

<b>Taxon:</b> <i>Trifolium resupinatum</i> L.	<b>Family:</b> Fabaceae
<b>Common Name(s):</b> annual strawberry clover bird-eye clover Persian clover reversed clover reversed trefoil shaftal clover	<b>Synonym(s):</b> <i>Amoria resupinata</i> (L.) Roskov <i>Galearia resupinata</i> (L.) C.Presl <i>Trifolium resupinatum</i> subsp. <i>Trifolium resupinatum</i> var. <i>Trifolium suaveolens</i> Willd.

<b>Assessor:</b> Chuck Chimera	<b>Status:</b> Assessor Approved	<b>End Date:</b> 23 Nov 2021
<b>WRA Score:</b> 6.0	<b>Designation:</b> EVALUATE	<b>Rating:</b> Evaluate

**Keywords:** Annual Herb, Naturalized, Fodder, Self-Compatible, Animal-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)	Intermediate
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	n=0, y = 1*multiplier (see Appendix 2)	y
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
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		
406	Host for recognized pests and pathogens		

Qsn #	Question	Answer Option	Answer
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		
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
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		
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	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
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		
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m <sup>2</sup> )	y=1, n=-1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
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
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	[Not domesticated] "Cultivars Some var. majus examples are Maral (Portugal); Assopos, Mornos and Ossa (Greece); Abon (United States of America); Morbulk, Lightning and Laser (Australia); and Wardan (India). Some var. resupinatum examples are Kyambro, Nitro Plus and Persian Prolific (Australia); and Accadia (Italy)."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2021). 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"	Intermediate
	Source(s)	Notes
	Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a> . [Accessed 10 Nov 2021]	"Additional information. Origin. Macronesia, north Africa, temperate and tropical Asia, Europe."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. <a href="https://npgsweb.ars-grin.gov/">https://npgsweb.ars-grin.gov/</a> . [Accessed 10 Nov 2021]	"Native Africa MACARONESIA: Spain [Canarias], Portugal [Madeira Islands] NORTHERN AFRICA: Algeria (n.), Egypt, Libya (n.), Morocco, Tunisia Asia-Temperate WESTERN ASIA: Afghanistan, Cyprus, Iran, Iraq, Israel, Jordan (n.w.), Lebanon, Syria, Turkey CAUCASUS: Armenia, Azerbaijan, Georgia, Russian Federation [Dagestan, Krasnodar, Stavropol] Asia-Tropical INDIAN SUBCONTINENT: Pakistan Europe MIDDLE EUROPE: Switzerland, Hungary EASTERN EUROPE: Ukraine (incl. Krym) SOUTHEASTERN EUROPE: Former Yugoslavia, Bulgaria, Italy, Malta, Romania SOUTHWESTERN EUROPE: Spain, France, Portugal"

202	Quality of climate match data	High
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. <a href="https://npgsweb.ars-grin.gov/">https://npgsweb.ars-grin.gov/</a> . [Accessed 10 Nov 2021]	

203	Broad climate suitability (environmental versatility)	y
	<b>Source(s)</b>	<b>Notes</b>
	Heuzé V., Tran G., Giger-Reverdin S., & Lebas F. (2015). Persian clover ( <i>Trifolium resupinatum</i> ). Feedipedia, a programme by INRAE, CIRAD, AFZ and FAO. <a href="https://www.feedipedia.org/node/244">https://www.feedipedia.org/node/244</a> . [Accessed 18 Nov 2021]	" <i>Trifolium resupinatum</i> is commonly found in grasslands and disturbed areas, fallows, roadsides and waste grounds within 40°N and the Sahara. It grows up to an altitude of 2500 m in the Afghan uplands, and 2750 m in the Himalayas. It is frost resistant but does not grow under low temperatures. However, it remains dormant under the snow-coat and quickly regrows when temperatures get warmer in early spring. In these elevated areas, it is thus grown as an overwintering annual (Suttie, 1999)."

