

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

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Abstract—A blacklist of the flora of Kabardino-Balkaria, which includes 22 species of invasive plants, has been compiled. According to recommendations for the Black Books, all plant species from the blacklist are divided into four groups according to their invasive status. A brief description of their naturalization history, occurrence, and ecological, biological, and phytocenotic features on the described territory is presented.

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

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INTRODUCTION

Biological invasions caused by intentional or accidental introduction of alien species became a serious global problem during the 20th century, when globalization processes acquired a large scale. Negative consequences of the introduction of alien species are widely discussed in the global community, including the Convention on Biological Diversity (Convention..., 1996), Global Invasive Species Programme (Global Invasive..., 1999), Global Ballast Water Management Program (GloBallast, 2000), Caspian Environment Program (Caspian..., 2002), etc. Such wide recognition of the problem of biological invasions is caused by both its ecological and socioeconomic character. Introduction and expansion of alien species may result in negative changes of natural ecosystems and cause serious economic damage and human health hazard.

Intensification of species migration processes due to climatic changes and increased intentional or accidental introduction represents a serious ecological and socioeconomic problem for the Kabardino-Balkar Republic (Kabardino-Balkaria, KBR). Before 2000, the KBR Government annually approved the Weed Control Regulation, in which the control measures, responsible persons, and financial provision were clearly described. Now the control of weed expansion is imposed on tenant farmers, for which such activity often means additional expenses. Introduction of alien plants represents a great problem not only for agrocenoses but also for both meadow and steppe phytocenoses of Kabardino-Balkaria.

The purpose of this study was the creation of a “blacklist” of flora of Kabardino-Balkaria based on the inventory and generalization of information about the naturalization history, introduction pathways and methods, expansion, ecological, biological, and phytocenotic features of alien plant species, as well as the character of their influence on the natural ecosystems, economics, and social sphere of the republic. In this study, we present for the first time comprehensive information about 22 invasive plants of the region, which will be used for preparation of the Black Book of the Central Caucasus Flora.

MATERIALS AND METHODS

Kabardino-Balkaria is situated in the central part of the northern slope of the Great Caucasus, in a basin of left tributaries of the Terek River (between 42°54' N and 44°01' N, 42°24' E and 44°28' E). The republic borders Stavropol krai to the north, with North Ossetia-Alania to the east and southeast, Georgia to the south, and Karachaevo-Cherkessia to the west. According to the relief character, Kabardino-Balkaria is divided into three regions: plains (33% of the territory), piedmont (16%), and mountains (51%). The mountain region is represented by the Great Caucasus Ridge, Lateral Ridge, and Rocky Ridge, which are divided by longitudinal valleys, or depressions (Gur'yanov, 1964). Because of a strong cooling effect of the Main Caucasus Ridge and Lateral Ridge, the mountains are characterized by a dry and cold climate, while climatic conditions in depressions are moderately cold and dry.

Climatic conditions of piedmonts are moderately warm and damp; those of plains are moderately warm and dry.

Kabardino-Balkaria is situated within the Elbrus (northwestern part) and Tersky (southwestern part) zonal variants of the northern macroslope of the Central Caucasus (Sokolov and Tembotov, 1989). The zonal spectrum of the Elbrus variant consists of meadow steppes and steppe meadows, as well as sub-alpine, alpine, subnival, and nival zones. The Tersky variant additionally includes a broad-leaved forest zone. Steppe vegetation is represented by plain, piedmont, and mountain steppes. Forest vegetation consists mainly of oak, hornbeam, pine, and birch forests, as well as aspen and alder trees. Meadow vegetation includes alpine, subalpine, post-forest, and riverside meadows (Shhagapsoev, 2015).

Data on the composition of invasive flora of Kabardino-Balkaria and on the main characteristics determining the invasive potential of separate species represent the results of investigations carried out by the authors of this study (Tsepkova and Yakimov, 2005; Tsepkova et al., 2013, 2014; Tsepkova and Taumurzaeva, 2016; Shhagapsoev et al., 2017; Shhagapsoeva et al., 2017; Chadaeva et al., 2018; etc.). In addition, the authors analyzed the few available regional publications devoted to this problem (Novopokrovskiy and Kosenko, 1933; Kos, 1959; Kushkhov, 1977, 1980, 1989; etc.).

