

Taxon: <i>Nasturtium microphyllum</i>	Family: Brassicaceae
Common Name(s): onerow yellowcress	Synonym(s): <i>N. officinale</i> sensu Hawaiian <i>Rorippa microphylla</i> (Boenn. ex Pursh)

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 30 Jul 2015
WRA Score: 14.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Aquatic, Herb, Weedy, Edible, Water-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
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)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
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		
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)	y
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	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens	y=1, n=0	y
407	Causes allergies or is otherwise toxic to humans		
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	n

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	n
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets		
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	y=1, n=-1	y
604	Self-compatible or apomictic	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	2
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	y
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	y
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 ²)		
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?	n
	Source(s)	Notes
	Hanelt, P. (ed.). 2001. Mansfeld's Encyclopedia of Agricultural and Horticultural Crops, Volume 3. Springer-Verlag, Berlin, Heidelberg, New York	[No evidence of domestication] "This more recently distinguished allotetraploid species is till now known from W and central Europe, but it might be found also in other parts of the world, perhaps everywhere within the area of <i>N. officinale</i> , but is not cultivated."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 30 Jul 2015]	"Native: AFRICA Northern Africa: Morocco ASIA-TEMPERATE Western Asia: Afghanistan [e.]; Iran [w.] ASIA-TROPICAL Indian Subcontinent: India - Himachal Pradesh, Jammu and Kashmir; Pakistan [n.] EUROPE Northern Europe: Denmark; Ireland; Sweden [s.w.]; United Kingdom Middle Europe: Austria; Belgium; Czech Republic; Germany; Netherlands; Poland [w.]; Switzerland Southeastern Europe: Italy [n.]; Slovenia Southwestern Europe: France; Spain"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed]	

Qsn #	Question	Answer
203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"Environmental requirements for optimal growth of <i>N. microphyllum</i> are not well-known, but are presumed to be similar to <i>N. officianle</i> (Howard and Lyon, 1952b). It grows well in warm temperate climates."
	Plants for a Future. 2015. <i>Nasturtium microphyllum</i> . http://www.pfaf.org/user/Plant.aspx?LatinName=Nasturtium+microphyllum . [Accessed 30 Jul 2015]	"USDA hardiness zone : 5-9"
	Erickson, T.A. & Puttock, C.F. 2006. <i>Hawai'i Wetland Field Guide: An Ecological And Identification Guide to Wetlands And Wetland Plants of the Hawaiian Islands</i> . Bess Press Books, Honolulu, HI	[Elevation range exceeds 1000 m] "it is common in taro patches, and in seasonally wet areas, from near sea level to 1220 m elevation:

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to western Europe, widely cultivated as a food plant and widely naturalized in many areas; in Hawai'i naturalized in running water or seasonally wet areas on Kaua'i, O'ahu, Maui, and Hawai'i."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"widely cultivated as a food plant and widely naturalized in many areas;"

301	Naturalized beyond native range	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i naturalized in running water or seasonally wet areas on Kaua'i, O'ahu, Maui, and Hawai'i. First collected on Kaua'i in 1917 (Forbes 773.K, BISH)."
	Wysong, M., Hughes, G. & Wood, K.R. (2007). <i>New Hawaiian plant records for the island of Moloka'i</i> . Bishop Museum Occasional Papers 96: 1-8	"In Kalaupapa National Historical Park it has been reported by Kalaupapa residents from Waikolu and Wa'ale'ia Valleys. Material examined. MOLOKA'I: Wai'ale'ia Valley, mouth of valley on east side of stream, growing in seepages from cliff face, 15 m, 4 Jan 2005, Wysong 557."

