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OVIPOSITION PREFERENCE DETERMINATION OF *Diaphorina citri* Kuwayama TO THE SYMPTOMATIC AND ASYMPTOMATIC CITRUS PLANT OF CVPD FOR SUPPORTING AGRO-TOURISM ON CITRUS

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ABSTRACT

Most of citrus orchards have been destroyed by Citrus vein phloem degeneration (CVPD). CVPD is the most impediment disease in citrus production in the world. The disease also caused some of Indonesian indigenous citrus varieties endangered. The varieties are locally specific which are potential for agro-tourism. The attractiveness of either symptomatic or asymptomatic citrus plants of CVPD to *Diaphorina citri* Kuwayama [Hemiptera: Sternorrhyncha: Psyllidae] was evaluated under laboratory conditions to determine the oviposition preference of *D. citri* on symptomatic citrus plant of CVPD. Iodine test was initially performed for determining five scores that expressed the level of severity of CVPD. Score one for asymptomatic citrus leaves, and the score 2-5 for symptomatic citrus leaves with a score of five as the highest level of severity. At the first experiment, gravid females were exposed to the five scores of citrus plants with four buds on each plant and the oviposition preference was determined. *D. citri* gravid females laid their eggs on the CVPD symptomatic as well as on asymptomatic citrus plant. The second experiment was conducted to determine the olfactory response of gravid females to the buds of five scores of citrus plants in Y tube olfactometer. The attractiveness of *D. citri* gravid females to the odor of CVPD symptomatic citrus plants was higher than to the asymptomatic. The result indicates that oviposition preference was not driven by olfactory response.

KEYWORDS: oviposition preference, *Diaphorina citri*, CVPD, citrus

INTRODUCTION

Agrotourism is an agriculture activity located at the tourism area. To attract the visitors, especially at fruit plant orchard, they are given an opportunity to pick and taste up the fruits directly at the location, so it is necessary to provide fresh fruits from healthy plants or uninfected plants. One of pest which attacks the citrus plants is *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae).

D. citri is a major pest in central and southern Asia due to its ability as the vector of citrus vein phloem degeneration (CVPD) (Aubert, 1990). Fourth and fifth instars as well as adults are able to transmit diseases (Xu et al., 1988). CVPD is caused by *Candidatus Liberibacter asiaticus* (Jagoueix et al., 1994), and it is noted as the most

plant were not significantly difference. The development and survivorship of insect that feed on diseased plant did not decrease (Musser et al., 2003). Moreover, the degeneration made the insect insert their stylet easily trough epidermis into phloem tissue. Some insects mainly aphids more prefer to feed on disease plant than on healthy plant (Wan & Barbosa, 1990; Kingdom & Hogenhout, 2007). Disease also caused the change of metabolism processes in plant, mainly the secondary metabolic products for the plant defense mechanism to insect attack. Disease decreased poisonous effect of the products to insect (Wan & Barbosa, 1990).

Degradation on nutrition by liberibacter in citrus plant with score 5 were suggested higher than other scores, and it affected to availability and composition of nutrition that lead to unsuitable for *D. citri* to live on.

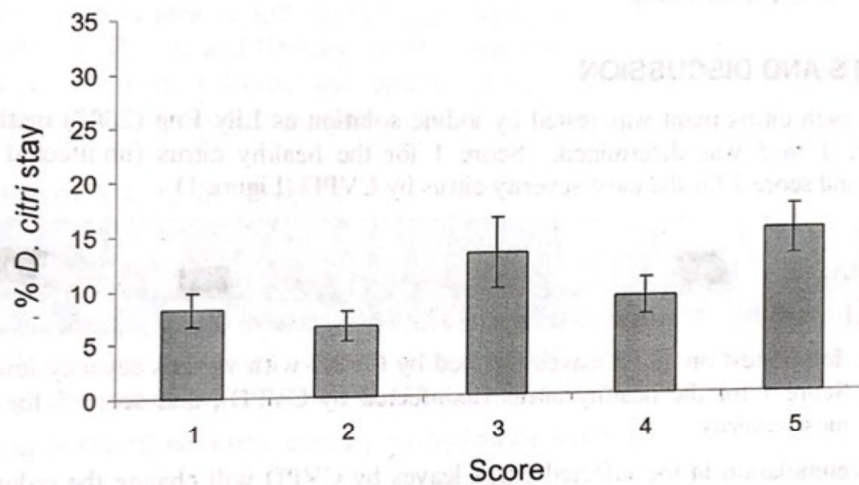


Figure 2. The percentage of *D. citri* gravid female stayed for laying egg on citrus buds with various score of severity level of CVPD. No significant difference was observed ($P=0.05$)

