Family: ***Polygonaceae***

Taxon: ***Emex australis***

Synonym:

Common Name: doublegee
southern three-corner-jack
spiny emex
three-corner jack

Questionaire : current 20090513 **Assessor:** Patti Clifford **Designation:** H(HPWRA)
Status: Assessor Approved **Data Entry Person:** Patti Clifford **WRA Score 17**

101	**Is the species highly domesticated?**	**y=-3, n=0**	**n**
102	**Has the species become naturalized where grown?**	**y=1, n=-1**	
103	**Does the species have weedy races?**	**y=1, n=-1**	
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**	
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)**	**n**
303	**Agricultural/forestry/horticultural weed**	**n=0, y = 2*multiplier (see Appendix 2)**	**y**
304	**Environmental weed**	**n=0, y = 2*multiplier (see Appendix 2)**	**y**
305	**Congeneric weed**	**n=0, y = 1*multiplier (see Appendix 2)**	**y**
401	**Produces spines, thorns or burrs**	**y=1, n=0**	**y**
402	**Allelopathic**	**y=1, n=0**	**y**
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**	**y**
406	**Host for recognized pests and pathogens**	**y=1, n=0**	
407	**Causes allergies or is otherwise toxic to humans**	**y=1, n=0**	**n**
408	**Creates a fire hazard in natural ecosystems**	**y=1, n=0**	**n**
409	**Is a shade tolerant plant at some stage of its life cycle**	**y=1, n=0**	**n**
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**	**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**	**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**	**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**	**y=1, n=-1**	**n**
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**	**y**
801	**Prolific seed production (>1000/m2)**	**y=1, n=-1**	**y**
802	**Evidence that a persistent propagule bank is formed (>1 yr)**	**y=1, n=-1**	**y**
803	**Well controlled by herbicides**	**y=-1, n=1**	**y**
804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y=1, n=-1**	
805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	**y=-1, n=1**	**y**

Designation: H(HPWRA) **WRA Score** **17**

Supporting Data:

