Crop Protection Compendium - *Clidemia hirta* (L.) D. Don

Pierre Binggeli 2005

NAMES AND TAXONOMY

Preferred scientific name

Clidemia hirta (L.) D. Don

Taxonomic position

Domain: Eukaryota
Kingdom: Viridiplantae
Phylum: Spermatophyta
Subphylum: Angiospermae
Class: Dicotyledonae
Order: Myrtales
Family: Melastomataceae

Other scientific names

Melastoma hirta sensu Miller
Melastoma hirtum L.
Clidemia crenata DC.
Melastoma elegans Aublet
Clidemia elegans (Aublet) D. Don
Melastoma hirta L.

BAYER code

CXAHI (*Clidemia hirta*)

Common names

English:
Koster's curse
soap bush
curse
Spanish:
camasey
camasey peludo
nigua
sietecueros
French:
canot-macaque
herbe-côtelletes
herbecrécré
Mélastome élégant
Mélastome poilu
Belau:
kui
kúi
Fiji:
Koster's curse
bona na bulamakau
kaurasinga
kauresinga
mara na bulumakau
mbona na mbulamakau
ndraunisinga
roinisinga
vuti
Haiti:
guéri vite
Madagascar:
manzana
mazambôdy
Martinique:
bonbon bleu
herbe à cré cré
Portugal:
caiuia
pixirica
Samoa:
la'au lau mamoe
Singapore:
hairy Clidemia

Notes on taxonomy and nomenclature

Varieties of *C. hirta* have been described. Var. *hirta* and var. *elegans* were introduced to Hawaii and the Seychelles, respectively.

HOST RANGE

Major hosts
Cocos nucifera (coconut), *Hevea brasiliensis* (rubber), *Theobroma cacao* (cocoa)

Minor hosts
pastures

HABITAT

Most tropical island forest areas appear to be susceptible to *C. hirta* invasion regardless of their floristic composition, as long as some form of disturbance affects them. In Hawaii all new instances of *C. hirta* occur in disturbed areas such as roadsides and landslides and following disturbance by windstorm, pigs, landslides and fire. In the East Usambaras (Tanzania) the shrub is found not only along roadsides but also in many parts of the undisturbed montane forest (Binggeli, 2003).

GEOGRAPHIC DISTRIBUTION

Notes on distribution

C. hirta originated in Central and South America, where it is still widely distributed. It is less common in the Caribbean islands (Wester and Wood, 1977). It is now found in a number of tropical Asian countries and Pacific Islands and it is likely to be somewhat underecorded.

The distribution map includes records based on specimens of *C. hirta* from the collection in the Geneva Herbarium, Switzerland.

Distribution List

Asia				
Brunei Darussalam	present	introduced		Waterhouse, 1993
[China]				
Taiwan	localized	introduced	invasive	Yang Sheng Zehn, 2001
India	present	introduced	invasive	Wester & Wood, 1977
Tamil Nadu	present	introduced	invasive	Manickam et al., 2000
[Indonesia]				
Java	present	introduced	invasive	Wester & Wood, 1977
[Malaysia]				
Peninsular Malaysia	widespread	introduced	invasive	Holm et al., 1979; Peters, 2001
Sabah	present	introduced		Wester & Wood, 1977
Singapore	localized	introduced	invasive	Wee & Corlett, 1986
Sri Lanka	widespread	introduced	invasive	Wester & Wood, 1977; Bremer, 1987
Thailand	present	introduced	invasive	Renner et al., 2001
Africa				

