

Verbenaceae, *Lantana camara*,
fankatavinakoho, fotatra, mandadrieko,
rajejeka, radredreka, ramity.

Pierre Binggeli

(2003) In Goodman S.M. and J.P. Benstead (Eds)
The natural history of Madagascar, pp. 415-417.
University of Chicago Press, Chicago.

This ornamental shrub, native to tropical America, is now found in most tropical and subtropical regions of the world. It is not only extremely widespread but it is also generally considered to be a major pest of agricultural and natural areas. Indeed, in many countries it has been declared a noxious weed. The species was first introduced to Europe from Brazil in the 17th century but was only widely distributed around the world during the 19th and early 20th century. During the 18th century *Lantana* became a favourite hothouse plant and numerous new varieties were bred and this resulted in hundreds of named cultivars being advertised for sale in Europe. Many of these cultivars were introduced world-wide so that new material was brought into various geographical locations on a regular basis. However, this history of introduction is generally poorly documented and as result the taxonomic identity of invasive populations is very difficult to determine. There are now hundreds of cultivars and hybrids and these belong mostly to the *Lantana camara* complex. Two groups are often recognised: one with few or no spines and limited fruiting commonly found in the neotropics and the other with spines, including the commonest variety the prickly *L. camara* var. *aculeata* (L.) Moldenke, invading much of the old tropics (Cronk & Fuller 1995, Swarbrick 1986, Swarbrick *et al.* 1995, Thaman 1974).

L. camara is a highly variable species. It may be erect in the open and scrambling in scrubland, reaching a height of two to five meters. Variations in flower size, shape and colour; leaf size, hairiness and colour; stem thorniness; growth rates; shade tolerance; toxicity to livestock; chromosome number and DNA content have been widely reported (Swarbrick 1986, Swarbrick *et al.* 1995). Typically flowers are yellow, later turning orange then red and remain on the axillary inflorescence for three days. The flowers, when yellow, produce nectar and are pollinated by butterflies and thrips. The species is an obligate outcrosser, but it is unclear whether apomixis occurs. One or two seeds are contained in a small fleshy drupe (3-6 mm in diameter) which mature rapidly changing colour from dark green to black (Schemske 1983). The main dispersal agents are wild birds and in Madagascar hens play an important role (hence the local name Fankatavinakoho: 'which fattens up chicken', Perrier de la Bathie 1928). Sometimes sheep and goats may also disperse the seeds. Flowering and fruiting usually occurs throughout the year and, in seasonal climates, with a peak during the first two months of the

rainy season, the period during which most seeds germinate.

As this shrubs regenerates freely from widely distributed seeds and spreads vegetatively (layering), it rapidly forms extensive, dense and impenetrable thickets in disturbed areas. Disturbance decreasing competition and increasing resource availability associated with fire and grazing promote lantana invasion whereas shading is a limiting factor (Gentle & Duggin 1997). Although it thrives in disturbed and natural, but open, vegetation, some invasive populations being somewhat shade-tolerant, it may become the dominant understorey shrub in forestry plantations, orchards and open forests. The species exhibits a broad tolerance to environmental factors. It may be found between sea level and 1000 m and in places even at higher altitudes, but is limited by frost. It is found in regions with a mean annual rainfall varying from 4000 mm to less than 1000 mm. Its distribution is affected by soil type, it is absent from boggy and saline soils, but it often grows well on poor soils. In areas where natural fires occur they stimulate thicker regrowth.

Besides its ornamental value lantana has few human benefits. It has often been used for hedges and erosion control and indigenous people sometimes used it as fuel and for medicine. Its negative effect on human activities are important as it encroaches agricultural land, reduces the carrying capacity of pastures and is a weed in many agricultural crops. The spiny nature of the shrub hinders human access to natural and agricultural areas alike. It may cause poisoning in cattle and sheep and children have died after eating unripe berries. In some regions its large dry biomass increases fire susceptibility and its massive seed production favours rat populations. Allelopathic effect induced by *L. camara* may inhibit growth of other plants and seed germination of both crops and natural vegetation. In natural areas the shrub has serious deleterious effects on some endemic animal and plant species and is known to displace natural scrub communities as well as prevent natural regeneration of some tree species (Binggeli *et al.* 1998, Morton 1994, Sharma *et al.* 1988).

