

Research Notes

Ants (Hymenoptera: Formicidae) associated with pig carcasses in Malaysia

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Received 22 October 2008, received in revised form 20 December 2008; accepted 21 December 2008

Abstract. An observational study was conducted in an oil palm plantation in Tanjung Sepat, Selangor, Malaysia on August until September 2007 to note the decomposition process of pigs and their related faunal succession. We collected six species of ants (Formicidae) from 3 subfamilies: Formicinae (*Oecophylla smaragdina* and *Anoptolepis gracilipes*), Myrmicinae (*Tetramorium* sp. and *Pheidologeton* sp.) and Ponerinae (*Odontoponera* sp. and *Diacamma* sp.) that were associated with pig carcasses placed on the ground. *Oecophylla smaragdina*, *Pheidologeton* sp. and *Tetramorium* sp. were found on a partially burnt pig carcass whereas the other species were recovered from unburned pig carcass. These ants predated on fly eggs, larvae, pupae and adults. Ants could be found at all stages of decomposition starting from fresh until dry stage. Predatory ants can reduce fly population and thus may affect the rate of carcass decomposition but this was not seen in our study. Even though *O. smaragdina* was seen at all stages of decomposition of the burnt pig, this did not alter much the decomposition process by fly larvae.

A number of different families of Hymenoptera have been reported from animal remains. Eighty two species have been associated with pig carrion in South Carolina, United States. Roles of these species on decomposed bodies differ ranging from direct feeding on the corpse, through predating, to parasitising of other insects exploiting remains. Among the predators, ants can be a significant factor in the decomposition process and retard decomposition of corpses or carrion by decreasing the maggot population (Early & Goff, 1986).

Ants often fed on human skin and body tissues when human remains were left outside in the environment and exposed. In the southeastern United States of America, at least one species of fire ant (*Solenopsis invicta*) is very common and aggressive in their foraging habits. The feeding of these tiny, 3 to 4 mm long ants often leave postmortem damage to tissues that appears to be premortem burns. Acrobat ants also affect the fauna of primary colonizers on remains by feeding on fly eggs and maggots. In some instances the predation rate of ants on fly eggs may be so great that initial

colonization of dipterans or other organisms on decaying bodies may be delayed 2 to 3 days (Bryd & Castner, 2001). If a corpse is located close to their nest they may slow the establishment of the blowfly population through removing eggs and young larvae. However, they may also feed on the tissue of the corpse and thereby speed the process of decay (Alan, 2006). Ants have been reported to cause postmortem damage that resemble premortem strangulation or burns caused by strong acid (Campobasso *et al.*, 2004).

Ants are often overlooked at the corpses' recovery site and the value of these insects as forensic indicators is still not appreciated by forensic investigators. Here we report for the first time six species of ants recovered from pig carcasses placed in an oil palm plantation in Tanjung Sepat, Selangor, Malaysia.

Two young pigs (*Sus scrofa* L.) weighing approximately 10 kg, which died from pneumonia, were immediately placed on the ground in an oil palm plantation (2.6°N, 101.6°E). They were later observed for insects' succession and decomposition process. One of the pigs was partially burned by petrol to simulate a crime whereby the victim was burned, and the other pig was left untreated. Observations were made for two weeks and the presence of arthropods visiting pig carcasses were recorded and photographed. Ants were collected using forceps and preserved in 70% ethyl alcohol and labelled. Species of ants were then identified by the authors from Institute of Biological Science, Faculty of Science, Universiti Malaya, Kuala Lumpur. The authors used the taxonomic keys of identification provided by Bolton (1994) and Hashimoto (2005).

Six species of ants were collected belonging to the family Formicidae and they consisted of three subfamilies: Formicinae (*Oecophylla smaragdina* and *Anoplolepis gracilipes*), Myrmicinae (*Tetramorium* sp. and *Pheidologeton* sp.) and Ponerinae (*Odontoponera* sp. and *Diacamma* sp.). For the unburned pig carcass, it attracted four species of ants such as *Odontoponera* sp., *Diacamma* sp. on the first day of observation

(fresh stage of decomposition). *Anoplolepis gracilipes* was collected on the second day (Fresh stage). *Pheidologeton* sp. was sighted on day-6 (Active decay stage of pig decomposition) and *Odontoponera* sp. was recovered on day-13 (Dry and remains stage of pig decomposition) (Table 1). *Odontoponera* sp. was observed predated on an adult platystomatid fly and carried the fly into their nest under ground. *Diacamma* sp. was observed predated on *Musca domestica* eggs laid on the unburned pig carcass. *Anoplolepis gracilipes* was also a fly-eggs predator. *Pheidologeton* sp. built their nest near the pig carcass on day-6 and carried away fly pupae on day-14.

Three species of ants were collected at the burnt pig: *Oecophylla smaragdina* (from day-1 until day-16, encompassing the fresh to dry and remains stages). *Tetramorium* sp. and *Pheidologeton* sp. were both collected on day-11 (Dry and remains stage) (Table 1). *Oecophylla smaragdina* was the dominant ant species on the burned pig carcass and their presence were diverting the landing of flies on the pig. They preyed on fly eggs, larvae, adult flies and an adult of staphilinid beetle. *Pheidologeton* sp. were also around the burned pig carcass and was seen carrying away blow fly pupae and *Ophyra spinigera* larvae.

