ISSN: 2707-1146
e-ISSN: 2709-4189

https://doi.org/10.36719/2707-1146/51/4-9

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Conservation Methods of Some *Brassicaceae* Burnett. Species in the Flora of Nakhchivan Autonomous Republic Considering Global Climate Change

Abstract

The article discusses the impact of drought on the development of wild species of the *Brassicaceae* Burnett. family in the flora of Nakhchivan Autonomous Republic and the ways to solve this problem. Researches were conducted in the direction of climate change of wild species of the *Brassicaceae* Burnett. family, which are distributed in Babek, Kangarli, Julfa, Ordubad, Shahbuz regions of the Nakhchivan Autonomous Republic, starting from the lowland region to the high mountain arches. The amount of precipitation in the plains is less than in the highlands and the annual temperature is higher. Considering these features, plains have been the center of attention. Plants belonging to the *Brassicaceae* Burnett. family (mostly belonging to the mesophyte type ecological group), which are distributed in water edges, wetlands, wetlands, meadows and agricultural areas, are exposed to drought stress more than species distributed in other ecological environments. The bioecological and geographical (phenophase, height, life form, ecological group, altitude zone and ecological environment) characteristics of these plants are tabulated. As the effects of drought are expected to increase in the future due to global climate change, more sustainable approaches are recommended in this area.

Keywords: *climate change, Brassicaceae Burnett., species, plant, mesophyte*

Introduction

Global climate change has become one of the most pressing economic and political issues in the world **(**Bondarenko et al., 2018, pp. 84-93). Global climate change is causing long-term changes in the Earth's climatic conditions, with serious impacts on plants as well as other living organisms. Rising temperatures, unusual weather conditions, changes in humidity and more extreme weather events are severely affecting plant growth, reproduction and productivity. Plants play an important role in maintaining the stability of ecosystems and meeting the nutritional needs of humans. In this respect, it is necessary to investigate the impacts of climate change on their life cycles and their role in ecosystems. Increased temperature causes atmospheric drought and over a long period of time can increase eva-potranspiration, leading to desiccation of the root-inhabited soil layer and increased salt content (Ergashev, 2010, pp. 64-70). Drought is a natural phenomenon characterized by limited water resources and significantly affects plant growth. Frequent droughts due to increasing global climate change and unusual weather conditions pose a major threat to plant species. Lack of water weakens the development of plant root systems, the absorption of nutrients and the process of photosynthesis, which leads to a decrease in productivity and, as a result, to an imbalance of ecosystems. Living organisms have to relate themselves to the environment for their sustenance. Environmental factors and metabolic processes in the body cause molecules or atoms to form free radicals that have increased chemical reactivity (Kaur, 2013, pp. 1-9). Under the influence of drought, both physical and biochemical changes occur in plants, which negatively affect the food chain and biodiversity. From this point of view, it is more realistic (for Nakhchivan AR) that many plants that exist in nature may disappear completely or be threatened with extinction.

Research

The *Brassicaceae* (*Cruciferae* or mustard family) is a large plant family with approximately 338 genera and 3709 species distributed worldwide, most are distributed in the temperate areas of the Northern Hemisphere (Younes et al., 2015, pp. 1448-1458). *Brassicaceae* Burnett. Cabbage family

