

Key to Identification of Invasive Knotweeds in British Columbia



Photo: L. Wilson

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March 2007



**BRITISH
COLUMBIA**

Ministry of Forests and Range
Forest Practices Branch
Invasive Alien Plant Program

Citation: Wilson, Linda M. 2007. Key to Identification of Invasive Knotweeds in British Columbia. B.C. Min. For. & Range, For. Prac. Br., Kamloops, B.C.

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Thanks to Cindy Roché for the illustrations rendered and portrayed in Figure 1 of this key.

Cover picture: Japanese knotweed by the Village of Queen Charlotte, B.C.

INTRODUCTION

“The largest female on earth could strangle Britain” was the title of an article in the London Daily Telegraph to describe the vastness of a single infestation of one of Britain’s worst weeds, Japanese knotweed. An interesting fact about Japanese knotweed is that in its native range some plants have normal, bisexual flowers (perfect and fertile) with complete sets of male and female floral parts, or plants have flowers with just female parts (sterile). And it happens that all the Japanese knotweed in the UK is the female type. Lacking male floral parts and thus pollen, knotweed does not bear seed in Britain. This fact has not hampered its spread in the UK, however, as knotweed relies on its vast network of creeping rhizomes to generate new shoots, eventually forming huge impenetrable thickets that are, essentially, single, individual females! This is the same pernicious Japanese knotweed we are battling in British Columbia and elsewhere in Canada and the United States.

Japanese knotweed is one of four invasive knotweeds in British Columbia. Everywhere they have invaded, knotweeds are posing serious threats to soil, water and land resources, impacting biodiversity and ecosystem processes. Japanese knotweed is particularly problematic where it occurs outside its native range, and has been listed among the “World’s 100 Worst Invasive Alien Species” by the World Conservation Union (www.issg.org/booklet.pdf).

TAXONOMY

Knotweeds belong to the buckwheat family, Polygonaceae. Four knotweeds have become major problem weeds in Canada and the United States, and all four occur in British Columbia. Japanese knotweed (Figs. 1, 4) was introduced into North America in the 1800’s along with its big cousin, Giant knotweed (Figs. 1, 3), as garden ornamentals (Barney 2006). A fertile hybrid between Japanese and giant knotweed, Bohemian knotweed (Figs. 1, 5), is a vigorous, aggressive offspring that has become even more abundant and invasive than either of its parents. The fourth, less abundant relative is Himalayan knotweed (Figs. 1, 2).

As the common names suggest, invasive knotweeds are native to Asia. Japanese knotweed is native to Japan, China, Korea, and Taiwan. Giant knotweed is native to northern Japan (Hokkaido and Sakhalin Islands). Himalayan knotweed is native to the Himalayan mountain region of southern Asia. Invasive knotweeds have also become weeds in Europe, Australia and New Zealand.

Scientific names of the invasive knotweeds have undergone changes in the last several years. Until recently, all four knotweeds were in the genus *Polygonum*. Japanese knotweed, formerly *Polygonum cuspidatum*, is now *Fallopia japonica*. Bohemian knotweed, formerly *Polygonum x bohemicum*, is now *Fallopia x bohémica*. Likewise giant knotweed, formerly *Polygonum sachalinense*, is now *Fallopia sachalinensis*. Only Himalayan knotweed, *Polygonum polystachyum*, has been retained in the original genus.

DESCRIPTION and LIFE HISTORY

Knotweeds are tall, herbaceous, creeping, perennial weeds. Large overwintering roots produce new shoots in March and April. Plants grow rapidly, reaching their full height by late June. Knotweed typically grows in large clumps of stout, bamboo-like stems 1.5 to 6m tall. Though hollow, the jointed stems have solid nodes, each surrounded by a papery sheath (stipule). Stems are unbranched to profusely branched, and all bear alternate leaves on a long stalk (petiole) arising from the stem. Japanese knotweed leaves tend to be very straight (truncate) across the base and taper sharply at the tip. Giant knotweeds leaves can reach 40cm in length and have a distinctly heart-shaped (cordate)

base. Not surprisingly, the leaves of Bohemian knotweed, being a hybrid between giant and Japanese knotweed, are intermediate in size and shape (Zika and Jacobson 2003). Himalayan knotweed leaves are narrower and more elongate than the other species.

