

## Distribution and habitat preferences in the genus *Hordeum* in Iran and Turkey

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### Abstract

The six taxa *Hordeum bogdanii*, *H. brevisubulatum*, *H. bulbosum*, *H. marinum*, *H. murinum*, and *H. vulgare* ssp. *spontaneum* are native to Turkey and Iran. The first three are perennials and the others are annuals. The distribution and biotope preferences are discussed (except for *H. vulgare* ssp. *spontaneum*). *H. bogdanii* has its westernmost locations in N Iran, where it is very rare. The status of this species should be further elucidated and an in situ protection plan initiated.

**Keywords:** *Poaceae*, *Hordeum*, distribution, biotopes, variation

### Zusammenfassung

*Hordeum bogdanii*, *H. brevisubulatum*, *H. bulbosum*, *H. marinum*, *H. murinum*, und *H. vulgare* ssp. *spontaneum* besitzen natürliche Vorkommen im Iran und in der Türkei. Die ersten drei Arten sind ausdauernd, die anderen einjährig. Die Verbreitung und der Vegetationsanschluß dieser Arten (außer *H. vulgare* ssp. *spontaneum*) werden diskutiert. *H. bogdanii* besitzt seine westlichsten Vorkommen im N-Iran. Der genaue Status für diese dort seltene Art bedarf noch weiterer Untersuchungen, ein in situ Schutzprogramm sollte initiiert werden.

### Introduction

The tribe Triticeae of the grass family Poaceae has one of its major centres of diversity in the Near East. This area is the cradle for domestication of grain cereals and several other crops of the Old World, starting some 10 000 years ago (ZOHARY & HOPF 1993). Wheat and barley evolved simultaneously in this area and one of the main reasons for the rapid progress of domestication is the great diversity of wild, annual grass species here. The immediate ancestors of both crops are still native in the area, along with several closely and more distantly related species of *Triticum*, *Aegilops*, and *Hordeum* and other genera of the tribe, including, *Taeniatherum*, *Psathyrostachys*, *Eremopyrum*, *Elymus*, and *Thinopyrum*. This makes the Near East one of the most important genetic diversity centres for crop relatives in the world. For some genera in Triticeae, basic taxonomic treatments have been carried out. However, there are still many gaps in our knowledge of relationships among species and the evolution of different taxa; more detailed knowledge of variation patterns (morphological, physiological, genetic etc.) and habitat preferences is also lacking. Such information is very important for understanding adaptive radiation and evolution, and is also the basis for an optimal utilization of the wild species as gene sources in plant breeding.

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The present paper aims to (1) sum up the present taxonomic knowledge of the important genus *Hordeum* in Iran and Turkey; (2) discuss distribution and habitat preferences of the taxa based on field work by the author and his colleagues and (3) elucidate important, outstanding issues for a better understanding of the evolutionary patterns and taxonomic problems in the genus. The cited material is deposited in herb. C and LD.

### ***Hordeum* species in Iran and Turkey**

*Hordeum* is a medium-sized genus comprising c. 31 species and 45 taxa (cf. BOTHMER et al. 1995). The genus is widely distributed in temperate areas of the world with diversity centres - defined as having the highest number of species - in southern South America, western North America, Central Asia, and Southwest Asia. The Mediterranean - Near East distribution is one of the original and most ancient centres of origin for the whole tribe. Turkey and Iran include Mediterranean as well as Central Asiatic taxa and are hence an important phytogeographic area. Altogether, the area includes 6 species of *Hordeum*, some of which are taxonomically complicated. Of these, *Hordeum vulgare* L. ssp. *spontaneum* (C.KOCH) THELL., the progenitor of cultivated barley (*H. vulgare* ssp. *vulgare*), is still common in large areas (GILES & BOTHMER 1985, NEVO et al. 1986 a, b). This taxon has been dealt with in detail by several authors and is therefore omitted in the present paper (cf. BOTHMER et al. 1995).

Most of the perennial *Hordeum* species are found in the montane to alpine regions (1100 - 4500 m), where they occur in a rather wide range of habitats, commonly in meadows or similar biotopes varying in moisture and salinity. The annual, Mediterranean species occur in many different biotopes, sometimes together with the perennials. Beside in disturbed habitats, which are the most common ones, the annuals also grow in more natural vegetation in Iran and Turkey. Information about habitat preferences, especially of the annual species in this area, is of great interest, since it may provide evidence about the more original biotopes for these taxa, which were widespread as weeds in many parts of the world.

