Invasion of the coconut hispine beetle, *Brontispa longissima*: Current situation and control measures in Southeast Asia

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Summary

The coconut hispine beetle, *Brontispa longissima* is one of the most serious insect pests of coconut in Southeast Asia. The beetle is believed to be endemic to an area which includes Indonesia and Papua New Guinea and it was accidentally introduced into continental Southeast Asian countries very recently. Since chemical control has not been used due to its high costs and risks for the environment, biological control has been recommended. With the support of FAO, the larval parasitoid, *Asecodes hispinarum* was introduced into some countries in the region. Although pest control has only focused on the promotion of mass rearing and release of the parasitoid, the biology and ecology of the pest and the parasitoid have been neglected. No sampling method to estimate local populations of the pest and parasitoid has been developed. Scientific knowledge is essential not only to rear the insects but also to control the beetle efficiently.

JIRCAS started a project to accumulate knowledge on the pest and its natural enemies that will be used to develop sustainable control methods against the beetle. These control methods will help small-scale farmers who make a living from coconuts by providing them with stable yields of the products and secure incomes.

Introduction

The coconut hispine beetle, *Brontispa longissima* Gestro (Coleoptera: Chrysomelidae) is potentially one of the most serious insect pests of coconut and ornamental palm plants in Southeast Asia. Larvae and adults of the beetle feed on tissues of unopened leaf buds of the coconut palm (Fig. 1). Infestations of the beetle turn the leaves brown and decrease fruit production. Successive severe defoliations

will lead to death of the tree (Fig. 2). Seventeen species of palm trees including oil palm, nipa palm and many ornamentals can be attacked. The beetle is believed to be endemic to an area which includes Indonesia and Papua New Guinea and was accidentally introduced into several other countries in the Pacific in the 20th century. However, the pest was not reported from continental Southeast Asian countries until the late 1990's when it was found in the Mekong Delta of Vietnam (Fig. 3). Around the same time, the pest was introduced into the Maldives. It is suspected that this pest was accidentally introduced into both countries with a shipment of ornamentals. The pest has been expanding in areas around Southeast Asian countries, and it was found in Myanmar in 2004, followed by the Philippines in 2005. The pest seemingly continues to spread further westward, and thus the resion of South Asia, including India, Sri Lanka and Bangladesh, is at great risk of invasion. Since there are a large number of coconut industries in these countries, the pest incursion would be catastrophic.

Fig. 1. Adults of *B. longissima* show on young coconut leaf.

Fig. 2. *Brontispa longissima* damaged coconut plants in southern Thailand.

