

# Morphology and karyology of wild growing Polish representatives of Triticeae (Poaceae)

Marta Mizianty<sup>1</sup> & Ludwik Frey<sup>2</sup>

W. Szafer Institute of Botany, Polish Academy of Sciences, Lubicz 46, 31-512 Kraków, Poland, e-mail: <sup>1</sup>Marta.Mizianty@ib-pan.krakow.pl, <sup>2</sup>Ludwik.Frey@ib-pan.krakow.pl

**Abstract:** Taxonomy (key characters), karyology (chromosome number and genome structure) and some remarks on chorology (general distribution and in Poland) of 9 wild growing species from the tribe Triticeae (Pooideae; Poaceae) belonging to 5 genera (*Elymus*, *Hordelymus*, *Leymus*, *Hordeum*, *Brachypodium*) are shortly presented.

**Key words:** variability, *Triticeae*, distribution, chromosome number, genotype, habitats, Poland

In the tribe Triticeae Dumort. (Pooideae; Poaceae) various numbers of genera and species were distinguished (Mizianty 2005). They occur in the temperate and warm zones, principally in the northern hemisphere. The taxonomy of the tribe is complex and still in a state of flux. In the majority of species the chromosome number is  $2n=28$  and  $2n=14$  (the highest  $2n=56$ ) (Clayton & Renvoize 1986; Watson & Dallwitz 1992).

In Poland the tribe Triticeae is represented by 11 genera and 33 species (Frey 2003). In the present paper 5 genera (*Elymus*, *Hordelymus*, *Leymus*, *Hordeum* and *Brachypodium*) comprising all 9 wild growing species (excluding ephemerophytes) are characterized.

The genus *Elymus* L. encompasses ca 150 mainly perennial species, which occur in temperate areas of the northern and southern hemispheres (being especially numerous in Asia) (Clayton & Renvoize 1986). In Poland, the genus is represented by 4 wild growing species (Mizianty *et al.* 2001).

*Elymus repens* (L.) Gould., perennial, in Poland is widespread in the lowlands and also at the lower mountain altitudes and grows in various ecological conditions, in natural and anthropogenic places (Mizianty *et al.* 2001). This species shows great morphological variation, creating problems with regard to infraspecific subdivision. There are 3 varieties in Poland: *E. repens* var. *repens*, *E. repens* var. *aristatus* (Schreb. ex Baumg.) Melderis & D. C. McClintock and *E. repens* var. *subulatus* (Roem. & Schult.) Szczepaniak

(Mizianty *et al.* 2001; Szczepaniak *et al.* 2002). *E. repens* is a grass with creeping, wiry rhizomes, forming a thick and stout net. Stem up to 170 cm, stout, smooth. Leaves flat or slightly convoluted at the margins. Spike erect, usually dense. Spikelets sessile, solitary, rarely double or triple at the spike's node. Glumes hairless, acuminate or with rough awn. Lemma sharply pointed, some awnless or with awn. Within the species two chromosome numbers,  $2n=28$  and  $2n=42$ , have been recorded (Mizianty *et al.* 2001 and literature cited therein). The genome: **StStH** (Wang *et al.* 1996).

*Elymus caninus* (L.) L., perennial, is common in Poland, growing in carr thickets and clear deciduous forests and occasionally in open and dry habitats. It has two morphotypes whose taxonomic status is unclear: "pauciflorum" and "caninus" (Mizianty *et al.* 2001; Mizianty 2005). *E. caninus* is a plant with or without very short rhizomes. Stem up to ca 180 cm, glabrous. Leaves hairy or hairless, rolled in a bud. Spike lax. Spikelets sessile, solitary. Glumes not connate at the base, acute, with awn. Lemma with long awn. Only one chromosome number  $2n=28$  has been hitherto established (Mizianty *et al.* 2001 and literature cited therein). The genome: **StH** (Dewey 1984; Löve 1984).

*Elymus hispidus* (Opiz) Melderis, rare perennial species, is represented in Poland by *E. hispidus* var. *hispidus* and *E. hispidus* var. *villosus* (Hackel) Assadi. They grow in xerothermic grasslands in the east of Poland where both varieties reach their northern limit (Mizianty *et al.* 2001). *E. hispidus* has long rhizomes.

Stem up to 150 cm, stiff and smooth. Leaves flat, more or less convoluted at the margins. Spike dense, but lax at the base. Spikelets sessile, solitary, hairless or pubescent. Glumes stiff, asymmetric, prominently and parallel veined, glabrous or hairy, often with a waxy covering. Lemma hairless or with sparse long hairs in the upper part. In the species the most frequent chromosome number is  $2n=42$ . However, the tetraploid plants,  $2n=28$ , has been also recorded (Mizianty *et al.* 2001; Szczepaniak 2003 and literature cited therein). The genome: **EES** (Löve 1986).

