

Malus florentina (Rosaceae): a new species for the Bulgarian dendroflora

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Received: July 26, 2023 ▷ Accepted: August 13, 2023

Abstract. *Malus florentina* is reported as new to the Bulgarian dendroflora. The species was found on the border of two floristic regions, occurring at an altitude from 600 to 900 m in both: Western Frontier Mts. (Vlahina Mts.) and the Valley of Struma River (*Northern*). The closest known natural localities are in North Macedonia, Serbia and Kosovo, and in the European part of Turkey. About 55 individuals have been recorded as a result of a fast preliminary inventory and about one-quarter of them were flowering and setting fruits. Although the actual size and status of the population of *M. florentina* in the region still have to be evaluated, immediate measures for its conservation should be taken.

Key words: *Malus*, *Florentine crabapple*, floristic record, rare species

Citation: Aneva, I., Zhelev, P. *Malus florentina* (Rosaceae): a new species for the Bulgarian dendroflora. – Phytologia Balcanica, vol. 29(2): 179-184. -- ISSN 1310-7771 (print), 1314-0027 (online).

Introduction

There are five to seven native *Malus* species in Europe, depending on the different taxonomists' opinions. Terpó (1968) listed six species, including *M. trilobata* (Poir.) C. K. Schneid. (*syn. Eriolobus trilobata* (Poir.) M. Roem.) and the cultivated *M. domestica* Borkh., a name presently considered illegitimate (Kurtto 2009). More recently, Kurtto (2009) treated *M. praecox* (Pall.) Borkh. as *M. sylvestris* subsp. *praecox* (Pall.) Soó and corrected the name of the cultivated apple to *M. pumila* Mill.

Valev (1973 a,b) reported three species occurring naturally in Bulgaria: *M. sylvestris* Mill., *M. dasyphylla* Borkh. and *M. praecox*, considering *M. trilobata* as belonging to genus *Eriolobus* (Ser.) M. Roem. The same treatment was accepted by Assyov & Petrova (2012) in the *Conspectus of the Bulgarian Flora*. The existing taxonomic difficulties are at least partly due to the great variation within the taxa, combined with certain degree of hybridization and overlapping of some metric characters. All these factors have resulted in controversies and taxonomic difficulties, espe-

cially within the group of *M. sylvestris* and the closely related species. The other two European apples – *M. florentina* (Zuccagni) C. K. Schneid. and *M. trilobata* – are morphologically well differentiated from the other species by their lobbed or toothed leaves and longer fruit stalks, usually exceeding the fruit size. They are also easily distinguishable from each other by numerous characteristics, like petiole and sepal length, and the leaf shape. *M. florentina* is known to occur in Italy, western and southern part of the Balkan Peninsula, and in Turkey (Terpó 1968, Browicz 1970, 1991, Pignatti 1982, Kurtto 2009). So far, this species has not been known as belonging to the indigenous Bulgarian dendroflora. In this paper we report its occurrence in the western part of the country, near the village of Skrino, Kyustendil region.

Material and methods

Field studies were performed in July 2022 and in April-May 2023. After incidental finding of some individuals in July 2022, a more detailed inventory was carried out in the region, on an area of approximately 0.5 km², consisting of forests, pastures, abandoned orchards, and roads. Besides the population size, we attempted to estimate the approximate age of the individuals. Considering that precise estimation of tree age is possible only by invasive methods – counting tree rings on stem discs or on core samples – which is not recommendable for rare species, the authors estimated the approximate age class of all recorded individuals based on a combination of three criteria: size (height and diameter at the base),

bark configuration, and generative stage of the respective individual (Table 1). Three provisional and approximate age classes were defined: up to 5-years, 5-20 years and above 20 years. Such an approach almost certainly underestimates the tree age. However, the authors believe that occurrence of trees belonging to different age classes and particularly to the highest age class, could prove the spontaneous origin of the locality and reject the hypothesis of a recent escape from cultivation.