### ***Hordeum brevisubulatum* (TRIN.) LINK**

One of the most variable groups of taxa in the entire *Hordeum* genus is the *H. brevisubulatum* complex. This group shows an extraordinary range of morphological and cytological variation (BOTHMER 1979, LINDE-LAURSEN et al. 1980). It has caused much controversy among taxonomists and several taxa of different ranks have been described. The whole complex has a wide range from western Turkey to eastern China. In recent taxonomic treatments, five entities have been recognized and given the status of subspecies, each covering a large distribution area (BOTHMER 1979). The species is a caespitose perennial, sometimes with short rhizomes and with a brittle rachis. It has long anthers (3 - 5 mm) as well as large and much-branched stigmata, indicating an out-crossing habit (BOTHMER 1979, DEWEY 1979).

The best characters to distinguish between the subspecies are the epidermal cell structure of especially the abaxial side of leaves, lengths of glumes and awns, as well as the hairiness of lemma and culm nodes. Despite the large morphological variation and occurrence

of different cytotypes (di-, tetra-, and hexaploids); all forms hybridize in nature in sympatric areas, hybrids are easily produced in artificial crossing experiments, forming fully fertile offspring (LANDSTRÖM et al. 1984, BOTHMER & JACOBSEN 1986).

In Iran and Turkey, two subspecies (ssp. *violaceum* and ssp. *iranicum*) have their main distribution area. A third one (ssp. *nevskianum*) reaches the northeastern part of Iran. Since overlapping zones between the taxa are common, several transitional forms occur.

#### **ssp. *violaceum* (BOISS. & HOHEN.) TZVELEV**

In Turkey and western Iran, ssp. *violaceum* occurs. It is mainly a diploid taxon, but tetraploid populations are not uncommon. In western Turkey all material is diploid ( $2n = 2x = 14$ ), but in eastern Turkey and in Iran (Azarbaijan) close to the Caspian Sea, some tetraploid ( $2n = 4x = 28$ ) populations have been found as well. This subspecies is characterized by long glumes ( $> 7$  mm) and lemma awns ( $> 3$  mm). Lemma and culm nodes are usually glabrous and the spikes are violet or greenish violet. The abaxial side of the leaves lack silica-cells and the walls of other cells are thin and straight.

NEVSKI (1941) and TZVELEV (1976) considered ssp. *violaceum* to be an almost exclusively Caucasian and Transcaucasian taxon. This is, however, not the case since later collecting has shown a much wider distribution area. It extends westwards in Turkey at least to Türkmen dagh west of Ankara and it is common in the Alborz mountain range. BOR (1970) recorded ssp. *violaceum* from Afghanistan, but the cited material belongs to ssp. *turkestanicum*, which does not occur in Iran.

Ssp. *violaceum* occurs in the montane to low alpine zone. It has been collected at altitudes from 1100 to 3600 m. In Turkey it has mainly been recorded between 1400 and 1900 m and in Iran between 2200 and 3000 m. It usually grows in mountain meadows (or fragments of meadows), along streams and in other moist localities with low salinity. The habitats where ssp. *violaceum* occurs are often heavily grazed or cut, which is probably not disadvantageous to the taxon. Even in a locality where it may be common, it can be very difficult to estimate whether it is a dominating species, since the vegetative parts (without culms and spikes) have no reliable diagnostic characters. Therefore, the population size is sometimes hardly measurable, but it obviously varies within wide limits. Some populations in ungrazed pastures were estimated to have 10000 - 50000 individuals, and in such pastures ssp. *violaceum* was a dominating grass in the vegetation. In a few localities which were not or only slightly grazed, the population size was obviously very small. In the large populations with many flowering culms, the seed-setting was very good throughout, but in the small or very small populations it was poor. This is certainly due to a self-incompatibility system (BOTHMER 1979, DEWEY 1979).

The most common species associated with ssp. *violaceum* are *Juncus inflexus* L., *J. articulatus* L. and *Mentha longifolia* (L.) HUDS. These species were recorded in almost all localities seen by the author and they grow on somewhat moister sites than ssp. *violaceum*. Among the grasses growing closely together with ssp. *violaceum*, *Alopecurus arundinaceus* POIR., *Agrostis canina* L., *A. stolonifera* L., *Puccinellia* spp. and *Elymus* spp. are the most common ones.