L. camara is thought to have been introduced to Madagascar by colonists from Réunion or the Mauritius during the latter part of the 19th century. The first botanical collection was made by Mocquerys in 1898 who described it as very common near Maroantsetra. By 1911 Perrier de la Bathie (1928) observed isolated individuals mainly around dwellings along much of the East coast, but by the mid 1920s he noted that the weed covered in excess of 100,000 ha in the Mangoro Valley. He concluded that it was too late to either prevent further spread of the species or indeed control it. He suggested that this sudden expansion was caused by a change in the birds' feeding habits. After ignoring this resource they became exceedingly fond of the lantana fruits (Perrier de la Bathie 1928, 1932). At that time the shrub was still absent from the Sambirano region but Perrier de la

Bathie reckoned that it was only a question of time before that region became infested too, whereas the Western region was thought to be too dry for it to spread.

As soon as lantana became a noxious weed on the eastern coast, the local Betsimisaraka people, rather than clear land smothered by the spiny and intertwined stems of lantana, preferred to abandon the infested areas. According to Perrier de la Bathie (1928) they claimed that the Colonial Administration prohibited slash and burn agriculture and they moved on to do just that in the virgin forest where this practice was indeed illegal. Thus the lantana invasion, combined with local people's reluctance to clear this weed and the lack of policy enforcement by local officials, promoted deforestation.

According to Perrier de la Bathie's (1928) observation lantana, identified as *Lantana camara* var. *aculeata* (L.) Moldenke (Moldenke 1956), appears to have an ecological impact on vegetation succession somewhat different from what has been reported elsewhere in the tropics as summarised above. He stated that the shrub had an ephemeral existence. After about a decade, during which time a thick humus layer was produced, native trees would become establish under its shade and these would eventually shade out the weed. He clearly viewed lantana as a facilitator in secondary succession, both by providing humus and shade necessary for successful seed germination and seedling establishment, and this is in sharp contrast to what is generally observed elsewhere. As a result of his observations, and the species' ability to recover from fire, he considered that lantana could be useful in reforesting laterite soils in humid regions of the island.

Overgrazing has been identified as the main cause of encroachment of western and southern grasslands by woody plants including lantana (Koechlin 1993). In the eastern and Sambirano regions lantana becomes one of the main component of secondary succession following slash and burn agriculture. In 75 vegetation inventories F. Vicariot (in Koechlin *et al.* 1974) found that lantana occurred in 30 fallows and was the 6th most recorded species. Like other woody plant species, lantana is eventually replaced by grasses whenever the cycles of slash and burn agriculture are reduced and fires become too frequent.

Although *Lantana camara* may become a major undercanopy component of open forests in some parts of the world (e.g. Heckel 1911), in Madagascar the shrub is restricted to open areas and in some protected areas to the edge of footpaths and tracks (Le Normand 1988, Preston-Mafham 1991). In the Montagne d'Ambre Park, lantana forms dense thickets along many of the tracks and it is reported to be the favourite food source of the endemic Madagascar Diadem *Hypolimnas dextithea* (Preston-Mafham 1991). This is an unusual case of a positive impact of this weed on endemic wildlife as it is generally viewed as favouring exotic animals, especially non-native bird species.

Being such a widespread and important weed, the control of the species has been a major focus of land managers world-wide. However, because of the plant's variability and plasticity, most control schemes have failed or have been too expensive to be implemented. For instance, in the 1920s Perrier de la Bathie (1928) noted that in Madagascar lantana clearing was very expensive and difficult in a country where manpower was becoming scarce. Mechanical control can be locally effective, particularly where land is cleared, but is labour intensive whilst chemical control is expensive. With both methods treated areas are rapidly recolonized by seedlings and stems as well as roots freely coppice and follow-up treatments are required. Both slashing and burning stimulate suckering. In South African conservation areas the use of chemicals proved to cause less disturbance than mechanical control and resulted in higher biodiversity (Erasmus *et al.* 1993).

Once established in a region the eradication of lantana is impossible and if the pest is to be kept under some degree of check, biological control is the only option. This has been attempted in many parts of the tropics using a variety of insects and fungal pathogens with varying degrees of success as different cultivars display differences in susceptibility to insect herbivores. In Madagascar *Teleonemia scrupulosa* Stål, released in 1961, caused tip die-back, and *Ophiomyia lantanae* Froggatt was observed in 1968, probably an accidental introduction (Julien 1992). Any successful biological control programme will depend, as elsewhere (e.g. South Africa, Baars & Naser 1999), on the establishment of an array of insects and fungal pathogens which are able to cope with the variability and climatic amplitude of this weed.

