1.0 Organism description

Scientific name
Dactyloctenium aegyptium (L.) Wild., Poaceae.

Common names
Beach wire grass, coast button grass, comb fringe grass, crowfoot grass, duck grass, Durban crowfoot, Egyptian fingergrass, Egyptian grass, finger comb grass, four-finger grass (PIER).

Synonyms (Randall 2002)
Eleusine aegyptia (L.) Desf.
Cynosurus aegypticus (L.)
Dactyloctenium aegyptiacum Willd.
Chloris mucronata Michx.
Dactyloctenium mucronatum (Michx.) Willd.

Cultivars, strains, or variants
None found.

Previously recorded in New Zealand
No (Ministry of Agriculture and Forestry, Landcare Research).

2.0 Summary

- *D. aegyptium* is a low growing, mat forming, annual or short-lived perennial grass. It is spread by seed, which it produces prolifically. Vegetative spread is by rooting at nodes, and it is sometimes stoloniferous.

- Pan-tropical overseas distribution, extending also into temperate and arid regions. In New Zealand it is likely to be restricted to the northern North Island but may extend to the top of the South Island, with a low probability of growing in the central South Island.

- Preferred habitats are coastal and lowland areas in open, disturbed places; including cultivations, open ground, waste areas, beaches and coastal dunes. It is used as a sand stabilizer in Australia and for erosion control elsewhere. It has some tolerance to salinity.

- The seed retains some viability for long periods in storage, and its seed ecology suggests it is likely to re-establish from the seed bank following disturbance or cultivation.

- Overseas, it is a serious or principal weed of cotton, sugarcane, peanuts and corn, and a common weed in many other crops. Serious impacts appear to be restricted to tropical/sub-tropical regions. It is listed as an environmental weed elsewhere but no impacts are known.

- In New Zealand, its relatively slow growth means that it is only likely to have very minor economic impacts in crops and pastoral agriculture. Environmental impacts are also unlikely.

- The leaves are reportedly toxic to animals at certain times, and consumption of seeds can cause internal disorders in humans. Despite the reported toxicity, human health effects are highly unlikely, as there are a number of toxic grass species already present in New Zealand and no human poisonings from these species are known.

3.0 Basic biology and ecology

3.1 Overseas distribution

- Asia, Africa, Arabia, North America, Central America, South America, Caribbean, Australia and the Pacific Islands. Mostly tropical/sub-tropical but extending into temperate and arid regions (PIER, Clayton et al. 2006, W³TROPICOS).

- Asia (tropical/sub-tropical); probably native to Asia. Found in India, Nepal, Sri Lanka, Malaysia, Myanmar, Philippines, China [Fujian, Guangdong, Guizhou, Hainan, Sichuan, Taiwan, Yunnan, Zhejiang], Japan, Singapore, Thailand, Vietnam, and Papua New Guinea (PIER, Clayton et al. 2006, USDA).

- Africa (tropical/sub-tropical/arid); widely distributed through eastern, western and central tropical regions. Also in North Africa [Algeria, Morocco, Egypt, Eritrea, Sudan, Tunisia and Libya], and southern Africa [South Africa, Namibia, Madagascar and Botswana] (USDA, Clayton et al. 2006).

- Arabia (arid/warm-temperate); Arabian Peninsula, Afghanistan, Israel, Lebanon, Turkey and Pakistan (USDA).

- North America (sub-tropical/humid continental); found in all southern states from the west to the east coasts, as well as in the north eastern states of Illinois, Ohio, Pennsylvania, New York, and as far north as Massachusetts (approx. 45° N). It appears to be more common in the south (USDA).

- Central America (tropical); Mexico, Nicaragua, Costa Rica, El Salvador, Guatemala, Honduras and Panama (PIER, W³TROPICOS).

- South America (tropical/sub-tropical/warm-temperate); Peru, Bolivia, Venezuela, Brazil, Ecuador, Galapagos Islands, Columbia, Paraguay, Argentina and Uruguay (PIER, W³TROPICOS).

- Australia (tropical/sub-tropical/arid/temperate); found mostly in tropical Northern Territory and north east Queensland with isolated records in Victoria, near Melbourne, and also scattered through central Australia (AVH).