Those meadows where no or very restricted grazing or haycutting had taken place were rich in herbs. Such a meadow was studied at Ardebil, Iran, prov. E Azarbaijan,

(no. B 1705), where a very large population of ssp. *violaceum* (4x) grew associated with the above-mentioned species as well as, e.g., *Eleocharis quinqueflora* (HARTM.) O. SCHWARZ, *Carex orbicularis* BOOTT ssp. *kotschyana* (BOISS. & HOHEN.) KUKKONEN, *C. divisa* HUDS., *C. distans* L., *Iris spuria* L. ssp. *musulmanica* (FOMIN) TAKHT., *Glaux maritima* L., *Lotus corniculatus* L., and *Plantago lanceolata* L.

West of Baladeh (Iran, prov. Mazanderan, no. B 1841) a medium-sized population of ssp. *violaceum* (2x) was studied. Within a very small meadow, more than 40 other species were recorded, among them *Isolepis setacea* (L.) R.BR., *Scirpoides holoschoenus* (L.) SOJÁK, *Carex caucasica* STEVEN, *C. diluta* BIEB., *Juncus fontanesii* GAY ssp. *kotschyi*, *Phragmites australis* (CAV.) TRIN., *Poa angustifolia* L., *Allium subvineale* WENDELBO, *Lotus corniculatus* L., *Trifolium campestre* SCHREB., *Leontodon hispidus* L., *Tragopogon graminifolius* DC., *Linum catharticum* L., *Sanguisorba minor* SCOP. ssp. *muricata* (SPACH) BRIQ., *Salvia verticillata* L. ssp. *amasiaca* (FREYN & BORNM.) BORNM., *Hypericum perforatum* L., and *Thalictrum minus* L.

The population no. B 1632 in Turkey, north of Erzurum (4x), was found on the shores of an irrigation canal, but in a rather dry, stony and somewhat ruderal biotope. Altogether about ten individuals were found along the stream. They were associated with, for example, *Glaux maritima* L., *Herniaria incana* LAM., *Sisymbrium loeselii* L., and *Hordeum marinum* ssp. *gussoneanum* (4x).

In a single locality ssp. *violaceum* (2x) was found in a different type of vegetation, viz. in a rich steppe at c. 3000 m, where it was associated with species of *Echinops* and *Astragalus* (Iran, W of Baladeh, prov. Mazanderan, no. B 1877).

In several localities, ssp. *violaceum* occurred together with one or both of the annual, weedy species of *Hordeum*, viz. *H. marinum* and *H. murinum*. *H. bulbosum* occurred together with ssp. *violaceum* in some localities.

The major topics for further investigations of ssp. *violaceum* include a more detailed clarification of the distribution of the different cytotypes (di- and tetraploids), as well as a study of the introgression between ssp. *violaceum* and *iranicum* in western and northern Iran. The very complex C-banding pattern also needs to be further elucidated (LINDE-LAURSEN et al. 1980, LINDE-LAURSEN & BOTHMER 1984).

### ssp. *iranicum* BOTHMER

Ssp. *iranicum* is endemic to Iran in the Zagros and Alborz mountains. It is throughout a hexaploid taxon ( $2n = 6x = 42$ , LINDE-LAURSEN et al. 1980). This tall and stout plant has long glumes (7 - 10 mm) and awns (up to 7.5 mm). The leaf epidermis has sinuous, thick walls and silica-cells. Ssp. *iranicum*, like *H. bogdanii*, grows in more saline habitats than ssp. *violaceum*, but it tolerates a greater variation in moisture than *H. bogdanii*.

A population of ssp. *iranicum* in Iran, prov. Hamadan east of Sanandaj (no. 77BS85, only seeds and a few living plants were collected), grew in a saline, heavily grazed, grass-dominated meadow on the shores of a salt river. Dominating species were *Juncus gerardi* LOISEL. ssp. *persicus* (BOISS.) SNOGERUP, *Puccinellia* spp., *Glaux maritima* L., *Triglochin palustre* L., *T. maritimum* L., and *Scorzonera parviflora* JACQ. The more or less ruderal *Cynodon dactylon* (L.) PERS. was also very common. Due to the heavy

grazing, only a few identifiable plants of ssp. *iranicum* were found, but the species was probably a dominating grass in the salt meadow bordering the stream.

A population of ssp. *iranicum* in prov. Kordestan, 17 km SE of Iranshah, 2030 m (no. B 1936), was found at a rivulet and a small pond together with *Juncus articulatus* L., *Agrostis stolonifera* L., *Poa trivialis* L., *Lotus corniculatus* L., *Epilobium minutiflorum* HAUSSKN., *Potentilla persica* BOISS. & HAUSSKN., *P. reptans* L., *Stachys setifera* C.A.MEY., and *Mentha longifolia* (L.) HUDS.

