ASSESSMENT OF THE PHENOTYPIC DIVERSITY OF *PRUNUS CERASIFERA* EHRH IN NATURAL AND ANTHROPIZED ECOSYSTEMS

EVALUAREA DIVERSITĂȚII FENOTIPICE A SPECIEI *PRUNUS CERASIFERA* ÎN ECOSISTEME NATURALE ȘI ANTROPIZATE

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Abstract.
The study aims are to identify valuable species and genotypes tolerant to extreme environmental conditions, diseases, and pests. Wild biotypes of fruit tree species represent important genetic resources for improving adaptability and yield under low-input conditions. In Constanta and Arges counties, several cherry plum biotypes were identified and characterized in terms of plant habit, vigor, health status, and fruit quality. Most fruit samples exhibited high dry matter content, exceeding 15° Brix, and were classified as sweet or very sweet. The most promising rootstock selections will be grafted and included in the National Collections, serving as a gene reservoir for future breeding programs.
Key words: biotypes, myrobalan plum, evaluation, fruit

Rezumat.
Lucrarea are ca scop identificarea unor specii și genotipuri rezistente la factorii de mediu extremi, boli și dăunători. Pentru speciile pomicole cultivate, biotipurile din flora spontană pot fi resurse de gene valoroase în ceea ce privește adaptabilitatea la condițiile de mediu și sporirea producției cu inputuri reduse, în urma utilizării acestora în activitatea de ameliorare. În vederea identificării celor mai valoroase exemplare de corcoduș, în județele Constanța și în Argeș au fost localizate diferite exemplare care au fost descrise din punct de vedere al habitusului și vigorii plantei, al stării de sănătate și au fost recoltate probe de fructe; Majoritatea probelor au avut avut un conținut ridicat de substanță uscata, peste 15^0 Brix, fiind încadrate ca fiind dulci și foarte dulci. Selecțiile pe rădăcini proprii care s-au evidențiat urmează și fie altoite și plantate în Colecțiile Naționale pentru a fi folosite ca resursă de gene in programele de ameliorare.
Cuvinte cheie: biotipuri, mirobolan, evaluare, fructe

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INTRODUCTION

The cherry plum (*P. cerasifera* Ehrh. or *P. divaricata* Ledeb.) belongs to the *Rosaceae* family. Worldwide, there are germplasm collections for cherry plum or myrobalan plum and other *Prunus* species, aimed at conserving genetic diversity and supporting breeding programs for stone fruits. In Asia, China hosts a vast germplasm collection in Xiongyue, Liaoning Province, with over 600 *Prunus* varieties, including *P. cerasifera* [Liu *et al*., 2007]. This represents one of the largest *Prunus* genetic resources in Asia and includes both local cultivars and introduced hybrids, intended to broaden the genetic base and support breeding efforts. This collection reflects a long history of natural and artificial selection, adapted to different ecological conditions, making it an important resource for the development of the plum and cherry plum industry in China and worldwide.

In Romania, cherry plum grows spontaneously and is found as a tree or shrub almost everywhere, demonstrating high adaptability to various environmental conditions. It bears fruit regularly, shows significant variability, and is an entomophilous allogamous species [Botu *et al*., 2007]. It is used both as a rootstock for plum and apricot [Butac *et al*., 2011; Romanian's Pomology, 2018] and for its fruits, which can be processed into compote, alcoholic beverages or even yoghurt [Moga *et al.*, 2024]. More recent studies indicate that the cherry plum provides multiple ecosystem services, including: reduce atmospheric CO_2 concentrations, pollutant filtering and biodiversity [Petrov *et al*., 2024].

The exact estimation of the number of cherry plum trees in Romania is difficult, as there is no census dedicated to this species, and official statistical sources do not provide detailed information about wild fruit tree species.

The cherry plum is a diploid species characterized by extensive phenotypic variability, which necessitates the selection and evaluation of the most promising genotypes.

MATERIAL AND METHOD

In order to identify the most valuable biotypes, several trees were recorded in Constanța County and described in terms of plant habit and vigour, plant health status, and fruit samples were collected. The fruits were analysed with respect to size and weight, average weight, fruit colour, pulp characteristics, aroma, stone, dry matter content, and harvest date of the samples. Each one was characterized according to the UPOV descriptors [TP 41/1 of 06.11.2003]. The fruit, 30 of each cultivar/variety were harvested at optimal maturity, the measurements being made with the support of the electronic calliper (mm). The fruit shape index was calculated as the ratio between fruit height and diameter. Fruit weight (g) was measured on 30 fruits per treatment using a technical balance (Kern 572-35, Kern & Sohn, GmbH, Balingen, Germany). The total soluble solids content of cherry plum juice was measured using a HI 96801 digital refractometer. Results were expressed as % Brix, in accordance with previous studies [Pereira *et al*., 2013; Panahirad *et al*., 2019; Adeboyejo *et a*l., 2022; Barać *et al*., 2022].

