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**Short communication**

# *Phytolacca acinosa* Roxb. (Phytolaccaceae), a new alien species in the Croatian flora

Valentina Borak Martan[1], Renata Šoštarić[2*]

[1] Kamaufova ulica 10, HR- 10000, Zagreb, Croatia

[2] University of Zagreb, Faculty of Science, Department of Botany with the Botanical Garden, Marulićev trg 20/II, HR- 10000, Zagreb, Croatia

**Abstract:** *Phytolacca acinosa* Roxb., an East Asian plant species naturalised in many parts of the European continent, has been recorded for the first time in Croatia in two anthropogenic habitats in Varaždin city (NW Croatia). This study reports the newly discovered localities and presents the characteristics of the new alien species in the flora of Croatia. A determination key is given for *Phytolacca* taxa registered in Croatia and neighbouring countries.

**Keywords**: alien plants, Croatia¸ *Phytolacca acinosa*, Varaždin

## Introduction

*Phytolacca* L. is the largest genus of the family Phytolaccaceae, with a number of species, ranging from 25 (Dequan and Larsen 2003, King 2011) to over 35 (Willis 1966). The genus is distributed worldwide, is nearly cosmopolitan and mostly native to South America, with a few species in Africa and Asia (Dequan and Larsen 2003). Several species are found in cultivation and occasionally escape and become naturalised (King 2011).

According to Drake (2009), on the List of Alien Species in Europe there are six *Phytolacca* species: *Ph. acinosa* Roxb., *Ph. americana* L. (syn. *Ph. decandra* L., *Ph. vulgaris* Crantz), *Ph. dioica* L. (syn. *Pircunia dioica* (L.) Moq.), *Ph. esculenta* Van Houtte, *Ph. heterotepala* H. Walter and *Ph. polyandra* Batalin. In Euro+Med PlantBase (2015), the occurrence of *Ph. pruinosa* Fenzl in Cyprus, Lebanon and Syria is quoted.

In Europe, the most commonly recorded species from the genus is *Ph. americana*, originating from North America and widely naturalised in southern Europe, locally also in western and central Europe (Webb and Akeroyd 1964). Unlike *Ph. americana* the species *Ph. acinosa* is much less common in Europe (Wyrzykiewicz-Raszewska 2009) and it is of East Asian origin. *Ph. acinosa* is native in China, Eastern Asia (Japan, Korea, Taiwan), the Indian Subcontinent and Indo-China (Dequan and Larsen 2003). It was brought to Europe as a vegetable as well as an ornamental plant (Wyrzykiewicz-Raszewska 2009).

According to available literature, the occurrence of *Ph. acinosa* has been reported in several countries: Belgium (Alien Plants of Belgium 2015, Daisie 2015, Q-bank 2015), Denmark (Daisie 2015, Q-bank 2015), Bulgaria (Q-bank 2015), Slovenia (Lešnik 2009), Sweden, United Kingdom, Netherlands (Q-bank 2015) and France (Daisie 2015). Considering the species *Ph. esculenta* as a synonym of *Ph. acinosa*, the species has also been recorded in Austria (Essl 1998, Q-bank 2015), Germany (Jäger et al. 2013, FloraWeb 2015), Switzerland (Info Flora 2015), in the Czech Republic (Pyšek et al. 2012), Romania (Webb and Akeroyd 1964, Q-bank 2015) Hungary (Balogh 2005) and Bulgaria (Zieliński et al. 2012).

Taxonomical status of the species *Ph. acinosa* and *Ph. esculenta* has been the subject of several discussions. According to Webb and Akeroyd (1964) the name *Ph. acinosa* is a synonym of the species *Ph. esculenta*, while for Clement (1982) there are the clearly separate species, *Ph. acinosa* and *Ph. esculenta* (Tab. 1). Recent taxonomists (see for instance Dequan and Larsen 2003) tend to include all eastern Asian'related taxa that are cultivated for ornament (*Ph. esculenta* and *Ph. latbenia* Buch.-Ham. H. Walter) in a broadly circumscribed *Ph. acinosa* (Alien Plants of Belgium 2015).

