1. A POSSIBLE RELATIONSHIP BETWEEN STEM PITTING AND CITRUS VEIN PHLOEM DEGENERATION (CVPD)

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Introduction

A disease, we call Citrus Vein Phloem Degeneration (CVPD), the symptoms of which resemble those of Likubin, is very serious for certain areas in Java and Sumatra[7,8]. In West Java alone it was estimated, that more than 3 million trees were destroyed, amounting to billions of rupiahs of lost[2].

In the context of determining CVPD affected areas, South Borneo was visited for the first time in 1971[8]. The areas surrounding Banjarmasin was again visited in 1974. Both visits gave negative result as to the presence of CVPD symptoms.

In 1975 it was reported, that in the Barambai area—not visited before—virus like symptoms on several young citrus trees were observed. The trees are marcots derived from local nurseries at Sungai Tabuk and Sungai Madang, located about hundred kilometers from the area where the symptoms were found.

To determine whether the symptoms were caused by CVPD or another agent, bearing any relationship with CVPD, a survey was conducted in the transmigration area Barambai as well as in the area where the marcots had come from, i.e. Sungai Madang and Sungai Tabuk. A comparison was made with trees of a certain CVPD affected area of West Java (Garut) and also with trees of another area of West Java (Pasirjati) that is certain not affected by the disease.

Method and Results

The identification of CVPD, as done before in sveral citrus areas in Indonesia, was based on typical external and internal symptoms. The external symptoms are a.o.: 1. Yellowing of leaves of a part or of the whole crown. 2. The yellow leaves are more or less stiff and leathery and seem to be thicker than normal. 3. Blotching may be present but not necessarily. 4. Veinlets (not mid or mainveins) of the yellow leaves are contrasted against the light coloured back ground, the mesophyll. 5. All these symptom[5] may be found on developed leaves, but not on young ones. 6. Almost similar symptoms may be found on the end part of a twig or a branch of a healthy trees, the bark of which has been ringed or removed as done in making marcots. Therefore, one has to be careful as not take leaf samples from such ringed twigs.

The internal symptoms are: 1. The phloem of the yellow or chlorotic leaves is much thicker than normal. 2. Sievetubes and companion cells are collapsed, forming white bands extending from sclerenchym to xylem. 3. Raycells remain intact, in which starch granules are stored in abnormal quantities.

The above symptoms were not found on all the suspected trees in South Borneo, which bear leaves showing deficiency symptoms to manganese, zinc and perhaps iron. Instead, symptoms were found on twigs, branches, limbs and trunk, consisting of longitudinal furrows in the wood beneath the bark, whereas on the inner part of the bark, corresponding pegs were present. These were found at Barambai as well as at Sungai

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Tabuk and Sungai Madang. There was no rotting of the bark, either of the limbs or of the trunk. Even the rootsystem seemed to be normal.

The discovery of these symptoms gave rise to a question, as to whether furrowing or pitting bears any relationship with CVPD or whether it represents another type of causal agent.

One of the efforts to answer this question is to collect twigs and small branches from CVPD affected areas in West Java (Garut) and to observe, whether this type of pitting is also apparent in the samples. More than 150 small branches were collected, each from CVPD affects tree. Beside this, stem pitting on the rootstock was also examined. The results are as follows:

Table 1. Stem pitting on branches and rootstocks of some mandarin varieties and a sweet orange, affected by CVPD.

Varieties or species	Number of trees observed	Stem pitting on branches		Total branches with stem pitting	Stem pitting on rootstock		Total rootstock with pitting
		mild	severe		mild	severe	
1. Onde	88	7	0	7	60	15	75
2. Manis, *C. sinensis*	11	2	0	2	0	0	0
3. Cina licin	53	4	0	4	18	5	23
4. Siem	17	0	0	0	8	1	9
Total	169	13	0	13	86	21	107

To compare the CVPD affected trees with those not affected, rootstocks of trees free of the disease were examined, i.e. in an isolated area, located about 60 kilometers from CVPD affected area. The results are as follows:

Table 2. Stem pitting on rootstocks of some mandarin varieties, a sweet orange and a pomello variety, free from CVPD.