- Pacific (tropical); American Samoa, Mariana Islands, Cook Islands, Micronesia, Fiji, French Polynesia, Guam, Hawaii, Kiribati Islands, Marshall Islands, Nauru, New Caledonia, Niue, Palau, Western Samoa, Solomon Islands, Tonga, Tuvalu Islands and Vanuatu (PIER).

3.2 Ecology/habitat

- Mat forming annual or short-lived perennial grass. Low growing (<0.6m), rooting from lower nodes, and sometimes stoloniferous (PIER). C4 photosynthetic pathway (ePic).

- Preferred habitats are dry, exposed, disturbed places in the lowlands (<300m) and on the coast. Often found in cultivations, open ground, waste areas, beaches and coastal dunes (Whistler 1995).

- When grown in New Zealand, specimens were slow growing and not as vigorous as *Brachiaria subquadripara* or *Axonopus compressus*. However, it was a prolific seeder, and had a shorter time to maturity than these two species (James pers. comm.).

- It prefers light, sandy soils and low moisture but has been recorded from heavier clay soils, brown loams and alluvium (Holm et al. 1977, ANHSIR).

- Propagation is by seed (Holm et al. 1977). Its seed ecology suggests it is likely to re-establish from the seed bank following disturbance or cultivation.

- Prolific seed production. Seeds are very small, with no specialized aids to dispersal (ePic). Seeds remain viable for long periods; 12% germination was observed following 8 years open storage at room temperature, and 5% germination after 19 years in dry storage (Holm et al. 1977, ePic).

- Germination occurs from 15 - 40° C with 20° C the optimum. Very few seeds germinated at temperatures of 10° C (Sharma & Chivinge 1982). Germination decreases as pH increases, with the optimum at pH 4 - 5. Germination is also reduced when subjected to water stress (Burke et al. 2003).

- Emergence is highest from seed buried at depths of 0 - 1cm. Emergence decreases with depth, with no emergence from seed buried 10cm below the soil surface (Burke et al. 2003).

- Gupta (1973) found that 5 months after-ripening was required to break seed dormancy, while Popay (1974) observed that fresh seed was quite dormant and that 22 months storage of dry seed at room temperature was needed to raise germination to 20%. Pricking the seed coat with a needle raised germination at room temperature (in Kenya) to 60-84% (Popay 1974). Low temperatures (5° C) prolonged dormancy (Gupta 1973).

- *D. aegyptium* has some salinity tolerance. Seeds germinate in up to 50% sea water (Okusanya & Sonaike 1991). Plant growth was unaffected in 10% sea water and reduced at higher salinities. At 50% sea water, plants still survived but with low growth rates (Adu et al. 1994).

- It is used as a sand stabilizer in Australia (PlantNET) and for erosion control elsewhere (SEPASAL).

- It is considered a fair to poor quality forage grass for cattle although the leaves are cited as being rich in cyanogenic glycosides and sometimes toxic to animals (Bor 1960, Holm et al. 1977, Randall 2002). For stock not used to it, the tough, wiry stolons and seed heads can cause problems with digestion (James pers. comm.).

- It is highly unlikely that enough plant material could be consumed to cause toxicity to humans (Fountain pers. comm.).

4.0 Likelihood of establishment and spread

4.1 Environmental tolerances overseas and comparison with New Zealand

4.1.1 Environmental tolerances overseas

- Mostly tropical or sub-tropical climates with associated high humidity and warm temperatures. Also recorded in temperate North America and Australia and in arid areas of Australia, Arabia and North Africa.

- Australia (tropical/sub-tropical); the climate of northern Australia is characterised by hot humid summers and hot to mild winters. In this broad region, mean daily minimum temperature ranges from 12-24° C, average annual rainfall is 800-3200mm, rain days (>1mm) number 50-150 days per year, frost days range from 0-10 days per year and humidity is 60-90% (Bureau of Meteorology).

- Australia (arid); climate through most of central Australia is classed as ‘hot dry summer, cold winter’ with mean daily minimum temperatures ranging from 9-15°C,

average annual rainfall 0-300mm, 10-30 rain days per year (>1mm per day), 30-50% humidity and 10-50 days of frost per annum (Bureau of Meteorology).

