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OCCURRENCE OF *HORDELYMUS EUROPAEUS* (L.) JESS. EX HARZ (POACEAE) IN THE WIELKOPOLSKA REGION

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Abstract. The paper provides information about new locality and the current distribution of *Hordelymus europaeus* in the Wielkopolska region. On the basis of a field study we present a comprehensive description of species locations, characterise inhabited communities, as well as the population size and morphological differences of wood barley in particular populations.

Key words: *Hordelymus europaeus*, Wielkopolska, rare species, Poaceae

INTRODUCTION

Wood barley (*Hordelymus europaeus* (L.) Jess. ex Harz) is perennial grass from the Triticeae tribe (Mizianty & Szczepaniak 1997). Culms of this species are erect, 40–130 cm long. Nodes and sheaths are hairy. Leaves have falcate auricles and a short membranous ligule. Inflorescence – the single and erect raceme – is 4–12 cm long. A cluster of tree spikelets is located at each node. Spikelets are up to ca 30 mm long from the base to the top of the very long lemma awn and comprise 1–2 fertile florets (Klimko et al. 2015).

Wood barley shows a dispersed pattern of geographical distribution. It is found in extensive parts of Europe, with the clear orientation to Central and South Europe. It also grows in Asia Minor, as well as Northeast Africa (Meusel et al. 1965). In Central Europe wood barley is a character species of the beechwood with the alliance *Fagion sylvaticae* R. Tx. et Diem. 1936 (Oberdorfer 1990). Its distribution visibly corresponds with the range of beech, however it is also encountered in oak-hornbeam forests and in other forest communities (Mizianty 2001).

Species is considered as a rare or very rare in Poland (Mizianty 2001). Most localities are situated in lower areas of the Carpathian Mountains and the Sudeten Mountains (Zając & Zając 2001, Barć & Brzustewicz 2006). The moderately numerous localities are reported in north-eastern Poland and very few localities are reported in the Pomerania and Kuyavia regions (Zając & Zając 2001, Mizianty et al. 2006). Till now, the species has been reported from only three localities in Wielkopolska, that is from a forest near Kąty, the Bytyń Forest as well as from Zielonagóra forest district (Mizianty 2001). It is listed as a critically endangered species in this region (Jackowiak et al. 2007).

In this note we provide a new locality of wood barley in Wielkopolska, as well as verify the former localities with detailed description of the position and coordinates. We characterise communities with *H. europaeus* and provide general information about population of this species.

MATERIAL AND METHODS

Field observations were carried out in 2014 and 2015. The historical localities of *H. europaeus* were verified and a new locality was found. Phytosociological relevés were prepared using the Braun-Blanquet method. The nomenclature of vascular plants followed Mirek et al. (2002), whereas that of mosses followed Ochyra et al. (2003). The names of the syntaxa and list of character species were given after Matuszkiewicz (2001). In each locality all shoots of wood barley were counted and 30 mature and most diverse shoots were measured. Measurements focused on the following features: height of a shoot, length of inflorescence, length and width of the middle leaf.

The herbarium material is deposited at the Department of Botany, the Poznań University of Life Sciences (POZNB).

RESULTS

NEW LOCALITY

1. Łopuchówko Forest District, Buczyna Forest Subdistrict

Hordelymus europaeus was found in division 113 of the Buczyna Forest Subdistrict (coordinate 16°58'E, 52°40'N). The division is situated ca 0.5 km SE of Słomowo and ca 4 km NE of the previously described locality in the Długa Goślina Forest Subdistrict. Wood barley specimens occur in the brown-mull Beech wood *Galio odorati-Fagetum* and form two agglomerations ca 150–200 m apart and ca 50 m from the forest border (Fig. 1). Agglomeration 1B occupies the seed tree stand. Due to harvesting of singular trees herb layer is relatively low-shaded and turf patches with a high participation of *Poa nemoralis* occur (Table 1).

