

SHORT COMMUNICATION

¹*Eleocharis dulcis* (kuta), a plant of economic and cultural importance in the South West Pacific: habitat restoration efforts in the vanua of Buca, Vanua Levu, Fiji

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Introduction

Eleocharis dulcis (Burm. f.) Trin. ex Henschel., known as *kuta* or *taria* in vernacular Fijian, is a plant of cultural and economic importance in the western South Pacific. Harvested stems are dried, flattened and woven into fine mats. These are used as floor mats, infant cradles, blankets and *ta'ovala*, the traditional formal sash worn by Tongans.

E. dulcis is a freshwater wetland species of the sedge family (Cyperaceae). It is widely distributed in warm tropical regions, being indigenous from tropical West Africa, through tropical Asia and Malesia, to northern Australia. In the Pacific Islands its range extends from Melanesia and Palau in the western Pacific to Tonga and Samoa in Polynesia. It is also cultivated in Hawaii (Smith 1979). In Fiji *E. dulcis* is regarded as native but because it is a species utilised by man, it may be an aboriginal introduction (Ash and Ash, 1984). It is one of three plant species in Fiji restricted to freshwater wetlands (Ash and Ash 1984).

In the *vanua* of Buca, Vanua Levu, *kuta* has been used for a long time for the production of fine quality mats. In this district the women of two villages, Navakasobu and Korovuli, had been harvesting *kuta* plants from two or three shallow ponds in a nearby wetland, but in recent years forest clearing and the plantation of sugarcane and pine in an adjacent area had resulted in the establishment of weeds that degraded the wetland and thus the habitat for *kuta*. This degradation was so drastic that introduced weeds, in particular the pink water lily (*Nymphaea capensis* var. *rosea*), out-competed *kuta* and other native

wetland species. As a result, *kuta* became extinct in these ponds.

Over the last two years the Pacific People and Plants programme of the World Wide Fund for Nature have been involved in this area in a project to restore the *kuta* habitat. The project is carried out through the support and effort of the women of the two villages. The restoration is a success in as much as the plants can now again be harvested for use, but there are concerns that the 'restored' habitat is so fragile that without continuous and laborious management it will quickly revert to its 'pre-restored' state.

Here I comment on the restoration of the *kuta* habitat in the wetland with reference to the guidelines on re-introduction and restoration of habitats provided by Botanic Gardens Conservation International (Akeroyd and Wyse Jackson 1995; Wyse Jackson and Akeroyd 1994; Maunder 1992), and report for the first time the morphology and septation of two stem types of *Eleocharis dulcis* ('soft' and 'hard' stems) present in the wetland ponds in Buca. The two stem types are important both ecologically and economically because they reflect the genetic variation of the *kuta* population in this wetland, and because only one of the two types is used for weaving mats.

***Eleocharis* species in Fiji**

Three species of *Eleocharis* occur in Fiji, *Eleocharis dulcis* (*kuta* or *taria* in Fijian), *E. ochrostachys* Steud. (*sasa* or *voca* in Fijian) and *E. geniculata* (L.) Roemer and Schultes (Smith, 1979). The main differences between the three

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species are that the flower heads are sub-globose in *E. geniculata* but cylindrical in the other two species, and that transverse septa are present in the stems of *E. dulcis* but absent in *E. ochrostachys* and *E. geniculata*. All three species of *Eleocharis* occur in association with other wetland species in swamps, marsh and wet areas, and in shallow lakes and ponds. *E. ochrostachys* also occurs in swamps in forests and is found from sea level to 400 m; *E. geniculata* occurs in wet areas near the coasts, often in coral sand, or in forest or grassland in rocky places, and is not a common species. *E. dulcis* usually grows in shallow freshwater lakes and ponds of 1 m depth or less, and is found from sea level to 800 m (Ash and Ash 1984; Smith 1979) but does not occur in brackish water.

