

ALIEN INVASIVE PLANTS AND THEIR POTENTIAL THREAT TO BIODIVERSITY IN RUBBER PLANTATIONS

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The plants that are most often not native to a country and have the ability to compete with and replace native habitats are categorized as invasive plants. Invasive species are alien species commonly referred to as exotics, introduced or non-indigenous species that have come from other geographical regions through intentional or unintentional introduction (Gunatilleka, 1999). On a global scale, alien invasive species have been identified as being one of the five most important direct causes of the worldwide decline in biodiversity and ecosystem services, and their impact is predicted to rapidly increase in tropical forests (Millennium Ecosystem Assessment, 2005). The threat of invasive alien species in to native and agricultural ecosystems and habitats is therefore recognized as a conservation priority by the UN Convention on Biological Diversity (CBD) and the International Union for Conservation of Nature (IUCN) (Mc Neely *et al.*, 2001).

Although some plant introductions are of significant benefit to the recipient country, some have ended up being invasive in both agricultural and native ecosystems. Some of the commonly found invasive plants in Sri Lanka in different habitats include *Weddelia trilobata*, *Lantana camara*, *Clidemia hirta*, *Dillenia suffruticosa*, *Myroxylon balsanom* and *Clusia rosia*. Of them, *Weddelia trilobata* L. (arunadevi) and *Lantana camara* L (Gandapana) have been ranked by the Ministry of Forestry and Environment of Sri Lanka as two of the most threatening alien invasive species that have invaded and affected native biota in Sri Lanka (Bambaradeniya, 2001). Except *Lantana camara*, other leading invasive plants, such as *Weddelia trilobata*, *Clidemia hirta* and *Dillenia suffruticosa* are found in rubber plantations especially in the Wet Zone of Sri Lanka as noxious weeds.

Weddelia trilobata

The establishment of a legume cover in young rubber plantations is a recommended practice in order to arrest soil erosion, to enhance the micro climatic conditions and also to improve the soil fertility. However, non leguminous creepers like *Weddelia trilobata* L. (current name is *Sphagneticola trilobata* (L.)) or commonly referred to as 'arunadevi' belonging to the family Asteraceae (Compositae). are found in some rubber plantations as a cover.

This plant had been introduced from India to some tea plantations in Sri Lanka as a cover crop in early 1980's, due to its rapid growth and the ability to cover the entire area within a very short period of time and thereby arrest soil erosion. Later, in mid 1980's, it was deliberately introduced in to some rubber plantations in

the Wet Zone as a cover crop. Currently it is widely distributed in many rubber plantations in Sri Lanka although it is not a recommended cover crop by RRISL and thriving well with no competition from other plants or from predators.

Weddelia is native to the tropics of Central America and now it is growing in many countries as noxious weed in agricultural areas, along road sides and trails in open and streams lots, waste places, disturbed sites, natural and planted forests, etc. It forms a dense ground cover, if allowed, preventing regeneration of other species (Space and Flyman, 2000). It is a creeping and mat-forming perennial herb with a rounded stem and rooting at the nodes. Leaves are fleshy, usually 4-9 cm long, 2-5 cm wide, irregularly toothed or serrate, usually with a pair of lateral lobes (Plate 1). The flowering portions are ascending, coarsely strigose to spreading hirsute, sometimes subglabrous. Peduncles are 3-10 cm long, involucre campanulate-hemispherical, ca. 1 cm high, chaffy bracts lanceolate, rigid ray florets often 8-13 per head, rays 6-15 mm long, disk corollas 4-5 mm long and pappus a crown of short fimbriate scales. Achenes are tuberculate, 4-5 mm long. It blossoms profusely and the flowers are yellow in colour (Wagner *et al*, 1990).

Weddelia has a very wide ecological tolerance range, and seems to be equally suited to dry and moist sites. Although it seems to prefer and do best in sunny sites, it survives in shady sites as well. It grows well on almost all soil types, including bare limestone and nutrient poor sandy beaches and swampy or waterlogged soils. It is tolerant to inundation and high levels of salinity (Thaman, 1999). Reproduction of *Weddelia* is mainly by vegetative methods. Stems form new plants where they touch the ground and pieces readily take root. Plants usually develop few fertile seeds. *Weddelia* is commonly spread by dumping of garden waste and hence it has been nominated as among 100 of the "World's Worst" invaders (PIER, 2003).

