

Occurrence and spread of *Solanum physalifolium* – a new invasive weed in the Czech Republic

J. HOLEC*, J. SOUKUP, M. JURŠÍK, P. HAMOUZ

Department of Agroecology and Biometeorology, Faculty of Agrobiological, Food, and Natural Resources, Czech University of Agriculture, Kamycka 957, 165 21 Prague 6 – Suchbátka, Czech Republic,

e-mail: Holec@af.czu.cz

*Corresponding author

Summary

Solanum physalifolium occurs in the Czech Republic as a neophyte since 1975. Four locations with its occurrence were known in 1999. We found six other locations between 2000-2005, three of them with high densities of this weed on arable land. *S. physalifolium* is well adapted at these locations and produce large numbers of seeds. Populations in Roudnice and Labem region show entire leaf margins, other populations (Prague or Mělník region) are composed by plants with dentate leaf margins. On arable land *S. physalifolium* occurred in vegetable crops and potatoes. As the number of known locations is increasing, independent, and selfreproductive populations had been created. Therefore, *S. physalifolium* can be classified in Czech Republic as an invasive weed.

Keywords: *Solanum physalifolium*, neophyte, invasive weeds

Zusammenfassung

Das Vorkommen und die Verbreitung von *Solanum physalifolium* als neue invasive Art in der Tschechischen Republik

Solanum physalifolium kommt seit 1975 als Neophyt in der Tschechischen Republik vor. Im Jahr 1999 trat diese Art an vier Standorten auf. In den Jahren 2000-2004 wurden sechs neue Standorte entdeckt; drei davon waren Ackerflächen mit einer hohen Populationsdichte von *Solanum physalifolium*. Diese Art ist auf den Ackerstandorten gut angepasst und bildet viele Samen aus. Die Populationen in der Umgebung von Roudnice nad Labem haben eingebuchtete Blattformen, andere Populationen aus Prag und der Umgebung von Mělník haben gelappte Blätter. In Äckern kam diese Art insbesondere in Gemüse und Kartoffeln vor. Das Vorkommen von *Solanum physalifolium* in der Tschechischen Republik steigt an. Die bestehenden Populationen haben eine hohe Abundanz und sie vermehren sich unabhängig voneinander. Deshalb können wir *Solanum physalifolium* als invasive Unkrautart klassifizieren.

Stichwörter: *Solanum physalifolium*, Neophyten, invasive Unkrautarten

Introduction

The following species of genus *Solanum* L. (nightshade) are considered as arable weeds in the Czech Republic: *Solanum nigrum* L., *Solanum decipiens* OPIZ, and *Solanum physalifolium* RUSBY. *Solanum villosum* MILL. occurs rarely on ruderal places so we classified this species as a potential weed (HOLEC *et al.* 2005). *Solanum nigrum* is widespread in warmer regions and most common compared to other weedy *Solanum* species. It occurs often in wide-row crop stands, especially and with high abundance in maize but can be found also in cereal stands. It occurs in the Czech Republic since Neolithic age as an archaeophyte. In 1999, populations resistant to PS II inhibitors were found. From this point of view it is

important that this species ($2n = 72$) can hybridise with other weedy *Solanum* species. Therefore, the spread of herbicide resistance is possible. In Prague-Suchdol there were found hybrids with *S. physalifolium* ($2n = 24$) (HOLEC *et al.*, 2003). *Solanum decipiens* is mostly ruderal, growing near the walls, pavements and gardens. It is not as common as *S. nigrum*. In the Czech Republic, *S. decipiens* was classified as a neophyte with first record in 1819. *Solanum villosum* was first identified in our country in 1998 in Prague-Libeň. Now it is spreading on ruderal places near pavements, lawns and ornamentals.

Solanum physalifolium was found in the Czech Republic for the first time in 1975 (PYŠEK *et al.* 2002). In some areas such as the lowland of the river Elbe and in Prague) this species is well established and can be found as a weed in vegetables and potato fields (HOLEC *et al.* 2004). The origin of *Solanum physalifolium* is in Chile and Argentina, where it occupies sites in altitudes of 1,000-2,000 m above sea level. This species was introduced to Northern and Western Europe, Central and North America, Australia and New Zealand. In Europe, it was observed in Spain and Scandinavia. In Sweden, *S. physalifolium* is often found together with *S. nigrum* in potatoes and vegetable crops (ANDERSSON AND YAHA 2003). Compared to other annual species of genus *Solanum*, *S. physalifolium* reaches the generative phase earlier. Fruits remain green-white even in the time of ripening and ripe seeds shed from mother plants onto the soil surface. Therefore, endozoochory common in other *Solanum* species that are spread by frugivorous birds (THÉRY 1989) has much lower importance for *S. physalifolium*.

Materials and methods

Solanum physalifolium RUSBY (syn. *S. nitidibaccatum* BITTER) occurrence in the Czech Republic was observed from 2000 until 2004. Locations, habitat type, number of plants, and morphology of leaf margins were recorded. Geographical data were used for the creation of distribution maps for *S. physalifolium* in the Czech Republic and compared with those locations published in Flora of the Czech Republic (SLAVÍK 2000), where locations known until 1999 were published.