Following Gel'tman (2006), we consider invasive species as actively naturalizing alien species generating numerous progeny, which expand far from parental specimens and have a potential for expansion across large territories. To determine the invasive status of species, we used guidelines for the maintenance of regional Black Books (Notov et al., 2010; Vinogradova et al., 2010, 2011). According to the level of aggressiveness and features of expansion, four groups of species were distinguished.

RESULTS AND DISCUSSION

Status 1 includes “transformer” species able to change the character, 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; they transform the structure and composition of plant communities, disturb succession and consortive relations via replacement of less competitive species, and play the role of edificators and dominants (Notov et al., 2010; Vinogradova et al., 2010, 2011).

Such species occurring on the territory of Kabardino-Balkaria include common ragweed (*Ambrosia artemisiifolia* L.), Canadian waterweed (*Elodea canadensis* Michaux), annual fleabane (*Erigeron annuus* (L.) Pers.), and Johnsongrass (*Sorghum halepense* (L.) Pers.). *A. artemisiifolia* is an annual and mainly monoecious

plant originating from North America and regulated as a quarantine weed. The first hotbeds of common ragweed in Kabardino-Balkaria were observed after World War II. Today the species is common in all administrative districts of the republic, from plains to medium-high mountains (400–1700 m above sea level; Chadaeva et al., 2018). In the case of freshly plowed steppe, fallow lands, wastelands in populated areas, and outskirts of agricultural lands, common ragweed produces shoots with the height exceeding 2 m, which have a great reproductive potential (>100 female inflorescences per plant). The species forms pure communities with the projective cover of 50–100% (Chadaeva et al., 2018). Seeds are easily spread by water flows and wind, on car wheels, and also on fur of animals. In mountain regions, they can also be introduced with forage grain and often with hay and straw. The main threats of this species are high allergenicity of its pollen and the ability to expand across gardens, pastures, and crops, suppressing other species and reducing soil fertility. In addition, common ragweed worsens forage quality of hay and reduces the possibility to pasture cattle.

Elodea canadensis is a perennial aquatic plant also originating from North America. In Kabardino-Balkaria, Canadian waterweed was first revealed in December 1997 in a settling pond of treatment facilities located in the northern part of Nalchik (Tsepkova and Yakimov, 2005). Today the species forms mass aggregations in settling ponds of the Maisky treatment facilities; probably, it came there with water from aquariums. The species is also found in the Shalushka River, where it appears with water discharged from settling ponds. This species actively propagates by thallus shreds. *E. canadensis* is a strong competitor to indigenous aquatic flora; in the case of luxuriant development, it displaces other plant species from water bodies and forms monodominant communities (Golovanov et al., 2016). Mass plant decay during summer and winter may result in a fish kill and negatively influences the quality of drinking water (Vinogradova et al., 2010).

Erigeron annuus is an annual or biennial plant species from North America. Its wide occurrence in the republic at the end of 1950s was reported by Kos (1959). In the 1970s, this species was observed among persistent weeds of agricultural crops (Ruguzov, 1971). Now this plant is widespread and can be found in wastelands, gardens, parks, walnut groves, on roadsides, in agrocenoses, dryish floodplain meadows, and on open slopes of the piedmont zone, where it is often aspecting. The projective cover of the species in piedmont haylands is 16–25% (Tsepkova, 2013). *E. annuus* forms monodominant communities (projective cover near 70–80%, plant height ~100 cm) in steppe meadows located 600–850 m above sea level. Growing along floodplains and federal highways, the species reaches the elevation of 950–1050 m above sea level, such as in the Baksan (plant height 40–70 cm, projec-

tive cover reaches 20%) and Malka (plant height 20–50 cm, sparse growth) gorges. In Kabardino-Balkaria, one 75-cm plant forms ~270 anthodia, each containing more than 250 flowers (Tsepkova et al., 2008). Mass expansion of this species is provided by the fact that animals do not eat it in a fresh form and also by a prolonged flowering lasting up to stable autumn frosts (Tsepkova, 2013). Seeds are spread by the wind; anthropogenic introduction occurs mainly along the roads. Growing on haylands, the species displaces valuable forage plants (Tsepkova, 2013). *E. annuus* is a threat to the floristic composition of plant communities.

