Distribution of selected neophytes along the national railway network of Luxembourg

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Abstract. This article presents the results of a first systematic survey of eight invasive alien plant species conducted along the complete network of the national railway company of Luxembourg in 2013: summer lilac (*Buddleja davidii*), Japanese knotweed, Sakhalin knotweed and their hybrid (*Fallopia japonica*, *F. sachalinensis*, *F. ×bohemica*), giant hogweed (*Heracleum mantegazzianum*), Himalayan balsam (*Impatiens glandulifera*), staghorn sumac (*Rhus typhina*) and black locust (*Robinia pseudoacacia*).

Keywords. biological invasions, invasive alien species, neophytes, plant invasions, vascular plants, railways, Luxembourg.

1. Introduction

During maintenance works along the railway tracks in Luxembourg, three employees of the national railway company CFL were injured because they had removed specimens of giant hogweed (*Heracleum mantegazzianum*) without the necessary safety equipment.

This incident led the railway company to order a survey of giant hogweed along their entire railway network in co-operation with the National Museum of Natural History. In order to gain some insights into the general distribution of further invasive neophytes along the railway tracks, the survey was extended to include *Buddleja davidii*, *Fallopia japonica*, *F. sachalinensis*, *F. ×bohemica*, *Impatiens glandulifera*, *Rhus typhina* and *Robinia pseudoacacia*.

The present contribution summarizes the results of this survey. The nomenclature of the vascular plants follows Lambinon et Verloove (2012).

2. Methods

From July 2nd to August 19th 2013 the railway tracks were inspected along the 275 km of the national railway network and scanned systematically for the presence of the different neophyte species.

Based on the Gauss-Luxembourg coordinate system we laid a 1 x 1 km grid over Luxembourg. Our sample (100%) consists of 324 grid cells containing at least one railway track. The maps also show the grid of the *Institut Floristique Belgo-Luxembourgeois* (IFBL).

Coordinates of neophyte populations were determined by GPS (Garmin Geko™ 301).

3. Results

3.1. *Buddleja davidii*

Summer lilac (*Buddleja davidii*) is widely cultivated in gardens across Luxembourg, from where it can easily make its way into the wild. At present, the occurrence of the species along the railway tracks in Luxembourg is limited to the South of the country and to Wasserbillig in the Moselle valley (Fig. 1). During the survey, populations of summer lilac have been found in seventeen grid cells (5,2%).

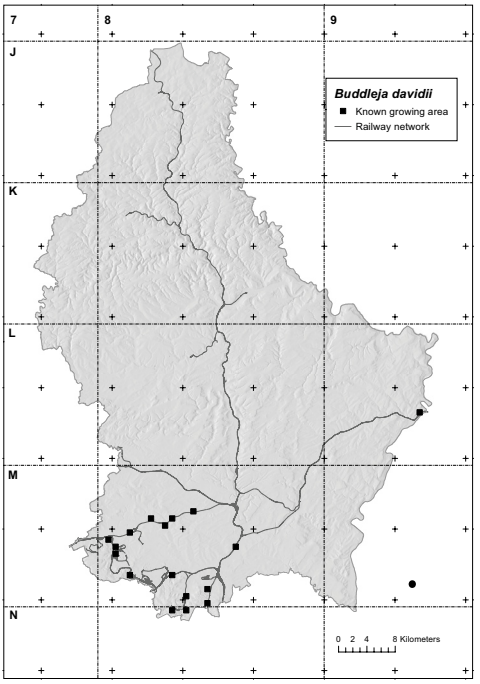

Fig. 1. Distribution of *Buddleja davidii* along the national railway network (2013).

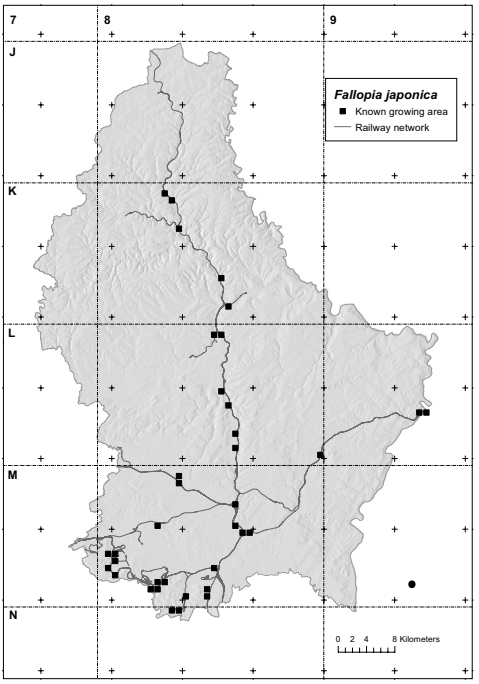

Fig. 2. Distribution of *Fallopia japonica* along the national railway network (2013).