Agglomeration 1A consists of ca 700 shoots, whereas 1B consists of ca 450 shoots. Singular specimens occupy the area between both agglomerations. Shoots with inflorescence range from 37 cm to 128 cm, racemes range from 4.5 cm to 11 cm, leaf length was between 10 cm and 32 cm while leaf width 0.4 cm and 1 cm (Table 2).

PREVIOUSLY DESCRIBED LOCALITIES

2. Łopuchówko Forest District, Długa Goślina Forest Subdistrict

Locality was published by MIZIANTY (2001) and based on unpublished data of KORCZEWSKA that had been collected in 1985. In literature it is recorded with a code "Kąty".

Current search shows, that the species occurs in division 153 of the Długa Goślina Forest Subdistrict

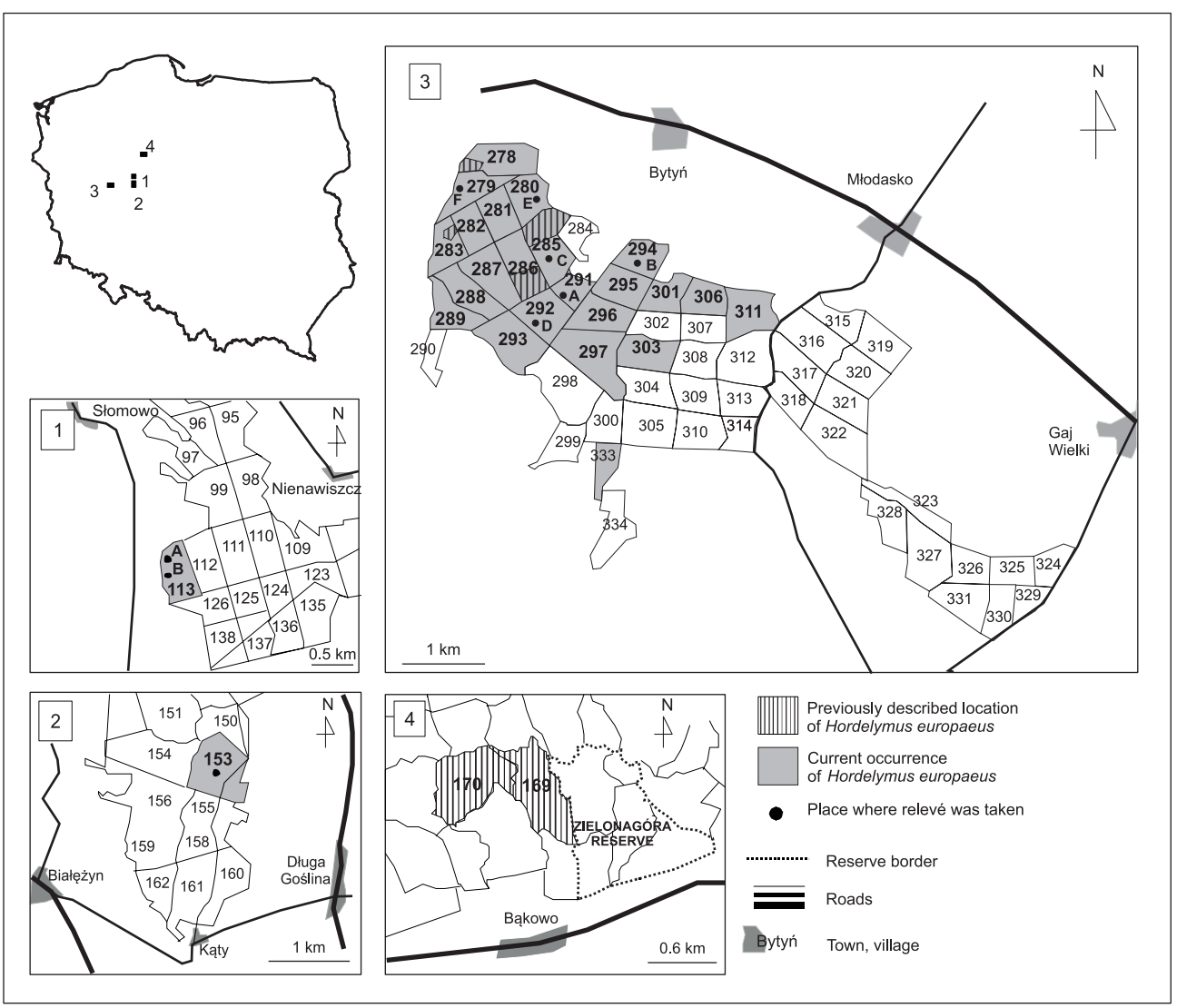

Fig. 1. Distribution of *Hordelymus europaeus* in the Wielkopolska region. Maps include the current division numbers

Table 1. Plant communities with Hordelymus europaeus in the Buczyna (Bu), Długa Goślina (DG) and Bytyń (By) Forest Subdistricts. To check up the position of particular relevés (1A, 1B etc.) see Figure 1

Successive number of relevé	1	2	3	4	5	6	7	8	9
Position of locality	1A	1B	2	3A	3B	3C	3D	3E	3F
Data	10.08. 2014	10.08. 2014	05.08. 2015	25.08. 2014	25.08. 2014	25.08. 2014	25.08. 2014	27.08. 2015	27.08. 2015
Forest Subdistrict	Bu	Bu	DG	By	By	By	By	By	By
Divisions	113	113	153	291	294	285	292	280	279
Area of relevé (m^2)	800	400	400	500	1000	1000	100	500	200
Cover of tree layer a1 (%)	80	80	20	80	80	70	70	10	50
Cover of tree layer a2 (%)	0	0	0	30	60	10	0	65	0
Cover of shrub layer b (%)	0	0	ex	5	ex	ex	ex	15	0
Cover of herbaceous layer c (%)	75	50	65	65	50	30	40	50	80
Cover of moss layer d (%)	ex	ex	5	ex	ex	ex	ex	ex	ex
Number of species	33	36	40	27	36	39	41	33	37