Sorghum halepense is a perennial plant, which, according to different data, originates from Asia Minor, North Africa, or Southeastern Europe. The species was introduced into Kabardino-Balkaria at the beginning of 1930s, probably with seeds of Sudan grass. In the mid-1950s, the species was already considered among persistent weeds and actively expanded its range in parallel with the increase in the irrigated area of agrocenoses on the territory of the republic (Klevtsov, 1973). In recent years, *S. halepense* has often been observed not only in fields and gardens but also in floodplains of the main rivers of Kabardino-Balkaria, wastelands, dumps, pastures, and forest edges, as well as in flower beds and wastelands of the towns of Baksan (Shhagapsoev and Ordokov, 2006), Nalchik, and Chegem. Within habitats, the projective cover of the species reaches 80–90% at a plant height exceeding 1.5 m; in some areas, its growth density reaches 65–90 plants/m². Seeds are introduced with grain or carried by the soles of shoes and wheels of cars or tractors and are spread with water flows. Johnson-grass is a persistent weed of irrigated agriculture; its density and dry mass may reach 30000 generative shoots and 2688 kg per ha, respectively, so it may cause significant soil exhaustion (Kozhaev, 2014). Rhizomes deeply penetrating into the topsoil hamper soil treatment. Young shoots may poison cattle, and the pollen is allergenic.

Status 2 includes alien species actively penetrating into disturbed, natural, and seminatural communities and continuing their expansion over the whole habitat. This group consists of Canadian fleabane (*Erigeron canadensis* (L.) Cronquist), hairy cupgrass (*Eriochloa villosa* (Thunb.) Kunth), shaggy soldier (*Galinsoga quadriradiata* Ruiz et Pav.), gallant soldier (*Galinsoga parviflora* Cav.), pineapple weed (*Matricaria discoidea* DC.), and yellow nightshade (*Solanum cornutum* Lam.).

Erigeron canadensis is an annual or biennial winter plant from North America. Mass expansion of this species in Kabardino-Balkaria was registered in 1922 in the plain part of the republic (Chernetskaya and Vinogradov, 1926). Today the species grows in vegetable gardens and flower gardens, agricultural fields, on vacant lands, fallow lands, lawns, roadsides, in spaces between rails, on railway slopes, and around landfills. The species was stably introduced into natural

meadow phytocenoses of the piedmont zone and reached medium-high mountains up to 1600 m above sea level (Sytin et al., 2012). Seeds are spread mainly by the wind, irrigation systems, and rivers, as well as along roads and railroads. Canadian fleabane infests more than 40 crops and is the host plant for some bug species reducing the yield of cereals and alfalfa (Vinogradova et al., 2010) and alien plant parasitic micro-mycetes (Poliksenova and Khramtsov, 2015). In the case of direct contact, leaves of this plant may cause skin irritation in humans and mucous membranes of horses (Weaver, 2001).

Eriochloa villosa is an annual plant whose natural range is located mainly in China. In Kabardino-Balkaria, this species was a well-known weed as early as the 1950s; it was introduced with wheat or oat seeds. Now hairy cupgrass is widespread in the steppe and piedmont zones of the republic. It infests cereal and fruit crops (Shhagapsoev and Zhankaziev, 2006); grows in flower gardens, on roadsides, vacant lands, in pastures, and along lakeshores; and manifests an extraordinary ecological plasticity and adaptation to the environment. The species is spread by spikelets and caryopses with food and forage grain; it strongly suppresses cultivated crops, rapidly expands across fields, exhausts the soil, and reduces yield quality.

