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Prevalence of an Entomopathogenic Fungus, *Hirsutella citriformis* on Leucaena Psyllid, *Heteropsylla cubana*, in Malaysia

AHMAD SAID SAJAP
Department of Forest Management
Universiti Pertanian Malaysia
43400 UPM, Serdang, Selangor Darul Ehsan, Malaysia

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ABSTRAK

Psilid petai belalang, Heteropsylla cubana *Crawford (Homoptera: Psyllisae) ialah perosak eksotik penting* Leucaena leucocephala *(Lam.) (Leguminosae) di Asia Tenggara, Kepulauan Pasifik, Hawaii dan Australia. Walaupun serangga ini telah merebak dengan meluas di Malaysia, tiada maklumat mengenai entomopatogen berkaitan dengan perosak ini telah direkodkan. Kajian ini melapurkan untuk pertama kali kehadiran kulat entomopatogen,* Hirsutella citriformis *Speare (Deuteromycotina: Hyphomycetes) pada psilid petai belalang,* H. cubana *di Malaysia. Keputusan dari penyampelan bulanan selama setahun menunjukkan bahawa psilid petai belalang boleh dijangkiti oleh kulat* H. citriformis. *Psilid mati didapati menjadi keras dan terlekat dengan miselia berwarna krim pada daun dan ranting pokok petai belalang. Keputusan juga menunjukkan bahawa psilid dewasa lebih mudah dijangkiti oleh kulat berbanding dengan nimf. Kadar purata jangkitan berlaku pada populasi dewasa ialah 20% manakala populasi nimf mengalami kurang daripada 2% kadar purata jangkitan.*

ABSTRACT

The leucaena psyllid, Heteropsylla cubana *Crawford (Homoptera: Psyllidae) is a serious exotic pest of* Leucaena leucocephala *(Lam.) (Leguminosae) in Southeast Asia, Pacific Islands, Hawaii and Australia. Even though the insect is already widespread throughout Malaysia, no information on the entomopathogens associated with this pest has been recorded. This study reports, for the first time, the occurrence of an entomopathogenic fungus,* Hirsutella citriformis *Speare (Deuteromycotina: Hyphomycetes) on the leucaena psyllid,* H. cubana *in Malaysia. Results from monthly sampling of the psyllid over a period of one year established that the leucaena psyllid,* H. cubana *was susceptible to infection by the fungus,* H. citriformis. *Dead psyllids were found mummified and cemented by cream-coloured mycelia to the leaves and branches of the leucaena plant. The results also showed that adult psyllids were more prone to fungal infection than nymphs. The adult population had an average infection rate of about 20% while nymphs had an infection rate of less than 2%.*

INTRODUCTION

Leucaena leucocephala (Lam.) (Leguminosae), an exotic fast-growing multipurpose species, is an important plant in the rural economy of the people in the Southeast Asia region. This perennial nitrogen-fixing plant, commonly found planted in farms with other crops such as maize, groundnut and tapioca, is widely used as animal feed, firewood and as a vegetable for human consumption. The plant has also been recognized as one of the most promising forage and tree crops for the tropics (Anon. 1977). In recent years, however, leucaena plantations in this region have been threatened with problems of frequent outbreaks of an introduced insect pest, the leucaena psyllid, *Heteropsylla cubana* (Crawford) (Homoptera: Psyllidae). This psyllid causes heavy defoliation and stunting of the plant. Repeated infestations can also lead to death of the branches and sometimes the whole plant. In Malaysia, the psyllid, which may have come earlier than 1986 when it was first re-

ported (Tho 1986), has spread widely throughout Peninsular Malaysia and Sabah and Sarawak.

Even though the psyllid can now be found essentially on any leucaena plant in Malaysia, few studies with respect to the biology and ecology of this pest have been undertaken (Lim *et al.* 1989). No information on its natural enemies, particularly its entomopathogens, has been documented. Studies elsewhere, however, have shown that this psyllid, like many homopterans, is prone to infection by a number of entomopathogenic fungi (Hsieh *et al.* 1987; Napompeth *et al.* 1989; Villacarlos *et al.* 1989). This paper reports for the first time the prevalence of an entomopathogenic fungus, *Hirsutella citriformis* Speare on the leucaena psyllid, *H. cubana* and its impact on the seasonal abundance of the psyllid population in Malaysia.

MATERIALS AND METHODS

Field Survey

A monthly field sampling, from October 1988 to September 1989, was carried out in two leucaena plots. These plots were located at the Universiti Pertanian Malaysia, Serdang and Ijok, Kuala Selangor, Selangor, Malaysia. Ijok is approximately 80 km from Serdang. From each locality, twenty leucaena plants were randomly selected and a shoot was randomly sampled from each plant. The chosen shoot was wrapped in a clear polythene bag and the shoot cut to a length of 15 cm. This was done quickly so as to minimize escape by the adult psyllids. The samples were kept in an ice chest and brought back to the laboratory for examination. The number of nymphs and adults, dead and alive, were recorded. Dead psyllids were examined under a dissecting microscope for fungal infection. Other dead individuals were examined under a scanning electron microscope. For this purpose, infected psyllids were air-dried, coated with gold-palladium alloy, and examined with a Stereoscan 360 Cambridge electron microscope. Samples of infected psyllids were also sent to the CAB-International Mycological Institute, Kew (U. K.) for identification.

