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Etiology of brown leaf-tip disease of Tangxi loquat

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SUMMARY – Loquat crop in Tangxi is very sensitive to brown leaf-tip disease, which greatly affected the quantity and quality of fruits. This paper presented the results of a study during 20 years aimed at determining the etiology of the disease conducted.

Key words: Brown leaf-tip disease, symptoms, etiological investigation, loquat.

RESUME – *"Etiologie de la maladie du brunissement de la pointe des feuilles chez le néflier Tangxi". Les néfliers de Tangxi sont très sensibles à la maladie du brunissement de la pointe des feuilles, qui affecte fortement la quantité et la qualité des fruits. Cet article présente les résultats d'une étude visant à déterminer l'étiologie de la maladie, menée sur 20 ans.*

Mots-clés : *Maladie du brunissement de la pointe des feuilles, symptômes, recherches étiologiques, néflier.*

Introduction

The mild weather and enriched soil in Tangxi suits very well for loquat crop. In Tangxi, the species was well-known as early as Tang Dynasty. However, since late of seventies, the crop suffered severe brown leaf-tip disease, which affected greatly the quantity and quality of fruits. We have been investigating the brown leaf-tip disease over 20 years, and report the results below.

Symptoms

The disease is mainly seen in young leaves. When leaves grow to around 2-3 cm, the tip begins to turn to brown, which gradually spreads to the middle and other parts of the leaf. The disease resulted in deformed leaves, sharp tip leaves, which a size 1/3-1/2 less than normal ones, in very severe cases the whole leaf becomes dark brown and dies.

Discovery of the disease and susceptibility to the disease

The disease was first noticed in young leaves of the Ruantiao-Baisha cultivar, located at Tangxi in the summer of 1979. Afterwards, we found that the disease is common in the whole Tangxi loquat planting area, around 100 square kilometers. The disease is more obvious in the areas that are close to the brickkiln and iron-casting factories. The disease is being increasing in the recent 20 years. However, it is not present in those areas located at 50-kilometer away from Tangxi, such as Xianlin and Shuanqian.

There is diversity among cultivars related to susceptibility to the disease.The Ruantiao-Baisha and Pingtou-Dahongpao are the most severely affected among all the cultivars from *Eriobotrya* species, and Daye-Yangdun is the least susceptible.

Etiology

In order to explore the etiology of the disease, we conducted a study which results are reported.

Cultivar degeneration

The loquat crop in Tangxi has a long planting history. Among the most ancient cultivars are Pingtou-Dahongpao and Ruantiao-Baisha, which are the cultivars where the disease showed the most severe symptoms. The cultivar most recent introduced is Baozhu, which showed the less severe symptoms. This fact suggested that the disease may be related to the cultivar degeneration. Therefore, we re-planted Pingtou-Dahongpao and Ruantiao-Baisha cultivars in other locations such as Shuanqian, Yuhang and Laolinwei, Chunan. After 18 years, these two cultivars grow strong and fine with no any evidence of such disease. The conclusion is that the disease is not related to the cultivar degeneration.

Plant aging

Institute of Horticulture, Agricultural Academy of Zhejiang examined the ages of loquat plants, finding that 92% of adult loquat trees from Tangxi area were 5-30 years old. Since the trees are not old, and the disease also occur in young plants, we believe that it is not related to the plant aging either.

Infectious disease

Is the disease due to an unknown infection? We sent loquat samples to Zhejiang Agricultural University for further examination. Professor Ruobin Cao concluded that it was not due to an infectious disease.

Soil physical-chemical properties

We measured the physical-chemical properties in 1984, and found that all the items examined were normal.There were not significant difference of N, P and K in loquat orchards between Tangxi and Huangyan. Organic material was seen higher in Huangyan, however it was not lower in Tangxi either (>1.4%, Table 1). We concluded that the disease is not related to the soil nutritional contents. Then whether it is related to any trace elements? The disease was seen in all the 567-acre area of loquat orchards from Tangxi. If trace elements lacking were the cause, it does not make sense that all the 567-acre area would share the same lacking or over-producing. So we excluded such possibility.

Table 1. Contents of nutritional component of Tangxi Loquat planting soil[†]

Sampling Place	NO_3- (mg/kg)	NH_4+ (mg/kg)	Quick P (mg/kg)	Quick K (mg/kg)	Organic material %	Notes
Tangxi Lijia Bridge	3.2	1.3	106.0	128	1.52	Severely affected area
Tangxi Zhujia Corner	6.2	7.8	67.6	108	1.42	As above
Yuhang Pinyao Zhujia Alley	3.0	3.4	8.7	83	1.70	Non diseased area
Huangyan Xiaochou	8.8	2.6	49.5	175	2.33	As above
Huangyan Minzhu	40.6	5.2	24.2	128	2.02	As above

[†]Measured by Agricultural Academy of Zhejiang in May, 1984.

Continuously planting

Loquat species in Tangxi is dated 1300 years ago. Whether does the long continuation of plantation cause the disease? During long continuation of planting, the plant produce several chemicals which may accumulate in the soil and cause the disease. Based on our observation, this is not the case. The disease was also found in soil in which there was never a long history of planting the species such as Chaoshan.

Industrial pollution

Since the later of seventies, Tangxi industries developed very rapidly, most of them were chemical factories. Hangzhou Environment Protection Bureau measured the F- and SO_2- discharge in Tangxi area in 1985-1986. Results showed annual discharge of F- 150,384 tonnes, SO_2- 34,224.47 tonnes. Tangxi area was classified as severe contamination area of F- and SO_2-. In the meantime, the results showed that the air pollution was also high for F- and SO_2-. F- contamination was 1.7-4.5 g/dm^3, averaged 2.6 g/dm^3, 0.7-3.5 times higher than control area, averaged 1.6 times. The symptom of brown leaf-tip is very similar to the F- damage. In 1983 we sent samples to Plant Protection Department, Zhejiang Agriculture University for F- measurement. F- contents were 31-48 mg/kg in a total of 400 leaf samples. We measured 3 times again in 1997, revealing that leaf F- was higher in Tangxi than control (non-disease area), averaged to 6.25 times (Table 2).

Table 2. Comparison of leaf F- (mg/kg) in Tangxi and Xianlin (control)†

Measuring date	Tangxi 1	Tangxi 2	Tangxi 3	Xianlin (CK)
1997-04-23	45.0	44.9	45.9	6.2
1997-04-29	49.0	47.7	46.1	6.9
1997-05-05	45.3	46.0	46.7	6.0
Average	46.43	46.20	46.23	6.37

†Measured by Yuhang Environment Protection Bureau.

Conclusions

(i) The factor causing the brown leaf-tip is waste pollution, mainly F-, secondly the SO_2-. The combination of F- and SO_2- would affect loquat trees more severely.

(ii) There is diversity among cultivars related to susceptibility to pollution. The susceptibility to F- is 35 mg/kg in Ruantiao-Baisha and Pingtou-Dahongpao, 50 mg/kg in Daye-Yangdun, others cultivars are in between.

(iii) The air F- concentration larger than 2 g/dm^3 may cause damage to loquat, for instance, the brown leaf-tip disease. It is not recommend to plant loquat species in those areas.