Because of its attractive nature of flowers, it has been used as an ornamental plant in many areas of Sri Lanka and as a result it has now become a noxious weed thriving where it is not wanted and becomes a nuisance due to its presence in large numbers. It has been reported that *Weddelia* is growing competitively with tea and has affected growth and other management practices on tea plantations due to improper control from the initial establishment stage (Personal communication).

In tea plantations, *Weddelia* has been used for making compost mixtures although it was advised by Tea Research Institute, Talawakelle, not to use this plant for any purpose. They prepare compost from *Weddelia* by collecting them in large holes and allowing them to deteriorate by mixing for several times. Even after a careful preparation, new plants had been reported from minute undeteriorated stem portions (Personal communication). Thus, people should not be encouraged to prepare even compost mixtures from *Weddelia*.

No diseases or pests have been recorded on *Weddelia*. However, in up country tea plantation, the dodder plant (*Cuscuta* spp.) grows parasitically on this plant. Nevertheless, growth of *Weddelia* could not be completely retarded by *Cuscuta* since upon dying of the dodder plant, *Weddelia* can grow without any harm. Although Dissanayake (2002) showed that this plant has potential for selective heavy metal

uptake, encouraging further distribution of *Weddelia* as a cover crop or ornamental plant and its transportation for any use in rubber plantations should be prevented in order to arrest its spreading as a noxious weed.

Dillenia sufruticosa

Dillenia sufruticosa Griff. (“diya para”) belonging to the family Dilleniaceae, is found massively in some rubber plantations in Wet Zone areas of Sri Lanka. This is a large shrub or small evergreen tree and grows up to 5 m. Leaves are elliptic to ovate, 15-30 by 8-15 cm, 12-20-nerved, rounded to obtuse at apex, obtuse at base and base continuous with petiolar wings. Petioles are 2-6 cm with 4-10 mm broad persistent wings enclosing terminal bud in young leaf. Flowers are in up to 18-flowered terminal simple or compound racemose inflorescences and 8-12 cm across. Pedicel are 1-3 cm, sepals obovate, 15-22 by 8-12 mm. Petals are yellow, 40-50 by 25-30 mm. Staminodes ca 100, 4-6 mm long. Carpels are 5-8, ca 5 by 2 mm with 10 mm long, each with 7-10 ovules. Fruit is dehiscent, sepals reflexed, carpels spreading, red, ca 20-25 by 10-16 mm. Seeds are arillate (USDA, 2001).

This distinctive shrubby tree grows vigorously in shade on eroded and infertile soils, wasteland, forest edges and swampy areas and can live for 50-100 years (Davies and Semui, 2006). This was also introduced to Sri Lanka during the British colonial period as an ornamental plant (PIER, 2002) and since then people tended to grow this plant in their home gardens and later it spread in to natural and cultivated habitats.

This is a pioneer species which can establish in bear lands and therefore there is a potential to invade it in to young rubber plantations as well. *Dillenia* sends out very deep tap root to reach underground water sources and hence some people use this plant as a guide to decide water well (Corner, 1997). Vegetative propagation occurs by means of roots and thus, it can spread in to entire area during a short period of time. Therefore, care should be taken to control this plant at early stage of its growth.

Clidemia hirta

Clidemia hirta (“Katakalu bowitiya”) which belongs to family Melastomataceae, is another invasive plant found in rubber plantations. This is a perennial shrub up to ca. 2 m tall (Plate 3). The stems are covered with red bristles that lighten with age. The leaves are opposite, simple and petiolate. The ovate-to-oblong leaf blades are hairy with crenate margins. The surfaces appear pleated. Five major veins originate at the base of the leaf and extend to the apex. The inflorescence is a panicle that can be terminal or axillary. The calyx has five hairy linear lobes along urceolate hypanthium. The corolla consists of five small white petals. The fruit is a hairy, ovoid, many seeded, bluish-black berry.

