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The Importance of Sustainable Management for Common Oil Palm Insect Pests

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ABSTRACT

The oil palm is an exotic plant from Africa that has contributed vastly to the national economy and development. Many of the insect pests on oil palm come from other native palms, in particular coconut palm. The outbreak of pests in coconuts is rare because the pests are usually controlled by their natural enemies. In recent times, the emergence of bagworms and the rhinoceros beetle, Oryctes rhinoceros, *in oil palm has raised concerns of growers. Recent studies have shown that both bagworms and rhinoceros beetle can be managed by native microbials, including* Bacillus thuringiensis, *nudivirus and* Metarrhizium *sp. The current state of oil palm pest control requires the expansion and use of the pest management control and tactics in order to ensure long term control of insect pests to sustain the profitability of oil palm.*

ABSTRAK

Sawit adalah tumbuhan eksotik dari Afrika yang telah banyak menyumbang kepada ekonomi dan pembangunan negara. Terdapat serangga perosak tanaman kelapa yang boleh merosakkan tanaman sawit. Serangan yang menyebabkan perosak merebak bagi perosak kelapa amat jarang berlaku kerana dikawal oleh musuh semulajadinya. Pada masa ini, ulat bungkus dan kumbang badak, menjadi perosak penting yang menimbulkan kebimbangan penanam sawit. Kajian terbaru menunjukkan bahawa ulat bungkus dan kumbang badak ini boleh diurus dengan mikrob asli seperti Bacillus thuringiensis, *nudivirus dan kulat,* Metarrhizium *sp. Kawalan perosak tanaman sawit perlu diperluaskan dan taktik kawalan secara biologi haruslah dieksploitasi untuk memastikan kawalan jangka panjang serangga perosak demi kesinambungan tanaman sawit yang mapan.*

INTRODUCTION

Malaysia enjoys the gift of a rich biodiversity. Although these organisms exist naturally and freely available, they are often disregarded in our haste to modernisation with very bad unexpected secondary consequences. Sometimes, pesticides which are broad spectrum and harmful to the natural enemies of the pests are being used to control the pest population which had reached outbreak levels.

The example of controlling rice brown planthoppers (BPH) using broad spectrum chemicals underlined this failure of management, which resulted in large outbreaks and subsequent losses to rice farmers (Ooi, 1984). Previous ecological studies have revealed the existence of effective predators that have always keep the BPH population in check (Ooi, 1988a). More ecological research techniques were suggested by Ooi and Shepard, 1994.

A similar situation exists in the oil palm crops and as noted by many authors, many of the serious ‘pest’ species came from coconut palms. (Wood, 1968c; Kalshoven, 1981; Robinson *et al*., 2001 and Kalidas, 2012). However, the coconut palms are generally not damaged by native insects and there are few reported pest outbreaks in tropical Asia including Malaysia. Hence, reports of insect outbreaks in oil palms may be due to injudicious chemical controls in the affected estates. To know this, good ecological studies must be implemented.

Management of Oil Palm Bagworms

Based on his ecological studies, Wood (1968c) suggested that outbreaks of bagworms, especially *Metisa plana* Walker (*Lepidoptera, Psychidae*), were caused by the use of chemical insecticides. As noted by Khoo *et al*., 1991, *M. plana* was not considered to be a significant pest problem in agriculture before 1956. Indeed, Wood (1968c) reported that the oil palm came from Sumatra and was established as an estate in 1917. The origin of this oil palm was believed to be West Africa. This suggested that *M. plana* was effectively controlled biologically between 1917 up to now. Ho *et al*. (2011) considered these pests to have a synchronised life cycles but did not explain how this happened and it is believed that outbreaks were caused by the destruction of natural biological control. The role of parasitoids in the management of oil palm bagworms were suggested by Wood (1968c), Sankaran (1970) and Sankaran and Syed (1972). Some of the common major parasitoids

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infesting on the bagworms have been reported by Norman *et al*., 1996. Several promising predators of the bagworms have also been reported (Norman *et al*., 1998).

The potential of these natural enemies in controlling the bagworms has been shown to be associated with the existence of beneficial flowering plants in the vicinity of the oil palm plantation (Norman and Othman, 2016). Zulkefli *et al.* (2004) and Siti Nurulhidayah and Norman (2016) have shown several examples which unravel the potential of mass rearing predators for controlling bagworms on oil palm. The inclusion of microbial control will further upgrade the research and understanding on management of the bagworms. Although *Bacillus thuringiensis* (Bt) has been shown to control bagworms effectively by aerial spraying using aircraft over a large hectarage (Siti Ramlah *et al*., 2013; Mohd Najib *et al*., 2017; Noorhazwani Kamarudin *et al*., 2017), other fungal pathogens such as *Beauveria* spp. (Nor Shalina *et al*., 2010) and *Paecilomyces* spp. (Shamsilawani *et al*., 2009) should also be further exploited so as not to rely solely on a single species of microbe for bagworm control. This is also necessary to avoid the possible resistance of Bt in bagworms, which occurs on other insects such as *Plutella xylostella*. However, further field work, such as the effect of ultra violet radiation, will determine the feasibility of using fungal pathogens for a sustainable Integrated Pest Management (IPM) in oil palm. For the time being, the use of Bt is the better option and is more sustainable for bagworm control as it is safer to the environment, including the oil palm pollinating weevil (Mohd Najib *et al*., 2009 and 2012).

