Biologically active compounds as a possible cause of invasibility of knotweeds (*Reynoutria* spp.) from eastern Asia

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INTRODUCTION

Two species knotweed (*Reynoutria* spp.) spread from East Asia to Europe at the beginning of the nineteenth century. Now, Japanese knotweed (*Reynoutria japonica*), giant knotweed (*Reynoutria sachalinensis*) and, in addition, their hybrid Bohemia knotweed (*Reynoutria* × *bohemica*) are widespread in central Europe. The hybrid is a very persistent, invasive plant which suppresses the original species and in this way changes biological diversity wherever it penetrates. Therefore, in our regions, Bohemia knotweed is undesirable.

The investigation is now concentrated on a study of resveratrol, piceid and other stilbenes in the roots of Japanese knotweed (Vastano *et al*., 2000; Vrchotová *et al*., in press). Several biologically active substances with the estrogenic activity have been found in the roots of Japanese and giant knotweeds, e.g. emodin and derivatives of 9,10-anthrachinon (Inoue *et al*., 1992; Yang *et al*., 2001), and extracts from the latter species contain substances with fungicide effects (Konstantinidou-Doltsinis & Schmitt, 1998). The pattern of phenolic compounds in the aerial parts of knotweeds have not yet been described in detail. However, catechins, chlorogenic acid, caftaric acid and quercetin derivatives have been found in *Reynoutria* by Vrchotová *et al*. (2004).

MATERIALS AND METHODS

The leaves and stems of knotweeds were collected in May, flowers in September and rhizomes in October 2002, in the Český Krumlov district (Czech Republic), from five specimens of each species. The leaves, stems and flowers were dried at laboratory temperature; the material was then pulverized and extracted with diluted methanol. Rhizomes were extracted fresh. The samples were analyzed using HPLC with a DAD detector on C18 column (2 × 150 mm, 3 μm), in water – acetonitrile gradient with the addition of trifluoroacetic acid.

For determination of total quercetin, the extracts were hydrolyzed in hydrochloric acid and then purified on a SPE column (C_{18}). After purification, the extracts were analyzed using CE with a UV detector, and borate buffer (pH 9.2) with the addition of SDS and methanol.

RESULTS AND DISCUSSION

Catechins (sum of catechin and epicatechin) were found in all parts of *Reynoutria,* but the largest amounts were found in the flowers of Japanese knotweed (2,035 mg/kg d.w.). The amount of catechins reached 2,400 mg/kg f.w. in the roots of giant knotweed, about twice that in Japanese knotweed (see Vrchotová *et al*., in press). Large quantities of quercetin derivatives were found in all aerial parts, e.g. the total amount of quercetin in the flowers of Japanese, giant and Bohemia knotweed was 11,100, 16,600 and 19,500 mg/kg d.w., respectively. Resveratrol and its derivatives occurred mainly in the subterranean parts. The amount of resveratrol in stems was 11-13 mg/kg d.w., but none was found in the flowers or leaves. The largest amount of resveratrol was found in the rhizomes of Japanese knotweed (1,800 mg/kg f.w.); only 24 mg/kg f.w. was found in the rhizomes of giant knotweed by Vrchotová *et al*. (in press).

Stilbenes and catechins are substances with antioxidative, antimicrobial, anticancerogenic and fungicidal effects. The viability and resistance of knotweeds against parasitic fungi and pollutants are connected most probably with the high content of the above-mentioned phenolic compounds. The invasive plants have only a few natural enemies. Japanese knotweed is more invasive than giant knotweed, and this could be due to the high content of stilbenes in the roots. This may also be the reason why dead masses of the knotweed decay slowly and incompletely.

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