204	Native or naturalized in regions with tropical or subtropical climates	y
	<b>Source(s)</b>	<b>Notes</b>
	Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a> . [Accessed 10 Nov 2021]	"Additional information. Origin. Macronesia, north Africa, temperate and tropical Asia, Europe."
	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.	"Native to central and southern Europe, the Mediterranean region, and western Asia; in Hawai'i at least sparingly naturalized on Hawai'i. First and only collection seen from Kuka'iau Ranch near Papa'aloa, made in 1940 (Hosaka 2520, BISH)."

205	Does the species have a history of repeated introductions outside its natural range?	y
	<b>Source(s)</b>	<b>Notes</b>
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	"Indigenous to central and southern Europe and to southwest Asia, where it is cultivated up to 2500 masl (Suttie, 1999b). Introduced to several countries, e.g. United States of America, Australia and South Africa."

301	Naturalized beyond native range	y
	<b>Source(s)</b>	<b>Notes</b>
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. <a href="https://npgsweb.ars-grin.gov/">https://npgsweb.ars-grin.gov/</a> . [Accessed 12 Nov 2021]	"Naturalized (widely natzd. elsewhere)"

Qsn #	Question	Answer
	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.	[Hawaii island] "Native to central and southern Europe, the Mediterranean region, and western Asia; in Hawai'i at least sparingly naturalized on Hawai'i. First and only collection seen from KI1ka'iau Ranch near Papa'aloa, made in 1940 (Hosaka 2520, BISH)."

302	Garden/amenity/disturbance weed	y
	Source(s)	Notes
	HerbiGuide. (2021). Shaftal Clover - <i>Trifolium resupinatum</i> . <a href="http://www.herbiguide.com.au/Descriptions/hg_Shaftal_Clover.htm">http://www.herbiguide.com.au/Descriptions/hg_Shaftal_Clover.htm</a> . [Accessed 12 Nov 2021]	"Detrimental: Weed of lawns roadsides and disturbed areas. Occasional weed of crops."
	Scattini, W. (2008). Persian clover (ssp. majus). Pastures Australia. <a href="https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm">https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm</a> . [Accessed 23 Nov 2021]	"Weed potential: Low. Seed very susceptible to sprouting in the head and to false breaks."

303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	Heuzé V., Tran G., Giger-Reverdin S., & Lebas F. (2015). Persian clover ( <i>Trifolium resupinatum</i> ). Feedipedia, a programme by INRAE, CIRAD, AFZ and FAO. <a href="https://www.feedipedia.org/node/244">https://www.feedipedia.org/node/244</a> . [Accessed 12 Nov 2021]	"In India, certain types of Persian clover are regarded as a weed in berseem fields (Suttie, 1999)."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Orchards & Plantations, Pastures, Pome Fruits"
	Scattini, W. (2008). Persian clover (ssp. majus). Pastures Australia. <a href="https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm">https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm</a> . [Accessed 23 Nov 2021]	"Weed potential: Low. Seed very susceptible to sprouting in the head and to false breaks."
	CABI. (2021). Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	No documented impacts.

304	Environmental weed	n
	Source(s)	Notes
	Scattini, W. (2008). Persian clover (ssp. majus). Pastures Australia. <a href="https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm">https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm</a> . [Accessed 23 Nov 2021]	"Weed potential: Low. Seed very susceptible to sprouting in the head and to false breaks."
	CABI. (2021). Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	No description of negative impacts

