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## SHORT COMMUNICATIONS

# THE POTENTIAL NATURAL PREDATORS OF *Elaeidobius kamerunicus* Faust, 1878 (COLEOPTERA: CURCULIONIDAE) IN MALAYSIA

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The pollinating weevil *Elaeidobius kamerunicus*, Faust 1878 is one of the main pollinating weevils for oil palm, *Elaeis guineensis*. This pollinating insect was brought from Cameroon (West Africa) and introduced in Southeast Asia in 1981, thus replaced the inefficient assisted pollination processes, reduced assisted pollination cost, increase quality of fresh fruit bunches (FFBs) and obtains higher profits (Syed et al. 1982; Basri et al. 1983). After a decade prior to the introduction of the pollinating weevil, there were a claimed that FFBs had declined tremendously causing several billion dollars lost in yearly

revenue (Rao & Law 1998; Kang 1999). Recently, there are even reports from plantation in Sarawak and Peninsular Malaysia of poor pollination and low fruit set (Teo 2015). The decline in yield has been associated with the decline in population and pollination efficiency of *E. kamerunicus*. Some probable cause was associated with predation, parasitism, disease and infection and also improper application of insecticides (Agus et al. 2014 and reference therein; Norman Kamarudin, pers comm).

*Elaeidobius kamerunicus* is highly dependent on the male spikelet, where they live, feed and breed on the male inflorescence flower. Prior to the visit, they would rely on the odour produced ascribed as P-methoxyally benzene or estragole (Lajis et al. 1985; Muhammad-Fahmi et al. 2016). During the visit on the male inflorescence spikelet, the pollen grains adhere to their body unintentionally. For pollination to occur, this pollinating weevil would subsequently visit the female flowers during anthesis, as female flower also produce a similar but weaker odour as that of male flowers (Muhammad-Fahmi et al. 2016). Indirectly, the pollen grains adhering to the pollinating weevils' body were deposited by chance onto the stigma of the female flower. Due to the absence of food source in the female flower, the weevils would return to the male inflorescence.

From opportunistic observations in Malaysian oil palm ecosystem, this note deals with potential natural predators which include insectivorous rodent, bird, bug, ant, spider, wasp, and dragonfly species that prey on the pollinating weevil. These predation risks may have directly or indirectly alter and influences the pollinating behaviour of the *E. kamerunicus* .

In many occasions that were found, male spikelets was grazed by several rodent pest species. These spikelets served as

important food sources, home and breeding site for the *E. kamerunicus* (Syed 1979). When rats grazed on male spikelets, they would undoubtly consume the eggs, larvae and pupae that live in the inner part of the spikelets. Liau et al. (1983) reported that the damage to oil palm inflorescences are extremely heavy when the number of *Rattus tiomanicus* is high. Due to that, preventive measures by using the Common Barn owl *Tyto alba* (Tytonidae) as biological control agent to suppress rodent pest of several species population in many Malaysian oil palm ecosystems have been implemented (Duckett 1991; Puan 2013). Moreover, nine out of 14 owl species that have been recorded in peninsular Malaysia can be found in oil palm ecosystems (Muhammad-Syafiq et al. 2016). These owl species would have probably reduced significant amount of rodent pest population that damages the oil palm. However, information concerning the rodent pest population that affected the population of *E. kamerunicus* is limited.

In Palong oil palm plantation, Negeri Sembilan, the Yellow-vented bulbul *Pycnonotus goiavier* (Pycnonotidae) was observed to fly from a perch to the anthesized male spikelets, and feed on the adult *E. kamerunicus* (Figure 1). This generalist bird species had been reported to consume more than 80% of its diet with *E. kamerunicus* in a Malaysian oil palm ecosystem (Bettycopa et al. 2015). In contrast, for Indonesian oil palm ecosystem, this bird species is a generalist and feed on wide range of insects including beetles, caterpillars and wasps, but not on the *E. kamerunicus* only (Chenon & Susanto 2006). Yet, two insectivorous bird, the Ashy Tailorbird *Orthotomus ruficeps* (Sylviidae) and Black-throated Prinia, *Prinia atrogularis* (Sylviidae) have been identified to account more than 75% of their diet with *E. kamerunicus* in Indonesian oil palm ecosystems (Chenon & Susanto 2006). These bird species could have modified their feeding behaviour targeting mostly on the *E. kamerunicus* as their main diet (Chenon & Susanto 2006). This

raises concern whether the abundance of these bird species affected the population of *E. kamerunicus* and pollinating activities in oil palm ecosystem.

