Eichhornia crassipes

Jacinthe d'eau, Tetezanalika, Tsikafokafona

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Native of South America *Eichhornia crassipes* (C. Martius) Solms-Laub. (Pontederiaceae) is a major freshwater weed in most the frost-free regions of the world and is generally regarded as the most troublesome aquatic plant (Holm *et al*. 1997). *E. crassipes* has been widely planted in pools and gardens around the world because of its striking flowers which are pale lilac or mauve with a yellow patch at the centre. Once introduced to favourable habitats, especially open waters, this species may spread very rapidly and forms dense monotypic mats. For instance, in the 1950s within three years of its first sighting it had spread 1600 km along the Congo River (Holm *et al*. 1969). It is now found in tropical Africa, Asia and Australia, and in sub-tropical parts of the U.S.A. as well as in Portugal (Gopal 1987).

E. crassipes forms dense free-floating mats consisting of branched stoliniferous rhizomes, up to 6 cm in diameter and 30 cm long. At each node they bear glossy leaves (10 to 15 cm across), which are upright or submerged, and many feathery roots (15 to 60 cm long). The plant may reach a height of over 50 cm and the plant's buoyancy results form the air contained in the swollen petioles. Typically 8 to 15 showy flowers (5 cm in diameter) are borne at the apex of a spike and are trimorphic. The flowers are bee pollinated and a high level of self-compatibility has been reported. A plant may start flowering from the age of 26 days and hence readily set viable seeds. The fruit is a capsule containing up to 450 small seeds (4 x 1 mm) which may remain viable for up to 15 years. In areas where water dries up the seeds lie dormant and only germinate when water returns. The submerged seedlings remain on the bottom for some weeks until they break away from the rootstock and float to the surface. (Wild 1961, Holm *et al*. 1969, Gopal 1987, Batcher 2000).

A variety of vectors may distribute either seeds or vegetative parts. Along rivers water flow is the prime mover of vegetative material and wind will readily move the plant, the upright leaves acting as sails, sometimes even upstream. New infestations may arise via unintentional human transportation such as canoes, boats and probably even charcoal transport as sacks used in the process are, in some parts of Africa, plugged with the plant. Seeds are thought to be transported over long distances by birds (e.g. waterfowl and shore birds) and if coated in mud may cling to both mammals and birds (Holm *et al*. 1969, Batcher 2000).

The growth of *E. crassipes* is extremely rapid and the plant may double its population size in 6 to 18 days. Dry matter yields per hectare per day may be as high as 800 kg, especially in nutrient rich water, but normally dry matter yields of up to 150 t per year per ha may be expected. This massive increase in biomass and the production of dense free-floating mats have major impacts on the environment and human activities. For instance, in India the loss of water of the mats of *E. crassipes* was 7.8 times greater that of open water thus resulting in massive wastage of water especially in dry regions (Holm *et al*. 1969, Vasudevan & Jain 1991).

Eichhornia crassipes was probably introduced to Madagascar around, or shortly after, 1900 as an ornamental (Cabanis *et al*. 1969) and was first recorded in 1920 (Decary 1965). In view of its pest status in other parts of the tropics (highlighted in the *Revue de Botanique Appliquée et d'Agriculture Tropicale* by J.-G. C. 1927), it was rapidly identified as a potential serious invader in the lowland regions of the island by Perrier de la Bâthie (1928). It was cultivated in the Tananarive region, and found in private collections in Tamatave, Nossibé and Majunga but was not yet found in rivers and canals. Perrier de la Bâthie (1928) predicted that the central region was too cold for the species to grow properly but considered that the plant would escape from cultivation and invade all water courses in the warmer parts of Madagascar. In view of the disastrous impacts caused by this weed in other parts of the tropics he thought that the destruction of all existing plants on the island was imperative. It is not known whether any measures to eradicate the species were ever initiated, but by the 1960s the plant was reported, when compared to mainland Africa, as "troublesome but not so serious in Madagascar" (Wild 1961) or as a pest with major environmental impacts (Cabanis *et al*. 1969). It was found in stagnant waters such as lakes, canals and slow-flowing rivers as well as in marshy areas susceptible to flooding. It was very common in the Imerina, the Betsileo, the Betsiboka Basin, the Pangalanes Canal (East coast) and the Alaotra Lake (Cabanis *et al*. 1969). It produced such thick covers over rivers and canals as to stop navigation (Guillaumet 1984). *E. crassipes* is now observable in most northern rivers and sometimes the populations build up massively (R.N. Mack, pers. comm. 2001). No attempts to initiate a biological control programme of the weed have been reported (Julien et al. 1996).

Its local names, tetezanalika ('dog's bridge') and Tsikafokafona (which always floats), clearly reflect the plant’s impact on the watercourses, respectively in term of density and floatability (Cabanis *et al*. 1969, Guillaumet 1984). Once it proliferates in a lake *E. crassipes* dramatically alters the ecosystem and may negatively impact some native species of invertebrates, fish, birds and plants. For example, many parts of the Alaotra Lake, a site of biological importance, are covered with carpets of *E. crassipes* that are detrimental to a number of species such as the duck *Thalassornis leuconotus* (Nicoll & Langrand 1989).

E. crassipes has many other detrimental impacts, including a reduction in water flow which can result in flooding or impede irrigation. By promoting stagnant water it favours mosquitoes and other insects as well as snails susceptible to propagate diseases (e.g. bilharzia, filariasis and malaria). Dense mats greatly hinder boating by fishermen and may prevent fishing altogether thus denying locals their main source of protein and sometimes forcing people to relocate. When mats decompose dissolved oxygen levels are reduced and sedimentation increases. The plant may invade rice fields resulting in decreased crop production and in extreme cases fields have been abandoned. (J.-G. C. 1927, Holm *et al*. 1969, Findlay & Jones 1996, Batcher 2000).

Worldwide much effort has been put into managing and controlling *E. crassipes* with varying degrees of success. The plant may be controlled by chemical means (glyphosphate) but this is expensive and needs to be regularly carried out. This weed is extremely difficult to eradicate because small vegetative segments may survive among other vegetation and rapidly re-infest cleared areas (Wild 1961). Vasudevan & Jain (1991) have suggested that control may be achieved by exploiting the weed for economic benefits. The use of the biomass as a source of energy, food, animal feed, fertilizer and even pulp and paper should be more closely investigated as laboratory and small pilot experiments indicate some potential avenues. However, Findlay & Jones (1996) viewed manual control as an important follow-up measure for chemical control and mechanical control is fraught with difficulties including an enormous amount of plant material, which may become an ecological problem on land, and reliance on expensive and unreliable machinery.

In neighbouring South Africa, where *E. crassipes* is the most important aquatic weed, biological control with five arthropod species and fungal pathogens has been attempted since the mid 1970s. Success has been limited and it has been suggested that additional control agents may be required as well as implementing site-specific integrated management plans (Hill & Cilliers 1999). Due to the weed's recent rapid increase in abundance and distribution in Africa and elsewhere, international co-operation has been promoted in order to effectively combat the plant (Julien et al. 1996).

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