305	Congeneric weed	y
	Source(s)	Notes

Qsn #	Question	Answer
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	" <i>Trifolium alexandrinum</i> ... Weed of: Orchards & Plantations, Pome Fruits" ... " <i>Trifolium alpestre</i> ... Weed of: Cereals" ... " <i>Trifolium angustifolium</i> ... Weed of: Cereals, Pastures" ... " <i>Trifolium arvense</i> ... Weed of: Cereals, Lupins, Orchards & Plantations, Pastures" ... " <i>Trifolium aureum</i> ... Weed of: Cereals, Vegetables" ... " <i>Trifolium campestre</i> ... Weed of: Cereals, Orchards & Plantations, Pastures, Pome Fruits" ... " <i>Trifolium cernuum</i> ... Weed of: Pastures" ... " <i>Trifolium clusii</i> ... Weed of: Orchards & Plantations, Pome Fruits" ... " <i>Trifolium dubium</i> ... Weed of: Cereals, Orchards & Plantations, Pastures" ... " <i>Trifolium echinatum</i> ... Weed of: Cereals" ... " <i>Trifolium fragiferum</i> ... Weed of: Cereals, Orchards & Plantations" ... " <i>Trifolium glomeratum</i> ... Weed of: Pastures" ... " <i>Trifolium hybridum</i> ... Weed of: Cereals, Nursery Production, Orchards & Plantations" ... " <i>Trifolium incarnatum</i> ... Weed of: Cereals, Vegetables" ... " <i>Trifolium lappaceum</i> ... Weed of: Orchards & Plantations, Pome Fruits" ... " <i>Trifolium medium</i> ... Weed of: Cereals" ... " <i>Trifolium patens</i> ... Weed of: Pastures" ... " <i>Trifolium pretense</i> ... Weed of: Cereals, Grapevines, Nursery Production, Orchards & Plantations, Pastures, Vegetables" ... " <i>Trifolium procumbens</i> ... Weed of: Cereals" ... " <i>Trifolium purpureum</i> ... Weed of: Orchards & Plantations, Pome Fruits" ... " <i>Trifolium resupinatum</i> ... Weed of: Orchards & Plantations, Pastures, Pome Fruits" ... " <i>Trifolium rubens</i> ... Weed of: Cereals" ... " <i>Trifolium rueppellianum</i> ... Weed of: Orchards & Plantations" ... " <i>Trifolium stellatum</i> ... Weed of: Cereals, Orchards & Plantations, Pome Fruits" ... " <i>Trifolium strepens</i> ... Weed of: Cereals" ... " <i>Trifolium striatum</i> ... Weed of: Pastures" ... " <i>Trifolium subterraneum</i> ... Weed of: Cereals, Pastures" ... " <i>Trifolium tomentosum</i> ... Weed of: Cereals,"
	White, M. R. (ed.). (2013). Invasive Plants and Weeds of the National Forests and Grasslands in the Southwestern Region. Second Edition. USDA Forest Service, Southwestern Region, Apache-Sitgreaves National Forests	"White clover may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed making it a concern in riparian and moist meadow habitats. This species generally occurs as a weed in wildland areas of the Southwestern Region rather than as an invasive plant."

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.	[No evidence] "Annual herbs with taproots; stems decumbent, not rooting at the nodes, 1-4 dm long, branched, glabrous. Leaflets obovate or narrowly obovate, 10-20 mm long, 6-10 mm wide, glabrous, margins denticulate or serrulate in upper 2/3, stipules ovate to lanceolate, adnate to petioles up to 2/3 their length. Heads axillary, in flowering stage more or less discoid, ca. 10 mm in diameter, peduncles 10-60 mm long, pedicels 0-1 mm long, each flower resupinate, bracts absent; calyx tube bilabiate, 1.5-2 mm long, inflated up to 8 mm long in fruit, stiff and membranous, reticulate-veined, the throat open, glabrous, the teeth 2-3 mm long, the upper 2 largest, divergent to recurved in fruit; corolla pink or purple, becoming brown, 2-8 mm long. Pods membranous, oblong to ovoid, dehiscent, enclosed in the bladderly calyx. Seeds 1-2, brown or blackish, ovoid, ca. 1.5 mm long."

402	Allelopathic	
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Heuzé V., Tran G., Giger-Reverdin S., & Lebas F. (2015). Persian clover ( <i>Trifolium resupinatum</i> ). Feedipedia, a programme by INRAE, CIRAD, AFZ and FAO. <a href="https://www.feedipedia.org/node/244">https://www.feedipedia.org/node/244</a> . [Accessed 12 Nov 2021]	"While in vitro experiments showed that Persian clover has an allelopathic effect (though to a lesser extent than berseem) on germinating weeds (Maighany et al., 2007), the efficiency of Persian clover at preventing weed seed development was not confirmed by field trials (Uchino et al., 2011)."