In this study, ants were the first to visit both pig carcasses and remained on the carcasses from the fresh stage until the skeleton stage of decomposition. Ants' density and species diversity were more on the unburned carcass compared to the burned one. This may be due to the condition of unburned carcass, which has more surrounding liquid along the body compared to the burned one. Ants were attracted to the decompositional liquid which provided food for them. This study did not reveal any particular ant successional pattern on pig carcasses due to their overlapping presence. However, the failure in detecting any particular ant species in a particular decomposition stages would not mean that ants species were absent during those stages. It could be due to ants hiding under the carcasses or were overlooked.

Table 1. Presence of ants at different stages of decomposition for burned/ unburned pig carcass

Species	Fresh		Bloated		Active decay		Advanced-decay		Dry and remains	
	B	UB	B	UB	B	UB	B	UB	B	UB
<i>Odontoponera</i> sp.		√								√
<i>Diacamma</i> sp.		√								√
<i>Anoplolepis gracilipes</i>		√		√						
<i>Pheidologeton</i> sp.						√			√	√
<i>Oecophylla smaragdina</i>	√		√		√		√		√	
<i>Tetramorium</i> sp.									√	

B = Burned; UB = Unburned

Ants, in particular, can be present at all stages of carrion decomposition as they are opportunistic feeders on fly eggs and larvae. They are typically observed shortly after death or during the early postmortem period and even after the fly maggots had left the body. Ants were categorized as predator in the context of forensic entomology (Smith, 1986). The ants were capable of removing and capturing adults and larvae of flies and beetles thus reducing significantly the rate of carcass decomposition. Nevertheless, ants also feed on carrion itself which could hasten the loss of carcass mass (Campobasso *et al.*, 2004). In our study, although both pig carcasses attracted different species of ants, the rate of decomposition were almost the same, whereby both carcasses achieved the dry and remains stage on day-9. This result indicated that the ant's activity on both pig carcasses produced little effect on the rate of decomposition. Ants were observed to feed on larvae, pupae and adult flies or beetles at the scene, but direct feeding on the carrion tissue was not seen. Since the ants did not eat on the decomposed pigs directly, postmortem artifacts on the pigs' bodies made by ants were also not noted in this case.

Campobasso *et al.* (2004) stated that ants can be numerically dominant arthropod

species on the corpse and can establish a colony. In this study, we found red ants, *O. smaragdina*, present during all stages of decomposition of the burned pig carcass. They fed on larvae and adult flies, and were also observed capturing adult staphilinid and dermestid beetles. *Oecophylla smaragdina* was also seen predated on another ant species (*Diacamma* sp.). *Pheidologeton* sp. was observed to build its nest around the unburned pig carcass on day-6. They established their colony just in one day and disappeared on day-7. *Anoplolepis gracilipes* was sighted on day-2 and was seen in quite a large number on the unburned pig carcass. They predated on blowflies eggs. *Pheidologeton* sp. was the dominant ants at the unburned pig carcass at the later stage of decomposition. They started carrying fly pupae on day-11 and were seen at both the burned and unburned pigs.

Altogether four species of ants (*Odontoponera* sp., *Diacamma* sp., *A. gracilipes* and *Pheidologeton* sp.) were seen on the unburned pig and three species were sighted at the burned one (*O. smaragdina*, *Tetramorium* sp. and *Pheidologeton* sp.). The ants were mostly predators, and even though some were seen feeding on tissues, they did not do much damage on the unburned pig's skin during

the early stage of decomposition. Ants had been reported to cause abrasion or artifacts resembling injuries on dead bodies (Campobasso *et al.*, 2004), but did not seem to produce such marking on our unburned pig.

Acknowledgement. The authors wish to thank Mr. Lay Ah Kwee for supplying the pigs and providing accommodation when the first author was in Tanjung Sepat, and to the Head and staff of the Department of Parasitology & Medical Entomology, Faculty of Medicine, Universiti Kebangsaan Malaysia., Kuala Lumpur for their support.

REFERENCES

- Alan Gunn (2006). *Essential Forensic Biology*. John Wiley & Sons Ltd. England.
- Bolton, B. (1994). Identification guide to the ant genera of the world. London. Harvard University Press.
- Byrd, J.H. & Castner, J.L. (2001). *Forensic Entomology. The utility of arthropods in legal investigations*. CRC Press. Boca Raton, Florida.
- Campobasso, C.P., Marchetti, D. & Introna, F. (2004). Postmortem artifacts made by ants and the effect of ant activity on decompositional rate. *European Association for Forensic Entomology. Second Meeting*. United Kingdom.
- Early, M & Goff, M.L. (1986). Arthropod succession patterns in exposed carrion on the island of Oahu, Hawaii. *Journal of Medical Entomology* **23**: 520-531.
- Hashimoto, Y. (2005). Ant parataxonomic training course. Kuala Lumpur, Universiti Malaya (www.antbase.net/sprache-englisch/ants-southeast-asia/keys.html).
- Smith, K.G.V. (1986). A manual of forensic entomology. Cornell University Press, Ithaca, New York.