- Australia (temperate); southern Victoria in the area of Melbourne has a mean daily minimum temperature of 9.3° C, 500-800mm mean annual rainfall, 100-125 rain days (>1mm per day) per year, 70-80% humidity and 10-50 frost days per year (Bureau of Meteorology).

- Arabia (arid); peninsula Arabia typically experiences average daily winter temperatures of 8-20° C and average summer temperatures of 27-43° C. There is a strong diurnal temperature range, but frosts are very infrequent. Average annual rainfall is about 100mm (World Climate[1]).

- North America (temperate); *D. aegyptium* is found as far north as 45° N in the USA but it is not a problem weed at that latitude (Holm et al. 1977). Average daily minimum temperature ranges from 3-6° C with average annual rainfall of 1000-12000mm in the Boston area (World Climate[2]).

4.1.2 Comparison with New Zealand

- The closest match to its sub-tropical environment overseas are the warmer regions of Northland, Auckland and coastal Bay of Plenty where average annual rainfall (1200-1500mm), rain days >1mm per year (111-137 days) and humidity (78-86%) are comparable, although mean daily minimum temperatures (10-11.8° C) are lower, and ground frosts more frequent (1-42 days per year) (NIWA).

- Note that the Australian, North American and Arabian distribution suggests that *D. aegyptium* tolerates both hot, dry conditions, and more temperate climates. In New Zealand it is likely to be restricted to the northern North Island but may extend to the top of the South Island, with a low probability of growing in the central South Island.

4.2 History of spread in other countries

- First recorded in Hawaii in 1909 (Whistler 1995). It is now throughout the Pacific and is naturalised or invasive in many places (PIER).

- Introduced and naturalised in North America. Considered a noxious weed in some states but is less common, and not considered weedy, in northern temperate regions (USDA).

- Introduced to Morocco in 1980, probably in contaminated seed. By 1997 it was becoming a major weed in at least one province (Tanji & Taleb 1997).

- Probably introduced to Africa and now widespread and naturalised throughout tropical areas. Has spread to southern warm-temperate regions (Clayton et al. 2006).

4.3 Natural dispersal mechanisms and human assisted means of spread

4.3.1 Natural dispersal mechanisms

- Reportedly dispersed by ants (ePic) and possibly internally by animals, although this is inconclusive; intact seeds survived digestion but there were high numbers of non-germinating seeds both before and after digestion (Gardiner et al. 1993). No references to avian dispersal were found.

- Wind/gravity is also likely to disperse the seed.

4.3.2 Human dispersal mechanisms

- Human mediated dispersal likely in contaminated machinery, produce and soil or stock feed.

4.4 Distribution of potential habitat in New Zealand

- Probably limited by climate to the northern North Island, but it may extend to northern and central areas of the South Island.

- Primary habitat in New Zealand are likely to be open areas such as cultivated and fallow land, roadsides, waste areas, open ground, beaches and sand dunes.

4.5 Constraints to spread and predicted rate of spread in New Zealand

4.5.1 Predicted rate of spread

- Moderate rate of spread by wind/gravity seed dispersal from local infestations.

- Could form widespread populations quickly via human vectors (e.g. in contaminated soil, produce and machinery).

4.5.2 Constraints to spread

- Spread probably limited somewhat by climate but overseas distribution suggests some tolerance for temperate conditions.

- At least some palatability to mammalian browsers.

- Host to a range of fungal pathogens including *Bipolaris* spp., *Cochliobolus* spp., *Colletotrichum graminicola*, *Drechslera* spp., *Setosphaeri*a spp. and *Uromyces* spp (Ecoport). Also host of viruses that cause rice leaf gall, corn leaf gall and sugarcane mosaic (Holm et al. 1977).

5.0 Consequences

5.1 Overseas impacts

5.1.1 Economic impacts

- Holm et al. (1977) cite *D. aegyptium* as a serious weed of cotton in Thailand, and a principal weed in the following crops and locations: cotton in Australia, Kenya, Mozambique, Nigeria, Tanzania, Uganda and the United States; sugarcane in India, Philippines and Taiwan; peanuts in Gambia and the United States; and corn in Thailand. Also a common weed of corn, rice, pineapples, tea, coffee, bananas, papayas, onions, cassava, citrus, sweet potatoes and millet.

