Outbreak of erythrina gall wasp (Hymenoptera: Eulophidae) on *Erythrina* spp. (Fabaceae) in Taiwan

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(Accepted for publication: Dec. 16, 2004)

ABSTRACT

Yang, M. M., Tung, G. S.*, La Salle, J., and Wu, M. L. 2004. Outbreak of erythrina gall wasp on *Erythrina* spp. (Fabaceae) in Taiwan. Plant Prot. Bull. 46: 391 – 396

The erythrina gall wasp was first recorded damaging coral trees, *Erythrina* spp. (Fabaceae), in southern Taiwan in 2003; since then it has rapidly spread throughout the island on various species of *Erythrina*. Galls form on the leaves, petioles, young shoots, and stems. Obvious swelling can be seen on infected tissue parts, and severe infestations cause curling of young shoots, defoliation, and death of the tree. At present, 5 species and a subspecies of coral trees have been recorded as suitable hosts. The gall inducer is *Quadrastichus erythrinae* Kim (Eulophidae), newly reported in Singapore, Mauritius, and Réunion, and it has also caused severe damage in those areas. In this research, we report the symptoms, the distribution of infested coral trees in Taiwan, identification characteristics of the galler, and pest control suggestions.

Coral trees, *Erythrina* species (刺桐), are found throughout tropical regions of the world, and many are used as ornamental trees. Several species are commonly distributed in Taiwan and are highly associated with farming and fishing activities. As indicated by its Latin name “erythros” meaning red, its obvious red flowers have been used as a sign of the arrival of spring and as a working calendar. Whenever the showy red flowers bloom, costal peoples of the Kavarawan, a Pingpu tribe (平埔族葛瑪蘭人), and the Yami/Tao tribe (雅美/達悟族) begin their ceremonies for catching flying fish(1), and it is also a sign for the Puyuma people (卑南族) to plant sweet

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potatoes. There is a folk belief that a disaster will occur in a year in which coral trees do not bloom. The importance of the tree can also be revealed by the fact that several local towns in Taiwan and southern China are named after this tree. In addition to their natural habitat, coral trees are widely planted as ornamentals, with at least 8000 trees in residential areas and roadsides in southern Taiwan.

Some distortions of young shoots and leaves of the coral tree were found in southern Taiwan in the winter of 2003. The following spring, severe infestations were found throughout nearly the entire island. Galls were found on leaves, petioles, young shoots, and stems (Fig. 1A, B) with obvious swellings on infected parts. Severe infestations result in defoliation (Fig. 1C) and can cause the death of the tree (Fig. 1D). Five species and a subspecies of coral trees have been found to be affected in Taiwan: *Erythrina variegate* L., *E. variegata* var. *orientalis* (L.) Merr., *E. corallodendron* L., *E. cristagalli* L., *E. abyssinica* Lam., and *E. berteroana* Urban. Infestation in different areas for each host species are shown in Fig. 2.

Fig. 1. Occurrence of eulophid wasp galls on coral trees. A, B, Wasp galls occurring on buds, young leaves, petioles, and shoots; C, all coral trees on the roadside infected; D, severe infection possibly causing death of the tree.