Although lantana is a major agricultural weed in Madagascar, reports cited in this review would indicate that the species may have more positive impacts on the island's ecology than it has elsewhere in tropics. The role of lantana as a facilitator of secondary succession, when the plant is generally viewed as having a strong allelopathic effect, and as a key food source to some endemic species deserves further investigations. A key feature of these important differences may reside in the nature of the genetic material found in Madagascar. If this were to be the case, it would be essential that other weedy varieties are not introduced to the island.

Baars, J. R. & Naser, S. 1999. Past and present initiatives on the biological control of *Lantana camara* (Verbenaceae) in South Africa. *African Entomology* 7: 21-33.

Binggeli, P., Hall, J. B. & Healey, J. R. 1998. A overview of invasive woody plants in the tropics. School of Agricultural and Forest Sciences Publication Number 13. University of Wales, Bangor. (<http://www.safs.bangor.ac.uk/iwpt>)

Cronk, Q. C. B. & Fuller, J. L. 1995. Plant invaders. Chapman & Hall, London.

- Erasmus, D. J., Maggs, K. A. R., Biggs, H. C., Zeller, D. & Bell, R. S. 1993. Control of *Lantana camara* in the Kruger National Park, South Africa, and subsequent vegetation dynamics. In Proceedings of Brighton Crop Protection Conference, Weeds. Farnham: BCPC, Vol. 1: 399-404.
- Gentle, C. B. & Duggin, J. A. 1997. *Lantana camara* L. invasions in dry rainforest - open forest ecotones: The role of disturbances associated with fire and cattle grazing. *Australian Journal of Ecology* 22: 298-306.
- Heckel, E. 1911. Sur l'envahissement des forêts de Nouvelle Calédonie par le *Lantana camara* L. et les dangers que la plante fait courir à l'économie agricole et sylvicole de l'île. *Bulletin de la Société d'Acclimatation de France* 58: 511-514.
- Julien, M. H. (Ed.) 1992. Biological control of weeds. A world catalogue of agents and their target weeds, 3rd edn. CABI, Wallingford.
- Koechlin, J. 1993. Grasslands of Madagascar. In Ecosystems of the world 8B. Natural grasslands - eastern hemisphere and résumé, ed. Coupland, R. T., pp. 291-301. Elsevier, Amsterdam.
- Koechlin, J., Guillaumet, J.-L. & Morat, P. 1974. Flore et végétation de Madagascar. Cramer, Vaduz.
- Moldenke, H. N. 1956. Flore de Madagascar et des Comores: 174. Verbénacées. Muséum National d'Histoire Naturelle, Paris.
- Morton, J. F. 1994. Lantana, or red sage (*Lantana camara* L., [Verbenaceae]), notorious weed and popular garden flower; some cases of poisoning in Florida. *Economic Botany* 48: 259-270.
- Normand, B. Le 1988. La Montagne des Français et l'Archipel de Nosy Hara. In L'équilibre des écosystèmes forestiers à Madagascar, ed. Rakotovo, L., Barre, V. & Sayer, J., pp. 265-266. IUCN, Gland.
- Perrier de la Bathie, H. 1928. Les pestes végétales à Madagascar. *Revue de Botanique Appliquée et d'Agriculture Tropicale* 8: 36-42.
- Perrier de la Bathie, H. 1932. Les plantes introduites à Madagascar. *Revue de Botanique Appliquée et d'Agriculture Tropicale* 12: 372-383.
- Preston-Mafham, K. 1991. Madagascar - a natural history. Facts on File, Oxford.
- Schemske, D. W. 1983. *Lantana camara* (Cinco Negritos, Lantana). In Costa Rican natural history, ed. Janzen, D. H., pp. 266-268. The University of Chicago Press, Chicago.
- Sharma, O. P., Makkar, H. P. S. & Dawra, R. K. 1988. A review of the noxious plant *Lantana camara*. *Toxicon* 26, 975-987.
- Swarbrick, J. T. 1986. History of lantanas in Australia and origins of the weedy biotypes. *Plant Protection Quarterly* 1: 115-121.
- Swarbrick, J. T., Willson, B. W. & Hannan-Jones, M. A. 1995. The biology of Australian weeds. 25. *Lantana camara* L. *Plant Protection Quarterly* 10: 82-95.
- Thaman, R. R. 1974. *Lantana camara*: Its introduction, dispersal and impact on islands of the tropical Pacific Ocean. *Micronesica* 10: 17-39.