from North America. In the KBR, the species is occasionally planted on the streets in settlements. In 2018, single specimens of fruiting wild-growing trees were found along the railway in Nalchik. The species is introduced as an ornamental plant and is spread by seeds. It invades into forest phytocoenoses of the southern macroslope of the Western Caucasus and grows in the valley of the Khosta River near the northern border of the Khosta yew-and-boxwood tree grove (Timukhin and Akatova, 2002).

Ipomoea purpurea is an annual climbing plant originating from the tropical regions of America. It is used for a vertical planting in front gardens and on streets (fences and building walls) in settlements of the KBR.

Wild-growing plants were observed in 2018 on wastelands of Nalchik (neglected lawns, construction sites, and dumps of construction materials) and on a barren located in the floodplain of the Nalchik River. The species is spread by introduction; the seeds are spread by wind and water flows.

Euphorbia humifusa is an annual herbaceous plant with stretched shoots, whose origin is considered to be East Asia. In the KBR, the species was first revealed in 2006; plants grew on the roadsides and in asphalt cracks in the resort zone of Nalchik (Tsepkova, 2007). By 2018, the species significantly expanded its habitat, spreading along the roadsides and spaces between asphalt plates to the streets, squares, and park zones of Nalchik. The plants form numerous small seeds spread by wind, rainwater, soles of shoes, and vehicles. The lack of data on the species expansion outside Nalchik determines its inclusion in the group of potentially invasive plants. As early as the 1960s, Grossgeim (1962) mentioned *E. humifusa* as a rare species of the wastelands in the Caucasus. The species was described for the flora of the Chechen Republic (roadsides in the Gudermes and Nadterechny districts and at the water supply point in Grozny (Terekbaev, 2013)) and was included in the list of synanthropic invasive plants of the Asian origin, which are typical of the Northwestern Caucasus (Litvinskaya, 2015).

Oplismenus undulatifolius is a perennial herbaceous rhizome plant with ascending shoots, which originates from the subtropical regions of Eurasia. In the KBR, the species was first observed in 2013 on the territory of the Geduko Reserve, where it sparsely grew under the canopy of a floodplain forest. The species is characterized by intense vegetative propagation by rhizomes, though its invasion into the territory of the reserve probably occurred with seeds. The species is common in shady broadleaf forests of the Black Sea coast in Krasnodar krai and represents one of the transformer species threatening the ecological safety of the region (Zernov, 2010; Litvinskaya and Savchenko, 2016). On the territory of the Caucasian State Nature Biosphere Reserve, this herb belongs to the group of the dominating grass species forming herb-oplismenus communities (Akatova and Akatov, 2013).

Duchesnea indica is a perennial herbaceous plant with creeping shoots, which originates from the South, East, and Southeast Asia (India, China, Japan, Indonesia, etc.). The plant is cultivated as an ornamental species on homestead plots of settlements of the KBR and is able to run wild. Wild-growing plants are observed in the floodplain of the Nalchik River, on the roadsides, and in parks of Nalchik, Chegem, and Baksan. The species intensely propagates by aboveground stolons and forms a dense ground cover at the points of invasion. *D. indica* is also propagates by seeds (endozoochory). Among neighboring regions, the species is observed (sometimes with high abundance) on the territory of the Caucasian State Nature

Biosphere Reserve (yew-and-boxwood tree grove, along the paths in the floodplain alder and broadleaf forests, in roadside vegetation) reaching an elevation of 1055 m above sea level (Akatova et al., 2009; Akatova and Akatov, 2013).

Picea pungens is a coniferous plant originating from North America. It is widely cultivated as an ornamental plant in all regions of Kabardino-Balkaria up to 2100 m above sea level. In 2018, we observed wild-growing plants in a forest tract near Tynyauz. Four young trees (1–2 m in height) of seed origin grew in a pine forest under the canopy of a group of maternal trees planted in the 1990s by amateur gardeners.

Phellodendron amurense is a dioecious deciduous tree, whose origin is associated with the Far East, Northeastern China, and Korea. It is sometimes cultivated in settlements of the KBR as an ornamental plant. The species was introduced in the floodplain of the Belaya Rechka forestry; today large undergrowth (0.5–3 m in height) is developed under the canopy of maternal plants. This endozoochoric plant, whose fruits are spread by birds, also propagates by root shoots. In the neighboring regions, the species was observed on the territory of the Caucasian State Nature Biosphere Reserve (Timukhin and Akatova, 2002).

CONCLUSIONS

At the current stage of invasion processes, the flora of Kabardino-Balkaria is characterized by the presence of 69 species with marked invasive potential. These species include five transformer species (status 1); 19 species actively invading into disturbed, natural, and seminatural communities with the expansion of their habitat area (status 2); 26 aggressive invasive species occurring in disturbed, ruderal, and segetal communities (status 3), and 19 potentially invasive species (status 4). Among them, three species (*Bidens frondosa*, *Ambrosia psilostachya*, and *Oplismenus undulatifolius*) were described for the first time for the flora of the KBR.

