Family: ***Asteraceae***

Taxon: ***Chromolaena odorata***

Synonym: *Eupatorium odoratum L. (basionym)*

Common Name: bitterbush
butterfly-weed
Christmasbush
devilweed
hagonoy
jack-in-the-bush
paraffin-weed
Siamweed
triffidweed
paraffienbos

Questionaire : current 20090513 **Assessor:** Chuck Chimera **Designation:** H(HPWRA)
Status: Assessor Approved **Data Entry Person:** Chuck Chimera **WRA Score 28**

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)**	**High**
202	**Quality of climate match data**	**(0-low; 1-intermediate; 2-high) (See Appendix 2)**	**High**
203	**Broad climate suitability (environmental versatility)**	**y=1, n=0**	**y**
204	**Native or naturalized in regions with tropical or subtropical climates**	**y=1, n=0**	**y**
205	**Does the species have a history of repeated introductions outside its natural range?**	**y=-2, ?=-1, n=0**	**y**
301	**Naturalized beyond native range**	**y = 1*multiplier (see Appendix 2), n= question 205**	**y**
302	**Garden/amenity/disturbance weed**	**n=0, y = 1*multiplier (see Appendix 2)**	
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**	**n**
402	**Allelopathic**	**y=1, n=0**	**y**
403	**Parasitic**	**y=1, n=0**	**n**
404	**Unpalatable to grazing animals**	**y=1, n=-1**	**y**
405	**Toxic to animals**	**y=1, n=0**	**y**
406	**Host for recognized pests and pathogens**	**y=1, n=0**	**y**

407	**Causes allergies or is otherwise toxic to humans**	**y=1, n=0**	**y**
408	**Creates a fire hazard in natural ecosystems**	**y=1, n=0**	**y**
409	**Is a shade tolerant plant at some stage of its life cycle**	**y=1, n=0**	**y**
410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y=1, n=0**	**y**
411	**Climbing or smothering growth habit**	**y=1, n=0**	**n**
412	**Forms dense thickets**	**y=1, n=0**	**y**
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**	**n**
604	**Self-compatible or apomictic**	**y=1, n=-1**	**y**
605	**Requires specialist pollinators**	**y=-1, n=0**	**n**
606	**Reproduction by vegetative fragmentation**	**y=1, n=-1**	**y**
607	**Minimum generative time (years)**	**1 year = 1, 2 or 3 years = 0, 4+ years = -1**	**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**	**y**
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**	**n**
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**	**y**
805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	**y=-1, n=1**	

Designation: H(HPWRA) **WRA Score** **28**

Supporting Data:

101	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	No evidence that Chromolaena odorata is highly domesticated
102	2011. WRA Specialist. Personal Communication.	NA
103	2011. WRA Specialist. Personal Communication.	NA
201	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Habitat: Tropics and subtropics…Siam weed is a native of Central America from Mexico to Brazil, including the West Indies."
202	1996. McFadyen, R.C./Skarratt, B.. Potential distribution of Chromolaena odorata (siam weed) in Australia, Africa and Oceania. Agriculture, Ecosystems and Environment. 59: 89-96.	"Chromolaena odorata (L.) King & Robinson continues to spread through southeast Asia into the south Pacific, and into central and eastern Africa from the infestations in western and southern Africa. It is regarded as a very serious threat to agriculture and the environment in most of these countries. The climate matching program CLIMEX was used with data from the known distribution of the weed in Asia and the Neotropics to predict areas suitable for its growth in Africa, Australia and Oceania. Results indicate that much of tropical Africa, the eastern coast of Australia and most Pacific islands are susceptible to invasion."
203	2005. Kriticos, D.J./Yonow, T./McFadyen, R.E.. The potential distribution of Chromolaena odorata (Siam weed) in relation to climate. Weed Research. 45: 246–254.	"A climate model of the estimated potential distribution of Chromolaena odorata has been revised. The new model fits the known distribution better, eliminates several internal inconsistencies, and employs more biologically appropriate cold stress mechanisms. The revised model reduces the estimated potential distribution of C. odorata, particularly in terms of the poleward and inland extents of suitable climates. Mediterranean, semi-arid and temperate climates are now predicted to be unsuitable. However, the revised model supports the previous conclusions that much of tropical Africa, the north-eastern coast of Australia and most Pacific islands are at risk of invasion. The distribution of C. odorata in South Africa extends further south than predicted by the model based on Asian and American distribution records. This anomaly supports the contention that the South African variety of C. odorata has different climatic requirements to the varieties commonly found elsewhere...If introduced into areas predicted to be marginally too cool for population persistence, C. odorata plants may still be able to survive and grow, but are unlikely to be able to reproduce in most years. The potential for C. odorata to persist in these marginally cold environments would also be affected by competition with other weedy shrubs occupying the same habitat but with lower temperature thresholds for development, such as lantana (Lantana camara) or Mexican sunflower (Tithonia diversifolia)."
203	2010. Beest, Mariska te. The ideal weed? : understanding the invasion of Chromolaena odorata in a South African savanna. Ph.D. Dissertation. University of Groningen, Groningen, Netherlands http://irs.ub.rug.nl/ppn/327289600	"The species is native in South and Central America but is rapidly invading a wide variety of ecosystems on other continents, ranging from tropical rainforests to savannas in most of the Paleotropics (McFadyen & Skarratt 1996; Kriticos et al. 2005; Raimundo et al. 2007). It invades not only human altered environments, like road verges and abandoned agricultural fields, but also nature reserves, where it forms dense monospecific stands in (broadleaved) woodlands and along river courses and forest margins...In South Africa this species is highly invasive in savannas, where it seems to thrive under different climatic conditions than in its native range (Goodall & Erasmus 1996; Kriticos et al. 2005; Robertson et al. 2008)...The species is common and widely distributed from southern Florida to northern Argentina in areas below 1,500 to 1,000 metres altitude and receiving over 1500 mm annual rainfall (Cruttwell McFadyen 1988a; McFadyen & Skarratt 1996; Kriticos et al. 2005; Raimundo et al. 2007). In the Neotropics, C. odorata is confined to the tropical zone and has not spread into the sub-tropical areas, as it has in the Paleotropics, nor does it show the aggressive invasive behaviour that is displayed in the Paleotropics (Cruttwell McFadyen 1991)."
204	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Siam weed is a native of Central America from Mexico to Brazil, including the West Indies."

