

<b>Taxon:</b> <i>Eutrema japonicum</i> (Miq.) Koidz.	<b>Family:</b> Brassicaceae
<b>Common Name(s):</b> Japanese horseradish wasabi	<b>Synonym(s):</b> Cochlearia wasabi Siebold, nom. nud. Eutrema koreanum auct. nonn. Eutrema wasabi Maxim. Lunaria japonica Miq. Wasabia japonica (Miq.) Matsum Wasabia pungens Matsum. Wasabia wasabi (Maxim.) Makino

<b>Assessor:</b> Chuck Chimera	<b>Status:</b> Assessor Approved	<b>End Date:</b> 26 May 2016
<b>WRA Score:</b> 3.0	<b>Designation:</b> L	<b>Rating:</b> Low Risk

**Keywords:** Domesticated Herb, Naturalized, Culinary, Shade-Tolerant, Rhizomatous

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	y
102	Has the species become naturalized where grown?	y=1, n=-1	y
103	Does the species have weedy races?	y=1, n=-1	y
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Low
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Intermediate
203	Broad climate suitability (environmental versatility)		
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	n
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	y
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed		
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	n
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	n
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y=1, n=-1	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)		
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m <sup>2</sup> )		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

**Supporting Data:**

Qsn #	Question	Answer
101	Is the species highly domesticated?	y
	Source(s)	Notes
	Chadwick, C. I., Lumpkin, T. A., & Elberson, L. R. (1993). The botany, uses and production of <i>Wasabia japonica</i> (Miq.) (Cruciferae) Matsum. <i>Economic Botany</i> , 47(2), 113-135	"Cultivars of <i>W. japonica</i> can produce enlarged stems 5 to 40 cm long, and 2 to 5 cm in diameter. Whole plants can weigh up to 3.4 kg (Miyake et al. 1983)." ... "Japanese growers distinguish between upland and semi-aquatic wasabi when selecting for new wasabi cultivars, i.e., those favoring an upland soil environment and harvested primarily for a leaf and petiole product and those favoring a flooded environment and harvested primarily for an enlarged stem product."
	Lim, T.K. 2015. <i>Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs.</i> Springer, Dordrecht	"The earliest cultivation of wasabi in Japan dates back to the tenth century."
	East Asia Biodiversity Conservation Network (2014), <i>Important Plants of East Asia: Plants tell stories.</i> Korea National Arboretum, Pocheon	"This species was domesticated in Japan and cultivated throughout Japanese Islands and Taiwan Islands: Russian Far East [Sakhalin Island], Japanese Archipelago [Islands], Taiwan Islands."

102	Has the species become naturalized where grown?	y
	Source(s)	Notes
	Lim, T.K. 2015. <i>Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs.</i> Springer, Dordrecht	"A temperate species, naturalised in wet areas along streams in mountains from near sea level to 2,500 m."

103	Does the species have weedy races?	y
	Source(s)	Notes
	Weber, E., Sun, S. G., & Li, B. (2008). Invasive alien plants in China: diversity and ecological insights. <i>Biological Invasions</i> , 10(8), 1411-1429	[Regarded as invasive, but impacts unspecified. Therefore designated as a minor weed for this assessment] "The term 'invasive species' is used in the sense of McNeely et al. (2001), meaning that they cause damage to species, habitats, or to the economy, and the same definition has been adopted in the sources given below." ... "Appendix 1 Invasive alien plant species in China" [ <i>Eutrema wasabi</i> listed as invasive in lakeshores, riparian habitats. Impacts unspecified]

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	Low
	Source(s)	Notes
	Lim, T.K. 2015. <i>Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs.</i> Springer, Dordrecht	"Wasabi is native to Japan, Korea, Russia (Far East) and North China. It is cultivated in China, Alisan in Taiwan, Dalat highlands in Vietnam, New Zealand and Tasmania in Australia."