I. *Hordelymus europaeus (Fagion)*	2.3	2.3	+	+	+	+	1.1	1.1	2.2
II. *Fagion sylvaticae* (incl. *Galio odorati-Fagetum)**									
Fagus sylvatica (a1)	4.3	3.3	.	.	.	.	.	.	.
Fagus sylvatica (c)	1.1	r	1	.	.	.	.	.	.
*Melica uniflora**	.	2.3	.	1.1	3.3	1.1	1.1	2.3	+
III. *Carpinion betuli* (incl. *Galio-Carpinetum)**									
Carpinus betulus (a1)	.	2.1	.	4.4	2.2	.	3.3	.	.
Carpinus betulus (a2)	.	.	.	3.3	4.3	2.2	.	2.2	.
Carpinus betulus (c)	.	+	.	1.1	.	.	.	r	2.3
Dactylis polygama	+	+	2.2	1.1	+	+	+	1.1	+
Stellaria holostea	.	.	.	.	.	1.1	1.1	+	+
*Galium sylvaticum**	.	.	.	r	.	r	.	.	.
*Chaerophyllum temulum**	.	r	r	.	.	+	+	.	.
IV. *Querco-Fagetea*									
Acer pseudoplatanus (a1)	.	.	2	2.2	.	.	.	.	.
Acer pseudoplatanus (c)	.	.	+	2.2	.	.	.	r	.
Acer platanoides (c)	.	.	.	.	+	.	.	r	.
Corylus avellana (c)	.	.	.	.	+	+	.	.	r
Euonymus europaea (c)	.	.	.	.	+	.	.	+	.
Sorbus torminalis (c)	.	.	.	.	r	.	.	.	r
Brachypodium sylvaticum	.	.	r	r	r	+	+	+	.
Festuca gigantea	.	.	.	.	r	r	r	.	r
Carex sylvatica	.	.	.	+	.	r	.		.
Poa nemoralis	3.3	1.2	r	.	.	.	.	.	.
Dryopteris filix-mas	.	r	1	.	r	.	.	1.1	.
Galeobdolon luteum	+	2.3	.	.	.	.	.	.	.
Galium odoratum	+	+	.	2.2	1.1	.	.	+	r
Milium effusum	+	1.2	.	.	+	+	.	r	+
Pulmonaria obscura	.	.	.	+	+	+	.	.	.
Stachys sylvatica	r	.	.	+	+	.	1.1	+	+
Viola reichenbachiana	+	+	+	+	.	+	r	.	r
Circaea lutetiana	.	r	.	r	r	r	r	r	r
Atrichum undulatum	r	r						r	r
V. *Artemisietea vulgaris*									
Cirsium arvense	.	.	r	.	.	.	+	.	r
Urtica dioica	1.3	1.2	2	+	+	+	1.1	r	+
Fallopia dumetorum	+	+	r	.	.	.	.	r	.
Rubus caesius	.	.	.	.	.	+	1.1	r	2.2
Galeopsis pubescens	r	r	1	.	r	r	+	r	.
Alliaria petiolata	r	.	1	.	.	+	.	.	.
Chelidonium majus	r	r	r	.	.	.	.	.	.
Geum urbanum	.	.	r	.	r	r	.	.	r
Geranium robertianum	+	r	+	.	r	.	+	r	r