Although trunk injection of chemicals are confirmed effective against bagworms (Wood, Liau and Knecht (1974), there are now many safer, less toxic alternative chemicals which can be utilised for pesticide application. For trunk injection, acephate seems to be a safer alternative to methamidophos and monocrotophos which are classified as Class 1a and 1b pesticides under the Malaysian Pesticide Board. Spraying specific, selective chemicals (trichlorfon, diflubenzuron, chlorantranilaprole) (Lai and Tey, 2009) may be advocated over the use of cypermethrin for large scale spraying, as it is disruptive to the population of natural enemies and also of the pollinating weevil populations. Most importantly, the application of any chemical or biopesticide should be targeted at the beginning of a generation, as younger larvae are more susceptible than the older. Therefore, the right time is extremely crucial to achieving effective control. In order to monitor any population resurgence, a follow up census should be conducted every six months after a control operation (Chung and Sim, 1991).

Nevertheless, the key factors in avoiding bagworm outbreaks rely very much on the management of the plantation, which are to conduct frequent censuses and controls when the pest populations exceed a certain threshold.

Research on the ecology of birds in oil palm may be useful to understand their role in keeping insect pest populations to non-outbreak levels (de Chenon and Agus, 2006; Asrulsani Jambari *et al*., 2012). Several species of birds are entomophagous (de Chenon and Agus, 2006) which have the potential to enhance their populations in oil palm plantations for bagworm control.

Management of the Rhinoceros Beetle

The rhinoceros beetle, *Oryctes rhinoceros* (L.) (Coleoptera: Scarabaeidae), is another pest that moves from coconut to oil palm (Ooi, 1988b). The most spectacular management was implemented in the early 1930s when *O. rhinoceros* was found to breed in dead stems of coconuts and other palms (Mann, 1923). With replanting of oil palm in Malaysia since 1985, it has emerged as a pest of oil palm. Replanting by the zero-burning method involves the shredding of oil palm trunks, subsequently stacking them in the interrows and leaving the debris to rot *in-situ*. Based on a survey, zero-burning replanting has the potential to attract this pest to breed and establish its population (Norman and Basri, 1997).

Cultural approach was recommended (Ooi and Mislamah, 1977, Wood, 1968a and b) and this would minimise the use of toxic poisons that may affect both humans and the environment. Methods of oil palm replanting may aggravate the infestation of this pest. The underplanting method of planting of young palms underneath old palms due for replanting was shown to be attractive to the beetle. After poisoning the old palms, planters often neglect the necessity to push them down to plant new palms, leaving the old stand to rot for several years. Thus, this situation attracts the beetles to come and breed in the rotting stands, thereby causing greater damage to the young palms below. It is therefore crucial to avoid the breeding chances of this beetle in order to prevent serious infestation and damage in the field.

In 1970, the soil borne fungi, *Metarhizium anisopliae* was used to control *O. rhinoceros* on coconut palms in the Pacific (Bedford, 1980). Infection of *O. rhinoceros* by *M. anisopliae* in oil palm plantations was reported by Sivapragasam and Tey (1994). Subsequently, the use of *M. anisopliae* as biocontrol agent of rhinoceros beetle has been practiced since 1990 (Ramle *et al*., 2006). The *M. anisopliae* has been formulated in granular form (Ramle *et al.,* 2009) and applied to the field to germinate and produce spores which are infectious to healthy larvae or adults.

The discovery of an *Oryctes* nudivirus in Malaysia further changed the approach to manage the rhinoceros beetle (Bedford, 2014) and its effectiveness was initially verified in New Guinea (Bedford, 1973b). In Malaysia, the nudivirus has been identified as types A, B, C and D (Ramle *et al*., 2005). In cell line production, the type B was found to be most pathogenic, followed by types A and C (Nur Ain Farhah *et al*., 2016a). However, based on feeding reduction rates, type A was found to be the most effective in reducing the feeding of the beetle neonates, followed by type C and type B (Nur Ain Farhah *et al*., 2016b).

The virus and the entomogenous fungi *Metarhizium anisopliae* were also found to be effective in India (Kalidas, 2012). Trapping of *O. rhinoceros* for auto dissemination of *M. anisopliae* was reported by Ramle, *et al*. (2011) and were found to be effective in Malaysia and was an improvement on the designs earlier reported by Bedford (1973a). In order to effectively manage *O. rhinoceros* using the nudivirus and *M. anisopliae,* the auto dissemination approach should be further expanded and tested in the field.

CONCLUSION

More research on ecosystem services will contribute to a better understanding of the agro-biodiversity in oil palm plantations and will contribute to a more sustainable and benign control over the pests of this crop. The roles of indigenous biodiversity in oil palm will not be any different from a native crop such as rice where there is sufficient evidence to avoid outbreaks by conserving the existing natural enemies. Awareness campaign on IPM in oil palm needs to be actively expanded to the smallholders, similar to the 10-year experience of IPM training for rice in Asia (Pontius, Dilts and Bartlett eds., 2002).

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