Taxon: Tetragonia echinata Aiton **Family:** Aizoaceae

Common Name(s): Klappiesbrak **Synonym(s):**
opskot seacoral

Assessor: Chuck Chimera **Status:** Approved **End Date:** 16 Mar 2024

WRA Score: 6.0 **Designation:** L **Rating:** Low Risk

Keywords: Annual, Naturalized (Oahu), Fodder, Succulent, 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)	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	n
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	n
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		
304	Environmental weed	y = 2*multiplier (see Appendix 2), n = 0	n
305	Congeneric weed	y = 1*multiplier (see Appendix 2), n = 0	y
401	Produces spines, thorns or burrs	y = 1, n = 0	y
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		
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)		

Qsn #	Question	Answer Option	Answer
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		
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)	y = 1, n = -1	y
702	Propagules dispersed intentionally by people		
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y = 1, n = -1	n
705	Propagules water dispersed	y = 1, n = -1	n
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	y
801	Prolific seed production (>1000/m2)	y = 1, n = -1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)	y = 1, n = -1	y
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
	Goldblatt, P., & Manning, J. (2000). Cape plants: a conspectus of the Cape flora of South Africa. National Botanical Institute, Cape Town	[Not domesticated] "Prostrate, succulent annual to 30 cm. Leaves ovate to orbicular. Flowers subsessile, 2–4 in axils, greenish, stamens as many as the sepals. Fruits globose, with spiny ridges and horns. June–Sept. Sandy slopes and disturbed ground, NW, SW, KM (Namibia to Stellenbosch, Ladismith to Grahamstown)."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2024). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2024). 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
	KewScience. (2024). Plants of the World Online - Tetragonia echinata. http://powo.science.kew.org. [Accessed 8 Mar 2024]	"Native to: Cape Provinces Introduced into: Canary Is."
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Naturalized on Oahu, Hawaiian Islands] "Tetragonia echinata was found during casual botanizing in Kapolei, where hundreds of plants were found in three scattered populations along Kualakai and Kapolei Parkways. A further population was later found in 'Ewa at One'ula Beach Park."

202	Quality of climate match data	High
	Source(s)	Notes
	KewScience. (2024). Plants of the World Online - Tetragonia echinata. http://powo.science.kew.org. [Accessed 8 Mar 2024]	"Native to: Cape Provinces Introduced into: Canary Is."

203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	Wells, M. J., Balsinhas, A. A., Joffe, H., Engelbrecht, V.M., Harding, G. & Stirton, C.H. (1986). A Catalogue of problem plants in Southern Africa. Botanical Research Institute, Republic of South Africa	"Moisture Regimes: Terrestrial dry Climates: Winter rainfall (temperate), all-year rainfall (temperate), summer rainfall (temperate), summer rainfall (sub-tropical)"
	Germishuizen, G. & Meyer, N.L. (eds). (2003). Plants of southern Africa: an annotated checklist. Strelitzia 14. National Botanical Institute, Pretoria	[Elevation range <1000 m] "echinata Aiton Annual. Herb. Ht up to 0.4 m. Alt 30-765 m. NC, WC, EC""

Qsn #	Question	Answer
204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	KewScience. (2024). Plants of the World Online - Tetragonia echinata. http://powo.science.kew.org. [Accessed 8 Mar 2024]	"Native to: Cape Provinces Introduced into: Canary Is."
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Naturalized on Oahu, Hawaiian Islands] "Tetragonia echinata was found during casual botanizing in Kapolei, where hundreds of plants were found in three scattered populations along Kualakai and Kapolei Parkways. A further population was later found in 'Ewa at One'ula Beach Park."

