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SHORT COMMUNICATION

AN INTRODUCTION ON BRACONIDS-TEPHRITIDS IN HOLTICULTURAL FIELDS IN MALAYSIA

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In Malaysia, two of the most serious fruit fly pests infesting and damaging fruits grown commercially are *Bactrocera carambolae* Drew & Hancock and *B. papayae* Drew & Hancock. The *B. carambolae* is recorded to infest starfruit (*Averrhoa carambola* L.), guava (*Psidium guajava* L.), soursop (*Annona muricata* L.) and water guava (*Eugenia* spp.), while *B. papayae* infests papaya (*Carica papaya* L.), 'ciku' (*Manilkara zapota* L.), banana (*Musa* spp.), tomato (*Lycopersicum esculenta* Miller), chili (*Capsicum annuum* L.), mango (*Mangifera indica* L.), guava and carambola (Chua & Khoo 1995). Therefore, the use of Braconidae as biological control agent is important to minimize the impact of the pest (Ovruski et al. 2000). Several braconids, largely from the Opiinae species are successfully used in several countries to overcome this problem. In fact, the braconids (parasitoids) are considered as pests and have economic importance in Malaysia.

Nowadays, molecular techniques have generally been used for insect identification of host-parasitoid interactions.

Identification based on morphological characters especially in immature stages may encounter difficulty in detection of both species. In these cases, molecular determination would be an advantage. For example, Roehrdanz et al. (1993) used RAPD-PCR to distinguish between five species of braconid parasitoids that attack aphids. In the context of biological control program, the identified parasitoid can be used as natural enemy to reduce pest population that infested fruits and crops. However, new method namely Multiplex PCR is an innovative tool in detection of many species in a single reaction. Accurate identification would be advantageous in order to identify the parasitoid to be used as biological control agent for these serious pest crops.

Recently, in Malaysia, detection of both species simultaneously based on molecular technique have never been made. The previous studies were only focused on tephritids species. Chua et al. (2010) used PCR-RFLP markers for differentiating the major of Malaysian *Bactrocera* pests based on COI sequences. This technique is useful for identifying *Bactrocera* species accurately and quickly. However, misidentification between closely related species still happens. The morphological characteristics are still unable to provide information in determining the status of these species. For accurate identification, Tan (2004) has developed PCR- based assay by using COI, 16S rDNA and heat shock protein 70 (Hsp 70) sequences to distinguish between *Bactrocera* species. Several previous studies on these species have focused on their phylogenetic relationship. However, there is still confusion in differentiating closely related species within *Bactrocera* genus. Therefore, phylogenetic relationship among species of the *Bactrocera* genus has been developed to improve the confirmation on taxonomic status of *Bactrocera* spp.

Besides, there are several molecular studies have been done on braconids species which focused on phylogenetic study in Malaysia and throughout the world e.g. by Gimeno et al. (1997) and Yaakop (2011). However, there is no molecular study made in combination or interaction of braconids-tephritids species, like what we are doing in the laboratory recently. Our research objectives are to clarify the species of braconids which are associated with the tephritids species using of Multiplex-PCR (as

parasitized larva as the voucher specimen) and also to record the crops species that are infested by the fruit flies for expanding the data on survey of the pests-parasitoids-crops by the Chinajariyawong et al. (1999) and Allwood et al. (1999). The phylogenetic study is a fundamental study to get some estimation on the related or closed species by estimating their biology (hosts, pests etc.), which is highly potential to be applied in the biological control program.

Although parasitoids have been released to control fruit flies populations, there are other techniques that are commonly used to suppress these species. These include Sterile Insect Technique (SIT) and quarantine project. SIT has been successfully used to eradicate fruit flies in several parts of the world. This approach is more advantageous because it is species specific and safe to the environment (Sati 2003). Male fruit flies will expose to gamma rays resulting sexual sterility. When sterile males mate with female fruit flies, infertile eggs will be produce. Females fail to reproduce and enhance reduction of fruit flies populations. SIT is known as an effective control for invasive fruit flies in many areas. Examples in Southern Australia, sterile males are being released near Adelaide to prevent the establishment of Mediterranean fruit fly, *Ceratitis capitata* coming from Western Australia. Therefore, reductions of this fruit flies species have been observed.

SIT is normally involves rearing of tephritids. Chang et al. (2004) has developed rearing system for melon fruit fly, *B. cucurbitae* (Coquillett) in a liquid larval diet. Then, a large number of male fruit flies will expose to irradiation in producing the sterilized males. It is useful in SIT program application. However, braconids are difficult to be reared in the laboratory because low percentage of parasitoids emergence (Greany et al. 1976). Abiotic factors such as unsuitable temperatures and relative humidity may cause mortality of parasitoids. Eventhough rearing method is more preferable applied to tephritid, but numerous studies have includes braconids species into this method. For example, more than a million of *D. longicaudata* have been produced when reared in the laboratory (Wong & Ramadan 1992). *D. longicaudata* is an obligate endoparasitoid of *B. dorsalis* larvae. So, this species is commonly used because it can be proliferate easily in large numbers.