Qsn #	Question	Answer
202	Quality of climate match data	Intermediate
	Source(s)	Notes
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	

203	Broad climate suitability (environmental versatility)	
	Source(s)	Notes
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	[Elevation range exceeds 1000 m, demonstrating environmental versatility, although primarily in areas with temperate climates. May only be able to survive at upper elevations in the tropics] "A temperate species, naturalised in wet areas along streams in mountains from near sea level to 2,500 m." ... "Wasabi thrives in cool, damp conditions and will sometimes grow if left undisturbed in misty mountain stream beds. It generally requires a climate with an air temperature between 8 and 20 °C and prefers high humidity in summer. Since it is quite intolerant of direct sunlight, wasabi is typically grown under shade cloth or beneath a natural forest canopy."

204	Native or naturalized in regions with tropical or subtropical climates	n
	Source(s)	Notes
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"Wasabi is native to Japan, Korea, Russia (Far East) and North China. It is cultivated in China, Alisan in Taiwan, Dalat highlands in Vietnam, New Zealand and Tasmania in Australia." ... "A temperate species, naturalised in wet areas along streams in mountains from near sea level to 2,500 m."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 25 May 2016]	"Cultivated: Asia-Temperate Eastern Asia: Japan; Korea; Taiwan"

301	Naturalized beyond native range	y
	Source(s)	Notes
	Wu, Z.Y. & Raven, P.H. (eds.). Flora of China. Vol. 8 (Brassicaceae through Saxifragaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Cultivated, also naturalized in wet areas along streams in mountains; near sea level to 2500 m. Taiwan [native to Japan, Korea, ?Russia (Far East)]."

302	Garden/amenity/disturbance weed	y

Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Weber, E., Sun, S. G., & Li, B. (2008). Invasive alien plants in China: diversity and ecological insights. <i>Biological Invasions</i> , 10(8), 1411-1429	[Regarded as invasive, but impacts unspecified. Therefore designated as a minor weed for this assessment] "The term ,invasive species' is used in the sense of McNeely et al. (2001), meaning that they cause damage to species, habitats, or to the economy, and the same definition has been adopted in the sources given below." ... "Appendix 1 Invasive alien plant species in China" [ <i>Eutrema wasabi</i> listed as invasive in lakeshores, riparian habitats. Impacts unspecified]

303	Agricultural/forestry/horticultural weed	n
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. 2012. <i>A Global Compendium of Weeds</i> . 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

304	Environmental weed	n
	<b>Source(s)</b>	<b>Notes</b>
	Weber, E., Sun, S. G., & Li, B. (2008). Invasive alien plants in China: diversity and ecological insights. <i>Biological Invasions</i> , 10(8), 1411-1429	"The term ,invasive species' is used in the sense of McNeely et al. (2001), meaning that they cause damage to species, habitats, or to the economy, and the same definition has been adopted in the sources given below." ... "Appendix 1 Invasive alien plant species in China" [ <i>Eutrema wasabi</i> listed as invasive in lakeshores, riparian habitats. Impacts unspecified]

305	Congeneric weed	n
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. 2012. <i>A Global Compendium of Weeds</i> . 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

401	Produces spines, thorns or burrs	n
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z.Y. & Raven, P.H. (eds.). <i>Flora of China</i> . Vol. 8 (Brassicaceae through Saxifragaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "Herbs 20–60(–75) cm tall, glabrous or sparsely pilose on upper parts; rhizomes fleshy, to 3 cm in diam. Stems erect or decumbent, simple. Basal leaves rosulate; petiole (6–)10–20(–26) cm, dilated at base; leaf blade cordate or reniform, (2.5–)6–15(–20) × (3–)6–18(–22) cm, base cordate, margin dentate, denticulate, shallowly crenate, repand, or subentire, with distinct apiculate callosities terminating ultimate veins, apex rounded or obtuse. Middle cauline leaves with petioles 1–5(–8) cm; leaf blade broadly ovate to ovate cordate, 1.5–4(–6) × 2–4(–6) cm, palmately veined, base and margin as in basal leaves, apex acute."

402	Allelopathic	n

Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	East Asia Biodiversity Conservation Network (2014), Important Plants of East Asia: Plants tell stories. Korea National Arboretum, Pocheon	[Possibly] "Rhizomes emit disinfectants and suppress the growth of other competitive species. However, growth of <i>Wasabia japonica</i> itself is also affected by its ingredients, and rhizomes do not develop as much in soil as when cultivated in water."