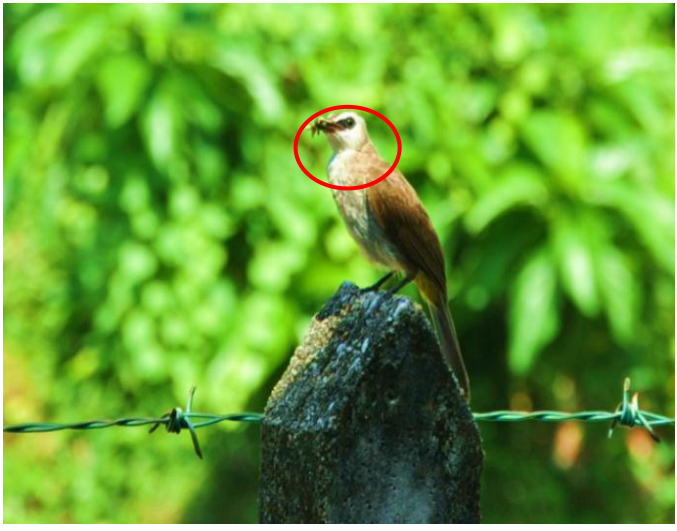

Figure 1. Yellow-vented bulbul *Pycnonotus goiavier* (Passeriformes: Pycnonotidae) flies to the male spikelets to feed on the adult weevil.

The yellow assassin bug *Cosmolestes picticeps* (Reduviidae) have occasionally been observed to feed on adult of *E. kamerunicus* in Lekir oil palm plantation (Perak), MPOB Teluk Intan oil palm plantation (Perak) and Naman oil palm plantation (Sarawak). The *C. picticeps* injected it long pointed proboscis into the body and suck the body fluid from the *E. kamerunicus*. In integrated pest management practice, *C. picticeps* were used as biological agents to suppress the population of bagworm *Metisa plana* (Lepidoptera) in an oil palm plantation (Syari et al. 2016). This *M. plana* is capable of being present as outbreak and cause crop loss of up to 40% (Norman & Basri 2010). However, if the number of *M. plana* is below par,

the *C. picticeps* probably shift to the *E. kamerunicus* as its alternative food choice (Figure 2).

Figure 2. Predation of *Elaeidobius kamerunicus* by *Cosmolestes picticeps* (Reduviidae) on male flower.

Moreover, the assassin bug *Sycanus dichotomus* of the same family as *C. picticeps* (Reduviidae) was also observed to feed on adult of *E. kamerunicus*. Similarly to *C. picticeps S. dichotomus* injected its long pointed proboscis into the body and suck the body fluid from the *E. kamerunicus*. *Sycanus dichotomus* was observed crawling on the male spikeletes and search for their prey. This assassin bug is a generalist predator that attacks bagworms and nettle caterpillars in oil palm plantations in Malaysia. Being an important predator to bagworms and used as biological control of *Metisa plana* (Basri et al 1995), they are commonly found at the ground level in oil palm plantations (De Chenon et al., 1989; Norman et al., 1998). It is predictable for most predators to locate their food source on flower-visiting insects. In oil palm ecosystem, the *E. kamerunicus* became the most abundance insect visiting male

flower, so they expose to predatory attacks (Hussein et al. 1991). After introducing beneficial plants in oil palm, populations of natural enemies including parasitoids was increased as they provide an important source for insect foraging activity (Donald 2004). Basri et al. (1999) reported that flowering plants may prolong adult parasitoid's life spans.