Qsn #	Question	Answer
	<p>USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 30 Jul 2015]</p>	<p>"Naturalized: AFRICA Northeast Tropical Africa: Ethiopia East Tropical Africa: Kenya; Uganda West-Central Tropical Africa: Zaire ASIA-TEMPERATE Arabian Peninsula: Yemen Eastern Asia: Japan AUSTRALASIA Australia: Australia New Zealand: New Zealand NORTHERN AMERICA Eastern Canada: Canada - New Brunswick, Newfoundland, Ontario, Prince Edward Island, Quebec Western Canada: Canada - British Columbia, Manitoba Northeastern U.S.A.: United States - Connecticut, Indiana, Maine, Massachusetts, Michigan, New York, Pennsylvania, Rhode Island, Vermont Northwestern U.S.A.: United States - Idaho, Oregon, Wyoming Southeastern U.S.A.: United States - Kentucky South-Central U.S.A.: United States - New Mexico PACIFIC North-Central Pacific: United States - Hawaii SOUTHERN AMERICA Southern South America: Argentina - Entre Rios; Chile"</p>

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	<p>CABI, 2015. <i>Nasturtium microphyllum</i>. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc</p>	<p>"<i>N. microphyllum</i> has been introduced to many countries well outside of its native range, including many parts of the USA and Australasia. Like <i>N. officinale</i>, this species has spread in some of the countries it has been introduced to, invading waterways and swamping existing native vegetation. Staples et al. (2000) listed it as an 'invasive or potentially invasive cultivated plants in Hawaii.' <i>N. microphyllum</i> is sometimes not considered as a potential invasive as it is not often a problem, even though related <i>Nasturtium</i> species can be problematic (Thomson, 1922; IPANE, 2013)."</p>
	<p>Stemmermann, L. 1981. A Guide to Pacific Wetland Plants. U.S. Army Corps of Engineers, Honolulu, HI</p>	<p>"This is the cultivated watercress which has become naturalized in some streams in Hawaii."</p>

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	<p>CABI, 2015. <i>Nasturtium microphyllum</i>. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc</p>	<p>"Since <i>N. microphyllum</i>, <i>N. officinale</i> and <i>N. x sterile</i> were not described separately until the 1940s (Howard and Lyon, 1952a) it is impossible to know which of species were responsible for historic infestations. However, the effects of invasive watercress are reduced in modern times, as in many places watercress has been partly displaced by other species of aquatic plants."</p>

304	Environmental weed	

Qsn #	Question	Answer
	Source(s)	Notes
	Queensland Government. 2011. Weeds of Australia - One-rowed watercress. <i>Rorippa microphylla</i> . http://keyserver.lucidcentral.org/weeds/data/03030800-0b07-490a-8d04-0605030c0f01/media/Html/Rorippa_microphylla.htm . [Accessed 30 Jul 2015]	"Synonyms: <i>Nasturtium microphyllum</i> Boenn. ex Rchb." ... "One-rowed watercress (<i>Rorippa microphylla</i>) is regarded as a minor environmental weed or potential environmental weed in Tasmania and other parts of south-eastern Australia. This semi-aquatic species generally grows in muddy sites or in shallow water. It has been recorded in conservation areas in New South Wales, including in the Nattai and Bargo Reserves (i.e. Nattai National Park, Nattai State Conservation Area and Bargo State Conservation Area) in the Blue Mountains region."
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Potential environmental weed] "Like <i>N. officinale</i> , this species has spread in some of the countries it has been introduced to, invading waterways and swamping existing native vegetation."

305	Congeneric weed	y
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium officinale</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"It has been deliberately introduced as a leafy vegetable to east and southeast Asia, sub Saharan Africa, the Americas and the Caribbean, Australia, New Zealand and Pacific islands. <i>N. officinale</i> is now found as a fast-growing environmental weed in parts of North America, Australasia and southern Africa. In some of these regions it has spread to invade waterways and swamp existing native vegetation, and it may smother native communities, altering their structure and composition."

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Aquatic or semiaquatic, somewhat fleshy, glabrous perennial herbs; stems floating, prostrate, or ascending, rooting at the nodes, hollow, 1-6 dm long, usually 2-6 mm in diameter. Leaves pinnately compound with (3-)6-9 leaflets, these ovate to elliptic, 1.5-4 cm long, 0.5-2 cm wide, margins subentire to sinuate-dentate, the terminal one often larger than lateral ones."