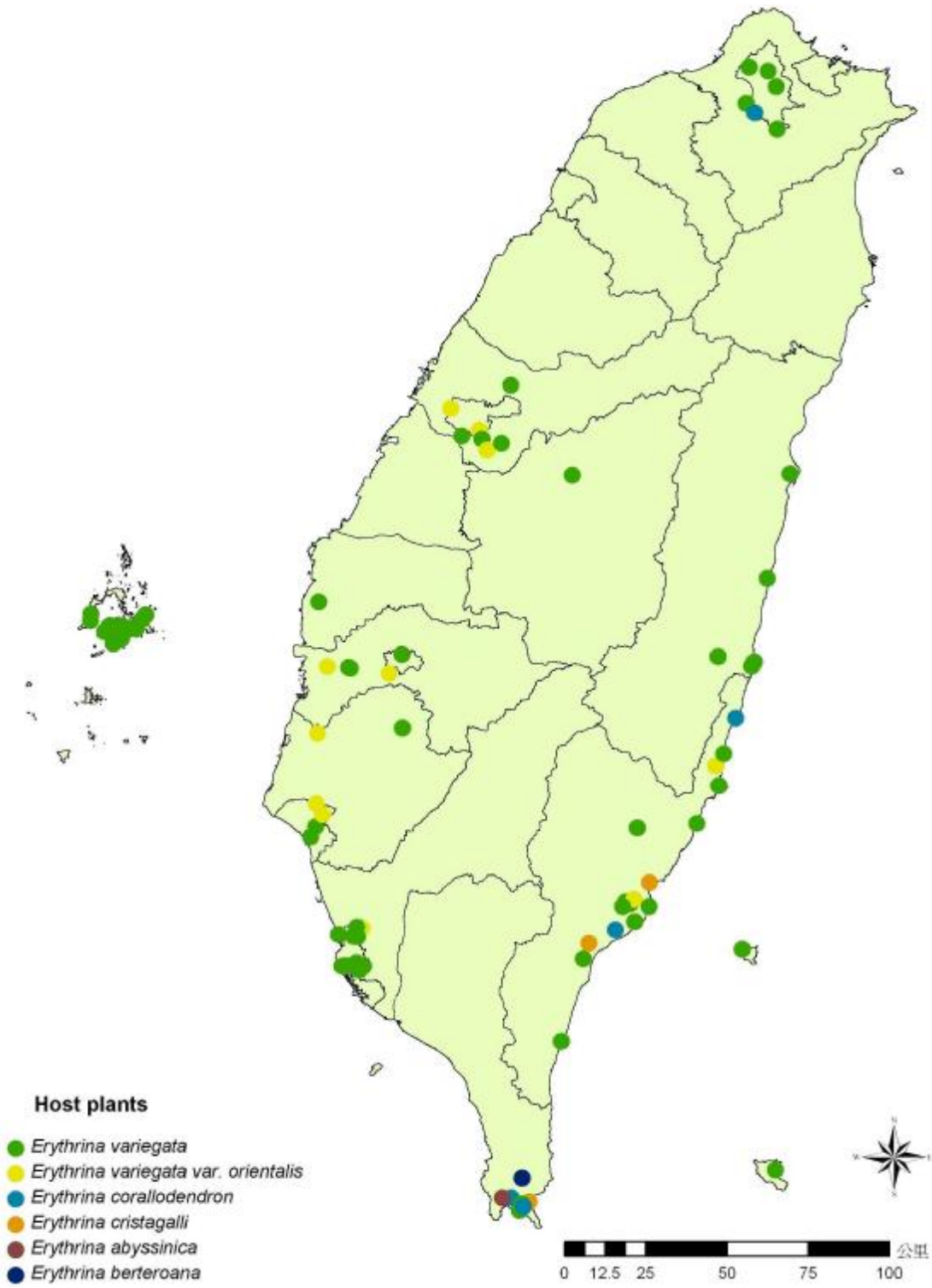

Fig. 2. Map showing the distribution of infected coral trees in Taiwan. Different colors represent different species of *Erythrina*.

More than 1 species of wasps were reared from twigs bearing galls, including the gall inducer (Fig. 3) and some parasitoids. The gall maker is the erythrina gall wasp (刺桐釉小蜂) *Quadrastichus erythrinae* Kim (Eulophidae: Tetrastichinae), which was recently described from Singapore, Mauritius, and Réunion[3]. It is the first gall-inducing species reported for *Quadrastichus*; most species of the genus are parasitoids of a variety of insect hosts. A few other parasitic wasps, including species of the Encyrtidae, Eupelmidae, and Pteromalidae, were reared from twigs with galls. There is a necessity to further clarify whether these are actually parasitoids of the gall wasps, since some of them are as yet known only to be parasitoids of scale insects. Although their exact biology is unknown, it is suspected that at least some of these are native parasitoids which are exploiting the new gall wasp as a host. It does not appear that they will provide high levels of control at this moment.