403	Parasitic	n
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z.Y. & Raven, P.H. (eds.). Flora of China. Vol. 8 (Brassicaceae through Saxifragaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Herbs 20–60(–75) cm tall, glabrous or sparsely pilose on upper parts; rhizomes fleshy, to 3 cm in diam." [Brassicaceae. No evidence]

404	Unpalatable to grazing animals	
	<b>Source(s)</b>	<b>Notes</b>
	Chadwick, C. I., Lumpkin, T. A., & Elberson, L. R. (1993). The botany, uses and production of <i>Wasabia japonica</i> (Miq.) (Cruciferae) Matsum. Economic Botany, 47(2), 113-135	"Crustaceans. <i>Gammarus nipponensis</i> (Am- phipoda: Gammaridae), a type of freshwater shrimp (yokuebi or tobimushi), feeds on wasabi in flooded fields. Damage is superficial, but affects marketability."
	MetaFilter. (2014). The Wasabi Challenge. <a href="http://www.metafilter.com/142875/The-Wasabi-Challenge">http://www.metafilter.com/142875/The-Wasabi-Challenge</a> . [Accessed 25 May 2016]	[Suggests plants may be palatable to browsing animals] "Wasabi is difficult to cultivate because it has unique requirements." ... " In about 3 years your first crop will mature. If the deer, rabbits or other pests don't eat it, and it doesn't die from some random other cause."

405	Toxic to animals	n
	<b>Source(s)</b>	<b>Notes</b>
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	
	<b>Source(s)</b>	<b>Notes</b>
	Miles, C. & Chadwick, C. (2008). Growing Wasabi in the Pacific Northwest. PNW0605. Washington State University Extension	"As a member of the brassica or crucifer family, wasabi is subject to many pests and diseases that attack other crops in the same family. Many of these pests and diseases cause deterioration in wasabi stem quality and yield."

Qsn #	Question	Answer
	Chadwick, C. I., Lumpkin, T. A., & Elberson, L. R. (1993). The botany, uses and production of <i>Wasabia japonica</i> (Miq.) (Cruciferae) Matsum. <i>Economic Botany</i> , 47(2), 113-135	[Possibly may impact other taxa] "The humid climate of Japan supports a diverse range of fungal and bacterial pathogens of wasabi. Six fungal species in the classes Ascomycetes, Oomycetes, Plasmodiophoromycetes, and Basidiomycetes cause major damage to wasabi. At least two genera of bacteria are pathogens of wasabi, i.e., <i>Erwinia</i> and <i>Corynebacterium</i> , and wasabi is also highly susceptible to at least three viruses." ... "The remaining pests of wasabi are insects." ... "Other pests and beneficials have been recognized. Adachi (1987) recognized a root knot nematode, <i>Meloidogyne</i> sp. (Tylenchida: Heteroderidae). Follett (1986) listed over 40 insect pests of wasabi in Japan"

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Modi, G. M., Doherty, C. B., Katta, R., & Orengo, I. F. (2009). Irritant contact dermatitis from plants. <i>Dermatitis</i> , 20(2), 63-78	[May be a skin irritant] "Along with mustards, members of the Brassicaceae family include cabbage, cauliflower, and radish. Horseradish ( <i>Armoracia rusticana</i> ) and wasabi ( <i>Japanese horseradish</i> , <i>Wasabia japonica</i> ) contain extremely reactive isothiocyanates and are accordingly especially potent irritants.[26]"
	Quattrocchi, U. 2012. <i>CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	No evidence
	Wagstaff, D.J. 2008. <i>International poisonous plants checklist: an evidence-based reference</i> . CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Lim, T.K. 2015. <i>Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs</i> . Springer, Dordrecht	[No evidence] "Wasabi thrives in cool, damp conditions and will sometimes grow if left undisturbed in misty mountain stream beds." ... 'An herb growing up to 20–75 cm high, glabrous or sparsely pilose on the upper parts."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Lim, T.K. 2015. <i>Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs</i> . Springer, Dordrecht	"Since it is quite intolerant of direct sunlight, wasabi is typically grown under shade cloth or beneath a natural forest canopy."
	Chadwick, C. I., Lumpkin, T. A., & Elberson, L. R. (1993). The botany, uses and production of <i>Wasabia japonica</i> (Miq.) (Cruciferae) Matsum. <i>Economic Botany</i> , 47(2), 113-135	"Wasabi grows naturally under trees and shrubs that provide summer shade and year-round protection. If wasabi leaves are exposed to too much radiation in Japan and Taiwan during the monsoonal summer, soft rot and leaf burn can become problems. Research in Taiwan showed that wasabi grew best under 70% shading (Hu, Chiu and Liu 1986) and research in New Zealand recommends keeping light levels below 700 micro Einsteins/m2/sec (Douglas 1992)."