101	2011. WRA Specialist. Personal Communication.	[Is the species highly domesticated? No] No evidence of domestication.
102	2011. WRA Specialist. Personal Communication.	[Has the species become naturalized where grown?] NA
103	2011. WRA Specialist. Personal Communication.	[Does the species have weedy races?] NA
201	2011. USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network (GRIN) [Online Database Index]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"? Intermediate] Native range: Lesotho; Namibia; South Africa - Cape Province, Free State, KwaZulu-Natal, Transvaal; Swaziland
202	2011. USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network (GRIN) [Online Database Index]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Quality of climate match data? High] Native range: Lesotho; Namibia; South Africa - Cape Province, Free State, KwaZulu-Natal, Transvaal; Swaziland
203	1961. Davis, C.J.. Recent introductions for biological control in Hawaii - VI. Proceedings Hawaiian Entymological Society. 17: 389-393.http://scholarspace.manoa.hawaii.edu/bitstream/handle/10125/10829/17_389-393.pdf?sequence=1	[Broad climate suitability (environmental versatility)?]The exotic range pest, Emex australis, was under heavy attack at Makahalau, 4,000 ft. (1219 m)elevation on the Parker Ranch, Hawaii by the introduced stem boring and leaf feeding weevil, Apion antiquum Gyllenhal, during February and March.
203	2011. Calflora. Emex australis. CalFlora.org, http://www.calflora.org/cgi-bin/species_query.cgi?where-calrecnum=2954	[Broad climate suitability (environmental versatility)?] In California Emex australis is found from 0-656 ft (200 m0.
204	1996. Pheloung, P.C./Scott, J.K./Randall, R.P.. Predicting the distribuiton of Emex in Australia. Plant Protection Quarterly. 11: 138-140.http://www.eksa.com.au/perthcare/GetFile.aspx?File=weedcrc_doublegee.pdf	Native or naturalized in regions with tropical or subtropical climates? Yes] Emex australis has naturalized in Australia, USA (California and Hawaii), India, Kenya, Madagascar, Malawi, New Zealand, Pakistan, Taiwan, Trinidad and Zimbabwe.
205	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Does the species have a history of repeated introductions outside its natural range? Yes] Emex australis has been introduced to: the Western United States (including Hawaii), Australia, New Zealand, Trinidad and Taiwan.
205	2011. CSIRO. Biological control of Emex: the weed and potential agents. CSIRO, http://www.csiro.au/resources/ps2hf.html	[Does the species have a history of repeated introductions outside its natural range?] Emex australis was brought to Australia from South Africa in 1830 as the vegetable Cape spinach.
301	1996. Pheloung, P.C./Scott, J.K./Randall, R.P.. Predicting the distribuiton of Emex in Australia. Plant Protection Quarterly. 11: 138-140.http://www.eksa.com.au/perthcare/GetFile.aspx?File=weedcrc_doublegee.pdf	[Naturalized beyond native range? Yes] Emex australis has naturalized in Australia, USA (California and Hawaii), India, Kenya, Madagascar, Malawi, New Zealand, Pakistan, Taiwan, Trinidad and Zimbabwe.
302	1996. Keighery, G.. Emex australis in Western Australia; an amenity or conservation problem?. 11: 143-144.http://www.eksa.com.au/perthcare/GetFile.aspx?File=weedcrc_doublegee.pdf	[Garden/amenity/disturbance weed?] Generally found only in highly disturbed sites (roads, tracks, firebreaks, picnic sites, old homesteads and clearings) in conservation reserves. [scored as an environmental weed]
302	1996. Moore, J.. Doublegee (Emex australis) in the great southern areas of Western Australia. Plant Protection Quarterly. 11: 145.http://www.eksa.com.au/perthcare/GetFile.aspx?File=weedcrc_doublegee.pdf	[Garden/amenity/disturbance weed?] "Doublegee could be classed as a minor weed of crops and pastures and a significant weed of horticulture in the great southern area of Western Australia."
302	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Garden/amenity/disturbance weed?] In Australia, Emex australis is a weed in disturbed agricultural, horticultural, pastoral, industrial, wasteland, grassland and conservation areas but is not usually found in natural ecosystems. [scored as an environmental weed]