Impatiens parviflora	+	1.1	2	+	.	+	1.1	.	+
Lapsana communis	r	.	r	r	r	.	+	r	.
VI. *Epilobietea angustifolii*									
Calamagrostis epigeios	+	r	.	.	.	.	+	.	2.3
Rubus idaeus	+	+	2	.	+	.	+	.	2.2
Bromus benekenii	.	.	.	.	+	+	.	.	.
Sambucus nigra (c)	.	+	.	.	+	+	.	r	r
Populus tremula	.	r	.	.	.	.	.	.	r
VII. Others									
Pinus sylvestris (a1)	.	.	.	.	1.1	3.3	.	2.1	.
Quercus petraea (a1)	.	.	.	.	1.1	1.1	.	.	.
Quercus robur (a1)	2.1	1.1	.	3.3	4.3	2.2	2.2	.	.
Crataegus laevigata (b)	.	.	.	.	+	.	.	1	.
Quercus petraea (c)	+	r	.	.	.	.	.	.	.
Crataegus monogyna (c)	.	.	.	r	r	.	.	.	r
Pinus sylvestris (c)	.	.	r	.	.	.	r	.	r
Betula pendula (c)	.	r	.	.	.	.	.	.	r
Larix cfr. *kaempferi* (c)	.	.	r	.	.	.	r	.	r
Dryopteris carthusiana	.	r	+	.	+	1.1	.	r	r
Luzula pilosa	+	.	r	.	.	.	.	.	.
Maianthemum bifolium	r	+	r	.	+	+	.	1.1	+
Moehringia trinervia	+	+	1	.	.	.	.	.	.
Mycelis muralis	r	+	+	.	.	.	.	.	r
Oxalis acetosella	+	+	+	.	.	+	.	r	+
Athyrium filix-femina	.	.	.	r	.	.	+	.	.
Chenopodium album	.	r	r	.	.	.	.	.	r
Conyza canadensis	.	.	r	.	.	.	r	.	.
Dryopteris dilatata	.	.	.	.	+	+	.	.	.
Hieracium sabaudum	r	.	.	r	.	.	.	.	.
Juncus effusus	.	.	r	.	.	.	+	.	r
Plantago major	r	.	.	.	.	.	r	.	.
Solidago virgaurea	r	+	.	.	.	.	.	.	.
Brachythecium rutabulum		r	r	.	.	.	.	.	.
Dicranella heteromalla	r	.	r	.	.	.	.	r	.
Hypnum cupressiforme	.	.	r	r	r	.	r	r	r