Species or varieties	Number of trees examined	Stem pitting on rootstock		
		mild	severe	total
1. Akhyar	11	6	1	7
2. Onde	5	1	1	2
3. Bali, *C. maxima*	9	3	0	3
4. Manis, *C. sinensis*	10	4	0	4
5. Kara	11	3	4	7
6. Siem	10	2	0	2
Total	56	19	6	25

Discussion and Conclusion

Stem pitting on branches and twigs is not much found on CVPD affected trees of West Java as contrary to that on suspected Siem trees in South Borneo. On the other hand, stem pitting on the rootstocks of CVPD diseased trees seems to be common as it is shown in Table 1. That this pitting is not uncommon on CVPD free trees is apparent from Table 2. In other words, stem pitting, both mild and severe on rootstocks, may be

found on CVPD affected trees as well as on CVPD free ones.

Although Fraser[1] has a somewhat different meaning attached to stem pitting or stem furrowing than that of Wallace[11], both are convinced, that the cause is a virus. According to Fraser, stem pitting may act as tristeza (kills budling, the stock of which is sour orange), if it is accompanied by another virus, the seedling yellows virus, whereas Wallace is convinced, that the stem pitting virus may act in the same way as tristeza, in the presence or absence of the seedling yellows virus.

That the stem pitting virus is widespread and found on different scion and stock varieties and species including *C. sinensis,* as represented by the pitting symptom on branches and trunk was published by Rodriguez et al[3], Rosetti et al[4], Salibe[5,6] and others. Nearly all of them consider it as the same as tristeza, thus supporting the findings of Wallace.

From the data presented by the survey, it could be concluded, that the stem pitting virus (SPV) alone may not produce CVPD symptoms, as stem pitting symptoms may be found on CVPD free trees. On the other hand, it is difficult to make a conclusion, that SPV does not take part in the production of the CVPD syndrome. The number of trees affected by CVPD which show stem pitting on the rootstock is too large and the small number that do not show the pitting may mask the symptom rather than not containing the SPV.

Another fact that could be obtained is that the scion varieties in West Java are relatively tolerant to the SPV present in this area, whereas the marcots in South Borneo are susceptible to the virus present there. On the other hand, rootstock varieties used in West Java are relatively susceptible as is shown by the large number of trees having the pitting.

That the SPV could be a component in the production of the CVPD syndrome may be supported by some reults obtained from previous experiments: 1. CVPD symptoms on mandarin seedlings could only be produced by inoculating them with both *Aphis tavaresi* and *Diaphorina citri,* but not by either one alone [10]. 2. Both slender virus like particles and mycoplasma like bodies were found in sieve tube cells of the phloem of a mid vein of a graft inoculated seedling, as observed under the electron microscope at Wageningen[9]. 3. Graft inoculations made on *Citrus aurantifolia* seedlings gave also stem pitting and vein clearing, beside the usual CVPD symptoms[7,10].

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Discussion

D.A. Benigno, Philippines: Please explain further No. 2 on page 4 last paragraph. Do you mean that CVPD is caused by 2 different organisms?

Answer: As we know, the presence of a micro-organism or micro-organisms in a tissue of a plant does not prove that it or they are the causal agent(s) of the disease unless you have successfully demonstrated it through Koch's postulates.

So we still consider the presence of both virus and mycoplasma as a clue for the possibility of the causal agent.

In other words it is possible that both the virus and the mycoplasma are both its causal agents of CVPD. It might be that there is some synergistic effect by both agents in forming CVPD symptoms as it is suggested with Likubin disease.

W. P. Ting, Malaysia: Apart from mandarin and sweet orange what other citrus species are affected by CVPD?

Answer: There are no resistent varieties or citrus species, including mandarins, oranges, limes. All are susceptible. Also seedlings can be affected.

Our citrus species collections in several places are wiped out by CVPD.

I. N. Oka, Indonesia: What is the nature of the infectious agents (mycoplasma) once it is in the body of the insect? Is it of persistent nature or something else?

Answer: Since there is a rather long latent period (more than 2 weeks) before the insect is infective, I think that the agent belongs to the persistent type. Besides, I do not think that there are instances in which mycoplasmas act as a non-persistent agent in their vectors.