205	**Does the species have a history of repeated introductions outside its natural range?**	**n**
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[Dispersed within native range] "Major Pathway/s: Contaminant, Ornamental Dispersed by: Humans, Animals, Goat, Livestock References: South Africa-R-121, South Africa-ZD-1579."
	KewScience. (2024). Plants of the World Online - Tetragonia echinata. http://powo.science.kew.org. [Accessed 11 Mar 2024]	Limited observations outside native range

301	**Naturalized beyond native range**	**y**
	Source(s)	**Notes**
	Padrón-Mederos, M. A., Guma, I. R., Santos-Guerra, A., & Reyes-Betancort, J. A. (2009). Apuntes florísticos y taxonómicos para la flora de las Islas Canarias. Acta botánica malacitana, 34, 242-251	[Canary Islands] "Especie nativa de Sudáfrica, donde se la considera como planta pionera propia de lugares abiertos, en ocasiones en bordes de carreteras (Adamsom, op. cit.). En Gran Canaria se ha observado principalmente creciendo en ambientes removidos próximos a la costa participando en las asociaciones Chenopodio-Malvetum parviflorae Lohmeyer y Trautmann 1970 y Mesembryanthemetum crystallinii Sunding 1972. Nueva cita para Macaronesia." [Species native to South Africa, where it is considered as a pioneer plant typical of places open, sometimes on roadsides (Adamsom, op. cit.). In Gran Canaria it has been observed mainly growing in removed environments close to the coast participating in associations Chenopodium-Malvetum parviflorae Lohmeyer and Trautmann 1970 and Mesembryanthemetum crystallinii Sunding 1972. New appointment for Macaronesia.]

Qsn #	Question	Answer
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Oahu] "Tetragonia echinata was found during casual botanizing in Kapolei, where hundreds of plants were found in three scattered populations along Kualakai and Kapolei Parkways. A further population was later found in 'Ewa at One'ula Beach Park. The identity of this species was determined using the keys in Adamson (1955). Tetragonia echinata is native to South Africa and has previously been reported as naturalized in the Canary Islands (Padrón-Mederos et al. 2009). In its native range, it is described as a pioneer plant, and is reported growing from roadsides and open areas (Adamson 1955). From where it has been observed in Hawai'i, it was only common on shallow, rocky soils where Cenchrus ciliaris was unable to establish, or from disturbed areas, making this plant unlikely to have a major environmental impact in Hawai'i. During roadside surveys on Hawai'i Island, T. echinata was also encountered and photographed at Waikoloa Village [link], but was unfortunately not collected. Tetragonia echinata differs from T. tetragonoides (the only other naturalized Tetragonia in Hawai'i) by its smaller leaves, only four anthers per flower, minute flowers with sepals only 2 mm long, and multiple fruits per node (Figure 1)." ... "Material examined. O'AHU: Kapolei, intersection of Kinoiki St and Kapolei Pkwy, in undeveloped, grassy area outside fire station, from shallow, rocky soil where buffelgrass wasn't growing, full sun, unirrigated, over 400 plants seen at this location, populations also seen about 0.7 km E of this location and 1 km N of here, flowers minute, greenish yellow, most of them 4-merous, but about 1/4 3-merous, fruits covered in conspicuous "ice" cells, 18 m, 21.336208, -158.053663, 18 Feb 2023, K. Faccenda 3028; 'Ewa, One'ula Beach Park, northwestern edge of park along park boundary, from gravelly substrate, full sun, dry, around 100 plants seen, 3 m, 21.307346, - 158.030940, 13 Mar 2023, K. Faccenda & M. Ross 3072."

302	Garden/amenity/disturbance weed	
	Source(s)	**Notes**
	Wells, M. J., Balsinhas, A. A., Joffe, H., Engelbrecht, V.M., Harding, G. & Stirton, C.H. (1986). A Catalogue of problem plants in Southern Africa. Botanical Research Institute, Republic of South Africa	"Kind Of Weed: Ruderal (general), agrestal (general) Undesirable Characteristics: Competitive (space, light, water, nutriment)"
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Roadside, potential disturbance weed] "Tetragonia echinata was found during casual botanizing in Kapolei, where hundreds of plants were found in three scattered populations along Kualakai and Kapolei Parkways. A further population was later found in 'Ewa at One'ula Beach Park."

303	Agricultural/forestry/horticultural weed	
	Source(s)	**Notes**
	Wells, M. J., Balsinhas, A. A., Joffe, H., Engelbrecht, V.M., Harding, G. & Stirton, C.H. (1986). A Catalogue of problem plants in Southern Africa. Botanical Research Institute, Republic of South Africa	"Kind Of Weed: Ruderal (general), agrestal (general) Undesirable Characteristics: Competitive (space, light, water, nutriment)"
	WRA Specialist. (2024). Personal Communication	Identified as an agrestal weed (growing wild in cultivated fields.), although impacts to yields have not been quantified.