In 2024, 28 cherry plum biotypes were analysed. Samples 1–4 and 11–28 represent biotypes on their own roots, while samples 5–10 are grafted cherry plum selections from the rootstock collection of the Research Station for Fruit Growing (RSFG) Constanța.

Also, 9 cherry plum biotypes from the rootstock collection of the Fruit Growing Research and Development Institute (RIGF) Pitesti-Maracineni were evaluated. The trees in the collection were established in the spring of 2009, at a spacing of 5×3 m, grafted onto Mirobolan C5 rootstock. In the spring of 2024, fruiting pruning was performed after a three-year interval, which promoted vegetative growth to the detriment of productivity. None of the biotypes exhibited visible symptoms of diseases or viral infections. Fruit evaluations were conducted on average samples of 30 fruits, in three replications. Stones were weighed after being washed and dried for several days.

RESULTS AND DISCUSSIONS

In Table 1, the geographic coordinates and the harvest dates of the cherry plum samples are presented. The samples were numbered in the order of collection.

Table 1

Identification of Cherry Plum Biotypes from Constanța County

Sample	Date of Collection	Location, Geographic coordinates	Sample condition*
1	16.07.2024	Valu lui Traian, 44.167634, 28.459381	1
2	17.07.2024	Constanța, 44.190054933224424, 28.644049186504635	1
3	18.07.2024	Valu lui Traian, 44.167813373338475, 28.491868810240085	1
4	20.07.2024	Constanța, 44°10'35.0"N 28°29'25.1"E	1
5	23.07.2024	SCDP Constanța, 44°10'35.0"N 28°29'25.1"E	5
6	24.07.2024	SCDP Constanța, 44°10'37.5"N 28°29'25.8"E	5
7	24.07.2024	SCDP Constanța, 44°10'35.0"N 28°29'25.1"E	5
8	25.07.2024	SCDP Constanța, 44°10'39.9"N 28°29'25.7"E	5
9	26.07.2024	SCDP Constanța, 44°10'39.9"N 28°29'25.7"E	5
10	26.07.2024	SCDP Constanța, 44°10'39.9"N 28°29'25.7"E	5
11	28.07.2024	SCDP Constanța, 44°10'42.1"N 28°29'27.6"E	1
12	28.07.2024	Valu lui Traian, 44.167450, 28.491787	1
13	29.07.2024	Ciocârlia de Sus, 44.1175660, 28.3342538	1
14	30.07.2024	Valu lui Traian, 44.1642817, 28.4630766	1
15	30.07.2024	Nicolae Bălcescu, 44°23'00.7"N 28°22'16.3"E	1

Sample	Date of Collection	Location, Geographic coordinates	Sample condition*
16	30.07.2024	Valu lui Traian, 44.165299, 28.489595	1
17	31.07.2024	Constanța, 44.1459743,28.63125	1
18	31.07 2024	Constanța, 44.1459743,28.63126	1
19	06.08.2024	Agigea, 44.089186, 28.610134	1
20	06.08.2024	Agigea, 44°10'42.1"N 28°29'27.6"E	1
21	08.08.2024	Agigea, 44.087743, 28.609226	1
22	08.08.2024	Agigea, 44.087995, 28.609022	1
23	09.08.2024	Agigea, 44.087578, 28.608901	1
24	09.08.2024	Valu lui Traian, 44.168897, 28.490733	2
25	09.08.2024	Valu lui Traian, 44.168862, 28.490471	2
26	10.08.2024	Valu lui Traian, 44.168160, 28.488703	2
27	10.08.2024	Valu lui Traian, 44.167785, 28.488611	2
28	12.08.2024	Ciocârlia de Sus, 44.118986, 28.334599	1

*Sample condition: 1- wild species; 2- traditional/heritage varieties;3- improved/modern varieties;4- clonal selections; 5- clonal rootstocks.