*Elymus farctus* (Viv.) Runemark *ex* Melderis subsp. *boreoatlanticus* (Simonet & Guin.) Melderis, the only perennial subspecies of *E. farctus* in Poland, occurs on white dunes along the shore of the Polish Baltic coast. It is an endangered taxon in Poland known currently from only five localities (Frey 1999). This subspecies is a plant with long rhizomes. Stem up to 60 cm, fragile, glabrous. Leaves convoluted, rarely flat with convoluted margins. Spike erect. Spikelets sessile, distant from each other, at least in the lower part of the spike. Glumes awnless, with prominent veins. Lemma unawned or sometimes with a very short awn. Only one chromosome number  $2n=28$  has been hitherto established (Mizianty *et al.* 2001).

The genus *Hordelymus* contains only one perennial species, *H. europaeus* (L.) Jess. *ex* Harz, which is scattered throughout most of Poland. In general, it grows in beech woods and oak-hornbeam forests and its area of distribution in the country corresponds to the distribution range of *Fagus sylvatica* L. (Mizianty 2001). It is a morphologically uniform plant, without (or with very short) rhizomes. Stem up to 120 cm, stiff, below the nodes and at the nodes minutely pubescent. Leaves flat, distinctly acute. Spike dense, spikelets always 1-flowered, 3 at each node of the spike. Glumes connate at the base, awned, very narrow. Lemma with very long awn. Only one chromosome number  $2n=28$  has been determined (Mizianty *et al.* 2001 and literature cited therein). The genome: **XoXr** (Wang *et al.* 1996).

The genus *Leymus* Hochst. comprises ca 40 species, distributed in the northern temperate zone (Clayton & Renvoize 1986). *Leymus* is one of the genera whose recognition is still disputed: is it a separate genus or it should be included in the genus *Elymus* L. (Barkworth & Atkins 1984; Mizianty *et al.* 2001). In Poland the genus is represented by the perennial *L. arenarius* (L.) Hochst. In its natural habitats i.e. dunes, it occurs throughout the entire length of the Baltic Sea coast. It has also been found in fairly numerous inland, mainly anthropogenic localities (Mizianty *et al.* 2001). *L. arenarius* has long creeping rhizomes. Stem up to 150 cm, robust and glabrous. Leaves wide, flat, often with convoluted margins. Spike dense. Spikelets in pairs at each node of the rachis. Glumes with distinct veins,

glabrous or with short hairs on the keel. Lemma densely hairy, with short, soft hairs. Only an octoploid chromosome number  $2n=56$  has been recorded (Mizianty *et al.* 2001 and literature cited therein). The genome: **NsXm** (Wang *et al.* 1996).

The genus *Hordeum* L. The subgeneric delimitation of it has been the subject of controversy. In the opinion of Bothmer *et al.* (1995) it comprises 32 species and altogether 45 taxa.

*Hordeum murinum* L., the annual, inbreeding complex is represented by three taxa: species, subspecies or varieties: *murinum*, *leporinum* and *glaucum* (it depends on taxonomy treatment). The natural centre of its distribution lies in the Mediterranean area, north central Europe, western Asia and north Africa (Bothmer *et al.* 1995; Jacobsen & Bothmer 1995). In the Poland *H. murinum* is represented only by *H. murinum* subsp. *murinum*, common in various anthropogenic places all over country. The subspecies is morphologically very uniform. It doesn't have rhizomes. Stem up to 84 cm, more or less erect. Leaves flat, with occasionally involute margins. Spike dense. Spikelets 3 at each node of the spike. Central spikelet sessile or subsessile. Glumes compressed, with ciliate margins, lemma with awn up to 55 mm long. Lateral spikelets usually shorter than central spikelet, palea almost glabrous. The chromosome number recorded for it is  $2n=28$  (Mizianty 2006 and literature cited therein). The genome: **Xu** (Wang *et al.* 1996).

The genus *Brachypodium* P. Beauv. comprises 16 species, primarily perennial, occurring both in forests and in open grasslands. They grow mainly in temperate Eurasia, though in the south they reach as far as the tropical mountains (Clayton & Renvoize 1986).

In Poland, the genus is represented by two perennial species: *Brachypodium pinnatum* (L.) P. Beauv. and *B. sylvaticum* (Huds.) P. Beauv. They occur fairly frequently in the mountains and in the lowlands (Zajac & Zajac 2001). *B. pinnatum*, grows mainly in thermophilous swards of the south-eastern and southern parts of Poland, and in the north – in the communities of thermophilous oak forests, sometimes together with *B. sylvaticum*. The latter species grows mainly in deciduous forests, scrub and shady woods-borders. In *B. pinnatum*, two morphologically different population groups have been distinguished. The first with culms, sheaths and blades strongly haired, which occurs in xerothermic habitats, and the second one, not so strongly pubescent, which grows in forest habitats (Paszko 2005). Both species differ in karyology: *B. pinnatum* is tetraploid with  $2n=28$  and *B. sylvaticum* has  $2n=18$  (Mizianty 2003 and literature cited therein).