Results and discussion

Malus florentina (Zuccagni) C.K. Schneider is a species new to Bulgarian dendroflora (Figs 1, 2). It was found south- and southwestwards of the Skrino village, Mt Vlahina, Western Frontier Mts floristic region, at altitude from 550 to 900 m. FM67, 42.17705° N, 22.96120° E, 30.07.2022, coll. I. Aneva & P. Zhelev (SOM 178264 – 178267).

A total of 55 individuals were found as a result of a preliminary inventory in the locality. The trees grew mostly on the edge of forests, within clearings, and occasionally in abandoned meadows and orchards. However, the two oldest trees, estimated to be older than 30 years or probably more, were found within the forests (Fig. 3).

About one-third of the individuals (17) belonged to the first age class, 32 trees were classified in the second age class (6-20 years) and six trees in the third age class (> 20 years). The trees were scattered across the area and although we did not aim at recording all individuals, their impression was that

Table 1. Criteria for approximate estimation of individual tree age

Age class	Size		Bark configuration	Generative stage
	Diameter at the base	Height		
1 (≤ 5 years)	≤ 3 cm	≤ 1.5 m	Smooth and glossy	No flowers and/or fruits
2 (5-20 years)	3-8 cm	1.5-3 m	Cracked and dark up to 1-1.5 m height	Flowering and fruiting observed
3 (>20 years)	> 8 cm	> 3 m	Cracked and dark above 2 m height	Abundant flowering and fruiting



Fig. 1. *Malus florentina* – new species for the Bulgarian dendroflora

after a more detailed inventory of a somewhat larger territory, the population size would turn out to be much larger.

Approximately, one-fourth of the trees were flowering and setting fruits. However, mass fruiting was observed only in 2022, while in 2023, despite of a visibly good flowering, only single fruits remained until the end of July on the observed individuals. A plausible explanation of this fruiting fault could be the inappropriate climate conditions during the flowering period in May 2023. It could be also attributed to an often observed phenomenon in apple trees called *biennial bearing*, meaning that the trees tend to produce less fruits after an abundant fruiting year (Guitton et al. 2012).

Natural regeneration was observed not only within the forests and on forest edges, but also along the dirt roads. The species is being dispersed by birds and seedlings were observed several kilometers apart from the locality. About 20 young plants (not included in the number above) were recorded westwards of Tsarvishte village (at about 4 km air distance from



Fig. 2. Leaf shape variation of *M. florentina*



Fig. 3. An old individual of *M. florentina* in a forest habitat above Skrino village.

the main locality) on forest roads opened recently for logging purposes. Also, another ~10 seedlings of natural regeneration were found at an altitude of 430 m, very close to the river Struma. Therefore, we have considered the locality as occurring in the border area of two floristic regions – Western Frontier Mountains and the Valley of River Struma (*Northern*) – and belonging to both of them.

The mixed forests, where the species occurs, are dominated by *Quercus pubescens* Willd., with participation of *Ostrya carpinifolia* Scop., *Carpinus orientalis* Mill., *Fraxinus ornus* L., *Ulmus minor* Mill., and *Prunus mahaleb* L., along with a number of smaller trees and shrubs. A thorough and detailed study could provide more information about the synecological characteristics of the species and the respective plant communities, but a preliminary survey clearly places the habitats into the alliance *Quercetalia pubescentis* Br.-Bl., as reported also by Tomović & al. (2003) for several Serbian localities.

Based on the inventory, we could firmly state that the occurrence of *Malus florentina* in the region near

Skrino village is a result of a natural process of the species spreading eastwards across the Balkan Peninsula. This apple tree is being distributed exclusively by birds and its occurrence in the western part of Bulgaria, close to the borders with North Macedonia and Serbia, has been rather expected (V. Vladimirov, pers. comm.).

As noted above, the species is known for the regions from Italy to Turkey (Terpó 1968, Browicz 1970, 1991, Pignatti 1982, Curtto 2009). Recently, its distribution in Italy has been reviewed by Giardini & Spada (2006). The species is relatively common in the Republic of North Macedonia (Em & Ristevski 1974, Browicz 1970, 1991). New localities have been reported for Albania (Barina & al. 2009), Greece (Christensen 1995, Bergmeier & al. 2020), Serbia (Tomović & al. 2003), and Kosovo (Krivošej & al. 2008, Prodanović & al. 2013). The present record fills up the gap existing between the Western Balkans and Turkey.

