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Complex evaluation of wild pear

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Abstract: The National Centre for Biodiversity and Gene Conservation (NBGK) started the gene bank collection and agrobotanical evaluation of wild pear varieties in 2022. The survey of individuals and the recording of descriptors was carried out in several rounds. Part of the data was recorded in situ on the field, and the other part was analysed after the trip. For the in-situ collection of wild fruit plant species and varieties, it was necessary to develop a method for the collection and description. This applied to the development of the survey methodology as well as to the design of the working method.

Keywords: gene bank, wild pear, collection, biodiversity

1. Introduction

Several scientific fields have processed and evaluated a subset of wild pear genotypes according to their own criteria. [8] has made a botanical description of the wild pear population of the Pannonian region [8]. [5] presents wild pear as rootstocks used in fruit production. Eplényi has shown, using the example of the Kalotaszeg (Rom. *Ţara Călatei*) region, that fruit trees and orchards can be of great visual importance at the landscape level, even despite their small share in the proportion of cultivated species [2][3]. It can be a landscape character and pattern that gives a unique distinctness to the whole area. In the same region, Varga studied the ethno-ecology of pasture wild fruit populations such as wild pears [11]. Szani described the different uses of wild pears based on the ethnopomological traditions of Nógrád County [7].

Both the number and the diversity of wild pears are threatened due to dwindling habitats. We suppose it is necessary to change the paradigm and to consider the diversity of the native wild pear population as an intrinsic value and to describe it as complexly as possible. This requires the development of a complex, species-specific assessment system.

2. Materials and methods

The *Pannonian Seed Bank Project*, which was implemented between 2010 and 2014 to collect and conserve seeds of native wild plant species in the long term, focused mainly on herbaceous plant species/ecotypes. Following the successful implementation of the project, the National Centre for Biodiversity and Gene Conservation considered it timely to continue the activity and extend it to other crop sectors such as wild fruit plants. Wild pear was chosen as the pilot plant species [4].

International guidelines for the description of vegetatively propagated, elder fruit pear cultivars are available, such as IBPGR (1982, 1983), UPOV (2000), or ECPGR (2022), which are well suited for the phenotypic description of the cultivars of fruit varieties and for the distinction of varieties from each other [6], [9], [10]. Brózik tried to make pear variety descriptions as complete as possible from the point of view of commercial fruit production [1]. However, a new, more comprehensive descriptive system needs to be developed for generatively propagated wild fruit species.

The National Centre for Biodiversity and Gene Conservation (NBGK) started the gene bank collection and agrobotanical evaluation of wild pear varieties in 2022 to assess and evaluate the wild pear population. The survey of individuals and the recording of descriptors was carried out in several rounds. Part of the data was recorded in situ on the field, and the other part was analysed after the trip.

For the in-situ collection of wild fruit plant species and varieties, it was necessary to develop a method for collection and description. This applied to the development of the survey methodology as well as to the design of the working method.

Before the ripening of wild pears, we carried out a trial collection, during which we collected 20 lots on one location. We are not yet able to collect fruit samples from the lots. During the on-site data collection, it was important to be able to collect all data relevant to the gene bank. The recording is carried out as efficiently as possible due to the defined time frame, and later the data can be recorded, evaluated, and compared in a uniform database. During the planning of the trial collection route, it was formulated that we need a special observation sheet to document the items.

For this purpose, we wanted to create a questionnaire on which all relevant information can be recorded in the field within a short time and which can be

easily read later, so instead of handwriting, it should be marked. During the design phase of the questionnaire, we took as a basis the experiences of previous gene bank fruit collection trips and surveys in civil community cooperation. It was an important aspect that, in addition to recording the basic data, we could also record as much of the grouping properties of the items as possible, as well as that it should be a maximum of 2 pages so that its use and filling in would not cause technical difficulties during the fieldwork.

3. Results and discussions

On the collection site, we created a collection sheet to record the data of the items to be collected. Specialized for field recording, it consists of a standard A4, 2-sided sheet, so it is easy to use, and there is no need to turn pages during documentation. The first page of the questionnaire details the circumstances of the collection, while the second page describes the collected item.

First, we record the collection location of the item (country, town). If there is a person providing information, their name and contact details are put down. The item to be collected is first marked at the species level, which is selected from the list on the collection sheet and then assigned a unique code. In the case of coding, we use at least one letter and two digits, for example: K01. We record the date of collection, the name of the person(s) collecting, and the collection location of the item using GPS coordinates. In addition to the coordinates, we also prepare a sketch of the lot's surroundings and location. On the sketch, we note the characteristic points of reference in the vicinity, such as roads, buildings, groups of plants, in relation to the position of the lot; also, environmental elements characteristic of the position of the item are noted down, which can be used to identify the location of the item later on. In accordance with the international gene bank guidelines, applying them to the case of fruit-bearing plants, we document the collected lot:

– the source of the collection (unknown / wild species / cultivation / trade / home garden / institution, organization / other);

– the status of the sample (unknown (seedling) / wild / feral / landscape variety / line / variety / other);

– we also include the method of propagation of the lot if it can be established (seeding, grafting / from seed / scion / cuttings, budding / other);

– we assess the condition of the tree, which ranges from the young, non-productive condition to the decaying state (dying / desiccating / old, sick, severely damaged / fertile, sick / fertile, not vigorous / fertile, vigorous / young, not yet productive / other);

– in terms of the use of the item, we indicate whether the fruit, other plant parts, or both can be used (fruit / other plant parts / both);

– the method of using the fruit is also indicated on the collection sheet, where it is important to take into account that in the case of wild pears, this is often multi-purpose; in addition to the human use of the fruit, it can also be used for animal husbandry or game management (fresh consumption / consumption after storage / jam / vinegar / pálinka (distillate) / aszalvány / juice (must) / fruit wine / healing / habit / other);

– we also include the use of other plant parts, which can be rootstock, pollinator, multi-purpose use, wild form, or other.