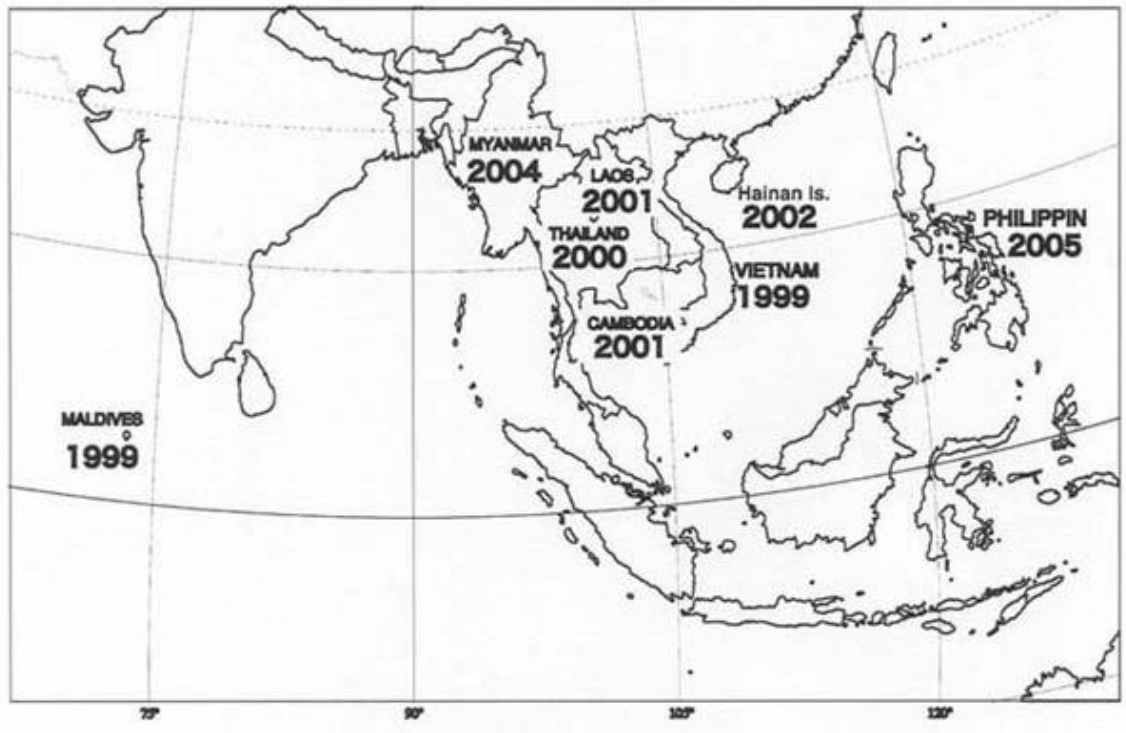

Fig. 3. The numbers indicate the year of the invasion by *B. longissima*

Coconut is, for instance, an important source of income for many households in Vietnam where there are nearly 200,000 hectares of coconut farms. Damage caused by the pest affects 30-40% of the coconut palms and more than 5% of the affected plants are killed by the pest, which causes an estimated loss of US$40 million annually. In Thailand, the recent incursion of the pest into the southern and central regions is a very serious threat to the country's coconut industry and the 50,000 smallholder farmers who rely on the industry. In addition, the crop provides a very significant land cover for areas of poor coastal soil, and is a major feature of the country's tourist industry.

Control measures

Chemical control has been conducted in most of countries that the pest invaded. However, the use of pesticides is not practicable. Pesticides are generally expensive to local farmers who obtain only a small profit from coconuts. Pesticide application to tall coconut trees also poses great risks for applicators because they must climb up to the crown of the tree without protective clothing. Besides, the frequent use of pesticides also raises serious concerns on risks to the health of people, domestic and wild animals, and the environment. Furthermore, as suggested for stemborers that hide inside of plant stems (van denBerg and Nur 1998), the effectiveness of insecticides is questionable because the larvae and adults of this pest spend most of the time hiding in unopened buds of coconut trees. Therefore, alternative control measures against this pest are needed.

Studies have been focused on natural enemies of this pest and their use for biological control. An entomopathogenic fungus was used in the 1980s in Samoa for a pest on young coconut seedlings in fields and in nurseries, but its application to tall trees was difficult and impracticable. Known egg parasitoids are *Hispidophila brontispae* (Ferrière), *Trichogrammatoidea nana* Zehntner (Hymenoptera: Trichogrammatidae), *Ooencyrtus* sp. (Hymenoptera: Encyrtidae) (Ferrière 1931, Ferrière 1933, Thomson 1954). Several eulophid parasitoids, such as *Tetrastichus brontispae* (Ferrière) and *Asecodes hispinarum* Boucek, attack the larval and/or pupal stages of *B. longissima.* Successful classical biological control of *B. longissima* was reported in several countries such as Celebes (Indonesia), Tahiti and the Solomon Islands (Stapley 1973), Samoa (Voegele 1989, Voegele, Klingauf and Engelhardt 1989), and Taiwan (Chiu et al. 1985). One of the most promising natural enemies to control *B. longissima* in continental Southeast Asian countries is now the larval parasitoid *A. hispinarum*. This parasitoid originated in the Papua New Guinea region

(Boucek 1988, Voegele 1989). This parasitoid was successfully introduced into Samoa in the early 1980's to control the *Brontispa* incursion (Voegele et al. 1989). FAO sent a specialist to collect the parasitoid in Samoa and then introduced it into the southern part of Vietnam in 2003. Some other countries in Asia have since been provided with the parasitoid from Vietnam via FAO projects to try to control *Brontispa* outbreaks (FAO 2004).

Current situation in Southeast Asia

We collected the latest information concerning *B. longissima* in the major invaded countries in Southeast Asia and describe the present situation of each country adding some information from the FAO report (2004).

Cambodia: The pest was found around 2001. Of the total 12.3 million coconut trees, 58 percent were infested with *B. longissima* and 16 percent were killed. Although the country at first employed a chemical control method due to lack of information on the pest, the trial was not successful. The short term projects of FAO started to introduce *A. hispinarum* from Vietnam for release into the field from September 2005.

China: The infestation of the pest was found mainly in Hainan Island in 2002, and chemicals were used to control the beetle for the first 2 years with a certain level of success. However, the two biological control agents, *A. hispinarum* and *Metarhizium anisopliae* have been tested to manage this pest. *A. hispinarum* was introduced to Hainan Province from Vietnam in 2002 and released.

Indonesia: During 1919-1934, *B. longissima* was found in five provinces, but is now one of the major pests in Indonesia. Different tactics were used for controlling the pest, but most of them heavily rely on the use of insecticides. However, biological control is now on trial. Three potential natural enemies are the pupal parasitoid, *T. brontispae*, and the entomopathogenic fungi, *Metarhizium anisopliae* var. *anisopliae* and *Beauveria bassiana*..

Lao PDR**:** *Brontispa longissima* was reported in Lao PDR from 2001. With support from FAO, national plant protection staffs were trained to rear *A. hispinarum* in Vietnam and started releasing the parasitoid into the field in October 2004.

