Rosa rugosa (*Rosaceae*): an alien species in the Bulgarian flora

Vladimir Vladimirov[1, 2], Antoaneta Petrova[3], Stoyan Stoyanov[1], Svetlana Bancheva[1] & Malina Delcheva[1]

[1] Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Acad. Georgi Bonchev St., bl. 23, 1113 Sofia, Bulgaria, e-mail: vladimir_dv@abv.bg (corresponding author)

[2] Faculty of Forestry, University of Forestry, 10 Kliment Ohridski Blvd., 1797 Sofia, Bulgaria

[3] Botanical Garden, Bulgarian Academy of Sciences, P.O. Box 664, 1000 Sofia, Bulgaria

Received: November 16, 2018 ▷ Accepted: December 10, 2018

Abstract. The aim of the article is to report the presently known localities of *Rosa rugosa* (*Rosaceae*) in the Bulgarian flora, and to discuss its alien and invasive status. The species is native to East Asia and has been introduced in Europe, North America and New Zealand where it became established and, in some parts, invasive. In Bulgaria, the taxon was introduced in the mid-20th century for cultivation for its edible and vitamins-rich rosehips. Consequently, it escaped in some parts of the country. So far, naturalized localities of the species have been recorded in three floristic regions: Black Sea Coast (*Northern*), Balkan Range (*Western*) and Rhodopi Mts (*Central*). The populations are relatively small, usually on a few square meters, and no invasive behaviour of the species has been observed so far. Therefore, *Rosa rugosa* should be regarded as naturalized, non-invasive alien in the Bulgarian flora. However, the behaviour of the species should be monitored, since it is still cultivated in some parts of the country, which may result in escape and establishment of new localities.

Key words: alien status; escape from cultivation; invasive status; non-native species; Rugosa rose

Introduction

Field studies into agricultural and horticultural fields, forestry plantations and plant species used for cultivation during the past few years have provided a number of new alien records for the Bulgarian flora, e.g. *Ammannia coccinea* (Vladimirov & al. 2017), *Euphorbia serpens* (Petrova 2018), *Larix decidua* (Petrova & Gerasimova 2017), etc.

The aim of the present article is to report the known naturalized localities of *Rosa rugosa* Thunb. in the Bulgarian flora and to discuss the pathways of introduction of the species and its current alien and invasive status. Since the 1970s, the species has been cultivated in different parts of the country, mainly for its edible and vitamins-rich fruits (rosehips) (e.g. Georgiev & al. 1980; Baldzieva & Popova 1983). The essential oil contents of the petals have been studied but it was found out that the species is not suitable as raw material for production of the Bulgarian type rose-oil, since the latter has a different aroma (Georgiev & al. 1980). *Rosa rugosa* has already been reported as an alien to the Bulgarian flora on a map showing the distribution of the taxon across Europe (Essl 2009) on the basis of a record provided by V. Vladimirov & S. Stoyanov. The species was also mentioned in a list of alien plants for the Kamchia dune system (Valcheva & al. 2018). However, in both cases neither the exact localities of the species were mentioned, nor its alien and invasive status in the Bulgarian flora was discussed.

Material and methods

Plant material was collected during field studies across the country. Data about the size of escaped localities and habitats of the species were noted down in the field. Analysis of the pathways of introduction and of the alien and invasive status of the species in the Bulgarian flora was based on the authors' personal observations in the field, as well as on relevant literature (e.g. Richardson & al. 2000; Bruun 2005, 2006; Weidema 2006; Essl 2009; Harrower & al. 2018).

Results and discussion

Rosa rugosa is easily distinguished from all native *Rosa* species in the Bulgarian flora by the thick, rugose leaves and densely tomentose prickles (Klasterski 1968; Dimitrov 1973). A concise morphological description of the species in Bulgarian was provided by Dimitrov (1973). The flowers are mainly cross-pollinated by insects, although self-fertilisation has also been reported (Bruun 2005).