Comoros	widespread	introduced	invasive	Wester & Wood, 1977; Roby & Dossar, 2000
Madagascar	widespread	introduced (1914)	invasive	Holm et al., 1979; Binggeli, 2003
Mauritius	localized	introduced	invasive	Holm et al., 1979
Réunion	localized	introduced	invasive	Macdonald et al., 1991
[Saint Helena]				
Ascension	localized	introduced	invasive	Duffey, 1964
Seychelles	widespread	introduced	invasive	Gerlach, 1933
Tanzania	localized	introduced	invasive	Sheil, 1994
Central America & Caribbean				
Antigua and Barbuda	present	native		Francis et al., 1994
Belize	present	native		Geneva Herbarium
Costa Rica	present	native		USDA-ARS, 2004
Cuba	present	native		Geneva Herbarium
Dominican Republic	present	native		Geneva Herbarium
Guadeloupe	present	native		Geneva Herbarium
Guatemala	present	native		USDA-ARS, 2004
Honduras	present	native		Wester & Wood, 1977
Jamaica	widespread	native		Adams, 1976
Martinique	present	native		Anon., 2004
Nicaragua	present	native		Wester & Wood, 1977
Panama	present	native		Wester & Wood, 1977
Puerto Rico	widespread	native		Holm et al., 1979
Trinidad and Tobago	widespread	native		Holm et al., 1979
North America				
Mexico	present	native		Wester & Wood, 1977
USA	present	native		Holm et al., 1979
South America				
Argentina	present	native		Wester & Wood, 1977
Bolivia	present	native		Wester & Wood, 1977
Brazil	present	native		Wester & Wood, 1977
Amazonas	widespread	native		Desjardins et al., 2000
Bahia	present	native		Franca et al., 1996
Matto Grosso do Sul	present	native		Geneva Herbarium
Minas Gerais	present	native		Geneva Herbarium
Parana	present	native		Geneva Herbarium
Pará	present	native		Geneva Herbarium
Pernambuco	present	native		Melo et al., 1999
Rio Grande do Sul	present	native		Geneva Herbarium
Rondonia	present	native		Geneva Herbarium
Colombia	present	native		Holm et al., 1979
Ecuador	present	native		Wester & Wood, 1977

French Guiana	present	native		Geneva Herbarium
Guyana	present	native		Geneva Herbarium
Paraguay	present	native		Geneva Herbarium
Peru	present	native		Holm et al., 1979
Venezuela	present	native		Geneva Herbarium
Oceania				
American Samoa	present	introduced		Wester & Wood, 1977
[Australia]				
Australian Northern Territory	localized	introduced		Anon., 2003
Belau	present	introduced	invasive	Wester & Wood, 1977
Fiji	widespread	introduced	invasive	Mune & Parham, 1967
Guam	widespread	introduced	invasive	Mune & Parham, 1967
Solomon Islands	present	introduced	invasive	Wester & Wood, 1977
Tonga	present	introduced		Wester & Wood, 1977

HISTORY OF INTRODUCTION AND SPREAD

C. hirta is a serious weed on many tropical oceanic islands, and in South-East Asia, India and East Africa. The date of introduction to the Hawaiian Islands is unknown, but it was first recorded in 1941. It was grown in the Wahiawa Botanic Garden and was thought to be 'very promising because it won't be spread by birds'. It was first noted as escaping in 1949 on the island of O'ahu and by 1952 covered at least 100 hectares. By the late 1990s it had invaded all suitable habitats covering over 100,000 hectares. In the 1970s and 1980s it was accidentally introduced by humans to five other Hawaiian islands (Smith, 1992). On Fiji, *C. hirta* was probably accidentally introduced prior to 1890 with coffee plants imported from British Guiana. It became a pest by 1920 (Mune and Parham, 1967). Only 4 years elapsed between the first record of *C. hirta* in the Seychelles and the realisation that the species could not be controlled by conventional methods (Gerlach, 1993). In Madagascar, it was a non-intentional introduction in 1914 as a seed contaminant (Binggeli, 2003).

In 2003 it was reported that during the previous financial year *C. hirta* had been discovered in Australia for the first time (Anon., 2003).

BIOLOGY AND ECOLOGY

Genetics

Some variation in shade tolerance cannot be excluded (Binggeli, 2003).

Physiology and Phenology

In Hawaii flowering and fruiting occurs all year round where there is no dry season and rainfall exceeds 2500 mm per year. In Brazil the plant flowers throughout the year (Melo et al., 1999).

Reproductive Biology

A mature plant can produce over 500 blue-black berries (6-9 mm long) per year, each containing over 100 seeds (0.5-0.75 mm long). Seeds form a very large seed bank where they remain viable for up to 4 years. In Hawaii, long-distance dispersal is carried out by human means, such as shoes and vehicle wheels, and seeds are locally disseminated by birds and feral pigs which can also carry seeds in their fur. In the Mascarene it is dispersed by the introduced bird Pycnonotus jocosus (Clergeau and Mandon-Dalger, 2001).