303	1996. Keighery, G.. Emex australis in Western Australia; an amenity or conservation problem?. 11: 143-144.http://www.eksa.com.au/perthcare/GetFile.aspx?File=weedcrc_doublegee.pdf	[Agricultural/forestry/horticultural weed? Yes] Because of its impact on agriculture, Emex australis is a declared noxious weed in most of Australia.
303	2011. CSIRO. Biological control of Emex: the weed and potential agents. CSIRO, http://www.csiro.au/resources/ps2hf.html	[Agricultural/forestry/horticultural weed? Yes] "An annual weed, it competes with crops and pastures and is estimated to cost A$40 million a year in crop losses/production costs in WA alone."
303	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Agricultural/forestry/horticultural weed? Yes] "As a significant weed of agriculture in temperate Australia, doublegee causes a loss of $20 million annually over an estimated one million hectares of crops and one million hectares of pastures in Western Australia alone. Doublegee competes against crops and reduces yield A presence of 8–9 doublegee plants/m2 can reduce wheat yield by up to 50%."
304	1996. Keighery, G.. Emex australis in Western Australia; an amenity or conservation problem?. 11: 143-144.http://www.eksa.com.au/perthcare/GetFile.aspx?File=weedcrc_doublegee.pdf	[Environmental weed? Yes] "Natural areas invaded by Emex are edges of creeks, riverine flats, alluvial flats (claypans, edges saline lakes) and granite rocks. These are the areas recognized as centres of biological diversity and refugia in arid Western Australia. Transference of resources and habitat to weedy species such as Emex in these areas is undesirable. A biological control program would be the only option in these remote areas."
304	1996. Pheloung, P.C./Scott, J.K./Randall, R.P.. Predicting the distribuiton of Emex in Australia. Plant Protection Quarterly. 11: 138-140.http://www.eksa.com.au/perthcare/GetFile.aspx?File=weedcrc_doublegee.pdf	[Environmental weed?] Emex australis is a weed of disturbed areas and is not usually found in natural areas.
305	2011. CalFlora. Emex spinosa. Calflora, http://www.calflora.org/cgi-bin/species_query.cgi?where-calrecnum=2955	[Congeneric weed? Yes] Emex spinosa is a declared noxious weed in the United States.
401	2011. Freeman, C.C.. Flora of North America Volume 5 - Emex australis. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242100050	[Produces spines, thorns or burrs? Yes] "Fruiting perianths 7-9 × 9-10 mm, spines ascending or spreading, 5-10 mm, base tapering."
402	2010. Nadeem, A.R./Asif, T./Asghar, A./A, Z.Z.. Effects of Emex australis Steinh on germination and early seedling growth of wheat (Triticum aestivum l.). Allelopathy Journal. 25: .	[Allelopathic? Yes] "Spiny emex (Emex australis Steinh. Family: Polygonaceae) is an annual weed in wheat crop, which adversely affects the growth and yield. We determined the phytotoxic effects of E. australis on germination and early seedling growth of wheat (Triticum aestivum L.) at 15 and 20°C. E australis infested soil significantly reduced the root/shoot length, dry weight and biomass of wheat seedlings than control. A particular high degree of inhibition occurred with E. australis infested soil at 15°C except for seedling emergence. This adverse effect on wheat seedling growth indicates the presence of some growth-retardatory substances possibly released by the residues into the soil medium. Hence, we prepared aqueous extracts from E. australis root, stem, leaf and seed. The stem extract at 15°C inhibited the seedling emergence (15%), root dry weight (23.96%) and biomass of wheat seedlings (34.86%). Leaf extract at 20°C inhibited the root and shoot length (42.96 and 42.03%, respectively) and shoot dry weight (42.86%) of wheat seedlings. Stem extract was most inhibitory to germination at 15°C, however, the germination of wheat seeds was delayed at 20°C, indicating the presence of water-soluble inhibitory substances. The study concluded that E. australis residual soil and aqueous extracts adversely affected the seed germination and early seedling growth of wheat."
403	2011. Freeman, C.C.. Flora of North America Volume 5 - Emex australis. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242100050	[Parasitic? No] Polygonaceae.
404	1993. Panetta, F.D./Randall, R.P.. Emex australis and the competitive hierarchy of a grazed annual pasture. The Journal of Applied Ecology. 30: 373-379.http://bio.fsu.edu/~miller/hierarchy_papers/pdfs/Panetta%20and%20Randall%201993.pdf	Unpalatable to grazing animals? No] "Emex seedlings were not grazed until they reached the three true leaf stage. Thereafter, individual plants escaped defoliation for short periods only; approximately 80% of the sampled population suffered some degree of defoliation during the period spanning 4-8 weeks after emergence. Less than 5% of the population escaped defoliation over the entire experimental period."