The majority of the samples are yellow in color (12), followed by shades of golden yellow (5), while darker colors such as red, purple, or black appear less frequently (1–3 samples each). Regarding aroma, most samples either have no aroma (8) or are aromatic (5), whereas the variants “slightly aromatic,” “sweet taste,” and “very aromatic” are less common.

Table 2

Characteristics of the Fruits from the Studied Biotypes, 2024

Sam-ple	Fruit shape index	Color of the skin	Skin thickness*	Skin adhesion**	Stone adherence***
1	0.92	yellow	2	NA	NA
2	0.96	yellow	3	A	NA
3	0.96	orange-yellow	2	NA	NA
4	0.92	yellow	2	NA	NA
5	0.97	black	2	NA	NA
6	1.12	yellow	3	A	A
7	1	yellow	3	A	NA
8	0.84	yellow	3	NA	NA
9	0.99	pink	2	A	A
10	1.04	coral-red	2	NA	SA
11	1.09	golden-yellow	2	NA	NA
12	0.99	yellow	2	A	NA
13	0.91	golden-yellow	3	A	A
14	1.02	yellow	4	A	A
15	1.08	red purple	2	NA	A
16	0.94	yellow	3	NA	A
17	0.94	golden-yellow	4	A	SA

Sam-ple	Fruit shape index	Color of the skin	Skin thickness*	Skin adhesion**	Stone adherence***
18	1.02	purple-black	1	NA	SA
19	1.08	orange-yellow	2	NA	A
20	0.94	pink	2	NA	A
21	1.2	ruby red	2	NA	A
22	1.03	black	1	NA	NA
23	1	dark red	2	A	A
24	0.93	yellow	2	NA	NA
25	1.04	black	2	NA	NA
26	1.02	dark purple	2	NA	NA
27	1.18	dark purple	2	NA	NA
28	0.88	yellow	3	A	NA

*1- very thin; 2- thin; 3- thick; 4- very thick
** A- adherent; NA- non-adherent
***A- adherent; SA- semi-adherent; NA- non-adherent

Table 3

Morphological and chemical parameters of the analyzed samples

Sample	Height (mm)	Diameter (mm)	Average weight (g)	SSC (Brix^0)
1	19.67	21.3	10.2	19.7
2	21.6	22.53	12.8	18.2
3	21.6	22.53	6	16.5
4	19.67	21.3	10.2	19.7
5	22.34	23.15	7	15.9
6	26.65	23.87	20.1	15.5
7	23.55	23.46	6.5	14.5
8	23.29	27.69	12.2	17.9
9	23.99	24.2	7.9	17.9
10	24.55	23.53	7.4	17.9
11	23.27	21.42	7.25	17.9
12	24.27	24.42	9.35	16.8
13	32.36	35.46	24.6	17.9
14	30.79	30.33	16.9	18.1
15	21.6	20.05	5.9	17.7
16	27.91	29.82	14.7	17.6
17	24.85	26.53	21	14.6
18	27.69	27.06	12.4	18.4
19	28.29	26.14	18	16.4
20	23.45	24.96	8.2	18.4
21	23.78	19.88	5.3	23.3
22	24.57	23.74	5.5	18.9
23	28.67	28.69	12.6	14.7
24	22.72	24.5	8.9	16.5
25	27.82	26.71	11.2	16.2
26	23.38	22.95	8.5	18.6
27	22.71	19.19	5.5	16.6
28	24.75	28	8.5	17.5

Pearson coefficient: average weight vs. height: moderate positive (~0.55), average weight vs. width: strong positive (~0.65), average weight vs. dry matter: weak, slightly negative (~0.15), height vs. width: moderate (~0.55). Interpretation: Weight is strongly associated with dimensions (particularly width), but shows little dependence on dry matter, which remains fairly constant.

At RIFG Pitești Maracineni, fruit ripening was monitored according to genotype over a two-month period, July and August. Four of the genotypes produced yellow fruits, while the others displayed shades of red. The number of pits per kilogram ranged from 1.602,98 in genotype CPC-V to 2.614,11 in genotype C11, table 4.

