



Biodiversity of weeds among Crop Wild Relatives in Poland

INTRODUCTION

Crop Wild Relatives (CWR) include both direct ancestors and other species evolutionarily related to crop plants. Plants of these species are a rich source of new genetic variation for breeding and/or may have great potential or even high economic or social value. They can be used indirectly or directly as edible, fodder, dye and fiber plants, as well as for the purposes of forestry, medicinal, cosmetic, ornamental, or as elements that maintain the balance of agricultural ecosystems (biocenotic plants, i.e. weeds - beneficial plants in agroecosystems). It should be borne in mind that some species or varieties may not represent much economic value on their own, but their genes may prove extremely valuable for breeding new crop varieties. Due to their genetic proximity to crop plants, all of these species should be preserved, protected and made available to promote food and agricultural security.

MATERIAL AND METHODS

A taxonomic hierarchy has been adopted for the preparation of the Polish CWR list which proposes that a CWR is a "wild plant taxon which has an indirect application due to its relatively close genetic relationship with a specific crop". Thus, crop wild relatives can be defined as all taxa that belong to the same genus as a specific crop species, or could also be the same species as a specific crop species, under the condition that it occurs in the wild. The starting point for the compilation was the study titled "Flowering plants and pteridophytes of Poland – a checklist". The flora of Polish vascular plants is estimated at approximately 3500 species (including alien plants), 1458 of which are considered in this study as species related to cultivated plants, without alien plants. CWR taxa have been divided into different groups of useful plants to show in the best way the possibilities for their uses. In the next stages of the study, the list was verified in terms of the species threat category presence on the European and Polish red lists (national and regional), the lists of plants protected by law, and finally according to the presence in the collections of gene banks, seed banks, botanical gardens and arboreta.



FIG. 4. *Allium rotundum* L.



FIG. 5. *Pastinaca sativa* L.

RESULTS AND DISCUSSION

The flora of Polish vascular plants is estimated at approximately 3500 species (including alien plants), 1458 of which are considered as Crop Wild Relatives (CWR). Some of the species from this group of plants are segetal and ruderal plants occurring in agricultural fields and their edges, therefore their richness and diversity is highly appreciated. This group of plants which has a positive significance (usefulness) in agroecosystems are mutually dependent on other living organisms inhabiting the same ecological system (agricultural lands) and are related to cultivated plants.

Agriculture is based on dozens of species of crops, producing large numbers of seeds and developed within habitats adapted to the human needs. Accompanying wild plants are characterized by tremendous vigor and produce large numbers of seeds. Wild species also produce seeds capable of long-term dormancy, are resistant to drought, disease, and most importantly, they adapt to changing climatic conditions - traits sought after by breeders to derive new varieties. In addition, field weed communities are characterized by seasonality - each year they are destroyed during soil cultivation, and yet on certain areas they continue to persist. Their constant persistence in crops is only possible due to their adaptive characteristics, such as: high fecundity - one individual can produce even several hundred thousand seeds, long dormancy period - they can survive in the soil seed bank for up to several decades, the method of propagation - both by seed, as well as vegetatively, including with the use of underground storage organs like rhizomes, tubers, etc, the ability to adapt to the life cycle of crops. Skilful breeding makes it possible to transfer all these desirable traits to varieties grown around the world, because CWRs are an excellent source of adaptive traits.