205	1996. McFadyen, R.C./Skarratt, B.. Potential distribution of Chromolaena odorata (siam weed) in Australia, Africa and Oceania. Agriculture, Ecosystems and Environment. 59: 89-96.	"C. odorata was introduced into Asia prior to 1870, probably through the Serampore Botanical Gardens at Calcutta (McFadyen, 1989; Gauthier, 1996). In charge of the gardens from 1834 to 1843, Voigt (1845) suggested C. odorata as a plant suitable for gardens in the area and the plant was naturalised in Dacca and the Ganges flood plain by the 1870s (Clarke, 1876). The source of the original introduction is not known, but is likely to have been Jamaica in the West Indies (McFadyen, 1996). From Calcutta, the plant spread east into Assam and Myanmar (Burma), and then progressively east and southeast through Indonesia and Indochina (McFadyen, 1989). It was first recorded in the Philippines in the late 1960s (Pancho and Plucknett, 1971), in Guam in 1963 (Marutani and Muniappan, 1991), the Marianas by 1973 (Fosberg and Falanruw, 1973), in East New Britain by 1982 (Henty and Pritchard, 1982), and in Timor by 1988 (S. Field, personal communication, 1988). It was introduced into West Africa in the 1930s and has since spread from Senegal in the west to the Central African Republic and Zaire in the east (Prasad et at., 1996)."
301	2008. Chauhan, B.S./Johnson, D.E.. Germination Ecology of Two Troublesome Asteraceae Species of Rainfed Rice: Siam Weed (Chromolaena odorata) and Coat Buttons (Tridax procumbens). Weed Science. 56: 567–573.	"Siam weed is a native of Central and tropical South America and the West Indies (Hilliard 1977), and it is considered a problematic weed in West tropical Africa, Southeast Asia, and the Philippines (Ambika 1980; Ivens 1974, 1975; Pancho and Plucknett 1972; Rai 1976; Sajise et al. 1974). This weed was ranked as one of the most serious alien invader weeds in South Africa (Wells and Stirton 1982)."
302	2011. WRA Specialist. Personal Communication.	A disturbance weed that causes problems in agricultural settings and natural ecosystems [See 3.03 and 3.04]
303	1996. McFadyen, R.C./Skarratt, B.. Potential distribution of Chromolaena odorata (siam weed) in Australia, Africa and Oceania. Agriculture, Ecosystems and Environment. 59: 89-96.	"In all countries affected it was rapidly recognized as a serious weed of plantation agriculture and of pastures in areas experiencing a dry season (Ivens, 1974; Soerjani et al., 1975; Ambika and Jayachandra, 1980; Leggitt, 1983; Wu et al., 1984; Olaoye, 1986)."
303	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"In the tropics, Siam weed is very competitive with pastures and plantation crops such as coconuts, rubber, tea, oil palm, sugarcane, pineapples and tobacco, reducing yields, and in the establishment phase, choking out these crops as well as young forest trees. It also competes with dryland rice and has forced some areas in the Philippines out of production."
304	1996. McFadyen, R.C./Skarratt, B.. Potential distribution of Chromolaena odorata (siam weed) in Australia, Africa and Oceania. Agriculture, Ecosystems and Environment. 59: 89-96.	"Chromolaena odorata (L.) King & Robinson continues to spread through southeast Asia into the south Pacific, and into central and eastern Africa from the infestations in western and southern Africa. It is regarded as a very serious threat to agriculture and the environment in most of these countries...C. odorata was identified as the greatest weed threat to northern Australia, because of its rapid spread towards Australia and its potential to damage agriculture and the environment (Michael, 1989)."
304	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"In Australia, it could be a serious problem in areas such as Kakadu National Park b competing with native vegetation and increasing the fire hazard."
304	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	"A nutrient-demanding, early successional species that is native to grasslands, savannas, and forest margins. Where invasive, it rapidly colonizes disturbed and cleared areas, and forms dense thickets that persist and prevent establishment of all other species."
305	2003. Waterhouse, B.M.. Know your enemy: recent records of potentially serious weeds in northern Australia, Papua New Guinea and Papua (Indonesia). Telopea. 10(1): 477-485.	"Chromolaena squalida (DC.) R.M. King & H.Rob. (Asteraceae) State government officers responsible for the eradication of Chromolaena odorata from north Queensland, discovered a 0.5 hectare infestation of an unrecognised shrub, within the eradication zone. Leaf and flower morphology suggested that it might be a species of Chromolaena, but these plants were small (to 1.5 m tall), usually single stemmed and generally did not appear to be invasive. Specimens could not be identified at Queensland Herbarium and were subsequently identified at the Smithsonian Institute as Chromolaena squalida, not previously recorded outside its native range in S. America (H. Robinson pers. comm. 2001). There is little doubt that C. squalida also arrived in north Queensland as a contaminant of pasture seeds imported from Brazil. Although it does not appear to be as serious a weed as its congener, it has been included in the C. odorata eradication campaign." [although not as serious as C. odorata, still targeted for eradication]
401	1996. McFadyen, R.C./Skarratt, B.. Potential distribution of Chromolaena odorata (siam weed) in Australia, Africa and Oceania. Agriculture, Ecosystems and Environment. 59: 89-96.	"Chromolaena odorata (L.) King & Robinson (Asteraceae, Eupatorieae) is a perennial shrub forming dense tangled bushes 1.5-2.0 m in height, occasionally reaching 6 m as a scrambler up trees. Growth is optimal in the open or in partial shade. The stems branch freely, with lateral branches developing in pairs from the axillary buds. Older stems are brown and woody, tips and young stems are green and succulent." [no spines, thorns or burrs]