402	Allelopathic	
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	Unknown. No evidence

403	Parasitic	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Aquatic or semiaquatic, somewhat fleshy, glabrous perennial herbs" [Brassicaceae. No evidence]

Qsn #	Question	Answer
404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Howard, H. W., & Lyon, A. G. (1952). <i>Nasturtium officinale</i> R. Br (Rorippa <i>Nasturtium-Aquaticum</i> (L.) Hayek). <i>The Journal of Ecology</i> , 40(1): 228-245	"Watercress is often extensively grazed, particularly by cows in dry weather(see IX). This may lead to little, if any, seed having set. It continues to grow well after such grazing" ... "The more creeping habit of <i>N. microphyllum</i> may make it more resistant to grazing and its occurrence in Port Meadow (Baker, 1937) certainly suggests that it can withstand grazing."

405	Toxic to animals	n
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	[No evidence] "According to Howard and Lyon (1952a; b) <i>N. microphyllum</i> is often extensively grazed by cattle, especially in dry weather. However, its more prostrate growth may make it more resistant to grazing by livestock than <i>N. officinale</i> (Howard and Lyon, 1952b)."
	Wagstaff, D.J. 2008. <i>International poisonous plants checklist: an evidence-based reference</i> . CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	y
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	"Several pests affect watercress, including the caterpillar of the diamondback moth, which defoliates the stems above water." ... "Also, the yellow aster leafhopper, vector of the aster yellows phytoplasma, has been identified in watercress farms on Oahu. Aster yellows does not affect humans but is known to infect about 300 plant species, including many common vegetables, and could be devastating to Hawaii's diversified agriculture."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[No evidence] "Native to Europe, this species of watercress has been widely introduced as a cultivated vegetable."

Qsn #	Question	Answer
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	[Non-toxic, but may be contaminated with pathogens or parasites] " <i>N. microphyllum</i> is an important food source in many of the countries where it is native or where it was introduced. Although introduced well after Maori settlement of New Zealand, it has become a favoured food of Maori, who know it as kowhitiwhiti. One of the downsides of consumption of wild-growing watercress is that it commonly carries the common liver fluke (<i>Fasciola hepatica</i>) when growing in places near where livestock graze. The alternate hosts of the fluke are water snails, which often live on watercress and can therefore pass the infection on to humans, where it can cause fasciolosis. The disease is rare in some countries, but more prevalent in others. It is a major health problem in Bolivia, Ecuador and Peru, the Nile Delta in Egypt and central Vietnam (WHO, 2007). Cooking watercress kills the parasite. Various studies have found watercress contaminated with a high number of protozoan pathogens (Soares and Cantos, 2006), significant levels of <i>E. coli</i> and <i>Campylobacter</i> (Edmonds and Hawke, 2004), and heavy metal contamination (Kara, 2005). "

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Aquatic or semiaquatic, somewhat fleshy, glabrous perennial herbs" ... "in running water or seasonally wet areas"

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	Plants for a Future. 2015. <i>Nasturtium microphyllum</i> . http://www.pfaf.org/user/Plant.aspx?LatinName=Nasturtium+microphyllum . [Accessed 30 Jul 2015]	"It cannot grow in the shade."
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	" <i>N. microphyllum</i> occurs at the edges of rivers, streams, ditches and springs, but not in stagnant water."
	Ortiz-Hernández, Y. D., Martínez-Gutiérrez, G. A., Urrestarazu, M., Vasquez-Vasquez, L., & Escamirosa-Tinoco, C. (2015). Productivity under Shade and Different Nutrient Solution of Hydroponic Watercress (<i>Nasturtium officinale</i> R. Br.). <i>Journal of Plant Nutrition</i> 38(10): 1495-1504	[Related taxon shade intolerant] "Shade cloth percentages higher than 10% caused a significant decrease in total cycle production; the use of shade cloth is not recommended during seasons with low incident radiation."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"It grows on gravel, sand, silt or clay but not on either acid or alkaline peats." ... "Howard and Lyon (1952a) also suggested that <i>N. microphyllum</i> may have a lower calcium and pH requirement than <i>N. officinale</i> ."

