

SURVEYS FOR THE NATIVE RANGE OF *CLERODENDRUM
CHINENSE* AND ITS NATURAL ENEMIES

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Summary. The perennial shrub *Clerodendrum chinense* has become a problem in countries of the South Pacific. In response to requests to assist in control of the weed preliminary surveys for the weed's native range and its natural enemies were conducted. The native range of *C. chinense* includes southern China and parts of the northern Vietnam border regions. The native range of the apparently closely related *C. chinense* var. *simplex* is wider and includes southern China, a large portion of northern Vietnam and northern Thailand. A wide variety of organisms including insects, fungi and mites were found on these plants. Some caused significant damage, including the leaf feeding beetle *Phyllocharis undulata*, a gall fly, stem tunnelling beetles and leaf attacking fungi. I concluded that a biological control project would identify suitable control agents for release in the South Pacific.

INTRODUCTION

Honolulu rose, *Clerodendrum chinense* (Osbeck) Mabberley (Verbenaceae), is widespread in the tropical and subtropical world as an ornamental shrub. It grows one to three metres tall, has attractive large, serrated edged leaves and white/pink to mostly white, sterile, double flowers in terminal clusters. It is part of a large genus of trees, shrubs and vines native to Africa and southern and eastern Asia.

C. chinense has become a problem in several countries in the South Pacific, namely Western Samoa (first recorded in 1955), American Samoa (no records), Fiji (1940) and Niue (1956). It is rated second most important weed in Western Samoa, high among the top 10 weeds in Fiji, among the 10 most important weeds in Niue and is rapidly becoming a major weed on American Samoa (9).

This weed has invaded fertile, humid lowlands and foothills, areas important for cultivation, estate crops and pastures as well as roadsides and wasteland (6). Weed clumps to several hundreds of metres diameter occur in Western Samoa and the diameter of clumps increase 6 to 8 m per annum in open areas and 2 m in forested areas. Within clumps, on average 11 stems per square metre with height 1 to 3 m provide 25-100% ground cover, dominating other species (2). The weed poses serious problems for relatively poor farming and subsistence communities. Chemical control is too expensive. Regrowth is rapid following chemical control or hand pulling because underground stems remain intact.

Western Samoa and Fiji requested assistance from ACIAR for biological control of this weed. As a result surveys were conducted in South East Asia and China with the following aims:

- to locate the plant and identify its native range;
- to make preliminary collections of organisms attacking the plant; and
- to determine whether a biological control project could be expected to find natural enemies suitable for release in the South Pacific.

PLANT TAXONOMY

Synonyms of *C. chinense* included *Clerodendrum fragrans* (7) until 1968 when it was found that the first valid name was *C. philippinum* Schauer (1847) (1). Until then many workers treated *C. fragrans* and *C. philippinum* as separate species or *philippinum* as a synonym of *fragrans*. Subspecific forms of *philippinum* were recognised: *C. philippinum* having double flowers without functional anthers or stigma; *C. philippinum* var. *subfertile* (5) having many or all flowers fertile and *C. philippinum* var. *simplex* having single fertile flowers. Other variety names were used, *multiplex*, *philippinum* and *pleniflorum*, that appear to be synonyms of *C. philippinum*.

In 1987, Mabberley pointed out that the first valid name was *C. chinense*, established by Osbeck in 1757. The type specimen was collected in southern China in 1751 but had been misplaced in the bromelaid genus *Cryptanthus*.

In this paper, as in the author's survey reports to ACIAR (1992) and Waterhouse (1993), the sterile, double flowered, weedy species will be referred to as *C. chinense* (Osbeck) Mabberley or Honolulu rose, and the fertile, single flowered plant as *C. chinense* var. *simplex*.

SURVEYS IN SOUTH EAST ASIA AND CHINA

Distribution and habitat of *Clerodendrum* in South East Asia and China. Surveys were conducted in northern and south-eastern Thailand, northern Vietnam and southern and eastern China.

Honolulu rose was common in southern and eastern China and in one area in northern Vietnam near the Chinese border, and was later found in Quang Ngai Province, central Vietnam. It was growing as a garden ornamental in Kao Yai National Park in south eastern Thailand, in southern Vietnam and in a village near Hanoi.