Qsn #	Question	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	<b>Source(s)</b>	<b>Notes</b>
	Miles, C. & Chadwick, C. (2008). Growing Wasabi in the Pacific Northwest. PNW0605. Washington State University Extension	"Wasabi grows best on soils that are high in organic matter; have an open, friable structure; and good drainage. In general, soils such as deep alluvial loam, sandy loam, or sandy clay loam are well suited for wasabi production. Sandy soils will need annual additions of organic matter and heavier soils need to have adequate drainage (Barber and Buntain, 1997)."
	Craigie, R. A. (2002). Yield and quality response of wasabi ( <i>Wasabia japonica</i> (Miq.) Matsumara) to nitrogen and sulphur fertilisers. MSc Thesis, Lincoln University, Canterbury, NZ	"Wasabi is currently grown on a wide range of soil types, in Canterbury, Southland and South Otago. Best practice has developed from trial and error to date."

411	Climbing or smothering growth habit	n
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z.Y. & Raven, P.H. (eds.). Flora of China. Vol. 8 (Brassicaceae through Saxifragaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Herbs 20–60(–75) cm tall, glabrous or sparsely pilose on upper parts; rhizomes fleshy, to 3 cm in diam."

412	Forms dense thickets	n
	<b>Source(s)</b>	<b>Notes</b>
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	[No evidence] "A temperate species, naturalised in wet areas along streams in mountains from near sea level to 2,500 m."
	Wu, Z.Y. & Raven, P.H. (eds.). Flora of China. Vol. 8 (Brassicaceae through Saxifragaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "Cultivated, also naturalized in wet areas along streams in mountains; near sea level to 2500 m."

501	Aquatic	n
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z.Y. & Raven, P.H. (eds.). Flora of China. Vol. 8 (Brassicaceae through Saxifragaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Not truly aquatic, but occurs near aquatic habitats] "Cultivated, also naturalized in wet areas along streams in mountains; near sea level to 2500 m. Taiwan [native to Japan, Korea, ?Russia (Far East)]."

502	Grass	n
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 23 May 2016]	Family: Brassicaceae (alt.Cruciferae) Tribe: Eutremeae

503	Nitrogen fixing woody plant	n
-----	-----------------------------	---



Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z.Y. & Raven, P.H. (eds.). Flora of China. Vol. 8 (Brassicaceae through Saxifragaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Herbs 20–60(–75) cm tall, glabrous or sparsely pilose on upper parts" [Brassicaceae]
<b>504</b>	<b>Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Gordon, D. R., Mitterdorfer, B., Pheloung, P. C., Ansari, S., Buddenhagen, C., Chimera, C., ... & Williams, P. A. 2010. Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly, 25(2): 56-74	"Answer 'no' for non-geophytes, including those with rhizomes or stolons only"
	East Asia Biodiversity Conservation Network (2014), Important Plants of East Asia: Plants tell stories. Korea National Arboretum, Pocheon	"Stems sometimes described as rhizome, cylindrical to conical, covered with numerous leaf scars."
<b>601</b>	<b>Evidence of substantial reproductive failure in native habitat</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	[No evidence] "Wasabi is native to Japan, Korea, Russia (Far East) and North China. It is cultivated in China, Alisan in Taiwan, Dalat highlands in Vietnam, New Zealand and Tasmania in Australia."
<b>602</b>	<b>Produces viable seed</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"Wasabi is commonly propagated from tissue culture offshoots and seeds."
<b>603</b>	<b>Hybridizes naturally</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	Unknown. No evidence
<b>604</b>	<b>Self-compatible or apomictic</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Chadwick, C. I., Lumpkin, T. A., & Elberson, L. R. (1993). The botany, uses and production of <i>Wasabia japonica</i> (Miq.) (Cruciferae) Matsum. Economic Botany, 47(2), 113-135	"[Cross-pollinated] Flowers are white, bracteate, arranged on racemes, with ascending sepals, cruciform- and obovate petals, perfect septum, elongate styles, and simple stigma (Fig. 5) (Ohwi 1984). Styles are 2 mm long and petals 8 to 9 mm long. Fertilization is primarily by cross pollination."

