

Aerial biomass of *Reynoutria japonica* and its comparison with that of native species

Nadzemní biomasa *Reynoutria japonica* a její srovnání s domácími druhy

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K e y w o r d s : *Reynoutria japonica*, invasive plant, aerial biomass, Czech Republic

Aerial biomass of *Reynoutria japonica* was estimated in one locality in South Bohemia, Czech Republic in 1993. Dry weight of aerial biomass averaged 903 g/m² which value is similar to that reported from the British Isles. By comparing this biomass with that of native plants which often grow in the same habitat as *R. japonica*, we argue that the aerial biomass itself probably cannot be responsible for a strong competitive ability of this alien species.

Introduction

There is hardly any other herbaceous species in central European flora exhibiting such strong competitive ability as *Reynoutria japonica*. If successfully established, this species is able to outcompete all other species in a site (Sukopp et Sukopp 1988, Grime et al. 1988, Beerling 1991). A hypothesis was considered that high productivity, reflected in high aerial biomass, is especially responsible for the competitive ability of the species (see, e.g. Grime 1979). The aim of this paper was to estimate the aerial biomass of *R. japonica* and compare it with that of other species which often interact with *Reynoutria* polycormones. Moreover, the data provide an opportunity to compare the species biomass with that reported by Brock (1995) from the British Isles.

Reynoutria japonica was introduced to the territory of the Czech Republic at the end of the last century. Since then it has spread rapidly over the country, especially during the last three decades (see Pyšek et Prach 1993). It has been expanding especially in various ruderal habitats and along rivers where it usually forms compact, thick layers. Subsequently, the species diversity in sites where *R. japonica* has become established is reduced, access to these sites is restricted, and various technical problems in river management often occur (Sukopp et Sukopp 1988, Wade et al. 1993, de Waal et al. 1994). Autecological characteristics of the species were summarized by Grime et al. (1988).

Table 1 - Aerial biomass of *Reynoutria japonica* stands in comparison with those dominated by species which often grow in the same habitats as *R. j.* and are outcompeted by it.

Stands dominated by:	Habitat	Dry weight (g/m ²)	References
<i>Reynoutria japonica</i>	Settlement	903	this study
<i>Reynoutria japonica</i>	Settlement/floodplain	937	Brock (1995)
<i>Urtica dioica</i>	Floodplain	948	Prach et al. (unpubl.)
<i>Phalaris arundinacea</i>	Floodplain	720	Prach et al. (unpubl.)
<i>Phalaris arundinacea</i>	Floodplain	1259	Tetter et al. (1988)
<i>Arrhenatherum elatius</i>	Abandoned field	686	Osbornová et Prach (1989)
<i>Artemisia vulgaris</i>	Abandoned field	502	Osbornová et Prach (1989)
<i>Tanacetum vulgare</i>	Spoil heaps	600	Prach (unpubl.)
<i>Calamagrostis epigeios</i>	Emerged bottom	1150	Dolečková (1989)
<i>Alopecurus pratensis</i>	Floodplain	360	Prach et al. (unpubl.)
<i>Alopecurus pratensis</i>	Floodplain	615	Rychnovská et al. (1985)

Methods

The study site was situated in the area of Botanical Institute at Třeboň, South Bohemia, 430 m a.s.l. The site was partly shaded by buildings, sufficiently wet and fertile, and was not mown.

Shoots were sampled at the beginning of October 1993. Twenty two shoots were randomly selected and cut at the stem base. The shoots were oven-dried for 30 hours at 90°C and weighed.

In the same stand, three quadrats of 2 × 2 m in size were randomly selected, all rooting shoots counted, and total aerial biomass was estimated on the basis of the average shoot weight. Data on aerial biomass (dry weight), both published and unpublished, were gathered for those species native to central Europe which often accompany *R. japonica*.

Results and discussion

The weight of individual shoot was 101.4 ± 47.8 g/m² (mean ± S.D.; n=22) and there were 8.9 shoots/m². The average standing crop of *R. japonica* was thus estimated at 903 g/m². This figure corresponds to that reported by Brock (1995) from United Kingdom (937 g/m² on average). Because in the present paper the sampling was carried out later in

the growing period, the value obtained might have been slightly lower than earlier in the summer. However, the stand was in good conditions, undamaged by frosts, and obviously there were only minor losses caused by leaf dehiscence. Maximum biomass reported by Brock (1995) was also attained in the late season.

No biomass estimations have been reported from central Europe (Sukopp et Sukopp 1988). Recently, Sukopp et Starfinger (1995) gave estimations on aerial biomass of the congener *Reynoutria sachalinensis* which reached 2000 g/m². Despite this high productivity, compared to *R. japonica*, this species is much less invasive in central Europe (Pyšek et Prach 1993).

Table 1 presents the comparison of our results with aerial biomass of some other species, commonly growing in the same habitats as *R. japonica*, and often being outcompeted by this species.

It is evident that the aerial biomass of *R. japonica* is comparable with productive native forbs and grasses. However, some recent results (Horn, unpublished data) indicate that higher values can be attained depending on a site. We conclude that the aerial biomass itself cannot be considered as responsible for the high competitive ability of this species (in the *Reynoutria* stand subjected to our study there were no other species recorded). Instead, some other growth characteristics must therefore play a role in conditioning its competitive success. *R. japonica* certainly profits from its fast growth early in the season (Grime et al. 1988) when it quickly overtops other species and develops dense and horizontally inclined leaves.

The seasonal dynamics of leaf area is probably a decisive factor responsible for suppressing the other species. Testing this hypothesis, however, requires further study. Underground competition can be another important factor. Underground biomass was estimated by Brock (1994) at nearly 1500 g/m². However, if not tested experimentally, the possible role of underground competition remains speculative. The exact answer to what makes *R. japonica* such a strong competitor is still open.

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Souhrn

Nadzemní biomasa invazního druhu *Reynoutria japonica* byla stanovena na jedné lokalitě v jižní části Čech v r. 1993. Činila průměrně 903 g sušiny na 1 m². Tato hodnota je blízka údajům z Anglie. Při srovnání s nadzemní biomasou porostů domácích druhů, které často rostou společně s *R. japonica*, vyplynulo, že nadzemní biomasa sama o sobě nemůže vysvětlovat silnou konkurenční schopnost druhu v našich podmínkách. Biomasa je sice vysoká, ale nepřevyšuje hodnoty udávané pro produktivní domácí druhy. Pravděpodobně důležitější je sezónní dynamika rozvoje listového aparátu, případně kořenová konkurence.

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