Its habitat included roadsides and pathways, banks of waterways, edges of cultivation, in pasture land and especially in unused areas that were partly shaded. Numerous plants were always found together at each location. Phenology of the plant varied with habitat from single stemmed, small leaved plants, less than 50 cm high on exposed dry areas, to shrubby clusters of stems exceeding 2 m in damp, shaded areas.

C. chinense var. *simplex*, was very abundant throughout northern Vietnam and common in northern Thailand and southern and eastern China. It grew in similar habitats to the double flowered plant, and although both forms were sometimes found in close proximity in China they were never mixed.

Both forms (Honolulu rose and var. *simplex*) were surveyed in detail since they appeared to be close taxonomically and have similar habitat requirements where they overlap. Of the two forms, the native range and abundance of var. *simplex* was much greater. If indeed these two forms are genetically close and have similar chemical and morphological characteristics, potential biological control agents may be found on either plant form.

Other species of *Clerodendrum* were also surveyed, particularly *C. paniculatum* (the pagoda plant) which hosted fungi that also attacked Honolulu rose and var. *simplex*.

Organisms associated with *Clerodendrum* species in South East Asia and China. A wide variety of organisms including fungi, mites and insects were found in association with the two forms of *C. chinense*. Those thought to be host specific and those about which little is known are included in Table 1. Numerous other species not included are known to attack other plant species. Several individuals and groups are of particular interest.

Phyllocharis undulata is a leaf eating beetle that attacked var. *simplex* in Vietnam causing considerable destruction in localised areas. This insect has been taken to Thailand and released onto var. *simplex* and onto cultivated plants of Honolulu rose where it has established (B. Napompeth, pers. comm., 1991).

An unidentified gall fly caused stem and leaf galls on var. *simplex* in China and Vietnam in areas where the weedy form did not occur. The damage caused deformation, stunting and reduced numbers of leaves and flowers.

Several fungi, a rust *Endophyllum superficiale* and a *Cercospera* like fungus, were found attacking both flower forms.

A variety of beetles were found damaging both plant forms of the plant. The most interesting appeared to be Cerambycids and Buprestids that damaged stems, Curculionids that damaged stems and leaves and Chrysomelids that fed on the foliage.

Should biological control of this weed be pursued, early studies conducted in Vietnam and China should aim to determine the biology and host range limits of *P. undulata* and the gall fly and the stem and leaf damaging beetles.

DISCUSSION

It is interesting that Honolulu rose has been widespread, mainly as an ornamental, occurring in over 90 countries, but has only recently become a problem and only in the South Pacific (8). In contrast, var. *simplex* is known from 12 countries, mostly in South East Asia, China, countries west to Nepal and Pakistan, Japan and the Philippines and Cuba. It is not considered weedy.

The general use of the name *C. chinense*, or its synonyms, *C. philippinum* or *C. fragrans*, for both Honolulu rose and var. *simplex* lead to considerable confusion when assessing the literature and corresponding with collaborators. The relationship between the two forms is not known; there are minor morphological differences, such as density of leaf hairs, as well as the floral and reproductive differences. Honolulu rose may derive from a mutation of the fertile *C. chinense* var. *simplex*. However var. *simplex* has a much larger southern range in South East Asia than Honolulu rose. Studies are needed on the relationships between the different taxa of *Clerodendrum*. This would help determine the plant species or varieties, and therefore the geographic range, to survey for biological control agents. It would also assist in interpretation of host specificity tests of potential control agents.

The results from the surveys indicate that if a biological control project is undertaken against Honolulu rose the exploration phase should be based in southern China and include work in northern Vietnam. Wider surveys than those already conducted for the plant would improve knowledge of the native range and provide limits for exploration for natural enemies.

Table 1. Organisms found associated with *Clerodendrum chinense* (C2) and *C. chinense* var. *simplex* (C6) in Thailand, Vietnam and China.

ACARINA: unidentified C2

COLEOPTERA: 11 unident. C2 C6.

