



Research Article

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Crop Wild Relatives of the *Hordeum* L. Genus in Georgia (South Caucasus)



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Abstract

The *Hordeum* L. has several species which will be crop wild relatives (CWRs) in Georgia. *Hordeum* wild species of barley are widespread in Georgia and there are total 10 species as CWRs represent the same species or direct ancestor of crop plants (GP-1B/TG-1B). Georgia other crops are remains from 1990 years and now are in Meskheta and Svaneti. The following species were in 1941 years as this Georgian Flora made 8 species on *Hordeum*. We have found 10 species of *Hordeum* in Georgia as accepted name and 15 species are synonyms from Georgian and Caucasian floras. Clipping the plants are 10 and 70 cm, respective on 28 February and 30 and 120 cm resulted in shorter plants 15 March years. Species has a low chromosome number $2n=14, 28, 42$ and one 70. Cultivates *Hordeum* is for crop breeding and evaluation with GP-1B and TG-1B it is for distributed in as CWRs. Barley is the name of the breed, and CWRs has many names for provided. Crops have two-row, four-row and six-roads of barley, which are cultivars. These species are located on high forest zones and on subalpine meadows at elevations of 2446 min different coordinates. CWRs of barley are widespread in Georgia.

Keywords: CWRs; *Hordeum* crops; Gene pool/Taxon group; Accepted; Synonyms

Introduction

The crop wild relatives (CWRs) are taxa related to species of direct socio-economic importance, which includes the progenitors of crops. Georgia is located in the South Caucasus and owns very old agricultural traditions that have preserved to our time. Georgian territory covers both mountain ranges between west 39°59"; east 46°36"; south 41°01" and north 43°29". Georgia officially covers a territory of 69,700km² and its population is almost 3.718 million. The Caucasus mountain system was formed ca. 28.5-23.8 million years ago as the result of a tectonic plate collision between the Anatolian and Arabian plate moving northward and the Eurasian plate [1]. The name of the country is "Sakartvelo" in the Georgian language but it is common name "Georgia" is semantically linked to Greek. Archaeological data clearly show that Georgian nation was settled in the Caucasus and Asia Minor areas from prehistoric time and the origin of ancient crop varieties and landraces in Georgia coincides with early Neolithic epoch.

The importance of CWRs in their ability to exchange genes with the crops was first emphasized by NI Vavilov [2]. It is evident that natural crosses between crops and their wild relatives have occurred since the beginnings of agriculture. Human has used CWRs germplasm is used to improve production and food quality of cultivars originated previously due to domestication of crop ancestor species. CWRs have already made substantial

contributions to improving food production through the useful genes that they contribute to new crop varieties. They have provided resistance to pests and diseases in a wide range of crops. The genes that come from CWRs and other wild plants make a direct contribution to increased human wellbeing through improving agricultural production and maintaining sustainable agroecosystems. Therefore, the effective conservation and sustainable use of CWRs and all wild plants are essential elements for increasing food security, eliminating poverty and maintaining a healthy environment.

According to modern concept of wild relatives, under CWR we should understand all species related to any cultivated plants, as well as to wild species of ornamental, food, fodder and forage, medicinal plants, condiments, forestry species and plants used for industrial purposes, such as oils and fibers i.e. to all plants of economic importance. Although, "classical" definition of CWR is restricted only to species related to cultivated crops, including such important field crops as barley. Wheat, barley and rye fields were planted throughout Georgia at elevations from 300 to 2160m a.s.l. only in Svaneti and Meskheta [3]. Barley was cultivated mainly in many species are in high mountain regions of Georgia (1800-2200m a.s.l.). The agrarian lands of these varieties were in other period in different hectares and these hectares were decreased from 1970s with grazing of the meadows. Many species are not correct and have other

names now. Agricultural regions in Georgia have classified by production of wine [4]. Lowlands called Bari (0-1300m a.s.l.) are oriented on wine production and high mountainlands called MTA (1300-2200m a.s.l.) produce beer from barley. Winemaking was main business of agriculture in Georgia. Winemaking was main business of agriculture in Georgia. Barley cereals are the second most important in Georgia after barley and main crop in high mountain regions used for bread, forage and production of beer, as well as an attribute of religious rituals and in the folk medicine.