Meanwhile, a Big-headed ant *Pheidole megacephala* (Formicidae) were observed feeding on adult of *E. kamerunicus* near the anthesized spikelets in Serting oil palm plantation (Negeri Sembilan) (Figure 3). This exotic ant species have a big and strong mandible used to tear the outer part of the body and consume the *E. kamerunicus*. It has two distinct sizes of workers (major and minor) and nests primarily outdoors, but invades structures for food ranging from sugar to meat products (Lee 2002). Benjamin & Catherine (2008) mentioned that the presence of *P. megacephala* could significantly reduce the number of other native ant and invertebrates species found within its range in a particular habitat. This exotic *P. megacephala* originally recorded from the Indian Ocean island of Mauritius (Fabricius 1793). On the contrary, weaver-ant *Oecophylla smaragdina* (Formicidae) that were used to control bagworm infestation in young oil palm trees can be found in high abundance but does not prey on the *E. kamerunicus* (Pierre & Idris 2013). This ant species can be almost everywhere crawling on the ground, on tree bole, and on palm fronds. More detailed information on *P. megacephala* is needed to understand its role in an oil palm ecosystem.

Figure 3. Big-headed Ants *Pheidole megacephala* (major and minor worker) crawls nearby the male flower takes advantage to feed on the adult weevil.

At MPOB Teluk Intan oil palm plantation (Perak), several adult of *E. kamerunicus* were found captured on the constructed web of web-building spiders, *Argiope* sp. (Araneidae) and *Leucauge grata* (Tetragnathidae) (Figure 4). The *Argiope* sp. usually constructed its web at the ferns (*Lygodium flexuosum*) growing on the oil palm tree bole, while *L. grata* constructed its web in open-space between one to two meters above ground in an oil palm ecosystem. These web-building spiders are highly dependent on the webs they construct at strategically chosen microhabitats that are able to provide adequate food supply and avoid competition with coexisting species (Dzulhelmi 2016). The spatial-distribution in placement of the webs could be as a result of prey-predator interaction in an oil palm ecosystem (Norma-Rashid et al. 2014). When the *E. kamerunicus* travels for anthesized male spikelets to feed on, they unintentionally get

caught on the web constructed along the journey. As successful predators that feed exclusively on wide range of invertebrates that are captured on the web, timidly small-size insects such as the *E. kamerunicus* would definitely be one of their diet choices. Although some studies identified spiders that contribute towards pest control in oil palm ecosystems, interaction between web-building spiders in relation to the pollinating weevil should be investigated for oil palm ecosystems.

Figure 4. *Argiope*.sp (Arachnida: Araneidae) commonly found constructing their webs close to the male flowers occasionally capture flying adult weevil on their web.

Hymenopteran i.e. bees and wasps can be observed collecting the pollen at the anthesized spikelets in MPOB Jerantut oil palm plantation (Pahang) and Chuping oil palm plantation (Perlis) (Noor Hasan Mohd Yob, pers. comm). They are ten times larger than the *E. kamerunicus*. The pollen collected can obviously be seen on the legs of the hymenopteran. During this time, *E. kamerunicus* can also be found crawling and flying about

at the anthesize spikelets. It is uncertain whether the pollinating is disturbed by the presence of the hymenopteran. Abbott (2006) also had proved that most of bumblebee (*Apis mellifera*) will not visit or attending any inflorescences with previous predatory attacks. In one occasion, one Vespidae species was observed to attack and feed on the larva that lived in the inner part of the spikelet. The vespid searched for larva by digging in to reach the larva living in the inner part of the post-anthesis spikelet in Serting oil palm plantation (Negeri Sembilan). Most vespid are opportunistic generalists and use a variety of mechanisms to locate and choose prey. Dukas (2005) had proved that several predatory insect species, comprising the bee wolves (*Philanthus* spp.) and sphecid wasps (Sphecidae) had drawn the lower abundance of bumblebees (*Bombus* spp.). Therefore, the impact of Hymenopteran visiting the male flowers towards *E. kamerunicus* should be investigated.

Till date, a total of 51 Odonata species, Libellulidae made up the most dominant family have been documented in oil palm ecosystems (Salmah & Wahizatul 2004). They have frequently been used as biological indicators in aquatic environments (Foote & Rice 2005). Unexpectedly, an unidentified Odonata species was seen to fly at rapid rate to the anthesized male spikelets and feed on the adult of *E. kamerunicus*. Previous information did not identify *E. kamerunicus* as one of the diet choice for Odonata species. Studies should focus on the dietary choice of odonata species in an oil palm ecosystem.