402	1993. Sahid, I.B./Sugau, J.B.. Allelopathic Effect of Lantana (Lantana camara) and Siam Weed (Chromolaena odorata) on Selected Crops. Weed Science. 41(2): 303-308.	"Abstract. Laboratory, greenhouse, and field studies were conducted to determine the allelopathic potential of lantana and Siam weed on the germination and growth of five crops. Emergence and dry weight of bioassay species were affected when lantana or Siam weed debris was present on the soil surface or incorporated into the soil. However, presence of Siam weed on the soil surface did not affect dry weight of rape. Emergence and dry weight of crops (except emergence of spinach) were not affected when crops were grown in soil samples collected from beneath field-grown lantana. Dry weight of Chinese cabbage and chilli was reduced when these crops were grown in Siam weed-contaminated soil. Germination of Chinese cabbage, chilli, and rape decreased progressively when exposed to increasing concentrations of aqueous lantana extract. However, the lantana extract at full strength (66.7 g L-1) did not reduce germination of spinach and cucumber seed. Siam weed extract, when applied at full strength to seed of spinach, Chinese cabbage, rape, and chilli, reduced germination by 10, 12, 21, and 19% of control, respectively. Full strength extract of lantana and Siam weed decreased seedling length and fresh weight of all crops."
402	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"The plant is known to produce allelopathic compounds…"
402	2010. Onwugbuta- Enyi, J.. Allelopathic Effects of Chromolaena Odorata L. (R. M. King and Robinson – (Awolowo Plant')) Toxin on Tomatoes (Lycopersicum esculentum Mill). Journal of Applied Sciences and Environmental Management.. 5(1): 69-73.	"ABSTRACT: Allelopathic effects of Chromolaena odorata L. (R. M. KING AND ROBINSON) aqueous leaf extract and residues incorporated in the soil on the growth and water status of Lycopersicon esculentum Mill were studied. Significant growth reductions in Lycopersicon esculentum were observed from additions of C. odorata aqueous – leaf extract at concentrations as low as 1g fresh weight in 40ml of water. Reduction in growth was accompanied by decreases in leaf water potential. Incorporation of C. odorata leaf material into the soil in which L esculentum Mill seedlings were germinated and grown caused significant depression in growth over the 2-week test period with addition of 2g residue to 80g soil. Allelochemicals released from C. odorata plants and residue are suggested as a possible explanation for yield reductions in crops in fields where C. odorata plants are present. One mechanism of toxic action on seedlings involved interference with water balance."
403	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	Not parasitic
404	2002. Aterrado, E.D./Bachiller, N.S.J.. Biological control of Chromolaena odorata: preliminary studies on the use of the gallforming fly Cecidochares connexa in the Philippines. Pp. 137-139 in Proc. 5th Int. Workshop on Bio. Control & Mgnt of C. odorata.	"It is unpalatable and, when ingested by cattle, causes diarrhoea. In extreme cases death has been reported (Sajise et al., 1974)."
404	2002. Bani, G.. Status & management of Chromolaena odorata in Congo. Pp. 71-73 in Proc. 5th Int. Workshop on Biological Control & Management of Chromolaena odorata. ARC-PPRI, Durban, South Africa	"No animal feeds on this plant. The regular consumption of palatable plant species allows C. odorata to colonise all the spaces among the pasturages and render them useless."
405	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"The plant is toxic to stock, killing more than 3000 cattle annually in the Philippines. It also causes abortions; the toxic principle is high nitrate which, in young regrowth, occurs at five or six times the levels normally considered toxic. It is also reputed to be a fish poison."
405	2005. Prasad, S./Narayana, K./Jayakumar, K./Srikanth, K.G.. Phytochemical Analysis of Toxic Plant Chromolaena odorata (Eupatorium odoratum). Journal of the Indian Society of Toxicology. 1(1): .	"Chromolaena odorata King and Rob. (Syn. Eupatorium odoratum Linn.) is a toxic weed that is widespread over many parts of the world including India. This plant is responsible for illness and death of cattle and goats in Karnataka. In this study, four extracts (petroleum ether, chloroform, methanol and aqueous) of Chromolaena odorata leaves were qualitatively analysed for the presence of various phytochemicals. The petroleum ether extract of Chromolaena odorata leaves showed the presence of steroids, triterpenes, alkaloids, flavonoids, tannins, diterpenes, and saponins. The chloroform extract showed the presence of steroids, alkaloids, flavonoids, tannins, and glycosides. The methanol extract showed the presence of steroids, alkaloids, flavonoids, tannins, lactones, diterpenes, and saponins, and the aqueous extract showed the presence of alkaloids, flavonoids, lactones, tannins, and saponins. The green leaves of the plant tested positive for the presence of nitrate. Manifestations of toxicity due to Chromolaena odorata depend upon relative abundance of these different toxins."
406	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"…an alternative host for fungal diseases."

