ESL 4: *Ex-situ* evaluation of morphological, agronomic and qualitative traits of a naturalized population of parsley (*Petroselinum crispum* (Mill) Nyman])

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Abstract

A naturalized population of parsley of the province of Trento, Italy, was evaluated *ex-situ* for its morphological and agronomic traits in a field trial in which it was compared with three commercial cultivars of the species. The naturalized population belongs to the smooth leaf type for the absence of curling, and differed from the other smooth leaf type accessions for the lower plant height, the smaller length of petiole and the prostrate attitude of the plant, all undesirable characteristics which make the harvest of plants more difficult. The yields of aerial parts and leaves were higher in the commercial cultivars, while the naturalized population had the highest yield and content of essential oil. Due to the high content and yield of essential oil, the naturalized population could be the object of an eventual breeding program aiming to improve the morphologic and agronomic undesirable characteristics.

Keywords: *Petroselinum crispum,* morphological traits, agronomic traits, essential oil.

Introduction

Parsley (*Petroselinum crispum* (Mill) Nyman, *Apiaceae*) is a biennial herbaceous plant naturalized in much of Europe and cultivated worldwide as an aromatic and edible plant. The origin of the species is uncertain, but perhaps South Est Europe or West Asia (Tutin *et al.,* 1976); in Italy it is present as cultivated or naturalized (Pignatti, 1982). A naturalized population of parsley is reported in the province of Trento, Italy, in the locality Cronil within the municipality of Ala (Prosser *et al.,* 2009). Its presence is known since long times by the people living in the neighbouring localities, who traditionally use to collect its seeds and to cultivate it in their homegardens. The aim of this study was to compare the morphological characteristics and the main agronomic traits of the parsley naturalized population with that of three commercial cultivars: information about the distinctness and productive capacity could provide the necessary cognitive basis for its improvement by the starting of a breeding program.

Materials and Methods

Seeds of the naturalized population were collected in their growing site in 2012, and plantlets obtained from them were cultivated *ex situ* and compared in a field trail with three cultivars, two of smooth leaf (Comune 2, Gigante di Napoli) and one curly leaf type (Nano Ricciuto 2). The trial was carried out during the years 2013-2014 at CREA-MPF of Trento, Italy, according to a block randomized design with four replications, consisting of forty plants per replication. Morphological traits were recorded twice, one day before starting the first and second harvest, on ten randomly chosen single plants per replicate, by the use of a modified CPVO technical protocol for the species (CPVO, 2007): nine characters, corresponding to qualitative characteristics, were determined by visual assessment, and ten, corresponding to quantitative characteristics, were measured. Plants were harvested two times, two and four months after transplant. Leaves were separated from petioles and yields of aerial part and leaves were recorded. Essential oils were extracted immediately after harvest from 1 kg of fresh leaves per replicate for the determination of the essential oil yield. For the determination of both morphologic and agronomic traits, average data of the two consecutive

harvests were subjected to ANOVA, being percentage data previously transformed in angular values, using XLSTAT software package.

Results

Morphological characterization

Results of the morphological characterization by qualitative traits are indicated in Table 1. The naturalized population belongs to the smooth leaf type for the absence of curling, but differed from the other two smooth leaf type accessions for a weaker undulation of the leaflet margin and for the attitude of leaves, prostrate instead of erect. Highly significant differences were detected among accessions for all the morphological quantitative traits (Table 2). In particular, the naturalized population parsley differed from the other two smooth leaf accessions for the lower height of plant and the smaller length of petiole. These characters, together with the prostrate attitude of plant, are undesirable for making the harvest of plants more difficult.

Tab. 1 Values of the morphological qualitative traits of the evaluated accessions.