More detailed studies should be undertaken on the present status of the distribution of ssp. *iranicum* as a basis for future protection plans. The genetic diversity within and between populations and the complex C-banding pattern need to be further elucidated.

### *Hordeum bogdanii* WILENSKY

*H. bogdanii* is a Central Asiatic species which extends its range eastwards to Mongolia and north-central China and with a few western, marginal populations in northern Iran. It is throughout a diploid ( $2n = 2x = 14$ ), inbreeding and very distinct species (BOTHMER 1979, LINDE-LAURSEN et al. 1980). It is probably not very closely related to the taxa in the *H. brevisubulatum* complex or to other *Hordeum* species. Material studied from the entire range of *H. bogdanii* shows little variation and the Iranian material does not deviate from that in other countries (BOTHMER 1979).

The species is very characteristic and recognized by the more or less tough rachis, long glumes and awns (5 - 11 mm), and a rachilla which is as long as the palea. Lemma and culm nodes are pubescent. The lateral florets are often perfect and seed setting.

The species was not recorded for Iran by BOR (1970). Two populations of *H. bogdanii* were discovered by the author, and one additional collection is present in herb. C (Køie no. 1005). The locations for these three populations are: Radschird, SW of Qum, 1200 m (Coll. Køie 24. 6. 1937); Prov. Markazi, between Saveh and Arak, 6 km E of Rahjerd, salty grassground at a small river, 1570 m (Coll. Bothmer & Buttler 3. 9. 1977, no. 77BS81, only seeds collected); Prov. Markazi, between Firuzkuh and Pol-e Sefid, c. 4 km NE of Firuzkuh, 1950 m (Coll. Bothmer & Buttler 26. 8. 1977, no. B 1771). The former two collections are in close vicinity of each other.

The altitude range for the species is 1000 - 3800 m. *H. bogdanii* is confined to saline, moist habitats throughout its range; rarely, it has been found by the author as ruderal (in western China) or in grassy slopes. It also occurs rarely in biotopes with freshwater. In the two localities in Iran seen by the author, crystallized salt was present on the ground surface. At Rahjerd (77BS81) the species was growing on a grazed, partly gravelly shore of a small salt river. This habitat was disturbed due to overgrazing and to road construction, and only a few plants of *H. bogdanii* were found there. Fragments of a more natural vegetation in this location included *Juncus gerardii* LOISEL. ssp. *persicus* (BOISS.) SNOGERUP, *Puccinellia* spp., *Tamarix* sp., *Triglochin palustre* L., *Glaux maritima* L., *Salsola kali* L., *Spergularia marina* (L.) GRISEB., and *Sonchus maritimus* L. Several weedy and ruderal elements were present, the most common among these being *Cynodon dactylon* (L.) PERS., *Peganum harmala* L., *Chrozophora obliqua* (VAHL) JUSS., and *Hordeum murinum* ssp. *glaucum*.

In the population north of Firuzkuh (no. B 1771) both *H. bogdanii* and *H. brevisubulatum* ssp. *iranicum* occurred together. They grew in a rather undisturbed habitat, viz. a moist, somewhat grazed, salt meadow along a small stream. The two taxa were the dominating grasses in the meadow. The populations of both species were large and they grew intermingled. Together with characteristic representatives of each species, some more or less intermediate specimens were found, which probably represented spontaneous, sterile hybrids. Among other dominant species were: *Puccinellia* spp., *Plantago maritima* L. ssp. *salsa* (PALL.) RECH.f., and *Hippuris vulgaris* L.

A more thorough field study should be initiated in order to establish the current status of *H. bogdanii* in Iran. This investigation should be the basis for an in situ protection plan for the species in the country. The variation pattern of *H. bogdanii* for the entire distribution area should be better assessed to establish whether the variation is clinal or disruptive and if the marginal populations in Iran deviate genetically from material in the central part of the distribution area.