In Croatia, *Ph. americana* is reported in cultivation and naturalised (Nikolić 2014). This species is invasive in Croatia (Nikolić 2015) and in some other European countries like France (Dumas 2011), Italy (Siniscalco et al. 2011), Portugal (Invasoras 2015), Switzerland (Wittenberg 2005), Greece (Arianoutsou et al. 2010), Czech Republic (Pyšek et al. 2012) and Bulgaria (Petrova et al. 2013). So far, no other species of the genus have been recorded in the territory of the Republic of Croatia.

* Corresponding author, e-mail: rsostar@biol.pmf.hr

## Material and methods

The city of Varaždin is the county town of Varaždin County and after Zagreb it is the second biggest city in the north-west of Croatia with 46,946 inhabitants (Fig. 1). According to Koppen's climate classification, the broad Varaždin area has a temperate humid climate with warm summers (Cfa) (Šegota and Filipčić 2003). The forest community of sessile oak and common hornbeam (*Querceto-Carpinetum orientalis*) (Horvatić 1967) would be the zonal vegetation but recently has been transformed into various kinds of anthropogenic and semi-natural vegetation due long human influence.


**Fig. 1.** Localities with coordinates of *Phytolacca acinosa* Roxb. in Croatia.

Plant identification was done according to Webb and Akeroyd (1964) and Clement (1982). The plants were photographed with Canon digital camera and geocoding of the locations was performed with use of a GPS device.

## Results and discussion

During a floristic investigation of Varaždin in 2014 *Ph. acinosa* was found at two localities. At the first location (GPS coordinates: 5601192, 5131810) a single specimen was recorded on June 8th 2014 in a landfill for various types of waste (occasional fire site). On August 11th 2014 two specimens were found at the second location (GPS coordinates: 5603637, 5129550) in the green area around a building (under a fir) (Fig. 1).

As the taxonomical status of the species *Ph. acinosa* and *Ph. esculenta* is still a matter of discussion (Webb and Akeroyd 1964, Clement 1982, Tab. 1), we consider both opinions in the analysis of specimens found in Varaždin.

The material had all characteristics of the species *Ph. acinosa* s. str., except the anther colour. According to Clement (1982) the anthers of *Ph. acinosa* are white, while our specimens had pink anthers. Something similar was noticed in Belgium where collections of the *Ph. acinosa* group are usually more or less intermediate between *Ph. acinosa* and *Ph. esculenta*: inflorescence axes are often scabrid-glandular (as in *Ph. acinosa*) but the floral characters resemble *Ph. esculenta* (Alien Plants of Belgium 2015). Whether this intermediate characteristic manifests possible hybridization is not quite clear and further investigation should give the answer.

**Tab. 1.** Differences between *Phytolacca esculenta* Van Houtte and *Phytolacca acinosa* Roxb. according to Clement (1982).

| Flowers characteristics | *Ph. esculenta* | *Ph. acinosa* |
|---|---|---|
| Pedicels and inflorescence axis | almost glabrous | scabrid-glandular |
| Perianth | white | greenish white to pinkish |
| Anthers | pink | white |

*Ph. acinosa* s. str. (Fig. 2) is a perennial, growing to a height of 1.5(–3) m (Nienaber and Thieret 2003). Roots are thick, fleshy. Stems are erect, green or reddish purple, longitudinally grooved, fleshy, branched (Dequan and Larsen 2003), naked, juicy, branching in the upper part (Wyrzykiewicz-Raszewska 2009). Leaves are spirally arranged, leaf blade is elliptic or lanceolate-elliptic, 10–30 cm long, and 4.5–15 cm wide. Leaf base is cuneate, apex acuminate or sharply pointed. Petiole is 1.5–3 cm long (Dequan and Larsen 2003). Numerous, densely clustered flowers form a cylindrical raceme of 15–20 cm in length, which grows sympodially and is erect not only during flowering, but also during fruiting. Flowers are radial, bisexual, of approx. 8 mm in diameter, growing from axils on peduncles 6–10(13) mm long. The simple perianth is composed of five petaloid sepals, initially white in colour, later changing into green to become purple-red during fruit ripening. Sepals are elliptical to ovoid, 3–4 mm in length and 2 mm in width. After pollination of flowers they do not drop, but tilt backwards. There are 8–10 stamens, equal in length to the perianth, filaments are persistent, white, subulate, wider at the base with pinkish, elliptical anthers. The pistil of hypogynous flower is composed of 7–15 free carpels. The fruit (Fig. 2), generally defined as a berry, is juicy and composed of 7–15, most often eight, adjacent single-seeded berries, forming a compound berry, approx. 7 mm in diameter. Each berry has