M. florentina is a diploid species ($2n=34$; Nebel 1929, Einset & Imhoff 1949, Schuster & Büttner 1995). Even though it is easily recognizable among the other apple species, its taxonomic position has been a matter of discussion among the taxonomists and has undergone many nomenclatural changes. Along with the original description by Zuccagni (1806), it has been classified into eight different genera before obtaining its current name (Schneider 1906) and has also been considered a result of intergeneric hybridization (Browicz 1970, Christensen 1995). However, the recent taxonomic and phylogenetic studies (Robinson & al. 2001, Qian & al. 2008) have not confirmed the hypothesis for a hybrid origin. The species has been placed into different sections and subsections of the genus *Malus* (*Calycomeles* Koehne, *Sorbomalus* Zabel ex C.K. Schneider, *Eriolobus* (DC.) C.K. Schneider) and only recently it has been classified into a new monotypic section *Florentinae* M.H.Cheng ex G.Z.Qian (Qian et al. 2008). According to the International Plant Names Index (<https://www.ipni.org>) and Plants of the World Online (<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:724828-1>), the discussed species represents the genus *Eriolobus*, as *E. florentinus* (Zuccagni) Stapf. However, we task has not been to resolve the taxonomic complexities,

which require specified studies and discussions.

Undoubtedly, the newly found species will require measures for its conservation. It should be included in the list of protected species in Bulgaria and the localities, where it occurs, should be put under some protection regime. Fortunately, a substantial part of the population of *M. florentina* falls within the Natural Locality of the Turkish Hazelnut (Anonymous 1981, 2023) and, on a broader scale, within the Natura 2000 zone BG0001013 Skrinio. A more detailed study of the distribution and population status of the species in the region would help justification of the necessary conservation measures.

Acknowledgments. The authors extend their thanks to the Bulgarian Ministry of Education and Science for the support provided under the national research programme „Protection of environment and reducing the risk of hazards and natural disasters“ approved by DO № 230/06.12.2018.