Qsn #	Question	Answer
	Palmer, J. (1990). Germination and growth of wasabi ( <i>Wasabia japonica</i> (Miq.) Matsumara). <i>New Zealand Journal of Crop and Horticultural Science</i> , 18(2-3), 161-164	"The flowering racemes of wasabi are indeterminate and may eventually exceed a metre in length (Fig. 2) after 2 months. Plants appear to be self-incompatible."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Grant, V. (1949). Pollination Systems as Isolating Mechanisms in Angiosperms. <i>Evolution</i> , 3(1), 82-97	"The genera were grouped into the following seven pollination classes: (a) bird plants; (b) butterfly and moth plants; (c) bee plants; (d) bee and long-tongued fly plants (Syrphidae, Bombyliidae in part); (e) promiscuous plants (miscellaneous bees, wasps, flies, etc.) ; (f) wind- pollinated plants; (g) water-pollinated plants." [Eutrema listed as promiscuous]
	Chadwick, C. I., Lumpkin, T. A., & Elberson, L. R. (1993). The botany, uses and production of <i>Wasabia japonica</i> (Miq.) (Cruciferae) Matsum. <i>Economic Botany</i> , 47(2), 113-135	"Togashi (1981) observed more than 44 species of insects visiting the flowers of wasabi, especially Syrphidae and Hymenoptera."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Miles, C. & Chadwick, C. (2008). Growing Wasabi in the Pacific Northwest. PNW0605. Washington State University Extension	"Plantlets (offshoots) are produced around the crown of the mother plant and can be used to propagate wasabi vegetatively." ... "Mature stems can also be used for vegetative propagation (Adachi, 1987). Each stem has the potential to produce up to 20 plantlets."

607	Minimum generative time (years)	
	Source(s)	Notes
	Miles, C. & Chadwick, C. (2008). Growing Wasabi in the Pacific Northwest. PNW0605. Washington State University Extension	[Perennial herb. Probably first sets seed in first or second year] "Wasabi ( <i>Wasabia japonica</i> [Miq.] Matsum) is a perennial plant that is a member of the Cruciferae or Brassicaceae family (commonly called the mustard family) and native to Japan." ... "Wasabi begins to flower in January, peaks in April, and ends in May (Figure 3); seed pods are mature and ready for harvest 50 to 60 days after flowering is complete."

Qsn #	Question	Answer
701	<b>Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Palmer, J. (1990). Germination and growth of wasabi ( <i>Wasabia japonica</i> (Miq.) Matsumara). <i>New Zealand Journal of Crop and Horticultural Science</i> , 18(2-3), 161-164	"Towards the end of flowering the lower seed pods dehisce and so complicate harvesting procedures. Pods never dry out naturally and at the time of release seeds are slightly sticky and tend to adhere to leaves, stones, etc."
	Lim, T.K. 2015. <i>Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs.</i> Springer, Dordrecht	[Possible that small seeds in mud could adhere to footwear, equipment or vehicles, but unlikely given areas where grown] "A temperate species, naturalised in wet areas along streams in mountains from near sea level to 2,500 m." ... "Fruit linear, 1–2 cm × 1.5–2 mm, terete, torulose. Seeds 6–8, oblong, plump, 2–3 × 1–1.5 mm."