405	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Toxic to animals? Yes] Although Emex is not readily eaten by stock except in the seedling stage, it has been responsible for sheep deaths in Western Australia due to oxalic acid poisoning.
405	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Toxic to animals?] The plants contain oxalate at levels that may not be toxic but may poison sheep if eaten in large quantities.
406	2011. WRA Specialist. Personal Communication.	[Host for recognized pests and pathogens?] Unknown.
407	2011. National Center for Biotechnology Information. PubMed. U.S. National Library of Medicine, Bethesda, Maryland http://www.ncbi.nlm.nih.gov/	[Causes allergies or is otherwise toxic to humans? No] No evidence of toxicity or allergies.
407	2011. Specialized Information Services, U.S. National Library of Medicine. TOXNET toxicology data network [online database]. National Institutes of Health, http://toxnet.nlm.nih.gov/	[Causes allergies or is otherwise toxic to humans? No] No evidence of toxicity or allergies.
408	2011. WRA Specialist. Personal Communication.	[Creates a fire hazard in natural ecosystems? No] No evidence. [unlikely to carry fire; herbaceous]
409	. Government of South Australia. Declared plant policy - three cornered jack (Emex spp.). Government of South Australia, http://www.pir.sa.gov.au/_media/pdf/pirsa_internet/biosecurity/nrm_biosecurity/pest_weed_policies/declared_plants_2/threecorner_jack_	[Is a shade tolerant plant at some stage of its life cycle? No] It is a weed of open disturbed sites, rather than the shade of other plants, consequently it does best in uncompetitive crops and pastures, in the lower rainfall areas.
410	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)? Yes] Spiny emex occurs on sandy soils and red brown earths, but it is by no means confined to these and often establishes on heavy soils.
410	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)? Yes] Emex australis can grow on a wide range of soil types from loam to clay loam. In Western Australia it is associated mainly with red brown soils where pH is neutral to slightly alkaline.
411	2011. Freeman, C.C.. Flora of North America Volume 5 - Emex australis. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242100050	[Climbing or smothering growth habit? No] Annual herb.
411	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Climbing or smothering growth habit? No] Emex australis is a vigorous annual herb with a strong tap root and a long, fleshy, hairless stem.
412	2011. Freeman, C.C.. Flora of North America Volume 5 - Emex australis. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242100050	[Forms dense thickets? No] Prostate annual.
501	2011. Freeman, C.C.. Flora of North America Volume 5 - Emex australis. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242100050	[Aquatic? No] Terrestrial.

502	2011. Freeman, C.C.. Flora of North America Volume 5 - Emex australis. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242100050	[Grass? No] Polygonaceae.
503	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Nitrogen-fixing woody plant? No] Annual; herbaceous.
504	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] Emex australis is a vigorous annual herb with a strong tap root and a long, fleshy, hairless stem.
601	2011. WRA Specialist. Personal Communication.	[Evidence of substantial reproductive failure in native habitat? No] No evidence.
602	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Produces viable seed? Yes] Seeds germinate at almost any time of the year.
602	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Produces viable seed? Yes] Seeds germinate mainly in autumn and winter although germination may occur any time during the year.
603	2011. Freeman, C.C.. Flora of North America Volume 5 - Emex australis. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242100050	[Hybridizes naturally? Yes] Emex spinosa and Emex australis were formerly geographically isolated, but hybrids between them have recently been reported in Australia (E. Putievsky et al. 1980). Hybrids exhibit irregular meiosis and high sterility when self-pollinated; backcrosses with either parent often yield viable seeds."
604	2011. Bala, R./Kaul, V.. Floral traits in relation to breeding system in Emex australis Steinh. Current Science. 101: 554-559.http://www.ias.ac.in/currsci/25aug2011/554.pdf	[Self-compatible or apomictic? Yes] "Self-compatibility and auto-fertility indices on fruit set exceed 1 and 0.75 respectively, confirming E. australis to be self-compatible and capable of setting fruit in the absence of pollinating agents."
605	2011. Bala, R./Kaul, V.. Floral traits in relation to breeding system in Emex australis Steinh. Current Science. 101: 554-559.http://www.ias.ac.in/currsci/25aug2011/554.pdf	[Requires specialist pollinators? No] Wind-pollinated.
606	2011. Freeman, C.C.. Flora of North America Volume 5 - Emex australis. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242100050	[Reproduction by vegetative fragmentation? No] Annual.
607	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Minimum generative time (years)? 1] Fruits can be produced by very young plants (less than 6 weeks old0.
607	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Minimum generative time (years)? 1] Annual.
701	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? Yes] "Mechanisms for the easy dispersal of seeds include movement in rubber tyres on farm vehicles or on shoes; transport with crop seed, silage or fodder; and animal movement."