### *Hordeum bulbosum* L.

*H. bulbosum* is a tall grown, broad-leaved, perennial plant with large auricles and it is the only species in the genus having a subterranean bulbous swelling at the base of the culm. Apart from *H. vulgare* ssp. *spontaneum*, *H. bulbosum* is the closest wild relative to cultivated barley (JØRGENSEN 1982, BOTHMER et al. 1986). *H. bulbosum* is an obligate outcrossing species with a self-incompatibility system (LUNDQUIST 1962). It is a typical Mediterranean element extending its distribution eastwards to Afghanistan and southern Tajikistan. *H. bulbosum* occurs in two cytotypes, one diploid ( $2n = 2x = 14$ ) in the western part of the Mediterranean, and a tetraploid form ( $2n = 4x = 28$ ) in the eastern part (KATZNELSON & ZOHARY 1967, LINDE-LAURSEN et al. 1990). The border between the two cytotypes is very sharp in Central Greece. All material studied from Turkey and Iran is tetraploid (JØRGENSEN 1982). The two cytotypes have been treated as different subspecies, but there are no unambiguous morphological traits distinguishing the two (JØRGENSEN 1982, BAUM & BAILEY 1985, BOTHMER et al. 1995).

The species usually grows in the lowland, but extends to higher altitudes, especially in Iran and Turkey. (It has been found by the author up to 2300 m.) It sometimes forms large, dense populations and is then the dominating element in the vegetation. However, most often it is encountered in smaller populations of 50 - 100 individuals.

The species occurs in many different habitats, for example meadows, hillsides and roadsides. In Turkey and Iran it occurs in rich steppe vegetation, in richer, grassy meadows, and in ditches and roadsides.

In one location (Turkey, Vil. Bolu, 10.2 km W of Yeniçaga at the road to Bolu, 1060 m, no. B 1495), *H. bulbosum* was found in a large, grassy field with a large number of species, among them: *Juncus inflexus* L., *J. articulatus* L., *Carex otrubae* PODP., *Poa compressa* L., *Potentilla reptans* L., *Teucrium chamaedrys* L., *Clinopodium vulgare* L., *Stachys thirkei* C.KOCH, and *Salvia verticillata* L. ssp. *amasiaca* (FREYN & BORN.M.) BORN.M. *H. bulbosum* is sometimes found together with the annuals *H. marinum* and especially *H. murinum*, and often with *Taeniatherum caput-medusae* (L.) NEVSKI and *Elymus hispidus* (OPİZ) MELDERIS.

Since *H. bulbosum* is a gene source for breeding of cultivated barley, a much more thorough investigation of variation and genetic diversity with marker systems as well as of adaptive and morphological traits in Turkey and Iran should be undertaken.

### *Hordeum marinum* HUDS.

The annual *H. marinum* is a Mediterranean element extending eastwards to western Afghanistan and western Pakistan. It is a variable species and several taxa of different ranks have been recognized. Recent investigations have shown that three morpho/cytotypes are present (BOTHMER et al. 1989a). One diploid type occurs mainly in western Mediterranean areas (ssp. *marinum*). It is distinguished by the broadened glumes of the lateral spikelets. In the eastern Mediterranean ssp. *gussoneanum* (PARL.) THELL. is particularly common. It occurs as a diploid and a tetraploid cytotype, but the two are impossible to distinguish morphologically and are hence treated in the same taxon (BOTHMER et al. 1989). The tetraploid cytotype has a more eastern distribution. Ssp. *gussoneanum* is distinguished from ssp. *marinum* by having setaceous glumes of lateral spikelets. Ssp. *gussoneanum* is the only subspecies seen by the author in Turkey and Iran. Both subspecies have spread as weeds in several areas of the world.

*H. marinum* is mainly a lowland plant extending up to 2000 m in Turkey and Iran. It is confined to wetter, sometimes somewhat salty habitats like ditches, shores of rivulets, canals, and small lakes etc., sometimes along roadsides. It prefers rather open ground and cannot compete in denser vegetation.

Some of the locations of ssp. *gussoneanum* seen by the author include the accompanying species:

*Triglochin palustre* L., *Mentha pulegium* L., *M. aquatica* L., and *Teucrium scordium* L. (Turkey, vil. Bolu, between Bolu and Kızılcıhamam; a heavily grazed meadow at a lake, 1270 m no. B 1517).

*Limonium gmelinii* (WILLD.) O.KUNTZE and *Allium atroviolaceum* BOISS. (Iran, prov. Azarbaijan, between Ardebil and Astara, 1240 m, saltsteppe in a dry ditch, 1240 m, no. B 1715).

*Juncus inflexus* L., *J. articulatus* L., *Taeniatherum caput-medusae* (L.) NEVSKI, *Elymus hispidus* (OPIZ) MELDERIS ssp. *barbatulus* (SCHUR) MELDERIS, *Diarthron vesiculosum* (FISCH. & C.A.MEY.) C.A.MEY., *Salvia hypoleuca* BENTH., *Stachys setifera* C.A.MEY. (Iran, prov. Markazi, 3.5 km E of Rudhen, steppe and a rivulet, 1880 m, no. 77BS44).