There was no significant difference ($P=0.05$) on the preference of *D. citri* gravid female stayed for feeding and laying egg on citrus buds with various score of severity level of CVPD (Figure 2). The performance of buds on healthy plant was not different to infected plant. The characteristic symptom of CVPD will appear after the leaves completely opened (mature leaves). The selection of buds by gravid female was tended only base on the age and the hardness of buds for laying egg and for feeding of their offspring. It was difficult to obtain the buds with the same length at once, so buds in range 6 – 10 mm length were used in this research.

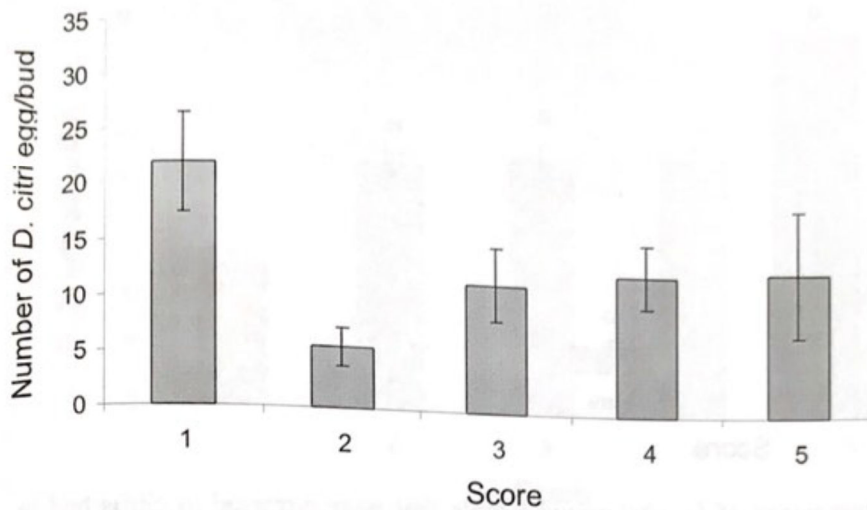


Figure 3. The number of *D. citri* egg per bud on citrus buds with various score of severity level of CVPD. No significant difference was observed ($P= 0.178$)

The number of egg laid in each citrus bud with various score of severity level of CVPD was not significantly difference ($P= 0,178$), as shown at figure 3. High variation of buds length in each sample plant and in replication produced high standard error value that lead to the insignificant difference. Highest number of egg was tended being laid at healthy plant (score 1).

Healthy plant with score 1 tended to have the highest number of eggs. High variation that gave rise to a high standard error on each score caused unnoticeable difference. The variation was caused by buds condition on the same tree or on its replicates.

These results indicated that symptom score did not affect the number of egg. The results also showed that the CVPD infection did not occur at the leaves which was still in bud stage.

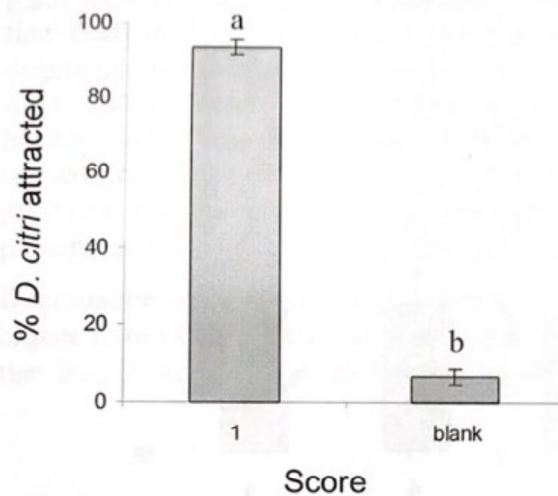


Figure 4. Percentage of *D. citri* gravid female that were attracted to citrus bud in comparison with those interested in blank tube. Column with the same letter tags indicated no significant difference was observed ($P=0.05$)

Before testing in various symptom scores of CVPD, *D. citri* adults and gravid females were tested by using citrus buds and blank. At the beginning of the test was almost 100% *D. citri* moved to citrus buds (Figure 4). It was verified that *D. citri* was able to recognize the original stimulus or its host. In addition, the results showed that the olfactometer was quite effective to test the olfactory response of *D. citri*.