Fig. 3. Mating pair of galling wasps on a host tree showing color sexual dimorphism. The white one behind is a male and the yellowish-brown one in front is a female.

The erythrina gall wasp shows dimorphism in body color. The female is yellowish brown, the male is white, and both have dark brown markings (Fig. 3). This wasp possesses all of the defining characters of *Quadrastichus* (Graham 1991): an SMV with 1 dorsal seta, antenna with all funicular segments longer than wide, and gaster longer than the head plus mesosoma, but it is distinct from other species of the genus due to the presence of a long hypopygium[3].

The species has overlapping generations, and different stages of development can be found at the same time. An examination under a scanning electronic microscope (SEM) based on 10 wasps found that 1 female, on average, carries 322±98 eggs.

Although we are looking for integrated pest management (IPM) solutions, chemical control seems to be the most efficient method against galling insects. A general problem for controlling concealed feeding insects is the development of resistance owing to the need to frequently apply insecticides. Systemic insecticides may be an effective agent to eliminate the developing insects in leaf galls. Before application of systemic insecticides, proper pruning and elimination of infested twigs and leaves are helpful for better control. However, problems resulting from drift and non-target exposure have to be considered. A combination of other methods to complement the chemical treatments such as thinning of coral trees, intercropping, and multiple cropping of non-hosts, may provide more-effective control of the gall wasp.

The most-effective long-term solution is still classical biological control using parasitoids from the gall wasp's native region. It is still unclear where the wasp came from originally, but investigations are underway to determine its native home. A *Quadrastichus* species is known to form galls on *Erythrina* in South Africa[4] (figured on p. 287 as *Eurytoma* in van Staden et al. 1977). This is not *Q. erythrinae* (JL, unpublished data) but may indicate that *Q. erythrinae* has relatives in Africa.

(Key words: gall, coral tree, *Erythrina*, Hymenoptera, Eulophidae, *Quadrastichus*)

ACKNOWLEDGMENTS

We are grateful to Feng-Ming Lu, Wen-Hua Chen (Fengshan Tropical Horticultural Experiment Station), Shou-Horng Huang (Chia-Yi Agricultural Experimental Station), Fong-Long Feng, Jeng-Tze Yang (National Chung Hsing University), Chih-Sheng Wu (East Coast National Scenic Area Administration), and Lin-Mu Jaung (Taiwan Forestry Research Institute), for providing specimens; Han-Wen Cheng (Tung Hai Elmentary School), for providing precious information on ethonobotany; Jung-Tai Chao, for his laboratory support; Wen-Chi Yeh (Taiwan Forestry Research Institute) for first wasp identification; and Mei-Fiang Lou, Ching-Horng Lee (National Chung Hsing University), Wei-Jhen Sun, and Jhen-Cai Chou (Taiwan Forestry Research Institute), for their help with field work and specimen handling.

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摘　要

楊曼妙[1]、董景生[2]*、方強恩[3]、吳孟玲[2]　2004　台灣刺桐釉小蜂蟲癭大發生　植保會刊 46：391 – 396　（[1]台中市 國立中興大學昆蟲學系；[2]台北市 農業委員會林業試驗所森林保護組；[3]CSIRO Entomology, Canberra, Australia）

2003 年在台灣南部刺桐上發現的蟲癭，如今已快速擴散全台，包含刺桐、黃脈刺桐、珊瑚刺桐、雞冠刺桐、毛刺桐、馬提羅亞刺桐等 5 種及 1 亞種刺桐嚴重受害。受害部位包括葉片、葉柄、芽與嫩枝部分，植物組織明顯外突腫脹，嚴重時呈現捲曲與落葉現象，甚至造成植株死亡。造癭者爲刺桐釉小蜂 *Quadrastichus erythrinae* Kim，爲近年來於新加坡、模里西斯與留尼旺島上發現的新種，在當地亦造成數種刺桐樹的嚴重危害。本文報導台灣刺桐屬植物受害情形，提供此一刺桐釉小蜂的鑑定特徵以及防治建議。

(關鍵詞：蟲癭、刺桐、膜翅目、釉小蜂科、刺桐釉小蜂、大發生)

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