The origin of *Clidemia* is South America and now it is cosmopolitan. In the lowlands of Central and South America and Caribbean Islands where it is native, it colonizes naturally and anthropogenically in disturbed open areas such as pastures,

riversides, roadsides, and tree plantations. In its introduced range *C. hirta* is abundant in open areas and gaps in the understory of old-growth forest. *C. hirta* appears to be more shade tolerant in its introduced range (DeWalt *et al.*, 2004). Spreading is by means of seeds and also by roots. Although it is not as invasive as *Weddelia*, care should be taken to control of this plant in order to prevent its further spreading.



Plate 1

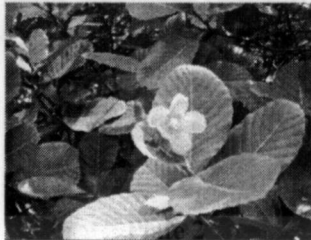


Plate 2



Plate 3

Plate 1. Densely grown *Weddelia trilobata* in a mature rubber field; **Plate 2.** *Dillenia suffruticosa* and **Plate 3.** *Clidemia hirta* found in some rubber plantations.

Special features of alien invasive plants and their possible impact on biodiversity in rubber plantations

All invasive plants listed above have rapid vegetative propagation methods and thus they have the ability to cover large areas suppressing other important native flora. *Weddelia* is known to give no chance for other plants to grow and suppressing the growth of even legume cover crops as well as native biota found in rubber plantations.

As far as rubber small holdings are concerned, they utilize their rubber lands for multiple purposes especially for intercropping and as a source of indigenous medicinal plants. Commonly found medicinal plants in rubber lands include "iramusu" (*Hemidesmus indicus*), "hatha wariya" (*Asparagus racemosus*), "Gotukola" (*Centella asiatica*), "Mugunuwenna" (*Alternanthera sessilis*) "thippili" (*Piper longum*), "kesipithhan" (*Cyclea brumani*), diya mittha" (*Cissampelos pareira*), wel penela (*Cardiospermum* sp.), "monara kudumbiya" (*Vernonia cinera*), etc. These are generally found in rubber plantations as weeds but have no major impact on rubber plants since their populations are too small when compared with other dominant weeds. Moreover, these shade loving native plant species contribute to increase the biodiversity in rubber plantations in addition to being a source of additional income through their medicinal and food value.

It is the experience of rubber small holders that many of the important medicinal plants which were commonly found in rubber lands for decades have now disappeared or found rarely. In this regard, threat from alien invasive plants on these native flora could not be neglected since the spreading of *Weddelia* and *Clidemia* occurs at an alarming rate in some rubber plantations.

The impact of these invasive species on biodiversity is immense, irreversible and hence irreparable yet still remains poorly understood. The outcome is that the

seed bank of native species is exhausted, effectively excluding the species from that area. The critical weakness is that the native species cannot compete against the aliens in the germinant and early seedling stages and hence native species is dismal.

Alien invasive plants not only affect the native floral populations but also faunal populations. Most of the invasive plants are not desirable for animals and if they are the dominance in a field, there is a less chance of surviving for more animals due to shortage of foods.

Plant invasions can alter the functioning of an ecosystem dramatically, for example through increasing fire frequency, changing hydrology or accelerating the turnover of nutrients (Dukes and Mooney, 2004). When there are invasive plants in rubber lands, they compete with for water, nutrients and light and thus ultimately affecting the growth of the rubber plants too. Furthermore, direct impacts of invasive species on native plant diversity, e.g. through resource competition or allelopathy, have often been reported, but mechanistic studies on how an invasive plant affects regeneration and persistence of native species are rare (Levine *et al.*, 2003). However, there is much debate to what extent invasive species have been involved in species extinctions (Gurevitch and Padilla, 2004). It is because of such considerations that it is imperative that the spreading of alien invasive plants should be stopped and long term strict monitoring and control measures are essential when introducing novel plants in to rubber plantations.

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