Malaysia**:** It is believed that the coconut leaf-eating beetle, *Plesispa reichei*, has emerged as a major pest of coconut after year 2000 and *B. longissima* is not yet present or not yet recognized as an important pest in Malaysia. However, intensive survey for this pest on coconut trees may not have been conducted in this country, because the coconut industry is not important. It is not possible to distinguish between

P. reichei and *B. longissima* only by observing damages of the leaves. To determine whether or not *B. longissima* is infesting on coconut trees, the specimens collected from the infested leaf buds of the trees should be examined. Considering that the first record of *B. longissima* in southern Thailand is in year 2000 from the border area near Malasia, it is reasonable that this pest has already invaded and established a population in this country.

***Maldives*:** Coconut has a major role in the economy of the country. The plants not only provide food and income from its products but also are an important component of the landscape contributing to its tourism. The pest was found in 1999 and probably was imported with ornamental palms from Malaysia and Indonesia. Although chemical control was partly successful in the beginning, it was expensive and posed a threat to the environment and health of people. In 2004, *A. hispinarum* was introduced from Vietnam, mass-reared and released to infested islands. The parasitoid appears to control the pest populations in some islands. However, there are more than 1,000 islands in the country, which form a chain 820 km in length. The environment makes the pest more difficult to be controlled. Most of the remote islands have difficulties for releasing the parasitoid. The parasitoid has also not established in some inhabited islands, despite the release of large numbers of adult parasitoids and mummies.

***Myanmar*:** The pest was found in 2004, but the occurrence and seriousness of the pest at present is unknown.

***Philippines*:** The country has the second largest coconut population in the world following Indonesia. The pest was probably introduced to the Philippines in early 2004 through the importation of ornamental palms, and its damages on coconut plants were found in 2005. Quarantine inspection has been initiated to aid in preventing movement of the pest. The introduction of *A. hispinarum* is unknown.

***Sri Lanka*:** *Plesispa reichei* is a minor coconut pest and *B. longissima* is not yet reported in Sri Lanka. However, the invasion of *B. longissima* is a serious threat to the country, since coconut is one of the main plantation crops and there are trade exchanges with Maldives where the pest has already existed.

***Thailand*:** The plant damage caused by *B. longissima* was first found near the border of Malaysia in 2000. Heavy infestation was reported in February 2004 in southern provinces, and since then the beetle has spread into central and southern parts of the country. *Asecodes hispinarum* was introduced from Vietnam in 2004, and the government started a project of "mass-rearing & releasing of the parasitoid" (US$1 million) from February 2006, together with a promotion of educating local farmers

about biological control. Most of the coconut trees in heavily infested areas such as Samui Island and Surat Thani are now almost recovering, but there are still some plants with heavy symptoms of damage existing in patches in these areas. The parasitoid has not been released in some of the central and most of the eastern regions where heavy infestations can be seen (R. Morakote, personal communication).

***Vietnam*:** The pest was first found in the Mekong Delta region in 1999. Although large-scale chemical control was practiced, the beetle spread and caused enormous losses to the coconut industry by 2002. With the support of FAO, *A. hispinarum* was introduced from Western Samoa in June 2003 and these were released into the field in August 2003. By 2004, the parasitoid became established in Southern and Central Vietnam. The parasitoids spread, and 60-90 percent recovery of palms was observed in Southern Vietnam. However, heavy infestations are still found in central parts of the country where the climate is relatively different from that of Southern Vietnam (T. T. Viet, personal communication).

JIRCAS Project: Biological control of invasive insect pests on coconut trees

This project was started in April 2006 for a 5-year term to accumulate scientific knowledge on the pest and its natural enemies that will be used to develop sustainable biological control methods against the beetle. The overall goal should be to help small-scale farmers who make a living from coconuts by providing stable yields of the products and secure income.

Asecodes hispinarum has been introduced for biological control of *B. longissima* in certain countries as mentioned above, and the parasitoid seems to be working in some areas. However, it is yet too early to determine the parasitoid's success in controlling pest populations, as pest-parasitoid interactions and population dynamics fluctuate considerably in the first few years following introduction of the natural enemy. Moreover, controlling the pest has only focused on the promotion of mass rearing and releasing the parasitoid, while studies on biology and ecology of the pest and the parasitoid have been neglected. Although some biological aspects of *B. longissima* have been studied, there are inconsistencies in descriptions such as the number of larval instars and developmental rate (e.g. Froggatt and O'Connor 1941, O'Connor 1940, Waterhouse and Norris 1987). No sampling method has yet been developed to estimate local populations of the insects, since larvae and adults of the beetle inhabit unopened leaf buds of the coconut palm where it is difficult for people to climb up for

surveys. Therefore, population densities, dispersal and parasitism rate of the pest and the parasitoid in the field are unknown.

It is essential to establish effective methods to survey population dynamics and parasitization of the insects in the field, as well as to investigate ecology and behavior of the insects. At the same time, this will be important for discovering promising natural enemies including indigenous species. We believe that these studies will help for a better understanding of the insects, which will enhance successful control of the beetle.

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