

How important is seed production in the spread of Japanese knotweed (*Fallopia japonica*)?

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A single female Japanese knotweed plant was introduced to England about 1850 and in the Pacific Northwest about 1905.

Once a prize winning horticulture plant, it is now listed in many areas as one of the **Top Ten** invasive species



Photo by Sharon Gillies

The problem with knotweed

Japanese knotweed is very tolerant of soil conditions and rapidly spreads by underground rhizomes and fragmentation.

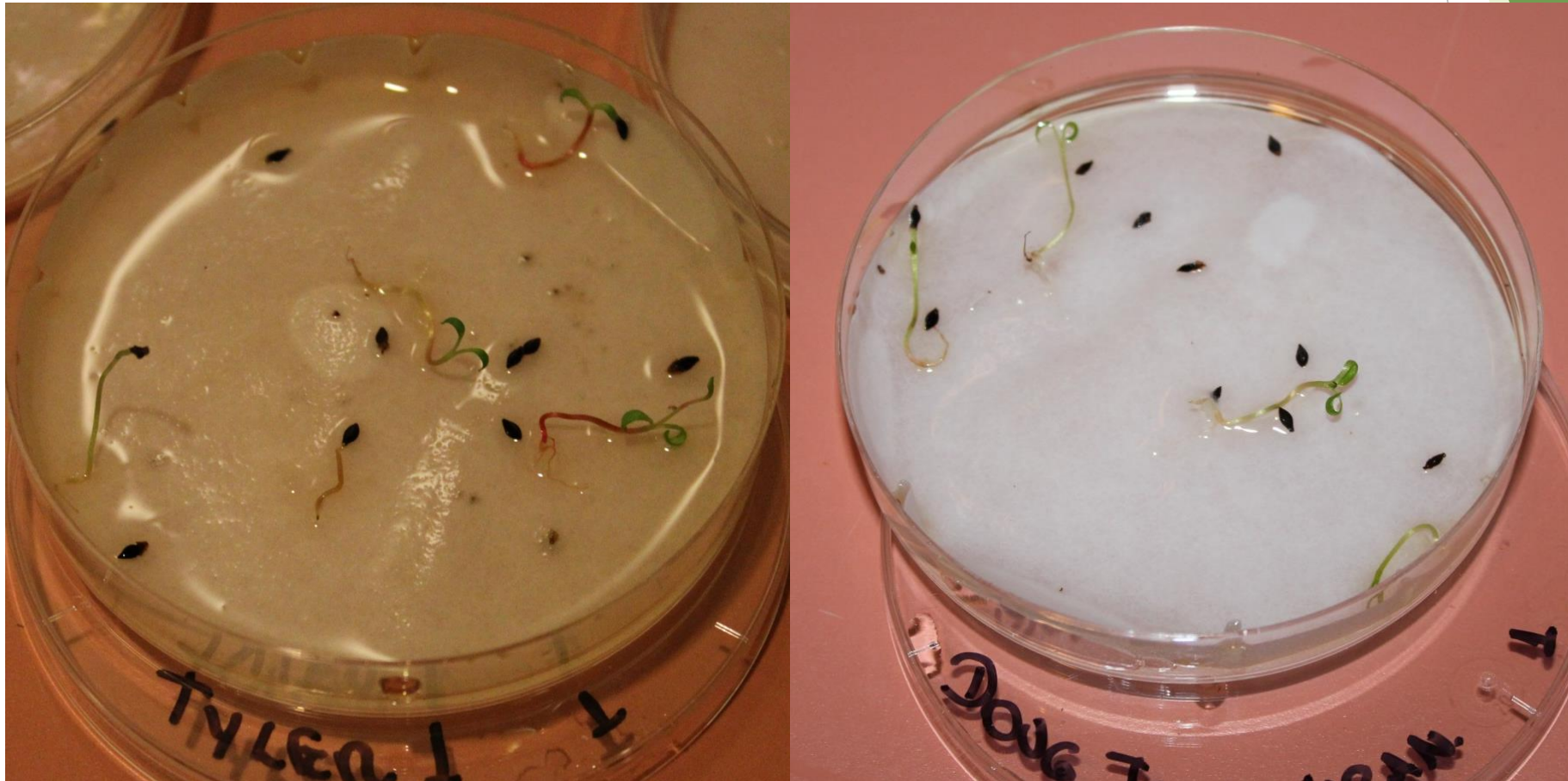


Female Japanese knotweed can produce seed - thousands of seeds



Viable Seeds

Japanese knotweed can cross with Giant knotweed and produce hybrid Bohemian knotweed