702	<b>Propagules dispersed intentionally by people</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Miles, C. & Chadwick, C. (2008). <i>Growing Wasabi in the Pacific Northwest.</i> PNW0605. Washington State University Extension	"Wasabi thrives in cool and moist temperate climates. It is poorly adapted to many regions of the United States, but does grow well in the coastal region of the Pacific Northwest. Wasabi is also very suitable for small-acreage production because it is a high-value crop. However, growers need to become familiar with the unique production requirements of wasabi."
	Parker, J. 2016. <i>BIISC Early Detection Botanist.</i> Pers. Comm. 10 May	sold in nurseries on Hawaii island

703	<b>Propagules likely to disperse as a produce contaminant</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Lim, T.K. 2015. <i>Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs.</i> Springer, Dordrecht	[Unlikely. Possible that small seeds could become a contaminant if grown with other semi-aquatic crops, but no evidence found in literature] "A temperate species, naturalised in wet areas along streams in mountains from near sea level to 2,500 m." ... "Fruit linear, 1–2 cm × 1.5–2 mm, terete, torulose. Seeds 6–8, oblong, plump, 2–3 × 1–1.5 mm."

704	<b>Propagules adapted to wind dispersal</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z.Y. & Raven, P.H. (eds.). <i>Flora of China. Vol. 8 (Brassicaceae through Saxifragaceae).</i> Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Seeds small, but otherwise lack adaptations for wind dispersal] "Fruit linear, 1–2 cm × 1.5–2 mm, terete, torulose; valves with an obscure midvein; gynophore (1–)2–5 mm; septum usually complete; style 2–3 mm. Seeds oblong, plump, 2–3 × 1–1.5 mm."

705	<b>Propagules water dispersed</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	[Seeds lack special adaptations for dispersal, but distribution along streams suggests plants will be dispersed by water] "A temperate species, naturalised in wet areas along streams in mountains from near sea level to 2,500 m." ... "Fruit linear, 1–2 cm × 1.5–2 mm, terete, torulose. Seeds 6–8, oblong, plump, 2–3 × 1–1.5 mm."

706	Propagules bird dispersed	n
	Source(s)	Notes
	Wu, Z.Y. & Raven, P.H. (eds.). Flora of China. Vol. 8 (Brassicaceae through Saxifragaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Unlikely. Not fleshy-fruited] "Fruit linear, 1–2 cm × 1.5–2 mm, terete, torulose; valves with an obscure midvein; gynophore (1–)2–5 mm; septum usually complete; style 2–3 mm. Seeds oblong, plump, 2–3 × 1–1.5 mm."

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	[Possible that small seeds in mud could adhere to animals] "A temperate species, naturalised in wet areas along streams in mountains from near sea level to 2,500 m." ... "Fruit linear, 1–2 cm × 1.5–2 mm, terete, torulose. Seeds 6–8, oblong, plump, 2–3 × 1–1.5 mm."
	Palmer, J. (1990). Germination and growth of wasabi ( <i>Wasabia japonica</i> (Miq.) Matsumara). New Zealand Journal of Crop and Horticultural Science, 18(2-3), 161-164	[Sticky seeds] "Pods never dry out naturally and at the time of release seeds are slightly sticky and tend to adhere to leaves, stones, etc."

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Gordon, D. R., Mitterdorfer, B., Pheloung, P. C., Ansari, S., Buddenhagen, C., Chimera, C., ... & Williams, P. A. 2010). Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly, 25(2): 56-74	[Seeds unlikely to be consumed by animals] "Answer 'no' where the taxon is unlikely to be eaten by animals or if seeds are not viable following passage through the gut."

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	Chadwick, C. I., Lumpkin, T. A., & Elberson, L. R. (1993). The botany, uses and production of <i>Wasabia japonica</i> (Miq.) (Cruciferae) Matsum. Economic Botany, 47(2), 113-135	[Densities unknown] "Fertilization is primarily by cross pollination. Seeds are borne in siliques which mature along the length of the peduncle (Fig. 2, 5) (Adachi, Nakamura and Suzuki 1975). Siliques are short, linear, oblong, torulose, and cylindrical with membranous valves. Each silique contains up to 8 seeds and each seed is 2 to 3 mm long and 1 mm in diameter, pointed at one end and flat on the other (Ohwi 1984)."