Table 4

Plant and fruit traits studied in nine genotypes of myrobalan plum from the rootstock collection (RIFG Pitești Maracineni)

Genotype	Tree vigor	Ripening time	Fruit skin color	Average weight (g)	Average stone weight (g)	Stones/ kg (pcs)	Stones / kg (pcs)
C1	high	15-25.08	yellow	7.86	0.47	127.18	2132.29
C4	high	10-20.07	dark red	9.94	0.44	100.67	2256.39
C11	high	10-20.07	yellow	8.07	0.38	123.88	2614.11
C18	medium	10-20.07	red-purple	9.60	0.53	104.18	1902.61
HC 82-C	low	10-20.07	yellow	7.75	0.51	129.00	1961.99
Hațeg Breazova	high	1-10.07	red	8.14	0.43	122.85	2349.41
Geoagiu Tileș 4	low	15-25.07	dark red	5.88	0.49	170.01	2063.65
CPC-V	high	25.07-05.08	pink	9.49	0.62	105.52	1602.98
Corcodus Merei	medium	25.07-05.08	yellow	8.80	0.58	113.68	1728.34

CONCLUSIONS

Under the current climatic conditions, the large number of existing cherry-plum biotypes makes it necessary to identify valuable specimens in terms of longevity, productivity, fruit quality, rooting ability, and resistance to biotic and abiotic factors.

Cherry-plum is widely distributed in the Constanța and Arges regions, occurring spontaneously in most areas. The analyzed samples exhibit biodiversity, resilience to prolonged drought, and resistance to specific diseases, with most biotypes bearing thorns. Fruit shapes ranged from spherical and flattened-spherical to elongated-ovoid, with average weights between 5.2 g and 24.6 g. Most samples had high dry matter content (>15 °Brix), classifying them as sweet to very sweet

[Sonea, 1957]. Outstanding selections on their own roots were either grafted or planted in the National Collections to serve as a genetic resource for breeding programs.

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REFERENCES

1. **Adeboyejo O., Olayanju T., Ogunmoyela O., 2022 –** *Physico-chemical and microbial stability of plum juice during storage*. Nutrition & Food Science*, 52* (5), 112–125.
2. **Barać M., Petrović J., Stanković M., 2022 –** *Effect of growth regulators on total soluble solids and titratable acidity in plums***.** Horticulturae, 8(7), 621.
3. **Botu I., Giorgota A., Botu M., Preda S., Achim Ghe., 2007 –** *Research on the population structure and component biotypes of Prunus cerasifera Ehrh. in the southern region of Romania*. Scientifical Papers RIFG Pitești Mărăcineni, vol. XXIII, "40 Years of Research in Fruit Growing".
4. **Butac M., Botu M., Militaru M., Budan S., 2011 –** *Romanian germplasm fund and its use in plum breeding program*. Scientific papers, R.I.F.G. Pitesti, Vol. XXVII.
5. **Liu C.Q., Chen X.S., Wang J.Z., Chen X.L., Wang H.B., Tian C.P., Wu C.J., 2007 –** *Studies on genetic diversity of phenotypic traits in wild Myrobalan plum (Prunus cerasifera Ehrh.).* Acta Horticulturae Sinica 35: 1261-1268.
6. **Moga M., Tita M., Constantinescu A., Tita O., 2024 –** *Valorification of Prunus cerasifera fruits (pulp, peel, whole fruit) for yogurt production*. Proceedings of 24th International Multidisciplinary Scientific GeoConference SGEM 2024, Vol. 24, pp. 339-348.
7. **Panahirad S., Khodadadi M., Fadaei H., 2019 –** *Postharvest quality evaluation of plum (Prunus domestica L.) fruits*. HortScience, 54(3), 505–511.
8. **Pereira P., Dias M. I., Lima R.T., 2013 –** *Classification of fresh intact plums according to sweetness using digital refractometry*. Food Chemistry, 141(4), 3650–3655.
9. **Petrov D., Ocokoljić M., Galečić N., Skočajić D., Simović I., 2024 –** *Adaptability of Prunus cerasifera Ehrh. to climate changes in multifunctional landscape*. Atmosphere 2024, 15 (3), 335.
10. **Sina N. C., Mira E. I. and Mutu N., 2018–** *Evaluation on genetic diversity of phenotypic traits in myrobalan plum* (*Prunus Cerasifera* EHRH.). South Western Journal of Vol. 9, No.1 Horticulture, Biology and Environment, pp. 25-34.
11. **Sonea V., 1957 –** *Myrobalan*. Publishing House of the Academy of the Romanian People's Republic, pp. 141.
12. *****, 2003**, UPOV descriptors: TP 41/1.
13. *****, 2018**, *Romanian's pomology, Vol. X- New varieties of peach, nectarine, nuts, new fruit species, berries, strawberry and rootstock bred in Romania*. Ed. Ceres, Bucharest.