403	Parasitic	n
	<b>Source(s)</b>	<b>Notes</b>
	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.	"Annual herbs with taproots" [Fabaceae. No evidence]

404	Unpalatable to grazing animals	n
	<b>Source(s)</b>	<b>Notes</b>
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	"Grazing management: It is highly suitable for grazing. If moderately grazed in spring, it can set seed for regeneration. It is sometimes utilized as zero grazing (cut-and-carry green forage) in southwest Asia."
	Heuzé V., Tran G., Giger-Reverdin S., & Lebas F. (2015). Persian clover ( <i>Trifolium resupinatum</i> ). Feedipedia, a programme by INRAE, CIRAD, AFZ and FAO. <a href="https://www.feedipedia.org/node/244">https://www.feedipedia.org/node/244</a> . [Accessed 12 Nov 2021]	"Persian clover is mostly used for fodder, supplying highly palatable and nutritive pasture and hay. Its high protein and moisture content may make it unsuitable for ensiling, depending on the variety (NSWG, 2003; Suttie, 1999)."

405	Toxic to animals	n
	<b>Source(s)</b>	<b>Notes</b>
	Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a> . [Accessed 12 Nov 2021]	"Toxicity. Possibly poisonous to stock."
	HerbiGuide. (2021). Shaftal Clover - <i>Trifolium resupinatum</i> . <a href="http://www.herbiguide.com.au/Descriptions/hg_Shaftal_Clover.htm">http://www.herbiguide.com.au/Descriptions/hg_Shaftal_Clover.htm</a> . [Accessed 12 Nov 2021]	"Toxicity: Closely related species may cause photo sensitisation in cattle and clover disease in sheep and occasionally bloat. No field cases have been reported for this species, possibly because of its low occurrence."
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	[Beetles contaminating hay are toxic to horses. Pure swards may cause bloat] "In the United States of America, blister beetle ( <i>Epicauta vittata</i> ) is an insect problem in hay since an intake of 4-5 dead beetles is fatal to horses (Hoveland and Evers, 1995)." ... "Anti-quality factors There is risk of bloat in cattle and sheep, though less so in mixed grass+clover swards than from pure-sown clover swards."

406	Host for recognized pests and pathogens	n

Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Scattini, W. (2008). Persian clover (ssp. majus). Pastures Australia. <a href="https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm">https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm</a> . [Accessed 22 Nov 2021]	"Major pests: Red legged earthmite and lucerne flea need to be identified and controlled rapidly during establishment. Major diseases: Some cultivars susceptible to leaf and stem rust ( <i>Uromyces trifolii-repentis</i> ) and clover rot ( <i>Scherotinia trifoliorum</i> )"
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	"Pests In Australia, seedlings of both var. majus and var. resupinatum are susceptible to red-legged earth mite ( <i>Halotydeus destructor</i> ), lucerne flea ( <i>Sminthurus viridus</i> ), cowpea aphid ( <i>Aphis craccivora</i> ) and blue-green aphid ( <i>Acyrtosiphon kondai</i> ) (Reed, 1999). In the United States of America, blister beetle ( <i>Epica vititata</i> ) is an insect problem in hay since an intake of 4-5 dead beetles is fatal to horses (Hoveland and Evers, 1995). Diseases Many of the cultivars of both varieties are tolerant of or resistant to clover scorch ( <i>Kabatiella caulivora</i> ) and phytophthora root rot ( <i>Phytophthora clandestina</i> ) (Dear, Lacy and Sandral, 2000)."