Results

From 1975 until 1999 only four locations with *S. physalifolium* occurrence were found in the Czech Republic:

1. Pardubice, 1975 – waste place in the area of railway station – first record in the Czech Republic (V. JEHLÍK);
2. Richardov u Chrástu (Pilsen = Plzeň region), 1977 – weed in maize field (S. HEJNÝ);
3. Vědomice (Roudnice nad Labem region), 1980 – weed on arable land (F. DVOŘÁK);
4. Ústí nad Labem – Střekov, 1990, sandy habitat on river Elbe bank (K. KUBÁT).

These locations were published in recent Flora of the Czech Republic (SLAVÍK 2000) and based on them map on Figure 1 was created. From 2000 until 2004 six new locations with occurrence of this species were found, three of them with high abundance:

1. Suchdol (Prague = Praha region), 2000, weed in vegetables and potatoes, common also on short time fallows after crop harvest, occurs continually in high densities, one of the major weed species on experimental field of University of Agriculture (J. HOLEC);
2. Ovčáry (Mělník region), 2000, weed on arable land – vegetable crops, potatoes, fallows, field margins, continual occurrence (J. HOLEC);
3. Červený Újezd, 2001, two individuals found near the path on experimental field of University of Agriculture, no other records in following years; possible source is the experimental field in Suchdol (J. HOLEC)
4. Mělník, 2003, one plant on sandy habitat on the river bank (Elbe), no other found in 2005 (J. HOLEC)
5. Lounky (Roudnice nad Labem region), 2003, common weed on arable land (vegetables, potatoes, fallows, margins of other crop stands), near the roads. Plants of *S. physalifolium* were found in the same region near the villages Chodouny and Vetlá in 2004 (J. HOLEC);
6. Popůvky u Brna, 2003, waste place near garden compost, 7 individuals; the first occurrence in Moravia (D. SIMONOVÁ).

The map in Figure 2 shows all known locations with the occurrence of *S. physalifolium* in year 2004.

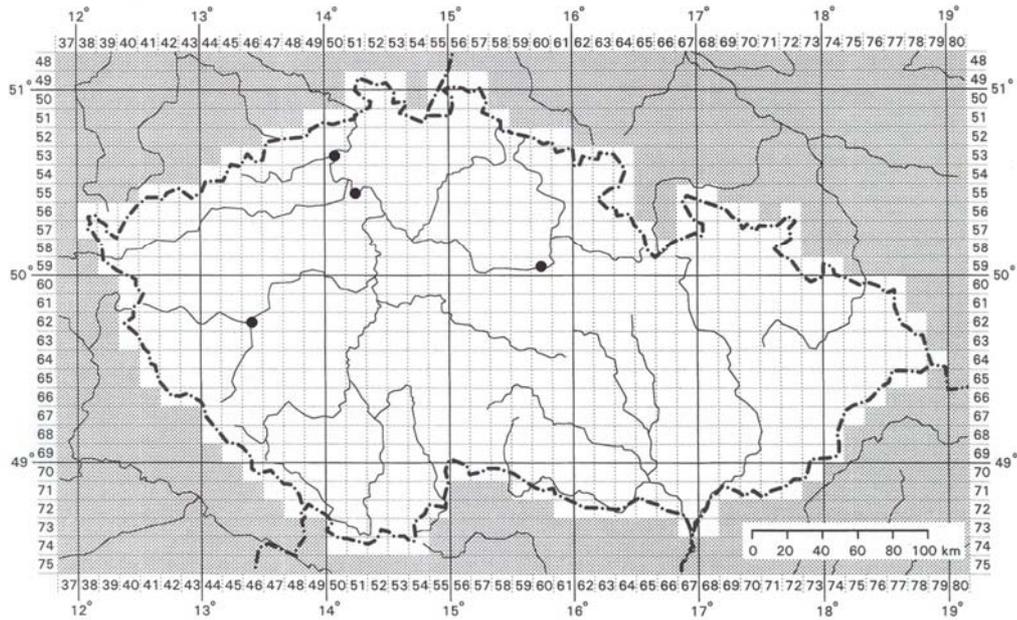


Fig. 1 *Solanum physalifolium* in the Czech Republic (1975-1999).
Abb. 1: *Solanum physalifolium* in der Tschechischen Republik (1975-1999).