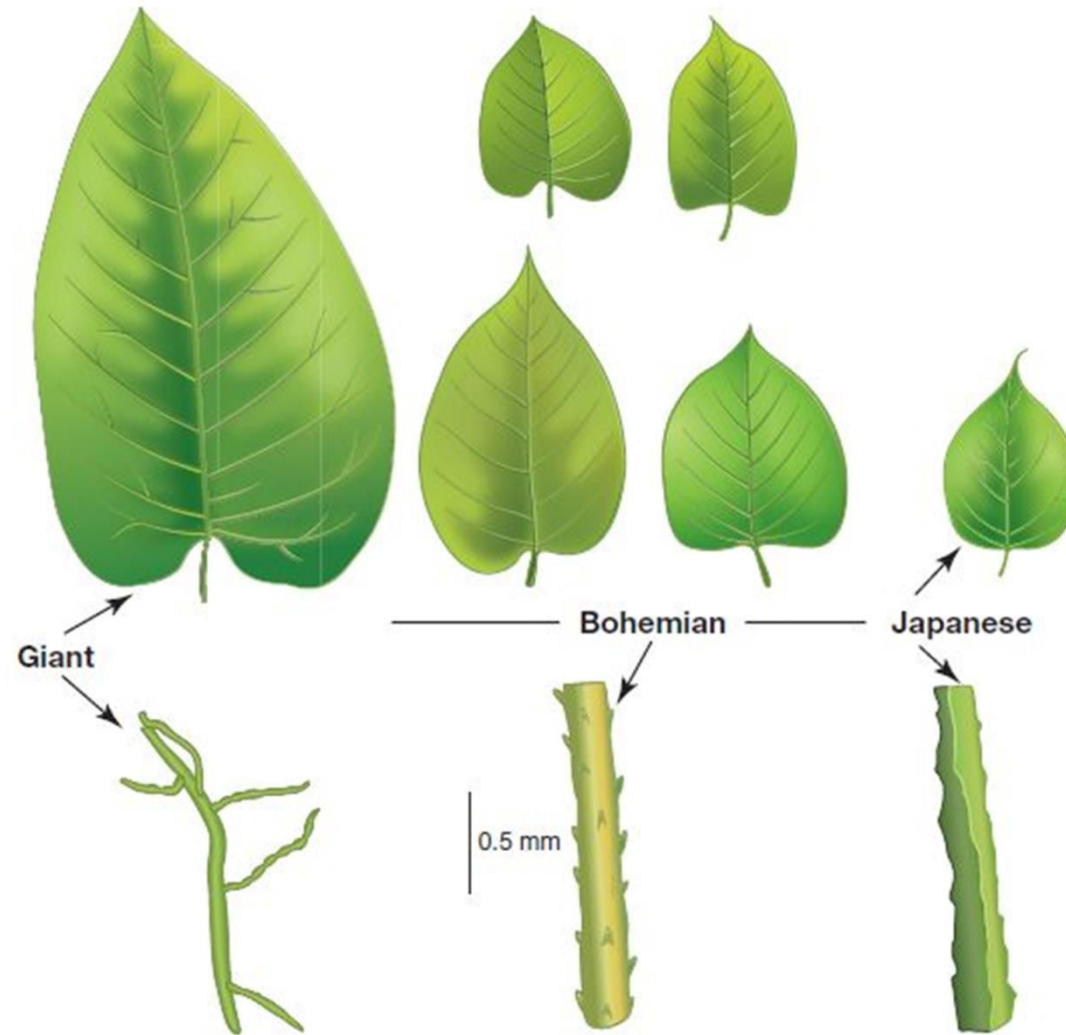




What is the identify of the invasive knotweeds in the Fraser Valley?

Are they a mix of Japanese, giant, and hybrid bohemian knotweed?