Cultivated species (Poaceae) of barley (*Hordeum distichon* L. and *H. vulgare* L.) are in Georgia other crops are remains from 1990 years and now are in Meskheta and Svaneti. Javakhishvili [4] is on crops of barley in 1930 years: *H. tetrastichum* L. var. *pallidum* Ser. - Svaneti, Racha, Liakhvi River, Tusheti; *H. sativum* subsp. *polystichon* Döll and *H. tetrastichum* L. var. *nigrum* Willd. - Enguri, Liakhvi River; *H. pallidum* var. *nigrum* Willd. - Racha; *H. distichon* L. and *H. distichon* var. *nutans* Schöll. - Svaneti, Racha, Liakhvi River, Tusheti; *H. hexastichon* L. - Imereti; *H. colchicum* R.E.Regel etc. Two different names used for barley in Georgian language - 'Krtili' and 'Keri'. 'Krtili' denotes six-row winter barley (*H. vulgare* subsp. *hexastichon* [L.] Celak. is a synonym of *H. vulgare* L.), which is sowed in autumn. 'Keri' refers to two-row summer barley 'Akhatesli' (*H. vulgare* subsp. *distichon* [L.] Körn. is a synonym of *H. distichon* L.), which is sowed in spring [5]. Other three cultivars are as two-row barley: 'Akhatesli' (*H. vulgare* var. *nutans* is a synonym of *H. nutans* Alef.); 'Kershveli' (*H. sativum* var. *nudum* (L.) Vilm. is a synonym of *H. distichon* L.) and 'Dzveltesli shavpkha' (*H. nigrum* Willd. is a synonym of *H. vulgare* L.) and all the cultivars are distributed up to 2100m a.s.l. in all high mountain areas. Four-row spring are two cultivars of barley (*H. vulgare* subsp. *tetrastichum* (Stokes) Celak. is a synonym of *H. vulgare* L.) and other is rare 'Tetri Keri' and the spring cultivar (*H. vulgare* var. *pallidum* Ser. is a synonym of *H. vulgare* L.). 'Tetri Keri' occurs only in the high mountain region of Meskheta, Tusheti, and Svaneti up to 2130 m a.s.l. These cultivars persist today only in high mountain regions [6]. However, their distribution has been seriously diminished. At present, introduced varieties of barley are widely cultivated in the lowlands and their names are unknown to the local population.

One of the most important threats to the diversity of CWRs is genetic erosion and pollution. The threat of genetic pollution or introgression, either from genetically modified organisms (GMOs) or from conventionally bred crops, to wild species has become an increasing risk to the in situ genetic conservation of crop wild relatives [7]. Because of its shorter life cycle than barleys can be grown on marginal areas of agriculture. There is abundance of diversity in forms from large-seeded, long-awn types to slender, small-seeded types. The following species occur in Georgia and in 1941 years [8] this Georgian Flora made 8 species on *Hordeum* L.: 1. *H. asperum* (Simonk.) Degen; 2. *H. bulbosum* L.; 3. *H. crinitum* (Schreb.) Desf.; 4. *H. europaeus* (L.) All.; 5. *H. fragile* Boiss.; 6. *H. leporinum* Linkö; 7. *H. hystrix* Roth; 8. *H. violaceum* Boiss. & Hohen. All 7 species are to synonyms

and the last time they are in other names and only *H. bulbosum* L. is an accepted name by fixation of genes controlling self-compatibility and annual habit.

We have found several *Hordeum* species in Georgia and we have much more species of this genus. It is assumed that *H. spontaneum* K. Koch and it is an accepted name [9]. *H. secalinum* Schreb. species is in Kakheti and v. Shilda, which has been introduced in the 1890s by the American by adding *Zea mays* and several species added. Different views, however, have been expressed with respect to the place, time and mechanisms of the origin of different forms of cultivated barley, particularly six-row forms. We have other species as well for Georgia in now years.

