

SHORT NOTES:

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**INSECTS ASSOCIATED WITH COLLAPSED PINEAPPLE
FRUITS, HEART ROT PLANTS AND INFLORESCENCES**

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RINGKASAN

Buah nenas yang diserangi oleh *Erwinia chrysanthemi* Burkholder *et al.* biasanya menarik perhatian kumbang, terutama sekali *Carpophilus foveicollis* Murr. dan *Haptoncus luteolus* Er. Semut, terutama *Pheidole* sp., *Iridomyrmex* sp. dan *Tapinoma* sp. dan lalat, terutama *Gymnorerius* sp., *Drosophila* sp. dan *Atherigona* sp. juga menarik perhatian tetapi agak kurang sedikit. Semua serangga ini, termasuk larva *Atherigona orientalis* Schin. *Graptomyza brevirostris* Wied. dan *Thressa incongruens* Beck. juga terdapat pada tisu reput daun yang juga disebabkan oleh kuman *E. chrysanthemi*. Di antara serangga yang terdapat pada bunga nenas yang terbuka, tempat kuman masuk, semut adalah yang terbanyak sekali. Tabiat serangga yang mustahak dan peranan mereka sebagai pembawa penyakit adalah dibincangkan.

INTRODUCTION

Pineapple fruit collapse and heart rot are two serious pineapple disease caused by the bacterium, *Erwinia chrysanthemi* Burkholder, McFadden & Dimock (LIM, 1974a). It has been established that the entry of the pathogen into the fruits was via the open flowers (LIM, W.H. unpublished) and that the main source of inoculum was from freshly collapsed fruits and heart rot tissues (LIM, 1974b).

JOHNSTON (1957) observed certain insects e.g. *Carpophilus foveicollis* Murr, *Haptoncus ocellaris* Frm, *Mimegrella* sp. and *Lasiodactylus pictus* Macl. on diseased fruit, but thought it unlikely they would act as vectors. At that time, little was known about the epidemiology of the disease. However, recent findings, such as entry of the pathogen via the open flowers, has re-opened the possibility of insects acting as vectors. A study was thus carried out to determine the types of insects visiting diseased fruits and 'heart' as well as the open flowers, to identify the possible carriers of the disease.

MATERIALS AND METHODS

Samples of collapsed fruits and flowers were collected at random from three localities: Alor Bukit, Simpang Rengam and Jalan Kebun. Collapsed fruits were encountered in all the areas except Jalan Kebun where over-ripe fruits were collected instead. From each area, 50 to 60 inflorescences and 20 to 40 diseased fruits were collected. Actively flying insects above the fruit or inflorescence were caught with a net while the less active ones were enclosed with a polythene bag and removed together with the fruit or inflorescences. The bag with their contents were taken to the laboratory where the insects were killed with ethyl acetate, identified and counted.

Insects associated with heart rot plants collected at random were only assessed qualitatively.

TABLE 1. INSECTS ASSOCIATED WITH COLLAPSED/OVER-RIPE PINEAPPLE FRUITS AND INFLORESCENCES. INSECTS COMMON TO BOTH FRUITS AND INFLORESCENCES ARE ASTERISKED (*).

	Mean number of insects/fruit or inflorescence					
	Alor Bukit		Simpang Rengam		Jalan Kebun	
	Collapsed Fruits	Infloresc.	Collapsed Fruits	Infloresc.	Collapsed Fruits	Infloresc.
BEETLES (Coleoptera)						
<i>Carpophilus foveicollis</i> Murr.*	35.2	0.05	52.0	0.07	76.4	0.1
<i>Carpophilus</i> spp. *+	2.5	—	2.3	0.3	10.7	0.7
<i>Haptoncus luteolus</i> Er.*	58.4	0.04	67.2	0.4	64.6	0.02
<i>H. ocularis</i> Fairm.	0.3	—	0.1	—	0.8	—
<i>Cryptarcha ocularis</i> Rtt.	3.4	—	4.0	—	—	—
<i>Lasiodactylus picta</i> Macl.	0.1	—	—	—	1.7	—
<i>Brachypephis aequalis</i> Walker	—	—	—	—	0.6	—
<i>Litargus</i> sp.	—	—	—	0.1	—	0.02
<i>Prionocyphon</i> sp.	—	—	—	0.04	—	—
Other beetles	2.6	—	—	—	0.4	—
FLIES (Diptera)						
<i>Drosophila</i> sp.*	0.3	0.02	26.7	0.1	5.8	0.03
<i>Gymnonerius</i> sp.	1.4	—	0.3	0.05	—	—
<i>Mimegrella</i> sp.	0.05	—	—	—	—	—
<i>Lonchaea</i> sp.*	0.07	—	0.2	0.04	—	—
<i>Atherigonal</i> sp.*	—	—	0.2	0.1	—	—
Other flies	0.06	—	—	—	—	—
ANTS (Hymenoptera)						
<i>Pheidole</i> sp.*	6.2	27.4	2.2	1.18	0.2	0.6
<i>Tapinoma</i> sp.*	0.02	—	—	0.07	1.4	1.6
<i>Iridomyrmex</i> sp.*	—	0.02	4.3	0.8	—	1.2
<i>Paratrechina</i> spp.++	—	0.5	—	0.5	0.1	—
<i>Monomorium</i> sp.*	—	0.2	—	—	—	1.8
<i>Solenopsis</i> sp.	—	—	—	—	5.6	—
Other ants	—	0.1	—	0.1	2.0	1.0

TABLE 1. INSECTS ASSOCIATED WITH COLLAPSED/OVER-RIPE PINEAPPLE FRUITS AND INFLORESCENCES. INSECTS COMMON TO BOTH FRUITS AND INFLORESCENCES ARE ASTERISKED (*). (CONTD.)