Summer lilac is native to China and has been introduced to Europe as an ornamental in the late 1800's. It has spread since World War II especially on urban ruderal areas and along railway tracks in Central and Western Europe (Kowarik 2003). As the species has not saturated its potential distribution range the invasion process is still going on (Ebeling 2008).

3.2. *Fallopia japonica*, *F. sachalinensis* and *F. ×bohemica*

Japanese knotweed (*Fallopia japonica*) occurs along most of the railway lines in Luxembourg (11,11% of the grid cells) and usually forms huge and dense colonies (Fig. 2). Originating from Japan, Japanese knotweed grows in Europe mainly along rivers, roads and railways. For the maintenance and security of transport infrastructure, this plant poses a problem since it occupies much space and can impair the function of these infrastructures because of its high growth and rapid spread. The rhizomes are able to detach paving stones and even break through asphalt. Once established in a slope, Japanese knotweed can grow onto the track. In addition, the plant is problematic because its dense foliage suppresses native vegetation and is extremely difficult to remove (Bollens 2005).

Originating from Sakhalin, the largest Russian Island, Sakhalin knotweed (*Fallopia sachalinensis*) is much less common in Luxembourg than Japanese knotweed. During the survey it was only found once along the railway line Bettembourg – Esch/Alzette in the centre of Schifflange (Fig. 3). The potential problems caused by the species are equivalent to those caused by Japanese knotweed.

Bohemian knotweed (*Fallopia ×bohemica*), the hybrid between *F. japonica* and *F. sachalinensis*, is generally an under-recorded component of the knotweed populations, because it is not easily identified. Usually, a genetic analysis is required to identify it without doubt. It occupies the same habitats as Japanese knotweed. During the survey along the Luxembourg railway network the

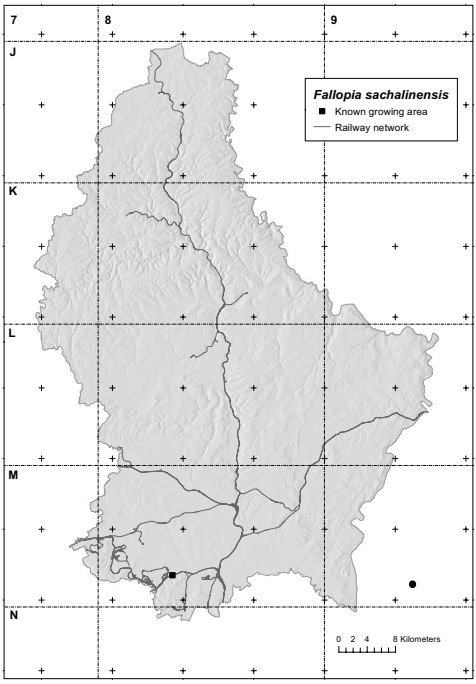

Fig. 3. Distribution of *Fallopia sachalinensis* along the national railway network (2013).

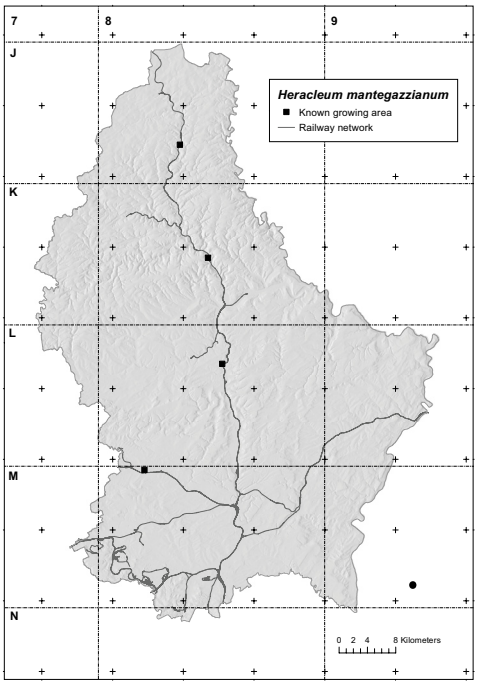

Fig. 4. Distribution of *Heracleum mantegazzianum* along the national railway network (2013).

hybrid has not been recorded. Because of the aforementioned identification problems, it cannot be excluded though that some of the populations of Japanese knotweed are in fact occurrences of its hybrid Bohemian knotweed.