ISSN: 2707-1146
e-ISSN: 2709-4189

is represented by 248 genera and 74 species in Azerbaijan and 67 genera and 165 species in the flora of Nakhchivan Autonomous Republic (Askerov, 2016; Talibov, Ibrahimov, & Ibrahimov, 2021). The family Brassicaceae unites insect-pollinated plants with regular leaves, characterized by the structure of the flower: it consists of 4 sepals, 4 petals alternating with sepals, 6 stamens, of which 2 are shorter than the others, 1 pistil with an upper two-nested ovary (Erzhapova et al., 2010, pp. 36-38). In addition to wild species, cultivated representatives are also known (Aliyeva, 2023, pp. 4-8). The Brassicaceae are an important family for three primary reasons (Koch, Al-Shehbaz, & Mummenhoff, 2003, pp. 151-171). The mustard family (Brassicaceae or Cruciferae) belongs to the order Brassicales and is readily distinguished from other flowering plant families by a cruciform (crossshaped) corolla, six stamens (the outer two shorter than the inner four), a capsule often with a septum and a pungent watery sap (Franzke et al., 2011, pp. 108-116). Numerous studies (e.g. Al-Shehbaz, 1984; Price et al., 1994; Appel and Al-Shehbaz, 2003; Koch et al., 2003a; Mitchell-Olds et al., 2005) have amply demonstrated that morphological characters in the *Brassicaceae* are highly homoplasious, making it virtually impossible to utilize them alone in establishing phylogenetic relationships on a family-wide basis or sometimes even within genera (Al-Shehbaz et al., 2006, pp. 89–120). Representatives of the section grow in different ecological environments of the region. The plant species (genotype) reflects the ecological conditions of the region of its occurrence (Mammadov & Ismayilov, 2012). It is known that due to global climate change (decrease in precipitation and the emergence of drought), water areas have started to decrease. This gives an alarm signal for the aquatic environment and the creatures living around it. Current climatic conditions pose a serious threat to plants growing in the aquatic environment, wetlands and humid parts of the season. Information on the plants in these regions and the bioecological characteristics of the season is given in the table below:

Table

Bioecological and geographical characteristics of *Brassicaceae* Burnett. family species facing extinction due to climate change

№	Species	Height and phenophase	Life form	Ecological group	Elevation zone	Ecological environment
1.	*Alliaria petiolata* (Bieb.) Cavara & Grande	20-100 cm, IV-V, VI-VIII	Biennial	Mesophyte	To mid-altitude	Forests, scrub edges, parks
2.	*Arabis carduchorum* Boiss.	2-5 cm V-VI, VI-VII	Perennial	Mesophyte	Alpine height	Grasses
3.	*Barbarea minor* C.Koch	5-25 (35) cm V-VI (VII), VI-VIII (IX)	Perennial	Mesophyte	From the middle mountain belt to the alpine altitude	Moist meadows, river banks
4.	*Barbarea plantaginea* DC.	20-60 cm V-VI, VI-VII	Biennial	Mesophyte	High mountain belt	Wet places, small river banks
5.	*Barbarea stricta* Andrz.	50-100 cm V-VI, VI (VII)	Biennial	Mesophyte	Low and middle mountain belt	River banks, wet forests, meadows, wetlands
6.	*Barbarea vulgaris* R.Br.	20-70 (100) cm, V-VI, VI-VII	Biennial	Mesophyte	Plains and hills	Grass, damp places, roadsides
7.	*Brassica campestris* L.	Up to 1 m IV-VII, V-VIII	Annual	Mesophyte	From lowlands to subalpine elevations	Grasslands, orchards, vineyards
8.	*Bunias orientalis* L.	25-80 (100) cm IV-V (VI), VI-VII	Annual or biennial	Mesophyte	From the lower mountain belt to subalpine elevations	Grasses, meadows and crops
9.	*Calepina irregularis* (Asso) Thell.	20-60 cm IV-V, V-VI	Annual	Mesophyte	Plains and hills	Places with low humidity