*Aleuopus lagopoides* (L.) TRIN. and *Halanthium rariflorum* C.KOCH (Iran, prov. West Azarbaijan, between Mahabad and Rezaiyeh, at the shore of the salty lake Rezaiyeh, 1250 m, no. B 1517).

Some of the more important topics for further investigations concern the genetic diversity within and between populations, genome relationships, and type of polyploidy.

### *Hordeum murinum* L.

*H. murinum*, like *H. marinum*, is an original Mediterranean element extending its natural distribution range eastwards to western Pakistan. It has also become adapted as a

noxious weed in many areas around the world. *H. murinum* is a taxonomically complicated aggregate of cytotypes and morphological forms (JACOBSEN & BOTHMER 1995). Taxonomists disagree on how to treat the different forms, from recognizing 3 - 4 different species to having one species with three subspecies, viz. ssp. *glaucum* (2x), ssp. *murinum* (4x), and ssp. *leporinum* (4x and 6x) (cf. BAUM & BAILEY 1989, JACOBSEN & BOTHMER 1995). The species is comparatively broad-leaved and with large auricles and long, tough glumes and awns. The central spikelet, which in all other *Hordeum* species is sessile (rarely subsessile), is distinctly stalked in most forms of *H. murinum*.

**ssp. *glaucum* (STEUD.) TZVELEV**

In Turkey and Iran this entirely diploid ( $2n = 2x = 14$ ) taxon is the most common one. It is a short and slender spring annual with a rapid life cycle. The lateral spikelets are of about the same size as the central one.

The natural habitat for this taxon in Turkey and Iran seems to be dry steppe areas, sometimes somewhat salty, and roadsides etc. It has been found by the author at altitudes up to 1700 m, and it is a common grass in the area.

Accompanying species from a few locations of ssp. *glaucum* are:

*Salvia hydrangea* DC., *Ziziphora clinopodioides* LAM., *Taeniatherum caput-medusae* (L.) NEVSKI (Iran, prov. West Azarbaijan, 12 km S of Bastan, steppe, 1390 m, no. 77BS28).

*Artemisia scoparia* WALDST. and *Limonium gmelinii* (WILLD.) O.KUNTZE (Iran, prov. West Azarbaijan, between Marand and Maku, saltsteppe, 1030 m, no. 77BS33).

*Carex divisa* HUDS., *Juncus gerardi* LOISEL. (Iran, prov. Azarbaijan, between Tabriz and Sarab; salty ground, roadside, and steppe, 1680 m, no. B 1693).

*Andrachne rotundifolia* C.A.MEY. (Iran, prov. Mazanderan, between Baladeh and Amol; steppe 1050 m, no. 77BS49).

**ssp. *leporinum* (LINK) ARCANG.**

Ssp. *leporinum* is a winter annual. It is a rather robust plant with the lateral spikelets much longer than the central one. It is a polyploid taxon occurring in two different cytotypes, one tetraploid ( $2n = 4x = 28$ ) with a large distribution in the Mediterranean eastwards to Afghanistan. It is a common plant. However, exclusively in Turkey, Iran and the adjacent Caucasus area, an endemic form which is hexaploid ( $2n = 6x = 42$ ) occurs. It was described as a separate species (*H. hrasdanicum* GANDILYAN), but according to our studies it is not possible to distinguish the cytotypes morphologically. For this reason they are kept together in one taxon, ssp. *leporinum* (JACOBSEN & BOTHMER 1995). It occurs in roadsides and gravelly meadows.

Despite the fact that *H. murinum* sensu lat. is the most common *Hordeum* species worldwide (occurring as a weed in all continents) it still contains many unresolved taxonomic and phylogenetic problems. These include, for example, a more detailed study of the distribution of the hexaploid cytotype of ssp. *leporinum* in Iran and Turkey and studies of genetic diversity and variation of all taxa. More detailed information about the original habitats of the *H. murinum* complex is needed. The polyploid cytotypes of



*H. murinum* behave as allopolyploids, but newer data indicate that the complex may have an autopolyploid background and that differentiation has appeared due to the evolution of strong diploidizing mechanisms regulating exclusive bivalent formation of meiosis (LINDE-LAURSEN & BOTHMER 1989, BOTHMER et al. 1989b, 1989c, JACOBSEN & BOTHMER 1995). The genome relationships to other *Hordeum* species are also poorly known.

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