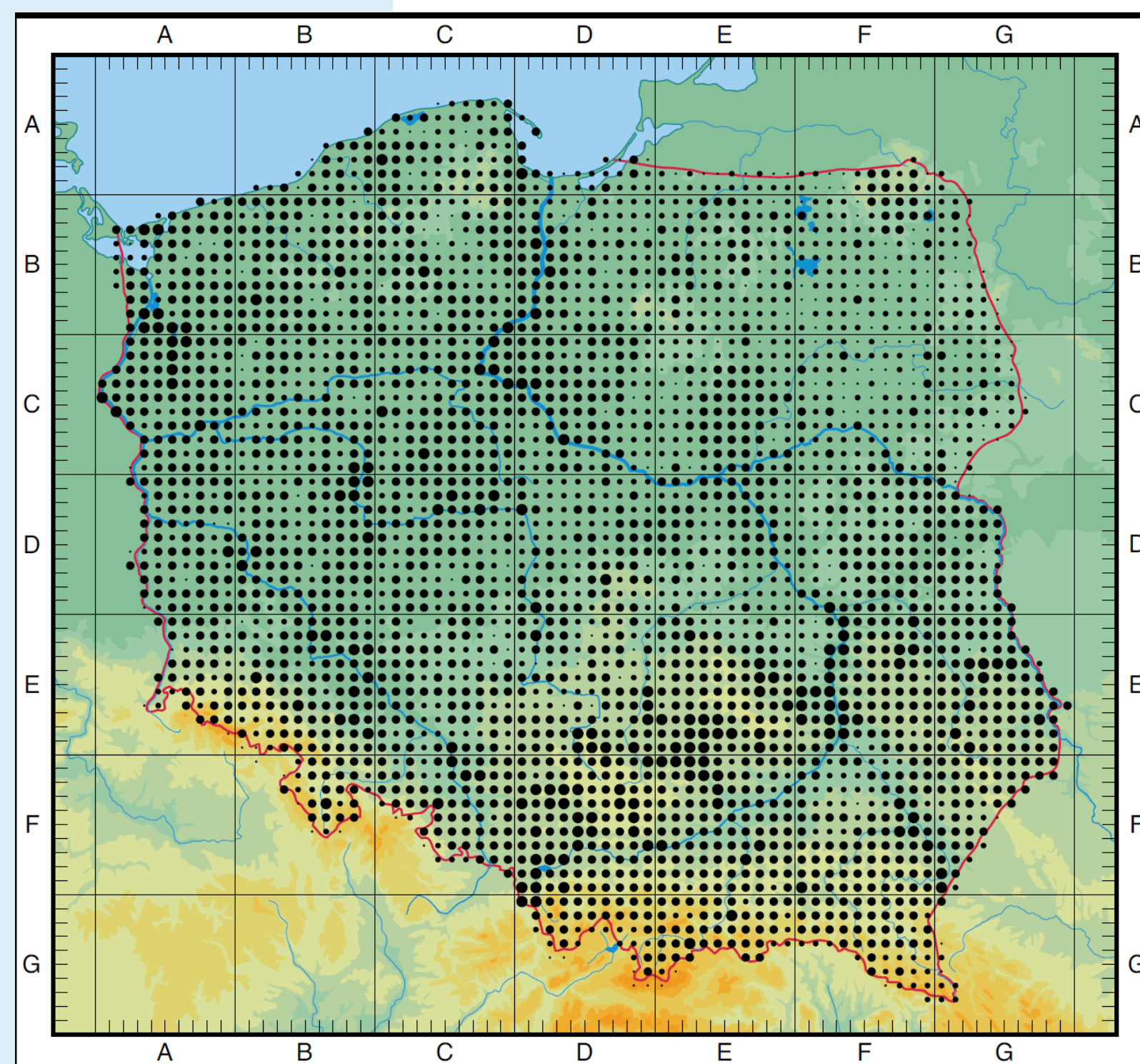


FIG. 3. Distribution map of segetal and ruderal CWR

TAB. 1. Percentage of CWR occurrence in *ex situ* collections

Nr of species	Collections	<i>ex situ</i> (%)
Segetal /ruderal plants CWR	Botanical gardens/arbo retra	Gene bank
213	77%	42%



RYS 6. *Lathyrus tuberosus* L. (edible tubers; photo: W. Szymański)

The mosaic structure of cultivated fields of small farms provides suitable conditions for the occurrence of many CWR species, playing an important role in agroecosystems, especially within the Nida Basin (Świętokrzyskie Province), Miechowska Upland (Małopolskie Province) and Lublin Upland (Lublin Province). These regions contain the most valuable xerothermic grasslands, occupying the largest areas in the country. Many of the species found within them often infiltrate adjacent farmland and baulks. Fig. 2 also shows that some sites of species from the group in question are concentrated in the valleys of large rivers, mainly the Vistula, Oder and Warta. In part, this may be due to the conditions of river valleys, which are characterized by a wide variety of habitat conditions that accommodate a high abundance of plant species, including those of the CWR group under discussion.

Of the 213 segetal and ruderal species found in agroecosystems, almost half (97 taxa) also belong to the medicinal plant useful group; 152 to the edible group; 85 to the cosmetic; 75 to the ornamental; 61 to the fibrous and dyeing; 30 to the forage. This illustrates the diversity of uses of the taxa in this group of plants. Of these, 26 are on the "European list of vascular plants" (Bilz et al., 2011), and 38 are on the "European list of medicinal plants" (Allen. et al., 2014). On the other hand, there are 51 species on the "Polish Red List of Vascular Plants" (Tokarska-Guzik, 2016), and 12 taxa in the "Polish Red Book of Plants" (Kazmierczakowa & Zarzycki, 2001) (e.g. *Allium rotundum*, *Conringia orientalis*, *Camelina allyssum*). Only one species is under strict legal protection under the Regulation of the Minister of Environment of October 9, 2014 on the protection of plant species (Journal of Laws of 2014) - *Muscari comosum*.

CONCLUSION

Beneficial species found in agroecosystems should be recognized, appreciated and preserved, in order to maintain balance in agroecosystems. Some of the taxa representing them are valuable, useful species or can provide a source of valuable genes for breeding new crop varieties. It is necessary to preserve local taxons, since they are perfectly adapted to local conditions. If we do not put more interest in the protection (particularly *in situ*) of the most valuable species, they may soon become extinct.