Sporadic species – **II:** *Fagus sylvatica* (b) 6(+); **III:** *Carpinus betulus* (b) 4(1.1); **IV:** *Acer platanoides* (a1) 4(1.1); *Corylus avellana* (b) 8(2.1); *Fraxinus excelsior* (c) 6(+); *Paris quadrifolia* 6(r); *Sanicula europaea* 4(+); *Rumex sanguineus* 7(r); *Stellaria nemorum* 1(r); *Ribes spicatum* 2(r); **V:** *Arctium tomentosum* 9(r); *Arctium minus* 7(r); *Artemisia vulgaris* 7(r); *Cirsium vulgare* 7(r); **VI:** *Fragaria vesca* 6(+); *Gnaphalium sylvaticum* 7(r); *Sambucus nigra* (b) 5(+); *Centaurium erythraea* 7(r); *Salix caprea* (b) 7(+); **VII:** *Cornus sanquinea* (b) 6 (+); *Crataegus laevigata* (c) 8(r); *Quercus robur* (a2) 8(2.2); *Quercus rubra* (b) 6(+); *Quercus rubra* (c) 6(r); *Betula pendula* (a2) 8(1.1); *Betula pendula* (b) 7(+); *Achillea millefolium* 9(r); *Cerastium holosteoides* 3(r); *Ajuga reptans* 3(+); *Astragalus glycyphyllos* 3(r); *Holcus mollis* 3(r); *Epilobium adnatum* 1(r); *Equisetum arvense* 3(r); *Hypericum maculatum* 7(r); *Hypericum perforatum* 9(r); *Lathyrus niger* 4(r); *Lithospermum officinale* 5(r); *Prunus cerasifera* (c) 8(r); *Pyrus communis* (c) 1(r); *Pseudotsuga menziesii* (a1) 7(2.2); *Ranunculus repens* 6(r); *Ribes uva-crispa* 8(r); *Trifolium campestre* 3(r); *Trifolium medium* 7(+); *Veronica chamaedrys* 7(r); *Veronica officinalis* 1(+); *Vicia dumetorum* 5(r); *Viola mirabilis* 9(r); *Vicia* sp. 3(r); *Rubus* sp. 3(+); *Anemone* sp. 3(r); *Aulacomium androgynum* 3(r); *Polytrichastrum formosum* 6(r); *Sciuro-hypnum oedipodium* 2(r); *Pohlia nutans* 1(r); *Plagiothecium* sp. 6(r).
Abbreviation: ex – exiguous.

(17°00'E 52°38'N). The division is situated ca 2 km N of the Kąty village. *Hordelymus europaeus* grows in a deciduous forest stand under artificial regeneration, where many mature trees had been harvested and *Fagus sylvatica* seedling was planted. *Hordelymus europaeus occupies* an area of 5 m^2, where ca 250 shoots were counted. Specimens are very robust, shoots with inflorescence range from 83 cm to 154 cm, racemes range from 7.5 cm to 12 cm (Table 2).

3. Pniewy Forest District, Bytyń Forest Subdistrict

The oldest known locality in the Wielkopolska region. It was announced by Rafalski & Urbański (1932) on the basis of specimens collected in "a deciduous forest near Bytyń" by Kulesza (6.06.1931; POZ) and by Krawiec (26.06.1931; POZ). Bielawska & Bodniak (1956, 1959) specified, that species occurred quite often in four divisions (Fig. 1).