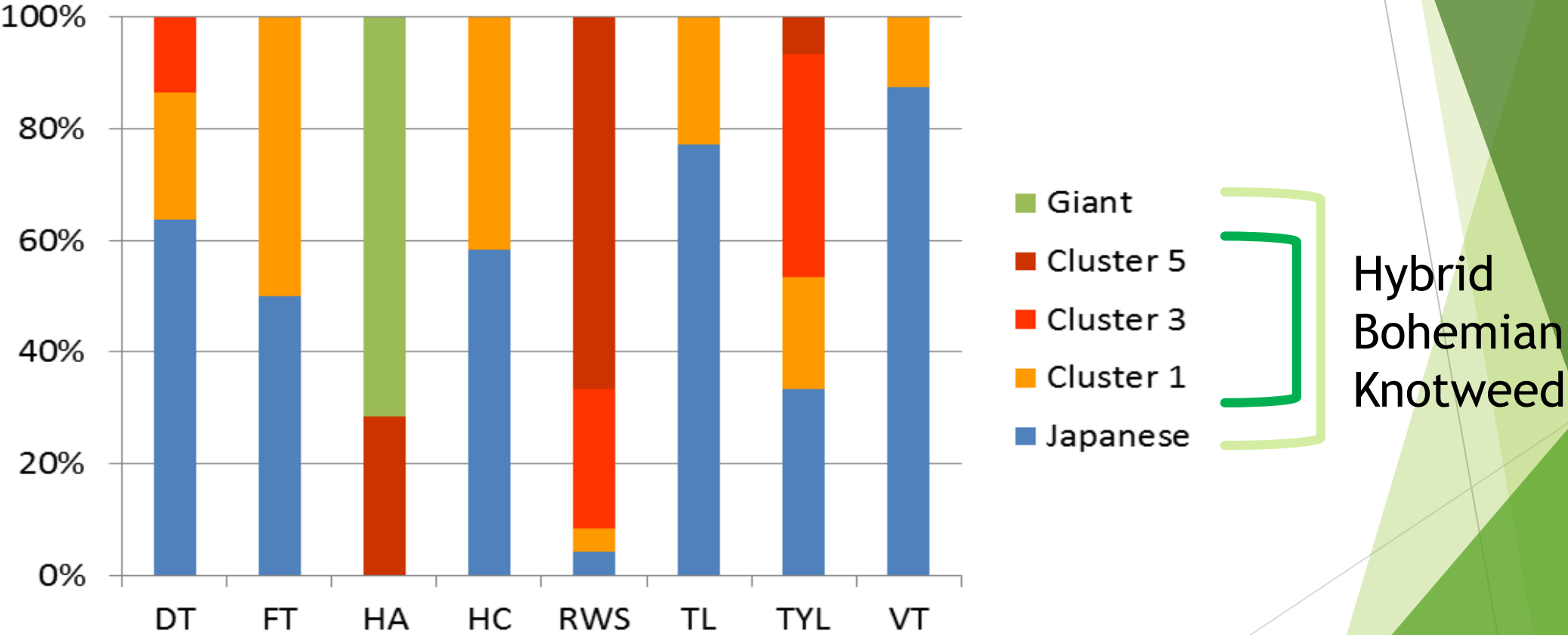
Morphology



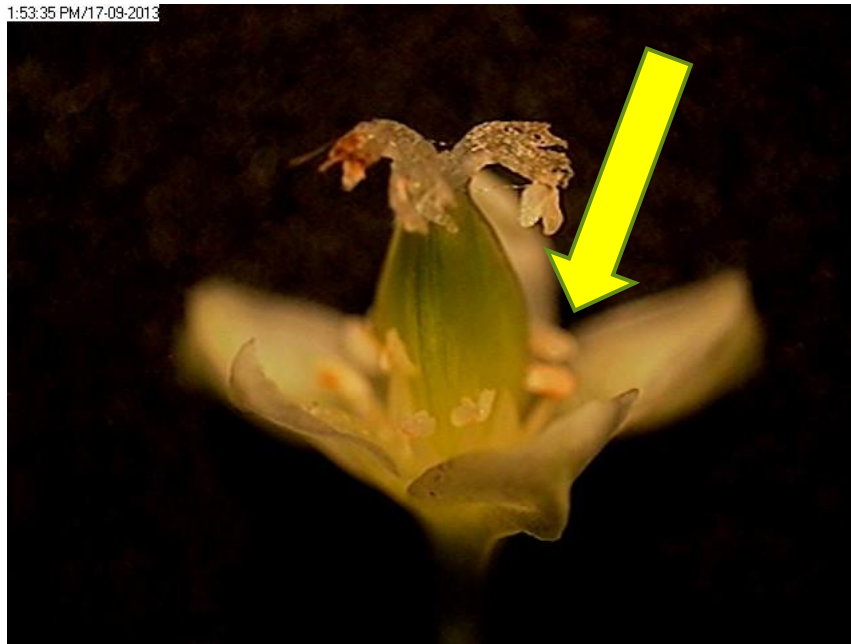
Morphology of invasive knotweed species in British Columbia. *Wilson, 2007*

Composition of Knotweed Stands in the Fraser Valley

Using Cluster Analysis for Knotweed ID



Flowers



Japanese knotweed



Bohemian knotweed

Knotweed hybrids seen at every site

- ▶ Increases availability of pollen