Materials and Methods

Plant material

CWRs of *Hordeum* are total 10 species and cultivated of barley were sampled in natural habitats and agrarian fields. These species are synonyms and some are an accepted name. Many species are difference and have other name from these periods. Many species are difference and have other name from these periods. All these species has different names for Latin as synonyms and subspecies. Plant height is different in other species. They according to other classification systems and these species are synonyms. However, these names are remained in Caucasian and Georgian Flora [10]. Distribution sites with coordinates and elevation data have been determined for all species. Chromosome numbers are known for all publications.

Methodology

Genus *Hordeum* involves the comparison of 'total' natural CWR species diversity as already actively conserved either in situ or ex situ. This is the basis for gap analysis, which can be divided into four consecutive steps [3].

Step 1: Circumscription of target taxon and target area: First, the taxonomic (e.g. genus, section or species) and geographical (e.g. global, regional, country or province) breadth of the analysis must be established.

Step 2: Assessment of natural diversity: The level of diversity occurring within the target taxon must be defined at the taxonomic, genetic or ecogeographical levels, i.e. how many taxa occur in the circumscribed taxon, but also the inherent genetic diversity within those taxa.

Step 3: Assessment of current conservation strategies: The diversity occurring in situ can be compared to the diversity currently conserved in order to assess the efficiency of both in situ and ex situ conservation techniques.

Step 4: Reformulation of conservation strategy: Assessment of the effectiveness of current conservation coverage in relation to natural in situ diversity identifies the element of diversity that is under conserved, i.e. the 'gaps' in the existing conservation strategy and helps refocus the strategy to conserve the maximum diversity and fill these gaps. The revised priorities are likely to

require complementary in situ and ex situ conservation actions to ensure the comprehensive conservation of the target taxon's gene pool.

CWR are commonly defined in terms of wild species related to agricultural and horticultural crops. As such a broad definition of a CWR would be any wild taxon belonging to the same genus as a crop. Under gene pool is considered definitions of gene pool concept [11,12]. A working definition of a CWR was provided by According to gene pool concept three gene pools are distinguished as follows:

- a. Primary Gene Pool (GP-1) within which GP-1A are the cultivated forms and GP-1B are the wild or weedy forms of the crop;
- b. Secondary Gene Pool (GP-2) which includes the coenospecies (less closely related species) from which gene transfer to the crop is possible but difficult using conventional breeding techniques;
- c. Tertiary Gene Pool (GP-3) which includes the species from which gene transfer to the crop is impossible, or if possible requires sophisticated techniques, such as embryo rescue, somatic fusion or genetic engineering. The taxon group concept is used to establish the degree of CWR relatedness of a taxon. Application of the taxon group concept assumes that taxonomic distance is positively related to genetic distance.

CWR rank of taxon groups is defined as follows: (1) Taxon Group 1A - crop; (2) Taxon Group 1B - same species as crop; (3) Taxon Group 2 - same series or section as crop; (4) Taxon Group 3 - same subgenus as crop; (5) Taxon Group 4 - same genus; (6) Taxon Group 5 - same tribe but different genus to crop.

Statistical analyses

Barley is one of the oldest crops to be domesticated from its wild progenitor *H. spontaneum*. Domestication of barley is said

to have taken place around 9000BP in the Near East. However, grains of barley have been found in Egyptian tombs dating from 15.000BP. The cultivated barley including two-row (*H. distichon* L.) and six-row (*H. hexastichon* L.) forms, and its closest wild relative *H. spontaneum* C. Koch are autogamous annuals which with the allogamous perennial *H. bulbosum* L. share basic genome I. The importance of this project is determined by ability of CWR to exchange genes with the crops. The analysis was performed using the software packages SPSS v.16.0 for Windows and Statistica 6.0.