The scientific name for *E. dulcis* is based on a collection from India named by Burmann as *Andropogon dulce* in 1768. Trinius later transferred the species to *Eleocharis* in 1833. *E. dulcis* is also known by several other names, including *E. plantaginea* Roemer and Schultes and *E. articulata* sensu Seem., both synonymous with *E. dulcis* (Smith, 1979). In Fiji the species was first collected by Berthold Seemann in 1860.

E. dulcis is a perennial with horizontal submerged stems that root in mud. The underground stems are somewhat swollen. Aerial stems reach up to 2 m in height. They are hollow, but transversely septate at intervals. The fresh stems are blue-green to green and are glossy. The flowers are small, cream in colour and are arranged in cylindrical terminal spikes. The fruit is a small hard nut.

The mat weavers in the *vanua* of Buca recognise 2 types of *kuta* based on the 'softness' or 'hardness' of the stems. The first type, locally called the 'true *kuta*' has soft stems and is used for weaving; the second type, locally called *na drau na marama rua*, has hard stems and is not used for weaving. *Sasa* or *voca*, with shorter, unseptate stems is used for weaving place mats, but not the larger infant and other mats. *E. ochrostachys* and the two types of *E. dulcis* are sympatric in the ponds in Buca.

The two types of *E. dulcis* identified by the weavers are not mentioned in published literature (Parham 1972; Smith 1979, and references therein) and have not been recognised as distinct varieties or forms. The difference between the two lies in the septation of the stems. In both the stems are septate, with the septa 2-3 mm apart throughout the length of the stem. However, in the 'true *kuta*' only the septa that are 5-10 mm apart are complete, whilst the intervening septa are incomplete and do not go across the diameter of the stem. In the type known as *na drau na marama rua* all septa are complete (Figure 1). When dried, the stems of the 'true *kuta*' are therefore softer and narrower than those of *na drau na marama rua*. There are no other apparent differences between the two types. Both are now in cultivation at the plant nursery at the School of Pure and Applied Sciences of the University of the South Pacific, Suva. Studies will be conducted to see if there are any other differences in the vegetative or reproductive structures or in the genetic make-up of the two types.

Ecology, conservation, restoration and management

In the vicinity of the villages of Navakasobu and Korovuli, four shallow, adjacent freshwater ponds are the natural habitat of *E. dulcis*. These ponds are present in the path of a natural water gully through cleared land planted with

sugar cane and Caribbean pine (*Pinus caribaea*). The first pond, adjacent to the track road, is overgrown by the pink water lily, *Nymphaea capensis* var. *rosea*, introduced and now naturalised in Fiji (Smith 1981). There is practically no growth of *E. dulcis* or any other wetland plant species in this pond. *E. dulcis* occurs in the other three ponds. Associated species on the edges of these ponds include some native wetland species such as those of *Cyperus*, but most of the species are introduced and weedy. These include species such as *Cuphea carthagenensis* (tarweed), *Ludwigia octovalvis* (primrose willow or swamp primrose; *lalakoivou* or *lalawaivou* in vernacular Fijian), *Mimosa pudica* (sleeping grass; *cogadrogadro* in vernacular Fijian), and grasses such as *Panicum maximum* (Guinea grass) and *Brachiaria mutica* (Para grass). Native wetland species such as the water fern, *Ceratopteris thalictroides*, the moss *Sphagnum cuspidatum* and the grass *Lepironia articulata* (Ash and Ash, 1984) are not present in any of the four ponds. The dominance of weedy species and the absence of native wetland species indicate disturbance of the natural habitat and an input of nutrients (from erosion, fertilizers and animal droppings by runoff) into the ponds.

Except for the first pond, which is not weeded, the women of the villages weed the ponds once a week. The water lilies and other weeds are manually removed at their roots. As a result, the weeded ponds contain *Eleocharis dulcis* in almost pure stands. From time to time these ponds are also replanted with young plants of *E. dulcis*, obtained mainly from the same ponds but sometimes from ponds elsewhere. Harvesting of *kuta* for the production of mats is mainly from two of these ponds. The last pond (also weeded regularly) is left to 'reseed' and regrow. Even though weeds are removed at their roots, it is clear that without this weekly effort the ponds would be completely overgrown with the aggressive water lily and other weedy species in a short period of time.