The concentrated population of *E. kamerunicus* during anthesized on the male spikelets makes them an easy targeted prey in oil palm ecosystems. The potential of biological control agent such as *S. dichotomus* and *Cosmolestes* species to become a predator and effecting the pollination of *E. kamerunicus* should be take into consideration. The implementation of the two predator in controlling the pest species in oil palm plantation,

particularly the bagworm may lead to the misleading in declining the population of *E. kamerunicus.* Thus, this should be regularly monitored and studied further.

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## REFERENCES

Abbott, K. R. 2006. Bumblebees Avoid Flowers Containing Evidence of Past Predation Events. *Can. J. Zool*. 84: 1240-1247.

Agus E.P, Wiharti O.P & Agus S. 2014. Elaeidobius kamerunicus: Application of hatch and carry technique for increasing oil palm fruit set. Journal of Oil Palm Research, 26(3), 109-119.

Basri, M.W., Norman, K. and Hamdan, A.B., 1995. Natural enemies of the bagworm, *Metisa plana* Walker (Lepidoptera: Psychidae) and their impact on host population regulation. *Crop Protection*, *14*(8), pp.637-645.

Basri, M. W., Siburat, S., Ravigedari, S. and Othman, A. 1999. Beneficial plants for the natural enemies of bagworm in oil palm plantation. *Proceedings of the 1999 PORIM International Palm Oil Congress: Emerging Technologies and Opportunities in the Next Millennium. Palm Oil Research Institute of Malaysia*, Malaysia, 165-179

Benjamin, D. H and Catherine, L. 2008. An invasion revisited: The African big-headed ant (*Pheidole megacephala*) in northern Australia. *Biological Invasions*. 10(7), 1171-1181.

Bettycopa A., Andrew A.T., Khalid H., Mohd-Haniff H. & Norman K. 2015. The diet of the yellow-vented bulbul (*Pycnonotus goiavier*) in oil palm agroecosystems. *Journal of Oil Palm Research*, 27(4), 417-424.

Che Salmah, M.R. and Wahizatul Afzan, A., 2004. Distribution of Odonata (Insecta) in various ecosystems in northern Peninsular Malaysia. *湿地科学*, *3*, p.004.

Chenon D.R & Susanto A. 2006. Ecological observations on the diurnal birds in Indonesian oil palm plantations. Journal of Oil Palm Research, special issue, 122-143.

De Chenon, D R; Sipayung, A And Sudharto, P S. 1989. The importance of natural enemies on leaf eating caterpillar in oil palm in Sumatra, Indonesia – uses and possibilities. Proc. of the PORIM International Palm Oil Development Conference. PORIM, Bangi. 5-9 September 1989. p. 245-262.

Donald. P. F. 2004. Biodiversity impacts of some agricultural commodity production systems. *Conservation Biology*. 18, 17-37.

Duckett, J.E., 1991. Management of the barn owl (*Tyto alba javanica*) as a predator of rats in oil palm (*Elaeis quineensis*) plantations in Malaysia. *Birds of Prey Bulletin*, 4: 11-23.

Dukas, R. 2005. Bumble Bee Predators Reduce Pollinator Density And Plant Fitness. *Ecology*. 86(6): 1401-1406.

Dzulhelmi M.N. 2016. Distribution of spiders in Malaysia with special emphasis of the systematic and ecology of the orb-web spider (Araneae: Tetragnathidae). *PhD dissertations*, Kuala Lumpur, University of Malaya.

Fabricius. J. C. 1793. Entomologia Systematica Emendata et Aucta. Secundum classes, ordines, genera, species. Adjectis synonimis, locis, observationibus, descriptionibus. Hafniae: C.G. Proft 2 viii. 519 pp.

Hussein, M. Y. Lajis, N. H., Ali, J. H. 1991. Biological and chemical factors Associated with Successful Introduction of *Elaeidobius kamerunicus* Faust, the Oil Palm Pollinator into Malaysia. *Acta Horticulturae*. 288: 81-87.