304	Environmental weed	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

Qsn #	Question	Answer
	CABI. (2024). CABI Compendium Invasive Species. https://www.cabidigitallibrary.org/product/qi. [Accessed 15 Mar 2024]	No evidence

305	Congeneric weed	y
	Source(s)	**Notes**
	Harris, G. (2002). Our native plant invaders. New Zealand Garden Journal, 5, 6-8	"Kokihi or New Zealand Spinach (Tetragonia tetragonioides) is a listed noxious weed in several states in the USA. As the plant is also found in Asia, Australia and parts of the South Pacific, New Zealand is not necessarily the source of the initial introduction."
	Buddenhagen, C. (2014). Tetragonia tetragonioides (New Zealand spinach). CABI Compendium. https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.52942. [Accessed 11 Mar 2024]	"T. tetragonioides is a leafy herb native to the Far East, parts of Australia, New Zealand and some Pacific Islands. It has been introduced to Africa, the Americas, Europe and parts of Asia. It is considered invasive in coastal habitats in Chile, Hawaii, Florida and California, and is one of several principal invaders in Reunion. The strongest case for its invasiveness is made in California, where it is controlled in natural areas. T. tetragonioides establishes in and competes with coastal, beach, dune, cliff and salt marsh vegetation. It is naturalized mainly in frost free coastal climates but it persists after cultivation in cold climates, such as in northern USA and Europe."
	Wells, M. J., Balsinhas, A. A., Joffe, H., Engelbrecht, V.M., Harding, G. & Stirton, C.H. (1986). A Catalogue of problem plants in Southern Africa. Botanical Research Institute, Republic of South Africa	[Tetragonia macroptera] "Kind Of Weed: Pastoral (natural)? Undesirable Characteristics: Competitive (space, light, water, nutriment)?, unpalatable (relatively) Subject Of: Herbicide registration"

401	Produces spines, thorns or burrs	y
	Source(s)	**Notes**
	Goldblatt, P., & Manning, J. (2000). Cape plants: a conspectus of the Cape flora of South Africa. National Botanical Institute, Cape Town	"Fruits globose, with spiny ridges and horns."

402	Allelopathic	
	Source(s)	**Notes**
	WRA Specialist. (2024). Personal Communication	Unknown. No evidence found

Qsn #	Question	Answer
403	Parasitic	n
	Source(s)	Notes
	Bredenkamp, C. L. (2019). A Flora of the Eastern Cape Province. Strelitzia 41(1): 194 - 195. South African National Biodiversity Institute, Pretoria.	[No evidence] "Annual herb, up to 0.4 m high; prostrate, slightly succulent, raised decumbent lines from leaf base, papillose. Leaves petiolate, oval, rhombic or deltoid, occasionally almost orbicular. Flowers 2-4 per cyme, subsessile; pedicles very short. Perianth 3-5-lobed, densely papillose, erect, triangular. Stamens 3-5, alternate with perianth but occasionally paired; anthers oval. Styles 3. Ovary inferior, densely papillose, with 3-5 obtuse projections opposite perianth. Fruit 3-5 projecting ridges with spiny outgrowths, rounded or truncate at top, papillose. Prostrate, succulent annual, up to 300 mm tall. Leaves ovate to orbicular. Flowers subsessile, 51-102 mm axils, greenish, stamens as many as sepals. Fruit globose, with spiny ridges and horns. Stamens as many as sepals. Prostrate, succulent annual to 30 cm. Leaves ovate to orbicular. Flowers subsessile, 2-4 in axils, greenish, stamens as many as sepals. Fruits globose, with spiny ridges and horns."