- ▶ Many pollinators (bees) seen on knotweed flowers
- ▶ Role of pollinators???



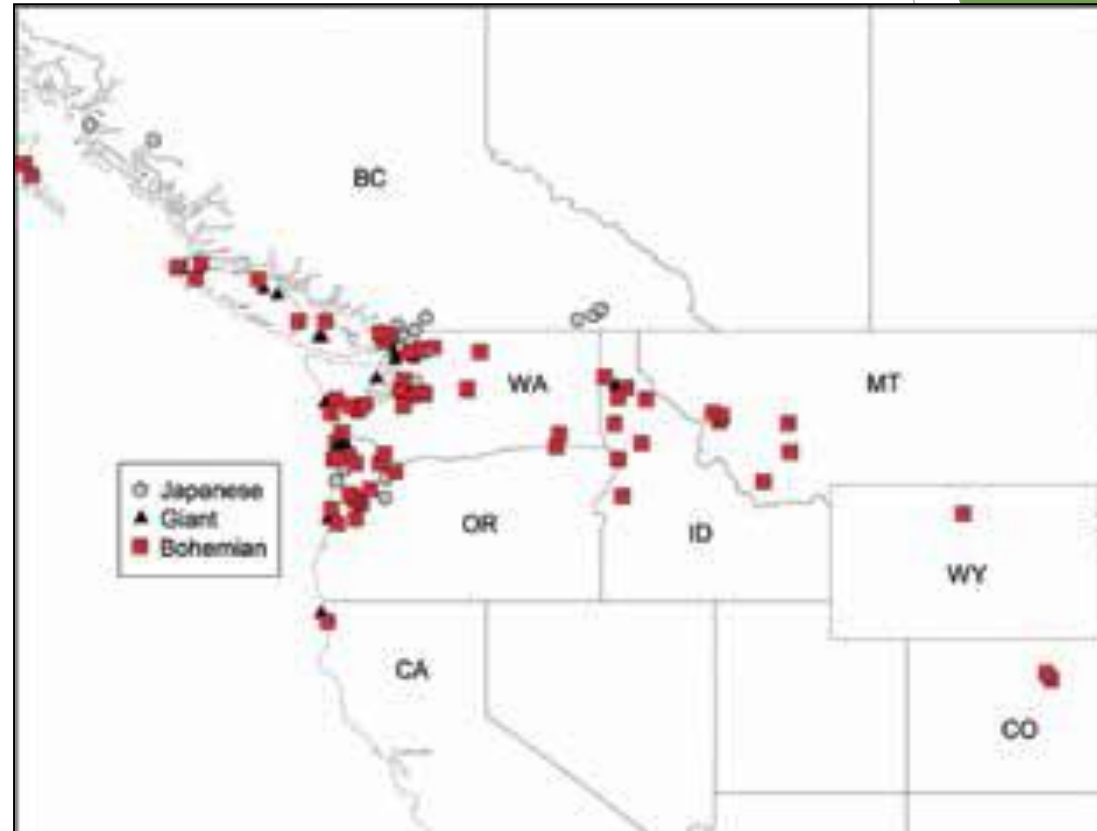
The problem with seeds

Bohemian knotweed can also become a prominent part of seed banks, with 786 seeds m² of Bohemian knotweed found in invaded sites.

Gaskin et al. (2014) postulated that the presence of novel Bohemian genotypes scattered over many locations suggests relatively frequent spread by seed.