Accession	CPVO N° and description						
	3	5	6	13	14	16	19
	Plant: density of foliage	Leaf: attitude	Leaf blade: curling	Leaf blade: intensity of green colour	Leaflet: shape	Leaflet: undulation of the margin	Petiole: anthocyanin coloration
Comune 2	medium	erect	absent	medium	narrow triangular	medium	absent or very weak
Gigante di Napoli	medium	erect	absent	medium	narrow triangular	medium	absent or very weak
Nano Ricciuto 2	dense	semi erect	present	medium	medium triangular	strong	absent or very weak
Naturalized population	medium	prostrate	absent	medium	narrow triangular	weak	absent or very weak

Tab. 2 Values of the morphological quantitative traits (mean ± standard deviation; n=4)*

Accession	CPVO N° and description								
	1	2	4	10	11	12	15	17	18
	Plant: height (cm)	Plant: width (cm)	Plant: number of leaves	Leaf blade: length (cm)	Leaf blade: width (cm)	Leaf blade: ratio length/ width	Leaf blade: distance between 1st and 2nd pair of leaflets (cm)	Petiole: length (cm)	Petiole: thickness (cm)
Comune 2	26.8 ± 3.4 A	42.2 ± 4.7 A	35.0 ± 21.5 A	18.3 ± 2.2 AB	13.1 ± 2.3 A	1.41 ± 0.20 A	8.4 ± 1.0 A	11.2 ± 1.1 A	3.9 ± 0.4 A
Gigante di Napoli	29.2 ± 2.7 A	39.4 ± 4.7 A	20.7 ±12.3 B	19.2 ± 2.1 A	13.9 ± 1.6 A	1.39 ± 0.10 A	8.3 ± 1.0 A	11.6 ± 1.5 A	4.3 ± 0.3 A
Nano Ricciuto 2	15.7 ± 1.4 B	29.7 ± 2.5 B	15.9 ± 6.0 B	11.3 ± 1.4 C	10.0 ± 0.9 B	1.13 ± 0.12 B	5.2 ± 0.4 B	6.7 ± 1.0 B	4.4 ± 0.4 A
Naturalized population	15.5 ± 2.9 B	39.0 ± 5.0 A	28.4 ± 18.5 A	15.9 ± 2.3 B	14.7 ± 2.2 A	1.09 ± 0.10 B	7.4 ± 1.0 A	7.0 ± 1.0 B	3.4 ± 0.4 B

* Mean values followed by different letters are significantly different at P<0.01 according to Tukey (HSD) test.

Yield and other agronomic traits

Cumulative yields of the two harvests of the investigated accessions are reported in Table 3. The naturalized population had the lowest yields both of aerial parts and leaves, and the highest essential oil yield, resulting statistically different from the other smooth leaf type accessions for the aerial part yield and from all the other accessions for the yields of leaves and essential oil.

Table 3 Agronomic traits of the evaluated accessions (mean ± standard deviation; n=4)*

Accession	Aerial part yield (g · m^{-2} dried weight)	Leaves yield (g · m^{-2} dried weight)	Essential oil yield (ml · m^{-2})	Essential oil content (% v/fresh weight)
Comune 2	410.8 ± 24.1 A	340.5 ± 14.1 A	1.93 ± 0.16 B	0.11 ± 0.04 B
Gigante di Napoli	394.3 ± 37.3 A	329.1 ± 23.2 A	1.54 ± 0.15 B	0.10 ± 0.04 B
Nano Ricciuto 2	343.3 ± 29.5 AB	320.7 ± 26.7 A	1.40 ± 0.24 B	0.10 ± 0.06 B
Naturalized population	277.5 ± 19.0 B	244.5 ± 19.3 B	2.92 ± 0.37 A	0.25 ± 0.06 A

* Mean values followed by different letters are significantly different at P<0.01 according to Tukey (HSD) test.

The naturalized population differed from the other accessions also for the essential oil content of the leaves calculated as a percentage of fresh weight, mean of the two harvests (Table 3), which was more than the double than the cultivars, and higher than those reported by the majority of previous authors, that is up to 0.16 % on the fresh weight basis (SIMON and QUINN 1988; PINO *et al.* 1997). In conclusion, the naturalized population differed from the smooth leaf type varieties evaluated in this study for some morphological characters that easily permit its identification. The small dimensions of the plant and especially its prostrate attitude are however two undesirable characters which could make more difficult its harvest. These characters, together with the low yields of leaves and aerial parts, could be improved in an eventual breeding program, which could be justified by the high yield of essential oil extracted from its leaves.

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