Among the studied species, 26 and 10% were represented by the families Asteraceae Dumort. and Poaceae Baruh, respectively; the families Euphorbiaceae Juss. and Solanaceae Juss. took 5.8% each. North America and Asia (China, Japan, India, etc.) were the centers of origin for 42 and 17% of species, respectively; other species were historically connected with the South and Central America (10%) or with Southern, Western, and Central Europe (5.8%). At the same time, 22% of invasive flora of the KBR have several genetic centers of origin or even unknown origin, which was not reliably confirmed. In the case of 20 species (~29% of the total number of species included in the study), there are no reliable data on the exact date of their first appearance in Kabardino-Balkaria. Thirteen species (~19%) were first registered in the KBR in the first half of the 20th century, while 24 species

(~35%) appeared in the second half of the 20th century. Nine species (*Bidens frondosa*, *Ambrosia psilostachya*, *A. trifida*, *Oplismenus undulatifolius*, *Euphorbia nutans*, *E. davidii*, *E. humifusa*, *Allium ramosum*, and *Acalypha australis*) were first observed in the KBR in the last decade.

The main ways for the introduction of the studied species on the territory of the KBR include introduction as agricultural crops, occasional introduction of seed germs into agricultural lands with seed material or agricultural machinery (55% of species), and also importation as ornamental plants (38% of species). The further expansion of species within the republic is determined mainly by anthropogenic activity: seed transport by wheels of vehicles and trains and with construction and road materials, cultivation on home-stand plots, activity of aquarists, etc. For example, man-caused introduction became the reason for the appearance of *Ambrosia artemisiifolia*, *Erigeron annuus*, *E. canadensis*, *Xanthium albinum*, *X. spinosum*, *Abutilon theophrasti*, and *Allium ramosum* in recent decades in the mountain (including high-mountain) regions of Kabardino-Balkaria. Except for *X. spinosum* and *A. theophrasti*, these species are able to complete a full cycle of a seasonal development, to form viable seeds, and to renew populations at the invasion sites. The vast majority of invasive plants in the KBR also propagate in a natural way (water and air flows, zoochory, and vegetative propagation) owing to the flying and floating ability of seeds, presence of hooks on fruits and seeds, root shoots, tubers, etc.

The majority (56%) of the studied species negatively influence agriculture in the KBR (segetal and pasture weeds) or represent weeds of urban territories. Six species possess manifested allergenic properties (*Ambrosia artemisiifolia*, *A. psilostachya*, *A. trifida*, *Cyclachaena xanthiifolia*, *Acer negundo*, and *Sorghum halepense*); 15 species are strong competitors in relation to aboriginal ruderal flora and plants of undisturbed terrestrial and aquatic ecosystems.

In the case of the lack of efficient control measures, such as organizational (examination of goods under quarantine, control inspections of agricultural lands and disturbed territories, liquidation of illegal dumps and wastelands, etc.), agrotechnical, chemical, phyto-coenotic, and mechanical (removal of plants) measures, one can expect in the very near future a significant expansion of the habitats of some of these species, including *Ambrosia artemisiifolia*, *Erigeron annuus*, *E. canadensis* (upward expansion along the elevational gradient), *Sorghum halepense*, *Eriochloa villosa*, and *Elsholtzia ciliata*. Changes in the invasive status are possible for *Erigeron canadensis* (transfer to the group of transformer species), *Ambrosia trifida*, *Acer negundo*, *Reynoutria japonica*, *Amaranthus retroflexus*, *Acalypha australis* (transfer to the status 2 group), *Bidens frondosa*, and *Euphorbia humifusa* (transfer to the status 3 group).

The data presented in this study will become a basis for a large-scale investigation of the invasive fraction of the North Caucasus flora. Results of our study can be interesting for the comparative analysis of alien components of regional floras and the assessment of the expansion features of invasive plants on the territory of Russia as a whole. Integrated data on the expansion, ways, and vectors of plant invasion will be useful for the legislative and executive authorities working in the field of environmental protection, agriculture, and health protection, as well as for tenant farmers and municipal authorities of the republic. Such data collection represents the basis for the development of measures to control the number of invasive species in Kabardino-Balkaria, as well as to prevent and to reduce ecological and economic losses caused by their expansion.

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COMPLIANCE WITH ETHICAL STANDARDS

Conflict of Interests

The authors declare that they have no conflict of interest.

Statement of the Welfare of Animals

This article does not contain any studies with humans or animals as the objects of studies.

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