Hybridization Common in North America DNA Analysis

A recent study of 865 knotweeds from 132 populations across the western United States and Canada showed that 72% of knotweeds sampled were the hybrid Bohemian knotweed.



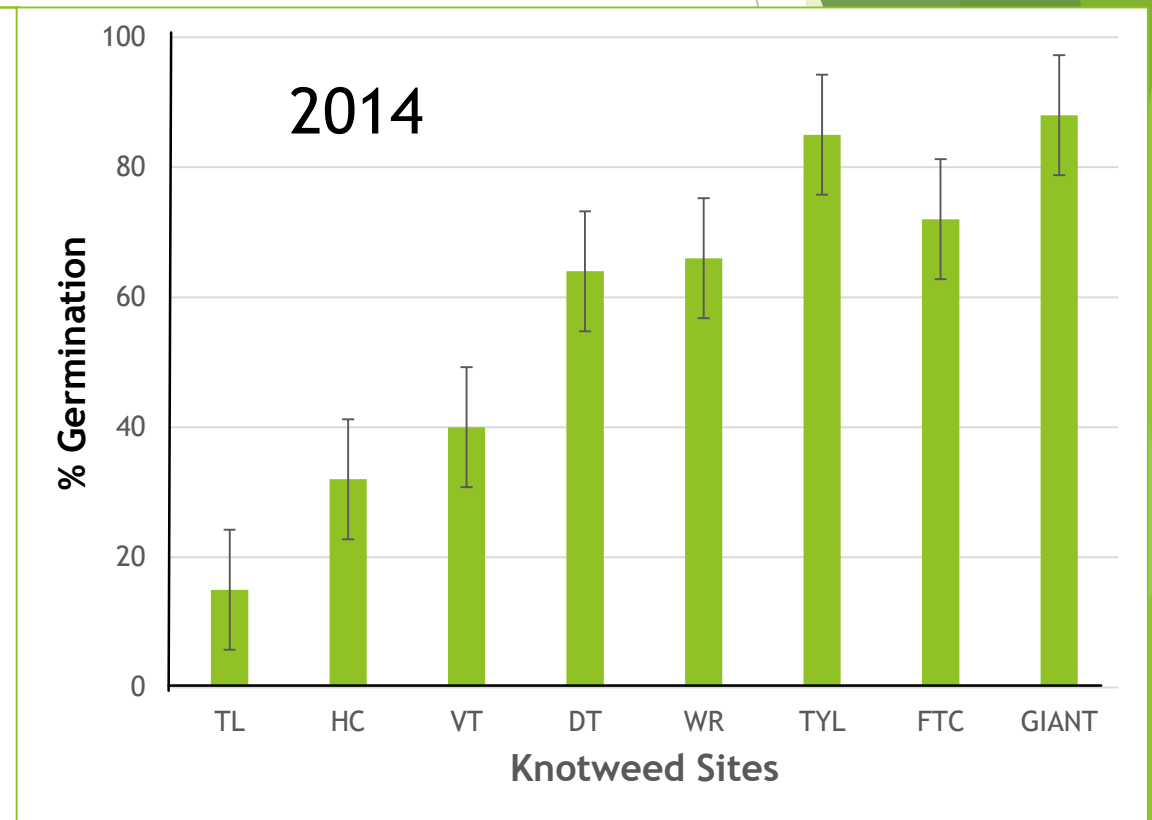
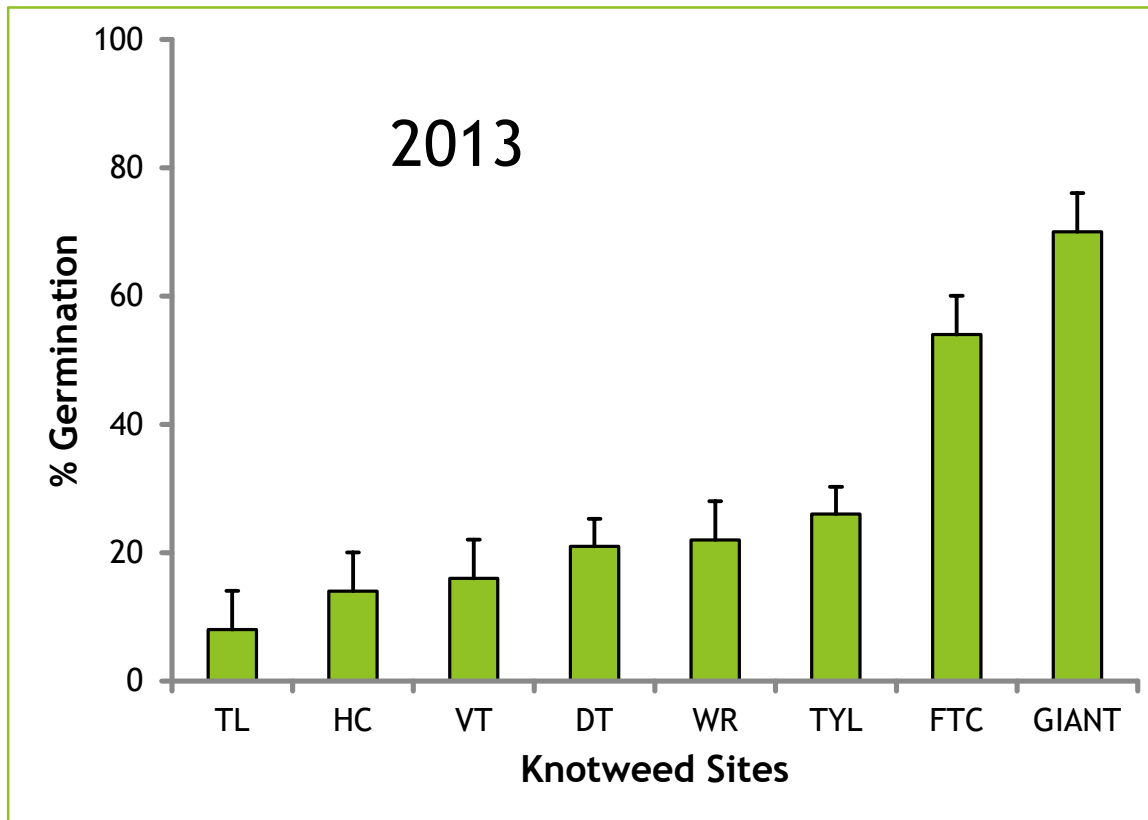
Gaskin et al. (2014)