C. hirta is visited by *Augochloropsis* sp. of bee and pollinated by the bees *Bombus transversalis*, *Euglossa* sp., *Melipona fulva*, *Trigona* sp. and three genera of halictids (Ferreira et al., 1994; Melo et al., 1999). The plant is agamospermous and exhibits a high level of male sterility, as indicated by its low pollen viability (Melo et al., 1999), and Ferreira et al. (1994) have stated that it is preferentially allogamous, but shows no genetic autoincompatibility.

In Malaysia's Pasoh Forest Reserve a demographic survey by Peters (2001) located 1002 *C. hirta* individuals, 69 of which were reproductive at the time of the study, and all but eight individuals were situated in high light gaps or gap edges; see also Teo et al. (2003). There was no mortality over 2 months.

C. hirta has a large seed bank but these seeds germinate better under partial shade than full light. Up to over 6000 germinants per m² of forest soil was obtained in trials and this figure was much greater than for any of the native species (Singhakumara et al., 2000). Similarly, in the submontane forest of the East Usambaras, Tanzania, *C. hirta* is the commonest germinant in the soil seed bank of the natural forest but is rare in Maesopsis eminii plantations where the species dominates the shrub layer (Binggeli et al., 1989). In undisturbed forest, the seedlings are common and in disturbed stands they can constitute up to 80% of the shrub layer (Pocs, 1989). Seedling densities can be extremely high, Ashton et al. (2001) in Sri Lanka reported 350/m² beneath a 20-year-old Pinus caribaea plantation and 500/m² on fernland after clearance and soil scarification.

Environmental Requirements

In the native range, *C. hirta* has broad climatic requirements ranging from dry to wet tropics. Similarly, in the naturalized range *C. hirta* tolerates widely differing tropical climatic conditions including a wide range of rainfall (<1000 to >2500 mm). On the Seychelles the shrub is absent from drier areas. In areas where a dry season occurs flowering ceases. *C. hirta* is resistant to droughts lasting up to 6 months, although some shoot tips die back during the dry season.

In Jamaica its altitudinal distribution ranges between 30 and 1200 m. In the Comoros it is more commonly found between 600 and 1200 m asl (Roby and Dossar, 2000). It does not appear to tolerate salt spray.

Although the plant thrives in full sunlight, it is also shade tolerant and is found in low densities in open forested areas, forest plantations and roadsides. Most tropical island forest areas appear to be susceptible to *C. hirta* invasion regardless of their floristic composition, as long as some form of disturbance affects them. In Hawaii all new instances of *C. hirta* occur in disturbed areas such as roadsides and landslides and following disturbance by windstorm, pigs, landslides and fire. If seeds are present they germinate rapidly and within 2 years the disturbed area can become smothered. However, on the steep slopes of the Seychelles enough light reaches the ground for *C. hirta* regeneration to take place without forest canopy disturbance (Gerlach, 1993). In many parts of the invaded

range the species regenerates readily in treefall gaps (Ashton et al., 2001) but in Tanzania it becomes established without canopy disturbance (Binggeli, 2003).

Associations

In the West Indies, *C. hirta* is an early colonizer of open areas, including slash-and-burn agricultural grounds, where it becomes dominant 12 months after disturbance, before being smothered by vines. Myster (2003) reported that in Puerto Rico on an abandoned pasture it was still increasing in cover and dominating after 5 years after abandonment. It is also subject to strong competition from other Melastomataceae.

Climatic amplitude (estimates)
- Rainfall regime: bimodal; uniform
- Absolute minimum temperature: < 0ºC

Soil descriptors
- Soil texture: medium; heavy
- Soil drainage: free;
- Soil reaction: very acid; acid; neutral

MEANS OF MOVEMENT AND DISPERSAL

C. hirta may be transported over long distances in soil or as a seed contaminant (Binggeli, 2003).

Transport pathways for long distance movement
- Soil, Gravel, Water, Etc.: Soil

NATURAL ENEMIES

In the New World all plants show signs of heavy herbivory, whereas in its naturalized range it appears to be only affected by insects introduced as biocontrol agents.