Galinsoga quadriradiata is an annual plant whose natural range is located in South and Central America. This species was first discovered in Kabardino-Balkaria in 1968, when its specimens were collected in the outskirts of Nalchik and the village of Belaya Rechka (Kushkhov, 1977, 1989). Now the species is common in all administrative divisions of the republic. Shaggy soldier grows in ruderal habitats, gardens, fields, and on lawns and road and railway embankments and is included in the composition of native communities (Shhagapsoev and Ordokov, 2006). Seeds are spread by the wind and water flows, with food and forage grain, and with seeds of vegetable or ornamental plants. The species infests greenhouses, reduces the yield of vegetable and cereal crops, and is the source of several pests, including insects, viruses, and nematodes (Vinogradova et al., 2010).

Galinsoga parviflora is a spring annual plant of South American origin. Mass expansion of the species was reported in the 1950s; the species was observed in wet vegetable and flower gardens, shady front gardens, and parks of the Nalchik district (Kos, 1959). However, until the 1980s, *G. parviflora* and *G. quadriradiata* were not distinguished in the Soviet Union; we suppose that the author of that study could have meant the latter species. Today *G. parviflora* occurs in all administrative districts of Kabardino-Balkaria. In towns, the plant often grows in flower gardens, in town dumps, on vacant lands, and partly on lawns (projective cover is 25–50%). It is also common in agricultural fields and predominates in disturbed habitats. The species was described as a part of a synanthropic

plant community formed in the pasture area in the Sukanskoe Gorge (1938 m above sea level; Tsepikova et al., 2014). Feathered seeds are spread by the wind and water flows, with food and forage grain, and with seeds of vegetable and ornamental plants. The species infests cereal and vegetable crops and is a dangerous weed for nurseries of ornamental plants.

Matricaria discoidea is an annual plant whose natural range covers the northeastern part of Asia (Far East and Hokkaido Island) and western regions of North America extending from Interior Alaska to northern Mexico (Nikitin, 1983). There are no reliable data about the time when this plant first appeared in Kabardino-Balkaria. Kos and Demishev (1951) observed this species only in the middle of the 20th century. Today pineapple weed is widespread across ruderal territories, along borders of agrocenoses, and in agricultural fields (Shhagapsoev and Zhankaziev, 2006) and also in disturbed meadows in all administrative districts of the republic. Since the 1980s, the species has become common in the upper part of the Baksan Forge (1800–2500 m above sea level), where it grows in settlements, along roadsides and paths, near cattle pens, and on floodplains. Achenes are spread by the wind and rain; when wet, they became slimy and stick to the soles of shoes. In addition, they can be spread by horses eating these plants (Vinogradova, 2010). Pineapple weed infests the fields of tilled crops, perennial herbs, and spring and winter cereals. Forming dense covers on disturbed areas, this species is a serious competitor to indigenous flora and is able to disturb natural secondary successions.

Solanum cornutum is an annual plant originating from Mexico and the southwestern part of the United States. The species was introduced into Kabardino-Balkaria in 1950s with hemp seeds received from Central Asia (Kos, 1959). Today the species is common in the republic. It grows in fields of cultivated crops, flower gardens, vegetable gardens, pastures, on fallow lands, in disturbed meadows, etc. (Shhagapsoev and Zhankaziev, 2006). Fruits and seeds of yellow nightshade are spread by wind and water flows and with seed and food material, hay and straw, and skins and fur of animals. The species is a persistent weed infesting tilled and spring cereal crops, flower gardens, vegetable gardens, and pastures. Leaves are poisonous to animals, thorns within hay may injure the oral cavity and gastrointestinal tract, and infested straw is unsuitable even for litter.

Status 3 includes aggressive alien species occurring in disturbed, ruderal, and segetal communities (fields, arable lands, cleared spaces, buffer zones of agricultural fields, roadside ditches, and urban agglomerations). Some of such species represent cultivated plants. The group consists of sugar maple (*Acer negundo* L.), giant ragweed (*Ambrosia trifida* L.), garden daisy (*Bellis perennis* L.), ruderal hemp (*Cannabis ruderalis* Janisch), sumpweed (*Cyclachaena xanthiifo-*

lia (Nutt.) Fresen.), Vietnamese balm (*Elsholtzia ciliata* (Thunb.) Hylander), flower-of-an-hour (*Hibiscus trionum* L.), and burweed (*Xanthium spinosum* L.). Some of these species probably will be able to invade into seminatural and natural communities.