407	2010. Koutika, L.-S./Rainey, H.J.. Chromolaena odorata in different ecosystems: weed or fallow plant?. Applied Ecology and Environmental Research. 8(2): 131-142.	"C. odorata can also promote wildland fires (Moore, 2004), and may also cause skin problems and asthma in allergy prone people."
408	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	""It causes a serious fire hazard in the dry season and interferes with normal farm operations.""
408	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	"In fire prone regions, dry plants may be a fire hazard."
409	1991. de Rouw, A.. The Invasion of Chromolaena odorata (L.) King & Robinson (ex Eupatorium odoratum), and Competition with the Native Flora, in a Rain Forest Zone, South-West Cote d'Ivoire. Journal of Biogeography. 18(1): 13-23.	"...If cultivation ceased after 1 year, fallow trees rapidly provided overstorey shade, followed by the degeneration of Chromolaena odorata...However, if a field is cultivated just 1 year and allowed to succeed back to forest afterwards, Chromolaena odorata will always decline in abundance and be shaded out within 2 or 3 years...It seems likely that a population of Chromolaena odorata is not only checked by overstorey shade but is also restrained by an impoverished environment."
409	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"It does not grow well on waterlogged or saline soils, nor in heavy shade, but tolerates severe dry periods."
409	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	"The plant grows fast but cannot survive in shade."
410	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"…occurring on most soil types in open or partly shaded, well-drained sites with annual rainfall greater than 1200 mm."
411	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"An erect or sprawling fast-growing shrub, forming dense tangles thickets 1.5 to 5 m high or higher when supported on adjacent plants or other objects…" [although may be supported by other plants, this plant is not a vine and outcompetes other plants primarily through dense infestations, and not through climbing and smothering]
412	2001. Witkowski, E.T.F./Wilson, M.. Changes in density, biomass, seed production and soil seed banks of the non-native invasive plant, Chromolaena odorata, along a 15 year chronosequence. Plant Ecology. 152: 13–27.	"Dense young stands of C. odorata are virtually monospecific in the sun and self-thinning occurs as the stand matures."
412	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	"Where invasive, it rapidly colonizes disturbed and cleared areas, and forms dense thickets that persist and prevent establishment of all other species."
501	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	Terrestrial
502	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	Asteraceae
503	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	Asteraceae [Not a nitrogen fixing woody plant]
504	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"An erect or sprawling fast-growing shrub…Root: Mostly fibrous roots confined to the top 30 cm of soil, some plants with a stout taproot." [This question relates to perennial plants with tubers, corms or bulbs. This question is specifically to deal with plants that have specialized organs and should not include plants merely with rhizomes/ stolons. Not a true geophyte]
601	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"It is not a serious weed in its native range but is a transient coloniser of cleared areas of the Amazon forest." [No evidence of substantial reproductive failure in native habitat]