Biological control, using the thrip *Liothrips urichi*, was initiated in Fiji in the early 1930s and two decades later in Hawaii (Mune and Parham, 1967; Wester and Wood, 1977). *L. urichi* seriously affects the growth of *C. hirta* in open sunny areas whereas in shaded areas (forest or frequent cloud cover) it is not effective. The thrips failed to establish following their introduction to the Solomon Islands (Julien, 1987). Over the past four decades extensive searches of biological control agents have been made to control *C. hirta* in Hawaiian forests (Nakahara et al., 1992). A pyralid moth, *Blepharomastix ebulealis* [*Ategumia ebulealis*], released in 1970 has been heavily parasitized and has been ineffective in controlling *C. hirta*. Several of 14 species of insects, recently evaluated in Trinidad, can be considered for introduction into Hawaii and the release of four pathogens is envisaged. A leaf spot fungus, *Colletotrichum gloeosporioides* f. sp. *clidemiae*, introduced from Panama to Hawaii for host-range studies, shows promise as a biocontrol agent.

Natural enemies listed in the database

The list of natural enemies has been reviewed by a biocontrol specialist and is limited to those that have a major impact on pest numbers or have been used in biological control attempts; generalists and crop pests are excluded. Additional natural enemy records

derived from data mining are presented as a separate list.

Natural enemies reviewed by biocontrol specialist		
Natural enemy	**Pest stage attacked**	**Biological control in:**
Herbivores:		
Ategumia ebulealis	Leaves	
Colletotrichum gloesporioides f.sp. *clidemiae*	Stems, Leaves	
Liothrips urichi (clidemia, thrips)	Leaves	Hawaii
Lius poseidon	Stems	

Additional natural enemies (source - data mining)		
Natural enemy	**Pest stage attacked**	**Biological control in:**
Pathogens:		
Colletotrichum gloeosporioides f.sp. *clidemiae*		

IMPACT

Economic impact

C. hirta is common in the New World. It is found in cocoa plantations but is not considered to be a serious pest.

In Fiji, prior to its control, *C. hirta* rendered large areas of grazing land useless and interfered with the development of plantations such as rubber and cocoa. The plant has no fodder value and no known uses. Hydrolysable tannins of *C. hirta* leaves are toxic to goat liver and kidneys and cause gastroenteritis (Murdiati et al., 1990). When fed the plant goats suffer toxicity from hydrolysable tannin (Francis, 2004).

Social impact

In Hawaii *C. hirta* is despised because of its dense growth. By spreading along trails and roadsides it increases maintenance costs as well as reducing the aesthetic, educational and recreational value of forest lands.

Impact on biodiversity

Under heavy infestations of *C. hirta* most plants, including most mosses and liverworts normally found in shaded habitats and subcanopy species, are displaced. It is thought that *C. hirta* has the potential to drive some native Hawaiian species to extinction. In disturbed stands of Tanzanian forests it is reported as suppressing all native ground plants (Pocs, 1989).

Summary of impact

Negative impact on: biodiversity; crop production; livestock production; rare or protected species; native flora; tourism

SUMMARY OF INVASIVENESS

C. hirta is a small shrub producing vast amounts of seeds that produce a large seed bank. Although the plant can grow in relatively shaded conditions, sexual reproduction only occurs in more favourable light regimes such as treefall gaps. Formerly, it was only considered as a pasture or crop weed but in recent decades it has become a major weed of natural forest communities. It may produce large quantities of seedlings with low mortality and is now viewed as a threat to native biodiversity in much of the tropics, but on the oceanic islands in particular.