It was suggested that CVPD infected citrus leaves released more specific volatile compounds in comparison with healthy one. This compound was used a cue of *D. citri* in searching the host. Similar results were also obtained by Eigenbrode *et al.*, 2002 in *Myzus persicae* with potato plants suffering from Potato leafroll virus. Volatile compounds produced by diseased potato plants were higher than healthy plants. The proportion of compound content did not differ between the diseased plants with healthy plants. This leads to strong stimulus (attractant) for *D. citri* puller to come on diseased plants.

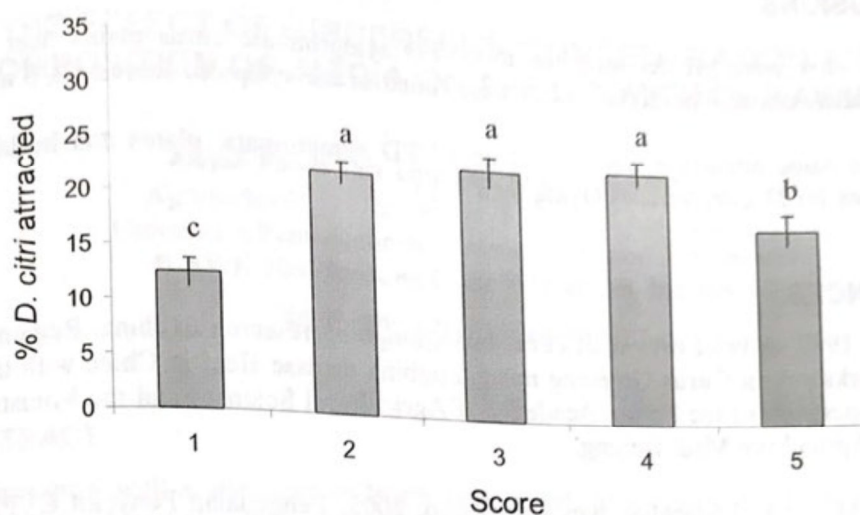


Figure 5. Percentage of *D. citri* gravid females attracted to citrus buds with a various of CVPD symptom score. Column with the same letter tags indicated no significant difference was observed ($P= 0.05$)

Olfactometer test indicated that *D. citri* gravid females more prefer the buds of the CVPD symptomatic plants (Figure 5). The most attracted citrus buds were the buds with a score of 2, 3 and 4, as 22.19%, 23.24%, and 23.69% gravid females move to the stimulus respectively. Buds in healthy citrus plant were only attract 12.39% of *D. citri* gravid females.

That was considerably caused by an increase of specific volatile compounds released by buds (Eigenbrode *et al.*, 2002). This compound was a cue of the existence host that could be used as a feeding site and laying their eggs.

Overall, there were specific and mutually beneficial relationship (mutualism) between insect vectors (*D. citri*) and bacteria of CVPD. By the presence of the bacteria that caused CVPD, *D. citri* was easier to find its host to feed and lay their eggs. While the presence of its vector (*D. citri*), pathogenic bacteria might spread rapidly, to infect new hosts (healthy plant citrus) if necessary

The implications of these results in the prevention of the spread of CVPD disease on citrus plants in citrus orchard which are potentially for agro-tourism are to deny the existence of diseased plants inside or around the area of healthy citrus plants. CVPD vector control should be more focused on the CVPD symptomatic plants. Endangered citrus varieties will be conserved and citrus orchard besides producing fruit, can also be developed into tourism destination as the added value. People are able to get the experience of managing, cultivating, harvesting, exploring or even tasting various citrus varieties which are unique and locally specific.

CONCLUSIONS

1. *D. citri* were greater attracted to CVPD symptomatic citrus plants than to healthy citrus. The highest rates were found in the symptom score of 2, 3 and 4.
2. The same attraction were found on CVPD symptomatic plants and healthy plant for *D. citri* females laying their eggs

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