Results and Discussion

CWRs species studied in the Georgia regions has revealed many species of high conservation value. Barley - *Hordeum* L. wild species of barley are widespread in Georgia and there are total 10 species are CWRs species represent the same species or direct ancestor of crop plants (GP-1B/TG-1B) of which are now synonyms 15 species belonging to the same section and other as crops in other genera are for these CWRs (Table 1): (1) *H. bulbosum* L. is an accepted name (=synonyms are 2 species: *H. strictum* Desf.; *Zeocriton strictum* (Desf.) P. Beauv.); (2) *H. spontaneum* K. Koch is an accepted name (=synonym is *H. agriocrithon* Åberg.). The material was described as *H. agriocrithon* and it was assumed to be the ancestor of six-rowed barley; (3) *H. zeocriton* L. and *H. colchicum* R.E. Regel are synonyms of *H. distichon* L.; (4) *H. marinum* subsp. *gussoneanum* (Parl.) Thell. (=synonyms are 3 species: *H. gussoneanum* Parl., *H. geniculatum* All., *H. hystrix* Roth.); (5) *H. murinum* subsp. *leporinum* (Link) Arcang. (synonym is *H. leporinum* Link); (6) *H. secalinum* Schreb. is an accepted name (=synonym is *Zeocriton secalinum* (Schreb.) P. Beauv.); (7) *H. violaceum* is a synonym of *H. brevisubulatum* (Trin.) Link; (8) *H. europaeum* (L.) All. is a synonym of *Hordelymus europaeus* (L.) Jess. ex Harz; (9) *H. fragile* Boiss. is a synonym of *Psathyrostachys fragilis* (Boiss.) Nevski; (10) *Taeniatherum caput-medusae* (L.) Nevski (=synonyms are 2 species: *H. asperum* (Simonk.) Degen, *H. crinitum* (Schreb.) Desf.).

Table 1: CWRs species of barley and synonyms for Georgia. Chromosome numbers are for genes synonyms species (2n=). Primery gene pool (GP) and Taxon Group (TG) 1b species as crop. Length are cm for species. Georgia and from another locations. N=10.

S.N	Cwrs of Barley Accepted Name	Cwrs of Barley Synonym Name	2n=	Gp	Tg	Length (Cm)	Name Of Local Crops
1.	<i>H. bulbosum</i>	<i>H. strictum</i> <i>Zeocriton strictum</i>	14, 28	GP-1B	TG1B	50-150	<i>H. hexastichon</i>
2.	<i>H. spontaneum</i>	<i>H. agriocrithon</i>	14	GP-1B	TG-1B	30-100	<i>H. vulgare</i> subsp. <i>spontaneum</i>
3	<i>H. distichon</i>	<i>H. colchicum</i> <i>H. zeocriton</i>	14	GP-1B	TG-1B	50-85	<i>H. distichon</i>
4	<i>H. marinum</i> subsp. <i>gussoneanum</i>	<i>H. gussoneanum</i> <i>H. geniculatum</i> <i>H. hystrix</i>	14, 28, 70 14, 28 14	GP-1B	TG-1B	65-90 30-70 10-30	<i>H. vulgare</i> subsp. <i>tetrastichum</i>

5	<i>H. murinum subsp. leporinum.</i>	<i>H. leporinum</i>	14, 28, 42	GP-1B	TG-1B	15-40	<i>H. vulgare var. pallidum</i>
6.	<i>H. secalinum</i>	<i>Zeocriton secalinum</i>	14, 28, 42	GP-1B	TG-1B	30-90	<i>H. vulgare</i>
7.	<i>H. brevisubulatum</i>	<i>H. violaceum</i>	14	GP-1B	TG-1B	30-75	<i>H. nutans</i>
8.	<i>Hordelymus europaeus</i>	<i>H. europaeum</i>	28	GP-1B	TG-1B	60-120	<i>H. pallidum var. nigrum</i>
9.	<i>Psathyrostachys fragilis</i>	<i>H. fragile</i>	14	GP-1B	TG-1B	30-70	<i>H. vulgare var. nudum</i>
10.	<i>Taeniatherum caput-medusae</i>	<i>H. asperum</i> <i>H. crinitum</i>	14 14	GP-1B	TG-1B	15-60 10-40	<i>H. tetrastichum var. pallidum</i>