Flowering occurs during late August to mid October, depending on location. The flowers of knotweed are unusual. They are small, 2.5-3 mm long, greenish-white to pinkish-white, and grow in showy drooping or upright sprays that are attached to the leaf axil near the ends of the stems. Japanese knotweed and the hybrid, Bohemian knotweed, are 'gynodioecious', meaning that some plants have only female flowers, and other plants have perfect, bisexual flowers, with both male and female floral parts intact. As in Britain, Japanese knotweed in North America bears only female flowers, and thus is sterile. Both types of Bohemian knotweed plants occur in British Columbia and elsewhere in the Pacific and Inland Northwest. Those Bohemian knotweed plants having perfect flowers produce pollen, and thus can produce seed. It appears that Bohemian knotweed's pollen can fertilize female Japanese knotweed flowers, enabling Japanese knotweed to bear seed where the two grow in the same location. Giant and Himalayan knotweed flowers are uniformly perfect, and these species regularly bear seed. The black shiny seeds are 3mm long, and are enclosed in a papery capsule. Leaves and stems die after frost but the tall stalks persist as sentinels through the winter and into the next year. Roots and rhizomes remain dormant but alive throughout the winter.

Because of sporadic seed production, and limited seedling survival, most reproduction and spread of knotweed is accomplished by vegetative means. Rhizomes, extending metres beyond the plant, are the main source of new shoots that arise throughout the growing season. Extensive networks of rhizomes can yield massive colonies of interconnected knotweed stems.

DISTRIBUTION and HABITAT PREFERENCE

In Canada, invasive knotweeds are found in seven eastern provinces and in British Columbia (USDA, NRCS, 2005). In the United States, knotweeds are reported in 41 states. In the west, they are most abundant in the coastal areas of Washington, Oregon and Alaska, where season-long precipitation supports its lush growth. Throughout the invaded range in North America, it appears as though most of what has been called Japanese knotweed is actually the hybrid, Bohemian knotweed, which is considered to be significantly more aggressive and better adapted to a broader range of sites than either of its parents.

Knotweeds grow in a variety of soil types, including loams, silts and sand, and can tolerate soils with pH to 7.4 (Shaw and Seiger 2002). They do not like shade, preferring open, exposed sites with full sun. They thrive on moist, disturbed sites, and thus are often associated with canals, ditches, streambanks, lakeshores and beaches (Beerling et al. 1994). Drier areas in the Inland Northwest limit knotweeds to moister habitats. The habitat requirements of Giant and Himalayan knotweeds are similar to Japanese and Bohemian knotweeds.

INVASION SUCCESS

'Escaped ornamental' is the term most often used to explain the widespread occurrence of our invasive knotweeds. Since arriving in the 1800's their brilliant, late-season flowers, handsome foliage, and striking height have made them highly sought after by gardeners and landscapers. After a time, these hardy, persistent denizens escape their manicured environs to colonize roadsides, streambanks, lakeshores, fields and meadows. All four knotweeds are capable of occupying diverse habitats in both moist and dry conditions, but spread most aggressively along rivers and streams. There are many examples of rhizomes being transported in soil by human activities and other disturbances. Flooding and erosion can dislodge rhizome fragments from the streambank, ditch or

shoreline: rhizome fragments become the source of new infestations as they lodge and root into favorable downstream niches. Even large segments of rhizome can float long distances in fresh water, and fragments even tolerate being transported, at least for short distances, in salt water (Beerling et al. 1994). This potentially can have important implications for how knotweed disperses or is spread along coastal BC. Moreover, plants can reliably regenerate from less than 2 cm of rhizome (Shaw and Seiger 2002), thus even the smallest piece of rhizome can initiate a major infestation. Once established, the knotweed clone spreads quickly, completely monopolizing limited above- and belowground resources, displacing other plants with its stout rhizomes and choking leaf litter, until all that remains is a deeply shaded monoculture.

MANAGEMENT

After gaining a toehold at a favorable site, knotweed is a pernicious occupier. The massive knotweed roots and rhizomes resist most control efforts, challenging land managers and gardeners who want to rid knotweed from the landscape.