References

- Anonymous**, 1981. Decree № 882 of 25.11.1980 for protecting the natural locality of Turkish Hazelnut. – State Gazette, № 1 (in Bulgarian).
- Anonymous**, 2023. Register of the protected territories and protected zones. Executive Environmental Agency, Ministry of Environment and Waters (in Bulgarian). https://eea.government.bg/zpo/bg/area.jsp?NEM_Partition=1&category-ID=3&areaID=396 (accessed 12.05.2023)
- Assyov, B. & Petrova, A.S.** (eds.) 2012. Conspectus of the Bulgarian Vascular Flora. Distribution maps and floristic elements. 4th revised and updated edition. S., Bulgarian Biodiversity Foundation.
- Barina, Z., Pifkó, D. & Mesterházy, A.** 2009. Contributions to the flora of Albania. – Willdenowia, **39**: 293-299.
- Bergmeier, E., Sakellarakis, F.-N., Strid, A. & Swinkels, C.** 2020. New additions to the flora of Prespa, Greece. – Phytol. Balcan., **26**(1): 103-130.
- Browicz, K.** 1970. *Malus florentina*, its history, systematic position and geographical distribution. – Fragm. Florist. Geobot., **16**: 61-83.
- Browicz, K.** 1991. Chorology of Trees and Shrubs in Southwest Asia and Adjacent Regions 9. Warszawa-Poznań. Polish Scientific Publishers.
- Christensen, K.I.** 1995. *Malosorbus florentina* (Zuccagni) Browicz. – In: **Phitos, D., Strid, A., Snogerup, S. & Greuter, W.** (eds). The Red Data Book of Rare and Threatened Plants of Greece. Pp. 358-359. Athens, Greece.
- Einset, J. & Imhoff, B.** 1949. Chromosome numbers of apple varieties and sports II. – Proc. Amer. Soc. Hort. Sci., **53**: 197-201.
- Em, H. & Ristevski, B.** 1974. *Malus florentina* (Zuccagni) C. K. Schneid. – Collected works, special edition *Wild Fruit Flora in SR Macedonia*, Faculty of Agriculture and Forestry of the University Skopje, Skopje: 91-100.
- Giardini, M. & Spada, F.** 2006. Segnalazione di una nuova stazione laziale di *Malus florentina* (Zuccagni) C.K. Schneider e aggiornamento della sua distribuzione in Italia. – *Informatore Botanico Italiano*, **38**(2): 379-381.
- Guitton, B., Kelner, J.-J., Velasco, R., Gardiner, S.E., Chagné, D. & Costes, E.** 2012. Genetic control of biennial bearing in apple. *J. Exp. Bot.*, **63**: 131-149.
- International Plant Names Index** (IPNI; <https://www.ipni.org>, accessed 14.10.2023)
- Krivošej, Z., Prodanović, D., Amidžić, L. & Lazarević P.** 2008. Novi lokalitet vrste *Malus florentina* (Zuccagni) C.K. Schneider (*Rosaceae*) na serpentinima Ibarske doline. – *Zaštita prirode*, Beograd, **60** (1-2): 313-318. (in Serbian)
- Kurtto, A.** 2009. *Rosaceae* (pro parte majore). - In: Euro+Med Plantbase - the information resource for Euro-Mediterranean plant diversity. <https://ww2.bgbm.org/EuroPlusMed/PTaxon-Detail.asp?NameCache=Malus&PTrFk=7300000> (assessed 14.04.2023)
- Nebel, B.R.** 1929. Zur Cytologie von *Malus* und *Vitis*. – *Gartenbauwissenschaften*, **1**: 549-595.
- Pignatti, S.** 1982. Flora d'Italia. Vol. 3. Edagricole, Bologna.
- Plants of the World Online** (<https://powo.science.kew.org>; accessed 14.10.2023)
- Prodanović, D., Krivošej, Z., Amidžić, L. & Bartula, M.** 2013. Floristic and chorological news from Northern Kosovo, in the Ibar river valley. – *Natura Montenegrina*, **12**(2): 257-269.
- Qian, G.-Z., Liu, L.-F., Hong, D.-Y. & Tang, G.-G.** 2008. Taxonomic study of the *Malus* section *Florentinae* (*Rosaceae*). – *Bot. J. Linn. Soc.*, **158**: 223-227.
- Robinson, J.P., Harris, S.A. & Juniper, B.E.** 2001. Taxonomy of the genus *Malus* Mill. (*Rosaceae*), with emphasis on the cultivated apple, *M. domestica* Borkh. – *Plant Syst. Evol.*, **226**: 35-58.
- Schneider, C.K.** 1906. *Illustriertes Handbuch der Laubholzkunde*. Gustav Fischer Verlag, Jena.
- Schuster, M. & Büttner, R.** 1995. Chromosome numbers in the *Malus* wild species collection of the genebank Dresden-Pillnitz. – *Genet. Resour. Crop Evol.*, **42**: 353-361.
- Terpó, A.** 1968. *Malus* Miller. – In: **Tutin T.G. & al.** (Eds.). *Flora Europaea*, Vol. 2, pp. 66-67. Cambridge Univ. Press, Cambridge.
- Tomović, G., Niketić, M. & Stevanović, V.** 2003. *Malosorbus florentina* (*Rosaceae-Maloideae*) – distribution, synecology and threatened status in Serbia. – *Phyton*, **43**: 295-306.
- Valev, S.** 1973a. Genus 410 (17) Apple – *Malus* Mill. – In: **Jordanov D.** (ed.). *Flora Republicae Popularis Bulgaricae*. Vol. 5, pp. 340-349. In *Aedibus Acad. Sci. Bulgaricae, Serdicae*, (in Bulgarian).
- Valev, S.** 1973b. Genus 411 (18) *Eriolobus* (DC.) M. J. Roemer – In: **Jordanov D.** (ed.). *Flora Republicae Popularis Bulgaricae*. Vol. 5, pp. 349-351. In *Aedibus Acad. Sci. Bulgaricae, Serdicae*, (in Bulgarian).
- Zuccagni, A.** 1806. *Centuria I. Observationum Botanicarum*, Florence