Qsn #	Question	Answer
	Palmer, J. (1990). Germination and growth of wasabi ( <i>Wasabia japonica</i> (Miq.) Matsumara). <i>New Zealand Journal of Crop and Horticultural Science</i> , 18(2-3), 161-164	[Sets seed abundantly] "Seedling wasabi plants were placed in potting mix in 15 cm plastic pots and grown in a shaded frame with twice daily automatic watering from early December 1986 to late April 1987 . Then 48 pots were transferred to a bench in a heated glasshouse (minimum temperature 15°C). The first flowers appeared almost immediately. Plants were staked and hand-pollination commenced in mid May. Reciprocal crossing with adjacent plants, first on one side then on the other on alternate days, was conducted 5 days a week. Most plants set seed abundantly but 13 of the 48 set no seed at all."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Palmer, J. (1990). Germination and growth of wasabi ( <i>Wasabia japonica</i> (Miq.) Matsumara). <i>New Zealand Journal of Crop and Horticultural Science</i> , 18(2-3), 161-164	"Germination of fresh seed does not occur at temperatures over 10°C, but occurs slowly at 5 C." ... "Short-term storage of air-dry seed is likely to decrease viability."
	Chadwick, C. I., Lumpkin, T. A., & Elberson, L. R. (1993). The botany, uses and production of <i>Wasabia japonica</i> (Miq.) (Cruciferae) Matsum. <i>Economic Botany</i> , 47(2), 113-135	"Seeds must be stored in a cool moist environment, since dry storage will result in desiccation and death. According to a storage classification of seed developed in South Africa (Farrant, Pammenter and Berjak 1988), wasabi can be considered a minimally recalcitrant seed. This type of seed can tolerate water loss, but not desiccation. The seed tolerates low temperatures but not zero or less."

803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

Qsn #	Question	Answer
804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	<b>Source(s)</b>	<b>Notes</b>
	Miles, C. & Chadwick, C. (2008). Growing Wasabi in the Pacific Northwest. PNW0605. Washington State University Extension	[Propagated vegetatively. May be able to resprout after cutting or harvesting] "Plantlets (offshoots) are produced around the crown of the mother plant and can be used to propagate wasabi vegetatively. Each mother plant can produce up to 20 plantlets depending on the cultivar. When wasabi plants are harvested for market, plantlets are cut from the plant and immediately replanted. Plantlets should be at least 1½ inches tall, with 4 to 5 leaves and a healthy appearance and color (i.e., dark green, not chlorotic, and no symptoms of disease such as spots on leaves)." ... "Mature stems can also be used for vegetative propagation (Adachi, 1987). Each stem has the potential to produce up to 20 plantlets. Stems should be cut into 5 pieces, with each sterilized by rinsing 3 times in a 0.05% bleach solution (Chadwick, 1990). Stem pieces can then be placed in a 50:50 mix of sand and compost in planting boxes or trays in a greenhouse with a temperature range of 46 to 50°F and 90 to 95% humidity. In about 2 months, plantlets will begin to grow. Once plantlets have 4 to 5 leaves they can be removed from the stem and planted out as described below for seedlings."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2016. Personal Communication	Unknown

**Summary of Risk Traits:**

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Naturalized in Taiwan & possibly elsewhere
- Regarded as invasive in lakeshores & riparian habitats, although impacts are unspecified
- May be a skin irritant to susceptible individuals
- Shade-tolerant
- Reproduces by seeds & vegetatively by rhizomes
- Seeds likely dispersed by water, adhering to surfaces, & intentionally by cultivation
- Seeds exhibit dormancy, but lose viability if dried
- May be able to coppice & resprout after cutting

Low Risk Traits

- Domesticated since about 10th century
- Although reported as invasive, no impacts have been specified
- Unarmed (no spines, thorns or burrs)
- Valuable food plant
- Self-incompatible
- Seeds lose viability if dried

Second Screening Results for Herbs

(A) Reported as a weed of cultivated lands? No. Reported as invasive in lakeshores & riparian habitats  
Outcome = Accept (Low Risk)