Knotweeds are very difficult and expensive to control by conventional means, e.g., cutting and herbicide treatments. Cutting, mowing or grazing can reduce shoot size and density but are not effective long term unless repeated three or more times per year for several years. Attempts to dig the roots or hand pull the stems are met with rapid, aggressive resprouting from rhizomes.

Several foliar herbicides have been used with good control. Herbicides provide good topgrowth control but resprouting will mandate repeated herbicide treatments. A new method of injecting the herbicide directly into the stem has also been effective. Salt water treatments have provided temporary topgrowth control. Shading and light restriction (using black plastic) have also given some measure of control, but have not been evaluated long term and are not practical for large infestations. To be effective, mechanical, cultural, and chemical methods need to be applied in a fashion that depletes the enormous carbohydrate reserves in the massive, persistent roots and rhizomes.

A biocontrol program against Japanese, giant and Bohemian knotweed is currently being developed by CABI Bioscience in England. The British Columbia Ministry of Forests and Range (on behalf of the Ministries of Agriculture and Lands, Environment, and Transportation and Highways) is partnering with the Knotweed Biocontrol Consortium to work with scientists and practitioners both in Europe and North America to continue and expand the existing research efforts in the hopes of finding suitable biocontrol agents to help combat these aggressive, tenacious invaders.

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Key to Identification of Invasive Knotweeds in British Columbia

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General Description: The four invasive knotweeds considered in this key are tall, perennial herbaceous plants growing from large, woody roots and a broad network of stout rhizomes. Plants are 1.5 to 6m in height, forming dense thickets of spreading, bamboo-like stems up to 3cm in diameter. Stems have jointed nodes, each surrounded by a papery sheath (stipule). Leaves range from broadly lanceolate to ovoid, attached to a long petiole and arranged alternately along the stems. Japanese and Bohemian knotweeds are gynodioecious; plants with only female flowers are distinct from plants with perfect flowers (bisexual – with both male and female parts). It is thought that all Japanese knotweed plants in North America are female. Bohemian knotweed occurs as both types – some plants are only female and some are bisexual. Giant and Himalayan knotweeds produce perfect, fertile flowers. The inflorescence (cluster of flowers) extends from the leaf axil as a drooping or erect, elongate panicle of small greenish-white to pinkish-white flowers. Seed production is sporadic to regular. The smooth, 3mm long, shiny black seeds are encased in a papery-fringed capsule.