Qsn #	Question	Answer
	Plants for a Future. 2015. <i>Nasturtium microphyllum</i> . http://www.pfaf.org/user/Plant.aspx?LatinName=Nasturtium+microphyllum . [Accessed 30 Jul 2015]	"Watercress is easily grown when given the correct conditions of slowly flowing clean water, preferably coming from chalky or limestone soils[264]."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Aquatic or semiaquatic, somewhat fleshy, glabrous perennial herbs; stems floating, prostrate, or ascending, rooting at the nodes, hollow, 1-6 dm long, usually 2-6 mm in diameter."

412	Forms dense thickets	n
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Possibly] "Like <i>N. officinale</i> , this species has spread in some of the countries it has been introduced to, invading waterways and swamping existing native vegetation."

501	Aquatic	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Aquatic or semiaquatic, somewhat fleshy, glabrous perennial herbs"

502	Grass	n
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 29 Jul 2015]	"Family: Brassicaceae (alt. Cruciferae) tribe: Cardamineae"

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	Brassicaceae [No evidence]

Qsn #	Question	Answer
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Aquatic or semiaquatic, somewhat fleshy, glabrous perennial herbs; stems floating, prostrate, or ascending, rooting at the nodes, hollow, 1-6 dm long, usually 2-6 mm in diameter. Leaves pinnately compound with (3-)6-9 leaflets, these ovate to elliptic, 1.5-4 cm long, 0.5-2 cm wide, margins subentire to sinuate-dentate, the terminal one often larger than lateral ones."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[No evidence. Broad native & introduced range] "N. microphyllum is native to the Middle East, parts of North Africa and Europe. It has been introduced to Japan, Yemen, Sub-Saharan Africa, the Americas, Australia and New Zealand. It should be noted that reports of the introduction, naturalisation and rapid spread of watercress in Australia (Australia's Virtual Herbarium, 2013) and New Zealand (Thomson, 1922) are difficult to ascribe to a particular species."

602	Produces viable seed	y
	Source(s)	Notes
	Howard, H. W., & Lyon, A. G. (1952). <i>Nasturtium officinale</i> R. Br (Rorippa <i>Nasturtium-Aquaticum</i> (L.) Hayek). The Journal of Ecology, 40(1): 228-245	"Seed production and dispersal. About 29 seeds per fruit and 20 or more fruits per inflorescence . Number of inflorescences per plant very variable but can be quite numerous. Seed production is thus high." ... "Viability of seeds. Seeds will germinate very soon after they are shed."

603	Hybridizes naturally	y
	Source(s)	Notes
	Garnock-Jones, P. J. (1979). Checklist of dicotyledons naturalized in New Zealand 4. Rhoeadales. New Zealand Journal of Botany, 17(3): 303-310	" <i>Nasturtium microphyllum</i> X <i>officinale</i> " ... "DISTRIBUTION: Ohariu Valley, Kaikoura."
	Howard, H. W., & Lyon, A. G. (1952). <i>Nasturtium officinale</i> R. Br (Rorippa <i>Nasturtium-Aquaticum</i> (L.) Hayek). The Journal of Ecology, 40(1): 228-245	"The cross N. <i>officinale</i> x N. <i>microphyllum</i> only produces good seeds when N. <i>microphyllum</i> is the female parent (Howard & Manton, 1946; Howard, 1947b). The hybrid is a common plant (see under N. <i>microphyllum</i>), but there is no evidence to show how often it is produced, its frequent occurrence being almost entirely due to persistence by vegetative reproduction. The hybrid can be recognized by its low seed fertility and consequent short fruits." ... "The hybrid N. <i>microphyllum</i> x N. <i>officinale</i> is a common member of the British flora and it is also cultivated as 'brown' or 'winter' cress."

