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Research Note

Predation on pupa of *Chrysomya rufifacies* (Marquart) (Diptera: Calliphoridae) by parasitoid, *Exoristobia philippinensis* Ashmead (Hymenoptera: Encyrtidae) and *Ophyra spinigera* larva (Diptera: Muscidae)

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Abstract. A forensic entomological study was conducted using monkey carcasses (*Macaca fascicularis* Raffles) that were placed in either an outdoor or indoor environment at a coastal area in Tanjung Sepat, Selangor, Malaysia during May until August 2008. We collected pupae of *Chrysomya rufifacies* (Marquart) from the carcasses and kept them individually. The emergence of 13 parasitic microhymenopteran, from one of the pupae occurring within a week were identified as *Exoristobia philippinensis* Ashmead (Hymenoptera: Encyrtidae). Another observation was made whereby a pupa of *C. rufifacies* was predated by a muscid larva, *Ophyra spinigera* (Stein). The larva squeezed into the pupa and consumed the contents. This paper report *C. rufifacies* as a new host record for *E. philippinensis* in Malaysia and highlighted the predatory behavior of *O. spinigera* larva in natural environment.

Insects are attacked by a wide variety of microorganisms, including viruses, rickettsiae, spirochetes, eubacteria, protists and fungi. Insects also are infected by flukes, tapeworms, roundworms, hairworms, thorny-headed worms and parasitic insects. Most of these infections result in death of the host insect and form the basis of several kinds of successful biological control of insect pests (Charles & Norman, 2005).

Parasitoids are most common among Diptera and Hymenoptera. Tachinids are the most important fly parasitoid; others include sarcophagids, pyrgotids, pipunculids, acrocerids and bombyliids. Hymenopteran parasitoids include many hundreds of species in the Ichneumonoidea, Chalcidoidea, Proctotrupoidea, Platygastroidea, Chrysidoidea and Vespoidea (Charles & Norman, 2005). In France, a survey of fly parasitoid showed 95 species of parasites used the nuisance fly, *Musca domestica* L. as a host for reproduction, including *Exoristobia philippinensis* Ashmead (Blanchot, 1992). In Malaysia, the *Sarcophaga* sp. laboratory colony maintained at the Department of Parasitology and Medical Entomology, National University of Malaysia, was parasitized by *E. philippinensis* and a pteromalid, *Pachycrepoideus vindemmiae* Rondani (Kadarsan & Jeffery, 1981). In

addition, there was an article that reported the occurrence of *Spalangia endius* Walker and new host record (*Chrysomya megacephala* F.) for *E. philippinensis* for the first time in Malaysia (Omar *et al*. 1988).

Sulaiman *et al*. (1990) conducted a survey of parasitic microhymenopterans in peninsular Malaysia from May to December and they recovered nine species of parasitoids that were parasitizing pupae of filth flies breeding in refuse dumps and poultry farms including *S. endius* Walker, *Spalangia cameroni* Perkins, *Spalangia gemina* Boucek, *Spalangia nigroaenea* Curtis, and two unidentified species. Other parasitoids collected were *P. vindemmiae* Rondani and *Dirhinus himalayanus* Westwood. They also found that the parasitized fly hosts included *M. domestica* L., *C. megacephala* (F.), *Fannia* sp. and *Ophyra* sp..

A forensic entomological study was conducted at a coastal area in Tanjung Sepat, Selangor, Malaysia (2.6 ºN 101.6 ºE) by using three cynomolgus monkeys (*Macaca fascicularis*) as the carrion model in studying of decomposition process and faunal succession. Observation was made from May to August 2008. The monkeys were sacrificed by euthanasia (single gunshot executed by personnel of Department of Wildlife and National Parks, Ministry of Natural Resources and Environment, Malaysia) and then placed into an abandoned cabin located near the seashore. We collected about 15 pupae of *Chrysomya rufifacies* (Marquart) from the vicinity of a monkey carcass and kept each of them in a separate clean empty bottle (height=5cm; diameter=1.5 cm).

Within a week, 13 microhymenopterans emerged from one of the pupae and these were identified as the parasitoid, *E. philippinensis* Ashmead (Hymenoptera: Encyrtidae) (Figure 1). Identification of the parasitoid species was based on the reference material kept in the medical entomology collection of Department of Parasitology and Medical Entomology, Universiti Kebangsaan Malaysia. Here, we record the pupa of *C. rufifacies* as a new host for parasitoid, *E. philippinensis*, as no previous record exists.