Regarding the wild pear batch, if there is fruit on the collected batch, we also record some important grouping descriptors for the fruit on site: the size of the fruit, the largest diameter of the fruit, the shape of the fruit, the basic colour of the shell, if there is a cover colour, the extent of its covering. If the collection is done during flowering or the flowering time is known, then the time of flowering is recorded. We also write additional comments on the collection sheet, which can be considered a special identification of the item, as well as the characteristics of the fruit's taste.

We also do photo documentation on site. We photograph the item according to a uniform setting. To illustrate proportionality, we use a measuring stick or a device whose exact dimensions we know. We photo-document the budding, fruiting, leaf colour, and backside of the item. This is done on an A4 white square grid sheet, and a 30-cm ruler is used to illustrate the scale. For subsequent recordings, we collect leaves from the middle third of the shoots, as well as at least 10 pieces of fruit.

The collected samples are stored in a refrigerator until processing. The following quantitative tests are performed on the leaf samples: measurement of the length and width of the leaf blade, measurement of petiole thickness and length. Then we record the visual parameters, for which we apply the ECPGR pear guideline, UPOV recommendations. In the case of fruit samples, we measure the length and width of the fruit at the widest point, the length and thickness of the fruit stalk, and then also record the qualitative parameters. We supplement the recordings with pomological photo documentation. The seeds are extracted from the fruits for long-term preservation in the seed bank. The gene bank method for maintaining generatively propagated wild pear genotypes and populations is yet to be developed.

We work as a team during collection work. Based on our experience, a proper session requires a minimum of three people, optimally four-five people. In the latter case, during the collection, one person fills out the pre-prepared collection sheet, one person collects and labels leaf samples for later recordings, one person collects and labels fruit samples, and two people carry out the photo documentation of the genotype and its surroundings, as well as its plant parts in scale such as its shoot, its leaves, and fruit on the spot.

Figure 1. On-site photo documentation of the genotype

Figure 2. Pomological photo documentation

One of the largest wild pear specimens surveyed during the collection trips in 2022 was examined in Bogyiszló. The height of the tree was 8.49 meters, and the diameter of the crown was 11.21 meters. The floor area of the crown was 98.6 m^2, while the volume of the crown was 538.3 m^3. The collected wild pear specimens can be evaluated from several points of view based on the on-site survey. When evaluating wild pear genotypes as elements of landscape character, in addition to the size of the tree, the general shape of the crown, the habit of the skeletal branches, and the ratio of the height and width of the crown are also decisive. In *Table 1*, we evaluated the wild pear populations in each collection location according to the above three aspects.

Table 1. Evaluation of wild pear genotypes

Place of production	Number of collected lots	Crown shape		
		Hemi-sphere	Sphere	Pyramid
1	7	14%	14%	71%
2	10	40%	20%	40%
3	6	33%	17%	50%
4	11	18%	18%	64%
5	20	65%	20%	15%
All	***54***	***41%***	***19%***	***41%***

Place of production	Number of collected lots	Position of the main branches				
		Disruptive	Half disruptive	Diverging	Stooping	Hanging
1	7	-	57%	29%	14%	-
2	10	-	20%	70%	10%	-
3	6	-	33%	50%	17%	-
4	11	-	45%	36%	18%	-
5	20	-	20%	45%	35%	-
All	***54***	-	***31%***	***46%***	***22%***	**-**

Place of production	Number of collected lots	Ratio of tree height/width				
		Strongly flattened	Flattened	Medium	Elongated	Strongly elongated
1	7	-	57%	43%	-	-
2	10	-	30%	30%	40%	-
3	6	-	33%	50%	17%	-
4	11	27%	64%	9%	-	-
5	20	-	10%	40%	40%	10%
All	***54***	***6%***	***33%***	***33%***	***24%***	4%

Note: Places of production: 1: Abaliget; 2: Bogyiszló; 3: Csokonyavisonta; 4: Nagybajom; 5: Tiszaug.

4. Conclusions

Based on the experience of the collection routes of the first year, it is worth expanding the documentation to document the habitat, to describe the tree as a landscape element. This is also necessary for the development of the method of seed bank maintenance and cultivation for populations of wild, foreign-fertilizing, native fruit species.

In Hungary, there is a high genetic diversity of the wild pear genotypes. From the point of view of biodiversity, the persistence of genotypes has a huge importance.

Our institute aims to continue the examination of the wild fruit species and to assess the population and the genetic diversity.

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