604	Self-compatible or apomictic	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Howard, H. W., & Lyon, A. G. (1952). <i>Nasturtium officinale</i> R. Br (<i>Rorippa Nasturtium-Aquaticum</i> (L.) Hayek). <i>The Journal of Ecology</i> , 40(1): 228-245	"It is self-compatible and a good set of fruits with many seeds is obtained when inflorescences are enclosed in cellophane bags and not artificially pollinated."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Howard, H. W., & Lyon, A. G. (1952). <i>Nasturtium officinale</i> R. Br (<i>Rorippa Nasturtium-Aquaticum</i> (L.) Hayek). <i>The Journal of Ecology</i> , 40(1): 228-245	[Visited by a number of insects, including flies and honey bees] "a certain amount of cross-pollination must normally take place. There are two green fleshy nectaries placed together on the inner side of the base of each short stamen and the flowers are visited by insects" ... "It is self-compatible and a good set of fruits with many seeds is obtained when inflorescences are enclosed in cellophane bags and not artificially pollinated."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Howard, H. W., & Lyon, A. G. (1952). <i>Nasturtium officinale</i> R. Br (<i>Rorippa Nasturtium-Aquaticum</i> (L.) Hayek). <i>The Journal of Ecology</i> , 40(1): 228-245	"Vegetative reproduction is by creeping stems. In many cases after flowering the stem falls over and roots by adventitious roots from the nodes." ... "In nature dispersal may take place by portions of the stem becoming detached and floating away."

607	Minimum generative time (years)	2
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	[Probably 1-2 years] " <i>N. microphyllum</i> flowers in June, about 14 days later than <i>N. officinale</i> (Howard and Lyon, 1952b). Growth can be frosted in winter, but <i>N. microphyllum</i> is apparently more frost-tolerant than <i>N. officinale</i> (Howard and Lyon, 1952b). Michaelis (1976) observed seasonal changes in growth of <i>N. microphyllum</i> over two seasons in Waikoropupu Springs in New Zealand. Number of leaflets per leaf was uniform for the youngest ten leaves on any given shoot, increasing from 3-7 leaflets in autumn and winter (early April to early August) to a spring and summer modal value of 9 or 11 (mid-October to mid-February). Shoots of <i>N. microphyllum</i> emerged from shallow water between October and May (late spring to autumn) and flowers were first observed in late November or early December, and flowering continued until May. Pods were present from early January to late May. <i>N. microphyllum</i> plants growing at depths greater than 1 m showed little seasonal change in growth form, did not flower, and maintained 1-5 leaflets per leaf all year round. Michaelis (1976) also measured the biomass of <i>N. microphyllum</i> in Waikoropupu Springs and found this reached about 1500 g m ⁻² between February and May (late summer and early autumn), and then declined. Up to about 30% of the biomass was consumed by cattle at some times."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
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Qsn #	Question	Answer
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"Seeds and stem fragments may be dispersed in mud attached to animals and vehicles (Weeds of Australia, 2013)."
702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to western Europe, widely cultivated as a food plant and widely naturalized in many areas"
703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"Accidental contamination of aquarium plants or animals could possibly spread the species."
	Uyehara, K.. 2009. <i>Practices to Enhance Native Wildlife Habitat on Wetland Taro Farms</i> . Biology Technical Note No. 21. USDA NRCS, Pacific Islands Area, Honolulu, HI	"Appendix C Plants found in wetland taro systems and habitat values" [Includes, <i>Nasturtium microphyllum</i> ; could become a contaminant of taro crops]
	Erickson, T.A. & Puttock, C.F. 2006. <i>Hawai'i Wetland Field Guide: An Ecological And Identification Guide to Wetlands And Wetland Plants of the Hawaiian Islands</i> . Bess Press Books, Honolulu, HI	[Likely transported accidentally in taro cultivation] "it is common in taro patches"
704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	[No evidence] "Seeds and stem fragments may be dispersed in mud attached to animals and vehicles (Weeds of Australia, 2013). Seeds and fragments can become attached to the feet of birds could be transported both locally and, possibly, for longer distances."
705	Propagules water dispersed	y
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"As with <i>N. officinale</i> , seeds and stem segments are commonly spread by water, especially during floods (Weeds of Australia, 2013). Parts of floating beds of <i>N. microphyllum</i> are sometimes washed downstream once or twice a year following grazing by cattle or human interference (Michaelis, 1976)."
	Howard, H. W., & Lyon, A. G. (1952). <i>Nasturtium officinale</i> R. Br (<i>Rorippa Nasturtium-Aquaticum</i> (L.) Hayek). <i>The Journal of Ecology</i> , 40(1): 228-245	"Vegetative reproduction is by creeping stems. In many cases after flowering the stem falls over and roots by adventitious roots from the nodes." ... "In nature dispersal may take place by portions of the stem becoming detached and floating away."
706	Propagules bird dispersed	y