Barley herbage at the tillering stage has a protein content equivalent to that of forage legume. This reported a 20% crude protein content in green barley tissues. The results of this study indicated that dual-purpose barley has high protein content during the active growth period, which was also characterized by low temperatures and moist conditions. Protein contents ranged from 18 to 25% between 28 February and 30 March, and dropped 5% when the plant reached maturity in May. However, the fibers increased gradually and peaked (60.8%) when the plant reached maturity. Clipping the plants on 28 February (10 and 70cm, respective years) and 15 March (30 and 120cm) resulted in shorter plants ($P < 0.05$) than unclipped plants. 10 species of barley have a height of 15-150 cm tall at the base, are tuberiform, thickened (Table 1) (Figure 1). Barley has the advantage, apart from being an important agricultural crop for food and feed, that it has also been used virtually worldwide as a model species for biological research. It is a diploid species with a low chromosome number $2n=14, 28, 42$ and one 70 (Table 1). Cultivates *Hordeum* is for crop breeding and evaluation with GP-1B and TG-1B it is for distributed in as CWRs (Table 1).

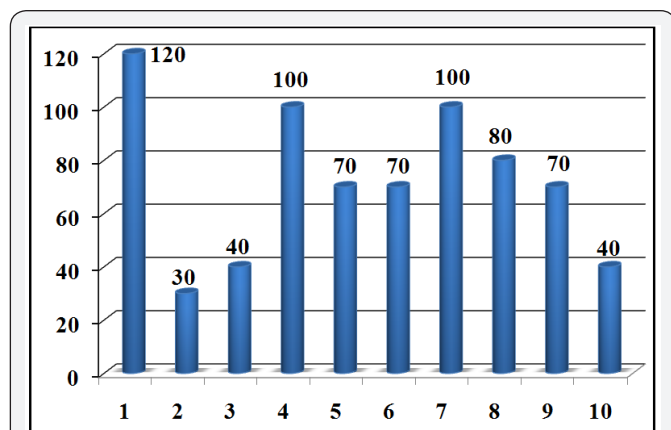


Figure 1: Mean and standard error (SE) of culms height (cm) of 10 species of *Hordeum* CWRs: 1. *H. bulbosum* (120cm); 2. *H. marinum subsp. gussoneanum* (30cm); 3. *H. murinum subsp. leporinum* (40cm); 4. *H. spontaneum* (100cm); 5. *H. secalinum* (70cm); 6. *H. violaceum* (70cm); 7. *H. zeocriton* (100 cm); 8. *Hordelymus europaeus* (80cm); 9. *Psathyrostachys fragilis* (70cm); 10. *Taeniatherum caput-medusae* (40cm) N=10.

We can make some CWRs add variety to species for crops in Georgia. The ecogeographical data base used to assess

the geographical and ecological diversity has revealed that priority CWR species might be grouped as follows: “Recovery, Conservation, and Sustainable Use of Georgia’s Agricultural diversity” (Table 1):

- a. CWR species with more wide range of distribution in natural habitats (number of populations >5): *H. bulbosum* makes with *H. hexastichon* L. and it is in Imereti and other is *H. vulgare subsp. hexastichon* (L.) Celak. and is a synonym of *H. vulgare* L. The capital letter H indicates the genome symbol for *H. vulgare* and *H. bulbosum*. This has six-row winter barley;
- b. Rare and endangered species represented by 1-5 populations in the region: *H. spontaneum* is for *H. vulgare subsp. spontaneum* (K.Koch) Asch. & Graebn. is a synonym of *H. vulgare*. Barley of *H. vulgare* is one of the oldest crops to be domesticated in this region, from its wild progenitor *H. spontaneum*. Two-row barley is cultivars of *H. vulgare subsp. spontaneum*;
- c. *H. zeocriton* and *H. colchicum* are synonyms for *H. distichon* and all are as crops in Georgia; Two-row barley is rare and the cultivar;
- d. *H. marinum subsp. gussoneanum* are three species for *H. vulgare subsp. tetrastichum* (Stokes) Celak. is a synonym of *H. vulgare* L. As regards alloplasmic wheat - barley substitution and wheat-barley addition lines isolated from the backcrossed progeny of barley - wheat hybrids *H. marinum subsp. gussoneanum* x *T. aestivum*, the data of previous works showed that heteroplasmy in these lines was manifested at a number of mtDNA sequences; However, some depression observed for the expression of phenotypic characters and fertility in alloplasmic lines (*H. marinum subsp. gussoneanum*) x *T. aestivum*, in comparison with common wheat, is likely to be associated both with the influence of wild barley chromosomes and with the presence of mitochondrial sequences of barley type. Six-row barley is rare and the cultivar;
- e. *H. murinum subsp. leporinum* makes with *H. vulgare var. pallidum* is a synonym of *H. vulgare*; synonym is *H. tetrastichum* L. var. *pallidum* Ser. - Svaneti, Racha, Liakhvi