Knotweed Seed Germination Trials



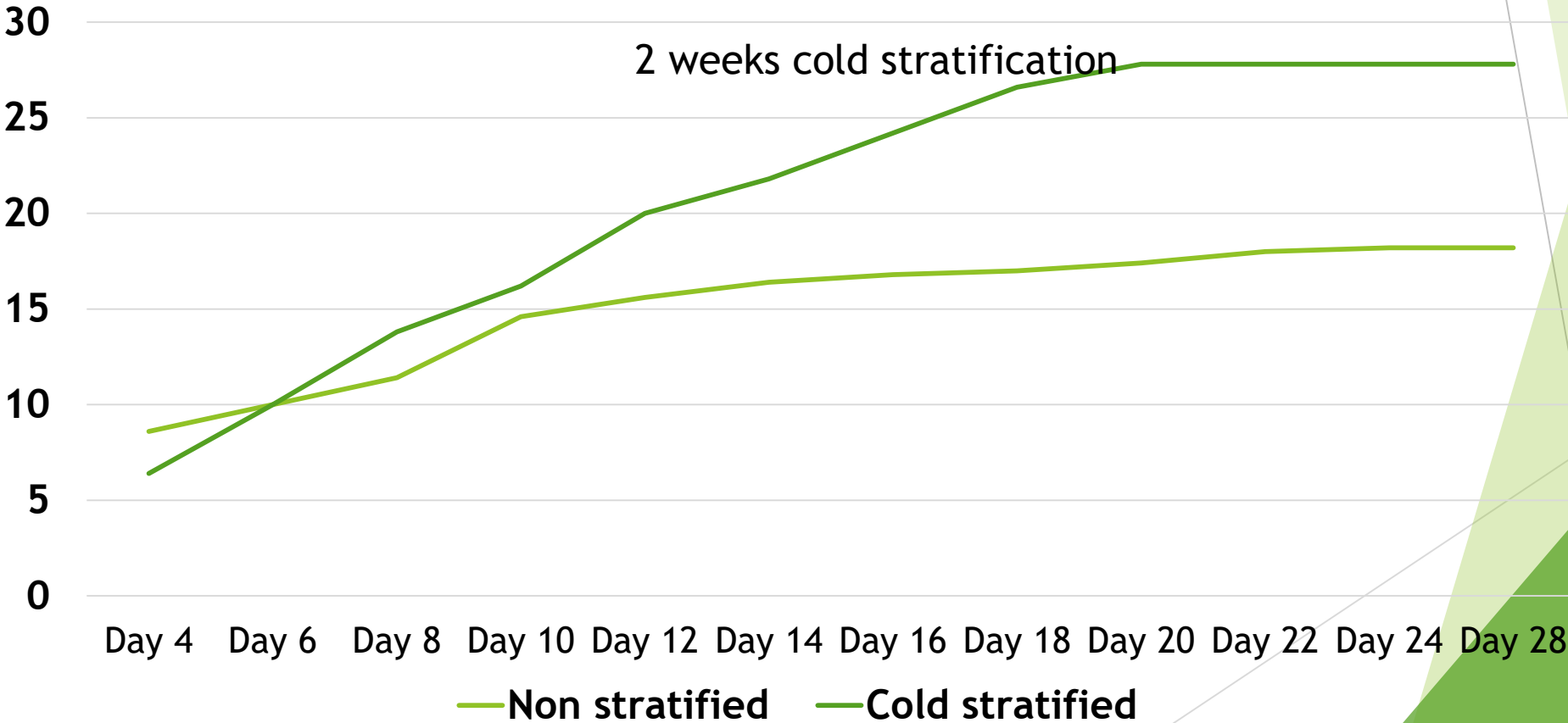


Site and Year Influences Germination Rates



General Seed Biology

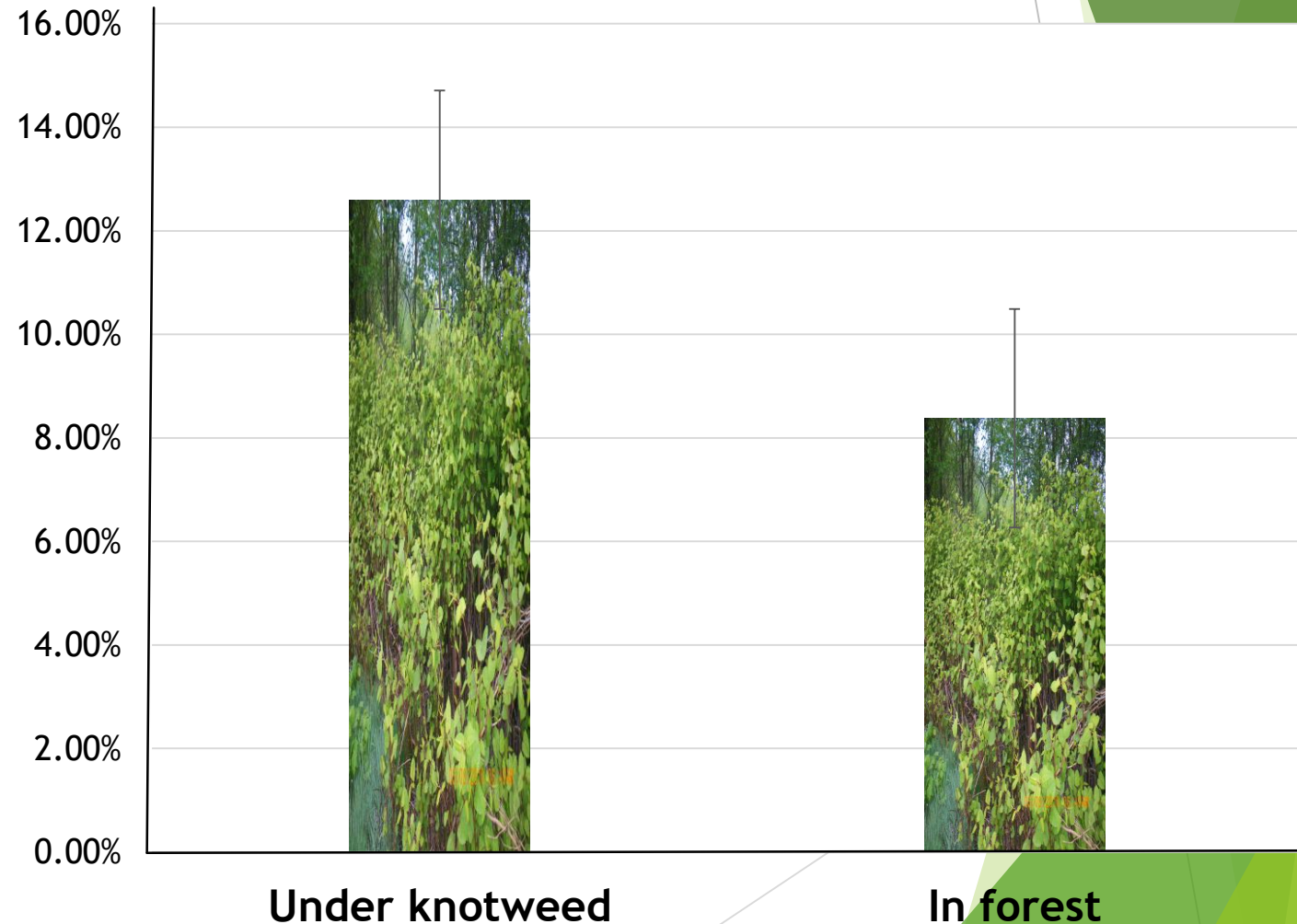
The Effect of Cold Stratification on Knotweed Seed Germination (%)



Field Germination of Knotweed Seeds

- ▶ Seeds were collected in the fall, stored until spring, given 2 weeks cold stratification.
- ▶ Placed in mesh bags and planted either under knotweed or nearby in forest regions.

