THE DISTRIBUTION, IMPORTANCE, BIOLOGY AND CONTROL, OF CHROMOLAENA ODORATA (L.) K. & R.A MAJOR WEED SPECIES OF COCONUT PLANTATION IN SRI LANKA

By
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ABSTRACT

Chromolaena odorata (L.) K. & R. is a tropical perennial weed species of the Asteraceae family that has become a serious problem in coconut plantations in Sri Lanka and in the tropics of Asia and Africa. The history of distribution, habitat and economic importance is summarized. The botanical features and seed biology of this species are presented in this review. Finally, information on the control measures such as mechanical, cultural, chemical and biological methods is discussed.

INTRODUCTION

Tea, rubber and coconut are the most important and widely distributed plantation crops in Sri Lanka. Coconut (Cocos nucifera L.) is the most widespread smallholder crop. The growth habit of the palm and its canopy structure requires a wide spacing between trees which permits abundant sunlight to reach the understory vegetation. As a result, the unutilized space beneath the plantation becomes invaded by a wide range of perennial and annual weed species. Management of the understory weed growth is therefore considered an essential step in maintaining the plantation. The density and vigour of weeds and their distribution depends largely on the age of the plantation, its agroecological zones and size of the holding.

Among the weedy shrubs, Chromolaena odorata is one of the most troublesome species that dominates the understory in young coconut plantations. It is not a native weed species of Sri Lanka, but its spread into cultivated areas poses a serious economic problem as it is propagated by both seed and vegetative means resulting in rapid colonization of the understory areas.

History and geographical distribution of Chromolaena odorata

C. odorata is native to the Caribbean islands, Central and South America. For many years it was widely known as Eupatorium odoratum L. but was transferred to the resurrected genus Chromolaena by King and Robinson (1970). The accepted view has been that C. odorata was first transported to the old world via ballast in ships from the West Indies, appearing in Singapore and Malaysia in the 1920's (Bennett and Rao, 1968). It was certainly recorded as a major weed in Bengal, Java and Sumatra by 1940 (Laan, 1940). It was reported as a dangerous weed in Sri Lanka in 1944 (Grierson, 1980).

Once established in the Bengal, lower Burma and Malaysia, C. odorata spread rapidly throughout South Asia. Much of this spread must have been natural progressive as the light wind-borne seeds were blown into new areas. By the late 1960s C. odorata was a major weed in Nigeria and since then, it has spread to Ghana, Ivory Coast and Cameroon.

Poddysinghomarang, the common name in Sri Lanka for C. odorata, is a perennial dicotyleclonous weed of the family Asteraceae (Compositae).

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C. odorata is a vigorously growing perennial plant with a life span of more than three years. It flowers during the first week of December. The species is known by other common names in different countries: Christmas bush (Triniclad), Siam weed (Malaysia and Indonesia), Communist weed (Vietnam) Saab sua (Thailand), Kalkun or Camphur grass (Burma), Banrnara (Nepal) and Ha-onorny (Philippines) (Muniappan and Marutani, 1988).

Economic Importance

C. odorata is considered one of the top three weeds in coconut plantations in Sri Lanka. In Asia it is a problem in coconut, rubber, oilpalm, tea, coffee, cashew, mango, rambutan, tea and other plantations of perennial crops, pasture, forests and vacant lands. In the Pacific, it is a weed of pasture, road sides and vacant lands. According to Holm, et al. (1977) C. odorata is a weed of 13 crops in 23 countries. In the Philippines some villages have become deserted because of non-productivity of the land infested with this weed (Pancho and Plucknett, 1977). It is also poisonous to livestock.

C. odorata is known to harbour a number of insects and mites injurious to crops in Asia. e.g. Aphis gossypii, Haplothrips gowdeyi (Naezer and Meer Mohr, 1953; Bennett, and Rao, 1968; Joy, Lyla and Abraham, 1979; Ramai and Haq, 1983; and Muniappan and Viraktamath, 1986). In Thailand it has been reported as an alternate host of the leaf fungus, Cercospor spp. (Puckdeedindan, 1966).

In Cambodia, C. odorata is used as a green manure crop for black pepper (Garry, 1963), rice and cassava (Litzenberger and Lip, 1961).