Risk and Impact Factors

- invasive in its native range: no
- proved to be invasive outside its native range: yes
- highly adaptable to different environments: no
- high reproductive potential: yes
- highly mobile locally: yes
- its propagules remain viable for more than one year: yes
- tolerates cultivation, browsing pressure, mutilation, fire etc.: yes
- competitive in crops or pasture: yes
- affects ecosystem: unknown
- adversely affects natural communities: yes
- adversely affects community structure: unknown
- adversely affect human health: no
- has sociological impacts on recreational patterns, aesthetics, property values: no
- harmful to animals: unknown
- produces spines, thorns or burrs: no
- host or vector of pests or diseases: no
- likely to be accidentally transported internationally: yes
- likely to be deliberately transported internationally: no
- difficult to identify or detect as a commodity contaminant: yes
- difficult to identify or detect in the field: yes
- difficult or costly to control: yes

MORPHOLOGY

Plant type: succulent; woody; seed propagated; perennial.

C. hirta forms a densely-branched perennial shrub up to 5 m tall but normally between 0.5 and 3 m. In windy areas, it is scrambling and is less than 1 m tall. The opposite leaves (up to 15 cm long and 8 cm wide) have prominent veins and are dark green. Most plant parts, including stems, leaves and calyx, are hairy. The flowers, 0.5-1 cm across, have white or pink petals and are borne on short pedicels in axillary or terminal cymes of 6-20 flowers. The fruits (berries) are borne in clusters and turn from green to blue-black or deep purple as they mature. Fresh fruits in Puerto Rico weighed about 0.2 g and air-dried seeds weighed 0.00383 g (Mune and Parham, 1967; Wickens, 1975; Francis, 2004).

DETECTION AND INSPECTION

Although *C. hirta* is rarely recorded until it forms monotypic stands, the more recent Hawaiian introductions suggest that it starts to spread as soon as it is introduced to new suitable habitats subjected to regular disturbance. The only hope of controlling an invading population of *C. hirta* is to identify the problem at a very early stage and eradicate all potential seed sources prior to the first fruit set.

CONTROL

Introduction

Repeated efforts to control seedlings in expanding Hawaiian populations have failed. This is the result of a large seed bank and the rooting ability of detached leaves in forested areas (Smith, 1992). Hand pulling of seedlings and digging up mature plants, inclusive of roots, is possible. On arable land traditional cultivation methods prevent the establishment of *C. hirta*.

Cultural Control

Although sheep have been shown to control most weeds in plantations they will not eat *C. hirta* (Francis, 2004). Norman and Trujillo (1995) have found that a mycoherbicide containing Colletotrichum gloeosporioides f.sp. clidemiae as the active ingredient, was effective against *C. hirta*.

Chemical Control

According to Mune and Parham (1967) no effective chemical control for *C. hirta* exists. However, Teoh et al. (1982) reports that *C. hirta* may be killed by applications of 2,4,5-T mixtures of 2,4-D and 2,4,5-T, or by triclopyr.

Biological Control

Biological control using the thrip Liothrips urichi was initiated in Fiji in the early 1930s and two decades later in Hawaii (Mune and Parham, 1967; Wester and Wood, 1977). L. urichi seriously affects the growth of *C. hirta* in open, sunny areas, whereas in shaded areas (forest or frequent cloud cover) it is not effective. The thrips failed to establish following their introduction to the Solomon Islands (Julien, 1987). Over the past four decades extensive searches of biological control agents have been made to control *C. hirta* in Hawaiian forests (Nakahara et al., 1992). A pyralid moth, Blepharomastix ebulealis [Ategumia ebulealis], released in 1970 has been heavily parasitized and has been ineffective in controlling *C. hirta*. Several of 14 species of insects, recently evaluated in Trinidad, can be considered for introduction into Hawaii and the release of four pathogens is envisaged. A leaf spot fungus, Colletotrichum gloeosporioides f.sp. clidemiae, introduced from Panama to Hawaii for range studies shows promise as a biocontrol agent. The introduction of effective biological control agents into Hawaii must be considered with care. The potential sudden death of large monotypic stands of *C. hirta*, found on steep mountain sides, could result in either severe soil erosion or the establishment of other invasive species such as Psidium cattleianum (Smith, 1992).

USES

The fruits are edible but insipid (Anon., 2004). *C. hirta* is used in Brazil to treat Leishmania braziliensis skin infections (Franca et al., 1996).

PESTS

Pests listed in the database

Wild host of:
Setora nitens (coconut nettle caterpillar)

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