Acer negundo is a deciduous tree from North America. In Kabardino-Balkaria, the species was actively planted in the 1950s–1960s in the park zone and areas of high-rise buildings in the city of Nalchik. Today Canadian maple grows on the territory of the majority of settlements in the republic, though no active invasion of this species into natural ecosystems is observed. Canadian maple has a significant transformation potential and prevents the renewal of other ornamental plants. The pollen of Canadian maple may cause allergic reactions (White and Bernstein, 2003).

Ambrosia trifida is an annual plant of North American origin. The first appearance of this plant in Kabardino-Balkaria was reported by Kushkhov (1989). In August 2012, the species was found at the edge of a maize field and on a roadside near the village of Uruk (Tsepikova, 2013). The population was represented by the group of large specimens (up to 2.5 m in height) forming a dense cover. In 2016, monodominant giant ragweed communities were observed in the Tersky region in irrigated fields of agricultural and vegetable crops, on roadsides, and on fertile soils near stock-breeding farms; the plant height reached 2.5 m. Fruits of this species are spread with seed food and forage grain, hay, straw, seedlings, and soil and on wheels of transport vehicles, as well as by wind, rain, and snowmelt runoffs. Giant ragweed strongly suppresses agricultural crops, exhausts the soil, and complicates harvesting (Osertak and Morozova, 2014). The pollen of this species has allergenic properties.

Bellis perennis is a perennial herb which is considered to originate from Southern and Central Europe. This species was probably introduced in Kabardino-Balkaria in the 1980s as an ornamental plant for use on lawns, in flower beds, and in home gardens. Today garden daisy actively grows on lawns, in flower beds, and in parks, though it is less common on floodplains (Shhagapsoev and Ordokov, 2006). For example, we observed mass expansion of this species in flower beds, on lawns, and in the park zone of Nalchik. Owing to active vegetative propagation, garden daisy occupies areas of 1–30 m² with the projective cover of 70–100%. Lawn mowing did not hurt daisy plants, which have basal leaf rosettes; moreover, this procedure activates their flowering owing to the removal of deflorated anthodia. In the case of mass growth, *B. perennis* becomes a serious competitor to local indigenous species, which negatively influences the biological diversity of plant communities.

Cannabis ruderalis is an annual plant which is considered to originate from Central Asia. According to archival data, reception of harvested ruderal hemp from the local population was registered as early as the

1920s “at the receiving points located between the Petropavlovsky farm and Altud” (Central State Archive Department of Kabardino-Balkar Republic, R-28, inv. 1, file 154, list 10). Today the species is common in maize, wheat, and buckwheat fields of the Urvan, Lesken, Zolsky, and Chegem districts of the republic; in maize fields and abandoned cattle pens of the Elbrus district; and in ruderal areas of the Maisky district (Shhagapsoev and Zhankaziev, 2006). In the wild form, the species is propagated by seeds and represents a persistent weed of spring crops (Virovets et al., 1989). Ruderal hemp is considered to be poisonous plant and is not eaten by animals (Oorzhak et al., 2007).