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Milton, S. J., W. Richard J. Dean, & Siegfried, W. R. (1994). Food Selection by Ostrich in Southern Africa. The Journal of Wildlife Management, 58(2), 234-248	"Appendix A. Nutrients and energy values of plants collected in southern Karoo, South Africa, in March 1992. Plant species arranged in order of the ostrich forage ratio." [Includes Tetragonia echinata as a forage plant]
	Milton, S. J., & Dean, W. R. J. (1995). Factors influencing recruitment of forage plants in arid Karoo shrublands, South Africa. Pp. 216-222 In Proceedings: Wildland Shrub and Arid Land Restoration Symposium. USDA Forest Service, Ogden, UT	[Sown as a forage plant] "This paper reports on the demography of shrub populations of the arid Karoo and on effects of weather, neighboring plants, microsites and grazing animals on the survival of seedlings. These preliminary observations provide a basis for assessing the feasibility of rehabilitating Karoo rangeland." ... "A total of 700 seeds of each of the 3 shrub species and 700 seeds of a winter annual (Tetragonia echinata: Aizoaceae) were sown in March 1990 in the 50 vegetated monitoring plots and in the 20 cleared plots."

405	Toxic to animals	n
	Source(s)	Notes
	Milton, S. J., W. Richard J. Dean, & Siegfried, W. R. (1994). Food Selection by Ostrich in Southern Africa. The Journal of Wildlife Management, 58(2), 234-248	"Table 3." [Tetragonia echinata - Toxin = none]
	Milton, S. J., & Dean, W. R. J. (1995). Factors influencing recruitment of forage plants in arid Karoo shrublands, South Africa. Pp. 216-222 In Proceedings: Wildland Shrub and Arid Land Restoration Symposium. USDA Forest Service, Ogden, UT	[Sown as a forage plant. No evidence of toxicity] "This paper reports on the demography of shrub populations of the arid Karoo and on effects of weather, neighboring plants, microsites and grazing animals on the survival of seedlings. These preliminary observations provide a basis for assessing the feasibility of rehabilitating Karoo rangeland." ... "A total of 700 seeds of each of the 3 shrub species and 700 seeds of a winter annual (Tetragonia echinata: Aizoaceae) were sown in March 1990 in the 50 vegetated monitoring plots and in the 20 cleared plots."
	Wagstaff, D.J. (2008). International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence
	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 in genus

Qsn #	Question	Answer
406	Host for recognized pests and pathogens	
	Source(s)	Notes
	Horvath, J. (1973). Tetragonia echinata Ait. as a new test plant for cucumber mosaic virus. Zeitschrift fur Pflanzenkrankheiten und Pflanzenschutz, 80(3/4): 129-132	"All 4 isolates of the virus induced round, chlorotic, local lesions 5-6 days after inoculation. Later these lesions became greenish and finally necrotic. Apical leaves showed systemic symptoms (deformation and chlorotic ringspots) after 12-14 days. Leaves on axillary shoots developed similar symptoms but with smaller ringspots."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Milton, S. J., W. Richard J. Dean, & Siegfried, W. R. (1994). Food Selection by Ostrich in Southern Africa. The Journal of Wildlife Management, 58(2), 234-248	"Table 3." [Tetragonia echinata - Toxin = none]
	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

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Goldblatt, P., & Manning, J. (2000). Cape plants: a conspectus of the Cape flora of South Africa. National Botanical Institute, Cape Town	"Prostrate, succulent annual to 30 cm." [No evidence. A prostrate, succulent annual is unlikely to provide fuel for, or carry fire]

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	"In its native range, it is described as a pioneer plant, and is reported growing from roadsides and open areas (Adamson 1955)."
	Goldblatt, P., & Manning, J. (2000). Cape plants: a conspectus of the Cape flora of South Africa. National Botanical Institute, Cape Town	"Prostrate, succulent annual to 30 cm." ... "Sandy slopes and disturbed ground" [A prostrate plant of disturbed, likely high light, open environments]

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	Notes
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	"From where it has been observed in Hawai'i, it was only common on shallow, rocky soils where Cenchrus ciliaris was unable to establish, or from disturbed areas, making this plant unlikely to have a major environmental impact in Hawai'i."
	Goldblatt, P., & Manning, J. (2000). Cape plants: a conspectus of the Cape flora of South Africa. National Botanical Institute, Cape Town	"Sandy slopes and disturbed ground"

411	Climbing or smothering growth habit	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	Bredenkamp, C. L. (2019). A Flora of the Eastern Cape Province. Strelitzia 41(1): 194 - 195. South African National Biodiversity Institute, Pretoria.	"Annual herb, up to 0.4 m high; prostrate, slightly succulent, raised decumbent lines from leaf base, papillose."