Weather Data

Weather data were obtained from Serdang only since Ijok has no facility for recording weather. Local temperatures, precipitation and relative humidities were recorded.

RESULTS AND DISCUSSION

Population of Leucaena Psyllid

Mean population estimates of leucaena psyllid densities sampled over twelve months from two localities are presented in *Figs. 1* and *2*. The overall results show that the psyllid population densities varied greatly from month to month with adult population densities invariably lower than those of the nymphs. The population from Serdang fluctuated from two to 160 nymphs/shoot with a mean of 68 nymphs/shoot/month and numbers of adults fluctuated from four to 44 adults/shoot with a mean of 22 adults/shoot/month (*Fig. 1*). The population density recorded from Ijok was significantly higher than that from Serdang with numbers fluctuating from 47 to 442 nymphs/shoot with a mean of 131 nymphs/shoot/month and adults from three to 137 adults/shoot with a mean of 70 adults/shoot/month (*Fig. 2*).

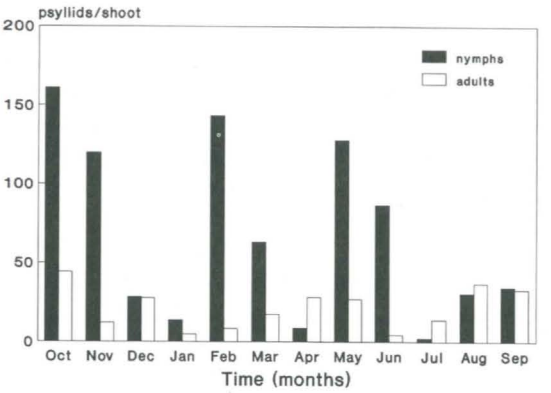

Fig. 1: Population densities of H. cubana *at Serdang in 1988/89*

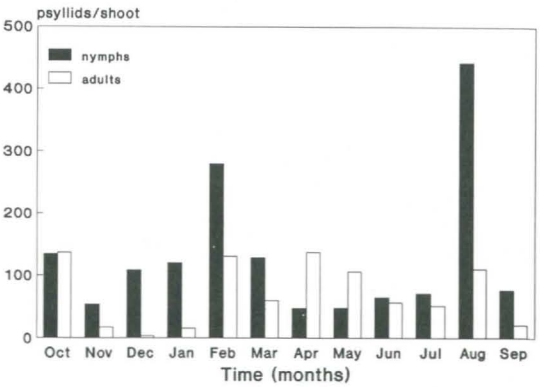

Fig. 2: Population densities of H. cubana *at Ijok in 1988/89*

Prevalence of H. citriformis*-infected Psyllids*

The leucaena psyllids were infected by *H. citriformis* in the two plots surveyed. Infected psyllids were mummified and cemented to leaves and branches of the leucaena plant. A thick mat of cream-coloured mycelia enveloped the psyllid and, in some instances, with synnemata growing from the mycelial substrate (*Plate 1*). This hyphomycete fungus is characterized by the presence of cylindrical synnematous hyphae which bear laterally-scattered phialides. The synnemata measure 114 - 200μm in width and 300-780 μm in length and are club-shaped. The phialides, clustered on the synnemata, measure about 20 μm in length, are cylindrical with globose bases tapering into a long neck towards the tip. The conidia which measure 0.33 x 1.00 μm are ellipsoidal in shape and are found singly at the pinnacle of the phialides (*Plate 2*).

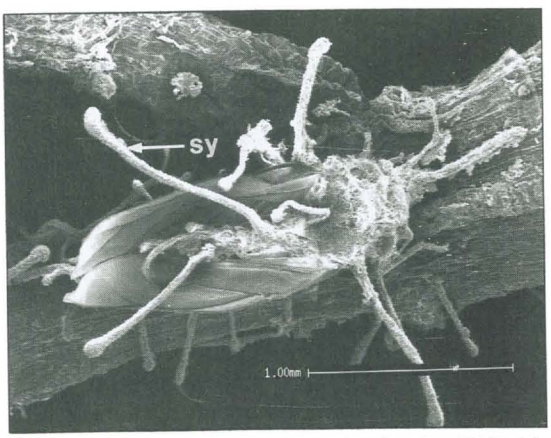

Plate 1 Heteropsylla cubana *adult infected and killed by* H. citriformis *fungus. sy = synnema*