3.3. *Heracleum mantegazzianum*

Giant hogweed (*Heracleum mantegazzianum*) is native to Caucasia and has first been reported from Luxembourg in the 1930s (Krippel & Richarz 2013: 5). The results of the present survey show that giant hogweed is not very common along the Luxembourg railway network. The species occurred in three different sites along the railway line Luxembourg - Troisvierges and one site near Windhof along the line Luxembourg - Kleinbettingen (Fig. 4), one of the oldest and largest populations of giant hogweed in the country (Reichling 1990: 62). These populations have been eradicated by the services of the railway company right after having been recorded during the present survey.

3.4. *Impatiens glandulifera*

Since the Himalayan balsam (*Impatiens glandulifera*) is usually confined to humid habitats, it's occurrence along the railway network is mostly linked to the closeness of a river. The species was present in 45 grid cells (13,89%). On the distribution map this is apparent along the rivers Alzette, Sûre, Wiltz and Clerve (Fig. 5). Not every railway line close to a river is affected though, as can be seen for example for the line Luxembourg – Wasserbillig where it runs in parallel to the Syre river.

3.5. *Rhus typhina*

The distribution of staghorn sumac (*Rhus typhina*) along the railway lines is comparable to that of summer lilac with a concentration in the South and East of the country but with a larger presence (8,64% of the grid cells) (Fig. 6). Native to eastern North America, the species tolerates a wide variety of conditions. Typical growing sites include ruderal habitats, open fields, roadsides and

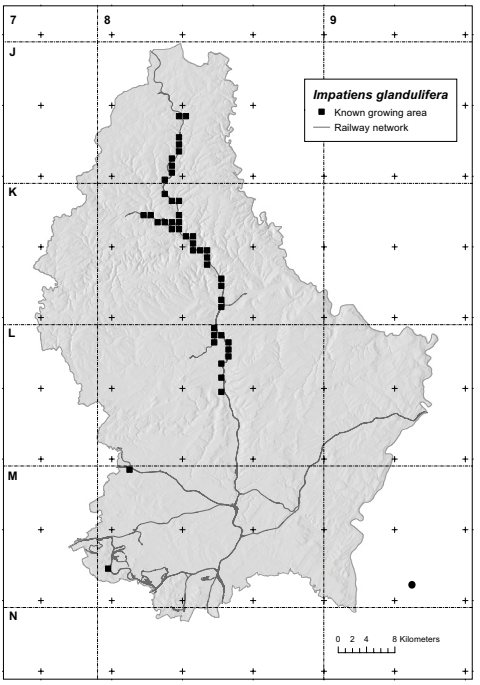

Fig. 5. Distribution of *Impatiens glandulifera* along the national railway network (2013).

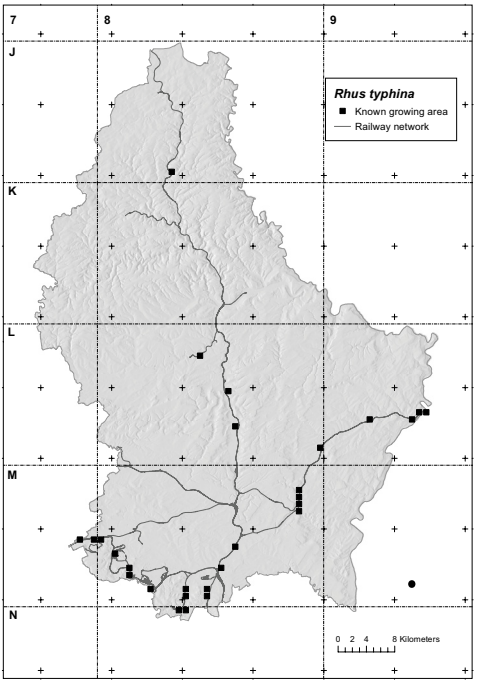

Fig. 6. Distribution of *Rhus typhina* along the national railway network (2013).

railway areas, but also forest edges, clearings and shrublands. Staghorn sumac is not highly shade-tolerant and is considered to be an early successional species. The plant may be easily propagated via root fragments in soil movement.