407	Causes allergies or is otherwise toxic to humans	n
	<b>Source(s)</b>	<b>Notes</b>
	Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a> . [Accessed 12 Nov 2021]	"Toxicity. Possibly poisonous to stock."
	HerbiGuide. (2021). Shaftal Clover - <i>Trifolium resupinatum</i> . <a href="http://www.herbiguide.com.au/Descriptions/hg_Shaftal_Clover.htm">http://www.herbiguide.com.au/Descriptions/hg_Shaftal_Clover.htm</a> . [Accessed 12 Nov 2021]	"Toxicity: Closely related species may cause photo sensitisation in cattle and clover disease in sheep and occasionally bloat. No field cases have been reported for this species, possibly because of its low occurrence."
	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 for humans

408	Creates a fire hazard in natural ecosystems	n
	<b>Source(s)</b>	<b>Notes</b>
	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.	[No evidence. Unlikely. A low-growing annual herb] "Annual herbs with taproots; stems decumbent, not rooting at the nodes, 1-4 dm long, branched, glabrous."
	CABI. (2021). Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	No evidence



Qsn #	Question	Answer
409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	Useful Temperate Plants. (2021). <i>Trifolium resupinatum</i> . Temperate Plants Database, Ken Fern. <a href="https://temperate.theferns.info">https://temperate.theferns.info</a> . [Accessed 12 Nov 2021]	"Grows best in a sunny position but toleratis light shade"
	The National Gardening Association. (2021). Persian Clover ( <i>Trifolium resupinatum</i> ). <a href="https://garden.org/">https://garden.org/</a> . [Accessed 12 Nov 2021]	"Sun Requirements: Full Sun"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	"Adapted to a wide range of soil and climatic conditions but prefers moderately acidic to alkaline heavy-textured soils."

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.	"Annual herbs with taproots; stems decumbent, not rooting at the nodes, 1-4 dm long, branched, glabrous."

412	Forms dense thickets	
	Source(s)	Notes
	Heuzé V., Tran G., Giger-Reverdin S., & Lebas F. (2015). Persian clover ( <i>Trifolium resupinatum</i> ). Feedipedia, a programme by INRAE, CIRAD, AFZ and FAO. <a href="https://www.feedipedia.org/node/244">https://www.feedipedia.org/node/244</a> . [Accessed 12 Nov 2021]	"It forms dense swards and has a rosette growth habit under grazing." [No indication if these dense swards can exclude other vegetation]

501	Aquatic	n
	Source(s)	Notes
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	[Terrestrial] "It is adapted to a wide range of soils, withstands temporary waterlogging, and is cold tolerant."

502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. <a href="https://npgsweb.ars-grin.gov/">https://npgsweb.ars-grin.gov/</a> . [Accessed 10 Nov 2021]	Genus: <i>Trifolium</i> Subgenus: <i>Trifolium</i> Section: <i>Vesicastrum</i> Family: <i>Fabaceae</i> (alt. <i>Leguminosae</i> ) Subfamily: <i>Faboideae</i> Tribe: <i>Trifolieae</i>

Qsn #	Question	Answer
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	[N-Fixing Herb] "Nitrogen fixation Seed inoculation with an effective strain of Rhizobium is necessary when sown on to land without a previous history of growing Persian clover."
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.	"Annual herbs with taproots; stems decumbent, not rooting at the nodes, 1-4 dm long, branched, glabrous."
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	[No evidence] "Indigenous to central and southern Europe and to southwest Asia, where it is cultivated up to 2500 masl (Suttie, 1999b). Introduced to several countries, e.g. United States of America, Australia and South Africa."
602	Produces viable seed	y
	Source(s)	Notes
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	"Ability to spread naturally Good regeneration capacity from hard-seeded var. <i>resupinatum</i> subspecies, but soft-seeded var. <i>majus</i> in Australia mainly used as 1-year crop because of difficulty in building up a long-term soil seed bank as the shed soft seed germinate readily following rainfall."
603	Hybridizes naturally	
	Source(s)	Notes