The efforts of the women of the villages to 'restore' the *kuta* habitat in order to be able to harvest the plants once again are highly commendable. This 'restoration' has so far concentrated mainly on removing the water lily and replanting young *kuta*. A few native trees have been planted on one side of the ponds, which, once fully grown, will help to prevent soil erosion and silting up of the ponds.

Guidelines for species' restoration and reintroduction programmes (Wyse Jackson and Akeroyd 1994; Akeroyd and Wyse Jackson 1995) recommend that landscaping, planting, weed control and measures to prevent soil degradation are important and necessary for habitat restoration. These measures have been undertaken by the WWF *kuta* project. However, the guidelines also indicate that a thorough knowledge of the ecology of an area is necessary, and that as much as possible of the community in which a plant species naturally lives (including both plant and animal species) must be restored for the successful restoration of a species. This aspect of the *kuta* project has been neglected.

At the moment, although *Eleocharis dulcis* is reported to be common in swamps and shallow ponds on the major islands of Fiji (Ash and Ash 1984; Parham 1972; Smith 1979), no information is available on its ecology. The only available study is that of Ash and Ash (1984) on the wetland vegetation of Viti Levu; this work describes the origin, geology and formation of the wetlands and the

species present therein, but does not give details of the ecology of wetland plant species.

As yet there has been no examination of the distribution of the usable type of *kuta* (with incomplete stem septa) and the unusable type (with complete stem septa) in the project area, and it is not known whether both or only one of the types are replanted by the weavers. Incomplete information in this respect may have repercussions for the natural variation in *kuta* populations and for the long-term use of *kuta*. In addition, no information is available concerning the effects of disturbance and pollution on the growth and productivity of *kuta*, either in its natural habitat or in the project area.

Restoration of a habitat in a highly modified surrounding is a difficult task. In this project, through the intervention of regular weeding, *kuta* has been allowed to dominate its habitat, and the species has been 'restored' locally. However, the habitat has not been restored, and the threat of a local decline or extinction of the species has not been removed.

The objectives of a restoration plan are to recover the functional values and self-sustaining characteristics of the original habitat. In this project a possible approach might have been to first recreate a suitable surrounding for the restoration of the wetland and then to remove weeds and to replant *kuta* and its associated plant species. An integrated project involving a reduction in soil erosion and a subsequent lower flow of nutrients from the surrounding land, combined with weeding and planting, would have produced a more sustainable habitat. The planting of wetland plant species, from different populations and ecotypes, that are naturally associated with *E. dulcis* would have yielded better results in the long-term, including a more stable habitat and increased vigour in the population of *kuta*, and would have required less management.

If *kuta* is to be sustained for its economic and cultural importance, locally or nationally, degradation of

freshwater wetlands has to be halted. It is also necessary to know the conditions necessary for the optimum growth and yield of *kuta*, and to understand, and control or minimise, the factors that may threaten it in its natural habitat. In this way maximum productivity and sustainable use can be achieved for *kuta* with little maintenance and without threats to its natural existence.

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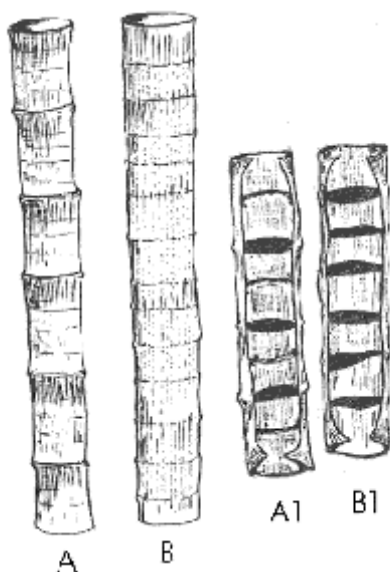


Figure 1. The two types of stem septation in *Eleocharis dulcis*. A, A1. Septa complete at intervals with the intervening septa incomplete; B, B1. All septa complete.