Distribution and habitats in Bulgaria: **Black Sea Coast (*Northern*):** in a depression between the sand dunes S of the mouth of river Kamchia, *ca.* 150 m NE of the road from Novo Oryahovo to Shkorpilovtsi villages (near the former Izgrev Camping Site), Varna district, 0 m a.s.l., NH75, 42.98106°N, 27.89207°E, 08.11.2012, V. Vladimirov, S. Bancheva & M. Delcheva obs., the area of occupancy of the species is *ca.* 15 m^2; *loc. ibid.*, 21.08.2014, coll. A.S. Petrova (SOM 170 537) (Fig. 1); **Balkan Range (*Western*):** on northern slopes along the asphalt road from Zlatitsa to Etropole towns, Sofia district, *ca.* 1205 m a.s.l., KH53, 42.74485°N, 24.05855°E, 23.07.2018, coll. V. Vladimirov (SOM), four flowering and fruiting shrubs recorded (Fig. 2); **Rhodopi Mts (*Central*):** near Chairite lakes, along the path from Osmanov vir locality (north of Trigrad village) to the lakes, Smolyan district, *ca.* 1365 m a.s.l., KG80, app. 41.588049°N, 24.444616°E, 24.06.2000, coll. A.S. Petrova; *loc. ibid.*, 30.08.2004, coll. S. Stoyanov (SOM 161381, 161382); *loc. ibid.*, 27.07.2011, A.S. Petrova obs. (Fig. 3), the area of occupancy is *ca.* 10 m^2; along the road *ca.* 0.3 km from Lyulka to Sivino villages, Smolyan district, *ca.* 1040 m a.s.l., LF09, 41.46194°N, 24.69157°E, 17.10.2012, V. Vladimirov, S. Bancheva & M. Delcheva obs., *ca.* 30 m^2 covered with fruiting shrubs of *R. rugosa* (Fig. 4).

In Bulgaria, the species has been recorded in the following habitats: B1. Coastal dunes and sandy shores, E5. Woodland fringes and clearings and tall forb stands, and FA. Hedgerows (EUNIS habitat classification, https://eunis.eea.europa.eu/habitats-code-browser.jsp). The high altitudinal range (0–1365 m) of the occurrence of the species in the country is worth mentioning.

Distribution and habitats worldwide: *Rosa rugosa* is native to East Asia, from Okhotsk and southern Kamchatka to Korea and the northern parts of China and Japan (Weidema 2006). The alien range of the species includes Europe, North America and New Zealand where it naturalized and became invasive in many parts (Bruun 2006). Within its native range

Fig. 1. *Rosa rugosa* at the sands southwards of the mouth of river Kamchia (photo A.S. Petrova).

Fig. 2. *Rosa rugosa* at the locality along the road Zlatitsa – Etropole towns, Balkan Range (photo V. Vladimirov).

Rosa rugosa grows on coastal hillsides, sandy soils on the sea-shores and offshore islands, below 100 m a.s.l. (Cuizhi & Robertson 2003). In Europe, the species invades: B1. Coastal dunes and sandy shores, B3. Rock cliffs, ledges and shores, including the supralittoral, E5. Woodland fringes and clearings and tall forb stands, F4. Temperate shrub heatland, FA. Hedgerows (Essl 2009).

Alien and invasive status in the Bulgarian flora: The species was introduced to Europe in the late 18th century as an ornamental plant and the first records of naturalized stands were from Germany and Denmark (Weidema 2006). The exact time of the introduction of the species to Bulgaria is unknown. However, in the 1970s it was already cultivated in many parts of the country for its edible fruits (Georgiev & al. 1980; Baldzhieva & Popova 1983). Even presently, the species is of interest and is recommended for cultivation, especially for places with high soil and air humidity in the lower mountain regions, at 500–1000 m a.s.l. (S. Stanev, Cultivation of *Rosa* cultivars for rosehips, www.susherbsbg.eu, in Bulgarian).

Fig. 3. *Rosa rugosa* at the locality near Chairite lakes, Rhodopi Mts (photo A.S. Petrova).