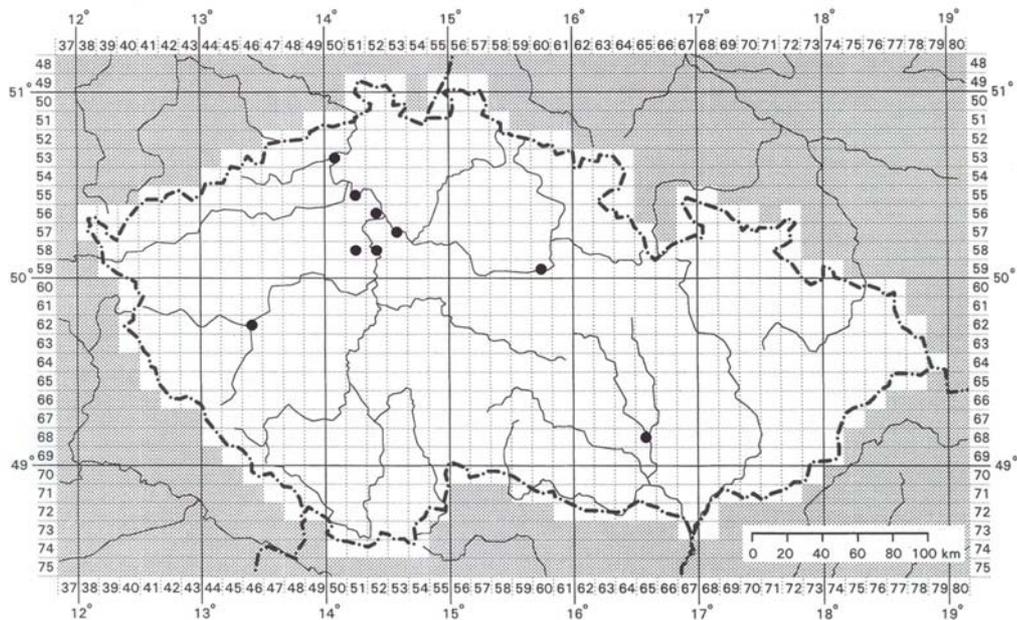


Fig. 2: *Solanum physalifolium* in the Czech Republic (2004).
Abb. 2: *Solanum physalifolium* in der Tschechischen Republik (2004).

During our observations, morphological traits were also recorded. There is a significant difference between populations in the region of Roudnice and Labem and the others. Plants growing near Roudnice show entire leaf margins, plants from the rest of locations show dentate leaf margins (Fig. 3).



Fig. 3: Morphological differences of *S. physalifolium* plants – Roudnice and Labem region (left), Prague (right).

Abb. 3: Die morphologischen Unterschiede bei den Pflanzen von *S. physalifolium* – links die Lokalität Roudnice and Labem, rechts Prag.

Discussion

Solanum physalifolium is not mentioned in classical papers dealing with invasive weeds in the area of the Czech Republic and the Slovak Republic (JEHLÍK 1998). Only four locations were known at the time of the release of this book (Fig. 1) but some other species with even lower number of locations were included (e.g. *Acroptilon repens*, *Eleusine indica* – both species had only 2 known locations in CZ). In Flora of the Czech Republic the species is classified as rarely introduced into the country, occurring only temporarily (SLAVÍK 2000). But authors mentioned that known locations can be only a part of its occurrence in the country as many other infested places can be omitted. This was confirmed by our work – three locations with continuous and dense occurrence of *S. physalifolium* (SUCHDOL, OVČÁRY, LOUNKY) had to be established many years before our findings.

Acknowledgement

Authors greatly acknowledge to Karel Fajmon and Deana Simonová (Masaryk University in Brno) for information about the occurrence of *Solanum physalifolium* in Moravia. This research was supported by projects 1R55010 and MSM 6046070901.

References

- ANDERSSON, L., A. YAHYA: Primary dormancy in *Solanum nigrum* and *S. physalifolium*. Aspects of Applied Biology, **69**, 339-235, 2003.
- HOLEC, J., L. TYŠER, V. KOHOUT: Jednoleté plevelné druhy rodu *Solanum* L. v ČR, jejich rozšíření a škodlivost (Annual weedy species of genus *Solanum* L. in the Czech Republic, their occurrence and harmfulness). XVI. Slovak and Czech Plant Protection Conference, Slovenská poľnohospodárska univerzita v Nitre, 237-238, 2003.
- HOLEC, J., J. SOUKUP, M. JURSIK, P. HAMOUZ: Invasive weed species on arable land in the Czech Republic. Journal of Plant Diseases and Protection, Special Issue XIX, 231-236, 2004.
- HOLEC, J., M. JURSIK, L. TYŠER: Biologie a regulace významných plevelů cukrové řepy. Lilky (druhy rodu *Solanum* L.). Listy cukrovarnické a řepařské, 1, 121, 18-20, 2005.
- PYŠEK, P., J. SÁDLO, B. MANDÁK,: Catalogue of alien plants of the Czech Republic. Preslia, Praha, 74: 97-186, 2002.
- SLAVÍK, B. [ed.]: Květena České republiky. 6. [Flora of the Czech Republic.]. Academia, Praha, 2000.
- THERY, M.: Consommation des fruits et dissémination des graines par le merle noir (*Turdus merula* L.) en zone périurbaine sous climat tempéré. Acta Oecologica/Oecologia Applicata, 10, 3, 271-285, 1989.