Habitat

The distribution of C. odorata is limited to warm and humid tropical regions. It is well established by ecologists that there is commonly a close correlation between the distribution of vegetation and two major features of climate namely temperature and precipitation (Woodward and Williams, 1987). The geographical distribution of C. odorata seems limited to areas where the rainfall is 200 cm and above per annum and the temperature range is between 20-37°C. It is distributed in areas up to about 1000m in altitude close to the equator.

C. odorata cannot tolerate heavy shading, as a result it does not penetrate thick undisturbed native forest vegetation. In the disturbed forest areas and in plantations of coconut, rubber, cashew, oil palm, citrus, coffee, tea, mango, rambutan and other perennial crops, pasture and vacant lands, it becomes very well established and better growth performance than open condition in partially shaded conditions (Gunasekara, 1993) and so becomes a serious weed.

Botanical features of C. odorata

C. odorata is a perennial herb. Under favourable weather conditions, the plant can grow up to 25 cm in height in a week and in six months can form an almost impenetrable shrub 2-4m high. The whole plant is hairy and glandular and emits a pungent odour when crushed (Sheldrick, 1968). On good open land Chromolaena forms much branched stems. The stems are woody and may be up to 5 cm in diameter at ground level. In shade it develops a more etiolated form and becomes a partial creeper on trees. Stems will grow up to 3m high, with large leaves and long slender internodes twisted among the branches of trees (Cruttwell, 1968). Leaves are opposite, triangular to elliptical with a serrated edge (Fig. 1.2). The length of a leaf is about 4-10 cm (Gooding, Loveless and Proctor, 1965) or 5-15 cm (Britton and Millsplough, 1962) and leaf width is about 1-5 cm. The youngest pair of leaves of a vegetative shoot have a characteristic purple pigmentation towards their bases (Sheldrick, 1968). The petiole is about 1-4 cm long (Britton and Millsplough, 1962).
Flowering takes place in December. Sajise, Palis, Norcio and Lales (1974) reported that the flowering response of Chromolaena to varying photo periods indicated that it can flower over a range of daylength conditions (10-14 hrs), but flowering was greatly enhanced by shorter daylengths (10 hours). The inflorescence is laxly to densely corymbose, the heads are terminal and cylindrical being 4-5 mm across and 8-12 mm long. The branches bearing the corymb often form a large pannicle like structures (Fig. 1.2). The involucre is cylindrical, and bears several series of bracts, which are oblong, bluish or straw coloured. The outer series being shorter than the inner, which are about 9 mm in length. No ray florets are borne in the flower heads, which bear 10-20 florets; the corolla is pale lavender or white and about 5 mm long. Achenes are 4-5 mm long, somewhat hairy or glabrous; the pappus is whitish and 4-5mm long (Britton and Millsapugh, 1962; Gooding, Loveless an Proctor, 1965).

After flowering there is a regrowth of new shoots from axils of all old leaves. During the dry season, if it is severe, all the old leaves may dry up and regrowth may be delayed till the onset of the rains. In most years, there is some growth throughout the year, though in very dry periods, this may be slight. With the rains for some time in the middle of the year, there is a spurt of growth with new shoots coming from ground level. Many stems and parts of the stem die after flowering, so that an old bush of Chromolaena is a tangled mass of old and new stems, long and short and much branched (Cruttwell, 1968).

Seed biology

The main medium of seed dispersedination is the wind. C. Odorata has an amazing ability to produce vast amounts of seeds. Seed production has been estimated at about 80,000 - 90,000 seeds/plant (Weerakon, 1972). The seeds are ideally formed for this purpose. They are produced in great numbers, are light and bear a pappus. Normally 100 seed weight is about 20 mg (Gunasekara, unpublished data). After the seeds fall to the ground, if the necessary conditions are available, all the seeds which are viable will germinate within a short period as they do not have dormancy (Weerakon, 1972). Erasmus and Van Staden (1987) reported that the percentage germination of achenes of C. Odorata stored dry in the dark at 25°C for seven months was markedly higher than that of freshly harvested achenes (seeds). This is indicative of an after ripening requirement that may be of benefit to the species by ensuring temporal distribution of germination. Germination of freshly harvested achenes from various sites differed. However, after 7 months of dry, dark storage at 25°C no differences were present, thus confirming the after ripening requirement (Erasmus and Van Staden, 1987). When the seeds are on the surface of the soil, they germinate immediately. But seeds that get buried at a depth of 0.5 cm or more do not germinate (Weerakon, 1972). Temperature is an important environmental factor for seed germination of Chromolaena. The optimal temperature for germination is 15-30°C (Erasmus and Van Staden, 1986). Light is essential for seed germination. Newly collected seeds show a greater percentage of germination when exposed to sunlight (NVeerakon, 1972). According to the experiments carried out by Erasmus and Van Staden (1986) the promotive effect of red light on the germination of Chromolaena achenes can be reversed by subsequent exposure to farred light. This is typical of a phytochrome mediated germination response.