- In the Pacific it appears to have a limited impact on agriculture. Waterhouse (1997) lists it as a weed of disturbed places and locally important only in the Cook Islands and Kiribati, and present but not important as a pest elsewhere.

- It is a minor weed of turf grass in Florida (Ferrell et al. 2006) where its presence increases production costs and lowers turf grass quality.

- The direct costs to agriculture are reduced growth and yield of crop plants through competition for light, water and nutrients. Indirect costs are associated with increased herbicide use and manual weed control.

5.1.2 Environmental impacts

- Listed as an environmental weed (Randall 2002) but no other information given. Given its spreading, mat forming growth habit, presumably dense infestations could smother or inhibit the growth of other species.

5.1.3 Other impacts

- None known.

5.2 Potential impacts in New Zealand

5.2.1 Economic

- Its relatively slow growth and annual habit means that it is only likely to have very minor impacts in crops and pastoral agriculture. It should be readily controllable in crops and it is unlikely to compete as a weed with kikuyu (*Pennisetum clandestinum*) in pasture.

5.2.2 Environmental

- *D. aegyptium* could be a low-level environmental threat in coastal areas and dunes. It is a prolific seeder, its growth habit is of some concern, and it seems likely to establish, at least in the northern North Island. However, as a slower growing annual, its impacts, if any, should be minor.

5.2.3 Other impacts

- It may be a nuisance weed in home gardens.

- Despite the reported toxicity, human health effects are comparatively unlikely, as there are a number of toxic grass species already present in New Zealand and no human poisonings from these species are known.

6.0 Control techniques

- An acceptable range of control techniques exist. Herbicides known to be available in New Zealand are underlined.

- Pre-emergent herbicides oxyfluorfen, pendimethalin, metolachlor, atrazine and simazine were effective in various crops (Murthy et al. 2007, Ferrell et al. 2006). MON 8793 was superior to paraquat and glyphosate in a non-crop situation (Ramani & Sukhadia 2004).

- Good biological control with fungal pathogens (*Drechslera gigantea*, *Exserohilium longirostratum* and *E. rostratum*) in the USA. Crop plants in the family Poaceae, and non-host crop plants in other families, were immune to all three pathogens (Chandramohan & Charudattan 2001).

- Hand weeding.

7.0 Uncertainty summary

- Potential New Zealand distribution is uncertain. Likely to be limited by climate but its overseas distribution suggests it grows in tropical and arid conditions equally well, and also tolerates temperate climates.

8.0 References

Adu, A.A., Yeo, A.R. & Okusanya. 1994. The response to salinity of a population of *Dactyloctenium aegyptium* from a saline habitat in southern Nigeria. *Journal of Tropical Ecology* 10(2): 219-228.

ANHSIR. Australian National Herbarium Specimen Information Register. http://www.cpbr.gov.au/cgi-bin/anhsir?040=dactyloctenium%20aegyptium (29 April 2008).

AVH. Australian Virtual Herbarium. http://www.anbg.gov.au/cgi-bin/avh.cgi (28 April 2008).

Bor, N. 1960. The Grasses of Burma, Ceylon, India and Pakistan (excluding Bambuseae). Pergamon Press, Oxford.

Bureau of Meteorology. Australian Government Bureau of Meteorology http://www.bom.gov.au/climate/averages/index.shtml?map_type=cdio&code=3 (14 April 2008).

Burke, I.C., Thomas, W.E., Spears, J.F. & Wilcut, J.W. 2003. Influence of environmental factors on after-ripened crowfoot grass (*Dactyloctenium aegyptium*) seed germination. *Weed Science* 51(3): 342-347.

Chandramohan, S. & Charudattan, R. 2001. Control of seven grasses with a mixture of three fungal pathogens with restricted host ranges. *Biological Control* 22(3): 246-255.

Clayton, W.D., Harman, K.T. & Williamson, H. 2006. GrassBase – the Online World Grass Flora. http://www.kew.org/data/grasses-db.html (30 April 2008).

Ecoport. Species record provided by Food and Agriculture Organisation of the United Nations. http://ecoport.org/ep?Plant=866&entityType=PLWE**&entityDisplayCategory=full (30 April 2008).

ePic. Royal Botanic Gardens, Kew. Seed Information Database. http://data.kew.org/sid/SidServlet?Clade=&Order=&Family=&APG=off&Genus=Dactyloctenium&Species=aegyptium&StorBehav=0 (30 April 2008).