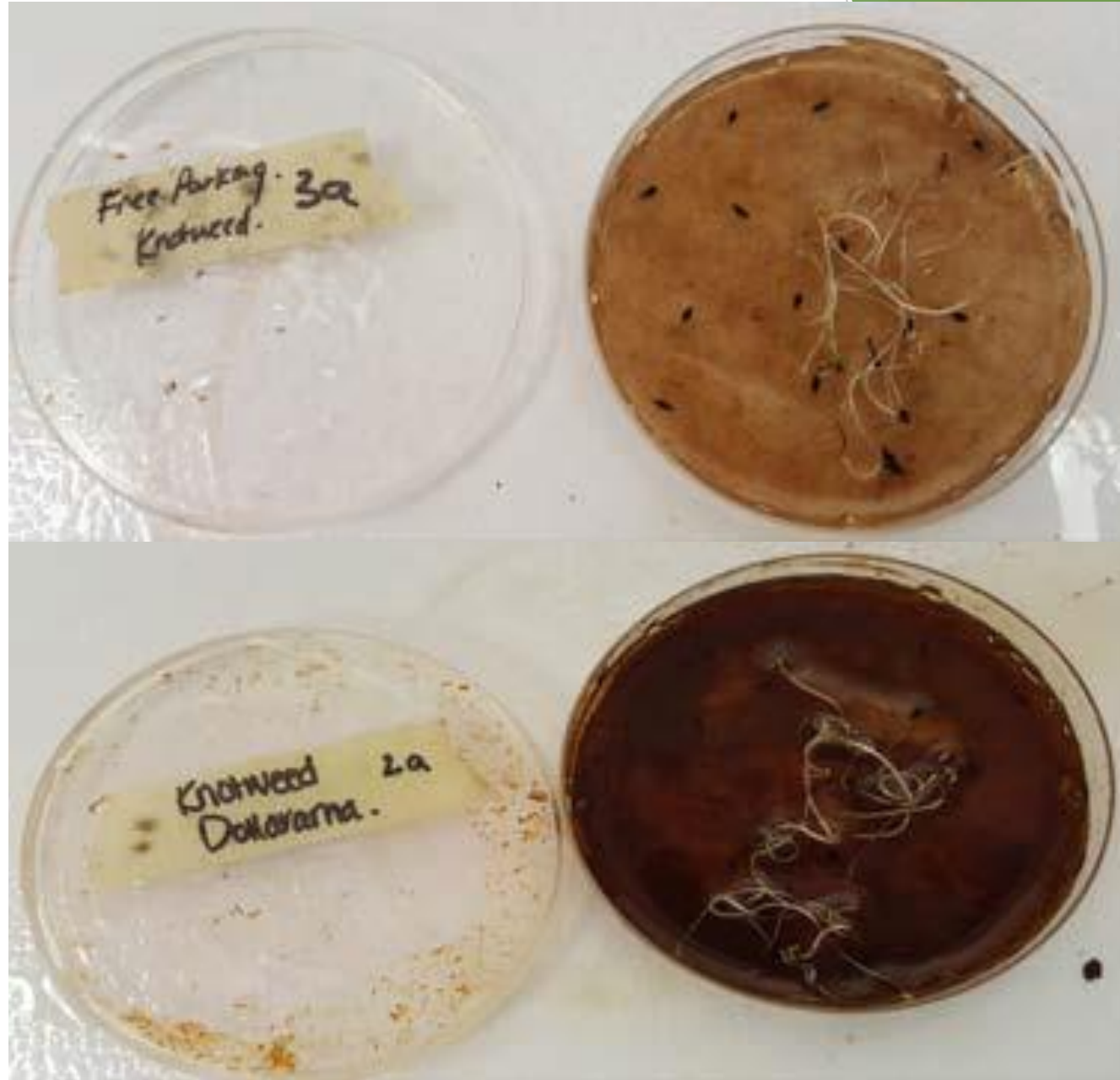
Knotweed Seed Germination Success



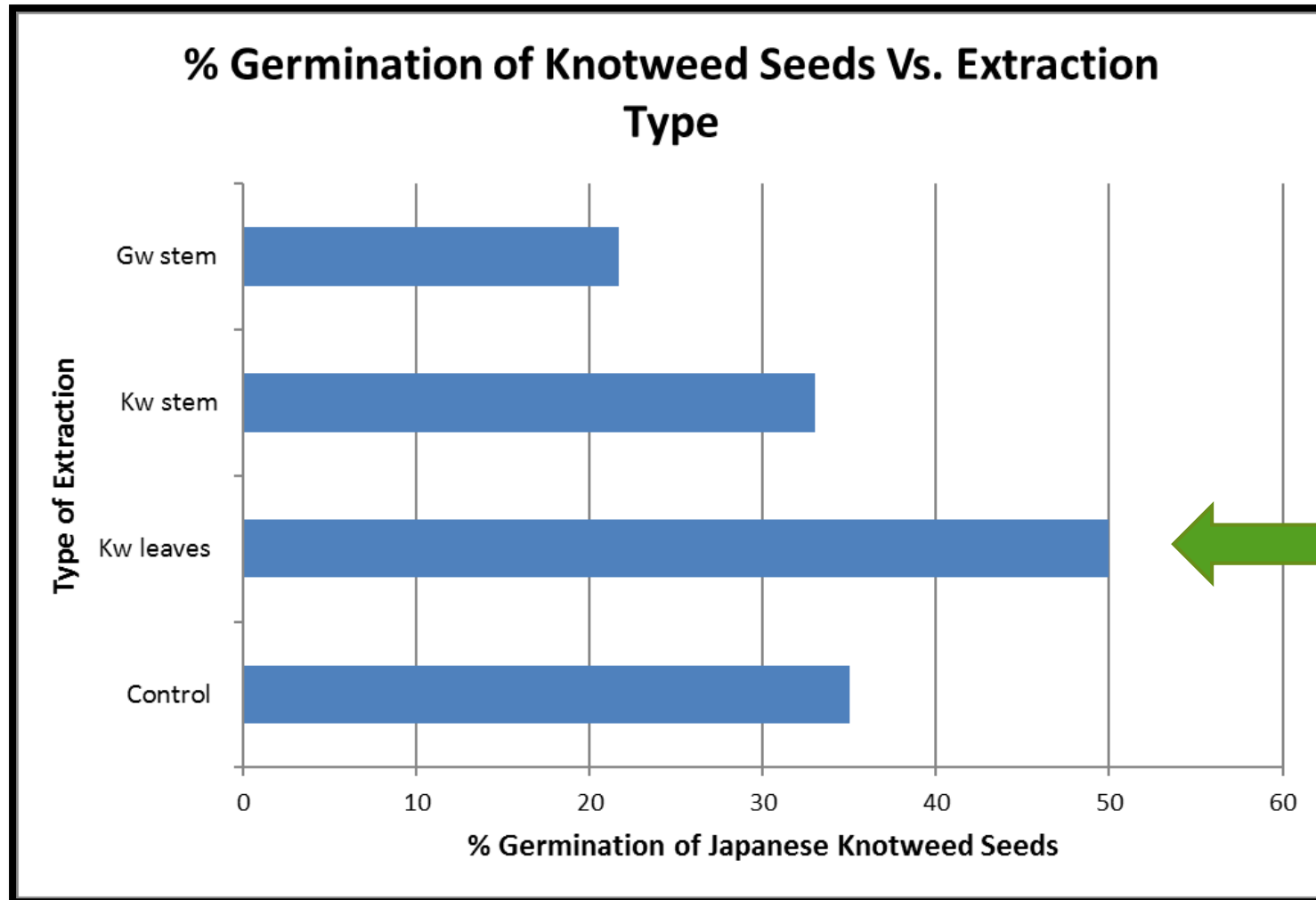
Does knotweed litter enhance knotweed seed germination?

Leaf and stem litter were collected in the fall and extracted with deionized water.

20 seeds per plate, germination was followed for 28 days.