Qsn #	Question	Answer
	Abberton, M. T. (2007). Interspecific hybridization in the genus <i>Trifolium</i> . <i>Plant Breeding</i> , 126(4), 337-342	[No evidence for <i>Trifolium resupinatum</i> ] "The genus <i>Trifolium</i> (Leguminosae) or clovers includes a number of agriculturally important forage species. In particular <i>Trifolium repens</i> (white clover) and <i>Trifolium pratense</i> (red clover) are widely used in temperate livestock agriculture. Interspecific crossing programmes within this genus have been carried out for more than 50 years, in many cases involving embryo rescue or ovule culture techniques. In general, the aims of these have been twofold: to aid understanding of evolutionary relationships within the genus and to introgress useful traits, predominantly into white or red clover. In the case of white clover, the greatest efforts have been made with respect to crossing with <i>Trifolium nigrescens</i> and <i>Trifolium ambiguum</i> . Novel germplasm has been developed and useful traits transferred, although no material has yet been commercialized. The main emphasis with respect to red clover has been increasing longevity through crosses with more persistent species, particularly <i>Trifolium medium</i> . Again, this work has not yet resulted in new varieties. Wider crossing programmes, allied in recent years to comparisons at the DNA level, have shed considerable light on the systematics and evolution of the genus. The future of interspecific hybridization for improvement of the agriculturally important clovers and the role of molecular approaches in this are discussed."

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Frame, J. (2005). <i>Forage Legumes for Temperate Grasslands</i> . CRC Press, Boca Raton, FL	"It is self-fertile and self-pollinating, but pollination is improved by the presence of honey bees ( <i>Apis mellifera</i> ) and leaf-cutter bees ( <i>Megachile rotundata</i> )."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Frame, J. (2005). <i>Forage Legumes for Temperate Grasslands</i> . CRC Press, Boca Raton, FL	"It is self-fertile and self-pollinating, but pollination is improved by the presence of honey bees ( <i>Apis mellifera</i> ) and leaf-cutter bees ( <i>Megachile rotundata</i> )."

606	Reproduction by vegetative fragmentation	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.	"Annual herbs with taproots; stems decumbent, not rooting at the nodes, 1-4 dm long, branched, glabrous."
	HerbiGuide. (2021). Shaftal Clover - <i>Trifolium resupinatum</i> . <a href="http://www.herbiguide.com.au/Descriptions/hg_Shaftal_Clover.htm">http://www.herbiguide.com.au/Descriptions/hg_Shaftal_Clover.htm</a> . [Accessed 12 Nov 2021]	"Vegetative Propagules: None."

607	Minimum generative time (years)	1
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	"Glabrous annual, procumbent to erect, thick hollow stems up to 80 cm."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Livestock, Sheep, Vehicles, Water, Escapee"
	Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a> . [Accessed 23 Nov 2021]	"Seed. Dispersal. Agricultural activities." [Possibly, although seeds lack means of external attachment]

702	Propagules dispersed intentionally by people	y
	<b>Source(s)</b>	<b>Notes</b>
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	"Indigenous to central and southern Europe and to southwest Asia, where it is cultivated up to 2500 masl (Suttie, 1999b). Introduced to several countries, e.g. United States of America, Australia and South Africa."

703	Propagules likely to disperse as a produce contaminant	y
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Contaminant, Crop, Herbal, Ornamental, Pasture Dispersed by: Humans, Animals, Livestock, Sheep, Vehicles, Water, Escapee"
	Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a> . [Accessed 23 Nov 2021]	"Seed. Dispersal. Agricultural activities." [Probably Yes. Grown as a pasture plant. Likely to be spread intentionally and accidentally with forage species]

704	Propagules adapted to wind dispersal	n
	<b>Source(s)</b>	<b>Notes</b>
	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.	"Pods membranous, oblong to ovoid, dehiscent, enclosed in the bladderly calyx. Seeds 1-2, brown or blackish, ovoid, ca. 1.5 mm long."
	Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a> . [Accessed 23 Nov 2021]	"Seed. Dispersal. Agricultural activities."

705	Propagules water dispersed	
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[Possibly by heavy rains, or if cultivated in riparian habitats] "Dispersed by: Humans, Animals, Livestock, Sheep, Vehicles, Water, Escapee"

706	Propagules bird dispersed	n
	<b>Source(s)</b>	<b>Notes</b>
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	[Ingested by grazing animals, but not fleshy-fruited, and unlikely to be consumed by birds] "When seed is ingested while grazing, the smallness and hardseededness of var. <i>resupinatum</i> allow passage of seed through the animal, thus assisting sward regeneration."