Apionidae (1 unident. C2; *Lobotrachelus* 2 spp. C2). **Brentidae** (6 unident. C2 C6). **Buprestidae** (1 unident. C2). **Agrilinae** (2 unident. C2). **Cerambycidae** (1 unident. C2). **Lamiinae** (3 unident. C2). **Chrysomelidae** (Bruchinae - 1 unident. C2; Cassidinae - *Aspidomorpha fuscopunctata* C2, *Cassida* sp. C2. Chrysomelinae - *Phyllocharis undulata* C2, Criocerinae - *Lema chujoi* C6, *Lema indica* C2, *Lema saigonensis* C2, *Lema testacea* C6, *Luperomorpha birmanica* C2. Eumolpinae - *Aoria bowringii* C2, *Platycorymus bicavifrons* C2. Galerucinae - *Haplosomoides annimita* C2 C6, *Haplosomoides appendiculata* C2, *Haplosomoides costata* C6, *Hoplosoma* sp.? C2, *Hoplosoma unicolor* C2 C6, *Hyphasis parvula*? C2, *Hyphasis* sp.1 C2 C6, *Hyphasis* sp.2 C6, *Monolepta signata* C2, *Nisotra* sp. nr. *madurensis* C2, *Sebaethe lusca*? C2, *Sebaethe* sp.1 C2, *Sebaethe* sp.2 C6, *Taumacera biplagiata* C2). **Coccinellidae** (6 Unident. C2 C6). **Curculionidae** (13 unident. C2 C6, *Blosyrus* sp. C2, *Hypomeces squamosus* C2, *Mecysolobus* sp. C2, *Myloccerus* sp. C2, *Tanymecini* sp. C2 C6, Cleoninae - 1 unident. C2. Entiminae - 1 unident. C2. Platypodinae - 1 unident. C6. Scolytinae - 1 unident. C2). **Elateridae** (2 unident. C2 C6). **Melyridae** (Prionocerinae, 1 unident. C2). **Mordellidae** (1 unident. C2). **Nitidulidae** (1 unident. C2, *Aethina* sp. C2). **Phalacridae** (2 unident. C2). **Ptilodactylidae** (*Ptilodactyla* sp. C2). **Rhychophoridae** (1 unident. C2). **Rhynchitidae** (1 unident. C2). **Scalytidae** (1 unident. C2). **Scarabaeidae** (9 unident. C2 C6, *Anomala* sp.? C2, *Protaetia* sp.? C2, Rutelinae - 1 unident. C2, Scarabaeinae - 1 unident. C2). **Scirtidae** (*Scirtes* sp. C2). **Scolytidae** (*Xyleborus* sp.? C2).

DIPTERA:

Cecidomyiidae (1 unident. C2).

HEMIPTERA: 1 unident. C2 C6.

Aleyrodidae (1 unident. C2). **Aphididae** (? unident. C2 C6). **Cercopidae** (1 unident. C2). **Cicadellidae** (*Tettigoniella ferruginea* C2). **Coccidae** (1 unident. C2). **Coreidae** (1 unident. C2, *Serinetha* sp.? C2). **Flatidae** (1 unident. C2). **Lygaeidae** (1 unident. C2). **Miridae** (1 unident. C2). **Plataspidae** (*Coptosoma* sp. C2). **Pseudococcidae** (2 unident. C2 C6). **Pyrrhocoridae** (*Physopela gutta* C2). **Tingidae** (1 unident. C6).

LEPIDOPTERA: 10 Unident. C2.

Arctiidae (4 unident. C2). **Cossidae** (2 unident. C6). **Lycaenidae** (1 unident. C2). **Phychidae** (1 unident. C2). **Pterophoridae** (1 unident. C2 C6). **Pyralidae** (3 unident. C2, *Archips micaceana* C2). **Tortricidae** (1 unident. C2).

ORTHOPTERA:

Acrididae (1 unident. C2, *Catantops* sp. C2, *Oxya diminuta* C2, Catantopinae - 1 unident. C2). **Pyrgomorphidae** (1 unident. C2). **Tettigoniidae** (*Phaneroptera* sp. C2).

FUNGI:

Endophyllum superficiale C2 C6. *Cercospora* sp. C6.

The number and diversity of organisms found during these preliminary surveys is encouraging for biological control. I concluded that a biological control project is likely to identify host specific natural enemies that could be released in the South Pacific to control *C. chinense*.

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