Cyclachaena xanthiifolia is an annual plant of North American origin. In Kabardino-Balkaria, it was first collected in 1965 from flower beds near the Nalchik railway station (Kushkhov, 1989). In the 1970s, the species was observed on railway embankments along the Mineralnye Vody–Prokhladny–Nalchik route, then in wastelands, agricultural fields, flower gardens, and vegetable gardens of the republic (Shhagapsoev and Zhankaziev, 2006). In 2012, two local sumpweed populations were revealed on the roadside near the village of Uruk (single specimens) and near a stock-breeding farm located in the outskirts of the village of Kamennomostskoe (large group of plants; Tsepkova, 2013). The total projective cover of the species in its habitats was 85%; the average plant height was 90 cm. Dissemination of the species occurs mainly via transport of infested goods, including agricultural products harvested from vegetable gardens and watermelon fields. Sumpweed strongly exhausts the soil and allelopathically suppresses the development of many weeds and cultivated plants (Kurdyukova and Zherdeva, 2015). Inhalation of the pollen causes hay fever (Konoplya et al., 2010). Presence of *C. xanthiifolia* in hay results in stomach diseases and poisoning of cattle (Mishina and Teryokhina, 2003).

Elsholtzia ciliata is an annual grassy plant whose natural range covers all provinces of China. At the beginning of the 1980s, Vietnamese balm was first reported in Kabardino-Balkaria by Kushkhov (1989), who observed it in gardens in the outskirts of Nalchik. Later, the species was observed in the basin of the Cherek Bezengiysky River: Portenier (1992) reported that it grew on roadsides and in ruderal places up to an elevation of 1300 m above sea level, and later Shhagapsoev et al. (2005) found it on roadsides and dry weakly matted slopes. In 2005, *E. ciliata* was observed in two garden plots near the village of Adiyukh, located in the northern outskirts of Nalchik, and on the roadsides near the village of Belaya Rechka (Tsepkova, 2013). The field germination rate of small-sized Vietnamese balm seeds is 65–69% (Kharina et al., 1995). Being the element of the pioneer flora, the species is able to displace competitive weeds and rapidly expand over available areas owing to a well-developed shallow root system; its expansion disturbs the natural evolution of secondary successions.

Hibiscus trionum is an annual cosmopolitan plant of East Mediterranean (or North and Central African) origin (*Flora SSSR*, 1949; Tuganaev and Puzyryov, 1988). In Kabardino-Balkaria, the species was first found in plowed fields (Kushkhov, 1989). Today the species has significantly expanded its range within the republic and has become one of persistent weeds of such agricultural crops as sunflower, maize, and wheat (especially in irrigated fields). It can be found in pastures near villages, in ruderal areas, and on roadsides. Under local conditions of Kabardino-Balkaria, one plant forms up to 500–600 seeds able to germinate for 7–8 years.

Xanthium spinosum is an annual plant of North American origin. In Kabardino-Balkaria, this species was first reported in 1965 and 1967 (Kushkhov, 1989). Today burweed represents a common segetal weed species growing on roadsides, in wastelands, pastures, and dry steppe meadows (Shhagapsoev, 2015). The species is spread by animals (seeds cling to the coat by hooked thorns), by water, and also with infested cereal seeds. Field infestation with burweed causes yield reduction because of the disturbance of the light, water, and mineral regimes and complicates land treatment. Thorny collective fruits become entangled in the wool of sheep and manes and tails of horses. Young shoots may poison animals; adult plants are not eaten by cattle.

Status 4 includes potential invasive species observed now as single specimens in natural and disturbed communities and able to regenerate in the places of invasion: Chinese chives (*Allium ramosum* L.), small carpetgrass (*Arthraxon hispidus* (Thunb.) Makino), David’s spurge (*Euphorbia davidii* Subils), and nodding spurge (*Euphorbia nutans* Lag.).

Allium ramosum is a perennial herb originating from the mountains of China. In recent years, Chinese chives has been grown in small private plots in settlements of Kabardino-Balkaria as an ornamental and food plant; sometimes it is also used for flowerbeds of town streets and parks. In 2017, we found two wild populations of this species in the floodplains of the Nalchik River (at the joints of concrete slabs along the reinforced riverbank in the southeastern part of Nalchik) and Terek River (meadow area in the left bank bordering the floodplain forest). These findings are probably caused by the invasion of the species from cultivated areas. Plants completely run the seasonal development cycle and form viable seeds in October–November. The species rapidly expands to available areas of disturbed territories via intense seed propagation (~270 well-filled seeds per plant) and reaches an average density of 20.48 plants/m². *A. ramosum* is able to grow stably in meadow phytocenoses, maintaining its density at the level of 7 plants/m².