ISSN: 2707-1146
e-ISSN: 2709-4189

10.	*Cardamine uliginosa* Bieb.	20-40 (50) cm V-VI (VIII), VI-VIII (IX)	Perennial	Mesophyte	Middle and upper mountain belt	Stony slopes and oases (occasionally)
11.	*Draba nemorosa* L.	8-30 (60) cm (IV)V-VII (IX), VI-VIII (IX)	Annual	Mesophyte	From subalpine to alpine	Subalpine and alpine meadows, grassy slopes, cultivated areas
12.	*Erophila verna* (L.) Bess.	2-15 (30) cm III-IV, IV-V	Annual	Mesophyte	From the plains to the central mountain belt	Steppes, grassy slopes, semi-deserts and meadows
13.	*Eruca sativa* Mill.	20-80 cm IV-V, V-VII	Annual	Mesophyte	Up to the central mountain belt	Cereal crops and pastures
14.	*Hesperis Buschiana* Tzvel.(*H. armena* Boiss.)	60-70 cm V-VI	Perennial	Mesophyte	Central highlands	Forest edge, scrub
15.	*Hesperis matronalis* L.	(15) 30-100 cm V-VI (VII), VI –VII (VIII)	Perennial	Mesophyte	From lowland to subalpine altitude	Forests, meadows, bushes
16.	*Lepidium draba* L.	16-40 (52) cm, IV-V, V-VI (VII).	Perennial	Mesophyte	Flat and low mountain belt, mostly middle mountain belt	As weeds in fields, plantations, gardens, roads, often in lawns
17.	*Lepidium latifolium* L.	40-150 cm, VI-VII, VII-VIII	Perennial	Mesophyte	Flat, central mountain belt	Moist, salty meadows, sometimes fields and gardens
18.	*Lepidium vesicarium* L.	20-40 (60) cm, V-VI, V-VI (VII)	Annual	Mesophyte	flat, low mountainous, rarely mid-mountainous	Wetland, semi-desert, as weeds in fields and plantations, riparian
19.	*Myagrum perfoliatum* L.	(10) 20-50 cm IV-V, VI (VIII)	Annual	Mesophyte	From the plains to the central mountain belt	Crops, mostly pastures
20.	*Neurotropis armena* (N. Busch) Czer.	25-50 cm IV-V, VI-VIII	Annual	Mesophyte	From lowland to high mountain belt	Grassy slopes, forest edges, shrubs and crops
21.	*Neurotropis platycarpa* (Fisch. & C.A. Mey.) F.K. Mey.	15-35 cm V, VI	Annual	Mesophyte	Medium and high mountain belt	Meadows and grassy areas
22.	*Neurotropis Szowitsiana* (Boiss.) F.K. Mey.	15-55 cm V-VI, VII-VIII	Annual	Mesophyte	Medium and high mountain belt	Grasses
23.	*Noccaea Tatinae* (Bordz.) F.K. Mey.	15-40 cm IV-V, VI-VII	Annual	Mesophyte	Medium and high mountain belt	Forest edge
24.	*Rorippa austriaca* (Crantz) Bess.	30-90 cm V-VI, VI-VII	Perennial	Mesophyte	To the central mountain belt	Wet areas along the coast
25.	*Sisymbrium Loeselii* L.	20-60 cm, IV-VIII (IX),V-IX (X)	Biennial	Mesophyte	Middle and subalpine mountain belt	Meadows, forest clearings, garbage dumps
26.	*Strigosella africana* (L.) Botsch.	18-30 cm IV-V, V-VI	Annual	Mesophyte	From lower mountain belt to middle mountain belt	Vacant land and crops, stony slopes
27.	*Thlaspi Huetii* Boiss.	15-40 cm, IV-VII	Annual	Mesophyte	Central mountain belt, rarely flat	Moist meadows, river banks, grassy areas

ISSN: 2707-1146
e-ISSN: 2709-4189

As can be seen from the table, species are distributed in wetlands, agricultural lands, river banks, marshes and other water areas. As a result of drought, these species are more likely to disappear in nature. For this reason, it is appropriate to collect the seeds of species and create a "Gene Fund" to protect biodiversity. In order to prevent such a dangerous situation, it is necessary to ensure that the seeds spread in nature at an artificial rate. It is also important that seeds are renewed every year to prevent their germination capacity from decreasing. As we know, under stress plants start and end the vegetation period quickly. Offspring care in stressed plants is stronger than in plants growing under normal conditions. In this respect, seeds should be collected in years when drought is more severe. Stress also affects annuals more than others.

Conclusion

During the observations, the effects of drought conditions experienced in 2022-2023 on the morphological structure and vegetation periods of plants were also revealed. The mesophytic ecological group of the Burnett family Brassicaceae, which is likely to be most affected by climate change, includes 27 species. Among the wild species belonging to the mesophytic ecological group, 13 species (48.14 %) are annual, 8 species (26.62 %) are perennial, 5 species (15.51 %) are biennial, and one species (3.70 %) are annual or biennial plants.

Figure 1
Lepidium draba L. (Batabat region 29.06.2022)

Figure 2
Bunias orientalis L. (Arafsa area of Culfa district 09.06.2022)

ISSN: 2707-1146
e-ISSN: 2709-4189

Figure 3
Cardamine uliginosa Bieb. (Khazinedara region 22.05.2022)

Figure 4
Strigosella africana (L.) Botsch. (Chalhangala region 17.05.2023)

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Received: 02.09.2024
Revised: 17.10.2024
Accepted: 16.11.2024
Published: 20.12.2024