412	Forms dense thickets	n
	Source(s)	**Notes**
	Goldblatt, P., & Manning, J. (2000). Cape plants: a conspectus of the Cape flora of South Africa. National Botanical Institute, Cape Town	[No evidence. Prostrate annual] "echinata Aiton (inch T. microptera Fenzl) Prostrate, succulent annual to 30 cm. Leaves ovate to orbicular. Flowers subsessile, 2–4 in axils, greenish, stamens as many as the sepals. Fruits globose, with spiny ridges and horns. June–Sept. Sandy slopes and disturbed ground, NW, SW, KM (Namibia to Stellenbosch, Ladismith to Grahamstown)."

501	Aquatic	n
	Source(s)	**Notes**
	Manning, J., & Goldblatt, P. (2012). Plants of the Greater Cape Floristic Region 1: the Core Cape flora, Strelitzia 29. South African National Biodiversity Institute, Pretoria	[Terrestrial] "Sandy slopes and disturbed ground,"

502	Grass	n
	Source(s)	**Notes**
	KewScience. (2024). Plants of the World Online - Tetragonia echinata. http://powo.science.kew.org. [Accessed 8 Mar 2024]	Aizoaceae

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	KewScience. (2024). Plants of the World Online - Tetragonia echinata. http://powo.science.kew.org. [Accessed 8 Mar 2024]	Aizoaceae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	Bredenkamp, C. L. (2019). A Flora of the Eastern Cape Province. Strelitzia 41(1): 194 - 195. South African National Biodiversity Institute, Pretoria.	[Annual, with no evidence of underground storage structures] "Annual herb, up to 0.4 m high; prostrate, slightly succulent, raised decumbent lines from leaf base, papillose. Leaves petiolate, oval, rhombic or deltoid, occasionally almost orbicular."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Foden, W. & Potter, L. (2005). Tetragonia echinata Aiton. National Assessment: Red List of South African Plants. http://redlist.sanbi.org/species.php?species=1989-10. [Accessed 7 Mar 2024]	"Status and Criteria Least Concern Assessment Date 2005/06/30 Assessor(s) W. Foden & L. Potter Justification This taxon was not selected in any one of four screening processes for highlighting potential taxa of conservation concern for detailed assessment and was hence given an automated status of Least Concern. The Threatened Species Programme is currently systematically completing full assessments for all taxa with an automated status. If you disagree with this taxon's status, please contact the Threatened Species Programme at the link below."

602	Produces viable seed	y
	Source(s)	**Notes**
	Milton, S. J., & Dean, W. R. J. (2001). Seeds dispersed in dung of insectivores and herbivores in semi-arid southern Africa. Journal of Arid Environments, 47(4), 465-483	"Table 4. Plant species identified from seeds dissected from, or seedlings emerging in dung samples of Ostrich and mammals foraging in Kalahari savanna or Karoo shrubland" [Tetragonia echinata - Animal source of dung or scat = Aardvark, goat, Kudu]
	Milton, S. J., & Dean, W. R. J. (1995). Factors influencing recruitment of forage plants in arid Karoo shrublands, South Africa. Pp. 216-222 In Proceedings: Wildland Shrub and Arid Land Restoration Symposium. USDA Forest Service, Ogden, UT	"the winter annual (T. echinata) had many innately dormant seeds which emerged at higher densities in the second autumn (Fig. 7). The resultant plants set more seed in cleared than in vegetated plots (Table 1) ."
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Presumably spreading from seeds] "Material examined. O'AHU: Kapolei, intersection of Kinoiki St and Kapolei Pkwy, in undeveloped, grassy area outside fire station, from shallow, rocky soil where buffelgrass wasn't growing, full sun, unirrigated, over 400 plants seen at this location, populations also seen about 0.7 km E of this location and 1 km N of here, flowers minute, greenish yellow, most of them 4-merous, but about 1/4 3-merous, fruits covered in conspicuous "ice" cells, 18 m, 21.336208, -158.053663, 18 Feb 2023, K. Faccenda 3028; 'Ewa, One'ula Beach Park, northwestern edge of park along park boundary, from gravelly substrate, full sun, dry, around 100 plants seen, 3 m, 21.307346, - 158.030940, 13 Mar 2023, K. Faccenda & M. Ross 3072."