601	2010. Beest, Mariska te. The ideal weed? : understanding the invasion of Chromolaena odorata in a South African savanna. Ph.D. Dissertation. University of Groningen, Groningen, Netherlands http://irs.ub.rug.nl/ppn/327289600	"The main factors controlling C. odorata in its native range are presumed to be competition with the numerous other closely related Asteraceous species and attacks by a large complex of insects and pathogens, both specialists and generalists (Cruttwell 1972; Cruttwell McFadyen 1988b; Barreto & Evans 1994). In a study assessing the level of damage to C. odorata plants due to insect attack, between 25 and 50% of all growing tips were found to be destroyed (Cruttwell 1972). In contrast, in the Paleotropics only a few phytophagous insects have been recorded to feed on C. odorata (Kluge & Caldwell 1992). Many specialist insect herbivores to attack leaves, stems and seeds have been tested for biocontrol programmes (Kluge 1991; Barreto & Evans 1996; Zachariades et al. 1999; Muniappan et al. 2005)."
602	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"...reproducing by seed and from buds at the crown and along the stems…Seed: Blackish with 4 or 5 pale roughened ribs, oblong, angular, slender, 4 to 5 mm long; pappus hairs to 5 mm long, white at first, brown when dry."
603	2009. Schierenbeck, K.A./Ellstrand, N.C.. Hybridization and the evolution of invasiveness in plants and other organisms. Biological Invasions. 11(5): 1093–1105.	No evidence
603	2010. Beest, Mariska te. The ideal weed? : understanding the invasion of Chromolaena odorata in a South African savanna. Ph.D. Dissertation. University of Groningen, Groningen, Netherlands http://irs.ub.rug.nl/ppn/327289600	No evidence [hybridization not listed among impacts or invasive traits]
604	2010. Beest, Mariska te. The ideal weed? : understanding the invasion of Chromolaena odorata in a South African savanna. Ph.D. Dissertation. University of Groningen, Groningen, Netherlands http://irs.ub.rug.nl/ppn/327289600	"The species can reproduce apomictically (Gautier 1992) and has a prolific seed production of light wind dispersed seeds that are easily dispersed by mammals or vehicles as well (Blackmore 1998)."
605	2004. Rambuda, T.D./Johnson, S.D.. Breeding systems of invasive alien plants in South Africa: does Baker's rule apply?. Diversity and Distributions. 10: 409–416.	"Table 2. Chromolaena odorata…Inferred Breeding System…apomixis" [does not require specialist pollinators]
606	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"...reproducing by seed and from buds at the crown and along the stems…Locally, pieces of broken crown could be spread during culitvation."
607	2001. Witkowski, E.T.F./Wilson, M.. Changes in density, biomass, seed production and soil seed banks of the non-native invasive plant, Chromolaena odorata, along a 15 year chronosequence. Plant Ecology. 152: 13–27.	"Seed production per plant increased exponentially with invasion age for the first 10 years (power function on an area basis), declining at >/= 15 years, with few plants producing seeds in their first year. A small proportion of plants flowered in the shade and semishade, with 100% flowering by 7 years in the sun. However a large proportion flowered and produced seeds in NE India in the first year (and in West Africa; Ivens 1975), increasing to 100% by the third year after disturbance, but declined thereafter (Kushwaha et al. 1981)...Plant traits associated with more invasive pine species (Rejmanek& Richardson 1996 and references therein) also fit the invasion profile of C. odorata. A short juvenile period and short intervals between large seed crops, result in early and continuous (exponentially increasing) reproduction, leading to rapid population growth."
701	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Contaminated ballast, equipment, clothing etc. has been responsible, presumably, for much of the present spread through Africa and Asia. Locally, pieces of broken crown could be spread during cultivation."
702	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"It seems to have been introduce to Calcutta in India as an ornamental in the 1840s from where it spread, initially, through Bengal, Assam and Burma to Siam. Much greater spread took place with the movement of people and materials during World War II until now the plant occurs from Mauritius to western India, Sri Lanka, Southeast Asia, China, the Pacific islands including the Philippines, Guam, the Marianas and as far east as the Caroline Islands." [intentionally dispersed in the past, but currently this plant's bad reputation indicates that most dispersal is unintentional]
703	1996. Prasad, U.K./Muniappan, R./Ferrar, P./Aeschliman, J.P./de Foresta, H.. Distribution, Ecology and Management of Chromolaena odorata. Proc. Third Int. Chromolaena Workshop. ORSfOM & ICRAF, Paris, France & Nairobi, Kenya	"C. odorata was first introduced into Nigeria, West Africa, around 1937 through contaminated seed lots of Gmelina arborea. G. arborea is a tree species which was imported from Sri Lanka for reforestation purposes...The ripe seeds are wind dispersed, although adherence to the fur of animals, clothes and machinery, and the contamination of planting material are also important mechanisms for seed dispersal over large distances."