707	Propagules dispersed by other animals (externally)	n
	<b>Source(s)</b>	<b>Notes</b>
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	[Internally dispersed] "When seed is ingested while grazing, the smallness and hardseededness of var. <i>resupinatum</i> allow passage of seed through the animal, thus assisting sward regeneration."
	Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a> . [Accessed 23 Nov 2021]	"Seed. Dispersal. Agricultural activities."

708	Propagules survive passage through the gut	y
	<b>Source(s)</b>	<b>Notes</b>
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	"When seed is ingested while grazing, the smallness and hardseededness of var. <i>resupinatum</i> allow passage of seed through the animal, thus assisting sward regeneration."
	Dovrat, G., Perevolotsky, A., & Ne'Eman, G. (2012). Wild boars as seed dispersal agents of exotic plants from agricultural lands to conservation areas. <i>Journal of Arid Environments</i> , 78, 49-54	[Seeds collected in boar dung] "Table 1. List of 31 species that germinated from wild boar-dung samples (n = 136) collected in Ramat-Hanadiv Park (2007e2008), Israel; number of seedlings, their origin (native or exotic), fleshy (+) or dry (-) fruit, seed mass (mg) and their relative abundance in the park (number of observation per 1000 m2)." [Trifolium <i>resupinatum</i> - Abundance = 171.5]

801	Prolific seed production (>1000/m2)	n
	<b>Source(s)</b>	<b>Notes</b>
	Scattini, W. (2008). Persian clover ( <i>ssp. majus</i> ). Pastures Australia. <a href="https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm">https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm</a> . [Accessed 23 Nov 2021]	"Ability to spread. Poor recruitment; most cultivars produce little hard seed."
	Parlak, A. Ö., Gokkus, A., & Demiray, H. C. (2011). Soil seed bank and aboveground vegetation in grazing lands of southern Marmara, Turkey. <i>Notulae Botanicae Horti Agrobotanici Cluj-Napoca</i> , 39(1), 96-106	[No evidence in natural and artificial settings] "Tab. 4. Characteristics of aboveground vegetation (means, plants/m2) of the grazing lands" [Trifolium <i>resupinatum</i> - Coastal pasture = 6.87; Reseeded pasture = 4.94; Artificial pasture = 9.16; Lowland shrubland = 0.97; Ungrazed pastured = 0.12; Hillside shrubland = No data]

Qsn #	Question	Answer
	<p>Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL</p>	<p>[Possibly if grown as a seed crop, but unlikely when mixed with other vegetation] "Seed production Seed crops may be direct combine harvested or cut, windrowed and threshed. Italy is the major seed producer in Europe, with an annual production of 265 t of certified seed, which meets its own internal demand of 130 t and only partially meets France's 180 t usage (Porqueddu, Ledda and Roggero, 2000). Yields of 170-336 kg ha<sup>-1</sup> are common in the United States of America, but 675 kg ha<sup>-1</sup> has been achieved (Knight, 1985b). Seed yields of 150-300 kg ha<sup>-1</sup> have been reported from Australia, but potential yields of 1000 kg ha<sup>-1</sup> have been measured (Dear, Lacy and Sandral, 2000). Average seed yields from experimental pure-sown var. <i>resupinatum</i> stands in southern Italy were 295 kg ha<sup>-1</sup> (unirrigated) and 732 kg ha<sup>-1</sup> (irrigated) when forage was not previously harvested, but fell to 62 and 153 kg ha<sup>-1</sup>, respectively, when forage was previously harvested (Martiniello, 1999). Experimentally, seed yields of 800-1300 kg ha<sup>-1</sup> have been reported in southern Australia for the var. <i>resupinatum</i> cv. Kyambro (Anon, 1989b)."</p>