3.6. *Robinia pseudoacacia*

Native to the southeastern United States, Black locust (*Robinia pseudoacacia*) is by far the neophyte with the largest distribution along the railway tracks in Luxembourg (Fig. 7). The species who has often been planted in order to stabilize slopes of transport infrastructure is found in 47,84% of the grid cells. Dry and well ventilated soil conditions, as found on railway tracks and slopes, facilitate installation and spreading of black locust. Once introduced, the species expands readily by root suckering and stump sprouting and forms dense clones creating shaded islands from which most native plants are outcompeted. The area potentially invaded by black locust is likely to increase considerably under a warmer climate.

4. Discussion

If one considers the results of the survey independently of the species, it becomes apparent that most of the Luxembourg railway network - 59,26% of the grid cells - is concerned by at least one of the neophytes that have been investigated (Fig. 8).

Along with waterways, railway lines are known to be one of the effective ways for the spreading of neophytes. Apart from the fact that the slopes of the railway network are often disturbed areas, the airstream caused by passing trains helps to spread the seeds of different neophyte species. So, since the middle of the 19th century, the construction of railway lines and the rail traffic have contributed to the spread of neophytes in Europe (Klein 1910, Kowarik 2010, Schuh et al. 2011).

The spreading of some species is related not only to the conditions on the railway tracks and its slopes but also to the management of the vegetation along the railway network. Whereas control measures are recommended against *Heracleum mantegazzianum*

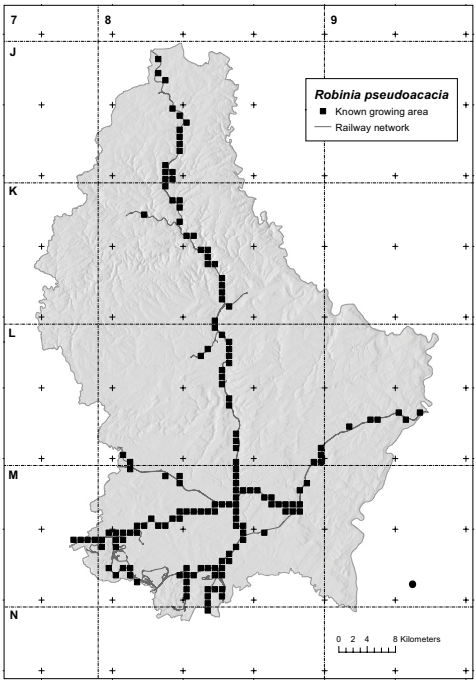

Fig. 7. Distribution of *Robinia pseudoacacia* along the national railway network (2013).

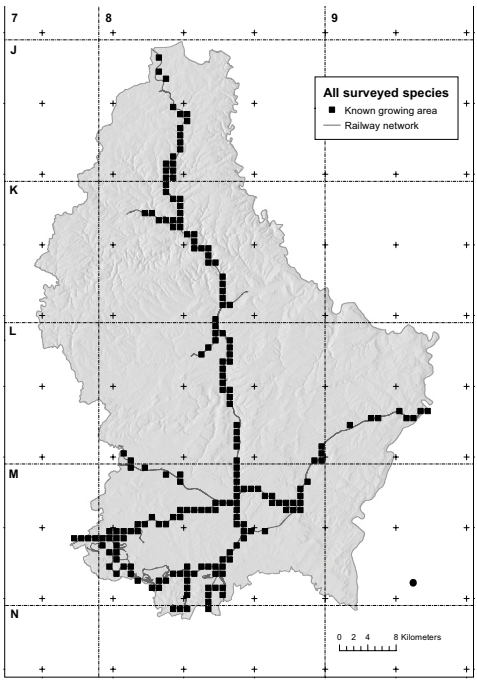

Fig. 8. Distribution of neophytes along the national railway network (2013).

and *Rhus typhina* because of human health issues, the populations of *Fallopia*-species should be monitored because of their potential to damage railway infrastructure.

Acknowledgements

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