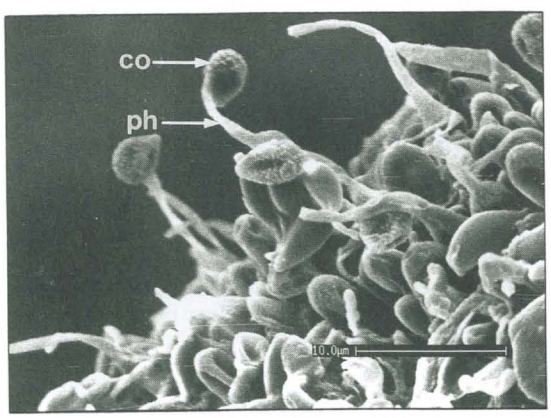

Plate 2 Conidia of H. citriformis *fungus formed at the tip of basally swollen phialides co = conidium; ph = phialide*

Although the psyllids were prone to infection by *H. citriformis*, the levels of fungal infection varied seasonally and from field to field. The psyllid population from Serdang had a mean number of infected nymphs and adults ranging from zero to 8 and zero to 12.2/shoot, respectively (*Fig. 3*). Samples from Ijok had a mean number of infected nymphs and adults ranging from zero to 7.5 and zero to 42.3/shoot, respectively (*Fig. 4*). These levels of infection constituted approximately 4.9 and 6.5% of the total monthly population densities sampled from Ijok and Serdang, respectively.

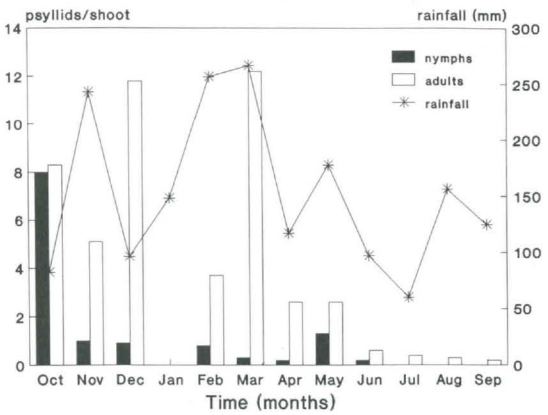

Fig. 3: Population of H. cubana *infected with* H. citriformis *fungus and rainfall recorded from Serdang in 1988/89*

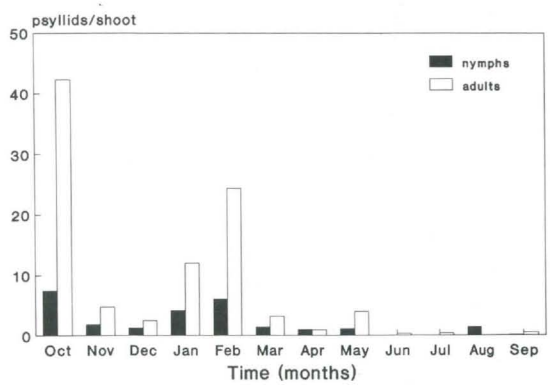

Fig. 4: Population of H. cubana *infected with* H. citriformis *fungus recorded from Ijok in 1988/89*

The prevalence of fungal-infected psyllid was apparently affected by the stage of psyllid development. Adults had a higher rate of infection than did the nymphs despite the fact that the proportion of nymphs in the population was

higher. The infection rates for adults ranged from zero to 77% with a mean of 20% in Ijok and from zero to 70% with a mean of 23% in Serdang compared with less than 2% in the nymphal population examined at both localities. The slow growth of the fungus relative to the frequent moulting and short duration of nymphal development may be in part the reason for the low rate of nymphal infection. On the other hand, long adult longevity could have permitted the process of successful fungal infection to occur and thereby contributed to a greater incidence of adult infection.

Even though no significant correlation between the level of infection and local temperature, humidity and precipitation was detected, there was, however, the tendency of higher rates of infection during the wet season and when population densities were high (*Fig. 3*). This relationship has also been observed in the Philippines where epizootics due to fungal diseases of leucaena psyllids occurred most frequently during wet seasons (Villacarlos *et al.* 1989).

CONCLUSION

Hirsutella, a common fungus isolated from a wide range of insects (Samson *et al.* 1988), has not been fully exploited for use in the microbial control of insects. Only one species, *H. thompsonii* Fisher, has been widely and effectively used against citrus mites (McCoy 1981). *Hirsutella citriformis* which was tested with considerable success for the control of the rice brown planthopper, *Nilaparvata lugens* (Stahl) (Rombach *et al.* 1986) has yet to be accepted as one of the potential means of controlling the insect pest. The frequent occurrence of *H. citriformis* in the natural psyllid population suggests that the fungus may have potential as a microbial control agent for leucaena psyllid. Augmentation of the fungus through field application could possibly induce epizootics in the pest population. The success of such technique, however, will be dependent on detailed information on the dynamics of the host, pathogen and disease (Carruthers and Hural 1990).

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