Kang S. M. 1999. The *Elaeidobius kamerunicus* story. *The Planter*, 75(876), 143-150.

Lajis N. H., M. Y. Hussien and R. F. Toia, 1985. Extraction and Identification of the Main Compound Present in *Elaeis Guineensis* Flower Volatiles *Pertanika*, pp. 105-108

Lee Foote, A. and Rice Hornung, C. L., 2005. Odonates as biological indicators of grazing effects on Canadian prairie wetlands. *Ecological Entomology* 30(3): 273-283.

Lee, C.Y. 2002. Tropical household ants: pest status, species diversity, foraging behavior and baiting studies. pp. 3 - 18. In: S.C. Jones, J. Zhai & W.H. Robinson [eds.], *Proceedings of the 4th International Conference on Urban Pests*. Pocahantas Press, Blacksburg, Virginia.

Liau, S. S., Goh, K. H., Chan, K. W. 1983. Some Effects of the weevil, *Elaeidobius kamerunicus* Faust (Curculionidae) on the Malaysian Oil Palm Industry – (i) Ecological. Proceedings of Kumpulan Guthrie Sdn. Bhd. Seminar, Port Dickson: 48-64.

Mohd-Basri W, Halim AH & Hitam AH. 1983. Current status of *Elaeidobius kamerunicus* Faust and its effects on the oil palm industry in Malaysia. PORIM Occasional Paper, 6, 1-39.

Muhammad-Fahmi M.H. Ahmad-Bukhary A.K, Norma H & Idris A.B. 2016. Analysis of volatile organic compound from Elaeis guineensis inflorescences planted on different soil types in Malaysia. *AIP Conference Proceedings*, 060020.

Muhammad-Syafiq Y, Puan C.L., Badrul A., Sharifah N.A. & Amal G. 2016. Nocturnal bird composition in relation to habitat heterogeneity in small scale oil palm agriculture in Malaysia. *Agriculture, Ecosystems and Environment*, 233, 140-146.

Norma-Rashid Y., Wan-Azizi W.Z., Dzulhelmi M.N. & Noraina M. 2014. Spiders as potential eco-friendly predators against pests. In: *Basic and Applied Aspects of Biopesticides* (Eds. Sahayaraj, K). Springer, India, 245-254 pp).

Norman, K and Basri, M.W. 2010. Interactions of the bagworm, *Pteroma pendula* (Lepidoptera: Phsycidae), and its natural enemies in an oil palm plantation in Perak. *Journal of Oil Palm Research*, 22, 758-764.

Norman, K; Basri, M. W. and Zulkefli, M. 1998. Handbook of Common Parasitoid and Predator Associated with Bagworm and Nettle Caterpillar in Oil Palm Plantations. PORIM, Bangi. 29 pp.Syed 1979..

Pierre, E.M. and Idris, A. 2013. Studies on the predatory activities of *Oecophylla smaragdina* (Hymenoptera: Formicidae) on *Pteroma pendula* (Lepidoptera: Phsycidae) in oil palm plantations in Teluk Intan, Perak (Malaysia). *Asian Myrmecology*, 5: 163-176.

Puan C.L. 2013. *Integrating ecology into rodent pest management in oil palm agroecosystem*. UPM Press, Serdang, 100 pp.

Rao V & Law IH. 1998. The problem of poor fruitset in parts of East Malaysia. *The Planter*, 74(870), 463-483.

Syari, J., Ahmad, N., Amal, G., Azlina, Z and Badrul, A. 2016. Impacts of 2 species of predatory Reduviidae on bagworms in oil palm plantations. *Insect science*. 00, 1-10.

Syed, R. A. 1979. Studies on Oil Palm Pollination by Insects. *Bulletin of Entomological Research*. 69: 213-224

Syed, R. A., Law, I. H. & Corley, R. H. V. 1982. Insect pollination of oil palm: Introduction, establishment and pollinating efficiency of *Elaeidobius kamerunicus* in Malaysia. *The Planter. Kuala Lumpur.* 58: 547–561.

Teo, T.M., 2015. Effectiveness of the oil palm pollinating weevil, *Elaeidobius kamerunicus*, in Malaysia. *Agricultural Science*. 1: 0-4.