Fig. 4. *Rosa rugosa* at the locality near Lyulka village, Rhodopi Mts: **a.** a group of shrubs; **b.** flowers; **c.** fruit (photo V. Vladimirov).

Therefore, the main pathway for introduction of the species to the Bulgarian flora is 'importation of a commodity: escape from confinement', especially from agriculture (CBD 2014; Harrower & al. 2018). We could not find any published data on how many times and from where the original material of *Rosa rugosa* was imported to Bulgaria but at least in one case the material originated from cultivations in Poland (Popova & Kozhuharova 1983). There is evidence for the localities in the Black Sea Coast and Rhodopi Mts floristic regions that *Rosa rugosa* was formerly cultivated in the same regions and, consequently, escaped and got established in the wild. For example, experimental fields for cultivation of the species existed in the region of Obzor town (*ca.* 18 km southwards of the presently known locality of the species) and near Trigrad village (*ca.* 6 km westwards of the known escaped locality) (Baldzieva & Popova 1983). From conversation with the local residents in the Lyulka village, it became clear that the species was cultivated in the region in the 1980s, and, consequently, the cultures were abandoned and eradicated. In fact, several cultivars of the species have been developed and grown in Bulgaria, e.g. '*Alba*', '*Rubra*', '*Rosea*', '*Paldin*', '*Nektar*', and '*Slantse*' (Baldzieva & Popova 1983). The exact mechanism of escape of *Rosa rugosa* from the cultivated fields is unknown but it may have happened by dispersal of seeds by birds or rodents, which are known dispersal vectors of the species (e.g. Bruun 2005), and/or by disposal in the natural environment of plant waste from the cultivated species containing viable propagules (fruits, seeds, underground parts). Once established in a natural environment, the species extends its occurrence locally mainly by vegetative means: by root-borne and stolon-borne suckers (Bruun 2005). Longer-distance dispersal is mainly due to seed dispersal and among the most important seed-vectors are birds and seawater (both hips and individual achenes can float for several weeks, due to special tissues in the cell-walls of the seeds) (Bruun 2005). In Bulgaria, seed dispersal by birds or human activities is the most likely long-distance dispersal mechanism, although seawater may potentially play a role in the coastal areas and cannot be fully excluded as a vector.

Taking into account the definitions and concepts proposed by Richardson & al. (2000), *Rosa rugosa* should be regarded as a naturalized alien in the Bulgarian flora since the observed populations may persist (and enlarge) for many years without any human intervention. In Europe, it is considered very common and invasive in some countries, e.g. in Denmark, Norway and Sweeden (Weidema 2009). In the currently known Bulgarian populations, the species does not show any invasive behaviour, although it may become locally abundant due to vegetative propagation. However, the behaviour of the species should be monitored, especially taking into account that it is still cultivated in some parts of the country (with a growing interest in cultivation for obtaining rosehips). There is a growing interest in the species as an ornamental plant as well. Therefore, the propagule pressure in many parts of the country is likely to increase and may result in the establishment of new populations in the wild. So far, no obvious impacts of the species have been observed or reported in the Bulgarian localities. However, its high competitive ability and a possibility to hybridise with some local species, e.g. with *Rosa canina*, should be taken into account (Popova & Kozhuharova 1983; Bruun 2005). Mention deserves the fact that *Rosa rugosa* is an endangered plant in the wild in China because of overpicking, uprooting, habitats fragmentation and loss. Therefore, the species is included in the Red Data Book of China (Cuizhi & Robertson 2003; Yang & al. 2009).

References

Baldzieva, M. & Popova, M. 1983. Some peculiarities in the phenophase development of *Rosa rugosa* Thunb. – Nauchni Trudove Selskost. Inst. "Vasil Kolarov", **28**(4): 51-57.

Bruun, H.H. 2005. Biological flora of the British Isles, no. 239: *Rosa rugosa* Thunb. ex Murray. – J. Ecol., **93**: 441-470.