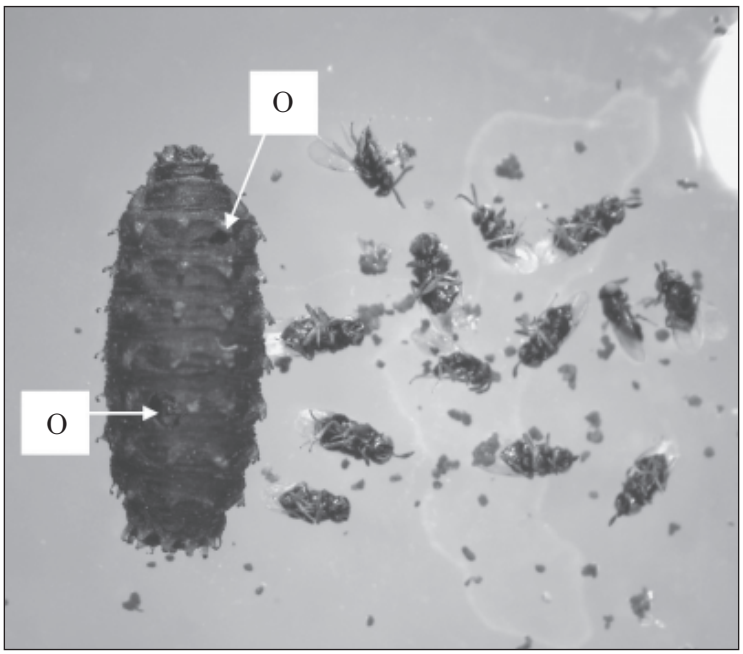

Figure 1. Pupa of *C. rufifacies* and 13 newly emerged parasitoids, *Exoristobia philippinensis* Ashmead. Several tiny openings were noted on the pupa casing (O).

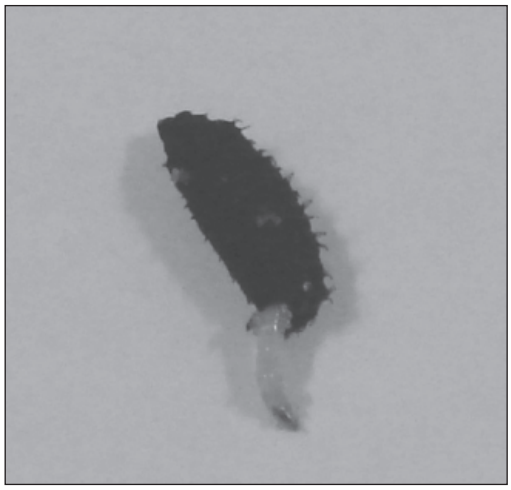

Figure 2. *Ophyra spinigera* larva squeezed into the puparium of *C. rufifacies* and consumed the developing pupa.

Another observation was made on the predatory behavior showed by a muscid larva, *Ophyra spinigera*, on the pupa of *C. rufifacies*. The larvae of *Ophyra* sp. normally feed on rotting organic matter but are also predacious in their second and third instars and are usually recovered from human cadavers during the late stage of decomposition (Byrd & Castner, 2001). In the present case, a monkey carcass was exposed on the beach to study the decomposition process and related faunal succession. We started our routine collection of insect specimens from the decomposing monkey carcass including fly larvae and pupae. During the collection process, we noticed that a *O. spinigera* larva was squeezing into a *C. rufifacies* pupa and remained inside for at least one day. We believe that this larva consumed the pupal content and came out from it on the second day (Figure 2). We later preserved the pupa in alcohol 70% and subsequently, the pupa was floating in the solution, suggesting an empty specimen. This predatory behavior may be related to the availability of food supply (carcass). As food supply decreased during the advance-decay stage of decomposition, the larva of *O. spinigera* started to search for other possible food sources. They could predate on other fly larva, or even predate on pupa, as reported in this study.

This paper reports *C. rufifacies* as a new host for *E. philippinensis* in Malaysia. We also document the predatory behavior showed by *O. spinigera* larva on *C. rufifacies* pupa, which is interesting in terms of ecology and life cycle. However, this predatory activity may occur by chance, and there was no obvious suppression effect observed on the emerging fly population. More ecological observation should be carried out to understand the prey-predator relationship of insects of forensic importance, which may prove useful in forensic investigation, especially in the determination of Postmortem Interval (PMI).

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