Ferrell, J.A., Murphy, T.R. & Webster, T.M. 2006. Using pre-emergence herbicides to improve establishment of centipede grass (*Eremochloa ophiuroides*) from seed. *Weed Technology* 20(3): 682-687.

Fountain, John. Pers. comm... National Poisons Centre, University of Otago, Dunedin.

Gardener, C.J., McIvor, J.G. & Jansen, A. 1993. Survival of seeds of tropical grassland species subjected to bovine digestion. *Journal of Applied Ecology* 30(1): 75-85.

Gupta, K.C. 1973. Factors influencing dormancy in seeds of crowfoot grass (*Dactyloctenium aegyptium*). *Biochemical Physiology* 164(5/6); 582-587.

Holm, L.G., Plucknett, D.L., Pancho, J.V. & Herberger, J.P. 1977. The World's Worst Weeds: distribution and biology. East-West Centre/University Press of Hawaii.

James, Trevor. Pers. comm. Weed Scientist, AgResearch, New Zealand.

Landcare Research. Flora of New Zealand online search page. Taxon search. http://floraseries.landcareresearch.co.nz/pages/Search.aspx (28 April 2008).

Murthy, K.N.K., Murali, K., Ramachandra, C. & Rajashekarappa, K.S. 2007. Effect of pre-emergent herbicides on weed control, growth and yield of transplanted onion (*Allium cepa* L.). *Research on Crops* 8(1): 204-208.

Ministry of Agriculture and Forestry, New Zealand.
Plants Biosecurity Index (version 1.6.0)
http://www1.maf.govt.nz/cgi-bin/bioindex/bioindex.pl (28 April 2008).

NIWA. National Institute of Water and Atmospheric Research. Crown Research Institute, New Zealand. http://www.niwa.cri.nz/edu/resources/climate (17 April 2008).

Okusanya, O.T. & Sonaike, A.A. 1991. Germination behavior of *Dactyloctenium aegyptium* from two localities in Nigeria. *Physiologia Plantarum* 81(4): 489-494.

PIER. Pacific Island Ecosystems at Risk.
http://www.hear.org/pier/species/dactyloctenium_aegyptium.htm (29 April 2008).

PlantNET. New South Wales Flora Online.
http://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Dactyloctenium~aegyptium (30 April 2008).

Popay, A.I. 1974. Investigations into the behaviour of the seeds of some tropical weeds. 1. Laboratory germination tests. *East African Agricultural and Forestry Journal* 40: 31- 43.

Ramani, B.B. & Sukhadia, N.M. 2004. Comparative efficacy of MON 8793, paraquat and glyphosate for weed control under non-cropped situations. *Indian Society of Weed Science* 36(3/4): 310-312.

Randall, R.P. 2002. A Global Compendium of Weeds. Shannon Books, Australia.

SEPASAL. Survey of Economic Plants for Arid and Semi-Arid Lands. http://www.kew.org/ceb/sepasal/ (30 April 2008).

Sharma, B.M. & Chivinge, A.O. 1982. Contribution to the ecology of *Dactyloctenium aegyptium* (L.). *Journal of Range Management* 35(3): 326-331.

Tanji, A. & Taleb, A. 1997. New weed species recently introduced into Morocco. *Weed Research Oxford* 37(1): 27-31.

USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?13133 (29 April 2008)

Waterhouse, D.F. 1997. The Major Invertebrate Pests and Weeds of Agriculture and Plantation Forestry in the Southern and Western Pacific. Australian Centre for International Agricultural Research, Canberra.

Whistler, W.A. 1995. Wayside plants of the Islands. Isle Botanica, Honolulu.

World Climate[1]. Online weather, rainfall and temperature data. http://www.worldclimate.com/cgi-bin/place.pl?pla=dubai (1 May 2008).

World Climate[2]. Online weather, rainfall and temperature data. http://www.worldclimate.com/cgi-bin/place.pl?pla=boston (1 May 2008).

W[3]TROPICOS. Nomenclatural and Specimen Database of the Missouri Botanical Garden. http://mobot.mobot.org/cgi-bin/search_pick?name=Dactyloctenium+aegyptium (30 April 2008).