river, Tusheti. Four-row barley is rare and the cultivar - *H. vulgare* var. *pallidum*; 'Tetri Keri' occurs only in the high mountain region of Meskheta, Tusheti and Svaneti up to 2100 m a.s.l.

f. *H. secalinum* makes with *H. vulgare*. One species like *H. secalinum* Schreb. is true allopolyploids including the I genome together with another genome, most probably the Xa genome from *H. vulgare*. Six-row barley is rare and the cultivar;

g. *H. violaceum* is a synonym of *H. brevisubulatum* and they have makes with *H. nutans* and this is in Georgia as *H. distichon* var. *nutans* Schöll. - Svaneti, Racha, Liakhvi river, Tusheti. The cultivars of two-row barley *H. vulgare* var.

nutans 'Akhatesli';

h. *Hordelymus europaeus* makes with *H. pallidum* var. *nigrum* Willd. - Racha, Quadrature barley Kober is a synonym of *H. vulgare*. The cultivars of two-row barley *H. vulgare* var. *nigrum* Willd. 'Dzveltesli shavpkha' are distributed up to 2100 m a.s.l.;

i. *Psathyrostachys fragilis* makes with *H. vulgare* var. *nudum* (L.) Hook.f. is a synonym of *H. distichon* L. 'Kershveli' two- row barley.

j. *Taeniatherum caput-medusae* make with *H. tetrastichum* L. var. *pallidum* Ser. Svaneti, Racha, liaxvi, Tusheti. Four-row barley is rare and the cultivar *H. tetrastichum* L. var. *Pallidum*.

Table 2: *Hordeum* species are in different heights in Georgia: location with coordinates with degrees and minutes, elevation with above sea level in meters N=10.

S.N	CWRs of Barley	Location	Coordinates	Elevation (m)
1.	<i>H. bulbosum</i>	Javakheti, Meskheta	N 41°41'/41°70' E 41°48'/43°37'	864-2446
2.	<i>H. spontaneum</i>	Javakheti, Kartli, Meskheta	2. <i>H. spontaneum</i> Javakheti, Kartli, Meskheta	963-2129
3.	<i>H. zeocriton</i>	Abkhazeti, Adjara, Kartli, Kakheti, Trialeti, Meskheta	N 41°15'/43°03' E 40°21'/43°38'	981-2160
4.	<i>H. marinum</i> subsp. <i>gussoneanum</i>	Kakheti, Kartli	N 41°24'/42°02' E 43°13'/45°37'	350-1939
5.	<i>H. murinum</i> subsp. <i>leporinum</i> .	Abkhazeti, Adjara, Gardabani, Imereti, Kartli, Kakheti, Kiziki, Trialeti, Meskheta	N 41°23'/41°43' E 43°06'/43°27'	420-1733
6.	<i>H. secalinum</i>	Kakheti: Shilda v.	N 41°54'/41°59' E 45°51'/45°42'	320-503
7.	<i>H. violaceum</i>	Imereti, Javakheti, Kartli, Khevsureti, Meskheta, Mtiuleti, Racha-Lechkhumi, Svaneti, Tusheti,	N 41°21'/42°55' E 43°12'/43°56'	1760-2100
8.	<i>Hordelymus europaeus</i>	Abkhazeti, Adjara, Kartli, Kakheti, Trialeti, Meskheta	N 41°27'/43°01' E 43°03'/43°56'	1946-2129
9.	<i>Psathyrostachys fragilis</i>	Abkhazeti, Kakheti, Kartli, Javakheti, Meskheta	N 41°36'/43°45' E 40°54'/45°77'	450-1042
10.	<i>Taeniatherum caput-medusae</i>	Abkhazeti, Imereti, Kakheti, Kartli, Meskheta, Racha-Lechkhumi, Svaneti	N 41°38'/43°45' E 40°12'/45°35'	350-1890