702	2011. WRA Specialist. Personal Communication.	[Propagules dispersed intentionally by people? No] No evidence of current intentional dispersal. However, Emex australis was brought to Australia from South Africa in 1830 as the vegetable Cape spinach.
703	2011. CSIRO. Biological control of Emex: the weed and potential agents. CSIRO, http://www.csiro.au/resources/ps2hf.html	[Propagules likely to disperse as a produce contaminant? Yes] "An annual weed, it competes with crops and pastures and is estimated to cost A$40 million a year in crop losses/production costs in WA alone. A single plant can produce more than 1 000 burrs which can contaminate agricultural produce such as wool, grain and dried fruit."
703	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Propagules likely to disperse as a produce contaminant? Yes] Emex australis can contaminate grain, leading to a rejection of grain deliveries "It is very difficult to separate doublegee achenes from the seeds of pulses. Although it is relatively easy to separate the achenes from cereal and canola seeds, additional cleaning post harvest may be required."
704	2011. Freeman, C.C.. Flora of North America Volume 5 - Emex australis. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242100050	[Propagules adapted to wind dispersal? No] "Fruiting perianths 7-9 × 9-10 mm, spines ascending or spreading, 5-10 mm, base tapering."
705	1996. Keighery, G.. Emex australis in Western Australia; an amenity or conservation problem?. 11: 143-144.http://www.eksa.com.au/perthcare/GetFile.aspx?File=weedcrc_doublegee.pdf	[Propagules water dispersed? Yes] "Natural areas invaded by Emex include edges of creeks, riverine flats, alluvial flats (claypans, edges saline lakes) and granite rocks. These are the sites of biological diversity and refugia in arid Western Australia."
705	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Propagules water dispersed? Yes] Emex australis fruits float and are dispersed along waterways when flooded.
706	1996. Keighery, G.. Emex australis in Western Australia; an amenity or conservation problem?. 11: 143-144.http://www.eksa.com.au/perthcare/GetFile.aspx?File=weedcrc_doublegee.pdf	[Propagules bird dispersed? Yes] Emex australis has become a major food source for Major Mitchell cockatoos and inland red tailed black cockatoos, and a minor source for galahs, little and long billed corellas in Australia. Emex is also recorded as a major weed of naturally disturbed seabird rookeries of the Abrolhos Islands.
707	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Propagules dispersed by other animals (externally)? Yes] "Mechanisms for the easy dispersal of seeds include movement in rubber tyres on farm vehicles or on shoes; transport with crop seed, silage or fodder; and animal movement."
708	1996. Keighery, G.. Emex australis in Western Australia; an amenity or conservation problem?. 11: 143-144.http://www.eksa.com.au/perthcare/GetFile.aspx?File=weedcrc_doublegee.pdf	[Propagules survive passage through the gut? Yes] Emex australis has become a major food source for Major Mitchell cockatoos and inland red tailed black cockatoos, and a minor source for galahs, little and long billed corellas in Australia. Emex is also recorded as a major weed of naturally disturbed seabird rookeries of the Abrolhos Islands.
708	2001. Castley, J.G./Bruton, J.S./Kerley, G.I.H./McLachlan, A.. The importance of seed dispersal in the Alexandria Coastal Dunefield, South Africa. Journal of Coastal Conservation. 7: 57-70.	[Propagules survive passage through the gut? Yes] In this study on seed dispersal in South Africa, Emex australis was dispersed by mammals. Seeds were found in the faeces.
708	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Propagules survive passage through the gut? Yes] "Mechanisms for the easy dispersal of seeds include movement in rubber tyres on farm vehicles or on shoes; transport with crop seed, silage or fodder; and animal movement."
801	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Prolific seed production (>1000/m2)? Yes] Infestations of Emex can be very dense and counts of more than 900 plants per square meter and 5,000 seeds per square meter have been made in Western Australia.
801	2011. CSIRO. Biological control of Emex: the weed and potential agents. CSIRO, http://www.csiro.au/resources/ps2hf.html	[Prolific seed production (>1000/m2)? Yes] "A single plant can produce more than 1 000 burrs and seed can last in the soil for more than seven years."