Current studies show, that *H. europaeus* occurs in extensive areas of oak-hornbeam forest (*Galio sylvatici-Carpinetum*). It was found in 23 divisions (Fig. 1), mostly in western part of the Bytyński Forest. Stands with wood barley represent diverse degrees of naturalness. Patches that are located in divisions 294 and 285 are protected (nature reserves "Brzęki przy starej

Table 2. Morphological characteristics of *Hordelymus europaeus* in the Buczyna (Bu), Długa Goślina (DG) and Bytyń (By) Forest Subdistricts. To check up the position of particular locality (1A, 1B etc.) see Figure 1

Locality Code (subdistrict)	Approximate no of shoots	Shoot with inflorescence height	Raceme length	Middle leaf length	Middle leaf width
1A (Bu)	700	37–83.5 (65.4 ± 0.31)	4.5–10 (7.35 ± 1.3)	10–28.5 (22.32 ± 3.77)	0.4–0.9 (0.69 ± 0.11)
1B (Bu)	450	43–128 (81.28 ± 23.19)	5–11 (7.47 ± 1.37)	11–32 (22.27 ± 5.08)	0.5–1 (0.74 ± 1.15)
2 (DG)	250	83–154 (116.27 ± 20.42)	7.5–12 (9.43 ± 1.38)	20–34 (25.05 ± 3.46)	0.5–1.5 (1.02 ± 0.27)
3C (By)	scattered	44.5–75 (59.08 ± 6.4)	4.5–55 (8.13 ± 8.91)	16–29 (23.22 ± 2.9)	0.8–1.5 (1.13 ± 0.16)
3E (By)	scaterred	40–100 (72.2 ± 14.84)	5.5–10 (7.47 ± 1.24)	12.5 (21.77 ± 4.74)	0.5–1.4 (0.99 ± 0.22)
3F (By)	450	74–131 (107.78 ± 16.35)	6–12 (8.4 ± 1.43)	16–35 (24.65 ± 4.84)	0.7–1.5 (1.1 ± 0.23)
ANOVA (F)		61,59***	1.31	3.13*	25.92***

* $p<0.05$; *** $p<0.001$.

Gajówce" and "Bytyńskie Brzęki"). Under the dense canopy cover, the scarce clumps (ca 5–10 shoots) of *H. europaeus* grow scattered throughout the whole forest area (Table 1; 3A, 3B, 3C). Wood barley grows more abundant under a thinner canopy (Table 1; 3D, 3E) whereas in a harvested stand with canopy gap we found rich agglomeration (ca 450 shoots) of this grass (Table 1; 3F). The lengths of shoots of *Hordelymus* vary considerably and range from 40 cm to 131 cm (Table 2). The highest shoots had specimens clustered in canopy gaps (3F), whereas the lowest were specimens growing in deep shadow (3C). The raceme was 4–12 cm long and did not differ among particular populations.

4. Kaczory Forest District, Zielonagóra Forest Subdistrict

Locality was reported by Kępczyński & Peplińska (1993). *Hordelymus europaeus* was characterised as rare species in the Zielonagóra Forest Subdistrict and occurred in two divisions (Fig. 1).

In 2015 we searched the forest area between Osiek nad Notecią, Bąkowo and Dębowa Góra however no specimens of wood barley were found.

CONCLUSION

At present, the occurrence of *Hordelymus europaeus* has been confirmed in three forest districts of the Wielkopolska region: Buczyna, Długa Goślina and Bytyń. *Hordelymus europaeus* is widespread and numerous, only in the Bytyń Forest, where the population is stable and not endangered. In remaining localities populations are clearly smaller, composed of singular isolated aggregations, and as a consequence, its persistence in the future is much more uncertain.

Hordelymus europaeus is a shade tolerant species. Under the dense canopy of deciduous trees it forms small clumps (Kępczyński & Peplińska 1983, Głowacki & Załuski 1997). Our observations showed, however, that lighting up a forest floor by selected harvest or even small clearcutting can stimulate the growth of wood barley and increase its abundance. Hence, it seems that sustainable silvicultural management does not negatively affect this grass.

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