Effectiveness of the oil palm pollinating weevil, *Elaeidobius kamerunicus*, in Malaysia

Manual pollination of oil palm was made obsolete in the early 1980s when the oil palm pollinating weevil *Elaeidobius kamerunensis* was introduced. It now looks as if the weevil alone is insufficient to maintain adequate pollination, and the industry is worried.

By T. M. Teo

The oil palm is an important crop for the Malaysian economy. Each tree bears male and female flowers, on separate inflorescences, requiring pollen to be transferred by wind or insects. In the beginning, oil palm plantations in Malaysia relied mainly on wind pollination. There were natural Malaysian oil palm insect pollinators, *Thrips hawaiiensis* and *Pyroderces* sp. But these were found to be inefficient (Wahid & Kamarudin, 1997). To improve the yield, hand pollination was developed and the collection, processing and trade in oil palm pollen became a thriving sub-industry within the oil palm industry until the introduction of the weevil *Elaeidobius kamerunensis*.

Modern oil palm variety with heavy predominance of female expression

Male inflorescence

The introduction of *E. kamerunensis* to address the poor natural pollination problem in Malaysia, was the result of a study led by R.A. Syed which commenced in Cameroon in 1977. Syed found that this weevil was the main pollinator for oil palm. It was found to be the most suitable of all species as it was the most abundant in both wet and dry seasons. It was also found to have the highest capacity for pollen cartage of all pollinators (Syed, 1979). Hence, *E. kamerunicus* was brought into Malaysia in 1980 to increase pollination of oil palm. The first release of these weevils took place in Johor and Sabah Pamol plantations (Syed *et al.*, 1982), and the weevils were found to multiply and spread rapidly in oil palm plantations nationwide in a few short years. Hand pollination was soon discontinued in most parts of the country.

Several *Elaeidobius kamerunicus* weevils on a spikelet of a male oil palm

Female flowers

Elaeidobius kamerunicusis is entirely dependent on the male inflorescence of the oil palm to survive. Adult weevils consume oil palm pollen and lay eggs in anthesizing male inflorescences. The larvae live on and consume the decomposing male inflorescence and pupate within the spikelets of the flowers, emerging as adults about 10 days later (Tuo *et al.*, 2011).

The new pollinator *E. kamerunicus* was also found to be able to co-exist in the oil palm ecosystem with the native *T. hawaiiensis* and *Pyroderces sp.* possibly due to differences in habitat requirements despite having to compete for a common food source (Wahid & Kamarudin, 1997). Following the introduction of *E. kamerunicus*, fruit set improved and yield jumped by 20% in Peninsular Malaysia and 53% in Sabah (Ponnamma, 1999).

The recurrence of poor pollination and its causes

After years of high yield following the introduction of *E. kamerunicus*, there have been reports of decline in oil palm yield since the late 1980s. Donough *et al.* (1996) estimated losses of more than RM300,000 at Pamol Sabah in 1993 due to poor fruit set. They also found that poor fruit set was correlated with seasonal fluctuations, with wetter weather possibly having negative effects on weevil population and weevil pollination activity (Sugih *et al.*, 1996). A survey in 1998 found that most parts of Sabah experienced the same problem (Rao & Law, 1998). Currently, there are even reports from Sarawak and Peninsular Malaysia of poor fruit set and abortive bunches, due to

poor pollination. So, with this increasing poor pollination problem, the question has arisen over whether the causal factors are only rainfall and climatic pattern.

Other causes of poor fruit set have been suggested. One theory is insufficient production of good pollen. Another is reduced pollination activity by the pollinating weevil, or a combination of both (Rao & Law, 1998). So far, no evidence has been found of decrease in pollen viability (Donough *et al*., 1996). Pollen quantity however could have been reduced markedly due to sex ratio skew of the oil palm in favour of female inflorescences. Oil palms produce male and female inflorescences in alternating cycles, but with modern planting materials and good growing conditions, the yields from increased female inflorescence cycle come at the expense of the male inflorescence cycle. The lower male inflorescence density per hectare could be having an effect on the population of the weevil which is so dependent on the male inflorescences for breeding sites. Rao & Law (1998) presented evidence from Pamol Sabah of such correlation. In Costa Rica, similar findings were also reported for their oil palm plantations (Bulgarellil *et al*., 2002).

Predation and parasitism are also factors to consider for the reduction in *E. kamerunicus* populations. Rats feed on weevil larvae by feeding on the post-anthesised male inflorescences (Syed & Saleh, 1988). An internal parasitic nematode, *Elaeolenchus parthenonema*, was also found to reduce the lifespan of *E. kamerunicus* (Poinar *et al*., 2002). It has also been suggested that the susceptibility of the weevil to parasitism could due to low

Adult weevil feeding on pollen, body dusted with pollen

Weevil larvae

levels of genetic diversity within the founder population (Caudwell *et al*., 2003).

Current management and research

The return to manually-assisted pollination is needed in some areas where poor fruit set has been consistently problematic. This practice however is only expected to be a short term solution to the problem, as assisted pollination is labour intensive. It is hoped that assisted pollination can "break" the reproduction cycle of the palms and encourage the male inflorescence phase after adequate pollination during the female inflorescence phase.

There are a number of strategies that are currently being researched. Reducing planting of palms with high female traits and integrating with palms that are more strongly male may be a way to address the problem. Planting materials may also be selected from a more diverse genetic

background to decrease the chances of high synchronised inflorescence cycle behaviour between palms so that enough male inflorescences are available all year round.

For a longer term solution, we must also improve our understanding of oil palm pollinators. In- depth studies are needed and are underway on the weevils to further understand the current problems faced by *E. kamerunicus*. With that, we hope that a solution can be found to boost weevil numbers and if needed, to find an alternative pollinator to *E. kamerunicus*.

Freshly collected pollen in 1979, before weevil introduction

Pollen packed in bags for use in manual assisted pollination, 1979

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