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	<p>Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a>. [Accessed 23 Nov 2021]</p>	<p>"Seedbank persistence. Short to medium term."</p>
	<p>Walters, C., Wheeler, L. M., &amp; Grotenhuis, J. M. (2005). Longevity of seeds stored in a genebank: species characteristics. <i>Seed Science Research</i>, 15(01), 1-20</p>	<p>[<i>Trifolium resupinatum</i> seeds able to be artificially stored for 43.7 years] "Table 1. Storage performance of seeds in the USDA National Plant Germplasm System (NPGS) collection. The study includes accessions that were harvested between 1934 and 1975 and had initial germination percentages greater than 75% (except where indicated). Seeds were initially stored at 5°C, but were transferred to -18°C in 1978. Data for most species reflect storage for 24- 26 years at - 18°C. Initial and final germination values are averages calculated within 1 year of harvest and after the indicated storage time, respectively."</p>

Qsn #	Question	Answer
803	Well controlled by herbicides	y
	Source(s)	Notes
	Scattini, W. (2008). Persian clover (ssp. majus). Pastures Australia. <a href="https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm">https://keys.lucidcentral.org/keys/v3/pastures/Html/Persian_clover_(ssp._majus).htm</a> . [Accessed 23 Nov 2021]	"Herbicide susceptibility. Glyphosate. Damaged by many broad-leaf herbicides."
	Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a> . [Accessed 23 Nov 2021]	"Suggested method of management and control. Prevent seed set for 5 years. Spot spray with 1% glyphosate before flowering. Otherwise spot spray with 4 g Lontrel®, 1 g Logran®, 0.1 g metsulfuron methyl (600 g/L) or 0.1 g Glean® in 10 L water + wetting agent when plants are actively growing. Repeat annually for several years. Read the manufacturers' labels and material safety data sheets before using herbicides."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Frame, J. (2005). Forage Legumes for Temperate Grasslands. CRC Press, Boca Raton, FL	[Tolerates grazing and cutting] "Traditionally used as a self-regenerating, autumn-sown cool-season annual, but can be grown as a special-purpose summer forage crop. Adapted to a wide range of soil and climatic conditions but prefers moderately acidic to alkaline heavy-textured soils. Intolerant of high concentrations of Mn (De Marco, Li and Randall, 1995). it displays moderate cold tolerance, and withstands moderate waterlogging and saline conditions. Good regrowth after grazing or cutting for hay, with most vigorous growth in late spring to early summer."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	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.	[Unknown] "Native to central and southern Europe, the Mediterranean region, and western Asia; in Hawai'i at least sparingly naturalized on Hawai'i. First and only collection seen from K11ka'iau Ranch near Papa'aloa, made in 1940 (Hosaka 2520, BISH)."

**Summary of Risk Traits:**

## High Risk / Undesirable Traits

- Broad climate suitability
- Can grow, and potentially spread, in regions with tropical climates
- Sparingly naturalized on Hawaii island, widely naturalize elsewhere
- Weed of lawns roadsides and disturbed areas
- Occasional weed of crops (impacts ambiguous)
- Other *Trifolium* species are invasive weeds
- Potentially allelopathic
- May be mildly toxic to livestock under certain conditions
- Tolerates many soil types (not substrate limited)
- Forms dense swards (could compete with other desirable vegetation)
- Reproduces by seeds
- Self-fertile and self-pollination
- An annual, reaching maturity in <1 year
- Seeds dispersed internally by animals and through agricultural activities (i.e. potential soil and seed contaminant)
- Tolerates cutting and grazing

## Low Risk Traits

- Despite naturalization and reports of weediness, generally not regarded as a problematic agricultural or environmental weed in the Hawaiian Islands
- Unarmed (no spines, thorns or burrs)
- Provides fodder for livestock
- Ornamental
- Not reported to spread vegetatively
- Herbicides may provide effective control if removal is desired

## Second Screening Results for Herbs or Low Stature Shrubby Life Forms

(A) Reported as a weed of cultivated lands? Yes, although impacts are ambiguous

(B) Unpalatable to grazers or known to form dense stands? Not unpalatable, but may form dense swards

Outcome = Evaluate