Quarantine project emphasized on quarantine strategies to prevent further spread of the olive pest from infested areas into another area e.g. by Yokoyama et al. (2004). He found that low-temperature storage can cause high mortality of the immature stages of walnut husk fly (*Rhagoletis completa* Cresson) and was investigated as a quarantine treatment for stone fruit shipped from California (Yokoyama & Miller 1996). After harvest, olives used for canning are stored in a brine of edible acid solution, which allows preservation without fermentation before pickling with sodium hydroxide. The quarantine project is a major and an active project doing by the group of Horticulture in the Malaysian Agricultural Research Development Institute (MARDI) (pers. comm. Mrs. Suhana Yusof). This project aim is to confirm that no *B. dorsalis* species has been transferred outside Malaysia through their exported crops. The rearing project also helps in determining the pests-parasitoids-crops species, however, it takes a long time and require very high budgets.

There were a lot of records on parasitoids; pests and crops existed in the past research, including those recorded from Malaysia. For example, Chinajariyawong et al. (1999) found that *D. longicaudata* has been parasitoid for *B. carambolae* and *B. papayae* for the *Terminalia catappa* L. and *M. indica* L., respectively. This research can be referred to for much more information and records on parasitoids that parasitized the pests of certain crops.

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REFERENCES

Allwood, A. J., Chinajariyawong, A., Drew, R. A. I., Hamacek, E. L., Hancock, D. L., Hengsawad, C., Jipanin, J. C., Jirasurat, M., Kong Krong, C., Kritsaneepaiboon, S., Leong, C. T. S. & Vijasegaran, S. 1999. Host plant records for fruit flies (Diptera: Tephritidae) in Southeast Asia. *The Raffles Bulletin of Zoology* 7: 1-92.

Chang, C. L., Caceres, C. & Jang, E. B. 2004. A novel liquid larval diet and its rearing system for melon fly, *Bactrocera cucurbitae* (Diptera: Tephritidae). *Annals of Entomological Society of America* 97(3): 524-528.

Chinajariyawong, A., Clark, A. R., Jirasurat, M., Kritsaneepiboon, S., Labey, H. A., Vijaysegaran, S. & Walter, G. H. 1999. Survey of Opiine parasitoids of fruit flies (Diptera: Tephritidae) in Thailand and Malaysia. *The Raffles Bulletin of Zoology 2000* 48(1): 71-101.

Chua, T. H., Chong, Y. V. & Lim, S. H. 2010. Differentiating Malaysian *Bactrocera* pests using PCR-RFLP analyses (Diptera: Tephritidae).

Chua, T. H. & Khoo, S. G. 1995. Variations in carambola infestation rates by *Bactrocera carambolae* Drew and Hancock (Diptera: Tephritidae) with fruit availability in a Carambola orchard. *Research Population Ecology* 37(2): 151-157.

Gariepy, T. D., Kuhlmann, U., Haye, T., Gillot, C. & Erlandson, M. 2005. A single-step multiplex PCR assay for the detection of Europian *Peristenus* spp., parasitoids of *Lygus* spp. *Biocontrol Science and Technology* 15: 481-495.

Gimeno, G., Belshaw, R. & Quicke, D. L. J. 1997. Phylogenetic relationships of the Alysiinae/Opiinae (Hymenoptera: Braconidae) and the utility of cytochrome b, 16S and 28S D2 rRNA. *Insect Molecular Biology* 6: 273–284.

Greany, P. D., Ashley, T. R, Baranowski, R. M. & Chambers, D. L. 1976. Rearing and life history studies on *Biosteres* (*Opius*) *longicaudatus* (Hymenoptera: Braconidae). *Entomophaga* 21: 207- 217.

Roehrdanz, R. L., Reed, D. K. & Burton, R. L. 1993. Use of polymerase chain reaction and arbitrary primers to distinguish laboratory-raised colonies of parasitic Hymenoptera. *Biological Control* 3: 199-206.

Sati, A. M. K. 2003. Population Dynamics and Movement of *Bactrocera Umbrosa* (Fabricius) in relation to *B. Papayae* (Drew & Hancock) (Diptera: Tephritidae) in Penang Island, West Malaysia. Tesis Ph.D Universiti Sains Malaysia.

Tan, L. Y. 2004. Identification of *Bactrocera* Genus (Diptera: Tephritidae) via molecular marker. Tesis Ph. D. Malaysia University of Science and Technology.

Wong, T. T. Y. & Ramadan, M. M. 1992. Mass rearing biology of larval parasitoids (Hymenoptera: Braconidae: Opinae) of tephritid flies (Diptera: Tephritidae) in Hawaii. Dlm. Anderson, T. E. & Leppla, N. C. (Eds.) *Advances in insect rearing for research and pest management*, hlm. 405-426. USA: West View Press.

Yaakop, S. 2011. Taxonomic and phylogenetic study of the Oriental Alysiinae and Opiinae (Hymenoptera: Braconidae). Tesis Ph.D. State University of Groningen.

Yokoyama, V. Y. & Miller, G. T. 1996. Response of walnut husk fly (Diptera: Tephritidae) to low temperature, irrigation, and pest-free period for exported stone fruits. *Journal of Economic Entomology* 89: 1186-1191.

Yokoyama, V. Y. & Miller, G. T. 2004. Quarantine strategies for olive fruit fly (Diptera: Tephritidae): low-temperature storage, brine, and host relations. *Commodity Treatment and Quarantine Entomology* 97(4): 1249-1253.