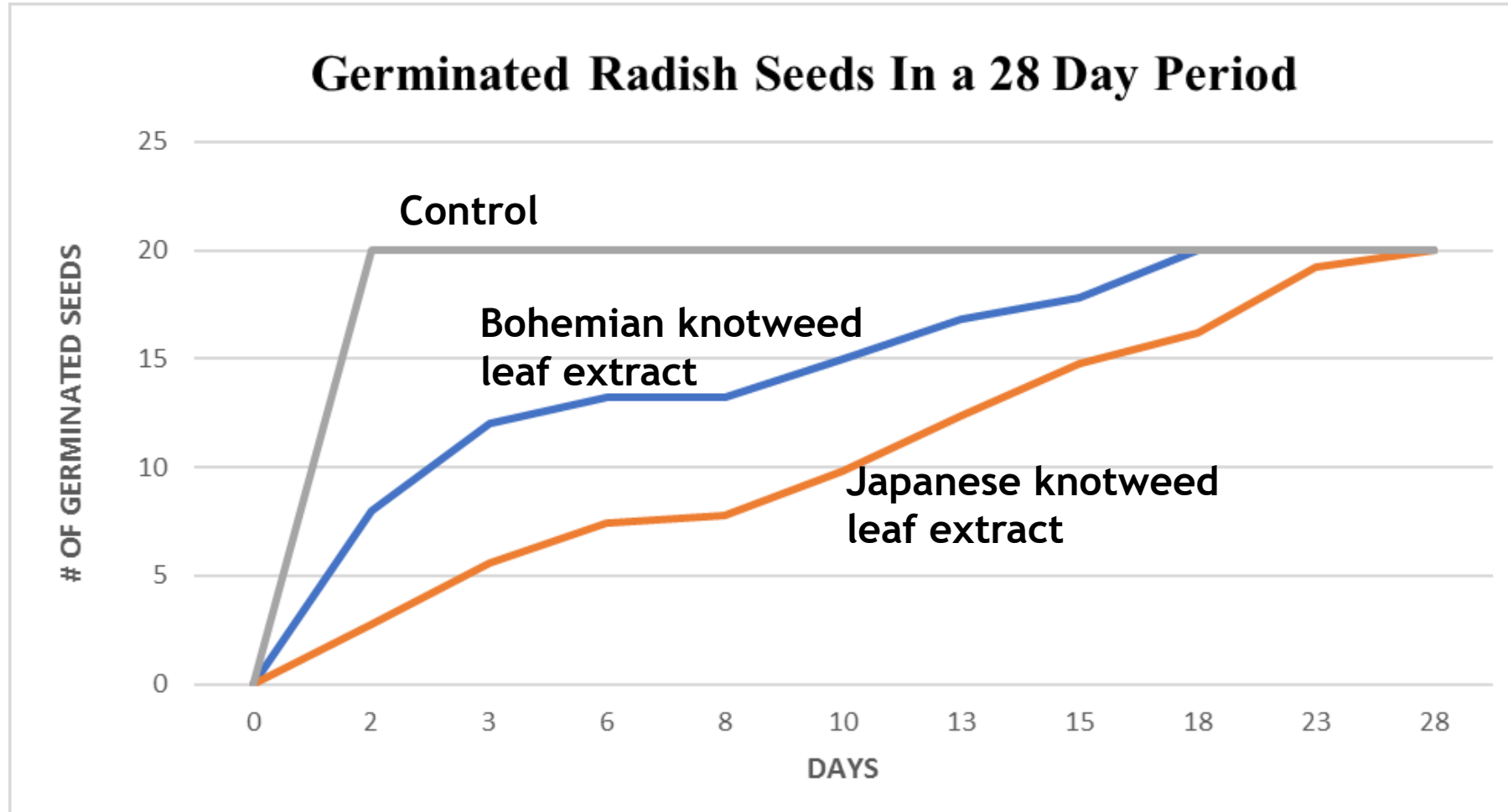


Leaf litter from knotweed leaves enhanced the germination of knotweed seeds



Allelepathy

- ▶ Similar to other studies we found knotweed leaves delayed the germination of several other species.



Gillies,
Clements +
Grenz, 2016

Viable
seeds
makes
invasive
knotweed a
'better'
weed.

Table 1. Ideal weed characteristics (ca. Baker 1974) possessed by knotweed plants (*Fallopia* spp.). Wording of Baker's traits modified according to Chaney and Baucom (2012).

Ideal weed trait	Knotweed trait(s)?
1. Germinates in many environments	May grow under a wide range of soil types, pH (e.g., pH 4.4–7.3) (Vanderhoeven et al. 2005)
2. Great longevity of seed	Insufficient data, but 80% germination rate after overwintering (Nishitani and Masuzawa 1996)
3. Rapid growth through vegetative phase to flowering	Capable of extremely rapid growth, high relative growth rate (Chiba and Hirose 1993)
4. Continuous seed production	Seed production period relatively short—September–November in North America (Barney et al. 2006)
5. Self-compatible	Most frequently not but occasionally self-compatible (Barney et al. 2006)
6. When cross-pollinated, unspecialized visitors or wind used	Pollinated by a wide variety of insects (Barney et al. 2006)
7. Very high seed output	A single stem may produce 191,892 seeds (Bailey 1994), but viability is not always high; varies with species
8. Tolerant and plastic	Many features of knotweed clones vary with environment and have been observed to adapt via epigenetic mechanisms (Richards et al. 2012); the Bohemian knotweed also exhibits genetic variation
9. Has adaptations for short- and long-distance dispersal	Short-range dispersal via stem and rhizome fragments, long-distance dispersal via wind-dispersed seeds (Gaskin et al. 2014)
10. Vigorous vegetative reproduction or regeneration from fragments	Extensive rhizome system, extending several meters underground and representing two-thirds of plant biomass (Alder 1993)
11. Plant not easily drawn from the ground	Knotweeds notoriously difficult to uproot (stem injection of herbicides recommended to ensure the whole plant is killed)
12. Ability to compete interspecifically by special means (rosette, choking growth, allelochemicals)	Strong competitive ability through forming monospecific stands and shading; allelochemicals produced (Murrell et al. 2011)



Thank you
Questions?