801	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Prolific seed production (>1000/m2)? Yes] One Emex australis plant growing under ideal conditions in the absence of competition may spread up to 1 m in diameter and produce as many as 1,100 seeds.
802	2011. CSIRO. Biological control of Emex: the weed and potential agents. CSIRO, http://www.csiro.au/resources/ps2hf.html	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "Seeds from both Emex species can remain dormant in the soil for more than seven years and this dormancy, together with rotational cropping-grazing farm practices, can make controlling them a problem."
802	2011. Hashem, A./Moore, J.. Weed 6: doublegee - Emex australis. Department of Agriculture and Food - Government of Western Australia, http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/weed/major/doublegee.pdf	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] Seeds may remain viable in the soil for more than 4 years.
803	1996. Moore, J.. Doublegee (Emex australis) in the great southern areas of Western Australia. Plant Protection Quarterly. 11: 145.http://www.eksa.com.au/perthcare/GetFile.aspx?File=weedcrc_doublegee.pdf	[Well controlled by herbicides? Yes] "In cereals it is usually controlled by dicamba or chlorsulfuron. In grain legumes it is usually controlled by simazine,cyanazine or diuron. In orchards and vineyards glyphosate and paraquat are usually used. In industrial areas and for eradicating small areas a combination of Tordon® and dicamba is common. In clover based pastures Broadstrike® is providing high levels of control especially when applied early in the season. Late germinations can be a problem that may require a second application. Broadstrike is cheaper and less damaging than the older treatments of Tribunil®, 2,4-DB and diuron + 2,4-DB. Increased sowing of perennial pasture species is also leading to a natural decline in the effects of doublegee in pasture. In most situations, except lupins, the new crop and horticultural species, there are now adequate techniques for controlling doublegee."
803	1996. Ralph, A.. Dicamba control o f Emex australis. Plant Protection Quarterly. 11: 157-159.	[Well controlled by herbicides? Yes] "Dicamba has long been used for the control of Polygonaceae weeds. The high efficacy against Emex australis is one of the major strengths of dicamba in southern Australia. The sulfonylurea group of chemicals also provides good control of Emex, however, there are two main benefits of using dicamba. Firstly, the very short plant back period of dicamba prevents the possibility of residue carryover into the next phase of the crop rotation. Secondly, the long term effects of continued use of Group B chemistry needs to be considered in terms of herbicide resistance. Rotation of herbicide groups is an essential component of Integrated Weed Management. The high efficacy of dicamba, in addition to these two factors, should favour the continued use of dicamba to control Emex."
804	2011. WRA Specialist. Personal Communication.	[Tolerates, or benefits from, mutilation, cultivation, or fire?] Unknown.
805	1961. Davis, C.J.. Recent introductions for biological control in Hawaii - VI. Proceedings Hawaiian Entymological Society. 17: 389-393.http://scholarspace.manoa.hawaii.edu/bitstream/handle/10125/10829/17_389-393.pdf?sequence=1	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Yes] "The exotic range pest, Emex australis, was under heavy attack at Makahalau, 4,000 ft. elevation on the Parker Ranch, Hawaii by the introduced stem boring and leaf feeding weevil, Apion antiquum Gyllenhal, during February and March. This weevil was liberated at Makahalau in 1957 in an emex infestation which encompassed approximately one quarter acre. Three years later a high population density of A. antiquum had built up and destroyed much of the emex in this area."

805	1992. Markin, G.P./Lai, P./Funasaki, G.Y.. Status of biolofical control of weeds in Hawaii and implications for managing ecosystems in: Alien plant invasions in native ecosystems of Hawaii: management and research. Cooperative National Park Resources Stud	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Yes] Three biocontrol agents (insects) were released in Hawaii to control Emex australis and Emex spinosa. One of the insects established and was successful in controlling Emex australis; the weed was nearly eliminated in three years.
805	2011. CSIRO. Biological control of Emex: the weed and potential agents. CSIRO, http://www.csiro.au/resources/ps2hf.html	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Yes] "The first agent released on Emex was the weevil, Perapion antiquum. Although this species controlled Emex in Hawaii, it did not establish in Australia because of our harsh summers."