603	Hybridizes naturally	
	Source(s)	**Notes**
	WRA Specialist. (2024). Personal Communication	Unknown. No evidence found

Qsn #	Question	Answer
604	**Self-compatible or apomictic**	
	Source(s)	**Notes**
	Sargent, R. D., & Otto, S. P. (2004). A phylogenetic analysis of pollination mode and the evolution of dichogamy in angiosperms. Evolutionary Ecology Research, 6(8), 1183-1199	"Dichogamy, the temporal separation of male and female function, is widespread among angiosperms" [A related species, Tetragonia expansa, syn. For T. tetragonoides, is listed in Appendix as exhibiting protogyny, which would functionally prevent self- pollination]
	Adamson, R. S. (1955). The South African species of Aizoaceae. II. Tetragonia. Journal of South African Botany 21: 109-154	[Unknown] "Flowers small, 2 mm long, in axillary groups of 2-4 on very short pedicels. Perianth densely papulose, the segments 3-5, erect, triangular, obtuse, concave inside. Stamens 3-5, alternate with the perianth segments but occasionally paired: anthers oval. Styles usually 3 less often 4 or 5, not longer than the stamens. Ovary densely papulose, inferior but with 3-5 obtuse projections opposite the perianth segments."

605	**Requires specialist pollinators**	**n**
	Source(s)	**Notes**
	Adamson, R. S. (1955). The South African species of Aizoaceae. II. Tetragonia. Journal of South African Botany 21: 109-154	[No evidence. Flowers unspecialized, and plants reproduce in Hawaii with no apparent pollinator limitations] "Flowers small, 2 mm long, in axillary groups of 2-4 on very short pedicels. Perianth densely papulose, the segments 3-5, erect, triangular, obtuse, concave inside. Stamens 3-5, alternate with the perianth segments but occasionally paired: anthers oval. Styles usually 3 less often 4 or 5, not longer than the stamens. Ovary densely papulose, inferior but with 3-5 obtuse projections opposite the perianth segments."

606	**Reproduction by vegetative fragmentation**	**n**
	Source(s)	**Notes**
	Goldblatt, P., & Manning, J. (2000). Cape plants: a conspectus of the Cape flora of South Africa. National Botanical Institute, Cape Town	[Annual] "Prostrate, succulent annual to 30 cm."

607	**Minimum generative time (years)**	**1**
	Source(s)	**Notes**
	Bredenkamp, C. L. (2019). A Flora of the Eastern Cape Province. Strelitzia 41(1): 194 - 195. South African National Biodiversity Institute, Pretoria.	"Annual herb, up to 0.4 m high; prostrate, slightly succulent, raised decumbent lines from leaf base, papillose. Leaves petiolate, oval, rhombic or deltoid, occasionally almost orbicular."

Qsn #	Question	Answer
701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	y
	Source(s)	**Notes**
	Milton, S. J., & Dean, W. R. J. (2001). Seeds dispersed in dung of insectivores and herbivores in semi-arid southern Africa. Journal of Arid Environments, 47(4), 465-483	[Adaptations for external attachment may facilitate movement on vehicles, footwear or equipment along roads, trails etc.] "Table 4" [Tetragonia echinata - Fruit type & probable dispersal agent - Adhesive - epizoochorous]
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Collected, and likely dispersed along roads on Oahu and Hawaii island] "Tetragonia echinata was found during casual botanizing in Kapolei, where hundreds of plants were found in three scattered populations along Kualakai and Kapolei Parkways. A further population was later found in 'Ewa at One'ula Beach Park." ... "During roadside surveys on Hawai'i Island, T. echinata was also encountered and photographed at Waikoloa Village [link], but was unfortunately not collected."