CWRs 10 species of *Hordeum* are distributed on Georgian places (Table 2). These species are located on high forest zones and on subalpine meadows at elevations of 2446 m in different coordinates. Endemic species of the Caucasus in Georgia are not as synonyms. 10 species occur in Georgia - *H. bulbosum*, *H. spontaneum*, *H. zeocriton*, *H. marinum* subsp. *gussoneanum*, *H. murinum* subsp. *leporinum*, *H. secalinum*, *H. violaceum*, *Hordelymus europaeum*, *Psathyrostachys fragile*, *Taeniatherum caput-medusae*. There are species occurring in the lower and middle montane belts, growing in shrub lands, at the edges of forests on dry stony slopes - *H. bulbosum*, *H. violaceum*, *Hordelymus europaeum*, *Taeniatherum caput-medusae* is growing on subalpine and alpine meadows. The habitats of the barley species distributed in Georgia are quite different. Some of them are growing in ruderal places, on roadsides and near gardens - *Psathyrostachys fragile*, *H. murinum* subsp. *leporinum* along road on roadsides and in ruderal places near settlements. The populations are not numerous and form dense canopy. All individuals are well developed from normal seeds. Some of them are grazed. Threats are road construction works, which might damage them and pollution. It is necessary to collect seeds from different populations and keep them in seed banks.

They belong to spring corn, double row variety of barley - *H. distichon*. The names of these varieties are unknown for the local population. There are some winter corn barley fields, represented by four- and six-row barley - *H. vulgare* ssp. *tetrastichon* and *H. vulgare* ssp. *hexastichon*. It is important to continue further investigation of CWRs in this region and create detailed data base including information on distribution, population status, ethno botany and their use in folk traditional being. CMRs include the ancestors of modern crops and closely related species. They often contain traits of great importance to agriculture, and modern varieties already depend on genes from crop wild relatives. It thus makes sense to protect and make use of wild relatives, but in many places the habitats that support them are under threat. Mountains, with their fragile ecosystems so easily disrupted by overexploitation, are among the most endangered. The five partner countries, however, have more than mountains in common. They are also all rich in plant diversity, and have pledged to protect it under the terms of the Convention on Biological Diversity.

Conclusion

The species of *Hordeum*, which are growing in rural habitats and on cultivated fields among field crops have different assessment to threats. These species are depending in their existence to the monitoring of cultivated fields, which crop will be sown, how will be transformed field crop to pasture or hay meadow, or what kind of herbicides and mineral fertilizers will be used in the field. The maintenance of wild populations growing as weeds in cultivated fields depends on sustainable

management of agriculture in the region. The governmental institutions should control the processes which might bring to the genetic erosion of CWRs having high value of conservation. In this case the legislation bases should be effective to control local farmers not affect CWRs with ecologically unsuitable for this species actions in the field e.g. use of fertilizers or introduction of new crops leading to changing in technology of field cultivation methodology and leading to disturbances of wild weed species of high conservation value. In addition to the main two-row versus six-row distinguishing factor, barley varieties also vary in that they may be winter or spring, hulled or hullless, for forage or grain, and for malting or feed purposes. Some forage varieties have increased isolation requirements as specified by the breeder. This additional requirement can be found in the 'Additional Comments' section of the variety description within the Product Registration System. Unlike the characteristics identifying barley are considered as definitive in that they do not vary over a range, resulting in greater certainty when identifying varieties. The following characteristics are to be considered for identification of purity of variety.

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