

Full Length Research Paper

Occurrence of *Phytophthora* root and collar rot disease of kiwifruit orchards in the west part of the Mazandaran Province

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High rot of the root of the kiwifruit due to *Phytophthora* fungus in 3 to 8 old kiwifruit gardens occurred in Tonekabon area from north of Iran in 2011. The symptoms like yellow leaves and fall of the fruits, root and crown rot and dry trees were observed in infected kiwifruit trees. This disease in lowland with weak drain studied in 17 of 20 gardens was relatively high. Appearance of infected kiwifruit in lands with heavy soils arrived more than 50% and a kind of *Phytophthora* fungus separated from inner tissues of root, collar and soils of rhizosphere part of plants. The element of the disease and pathogen was characterized based on mycology properties, *Phytophthora citrophthora*, where the symptoms and the element of this disease completely conform to external sources. The fungus pathogenicity was confirmed by artificial insemination to Hayward kiwifruit seedlings. Kiwifruit root caused by *P. citrophthora* has been reported in Iran, previously.

Key words: Kiwifruit, *Phytophthora citrophthora*, root and collar rot.

INTRODUCTION

In 1990, after the kiwifruit plant was introduced in Iran in business in which now more than 4,000 hectares is under cultivation is in the west of Mazandaran province. Recently, kiwifruit plants were observed with weak drained and appearance of dry tree and *Phytophthora* crown and root rot in some gardens. According to the essence of epidemic from injury, it was suspected that some pathogens may be associated with this disease. Specifically, it was believed that the species of *Phytophthora* are as a possible reason, because fungus were reported as major pathogens causing diseases which appeared in kiwifruit in New Zealand, California, Chile and France.

In 1990, conducted reviews of diseased kiwifruit which are suspected to be root rot was identified as *Phytophthora*. Disease has spread widely in a number of orchards in the west of Mazandaran province and emerged as a threatening factor to kiwifruit trees in Iran.

In 1989, Binesh and Porabdollah *Phytophthora* sp. fungus were separated from the end part of the kiwifruit scions in gardens in Iran. Taheri et al. (2008) reported *Phytophthora citrophthora* species in Ramsar area. In 1989, the first studies on developed pathogens of the

diseases of kiwifruit (Ablakatova, 1960, 1961) were performed by Russian scientists. The diseases of kiwifruit are high and varied caused by fungi, bacteria, nematodes and unbalance of foods in plants. Root and crown rot is an important and current disease of this plant in world which infect 50% of gardens.

Zuccherelli (1989) reported this disease in New Zealand. Robertson (1982) described the symptoms of kiwifruit root and crown rot disease. This disease was reported by researchers in New Zealand, California, Chili and France (Stewart and McCarrisan, 1991; Conn et al., 1991; Latorre et al., 1991; Baudry et al., 1991). Yong et al. (2001) studied this disease in Korea.

MATERIALS AND METHODS

Samplings

Different areas of cultivated kiwifruit were visited and 20 samples of infected root and collar were collected from 20 kiwifruit gardens in Tonekabon area and studied separately.



Figure.1. Not opening and delay of buds by *Phytophthora citrophthora* fungus



Figure 2. the withered leaves by *Phytophthora citrophthora* fungus

Isolation, purification and identification of pathogen

First, parts of main and sub-roots and collar of infected trees was washed with usual water and then disinfected superficially with 0/5% sodium hypochlorite and placed on PARPH medium (50 mg Pimaricin, 200 mg Ampicylina, 10 mg Rifampicin, 100 mg Pentachloronitrobenzene (PCNB) and 40 mg Hymexazol in each liter of corn meal agar (17 g/L CMA)) and after 3 to 7 days obtained colonies were purified and *P. citrophthora* fungus were isolated and identified.

Pathogenicity test

Young two years old tree Hayward variety grown in sandy loam soil was selected and then roots washed under tap water surface. A small piece of grown fungus was taken and placed on prime roots which were scratched. Infected trees were moved to pots with 15 cm diagonal which include sandy loam soil. Kiwifruit tree was also planted without inoculums in control pot. Inoculated and control kiwifruit plant pots was immersed separately in 1 to 2 cm deep water for 24 hr and then placed in



Figure 3. Drying and falling leaves due to *Phytophthora citrophthora* fungus



Figure 4. Drying kiwi tree due to *Phytophthora citrophthora* fungus

greenhouse in 24 to 30°C for 14 days.

RESULTS

Disease symptom

Wilting foliage, deflection and brown leaves, decrease of fruit size and quality and in severe cases destroyed plant leaves and kiwifruit tree mortality was observed. Wilting symptoms are not related to dryness stress and it does not decrease by increase of irrigation. Testing from underground parts (collar and root) showed high rot of

kiwifruit and in particular the lack of feeder roots. Primary symptoms of infection to soil-borne fungus appear in spring and early summer in gardens and cause delay opening in the sprouts.

In addition, the leaves wither and their size will small or stem dry. The number of species of this fungus first attack to roots and after colonized the root goes in collar part. In these cases, yellowish and welter symptoms appears rapidly and in other side, some kinds of this fungus which attack to crown colonize the roots later because tree attacked with complete rot. In these conditions, Seedling mortality is more gradual. Collar and root rot increased due to disease progression and plant



Figure 5. the change of collar color due to *Phytophthora citrophthora* fungus



Figure 6. the change of root color and dark skin due to the rot disease of *Phytophthora citrophthora* fungus

unable to absorb food and water and finally tree will dry (Figures 1 to 6).

Disease factor

The root and collar rot disease factor of kiwifruit is a Soil-borne fungus which called *Phytophthora citrophthora*.

Pathogenesis

Shrubs leaves fell and were injured after 10 days of

inoculation. The similar disease factor fungus was isolated from diseased trees.

DISCUSSION

Eight species of *Phytophthora* have been reported to infect kiwifruit in many other countries (Stewart and McCarrisan, 1991; Conn et al., 1991; Latorre et al., 1991; Baudry et al.1991). The root rots of *Phytophthora* sp fungus of kiwifruit trees have been already reported in Iran (Binesh and Poor Abd-Allah, 1989; Tahery et al., 2008). The results showed that *P. citrophthora* fungus is

the factor of kiwifruit root rot in the Tonekaboon in north of Iran.

P. citrophthora species obtained in this study was similar with the study performed in Turkey, Chili and Iran. This kind of *Phytophthora* is very aggressive and threatening factors for kiwifruit production in Iran specially, in soils that are weakly drained. As has been reported, this disease is favorable in soils with high humidity in kiwifruit gardens. The morphological characteristics of *P. citrophthora* species conform to properties mentioned in the study.

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