Bruun, H.H. 2006. Prospects for biocontrol of invasive *Rosa rugosa*. – BioControl, **51**: 141-181.

CBD (Convention on Biological Diversity). 2014. Pathways of introduction of invasive species, their prioritization and management. – https://www.cbd.int/doc/meetings/sbstta/sbstta-18/official/sbstta-18-09-add1-en.pdf.

Cuizhi, G. & Robertson, K. R. 2003. *Rosa*. – In: **Wu, Z.-Y., Raven, P.H. & Hong, D.** (eds), Flora of China. Vol. **9**: 339-381. Sci. Press, Beijing & Missouri Bot. Gard. Press, St. Louis. – http://www.efloras.org

Dimitrov, S. 1973. *Rosa*. – In: **Jordanov, D.** (ed.), Fl. Reipubl. Popularis Bulgaricae. Vol. **5**, pp. 114-170. In Aedibus Acad. Sci. Bulgaricae, Serdicae (in Bulgarian).

Essl, F. 2009. *Rosa rugosa* Thunb. ex Murray, rugosa rose (*Rosaceae*, *Magnoliophyta*). – In: **DAISIE** (eds), Handbook of Alien Species in Europe, p. 358. Springer, Berlin.

Georgiev, E., Baldjieva, M. & Popova, M. 1980. Study on the essential oil content of *Rosa rugosa* Thunb. flowers. – Rasteniev. Nauki, **17**(7): 10-13 (in Bulgarian).

Harrower, C.A., Scalera, R., Pagad, S., Schönrogge, K. & Roy, H.E. 2018. Guidance for interpretation of CBD categories on introduction pathways. Technical note prepared by IUCN for the European Commission.

Klasterski, I. 1968. *Rosa*. – In: **Tutin, T.G. & al.** (eds), Flora Europaea. Vol. **2**, pp. 25-32. Cambridge Univ. Press, Cambridge.

Petrova, A.S. 2018. *Amaranthus viridis* and *Euphorbia serpens*, new alien species records for the flora of Bulgaria. – Dokl. Bulg. Acad. Nauk., **71**(1): 46-52.

Petrova, A. & Gerasimova, I. 2017. A naturalised population of *Larix decidua* Mill. (*Pinaceae*) in the Rhodope Mountains, Bulgaria. – Acta Zool. Bulg., Suppl. **9**: 29-32.

Popova, M. & Kozhuharova, K. 1983. Studies on the hybridization of the species *Rosa canina* L. and *Rosa rugosa* Thunb. – Nauchni Trudove Selskost. Inst. "Vasil Kolarov", **28**(4): 58-66.

Richardson, D.M., Pyšek, P., Rejmánek, M., Barbour, M.G., Dane Penetta, F. & West, C.J. 2000. Naturalization and invasion of alien plants: concepts and definitions. – Diversity and Distrib., **6**: 93-107.

Valcheva, M., Sopotlieva, D., Meshinev, T. & Apostolova, I. 2018. Is penetration of non-psammophytes an underestimated threat to sand dunes? – A case study from western Pontic coast. – J. Coast. Conserv. – https://doi.org./10.1007/s11852-018-0656-3.

Vladimirov, V., Delcheva, M., Georgiev, V., Tsoneva, S. & Gussev, Ch. 2017. *Ammania coccinea* Rottb. (*Lythraceae*): the first report for the Bulgarian alien flora. – Acta Zool. Bulg., Suppl. **9**: 39-42

Weidema, I. 2006. NOBANIS – Invasive Alien Species Fact Sheer – *Rosa rugosa*. – Online database of the European Network on Invasive Alien Species – NOBANIS. – www.nobanis.org (accessed on 10.11.2018).

Yang, J.-H., Zhang, S.-P., Liu, J., Zhai, W. & Wang, R.-Q. 2009. Genetic diversity of the endangered species *Rosa rugosa* Thunb. in China and implications for conservation strategies. – J. Syst. Evol., **47**(6): 515-524.