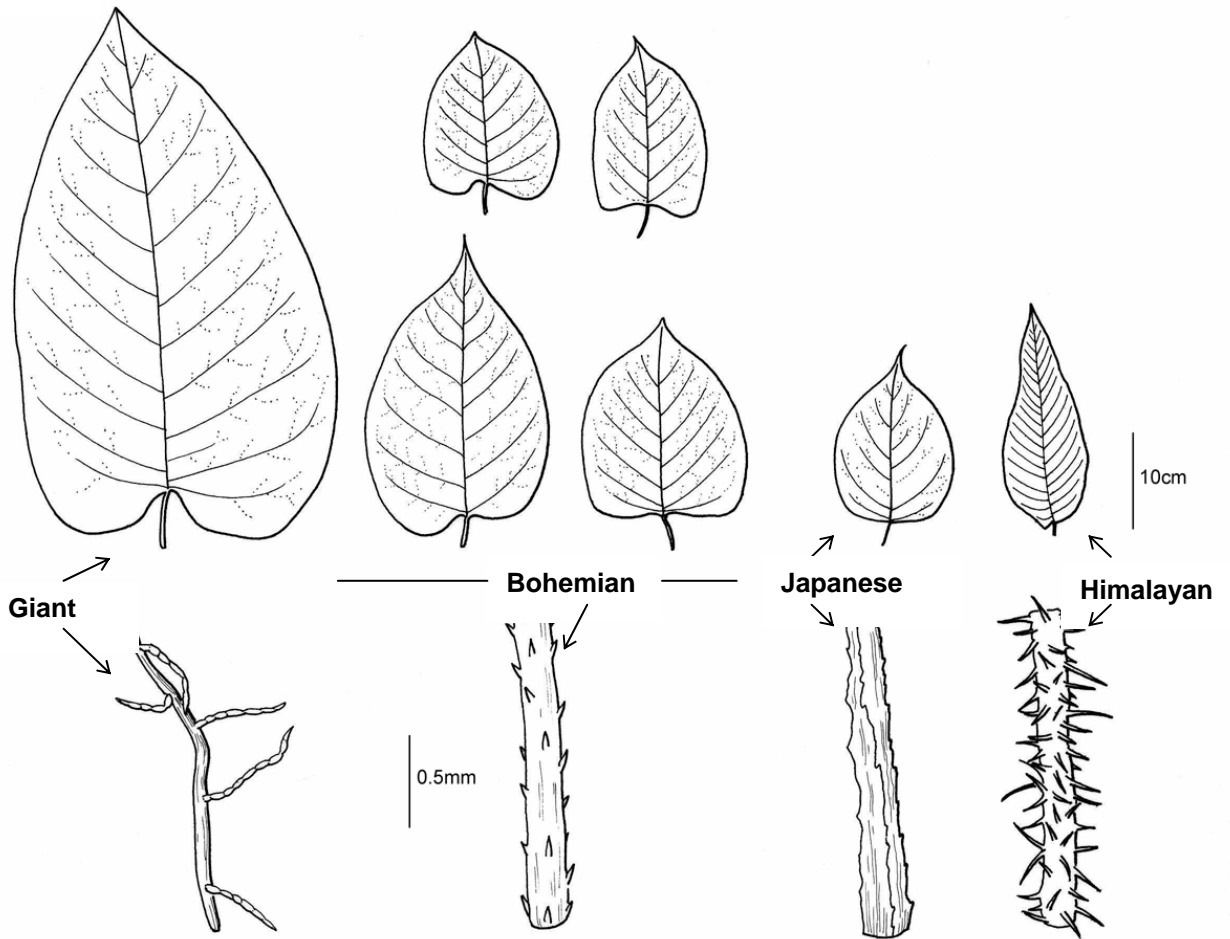
Examination of *mature, mid-stem leaves* is important to identify knotweeds. The distinguishing characters for these knotweeds are best represented on mid-stem leaves. See also Table 1.

- 1a. Leaves broadly lance-shaped, with a long pointed tip (Fig.1a), up to 20 cm long and less than ½ as broad, margins and veins on the underside of leaves with copious hairs (Fig.1b); stems branched, reddish; inflorescence a loose, spreading panicle, flowers pinkish-white, perfect (male and female parts present) (Fig.1c); plants 2 to 3 m tall
..... **HIMALAYAN KNOTWEED (*Polygonum polystachyum*)**
- 1b. Leaves ovate, with a tapered or abrupt tip, 3 to 40 cm long and about 2/3 as broad, hairs variable or absent; stems mottled purple-brown; flowers greenish-white to creamy-white..... 2
 - 2a. Mature leaves 20 to 40 cm long, base deeply curved and heart-shaped (cordate) (Fig.1a), margins and veins on the underside of leaves with distinct multicellular hairs (Fig. 1b); stems mostly unbranched; inflorescence a compact drooping panicle, flowers perfect (Fig. 1c), seeds commonly produced; plants 3 to 6 m tall
..... **GIANT KNOTWEED (*Fallopia sachalinensis*)**
 - 2b. Mature leaves usually 3 to 30 cm long, base is straight or slightly to moderately curved, flowers and inflorescence variable..... 3
 - 3a. Leaves with straight (truncate) bases, from 3 to 10 cm long, with an abruptly pointed tip (Fig.1a), margins and veins on the underside of leaves with small ridges or bumps (Fig.1b); stems profusely branched; inflorescence a loose, drooping panicle, flowers with well-developed female parts (pistils) and small, much reduced or absent male parts (stamens) (Fig.1c); seeds rarely produced; plants 1.5 to 2.5 m tall.....
..... **JAPANESE KNOTWEED (*F. japonica*)**
 - 3b. Leaves with slightly to moderately curved bases, from 5 to 30 cm long, with a sharp or tapered tip (Fig.1a), margins and veins on the underside of leaves with small hairs or blunt spines (Fig.1b); stems moderately branched; inflorescence an erect or drooping panicle, flowers with only female flowers or with perfect flowers (Fig.1c), not both; seeds often produced; plants 2 to 5 m tall **BOHEMIAN KNOTWEED (*F. x bohemica*)**