Qsn #	Question	Answer
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	[External bird dispersal] "Seeds and fragments can become attached to the feet of birds could be transported both locally and, possibly, for longer distances."

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"Seeds and stem fragments may be dispersed in mud attached to animals and vehicles (Weeds of Australia, 2013). Seeds and fragments can become attached to the feet of birds could be transported both locally and, possibly, for longer distances."

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"Seeds and stem fragments may be dispersed in mud attached to animals and vehicles (Weeds of Australia, 2013). Seeds and fragments can become attached to the feet of birds could be transported both locally and, possibly, for longer distances."

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	[Densities unspecified] "Seed production is very high at about 29 seeds per fruit and 20 or more fruits per inflorescence. Most seeds fall close to the parent plant (Howard and Lyon, 1952b)."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Howard, H. W., & Lyon, A. G. (1952). <i>Nasturtium officinale</i> R. Br (<i>Rorippa Nasturtium-Aquaticum</i> (L.) Hayek). <i>The Journal of Ecology</i> , 40(1): 228-245	"Seed is viable up to about 5 years when stored dry in packets in the laboratory ..."

803	Well controlled by herbicides	
	Source(s)	Notes
	CABI, 2015. <i>Nasturtium microphyllum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"Chemical control is rarely warranted for watercress, although glyphosphate has been suggested (Monsanto, 2013)."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes

Qsn #	Question	Answer
	<p>CABI, 2015. <i>Nasturtium microphyllum</i>. In: <i>Invasive Species Compendium</i>. Wallingford, UK: CAB International. www.cabi.org/isc</p>	<p>[Damage may result in dispersal, rather than mortality of parent plants] "Parts of floating beds of <i>N. microphyllum</i> are sometimes washed downstream once or twice a year following grazing by cattle or human interference (Michaelis, 1976). Vector transmission (biotic) Seeds and stem fragments may be dispersed in mud attached to animals and vehicles (Weeds of Australia, 2013). Seeds and fragments can become attached to the feet of birds could be transported both locally and, possibly, for longer distances."</p>

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	<p>CABI, 2015. <i>Nasturtium microphyllum</i>. In: <i>Invasive Species Compendium</i>. Wallingford, UK: CAB International. www.cabi.org/isc</p>	<p>"Biological control would not be tolerated in most countries, since many people collect and consume wild-growing watercress."</p>
	<p>Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i>. Bishop Museum Press, Honolulu, HI</p>	<p>"Several pests affect watercress, including the caterpillar of the diamondback moth, which defoliates the stems above water."</p>

Summary of Risk Traits:

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Grows in warm temperate & tropical climates
- Widely introduced and naturalized (including Kauai, Oahu, Molokai, Maui & Hawaii islands)
- Possible aquatic environmental weed
- Other *Nasturtium* species have become invasive
- Pathogen host
- May be contaminated with parasites that can infect people
- Reproduces by seeds
- Hybridizes with *N. officinale*
- Self-compatible
- Reproduces by vegetative fragments
- Readily dispersed. Seeds & vegetative fragments dispersed in water, in mud stuck to birds, other animals, vehicles, equipment

Low Risk Traits

- No spines, thorns or burrs
- Palatable to livestock
- Non-toxic
- Edible uses (although may be contaminated with parasites)
- Shade intolerant