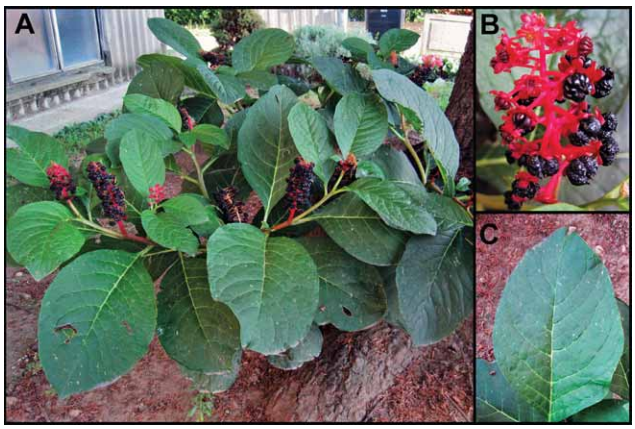


**Fig. 2.** *Phytolacca acinosa* Roxb. in location number 2 (Photo by V. Borak Martan).

an excrescence on the top, a remnant of the style. At maturity fruits are shiny purple-black. Seeds are kidney-shaped, smooth, slightly 3-angulate, approx. 3 mm in length (Wyrzykiewicz-Raszewska 2009).

All three specimens have been found in anthropogenic habitats, similar to cases in the neighbouring countries (Essl 1998, Lešnik 2009, Zieliński et al. 2012). *Ph. acinosa* is a gradually spreading, locally naturalised garden escaper. It most often occurs in gardens or parks (under trees or shrubs, foot of walls), in cemeteries or in urban wastelands. *Ph. acinosa* often occurs in single specimens but bigger local populations are increasingly recorded (Alien Plants of Belgium 2015). *Ph. americana* survives in most environments, in woodlands, pastures, fields, forest margins and disturbed sites such as ornamental landscapes, urban waste areas (Di Tomaso et al. 2013) so it is possible to find both species in the same type of habitat. According to the available literature *Ph. acinosa* always is a much smaller plant (rarely exceeding 100 cm) with an erect inflorescence and broader leaves (Wyrzykiewicz-Raszewska 2009, Alien Plants of Belgium 2015) and fruit composed of eight free segments (representing the eight carpels) and erect inflorescences, which remain erect even after the ripening of the fruits (Petrova et al. 2013).

The specimen found at locality number 1 was burnt down during a fire in the habitat, whereas the other two specimens found at locality number 2 survived through the winter, showing that they are adjusted to a moderate continental climate. The same was also noticed in Slovenia. According to Lešnik (2009) *Ph. acinosa* is a perennial and it recovers from the buds on a thickened root.

Since it is the first finding of the species *Ph. acinosa* in Croatia, it is necessary to follow its spread so it can be classified according to criteria applied for alien species, established by Richardson et al. (2000) (casual plants, naturalised plants, invasive plants) and adjusted for Croatia according to Mitić et al. (2008). According to the above stated criteria, the mentioned species has been already naturalised in several countries of Europe: Switzerland (Wittenberg 2005), Hungary (Balogh 2005), the Czech Republic (Pyšek et al. 2012), Belgium (Alien Plants of Belgium 2015) and Germany (FloraWeb 2015). In neighbouring Hungary the occurrence of both species (*Ph. acinosa* and *Ph. esculenta*) has been recorded (Balogh 2005). *Ph. esculenta* is considered an invasive alien species in Hungary (Balogh 2005, Tiborcz et al. 2012), so it is important to emphasise the possibility of the species spreading into the territory of the Republic of Croatia.

**Determination key for *Phytolacca* species in Croatia and neighbouring countries:**

1 Carpels 7–15, usually 8, free; racemes erect in ripening; 8 single seed berries forming a compound berry; leaves broadly ovate. . . . . 2

1 Carpels 10, united; nodding racemes; typical single berry (10-seeded); leaves ovate-lanceolate . . . ***Ph. americana***

2 Flower pedicels and inflorescence axis almost glabrous; perianth white; anthers pink . . . . . ***Ph. esculenta***

2 Flower pedicels and inflorescence axis scabrid-glandular; perianth greenish white to pinkish; anthers white . . . . . ***Ph. acinosa***

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