Arthraxon hispidus is an annual hygrophyte plant naturally growing in Africa and Southeast Asia. The species was introduced into Kabardino-Balkaria prob-

ably in the 1940s, during several attempts at rice cultivation within the territory of the republic. In 1966, small carpetgrass was collected by A.Kh. Kushkhov near the town of Nartkala and the village of Psykod; later, it was also found near the village of Altud (Kushkhov, 1989). Today the range of the species has slightly expanded. It occurs in coastal and near-water communities and on pebble beds of the Maisky, Urvan', and partially Chegem districts of the republic; the species is capable of self-maintenance in the nodes of invasion (Shhagapsoev, 2015). Seeds are spread by water flows and strong wind; in addition, owing to the activity of aquarists, they may get into water bodies. In the nodes of invasion, the species manifests itself as an aggressive competitor (Leck, M.A. and Leck, C.F., 2005).

Euphorbia davidii is an annual herb with the natural range covering northern Canada, the United States, and Mexico. In Kabardino-Balkaria, David's spurge was first observed in 2014 on the slopes of the North Caucasus railway in the northern part of Nalchik; it was probably introduced with the seed material of cultivated plants (Tsepikova and Taumurzaeva, 2016). Within two years, the species expanded along 185 m of the railroad bed within the borders of Nalchik; the area occupied by its population reached 463 m². The magnitude of this population increased from several dozen (several local nodes) to 603 (Shhagapsoev et al., 2017). The species successfully completes the full cycle of seasonal development. One shoot forms 206–535 seeds on average, which provides a yield reaching 370.5 seeds/m² (Shhagapsoev et al., 2017). *E. davidii* was also observed in agricultural fields and apple orchards of the Lesken and Chegem administrative districts, respectively. Seeds are spread by wind and water and are also disseminated along railways with imported cereals and by the soles of shoes and wheels of cars and agricultural machinery. The species is able to rapidly expand on available territories and to create a seed bank in agrocenoses.

Euphorbia nutans is an annual herb originating from North America. In Kabardino-Balkaria, it was first observed in the outskirts of Nalchik by Shhagapsoev and Karachayeva (2009). Today the species is scattered along roadsides and in ruderal areas; owing to the seed renewal of populations, it is able to occupy a territory for a long time (Shhagapsoev, 2015). Seeds are spread with the imported cereals, including their railway delivery, and also by wind and water and on the soles of shoes and wheels of cars and agricultural machinery. In the case of mass expansion, *E. nutans* is able to infest agricultural fields.

CONCLUSIONS

Today the occurrence of invasion processes in the flora of Kabardino-Balkaria is characterized by the presence of some species with a strong invasive potential. These species include four transformer species

(status 1), six species actively invading into disturbed, natural, and seminatural communities with the expansion of their habitats (status 2), eight aggressive invasive species occurring in disturbed, ruderal, and segetal communities (status 3), and four potentially invasive species (status 4). It is quite possible that this list is incomplete. In the absence of any efficient organizational (inspection of regulated products, control examinations of agricultural lands and disturbed territories, elimination of unofficial dumps and wastelands, etc.), agrotechnical, chemical, phytocenotic, mechanical (plant removal), and other control measures, one should expect in the near future a significant expansion of ranges of some of the above-mentioned species. Among such species, there are *Ambrosia artemisiifolia*, *Erigeron annuus*, *Erigeron canadensis* (upward expansion along the altitude gradient), *Sorghum halepense*, *Eriochloa villosa*, *Solanum cornutum*, *Bellis perennis*, *Cyclachaena xanthiifolia*, and *Elsholtzia ciliata*. Changes in the invasion status are possible for *Erigeron canadensis* (transition to the status 1 group) and *Bellis perennis* (transition to the status 2 group).

COMPLIANCE WITH ETHICAL STANDARDS

Conflict of interests. The authors declare that they have no conflict of interest.

Statement on the welfare of animals. This article does not contain any studies involving animals performed by any of the authors.

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