702	**Propagules dispersed intentionally by people**	
	Source(s)	**Notes**
	WRA Specialist. (2024). Personal Communication	Unknown. May have been mistaken for other species, but evidence of cultivation and/or online sales are lacking

703	**Propagules likely to disperse as a produce contaminant**	
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Contaminant, Ornamental"
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Pathway of introduction unknown. Possible contaminant of soil or other plant materials] "Material examined. O'AHU: Kapolei, intersection of Kinoiki St and Kapolei Pkwy, in undeveloped, grassy area outside fire station, from shallow, rocky soil where buffelgrass wasn't growing, full sun, unirrigated, over 400 plants seen at this location, populations also seen about 0.7 km E of this location and 1 km N of here, flowers minute, greenish yellow, most of them 4-merous, but about 1/4 3-merous, fruits covered in conspicuous "ice" cells, 18 m, 21.336208, -158.053663, 18 Feb 2023, K. Faccenda 3028; 'Ewa, One'ula Beach Park, northwestern edge of park along park boundary, from gravelly substrate, full sun, dry, around 100 plants seen, 3 m, 21.307346, - 158.030940, 13 Mar 2023, K. Faccenda & M. Ross 3072."

704	**Propagules adapted to wind dispersal**	n
	Source(s)	**Notes**
	Milton, S. J., & Dean, W. R. J. (2001). Seeds dispersed in dung of insectivores and herbivores in semi-arid southern Africa. Journal of Arid Environments, 47(4), 465-483	[Fruits with spines presumably adapted for adhesion and animal dispersal] "Table 4. Plant species identified from seeds dissected from, or seedlings emerging in dung samples of Ostrich and mammals foraging in Kalahari savanna or Karoo shrubland" [Tetragonia echinata - Fruit type & probable dispersal agent = Adhesive - epizoochorous]

705	**Propagules water dispersed**	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Milton, S. J., & Dean, W. R. J. (2001). Seeds dispersed in dung of insectivores and herbivores in semi-arid southern Africa. Journal of Arid Environments, 47(4), 465-483	[Fruits with spines presumably adapted for adhesion and animal dispersal] "Table 4. Plant species identified from seeds dissected from, or seedlings emerging in dung samples of Ostrich and mammals foraging in Kalahari savanna or Karoo shrubland" [Tetragonia echinata - Fruit type & probable dispersal agent = Adhesive - epizoochorous]

706	Propagules bird dispersed	n
	Source(s)	**Notes**
	Milton, S. J., & Dean, W. R. J. (2001). Seeds dispersed in dung of insectivores and herbivores in semi-arid southern Africa. Journal of Arid Environments, 47(4), 465-483	[Fruits with spines presumably adapted for adhesion and animal dispersal] "Table 4. Plant species identified from seeds dissected from, or seedlings emerging in dung samples of Ostrich and mammals foraging in Kalahari savanna or Karoo shrubland" [Tetragonia echinata - Fruit type & probable dispersal agent = Adhesive - epizoochorous]

707	Propagules dispersed by other animals (externally)	y
	Source(s)	**Notes**
	Milton, S. J., & Dean, W. R. J. (2001). Seeds dispersed in dung of insectivores and herbivores in semi-arid southern Africa. Journal of Arid Environments, 47(4), 465-483	[Fruits with spines presumably adapted for adhesion and animal dispersal] "Table 4. Plant species identified from seeds dissected from, or seedlings emerging in dung samples of Ostrich and mammals foraging in Kalahari savanna or Karoo shrubland" [Tetragonia echinata - Fruit type & probable dispersal agent = Adhesive - epizoochorous]

708	Propagules survive passage through the gut	y
	Source(s)	**Notes**
	Milton, S. J., & Dean, W. R. J. (2001). Seeds dispersed in dung of insectivores and herbivores in semi-arid southern Africa. Journal of Arid Environments, 47(4), 465-483	"Table 4 - Continued." [Tetragonia echinata collected in Aardvark, goat, Kudu dung. Presumably viable] "Seedlings of 55 taxa were identifiable to specific or generic level (Table 4). With the exception of the six fleshy-fruited shrubs and some of the Fabaceae (legumes), the dung-dispersed taxa had small ((2-mm diameter) seeds, many of which were smooth textured and were dark in colour."