Taxonomic and evolutionary studies of the genus show that it is not closely related to Triticeae, and it seems more appropriate to place it in a separate tribe

Brachypodieae (Watson & Dallwitz 1992; Paszko 2005).

**Acknowledgements.** The study was financed by the State Committee for Scientific Research (project 3P04C 050 23).

## References

- BARKWORTH M. E. & ATKINS R. J. 1984. *Leymus* Hochst. (Gramineae: Triticeae) in North America: taxonomy and distribution. *Am. J. Bot.* 71: 609-625.
- BOTHMER R. VON, JACOBSEN N., BADEN C., JORGENSEN R. B. & LINDE-LAURSEN. 1995. An ecogeographical study of the genus *Hordeum*. 2<sup>nd</sup> edition, pp. vi+129. Systematic and Ecogeographic Studies on Crop Genepools 7. International Plant Genetic Resources Institute, Rome.
- CLAYTON W. D. & RENVOIZE S. A. 1986. *Genera graminum. Grasses of the world*. 389 pp. Her Majesty's Stationery Office, London.
- DEWEY D. R. 1984. The genomic system of classification as a guide to intergeneric hybridization with the perennial Triticeae. In: P. GUSTAFSON (ed.). *Gene manipulation in plant improvement*. Proc. 16<sup>th</sup> Stadler Genetics Symp. pp. 209-279. Plenum Publishing Corporation, New York.
- FREY L. 1999. The *Agropyron-Elymus* complex (Poaceae) in Poland: disappearance of *Elymus farctus* subsp. *boreoatlanticus* on the coast of the Baltic Sea. *Fragm. Flor. Geobot.* 44(1): 35-42.
- FREY L. 2003. Grass taxonomy in Poland. In: L. FREY (ed.). *Problems of grass biology*, pp. 27-49. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- JACOBSEN N. & BOTHMER R. von 1995. Taxonomy in the *Hordeum murinum* complex (Poaceae). *Nordic J. Bot.* 15: 449-458.
- LÖVE A. 1984. Conspectus of the Triticeae. *Feddes Repert.* 95: 425-521.
- LÖVE A. 1986. Some taxonomical adjustments in Eurasian wheatgrasses. *Veröff. Geobot. Inst. Rübel Zürich* 87: 43-52.
- MIZIANTY M. 2001. The *Agropyron-Elymus* complex (Poaceae) in Poland: occurrence of *Hordelymus europaeus*. In: L. FREY (ed.). *Studies on grasses in Poland*, pp. 161-176. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- MIZIANTY M. 2003. Karyology of grasses in Poland. In: L. FREY (ed.). *Problems of grass biology*, pp. 51-69. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- MIZIANTY M. 2005. Variability and structure of natural populations of *Elymus caninus* (L.) L. based on morphology. *Pl. Syst. Evol.* 251: 199-216.
- MIZIANTY M. 2006. Variability and structure of natural populations of *Hordeum murinum* L. based on morphology and cytology. *Pl. Syst. Evol.* 261: 139-150.
- MIZIANTY M., FREY L. & SZCZEPANIAK M. 2001. The *Agropyron-Elymus* complex (Poaceae) in Poland: biosystematics. In: L. FREY (ed.). *Studies on grasses in Poland*, pp. 25-77. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- PASZKO B. 2005. Zmienność morfologiczna *Brachypodium pinnatum* i *B. sylvaticum* w Polsce. In: B. JACKOWIAK & Z. CELKA (eds.). *Taksonomia, chorologia i ekologia roślin w dobie zagrożenia różnorodności biologicznej. Materiały Konferencji Naukowej dedykowanej Profesorowi dr. hab. Waldemarowi Żukowskiemu z okazji 70-lecia urodzin*, p. 193. UAM Poznań.
- SZCZEPANIAK M. 2003. Zmienność morfologiczna *Elymus hispidus* (Opiz) Melderis. In: J. JAKUBOWSKI & J. WĄTROBA (eds.). *Zastosowania metod statystycznych w badaniach naukowych II*, pp. 361-370. StatSoft Polska, Kraków.
- SZCZEPANIAK M., CIEŚLAK E. & BEDNAREK P. T. 2002. Morphological and AFLP variation of *Elymus repens* (L.) Gould (Poaceae). *Cell. Mol. Biol. Letters* 7(2A): 547-558.
- WANG R. R.-C., von BOTHMER R., DVORAK J., FEDAK G., LINDE-LAURSEN I. & MURAMATSU M. 1996. Genome symbols in Triticeae (Poaceae). In: R. R.-C. WANG, K. B. JENSEN & C. JANUSSI (eds.). *Proc. the 2<sup>nd</sup> International Triticeae Symposium*, pp. 29-34.
- WATSON L. & DALLWITZ M. J. 1992. *The grass genera of the world*. 1038 pp. C.A.B. International, Wallingford.
- ZAJĄC A. & ZAJĄC M. (eds.). 2001. *Distribution atlas of vascular plants in Poland*. xii+714 pp. Edited by Laboratory of Computer Chorology, Institute of Botany, Jagiellonian University, Cracow.