	Mean number of insects/fruit or inflorescence					
	Alor Bukit		Simpang Rengam		Jalan Kebun	
	Collapsed Fruits	Infloresc.	Collapsed Fruits	Infloresc.	Collapsed Fruits	Infloresc.
MISCELLANEOUS						
<i>Cockroach</i> (Field)	—	0.02	1.0	0.9	—	0.7
<i>Dysmicoccus brevipes</i> ckl. (mealybug)	—	—	—	—	—	0.07
<i>Pseudeucoila</i> sp. (cynipid)	—	—	0.5	—	—	—
<i>Staphylinids</i>	0.2	—	—	0.5	—	0.2
<i>Vespid</i>	—	0.02	—	0.4	—	—
<i>Chalcid</i>	0.04	—	—	—	—	—

+ *Carpophilus* spp. includes *C. mutilatus* Erich. *C. maculatus* Murr. and an unidentified species.

++ *Paratrechina* spp. includes *P. bourbonica* Fore and *P. longicornis* Latr.

RESULTS AND DISCUSSION

The insects common to both inflorescences and collapsed fruits belonged to four taxa: the beetles, ants, flies and field cockroaches (*Table 1*). On the diseased fruits, the beetles, averaging 123 per fruit, were the most common. All the fruits sampled harboured beetles, the most prevalent of which were the souring beetles *Haptoncus ocellaris* Frm., *H. luteolus* Er. *Carpophilus foveicollis* Murr., *C. mutilatus* Erichson, *C. maculatus* Murr., *Carpophilus* sp., and *Cryptarcha ocellaris* Rtt. Among them, *H. luteolus* and *C. foveicollis* were most predominant (*Table 1*). Ants e.g. *Pheidole* sp., *Iridomyrmex* sp., *Tapinoma* sp., and *Paratrechina* spp. and flies e.g. *Gymnonerius* sp., *Atherigona* sp. and *Drosophila* sp. were also observed on diseased fruits. The average ant population observed on fruits was relatively low (5.4 per fruit). It was noted that the ants were continuously on the move along trails, unlike the more sedentary beetles. Thus the number of ants counted from sampled fruits or inflorescences at any one time may not reflect the actual number visiting them.

On the inflorescences, however, the insect complex was different. The ants, averaging 12 per inflorescence were the most prevalent, followed by the beetles (0.6 per inflorescence), cockroaches (0.3 per inflorescence) and flies (0.1 per inflorescence) (*Table 2*). In addition, the ants were the most widespread, being isolated from 71.5 percent of the inflorescences sampled, followed by the beetles (23.3%) and flies (4.1%) (*Table 2*). Of these, the ants appeared to be the main insects visiting the open flowers in search of nectar. Inflorescences with more than 60

ants (*Pheidole* sp.) were observed. The same species of ants that visited the collapsed fruits, an important source of inoculum, also visited the open flowers, which has been established as the main point of entry for the pathogen (LIM, W.H. unpublished). In a well established pineapple field, ants forming trails on the ground, may pass over diseased fruits, plants with heart rot, trash and plant parts contaminated with diseased juice. In the process, they could probably pick up the pathogen and transfer them to the flowers.

TABLE 2. SUMMARY OF THE 3 MAIN CATEGORIES OF INSECTS ASSOCIATED WITH COLLAPSED FRUITS AND INFLORESCENCES IN THE 3 LOCALITIES STUDIED.

Insects	Mean number of insects per inflorescence of fruit		Percentage of sampled inflorescences having these insects.
	Collapsed Fruits	Inflorescence	
Beetles	123.1	0.6	23.3
Ants	5.4	12.0	71.5
Flies	11.7	0.1	4.1

The occasional souring beetles found on the inflorescence do not normally visit open flowers directly, although they may walk into them while wandering on the inflorescence. They are usually found beneath the petals of withered flowers.

In general, the flies hover above the inflorescence, occasionally settling down on the open as well as decaying flowers. The few cockroaches encountered were essentially scavengers.

The insects on heart rot plants, also a source of inoculum, were similar to those observed on the diseased fruits, but in addition, the larvae of some flies viz. *Graptomyza brevirostris* Wied, *Atherigona orientalis* Schin, and *Thressa incongruens* Beck, were found.

CONCLUSION

With so many insects visiting collapsed fruits and heart rot plants, two important inoculum sources for the disease, it is highly probable that they help in the dispersal or transmission of the pathogen. Ants, because of their almost constant presence on open flowers and their association with collapsed fruits, are thought to be the most likely agent responsible for transmitting the disease. Flying insects such as beetles or flies, although not often seen on open flowers, also visit the inflorescences and thus may act as vectors of the pathogen, though probably to a lesser extent.

Transmission studies of the possible carriers (especially the ants and beetles) and related studies will be reported in a subsequent paper.

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SUMMARY

Pineapple fruits attacked by *Erwinia chrysanthemi* Burkholder *et al.* frequently attracted large populations of the souring beetles, predominantly *Carpophilus foveicollis* Murr. and *Haptoncus luteolus* Er. Ants, mainly *Pheidole* sp., *Iridomyrmex* sp. and *Tapinoma* sp. and flies, mainly *Gymnorerius* sp., *Drosophila* sp. and *Atherigona* sp. were also attracted but to a lesser extent. These insects, including the larvae of *Atherigona orientalis* Schin. *Graptomyza brevisrostris* Wied and *Thressa incongruens* Beck were also found on heart rot tissues. Among the insects found on open pineapple flowers, the point of bacterial entry, ants were the most widespread and abundant. The habits of the more important insects and their roles as possible carriers of the disease are discussed.

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