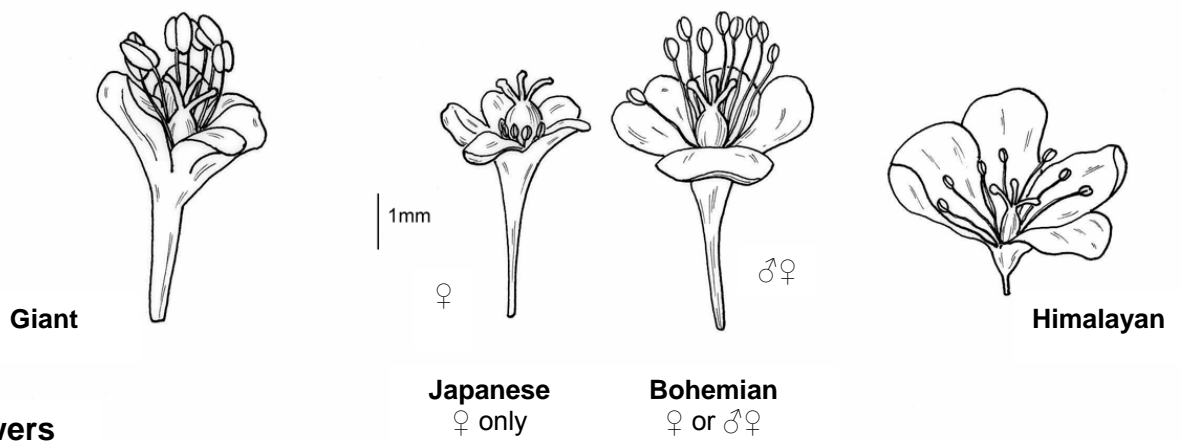
Table 1. Characteristics of invasive knotweeds in British Columbia.

Species	Stems	Leaves		Flowers			
		Size and shape	Hairs	Sex	Arrangement	Color	Seed
Himalayan knotweed	2 to 3 m, branched at upper half, stems reddish	Broadly lance shaped, up to 20 cm long and less than half as wide	Copious stiff hairs on leaf margin, veins on leaf underside with numerous stiff hairs	Perfect and fertile	Loose, spreading panicle	Pinkish-white to pink	Usually produced
Giant knotweed	3 to 6 m, few or no branches, stems mottled purple-brown	Ovate, 20-40 cm, about 2/3 as wide, deeply indented at the base (cordate), leaf tip pointed, leaf texture thin and flexible	Tiny, stiff hairs on leaf margin, veins on leaf underside have long, multicellular hairs	Perfect and fertile	Compact, drooping panicle	Greenish-white to creamy-white	Usually produced
Japanese knotweed	1.5 to 2.5 m, multiple branches, stems mottled purple-brown	Ovate, 3-10 cm, about 2/3 as wide, base straight, not curved, leaf tip abruptly pointed, leaf texture thick and leathery	No stiff hairs on leaf margin, veins on leaf underside have blunt knobs (scabers), giving them a slightly rough, ridged appearance	Female	Loose, drooping panicle	Greenish-white to creamy-white	Occasionally produced
Bohemian knotweed	2 to 5 m, few to several branches, stems mottled purple-brown	Ovate, 5-30 cm, about 2/3 as wide, base variable in shape, from \pm straight to moderately curved, leaf tip gradually to sharply tapered, leaf texture intermediate	Few or no hairs on leaf margin, veins on leaf underside have small, stout hairs	Either female or perfect	Erect or loose, drooping panicle	Greenish-white to creamy-white	Occasionally produced

a) Leaves



b) Hairs on the underside veins of leaves



c) Flowers

Figure 1. Invasive knotweeds in British Columbia. Line drawings by C. Roché.

Figure 2. Himalayan knotweed



Figure 3. Giant knotweed



Figure 4. Japanese knotweed



Figure 5. Bohemian knotweed