Control of Chromolaena odorata

Manual slashing and use of motorized bushcutters and tractor drawn equipment are commonly used for clearing C. odorata. Okioye (1977) found that slashing caused rapid regeneration but repeated slashing eventually caused the death of weeds. Manual weeding is mostly done in places where cheap and plentiful labour is available. Use of motorized bushcutters and tractor drawn equipment is also limited because of the restricted accessibility of areas where this weed grows (Erasmus, 1988). Slashing and burning are carried out in some places. The top portions of C. odorata
bum readily during the dry seasons, while the bases of plants are resistant to fire. Seeds also germinate well after a fire (Liggitt, 1983).

b) Cultural control

Cover crops such as *Pueraria javanica*, *Pueraria phaseoloides*, *Calapagonium caeruleum* and *Desmodium ovalifolium* have been used to suppress of *C. odorata* and found to be ineffective (Ambika and Jayachandra, 1990). However, Salgado (1972) reported that *Tephrosia purpurea* grown as a cover crop in coconut plantations was ineffective in suppressing *C. odorata* in Sri Lanka.

c) Chemical control

In India Nair (1973) reported that Gramoxone at 0.3% concentration was not effective in controlling this weed. However, Rai (1976) found that Gramoxone in combination with 2-4D sodium salt was effective. Mathew, Punnoose and Potty, (1977) reported that a combination of 1.5 litres of Gramoxone and 0.75 kg Fernonoxone gave good control of this weed. Tumaliuan and Halos (1979) also reported that Gramoxone was effective in controlling *Chromolaena* in the Philippines. In Indonesia, Soerjani, Soedarsan, Mangoensoekarjo, Kuntohartono and Sundaru (1975) found that Picloram was also effective in its control of Chromolaena. Madrid (1974) reported that Picloram at 1 kg/ha and Dicamba at 2 kg/ha were the recommended rates to control the weed.

Erasmus (1988) and Liggitt (1983) reviewed chemical control of *C. odorata* in South Africa. In general, the timing of herbicide application was important in its control. Plants were most susceptible when herbicides were applied at the young seedling stage or to the regrowth after slashing.

d) Biological control

Several insects and mites feed on *Chromolaena* (Crutwell, 1974) and this has led to biological control measures being introduced. *Pareuchaetes pseudoinsulata* Rego Barros (Lepidoptera Arctiidae) was introduced to Ghana, Nigeria, India, Sri Lanka and Sabah (Malaysia) by the Commonwealth Institute of Biological Control (CIBC) in the early 1970's to attack *Chromolaena* (Julian, 1987). The insect was successful in Sri Lanka. The seed feeding weevil, *Apion brunneonigrum* Beguin- Billecoq Coleoptera: Curuloinidae) has been released in India, Sabah, Sri Lanka, Ghana, Nigeria (Julian, 1987). No recoveries of this weevil have been made in these countries. *Acalitus adoratus* Keifer (Acarinae: Eriophydae) has been identified as one of the natural enemies of *C. odorata* in the neotropics and recommended as a biological control agent (Cook. 1984).

ACKNOWLEDGEMENTS

I thank Dr. M. de S. Liyanage, Deputy Director (Research) and Acting Director of the Coconut Research Institute for his assistance. The assistance given by Dr. D.N.S. Fernando, Dr. C. Jayasekara, Miss S. Ranasinghe and Mr. A. Nainanayake is also acknowledged.
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