704	1996. McFadyen, R.C./Skarratt, B.. Potential distribution of Chromolaena odorata (siam weed) in Australia, Africa and Oceania. Agriculture, Ecosystems and Environment. 59: 89-96.	"Seed production is prolific; the achenes bear a small stiff pappus and are wind dispersed."
704	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	"Fruits are linear, brown to black achenes of c. 5 mm length, and with stiff hairs on the angles. The pappus is white, c. 5 mm long and consists of rough bristles...Seed production is prolific and seeds are dispersed by wind."
705	2010. Beest, Mariska te. The ideal weed? : understanding the invasion of Chromolaena odorata in a South African savanna. Ph.D. Dissertation. University of Groningen, Groningen, Netherlands http://irs.ub.rug.nl/ppn/327289600	"Wind dispersal of seeds" [no evidence of water dispersal]
706	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"The seed is light and equipped with a fine pappus; hence wind dispersal is significant." [no evidence of dispersal by birds]
707	1996. Prasad, U.K./Muniappan, R./Ferrar, P./Aeschliman, J.P./de Foresta, H.. Distribution, Ecology and Management of Chromolaena odorata. Proc. Third Int. Chromolaena Workshop. ORSfOM & ICRAF, Paris, France & Nairobi, Kenya	"...adherence to the fur of animals, clothes and machinery, and the contamination of planting material are also important mechanisms for seed dispersal over large distances."
707	2010. Beest, Mariska te. The ideal weed? : understanding the invasion of Chromolaena odorata in a South African savanna. Ph.D. Dissertation. University of Groningen, Groningen, Netherlands http://irs.ub.rug.nl/ppn/327289600	"...has a prolific seed production of light wind dispersed seeds that are easily dispersed by mammals or vehicles as well (Blackmore 1998)."
708	1996. Prasad, U.K./Muniappan, R./Ferrar, P./Aeschliman, J.P./de Foresta, H.. Distribution, Ecology and Management of Chromolaena odorata. Proc. Third Int. Chromolaena Workshop. ORSfOM & ICRAF, Paris, France & Nairobi, Kenya	"...adherence to the fur of animals, clothes and machinery, and the contamination of planting material are also important mechanisms for seed dispersal over large distances." [no evidence of internal animal dispersal]
801	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Up to 87000 seeds per plant have been recorded in India."
801	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	"Seed production is prolific and seeds are dispersed by wind."
801	2010. Beest, Mariska te. The ideal weed? : understanding the invasion of Chromolaena odorata in a South African savanna. Ph.D. Dissertation. University of Groningen, Groningen, Netherlands http://irs.ub.rug.nl/ppn/327289600	"A single shrub can produce as many as 800 000 seeds (Witkowski & Wilson 2001)."
802	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	"The shrub accumulates a soil seed bank."
803	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Applications of 2,4-D kills seedlings and a mixture of 2,4-D + picloram is effective on actively growing, more mature plants."
803	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	"Chemical control is done by foliar sprays of 2,4-D esters, picloram, imazapyr, or 2,4,5-T."
804	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Mechanical removal of isolated plants is effective, but impractical with dense infestations. Slashing and burning give temporary control, but are followed by strong regrowth."
804	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	"Control is difficult as the plant easily regenerates from its rootstock after damage. Repeated cutting and burning has been recommended for infested grasslands, combined with resowing of desired species."

804	2010. Beest, Mariska te. The ideal weed? : understanding the invasion of Chromolaena odorata in a South African savanna. Ph.D. Dissertation. University of Groningen, Groningen, Netherlands http://irs.ub.rug.nl/ppn/327289600	"Similar to other climbing herbs with very light wood, the species can be viewed as a 'structural parasite' that profits from the structural investment in durable stems of other species. The species is quick to lose its leaves and suffers stem die-back when conditions become bad, but can re-grow rapidly from the living stem-base when conditions change. This strategy results in impenetrable shrubs with many dead and dry stems that form a physical barrier as well as a fire hazard in fire sensitive habitats like gallery and riverine forests (Macdonald 1983; Macdonald & Frame 1988; Goodall & Erasmus 1996)."
805	2001. Parsons, W. T./Cuthbertson, E. G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Biological control has been investigated since 1966 and a leaf-feeding arctiid moth, Pareuchaetes pseudoinsulata, has given excellent control in the Marianas Islands but is less effective elsewhere. Several other organisms show some promise." [Unlikely, but unknown if any effective natural enemies are present in the Hawaiian Islands]
805	2001. Witkowski, E.T.F./Wilson, M.. Changes in density, biomass, seed production and soil seed banks of the non-native invasive plant, Chromolaena odorata, along a 15 year chronosequence. Plant Ecology. 152: 13–27.	"Although it is generally held that biological control is the only long-term means of controlling C. odorata (Macdonald & Frame 1988), it has been unsuccessfully attempted in several countries (Cronk & Fuller 1995; Goodall& Erasmus 1996). Partial control has been achieved in Sri Lanka with a lepidopteran defoliator (Pareuchaetes pseudoinsulara Rego Barros). Thus biological control may only be successful within an integrated control framework."