801	Prolific seed production (>1000/m2)	n
	Source(s)	**Notes**
	Milton, S. J., & Dean, W. R. J. (1995). Factors influencing recruitment of forage plants in arid Karoo shrublands, South Africa. Pp. 216-222 In Proceedings: Wildland Shrub and Arid Land Restoration Symposium. USDA Forest Service, Ogden, UT	"Table 1-Numbers of seeds produced by a winter annual (Tetragonia echinata) grown in cleared and vegetated plots in exclosures and grazed rangeland in the southern Karoo. Means with shared superscripts do not differ significantly (ANOVA, P < 0.01)." [Seeds per plant ranges from 0.95 to 6.36]

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	**Notes**
	Milton, S. J., & Dean, W. R. J. (1995). Factors influencing recruitment of forage plants in arid Karoo shrublands, South Africa. Pp. 216-222 In Proceedings: Wildland Shrub and Arid Land Restoration Symposium. USDA Forest Service, Ogden, UT	[Seeds dormant and may persist beyond one year] "the winter annual (T. echinata) had many innately dormant seeds which emerged at higher densities in the second autumn (Fig. 7). The resultant plants set more seed in cleared than in vegetated plots (Table 1) ."

Qsn #	Question	Answer
803	**Well controlled by herbicides**	
	Source(s)	**Notes**
	Arends, L., & Pegg, I. R. (1990). Thifensulfuron methyl with metsulfuron methyl-a new sulfonylurea herbicide for broad-leaved weed control in winter cereals in New South Wales and Queensland. Pp. 60-64 in Proceedings of the 9th Australian Weeds Conference Adelaide, SA	[Related species successfully controlled] "Thifensulfuron-methyl at 682 g/kg with metsulfuron-methyl at 68 g is a new post em. herbicide (Harmony M Herbicide) for control of broadleaved weeds in wheat, barley, oats and triticale in Australia. Results from 24 field trials carried out in Queensland, New South Wales and Victoria in 1987-88, showed that effective control of Fallopia convolvulus was obtained with 27.3 g thifensulfuron methyl and 2.7 g metsulfuron-methyl. This rate was also effective against Polygonum aviculare, Lamium amplexicaule, Rapistrum rugosum and Tetragonia tetragonioides. Emex australis control as good as the standard was obtained with 30.7 g thifensulfuron-methyl and 3.1 g metsulfuron-methyl. Crop tolerance trials showed that all 16 varieties of wheat, 3 varieties of oats, 2 varieties of barley and 1 of triticale were tolerant. Trials on safe intervals for sowing rotational crops showed that summer crops of sorghum, mung beans [Vigna radiata], soyabeans, maize and sunflowers can follow winter cereals 4 months after treatment with Harmony M on soils of pH 7.8 or less and OM content of no less that 1.7%"

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	
	Source(s)	**Notes**
	WRA Specialist. (2024). Personal Communication	Unknown

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	WRA Specialist. (2024). Personal Communication	Unknown

Summary of Risk Traits:

Tetragonia echinata is a prostrate, succulent annual plant native to open, sandy slopes on disturbed ground in South Africa. The globose fruit, with spiny ridges and horns, may aid in dispersal by attaching to animals, clothing or other surfaces, and the seeds can be spread by animals that feed on the plants. It is now naturalized on the island of Oahu, and is common on shallow, rocky soils where buffel grass (Cenchrus ciliaris) was unable to establish, but it not expected to have serious negative impacts to agricultural or natural areas.

High Risk / Undesirable Traits
• Able to spread and naturalize in regions with tropical climates
• Naturalized on Oahu (Hawaiian Islands), and in the Canary Islands
• Described as a disturbance weed and an agrestal weed (growing wild in cultivated fields.) but impacts to crop yields have not been documented.
• Other Tetragonia species have become invasive weeds
• Fruits with spiny ridges and horns
• Reproduces by seeds
• An annual, able to reach maturity in one growing season
• Seeds dispersed externally by attachment to animals, and probably through human activities, and internally after ingestion by animals
• Seeds able to persist beyond one growing season

Low Risk Traits
• Prostrate growth form and occurrence in disturbed habitats may minimize negative impacts to agriculture or natural areas
• Unarmed (no spines, thorns, or burrs)
• Palatable to browsing and grazing animals
• Not reported to be toxic
• Not reported to spread vegetatively

Second Screening Results for Herbs or Low Stature Shrubby Life Forms

(A) Reported as a weed of cultivated lands? Possibly, but impacts have not been quantified.
(B) Unpalatable to grazers or known to form dense stands? No.
Outcome = Accept (Low Risk)